WHAT COMES FROM WHAT*

This pamphlet in a series of 41 diagrams modestly attempts to show the relationships and development of all forms of life. The author claims simply "to set forth the opinions of specialists as they have been gathered a little here and a little there." Diagram 1, beginning with *Hydrogenomonas*, shows by arrows the derivation of the nitrobacteria and from them of the flagellates which in turn give rise to the various groups of algae and protozoans. Diagram 2 completes the algae and leads to the mosses in one direction and to the sponges and coelenterates in another. There follow ten diagrams tracing the plant groups up to the *Asterales*, where fifty of the genera are worked out. The remaining diagrams trace the development of animals up to man.

The tables are rather difficult to use as there is but little to show how they are connected to each other. With their maze of lines and scientific names the diagrams can be of little value to any except scientists. The author realizing this has given below each a simple description, the character of which can best be shown by a few quotations: "When the naked seeds of the Gymnosperms clothed themselves with skins or otherwise they became Angiosperms." "It is believed that the fins of fishes, paddling on muddy shores, became feet."—G.T.H.

PROCEEDINGS OF THE CLUB

Meeting of March 13, 1923

The meeting was held at the American Museum of Natural History. The program consisted of an illustrated lecture by Dr. Ralph C. Benedict on "Variation in *Nephrolepis*—its possible Significance." An abstract furnished by the speaker follows:

Variation in *Nephrolepis*, considered as a process, may at present be judged only by its products, the different species and varieties. According to the multiplicity of these, modi-

* What Comes from What or the Relationships of Animals and Plants. Charles L. Abbott, Published by the Author, 600 Ivy St., St. Paul, Minn. 48 pages, 41 diagrams. $1.00.

fications in the germ plasm must take place very frequently. The problem of describing all these multifarious types is most extensive and calls at first for descriptive treatment before any thoroughgoing attempt is made to work out their possible mode of origin through experiment or cell study. While the general run of papers on variation in most plants have to deal with one or two new and undescribed types, the investigator of *Nephrolepis* meets the problem of differentiating and describing scores, even hundreds of new sports. Some of these new types receive the recognition of a florist's name and are likely to be preserved but many do not have the qualities required for horticulture and their only chance of preservation lies in a scientific experimental collection. So many have been accumulated at the Brooklyn Botanic Garden that in the space available it is scarcely possible to do more than grow single plants of many of the most important and interesting varieties. As a matter of convenience, all *Nephrolepis* forms may be classified into four groups.

1. *Systematic species.* All the wild forms are once pinnate, tropical ferns, found in varying habitats and differing in details of habit, color, size, form, scaliness, shape of pinnae, shape of indusium, and other minutiae. The American species appear to number eight or nine, well distinguished on the bases of habitat and form characteristics. When Old World forms are also considered the classification is more complicated as several of the American forms occur also in Africa and Asia. Study of these wild types recognized as species is of special interest as a basis for comparison with the new forms continually appearing under conditions of cultivation.

2. *Bud variation in the Boston fern.* From a single variety discovered in cultivation twenty-five or thirty years ago, the Boston fern (*Nephrolepis exaltata bostoniensis*), there have arisen at least one hundred horticulturally named varieties by bud sporting. As many more have appeared which have not received any name. The majority of named types occurred as the result of progressive variation away from the Boston fern along four lines of sporting; viz., increased leaf division, dwarfing, ruffling, and cresting. Six primary sports embodying these four types of variation in different manifestation were followed by a group of secondary sports in which the same four lines of

mutation appeared in intensified form or in combination, and, later, third, fourth and even fifth degree sports carried the intensification of the basic variations to an apparent maximum condition. Variation in the reverse direction also occurs in which the progressive steps are reversed, though without the production usually of sports identical with any of those progressively developed. None of these sports produced fertile spores; reproduction and probably variation occurs in runners.

