SCIENCE

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THE TEACHING OF CLINICAL MEDICINE[1]

THE SCIENCE OF CLINICAL MEDICINE

CLINICAL medicine is the most complex of all the natural sciences, for successfully to study it one needs to be more or less familiar with the content and the methods of investigation of a whole series of ancillary natural sciences (physics, chemistry, biology, anatomy, physiology, psychology, physiologic chemistry, pharmacology, pathologic anatomy, pathologic physiology, bacteriology and parasitology, immunology, etc.). Like other natural sciences, clinical medicine consists of a growing accumulation of truths that make up a more or less distinct body of knowledge. In order that this body may be conveniently organized, the facts of the science have to be collected, compared with one another, arranged in logical sequence, and, as far as possible, summarized in the form of generalizations known as laws or principles. The many ways of accumulating and organizing the facts pertaining to the sick constitute the scientific method of internal medicine.

Studies of patients have shown us that the transformations of matter and energy in the bodies of the sick, though conforming to natural law, deviate to a certain extent either qualitatively or quantitatively from the transformations in health. Workers in clinical medicine are gradually finding out how to detect these deviations from the normal by systematic inquisition of the minds and bodies of their patients. They

[1] Read at the meeting of the Association of American Medical Colleges, Chicago, February, 1916.

began their studies by using the method of simple observation, but they have learned how to make observation more accurate by experiment so that internal medicine has now become an elaborate experimental science. The study of a single patient by modern methods includes the making of a very large number of experiments, that is, of test procedures adopted on the chance of their yielding to observation under especially controlled conditions definite information that is not obtainable by simple non-experimental observation. There is no other science in which the technic of accumulating facts is as extensive as in clinical medicine, for its methods of examination are based on and include the technical methods of the preliminary natural sciences and of all the intermediate, simpler pre-clinical sciences.

The end, or goal, of clinical medicine is to understand the abnormal conditions that may occur in the human organism in order that physicians may act in a rational way to cure them or to prevent them, instead of being content to act in the blind and haphazard way of the ignorant. The collection of data, the arrangement of them according to their similarities and sequences, the epitomizing of them in the form of brief symbols or generalizations such as syndromes or disease complexes, while important in themselves for the construction of the science, are in reality only means to the larger end of permitting suitable action for the welfare of human beings that entrust themselves to the care and supervision of the medical profession.

The great *science of clinical medicine* is, therefore, subdivisible into two large parts: (1) That dealing with the understanding of exactly what is going on in the body and mind of the patient and how it has come to pass—the *science of diagnosis;* and (2) that dealing with the fitting action to be taken to prevent the origin or extension of abnormal processes, and, when possible, to restore bodies and minds deviating from normal function to a healthy state—the *science of prophylaxis and therapy.* We endeavor to *know* in order to be able to *predict* and to gain the power to *control.*

The imperative need of the clinician to know in order rationally to act has accounted for the origin of the whole group of the natural sciences. For, as every one knows, physics, chemistry and biology had their birth as a result of this need felt by physicians; these sciences, and each member of the whole group of the preclinical medical sciences, began as daughters of the clinic. In their infancy they were under the fostering care of medicine; but they have grown up into lusty adults, and now, many of them, besides contributing handsomely to maternal support, are rendering notable service to human efficiency and culture in domains far removed from clinical medicine. I mention the primary relationship, for some understanding of it is of importance for the planning of clinical teaching.

THE NATURE OF CLINICAL TEACHING

If the definition of clinical medicine that I have given be accepted, the nature of the teaching will be readily understood. It will consist (1) in *instructing* the students regarding the organized body of knowledge that has been accumulated concerning diagnosis and therapy (as already broadly defined); and (2) in *educating* them in the methods used in accumulating facts, in arranging them, in comparing them, in epitomizing them, and in acting in a rational way afterward—preventing, curing and mitigating.

