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THE PRELIMINARY SCIENCES IN MEDICINE

A PLEA FOR A NEW OUTLOOK

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A hundred and fifty years ago there were many more institutions teaching medicine than at present; they were for the most part places where instruction was given in anatomy and materia medica, but only these survived which had the foresight to become associated with schools of science that provided the necessary instruction in chemistry, physics, zoology, and botany. During the last century there have been more and more additions to the time-honoured teaching of Sydenham, which depended solely on clinical observation, until so great a part do the sciences play in modern medical education that the medical student spends almost half his time in studying them.

MEDICINE THE MAKER OF SCIENCES

The preliminary sciences themselves have greatly multiplied. From anatomy, or the study of bodily structure, has developed physiology, the study of function, and, from the latter, biochemistry, the chemistry of living processes, and pharmacology, the nature of the action of drugs. We may recall that in the last three hundred years medicine has taken a large part in the development of chemistry and biology. All these subjects have now become completely independent sciences, pursuing knowledge for its own sake irrespective of the needs of medicine. Nor has medicine come to the end of making new sciences. In the near future we may expect to see the subject of symptomatology, for example, receive more and more attention. At the present time there is an enormous hiatus not only between the sciences and clinical work, but between medicine and surgery, and much would be gained if a systematic effort was made to take advantage of the opportunities of surgery and to bring the facts thus collected into medicine. For example, some physicians talk a great deal about toxæmia and auto-intoxication, but how many have investigated the effects of a severe burn or simple septic condition upon the general health? How seldom, indeed, is a blood pressure apparatus available in a surgical ward, although surgery presents almost unrivalled facilities for the study of blood pressure. The majority of surgeons have not the time, the training, or the incentive for such research, and much valuable information is lost. They are too busy "making a living!" I prefer to call this new subject a science, for it is evident

that a large amount of information would be obtained which would not necessarily be of immediate practical value. So far the subject has been studied by individual workers for their own interest, some clinical and some not.

GROWING INDEPENDENCE OF SCIENCES

As the early medical sciences gradually developed along their own lines the physician and surgeon lost touch with their work. If we can judge by the writings of thirty years ago, it would almost appear that a certain amount of resentment grew up on the part of the clinicians who saw their children develop into somewhat obstreperous adolescence and full of determination to make their subjects often at the cost of considerable material loss. At a complimentary dinner given to one of our most distinguished physiologists he recalled the difficulties of the relatively recent makers of physiology. Often the payment of the laboratory boy was the carcass of the rabbit used in the experiments. Medicine has good reason to admire and be grateful to those pioneers of medical science.

Twenty-five years ago it was fashionable for clinicians to scoff at the early scientific teaching to students. I have beside me an address by a distinguished physician who gives four examples of the futility of physiological teaching. Succeeding years have already shown how limited was his vision, for each of his "futilities" has borne rich fruit in medicine. One was the then physiological curiosity—the current of action produced when a muscle contracts. Little did he realize that this curiosity would soon become the basis of electrocardiography. Again, a great surgeon once told the members of his class that now they had come to the wards they must put their science behind them. He was reproached by the local professor of physiology, but with characteristic wit and skill he escaped by replying, "Ah, my dear professor, I meant that they were to put it behind them as a *vis a tergo*." It is pleasing to record that he has since indicated that he does believe in physiological science as a real force, even in surgery.

In this connexion it is interesting to recall that some of the great advances in the sciences have not been followed immediately by their obvious application clinically. For example, surgeons continued to remove the whole thyroid for twenty years after Schiff had shown in dogs

that its removal resulted in myxoedema, while we read that Harvey's discovery of the circulation of the blood had no effect on current medical teaching, including that of the great Sydenham, whom, with Boerhaave in Leyden, we look upon as the parents of post-Renaissance clinical medicine. Fortunately such days are now remote.

SCIENCES NOT VOCATIONAL

At the same time we must not imagine that the preliminary sciences are entirely free from the indictment made against them that they do not serve medicine so well as they might, but let it be said at once the fault is as much that of medicine. All the preliminary sciences have grown enormously since they were introduced into the medical curriculum. The medical student receives a course similar to, but less concentrated than, that of the student preparing for a degree in science, and he has to make the best of it; the state of affairs obtaining in many universities bears very little relation to the vocational needs of medical students. It is generally agreed that this arrangement is in some respects ideal, or was so thirty years ago; but, as will be discussed below, how far this non-vocational outlook should be carried is now a very debatable problem, for the sciences are inclined to be taught at the expense of the vocational needs of medicine. This is particularly true of botany, zoology, chemistry, and physics, and is only to be expected when we remember that these departments have to consider many students who will pass on to fields other than medicine, and that the students who are going to continue these subjects in later life are regarded as having first claim.