3. *Spore variation in a fertile type of N. exaltata.* (*N. exaltata fertilis*). One fertile variety has been found in the Boston fern series, although its exact origin is uncertain. Its spore progeny comprise mainly once pinnate forms like wild *exaltata*, and twice pinnate plants of the type of *fertilis*, but perhaps ten per cent present new forms differing in size, leaf cutting, growth habits, susceptibility to disease, etc. Most of this ten per cent of new types is sterile. From several of the fertile strains second generation cultures have been raised in which heredity of parent characteristics is predominant but which offer still further types of variants.

4. *Variation in species other than N. exaltata.* At least ten native species of *Nephrolepis* are in cultivation, especially in England. Several of these species have given rise to new forms under cultivation which parallel those already commented upon under the topic of bud variation of the Boston fern. Some of the same kinds of differences have arisen, though by spore reproduction. Of further interest is the fact that the same types of variation occur in other fern genera, both in cultivation and among wild plants, and the fact that many of the distinctions counted as valid for the separation of species among ferns may be found as bud variants in the Boston fern series.

Adjournment followed.

MARSHALL A. HOWE,
Secretary.

MEETING OF MARCH 28, 1923

The meeting of March 28 was held in the Museum of the New York Botanical Garden, beginning at 3:30 P.M. Twenty persons were present. President Richards occupied the chair.

The minutes of the meetings of February 28 and March 13 were read and approved.

The following were elected to membership:

Charles Carroll Greene, 181 Beebe Ave., Long Island City, N. Y.

Leland S. Smith, Alturas, Modoc Co., California.

Miss Rose Wald, 245 Lowery St., Long Island City, N. Y.

After the reading and discussion of a letter from Dr. Francis W. Pennell, it was voted to leave the matter of securing a Bibliographer to a special committee consisting of the President and Secretary.

The first paper of the scientific program was on "Onion Smut" by Mr. A. W. Blizzard. The speaker's abstract follows:

Spores of *Urocystis Cepulae* germinate immediately after maturity in onion decoction or onion agar. The first indication of germination is the putting forth of a spherical promycelium which varies in size. The promycelium soon buds off a varying number of mycelial threads, usually up to eight in number. These mycelial threads branch, and, by continued growth, a tuft of mycelium is soon produced about the germinating spore-ball. No sporidia are produced.

Mycelium of *U. Cepulae* was grown in pure culture on onion agar, and transferred to the following media: sterile bean, carrot, onion, and onion agar. A luxuriant growth was obtained in each case. Forty-eight hours after transfer, it appears as a fluffy, snow-white, little mycelial ball. In five to seven days, the mycelium has spread itself to the extent of a centimeter or more in diameter. At this time a characteristic wrinkling appears, which serves to distinguish the organism. The color is at first white, then gray. The culture may be transferred a number of times without losing vitality.

The cells of the mycelium of old cultures tend to round up and are easily broken apart. If these separate mycelial cells are placed on new onion agar or in onion decoction, each cell will germinate by sending out a branching mycelium, which, in turn, will produce a mass of mycelium. Thus each cell of the saprophytic mycelium may function as a spore. In this way the fungus maintains itself in the soil, by which process the soil is continually being re-infected, the mycelium growing saprophytically. Infection tests were made as follows: onion seeds were sterilized and placed in a sterile moist chamber. Ger-

minating seeds were then transferred to sterile soil in test tubes and pots. Mycelia from the cultures were introduced. Infection occurred in the greatest number of cases. In some pots every seedling was infected and produced spore pustules. Controls uninfected.

The mycelial cells from the beginning of germination are uni-nucleated (the saprophytic mycelial cells). The mycelial cells when broken apart are uni-nucleate and germinate as above described, producing a uni-nucleated mycelium. No fusion of any of the hyphal cells of the saprophytic mycelium occurs.

The parasitic mycelium in the host plant is intercellular, growing and spreading rapidly. Certain of the vegetative hyphae are uni-nucleate but as one follows the hyphae toward the sorus, bi-nucleate cells are found to predominate. Large-sized hyphae were observed to penetrate through several cells of the host. These are supposed to be special nutritive hyphae. Haustoria are rare. Those observed had penetrated the cell walls of the host plant and were clavate in form.

