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AN

APOLOGY FOR THE MICROSCOPE:

BEING THE

INTRODUCTORY LECTURE

TO THE FIRST COURSE ON

MICROSCOPIC ANATOMY AND PATHOLOGY,

DELIVERED IN THE

THEATRE OF THE ORIGINAL SCHOOL OF MEDICINE,

DURING THE MONTHS OF FEBRUARY, MARCH AND APRIL, 1851:

BY

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"Hear me for my cause."

DUBLIN:

FANNIN AND CO. 41, GRAFTON STREET.

1851.

TO THE

STUDENTS OF THE IRISH SCHOOL OF MEDICINE,

THE FOLLOWING PAGES ARE INSCRIBED,

BY ONE WHO LOOKS, WITH CONFIDENCE, TO THEM ALONE

FOR SUPPORT AND COOPERATION,

IN AN EFFORT TO PROMOTE THE CULTIVATION

OF

MICROSCOPIC RESEARCH IN IRELAND;

AND THUS TO FILL THE ONLY BLANK WHICH CAN BE POINTED OUT

IN THE

NOW EXTENSIVE LIST OF IRISH CONTRIBUTIONS

TO THE

LITERATURE OF MEDICINE.

PREFACE.

THE aim held in view, in the publication of the following observations, has been to call the attention of those who are interested in the advancement of medical science in Ireland, to the hitherto neglected condition amongst us, of a department which now occupies a prominent position in all the more eminent schools of Europe. To effect this object, a rapid survey has been taken of the more important applications of the Microscope to the purposes of general scientific investigation; and evidence has been adduced to show how far medical knowledge in particular has been extended by its aid, as regards not only subjects of a theoretical nature, but also those which have a direct bearing on questions of practice. It is to be regretted that the brilliant example afforded by the Continental and British schools, (where numerous observers have, within the last twenty years, risen to fame and eminence by the prosecution of this method of research,) has failed to stimulate us to emulation of their labours. For though the microscope

has been for some time employed amongst us to a limited extent, we cannot point to any results of original observation by Irishmen actually connected with schools in this country, though elsewhere they are amongst the foremost in this department; it is almost superfluous to mention the names of Todd, Quain, &c., who have shed such honour on the school of London. In these remarks, I beg it to be understood that it is very far from my intention to underrate the abilities of one who was prematurely taken from the scene of his labours; I allude to the late Dr. Houston. By reference to his observations on cancer, communicated to the Surgical Society, and the first paragraphs of his lecture introductory to the course of surgery delivered in the Medical School of Park-street, session 1844, it will be seen that he was fully alive to the importance of microscopic research, and well informed on the existing condition of the science. And no reasonable doubt can be entertained, that had he been spared to prosecute his studies with that zeal and assiduity which ever characterized him, his mind would have been directed to the more ambitious path of original investigation in this department; for which his previous contributions to medical literature shew him to have been eminently qualified. While it is to be lamented, that in the years which have elapsed since his death, the subject has found no warm advocate or devoted follower in the purely medical field, we can point with feelings of just pride to the microscopic observations of Professor Allman,

in the departments of Natural History and Botany. *The Proceedings of the Royal Irish Academy, of the British Association, and the Annals of Natural History*, bear evidence of the industry and high qualities for original research possessed by this excellent observer, and which have largely contributed to extend our knowledge of the zoophytes. In the hands of Professor Harvey, also, the microscope has been brought to bear on the structure of the marine algæ.

It is time, then, that a strenuous effort should be made to place Irish medicine, in this department, on a par with its sister branches of science. It could be wished that it had won a more able advocate than he who pens these lines, and who himself feels, that in the importance of the topic he has undertaken to treat, and in the continued silence of those more competent by their talents or position to urge its claims, will be found the apologist's best apology.

R. D. L.

11, South Frederick-street,
Dublin, April 21, 1851.

AN

APOLOGY FOR THE MICROSCOPE.

GENTLEMEN,

Up to the present hour, circumstances for which it would be difficult indeed to find any explanation, have withheld Irishmen from labouring in one portion of the field of original research, and left one department of science totally unrepresented in the otherwise almost perfect educational system of the Irish school of medicine. And thus, while we cannot point to any valuable contributions to the now extensive literature of Histology, instruction in the use of the microscope and its application to the study of normal and pathological anatomy is the only element of education which the Irish school does not possess in common with its rivals in Great Britain and on the continent. Yet, an acquaintance with this instrument must be considered in the present day indispensable to all who are anxious to keep pace with the progress of medical science, in the advancement of which, during the last quarter of a century, it has played such an important part.

Actuated by an ardent desire to assist in supplying this deficiency, I have hoped, by thus boldly calling

attention to our backward condition, as well as by stimulating the ambition of my fellow labourers with an aim worthy their noblest efforts and highest talents, to give an impulse to the prosecution of microscopic research in Ireland ; and, by the establishment of a course of lectures on this department, to fill what may be truly considered as the greatest blank that has ever been suffered to exist for so long a period, in the curriculum of the Irish school of medicine. On no former occasion have great discoveries in our science, or new methods of investigation appeared on the field, that Irishmen were not quickly found to step forward to test their merits, appreciate their importance, and apply them with ability and enthusiasm to the advancement of professional knowledge in the new direction : and with what eminent success, in numerous instances, it is needless for me to particularize in an Irish school of medicine ; as I feel convinced there are few amongst my audience, who are unacquainted with the extent and importance of the highly original contributions to practical medicine, surgery and pathology, which have emanated from the Irish school, and which have not failed to win for it the highest meed of approbation to which such labours can aspire. From these very considerations, however, it is the more to be wondered at, the more to be lamented, that during a period remarkable for the most active prosecution of microscopic research in the schools of the continent, and more recently in those of Great Britain ; during which the British and foreign journals literally teemed with contribu-

tions to Histology, both normal and pathological, and facts the most interesting and important for the advancement of our science, as well in a practical as an abstract point of view; no name has appeared on the records of our societies, or in the pages of our journals, which could emulate the fame of a Purkinje, a Henle, or a Vogel, dispute the palm with a Mandl, a Lebert, or a Dounè, or, for the honour of our nationality, enter the lists with Gulliver, Sharpey, Goodsir, Johnson, Bowman, Bennett or Gairdner. And thus it is that, while our labours in all other branches of medical literature have raised us to a level with the most famed schools of Europe, an apathy and indifference to the immense importance of microscopic investigation have prevented us from bearing a share in new honours, and brought on us from more than one quarter the reproach of want of energy and enthusiasm in the advancement of scientific medicine.

