

THE DEPARTMENT OF THE AMERICAN ASSOCIATION OF COLLEGES OF PHARMACY

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DEPARTMENT.

THE INTRODUCTORY COURSE IN BOTANY.*

BY H. B. SIFTON.¹

"Shall we employ a botanist with no training in pharmacy to teach introductory courses in botany to students of pharmacy? The Editor believes there can be but one answer to this question, and that is 'Yes,' provided the instructor is sympathetic with pharmaceutical education. Professor H. B. Sifton, whose paper on 'The Introductory Course in Botany' follows, is one of these scientists who can appreciate the viewpoint of the professional man and therefore can teach a fundamental course with illustrative material from the field that the student plans to enter. His paper is a very timely one and its careful perusal will be beneficial to all those engaged in the field of pharmaceutical botany."—C. B. JORDAN, *Editor*.

As one whose small knowledge of things pharmaceutical has been entirely self-taught, I have accepted with some diffidence the honor you have done me in inviting me to discuss before you the teaching of Botany to students in Pharmacy. On the contrary, I accept with alacrity the opportunity thus afforded of acknowledging the kindness and help invariably extended to me by members of your organization. Some years ago, when planning my first course for Pharmacy students, I paid a brief visit to a number of Colleges of Pharmacy in the United States, in order not to be too much out of step in my teaching. On that occasion I was received with such kindly courtesy that it was with a tinge of regret that I found that the time had come to return to earth and ordinary routine.

In planning such a course as we are to discuss, the first necessity is to outline in our own minds a precise concept of what useful additions the course, if successful, may make to the stock-in-trade with which we equip our students before abandoning them to the ruthless competition of the modern world. After that, it merely remains for each individual teacher to outline a mode of procedure by which he, with his peculiarities of mind and training, may best accomplish the object in view. I venture to say that if a sort of botanical millenium were to arrive, and each of us were in some miraculous way to become a perfect teacher with a perfect course, one might circle the globe without finding two courses identically the same, for personalities differ, and the course that does not reflect the personality of the teacher cannot be perfect.

Perhaps we may profitably spend a few moments considering the former of our two problems. What should we teachers of Pharmaceutical Botany aim to give our students? There are certain bits of botanical knowledge that are useful as tools to the pharmacist, knowledge without which he cannot intelligently read the literature of pharmacy, or discuss pharmaceutical problems. He must, to select an example, appreciate the meaning of the morphological and systematic botanical terms used in describing vegetable drugs. If you will pardon a personal allusion,

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I may say in passing that when planning our course, I systematically covered a number of standard works on Pharmacognosy, listing the botanical terms they utilized, and was rather pleased to find it unnecessary to add to those we had been using in our general botanical courses.

Before this audience it would be mere presumption on my part to spend time discussing further the details that, as every pharmacist knows, should be included in the course, for use in more specialized courses to follow. One point in this connection has, however, intruded itself on my attention, and I wish to suggest it for your consideration. All these facts and details are a part of the senior courses, and could be acquired by the student in his study of pharmacognosy, physiology and microbiology, were there no introductory course in botany at all. If they constitute the sole, or even the main reason for the existence of the botany course, I suggest for your consideration the question whether the course might not profitably be abolished, the time at present devoted to it, to be allotted to these other subjects.

Personally, I should be very sorry to see such action taken, for while fully cognizant of the importance of the details we have been considering, I am convinced that the greater value of the course, the real reason for its existence, is to be found elsewhere. It lies in the training in scientific thinking and scientific methods of procedure, which, if properly imparted, will be an invaluable aid to the student in his more advanced studies and throughout his life.

If this is admitted, consideration must be devoted, when planning the botany course, to two further aspects of our problem. What, exactly, do we mean by scientific methods, and how may they best be inculcated? To be a scientist, one must add to the gifts with which Nature has provided him, three things that we may help him to acquire:

- (1) Facility in ascertaining, evaluating and logically arranging the discoveries of earlier investigators.
- (2) The faculty of seeing clearly and exactly any additional facts brought to light during his own work.
- (3) The ability to record his findings with precise accuracy of detail for the use of future students of his subject.

Keeping these principles constantly before him, and not forgetting to include those details that will be useful in the student's future work, each teacher may plan his own soundly scientific course. There will be differences of detail, arrangement and emphasis, depending on the personality and training of the teacher. These differences matter little in comparison with the desirable features that would be lost were all of us to attempt to subject ourselves to a common standardized curriculum, and set of rules.

In planning the course, certain general principles should be observed. It should have unity. The arrangement of material should be such that the student can realize the essential unity of plan underlying the plant kingdom, and reason from one part to another, thus minimizing the amount of deadening memorization. It should be interesting, not through the artificial injection of bizarre forms, and experiments otherwise unnecessary, but with a unified interest due to logical arrangement and clear exposition. In this way a stimulus to scientific reasoning and imagination is achieved. It should be difficult. If it is made easy the student

will have no incentive to exercise his talents, they will not be developed, and the course will be relatively useless. The student should be led to exercise his own initiative and depend on his own powers of reasoning and observation, and in laboratory work absolute accuracy, even in the smallest and seemingly most unimportant details should be insisted on.

Perhaps I may be forgiven if I allude briefly to our own course in elaboration of the above paragraph. In it, the aspects emphasized are morphology, including anatomy and histology, and systematic botany. The unifying interest is provided by the concepts of evolution, physiological function and ecology.

