LIONEL SMITH BEALE (1828–1906) AND THE BEGINNINGS OF CLINICAL PATHOLOGY

by

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SPECIALTIES arise in medicine by the gradual accumulation of related techniques until a body of new methods and new knowledge is built up, which forms a convenient and satisfying occupation to which a man can devote the whole of, or a large part of, his time. It is in this way that the speciality of clinical pathology has arisen. For many years physicians and surgeons made observations on clinical pathology. The fur capped physician of the sixteenth century holding up a flask of urine for inspection has been a favourite subject for the artist. The phlebotomists of the eighteenth century observed their bowls of blood and noted the relative proportions of red clot, 'buffy coat' and serum. The great Richard Bright tested urine for protein by boiling it in a spoon over a candle flame.

One instrument, however, more than any other played an important part in stimulating the growth of clinical pathology—the microscope. Since its improvement in the seventeenth century this instrument had, in the hands of pioneer workers, added greatly to knowledge of anatomy and physiology, and with the improvements in optics in the early nineteenth century a great impetus was given to such studies. In the hands of men like Henle and Kölliker knowledge of the microscopic structure of man and animals rapidly advanced, and by the middle of the century the basic micro-anatomy of the body was accurately known. But it is with the use of the microscope in the everyday problems of diagnosis that the beginnings of modern clinical pathology are to be found.

It was not until the last decade of the nineteenth century that laboratories for clinical pathology began to be founded even in the London teaching hospitals. However, some forty years before this a pioneer clinical pathologist set up a private laboratory and showed how the microscope could be used with profit in everyday medical practice. His name was Lionel Smith Beale. He was born in 1828, the son of a London surgeon and educated at Kings College School. Whilst yet a schoolboy, aged only thirteen, he was apprenticed to a surgeon of Islington. His education appears to have been more liberal than might be supposed, and some six years later he matriculated at London University with honours in chemistry and zoology. Then followed two years' work at anatomy under Acland in Oxford and at the age of twenty-three he qualified and became resident physician to Kings College Hospital, at that time situated in Carey Street just south of Lincoln's Inn Fields. In 1852 he

established a private laboratory near the hospital and gave a course of lectures on 'The Microscope in Medicine' which included practical demonstrations. In eight lessons students were taught how to use a microscope, do microdissections, cut sections by freehand techniques and to use the simple reagents then available for preparing tissues for examination with the microscope. Meanwhile Beale devoted himself with great energy to laboratory researches in medicine and in a few years produced an enormous number of scientific papers. His work was early recognized and at the age of twenty-nine he was elected F.R.S., and F.R.C.P. at thirty-one. At Kings College Hospital he held in succession the chairs of physiology (being appointed in preference to T. H. Huxley), pathology and medicine.[1] He wrote a number of important books. One of his best-known works was *Disease germs, their nature and origin*, published in 1872.[2] In this contribution to the germ theory of disease, in which he did not believe, Beale advanced cogent reasons against it. To read this book is to realize that all opposition to the theory in its early days was not mere pig-headedness for there were many objections to the germ theory which its supporters, at that time, could not adequately overcome. The two books by which he was best known and which entitle him to recognition as a pioneer clinical pathologist are *The Microscope in Medicine* and *How to work with the Microscope*, which grew out of the course of lectures given at his Carey Street laboratory in 1853. The first edition of *The Microscope in Medicine* appeared in 1854. In 1858 much of the merely technical matter was incorporated in a separate work entitled *How to work with the Microscope*, and subsequent editions of *The Microscope in Medicine*, which ran to four ever-expanding editions during the next twenty-four years, were devoted more exclusively to medical matters. These works were deservedly popular. Sir William Osler remarked in the obituary notice on Beale in the *Lancet*:[3]

> The influence of Dr. Beale as a scientific investigator and as a clinical physician was much more widespread than perhaps was recognised in London or Great Britain at large. . . . His early histological studies were of great value, while as practical physicians we must always be thankful to him for the stimulating work which he did in medical microscopy. His two well-known books *How to work with the Microscope* and *The Microscope in Medicine* were of the greatest service to two generations of medical students. Many practical points which he introduced in technique, while now superseded, formed important steps in the progress of the art. Both in Canada and in the United States there are scores of men of my day who, like myself, knew Dr. Beale only through his writings, who will hear of the death of their old teacher with sincere regret and who will recall with gratitude labours which so often helped to lighten their own.

