

The limits of knowledge : the inaugural address of the Medical Faculty of the McGill University, Montreal, 22nd September 1908 / by G. A. Gibson.

Contributors

Gibson, George Alexander, 1854-1913.
Royal College of Physicians of Edinburgh

Publication/Creation

Edinburgh : Oliver and Boyd, 1908.

Persistent URL

<https://wellcomecollection.org/works/uksj78rd>

Provider

Royal College of Physicians Edinburgh

License and attribution

This material has been provided by This material has been provided by the Royal College of Physicians of Edinburgh. The original may be consulted at the Royal College of Physicians of Edinburgh. where the originals may be consulted.

Conditions of use: it is possible this item is protected by copyright and/or related rights. You are free to use this item in any way that is permitted by the copyright and related rights legislation that applies to your use. For other uses you need to obtain permission from the rights-holder(s).



Wellcome Collection
183 Euston Road
London NW1 2BE UK
T +44 (0)20 7611 8722
E library@wellcomecollection.org
<https://wellcomecollection.org>

THE LIMITS OF KNOWLEDGE

THE INAUGURAL ADDRESS OF THE MEDICAL
FACULTY OF THE MCGILL UNIVERSITY,
MONTREAL, 22ND SEPTEMBER 1908

BY

G. A. GIBSON, M.D., LL.D.

PHYSICIAN TO THE ROYAL INFIRMARY, EDINBURGH

*Reprinted from the "Montreal Medical Journal" for
October 1908*

EDINBURGH:
PRINTED BY OLIVER AND BOYD

THE LIMITS OF KNOWLEDGE

THE LECTURES OF THE LATE
JOHN DE VRIES, D.D.,
OF THE UNIVERSITY OF LEIDEN

G. A. THORNTON, M.A., EDITOR

OF THE LECTURES OF THE LATE

JOHN DE VRIES, D.D.,
OF THE UNIVERSITY OF LEIDEN

PRINTED BY
JOHN DE VRIES, D.D.,
OF THE UNIVERSITY OF LEIDEN

THE LIMITS OF KNOWLEDGE

SUCH an honour as that which the Faculty vouchsafed to me in the request to address you to-day led—as you may readily believe—to much searching of heart. At the first blush the prospect seemed too alluring to be foregone; second thoughts followed, burdened with doubts whether it would be possible to rise equal to the demands of the occasion; these, however, in turn faded before the feeling that the only fitting acknowledgment of your kindness lay in yielding to your wish.

It is indeed a source of much pleasure to be again amidst the fair scenes of this great Dominion, and to dwell upon the manifold beauties showered upon her by the ungrudging hand of nature. It is delightful to gaze once more upon the broad bosom of the silver river with its emerald jewels, reflecting the glowing tints of the woods in their winsome robes. It was amongst these lovely scenes that the thrilling pictures of Parkman first held me in thrall, and led me to understand, as would in no other way have been possible, the lives and works of those who, during two centuries of conflict, strove for the mastery of the new world. Here also was borne in upon me the full meaning of the charming tales of Parker, and amidst their natural surroundings the characters whose loves and hates throb in his pages took an even more living form.

Under the witching wand of these, and many other wonder workers who have lived in your midst, the ground is hallowed by thoughts of the past. What a marvellous vista it is! The brave stealthily gliding through the primæval forest: the pioneer pushing further into the western fastnesses: the seigneur struggling for the foundation of a new nation: the priest labouring for souls, faithful unto death: the soldier freely

shedding his blood for the honour of his flag: the statesman spending his energies in work for the common weal—these and a hundred more scenes rise before our eyes.

