the medical course, to provide a *liberal* education, we can, if we teach in the Socratic tradition, at least provide a *medical* education.

If we enlarge the scope of medical training a little by including the historical development of medical thought we may get a little nearer a liberal education. With the same object, the university might demand more in the way of a general education in the schools and less training in the sciences as a preliminary to medical education. It seems very doubtful whether science as taught in the schools to-day helps much in education, liberal or scientific. The personal influence of the teacher upon the student is, of course, essential in any form of true education. A tutorial system and the extension of bedside teaching of small groups of students are the obvious ways of enhancing that. Clinical and clinico-pathological conferences will help to demonstrate to the student the merits of discussion as a learning method, especially if he is encouraged to play his part.

Need for Changes in Medical Education

I believe that the time has come when we must face the problems of medical education afresh, in the light of the great changes in medical practice. Medicine now changes so rapidly that technological training alone will not enable the student to cope with the advances in diagnosis and treatment that will occur in his practising lifetime, and he has never been more in need of scientific education. Nor do I believe that scientific education is enough, for many of the situations he will have to face in practice will arise from those human problems common to everyone, but often brought to the doctor for help. In these problems I do not regard psychiatry as an adequate substitute for education, for the way a man is educated determines what he is, whereas the study of psychiatry may only enhance what he knows.

The need for a review of the whole scheme of training of the doctor, including his school education, medical education, and postgraduate education, in an attempt to reorganize and integrate it so that it reflects the changed outlook in the practice of medicine is, I believe, now apparent. But before this can be undertaken we must formulate our ideas of the objects we want to achieve and the sort of doctor we want to produce. That is what I have been trying to do. I hope that what I have said will help to emphasize the desirability of a medical training which is an education, and the importance of laying a good deal of stress on the cultivation of the arts of medicine, as well as the science. Perhaps we may even try to make the medical course as liberal an education as its limited subject matter will allow.

But, whatever changes in medical education seem to be desirable, my main point has been that the rapidity of medical progress has not been matched by an equally rapid reorganization of the medical course, so that, by unplanned incorporation of more and more technological training, we are tending to lose the essential educative character of the medical course. The result is that, only too often, the final-year medical student reaches a state of mind which reminds us of Cardinal Newman's description, written a hundred years ago, of "those earnest but ill-used persons who are forced to load their minds with a score of subjects against an examination, who have too much on their hands to indulge themselves in thinking or investigation, who devour premise and conclusion together with indiscriminate greediness, who hold whole sciences on faith, and commit demonstrations to memory, and who too often, as might be expected, when their period of education is passed, throw up all they have learned in disgust, having gained nothing really by their anxious labours, except perhaps the habit of application."

The longer we leave the present situation, the worse it will get. Let us take warning from the words of Francis Bacon: "He that will not apply new remedies, must expect new evils; for time is the greatest innovator."

PROBLEMS AND RESPONSIBILITIES OF THE UNIVERSITY SURGICAL UNIT*

BY

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As my theme for this lecture I have chosen with some diffidence the "university surgical unit," and my purpose is to discuss its special functions and the special problems which confront it. The past 25 years have brought great changes to the structure of the hospital and specialist services, and these have brought in their train many new problems, two of which I shall discuss in some detail. But first let me outline what I take to be the principal tasks of a university surgical unit.

Care of Patients

The first and pre-eminent charge is the clinical care of the patients admitted to its wards. This means that whatever other qualities the staff possess they must, above all, have wide surgical training and experience. In addition, there must be free consultation within the unit about the management of cases, and specialist opinions must be readily available and readily sought. A weekly review of the progress of all cases in the unit is of first importance, and each quarter those cases which have ended fatally should be discussed in retrospect after a full pathological report has been obtained. Only in this way are errors of diagnosis or management kept continually in the forefront of unit affairs, and every member of the team profits by each individual's experience.

Closely bound up with the clinical care of patients is the keeping of adequate clinical records. The notes must be full enough to be of value in subsequent analysis, and must be typewritten to be legible. It is one of the great paradoxes of the hospital services that clinical records of the progress of the patients for whom the hospital was built are traditionally in longhand and usually illegible, while the records of the hospital kitchen, dispensary, and workshop are invariably typewritten. There must be a satisfactory disease index system so that analysis of cases becomes simple and convenient. For all this a unit secretary is an essential member of the clinical team. She should be in charge of all case records and be responsible for filing and indexing, for the production of records when required, and for the communication of information to the general practitioner. Casual secretarial help is of little value in this matter. It is essential to have someone who takes a personal pride in the standard of record-keeping in the unit.