On these general principles as a foundation, the teachers of clinical medicine have to construct a suitable concrete curriculum

for the clinical years, in planning which every effort should be made to parcel out the precious time, and to fill the periods, in such a way as to give the best opportunities possible, under the teachers and with the equipment available. It is desirable that the students shall gain a comprehensive knowledge of the principles of clinical medicine and a systematic schooling in its practical-technical methods, both of which are necessary for a medical career that shall be satisfying to the man and of adequate service to society.

THE STUDENTS AS THEY ARRIVE IN THE CLINIC

Fortunately, students now enter the clinical years, or should do so if they take advantage of the opportunities offered them, habituated to the method of science. They have become familiar with the general principles of the three great preliminary natural sciences (physics, chemistry and biology) and of the three great preclinical medical sciences (anatomy, physiology and pathology), and to a certain extent they have been trained in the actual use of the practical-technical methods of investigation employed in the laboratories of these six sciences. By the time they have reached the clinics, we may assume that they know what the scientific method of inquiry is. We may take it for granted they have learned how problems are set and solved, that they have acquired a feeling for accurate observation, for the critical sifting of facts, and for resorting to experiment to perfect their observations. Students thus trained will enjoy considerations of comparison and of regularity of sequence. They will be acquainted with libraries and will know how quickly to consult sources. Many of them will have learned properly to doubt when convincing evidence has not been brought, whereas they will also, through their experiences, have found that they may confidently act, after inquiry has shown that action can be taken along lines of sequences known to be invariable.

The student's knowledge of man and of his relations to the rest of nature should by this time be fairly large. The student knows man as a living, thinking, feeling, acting social organism, very much like other living beings, and yet differing strangely from them. He has opened the body of man after death and knows what his organs, tissues and cells look like to the naked eye and under the microscope, and he remembers how these have all gradually grown from the fused germ cells. He has had a glimpse of the materials of which the cells and juices of man's body are composed, has isolated some of these materials and studied their properties and origins. He has found out that the materials in man are constantly undergoing change, that with these changes, synthetic and analytical, remarkable transformations of energy go on, under special conditions it is true (colloidal states; ferment-activities, etc.), but always in obedience to the laws of the conservation of mass and energy. He has been fascinated by the study of processes known as irritability, contraction, circulation, respiration, secretion, digestion, absorption, metabolism, excretion and reproduction. He has seen how these various functions can be modified by environmental influences, and has come to look on the body and mind of an organism at any given moment as the direct resultant of the energies in the germ cells and the energies that have acted upon the organisms from without from the time of germ-cell fusion until that moment. He has come to see that what we call "disease" is modification of structure and function beyond certain limits, whereas maintenance of structure and function within these limits is designated as "health."

In the bodies of men dead of long-con-

tinued disease, he has studied the coarser and finer changes in the organs and in the cells, and has contrasted them with the findings in a healthy man of the same age killed by accident. His teachers have shown him specimens illustrating transition stages between coarser structural changes and the beginnings of organic disease. Studies of pathologic chemistry have convinced him that, in the absence of changes in form recognizable by our present methods, deviations of the chemical composition from that of health can often be found. Among the many deleterious environmental influences, he has discovered bacterial and parasitic invasion to be especially important; he has studied these bacteria and parasites, and has used them to produce diseases in animals for experimental comparative study. He has observed striking differences in susceptibility to noxæ among these experimental animals, and has seen that this susceptibility is capable of artificial modification. His studies in immunology and in pharmacology have convinced him that man can often intervene in a strictly rational way favorably to modify the processes that go on in an organism.

During this whole period of preliminary and preclinical study, the student's background has been gradually and extensively elaborated. His studies in each successive science have been, to a certain extent, a review of the sciences preceding. *Repetitio est mater studiorum.* And yet, even more important for the clinic than the actual content of the student's mind as regards the ancillary sciences is the long discipline that his mind has had in observing and reflecting —I mean, the development in it of a permanent scientific habit.

