THE DEPARTMENT OF THE AMERICAN ASSOCIATION OF COLLEGES OF PHARMACY

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At THE annual meeting of the A. A. C. P. held at Dallas, Texas, last August, Professor DeKay of Purdue University presented the following paper before the Conference of Teachers of Pharmacy. Although it is intended primarily for teachers of pharmacy it should prove of interest to all individuals in the field of pharmaceutical education.

Most of us willingly admit that many worthy objectives can be obtained by a variety of different methods and that certain destinations may be reached by various avenues of approach.

Without an adequate knowledge of the various methods now employed and the results obtained by them, one cannot arrive at the wisest decision as to what his policies and procedures should be.

Professor DeKay's suggestions should prove of special interest to teachers who are engaged in pharmacy laboratory instruction and of general interest to all.—ERNEST LITTLE.

A STUDY OF PHARMACY TECHNIQUES.

H. GEORGE DEKAY.*

The curriculums of the schools of pharmacy are so arranged that there are repetitions of laboratory techniques and operations. The teacher of the beginning course is concerned in starting the student right. The courses in pharmacy are so related that the procedures gained in one course can be used in those that follow. The first impressions are usually retained over a long period of time. The students' interest in pharmacy is formed in the first year and it may oftentimes be a reflection of the instructor's interest in the subject. The teacher's concern should be in performing the task to the best of his ability and his reward will be the satisfaction of a job well done. It has been a problem for him to determine how much of the basic training is carried over into future courses.

In this respect, Charter's Report is worthy of consideration. It is accepted in pharmacy as a survey of the field and a great deal of knowledge of the needs of the student should be obtained from it. In the section on Operative Pharmacy it states that "A pharmacist should possess a general knowledge of the methods of manufacture and the physical properties of all preparations sold by him." This survey was made of pharmacy. The data was compiled from a study of 17,000 prescriptions collected from all parts of the United States. It should be an acceptable estimate of the needs of the profession.

From this data one can see where many conclusions could be drawn as to the necessary techniques needed by the pharmacist. It states that "after the list of preparations was prepared the next step was to study them in order to develop what knowledge is needed to make them." Among the things listed are official English titles, synonyms, percentage strengths and the active constituents. This same report states, "The pharmacist needs a very high degree of skill in the techniques of these operations and an accurate familiarity with the closely associated facts listed."

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According to this report, "there is a mass of information and techniques which the student can learn in practice. This information can be learned best and most quickly under guidance. The pharmacist needs a very high degree of skill in the use of the various operations connected with compounding and dispensing of prescriptions and manufacturing those preparations recommended to be made in the operative pharmacy study." There is a question in the minds of many of us just where the student is to get this experience or practice. Many states do not require apprentice or drug store experience. The experience, for those who do not get it in drug stores, is gained in the schools of pharmacy under guidance of the instructors and teachers. Many of the students obtain their first touch of prescription work in the course in dispensing.

REPETITIONS IN TECHNIQUES.

A study of the content of courses will reveal a similarity in the type processes and techniques which are used in completing the work in the laboratory. The repetition in these courses is of great value to the student if he can be shown wherein they are related. We know the value of repeating and it has oftentimes seemed that we repeated certain directions until they had become rote but we must realize that students are pliable subjects who are being taught by many instructors. The instructors have ideas of performance and application which are, in part or as a whole, different from those of his colleagues. The question of whether a student should have a number of different instructors is debatable. We know that a wider variety of experiences tends to educate an individual and because of this it is, perhaps, advisable for the wide range in courses.

The methods of the pharmacy teacher may not be those used by the chemistry or biology instructor, and the student may become confused as to which method is the correct one to use. The laboratory techniques and methods of approach are similar in the pharmacy courses because the student is usually under the direction of one professor or instructor. There should be a correlation in the pharmacy laboratory which could be measured.

This correlation should be measured objectively. There have been no tests or measuring sticks made for such a means of testing. According to Tyler, in his Constructing Achievement Tests, "adequate and reliable methods for testing the amount of information which a student remembers have been developed recently in many fields of subject-matter. Few tests are yet available for measuring the degree of laboratory skill attained by the students. The important problem in higher education is the permanence of learning. Early investigations of the learning of nonsense syllables showed a rapid rate of forgetting as soon as the learning exercises were discontinued. Studies of the retention of information acquired in college courses have been made in several universities, but no attempt has been made to compare the degree of forgetting which takes place with reference to the remembering of different types of material acquired by college students."

