able that none was, but that the striking change depended upon the massing of the dark granular matter from the rhachis to the barbs and their appendages. The absence of definite data upon the chemistry of animal pigments makes remarks in a qualitative direction wholly undesirable.

To conclude our microscopic study, however, we may affirm: (1) that microscopically as well as macroscopically an appreciable Aptosochromatic change took place in the individual feathers of my *Passerina cyanea;* (2) that this change far from being analytical or retrograde was inclined to the nature of constructive synthesis, probably passive in nature; (3) that the change was definite as shown by comparison with the blue areas of unchanged feathers; (4) that it depended chiefly upon the gain of dark pigment in the vicinity of the prismatic column, and (5) that there was an appreciable difference in the amounts of blackish pigment supplied to the barbs and barbules, before and after the change.

F. J. BIRTWELL.

ALBUQUERQUE, NEW MEXICO.

THE SOCIETY FOR PLANT MORPHOLOGY AND PHYSIOLOGY.

THE Society for Plant Morphology and Physiology held its third meeting, with the American Society of Naturalists and the Affiliated Scientific Societies, at Yale University, New Haven Conn., December 27th and 28th, with President J. M. Macfarlane in the chair. For the ensuing year the following officers were elected: *President,* D. P. Penhallow; *Vice-Presidents,* Roland Thaxter and Erwin F. Smith; *Secretary,* W. F. Ganong. The following new members were elected: Oakes Ames, J. M. Coulter, Carrie M. Derick, B. M. Duggar, A. W. Evans, M. A. Howe, L. R. Jones, Henry Kraemer, F. E. Lloyd, D. T. MacDougal, Conway MacMillan, G. T. Moore, Adeline F. Schively, Hermann von Schrenk, Julia W. Snow. The business transacted of most general interest was the appointment of a committee, consisting of W. G. Farlow, D. T. MacDougal and H. von Schrenk to consider ways of securing better reviews of current botanical literature. It was voted to communicate the views of the Society upon this subject to the editors of the *Botanisches Centralblatt.* The following papers were presented. The abstracts are furnished by the authors.

Geotropic Experiments: DR. G. E. STONE, Massachusetts Agricultural College.

This paper dealt with the question at which angle gravity acts most strongly on a geotropically sensitive organism. The results were obtained by the use of grass nodes and in one or two instances the roots of *Vicia faba* were used. Three methods of experimenting touching upon the solution of this problem were described.

The first series give the results of dynamometer experiments in which the power of growth shown by different nodes placed at different angles was illustrated.

The second method consisted of taking the average of a large number of cut plants grown in moist sand and placed at different angles.

The third method showed the results of experiments due to the after effect of stimulation.

The results of all these experiments were similar and may be partly summarized as follows:

The horizontal position is the position of greatest geotropic excitability. This is shown by the increased amount of weight nodes will lift in this position, the amount of growth they display and the after effect reactions.

The relationship existing between nodes at oblique angles and those in a horizontal position is one which is proportional to the cosines of their angles. This also holds

good when the nodes were placed at angles below the horizontal position. Young nodes show a definite response to geotropic stimulus when exposed for so short a period as 30 seconds. The latent period is about 30 minutes long.

On the embryo sac of Saururus cernuus: Dr. D. S. Johnson, Johns Hopkins University.

The development of the bract and flower is essentially like that found in the Piperaceæ by Schmitz. In the material studied there were two ovules to each carpel, of which only one, the upper one, matured to a seed. There are two integuments as in most of the Piperaceæ and both grow up to form the micropyle. The primary archesporial cell is single and hypodermal in position. It divides to a definite archesporial cell and an upper tapetal cell. The former then divides to three potential macrospores, of which the lower only becomes functional. This grows and the nucleus divides in the usual way to form a seven nucleate embryo sac. The embryo sac soon widens at the base to become flask-shaped, with the egg apparatus at the upper end of the neck and one endosperm nucleus in the neck and probably a second one in the body of the flask. The antipodals soon become indistinguishable, probably degenerating. Endosperm cells are formed in the neck of the flask before any change can be seen in the egg itself. In the ripe seed the endosperm is found to have swelled laterally using up only the tip of the large nucellus while the lower or body end of the embryo sac is still without endosperm cells or nuclei. The features of the development of *Saururus* thus far studied give no conclusive evidence of its primitive character.

