Section on Education and Legislation

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THE TEACHING OF AND EXAMINATIONS IN PHARMACOGNOSY.*

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While it is true in teaching that success depends in large part upon the earnestness and personality of the teacher as well as his knowledge of the subject much also depends upon the methods that are followed. It was the Aggassiz method that developed a school of clear-headed and distinguished American zoologists. Aggassiz's words, "Study nature, not books," ring true and are well worthy to be framed and hung up prominently in all laboratories. Some teachers feel that they would like to impress upon the students the facts which they have acquired or the point of view which they have attained. Others use some particular textbook and it is upon the facts that are to be gleaned from this that the student's efficiency is finally determined. A happier method is the one in which after certain fundamental principles have been mastered, the teacher draws out from the student what he observes from the specimen in hand. Of course, to the ordinary student this may be irksome as it is often difficult for him to discern the progress that has been made. It is also harder for the teacher, as in nearly every class there will be found some who are keen observers and likely to ask questions which require the teacher to admit that he does not know it all. It has usually seemed necessary in order to maintain discipline for the teacher to stick near his desk and the student to follow the exercises laid down. Happily for all concerned we are approaching a condition when it is possible for student and teacher to work together, each receiving an inspiration from the other and each contributing to the *summum bonum* of knowledge. I have in a previous paper indicated what I consider to be the principal object in the study of Pharmacognosy as it relates to the training of the pharmacist. I said then that in view of the problems that confront us and that are constantly arising, the aim first should be the attainment of a knowledge of the characters of drugs rather than a general knowledge of them. The object of a course in Pharmacognosy is, I take it, not that a student shall examine so many drugs, but that he will be able to use his eyes so that he can determine whether a drug corresponds to a description as that of the Pharmacopœia, whether the specimen is all of one kind, the quality of it, and similar practical questions when he is in business. We all know that a student usually examines but a small sample of the drug. His specimen may differ from that of his comrades in certain particulars, as in the case of Rhamnus Purshiana, and

* Continuation of a previous paper presented to this Association (see Proceedings, Vol. 56, 1908, p. 672).

this is confusing. But let him examine, say five or ten pounds of this drug, and the characteristics will be so impressed upon him that he will be able to recognize even fragments of the drug.

While at college a student cannot possibly study thoroughly all of the drugs of the Pharmcopœia and National Formulary. I am beginning to be more impressed with the foreign method of teaching, in which the study is limited to a number of important drugs, or to such drugs as those the study of which has a didactic value, and in the case of which the work is required to be well done. Let the student spend three or four hours upon each of the twenty-two important official drugs † and he will not only know these well, but he will find it comparatively easy to acquire a knowledge of other drugs under circumstances that will not make him confuse so many of them. I have in preceeding years, because of the lack of time at my disposal considered from six to ten drugs in the course of a two-hour period. The result was one of confusion to the student which was manifest in subsequent examinations. I find that students are better able to recognize crude drugs after they have handled a single lot during several hours, including the making of sections and the examination of them with the microscope.

During the session that a particular drug is being studied by the students it is a good thing to break up the monotony of the work by talking about the plant yielding the drug and if possible try having some growing specimens in a prominent place and in addition a herbarium specimen of the plant for each student. At the same time one can give some facts regarding the distribution of the plant, the history of the drug and its important constituents. In this way a student is enabled to concentrate himself upon a single drug, and thus the facts impress themselves and he acquires a knowledge of drugs in a more natural way.

Permanent mounts of drugs should be at his command for purposes of microscopic comparison. Sections, however, should be made by the student and these should not only be cross-sections but tangential—longitudinal and radial-longitudinal as well. He should keep a record of his observations and make a series of drawings illustrating what he has seen, using both the simple microscope and the compound microscope. Sufficient assistance should be provided so that a student's question may be answered and his specimens or slides examined, as he should not leave the laboratory without all doubtful points being made clear.

