Half-Century of Fellowship

Professor Brian J Ford looks back over fifty eventful years as a Fellow of the Royal Microscopical Society

Brian J Ford

In April 1962 I was recommended to become a fellow of the Royal Microscopical Society. The Fellowship was competitive in those days; candidates needed support from signatories who had to attest that they recommended your work. The microscopist Parry Morton, a kindly, sharp-eyed and distinguished man, kept some of my slides for study, many of them made when I was still a schoolboy. At the time I was studying trypanosome infections of fish, and he found my preparations fascinating.

I had spent a year at the Medical Research Council before going to University and, to bring in a regular income, I was already writing a newspaper column on science. There were many talented people in that social circle, all bubbling with enthusiasm and lively as crickets, including Michael Aspel, John Humphrys, Sue Lawley, Martyn Lewis and Michael Buerk. I was giving talks on microbiology and twice a week played blues piano in a nightclub, which brought with it a different and equally crowded social life.

Applying for university was a last-minute decision. For most students, going to college is the most painless way of leaving the parental home, but I already had a flat of my own and a burgeoning career. The academics were encouraging but with much going on outside college, I found settling into the passive role of a student each day didn't work: I wanted to do science, not just learn it. It was as if we were being taught to chug along with an outboard motor when my world had a stiff breeze and a full set of sails ready and waiting. I started my second year at university, but it became so frustrating that I left to set up my own laboratory. By the time my contemporaries graduated I had research projects coming to fruition. I was soon publishing on microscopy and was engaged on my first academic assignments. I was exhibiting micrographs as art and studying microorganisms, snowflakes and cell specimens. Biology was turning to the electron microscope and views of dead matter, whereas I was concerned with looking at life as it was lived. It was the light microscope that became my vehicle on a voyage of discovery.

In 1962 I attended the RMS annual meeting at Balliol College, Oxford, and from the moment of arrival I was in my element. I discussed my work with Sir Howard Florey, and met John Bunyan, one-time RMS President, who invited me to join him in research on wound healing. He encouraged my work on a paradox of blood coagulation that had preoccupied me since my days at the MRC. Blood cells, we were taught, became trapped in a network of fibrin threads. It was clear to me that this couldn't work. The freshly-forming threads from the site of a damaged blood-vessel would be swept down-stream – there was no way in which

Optical instruments were always an attraction to this teenaged schoolboy, and the revelations made possible by a spectrometer had a particular appeal. Microscopes quickly became a major preoccupation from the age of twelve, and capturing micrographs of elusive images was soon to become an enduring fascination.

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Photographed from the audience, this was the first lecture on my microscopical research in London and took place at Burlington House, Piccadilly, in the Royal Society's lecture room. It was 1965 and the subject of my illustrated presentation was human blood coagulation. The mechanism of erythrocyte capture is shown on the board.

they could, like an arrow shot from a bow, connect across the wound. I showed that erythrocytes attached themselves to threads like balloons on strings, and this was how occlusion of a damaged vessel came about. At the age of 25 I was given a slot to present this research in the lecture room of the Royal Society. The micrographs won awards, and the research was widely discussed in the press. The *London Evening Standard* described the results as 'sensational', and it featured on the front page of *Medical News*.

Setting Standards

In my mid-twenties I was asked to report on the skeleton of a murder victim from the Dark Ages and the Home Secretary, Henry Brooke, issued me with an exhumation license. The microscope revealed traces of iron in damaged ribs, and I found that a cerebral growth had eroded the skull. One could determine the likely cause of death and even offer a motive. The project featured in the press and on TV and the new techniques we developed were published in a UNESCO textbook. Elsewhere I was publishing on microscopical terminology and the nature of artificial life. As the sixties ended the blood research was featured as an international highlight in the McGraw Hill *Yearbook of Science and Technology*, and my first paper on microscopy was published in the United States.