Upon the best way of securing a good review of Current Botanical Literature: Professor W. G. Farlow, Harvard University.

Professor Farlow's address upon this subject appeared in synopsis in the *Botanical Gazette* for January. He pointed out that this is a question distinct from that of a card catalogue, international or other, of literature. None of the existent journals fully meets the needs of botanists for prompt descriptive synoptic reviews of current literature. The *Botanisches Centralblatt* comes the nearest to the needed journal, and if its reviews were more prompt, and, in many cases, of a more descriptive character, and if it did not take up with original articles so much space which ought to be given to reviews, thus forcing many of the latter into Beihefte for which an additional subscription must be paid, it would be much more satisfactory. The discussion following this paper showed that similar opinions are held generally by botanists in this country, and steps were taken to communicate the Society's opinions upon the subject to the editors of the *Centralblatt.*

Fasciation in the Sweet Potato: Mr. Henry S. Conard, University of Pennsylvania. (By invitation.)

The author stated that typical fasciations ½ in. to 3 in. broad are common in the sweet potato. The internal structure of these differs from that of normal stems only in the shape of the cross-section. On poor soil 12% of the stems are abnormal, on good soil 18% ; counting apices only, 20% are abnormal on poor soil, 54% on good soil. Of the abnormal stems ½% to 1% are ring-fasciated. Such stems enlarge gradually from the base, but maintain a round cross-section. They become hollow within, the cavity opening to the air at the growing apex. The apex has a wavy margin; or the tube may be split above, and may give rise to plain fasciation. The tubular portion may be as much as 2 or 3 ft. long by ½ to ¾ in. in diameter. The cavity has on its walls acropetally developed leaves, and adventitious roots; the latter become func-

tional when cuttings of the ring-fasciation are planted. The transverse section shows two bundle-systems, an outer normal one, and an inner surrounding the cavity with its normal phloem facing the cavity. The hollow is bounded by epidermis and cortex. Internal phloem (bicollateral structure) is a marked feature of both internal and external bundle-systems of the ring-fasciated stem, as it is of the normal stem. The two bundle-systems of the anomalous specimens are entirely separate, but merge into common ring-shaped apical meristem. Toward the root the cavity tapers to a close, leaving a ring of bundles; these dwindle away one by one, the phloem elements persisting longest. The writer's observations agree essentially with similar ones of de Vries and Nessler; he also considers Masters' 'tubular stem of Sempervivum' and Qualch's 'fasciated sweet-pea' as probable cases of ring-fasciation.

Leaf Scorch of the Sugar Beet: MR. F. C. STEWART, New York Experiment Station.

During August, 1899, some fields of sugar beets in Central New York were severely injured by sudden scorching of the foliage due to excessive transpiration. The foliage, wholly or in part, turned black and died. A majority of the affected plants recovered and made a second growth, but some were killed outright. The dead roots showed internal browning around the circumference and dark colored, raised, somewhat V-shaped areas on the surface. Later in the season the raised surface areas became affected with dry rot and the dead tissue was eaten away by millipedes, leaving shallow cavities resembling scab spots. It has been proved by an inoculation experiment that the internal browning is not caused by parasitic organisms. All affected beets were low in sugar content.

This paper has been published in New York Agricultural Experiment Station Bulletin, No. 162.

Distribution of red color in vegetative parts in the New England flora: MISS F. GRACE SMITH, Smith College. (By invitation.)

The author called attention to the various and more or less conflicting views as to the meaning of the presence of red color in vegetative parts of plants. In order to test these theories, observations were made to determine how many plants in the New England flora show the red color. Careful account was taken of the exact structural part in which the color occurs, and of the relation of the position of the color to external conditions of light, dryness, etc. The results were reduced to percentages and showed that none of the existent theories will explain the distribution of the color in our vegetation. The conclusion is drawn that either the red color must have several different reasons for being, or else it has some significance to which we as yet have no clue. The studies are to be continued.

