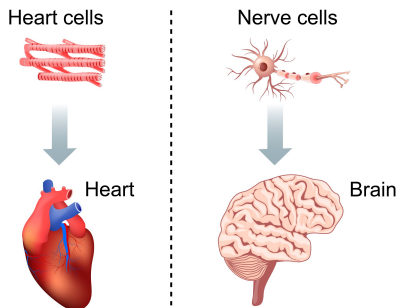
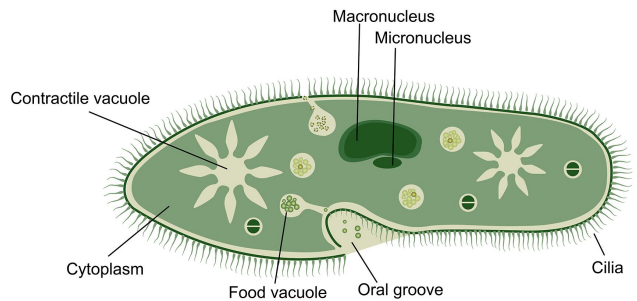
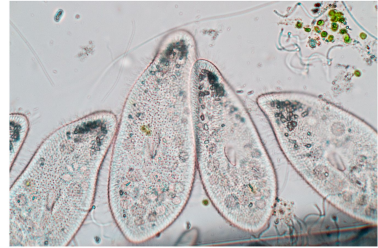


## Reflect

Cells are the basic units of living things. Single-celled organisms contain all the functions necessary for life within one cell. Paramecia are single-celled microscopic organisms that live in ponds. They swim through the water by waving their cilia, which are small, hairlike structures that are spread out across their cell membrane. Genetic information is stored in their DNA for replicating new paramecia. Their ribosomes make proteins necessary for cell growth. Although there are differences between different types of cells, all cells—both in unicellular and multicellular organisms—have DNA, a cell membrane, and ribosomes.

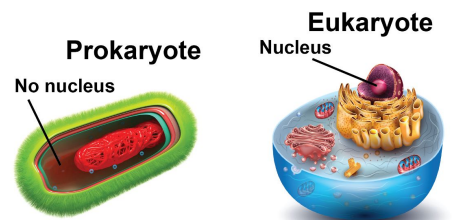
### Paramecia



Multicellular organisms such as plants and animals have developed a variety of cells within their bodies that carry out specific functions. Specialized cells work together to form tissues that make up organs such as the heart and brain. Organs work together in organ systems such as the circulatory system and nervous system.

## Prokaryotic and Eukaryotic Cells

Scientists divide organisms into two main groups based on their cell structure. Cells that have DNA that is not inside a nucleus and that do not have any membrane-bound **organelles** are called prokaryotes (bacteria). Cells that do enclose the DNA inside a nucleus and have other membrane-bound organelles are called eukaryotes.



## Organelles carry out special functions in eukaryotes.

Just as the body has organs that carry out different functions, each cell in the body has special structures that carry out particular functions. These structures are called organelles. Each organelle is surrounded by a membrane. The membrane keeps it separate from other cell components. An organelle performs a specific function to help meet the basic needs of the cell. Together, the sum of these contributions ensures the survival of the cell.

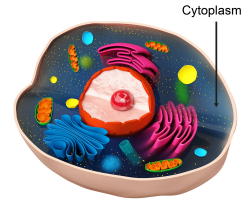
**organelle** – a membrane-bound structure inside a cell that performs a specialized function

## Look Out!



Not all cells contain organelles. Eukaryotic cells contain membrane-bound organelles; prokaryotic cells, such as the bacterium on the left, do not. However, all cells have a cell membrane that surrounds the cytoplasm. The *cytoplasm*

is a dense, gel-like liquid that contains all the structures needed for the basic life functions of the cell. In prokaryotes, these components are not separated into organelles but coexist in the cytoplasm. Cells must take in substances from their environment and use them to perform basic functions of life, including growth, repair, and reproduction. The cytoplasm provides a site for chemical processes to perform these life functions. In eukaryotic cells, some of these processes occur inside the organelles, which are located in the cytoplasm. However, because each organelle has a membrane that surrounds and defines it, these organelles are separate from the cytoplasm.



## Reflect

### Cell Membrane and Cell Wall

All cells have a cell membrane that surrounds the cytoplasm, holds the cell together, and acts as a boundary between the cytoplasm and the external environment. Only certain substances can enter and leave the cell through this membrane. Plants, bacteria, algae, fungi, and some archaea have an added layer called a cell wall for protection and structure. Animals and protozoa do *not* have cell walls.

Organelle	Function	Diagram
Cell membrane	Barrier/ gatekeeper	
Cell wall	Protects	

### Nucleus and DNA

In eukaryotes, the cell nucleus is an organelle found near the center of the cell that acts as a control center for the cell. Chromosomes, which contain DNA, are located inside the nucleus. The genetic information in DNA directs the main functions of the cell, including protein synthesis, reproduction, and heredity. A nuclear membrane allows movement in and out of the nucleus. In prokaryotes, a single circular strand of DNA floats in the cytoplasm.

