THE DEPARTMENT OF THE AMERICAN ASSOCIATION OF COLLEGES OF PHARMACY

C. B. JORDAN—CHAIRMAN OF EXECUTIVE COMMITTEE, A. A. C. P., EDITOR OF THIS DEPARTMENT.

HOW SHOULD FUNDAMENTAL COURSES IN CHEMISTRY BE TAUGHT IN A COLLEGE OF PHARMACY?

BY ERNEST LITTLE.*

Is there such a thing as pharmaceutical chemistry? Is there such a thing as agricultural chemistry? Are these not special applications of the general science of chemistry? If so, should not our fundamental courses be taught by men who are specialists in their fields rather than by individuals who are able to add a few special applications to the special field for which the student is preparing? Your Editor believes that the fundamental courses in chemistry for pharmacy students can best be taught by those who had training in and full appreciation of the science of pharmacy, provided they are thoroughly grounded in the phase of chemistry they are teaching.

Chemistry has developed so rapidly that it is almost impossible to find an individual who is a specialist in more than one narrow field. It is far better to have our pharmacy students taught the fundamental courses in chemistry by specialists in each branch than that they be taught by pharmaceutically trained individuals who have only a general knowledge of chemistry. The happy combination is secured when we have a pharmaceutically trained teacher who is also a specialist in the branch of chemistry he is teaching.—C. B. JORDAN, *Editor*.

A few weeks ago Dr. Glenn L. Jenkins, chairman of the Committee on Chemistry for the Colleges of Pharmacy and Boards of Pharmacy of District No. 2, requested me to present a paper at the March meeting of these two groups. In accordance with his request I read a paper entitled "How Should Fundamental Courses in Chemistry Be Taught in a College of Pharmacy?" Following the meeting Dr. Jenkins stated that he thought the paper should be presented at this meeting and suggested that I send a copy to Secretary Jacobs for his consideration. Having learned to respect the judgment of Dr. Jenkins, I again acted upon his suggestion and was requested by Dr. Jacobs to present the paper at this meeting. Although it is substantially the same as presented at Baltimore, a number of changes have been made in order to make it more appropriate for presentation to this group.

Following this introduction, which perhaps places altogether too much of the onus for the presentation upon the broad shoulders of one of my respected colleagues, I am prepared to present the question to you for your consideration and discussion.

May I call to your attention that the title of my paper is expressed in the form of a question, rather than a positive statement: "*How* Should Fundamental Courses in Chemistry Be Taught in a College of Pharmacy?"

At our Madison meeting last August, C. J. Klemme of Purdue University presented a short paper entitled "Why Organic Chemistry Should Be Taught in the School of Pharmacy." During the presentation of his paper, Mr. Klemme stated:

"There are some things a pharmacy student should be taught that are not emphasized in general chemistry. The reason for the U. S. P. caution about ether for anesthesia will be plain if an instructor in organic chemistry discusses the formation of peroxides and their possible effects.

* New Jersey College of Pharmacy.

Discussion of chloroform would explain its decomposition into hydrochloric acid and phosgene and the use of ethanol as a negative catalyst; also why chloroform for anesthesia is made from chloral. The author feels that wherever the physical set-up of the school makes it possible, organic chemistry should be taught to pharmacy students in the school of pharmacy by an instructor who has been graduated from pharmacy."

I quote Mr. Klemme at some length in order to present just the opposite point of view from that which I hold. I am not particularly interested in where a fundamental course in chemistry is presented. That is not a matter of paramount importance. I am, however, vitally concerned about how these fundamental chemistry courses are presented and the training of the individuals who present them.

