


# What Is the Cell Theory?

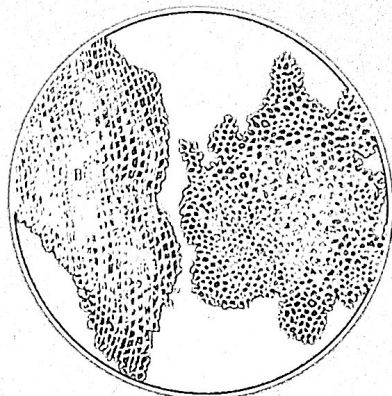
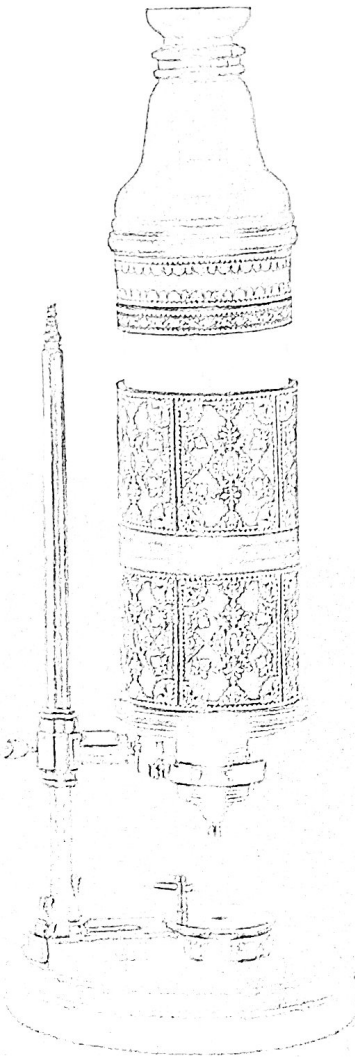
Until the 1600s, no one knew cells existed because there was no way to see them. Around 1590, the invention of the first microscope allowed people to look at very small objects. A microscope is an instrument that makes small objects look larger. Over the next 200 years, this new technology revealed cells and led to the development of the cell theory. The cell theory is a widely accepted explanation of the relationship between cells and living things.

**Seeing Cells** English scientist Robert Hooke built his own microscopes and made drawings of what he saw when he looked at the dead bark of certain oak trees. Hooke never knew the importance of what he saw. A few years later, Dutch businessman Anton van Leeuwenhoek (LAY von hook) was the first to see living cells through his microscopes.

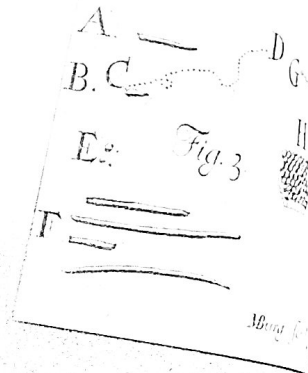
FIGURE 2

## Growth of the Cell Theory

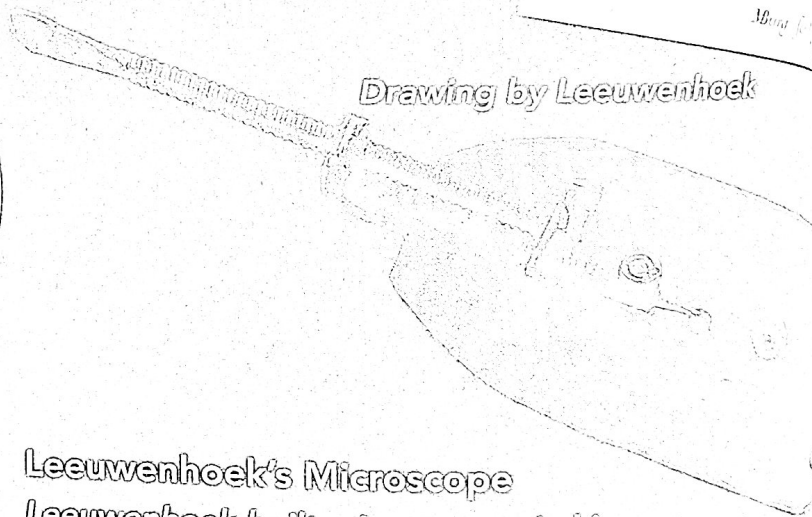
The cell theory describes how cells relate to the structure and function of living things.  Review Answer the questions in the spaces provided.



