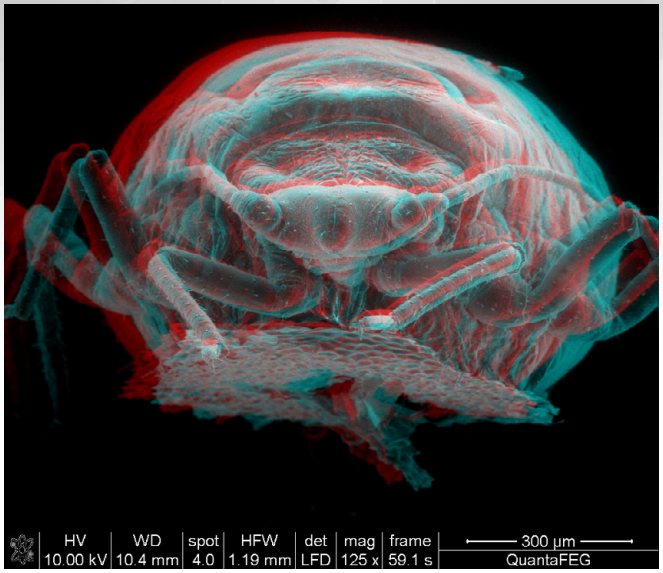
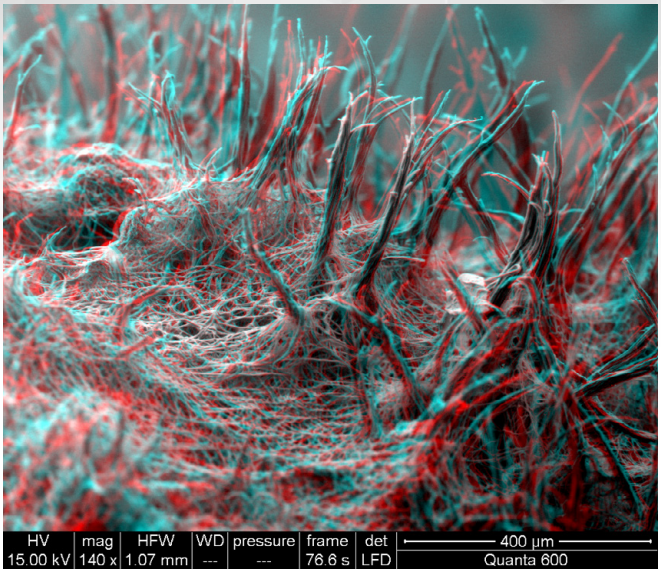
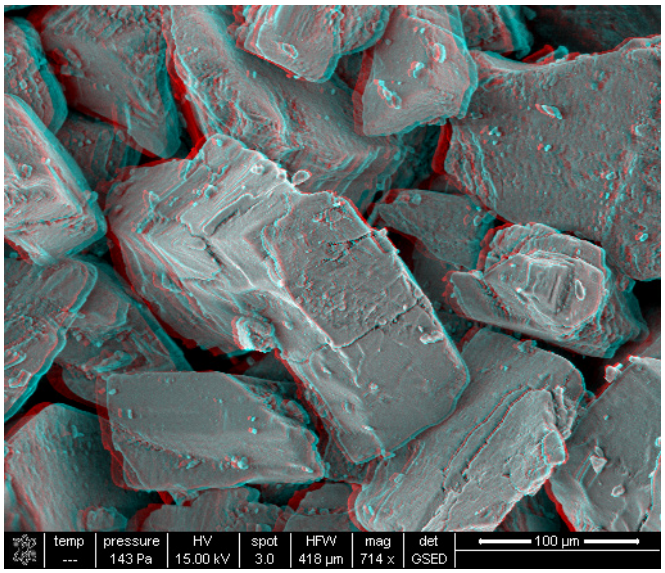
Micro-Scale World in 3D



Garden aphid. Found worldwide, aphids are among the most destructive agricultural pests in temperate regions. They damage plants by drinking their sap and by spreading plant viruses. This particular garden aphid was caught in the middle of dining on a leaf.

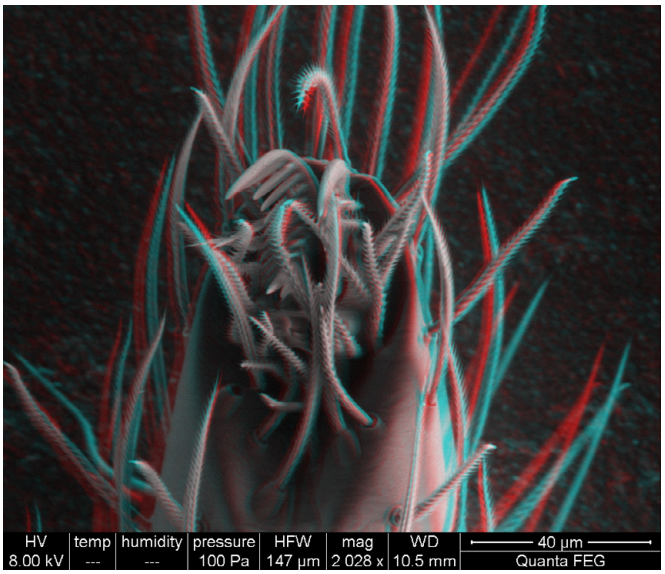


Bird's nest fungus. *Nidulariaceae*, commonly known as "bird's nest fungi," have fruiting bodies that resemble tiny birds' nests full of eggs. The fungi feed on decomposing plant matter such as decaying wood, wood chips, and bark mulch.



Graphite particles. Ever press hard when writing or drawing with a pencil and notice the pencil lead "dust"? This is actually tiny particles of graphite, such as those shown in this photo.