Osler retained in his great library his old teacher's copy of *How to work with the Microscope* in memory of happy student days.[4]

Beale had a considerable reputation as a practical physician and was particularly skilled in making 'spot diagnoses' from the patients' facies. But the scientific investigation of disease in the laboratory was his main interest, and he was a tireless advocate of the improvement of facilities for such work. In the middle of the last century, despite good works by individuals, England lagged

behind the continental countries in the laboratory investigation of disease. This was due to two main reasons. Firstly, all the great hospitals in the country were charities for the relief of the sick poor, and their governors considered it no part of their duty to spend the funds of their charity in providing laboratories or paying research workers. Secondly, the senior positions in academic medicine were held by men who devoted the bulk of their time to private practice and the remainder to teaching and clinical work in the wards. This led to a great flowering of clinical medicine associated with the names of Addison, Bright, Gull and many others, but was detrimental to laboratory studies. It is true that some men provided themselves with private laboratories, and indeed the antiseptic system of surgery was worked out as much in Lister's home laboratory as in the wards of the Glasgow Royal Infirmary. Nevertheless, to quote Beale, 'A poor scientific worker is too often regarded as an impractical half mad enthusiast.' Beale wanted to see laboratories established at the great teaching hospitals and government grants to men doing original investigations. The fourth and final edition of *The Microscope in Medicine*, published in 1878, is prefaced by an appeal for the scientific investigation of disease.[5] The following quotations give the gist of his proposals.

> There is, I believe [he wrote], only one hospital in London in which there are efficient means for conducting scientific enquiries into the nature of disease, and I do not believe there is one, the managers of which would allow a very moderate sum, say £300, to be set apart for working expenses . . . surely it would be right if rich bodies like Guys, St. Thomas's and Bartholomews took the lead in this matter. One would think that £1000 of their large incomes might be spent very advantageously in scientific work, but I fear it will be difficult indeed to convince the authorities who have command of the purse. . . . All that is required to carry out such work is well arranged laboratories and work rooms in our public hospitals and qualified officers to do the work . . . the persons to conduct advanced scientific enquiries in connection with medicine, are undoubtedly the young physicians and surgeons attached to our medical schools and hospitals. Were but a little encouragement afforded, I am sure that many who are eminently fitted for such work would willingly study, here and abroad, so as to perfect themselves in the brand of investigation they desire to pursue and thus become highly skilled original enquirers. And when I say, if 'a little encouragement were afforded' I mean if a place in which they could work was found for them, and an income just sufficient to provide the necessaries of existence, say £100 a year. Would not many a talented young physician and surgeon be better employed in spending part of his time thus than in devoting himself for 15 or 20 years to seeing out-patients.

However, turning from research work to routine clinical pathology, in the introduction to the second edition of *The Microscope in Medicine* he stated:[6]

> It is needless to discuss the vast importance of microscopical research in the study of anatomy and morbid anatomy, and hence its bearing on practical medicine . . . in many instances, however, the microscope is of greatest immediate use to the practitioner and there are a number of cases the diagnosis of which is much facilitated, and often placed beyond all doubt, by its use.

Time has confirmed the value of microscopical examination in many of the conditions described in this book.

Examination of Urine

Of course every type of crystal that may be found in the urine is described and figured. (Beale also devoted a whole book to this subject.) The various types of casts are described and correctly interpreted. It is suggested that the diagnosis of bladder tumours may be confirmed by the finding of microscopical fragments of growth in the urinary deposits and the malingerer, who adds extraneous material such as starch to his urine, may be unmasked.

Examination of Blood

A crude red cell count was done by placing a drop of blood on a slide with a small area marked out on it. A coverslip was then pressed down on it to give a thin film and the number of cells in the area counted. No absolute figures were given, but it was suggested that marked variation would be found in different diseases. The diagnosis of leukaemia, which had been first described by Virchow and Bennett in 1845, was made by noting the proportionate increase in white cells to red cells.

Examination of Surgically Removed Tumours

The technique of section cutting and staining was in its infancy and not suitable for routine work. Beale, however, proceeded much as the modern pathologist doing a 'quick smear' during a surgical operation. The exudate from the cut surface of the tumour was examined and malignancy diagnosed by just those criteria used today: variability of the size of individual cells, the presence of multinucleate cells, the variation in nuclear size and the increased cellularity of the juice obtained by scraping the tumour surface. These examinations were of course made on unstained preparations. At most a little acetic acid might be used to accentuate nuclear structure.

Examinations for Parasites

The list of pathogenic parasites known at the time was small, but the microscope was of value in recognizing the fungi of ringworm and the hooklets of echinococci in vomit, sputum or pleural exudate in suspected cases of hydatid disease.

Other miscellaneous uses of the microscope were the recognition of fragments of lung tissue in sputum considered to be incontrovertible evidence of cavitation, the recognition of blood stains and the detection of spermatozoa in suspected cases of rape.

When one considers how clearly Beale demonstrated the great practical utility of the microscope it is indeed remarkable how slowly the necessity for laboratories for clinical pathology was appreciated.

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