ASSOCIATION OF AMERICAN MEDICAL COLLEGES

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ADDRESS OF PRESIDENT

THE GENERAL PRACTITIONER'S VIEW OF THE DEFECTS OF MEDICAL EDUCATION

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During 1919 there appeared in the *Edinburgh Medical Journal* a series of papers on medical education instigated by the Edinburgh Pathological Club. The introductory paper of the series was contributed by James MacKenzie, who called attention to the fact that in discussions of medical education in the past, teachers in medical schools had furnished most of the contributions, and that the views of general practitioners had seldom been presented. It seemed to me that it would be of advantage to open up this untapped vein of wisdom, and after the deans of a number of Class A schools had furnished lists of representative practitioners, a circular letter was sent out to these men asking for their impressions regarding weak spots in their medical education. A gratifying number of replies were received and this paper is an attempt to classify and analyze these.

It is obvious, that the answers received must be tinctured by the personality of the writer, and reflect in a given instance the weaknesses of a particular school rather than the general weaknesses of American medical education. It seems fair to assume, however, that if from various parts of the country there come similar criticisms in sufficient numbers, these will refer to general rather than local weaknesses. By sifting the opinions of a large number of men, graduates of various schools, we obtain a cross section of the weaknesses of medical education in the United States as they appear to the practitioner. Even if this be not conceded, it is hoped that an analysis of this kind will furnish food for thought to medical educators.

The subject matter which has been obtained as a result of the analysis of the replies to my inquiry can be grouped under various headings. Certain of the criticisms relate to matters bearing on general educational conduct or policy, and others relate to specific criticisms of details. Not a few isolated criticisms have been disregarded as they are obviously inspired by transitory local situations.

GENERAL CONSIDERATIONS

Not many of the writers have much to say about the teachers. There is some evidence that a few persons have had painful experiences. One suggests the elimination of "orators, faddists

and the superannuated." Another suggests that all teachers in medical schools should have an M.D. degree. Several bring up the question of the full time versus the part time clinical instructor. While we must sympathize with the person who has had the misfortune to be orated to, and who suffered at the hands of faddists, there are really only two fundamental questions raised as to the composition of the teaching staff.

The question whether all teachers in the medical schools should be medical men is one which has recently given rise to some discussion. It is not within the scope of an article of this sort to discuss the matter in detail. My experience with nonmedical teachers indicates that it is the man who counts and not the training. Some nonmedical men may be failures as medical school teachers, others are decided successes and prove stimulating to the medical colleagues on account of their different viewpoint. Those interested in the pros and cons of this question are referred to the article of Dr. Symmers in *The Journal of the American Medical Association,* Nov. 29, 1919, and the reply of Professor Stockard in the Jan. 24, 1920, issue of the same journal.

The criticisms on full time as contrasted with part time clinical professors favor, on the whole, the full time plan, though one observer states that "the employment of full time clinical teachers is a body blow to the practitioner who thereby loses all contact with medical education." Attention is called to this criticism because it voices a fallacy which has frequently been dwelt on and which should be corrected. The full time plan has never aimed at the elimination of all part time teachers. The employment of practitioners of ability and experience has always been regarded as an essential part of the plan.

Several of the writers have something to say about the general point of view which medical schools attempt to inculcate. The criticism is made that sufficient attention is not paid to teaching the student how to think, that the biological conception of disease is frequently not preserved in the presentation of medical subjects, and that not sufficient stress is placed on the acquisition of the scientific attitude of mind. It is suggested that not enough emphasis is placed on the social aspects of medicine, that the history of medicine should be taught more extensively on account of its broadening influence, and that the value that many young practitioners of the present day place on their services indicate the need for the cultivation of the spirit of humility and service. In brief, the critics of this aspect of the question rather indicate that in many of our medical schools too much emphasis is placed on material at the expense of spiritual values.

It is difficult to deny that there is some truth in these particular criticisms. Most teachers who have had experience in several

medical schools have become aware of the fact that the intangible something which we call the spirit of the place is not the same in all of them. We know, however, of few medical schools in which there are not teachers who are imbued with the spirit of science and service. It is true that individuals capable of handing on this invaluable essence to any considerable extent are the great teachers and are of necessity limited in number at any particular time, but few schools are lacking in men capable of inspiring occasional students.

The general teaching methods employed in medical schools come in for a good deal of criticism from their graduates. So far as the preclinical sciences are concerned, the most frequent criticism is to the effect that they are too often taught without reference to their future application. The frequent remark that there is a lack of correlation between preclinical and clinical subjects doubtless refers to this. Anyone who is interested in reading the series of articles published in the *Edinburgh Medical Journal* will be struck by the fact that medical educators themselves are aware of this. They also decry the tendency of some teachers to shut themselves up in their own little watertight compartments.

There is no question of the validity of this criticism, but there is good reason to believe that there are factors which make for the gradual disappearance of this condition. The clinicians of the past, and, sad to say, some of the present generation of clinical teachers, lack fundamental training in the preclinical sciences. This has retarded the application of the methods of the laboratories to the clinics and has prevented cooperation between the teachers in the preclinical and clinical years. Furthermore, under the system at present commonly in vogue, the clinical professors, even when they have the necessary training in the sciences, have not the time to apply it. A generation of better trained men and the extension of the full time plan will remedy the defect.

Several practitioners criticize the emphasis which is placed on laboratory methods in clinical medicine. They feel that these are stressed at the expense of training of the unaided senses. The character of textbooks in general use is also remarked on, they are said to be too diffuse, too impractical and not sufficiently concise. It is also stated that the value of monographs and periodicals as contrasted with textbooks is not presented to students.

It is true, that there are dangers connected with the improper valuation of laboratory methods, but these are not inherent in their use. It is very important that students should realize that a laboratory test is frequently of no more significance than a clinical observation. There is room in the curriculum for proper train-

ing in both laboratory and purely clinical methods. There is little excuse for a failure to train students in the importance of current literature and the technic of using it.

There is conflicting criticism as to the relation which didactic teaching should bear to clinical teaching. As a rule, it is stated that there is too much didactic teaching and that the ground covered in lectures could be covered satisfactorily by the reading of a good textbook. The tendency in American medical schools in recent years has been to reduce didactic teaching and to replace it by practical work which brings the student into contact with patients. At least one critic voices the opinion that this has been overdone and that some students evidence a lack of general viewpoint on this account.

I am loath to believe that there is any insufficiency of didactic teaching. It is probable that there is a good deal of bad didactic teaching. Most instructors try to cover too much ground; indeed, this is a weakness which is apt to attack the best of them. Then there is a type of didactic teacher who confines himself to information which may readily be obtained from a textbook, and of this kind of didactic teaching nothing bad enough can be said

There are other criticisms of teaching which are not without interest. The tendency of clinicians to overemphasize rare conditions and chronic diseases at the expense of more acute affections undoubtedly exists. A criticism that students receive insufficient instruction as to the frequency of different diseases is also made.

There is undoubted truth in the statement that there is a tendency to exhibit patients with rare diseases in the clinics, but in a school with the clinical clerk system this is always offset by the extended experience with common diseases which the student receives. As to instruction regarding the frequency of different diseases, it must be stated that it is difficult to obtain accurate figures indicating the incidence of different diseases. There are, no doubt, local differences causing considerable variations. Then, too, the mortality figures which are frequently available are no guide to the morbidity figures. I have obtained lists from a few practitioners of the diagnoses made in 200 consecutive patients, and the result will be found in an appendix to this article.

The criticism is also made that teaching is frequently too diffuse, that there is a lack of precision, that too much time is spent in the discussion of more or less questionable theories and not enough is given to definite and specific instructions. Attention is also called to the confusion created by the unnecessary multiplication of minor modifications of standard procedures and the tax which this places on the students' memory.

There is little doubt that some teachers fail to appreciate the truly gargantuan task which faces the student of medicine. Most

teachers are specialists and their perspective as to the needs of students is often faulty. In four years time we can at best instruct the students in principles only. They can safely be left to specialize later in their careers. It would be well if each teacher would only attempt to cover the important facts concerned with his subject and if he would attempt to simplify the subject to the highest degree consistent with clear understanding.

Another matter which comes under general considerations is examinations. Several of the practitioner critics point out that most examinations are not practical, and that the questions often relate to rare diseases or unusual situations. I have long felt that the present examination system is a farce and should be replaced by practical tests and a different kind of written examination. The purpose of an examination should be to test qualities of mind and not those characteristics which are exhibited in the highest degree by the trained parrot. There should be a definite understanding among medical schools and state examining boards as to the ground to be covered in each subject, and only common diseases and standard remedies should be covered in examinations to test fitness to practice medicine.

THE PRECLINICAL YEARS

Many of the criticisms of the preclinical years have already been touched on under the heading of general considerations because they bore on the general problems of instruction rather than on specific weaknesses. Practically the only criticism of anatomy has to do with its teaching without due emphasis on its future relations to medicine and surgery. Little is said about the teaching of physiology, except an occasional criticism to the effect that more practical laboratory work in this subject is needed. With regard to pathology, several critics express the view that more necropsies should be seen by medical students and that the gross side of anatomy should be emphasized rather than the microscopic side. Bearing on the relation of pathology to medical practice, is the criticism of some that sufficient emphasis is not placed on the pathology of the disease in presenting patients.

It is probably true that the teaching of physiology can be improved by additional laboratory work, provided the increase represents training in the use of apparatus which elucidates clinical phenomena and is capable of transference to clinical uses. At present, the amount of time spent on muscle nerve experiments and similar fundamental procedures is sufficient in most good schools. The necessity for thorough training in gross pathology has never been in greater need of emphasis. There has been a tendency in recent years for the emphasis to be placed on experimental and chemical pathology, but, indispensable as these branches are, we must never lose sight of the fact that gross pathology is the chief foundation stone of clinical medicine.

Several criticisms regarding clinical teaching are repeated so frequently that they stand out from the rest. One of these is the view that students are not, as a rule, sufficiently grounded in the fundamentals of history taking and physical diagnosis, and with this is often combined the statement that close individual instruction is needed in connection with these studies. Several critics mention the lack of instruction in normal physical diagnosis, and we suspect that, perhaps, recent experience with examinations for the draft may have had something to do with opening their eyes to this aspect of the situation.

We are quite sure that criticisms regarding history taking and physical diagnosis will fall to the ground when all schools control their own teaching hospitals and supply them with a graded resident staff. The criticisms probably come from graduates of schools which had not in their day adopted the clinical clerk system. Indeed, it is fair to say, that it is only through a well conducted intern year that students are likely to become thoroughly familiar with history taking and physical diagnosis.

Another criticism which is frequently voiced is the futility of amphitheater clinics in which the objects most in evidence are the back view of the surgeon and his assistants. Less criticism of medical amphitheater clinics is voiced, but even these do not escape, and the old time bedpost clinic, essentially a lecture during which the lecturer affectionately rested one hand on the corner of the bed in which reposed the patient, does not escape unscathed.

Most medical graduates have probably felt doubt at some time as to the value of large amphitheater clinics, particularly operative clinics. Nevertheless, this form of instruction has its function. It is not that the patient always shows very obvious lesions, but that the facts brought out in connection with a specific case often stick in the mind better than those presented as part of an abstract discussion. A properly conducted clinic is to be regarded as an opportunity to elaborate on the briefer discussions of ward rounds rather than as a chance to give a didactic lecture with a human text. Students should always participate in such clinics.

The criticisms regarding therapeutics are somewhat contradictory. There are, however, certain criticisms that occur frequently. Prominent among these is the criticism that altogether insufficient attention is paid to instruction in dietetics and in physical therapy. There is a good deal of criticism as to the lack of instruction in the writing of palatable prescriptions. Some critics regret that as students they had little or no experience in actually administering treatment, particularly such treatment as hypodermic medication, enemas and therapeutic measures of the sort which involve active participation on the part of the physician. One practitioner criticizes the teachings of his time

as failing to emphasize the importance of the individual in treatment. He wisely remarks that the individual often needs more careful treatment than the disease. Another criticism of the teaching of therapeutics is that altogether too much attention is paid to remedies of dubious value, and that not nearly enough separation of the wheat from the chaff is attempted. It is also stated that not sufficient emphasis is placed on the little things that make for comfort, things which are known by quacks, nurses and old women, but which must often be learned by the practitioner at the expense of painful and sometimes humiliating experience. One lone critic states that too much therapeutic nihilism is taught.

It seems to me that many of these criticisms are valid. It is reasonably certain that if the regular medical profession had been trained in the methods of physical therapy, and understood the indications for and the applications of hydrotherapy, massage and similar methods, many of the cults and fads of recent years would have failed to develop. It is certain that the instruction of medical students in dietetics has been grossly inadequate in many good schools. It is also true that too much time has been spent in the consideration of remedial measures of dubious efficiency. This last condition is, in part at least, due to the attitude of state boards whose examination papers still too frequently contain questions which relate to remedies seldom used and of doubtful importance. It is very necessary for both medical school faculties and state board members to agree on a list of standard remedies to the consideration of which both instruction and examination should be limited.

THE DEFICIENCIES

So far we have discussed the criticisms which concern medical school methods and the medical curriculum as it exists today in the average institution. We find, however, that many of the criticisms refer to lack of instruction in certain phases of medicine. The most common complaint, so far as the clinical years is concerned, is the lack of instruction in minor ailments and minor details of practice. The form which this criticism takes varies considerably. One critic looks at it from the point of view of the handling of office patients and the treatment of the little things, another suggests the establishment of dispensary clinics or dispensary courses whose main purpose shall be the discussion of minor ailments. Another speaks of lack of instruction in minor details of technic, mentioning under this head the method of approaching the patient, the use of the thermometer, the taking of the pulse, the technic of administering hypodermic medication, the obtaining of blood for cultures and serologic examinations, thoracentesis and the like.

There is, doubtless, truth in the criticism that in many schools the minor ailments are inadequately considered. We believe that this situation will improve as the dispensary is more adequately developed. There has been too much tendency in the past for hospitals to treat their dispensaries in a stepmotherly fashion, and medical schools have usually delegated the conduct of the dispensary to the younger and less experienced instructors. All this must and will change, for it is obvious that it is in the dispensary that the beginnings of disease must be studied. Furthermore, the increasing socialization of medicine will throw an increasing burden on this part of the organization. The dispensary is capable of furnishing even at the present time adequate material for training the student in minor ailments and minor technic.

Several graduates deplore the lack of training in most medical schools in personal and occupational hygiene, in public health in the broader sense, and in preventive medicine. Several state that not enough instruction is given in psychology. It is evident, from the perusal of their remarks, that they refer not merely to abnormal psychology as it bears on the study of insanity, but also to those aspects of psychology which relate to normal human conduct and would be of value in their bearing on therapeutics and the ordinary handling of patients. Various individuals lament the lack of sufficient consideration of the various specialties, such as dermatology, neurology, radiology, urology, psychiatry and medical jurisprudence.

I have long felt that medical students should receive instruction in the principles of public health during their undergraduate course, and that preparation in psychology is necessary to the study of psychiatry. The extent to which courses in these subjects and in the specialties can be introduced into the curriculum is debatable, and brings up the much discussed general question of when a student should be allowed to begin specializing.

THE BUSINESS SIDE OF MEDICINE

So many writers urge that instruction should be given in the business side of medicine that special consideration is given to this. While the underlying idea is evidently the same, different critics have different views as to what is meant by training in the business side of medicine. One man suggests that students should be informed regarding the expenses connected with the opening of an office and the general conduct of a practice. Another suggests that the question of hospital finances should be touched on. Still another emphasizes the need for a few lessons in investment finance, and comments on the well known fact that the names of the medical profession have long been promi-

nent on so-called "sucker lists." A lack of training in the methods of salesmanship is emphasized, and the necessity for instruction as to the methods of bookkeeping, legitimate advertisement, protection against sharpers, and the legal side of the practitioner's responsibility is suggested. It is also intimated that instruction in the handling of people should be given.

One must concede that there is a business side to medicine, and that certain kinds of knowledge concerning it can and should be transmitted. There is no earthly reason why information should not be available to medical students and physicians as to the details of equipping themselves for the adequate practice of their profession and as to the financial methods which are best adapted to the business conduct of their life work. At the same time, one may, perhaps, question whether very much can be done, except by example, in the way of instruction in qualities like tact and "horse sense" if these or their rudiments are not already innate. It is conceivable, however, that a successful practitioner might be able to impart some knowledge of the art of medicine to the younger generation.

THE INTERN YEAR

There is plenty of evidence that the successful practitioner realizes the importance of the intern year. Some demand that it be made obligatory, while others merely insist that it shall be taken. There is a decided tendency among the critics to emphasize the importance of utilizing the intern year for purposes of instruction to a much greater extent than has been the case in the past. Indeed, this feature stands out with great prominence, and well illustrates the trend of professional opinion and the deficiencies which have existed in connection with intern service.

FINAL CONSIDERATIONS

It is not to be expected that the practitioner of medicine should have the same viewpoint as the teacher of medicine. It is natural that in a series of criticisms of this sort the critics cannot see all the difficulties that stand in the way of reform. Those who suggest additions to the already overcrowded curriculum do not quite appreciate the degree of overcrowding. Those who advise deletions or changes sometimes forget that the curriculum is to some extent fixed by the demands of the state examining boards. To my mind, there seem to be two or three possible changes capable of improving the present situation. These are: 1. The adoption of an obligatory fifth year to be spent under supervision either in a hospital or a laboratory. During this year much more instruction must be given than has previously been the case. 2. A mutual agreement between the

state examining boards and the medical schools as to the content of the medical curriculum so that only necessary subjects shall be covered in the course and in state board examinations. 3. A change in the character of both medical school and state board examinations, with emphasis on practical examination and tests of ability to think rather than ability to memorize. 4. The relegation of the study of more than the barest outline of the specialties to the postgraduate period.

APPENDIX

Tables 1 and 2 represent an analysis of 1,900 diagnoses furnished by general practitioners in various parts of the country. Each practitioner furnished the diagnoses in approximately 200 consecutive cases. These were then analyzed by groups and are printed in the order of their frequency. In addition, the individual diseases of which more than ten cases were reported are also printed in order of their frequency. While a very much larger series of cases would be required to give a really accurate idea of the kind of diseases the general practitioner is likely to meet, the list is, perhaps, not entirely without value. I am indebted to the following gentlemen for the information on which the lists are based: Dr. Harold Bowditch, Dr. M. B. Call, Dr. Charles D. Enfield, Dr. W. K. Fast, Dr. H. P. Greeley, Dr. R. C. Halsey, Dr. W. B. Hardesty, Dr. R. T. Mauer, Dr. Frank R. Nuzum, Dr. Charles J. Reilly and Dr. E. L. Tuohy.

TABLE 1

Infectious diseases	474	cases
Gastro-intestinal diseases including infant feeding	252	"
Cardiovascular diseases	117	"
Diseases of the lymphatic system, including tonsils	114	"
Diseases of the genito-urinary organs	113	"
Pregnancy and its complications	96	"
Diseases of the nervous system	94	"
Skin diseases	89	"
Gynecologic affections	81	"
Diseases of the locomotive organs	73	"
Abrasions, sprains and slight injuries	71	"
Diseases of the glands of internal secretion	62	"
Diseases of the ear, nose and throat, including the mouth	59	"
Boils, abscesses, carbuncles and superficial infections	39	"
Diseases of the liver and bile passages	34	"
Poisoning, including poisonous drugs and anaphylactic poisoning	30	"
New growths	27	"
Diseases of the blood-forming organs	24	"
Miscellaneous	24	"
Diseases of the eye	23	"
Diseases due to worms	3	"
Trophic and vasomotor disorders	1	"
Total	1,900	cases

TABLE 2

Tonsillitis	102	cases
Coryza	68	"
Influenza	66	"
Tuberculosis	61	"
Bronchitis	58	"
Appendicitis, vaccination, normal pregnancy, each	46	"
Gastritis	44	"
Gonorrhea	43	"
Constipation, minor accidents, each	35	"
Wounds, incised and punctured	33	"
Syphilis, uterine diseases, each	31	"
Rheumatic fever	29	"
Pneumonia	27	"
Dermatitis	26	"
Dysmenorrhea, neurasthenia, malignant growths, each	25	"
Chronic arthritis	24	"
Valvular disease of the heart	23	"
Diabetes, fractures, hypertension, each	21	"
Diphtheria	20	"
Goiter, nontoxic	19	"
Cystitis, myocardial diseases, hernia, each	18	"
Diseases of the gallbladder, eczema, each	16	"
Secondary anemia, abscesses, minor infections, gastric neuroses, hemorrhoids, each	14	"
Goiter, toxic, abortion, menopause, each	13	"
Neuralgia, functional diseases of the heart, arteriosclerosis, each	12	"
Peptic ulcer, asthma, lacerations of the cervix, each	10	"

REPORT OF THE COMMITTEE ON THE TEACHING OF GROSS HUMAN ANATOMY

C. R. BARDEEN, Chairman; C. M. JACKSON and WM. R. KEILLER

In 1909 a report on teaching human anatomy was made by the subcommittee on anatomy of the committee of one hundred appointed by the Council on Medical Education of the American Medical Association. In this report the questions of studies prerequisite for human anatomy, the place of the anatomic sciences in the medical curriculum, required and elective studies in anatomy, qualifications of instructors, methods of instruction, necessary laboratory equipment, cost of maintenance of a department of anatomy, and similar questions were discussed. Opinions of many of the leading anatomists of the country concerning certain of these questions were quoted, and a bibliography on the teaching of anatomy was appended. At the 1918 meeting of the American Association of Anatomists, a symposium was held on the teaching of anatomy and the inculcation of scientific methods and interest. The papers read at this meeting were published in the *Anatomical Record,* (June) 1918, XIV, No. 6.

It is not our purpose in the present report to attempt to go over all the ground covered in the report and in the symposium referred to above, but rather to restrict our attention to some of the more important problems of education in gross human anatomy.

1. THE PROFESSOR

The most important problem in education is the educator. The medical student is required to spend a considerable amount of time in the study of gross human anatomy in order that he may become the more efficient professional man because of this study. It is the duty of the educator to do what he can to aid the student to make the time and energy spent on the subject of greatest ultimate value. As one anatomist has put it, we are now required to give twice as good a training in anatomy as was given in the old days in half the time and, on the whole, this is acutually being done. The success of the educator depends partly on his own personality and previous training, partly on his opportunities to keep in touch with the activities of his own profession and with those of the profession for which his students are trained, partly on the personality and previous education of his students and their social environment and partly on the facilities which he can command and place at the disposal of his students.

The most important natural qualifications of an educator are executive ability and ability to do constructive research. By executive ability we mean the ability to set others at tasks which they can understand, take an interest in and work at with enthusiasm. In the business world these tasks, in general, are directed toward the production or distribution of commodities and if wisely set bring financial returns to those who perform them, to the executive who directs them, and to the capitalists who furnish the material and tools. In the educational world the tasks are, as a rule, directed not toward the production of articles or services of value, but for the sake of training for future production. The immediate product is the indirect one of gain in ability to do something of value while doing something which in itself has no value. Young animals get a similar training at play in preparation for the subsequent struggle for existence. Except in so far as the work of students in anatomical laboratories can be made subservient to anatomical research (in gross anatomy in the collection of statistics, for example), it must be looked on as in the nature of play, the educator as a director of play, and the spirit should be one of the higher kind of intellectual play. As President Eliot said, "The teacher should be either a young man or a man who never grows old." The educator has not only to have executive ability as a director of play, he has also to have executive ability in providing facilities and materials and in choosing and directing the subordinate personnel of his department.

Of equal importance with executive ability of the type suggested is ability for scientific research. The student should be led to undertake his work in dissection and in the study of topographical anatomy, so far as possible, with the spirit of the investigator, the delight in first hand information about natural phenomena, the willingness to work hard to get at the truth. This spirit will not be aroused in the student by one who is not himself filled with it.

The ability to teach in the sense of imparting knowledge through talent for clear verbal expression, or dexterity through talent for showing others how to perform a given task skilfully, is of value, but this value is relatively much less than that of executive ability or that of ability for research. The man who stands foremost in his influence for good in the teaching of anatomy in this country was a great executive and scientist, but he had very little talent as a teacher in the sense described above. The teacher with talent for clear expression should not and usually does not confine his teaching to his classes. He prepares textbooks and reaches a wider audience. The good executive sees that these books are placed within ready reach of his students. Aside from systematic anatomies and dissecting room guides, we have had within recent years several valuable books of this kind

brought out in America, among them, Eycleshymer and Schoemaker's work on topographical anatomy and on anatomical names, and Emmel's anatomical terminology. We are, however, still greatly in need of a first class book on physiological anatomy and of a good book on human structure as revealed by roentgenology. Here are great opportunities for those who have talent for imparting information.

Assuming that executive ability and talent for investigation are fundamental requirements for the man in charge of teaching gross human anatomy, what are the fundamental requirements in his training?

First of all, he should have had a thorough training in the study of the human body as an active mechanism. A requisite for this is clinical training in a first class hospital or clinic. The good clinician has to think of the patient as an individual. It is important for the teacher of gross human anatomy to acquire this point of view. He can then lead the student to dissect from the standpoint of trying to get an idea of the mechanism of an organism that works as a unit rather than from that of dissociated structures. An M.D. degree in itself has no special value. It is the scientific clinical training that counts. A man with a Ph.D. degree, who takes occasion to associate himself with scientific clinicians, frequently acquires a greater appreciation of the human physiology that can be studied best in the clinic than is acquired by the average M.D. who goes directly from the medical school into an anatomical laboratory.

With the point of view of the human organism as an active mechanical unit the teacher of gross human anatomy should have experience as a scholar and a productive investigator in human embryology, in histology, in neuro-anatomy and in physiology, as well as in gross human anatomy. He should have a clear conception of the part played by these various special branches in throwing light on the action of the mechanism as a whole, and should so direct the practical work and reading of the student as to enable him to correlate his studies in the various branches toward the same end. He should have at least a fair education in general biological problems so as to correlate the structure and functions of the human body with those of other living forms. He should know something of the broader aspects of physical and social anthropology so as to have some understanding of the racial and individual reaction of the human body to its physical and social environment. He should have this broad training not for the sake of trying to impart all he knows to a class of students who can give only a few months to a subject to which the teacher has devoted years of work, but for the sake of directing the student's attention toward those points of view which will make his work in gross anatomy of greatest value.

For the professor of gross human anatomy we, therefore, demand a man of unusual natural ability and unusual experience and training. Such a man certainly deserves as much in the way of financial reward as the full time clinical teacher. For a man meeting all of the requirements in an unusual way, an annual salary of $10,000 is none too large. Yet, we find the highest salary paid today is about $6,000 and the average salary is about $4,000. The replies which the committee has received show a surprisingly good general standard of fitness on the part of our teachers of anatomy in spite of inadequate compensation. There is evidence, however, that compensation for teachers of anatomy as for teachers in other fields must be increased if the supply of qualified teachers is to be maintained.

2. THE STUDENT

So much attention has been paid in recent years to premedical requirements that we need not here discuss this aspect of the question. Since the professor of anatomy has the major part of the task of preparing students entering on the study of medicine, he is naturally especially interested in the required preliminary training. After the entrance requirements now established have been tried out for a number of years longer, we shall be in position to determine to what extent they fulfill the expectations which have led to their establishment. The question as to whether or not it is wise to keep first year medical students isolated from a clinical environment, as is now the practice, is likewise one open to careful consideration.

3. FACILITIES FOR TEACHING

The facilities required for teaching gross human anatomy were treated at length in the report made to the Council on Medical Education referred to above and need not be discussed here. The roentgen-ray machine and the living model are, perhaps, the most important additions to the teaching equipment which have come into considerable use since that report was issued.

4. METHOD OF TEACHING

The education of the medical student in gross anatomy has to do with (*a*) technic, (*b*) terminology and topography, (*c*) comprehension, and (*d*) initiative.

(*a*) *Technic.*—By education in technic we mean education in (1) preparation of material for study, (2) methods of study, and (3) expression of observations and ideas.

1. Preparation of material for study: In gross anatomy the chief education in preparation of material is training in methods of dissection. In the time at present allotted for the required work in gross anatomy in the medical curriculum, and with the material available, it is possible to teach effective skill in the

use of the scalpel in separating skin from fascia, in the use of the probe and forceps in removing fat and areolar tissue so as to reveal the chief nerves and vessels, in methods of distention of cavities with air, fluid or wax, and similar simple procedures. It is not possible to teach great skill in the dissection of special regions because even the gifted require practice for skill, and, as a rule, the average student has only one opportunity to dissect a given region. In courses in human anatomy in which the main emphasis is laid on training in specialized technic, the student has each step which he is to take in the dissection carefully outlined for him. His work is supervised so that as a given part is dissected it may be dissected as nearly as possible according to procedures which the instructor believes to be the best. He may be given detailed outlines to follow. In extreme cases, the whole class begins the dissection of the same part at the same time, and each day performs certain specified steps in the dissection of that part. The average student, under a plan of this kind, probably dissects one-half of the body fairly acceptably in a shorter time than when he is given more freedom but it is doubtful if he acquires as good a general dissecting technic, and it is certain that he acquires far less initiative than when he is given more freedom. In departments in which a certain number of medical students are permitted to elect advanced work in anatomy, considerable technical skill is frequently acquired by some of these advanced students. In the older days, such students, as prosectors, prepared special dissections for the demonstration lecture then a part of the course, but this procedure seems to have disappeared nearly completely from our schools.

2. Training in methods of study: The average student is much more easily taught to dissect fairly well than he is to study the part dissected. Dissection, if done at all carefully, gives considerable training in observation of qualitative differences of structure, the differences in appearance and touch between fascia, areolar tissue, fat, muscle, nerves, blood vessels and the like. To get much beyond this, the student has to learn how to make use of textbooks, atlases, charts and outlines, reference books, journals, special preparations, models, roentgenograms and similar facilities. He has to be taught to make use of himself and his fellow students as living models, and it is an advantage if, in addition, he can make use of professional living models. Generally speaking, training in the technic of study is less efficient in our anatomical departments than training in dissection. It is apt to be forgotten that it is more important for a student to learn to know how to seek light on an obscure question of structure than to commit to a memory necessarily imperfect a vast amount of detail well recorded in books practically always available. Variation in human structure is the salvation of gross anatomy as an object of intellectual interest to teachers and students.

3. Training in methods of expression: Observations and ideas concerning structure may be expressed by words, by drawings or by models. The words may be either oral or written. The drawings and models may be either diagrammatic or objective. Judging from the replies which have come in response to our questionnaire, much less attention is paid to this important aspect of training in anatomical technic than to training in methods of dissection and study. The student is given some training in oral expression when he is questioned at the dissecting table or in the quiz class. Note books, written quizzes or written essays on assigned topics appear to be required infrequently. Drawings, either free hand or diagrammatic, are still less frequently required, except in courses in topographical anatomy in which drawings of cross sections are a usual requirement and diagrammatic reconstructions a frequent requirement. Modelling, at one time tried in a few laboratories in connection with osteology, appears to have been given up as a part of the required work in gross anatomy. From the standpoint of the use in clinical work which the student may or might subsequently make of his training in anatomy, far too little attention has as yet been paid to the technic of anatomical expression and especially to that of anatomical drawing. Such a training would make a firm basis for history taking. Ideal teaching of gross human anatomy would include some instruction by an expert in anatomical drawing. In some laboratories, the dissecting room is divided into sectional alcoves by blackboards. This offers an excellent opportunity for instructor and students to make life-size drawings. Skeletal outlines, painted on blackboards of this kind, aid in making sketches of other parts. The chairman of the committee submitting this report believes that since the time for gross anatomy in the medical curriculum is limited, it might be well to sacrifice the mechanical dissection of one part of the body, say, an upper or a lower extremity, in favor of a series of careful drawings of dissections of this part. The relative values of training in the technic of preparation and of expression might thus be better preserved. This object may be attained by assigning the extremities to a pair of students one of whom dissects one extremity while the other illustrates it. The two students would exchange tasks in the dissection and illustration of the other extremity.

(*b*) *Terminology and Topography.*—By training in terminology and topography we mean acquiring the use of anatomical terms in association with a visualization of the structures to which these terms refer and of the relations of these structures to neighboring structures. Most people have a memory in the main visual. Words are usually best remembered when the sound of the word is associated with a vision of the printed word. The meaning of a noun is usually best remembered when the noun

is associated with a vision of the object to which it refers. In learning anatomical terminology, the student may merely associate the sound of the word with a vision of the printed word or with the place of the word on a printed page or set of outline notes. The spelling of the average student in anatomy indicates, however, that this is, as a rule, none too perfectly done. A higher stage is to associate the word not only with its printed form but also with a diagram or picture of the structure to which the word refers. The old fashioned prize student in anatomy who knew Gray's Anatomy by heart belonged usually in this group, while the old fashioned rhymes, as an aid to memory, were an aid to those who belonged in the preceding group. The highest stage is reached in the field under consideration when the auditory and visual memories of the term are associated directly with a visualization of the structure to which the term refers and with the relations of this structure to other structures. It is for this reason that modern teachers of anatomy in this country stress the importance of learning anatomical terminology in the dissecting room.

It will be fairly generally acknowledged that such anatomical terminology as the student commits to memory should be associated with the form and relations of the structures to which the terms apply. The extent and nature of the anatomical vocabulary which the average medical student should be expected to master in this way is, however, a matter concerning which teachers of anatomy can scarcely be expected to agree. Methods of getting students to master an anatomical vocabulary likewise differ greatly and should be expected to continue to vary. Practically all our teachers of anatomy are agreed that the old fashioned didactic lecture on descriptive human anatomy is of little or no value for the purpose under discussion, but beyond this opinions and practices differ widely.

On the one hand, we have teachers who discard not only all formal lectures but also all formal quizzes. Facilities are furnished the student for dissecting and for making use of textbooks and reference books. Each individual student is given some directions as to how to start dissecting, and the progress of his work is more or less closely followed. From time to time, he is asked a few questions concerning the parts he is dissecting, or he is asked to demonstrate the structures he is studying. When he has finished a part of or the whole dissection, he may be given either a practical oral or a written examination. The vocabulary each student picks up is determined partly by the individual conferences which he has with his instructor, partly from talks with fellow students, and partly from his textbooks. It differs greatly from one student to another in the same class.

At the other extreme we find systematic quizzes held at frequent intervals. Usually, the quiz sections consist of from ten to twenty students each. The instructor in charge of the quiz section gives his students a careful drill in the terminology of the structures which he deems essential, and holds the students fairly rigidly to a more or less fixed set of structural formulae. When quiz sections of this kind are held and an effort is made to keep anatomical terminology closely associated with visualization of structural form, it becomes necessary to arrange the work of the quiz section in such a way that all members of the section are dissecting the same region of the body and to base each quiz on the parts being dissected at the time the quiz is held.

Whatever method be adopted of teaching anatomical terminology and the association of a term with a visualization of the structure to which it refers systematic groups of anatomical terms such as those provided in the Barker edition of the B N A and the fine compilation made by Professor Emmel of the University of California will be found of great help by both teacher and student. We believe that most teachers will agree that a student who masters a limited part of the anatomical terminology in such a way as to visualize and localize accurately the structures to which the terms refer, is more fortunate than the student with a more extensive but more hazy vocabulary.

(*c*) *Comprehension.*—The student may learn skill in the simpler technical procedures employed in gross anatomy. He may learn a large number of anatomical terms and to visualize the structures to which the terms apply. If he does not do more than this he will not get from the long hours of work devoted to the subject a sufficient return for the energy expended. He should be inspired so far as possible to comprehend the subject. In order to do this he must, first of all, closely correlate his knowledge of gross structure with a knowledge of microscopic structure and of growth, on the one hand, and with some knowledge of function as well as of topographical relations, on the other hand. He must get a dynamic conception of human structure. He must correlate his knowledge of human anatomy and physiology with ideas of the more fundamental aspects of structure and function in the lower organisms. He must acquire an attitude of mind which will enable him to make use of his knowledge of normal anatomy and physiology when he comes to study pathology and pharmacology and the various branches of clinical medicine. He must have some conception of the interactions between the structures and functions of the human body, and the physical and social environment, and some conception of the simpler aspects of anthropology. He must have some conception of how imperfect our knowledge of the human organism and of vital processes really is and be inspired to do his bit

toward adding to it. He should know something of the history of anatomy as a science. Memory of details is usually far less important than comprehension of fundamentals.

The part played by the teacher in aiding students to acquire some comprehension of human anatomy depends primarily on the comprehension which the teacher himself has of the subject, and this varies both with the natural capacity and the training of the teacher.

Some teachers attempt to arouse in their students a comprehensive point of view through lectures, others through informal quizzes in which the teacher does much of the talking, and still others by individual conferences and talks. Much depends on the personality of the teacher, on the one hand, and the size of the classes and type of students taught, on the other hand.

(*d*) *Initiative.*—Aside from training in the subject matter, courses in gross anatomy offer unusual opportunity to develop independence and initiative in the student. If granted considerable freedom the student may waste some good anatomical material, but he has not much opportunity to injure physically either himself or his fellow students as he would have if granted the same freedom in a chemical laboratory or delicate apparatus or specimens difficult to replace as he would in a physics or a histological laboratory, or cause suffering to the subjects on which he is working, as he might in a physiological laboratory or a clinic. For the sake of thus developing independence and initiative, some teachers are willing to sacrifice the amount of additional knowledge which the average student might absorb under a carefully controlled method of instrutcion. A system of teaching of this kind can, however, be effective only in a department where the teacher has the ability to inspire his students with desire for effective work and for comprehension of the subject. Elective work in anatomy offers an especially good opportunity for developing initiative.

SUMMARY

The man in charge of gross human anatomy should have ability as an executive and as an investigator. He should have had a good training in and be in active touch with anatomy and the cognate sciences, especially with clinical physiology. He should have ability to arouse in his students pleasure in working to understand the human mechanism. He should arrange their work so that they may get training not only in the technic of dissecting but also in the art of expressing the results of observation; not only in the use of anatomical terminology but also in anatomical comprehension; not only in following directions but, above all, in resource and initiative.

The following summary of the answers to the questionnaires gives some insight into methods of teaching and point of view

in the anatomical departments of our medical colleges. In many instances answers to various questions have been quoted in detail. We should have been glad to quote such detailed answers at greater length but have refrained from doing so for fear of making the report too long.

1. CITATIONS OF OPINIONS EXPRESSED CONCERNING THE MORE GENERAL ASPECTS OF TEACHING GROSS ANATOMY

PROF. W. M. BALDWIN, UNION UNIVERSITY MEDICAL DEPARTMENT

I am in receipt of the anatomy questionnaire prepared by the subcommittee on anatomy. I will speak frankly my opinion regarding the scope of these questions. The first feeling which I experienced in looking over the questionnaire was one of regret, that, with so many years of scientific laboratory training in anatomy behind us, the anatomical committee should still be concerned with questions as to whether demonstrations, lantern slides, charts, lectures, etc., were necessary or optional in good anatomical instruction. On the whole, I have been profoundly disappointed that such vital questions as the relation of anatomical teaching to the scientific laboratory instruction received in the courses on comparative anatomy should have been disregarded. One of the most important points to be considered by the anatomist at present is the question as to how much instruction in gross human anatomy should be delegated to the academic departments of comparative anatomy. Such a consideration is not merely feasible, but intensely pertinent and can well be carried out without opposition on the part of the New York State laws. This would mean, necessarily, a readjustment of the subjects now taught in the first two years of the medical curriculum, and would involve a much needed amplification of the course on applied anatomy, both medical and surgical, in the medical school.

Inasmuch as in some of our good medical schools both histology and embryology are well handled, or to make it stronger, much better taught by the academic department of the university, I can see no reason why there should not be a transfer of the entire department of anatomy to the university. I firmly believe that, were this change made, anatomy and its subdivisions could be brought under more direct supervision on the part of trained, scientific laboratory instructors and the result would be of incalculable value to the medical student.

With regard to Question 4, which refers to the amount of dissection required by us, I may be permitted to say, that both the state and the medical faculty, by placing restrictions on the course in dissection, have made it superfluous for the anatomist to express an opinion regarding the amount of dissection necessary for good instruction in the anatomical subjects. In this state, we are restricted to dissection covering 480 hours, which must comprise, as you know, at least one-half of the body. The faculty specifies, moreover, that this dissection must be completed in one term of the medical year. These two limiting factors make it impossible for the student to train himself either in methods of precision or to acquire methods of neatness and thoroughness in his work.

Regarding the last question of the questionnaire, concerning compensation, may I ask, are not those of us in endowed institutions necessarily limited by the income of that endowment? While we may feel that the services of the trained laboratory man are fully as valuable to the medical course as are those of the skilled diagnostician, a maximum limit on the salaries of both is placed by the trustees involuntarily as a result of their limited means.

We in Albany, believe in both personal and in practical instruction. To this object, our classes in all four years of the medical course are restricted in number. In the laboratory branches there is on an average of from twenty to twenty-five students to one instructor. In the clinical branches there are from two to three students to one instructor.

PROF. GEORGE S. HUNTINGTON, COLUMBIA UNIVERSITY

I beg to acknowledge the receipt of the circulars dealing with the teaching of the anatomical sciences from the chairman of the subcommittee appointed by the Committee on Medical Education and Pedagogics of the Association of American Medical Colleges.

I have made an earnest effort to frame useful replies to the questions proposed, but have found it impossible to do so with any satisfactory results. This failure I ascribe, primarily, to the radically different conception and practice of anatomical teaching which has been developed during many years at Columbia University and which fails utterly to fit itself into the lines on which the questionnaires have been framed.

I have been long completely convinced that the distinction between what is termed "microscopic and gross anatomy" retains only the slight interest of a lamentable historical tradition, and should not scientifically or practically determine in any degree whatever the pedagogic administration of the anatomical sciences. Holding these views, and finding that their practical application meets the demands of my educational office in a way which I consider satisfactory to my students and to my own conscience, I am loath to enter into a discussion which appears on its face fruitless. I am entirely aware that educational methods and standards differ, and should rightly do so under different conditions of environment, training, material, equipment, opportunity and personality, both of instructor and student, and in many other ways. For this reason, I am not in sympathy with the attempt rigidly to standardize an anatomical curriculum or the education which it is supposed to offer. Except along the very broadest lines, which are already uniform and well established, such an undertaking will, I believe, fail in giving the best possible educational sum-total.

As I survey the splendid anatomical departments which have appeared throughout the country in the last ten or fifteen years and realize the excellence of their service and production, I am constantly confirmed in my belief that anatomical science will continue to maintain and further develop the high standards of teaching and investigation which now characterize it.

Please do not interpret anything that I have said in this letter as illnatured criticism or as an unwillingness to help, which is far from being the case. It is only that I find myself somewhat out of accord with the general plan proposed, and have much other pressing work on my hands. If I can really be of any actual service, please command me.

PROF. WILLIAM KEILLER, UNIVERSITY OF TEXAS

I am thoroughly in sympathy with the general report of the "Committee of One Hundred," but I am firmly convinced that concentrating anatomy into one year would be a great mistake. It would be easier for teachers, and students would pass examinations all right; but they would forget the subject just as quickly as they had learned it. I also emphatically disagree with the idea that students should not be required to remember anatomy. The physician and surgeon, other things being equal, will be strong in proportion to the amount of anatomy which he has had; even its details should be at his immediate command all of the time. Anatomy should be absorbed slowly so that it may have time to sink in. I consider my third year's laboratory course in applied anatomy of the greatest importance in fixing the subject in the memory and training the student to think anatomically.

PROF. MCE. KNOWER, UNIVERSITY OF CINCINNATI

In summing up the work of the anatomical department, it should be explained that it is not merely a dissecting room, nor a series of laboratories for gross anatomy, osteology, histology, neurology, embryology, topographical and regional anatomy, or special study; it is rather an organized system for the study of the human body, by every method available in all of these laboratories; whether by analysis, reconstruction, comparison or even experimental study. The students profit by such an organization, and form an important part of the system, since each one contributes many points to the insight gained by all.

Studying anatomy in this manner, the student obtains a thoroughly practical training, not only in actual knowledge but in method. Much effort is devoted to leading him to think of the body as made up of parts which work together as in a machine, even to microscopic detail. He is taught to think of the interrelations and interactions of the various anatomical mechanisms whenever he deals with a region, the adaptations of structures to special functions form important problems to him. For instance, the arrangement of bones, ligaments and muscles of the arches of the foot to assist in maintaining an upright posture; or the connections and course of the muscle bands of the heart to coordinate the various chambers and the valvular actions, are examples of these problems. He must know the normal from all sides.

This is all of fundamental practical use when he faces abnormal conditions and distortions of normal relations. The persistence of embryologically established structural groups and relations must be kept in mind as important to both normal and pathological results. His training in methods of studying the body and of examining and handling it from many points of attack forms the best possible basis for clinical studies later.

During this introductory study, when the student is gaining his first acquaintance with the body, it is not considered practical to divert his interest from anatomy and its method, as outlined above, to applied aspects of this subject during the limited time allotted.

It is never to be forgotten that the great majority of students of human anatomy are to practice medicine. Hence, their work must be planned with this constantly in view.

The advantages of correlation with pathology, surgery, physical diagnosis, etc., are to be kept in mind, but it is insisted that all this be held in a subordinate relation until later. Anatomy with physiology first; its special uses in medicine and surgery later!

This represents an economy of time and attention. Useless repetitions are eliminated. Teachers in the more advanced and special courses can then assume a basis with which to correlate the new facts and ideas which concern their work. The student brings a fair familiarity with the machine to be dealt with and understands its principal adjustments for action.

The anatomical department aims to supply him with thoroughly modern facilities and methods of securing the fair and square, reasonable knowledge of the body needed for his further work.

PROF. A. G. POHLMAN, ST. LOUIS UNIVERSITY

I am requesting Dr. D. M. Schoemaker, who has charge of the teaching of gross and topographic anatomy in this department, to make specific replies to your questionnaire. I purpose in this brief note to set forth certain suggestions for the better teaching of anatomy in this country. I am sending copy to Dr. Waite as a reply to some of the answers asked in his questionnaire (see note). I call your attention to a rather intensive as well as extensive experience of some twenty years; two-thirds of which has been mainly in gross and one-third mainly in microscopic anatomy. At least, I feel I am not a novice.

The pedagogy of anatomy in this country has not made material advances in the past twenty-five years, and, perhaps, the old system has been rendered hopelessly inadequate through specialism in teachers and in segmentation and fragmentation in courses. The time is about at hand for an entire revamping of the anatomical curriculum. Concentration courses, while excellent in theory, are chiefly of advantage to the instructor in limiting his amount of teaching work, and, therefore, liberating him for research. I propose that the entire course be taken up in two parts: (1) a first year course to include gross and microscopic anatomy, organogenesis and neural anatomy; and (2) a second year course to include topographic, regional and cross section anatomy to be accompanied with roentgen ray and flouroscopic examination on the cadaver and on living subjects. I submit a brief outline for the first year's work, building up the course around the cadaver, and with a maximum efficiency in manner of dissection and correlation. The scheme would take six half days a week with a minimum of three and a maximum of four hours daily.

A. Dissection of upper and lower extremities with four men on each body, the uppers to include shoulder girdle and the lowers outer surface of the pelvis, including disarticulation of hip. The object is to remove the parts from the body as soon as possible. The lower adds dissection of the back to make this part the equivalent of the upper. The cadaver is to be tanked as soon as the extremities are removed.

B. Same as A, reversing parts, the upper to take the lower and the lower to take the upper. This permits rapid work because the men assist each other. Examination at the close of the dissection of extremities.

C. All cadavers are brought up, and two men are given one body, *all working at the same part,* and the dissection from here on to carry

with it microscopic anatomy, organogenesis and neural anatomy. Absolutely, then and there, correlated with particular reference to physiology and pathology as a guide for emphasis.

C 1. Complete dissection of the back, including exposure of the spinal cord intact in its membranes. Cervical plexus from behind and structures at root of neck. Cut through trachea and esophagus and reflect upward and prevertebral fascia. Cut through vertebral column and remove head part, including spinal cord, to tank.

C 2. Dissection of thorax from above and from the sides.

C 3. Dissection of diaphragm from above and anteriorly. Abdominal wall leaving lower quadrant intact. Complete dissection of abdominal viscera to pelvic brim, and complete with lumbar plexus.

C 4. Dissection of pelvis viscera from above. Ischiorectal and superior perineal region. Cut through pelvis in coronal plane to include rectum, internal iliac vessels and sacral plexus on dorsal segment. Dissect urogenital organs and ventral abdominal wall from behind and complete dissection with inner and outer pelvic wall.

C 5. Dissection of head. Begin with removal of brain after usual manner. Additional lateral cut back of mastoid to foraman magnum. Study cranial nerve root in situ before removing brain, and leave spinal cord attached. Follow with joint series at base of skull and remove cervical vertebrae from skull. Dissection of pharynx and lower cranial nerves from behind. Open pharynx at midline dorsally and study relations to nose, mouth and larynx. Remove larynx. Split head and continue head dissection finishing with ear and eye.

C 6. Gross and microscopic neurology.

The course as outlined has many mechanical and pedagogical advantages and demands an absolute correlation of important facts in gross anatomy, organogenesis and microscopic anatomy. The students keep out of each others way, and learn the body as a unit structure. It is my experience nowadays that they learn each subject for itself, and insofar as results show, they learn each subject for its particular instructor in the hope that they may "get by."

What does one mean by a qualified teacher? If a man discovers a new mitochondrial technic; becomes proficient in microdissection; discovers that an excess of urea inhibits the growth in tissue culture, he is at once a qualified teacher who forever after enjoys immunity from personal contact with his students. Where shall we send a man that he may become a qualified teacher of anatomy?

The course as herein outlined is a workable feasible proposition, and I would like nothing better than to attempt to give a course in this manner with one assistant, a technician and a diener. However, it might be that the council would demand a systematic course in osteology as not given by members of the committee making the report, or would determine that the courses in anatomy are tapewormlike, and, therefore, necessarily segmented.

The prime function of a medical college is to turn out capable physicians, and because of their efficiency in this particular, the institutions should give every facility for research to offset the low salaries paid. A research man who does not teach is in an ideal position, but a teacher who cannot find time for investigation is an impossible character. I personally favor the Ph.D. man without reservation, partly because he is

supposed to be well trained, and partly because he is likely to stick and not be seduced away into more lucrative fields. However, here again we find that the large per cent of these Ph.D. men are "still-births."

The problem as I see it is not only in better research but also better teaching, directed, correlated teaching, not merely a series of concentration courses which present the instructor with plenty of opportunity for his own work. His first function is teaching the student, and anything which cramps his originality in this particular is just as undesirable as anything which obstructs his originality in advancing the art.

Twenty years ago there may have been a necessity for a directing board of supervising the teaching of anatomy. The time for that is past, and we will have to trust the individuals who wish to advance the methods and not hedge them in with too many rules and regulations. If the committee does not feel they are competent, let some methods be devised for their removal.

