

## Lesson 3 Cell Structure

**You will learn that all cells have specialized parts that perform specific functions. Some of these parts are common to all cells, but there are differences between prokaryotic cells and eukaryotic cells and between plant and animal cells.**

**Organelles** are structures in the cytoplasm of eukaryotic cells. They perform all the activities necessary for the life of the cell. Each organelle has a specific structure and function.

The **nucleus** is usually the largest structure in a eukaryotic cell. It contains most of the cell's DNA.

The **endoplasmic reticulum (ER)** is an organelle that moves molecules, including proteins, from one part of the cell to another. Rough ER is covered with ribosomes. Smooth ER makes protein useable and contains enzymes to make lipids.

The **Golgi apparatus** is an organelle that takes proteins made in the ER, sorts them, and attaches carbohydrates and lipids to them. Then it repackages the proteins and sends them to other parts of the cell.

**Mitochondria** are organelles that convert glucose molecules to energy in the form of ATP, which is the cell's main energy source.

The **cell wall** is a structure in a plant cell that protects and supports the plant.

The **chloroplast** is the organelle in plant cells where photosynthesis takes place. Plants use the carbohydrates produced in the process for energy and to make other materials for the cell.

The **central vacuole** is a membrane-bound sac in a plant cell that acts as a storage area.



### GUIDED INSTRUCTION

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**DIRECTIONS** Read the following information and answer the questions.

The simplest cells alive today are bacteria and archaea, which are prokaryotes. Like all cells, prokaryotes have a cell membrane that surrounds the cytoplasm of the cell. Outside the cell membrane is a cell wall that provides structure and support. The cell walls of some bacteria are surrounded by a structure called the *capsule*. The capsule can cling to the surface of cells. It protects the bacterium from drying and from chemicals and other substances that might harm it.

The cytoplasm of the prokaryotic cell includes everything inside the cell membrane. These materials are not enclosed in membranes, so they can move freely in the cytoplasm. One of these is the cell's ribosomes. Since a bacterial cell does not have any internal compartments to surround and protect the cell's genetic material, its DNA is located near the center of the cell where it will get the

#### Guided Questions

What main parts do all bacterial cells have?

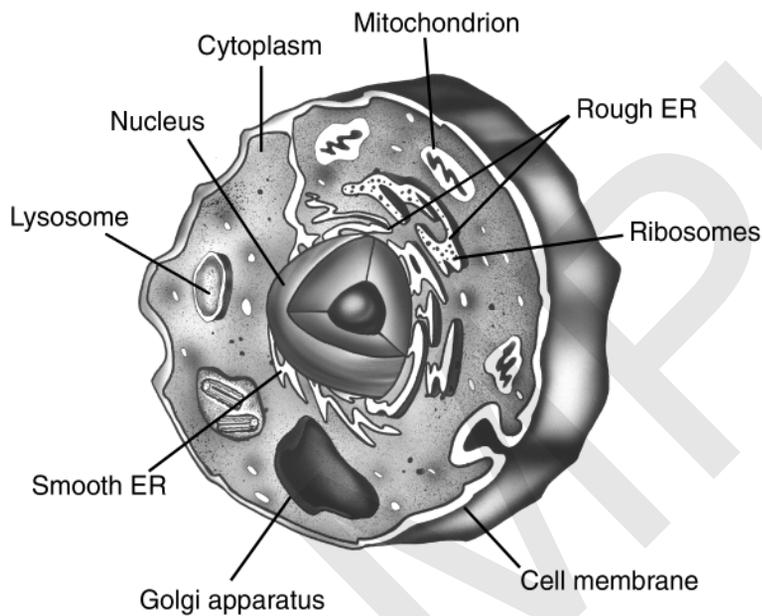
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most protection. Some prokaryotes also have flagella. These long, threadlike structures extend from the surface of the cell. The flagella rotate and enable prokaryotic cells to move.

The cells of all organisms other than prokaryotes—protists, fungi, plants, and animals—are eukaryotes. Eukaryotes differ from prokaryotes in two important ways: Their DNA is enclosed in a nucleus that is surrounded by a membrane; and eukaryotic cells have other membrane-bound parts, called organelles. An **organelle** is a structure that carries out a specific activity in a cell. The number and kinds of organelles in a cell depend on the cell's function. The diagram shows some of the common organelles in an animal cell.