Gentlemen, it is time that this apathy and indifference should cease; that we should be up and stirring; and if we may not originate, let us at least send volunteers from amongst us, to explore where others have struck out the path. What discoveries have been already made therein; what rewards have crowned the labourer's toil; in fine, what claims the microscope possesses on your consideration, it shall be my duty to bring before you this evening.

Gentlemen, the microscope is an aid to the prosecution of scientific research, which it is not in the power of the student of nature, whether physiologist, naturalist, or physician, to take up at will, to

be followed or laid aside as he pleases. There are certain definite and distinct objects which microscopic investigation is called upon to fulfil; and without the aid of the microscope, there are certain subjects as well in general science as in anatomy, physiology, and medicine, of which we must be satisfied to remain for ever ignorant. In truth, it may be said that what the telescope is to the astronomer, to whom it reveals the wonders of the double stars, and resolves the nebulæ, annihilating the almost immeasurable intervals of space, the microscope is to him who would explore those countless, wonderful, and exquisite productions of nature, whose minuteness of size separates them from the limits of our unaided vision by an interval of space almost proportionate to that which divides earth from her sister orbs. It is my intention, before more particularly bringing under your notice the subjects connected with medicine which the microscope is calculated to elucidate, to lay before you a general view of the several departments of science upon which it has shed light, and the numerous highly interesting and important questions which have been solved by its aid.

The epoch which has been marked, in the history of modern philosophic investigation, by the introduction of the microscope as a new means of prosecuting scientific research, may with justice be referred to the lifetime of the immortal Leeuwenhoeck, who may be regarded as the first observer that undertook extended researches by its aid, having greatly enlarged the sphere of its applica-

tion ; and in the works which have come down to us from his hands, will be found ample records of the various microscopic examinations which he made. In the year 1673, this distinguished naturalist communicated to the *Philosophical Transactions*, an account of the discoveries which he had made, with microscopes of his own construction, consisting of single lenses of powers varying from 40 to 160 diameters ; and with which, in addition to his other labours, he had conducted extensive observations on the blood corpuscle in the different classes of animals. Previous to this, however, the *Micrographia* of Hooke had appeared ; and there is distinct evidence to shew that the magnifying powers of the glass globule and biconvex lens had been applied to the study of various minute objects. So early as 1665, Malpighi had signalised the discovery of the corpuscle of the blood, which, however, he regarded only as an oil globule. Indeed, as far back as 1590, which is assigned as the date of the discovery of the compound microscope by Zacharias Janssen or Zanz, a spectacle maker of Middleburg in Holland, those interested in the history of the miscroscope will find allusions in the older writers to its employment in various investigations.

Amongst the subjects which earliest commanded the attention of the first microscopic observers, and which, in fact, without aids to the imperfection of our visual apparatus, should ever have been unknown to us, may be enumerated the study of the Infusory Animalculæ ; and such is the interest that

has ever since attached to this absorbing and delightful pursuit, that from Leeuwenhoeck to Ehrenberg a long array of names may be produced, illustrious by research in this new world of organisation, which, though invisible to our unaided sight, yet reveals to even low powers of the microscope, complexity of structure and high vital endowment, combined with a minuteness of size which almost reaches the limits of comprehension; and, in the language of Ehrenberg, shows an unfathomableness of organic creations, when attention is directed to the smallest space, as it does of stars when reverting to the most immense. Here, in fact, the microscope throws open to our view a new field of existence, far surpassing in extent while it vies in beauty of form and completeness of organisation with that which more ordinarily engages the attention of the naturalist. "In the clearest waters, and also in the troubled, strongly acid, and salt fluids of the various zones of the earth; in springs, rivers, lakes, and seas; in the internal moisture of living plants and animal bodies, and probably, at times, carried about in the vapour and dust of the whole atmosphere of the earth, exists a world, by the common senses of mankind unperceived, of very minute living beings, which have been called for the last seventy years INFUSORIA." This name they have received from the fact of their being found in most abundance in all infusions of animal or vegetable matter. With a small drop of such fluid, and a magnifying power of some 250 diameters,

(Ehrenberg's discoveries were made with a power less than 380) we are furnished with all the requisites for observing the rapid motions and beautiful outline of many of the most interesting varieties of these wonderful little creatures, from the Monas Crepusculum, the smallest of all living beings, of which it is computed that *eight millions* would not occupy more bulk than that of a mustard seed, (about one-tenth of an inch) to the more complicated Rotiferæ and Volvocina. And of all the recreations which the pursuit of science affords to a mind duly cultivated, and capable of appreciating the pure and unmixed pleasures reserved for her votaries, hardly one surpasses that presented to the physiologist and the naturalist in the study of the animalculæ. The researches which have been prosecuted with such vigour in this department, show that the Infusoria form two separate and distinct classes (Polygastrica and Rotatoria) to be added to the animal kingdom ; and there can be no doubt that from their completeness of organisation and high condition of animality, they are entitled to a position in the scale far above that of many beings which have attracted more attention from the naturalist by reason of their greater size.

Let us turn for a moment to these drawings of some varieties of that almost innumerable tribe, the Naviculæ, so called from their boat-like figure ; observe their beautiful outline, their numerous and delicate transverse and longitudinal striæ, the minuteness of which in the Navicula Hippocampus and Angulata is such, that they form

most excellent objects for testing the highest magnifying powers of our object glasses; or again, look to this Rotifer, with his two coronets of vibratile ciliæ, which enable him to make currents of water set towards and around him, and thus bring his prey within his reach. What study is there of more absorbing interest than to trace, with Ehrenberg, the internal organization of these minute yet highly endowed creatures, by means of the simple but ingenious process of feeding them with colored fluids, while on the field of the microscope.

From an early period, as I have before stated, this subject attracted the attention of observers in every way competent to do justice to its importance, from the philosophic tendency of their minds, and their patient habits of industry and research; but it is especially to the German school that we must refer, for the most extensive and complete contributions to the natural history and literature of the Infusoria. The name of Otho Müller, in particular, deserves to be mentioned with honor. His work, which appeared in 1770, is a splendid monument of industry and zeal, and till our own days, signalised by the extensive researches of the illustrious Ehrenberg, constituted the standard authority on this subject.