My dissatisfaction with university teaching gave rise in 1970 to my book *Microbiology and Food*, which looked at nutrition, the nature of food and food spoliation with a common theme – that of the single cell. Although we deal separately with organisms like *Saccharomyces* (the yeast we use to make bread and wine) and *Salmonella* (which causes food poisoning), I argued that their challenges are those of any living cell, and they had more in common than in disparity. The book was widely reviewed in publications like *New Scientist* and is still being consulted.

During my twenties I presented reports for TV news that were often on microscopical subjects. One of my good friends at the time was a young Claire Rayner, broadcasting on medical matters (I was recently interviewed for BBC's The One Show by her son Jay). This single frame is from a 16 mm TV film I made of Pediculus, the head louse.

Speaking Overseas

America beckoned, and in 1971 my first lecture tour was arranged. I was welcomed by microscopists across the USA. I came greatly to enjoy their openness and warmth and knew I would return.

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Back at Bristol University I came to know Professor C R Burch, who disclosed that he took amphetamines to work at night when making his reflecting microscopes, since this was the only time that traffic vibration was absent. He gave me one of his instruments, weighing at least 80 kg. The lack of

Sandy Gall was among the first television reporters who came to film research at my home laboratory. This ITN news team in the 1960s was never composed of fewer than four people – camera, sound, assistant, presenter – whereas in the modern deregulated world of broadcasting it is normal for a single person to do it all on their own.

regulations for the safe handling of pathogens began to concern me; I wrote a paper for the *New Law Journal* and a leading article for *Nature* – newspapers

The title of the television series 'Take Nobody's Word For It' was a vernacular translation of the Royal Society's motto 'nullius in verba'. Carol Vorderman came to present a report about my work on the microscopy of living cells and we filmed a number of microorganisms for transmission by the BBC. Carol and I remain good friends.

including *The Times* followed up the subject. I discussed it on the BBC programme *Panorama,* producing a typhoid culture on-screen to prove the point, and was asked to prepare submissions on the subject. Biohazard legislation was passed as a result of this campaign. Laws of this sort have since been enacted all around the world.

My books had been selling well and in 1973 I had two new titles published – *The Revealing Lens* by Harrap, and the *Optical Microscope Manual* from David & Charles. There was much media interest and both books were extensively reviewed. In the same year I gave my first lectures at Cambridge University, speaking on the role of microorganisms in the control of environmental pollution, and on biohazard legislation. I was invited to write a leading article for *Nature* in which I lamented the lack of public familiarity with the microscope, and this remains a matter over which I continually campaign.

My interests in the importance of microorganisms led to a major book entitled *Microbe Power, Tomorrow's Revolution,* published in London in 1976, with editions in the United States and Japan. It triggered an unexpected amount of interest. With fanciful exaggeration the *Daily Mail* said it superseded H G Wells, and Brian Redhead interviewed me about it live on the BBC Today programme, where they gave me twice as much time as allocated because of the interest of the subject. Recently I was taken round a Japanese recycling system that incorporated many of those ideas. To see well-thumbed copies of my book being used to such effect was humbling.

By 1978 I was off on my first of many world-wide lecture tours and the British Council arranged a series of appearances. I spoke for the first time in Singapore, for example, though I have returned for public lectures many times since. I met the Premier of India, Mr Morarji Desai, and of Tasmania, Mr Doug Lowe, who presented me with the gold state cufflinks – they remain my favourites for formal occasions. Professor John Cairns Jnr. was a lecturer at the conference in Tasmania, where I was the keynote speaker, and we became instant friends. I later spent time with him in Virginia, and he stayed with us in Britain. On the same tour I visited the Pacific islands (and was sunning myself in Tonga as the family in Britain were wrestling with record-breaking snowfalls) and spent time with microscopist friends in the United States on my return route.

Royal Society Research

Research became easier in 1981 when I was awarded a generous Kodak Bursary to return to my studies of the early days of microscopy. It was supplemented by grants from the Linnean Society and the Royal Society whose president, Sir Andrew Huxley, made me welcome and asked if I had ever consulted the Leeuwenhoek letters. It was overwhelming to be taken down to the strong-room and handed the bound volumes. Scholars ordinarily didn't have this access; the Dutch, who were translating them, worked from microfiche copies.