PROF. A. KERR, CORNELL UNIVERSITY, ITHACA

The greatest problem in the teaching of anatomy today in the medical schools in this country seems to me to be the question of recruiting the teaching staff. It has been increasingly difficult each year to secure properly qualified instructors and assistants. I have recently adopted the policy of taking as assistants in the department young college graduates who have completed their first year in medicine and who are willing to wait a year or more before going on with their course and to remain as assistants for one or more years and at the same time work for an advanced degree, an A.M. or Ph.D. (A better name for these positions would be, perhaps, that adopted at Harvard of Teaching Fellows.) I hope in this way to get some of these students sufficiently interested in anatomy so that after completing their medical course they may be drawn into the teaching of anatomy again. Of course, the prime difficulty is the meager compensation offered to teachers, but I am hoping that the agitation now going on in the various universities of the country for better salaries for the teaching profession may be successful in raising the scale of compensation.

Some years ago it became apparent that in order to properly handle the work, as I thought it should be handled, it was necessary to prepare special dissecting directions. These I have done and I have had them mimeographed. Under separate cover I am sending you copies of my directions for the abdomen and head and neck. Using these directions makes it possible to get on with young instructors better than with any other method that I have been able to devise. Most dissecting manuals describe too fully the structures that the student is expected to find, and they do not stimulate him sufficiently to work these out for himself. My effort is to develop in the students a research method of approach to the work in anatomy, a method similar to that which should be followed in working out each case as he will find it in clinical medicine and surgery.

Osteology is taught along with the dissection, and frozen sections are used at the same time. A complete skeleton is loaned to each student and special preparations of various kinds are available for his study at the time that he is doing the dissection. A certain number of class conferences are held following dissection. These are a combination of lectures, recitations and demonstrations. A reading and reference library

is kept next to the dissecting room with atlases and journals and monographs for the students to use as much as their time will permit.

Each student is supplied with drawing boards, reading stands and drawing paper, but the limited time for the course does not permit as much drawing as I think is desirable. A living model is used wherever possible, and although the scientific sides of anatomy are not neglected, at the same time the student is made to feel that he must acquire a knowledge of the structure of the human body, sufficient to understand the function and workings of the live body.

PROF. BURTON D. MYERS, INDIANA UNIVERSITY

Lectures are helpful in teaching gross anatomy, in the ratio of one lecture to twelve or fifteen hours of laboratory work. During the past semester my practice has been as follows:

Let us say that the class is divided into two groups, one group doing thorax and the other group doing abdomen. They devote about twenty-five hours per week to laboratory work. On Tuesday I lecture on thorax; on Thursday I lecture on abdomen, and on Wednesday a general lecture on a subject of equal interest to each dissection, such as fascia, sympathetic nervous system, spinal nerves, origin, distribution, et cetera. This, of course, would hold only during the dissection of these two parts. The number of lectures during the leg and arm dissection is materially fewer. On the other hand, the osteology involved in the head dissection, with the smallness of many of the structures, makes about two lectures a week desirable.

The aspects of the subject that lectures should cover are such discussions as enable the student to visualize human dissection as a whole rather than a series of separate parts. The lectures should aim to explain certain features of the dissection which experience has shown students are likely to be somewhat confused about.

A few demonstrations on the part of the instructor are highly desirable during the first week of dissection, and, indeed, I have used prosectors with advantage during the first four or six weeks of a semester. These prosectors are experienced dissectors who are repeating dissections and who work ahead of the class, getting out the structures in a beautiful way and leaving them during class hours for inspection by members of the class, and as an example of the quality of work toward which the dissector should aim. Demonstrations on the part of the student I believe in most strongly, and it has been my practice for some years past to have on my staff three or four assistants, the "star" men of some preceding year, who take demonstrations, not recitations, in small groups of two to four. We have about six demonstrations on each dissection, i. e., on each part.

I prefer the use of the episcope to either lantern slides or charts in connection with this work.

The number of lectures in the required work of the course in gross anatomy is about thirty.

I have not offered an elective series of lectures. I have been very strongly of the opinion that many lectures in gross anatomy are undesirable and I am strongly convinced that the thirty demonstrations required of each student, demonstrations of an hour and a half each, in which the student does the talking and shows his work, are much more

valuable than lectures by the professor in helping the student get the details of a dissection clearly in hand. Historical considerations I consider valuable in the lecture work.

I have very little confidence in the value of quizzes in connection with the work of gross anatomy. The quiz merely brings out the parrot in the student. The demonstration, on the contrary, rests on something that the student has done; it requires all the preparation and knowledge of the subject necessary for a student to pass a good quiz, but it rests on actual accomplishment on the part of the student rather than on mere textbook cramming. I have seen students pass a wonderful quiz who are entirely unable to recognize structures which they had just brilliantly described when called on to demonstrate them in a good dissection.

I always hold a certain number of quizzes early in the semester in which all the students doing a certain dissection are brought together. The object of the quiz is to develop and correct certain errors into which the dissectors are likely to fall; to bring out examples of a high degree of accomplishment in the way of familiarity with the particular dissection. But I have seen too many instances of the man who did brilliantly in quiz falling down completely when called on for demonstration over the same subject matter, to place any considerable confidencc in the quiz method.

The subject of osteology is deveolped in connection with the dissection in so far as it is important to a clear understanding of muscular attachments, relationships, et cetera. During our sophomore year, we give a separate two-hour course in osteology in which the subject is taken up in a systematic way. This is a combination of lecture and quiz course, except that the student answers questions with the bone in his hand, and accompanies by demonstration. This course in osteology, of course, affords an opportunity for review of origins and insertions of muscles.

We require the dissection of one lateral half of the human body by each student. In our small group demonstrations we aim to have both sides represented, so that the student is not entirely lost when he comes to a demonstration of the side opposite to that which he has dissected.

We count on about 120 clock hours for each dissection. No dissection room period should be less than two hours in length, and I have only one period per week of that length. All the other dissecting room periods are from three to four hours in length.

The quality of the dissection is checked by the daily rounds which I, myself, make, and by the half dozen demonstrations on each part referred to above.

We require no note books or drawings in connection with our work. I believe, however, that a certain amount of this work in connection with the charts which Dr. Bardeen got out fifteen or twenty years ago, and in which the osteology of certain parts was printed on separate sheets, is valuable. We use the living human model in teaching gross anatomy to only a limited degree, inasmuch as our classes are coeducational. We use roentgenograms and fluoroscope drawings to a very limited extent in teaching gross anatomy. We have a study room near the dissecting room in which there are models, books and special preparations easy of access for the students.

I use the large dissecting room. If I were building anew I would have a large dissecting room for students all doing the same part or the same two parts, like thorax and abdomen, then I would have a separate

room for all those students who were irregular in their work and doing parts to which the class as a whole is not devoting its immediate attention.

Our bodies come to us with a preliminary embalming. The embalming fluid used by the undertakers of the state always includes a bit of formalin. On receiving the bodies we give a second injection of a gallon and one-half or two gallons of equal parts of alcohol, glycerin and phenol. For special preparations we use a 10 per cent. formalin injection.

Gross anatomy should be given in the first year of the medical course. In the first semester of our freshmen year our schedule calls for histology, four dissections of gross anatomy, and three hours a week in physiology. In the second semester of the freshmen year our schedule calls for the remaining dissection in gross anatomy and the three-hour course in neural anatomy. In our sophomore year, we give osteology in the fall semester and topographical and applied anatomy in the second semester. This arrangement is not entirely ideal. If all of our work were located on one campus, I should wish to have the course in osteology given during the freshmen year.

PROF. R. J. TERRY, WASHINGTON UNIVERSITY

I am sending you enclosed herewith answers to your questionnaire on the teaching of gross anatomy. I hope that the tendency to push the subject of human anatomy out of the medical school can be resisted. As time goes on I feel more convinced that the problems of human structure can best be treated under the influence of a faculty of medicine.

PROF. C. R. STOCKARD, CORNELL UNIVERSITY MEDICAL COLLEGE

It would be well to emphasize or recall that in the early medical course, when anatomy was the only laboratory subject, it usually occupied about twice as much time as is now given to it, and was presented about half as well. So that the modern anatomical laboratory is covering twice as much ground in half the time that the old amateur anatomists spent in going through the subject.

Your paragraph at the bottom of page two and at the top of page three of the report is very important regarding more latitude and freedom in the medical course. It is certainly true that "what we should aim at is not a fixed curriculum. We should aim primarily at more facilities for students and a better quality of the teachers in our school."

Too much standardization and central control will certainly check out all opportunity for originality and individual perfection. In all lines of science, both pure and applied, great things have happened sporadically in isolated places. Centralized and controlled science has never been a great success. The Carnegie Stations, after fifteen years, have not accomplished as much as isolated individuals have in the several fields. T. H. Morgan has learnd more about heredity and evolution than the entire biological system of the Carnegie Institute.

Under qualifications of instructors the one very necessary element, it seems to me, is that experienced teachers be in charge of the main laboratory courses and that student assistants and inexperienced instructors are rarely more than a handicap to the student's own efforts.

One instructor to twelve or fifteen students is quite a liberal supply of teachers. I would say the number of instructors to students is a very variable quantity and depends on the quality and ability of the instructor. One capable, ingenious instructor can handle a class of fifty students

better than four inexperienced laboratory teachers. So that, in one department one instructor may be sufficient for a given class, whereas another class with different instructors might need a bigger teaching force. The introductory work in anatomy should certainly be given by the head professor in the department.

Under methods of instruction it would also seem best, from my standpoint, to use a living model during the very first part of the introductory course, as well as during the regional anatomy, or second year course. The living model at once makes it essential for the student to introduce a certain amount of interpretation into his dissection, and this helps considerably in teaching him to study and think about the structures encountered.

The proportionate number of hours to be devoted to the different courses in anatomy are very well arranged it seems to me on page 13.

If you secure any extensive amount of data regarding the salaries in different universities, and a further estimate was given, it seems to me that we should state at once that the directing professor of the major medical laboratories should receive a ten thousand dollar annual salary and other members of the department be paid accordingly.

The most important question to be considered is always the quality of the instructor. I believe this should be rated on the accomplishments of the individual in his special field. A professor should certainly be master of his field, and should appreciate fully the uses and applications of his subject.

Every anatomist should have a broad training in general biological principles and must be a thoroughly good embryologist in order to properly appreciate the value and meaning of structural arrangements. He should also know the subject sufficiently well to be able to make it perfectly clear and simple to the student. Certainly every man filling these requirements will be an investigator in the subject, and he should be so devoted to it as to continue his investigations throughout his life.

PROFS. TODD, HAMANN, AND INGALLS, WESTERN RESERVE UNIVERSITY

In order to reduce the number of replies and since we are agreed as to the methods for carrying out the work in human anatomy, this report may be considered the personal views of each one of us who have signed.

A. Chief course in gross human anatomy.

1. Lectures, lantern slides and charts are necessary to correlate the information obtained by students in the dissecting room with physiological facts, practical applications and points in general morphology which have important bearing on the interpretation of the human body. We desire to emphasize our entire agreement with the remarks of Dr. Pierson on page 25 of Report of the Committee of One Hundred on a Standard Curriculum for Medical Colleges.

Regarding lectures we do not hold ourselves bound to adhere in number or time to the exercise as scheduled in our catalog, believing that lectures, demonstrations and laboratory work must be interchangeable and the schedule plastic to meet the peculiar needs of the class and the particular topic. We regard demonstrations as essential. Lectures, and especially laboratory exercises of an advanced character are offered as electives.

2. Quizzes which are constructive as distinct from inquisitive are very helpful. We believe that to make the quizzes of real benefit the student must be attracted and his presence must not be compulsory. Our quizzes are optional and vary in number from year to year. The number is according to the needs of the particular topic which itself will determine the number of students who can adequately be dealt with at one time. The essential character of a course is its plasticity and adaptability in teaching methods. No quizzes ought ever to be based on specific textbook assignments, lectures, topical outlines, or anything else which tends to narrow the student's range of vision.

No method of recording is feasible as it calls for too great an expenditure of time on the part both of the student and the instructor. Such observations are too loose and inaccurate for research purposes and are of very questionable value in fixing facts in students' minds.

We have a distinct preference for the large dissecting room since this enables the students to compare notes on a large number of cadavera, which comparison we feel is most important in their training and easily compensates for what appears to be loss of time from conversation.

We include in our ordinary course in gross anatomy features of racial anatomy, physical anthropology, phylogeny of man and comparative anatomy of primates, especially anthropoids, as part of the general treatment which we endeavor to use in presenting the subject. Physical anthropology of European and American Negro races should always receive some consideration in the regular course. It is essential to make frequent allusions to comparative anatomy as time permits and as the treatment of particular questions may dictate.

We do not feel that separate courses in the foregoing subjects are advisable; they are ancillary and should form integral parts in the instruction in human anatomy.

PROF. LEWIS H. WEED, JOHNS HOPKINS UNIVERSITY

In teaching gross human anatomy there are two points which to my mind should be emphasized. In the arrangement of the proper course, it seems essential, in the first place, to make the course as "live" as possible. This can be achieved to best advantage by introducing in the discussions with the students, in small groups, the idea of the function of the parts dissected. Such a physiological anatomy requires not only that the teaching should be spirited but that the teacher should himself have first hand knowledge of physiological investigation. In the second place, the students should be stimulated to go to the original sources in the literature for the explanation of the various anomalies and of the underlying mechanisms of the embryological development of the body. Additional emphasis will be laid on these two factors in the future teaching here.

In teaching gross anatomy it is our purpose to inaugurate, as soon as possible, elective courses in physiological anatomy which will cover the physiological explanations necessary for the proper elucidation of the anatomical problems confronting the student. These courses will be arranged with particular reference to the courses given in the physiological department.

In teaching neurology to students in medicine, the combination of physiological experimentation with anatomical study of the nervous

system will be ultimately made as close as possible. The two subjects of anatomical and physiological neurology must be intimately interwoven for the proper understanding and teaching of the central nervous system.

II. QUALIFICATION OF TEACHERS

Answers to questions concerning the most important qualifications of teachers may be summarized as follows:

Capacity for research, 3.
Spirit of progress, 1.
Adequate anatomical and biological training, 4.
Training in anatomy and medicine, 4.
Training in anatomical research and in medicine, 2.
Training in anatomy, biology and medicine, 5.
Training in anatomy and physiology, 2.
Capacity for clear expression, 1.
Training in anatomy, physical anthropology and medicine, 1.
Training in biology, anatomy and medicine, 1.
Faith in students, 1.
Ability to investigate and teach, 1.
Ability to teach, 2.
Inspiring personality and fine character, knowledge of his students, realization of the students' problem and breadth of vision gained by research, 1.

In most cases, capacity for research is deemed of great value, but in a few cases, capacity for research is deemed of less importance than the capacity to impart information. Thus:

PROF. WILLIAM KEILLER: Teachers are born not made. So long as teachers are chosen for their research work without any regard to their teaching enthusiasm for just so long shall we fail to send out well equipped doctors. If the head of a department be chosen for his research work he should be required to surround himself with a sufficient number of well paid men who are first of all teachers. Every great school should conduct research and for this purpose should have money for the adequate remuneration of research fellows whose chief business should be research and who should only be required to give special lectures to selected classes on their special subjects. But the first duty of each medical school is to supply the world with well taught physicians and surgeons.

PROF. R. STOCKARD gives the following summary of the training of American teachers of anatomy: The American Association of Anatomists counts among its members full time men of professorial rank in almost every department of anatomy in the United States. Of the full professors of anatomy there are forty-five with a medical school education, and twenty-seven have been educated in the universities. Among the professors with the degree of M.D., thirty-five are directors or heads of anatomic departments, while twenty-one of the nonmedical professors likewise head departments. In this country, there are seventeen assistant and associate professors of anatomy with the M.D. degree, and twenty-four men of similar rank who are doctors of philosophy or science. There-

fore, of the professional anatomists, sixty-two have gone into the subject after receiving the medical degree, but only the smaller percentage of these have served as hospital interns or had any clinical experience other than that obtained during the last year of the medical course. The same, in general, is true of the European anatomists. As Dr. Symmers mentions, Guy's Hospital requires the anatomist to have passed the examination for a Fellowship in the Royal College of Surgeons. It must be known, however, that this is simply another examination; the candidate need never have served in a hospital or had clinical experience. I have met men studying on the continent for their Fellowship examination, and it is largely a matter of cramming, much like our state board and hospital examinations. The Fellowship is sometimes taken by a chemist working in the laboratory merely to obtain the letters F.R.C.S., which means much to some people.

After the medical graduate becomes a professional anatomist, his time and efforts are so completely devoted to the difficult task of learning the subject and problems of morphology, and the teaching of students, that interest in the practical aspects of medicine other than its educational phases is soon lost. It has been said in this country that the teaching of medicine is not a medical problem but an educational problem.

Fifty-one professional anatomists have received their morphologic training in the universities, and have developed an appreciation of the medical and surgical aspects of the subject through a contact with the clinics after becoming associated with the medical school.

STUDENT ASSISTANTS

Student assistants are not, in general, held in great esteem. Ten laboratories report making no use of them, fifteen laboratories report some use of them but that not through choice. Two report a liberal use of student assistants. The student assistant may be of real value if he is restricted in the amount of time he is allowed to devote to other subjects while aiding in teaching anatomy. For instance, a student assistant may be required to devote two years to taking one year of the medical course so that he has half time for two years to devote to anatomy. Such student assistants are frequently of value in teaching the technic of dissection, in aiding in the study of terminology and frequently in aiding in the art of anatomical expression. They rarely lend much assistance in getting the student to comprehend anatomy. For this the experienced instructor is essential.

III. METHODS OF TEACHING

A. Lectures and Quizzes

Of thirty-one departments, five report no lectures in the main course in gross anatomy; two occasional lectures; two, ten lectures or less; eight, ten to twenty lectures; seven, twenty to thirty lectures; and seven, two or more lectures per week throughout the year. The greatest number of lectures reported is 168, covering "osteology, etc., and splanchnology" and accompanied

by seventy-two quizzes. Professor Prentiss of Iowa, who reports this number, states: "If the instructor can teach, lectures are extremely valuable. If the instructor feels his obligation to the student and not that they are an interference with his research work, his lectures are exceedingly helpful, provided the lectures are followed by investigation on the part of the students." They cover "Points where the text is obscure; osteology, arthrology, myology, not as to simple origin and insertion but as to the relations so that the student in the dissecting room can appreciate the same; angeology, not as to the multiple of details, but as to the heart, for instance, and the reason for its position that the student can appreciate why the so-called left heart reaches more ventrally and dorsally, etc.; the vascular sheath in the neck and its relations to the visceral sheath and what the same implies, etc.; anatomical spaces—axilla and perineum, for instance, that the student can intelligently dissect the same as he might in practice and not tease and tease the tissues, till he has unraveled a complex and in so doing lost the viewpoint of becoming a doctor of medicine." At the other extreme we have Professor Bean, of Virginia, stating that lectures are "not at all" helpful in teaching the main course in gross human anatomy. Professor Bean, however, believes in quizzes of which he holds about fifty per year. These quizzes are based on work completed in the dissecting room. Yet we find Professor Sullivan, of Tufts, writing: "I believe the harm done by quizzes very greatly exceeds the good. They put the responsibility on the instructor rather than on the student. However, sufficient questions should be put in the daily round to make sure that each student is working intelligently." Professor Stockard, of Cornell, believes that "simple quizzes as such are harmful in making the subject a memory feat instead of an understanding of structural principles and arrangements. Professor Stockard believes in "one-man" quizzes over the body in the dissecting room. As to lectures, Professor Stockard writes that their "value" depends entirely on the lecturer; they may be very valuable or may be harmful." The lectures should cover the "general morphological principles with their bearing on functions not accessible in the textbook." Professor Stockard gives no formal lectures but gives about thirty-five demonstration conferences. These are likewise preferred by Professor Ransom, of Northwestern University, who writes as follows:

> A formal lecture course is worse than useless. This is true whether the course consists of the old-fashioned demonstration lecture, or of the presentation of lengthy accounts of the phylogenesis of particular structures as advocated by Huntington. The former can be replaced to advantage by study of the textbooks; and before a student can appreciate the principles presented in the second type of lecture he must master a great mass of otherwise useless detail. Such lectures are therefore likely to

become a burden not an aid to the student. Lectures should be closely correlated with the laboratory work day by day or week by week and should aim at making the student think about the significance of what he has learned from dissection. In the dissecting room the student deals with dead material; in the lecture room he should be made to think of the body as a living, growing and functioning organism. The starting point for every lecture should be the organs or parts which the class has just dissected. A review of the anatomical facts involved may be followed by brief excursions into the embryology, phylogenesis and function of the part under consideration, its derangement in disease, and the more obvious practical application of the information the student has acquired.

We give no formal lecture course, but have a conference once a week, 32 hours in all, which varies from a lecture to a quiz or a combination of the two according to the subject matter and needs of the class. These follow closely the work of the dissecting room along the lines laid down in the preceding paragraph. We find lantern slides and opaque projection very useful in bringing before the student a large number of good pictures which he might not otherwise see. Charts have but a limited use in gross anatomy for diagrammatic representations only.

No attempt is made to use the weekly conference as a whip to drive the students on with their work nor as a means of testing the amount of information each student has acquired. Attention is focused on the development of the topic under consideration and so far as possible the students are allowed to fill in the details in response to carefully framed questions.

We believe, however, that every student should study his text-books day by day as the work advances and not be allowed to leave this for a final cram at the end of the term. To secure this result and also to furnish a basis for determining the amount of information each student is acquiring we give a fifteen minute written quiz each week. These written quizzes make it necessary for each student to do his reading at the proper time and, since with us they take the place of a final written at the end of the semester, they tend to do away with the objectionable text-book cramming.

By frequent inspection of the dissection during its progress we check the character of the laboratory work. At the same time that these inspections are made we talk with the student about his work, test his familiarity with the structures he has exposed as well as his general biological information, try to guage his mental capacity, and offer such suggestions about his methods of work as may be required. If this method is used the teacher can learn little more about the student or the character of his work from the final oral practical as ordinarily conducted. Every teacher who has used this form of examination knows the difficulties involved in making them entirely objective, free from personal bias, and of the same standard for each successive student.

We have evolved a form of practical examination which we believe gives a much fairer test than the oral practical. At the end of the term or semester a number of specimens, equal to the number of students to be examined at one time on one dissection, are placed on tables around the room. In our laboratory we can handle about thirty students at one time. A string, to one end of which a tag is attached, is tied or pinned to some structure which may be a branch of a nerve, a tendon, a surface

of an organ or anything else—on each specimen. The tags are then numbered in rotation. The class is then admitted to the room and a student takes a place at each specimen. On paper furnished him he numbers the lines, say from 1 to 30, and then proceeds to write down after its proper number the name of the structure tagged on his particular specimen. The entire class then moves one place to the right and each student writes down opposite its proper number the name of the structure tagged in the specimen before him. One minute and a half has been found to be ample time for the examination of one specimen and the necessary change of places—and forty-five minutes will thus dispose of 30 practical examinations, in which each student has identified 30 structures. It might seem that such an examination puts a premium on the mere remembering of names; but this is not so, for to identify a structure one must be familiar with its shape, size, appearance and relation to other structures. A tendon, from which the muscle has been cut away but whose bony attachment is in evidence, can be identified only if the student is familiar with all of the muscle attachments to that bone.

Of course, such an examination does not give the teacher any information concerning the type of mentality of the student. Daily contact with the student in the laboratory should however have already supplied this information and the weekly quizzes should have shown whether the necessary reading has been done. A practical examination should be a test of the student's ability to use the information he has acquired; and this end is, we believe, best secured by the type of practical examination we have outlined.

This type of practical should be useful in State Board examinations because it is entirely objective and free from personal bias.

Special preparations are made from formalin hardened bodies and from those embalmed in the usual way. They are kept in galvanized iron tanks and are supported on wire screen false bottom over a 5 per cent. solution of carbolic acid in water, and are covered with muslin that dips down into this fluid. The specimens are always moist but never wet. Sections and other material from formalin hardened bodies are first washed free of formalin, drained, and then immersed in a five per cent. solution of phenol in pure glycerin until thoroughly penetrated, then drained and put away in the galvanized iron boxes without any fluid beneath the false bottom. Prepared in this way they will keep for years without drying or discoloring.

Professor Weed, of Johns Hopkins University, believes that formal quizzes are of no value, and that group discussions are of great value.

Apparently the old-fashioned systematic lecture has nearly disappeared from departments of gross anatomy. Such lectures as are given, be they few or many, are designated to widen the horizon of the student beyond mere description of structure. Professor Schaeffer, of Jefferson Medical College, expresses this as follows: "The lecture enables the teacher to present the basic principles and significance of structure of organic systems, to assemble the subject matter and interpret anatomy in terms of the living body. Lecture sheets cover anatomical physiological

conceptions of the important systems of the body." For this purpose an informal quiz conference, like that described above by Professor Ransom, is preferred by many to the more formal lecture. So far as we can determine from the replies received, however, the majority of our teachers, while they have given up systematic lectures, still believe in systematic quizzes, although in most cases, the quizzes are stated to be based primarily on work done in the dissecting room rather than on topical outline lectures or textbook assignments. The general sentiment appears to be well expressed by Professor Schaeffer, of Jefferson Medical College, who states that quizzes are useful to develop expression of thought on the part of the student, to check up the progress of the student, and to correct errors in interpretation and visualization. Of the thirty-one reporting, three hold no formal quizzes, four hold optional quizzes, others hold quiz sections varying in number of students from ten to forty in a section. The most frequent number is ten to twenty students (twelve instances). The number of quizzes in the course for dissecting varies, the greatest number reported is seventy-five, the most frequent number is thirty. Of twenty-four departments holding regular quizzes, twenty report that the quizzes are based primarily on the laboratory work of the preceding week. In only six cases are lectures specifically stated to be basis for the quiz, and in six cases topical outlines.

As an aid to lectures, conferences or quiz work demonstrations are considered by most teachers to be of value. These appear to be used most extensively by Professor Keiller, of Texas, who states:

> We give ten to twenty minute demonstrations to freshmen at the beginning of each laboratory period of two hours; to sophomores we give a forty minute demonstration leading up to each two hours of laboratory work. Our whole freshmen and sophomore classes dissect together in sections, and the work of each section is strictly synchronized with the demonstrations. Our systematic lectures are limited to two or three introductory lectures to freshmen; and lectures on the cranial nerves to sophomores. There are also a few lectures introductory to the study of the nerve tracts. The total number of lectures is about ten. All our other lectures are demonstrations on specimens or charts synchronized with and leading to the laboratory work immediately succeeding. Demonstrations are regarded as essential. Charts are absolutely necessary especially if classes are large. Lantern slides are only used for purposes of rapid review. They are only of very limited use in teaching anatomy. Lectures in a darkened room are always given at a disadvantage and each succeeding picture obliterates the preceding picture from the student's mind. Approximately 150 demonstrations are given in the freshman year; 120 demonstrations in the sophomore year; and 32 lectures in applied neurology in the junior year. There are no elective courses. Our students are too busy with required work to find time for elective courses.

Professor Weed, of Johns Hopkins University, however, believes that "demonstrations are of use only on the individual cadavers to students dissecting it."

Charts are generally regarded as useful, although not by all teachers. On the other hand, only eight teachers speak in favor of the use of lantern slides in teaching gross anatomy. Among them there is Professor Ransom, whose remarks have been quoted above.

We may sum up the question of lectures and quizzes in the main course in gross human anatomy as follows:

Lectures given to impart information which is to be found in our better textbooks of anatomy are without sufficient value to justify themselves. Lectures given to illustrate points of view not clearly given in textbooks or to emphasize important aspects of the subject of anatomy and of the relation of anatomy to correlated fields may be of value if the lecturer has talent for clear expression. They offer an economical method for the teacher to impart his views to the members of the class in so far as the expressions which he uses are grasped by those present. It is easier to say a thing once to one hundred at one time than to the same group one at a time. Another value of lectures lies in the possibility of arousing group feeling, and the strength then comes from the consciousness of being a part of a social unit working with common ideals. The lecture may be given to the whole class. The quiz, on the other hand, is designated primarily to give the student opportunity for self-expression. The quiz section should, therefore, be small in order that each student in the section may have as great an opportunity as possible for self-expression, and be required to waste as little time as possible in listening to the efforts, usually crude, of his fellow students.

LABORATORY WORK IN DISSECTING

Except for an occasional department in which elective work is offered in gross anatomy, the work of the student in the dissecting room is confined to the dissection of a lateral half of the body. Usually, the two students on corresponding halves of the body work in pairs when the thorax and abdominal viscera are dissected. At the University of Texas, students work in pairs not only on the trunk but also on the limbs and on the head, both sides of which are dissected by a pair of students. The two students who are paired may both dissect at the same time or one may read while the other dissects.

For the sake of convenience in dissecting, the body is variously subdivided into "parts." The following subdivisions are reported in answer to our questionnaire on this subject. Some misunderstood the question as formulated, so we have limited statements on the subject:

Numerals refer to minimum number of hours ordinarily devoted to the part.

Wisconsin

Head and neck	100
Thorax and upper extremity	100
Abdomen and lower extremity	120

Minnesota

Head and neck	84
Thorax	24
Abdomen	72
Upper extremity	36
Lower extremity	48

Loyola

Head and neck	132
Upper extremity	65
Lower extremity	132
Abdomen and thorax	100
Osteology	

Kansas

Head and neck	192
Upper extremity	144
Lower extremity	144
Abdomen and thorax	192
Osteology	50

St. Louis

Head and neck	
Upper extremity	
Lower extremity	
Abdomen and thorax	
Osteology	

St. Louis Washington University

Head and neck	100
Upper extremity	48
Lower extremity	60
Abdomen and thorax	90
Osteology	

Tulane

Head, neck and thorax	150
Upper extremity	50
Abdomen and pelvis	150
Lower extremity	50

Leland Stanford, Jr.

Head, neck and thorax	200
Upper extremity	72
Abdomen, pelvis and lower extremity	113

Northwestern

Head and neck	100
Upper extremity	60
Thorax	50
Abdomen	120
Lower extremity	54

Marquette

Head and neck	100
Upper extremity	44
Thorax	30
Abdomen	100
Lower extremity	32

Pittsburgh

Head and neck	100
Thorax and upper extremity	90
Abdomen and lower extremity	90
Thoracic viscera	35
Abdominal viscera, perineum	80

Iowa

Head, neck and thorax	120
Upper extremity	80
Lower extremity	80
Thoracic viscera	30
Abdominal viscera	74

Arkansas

Head	64
Neck and thorax	64
Upper extremity	64
Abdomen	112
Lower extremity	64

Buffalo

Head, neck and thorax	132
Abdomen	132
Upper and lower extremity	132

Vanderbilt

Head and Neck	95
Upper extremity	62
Lower extremity	56
Abdomen	60
Pelvis	45
Thorax	28
Back	10
Brain	32

Louisville

Osteology	85
Head and neck	117
Upper extremity	60
Thorax	30
Abdomen	99
Lower extremity	72

Texas

Head and neck	120
Upper extremity	94
Lower extremity	94
Thorax	30
Abdomen	90
Pelvis	30
Skeleton	100

Jefferson: One half of college year above diaphragm; one half below diaphragm.

Since the average student is limited to dissecting one body, provision is usually made for a student who has dissected a male body to study the female pelvic organs. This may be done by giving the student special preparations to study, or by having him watch the work of a student working on the body of a sex opposite to that of the subject he himself dissected. A similar opportunity should be offered for the study of cadavers of infants and children.

The length of the standard laboratory period in dissecting is almost universally three hours. In one university it is four hours, and in one (Texas) it is two hours.

In controlling the practical work of the student we find various procedures between two extremes. On the one hand, a student may be assigned a "part" to dissect, be shown how to start on the simpler, technical procedures, and then left fairly free to make such progress as he can. When the part is completed the student is given a practical and oral examination. As the other extreme, all of the students in the class work on the same part at the same time under careful supervision. This method of procedure is described as follows by Professor Keiller of Texas:

We have no time for quizzes. We give a written quiz to each section about once in two or three weeks. There are no quiz hours. No quiz hours are necessary if laboratory work be properly assisted and supervised and examinations be sufficiently rigid. There are no optional quizzes. Osteology of the upper extremity is taught as a laboratory course for two weeks before the section is allowed to begin dissecting the part. A graded quiz is given before dissection is commenced. Skull and trunk bones are taught during the first four weeks after Christmas holidays. Each student with a companion dissects one upper extremity, one lower extremity, including joints and the thorax, during his freshman year. During the sophomore year students in couples dissect:

First semester: Eye, one week; ear, one week; abdomen, nine weeks; brain and nerve tracts, five weeks. Second semester: Head and neck, eleven weeks; male and female pelvis and perineum, three weeks; nose, pharynx and larynx, two weeks.

Students dissect in couples, each reading and dissecting alternately (Cunningham's Manual used), or both, when more convenient, dissecting at the same time. Each couple dissects one upper extremity, one lower extremity, one thorax, one abdomen (both sides), one head and neck (both sides), one female pelvis (A large number of wet specimens of female pelves are available for study), one brain and cord, including microscopic work on nerve tracts, several eyes of oxen, one human eye, one human ear. The hours are: eye, four demonstration hours, ten laboratory hours; ear, four demonstrations hours, ten laboratory hours; brain (gross anatomy), twelve demonstration hours, thirty laboratory hours; nerve tracks (microscopic anatomy), eight demonstration hours, twenty laboratory hours; abdomen, thirty-six demonstration, ninety laboratory hours; male pelvis, six demonstration hours, sixteen laboratory hours (with perineum); female pelvis, six demonstration hours,

fourteen laboratory hours (with perineum); head and neck, forty-four hours, 110 laboratory periods; nose and pharynx and larynx, eight demonstration hours, ten laboratory hours; upper extremity, ninety-four laboratory hours; lower extremity, nine-four laboratory hours; osteology, seventy laboratory hours (partly demonstration, partly laboratory work); joints, thirty laboratory hours; thorax, thirty laboratory hours.

Dissecting room period is two hours. In sophomore year this is preceded by a forty minute demonstration four days a week. Dissecting is under constant supervision and direction. Cunningham's Manual is used. Occasionally, we give 5 per cent. of the term grade on the dissections. Students never know when we are to decide to do this. I believe also that our dissecting room spirit is such that there is very little careless dissecting. Further, a certain time is required to be spent on each dissection. The more I think of this the more I am convinced that the quality of the work done in the dissecting room depends most on the laboratory spirit, and that again is mainly due to the character of the teaching. An enthusiastic laboratory teacher will make enthusiastic students, other things being equal. All my staff, myself included, are constantly in the laboratory, assisting, supervising, and directing the work. There are men, of course, who never can be made good dissectors, but with few exceptions they all want to see everything. We require no drawings, or note books, except drawings on topographical anatomy mentioned below, but graded quizzes averaging every two to three a week keep a check on the quality of the work done. We do not use living models but bony landmarks are shown on cadavers and questions are asked on bony landmarks in oral examinations. We recognize the value of living models, but they are difficult to procure in a small town. Occasionally roentgenograms are shown but not in any systematic manner. An optional course in roentgen ray work is given to seniors by the radiologist and roentgenograms are used freely clinically. There is a dissecting room library and a special museum where mounted wet preparations of special teaching value are labelled and described in handbooks. A large dissecting room is used. We believe that we can better control the students with our small staff in a large room. I have no experience with small dissecting rooms. We have seldom more than sixty-five students in the dissecting-room at one time. Our staff consists of one professor, one associate professor and one instructor (graduate). We need at least one more instructor.

Professor Terry, of Washington University, describes his method as follows:

How many quiz hours are demanded, etc.? None.

Do you offer optional quizzes?

Yes—in the form of a conference, one hour a week, throughout the year on the laboratory work in gross anatomy and also a conference of one hour a week for one-third of the year on osteology.

Are the quizzes based on specific text-book assignments, etc.?

Based on the laboratory work done by the class during the past week. Note: In our laboratory all members of the class dissect and study the same part at one time just as is the common practice in class work in histology and chemistry; therefore confer-

ences and lectures deal with the subjects in gross anatomy with which every man in class is at the same time concerned in the laboratory.

How do you treat the subject of osteology, etc.?

As part of the work in dissection. A conference in osteology is offered as an optional course (see above).

How much dissection do you require?

Approximately 300 hours.

(a) Parts of the human body dissected, etc.?

Unilateral.

(b) Minimum number of hours required for each part?

Lower limb, about sixty hours; upper limb, about forty-eight hours; thorax and abdomen, about ninety hours; head and neck (exclusive of the brain and sense organs), about 100 hours. Note: As the student begins with the lower extrmity time is consumed in learning the technic of human dissection, the ways of the laboratory, reference to the collections, library, etc., therefore, the number of hours taken for the lower limb is considerably in excess of what would be the case if it were the second in the order of dissection.

(c) Minimum length of time for a given dissecting room period?

Three hours.

How do you check up the quality of the dissection of a given part?

By daily inspection; by record sheets which, however, are issued primarily for another purpose. These sheets record notations on every part called for demonstration and any variation in the part. These methods of checking up are not adequate. By experience in the past am assured that week end demonstration by student (practical quiz) is an excellent method for checking up.

Do you require any method of recording, etc.?

Use printed forms for recording all structures to be demonstrated, for notation of variations, for drawings of the parts presenting variation or fluctuation.

Do you make use of living human models, etc.?

The study of surface anatomy by inspection and palpation is a routine in the study of every part, the student himself serving as the subject.

At the University of Minnesota printed laboratory dissection records are furnished to each student. An instructor is constantly present in the dissecting room to aid the student. Drawings and notes are strongly advised but are not required.

METHODS OF CHECKING UP WORK IN DISSECTION

In most laboratories, the work of the student is inspected daily by an instructor and more or less quizzing is done on the part. At Iowa there are "always four instructors present whose business it is to assist and check up. One of the department always has a drawing board, and sketches any anomalies. The result is that the students are always looking for same, even to

small muscle slips going from the brachialis anticus to brachioradialis, for instance. This method results in careful dissections."

The record sheets used at the University of Minnesota have been adopted in a modified form in one or two other laboratories. Note books are reported as required in only two or three laboratories. Drawings are required in four laboratories. At Louisville, drawings of selected parts are made life size. Professor Evans, of the University of California, writes: "A few careful records in which drawings are employed are valuable. Many inaccurate ones are pernicious, many good ones are impossible." Professor Sullivan, of Tufts, writes: "Students are strongly urged to make records of their findings and each one is expected to make accurate records of some part of his dissections. Mimeograph charts are available, and are used by a fair percentage. In addition, many free hand drawings are made." Professor Allen, of Oregon, reports the use of drawings partially diagrammatical, partially original.

The chairman of the subcommittee presenting this report devised outline charts to aid students in making drawings of parts. He has found these of value when the instructor takes the time to check up the drawing with the part on which it is based, but otherwise not of great value.

ACCESSORY AIDS

Students are universally encouraged to make use of themselves as living models while studying anatomy. In addition, some laboratories provide professional models at certain periods. Professor Stockard, of Cornell, who has done this the most extensively, believes that such models are of great value at the opening of the course.

Models, charts and special dissections are commonly placed at the disposal of the student during dissecting. Professor Poynter, of Nebraska, has the Cunningham stereoscopic photographs conveniently mounted in illuminated boxes for student use. Eleven laboratories report the use of roentgenograms. These are of a great aid in enabling the student to visualize internal structures, especially when mounted, to be viewed stereoscopically. They are of special value in the study of the joints in the various positions, in the study of the blood vessels, and in the study of the thoracic and abdominal viscera. A large display room for roentgenograms is fairly certain to become a regular part of the equipment of an anatomical laboratory. A fluoroscopic outfit is likewise of value, although it has to be much more carefully supervised than the display room for roentgenograms. One, two or three laboratories have fluoroscopic outfits at their disposal at present.

Out of the thirty departments reporting, twelve state that they have a well equipped study room; two that they have a fairly good one; four that they have a poor one; six that the facilities commonly furnished in a study room are supplied in the dissecting room itself; and six that no such facilities are provided.

As to the dissecting rooms themselves, twenty-one report the use of large rooms; seven the use of small rooms, and one the use of a large room with alcoves. Seventeen prefer small rooms, seven large rooms. The terms large and small are indefinite. I shall define a small room as one containing four dissecting tables or less. The large room with alcoves seems to have many of the advantages of both. On the one hand, it has the comparative privacy of the small room. On the other hand, it makes possible the calling of the class together for informal talks during dissecting room periods, and encourages comparative study of dissections. The most important thing is to have the dissecting room appear like a clean laboratory, not like an uninviting barn.

METHOD OF PRESERVING BODIES

Since the main factor in teaching gross human anatomy has come to be the careful dissections of a well preserved body, the methods of preservation selected in different laboratories are of interest.

The phenol-alcohol and glycerin mixture, introduced by Professor Mall, is used in ten laboratories; the formalin-glycerin-phenol acid mixture, introduced by Professor Streeter, is in use in five laboratories; a mixture of phenol, alcohol, formalin and glycerin is used in six laboratories; a mixture of arsenic, glycerin and phenol is used in one laboratory; a 2.5 per cent. formalin solution, followed by treatment in brine, is used in one laboratory; and a modified Souchon is used in another laboratory; while Professor Meyer, of Leland Stanford, makes use of his mineral oil method, "the best he knows of." Professor Ransom, of Northwestern, states "bodies are being embalmed with 5 per cent. phenol, 5 per cent. formalin and 10 per cent. glycerin in water. Before the war we used equal parts of glycerin, phenol and alcohol with better results, and expect to return to that method as soon as possible."

The arterial injection most used is a starch and red lead mixture, although some prefer Mall's shellac and Prussian blue mixture.

After injection, a few use cold storage for preservation of the bodies; some immerse the body in a phenol solution; most keep the bodies in boxes or tanks filled with phenol-alcohol vapors. A few cover the body carefully with petrolatum, and wrap it up with paper and cheesecloth and keep it in a closed box.

PLACE OF THE REQUIRED COURSE IN DISSECTION

In twenty-three of the laboratories reporting, this course extends throughout the full year. At Johns Hopkins, it extends over the first six months of the college year; at Minnesota it extends over the first two quarters. At the University of Texas, the work is distributed as follows:

Freshman year: Two hours laboratory work, five days weekly, throughout the year. Freshman work covers: upper extremity, lower extremity, thorax, joints, all the bones of the body. Early in the year a special laboratory course is given on the general architecture of the body, and the thorax and abdomen with special reference to the cavities and organs. Ten laboratory hours —special handbook. This is to prepare freshmen for the work in histology, embryology, biochemistry and freshman physiology.

Sophomore year: Forty minutes demonstrations, four days a week; two hours dissecting room period, five days a week, throughout the session. Abdomen (except pelvis), eye, ear, and brain, including nerve tracts, first term. Head and neck, nose, pharynx and larynx, male and female pelvis, second term.

CORRELATION OF GROSS ANATOMY WITH OTHER SUBJECTS

There is a general agreement among those in charge of teaching gross anatomy that this subject should be correlated in the closest possible way with the other subjects belonging within a department of anatomy, embryology, histology and neurology; and with the work in physiology; that it should be linked up with the required premedical work in biology, on the one hand, and with pathology and the clinical branches, on the other hand. Methods devised for affecting this purpose lie partly in the arrangement of the medical curriculum, partly subjects treated in lectures and quizzes, partly in the order in which various anatomical subjects are taken up within the department. It is obvious that the main thing necessary is harmonious cooperation toward the end sought on the part of the whole medical faculty.

TOPOGRAPHICAL ANATOMY

In the departments of anatomy, out of thirty-one reporting, the required work in dissecting and systemic anatomy given in the first year is followed by a required course in topographical anatomy given in the second year. In eleven departments, the course in topographical anatomy is elective in the second year. It may extend throughout the second year, or only through a part of the year. At Minnesota, where work in topographical work is elective, the work extends throughout the three quarters of the second year. All three quarters may be elected, or any one or two quarters may be elected. In one institution, required

work in topographical anatomy consists of thirty demonstration hours in the third year. Most departments offer some required or elective courses in applied anatomy in the third or fourth year.

With one or two exceptions, the major work in the course in topographical anatomy of the second year consists of a study of sections of formalin hardened bodies, cut either with a hand saw or band saw after freezing, or with saw and knife after decapitation of the head. The main emphasis is laid on a study of cross sections, but sections cut in other planes are freely used. Models, charts, special preparations and the like are used as accessories. For drawing the cross sections, the glass plate method is nearly universal, although at Washington University outlines of the sections are traced on parchment paper after moistening this with gasoline. Drawings are required in thirteen, not required in seven institutions reporting on this subject. In one or two institutions a Bly camera lucida is utilized as an aid to drawing. In two or three institutions mimeographed outlines are used. Such outlines are a help in making diagrammatic reconstructions from the section drawings. Reconstructions of this kind are stated to be required in only a few institutions, but probably are more widely required than the questionnaires indicated.

Professor Keiller, of the University of Texas, in teaching topographical anatomy makes relatively less use of cross sections than is usually the case. His work in this field is described as follows:

Applied Neurology.—A special lecture course in applied neurology is given to junior students; one hour weekly throughout the session. This is correlated with laboratory study of typical nervous lesions in the pathological laboratory (Chair of Pathology). The relation of the anatomy and physiology of the nerve tracts to those nervous diseases which are dependent on definite pathological lesions is described with the help of diagrams and pictures of typical nervous cases. Symptomatology is discussed in its anatomical and physiological relations. A special mimeographed text is used.

Comment: I find this distribution very satisfactory especially since I introduced the short laboratory course on organology early in the freshman year, and had all the sophomores dissect the abdomen in the first term of the sophomore year. Freshmen get enough general idea of the cavities and organs for their histology and embryology and sophomores get the abdomen (they have had the thorax in their freshman year) in time for sophomore pathology during the second term. Neuro-anatomy including the nerve tracts and the eye and ear are completed in time for the physiology of these organs.

Topographical Anatomy.—Topographical anatomy is taught in the *sophomore* year by requiring each group of two students to outline the undisturbed abdominal organs as soon as the abdomen is opened, on a special life size clinical chart provided for the purpose. These charts are carefully checked and are found of great teaching value. They are pre-

served for reference. Two demonstration hours and six laboratory hours are given to this work. In the *junior* course in applied anatomy, the student outlines in chalk on the cadaver which he is about to dissect most of the thoracic and abdominal organs. The chief outlines are scratched in on the skin and the position of the organs compared later with the marking. Mounted sections are used for illustration. A special mimeographed laboratory guide is used for these exercises. If the students are required to dissect the body thoroughly, they have no time for elective courses nor have we time to supervise such courses. We encourage our graduates to come and do special work. What is called topographical anatomy in many schools is covered in our laboratory course in applied anatomy. The time required for this course is thirty-two hours in the sophomore year (upper and lower extremities) and sixty-four laboratory hours in the junior year (thorax, abdomen, head and neck). There are no lecture or quiz hours. In practical work we use mounted formalin sections of abdomen, thorax, head and neck and extremities for reference where they seem useful. Museum preparations are used where they illustrate special points and for review. Many hand specimens of sections of the brain and thoracic and abdominal organs mounted in formalin gelatin are used freely and are always available. Many hand specimens of thoracic abdominal and male and female genito-urinary organs are always at hand for study and reference. At least ten wet preparations of dissected extremities and many female pelves are always at hand and are freely available for the use of students. Charts are used extensively in demonstrations and in the dissecting rooms and students are encouraged to copy the more helpful ones. The school is well supplied with models and we have many of our own wax casts. All these are available to students. The living model and roentgen ray apparatus are not used. Stereopticon demonstrations and microprojection of brain and eye sections are given as they seem called for. We have needed no frozen sections since we used formalin. A body embalmed by injection with ten per cent. formalin after a short interval can be cut perfectly with a power band saw, even abdominal viscera retaining their proper relations. We have quite a number of such preparations mounted by embedding in parafin or plaster of Paris (paraffin is now preferred) and preserved as permanent mounts. We have at least a dozen heads in mesial sagittal section as hand specimens. Students have from time to time been provided with life size hectograph outlines of the bones of the extremities and trunk to be filled in with muscles, organs, etc. They are encouraged to make large copies of special diagrams by use of a large drawing slate, and are furnished with colored chalks for the purpose.

Sophomore Applied Anatomy.—A laboratory course in the applied anatomy of the upper and lower extremities, including bony landmarks, surgical exposure of arteries and nerves, surgical approach to bones, anatomy of excisions and amputations.

Text: Beasly & Johnson, Special Laboratory Guide. Two hours weekly, for sixteen weeks.

Junior Applied Anatomy.—A laboratory course of two hours weekly throughout the year is given in applied anatomy. The students in groups of three or four outline cavities, regions and organs on the surface of the cadaver; study the anatomy of typical incisions, and the surgical and

medical anatomy of organs. Most typical operations are done with special reference to their anatomy.[1] A special laboratory guide is used. Two hours weekly throughout the session.

There is wide divergence in different schools both in the extent of the course in topographical anatomy and in the methods of teaching used. On the one hand, we have the carefully planned out course of which that described above is perhaps the best example. On the other hand, we have great latitude offered the student, as at Wisconsin. Here the work is elective. The minimum requirement of a student who elects the work is that he shall draw cross sections of the trunk and make an outline reconstructing the organs. The student can work at such hours as he pleases, gets little supervision, although help when he seeks it, and is graded on the quality of his drawings. Beyond this the student can go as far as he desires in studying cross sections of other parts of the body. in making special radiographic and fluoroscopic studies and making special dissections. Credit is given according to work accomplished. In most cases the student selects a special region for investigation, utilizes various methods for the study of this region, looks up the literature and writes a thesis. No lectures, quizzes, or examinations are given.

Of departments reporting, there are no lecture or quiz hours in three; 16 in three; 18 in one; 25 in two; 32 in two; 33-36 in one; 33 in two; 36 in three; 40 in two; 60 in two. The required laboratory hours are 22 in one; 24 in one; 32 in three; 40 in one; 48 in two; 60-64 in two; 70-72 in three; 80 in two; 90 in two; 99 in one; 120 in two; 128 in one; 150 in one.

The use of the living model is reported more frequently in connection with the work in topographical anatomy than in that of dissection. In one institution, while the male students work on one another as "models," the girl students are provided with a professional model.

OTHER COURSES

A department of anatomy which is an integral part of a great university in which the medical school is located in close association with the other colleges and schools may well include within its scope courses designed for other than medical students and nurses. Such as courses for students of physical education, and courses for students of art might be included. Such a department, in friendly cooperation with the department, may include within its scope the major courses in mammalian anatomy or even in vertebrate anatomy. It should be the best place in which to localize courses in physical anthropology. We are here

1. This is entirely independent of the course in operative surgery to seniors under the Chair of Surgery.

concerned, however, with the activities of the department in relation to medical students. For them the following elective courses are recommended by various anatomists:

Physical anthropology, 3.

Study room course in living anatomy, 1.

Course on the anatomy of fetus, infants and children, 3.

