Thomas Vicary Lecture

ON

THE SIGNIFICANCE OF ANATOMY.

DELIVERED BEFORE THE ROYAL COLLEGE OF SURGEONS
OF ENGLAND

BY

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MR. PRESIDENT AND FELLOWS,—In the first place I must express to you, Sir, my appreciation of the unexpected distinction of being invited by your predecessor, Sir John Bland-Sutton, to deliver this address.

It may seem strange that in this museum where the Hunterian Collection is housed I should discuss such a subject as the significance of anatomy, the scientific and practical value of which as the essential foundation of surgery John Hunter has surely established once and for all. But no one who is familiar with the attitude towards morphology which is widespread at the present time can doubt that there is need for an appreciation of the part the study of anatomy has played in the history not only of biology and medicine but also of civilization as a whole, and the even greater services it still remains for the morphologist to achieve.

At the present time it is not only the physiologists and clinicians who fail to realize the importance of morphology, but also some anatomists and even more biologists bow the knee to the strange fashion of depreciation. In some famous medical schools it is considered almost an offence on the part of an anatomist or biologist to devote himself to the essential business of his subject, and work at real anatomy. The interest and importance of experimental embryology and the fascination of this method of interrogating the processes of nature everyone will readily admit. But even the fullest recognition of the value of such work and of the brilliance of its pioneers does not lend any sort of justification for the strange assumption that anatomists who devote their attention to other no less important parts of their subject are wasting their time in obsolete diversions. The situation has been so accurately diagnosed by Professor H. S. Jennings of the Johns Hopkins University that I make no apology for quoting him. Referring (*Science*, July 30th, 1926, p. 98) to anatomy as "the physics of organism," he said:

"It requires separate consideration, both because of its extreme importance for zoological experiment, and because it was minimized, nay, despised and rejected of the physiological impulse in zoology. This is the role of physical arrangements of material in organisms; gross physical arrangements as well as minuter ones; what is variously called organization or structure. Structure had become the object of one of those epidemic phobias that beset scientific men as they do other men. In the days before experimentation zoologists had given a romantic and mystical turn to the phenomena of structure in organisms; they built upon it a great edifice which was called morphology. They discovered in organic structure plans, styles, comparable to the diverse styles of architecture—to Gothic, Romanesque, Classical, and the rest. But the physiologists said: This may be pretty, but is it Science? It is not. Out with it. We shall have nothing to do with morphology; it is fantastical. And throwing away the baby with the bath water, they largely rejected also the role of structural arrangements, even in experimentation. This it was that led to most of the adventures or misadventures of the sort I have recounted, in the progress of experimental zoology. It is important that this phobia should no longer dominate our work. Consider for a few moments the role of arrangements or organization in experimental work, and the consequences of its neglect.

"Structural arrangement, organization, is of course physics; we find it playing a very great role in physics as that science advances. The properties of atoms depend upon the arrangement of electrons; of molecules on the arrangement of atoms; of crystals on the arrangement of molecules. In organisms there is a great extension of this. They are bodies in which the arrangements have become complex and differentiated, and have passed into the grosser, the visible features as well as in the finer details. They are bodies in which there is an almost infinite variety of these arrangements, as we pass from species to species. They are systems of structures. In consequence, their properties and the way they respond to experiments, depend largely on these systems."

This so admirably explains the real significance of morphology as the foundation of all science, physical as well as biological, that it is hardly necessary for me to add to it. It also emphasizes the fact that when dissociated from morphology so many lines of experimental research soon become exhausted.

The disparagement of anatomy extends also to morbid anatomy, and at the present time in many schools, with a few conspicuous exceptions, medicine and surgery are suffering from the neglect of adequate morphological inquiry into the reasons for diagnostic and therapeutic failures.

The eponymous label attached to this lectureship is not without significance. Thomas Vicary was the Court surgeon of Tudor kings and queens, and he left behind him an obsolete treatise on scholastic anatomy, based upon the writings of Lanfranchi and Mondeville in the fourteenth century, which completely ignored the revolution that had been effected in the whole outlook and discipline of anatomy by Vesalius twenty years before Vicary's death. Like Thomas Vicary, the anatomist at the present day has retained in his teaching an undue amount of mediæval method and material that has no justification either on the ground of its practical or scientific value. In paying respect to these antiquated conventions—what earlier bookmen wrote rather than what the body itself reveals—he has neglected the great opportunity of bringing the subject of anatomy into closer correlation with the needs of the times. The possibilities for great achievements in anatomy were never so great as they are to-day; and the need for men who will devote their whole time and energies to the exploitation of these rich veins of ore was never so urgent as it is now in England. It was a great step forward when, a generation ago, men were appointed to devote their whole time to research and teaching in anatomy. The problems to be solved are so complex, and the technique of inquiry so exacting, that those who work at the subject must be wholly absorbed in it.

It will help us to realize what anatomy has done for mankind and civilization if we glance at certain aspects of its history. So far as the development of a systematic study of the human body is concerned, the Ptolemaic school at Alexandria, founded by the disciples of Aristotle three centuries before Christ, represents the beginning of the story. In the museum, which was the essential achievement of that school, the discipline of true science was developed and organized. This Egyptian town gave the world its greatest heritage—namely, the scientific method. This decisive advance in the history of civilization extended to all sciences. It was the triumph of the inductive method based upon observation and the formulation of laws to give expression to the observed facts as generalizations. Experimentation was the complement of the inductive method, but not the real foundation of it, for without morphology experimentation would be quite inconclusive and frivolous.

In studying the development of the scientific school at Alexandria it is important to remember that the anatomical researches of Herophilus and Erasistratus played a very important part, not simply in establishing the importance of observation in anatomy itself, but in the demonstration of method for all the sciences. As Galen, a student of the Alexandrian school, pointed out five centuries later, the study of the phenomena of life is based upon the solid foundation of anatomical observation, experiment, and clinical observation. Until the anatomists had begun their work the profession of medicine lacked any real discipline and professional standard. Galen attributed to an ignorance of anatomy on the part of medical men the lack of success in the treatment they often administered.

The special force of these observations is revealed more clearly if we push back the inquiry to the dawn of civilization, more than thirty centuries before Aristotle. Then it becomes clear that the study of mankind (and in particular the phenomena of life and death) was indeed the sole aim of all science and art.

The farther back we go in the history of civilization the more definitely and exclusively anthropocentric all inquiries into natural phenomena become. There is no innate curiosity in mankind to study the forces of nature; but such things as seemed directly to affect his own welfare appealed to man's interests. Man did not at first study physics, astronomy, zoology, and botany simply for the intellectual joy of discovery, but so as directly to benefit himself other than by a reputation for wisdom. In particular attention was paid to the problems of life and death, the solution of which might enable man to safeguard his own existence and avert the risks of death.

For example, celestial phenomena at first interested man solely because the moon seemed to control the physiological periodicity of women and the life-giving functions. The sky, therefore, was believed to regulate and measure the duration of life, and was studied for the purpose of controlling human destiny—a sort of life insurance of the individual who made the inquiries. It can be shown that in a similar way all man's early nature studies were self-centred, and in the last resort were related to the expressions of life in his own body—the heart, liver, kidneys, the breath, the blood, the moisture, and the odour of life—the safeguarding of which was the underlying motive of all early speculation and belief. Several millennia before man systematically studied anatomy he was building up the fabric of civilization under the influence of doctrines based upon his ideas of the functions of his heart and blood, his breath and moisture, the placenta and the "life-substance." It would, in fact, not be an exaggeration to claim that civilization was evolved out of man's endeavours to understand the constitution of his own body and to preserve the life that animated it.

All learning was at first focused on the preservation of life. As the Greeks expressed it many centuries later, the healer was a naturalist (physician, from φύσις=nature)—one who studies the forces of nature to safeguard life. Throughout the ages the essential doctrines of philosophy centred around the anatomical facts of the anatomy of the brain and heart, as the means of interpreting thought and behaviour.

But having thus referred to the fundamental significance of anatomical studies in the history of civilization, it will now be more illuminating to cite certain illustrations that have some direct bearing on medicine.

WILLIAM HARVEY AS AN ANATOMIST.