It is only with the greatest difficulty that the material suitable for science students can be selected, and many strange anomalies exist. For example, the term chemistry in the intermediate examination in science of the University of London does not include organic chemistry, although this examination is the sole intermediate examination in chemistry for a student passing on to honours in physiology, and exempts from the whole chemistry examination for many degrees and diplomas. If those responsible for the science curricula find it difficult, how much more difficult it must be when non-medicals attempt to devise a course for a profession of which they know very little.

BOTANY A RELIC

Botany is an anachronism in the medical curriculum and a relic of the days when the doctor prepared his own drugs from plants, but its retention is insisted upon by those who, knowing little of the composition of a present botany course, feel that somehow it may have some cultural value. They do not realize that one of the chief considerations of botany teachers is to prepare students whose prospect is for the most part the teaching of botany in girls' schools, botany being one of the more polite subjects. In zoology the keynote is still the Huxley types, which are laboriously memorized, and from which the student rarely comes away with much idea of why Huxley emphasized these types or of the great principles of biology.

It cannot be denied that some of the details taught in botany and zoology have a relation to medical work, but in many instances they have little relation to biological principles and are merely crammed for examination purposes and should not be taught. For example, the details of flat and round worms could with advantage be deferred, since they are of greater interest in parasitology. In botany the details of moulds and bacteria could just as well be postponed until the student takes bacteriology. Teachers of these subjects are sufficiently astute to include such matters in the examination for obvious reasons, but they are quite oblivious of the psychological (really biological) consideration that

isolated and unrelated facts are extremely difficult to retain except by those of Eastern descent with prodigious memories.

UNDUE DETAIL HARMFUL IN EARLY YEARS

It can indeed be claimed that not only is the requirement of such detail at this stage useless, but it is actually harmful, as it gives the student the idea that he must memorize rather than understand. Those of us who meet students later know that their outstanding characteristic is that they have committed to memory more than they really understand, and as a result their knowledge is in compartments. If they are asked a question in the way they have crammed it they answer volubly, but if the same question is turned the other way round they are strangely silent. This criticism is true, unfortunately, of much so-called education other than medical. It is probable that the old-fashioned natural history was much more valuable as a preliminary to medical education than what is taught at present, as it gave students a real interest in biological problems.

The physiologist, coming into contact with the students in their second year, is in the unfortunate position of seeing how completely inadequate is the first-year teaching. The student comes to him possibly with an excellent idea of the blood vessels of the frog or the bird, but with quite an insufficient knowledge of the mammal. There is a good deal to be said for the study of human anatomy before comparative anatomy. What a great advantage it would be if the mammal was more fully studied, especially with regard to relation of organs and the possible effects of erect posture. The gross errors committed in chemical physiology make it evident that if more attention was paid in the first year of chemistry to technique in weighing, measuring, and handling materials, instead of collecting scattered facts, an enormous advantage would accrue which would be of value throughout the rest of the student's life.

ANATOMY AND PHYSIOLOGY

Nor are anatomy and physiology free from similar defects. Some years ago it was my fortune to take part in clinical teaching, and it will be generally agreed that the student passes on to the wards insufficiently prepared. Under the present system it is practically impossible to avoid this. It would be almost possible to divide the facts of physiology into two categories: those which are essential to medicine and those which are not so essential—for example, the heart sounds and the measurement of the hydrogen-ion concentration of the blood. Suppose questions on these two subjects appear in an examination paper and the pass mark is the usual 50 per cent. It is quite common for students to know much about the latter question and nothing about the former, and, according to custom, to pass; yet it will be agreed that a student who does not know anything about the heart sounds ought not to be allowed to pass to clinical work, but in the science of physiology hydrogen-ion concentration is more important than the heart sounds. It is common for a man to fail in a final examination because he does not know an elementary fact, but this does not occur in the preliminary sciences, nor is it possible, because what is a necessary fact for the science of physiology is not essential to medicine, and vice versa. The student himself cannot be expected to differentiate.

