THE PLACE OF PATHOLOGY IN THE MEDICAL CURRICULUM.

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By J. LORRAIN SMITH, M.D., F.R.S.,
Professor of Pathology, University of Edinburgh.

When we consider the prominent place which is given to pathology in the medical curriculum of to-day, it is at first sight difficult to realise that it was as late as 1831 that the University decided to establish a chair in the subject. Though this was the date at which the step was taken, we are not to suppose that the subject had sprung into existence in the early years of the nineteenth century, and that the University had awakened suddenly to its importance. You will find that from the earliest times all who worked at the explanation of the facts that came under their observation in the field of medicine were necessarily pathologists. The duty of teaching the subject was undertaken in the schools by the departments of medicine and surgery, and pathology came to be treated as a separate subject when they found it impossible to do it justice while they were responsible for their own branches of medical science. The separation of medicine and pathology is even now in the process of completion, and in certain schools you will still find pathology in the charge of those who at the same time teach other subjects.

Further, you will hear the view put forward that the separation has not been altogether beneficial. The teacher of pathology who is entirely freed from all responsibility for the care of patients is said to become indifferent to certain aspects of the subject which are of vital importance. He tends, we are told, to become absorbed in abstruse questions which, except to a few like himself, have little interest, and are too far removed from daily practice to be of any utility. The corrective for this abnormal habit of mind is the demand for immediate attention to concrete things—a demand which is presented by the patient suffering from disease and requiring to be healed. The knowledge of disease which is to be obtained from a study of diseased tissues in the laboratory is made wider and deeper and truer by a simultaneous study of the patient to discover how to bring about a cure. Hence arises the reluctance to separate pathology and medicine. The reasons for the separation were, however, sufficient to convince the University authorities of eighty years ago that a chair
in pathology would be a valuable addition to the medical faculty. But up till the present time the holder of the chair has had, as you all know, the charge of patients in the Infirmary. He is henceforward to be freed from this responsibility, and, according to the law which is laid down in the Ordinances, he is not to engage in private practice. The attractions of private practice I need not describe; they are familiar and well known to be powerful, but in resisting this temptation the professor of pathology will in future have the valuable support of the strong arm of the law. The corresponding temptation to engage in pathology which might conceivably come to teachers of the practice of medicine and surgery has for some unexplained reason escaped the attention of legislators. The Ordinance forbidding practice is but the further development of the policy which was adopted by the University eighty years ago. The fact that this step has now been taken will have the attention of all who have at heart the interests of the medical school. The effect of the change will be in the first place to restrict the field of labour for the professor, and since this change has been brought about by the development of the subject, it is worth while at this point to explain the problem which the pathologist sets out to solve, and the relation of its subject-matter to that of the clinical physician and practitioner.

Pathology is often defined as the science of disease. This general definition is easily remembered, and while it is not very precise, it has the merit of simplicity. The study of the body in health is carried out by the two sciences of anatomy and physiology. When the body becomes diseased the normal activities are modified with more or less harmful results to the general life, and in cases when this condition endures for a sufficient time, even the structure of the tissues becomes changed. So that tissue elements, the presence of which are essential to the activity of the various organs, are destroyed, and the body becomes permanently maimed. There is therefore a certain physiological degradation of tissues in disease. If you have studied anatomy and physiology never so little you must have found much interest in observing the way the different organs are built up of a combination of highly specialised forms of tissue, delicate in structure, but full of activity by which the body as a whole profits, while along with these elements are to be found more simple and less developed tissues whose function shows little activity, and consists chiefly, if not altogether, in forming the framework which binds the organ together and supports
it. These structures are called the connective tissues, and when disease takes effect it becomes evident that the chief damage falls on the highly specialised and delicate tissues, and they are injured often to the point of complete destruction; but the attack which is sufficient to destroy these structures may do no more than stimulate the connective tissues into active growth. Disease of long standing tends therefore to substitute the inactive elements for the more active—to deprive an organ of its function by destroying the very elements on which its special activities depend. The aim of treatment is to prevent this process from taking place, by discovering the means of neutralising the effects of the primary attack, or, if this be impossible, to arrest its development, so that further tissue degradation may be avoided. There are therefore two ways of studying the process of disease. We may adopt the original method of observing the patient clinically, and discovering as best we can the progress of his case by careful study of his symptoms, and the development of all unfavourable signs. The other way of gathering knowledge of disease unfolds itself when we find that certain structural changes occur in the organs corresponding with the perversion and loss of function which we have clinically observed.

