Chapter 3 • Lesson 10

Objective: 8.L.5.1

Cells

Key Words • organism • cell • organelle • eukaryote • prokaryote • cytoplasm • nucleus • chromosome • cell membrane • ribosome • mitochondria • vacuole • chloroplast • cell wall

Getting the Idea

All **organisms**, or living things, are made up of cells. Some organisms consist of only one cell. Other organisms, including humans, are made up of trillions of cells. Cells are very small, and individual cells can be seen only under a microscope. In this lesson, you will learn about the parts of a cell and different kinds of cells.

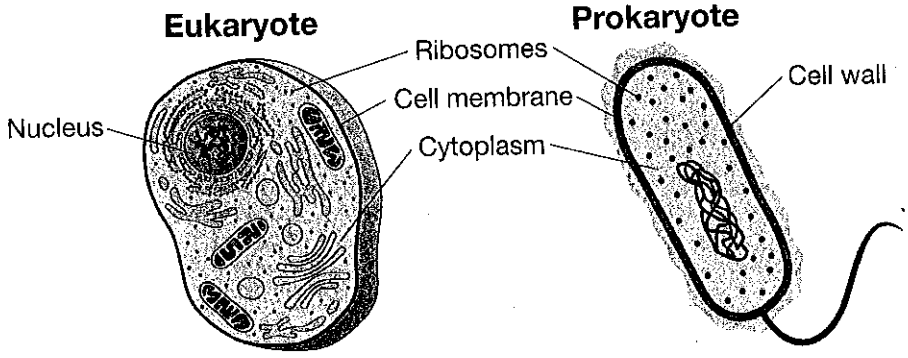
The Unit of Life

The **cell** is the basic unit of structure and function in all organisms. This means that a cell is the smallest structure that can carry out all the functions of life. These functions include growing, taking in and using food, responding to the environment, and reproducing. Cells also regulate the amount of water they contain and release waste products.

Some organisms, such as bacteria, are made up of only one cell. You will learn more about bacteria in Lesson 14. Other organisms consist of many cells working together. These include the plants and animals you see around you.

Prokaryotic and Eukaryotic Cells

There are two basic types of cells: prokaryotic and eukaryotic. These are shown below:



The diagrams above are not drawn to scale. In fact, eukaryotic cells are much larger than prokaryotic cells.

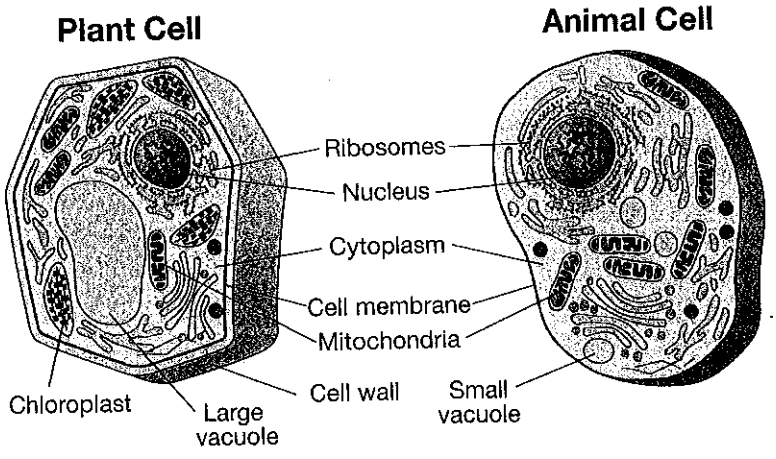
Both kinds of cells perform all the functions of life. For example, they release energy from food and get rid of wastes. But the two kinds of cells have different internal structures. A eukaryotic cell has a large structure called a nucleus, which is enclosed within a membrane. The nucleus is an **organelle**—a structure inside a cell that carries out a certain function. A eukaryotic cell also has other organelles, which you will read about in this lesson. Like the nucleus, these organelles are enclosed in membranes. Organisms whose cells have a distinct nucleus and organelles are called **eukaryotes**.

Plants, animals, protists, and fungi are all eukaryotes. Many eukaryotes consist of large numbers of cells that work together. All plants and animals, and some protists and fungi, are *multicellular*, or made up of many cells. Some protists and fungi are *unicellular*, or made up of a single cell. You will learn more about protists and fungi in Lesson 32.

Notice that the prokaryotic cell is much simpler. It does not have a nucleus. It does not have organelles enclosed in membranes. It does have structures called ribosomes, but they do not have membranes around them. Organisms whose cells lack a nucleus and membrane-bound organelles are **prokaryotes**. In prokaryotes, most of the processes of life occur in the cytoplasm. The **cytoplasm** is the fluid that fills most of the space in a cell. Almost all prokaryotes are one-celled. Bacteria are prokaryotes.