In his Harveian Oration a fortnight ago the President of the Royal College of Physicians (Sir John Rose Bradford) gave an eloquent exposition of the significance of the experimental method and of the debt of medicine to Harvey for having introduced it. Thanks largely to the work of Harvey, to quote Sir John's conclusion, we may claim that medicine has a scientific status as a branch of natural knowledge.

In this connexion, however, we should not overlook the fact that Harvey himself called his magnum opus *An anatomical dissertation on the movement of the heart and blood in animals*, and that he was an anatomist, a pupil of Fabricius of Aquapendente, under whom he worked for five years at Padua, when he was demonstrating the existence of valves in the veins. Harvey used his master's picture of these valves to illustrate his own book; and it is clear from his writings that this anatomical fact formed the solid ground upon which was based the great achievement that at the beginning of the seventeenth century transformed the whole scientific outlook on the human body.¹ On the other hand, Sir Charles Sherrington has summed up the experimental investigations of a generation on reflex action in terms of structure.

The state of anatomy in England at the time when Harvey introduced into it the new life of the scientific method is revealed in the fact that Vicary's mediaeval nonsense was still in circulation as a textbook of anatomy at the time when Harvey brought back from Padua the methods of comparative anatomy Fabricius was inculcating. Harvey was none the less an anatomist because he resorted to experiment to test the meaning of the arrangements revealed in the dissection of the body, as every anatomist should in order to interpret anatomical facts. The experimental degenerations in the nervous system, for example, are devices for discovering facts of structure.

WILLIAM SHARPEY.

Another British anatomist, who like Harvey was a student of the Paduan school, invented the modern methods of practical physiology at University College. William Sharpey's disciples, Sir Michael Foster, Sir J. Burdon-Sanderson, Dr. W. H. Gaskell, and Sir Edward Sharpey-Schafer, carried their master's methods and his inspiration into other British universities. But, unfortunately for anatomy, these anatomically trained physiologists insisted on retaining microscopic anatomy as part

of their subject, to the grave injury of anatomy in this country. It is worthy of note that until the time of Sharpey there was in England no separation between anatomy and physiology; and it is a consideration of fundamental importance to recognize that each of them should be free to employ any technical methods that promote its particular aims. For anatomy is not simply descriptive: it aims at understanding and interpreting the meaning of structure, and experiment is one of the necessary procedures for elucidating structure. In the school where Sharpey accomplished his great pioneer work efforts are being made to retrieve the disaster he unwittingly inflicted upon his subject. By bringing the two departments into close contact as a single unit, and by integrating the two subjects into one discipline, it is hoped to break down the artificial barriers between the investigators of structure and function.

JOHN HUNTER.

If Harvey laid the foundation of a real science of medicine, John Hunter can with equal truth be said to have accomplished a like service for surgery. His principles were established on the basis of a wide comparative study of anatomy and the phenomena of growth. By investigating the means adopted by Nature for dealing with the infinite variety of problems that arise in the animal economy, to use a favourite word of his, Hunter discovered methods to imitate in surgical procedure. He raised surgery from the empiricism of the barbers to become a craft inspired by the methods of true science and a technical skill controlled by reason and understanding.

The late Mr. Stephen Paget refers to the work of William and John Hunter on the lymphatic system as a new truth of vast importance, second only to Harvey's discovery of the circulation of the blood; and in estimating its significance he uses the words so many writers have applied to Harvey's achievement: "it changed the whole character of medical science and practice." That the lacteals, which carry food products into the blood, were absorbent vessels men knew already, but they had not realized that the whole body, every organ and tissue of it, is penetrated and drained by a special system of vessels to bring the fluids in the tissues back into the blood stream. It is not necessary for me to say anything to impress upon this audience the importance of the lymphatic system in surgery and the value of the pioneer work of the Hunter brothers. A vast amount of detailed work on the lymphatic vessels and glands has been accomplished in recent years, and valuable light has been shed, especially by our American colleagues, upon their developmental history. But the satisfactory solution of the controversies that have arisen as to the interpretation of the meaning of these observations will not be attained until we return to comparative methods and study the phylogeny rather than the mere ontogeny of the system.