I quite agree with Mr. Klemme that the important applications of organic chemistry which he mentions, and, of course, thousands of others of equal importance, should be brought out and adequately stressed somewhere in the pharmacy course, but why try to crowd them into a course in organic chemistry? Is this not the very material from which we should construct our courses in organic pharmaceutical chemistry? Will not more of these important applications be made in materia medica and in manufacturing pharmacy as well? Most colleges of pharmacy can afford no more than three hours of class-room work a week in organic chemistry throughout one college year. Those of us who have taught organic chemistry know that is hardly enough time to present a fundamental course which is adequate to serve as a foundation upon which other more specialized courses may build. Under the best conditions, this foundation cannot be made as broad as we would like to have it, but we can see to it that what we do complete is as firm and strong as possible. Infiltrations of practical applications may make it more diversified, perhaps somewhat more interesting, but certainly weakness, rather than additional strength, will result. I think there is a great deal of wisdom in President Butler's definition of the specialist when he says: "A specialist should be a broadly educated man, sharpened to a point."

Not only are there many fundamental principles to be presented but their inter-relationships must be definitely and clearly established. Similarly, parallelisms between organic and inorganic chemistry must be pointed out in order that all the fundamental chemistry courses may be properly coördinated and adequately linked together, thus collectively offering a strong and as adequate a foundation as possible. All professional, technical and applied courses will send deep roots into this foundation and from it their sustenance and building materials are obtained. We cannot expect an adequate, useful, super-structure unless our teachers of professional subjects have been provided with an adequate foundation upon which to build, and unless they also know how to make full use of the materials which have been furnished them.

For example, it is essential that in our courses in general chemistry the students be acquainted with the fundamental principles of hydrolysis. This is, of course, done in all schools. We bring out as clearly as possible what the process of hydrolysis consists of and why the three conditions of (1) large volume, (2) low acidity and (3) high temperature, may be essential to a successful hydrolytic reaction. I doubt the wisdom, however, of taking time to point out to students in general chemistry the important application which is made of this fundamental principle

in the basic acetate separation of iron, chromium and aluminum in the presence of phosphates. If more time is available, it might rather be spent in further stressing the fundamental principle, leaving the many important applications to be brought up later, as they will be, in their appropriate places. Qualitative analysis is nothing more than an application of general chemistry. The student of qualitative analysis learns very little, if any, new chemistry. If general chemistry has been taught in an applied manner, I fear the teachers of qualitative analysis and of applied and professional subjects will find their work greatly handicapped by an ignorance of fundamentals on the part of their students.

On the other hand, when the student is studying the preparation of a solution of aluminum subacetate, as outlined in the N. F. V, the fundamental principles of hydrolysis may well be briefly reviewed and the student made to understand that the concentration of acetic acid here recommended is such as to stop or tremendously slow down the hydrolysis when the salt $Al(OH)(C_2H_3O_2)_2$ is formed, instead of allowing it to continue until the less soluble $Al(OH)_2C_2H_3O_2$ is precipitated, as is the case in the basic acetate separation of iron, chromium and aluminum. The student will also understand why it is that this solution of aluminum subacetate gradually becomes turbid as it is allowed to stand and the greatly retarded hydrolytic reaction slowly proceeds, forming a more basic and hence less soluble salt.

In presenting the Solubility Product Principle, as is done by all teachers of general chemistry, it is not at all necessary that its application in qualitative analysis, showing why cadmium sulphide will dissolve in hydrochloric acid whereas the less soluble copper sulphide will not, be even mentioned.

Again, however, in the preparation of syrup of calcium iodide, after having dissolved the iron wire in an aqueous solution containing iodine, the iron is oxidized to its higher valence before removing it by the addition of portions of precipitated calcium carbonate. This oxidation is carried out because an examination of the solubility products of ferrous carbonate and ferric hydroxide shows that the syrup will contain smaller traces of iron if it is removed by precipitation after oxidation to a valence of three. The rather pronounced evolution of carbon dioxide in this preparation may be pointed to as an evidence of the hydrolysis of ferric carbonate to ferric hydroxide, or a highly basic carbonate, and also as a reason why the precipitation of the ferric iron proceeds as rapidly and completely as it does in spite of the fact that there is so little difference in the solubility products of calcium carbonate and ferric hydroxide.