**ANIMAL CELL**

As you can see in the illustration, a cell membrane surrounds the cell. It separates the cytoplasm inside the cell from the environment outside the cell. Yet all cells depend on the outside environment for nutrients and other materials they need. However, not all materials outside the cell are safe to enter it. The cell membrane protects the cell by being *selectively permeable*—that is, it controls what materials enter and leave the cell. This control keeps unwanted materials from entering the cell and maintains balance within the cell. You might think that the cell membrane is rigid, but it is fluid like a soap bubble. The cell membrane constantly breaks down and reforms during the life of the cell.

The **nucleus** is usually the largest structure in the cell. It acts as the cell's control center, directing all the activities in the cell. The nucleus is filled with a jellylike substance, and a double-layered membrane surrounds it. Holes in the membrane allow materials to enter and leave the nucleus. The nucleus contains most of the cell's DNA. The long strand of DNA coils during cell division to form chromosomes. Animal cells have one nucleus, but some cells

### Guided Questions

What are the two main differences between prokaryotes and eukaryotes?

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What determines the number and type of **organelles** in a cell?

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What does it mean that the cell membrane is selectively permeable?

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What is the function of the **nucleus**?

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have more than one. For example, fungi may have many nuclei in a single cell.

The cell's interior between the cell membrane and the nucleus is filled with cytoplasm. Cytoplasm consists of a jellylike liquid and the organelles.

Ribosomes are the cell structures on which proteins are made. They are the most common structures in all cells, but unlike organelles, they do not have a membrane. In eukaryotes, ribosomes are attached to the rough endoplasmic reticulum.

The **endoplasmic reticulum (ER)** is made of twisting and winding membranes. It carries molecules from one part of the cell to another. The ribosomes that are attached to the rough ER provide its rough appearance. The ER transports proteins that are made by the ribosomes. As each protein is made, it crosses into the ER. The part of the ER that contains the protein pinches off to form a small sac, which transports the protein throughout the cell. Smooth ER does not have ribosomes, but it breaks down complex proteins into simpler proteins that the cell can use. It also contains enzymes that make lipids.

The protein sacs move to the **Golgi apparatus**. There the proteins are sorted and carbohydrates and lipids are attached to them. Then they are enclosed in new packages that pinch off from the Golgi apparatus. The protein packages are then sent to other parts of the cell.

**Mitochondria** are large organelles found throughout the cytoplasm. They change energy from glucose molecules to ATP, the cell's main energy source. Mitochondria contain their own DNA. The number of mitochondria varies among different kinds of cells. Cells that need high levels of energy, such as heart and muscle cells, have more mitochondria than other cells that use less energy.

*Lysosomes* are small organelles found throughout the cytoplasm of the cell, except in plant cells. They contain enzymes to digest and recycle the cell's used components, such as proteins, carbohydrates, and lipids. Lysosomes also digest old and worn-out organelles and even the cell itself when it no longer works properly.

A network of tubes and filaments called the *cytoskeleton* provides a framework for the cell, much as our skeletons provide a framework for our bodies. The cytoskeleton also helps the cell move. Hollow tubes maintain the shape and size of the cell and provide tracks for the organelles to move along. *Microfilaments* are twisted, double strands of the protein actin that can contract to move the cells. Muscle cells have many microfilaments.

All the cell parts described so far, except lysosomes, can be found in animal cells as well as plant cells. If you compare the animal cell above to the plant cell shown below, you will see that there are some differences.

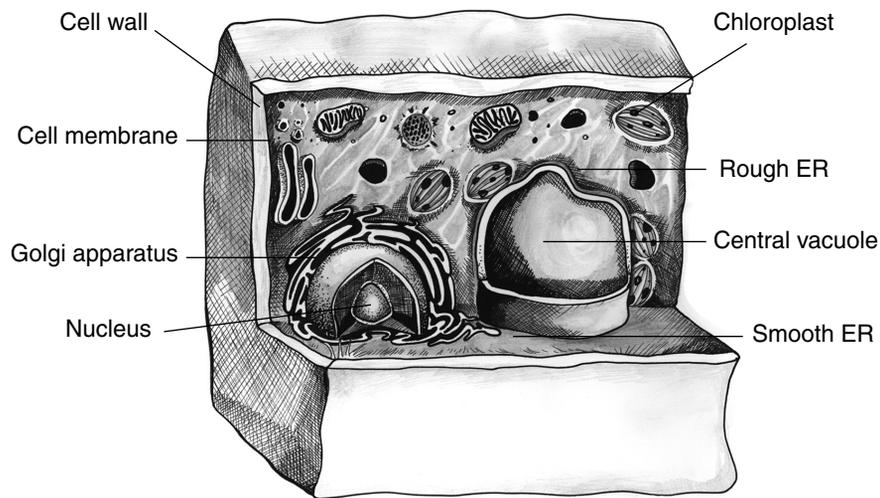
### Guided Questions

Why are ribosomes important to a cell?

