

The prescription counter is an asset that is often underestimated. It is the department around which centers professional pride. It is the heart of the true drug store, no matter how many other departments there may be within the walls. It is the department that keeps the pharmacist alive to his duties and which spurs him on to better things in pharmacy. Let all pharmacists guard this important division of the store and care for it with jealous zeal.

UNIVERSITY OF MICHIGAN,
COLLEGE OF PHARMACY.

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CONTENT OF PHYSIOLOGY COURSES GIVEN AT THE NEW JERSEY COLLEGE OF PHARMACY.

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The adoption at the New Jersey College of Pharmacy of the three-year course leading to the degree of Ph.G. makes available for instruction in physiology and related subjects at least two one-hour lecture periods each week during the entire course. The proper utilization of these—some two hundred hours—for instruction in biological sciences is the serious responsibility of those who have this work in charge and it is with the hope of provoking discussion and obtaining the views of my colleagues in this field that this paper is presented here to-day (Philadelphia meeting A. A. C. P.).

The great and continual increase in the number and importance of medicinal biological products is one of the great outstanding characteristics of the development of modern medical science and I believe that the statement that the scientific pharmacist should, in order to keep abreast of the times, have at least an elementary knowledge of this important line of medicinal products is a proposition which requires no supporting arguments.

It is now 130 years since Jenner, in 1796, gave definite proof that vaccination with the virus of cowpox gave complete protection against variola or small pox. It is, nevertheless, quite generally true that the study of immunity and immunizing agents is a rather new subject; so new in fact, that the last few months have been the introduction of several new products such as scarlet fever toxin and antitoxin, erysipelas antitoxin and measles antitoxin.

It was only twenty-five years ago that the constitution of epinephrine was demonstrated by Tackamine (1901). Since that time the pituitary body, the thyroid gland, the islet tissue of the pancreas, the parathyroid gland, lung and brain tissue and the ovaries have yielded medicinal products either of known chemical constitution (thyroxin) or which may be standardized by biological methods.

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Biological standardization of drugs, vitamine assay, etc., are now definitely a part of the Pharmacopœia and it is not improbable that future editions of this standard work will contain additional biological products and assays.

It is manifestly impossible that, in the time allotted to biological study in a three-year pharmacy course, students should be turned out as experts in the fields of physiology, biochemistry, immunology, endocrinology, nutrition and biological assay. Nevertheless, it appears that an attempt should be made to teach at least that portion of the fundamental aspects of these subjects which will enable the practicing pharmacist to comprehend and discuss intelligently with his clients of the medical profession the nature of the great mass of biological products and biologically standardized remedial agents which pass through his hands.

There appears to be no good reason why any pharmacy graduate of the present day should make so fundamental and elementary an error as to call either a concentrated antitoxin or a refined glandular extract a serum. Nevertheless such errors are all too common. It may also be remarked in passing that the physician to whom all biological products are "serums" is not, even to-day, an absolute novelty.

All this is, of course, quite an old and familiar story to all who are interested in the teaching of biological sciences. It has been presented here for the purpose of indicating in a very general way the trend of thought which we, at the New Jersey College of Pharmacy, have been following in an attempt to set up for ourselves a goal we hope to achieve in the course of instruction, which we comprehend under the broad general term Physiology.

We tentatively propose that the freshman year of physiology teaching be devoted to what is ordinarily called "Elementary Physiology," introducing only such considerations of anatomy as are essential to the understanding of the functions of organs, tissues and cells. We propose to devote the second year very largely to chemical physiology or biochemistry. We hope in these two years to build up such a background that the third year may be given over to a study of what might be called, so far as the science of pharmacy is concerned, the practical applications of the work of the first two years. In the senior year we propose to pursue an elementary study of immunology, a foundation for which will have been laid in the first two years of physiology and in the course in bacteriology. The physiologic action of drugs and the biological assay of official drugs will then be considered and the vitamine assay (U. S. P. for vitamine A) will be introduced. Finally we propose to study the medicinal products obtained from the ductless glands and other animal tissues. It is hoped that we will be able to give demonstrations of the assay of all of these glandular products.

It is, of course, impossible in the time available to discuss our outline of topics in any detail, but we may give one or two illustrations. Let us take for example, the teaching of the blood. We propose in the first year to treat the blood as a tissue; to first discuss the composition of blood as a whole and then take up in more detail the plasma and the form elements.

Our outline for the white blood corpuscles includes the elements of the anatomy of the various types of leucocytes, *i. e.*, their form, size, structure, staining reactions and number. We plan, however, to omit the differential leucocyte count. We make a special topic of amœboid movement and thus introduce the ideas of

phagocytosis and of wandering cells. In connection with a study of the blood-forming organs the origin of the polymorphonuclear leucocytes and of the lymphocytes is pointed out in an elementary way. Finally the relation of leucocytes to pathological conditions, such as general infections and inflammatory processes, is touched upon.