We see, therefore, that there is a great deal of fundamental chemistry in as simple a process as the preparation of Syrup of Calcium Iodide. It is, however, not essential that this preparation be even mentioned when hydrolysis, oxidation and solubility products are being discussed in the course in general chemistry.

As to the individual who should teach these fundamental courses, my chief concern is that he should be a person fundamentally trained in chemistry. If he be a teacher of organic chemistry, he should have a thorough grasp of the whole field of organic chemistry. He should have a tremendous reserve of the subject as a background, which he is not compelled to draw upon in his every-day, class-room work. An individual so grounded, who is also a graduate pharmacist, should prove to be a very successful teacher of this subject. It seems to me to be more essential that teachers of professional and technical courses should have a profound knowledge of

the fundamentals upon which their specialities rest than that the teachers of fundamental subjects should have in mind all the important and useful applications which their subjects make possible.

I sincerely hope that my presentation has not sounded arbitrary or uncompromising. I realize that there are two well-defined schools of thought in this connection. I realize also that there possibly is no particular task which cannot be well done in more than one way. Who, then, is to say that *his* method of procedure is *the* best?

I have tried, however, to present my ideas as concretely and definitely as possible in order that they may serve as a basis for your consideration and discussion. The point involved is not a minor one. It is of fundamental importance. It is not so long ago that many schools, which are now members of this association, were giving minimum two-year and in some instances part-time, three-day-a-week courses in pharmacy. Under such conditions the question which I am now discussing did not exist. There was not time enough available for the presentation of either fundamental courses in science, or strictly technical and professional subjects. Nondescript combination courses were given, because they were the best that could be formulated under the then existing conditions.

Now, however, conditions have changed. We adopted the three-year course and then the minimum four-year course leading to the Bachelor of Science degree. With twice as much time available, should we simply devote twice as many hours to the same type of courses, or should a fairly distinct line of cleavage appear between the fundamental science courses on the one hand and the professional and technical courses on the other? My answer is that the latter procedure seems preferable.

I, of course, realize that one of the most fundamental principles of good teaching is to present a course in as interesting a manner as possible. I do not object to the *judicious* use of applications in a fundamental course in science. Good pedagogy must be served in a variety of ways and is very properly promoted by various devices and procedures. This concession, which is most willingly granted, does not, however, confuse the issue at stake or detract from the general principle for which I am arguing. I conclude, as I started, with the query: "How Should Fundamental Courses in Chemistry Be Taught in a College of Pharmacy?" I am sure you have some decidedly worth-while ideas on this subject.

Teachers of botany will find much to commend in the following paper presented by Professor C. C. Albers. The thoroughness of presentation of this phase of the work can easily be extended to other parts of the plants used in medicine and thus make the course in botany a splendid foundation for pharmacognosy.—C. B. JORDAN, *Editor*.

THE BOTANY COURSE AS A FOUNDATION FOR THE PHARMACOGNOSY OF STEM AND BARK DRUGS.

BY C. C. ALBERS.

In taking up the study of stems in a botany course, one must, of course, distinguish between aerial stems and underground stems, of which there are several types. One of the chief difficulties of and causes of confusion to the beginning botany student arises in the attempt to distinguish between underground

stems and roots, a difficulty no doubt arising from the common conception that all underground parts of the plant are roots. Nor are aerial stems always evident to him, as in the case of the prickly pear (*Opuntia* species), for example, in which case the real stems are regarded as leaves, another error very likely arising from the popular conception.

Hence, in the first place, it becomes necessary to distinguish between roots and stems, since so many of the important plant drugs consist of underground stems and roots. The differences between these two types of plant organs should then be emphasized as regards the following features: The location of the growing point, the manner of branching, the origin of the branches, buds and leaf scars, the functions of each, and finally the internal or microscopic structure of each. The majority of these differences can be pointed out in the field or in the laboratory, where representative specimens of each may be selected from the stock of drugs. A microscopical examination of longitudinal sections of root tips and stem buds will reveal the difference in location of the growing points.

