

# THE DEPARTMENT OF THE AMERICAN ASSOCIATION OF COLLEGES OF PHARMACY

What a pharmacist should know about Toxicology is a much discussed subject; some taking the view that he should be well-grounded in the subject and others that he should know only the fundamentals regarding the treatments of the more common poisons. The following paper, "The Teaching of Toxicology," by Prof. Clayton S. Smith will be helpful to all teachers of the subject and to the makers of our college curricula.—C. B. JORDAN, *Editor*.

## THE TEACHING OF TOXICOLOGY.

BY CLAYTON S. SMITH.

That the pharmacist needs to know something of toxicology has long been recognized. This has been adequately demonstrated by the recent painstaking survey of Dr. Charters and his associates. In their report, "Basic Material for a Pharmaceutical Curriculum," the section on toxicology contains primarily statistical data obtained from eight (8) boards of health, nineteen (19) coroners, fifty-five (55) hospitals and twenty-five (25) physicians relative to cases of poisoning as well as data secured from the reports of 934 retail pharmacists. In addition, the actual poisonous substances prescribed as drawn from a list of 17,577 prescriptions are recorded. The construction of a curriculum by the functional method is a recently developed procedure. So far as I am aware, pharmacy is the only profession outside of the field of education to which it has been applied.

This method of curriculum building applied to pharmacy seeks first to learn what the pharmacist does, and, second, to determine what he must know in order to perform his duties intelligently. The traditional method of curriculum construction is based upon individual opinion, or upon the consensus of opinion of several teachers. A group of men or an individual decides on the basis of personal judgment what shall be included in a given curriculum. By this method courses are often included because of the influence of departments or individuals rather than for the value of the course of a practicing pharmacist. The functional method of curriculum building is objective. Its ideal is to substitute facts for opinion. In their report Dr. Charters and his associates were not quite able to reach this ideal and where gaps occurred in the facts sought, the concensus of opinion of experts was substituted. What is true as to the method for the construction of a curriculum is also true in the development of a course, for the course is an integral part of the curriculum.

In approaching the problem of what shall be included in a course in toxicology we have two methods at our disposal. If it had not been for Dr. Charters' report we would have had only one. To secure the facts necessary for a functional approach requires considerable time and the intelligent coöperation of many individuals. Because we have the statistical data covering the various poisons handled by the pharmacist and the emergency cases treated by him does it mean that the functional method will solve our problem as to what goes into a course in toxicology? I think not. When the functional study of toxicology was undertaken it was originally planned to include with each poison, the organs affected, the symptoms produced and the antidotal treatment. To place the last-named

items in the report on a strictly functional basis would require that only those organs that were found to be affected in the cases actually reported could be included. Likewise, the symptoms would have to have been those observed by the reporting collaborators, and the treatment that which was actually given in the emergency recorded. These facts were not available so the items, organs affected, symptoms and antidotes were left out of the report as printed. All will agree, however, that a course in toxicology should contain something covering these points.

In building up a course in toxicology due cognizance should be taken of the data secured by the objective method and recognition must be made of the traditional method. For convenience toxicology may be divided as follows, clinical and analytical. The classification of drugs will vary depending upon whether the viewpoint is clinical or analytical. Whether the pharmacist should receive any instruction in analytical toxicology is a question upon which there may be a wide difference of opinion. By either the objective approach or the traditional approach the conclusion is reached that the pharmacist should have some definite information about the poisonous substances which he handles. In the section on jurisprudence of Dr. Charters' report mention is made of state laws requiring a poison register and the Federal insecticide, narcotic, prohibition and postal laws. The general intention of these laws is to so regulate the handling of poisonous substances as to reduce the possibility of poisoning. That these laws exist is known in a general way by everyone. By discussing these laws early in the course the student may be brought to realize more fully the importance of toxicology and its relation to society.

The pharmacist sells insecticides and fungicides. These substances include volatile as well as non-volatile poisons as represented by phosphorus and hydrocyanic acid on one hand and strychnine and arsenic on the other. Particularly in the rural districts the pharmacist would be looked upon as an important source of information concerning the composition and use of insecticides and fungicides. While all of the substances used in these preparations are not as dangerous to man as to lower forms of life, yet the ingredients of some contain poisons which are deadly to man. As a group insecticides and fungicides are of considerable toxicological importance.