THE PHARMACY COURSES.

The first course in pharmacy at Purdue University embraces a foundation in pharmaceutical arithmetic, Latin and the fundamentals of pharmacy. The student becomes conversant with the United States Pharmacopœia and the National Formulary. He is taught the use and manipulation of the working tools of his profession. In the first semester, he obtains instruction and training in the common techniques which include weighing and weight systems, measures and measurements, the properties of liquids and solids, methods of subdivision, characteristic properties of solutions, methods of extraction and separation including percolation, distillation, calcination, incineration and sublimation, and many other type processes of manufacture.

In the second semester he is given assignments which cover the manufacture of a number of official preparations which he will use in pharmacy. The technique of manufacture is the same for the beginner as it is for the more advanced student. He is beginning and is therefore not entirely conscious of what value the work will have on his future training. The student is made pharmacy-conscious in the work because if his interest is developed at this time, there will be a greater amount of retention. He is interested in making preparations which are used in his profession and at this time the stressing of what the prescription must be and the care needed in its compounding should make a deep impression which may be permanently retained by the student.

The advanced courses are given in the junior and senior years. The student is assigned to one semester of prescription practice and one semester of manufacturing pharmacy. The question of the carrying-over of habits, skills and techniques from previous courses becomes an important one. In the course in prescription practice he is required to fill a large number of prescriptions which are not made for his special benefit. They are compiled from a large number of prescriptions written by physicians in the State of Indiana and elsewhere. The student is impressed with the variations and types of prescriptions which he is to fill.

The ability of the student to retain part of the technique of manufacture is soon apparent. It is usually necessary for the instructor to give aid to each student until he has again reclaimed the skill which he had obtained as a freshman student. The first part of every semester is given over to a review and application of the laboratory work of his previous semester. Those students who have become pharmacy-minded do not find it very difficult to regain their ability to fill prescriptions. Some of the students have carried over many of the bad habits and their work is oftentimes sloppy and lacks that degree of neatness and finish which the pharmacist needs in his work.

In all courses of pharmacy the methods of manufacture are the same as those of the beginning course with the exception that the quantities of finished products are much greater. The student must apply the knowledge learned in the first year to the problems which arise in the advanced work. The skill gained in pharmaceutical arithmetic must be used to enlarge formulas. His knowledge of weights and measures is needed in the measuring and weighing of his larger quantities. He needs his training of making changes from one system to another. The general laboratory techniques of filtering, percolating, mixing, etc., are needed at this time.

THE VALUE OF EXPERIENCE.

We have found that the student who has had some drug store experience between his freshman and junior years will usually do a better job in the manufacturing of preparations than one who has had no experience. The one who has worked in a drug store has obtained certain values of the professional attitude which aids him in his work. He has gained a realization of the responsibility of his position or become pharmacy-conscious. It is our observation that the student who has had this additional experience with the public will attack his problem with a degree of certainty, while the student who has not become pharmacy-conscious will possess a degree of fear and uncertainty. The finished products may be of an equal quality, yet the amount of time consumed in their manufacture will be considerably different.

APPLICATIONS OF TECHNIQUE.

An example of how the student may apply his previous training and experiences to new situations is clearly shown in the manufacture of tablets by machinery. He has had no experience in this definite assignment yet he has had all of the experiences needed for its completion. The problem is analyzed by the student in the light of these situations. The weighing of the quantities and mixing of the ingredients are the same as those used by him in his first year. The granulation of the powder can be compared to the granulation of effervescent salts. The new problem is the compressing of the tablet. He is now able to apply his experiences of the manufacture of tablet triturates to this new problem. The questions of pressure, disintegration, appearances of finished product, *etc.*, are the same as those of the former problem.

Another example of laboratory technique is found in the manufacture of emulsions. He is taught the procedures and the need of care in manufacture, yet he does not fully realize just why these things are necessary until he has homogenized an emulsion. He is able to see the finished product under the microscope and can compare the hand-made emulsion with the one made by machinery. He sees the difference in the size of oil particles and the differences in texture of the finished product. The keeping qualities of the two emulsions are stressed at this time.

