TEACHING A "READING" TEXTBOOK OF BOTANY.

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The title of this article, which no doubt impresses one peculiarly, refers to a certain type of textbook in use in secondary schools. The material in these books is usually presented in a psychological, rather than in the less interesting and logical manner. To many mature laymen, this represents an ideal way, the subject seemingly being easily mastered by a series of scarcely perceptible gradations. An important scientific term is scattered here and there, and at least until the student has progressed, say a half year, he is not troubled with those brazen-faced classifications which were the nightmare of earlier students in secondary science.

This type of book is just what the title implies—something which one, without some knowledge of botany and desiring some, can sit down and acquire without extraordinary exertion. Unless the above be construed as such, I have no criticism to offer upon this type of book, as I feel its non-justification may only be sought for after we have had more experience with the elementary science movement, when we may find that the high-school student's intellect is not as limited as sometimes we assume, and quite capable of acquiring logically a training in scientific method. The gist of the latter statement is, therefore, that our science courses must remain largely informational for a time, for which this type of book is seen to be well adapted. To the teacher whose enthusiasm is only too often killed by the "drill" process, it offers, as may be seen in the following, the satisfactory fulfillment of the old master's injunction, "Study Nature, not books."

I shall endeavor, as briefly as possible, to sketch the application as I have found it practicable, it being assumed that an ideally short and comprehensive method of keeping a laboratory notebook has been adopted. To begin with, no demonstration as described in the textbook is left merely described—it is already reduced to lowest terms. Right away up go hands in horror, "Where have we the time to do all of this?"—the work anticipated. Only to a limited extent does the ability to fulfill the program depend on the climate of environment surrounding the school. In the latter, if it has no greenhouse, may always be found some place where the few requisite plants will thrive. Often the teacher complicates the problem by insisting on a

tropical plant which may be indicated by the text, when a more homely and "almost as good" substitute grows near the school premises. Then with the formality which is now *passé*, the teacher refrains from requiring the students to collect commonplace material required, or even hesitates to accept it if offered from the pupil's home. Or, those thoroughly essential components of the botany course—field trips or visits to local conservatories, the year around—are neither taken nor utilized to collect material when so many willing aides may be found. Finally, odds and ends of time during periods of instruction—the technic once acquired—can be used.

To make the above fit in as it should, the teacher will make a comprehensive survey of his textbook, and endeavor to maintain a plastic, adaptable mind with regard to material the season may indicate. It will be remembered that part of the pupil's education is training in methods of study; consequently, when it is seen that such real application is necessary in certain parts of the book in order that the ground be covered, it should be strictly required. The teacher should be able to indicate, from his knowledge of the psychological processes, the manner in which the reading should be done at home. My own method for the latter is to take a few minutes a day for a month or two, in endeavoring to guide their train of thought along associated lines (for it will be remembered that the reading type of botanical textbook has not the skeleton of a college type), and where home reading is given, endeavor to point out by not too searching questions, the paths they should follow.

Laboratory work is most successfully given every day with wonderfully "sticking" results for the whole subject, as one may test for himself. If, for example, the types of parts of leaves are brought out in the subject of the day's lesson, they are shown the student and not always the same volunteer names them, or the teacher makes a rough sketch on the blackboard. Then the whole class with the material before them, draws and appropriately labels them. Or the description, as given in the textbook, may be read aloud jointly, or singly, with the teacher giving a synchronized demonstration.

The technic of presenting the matter of microscopic structures is more complicated. In my opinion, usually a great deal of microscopical work is far from beneficial as subtracting from the great whole. Yet we may continue our policy of seeing in a way that even the poorly equipped country high

school with its one or two decrepit microscopes can handle. For example, consider the structure of a leaf. Sections may be prepared with the hand sectioning razor, and successively seen by the members of the class, who, in the meantime may copy the illustration given in the textbook of the same object—the latter in itself a valuable experience. Many plants give all essential details even with the dissecting microscope, of which there are usually more in the schools.

The demonstrations of the physical and chemical phenomena associated with plant life are things which adolescents easily hold—especially if strikingly given—yet no complicated apparatus is necessary. As indicated above, the subject matter is read slowly or brokenly, as the demonstration proceeds, and the matter is wound up by the pupils making a free hand sketch of the apparatus. It is wise to let botany be the outlet for every other talent of the pupil which can be made to bring to bear upon it.

A happy simplification of the teacher's work can be found in the results from pursuits along these lines. High-school laboratories are often littered with a variety of things, usually well-meaning apparatus which has passed its day, or whose manipulation requires more time than can be given. Without endeavoring to furnish a list of required apparatus and supplies it may be said that it is astonishing how little of these are necessary to balance with what, at our present stage, we think the pupil should have, and still have him see the knowledge given in the reading textbook.

A few suggestions as to what I have found worth while. Leaves are everywhere—they may be dried and pressed for future needs. A hardy aquarium plant, easily obtainable at pet stores or conservatories is *Elodea*, excellent for the photosynthesis experiment, whose leaves may also be made to show cell structure and protoplasm. *Amaryllis*, a common household plant, is splendid for epidermal structures, cross section of leaf, while its subterranean parts when split lengthwise show admirably the structure of the root. Preserved, it may be used year in and out. Radish seedlings, sprouted on moist filter paper, in a Petri dish, are probably most convenient for root hairs. The screw pine, *Pandanus*, is excellent for stomata, which may be seen under the ordinary dissecting microscope. Lilac buds may be produced any time. Blocks of locust poles, four inches long, cut in three planes, with a portion of bark still attached,

show conveniently a woody stem, while pieces of corn stalks, preserved or raised in the laboratory, are handy for monocotyls. The less experienced teacher does well to have on hand two or three laboratory manuals as provocative of ideas.

Unforeseen interruptions like those of late tend to demoralize the school year, often cutting down the ground to be covered, but in seeing the botany course through, the great groups of plants and their subdivisions must not be forgotten, some definite knowledge must be given (not necessarily of reproductive phases below seed plants), and some definite mental picture must be formed as to what are, with their importance to life and relation to one another, the algae, fungi, lichens, bacteria, mosses, ferns, conifers, and palms, neglecting which high-school botany has scarce continued the knowledge previously imparted through Nature study and geography.

HORNER'S METHOD.

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Have you ever asked why asylums were filled
With people whose sweet dispositions were killed?
It's because of one man, with a Mother Goose name,
Who invented a system to drive folks insane.
That's Horner.

Have you ever figured six sheets and a half
And sighed with relief that so much work was passed,
Then had the first figure point at you in glee,
Because you had put down a four for a three?
That's Horner.

Have you ever wished to commit suicide,
From this vale of numbers forever to glide,
When you've worked and you've cursed for an hour or more,
And the problem is not as correct as before?
That's Horner.

Have you ever gotten the answer at last,
Then turned to the page where last judgment is passed,
"Just to see if its right"—though there's no doubt at all—
And found you're as close as ping-pong to baseball?
That's Horner.

Have you ever wished that you just had the man
Who maliciously thought of that dastardly plan?
Hemp or bullets would be far too good for the beast,
We would have him work 10,000 problems at least.
That's Horner.