The labours of this latter great microscopist have been conducted on such a gigantic scale, have so demonstrated the almost universality of animalcule life, and have so contributed to elevate the rank of this kind of investigations, by applying it to the

solution of great problems in other departments of science, that I feel convinced I can in no way more forcibly bring before you the claims of the microscope to be considered, in the present day, as an indispensable means of scientific research, than by endeavouring to sketch for you, in a rapid, though, as it must necessarily be, imperfect manner, the extensive observations which he has prosecuted on the marine infusoria; and the important questions in fossil geology which have received elucidation at his hands, by the study of the remains of those minute animals, the abundant existence of whose siliceous loricæ, revealed to us by the microscope in situations where they were quite unsuspected, affords unmistakeable evidence that their date of life must be referred to a period many thousand years antecedent to the oldest historic epoch.

The appearance of Ehrenberg's great work "*Die Infusionsthierchen*" astonished the scientific world, by the magnitude and extent of the observations on which it was founded. From the Cattegat and the Baltic to the Mediterranean, from the Indian Ocean and the Red Sea to the Atlantic, materials had been accumulated by this indefatigable labourer; while the slate, the chalk, and even the siliceous formations yielded up their enclosed treasures. From the summary of his observations, the following statements are drawn:—

"The Infusoria constitute two very natural classes of animals, according to their structure; which classes admit of subdivision on the same principle.

"The existence of the Infusoria in the four quarters of the globe and the sea is proved ; as also that of individuals of the same species in the most opposite ends of the world.

"The geographical distribution of the Infusoria upon the earth follows the laws observed regulating that of other natural bodies.

"The Infusoria, in consequence of their siliceous shells, form indestructible earths, stone, and rocky masses."

Subsequent investigations, pursued with the same unwearying energy, have enabled M. Ehrenberg to identify many species found in the chalk formations, and the slate, with those yet in existence ; and thus has he lent new light to decipher these unwritten but imperishable records which reveal to us the history of the formation of the earth's crust—a path of research pursued with such splendid results, as regards the remains of the larger animals, by the illustrious Cuvier ; but which yet presented many difficulties unsolved, and not amongst the least that which has been cleared up by the discovery that the cretaceous rocks are in great part formed by the imperishable loricæ of minute infusoria.

The study of the fossil infusoria cannot fail to prove interesting of itself, independent even of the generalizations in geology which may be deduced from a knowledge of the structure of those minute loricæ, which are to be found so abundant in the chalk, the slate, and many siliceous formations.

An interesting application of this study to antiquarian purposes is mentioned by Mr. Pritchard, who states that the examination of infusorial remains in many ancient articles of pottery, and the remains of similar species in the clay from the vicinity in which they occur, has furnished evidence for proving that these specimens of antique art were made on the spot, and not imported from the more highly civilised nations of that day, as had been previously supposed. To the physiologist, and the physician likewise, a knowledge of the existence of minute organised beings in the tissues and fluids of the animal body, has been revealed by the microscope; and as we shall hereafter endeavour to shew, a considerable amount of importance must be attached to this discovery, many interesting physiological and pathological questions depending thereon. Again, the laws which preside over the developement of the infusory animalculæ, as well as the more minute forms of vegetable life, may demand investigation in reference to important sanitary questions, as has been recently very clearly shewn by the examinations conducted on the water supplied to the city of London.

Another subject which has received considerable elucidation from the labours of the microscopist, is the history of the formation of the great coal strata. For a long period their vegetable origin has been placed beyond a doubt, and we have been long familiar with the fact that the pine and large species of the tree-ferns had been found in consi-

derable quantity. By the aid of the microscope, however, it has been shown that by far the most abundant element in these formations are the fossil remains of much humbler beings of the vegetable world, whose genera and species we have been in many instances able to recognise, while here, too, the loricæ of many tribes of infusoria are to be met with.

Thus has the microscope been proved an important aid in more than one department of palæontologic research ; and thus may its claims to be ranked amongst the foremost of those aids to science, by which the human mind has cleared the barriers imposed on her unaided powers, be indisputably established. What has been already achieved is but earnest of what may yet be done, when this method of investigation shall have become more generally appreciated, and more extensively employed in exploring the many yet obscure portions of the vast field of human knowlege. While, from the advances made within late years, in bringing nearer to perfection the optical and mechanical parts of the instrument itself, we have just grounds to hope that art will yet furnish us with microscopes superior even to those splendid triumphs of skill we now possess.

The preceding observations, gentlemen, have been intended to shew the general importance of microscopic investigation, and its connexion with and relation to other departments of science. We pass to the consideration of the question, as to how far this instrument is capable of being made avail-

able in the researches of the physiologist, the physician, and the pathologist. For it may be asked, in how far are the latter concerned with the miscroscope, if it but throw light on the history of fossil and living Infusoria, or elucidate questions in geology. Here, however, the microscopist is furnished with a triumphant reply to such objections ; for however rich the harvest which has been reaped by the aid of his labours in other departments, it is in physiology and medicine, above all, that his investigations have been attended with results which may be compared with any thing that has ever been effected in the history of discovery, or that can be submitted to the test of the most rigid cui-bonoism.

I shall first proceed to lay before you a brief historical outline of the additions which have been made, in latter times, to our knowledge of the structural elements of the animal frame ; for in no way can more striking proof be adduced of all that this department of medical science owes to the microscope. From the revival of learning to the early part of the seventeenth century, the united labours of the several distinguished anatomists who flourished in the different cities of Europe, had brought our knowledge of the human body to a very considerable degree of perfection. From Mundinus to Malpighi a long line of illustrious names could be cited, who had contributed to the general fund, and established anatomy as well as physiology on something like a scientific basis. As far as the outline of parts, their conformation and

uses, little remained to be achieved. But with regard to their more intimate structure, and the arrangement of their component elements, in fact their general *histological* characters, absolutely nothing was known ; and but for the discovery of the microscope about this period, and its application to the study of animal tissues, since prosecuted with such devotion and enthusiasm, and especially at all times in the schools of Germany, we should have remained for ever in ignorance of many of the most beautiful and most curious phenomena which the whole field of science presents. We have already alluded to the discovery of the blood globule by Malpighi, and the observations subsequently conducted on it by the great Leeuwenhoeck. Passing over a brief interval, we are arrested in our historical survey by the name of Nathaniel Lieberkühn, whose researches into the structure of the mucous membrane and glandular apparatus of the alimentary canal, communicated to the scientific world in 1738, have immortalised his name, and added so vastly to our more accurate knowledge of these organs.