Such thoughts fill the mind with vivid pictures of the past, and it is meet that we should dwell upon them. The eyes of the world were turned with warm sympathy to Canada while you recently celebrated the third centenary of the foundation of Quebec by Champlain. Well nigh four centuries have elapsed since Cartier called the beautiful ridge near which we stand Mount Royal, "and hence the name of the busy city which now holds the site of the vanished Hochelaga." A hundred years passed away before your city was founded—years of conflict with foes without and foes within; of undaunted labours for the creation of a new France; of success and failure in the great schemes of conquest. Amongst the great names which will for all time hold a place on the scroll of fame, there will assuredly be none more free from fear or reproach than that of the intrepid and lofty being who planted your fair city. Well has the historian said: "The spirit of Godfrey de Bouillon lived again in Chomedey de Maisonneuve."

To turn from general topics to those which are more nearly allied with the object of to-day, a glance may be cast at the rise and growth of the University. Its far-seeing founder died in 1813, and eight years afterwards a charter was obtained for its erection. A teaching staff was appointed in 1832, and, although many of the posts were nominal, the healing art was, from the first, represented—Thomas Fargues, a graduate of Edinburgh, being elected in that year as Professor of Medicine.

The "House of Recovery" was opened for the reception of patients in 1818, when T. P. Blackwood was appointed Medical Officer. Three years later, in the same year which saw the foundation of the University, the Montreal General Hospital was instituted, and the first medical officers were, Robertson, Stephenson, Holmes, Caldwell, and Leodel, who organised themselves as a teaching body under the name of the Montreal Medical Institution, and began to give systematic instruction in 1824. The members of this teaching body entered the McGill University as its Medical Faculty in 1829, and that no time was

lost receives abundant proof from the fact that in 1833 the degree of Doctor of Medicine was conferred upon William Logie, who was the first graduate of McGill University.

It is very pleasant to know that amongst the distinguished group of men who formed the pioneers of medical education in Canada, several were graduates of my own university. Stephenson, Holmes, and Robertson studied and graduated in Edinburgh; the origin of McGill University, on its medical side, is therefore connected with "Modern Athens," and its early teachers brought to Canada the methods of the sagacious Whytt and the philosophic Cullen, as well as the spirit embodied in that wonderful academic succession furnished by the celebrated families of Gregory and Monro.

To one conning the memorials of your early past, it is a source of much interest to be able to trace the homes of medicine in this great Dominion. Thus it is that the drawing of the General Hospital, as it was in 1830, in "*Hochelaga depicta*" is to me full of interest, while the painting by Lamb of Burnside House, showing how it nestled at the foot of the mountain, in 1843, furnishes a historic link in the academic chain.

It would be tedious to you, who know the various steps by which the University grew from its picturesque birthplace at Burnside, till it finally reached the superb site it now holds near the old home of its founder, to follow the various steps; to those, like myself, pilgrims from the mother land, there is a fascination in tracing out the successive stages of its development, and in recognizing how similar the mode has been to that which may be seen in the old world. In the course of this development it is a very agreeable fact that the academic ties with the old country are becoming closer instead of weaker.

Without dealing with such as unite Montreal to the Universities of the rest of the United Kingdom, a word or two may be allowed as to the present links between Canada and Scotland. Your Chancellor holds a like position in the Northern University, situated between the Dee and the Don; there, as here, he has so fostered the growth of learning and inquiry as to merit the title of a modern Mæcenas. That

many years may yet be vouchsafed to him in which he may continue his beneficent endeavours for the advancement of education is a prayer as frequently and as fervently offered on the shores of the North Sea, as on the slopes of the Mountain. And in this connection let me add, that the kinsman and colleague of your Chancellor, who along with him not only founded and endowed the beautiful Victoria Hospital, but aided the development of the McGill University by munificent gifts, must be likewise regarded as a large-hearted benefactor on both sides of the Atlantic.

It is impossible to resist the impulse to make some reference in this place to the noble gifts of your most sincere friend, Sir William Macdonald, who has not only manifested his interest in the University by donations which are more than princely, but has also devoted his time and energies to the personal direction of many improvements which his generosity has made possible. The erection and equipment of magnificent laboratories, and the foundation and endowment of additional chairs, are sufficient evidence of his beneficent exertions, but even these have been overshadowed by the establishment of the most admirable Agricultural College which the world has ever seen.

