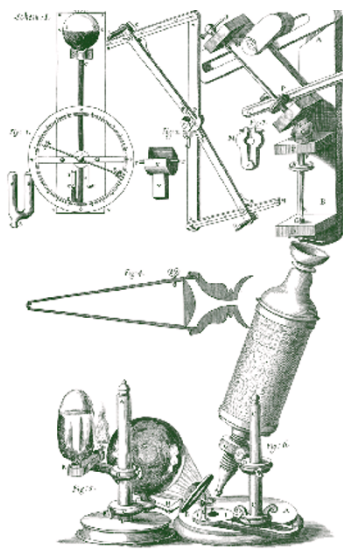


 MILESTONE 1

# The beginning

If a microscope is defined as an instrument that enables the visualization of objects or structures that are usually invisible to the naked eye, then microscopes appeared at the end of the sixteenth century. The properties of concave and convex lenses were first described around the year 1000, although magnifiers in the form of lens-shaped crystals or glass may have been used much earlier. Spectacles were invented around 1300 and became widely used across Europe.

Letters by William Borel, the Dutch envoy to the court of France, mentions the Dutch spectacle-maker Hans Jansen and his son Zacharias as inventors of the first compound microscope in 1595. Their microscope had two lenses combined in a tube in which the magnification was varied by altering the distance



Drawings of the instruments used by Robert Hooke. Image is reproduced from R. Hooke (1665).

between the lenses. However, the Jansens are not known to have published any observations through their microscope; instead, the two names associated with the origin of microscopy are Robert Hooke and Antonie van Leeuwenhoek.

Hooke's masterpiece, known widely as simply *Micrographia*, was published in 1665 and is the first book on microscopy by a scientist. At the time of *Micrographia's* publication, Robert Hooke (1638–1703) was a Fellow of the Royal Society in London, holding the position of Curator of Experiments. His refined compound microscope, described and illustrated in the preface to his book, was a forerunner of modern microscopes — equipped with a stage, a light source and three optical lenses. *Micrographia* puts forward scientific theories on many subjects, as well as containing descriptions of biological and other specimens that are accompanied by beautiful drawings made by Hooke himself. Among these are drawings of a louse and a flea, the compound eye of a fly, seeds and plant sections. He observed the porous structure of cork and famously described the pores as “cells”. Although these were not cells in the biological meaning of the word, the modern term derives from Hooke's usage. The book was enormously influential and demonstrated for the first time what microscopy could do for science.

Van Leeuwenhoek (1632–1723) was a Dutch draper with no formal scientific training, who became fascinated by the magnifying glasses used to count the threads in cloth. He learned how to grind and polish lenses and developed such techniques further. Van Leeuwenhoek made

“

... and by the help of Microscopes, there is nothing so small as to escape our inquiry...

*Robert Hooke*

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more than 500 simple microscopes, each containing a single, tiny convex lens that could resolve detail as small as 1 micrometre. He became extremely skilled in dissecting and mounting specimens and, although his microscopes were laborious to use, he was the first to describe sperm cells and life in droplets of water in the form of bacteria and protozoa. From 1673 onwards, he communicated his observations to the Royal Society in a series of letters, eventually being recognized for his careful observations when he was elected a member of the Royal Society in 1680.

The introduction of multiple lenses increased problems with spherical and chromatic aberration. Van Leeuwenhoek's simple instruments were, in fact, superior to compound microscopes such as those of Hooke, and many microscopists continued to use single lens microscopes until achromatic lenses (corrected for chromatic aberration) became widely available in the early nineteenth century.

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