KEY CONCEPT

1.2 Microscopes allow us to see inside the cell.

BEFORE, you learned

- Some organisms are unicellular and some are multicellular
- A microscope is necessary to study most cells
- The cell theory describes the cell as the fundamental unit of life

NOW, you will learn

- About different types of microscopes
- About prokaryotic and eukaryotic cells
- How plant and animal cells are similar and different

VOCABULARY

cell membrane p. 20
cytoplasm p. 20
nucleus p. 20
eukaryotic cell p. 20
prokaryotic cell p. 20
organelle p. 20
cell wall p. 21
chloroplast p. 23
mitochondria p. 23

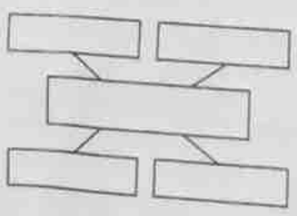
THINK ABOUT

How small are cells?

Because cells are so small, describing them requires a very small unit of measure: the micrometer (μm). A micrometer is one millionth of a meter. Most cells range in size from about 1 micrometer (some bacteria) to 1000 micrometers (some plant and animal cells). To get a sense of the sizes of cells, consider that it would take about 17,000 tiny bacterial cells lined up to reach across a dime. How many of these cells might fit on your fingertip?

The microscope is an important tool.

MAIN IDEA WEB
Make a main idea web that explains the importance of the microscope.



The invention of the light microscope led to the discovery of cells and to the development of cell theory. In light microscopes, lenses are used to bend light and make objects appear bigger than they are. Modern light microscopes can magnify objects up to 1000 times.

The light microscope is still used today to study cells. Over many years scientists have found ways to make light microscopes more useful. Cell samples are treated with dyes to make structures in the cells easier to see. Scientists use video cameras and computer processing to observe the movement of cell parts and materials within cells. One important advantage of light microscopes is that scientists can observe living cells with them.

Two other types of microscopes are important in the study of cells. The scanning electron microscope (SEM) and the transmission electron microscope (TEM) can produce images of objects as small as 0.002 micrometers. The light microscope can be used only for objects that are larger than 0.2 micrometers. Therefore, although a light microscope can be used to see many of the parts of a cell, only the SEM and TEM can be used for looking at the details of those parts.

SIMULATION
CLASSZONE.COM
View cells through different types of microscopes.

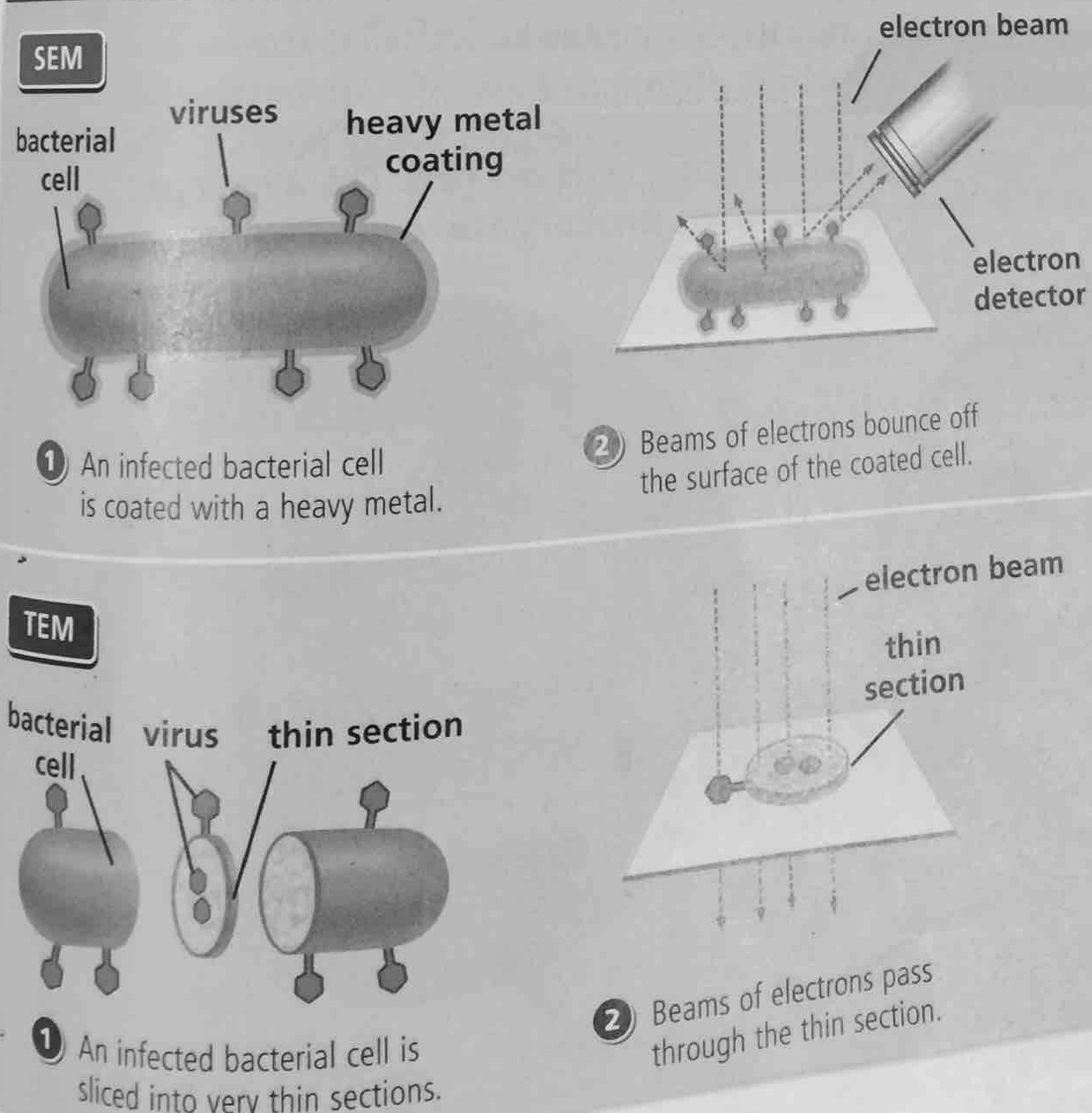
In both the SEM and the TEM, tiny particles called electrons, not light, are used to produce images. The advantage of these microscopes is that they can magnify objects up to a million times. The disadvantage is that they cannot be used to study live specimens.