Some years ago you carried away the head of one of the Colleges belonging to the University in the "grey old town" to preside over your labours, while we who are connected with that ancient seat of learning have, within the last few weeks, spirited away one of the most brilliant of your younger colleagues. Such interchanges are fraught with far-reaching influences for good. We have many other ties between us. The names of Osler, Roddick, and Shepherd, to mention only those connected with the Medical Faculty, are inscribed on the rolls both of Montreal and Edinburgh. In the other Faculties there are also bonds of union with many of the Universities of the United Kingdom, and we are therefore not merely united by the ties of sympathy, but by those of personal connection.

The commonwealth of learning throughout the world shared the grief of the University in the loss sustained by the Medical Faculty through the lamentable fires which destroyed the results of many years of labour, but observed with delight the

dauntless energy with which you at once set to work to repair the damage and replace what had been swept away. The new buildings which are now arising like a phoenix, as the late Dean has well put it, from the ashes of their predecessors, are an evidence of the indomitable spirit with which the University is instinct.

That the good fortune which has attended the Faculty of Science may be extended to that of Medicine, is the sincere wish of the many friends you possess on both sides of the Atlantic, who felt the deepest sympathy with you in your misfortunes. The hope has been universally expressed, that some man of open mind, with a large heart and a long purse, will realize the importance of a good endowment towards the erection of a perfect Medical School. While recognizing that a school is not necessarily created by bricks and mortar, and that imposing piles of stone and lime do not themselves form a university, yet we acknowledge that many departments of modern medical research can only be carried out in suitable structures, and we realize the mutual influence of beautiful buildings and a university spirit. It is matter for regret that only half of the new home of the Medical School, now in progress, can at present be erected for want of funds, and that years may elapse before it can be completed. Will you let me express the earnest desire that you may have the aid of friends in need?

It would not become me at this time to dwell upon the achievements of the University in the varied walks of knowledge. The special matter to which it is my wish to direct your attention will afford an opportunity of showing that, in those fields best known to me, yeoman work has been done by her children. But there is one subject to which in common fairness you will allow me to refer.

About two years ago certain changes in the blood, taking rise in affections of the intestines, which had till then only been described by three workers in the Netherlands, were found by Carstairs Douglas and myself, to be not merely due to the presence of a bacillus in the bowel, whence toxins were absorbed into the blood, but were found to be produced by the actual entrance of the microbe into the blood, where

it multiplied, and poisoned the very springs of being. We felt a little glow of pleasure in having, as we thought, added a new chapter to the life history of bacteria—one which held out, moreover, the promise of practical usefulness: our results, however, had been, unknown to us, forestalled by other observers. About a year before our work was done, identical results had been obtained in the wards of the Montreal General Hospital by Blackader with the assistance of Gillies and Duval. In a group of symptoms similar to those which engaged our attention they discovered the bacillus coli in the blood. It is a bounden duty, as well as a sincere pleasure, to make it quite clear that this discovery belongs to the banks of the St Lawrence and not to the shores of the Forth. The reason of our ignorance of the Montreal results lay in the fact that those interesting observations were not placed on record until last year, and we had in consequence no means of learning the valuable facts before we published our own later investigations. In the light of what we know it is a great satisfaction to be able to award the palm to those who deserve it. Their researches form a fitting termination to the careful investigations carried out, in this University also, by Charlton, working under the supervision of Adami.

The comparison of the past with the present affords us the best means of guiding future advances. From the failures no less than the successes of ourselves, as well as of those who have gone before us, we are enabled to discern the most fruitful paths of inquiry, and are led to shun the pitfalls which have hindered effort in the past. In other words, our footsteps in the present require to be guided by the light of the past, so that the future may bring with it fruits meet for progress.

