

chapter
7

Cellular Structure and Function

section 7 Structures and Organelles



Biology/Life Sciences 1.c Students know how prokaryotic cells, eukaryotic cells (including those from plants and animals), and viruses differ in complexity and general structure. **Also covers:** **Biology/Life Sciences** 1.a, 1.e, 1.f, 1.g, 1.j

● Before You Read

For cells to function correctly, each part must do its job. Members of families have jobs that help the whole family. On the lines below, list your family members and their jobs.

MAIN Idea

The eukaryotic cell contains organelles.

What You'll Learn

differences in the structures of plant and animal cells

● Read to Learn

Cytoplasm and Cytoskeleton

The environment inside the plasma membrane is a semifluid material called **cytoplasm**. Scientists once thought the organelles of eukaryotic cells floated freely in the cell's cytoplasm. As technology improved, scientists discovered more about cell structures. They discovered a structure within the cytoplasm called the cytoskeleton. The **cytoskeleton** is a network of long, thin protein fibers that provide an anchor for organelles inside the cell. The cell's shape and movement depend on the cytoskeleton.

Two types of protein fibers make up the cytoskeleton. Microtubules are long, hollow protein cylinders that form a firm skeleton for the cell. They assist in moving substances within the cell. Microfilaments are thin protein threads that help give the cell shape and enable the entire cell or parts of the cell to move.

Cell Structures

All chemical processes of a typical eukaryotic cell take place in the organelles, which move around in the cell's cytoplasm. Proteins are produced, food is transformed into energy, and wastes are processed in the organelles. Each organelle has a unique structure and function. ✓

Mark the Text

Identify the Parts Highlight each cell structure as you read about it. Underline the function of each part.

✓ Reading Check

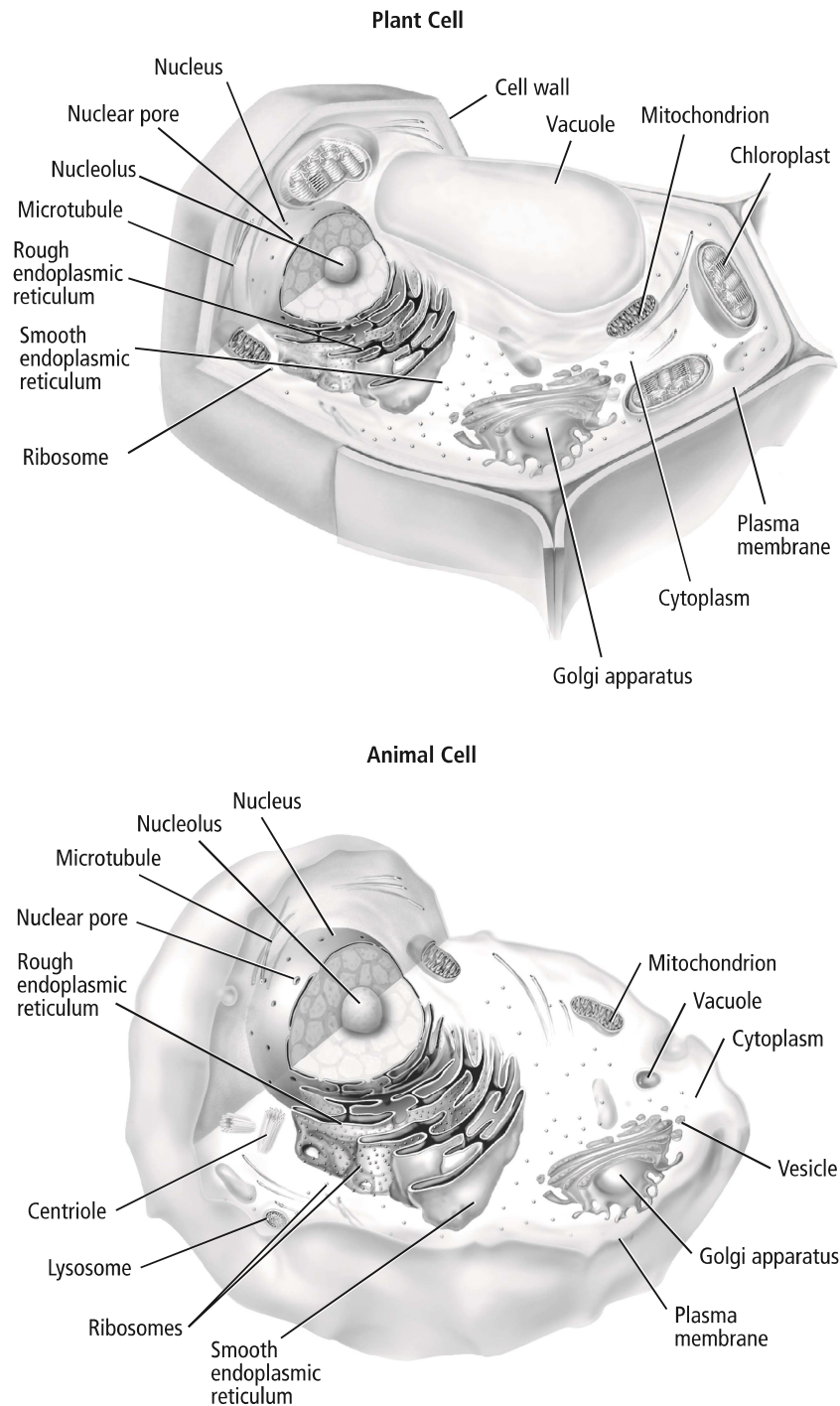
- 1. Name** one cell function that takes place in organelles.