It would be tedious to pass in review, however rapidly, the many illustrious men whose successive labours have brought together the vast materials which now form the basis of our histological knowledge ; but the early parts of the present century have been so prolific in microscopic discovery, that I feel called upon to make at least some allusion to such names as those of Henle, Valentin, Treviranus, Purkinje, Wagner, and

Müller, observers whose devotion to their science has obtained a just recompense in the world-wide fame which they have won, and whose names are only selected at random from the long list of those who have rendered the school of modern Germany illustrious. Time would fail, were I to enumerate also their worthy collaborateurs in every department of histology, who have flourished in the other schools of Europe, but especially in those of England and France ; while to chronicle the results of their investigations would lead us far beyond the limits prescribed on the present occasion. I trust, however, in the sequel of my course, to make you familiar with the most important of their contributions, to the now very extensive literature of this department of medical science. Suffice it here to say, that no element of the animal organization has been left uninvestigated by the microscope, while the assistance of the arts of design has been abundantly availed of, to illustrate the minute structure of every tissue and organ in the body.

The years 1837 and 1838 will be ever held memorable in the annals of histological science, from the fresh impulse given to original investigation in this department by the discoveries of MM. Schleiden and Schwan. The same period which witnessed the profound researches of Ehrenberg, into the history and geographical distribution of animalcule life, to which we have already so extensively referred, was further signalised by the promulgation of the *theory of Cytogenis*, or that by which the growth and development of all

organised beings, as well vegetable as animal, was explained by the reproductive power of one single element, the cell. Previous observers had remarked the existence of the cell as an all pervading element of the vegetable kingdom ; and indeed, in more than one instance, its metamorphosis into tissue had been established ; but to Schleiden is unquestionably due the merit of combining the results of observations undertaken without a common purpose, from which, and his own investigations added thereto, he was led to the discovery of the universally applicable law, that all vegetable tissues are developed from one primary element, the cell. This simple and beautiful law soon found extensive application to animal organization. As is well remarked by Schwan, in the preface to his celebrated Microscopical Researches :—"It is one of the essential advantages of the present age, that the bond of union connecting the different branches of natural science is daily becoming more intimate ; and it is to the contributions which they reciprocally afford each other, that we are indebted for a great portion of the progress which the physical sciences have lately made." Of the justness of this position the instance under consideration is a memorable proof. In a spirit of brotherhood worthy of enlightened and scientific minds, we see the two friends, the one at Jena, and the other at Louvain, (now at Liege), interchanging ideas before they had been as yet subjected to the test of public criticism:—"Schleiden communicated the results of his investigations to me," says M. Schwan,

"previous to their publication, in October, 1837. The resemblance in form, which the chorda dorsalis, (to which J. Müller had already drawn attention) and the branchial cartilage of the tadpole, present to vegetable cells, had previously struck me; but nothing resulted from it. The discoveries of Schleiden, however, led me to more extended researches in another direction." The examples and inquiries of his friend had touched a spring, and before long he gave to the world, (the same year that Schleiden published the *Contributions to Phytogenesis*, viz. 1838), his "Microscopical Researches into the accordance in the structure and growth of animals and plants," embodying a theory which not only comprised all the isolated facts that had been previously recorded by Henle, Turpin, and Dumortier, but went immeasurably farther; and supplied us with those ideas of development and growth by continued renewal and decay of cells, which reign undisputed even in the present day; while it further teaches us that all anatomical elements, however different in form, whether cartilage, bone, muscle, or nerve, all originate from one and the same elementary form, the cell.

Thus, gentlemen, has the microscope not only extended our knowledge of structure, but also supplied us with juster views on many physiological questions. How much that is wonderfully beautiful in our organization shall we remain for ever in ignorance of, if we forego its aid. Without the microscope, the circulation of the blood, which it was not permitted to its immortal discoverer to

behold, would never have become a matter of ocular demonstration, as we can every day study it in the web and tongue of the frog, and other situations. Without the microscope, this complex and highly organised fluid itself would never have revealed to us its corpuscles. We may know for all ordinary purposes that a bone is a bone, and possesses such and such processes, and yet remain for ever ignorant of the exquisite structure of its Haversian canals, canaliculi, and bone-cells. But it is needless to occupy you with further examples ; those already cited are more than sufficient to establish the claims of this instrument to the attention of the anatomist and physiologist. I shall only take occasion here to indicate, in what manner the prosecution of such researches may come to have an all-important bearing on questions of the highest moment connected with forensic medicine, a department in which, above all others, the practical value of histological knowledge may be tested. It may be stated, that hitherto chemical investigation has almost completely absorbed the attention of those who have been called upon to conduct inquiries connected with forensic medicine, and that as yet the microscope has by no means been so extensively applied to this kind of investigation as it is in every way entitled to be. For myself, I cannot entertain the smallest doubt that, in practised hands, this instrument will yet prove competent to the successful investigation of animal remains, minute fragments of organised structure, stains of fluids, besides the determination of the

animal, vegetable, or mineral nature of minute particles of matter, of what kind soever—questions which, in the history of criminal jurisdiction, have often seriously engaged attention, but only admitted of very partial solution hitherto. It may be a matter of speculation, whether further research will enable us to establish such specific differences, as will lead to the detection of the precise nature of such matters, and the particular source whence they are derived. Thus, if proved to be animal, shall we be in a position to pronounce whether a given structure belong to the human frame or to that of some lower animal? That such will be possible in more instances than one, appears to me at least not to exceed the limits of probability.

In the present condition of the question, the blood and the hair are, as far as I am aware, the only subjects which have been submitted to this test. With regard to the latter, a case is recorded as having occurred in one of the French courts, where a hatchet having clotted blood and hair adherent to it, was brought in evidence against the accused, under whose bed the weapon had been found. This, in conjunction with other circumstantial evidence, had completely turned all opinion against the prisoner, when a young physician who happened to be in court, and had through curiosity examined with a pocket lens the hair on the hatchet produced in evidence, pronounced as the result of his examination that the hair was not human, but presented sufficient characteristics to enable him to recognise it as belonging to some

inferior animal. This circumstance led to a more complete sifting of the other matter brought in evidence, and the final acquittal of the accused; who, it was proved, had killed the animal, and carelessly thrown the instrument under the bed, the situation in which it was found.