So far as the underground stems are concerned, the outstanding characteristics of the four types, namely, rhizomes, corms, bulbs and tubers, should be pointed out. A textbook definition of each will scarcely be sufficient. Representative specimens of each (selected from official drugs as far as possible) should be chosen for study. In the case of rhizomes, the leaf scars and bud scales on the surface should be pointed out, as well as the rootlets on the lower surface. Johnson grass, Bermuda or Couch grass rhizomes exhibit these features excellently, as well as the jointed nature of the monocotyl type of stem. The official iris rhizome and ginger rhizomes show the irregular structure of the underground stem and also the numerous root scars (especially of iris) on the lower surface.

For the study of bulbs, the common onion, garlic or even the squill bulb may be used. The outer papery membrane of these, the fleshy scales enclosing the buds, and the roots growing from the lower end should be emphasized. The corm, on the other hand, though it is likewise enclosed in a papery membrane and is erect, short and thickened, does not consist of thick, fleshy scales, but is solid and more flattened from the top to bottom. The attention of the student should be directed to the symmetrical nature of both these types and contrasted with the lack of symmetry of the rhizomes and tubers. Since only one official drug consists of a corm and it is not readily obtainable in the unsliced form, the ordinary gladiola or crocus corm from the flower shop can be utilized.

As an example of a tuber, perhaps no better type can be found than the common Irish potato. It would be better to have an entire Irish potato plant with the tubers attached to show the manner in which the tubers are attached to long slender rhizomes. The buds or "eyes" should be carefully examined and the terminal and lateral buds noted, as well as the outer corky layer and the rows of vascular bundles internally. Finally, some scrapings from the fleshy part of each of these underground stems should be examined microscopically and the large amount of storage material in the cells noted.

So far as the microscopic structure of the stem is concerned, it would appear that this study would be even more important than the gross anatomy. Whereas the student may understand that the bark of a stem is that portion which he can "peel" off, yet without a knowledge of the structure he will have no conception

as to what constitutes a bark, no knowledge as to what plant elements are present or of the distribution of these in the bark. Nor will he understand without it just why the bark peels off so readily from the rest of the stem. Furthermore, a knowledge of the tissues present in the entire stem and their distribution will enable the student not only to understand better its functions and its general make-up but also to anticipate the elements to be encountered in examining the stem drug in powdered form. Again, the structure of the stem can be made use of in distinguishing between the various types of stems, namely, the monocot type, the dicot type and the fern type. If a distinction of the first two has been made on other grounds, it should be "clinched" by comparing the vascular bundles and their arrangement in these two types, as well as in the fern type. Nor should the comparison end here, but in the case of the dicots should be carried to those exhibiting primary and secondary structures. Then will the student fully comprehend the meaning of such terms as bark and phloem, of herbaceous and woody, of heartwood and sapwood, of periderm and borke, of cortex and cork, of cambium and phellogen, of pericycle, medullary rays, tracheids, sieve cells, collenchyma, and numerous other terms encountered in the official description of the structure of drugs derived from the stem of the plant.

The various types of vascular bundles should be studied in detail not only to ascertain the elements present and their arrangement, but also to observe what changes take place in the bundles of stems which undergo secondary growth. This change is excellently demonstrated by comparing young and old stems of *Menispermum canadense*. By this time the term "bark," defined as all tissue regions exterior to the cambium, should mean something to the student; and he should also by this time comprehend the nature of the three parts, namely, the inner, middle and outer parts, and realize why a certain bark drug is stipulated to consist of the inner bark in one case and to be "rossed," or have the "borke" removed, in another case.

For a more detailed study of a bark, Cascara Sagrada lends itself very nicely in transverse section. The three parts show up very clearly, the inner bark with its phloem elements and medullary rays, the middle bark with its cortical parenchyma and patches of stone cells, and the outer bark consisting chiefly of phellogen and cork cells.

If the above amount of detail is devoted to these plant parts in the botany course, the student should be fairly well equipped to take up a study of the drugs consisting of those plant parts.

TWENTY-FIFTH ANNIVERSARY CELEBRATION, HONORING DEAN C. B. JORDAN,* MARCH 13, 1935.

