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BOTANICAL TEACHING[1]

I. ON THE PREPARATION OF BOTANICAL TEACHERS

SOME months ago a suggestion was made that at this dinner we should ask ourselves the question: Why is it that with the enormous classes we are having in botany there is a marked dearth of properly trained men who can serve as instructors in colleges and universities?

In order to be sure that I was right in regard to such a dearth I wrote to something like a dozen of the professors of botany in prominent institutions in the country, making the inquiry whether they had noticed the same thing, and uniformly the answer was that there seems to be a shortage in the supply of material for instructors (in the college sense) and young men for other minor positions.

I think there is no lack of men who are ready to be professors of botany. I am very certain that there is no trouble here, but when a professor who knows what he wants asks for a man who can take up this work or that work as an instructor, the situation is quite different.

What becomes of the great number of students who are in our classes? The professor of botany in the University of Minnesota tells me that he has over 500 students in his beginning classes. In Nebraska we have about 350, and elsewhere I find essentially the same thing. Enormous classes are pursuing general botany, and

[1] From the stenographic report of oral addresses delivered at the conference on botanical teaching at the dinner for botanists, Minneapolis, December 29, 1910.

yet so few are going on and qualifying for even the minor teaching positions.

In talking this matter over recently with a clergyman, who is also a botanist, he said, "The truth is there is less real scholarship among students to-day than there used to be," and I think there is a grain of truth in his remark.

I stopped our professor of Greek the the other day and asked him what he thought of our botanical problem. He said, "It is just because the students have got into the way of taking nothing but first-year work. They take first-year Greek, and that is the end of it, first-year college Latin, first-year geology, first-year philosophy, first-year physics, first-year astronomy, and first year American history, and so on." There is a good deal of truth here too.

Here then is something to be thought of. Students in the universities are taking beginning work only, and botany suffers with all other subjects. As educators we should give serious consideration to this matter. It is not right that we should permit pupils to be taking these little educational bites of all kinds, and in any sequence; on the contrary they should be required to sit down to a good square educational meal taken in proper order.

It makes one sick at heart to witness what is actually going on in the universities under our very eyes. We spread out before the students the courses we have to offer, and in tempting phrase try to induce as many as possible to enter our classes. I am reminded of the proprietors of bazars who have trinkets for sale, and try to induce every passer-by to purchase, by loud insistence upon the advantages resulting from such a transaction. And the bewildered student is left without a guiding suggestion in the bulky catalogue. Oh, the folly and the cupidity and the cowardice of the system that bids the student make a wise choice, but gives him no guide! Had I the power I should certainly sweep out of existence all of the go-as-you-please arrangements in the universities, and I should substitute for them a logical and carefully selected sequence of studies.

There is no doubt that many young men turn from botany into various related subjects, as agronomy, horticulture, forestry, etc., and I have no complaint to make if they do; but these subjects do draw students away from scientific botany, and so reduce the number available for teachers.

Nearly every one of the professors to whom I sent inquiries referred to the low remuneration that comes to the young man who has fitted himself to be an instructor in botany in college or university. And no doubt this is a potent factor, and it is likely to turn away many of the best men from the teachers' ranks. The fact is that a bright young man looking to his life-work will be turned more or less this way or that way, as he sees that the world is ready to pay him for it. Now I dislike to have to say this; we like to think that the best men will go forward if they have to go with only a crust a day, and all that. There is very little truth in it, however. We ourselves go where we find employment and adequate remuneration. And so young men are lured away from botany with its low remuneration, leaving us too frequently only the poorer men.

Now we do not like to acknowledge this condition of things. We like to think that science is a sacred calling, something apart from business, and we do not like to acknowledge that a man who has the scientific spirit in him can possibly be turned aside by any thing like a salary. But botany is a business, and it is not sacred any more than selling shoes or editing a newspaper is sacred. And as most men