Our outline on the red blood corpuscles calls for the presentation of their number, size, structure, etc., and points out their lack of nuclei and the probable relationship between this fact and their partially lost power of respiration and their totally lost power of growth, or synthetic metabolic activities. The chemistry of hemoglobin is treated in a very elementary manner and the oxidation and reduction of hemoglobin is demonstrated.

Blood platelets are merely mentioned in the first year and a discussion of these bodies is postponed until a later time.

The composition of plasma is treated in quite an elementary way. Its salts and proteins are discussed, but a discussion of its content of sugar, amino acids, urea and uric acid, etc., is postponed until a later time.

Special emphasis is placed upon the intimate relationship existing between blood, lymph and the cells of the various tissues.

In the second year the composition of plasma is considered in considerably greater detail. The separation of the several blood proteins is demonstrated and their properties studied. Preliminary announcement is made of the close relationship existing between globulin and antibodies.

The coagulation of the blood is studied in some detail, but controversial theoretical considerations are very largely avoided.

The chemistry of hemoglobin is further studied and the idea of the relation of oxygen tension in the lungs and in the tissues as the determining factor in the oxidation and reduction of hemoglobin is introduced and used as a basis for a discussion of oxygen transportation and cell respiration.

Blood is considered as a carrier of absorbed food products and also as a carrier of the waste products of cell metabolism. The subjects of digestion, absorption, metabolism and excretion are thus related through a study of the blood.

Finally the blood is considered a physicochemical system by which the acid base balance of the body is indicated. In this connection we expect to introduce the conception of salt and protein buffer solutions.

Our outline for the study of blood in the third year calls for a brief study of various hemolyzing or laking agents (physical and chemical agents, unknown constituents of blood serum, bacterial products, vegetable poisons and snake venoms).

An elementary study of immunity is undertaken. Natural, active and passive immunity are discussed in some detail. The relationship between infection and active immunity, also the artificial production of active immunity by the use of vaccine viruses, toxins, bacterial vaccines, toxin antitoxin mixtures and proteins (allergens) is given in considerable detail.

The preparation and characteristics of immune sera and antitoxins are described and related to the chemistry of the blood proteins discussed in the second year.

The preparation and characteristics of cowpox virus and of the attenuated virus of rabies employed in the Pasteur Antirabic treatment is discussed and some-

thing of the history of the discovery and development of these two important procedures is introduced.

The idea of the primary toxicity of several proteins (toxicity of human serum for guinea-pigs) is introduced and very carefully distinguished from the toxicity of proteins to animals previously sensitized by small injections of the same protein (anaphylaxis). Upon the foundation thus laid a discussion of desensitization by means of specific food and pollen proteins (allergens) is presented. The diagnostic tests for protein sensitivity are also considered.

The preparation and action of bacterial vaccines, autogenous and stock vaccines, are discussed in some detail.

The coagulation of the blood is again studied and the action of various tissue extracts marketed for the purpose of hastening the coagulation of blood are discussed and their action demonstrated.

The phagocytic action of the white blood corpuscles is reviewed and the idea of opsonins is introduced and discussed in a rather elementary way.

Perhaps more space than is necessary has been given to a discussion to our outline on the blood but this has been done because of the relative complexity of the subject and the considerable importance of the topics introduced.

The ductless glands are similarly treated in our outline. For example, in the first year, the elementary anatomy and physiology of the thyroid gland are discussed with special reference to hypothyroidism, pathological as well as experimental, also hyperthyroidism both experimental and pathological are discussed. In the second year the relation of the thyroid gland to basal metabolism is discussed and an elementary review of Kendall's work on thyroxin is presented. In the third year various medicinal products of the thyroid gland are discussed as is also the Hunt Acetonitril Method of assay of thyroid preparations.

These illustrations are, I believe, sufficient to indicate our method of attack. The topics which we introduce in the first year are as follows:

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| 1. The cell | 6. Respiration | 11. Excretion |
| 2. Tissues | 7. Food materials | 12. Nervous system |
| 3. Muscle physiology | 8. Digestion | 13. Special senses |
| 4. Blood | 9. Absorption | 14. Ductless glands |
| 5. Circulation | 10. Metabolism | 15. Reproduction |

Our topics for the second year are as follows:

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| 1. Carbohydrates | 6. Gastric digestion | 11. Nutrition (including vitamins) |
| 2. Fats | 7. Digestion in the intestine | 12. Chemistry of blood |
| 3. Proteins | 8. Metabolism | 13. Ductless glands |
| 4. Enzymes | 9. Excretion (Urine) | 14. Brain and nervous tissue |
| 5. Salivary digestion | 10. Feces | 15. Chemistry of several tissues |

Our topics for the third year are as follows:

1. Principles of immunity and their application to a study of immunizing agents.
 2. Medicinal biological products obtained from ductless glands and from other tissues.
 3. The physiologic action of drugs and their biologic assay.
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