Medical Wards; Ambulatorium; The Institute for Clinical Medicine

The teaching of clinical medicine as a science demands conditions very different from those that formerly existed, and very different from those that are even at present available in any of our medical schools, though some schools have been fortunate enough to secure conditions that approach what is needed. Briefly stated, the conditions that a department of clinical medicine should control include (1) a medical clinic to which may be admitted a sufficient number of patients suffering from all varieties of both acute and chronic internal diseases (infectious, parasitic, respiratory, circulatory, hemopoietic, digestive, urogenital, locomotory, nervous, metabolic), with ward laboratories for routine application of the commoner laboratory methods; (2) a medical dispensary or ambulatorium, to which a large number of patients, who, for various reasons, do not enter the stationary clinic, apply for diagnosis and treatment, and in connection with which there are large and small teaching rooms, a laboratory and also quarters in which the various special branches of internal medicine apply their special methods of examination; (3) a large clinical institute adjacent to the wards and dispensary, containing (*a*) a clinical amphitheater for lectures, clinics and lantern-slide demonstrations to a whole class; (*b*) a general clinical laboratory in which systematic courses in clinical chemistry, clinical microscopy, etc., can be given to the whole class at the beginning of their clinical work; (*c*) a series of smaller laboratories especially equipped for routine work in clinical bacteriology, clinical immunology, clinical physiology, etc.; (*d*) other laboratories for advanced investigative work in metabolism, for the study of materials from clinical autopsies, and for animal experimentation; (*e*) a "heart station" in which sphygmographic and electrocardiographic and other graphic registrations can be made; (*f*) a capacious roentgenologic laboratory with complete outfit for modern roentgenography and

roentgenographic studies; and (*g*) many small rooms for special examinations with instruments of precision (ophthalmoscope, pharyngoscope, laryngoscope, esophagoscope, cystoscope, etc.), for members of the staff, for advanced students (undergraduate or graduate), for an artist, for photography, for technical assistants, for clinical records and for supplies. The institute should also contain at least a small departmental library for immediate reference; though for books and journals not daily in use the general library of the medical school and hospital will suffice.

THE INSTRUCTION AND EDUCATION OF THE STUDENT IN THE METHODS OF CLINICAL DIAGNOSIS

At the very beginning of the clinical work, a few general lectures should be given to the students offering a bird's-eye view of the scope of the sciences of diagnosis and therapy, explaining the relation of these sciences to the student's earlier studies, discussing the nature of the undergraduate curriculum in clinical medicine, and giving the reasons for the arrangement of the courses in a certain sequence. The first year of clinical work should consist almost entirely of a systematic education in the *methods of clinical examination* of the normal and the diseased human being and of substances derived from normal and from diseased people. Some lectures and demonstrations will be necessary properly to coordinate this work and to determine its being done intelligently, but the education at this time will depend mainly on closely supervised personal work of the student in the study and practise of methods of history-taking and of physical and instrumental examinations of healthy people and of dispensary patients, and in the laboratory study of materials derived from healthy and diseased living persons.

In teaching history-taking, the various parts of the clinical history—*anamnesis, status præsens, catamnesis, epicrisis*—should be systematically described, and each student should be given opportunity for personally questioning dispensary patients and recording the anamnesis he obtains from each.

In teaching physical diagnosis, a fundamental course in the clinic, the physical principles involved should be succinctly reviewed and the application of these principles to diagnostic methods, especially to auscultation and percussion, should be thoroughly described and illustrated by a teacher of ability, one that has had a sufficient training in the science of physics himself, and also an extended clinical experience. This course in physical diagnosis will also be a course in medical applied anatomy; it should be illustrated by models, by dissected specimens and by sections of formalinized cadavers. The theoretical and demonstrative side of this course in physical diagnosis should run parallel to a strict drilling of the student in the practical-technical details of the methods of physical examination, small groups of students carrying out the several procedures themselves on fellow students or on dispensary patients (the latter perhaps paid a small sum) under the eyes of young instructors who see to it that skill in the technic is gradually acquired. At this stage, too, a course in chemical physiology, like that advised by Professor Lee, will be of great advantage to the student. Much time should be devoted to these practical courses—enough to ensure mastery of method and the confidence of the student in the reports that his sense organs make to him.