The course begins with an introduction to the unspecialized cell. It is presented as a living creature to which the functions of life are necessary. Its form and structure are studied. By their own experiments, and from the accounts of work of earlier investigators, the students study to understand its life processes—the intake of water and food materials, turgor, plasmolysis, food manufacture, storage, digestion, respiration, assimilation and growth, excretion and reproduction by mitosis.

In the rest of the course they obtain a picture of the plant kingdom composed of these cells, which specialize and coöperate more and more as we pass from lower to higher plants. Blue-green algæ and bacteria are even more simple than the cells originally studied, but show some development from lower to higher forms. Green algæ illustrate the development of sex and the reduction division, and the progress of specialization from simple, animal-like, unicellular plants to the point where multicellular plants replace cell colonies. In red and brown algæ are found somewhat more complex developments.

Fungi have modifications enabling them to follow their source of food supply. Mosses and liverworts show various primitive methods of coping with dry land conditions. Pteridophytes have gone much further, developing large sporophytes with highly specialized organs and tissues which in turn are studied in detail. Gymnosperms again illustrate many advances, and in Angiosperms we have the acme of ecological specialization, with corms, bulbs, rhizomes, fruits, variously modified roots and leaves, hairs, fibres, stone cells and the other specializations so valuable in pharmacognosy. After studying in detail the parts of a complete hypogynous flower in connection with an Angiosperm life history, the numbers and arrangement of parts in various families are investigated in the laboratory, in supposed phylogenetic order and with ecological adaptations in mind. Other organs and their tissues are studied similarly.

In the laboratory the material studied is for the most part such as has been treated generally in the lectures, the students being encouraged to see and record details additional to those previously mentioned. Some botanists have concluded that the time spent on laboratory drawings is largely wasted, and have overcome this supposed weakness by presenting their students with more or less conventionalized drawings to label. With this we are not in agreement. Botany and the allied subjects present a unique opportunity for training in precision of observation and record, in that no two plants or plant parts are found to be exactly alike. This opportunity is lost unless accurate drawings are insisted on.

To train a student to draw with scientific rather than artistic accuracy is often most difficult. His impulse, on being presented with a section for example,

is to make a record of the impression he obtains from it, rather than a scientifically accurate record of its details. For illustration two drawings from a transverse section of *Hydrastis* root will serve. Figure 1 (A) is a type of drawing to be persistently discouraged. The student, in attempting to reproduce artistically his impression of the section, draws immense numbers of irregular ovals. If he is an artist, which few are, he succeeds in his aim, without accurately recording, and probably without accurately seeing, anything. After perhaps the twentieth cortical cell has been drawn, he has hypnotized himself into a sort of pleasant Nirvana where his mind lies quiescent while his hand automatically proceeds, making oval after oval until the space is filled. From the standpoint of scientific training or mental improvement, fully ninety per cent of his time has been agreeably and industriously wasted. Figure 1 (B) is a drawing of much greater value—an outline diagram, as nearly like a camera lucida outline of that particular section as he can possibly make it, followed by equally accurate, enlarged drawings of a few cells carefully selected from each particular tissue. The second record, conscientiously done, requires as much time as is ordinarily devoted to the first, but every second of that time has added to his capacity for accurate observation and record, so that by the time his course is finished, he has acquired a portion at least, of the patience, care and accuracy so essential to real success in his profession.

In conclusion, our discussion may be summarized by saying that in the course in botany we should aim, not only to supply necessary facts to those who may specialize in pharmacognosy or allied subjects, but also to provide a training for all, in methods of thought and action that will increase their usefulness in whatever branch of their profession their lot may be cast.

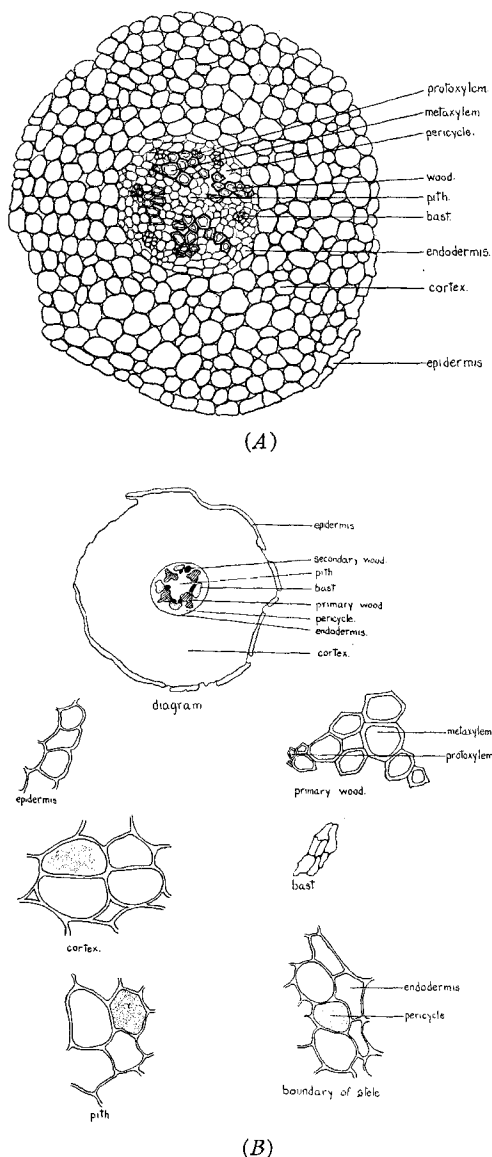


Fig. 1.—Two types of record from a transverse section of the root of *Hydrastis canadensis*.

(A) A type of record to be discouraged.

(B) A more satisfactory drawing from the same section.