Valedictory address by John Gray M'Kendrick, Professor of Physiology in the University of Glasgow at the close of the summer session of 1906.

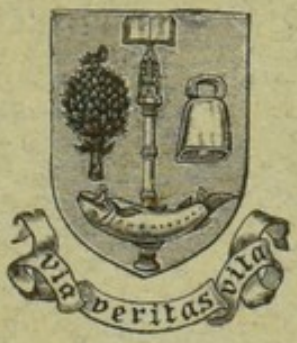
VALEDICTORY ADDRESS

BY

JOHN GRAY M'KENDRICK

PROFESSOR OF PHYSIOLOGY IN THE UNIVERSITY OF GLASGOW

AT THE CLOSE OF THE SUMMER SESSION
OF 1906



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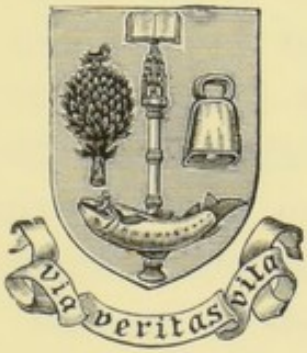

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JAMES MACLEHOSE AND SONS

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Valedictory Address to the Physiology Class.

GENTLEMEN,

There comes a time in the life of every man when he must leave the old and well-trodden paths and enter upon a new road. This day marks such an event in my life. After thirty years of service in this University, I have resigned my office, and I desire to commit the active duties of the chair to a younger man. Such a crisis in one's life cannot be passed without awakening many thoughts both as regards the past and the future, and perhaps you will pardon me if I lay before you some reminiscences and reflections.

Even before I became a student of medicine I was attracted by the wonders of natural science, and especially by physiology. In 1857 I read a large portion of Carpenter's *Physiology*, and I had the audacity to give a lecture on the Brain. The first systematic course of lectures on Physiology which I had the privilege of attending were delivered by the late Professor George Ogilvie Forbes in Marischal College, Aberdeen, in the winter session of 1861-2. My notes of those lectures are still

before me, and they show that the subject was treated in a broad and philosophic spirit. There was no attempt, however, at demonstration except by diagrams, and a few microscopes on a side table. There were no experiments, and the only instrument we saw was a sphygmograph, to a demonstration of which a special hour was devoted. As I have indicated, the Professor possessed a philosophic attitude of mind. His course was introduced by deeply interesting lectures on typical organic forms, and these were discussed chiefly from a Lamarckian point of view. The *Origin of Species* appeared in 1859, but no theory of evolution had been brought forward.

Circumstances led me to pursue part of my medical studies at the University of Edinburgh. There I came under the influence of several great teachers in their day, and more especially I desire to mention John Goodsir, who held the chair of anatomy. He was one of the first men of his time and he will always have a place in the front rank of naturalists, using the word in its broadest sense. He was no mere human anatomist, but he took a wide view of organic structure in all its aspects, anatomical, morphological, physiological. I shall never forget the impression he gave of being really a great man, a philosopher, one who saw deeply into things, one whose mind recognised the importance of what to other minds seemed trivial, one who lived for science and the expansion of human thought. To John Goodsir may also be traced the rise of the modern physio-

logical school in Great Britain. About this time, under the influence of the disciples of Johannes Müller, physiology in Germany had entered on a new phase, that of being an experimental science. Helmholtz had made an experimental study of muscle, he and Du Bois Reymond had determined the velocity of the nervous impulse, Du Bois Reymond had caught the mantle of Matteucci and had become the apostle of electro-physiology, and Brücke and Ludwig had investigated the hydraulics of the circulation, a subject that had not advanced since the classical researches of Thomas Young. But the wave had not reached our northern shores. Goodsir, however, was in the habit of visiting the Continent, and he brought to Edinburgh strange and wonderful apparatus, myographs, electrical appliances, a kymograph, a Vierordt's sphygmograph, and such like instruments. These at first found a home in the Anatomical Department. But the Professor of Physiology of the day, the late Hughes Bennett, became deeply interested, and his practical instincts showed him that there must be new methods of teaching physiology in his laboratory. He accordingly acquired from Goodsir all the apparatus he had brought from Germany, he added largely to it, and thus the new school of physiology found a home in Edinburgh. About the same time Sharpey in University College, London, also took up this new development of physiological science, but, as I have said, the man who first caught the inspiration from Germany was John Goodsir.

Years passed, but after graduation I saw no hope of reaching the fairy land of science. Hospital and Dispensary appointments brought me into contact with the phenomena of disease. I shall never regret having had this experience, because it gave my mind a bias, it led me to view physiological problems in the way they are continually forced on the attention of the medical practitioner, and it has undoubtedly influenced all these years my teaching as a Professor of Physiology.

