being held responsible in examinations for material not in his textbook is entirely eliminated.

TOPIC ASSIGNMENT METHOD.

This method is somewhat in keeping with that followed in advanced work, namely, the assignment of different topics to each student, with scarcely any direction, leaving the student to develop the ingenuity necessary to the final solution of the problem. With exceptional students there is little doubt but that they will make a creditable showing, while the average or below average student has accomplished little or nothing as a result of his efforts. A basis for such procedure should first be established by well-outlined work.

The following discussion applies to any separate one of the three methods previously outlined.

If the colorimeter, polariscope, refractometer or other special equipment are to be presented, they should by all means be accompanied by sufficient work in the laboratory in order to demonstrate their practical application. Demonstration of this equipment to a class or to groups of students is far removed from teaching.

From an analytical point of view the presentation should not involve a great number of laboratory assignments for the sake of method, but rather one of accuracy and a thorough understanding of the application of data when at hand. In other words, the student should be taught, when quantitative results become qualitative, as for example, refractive indices, iodine values, optical rotation, specific gravity, etc., represent very definite values but may be used as a means of identity as well as purity standards.

Supervision of the laboratory work should not necessarily be as extensive as that of the early chemistry training, but it has been found quite helpful for the student to have an exact subject outline of the laboratory work to be done. Detailed laboratory note books should be kept by the student and they should be periodically inspected and graded.

Organic Pharmaceutical Chemistry as has been outlined tentatively for the Syllabus may well be limited to those substances in the United States Pharmacopœia and National Formulary, except perhaps to digress in the selection of topics from new synthetics or recently isolated natural products from plant and animal sources, in order to keep the student alive to current progress. This subject lends itself perhaps less than any other to the textbook mode of presentation.

In conclusion it may be said that one's success or failure in presenting any phase of Pharmaceutical Chemistry depends largely upon ability, personality and interest in the particular work which is allotted for his presentation.

THE SCOPE OF PHARMACEUTICAL CHEMISTRY.

BY GLENN L. JENKINS.*

An incomplete study of the course descriptions under pharmaceutical chemistry as set forth in the collective pharmacy school catalogs reveals a great diversity

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of subject matter. Taken as a whole, the descriptions indicate that a "shotgun prescription" of academic instruction containing some chemistry, a little pharmacy, a little therapeutics and even some posology is administered to our students under the name of pharmaceutical chemistry. Under other departments of instruction, a similar variety of course content is included. Thus, in pharmacognosy, it is the rule rather than the exception to find usage or therapeutics and dosage or posology included and, in pharmacy, assaying and qualitative chemical tests are frequently given. Herein lies one of the most severe and far-reaching criticisms of much of our pharmaceutical education as made by non-pharmacists. In answer to the question "What is Pharmacy?" they conclude from a study of our catalogs that pharmaceutical sciences are a hodge-podge of sciences and that they have no distinct entity of their own.

Pharmaceutical chemistry may be defined as that branch of chemistry which treats of the materials employed in pharmacy. It is a division of applied chemistry which utilizes the theories and the practices of chemical science just as agricultural chemistry and food chemistry do. The scope of pharmaceutical chemistry is and has always been fixed. Therapeutic usage does not fall within its scope except as it may be essential to point out chemotherapeutic relationships, the pharmaceutical importance of certain materials, or to explain certain terms, for example, mydriatic alkaloids.

Since pharmaceutical chemistry is a division of applied chemistry, it follows that the fundamental principles and knowledge used must be acquired through pre-requisite instruction. If this fundamental instruction is given a pharmaceutical slant (a very appropriate expression because the knowledge thus imparted is not made to penetrate but is only distorted), pharmaceutical chemistry must either be a repetition of much that has preceded, or it must be a smattering of disjoined subject matter left over from other courses. The desired end may best be obtained, in my opinion, when the pre-requisite instruction is given by adequately prepared chemists who teach the fundamentals of chemical science, and when the pharmaceutical chemistry is taught by chemists with a broad pharmaceutical education.

Pharmaceutical chemistry may be defined easily in broad terms, but it is difficult, if not impossible to draw a sharp line of demarcation between it and non-pharmaceutical chemistry. Certain standards are available, however, for guidance. Thus the materials described in the United States Pharmacopœia, in the National Formulary and in New and Non-Official Remedies, are obviously basic and appropriate subject matters to be considered in courses of instruction. Other materials not included in these standards might also be studied, but their selection should be based on importance and extent of use. The occurrence, method of production, purification, properties, characteristic reactions, tests for identity and purity and assay of each class of materials should be covered. The emphasis given to any phase of instruction must necessarily be determined by the individual teacher. The formulation of any definite course content must be based upon and correlated with pre-requisite courses.

The pressing question which confronts us is not how to define the scope of pharmaceutical chemistry but how to present the subject matter with a reasonable degree of completeness in any given curriculum. The subdivision of chemistry

into courses having a limited and definite objective has, I believe, been proven wise by extensive experience. Following this precedent, we might give courses in inorganic, qualitative, organic, quantitative and physical pharmaceutical chemistry. If we consider, however, that general inorganic and organic chemistry, and qualitative and quantitative analysis should be given as pre-requisite instruction and that courses in physical chemistry, physiological chemistry and food analysis are important for pharmacy students, it becomes apparent that a compromise founded on rational practical needs in arranging curricula must be accepted. The difficulties may be partly overcome when, if ever, the facilities of our pharmacy schools offer opportunity for students to major in certain fields such as pharmaceutical chemistry, pharmacy, pharmacognosy or pharmacology.