CHECK YOUR READING Compare light microscopes with electron microscopes. What are the advantages and disadvantages of each?

To be viewed with an SEM, a cell sample is coated in a heavy metal, such as gold. Then a beam of electrons is run back and forth over the surface of the cell. The electrons bounce off the coating and are read by a detector that produces a three-dimensional image of the surface.

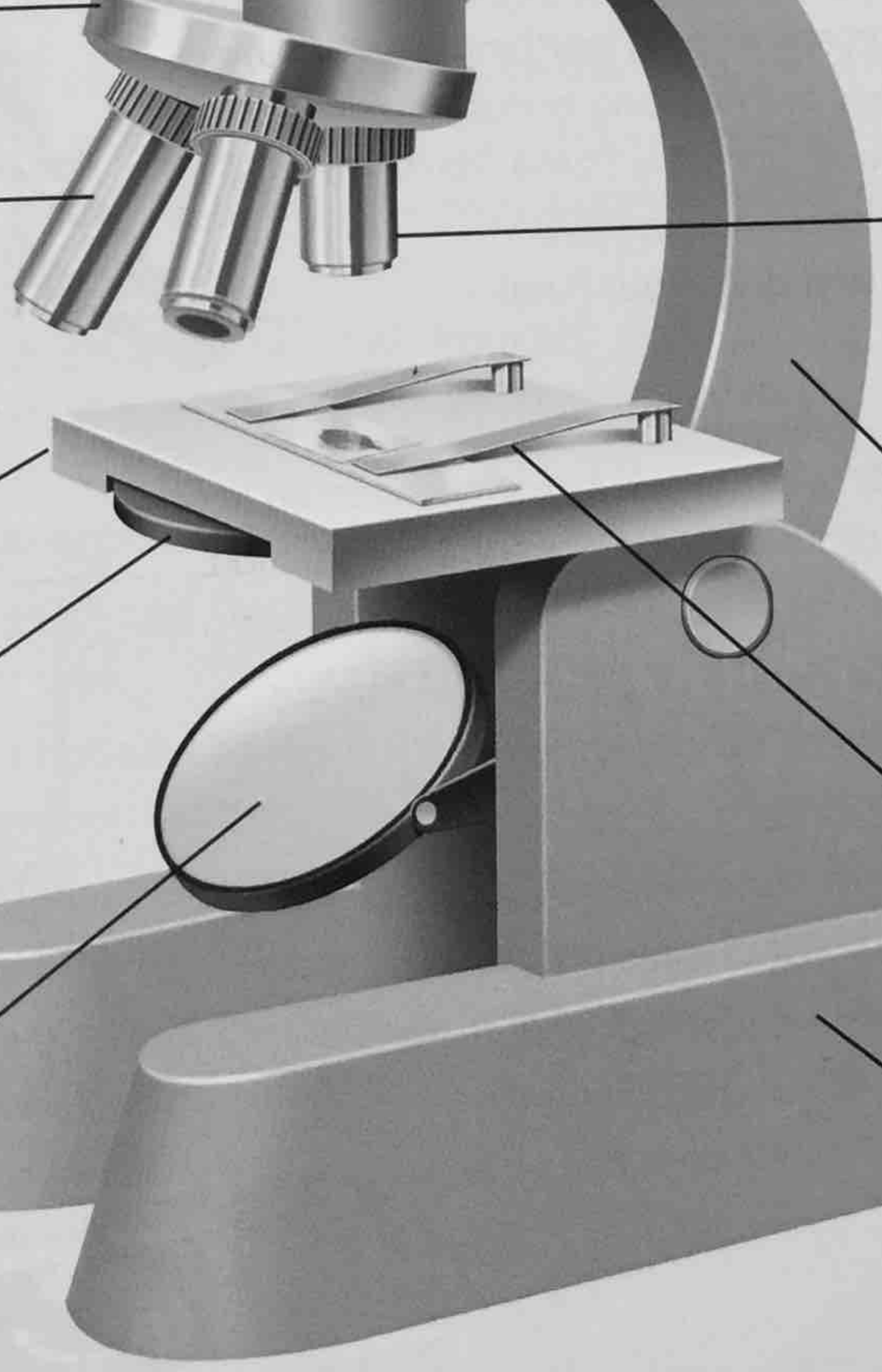
A cell viewed with a TEM is sliced extremely thin. Electrons pass through a section. Images produced by a TEM appear two-dimensional.

