

BEFORE YOU READ

After you read this section, you should be able to answer these questions:

- What are the parts of a eukaryotic cell?
- What is the function of each part of a eukaryotic cell?

National Science Education Standards

LS 1a, 1b, 1c, 3a, 5a

What Are the Parts of a Eukaryotic Cell?

Plant cells and animal cells are two types of eukaryotic cells. A eukaryotic cell has many parts that help the cell stay alive.



Organize As you read this section, make a chart comparing plant cells and animal cells.

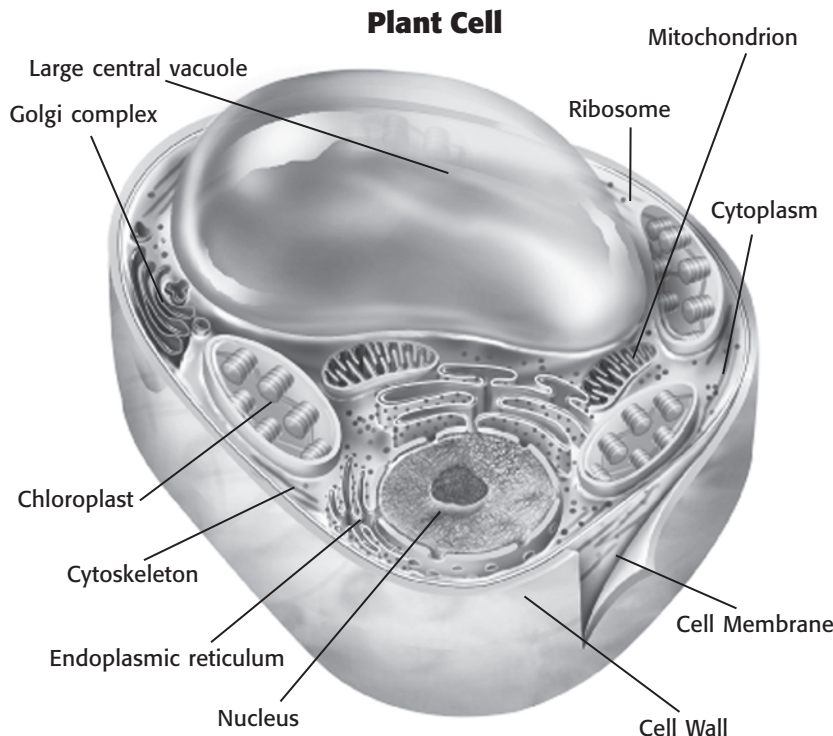
CELL WALL

All plant cells have a cell wall. The **cell wall** is a stiff structure that supports the cell and surrounds the cell membrane. The cell wall of a plant cell is made of a type of sugar called cellulose.

Fungi (singular *fungus*), such as yeasts and mushrooms, also have cell walls. The cell walls of fungi are made of a sugar called *chitin*. Prokaryotic cells such as bacteria and archaea also have cell walls. ✓