We have not included in the courses mentioned above special advanced courses in subjects specially included in the medical curriculum, such as embryology, histology, neurology, and topographical anatomy nor the courses given in connection with the teaching of various clinical specialities in the third and fourth year, such as on the eye, nose, ear and throat. Courses in applied anatomy of this kind may be expected whenever the clinicians desire them.

The importance of the elective system in the medical curriculum with special reference to anatomy has been emphasized by Dr. Jackson.

SALARIES OF TEACHERS

The maximum, minimum, and average annual salaries paid teachers of gross anatomy in twenty-one institutions reporting are as follows:

	Maximum	Minimum	Average
Professors	$6,000	$2,750	$4,000
Associate professors	4,500	2,000	3,000
Assistant professors	4,000	1,750	2,300
Associates and instructors	1,750	1,000	1,400
Assistants	1,500	500	900

The salaries deemed "fair" for the same positions are as follows:

	Maximum	Minimum	Average
Professors	$10,000	$4,000	$6,650
Associate professors	6,500	2,250	4,200
Assistant professors	4,500	1,750	3,000
Associates and instructors	2,000	1,000	1,750
Assistants	1,500	750	1,200

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REPORT OF THE JOINT SUBCOMMITTEE ON THE TEACHING OF NEURO-ANATOMY

IRVING HARDESTY
NEW ORLEANS

At the time when it was inferred that the pedagogics for neuro-anatomy lay within the scope of the subcommittee on the teaching of all microscopic normal anatomy, we made out a questionnaire for neuro-anatomy.

That subcommittee, or this joint subcommittee, on neuro-anatomy could have made out a set of teaching procedures and recommendations proven necessary in the class room experiences and judgments of its members alone, and then have been acting wholly within the purpose for which it was appointed. But, hungry for suggestions from others with equal or greater experience and success in teaching the subject, and desiring to be as democratic as possible, we made out the questionnaire and sent it to the colleges in membership in the Association. We admit that many of the questions could be improved on or omitted; that many of them are *purely pedagogic*. We are a committee on pedagogics. Some of the questions were asked solely to learn how certain things are done in other schools or whether or not they are done at all. We did not intend to jar the lofty scientific pedestal of any man. We felt that the medical student has a psychology as well as others, and that considerable "pure pedagogy" is deserved by him in teaching him our subjects. Yet, from one or two of the colleges a seemingly scornful reference to their purely pedagogic character was the only answer we got to some of our questions.

As the first point in this preliminary report, we wish to reflect a feeling that a few of our professors of anatomy do not seem to realize the chief of the two purposes for which they are appointed on faculties, that is, to devise the most efficient means for and to train as thoroughly as they possibly can every individual man or woman who *may possibly be liberated* to practice or to prey on his fellow beings. This training of physicians is also our moral duty to society and to the government. This training of men is our "job."

We received answers to the questionnaires from forty-two of the fifty-nine colleges of the Association. We wish to thank the men of these forty-two colleges for the time and tedious effort given at our request. As questionnaires usually go, forty-two out of fifty-nine is not a very bad showing.

We are sorry that we did not receive answers from all the colleges. Some not answering we know do not give a course in neurology at all. We now know that some who answered do not.

Manifestly, from the answers, an attempt seemed to have been made in a few cases to create an impression that a course in neuro-anatomy is offered by patching together time and subject matter covered in the usual routine courses in dissection, histology, organology and embryology. In other colleges, from which as yet we have received no answers, we know that excellent courses in neuro-anatomy are given and we deplore that we have not had their aid.

DEFINITION OF NEURO-ANATOMY

Neuro-anatomy is the division of anatomy most neglected in the curricula of the past; and, though much more honored during the past ten years than before, it is still sadly neglected. Many schools, satisfied with the training given their instructors ten or twenty years ago, offer either no course at all or none actually deserving the name. It is the most difficult subject in all anatomy, most complex in subject matter and most difficult to teach to the average student. It has been avoided.

From our personal knowledge of the instruction given in the colleges, or from conditions made manifest in the answers to our questions, some sets of answers in all fairness should not be considered in this report.

However, in this report, we have purposely used all the answers received and have confined ourselves to summaries of opinions and averages of figures obtained from them, feeling that such, with occasional brief comments, will be of more immediate interest to this body than a fuller airing of our own opinions and practices.

The name "neuro-anatomy" is accepted for the course by 56 per cent. of the colleges answering the questionnaire, while 24 per cent. specify the term "neurology." Others suggest excellent but more cumbersome terms. Doubtless, nearly all prefer neurology in that it is shorter and carries the more suitable meaning—"knowledge or discussion of the nerves or nervous system," while neuro-anatomy carries the untrue inference that the subject is wholly anatomy. Let us hope, that the reasons for denying us the term neurology are not so positive as is felt. A large number of colleges designate the conflicting branch not as neurology but as either "clinical neurology," or "department of nervous and mental diseases," or simply as "diseases of the nervous system." And the names of the special sense branches do not conflict at all.

PURPOSE OF COURSE IN NEURO-ANATOMY

As to the chief broad purposes for giving a course in neuro-anatomy, thirty answers include it as a basis for the study of nervous and mental diseases; twenty-nine urge it as a basis for

physiology; six as a basis for pathology; three as a basis for research; two urge it for medicine and surgery, and twenty-two think it should be taken for its general culture value, including "intellectual discipline," i. e., that those of us who have and use a nervous system should know on general principles its construction and how it works.

HOURS IN COURSE

Many of the answers as to time allotment give the time now allowed in the colleges instead of answering the question as to the minimum time considered necessary for the course. The highest number of scheduled hours given is 144 hours; the lowest, 40 hours; the average for the answers is 101.2 hours. The college giving 40 hours and one giving 68 offer no course in neuro-anatomy at all. The minimum time necessary should be given at from 120 to 132 hours at least.

About 86 per cent. (85.36) of the answers state without equivocation that neuro-anatomy should be offered as a separate individual course while only five colleges favor it in two separate courses.

The averages of the replies given as to what proportion of the total time of the course should be devoted to the microscopic part and what proportion to its gross features are, 55 per cent. of the time to microscopical and 44 per cent. to the gross. The highest allotment given the microscopical part is 80 per cent. and the highest for the gross is 66.6 per cent. Twelve colleges divide the time equally between the two.

The average proportions of the time given to didactic and to laboratory work are 29 per cent. didactic and 71 per cent. laboratory; the highest claim for didactic being 50 per cent. and the highest for laboratory work being 90 per cent. Neuro-anatomy requires more lecture and explanatory work than any other division of anatomy as such. From 25 to 30 per cent. is probably the proportion of time given to lectures in most of the better courses.

The average proportion of the total time to be allotted to the natural divisions of the subject matter, computed from the answers, is 17 per cent. to the spinal cord; 30 per cent. to the rhombencephalon; 29 per cent. to the cerebrum and 24 per cent. to the sense organs; and that the sense organs, the eye and the ear should receive the most attention.

OUTLINE OF COURSE

As to the minimum number of sections of which detailed drawings should be made in the laboratory, some of the answers are amusing. One man gives sixty-two sections to be drawn in sixty hours of laboratory work! The average number of sec-

tions to be sketched, compiled from the answers, is twenty-six; eighteen of the nervous system proper and eight of the sense organs. This average, while by no means more than is needful, calls for more actual drawings than can be made in the time allotment given by several of the colleges.

Seventy per cent. of the answers state that it is found necessary to repeat briefly both discussion and laboratory exercises in the work previously covered in histology proper and 50 per cent. state that the same is necessary for embryology. This may be the fault of the teacher of neuro-anatomy rather than of those of the other subjects. The remaining answers suggest either brief review of history and embryology in lectures alone, or that no review at all is necessary.

Fifty-five per cent. of the answers place neuro-anatomy in the first part of the second year of the curriculum, and 44 per cent. suggest the last part of the first year. It is urged that the latter position in the schedule must mean either inefficient sequence of courses or overconcentration of the work of the first year.

Neuro-anatomy requires more concentrated and consecutive effort on the part of the student and instructor than any other division of anatomy. It deals with one continuous functional apparatus, knowledge of which must be added to day by day, with as little break in effort and as little diversion by other courses as possible. We urge that concentration of hours is very profitable for the student learning it. Eighty-six per cent. of the answers favor concentration of the course, while only 14 per cent. favor the diffuse arrangement of the available time. "Concentration" should mean not less than three nor more than five half days per week, including lecture and laboratory periods. In this, as in all courses in anatomy, concentration can easily be overdone.

MATERIAL FOR STUDY

All agree that for the medical student the material for the course should be human for the most part. Eleven answers express the desire that all material be human. The remainder, on the contrary, suggest that material from animals is even of some advantage in the work. For this supplementary material, the sheep, shark, dog, hog and cat are most favored, in the order named.

About 83 per cent. of the answers agree in that most obvious fact that the use of a few sections showing pathologic lesions is very useful for the demonstration and tracing of nerve tracts, for stimulating interest in the work and for illustrating methods of investigation. Seventeen per cent. state that no pathologic material is necessary!

Attention is called to a rather too common defect in our formal courses in pathology. In 54 per cent. of the colleges it seems that either very little or no neuropathology is offered in the department of pathology. In a few colleges it is stated that special attention is given neuropathology.

Modern anatomy is getting well away from the old idea that it involves only the treatment of structure. Correct interest cannot be aroused in it without special attention as to the function each structure performs. The teaching of neuro-anatomy must be from the functional point of view, the names used being merely for convenience in describing structures that do things. Yet time must be given to the character and position of structures. The question of the relative importance and proportion of time to be allotted to "mere anatomy" of the nervous system, as compared with that necessary for the consideration of functional nerve paths, is a vigorous question. One answer urges that as much as 80 per cent. of the time of the course be devoted to the tracing of paths. This is more than is possible. The average proportion of time for it, computed from all the answers, is about 46 per cent. Only one answer claims as high as 75 per cent. of the time for mere anatomy.

Seventy-four per cent. of the answers suggest it as advisable that, at the end of each division of the course, diagrams and plottings illustrating the origin and course of the chief tracts involved in that division be required of the student. The others state that such diagrams are not essential, or some that should not be required, or some fail to answer the question at all.

STUDENT'S RECORDS AND GRADING

There is a general agreement that some form of complete record of the student's laboratory work is necessary, and the answers suggest that records should be required because some students will not make them otherwise. As to the kind of laboratory records to be required of the student, 27 per cent. of the answers give drawings of the material as most necessary, with diagrams and plottings of paths accompanying them as of next importance. Twenty-seven per cent. place diagrams and plottings as most important, supplemented by drawings. Two colleges suggest the making of models for the tracts, two recommend written reports also, and two require no form of records.

The correcting and grading of the students' laboratory records is among the most laborious routine drudgeries the teacher has to perform, and all of us would arrange to avoid it if the course could be conducted effectively otherwise. The frequency with which the records should be called in for correction by the instructor varies in the different answers, from daily correction down to but once, and that at the end of the course. The logical frequency is three times during the course: one set of records

for each of the three logical divisions of the subject matter, i. e., one for the spinal cord, one for the encephalon and one for the organs of special sense. Handed in at the completion of the division, the records should be corrected, graded and returned to the students as promptly as possible that mistakes may be realized and profited by in succeeding records. The large majority of the answers favor this.

ORAL QUIZZES

Frequent oral quizzes are probably of more value to the student in neuro-anatomy than in any other work of the first two years. The optimum number of oral quizzes per month will depend on the number of laboratory periods. The large majority of the answers favor weekly oral quizzes, or one to each three or four laboratory periods. The quiz section should be small enough to permit each student in it being quizzed thoroughly on a problem during each quiz period. Usually, the sections must be approximately the size of the sections of the class assigned to the instructors in the laboratory. The method of the quizzes should be developmental of the problem rather than a single question to a student.

The answers suggesting the optimum number of students per quiz section vary from "the class as a whole" (three answers) and twenty-five students (six answers) to as low as six students (two answers). The average of all the answers gives seventeen students per quiz section. From twelve to fifteen would be more propitious numbers.

WRITTEN TESTS

Written tests should have two purposes: (1) to induce the student to summarize and systematize the subject matter so far covered, and (2) to induce him to realize the amount and accuracy of his knowledge so far obtained. The most efficient frequency of written tests in a course in neuro-anatomy is a matter of opinion. Because of the drudgery of correcting and grading, all of us would like to make them as few as possible. The answers to the questionnaire vary from none at all (two answers) to twelve such tests during the course.

The approximate average of all is three tests during the course. Two written tests during the course, exclusive of the final examination, should be the minimum. As is obvious from their purpose, written test papers should be graded and returned to the student promptly. Only three answers oppose returning the papers, one stating that "grading may be harmful."

Shall the passing of a subject depend wholly on the final examination? It did in the olden time and in some of the old countries. Or shall the student's term work (laboratory and quiz records) be considered in determining the final grade? It

is urged that his industry and accomplishment during the course should be considered. One answer values the term work as high as 80 per cent. of the final grade; another values the final examination at 90 per cent. of the final grade. Six consider the term work more important, and three the final examination as more important. Twelve consider term work and final examination of equal value. The average of the answers gives a value of 57.6 per cent. to the term work in the final grade and the remaining 42.4 per cent. is given as the relative value of the final examination.

FINAL EXAMINATIONS

As to whether the final examination in neuro-anatomy shall include both a practical and a written examination, 92 per cent. of the answers give an unqualified "yes." Two colleges only claim the distinction of "no," favoring written examinations only. Approximately, all the answers seem to agree that the practical is best given orally, using stained sections (with projection lantern suggested by some), gross dissections and sections, models and charts. And in answer to a question as to the relative value of the practical examination, 71 per cent. of the answers agree that the passing grade should be required in the final practical, regardless of whatever grade may be obtained from the term work and the other part of the examination. The memorizing of subject matter in anatomy should never be credited. The absolutely necessary essential for the student of medicine throughout his entire training is visual images. He must know things when he sees them. This is the chief purpose of the numerous drawings so commonly required throughout the study of all anatomy.

PREREQUISITE AND SUPPLEMENTARY COURSES

From the very nature of what the course should be, it is obvious that the courses in histology and embryology should be required as prerequisite to entering the course in neuro-anatomy, and practically all the answers make them prerequisite. Answers from the large majority of the colleges make gross anatomy prerequisite also, some requiring the dissection of the entire body, others only the head and neck. The entire body should be completed before neuro-anatomy, certainly the head, neck and thorax. Answers from two colleges state that no prerequisites are required.

Twenty-eight of the answers hold that the passing of neuro-anatomy should be prerequisite to entering physiology; twenty-four hold that it should be prerequisite to the work in nervous and mental diseases, and eighteen hold that it be prerequisite to entering pathology. The courses in psychology, medicine, pharmacology, surgery, topographic anatomy and medical jurisprudence are scatteringly included.

Sixty-one per cent. of the answers agree that a supplementary review course in neuro-anatomy is advisable in the later years of the curriculum, introductory to the work in nervous and mental diseases, and the same percentage of answers recommend that such a course be offered by the staff of nervous and mental diseases. The remaining 39 per cent. hold that if offered, this review course should be taught by the staff of anatomy. A great majority of the answers agree that such a course should be brief, from two to thirty-five hours being mentioned for it, and 84 per cent. state that it should be wholly didactic, with demonstrations, using sections, charts and models. The remaining 16 per cent. recommend that this review should be accompanied with laboratory work, one that it be offered as a seventy-two hour elective course.

Our invitation to make comments and additional suggestions as to scope and procedures in teaching neuro-anatomy brought some very good responses. One is a plea for cooperation in teaching among the staffs of neuro-anatomy, physiology, pathology and the staff of nervous and mental diseases. All of us realize the need of this cooperation. Another is a plea that the anatomic names used be as short as possible, and each carry the proper functional significance in its meaning. A third impresses on us that the tracing of nerve paths is by far the most important object of the course, supplemented by the plea of another that the subject be taught wholly from the viewpoint of the functional significance of each of its components. One urges that the course either precede or be given simultaneously with experimental pathology. And last to be noted is a plea that throughout the country the course be much extended, as its subject matter deserves, and that it be retained wholly within the scientific laboratories of the first two years.

Respectfully submitted,

[Signed] IRVING HARDESTY, Chairman.

NOTE: The report of the subcommittee on Histology, read by Dr. F. S. Waite, could not be completed for publication until 1921.

DISCUSSION

DR. BURTON D. MYERS, Bloomington, Ind.: I am very much interested in these reports, and particularly in the teaching of the last subject presented, neuro-anatomy. As has been stated, it is one of the most recent developments in anatomical teaching. As a student in 1897, I remember very well the boast of my old teacher that for the first time in the teaching of brain anatomy in America, human brains were placed in the hands of students for study. In 1902, I wrote to Dr. Mall, stating that I was dissatisfied with my knowledge of human brain anatomy and that I would like to have him tell me of some place in America where I could go and

have an opportunity of studying a series of human brain sections. Dr. Mall replied that there was no such a place in America. There are places of that sort in America today.

I feel the time necessary to devote to a course in neuro-anatomy must depend on the equipment which the department has for teaching the subject. You cannot teach neuro-anatomy without brains, as was attempted when I was a student, and you cannot teach it successfully without sections of the brain.

I believe if a department of anatomy has a complete series of sections from about the second cervical nerve up beyond the anterior commissure and uses them freely in projection apparatus, the subject matter of neuro-anatomy may be given in from 85 to 105 clock hours.

I know of no subject that is harder to teach than neuro-anatomy. The student must learn so much before he begins to get anything. He must spend from 50 to 75 per cent. of his time in learning location and function of various isolated features of the brain, before he knows enough to tie them together and trace tracts or impulses.

Instead of written reports which have been recommended, I believe we can get rid of these by using the projection apparatus. With the projection apparatus we could demonstrate brain sections to every man in this room. Calling on student after student to demonstrate section after section you get the interest and attention of a large number of students at one time and learn whether the student is getting the subject or not. This gives opportunity for review so essential to an enduring knowledge of the subject matter of the course.

I am talking from an experience of seventeen years during which time we have had a complete series of more than 2,000 sections divided into fifty sets of forty sections each. This gives each student ten sections to the inch through the brain stem. Today one and tomorrow another of these sets of sections is taken for demonstration. The demonstration material and the study material is the same. The students know that the tracts and nuclei were once actually functioning in a quarreling gun-fighting human being, and so the projection of these sections has an appeal that is much farther removed in a diagram, chart or lantern slide.

For the final examination, instead of using a great number of students, we have found it tremendously advantageous to use the Edinger drawing board with horizontal plane. With half a dozen students about you, each student can see clearly and has an opportunity to demonstrate different regions. In an hour a half dozen students may be carried through a demonstration that tells you whether they have a fair knowledge of the subject or not.

Finally, in all these courses, I believe the student should not be given a passing mark unless he has made a passing grade in his final examination. If he makes a passing grade in his final examination, then it seems to me proper to take term work into account in determining final mark.

Dr. W. H. MacCracken, Detroit, Mich.: So far as the average student is concerned, a formal examination is a dead waste of time. Long before the course of which we have charge is completed, we know absolutely and positively the men who are entirely qualified to receive a passing mark in that course and be permitted to advance. We also know the men who are entirely unfit to be permitted to advance. It not infrequently happens that one unfit student may do pretty well in his final examination by accident or otherwise. The examinations are of value

only for the border line students. We do not know precisely whether a certain student ought to be promoted or held back. To students of that kind a final examination is distinctly valuable. I am inclined to agree with Dr. Myers, that if a student passes his final examination he should have credit for the past work. I believe that is true that the students for whom the final examination should count and have much weight should be the borderline students concerning whom we can scarcely decide.

Dr. H. Gideon Wells, Chicago: I do not wish to make myself unpopular with my friends Drs. Bardeen, Waite and Hardesty, but I think this committee made a mistake in selecting its sources of information. They should have sent the questionnaires to pathologists in order to get a heartfelt constructive criticism. The pathologist is a man who has to handle the product of the anatomist, who has to act as buffer between the anatomist and the clinician, and I think you will find that a large proportion of pathologists feel that an undue proportion of the time assigned to them in the curriculum, if not most of it, is spent in removing or remedying deficiencies in the instruction in anatomy. We spend so much time in trying to convince the student against his better judgment that the renal vein is not an essential part of the portal system, and things of that sort, that it leaves little time for teaching pathology, and the clinician has to teach pathology to our students in the time they should spend in teaching clinical medicine. Eventually, I suppose, the students get clinical medicine by their own observations with constructive criticisms from the coroner. But in any event there is a considerable drag in the medical curriculum—at least, the pathologist feels so. I speak for my own guild on the deficiencies in certain departments of instruction in anatomy. It seems there is a growing tendency or development in the instruction in anatomy that leads the professional anatomist to feel it is entirely beneath his dignity to give the student a conception of the exact differences between the kidney and liver and things of that sort.

There is one definite concrete matter I wish to speak of. Dr. Waite referred to the use of the loan collection. I object to that. Students as they come to us to take up pathology need to review their histology and need to have normal structures before them for the sake of comparison. I should very much object to students coming to me without a reasonable collection of normal tissue. The loan collection is merely an easy way of getting around difficulties. It is not fair to the student. I would recommend that the attention of the histologists be called to the desirability of conferring with the pathologists while considering possible modifications in their courses.

Dr. J. W. Jobling, New York City: Dr. Wells has spoken of the student's lack of knowledge of normal histology. There is another phase of the subject that is more or less ignored, and that is the appearance of the fresh organs. Students come to us with an excellent knowledge of the relation which one tissue bears to another, with the vascular and nerve supply, but with little knowledge of the gross appearance of fresh tissues. I would suggest that you show the students fresh tissues while they are doing their dissecting, so that they will know the appearance of a normal organ. This is important not only to the pathologist, but also to the surgeon. The surgeon should know the appearance of normal tissues, yet in his anatomy he sees only the "pickled" organs.

DR. JAMES EWING, New York City: I agree with Dr. Wells that the committee made an error in the sources they chose for information. Instead of going to the pathologists, however, I think they might have secured interesting and even valuable data by referring the questionnaire to the students and getting their reaction to it. As a teacher of a laboratory subject, I fear that we may at times overestimate the importance of very rigid class room methods. It is easy to become enamoured with particular methods of putting information into the heads of students, while forgetting what education really means. The details of some of the courses in anatomy seemed to me not entirely adapted to a professional school. In such a complex subject as neuro-anatomy, efficiency in teaching may demand regularly prescribed lessons, quizzes, drawings and frequent markings, occupying every hour of the course, but where in such a system does the initiative of the student come? After all, our students are human beings, and possibly equally good or even more permanent results might come from more liberal methods.

DR. W. F. R. PHILLIPS, Charleston, S. C.: I feel great hesitancy in saying anything on this subject, because I realize, after spending a great deal of time in teaching anatomy, that I know nothing about it. I know less how to teach anatomy than when I began as a young demonstrator. I can say the only worthwhile method I know is that indicated by Vesalius when he stated that he had "to get his own hands into the business." I know of no other way to teach anatomy than to put the subject before the student and say, "There it is, go to it," and to say, "You have got it out" or "You have not got it out." If he has got it out, well and good. He realizes he has accomplished something. If he knows he has not got it out, then he knows he must find it. That is the method I have tried to carry out in teaching anatomy of late years. Whether it is better, this method of late years than that of earlier years, which was to take the scalpel and forceps in my hand and show the student how to do things, I do not know. Students today are just as glad to have me help them out of their difficulties as were my earlier students, but I decline to help them out till I am satisfied they have exhausted their own ability to help themselves.

I have tried to do in my anatomic teaching what Dr. Ewing said. I have tried to go to the student and find out from him whether I was making the subject plain to him, and I have tried to profit by his experience because, I realize that he is a person to whom I am trying to impart knowledge; that I should consider him rather than myself.

In regard to the criticism that has been made in reference to teaching normal anatomy and normal histology from the standpoint of the pathologist. If we can be supplied with normal cadavers, we can teach normal human anatomy. Teaching normal anatomy from cadavers of persons who have died of disease is the hardest thing the teacher has to do—to explain to the student that a very great part of what he sees is not normal, but pathologic; to teach the student to deduce the normal from the abnormal.

The same is true with reference to microscopic anatomy. If we could but get normal human anatomic material, both gross and microscopic, we should turn out better anatomists. We could pass them on knowing a little more than they do. Every anatomist knows how often he has seen all the viscera of a subject an absolute mass of adhesions, abscesses,

etc., and it is from this kind of material that the student is to separate the normal from the abnormal. The anatomist knows that normal subjects for study are not plentiful, notwithstanding the impression that they are plentiful.

I agree, generally, with everything Dr. Bardeen has said about teaching anatomy. After all, I think the successful teaching of anatomy depends on two or three things—the individuality of the teacher, the enthusiasm he displays in teaching his subject, the impression he makes on the students, and his ability to get himself in touch with the students individually. No one method will answer for all students. One man working on a subject will handle it from one standpoint, and another working on the same subject will handle it from another standpoint. That is where I think our teaching in anatomy is weakest. We do not have enough teachers in our anatomical departments to get close to the students. We should be heavily manned if we are to do the most efficient teaching.

I think all of us have made the mistake that Dr. Bardeen referred to, that of not getting the student in touch with the clinical side of the subject. I should not be surprised if we were pursuing a wrong method in our medical teaching at the present time. We are taking fundamental subjects off by themselves, divorcing them two years from their practical applications. One of the great difficulties I have as a teacher of anatomy is to get my student generally interested in his subject. The moment I tell him that he is going to make practical use in his career as a physician of certain anatomical points he becomes wide awake, interested, and if I give him in a few words some conception of the uses he is going to make of these points—no details, but a general conception—I find subsequently he remembers these points. Whatever else he may forget, he can tell something about these points three months later.

I wonder if it would not be better for us if we were to adopt the method in vogue in France outlined in Dr. Bierring's report, and take our freshmen students to the hospital, let them see something of disease and injury and of the application of some of the fundamental sciences to their cure or relief, and then let them go back to their anatomical work, realizing that they are going to use the anatomy and other subjects they are learning subsequently.

Dr. Bardeen also mentioned a point that many teachers who criticize anatomists and anatomic teaching do not appreciate, namely, the fact that the student has to get his first training in medical nomenclature from the anatomist—that it is the province of the anatomist to teach the student an absolutely new language, in addition to teaching him a complex subject. I have found, personally, that one of my big tasks is to teach the student this medical nomenclature, so entirely new to him that he is in reality learning a new language. He has to remember approximately 5,000 words, pushing each other out at one end as they are pushed in at the other.

The whole problem of teaching anatomy, like the teaching of any other subject, hinges on getting the student in the habit of studying, and also of knowing how to study. It is a real joy to all of us to find a student, who comes to us after his two or four years college preparation, who knows how to go about his work—who really has the idea that in

order to get something out of his work he must put something into it—some personal initiative. There is still something wrong in our preliminary education, notwithstanding the efforts at standardization that have been and are being made. As a rule, in my experience, we do not get students with initiative. They do not know how to do things. They have been too much spoonfed, at least they impress me so, and we have to spend too much of our time and their time trying to teach them how to go at things.

As to drawing, I agree with Dr. Bardeen; I think it is a most valuable thing in learning anatomy. It is one of the things we should require in our prerequisites. If we could require drawing, in my opinion, it would be a great deal more advantageous than some other subjects we require or urge. However, it is a difficult proposition to get students to draw. I have made it obligatory in my course and subsequently I have abandoned making it obligatory; I have used persuasion; I think I have tried every way to induce students to draw, and some students will draw or sketch, while others will not do so.

In fine, we have to apply ourselves to the individual student and do the best we can.

Dr. Irving S. Cutter, Omaha: The teaching of anatomy is a serious proposition. The average clinical man will make an affidavit that no one completing the work of the anatomical department knows anatomy. I have asked practitioners of medicine where they learned the most of their anatomy and I was astonished at the answer: at the postmortem table!

I hope that the work of this committee will not end, but that it will continue the investigation and report fully on this subject because it will help out the situation very materially. If the course is too concentrated in the freshmen year and subjects should be advanced to the sophomore or junior year, let them tell us how to do it. There should be greater efficiency on the part of the student when he comes to clinical surgery. When it comes to discussing the pathology in certain surgical cases he should have as a basis a better knowledge of anatomy.

I doubt very much if the clinician who observes the student who has taken anatomy under the best anatomist would fail to find some fault with his knowledge of anatomy.

Dr. A. C. Eycleshymer, Chicago: In reference to the remarks made by Dr. Wells, I may say that the loan of the collection of histologic slides should extend over a period of two years, instead of one, thus enabling the student to use these preparations while taking his work in pathology. There is much force in Dr. Ewing's remarks. It seems to me that we are adopting a kindergarten plan in mapping out rigid methods of study, of recording observations and of conducting examinations. I think we will eventually say to the anatomist: you have 500 or 700 hours in which to cover the subject; use them as you wish; make your subdivisions, and conduct your work as you please, i. e., after you find out from the students the methods to which they respond most enthusiastically. We will not prescribe ten or fifteen hours for this, that or the other segment of the work, but simply say: you have your allotment of 500 or 700 hours; tell us what you want and we will have the students go ahead with the work as outlined by you.

DR. IRVING HARDESTY (closing): I would like to say a few words as to the use of the lantern. Moving pictures are too common now for the student to enjoy a lantern show. For the teaching of anatomy, I have found a period with the lantern nothing more than a show. With the use of the lantern in routine instruction, the student cannot take notes, merely hears the rapid talk of the instructor and the image on the retina is not prolonged enough for the desired permanence of the visual image of the student. It is like the old story of going into one ear and out of the other. Microscope projection of the actual sections of the material has the same defects, and, obviously, for teaching is less efficient than well made lantern slides of carefully selected illustrations. To describe a bit of research or to tell a short story of development, a series of lantern slides is the next best device to a series of drawings laid out in sequence illustrating the chapters of the story.

In teaching anatomy I want to mention a substitute for the lantern. You can at small expense select your illustrations showing desired anatomic details in greatest clearness. Have negatives, 5 x 7, medium rapid, contrast plates made of these. Get bromin paper, 48 inches wide if desired and make enlargements of them with labels on, or take the labels off. You can hang these pictures on the walls of the laboratory and across the lecture room. You can have a chart rack in the lecture room for a double row of these so that the student may stare at them until he gets them imprinted on his mind; and, in using these charts for lecture, you can refer from one to the other and back as is impossible with lantern slides and tell the story of a component structure while the thing is before the student all the time. Lantern slides, in my judgment, are a waste of time in teaching anatomy.

For the passing of a course, to depend wholly on a final written examination is not very good. The criticism is made that the final examination should have more value than 50 per cent. of the final grade in a course in anatomy and that the student should pass it. A thorough practical examination, an actual test that the student knows his structures when he sees them, is the most essential thing in anatomy. The requirement should be made in every course in anatomy that the student must make a passing grade in the practical examination regardless of all other grades. Then the question of the other grades will take care of itself beautifully.

REPORT ON THE TEACHING OF PHYSIOLOGY

E. P. LYON, CHAIRMAN; C. C. GUTHRIE AND D. R. HOOKER

When the archaeologists of medical education dig into the mold of the caves where medical faculties live and labor and fight, they will find a centuries-long accumulation which they will call the anatomic age; on top of this, a gradually changing stratum which they will call the physiologic age. In this later layer, mingled with the remains of discarded methods and the skeletons of momentary theories and the imperfect implements of new specialisms, your bones and mine, fellow medical teachers, will be imbedded.

This is the era of function. Physiology is the medical curriculum. Physiology is medicine. If you doubt, ask the anatomist who advocates "anatomic physiology," "living anatomy," —the emphasis on "mechanism in operation." Ask the pharmacologist who defines his science in terms of action of drugs. Ask the pathologist who has adopted the experimental method and is speculating on "how?" and "why?" Ask the internist who dickers with symptoms and studies their meaning and cause. Ask the surgeon who acknowledges he is a plumber but desires to understand "shock."

All of which facetious exaggerations are preliminary to the serious statement that in so far as this body is able to improve physiology and education in physiology, to that extent you will improve medical education.

TRAINING OF PHYSIOLOGISTS

What, then, should be the physiologist? Surely not any doctor, as in the old days, who was willing to teach but who failed to get one of the "better chairs." Surely not some young M.D. who has gone through the regular curriculum and is willing, for a while, to forego the emoluments of practice. Since we cannot influence the physiologist's heredity, we can help if we make clear the kind of education he should have. Since, moreover, physiology is the physics and chemistry of living matter, we easily see the foundations of physiologic education in physics, chemistry and biology. In all these he should have better preparation than the average medical student. Then he should master physiology. The average M.D. has not mastered physiology. To master the science one must live in it for several years, in a laboratory presided over by a productive and stimulating physiologist.

Your young physiologist trained in this environment almost always will have been, also, in a medical environment. Whether he studies pathology and clinical medicine in a formal way, he cannot help knowing the problems and aims of practical medicine. If he is able to know them at first hand, it is an advantage; but no amount of such knowledge can substitute for the years of study of physiology itself. Nor can the physiologist expect to be at once physiologist and practical physician. He has job enough of his own.

In this apprenticeship he will probably have learned to teach, have become familiar with the literature, have published commendable research and have been accepted into the society of fellow scientists. What difference will it make, then, whether he hangs a Ph.D. or an M.D. after his name? The discussion of this question is futile.

SCIENTIFIC IMAGINATION

But when you go among men trained as I have described to select your professor, other qualities not specifically included in the training mentioned should be in your mind. Perhaps, you will look for different qualities than in the anatomist—qualities Dean Bardeen has so well portrayed. At any rate, I should put first a quality which he has no more than implied, the quality of scientific imagination, which ought to be, I think, the basis of inspiring leadership.

The anatomist teaches our students to see with their eyes, to touch with their fingers and to exercise the stereognostic and muscular senses. He teaches them structure and accurate description. He puts their feet on solid ground; for correct observation is the basis of correct thinking. Facts are the things the mind conjures with.

But the physiologist must do more than use his sense organs and make true brain connections. More than the anatomist, he must be able to see with his imagination and touch with his spirit. 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 inpenetrable 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 physiologist! Objectified idealist! Scientific romanticist! Spiritualized materialist! A cross between a butcher and a poet!

And yet again, speaking seriously, just in proportion as the physiologist is able to see processes, visualize functions, feel the struggling forces of life, and just so far as he is able to arouse in others this favor of scientific imagination, to that extent he helps to make your medical school itself a living thing.

SELECTION OF DEPARTMENT HEAD AND STAFF

Select a man with this education and these qualities. Give him freedom and security of tenure. Do not "teach" him to death. Give him an adequate salary. Supply a well trained staff. Do not forget that his leading subordinates should be strong men and should have good salaries, not a third or half, but 75 or 90 per cent. that of the chief. Supply such salaries not only because they are deserved, but because from this group of assistants must come the future leaders. We must have a school of physiology and some future for its students, or they will leave the science; as they are now doing. Supply reasonable help, equipment and funds for current expense. Thus, you will have a department of physiology; and really if you have such a department, little can be said here that will help you.

The committee has, it is true, accumulated replies to a detailed questionnaire; but I shall give at this time only certain outstanding impressions left on the chairman by the study of the replies. (See supplementary report following.)

COURSE IN PHYSIOLOGY

Hours.—The time assigned to physiology varies from 200 clock hours (Hopkins) to 416 clock hours. Some men think their hours should be increased. Nobody suggests any reduction. Your chairman, therefore, was enabled to complete this study as one true to form and not endangering nervous collapse from sudden shock. The most he is able to conclude is that variation is desirable and that the usual time is about 280 hours. If you have that much time, Brother Physiologist, don't kick for more but try to use it better.

Place in the Course.—Physiology is usually taught in the last part of the freshman year and first part of the sophomore year; or wholly in the sophomore year. Desirable prerequisites are strong premedical courses in biology, physics and mathematics, all the chemistry possibly, gross and microscopic anatomy; also anatomic neurology, before or with the physiology of the nervous system. Pathology certainly should be taught from the functional viewpoint, and therefore after all or part of physiology. It seems, therefore, that the course in physiology is for the most part rightly placed.

Concentration System.—A few schools give all the required physiology in one semester. I have no personal experience with this arrangement. I have, however, seen courses in other subjects which were manifestly weakened by being too long drawn out—"diluted to tastelessness," I once characterized such courses. Certainly, they were too attenuated to maintain the interest of students or teachers. Perhaps, as I then said, there is such a thing as "concentration to the point of precipitation." I am doubtful, however, about the "time to soak in" theory. I believe that the Harvard system gives good results, and would be more inclined to decry spreading the course in physiology through two years. On the whole, I favor the one year course.

METHODS OF TEACHING

The Lecture Method.—Some men strongly favor lectures; others think them of little value. Probably, in each case, they are just what the proponents believe.

The revolt against the old lecture system was justified. In such subjects as anatomy, the descriptive lecture—"reading from Gray"—is an anachronism and absurdity. Still, I feel that used reasonably and by men who have talent for exposition, the lecture is a permanent and worthy method of instruction.

For one thing, the students usually find their lectures valuable. I have a large regard for student opinion and have attempted to analyze their predilection for the lecture method. It seems the more strange at first, inasmuch as one meets so often the statement that visual memories are the stronger. My conviction is that the answer is one of personality. For most students Howell and Starling are a long way off. Their written words may carry authority, but it is the captain in immediate command who "puts it across." Group psychology is another factor. It is lonesome business grinding on a textbook. The marking system and the desire to know what the teacher wants you to know are other and not so worthy factors.

Proper lectures do not make an exclusive appeal to the ear. Charts, the blackboard, perhaps lantern slides, the textbook, and always the student's notes are visual aids to final results.

I am in favor of lectures in physiology, because I think they can be of the greatest aid in stimulating the imagination and arousing interest. I recall the wonderful lectures of the master under whom I sat for three years, Jacques Loeb. I can see him walking up and down, thinking out loud. "Now, this is so and so"—here his voice might trail off and his eyes be fixed far away. Silence. "No," he would slowly begin, "It might be so and so. Garrey, we must try that out. Lyon, we must try that"; and his finger and eyes cut to your inmost soul. Exhilarating, suggestive, inspiring, physiology under Loeb was

no cut and dried study, no *corpus delicti*! Rather, it was resplendent with life, an amazing conjury of fact, theory and hypothesis—challenging, just as all medicine challenges, every power of the human mind. Let the lecture stay in physiology for him who can use it, but do not overdo it.

Laboratory Course.—Do not overdue the lecture for the real life of the physiology course is the laboratory work, learning by doing, just as we learn most valuable things in this world. On the choice of laboratory material, the equipment, and especially on the laboratory teaching, the professor of physiology should put all the intelligence, ingenuity and fervor that he can command. It is so easy to fail, to overdo or to underdo; now in the direction of a mechanical perfection that leaves no room for student initiative; now in an inadequacy of provision that renders it impossible to get decent results and discourages the student; again in minuteness of adhesion to manual and rule, in a failure to permit reasonable latitude. Sometimes the student is helped too much; but most of all the failure is to strike home the meaning of the work, whether it be of a kind applicable to practical medicine or rather contributory to intellectual background and the understanding of principles.

Quantitative Experiments.—The answers to our questions bring out an increasing belief on the part of physiologists that laboratory exercises should be so far as possible quantitative in character. Loeb used to say that no phenomenon has received a scientific explanation until it can be expressed mathematically. He pointed to the dioptric apparatus of the eye as a mechanism susceptible of complete mathematical expression, and to the therapy of lens fitting as the result in practical medicine. Whereas the physiology of sensation and of the nervous system is unsatisfactory because it cannot be attacked, as yet, in any adequate way, by quantitative methods. Clinical neurology is likewise unsatisfactory, and for the same reason.

Practical medicine becomes, year by year, more quantitative and, thereby, more scientific. Recall the bedside instruments in every day use, the newer developments in nutrition and metabolism, the quantitative blood analyses just now coming into practical use. Physiology and physiologic chemistry have laid and must continue to lay the foundation for this work. Moreover, these facts clearly demonstrate that quantitative chemistry, physical chemistry, strong laboratory courses in physics and good training in mathematics, have a rightful place in the premedical or preclinical requirements.

The physiologist should bear in mind that every kymograph tracing is capable of quantitative interpretation. He should never be content with pretty tracings, neatly mounted, and perhaps quantitatively described. The insistence should be on "How

much?" Complete interpretations or descriptions in terms of time, space, mass and energy should always be required. Sources of experimental error should be looked for. Percentages of error should be calculated. Especially the student should learn that if in one procedure his error is 10 per cent. it is folly to work to 0.1 per cent. in another part of the same experiment. Students should be taught to distrust measuring instruments. Exercises in the calibration of such apparatus as blood counters and sphygmomanometers would form a valuable part of physiology laboratory work.

PROBLEMS IN PHYSIOLOGY

Problems for mathematical solution could be set profitably in almost every field of physiology. It is a pertinent fact that a good many doctors do not know enough about mathematics to count up the day's expenses. They say the blood pressure is 120, with no more idea of the meaning in terms of known forces than they have of Martian folk lore. I once met a doctor who thought there were five million red corpuscles in the whole human body! Poor physiology teaching, gentlemen, poor physiology!

CHOICE OF LABORATORY ANIMALS

It is not what animal you use but how you use it. All are useful in their place. A reasonable balance is the mark of a successful laboratory course.

Nerve-muscle physiology taught for itself is of little value. Taught to bring out fundamental principles it is priceless. You cannot understand the complex functions of conduction, coordination, sensation—the mysteries of stimulation and response—without the basis which this study affords. The experiment with varying weights in itself has only an isolated interest. Made the opening for a discussion of tonus it has very great value. The experiment on repeated stimulation gives a pretty tracing. If that were all, it should have no place in the laboratory course. But if you make it the gateway to the great field of efficiency and fatigue, you will lack not for interest or useful results.

Mammalian experiments have the advantage of student interest and of more direct applicability to so-called "useful" human physiology. But beware of pitfalls. 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 learner's attention on the essential and useful. Beware lest he shoot into a flock of phenomena and hit no useful fact. The interest of the doing may detract from the purpose of doing. The glamour of surgery is a dangerous thing. Mammalian experiments demand closest supervision and most careful teaching.

Professor Dresbach dwells on the necessity of extreme care in the use of mammals from the humanitarian and legal stand-

point. I sincerely echo this warning. But after all this warning, use mammals, provided you do it well.

Lastly, there is the human animal, cheap and always at hand. Do not overlook him. Says Dr. Hooker: "It is desirable that as many laboratory procedures as possible should utilize the human being as subject." Says Professor Henderson: "The human being should be the center of interest, and the frog and mammal used as a means of filling out topics not possible in man."

It takes a good laboratory morale, supported by vital interest, to secure painstaking and accurate work on the student subject, himself a disturbing influence. Here is where the stimulating, resourceful teacher again comes to the fore. Neilson at St. Louis used to have every student take the stomach tube, and they did it willingly. If you have such command over your students, you are a real leader and a real teacher.

Demonstrations.—I am surprised to learn of the differences of opinion that exists relative to demonstrations. "As few as possible," says Simpson. Carlson gives about thirty a year, and requires notebook records and discussions. Fischer says, "Daily demonstrations," and has abandoned many of the mammalian experiments done by groups of students. But some physiology teachers do not employ them at all. On the whole, the sentiment is for few demonstrations.

My own experience and that of co-committee men, Guthrie and Hooker, goes the other way. To some extent at Minnesota we demonstrate even those experiments that the students are to do. We certainly get more intelligent work from the students themselves. I do not believe that what we take away in primary interest detracts from the final value. For the very difficult experiment the demonstration is the only method.

Several of our contributors suggest that students be assistants at demonstrations. This seems a very sensible plan.

The "Quiz" and Recitation.—Again differences of opinion. For myself I swear at the beginning of every year that I will get down to hard business, and quiz and mark. In the end, the class and I get to talking and the thing "degenerates" into a Socratic conference! I cannot cover ground. There are more hiatuses in my quizzing than in a cathedral window after a bombardment. Dresbach says the object of recitations is to find out what the student knows. If that is true, I never succeed. I honestly confess I do not know whether my quizzes pay or not. But nobody goes to sleep.

PRINCIPLES VS. USEFULNESS

I have dwelt at length on the importance of the laboratory course. Our questionnaire brings out many suggestions of practical importance. We have not time here for the discussion of

details. But I venture to discuss the replies to one question: "Should the laboratory course be formulated on the idea of physiologic principles? Or on that of 'useful information'? Or on that of 'technic'? Or which ideal should be most prominent?"

I am proud to say that a big majority of my physiologic brethren and of clinical correspondents are strong for "principles."

We in physiology face this problem at every turn. Shall we teach the little tricks of blood counting and demand repetition until the student can do it well? That would certainly be training in a useful technic. Or shall we rather teach the principles of the hemacytometer and its use? Shall we give students useful information as to the diseases in which the number of corpuscles varies from usual, or is it wiser to discuss the broad principles under which such variations may occur? Blood pressure would, perhaps, be a better example; or the heart sounds.

The physiologists hold that they are doing best for future medical men by giving them big, broad conceptions of function. They deplore too narrow an application of the practical. "What is useful, anyway?" writes Professor Maxwell, echoing the tragic question of Browning, "Who knows what's best for us?" Who knows, indeed? Twenty years ago the medical students in Chicago were bitterly complaining because Loeb spent so much time talking about ions and other foolish stuff. Today I presume some of those same men are talking learnedly about hydrogen ion concentration in this or that clinical case. Several of our correspondents call attention to the electric variation in the heart as a phenomenon not so long ago only an interesting laboratory exhibition and now the basis of electrocardiography.

I am saying all this for the benefit of clinical men who contend that physiology courses are too theoretical, and that students come to them without knowing clinical methods. Consistency is said to be the bugbear of little minds. Well, "usefulness" is barest bear; and the advocate of the purely "practical" is the buggiest kind of a bug. Stand by your "principles," Mr. Physiologist, and let the doctors howl.

But often you can combine principles and knowledge immediately "useful." Do it. Often you can point out how principles will apply in practice. Do it. Often without losing sight of your primary aim you can spare time for "useful" information or "useful" technic. Grasp such opportunities. Be sure that your picture is broad and clear and true. Then put in detail. I think that is good art. Anyway, it is good pedagogy.

Hold with Dewey, if you will, that "science is method." I do not recall the connection in which he used that aphorism; but I acknowledge that every advance in method is a step forward in science. But unless you have a grasp on the principles of science you do not know where to step, and methods are no

more than spectacles to the blind. Methods, after all, are only methods. They come and vanish. But the facts of science stand. *Principles are just the underlying facts.*

PURPOSE OF PHYSIOLOGY

And now I recur to the first question of our fifty-seven varieties and ask what is the purpose of physiology? Why is a physiologist?

I am tempted to quote Professor Henderson: "The motto of my course is 'Physiology is not a mass of facts, but a mode of thought';" and let it go at that. Still I must suppose that some good will come from a broader statement, and perhaps I can arouse some discussion from this body.

In our questionnaire we asked physiologists to express their opinions on the broad purposes of the course in physiology for medical students. Among the purposes which we ask them to consider and relatively evaluate were the following:

(*a*) To give familiarity with established facts and pending theories; i. e., information.
(*b*) To train observation and interpretation; i. e., discipline.
(*c*) To familiarize students with exact experimental methods; the idea of "control."
(*d*) To turn students to the original literature and create a critical spirit of reading.
(*e*) To arouse interest in functional activity.
(*f*) To teach physiologic methods applicable in the clinic.
(*g*) To interest a certain number of students in further study and research.
(*h*) To stimulate a certain number to become teachers of physiology.

We have a mass of well considered replies which are hardly susceptible of statistical presentation, but which are filled with valuable expressions that should find a place in the final report of the committee on pedagogy.

Moreover, I have letters from numerous clinical teachers on this topic. As I have said, they support the physiologists' contention that he should emphasize principles rather than practical methods. But, again, I cannot tabulate but must rather present impressions.

Facts, Information, Theories.—Of course, one must teach facts. The alternative is to teach lies. Moreover, the quantity of necessary facts is greater than can be demonstrated first hand within the time assigned to physiology. So you must do a lot of didactic teaching. And why not? My idea is to so use the laboratory work, that is, the things the student actually sees and does, so as to enable him in his imagination to see and do a lot of other things.

I never saw San Francisco, but I know how it looks for I have seen other cities. There you have in a nutshell the theory of the relation of observational and didactic teaching.

As to theory, we all know how the average student hates the word; and we all know the part that theory has taken in the progress of science. To neglect theory in the undergraduate course is to neglect indispensable exercise of the imagination and an important stimulus to critical judgment. To neglect theory means to keep students away from borderlands of knowledge. To keep the students' feet on solid ground of fact but to direct their eyes as far as possible into the realm of the unknown should be the constant, conscious purposes of the teacher of physiology. Everlastingly must he show where the boundary lies. Everlasting must he bring up the accumulated facts on which to stand. All the time must he point out that beyond lies ignorance, and also the way to progress.

To Train Observation and Interpretation.—This purpose physiology holds in common with all the other departments, but it has no greater duty in this respect than the others. It is extremely important; not to be lost sight of; but not specific.

To Teach Experimental Methods.—The idea of control. Here physiology has a very great responsibility. Every case is to the physician an experiment. Unless he is sure of conditions and has adequate control he can never draw conclusions. Dr. Hirschfelder told me a few days ago that he does not consider that physicians have evidence in one case in fifty that their medication has any effect. They think it does, but they do not *know* one way or the other. Well, my only comment is that I should feel pretty discouraged if I made forty-nine experiments without knowing whether I had any results. I do not mean final results, but some knowledge of what happened in particular cases. Further, I am confident that on physiology and pharmacology falls the responsibility to develop the scientific experimental spirit. This is one of the essential duties of these departments.

To Teach Physiologic Methods Applicable to the Clinic.—There is a strong sentiment, as I have indicated, against the strictly utilitarian course in physiology. The principles, limitations and errors of instruments and methods are legitimate parts of physiology. The little tricks of the trade and the repetitions that are necessary for accuracy are for the clinical departments to develop, in their actual work. On these views the clinicians agree with the physiologists remarkably well. "The department of physiology should teach . . .," says Professor Barker, "without too close an eye on how the material and training will be valued in clinical work."

While I am on this topic, let me give a few further gleanings from the letters of clinicians. Dr. Howland makes a strong plea for better training in nutrition as a basis for pediatrics. He thinks nutrition is neglected by both physiologists and biochemists; while Professor Lusk says: "There is usually a lamentable ignorance among the medical profession with regard to the problems of nutrition." Who is to blame?

Dr. Billings speaks of the necessity of so housing the fundamental departments in relation to the hospital that all teachers shall be in daily contact and have common problems and points of view. He hopes that in the new University of Chicago Medical School the professor of physiology "may have an opportunity to teach abnormal physiology in the wards of the hospital and in the outpatient department."

Dr. Joseph Miller thinks "medical students should be strongly urged to take special work in physiology in addition to the required course. Such a course . . . might profitably include those topics with which every clinician comes in contact." I take it that this is the clinical physiology course which Lee and others have advocated and which we are trying to develop at Minnesota. This is a very important proposal which should be developed in several laboratories and the results reported.