The brilliant research on the lymphatic system of *Lophius* that has recently been accomplished in this museum by the physiological curator, Mr. Richard H. Burne, is an encouraging sign that this great work is being carried on in its appropriate setting.

CHARLES DARWIN.

If Harvey introduced a new era in medicine and Hunter in surgery, Charles Darwin gave the whole world of learning a new outlook.

The recognition of the reality of evolution effected a revolution, not simply in biology, but in every field of intellectual work. Although Darwin's work was inspired primarily by what we now call nature studies, it is clear that the foundation of the argument, without which he would not have been able to convert people to accept his views, was represented by the facts of comparative anatomy and embryology. He himself says in the *Origin of Species* that morphology is the soul of natural history.

Darwin's achievement gave a new orientation and a new meaning to morphology. What is not generally recognized by physiologists at the present time is the vast scope of evolution and the significance of processes that took many millions of years to effect. They do not seem to appreciate that only an altogether insignificant fraction of the great natural processes is susceptible of experimental

inquiry. When they ask what use can be assigned, say, to the morphology of the lizard's chondrocranium, they thereby show a failure to appreciate that the great story of evolution is based upon the linking-up of the facts of morphology and palaeontology. No full understanding of the behaviour of man or any experimental animal can ever be attained without a knowledge of his or its origin and evolution.

THE CELL THEORY.

What Professor E. B. Wilson calls a milestone of modern scientific progress—the cell theory enunciated by Scheiden and Schwann in 1838-39—stands forth as one of the greatest achievements in biology, which marked the beginning of a new era in knowledge and its application in practice. Goodsir, Virchow, and their successors used this conception for the analysis of the structure of organisms, and in doing so opened far-reaching vistas of progress in every department of biology and medicine. In more recent times the evidence afforded by the behaviour of chromosomes afforded anatomical corroboration of the results of experimental breeding, and compelled even the geneticists to admit that morphology had its uses.

THE PRESENT POSITION OF ANATOMY.

Even if anatomy had achieved nothing more than make vital and essential contributions to the great revolutions in thought effected by William Harvey, John Hunter, William Sharpey, Rudolf Virchow, and Charles Darwin, its place in the forefront of progress would be established. But its claims are much wider than that. Its influence was in fact universally felt in the advance of civilization. It is not, however, the place of anatomy in history with which I am chiefly concerned to-day. It is rather its present position and future development that I want to discuss.

In your museum the word "physiology" is, significantly enough, used to connote comparative anatomy. This uncommon usage expresses an important truth. For no method more clearly reveals the functions of structures than the correlation of their varying size and structure in animals of differing capabilities.

In his comparative study of the heart, and in particular of the bulbus cordis, the present conservator of the museum has shown, perhaps more clearly than in any other of his numerous works, that the spirit of John Hunter is still alive here. For the use of comparative anatomy, in conjunction with the study of the functional meaning of the varying arrangements, to illuminate the normal morphology and pathological states of the heart would have delighted the founder of the museum. Sir Arthur Keith's greatest service to science, however, has been his persistence in keeping constantly before the anatomist the urgent need for the study of function as an essential part of the interpretation of structure. From its foundation the principle has been emphasized in your museum. The use of the term "physiological series" for the collection of comparative anatomical preparations is a happy illustration of the real spirit of Hunter's work.

Take, for example, the case of the cerebellum, which I discussed in the Arris and Gale Lectures in this room six years ago. Some physiologists (for example, Professor Magnus in his Croonian Lecture to the Royal Society this year) are now proclaiming that their experiments do not reveal any functions for the cerebellum; but anyone who walks through the gallery of this museum, where the wonderful collection of vertebrate brains is exhibited, can see for himself that Nature's great experiments in modes of posture and locomotion have left their impress so clearly in the cerebellum that he who runs may read. So also in the morphology of the brain as a whole, the varying sizes and histological structure of its parts express the habits and capabilities of animals and reveal the broad lines of their functions.