The general course in clinical laboratory work, properly given, is one of the most important courses given in the medical school. It should consist of three half-day exercises

in the laboratory, extending over a period of at least six months. With judicious selection, a large amount of ground can be thoroughly covered, each student learning and practising the best methods of the time for the physical, chemical and microscopic study of the urine, the gastric contents, the duodenal contents, the feces, the sputum, the blood and the fluids obtained by exploratory puncture. Many of the methods need only be done once, but certain of them should be practised under control until the student satisfies himself and his instructors that he has acquired skill and accuracy enough in the technic to permit him to participate, in his last year, in the actual investigation of patients, with recording of his results in the official records of the hospital. This extra practise will be especially necessary in quantitative chemical examinations of urine and stomach contents, in blood counting and hemoglobin-determinations, in differential counting of white blood cells in stained smears, in examinations of cerebrospinal fluid, and in agglutination and complement-fixation tests.

During this first year of clinical work, the student should also acquire the technic of a whole series of special and instrumental methods of examination. Hitherto, students have too often been led to think that these special methods are beyond the scope of the work of the general practitioner, that there is something mysterious about them, and that the technic of their use is the prerogative of specialists upon whose rights and privileges the general student of medicine dare not encroach. Now, I am convinced that this is a great mistake. I think it exceedingly important that the minds of students and of general internists should be disabused of this fallacy. Most of the methods are very easy to learn and apply, and these every student should actually learn and practise.

The mystery should be taken away from all these methods. Even if, later on, as a practitioner, he evoke the aid of specialists in his work, the student will find that the training he has had in the methods of the medical specialists, giving him an acquaintance with these means of diagnosis and the power to interpret their applications, will place him distinctly at an advantage over practitioners whose schooling has not included training in such technic. Thus, in my opinion, every student should at this period of his growth become acquainted with Roentgen-ray apparatus and the technic of roentgenoscopy and roentgenography as applied to the study of different parts of the body. In the clinical, bacteriologic and immunologic laboratories he should learn the clinical applications of bacteriologic methods (collection of materials; diagnostic examinations by microscopic and cultural methods, or by animal inoculations and virulence tests), and the application to the clinic of the doctrines and technic of immunology (clinical studies of agglutinins, bacteriolysins, hemolysins, precipitins, opsonins and ergins), with especial emphasis on, say, the Widal reaction, the Wassermann reaction, the Schick reaction and the tuberculin tests. Next might come training in special methods of studying the respiratory apparatus (rhinoscopy, pharyngoscopy, transillumination of the paranasal sinuses, laryngoscopy, a demonstration of the use of the bronchoscope and of exploratory puncture of the pleural cavity); such studies, supplementing the course in general physical diagnosis of the lungs and pleuræ, the course in the examination of the sputum, and the course in roentgenology of the thorax, bronchi, lungs, pleura and diaphragm, will be the best possible preparation for the investigation of the special diseases of the respiratory system to follow in the last year of the student's course. Similarly, the special methods

useful in investigating conditions in the circulatory apparatus may now be rapidly acquired.

It is not as though we were educating raw high-school graduates; the students that are arriving in the clinics now are accustomed to the use of instruments of precision of various sorts, and are familiar with the general mechanical, optic, acoustic and electrical principles underlying them; they can, therefore, acquire much more rapidly an acquaintance with and skill in the use of clinical instruments and graphic methods of registration than would be possible for students untrained in the natural sciences. Roentgenoscopy of the cardiovascular stripe, so helpful for examining the configuration of the heart and in the recognition of aortic dilatations, will present no difficulties to our clinical student, and he will be fascinated by the simplicity and precision of teleroentgenography, which has largely replaced orthodiagraphy and which serves as a salutary control of the results obtained on percussion of the relative cardiac dullness.