This example brings home to us the difficulty of the present system of teaching the sciences in medicine. The relative importance of the same facts may appear quite different to the science concerned and to medicine; to look from the point of view of the science may be the better culturally but detrimental vocationally. That, at first sight, may not appear serious until it is realized that

the student badly educated vocationally in the rudiments is fundamentally unsound throughout the rest of his course and wastes the time of his teachers and of himself. Clinicians who have to inculcate elementary anatomy and physiology upon students in the wards appreciate this as much as the chemical physiologist or pathologist who has to teach students how to weigh and measure.

Having criticized my own subject, I feel that anatomy cannot escape censure. May one ask—Would even the average surgeon be any the worse if he only knew half the anatomy required for the Second M.B.? Need he know the relations of even such a large structure as the innominate artery, which he is never likely to have much interest in again except in the post-mortem room, not to speak of many details about bones? Many students who have not a good visual memory have the greatest difficulty in amassing the vast amount of detail required; moreover, it is promptly forgotten. We have only to ask ourselves how much we remember of the anatomy we knew to realize the truth of this statement. Surely it would be a great advantage if more time was spent on the study of movement. The average doctor might then be at least a little more capable of treating a multitude of football injuries which at present find their way too often into the hands of bone-setters and osteopaths. I know that I am raising my voice against a time-honoured tradition, and we all must honour the tradition which has brought us successfully, thanks to Vesalius and his successors, out of the Dark Ages when anatomy was at a very low ebb. In preserving the Vesalian tradition in teaching to-day, however, we must be careful that we do not place ourselves somewhat in the position of those who burned Servetus at the stake because by discovering the pulmonary circulation he struck a vital blow at the great and honoured tradition of Galen which had stood unchallenged for actually a thousand years.

Why not let us have a 75 per cent. pass mark on a smaller field of knowledge and a 40 per cent. pass mark on matters less essential vocationally? This would undoubtedly lead to a generally increased proficiency, although it might make it more difficult for examiners to differentiate between the best candidates. The present system by which an enormous amount of information may be required leads to a vast amount of gambling which has made it necessary for certain questions to be compulsory even in the London M.B. Students, for example, in physiology often find it more profitable to omit reading the nervous system altogether, especially where there is some choice of questions. In this connexion we should remember that a course in Medicine is different from a course in Arts, or even Science, as it is for many students their sole preparation for the task of treating patients, and it is of national importance that there should be a minimum all-round efficiency, and that the time of training should be used to the best possible advantage.

It is easy to criticize, but in doing so we must not be unfair to those who have gone before us, and we must remember that the general lay-out of the medical curriculum was made when many of its subjects were very much smaller than they are now. All was then done for the best. It may be said that it is educationally good for the student to learn a great deal of what is really unnecessary, but are we entitled to teach much that is unnecessary while the curriculum is so overcrowded that he has scarcely time to think and while we have to omit a great deal of what would be really useful to general practitioners of medicine? Even if we may teach him some facts that are not essential, is it not best to teach those things which are in most immediate relationship to his later work? If he must learn about iron, is it not better for him to learn about the function of iron as haemoglobin in the body than to learn how the mineral

is obtained from natural ores and converted into steel, however interesting it may be? We cannot make the medical course longer, for it would be an uneconomical proposition not only financially, as it would reduce numbers entering, but because there is a limitation to mental capacity; the evidence is very complete, and indeed it is our common experience that we reach a stage when we can only accumulate new information at the expense of some which we already have.

There is very little doubt that the existing methods of teaching the preliminary sciences merely give the student a loathing for them which may never be dispelled, instead giving him an absorbing interest in the wonderful processes of nature on which his future knowledge will be based. The preliminary sciences have many fascinating problems in common with medicine which are of the greatest possible educational value, but if they are taught at all they form a very minor part of the teaching. In biology there is the problem of heredity, the relation of structure to function and adaptation to environment. In chemistry there are the great problems concerning the passage of substances through membranes; their study would afford excellent training and would also be useful, but they are almost omitted from the usual chemistry course. Such examples could be multiplied indefinitely, but those given serve to indicate that the preliminary sciences might serve medicine more adequately without losing their own dignity.

