

3.1

Cell Theory

KEY CONCEPT Cells are the basic unit of life.

MAIN IDEAS

- Early studies led to the development of the cell theory.
- Prokaryotic cells lack a nucleus and most internal structures of eukaryotic cells.

VOCABULARY

cell theory, p. 71
cytoplasm, p. 72
organelle, p. 72

prokaryotic cell, p. 72
eukaryotic cell, p. 72



FLORIDA
STANDARDS

SC.912.L.14.1 Describe the scientific theory of cells (cell theory) and relate the history of its discovery to the process of science.

Connect You and all other organisms are made of cells. As you saw on the previous page, a cell's structure is closely related to its function. Today we know that cells are the smallest unit of living matter that can carry out all processes required for life. But before the 1600s, people had many other ideas about the basis of life. Like many breakthroughs, the discovery of cells was aided by the development of new technology—in this case, the microscope.

MAIN IDEA

Early studies led to the development of the cell theory.

TAKING NOTES

As you read, make an outline using the headings as topics. Summarize details that further explain those ideas.

I. Main Idea

A. Supporting idea

1. Detail

2. Detail

B. Supporting idea

Almost all cells are too small to see without the aid of a microscope. Although glass lenses had been used to magnify images for hundreds of years, the early lenses were not powerful enough to reveal individual cells. The invention of the compound microscope in the late 1500s was an early step toward this discovery. The Dutch eyeglass maker Zacharias Janssen, who was probably assisted by his father, Hans, usually gets credit for this invention.

A compound microscope contains two or more lenses. Total magnification, the product of the magnifying power of each individual lens, is generally much more powerful with a compound microscope than with a single lens.

Discovery of Cells

In 1665, the English scientist Robert Hooke used the three-lens compound microscope shown in **FIGURE 3.1** to examine thin slices of cork. Cork is the tough outer bark of a species of oak tree. He observed that cork is made of tiny, hollow compartments. The compartments reminded Hooke of small rooms found in a monastery, so he gave them the same name: cells. The plant cells he observed, shown in **FIGURE 3.2** (top), were dead. Hooke was looking only at cell walls and empty space.

Around the same time, Anton van Leeuwenhoek, a Dutch tradesman, was studying new methods for making lenses to examine cloth. As a result of his research, his single-lens microscopes were much more powerful than Hooke's crude compound microscope. In 1674, Leeuwenhoek became one of the first people to describe living cells when he observed numerous single-celled organisms swimming in a drop of pond water. Sketches of his "animalcules" are pictured in **FIGURE 3.2** (bottom).

FIGURE 3.1 Hooke first identified cells using this microscope. Its crude lenses severely limited the amount of detail he could see.



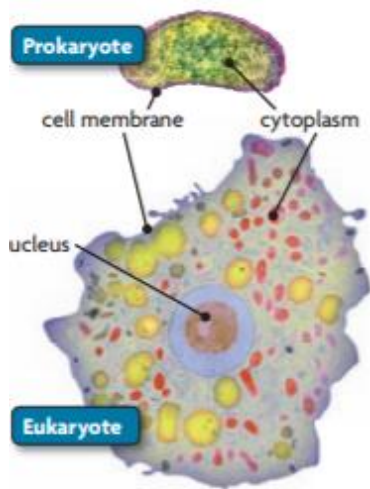


FIGURE 3.4 In prokaryotic cells, such as this bacterium (top), DNA is suspended in the cytoplasm. In eukaryotic cells, such as this protozoan (bottom), the nuclear envelope separates DNA from the cytoplasm. (colored TEMs; magnifications: protozoan 3200 \times ; bacterium 19,000 \times)

Connecting CONCEPTS

Prokaryotes You will learn more about prokaryotes in Chapter 18, which discusses their requirements to sustain life, their role in the ecosystem, and, their role in human disease.

MAIN IDEA

Prokaryotic cells lack a nucleus and most internal structures of eukaryotic cells.

The variety of cell types found in living things is staggering. Your body alone is made of trillions of cells of many different shapes, sizes, and functions. They include long, thin nerve cells that transmit sensory information, as well as short, blocky skin cells that cover and protect the body. Despite this variety, the cells in your body share many characteristics with one another and with the cells that make up every other organism. In general, cells tend to be microscopic in size and have similar building blocks. They are also enclosed by a membrane that controls the movement of materials into and out of the cell.

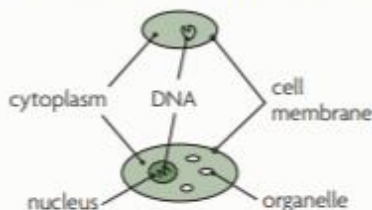
Within the membrane, a cell is filled with cytoplasm. **Cytoplasm** is a jellylike substance that contains dissolved molecular building blocks—such as proteins, nucleic acids, minerals, and ions. In some types of cells, the cytoplasm also contains **organelles**, which are structures specialized to perform distinct processes within a cell. Most organelles are surrounded by a membrane. In many cells, the largest and most visible organelle is the nucleus, which stores genetic information.

As shown in **FIGURE 3.4**, cells can be separated into two broad categories based on their internal structures: prokaryotic cells and eukaryotic cells.

- **Prokaryotic cells** (pro-KAR-ee-AHT-ihk) do not have a nucleus or other membrane-bound organelles. Instead, the cell's DNA is suspended in the cytoplasm. All prokaryotes are microscopic single-celled organisms.
- **Eukaryotic cells** (yoo-KAR-ee-AHT-ihk) have a nucleus and other membrane-bound organelles. The nucleus, the largest organelle, encloses the genetic information. Eukaryotes may be multicellular or single-celled organisms.

VISUAL VOCAB

Prokaryotic cells do not have a nucleus or other membrane-bound organelles.



Eukaryotic cells have a nucleus and other membrane-bound organelles.

A Summarize What characteristics are shared by most cells?

3.1 ASSESSMENT

SC.912.L.14.1, SC.912.L.14.3

REVIEWING MAIN IDEAS

1. How did improvements in the microscope help scientists form the **cell theory**?
2. How do **prokaryotic** and **eukaryotic cells** differ?

CRITICAL THINKING

3. **Analyze** Today, scientists can study human cells grown in petri dishes. Explain how this technique builds on the work of early scientists.
4. **Compare** In what way are cells similar to atoms?

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Connecting CONCEPTS

5. **Medicine** Suppose a certain poison kills human cells by blocking pores in the nuclear membrane. Explain why it would or would not kill bacteria.