

The medical curriculum : an address delivered on the 1st October, 1903, on the occasion of the opening of the winter session of the Medical Department of Yorkshire College / by E.A. Schäfer.

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THE MEDICAL CURRICULUM

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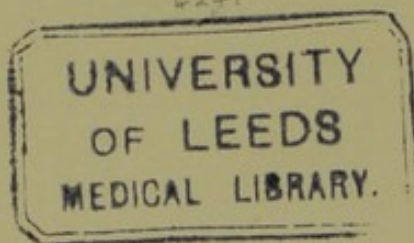
THE MEDICAL CURRICULUM

AN ADDRESS

Delivered on the 1st October 1903, on the occasion of the
Opening of the Winter Session of the Medical
Department of Yorkshire College.

Sir Edward Albert Sharkey
BY
PROFESSOR E. A. SCHÄFER, LL.D., F.R.S.

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THE MEDICAL CURRICULUM.

GENTLEMEN,—There is no subject which will require more careful consideration in the settlement of the educational details of the new university of which Leeds is to be the centre than that of the choice and arrangement of the curriculum to be required for the degrees in medicine, and I therefore make no apology for introducing this as the subject of the address which I have been honoured by being asked to deliver to you to-day. An exceptional opportunity presents itself: you have, within certain limits, a *tabula rasa*, and it behoves the authorities of the future university to mark it in the manner best calculated to promote the advance of medical science and the efficiency of medical teaching. If, from an experience acquired as teacher and examiner in various universities during a period of more than a quarter of a century, I can help in the promotion of these objects, by pointing out virtues which may be emulated here, and failings which may be avoided there, I shall at least feel I have done something to assist in the modelling of what will, we all hope, become one of the great centres of learning of the Kingdom and Empire.

But whilst endeavouring to sketch out what subjects should form part of the medical curriculum of a university, and to appraise their relative order and value, I do not propose to place before you an ideal which is unattainable under the circumstances of place and time, and, more important still, of finance in which you find yourselves, although it would be easier to construct an ideal curriculum than to plan one out within the limits of present-day practicability. I suppose that the curricula now being

established in some of the newly endowed American universities will more nearly approach the ideal than is possible anywhere upon this side of the Atlantic. In the Johns Hopkins University at Baltimore no student is admitted as an undergraduate in medicine who has not previously passed a special examination in arts and science, and the knowledge required for this is such as will be productive of the greatest amount of benefit in preparing for the medical sciences properly so called. It includes amongst other things a reading knowledge of French and German, and a thorough practical study of the preliminary sciences. The medical curriculum proper extends over four years, so that a period of study of at least six years in all is required of the student before he can receive the university stamp in the form of a degree in medicine. A similar principle has lately been established for Harvard, and it seems likely that all the American universities of the highest rank will follow suit. It is certainly not a little remarkable that the American universities, when placed in the possession of adequate endowments, make no attempt to increase the number of their graduates by a lowering of standards—a method of procedure which I believe may still be observed in operation in some which are not yet in that favourable condition, and which has, I fear, not been universally avoided in our own country—but aim entirely at attracting students both by the thoroughness and efficiency of their teaching and by the facilities for post-graduate study and research which they offer in all departments of science and medicine. The natural result of this must be that these universities will not only obtain the pick of the American students, but will, as years go on, attract students—as they already have begun to attract professors—from other countries, so that eventually the centre of gravity of medical science will become shifted westward. This must certainly be the result of the development of the universities in the States, which will eventually take the part which was played by the universities of Italy in the Renaissance, and by those of Germany in more recent times. Unless, by the munificence of the private benefactor, or direct and adequate endow-

ment by the State, our own universities are placed upon a footing which shall render it possible for them to compete, by thoroughness of equipment and the adequate provision of a staff qualified in the highest manner both for teaching and research, with those which are now, by virtue of the possession of these requirenda, outstripping us upon the other side of the Atlantic. But the object of this address being not so much to place before you an ideal at present impossible of attainment as to offer practical suggestions regarding the manner in which a medical curriculum may be planned out under actually existing circumstances, let us turn our attention to this.

It may be premised that every university should endeavour so to arrange its teaching and examinations as to render it possible for all students who have conscientiously followed the teaching, and who have worked steadily during their period of study to obtain the degree which marks a certain standard of efficiency. This is the pass standard, and the medical degree in many universities is restricted to this standard, which, however, varies considerably in different centres. I myself think that it is not only right for a man who has shown himself superior to his fellows in learning to be able to have that superiority recognised by an honours degree, but that the promotion of higher teaching in the university suffers from the absence of such degrees, since, if there is but one standard, and that not a particularly high one, the teachers will be chary of offering, and the pupils impatient of receiving knowledge which both know will not be required for any examination. I do not, however, propose to divert the course of your attention along by-paths which lead in the direction of special or honours degrees, which, when all is said and done, must at best concern only a small proportion of undergraduates, but will try and confine it to the manner in which the requirements for a pass only should be met.