In the event I found nine envelopes among the letters, all but one containing the original specimens Leeuwenhoek sent to the Society in the seventeenth century. It was a stunning revelation. They disclosed much about how that great man worked, and – after the announcement in my Royal Society paper – further publications followed in journals ranging from *Nature* and *New Scientist* to *Scientific American* and the *British Medical Journal*. I took micrographs of Leeuwenhoek's sections through the surviving microscope at Utrecht with the encouragement of Dr Peter Hans Kylstra, and Dr J van Zuylen, both experts on Leeuwenhoek's microscopy. Peter gave me one of the replica microscopes they had made and I was presented with another by Dr H Hansen whom I visited in Antwerp. Others have since tried to repeat my experiments, including the technical specialists at BBC television, though none has captured the magic that I observed that day.

Each year the Royal Society stages an open day when they invite distinguished guests to view a selection of current research projects. In 1981 Sir Harold Wilson was particularly fascinated by the images we were taking through early microscopes, and how they could be correlated with high-resolution micrographs made with the scanning electron microscope.

Luminaries

At the Linnean Society, where I had been appointed Honorary Surveyor of Scientific Instruments, we held the microscope Robert Brown used in his work on the cell nucleus and on Brownian motion. Professor Irene Manton had reported it was in poor condition. I found it bent, distorted and wrongly assembled, but it was possible to clean the lenses meticulously and return it to the workable condition it would have been in Brown's time. On the body pillar, wear can be seen where Brown's forefinger had rubbed against the brass as he focused his specimens. The microscope had been dismissed in the 1930s as inadequate for research, though Manton's technician had managed to resolve cell nuclei. I made a series of colour studies of specimens with which Brown had worked, and the

Sir Edward Heath, by contrast, had little knowledge of science. At his home in Salisbury, he showed off his grand piano with pride, though – truth to tell – he did not play it well. His garden was separated from public parkland by a narrow backwater, and he liked to stroll along the banks waving courteously to people on the opposite side and posing for photographs.

Winston Churchill's brilliant intelligence specialist, Professor R V Jones, became a good friend who greatly extended my private passion for the history of science in WWII. In 1981 he was my guest of honour at a Savage club dinner. We were portrayed by the legendary cartoonist Michael ffolkes, showing R V with a radio antenna, while I was studying a gastropod with a lens.

results were spectacular. A television crew recently tried to repeat the experiments with their latest cameras, but failed to resolve what I had shown Brown could see in the 1820s. I am certain that he'd have been privately pleased.

The publishers of my 101 Questions about Science books wanted an author's cartoon on the jacket, so I recommended my great friend Brian Bagnall. His watercolour sketch showed me with an R & Beck Popular microscope from my collection. Brian also decorated my text with drawings for the book, and went on to become a top Private Eye cartoonist.

The Royal Society proposed that the research should feature at the Society's Conversazione in May 1984 and Soirée in June. My wife Jan, who has become a blend of administrative officer and senior technician, helped plan the demonstration. Sir Harold Wilson (whom I had come to know during committee meetings at the House of Commons) spent much time looking at the specimens with us, and the editors of the *Proceedings* described them as 'fascinating'.

In the following year my fifteenth book *Single lens, Story of the Simple Microscope* was published in Britain and the United States. There was much international interest, and it gave rise to further invitations to lecture. I never regarded my earlier books as well written, even though the reviews were generous; but with *Single Lens*, I felt I had matured as an author.

Journey of Discovery

Other mysteries arose. One was why deciduous plants shed their leaves. The arguments were that the leaves would be damaged in winter, but evergreens showed that was not inevitable. Evergreens also shed their leaves (in the summer, not the fall). Water shortage provided another reason, though that did not explain why aquatic species abscised leaves. Microscopy proved that pigments were not (as the books said) 'revealed' when chlorophyll was withdrawn; one could show how materials were positively translocated into the leaves before they were shed, including heavy metals. I developed a view that this was a plant's excretory mechanism, and that abscission (of sepals, petals, etc.,) was a consequence of any metabolically-active phase of a plant. The concept was widely reported, and featured on the BBC's Autumn Watch programme. I have recently been lecturing on it at Cambridge.