This case, solitary as I believe it is, evidently points to a field for investigation which has been hitherto completely unworked, and the extent of which cannot be exaggerated, nor its importance over estimated.

With regard to the next point, one of intense interest, namely, the determination of the nature of certain stains which resemble blood in colour, it is really astonishing that while all writers on the subject have laid such stress on chemical examination, which, to say the least of it, is open to such innumerable objections and so fertile in fallacies, the microscope should have been employed so little. And yet it will not be difficult to shew, that it approaches nearer to the perfect solution of such problems than any other known means of inquiry; and that, while it far surpasses chemical investigation in enabling us to pronounce whether a certain stain be blood or not, it in addition gives us grounds, in a large number of cases, for attempting the solution of a question which cannot be at all entertained by any other means of inquiry, viz. as to whether the stain, if blood, be that of man or of some inferior animal.

It is worth while to compare for a moment the relative merits of the chemical and microscopical

examination of a suspected stain. The chemical depends entirely on the recognition of two well known elements of this fluid, by their comportment with certain re-agents. The stain, treated with distilled water, is tested for albumen and hæmatosine, the chemical behaviour of the latter resulting from the iron which it contains. That perverted ingenuity may yet discover a means of imitating these effects, by appropriate mixtures of albumen with a persalt of iron, is at least possible, and, theoretically speaking, necessarily much invalidates this kind of testimony. Let us now turn to the evidence which the miscroscope is capable of affording. This we find to be based on the peculiar form of the blood corpuscle, which it has been ascertained may be easily recognised with the microscope, after the lapse of a considerable period of time. Mr. Hassall, an excellent authority on these subjects, states that in stains six months old, he has been able to detect the blood disk without difficulty, and, until the contrary be established, it is fair to presume that it would be possible to do so even after a very much longer period. It is my intention to institute some inquiries on this important point. In a stain, then, submitted to us for examination, within a reasonable time after it has first been deposited on any substance, the following very simple process will enable us not only to pronounce with precision and certainty, as to whether it be blood or not, but even in some instances to carry our deductions still further, and decide satisfactorily whether it be human blood or

that of some other animal. A small portion of the suspected coloured matter is to be treated with a solution of sugar, or white of egg, which approaches in specific gravity the serum of healthy blood; and when any appreciable quantity is taken up by this fluid, and placed on a glass slide, in the field of the microscope, we shall at once observe the well known figure of the blood disk, if the spot under investigation be a blood stain. Any modification in form which it may have undergone by desication, endosmose, or other agencies, will not prevent the observer, who is practised in microscopic examination of the animal fluids, from arriving at a positive and satisfactory conclusion. The presence of the disk may be taken as infallible proof of the presence of blood, from whatever source derived; and it may be further stated, that if not detected after a sufficiently careful and patient examination, the absence of this fluid may be asserted with no little degree of confidence, the chances of error being at a minimum. The disk, if discovered, may possibly now lead to further and most important disclosures. Our knowledge of comparative histology, and the researches which have been so extensively prosecuted on the figure of the blood corpuscles, as found in the lower animals, have furnished us with ample data for distinguishing the blood of one animal from that of another, in not a few instances. To Mr. Gulliver, the distinguished surgeon of the Guards, we are especially indebted for able investigations of this subject. He has communicated to the scientific world the results of a

large number of observations, evidently made with great care and accuracy. The two principal elements which are available for this species of diagnosis, are the *size* and *shape* of the red corpuscle. Other circumstances, which, in an actual examination, may prove important, it is unnecessary to particularise here.

By their *shape alone* the corpuscles of the three great classes, birds, reptiles, and fishes, may be at once recognised from those of mammalia, their figure in the latter being circular, in the three former classes oval. To this rule but two exceptions are known, viz.: that in the order *camelidæ* the blood disk is oval, while in the *lamprey* amongst fishes it affects the circular form. Again, amongst mammalia, we are not wanting in data for arriving at a diagnosis in numerous instances. As we have seen, the blood of the Camelidæ may be known by the oval figure of the disk; but size will here be found the characteristic in which the greatest differences are observed. Thus, the blood of the elephant presents the largest corpuscle, that of the goat and napu musk deer the smallest; while by reference to the ample tables supplied by Mr. Gulliver, and which will ever be regarded as an evidence of his zeal and industry, it will be seen that the various dimensions of the disks of the mammalia, expressed in fractions of an English inch, present in many instances very appreciable differences, and which, I make no doubt, would enable us, in more than one case, to pronounce that a given specimen of blood was not human.

Of the value of this knowledge we can hardly form too high an estimate, and I make no doubt that when fully tested in the practice of forensic medicine, it will be found to supply the medical witness, in very many instances, with most important aid in arriving at truth, and furthering the great ends of justice. It would be almost impossible to enumerate the many practical applications which may be made of the microscope in this way. Those fertile in expedients may be stimulated by the examples adduced by Dr. Bennett, who records a case in which an attempt at imposture, by the admixture of blood with matter expectorated from the chest was immediately detected. He was induced for some reason to suspect the veracity of the patient's statements, and on submitting to the microscope a portion of the blood, alleged to be expectorated it was ascertained to be that of a fowl. A confession of the attempted deceit was obtained from the patient when suddenly confronted and unexpectedly charged with the offence.

Thus it will be perceived that, with the aid of the microscope, an immense field of inquiry is opened up to us ; not only are we made acquainted with new beauties in structural arrangement of parts, which without its aid would remain for ever hidden from our view, but, as we have seen, in the few examples to which I am confined by the limits of a lecture, the microscope supplies us with the only means of satisfactorily solving many of those questions which, in the occurrences of social life, so often arise to peril the fame and fate of the inno-

cent, or, with a veil of doubt and uncertainty screen the guilty from that just retribution which their dark deeds often but too well merit.