The powdered drug should be examined after the studies on the crude drug have been completed. It is surprising to see how the student views the whole subject after he has spent an afternoon first examining the crude drug with the naked eye and of the simple microscope, then making sections and carrying on his studies with the compound microscope, and finally working with the powdered drug. He finds that the study of powdered drugs is not so difficult and furthermore, as in the study of Belladonnæ Folia, an adulterant of Poke Leaves is more readily determined in a powdered drug than in the crude drug. He finds as a matter of fact that one of the simplest methods in the examination of a num-

† The following are the drugs that I include in the list of the 22 most important drugs of the Pharmacopœia: Acacia, Aconitum, Belladonnæ Folia, Cantharis, Capsicum, Cinchona, Cinchona Rubra, Digitalis, Ergota, Gentiana, Ipecacuanha, Jalapa, Lycopodium, Nux Vomica, Opium, Podophyllum Quassia, Rhamnus Purshiana, Rheum, Senna, Sinapis Nigra, Strophanthus, Zingiber. Of course, there are a few other drugs that might be considered equally as important as some of these by some teachers.

ber of drugs, that may seem to be of good quality is to take five or ten grams of the material selected from various portions of the lot, powder it in a small mill and examine the powder under the compound microscope I have seen students again and again find Poke Leaves in a sample of Belladonna Leaves that otherwise would have been pronounced of good quality. While we require students to make a permanent collection of the specimens of crude drugs which are furnished them for study, I feel that the time is at hand when we should require them to make a permanent collection of microscopic slides, illustrating these twenty-two important official drugs. As the compound microscope can be had at such a reasonable figure at the present time I think that every thing should be done to encourage students to invest in this piece of apparatus which is indispensable not only in detecting adulteration, but also in determining and establishing confidence in reliable jobbing houses.

EXAMINATIONS.

After the student has taken up the practical studies of vegetable drugs and has concentrated his attention on the most important of those that are official, the question is what tests shall be applied to determine his qualifications to be a safe pharmacist. Of course, the professor has the advantage of seeing the student day after day, and if he has been faithful in attendance and has conscientiously carried on the work the teacher must know his general ability after the entire course of instruction. Usually, however, an examination is given for the purpose of testing a candidate's knowledge of the subject But what is the test of knowledge? What is the nature of the questions that are to be asked to test the candidate's knowledge in this particular branch? We have all been familiar during our college days with men who failed in examinations and who really knew more about the subject than some of those who passed the examinations. The secret of the latter in passing an examination very often consists really in concealing from the examiner what they do not know. If this is done discreetly and the student can impress upon the examiner what he does know he will probably pass the examination. There are some examinations where this cannot be done and this is particularly true of examinations in Materia Medica as conducted in most Colleges of Phaarmacy and of Boards of Pharmacy.

In these examinations the memory test is largely relied upon. So much hinges upon giving the "Natural Orders," "Habitats," etc. The student preparing for these examinations usually uses some book in which in a series of parallel columns are given one or two words covering the information that is expected of him in the examination. Partly because the subject of the examination is so lifeless, the student has never been stimulated in his studies. Furthermore because the examination is so perfunctory the student's thoughts are seldom carried beyond these parallel columns, and he can truthfully say that the whole subject is dry and uninteresting. Besides on this account the general inference is that the subject is of little or minor importance.

Occasionally we find teachers who dilate upon the subject of the history of drugs and the countries in which the plants are indigenous but say practically nothing more of the drug than is contained in the Pharmacopœia. We find students who have had a good preparatory education who believe that in this

knowledge that they have valuable information to fit them to become retail pharmacists and usually they are very easily confused when it comes to the identification of specimens. Sometime ago I heard a judge in one of our city courts make some remarks in the course of an after-dinner address that impressed me very much. He said "the fact that you know that a certain drug is gathered in the Himalayas is not going to make you either a safe or successful druggist; you must know the nature and property of the substances you are handling and how safely to fill prescriptions and a good many other things that you only learn by experience." Any practical pharmacist knows this and yet the burden of most examinations in Materia Medica are upon questions that few teachers and examiners would pass an excellent examination upon without considerable study beforehand. While the aim of an examination before a Board of Pharmacy appears to be to test the candidate's knowledge, the college examination should be with an additional object, viz., to round out the knowledge gained during the course of instruction and give the student self-reliance and confidence in himself. It should not be with the object of getting him ready to pass the Board of Pharmacy examination as now conducted.

