

Microscopy

A Very Short Introduction

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Questions for Thought and Discussion

- When and where were the first steps in microscopy taken, and what facilitated them?
- Although Leeuwenhoek's results were the catalyst to an awakening of a new world previously unseen by the human eye, his design of microscope was never developed further- why was this?
- What very recent development in microscopy has similarities to the Leeuwenhoek instrument, and why might it have a larger impact worldwide?
- How did Ernst Abbe (albeit unwittingly) put a limit on the ultimate performance of microscopes that was to last over a hundred years?
- Although resolving power is considered the crucial element in judging the performance of a microscope, there is another factor related to the specimen which is required to extract detail. What is it, and how have microscopists gone about optimising it?
- Over the course of its history, Light Microscopy has been advanced by manipulation of the interactions between the illuminating beam and the specimen- which were the major advances, and what improvements did they produce?
- How does confocal microscopy produce advances in the collection of specimen information not possible by widefield microscopy?
- What are the advantages of spinning disc microscopy?
- What are the main requirements for the in situ localisation of individual molecules in biological material, and how has this field been developed by the incorporation of (apparently unrelated) discoveries over the last fifty years?
- What is Superresolution, and how has it been achieved?
- Which two pioneers were mainly responsible for the development of transmission and scanning electron microscopy?
- How similar is transmission electron microscopy to conventional light microscopy, and what is the advantage of imaging with electrons rather than light?
- What are the limitations of transmission electron microscopy in respect to biological material, and how did the early biological electron microscopists get round the difficulties of imaging biological material in the first place?
- The involved preparation techniques required for electron microscopy of biological material led to criticism that results might contain significant artefacts- what alternative preparation method was used to validate these results?
- What are the main differences between scanning and transmission electron microscopy?
- Why has scanning microscopy attracted popular public attention in a way that transmission microscopy has not?
- Besides scanning EM, what other ways of investigating surfaces at molecular resolution (and better) have emerged in the recent past?
- As well as being largely dependent on various microscopical modalities, how might nanotechnology provide materials for the construction of a 'superlens'?

- Microscopy impacts most aspects of our daily activities, just how widespread is its usage, and which recently produced instrument could take microscopy into the currently underdeveloped parts of the world with a significant impact on mass disease.

Other Books by the Author

The Cell: A Very Short Introduction (With Graham Cowling, Oxford University Press 2011)

Introduction to Electron Microscopy for Biologists (Methods in Cell Biology Vol 88- Elsevier, 2008)

Further Reading

Murphy D.B. and Davison M.W. *Fundamentals of Light Microscopy and Electronic Imaging* (Wiley Blackwell 2012)

Kubitscheck U *Fluorescence Microscopy: From Principles to Biological Applications* (Wiley VCH 2013)

Blushan B *Scanning Probe Microscopy in Nanoscience and Nanotechnology* (Springer 2012)

Rogers K *The Usborne Complete Book of the Microscope* (Usborne London 2012)