In the first place I would insist that a university degree in medicine should invariably—although in some instances it is not so—be a sign of higher attainments than a mere qualification to practise. I do not think there is any fear that the new university which is to be set up here

will depart from this principle, or is in the least likely to go back upon the traditions of the Victoria University of which it is one of the offspring. I will assume that the medical degrees will, as they should do, confer a real distinction and indicate a fair amount of scholarship. To attain these or any other university degrees, it is necessary to pass through certain stages of prior education, and to produce evidence by examinations or otherwise, that in each stage a certain proficiency has been acquired. Of these stages the elementary and secondary are common to most degrees, and the subjects embraced by them are regarded as essential elements of a general education. How far this may be true for all of them, I am not now prepared to discuss at length. We still follow in some respects the traditions handed down to us from the Middle Ages regarding the education of our boys. It is no longer considered essential that a member of Parliament should introduce from time to time a quotation from Virgil or Herodotus into his speeches, and probably only a minority of the members are now able to understand such a quotation were it forthcoming. But a certain smattering of a "little Latin and less Greek" is still regarded, whether rightly or wrongly, as part of the education of a gentleman. This is a social tradition which is deep rooted, and although real scholarship in the classical languages is rare, in spite of the vast amount of time which is devoted—during school and university life—to their study, it is kicking against the pricks to suggest that subjects which will be more useful to a man in after-life might, even as a form of mental training—and that is the reason now usually given for the retention of the prominent position occupied by the classics in our large secondary schools—take their place with advantage in the school curriculum. If as much time were to be devoted to the acquisition of a knowledge of French and German as is given to that of Latin and Greek, the result would at least be the acquisition of knowledge which would in nine cases out of ten prove an important advantage in a man's subsequent career, and most emphatically is this the case if that career is to be the profession of Medicine. The Latin and Greek which is learned at school by most boys is,

in ninety-nine cases out of a hundred, useless to them in their future occupations, and even in the medical profession where terms derived from those languages are largely employed, a very small acquaintance with them is sufficient for understanding such terms. It is mere common-sense to insist that it is better to have a useful acquisition than one which at the best is purely ornamental ; but experience teaches that when we oppose common-sense to tradition, the latter usually comes off victorious. There is indeed nothing so hard to eradicate as a long-standing tradition. It has often happened before, and may happen again, that the clinging to traditions has barred the way of advancement of whole communities and races of mankind.

I suppose it will be even more difficult to obtain the general introduction of the teaching of natural science than of modern languages into secondary schools, in the place of a large part of the time now occupied by classical studies. It is appalling to think that many people who pass as highly educated have absolutely no knowledge of any of the natural sciences ; that most leave school and the university and remain throughout life entirely ignorant of such fundamental and everyday subjects as the composition of the atmosphere, of water, and of the soil, the operations of physical and chemical agencies, such as produce heat, light, sound, and electricity, the relationships between electricity and magnetism. They know nothing regarding the structure and mechanism of any plant or animal, and least of all of the structure and mechanism of their own body, although they often profess a profound knowledge of an intangible entity which they assume to inhabit it. Nature is to them a sealed book. Her forms and colours may produce impressions of pleasure, but they care not to inquire why. Their "ignorance is bliss," they find it "folly to be wise"! They "ask not proud philosophy to teach" them what things are. They probably still believe that the earth and all things therein were created in six days, they resent the idea of a quadrumanous ancestry, and are convinced of the existence of an inferno somewhere in the bowels of the earth and of a

paradiso somewhere in the sky above them, although, how that can be arranged conveniently for the inhabitants of the antipodes they do not trouble to conceive. I do not assert that there are people who pass socially as educated persons who still retain the idea which was imparted to us all in our childhood that the moon is made of green cheese; but, at any rate, I am perfectly sure that there are a vast number who have not the slightest inkling what any of the celestial bodies are composed of, and many more who could not for the life of them say how it is possible to arrive at a notion regarding their nature. A certain proportion of people pick up a smattering of knowledge regarding some of these things from the hearing of occasional lectures at Philosophical Institutions or from the perusal of articles in the reviews and journals or even in Strand magazines. But the general fact remains that the ignorance, not of the populace alone, but of the so-called educated classes regarding all matters relating to science is—I can find no other word for it—appalling. Small wonder that Christian scientists, anti-vaccinationists, anti-vivisectionists, *et hoc genus omne*, flourish in a soil so fertile!

But whatever may be thought about it as a subject of general education, a knowledge of the sciences is an absolutely essential preliminary to the study of medicine, and because such knowledge is not imparted in our schools, it has become necessary to incorporate into and in so far to burthen the medical curriculum with courses of preliminary science. At least a year of the precious time which might be devoted to the study of medicine is thereby occupied by subjects which could be equally well acquired before the study of medicine is actually begun. This is only partly due to the fact that secondary schools do not lay themselves out to give instruction in science. For even if they did so, and if the education they gave were as thorough and practical as it should be, and as it undoubtedly is in a very few exceptional instances amongst English public schools, the rules of the General Medical Council would render the taking of it in schools nugatory. For there is, as you are aware, a regulation of the General

Medical Council to the effect that no course of instruction which has not been attended subsequent to registration as a medical student shall be permitted to count in fulfilment of the requirements as to science courses necessary for qualification. In other words, a student may have gone through at school or even at college a thorough course of instruction in the natural sciences and is yet—unless he happen to have had himself registered beforehand as a student of medicine—debarred from presenting himself at the preliminary scientific examination for the medical degree of a university until he has again attended the same courses after registration. You are further doubtless aware that this regulation is at the present moment being defied by the Royal Colleges of Physicians and Surgeons. Whatever the motives of the Royal Colleges may be, I confess that they have my entire sympathy in the action they have taken, and I trust the result will be that this registration of medical students will be either ended or mended, for as it at present stands it is a direct discouragement to the teaching of science in schools. But although the main fault lies with the General Medical Council in maintaining a regulation the utility of which has long been a negative quantity, one cannot exonerate the universities themselves in the matter; indeed I am not sure that the continuance of the regulation is not the result of the large representation which the universities possess upon the General Medical Council. For many, if not all, the universities insist that registration by the General Medical Council shall precede attendance on any course which is required for their medical degree, although such registration has nothing whatever to do with the university, and should be unnecessary so far as a university degree is concerned. The regulation is certainly an advantage to the university in so far that it compels the attendance of more students upon the science courses of the medical curriculum and brings in more fees to the university chest or to the university teachers. But, gentlemen, this should not be the aim of a university. Its only aim should be the encouragement of learning, and in no way can this be better attained than by influencing the

