

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.

THE TEACHING OF PHYSIOLOGY IN THE SCHOOL OF PHARMACY OF THE UNIVERSITY OF TENNESSEE AT MEMPHIS.

BY A. RICHARD BLISS, JR.*

When, years hence, the pedagogical archæologists of pharmaceutical education excavate the moldy caves where pharmaceutical educators exist and labor, they will find an accumulation of centuries which they will call the anatomic stratum and immediately above this layer they will discover a gradually changing stratum which they will term the physiologic stratum. Among the debris will be found the cadavers of discarded teaching methods, the mummies of forsaken hypotheses, the skeletons of abandoned theories, and your bones and mine, fellow teachers.

Someone has said that the present is the era of function. Physiology, in spite of its slender time-allotment in the Syllabus, is the pharmaceutical curriculum. Physiology is pharmacy. If you are in doubt, ask the teacher of *Materia Medica* and Pharmacology who defines at least a portion of his subject in terms of the action of drugs. Ask the pharmaceutical chemist and the pharmacist who cannot refrain, and this inclination is quite correct and proper, from including in their discussions references to the applications of the materials they handle to the treatment of disease, frequently alluded to as abnormal physiology. Ask the bacteriologist who has adopted the experimental method and is speculating on the "how and why" of the things he handles and the effects they produce on animal or vegetable organisms. Ask the botanist and the pharmacognosist whether these subjects are taught without frequent reference to the physiology of both plant and animal.

All of these jocular exaggerations are but preliminary to the statement that in so far as the teachers of Physiology are able to improve the subject itself and the teaching thereof, to that extent will pharmaceutical education be improved.

The Teacher of Physiology.—The teacher of Physiology in a pharmacy school should not be one of those specialists "who knows more and more about less and less." The average M.D. has not mastered physiology. A young M.D. who has completed the regular medical curriculum and who is willing to give a few hours from his practice to teaching does not fulfill the demands of the rôle of the physiology teacher. It is true that we cannot influence the physiologist's heredity; however, we can render some assistance by defining the kind of education the teacher should have. Physiology is the Physics and Chemistry of living matter. Accordingly, Physics, Chemistry and Biology constitute the very foundation of Physiology. His preparation in these subjects should be better than that of the average medical student. Having completed satisfactorily these foundation subjects, he should then master Physiology. In order to accomplish this, the individual must live in the science itself by working in a physiological laboratory under

* Dean of the School of Pharmacy.

the supervision of an enthusiastic, productive physiologist. During this apprenticeship, it is probable that the individual will have learned to teach, will have become familiar with physiological literature and will have published the results of some commendable work. What difference then as to the degrees the individual may write after his name?

In addition to being the possessor of the scientific training already mentioned, the teacher of Physiology should possess the quality of scientific imagination. In Anatomy the student is taught to see with his eyes, to touch with his fingers, to develop his ability to appreciate forms of objects and parts by means of touch, and to exercise muscle sense. He is taught structure and accurate description. His feet are placed on solid ground, for correct observation is the only acceptable basis of correct thinking. Facts are the things our minds conjure with. However, the physiologist must do something more than simply use his sense organs and make true brain connections. More than any other teacher, possibly, he must be capable of seeing with his imagination and touching with his spirit. As Lyon says:

"He must visualize nerve impulses hurrying in their pathways, hurdling synapses, striking closed passages, seeking open switches, scuttling along collaterals, firing off stored explosives—yea, knocking on the secret and impenetrable walls of consciousness itself. He must see the whirlpool of the blood, the seeping lymph, the trickling secretions, obedient each to the interplay of osmosis, chemical affinity, electric charges, surface tension, gravitation, hydrostatic pressure, all at work in intimate harmony. He must look into the laboring cells, wondrous laboratories, engines, factories. He must see them select and reject, build and tear down, release energy and store it away—work as individuals and yet integrate a human being. All these he must do and yet keep his thinking objective and his philosophy sound. Some boy, the teacher of Physiology! Objectified idealist! Scientific romanticist! Spiritualized materialist! A cross between a butcher and a poet."

In proportion to the ability with which the physiologist is able to visualize processes, see function and feel the struggling life forces, and so far as he is able to arouse in his students scientific imagination, to that extent does he aid in making the pharmacy school a live thing.

The teacher of Physiology should be given freedom and security of tenure. He should be given an adequate salary and his teaching hours should not be unduly conducive to early death. He should be furnished with reasonable assistance, equipment and funds for running expenses. Adequate salaries for assistants should be provided not only because it is their just due, but also because of the fact that from this group must come the future heads of departments.