How are plant and animal cells different?

The figure below shows a typical plant cell and a typical animal cell. Note how many organelles are found in both types of cells. Also, note a few differences, such as the chloroplast that appears only in the plant cell. Observe that the vacuole in the plant cell is much larger than the vacuole in the animal cell.

Picture This

2. Highlight the names of structures found in both plant cells and animal cells. Circle the names of structures that are found only in animal cells. Underline the names of structures that are found only in plant cells.



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What structure manages cell processes?

The nucleus is the cell's managing structure. Most of the cell's DNA is in the nucleus. DNA defines the cell and controls protein production. A nuclear envelope surrounds the nucleus. Substances pass through the nuclear envelope to move in and out of the nucleus. ✓

Which organelle produces proteins?

Ribosomes produce proteins and are made of two components—RNA and protein. Ribosomes are produced in the **nucleolus**, a structure located inside the nucleus. Some ribosomes float freely in the cytoplasm. They produce proteins that will be used by other cells. Other ribosomes attach to an organelle called the endoplasmic reticulum.

What attaches to rough endoplasmic reticulum?

The **endoplasmic reticulum**, (en duh PLAZ mihk • rih TIHK yuh lum) also called ER, is a membrane system of folded sacs and channels to which ribosomes are attached. There are two types of ER. The first type is called rough endoplasmic reticulum. This is the area where ribosomes attach to the ER's surface. The ribosomes appear to create bumps or rough places on the membrane. The second type, smooth endoplasmic reticulum, has no ribosomes attached. Smooth ER produces complex carbohydrates and lipids.

What is the purpose of the Golgi apparatus?

Once proteins are created, they move to another organelle, the Golgi (GAWL jee) apparatus. The **Golgi apparatus** modifies, sorts, and packs the proteins into sacs called vesicles. The vesicles fuse with the cell's plasma membrane. There the vesicles release the proteins, which move through the plasma membrane to the environment outside the cell.

What is stored in vacuoles?

Cells have vesicles called **vacuoles** that act as temporary storage for materials in the cytoplasm. Vacuoles can store food and other material needed by a cell. They can also store wastes. Plant cells normally have one large vacuole. Animal cells might or might not have a few small vacuoles.