Even the precise methods of mechanical registration of the movements of the heart and blood vessels (sphygmography, cardiography), of the heart sounds (phonocardiography), of the electrical currents generated in the heart during its activity (electrocardiography), and of the pressure of the blood within the arteries and veins (sphygmomanometry or tonometry of the blood vessels) can be speedily acquired, for the student has already had at least a glimpse of them in the laboratory of physiology. Though as yet we do not know how to value the results clinically as well as we should like, the methods that have been devised for determining the functional capacity of the heart should also be demonstrated. The student thus trained at the beginning of his clinical angiological studies, in addition to training in the ordinary physical methods, should have no difficulty in his later studies in accumulating the data necessary for forming a diagnosis when confronted by a cardiac arrhythmia, an inflammatory or a degenerative cardiopathy, or a hypertensive arterial malady.

Turning to the special methods useful in investigating the digestive system, the student has a considerable technic to acquire in addition to the ordinary physical methods of examination of the viscera, and the laboratory studies of the secretions and excretions. Thus, instruction should be given in the methods of examining the teeth and gums, preferably by a dentist attached to the clinic. Dental caries, paradental infections with formation of blind abscesses at the roots of teeth, and pyorrhea alveolaris are now so important, not only for themselves, but also in their bearings on disease elsewhere in the body that students dare not be permitted to leave the medical school without knowing how they may be recognized by inspection, by percussion, and by special roentgenograms on dental films, so that dental aid may, when required, be obtained. Then the newer technic of examining the esophagus should be demonstrated, though it may not be possible to give the undergraduate student actual practise in the passage of esophageal bougies, in roentgenology of the esophagus or in esophagoscopy. The physical exploration of the abdominal viscera will be taught in the general course on physical diagnosis.

Actual practise in gastric intubation of the fasting stomach and of the stomach after a test diet, and actual experience in roentgenoscopy and roentgenography of the stomach and intestines after a contrast-meal and a contrast enema, should now, in my opinion, be required of all students. The roentgenologist of the clinic should have a large demonstration room that stu-

dents may visit; there they should see typical normal and pathologic roentgenologic findings serially displayed; moreover, a few systematic demonstrations of these should be made by the roentgenologist to the class, so that every student may become familiar with the roentgenographic appearances of conditions like idiopathic dilatation of the esophagus, filling defects due to ulcer or carcinoma of the stomach and duodenum, intestinal stasis, kinks, adhesions and other forms of intestinal obstruction, diverticula of the sigmoid, etc., and will know how to make use of the Roentgen-ray method for recognizing them.

The special methods of studying the pancreatic functions by examination of the duodenal contents (obtained by the duodenal pump), the feces, and the urine, will require but little time; the same applies to the special methods of examining the liver and the biliary passages and their functions. Instruction in digital exploration of the rectum and demonstrations of proctoscopy and of rectosigmoidoscopy should form a part of the course.

As regards the *urogenital* system, its examination dare not be omitted in the teaching of clinical medicine. This part of the body should be as systematically examined as is every other part, for otherwise conditions of great importance for the general medical diagnosis frequently will be overlooked. It may be desirable, however, for obvious reasons, to have certain parts of urogenital methodology taught in the surgical and gynecologic clinics. The teaching of methods of examining the urine, of physical and roentgenologic methods of examination of the kidneys, and of methods of testing the capacity of the kidneys to excrete certain substances, belong in the medical clinic; and if, for any reason, the other clinics do not demonstrate urethroscopy, cystoscopy, ureteral catheterization, pyelography, etc., the medical clinic would have to provide for this teaching.

As to the special methods of examination of the *bones, muscles and joints,* only brief instruction will be necessary in the medical clinic, since by custom those methods are usually very extensively taught in the surgical clinic, especially in its orthopedic subdivision. For a rounded view of clinical medicine, however, some attention to them is necessary in the medical clinic where examinations for pain, limitations of movement, Roentgen-ray examination, trichinæ in muscles, etc., may often have to be made. The examination of the skeleton is often very important for the internist as throwing light on the metabolic functions and especially on the functions of the endocrine glands. I shall not be surprised if, later on, all the patients entering a general hospital, except those of surgical emergency, will first be sent to the medical clinic for thorough diagnostic study, before being distributed to the surgical, gynecologic, urogenital or other special clinics for therapy should the diagnostic study reveal that the patient requires surgical treatment.