Instruction of Students

The second responsibility of the university surgical unit is the instruction of students. Here it is pertinent to inquire why students should be taught surgery at all. Surgery is essentially a craft, a manual occupation, and sometimes a laborious one. I must confess to having had serious qualms about its right to be admitted as an academic discipline. It is certainly true that only a small minority of medical students are attracted to its practice and still fewer ever become surgeons. Why should instruction in surgery not be restricted to those who after qualification decide to take up surgery?

There are three principal reasons why undergraduate instruction is essential in the present state of organization.

First, the original role of surgery has changed and, instead of being content to carry out operations at the request of

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physicians, surgeons have assumed the diagnostic role of their medical colleagues. As a result there are large fields of medicine which the general physician seldom encounters. Notable among these are the extensive subjects of suppuration, new growth, and trauma, all matters of great importance to the general practitioner. It is clearly essential that the student should have experience in the diagnosis and management of these conditions. The emphasis should be on personal observation and experience rather than on professional demonstration. The student must be a member of the team rather than a spectator with aching feet. It is one thing to see the salient clinical features of tuberculous disease of the hip-joint demonstrated at a distance varying from a few feet to several yards. It is quite another to examine a patient who is complaining of a limp, to elicit the essential physical signs, and to come to the conclusion that the correct diagnosis is tuberculosis of the hip-joint. Active participation in the diagnosis is the secret of profitable clinical experience.

Secondly, the student must see for himself that surgery is capable of curing a few conditions and of favourably influencing many. Here again the significant point is the personal experience which brings conviction. Formal ward rounds and set demonstrations are so convenient for teacher and student—they are so easily organized—that they are almost always preferred by both. But the value of a clinic on the surgical management of compound fractures is not to be compared with the experience of seeing a patient exsanguinated and gravely ill from a motor-cycle accident, of watching his circulation improve during blood transfusion, of seeing the haemorrhage controlled and the fractures reduced and splinted, and of observing his post-operative recovery.

Finally, it is necessary that the student should know something of the scope and extent of the various technical procedures commonly used in surgery, so that he may be able to discuss them with his patient. The latter, reasonably enough, is dissatisfied with the brief consultation with the specialist in a consulting-room or out-patient department when the decision to operate is made. He turns to his general practitioner, whom he knows and trusts, to explain the details and implications of the operation, the effects on his everyday life, and the limitations on his activities which it may entail.

This aspect of undergraduate teaching is best achieved in a follow-up department, where all patients are seen from time to time after operation. Here the student may see for himself the late results of surgery, and hear the patient describe his post-operative course and his capacity for work and recreation. It cannot be stressed too strongly that all patients, well or ill, must attend the follow-up department. Not unnaturally, fit patients are reluctant to waste a morning in coming to hospital for a brief interview from which they gain nothing. But it is imperative that they should do so in order that the unit may keep complete records of its cases and that the student may gain a true impression of the end-results of surgery.

These are the reasons why the undergraduate should be burdened with an essentially technical subject such as surgery, and these should be our aims in surgical teaching. At present it must be admitted that they are almost impossible to achieve because of the large number of students in relation to the available beds. However, a good deal can be done by bed allocation in the senior years so that each student can have four or five patients whom he examines on admission and follows throughout treatment in the hospital. Patients regard these senior students as part of the surgical team and do not resent the repeated examination which is necessary to follow clinical progress.

Promotion of Original Work

The third task which falls to the university unit is the promotion of original work. I think it is true to say that, though the local good name of the unit rests on the clinical

service which it renders to patient and practitioner, its reputation in the surgical world rests on the standard of original work which it undertakes.

The investigations may be fundamental or applied. By fundamental I mean that they are not governed by what seem to be the therapeutic demands of the moment, but by what might be called the natural evolution of the problem. This approach will often lead the investigator up blind alleys and result in a mass of data which are of no apparent worth. Medical journals are full of publications of this type, and it is tempting to point to them as exemplifying the waste of money involved in research. Do not let us be deceived. If the work has been well and truly carried out the results have an intrinsic value in themselves quite apart from any practical value they may possess at the moment. For example, I recollect that in 1937, while studying adrenalectomized animals, we used a substance called "adrenal compound E" to prevent salt depletion. The substance was discovered and prepared in Dr. Kendall's biochemistry laboratory in the Mayo Clinic and was regarded as another of the innumerable fractions of the adrenal cortex, of academic but of no practical interest. Ten years later the outlook in rheumatic disease was revolutionized when Hench injected this same material into a patient with rheumatoid arthritis. The biochemical curiosity had become a therapeutic measure of great magnitude.