On the morphology of certain plants from the Devonian of Europe and America: PROFESSOR D. P. PENHALLOW, McGill University.

The author drew attention in particular to two types of plants which had been the subject of investigation for a number of years.

In 1831 Fleming described certain interesting and peculiar fossils from the Devonian of Scotland under the name of *Parka decipiens*, and subsequently Hugh Miller gave them much consideration in his Old Red Sandstone. Since that time they have excited the interest of paleontologists at various times, but always with reference to the eggs or spawn of some animal form of life. In 1891 they were first clearly proved to be of plant origin by Dawson and Penhallow, who, however, were unable to

clearly establish their relations to existing types. So far as investigations have proceeded, we can now recognize a sporocarp enclosing both macro- and micro-sporangia, from which may be obtained the corresponding spores with dimensions of 40 and 15 microns respectively. Prothalli in various stages of development have also been obtained. There is presumptive evidence that the sporocarp may have been stalked as in Marsilia, but the character of the contents points more to an affinity with Pilularia. The association of creeping rhizomes strengthens the supposition that they were aquatics of the general habit of growth of Marsilia and Pilularia, while the recently discovered occurrence of leaves of the general type of Marsilia would seem to add to the validity of this hypothesis. Although closely and constantly associated in the same beds, and even on the same slab, the unfortunate separation of members will not permit final conclusions as to the nature of this plant at the present time.

In 1885, the late Sir William Dawson discovered in the Devonian sandstones of Gaspé, the remains of a gigantic alga to which he subsequently gave the name of *Nematophyton*. This genus has since been found to have a very wide distribution, being found in Great Britain, Germany, and various parts of the United States and Canada as far west as Ohio. At present eight species are distinguished, but it is highly probable that with a more complete knowledge of the plant, this number will be greatly reduced, while the number of genera may have to be increased.

They were plants of arborescent habit, attaining a diameter of two feet or more and a height which was undoubtedly great, but which can only be conjectured from the diameter and the fact that the largest specimen so far recovered from the Hamilton Group of New York, although incomplete, had a length of 24 feet. No foliage or fruit has yet been obtained, and our only guide to relationship is through the character of the internal structure. A pseudo-exogenous structure, as in many Laminarieæ, is conspicuous. Isodiametric, radial or irregularly branching openings occur in the various species, and in these areas or in their immediate neighborhood, the larger cellular elements branch more or less freely into small hyphæ which form an intercellular plexus. The principal elements of structure consist of exceedingly long, non-septate, thick-walled, tubular cells which traverse the stem in the direction of the longitudinal axis—though to a minor extent transversely—and interlace freely to form a medulla as in the larger forms of the Laminarieæ. No surface markings of the walls have been observed, but in one species (*N. Ortoni*) the cells show local enlargements closely resembling the trumpet hyphæ of *Macrocystis*.

One of the most instructive features of these plants is to be found in certain structural modifications which they exhibit. In working up material from various sources, it was discovered that many specimens exhibited certain transitional forms from normal structure to what was described many years since by the late Sir William Dawson under the name of *Celluloxylon primævum*. A closer study revealed the fact that this alteration was incident to the crystallization of the infiltrated silica and the operation of decay, whereby the carbon particles of the original cell walls were redistributed upon the surfaces of the crystals in such a manner as to produce the general effect of a coarse cellular structure.

Notes on the morphology and reproduction of Chlorocystis Cohnii: Mr. G. T. Moore, Dartmouth College. (By invitation.)

The structure and development of this unicellular alga growing on Entromorpha was described and several points differing

from those previously recorded were referred to. It was shown that the habit of the plant is not that of a universal endophyte but is quite as often merely epiphytic. The character of the chromatophore was found to vary from the 'one-sided' arrangement, considered by Reinhard as typical, to a condition where the cell wall was completely lined by the color body. Two sizes of zoöspores, formed by successive divisions, were described, but no suggestion of conjugation could be observed and it seems probable that nothing of the kind occurs. In the material examined the discharge of zoöspores was found to take place through a circular opening of considerable size instead of through a tubular neck as recorded by European writers on this subject. The paper will be published in full later.