In his great treatise *The Integrative Action of the Nervous System*, which opened a new era in the interpretation of the brain's meaning, Sir Charles Sherrington calls the cerebrum "the ganglion of the distance-receptors," by which are initiated and guided long series of reactions of the animal as a whole. Unfortunately he did not avail himself of the facts of comparative anatomy to elucidate and reap the full harvest of his illuminating idea. Here again it requires no difficult technical procedure or abstruse

knowledge to discover facts of fundamental importance, which have escaped those who neglect to give due consideration to comparative anatomy. It is only necessary to look at a comparative collection of brains such as this museum contains to see at a glance that the most primitive type of cerebrum is not equally the ganglion of all the distance-receptors, but predominantly of the one concerned with smell. The part of the brain that eventually became the organ of mind is primarily a receptive centre for olfactory impressions, and the instrument whereby such experience can influence behaviour. The whole arrangement of the brain is dominated by this fact, which is fully borne out by experiments on the dog-fish such as those of Professor Parker of Harvard University.

Considerations of structure cannot be ignored with impunity by those who aim at understanding function. After all, the aim of experiment is to interpret the working of an instrument, and the mode of construction of that instrument cannot be neglected. It is not, however, morphology alone that is essential, but also considerations of phylogeny, the relative place in nature and affinities of the experimental animal, the appreciation of which is based upon morphology. In all investigations considerations of evolution are matters of fundamental importance, and are especially significant in the case of the nervous system, which undergoes profound changes in the course of its history. In such researches as those now being carried on by Professor Magnus and his collaborators the differences of behaviour in various grades of animals are being forced upon their attention. But the full fruits of much patient work are being lost by many physiologists from their neglect of the phylogenetic factor.

How fruitful researches can become when due importance is given to the facts of evolution is revealed in the splendid experimental and clinical researches of Professor Brouwer of Amsterdam. By arranging the experimental animals in an orderly series he has been able to demonstrate the progressive changes that occur in the lateral geniculate bodies, the oculomotor nuclei, and the cerebral cortex in a series of vertebrates, and has shed a brilliant light upon a series of problems of fundamental importance to the morphologist and clinician. In particular, his work illuminates the process of evolution of the brain that ultimately brought about the emergence of man's high intelligence. Dr. Brouwer's researches have given the lead in this country to Dr. H. H. Woollard and Mr. W. E. LeGros Clark to work the rich vein of ore opened up by his genius.

THE NEW OUTLOOK IN ANATOMY.

As knowledge advances in physiology, pharmacology, biochemistry, and clinical medicine and surgery a host of new problems arise, for the solution of which anatomy provides in many cases the field of research, and in all cases the coping-stone of objective demonstration, and becomes the last court of appeal for its validity—the translation of elusive modes of reaction into the concrete terms of structure.

Experimental physiology aims at explaining the behaviour of living organisms and tissues, and if it is successful its results must be expressed in terms of the constitution of the organism and its parts. Morphology is not only the foundation of experimental research—the territory in which the work is done and the study of the physical properties of the material investigated—but it also affords the ultimate test of the significance and validity of the results attained. Hence both kinds of investigation are essential and complementary the one to the other. The morphologist and the physiologist should work in close co-operation the one with the other, and the clinician has opportunities for applying their results and making fresh observations suggesting new problems for the morphologist to investigate. How fruitful this co-operation of workers in the three fields can be is shown by recent research in neurology, by such bridge-builders as the Dutch investigators Magnus and Brouwer, who in different domains of neurology have revealed the importance of the combination of morphological, experimental, and clinical methods in dealing with complex problems.

The results of a great deal of experimental and clinical work are being interpreted to-day in defiance of the clear

facts of structure. The recognition of the significance of morphology is of vital importance as a preventive of such errors. It can also be shown that a lack of anatomical knowledge at certain epochs in the history of civilization was responsible for hampering progress. In 1674 Malebranche (*Recherche de la vérité*) expressed his belief² in the existence of vasomotor nerves ("Nerfs qui environnent les artères pour fermer, par leur contraction, le passage au sang qui montre vers le cerveau, et l'ouvrir par leur relâchement à celui qui se répond dans toutes les autres parties du corps"), but he lived two centuries before men had sufficient knowledge of bodily structure to appreciate all that was involved in this precocious intuition of genius.