What is the main function of the **endoplasmic reticulum**?

What **organelles** are responsible for converting energy for the cell?

What do lysosomes contain that enable them to break down the cell's used components?



### PLANT CELL

Plant cells have a thick **cell wall** made of cellulose. It is on the outside of the cell membrane. The cell wall supports and protects the cell.

Plant cells also have **chloroplasts**. These organelles use light energy to make carbohydrates from carbon dioxide and water in the process of photosynthesis. The plants use these carbohydrates to make other materials for the cell. Plants also use the energy stored in the carbohydrates to power the activities of the cell. Chloroplasts and mitochondria supply much of the energy needed by the cell.

The **central vacuole** is the storage area of the plant cell. It is a large, membrane-bound sac that fills up most of the plant cell. The central vacuole stores organic molecules, water, enzymes, and other materials. Some plant cells have other vacuoles that might store poisons to keep animals from eating the plant or pigments that give the plant color. When the vacuole is full, it presses the cell's internal materials against the cell wall. This pressure enables the plant to stand upright.

### Guided Questions

What three structures are found in plant cells, but not in animal cells?

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## SHORT-ANSWER QUESTIONS

**DIRECTIONS** Answer the following questions.

1. What is the advantage of having the bacterial DNA near the center of the cell?

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2. Why is the cell membrane said to be selectively permeable?

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3. What three cell parts act like an assembly line to produce and distribute proteins?

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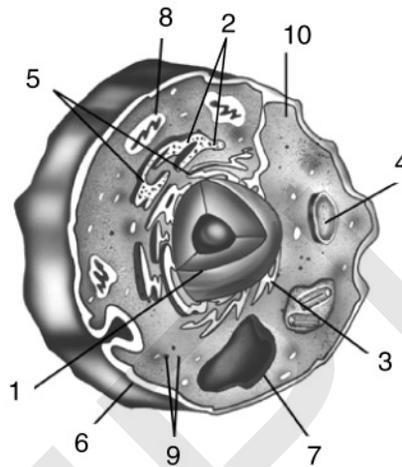
4. Which plant cell structure provides support for the cell?

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## APPLY THE TEKS

**DIRECTIONS** Read the paragraph, study the diagram, and answer the questions.

Animal cells have many different parts, which you can see in the picture. Some of these parts can also be found in plant cells and in prokaryotic cells.



1. Which numbered structure would you also find in both a plant cell and a bacterial cell? What is the name and function of this cell part?

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2. How can you tell that this cell is not a plant cell?

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3. Both structures 3 and 5 are part of the endoplasmic reticulum. How do they differ?

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4. What is the name of structure 8? Would you probably find more of these structures in a muscle cell or in a skin cell? Explain your answer.

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 STAAR PRACTICE

**DIRECTIONS** Read each question and choose the best answer.  
Then circle the letter for the correct answer.

- 1 Which of the following is not a cell organelle?
  - A Mitochondrion
  - B Cytoplasm
  - C Endoplasmic reticulum
  - D Lysosome
  
- 2 Which of the following would you find in a plant cell but not an animal cell?
  - A Cell membrane
  - B Endoplasmic reticulum
  - C Nucleus
  - D Chloroplast
  
- 3 If a cell has a very large number of ribosomes attached to its rough endoplasmic reticulum, what is the cell probably specialized to manufacture?
  - A Protein
  - B Glucose
  - C Lipids
  - D Nucleic acids
  
- 4 Which structure is selectively permeable?
  - A Nucleus
  - B Cell membrane
  - C Centriole
  - D Golgi apparatus
  
- 5 Where does the cell produce ATP?
  - A Lysosomes
  - B Ribosomes
  - C Endoplasmic reticulum
  - D Mitochondria



## CUMULATIVE REVIEW

**DIRECTIONS** Read each question and choose the best answer.  
Then circle the letter for the correct answer.

- 1 What type of organisms are prokaryotic?
- A Animals
  - B Plants
  - C Bacteria
  - D Protists
- 2 Which statement is not part of the cell theory?
- A All living organisms are composed of one or more cells.
  - B Cells come only from existing cells.
  - C All cells have a nucleus.
  - D Cells are the basic units of structure and function in an organism.
- 3 Cellulose is which type of organic compound?
- A Carbohydrate
  - B Lipid
  - C Nucleic acid
  - D Protein
- 4 Which are proteins that act as catalysts?
- A Nucleotides
  - B Disaccharides
  - C Fatty acids
  - D Enzymes