In looking about for some particular subject which might usefully occupy our attention to-day, it has seemed to me advisable to take some matter with which my own work has rendered me specially conversant. That now chosen is a subject pregnant with interest, showing how the grey dawn which we owe to the keen insight of the fathers of modern medicine has brightened into the morning light, and how both sides of the world have been engaged upon it, every civilized

country in a spirit of generous rivalry doing something to aid the efforts to reach the noontide of knowledge. It is a matter also full of encouragement, for it shows how much may be done by earnest men possessing apparently but small opportunities for original research.

To some of us it is only vouchsafed to spin the thread, and we have to learn to rejoice in cheerful vein when another weaves the web. To the loyal worker in scientific fields it is enough if he feels that he is adding something to the general fund of knowledge. He may not be able to see at the time whither his observations lead, but he knows that, when joined to the results of other investigations, they will be useful. They may not be fitted to enter into the warp and woof; the work of others may be of stronger stuff, for "the web of our life is of a mingled yarn, good and ill together." But even if they do not become woven into the finished fabric, they have at least helped other labourers by the example they have shown.

Two of the great men who adorned Dublin during the first half of last century observed a group of symptoms which have in recent times been the object of close scrutiny. Adams, in one of the most remarkable of single contributions ever made to medicine, described infrequency of the pulse attended by apoplectic attacks in cases which presented the pathological appearances of fatty heart. He was followed by Stokes, who, in adding further observations, noticed a want of harmony between the movements of the veins in the neck and of the arteries at the wrist; he stated, indeed, that the number of the venous pulsations was more than double that of the ventricular contractions. Stokes further described feeble sounds heard between the cardiac impulses. The meaning of these facts will be clear to us in the sequel. Many years passed before the observations of Adams and Stokes received any additions. It is true that a brief mention is made by Skoda to the subject, but new interest was not aroused until the appearance of some investigations by Leyden. The subject was afterwards discussed by Roy, who ranged himself alongside of Leyden in favour of hemisystole as the cause of the want of harmony in the action of the veins and arteries.

To show how our various additions to knowledge are knit together, it may be mentioned that almost immediately after the appearance of Roy's contribution, a paper was published by Malet and myself in which we described the sound of the auricles in a healthy heart. The case was one of sternal fissure. Little did we think when placing this observation on record how it might afterwards prove fruitful. Linking it with the observations of Stokes, these isolated facts, apparently of no great value at the time, were afterwards found to be of real importance.

Some five years after our observation was placed on record, Chauveau described a case of heart disease in which, for the first time, a dissociation of auricular and ventricular rhythm was carefully analysed by modern methods. This was followed by an excellent study, in which Vaquez and Bureau still more clearly emphasized the lack of harmony between the movements of the auricles and ventricles. These investigations have been followed by the results obtained by a large number of observers who, by means of clinical methods, have been able to demonstrate in the most complete manner that a partial or total dissociation may take place. It may seem almost invidious to single out any names in this connection, but it is only right that we should honour those who have been pioneers in this field, and it is accordingly a pleasure to refer to the work of Moritz, His, Lichtheim, Mackenzie, Wenckebach, Hisschfelder, and Osler.

Besides obtaining such results in the investigation of the cardiac, arterial, and venous movements by the graphic method, it is full of interest to be able now to add that the sounds of auricular contraction have been over and over again heard by many observers in the intervals between the complete systole of the heart. These facts absolutely prove the correctness of Stokes' observations, and bring them into harmony with the physiological sounds described by Malet and myself.

Another addition to our knowledge of this interesting condition is due to Ritchie, Magee Finny, and Brouardel and Villaret, who, independently of each other, took advantage of the fluorescent screen in order to watch the movements of the

heart. They published the interesting fact that the auricles can be seen beating in the intervals between ventricular systoles. During the last three years this observation has been frequently repeated by other observers, and is now well known.

