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THE IMPORTANCE OF PHYSIOLOGICAL CHEMISTRY IN MODERN PROFESSIONAL PHARMACY.*

BY LLOYD RIGGS.

Any treatment of the subject that has been assigned to me for discussion to-day obviously requires either that certain definitions be set up or that certain points of view be stated. The chief contact of the author with modern professional pharmacy is at the present time through a college of pharmacy. It may not, therefore, appear to be out of the way to discuss the subject very largely from the point of view of one who is interested in pharmaceutical education. I do, however, wish to insist upon a conception of professional pharmacy which is made sufficiently broad so as to include the practice of pharmacy in the truly great pharmacies of the present day, *i. e.*, in the large pharmaceutical manufacturing establishments, in hospitals, laboratories and pharmacy colleges, as well as in the smaller privately controlled institutions for the practice of the profession.

With regard to the question as to what is bio-chemistry or physiological chemistry, I can do no better than to quote from the statement of Professor Gortner in the May 1930 issue of the *Scientific Monthly* (page 416); "For the present the definition of bio-chemistry may be stated as 'A field of science devoted to the study of the natures and reactions of those compounds found in living matter and the rôle which these compounds play in the living organism,' with the ultimate hope that this definition may be restated as a field of science yielding an interpretation of the reactions of living organisms in terms of physics, chemistry and mathe-

* Section on Education and Legislation, A. PH. A., Baltimore meeting, 1930.

matics." The one point of view upon which I would insist is that physiological chemistry is one of the biological sciences and that physics, chemistry and mathematics are the tools that make its development possible.

The development of physiological chemistry as a science "in its own right" has come about in two different ways. *First*, chemists have become interested in the materials and the phenomena of life and have made outstanding contributions to our understanding of the chemistry of life. In this connection one naturally thinks of the pioneer work of Lavoisier and of Liebig and also recalls the sensation made by the first synthesis of urea by Wöhler. Our present understanding of the chemistry of the carbohydrates, proteins, lipins, excretion products and of intermediary metabolism are the results of work following along this line of effort. *Second*, biologists have turned to physics and chemistry for an explanation of the phenomena which they observe. Claude Bernard, with his mechanistic conception of life, is perhaps the outstanding example of this line of thought which has produced such men as Mathews, Leob and Michaelis and contributed to our knowledge of the importance of hydrogen-ion concentration, the rôle of protein chemistry and of inorganic salts in life phenomena.

Bio-chemistry as a separate science is young. Twenty-five years ago there were but three bio-chemistry departments in American universities. At the present time practically every university has its department of physiological chemistry, named, however, by a variety of names.

Even the most cursory glance at the several departments of physiological chemistry in American universities brings out the fact that there is a wide divergence in their organization, their aims and in the actual subject matter of the courses given and the directions in which their research trends. A rough classification of such departments might be given somewhat as follows:

A. One of the most numerous types of bio-chemistry department is that which exists in so many of our medical schools and which might be very properly called departments of pathological chemistry. Much work of outstanding merit and of value both to medicine and pharmacy comes from such a department.

B. Colleges of Agriculture all have departments which devote their energies to the development and teaching of agricultural bio-chemistry.

C. A certain number of pharmacology departments are very largely given over to a study of bio-chemical problems, and great developments in pharmacy and medicine have come from the work thus organized.

D. Some few departments of bio-chemistry appear to give attention only to that fascinating and dimly seen field where physics, chemistry and mathematics meet in an attempt to solve some of the riddles of life. Theoretical advances in pure physical chemistry come with more or less regularity from such departments.

E. This fifth type of department of physiological chemistry is that of pharmaceutical bio-chemistry and is, so far as I know at the present time and for all practical purposes, non-existent.

What pharmaceutical bio-chemistry is, or should be, is not in my opinion a difficult question to answer. The general statement that such a department should direct its energies toward a study of the bio-chemistry of medicinal agents (pharmaceutical products) about covers the answer to the question. Such a statement, no doubt, calls for some more or less obvious remarks by way of elucidation.

tion, but before attempting this, let me say that it appears to me to be obvious that colleges of pharmacy under the rapidly changing conditions of to-day have a responsibility in this matter. The two-year pharmacy course is a thing of the recent past, the three-year course is almost a thing of the past, the four-year course is upon us and the demand for graduate work is felt more keenly almost daily. I, for one, could never develop any enthusiasm for a pharmacy school which had for its only object the training of drug store clerks. If the additional educational requirements of pharmaceutical education mean anything they mean the training of young men and women for leadership in a great and rapidly growing field which is at the present time very largely unoccupied, or at least occupied to a great extent by people who do not have a pharmaceutical background.

The manner in which recent outstanding developments involving pharmaceutical products have come about, well illustrates the point that I have just tried to make. A discovery is made usually in some medical school or institute. This discovery, it appears, may eventually be of utilitarian importance and result in placing on the market a new pharmaceutical product. Such a discovery is announced in the scientific journals and usually the next step is taken by some large manufacturer of pharmaceuticals who coöperates with the discoverer and carries on the investigations essential to the preparation of the material on a commercial scale. Once the new product is on the market the question of assays, standards, etc., is again taken up, but not usually by pharmaceutical institutions. Pharmacy students generally and occasionally, perhaps, faculty members, first learn of such developments after the new product is on the shelves of the local drug store. The examples of insulin, ovarian extracts, the newer antitoxins and synthetic drugs, such as germicidal agents, come promptly to mind. It may not be out of place to ask about the part that colleges of pharmacy have played in such developments. Great pharmaceutical manufacturing establishments are indeed pharmacies and it might be well to ask the question as to whether the men in these great pharmacies who are directly responsible for this work are men trained in colleges of pharmacy. There exists an enormously important field which will be developed, and those of us who are interested in pharmacy colleges are concerned in the question of those who are to be active in such development. Pharmaceutical bio-chemistry is far from being the whole story, but it is perhaps not overstating the case to say that this field is a crucial division of the problem.

Now as to the content of pharmaceutical bio-chemistry. First of all this division of the subject must contain the fundamentals of bio-chemistry which are included in all of the subdivisions of bio-chemistry, such as physics, chemistry, physical chemistry, colloidal chemistry, etc. It must next draw upon pathological chemistry and pharmacological bio-chemistry and be concerned particularly with the chemical aspects of immunology, the vitamins, medicinal agents of biologic origin, and must beyond all maintain itself as a biological science.

If we should grant, for the sake of argument, that a development such as outlined above is desirable, then we must be concerned with the question as to the procedure by which it may be accomplished. I should like to suggest that one of the best methods is to induce young men of ability to think and to see the problems involved and possessing the minimum training of the Ph.D. in bio-chemistry to enter our colleges of pharmacy as members of a faculty or research staff. It is

my opinion that such a man will find problems to challenge his best efforts and will make for himself a place in the world of science; and it is not holding out too great a hope to say he may write a new chapter in the book that will, later on, detail the development of American pharmacy. There is one thing which is of even greater importance than the tentative suggestion of a possible procedure made here, and that is, more harm than good will be done if pharmaceutical bio-chemistry is to be made a step-child in our colleges of pharmacy. It takes time to make a bio-chemist of full professional standing, but bio-chemistry departments in pharmacy colleges should be headed only by such men.

The question may be asked, what can be done about all of this in the four-year course in pharmacy? In reply I would say that the introduction of a certain amount of elective work will come in the four-year course anyway and that the colleges should be in a position to give their best students a chance to specialize along this as well as other lines. But what chance for employment has the student who thus specializes? Large pharmaceutical houses continually need such men. In many of our hospitals the ability to pour medicine out of a bottle qualifies for the practice of pharmacy, and bio-chemistry is presided over by routine technicians in a truly appalling number of cases. Would not many of our hospitals be enormously improved by the establishment of a strong department combining the functions of pharmacy and bio-chemistry? Here is the opportunity for work with a challenge in it and many chances for worth-while investigations. It also seems to me that the private practice of professional pharmacy might well profit by the help of pharmaceutical bio-chemistry. Who to-day thinks of the pharmacist as one who can and will prepare an autogenous vaccine or determine the blood type preparatory to a transfusion? Yet these are labors easily learned and easily carried out.

Of course, such developments in our colleges of pharmacy mean new laboratory facilities and more money, but such things, after all, constitute only one more problem for the deans.

ABSTRACT OF DISCUSSION.

D. B. R. Johnson inquired whether bio-chemistry could be standardized in such a way that there will be agreement. The author replied that there was no agreement; he stated the chief reason for presenting this paper was because of experimenting, in the school with which he was connected, in giving bio-chemistry; at the present time, one year with two lectures a week and laboratory work is given. He said that most of the students and former graduates do not want to drag it out for a year; they want some sort of hurry-up course, where they can learn blood and urine analyses, and a few other things, in a short time. There are a number of technicians in hospitals who have not the faintest idea of what these tests are about, but certainly with one year background as they go through school, they would have the fundamentals of bio-chemistry, which includes the chemistry carbohydrates and other things that pave the way for a sufficient comprehensive study of the pathological side of bio-chemistry. In his opinion colleges of pharmacy should certainly go into this work, and not in a half-hearted way. A four-year course gives adequate time to make a man a practitioner, and this tends to develop a pharmacist's professional standing.

J. H. Webster asked what the prerequisites were. The author replied: "General chemistry, organic chemistry and biology."

Mr. Webster asked further whether the students have a background of organic chemistry; to this the author replied that with the three-year course they had not been able to do this; the work at present is still in the experimental stage.