can succeed in more than one of several pursuits, so most men can succeed in botany if they take hold of it seriously. Here again we do not like to acknowledge the truth of this statement; we think that we are made of different kind of stuff. But I do not believe it for a moment. I have no doubt that some of us here might have been millionaires if we had gone into business. What I want to insist upon is this: that we look at this matter squarely, and not try to make out that we are a different kind of people, and made out of different material. We are not, and our business isn't any different; it isn't any more sacred. We must be candid in this matter and admit that our profession hasn't anything sacred in it; there is no sacred fire that must touch every man before he can be a botanist. There is nothing in this sentiment. As I said before, botany is comparable to the selling of shoes, or the running of a newspaper. Botany is not extraordinarily difficult, and it does not require geniuses; only just good ability and perseverance; that's all. So men who might have been botanists will continue to choose other vocations, and some others will choose to become botanists, and some of either will fail, and some will succeed, just as is always the case. Some men who might have become brilliant botanists will become brilliant business men instead. It has been said that "botanists are born and not made." Maybe they are, but if so, they are born with a multiplicity of other possibilities also.

Brethren, let us remember that we are quite like other men, and that with us the factor of remuneration cuts as great a figure as it does elsewhere in society, in the selection of a vocation.

Many of those to whom I wrote expressed doubts as to the wisdom and effectiveness of some of our teaching, and out of these doubts that have been passed along to me I obtain these suggestions:

There is some faulty elementary instruction; probably I should have said much faulty instruction. Again, we do not begin early enough in bending the human twig in the right direction to make a good botanist. There is a good deal of improper presentation. We too often try to offer "attractive" courses for the sake of drawing students into our work. And this is necessarily fatal to a scientific presentation. Some of my correspondents suggest that there are such persons as incompetent assistants who supervise our laboratories, and by their incompetence tend to drive away some men. Further, it has been suggested that probably there is nowadays too great a neglect of field work. It used to be that in vacation time the young botanist had something to think about, and something to do. He could go out in the woods on long botanical trips. He can not do this to-day if he is a mere laboratory man. He can not conveniently carry his microscope along with him. A vasculum is a great deal easier to carry than is a microscope, and far easier to handle. I think my correspondent was right: we have lost something of our hold on young men because we have nothing to substitute for the old-time field botany. You can not do laboratory work in vacation. Of course you can go to summer school, and sit down by the side of a lake and study some of the algæ found there, but even that doesn't compare favorably with the old-time tramping for miles and miles through the woods and swamps, with a vasculum slung over your shoulder.

Some of my correspondents suggested that there is too much narrow training nowadays. I think this probably comes rather close to some of us. We get hold of a bright young fellow after he has had a half year's work, or little more, and put him

into something that narrows him to a single line of work. He makes a good specialist, but he is too narrow for a botanist. He is far too narrow a man to be put in charge of classes in general botany.

Again, I think we set our requirements too high for the young teacher. We demand much more than is really necessary. We older men forget how very little we knew when we began teaching. We act as though we felt that men must be stuffed with every detail of technical knowledge before they are ready to be sent out as teachers. We want these men to be prepared all around, and well prepared, too. This is all right enough when you are thinking of specialists to fill positions calling for a particular preparation. But when the inquiry is made for a young man to be an instructor we should go back to our own experience. We did not know much, but we got on somehow, and our classes seemed to learn from us. Yet today we act as though we felt that we must send out young teachers who are perfect machines for any kind of botanical work. We act as though we were not sending out men with initiative and with ability.

Let me illustrate my meaning by an example. A few years ago the government sent to Nebraska for a young fellow who was not especially well prepared in botany and took him to Washington, and after a few days shipped him down to Alabama, and put him in charge of a group of men. They were studying pecan tree diseases. This man from northern Nebraska, who had never seen a pecan tree, found himself in charge of a squad of men engaged in budding pecans. He knew nothing about budding pecans. But he had initiative enough to master the situation, and after a night's study and practise he went ahead as though he had been budding pecans all his life, *and succeeded!* I did not train that man in pecan budding; in fact I could not have recommended him as a budder of pecans. Yet he "made good," not because he had been stuffed by the right kind of knowledge, but because with his foundation of knowledge he had energy and ability.

Now let us ask whether we are not setting up a wrong standard? We are thinking of how full a man is of the botany we have put into him. Should not our attitude be this: "this man has made a good beginning, he has the right kind of material in him, take him and let him grow up with his work."