Dr. Hoover states that in spite of the excellent teaching in physiology that has always been had at Western Reserve, the students in their clinical years "have to learn their physiology anew." He says he thinks that is inevitable.

I think so too. I think it is the duty of the clinical departments to review, amplify and point out the applications of all the fundamental work. I think that the complaints of surgery against anatomy and of medicine against physiology and biochemistry, usually, are not justified. I think what is needed is not better medical men in physiology, but *better physiologists in medicine*. This you will recall has been very strongly urged by Graham Lusk. I advocate that every assistant, instructor and professor of medicine be chosen from men who have served a good long apprenticeship in physiology and biochemistry, or in pharmacology. The complaint concerning the long gap between physiology and its clinical application would be answered if there were better gap-closers in the clinics. Clinicians can help themselves and also physiology by taking this thought to heart. As one physiologist said, they would "give us a market for our wares." They would help, further, in the long run, to make some physiologists who would stay in physiology.

REFERENCE TO LITERATURE: CRITICAL SPIRIT OF READING

Returning to our questionnaire on the purpose of physiology, it may be said that physiologists believe that students should learn

that there is such a thing as original literature; that they should use the library and should know that textbooks are merely compilations; and that physiology is a changing and growing science. But there is difference of opinion about required reading. The remark of Morgulis is cogent: "Articles should be carefully selected by the instructor. Narrow technical papers may destroy the students' desire ever again to consult original literature."

THESIS

Many teachers require a thesis. Others think the thesis valuable but do not require it on account of the crowded condition of the curriculum. Your chairman concurs in the opinion of Hough: the thesis "is valuable in itself. I do not think it essential in every course. A man gets the same training from this work in pathology as in physiology. It can easily be overdone."

Attention is called to the last sentence in particular. At Minnesota the Department of Pathology requires a thesis added to the work of a strenuous, concentrated laboratory course. As a result, students neglect their other studies and even voluntarily take a failure in such subjects as pharmacology, through fear of failure in pathology.

I think thesis work should be required, say, in the second, and, perhaps, again in the fourth year; but the student should select the department with which and the instructor under whom he desires to write his thesis. It should not be a part of any course. It might contribute a mark or grade of its own to the student's final record. Give it a research basis if possible.

RESEARCH: THE MAKING OF PHYSIOLOGISTS

Prof. C. M. Jackson says anatomists are extinct, like the dodo. As he and a few others still survive, I presume his remark was exaggerated. But the race of laboratory teachers seems on the way to extinction. The few now in captivity are the only known specimens. One imagines a few years hence that museums will point with pride to a well preserved jaw bone of an anatomist, or the gallbladder of a physiologist still filled with bitterness, or a pharmacologist's egg. One imagines the medical school left the untrammelled control of the clinicians. One wonders what tears would be shed; what obituaries would be penned. Will they miss us when we are gone, as the soldier misses the cootie; or will it be as the modern street misses the horse, displaced by something better?

Moraturi Salutamus.—However, we are not dead yet. Are there any steps we can take to preserve these interesting—not

to say useful—species? Has the breeding instinct disappeared? Are the young still-born, or do they all die from lack of nourishment? Vitamins, perhaps?

Many of our correspondents are pessimistic. "At the present time," says Burton-Opitz, "physiology is in such a lamentable condition that it would be almost criminal on the part of any instructor to lead a student of medicine into physiologic research." Professor Bachman says, "Only those having unlimited faith and an inexhaustible capacity for the renewal of disappointed hopes may become candidates for teachers of physiology." Professor Reichert states, "It is questionable if any one should be encouraged to take up teaching as a profession under present conditions of emolument." Another suggests that only rich men go into the fundamental sciences.

These are extreme views, but the opinion is common that the financial outlook must be improved before one can expect gifted young men to select physiology as a career. Some believe that no effort should be made to turn toward the laboratory students who have chosen a life work in practical medicine. Several think laboratory teachers are to be looked on as occasional by-products of the medical curriculum, but not definitely sought as a purpose of physiology teaching. Of course, there is the usual complaint that the course is crowded and that even the able and interested student finds no time for research or advanced study. One or two state that laboratory men not only will but should come from college courses, and not from medical schools, except, perhaps, occasionally.

I take exception to many of these views. I believe that medical students generally have exaggerated ideas of the probable or average emoluments of practice. It is our duty as physiologists to recruit our profession. The opportunities for trained physiologists will not be confined exclusively to teaching; but openings will gradually be found in group clinics, industrial concerns, clinical departments and hospitals. The advantages of the academic life may properly be held out to a young man seeking a useful career. No men contribute to human welfare more than those engaged in fundamental medical research. No medical student will be injured by being urged into advanced study and research in physiology or other sciences, but rather that such a student will be a better man if later he turns back to medical practice. Finally, the teaching career as a life of service and sacrifice may properly be placed before young men of high ideals and altruistic aspirations.

The laboratory departments must be preserved. It is worth the attention of medical educators to see that this is accomplished. Conscious and well considered efforts are necessary to

this end. I wish to commend the special report [1] of the Division of Medical Science of the National Research Council.

I take it that we shall all work for better salaries, not only for department heads but also especially for assistant and associate professors. We shall work for better working conditions for laboratory men as another means of recruiting science teachers.

But there are other things which we can do. We can make the medical curriculum more elastic, not only for this but for other educational reasons. We can shorten the required courses and make room for electives. No use to say, "It can not be done." It has been done. We can thus give students space to move a little in the direction of their desires and interests. Some will find their way into the laboratory departments. We can consciously urge strong young men in these directions. Idealism has not entirely died out. Some men can still see the difference between the caduceus and the dollar sign.

We can advocate that our laboratory departments be manned sufficiently in number and quality of instructors so that these may afford proper training places for medical scientists. Research must be kept alive and made attractive to students.

We should urge the establishment of more and better fellowships. At Minnesota we have this year increased the stipends of the fellowships in the fundamental subjects to $900, $1,200 and $1,500, respectively, for three years of advanced study. We at once see that we can fill the places with better men. The stipends could well be put higher still. I should like to see them go to $1,200, $1,500, $1,800, at least.

We should make it easy for certain men to do advanced work and teaching in the laboratory branches, while at the same time progressing in the medical course. Half time assistantships, instead of being deplorable makeshifts, may be looked on as desirable alike for the student and for the progress of science. We might even give credit on the medical course for laboratory teaching. Some of the things we do give credit for are less valuable.

As I have indicated, we should not be disappointed if our research students go into practice. At Minnesota every Ph.D. in anatomy of the last seven years, six men in all, has gone into clinical work. However, clinical medicine and clinical teaching need such men. And the seventh man may remain in anatomy and help perpetuate the species.

There are other interesting topics contained in our questionnaire, concerning which the physiology teachers have interestingly expressed themselves. These deal in the main with details of teaching and may well be placed in the supplemental report.

1. J. A. M. A., 74: 1117-1122, 1920.

SUPPLEMENTARY REPORT ON THE TEACHING OF PHYSIOLOGY

In preparation for the main report read at Chicago in March, 1920, the chairman of the subcommittee on physiology sent an exhaustive questionnaire to all professors of physiology in the United States and Canada. The replies to certain broad, general questions were used as a basis for the main report. The entire mass of replies has now been analyzed; and the results in the form of excerpts, discussion and, in a few cases, statistics, are herewith presented. To this material is added a bibliography on physiology teaching, prepared by Professor C. C. Guthrie, a member of the sub-committee.

PART I. ANALYSIS OF REPLIES TO QUESTIONNAIRE

E. P. Lyon

AUTHORITIES

The questionnaire was answered by the following physiologists: George Bachman, Emory University; Clyde Brooks, Ohio State University; A. P. Brubaker, Jefferson Medical College; R. Burton-Opitz, Columbia University; A. J. Carlson, University of Chicago; W. S. Carter, University of Texas; M. Dresback, Albany Medical College; Martin Fischer and E. M. Baehr, University of Cincinnati; S. I. Franz, George Washington University; A. E. Guenther, University of Nebraska; C. C. Guthrie, University of Pittsburgh; Yandell Henderson, Yale University; Dr. R. Hooker, Johns Hopkins University; Holmes C. Jackson, New York University; F. P. Knowlton, Syracuse University; E. G. Martin, Stanford University; Graham Lusk, Cornell University Medical School, New York; S. S. Maxwell, University of California; F. R. Miller, Western University of Canada; S. Morgulis, Creighton University; E. T. Reichert, University of Pennsylvania; E. L. Scott and F. H. Pike, Columbia University; Sutherland Simpson, Cornell University, Ithaca, N. Y.; O. O. Stoland and Dr. Reid, Kansas University; Swale Vincent, University of Manitoba; C. J. Wiggers, Western Reserve University.

Letters discussing certain features of physiology teaching were received from the following: W. B. Cannon, Harvard University; Joseph Erlanger, Washington University; W. H. Howell, Johns Hopkins University; F. S. Lee, Columbia University; J. J. R. Macleod, University of Toronto; A. R. Moore, Rutgers College; W. T. Porter, Harvard University.

Letters from clinical teachers were received from: I. A. Abt, pediatrics, Chicago; L. F. Barker, medicine, Johns Hopkins University; Frank Billings, medicine, University of Chicago; Henry A. Christian, medicine, Harvard University; David M. Cowie, pediatrics, University of Michigan; George Dock, medicine, Washington University; David L. Edsall, medicine, Harvard University; L. Emmett Holt, pediatrics, New York; C. F. Hoover, medicine, Western Reserve University; C. P. Howard, medicine, University of Iowa; John Howland, pediatrics, Johns Hopkins University; W. T. Longcope, medicine, Columbia University; William Palmer Lucas, pediatrics, University of California; Joseph L. Miller, medicine, Rush Medical College; John Lovett Morse, pediatrics, Harvard University; Walter W. Palmer, medicine, Johns Hopkins University; C. Canby Robinson, medicine, Vanderbilt University; Richard M. Smith, pediatrics, Harvard University; Fritz B. Talbot, pediatrics, Harvard University.

To all these physiologists and physicians the cordial thanks of the subcommittee are extended.

THE QUESTIONNAIRE

A. PURPOSE

Question 1: *Express your opinions on the broad purposes of the course in physiology for medical students. Subdivide your reply so as to indicate your idea of the relative importance of the several purposes. Among the purposes to be considered are:*

(*a*) To give familiarity with established facts and pending theories; i. e., information.

(*b*) To train observation and interpretation; i. e., discipline.

(*c*) To familiarize students with exact experimental methods: the idea of "control."

(*d*) To turn students to the original literature and create a critical spirit of reading.

(*e*) To arouse interest in functional activity.

(*f*) To teach physiologic methods applicable in the clinic.

(*g*) To interest a certain number of students in further study and research.

(*h*) To stimulate a certain number to become teachers of physiology.

DISCUSSION

See the main report. After spending much time on the voluminous replies to Question 1, the chairman finds himself unable to formulate the majority value as to the relative value of the various purposes named. It appears, however, that physiologists consider a, b, and c as more important than the other purposes named in the question.

There is constant effort to arouse interest in the subject of functional activity; to call attention, for example, to the fact that, whereas the red blood cells can be seen under the microscope, the absorption, assimilation and destruction of amino-acid can not be seen—but must be visualized through the imagination (Lusk).

When I studied physiology in the University of Edinburg, it was known as the "Institute of Medicine," a very good designation, the bedrock in the practice of medicine (Simpson).

I have long regarded "b" as the more worthy endeavor. Under the term discipline, I would include the power of inductive and deductive reasoning; the power of weighing the value of scientific evidence so as to be able to differentiate between facts and inferences (Guenther).

Franz thinks:

(*b*) Should have a prominent place, but if the premedical work was properly conducted, this should be at the end of the series, since the student should have received, before entrance to the medical school, his chief training in observation and interpretation, and this should be continued in the professional school, rather than made a special part of its function.

Purposes (*e*) to (*f*), inclusive, are essential to any adequate course in physiology (Hough). Clinical physiology should be included or taught as a separate course (Burton-Opitz). The most important aims of the course are direct and personal observation of physiologic facts . . . ; experimental modifications of conditions . . . ; observations of normal variations, and determining the principles underlying such variations . . . If the teaching is vital, if the entire atmosphere of the laboratory is one of continued and direct contact with the critical study of vital phenomena, the average student soon develops the research attitude of mind (Carlson). Our chief purpose is to develop a "functional point of view to displace the structural one more or less established as the basis for the science of medicine (Fischer and Baehr).

One object of departments of physiology in universities should be to interest college students in the teaching of physiology outside the medical schools. . . . With a different attitude on the part of the public, it will be much easier for the physician to practice scientific medicine (Stoland).

Any course of instruction which merely puts him [the student] in possession of the present knowledge of the facts without preparing him rightly to appreciate future development fails in its most important function (Maxwell).

The attention given to theoretical considerations must be adjusted to the mentality of the student. . . . At ——— students . . . eagerly absorbed any discussion . . . on broader questions of biology and philosophy. At ——— I found the students practically impervious to general ideas. . . . It distresses them to regard a fact from any other point of view except as something to be committed to memory (Morgulis).

A clear and critical idea of *"proof"* either in experimental work or in the reports of the experimental work of others is of great importance and often absent (Weymouth).

The chairman desires to reinforce the last statement. It could be illustrated in many ways. Take a usual fatigue experiment: stimulate the nerve until the muscle fails to respond. Now stimulate the muscle directly and it contracts. Ask the student what the experiment *proves;* and he almost invariable says, "Fatigue is primarily located in the nerve endings." He gets this fact from his lectures or reading, and does not see that the particular experiment mentioned does not prove it.

Post hoc, propter hoc reasoning is another thing to be combated. In considering the complex interplay of functions in the human organism, it is doubtful whether any of us are entirely free from this error. Practical medicine is full of it.

Regarding the last purpose named in the questionnaire, the following is quoted:

As the curriculum is arranged in American medical schools it is not easy to get medical students permanently interested in research or trained to become teachers in physiology, for the reason that they pass on to other subjects and when, at the end of four years, they obtain the M.D. degree there is no inducement for them to return to physiology and interest in other subjects studied more recently is likely to have replaced that in physiology, which was taken in the first year. This problem would be solved, to a large extent, by the establishment of a higher degree in medicine corresponding to the Ph.D. in Science, Literature or Philosophy. In the Scottish universities (and all other British medical colleges, too, I believe), at the end of a five years' curriculum, the student, if he is successful, is granted the degree of M.B.Ch.B. (Bachelor of Medicine and of Surgery), which qualifies him to practice medicine and surgery. Comparatively few proceed farther. If he works two years more in a laboratory, writes a thesis embodying the results of his research and passes a stiff clinical or surgical examination, he gets the M.D. degree. There is no difficulty in filling all the available space in the laboratories with men who are ambitious to get the higher degree, the pick of the medical students, and from them the future teachers and investigators come. The best get positions as assistants in the departments; and there is always a goodly number of scholarships and fellowships in the other medical schools, available for those who are unable financially to maintain themselves for these two years. The M.D. there counts for much more than it does here. If such a change were made in this country we would find no difficulty in filling our laboratories with picked and highly qualified research students with a medical training and point of view (Simpson).

OPINIONS OF CLINICIANS ON THE PURPOSE OF PHYSIOLOGY

The pediatrists ask especially for teaching of physiologic chemistry and physiology that will apply to the infant. The following excerpts from their letters are offered:

There is a great weakness among clinical teachers, who know too little physiologic chemistry and physiology (Talbott).

I believe very strongly that in the near future our best medical schools will be compelled to develope a specal type of teachers who may be appointed to represent both the physiologic and clinical branches, or appointees purely for the clinical side whose training has been mainly in the fundamental branches (Lucas).

The three things which, as pediatrists, we would like to see particularly investigated are: 1. Physiology of the new-born. 2. Problems of metabolism or nutrition. 3. Difference in physiology between infants and adults (R. M. Smith).

It seems to me that general physiology is most important and that too much attention is usually paid to the nervous system and senses (Morse).

Progress in the clinic depends on the further use of functional study along the lines of metabolism, circulation and respiration (Abt).

The whole general subject of nutrition is uncovered or improperly covered. On it pediatrics largely rests (Howland).

Too much stress cannot be placed on the importance of physical chemistry. . . . If there could be a close relationship between the clinical branches and the physiologic department, more men would be encouraged to enter the field of physiology (Cowie).

WHAT THE INTERNISTS SAY

See the main report. Also note the following opinions and suggestions:

I have always regretted that my own early training had not been more physiologic and less anatomic. . . . The great difficulty in the past has been that physiology as taught has been regarded as the "romance of medicine" and not practical (Howard).

I feel . . . that it is necessary for university medical schools to have in their clinical departments men with special interest and training in physiology so that the more practical side of physiology can be emphasized throughout the course (Robinson).

Subjects which should receive special attention are acid-base equilibrium, its regulation; digestion; acidosis, method of study; respiratory functions of blood; respiration; digestion; metabolism; nutrition; circulation. . . . There should be affiliations between physiology and . . . medicine through the medium of better trained young men in clinical medicine as instructors in . . . physiology (Palmer).

I do not think its is desirable to narrow . . . physiology to those things which are of practical value, but there is a tendency to excuse the inclusion of subjects which are not of practical value on the ground of great value in training students in observation, etc. It seems to me that all the discipline can be obtained . . . [from] those phases of physiology more directly applicable to medicine or which seem to be the underlying principles of advancement of medicine. . . . I believe that in the medical curriculum there should be a certain amount of free time for the students to employ in special lines of work, and if these students like physiology, they should be encouraged to carry on some simple piece of investigation. . . . There is distinct value in taking the student while he is in the course in physiology . . . occasionally into the clinic so that he may be shown on patients some of the applications of physiology (Christian).

I should be strongly in favor of the physiologist being a member of the staff of a teaching hospital and expected to be frequently called on in consultation with the clinicians (Miller).

A clinician should be trained in exact experimental methods and with at least a little experience in research lines and point of vew. . . . Some method of providing better correlation of the medical sciences with each other and with the clinical work is probably the most important thing to be developed in medical teaching at present. . . . We are now working out a plan here . . . to have young clinicians, . . . highly trained in the relations of medicine to physiology, . . . teach the second year men . . . the relatons between the laboratory branch they are just leaving and the clinical branches that they are entering. . . . This, heretofore, the clinicians have not done well in most instances and often not at all (Edsall). He favors electives and that promising men be encouraged to do research.

The teaching of physiologic methods applicable in the clinic has, I am sure, in some departments of physiology been over-emphasized (Longcope).

I . . . believe that teachers of physiology should teach physiology. I do not see how any large proportion of physiologists could have a knowledge of clinical matters that would be of great value (Dock).

Dr. Dock urges strongly that all work done by the Committee on Pedagogy be suggestive only. It would be unfortunate if it be considered authoritive. This was too much the result of the standard curriculum adopted ten years ago, in Dr. Dock's opinion.

B. TIME

Question 2: *What total number of scheduled hours in the four year medical curriculum are now devoted to physiology in your school, and what number do you think should be assigned to this subject? Total hours in the entire curriculum in your school?*

Question 3: *How would you divide the scheduled hours between different types of teachings, as lectures, laboratory, quiz, conference, demonstration, etc.?*

School	Total Hours for Physiology	Total Hours for Entire Course	Division of Physiology Hours			
			Lectures	Laboratory	Recitation or Quiz	Demonstrations
Albany	360	.....	50	250	45	15
Atlanta	288	4,845	160(9)*	182 (6)		
California	288	.....	48	192	32	16
Chicago (Rush)	300 (1)	.....	66 (6)	200 (6)	34	
Cincinnati	288	2,956	96 (9)	182		
Columbia	360	.....	90 (9)	180	60	3 0
Cornell (Ithaca)	352 (3)	4,000	144 (9)	208		
Cornell (New York)	385	.....	100	198	87 (5)	
Creighton	288	4,430	72	144	72 (6)	
Johns Hopkins	200	.....	80	120		
Jefferson (11)	242	4,000				
Kansas (12)	272	4,513	80	192		
Manitoba	225	.....	75 (3)	150		
Minnesota (10)	253	4,433	80	127	46 (6)	
Nebraska	280	4,531	80(6, 9)	200		
New York (Bellevue)	320	4,736	96	134	80	10
Ohio	416	.....	64	192	96(16)	64
Pennsylvania (15)	416					
Pittsburgh (17)						
Stanford	297(10)	4,182	99 (9)	198 (6)		
Syracuse	282	4,200	146 (9)	114	..	22
Texas	395	5,040	60	270	45	
Virginia	280	.....	150 (7)	130		
Western Reserve	304	5,224 (4)	166 (7)	188		
Western Univ. of Canada	360 (2)					
George Washington (13)	252	4,607	44	166	42	
Yale (14)						

* Numbers in parenthesis refer to the following notes.

NOTES ON HOURS AND THEIR DISTRIBUTION

1. About 40 per cent. of students do 100 to 200 hours' additional work in physiology.
2. For new six year course number of hours not settled.
3. Ithaca students also obliged to take six weeks' metabolism course in New York.
4. Based on 48 weeks in senior year.
5. Includes 15 hours' written work.
6. Including demonstrations.
7. "Didactic."
8. Dr. Vincent says formal lectures should be a "minimum."
9. Including quizzes and conference.
10. A fair percentage of students take advanced work in physiology to a total of 350 hours or above.
11. Dr. Brubaker advises 130 hours' lectures, 140 hours laboratory, 30 hours' recitation.
12. Drs. Stoland and Reid advise 112 hours' lecture and 240 hours' laboratory.
13. Dr. Franz advises 300 hours for physiology.

14. Dr. Henderson advises five full mornings for half a year; 4 or 5 lectures and quizzes and 1 or 2 demonstrations a week; the rest, laboratory.

15. Dr. Reichert advises from 417 to 496 hours for physiology; from 175 to 200 hours' lectures; 200 hours' laboratory; 64 hours' demonstrations; 32 hours' conference and quizzes.

16. Includes 32 hours' seminary.

17. Dr. Guthrie advises 260 hours or more; not less than 3 hours a week lectures, conferences, etc., and 9 hours a week laboratory.

Question 4: *How would you divide the scheduled hours between the various branches of the science, as general physiology, blood, circulation, respiration, nervous system, special senses, etc.? Or give a more general answer as to the relative importance of these branches of physiology in the required course.*

DISCUSSION

It is a general opinion that any attempt to make an arbitrary division of time binding in all schools would be a mistake. The following are some of the arrangements in use:

Chicago: Blood, circulation and respiration, 100 hours; gastro-intestinal mobility, secretion, absorption, metabolism, internal secretion, muscle and animal heat, 100 hours; nervous system and senses, 100 hours.

Hopkins: Lectures, muscle-nerve, 8 hours; spinal cord, 4 hours; respiration, 8 hours; blood, lymph, circulation, 20 hours; special senses and central nervous system, 20 hours; secretion, digestion and nutrition, 20 hours.

Columbia: Lectures, 10 in general physiology and muscle-nerve; 30 on blood and circulation; 10 on respiration; 20 on metabolism; 10 on audition and sight; 10 on reproduction, internal secretion, animal heat.

New York (Bellevue): Lectures, general physiology, 9; muscle-nerve, 9; circulation, 13; respiration, 12; nervous system, 9 hours; senses, 10; secretion and excretion, 11; endocrine organs, 7; metabolism, 10; reproduction, 6.

Virginia: Lectures and conferences, general physiology of muscle and nerve, 21; general features of nervous system, 5; circulation, 18; blood and lymph, 6; respiration, 6; senses, 8; nervous system, 6; secretion and digestion, 12; excretion, 3; internal secretion, 4; heat regulation, 2; metabolism and nutrition, from 8 to 12.

It will be noted that there is a large amount of variation. Fischer says: "Build around the men available for teaching, allowing the greatest time for those subjects which specific members of the staff are best qualified to teach." Apparently from the examples given, this principle or the similar one of individual interest in various topics finds wide acceptance among teachers of physiology. Desbach thinks one should guard against the tendency to "over-emphasize the part of the field in which he works." Over emphasize, perhaps, yes. But that one should *emphasize* that part, the chairman thinks good pedagogy, of value for teachers and students alike.

Physiologists are divided as to the place which general physiology should occupy in the course. This depends on their views of "usefulness," which has been discussed in the main report.

C. PLACE IN THE MEDICAL COURSE

Question 5: *In what year or years should physiology be taught?*

First year: Burton-Opitz.

Second half of first year: Maxwell.

Second half first and first half second year: Lusk, Martin, Fischer, Hooker, Carter, Wiggers.

First and second years: Dresbach, Franz, Simpson, Reichert (second half of first and second).

Second year: Brooks, Brubaker, Bachman, Jackson, Morgulis, Hough, Scott and Pike, Guenther, Stoland and Reid.

First half of second year: Henderson, Lyon (first two quarters).

Another way of looking at this question is from the standpoint of prerequisites. See the main report and Question 6, below.

Several correspondents think a course in clinical physiology must be developed for the third or fourth year.

Question 6: *What courses, premedical and medical, do you consider indispensable prerequisites? Desirable prerequisites?*

Chairman's summary: Indispensable, English, biology, mathematics, physics, chemistry, including organic, physical and physiologic, gross anatomy, and histology, anatomical neurology before or with the physiology of the nervous system.

Desirable: Foreign language, quantitative analysis, psychology, drawing, more mathematics, comparative anatomy and comparative physiology.

D. METHODS

Question 7: *If you have laboratory directions peculiar to your laboratory, kindly send a copy of same and if possible place therein, in relation to each experiment, your reasons for choosing it as part of your course.*

See the main report. It is impossible to summarize further the material received.

Question 8: *To what extent should laboratory work be quantitative in character?*

See the main report, particularly on quantitative experiments.

Question 9: *Give your ideas as to the relative value of frog and mammalian experiments.*

Favor mammals strongly (not exclusively): Vincent, Knowlton, Lusk, Jackson, Carlson.

Favor both mammals and cold blooded animals: Dresbach, Brubaker, Simpson, Bachman, Burton-Opitz, Wiggers, Morgulis, Guenther, Stoland and Reid, Scott and Pike, Carter, Martin, Hough, Miller, Fischer and Baehr, Lyon, Guthrie.

Favor cold blooded animals strongly: No physiologist advocates an exclusively "frog course."

Favor the human subject (not exclusively): Henderson, Hooker.

Question 10: *If mammalian experiments are emphasized, to what extent should surgical methods be taught to physiology students? Survival experiments?*

Most physiologists are opposed to the teaching of surgical methods as part of the required work in physiology. Some instruction in anesthesia and the handling of blood vessels is advisable. Most physiologists are opposed to survival experiments done by students.

Simpson requires five "antiseptic operations," as follows: (1) division of sciatic in cat or rabbit to produce Wallerian degeneration; (2) division of sympathetic in the neck (rabbit ear experiment); (3) division of sciatic in cat to show effect on sweat glands; (4) thyroidectomy in dog, cat and rabbit; (5) ovariotomy in young rabbits to show effect on growth of uterus. In all of these the animals are allowed to recover and the wounds heal by first intention as a rule.

Guthrie thinks neither surgical methods nor surgical administration of anesthesia should be taught by physiology.

Carlson says: "Survival methods and survival experiments are taken by the students only after they have had their first year work in physi-

ology, and as elective work. The surgical methods are taught as a means to an end and not as an end in itself."

Scott and Pike say: "Technic as nearly approaching as possible that of the surgeon should be required at all times. . . . However, in the majority of cases, survival experiments should be confined to demonstrations."

Henderson says: "Avoidance of sepsis should be omitted. We do no survival experiments."

Some think if no animal surgery is taught in the Department of Surgery, it might be taught in physiology.

The chairman thinks it should not. The chances of having a really trained surgeon in the department are small. If there is one, let him give such a course under the surgery department, and with its aims and ideals in view.

Question 11: *What type of notes or records should be required; e. g., detailed vs. outlined; descriptive of apparatus and operations or confined to results? What use should be required of tables, charts, diagrams of apparatus, etc., in notebooks? If you can do so, send an actual student's report on one experiment, of the sort you believe in and require.*

Again, every shade of opinion from "detailed and complete descriptions" to "brief outline of salient facts."

Here are a few sentiments that struck the chairman:

We spend as much time as possible discussing results, rather than writing a lot of stuff beforehand and then laboriously correcting long sets of notes (Dresbach).

The method and form should be left largely to the student (Henderson).

The object of notes is to serve as a memorandum of observations. . . . I like to see laboratory books bearing all the marks of having been produced in the laboratory. . . . Nothing gives me so much insight into the personality of a student as his notebook. Hence no fixed rules. Ideal is the research notebook (Morgulis).

In the opinion of the chairman, much might be said in favor of this view. What kind of data is the future physician going to record? Take case histories and ward charts, for example. Conciseness, accuracy, ability to express facts graphically and by charts—these are more important than detailed description. Neatness may be insisted on, but laboratory "notes" should not be used for practice in English composition. Committeeman Guthrie, on the contrary, says laboratory results should be "utilized for the definite purpose of supplying the basis for concrete written exposition."

Primary emphasis on the actual laboratory experiments and not on the notebook record (Carlson).

Question 12: *To what extent and when should laboratory notebooks be read, criticized and graded? This really rests on your conception of educational methods. To what extent must medical students be subject to Junior College methods?*

Irregular intervals and without notice in advance. . . . Grading notebooks hardly to be considered; examined and criticized to aid the student, not to measure him (Maxwell).

Weekly laboratory reviews (with small groups) is more satisfactory than calling in notebooks at long intervals for final examination (Martin).

Fully and at once (Reichert).

We make only a superficial examination of laboratory results at the end of the course. At the completion of each experiment the student is required to report for consultation with a demonstrator, at which time his results are gone over and criticized (Hooker).

Notebooks are inspected early in course in order to give benefit of criticism to those who need it (Brubaker).

Books called early and general suggestions and corrections taken up in a conference (Knowlton).

The student is given an oral examination on the contents of his [completed] notebook (Lusk).

Lusk states that three or four oral quizzes a week are given; that attendance is optional and no marks given. A weekly written exercise is held; papers criticized, marked and returned. "Junior College methods," he says, "are good, but the attitude of the instructor should be different, the aim being to assist and elucidate, not to grade."

In the matter of notebooks, the chairman would advocate some method by which they should be examined at once or very frequently, and in the presence of the student, rather than the laborious correction, grading and returning at the end of the course, from which the student will hardly gain anything. Often he never looks at the book again except to see the grade.

Question 13: *What value should be given to expertness in handling apparatus, etc.? Should tracings be graded?*

I do not grade tracings except to O.K. satisfactory ones and reject unsatisfactory ones. I advertise to the class the good tracings and this seems to produce the desired result (Brooks).

Expertness is a quality to be aimed at and duly recognized, in the opinion of numerous physiologists. But others emphasize intelligence rather than expertness.

We subordinate the development of technic to the getting of results (Carlson).

I believe the skilful use of the hands is a large part of the intelligence (Henderson).

Expertness is highly essential to the physician. Since it is its own reward no serious account need be taken of it in making grades (Martin).

Question 14: *Should the laboratory course be formulated upon the idea of "physiologic principles," or upon that of "useful information," or upon that of "technic"? Or which ideal should be most prominent?*

See the main report. "Principles" as an end, "technic" as a means, "useful information" as a by-product, seems to the chairman, on rereading the answers, to be the concensus of opinion. Do not forget that byproducts are often valuable.

Question 15: *Should a laboratory examination be required? If so, of what character?*

No concensus of opinion.

Should be held to make the student realize that laboratory method is to be taken seriously (Maxwell).

Not in favor . . . as nervous students never do themselves justice when limited as to time (Miller).

Others (Knowlton, Dresbach, Simpson) give out new experiments, using old technic and without directions.

We have an extensive laboratory examination which usually includes some experiments which the student has never done before. Topics known and unknown include diagnosis of experimentally induced nerve lesions in frogs, listening to the

instructor's heart and stating when the first and when the second heart sound is heard; measuring the instructor's arterial pressure with a gauge which is set so as to read 50 or 80 mm. too high; calculating the pressure in a rather complicated system of manometers (some water, some mercury, some oil, of which the specific gravity is given, and arranged so as to have various positive and negative pressures. Sometimes this is done by means of a drawing); putting a cannula into a thin rubber tube in which there is maintained a high pressure, and connecting this cannula with a manometer, "without hemorrhage" (Henderson).

A laboratory examination should not be required. Better information of actual technic and laboratory fidelity may be obtained from the notebooks. Of much greater value are the occasional written discussions of problems recently investigated. The student may refer to his own laboratory notes and data on the subject to illustrate his ideas and arguments (Fischer and Baehr).

Yes, the student should be set to carry out experiments occasionally without directions, i. e., experiments which he has already done (Simpson).

The limited time during the examination periods makes it impossible to hold laboratory examinations here. Close supervision of the laboratory work during the course enables the teacher to judge of the character of work done by the student (Carter).

To be left to the discretion of each instructor. An examination in my mind, is primarily for the benefit of the instructor in determining the status of the class. The use of an examination in promoting greater diligence in application, etc., is entirely secondary (Guenther).

Question 16: *How many students may be properly supervised in laboratory by one instructor?*

Most men say "fifteen to twenty." Varies with (*a*) ability and experience of instructor; (*b*) organization; (*c*) character of work (mammalian work, one instructor to six to ten students; say, to two tables); (*d*) quality of students.

Twenty to twenty-five students can be supervised by one *overworked* instructor (Henderson).

In general, the chairman holds that department heads cannot do better for their students and for their science than by insisting on adequate assistants for the laboratory work.

Question 17: *What are the functions of a laboratory instructor?*

First prize answer:

(*a*) To stimulate interest in the subject; (*b*) to inculcate knowledge, and (*c*) to maintain as high a technical efficiency as would be required of a physician in handling the sick (Hooker).

Second prize answer:

(1) To stimulate students to consider the meaning of their experiments; (2) to teach students to do accurate work; (3) to bring out obscure points; (4) to suggest new lines of experiments in addition to routine requirements (Stoland and Reid).

The function of the laboratory instructor is to *teach,* not to help students do experiments. Most useful elements in such teaching are criticism, suggestion, stimulation to collateral reading and, to a limited extent, demonstration. Every time the instructor fixes a wire or adjusts a student's lever, he does harm. Every time he says, "Better go over that wiring," or "Is that lever all right?" he does good.

The instructor should not be merely a "diener" or mechanician in the course (Maxwell).

Question 18: *Should laboratory work precede or follow didactic instruction of particular topics?*

Two to one the positive answers are that the laboratory work should follow the didactic instruction; but a few place it after the laboratory;

some say "precede" in some cases, "follow" in others. Franz says, "The matter is one that demands special and thorough pedagogical investigation. Opinion is not sufficient."

The editor of this report has for a long time desired that the problems of medical education should receive attention from educational psychologists. They would probably have lots of fun in making such an investigation. We medical educators might be tolerably shocked and chagrined. Possibly we might even be shaken from our position of smug confidence, if demonstrated facts were substituted for the opinions, impressions and frank prejudice upon the basis of which our problems are now chiefly discussed.

Question 19: *Call attention to original features of your laboratory course that you consider of value.*

The feature of our work here that might interest others is the use of transparent kymograph paper and printing copies of tracing for all who need such copies (Brooks).

A distinctive, but perhaps not unique, feature of the laboratory course in physiology here is the frequent submission to the students of very simple problems for solution . . . For instance, the student has just made a determination of the value of the latent period in the myogram of a frog's gastrocnemius with all the accuracy possible. Usually, it is found that students will accept unquestionably the rate of the tuning fork given in the experiment, as stated in the mimeographed directions, at 100 vd per second. This permits, then, the giving of a problem . . . "Determine the average time value of your tuning fork tracing from crest to crest to the third decimal place" (Guenther).

Probably the instruction in respiration is comparatively the best feature of the course given here. I enclose a reprint of a paper discribing some of the experiments used and which was printed in *The Journal of the American Medical Association* a few years ago (1914) (Henderson).

The directions for our laboratory experiments are very brief and require for the most part a demonstration by an instructor before the student is competent to proceed. This per-its of a certain amount of individuality in methods of attack and tends to keep the student from proceeding without thinking of his work. The first experiments done in the course cover muscle experiments, which gives the student some technical facility in handling apparatus so that he may subsequently attack the more difficult problems with greater success. It is important, in my opinion, that the list of experiments should be varied from year to year in order that the members of succeeding classes may not have the impression that suitable experimental work is limited, or inherit results from preceding classes (Hooker).

The main feature of the course in the University of Cincinnati College of Medicine is the pronounced departure from the customary routine investigation of animals alone and ever increasing interest in investigation of function of human beings. This has reached the point where variations from the normal, as observed in sickness and injury, are now regarded as laboratory experiments and are so studied in the hospital wards, and recorded by the students. This must lead, in a very short while, to the development of a laboratory course of abnormal physiology, of at least four weeks' duration (Fischer and Baehr).

We aim to put the teaching on a research basis and subject every fact and principle enunciated to laboratory tests, demonstrations and criticisms. Abundant material is provided for the student so that for a time the student lives or should live in the atmosphere of research physiology (Carlson).

Question 20: *How do you bring out the significance of laboratory work; i. e., make it more than a manual exercise? Notebooks? Quiz? Conference? Reports?*

Small group conferences are considered most satisfactory. At Hopkins the first hour of each laboratory period is given to consideration of the previous day's work.

Notebooks are stressed by some, for this purpose. Good teaching at the laboratory table is very important.

Question 21: *To what extent should demonstrations be given?*

See the main report.

Following is Carlson's list of demonstrations:

Physiology 12.—(1) Artificial respiration; (2) intrathoracic pressure in man; (3) Hale's method of blood pressure; (4) nervous control of the bronchial musculature.

Physiology 13.—(1) Peristalsis of the esophagus in man; (2) direct observation in cat of gastro-intestinal movements; (3) hunger contractions in man; (4) gastro-intestinal movements, roentgen ray; (5) psychic secretion of gastric juice in man; (6) action of gastrin; (7) secretion of gastric juice from the Pawlow pouch; (8) analysis of the test meal in man.

Physiology 14.—(1) Monopolar stimulation of human nerve; (2) reaction of degeneration; (3) action current; (4) current of injury; (5) cooling block of nerve; (6) heat paralysis of nerve; (7) nerve degeneration; (8) spinal shock; (9) spinal dog; (10) reflexes after spinal transection; (11) hemisected spinal cord; (12) section of posterior spinal roots; (13) decerebrate bird and rabbit; (14) removal of motor cortex (dog); (15) experimental Jacksonian epilepsy; (16) chemical stimulation motor pathways, absinthe; (17) cerebellar lesions; (18) visual cortex; (19) innervation of pupil; (20) lesions of labyrinth.

Very difficult to answer categorically. So much depends on the size of the instructing force, on the character of the class, etc. In general, I believe in having the student do things for himself rather than seeing them done for him. Certain complicated experiments are demonstrated, and also many simple ones, purely for the sake of saving time (Hough).

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Physiology 13: (1) Peristalsis of the esophagus in man; (2) direct observation in cat of gastro-intestinal movements; (3) hunger contractions in man; (4) gastro-intestinal movements, roentgen-ray; (5) psychic secretion of gastric juice in man; (6) action of gastrin; (7) secretion of gastric juice from the Pawlow pouch; (8) analysis of the test meal in man.

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Question 22: *How should they be given? Number of students, etc.? Student participation? Reports?*

A demonstration should not be given before a larger number of students than can actually see the apparatus, procedures and results. This will vary with the type of experiment and the physical facilities available. In general, the number will be small.

Many teachers use students as assistants. Many require the writing up of demonstrations exactly the same as experiments individually performed; in fact, consider the demonstrations as part of the laboratory course.

Question 23: *To what extent should experiments be demonstrated preliminary to the students' doing the same experiments?*

Most teachers are against this, except, perhaps, at an early stage in the laboratory work. The chairman believes in it to a considerable degree. To Maxwell's comment: "To what extent should the instructor chew the student's dinner preliminary to the student chewing the same dinner?" he rejoins: Cooked food is more digestible. The instructor is the cook. Some food, also, is better taken raw! Mix the diet!

Question 24: *How and to what extent should the lecture method be used?*

See the main report.

Question 25: *Comment on the relative value of lectures as compared with recitations based on a textbook.*

Several physiologists have tried recitations in place of lectures and report themselves dissatisfied with the results. Most teachers use quizzes or recitations in addition to lectures.

Question 26: *What use do you make of blackboard diagrams, charts, lantern slides, moving pictures, etc., in physiology lectures? Opinion on these and other visual methods.*

Everybody uses the blackboard, charts and models; some use lantern slides. Few, if any, use moving pictures, "on account of the expense."

The lantern has opponents and defenders. Many do not like darkening the room, believe the impressions given are too fleeting, decry the confusion, and point out the lack of possibility of simultaneous comparison. On the other hand, Jackson, as an example of lantern advocates, says: "In using a small hand lantern operated by myself, slides can be taken out and placed back at will. Room not completely darkened, so that students may take notes." While others use charts so that students may copy them, he uses slides so that they cannot "memorize the detail which is being presented."

Question 27: *What use should be made of the "thesis" or paper based on library work?*

This has been discussed in the main report. It might be added that several speak of the desirability of thesis work for the superior, if not for all, students. Dr. Cannon writes:

> The custom which has prevailed here for many years of requiring students to prepare a thesis or brief paper concerned with some limited subject in physiology, and based on actual reading of the original papers is, I believe, an important educational method. By dividing the class into thirds and having one-third, perhaps the best men in the class, write such papers to be read before the class, and two members from the other two-thirds to read some of the original articles on the subject and be ready for discussion, the students get the stimulation which comes from contact with the reports of the investigators themselves, and, furthermore, they learn to evaluate the textbook. They come to realize that the textbook is an abstraction, that science itself is not the smoothed out body of knowledge that the textbooks present. The discussion of the paper by members of the staff as well as by students offers an excellent opportunity to point out the desirability of further knowledge and the chances which the students may have to make contributions.

Guthrie has the following to say on this topic:

> After about six weeks, students volunteering on invitation are assisted to select subjects or are assigned subjects on which they prepare papers to be read before the class. Usually, four students report at one time, the papers being limited to ten minutes each. References to original papers are supplied and assistance, in the nature of discussion or suggestion is available in the preparation of the papers After the papers are read, the class discusses them, asks questions, and finally the instructors are invited to participate. Not infrequently it happens that general discussion exceeds the time allotted. It is surprising and most gratifying to observe the high plane usually set and maintained both as to the papers and the discussion, even in the earlier conferences; and that the serious students dominate and overwhelm any attempt at frivolity that an occasional misguided individual may attempt to exhibit. The successful conference is the supreme feature and achievement of the theoretical course.

Question 28: *What use do you make of written tests? Do you think the correcting and return of papers advisable?*

Some opinions are the following: "Important," "at conclusion of each subdivision," "midyear tests," "frequent and irregular intervals," "three during the course," "every two weeks," "weekly," "five minute paper at beginning of each laboratory period; serves as a roll call also," "monthly."

You pay your money and take your choice! Same variety of opinion as to reading and correcting papers. "The reading of written tests is asking too much of an instructor" (Henderson). "If papers are worth writing, they are worth correcting" (Scott and Pike). Chairman echoes latter statement.

Wiggers tells of an interesting new form of examination: "This test consists of giving the student a short physiological essay containing a mixture of facts and fiction and asking him to correct any erroneous statements that appear within." He will send copies of such papers if you ask him.

Question 29: *Character of final examination?*

Practically all favor a comprehensive written examination. Many favor oral and practical tests in addition. A very few favor orals for the entire test.

There is general agreement that the final should be so planned as to demonstrate students' general grasp of the subject rather than memory of details.

Question 30: *Relative value of term work, laboratory work and final examination in determining final standing?*

No agreement. Perhaps most usual practice gives about equal value to term and laboratory combined, as contrasted with final examination.

This university has adopted the general plan of distribution of grades among the members of the class in accordance with the normal probability curve, which facilitates, somewhat, the assignment of grades (Martin).

Question 31: *The concentration (Harvard) method, arguments for and against. Is it advisable that this method be generally adopted? There is surely a desirable optimism between "concentration" and "dilution." Where? This question requires consideration both as to physiology alone and also in relation to the other parts of the medical course.*

Discussed in the main report.

Dr. Cannon writes as follows:

The great advantage of the block system of teaching is that there is a sequence which places structure, function and disturbed structure and function in that order, so that the student is not learning about the workings of organs which he has not seen and whose structure he is ignorant of. Secondly, there is the definite advantage, in a school whose teachers are investigators, in that the block system allows two-thirds of the time to be practically free for research. Of course, half of the time when teaching is going on is also free, though in my experience, as the teachers get older, the concentrated instruction leaves them somewhat fagged and lacking in vim for research. The fault of the concentration system arises from an insufficient attention to the correlation of subjects which are, in fact, intimately connected. In part, this is due to lack of reference to previous subjects when teachers of later subjects are presenting their facts. I endeavor in teaching physiology to remind the students of the histologic and gross anatomic features of structures which are being considered, e. g., the heart; and the pathologists, of course, should refer back both to anatomy and physiology. My own belief is that a definite advantage is to be obtained through a general examination at the end of the first two years, in which questions involving correlations of the medical sciences are asked. Such an examination requires the student to bring together at one time his knowledge of the medical sciences. This provides an occasion for correlation and also summarizes his knowledge of these subjects just before his entry on clinical work.

Hough says:

Here we have usually three studies pursued at one time, and I regard this as better than having only two. I think this is perhaps the desirable compromise between concentration and dilution.

Carlson says:

We do not believe in the Harvard method of concentration. We may be excused for saying that we believe in the Chicago method of concentration; that is, the

student works in physiology every day for nine months, and the course is made so strenuous that the student cannot complete it without giving daily attention to the same.

It is evident that the Harvard plan cannot be used exactly in schools having the quarter system. At Minnesota for the last two years physiology has run through two quarters or twenty-four weeks. The instructors like this, and it does not appear too concentrated.

Question 32: *What can be done to teach the physiology of relationship, e. g., of the various systems? For example, how will a change in the circulatory system affect digestion?*

These are important to clinicians; and as Dr. Pike points out in a recent letter, the physiologist has hardly begun to answer.

From Dr. Pike's original letter raising this question the following is quoted:

When the clinician sees his patient, he has certain questions to answer for which we have not yet provided the data. He finds something wrong with one of the great systems, whose physiology the student has attempted to learn. But the problem of the clinician requires a somewhat different kind of knowledge for its solution. He wants to know what effects a derangement of function in one system will entail in any other, or all other systems. I think the physiologist has not yet provided data for the answer to these questions We have been too prone to take the machine apart and study the pieces. Some time we must put it together and start it ticking again. We must know, not only what the manner of action of the circulatory system is, and the digestive system, and the respiratory system; but we must some day know what effects a change in the circulatory system will have on the respiratory and the digestive system. The clinician would like to have us tell him now, but the best we can do at present is to exhort him to have patience. In the meantime, we will kill a cat.

Some correspondents believe Dr. Pike is right.

Too much of the literature of relationships is more or less unverified *a priori* speculation (Maxwell).

We have hardly made a start in this direction (Dresbach).

The physiology of relationship consists at present mostly of gaps and guesses. There is no advantage, that I can see, in the instructor using his imagination as to how vasomotor and other adjustments may possibly work (Hudson).

Likewise on this question writes Dr. Morse, professor of pediatrics at Harvard:

What the practitioner needs is answers to practical questions he cannot answer himself. My own experience is that those are just the things the physiologists cannot tell me.

Such are the extreme expressions on this topic. Others call attention to the dangers connected with the teaching of the physiology of systems.

It is possible that the subdivisions of our subject have been too much in the nature of "water-tight compartments" (Vincent).

If the functions of the several systems are not taken apart, they will not have to be put together again (Scott and Pike).

A good number do not take a pessimistic view either as to teaching or as to our available knowledge of relationship. They think the teacher must always have this phase of his subject in mind and prevent the compartment building of which Vincent speaks. That one must emphasize all the time "the organism as a whole" seems the duty of every physiology teacher.

Relationship or coordination is the alpha and omega of physiology (Carlson).

Students should be thoroughly instructed concerning the intimate integration of the various parts of the body and the various processes involved (Jackson).

I hold that such points as you give here [in Question 32] are well taken care of: in fact, it is the chief subject of clinical physiology (Burton-Opitz).

Finally, some physiologists, as Burton-Opitz indicates, think we are, here, on the borderland of the clinic; and some would turn over the whole matter of clinicians or to clinical physiologists as laiason officers between physiology and practical medicine. The editor cannot agree with this latter view, because the interrelations exist as truly in the healthy as in the abnormal body. They are part of normal physiology. Let your teaching be analytic. You've got to take the machine apart both structurally and functionally. But at the same time be constantly synthetic. Put the parts together and see how they work together. Says Martin: "Insist that the student as he passes from topic to topic . . . shall form the habit of asking how all the various functions which have been studied thus far by him will be affected by the operation of the function now under examination." For example, he stresses effect of muscular activity.

Of course, as Fischer and Baehr say, "the physiologist is handicapped because students do not know pathology and clinical medicine. What is needed are physiologic minded men in the wards." Give us the clinical physiologists or physiologic clinicians in the third and fourth years. Let the physiologist keep away from the abnormal; but normal relationships are undoubtedly his "job"; and if he does it well with present science as his guide, the clinical men will find a good foundation on which to build.

Meanwhile, *mehr licht!*

E. RELATIONSHIP TO OTHER COURSES

Question 33: *Is the premedical course in biology adequate? Suggestions.*

Courses as given in the better colleges are satisfactory. Of course more biological training is desirable, but the standard requirement is about as much as we can expect.

Question 34: *Is the premedical physics course adequate? How could it be improved?*

There is more doubt as to the adequacy of the ordinary physics course. Numerous correspondents speak to that effect.

The instructor in physics seldom understands just what he is giving a course to medical students for (Stoland and Reid).

The course can be improved by allowing the physiologist to point out to the instructor in physics important chapters in physics which should be considered in more detail for those preparing for medical studies (Jackson).

Dr. Franz writes to similar effect and thinks this should be reported to all departments of physics. Who will undertake this task?

Dr. Reichert is so impressed with the inadequacy of biology and physics premedical work that he thinks both subjects should be taught as part of the medical curriculum. He considers that one reason for the deficiency, which in his opinion applies also to chemistry, is failure of the premedical student to study seriously.

The question may be raised whether under our American plan of tieing up with the academic colleges in combined courses, we are sacrificing an initiative and interest naturally pertaining to professional education and whether such loss, if it occurs, is compensated for, in the final result, by the advantages of these college years. The chairman of this subcommittee is not ready to answer. Perhaps a careful comparison of results of Canadian schools with those obtained in the United States may at a later time give necessary data for a conclusion on this point.

Question 35: *Chemistry. What courses should be required in the premedical years? Should physical chemistry be required? If so, when? Outline scope and indicate time.*

Everybody is strong for chemistry. There is agreement that organic chemistry should be a premedical requirement. There is much sentiment that quantitative analysis be also a premedical requirement. Some would place physical chemistry in the same category, while others think the necessary parts of physical chemistry can be given under general chemistry or, later, in the medical school by the physiologist.

