

Techniques in Light Microscopy

This textbook provides an accessible and pedagogical explanation of the way microscopes magnify images and covers all techniques to date in transmitted and fluorescent light microscopy. The first section covers basic optics as it relates to microscopy. The second section describes all the major optical techniques of transmitted light microscopy, starting with brightfield, through darkfield, polarized light, phase contrast, differential interference contrast, and Hoffman modulation contrast microscopy. The final third of the book covers all the techniques of fluorescence microscopy. It begins with a simple explanation of fluorescence and is followed by Widefield epifluorescence, confocal, and 2-photon microscopy. This is followed by computational imaging including restoration ('deconvolution') microscopy, and all the present super-resolution techniques. The book concludes by discussing attainable resolution using transmitted light microscopy, including a thorough discussion of the Rayleigh, Sparrow, and other criteria of resolution, ending with a short discussion of the common pitfalls that result in decreased microscope resolution. The final chapter in the book is a short history of the microscope, beginning with the ancients, then discussing three seminal natural philosophers: Leeuwenhoek, Swammerdam, and Hooke. The remaining sections of the history chapter cover mechanical and optical advancements in the history of transmitted light microscopy. Finally, it includes a short history of fluorescence microscopy starting with Köhler and Rohr's first use of fluorescence microscopy in 1905, and ending with a description of the Sarastro Phoibos 1000, the first commercial confocal microscope.

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