PURE SCIENCE NECESSARY IN MEDICINE

During this discussion we must be clear that we do not confuse research in the medical sciences with teaching, for there is much evidence in medicine that purely scientific research has proved extremely useful. When von Mehring and Minkowsky removed the pancreas *to see what would happen* they did not suspect that their findings would lead to a treatment of diabetes, nor did Halliburton and Rosenheim, when they studied the chemistry of nervous tissues, imagine that the facts which they collected would lead to a cure for rickets. We may recall Sprat's *History of the Royal Society*, in which he says:

"If they will persist in contemning all experiments except those which bring them immediate gain and a present harvest, they may as well cavil at the providence of God, that He has not made all the seasons of the year to be times of mowing, reaping, and vintage."

The sciences must be taught to the medical student, because the methods of science are the methods of medical research, and they teach him to think clearly and logically. But they must not and need not be taught *at the expense of his vocation*, and in most instances the principles of a science can be taught, using examples which are of the greatest medical interest and importance. It is not enough to give a medical student a smattering of a science and to cram him with details for this or that examination. That is not education, although it is what commonly goes by that name. The student must be taught primarily to think and to weigh evidence. It would be well if every ten years the syllabus was reviewed to ensure that this principle was being maintained, for there are constant changes in the possibilities of correlation between the preliminary sciences and medicine. It is doubtful if the teachers of these sciences are always capable of judging what should be taught, as they are often not medically qualified; frequently they are juniors in scientific departments waiting for posts in pure science who may have little real interest in medical requirements. There is an increasing need for good chemists, physicists, and biologists who will devote their full energy to the needs of medical teaching and research rather than to pure science. In Scotland some of the universities are already provided with senior posts for this purpose.

As the years go on more and more competent teachers will be required in the preliminary sciences, for these sciences are gradually extending into the clinical years. The establishment of full-time chairs of medicine and surgery is an indication of the requirements of the sciences in more intimate association with the study of disease. For example, our greatest need to-day in the investigation of cancer is a more comprehensive knowledge of the fundamentals of normal growth and repair; and thousands of persons die annually from surgical shock because of our ignorance of the control of the circulation of the blood.

SCIENCE IN THE SCHOOLS

One of the important problems to-day is how far science taught in schools can replace that taught in the first year of the medical curriculum. A great complaint regarding the teaching of the sciences in schools is that the teachers have to cater for a number of men whose intended occupations are very diverse, and it cannot be expected that the science taught can have any particular bias. It should, however, become generally known that, quite apart from bias, it is most unwise for medical students to take their chemistry and physics at school, especially if they do no biology at the same time, since they find themselves for a year with biology on their hands. The universities have been placed in the unfortunate position of receiving students some of whom have studied chemistry and physics at school and some who have not. It becomes necessary to provide for both, and much additional teaching is required. This reacts on the staff, since excessive teaching reduces time for research and makes the ablest men avoid such posts. It would probably be best if Medicine took a firm stand and established a subject of medical chemistry which included not only organic but also physical chemistry, a subject which is becoming increasingly important in the study of physiological processes. Further, intermediate chemistry for a science degree as it at present exists should not be allowed to exempt from medical chemistry, which would then be much more adapted and useful for medical needs. Let it be said at once that this medical chemistry would not in any way be easier than intermediate science chemistry, rather the reverse. Then might follow medical physics and medical biology, which would be a much more useful introduction to medicine than diluted science courses. The revised curriculum of the Conjoint Board is a definite step in the right direction, but it would have been better still if it had not allowed details—even details of medical interest—to obscure the great biological principles which are so important in real education.

RECENT MEDICAL ADVANCES

The great advances in medicine in the last fifty years have shown an interesting grouping. First came the study of pathology, which from investigations post mortem gradually established certain principles by which primary disease in one organ may affect another, and by which it was shown that certain symptoms probably depended on certain pathological lesions. In these days we are inclined to forget the pathologists of fifty to a hundred years ago who, with the aid of often very indifferent microscopes, laboriously searched the organs of the body for evidence of disease, the cause of which was unknown. Often their researches were unrewarded, but with each new advance we are beginning to realize what valuable work they did. But the great work of the pathologists was overshadowed in the later part of the last century by the bacteriologists, who followed in the footsteps of Lister and Pasteur. The bacteriologists demonstrated the bacterial origin of many diseases and treatment on anti-bacterial lines.