It should be borne in mind that two years of premedical chemical study is all that can rationally be expected. The conditions under which collegiate departments of chemistry are operating must be borne in mind. It would be well if a conference of college chemists and medical school physiologists could work on the problem of a standard premedical chemistry requirement, just as Prof. Franz suggests for physics.

At Minnesota physical chemistry is a required subject of the medical curriculum and is taught to the medical group by itself by the regular chemical department of the university. The course is of nine hours a week for the first "quarter" of the freshman medical year.

Question 36: *Anatomy, gross and microscopic. Do you find that anatomy courses offer proper preparation for physiology? To what extent is it necessary to review, particularly histology?*

Practically all physiologists think the preparation of their students in anatomy, both gross and microscopic, is adequate. A few would like more stress on visceral anatomy

Prof. Hooker says:

> My only criticism of gross anatomy is that the student in general is not taught to dissect physiologically; that is to say, he is permitted, for example, to pick up a nerve or blood vessel with his forceps when he is dissecting it free from neighboring tissues. It follows, therefore, that when he is dealing with the living organism he has to learn an entirely new technical procedure.

Vincent, Henderson, and Fischer and Baehr believe too much time is given to anatomy. They probably have their eye on that time for physiology!

Martin and Maxwell hold that comparative anatomy is more valuable for physiology than human dissection. At Stanford many students take physiology before human anatomy, but after comparative anatomy Prof. Martin says he sees no disadvantage in this arrangement.

Dr. Reichert thinks the histology course is deficient "in respect to the presentation of the changes that take place during rest, activity and exhaustion."

Some physiologists review histology somewhat, but think such reviews are desirable in all departments.

Question 37: *Neurology. Is there undesirable duplication in the teaching of neurology and the physiology of the nervous system and senses? Suggestions. Should nervous anatomy, physiology of the nervous system and perhaps clinical neurology be concentrated in one department? (Hough).*

> It would be very important if a good, separate monograph on the physiology of the nervous system were available for teaching purposes (Lusk).
>
> The physiologist should treat the physiology of the nervous system according to the principles worked out by Sherrington (Miller).

The consensus of opinion is that such duplication as occurs is not undesirable. Physiologists are opposed to the giving of the anatomy and physiology of the nervous system over into a clinical department. They think the scientific teaching would not be so good and that unnecessary duplication of equipment and staff would result.

A few receive Hough's suggestion with favor. The whole nervous system "to advantage might be left to anatomy or physiology or a third department," says Hooker. Presumably he does not advocate that the third department should be clinical.

Henderson, always constructive iconoclast, puts forward these interesting proposals:

> I heartily concur in the suggestion of Dr. Hough. Something of the same sort will come about ultimately in other branches. For instance, there will be a subject of respiration and circulation which will cover as much as is necessary of anatomy, all of the physiology, and much of the clinical side of these functions. In the nervous system, however, the matter can be put to the test, and we are moving here as rapidly as we are allowed to in that direction.

Can you see in imagination the medical school of the future? No departments of anatomy, physiology or medicine, perhaps no department of surgery or of obstetrics. On the other hand, there would be a department of the nervous system, a department of the circulatory system, a department of the reproductive system, etc. Each of these departments would take to itself the anatomy, physiology, pathology and clinical procedures appropriate to its system of organs. Perhaps there would be an integrative "Department of Man as a Whole," presided over by the Dean!

I am not poking fun at Prof. Henderson's proposals. Too often we get accustomed to horizontal cleavage and think the rock cannot be split in any other way.

Dr. Hough himself says, however, he fears his suggestion is at present a "counsel of perfection."

Question 38: *Physiologic chemistry. For example, how do you handle the physiology of digestion, if physiologic chemistry comes before physiology; or the reverse? Metabolism?*

The majority of opinion is that biochemistry should precede physiology. A minority is satisfied if the two subjects accompany each other.

These are evidently two branches in which careful conference should be held as to the distribution of topics. For example, where does coagulation of blood belong? Some repetitions are desirable, but unless the departments have an understanding with each other, both repetitions and omissions are likely to be too large. It is evident that physiology, or physical physiology as some are pleased to call it, cannot cut loose from chemistry. When we consider the nervous and mechanical features of digestion or of secretion, we must take up the chemistry as much as is necessary for a full picture of organs in operation. The biochemist should have prepared the way for this.

Guenther says in this connection:

> Participation by the physiologic chemist with utilization of his faculties . . . is an excellent plan.

Question 39: *To what extent should physiology have definite relation to physical diagnosis?*

See general discussion in the main report.

> In this school physical diagnosis and physiology are closely correlated. Course Physiology 3 is normal Physical Diagnosis and identical with Course ,1 in Internal Medicine. It is given in the Physiology Department, but in charge of the same instructor (clinician) and assistants who give physical diagnosis proper (Guenther).

On the whole, the opinion is that unless the physiology department has qualified instructors (and men are not likely to be qualified unless they are constantly in it, i. e., are clinicians), it should not *teach* physical

diagnosis. Indeed, Dr. Guenther's description of arrangements at Nebraska leaves a doubt as to whether normal physical diagnosis is taught by active, *bona fide* members of the physiology department.

But physiology should *prepare the way* for all kinds of diagnosis. Note the distinction between preparing the way and offering the systematic practical instruction. Nor should it be lost sight of that physical diagnosis is largely anatomy, another reason why physiology should not take on the course.

Dr. Lusk's suggestion is as follows:

'The course in physiology should be immediately followed by an elementary clinic which should be given by someone *familiar with* the course in physiology.

Question 40: *Comment on other relations that should be fostered and methods of doing this.*

Pharmacology will, in most cases, be most conveniently taught in conjunction with and in the same department as physiology. The pharmacodynamics of a drug is a physiologic problem. The methods are those of physiology and the results are most often chiefly of physiologic value (Vincent).

If, subsequently, in the senior year there exist physicians who will tell the students, what is absolutely true, that the knowledge of physiology is one of the cornerstones of medicine, there will be a reflex from the higher fountains of information which will affect the morale of the preclinical years for the general welfare and benefit of all the students (Lusk).

The best way in which the practical relations of physiology to medicine can be adequately presented, is by the establishment of a chair of experimental medicine, held by a full-time teacher with adequate support (Bachman).

We try to utilize the work in physiology, along with work in pathology, by having the students do experiments, and determine by necropsy and subsequent microscopic examinations the results of the physiologic experiments, and the correlation of the symptoms exhibited by operated animals with the destructions that have been produced (Franz).

F. ELECTIVES

Question 41: *Do you favor electives in the medical sciences for medical students? If so, to what extent? In what years of the course?*

Three fourths of the physiologists throw up their hats in favor of electives, and then immediately half of them back off and say it cannot be done. "There is no time!" All of which is piffle and tommyrot. It has been done, and students trained under a system permitting electives are no worse, possibly they are better, than under a rigidly fixed curriculum.

The overwhelming conceit of the average medical faculty that it can pick out the exact subjects and the exact hours of each subject that will make the best doctor needs the stone hatchet. You all know this if you stop to think.

Then if you decide the electives would be a good thing, the only way to get the time is for each department to give up some of the time which *you all know you do not know* whether it is the right amount of time or not. Throw this time into the pot. Make the student elect that amount and you have an elective curriculum.

To be more specific, if your total hours are 4,000, and you want to make 400 of these elective, each department must shorten its required work, on the average, 10 per cent. Departments that will not do this voluntarily should be sandbagged or chloroformed, and the hours taken by force. Then your curriculum is defined still as 4,000 hours, but 3,600 of these are in required courses and 400 in elective courses.

We have no electives as yet. Personally, I feel that if the required courses in the entire medical school were cut down to what I would call trunk courses, there

would be time in the senior year for electives; and in that case I should welcome an opportunity to give advanced work in regard to respiratory metabolism, circulation, etc. (Henderson).

There you have it! Use the sandbag, Brother Henderson. Use the sandbag all of you who keep saying you want electives, but there is no time!

Say frankly, if you like, that you do not believe in electives. But stop saying there is no time. Probably a dozen good schools have curricula with elective privileges. It can be done.

You never will solve the question by having a full program of required studies and offering optional electives. Not one student in a hundred will take any of them. In the student's case the "have no time" cry would be the real truth, under such a curriculum.

The decision as to what part of the four year course shall be open to electives must be made on other grounds. The chairman of this subcommittee believes that reasons can be given for scattering the elective hours throughout the course, at least from the sophomore year on. Other medical educators think electives should not come before the third or fourth year. Still others believe in a fifth year of elective work and a special advanced degree. This is not the place for the pros and cons of this question.

Naturally a school with very restricted staff will have more difficulty in offering electives than one will on ample personnel. This is a local problem and has nothing to do with the question as to whether the ideal curriculum should contain opportunities for student choice of part of his work.

"Electives," says Carlson, "are highly desirable, especially for the best medical students." Yes, echoes the editor; but equally for the poor man, who can select something along the lines where he is weak. It is good for all because it makes them think about their work and what they need. But there are other and better reasons not to be gone into here.

I believe that the plan of this university is good. This plan is to cut to the minimum the required time in each subject, leaving the students free to elect from whatever field interests them. This scheme permits some degrees of election during each year of the medical course (Martin).

Question 42: *How can provision be made for electives in physiology: (a) as regards students' time; (b) as regards instruction.*

This has already been discussed. All the men see that the only way to do it is to prune the required courses.

The instruction question is entirely different. One-man departments can hardly enter the race on the extensive elective curriculum. They had better stick to the conventional one-mile track. Only point is, that is not the best track to develop all-round utility horses.

Question 43: *What elective courses do you offer or consider desirable?*

Each member of the department should offer at least one elective along his special line in research (Scott and Pike).

Most of the elective courses consist of directed reading along selected lines, with frequent conferences to judge and regulate progress. A certain number of research courses are offered (Martin).

The following elective courses are offered at the University of Chicago:

1. Critical study (lectures and laboratory work) of the physiologic glands of internal secretion, 100 hours. This course involves aseptic surgery.
2. Course of acute mammal experiments in definite fields of physiology carefully selected, so as to illustrate important principles and methods of analytic physiologic problems, fifty hours.
3. Advanced physiology (principles and problems) of the central nervous system, 100 hours.

4. Course correlating anatomic-physiology and nervous system, with particular attention to the cranial nerves, fifty hours.
5. Course of principles and problems on dietetics and nutrition of man, 100 hours (Carlson).

The following were offered at Minnesota during 1919-20. The instructor and number of students in each course is shown:

FALL QUARTER

1. Physical Chemistry of Vital Phenomena (McClendon), 66 hours, 12 students.
2. Problems (leading in some cases to beginning research), (Lyon, Scott or McClendon). Varying amounts of time credit, 11 students.
3. Advanced Physiology of Muscle, Blood, Circulation (Scott), 66 hours, 8 students.

WINTER QUARTER

1. Electrophysiology (McClendon), 66 hours, 14 students.
2. Problems, 10 students.
3. Advanced Physiology of Muscle, Blood, Circulaton (Scott), 66 hours, 8 students.
4. Research, 3 students.

SPRING QUARTER

1. Vitamines (McClendon) 66 hours, 11 students.
2. Problems, 9 students.
3. Advanced Physiology of Respiration, etc. (Scott), 66 hours, 4 students.
4. Applied Physiology (Gault), 22 hours, 5 students.
5. Physiologic Optics (Lyon), 44 hours, 4 students.
6. Research, 2 students.

G. RESEARCH

Question 44: *How and to what extent can and ought the required course to be used as a stimulus to research?*

1. Teaching by research men. Entire course permeated by the research spirit (Carlson).
2. Inductive experimental development of each subject (Hough).
3. Taking advantage of results contrary to those expected (Dresbach).
4. Historical presentation (Bachman).

The first method, which is stated in different words by several correspondents is, of course, the most important.

Question 45: *Should undergraduate medical students be encouraged to undertake research?*

Yes. There is no need to consider research a kind of religious rite, or divine inspiration, or anything other than what it really is—the attempt at a careful analysis of a certain phenomenon or series of phenomena; and many students are capable of conducting a piece of research if given the proper guidance (Franz).

Most of the physiologists say "yes," and some of them very emphatically.

Every medical student of more than mediocre ability should be encouraged to undertake an investigation of a problem in some one of the branches of medicine (Hooker).

See also what Dr. Christian and Dr. Edsall say in discussion of Question 1.

H. PREPARATION OF TEACHERS

Question 46: *What can be done to encourage good men to enter the field of physiology teaching?*

Discussed in the main report. Of course everybody mentions better remuneration as the first necessity. Other suggestions are: (1) proper

equipment; (2) fellowships; (3) prizes; (4) attractive junior positions; (5) time for research; (6) "catch the prospective teacher during his premedical career"; (7) campaign of education leading to appreciation of the services of teachers to society; (8) do away with the "autocracy" of educational institutions, i. e., give the control to the actual teachers; (9) "agreeable surroundings, devoid of political intrigues"; (10) "emphasize the intrinsic importance of physiology as a branch of biological science, and as such entitled to rank with zoology and botany in the university."

Question 47: *Bearing in mind the training of each, which is the better physiology teacher, M.D. or Ph.D.?*

See chairman's opinion in the main report.

Everybody agrees that the *training is the main thing.* Of course, some lean to the practical and say "M.D."; others to broad, general education and say "Ph.D." In some respects, the Ph.D., with narrower specialization and acquaintance with fields not ordinarily covered by the M.D., is better. In respect to knowledge of pathologic physiology, the M.D. is likely to be better. A narrow Ph.D. is less dangerous than a narrow M.D., because his shortcomings will be balanced by the work of the clinician; whereas there is no one to counteract the narrowly "practical" teaching of the second type. Given a broadminded, thoroughly trained teacher of five years' experience, degrees are of no importance.

Question 48: *Do you see any way of fostering a central adequate training school for physiologists?*

This idea is not favored by the physiologists. Adequate, fully manned departments of physiology should be developed in the great endowed universities and in some of the state universities. These should be related to their respective graduate schools, at the same time being teaching departments of the medical schools. The man who desires to become a physiologist should be free to select his master and to move about from laboratory to laboratory. Some substantial traveling fellowships open to all candidates would be a better thing than a central training school.

I. OTHER TOPICS

Question 49: *You are invited to discuss any subject pertinent to physiology teaching or the development of this science.*

In this university the department of physiology was one of the original departments, established long before the university had any definite medical school affiliations, and ranking from the beginning equally with the other university departments. The result of this history is that here physiology is thought of as a university subject, and only secondarily as a medical school subject. It is taken every year by a number of nonmedical students. Physiology is taught as a biological science rather than as a phase of professional training. Of course, the needs of the medical student are uppermost in the minds of the teaching staff, but the attitude is scientific rather than medical. I speak of this because we are carrying on here an experiment in physiology teaching which seems to me significant. Is the university attitude desirable in the teaching of medical subjects? My personal connection with this department has not been long enough to permit me to form a decided judgment in the matter, but thus far my impressions are all favorable to the plan as it exists here (Martin).

Treat a physiologist like a clinician—give him time, opportunity and an economic outlook, the equivalent of the clinicians, and all worry may cease (Fischer and Baehr).

The pure physiologist must awaken to the fact that there are enormous possibilities of practical application of the subject outside of the routine medical course and that while the practical value of a problem should not be the only incentive to its completion, on the other hand, there is a great deal of material of scientific value that is not being applied practically, though it should be, e. g., industrial hygiene, industrial pharmacology, physical culture, etc. (Stoland and Reid).

We have built up several wonderful clinics in this country. These clinics are manned by so-called "full time" professors, whom Mall called "full pay" professors. It is a duty now to see that the professors and the assistants in the medical sciences

are placed on at least the same level of remuneration as is enjoyed by the professors of clinical medicine and their assistants in the so-called "full time" medical schools. Until this is accomplished there will be a tendency towards regression in our philosophical faculties (Lusk).

PART II. BIBLIOGRAPHY ON PHYSIOLOGY TEACHING

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REPORT ON TEACHING OF BIOCHEMISTRY

OTTO FOLIN, PH.D., CHAIRMAN; P. A. SHAFFER AND A. P. MATHEWS

In considering physiological chemistry as a part of the medical school curriculum, it is first of all to be noted that this science is from a chemical standpoint necessarily an advanced subject. Unless the medical student can think in terms of the chemical constitutions of organic compounds, he cannot be made to comprehend the chemistry of the products and processes involved in animal metabolism. A quarter of a year's work (that is, one full course for a college year) in inorganic chemistry, followed by one eighth of a year's work in organic chemistry, both accompanied by laboratory work, should be considered the irreducible minimum of preliminary chemical training necessary for the study of physiologic chemistry. Certain fundamental concepts of physical chemistry, such as the law of mass action and the principles governing the behavior of substances in solutions, must somehow be mastered by the student of physiologic chemistry. But at the present time it is not practical to demand that the medical student shall have had even a most elementary course in physical chemistry, and the concepts referred to must, therefore, be incorporated in the medical school course of physiologic chemistry. Training in analytical chemistry is, of course, desirable, but it cannot be required, and this training can be spared because the major part of the medical student's practical work in physiologic chemistry should consist of quantitative analytical work.

It is unfortunately true that even the minimum requirements in chemistry mentioned, namely, a year's course in inorganic chemistry and a half year's study of organic chemistry, are not now being fulfilled, and some Class A medical schools have to offer a course in the subject of organic chemistry. In favor of this practice it is justly argued that even a very short course, planned specifically for the needs of the student of physiologic chemistry and immediately preceding the study of that subject, is more adequate than is the ordinary short college course in organic chemistry, which may have been taken two or more years before the student enters the medical school. It is to be noted, however, first, that the time alloted to organic chemistry plus physiologic chemistry is usually no greater than the time allotted to physiologic chemistry alone in other medical schools, and, secondly, that the four-year medical school curriculum is so overcrowded with prescribed courses that any study which

can properly be demanded as an entrance requirement should not be allowed to absorb any of the time needed for professional studies.

Closely associated with the problem of the necessary entrance requirements in chemistry is the question as to the amount of time which should be allowed for the teaching of physiologic chemistry in the medical school. This topic is a complicated one because time is not to be had for the asking, and cannot be increased or diminished for one department except with the consent of others. The extraordinary variations in time allotted to other older laboratory subjects, notably anatomy, has naturally led to corresponding variations in the time set aside for biochemistry.

TIME ALLOTMENT

We hesitate to recommend any specific minimum time for physiologic chemistry, but it may be suggested (*a*) that physiology and physiologic chemistry should have about the same time, and (*b*) that one fourth of a college year be given to each of these two subjects.

EQUIPMENT

Although the question of equipment is not included in this report it must be pointed out that the time officially allotted to a laboratory subject like biochemistry is meaningless unless space and equipment for *uninterrupted* individual work are provided. Individual desk space in the laboratory is absolutely necessary. It may seem like going into trivial details to mention gas, water, hoods, and sinks, but unless these items are adequate uninterrupted individual work is impossible. Two gas jets and one running water tap for each student must be considered minimum requirements. A large sink, a hood and an analytical balance for each ten students are also minima. It is also necessary that there should be in the laboratory at least 10 per cent. of unoccupied desk space available for miscellaneous uses, for extra reagents, polariscopes, colorimeters, scales, etc. The larger the class the greater becomes the need for extra space.

SCOPE OF COURSE IN PHYSIOLOGIC CHEMISTRY

In a rapidly expanding subject like biochemistry it is not suitable or practical to outline too closely the topics which are to be covered in teaching. It may be said at the outset that in all schools where the teachers of biochemistry are active biochemical investigators nothing suggesting any regulation as to what should be taught could fail to be either superfluous or harmful. This subject was brought up for discussion at a conference of teachers of biologic chemistry at the last annual meeting of the American Society of Biological Chemists, and the

opinions were practically unanimous on that point. At that meeting it was, however, also brought out that there are medical schools (including Class A schools) in which physiologic chemistry is taught by persons who are not even eligible for membership in the American Society of Biological Chemists, and that so long as such a condition exists, a tentative outline of an approved course in physiologic chemistry for medical students would be useful. In view of the lively interest which was taken in the subject at the meeting referred to, and in view of the fact that more similar meetings will be sure to take place (the Society meets once a year) the tentative, provisional character of the recommendations here given should be emphasized.

The course in physiologic chemistry should consist of from seventy-five to eighty lectures and conferences (except in so far as some of the lecture periods are used for one-hour written examinations) and an equal number of laboratory periods, two and one-half hours each (except in so far as some of these are replaced by practical examinations).

The first two weeks in the laboratory are needed for the preparation of standard solutions involving the use of the balance and for learning volumetric analysis. The lectures during this time must be partly instructions concerning the laboratory technic, but should deal mainly with the chemistry of solutions, the theory and practical use of indicators, and such topics as osmosis, reversible reactions, and the law of mass action.

The work in volumetric analysis leads directly to the subject of quantitative nitrogen determinations, and the students can at once apply and fix their newly acquired experience by working on pure nitrogenous compounds, such as ammonium sulphate, urea and uric acid. The theoretical nitrogen content of these products furnishes the student a strictly impersonal judgment of the quality of his work. The lectures and reading at this time can advantageously cover the field of catalysis leading up to a general consideration of the field of enzymes.

The work outlined above, covered about the first three weeks, or from fifty-five to sixty hours, trains the student as no other kind of work can train him in precision and attention to details. With an adequate system of checks and required records, this part of the course reveals the quality and the preliminary training or lack of training of each student. We call attention to these merits involved in making the beginning of a course in physiologic chemistry the most exacting. In a large number of medical schools the students study physiologic chemistry for many weeks before they are called on to do any quantitative work, except sugar titrations. Incidentally, it may be remarked that the annual cost per student for the training in analysis as outlined is small after a department has been once equipped with the necessary number of balances and volumetric utensils

Following the possibly debatable three weeks introductory course in analytic procedures comes a course of from forty to fifty lecture periods, with a corresponding number of laboratory periods, on the chemistry and metabolism of fats, carbohydrates and proteins. These topics represent the major part of every course in physiologic chemistry, yet they require comparatively little discussion. Practices differ concerning the order in which they are considered; in most schools the chemistry of all three is covered before their metabolism is taken up; in some the chemistry of one class, such as the fats, is followed by a series of metabolism lectures before the chemistry of the next class is given. Such intertwining of pure chemistry with metabolism discussions is, perhaps, more suitable for schools possessing more than one lecturer in biochemistry. The chief merit of this system lies in the fact that medical students are so keen for the "practical" applications which appear in connection with metabolism lectures; to the average medical student a very long stretch of pure chemistry, unless given by a really gifted lecturer, is more irksome and less interesting than when that same stretch is interspersed with discussions of normal and abnormal metabolism. When a student gets the story of the formation of acetone bodies with allusions to diabetic coma and to the peculiar conditions encountered in children, his interest in the chemistry of fats is renewed and is extended to the chemistry of the carbohydrates. It is impossible to lay down any general rule as to the order in which these different topics should be taken up. Even as to the starting point there is no general agreement, while in most schools the chemistry of the carbohydrates is taken up first, in others the beginning is made with the fats, and some begin with the proteins. These variations are not important. The conventional order found in practically all textbooks is to begin with the carbohydrates and to end with the proteins, and the majority of teachers simply follow a textbook. Incidentally, it may be noted that very few textbooks have been written on physiologic chemistry which are suitable for medical students, so that the possible range of choice is really very small.

The laboratory work during the long period covered by lectures on the chemistry and metabolism of fats, carbohydrates and proteins could profitably be made the subject of a more detailed report than we are now prepared to give. A considerable part of it represents a rather barren test tube period during which the average student becomes mechanical, careless and indifferent. There is a nearly useless and superfluous abundance of qualitative tests and reactions and relatively few experiments which furnish valuable information or which tend to develop the student's skill or judgment.

To give but one illustration: one good alkaline copper test for sugar, such as Benedict's, is enough, yet in many medical schools from three to six different copper tests are applied to the different reducing sugars. The qualitative work should be shortened so as to give more time for metabolism experiments and for quantitative analysis of urine, milk and, if possible, blood.

The long period of from forty to fifty lectures and laboratory periods includes at least a partial consideration of urine. If it is to cover this subject entirely the period should represent not less than forty-five lectures and not less than forty-five laboratory periods of two and one-half hours each. Concerning the distribution of the lectures, it may be suggested that the pure chemistry of the fats, carbohydrates and proteins is in a more nearly finished condition than is the story of the metabolism processes in which they take a part. The student can, therefore, profitably acquire the pure chemistry in a larger measure than he can the facts of metabolism processes from the textbook. This does not mean that the pure chemistry can be slighted; on the contrary, the medical student must learn the structural formulas, physical properties and chemical reactions of fats, sugars, amino acids, peptids, etc., though we all know that he promptly forgets them, just as he forgets his anatomy. During this period, if not before, the student must also be given a brief presentation of the rapidly growing field of colloidal chemistry. Two or three lectures on that subject are now nearly, if not quite, indispensable. Eighteen lecture periods are needed for chemistry of the fats (4), carbohydrates (6) and proteins (8). Thirty lectures are needed for a reasonably well rounded presentation of the more important established facts and competing interpretations in the field of the metabolism of fats, carbohydrates and proteins (from four to six lectures on fat metabolism; from six to eight lectures on carbohydrate metabolism, and from twenty to twenty-three lectures on protein metabolism and urine). In connection with these lectures, emphasis must be laid on the fundamental principles (biological, physical and chemical) rather than on clinical illustrations and applications.

The topic of fuel requirements, of energy metabolism, of oxygen consumption and the respiratory quotient belongs partly to physiology and partly to biochemistry; so many metabolism problems cannot be discussed without reference to this field that two or three lectures on this subject are practically indispensable. A certain amount of overlapping between physiology and biochemistry is unavoidable and is by no means undesirable. Two or three lectures are called for on the metabolism of inorganic materials, salts and water. These can come partly as a feature of the discussion of urine, partly in connection with lectures on the blood. They will include consideration of the acid and base

balance and the maintenance of neutrality in the blood and tissues, a subject which will require from two to four lectures in addition to the regular metabolism lectures. The various secretions of the body are mostly discussed in connection with the metabolism lectures, but two or three special lectures on milk are called for.

The laboratory work on milk, as on urine, should consist almost exclusively of quantitative work. A few successful preparations, such as the preparation of milk sugar from milk, and urea, uric acid and hippuric acid from urine, furnish more instruction and real training than do a very large number of qualitative tests. This is especially true when the classes are large and the supervision is meager.

The elementary first course in physiologic chemistry, coming as it generally does during the second half of the first year, or first half of the second year, is not a course in pathologic chemistry, yet it includes the principles and methods on which the later applications to clinical materials are based. The student should not examine stomach contents, yet he studies pepsin and peptones and he learns to differentiate between hydrochloric acid and lactic acid, and acquires some familiarity with the pigments of bile. He need never see a urine representing diabetes or nephritis, yet if given such a urine at the end of his course in physiologic chemistry, he should be able to make a better chemical examination than he would four years later, when he is engaged as an intern in a hospital.

EXAMINATIONS IN COURSE

The problem of examinations, of tests by which the students in physiologic chemistry are to be graded, passed or failed, is an important feature of successful teaching. Two points should especially be borne in mind in connection with such examinations: First, they can and should, in part, be considered as one aspect of teaching by which the student is helped in clarifying his ideas; secondly, the examinations are very important to the student and they should be planned so as to give him abundant opportunity to show that he deserves a passing mark.

The examinations in biochemistry should be partly practical and partly written. These examinations should be numerous enough to permit a partial classification of the students by the time the course is half over. The practical examinations can advantageously consist, in part, of problems which the student solves when he gets ready—at a time chosen by himself; but, in part, they must consist of general examination sessions. Four such general examinations (besides the final) is a large enough number. These may be distributed as follows: The first, volumetric analysis (including nitrogen determinations), the differen-

tiation between strong and weak acids, and the use of different indicators. Second, the reactions of fats and carbohydrates, including sugar titrations. Third, identification of protein materials and milk constituents, including quantitative milk analysis. Fourth, urine analysis and other topics. On the basis of four such general examinations, and four individual problems, the students' ability in laboratory work becomes so clear that 50 per cent. of a class can be excused from the final practical examination. It should be noted that it is not possible to take more than one-half the class at a time for these practical examinations. They will therefore occupy either eight laboratory periods, or four lecture plus laboratory periods.

There should also be four one-hour written examinations covering broadly the same subjects as the practical examinations, but based, of course, on the lecture and textbook materials.

The question of quizzes, in addition to examinations, should be brought up for discussion. As a tentative suggestion, the following scheme may be mentioned: Give a five minute written quiz at the beginning of each lecture, on uniform slips of paper distributed beforehand. The slips are immediately shuffled, and redistributed and marked by the students, after the lecturer has explained what the answer should be. The marker as well as the original student sign their numbers, instead of their names. The whole process can be finished in from ten to twelve minutes and the size of the class is immaterial. The marks so obtained must be recorded and should be taken into account in the grading of students. The students as well as the professor find out by this process whether they are marching together. If at the beginning the suggestion is made that the students might find the questions helpful in their reviews, the students will take the hint and preserve copies of the questions. If encouraged, they will also ask questions of their own for the professor to answer. This quiz system compels students to be on time and incidentally serves as an informal roll call.

THE TEACHER

The more one studies the problem of how satisfactory teaching in physiologic chemistry is to be provided for, the more prominent becomes the question of how to provide the teachers. Given adequate time, space, equipment and teachers and the problem virtually disappears. Medical schools and the American Medical Association have been making commendable efforts to supply everything—except the teachers. The members of this committee, none of whom holds an M.D. degree, have no fault to find with last year's recommendation by the Council on Medical Education to the effect that nonmedical men should be selected as teachers in medical schools only when medical men of equal

special capacity are not available. The recommendation is, however, incomplete. The kind of men desired are certainly not now available for biochemistry, nor do we see any signs of their becoming more numerous in the immediate future. On the contrary, the ever tightening regulations about the granting of the degree of M.D. are strangling such laboratory departments as biochemistry and physiology, so far as their supply of special students and assistants is concerned. The difficulty is greatest in the field of biochemistry, because the biochemist must also have a respectable command of the various branches of pure chemistry, branches which are not taught in medical schools. There is urgent need for some constructive recommendations as to how the great and growing demand for well trained and productive biochemists by medical schools and hospitals may be met. It is to be remembered in this connection that a very large proportion of the older professors in the laboratory subjects received at least a part of their training in Europe, so that American medical schools have never been what might be called self-supporting in these subjects.

DISCUSSION

DR. GEORGE M. KOBER, Washington, D. C.: I have profited tremendously by the papers that have been read this afternoon. The primary object of medical education is to turn out competent practitioners, and one of the weakest spots in medical education today, not only in the United States but also in Europe, is the question of physical diagnosis. It has been demonstrated very clearly that there is a woeful deficiency in the knowledge in the subject, which was detected during the training of medical officers in the recent war. The papers this morning show that the foundation for scientific diagnosis must be laid in the early years of medical education, and must be laid fundamentally during the course in anatomy and physiology, with special reference to a painstaking study of the living normal subject and with all the aids of instruments of precision. This requires time and patience, but it is time well spent. I have held for years that normal physiologic diagnosis should be taught in the first two years both in the anatomic and physiologic laboratories, in order that our students may become familiar with normal man and be able to differentiate abnormal conditions with which they may be confronted. I also found that witnessing of autopsies at coroner's inquests is helpful to first and second year students to familiarize them with normal anatomic conditions in a large number of cases.

DR. THEODORE HOUGH, Charlottesville, Va.: I do not feel that I have anything to add to the paper presented by Dr. Lyon on physiology, and I simply content myself with expressing my thorough agreement with the spirit of it. He has most admirably portrayed the great rôle the physiologist should play nowadays in the medical curriculum. While there is, of course, a large mass of facts to teach the student, yet the physiologist must infuse into the student the spirit of experimental medicine. That is his chief job.

DR. A. P. MATHEWS, Cincinnati, Ohio: I have only a few words to say in reference to these papers. In the first place, we should try to get our faces in the right direction. There is one answer to all the problems we were discussing yesterday and have been discussing today, and that answer is, *research.* The great need in medical institutions in this country is research. The future of medical education lies in research. All the problems of instruction will solve themselves as soon as we realize that the development of the research spirit is at the bottom of all good education. How we are going to develop that spirit is, perhaps, open to question, but that must be the fundamental aim. I believe Dr. Bevan has been walking forward while he has been looking backward all the years I have known him. He emphasizes always that the aim of the medical school is to turn out practitioners of medicine. Practitioners of medicine are the by-products in my opinion. Once you have the proper spirit developed, you will have good practitioners in medicine, and I do not believe you will have them until you have that spirit.

As regards the need of more quantitative work in training students in physiology and biochemistry, I am in full accord with the inspiring message in this direction by Dr. Lyon, and the equally inspiring and precise statement of the problem by Dr. Folin. By quantitative methods you make a man capable of doing research and you teach him honesty and technic. His ideas become precise, and his thinking becomes accurate, and that is the reason we emphasize quantitative work.

There is one other thing I want to speak of, and that is in most of this discussion the fundamental function of all good departments has been overlooked. The fundamental function of all organisms is reproduction. We must provide for those who are to come after us. We must reproduce ourselves. That is the first and fundamental thing. You can never reproduce biochemists by training physicians. The biochemist has to realize always that that is one of his fundamental duties, and if he is not doing that, he is not doing the thing he should be doing. Our teaching must be of such a nature as to inspire others to follow in our path and to train them to become leaders in our science. The clinician, seeing the pressing needs of the practitioner, is liable to overlook and forget this fundamental necessity.

DR. FRANK BILLINGS, Chicago: May I say a word or two as a clinician? The session of yesterday and that of today have been full of fruitful knowledge to all of us. As one who has practiced medicine for many years, it impresses me more and more that the practitioner does his work most efficiently, after all, in proportion to the extent that he has been well grounded in the fundamentals of medicine.

We have in this country an enormous number of doctors, practitioners of medicine. The greater number of them graduated before we had made much, if any, advance in medical education. They make attempts at practice in therapeutics. They do not think in terms of anatomy, physiology, pathology and physiologic chemistry. They do not think much in terms of real symptoms, that is, of abnormal physiology. They think only of a patient and an opportunity to prescribe some drug.

In listening to the papers one is struck with the little prejudice or bias that continues to be expressed by the readers of the papers, both

in the fundamentals and in the clinical branches. In other words, there is more or less antagonism that should not exist. I will say this of the fundamentals: I do not think you have time enough in two years in which to teach them properly, and we are embarrassed when we speak of the curriculum of both the fundamentals and clinical branches to find enough time to teach both so that the product turned out is the best that can be produced. One wonders in listening to the papers today and to the needs, as expressed by the specialists and qualified men in each department, if we could not make some of these branches, or some introductory work to them, a prerequisite to the beginning of the study of medicine. We do not accept a medical student who has not had some training in physics. He must have had, at least, one year in inorganic chemistry. He must have some training in the principles of biology before he begins. Why should he not have a good knowledge of cytology before he goes into medicine, both plant and animal cytology? Why should he not study a part of general histology before he comes to medicine?

In writing to Dr. Lyon in answer to his questionnaire, I told him with due modesty that I could not answer the questionnaire, but I had some suggestions to make with the idea that there should be a closer association of the teachers of the fundamentals and the clinical branches which would be helpful to both.

In listening to Dr. Lyon, I did not hear quite so much optimism expressed as he ranks physiology relation to other subjects. In military service, the psychologist is the whole thing. (Laughter.) While we give due credit to physiology, the clinician must have not only a good fundamental knowledge of physiology, but of anatomy, pathology and biologic chemistry in order to be an efficient clinician. Every time I listen to Dr. Folin I feel the shortcomings of the clinician in physiological chemistry. It is always a delight to listen to him. If Dr. Folin could command some of the patients, I am sure students taking the course in the wards would take greater interest in biochemistry, just as they take greater interest in neuropathology if the neuro-anatomist could go into the wards and see some of the patients suffering from nervous disease.

Dr. E. P. Lyon (closing the discussion on his part): Some of the remarks I made in my paper were in a spirit of fun. You all know that I have the highest regard for the clinician and his work. The thought I wish to leave is that all investigation is useful. If you want to know about things, you have to go to the bottom of them. Those physiologists who are working in the outlying provinces are, perhaps, not immediately helping, but some day you will be able to apply the things they are doing. Physiology problems are clinical problems in embryo. Methods grow just as organisms grow. My paper is intended to show the necessity of getting new facts and of getting closer to the underlying things of life.

Dr. Otto Folin (closing the discussion): I desire to call your attention to the fact that Dr. Billings gave you a full picture of how specialists are made. When you live with experienced men and working with them, it is the way to replenish a good profession. Give us your assistance to go and do this or that thing, and we will supply specialists. Specialists are not so impractical as some of you may, perhaps, think they are.

We deal in principles, as Dr. Lyon has so well said, but we should constantly try to know where these principles lead. No man is more interested in human metabolism than I am. I constantly bring that out to my students, and I want to say that our students are interested in the subject of biological chemistry. You will find our laboratories crowded with students at 5:30 or 6:30 p. m., and we have a considerable sprinkling of students as late as 10 o'clock at night.

REPORT OF COMMITTEE ON PUBLIC HEALTH AND PREVENTIVE MEDICINE

VICTOR C. VAUGHAN, M.D.
ANN ARBOR, MICH.

The whole trend and spirit of medical schools is toward curative medicine or treatment. The graduates of our best medical schools today are not in any way fitted or adequately fitted to do public health work. We recommend that an improvement be made in this direction. The National Board of Medical Examiners, in examining students who graduated from Class A schools only, and the very best picked graduates of those schools, have scarcely, in the two or three years they have been examining, found a man who could get a passing mark in preventive medicine, although many had excellent marks in surgery and medicine. When the war began, General Gorgas authorized me to place in each camp an epidemiologist. I found a few splendid epidemiologists, but they were so good that we could not keep them in that office. I refer to such men as Goler, who has been health officer of Rochester, N. Y.; Alexander C. Abbott, University of Pennsylvania, and Paul Woolley, of the University of Cincinnati; McCampbell, of the University of Ohio, and a few others. I simply mention these as illustrations. The highest rank allowed for epidemiologist was that of major, and most of the organization men objected to giving the epidemiologist as high a rank as major, but the men to whom I have referred got to be lieutenant-colonels. The result was that we had to go outside the medical profession to get epidemiologists for our camps, and we found good ones outside of the medical profession. It is a matter for careful consideration as to whether the medical profession should undertake to fit men for preventive medicine, or whether it should not turn this function over to somebody else. As a rule, there are good medical men who could be fitted for the position of epidemiologist. However, I do not hesitate to say that the sanitary engineer is as well fitted as an epidemiologist as the average doctor. Such men as Whipple, Soper, Phelps, and half a dozen others I could mention, are among the most eminent men in epidemiology today.

COURSES IN PUBLIC HEALTH

Your committee recommends that we should recognize the fact that the medical course does not fit men to serve as public health officials, and that special courses, after the completion of

* This committee consisted of Drs. Victor C. Vaughan, M. J. Rosenau and C.-E. A. Winslow.

the medical course, are necessary in order to give that fitness. A number of medical schools are offering courses in public health. They have not been patronized very largely by medical men. They have so far lived a very precarious existence. Many of the men that are attending are not doctors; they are sanitary engineers. In Pennsylvania, in Michigan and in Ohio, and I am sure in many other schools that are offering courses, we have only a few students each year. The regulations of most states and many municipalities are being changed and have been changed, many of them, in the last few years so that a medical degree is not required for health officer, state health commissioner, municipal health commissioner. Some of the best municipal health commissioners in the United States today are not doctors. May be it is the best thing to divorce preventive medicine from curative medicine. It is a matter for consideration.

Even the professor of bacteriology, as a rule, in our medical schools does not teach epidemiology. He teaches the effect of the specific bacterium that he studies on the individual, such as the dysentery bacillus, the typhoid bacillus, and so on. The professor of internal medicine, when he has a case of scarlet fever or diphtheria, does not give any attention, as a rule, or any adequate attention, to the epidemiology of the disease, but to the treatment of the patient.

The committee recommends that we should recognize this fact, and should insist that medical men who are fitting themselves for health commissioners should take an additional course, of not less than two years. We are quite satisfied, however, that even to make properly qualified medical men we need more hygiene and preventive medicine in the medical course than we have. Most medical schools give one semester of general hygiene —three, four, and I think some of them five counts. This is independent of bacteriology and of the clinical medicine course. Only one semester of from three to five hours is given to epidemiology. Your committee recommends that this is not enough even for those who are going to practice medicine, and we recommend five hours a week for one year; in other words, double the amount of preventive medicine we are now giving. We do not expect to make expert epidemiologists in this way, but we think possibly we can give what the ordinary practitioner needs.

DISCUSSION

DR. ALEXANDER C. ABBOTT, Philadelphia: I do not feel particularly pessimistic on the future of this work. Its progress is necessarily slow for several reasons. We are not yet certain as to the best course to pursue; there are obstacles to be overcome, and facilities are needed that cannot always be had—but we are all making an honest effort to devise a practicable plan of liberal education in the subject of public hygiene, and I, for one, am hopeful of the result. That progress is slow and that

as yet there is no great demand for special education in this field, is well illustrated by the school with which I am identified. In 1906, the University of Pennsylvania offered the first group of courses leading to the degree Doctor of Public Hygiene. We did not have a single candidate for those courses until the session 1909-10. Since that time we have graduated with the degree Dr. P. H. a total of thirty persons, and in the present class there are six to whom the doctor's degree will probably be awarded this coming spring.

During the same period we have had a fair number of persons not qualified for the doctor's degree to whom certificates were awarded, and an approximately equal number of students taking instruction in special subjects of the course.

Up to the present we have demanded a medical degree from a recognized school as prerequisite for all candidates for the Dr. P. H. degree, and since 1914 we have insisted that the medical degree shall be from schools demanding at least the same entrance requirements as those of the University of Pennsylvania, namely, two years of college work, including specified amounts of physics, chemistry and biology. While I believe that the man with a good medical education has a great advantage over the man without it, I still believe that the time has come when the doctor's degree in public hygiene should be open to qualified nonmedical as well as medical men, and to this end a proposition is now before the authorities of the University of Pennsylvania. It is not necessary to go into the details of that matter here.

One of the difficulties mentioned here is the scarcity of persons competently trained in public hygiene. We, as well as others, are conscious of that. There come almost constantly requests for persons to fill vacancies to which I cannot reply favorably. I simply do not have the men. I believe this field of work must become more popular, for the demand for services is pressing and growing daily. The Rockefeller Foundation in its international health activities, and the Red Cross with its health centers, to mention no other openings, offer opportunities of a most attractive character.

Dr. Vaughan's complaint concerning the scarcity of epidemiologists interests me. It is doubtless true that men who do nothing but epidemiology are scarce, but there is no particular mystery surrounding the principles of epidemiology. The successful epidemiologist is the person with the detective instinct, with insatiable curiosity, and with an acquaintance with the causes, modes of transmission and methods of preventing epidemic diseases, as well as a ready working knowledge of the graphic and statistical methods. If this summary of equipment be correct, we must have with us the makings of epidemiologists in large numbers. Probably the scarcity of such specialists can be explained on the absence of demand or the scarcity of the detective instinct and curiosity so necessary to the successful pursuit of the work. I might add that this instinct can be developed. I doubt if by any plan of teaching it can be created.

One of the things that makes me hopeful concerning the future of the work is the change that has come about in the attitude of public opinion to it. While formerly the public was indifferent, now as a result of widespread educational propaganda, the public realizes how vitally these activities affect their every day life; how significant they are in all social

activities and how much economic value accrues from health activities intelligently projected. As I said, I do not feel in any way hopeless concerning the future.

DR. EUGENE F. MCCAMPBELL, Columbus, Ohio: This work in public health education has been close to my heart for many years. We started several years ago at the Ohio State University to give a course in preventive medicine. Shortly thereafter we established cooperative relations with the State Department of Health, and for four years we had a cooperative course in operation. At the present time, the connecting link with the State Department of Health is not so close, but we are still working in cooperation.

Our work in preventive medicine we think covers the situation very well. In the Ohio State University a course in personal hygiene is given in the first year in medicine; then a course in clinical medicine in which epidemiology and communicable diseases are dealt with in the junior year. The senior year schedule includes a course in preventive medicine of only two hours. I do not believe that this number of hours is sufficient in the senior year as Dr. Vaughan has indicated. The whole field needs careful and intensive consideration. I think the five hour course referred to by Dr. Vaughan is probably adequate for medical students, except those who desire to enter the field of industrial medicine for which there is a great demand at the present time. It seems to me that opportunities for election should be given in the junior and senior years, particularly in the senior year, for intensive study in this particular phase and line of public health work.

As indicated by Dr. Abbott, the demand far exceeds the supply. In Ohio, commercial concerns, particularly the rubber works and the large steel works in the various parts of the state are asking for young medical men who are trained in public health work, particularly in preventive medicine, in industrial medicine and in industrial surgery, and so on. We find that it is impossible to supply properly trained men.

In regard to public health postgraduate work: Four years ago we started a course leading to a master's degree in public health, or a master of science degree in public health, after one year's work in the graduate school. As a prerequisite we require a doctor's degree in medicine, or a bachelor's degree from an institution giving a definite line of work, such as bacteriology, hygiene, sanitary engineering, chemistry, the prerequisites being specific in the requirements, so that a man who came to us with a bachelor's degree, who had considerable public health training, after taking a year's public health work could appear as a candidate for a degree of master of science or public health. We do not give a doctor's degree in public health. Our experience has been like that of the University of Pennsylvania. There has been an increased growth in the number of students, and probably this growth has been more rapid because of the fact that this course was opened to students who had a bachelor's degree, and it is not confined entirely to the medical men, are eligible candidates.

Our experience has been that very satisfactory work has been done by students who were not medical men at all, who had had a proper background of general sanitary training—for instance, sanitary engineering, and I do not think it can be said definitely that the man who has the degree of doctor of medicine is necessarily going to make the best

public health worker. It is true, his background is good, but we have had the experience that a large number of men who have had other training have shown themselves to be most excellent students, they have done work most acceptably, and altogether we have the definite impression that they have been better students than medical men who have come to us to take the public health work.

I feel strongly that provision must be made by practically all leading universities for postgraduate or graduate work, if we make a distinction between all graduate and postgraduate work, in public health in order to supply the demand for properly trained men, which is very great the country over. In the various industries, where there is so much variation in the character of the work done because of the fact that these men have come from medical schools without an intern training, an attempt has been made to make public health workers under the supervision of some of the older men, and the results show that it is not a satisfactory procedure. We have planned at the Ohio State University to work this out to a point where we can supply a reasonable number of properly trained men in industrial hygiene and surgery and medicine, and a reasonable number of well trained men for health positions. The recent law in Ohio for full time health officers has been modified, but it is a marked progressive measure. This year we had thirty-five medical men and one engineer to take this course. They have been placed in health positions in Ohio, but it is fair to say that these men had not received as complete a training as we would desire. However, they have covered the field fairly well and have gone out certainly much better qualified than they otherwise would be.

Dr. John Sundwall, Minneapolis: Public health workers should be in a very large measure recruited from the medical profession; that is, they should be well trained in the fundamentals of medicine. There is no doubt but that sanitarians and other health workers without medical training are making good officers in certain phases of health work. Public health work in the future is going to be concerned with a great many large problems. In addition to infectious diseases, bacterial diseases, industrial hygiene, etc., we are going to be concerned with mental hygiene. Industrial hygiene itself will be expanded to include all adult hygiene. We have our school health problems; we have our work in infant hygiene, and so on. Past work in hygiene has been concerned chiefly with environment. We are now realizing more than ever before that the detection and control of the infected person or the person who is disseminating disease, is the first step in the control of disease; that a community, no matter how free from garbage and unsightly litter its back yards, alleys, etc., may be, is still an unsafe community so long as persons with transmissible diseases or who are "carriers" of disease germs are going about undetected and uncontrolled, in the community. The detection of people whose freedom thus jeopardises the health of others calls for health officers trained in medicine—in diagnosis, in the recognition of diseases. Clinics and dispensaries are essential. Practically every phase of medicine must be included, and I for one certainly feel that public health work—the promotion of health and prevention of disease—can not be divorced from the profession that trains for the recognition of and treatment of disease.

DR. GEORGE M. KOBER, Washington, D. C.: I have been teaching hygiene since 1889, and I want to make a plea in favor of the report of the committee for a greater number of hours to be devoted to hygiene in the curriculum in our medical schools. In our own school we give at least sixty hours to general hygiene; thirty hours to the etiology and prevention of communicable diseases, and fifteen hours to military and naval hygiene. I believe that number of hours is sufficient to create an earnest interest on the part of our students in the particular subject, and is, perhaps, no more than sufficient to be of substantial aid to the average practitioner in the treatment of disease. The particular object of hygiene is not only the prevention of disease but also the improvement of health, which is an important factor in the treatment of disease. Every young man who has an appreciation of the principles laid down in the hygienic and dietetic regime in the treatment of disease will be a much more successful practitioner than one who has little or no knowledge about the hygiene of habitation, the hygiene of food, clothing, exercise, and so on. I heartily endorse the recommendations of the committee.

DR. G. CANBY ROBINSON, St. Louis, Missouri: I want to speak of one method of teaching preventive medicine that we have considered. We are not proud of our course in preventive medicine at Washington University. We have a course of thirty-three lectures in preventive medicine given by one man, and eleven hours in social medicine given by various persons. We have considered ways of improving these courses, and as we have discussed a plan of departmental cooperation in this matter, I think it might be worth while mentioning here. There are so many sides to hygiene and preventive medicine that various departments can contribute to the subject. Internal medicine, bacteriology, pathology, and even obstetrics, all deal with certain aspects of the subject. We have considered a plan of putting one person in charge of the course, but having the various departments participate in giving the course. Lectures and laboratory work can be contributed by several departments. I realize that this is a makeshift and I only mention it as such.

DR. A. P. MATHEWS, Cincinnati, Ohio: I thought it might be interesting to tell you what we have been trying to do in the University of Cincinnati since there are one or two aspects of it which have not been brought out here. In the first place, as regards Dr. Vaughan's recommendation; this was mainly along the line of epidemiology. But as Dr. McCampbell has said there is in addition a very important field in industrial hygiene, in industrial medicine, the care of the health of people in the various industries. That has been the point of approach to the industries we have made in the University of Cincinnati in getting support for a department of industrial medicine and preventive medicine, or public health. The business men of Cincinnati, at the suggestion of the late Dr. Holmes, formed a committee of business men who owned industrial plants, and they have organized and secured money to support a department of industrial medicine. There is undoubtedly great possibility of the medical profession getting in closer touch with business and the various industries through this means. There is nothing, I think, which will bring the medical school of the University of Cincinnati more closely in touch, or make the people of Cincinnati feel an interest in the school that belongs to them, than the development of this particular line of work.