REMARKS OF ROBERT P. FISCHELIS, PRESIDENT OF THE AMERICAN PHARMACEUTICAL ASSOCIATION.

To review the progress of American Pharmacy in the past quarter century in three minutes, as requested by the Committee on Arrangements, appears to be a rather formidable task. If we bear in mind, however, that the recorded history of pharmacy covers 40 centuries, it is quite obvious that the historian of the future will probably discuss this period—which looms so large in the minds of the present generation—in comparatively few words. At the rate of 3 minutes

* Purdue University School of Pharmacy.

per quarter century it would take just 8 hours of continuous talking to review the accomplishments of our profession from its beginnings in the mists of antiquity to its present status in the fogs of the New Deal.

In twenty-five years we have lived through the entire or partial administrations of six Presidents of the United States. We have lived through one of the greatest wars of history. We have baptized and buried prohibition. We have gambled our way into and out of prosperity, and through it all Pharmacy seems to have made some real progress.

A quick bird's-eye view of the situation indicates:

1. A sharp trend toward better regulation of the commerce in drugs and medicines.
2. An industrial development which, in line with other national trends, has favored the expansion of corporate interests at the expense of the small operator, and
3. A distinct elevation of our professional standards.

In 1910 only three states required pharmacists to possess a college education. The restrictions of the sales of narcotic drugs were inadequate. Restricting the sale of hypnotic drugs had hardly been thought of. Federal Food and Drug regulations were in their infancy. The Harrison Anti-narcotic Act was just in the making. To-day, after the lapse of 25 years we find two-thirds of our states requiring pharmacists to be college graduates and pharmacists urging still more stringent regulations for the control of adulteration, misbranding and advertising of drugs and with a fair prospect of obtaining them.

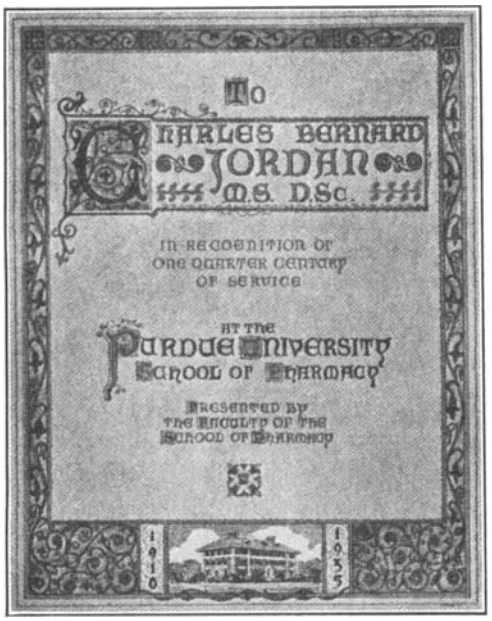
We have accomplished strict regulation of the dispensing of narcotics and there is an increasing demand for the regulation of sales of hypnotics as well as a more general public appreciation of the need for confining sales of all drugs, medicines and poisons to qualified pharmacists. The experimental work of pioneer states in this field has in many cases led to standardized national and state procedures. The closer coöperation of state and national pharmaceutical organizations is responsible for much of this progress. Monthly publications, full-time secretaries, legal advisers and specialized activities in our state and national associations are all developments of the past quarter century.

The World War gave a great impetus to the medicinal chemical industry in the United States. We are no longer dependent upon Europe for synthetic organic chemicals. The development of the machine aided and abetted by the difficulties in obtaining supplies of alcohol for manufacturing purposes on a small scale both during and since prohibition has removed much pharmaceutical manufacturing from the retail drug store. We can only marvel at the development of the manufacturing, control and research facilities of drug manufacturing corporations during the past twenty-five years, even as we regret to see the original servant of the pharmacist apparently becoming his master.

