

XI. PHYTOBIOLOGY, the study of the immediate relationship of plants to their environment. It views plants not only as living, but also as plastic beings, moulded in the past and in the present by their surroundings, and to some extent reciprocally affecting them. It has primarily to do with *adaptation*, or fitting of form and structure to function. When it traces the structural history of an adapted part, it employs morphology, which is thus inseparably connected with it; and where it considers that history causatively or dynamically, it approaches philosophical botany. It investigates the use or meaning of form, color, size, position, and the like in plants and their parts. It is therefore the most living and generally interesting department of botany, and is destined to expand enormously in the future. The relationship to it of the local botanist has been indicated already, and will now be traced more fully.

II.—THE NATURE AND METHODS OF PHYTOBIOLOGICAL STUDY.

Phytobiology, as we have seen, is the study of adaptations, that is of the arrangements by which plants and their parts are brought into responsive contact with external influences. It investigates in all degrees the effects upon plants of the external phenomena of the world, that is, force in all its forms and matter in its various states; and as well considers the utilization of these by plants in their organic necessities, nutrition, locomotion, protection, reproduction, competition. From the most general relationships of influences and necessities, resulting in the formation of the primary organs of plants, it proceeds through all grades to the most minute analysis of details, explaining the most superficial characteristics of form, size, color, position.

The study of the re-action of the plant to the conditions of its environment would be comparatively simple were we concerned but with the present, and a completely plastic plant. But in fact all of the complexities of relationship of the past, the resultant effects of which we are accustomed to designate *heredity*, together with a little-understood *internal constitution*, of which variation is the most important phase, and which may or may not be included with heredity,—these two impose great restrictions upon the operation of the present environment. Every plant, and every part of it, represent the resultant of an enormously complex inter-operation of the influences of these three conditions—heredity, internal constitution and present environment, and each of these plants and its parts is in a state of unstable equilibrium, and readily alterable through movements in the

environment. The delimitation of the effects of these influences upon plants is the ideal of phytobiology in its most philosophical phases.

Viewed in this light, phytobiology certainly does seem the most difficult of the departments of botany. So in its higher branches it is, but like all other branches of science, it has three grades: first, the observation of facts; secondly, the correct interpretation of the immediate meaning of these; third, the composition of knowledge thus gained into the principles of a science. It is in the first and second, but especially in the first, that the local botanist can render invaluable service. The first great need of phytobiology, that upon which its progress depends, is accurate observation of fact in the field; for it must be remembered that it deals with living things in action and the laboratory or herbarium can help but little. Field study of how plants behave in relationship to the external world is the great aim which the local botanist should keep clearly before him.

Limiting ourselves now to the subject from the point of view of the local botanists, we have to consider first of all certain general principles.

The first pre-requisite for active work in phytobiology is an acquaintance with what has already been learned, and some idea of the problems to be studied. The best single work upon the subject is unquestionably the admirable "*Pflanzenleben*," by Kerner von Marilaun, of course in German, as are the other very important works by Goebel, Schimper, Warming, Stahl, Kihlman, and others. Unfortunately there is no such work in English, and it is to supply in some measure this want for Acadian students, that a series of articles upon the subject will follow the present one.

The other great pre-requisite is a proper training in the three scientific faculties—observation, experiment, judgment.

We have already but just referred to field study, and the local botanist's opportunities for it. It cannot be emphasized too often, nor too strongly, that just here is his true field, and that his greatest triumphs will come from his observation of nature in action. It is under the extreme conditions of nature that her adaptations are best seen, and in all seasons and times and weathers