Einthoven has taken advantage of the electromotive changes produced by the action of the heart, and by means of the string galvanometer has obtained beautiful tracings from cases of heart block, which demonstrate beyond the possibility of doubt that the electromotive changes caused by the action of the auricles may be seen entirely dissociated from those caused by ventricular action. In ignorance of the important observations being made by Einthoven, the electromotive changes in heart block simultaneously engaged my attention. My investigations were carried out with Lippmann's capillary electrometer. The movements of the column of mercury, thrown upon the screen by means of a projection microscope, showed the ordinary oscillations caused by the electric changes attending the apex beat, but, between these, smaller waves were distinctly visible, and were undoubtedly produced by the contraction of the auricles.

One more clinical result obtained in this disease may be referred to before we pass on to the explanation of the condition. The arterial pressure in such cases has attracted my close attention. Observations on a good many cases has now proved that the systolic pressure may reach a level of from 270 to 300, while the diastolic may, at the same time and in the same individual, be as low as from 70 to 80 mm. Hg. This must be regarded as a most interesting fact, showing that the long interval of time following each ventricular contraction allows the high arterial pressure to fall to a low ebb before the succeeding systole occurs. It need scarcely be added that in such cases there is no aortic incompetence, nevertheless clinical investigation of the arterial pressure yields results singularly like what we are accustomed to observe in that condition.

We have in this chain of investigations a really interesting illustration of the gradual evolution of clinical knowledge, and we must now enter upon the successive steps by means of

which the different facts have been subjected to analysis and synthesis.

All of us who have sat on the upper forms at school must remember that the great epic poet of Rome tells of the happiness of him who is able to discern the causes of what he sees. The investigation of a series of appearances such as those that have now received our attention has furnished abundant interest, and therefore happiness, for all of us who have worked at the subject. Some points were found to be easy of explanation; others much more difficult. We have not merely to exercise the imagination in the search for these causes, but we may even invade with caution the realm of speculation. It is a subject which allows opportunities to "spin the gossamer as well as forge the anchors of the mind." Our thoughts are not all endowed with the possibility of soaring to the very roof of heaven, but it is within the reach of us all to contribute what we can to the general advance, and some of the suggestions, as well as many of the observations, are due to men deeply engaged in the hard work of general practice.

Until the last quarter of the previous century the heart was considered to consist of what might be termed distinct compartments, absolutely separated from each other and not united by any continuity of muscle fibres. The first light borne in on the subject came from the investigations of Gaskell, who showed that there was a direct and continuous connection of the sinus, the auricle, and the ventricle. It is exactly a quarter of a century since this great work made its appearance. Every succeeding observation has only served to prove more thoroughly the accuracy of the views which he then expressed, and to show the remarkable foresight which he manifested in his analysis of the various functions which he described. His investigations, in truth, have permitted the esoteric explanation of the condition at present under consideration. The facts unfolded by him formed, ten years afterwards, the subject of an interesting study by Stanley Kent, who, devoting attention more exclusively to the connecting link between the auricle and ventricle, showed the path by which impulses passed from one to the other. His, in the same year, published the

anatomical researches by which he still further advanced the subject, and with these investigations the first chapter of the anatomical explanation terminates. Eight years afterwards Ewald returned to the link binding auricle and ventricle in the frog, and shortly afterwards Retzer, Bræunig, and Humblet extended the observations. These workers paved the way for the elaborate investigations of Tawara, who carried out a most valuable research, fully demonstrating the origin and ramifications of the structures by which the anatomical gaps separating the different portions of the heart are bridged over. Keith has more recently, in a manner as lucid as it is luminous, further extended these remarkable investigations.

The researches of Tawara have shown that the auriculo-ventricular bundle is only a part of a great system; it descends on the interventricular septum, ramifies throughout every part of the ventricular walls, and is continuous with the system of Purkinje fibres. The papillary muscles are brought into especial relation with the system, and this very interesting point throws a vivid light upon the important observations made on the functions of these structures by Roy and Adami, to which the latter has again returned more recently.