course of teaching in schools which send pupils to the university. The present system of insisting upon the science subjects being taken at the university is detrimental both to the schools and to the universities. It is detrimental to university teaching, because it compels teachers of university rank, who should be engaged in giving instruction in the more advanced parts of their subjects, and in prosecuting and directing research, to devote most of their energies to the teaching of such elementary parts of their science as could be quite as readily imparted by properly qualified science masters in schools. It is detrimental to the schools, because it opposes an obstacle to the pursuit of science teaching in them, by withholding recognition of such teaching, so that boys who might well be occupied in acquiring, whilst still at school, a knowledge of the sciences which they will need, are led rather to continue to work upon lines which will be of little or no use to them in their subsequent career in medicine.

I suppose that most intelligent boys of sixteen who have been properly taught would have no difficulty in passing the preliminary examination in arts which is required for any medical degree or diploma, since they have by then acquired a sufficient knowledge of classics and other subjects of general education. But it is customary to keep boys of the upper classes at school until eighteen. The years from sixteen to eighteen are two of the most important years of life. Intelligence is by then fully developed, memory is retentive, attention readily concentrated. Nevertheless these two years are ordinarily occupied by an extension of instruction in the same subjects as occupied the earlier years ; or if there is any change it is in the direction of the exclusion of all other study but that of classics and mathematics, the former usually greatly preponderating. As I have already said, these studies can be of no conceivable advantage in after-life to ninety-nine out of a hundred boys. But supposing that this time of life were occupied—not as an exception but as a regular thing—in all schools by similar systematic instruction in one or more branches of science, as it is now customary to give in classics. Will any one contend that such general instruction of all boys in the

principles of science—instruction which I would emphasise must be of a thorough and practical nature—would not be an incalculable gain? No one would be a worse man of business, a worse lawyer, a worse clergyman for possessing a little accurate knowledge of the nature of things. As compared with the acquirement of a little classical learning, the gain to the individual would be great, to the community still greater. But for the future medical man the advantage of such a course is preponderating. Even if a part only of the two years were devoted to science study, he would be able to acquire before leaving school for the university a far better knowledge either of biology or of chemistry and physics than he does in the meagre amount of time which is often allotted to those subjects in the crowded medical curriculum.

I am, it will be seen, a strong advocate of the relegation of the teaching of the preliminary sciences of the medical curriculum to the school period. But I recognise that it is at present impossible by reason of two circumstances—one being that most schools are not yet organised for the proper teaching of science, and the other that the regulations of the General Medical Council and of the universities directly or indirectly discourage such teaching. Were this disability removed I am convinced that the other circumstance would in the course of time right itself. Schoolmasters are not an obstacle. They will teach whatever it is to the advantage of their pupils to learn. But until the universities encourage—cease, I ought to say, to discourage—the teaching of science in schools, it will not be adequately taught there. I trust that your new university at least will do what in it lies to promote this reform—one of the most important, I believe, which can be instituted—not only in the interests of the medical profession in this country, but in those of the community at large.

You will be saying to yourselves that I have got away to the ideal, which I promised to avoid, and in a sense that is true, for it is impossible to suppose so fundamental a change in school teaching to be within the range of early possibility. We must, in the meantime, take things as we

find them, that is to say, take students and begin their training as medical men at a stage when they are in most cases still entirely ignorant of any of the natural sciences, and it is for these that we must plan out our medical curriculum. In it must therefore be included the so-called preliminary sciences, that is physics, chemistry, and biology. But if the student can produce evidence that he has attended a sufficient course of instruction in any or all of these subjects, and can pass a qualifying examination, he ought to be exempted from any further attendance in that subject or subjects whether previously registered or not. For, if he were able to pass in all, this would at once enable him to proceed with what may be termed the medical curriculum proper, and he would have the advantage over his fellows, either of obtaining his degree within four years instead of five, or of being able to devote one year more than they to actual medical subjects. At present, in the vast majority of instances, these preliminary sciences have to be included in the five years' curriculum, which must also include anatomy and physiology, pharmacology and pathology, hygiene and forensic medicine, midwifery, surgery, and medicine.

In devising a plan of study and examinations which shall embrace all these subjects, it seems a mere platitude to say that they should be taken—not haphazard—but in regular sequence; that one subject or class of subjects should lead up to another; that no part of the curriculum should be begun until the parts which should rightly precede it have been mastered. The reason for including physics, chemistry, and biology in the medical curriculum is, that anatomy and physiology—especially physiology—can only be understood by those who have previously acquired a knowledge of these preliminary sciences. Physiology is the physics and chemistry of the living organism, and it is obvious that it cannot be studied before, or even along with these subjects; they must first be mastered. It is therefore clear that the first part of the curriculum must be given up to physics, chemistry, and biology, and it is impossible to allow less than one year to those subjects; they cannot be learned in less time, and I

doubt whether any student can obtain such a mastery over them even in a year as will enable him to follow out the physical and chemical problems which are presented by the animal body. Here, once more, comes out the supreme importance of rendering it possible to acquire the necessary knowledge of at least a part of these subjects at school. For the knowledge of physics and chemistry required for the study of physiology is not, as is sometimes assumed, a mere smattering, but should be a very accurate knowledge of certain parts, and a good general knowledge of the whole. A year is the very least time that must be set aside for the preliminary science subjects, and as physics and chemistry are without doubt the most important and also the most difficult of these subjects, two terms out of the three which constitute the academic year must be given up to them, the remaining term being devoted to biology. It is usual to study physics and chemistry in the two winter terms, and biology in the summer, and this arrangement is natural and convenient. These subjects, which have little in common, should not overlap; this is indeed a general principle which may be laid down regarding all subjects of a curriculum. It is far better that the student should have his mind saturated with one subject than that he should attempt to master at the same time others which are not immediately cognate.