Hooke's drawing of cork



Drawing by Leeuwenhoek



## Leeuwenhoek's Microscope

Leeuwenhoek built microscopes in his spare time. Around 1674, he looked at drops of lake water, scrapings from teeth and gums, and water from rain gutters. Leeuwenhoek was surprised to find a variety of one-celled organisms. He noted that many of them whirled, hopped, or shot through water like fast fish. He called these moving organisms *animalcules*, meaning "little animals."

What did Leeuwenhoek's observations reveal?

---



---



---

## Hooke's Microscope

In 1663, Robert Hooke used his microscope to observe a thin slice of cork. Cork, the bark of the cork oak tree, is made up of cells that are no longer alive. To Hooke, the empty spaces in the cork looked like tiny rectangular rooms. Therefore, Hooke called the empty spaces cells, which means "small rooms."

What was important about Hooke's work?


---



---



---

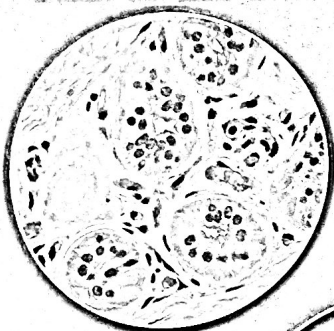
**What the Cell Theory Says** Figure 2 highlights people who made key discoveries in the early study of cells. Their work and the work of many others led to the development of the cell theory.  The cell theory states the following:

- All living things are composed of cells.
- Cells are the basic units of structure and function in living things.
- All cells are produced from other cells.

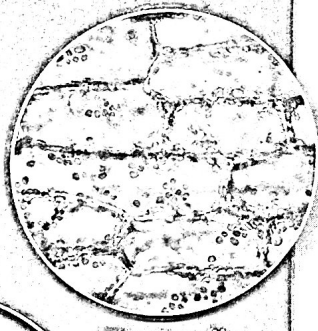
Living things differ greatly from one another, but all are made of cells. The cell theory holds true for all living things, no matter how big or how small. Because cells are common to all living things, cells can provide clues about the functions that living things perform. And because all cells come from other cells, scientists can study cells to learn about growth and reproduction.

### Schleiden, Schwann, and Virchow

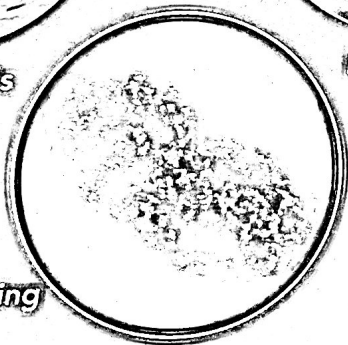
In 1838, using his own research and the research of others, Matthias Schleiden concluded that all plants are made of cells. A year later, Theodor Schwann reached the same conclusion about animals. In 1855, Rudolf Virchow proposed that new cells are formed only from cells that already exist. "All cells come from cells," wrote Virchow.



Animal cells




Plant cells



A cell reproducing

To which part of the cell theory did Virchow contribute?

 **Sequence** Fill in the circle next to the name of the person who was the first to see living cells through a microscope.

- ☐ Matthias Schleiden  
☐ Robert Hooke  
☐ Anton van Leeuwenhoek  
☐ Rudolf Virchow  
☐ Theodor Schwann



Do the Quick Lab  
Observing Cells.

### Assess Your Understanding

**1a. Relate Cause and Effect** Why would Hooke's discovery have been impossible without a microscope?

**b. Apply Concepts** Use Virchow's ideas to explain why plastic plants and stuffed animals are not alive.


got it? .....

- ☐ I get it! Now I know that the cell theory describes \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_


☐ I need extra help with \_\_\_\_\_

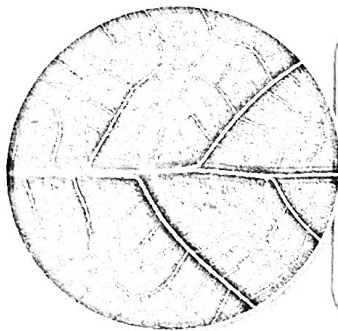
Go to **my science**  **coach** online for help with this subject.

## How Do Microscopes Work?

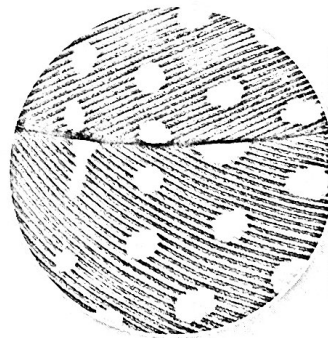
The cell theory could not have been developed without microscopes.  Some microscopes focus light through lenses to produce a magnified image, and other microscopes use beams of electrons. Both light microscopes and electron microscopes do the same job in different ways. For a microscope to be useful, it must combine two important properties—magnification and resolution.