The roots and mycorhizal adaptations of the Monotropaceæ: PROFESSOR D. T. MACDOUGAL, New York Botanical Garden, and PROFESSOR F. E. LLOYD, Teachers College. (By invitation.)

The Monotropaceæ have been under investigation with respect to their mycorhizæ since 1840. Of the genus *Monotropa*, *M. Hypopitys* only has received consideration, and all references made in text-books hitherto have referred to this plant. *Monotropa uniflora* has now been added to the list. In this plant the roots are found to be entirely invested by the mycelium of the fungal symbiont, even over the cap. The latter is 2–4 cells in thickness but arises from a calyptro-dermatogenic layer. The plerome and periblem arise from a common initial tissue and may not be distinguished for some distance back from the apex. The stele and cortex arising therefrom are not distinctly delimited, there being no well marked endodermis. The stele is very irregular in structure. The hyphæ of the fungus gain access to the epidermal cells at about the backward limit of the root-cap, but never enter these. The short haustorial branches which gain entrance enlarge into more or less irregular vesicles, and these come partly to surround more or less the nucleus which, however, does not become hyperchromatic, but maintains its normal condition for a long time. The epidermal cells ultimately become separated from each other by the hyphæ which penetrate between them, but not between the cells of the cortex, or only very rarely. The vesicles sometimes produce spore-like bodies and are believed to be reproductive. A most interesting gradation from the arrangement of the mycorhizas in the nearly related *Pyrolas* is shown. The branching of the root in *M. uniflora* is exogenous, this result not according with that of Kamiensky on *Hypoitys*.

The general statements which may be made concerning all the Montotropaceæ now studied with reference to their mycorhizas are as follows:

1. The shoots are free from chlorophyll, and have no stomata except in the case of *Pterospora*.

2. The customary relations in size of the root and shoot are lost.

3. The stele is much reduced in both the shoot and root, and shows perforated vessels and companion cells only.

4. The fungus sheathing the root encloses the tip completely, at least at certain seasons, and penetrates the epidermal cells in all of the genera examined. Vesicles, sporrangioids or organs of interchange are formed in the epidermal cells. The relation between the fungus and the seed plant is a pure symbiosis and the latter does not act as a fungus trap in accordance with Frank's theory.

5. The root cap is one to many layered, and with the epidermis is derived from a dermato-calyptrogenic layer. The periblem and plerome are not distinguishable in form or content.

The structure and reproduction of Compsopogon: Dr. Roland Thaxter, Harvard University.

The author gave some account of the distribution of *Compsopogon* in Florida, mentioning the localities where it had been found by himself and others, in fresh as well as partly tidal waters. Its general structure was described, attention being called to the fact that the older filaments may possess a cortex of from two to four layers of cells. Details of cell structure and the normal reproduction by aplanospores were illustrated, as well as the formation of small aplanospores developed from sorus-like groups of superficial cells.

On some diseases of New England Coniferæ: Dr. Hermann von Schrenk, Shaw School of Botany. (By invitation.)

The coniferous woods of this region are being destroyed by the mycelia of a number of fungi, chief among which are, *Polyporus tenella*, *Polyporus Schweinitzii*, *Polyporus piceinus*, *Polyporus pinicola*, *Polyporus sulfureus* and *Agaricus melleus*. The mycelia bring about characteristic changes in the wood either by destroying the lignin and leaving pure cellulose, or by transforming the wood into a brown brittle substance. The changes are caused by enzymes one of which was obtained from *Polyporus tenella*, capable of destroying the substance hadromal, leaving pure cellulose. This enzyme is not diastase. The extent to which decomposition is carried on is apparently determined by decomposition products such as humus compounds, citric and succinic acids and others. These stop the action of the enzyme at a certain point. The enzyme transforms the wood in great quantities; many pounds of pure cellulose are often found in one place. Masses of cellulose and some hadromal were exhibited. The mycelia of these fungi live both as parasites and saprophytes, some entirely in the ground. The sporophores of many excrete manitose in quantity at the time when the spores are ripe. This may aid in the dissemination by attracting bark beetles. Six forms of wood destruction were described, and specimens and photographs of the same were shown.