In some medical schools, as at Edinburgh and Dublin, it is customary to recommend students to begin the study of human anatomy in the first year. This would be an excellent arrangement were any of the subjects of the science preliminary disposed of prior to the commencement of the curriculum, but without this proviso it only serves to overload the work of the first year, and to prevent the student from devoting all his time and energies to the sciences which are essential both to the understanding of physiology and to the proper appreciation of human anatomy. Under present circumstances it is absolutely to be condemned. Let the student first surmount the difficulties of the preliminary sciences, and it will then be time for him to attack the intricacies of human anatomy.

The preliminary sciences having been, we will assume,

overtaken in the first year, four years out of the five remain. How are these to be apportioned, and what is to be the order of study? The subjects which must be mastered during these years are multifarious, but allow of division into three groups, the first of which embraces anatomy and physiology, the second pathology and pharmacology—which may in a sense be looked upon as an extension of the first two—and the third, medicine and surgery in all their branches. In considering the order of study the relations which these subjects bear to one another must be kept in mind. Surgery and medicine are based upon anatomy and physiology, they cannot be studied or understood without a previous and thorough knowledge of anatomy and physiology. It is as absurd to attempt to teach medicine or surgery before anatomy and physiology have been mastered as to endeavour to teach algebra before arithmetic. I well remember the time—it seems to me only the other day, but it is really five and thirty years ago—when I entered University College, London, as a student of medicine. It was then customary at all medical schools in this country for the students, at the same time that they were studying anatomy, physiology, and chemistry, to attend the clinics in the wards and the operations in the theatre—to “walk the hospitals” as it was then termed. We usually followed round the wards those members of the staff who had titles to their names; we applauded the dexterity of the surgeon who could whip off a leg or crush several stones before one could say Jack Robinson; we studied human nature of all sorts in the outpatient department, but of knowledge which was likely to prove of value to us in our future profession we acquired not one iota! It was impossible for us to understand even the language which was used in describing the symptoms of disease, and if a physician, ignorant of our status, addressed to any of us a question bearing upon the case he was discussing, we could only blush with confusion in our entire ignorance of the subject. Our fond parents thought no doubt that we were imbibing useful knowledge and were interested listeners when we enumerated the operations we had witnessed and the various maladies with which we had made acquaint-

ance, already looking upon us as budding Listons or Jenners, soon to be as competent to cure and qualified to kill as the best: "The dear boy is beginning early to acquire a practical knowledge of his profession," they would probably remark.

I am afraid some of us fostered this delusion, for it did not come amiss to many to idle about the hospital rather than to work strenuously in the dissecting-room and in such laboratories as were then available or to read up anatomy and physiology in the library. But there were others who early discovered that the time spent in the wards during those first years was wasted, and who soon discontinued attendance at the clinics, resolving to defer such attendance until the subjects which were necessary for obtaining any benefit from it were finished with; and these, I am sure, include all those of my own fellow-students who have risen to eminence in the profession. Not long after the time I am alluding to discontinuance of attendance at the hospital during the years devoted to the study of the preliminary sciences and of anatomy and physiology became general, the practice being discouraged by the rising generation of physicians and surgeons; and it was ordained that no one might have a clerkship or dressership until he had passed his examinations in anatomy and physiology.

I believe that the practice in other schools, with which I am less familiar, has followed similar lines, and that at most if not at all English schools, both in London and the provinces, it is unusual for the student to attend the hospital clinics or to hold any hospital appointment until he has mastered the subjects which alone will enable him to benefit by the instruction there given. I do not know and have not inquired what may be the case here, so that if I am treading upon any present toes in making these remarks and comparisons it is done accidentally. But I do know that the ancient system still prevails in most of the Scottish universities, and notably in that with which I am myself connected. In Edinburgh the student of medicine is still at this present day, *incredibile dictu!* not only permitted but actually enjoined by the Faculty of

Medicine to attend lectures on surgery and clinical surgery and to take up his dressership of surgical cases during his second winter. Remember that when he begins this work he has hardly begun to dissect, and we may fairly assume that he knows next to nothing of anatomy; he is only just beginning to study physiology and is entirely ignorant of pathology. He may go straight from the dissecting-room to an operation or to the dressing of a surgical case, and this in the very cradle of Listerism! I have indeed heard it alleged by a professor of anatomy that the condition of the subjects in the modern dissecting-room is such as to be by no means unfavourable to the promotion of asepsis. This may be so—I admit I have only the evidence of my olfactory sense to contradict it—but I confess that that for me is sufficient, and were I a surgeon or even only a patient, I would prefer to have my antiseptics administered in some other form.