Now there is not one of you here who has not learned ten times more of botany out of college than he learned in college. You had the qualities in you to make you successful, and had a fair beginning in the science. I was quite interested in looking over the summaries in the second edition of the "American Men of Science" to find that the botanists are requiring young men to work longer for their bachelor's and doctor's degrees than are the chemists, physicists, zoologists, mathematicians or geologists. I do not believe botany is proportionally that much harder. We are putting too high a value on what we are *putting into* our students, and neglecting the man himself. We are in danger of having men grow "stale," as the athletes say. Probably we keep our men with us too long. We should send them out while they are still fresh and vigorous.

I think we should map out very definitely a series of successive semesters of work that should constitute fair preparation for the average young man who wishes to become a botanist. Such a botanist should be ready to begin teaching, or even investigating, not as an expert, but as a beginner. And every one must necessarily be a beginner in his work at one time in

his life. Let us think of these young men that we are suggesting for positions as beginners merely; and when you send one to me I shall take him as a beginner, not as a finished botanist. Yet very commonly we say to our students that they can not begin either investigating or teaching until they have made a special study in particular fields. We try to impress them with the great importance of graduate work, and the littleness of their present knowledge, and we impress upon them also our conviction of their general inability.

We need broad general courses with definite beginnings and endings, and including something of all the phases of the science, well wrought together into one science, and not courses consisting of a collection of disjointed and disconnected phases of the subject. I think here is one of our mistakes. As one of my correspondents wrote very emphatically, "this splitting up of the science so that the student thinks of it as morphology, so many hours; physiology, so many hours; pathology, so many hours; and mycology, and algology, and bryology, and taxonomy, etc., has done much to discourage young men."

No doubt also we can help to make more botanists by encouraging an *esprit de corps* among our students, whether they are undergraduate or graduate students. All are botanists; even the newest recruit belongs to the botanical army. Let us not withhold honor from these new additions to our force. And yet I have seen in many places a tendency to persistently belittle the knowledge of the student in his first and second years on the theory, I suppose, that it is good for a young fellow to be "taken down," and made to feel that in this stage he is little better than a fool. I do not think this is right.

Another thing that we can do is to study our men, and select the more promising. And we must not be too particular, either, in our choice. I have seen some rather unpromising men turn out to be very successful botanists. We must not turn men away simply because at first they do not seem to be promising. Some slow men finally become good botanists and successful teachers. On the other hand, I have known some brilliant men who in the end have done very little with all their brilliancy. I feel sure that as teachers we should frankly tell our students what we think they are able to do. Let us stop looking for Torreys, Grays, Farlows, Barneses, Coulters, etc. That, however, is what we are doing. We are putting up a standard that is only reached once in a long while. Let us realize that the young fellows in our classes are very much as we were—just mediocre men. Most of us are that, but we got on somehow, and have been measurably successful. And so will they. Give them a chance.

Then I fear that we have not treated botany as a profession, but merely as a subject of study. Of course it is to be studied, and of course, also, it is to be taught. But it is also a profession, and we should weave into our instruction much of the ethics of the science, whether it is to take the form of teaching or investigation. The young botanist should be made to feel that he is going to *use* his botanical knowledge, and that he can do so with entire propriety. Let us stop saying to the young man: "You do not know enough yet to begin"—but let him begin!

Now, before I come to my closing discussion I want to make a slight digression in order to speak of college courses in general, and especially the go-as-you-please method to be found in most of our institutions. I fully believe in having work prescribed as to kind and place in the college curriculum. I believe in prescribing the

necessary language work early in the course. I believe also in prescribing the other science work. The old-fashioned classical courses, with some modifications admitting science, appear to me to be about the best foundation. You ask me why so? For the reason that they began at some place and ended at some place. There was consistency and continuity, with resultant training. The so-called "free elective" plan is to me the worst of all plans. The student is dazed by the many things that he can do; and he does not know what to do. In most institutions, he is supposed to have an adviser, but, as Abraham Flexner shrewdly says, "the advice is equivalent to perfunctory consent to propositions which the student himself submits." So the student generally ends by doing a lot of the easier things in a hodge-podge, aimless manner.

Now let me make a few suggestions with regard to the courses in botany. I fear that I may shock some of you by some things I am going to say.