Because anatomy had not prepared the way, for instance, the understanding of the injuries that produce aphasia had to wait for three centuries. In the year 1558 Nicholas Massa published an account of a case of traumatic aphasia, which disappeared after operation. The patient received a blow from a halberd that perforated the base of the skull and penetrated the meninges and brain, into which a fragment of bone was driven. He makes the comment, which in the mouth of a surgeon has a very modern and familiar ring about it, that the physicians had not noticed the depressed bone. Massa assumed that the loss of voice might be due to the pressure on the brain of the piece of bone he had detected. Hence, in the presence of the physicians and other onlookers, he proceeded to remove it. To their intense astonishment the patient at once recovered his speech.*

It was not until the beginning of the nineteenth century that, as the result of anatomical observations, Dr. Joseph Gall was able finally to demolish the old theory of animal spirits, which had prevented a proper understanding of the nature of the problem. Then the way was prepared for the admission of the reality of cerebral localization. In a work published in 1818 Gall recorded a case of traumatic aphasia such as Massa had seen in 1558—an officer who received a sword thrust just above the left eye and lost "the memory for words." But it took more than another half-century before physiologists and clinicians were willing to admit the reality of localization, and then only when the genius of Hughlings Jackson and Broca and the experiments of Fritsch and Hitzig, Ferrier, and others had given the observations an anatomical setting by assigning to definite areas of the cortex the control of certain movements. The history of these fifty years is told in full by Dr. Henry Head in his great treatise on *Aphasia and Other Disorders of Speech* (1926).

With reference to the question of cerebral localization, it will be common knowledge that the histological investigations of Dr. Bevan Lewis from 1869 onwards established the fact of anatomical localization. Yet Lewis's important work was brushed aside because the precise results obtained by him seemed to come into conflict with those obtained by experimental investigations.

The difference in structure between the pre- and post-central convolutions of the brain was completely overridden by the fact that Sir David Ferrier and others obtained responses to electrical stimulation from both convolutions. It is important to remember that when Sir Charles Sherrington in 1900, using a more exact method of investigation, was able to prove that the post-central convolution was not excitable, the method of histological localization was restored to favour, and the work which Dr. Bevan Lewis had begun more than thirty years previously was taken up with renewed vigour, and yielded some of the most significant additions to our knowledge of cerebral structure, the full extent of which has been impressed upon us recently by the great treatise by Professors Economo and Koskinas.

THE SYMPATHETIC NERVOUS SYSTEM.

The new chapter in the history of medicine created by the work of Gaskell, Langley, and Anderson on the sympathetic system was based essentially on anatomical investigations. At the present time the question of the practical and clinical applications of this knowledge is the subject

of lively controversy. There are grave differences of opinion in respect of almost every aspect of these problems. But in the long run the issue will be settled by the facts of anatomy. When we know more of the structure of the nerves passing to muscles and their connexions in the central nervous system the decisive evidence for the solution of these difficult problems will have been attained. In respect of this matter the morphological outlook comes into direct conflict with the attitude taken up by many of those who rely solely on experimental evidence. It is generally admitted that muscles have two more or less distinct functions to perform—contraction and maintenance of posture. The brilliant investigations of Sir Charles Sherrington have demonstrated beyond question that posture is automatically regulated by means of proprioceptive reflex arcs. It is also admitted that in invertebrates there are separate and distinct muscles for performing these two functions, even though the movements of the animal are slow and clumsy.

To the morphologist, in whose outlook ideas of evolution loom more largely than they do to the mere experimentalist, it seems in the highest degree improbable that vertebrate animals, in which muscular activity attains a much higher degree of rapidity, skill, and complexity than it does in most invertebrates, should reveal no corresponding differentiation of muscles and nerves for carrying out these two functions. For fifty years it has been known that there is a duality of innervation. We know that there are differences in muscular fibres—the thick and the fine—the relative proportions of which are responsible for the obtrusive differences in colour between red and white muscles. It seems, therefore, if one applies the morphological argument, in the highest degree probable that the greater efficiency of the vertebrate muscle may be due to the fact that the two kinds of muscle fibre, instead of being separate as they are in invertebrates, are intimately blended to form composite muscles.