This is an extraordinary instance of the survival of the unfittest, and, so far as I can ascertain, has not one single point to recommend it. It is sometimes suggested in its favour that the study of surgery lends interest to anatomy; this has even been advanced as an argument for the adoption of the Edinburgh system. But the argument is only applicable where there is already a thorough knowledge of anatomy, and if this knowledge is non-existent the applicability fails. The argument might equally well be applied to all the sciences which are preliminary to the study of medicine. No doubt its relationship to physiology, pathology, and forensic medicine lends interest to chemistry—it is indeed on this account that chemistry is a necessary part of the education of a medical man. But no one would seriously contend that these subjects should therefore be studied at the same time with that science. It has also been suggested that it is a good thing for a medical student to come in touch as early as possible with disease and its treatment. *Cui bono?* Better far return to the old apprenticeship system, which has had its "day and ceased to be," for under this a certain amount of rule-of-thumb knowledge of diagnosis and treatment was undoubtedly acquired. At least it did not interfere with the acquisition

of knowledge which is now rightly regarded as essential, but which was formerly looked upon merely as subsidiary, the knowledge of the sciences upon which medicine and surgery are based. For bear in mind that there is a vast difference between the point of view from which medicine and surgery were regarded then and now. Then—and I am speaking of a time extending beyond the middle of the last century—medicine was looked upon as an art—“the art of healing” is a term which still perpetuates this aspect—and as such it was practised. The individual experience of its practitioners counted for much more in proportion than can ever be the case again. It is now every day becoming less of an art and more of a science. *Ceteris paribus*, the young practitioner may be, ought to be, a better doctor than the old one. Not that I would underrate the value of experience. But the phenomena of disease cannot any longer be considered apart from their causes, and a knowledge of these is only to be obtained through pathology and bacteriology—sciences which progress by leaps and bounds, so that each year sees important advances in them. The only argument in favour of the Edinburgh system of taking surgery during the second winter which has ever appealed to me, came from one of my students, who said, “You see, sir, we have to be signed for it, and we get it over early.”

On the other hand, the disadvantages of the system are only too apparent. While little or no surgery can be properly learned on account of the want of a previous knowledge of anatomy and physiology, the time which is required to be given up to surgery and clinical surgery renders it absolutely impossible to give adequate attention to anatomy and physiology. Lectures on surgery and clinical surgery and hospital work occupy three hours a day, and one hour more must be reckoned for the copying out of notes and the reading up of cases: at least half the working day devoted to a subject which cannot be properly learned or taught on account of ignorance of the sciences upon which it is based! And unless the student takes out his surgery again towards the end of his curriculum—as many of them do—whatever else he may be, he will be a

very poor surgeon. There is, therefore, no advantage from the point of view of surgery to compensate for the interference with the study of anatomy and physiology. The second year is that which is naturally occupied by these subjects, and the student should devote himself to nothing else, for they are in all conscience subjects of sufficient magnitude. Physiology used to be looked upon as quite secondary in importance to anatomy, and it was considered sufficient to attend one or two courses of lectures upon it, whereas anatomy had to be studied both with the aid of lectures and by dissections. It is, however, now recognised that a thorough knowledge of physiology is of equal importance with a knowledge of anatomy, and that it is not sufficient to teach the subject by means of lectures, but that all parts of it should be studied in a practical manner. For this and dissections the whole time of the second *annus medicus* is necessary. For advanced knowledge a further year of study would be required, but for the acquisition of a sound knowledge of the principles of physiology based mainly upon practical work and demonstrations, one year, provided it were not broken in upon by other subjects, would for most students be sufficient. I have no desire to magnify my subject. Because I am myself a physiologist I do not think it is necessary that every medical student should become one. Although I admit the importance—actual and prospective—from a scientific point of view, of the study of such parts of the subject as electro-physiology and the mode of production of visual illusions, I do not think it is possible or desirable to require an acquaintance with all the details of these from a candidate for a pass degree in medicine. But it is absolutely necessary that every student should rightly comprehend the chemistry of food and digestion, the physics of the circulation and respiration, the structure and action of secretory glands, the nature of muscular contractions, the operations of the nervous system. He should be taught how to investigate physiological problems for himself, so that he may be able to apply the knowledge which he acquires to the investigation of similar problems under the abnormal conditions induced by disease. All this can be and is done systematically in

well-organised medical schools—it is done, as I well know from my experience as a former examiner, excellently in this school. I doubt, however, whether here or in any other medical school in this country a sufficient amount of time is given to the practical study of physiology. But if his whole time during only one year were to be given to physiology, unfettered by any other studies, except such a cognate subject as anatomy, the student could become saturated with the principles and methods of the science, and a single year would probably suffice for many, although others might require somewhat longer. I am convinced that more benefit would be obtained from working almost wholly at the one subject for an entire year than during two years with the interpolation of other subjects.

The case of anatomy is more difficult, the difficulty arising mainly from the impossibility of getting through the dissection of the entire body within a less time than one summer and two winter sessions; this is largely owing to the lack of a sufficient amount of material. It is well known that the teaching both of anatomy and of operative surgery is hampered in this country on this account. I do not know why we should compare unfavourably in this respect with other countries; but I suspect it lies in the working of the Anatomy Act. At any rate the evil is a serious one, and the attention of the Government should be called to it. For without adequate provision for the practical study of anatomy, the study of medicine and surgery must unquestionably suffer. Let me impress upon you, in drawing up a plan of curriculum, the vital importance of keeping apart one solid year for the study of physiology and anatomy alone. It may be necessary to encroach somewhat upon the following year to complete the study of one or both of these subjects, especially that of practical anatomy; but this is not too much time to demand for acquiring a knowledge of the two sciences upon which the whole of medicine and surgery are based. Do not be misled by the specious argument that medicine and surgery are after all the subjects a knowledge of which is alone required in practice, and that on this account the largest part of the medical

curriculum ought to be occupied by them. Remember that this is the one and only opportunity that the student will have of acquiring a knowledge of these "ground sciences," whereas he will be continuing all his life to study surgery and medicine. But his study of these will be to little purpose unless it is controlled by an adequate acquaintance with anatomy and physiology.