By continued branching and growth of the intercellular mycelia, the cells of the host plant are pushed apart or broken down. This is the beginning of the formation of the sorus. At this stage of development the mycelium of the fungus stains densely. All the mycelial cells of the young sorus are bi-nucleate. The first appearance of spore formation occurs among these hyphae rich in protoplasm. The spore begins by very rapid enlargement of one of the bi-nucleate cells. This growth is so rapid that the enlarging cell encroaches upon the neighboring hyphal cells from which it apparently now draws a portion of its sustenance. The surrounding cells are brought completely under the dominance of the young developing spore. As the spore cell enlarges, the functioning nurse cells adhere or fuse to its wall and become the sterile cells (pseudospores) about the fertile spore, the whole forming the spore-ball. At the beginning, the young spore contains two nuclei, which soon fuse. Thus the mature spore becomes uni-nucleated. By the rapid enlargement of the spore-balls, the sorus bursts the surrounding host tissue, which frees the spores.

The second paper was by Mr. S. A. Wingard on "A Yeast Disease of the Lima Bean." The following abstract was furnished by the speaker:

Examination in the fall of 1921 of diseased Lima beans from eastern and central Virginia revealed the presence of the vegetative cells, asci and ascospores of a yeast which later proved to be the organism responsible for the disease. The yeast proved to be a species of the genus Nematospora which was established by Peglion in 1901, but it differed in certain characters from the species previously described; therefore, the name *Nematospora Phaseoli* was proposed.

The disease occurs on the seed in the pod, causing numerous dark, sunken areas on the cotyledons. Infection occurs at any time during development, but the most severe damage results when infection takes place before the seed is half grown. Affected seeds vary from one tenth to the normal size. The disease has been found in ten counties in Virginia. The loss from the disease in severe cases amounts to as much as 60 per cent of the crop.

The organism grows well on beerwort agar and also on vegetable material such as beet, carrot, parsnip, turnip, seed potato and Irish potato. The optimum temperature is about 30 degrees C.

The vegetative stage of the organism is composed of the typical yeast cells but in some cases a mycelium is produced. Asci and ascospores are produced in great numbers in the lesions on the Lima bean seed and also on favorable culture media. The asci are cylindrical with rounded ends, 60–80 × 10 microns; ascospores 8, in two groups of 4, 40–46 × 2.5–3 microns, slender, 1-septate, apex acute, base extended into a slender, non-motile whip, which averages about one and one fourth times the spore length.

After discussion, adjournment followed.

MARSHALL A. HOWE,
Secretary.

MEETING OF APRIL 10, 1923

The meeting of the above date was held at the American Museum of Natural History, beginning at 8:15 P.M. President Richards occupied the chair. Fourteen persons were present.

The program consisted of an illustrated lecture on "Shade Trees" by Dr. W. A. Murrill. The speaker discussed several

phases of this rather comprehensive subject, including the value of shade trees and their selection, arrangement, planting, protection, and care. The slides used in illustrating his remarks were largely made from photographs taken by him on his travels. Although lawn and park trees were mentioned more than once, attention was given chiefly to trees adapted to city streets, such as the red oak, the plane-tree, and the Norway maple. A bulletin on this subject, prepared by Dr. Murrill, was published and distributed several years ago by Cornell University.

Adjournment followed.

MARSHALL A. HOWE,
Secretary.

NEWS NOTES

The first forestry camp for Boy Scouts has been organized this summer in connection with the large group of scout camps on the Kahnowahke Lakes in Harriman Park. Here some forty boys have lived in the dense woods on the side of Wildcat Mountain, receiving instruction on trees and forestry. Below the tents is Spruce Pond with a narrow border of sphagnum bog with its pitcher plants, sun-dews and heaths, and at one side a tangle of rhododendron. Mr. George E. French of the Syracuse College of Forestry is director of the camp with Professor S. N. Spring of Cornell in charge of instruction and Mr. B. T. B. Hyde as supervising Director.