Topic Page: microscope

Definition: **microscope** from *The Penguin Dictionary of Science*

A device that allows a small object to be viewed under high magnification. An **optical microscope** achieves this by passing light reflected from the object through a combination of magnifying lenses. An ➤electron microscope produces images by using electrons and electron lenses. ➤➤atomic force microscope; proton microscope; scanning tunnelling microscope; ultramicroscope.

Image from: **An optical microscope magnifies a sample (1) held...** in *Philip's Encyclopedia*

Summary Article: **microscope**
From *The Columbia Encyclopedia*

optical instrument used to increase the apparent size of an object.

Simple Microscopes

A magnifying glass, an ordinary double convex lens having a short focal length, is a simple microscope. The reading lens and hand lens are instruments of this type. When an object is placed nearer such a lens than its principal focus, i.e., within its focal length, an image is produced that is erect and larger than the original object. The image is also virtual; i.e., it cannot be projected on a screen as can a real image.

Compound Microscopes

The compound microscope consists essentially of two or more double convex lenses fixed in the two extremities of a hollow cylinder. The lower lens (nearest to the object) is called the objective; the upper lens (nearest to the eye of the observer), the eyepiece. The cylinder is mounted upright on a screw device, which permits it to be raised or lowered until the object is in focus, i.e., until a clear image is formed. When an object is in focus, a real, inverted image is formed by the lower lens at a point inside the principal focus of the upper lens. This image serves as an “object” for the upper lens which produces another image larger still (but virtual) and visible to the eye of the observer.

Computation of Magnifying Power

The magnifying power of a lens is commonly expressed in diameters. For example, if a lens magnifies an object 5 times, the magnification is said to be 5 diameters, commonly written simply “5x.” The total magnification of a compound microscope is computed by multiplying the magnifying power of the objective by the magnifying power of the eyepiece.

Development and Uses

The invention of the microscope is variously accredited to Zacharias Janssen, a Dutch spectaclemaker, c.1590, and to Galileo, who announced his invention in 1610. Others are known for their discoveries made by the use of the instrument and for their new designs and improvements, among them G. B. Amici, Nehemiah Grew, Robert Hooke, Antony van Leeuwenhoek, Marcello Malpighi, and Jan Swammerdam. The compound microscope is widely used in bacteriology, biology, and medicine in the examination of such extremely minute objects as bacteria, other unicellular organisms, and plant and animal cells and tissue—fine optical microscopes are capable of resolving objects as small as 5000 Angstroms. It has been extremely important in the development of the biological sciences and of

medicine.

Modified Compound Microscopes

The ultramicroscope is an apparatus consisting essentially of a compound microscope with an arrangement by which the material to be viewed is illuminated by a point of light placed at right angles to the plane of the objective and brought to a focus directly beneath it. This instrument is used especially in the study of Brownian movement in colloidal solutions (see colloid). The phase-contrast microscope, a modification of the compound microscope, makes transparent objects visible; it is used to study living cells. The television microscope uses ultraviolet light. Since this light is not visible, the apparatus is used with a special camera and may be connected with a television receiver on which the objects (e.g., living microorganisms) may be observed in color.

Electron Microscopes

The electron microscope, which is not limited by the powers of optical lenses and light, permits greater magnification and greater depth of focus than the optical microscope and reveals more details of structure. Instead of light rays it employs a stream of electrons controlled by electric or magnetic fields. The image may be thrown on a display screen or may be photographed. It was first developed in Germany c.1932; James Hillier and Albert Prebus, of Canada, and V. K. Zworykin, of the United States also made notable contributions to its development. The scanning electron microscope, introduced in 1966, gains even greater resolution by reading the response of the subject material rather than the direct reflection of its beam. Using a similar approach, optical scanning microscopes achieve a resolution of 400 Angstroms, less than the wavelength of the light being used. Finally, the scanning tunnelling microscope, invented in 1982, uses not a beam but an electron wave field, which by interacting with a nearby specimen is capable of imaging individual atoms; its resolution is an astounding one Angstrom.

Bibliography

See Marmasse, C. , Microscopes and Their Uses (1980).


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microscope. (2018). In P. Lagasse, & Columbia University, *The Columbia encyclopedia* (8th ed.). New York, NY: Columbia University Press. Retrieved from https://search.credoreference.com/content/topic/microscope

Chicago

"microscope." In *The Columbia Encyclopedia*, by Paul Lagasse, and Columbia University. 8th ed. Columbia University Press, 2018. https://search.credoreference.com/content/topic/microscope

Harvard

microscope. (2018). In P. Lagasse & Columbia University, *The Columbia encyclopedia*. (8th ed.). [Online]. New York: Columbia University Press. Available from: https://search.credoreference.com/content/topic/microscope [Accessed 17 November 2019].

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"microscope." *The Columbia Encyclopedia*, Paul Lagasse, and Columbia University, Columbia University Press, 8th edition, 2018. *Credo Reference*, https://search.credoreference.com/content/topic/microscope. Accessed 17 Nov. 2019.