The considerations with which we have been occupied hitherto have, I trust, fully demonstrated that microscopic research has placed within our reach a store of knowledge, which can no longer be neglected by those who raise any pretensions to an acquaintance with the scientific literature of our age, both general and medical. But it yet remains to be shewn how much practical assistance, in the diagnosis of disease, and the furnishing of correct indications for the application of remedial agencies, may be expected from the introduction of the microscope to a place amongst our other numerous means of clinical investigation. And here, before we enter on this most important question, let it be once for all clearly enunciated, and universally understood, that the microscope comes not to supersede or supplant any other means of inquiry, but aims rather, by the addition of one element the more to the means of research we are already in possession of, to enable us to approximate nearer to perfection in the science of diagnosis. The philosophic reply made me by M. Gluge, when I asked his opinion of the true value of the microscope to the investigator of disease, is remarkable for candour and truthful precision : "*c'est un moyen de plus*," said this distinguished observer, whose contributions to histology have conferred honour on the school of Brussels, and entitle him to pro-

nounce with authority on every thing connected with his favourite study.

That noble but exaggerating enthusiasm which ever characterizes those whose mission it is to give fresh impulses to science, by the introduction of what is new, has, perhaps, in the case of the microscope, as in all others, led its earlier advocates to predict too highly of its powers, and to claim for it a pre-eminence which in many instances it did not deserve; while, on the other hand, it is to be regretted, that in not a few instances an irrational conservatism presented obstacles to its introduction. But, gentlemen, he who would worthily approach the philosophic investigation of nature, bringing to his task a mind unfettered by prejudice, will reject no proffered aid, whether it come from that antiquated store of science revered by our fathers as the ne plus ultra of human wisdom, or have not yet battled its way against that array of hostile opinion ever ready to rise in arms, and stay the progress of that which is new.

Let us turn, then, in all spirit of fairness and truth, to inquire what claims the microscope has to the consideration of the pathologist, the surgeon, and the physician.

In the early part of the present century, the position of anatomy and pathology presented an almost exact parallel ; as in the one the structural arrangement of tissues and the beauty of minute organization were unknown, so in the other we were equally deficient in knowledge with regard to the elementary composition, as well as growth

and development of pathological formations. The broad basis of the science had been undoubtedly laid by the older great morbid anatomists; the labours of Baillie, Hope, and the more modern observers had increased its dimensions; while in our own times, Cruveilhier, Rokitansky, and others have shewn what invaluable results may yet be obtained from diligent prosecution of the older methods of research. Without fresh aid, however, and increased means of exploration, no further advance was possible. Observations could no doubt be multiplied; the laws of morbid association and the statistics of diseases were yet to be deduced; but the science could take no new direction, could undergo no new development. At this crisis it was that the chemist and the microscopist entered the field, and gave to pathology that impulse which cannot but be appreciable to all who are familiar with the literary activity so remarkable in this department within late years, in all the schools of Europe, with the exception of our own. It is not my province here to dilate on the advantages which pathology has derived from chemical research; suffice it to say, that I am fully impressed with its great importance, and that it is my deep conviction that without its aid we should have remained for ever ignorant of much that is of the highest importance in the study of disease. To the microscopist, chemical knowledge is of direct utility.

With the introduction of the microscope, a new era may be truly said to have commenced for pathology, and before many years, where all had

been blank before, a new and extensive literature had sprung up, such were the enthusiasm and devotion as well as the number of those who undertook researches by its aid. The names of Gruby, Donne, Hasse, Vogel, Gluge, Lebert, and Virchow deserve to be especially mentioned, and with every mark of honor and respect. The extension of the cell theory was subsequently made to embrace all varieties of pathological formations ; and the period which witnessed its introduction into the study of physiology and anatomy, with such marked influence on these departments of science, beheld likewise new and rapid strides in the advancement of our knowledge of diseased structure. On the phenomena of inflammation new light was shed ; its various effects became matters of ocular demonstration in the web of a frog's foot, by the aid of the microscope ; on the nature of suppuration, the formation of pus, and the characters of this fluid, more correct ideas were promulgated, while the results of the inflammatory process, as manifested in the glandular organs, were revealed to us with accuracy and precision. In fine, we have been enabled to approach much more closely to true views of all varieties of lesion ; while, as we shall now proceed to consider, data were furnished of a totally novel kind, for estimating important differences in structures, whose general mutual resemblance was such as to baffle all previous attempts to distinguish them.

In approaching the subject of the diagnosis of cancerous formations, by the study of their histo-

logical element, it must be freely admitted that the questions, is one surrounded by difficulties of no ordinary kind, and that as yet we cannot pretend to have attained to that degree of accuracy and precision so much to be desired, and which we are not without grounds for hoping will yet crown the labours of future observers. Still, even in the present condition of our knowledge, it is in the power of the practised microscopist, in no few instances, to pronounce with certainty on the nature of a tumor whose claims to be ranked as malignant or non-malignant, cannot possibly be decided in any other way; while, in a very large majority of cases, the assistance afforded us by the microscope, combined with that information which is to be drawn from the history and progress of symptoms, will enable us to arrive at positive and just conclusions. And here I shall take occasion to notice a most erroneous, and, as it appears to me, unfair method, which has been adopted in many instances by those who, themselves unacquainted with the practical details of a microscopic examination, supposed they were thus making an *experimentum crucis* on "the value of the microscope." I allude to the practice of submitting for examination a fragment of a particular growth, to an observer who is not permitted to know aught of the symptoms, history, or even appearances presented by the disease. Should an answer unfavourable to the opinion they have perhaps already formed, chance to be returned, these short sighted philosophers at once

make up their minds that the instrument has no claims to the attention of the surgeon. Would it, I ask, be considered as a fair argument against the value of the stethoscope, that an observer, on the faith of a crepitus, and without attention to other means of diagnosis, had pronounced the existence of a pneumonia when some other lesion existed? Anxious to gain over even such ungenerous minds, I have never declined to undertake these examinations, knowing that in some cases the microscope does reveal characters altogether unmistakeable, while in all others my reply embraced a description of the elements I had observed, their accordance with or disagreement from certain types, and a truthful statement of my doubts or uncertainties.