In working the scheme out we have had to contend with various difficulties. The heads of the plants are many of them interested from a dollar and cents point of view. They want to be shown results. They are not interested primarily in the scientific side, and that has been a point of considerable friction in the development of this department. I believe we are going to overcome that friction. They want the main emphasis put on industrial medicine; they want men entering the plants to look after the personal hygiene of the worker, to diminish the number of absences, to advise them as to methods of avoiding industrial hazards and diseases and accidents, many of which are simply due to defective lighting and things of that sort which can be remedied readily. Those are some of the difficulties which we have met.

We have got now the promise of a separate endowment for this department, but I am sure that we shall have to depend in the future, as we have in the past, very largely on the contributions of the heads of these industrial plants. They contribute a certain sum per year. Of course, some of them are interested in getting cheap medical attendance, and that we have to be on our guard against; but I feel sure that this side of the work, as Dr. Sundwall has pointed out, and to which Dr. McCampbell has called attention, will be an important part of the work in public medicine in the future. Although I was brought up in sanitary science and in an engineering school, I believe the men to handle this work will be better equipped if they have a medical degree, and I should be sorry, indeed, to see that department pass out of the control of medical schools, as it is certainly going to do unless the medical schools wake up to their duties and privileges in this respect. It will certainly go to the engineering colleges if we do not provide for the training of men in these directions. I believe a considerable degree of training can be given, as Dr. Vaughan has suggested, to the undergraduate in medicine. He can use the plants as his laboratories in the illustration of these points.

DR. E. P. LYON, Minneapolis: I should like to ask Dr. Vaughan the question, if the required work were reduced to a minimum, and if the student elected the rest of his course, whether under those conditions, if a public health course were offered as an elective part of the medical course, it would be possible during the regular four years medical course to produce competent health officers. It seems to me that men with a larger training in public health and somewhat less in curative medicine, to whom you might give the M.D. degree, would be as safe men for the public to have as the men you are training at present. That is, what they lacked in one direction would be compensated in another direction.

I have the feeling that as more and more subjects are pressed for representation on the medical curriculum, we shall have to do exactly what the academic colleges did and make a curriculum which will be more elective than any medical school so far has done. That will mean either that you will have to specialize in degrees, and certain men who have not taken a maximum of clinical work would not be qualified for licensure but would have to be content with a life spent in other work, such as public health or laboratory teaching. Or else you may call them all doctors of medicine and act on a broad basis, letting all be licensed, and expecting that in general each man will finally do the work for which he is best prepared. This is exactly what we expect of medical specialists now, although all have a general license and might undertake any kind of medical work.

DR. OSKAR KLOTZ, Pittsburgh: We have repeatedly considered the best arrangement for the department of hygiene, and up to the present have only approached the subject in a tentative manner to carry forward the work of the students. There are various sides to every department as to the duties it has to perform. We realize that in the various departments of a medical school we have more duties than merely that of the education of students. We realize that we must provide for the education of the more advanced type of students in which the course of D. P. H., or a course leading to the Master's Degree of Science is carried out. We have only temporized with the matter so far, hardly knowing on what phase of the work to place most emphasis, inasmuch as we feel that in the departments of hygiene throughout the country there are variable demands and standards. I think we come to realize more and more that each school has a duty to perform which differs with the situation of the school, and it is hard to apply a given standard to every school. Our own situation is very much like that described in Cincinnati. We have certain problems in our community in which the public is interested. They want us to participate in them, and yet, if we were to follow out the established curricula in hygiene, we would fail in the result. We have the industrial demands, which are peculiar, being made up of a great number of different companies, with different types of work within them, particularly the steel works, as well as the large problem of the coal companies, each having different problems in which the ordinary individual having had training in hygiene would hardly be able to participate to the extent of the public demands. It is for that reason that we have temporized with the matter in the hope for a satisfactory solution.

I am very much interested in what is taking place in Cincinnati, inasmuch as it appeals to us as a comparable situation to our own. If we look over the schools carrying larger departments of hygiene we will find them assuming different attitudes. In some of them, tropical medicine, in others, immunology, and in the older departments, hygiene of urban life, is the important phase of this work. I believe that we have arrived at a time when the department of hygiene in a medical school must consider as its most important duty the services which it can render, directly or indirectly, to the community in which it exists.

I believe the question of standardization of departments of hygiene is a very difficult matter, and must be considered from the viewpoint of the different localities and their immediate needs. In our situation, I believe we can do no better than by developing a scope of work in which, although including the usual work in hygiene and preventive medicine, occupational diseases and industrial hygiene will receive a very large share of our attention.

DR. WORTH HALE, Boston: We are developing an elective system at Harvard in the study of this subject, and are permitting fourth year students to elect the course beginning in February and continuing until June. In this group course we deal with problems which relate to public health, hygiene and industrial medicine. We do not anticipate that our students will become finished public health officials, but we do hope that a certain group of men will become sufficiently interested to continue further in this particular branch, and thus supply some of the demand that appears to be urgent at this time.

DR. VICTOR C. VAUGHAN (closing the discussion): When I spoke before I represented a committee, and I did not feel quite free to express my individual opinion. I am going to do that now. The prime and principal object of a medical school is to teach preventive and curative medicine. In looking at this matter from a broad standpoint, we must look higher than the good of the medical profession. We should take into consideration what is good for the country, and I think we ought to welcome the sanitary engineers and sociologists and probably others. I do not believe the school of hygiene should be under the medical department, but the university department or graduate schools, and that it should embrace many more things than what is taught in a medical school. Take the question of tuberculosis, and tuberculosis is the foundation of all our work in public hygiene: In 1900 (twenty years ago) we were crying out, even the most conservative of us, no tuberculosis in 1950. Some of us, and I think I was among that number, a little more enthusiastic, and a little more ignorant, perhaps, than the others, cried out, no tuberculosis in 1920. If I were asked when we were going to get rid of tuberculosis, I should say that if we do it in five hundred years we will have accomplished great things. The eradication of tuberculosis is a big problem, and we cannot be a healthy nation until we have eradicated it. As a matter of fact, it is very largely a question of housing, especially of occupation, and as Gilman Thompson has pointed out, it is not the occupation that predisposes to tuberculosis, it is the condition of the occupation. Take industrial hygiene: An engineer is often more competent by training to attend to these things than a doctor. He knows machinery; he knows these things better than a doctor. I think we should give, at least, one year of five hours a week to our medical students in hygiene; that is, in addition to what they get from the bacteriologist and from the clinician. And, then, we should have in some of our universities, probably most of them, a graduate department of hygiene, a graduate school of the university, and it should be open not only to students of medicine but to sanitary engineers, etc. The medical profession alone cannot lead the people of this country or any other country out of chronic diseases, and while I am speaking about this subject, I want to say that England, of all countries in the world, has led in rational sanitation; not the Germans, nor ourselves. The English have led in practical sanitation. They have a lower death rate than any country in the world, and even before the war they had a lower tuberculosis death rate, and it has largely been due to practical sanitation, notwithstanding that the poor have been very numerous in England. England having a very small amount of land, I suppose for that reason the people like to get near the land, and it has always forbidden the building of sky scrapers. In some parts of Scotland we have a most distressing illustration of narrow streets, crowded tenements, and so forth. In England the tendency has been to build garden cities, and before the war they were building garden cities all over England. What is a garden city? One man says the capital of the United States was the first garden city in the world. No doubt from an engineering standpoint Washington is a garden city, but from a sanitary standpoint it is a long ways from being a garden city. There are slums in Washington, as Dr. Kober knows, and Dr. Kober has shown up places as bad as you will find in New York, Pittsburgh, Chicago, or anywhere else. A garden city is a city that furnishes a garden with every residence. The gardens

are not necessarily on the streets or in circles. When we come to what the English have done we find for every residence there is allowed a minimum of one-sixth of an acre of ground. This may mean five or six residences on an acre with about thirty or forty inhabitants.

The eradication of tuberculosis is a sociological problem. It is a housing problem, and we want the cooperation of the sanitary engineer, the sociologist, and everybody interested in the uplift of the people. We say tuberculosis is the product of our civilization. I suppose that is true, but I usually say it is an incident to our civilization, and when we get more civilized we will not have it. We know now that tuberculosis is simply an evidence that we are not civilized. When the building laws will no longer permit the distressing conditions we find in our large and small cities today, then we will begin to get rid of tuberculosis. I went to a relatively small city not long ago and said, "Have you any congested areas here? How many people are living in a room?" This was not a very large city; it was a manufacturing town. In a room about twenty feet long, and ten or twelve feet broad, cots were packed in one up against the other, and every cot was occupied, and there were two shifts a day. In the contest against disease we need everything the medical profession can do, and we need the help of every body else, and I hope that schools of hygiene will be open not only to medical graduates but to the sanitary engineer, to the sociologist, or to any one who is interested.

THE TEACHING OF PHARMACOLOGY*

C. W. EDMUNDS
Chairman of Committee
ANN ARBOR, MICH.

About ten years ago a subcommittee of the general "Committee of One Hundred" made under the auspices of the Council on Medical Education of the American Medical Association an extensive examination of the condition of the teaching of pharmacology and therapeutics in the medical schools of this country and presented in its report certain recommendations and suggestions for improvement in the presentation of this subject to the medical student. There cannot be any doubt that this report has been of considerable value both to the teachers of pharmacology and also to medical educators in general as it served to crystallize thought on a subject which, owing to its recent development, has received scant attention in many medical schools. Particularly was it valuable to those who assisted in framing the report as the very act of considering the subject in an intensive manner tended to concentrate their minds on what was valuable and essential in the teaching of pharmacology to the exclusion of what was superfluous.

The report referred to has not been the only influence which has aided in the teaching of pharmacology as it, like the other branches included in the medical curriculum, has shared in the general improvement in medical education which has been very marked all over the country.

Another powerful influence has been the state licensing boards, which in many cases have laid down certain definite requirements for the physical equipment of the various scientific branches of the medical schools and have also aided in the presentation of the subject by concentrating their attention in examinations more and more on the more valuable drugs to the exclusion of those which are of doubtful value or which have been proved worthless.

As a result of these and other influences, the teaching of pharmacology has greatly improved in the past ten years.

New and separate departments have been established in schools where there were none previously; more men are devoting their entire time to the subject, both in teaching and in research; and in other schools, where the department had pre-

*This committee consisted of Torald Sollmann, A. W. Richards and C. W. Edmunds.

viously been under the guidance of the head of one of the older preclinical branches, it has been split off and taken its place as one of the fully developed self-governing branches of medical science.

NEED FOR DEPARTMENT OF PHARMACOLOGY

It may seem that, perhaps, too much space has been devoted to recent history and a survey of the subject to the exclusion of the assigned title, namely, the teaching of pharmacology. The committee, however, feels otherwise for the reason that the factors mentioned are so intimately connected with the teaching of pharmacology in the future. They have played their part and had their influence in the past, but if growth is to proceed, they must continue to function in the future. For instance, it goes without saying that in those medical schools not possessing a separate full-time department, one should be organized at the earliest opportunity just as soon as means and properly trained men are available. It may safely be said that the subject can never reach its fullest development and wield more than a fraction of its proper influence so long as it is a more or less neglected side-chain of some other branch of medicine. The department which is independent also, if properly manned, allows time for research without which no department can be said to be truly alive. Without research it has merely a parasitic existence, living from year to year on the food gained by the efforts of others.

Also, the state licensing boards are urged to continue to exert their influence in favor of a simplified and efficient materia medica. Better by far a full knowledge of a few dependable drugs of proved merit, than a smattering knowledge of the multitudinous preparations of the Pharmacopeia.

WHAT THE STUDENT SHOULD KNOW OF PHARMACOLOGY

With so much agreed on, a few minutes may be devoted to the consideration of some of the points a student should gain in pharmacology. First, he should learn what the really useful drugs are and also the limitations of their usefulness. It is as important for him to know what drugs will not do as for him to know what they will do. He should know thoroughly their fundamental action for which they are employed in medicine and also their side effects which may be detrimental or possibly lead to untoward effects. This study of the physiologic action of the drugs leads naturally to an examination of the toxicologic effects and how they may best be treated. The students must learn enough materia medica to know something of the physical and chemical characters of drugs and of their principal preparations, so as to be able to prescribe them correctly. But this division of the subject should be curtailed to as great an extent as possible,

as the study of the old-time descriptive materia medica and drug lore should distinctly be discouraged. The student must also learn how to write prescriptions for all the common drugs, and should be given constant practice in order to become proficient in this art. This practice should not end with the course in pharmacology proper, however, but greater attention should be given to it in the courses in practical therapeutics and in the other clinical courses which follow in the latter part of the medical curriculum. Probably in no subdivision of the subject is greater improvement needed as lack of ability to write prescriptions has been shown to be one of the most fruitful causes for the prescribing of proprietary remedies. It is without doubt true that the teacher of the clinical subjects can be of very great assistance here if he is only willing to assume some of the responsibility in the matter.

Finally, some instruction in therapeutics may be included in the course in pharmacology. The committee is well aware that some teachers of the subject have taken a different view of the matter and prefer to consider pharmacology merely as a pure science without considering it also in the light of its practical bearings. However, while practical therapeutics, of course, cannot be taught apart from a hospital ward, yet a certain amount of therapeutics given with the course in pharmacology will not only increase interest in the subject, but will also be a positive aid to the student in fixing it in his mind and especially will it aid him in his course in prescription writing.

TIME ALLOTTED TO PHARMACOLOGY

With the scope of the subject matter to be covered in mind, there remains for consideration the best distribution of the time to be allotted to the subject. It would seem that approximately a total of from 175 to 200 hours should be devoted to pharmacology proper, not taking into consideration the instruction in practical therapeutics. This time may roughly be divided into two parts: about one half to be given to the laboratory course, and the remainder to the lecture or quiz course, as may be preferred. The laboratory time may be divided into two parts if desired, and an elementary course in materia medica given in the first year. Or, on the other hand, the entire time to be devoted to laboratory instruction may be given to one course which should follow the laboratory course in physiology, and probably best in the second year. In this course may be included a few hours to be devoted to pharmacy, during which the student may be taught to make pills, extracts, ointments, etc., merely to give him an idea as to how preparations are made and to prevent him from making such gross errors in his prescription work later. A few hours

may be given to work in the chemistry of drugs, and it is probable that greater emphasis might be laid on this phase of the subject. But the greater part of the time should be devoted to experimental pharmacodynamics, as this is really the root of the whole matter.

Students should work in groups of two or more according to the nature of the experiment.

DETAILS OF COURSE

It goes without saying that there must be adequate help to supervise the students—an average of twelve students to one assistant should not be exceeded. Notebooks, carefully kept, should be required, as this requirement necessitates that the student shall develop his powers of observation and acquire the habit of making scientific deductions. It is probable that this training will be among the most valuable of any which the student will gain in the course. Such experiments as are unsuitable for the students to carry out themselves may be given as demonstrations with the students possibly acting as assistants in the operative procedures. In localities where for one reason or another it is difficult to secure a sufficient number of animals to enable students to carry out all the experiments themselves it may be necessary to substitute demonstrations for such work as cannot be given in any other manner. Finally, the laboratory course should be rounded out by frequent informal conferences, quizzes, and such lectures as may seem desirable in order to give the student an intelligent knowledge of the subject under discussion, and of the objects sought in the experimental work.

The remaining seventy-five or one hundred hours to be devoted to the subject may be utilized according to the wishes of the instructor in charge, either as a lecture course with frequent quizzes, or as a quiz course proper following one of the standard textbooks and supplements by lectures on different phases of the subject. This course should follow on the completion of physiology and would, therefore, naturally come in the second year or early in the third year. Its scope has already been indicated—such materia medica as may seem essential; prescription writing, which should be practiced at every opportunity, but above all, a thorough study of the pharmacology of the more important drugs with briefer reference to those of lesser importance and the ignoring of those which should be discarded entirely. Such mention of therapeutics may be made as will serve to assist the student in the memorizing of his pharmacology and lend greater interest to the subject, and, in addition, give him a foundation for the courses in practical therapeutics which will be given him later.

DISCUSSION

DR. A. N. RICHARDS, Philadelphia: Dr. Edmunds' report has contained few details concerning the actual carrying out of the course in pharmacology, and we think quite properly so, since it is the spirit of the teaching which should most be emphasized here. Dr. Lyon, in his brilliant exposition yesterday, made a statement applicable to pharmacology as well as to physiology, that if the proper spirit is attained in our teaching the letter will take care of itself. Pharmacology is an experimental science and the laboratory work and laboratory methods form the nucleus about which the rest of the course must center. By laboratory work I mean not only that which the student himself does and those experiments which he is shown by the more expert instructor, but also the experimental work which constitutes the body of knowledge which makes up the science. The student must be brought to know what people have been thinking about when they have devised experiments, how the results of those experiments have been interpreted. He must learn something concerning the evaluation of evidence and gain some capacity to interpret evidence. He will then be in a position to protect himself against the embarrassment of conflicting evidence and against half digested views of others with which he may be confronted later on. If we can impart the spirit of research to the student, make him know that the subject is a living thing, that it is fallible, that its information contains gaps, that there is room for difference of opinion, and if he can further realize the intrinsic difficulty of the subject, then, I think, we have accomplished more than half our task.

Dr. Edmunds has said little about methods. There are two points concerning pedagogic methods in pharmacology which have helped me sufficiently to prompt me to speak of them. The first concerns the selection of laboratory experiments. In some courses emphasis is laid largely on descriptive experiments, experiments which call for observation first and in many cases observation only. It seems to me that emphasis should also be laid on the analytical experiment. By that term I mean the experiment which includes not only the discovery of a fact but also an explanation or the beginning of an explanation of the fact. To illustrate: The action of adrenalin on blood pressure before and after dosage with atropin: the action of a drug on a physiologic system and then the action of the same drug on the isolated component parts of that system.

The second point may seem too trivial to mention. It was given me by a student years ago when I first began to quiz in pharmacology. He came to me and said that before studying medicine he had been a teacher in the public schools of New York and had been surprised to find how little the medical teachers knew of simple pedagogic devices with which every public school teacher was familiar; that so far he had not encountered anyone in the medical school who know that in conducting a recitation the question must be asked before the student is called on to answer it. This is sound psychology. If one asks the question and then stops a moment, every member of the class begins thinking about it, intensively and possibly apprehensively. The results of the application of this point are fruitful to a degree quite out of proportion to its apparent immediate imortance.

DR. JOHN W. SCANE, Montreal: I have been very much impressed with Dr. Edmunds' report, and I am sure all those who are engaged in

teaching pharmacology will appreciate what he has brought forward. There were only two points I made note of as he went along, and these concern the amount of pharmacy to be taught and the methods of teaching in the laboratory. I doubt very much the value of teaching students nowadays how pills are made. This should be done as a demonstration by the head of the department, and better, no doubt, by the head of the department of pharmacy rather than by the head of the department of pharmacology. In McGill University we precede the course in pharmacology by a short course in pharmacy, which is given by the head of the department of pharmacy under the direction of the department of pharmacology. We indicate how much pharmacy he is to give the students.

In teaching laboratory methods the thing that impressed me most is, whereas some years ago I generally devoted my time, and the assistants all devoted their time, to passing around among students and helping them in their laboratory work. I do not depend so much now on this personal assistance but let the students do the experiments largely themselves. During the last two or three years I have adopted a method which is neither extraordinary nor unique, and perhaps others are doing the same thing. If the student has a good synopsis of each experiment in his hands, with clear directions and is left alone to work it out in his own way, having no actual assistance in its performance, he derives much more benefit even if he fails to secure expected results. That is the method I have pursued during the last few years, and I have found that the men get a great deal more than they ever got before. I have stopped helping them except, of course, after the work has been done. Then I find out how much they have learned, and if they have done the wrong thing I put them right. I think it is better for them to get along by themselves than to show them how to do a certain thing. I have found that now I have a far better lot of men than before.

Dr. Worth Hale, Boston: I think the general outline given by Dr. Edmunds has been very good, but individual schools are handicapped by the amount of time which they can give to the subject, some schools having a great deal and others very little, comparatively speaking, so that one has to adapt the course to meet his local conditions. We ourselves teach very little materia medica and very little pharmacy. We do attempt to give the student a great many of the chemical relations of drugs in the laboratory, and devote about an equal amount of time to pharmacodynamics. The more I teach, the more I am impressed that the student can frequently get historical knowledge more easily from reference textbooks and original papers than he can from laboratory experiments themselves. However, I am a thorough believer in laboratory experiments because they give the student a curiosity about drugs. These experiments teach him how to assimulate the knowledge which he gets from various sources in original papers and in textbooks, but I think a very important thing about it is that it gives him curiosity. We do not attempt to teach a student a definite fact about a drug, when there are often differences in point of view. We attempt to teach him that knowledge is not a hard and fixed thing, and that there are many things which we do not know. The student in pharmacology, as does the practitioner in medicine, needs to know absolutely certain facts. The more we can cut these down, the more advantageous it is, and the more we can teach him methods and attitude, the more important it is. Of course, he cannot go into the clinic without knowing the doses of drugs and

their general effect, and that should be required. But he should have such an attitude toward pharmacology that when he comes to something that he knows relatively little about, he will be eager to go to sources of information. It is quite impossible to teach the subject in detail and to say that this is desirable, but there are sources of information and we try to emphasize to the student the desirability of going to these rather than teach him a very much larger mass of detail.

DR. HUGH MCGUIGAN, Chicago: There is not very much I can add to Dr. Edmunds' paper because he has covered the ground well, and I do not think it is necessary to enter into the method of teaching for I believe that the trouble is not in methods of teaching pharmacology, but in what should be taught. In Chicago I find that the man who is teaching pharmacodynamics has little trouble. In the first place, the men in physiology who precede us can procure animals that they can use; and consequently the students can do the necessary operative work when they come to us and do it well. The physiologists, for some reason or other try out such drugs as adrenalin, nicotin, strychnin, and so on; and this again makes the teaching of pharmacodynamics more easy.

One of the greatest handicaps I find in the students who come to us is that eight out of ten know little or nothing about chemistry, and when I say this I do not mean to criticize the men from Chicago in particular, because we get students from the entire United States. To my mind pharmacology if anything is applied organic chemistry and the students do not know that subject. This is a general failing that comes up time and again. The main reason for it is this: In chemistry the students do not study the subject long enough to get to the point where they can think in chemistry. The students go through test tube gymnastics, but that is as far as they go. They need a longer exposure to chemistry. The majority of medical students, when they finish their physiologic chemistry, drop it along with all other chemistry. For this reason I think at least one-half of the time, not only in pharmacology, should be devoted to the chemistry of drugs and a continuation of biological chemistry. The farther one goes from pharmacology the worse it gets, so that when the students get to the senior year, if they are examined in chemistry they will be found very deficient in their knowledge of it. They are able to make tests for sugar and bile and albumen and that is about all they know.

Again, on the pharmacy side there are a lot of things that men interested in medical chemistry can learn. They can learn about incompatabilities and solubilities, glucosids, tannins, alkaloids, etc., that they study but little before this time. Seeing a pill made is not sufficient for the medical student. There are lots of simple things about a pill the student can find out by preparing pills. Personally, I should never prescribe a pill if I could get a patient to take medicine in any other form. The only reason for giving a pill is that it is more pleasant to take than other forms of medicine. But a knowledge of solubilities, excipients, and resistance to digestive fluids should also be studied.

The plea I would like to make is for more pharmacy and more chemistry, and especially that part of pharmacy which relates to the clinical side of medicine. Let us take, for instance, the active principles of drugs concerning which the senior student knows very little, if anything, and it is very rarely that a student can tell you the difference between a glucosid and an alkaloid or a tannin. These are the things I find most

trouble with and the students should know them. There is no necessity of showing a student how to take out a brain tumor in the early part of his medical career. He can learn this in a hospital, and that is the place to learn it. There is no use in using the time that should be devoted to pharmacology and therapeutics for such surgical work, or some other work that is useless to the student and dangerous to the patient. We should have more time for the teaching of pharmacology, and I have been fighting ever since I became connected with the University of Illinois for more time for this subject and therapeutics. One-third of the whole time I think should be devoted to pharmacy; a third of the time to pharmacodynamics, and another third to toxicology and chemical pharmacology. With such a division of the subject, and with proper attention to therapeutics in the clinical years, much of the just criticism now directed at pharmacology and therapeutics will be unnecessary.

DR. ALEXANDER MACALISTER, Trenton, N. J.: I quite agree with what Dr. Edmunds has said in regard to the teaching of these branches, and as a member of the state board for a number of years I find that students in their answers to questions on materia medica and therapeutics are very deficient. At our last examination in New Jersey we had twenty-six applicants (all regulars) who came up for examination, and we found they were very deficient in a knowledge of dosages and in prescription writing. I asked them to write a prescription, and of the twenty-six there were only two men who wrote prescriptions properly. The others were very deficient in prescription writing and in dosage. That has been my experience from being a member of the board for a number of years. I think these branches are very inefficiently taught in the majority of medical schools.

DR. C. W. EDMUNDS (closing the discussion): In respect to the question of a pharmacy school, personally I do not favor students going over to a school of pharmacy to take a course in how to make pills and extracts and all the rest of preparations. I can teach them how to make a pill in two or three minutes. This whole discussion has come up before. The report of the committee does not go into detail, but it is simply suggestive. Any one who is interested in a fuller detailed discussion of the thing can be referred to the proper sources for the opinions of the different men. A report was made ten years ago, which was practically unanimous, against putting students in a school of pharmacy. The whole thing has very largely to be determined by the local conditions, by the number of students you have, the help you get, and the man at the head of the course. The man at the head of the course will make his impress on it, it seems to me, if he has half decent assistants. That is an individual matter.

Dr. Richards struck the keynote when he said that pharmacology is the deadest subject in the whole curriculum, hence it is very essential to breathe some spirit into it. That will be the determining factor in the interest of the student in the course.

REPORT ON THE TEACHING OF PATHOLOGY*

JAMES EWING
NEW YORK

The present report has been compiled from the answers received to a questionnaire sent to the departments of pathology of the schools of classes A and B of American medical colleges, and covering thirty-four topics. Fifty replies were received. The report endeavors to present some statistical information, and the opinions of the teaching pathologists of the country as accurately as may be. These opinions are quite generally in accord with the views of the committee.

COMPOSITION OF DEPARTMENTAL STAFFS

The total number of teachers attached to the pathological departments in the fifty schools is about 225, and the average for each school is about 4.5. One or more part time instructors are required in all but nine. In ten, the staff consists of one full time professor and one or more part time instructors. These conditions are doubtless caused by the limitation of the budget. Considering the very large number of names listed on the teaching staffs of the schools, this number will appear to many as remarkably low. This small corps of men not only teaches pathology but it conducts nearly all the pathological work of the hospitals used by the colleges. In more than one half of the schools it also conducts the work in bacteriology, in fourteen the tasks of clinical pathology are added to its duties, while in many there is a dash of serology to fill up the cup of the pathologist. Of full time teachers in fifty schools there are 151. Occasional assistance in several fields is acknowledged from students, hospital interns and practitioners. The proportion of instructors to students in the course varies from one to seven to one to forty, average about one to fifteen. Twelve schools have two or more full professors or associate professors of pathology.

BUDGET

The proportion of the total resources of the schools that is devoted to the department of pathology varies from 6.5 per cent. in two of the largest institutions to 20 per cent. in several of the smaller institutions. The average is about 13 per cent. The high proportion in the smaller schools is doubtless owing to the lack of full development of other departments, while the low figures of the older schools probably means a subdivision of the patho-

*For the Committee: H. Gideon Wells, Henry Albert and James Ewing, by the Chairman.

logic work among the clinics and hospitals. Nevertheless, the committee believes that the tendency has swung too far in this direction, which means the loosening of the control of pathologic teaching and the decline of standards. A large, fully manned and liberally supported department of pathology is a first essential in a well organized medical school, and it may well be doubted if one sixteenth of the resources of any school is adequate to support such a department.

HOURS

The regular courses in pathology run rather uniformly between 300 and 350 hours, the lowest 260, the highest 417. With electives it is possible for the student in some schools to spend as much as 500 hours in pathology. There are, in addition, variable periods spent in pathologic work in clinical clerkships, and in the specialties.

In the opinion of most of the pathologists, these hours are adequate for the systematic work in general and special pathology, but there is a general call for more time in the fourth year for witnessing and performing necropsies.

The division of these hours averages 210 for the second year, 130 for the third year, and rather indefinite periods for the fourth. Except for electives, systematic teaching of pathology in the fourth year may be said not to exist.

It is evident that the teaching of special pathology has now been advanced very largely to the second year when the student knows little or nothing of the general aspects of the diseases whose fundamental nature he is expected to investigate. The danger of this situation is recognized by many pathologists, and numerous complaints have been received against the plan of teaching the pathology of disease of lungs, liver, kidneys, etc., before the student has acquired some knowledge of these diseases by reading or contact in the clinic. On the other hand, one pathologist states that he would prefer to lay the foundation for later clinical study rather than combat poorly assimilated clinical ideas.

The committee believes that the historical method is the logical one, first the study of the external phenomena of disease, then the dependence of these on pathologic anatomic lesions, and then the pursuit of etiology and pathogenesis by more refined methods. The committee recommends that this method should be followed to the extent that the student should be required to read medicine during the course in general pathology, and should attend clinical demonstrations of the more striking forms of disease, while the course in special pathology should be given in the third year in connection with systematic work in clinical medicine. In one school three months' work in clinical medicine is required before special pathology is begun.

METHODS OF INSTRUCTION

The main teaching material in pathologic histology consists of from 250 to 350 stained slides which are usually loaned to students. A few schools give away and replace the collection each year, the student staining his own slides. One school sells the collection at a moderate price. These slides are used in connection with gross specimens, lantern pictures and charts to illustrate the various topics in the course. Lectures are generally accompanied by demonstrations.

The concentration system is approved by only ten teachers, and then only for the main laboratory course. In several schools the concentration method has been tried and abandoned, with notable improvement in the results. It is obvious that the concentration system violates the main pedagogic principle that it takes time to assimilate knowledge. In the case of pathology it also renders coordination impossible, and widens the breach between pathology and medicine.

ELECTIVES

Seventeen schools offer elective courses, which have a varied complexion. Some consist of rather informal extra work during the regular course or during vacations. Others, and the more substantial type, call for definite hours in the fourth year and cover a variety of subjects. In some schools the student may devote a large part, or all, of the last period of his course to pathology, learning technic, performing necropsies, or pursuing a problem. In one school, the student may elect to spend the major portion of the last three years in pathology.

The committee heartily approves of these latter types of substantial electives. They enable the student to concentrate his attention on the study of a problem or a group of cases in a pathologic laboratory when he is sufficiently advanced to appreciate his own work. It gives him an opportunity to realize the importance of pathologic anatomy and histology as instruments of investigation. It should provide time for the study of the literature of his problem. It may be made an influence in turning certain men into pathology as a career. Such electives have led to the production of fifteen student theses worthy of publication which were announced by eight pathologic departments during the past year.

EXPERIMENTAL PATHOLOGY

Four schools announce more or less systematic courses in experimental pathology. Many others say that experiments are used at suitable times in the course on general pathology. Some teachers state their belief that this work should be entirely elective or even postgraduate. It is evident that the growth of experi-

mental pathology in the undergraduate curriculum has not made much progress. The committee recognizes the great teaching value of well conducted experiments in pathology, but is uncertain whether the medical curriculum justifies the assignment of any considerable portion of time to this subject.

SURGICAL PATHOLOGY

The teaching of the pathology of surgical diseases is controlled by the department of surgery in twenty-five schools and by the department of pathology in twenty. In the opinion of thirty-five pathologists it should be controlled by the department of pathology, while twelve assign it to surgery.

The reasons given for the latter opinion are to the effect that only the surgeon can know the clinical applications of pathology, and that the material is needed by the department of surgery, which should have facilities and staff for its full use in teaching and research.

On the other hand, if the department of surgery keeps its material, what is to become of the department of pathology? Most pathologists feel the responsibility of knowing and teaching rather accurately the clinical applications of pathologic anatomy and histology. The main consideration is that the young surgeon can seldom devote himself to the general and special pathology of his subject long enough to become thoroughly competent, and that the most mature talent available in the department of pathology is none too good to guide the pathologic work of a surgical clinic. There have been few Billroths, but the literature of surgery is considerably burdened by the utterances of immature surgical pathologists.

For these reasons the committee agrees with the majority of pathologists that the teaching of surgical pathology should be directed by the department of pathology, but they recommend the fullest cooperation between the two departments in order to secure the best results. The same considerations apply to the department of medicine. Success would be assured by clinical-pathologic conferences.

MEDICOLEGAL PATHOLOGY

Medicolegal pathology receives a certain attention in several of the large cities but no systematic instruction in this most highly specialized branch of medicine appears to exist in America.

MUSEUM MATERIAL

Museum preparation is an incident in a few schools but is generally and effectively ignored. The committee holds that every student should know what constitutes a good museum specimen and be familiar with the methods of preparing them.

From two to five hours systematic discussion is all that is necessary, but actual practice can only be acquired at necropsies in the fourth year. Attention to this subject is recommended in electives.

CLINICAL SPECIALTIES

The clinical specialties are represented by special courses in the departments of pathology as follows: neurology, 14; gynecology, 12; ophthalmology, 4; pediatrics, 1.

Among other advantages such arrangements greatly aid the coordination of clinical and laboratory teaching, and if conducted under the supervision of the head of the department, it should assure the teaching of sound pathology.

The proportion of the clinical instructors who have done special work in some department of pathology varies widely. The average is undoubtedly very low. The answers to this question run about as follows: none, two; 2 per cent.; several; at least three; only one; one in ten; fair number; very few; four of twenty-three in medicine, and six of twenty-seven in surgery; 20 per cent.; 50 per cent.; 75 per cent.; all; etc. It is evident, that first hand acquaintance with the pathology of their subjects is not now regarded as an essential qualification for entrance on a university career in American medical colleges. The committee regards this fact as one of the most important results of their investigation, and as one which requires careful consideration by clinical teachers.

POSTGRADUATE INSTRUCTION

Fifteen schools gave postgraduate courses in pathology in 1919 to a total of 120 students. These courses do not include the postgraduate instruction given in many schools during 1918-1919 to military students.

It is quite clear that the present equipment and staffs of the medical schools are inadequate to undertake postgraduate teaching on any considerable scale.

GRADUATE INSTRUCTION

Graduate instruction in pathology is given in eighteen schools, leading to the degree of Ph.D. in fourteen, M.S. in eight, and M.A. in five. The number of students taking such courses was not ascertained but is evidently quite small. Without attempting to enter minutely into the subject of graduate degrees in pathology, the committee offers the following comments on this subject:

(1) The judicious awarding of the Ph.D. or other degrees may be useful in inducing men to take up pathology seriously, in stimulating original work, and in broadening the education of pathologists.

(2) The conditions surrounding the young assistant in a pathologic laboratory are not easily adjusted to the rigid requirements of a graduate school and might well be altered so that the industrious worker who has produced a creditable thesis after four or five years, and has become thoroughly grounded in the history, principles and technic of pathology might be given a Ph.D. degree even if he has been earning his living during the period.

(3) Students who spend a fifth year in pathology in the pursuit of a problem and the writing of a creditable thesis, deserve the M.S. degree.

GROSS PATHOLOGY

Fourteen schools provide a course of from fifty to 100 hours in which gross pathologic anatomy is taught apart from necropsies. Most of the schools confine the teaching of this subject to the necropsy table.

The committee believes that this method of teaching pathology and medicine is insufficiently developed. A canvass of the students in one school brought out the verdict that the course in pathologic anatomy, using material gathered from necropsies, was the most valuable in the curriculum. The organs and clinical histories from as many as 500 necropsies have been demonstrated to one class during its last three years. This is far more than the student can possibly see at necropsies, and is sufficient to give him a fairly wide acquaintance with what disease does in the body, especially when supplemented by a well chosen museum. The fresh material from necropsies permits the efficient training of the student in pathologic anatomic diagnosis, which cannot be accomplished at the few necropsies the student can witness or perform. The ability to recognize in the gross what changes have occurred in an organ, and to correlate these changes with the course of the disease, it is hardly necessary to assert, is one of the first essentials of pathologic training. It cannot be attained without a wide experience, and for this purpose all available material should be gathered and used.

The number of necropsies that the student witnesses varies widely and is estimated with difficulty. Most of the schools report that from thirty to fifty necropsies are performed before students each year. The attendance of the student, however, is irregular. Much of this experience comes with the clinical clerkships. The actual performance of necropsies by students is done in only thirteen schools. In others the student may elect a special course in necropsy technic. Most physicians perform their first necropsy as a hospital intern.

While urging the importance of familiarity with correct necropsy technic, the committee feels that the disposition of this privilege must depend on local conditions and the supply of

material. Competent performance of a necropsy in all its demands is far beyond the reach of an undergraduate student. Probably, under most circumstances, the necropsy privilege is best reserved for the hospital interns who may be active in securing permission. Unless material is very abundant, it is probably enough to permit the student to assist a competent instructor. Whenever possible, elective courses involving full responsibility for the performance of the necropsy, interpretation of results and recording of protocols, are strongly recommended.

SOURCES OF PATHOLOGIC MATERIAL

The sources of pathologic material seem to be quite abundant in nearly all the schools. A total of 39,000 hospital beds is reported as supplying pathologic material directly to the colleges represented in this report, an average of about fifteen to every student in the regular courses in pathology and of 250 to every man engaged in teaching pathology.

To this must be added an extensive material from private sources, and from hospitals more or less dependent on university laboratories. These rough statistical data accord with the generally recognized fact that the hospitals of the country are very inadequately supplied with pathologists. Nearly every university pathologist could use more assistants than he possesses, and at the same time has on his files one or more applications for men whom he cannot supply.

In securing permission for necropsies wide-awake hospital interns have proven most successful; hospital clinicians are uniformly reported as desirous for necropsies but not very active in securing them; the indifference of public officials may be depended on; while the public, although opposed, is increasingly accessible.

The opposition of undertakers is met in two schools to which are attached, by the aid of special funds, schools of embalming. The practical work of the schools is done in the hospital morgue. Another suggests that a course in embalming and restitution of the body be offered jointly by the departments of anatomy and pathology. In one hospital all bodies after necropsy are embalmed by the hospital for the undertaker.

Good facilities, technical assistance when requested, and attention to the convenience of the undertakers are always efficient aids in securing their cooperation.

PATHOLOGIC MUSEUM

Forty schools report the possession of a pathologic museum, containing from 500 to 12,000 specimens. At Washington, the Army Medical Museum appears to be available but little used for undergraduate instruction. Only ten schools claim to enjoy

a special annual appropriation of from $100 to $2,000 for this object, and only four appear to employ a curator. All but ont bear witness to the great value of this material in teaching pathology and many state that it is extensively used by other departments. One dissenting opinion is that students and instructors can spend their time better in other ways, so that this school has no museum.

The commitee regards a pathologic museum as indispensable in a well equipped department, and strongly recommends the systematic development of this branch of teaching material. They would even go so far as to suggest demoting from Class A any school which does not possess a working museum and does not devote at least from $200 to $300 yearly to its maintenance.

COORDINATION

A definite plan of coordination of pathologic and clinical teaching exists and appears to be pursued in comparatively few schools. This plan involves:

(1) Clinical demonstrations and reading of medicine beginning simultaneously in the second year with the course in general pathology.

(2) Simultaneous discussion of the pathology of bacterial diseases with the study of these bacteria in the department of bacteriology.

(3) In the third year coordination of the study of special pathology with lectures and demonstrations in the departments of medicine and surgery.

(4) Clinical pathologic conferences in both medicine and surgery.

(5) Full attention to pathologic opportunities by students during clinical clerkships.

(6) Attendance at necropsies.

(7) Frequent conferences between heads of departments.

In the majority of the schools this coordination appears to be indefinite and inadequate, only eight pathologists reporting satisfactory results. In one school, the course in general pathology is followed by two terms of clinical instruction and reading of medicine, after which the course in special pathology is begun. The reports bring out much complaint that the advancement of the major portion of the course in pathology to the second year has rendered coordination impossible.

LIBRARIES

Good working libraries are available in nearly all the schools, only eight failing to reply on this question. In many instances these libraries, containing from 500 to 15,000 volumes, are

attached directly to the department of pathology. In a few cases, a larger general university library, numbering from 5,000 to 26,281 volumes, is available. In general, its use by students is limited, owing to lack of time. Several report very free use of the library, especially of well illustrated current textbooks employed in the course. Others claim to develop a taste for and capacity to use good literature, especially in the production of student theses. Not unknown among the departments of pathology is the spirit of the booklover, who is quite oblivious of the modern race for efficiency, but who likes to collect the original sources of medical knowledge, and to compare thoughtfully the free philosophy of the older physicians with the finality of our modern science.

THE FIFTH YEAR

Eight schools acknowledge responsibility for the control of a fifth year spent in a hospital. Up to date the conduct of this fifth year has done little for pathology. At least one state takes the position of refusing to recognize a year spent in the pathologic laboratory as equivalent to a year in the various wards. This ruling indicates a misconception of what goes on in well regulated hospital pathologic laboratories. Pathologic internships, permitting six months' experience in the laboratory, are available in hospitals connected with nine schools. Only one student is reported as formally registered for a required fifth year in a university hospital laboratory.

What Steps Do You Recommend to Improve the Position of Pathology in the Medical Profession? — One correspondent replies, "Improve the medical profession."

Many replies to this question appear so carefully considered that we beg to quote them directly:

"It is essentially a matter of more and better education of both clinicians and pathologists. A clinician untrained in laboratory practice is totally incapable of appreciating pathology."

"Better education of clinician leading to more general and sincere recognition of the value and practical application of the laboratory man's point of view."

"Encourage more graduates to take at least one year in a routine pathologic laboratory. The number which may do so will be small, but their influence as practitioners will be great."

"The younger clinicians are less interested in necropsies than their predecessors; they are more attracted by serology, chemistry and radiology."

This comment is followed by others who recommend that all candidates for clinical professorships be required to qualify in the pathology of their subjects, which may be accomplished, in the opinion of another "by establishing full-time staffs in clinical

medicine and surgery whose members would be adequately trained in pathology. This plan would assure the future standing of pathology, but for the contemporary profession there is no remedy." As one phase of this plan comes the recommendation that "all workers in experimental pathology and clinical research should first be grounded properly in pathologic anatomy." To many the education of the profession and the public to the necessity of postmortems, appears most important. "The public must be made to recognize the value of autopsies to the community, as the best guarantee that the interests of the living will be protected and the practice of medicine improved." One enthusiast adds, "Let us offer free necropsies to all private practitioners and publish abroad the comparison of clinical with anatomic diagnoses."

To complete the arraignment of our colleagues, the schools are urged to increase the hours of required instruction, to make more and better provision for electives, to add postgraduate courses, to provide fellowships, and to increase the staffs and the appropriations of departments of pathology.

The pathologists seem, on the other hand, to be rather sharp self-critics. "Improve the caliber of pathologists," says one; "Train better pathologists," advises another. "Make the field attractive to able men, instead of forcing them to make sacrifices to enter and remain in pathology. The standing of pathology reflects the standard of pathologists." The organization of an American college of pathologists is recommended by one who would set a standard of what constitutes a well trained pathologist. "There should be greater emphasis by the pathologist of the clinical manifestations of disease. He should take a more active interest in the problems of the clinician, and by judicious constructive criticism make himself indispensable in the clinic." "Develop the clinical pathologic conference and see that all teachers of pathology are in constant association with the clinical branches and come in close contact with the sick." "Precision, careful work, conservatism, research, and frank confession of the limitations of men and methods, are needed in pathology."

Lectures on the history of medicine should be given to show the fundamental part played by pathologic anatomy and the general pathologist.

A practical critic advises the publication of less technical articles—conclusions rather than lengthy methods. "Find out what kind of research the profession needs and give it to them. Abstract problems may be discussed among pure scientists, but the profession wants its practical problems solved."

Pathologists should make more use of the modern clinical methods of securing information about disease, especially of its early stages. Three such methods may be mentioned as particu-

larly fruitful: (1) radiography; (2) the study of pathologic processes as revealed at operation, and (3) observation of the course of disease in the living.

Radiography is mainly a study in pathologic anatomy, in which pathologists have taken too small a part.

Surgical operations often reveal significant phases and early stages of disease, very suggestive to the pathologist, but which are transient and never appear at the necropsy table.

In the wards the pathologist will see the changes of disease in new and unfamiliar phenomena, his ideas of time span will be corrected, he will become schooled in the correlation of lesions with symptoms, and in diagnosis he will learn the deficiencies of his own knowledge of pathology.

All the defects thus enumerated the 150 teaching pathologists of the country gratefully acknowledge and will endeavor to remedy.

What Steps Do You Advise to Recruit the Ranks in Pathology?—Some highly important matters have been raised by this inquiry.

(1) Unquestionably, the necessity of large salaries for heads of departments, and especially for young men entering the laboratory, causes the greatest anxiety to most pathologists for the future of their calling. It is stated that only unmarried men, or those without families, or those with independent means should enter pathology, for the time and energy required to become a competent pathologist are greater than in any other branch of medicine, and the financial reward is far less than for a similar degree of specialized knowledge in other fields. These conditions have long hampered the progress of pathology, clouded the career of the pathologist, and suppressed the scientific tendencies of young physicians, and they are only moderately aggravated by the present world temper. It is not the young man who makes the real sacrifice. He has a good time indulging his youthful enthusiasm. But when he is indiscreet enough to marry and have a family, it is his wife and children who suffer. With this dilemma in mind, no middle-aged pathologist can seriously urge a young man to enter pathology under the conditions generally existing in America. To the claim that medical institutions do not possess sufficient funds, a single incident may reply. Recently a commission of practitioners recommended the expenditure of $10,000,000 for the care of the insane in the state of New York, concluding their report by bemoaning the paucity of research in psychiatry. But the highest salary they provided for a pathologist was $3,500!

(2) The future of pathology in America is now seriously jeopardized by the movement to secure full-time clinical teachers

and pay them larger salaries than are paid the teachers of the medical sciences. If one can obtain the same opportunities for research and the same academic conditions in the branches of clinical medicine with higher salaries, any young man who will fit himself for anything except the clinical branches must have something wrong in his make-up. If the young clinician can be well paid for his work in a university clinic until such time as he elects to step out as a consulting practitioner, it will be difficult to induce any one to enter a pathologic laboratory.

The ambitions of the great clinic, though doubtless designed for and contributing toward other and better ends, are nevertheless well calculated to add the glamour of a scientific reputation to the emoluments of a rich practice. Your committee wishes firmly to state its belief that unless it is intelligently controlled, this movement, which is peculiar to the United States, will become a grave menace to the progress of medical science.

(3) Many pathologists, however, regard the financial question as rather secondary, although highly important.

At a recent after-dinner conversation seven pathologists told why they took up their careers. All acknowledged a strong desire for accurate knowledge and especially for new knowledge, which they felt could not well be obtained in the clinic. All expressed a strong aversion for the insincerities which they believed were forced on the practitioner of medicine. If these motives continue to exist, there will always be a certain number of men who choose to study medical problems in a pathologic laboratory regardless of financial considerations.

What, then, is pathology, that it can exert its attractions and induce men to pursue it through many obstacles?

Pathology is a branch of biology. It deals with morbidity in the animal and vegetable kingdom. It must be broadly comparative, although finding its chief aims human. It draws to its aid general biology, chemistry, physics, anatomy and physiology. It attacks the problems of disease from every side, clinical, morphological, bacteriological, experimental, statistical and historical, and its product forms a scientific basis for the care of the sick and the prevention of disease.

Its main interest is in the unsolved problems of disease, and when the solutions are reached they are turned over to the clinicians for practical employment, and become of secondary interest to the pathologist.

Certain things pathology is not. It is not morbid anatomy, although many of its tasks are most directly approached through this avenue. It is not pathologic histology, although a vast and intricate field is opened up by the microscope, and many clues to the nature of disease are thus revealed. It is not a preclinical

science. On the contrary, as stated by Sir George Newman, it is the first great clinical subject in the medical curriculum. It is *the* medical science. It is not the study of the cadaver but the investigation of the processes of disease which occur only in the living. It is not scientific clinical medicine, for the successful care of the sick requires and mainly develops other qualities than those of the investigator. For the same reason pathology will not prosper under the direction of the clinic.

The successful pursuit of pathology requires an elaborate organization to assure the aid of the fundamental sciences, to supply an extensive material and to provide space and means for the methods of laboratory study. The German pathologists were great mainly because of their correct conception of pathology, and their systematic organization.

Pathology has many urgent practical relations and there is a strong temptation for the pathologist to devote himself wholly to placing the results and technic of pathology at the routine disposal of the clinic. This field, however, is clinical pathology, and belongs to the clinician. Some are confirmed microscopists or morphologists, to the neglect of some broader aspects. Others are experimentalists and try to unravel the threads of disease under controllable conditions. Many have been designated reproachfully as etiologists, looking mainly for specific micro-organisms as the cause of disease. There are many sides to pathology, the study of disease, but the animating spirit is the pursuit of problems under favorable conditions.

Provide these conditions, and there will always be young men who choose pathology, in spite of financial and other difficulties.

Accordingly, most of our replies emphasize the great importance of improving the conditions under which the pathologist works, by better necropsy rooms, better equipment of laboratories, more necropsies, larger staffs of assistants and technicians and more time for original work, so that the pathologist may more often realize his ambitions.

There should be room in every well organized department of pathology for one or more experimentalists whose time should not be taken in teaching or in descriptive pathology, but whose interests and talents lie in the field of pure experimental research. There is no more stimulating environment for the genuinely original mind than the pathologic laboratory.

(4) An important matter is the reorganization of the pathologic work in hospitals. Much of this work in American hospitals is now done by inexperienced practitioners, chemists and dieners. The extent to which the lives and welfare of patients are jeopardized by assigning histologic diagnosis to technicians, mushroom commercial laboratories, and convenient but untrained

physicians, is appalling. A vast income and material are thus taken away from the support of competent pathologists. Since they can take care of the sick fairly well with a part-time clinical microscopist, the salary of a pathologist is often the last thing provided by many practitioners who organize and manage hospitals. They provide for many clinical tests on the living, but time does not permit the correction of errors on the dead, nor the pursuit of postmortem problems. We are glad to say that these deplorable conditions are being recognized, and efforts made to remedy them. The demand for pathologists far exceeds the supply. The practice of establishing pathologic internships for the period of a full year will start many young men on a course of sound training, and render them fairly competent to conduct the diagnostic work of a hospital if assisted by an older consultant. Reform in this field would greatly help pathology.

What Do You Advise the Committee to Particularly Emphasize in Their Report?—The answer is—pathologic anatomy.

The committee's canvass of the general situation in America reveals steadily diminishing attention to the importance of pathologic anatomy at the necropsy table as a means of educating students and physicians, and they believe that the standards of medical practice are bound to decline, and have declined, in a corresponding degree. We have been advised by a large majority of the heads of pathologic departments to emphasize this matter above all other considerations in our report. Curiously enough, this admonition comes most urgently from the pathologists who are located in large cities.