What are lysosomes?

Lysosomes are vesicles that contain substances that digest excess or worn-out organelles and food particles. Lysosomes also digest bacteria and viruses that enter the cell.

✓ Reading Check

3. Explain What is the role of DNA?

What makes up a centriole?

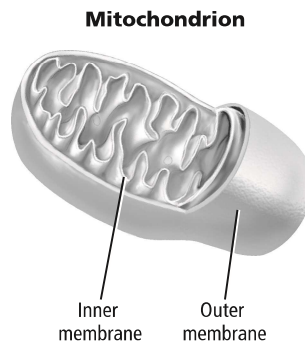
Centrioles are organelles made of microtubules that function during cell division. They usually are found near the nucleus of the cell. Plant cells do not contain centrioles.

Which organelle produces energy?

Cells need energy to survive. The organelles that convert fuel particles such as sugars into usable energy are called **mitochondria** (mi tuh KAHN dree uh). A mitochondrion has an outer membrane and an inner membrane with many folds, as shown in the figure below. The membrane provides a large surface area for breaking the bonds of sugar molecules. Energy is produced when the bonds are broken.

Picture This

4. **Explain** why the inner membrane has many folds.



How do plant and animal cells differ?

In addition to mitochondria, plant cells contain chloroplasts. **Chloroplasts** are organelles that capture light energy and convert it to chemical energy through a process called photosynthesis. Plants can use light energy from any light source—usually solar. Animal cells do not have chloroplasts and cannot use the Sun's energy as fuel for cell processes.

Plants also have cell walls. The **cell wall** is a mesh of fibers that surrounds the plasma membrane. It protects and supports the cell. Plant cell walls are made of a carbohydrate known as cellulose.

What are cilia and flagella?

Some animal cell surfaces have cilia or flagella that extend beyond the plasma membrane. **Cilia** are short projections that look like hairs. They move back and forth, similar to the motion of the oars of a rowboat. **Flagella** are longer projections that move in a whiplike motion. Both cilia and flagella are composed of microtubules. They move cells through their watery environments. Cilia also move substances along the surface of the cell.

Think it Over

5. **Recall** What is another function of microtubules?

Comparing Cells

The table below summarizes the structures of eukaryotic plant and animal cells. The function of each structure is described. Note that prokaryotic cells lack most of the organelles found in eukaryotic cells.

Picture This

6. Highlight the organelle to which ribosomes attach.

Cell Structure	Function	Present in Plant/Animal Cells
Cell wall	protects and supports plant cells	plant cells only
Centriole	important in cell division	animal cells only
Chloroplast	site where photosynthesis occurs	plant cells only
Cilia	aids in moving the cell and moving substances along the surface of the cell	some animal cells
Cytoskeleton	a framework for the cell within the cytoplasm	both
Endoplasmic reticulum (ER)	site of protein synthesis; where ribosomes attach	both
Flagellum	aids in moving and feeding the cell	some animal cells
Golgi apparatus	modifies and packages proteins for distribution outside the cell	both
Lysosome	breaks down excess or worn-out substances in the cell	animal cells only
Mitochondrion	supplies energy to the rest of the cell	both
Nucleus	directs the production of proteins and cell division	both
Plasma membrane	controls the movement of substances in and out of the cell	both
Ribosome	produces proteins	both
Vacuole	stores materials temporarily	plant cell—one large; animal cell—a few small

Organelles at Work

The structures in the cell work together to perform cell functions. The synthesis of proteins is a major cell function, which begins in the nucleus. Protein synthesis continues with the ribosomes on the rough ER and the ribosomes that float freely in the cytoplasm. Most proteins made on the rough ER are sent to the Golgi apparatus. There they are packaged in vesicles and sent to other organelles or out of the cell. Like each member of a soccer team, each cell structure has a specific task to do to make the cell function properly. ✓

Reading Check

7. Identify a major cell function.