Structure of Eukaryotic Cells

The cells of eukaryotes have many specialized structures in the cytoplasm. As you have learned, this type of cell has a nucleus. The **nucleus** is a large structure inside the cell that controls many functions in the cell. The nucleus contains the cell's genetic material. This material is organized into structures called **chromosomes**. Recall that a prokaryotic cell does not have a nucleus. In these cells, the genetic material is found in the cytoplasm.



The **cell membrane** is a thin, flexible outer layer that holds the cell together and controls which materials can enter and leave the cell. **Ribosomes** are cell structures that make proteins. As shown in the diagram on page 60, prokaryotic cells also have cell membranes and ribosomes. However, prokaryotic cells do not have most of the other structures shown in the diagram above.

All cells need energy, which they get from molecules of glucose, a kind of sugar. In eukaryotes, structures called **mitochondria** (singular: *mitochondrion*) release the chemical energy stored in glucose. Mitochondria are like power plants. They take in fuel—glucose—and change it into a substance that the cell can use for energy. You will learn more about this process in Lesson 11.

Vacuoles store materials inside the cell. These saclike organelles store water, salts, proteins, and carbohydrates. Animal cells have small vacuoles. Plant cells usually have one large vacuole, which helps support the structure of the cell.

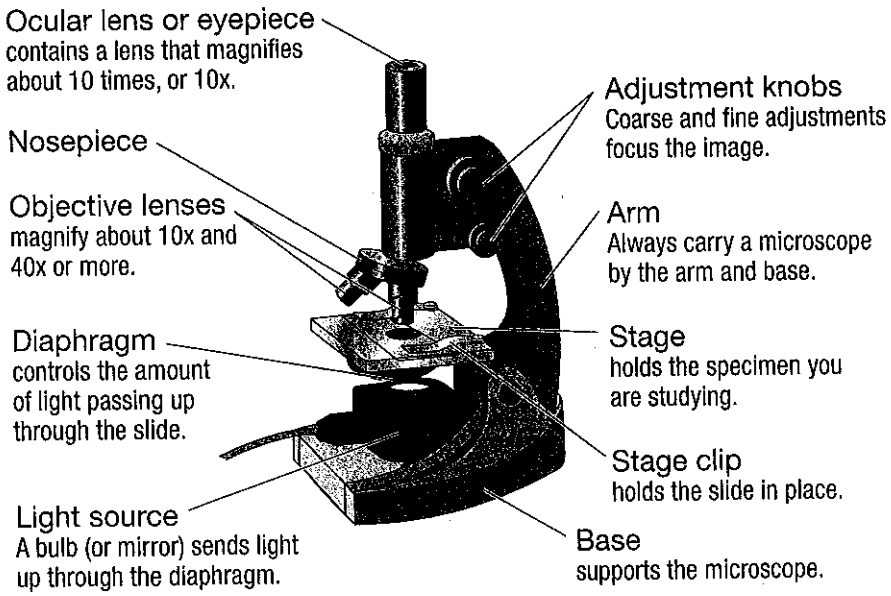
Plant cells have two structures that animal cells do not have: chloroplasts and cell walls. **Chloroplasts** are organelles that make food for the cell. Chloroplasts contain chlorophyll, a pigment that makes plants green. Chlorophyll captures energy from sunlight. In the chloroplasts, this energy is used to convert carbon dioxide and water into glucose and oxygen. In Lesson 11, you will learn more about this process.

The **cell wall** is a protective layer that surrounds the cell membrane of plant cells. The cell wall is made of a tough carbohydrate called cellulose. Because the cell wall is rigid, it supports plant cells. The cell wall allows plants to stand upright and to support heavier structures such as flowers and leaves.

Focus on Inquiry

The compound microscope is an important tool used for observing cells. A compound microscope uses two or more lenses to magnify small objects. The diagram shows and describes the main parts of a compound microscope.

Parts of a Compound Microscope



Lesson Review

1. How does a prokaryotic cell differ from a eukaryotic cell?

   A. A prokaryotic cell does not contain ribosomes.

   B. A prokaryotic cell does not contain genetic information.

   C. A prokaryotic cell does not have a cell wall.

   D. A prokaryotic cell does not have a nucleus.

2. What cell structure controls which materials enter or leave a cell?

   A. nucleus

   B. cytoplasm

   C. cell membrane

   D. vacuole

3. What is the function of mitochondria?

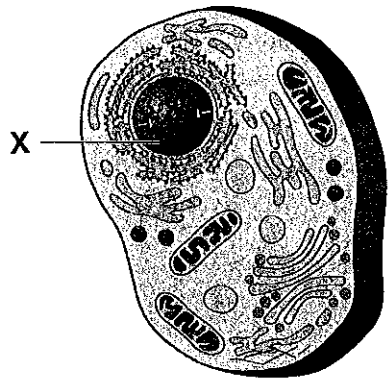
   A. to make food

   B. to make proteins

   C. to release energy

   D. to store proteins

4. A diagram of a cell is shown below.



Which of the following structures is labeled "X" on the diagram?

A. nucleus

B. mitochondrion

C. ribosome

D. vacuole