The pendulum has swung too far away from this fundamental basis of medicine. The American medical profession does not adequately know what disease does in the body, to the great detriment of the standards of practice, and the progress of research. Submersion in the multitudinous details of the care of the sick, elaborate cataloging of the ordinary phenomena of disease, pursuit of minor problems by half-trained researchers, multiplication of indirect and mechanical methods of diagnosis, have, for the time, submerged the necessity of a broad acquaintance with the mode of origin, relations, and effects of the gross lesions of disease.

As a system of therapeutics, medicine comes in constant conflict with the medical cults, but as a science fundamentally based on and controlled by pathologic anatomy, medicine is unapproached and unassailable.

Accordingly, we recommend a country-wide movement on the part of teachers of pathology and clinical medicine, university authorities, hospital governors, academies of medicine, public health organizations, pathologic societies, local and national medical associations, and especially this Association, by systematic

propaganda and appropriate legislation, to restore pathologic anatomy to its proper place in the scheme of hospital organization and general practice.

When this has been accomplished, we shall have saved the heritage of the time of Virchow, when the essential importance of pathologic anatomy was fully recognized. Thereafter, on a safe foundation, we may continue to build medical education and research by means of the more refined instruments of medical science.

REPORT OF THE COMMITTEE ON THE PEDAGOGICS OF BACTERIOLOGY AND PARASITOLOGY*

A. I. KENDALL
CHICAGO

MEDICAL BACTERIOLOGY AND IMMUNOLOGY

INTRODUCTION

Medical bacteriology and immunology, the youngest of the biologic sciences, are unique in that they deal not alone with the organisms peculiar to their domain, but they contemplate as well those complex reciprocal relationships which exist between host and parasite.

The monotony of form, characteristic of bacteria, combined with a considerable versatility of physiologic activity, has compelled the bacteriologist to pay much attention to means whereby such activities may be registered accurately, in order that they may serve as a supplementary basis for classification. These manifestations of cell activity in unicellular organisms, furthermore, have become most important phenomena for study, since it is through such considerations that the elucidation of the phenomena of parasitism and pathogenism, of infection and immunity, must be sought for.

"It is what bacteria do, rather than what they are," as Theobald Smith so aptly says, "since our interest centers in the host rather than in the parasite." What bacteria do and how they do it is a problem in dynamics—of chemistry and physics—rather than one of statics or morphology, and in this sense bacteriology is a focal point of the natural sciences.

Although bacteria play an important part in many fields of activity, the earlier developments of the subject were almost exclusively in the domain of medicine. The earliest tangible relationship of bacteria to human infection takes its origin in a communication on staphylococci and streptococci as causative agents in certain types of pyemia and sepsis by Pasteur in 1878.[1] Many of the most important phenomena of contagion, however, were most carefully described by Oliver Wendell Holmes in a classical study of puerperal fever, published in 1843.[2]

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* This committee consisted of Drs. E. R. Stitt, William H. Park and A. I. Kendall, Chairman.

[1] Communication to the French Academy of Sciences, April 29, 1878, published in Comptes Rendus de l'Acad. d. Sc. **86**:1037.

[2] Contagiousness of Puerperal Fever, New England Quart. J. M., 1843.

The subsequent history of the development of medical bacteriology has been largely in association with pathology, in the United States at least, although in Europe the affiliation has been in noteworthy instances with hygiene or in institutions devoted largely or exclusively to the subject itself. Within the last decade, biologic chemistry, physical and colloid chemistry, have developed to such a degree that new and important methods applicable to the study of bacteriology and immunology are available, leading to entirely new viewpoints, highly important for the advancement of these subjects. These advances have so enlarged the horizon of bacteriology that a gradual separation from the earlier affiliation with pathology is taking place.

In this regard, bacteriology is following a course somewhat parallel with that of biologic chemistry, which developed originally within and was taught as a part of physiology. The striking disclosures of biologic chemistry during the past decade have made it impossible for any one man or department to encompass the broad and divergent fields of investigation in physiology and biologic chemistry, however intimately they may be related at certain points of contact, and do justice to both. A separation has taken place, much to the advantage of each, and the wisdom of the severance is no longer questioned, even by those who most earnestly opposed the change at the time it was effected.

In like manner, bacteriology and immunology have developed to such proportions and in such divergent lines, that only the most exacting financial restrictions would appear to justify the inclusion of these subjects with pathology in a single department. It is worthy of note that in the earlier days when bacteriology was in its infancy, the field covered by pathology was restricted largely to morbid anatomy, a purely morphologic subject. Now pathology is making great progress along dynamic lines—in morbid or pathologic chemistry, and morbid or pathologic physiology. Pathology, therefore, even as bacteriology, by widening its legitimate field of activity has become a focal point of the biologic sciences.

The lesson to be learned from the emancipation of fundamental biologic sciences is the intensification of research in each individual field; the ultimate goal—the advancement of the domain of scientific medicine—is thereby more rapidly approached. It is obvious that bacteriology and immunology together constitute a definite entity in the medical curriculum. The future development of this important group will be best accomplished on an independent basis. A separation of bacteriology and immunology from pathology, therefore, appears to be logical, desirable and in the interest of the future development of the respective subjects.

It is desirable at this point to consider the rise and development of hygiene and preventive medicine. These subjects have an

important point of contact with bacteriology and immunology through the common factor of micro-organisms. It is undesirable in the present state of development of bacteriology to establish a formal line of demarcation between bacteriology and immunology, on the one hand, and hygienic bacteriology, on the other. Nevertheless, a rather definite viewpoint of the activities of bacteria which are in partial opposition to those of man is discernible in each subject.

Bacteriology and immunology consider primarily the phenomena attending the development of bacteria in the individual and the reciprocal relationships between the host and parasite. Preventive medicine and hygiene, on the other hand, is concerned more specifically with the modes of transmission of bacteria from host to host. The former deals fundamentally with the individual phenomena of infection and immunity; the latter with the more communal and vocational phenomena of contagion and prophylaxis. From this angle, the elucidation of cycles of invasion and infection of the host by parasitic and pathogenic microbes, together with the effects of environmental factors become subjects of paramount importance for investigation in the broad field of preventive medicine and hygiene. Equally relevant is the study of the seasonal distribution of bacteria and their mechanism of transmission from host to host.

The future developments in the bacteriology of disease, its diagnosis, mode of spreading, prevention and cure, will probably follow in no inconsiderable measure along these two lines. A time will almost certainly come, furthermore, when some degree of specialization between medical and hygienic bacteriology will be desirable. The immediate need, however, is to make educational conditions attractive enough to encourage men with training and aptitude to enter on bacteriology as a career.

REPORT ON THE PEDAGOGICS OF BACTERIOLOGY AND IMMUNOLOGY

The subjoined report, the Pedagogics of Medical Bacteriology and Immunology, is in response to a request from the chairman of the Committee on Pedagogics of the Association of American Medical Colleges. The material on which this report is based is found in the answers to a questionnaire on these subjects, mailed early in October, 1919, to the ninety-eight medical schools listed in the Educational number of the *Journal of the American Medical Association*, Aug. 16, 1919, pp. 500 and 501. This questionnaire consisted of two parts, devoted respectively to current practice and ideal courses of instruction. Inasmuch as bacteriology and immunology are relatively new subjects in the medical curriculum, current methods of teaching and application will of

necessity vary considerably in different institutions. This is clearly indicated in the replies elicited. This variation will be in detail, however, rather than in principle, because bacteriology and immunology are inherently relatively definite, homogeneous sciences whose scope is restricted to the activities, and the results of the activities, of a limited group of micro-organisms.

This report considers the relation of bacteriology and immunology to the other fundamental sciences, the field and purpose of bacteriology and immunology in the medical curriculum, prerequisites and preliminary courses, time and place in the curriculum, and research in bacteriology and immunology.

A copy of the questionnaire, together with a tabulation of the replies, is appended:

DISCUSSION

1. *The Scope of Bacteriology and Immunology in the Medical Curriculum.*—The consideration of pathogenic and related bacteria and their activities, together with those highly complex reciprocal relationships which exist between host and parasite, constitute the field of bacteriology and immunology in the medical curriculum. The activities of bacteria play a prominent part, both in individual and communal or social medicine.

A line of demarcation can be drawn in the interest of instruction between the fundamental courses in medical and hygienic bacteriology and immunology, on the one hand, and the supplementary applied courses—as clinical diagnosis—on the other. In the latter type, of course, the activities of bacteria are considered in intimate association with biologic chemistry, physiology, and other fundamental sciences, for the solution of practical problems in the immediate interest of the patient rather than the science. Similarly, advanced work in applied immunology is frequently offered in the courses of dermatology and syphilology. In many medical colleges, furthermore, students are required to make bacteriologic observations and diagnoses on appropriate dispensary and hospital patients. Usually, the supervision of this work is under the respective clinical instructors, but the department of bacteriology and immunology should be always available for consultation in unusual or difficult cases.

2. *The Purpose of Bacteriology and Immunology in the Medical Curriculum.*—These subjects, bacteriology and immunology, are too extensive to present in their entirety in the medical curriculum. It is necessary, therefore, to restrict the subject matter to correspond with the time available for instruction. Inasmuch as the length of the course differs in different medical schools, the ground covered in bacteriology and immunology varies somewhat.

It is a safe generalization, however, to state that the fundamental courses in bacteriology and immunology should be designed

with particular reference to the future needs of the student, in so far as such a program does not interfere with an adequate exposition of the principles of the subject, and a consistent, progressive laboratory course to compel familiarity with the important groups of pathogenic bacteria and with technical procedure. The fundamental courses must include as a minimum as much of the theory and practice of bacteriology and immunology, in other words, as shall enable the student to utilize comprehensively his knowledge of the subjects in the interest of the patient and the community.

The fundamental course in bacteriology is usually both didactic and practical, approximately one-fourth to one-third of the time being devoted to lectures, quizzes, and demonstrations, the remainder to practical experience with the organisms themselves.

The didactic course usually consists of a systematic presentation of the principles of bacteriology, and of the relationships between bacteria and the host. This involves a brief discussion of the salient features of the anatomy, physiology and chemistry of bacteria, their relation to other micro-organisms, and an exposition of their reciprocal relationships with the host. The relationships between host and parasite lead directly to the principles of immunology.

The fundamental principles of immunology are inseparably connected with the course in bacteriology and in a majority of medical colleges, particularly those which schedule 125 hours or more for the work in bacteriology, this arrangement is adhered to. Detailed instruction and practice in immunology is presented in a special advanced course. This appears to be a wise policy.

Quizzes and demonstrations test the mental progress of the student and illustrate phenomena inapplicable to individual performance.

The laboratory course is devoted chiefly to a systematic study of the important bacteria which are parasitic or pathogenic for man. This requires the acquisition of bacteriologic technic, and a careful study of the details of isolation and recognition of these bacteria, the factors underlying their occurrence and significance in lesions and morbid conditions, and a practical working knowledge of their immunologic reactions, where such exist. Special emphasis should be placed on the repeated examination of material from which the various microbes may be sought for in naturally occurring processes. The importance of repeatedly testing the ability of the student to perform and evaluate such examinations cannot be overstated.

When time is available, the student should reproduce experimental infection in animals and become familiar with the essential features of antibody production and the preparation and

standardization of the more common and important therapeutic agents of bacterial origin. Not infrequently, the latter is reserved for the course in immunology.

A word may be said at this point about the instructor in bacteriology. It is distinctly against the interests of bacteriology, both with respect to teaching and research, to permit a junior member of another department to present the courses in bacteriology and immunology. The primary objective of the instructor is advancement to a senior position in the primary subject. Naturally, the investigational work of such an individual will be along lines that will attract attention to the subject in which he seeks advancement. This is neither in the interest of the individual nor the subjects in which his activities are confined.

On the other hand, a tendency toward specialization in either medical bacteriology and immunology, or hygienic bacteriology, is clearly discernible and, in general, those who enter on bacteriology as a career will find that their interests will be drawn toward one or the other aspect of the subject. The underlying cause for this line of demarcation is not primarily a difference in subject matter. The developments of bacteriology in the domain of communal or social medicine are as yet largely in prospect—rather, the origin is to be sought for in the difference in affiliation with which the medical and the hygienic bacteriologists respectively must become allied.

Present conditions emphasize the desirability of creating conditions which shall induce young men of promise to enter on bacteriology as a career; future developments, particularly in the field of hygiene, will point out more definitely the degree of specialization which is desirable within this field.

3. *What Prerequisite Courses Are Desirable as Introductory to the Study of Bacteriology and Immunology?*—Bacteria are fundamentally living chemical reagents or entities, which in the domain of medicine enter into complex reciprocal relationship with a living host. Such being the case, it is not surprising to read in the replies to the questionnaire, on this point, that biology and organic chemistry are regarded as essential prerequisite subjects by 80 per cent. of the answers. To be explicit, out of a total of twenty-nine answers to the question relating to essential prerequisite courses, twenty-four specified biology and twenty-four specified organic chemistry. Twenty out of the twenty-nine specified both biology and organic chemistry. Eleven mentioned biologic chemistry, and of these several failed to state specifically both organic and biologic chemistry on the grounds that organic chemistry must of necessity precede biologic chemistry. The gradual development of the newer fields of colloid and physical

chemistry, which promise such important developments in certain lines, were mentioned as essential prerequisite courses to bacteriology by seven out of a total of twenty-nine.

It can definitely be stated that biology [entrance requirement], organic chemistry [entrance requirement in many medical schools] and biologic chemistry together furnish a proper background for the study of bacteriology. A time will come in the not distant future, when physical and colloid chemistry will develop to such an extent that a knowledge of these subjects will also be a necessity.

4. *What Preliminary Courses Are Desirable for Medical Bacteriology and Immunology?*—The technic of bacteriology and of immunology is essentially different from that of any other fundamental medical science. The necessity of dealing with cultivatable living organisms, wholly apart from all other living organisms, involving not only isolation but cultivation as well, introduces factors of culture media, staining methods, biochemical and physiological procedures, and the use of experimental animals, the principles of asepsis, and other features which should be practically mastered before the student can realize satisfactory results. In terms of current practice, the technic of bacteriology, the study of a considerable number of bacteria, and the principles and practice of immunology, must be mastered within a span of 126 hours. according to the program now in general use. In this connection, the average time devoted to bacteriology and immunology in medical schools at present, judging from twenty-nine definite replies, is about 150 hours. The ideal program suggested for bacteriology is 145 hours with an additional allowance for immunology.

Much of the embarrassment now experienced in regard to time would be overcome if a general course in bacteriology could be made an entrance requirement, but two highly important factors are in opposition to this possibility. First, the colleges which give premedical work are not, except in unusual instances, equipped with the personnel or materials to give such a course, and, secondly, the courses in chemistry, organic and physiological, are not completed before such a course could be started profitably. It is necessary, therefore, to devote a not inconsiderable percentage of time required for the study of pathogenic bacteria to the acquisition of general bacteriological technic. For the present, the handicap must be endured, because the medical curriculum is not indefinitely extensible and a proper balance with other subjects must be maintained.

A few replies state that pathology, anatomy and histology, or physiology, should be required courses preliminary to medical bacteriology. Bearing in mind the distinction drawn before between the fundamental course in the theory and principles of

bacteriology, and the practice of applied bacteriology in the course in clinical diagnosis, it is not illogical to refer these suggestions to the latter course, where a conjunction of bacteriology with pathology, chemistry and physiology comprises the greater part of the subject matter.

5. *The Position of Medical Bacteriology in the Medical Curriculum.*—Replies to the questionnaires, both with respect to current practice and ideal or future development, indicate that the second or sophomore year of the medical curriculum is most commonly regarded as the best time to present the course in medical bacteriology. This appears logical in view of the fact that the course in biological chemistry is completed before this period is reached, in a majority of medical colleges. Biological chemistry is a very important prerequisite course to medical bacteriology.

The actual statistics are as follows: Nine medical colleges offer medical bacteriology in the first year, and eighteen the second. No replies indicate that the subject is given in the clinical years. The ideal program indicated that eight institutions would offer the work in the first year, seventeen the second, three in the third, and one in the senior year. In general, the tendency in American medical colleges has been, and still is, to concentrate the preclinical work in the first two years. In France, bacteriology is frequently given in the third year, but it should be remembered that the scientific or fundamental courses are given there for somewhat longer periods than appears to be the case in the United States.

The advantages that are associated with the presentation of bacteriology in the sophomore year will become more apparent when the students in clinical courses are required to perform systematic, routine laboratory examinations in connection with their physical survey on appropriate patients.

There appears to be no definite choice of the semester in which the course in medical bacteriology is presented. If immunology follows the course in bacteriology in the second year, either as an advanced course or as an elective course, some advantage might be attained by giving the fundamental work in the earlier portion of the academic year.

The amount of time devoted officially to bacteriology deserves special mention. The present approved curriculum apportions 3.5 per cent. of time, or a total of 126 hours, to bacteriology and immunology. Nevertheless, the replies from twenty-nine schools which answered this question specifically indicate that 150 hours is the average amount of time devoted solely to medical bacteriology. The time which was regarded as sufficient in the ideal program was 145 hours, with an extra period for immunology. One hundred and fifty hours, therefore, would appear to be a reasonable allotment, and inasmuch as the average from all

schools coincides with this figure, at the present time, it may be confidently assumed that no additional burden will be imposed on the curriculum or the student to maintain this procedure.

It is, of course, important to have consecutive time for the work. Bacteria are living reagents, and reactions of significance must be observed at proper intervals. Otherwise, the effort is utterly lost. The plan of five consecutive afternoons of each week for the required period has much to recommend it, even though the course must be brought to a close before the formal end of a semester. If immunology follows medical bacteriology and a period of forty to fifty hours is allotted to it in addition to the 150 hours for bacteriology, the two courses together make just about a full semester's work. The continuity of the subject matter lends itself admirably to such an arrangement.

6. *Immunology.*—Those complex, reciprocal relationships between host and parasite which comprise the phenomena of infection, resistance and immunity constitute the domain of immunology. The underlying facts and principles of immunology are inseparably associated with bacteriology. The practice, and the more refined aspects of the theory are susceptible of independent treatment, and they are advantageously presented to the student of medicine as an independent, advanced course.

7. *Prerequisite Courses Desirable as Introductions to Immunology.*—The fields of organic, biological, colloid and physical chemistry, together with certain aspects of physiology, notably the physiology of blood and other circulating media, are brought into intimate relations with pathogenic and parasitic microbes through the common factor of immunology. A reasonably thorough knowledge of these subjects, therefore, is of practical importance for the study of immunology. One medical college made the extremely interesting and important suggestion that a course in physical measurements should precede the course in bacteriology and immunology. The committee is of the opinion that such a course, judicially selected with reference to the needs of the student of medicine, would be a most useful prelude to a number of the preclinical subjects. This view is reflected in the answers of five institutions that physics should be a prerequisite course. Physics is an entrance requirement, but it is very probable that emphasis might be profitably place on those divisions of physics which are of immediate concern to the medical student, touching less extensively on other aspects of the subject.

It would be unprofitable, however, to enter on a discussion of premedical subjects in this report. Many universities are unprepared to offer specialized work in several important premedical courses at the present time. At some future conference, this subject of premedical courses will have to be reopened in the interest

of economy of time in the medical curriculum. For the present, the courses prerequisite to bacteriology together with some physiology are highly important as introductory to the study of immunology.

8. *Preliminary Course Desirable for Immunology.*—It is almost axiomatic that a systematic course in medical bacteriology is an essential preliminary to the study of immunology. The general principles of immunology, on the other hand, and a not inconsiderable amount of practice, must of necessity be given to the fundamental course in bacteriology. The ever-increasing number of culturally identical, but serologically different strains of pathogenic organisms, as the meningococcus, tetanus and dysentery bacilli, is illustrative of the importance of immunologic reactions for the ultimate identification of bacteria.

It may be stated at this point that serologic variants within a cultural type of micro-organism may become of paramount importance for investigation in the domain of hygienic bacteriology. The introduction of serologically alien strains to a community by unrestricted immigration or otherwise, may conceivably lead to epidemics among theoretically resistant groups of people. Thus, an alien serologic strain or type of typhoid bacilli, introduced from without by a carrier, might be a starting point for an epidemic of typhoid fever in a theoretically protected group. The geographic distribution of serologic variants of pathogenic bacteria, in other words, will be a fruitful field for investigation.

9. *Should Immunology be a Separate Course in the Medical Curriculum?*—Immunology is given in association with the fundamental course in medical bacteriology in fully one-half of the medical colleges which offer work in this subject at the present time, judging from the replies to the questionnaire. It is significant that a clear majority of teachers favor the presentation of practical work in immunology in a separate course in an ideal program. The apparent difference between current practice and ideal procedure is statistical rather than actual, however, inasmuch as the subject matter of immunology is essentially the same whether published as a separate course or as a continuation of, or an advanced course in, bacteriology.

In general, it may be stated that the amount of time to be devoted to an independent course in immunology will depend on the amount of instruction, both in theory and practice, given to it in the fundamental course of medical bacteriology. It is not deemed advisable for this reason to recommend formally that a separate or distinct course in immunology should be made an integral part of the medical curriculum. On the other hand, the ever-increasing importance of immunologic phenomena in diagnosis, prevention and treatment of disease affords ample justification for the inclusion of a course of instruction in immunology as

a routine for the medical student. Local conditions will determine whether this course shall be a continuation of medical bacteriology, an advanced course in bacteriology, or a separate course specifically designated. In any event, systematic instruction in the entire subject should be offered rather than the mere acquisition of technic in a special or limited field.

10. *Clinical or Diagnostic Bacteriology.*—Clinical or diagnostic bacteriology is essentially applied bacteriologic practice. Applied bacteriology, together with applied biochemistry, applied physiology and other preclinical subjects, are usually grouped together as a composite course of the medical curriculum known as clinical diagnosis. The primary objective of such a course is to utilize the combined resources of the preclinical subjects in the interest of the patient. As the preclinical subjects develop, the importance of courses in clinical diagnosis, as liaison or intermediary departments, uniting the laboratory and clinical branches, will receive increasing attention. The artificial chasm between the laboratory and clinical years can best be bridged by the extension of intermediary instruction. The improvement of bacterial procedures, and their introduction into the domain of clinical diagnosis, will be a factor in the realization of this program.

11. *Hygienic or Sanitary Bacteriology.*—It has been stated above that the details of extrinsic phases of the parasitic and pathogenic bacteria may be logically and conveniently referred to preventive medicine or hygiene. The more general phenomena are very properly considered in the course in medical bacteriology. The part played by bacteria in food, air, water and other environmental factors is a connecting link between the purely medical and the social aspects of medicine. The bacteriology, or more accurately, the microbiology of food, air and water should receive some attention in the curriculum of the medical student. The time and place will be determined largely by local conditions. The development of courses in preventive medicine or hygiene will gradually absorb the environmental aspects of microbiology.

12. *Research.*—A university, and therefore every department of a university, has two primary and distinct functions: To impart available knowledge, and to advance the frontiers of knowledge. Medical bacteriology, immunology and hygienic bacteriology cannot justify their claims to recognition in the medical sciences, nor should they enjoy separate and distinctive places in the curriculum, if opportunities for original work are not offered to faculty and students alike.

It is most suggestive for the claims to recognition of bacteriology and immunology as distinct entities that two thirds of the replies received indicate that investigational work is offered to both students in course and to those seeking university degrees. The committee believes that all medical schools which are worthy

of recognition as university medical schools should provide the physical basis for productive investigation in bacteriology and immunology.

SUMMARY

The committee recommends:

1. Bacteriology and immunology should constitute a separate and distinct department in the division of medical sciences and should be so recognized in the medical curriculum.

2. Biology, organic and biologic chemistry should be prerequisite courses to be completed by medical students before the course in bacteriology is entered on.

3. Bacteriology and immunology should be given in the second or sophomore year of the medical curriculum. It is recommended that immunology be presented as an advanced course in bacteriology, or preferably as a distinct course, following immediately the fundamental course in medical bacteriology.

4. One hundred and fifty hours should be allotted to bacteriology in the approved and official medical curriculum; an additional period of fifty hours should be apportioned to immunology.

5. A course in general bacteriology of at least three semester hours should be made a premedical subject when the next revision of the premedical schedule is undertaken.

6. When adequate time is officially apportioned to courses in preventive medicine and hygiene, the communal and prophylactic or preventive aspects of bacteriology should become subjects for special emphasis and study in these departments. At the present time the highly important field of communal bacteriology is scarcely touched on, either in theory or in practice.

7. The committee recommends that adequate time and equipment be afforded for research in the broad fields of bacteriology and immunology. The advancement of the frontiers of these subjects is a genuine obligation of every university medical school.

8. The future of bacteriology and immunology is unalterably associated with departmental independence.

QUESTIONNAIRE

October 25, 1919.

Dear Doctor:

The Committee on Medical Education and Pedagogics, of the Association of American Medical Colleges, has appointed a subcommittee consisting of Admiral E. R. Stitt, Dr. William H. Park and Dr. Arthur I. Kendall, to present a formal report on the pedagogics of Bacteriology and Zoology. This report will be of value in so far as it reflects accurately a resultant of current practice and ideal development or extension of these subjects in the curriculum of medical schools in the United States.

The enclosed questionnaires are designed to reduce to tabular form that information of current practice and ideal extension which can be reproduced graphically. They do not and can not cover the field completely. The information asked for is a minimum. No attempt is made to enter into details of equipment, personnel, or instruction. The primary object is to chart the broader aspects of the present status and to estimate, if possible, future desirable developments, with due consideration to the obvious limits of time and relationship to the broad fields of medicine.

It is earnestly requested that marked and, if necessary, annotated tabular reviews of courses of instruction in these subjects be included in the replies. Information and explanation will be gratefully received by the Committee.

Inasmuch as the information desired must be obtained in many instances from more than one department of instruction, the Questionnaires are addressed to the executive officer of each school, as published in the last report of the Committee on Education of the American Medican Association, under date of August 16, 1919. The distribution of the blank forms, the entering of the data, their collection and prompt return, constitute a courtesy for which the Committee will be deeply grateful.

For the Committee,

ARTHUR I. KENDALL, Chairman.

A. BACTERIOLOGY AS TAUGHT

	Hours	
	Year	Lecture	Laboratory
1. Prerequisite courses required[1]			
2. Preliminary courses required[2]			
3. Medical Bacteriology			
4. Immunology[3]			
5. Clinical Bacteriology[4]			
6. Sanitary Bacteriology[5]			
7. Other courses in Bacteriology			
8. Research[6]			

B. IDEAL PROGRAM FOR BACTERIOLOGY

I. A. Should Bacteriology be a Separate Department, or
Should Bacteriology be given under the direction of one of the following groups:

Pathology *Hygiene* *Clinical Diagnosis*

	Hours	
	Year	Lecture	Laboratory
B. What prerequisite courses should be required for Medical Bacteriology?			
1. Chemistry?			
2. Biology?			
3. Other Courses?			

1. Biology, Chemistry, etc.
2. General Bacteriology.
3. When given as a Special or Advanced Course.
4. Routine examinations of pus, sputa, feces, urine, etc., other than the regular course in Bacteriology.
5. Examination of Air, Food, Water, Milk, etc., either alone or as a part of a course in Hygiene.
6. Credit given for original work either in course or toward advanced degrees.

C. What preliminary courses should be required for Medical Bacteriology? Year Hours: Lecture, Laboratory
1. Medical Bacteriology?
2. Other Courses?

II. A. Should Immunology or Serology be a separate course?

B. What prerequisite courses should be required for Serology?
1. Physiology?
2. Chemistry?
3. Other Courses?

C. What preliminary courses should be required for Serology?
1. General Bacteriology?
2. Medical Bacteriology?

What Year and Semester should include Serology?
How Many Hours?

What Year and Semester should include Medical Bacteriology?
How Many Hours?

If the following additional work be given in Bacteriology, please indicate the year and hours:
Clinical Bacteriology, or
Clinical Diagnosis
Sanitary Bacteriology

Other Courses?

A. Medical Zoology or Parasitology as Taught

	Year	Hours: Lecture	Laboratory
1. Prerequisite Courses Required[1]			
2. Preliminary Courses Required			
3. Medical Zoology or Parasitology			
4. Other Courses in Zoology or Parasitology			

B. Ideal Program for Medical Zoology or Parasitology

A. Should Medical Zoology be a separate department, or should it be given in affiliation with: Bacteriology ——— Pathology ——— Clinical Diagnosis ——— Hygiene———

B. What prerequisite courses should be required for Medical Zoology?
1. Biology?
2. Zoology?
3. Other Courses?

C. What preliminary courses should be required for Medical Zoology?
1. Pathology?
2. Other Courses?

D. What Years and what Semesters should include Medical Zoology?

1. Biology, Zoology.

E. If additional work is given, please indicate years and hours:
Clinical Diagnosis
Hygiene
Other Courses?

APPENDIX

The questionnaire elicited replies from thirty-one medical colleges. A large majority of these replies were sufficiently detailed to give the desired information. The following tabulation, in parallel, contains the essential details:

TABLE 1.—BACTERIOLOGY

	Bacteriology as Taught No. of Colleges	Ideal Program in Bacteriology No. of Colleges
PRE-REQUISITE COURSES:		
General Admission[1]	31	29
Biology	21	24
Chemistry (organic)	22	24
Chemistry (biological)	10	11
Chemistry (physical)	0	5
Chemistry (colloid)	0	2
Physics	8	4
Anatomy	3	0
Physiology	3	0
Modern Language	1	3
Psychology	0	1
Not specified	9	2
Biology and chemisty	20	20
Biology and organic chemistry	9	11
Hygiene	0	1
PRELIMINARY COURSES:		
None required	25	10
General Bacteriology	6	15
Pathology	0	6
Anatomy and Histology	3	5
Physiology	0	6
YEAR IN CURRICULUM:		
I	9	8
II	18	17
III	0	3
IV	0	1
I and II	0	2
Not specified	4	0
SEMESTER IN CURRICULUM:[2]		
I	4	8
II	3	8
I and II	2	1
Not specified	22	14
HOURS REQUIRED:		
Lecture Hours		
Greatest	96	48
Smallest	12	20
Average	41 +	36 +
Number of replies	24	18

1. Regular two years' premedical work; no mention of specific subjects.
2. In no case where the time was definitely stated did the term trimester appear.

	Bacteriology as Taught No. of Colleges	Ideal Program in Bacteriology No. of Colleges
Hours, Laboratory:		
Greatest	180	175
Smallest	50	50
Average	115 +	106 +
Number of replies	24	18
TOTAL HOURS:		
Greatest	272	300
Smallest	48	48
Average	151 +	145 +
Number of replies	29	29
SEPARATE COURSES OR SEPARATE DEPARTMENT:		
Bacteriology a Separate Department		11
Bacteriology with Pathology		8
Bacteriology with Hygiene		5
Bacteriology separate or with Pathology		3[3]
Bacteriology separate or with Hygiene		1
Bacteriology with Hygiene or Pathology		1

TABLE 2.—IMMUNOLOGY

	Immunology as Taught	Ideal Programme for Immunology
PRELIMINARY COURSES:		
Chemistry		21
Physiology		22
Anatomy		1
General Pathology		4
Biology		1
Colloid Chemistry		2
Physiological Chemistry		18
Physics		5
Physical Chemistry		2
Physical Measurements		1
None Required		6
PRE-REQUISITE COURSES:		
General Bacteriology		20
Medical Bacteriology		24
Pathology		1
None Required		4
Separate Course:	4	15
Course with Medical Bacteriology	11	4
Course with Medical Bacteriology, advanced course to follow	0	6
Course with Medical Bacteriology, advanced course elective	7	3
Course in Medical Bacteriology, advanced course with Hygiene	1	0
Elective Course [Separate]	3	1
Elective Course in Clinical Pathology	1	1
Not given	4	1

3. Separate department if on a University basis.

	Bacteriology as Taught No. of Colleges	Ideal Program in Bacteriology No. of Colleges
YEAR:		
I	1	0
II	4	12
III	2	8
IV	3	6
Not specified	17	4
Not given	4	0
SEMESTER:		
I	0	9
II	2	7
Not specified	29	15

CLINICAL BACTERIOLOGY

	Bacteriology as Taught	Ideal Programme in Bacteriology
Separate Course	5	5
Separate Course, elective	2	1
With Clinical Diagnosis	16	15
With Clinical Diagnosis, elective	2	1
With Hygiene	0	8
With Hygiene, elective	0	3
With Clinical Medicine	1	5
With Medical Bacteriology	5	0
With Clinical Clerkship	2	0
Not given	2	2
Average time	51 hours	

SANITARY BACTERIOLOGY

With Medical Bacteriology	12	0
Separate Course	1	5
With Hygiene	8	..
Elective Course	4	4
Not offered	6	4
No Report	0	18

RESEARCH

Elective	23	..
Not Offered	6	..
No Report	2	..

MEDICAL ZOOLOGY OR PARASITOLOGY

INTRODUCTION

Medical zoology, animal parasitology or parasitology is that branch of natural science which treats of members of the animal kingdom whose activities are directly or indirectly in opposition to those of mankind.

The term parasitology is commonly applied to this subject, but this usage is clearly incorrect because many human parasites belong to the plant kingdom. Animal parasitology is not open to this criticism, but it has the disadvantage of excluding, in theory at least, certain insects which are or may be accidental mechanical carriers of infection. It is also a binomial. Medical zoology is

also a binomial, but it is somewhat more desirable than either parasitology or animal parasitology in that no false premises are inherent in its use. An entirely new name is desirable. The committee hereby registers its inability to formulate it and adheres to medical zoology, pending the substitution of a satisfactory monenomial.

Medical zoology and bacteriology possess in common relationships between host and parasite, but the former is a much less homogeneous subject than the latter. The domain of bacteriology is restricted to micro-organisms belonging to very similar and related groups. The domain of medical zoology, on the contrary, includes organisms as remotely related as the protozoa, which are microscopic or nearly so and the serpents, some of which are very large. Again, there is no well-defined analogue of immunity discernible in the relations between pathogenic animals and man, although antibodies may be produced to the venom of serpents and the poisons of spiders, and perhaps a few other animals. Among the smallest animal parasites, reciprocal immunologic relations with man are practically unknown at the present time.

It is worthy of note that the geographic distribution of animal infections of man are more sharply defined than diseases of bacterial causation. It follows that material suitable for instruction and study is more difficult to obtain from the zoologic field than from the domain of bacteriology.

REPORT ON THE PEDAGOGICS OF MEDICAL ZOOLOGY OR PARASITOLOGY

DISCUSSION

1. *The Scope of Medical Zoology in the Medical Curriculum.*—A complete and comprehensive course in medical zoology would comprise a study of the parasitic protozoa—chiefly the rhizopoda, sporozoa and flagellate—the worms—cestodes, trematodes, nematodes—the arthropods, including spiders and myriapods, and the insects including principally fleas, lice, biting flies and mosquitoes. Poisonous fish and venomous reptiles should have at least some mention. The course of instruction in medical schools of the United States, when given, is usually restricted to the pathogenic protozoa and the vermes.

2. *Prerequisite Courses Desirable as Introductory to the Study of Medical Zoology.*—A survey of the comparatively few definite responses to the questionnaire sent to the various medical colleges indicates that biology and zoology are regarded as essential introductory or prerequisite courses for the study of medical zoology by a majority of teachers. It is indeed fortunate that these subjects are required premedical subjects. In addition to biology and zoology a smaller number of related courses—as advanced zoology or comparative anatomy—are individually sug-

gested. One institution suggests that medical zoology be made a premedical elective course. Seven colleges do not offer work in the subject at all.

3. *Preliminary Courses Desirable for the Study of Medical Zoology.*—One half of the replies indicate that bacteriology is a required preliminary course, and about the same number believe the ideal program for medical zoology should also be based on this requirement. Inasmuch as protozoology is not infrequently given as part of the course in bacteriology, in many schools at least, this requirement is not surprising. It is to be interpreted as an expression of existing conditions rather than ideal procedure, however, because bacteriology and protozoology have relatively little fundamentally in common.

In this connection the great increase in replies requiring pathology as a preliminary course for an ideal program in medical zoology is extremely significant. It not only suggests a gradual emancipation of protozoology from bacteriology, which is theoretically wise, but it emphasizes the fact that other members of the animal kingdom than protozoa are formidable antagonists of man.

4. *The Position of Medical Zoology in the Medical Curriculum.*—The final decision of the position of medical zoology in the medical curriculum rests on two very important points: Is medical zoology to become a required subject in the program of instruction, and, if so, is its affiliation with bacteriology, pathology, clinical diagnosis or hygiene, or should it be a separate entity?

Replies to the questionnaire are almost individualistic in their response both with reference to the question of affiliation and time and place in the curriculum. The last report of the Council on Medical Education, which contains the official curriculum, fails to mention medical zoology (parasitology) and this may be a factor in the case. It is a notorious fact that the medical program is already overcrowded, and medical colleges are loath to offer courses not specifically recommended in the official curriculum. The expense of maintaining courses not deemed essential is a deterring factor in many institutions.

In general, medical zoology is not systematically taught in American medical schools. In this respect there is a sharp contrast with English and French schools of medicine, where medical zoology receives much attention. Very probably, the interest of European countries in their tropical and subtropical colonial possessions has stimulated interest, and created a demand for instruction, in diseases of animal causation. The close relationships between colonial and home medical military service, and the relatively large number of graduates in medicine who for one reason or another spend some time in the tropics has undoubtedly

given an impetus to the study of medical zoology, which is unfortunately lacking in the United States.

The committee believes that medical zoology is an important medical subject—important enough to justify the allotment of at least forty hours in the medical curriculum. Furthermore, the subject should receive official recognition in the medical program. Past experience, however, fails to offer any very tangible suggestions for present needs and future developments, and the committee is undisposed to make definite recommendations concerning prerequisite and preliminary courses, place in the curriculum, or subject matter other than that outlined above.

It is suggested that the Council on Medical Education appoint a committee drawn from the several geographic and climatic divisions of the United States and its insular possessions to discuss the entire question of medical zoology in relation to the medical curriculum. A study of representative European courses would undoubtedly be helpful, if evaluated in terms of the needs of American graduates in medicine.

APPENDIX

TABLE 3.—MEDICAL ZOOLOGY OR PARASITOLOGY—PARASITOLOGY AS TAUGHT

1. PRE-REQUISITE COURSES:	
General Admission	7
Zoology	10
Biology	12
Anatomy	3
Botany	2
Physics	1
Advanced Zoology	1
Comparative Anatomy	1
Course not given	7
Elective course only	1
Premedical elective course	1
2. PRELIMINARY COURSES:	
None required	13
Bacteriology	6
Physiological Chemistry	3
Pharmacology	1
Pathology	1
Clinical Diagnosis	1
Advanced Course in Bacteriology	1
3. ADMINISTRATION OF PARASITOLOGY:	
Separate Course	2
With Bacteriology	5
With Pathology	5
With Hygiene	1
With Clinical Diagnosis	2
With Bacteriology and Clinical Diagnosis	1
With Pathology and Clinical Diagnosis	2
With Bacteriology, Pathology, and Clinical Diagnosis	1
With Pathology, Clinical Diagnosis and Hygiene	1
With Clinical Pathology and Hygiene	1

TABLE 4.—Ideal Programme for Parasitology

1. ADMINISTRATION OF PARASITOLOGY:	
Separate Department	3
With Bacteriology	3
With Pathology	3
With Clinical Pathology	3
With Clinical Pathology, and Clinical Diagnosis	1
With Pathology and Hygiene	4
Several Complex Combinations	..
2. PREREQUISITE COURSES:	
Zoology and Biology	11
Biology	3
Zoology	4
Entomology	2
Advanced Zoology	2
3. PRELIMINARY COURSES:	
None required	3
Pathology	16
Medical Bacteriology	12
Clinical Diagnosis	3
Hematology	1
Pharmacology	1
Biological Chemistry	2
Physiology	2
Anatomy	2
Physics	1
Preventive Medicine	1
4. YEAR AND SEMESTER:	
No Agreement	
5. PARASITOLOGY IN OTHER COURSES:	
Clinical Diagnosis	12
Hygiene	9
Autopsies	1
Tropical Medicine	2

DISCUSSION ON REPORTS ON PATHOLOGY AND BACTERIOLOGY

Dr. Louis B. Wilson, Rochester, Minn.: Getting more men to go into pathologic work is essentially a question of finance. It seems to me, we men in the fundamental sciences are in the attitude of the chap who has fallen through the ice and just before he is on the edge he takes the opportunity of trying to pull in the other fellow who is trying to help him out. We ought to do a little kicking for ourselves. It does seem to me that some of the departments are so well under water that they are almost lifeless, and I believe the fundamentals in medicine should have their noses above water. Do not let us drag down the other fellow, but let us do a little kicking ourselves and try to get out.

To take up one or two other points, I cannot wholly agree with Dr. Ewing on the impossibility of teaching men autopsy technic in the undergraduate course. I do agree with Professor McGuigan as to the undesirability of teaching men how to do brain tumor operations. One of the worst things is the undergraduate men who come for surgical training and who have had some surgical training. He swells up and says he is an assistant to Doctor So and So. It takes two years to get the fear of God into him. It is not impossible to teach men quickly reasonably good autopsy

technic, and unless we teach them this in their undergraduate days they never get it after they get out, and they lose in a large measure their autopsy work and experience.

In France autopsies were made on bodies of persons dying in hospitals in which there were laboratories. We had only 12 or 14 per cent. of autopsies at first, but when we started a vigorous campaign in September, 1918, we were having postmortems on 92 per cent. of all persons who died in hospitals. Although the laboratory division closed in May, 1918, we received 16,000 protocols which showed that about 70 per cent. of the postmortem examinations had been done in a competent manner. These autopsy protocols were signed by 417 men, 250 of whom received credit "good" or better than good. These postmortems were not beautiful works of art, but they did show what men needed to know as surgeons and clinicians. If we teach men a little autopsy technic, they will not be so stupidly crude when they come to the necessity of doing work afterward.

Let me make another suggestion: As I visit various institutions where experimental work is done, I am struck with the crudeness of the autopsy technic on laboratory animals. We can teach autopsy technic to a large extent on experimental animals, and as investigators we are making autopsies on animals in the most absurdly stupid manner, many of us, and we are teaching men by observation in a very imperfect way. Pardon me for referring to some of these things because I feel that it may be of interest to you to say just a word from the attitude of the graduate school concerning pathology.

There is not a lack of interest in pathology. The young intelligent graduate student is much interested in it for his own benefit in his subsequent clinical work. Ninety per cent. of the men coming to us ask for pathology as the minor; which means six months. Only two out of 1,027 asked for pathology as a major. There is the whole story. They have not had enough pathology and must get it.

As to the facilities for giving it, we can give it. We have seven men devoting their whole time to that work, and the work we are getting from surgical specimens and autopsy specimens, so that I would like to call your attention to the fact that it is possible to get autopsies. We have about 156,000 cataloged specimens in our museum, more than 12,000 varieties alone, and these have grown up from the surgical clinic of approximately 12,000 operations a year, and 600 postmortems last year. These 600 postmortems represent from 85 to 90 per cent. of all deaths that occur in the clinic. These autopsies are made by students under the immediate supervision of the instructor who is a competent man. Furthermore, on him, as on me, rests the duty to get permission for postmortems. I want to say to you, it is possible to get postmortems in any hospital in this country in a much higher percentage than we get them now. The men I am speaking of would get postmortems in the Sahara Desert; but you cannot expect to get a director for $3,500.00 a year or twice that amount for a pathological institute like Blockley, a man who has had five years experience in pathology, who must be an executive, who must be an investigator, who must be all the things we would like him to be. It is all nonsense to offer such a man $3,500.00 a year. At the other end of that great State of Pennsylvania they are paying coal miners nearly that much for digging coal. I speak advisedly because I have the figures on it.

One thing more concerning the teaching of pathology. As men come to us I find that they lack personal touch with the pathologist, and if you will pardon me as a teacher of pathology, I have to make this criticism, that they have the attitude of men who have been spoon fed with their mouths open. They do not know how to do the work themselves.

In one sense, the Mayo Foundation is not a teaching institution if you mean that is the way we are teaching pathology. It is difficult to take men who are intensely anxious to get work in pathology to change that attitude. I do not know where to lay the blame. We will not blame the pathologists for it.

I wish to say a word in earnest support of what Professor Ewing has said on the importance of teaching pathological anatomy. For years I have watched the attendance at the meetings of the American Association of Anatomists, and it is larger than the attendance at the meetings of the Association of American Pathologists and Bacteriologists, simply because there is so little attention given to pathological anatomy. It is not everything at all; it is only a little narrow field but it is an important field, and we ought not to neglect it as much as we have.

As an examiner in the National Board of Medical Examiners, I reach men from Class A schools all over the country. I have given an examination here in Chicago to thirty-three men; another in St. Louis to fifteen men, and they were strong on the theoretical side and pretty good on the microscopic, but none of them had ever seen a thyroid, either grossly or microscopically. They ought to be able to differentiate a breast with a nipple on it and a carcinoma as large as my fist in it, with bronzing on the skin, from a lipoma. They ought not to call that a lipoma, but they did. That is not very much work, is it? They should be able to differentiate the two ovaries (?) which were removed for an old prolapse from an endometritis, and perhaps the surgeon had taken out the uterus because there was nothing the matter with it, but it was not where it ought to be. Those men ought to be able to differentiate that, not as a carcinoma but as an endometritis. They ought to be able to distinguish between an infiltrating carcinoma of the fundus of the uterus from an endometritis. I am speaking rather harshly because I feel strongly the foundations of medicine are being shaken today by the lack of men in numbers and in quality in pathology. Pathology is medicine, and unless we teach it better we are going down as a profession.

Dr. J. W. Jobling, New York City: Pathology is the link between the laboratory departments and the clinical departments, and is probably the first subject the medical student takes up in which he applies to a large degree the work he has already gone over. It should be taught, so far as possible, by actual observation and experimental work. The time pathology is to be given is a matter that has been discussed a great deal and about which there is considerable differences of opinion. Personally, I believe general pathology should be given in the second year, and gross pathology and autopsy work in the third and fourth years. Students do not obtain much information from autopsies until they have completed most of their work in general pathology. On the other hand, if given in the third or fourth year, he can correlate it with his clinical work. In this manner, he obtains the maximum amount of information. Some fresh gross material and museum specimens should, however, be demonstrated to the students during the work in general pathology. The

separation of surgical pathology from the department of pathology is bad from the standpoint of training assistants. It makes them unfit for positions where this character of work is required. There should be a greater centralization of work along these lines. It would be better to have it confined to one building, so that all would be conversant with the work that is being done. This would not interfere with the work being done along these lines by the young men in the different departments. Present conditions mean that some of our assistants will be turned out sadly deficient in certain phases of pathology.

My own conception of a plan for handling this is somewhat as follows: I believe the work should be done in the department of pathology under the supervision of the professor of pathology. The actual work in surgical pathology should be done by one of the young surgeons, but under proper supervision. I would have a man, for instance, spend two years as junior in surgical pathology, and one or two years as senior. It is understood, of course, that he would be doing a certain amount of clinical work at the same time. In this way, he would be getting what I believe to be a very necessary part of his training in surgery.

We all agree that it is important to get students interested in the literature. During the past year, we have adopted the method of having all students write theses. Each thesis requires twenty minutes to read, and we have been much pleased at the interest taken in the subject by the class as a whole.

Dr. Oskar Klotz, Pittsburgh: The pathologist today is realizing more and more that pathology is only a special department dealing with morbid anatomy in its many phases; but we must not forget the human side of the subject.

It has been stated several times at this conference that pathology forms a link between the fundamental departments and the clinics, and that is true. It has all the attributes of the fundamental departments in their ideals. It has, however, also another attitude, and that is of making its studies eminently human in their application to disease. That is much more difficult often to bring into some of the other fundamental departments, such as anatomy and chemistry. But pathology is the subject in which the student realizes for the first time that he is attaining his goal in medicine. It is a very impressionable time, it is a time in his career when advantage can be taken to impress him with the essentials of medical science. He should also be impressed with the fact that this science will remain a part of his practice, a part of even his life itself. That is one of the reasons why pathology most needs cooperation with the fundamental branches and with the clinical branches given elsewhere. Unless pathology makes use of the fundamental departments to the fullest degree it fails. A closer cooperation is essential between pathology and the other departments. It is impossible to make pathology an entity contained within itself. If we try it, we will get into those enormous budgets, and each department will not receive the proper share of money that it deserves. It will tend in the end to a duplication of departments, and so on. I do not think that in the development of the various departments of medicine any one department should be isolated from the other, but that all of them should cooperate closely for teaching and research. If we do not make use of these opportunities, we lose very largely what is available to us now. Furthermore, within the depart-

ment of pathology, as indicated by the report of Dr. Ewing, subdivisions are being made. The question arises, how should museum teaching be given? What relation do microscopic and gross pathology have? Where, and how shall we teach pathologic physiology? If we segregate these under different heads within the department itself and try to isolate them as distinct parts of the teaching, I am afraid we will get into the difficulties that have already confronted certain departments. This has already taken place to too large a degree in the subjects of hygiene, bacteriology, immunology and pathology organized in different institutes, with no relation between them.

There should be correlation between pathology and bacteriology. As Dr. Kendall has said, they must be instituted under separate heads, but we must not allow them to become separated too widely. If the pathologist has not a close cooperation with the bacteriologist he is going to fail in the interpretation of a great deal of his own work. That is true in teaching as well. If the bacteriologist has not an opportunity to make use of the materials that go into the hands of the pathologist, if his work in teaching is purely academic, and only from the standpoint of the biologist, it loses its value in medical education. We must cooperate with the bacteriologist in those materials which essentially have to do with infectious diseases.

In the teaching of pathology, going back to what I mentioned a moment ago, a subdivision within itself into various groups, is, I believe, a mistake. If in general pathology we can correlate more closely all phases of our problem so that experimental pathology, histologic pathology, functional pathology and so on, are a part of general pathology we will achieve better results for our students. We are trying this out and are well pleased with the experiment. It requires a somewhat different organization and reorganization of the method of carrying out the course, but I am satisfied that the final results will be better.

Regarding the association of the pathological laboratory with the hospital, how foolish it is to speak of a pathologist in a hospital having only to do with postmortems. There is nothing more fatal to all of the hopes of the department of pathology and its usefulness to the clinical branches than to subdivide materials coming from the hospital among several clinical laboratories. It is a waste of money for the various specialties that deal with them. I question very largely the appreciation of the specialist of the underlying factors of disease when he is dealing only with special material from his own department. It is true, the publication of studies from such special departments has value, but it lacks very much the appreciation of pathology in a broad way. Surely, the only method is to correlate or bring together all of these materials under the one head, as has been suggested, and encourage the specialist to carry on his studies under the general direction of the pathologic laboratories.