The Course in Physiology—Hours.—Replacement pages 14 and 15 of the 3rd edition of the Pharmaceutical Syllabus assign 60 hours in the first year of the three-year course to Physiology. This represents an increase of 10 hours, or 20% over the allotment of the two-year course.

The experiences of the writer and members of his staff, more particularly during the past five years, have brought the conviction that the 60 hours of the Syllabus are insufficient. At the University of Tennessee the hours were increased from 66 to 99 three years ago, and it has been found that the physiological material brought to light by the Commonwealth Fund Study can be adequately handled in from 90 to 99 hours.

Place in the Three-Year Course.—The Syllabus places Physiology in the first year. While it is true that Physics, Chemistry and Biology are desirable prerequisites, and that on this basis some schools have placed the course in Physiology in the second and in the third years, the pharmacy student is involved in physiological references in other subjects of the first year, more especially in his work in Botany. In his courses in Organic Chemistry and *Materia Medica* (with its sub-divisions) of the second and third years, the student is definitely involved in physiology. It appears, therefore, that the course in Physiology is for the most part rightly placed in the first year.

Method of Teaching.—At the University of Tennessee lectures, for the most part informal, charts, lantern slides, the blackboard, the skeleton, models, the cadaver, the living subject, recitations, laboratory demonstrations, the textbook, collateral reading, and the student's notes constitute the oral and visual aids to final results.

Lectures.—Some teachers strongly favor lectures, while others believe that they are of little value. It is probable that in each case they are just what the proponents believe. Students usually find lectures of value. Written words may carry authority, but it is the personality in immediate command who "puts it over." One must not forget the important factor of group psychology, for most students find that grinding on a textbook by oneself is a lonesome proposition. The desire to know what the teacher wants the student to know and the marking system are further factors in favor of lectures. Proper lectures constitute one of the greatest aids in stimulating imagination and arousing interest. I often recall the splendid lectures of Doctor Henry Hurd Rusby under whom I had the pleasure and privilege of working for three years. Rusby not only talked, but he thought out loud. His lectures were inspiring, suggestive and exhilarating. Physiology was no cut-and-dried study under Rusby. Instead, his presentation of the subject was resplendent with life, an amazing conjury of facts, theories and hypotheses, challenging every power of the human mind. Let the lectures stay in Physiology for those who can use them, but do not overdo it.

Lectures of the proper sort do not make an exclusive appeal to the ear. At Tennessee a collection of good charts, lantern slides, accurate models, the skeleton, the blackboard and the cadaver (borrowed from the Medical School) are among the aids of visual memories. In addition to the foregoing, students themselves are employed as living models for the surface and regional anatomic portions of the course. Girls in the classes are given this part of the instruction by women members of the anatomic staff of the Medical School.

Recitations.—The ratio of recitations to lectures is as 1:2. Recitations, as with most of the lectures, are informal and partake largely of the nature of general discussions and conferences. A written recitation is injected twice a month. Recitations cover the material already discussed during the previous lecture periods.

Laboratory Demonstrations.—Demonstrations are still used in lieu of a laboratory course, and, since these are given properly and under conditions which permit each student to see clearly what is going on, it seems that this plan is for the most part satisfactory for the present. The demonstrations should be, so far as possible, quantitative in character. Nerve-muscle demonstrations are given to bring out fundamental principles. The complex functions of conduction, coördination,

sensation and the mysteries of stimulation and response can be understood more readily by the average student with the basis afforded by these demonstrations. A demonstration with varying weights presents a very valuable opening for an interesting discussion of tonus. The effects of repeated stimulation may be made the gateway to the great field of efficiency and fatigue. Demonstrations on mammals have the advantage of student interest and of more direct applicability to human physiology. However, complexity of conditions adds to difficulty of control, and control is the keynote to experimentation. In a multiplicity of happenings it is difficult to focus the student's attention on the essential and useful. The human animal himself is always at hand and available, and should be the center of interest. Frog and mammalian demonstrations should be employed as a means of filling out subjects which are not possible in man.

Collateral Reading.—Pharmacy students at Tennessee are assigned carefully selected articles to read, abstract and report on. Each student is given at least two assignments. This plan is followed in the belief that students should learn that there is such a thing as original literature, that they should use the library, that they should know that textbooks are merely compilations and that Physiology is a growing and changing science.

Purposes of the Physiology Course.—On page 29 of the 3rd edition of the Syllabus, under the title "Physiology and Hygiene" is found the following:

"Physiology treats of the organic functions in a state of health.

"It is obvious that the introduction of the amount of physiology that is essential to an understanding of the subjects listed herein will strain the possibilities of this part of the course to the utmost. This fact precludes the study of anatomy, as such, which subject is therefore presented only in connection with, and as required for, the teaching of physiology.