Organelle	Function	Diagram
Nucleus with nuclear membrane	Control center; holds DNA	
DNA	Genetic code	

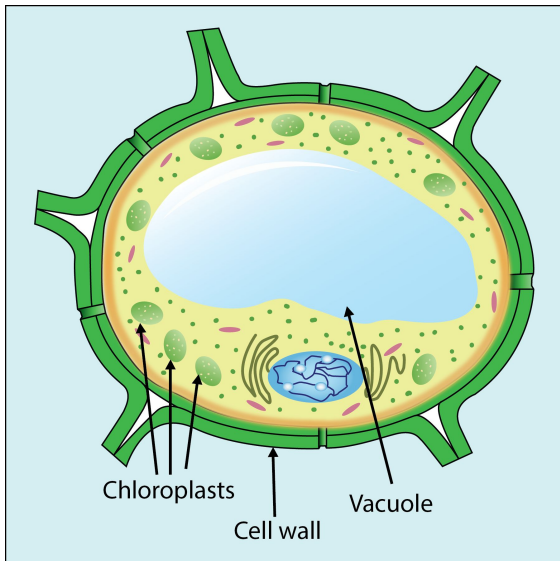
## Mitochondria

Only eukaryotic cells have mitochondria in their cytoplasm. Mitochondria contain their own DNA and are the sites where sugars (glucose) are broken down for energy production in eukaryotes. This process is called *cellular respiration*. Mitochondria are the organelles that produce ATP, or the energy currency of the cell. The mitochondria are equipped with structures that capture this energy and store it in a form the cell can use for energy-requiring processes.

Organelle	Function	Size	Diagram
Lysosomes	breaks down substances	0.5 $\mu\text{m}$ thick	
Mitochondrion (Mitochondria)	produces energy	0.5 $\mu\text{m}$	

## Plant cells are different from animal cells.

So far, you have learned about the similarities in all eukaryotic cells. However, there are two groups of eukaryotic cells that demonstrate significant differences: animal cells and plant cells. The image on the left highlights three structures that distinguish plant cells from animal cells.



- Cell wall:** First, plants have a cell wall that is absent in animal cells. The cell wall is a rigid structure that encloses the cell membrane. Because it is rigid, the cell wall can provide structural support for a plant.
- Chloroplasts:** Next, plant cells contain organelles known as chloroplasts, which are needed for a plant cell to carry out photosynthesis. In their natural state, these organelles are green in color. The color is due to the presence of the green pigment called chlorophyll. This pigment absorbs the light that provides the energy for conducting photosynthesis. Chloroplasts and chlorophyll are absent in animal cells. Because of this, animal cells cannot carry out photosynthesis.
- Vacuole:** Finally, plant cells often contain a large vacuole, which is an organelle used for storage. Most animal cells have multiple vacuoles that are considerably smaller than the one large vacuole found in plant cells.

## What Do You Think?

If you forget to water some plants, they wilt. After you water them, they perk up. Which plant organelle do you think helps a plant recover from wilting? How do you think this happens?

## Try Now

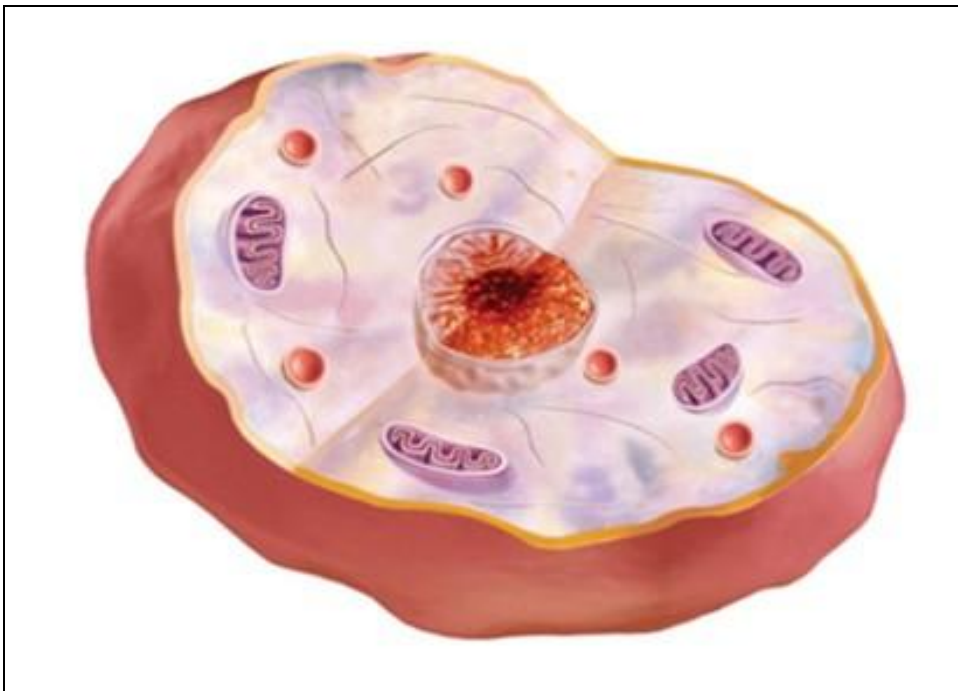
Study the image below. Does it show a plant cell or an animal cell?

Write your answer on the line above the cell. Then label each of the organelles in the diagram.

Note: Depending on whether the image shows a plant cell or an animal cell, some of the organelles may not appear.

- Cell membrane
- Cell wall
- Chloroplasts
- Nucleus
- Mitochondria
- Vacuole

This is a (an) \_\_\_\_\_.



List any organelles that do not appear in the diagram: