

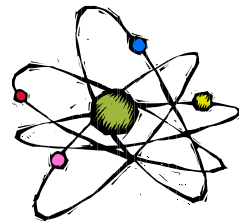
Basic Operating Principles

Scanning Electron Microscope User Training

What is a Scanning Electron Microscope?

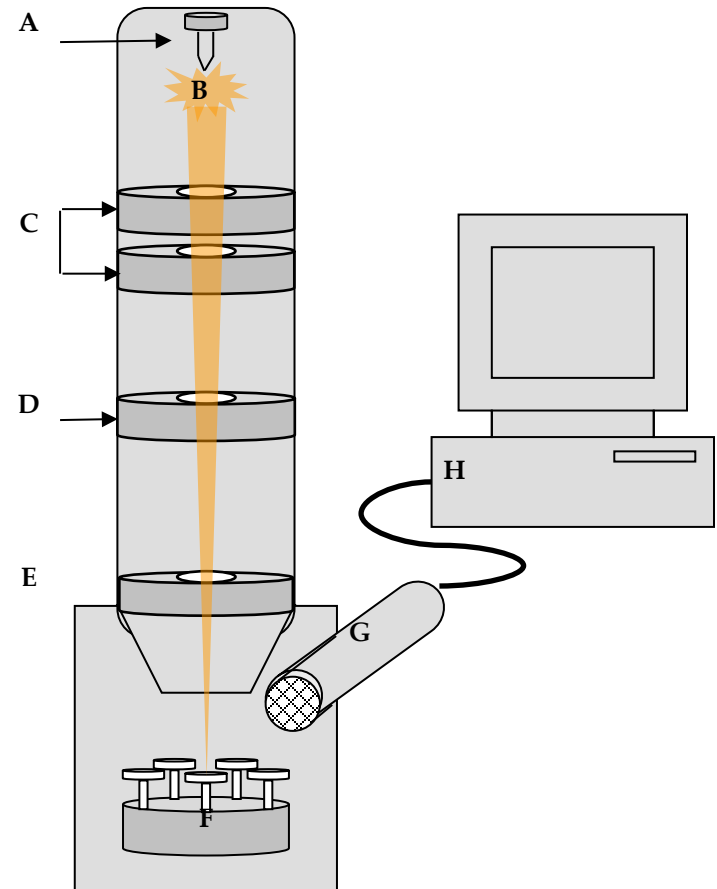
A Scanning Electron Microscope (SEM) is a microscope that:

- ❖ Uses electrons, rather than light, to create a magnified image
- ❖ Can magnify well above 100,000 times (3nm resolution)
 - light microscopes are only able to magnify approximately 1000 times
- ❖ Can be used to look at a variety of materials such as minerals, artifacts, microorganisms, and manufactured materials.



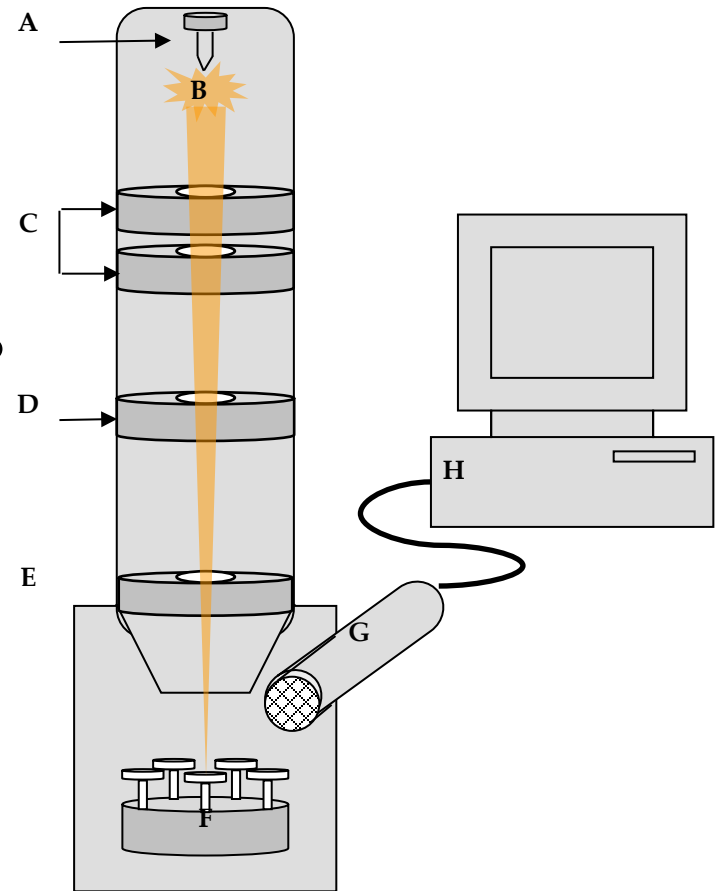
How does an SEM work?