Introduction and General Considerations.—It is scarcely practicable to prescribe the details of this portion of the subject, as each teacher is likely to have his own original method of introduction. It is wise, however, to commence with a reference to the amoeba, describing its form and structure, and showing that it possesses all the essential properties of a living being: sensation, voluntary motion, locomotion, digestion, assimilation, disassimilation, growth and reproduction. The cohesion of similar bodies, in masses or colonies, yet each vitally independent, follows; then similar masses with the individuals composing certain parts so modified as to perform certain parts of the work, while losing other powers, which are specially delegated to other individuals of the mass. Each is thus no longer an animal, but a cell, forming a part of the animal body. This leads to the teaching of unicellular and multicellular animals, of tissues, organs and functions, anatomy and physiology and organic systems and opens the way for the main subjects of human physiology, which follow."

On page 167 of "Basic Material for a Pharmaceutical Curriculum" appear the following statements:

Objectives: Information.—The pharmacist needs to possess a knowledge of physiology of such quality and quantity as will enable him to grasp and understand those portions of pharmacodynamics with which he is expected to be familiar, as well as such portions as are necessary to an understanding of other pharmaceutical branches involving physiological information, such as toxicology, hygiene and first aid.

Skill.—The pharmacist should be very familiar with such physiological terms as are needed for a proper understanding of functional pharmacology, as applied to pharmacy.

Method.—The anatomical and physiological terms found in Table XIV were drawn from the study of pharmacology. Since most drugs produce their effects or actions by stimulating, augmenting, decreasing or paralyzing one or more bodily functions of the living organisms, the

physiology necessary to an intelligent consideration and understanding of the pharmacodynamics involved was thus brought out. To the terms thus obtained were added such physiological terms as are needed to intelligently read the National Standard and United States Dispensatories, the First Aid Manual of the U. S. Public Health Service and Hough and Sedgwick's 'Hygiene and Sanitation.'

"All of the physiological data thus obtained were classified anatomically and physiologically as presented below. Since there is no indication that the pharmacist requires anatomy as such for the successful fulfilment of his functions, the anatomical data have been classified with the physiological. It must be borne in mind however, that this list of terms is not submitted as a syllabus or outline of a course in physiology; it represents simply the anatomical and physiological terms derived as indicated above. For convenience and organization they have been assembled according to their anatomical and physiological relationship.

"Although practically every system or apparatus of the human mechanism is represented by the physiological data compiled, there are many terms and topics which do not appear in the data but which are absolutely essential to a proper understanding of the subject of Physiology. The sources of the terms found are indicated by figures which are explained in foot-notes. The terms so indicated represent the purely functional terms as based upon the objectives indicated above. Such additional terms as are needed for their proper understanding must be considered 'connective tissue.' The quantity and quality of such additional material remains a matter for the personal opinion and judgment of the instructor."

The broad purposes of the course in Physiology for the pharmacy student are:

- (1) To provide pharmacy students with a knowledge of Physiology of such quality and quantity as will enable them to grasp and to understand those portions of pharmacodynamics, toxicology, public health, hygiene, first aid and other subjects of the pharmaceutical curriculum which involve physiological information.
- (2) To aid in training pharmacy students in observation and interpretation.
- (3) To assist in familiarizing students with the value of exact experimental methods; the idea of "control."
- (4) To assist in creating in the students a critical spirit of reading by turning them to the original literature.
- (5) To interest some students in further study and research with the idea of stimulating a certain number to become teachers of Physiology in pharmacy schools.

CHICAGO WORLD'S FAIR.

Dr. Max Mason, former president of the University of Chicago, and Dr. William Allen Pusey, former president of the American Medical Association, have been appointed members of the Committee on the Chicago World's Fair. The special committee of which of Dr. Mason and Dr. Pusey are members is to cooperate in the development of the scientific theme of Chicago's centennial celebration. Pharmacy should be properly represented.

FEW DRUG CONCERNS BREAK THE LAW.

In the annual report of the Department of Agriculture, Director Walker C. Campbell of

the Food, Drug and Insecticide Administration states that "observations through more than twenty years of law enforcement have demonstrated convincingly that only an insignificant proportion of the members of the industries concerned deliberately violate the law. Most of them earnestly desire to comply with all reasonable regulations not only on ethical grounds but also because it is the part of good business. Recognizing this the Department has chosen to consider the six laws coming under the direction of this division as corrective rather than punitive and has adopted an advisory-before-the-act attitude of offering constructive suggestions which should enable manufacturers to keep their products in compliance with the law."