The chain-store movement in the retail drug field is largely a development of the past quarter century. While it has undoubtedly had a stimulating effect upon the merchandising activities of retail druggists, its effect on the professional side has been unfortunate for it has not only detracted the attention of retail pharmacists from their primary function but has introduced into their establishments a variety of merchandise in which they ordinarily have no interest and which has made them a target for complaint from merchants in other fields and has had a tendency to obscure their professional status in their own communities.

To combat the unfavorable developments resulting from mass production and mass distribution, leaders in pharmacy have resorted to the most formidable weapon at their command—education. To paraphrase a biblical expression, "where there is vision the people will live," and vision is the result of education. The most encouraging development in American Pharmacy during the past quarter century is the rapid increase in standards of education and licensure. From no general high school requirement for college entrance in 1910 to not less than 4 years in 1923 and from a short 2-year college course in 1910 to a minimum 4-year course on an academic basis in 1932 is the record of progress stated briefly. That this minimum educational requirement is in force now in more than two-thirds of the States of our Union and that the courses given by the American Colleges of Pharmacy have reached the high standard now obtaining is due in large measure to the foresight and determination of a relatively small group of leaders in American Pharmacy.

Right here in Indiana and on this very campus there has labored long and faithfully an individual to whom the last 25 years must have passed very rapidly and who can look back on them with considerable satisfaction.



Memorial Plaque, honoring Dean C. B. Jordan, presented by the faculty of the School of Pharmacy, Purdue University.

While turning out a new generation of pharmacists in his own college and leaving upon them the imprint of his personality and passing on to them the idealism of a noble calling, he has also for many years exercised a judicious and wholesome influence upon the destinies of pharmaceutical education throughout the United States. I need not tell you that I refer to Dean Jordan.

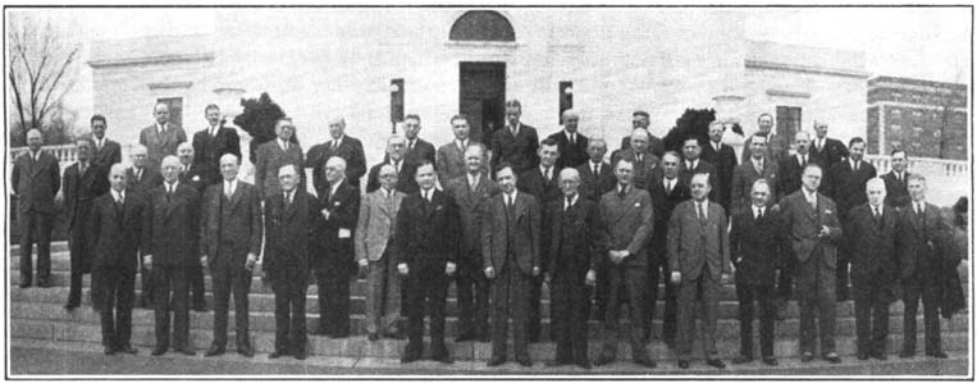
His services as president and later as chairman of the Executive Committee of the American Association of Colleges of Pharmacy have been of a high order. He has served the AMERICAN PHARMACEUTICAL ASSOCIATION as secretary and chairman of its Section on Education and Legislation and as vice-chairman and chairman of its House of Delegates.

It is my great privilege to bring the greetings and congratulations of the AMERICAN PHARMACEUTICAL ASSOCIATION to Dean Jordan and to Purdue University on this very enjoyable occasion and to wish for both the Dean and the University many additional years of the happy and fruitful association which has brought great credit to them as well as to American Pharmacy.

CALIFORNIA ASSOCIATION.

The 1935 convention of the California Pharmaceutical Association at Hotel Coronado, San Diego, June 23rd–26th, with the added drawing power of the International Pacific Exposition, is expected to establish an attendance record for state pharmaceutical conventions.

A Scientific Pharmacy section, a distinct innovation this year, will round out a well-balanced program of business and pleasure.



Annual Meeting of Boards and Colleges of Pharmacy, N. A. B. P. District No. 2, at the AMERICAN INSTITUTE OF PHARMACY, Washington, D. C., March 11 and 12, 1935.