In the post-war era the advances have been due to physiology and biochemistry, and the discovery that a large amount of disease can be elucidated by the investigation of normal function. Unfortunately, as a physiologist, I cannot claim that all these advances have been made directly by professional physiologists. The discovery of the successful treatment of diabetes, pernicious anaemia, and rickets was not made by physiologists, but they depended entirely on methods of investigation which had been elaborated in the physiological and biochemical laboratory. It is almost impossible for any new investigation into the causation of any disease to proceed without frequent resort to recent physiological and biochemical literature, and, as we have indicated, the day is dawning when a systematic study of symptomatology with a basis on these subjects will take its place as an indispensable preliminary to the study of medicine and surgery.

THE SCIENCES BENEFIT STILL FROM MEDICINE

It has been said that the art of medicine is national, but that the science of medicine is international, because it stands on the firmer basis of the preliminary sciences, which have certain conventional fixed points. Nothing is more interesting or surprising than to learn how very differently the practitioners of different countries treat many complaints. We no longer look upon the preliminary sciences as being preliminary except in time; they are really auxiliary. We need chemists, physicists, and biologists interested in the problems of physiology and pathology just as we need experienced anatomists, physiologists, biochemists, and pathologists investigating the problems of medicine and surgery. Nor will the sciences suffer thereby; physiology and biochemistry have still much to learn from medicine and surgery. Our knowledge, for example, of carbohydrate metabolism owes much to the study of diabetes; our knowledge of the ductless glands and of the nervous system owes an enormous amount to clinical observation, and the astuteness of the clinician will always be a potent factor in physiological advance. In turn physiology and biochemistry enrich the subject of chemistry and even physics. The oxidation of fats in the body gave chemists a new conception of oxidation processes, while the principle of the string galvanometer, invented by a physiologist, is now extensively used in physics.

It is becoming increasingly common for medical students to supplement their training by taking a science degree in physiology, usually immediately after anatomy and physiology. A physiologist may be accused of emphasizing his own subject, and to a parent the extra year may appear an extravagance. A glance at the subsequent records of students who have taken this additional course shows most clearly how they stand out beyond their fellows, while it is interesting that many of the great leaders of medical science have been among them. Judging by results, then, it can be stated that the extra year is a good investment. The staffs of our universities are recruited largely from such men, and it is they who, by their knowing a little more of the sciences than their colleagues, may be expected to make use of them in the interest of medicine.

THE DUTY OF THE ADMINISTRATOR

Medical education has been slowly evolved, and those who guide it have a great responsibility. It is they who have to say, not that this or that piece of knowledge is valuable, but whether in a given time it is profitable to learn this piece or that; whether, for example, it is more profitable to learn the structure of a plant root, however interesting, or to require a higher standard of knowledge

regarding growth and repair, or to learn why a cardiac patient is breathless.

Too often the faculties concerned simply allocate times to definite subjects, and leave the syllabus to the teachers concerned. The variety of teaching evident from the syllabuses of various schools indicates the chaos which exists. In medicine we know well that when there is a variety of treatments for the same complaint there is something very unsatisfactory about each treatment. The difficulty, of course, is that those concerned with final-year subjects are a little diffident in advising on subjects about which they admittedly know practically nothing, but many first-year teachers would welcome some better attempt to advise them more definitely than is done by the General Medical Council, which is also too remote to give adequate advice. In ignoring the syllabus a duty to the medical student is shirked. The medical student is the future custodian of our profession, and he must not be allowed to muddle through, guided more by the vested interests of the departments concerned than by the real need of his profession. He must be encouraged to develop his sense of values and to weigh evidence, in the hope that he will one day add his quota to the sum of human knowledge, and be all the more capable of preventing and alleviating human suffering.

Medicine must put its house in order, but those who are most immediately and personally interested in the advance of medical science are seldom the administrators. Each administrator might well ask himself, "Could I improve the early training of the medical student to equip him better for my own particular specialty?" This question he could invariably answer in the affirmative, and if he tries to imagine the other specialties he can easily realize that vast changes in the curriculum are really needed. Probably the best preliminary science course could be secured if a specialist in each branch of medicine, of surgery, and of public health, well versed in research in his subject as well as in the applied side, was asked what he needed to be taught in the best interest of his specialty, and if these were subsequently welded together. Then could be added the subjects of cultural value at suitable periods.