Keith has illuminated the subject, as he usually does, by the brilliance of imagination as well as the result of labour. He described the musculature of the sinus as being freely continuous with that of the auricular canal and auricular appendix. In searching for a clearly differentiated system of fibres within the sinus, which might serve as a basis for the inception of the cardiac rhythm, he discovered a peculiar structure surrounding the arterial circle at the junction of the sinus and the auricle. The structure closely resembles that of the auriculo-ventricular bundle, consisting of an intimate network of pale, undifferentiated fibres with well-marked nuclei. This structure contains numerous nerve cells and nerve fibres. Although the mass is undoubtedly muscular in its main structure, yet the nerves in the neighbourhood of the vena cava enter into very intimate connection with it, so that Keith feels justified in stating that a peculiar neuromuscular junction occurs at this point.

As assisting us in understanding the functions of the heart, the researches of MacCallum on the muscular connections of the two ventricles, of Keith upon the special anatomy of the heart, of Porter on the relation of blood supply to cardiac activity, and of Henderson upon ventricular movements, are far reaching in their results, and enable us more fully to apprehend the questions arising in connection with this subject. The former has shown most distinctly that the ventricles are composed of a simple long band of muscle beginning and ending with a tendon. It has its origin in the connective tissue of the auriculo-ventricular junction on one side of the heart; it passes around the outer wall of that side and reaches the ventricular septum, whence it goes on to encircle the outer wall of the other ventricle, and finally terminates in the tendinous cords of that side. It is probable that the fibres of the auriculo-ventricular bundle enter into direct relation with the centre of this long scroll.

Some of the results obtained by Keith have already been referred to, but the observations which he has made from the standpoint of comparative anatomy deserve to be recalled. He has shown that the sinus venosus, the auricular canal, the auricle, the ventricle, and the bulbus, are all represented in the mammalian heart, and he has been able not merely to trace these primary divisions, but to show how in the evolution of the heart in the higher mammals these various parts have been modified to suit the requirements of development. The results of the investigations of Porter and of Henderson have been of the greatest service to us in our clinical work on disturbances of the heart muscle.

Turning to the results of experimental physiology as directed more particularly to our subject, we have to acknowledge a deep debt of gratitude to certain distinguished observers. First again, physiologically as well as anatomically, comes the name of Gaskell, in the epoch-making work to which reference has already been made. He pointed out the existence of a natural block at the auriculo-ventricular junction, and further showed that a more or less complete stoppage could be produced either by section of the auricle or by increase in the natural block.

In this way he was able at will to interrupt the passage of impulses more or less completely. His, from a number of experimental investigations, showed that interference with the conduction of impulses could be produced by section of the auriculo-ventricular band. It is, however, particularly to Erlanger that we are indebted for a study of this important subject. By his ingenious method of experimentation the auriculo-ventricular bundle can be subjected to varying degrees of pressure, and he has been able in this way, as is now widely known, to produce at will every degree of partial or complete blocking of impulses. From the experiments of Gaskell, His, and Erlanger, it is clear that the upper parts of the heart possess the quality of rhythmicity in a higher degree than the lower; that the rate of the heart is determined by the upper and more rhythmical portions, and if the lower and less rhythmical are separated from the upper and more rhythmical portions, the lower part may assume a rhythm of its own. From two very interesting studies by Hering, and by Erlanger and Blackman, which have recently made their appearance, the relative rhythmicity, excitability, and conductivity of the different portions of the heart are most clearly brought before us.

Pathological evidence has not been long in following upon the heels of anatomical and physiological investigation. Stengel, Jellick Cooper and Ophüls, in America, and Keith and myself in Europe, in the same year, put on record instances of disease of the auriculo-ventricular band from cases of heart block. In some of these cases the structural alteration was a gumma of the interventricular septum; in others it was a simple fibroid change, without any very obvious cause. In one instance which aroused a most widespread interest, seeing that it occurred in the person of one of the most venerable and distinguished physicians of the British Isles, the change has been found to be of the nature of a calcareous infiltration.