In insisting so strongly upon the necessity of postponing the study of surgery and medicine until anatomy and physiology are mastered, I am, I daresay, flogging a willing horse. It is quite probable that in this city, the medical school of which has long occupied an honourable position amongst the schools of medicine in the United Kingdom, any suggestion of a return to the old and pernicious practice which is still persistent farther north would be scouted as inconsistent with that proper concatenation of subjects which should be the basis of every curriculum. But I am credibly informed that in a sister city—the university of which is in a similar condition of transition—a vigorous attempt, fortunately unsuccessful, was made to modify the curriculum in what I will call, for the sake of brevity, the "Edinburgh" sense, and it is well therefore to be on guard in this matter.

Supposing the way to be cleared by the courses of anatomy and physiology having been completed, and the examinations in these subjects passed, the student is equipped for the study of pathology and pharmacology, and may also begin to work at medicine or surgery in the wards. Of these two I would myself give the preference to medicine, as fitting in better with the study of pathology and pharmacology. Besides, it is for various reasons undesirable that the work of the pathological laboratory and attendance in the deadhouse should be concomitant with attendance on operations and the dressing of surgical cases. It is, I know, a common practice to take dresser-ships in surgery before clerkships in medicine, this being, I presume, one of those traditional usages which die hard. But I know of no valid reason for the practice, and I believe the sequence pathology, medicine, surgery to be better. The exact arrangement of the other subjects belonging to

the final part of the curriculum matters less. Some of the special subjects may be taken earlier, others later. The relative importance of these special subjects is a question about which, as about many others connected with the curriculum, there is by no means a consensus of opinion. But I think that most would agree that it is undesirable to expect as much time to be given to the teaching of such subjects as midwifery as to medicine; to pharmacology as to pathology. *Materia medica* in the strict sense ought not to be part of the curriculum. If a man intends to be a chemist as well as a doctor, he should hold the pharmaceutical diploma. A knowledge of the raw materials of pharmacy is of no value to the student. As a rule it is crammed up for examination, and speedily forgotten. But a scientific acquaintance with the action of drugs under both normal and abnormal conditions is quite another story, and pharmacology must in future have its due position in the medical curriculum, and may very conveniently follow physiology, of which it is in a sense an extension. As with all other practical subjects, the teaching in pharmacology should be largely of a practical nature. Lectures upon practical subjects are of much less value than practical work in a laboratory. They at least can be replaced by reading; that cannot. It is true that here and there one meets with a lecturer who has the faculty of imparting information in a manner which makes it stick in the brains of his hearers, and here and there with a student who can retain more of a subject from the hearing of a lecture than from the reading of the same subject in a text-book. But these cases are rare. More sound knowledge of almost any scientific subject can be obtained within a limited time—and the time devoted to medical studies is very limited—by properly directed reading, accompanied and illustrated by thorough practical work and numerous demonstrations than from any course of lectures however long. Fortunately the tendency of the present day is to encourage the development of the practical side of teaching. But it is often forgotten in doing so that unless time is found for the practical courses by cutting down the number of lectures, the hours of work become unduly pro-

longed. The number 100 for a course of lectures seems to be a sort of fetish in many universities, as if there were a special virtue in that number, or some multiple of it. In these days of good text-books, lectures have largely lost the importance they formerly had. Yet we find the newest university, that of Birmingham, the medical curriculum of which is planned, in many respects, on excellent lines, requiring two attendances on complete courses of lectures on anatomy, medicine, and surgery—no less than six hundred lectures on these subjects alone! This, gentlemen, is one of the faults which I would have you avoid.

Let us briefly consider the order and place of the examinations. Examinations are necessary evils; it is not possible, I believe, to devise any means of testing the knowledge of candidates for a medical degree which is to confer a diploma to practise, to which far more important objections could not be urged. Nor can the same objection be taken to practical as to written examinations. A sound practical knowledge cannot be crammed; it must be acquired by actual experience. But in most subjects a practical examination is insufficient, because it is rarely possible to cover enough ground in the available time. Nevertheless, the practical side of the examination should be made to preponderate, for it is the best test of real knowledge. Account may also be taken, as is done in the University of Birmingham, of the manner in which the work of the practical courses, including the clinical courses, has been performed. With this combination a fair estimate of the capabilities of the student could in all probability easily be arrived at.

To understand the existing examination system the manner of its development must be borne in mind. In the beginning, certain persons or collections of persons (corporations and universities) were privileged to ascertain the qualifications of those who desired to practise medicine. The candidates were not required to submit evidence of having passed through any particular course of study, but were expected to satisfy those to whom the above privilege had been accorded, or ultimately their nominees, that they possessed an adequate acquaintance with medicine, surgery,

and the preparation and action of drugs. The candidate was always apprenticed to some practitioner—himself a graduate or licentiate of one of the corporations—who gave the necessary instruction, which might be, and ultimately usually was, supplemented by attendance at a private school of anatomy as well as in the wards of a hospital. There was for a long time but one examination, all the subjects examined on being taken at one sitting. You will find an amusing account of such an examination, evidently taken from the life, in "Roderick Random." Precise knowledge of detail was not expected, or did not exist, and the effort of memory needed to recall the various subjects of the examination would not therefore be great. But as knowledge of things medical became more extensive, and especially after it had begun to be recognised that a regular sequence of instruction was necessary, more defined courses of lectures began to be prescribed, and it was found convenient to subdivide the subjects of examination, and to hold this in two parts at definite intervals; anatomy, with a little physiology, being the main subject of the first part, and medicine, surgery, and midwifery those of the second. It is along these lines that the evolution of medical examinations has proceeded. There is a constant tendency to subdivide, and in subdividing to get past the earlier subjects of the curriculum before proceeding to the later ones. It is now usual in many universities to examine first of all in the preliminary sciences of chemistry, physics, and biology—the last again being often taken separately; secondly, in anatomy and physiology, with materia medica thrown in; thirdly, in pathology; and lastly, in medicine, surgery, and midwifery.