When, however, accorded a more liberal and fair trial, the microscope will be found to lend immense assistance to the surgeon, and not less to the accoucheur; both of whom, in dealing with cases suspected to be of a cancerous nature, have it often in their power, previous to undertaking operations or pronouncing any opinion, to procure for microscopic examination a portion of the growth. The proposal of M. Küss of Strasburg, to use an exploring needle in those cases in which the disease has not yet opened on the surface, is, as Dr. Bennett says, worthy the attention all practical surgeons. A portion sufficient for microscopic examination may be thus obtained, and may either confirm previous opinion, or lead to important modification of practice. The examination of growths as well after as before removal will often, in the hands of

the surgeon and accoucheur, lead to important conclusions; we may thus be enabled to relieve our patient's mind of that dread apprehension which ever attends the unhappy being who, but just freed from the pains of an operation, looks anxiously forward to that period when lapse of time shall have pronounced her free from cancer; and what other test in doubtful cases has he who discards the assistance of the microscope?

In the practice of medicine likewise, and those cases which more particularly fall within the province of the physician, the microscope will be found to fulfil many and important ends. Indeed it may be confidently stated, as regards both medicine and surgery, that there are distinct departments of practice, and numerous cases, the treatment of which we cannot be considered at all competent to undertake without an adequate knowledge of the microscope. And of this no better proof could be adduced, than a simple enumeration of the several additions which have been made to our knowledge of renal pathology, and the abnormal conditions of the urine, since the introduction of this instrument as a means of studying disease. In fact, it may be laid down, that *what the stethoscope is to the diagnosis of thoracic, the microscope is to the diagnosis of renal lesions.* As the stethoscope may be looked on as the earliest addition to our means of investigation which this century has introduced, so may the microscope rank next in point of time and merit, in its application to renal pathology. The discovery of the latter belongs, as we have seen, to a far

earlier age ; but it will be something to say for this century, when it has passed, that it witnessed the successful application of both these great agents of investigation to the pursuit of medical science. And in no department have more happy results been obtained, than those which have of late given a precision to our diagnosis of the diseases of the kidney, and the several morbid conditions of the urinary secretions, which could hardly have been anticipated by the most sanguine advocates of microscopic research.

The works of Bright and Rayer exercised a most powerful influence on the subject of renal pathology, and by the extensive researches of subsequent investigators, who have brought the microscope to their aid, this once neglected and uncultivated department bids fair soon to rank high amongst the best known in the whole category of disease ; while, at the same time, so great have been the advances made in the diagnosis of this class of lesions, that not only have our nosological tables been greatly increased, but what is of infinitely more practical value, we are now in a position to appreciate deviations from health in their earliest and consequently most curable stages ; as well as in all cases to distinguish between affections which present more than one common point of resemblance, but which are often as fundamentally different in their pathological nature, as they are in their ultimate effects on the welfare and life of our patients. Thus, while albuminuria and dropsy are the almost invariable attendants of that profound lesion of the

kidney denominated *Bright's disease ;* they are also to be met with in the acute and chronic forms of *desquamative nephritis*, affections which, though of a serious nature, are yet under the controul of the physician ; who, if he wish to deserve the confidence of his patient, and to fulfil faithfully the high trust reposed in him, will hesitate to undertake the responsibility of treatment, unless he be fully informed in the means of diagnosis, and the more judicious indications for the exhibition of medicinal remedies, which have been furnished by the labours of recent observers.

Again, let us take the example of those renal affections which form the sequelæ of other diseases ; that, for instance, which so often attends scarlatina in so fatal a form. Here, while our attention is absorbed by other symptoms, a disorganization of the kidney is frequently proceeding with certainty and rapidity, unaccompanied by pain, or anything to excite our suspicion ; until dropsy finally supervenes, at a period when perhaps the organ has been irreparably damaged, and the indication consequently is of little practical value : while, had the patient's urine been examined by the microscope from time to time, during the progress of the original disease, we should, in the vast majority of instances, from the detection of epithelial scales, blood disks, and fibrinous casts of the uriniferous tubes, have obtained information that would have led to the adoption of appropriate remedies, at that period when all disease is most under our controul. In these and like cases, then, *neglect of the means of*

diagnosis placed in our hands by the microscope is most reprehensible, and may lead, as we have seen, to both omissions and errors in practice, which will have the most sinister effects on the fate of our patients.

It is to the combined labours of numerous observers, both on the continent and in England, that we owe the extensive literature which we now possess in this department of medical science. The names of Bowman, Valentin, Kœlliker, Gerlach, Johnson, Simon, and Gairdner, demand to be recorded as amongst the most prominent of those to whose researches we are indebted for our present correct knowledge of the normal and pathological anatomy of the kidney. The following quotation from Dr. George Johnson's admirable essay on the inflammatory affections of the kidney, will serve to show what precise and definite ideas are now entertained on these subjects :—

" I have now," says this able histologist, " distinguished and described four conditions of the kidney :—1st, acute desquamative nephritis ; 2nd, chronic desquamative nephritis ; 3rd, simple fatty degeneration ; and, 4th, a combination of fatty degeneration with desquamative nephritis. The diagnosis of each of these conditions of the kidney, during the life of the patient, is a matter of the greatest importance with reference to prognosis and treatment ; and the diagnosis may be made with ease and certainty by a microscopical examination of the urine."

The opinions of this distinguished pathologist

and admirable observer are worthy of the highest confidence ; his researches in this department have earned for him a high repute amongst scientific physicians. Independent of our knowledge of actual renal lesions, as obtained by the microscopic study of the urine, there are several important pathological conditions of this fluid, which may be taken rather as indications of general morbid states of the system, than as the result of special organic change in the secretory apparatus of the kidney itself. Under this head may be enumerated the lithic, phosphatic, and oxalic diatheses, with all the different varieties of crystalline and amorphous deposits, which are at once recognised with such facility by the microscope ; and the study of which has led to so many important results both in diagnosis and practice. Indeed, in this extensive field so much has been achieved, that it may be pointed to with confidence, as one of the most tangible proofs of the great value of the microscope in the practice of our profession. Again, what delicate questions affecting the happiness of individuals may we not be called upon to solve, by the microscopic examination of the spermatic fluid ? That we may be thus enabled to lend further assistance to the investigations of forensic medicine, is also a matter for speculation.