Asian audiences are particularly interested when I speak on my work with single-celled organisms. This group of students from one of my recent lectures in Singapore kept me entertained for half an hour after my lecture with penetrating and incisive questions. Their eagerness to know more about microscopes is refreshing, and I have given television interviews on the topic for Channel News Asia.

I have explained my ideas on foreign TV channels but living cells remain a rarity on British television; editors argue that the public are not familiar with microscopes, so there is no demand for programmes. This "Catch-22" argument is rife among producers, and the microscope is badly served by television.

Television film makers have since come to visit us from many countries, and my research has featured on Korean national television more than once. These documentary producers from Seoul concentrated on the history of microscopy and here we are with a copy of Robert Hooke's 1665 book Micrographia from my library collection.

By the 1990s I was contributing chapters to multi-authored volumes, first on viruses in drinking water, then on sexually-transmitted diseases, the physics of early microscopes, and on emergent infections. I was asked to speak on many of these topics around the world, and further publications subsequently emerged. My research on Leeuwenhoek continued and in 1991 my book *Leeuwenhoek Legacy* appeared in Britain and America. It was extensively illustrated and widely acclaimed, though to me it was a modest supplement to Clifford Dobell's magisterial biography, *Antony van Leeuwenhoek and his Little Animals*.

I knew several people acquainted with Dobell, including Walter, Lord Perry with whom we stayed in Edinburgh, and who sat at my breakfast table in Cambridgeshire reminiscing about Dobell and his wife Monica. Walter was first Vice-Chancellor of the Open University, where I became a fellow for several years. Monica Dobell and I also became good friends, and she presented me with Clifford's original copy of the book, complete with his amendments and marginalia.

When I published *Images of Science, the Story of Scientific Illustration* in Britain and the United States, there was an entire chapter on microscopy, and the

end-papers were photomicrographs of fern sections. Among my friends by this time were Dame Miriam Rothschild, whose splendid parties at Ashton Wold became a highlight of the year; Horace Dall, that great optical technician, and Es Reid, superb lens maker, who helped crucially with my research on imaging through simple microscopes. Discussions with Ellis Cosslett, Debbie Stokes and Archie Howie proved invaluable over the years.

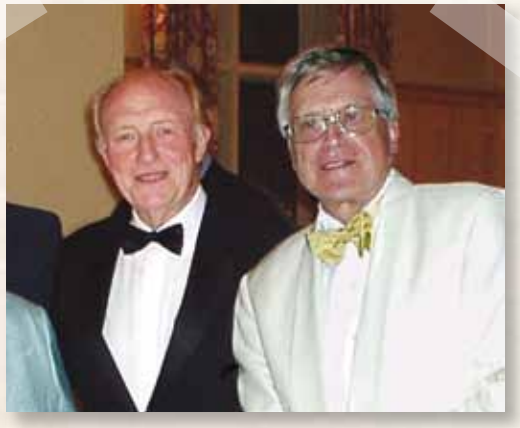
The portable Lensman microscope was released in 1989, and I compiled the manual. Ten years later I did the same for the Intel QX3 digital microscope. I undertook an extensive programme of research with this ingenious instrument and my full-colour manual showed children how to identify forged documents, discover algae, research plants, investigate their own bodies - a whole range of uses was explained and illustrated. This was my thirtieth book and it was translated into Welsh, the first science book in that historic language in living memory. As a result of this venture we had a digital microscope donated to every school.

That type of digital instrument gives us a computer interface, and I had long hoped for this facility. My first work with computers was in 1965 when I wrote a program that allowed us to study the circulation of blood cells (I demonstrated that they circulate faster than the blood!) and I wrote a book called *Compute!* in 1985. By 1993 we were on email. When our first website went live in 1996 I launched into a study of Internet access, and was appointed Visiting Professor at Leicester University to research e-learning in 2005. The digital world gives us, as microscopists, extraordinary new facilities.