At last my opportunity came. It is one of the experiences of life that opportunities arise often in the most unlikely circumstances. In 1868 I was the Resident Surgeon in the Belford Hospital, Fort-William, a little hospital under the shadow of Ben Nevis. It seemed most unlikely that I would be transferred from such a position to a physiological laboratory. And yet so it came about. Bennett came to see an English gentleman who was dying in a shooting lodge at the mouth of Glencoe; I met him there; probably he saw the bias of my mind; we corresponded; and one day I was surprised and delighted to receive a letter from him offering me the post of assistant in his laboratory, vacant on the removal of the late Professor Rutherford to King's College, London. I went to Edinburgh and succeeded Rutherford. He in turn had succeeded Dr. Argyll Robertson, the well-known ophthalmologist, who began his career in the Physiological Laboratory in the University of Edinburgh. Dr. Argyll Robertson was, I believe, the first to teach Practical Physiology in

this country; he was succeeded by Rutherford, who developed the methods of practical teaching to an astonishing degree; and I had the honour to come after him. In due time I came to Glasgow in 1876, and here the happiest days of my life have been spent. It was my privilege to initiate the teaching of Practical Physiology in this University, and to develop a laboratory. In carrying this out, I have been always encouraged and assisted by the University authorities, and by many friends. There is now a large and valuable collection of apparatus, both for teaching and for research purposes, and I shall have the satisfaction of leaving to my successor the splendid new laboratories in the vicinity of the University. One of the candidates for the Chair remarked to me after I had shown him over the rooms: "Why; this is not a laboratory; it is an institute."

Nothing more strikingly shows the requirements of modern science than the statement of the fact that, during these thirty years I have been obliged to be content with five rooms, but the new Institute contains twenty-five! Yet, far be it from me to address you to-day in a boastful spirit. No one is more conscious of shortcomings than I am; no one recognises more how little one has been able to do in the short space of a working life. Many of the dreams of youth have faded away, and even bits of work that seem to be solid achievements in science pass into comparative insignificance as time rolls on. Even the greatest workers in science add only a little to the fabric of the great temple,

but it is a joy to a man of scientific spirit to put in even a single stone.

It occurs to me that perhaps it may be of some interest to you and to my fellow-workers in physiology if I endeavour to state how the science appears to me after having watched its progress for at least thirty-seven years. Physiology is a somewhat peculiar science. It has no methods of its own except that of observations on living animals, but it calls to its aid all the methods of the other experimental sciences. The science of physiology is in reality the application of the methods of histology, physical science, and chemical science to the elucidation of the phenomena of life. Even histology consists of the application of the microscope and the use of physical and chemical agents and methods to the examination of the structure of tissues and of organs, so that physiology becomes the science that uses chemical and physical methods in the examination of function. So far as histology is concerned, immense progress has been made during the last thirty years. As an instrument, the microscope has been so improved that we may safely say that of physical instruments it is perhaps the one that most nearly approaches perfection. The methods of histological research have also become more thorough and scientific, and the use, for example, of many staining reagents, is more surely based on a scientific knowledge of the chemistry of the process. By the advance of method, you have in your possession to-day, at the close of this session, many specimens that a

few years ago would have been found only in the cabinets of experts. Still, it is doubtful if we can expect much more progress in the direction of histology. True it is that histologists are back again to the cell. The analysis of the modes of karyokinesis, for example, is marvellous, and it has had an important bearing on notions as to hereditary transmission and also as to certain pathological phenomena. Still, it is more than probable that the molecular phenomena on which life depends will be for ever hidden from the human eye. All physiological phenomena, in a sense, are concentrated in the cell; the action of all organs depends on cellular activity; but just for that reason it is doubtful if this activity can be directly scrutinised.

We have next to consider the experimental methods. Those that are possible with living tissues from recently killed animals have been well worked out. The graphic method, by which movement and the registration of time may be carried out with great accuracy, took its origin not long before my attention was directed to physiology, and I have seen it develop and take its place as one of the acknowledged methods of physiological science, and in the possession of every student of medicine. The study of the movements of muscle, of the heart, of the pulse, of the respiratory organs has been carried out with great precision, I doubt much if more is to be gathered in this direction. The phenomena of animal electricity since the days of Du Bois Reymond have been investigated with

remarkable success, and the action of electrical stimuli on muscle and nerve has been laboriously worked out. Until recently there seemed to be little hope of progress in this direction, but within the last few years the phenomena of ionisation appear to offer a new explanation of the facts, and a number of able men are engaged in this new field.