Vegetative reproduction and multiplication in Erythronium: Mr. Frederick H. Blodgett, New York Experiment Station. (By invitation.)

The presence of underground runners in *Erythronium americanum* has been recognized for some time. The development of the runners, and especially of the bulbs which are formed from their terminal buds was published in 1895. In the present article the author describes the common origin within the bulb of these runners and of the annual bulbs of the mature individuals, as axillary buds between the base of the stem and the inner bulb scale. The development of the first bulb from the seedling is also described. It is characterized by containing the plumule instead of the normal foliage leaf and remains latent for a year. From one bulb, thus developed from a seed, the life cycle is shown to occupy not less than four years, probably six or seven years in most instances. During this interval runners are given off each year, usually three annually, resulting in a bed in five years of from six to nine plants for each seed, or ninety plants if ten seeds of a single fruit should survive all steps of the cycle.

Current problems in Plant Cytology: Professor J. M. Macfarlane. (Presidential Address.)

This address is expected to appear in abstract in Science.

The structure of starch grains: Dr. Henry Kraemer, Philadelphia College of Pharmacy. (By invitation.)

In the different text-books starch grains

are represented as having either a light-colored point of growth (nucleus or hilum) with alternate dark and light lamellæ as figured in Sach's works or having a dark point of growth and alternate light and dark lamellæ as illustrated by Strasburger. The appearance of the grain as given by these and other writers is dependent upon the view of the grain by the observer. In focusing upon the top of the successive lamellæ of the grain, one observes the view as given by Strasburger; whereas if one brings the focus to the base of the lamellæ the appearance of the grain as given by Sachs is observed. If we focus upon the top of the various lamellæ of the potato starch grain, we find not only grayish and light colored lamellæ alternating with each other, but we find in the center of the grayish colored zone at the point of growth a much darker area. A layer having the same appearance as this dark area is also observed on the outside of one or more of the grayish lamellæ. The grayish and dark colored layers, just referred to, have a reddish appearance, the dark colored layers being slightly bluish also.

Upon treating the starch grains with an aqueous solution of an aniline stain such as safranin, gentian violet, etc., the stain is apparently taken up by the darker lamellæ, *i. e.*, when focusing upon the top of the layers or lamellæ. On the other hand on treating the grains with chromic acid, calcium nitrate, etc., or with water at different temperatures for varying periods of time, the characteristic sphero-crystalloidal structure is brought out in the light lamellæ, *i. e.*, when focusing on top of the layers or lamellæ.

We find further that the layers which do not take up the aniline stains become blue with iodine, whereas the alternating layers are not at all affected apparently by this reagent. It appears that the layers not affected by iodine, but stained by the aniline colors, are rich in colloidal substances but poor in crystalloidal materials. These correspond to the cellulose layers of Nägeli, the farinose layers of von Mohl and the β-amylose layers of Meyer. The layers stained blue by iodine and not stained by the aqueous aniline solutions, are poor in colloidal substances but rich in crystalloidal materials, these corresponding to the granulose layers of Nägeli and von Mohl and to the α-amylose layers of Meyer.

The toxic action of a series of Sodium Salts: DR. RODNEY H. TRUE, Cambridge, Mass. (By invitation.)

From experimental results worked out by Drs. Kahlenberg and True, the latter formulated the results presented under this title.

After studying the toxic action exerted on roots of *Lupinus albus* by a series of acids and by their Na salts, in view of the ionization of these compounds, an analysis of their toxic action has been made into the partial-toxicities due respectively to H ions, anions and ionized molecules. In inorganic acids of the type of HCl, the action of the anions is so slight, relative to that of H ions, as to be thrown into insignificance. In the organic acids where ionization is usually much less advanced, the predominance of the H effect is less marked. In formic, salicylic, ortho-nitrobenzoic and protocatechinic acids, the H ions exceed in effectiveness all other factors. In propionic, butyric, gallic, cinnamic and hippuric acids the action of the unionized molecules predominates over all other factors. In the sodium salts where a greater degree of ionization exists, a greatly diminished toxic action is seen, due chiefly, apparently, to the action of the anions. In carbolic acid, having its hydrogen in the hydroxyl (—OH) form as contrasted with the above organic acids in which it exists as carboxyl (—COOH) hydrogen, ionization is at a

minimum and the toxic action is due solely to unionized molecules.