Along the same lines it appears to me the evolution of the examination system will continue; indeed I see no sufficient reason why the process of subdivision should be confined to groups. If a student has attended the prescribed courses upon any subject, why should he not be allowed to present himself for examination in that subject? There is, I know, an impression in some minds that the taking of subjects in this way has a tendency to cheapen

the degree. That it will tend to render a degree easier of attainment I am prepared to concede, and to my mind that is a very strong argument in favour of the adoption of the plan. But that it will tend to lower the standard of knowledge required for the degree, I altogether deny. On the contrary it will raise that standard, for a student would certainly be better able to master one subject at a time, and the standard of examination in each subject might easily be higher than with the group system. Even under this system there has grown up a tendency in many quarters towards disintegration of the groups. Thus in the University of Edinburgh, and in other universities which might be named, although the subjects which are grouped together under the headings of first, second, third, and final examinations are supposed to be taken together, a large amount of latitude is permitted with regard both to the deferring of certain subjects of a group, and to the acceptance of a subject in which a sufficient standard is judged to have been attained, even when the pass standard has not been reached in other subjects for which the student presents himself at the same time for examination. Thus for the so-called second professional examination, the subjects of which are anatomy, physiology, materia medica, a student may not only defer presenting himself in materia medica, but may be credited with a pass in only one of the other two subjects of the examination—may, that is to say, pass in anatomy alone or in physiology alone. It would, I think, be better to take a step further, and permit the student to present himself in the one subject only. This indeed he sometimes does in an irregular way—riding for a fall in anatomy for example, in order to get through his examination in physiology; but he thereby incurs the stigma of having failed in the subject which he had not really prepared for, and which he had no idea of passing.

But it might be argued that in many cases two or more subjects are so inter-dependent that from the educational point of view, it would be a bad arrangement to allow them to be taken independently. This argument applies more strongly to anatomy and physiology than to any other of the subjects in the curriculum. Physiology at any rate cannot be

properly studied without a previous knowledge of anatomy. This anatomy need not, however, necessarily be human anatomy, for the previous study of comparative anatomy is all that need be required for the understanding of physiology—which is, in fact, as everybody knows, very largely comparative physiology. If the subjects of the curriculum were directed to be taken in regular sequence, the principle being as much as possible preserved, that each subject is disposed of—as regards both study and examination—before the next subjects are attempted, I venture to think that a much more thorough knowledge of each subject would be attained with far less strain on the mind of the student. Above all there should be no long interval of time between attendance on the courses of study and examination in a subject. The examinations should come whilst the student is fresh from study, for it is impossible to keep up indefinitely the details which are demanded in examinations, and the deferring of the examination often leads to neglect of work during the course of study, followed by a feverish attempt to cram up the subjects during the few weeks before the examination. We have experience of this in Edinburgh where the students take out their courses of physiology and practical physiology—including histology—during the second year, but are not permitted to present themselves for examination before the end of their third winter; that is to say, they may be ready in all respects by the end of the second summer, but must wait another nine months before they can be examined in the subject. This is unfair on the student, and it operates detrimentally upon his work. For human nature being what it is, it is improbable that a man will devote himself with the same earnestness to the study of a subject which he will not be examined upon for nearly two years as he would were the examination to come at the end of the courses he is attending. It is a distinct hardship that students who may have completed their courses either in anatomy or in physiology by the end of the second *annus medicus* are prevented from presenting themselves for examination in either of these subjects for nearly a year. I put this before you as one of the examples

which should *not* be followed in framing the curriculum for your university.

An important principle to be kept in mind in settling the periods of examination is to so arrange matters that there shall be no year, and if possible no term of study, without its corresponding examination or examinations. For as has just been pointed out, do what you will to urge the necessity of work, many students will not work except with a view to the immediate exigencies of an examination. If the examinations for each subject are to be taken separately, they would necessarily come even more often than at the end of each *annus medicus*. And if subjects require a second year of study—as with practical anatomy—there should always be an examination at the end of the first year or at the end of the first winter. This may be elementary, or it may embrace a part only of the subject, but it will serve to stimulate work during that year, and render the student better able to attack the work of the second year. To again take the example with which I am most familiar, that of Edinburgh. The student there during his second year is studying anatomy and physiology, which he cannot be examined in before the end of his third winter, and surgery, for which the examination comes at the end of the fifth year. The result is that a number of students, who have not at that early stage in the curriculum yet acquired a full sense of responsibility, yield to the tendency to procrastination which is inherent in most of us, and devote a large part of their energy during the second *annus medicus* to the recuperation of their physical forces. The result is excellent so far as University athletics are concerned, but is much less successful from the academic standpoint. I would strongly urge in the real interest of the student, whose future career does not depend upon his proficiency as an athlete, that this should not be possible. In saying this I would not be understood to imply any discouragement of athletics, which in my judgment should play an important part in the amenities of every university. But they are not the most important element, and should never be allowed to interfere with the main purpose of a student's career. By all means encourage

all those manly games, the pursuit of which has given a characteristically healthy tone to university life in this country, but let this pursuit take its proper place in the curriculum, and do not let it at any stage override the pursuit of knowledge.