The teaching of *neurologic* and *psychologic methods of examination* should occupy enough time to enable the students to acquire competence in at least the main procedures of clinical medical inquiry. It is best to divide this work into three parts, the first part dealing with the methods of accumulating neurologic and psychologic data from the patient, the second part dealing with the utilization of the accumulated data for deciding on the site of any lesions or of any abnormal processes present in the nervous system (topical diagnosis), and the third part dealing with the considerations that permit the drawing of inferences regarding the nature of the lesions or of the

pathologic processes. Thus, in the first place, the student will be taught how to make accurate examinations of the senses and of the sense organs (cutaneous, deep, gustatory, olfactory, acoustic, vestibular and visual); of the motor functions and the reflexes; of the coordinating powers; of the capacity for speech, for writing and for other complex movements; of the functions of the smooth muscle and of the secreting glands; of the sphincters, and of the trophic functions. In this connection, certain applications of anthropologic methods of measurement may be practised, as well as the technic of roentgenologic examinations of the nervous system, skull and spine; that of lumbar puncture; and that of diagnostic electrical examinations of the muscles and nerves. The student will be taught at this time, too, how to examine the mental state of a patient, paying attention not only to the patient's consciousness as a whole, but also to the special powers of attention, of apperception, and of identification, to the affective life of the patient as revealed by his feelings, emotions and moods, and to his conative functions, often called "the will," and judged of by the person's behavior or conduct.

The second part of this instruction in clinical neurology will involve a review of the architecture of the nervous system and of the physiology of the several neuron systems (centripetal, centrifugal and associative), in as far as these subjects can be applied to localizing diagnosis; the student will quickly see the reasons for deciding whether the lesions present, or the pathologic processes going on, concern the peripheral nerves, the spinal cord, the medulla, pons or cerebellum, the mid-brain, the interbrain or the end-brain, and whether they are focal or diffuse, single or multiple.

And in the third part of the neurologic work, instruction will be given in the principles on which the diagnosis of the nature of a nervous disease is arrived at. The difference between the so-called "organic" and "functional" diseases of the nervous system will be discussed, and the student will learn the criteria for recognizing whether a given organic disease has been due to disturbances of development, of the blood supply, or of the nutrition; to toxic or infectious processes causing degeneration or inflammation; to trauma; to parasitic invasion; or to tumor growth.

Instruction in methods should include finally the procedures used for the *clinical study of metabolism.* After a brief review of the physiology of metabolism, the student should be taught the requirements of systematic metabolic studies. Though there may not be time to do actual practical work in the quantitative chemical analysis of foods and excreta, the organization of a modern metabolic study will be illustrated and the students will become acquainted with the manner of preparing a patient for such a study, with the periods of observation required, with the doctrine of "balance," and with the preliminary tests that may have to be made of assimilation, digestion and absorption. After this introduction, the methods of determining in man the metabolism of proteins, nucleins and purins, carbohydrates, fats, water, mineral substances and vitamines will be demonstrated. The different forms of apparatus for direct and indirect calorimetry will be described and the use of at least some of them actually demonstrated. Such a preliminary discipline in the practical-technical methods of metabolic study I regard as essential if the students are later in their course to proceed to the study of states of under-nutrition and over-nutrition, of the several amino-acid diatheses, of diabetes mellitus, and of gout, armed with the knowledge and technic that the science of

medical diagnosis has now made available. Teaching hospitals should take the lead in making suitable provision for these studies of metabolism that are now indispensable for satisfactory diagnostic and therapeutic work.