We know that in the case of the viscera there are two functionally distinct groups of nerve fibres, and it seems again highly improbable that the voluntary muscles, which have automatic functions to perform like those of the involuntary muscles and in addition the highly complex reactions associated with willed movements, should be less well equipped for these more complicated functions than the simpler muscles. It remains for anatomical studies to provide the explanation of the conflicting evidence derived from experiments and surgical operations.

SOME PRACTICAL APPLICATIONS.

In spite of the widespread neglect of morbid anatomy, the development of cytology and the recognition of its fundamental importance in the investigation of cancer is bringing an increasing number of pathologists back to morphological studies. An interesting application of such knowledge is now being made in clinical surgery, in which observations in the cytology of cancer (such as were made years ago by Sir G. Lenthal Cheate) are being used by Dr. McCarty in the Mayo Clinic to determine the prognosis in cases of carcinoma.

Some observations that my colleague Dr. H. H. Woollard has been making on the neuro-muscular lesions of so-called beri-beri induced experimentally by depriving rats of certain vitamins suggest that in the last resort the evidence afforded by the structural changes in muscles and nerves cannot be neglected in any estimate of the effects of food deficiency. This impression is even more emphatically confirmed by the observations on bone growth by another of my colleagues, Dr. H. A. Harris. He has been able to demonstrate by anatomical studies that after any diminution of the growth processes of the body (such as normally occur during the week after birth and in certain phases of puberty, as well as in grave illness, or even deprivation of a diabetic patient of his dose of insulin) an opaque line makes its appearance in x-ray photographs of bones. This has been mistaken for and used as a diagnostic sign of healed rickets, and many observers' work has been vitiated by erroneous interpretations of the effects of vitamins, etc., on bone growth. Such results indicate that morphology provides criteria by which the influence of the various

* This case of Marcus Goss is reported in Nic. Massa, *Epistol. medicinal.*, II, 90-91 (Venetis, 1558); and a similar case in Fr. Arcaeus, *De recta curandorum vulnerum ratione*, 62-27 (Antverpiæ, 1574). My attention was called to these surprising records by the reference to them in Jules Soury, *Système nerveux central*, 1899, T. I.

vitamins on growth and metabolism will in the future be tested, as for some years in California Professor Herbert M. Evans has been testing their potency.

The knowledge of the arrangements of the tracts in the spinal cord that has been acquired within recent years seemed at first to have little more than an academic interest, or at most a use in diagnosing lesions beyond the scope of treatment. But in 1911 Dr. Spiller suggested that the knowledge could be put to the humanitarian purpose of relieving the terrible sufferings of patients with inoperable cancer. In the *Archives of Surgery* three months ago Dr. M. M. Peet has described the truly wonderful results obtained by cutting that part of the antero-lateral column of the spinal cord which conveys impulses provocative of pain. Thus the unfortunate victims of incurable disease can get relief from their suffering without resort to drugs. Such a technical procedure has the advantage over section of posterior nerve roots because it does not deprive the parts of all sensation, and the patient is unaware of any abnormal feeling.

During the last ten years thorough investigation of the effects of nerve injuries in soldiers and the correlation of evidence so obtained with the facts of anatomy has enabled Professor Stopford to extend and clarify our knowledge of the arrangement of the sensory nerves and has given the surgeon new and exact methods for the diagnosis and prognosis of nerve lesions.

Only four years ago the pancreas used to be cited as an example of an organ which when diseased could give rise to such profound changes in the whole organism as we know in diabetes without revealing any structural indications of disease. But we now know that this is no longer the case. The morphological changes in the islands are clear enough once one knows where to look for morbid changes.

The anatomical localization of the lesions of encephalitis lethargica and morphological studies to determine the sites of injuries to the mid-brain and hypothalamus that in experiments and clinical cases give rise to definite reactions of body and mind will eventually give us a new insight into the physical factors concerned with personality, and also the neural processes concerned with the manifestations of the common symptoms, such as raising of the body temperature, nausea, etc., in grave constitutional diseases with which every medical practitioner is daily concerned.

