# SCIENCE



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MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Professor J. McKeen Cattell, Garrison-on-Hudson N. Y.

## *PROCEEDINGS OF THE SECTION OF BOTANY AT THE NEW YORK MEETING OF THE AMERICAN ASSOCIATION.*

VICE-PRESIDENT TRELEASE'S address on 'Some Twentieth Century Problems' was given in the large botanic laboratory in Schermerhorn Hall, on Monday, June 25th, at 3 p. m. (Published in SCIENCE, 12: 48, 1900.) On the following day and on the 29th, regular sessions were held for the reading of papers after the customary manner, and a list with some abstracts is given below.

The Torrey Botanical Club gave, by invitation, a special memorial program in honor of Dr. John Torrey, in the Museum of the New York Botanical Garden, on Wednesday, June 27th. The principal features of the day were:

'Reminiscences of Dr. Torrey': DR. T. C. PORTER.

'Work of Dr. Torrey as a botanist': DR. N. L BRITTON.

'Historical sketch of the development of botany in New York City': DR. T. F. ALLEN.

'Comment on the earlier botanical history of New York': JUDGE ADDISON BROWN.

'Work of the Torrey Botanical Club': SECRETARY E. S. BURGESS.

Comments and reminiscences: PROFESSOR PECK, PROFESSOR MACLOSKIE, PROFESSOR BEAL and DR. T. F. ALLEN. A communication from JAS. HYATT was also read. These papers will be published in the *Bulletin of the Torrey Botanical Club.*

The sectional committee had concluded arrangements with the Council of the Botanical Society of America by which the pro-

gram of the latter occupied the sessions on Thursday. A symposium on the plant geography of North America had been arranged for Friday, June 29th, in which the following papers were read:

'Distribution of the Spermatophytes in New England': B. L. Robinson.

'Distribution of the Spermatophyta in Southeastern United States': J. K. Small.

'Notes on the Lower Austral Element in the Flora of the southern Appalachian region': Thos. Kearney.

'Physiographic Ecology of Northern Michigan': H. C. Cowles.

'Vegetative Elements of the Sandhill region': Roscoe Pound.

'Composition of the Rocky Mountain Flora': Per Axel Rydberg.

'Flora of the Columbian Lavas': C. V. Piper.

'Distribution of the Grasses of North America': G. V. Nash.

'Relationship between the North and South American Floras': W. L. Bray.

'Floral Zones of Mexico': J. N. Rose.

'Origin of the flora of North America': N. L. Britton.

The committee on bibliography reported that the publication of the card catalogue of literature relating to American Botany had been undertaken by the Torrey Botanical Club.

*The Bacterial Air-Flora of the Semi-Desert Region of New Mexico:* By John Weinzirl.

The study of the air-flora of our semi-desert region possesses considerable interest, especially since no similar investigation has been made under the same conditions. Our climate is characterized by extreme dryness, intense sunlight, hot summers and mild winters, and possesses considerable altitude.* Outside of the river valleys and in the mountain ranges, vegetation is scarce. Because of these facts it is generally supposed that practically no bacterial life exists here. In making this investigation, it was thought that simple petri plate exposures would give results sufficiently accurate for our purpose. Later a number of quantitative determinations were also made, a sand filter and aspirator can being used for this purpose. Regulation petri plates of approximately 3.5 inches internal diameter were used. Agar-agar seemed to be the most suitable medium, since the high colors of the air germs are especially prominent upon it. For comparative purposes, the number of bacteria falling upon the plates were reduced to a basis of 10 min. exposures. The number of plates exposed at one time was usually three, the results being averaged for the final figure. Seventeen exposures were made near the University of New Mexico, which is situated upon an elevated table land or 'mesa' east of Albuquerque. The time covered seven months—September to May. The number of bacteria falling upon the plates during 10 minutes was 35.8. The number fell as low as 3.8 in February, and rose to 71 in September. Thus the falling off in number during the winter season was quite marked. Comparative experiments were also made between the air of the 'mesa' and that of the residence and business districts of Albuquerque, the population of which is about 10,000. For approximate ratios we have 1:6 between mesa and residence district; and 1:80 between mesa and business district. Similar experiments were made to show the difference between the air in the morning and evening for residence and business parts of the city. For the former we have an approximate ratio of 1:4; and for the latter 1:5. It need scarcely be added that the great increase for the evening (6 P. M.) is due to the activities incident to city life. A special test of the altitude factor was made in the latter part of July, 1900, the Sandia Mts. being selected for the experiments. Plates were exposed in the usual way, at approximately 7,000 ft., 8,500 ft. and 10,000 ft.,