As an appendix to the doctrines of metabolism, the methods of investigating the disturbances of function of the *endocrine glands,* so interesting at the present time to all workers in internal medicine, should be taught. Aside from certain pharmacodynamic tests to be made with epinephrin, atropin, pilocarpin, etc., judgments regarding the activities of the several endocrine glands depend largely upon (1) observations of the general *exterieur* of the body (facies, height, bony skeleton, span, skin, hairs, mass and distribution of subcutaneous fat, shape of pelvis, appearances of the acra, and of the genitalia, teeth); (2) systematic metabolic studies; and (3) systematic studies of the functions of the autonomic nervous system. The main diagnostic facts in this active area of clinical medicine can be quickly assembled and given in concise form to the students; thereafter, they may apply them in their work in the wards to the analysis of endocrinopathic cases.

PRACTICAL APPLICATIONS OF THE PRINCIPLES AND METHODS THUS LEARNED IN THE ACTUAL STUDY OF PATIENTS ENTERING THE CLINIC FOR DIAGNOSIS

The rather extensive propædeutic clinical training that I have just described should, I think, be undertaken and finished before the students take up the complete diagnostic study of single unknown cases.

Students may then enter the wards for a period of say three months of concentrated clinical study of patients, and though still under strict control become an integral part of the working force of the clinic. If the wards of the clinic are under the close supervision of a junior and a graded senior resident staff, and are also daily visited by professors and associate professors, there is no reason why students educated in the way mentioned may not make possible more exhaustive studies of the patients than could otherwise be made by the staff, while the students themselves are gaining an invaluable clinical experience.

During this period of the clinical clerkship, the student should spend practically his whole day in the medical wards and in the laboratories and library adjacent to the wards, very much as does the regular medical house officer. A certain number of beds—say three or four—are assigned to each student. When a new patient enters one of these beds, the anamnesis is taken by the student, who submits it to the resident house officer for criticism or approval. The student makes a general physical examination, the results of which he records for himself, though this record may or may not be incorporated in the hospital records. In any case, the student has had an opportunity of making a physical examination without prejudice and of recording a *status præsens,* and he later has opportunity to compare his findings with those of the resident staff and with those of the visiting physicians. Certain routine laboratory and instrumental examinations he makes at once and records the results in the history, so that any member of the staff on coming to the patient finds not only a complete anamnesis ready for him, but also some reports on the urine, the feces, the blood and the blood pressure. After a review of the anamnesis and of the general physical findings by a member of the senior resident staff, further steps to be taken in the diagnostic study are discussed and the decision arrived at concerning the series of examinations next to be applied. The stu-

dent accompanies the patient to the special examining rooms and assists with the technic of the roentgenologic, immunologic, ophthalmologic, urogenital and other methods of examination employed.

Gradually the data bearing on the case are accumulated. The student is asked his opinion of their meaning, and every effort is made to lead him to form his own independent ideas regarding (1) the structural changes that have occurred in the patient's body; (2) the pathologic-physiologic processes that are going on; and (3) the etiology and pathogenesis of the disease. To his surprise, the student often finds that, at first, he can not see the woods on account of the trees. He is confused by the wealth of abnormal findings the study has yielded. He is in doubt as to the relative importance of the several findings, and may have difficulty in seeing internal connections that exist. He does not know yet how to arrange the findings in logical sequence. He has had no experience in the epitomizing of a group of observations in the form of a so-called "syndrome." He is not yet an adept in the construction of a clinical (or pathological-physiological) picture. And this is as it should be. The student who begins his clinical studies by looking for ready-made clinical pictures or syndromes goes at his work at the wrong end. Only after long experience at clinical analysis is the synthetic work of syndrome-formation desirable or profitable. For working in the right way, he finds that what is called a syndrome is only a generalization, or kind of shorthand expression, to abbreviate description—for proper use, not for abuse.

Through the whole period of the patient's stay in the hospital, the student follows the case closely. The course of the disease is observed and recorded. Complications are watched for. Early erroneous impressions are corrected. The student goes to textbooks, monographs and journals in search of descriptions of similar cases.