Further notes on the Embryology of the Rubiaceæ: Professor F. E. Lloyd, Teachers College. (By invitation.)

The Rubiaceæ reported upon up till now include the *Stellatæ*. The present paper deals with *Diodia virginiana*, *D. teres*, *Richardsonia pilosa* and *Cephalanthus occidentalis*. All are similar morphologically as to the topography of the ovule. They vary, however, in the relative rapidity of development of the basal partition and of the nucelli. *Cephalanthus* possesses the most rapidly developing basal partition with the result that the ovule is rotated so that the funicle is inserted in the top of the ovary and the embryo sac is inverted. All possess an outgrowth of the funicle, resembling a second integument, which in *Richardsonia* and *Diodia* becomes loaded with raphides and is believed to have a nutritive rôle. The 'spongy' funicular appendage in *Cephalanthus* is shown to be the homolog of that in *Diodia* and *Richardsonia*, but the nutritive function is here less probable. The funicle in *Diodia* and *Richardsonia* is surrounded by a collar of peculiar epithelial cells which in *Richardsonia* are the path of the pollen tubes; the latter never travel freely in the ovarian cavity. The archesporium consists of but one cell which gives rise to four megaspores. One of these is the embro-sac mother cell. The embryo-sac is of the elongated type with the usual number of cells. One of the antipodal cells is rather long in *Diodia*, but the three are of equal size in *Richardsonia* and *Cephalanthus*. *Diodia virginiana*, however, has four antipodal cells from the division of the long cell after the small ones are cut off. The embryo possesses a short cylindrical suspensor from which the haustoria characteristic of the *Stellatæ* are absent. There is, however, evidence of a nutritive function. The embryo develops at first very slowly, in contrast with its rapid early development in the *Stellatæ*, a fact which is correlated with the absence of haustoria. The endosperm at first is parietal.

The stimuli that cause the so-called 'peg' or 'heel' on Cucurbita seedlings: Dr. J. B. Pollock, University of Michigan.

No abstract of this paper is available.

On the prothallus of Taxodium distichum Richard: Mr. W. C. Coker, Johns Hopkins University. (By invitation.)

The archesporium consists of a group of cells near the base of the nucellus. One of its central cells enlarges at the expense of those around it and becomes the embryo-sac. The archegonia arise at the upper end in a group and soon come to lie in a depression, which is at first covered over by the wall of the embryo-sac. There are four neck cells, and a ventral canal cell is cut off. Soon after the formation of its cell-walls the endosperm cells become multinucleate by amitotic division.

The pollen sprouts soon after pollination (which in Baltimore takes place about the middle of March) and reaches the embryo-sac before a solid endosperm has been formed. The end in contact with the sac now contains three nuclei, not greatly differing in size, one of which is the body cell nucleus. This increases in size, surrounds itself with a dense mass of cytoplasm, and just before fertilization divides into two male pro-nuclei each with its mass of cytoplasm. Several pollen tubes may push their much enlarged ends into the depression in the embryo-sac. The male and female pro-nuclei come in contact near the upper end of the oösphere and move towards its base. Fusion is complete about the time the base is reached. The young pro-embryo consists of four tiers of four cells each, the upper tier lying free in the archegonium.

A new type of branching in the leafy Hepaticæ: DR. A. W. EVANS, Yale University. (By invitation.)

According to Leitgeb, who made a thorough study of the various kinds of branching exhibited by this group of plants, his so-called 'Endverzweigung' or 'terminal branching' always occurs in the ventral half of one of the lateral segments cut off from the apical cell. In the curious *Mastigobryum integrifolium* Aust. of the Hawaiian Islands, this same kind of branching occurs in both lateral and ventral segments, showing that it is much less restricted than Leitgeb supposed. In this case the ventral branches, apparently from their place of origin, are specialized as flagella.

The geotropism of split stems: DR. E. B. COPELAND, University of West Virginia. (By invitation.)