In arriving at a compromise between what should be given as pre-requisite instruction in pure chemistry and what should be given in pharmaceutical chemistry, it is of paramount importance that a singleness of purpose be maintained rather than to include a variety of subject matter in any definite course. A blanket course in pharmaceutical chemistry covering all phases of instruction might conceivably be made to cover the entire scope of the subject matter, but such an arrangement lends itself to poorly organized, objectiveless teaching. It is advisable, consequently, to subdivide the scope of pharmaceutical chemistry for purposes of teaching.

The partitioning of pharmaceutical chemistry into courses can best be made along conventional lines and without great difficulty, and these courses can be correlated with pre-requisite instruction. After this is done, however, it will be found that there is not room for so much chemistry in the pharmacy curriculum. It is best that general inorganic chemistry, qualitative analysis and organic chemistry be given as pre-requisites preferably as fundamental sciences and not as applied chemistry since they are generally well organized, credits for them are readily accepted for inter-college transfer, and the Council on Medical Education requires that credit in these courses be taken in other than professional schools by pre-medical students. Whether or not a general course in quantitative analysis should be required as a pre-requisite to quantitative pharmaceutical chemistry is a debatable question since all of the fundamental theory and analytical technique utilized in the procedures usually covered in such courses, and more, is found in our official standards.

It is not my intention to outline the course content here that should be covered in pharmaceutical chemistry, for that has been done in the tentative outline of the new Syllabus for courses in inorganic, organic and quantitative pharmaceutical chemistry and the outlines have already been made available to you for study. Certain pertinent observations may be made, however, advantageously. A course in pharmaceutical inorganic chemistry is essential to teach the methods of preparation and purification and to emphasize the properties of the particular inorganic chemicals used in pharmacy. Instruction in pharmaceutical organic chemistry is necessary to treat in an adequate manner of those materials of great pharmaceutical importance, which are considered lightly if at all in the general course, such as, alkaloids, volatile oils, enzymes, glucosides, glandular products, and synthetic compounds. A quantitative pharmaceutical chemistry course is needed to teach the fundamental principles of analysis used to establish the purity of pharmaceuti-

cals. If a pre-requisite course in quantitative analysis is given, it is doubtful whether all of the elementary procedures, such as those involved in acidimetry and alkalimetry, need be repeated in the applied course. It should be borne in mind, however, that the official assay methods frequently differ from and utilize a distinct technique not encountered in general analysis. Since practically all of the fundamental principles and practices considered in a general course are included in the official methods and since the student can as well study these principles and practices in the applied as in the general course, pre-requisite instruction in quantitative analysis might be omitted more advantageously than could inorganic, organic or qualitative work.

Applied instruction in qualitative inorganic and organic chemistry should preferably be given in a separate course. The limitations of time in the curriculum, in most cases, make it necessary, however, to give this work along with and as a part of courses in pharmaceutical inorganic and organic chemistry. The official tests for identity and purity may readily be so included.

It is obvious that the subject of "The Scope of Pharmaceutical Chemistry" has been treated in this paper from the viewpoint of course content and curricula formulation. The important subjects of physical and industrial chemistry in their pharmaceutical applications have not been taken up. The essentials of these subjects might be considered, in part at least, in other well-ordered courses. The scope of pharmaceutical chemistry in the curriculum of any given school must be dependent in a large measure upon the objective of the school. In those schools where the only objective is to train retail pharmacists, extensive, systematic courses in pharmaceutical chemistry may seem unimportant, although they are not in their ultimate effects upon the general status of pharmacy. When the purpose is to give a basic pharmaceutical education in preparation for the practice of pharmacy in any or all of its ramifications, the extent of and emphasis placed upon general as well as applied courses cannot be overstressed. In the attainment of the latter, it may be necessary to give some courses in graduate work for those who wish to specialize in order to cover the scope of pharmaceutical chemistry. Where the entire scope cannot be covered, it would be better to present even a single thorough course of instruction in one phase of the subject matter than to give a greatly diversified, all-inclusive course.

THE NATIONAL FORMULARY OF BELGIUM.

"For a considerable time a special committee of pharmacists and representatives of the medical profession have been engaged in the preparation of a new edition of the 'National Formulary,' and the work was so far advanced as to justify anticipation of early publication, but the advent of the second edition had to be postponed until the new edition of the Belgian Pharmacopœia was issued, in order that the Formulary may not clash in any respect with the official publication. Now that the Pharmacopœia has appeared, the Formulary Committee has published a list of 184 drugs and galenical and other preparations 'nominated' for the second edition of the Formulary, upon which observations are invited. The preparations include medicated waters, medicated cigarettes, granules and factitious mineral water powders."

The efforts of pharmacists should be encouraged to improve the professional atmosphere of the pharmacy and as far as possible give the store a distinctive appearance rather than copy other classes of stores.