But more suited to a clinical unit than fundamental research is the applied research which has a definite aim in view. Here the essential point is the construction of a concrete question which usually has some such form as this: Is the course of this disease modified by this new procedure?

The basis of the question must lie in a reasonable supposition founded either on fundamental research (as in the case of the chemotherapy of infections) or in clinical deduction (as in the case of tenotomy for intermittent claudication, which was planned on the very reasonable supposition that if the claudicating muscle is put out of action the pain will be relieved). The conclusion whether in fact the procedure is beneficial may be very difficult to draw, and as a rule the clinician would be wise to turn his back on the statisticians and their tests of significance and stick to the old rule, "If it strikes you in the eye it's significant, if it doesn't, it isn't." By this I do not mean that the statistical analysis of research data in medicine is not of great value. In the field of well-controlled experimental work the technique is essential. Unfortunately, in clinical research the variables are so immense, control so difficult, and the data so inexact that statistical analysis is not of much value. An effect that requires demonstration by statistical means is not likely to be reproducible.

In order to make original work of this type possible and practicable it is essential that the university unit should have a branch of surgery in which it has special knowledge and experience. This is particularly true of our medical school, which derives its patients largely from a population of well below half a million. To carry out therapeutic trials of a worth-while size there must exist machinery for directing special types of cases to each unit—the machinery is, of course, the good will of one's colleagues, and I should like here to thank my own colleagues for their generous co-operation during the past year, which has enabled us to lay the basis for a study of the surgical aspects of the circulation.

We should not be too sanguine about the outcome of our original work. Only once in a thousand instances does the investigation lead to a result which, judged by practical standards, is profitable. We should rather aim at a good standard of research technique, care in the presentation of results, and a conservative attitude towards conclusions. The important thing is to keep trying. We can be very sure that there lie under our very noses many answers to the problems which perplex us. The greatest danger is not to be perplexed but to clothe our meagre sum of knowledge

with an explanation which satisfies our curiosity and dulls the spirit of inquiry. The temptation to be satisfied with current theory is encouraged by the desire to give patients some sort of explanation of their symptoms and students some sort of coherent instruction. How often one finds oneself face to face with the dilemma either of giving an explanation which seems rational or of admitting ignorance. I do not doubt that the latter is the correct course in almost every case. As Russell has put it, "The principle that anything which cannot be proved untrue may be assumed to be true is a principle whose falsehood is proved by the fortunes of bookmakers." But, human nature being what it is, it is inevitable that emotion overcomes reason, and so students are instructed in dogma which often has the flimsiest basis in fact.

A final point about research is worth mentioning. Modern research is becoming so complex and the methods so specialized that very few doctors are capable either of constructing or of servicing the complicated equipment which is required. There is, therefore, the need in the research team for a pure scientist whose primary interest is in the application of physical or chemical analysis to medicine. As a rule the most suitable person is the physicist or chemist, who already teaches these subjects to medical students. I have personal experience of this arrangement and know that it is profitable not only to the surgical unit but also to the pure scientist, who thereby gains an insight into biological problems which stands him in good stead in his medical teaching.

So much for the responsibilities of the surgical unit. We turn to its problems.

Surgical Specialism and Undergraduate Teaching

The first problem is the relationship of surgical specialism to undergraduate teaching. The problem is relatively new, though surgical specialism has been a fact for many years and the trend has been increasing in momentum during the past 25 years.

In Great Britain there are now fully established specialties in neurosurgery, orthopaedics, thoracic surgery, plastic surgery, and urological surgery, each with its own specialist association and journal. It is likely that this trend will increase, and already in the United States there are discernible the specialties of gastro-intestinal and cardiovascular surgery. This trend has inevitably changed the pattern of the teaching hospitals, and in several of the London hospitals each of these specialties is represented by a separate unit. One can foresee that the surgical side of the hospital of the future will be largely composed of special units each dealing with its own problems.

On the other hand, there is the responsibility of the university surgical unit to co-ordinate the teaching of undergraduates, 80% of whom will eventually become general practitioners. In planning the medical curriculum it is essential that some note should be taken of the terrestrial destination of undergraduates, though it would be wrong to make this the chief guiding principle. No medical school can ever turn out a finished general practitioner. But it should certainly attempt to give him the basic training most likely to be of value to him.

The problem, then, is this. How is the university to reconcile the ever-increasing specialization of the surgical teachers with the needs of the undergraduate medical school?