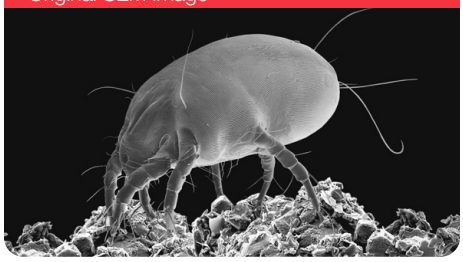
NOTE: You'll need "red/blue" 3D glasses to view these images.



Spider's "foot." The comb-like structures are claws used for capturing and holding prey, while the fuzzy, hair-like structures are used to move around on the web and are sensitive to vibrations. The leg seen here is slightly narrower than a human hair.

Why are electron microscope images in black and white?

Original SEM image



Colored SEM image

Electrons do not show color like visible light does. Therefore, images created by electron microscopes are in black and white. Researchers add color to images to provide clarity and help distinguish one structure from another.

Coloring the images also looks cool and helps them look more realistic!

All images on this page were produced by scanning electron microscopes (SEM).

Find out more at **thermofisher.com/EM**

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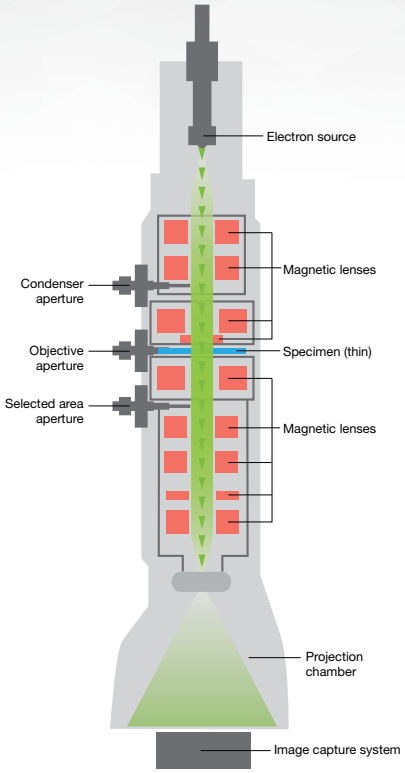
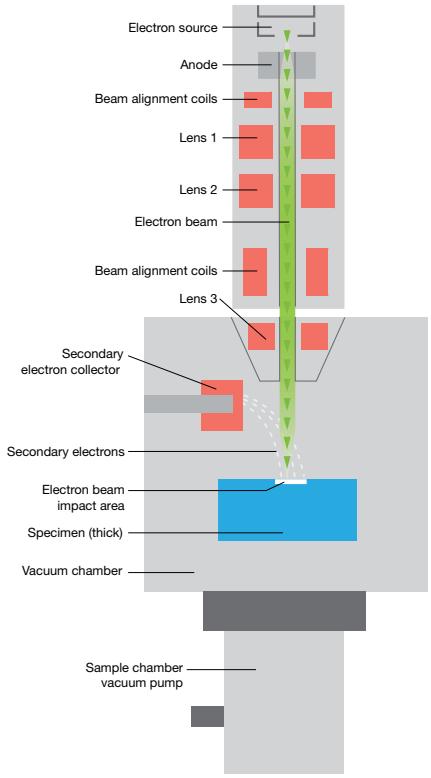
Types of Electron Microscopes

Comparison of the TEM and SEM

Transmission Electron Microscope (TEM)

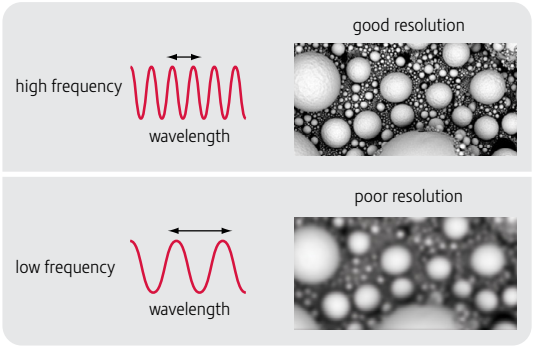


Scanning Electron Microscope (SEM)



Resolution of the Human Eye

Given sufficient light, the unaided human eye can distinguish two points 0.2 mm apart. If the points are closer together, they will appear as a single point. This distance is called the resolving power, or resolution, of the eye. A lens, or an assembly of lenses, (as in a microscope) can be used to magnify this distance and enable the eye to see points even closer together than 0.2 mm. For example, try looking at a newspaper picture, or one in a magazine, through a magnifying glass. You will see that the image is actually made up of dots too small and too close together to be separately resolved by your eye alone. The same phenomenon will be observed on an LCD computer display or flat screen TV when magnified to reveal the individual “pixels” that make up the image.



Resolution and Wavelength

When a wave passes through an opening in a barrier, such as an aperture in a lens, it is diffracted by the edges of the aperture. Even a perfectly shaped lens will be limited in its resolving power by diffraction. This is why a high quality optical lens may be referred to as a diffraction-limited lens — it is as good as it can be and any further effort to improve the quality of the lens surface will not improve its resolution. The amount of diffraction is a function of the size of the aperture and the wavelength of the light, with larger apertures and/or shorter wavelengths permitting better resolution. The wavelength of an electron in a TEM may be only a few picometers (1 pm = 1 trillionth of a meter), more than 100,000× shorter than the wavelength of visible light—about 400-700 nanometers (1 nm = 1 billionth of a meter). Unfortunately, the magnetic lenses used in electron microscopes do not approach diffraction-limited performance and so electron microscopes have been unable to take full advantage of the shorter wavelength of the electron. Ultimately, the resolving power of an electron microscope is determined by a combination of beam voltage, aperture size, and lens aberrations.

Explore the SEM simulator at myscope-explore.org

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