In conclusion I will in a few words sketch out what I should regard as, in existing circumstances, the best manner in which the subjects of the medical curriculum can be arranged. Supposing that a student enters in October, as most do. In his first winter he would study only chemistry and physics, and would present himself for examination in those subjects at the end of the winter. In his first summer he would take a course of biology, including the lower forms of plant life but mainly founded on comparative anatomy: a course of botany strictly so called is in my judgment not essential to a scheme of medical education. The examination in biology would immediately follow. The second winter would be occupied by courses of lectures on anatomy and physiology, by courses of practical physiology and by attendance in the dissecting-room; the second summer by attendance on practical histology with such expository lectures as might be considered necessary, and by a continuance of dissection. At the end of this summer the student should be allowed to present himself for examination in physiology if he is sufficiently prepared. A certain number will be able to do so, while others may need to defer the subject for three or six months; if this is done, an advanced course may be taken in the following winter. The third winter will be occupied by dissections and anatomical demonstrations and by lectures and practical instruction in pharmacology, which would follow naturally upon the courses of physiology. Those students who have completed their dissection of the body by the end of the first winter term, *i.e.*, by Christmas, might be permitted to present themselves then for examination in anatomy—otherwise they would defer the examination until the end of the second term (Easter). The examination in pharmacology would naturally come at the end of the third winter.

After anatomy and physiology are finished, clinical

work may be allowed to begin with the holding of a clerkship in one of the medical wards, to be followed by a dressership in the surgical wards. *Such appointments should always be continued during the vacations.* During the third summer a course of pathological anatomy and histology—lectures and practical—would be taken, as well as a course of bacteriology, and this would also be a suitable time for including the subject of public health—examinations in these subjects coming at the end of that summer. The fourth winter would be occupied by medicine and therapeutics, and by general pathology, including practical work in experimental and chemical pathology: the interest in these subjects would be enhanced by the previous attendance in the medical wards and in the post-mortem room. The examination in pathology would come at the end of the fourth winter, and certain parts of medicine might now also be taken. The fourth summer session would be occupied by attendance on midwifery, and on a separate three months' course of instruction in the special diseases of women and children, to be followed as before by examination in those subjects. Practical midwifery would be attended at any time after the systematic instruction had been taken.

The fifth winter would be devoted to attendance on systematic surgery, surgical anatomy, operative surgery, ophthalmic medicine and surgery, and diseases of the ear, nose, and throat. The use of anæsthetics and instruction in vaccination might also be conveniently taken at this period. The course of systematic surgery would extend over six months, but the other courses would each occupy not more than half that time. At the end of this fifth winter would come the examination in surgery. The April vacation and summer of this fifth year would be devoted to attendance at a fever hospital and an asylum, to lectures on mental diseases and on forensic medicine, and at the end would come the examinations in forensic medicine and the final examination in medicine.

The curriculum as here planned out can readily be modified to meet the case of instruction in surgery being taken before instruction in medicine, if this—the more usual

course—were preferred. In that event a dressership would precede a clerkship; the fourth winter would be devoted to the surgical subjects and to pathology, and the whole of the fifth year to medical subjects: the examination in surgery being taken at the end of the fourth winter, and all the examinations in medicine at the end of the fifth year.

The student is now equipped with his degree of M.B., B.S., and thereby receives his qualification to practise. In some universities he passes after a certain period of time to take up his M.D. or M.S. without further examination or other test of work or knowledge. In the University of London before its reorganisation a severe examination was demanded before either of these titles were conferred. In the Scottish universities and in the universities of Germany and most foreign universities, it has long been the custom to demand the presentation of a thesis upon some subject in medicine or surgery or in one of the related sciences. This is a custom you will do well to follow in this university, for it has the undeniable advantage of promoting research, and has in the past been productive of a large amount of original work, which, although it may sometimes have been mediocre, has in many cases proved of a high order of merit. As an alternative to the presentation of a thesis, the candidate may be allowed to present himself for examination, such examination being either in general medicine or surgery or in some special branch which the candidate may himself select, such as midwifery, gynaecology, ophthalmic surgery, or public health. In this way encouragement is afforded to specialisation after a general knowledge of medicine and surgery has been acquired. In some of the best American universities specialisation is encouraged even for the work of the pass degree. We are also, of course, familiar in this country with the specialisation which is necessary for the diploma of a dental surgeon. But for those who are to receive a diploma to practise medicine and surgery, a thorough groundwork in all branches of these subjects seems requisite, even if they intend to practise in only a limited branch. The time of the ordinary curriculum is fully occupied in furnishing this groundwork; nor do I think

that any of the subjects I have enumerated could well be omitted from a general course of medical education which is to confer the diploma to practise.

I will not apologise for having taken up time with these details, for it is only by the plotting out of details that the working of general principles can be illustrated. The principles, however, must not be lost sight of in considering the arrangement of the details, and I will therefore again state them in the briefest possible terms :—(1) The relegation of some or all of the preliminary scientific subjects to the year or two preceding entry in the medical school : the examination in these subjects should be not only permitted but encouraged before entry ; (2) the maintenance of a proper sequence of subjects so that in no case should any subject be begun until those on which it is founded have been mastered ; (3) the breaking up of the examinations, and the taking of the examination in each subject as far as possible immediately after the courses of instruction in that subject are completed. I am confident that the carrying out of these principles will greatly lighten the curriculum, which in its present form is a grievous burthen on the student, and that so far from having a tendency to lower the standard of knowledge it will help to raise this standard, although rendering the degree more easy to obtain. It is, as you will see, no unattainable ideal which I have set before you, but a plan of study and examination which is easily capable of realisation. The medical school in Leeds is for its size one of the best appointed, and the hospital with which it is connected one of the noblest in the kingdom. The opportunity which now presents itself of carrying out such a plan may never recur. "There is a tide in the affairs of" institutions as of "men which taken at the flood leads on to fortune," but if left to ebb will leave them stranded in obscurity. Let it be yours to steer the good ship which is entrusted to you clear of the shoals of obsolete tradition into the profound channels, which have been buoyed by science, and along which the tide of progress is surely and swiftly flowing !