*The altitude of Albuquerque is nearly 5,000 feet.

the last number representing the highest peak. A considerable number of bacteria were obtained in each instance, the highest peak giving 18 per plate for 10 minutes. Quantitative determinations were made of the bacteria in mesa air and that of the residence district of Albuquerque. Five determinations (Nov.–Apr.) on the mesa gave an average of 41.6 bacteria per cubic meter or 1,000 liters. The eleven determinations in the city gave 143 bacteria per cubic meter. Both these results are lower than Miquel's figures for Mont-Souris park near Paris in winter, his average for 10 years being 170 per cubic meter. It would seem then, that the air of our semi-desert region is freer from bacteria life than other inhabited regions, but not as free as is popularly believed. The presence of a considerable number of bacteria in the air here, and even on the mountain tops is accounted for mainly by two factors, viz, large quantities of dust and relatively high winds. The extreme dryness facilitates dust formation and the high winds distribute what bacteria may be contained in the dust. As to the flora itself, it has already been noted that chromogenic species are prominent. Six out of fourteen species isolated are chromogens. Four of these are micrococci, viz, $A_1$ (salmon-pink), $A_5$ (pink), $A_2$ (sulphur-yellow) and $A_4$ (orange). Two are bacilli, $A_6$ (yellow) and $A_{10}$ (pale-yellow). The remaining colonies are white or gray-white, and with the exception of $A_8$, all are bacilli. Apparently all the species are new. It is worthy of note that this flora is characteristic for a large area of territory as is shown by experiments made at Belen, Socorro, Magdalena, Magdalena Mts. and the Sandia Mts. previously mentioned. This includes territory more than 100 miles distant from Albuquerque. The wide distribution of this flora is undoubtedly due to the high winds which have a free sweep over the nearly barren mesas.

*Field Experiments with Tomato Rot:* By F. S. EARLE.

In a paper read before the Botanical Club at the Columbus meeting* it was pointed out that the 'black rot' or 'blossom end rot' of the tomato was caused by an undetermined species of *Bacillus;* and it was suggested that natural infections in the field were probably due to the agency of some small insect. Thrips were suggested as the possible agents of infection since they had frequently been observed in connection with the disease. It was also remarked that there seemed to be more hope in seeking remedies among the insecticides rather than among the fungicides. In order to test these views the following field experiments were carried out during the spring of 1900. It was hoped that some of the insecticides used might also be of benefit in controlling the fall worm. Nine plots were set with approximately 100 plants each. All were fertilized and cultivated alike and all were pruned to a single stem and were topped after setting the third fruit cluster. Plots 1, 8 and 9 were checks. The other plots were sprayed eight times each at intervals of three to five days with kerosene, whale oil soap and 'Rose Leaf' tobacco extract, singly and in combination as is shown by the following table. The kerosene was applied as a 10% mechanical mixture, the soap as a $1\frac{1}{2}$ lb. to 1 gal. of water solution and the 'Rose Leaf' as a 1 pt. to 1 gal. solution. The kerosene proved to burn the foliage injuriously when applied with the other solutions and it was dropped from plots 3 and 6 after the third spraying. The whale oil soap solution also injured the foliage slightly. The plots were gone over every other day and all wormy and rotted fruits were removed and counted. The ripening fruits were also counted when picked and the

* Since published as a part of Ala. Exp. Sta. Bull., No. 109, pp. 20–25.

sound ones remaining on the vines at the close of the experiment.