Numerous experiments show that if a stem be split into two equal halves and then placed in a horizontal position, the lower half is stimulated to grow more rapidly than the upper. As compared with an erect half stem, the upper horizontal half (that with the split surface downward) has its growth depressed, while the lower horizontal half has its growth considerably more accelerated. This is what happens in an uninjured prostrate stem in the execution of a response to the geotropic stimulus, except that the difference in growth between the halves is much greater when they are separated.

It has been held that in the geotropism of stems there must be at least a transverse transmission of the 'sensation,' by which the halves can compare their positions; but in view of the behavior of the isolated half-stems this argument is obviously invalid.

Some variations and correlations in the leaves of trees: MISS HARRIET B. WINSOR, Springfield, Mass., and DR. W. F. GANONG, Smith College.

This paper, offered as an illustration of method, represented the results of an attempt to apply statistical methods to the study of an ecological problem, namely the factors determining the length of petioles and the size and shape of the leaf. The studies are to be continued.

Perennation in the stem of Lycopodium alopecuroides: DR. J. M. MACFARLANE, University of Pennsylvania.

The author pointed out that in this species the branch extremities begin to dip into the ground in autumn by what has been proved to be geotropic growth. This portion becomes colorless, greatly loaded with starch, and bears leaves that become specially modified from those of the normal green type. When the perennating part is fully developed it is a hook-like depression which lies dormant until the succeeding spring. By succeeding apogeotropic growth it again reaches the surface and assumes its usual development.

Of special interest is the fact that the above peculiarity is being gradually acquired, for while a large proportion of plants show it, a few that may grow protected in loose sphagnum or under water only show it to a feeble extent.

The phytoëcology of the Bay of Fundy salt marshes: DR. W. F. GANONG, Smith College.

At the head of the Bay of Fundy occur great salt marshes which bear a remarkably varied vegetation, showing transitions from the usual salt marsh to fresh-water bogs. The reclamation of the marshes for cultivation brings in another element, and all transitions may be found between the salt and the reclaimed marsh. These transitions of conditions afford an unusual opportunity to investigate some phases of the dynamical relationships of plants to their surroundings, and the author has attempted to work out this problem in ecology. The

physical conditions of the marshes are discussed, the flora described and the segregation of the vegetation into formations illustrated. The physiological and structural peculiarities of the leading plants of each formation are then described. Finally an attempt is made to formulate the results into a series of principles of general application.

Complications in Citrus hybridization caused by polyembryony: Mr. H. J. Webber, Department of Agriculture.

During the last five years the writer has made about a thousand hybrids of the various species of *Citrus* commonly cultivated, and has had under his care and observation about an equal number made by Mr. W. T. Swingle. Last spring a careful comparison of the foliage characters of these hybrids led to the interesting observation that where two or three seedlings were developed from a single seed, as was frequently the case, they not infrequently showed marked foliage differences. The fact that the common orange and many other species of the genus *Citrus* are commonly polyembryonic is well known. A single seed of the common orange has been known to produce as high as thirteen different seedlings, although it is seldom that more than three of the embryos are capable of development. Strasburger, in his critical study of the polyembryony of this group, found that the embryos, other than that developed from the fecundated egg cell, are derived from certain cells of the nucellus lying near the embryo sac wall which become specialized, grow and divide rapidly, and form a tissue mass which pushes out into the embryo sac and forms an embryo similar to that formed in the normal way from the egg cell. The embryos formed in this way Strasburger called adventive embryos. If we correctly understand the action of fertilization it is clear that in hybridizing fruits of this sort only those embryos developed from the egg cell proper, as a result of the fecundation, would show an indication of the hybridization. The adventive embryos developed directly from the mother tissue we should not expect to show any of the characters of the male parent. This was the conclusion reached by Mr. Swingle and the writer jointly in discussing the matter several years ago, and the development of the hybrids has now shown this to be the case. In several instances of hybrids of *Citrus aurantium*, which has unifoliolate leaves, with *C. trifoliata*, which has trifoliolate leaves, where the former was used as the female parent, two and three seedlings have been produced from the same seed, one of which had trifoliolate leaves and the others strictly unifoliolate leaves exactly like those of the mother parent. In such cases it is evident that the trifoliolate seedling inherits this character from the male parent and that the embryo from which it grew was developed from the egg cell proper. The other seedlings in such cases, having unifoliolate leaves like the mother parent, are doubtless developed from the so-called adventive embryos. The writer has also observed the same phenomenon in the reciprocal hybrids, *Citrus trifoliata* ♀ × *C. aurantium* ♂, and in the hybrids of *Citrus nobilis* ♀ × *C. aurantium* ♂. The observations have been sufficiently extended so that we may be certain of the common occurrence of the phenomenon in citrous hybridization.