Physiologists are acquiring better methods of studying the functions of living isolated organs, such as muscle, the intestinal wall, the liver, and the kidney, and there appears to be good hope that the perfusion method, that is of feeding an organ with blood under suitable conditions, will yet do much towards an explanation of function. Vivisectional methods also, if carried out by competent persons and with all due precautions, cannot fail to advance physiological science. It is not my purpose here to discuss this method as a controversial subject. I find it difficult to imagine how those who deny its use altogether in physiological science can fail to see what remarkable progress has been made in our knowledge of the digestive processes by the methods of Paulow, the Russian physiologist. At the same time, I think there should be a wise self-restraint exercised in the use of this method. It is not necessary to demonstrate to students all the facts that have been gained by this method, nor is it necessary to repeat the experiments of previous observers except at the beginning of a new line of research. In my opinion the educational value of vivisectional experiments before students

has been over-estimated, and has led to considerable misconception of the aims of physiologists. Only a very few are necessary ; others should be carried out only with a view to research. I am also of opinion that in the past, in the education of the student of medicine, too much time and energy have been expended on difficult experimental work on the physiology of nerve and muscle, and on relatively unimportant matters in electro-physiology, such as a demonstration of Pflüger's law of contraction and electrotonus. In the future the experimental course should be much broadened, so as to include simple experiments on the hydraulics of the circulation, on respiration, on the physical properties of blood, on the phenomena of the senses, and on processes of digestion. If the course were skilfully devised, a student, before entering the clinical wards, might be able to use the sphygmograph, the laryngoscope, the ophthalmoscope, the haemocytometer and other instruments now used in scientific clinical work. To carry this out requires adequate accommodation and expenditure of money, but I have a strong belief that my successor will find these conditions supplied when he enters on the new laboratories.

The two departments of physiological science in which there has been, in my judgment, the most marked progress during the last thirty years are our knowledge of the nerve paths in the central nervous system and the subject of internal secretions. The requirements of clinical research into the causation of various forms of paralysis

stimulated pathologists and physiologists to attack the difficult problem of tracing the paths of nervous impulses in the brain and spinal cord, with the result that the nervous mechanism has been found to be much more complex than it was supposed to be, and it has also become apparent that, in the evolution of the central nervous system, the parts become more and more complex in the scale of vertebrate life until we come to man, who possesses not only the most complicated brain, but also the most complicated spinal marrow. The reflex influence of this increase of knowledge is seen in yearly increasing accuracy in the diagnosis of cerebro-spinal diseases.

The doctrine of internal secretions has thrown a new light not only on the functions of special organs, but also on the general physiological economy of the body. Each organ apparently not only discharges its specific functions, but it so modifies the quality of the blood by producing what we term internal secretions, that the functions of other organs are modified, a view suggested long ago by a highly philosophical book, now seldom read, the *Lectures on Surgical Pathology*, by the late Sir James Paget.

I think there can be little doubt that it is in the direction of physiological chemistry that progress will be made in physiology during the next few decades. It is a great gratification to me to leave a lecturer on physiological chemistry in connection with the department, and there will be ample accommodation for him in the new labora-

tories. Physiological chemistry is confessedly the most difficult of all branches of investigation. This view cannot be too strongly urged. The physiological chemist must be a trained chemist as well as a physiologist; he must have a profound acquaintance with organic chemistry, and he must also be a good physicist, in the modern sense of the word. It is not too much to say that he will have to begin where other men leave off. Could we only dovetail into each other a few scientific lives, so that the powers of all were brought to bear on the ultimate problem, how rapidly science might advance! To make an ideal physiological chemist we would begin with a Roscoe, to him we would link an Emil Fischer, and we would weld these two with a Kelvin and a Paulow! This, however, is impossible, so we must move slowly. But it seems to me that when we get a grasp of the chemical processes in the cell—any cell, but say the hepatic cell—we will be near an understanding of the phenomena of life. If the secret of vitality for ever eludes the human mind, we may be sure of this, that in the search for it, by the methods of chemistry and physics, new facts and phenomena will be brought to light of which we have at present no conception.

There is undoubtedly a great volume of research work poured into physiological science every year. Much of it has, however, struck me as of a transitory and incomplete nature. There seems to be a feverish haste to publish, a determination to

produce by hook or crook what is regarded as original work. The result is that much incomplete work is published, and hence there is far too much controversy even as to statements of fact. It would be well if more restraint were exercised in this matter. Work of a substantial character cannot be forced by an itching after results, nor even by grants of money. Time is needed for all solid work, and you can no more create by artificial means a researcher than you can make a poet. Great researchers are born not made; and what we should aim at is to give them, when we discover them, every facility for doing their work. Science, and I include physiological science, more especially in relation to the chemistry of vital processes, would, I believe, be benefited if the workers scrutinized and revised their work, and published nothing for the next five years. Such, gentlemen, is, in my humble opinion, the future of physiology.