1. Identify Name two kinds of eukaryotes that have a cell wall.



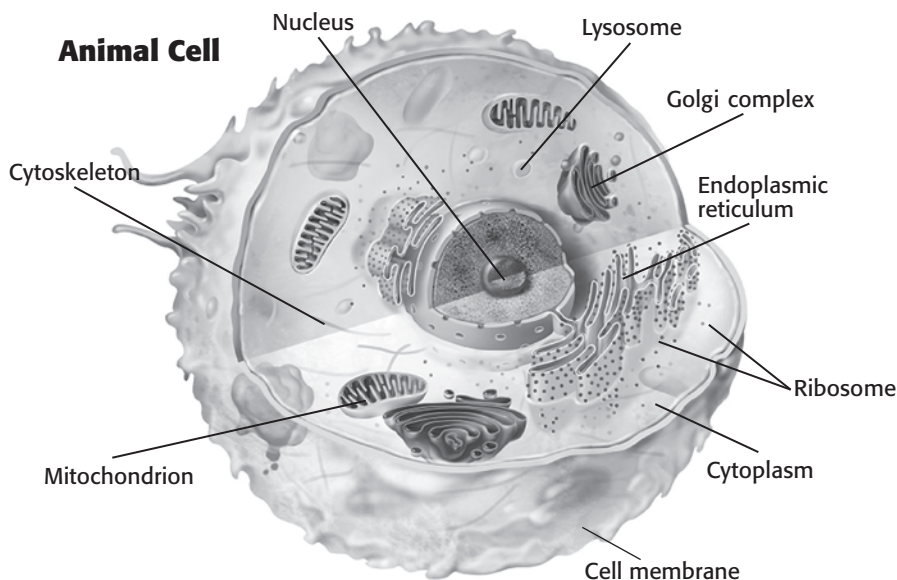
TAKE A LOOK

2. Identify Describe where the cell wall is located.

SECTION 2 Eukaryotic Cells *continued*

TAKE A LOOK

3. Compare Compare the pictures of an animal cell and a plant cell. Name three structures found in both.



STANDARDS CHECK

LS 1c Cells carry on the many functions needed to sustain life. They grow and divide, thereby producing more cells. This requires that they take in nutrients, which they use to provide energy for the work that cells do and to make the materials that a cell or an organism needs.

Word Help: function
use or purpose

4. Explain What is the main function of the cell membrane?

CELL MEMBRANE

All cells have a cell membrane. The cell membrane is a protective barrier that surrounds the cell. It separates the cell from the outside environment. In cells that have a cell wall, the cell membrane is found just inside the cell wall.

The cell membrane is made of different materials. It contains proteins, lipids, and phospholipids. Proteins are molecules made by the cell for a variety of functions. Lipids are compounds that do not dissolve in water. They include fats and cholesterol. Phospholipids are lipids that contain the element phosphorous.

The proteins and lipids in the cell membrane control the movement of materials into and out of the cell. A cell needs materials such as nutrients and water to survive and grow. Nutrients and wastes go in and out of the cell through the proteins in the cell membrane. Water can pass through the cell membrane without the help of proteins.

RIBOSOMES

Ribosomes are organelles that make proteins. They are the smallest organelles. A cell has many ribosomes. Some float freely in the cytoplasm. Others are attached to membranes or to other organelles. Unlike most organelles, ribosomes are not covered by a membrane. ✓

READING CHECK

5. Compare How are ribosomes different from other organelles?

SECTION 2 Eukaryotic Cells *continued*



Ribosome

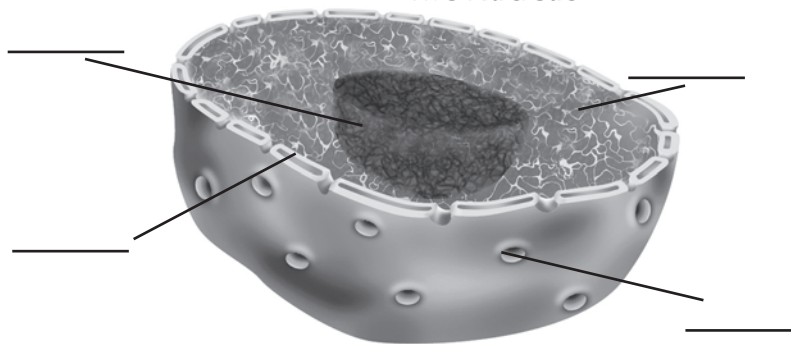
This organelle is where amino acids are hooked together to make proteins.

NUCLEUS

The nucleus is a large organelle in a eukaryotic cell. It contains the cell's genetic material, or DNA. DNA has the instructions that tell a cell how to make proteins.

The nucleus is covered by two membranes. Materials pass through pores in the double membrane. The nucleus of many cells has a dark area called the *nucleolus*.

The Nucleus



TAKE A LOOK

6. Identify Label the diagram of a nucleus using these terms: pore, DNA, nucleolus, double membrane.

ENDOPLASMIC RETICULUM

Many chemical reactions take place in the cell. Many of these reactions happen on or inside the endoplasmic reticulum. The **endoplasmic reticulum** (ER) is a system of membranes with many folds in which proteins, lipids, and other materials are made.

The ER is also part of the cell's delivery system. Its folds have many tubes and passageways. Materials move through the ER to other parts of the cell.