| Plot number. | Treatment, sprayed 8 times at 3 to 5 day intervals. | Total yield of fruits per 100 plants. | Number of rotted fruits per 100 plants. | Per cent. of rot. | Number of wormy fruits per 100 plants. | Per cent. of wormy fruits. |
|---|---|---|---|---|---|---|
| 1. | Check. | 1366 | 379 | 27 | 187 | 13 |
| 2. | 10 per cent. mechanical mixture kerosene and water. | 1417 | 301 | 21 | 378 | 26 |
| 3. | 10 per cent. kerosene and whale oil soap, 1½ lbs. to 1 gal. | 1495 | 384 | 25 | 407 | 27 |
| 4. | Whale oil soap, 1½ lbs. to 1 gal. | 1309 | 243 | 18 | 456 | 39 |
| 5. | 'Rose Leaf' tobacco extract, 1 pt. to 1 gal. | 1467 | 202 | 13 | 443 | 32 |
| 6. | 'Rose Leaf' as above and kerosene 10 per cent. | 1355 | 170 | 12 | 513 | 37 |
| 7. | 'Rose Leaf' as above, and whale oil soap as above. | 1518 | 339 | 22 | 584 | 38 |
| 8. | Check.* | 1490 | 188 | 12 | 589 | 39 |
| 9. | Check | 1241 | 177 | 14 | 526 | 42 |

As seen from the above table the number of rotted fruits varied from 12% to 27% in the different plots, the highest being one of the checks and the lowest also one of the checks and the plot receiving 'Rose Leaf' and kerosene. The average for all the plots was 20½%, for the three check plots it was 17⅔%, for the three plots receiving 'Rose Leaf' tobacco extract either alone or in combination, it was only 15⅔%, while for the three whale oil soap plots it rose to 21⅔%. These figures slightly favor the tobacco treatment, but as the average is only 27% less than that of the checks and only 5% less than the average for all the plots, while the different check plots varied among themselves as much as 15%, it seems best to consider the case as not proven. Thrips were almost entirely absent from the tomato plants this year and no other small insect was observed in sufficient numbers to account for the spread of the disease. It must be admitted that the problem of how natural infections occur is still unsolved, and that no remedy has been discovered. It was noted that on some vines nearly or quite all the fruits rotted, while on others in the same plot all remained sound. The high average in plots 1 and 3 was due to the condition of a few plants where all the fruits became diseased and plot 9 would have had a lower average than any but for a few plants in the outside row. It was also noted that dry weather favored the spread of the disease, while a period of daily showers would almost entirely prevent the appearance of new cases. This agrees with previous observations.

The number of wormy fruits varied from 13% in plot 1 to 42% in plot 9. This progressive increase in numbers indicates that in this case the position of the plot in the field rather than the treatment was the controlling factor.

*Concentric Spore Spots:* By B. D. Halsted.

The spores of parasitic fungi generally reach the surface of the host for aërial distribution by either the hyphæ of the fungus passing out through the stomata and afterwards bearing the spores free in the air, or in forming in masses just beneath the epidermis through which they break and thus become liberated. The peronosporas, cercosporas, ramularias and macrosporiums are good examples of the first named method, while the cystopus and gloeosporium are instances of the second type, which includes the vast number of members of the true rust fungi. In Æcidium and allied genera there is a special organ which envelops the spores, lifts the epidermis and bursts open as a deeply-seated cup. Similar to this is a large number of the *fungi imperfecti* with the septorias and phylostictas as types where the pycnidium makes a way through the epidermis and presents its mouth free for the

* This plot was intended for Bordeaux mixture and Paris green, but owing to accident to spray pump, only one application was made and that is not believed to have affected the result.

discharge of the spores. Those fungi that produce their spores directly upon the surface through the stomata have their area of sporification defined by the distribution of the stomata and the veins and veinlets become boundary lines in many instances. When the fungus has the habit, as in the rusts, of massing the sporiferous hyphæ beneath the epidermis a new set of conditions is introduced. It is found in such, by microscopic examination, that the portion of the host just beneath the rupture is almost entirely replaced by the dense plexus of fungus hyphæ, and the host tissue is destroyed and the immediate threads are not favorably situated for further growth. At a short distance from the sorus in all directions the vitality is probably greater and new points of spore-production are established, resulting in a secondary circle of sori surrounding the original spore-spot. The development of this circle may be followed by a second ring of sori, each sorus more or less crescent-shaped until the host shows 'fairy rings' as real as those in the lawn or meadow and for a similar reason. Plants showing this concentric growth and fruitage of its fungous parasite are numerous. Among those best illustrating the phenomenon are *Cystopus candidus* (P.) upon Bursa, Nasturtium, and several other Cruciferæ; *Puccinia asparagi* DC. upon *Asparagus officinale* L.; *Puccinia Arenaria* (Schum) on *Dianthus barbatus* L.; and *Puccinia Hieracii?* upon *Chrysanthemum Sinense* Sab. All of these were shown by means of microphotographs.