It has often been suggested that the student would appreciate the science more if he did some clinical work in his early years, but this is probably not so. Some schools allow, or used to allow, the men to attend surgical out-patients before they had completed anatomy and physiology, but there can be no doubt that the clinical work proved too strong a distraction to men who were tasting for the first time the pleasure of doing something useful, and was definitely detrimental to their more academic studies. Experience, however, shows that the senior student, like the general practitioner, is appreciative, as shown by attendance at voluntary classes, of properly chosen instruction in the preliminary sciences.

CULTURE IN MEDICINE

One word about culture in medicine. Doctors have ten been rather sensitive about being called the worst-educated profession, although with the increasing number of men whose education is chiefly scientific the accusation loses much force. The term "education" is surrounded by certain conventional ideas born of the schoolroom, and in the average university it is bolstered up by vested interests. To consider an Arts professor who knows nothing of the natural sciences, or of the functions of his own body, or very little of human nature and frailty, better educated than a doctor is simply convention and nonsense; for if the limitations of time have made it necessary that the doctor is weak in his classics, his history, or his literature, he has gained a vast and varied knowledge of nature which would be of

inestimable value to his Arts colleague. Probably the best purely cultural subject for the medical student is the history of medicine, by which he is brought to learn to be grateful for his heritage; to learn of the years and years of patient endeavour which have led to the discovery of facts which he now considers commonplace, and to realize that he, too, may make a modest contribution, whatever his sphere. It is a most remarkable fact that medicine is one of the few professions which does not make an elementary study of its history obligatory on those who intend to adopt it, to maintain its traditions, and to reap its rewards.

ECONOMICS IN MEDICINE

The preliminary sciences of medicine have to face another problem, which is one of economics. There is a Scottish saying that "the man who pays the piper calls the tune." Medicine is entitled to call the tune, and history shows full well that it is generous to the sciences which serve it so well. The present strong position of the medical sciences with their associated laboratories is due largely to medicine. Medicine realizes full well that the independent anatomist, embryologist, histologist, physiologist, biochemist, and pharmacologist justify their existence because of their researches, *provided* they do not forget altogether that they owe much of their welfare to the medical student.

This problem is not confined to the medical sciences, but concerns also the older sciences of chemistry and physics, which have also tended to forget the hand that feeds. The scientific industries found that the universities were not sufficiently elastic in their outlook, and largely ignored their needs, with the result that they themselves have established laboratories, often better equipped and with staffs better paid than in the universities; and so these laboratories have become a strong counter-attraction to university life. Even the great pharmaceutical chemists have done likewise, to the detriment of the pharmacological laboratories in our universities. To think of what many of our scientific departments might have become had they been more willing to assist industry makes us weep for the land of the might-have-been. It is not too late. There is no reason why the worker in applied science should not work side by side with the worker in pure science; indeed, both would gain considerably. Were the universities really willing as a whole, industry could be made to realize that it is much more economical to endow workers and laboratories in the universities than to establish its own laboratories, in which the workers are more isolated and have not the advantage of discussion of their problems with the diversity of persons to be found in a university.

The co-operation between science and industry in the universities is much better seen in some other countries than in our own, and of recent years workers in industrial laboratories have made important contributions to pure science. We shall see in the near future the foundation of schools of industrial science which will compete with universities for students, if the universities do not recognize this danger.

COMPETITION BETWEEN DEPARTMENTS

Unfortunately, for similar reasons there is arising a competition among departments of medicine. I refer particularly to the establishment of medical and surgical departments with extensive laboratories which correspond to the laboratories of industry. In these departments is duplicated a large amount of apparatus in part-time use in physiological and biochemical departments, and indeed I know of some medical departments infinitely better equipped in physiological apparatus than the physiological laboratory in the same school. But what is still more serious,

the senior departments, by offering greater emoluments, are having first option on the few men willing to take up academic life. In a medical department they may do exactly the same research work as in a physiological department, but they are better paid in the former. Biochemistry, which might be so much more valuable, has undoubtedly suffered particularly from the anxiety of non-medical biochemists to demonstrate their independence of medicine, forgetful of the fact that *every department of science, unless endowed, lives upon an applied science, through which it serves the community*. Biochemistry, it is true, has applications other than medical, but these are insufficient to induce students to study this new science in numbers large enough to maintain it. The result of this attitude of the biochemist is to discourage the foundation of chairs of biochemistry. The hospitals appoint their own biochemists to supply their needs, and academic biochemical departments are scarcely cognizant of the problems which present themselves in the wards. How much better it would have been for biochemistry and for its students if these hospital biochemists had been on the staff of departments of biochemistry. Now biochemistry has to content itself by attempting the impossible—to take over certain chemical parts of physiology. It is beginning to consider that digestion and metabolism, and even more, are its own particular preserve, and appears to imagine that these processes can be studied with little

reference to the body as a whole or without any knowledge of the nervous system which controls them.

