Electron microscopy/principle

This article was checked by pedagogue

This article was checked by pedagogue, but later was changed.

This article was checked by pedagogue

This article ws checked by pedagogue, but later was changed.

Checked version of the article can be found here (https://www.wikilectures.eu/index.php?title=Electron_microscopy/principle&oldid=18586).

See also comparation of actual and checked version (https://www.wikilectures.eu/index.php?title=Electron_microscopy/principle&diff=-&oldid=18586).

Principle of electron microscopy

Electron microscopes were developed due to the limitations of light microscopes, which depend on the physics of light. Ernst Ruska understood that electron wavelengths are far shorter than light wavelengths a.,,..nd used this principle to assemble the electron microscope.

Electron microscopes use signals arising from the interaction of an electron beam with the sample to obtain information about structure, morphology and composition. Electrons are such small particles that, like photons in light, they act as waves. A beam of electrons passes through the specimen, then through a series of lenses that magnify the image. The image results from a scattering of electrons by atoms in the specimen. A heavy atom is more effective in scattering than one of low atomic number, and the presence of heavy atoms will increase the image contrast.

All EMs use electromagnetic and/or electrostatic lenses, which consist of a coil of wire wrapped around the outside of a tube, commonly referred to as a solenoid. The conventional electron microscope requires that the electron beam be in a vacuum, because electrons cannot ordinarily travel an appreciable distance in air at atmospheric pressure. The column of the electron microscope is evacuated by pumps, and the specimens and any other necessary apparatus are introduced into the vacuum by means of air locks. The EM has variable-focus lenses, and the distance between specimen and objective lens and the separation of the lenses remain constant. The magnification is determined mainly by the value of the current through the intermediate and projector lens coils. The image is focused by changing the current through the objective lens coil.

A thermionic gun is used as an electron source and the image or electron micrograph is viewed on a screen rather than an eyepiece. In addition, EMs use digital displays, computer interfaces, software for image analysis and a low vacuum or variable pressure chamber, which upholds the pressure differential between the high vacuum levels essential to the gun and column area and the low pressure required in the chamber.

The final image obtained using the EM is invariably real.

There are two types of electron microscopes, with different operating styles: the transmission electron microscope (TEM) and the scanning electron microscope (SEM). ONE SHOULD AT LEAST MENTION THE PRINCIPLE OF EACH

Sources: http://www.fei.com/introduction-to-electron-microscopy/applications/ http://scienceaid.co.uk/biology/cell/analysingcells.html http://www.microscopy.ethz.ch/ http://www.ibiology.org/ibioseminars/techniques/eva-nogales-part-1.html http://www.gizmag.com/lenless-electron-microscope/21751/ http://www.britannica.com/EBchecked/topic/183561/electron-microscope/285629/Operating-principles http://www.microscopemaster.com/electron-microscope.html http://web.utk.edu/~prack/MSE%20300/SEM.pdf