*An Anthracnose and a Stem Rot of Antirrhinum majus:* By F. C. STEWART.

*Antirrhinum majus* is subject to two destructive diseases: (1) An anthracnose caused by a new species of *Colletotrichum* for which the author proposes the name *Colletotrichum antirrhini;* (2) A stem rot caused by an undetermined species of *Phoma.*

The *Colletotrichum* is destructive to plants of all ages, at all seasons, both in the greenhouse and in the field. It produces numerous elliptical depressed spots on the stems and circular dead brown spots on the leaves. It fruits sparingly, except in a very moist atmosphere. It has been successfully combated by spraying the plants once a week with Bordeaux mixture. The *Phoma* attacks the stems, causing sections an inch or more in length to turn brown or black. The attack may be made at any point on the stems above ground but is most likely to occur a few inches below the tips of succulent shoots. The portion of the shoot beyond the point of infection quickly wilts and dies. Inoculation experiments with pure cultures of the *Phoma* have shown that it is an active parasite on succulent shoots but attacks woody stems with difficulty.

*Notes upon Peltandra rust, Cœomurus Caladii (Schw.) Kunze Abstract:* By F. H. BLODGETT.

This rust was very abundant in the æcidial stage about the 15th of May, in a bed of hardy aquatics within the New York Botanical Garden. Some leaves were infested upon nearly every plant in the bed, and upon some, all the leaves were infested. Usually the upper portion of the petiole was most severely attacked. In the worst cases the midrib and its branches, and the petiole nearly to the water would be covered with the æcidia. In such cases the plants suffered severely from a bacterial rot affecting first the stems at those points most rusted, thence spreading, until the stem rotted away. Uredosori were not observed until June 7th; they became gradually more abundant, but at no time were they so virulent or so conspicuous as in the earlier stage. The uredosori were confined in many cases to the blade of the leaf, although occasionally found on the midrib and petiole. The uredospores bear a decided resemblance in

shape, to those of the fern rust *Melampsorella aspidiotus* (Pk.) Mag., upon *Onoclea* and other marsh ferns.

*A Mold Isolated from Tan-Bark Liquors:* By Katharine L. Golden.

A mold was isolated from tan-bark liquors which were obtained from a tanning factory employing the liming process for unhairing the hides. The mold was present in both fresh, sweet and sour liquors. The mold is pink in color and has a characteristic floury appearance, due to the great number of spores formed. The organism fermented sucrose, dextrose and maltose. In most gelatine it grew profusely, developing a pronounced pink color, whereas in the ordinary meat gelatine the development was scanty and pale. Three distinct enzymes were developed by the action of the mold; a tryptic, a diastatic and a rennet enzyme; all three fairly active. The protoplasm in some of the larger hyphæ was strongly motile, though the hyphæ seemed to be possessed of septa. So far as could be determined by the aid of stains and by salts causing osmotic activity in the mold, the seeming septa are thickened rings on the outside of the filaments. The mold developed, in the various media used, an odor resembling that of tanned hides. No sexual organs were developed. Photo-micrographs and diagrams were used to show the appearance of the mold in the various stages of development.

*The Embryo-sac of Peperomia pellucida:* By Duncan S. Johnson.

The primary archesporial cell of *P. pellucida* is single and subepidermal. It cuts off a single tapetal cell above and then immediately develops to the embryo-sac. The nucleus of the embryo-sac divides by mitosis to sixteen similar nuclei, distributed about in the peripheral layer of cytoplasm. Two of these nuclei are soon found at the upper end of the sac with a rather larger portion of cytoplasm about each. The larger of these two nuclei with its cytoplasm forms the egg, the wall of which is at first very delicate and indistinct. The other seems to play the part of a synergid, and it also has no distinct wall until a much later stage. Eight of the remaining fourteen peripheral nuclei collect in a compact group, located near the lateral or basal wall of the embryo-sac, or often just below the egg. Before the male and female nuclei fuse these eight nuclei fuse together completely into one large nucleus which from this time behaves like the endosperm nucleus of the ordinary Angiosperm embryo-sac. This nucleus divides before any change is visible in the egg. A cell wall is formed immediately at each division, from the cell plate of the spindle, so that in the ripe seed there are forty or more endosperm cells, completely surrounding the embryo except above. The embryo at this time consists of twenty or more cells and reaches half way to the base of the embryo-sac. The remaining six peripheral nuclei are seen at this stage to be flattened against the wall of the but little enlarged embryo-sac by the endosperm cells and show signs of degeneration. The endosperm cells appear at this time to have protoplasmic contents only, but the whole tissue of the relatively much enlarged nucellus is densely packed with starch. The results here given agree with those recently published by Campbell, for this form up to the sixteen-nucleate stage of the embryo-sac. But he finds two synergidæ and interprets the group of eight nuclei as probably antipodals, which he thinks separate again later. He also apparently interprets as part of the embryo the mass of endosperm cells which finally fill most of the embryo-sac and therefore concludes that there is no endosperm.

