

## A dozen favourite books related to microscopy

This article is an altered version of that which I was asked to write for the [Quekett Journal of Microscopy](#).

I suppose most microscopists have accumulated books about microscopy, natural sciences and imaging in general. My microscopy library takes up about 25 feet of shelving full of books (which is modest by some standards) and, yes, it is very difficult to make a selection of just a dozen books. Because of my role as a microscopy facility manager, and the need to teach others, my final choice of a dozen books will reflect my involvement in, and enjoyment of, teaching light microscopy. I find that a chapter or a part of a single book has its merits, and I value the way a particular subject is approached by one author over another. So, like most of us, I dip into my books.

My first choice must be ***An Introduction to the Optical Microscope*** by Savile Bradbury [1]. This was the first in the series of Microscopy Handbooks published by the Royal Microscopical Society in 1984. It is only 85 pages, published in monochrome (I also have bigger, more colourful texts) but for me this little book is an absolute gem, imbued with the character and personality of the author like no other.

Over 20 years ago I was an under-employed, restless, junior technician who had been given the task of buying a research-grade fluorescence microscope for the place where I then worked. I arranged demonstrations, and spoke to company representatives and very quickly found out how desperately little I knew about either end of a microscope.

At that time Baird & Tatlock operated a franchise arrangement for Zeiss West (Oberkochen), and I enquired of the rep. 'what is a diatom?' He looked at me with pity and bemusement and said "You really don't know *anything* about microscopy, do you?" as if to say 'why have you of all people been given this purchase exercise?'. The stress on 'anything' was embarrassing, and I had to admit the plainly obvious - that indeed I did not know anything. I have never forgotten his advice by way of a reply. "What you must do" he said firmly and cheerfully "is read the newly-published RMS handbook on the light microscope by Savile Bradbury".

I was grateful for the advice, intrigued by the author's unique Christian name, and promptly went out and bought my copy. A few years later I was fortunate to be employed as a research technician at the department of Human Anatomy, where Savile was a senior member of staff. He very kindly took me under his wing, encouraged and taught me, and very much helped me in my career. Savile was an accomplished and prolific author, clear and lucid, and very widely-read with a most comprehensive library of his own. It would be interesting to know what his choice of a dozen books would have been. I dare say one of them would have been *Principles of Biological Microtechnique* [2] written by John Baker, his D-Phil supervisor at Brasenose, for whom Savile had enormous regard and respect and to whom he referred in his Presidential address to the Quekett Microscopical Club [3] in 1993.

***Contrast Techniques in Light Microscopy*** [4], handbook No. 34 in the RMS Handbook series by Savile Bradbury and Peter Evennett, has to be my second choice. My everyday copy of Bradbury & Evennett is dog-eared from constant use, like any good bible. I refer to it frequently, and recommend it to all who will listen. I have three copies: two were given to me by the authors, and are priceless for their inscriptions,

because Savile and Peter taught me pretty much all I know regarding light and electron microscopy. This is a favourite book for me not merely because of its clarity and completeness of instruction, but because I can see these two friends of mine in my mind's eye, teaching students, as I read their work. I have been very fortunate to have been involved with them in teaching students on the Royal Microscopical Society's summer school in light microscopy, and have not only witnessed their skill at first-hand but have benefited also from their superb teaching. The third well-used copy has 'working copy' in large red letters on the inside front cover, so I know which one to lend out and which to refer to and teach from. You will not find a better explanation of phase contrast or interference contrast anywhere, and I have been recommending this book to all my students, be they Professors, PhDs or lesser-mortals, ever since its publication.

Occasionally a book will come along that you treasure as a well-loved tool. Ron Oldfield's ***Light Microscopy: an illustrated guide*** [5] is one such. I turn to it frequently to clear up a point, and I like the familiarity of knowing my way around the book. Again it is dog-eared (at A4 size I wish it were in hardback and more rigid), and I would happily have more than one copy to work from, but this book appeared quickly to go out of print, which is a great shame, for it is a very good book indeed, and copies are not easy to find. In my view, *Light Microscopy: an illustrated guide* is good because it was developed out of the material from a teaching course that Ron organised. I particularly value the practical exercises that are included at the end of each chapter.

I now find myself using two more recent books more frequently. The first of these is Spector & Goldman's *Basic Methods in Light Microscopy* [6], and Sluder & Wolf's *Digital Microscopy* [7]. I really value the chapter in Spector & Goldman by John Murray on fluorescence optical sectioning, which is the best that I have seen on the subject, and it is probably the hardest choice that I have to make for this selection in distinguishing between these two books. However, I think that recently I have pulled Sluder & Wolf down from the bookshelf more often. Therefore, my fourth choice must be ***Digital Microscopy 3<sup>rd</sup> edition***, *Methods in Cell Biology*, volume 81. This text arose from two earlier editions edited by the same editors, and has remained popular for over 10 years. There are good chapters on image formation, microscope alignment, fluorescence microscopy and most aspects of cameras and digital imaging, but the chapter that I find most useful in a professional capacity is that on live-cell fluorescence imaging by Jennifer Waters.