In the University of Nebraska we are working on a three-year schedule (in a four-year college course) for undergraduate work in botany, intended to fit men for filling instructorships in botany. I do not believe in the "quick-meal" process in education, but as I look over what I have been doing the last forty or more years, it seems to me that we can concentrate our work to such an extent that a man who brings proper preparation otherwise to the work ought to be able, in three years, if properly guided, to complete the course. We are making this schedule aggregate from twenty to twenty-five hours only—not quite the equivalent of a single study taken three years. In this time we think it is possible to take a bright young man and fit him well to begin work. Of course he will not be the equal of our older men. Let us, however, give up the idea that we can turn out young men who know as much as Dr. Coulter or Dr. Farlow. That will take years; but a man can have a good preparation for teaching botany, as good as the young engineer gets—and he is ready for work when he finishes his course. So we are working on a three-year schedule and I think we are going to accomplish with it what has hitherto taken a much longer time.

We are proceeding with the following limitations. First: Such a three-year schedule must include a general survey of the plant kingdom.

Second: This three-year course must include the essentials of cytology and histology. It may not include an extensive knowledge of them, but their technique at least, and enough so that a man has mastered a few, at least, of the principles.

Third: Such a schedule must include the essentials of plant physiology.

Fourth: It must include also the essentials of taxonomy. I will not attempt to say how much that should be, and yet I am certain that there should be a considerable knowledge of taxonomy in regard to the plants that a man is likely to come in contact with. I should feel embarrassed if called upon to teach in a part of the world where I did not know what the plants around me were. I would not like to employ a man in my department who would frankly confess that he could not tell an ash tree from a maple.

These are some of the things that should be known. There are many things I have not included, but I think that what I have put into my schedule will fairly prepare a young man for beginning to teach. He can not take my classes, perhaps, nor Dr. Coulter's classes, but he can begin where we began in teaching, and *work up!*

Now this amount of botanical knowledge,

as I have mapped it out, is very much more than many of us had when we began. It should fit a man for beginning to give instruction in the smaller colleges or in the minor positions in the universities. It should fit him to lead intelligently the students that come to him in our normal schools. I take it that it is in this direction that we must move if we are to be able to supply from our schools and our universities the men who are to follow us.

You will notice that in all this I have said—"men." I have said so because I have found that when the demand comes, it is mostly for men. I do not know why this is so. We say very pretty things about our women students, and give them good high standings, and say complimentary things about them *as students*; and yet when you yourselves look around for some one to be an instructor, and we write and say—"there is a young woman here who will make a good instructor"—you say: "Our present circumstances are such that we can not employ a woman." Here is one thing that we ought to change. The supply of competent women is much larger than of competent men, and I can assure you from experience in my own department that they make admirable instructors.

I have gone over this problem of the making of botanical teachers in this rapid way in order to stir up thought along many lines. For I hold that it is a serious problem; and that we as teachers of botany owe it to the future that we should prepare in a proper way for the succession of teachers that must follow us.

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II. THE PRODUCT OF OUR BOTANICAL TEACHING

NOTWITHSTANDING the frequent assertion that teaching of botany is not what it should be, it seems safe to say that there was never a time when there was more good teaching of the subject than we have to-day. That we should have dissatisfaction at a time when so much good teaching is being done, is not at all surprising, inconsistent or undesirable. Botany itself has grown so rapidly, its call for new researches has been so insistent, its place in the applied sciences and in the affairs of men in general, has assumed such prominence and importance, its use as a means of giving a proper education in scientific thought about things that are worth knowing has been so vigorously claimed, that in consequence our attention is directed as never before to the possibilities and errors of botanical teaching.

The teaching is not poorer—we merely know more about it. Present practises are not wholly bad and need not be discontinued, but with the increasing richness and diversity of botanical knowledge, and with better definitions of the purpose of science education, particularly education by means of botanical science, we need to consider our practises anew. If a prominent feature of reform is discontinuance of past vices, a feature of progress is discontinuance of past virtues for better and larger ones.

If the product of our botanical teaching does not meet our ideals, we should look for explanation to some or all of the factors or causes of the very complex situation which confronts us.

1. First, what are our ideals? What do we wish to accomplish through botanical teaching? Do we wish to use the study of botany as a means of developing on the part of the people in general a more dependable method of thinking, better reliance upon native powers of observation, experimentation and interpretation, an attitude that demands evidence before judg-