Now that the Boards of Pharmacy are seriously considering improving the methods of examination, it seems to me that we might well ponder upon the subject and try to look at it from the point of view of testing a candidate's fitness to practice pharmacy. In my judgment we must eliminate the idea that because a professor gives an interesting historical lecture upon certain drugs it is expected that the student will have all of this information at his fingers' ends. There are some things taught which make for the culture of the pharmacist and happy is the student who can sit under a professor that is learned and well-balanced. There is something deeper and more important to the pharmacist than this general knowledge of drugs and that is knowledge of the characters of the drugs which he handles in practice. The history of each drug is exceedingly interesting, but this does not become a real part of a pharmacist's knowledge save after many years of experience and reading which he can do without the aid of a teacher, and when his horizon has been broadened. In one sense the same may be said of descriptions of plants yielding drugs. As in the learning of a foreign language we lay the foundation by first taking up the grammar of the subject and later taking up as much reading and study of its literature as time and inclination permit, so in the study of Pharmacognosy we first take up the specific characters and properties of a drug and then follow this by as must reading and study of a general character as we are able to do. There is, however, nothing stimulating and so far as I can see it nothing useful in asking a question like the following: "Nux Vomica: (a) give habitat; (b) origin; (c) part used in medicine; (d) active principles; (e) official requirement." Ever since the days when I was a Quizz Master my conviction has been growing that questions of this type, which are asked on every hand, do more harm to the cause of teaching in pharmacy and to the development of professional pharmacy than is generally realized. Every man's knowledge must fit in this one groove. There is no individuality to be developed, no increase in knowledge expected and no vitalizing influence in either the subject as taught or the examination which follows.

The following is another type of question that is asked in certain states by the

Boards of Pharmacy and illustrates very forcibly the type of question that should not be asked: The questions for the most part being confined to unimportant drugs and specifying the reading of certain books makes it obligatory upon the candidate to determine before taking the examination the books on which the examination is based. The following is a typical example: "What dose is given in Remington's Pharmacy, Fifth Edition, of the following: Rhus Glabra, is it considered a poison? (b) What is a minimum dose of Quercus, Rhubus, Geranium? What is the common name of Convallaria? Name twenty-two incompatibles with mercuric chloride (Corrosive Sublimate). There are thirty-three. Name as the tenth edition of Potter's Materia Medica gives them. Does Potter's Materia Medica say Mercury is a tonic? Answer Yes or no. Does he say it is a poison? A purgative? From where is a Veratrum obtained? And in action, is it related to Aconite in any form? Answer Yes or No. What is the average dose of Eucalyptus as given in Potter's Materia Medica, Tenth Edition?"

In addition to the slovenly construction of the question and the veritable hodge-podge manner of associating the subjects, I think it is quite clear how questions of this kind really hinder sound pharmaceutical education. I think students are to be pitied who have to run the gauntlet of such examinations in the various states, and the wonder really is that young men of education and good training are willing to come into the ranks of Pharmacy. It is quite clear on the face of it that the examiners who ask such questions are quite incompetent to fulfill their duties.

Of all subjects that are living, interesting, full of the greatest of possibilities and of the greatest of benefit to the professions involved, there is no subject that offers such a fertile field for the teacher and that can hold the interest of the student like that of Pharmacognosy. I am quite aware that while my enthusiasm may be shared by some teachers that my point of view may not have occurred to them. However, I would say that the teaching of Pharmacognosy in its direct application to the retail druggist will prevail and if the examinations by Boards of Pharmacy bring out the practical knowledge of the candidate we will find that the student will also have attained culture and those things that constitute the professional man.

I have often thought that it would be a splendid thing if Pharmacognosists could meet together occasionally and discuss not only methods of teaching but the subject of examination questions. In order that we might improve on our work and be able to utilize the results of our colleagues in other colleges I have requested a number of professors to send me a set of model questions. I regret that there is not space for me to publish all of these at this time. One professor has written stating that as his course is entirely laboratory work it does not involve questions. This is certainly novel and I should like to know how it is done. Apparently the professor relies entirely upon the student's work during the course. I feel that really every teacher ought to know before the end of the term the standing of every student, but I feel as already stated, that an examination should be held more for crystallizing out the thoughts of the student and his knowledge gained than for any other purpose. In other words an examination should be in the nature of instruction to the student and should give him an opportunity of showing to what extent he has mastered the subject.