As to the statement that there are some pathologists who do not have an opportunity of seeing surgical material, I was impressed with this unfortunate state of affairs in the pathological laboratory of one school, where the first assistant, receiving a specimen from an outside source, was unable to distinguish a tubal pregnancy from a pus tube. He has been the first assistant in that particular laboratory for a period of four years. That is lamentable and brings out what Dr. Ewing has indicated, that the development of pathologists is a very difficult problem requiring the cooperation of the clinical departments.

DR. ALEXANDER C. ABBOTT, Philadelphia: I have attended every session of this conference, and in consequence have the impression that the results of the teaching experiment with which we have all been concerned for the past fifteen years is unsatisfactory to most of us. When boiled down, the general opinion is that there is too sharp a line of demarcation between the so-called scientific studies of the first two years and the clinical studies of the third and fourth years. If this be true, then our plan should be modified. It has been stated here that students at the end of the second year leave their work with a sigh of relief and never think of it again in their course in medicine. If that be true, the work of the first two years, both of student and instructor, obviously is wasted. If that also be true it is clear that the teaching of the fundamental branches has not been with their application to medicine in mind, but rather as abstract sciences apart from their subsequent usefulness. There is every reason why there should be no obstacle put in the way of the independent development of chemistry, physiology, bacteriology, etc., as pure sciences, but when they are taught as a part of the medical course, they must be taught as applied sciences or we waste our time and that of the student. I am convinced from the discussion I have heard here that a plan must be devised whereby the student of the first two years may be brought more nearly in contact with the patient, in such a way that he can realize the relation of the scientific subjects to the solution of the problems of clinical medicine. He must be made to feel from the first that no matter what special subject he may be working on, it is closely related to an understanding of disease and that he is really studying medicine from the day he enters the medical school.

I know of no better way of linking up the fundamental branches of the first two years with the clinical work of the last two than by the organization of real clinical laboratories. I do not mean the kind one ordinarily sees—but a clinical laboratory in which use is made, as a matter of course, of chemical, physiologic, bacteriologic and pathologic methods in the complete study of patients in the dispensaries and hospitals. Such laboratories, developed in a comprehensive way, would go very far toward the elimination of the line of demarcation between the fundamental and clinical branches and would soon show to the students the priceless value of a knowledge of the fundamental subjects to his understanding of clinical phenomena.

DR. A. I. KENDALL (closing the discusion): I did not emphasize that which we all recognize contributes very much to the success of a course in bacteriology. The real function of the course is to make it a living entity which the student can utilize in the interest of his future work in clinical medicine. It is, of course, necessary that the essential principles of the subject be presented as part of the work. A striking, almost unanimous, response to our questions indicated that the material for instruction should be obtained from natural sources wherever possible. The psychic effect on the student of studying material from a real live patient is a feature that should not be overlooked in teaching the fundamental branches.

JOINT ANNUAL CONFERENCE OF THE COUNCIL ON MEDICAL EDUCATION OF THE AMERICAN MEDICAL ASSOCIATION WITH THE ASSOCIATION OF AMERICAN MEDICAL COLLEGES AND THE FEDERATION OF STATE MEDICAL BOARDS OF THE UNITED STATES

This conference was held in Chicago, March 1-3, 1920. The program was a joint one, contributed to by the three organizations. On the first day the chairman of the Council on Medical Education presided; on the morning of the second day, the president of the Federation of State Medical Boards presided. The vice president of this association presided at the remaining two sessions.*

The joint conference met at 2 p. m. and was called to order by Dr. A. C. Eycleshymer, vice-president of the Association of American Medical Colleges.

Reports on Medical Teaching from the Committee on Medical Pedagogy of the Association of American Medical Colleges

Dr. W. S. Carter, Dean, University of Texas Department of Medicine, Galveston, presented the following report:

The Association, at its annual meeting in March, 1919, instructed this committee to arrange for the preparation of monographs on medical pedagogy for presentation at the annual meeting in 1920, and to appoint subcommittees for this purpose. The committee has carried out these instructions by appointing the following subcommittees on the teaching of the fundamental medical sciences:

ANATOMY

C. R. Bardeen, University of Wisconsin, Chairman;
C. M. Jackson, University of Minnesota;
Wm. Keiller, University of Texas.

HISTOLOGY AND EMBRYOLOGY

F. C. Waite, Western Reserve University, Chairman;
H. E. Jordan, University of Virginia;
Irving S. Hardesty, Tulane University.

PHYSIOLOGY

E. P. Lyon, University of Minnesota, Chairman;
D. R. Hooker, Johns Hopkins University:
C. C. Guthrie, University of Pittsburgh.

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*The proceedings of the whole conference were published in abstract in the *Journal of the American Medical Association*, **72**:757, 823, 913, 975, 1920.

BIOLOGICAL CHEMISTRY

Otto Folin, Harvard University, Chairman;
P. A. Shaffer, Washington University;
A. P. Mathews, University of Cincinnati.

PHARMACOLOGY

C. W. Edmunds, University of Michigan, Chairman;
Torald Sollmann, Western Reserve University;
A. N. Richards, University of Pennsylvania.

BACTERIOLOGY AND PARASITOLOGY

A. I. Kendall, Northwestern University, Chairman;
E. R. Stitt, U. S. Navy Medical School;
W. H. Park, University and Bellevue Hospital Medical College.

PATHOLOGY

James Ewing, Cornell University, Chairman;
H. Gideon Wells, University of Chicago;
Henry Albert, University of Iowa.

PUBLIC HEALTH AND PREVENTIVE MEDICINE

Victor C. Vaughan, University of Michigan, Chairman;
M. J. Rosenau, Harvard University;
C.-E. A. Winslow, Yale University.

Each subcommittee was limited to three members as small committees can accomplish more than large ones. As far as practicable, the members were selected from different colleges in membership in the Association. Clinicians were not appointed on the committees as it seemed best for them to discuss the preliminary reports of the subcommittees when these were presented to the Association, it being understood that views so expressed would be incorporated in the final reports to be subsequently prepared for publication.

The real work assigned by the Association has, therefore, been performed by the subcommittees and too much credit cannot be given to them for the splendid spirit of cooperation shown by the members of the subcommittees. They have not spared any trouble in the preparation of their reports, and as they have given much thought and study to their respective subjects, their conclusions must be of great value to all teachers of these subjects. The committee recommends that these subcommittees be continued and authorized to publish their final reports.

In order that the greatest good may come from this effort, the committee on Education and Pedagogics recommends that at least ten (10), and if possible twenty (20), copies of the transactions containing these reports be sent to each institution in membership in this Association. If this is not practicable, on account of the expense, separate reprints of the different reports should certainly be sent, so that copies may be distributed to the different departments of instruction. If only one copy is sent to the dean's office or the library of each college, as at present, the

teachers of the fundamental subjects will not get the full benefit of these studies. The committee strongly urges the adoption of this recommendation by the Association.

It did not seem practicable to include all of the subjects of the medical curriculum in this study for the present year. The committee recommends that similar reports should be prepared on the teaching of the clinical subjects for presentation at the next annual meeting, and that the Committee on Medical Education and Pedagogics for 1920-21 should consist largely or wholly of clinicians as that seems the most desirable arrangement to accomplish this purpose.

Your committee is heartily in accord with the spirit of the resolution which was adopted by the Executive Council in June, 1918, and by the Association in March, 1919, from which the following statements may be excerpted:

"After several years of experimentation and study, the Association of American Medical Colleges, in cooperation with the Council on Medical Education of the American Medical Association and the Association of American Universities, has arrived at a standard of minimum entrance requirements which the great majority of medical schools in this country are prepared to meet. These requirements have been carefully formulated by a joint committee appointed for this purpose, and it seems best for the present not to attempt further general experimentation along these lines, but to focus attention on other aspects of medical education which are now of much greater relative importance."

There are, however, two matters concerning entrance requirements to which your committee desires to direct attention, viz., the amount of prescribed work (1) in physics and (2) in organic chemistry.

Last year the Association changed the entrance requirements in physics from eight (8) to six (6) semester hours. It is a matter of common experience in medical schools to find that many students are poorly prepared in physics, even when they have been admitted with credit for eight semester hours in this subject.

The Council on Medical Education is unwilling to lower the requirement in physics from eight to six semester hours, and most medical schools require eight semester hours in physics for admission. Your committee is of the opinion that it is highly desirable to have a uniform requirement in this subject and that a course consisting of six semester hours does not give sufficient training. The committee therefore recommends that the entrance requirement in physics be changed from six to eight semester hours.

It would probably be well for the Association, acting through a special committee and in conjunction with similar committees from the Council on Medical Education and the Association of American Universities, to prepare an outline of a suitable course giving the necessary training in physics in the premedical college course. This could be offered to the colleges as a suggestion and not as an absolute requirement.

Your committee is also of the opinion that four semester hours in organic chemistry do not give sufficient preparation in this subject. It does not seem desirable to increase the requirement in this subject immediately as organic chemistry only became a prescribed subject Jan. 1, 1920. Sufficient time should be allowed for colleges to readjust their courses, if necessary, and notice of an increase in the requirement in this subject should be given for at least two years before it becomes

effective. The committee, therefore, recommends that after Jan. 1, 1922 (or 1923) six (6) semester hours be required in organic chemistry, half of which shall consist of laboratory work.

Many colleges and universities now give courses in organic chemistry which would satisfy this requirement, although the colleges themselves evaluate it as less by counting three hours of laboratory work as equivalent to one class room hour.

It should be remembered that college courses are evaluated for admission to medical colleges by counting two hours of laboratory work as equivalent to one class room hour. On this basis it would not work a hardship on colleges to give the necessary training in organic chemistry (six semester hours) in addition to the eight semester hours in general inorganic chemistry, thus increasing the total requirement in chemistry from twelve to fourteen semester hours.

Respectfully submitted,

(Signed) W. F. R. PHILLIPS,
THEODORE HOUGH,
W. S. CARTER, Chairman.

Reports were presented as follows:

"Anatomy," by Dr. Charles R. Bardeen, Dean, University of Wisconsin Medical School, Madison.

"Histology and Embryology," by Dr. F. C. Waite, Professor of Histology and Embryology, Western Reserve University School of Medicine, Cleveland.

"Neuro-Anatomy," by Dr. Irving Hardesty, New Orleans, Louisiana.

These reports were discussed by Drs. Burton D. Myers, W. H. MacCracken, H. Gideon Wells, J. W. Jobling, James Ewing, W. F. R. Phillips, Irving S. Cutter, A. C. Eycleshymer and Irving Hardesty.

Dr. E. P. Lyon, Dean, University of Minnesota Medical School, Minneapolis, read the report on the teaching of "Physiology."

Dr. Otto Folin, Harvard University Medical School, read the report on "Biochemistry."

These reports were discussed by Drs. Geo. M. Kober, Theodore Hough, A. P. Mathews, Frank Billings, E. P. Lyon and Otto Folin.

Dr. Victor C. Vaughan, Dean University of Michigan Medical School, Ann Arbor, read the report on "Public Health and Preventive Medicine."

This report was discussed by Drs. A. C. Abbott, Eugene F. McCampball, John Sundwell, Geo. M. Kober, G. Canby Robinson, A. P. Mathews, E. P. Lyon, Oskar Klotz, Worth Hale and V. C. Vaughan.

Dr. C. W. Edmunds, Associate Dean University of Michigan Medical School, Ann Arbor, read the report on "Pharmacology."

This report was discussed by Drs. A. N. Richards, John W. Scane, Worth Hale, Hugh McGuigan, Alexander MacAlister and C. W. Edmunds.

Dr. James Ewing, Professor of Pathology, Cornell University Medical School, New York, read the report of the committee on "Pathology."

Dr. A. I. Kendall, Dean, Northwestern University Medical School, Chicago, read the report of the committee on "Bacteriology and Parasitology."

These two reports were discussed jointly by Drs. Louis B. Wilson, J. W. Jobling, Oskar Klotz, A. C. Abbott, H. Gideon Wells and A. I. Kendall.

Adjourned.

MINUTES OF THE THIRTIETH ANNUAL MEETING HELD AT CHICAGO, MARCH 1-3, 1920

EXECUTIVE SESSION

In the absence of both the president and the vice president, the meeting was called to order by the chairman of the Executive Council, Dr. I. S. Carter, at 9:30 a. m., in the Hotel La Salle.

The secretary announced that the president, Dr. George Blumer, was absent because of illness, and that the vice president was unable to be present, therefore the chairman of the Executive Council would preside.

ROLL CALL

The roll call showed that fifty-two of the colleges in membership were represented by delegates, as follows:

Leland Stanford Junior University School of Medicine.—Ray Lyman Wilbur.

University of California Medical School.—L. S. Schmitt.

University of Colorado School of Medicine.—Charles N. Meader.

Army Medical School—Louis A. LaGarde.

George Washington University School of Medicine.—William C. Borden.

Georgetown University Medical School.—George M. Kober.

Navy Medical School.—W. S. Braisted.

Howard University School of Medicine.—Edward A. Balloch.

University of Georgia Medical Department.—Hugh N. Page.

Northwestern University Medical School.—C. W. Patterson.

Rush Medical College.—J. M. Dodson.

University of Illinois College of Medicine.—Henry B. Ward, A. C. Eycleshymer.

Indiana University School of Medicine.—B. D. Myers.

University of Iowa College of Medicine.—L. W. Dean, J. F. McClintock.

University of Kansas School of Medicine.—George E. Coghill.

University of Louisville Medical Department.—Henry E. Tuley.

Tulane University of Louisiana School of Medicine.—Isadore Dyer.

Johns Hopkins University Medical Department.—J. Whittridge Williams.

University of Maryland School of Medicine, College of Physicians and Surgeons.—J. H. M. Rowland.

Medical School of Harvard University.—Alexander S. Begg.

Tufts College Medical School.—W. E. Sullivan.

Detroit College of Medicine and Surgery.—W. H. MacCraken.

University of Michigan Medical School.—Victor C. Vaughan, C. W. Edmunds.

University of Minnesota Medical School.—E. P. Lyon.

St. Louis University School of Medicine.—H. W. Loeb.

University of Missouri School of Medicine.—Guy L. Noyes.

Washington University Medical School.—G. Canby Robinson.

John A. Creighton Medical College.—H. von W. Schulte.

University of Nebraska College of Medicine.—Irving S. Cutter.

Columbia University College of Physicians and Surgeons.—William Darrach.

Cornell University Medical College.—J. Ewing, Walter L. Niles.
Syracuse University College of Medicine.—John L. Heffron.
University and Bellevue Hospital Medical College.—John H. Wyckoff.
University of Buffalo Medical Department.—C. Sumner Jones.
University of North Dakota College of Medicine.—H. E. French.
Ohio State University College of Medicine.—E. F. McCampbell.
University of Cincinnati College of Medicine.—Charles William Dabney, A. P. Mathews.
Western Reserve University School of Medicine.—C. A. Hamann.
Hahnemann Medical College and Hospital.—W. A. Pearson.
Jefferson Medical College.—Ross V. Patterson.
University of Pennsylvania School of Medicine.—William Pepper.
University of Oklahoma School of Medicine.—LeRoy Long.
University of Pittsburgh School of Medicine.—R. R. Huggins.
Woman's Medical College of Pennsylvania.—Martha Tracy.
Medical College State of South Carolina.—W. F. R. Phillips.
University of South Dakota College of Medicine.—C. Lommen.
Vanderbilt University Medical Department.—Lucius E. Burch.
University of Tenneessee College of Medicine.—H. V. Williams, A. H. Wittenborg.
Baylor University School of Medicine.—E. H. Cary, S. P. Brooks.
University of Texas Department of Medicine.—W. S. Carter.
University of Vermont College of Medicine.—Henry C. Tinkham.
Medical College of Virginia.—A. L. Gray.
University of Virginia Department of Medicine.—Theodore Hough.
Marquette University School of Medicine.—Louis F. Jermain.
University of Wisconsin Medical School.—C. R. Bardeen.

COMMITTEES APPOINTED

The secretary announced that the vice president had appointed the following committees:

Nominating Committee: Drs. H. B. Ward, J. Ewing and Charles N. Meader.

Auditing Committee: Drs. W. F. R. Phillips, J. H. M. Rowland and Edward A. Balloch.

MINUTES OF THE PREVIOUS MEETING

The secretary submitted the minutes of the previous meeting as published in the volume of Transactions for 1919, pages 59-86, and, on motion, they were adopted as printed.

On motion, the report was received and the financial statement referred to the Auditing Committee.

REPORT OF THE SECRETARY-TREASURER

PROGRAM

The secretary presented the following report:

The program for this meeting is the result of conferences held by the secretaries of the three organizations participating in the Congress on Medical Education and Licensure, the Council on Medical Education of the American Medical Association, the Federation of State Medical Boards and the Association of American Medical Colleges. It was believed that by having only one program, consisting of papers offered by each one of the three organizations named, greater unity would be estab-

lished for the conference and it would thus partake more of the nature of a congress. By extending the program over two and one-half days, it would give each organization an opportunity to hold its executive session on the afternoon of the third day, thus doing away with conflicts, such as have in the past taken place at these annual meetings. The scheme is on trial, and if it proves successful, it will be well to adopt for the future meetings.

MEMBERSHIP

The membership has changed in only one particular: the Fordham University School of Medicine has ceased to exist. Although no official notice to this effect was received by your secretary or other officers of this Association, the information was imparted in the news published in medical journals.

APPLICATIONS

Three applications for membership were received during the year: (1) Long Island College Hospital; (2) College of Medicine of the University of South Dakota, and (3) Jefferson Medical College. Sixty-two colleges are now in membership, including the two government service schools, the Navy Medical School and the Army Medical School. Fifty-eight of these colleges are in Class A of the classification made by the Council on Medical Education; two are in Class B. Twenty-eight medical colleges are not now in membership in this Association, not including the three colleges which have applied for membership. Eight of these twenty-eight colleges are in Class B and ten are in Class C. Three of the eight colleges in Class A not in membership are so-called two-year schools and one is a homeopathic school. Of the two colleges in membership that are classified as B, one is a school for negroes, which is an affiliated member, and the other is to be rated as Class A soon, the B rating having been given because of the insufficient clinical facilities, a condition which no longer exists. Therefore, it can be stated that all the schools in membership in this Association are in good standing with all evaluating bodies, whether educational or licensing.

INSPECTIONS

Pursuant to a motion passed at the annual meeting of 1917, the first levy for the assessment to defray the expense of inspection of the colleges in membership in this Association was made in 1919. It will be remembered that this work was to have been undertaken in the fall of 1917, but owing to the declaration of war in April, the work was deferred indefinitely. These inspections were planned to be made in company with the secretary or inspector of the Council on Medical Education. The work was begun in October, 1919. It is not yet completed. The inspectors for this Association were either members of the Executive Council, or persons selected by the Council when it was not possible to have a Council member make the inspection. In each instance, Dr. Colwell represented the Council on Medical Education. The following colleges were inspected:

By Dr. William Pepper: University of Virginia: Medical College of Virginia; Howard University; George Washington University; Georgetown University; Johns Hopkins University; University of Maryland and College of Physicians and Surgeons; University of North Carolina; University of South Carolina; Wake Forest College; Vanderbilt University;

Meharry Medical College; University of Alabama; Columbia University; Cornell University; University and Bellevue Hospital Medical College.

By Dr. E. P. Lyon: University of North Dakota.

By Dr. C. R. Bardeen: University of Minnesota; University of Nebraska; Creighton Medical College; University of Iowa.

By Dr. F. C. Zapffe: University of West Virginia; University of Pittsburgh.

The work will be continued soon and completed before the next annaul meeting.

Reports on the inspections will be made to the Executive Council, and if the Council deems it necessary that the Association take action on any or all of the reports, the details connected with these inspections will be presented to the Association, as provided for in the By-Laws.

AMENDMENTS

Your attention is directed to the amendments proposed for consideration at this meeting by the University of Louisville and the University of Virginia. Notice of such action to be taken was given to the colleges in membership thirty days before this meeting, as provided for in the By-Laws.

1. The University of Louisville proposes to amend the Constitution and By-Laws as follows: Article VI, Section 5, by adding in the eighth line after the portion of the word necessary, to wit, "essary," the following: "The members of these various committees shall be appointed in such manner, that each year one member shall retire from the committee, the new appointee to serve as many years as there are members on the committee."

2. The University of Virginia proposes to amend Section 7 of the By-Laws as follows: (a) In place of "Physics, 6 semester hours," in the table of REQUIRED SUBJECTS in the premedical course, read "Physics, 6 or 8 semester hours." (b) After the section headed "(a) Chemistry" at the bottom of page 7 of the Constitution and By-Laws as printed and before the section headed "(b) Biology" at the top of page 8, insert the following, making the necessary changes in the lettering of these explanatory descriptions on the requirements in biology and English: "(b) Physics: Eight semester hours required. This requirement may also be satisfied by six semester hours of collegiate physics, if preceded by one year (one unit) of high school physics."

3. The University of Virginia proposes to amend the last sentence on page 7 of the printed Constitution and By-Laws to read: "After January 1, 1921, the remaining (4) semester hours shall consist of work in organic chemistry." This amendment changes the date when this requirement becomes effective from 1920 to 1921.

4. The University of Virginia proposes to amend Section 7 of the By-Laws, II PREMEDICAL COLLEGE COURSE: *Required Subjects.*—Chemistry (a) 12 hours to read: "Chemistry (a) 12 hours (after Jan. 1, 1922, 16 hours). (a) After Jan. 1, 1922, 16 semester hours are required, of which at least 8 semester hours must be in general inorganic chemistry, including 4 semester hours of laboratory work, and 8 semester hours must be in organic chemistry, including 4 semester hours of laboratory work. In the interpretation of this rule, work in qualitative analysis may be counted as general inorganic chemistry."

BULLETIN

Two years ago it was voted to resume publication of the Quarterly Bulletin of the Association, but because of the very high cost of printing and the insufficient funds in hand at that time, nothing was done to carry out this plan. Although the cost of printing has not diminished since then, in fact, it is greater now, the funds in hand make it possible to take up this work, if it is the wish of the Association that this should be done. In order that there will not be any misunderstanding on this point, it is advisable to affirm the action taken in 1918 that the BULLETIN be again issued. It would seem that some medium of interchange between the colleges in membership in the Association, other than the transactions and correspondence, is desirable, although it be only by a quarterly publication, and sufficient material ought to be available to make such a publication a most interesting one and eventually a very necessary means of communication.

AMERICAN CONFERENCE ON HOSPITALS

As the result of a discussion and a motion made at the joint meeting between this Association and the Federation of State Medical Boards held in this city March 4, 1919, there has come into existence the American Conference on Hospital Service. President Blumer appointed as delegates from this Association, Dr. Roger S. Morris and Dr. Fred C. Zapffe. A report on this work will be made later.

The cash balance on hand March 1, 1920, was $2,347.70.

Respectfully submitted.

FRED C. ZAPFFE.

On motion, duly seconded and carried, the report was ordered published in the transactions and the financial statement was referred to the auditing committee.

The report of the Executive Council was called for and was then read by the chairman of the Council, Dr. Irving S. Cutter.

REPORT OF THE EXECUTIVE COUNCIL

The Executive Council has held a number of meetings at which were discussed problems which have arisen in the course of the past year, and such business as comes within the province and jurisdiction of the Council.

APPLICATIONS FOR MEMBERSHIP

Three applications for membership in the Association were received during the year.

1. *Jefferson Medical College,* Philadelphia.—This college was inspected by Dr. James Ewing and his report is favorable to acceptance of the application. Therefore, the Executive Council recommends that the Jefferson Medical College be received into membership in this Association.

2. *University of South Dakota College of Medicine,* Vermilion.—This college, which offers only the first two years of the medical course, was inspected by Dr. C. R. Bardeen, in company with Dr. N. P. Colwell of the Council on Medical Education, and his report is favorable to acceptance of the application. Therefore, the Executive Council recommends that this college be received into membership in this Association.

3. *Long Island College Hospital,* Brooklyn.—The inspection of this institution was made by Drs. George Blumer and James Ewing. The inspectors recommended acceptance of the application, but urged that the college be advised to discontinue the teaching of the premedical course and that a new laboratory building be erected. The Executive Council recommends that the college be received into membership in this Association and that it be advised as to the recommendations made by the inspectors.

INSPECTIONS OF COLLEGES IN MEMBERSHIP

As has been pointed out by the Secretary, the work of inspecting the colleges in membership was begun last fall and was carried on in accordance with the plan outlined in 1917. An inspector from this Association who is either a member of the Executive Council or a person delegated by the Council to act in that capacity—and this is done only when it is not feasible for a member of the Council to act, because of great distance and great expense—has accompanied the inspector of the Council on Medical Education on his tour of inspection. About one half the colleges in membership have been so visited, and the inspectors have reported to the Executive Council as to their findings. The Secretary has given the names of the colleges visited and of the inspectors in his report.

No action on this report is to be taken unless they are unfavorable and a suspension from membership is made necesary. Such a recommendation was made in the case of two institutions only. The Council has considered the reports on these two schools very carefully and with due regard to the effect of any action which this Associtaion may take on the college. The result of this deliberation is that the Council recommends that the Wake Forest College School of Medicine, Wake Forest, N. C., and the University of West Virginia School of Medicine, Morgantown, W. Va., be suspended from membership in this Association, and that reinstatement can only be made when inspection shows that these institutions have met and overcome the objections stated in the reports made by the inspectors. Copies of these reports have been forwarded to the schools.

AMENDMENTS

The Council has considered the amendments proposed for adoption at this meeting, and recommends:

1. That the amendment proposing to change the method of appointment as to tenure of office of standing committees be not adopted, because the present method of appointing these committees allows of changing the personnel from time to time to meet the demands which may be made of a committee and to remove inactive members from committees.

2. The Council recommends the adoption of the amendment raising the requirement in physics from six to eight hours, without any proviso or possibility of allowing credit for work done in the high school. This recommendation is made because of the uncertainty of the evaluation of the high school physics credit and because most institutions are now requiring at least eight hours in physics.

3. The Council recommends that the amendment to extend the time for making the greater requirement in chemistry effective be not adopted.

It is believed that sufficient notice of this requirement was given so that prospective medical students had the opportunity to prepare to meet it. The Council recommends, further, that such schools as may find the application of this rule to work hardship, may, on proper presentation of evidence to the Council, be given permission to waive this requirement until Jan. 1, 1921.

4. The Council recommends that the amendment to raise or increase the chemistry requirements be not adopted for the reason that the present requirement has not been tried out to the point where an increase in the requirement would seem advisable.

MEMBERSHIP IN OTHER ORGANIZATIONS

The Council recommends that this Association affiliate itself in membership in the American Conference on Hospital Service, and that it withdraw from membership in the National Council on Education, the successor of the Emergency Council on Education brought into being early in the late war to aid the government in its educational work.

EVALUATION OF CREDITS

In view of the apparent misunderstanding which seems to exist with reference to the interpretation and meaning of the various terms used by different evaluating bodies, it appears to be desirable that, if possible, some uniformity in terms be brought about, thus aiding not only the evaluating officer or examiner of credentials, but also facilitating the transfer of students; therefore, the Executive Council recommends that the question of evaluation of credits in terms of semester or college hours be referred to the Committee on Medical Education and Pedagogics, with instructions to make a survey and study of this matter and to report at the next annual meeting of this Association.

Respectfully submitted.

ISADORE DYER.
JAMES EWING.
C. R. BARDEEN.
FRED C. ZAPFFE.
IRVING S. CUTTER, Chairman.

On motion of Dr. Phillips, the report of the Executive Council was received and the various items mentioned therein were considered seriatim.

The recommendation to receive into membership the School of Medicine of the University of South Dakota, Vermilion, was read and, on motion of Dr. Myers, duly seconded, was concurred in by the Association.

On motion of Dr. Myers, duly seconded, the recommendation to receive into membership the Jefferson Medical College of Philadelphia was endorsed, and the applicant declared elected to membership.

On motion of Dr. Meyers, duly seconded, the recommendation to accept the application for membership of the Long Island College Hospital, Brooklyn, was concurred in and the applicant declared elected to membership.

On motion of Dr. Phillips, duly seconded, the recommendation as to the evaluation of credit hours was adopted.

On motion of Dr. Phillips, duly seconded, the recommendation to suspend the School of Medicine of the University of West Virginia and Wake Forest College School of Medicine, was concurred in and the secretary was instructed to notify these schools of such action.

On motion of Dr. Hough, duly seconded, the recommendation to take membership in the American Conference on Hospital Service, was adopted.

On motion of Dr. Phillips, duly seconded, consideration of that portion of the report referring to amendments was deferred until the head of new business was reached in the proceedings.

On motion of Dr. Myers, consideration of that portion of the report referring to withdrawal from membership in the American Council on Education was deferred until after the reading of his report as representative from this Association to that body.

REPORT OF COMMITTEE ON MEDICAL EDUCATION AND PEPAGOGICS

The report of this committee was read by the chairman, Dr. W. S. Carter.

At the annual meeting in March, 1919, the Association of American Medical Colleges adopted the recommendation of the Executive Council instructing the Council on Medical Education and Pedagogics to take measures to secure the preparation of monographs on medical pedagogy and to appoint subcommitees for that purpose. The different committees were instructed to report at the annual meeting in 1920.

Acting in accordance with these instructions the Council on Pedagogics appointed the following subcommittees:

ANATOMY:

Dr. C. R. Bardeen, University of Wisconsin, Chairman.
Dr. C. M. Jackson, University of Minnesota.
Dr. William Keiller, University of Texas.

HISTOLOGY AND EMBRYOLOGY:

Dr. F. C. Waite, Western Reserve University, Chairman.
Dr. H. E. Jordan, University of Virginia.
Dr. Irving Hardesty, Tulane University.

PHYSIOLOGY:

Dr. E. P. Lyon, University of Minnesota, Chairman.
Dr. D. R. Hooker, Johns Hopkins University.
Dr. C. C. Guthrie, University of Pittsburgh.

BIOLOGIC CHEMISTRY:

Dr. Otto Folin, Harvard University Medical School, Chairman.
Dr. P. A. Shaffer, Washington University.
Dr. A. P. Mathews, University of Cincinnati.

PHARMACOLOGY:

Dr. C. W. Edmonds, University of Michigan, Chairman.
Dr. A. M. Richards, University of Pennsylvania.
Dr. Torald Sollmann, Western Reserve University.

PATHOLOGY:

Dr. James Ewing, Cornell University Medical School, Chairman.
Dr. H. Gideon Wells, University of Chicago.
Dr. Henry Albert, University of Iowa.

BACTERIOLOGY AND PARASITOLOGY:

Dr. A. I. Kendall, Northwestern University, Chairman.
Admiral E. R. Stitt, U. S. Navy Medical School.
Dr. W. H. Park, University and Bellevue Hospital Medical School.

PUBLIC HEALTH AND PREVENTIVE MEDICINE:

Dr. Victor C. Vaughan, University of Michigan, Chairman.
Dr. M. J. Rosenau, Harvard University Medical School.
Dr. C.-E. A. Winslow, Yale University Medical School.

It did not seem practicable to prepare reports on all the subjects of the medical curriculum at this time, hence these were limited to the fundamental medical sciences which are taught by laboratory methods during the first and second years. with the exception of public health and preventive medicine which is usually taught in the years devoted to clinical subjects.

The members of the subcommittees were appointed from as many different colleges in membership in the Association as far as practicable.

Each committee was limited to three members because small committees can accomplish more than large ones.

It is recognized that it is desirable to have the opinion of clinicians concerning the teaching of the laboratory subjects taught in the preclinical years of the curriculum, e. g., surgeons are concerned in the teaching of anatomy; internists should be interested in the teaching of physiology and clinicians may have important criticisms or suggestions concerning the teaching of pathology and bacteriology.

The committee feels that the discussion of these reports will offer a better opportunity for such an exchange of views than would be possible in the preparation of reports by large committees.

The subcommittees have therefore prepared preliminary reports in the hope that they will be discussed fully in this conference. The final reports will then be prepared for publication by the subcommittees with due consideration of the views expressed in the discussion, in addition to the original preliminary reports to be presented today.

The Committee on Medical Education and Pedagogics recommends that arrangements be made for the publication of a large number of the reports, so that copies may be placed in the hands of those engaged in teaching these fundamental medical sciences in all of the colleges in membership in the Association.

The committee feels that one copy of the transaction sent to the dean of each college is not sufficient to give to the various members of the faculties the benefit of the attention that has been given to these subjects by the various subcommittees.

The preparation of these reports is in no way a duplication of the work done by the ten committees of ten members each, or the committee of one hundred, appointed by the Council on Medical Education in 1909, to arrange a standard medical curriculum. Many of those who served on that committee are members of the present subcommittees. The purpose

of the reports to be presented is not to standardize, but to consider the methods of teaching the subjects which occupy the preclinical years. In view of the different opinions expressed on this subject yesterday, it seems well worth while to give attention to the pedagogy of these subjects.

(Signed) W. S. CARTER, Chairman.
W. F. R. PHILLIPS.
THEODORE HOUGH.

On motion, duly seconded, the report was received and the recommendation with reference to the printing of a larger number of copies of the transactions for wider distribution was adopted.

REPORT OF COMMITTEE ON POSTGRADUATE DEGREES

The Committee on Postgraduate Degrees, Dr. A. C. Eycleshymer, chairman, reported that its report had been adopted by the Council on Medical Education of the American Medical Association and that that body will join this committee in taking up this matter with the Association of American Universities.

On motion, duly seconded, this report was received and ordered spread on the minutes. The committee was continued.

REPORT OF DELEGATE TO NATIONAL COUNCIL ON EDUCATION

Dr. Burton D. Myers read his report, which was as follows:

One year ago, I reported that it was the purpose of the American Council on Education to raise the annual fund for the expenses of the Council. This has been done, and the Council now has a budget of between $2,200 and $2,300 a year pledged for five years. Dr. Samuel P. Capen, formerly of the Department of Education, Washington, has been apppointed as director of the Council.

The American Council on Education is composed of three classes of members: constituent members, associate members and institutional members. The constituent members are sixteen national associations dealing with education. With the exception of the National Educational Association and the Department of Superintendence, all of these associations are of higher educational interests. The constituent members pay membership fees of $100 a year. Associate members are such other educational or learned societies as may appropriately be affiliated with the work of the Council. At present there are ten of these. All colleges and universities have been invited to become institutional members and pay membership fees ranging from $100 to $500 a year in accordance with the size of the institution. Something over one hundred institutions have joined on this basis.

1. One of the most pressing problems that lies before the Council is to make clear to the educational interests of the country the meaning of pending legislation affecting education. It has, therefore, appointed a standing committee on federal legislation. The chairman is President John H. McCracken, of Lafayette College. The Council's office has digested the seventy-odd educational bills now before Congress and has summarized and classified them. The summary will be printed in a few

days in the first issue of the Council's Bulletin. It will be followed by a critical analysis and discussion of the principles involved in various legislative measures in later issues of the Bulletin. The Committee on Federal Legislation purposes eventually to present a constructive program for the participation of the federal government in educational affairs.

2. During the past eighteen months, eight or nine different agencies have entered the field of international education, to the confusion both of foreign educational officers and of the educational interests of the United States. The American Council on Education has a standing committee on international educational relations. Through this committee it has succeeded in bringing about a working agreement between four or five of these bodies so that duplication may be avoided and the situation made clear to foreigners. It hopes to effect a still greater consolidation of these activities in the near future. Probably, in view of the large number of bodies now active in the field, the Council will not itself take a very prominent part in the promotion of international exchanges of professors and students. It has stated, however, that it would be responsible for an effort to bring about a uniform treatment by American universities of foreign degree holders. It has also agreed to interpret to foreign educational officials, existing lists of approved institutions. It will, of course, participate in the entertainment of any official foreign delegation of scholars.

3. The Executive Committee has authorized the appointment of a standing committee on the status and problems of colleges of arts and sciences. This committee has not yet been appointed, but it is assumed that it will make a comprehensive study and report on the present relations of the college of arts and sciences to the university and professional schools, to the vocational schools on the same level, such as schools of commerce, journalism and engineering to the junior college, etc. It will also, undoubtedly, consider the fundamental aims of colleges of liberal arts with a view to formulating a definition of this type of institution appropriate to the present time. The committee will probably have to seek additional financial support for such a study. There is some prospect that this support will be forthcoming.

4. The Council has a standing committee on education for citizenship, including military training. The chairman of this committee is President Marion L. Burton, of the University of Minnesota. The committee proposes to study and report on education for citizenship in higher institutions and teacher training agencies with particular reference to the question of military training. It expects also to review the work of various committees on education for citizenship which have been appointed by other educational associations and to make a final report which will combine the basic principles and recommendations on which all agree.

5. The Council also has a standing committee on the training of women for public service. The chairman is Mrs. Gertrude S. Martin, of Cornell University. The personnel of this committee has not yet been selected and its plans are somewhat indefinite.

6. The Council also proposes to bring about a greater uniformity of procedure among the principal agencies now engaged in defining college standards. To this end the Executive Committee of the Council has authorized the appointment of a committee which shall be composed of representatives of the principal standardizing bodies.

There has been presented to the Council in the six weeks that the present director has been in office a number of projects which have a wide bearing on American education. Action by the Council on any of these projects has not yet been authorized by the Executive Committee. Two of them are (a) the sponsorship of a study of the teaching of modern foreign languages, and (b) administration of a center of higher studies in Washington to be patronized particularly by students in the social sciences. These indicate the kind of things which will evidently be brought to the Council for its consideration. The policy of the present Executive Committee is to undertake nothing that does not have wide national significance.

In concluding my report, I wish to recommend that the Executive Council make appointments to fill the place of the retiring members of this committee, and authorize membership in the Council with the obligation to pay the $100 annual dues.

BURTON D. MYERS, Chairman.

On motion, duly seconded, the report was received and ordered spread on the minutes. The recommendation to retain membership in the Council was concurred in.

On motion, the report was received and ordered spread on the minutes.

REPORT OF REPRESENTATIVES TO AMERICAN CONFERENCE ON HOSPITAL SERVICE

This report was read by Dr. Fred C. Zapffe.

As the direct outcome of a paper and discussions on the subject of the standardization of hospitals at the meeting of this conference last year (1919), there has come into existence the American Conference on Hospital Service.

The first meeting of representatives of various organizations interested in or concerned with the standardization of hospitals was held in Chicago, April 21, 1919, pursuant to a call issued by the President of the American Medical Association. The representative from this Association was Dr. Fred C. Zapffe, appointed by President Blumer.

The organizations represented at this meeting were the following: American Medical Association; American Hospital Association; American College of Surgeons; Association of American Medical Colleges; Catholic Hospital Association; American Nurses Association; American Association of Hospital Social Workers; Federation of State Medical Boards. The Mt. Sinai Hospital, New York, Rush Medical College, School for Nurses of the Presbyterian Hospital, Chicago, and the Council on Medical Education of the American Medical Association were also represented.

It was decided to organize an American Hospital Conference to be made up of two representatives of each of the organizations above named and two each also from the American Association of Industrial Physicians and Surgeons and the medical departments of the United States Army, Navy and Public Health Services, altogether twenty-four members. An executive council of three members was created to have in charge the formulation of standards, constitution and other essentials to be presented at the first meeting of the conference which was held in connection with the annual meeting of the American Hospital Association in September, 1919.

President Blumer appointed Dr. Roger S. Morris, Cincinnati, and Dr. Fred C. Zapffe, Chicago, the representatives from this Association.

At this meeting a constitution and by-laws were adopted in which the name of the organization was changed from the American Hospital Conference to the American Conference on Hospital Service.

The organization is composed of two accredited delegates from each of the following fifteen organizations:

American Association of Industrial Physicians and Surgeons.
American Association of Hospital Social Service Workers.
American College of Surgeons.
American Hospital Association.
American Medical Association.
American Nurses Association.
Association of American Medical Colleges.
Catholic Hospital Association of the United States and Canada.
Federation of State Medical Boards of the United States.
International Compensation Board.
Medical Department of the United States Army.
Medical Department of the United States Navy.
National League of Nursing Education.
National Organization for Public Health Nursing.
United States Public Health Service.

Provision was also made for the appointment of honorary delegates who have the privilege of the floor and may serve on committees but are not entitled to vote or to hold office. The organization will be controlled by a board of eleven trustees, including the president and treasurer; the other nine were elected for terms of one, two and three years, so that three vacancies will occur each year.

The office of president and that of executive secretary for the present have been left vacant, the trustees being empowered to fill these positions from the best talent available. In the election of officers, Dr. A. R. Warner, superintendent of Lakeside Hospital, Cleveland, was made first vice president; Miss Clara D. Noyes, president of the American Nurses Association, second vice president, and Dr. Harry E. Mock, president of the American Association of Industrial Physicians and Surgeons, was elected treasurer. Nine trustees were elected, three each for terms, respectively, of three years, two years and one year. Those for the three year term were Dr. S. S. Goldwater, director of Mount Sinai Hospital, New York; Dr. John M. Dodson, dean of Rush Medical College, Chicago, and Mr. John G. Bowman, director of the American College of Surgeons, Chicago. For the two year term those elected were Father Charles B. Moulinier, president of the Catholic Hospital Association, Milwaukee; Miss Edna G. Henry, president of the American Association of Hospital Social Workers, Indianapolis, and Dr. Roger Morris, professor of medicine at the University of Cincinnati. For the one year term those elected were Col. James D. Glennan of the Medical Department of the United States Army; Senior Surgeon J. H. White of the United States Public Health Service, and Dr. David A. Strickler, president of the Federation of State Medical Boards of the United States, Denver.

The annual dues for each organization represented in the conference are $25.

Action was also taken to provide for the appointment of four committees: (1) Committee on Hospital Interns; (2) Committee on Standardization of Hospital Service; (3) Committee on Nursing and (4) Committee on Medical Service Under Social Insurance. The chairman of each committee was to be selected from the organization which was most interested and best equipped to carry on the work of the committee, as follows: Interns, American Medical Association; Standardization of Hospital Service, the American College of Surgeons; Nursing, the American Nurses Association of Industrial Physicians and Surgeons. All other organizations in membership in the conference are at liberty to appoint one representative to any or all of these committees.

The third meeting of this conference is being held today (March 3) and will be concluded tomorrow.

FRED C. ZAPFFE.

On motion, duly seconded, the report was received and ordered published in the transactions.

AMENDMENTS

Amendments Referring to Appointment of Commitees.—After considerable discussion, the making and failure to pass various motions made to adopt and not to adopt, Dr. Noyes moved that the recommendation of the Executive Council not to adopt the amendment be concurred in. The motion was seconded and carried.

Amendment Raising the Physics Requirement.—On motion of Dr. Rowland, duly seconded, the recommendation of the Executive Council to adopt this amendment was concurred in.

Amendment to Extend Time for Making Chemistry Requirement Effective.—On motion of Dr. Kober, duly seconded, the recommendation of the Executive Council not to extend the time was concurred in.

Amendment to Increase Chemistry Requirement.—On motion of Dr. Phillips, duly seconded, the recommendation of the Executive Council not to increase the chemistry requirements was concurred in.

REPORT OF NOMINATING COMMITTEE

The Nominating Committee appointed by the chairman, consisting of Drs. Henry B. Ward, James Ewing and Charles N. Meader, reported as follows:

President: WILLIAM PEPPER, Philadelphia.

Vice President: THEODORE HOUGH, Charlottesville, Va.

Secretary-Treasurer: FRED C. ZAPFEE, Chicago.

Executive Council: IRVING S. CUTTER, Omaha; ISADORE DYER, New Orleans.

On motion of Dr. Meader, the report of the committee was accepted and the secretary instructed to cast one ballot for the Association for the election of the nominees. The secretary did so, and the chairman declared the nominees duly elected to the offices mentioned in the report.

REPORT OF AUDITING COMMITTEE

The Auditing Committee, consisting of Drs. Edward A. Balloch, J. H. M. Rowland and W. F. R. Phillips, reported that the accounts of the treasurer had been audited and found to be correct.

On motion, the report of the committee was accepted.

There being no further business to come before the Association at this time, a motion to adjourn *sine die* prevailed.

Adjourned.

IRVING S. CUTTER, Acting President.
FRED. C. ZAPFFE, Secretary.

MINUTES OF THE ORGANIZATION MEETING OF THE EXECUTIVE COUNCIL

At the meeting of the Executive Council held in the Congress Hotel, Chicago, March 3, 1920, the following business was transacted:

The meeting was called to order by the secretary.

On motion, duly seconded and carried, Dr. Irving S. Cutter was elected chairman of the Council for the ensuing year.

On motion, duly seconded and carried, Dr. Cutter was appointed the delegate for the Association to the Council on Medical Education of the American Medical Association.

On motion, duly seconded and carried, an honorarium of $750 was voted to the secretary-treasurer for the ensuing year, and an honorarium of $200 to the chairman of the Council.

On motion, duly seconded and carried, the following membership of the three standing committees of the Association was appointed:

Committee on Education and Pedagogics: Dr. Charles P. Emerson, University of Indiana, Chairman; Dr. J. Whittridge Williams, Johns Hopkins University; Dr. Ray Lyman Wilbur, Leland Stanford Jr. University; (two appointments to be made).

Committee on Equipment: Dr. John F. McClintock, University of Iowa, chairman; Dr. George E. Coghill, University of Kansas; Dr. L. S. Schmitt, University of California.

Committee on Medical Research: Dr. Frederic S. Lee, Columbia University, chairman; Dr. R. M. Pearce, University of Pennsylvania; Dr. W. B. Cannon, Harvard University.

The Council then adjourned.

IRVING S. CUTTER, Chairman.
FRED C. ZAPFFE, Secretary.

OFFICERS AND COMMITTEES FOR 1920-1921

President: Dr. William Pepper, Philadelphia.

Vice President: Dr. Theodore Hough, Charlottesville, Va.

Secretary-Treasurer: Dr. Fred C. Zapffe, 3431 Lexington Street, Chicago.

EXECUTIVE COUNCIL

Irving S. Cutter, Chairman, Omaha.
Isadore Dyer, New Orleans.
Charles R. Bardeen, Madison.
J. Ewing, New York.
Fred C. Zapffe, Chicago.

COMMITTEES

Committee on Education and Pedagogics

Charles P. Emerson, Chairman, University of Indiana.
J. Whittridge Williams, Johns Hopkins University.
Ray Lyman Wilbur, Leland Stanford Jr. University.

(Two appointments to be made.)

John F. McClintock, Chairman, University of Iowa.
George E. Coghill, University of Kansas.
L. S. Schmitt, University of California.

Committee on Medical Research

Frederic S. Lee, Chairman, Columbia University, New York.
R. M. Pearce, University of Pennsylvania, Philadelphia.
W. B. Cannon, Harvard University, Boston.

MEMBERS

ALABAMA

University of Alabama School of Medicine, Mobile.

CALIFORNIA

Leland Stanford Junior University School of Medicine, San Francisco.
University of California Medical School, San Francisco.

COLORADO

University of Colorado School of Medicine, Boulder and Denver.

CONNECTICUT

Yale University School of Medicine, New Haven.

DISTRICT OF COLUMBIA

Georgetown University Medical School, Washington.
George Washington University School of Medicine, Washington.
Howard University School of Medicine, Washington.
Army Medical School, Washington.
Navy Medical School, Washington.

GEORGIA

Emory University School of Medicine, Atlanta.
University of Georgia Medical Department, Augusta.

ILLINOIS

Northwestern University Medical School, Chicago.
Rush Medical College (University of Chicago) Chicago.
University of Illinois College of Medicine, Chicago.

INDIANA

Indiana University School of Medicine, Bloomington and Indianapolis.

IOWA

State University of Iowa College of Medicine, Iowa City.

KANSAS

University of Kansas School of Medicine, Lawrence and Rosedale.

KENTUCKY

University of Louisville Medical Department, Louisville.

LOUISIANA

Tulane University of Lousiana School of Medicine, New Orleans.

MARYLAND

Johns Hopkins University Medical Department, Baltimore.
University of Maryland School of Medicine and College of Physicians and Surgeons, Baltimore.

MASSACHUSETTS

Medical School of Harvard University, Boston.
Tufts College Medical School, Boston.

MICHIGAN

Detroit College of Medicine and Surgery, Detroit.
University of Michigan Medical School, Ann Arbor.

MINNESOTA

University of Minnesota Medical School, Minneapolis.

MISSISSIPPI

University of Mississippi School of Medicine, University.

MISSOURI

St. Louis University School of Medicine, St. Louis.
University of Missouri School of Medicine, Columbia.
Washington University Medical School, St. Louis.

NEBRASKA

John A. Creighton Medical College, Omaha.
University of Nebraska College of Medicine, Lincoln and Omaha.

NEW YORK

Columbia University College of Physicians and Surgeons, New York.
Cornell University Medical College, Ithaca and New York.
Long Island College Hospital, Brooklyn.
Syracuse University College of Medicine, Syracuse.
University and Bellevue Hospital Medical College, New York.
University of Buffalo Department of Medicine, Buffalo.

NORTH CAROLINA

University of North Carolina School of Medicine, Chapel Hills.

NORTH DAKOTA

University of North Dakota School of Medicine, University.

OHIO

Ohio State University College of Medicine, Columbus.
University of Cincinnati College of Medicine, Cincinnati.
Western Reserve University School of Medicine, Cleveland.

OKLAHOMA

University of Oklahoma School of Medicine, Norman and Oklahoma City.

PENNSYLVANIA

Hahnemann Medical College and Hospital, Philadelphia.
Jefferson Medical College of Philadelphia.
University of Pennsylvania School of Medicine, Philadelphia.
University of Pittsburgh School of Medicine, Pittsburgh.
Woman's Medical College of Pennsylvania, Philadelphia.

PHILIPPINE ISLANDS

University of the Philippines College of Medicine and Surgery, Manila.

SOUTH CAROLINA

Medical College of the State of South Carolina, Charleston.

SOUTH DAKOTA

University of South Dakota College of Medicine, Vermilion.

TENNESSEE

University of Tennessee College of Medicine, Memphis.
Vanderbilt University Medical Department, Nashville.

TEXAS

Baylor University School of Medicine, Dallas.
University of Texas Department of Medicine, Galveston.

VERMONT

University of Vermont College of Medicine, Burlington.

VIRGINIA

Medical College of Virginia, Richmond.
University of Virginia Department of Medicine, Charlottesville.

WISCONSIN

Marquette University School of Medicine, Milwaukee.
University of Wisconsin Medical School, Madison.

AFFILIATED MEMBER

Meharry Medical College, Nashville, Tenn.

ASSOCIATE MEMBERS

Dr. James R. Guthrie, Dubuque, Iowa.
Dr. William P. Harlow, Boulder, Colo.
Dr. George H. Hoxie, Kansas City, Mo.
Dr. William J. Means, Columbus, Ohio.
Dr. W. F. R. Phillips, Charleston, S. C.
Dr. Henry B. Ward, Urbana, Ill.
Dr. Fred C. Zapffe, Chicago.

HONORARY MEMBERS

Dr. Henry S. Pritchett, New York.
Dr. Kendric C. Babcock, Urbana, Ill.