Here again Montreal is going to help us. We await with lively interest the publication of a very remarkable case lately under the care of Professor Martin, in the Royal Victoria Hospital. The heart, which has been kindly shown me, with

the permission of Dr Martin, by Professor Adami and Dr Klotz, shows a total destruction of the bundle by a sarcomatous invasion; the patient, notwithstanding, never showed any of the usual appearances of heart block. It would not become me to discuss the possible bearings of this remarkable case; we shall look forward with eagerness for the full details which Dr Martin has promised.

Such then are the main lines of the explanation of these interesting appearances. When we seek to enquire which of the five distinct functions of cardiac activity are involved, we discover that it is easy to demonstrate the implication of two of them. Rhythmicity in itself is not disturbed, for the auricular pace-maker pursues its even tenor; contractility is in no way lessened, since the work of the heart may be in no degree diminished; tonicity, it hardly be said, is not a function necessarily involved in this group of symptoms, although undoubtedly, seeing we deal with the senile heart in many instances, this property may be lessened. The cause of the appearance lies, as a rule, in diminished conductivity, the auriculo-ventricular bundle being so damaged as to diminish the function, or even abrogate it. Some interesting tracings from a patient long under my care have, however, shown that the function of excitability may be disturbed, and this may, therefore, be partly responsible for the symptom. Hay has especially devoted attention to this aspect of the subject.

Is it possible to get beyond this point? Can we peer further into the darkness which surrounds the real cause of these varied appearances? In other words, are we able to say how the heart is endowed with such functions, and in what way they are disturbed?

We may fearlessly assume that the entire realm of nature is freely open to our enquiries. The Venusian bard, whose verses have, ever since the revival of learning, been the solace of such a multitude as no man can number, is assuredly astray when he sings:—"Nec scire fas est omnia." But while we claim the right to examine every natural phenomenon, we are led to acknowledge that some facts are within our reach, while others are beyond our ken. In the quest of truth it is wise to

bethink ourselves of this distinction between the attainable and the unattainable. Above all, it is our duty not to be dogmatic as regards matters which we cannot know. It was Huxley who said that "the assertion which outstrips evidence is not only a blunder, but a crime." Some of the appearances which have been brought before you to-day have furnished an example of speculation in the region of the unattainable, of playing with words rather than working with things. Within recent years much time has been wasted in futile assertions that the five great functions of cardiac activity, recognized by Gaskell, are entirely due to inherent properties of the heart muscle, or, as it is put, are of myogenetic origin. According to this view, or, as it would be better to put it, according to these views—for the opinions of the myogenetic school are often so contradictory as to cancel each other—the heart lives and moves and has its being independent of the wonderful and beautiful arrangement of nerve ganglia and nerve fibres, as also with their intimate connections with the central nervous system. To suit these hypotheses the nervous system is allowed to interfere with, but has no part in, the production of cardiac action. Is this not a strange departure from the deep saying of Galen, that "Nature does nothing imperfectly or vainly"? But this is a matter with which on the present occasion there is no time to deal. Suffice it to say, that there is no proof of these assertions. Last year the subject occupied my attention in the Oration of the Medical Society of London, and it was a sincere pleasure to be able to range myself beside your Professor of Physiology, who, a few weeks before, in an eloquent address, gave a powerful indictment of the fallacies of the myogenesists. It is unlikely that any man of science with balanced mind will commit himself to the tenets, either of the myogenetic or of the neurogenetic school. We must wait for more light before we are in a position to dogmatize on this matter. "Far more of our mistakes," says Matthew Arnold, "come from want of fresh knowledge than from want of correct reasoning." The intolerance which has been shown by the protagonists on both sides as regards this question makes many of us doubt whether the tart apostle of sweet reasonableness was right in his remark.