There are two types of ER: rough and smooth. Smooth ER makes lipids and helps break down materials that could damage the cell. Rough ER has ribosomes attached to it. The ribosomes make proteins. The proteins are then delivered to other parts of the cell by the ER. ✓



Endoplasmic reticulum

This organelle makes lipids, breaks down drugs and other substances, and packages proteins for the Golgi complex.

READING CHECK

7. Compare What is the difference between smooth ER and rough ER?

SECTION 2 Eukaryotic Cells *continued*

MITOCHONDRIA

A **mitochondrion** (plural, *mitochondria*) is the organelle in which sugar is broken down to make energy. It is the main power source for a cell.

A mitochondrion is covered by two membranes. Most of a cell's energy is made in the inside membrane. Energy released by mitochondria is stored in a molecule called ATP. The cell uses ATP to do work.

Mitochondria are about the same size as some bacteria. Like bacteria, mitochondria have their own DNA. The DNA in mitochondria is different from the cell's DNA. ✓

READING CHECK

8. Compare How are mitochondria like bacteria?

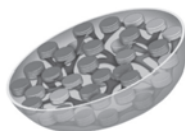


Mitochondrion
This organelle breaks down food molecules to make ATP.

CHLOROPLASTS

Plants and algae have chloroplasts in some of their cells. *Chloroplasts* are organelles in which photosynthesis takes place. *Photosynthesis* is a process by which plants use sunlight, carbon dioxide, and water to make sugar and oxygen. Animal cells do not have chloroplasts.

Chloroplasts are green because they contain a green molecule called *chlorophyll*. Chlorophyll traps the energy of sunlight. Mitochondria then use the sugar made in photosynthesis to make ATP.



Chloroplast
This organelle uses the energy of sunlight to make food.

Critical Thinking

9. Infer Why don't animal cells need chloroplasts?

CYTOSKELETON

The cytoskeleton is a web of proteins inside the cell. It acts as both a skeleton and a muscle. The cytoskeleton helps the cell keep its shape. It also helps some cells, such as bacteria, to move.

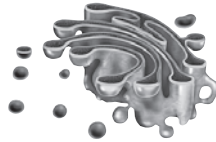
VESICLES

A **vesicle** is a small sac that surrounds material to be moved. The vesicle moves material to other areas of the cell or into or out of the cell. All eukaryotic cells have vesicles.

SECTION 2 Eukaryotic Cells *continued***GOLGI COMPLEX**

The **Golgi complex** is the organelle that packages and distributes proteins. It is the “post office” of the cell. The Golgi complex looks like the smooth ER.

The ER delivers lipids and proteins to the Golgi complex. The Golgi complex can change the lipids and proteins to do different jobs. The final products are then enclosed in a piece of the Golgi complex’s membrane. This membrane pinches off to form a vesicle. The vesicle transports the materials to other parts of the cell or out of the cell. ✓

**Golgi complex**

This organelle processes and transports proteins and other materials out of cell.

LYSOSOMES

Lysosomes are organelles that contain digestive enzymes. The enzymes destroy worn-out or damaged organelles, wastes, and invading particles.

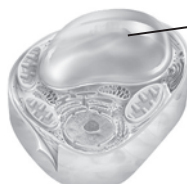
Lysosomes are found mainly in animal cells. The cell wraps itself around a particle and encloses it in a vesicle. Lysosomes bump into the vesicle and pour enzymes into it. The enzymes break down the particles inside the vesicle. Without lysosomes, old or dangerous materials could build up and damage or kill the cell.

**Lysosome**

This organelle digests food particles, wastes, cell parts, and foreign invaders.

VACUOLES

A vacuole is a vesicle. In plant and fungal cells, some vacuoles act like lysosomes. They contain enzymes that help a cell digest particles. The large central vacuole in plant cells stores water and other liquids. Large vacuoles full of water help support the cell. Some plants wilt when their vacuoles lose water. ✓

**Large central vacuole**

This organelle stores water and other materials.