*A Contribution to a Knowledge of the Organogeny of the Flower and of the Embryology of the Caprifoliaceæ:* By Nellie P. Hewins.

A study of the embryology of *Viburnum prunifolium* is interesting because the ovules of two of the locules of the tricarpellary ovary early become aborted, while the single ovule of the remaining locule develops normally. The functional ovule which occupies the largest locule attains the anatropous condition before the abortive ovules, from three to five in number, in each of the smaller locules, begin their development. The abortive ovules never become anatropous because of the mechanical conditions arising from lack of space in the locules, which are soon filled by the developing nucelli. The archesporial cell of the abortive ovules either divides to form two megaspores, each of which by successive divisions forms eight nuclei, or else it forms the embryo-sac directly, which in its completed state contains sixteen nuclei. The nuclei are similar in appearance and fail to become differentiated and arranged according to the usual plan of embryo-sacs. These abortive embryo-sacs persist until after fertilization, when they begin to disintegrate. The archesporial cell of the functional ovules divides to form two megaspores, the lower of which usually enlarges to become the embryo-sac. The polar nuclei fuse before anthesis. The antipodal apparatus, which consists of three large cells, increases in size after the formation of the endosperm nucleus until the differentiation of the egg apparatus, when it begins to disintegrate. The nucellar tissue, small in amount, disappears as the embryo-sac develops. The endosperm nucleus divides rapidly, after fertilization, by free-cell division. A bulky endosperm is soon formed and is surrounded by the integument; integumental cells infringing upon the endosperm constitute, as in certain other gamopetalæ, a tapetum, which does not disintegrate. An accumulation of food near the embryo is to be noted.

*On the supposed Polymorphism of Eremosphœra viridis:* By G. T. MOORE.

This unicellular alga has been the subject of considerable speculation as to its life history and consequent systematic position. De Bary who first described it, thought it might be a desmid, while De Wildeman believed it was more probably a zygospore than a desmid itself. De Toni suggested that *Eremosphœra* was nothing more than a prothallial condition of some fern, and Chodat, one of the most recent observers of this plant, has made out a remarkable case of polymorphism; finding stages resembling *Palmella*, *Schizochlamya*, *Centrosphœra* and other genera, in addition to the formation of zoospores. The author of the present paper has attempted, by means of pure cultures, to demonstrate the true affinities of the plant and after studies covering several years, comes to the conclusion that *Eremosphœra* has no other method of reproduction than that of simple division, and that it cannot be related to any of the numerous genera it has been supposed to resemble. The paper will be published in full in the *Botanical Gazette*.

*Note on Arceüthobiüm:* By HERMANN VON SCHRENK.

The speaker described the method of seed distribution of these mistletoes, and the germination of the seed. Some large brooms formed by *Arceüthobium pusillum* on the black spruce were shown, and the occurrence of this species on the red spruce in the southern Adirondacks was reported.

*The Origin of the Tannin in Galls:* By HENRY KRAEMER.

In presenting some notes on the origin of tannin in galls the author limits his observations to examinations of the common 'ink ball' or 'oak-gall' which is produced on *Quercus coccinea* Wang, and *Q. imbricaria* Michx, probably by *Cynips aciculata* O. S. The galls are nearly globular in shape and

mottled with a yellowish or greenish brown. When they fall from the tree the cell contents (besides the organized contents) are made up largely of starch grains. With the development of the larva certain changes are observed in the cell contents. If the galls are placed in solutions of copper acetate (7 per cent.) and allowed to remain for several weeks or months, there separates in the parenchyma cells of the middle zone yellowish crystals or crystalline masses, which may be lens-shaped, star-shaped or fan-shaped, much resembling the different carbohydrates as hesperidin, inulin, etc., which separate in certain plant cells when specimens are placed in alcohol. They are insoluble in water, alcohol, glycerin or chloral solutions. The appearance, reactions and a comparison with copper gallate crystals lead to the conclusion that they are of this composition. When the winged insect has developed, specimens which have been treated with copper acetate solutions show in the parenchyma cells numerous brownish-red tannin masses to which may be adhering some yellowish-brown crystals of gallic acid. The gallic acid appears to be formed at the expense of the starch in the gall during the chrysalis stage of the insect. With the development of the winged insect this then is changed (by simple condensation of two molecules of gallic acid with the loss of one molecule of water) to tannic acid.