These instances chosen at random are enough to indicate that in the near future anatomy promises to become the stepping-stone to a new revelation of knowledge, which will illuminate the whole field of human endeavour.

In this address I have endeavoured to suggest the vastness of the opportunities that now present themselves in anatomy, and how vitally they affect the progress of surgery, not merely the mere craft of operating, but also the wider problems of diagnosis, prognosis, prevention, and treatment. This College has the power actively to promote progress on these lines, which I hope you will permit one who is beyond the pale of your membership to mention. By means of the primary examination for its Fellowship it can insist that the rising generation of British surgeons is inspired with the true spirit of understanding of the human body and is alert and open-eyed to appreciate the great vision that is about to be revealed. Instead of helping the persistence of the mediaeval conceptions of anatomy, it can encourage the development of an anatomy that deals with really vital problems. The College has in its great museum the most valuable instrument for promoting the study of anatomy on right lines. The growth of the collection started by John Hunter is one of the great scientific achievements of the last century; under the direction of Sir Arthur Keith the opportunities for the comparative study of anatomy have been brought to a higher pitch of efficiency than ever. The College has it in its power to induce the candidates for its Fellowship to avail themselves of this wonderful instrument that is now too much neglected, and in doing so it will enhance the importance of the College itself and raise the standard of the science and practice of surgery.

REFERENCES.

- ¹ Charles Singer: *The Evolution of Anatomy*, 1925, p. 174.
- ² Quoted from Jules Soury, *Système nerveux central*, 1899, T.I, p. 407.

British Medical Association.

PROCEEDINGS OF SECTIONS AT THE ANNUAL MEETING, NOTTINGHAM, 1926.

SECTION OF LARYNGOLOGY AND OTOTOLOGY.

A. BROWN KELLY, M.D., D.Sc., President.

DISCUSSION ON THE TREATMENT OF MALIGNANT DISEASE OF THE UPPER AIR AND FOOD PASSAGES.

OPENING PAPERS.

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SURGICAL TREATMENT.

THE subject of this discussion is so vast that no individual speaker can attempt to deal with more than a small section, and even then anything in the nature of detail is not to be thought of.

In the time at my disposal I propose to consider briefly some of the general principles involved in the surgical treatment of malignant disease of the mouth, fauces, and the oral and laryngeal portions of the pharynx. These will be considered under four heads: (1) selection of cases; (2) preparation for operation; (3) the operation; (4) after-treatment.

Selection of Cases.

As regards suitability for operation, cases fall naturally into three groups—favourable cases, doubtful cases, and hopeless cases.

The group of really early, favourable cases is a small one—10 per cent. of the total or less—and includes those in which the primary growth only involves a limited area, no enlarged lymphatic glands are palpable, and the general conditions are good. In the majority of such cases operation results in apparent cure, but even here it is easy to be too optimistic—for instance, the smallest epithelioma of the tongue I ever saw led to the death of the patient from secondary deposits within three months.

Doubtful cases constitute the majority—I should say about 50 per cent. of the total. Here it is usually a question of giving the patient a chance, and provided that the growth can be completely removed without too great interference with function, there is a chance of cure, a probability of a considerable respite, and almost a certainty of alleviation, even though the primary growth is extensive and the glands on one side of the neck are definitely invaded. The actual site of the growth is largely immaterial, for if a suitable method of approach is adopted the growth can usually be so completely exposed to view that its removal is comparatively simple. About four in every ten cases I see are obviously hopeless, either on account of the extent of the primary growth, or of the glandular involvement, or both. Even here, however, a purely palliative operation may be indicated—for instance, the removal of a tongue that has been largely converted into a fetid, bleeding ulcer, and is associated with extensive glandular disease, or the destruction of a widespread ulcerating growth by diathermy, will quite often give the patient several comparatively comfortable years.

Perhaps the most difficult decision which has to be made relates to the group of doubtful cases which more nearly approach the hopeless class. I can only suggest that every factor which has a possible bearing on the question must be taken into consideration and carefully weighed in the light of experience. While desiring, on the one hand, to avoid subjecting the patient to a trying ordeal which is foredoomed to failure, yet, on the other hand, it is necessary to be careful not to let slip the chance of a brilliant success.