Another book which is never far out of reach, and which I have either bought or recommended for every light microscopy facility that I have worked in, is Douglas Murphy's ***Fundamentals of Light Microscopy and Electronic Imaging*** [8]. A hallmark of the success of this book by Murphy is the fact that it is carried by major scientific supply houses in their general catalogues. I especially like the treatment of Abbe's theory for image formation in the microscope in Chapter 5, and the explanation of spatial resolution in Chapter 6 neatly illustrated (Figure 6-1) with a beautiful illustration of *Pleurosigma angulatum*.

Sixth on the list must be Needham's ***The Practical Use of the Microscope*** [9] for in this book you will find a description of most of the microscopical gear available post-war. Arguably, the golden hey-day of the light microscope was the first two-thirds of the 20<sup>th</sup> century. Where now can you get the esoteric accessories that are no longer made, yet are so useful: the apertometer, Abbe test plate, Lieberkühn illuminator, Traviss expanding dark-field stop or Nelson's cassegrain dark-ground illuminator? With my interest in test diatoms, I particularly like Figures 49 (page 127) and 53 (page 144) comparing the resolution of the frustule of *Amphipleura pellucida* into striae and puncta by oblique illumination, near UV and electron microscopy.

Arthur Barron's *Using the Microscope* [10] is seventh on my list. I have the third edition of 1965, which I particularly like for its clear explanation on how to set up a microscope with a mirror and external light source. It also has a very clear, and readable, section on the polarising microscope which I refer to often. Bradbury's *The Evolution of the Microscope* [11] is my eighth choice. This book is a very clear and readable history of the light microscope from the earliest times, and I am fortunate to have the author's own copy. In a similar vein Gilbert Hartley's *The Light Microscope: its use and development* [12] also describes the history and development of the light microscope, but in a different style to Bradbury. I am fond of it for its sheer readability and enjoyment. It is difficult to pick any one passage, but I particularly like reading Hartley's thesis regarding the discovery of the microscope following the invention of the telescope, and am amused by the illustration in Figure 59 on page 131 showing the trinocular microscope for three people in use! I am fortunate to have two copies, so keep one at home and the other at work.

My tenth choice is Carpenter & Dallinger's 8<sup>th</sup> edition of *The Microscope and its revelations* [13], a favourite of several serious amateur microscopists. I had been looking for this exalted book for quite a while when an example bound as two volumes came up for sale for £30. At the time I had a young family to feed, and spare cash for microscopy was not in abundance. I enquired, put the 'phone down, and took a few minutes too long to rationalise my decision (i.e. what can I, in all honesty, plausibly say to my wife); when I 'phoned back it had gone. I very much regretted this, and so leaped at the chance of a single-bound copy when this presented itself. The book is beautifully bound and illustrated, and my copy naturally falls open at Plate XII, an illustration of *Arachnoidiscus japonicus*, which I absolutely love. I have photographed this, and have a print of it at work by my desk.

*Aglow in the Dark*, my eleventh choice [14], is the smallest book in my selection, measuring only 17 x 14.7 x 1.8 cm (6.7 x 5.8 x 0.7 inches). It describes how bioluminescence has been put use in the service of mankind, and is a wonderfully entertaining, yet informative, read about how genetically-engineered fluorescent proteins have revolutionised light microscopy within the last decade. You can find this gem quite cheaply on-line in the second-hand book market for about £10; in my view, money well-spent by any criterion. Here is a quotation from pages 141-2 to whet your appetite:

'Heim, Tsien and other scientists swapped virtually every amino acid in the 238 amino acids of the jellyfish protein. To check for fluorescence, Heim used an old spectrofluorimeter, referred to as the Green Monster. The operation was low-tech. Heim looked through different colored Kodak filters that he taped to his lab goggles while changing the color light by hand on the old Green Monster. "At Berkeley they were ready to throw it away, but as an old pack rat or magpie, I refused to let it go." Tsien says of the spectrofluorometer.'

The three men instrumental in the discovery and application of Green Fluorescent Protein (GFP) and its derivatives – Shimomura, Chalfie and Tsien - jointly shared the Nobel Prize for Chemistry in October 2008 [15, 16], and very rightly so.

My last choice is a very recent publication. It is Randy Wayne's *Light and Video Microscopy*, [17]. There is a decided historical slant to the tuition, which I find grows on me, and I particularly like the exercises and clear diagrams. Given that this book is also one that has arisen from a formal taught course in microscopy, I'm intrigued by the discourse on the 'Microscopist's Model of the Photon' in the Appendix.

## References

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URL: <http://download.cell.com/pdf/PIIS0092867408015006.pdf>
- [16] Zimmer, M (2009) GFP: from jellyfish to the Nobel prize and beyond *Chemical Society Reviews* 38/10: 2823-32  
URL: <http://www.rsc.org/ej/CS/2009/b904023d.pdf>
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If I could add another, recently-published book to the list, it would be ***The Science of Imaging: an introduction* 2<sup>nd</sup> Edition** by Graham Saxby. He writes in a readable and easy-going style, and this book will give you a good overview of how images are formed in photography and allied disciplines to microscopy.

- [18] Saxby, G (2011) *The Science of Imaging* 2<sup>nd</sup> Edition CRC Press, Boca Raton ISBN 978-1-4398-1286-0