*A New Species-Hybrid, Salsify:* By B. D. Halsted.

*Tragopogon*, a rather large genus of the Chicory family has two species in the flora of the United States, namely, *T. porrifolius* cultivated for its roots as the 'oyster plant' and a wild species the *T. pratensis* L. The cultivated species is in many ways very different from the wild form, being larger, but most strikingly in the heads of flowers. The *T. porrifolius* has purple corollas, while the *T. pratensis* has yellow and much smaller flowers. The hybrid obtained under garden culture is a close average between the two plants as to size, style of branching and the like, while the flowers are of a peculiar rose color. Perhaps the most interesting feature of the hybrid plants is their great vigor, they blooming profusely after the parent types are out of season and even dead and gone. The number of seeds produced in each head is small in the hybrids, not more than four usually, and a small fraction of the number in the heads of the parent. The individual seeds, however, in the hybrid are much larger than in the true *porrifolius* the larger of the parents. The hope of getting greater vigor of plant and size of root, with possibly a diminished tendency to disease in the hybrid than now found in the old garden form is fully sustained for the first year. Several photographs were shown of flower, fruit, etc.

*The Development of the Ovule in Delphinium exaltatum Ait.:* By Louise B. Dunn.

The gynœcium of *Delphinium* consists normally of three separate carpels, each bearing two rows of anatropous ovules; the development of the ovule as far as determined was the usual angiosperm type. Some of the earlier stages of the embryo-sac were missed. The archesporial cell is one or two layers below the epidermis of the nucellus. The integuments arise first as two annular thickenings around the nucellus, but as the ovule becomes anatropous the integument appears single. The cells of the embryo-sac divide—until they number eight, and the endosperm nucleus is regularly formed by a fusion of two nuclei, one from each pole. The three gourd-shaped antipodal cells are unusually large before fertilization; as in *Aconitum* and others of the *Ranunculaceæ* they seem active from the appearance of their cytoplasm and the staining of the surrounding cells; mitosis

also occurs in them sometimes. It is probable they have some physiological importance in transferring food from the chalazal portion of ovule to the embryo-sac, especially after fertilization, to the growing endosperm tissue. They persist until the embryo is fully formed and do not elongate (as in *Aconitum*) or multiply, but show no signs of degeneration even in the seed. The embryo is very small with heart-shaped cotyledons, and a hypocotyl about one-tenth their length. The suspensor is short, probably only one cell long. The endosperm tissue fills the entire embryo-sac, and is full of oil. The only interesting feature of the ovule development in *Delphinium* seems to be the added arguments in favor of regarding the antipodals as of present physiological use, and not as mere degenerating evidences of a tendency to produce spores in tetrads, or as a partial and functional homologue of the prothallus.

*An Attempted New Method of Producing Zygospores in Rhizopus nigricans:* By LOUISE B. DUNN.

The method consisted in cultivating spores of stock material of *Rhizopus* on a solid nutrient substance in test tubes. The stock material was the sporangial form, and usually produced zygospores in about a month when sown on sterilized bread. But on a mixture of Pfeffer's nutrient solution and enough gelatine to make it stiff at room temperature, the zygospores were produced in from 6 to 10 days. Trial cultures were also made in test tubes kept at 10° C. and in Petri dishes at room temperature, using the mixture as above; in Pfeffer's solution without the gelatine and on agar-agar. None of these cultures was successful, as only sporangia were formed.

This rapid production of the zygospores could not always be controlled, averaging three times out of five. Experiments to force zygospore formation in wild *Rhizopus* or *Mucor* have not been successful as yet, but it is hoped that future cultures may determine more definitely whether the results are due to confined space and lack of oxygen, to temperature conditions or to nutrient substance used.

*The Composition of Endosperm and Milk of the Cocoanut:* By J. E. KIRKWOOD and WILLIAM J. GIES.

