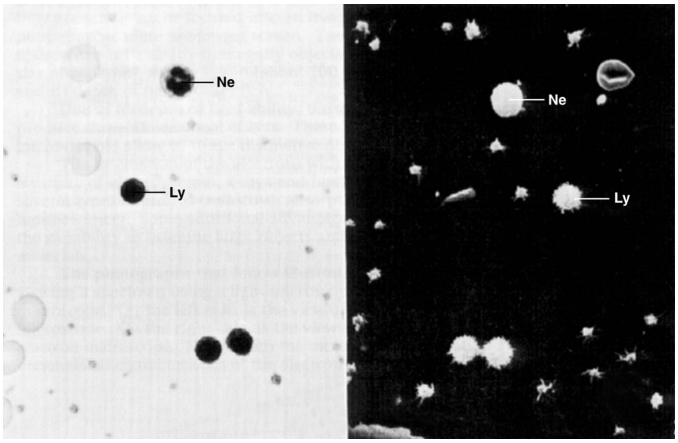
How a Scanning Electron Microscope Operates

Electron microscopes use electrons produced by a heated tungsten filament to illuminate an object. In addition, lenses (magnetic coils) are also used to speed up these electrons and focus them into a narrower beam that moves across the specimen (which is in a vacuum). A detector picks up the electrons as they are scattered or focused into an image. This image is preserved on a photographic plate or viewing screen. The obvious value of this type of microscope is its ability to magnify objects (as small as 0.1 nanometer—the size of an atom), its resolution (about 100 times better than a light microscope), and its depth of field.

Due to its depth of field ability, the scanning electron microscope is able to produce three-dimensional; effects. These 3-D photographs (electron micrographs) allow us to see distinctive depressions and elevations of an object.

The interaction of the electrons with the surface of the object can produce a variety of electron types, x-rays and luminescence. This diversity provides several types of images (reflective, absorptive, transmission, x-ray and luminescence). Some additional advantages of this type of microscope include the capability to examine large objects and the use of both living and nonliving materials.

The images that follow illustrate the striking differences between viewing a specimen using a light microscope vs. a scanning electron microscope. On the left is the view of a blood smear using a light microscope. On the right is the view of a blood smear using a scanning electron microscope. Notice both the increased magnification and the three-dimensional characteristics of the electron microscope.



References:

Alberts, B., D. Bray, J. Lewis, M. Raff, K. Roberts and J. Watson, *Molecular Biology of the Cell*, New York: Garland Publishing, 1994.

Everhart, T. E., and T. L. Hayes, "The Scanning Electron Microscope," *Scientific American*, Vol. 226, 1972, pp. 55–69.

Kessel, R. G., and C. Y. Shih, *Scanning Electron Microscopy in Biology*, Berlin: Springer-Verlag, 1976.