New facts will be gained which will help us to reach more definite conclusions as to the esoteric meaning of cardiac activity, and until we are in possession of such facts we must keep our judgment in reserve. Hence the title chosen for this address.

A few words, addressed more especially to the undergraduates of the University, may in the last place be allowed me. These must be taken as coming from an older to younger brothers. You will not expect me, in the terms of a certain school of theology, to "improve the occasion." If you do you will be disappointed. The purpose of the remarks which have been made is to bring some aspects of modern research before you, to hearten you in your studies, but at the same time to warn you of the dangers which may attend them. We have seen in one small field of the vast domain of medical study that many industrious labourers have been engaged upon the matter; that the gradual growth of knowledge has taken place by separate additions made by patient observers; and that it is within the power of each and all of us, to contribute to the store of information. In all this you have great encouragement for your work to come. The illustration chosen is only a single example of what you will find in every branch of science. The first aim of every one of us must be to strive after fitness for the task which each will find. Again, one of the clearest duties lying to our hand is to discover in which direction practical usefulness may most likely be found. In the present age omniscience cannot be our foible, and a wise choice of study is an absolute necessity. To be able to grasp the real and eschew the unreal is the first requisite of him who is in quest of truth. You will be guided in your early footsteps by men of experience and distinction, who will help you to gain an insight into what is worth study. In this way you will escape the risk of resembling the dull pedant of whom the American humourist sings :—

"A reading machine ever wound up and going,
He mastered whatever was not worth the knowing."

In the search for truer interpretations of natural appearances we must train ourselves to build our foundations on the

solid bedrock of fact. Blowing hypothetical bubbles will not avail. It would be foreign to the genius of my race to condemn philosophical reasoning, but it is nevertheless a duty to condemn baseless speculation. Imagination rightly used is of the highest value in science,

"But not for golden fancies iron truths make room."

The scientific method is, as Huxley has clearly stated, "nothing but trained and organized common sense, differing from the latter only as a veteran may differ from a raw recruit." No one can successfully dispute this statement, and probably few will make the attempt. There is no need for me to dwell on this theme, but it will not be out of place to add that this quality of common sense is not the possession of mankind in equal proportions. To some it has been granted in fuller measure than to others, but to most men a fair share has fallen. It is one of our first duties to listen for the whisper of this inborn wisdom or common sense which must be our final guide in all our work. May we not without any great strain apply to this gentle voice the words of an early English poet, who died just four hundred years ago?

"The vertue of her goodly speche,
Is verily myne hartes leche."

Goethe long ago frankly said that in his old age he had found it hard to be as wise as he had been in youth. This is a brilliant paradox, the meaning of which is clear, so that he who runs may read. But there is another side to the shield. It is within reach of all of us to train this inherent quality by the discipline of experience. There is but one way in which this can be done; the way of hard work. In this age of strenuous endeavour it seems unnecessary to emphasize this gospel. It has been preached by many modern writers, from Carlyle to Kipling, and the nobility of work in every field is now universally recognized. Upon us, most of whom are or will be concerned with the practical duties of serving our fellow-men, it is incumbent to remember to what a high calling we are devoting ourselves. We have to enter into the lives of others in the fellowship of suffering as well as the brotherhood of

happiness. "Man is the only book of life," says Pierre, and in this saying of Parker's interesting creation there is deep significance. It is our privilege, above all other men, to have the leaves of this book opened to us, and we must fit ourselves for its study.

In all our doings we must spend our lives in truth, faith, hope, love—clinging to that mood of mind, bent on winning to the very heart of everything; believing in real work as the means whereby in its own good time what is now hidden will be laid bare; trusting that the end of our quest will be the furtherance of knowledge and the good of mankind; and holding each of our fellow workers in such kindly thought as will lead us to be happy when any of them makes a forward step. May each of us be able to say in the words of a historic rascal, who yet had the elements of good in him, François Villon:—"En ceste foy je veuil vivre et mourir."