In hybridizing citrous fruits to secure improved sorts this fact unfortunately introduces a serious complication. The majority of citrous hybrids, in almost every case resemble the female parent in foliage characters, and it will thus be seen that until they fruit it will be impossible to determine whether they are true hybrids, showing a preponderating influence of the

female parent, or simply false hybrids developed from adventive embryos. It is thus probable, or we may say certain that in such work many seedlings will have to be grown and fruited which are from adventive embryos and are not true hybrids. These of course cannot be expected to give rise to valuable new varieties, and growing them will greatly increase the trouble and expense.

W. F. GANONG,
Secretary.

SCIENTIFIC BOOKS.

Insects, their Structure and Life. By GEORGE H. CARPENTER, B.Sc. London, J. M. Dent & Co. 1899. Pp. 404, figs. 183.

There is need of a modern elementary text-book of entomology covering all the important phases of the study of insects. Comstock's Manual in its present form is chiefly devoted to the systematic and ecologic phases, while Packard's new text-book is given up exclusively to the morphological, physiological and developmental phases of insect biology. Mr. Carpenter's book is an attempt to supply the need. Its six chapters treat respectively of the Form of Insects (anatomy and, very slightly, of physiology), the Life-history of Insects (embryonic and post-embryonic development), the Classification of Insects, the Orders of Insects (these two chapters including the classification of insects as far as families, and brief mention of the habits with families as units), Insects and their Surroundings (ecology) and the Pedigree of Insects (phylogeny). These subjects include all the principle phases of the general biologic study of a group of animals, and in this respect the book is wisely planned to meet a real need. For the most part this presentation of the elementary facts of the 'structure and life of insects' will meet with the approval of teachers of entomology. The selection from the mass of material constituting the science of entomology of the little that can be included in an octavo volume of 400 pages, is a matter requiring a large knowledge of insects and a discriminating and clear pedagogic insight. The author (an active naturalist of Dublin) has a good knowledge of entomology, a discriminating perception of the relative importance of facts, and a clear and simple style.

In undertaking to write an elementary general text-book of entomology, the most difficult task is that of the satisfactory treatment of the systematic phase. The enormous number of insect species precludes the use in such a book of classificatory units smaller than families, and indeed renders the adoption of the family unit unsatisfactory. It is this part of the book, the chapter, Orders of Insects, devoted to the systematic consideration of insects, which is the least satisfactory part of it. To treat systematically the whole class of insects, using families as units, in a few more than one hundred octavo pages, and to impart to this treatment any real interest or life, or, one is forced to say, real value, is too nearly impossible to be expected from even the capable author of this book. He adopts a 15-order classification and races through these orders, leaping family barriers three or four to the page. To be sure, certain mechanical assistance, a resorting to small type, is offered to give each family a chance to have its habits told in two lines instead of one, but that hardly betters matters. There is simply no space for what is the absolute minimum of treatment necessary to make such a syllabus or synopsis worth anything more than a list.

It is with relief, therefore, that we leave this distressful attempt to do the impossible, to examine the following interesting and admirable chapter on 'Insects and their Surroundings,' where those general relations of insects to their surroundings, distribution, parasitism, protective resemblances and mimicry, social and communal life and other phases of insect ecology, are presented. Similarly good are the chapters on embryonic and post-embryonic development. Much of the matter of these chapters has never before been given in a small text-book of entomology, and that is the special value of this book. The illustrations are, while mostly good in themselves, often not very apposite to the context. Very few new figures have been made for the book. The excellent blocks (more familiar to American entomologists than they probably are to English students) of the Divi-