Observations of this kind form the body of knowledge which has been called morbid anatomy, and it is on this foundation that the science of pathology is built. It is in morbid anatomy that there has been found one of the commonest meeting-grounds of the pathologist and the practitioner. That the two should agree in their conclusions is the aim before each investigator, and until they agree there remains an irritating dissatisfaction which goads the observers into further inquiry and research. The pathologist and the clinician cannot do without each other. The perfect clinical observer examining a patient must have in his mind's eye a picture of the structural changes which have occurred in the body and which have led to the development of the symptoms. Without this his knowledge is, above all, formless and vague. All this, you will say, justifies the old arrangement that medicine and pathology should be taught together, and were pathology nothing further than description of structural changes, there would be much to be said for the continuance of the original plan.

It would be interesting to resuscitate an undergraduate of the year 1831, when the University was taking the step of giving pathology a separate chair. He would, I have no doubt, feel sorry that he had not lived a little earlier in the history of the world—
say, 100 years before his day—when the joys of his life as an undergraduate would not have been reduced by his having to take on his shoulders this additional burden. A striking characteristic of the medical student is the instinctive dread he has of becoming over-educated. He often gives expression to his feelings on this subject, and not infrequently he spends much time in the effort to make sure that he shall not suffer from this form of mental deterioration. Taking the undergraduate of to-day, however, let us try to look at the subject from his point of view. He comes to the science of pathology after he has mastered anatomy and physiology, so that he is now familiar with the structure of the normal body and its various functions. He has to set out for new worlds to conquer, and one of these he finds in the science of disease. The difficulty he has to face is, that he is set to study in detail one side of the subject while he is unacquainted with the other. He must, in the first instance, inform himself of the appearances of the organs which are abnormal, and associate them with the disease to which they are due, and he must learn their meaning; but it is from observation of the disease in the living subject that the meaning is obtained, and this is an effort which is as yet beyond him. We can show him the heart, let us say, and the abnormal appearances which are to be seen in its covering, its walls, its blood-vessels, its nerve supply, and on that we build up an account of the disease. But he has never made an examination of the heart in its activity. He therefore becomes a pathologist before he is a physician. Observe how the order of things is reversed. In the old days before 1831, to which we have been looking back sympathetically, the teaching was by men who were engaged in medical and surgical practice, and the pathology which was taught did not, as now, come before clinical experience. At the most it came along with it. Now it is studied before medicine, and in the reasons for the change we may discover the part which pathology has to take in training the undergraduate for his professional work. The undergraduate is a pathologist before he is a physician or surgeon, and there is a real reason for this, though on the face of it it looks like a reversal of the natural order of the curriculum. The reason is that the subject has developed in various directions, much in the same way as has happened in physiology—by the application of the exact methods of physics and chemistry, and it is due to this that pathology no longer remains in the obscurity of being an appendage to medicine.

We must still begin work at pathology with a study of morbid
anatomy in the post-mortem room and in the laboratory, and when we have learned the general facts which are observed there, we proceed to the experimental analysis of them by the more elaborate methods. The student must become master of morbid anatomy whatever else he may neglect. It is the part of pathology which he will be called upon to apply in his practice, however humble or exalted that may be, and the demand for knowledge of this kind has been very much increased by the duty of drawing up reports of cases for the law courts which is becoming more and more a part of ordinary professional work. This branch of pathology is indeed essentially the same as clinical medicine.