Origins of Specialization

It is of interest to consider the origins of specialization. There seems to have been two characteristic patterns. In the first, the basis of the specialty has been laid down by an individual who, starting as a general surgeon, has become absorbed in the problems of one field and gradually brought his whole intellectual activity to bear upon it to the exclusion of everything else.

The clearest example of this is provided by neurosurgery. Harvey Cushing was a pupil of Halsted, the first professor

of surgery in Johns Hopkins. Trained and for several years practising as a general surgeon, he became intrigued with the special problems presented by intracranial surgery. When at Harvard he attacked these difficulties with all his supreme intellectual ability. Surgeons were attracted to his clinic from all over the world. Professor Norman Dott became his pupil and brought back the specialty to Scotland. It is well to note that intracranial surgery was a branch of general surgery in this country long before this. Sir William Macewen, professor of surgery in Glasgow University, was one of its pioneers. But as long as it remained a branch of general surgery progress was slow. When all the intellectual endeavour of a few outstanding men was directed upon this relatively narrow field rapid advance was seen, until the successful removal of a brain tumour, from being a thing of extreme rarity, became an everyday affair.

The second way in which a surgical specialty has developed is seen in the case of orthopaedics and of urological surgery. Each of these reached a high degree of organization and skill while still branches of general surgery, and were practised by men who were general surgeons with a special interest in one field. Such men as Lane, Kocher, and Hey Groves, whose contribution to orthopaedic surgery was immense, were primarily general surgeons. It was not until the field of orthopaedic work became too large for a general surgeon to become proficient in it that the complete specialty developed. In urological surgery a similar pattern may be discerned—the operations of prostatectomy, nephrolithotomy, and urethrotomy were all originated by general surgeons with a special leaning towards urology. The full specialty gradually emerged as the range of techniques became larger.

Advantages and Disadvantages of Specialism

That this trend towards specialism is sound from the point of view of the patient we cannot doubt. Every surgeon knows that his professional skill is chiefly governed by experience. The morbidity of his first hundred cases of any major surgical disorder is much greater than that of the next hundred. It is often difficult to lay one's finger on any one factor in this improvement, and it is probably true to say that a large number of impressions, often apparently unimportant in themselves, summate to give the indefinable quality of clinical skill. Again, knowledge of the end-results of alternative procedures becomes more secure as experience grows and ability to plan advances in technique becomes greater. Not least, judgment of when surgical intervention is likely to be disastrous becomes sounder. The matter may well be different in non-technical fields, and it is quite possible that in internal medicine, with its emphasis on diagnosis, the trend towards specialism is less desirable. Here perhaps an ability to survey the patient as a whole may be of more importance than detailed knowledge of management. Yet here, too, technique is beginning to demand specialization. Few general physicians would care to undertake the investigation necessary for the accurate diagnosis of congenital heart lesion or the metabolic studies essential in diseases of the endocrine system. Perhaps the best solution in medicine lies in the hands of the general physician with a special knowledge of one field.

From the point of view of the medical student the trend towards special surgical units has been unsatisfactory. The difficulty which specialization raises is that it is impossible for a student to spend enough time in each unit to permit him to become part of the team and to gain a profitable amount of insight into its problems. Let us suppose that in the central hospital of the future there are special units for orthopaedics, urology, thoracic surgery, plastic surgery, and neurosurgery. A student has only a limited amount of time to spend in clinical surgery, and it is patently impossible to spend a profitable period in each of these units. Yet if he sees nothing of urology or of the special problems involved in orthopaedics there will be serious gaps in his experience which will handicap him in later professional life. It becomes obvious that the best interests of the

patient are incompatible with those of the student, and that the university must seek some compromise solution for the future. Three possible solutions suggest themselves.

Composite Teaching Units

The first possible solution is that the teaching hospital of the future might be made up of a number of composite teaching units each containing a representative sample of general and special surgical cases. Since it is almost certain that in new hospitals wards will be divided off into a number of small rooms, perhaps of six beds, an arrangement like this could conveniently be made. The operating theatres are almost certain to be on the block system, so that objections on the grounds of remoteness from the theatres are likely to be invalid. This arrangement would be admirable from the point of view of teaching, as students in a three-months appointment to such a ward would have the opportunity of seeing a very representative group of cases while the patients would still have the benefit of specialist treatment.

The disadvantages, however, are very great. As many different surgeons would have beds in the unit, there could be no single chief charged with its administration. The resident and nursing staff would be responsible to all of the surgeons equally, and the difficulty of making an efficient team would be tremendous.