Electron Microscopes



Microscope

Scientists use microscopes to see very small objects that cannot easily be seen with the eye alone. A microscope magnifies the image of an object so that small details may be observed. A microscope that you may use can magnify an object 400 times—the object will appear 400 times larger than its actual size.



Eyepiece Objects are viewed through the eyepiece. The eyepiece contains a lens that commonly magnifies an image 10 times.

Body The body separates the lens in the eyepiece from the objective lenses below.

Coarse Adjustment This knob is used to focus the image of an object when it is viewed through the low-power lens.

Nosepiece The nosepiece holds the objective lenses above the stage and rotates so that all lenses may be used.

Fine Adjustment This knob is used to focus the image of an object when it is viewed through the high-power lens.

High-Power Objective Lens This is the largest lens on the nosepiece. It magnifies an image approximately 40 times.

Low-Power Objective Lens This is the smallest lens on the nosepiece. It magnifies an image approximately 10 times.

Stage The stage supports the object being viewed.

Arm The arm supports the body above the stage. Always carry a microscope by the arm and base.

Diaphragm The diaphragm is used to adjust the amount of light passing through the slide and into an objective lens.

Stage Clip The stage clip holds a slide in place on the stage.

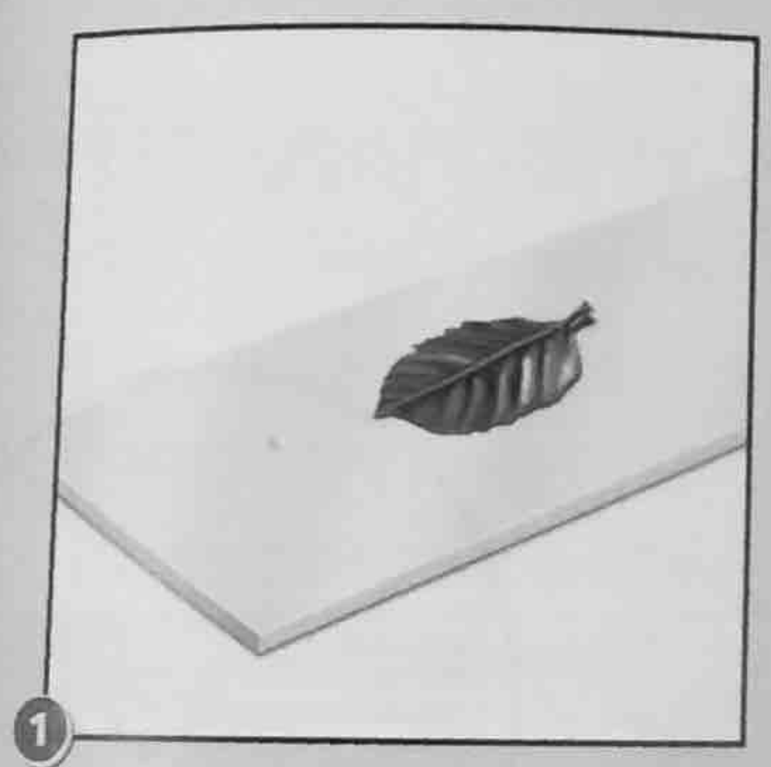
Mirror or Light Source Some microscopes use light that is reflected through the stage by a mirror. Other microscopes have their own light sources.