There is another subject in which I have for many years been deeply interested, that of Experimental Psychology, or, as I would express it, the physical examination of all those physiological processes that lie at the basis of our mental life. Since the days of Fechner this subject has become an important branch of science. It is the link between physiology and psychology, and from the latter we pass into mental philosophy. All graduates in mental science should have a thorough grounding in experimental psychology so that they may understand something of the wonderful

physiological mechanism that is at least correlated to mental activity. It is a satisfaction to me to have made provision in the new laboratories for teaching and research into this department of science, and what is now required to place our University alongside of other great schools in this comparatively new departure is the foundation of a lectureship with an adequate endowment.

And now I lay down my arms, not as a tired or beaten soldier, but as one who has tried to serve his time, and who now wishes to retire in favour of youth and energy and enthusiasm. The evening approaches, and one wishes to have some time to work on tasks that are altogether congenial, to meditate on the past, and to search the intellectual horizon with hopeful eyes for the revelations of the future.

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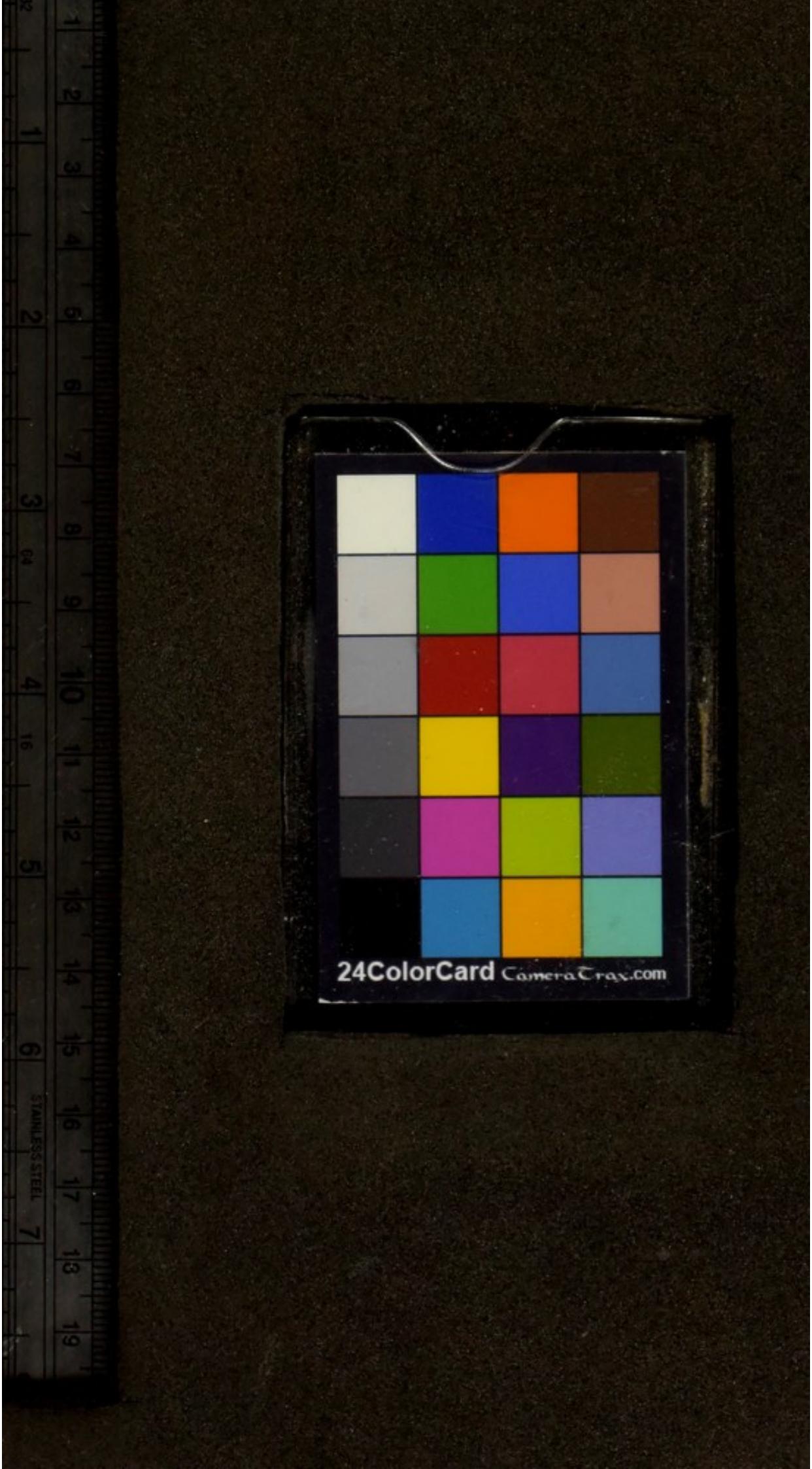
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