

The Cell

Objectives

- Describe prokaryotic and eukaryotic cells.
- Compare plant, bacterial, and animal cells.
- List and describe the parts of cells.

The BIG Idea

- All living things are made of cells.

Key Concept

- The cell is composed of many parts.

Cells are small.

- Because cells are so small, describe them requires a very small unit of measure: the **micrometer** (μm).
- One μm is one millionth of a meter. That means 1,000,000 of them can fit into a meter!
- Most cells range in size from about 1 μm (usually **bacteria**) to **1,000** μm (mostly **plants** and **animals**).
- To get a sense of the sizes of cells, consider that it would take about 17,000 tiny bacterial cells lined up to reach across a dime.

Cells are diverse.

- Very early on, the people studying the cells knew that cells have a great diversity of **sizes** and **shapes**. As microscopes were improved, scientists could see more and more details of cells.
- What they saw was that the inside of one cell can be very different from that of another cell.
- Every cell has a boundary that separates the inside from the outside. That boundary is called the **cell membrane**, a protective covering that encloses the entire cell.
- Any material coming into or out of the cell must pass through the cell membrane.

- Contained inside the cell membranes is a gelatin-like material called **cytoplasm**. Most of the work of the cell is carried out in the cytoplasm.
- Scientists separate cells into two broad categories based on one key difference: the location of the **genetic material** cells need to reproduce and function.
- In a eukaryotic cell the genetic material is in a structure called the **nucleus**, a structure enclosed by its own membrane (called the **nuclear membrane**).
- Scientists use the word **organelle** to describe any part of a cell that is enclosed by membrane.
- In a prokaryotic cell, there is no separate compartment for genetic material. Instead, it is in the cytoplasm. There are no organelles.
- Most unicellular organisms are **prokaryotic** cells. Almost all multicellular organisms are **eukaryotic**.

CHECK YOUR NOTES

What is μm a unit of measurement for? **Micrometers**

What do you call a protective covering that encloses the cell? **The cell membrane**

Where is most of the work of a cell carried out? **The cytoplasm**

What is an organelle? **Any part of the cell that is enclosed by membrane**

CRITICAL THINKING

What are the differences between prokaryotic and eukaryotic cells? **Prokaryotic cells do not have a nucleus or organelles. Eukaryotic cells have a nucleus and organelles.**

Plants and animals have eukaryotic cells.

- Plant and animal cells, like all eukaryotic cells, are divided into two main compartments. The **nucleus**, usually the largest organelle, is the compartment that stores the instructions a cell needs to function.
- Surrounding the nucleus is the **cytoplasm**. The cell membrane is the boundary between the cytoplasm and the outside of the cell.
- Plants also have **cell walls**. This is a tough outer covering that lies just outside the cell membrane. The cell wall supports and protects the cell.
- Having a cell wall is one important way in which plant cells differ from animal cells.

The cell has structures that process information.

- The nucleus is often the **largest** organelle in a cell.
- It contains information a cell needs to function. (I hope you have this memorized by now. It's the third time I've put it in your notes!) This information is contained by **chromatin**, which holds the genetic material for the cell.
- Some of the information is translated by **ribosomes**, tiny structures located in the cytoplasm and the **endoplasmic reticulum**.
- Ribosomes use the information to build important molecules called **proteins**.
- The ribosomes are created by the **nucleolus**, which is found in the nucleolus.

The cell has organelles that provide energy.

- No cell can stay alive without energy. Cells need energy to perform the activities of life. Plants get their energy direction from the **Sun**.
- Within plant cells are **chloroplasts**, organelles in which the energy from sunlight is used to make **sugar**. Plants use some of the sugar immediately, to keep their cells functioning. The rest of the sugar is stored in the cells.

- Animal cells do not contain chloroplasts. As a result, animals are not able to use the energy of the Sun directly. Instead, animals get their energy from **food**.
- Much of the food an animal uses for energy comes from the sugar that plant cells have stored. Animals can get this energy by eating plants or by eating animals that have eaten plants.
- Both plant cells and animal cells must be able to use energy to do work. The energy is made available by organelles found in all eukaryotic cells.
- **Mitochondria** are the organelles that use oxygen to get energy from processing food.

CHECK YOUR NOTES

What is one way plant cells differ from animal cells? **Cell walls and chloroplasts.**

What holds the genetic information in a cell? **Chromatin**

What translates the genetic information? **Ribosomes**

CRITICAL THINKING

How can a chloroplast, a structure found in plant cells but not in animal cells, provide energy for both plants and animals? **Plants use chloroplasts to create sugar, which animals eat to get energy.**

The cell has organelles that process and transport.

- You know that plant and animal cells get their energy from the **sugars** that the organisms make or consume. Sugars are also an important part of the starting materials that cells use to **maintain** themselves and **grow**.
- The job of making cell parts from the starting materials that enter a cell is divided among a number of structures in the **cytoplasm**.
- The endoplasmic reticulum is a system of twisting and winding **membranes**. Remember, some ribosomes are found here. The

ribosomes manufacture **protein**. The endoplasmic reticulum manufactures parts of the cell **membrane**.

- The endoplasmic reticulum is also part of the **cellular transport system**, a system that carries supplies and information throughout the cell. Portions of the endoplasmic reticulum break off to form small packages called **vesicles**. The vesicles transport processed materials to an organelle called the **Golgi** apparatus. This organelle takes the materials manufactured by the endoplasmic reticulum and finishes processing them.

Pete Ower 2/11/08 1:27 PM

Comment: Think of it as baking a cake. You mix all the ingredients together in a bowl (the endoplasmic reticulum). You pour the batter into the cake pans (the vesicle). Then you place the cake pans into the oven (the Golgi apparatus) where it cooks to make the actual cake.

The cell has organelles for storage, recycling, and waste

- Cells store water, sugar, and other materials, which they use to function.
- Cells must also store waste materials until they can be removed.
- Inside plant and fungus cells are sacs called **vacuoles**. Vacuoles are enclosed by a **membrane** that can hold water, waste, and other materials.
- Vacuoles function with the **cell membrane** to move materials either into or out of the cell.
- A plant has a large central vacuole which water and other materials can be stored. Water in the vacuole provides **support** for small plants.
- Animal cells do not have central vacuoles. What animals do have are similar structures called **lysosomes**. These are vacuoles that contain **chemicals** that break down materials taken into the cell, as well as old cell parts.
- Remember that animals, unlike plants, take in food. Nutrients brought into the cell need to be broken down, as well as wastes contained.

CHECK YOUR NOTES

What are three functions of the endoplasmic reticulum? **To create vesicles, to transport materials and information, and to manufacture parts of the cell membrane.**

What carries processed materials to the Golgi apparatus?

Vesicle

CRITICAL THINKING

Compare and contrast lysosomes and central vacuoles.

Lysosomes in animal cells contain wastes and store and break down nutrients. The central vacuole in plant cells stores and holds water. Both are vacuoles.

For Your Information...

Here is a list of all the cell parts that you will have to know!

1. Cell wall
2. Cell membrane
3. Lysosome
4. Golgi Apparatus (body)
5. Nucleus
6. Nucleolus
7. Chromatic
8. Ribosome
9. Endoplasmic Reticulum
10. Cytoplasm
11. Vacuole
12. Vesicle
13. Chloroplast
14. Mitochondria
15. Nuclear Membrane