READING CHECK

10. Define What is the function of the Golgi complex?

READING CHECK

11. Identify Vacuoles are found in what types of eukaryotic cells?

Section 2 Review

NSES LS 1a, 1b, 1c, 3a, 5a

SECTION VOCABULARY

cell wall a rigid structure that surrounds the cell membrane and provides support to the cell

endoplasmic reticulum a system of membranes that is found in a cell's cytoplasm and that assists in the production, processing, and transport of proteins and in the production of lipids

Golgi complex cell organelle that helps make and package materials to be transported out of the cell

lysosome a cell organelle that contains digestive enzymes

mitochondrion in eukaryotic cells, the cell organelle that is surrounded by two membranes and that is the site of cellular respiration

ribosome cell organelle composed of RNA and protein; the site of protein synthesis

vesicle a small cavity or sac that contains materials in a eukaryotic cell

1. Compare Name three parts of a plant cell that are not found in an animal cell.

2. Explain How does a cell get water and nutrients?

3. Explain What would happen to an animal cell if it had no lysosomes?

4. Apply Concepts Which kind of cell in the human body do you think would have more mitochondria—a muscle cell or a skin cell? Explain.

5. List What are two functions of the cytoskeleton?

Cells, Heredity, and Classification Answer Key

Chapter 1 Cells: The Basic Units of Life

SECTION 1 THE DIVERSITY OF CELLS

1. a cell
2. Bacteria—bacterial cells are usually smaller than other cells.
3. cell membrane, genetic material, organelles
4. DNA carries information on how to make proteins, new cells, and new organisms.
5. Clockwise from left: cell membrane, organelles, DNA
6. A eukaryotic cell has a nucleus; a prokaryotic cell does not.
7. Many bacteria are helpful. Only some bacteria can make you sick.
8. Left to right: DNA, flagellum, cell membrane, cell wall
9. Cell walls are made of different materials; many archaea can live in places no other organisms can live.
10. a nucleus, membrane-bound organelles
11. in the nucleus
12. Cells are usually small because then they have enough surface area for nutrients and wastes to pass in and out of them. Because a yolk doesn't need to take in nutrients, it can be larger than most cells.
13. 11:8
14. a smaller cell

Review

1. All living things are made of cells. The cell is the basic unit of all living things. All cells come from other cells.
2. Prokaryotes: Cells have no nuclei; cells have no membrane-bound organelles; cells are smaller than eukaryotic cells; all are single-celled.
Eukaryotes: Cells have nuclei; cells have membrane-bound organelles; cells are larger than prokaryotic cells; organisms may be single-celled or multi-celled.
Both: Organisms are made of cells.
3. It is probably archaea, because it has no nucleus like a prokaryote and can live at high temperatures like some archaea.

SECTION 2 EUKARYOTIC CELLS

1. plants and fungi.
2. outside the cell membrane
3. nucleus, mitochondria, endoplasmic reticulum
4. To control what moves in and out of the cell. It lets nutrients and water in and lets wastes out.
5. They don't have a membrane.
6. Clockwise from top left: nucleolus, DNA, pore, nuclear membrane
7. Smooth ER makes lipids and breaks down harmful materials. Rough ER has ribosomes that make proteins.
8. They have their own DNA.
9. Chloroplasts are used in photosynthesis. Animal cells don't make their own food.
10. Package and distribute proteins.
11. cells of plants and fungi

Review

1. large central vacuole, chloroplasts, cell wall
2. Water can pass through the cell membrane into the cell. Nutrients enter the cell through proteins in the membrane.
3. The cell couldn't break down materials. Old cell parts and dangerous materials would build up and could damage or kill the cell.
4. A muscle cell—mitochondria make energy for a cell. A muscle cell would use more energy than a skin cell.
5. structure, movement

SECTION 3 THE ORGANIZATION OF LIVING THINGS

1. anything that can perform life processes by itself
2. In general, a large animal has fewer predators.
3. cells, tissues, organs, organ systems
4. Eukaryotic—each cell has a nucleus.
5. No, prokaryotes have only one cell. Tissues are made of groups of cells.

Review

1. Multicellular organisms are larger and don't have as many predators. They typically live longer than single-celled organisms. Cells in a multicellular organism are specialized, so they function more efficiently.