Pharmacology, or more specifically pharmacodynamics is the basis of clinical toxicology. Before the pharmacist can understand the rationale of treatment he must be able to recognize the symptoms and know the principal action of poison. While pharmacology includes the consideration of other chemicals and medicinal agents particular emphasis should be placed on those drugs which are considered poisonous in the ordinary sense. Assuming that pharmacology precedes toxicology in the curriculum an opportunity will be afforded to stress the poisonous drugs the second time in the course in toxicology.

In his course in posology the student is taught that while he does not prescribe drugs he is legally responsible for the dispensing of the potent ones. The doses of the toxic drugs must be an integral part of his knowledge of toxicology. In addition to the drugs prescribed by the physician the pharmacist must know something of the dose of potent drugs used by veterinarians.

Just how close the relation between toxicology and chemistry should be will

depend upon how much analytical toxicology is included in the course. So far as the clinical side of toxicology goes the intelligent use of antidotes depends in a large measure upon a sound foundation in Chemistry. For convenience in discussing the content in a course in toxicology let us consider the clinical side first.

The pharmacist is supposed to know the standard, lethal and toxic dose of the drug, its poisonous action and the symptoms produced by this action. In addition he should know the antidotal treatment and any danger that might be attendant upon such treatment. What drugs shall be considered in the course and how shall they be classified? A list of drugs that have figured in cases of poisoning is to be found in the section on toxicology of "Basic Material for a Pharmaceutical Curriculum." The list of poisons was drawn from 17,577 prescriptions, the U. S. P. and the N. F., crude drugs found in 1144 retail pharmacies and 27 drug store inventories. The list is adequate for any course but it would be impracticable to consider each drug in detail. The poisons are classified on a physiological basis according to their predominant action. Three main groups are recognized, Corrosives, Irritants and Neurotics. These in turn are subdivided. The Corrosives may be divided into acids, alkalies and phenols. Since these substances are used rather extensively in the industries each of the members of this group should receive some particular attention.

The symptoms produced by the different acids are somewhat similar and vary principally with the concentration. Likewise, the various alkalies produce similar symptoms. In general acid poisoning is treated by the administration of dilute alkalies, an alkali poisoning by the administration of dilute acids. To this general statement the exceptions must be emphasized. Sulphuric acid and water produce heat. In sulphuric acid poisoning the use of water should be avoided or else the water should be given rapidly and in large quantities. In corrosive poisoning with acids the use of bicarbonates internally should be avoided on account of the gas produced. It should also be pointed out that the alkali salts of oxalic acid are as toxic as the acid itself and the antidotal treatment in this case is to render the oxalic acid or its soluble salt inert by the precipitation of insoluble calcium oxalate.

In discussing the irritants the general symptoms produced should be mentioned and the general principles underlying the antidotal treatment outlined. For example, the majority of the irritants affect primarily the gastro-intestinal tract, a few such as poison ivy and poison oak are principally irritants to the skin. The irritants which are most frequently the cause of poisoning should be discussed more fully and some of their characteristic lesions emphasized. Arsenic, mercury and lead seem to me to be the most important of this group.

The neurotic poisons comprise the most varied group from a chemical standpoint. The chemical composition of many of the substances is unknown. Here it should be pointed out that many of the dangerous symptoms are produced by the action of the drug on the nervous system. Chemical antidotes are of value only insofar as they render any poison remaining in the gastro-intestinal tract non-toxic or less easily absorbed. The antidotal treatment in this class of poisoning is pharmacological rather than chemical. In general, the student should be taught to treat cases of poisoning of this class symptomatically. No attempt

should be made to learn the symptoms caused by each drug. However, there are a few that because of certain characteristic symptoms should be emphasized. Among these I would stress morphine, strychnine, cocaine and atropine.

The student also should be given some instruction as to the procedure to follow when neither he nor anyone else concerned with the case has any idea what the poison is.