The last subject to which I shall make allusion, as coming within the province of the microscopist, is that of cutaneous disease, in which alone sufficiently important and interesting discoveries have been made by the aid of the microscope, to satisfy even the most sceptical of its claims to our consi-

deration. Without the microscope, how little should we know of the delicate and exquisite structures subservient to the function of *tactile* sensibility, with their highly organised nervous and vascular apparatus, or of the extensive and physiologically important tegumentary glandular system. With our improved knowledge of the minute anatomy of the skin, we have also obtained much more precise and accurate information with regard to the various morbid processes by which it is affected ; while it is solely to the aid lent us by the microscope, that we are indebted for a knowledge of those parasitic growths, both animal and vegetable, with which the continued prosecution of this method of research is daily making us better acquainted, and which we now know play such an important part in the production of several of the most obstinate diseases which fall under the care of the physician. Were examples needed, we could cite the well-known observations of Raspail on the acarus scabiei, its natural history and pathological relations, the fungi of tinea favosa, &c. We have before alluded to the parasitic infusoria and the minute vegetable beings found in the animal tissues and fluids under several conditions.

This accumulated testimony in favour of the claims of the microscope, to be ranked amongst the most valuable, and at the same time most generally applicable of our methods of scientific investigation, which, gathered as it is from such various sources, I have endeavoured to present in a connected form, has, I trust, disarmed all prejudice,

satisfied the doubts of the wavering, and confirmed the opinion of those who were previously disposed to advocate its merits. If, then, gentlemen, it be established that the microscope has rendered large services to science ; if, as we have seen, it has not only extended the enquiries of the geologist and the naturalist, but has conferred signal benefits and led to great advancements in physiology, pathology, surgery, and medicine, how long shall we, in the Irish school of medicine, suffer apathy and indifference to withhold us from pursuing investigations in a direction which offers so many honourable inducements to labour ? How long shall we suffer it to remain as a reproach to this school, whose honour and fame are so wound up with our national pride, that it has never produced a microscopic observer of repute ? And, gentlemen, on more than one occasion it *has* come painfully to my knowledge, that a reproach has been cast upon us for our deficiency in this department. When I had the honour of an introduction to M. Gluge of Brussels, one of his first questions to me was, " Who professed pathology and histology in the Dublin school of medicine?" I answered him, with feelings of wounded pride, that no such branch was taught here, that no such chair existed; and I was even forced to admit that we could not boast a single contributor to this section of science. How different is this state of things from that to be found in the English and continental schools, where for many years past the importance of this subject has been recognised, and the number of original

observers which it claims equals if not surpasses that to be found attached to any other branch.

That our University and our College of Surgeons have not followed the liberal and enlightened example set them in other countries, by the establishment of chairs for the teaching, and prizes for the encouragement of this with-us-neglected department of science, is deeply to be regretted ; and has, no doubt, contributed much to keep us in a backward condition for such a long period. But, gentlemen, even without such assistance and encouragement, there are those in Dublin whose duty it was to have come forward to take up this means of research. There are many who, if they did not add to our stock of knowledge by original investigations, could have yet made themselves familiar with the practical details of microscopic manipulation, and undertaken to give instruction. And had the influence and support which their position would have commanded been brought efficiently to bear, an impulse could have been long since given to the prosecution of microscopic research in Ireland. Year after year, however, has witnessed the same condition of apathy and neglect, and without prospect of any move being made. For a long time this blank has struck me forcibly, and I have long looked forward with ambitious, though perhaps presumptuous aspirations, for an opportunity to devote my humble services to this noble aim. That blank still exists: no one has come forward to fill it up ; and on the faith of that old but true maxim which says, " that the master need be but

one day in advance of his pupil," I have ventured to undertake to teach the use of the microscope in Dublin. If I shall be enabled to shorten the labours of initiation for the student, or to stimulate to exertion men whose opportunities for observation and abilities for research are more extensive than those allotted to me, my aim will have been reached.

In conclusion, there are a few observations which I would take the liberty of addressing, in a more especial manner, to that portion of my audience which is composed of students; feeling convinced as I do, that it is amongst their numbers the professional ranks in Ireland must seek for recruits, to enter with energy and enthusiasm on the arduous duty of aiding to fill that blank which I have shown to exist in the records of Irish medical literature ; and to accomplish which will require the joint efforts of many, extended over a considerable period of time. Those who are actively engaged in practice have it not in their power, even if they would, to devote the requisite time to this laborious but important method of investigation ; while even the junior members, distracted by the cares, hopes, and aspirations which attend a young man's first introduction to a sphere of independent action, will hardly, I fear, be found willing to resume the student's patient habits, or undertake a new task, whose very elements must be learned. With you, gentlemen, however, the case will be different. Instruction in the use of the microscope, and its applications to the study of medicine, shall henceforward,

if my humble efforts can avail aught, take its place among the other elements of education which the Irish school at present possesses. And thus microscopic investigation, when brought before you along with the other departments of our science, will, I trust, soon win zealous advocates and observers. It may be urged that the student has even now, in the routine of preparation for the ordeal of a final examination, more than ample occupation for his time in the acquirement of a certain *average* knowledge of all the subjects with which he is required to make himself acquainted. To this I would answer, that while in all cases it is indispensable that the possession of this *average* acquaintance with all practical subjects should be tested by *the severest criteria*, no effort should be spared to foster and encourage that tendency and predilection for one particular object of study, which are almost invariably to be met with as marked characteristics of every mind, and to an eminent degree amongst the students of medicine. That even with his all-absorbing engagements, the student may, if possessed of sufficient enthusiasm, find time to prosecute his favourite study with success, and in many instances with the result of arriving at original discovery, we have many notable examples in the continental schools, where, in numerous instances, the inaugural theses presented at degree examinations, and consequently the result of labours during studentship, are in the present day standards of authority and reference.

To you, therefore, gentlemen, I would say, che-

rish such predilections, as you would hope for ulterior honour or reward. Cultivate some especial subject; give your minds a definite and distinct direction. All parts of our science are imperfect: select for observation a particular subject. You will exhaust the literature of the best known in a year; and if, yielding to the noble impulses of a wisely directed ambition, you commence early to ally yourselves to the high aim of advancing your profession, and aiding the progress of your science, you will not only find this the surest road to fame and fortune, but, should fate not smile propitious at that momentous period when the first stage of your studentship closes, (the life of the physician is but one long studentship) and you are thrown on that world which judges the young man with scrutinizing and impartial eye,—it will gain you the respect of the good and the learned, it will open many a door to you at home and abroad; and, higher recompense still, the pursuit of science and the preoccupation of your mind with the study of any of the branches of our noble profession, will ensure you a tranquil and unruffled breast, which it will be above the power of passing ills to agitate.