The methods of filtration, measurements, *etc.*, are used by the student in the pharmaceutical chemistry courses. The analytical courses require the use of the analytical balance and apparatus commonly used by the pharmacist. His methods of solution, precipitation and decantation are used in the qualitative analysis laboratory. The course is based upon precipitation, solubilities and separation of component parts. He is taught the methods of chemical reactions and how to recognize the changes which occur. The characteristic properties of inorganic solids used in pharmacy are explained to him. He is given techniques needed in his future work in pharmacy.

He uses his qualitative analysis training in the study of incompatibilities found in prescriptions. From his training he should be able to recognize any change which might occur in compounding. The problem of ointment manufacture is again brought to his attention and he now understands why he was directed to use a bone spatula in place of one made of iron. The chemical changes which occur in the manufacture of ointments containing iodine, mercury, benzoic or salicylic acid when an iron spatula has been used will show in the finished product. The responsibility, training, skill and technique needed in the practice of pharmacy becomes something real at this time.

In the prescription practice laboratory a large number of incompatible prescriptions are studied and the student is able to apply the qualitative work to this course with a degree of understanding. He is more able to realize the care needed in filling prescriptions containing alkaloids and their salts. Numerous other problems of a similar nature could be cited.

There are many situations and experiences gained in the beginning courses which can be related to those used in the advanced work in pharmacy. A more complete correlation of techniques could be worked out if a series of tests or measurements were made and then applied to both the beginning student and those of advanced training.

CALCIUM DETERMINATION IN BLOOD SERUM.*

BY C. W. EDMUNDS, M.D.

(SUGGESTED FOR U. S. P. ADOPTION.)

Place 2 cc. of clear blood serum, 2 cc. of distilled water and 1 cc. of a 4 per cent ammonium oxalate solution in a graduated, 15-cc. centrifuge tube with an outside diameter of from 6 to 7 mm. at the 0.1-cc. mark and mix. Mixing is facilitated by giving the tube a quick, jerky, whirling motion. Allow it to stand for thirty minutes. Again mix the contents and centrifuge for about five minutes at 1500 revolutions per minute. Carefully pour off the supernatant liquid and, while the tube is still inverted, allow it to drain in a rack for five minutes, resting the mouth of the tube on a pad of filter paper. Wipe the mouth of the tube dry with a soft cloth. Stir up the precipitate and wash the sides of the tube with 3 cc. of dilute ammonia (2 cc. of stronger ammonia T.S. to 98 cc. of distilled water) directed in a very fine stream from a wash bottle. Centrifuge the suspension and drain again as before. Add 2 cc. of approximately normal sulfuric acid by blowing it from a pipette directly upon the precipitate so as to break up the mat and facilitate solution. Place the tube and contents in a bath of boiling water for about one minute and titrate with one hundredth-normal potassium permanganate to a definite pink color which persists for at least one minute. During the course of the titration the contents of the tube must be maintained at a temperature of from 70° to 75° C. A micro-burette, graduated in 0.02 cc., should be used.

Hundredth-Normal Potassium Permanganate.—It is essential that the potassium permanganate solution be carefully prepared and standardized as directed below:

Dissolve approximately 4 Gm. of reagent potassium permanganate in 1000 cc. of redistilled water in a thoroughly clean Florence flask. Insert a funnel, covered with a watch glass as a condenser and digest for several hours at approximately the boiling point. Cool, allow it to stand over night and filter with gentle suction through a 3-inch Buchner funnel lined with ignited asbestos. Transfer this to a perfectly clean glass-stoppered bottle and keep it in a dark place. This serves as the stock solution. From this stock solution approximately hundredth-normal potassium permanganate is prepared by dilution and standardized against hundredth-normal sodium oxalate which should keep for several months.

Hundredth-Normal Sodium Oxalate.—Dry reagent sodium oxalate in an oven at from 100° to 105° C. for twelve hours. Dissolve exactly 0.67 Gm. of this oxlate in redistilled water, add 5 cc. of reagent sulfuric acid and dilute to 1000 cc. Mix well. Transfer exactly 25 cc. of this solution to a 100-cc. Erlenmeyer flask, add 1 cc. of reagent sulfuric acid, warm to about 70° C. and titrate with the permanganate solution.

The permanganate solution should be frequently restandardized. A fresh solution of hundredth-normal potassium permanganate should be prepared from the stock solution by dilution, each time the reagent is to be used.

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* See page 202.