Base The base supports the microscope.

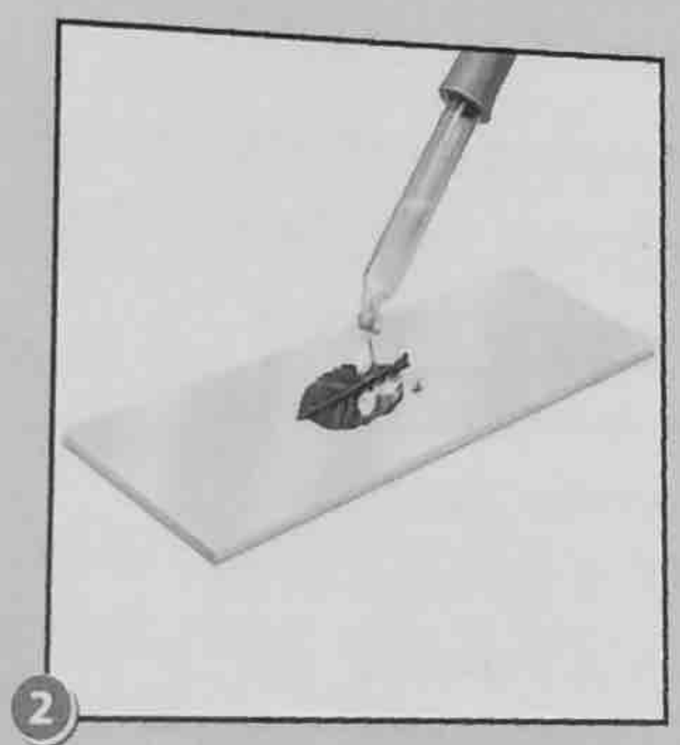
VIEWING AN OBJECT

1. Use the coarse adjustment knob to raise the body tube.
2. Adjust the diaphragm so that you can see a bright circle of light through the eyepiece.
3. Place the object or slide on the stage. Be sure that it is centered over the hole in the stage.
4. Turn the nosepiece to click the low-power lens into place.
5. Using the coarse adjustment knob, slowly lower the lens and focus on the specimen being viewed. Be sure not to touch the slide or object with the lens.
6. When switching from the low-power lens to the high-power lens, first raise the body tube with the coarse adjustment knob so that the high-power lens will not hit the slide.
7. Turn the nosepiece to click the high-power lens into place.
8. Use the fine adjustment knob to focus on the specimen being viewed. Again, be sure not to touch the slide or object with the lens.