When therapeutic measures are instituted, their effects are observed. Should surgical operation become necessary, a student knows it and is present to observe what is found. Should death occur, the student assists at the autopsy, makes histologic and bacteriologic examinations of the organs, and, later, attends the clinical-pathological conference at which the case is discussed by the professor of pathology and the professor of medicine. After the study of any case has been finished, the student writes down his final impression of the whole case, in the form of an "epicrisis."

It is a disadvantage to the clinical clerk to be responsible for over three or four patients at once. He should not be hurried or overburdened at this stage of his development. It is better that he study one patient thoroughly and read and reflect on the case carefully, than that he study superficially a dozen different patients. During a clerkship of three months he will have studied a number of patients in a careful way, and rubbing elbows with his fellow clerks in the ward will have benefited by their studies of patients nearby.

Moreover, at the daily ward rounds he hears staff and students discuss various cases, and at the amphitheater clinics, which he can now really begin to enjoy, he listens to the presentation of a case, or of a subject in its entirety, and revels in the beauty and artistry of the clinical pictures that the experienced clinical teacher finds it possible and legitimate to compose.

In the clinics he hears also the results of the original inquiries that are under way, and if he has an original mind, the atmosphere of the clinic may incite in him visions of some new application of an ancillary science to the solution of some clinical prob-

blem and the desire to make a trial of it. Such a student will be very sorry when his clerkship in the clinic comes to an end.

Were the time of undergraduate medical study longer, the student could profit by attending special courses on clinical medicine in which a single group of diseases is intensively treated, say those of the digestive system, etc. Such courses should be offered in every medical center. They should be optional for medical students, not obligatory, and should be opened to physicians that apply to the medical clinic for "continuation courses." It may be that, sometime, as Professor Ewing has advised, we may add a fifth year to the medical curriculum, in order that more of this training may be given.

During his first year of clinical work, the student should study carefully a text-book of clinical methods of investigation; during his second year of clinical work he should study a good text-book of medical practise, in which both the diagnosis and treatment of internal diseases are dealt with. Such texts replace, to a large extent, the formal systematic lectures that formerly were given on medicine in the medical schools.

Above I have dealt only with the development of the teaching of the science and art of diagnosis. The teaching of clinical medicine includes, of course, that of therapy, and it, in my opinion, should be taught in a similar way, that is to say, first by a thorough education in the principles and technical methods of therapy, general and special; and, second, by first-hand experience in the application of these methods to the actual treatment of patients during the clinical clerkship. Unfortunately, the medical wards of our hospitals are all too often mere diagnostic institutes, unprepared for the teaching and application of therapeutics. It seems to me very desirable that each university medical clinic should have associated with it, not only an institution for clinical diagnosis, but also an institute for therapy, in which the methods of modern therapy may be systematically taught and applied.

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OUR UNIVERSITIES[1]

Such an organization as the American Philosophical Society represents a body of men who are keenly interested in the important problems that confront our universities. In my judgment, among the most significant problems we are facing to-day are the following: (1) the relation between instruction and research; (2) the relation in research of pure and applied science; and (3) the relation between university work and the modern commercial doctrine of efficiency. I wish to formulate a statement which will involve these three questions.

The research function of a university is its greatest function. In biological terminology it may be said to represent the central nervous system of the university organism. It stimulates and dominates every other function. It makes the atmosphere of a university, even in its undergraduate division, differ from that of a college. It affects the whole attitude toward subjects and toward life. This devotion, not merely to the acquisition of knowledge, but chiefly to the advancement of knowledge for its own sake, is the peculiar possession of universities.

This does not mean that teaching is not also an important university function; but it means rather that teaching is to be made most effective in an atmosphere of research. The university investigator not only lives on what may be called the "firing line" of his subject, but he is training group after group of recruits to continue the conquest of the unknown. To extend the boundaries of human knowledge, and to multiply oneself in genera-

[1] Response to the toast "Our Universities" given at the annual banquet of the American Philosophical Society, April 15, 1916.