The authors supplemented the report of their work previously given before the New York Academy of Sciences (SCIENCE, 11, 12; 951, 1900), by presenting the results of later quantitative analyses: The following figures represent the average general composition of the endosperm: Water, 46%; solids, 54%. Of the latter 98.1% is organic and 1.9% inorganic; 43.4% is fat and 21.9% 'crude fiber.' The fresh endosperm contains 0.75% of nitrogen, which is equivalent to about 4.7% of 'albuminoid.' It is probable, however, that much of the nitrogen found exists in the form of 'extractives.' General analysis of the milk gave the following average data: Water, 95.3%; solids, 4.7%. Of the latter 88.5% is organic; 11.5% inorganic. Three dozen determinations of gross relationships gave the following average weights and percentages:

Weight of whole nut, 610 grams.
Integument, 170 grams = 27.9%.
Endosperm, 333 grams = 54.5%.
Milk, 107 grams = 17.6%.

The volume of the milk averaged 105 c.c.

*When Increase in Thickness begins in our Trees:* By GEO. T. HASTINGS. Presented by W. W. ROWLEE.

As far as could be ascertained no special attention has been given to the time when increase in thickness takes place in our trees. One finds only such general statements as this.* "The inner portion of any one annual ring . . . is formed in the spring; while the outer portion . . .

* Sachs, 'Physiology of Plants,' 1887, pp. 162.

has arisen towards the conclusion of the period of wood-forming activity." It was found that in the broad-leaved trees examined no increase in thickness took place until the buds had opened and the first leaves expanded; that the first formation of new wood was in the neighborhood of the terminal bud; that the first growth was not continuous around the stem, but of vessels and tracheids in irregular groups; that the growth was continued gradually from the one-year twig to the two- and three-year twigs; and that when the new wood begins to form on five- and six-year twigs the process becomes very rapid, seeming as if at that time growth began simultaneously over the whole tree. Growth usually begins and extends more rapidly on the upper more exposed limbs sometimes a week before any sign of growth can be seen on the lower limbs. In the pine an apparent exception was found, for increase in thickness began on two- and three-year twigs before it began on one-year twigs and before the buds had opened. By the time the buds were well opened the growth had extended from the terminal shoot down the trunk and growth was just beginning on the lower branches. This seems to be due to the leaves remaining on the twig for two or three years. In the hemlock, which holds its leaves for six or seven years, the growth, when examined about the end of May, was greatest on six-year twigs and decreased up to the one-year twigs where the growth was slight. On one of the deciduous Gymnosperms, the bald cypress (*Taxodium distichum*), the conditions seem to be as in the broad-leaved, deciduous trees; no growth in thickness begins till the leaves are expanded, and then it begins at the younger branches and extends back to the older ones.

*On the Assimilation of some Organic Substances by Plants:* By J. F. CLARK.

*The Rheotropism of Roots:* By F. C. NEWCOMBE.

*North American Sordariaceæ:* By DAVID GRIFFITHS.

*The Development of the Egg and Fertilization of Pinus Strobus:* By MARGARET C. FERGUSON.

*Nuclear Division in the Hepaticæ:* By B. M. DAVIS.

*The History of the Bulbils of Lysimachia terrestris L.:* By D. T. MACDOUGAL.

*Observation on Root Hairs:* By W. J. BEAL.

The root hairs of *Agrostemma Githago* L. and *Lilene notiflora* L. arise in vertical rows of epidermal cells, and those of the former are always extensions of the apical end, while they arise in the middle of cells in other species. Great variations in size and form were found, and septate hairs were seen on Chenopodium hybridum. Root hairs are extremely sensitive to changes of temperature and moisture.

D. T. MACDOUGAL,
*Secretary.*

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## *THE FAITH OF SCIENCE.**

IT has been said that each man has one thing to say, and that when he speaks twice he repeats the second time what he said the first. I hope that the saying is not wholly true; and yet I fear that in my case there is a grain of truth in it. I was invited to speak a year ago to the Graduates' Club, and I suspect that I then said much that I am always tempted to say to graduate students. However, as your Dean has, for lack of better available material, invited me to address you at this your first meeting of the year, I must say something; and so I shall take down again the old fiddle, and give you what some of you will recognize as merely a variation upon the old tune.

* An address before the Graduate School of the University of Pennsylvania.