The further developments may be divided into three groups—chemical pathology, morbid histology, and bacteriology. The division is, however, a very rough one, for these three parts of the subject cannot be separated from each other by any strict delimitation. By means of chemical methods much progress has been made in the explanation of the changes in metabolism which result in degeneration and death of the tissues. The outstanding characteristic of the problem which presents itself to the chemical investigator is its complexity, and consequently the greatest difficulty is to discover methods by which the complexity can be unravelled. The materials which enter into the living cell form a structure, or system, the elements of which are all related to each other in a subtle fashion which we endeavour to define; but the more this system is studied, the more does it appear that the ordinary conceptions of chemical and physical relationship are too simple for the purpose. The bodies on which the activity of protoplasm depends are often to be described solely by the effect on the cell itself of their presence or absence, and as yet we are unable to isolate them and study them by the ordinary methods of chemical analysis. We find, for example, that the presence of a toxin may so act on the structure of striped muscle that it is converted into a homogeneous mass which no longer has the power of muscular contraction. The toxin we have never succeeded in isolating chemically, and the molecular arrangement by the disturbance of which the muscle fibre loses all its characteristic structure and activity is also unknown. We know here only that the action of the toxin has taken place by the effects on the living structure. Much progress has been made, however, and important conclusions have been established in relation to the various organic and inorganic bodies which enter into the living cell. We find, for example, that work on the dis-
turbances which are connected with carbohydrates and fats and lipoids has been carried to a stage at which the conception of degeneration begins to take a definite shape, and the essential elements of the disturbance can be to some extent separated from the accidental. Similar results have been obtained in regard to nitrogenous bodies, and from these we are on the way to learn how a toxin attacks the cell structure and reduces it to chaos.

Again, the application of histological methods is yielding most important results in enabling us to interpret the processes of disease. It is sometimes contended that the histological study of pathological processes is more or less barren in results. The tissues of the body have all been carefully examined, and we are told this field of work has been exhausted. We have only to reflect, however, on the contributions to pathology which have come from the histological work of Weigert and Ehrlich, to see at once that a new principle introduced as a basis of microscopic investigation may revivify the whole science, not because we can make more beautiful preparations to look at, but because the new methods enable us to throw more and more light on the obscurity of the problems we have to solve. Histology will not be exhausted till the problems to be investigated in pathology generally have all been solved.

In the third place, we also owe much to the science of bacteriology. It has introduced us to a new conception of the process of acute diseases, and many of these have been actually proved to be due to bacterial poisons. It has also made clear the nature of many of the long-standing chronic processes which develop slowly, and at the present time a great deal is being done to work out methods of treatment which have been derived from experimental investigations in the bacteriological laboratory. By the help of these three branches of pathology we are now gradually reaching a conception of the cell economy, and of the nature of the molecules, or combinations of molecules, which can be attacked by toxins, or other poisons. The nature of the attack we try to define chemically; the effects on the protoplasmic structure we observe by histological methods; the nature of the attacking agent we define in the study of bacterial toxins.

It would take me too far afield to deal with other illustrations of the work of pathology. Nor do I wish to burden you with further detail. The purpose I have in view is to show how pathology has come to take its present-day form as an independent science which gives its own description and
interpretation of disease, and how it is possible for the undergraduate to be a pathologist before he is a clinician. When both branches of medicine have been mastered by the student, their essential unity will become clear to him. It is the aim of the course to provide the undergraduate with a knowledge of the principles of pathology and as far as possible to leave him in the attitude of inquiry. He will during his professional life have ample opportunity of making observations, and the aim of the pathological teaching must be to show him how the facts which he is observing can be made the subject of exact scientific investigation. The time will come when he has passed his examination in pathology, and he will realise then how short has been the period allowed in his course for acquiring so much knowledge. Knowledge rapidly acquired is apt to vanish away, and the amount of knowledge which can in the time be packed into the "one small head" which is available, is not very great. The medical curriculum as a whole perhaps hardly takes sufficient note of the frailties of the average man.