Professor Daniel Base has written in a spirit with which I hearily coincide, and I quote the following from his letter:

"I think State Boards would do well to confine questions in Materia Medica to the chief inorganic, vegetable and animal drugs and not ask questions about things with which the average pharmacist may have to do but once or twice in a year. The questions might reasonably involve a knowledge of botanical source, part official, when collected and why, description in correct terms, of the whole drug, drugs that resemble each other outwardly and how to distinguish them, the principal and some of the less important constituents, forms in which the drug is used, usual action of the drug, antidotes to principal poisonous drugs or their preparations, doses. I would advocate framing questions both in Board examinations and those of the college in such a manner as to test the candidate's thinking ability rather than his cramming powers. Perhaps this cannot be done so thoroughly in Materia Medica, as in Chemistry or Pharmacy, because of the nature of Materia Medica which necessitates memorizing to a greater extent than the other two subjects do. Examinations in Pharmacognosy, in addition to requiring the recognition of drugs from outward physical characters, taste, odor, fracture, chemical tests, etc., would properly require also microscopic knowledge, but I fear that the teaching and requirements in some states have not advanced to such a stage as that the Boards could be persuaded that the examinations should include microscopic work. In those advanced states in which the Boards would not hesitate to ask questions involving microscopic knowledge, I think the questions should be moderate and practical and perhaps along such lines as the following:

1. Relation between magnification and focal length.
2. Mounting of objects.
3. Familiarity with a few staining reagents, permanent and temporary.
4. Process of making a permanent mount, with two differential stains.
5. Ability to recognize and name the different kinds of cells in a section.
6. Naming the kinds of cells in a powdered drug, especially such as stone, bast, tracheids, trichomes."

One of the questions in the list submitted by Professor G. H. Janson strikes me as being very practical. It is, "In the examination of a powder, what elementary structures place it into the class barks, woods, and leaves?" Professor Albert Schneider has submitted a similar question which reads, "Name the tissues and tissue elements that are found in barks, and roots, in leaves, in seeds, in woods."

I also received a number of other lists of questions, but they did not strike me as having anything novel in them and so I do not give them at this time, although I will probably refer to them in another paper.

Professor Sayre has written in addition to sending me a list of questions some things that I feel like adding in this paper. He says, "Permit me to state that you could not get ten men to agree on any set of questions, nor to agree on the policy of making up the questions, but I venture to give you my own ideas in the limited time I have to dictate them off hand.

"In the first place, questions should have a carefully selected variety, that is, there should be a variety chosen from different classes of crude drugs. In the second place, in almost every question something should be drawn out of the student in his answers as to the microscopical and now and then, the botanical characteristics. Third, there should be sometimes added to the questions a general question rather than a specific one, such as, 'Write a paragraph or a treatise

of at least 250 words on what you know of a certain subject.' In the fourth place, I believe that examinations should represent modern thought and teaching and should include laboratory demonstrations where the student should have an opportunity to show, first, that he knows how to use the microscope, and second, that he has done microscopical work, and third, that he shall be able to demonstrate that he is familiar with certain microscopical processes. Fifth, I think that examinations in Materia Medica should be confined to well established and commonly recognized drugs."

In summarizing I may say then that in discussing this subject of the teaching and examinations in Pharmacognosy that I have not been aiming to establish an ideal, so much as to direct attention to the need of our considering our work from the standpoint of the practicing pharmacist. There are many things that every pharmacist should know and these relate especially to the specific characters and properties of the important drugs. Then there are other things which he ought to know of certain drugs and indeed should know to stimulate him in his professional work. But these are subjects that can be better handled in an oral examination than in written examinations. In Pharmacognosy we have a subject dealing with natural products and we should treat it in a natural way, instead of according to hard and fast lines involving the framing of questions in the form of riddles or conundrums which depend for their solution upon so much memorizing rather than clear thinking and direct study of the drugs themselves as we do in the study of other physical objects.

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