1. Electrons are generated at the top of the microscope by a metallic filament (A)
 - This region is referred to as the electron gun.
 - The filament is very similar to what you see inside a light bulb.
2. The emitted electrons are then formed into a beam (B) and accelerated down the column toward the specimen
3. The beam is further focused and directed by electromagnetic lenses (C-E) as it moves down the column.



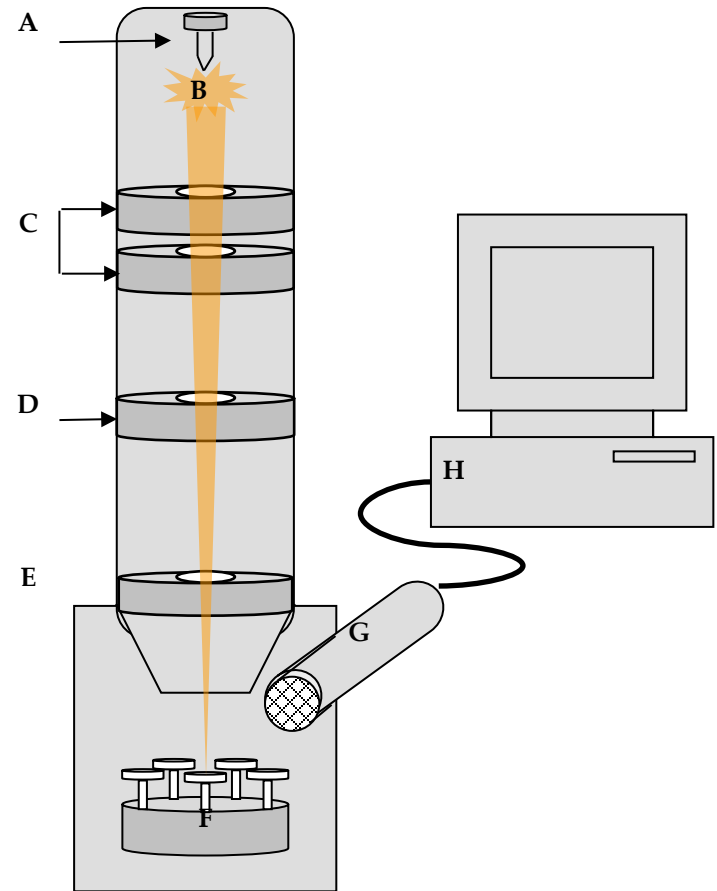
How does an SEM work?

4. When the beam reaches the specimen, electrons are knocked loose from the surface of the specimen. These electrons are referred to as secondary electrons.
5. These electrons are “seen” by a detector (G) that amplifies the signal and sends it to a monitor (H).
6. The electron beam scans back and forth across the sample building up an image from the number of electrons emitted from each spot on the sample.



How does an SEM work?

- ❖ This entire process takes place inside a vacuum. The vacuum ensures that the electron beam interacts with the sample rather than the air.
- ❖ Samples to be viewed with the SEM must be able to withstand a vacuum and need to be conductive.
- ❖ Samples that are not conductive can be coated with a thin layer of conductive material by a process called sputter coating.



Scanning Electron Microscopy at WWU



WWU owns a Tescan VEGA TS 5136MM Scanning Electron Microscope. The microscope was purchased in 2003 with funds from the WWU Student Technology Fee program. The SEM is fully PC controlled and can be remotely operated over the internet. The VEGA is designed for high and low vacuum operation. The SEM is maintained by SciTech staff.