Pathology is an early subject in the curriculum, and before the final stage is reached you will find much of it requires to be re-absorbed. Now the remedy for this is post-graduate study, which can be done slowly and deliberately, and which will therefore in the best possible way supplement the work of the undergraduate days. To the post-graduate student, however, the best means of study is not to be found in stated courses of lectures, but in research. It is impossible with the limited time at his disposal for the undergraduate to do any serious research work, but when he has taken his degree it often happens that there are still undisturbed hours in his life when quiet work and reflection are possible. He is left to the freedom of his own will, for he has no more examinations before him, and he has not yet submitted to the cares of a large practice. Let me commend to him the wisdom of using this time for original research should the opportunity offer. While he is holding a junior post in the hospital, or after that period has passed, he should, when possible, find his way to a laboratory, and take up research that he may discover the basis of that knowledge in the acquiring of which he has spent so much time and effort. The development of pathology, to which I have referred in what I have already said, is due entirely to research, and modern schools of medicine are vying with each other in investigation and in the work of adding to our present knowledge. I do not urge any
special claim for pathology in comparison with other medical sciences as a field of research; but the very intimacy of the connection between it and clinical medicine makes it easier for a man whose chief interest is in practice to undertake research in pathology. I have tried to show that pathology in modern times is an experimental science, and anyone who desires to be really abreast of it must give himself to research. The reply which I hear when I urge this view of the matter on graduates is that research is too difficult, and implies gifts that are not bestowed on the ordinary man. This is no doubt true if all who enter a laboratory aspire to emulate the masters of science. Dr. Hutchison Stirling in his well-known address to your predecessors who were undergraduates in this school, said: "If the fall of an apple on the nose of Newton caused the thought of gravitation in his brain, it is quite certain that whole bushels of apples might have fallen on our noses without the least approach to any such result." Should such an experience be ours, no doubt some of us would be troubled about our noses and the risk to which they had been exposed, while others perhaps would turn their attention to the apples. Each man must work according to his several ability, and one benefit which inevitably comes, even though no world-shaking discovery may have resulted from his research, is that he learns to understand and value the research work of others.

The field for research is exceedingly wide, and becomes wider as the years pass. It is gradually being recognised that since pathology has been clearly divorced from medicine, so that each can pursue its own path, the time is coming for bringing them together again in a state of amicable independence. It is found that the methods of investigation which have been shown to be applicable to the study of disease in the laboratory must be used in conjunction with observations on the living subject. With this in view special observation hospitals are being formed in connection with the research departments of some of the medical schools. How far this development will go, we need not attempt to prophesy. It has followed from the fact that so much of direct therapeutic value has come from the laboratories. Now a fully-equipped pathological institute finds it necessary to provide for the investigation of curative methods. To put this work on a perfectly satisfactory footing, it is becoming essential that the department should be able to give the workers full control of the means of making these observations. The phar-
macologist, the bacteriologist, and the pathologist are each asking for these opportunities.

The same purpose is in the minds of those who are suggesting that some of our clinical teachers should be appointed to posts in which they would be free from the claims of practice, and be able to give all their time to the work of the observation and investigation of disease in the hospital wards. These various suggestions have all the same aim, and that is, to bring the laboratories and the practice of medicine together again, so that the science of medicine may no longer suffer the loss which came from their separation.

This re-arrangement of the work of the school raises far-reaching questions, the answer to which lies in the future. The isolation of the laboratory workers in the past has perhaps provoked some to doubt as to the aim for which these institutions have been established and carried on, and the purpose for which they have been founded has been liable to be misunderstood. But they have gradually by the results of their work more than justified themselves, and now the development of the sciences they represent is leading to an extension of their sphere of work, so that by the direct observation of patients they may apply all their resources to the diagnosis and treatment of disease.

The new method of working on this old principle will have been discovered when we find an arrangement by which the departments of pathology and of medical practice will be so united that, without limiting or restricting the field of either, together they will more effectively than in the past contribute to the great purpose of preventing suffering and the wastage of human life.

HABIT: AS EXEMPLIFIED IN THE FUNCTIONAL ACTIVITY OF THE EYE MUSCLES.

By GEORGE A. BERRY, M.B., LL.D.,
Hon. Surgeon-Oculist to the King in Scotland; Ex-President, Ophthalmological Society of United Kingdom.

The innervation of the eye muscles offers one of the most beautiful and most easily studied examples of the development of a habit. There is exhibited in connection with the functional activity of these muscles what I have elsewhere called the tendency to the persistence of constantly called-for states of innervation. In other