Separation of Diagnostic and Therapeutic Sides

The second possible solution is that the diagnostic side of surgery should be clearly divorced from the therapeutic side, as is done in many American clinics. The diagnostic side might consist of a group of out-patient clinics each responsible for the investigation of all types of surgical disorders, for calling in specialist advice when necessary, and for making up waiting-lists for the wards. Without doubt fine opportunities would be provided for undergraduate teaching by this method. The student in a three-months tour of duty would be able to see and examine a range of surgical cases such as would be difficult to obtain in any other way. He would have the great advantage of seeing the case from the beginning, of making an attempt at a diagnosis, and, finally, watching the consultant approach the same problem and decide on a course of action.

A further period of several months might then be spent passing through the various special units to which the cases had been referred. There he would see the definitive treatment and learn a little of the methods employed.

The difficulty about this arrangement, which would be admirable from the educational standpoint, is again the question of staffing. The diagnostic units would have to be staffed by men of very wide training in surgery; their task would be a very arduous one, and it would encroach severely on their other professional activities. Specialists would not like the arrangement, for a great deal of their time would be taken up with consultations, and, finally, patients might prefer to see the "specialist" at once without being examined by the general diagnostic surgeon. Nevertheless, I have seen an arrangement like this work very smoothly in the Mayo Clinic, where there is almost complete separation of diagnostic and therapeutic sides of medicine.

General Surgery Units and Smaller Special Units

The final and I think the most practical solution is that in the teaching hospital there should be the usual general surgery units dealing with straightforward cases in all fields, but in addition there should be smaller units representing the major specialties. The more difficult special problems might be dealt with in these special units—for instance, in urology total cystoprostatectomy for carcinoma and trans-urethral resection of the prostate. The main units of the specialists would then lie not in the undergraduate teaching hospital but in a specialist hospital more suitable for the teaching of postgraduates. This is in effect what has been

done with conspicuous success in many teaching hospitals in this country and in America. The main clinical appointment of the undergraduate is to the large general units, where he receives a wide training in the diagnosis and management of the common surgical disorders. Shorter periods are spent in each of the special units, where he learns a little of the way in which the particularly difficult problems are dealt with.

This seems to be the most practical way in which to resolve the conflicting interest of patient and student. It is by no means a perfect solution. Few specialists would agree that a general surgeon should treat cases in the specialist province at all. They will say with perfect justice that it is difficult to tell at the outset of treatment whether a case is going to be straightforward or complicated, and that the best way of ensuring freedom from complication is to refer the case to the specialist from the start. The answer to this is that in this imperfect world the ideal can rarely be obtained, and in an undergraduate teaching hospital this compromise is essential in the interests of medical education.

The Surgical Unit and the Community

The second problem which confronts a university surgical unit is concerned with its relationship to the community which it serves. As a result of recommendations made by the Haldane Commission on Medical Education in 1913 and by the Goodenough Committee in 1945, the staff is debarred from consulting practice outside the hospital. This recommendation was made with the admirable aim of freeing the staff from the burden of private practice and so of allowing enough time for the planning and prosecution of research. It has had effects which were not foreseen by its originators.

First, the university staff has tended to lose touch with the general practitioners in the area and to become involuntarily divorced from the problems of general practice. There can be no doubt that the consultant-practitioner relationship is one of great importance in a first-class medical service. Each derives from the other a fresh outlook on the problems presented by illness. The practitioner's point of view is the healthy one of getting the ill person back to work, while the consultant usually looks upon disease as a problem, often fascinating, which may or may not be capable of solution. The one approach is practical, the other speculative; the one is complementary to the other and each is necessary. That the university staff is in danger of losing this relationship is something which we cannot regard without misgiving.

In the same way the university surgeon loses touch with the patient in his own home. His mental image of illness tends to become fixed in the pattern of a patient in a tidy hospital bed, with temperature charts and laboratory reports ready to hand. He tends to forget the family problems involved in illness. His task is to make the patient, if he can, a happy and useful member of society, and anything which prevents him from seeing ill patients in relation to their background must make this task more difficult. It is not easy to see the solution to this problem. It is imperative that the members of the staff of the university unit should not be so preoccupied with practice that the end of a day sees them too tired to undertake research; yet it is equally imperative that they keep in touch with the general problems of medical practice. I do not think that this is the place to elaborate this theme further, but I believe that the universities will have to face the problem in the future.

I fear that my account of the university surgical unit, its responsibilities and its problems, has been very remote from the reality. It cannot be resolved by an hour's discussion. Ultimately it is a problem of human relationships: on the one hand with the colleagues upon whose advice and help the project largely depends; on the other with patients whose courage in the face of adversity is of more importance than the skill of the surgeons.