Coming now to a discussion of analytical toxicology there is probably a wide difference of opinion as to what, if any, should be included in a course in toxicology for pharmacists. From a functional standpoint it may be said that the pharmacist will not be required to make any toxicological examinations of organs, foods or medicine, and, therefore, it is not necessary to include such instruction in the course. On the other hand, the pharmacist does receive instruction in how to make tests for purity of the U. S. P. preparation and how to detect adulterants. This instruction is usually given in some other course than toxicology. Inasmuch as this matter is not entirely foreign to him I see no reason why the pharmacist should not be told how the analyst proceeds to separate poisons into the various groups in order that their detection can more readily be made. He should be given a classification of drugs for analytical purposes. The knowledge he has already acquired concerning the solubility and various properties of drugs will explain why certain drugs fall in the various groups. What is the practical value of giving any analytical toxicology? I believe there are two points that should be mentioned. First, it serves to correlate toxicology with other preceding courses. Second, it gives the pharmacist an intelligent idea of what ought to be done with any material that may come into his possession in connection with a case of poisoning. If he knows something of the subsequent procedure he will know how to preserve the samples uncontaminated for the chemist. He should also be told the importance of preserving the identity of the samples so that he is able to state of his own knowledge just what happened to the sample from the time when he received it until it was delivered to someone in authority. This is of the utmost importance in criminal cases. Cases are frequently lost when there is some question as to the identity of the sample analyzed. Inasmuch as no one knows at the time whether a case of poisoning will turn out to be of a criminal nature the pharmacist should be put on his guard. It is his duty to society to see that the ends of justice are met. Just what laboratory work in analytical toxicology should be included in the course I am not prepared to say. Probably not any, unless the laboratory work should be made to include tests for impurities and adulterants in addition to a few important tests for common poisons. Certainly a pharmacist should not be expected to master a system of toxicological analysis.

To summarize: The course in toxicology should be constructed somewhat as follows:

*Introduction.*—Discussion of the laws regarding the handling of poisonous drugs showing the relation of toxicology to everyday life.

Discussion of the frequency of cases of poisoning, mentioning the drugs which figure in such cases.

Show the relation between toxicology and insecticides and fungicides, pointing out the importance of this to pharmacists who expect to practice in rural districts.

Point out the importance of a foundation in pharmacology for the proper understanding of toxicology.

Connect posology with toxicology by emphasizing the pharmacist's legal responsibility in regard to potent drugs.

Show that the principles of chemical qualitative analysis are used particularly in the antidotal treatment of inorganic poisoning.

With this introduction the student is shown the relation of toxicology to his preceding courses. He should be taught to look for correlations between toxicology and other courses as the course is developed. In this way he is more likely to overcome the common tendency among students to view each course by itself as something to be passed. It is hoped thus to arouse the student's interest before the substance of the course is actually presented.

The course should be divided into two sections, clinical and analytical.

*Clinical Toxicology.*—The drugs should be classified in a simple manner, such as corrosives, irritants and neurotics. The characteristic features of each group should be discussed, together with the general symptoms and antidotal treatment. Special features concerning important members of the group should be emphasized. No attempt should be made to have the student memorize a long list of drugs and their antidotes. In an emergency the pharmacist must use his head and it is the general principle that must be stressed.

*Analytical Toxicology.*—A general statement of the analytical procedure. Emphasis upon the importance of keeping the sample intact so as not to invalidate the analytical results to be obtained later.

It is not necessary that the pharmacist be taught how to make a systematic toxicological examination.

Laboratory work might include tests for purity of various drugs, tests for common preservatives and the more important poisons.

These I believe are the essential features of a course in toxicology. The details of such a course will depend upon its position in the curriculum with reference to closely related courses and upon the time allowed for giving the course.

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#### SHOPKEEPING vs. PHARMACY—NOT SO VERY DIFFERENT.

Surely if it be a matter of importance that an artist, himself a professional man, should know something practically of the materials which he employs, to what condition of weakness is the pharmacist reduced who is content to be the mere salesman of the preparations which he offers to the public? There is a scare just now about coöperation, because the British pharmacist has neglected his profession, and trusted solely to his trade. That trade itself has been mostly adventitious, generally

precarious and of necessity restricted. No system of coöperation, with its keenest breath of competition, can dethrone or undermine the value of a position gained by acknowledged excellence in the department of pure pharmacy. But if men will starve the laboratory and emulate the Lowther Arcade can we wonder that the world sees little difference between one class of tradesmen and another, and goes to where there is the largest discount?—*The Chemist and Druggist*—"Retrospect of Fifty Years Ago."

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"The formation of State Associations was but the beginning of the work which the AMERICAN PHARMACEUTICAL ASSOCIATION has done to touch the life and the problems of the individual pharmacist."