**Magnification and Lenses** Have you ever looked at something through spilled drops of water? If so, did the object appear larger? Magnification is the condition of things appearing larger than they are. Looking through a magnifying glass has the same result. A magnifying glass consists of a convex lens, which has a center that is thicker than its edge. When light passes through a convex lens and into your eye, the image you see is magnified. Magnification changes how you can see objects and reveals details you may not have known were there, as shown in **Figure 3**.

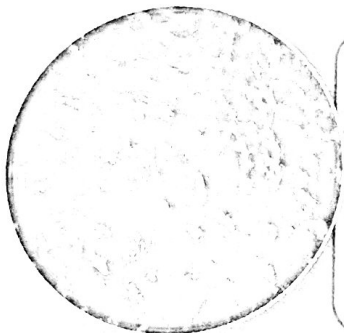
 **Vocabulary Prefixes** The prefix *magni-* means "great" or "large." Underline all the words in the paragraph at the right that you can find with this prefix.



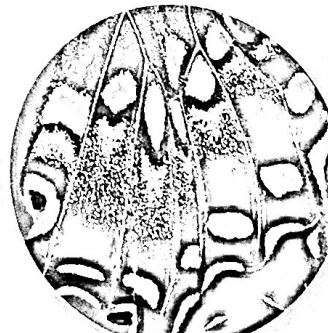
① Leaf; green  
color and  
veins



②




③

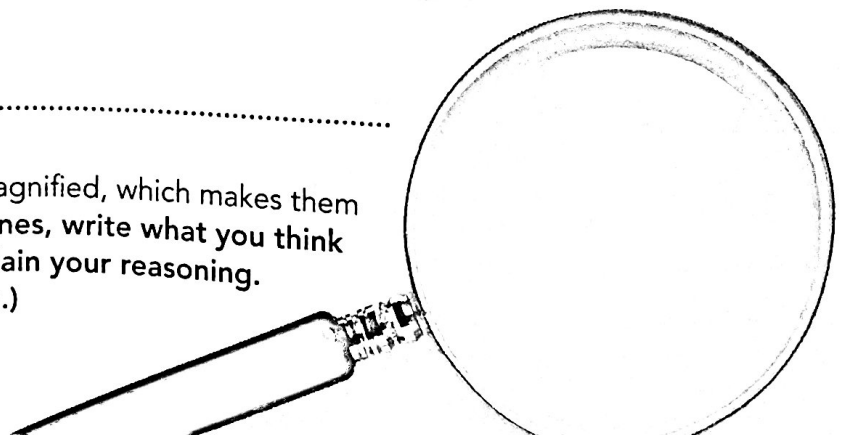


④

FIGURE 3

### Magnification

The images above have all been magnified, which makes them look unfamiliar.  **Infer** On the lines, write what you think each photograph shows, and explain your reasoning. (One answer is completed for you.)



## Magnification With a Compound Microscope


**Figure 4** shows a microscope that is similar to one you may use in your classroom. This type of instrument, called a compound microscope, magnifies the image using two lenses at once. One lens is fixed in the eyepiece. A second lens is chosen from a group of two or three lenses on the revolving nosepiece. Each of these lenses has a different magnifying power. By turning the nosepiece, you can select the lens you want. A glass slide on the stage holds the object to be viewed.

A compound microscope can magnify an object more than a single lens can. Light from a lamp (or reflecting off a mirror) passes through the object on the slide, the lower lens, and then the lens in the eyepiece. The total magnification of the object equals the magnifications of the two lenses multiplied together. For example, suppose the lower lens magnifies the object 10 times, and the eyepiece lens also magnifies the object 10 times. The total magnification of the microscope is  $10 \times 10$ , or 100 times, which is written as "100 $\times$ ."

FIGURE 4 .....

### **VIRTUAL LAB** A Compound Microscope

This microscope has a 10 $\times$  lens in the eyepiece. The revolving nosepiece holds three different lenses: 4 $\times$ , 10 $\times$ , and 40 $\times$ .

 **Complete these tasks.**

- 1. Calculate** Calculate the three total magnifications possible for this microscope.

---



---



---

- 2. Predict** What would happen if the object on the slide were too thick for light to pass through it?

---



---



---