Recent Decades

With the dawn of the new millennium, I was awarded a NESTA Fellowship (National Endowment for Science, Technology and the Arts) which funded time to pursue research. I demonstrated my work at a large conference that NESTA arranged in London, and a highlight was audio recordings processed to disclose the utterances that neurons exchange. They seemed to be processing data within each cell, and not just at the synapses. When this was broadcast on the BBC Today programme, it left the interviewer speechless and, when repeated on Pick of the Week, it was heralded as 'momentous'. The log of the Fellowship is the closest I have come to keeping a diary. It reveals that I met over 10,000 people, visited 366 universities and gave 150 lectures to audiences totaling 20,000; I made 77 international visits and chaired 24 conferences – all in three years. It seems unmanageable but, truth to tell, that is how life has become.

Cardiff University has always been an important part of my life. I was honoured to be elected a Fellow and a member of the University Court, positions that I still hold. I was President of the Association of Past Students for several years, and I owe my University friends so much. I have known all the Vice-Chancellors, and was particularly pleased



Neil Kinnock – now Baron Kinnock of Bedwellty – was a contemporary of mine at Cardiff University in the early 1960s. We renewed our acquaintance when Neil was appointed President of Council at the university, where I am a Fellow and a member of the University Court. His successor is Sir Martin Evans, who won a Nobel Prize for his work on stem cells.

when Neil Kinnock (a contemporary from my student days) became the University President.

In my 1970 book *Microbiology and Food*, was a section entitled 'man as microbe'. The subject was expanded in *Microbe Power* of 1976, when I went in greater detail into the autonomous abilities of living cells. By the 1990s, when I wrote *Genes: the Fight for Life*, it was apparent to me that organisms like predatory protozoa and shell-building amoebae showed unmistakable ingenuity, and cell repair in the rhodophyte algae could reveal the roots of intelligence. I published a lengthy paper on this concept in *Interdisciplinary Science Reviews* and an article in *New Scientist*. This is now a major thread of my research after 50 years of fellowship.

As a boy, the actor Victor Spinetti always wanted to be a microscopist but his attempts to buy an instrument were thwarted. Staying with us in rural Cambridgeshire he became transfixed by the spectacle of aquatic microorganisms living their intricate lives, and we spent half the night investigating a variety of specimens. A TV company arrived next day to film us.

The endless variety of this life continues to catch me by surprise. Discussing matters with our own Royal Family and with the Emperor of Japan, appearing on TV with Michael Parkinson and broadcasting with Lulu, featuring in TV documentaries with Joe Brown and Victor Spinetti, debating over dinner with such brilliant luminaries as Sir Sam Edwards (former chair of the Science Research Council) and Sir Tom Blundell (who chairs the BBSRC), dining regularly at Gonville and Caius college and at Murray Edwards college at Cambridge University provides invaluable exchanges of views – and such stimulating company cannot have been deserved by anything I have striven to achieve.

Costly particle physics has come to dominate the media, but the microscope provided the theme of my life and it has led me on to fresh discoveries at every turn. Its revelations are breathtaking, and the microscopical vision of the world informs us on so many levels. My own instruments are old, worn and distinctly out of date – but I wouldn't be without them for the world.

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Brian J Ford was elected to Fellowship of the RMS in 1962 and is now a leading microscopist – a search on Google for *microscope research* shows his site top in the world out of 30,000,000 web sites. He is a Fellow of Cardiff University, former Fellow of the Open University, and was appointed Visiting Professor at the University of Leicester. Brian is based at Gonville & Caius College, Cambridge University. He has published hundreds of research papers and over thirty books, and has presented TV programmes including Computer Challenge and Food For Thought. On radio he featured (with Lady Antonia Fraser) on Round Britain Quiz and hosted his own series Science Now and Where Are you Taking Us?.