An unduly independent attitude of the preliminary sciences must lead to their own impairment, for they cannot escape from the ordinary economic laws. The lack of sympathy between purely scientific and medical departments is, however, not only of growing economic importance, but creates a vicious circle which tends to increase lack of sympathy, and the student is very adversely affected. At present the organic chemist teaches certain methods for certain tests and estimations; these are re-taught in another way by the biochemist, and again in still another way by the hospital biochemist. The medical student naturally considers that the methods which have the nearest relation to practical affairs are best, and does not have his opinion of his earlier teachers enhanced. This opinion he will never lose.

It would be well if the words of the late A. D. Waller were better known. They were spoken of physiology, but are applicable to all the medical sciences.

"Physiology must be studied for its own sake, but the physiologist whose immediate motive is *the want to know* may not deny his debt of service to the community of which he forms a part and whose services he enjoys, and the channel through which he can repay some part of that debt lies first of all in the service he may be able to render to the practice of medicine, to the knowledge and power of the physician whose immediate motive is *the want to help*."

THE PROFESSION OF MEDICINE

INTRODUCTORY

In accordance with long-standing custom we publish now, some weeks before the opening of the winter session at the medical schools, a special Educational Number. The form and contents of this annual issue have been modified from time to time, but its purpose remains unchanged, and the seasoned medical reader must expect to find here a great many familiar facts and phrases. The first object of the Educational Number is to give prospective students and their parents full information about the steps that must be taken in order to become a registered medical practitioner. The second object is to assist those wishing to know what a medical career has to offer, and others who, having already decided to study medicine, are uncertain about the line of work for which they are best suited. Our purpose is to supply information rather than to offer advice; but, as in past years, this introductory article gives an opportunity of reviewing some aspects and tendencies of medical study and practice, and of directing attention to a few points which might not occur to anyone without some experience of the medical life.

Intending students will find in the pages that follow an account of the course of training required of them, the places where it can be obtained, and the universities and other licensing bodies which test the knowledge gained and confer degrees or diplomas entitling successful candidates to become legally qualified medical practitioners. Sections are included also on post-graduate medical study, on the higher qualifications, both general and special, and on the many and varied spheres of work open to registered medical men and women at home and abroad. The details given are founded on official information, and arranged along the customary lines.

It may be well to repeat here, what has often been said before, that the aim of a medical education is to impart not only the essentials of medicine, but also the right principles and methods of adding to knowledge after qualification. Such teaching, to be effective, presupposes

a good general education. Next in importance is a good scientific education—a thorough grounding in the basic principles of science. Upon these the student of ordinary intelligence and industry can build up an adequate technical equipment for the practice of his profession. An unfortunate tendency in studying the preliminary subjects is to acquire a mere "cram" knowledge, quickly forgotten after the particular examination is passed. These sciences interlock with each other and with the later subjects, and, properly approached, they give a drilling in exact methods and vigorous reasoning which will bear immediate fruit in the clinical part of the curriculum. Chemistry, physics, and elementary biology prepare the way for anatomy and physiology, and so for medicine and surgery and obstetrics. The curriculum is not perfect. It is always undergoing revision, to keep pace with new knowledge and improvements in practice. But all authorities are agreed that the preliminary and intermediate sciences form the only appropriate introduction to the study of clinical medicine, and attempts are made from time to time to bring the teaching of these subjects into closer relation with the life-work of the practitioner.

PORTALS OF THE PROFESSION

The obvious goal of every student is the entry of his name in the *Medical Register*, which is the official statutory list of qualified medical practitioners kept by the General Medical Council. There are many ways in which admission can be obtained to the *Register*. No fewer than twenty-seven bodies—eighteen universities and nine corporations—either separately or jointly issue registrable qualifications; and the number of teaching institutions is even larger. Nevertheless, although in this country we have no single State examination in medicine—no "one portal system"—the medical courses of the various universities and schools in Great Britain and Ireland run on parallel lines, and the obligatory curriculum is much the same for all students. As, however, the individual teach-