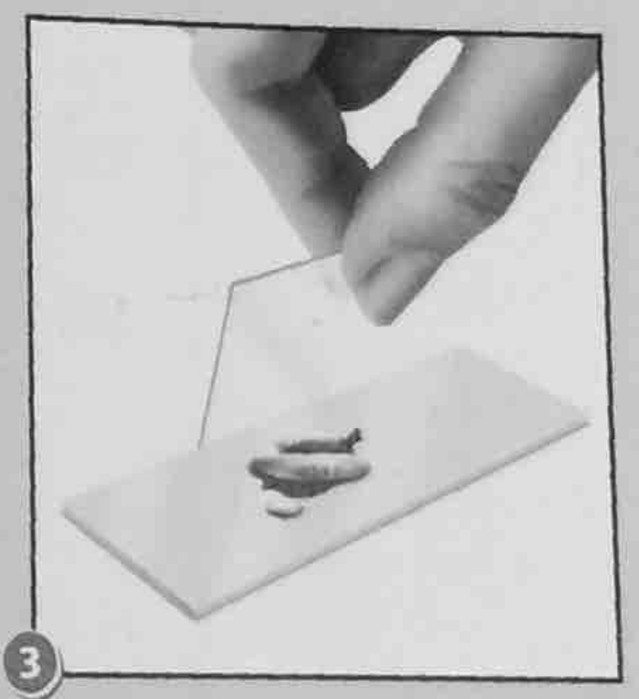
MAKING A SLIDE, OR WET MOUNT



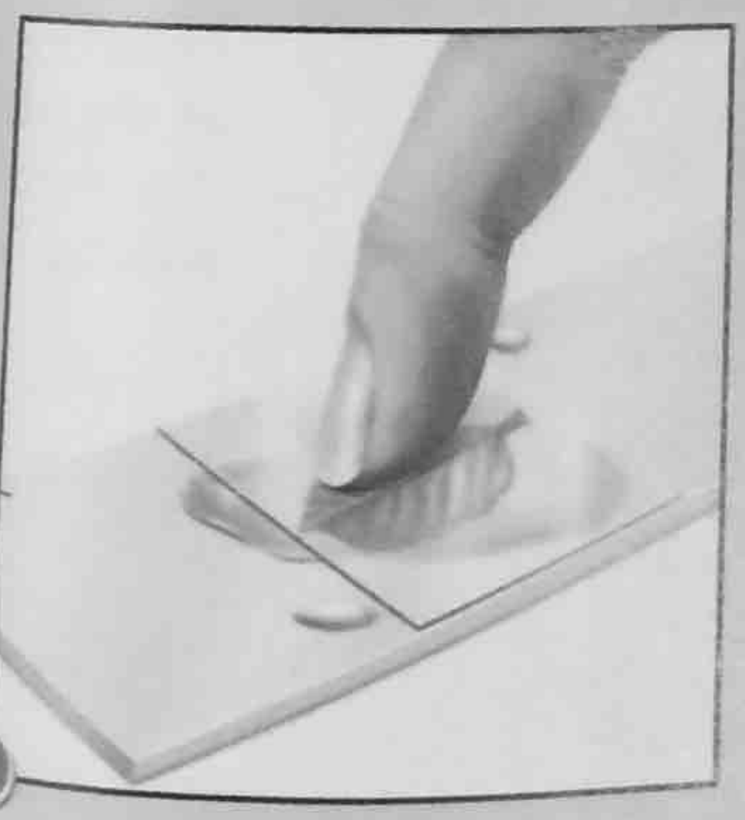
Place the specimen in the center of a clean slide.



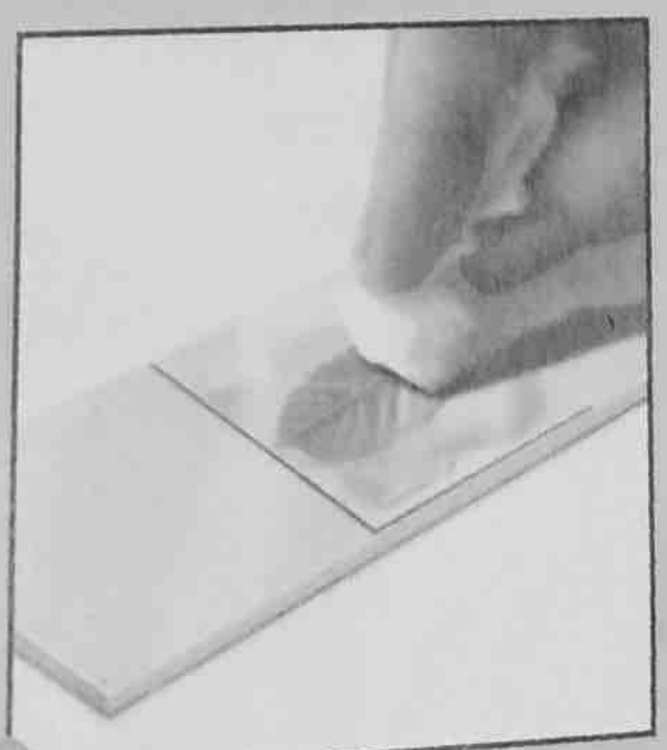
Place a drop of water on the specimen.



Place a cover slip on the slide. Put one edge of the cover slip into the drop of water and slowly lower it over the specimen.



Remove any air bubbles from under the cover slip by gently tapping the cover slip.



Dry any excess water before placing the slide on the microscope stage for viewing.