Cell Structure and Function

Cells and Life

Before You Read

What do you think? Read the two statements below and decide whether you agree or disagree with them. Place an A in the Before column if you agree with the statement or a D if you disagree. After you've read this lesson, reread the statements to see if you have changed your mind.

Before	Statement	After
	1. Nonliving things have cells.	
	2. Cells are made mostly of water.	

Key Concepts

- How did scientists' understanding of cells develop?
- What basic substances make up a cell?

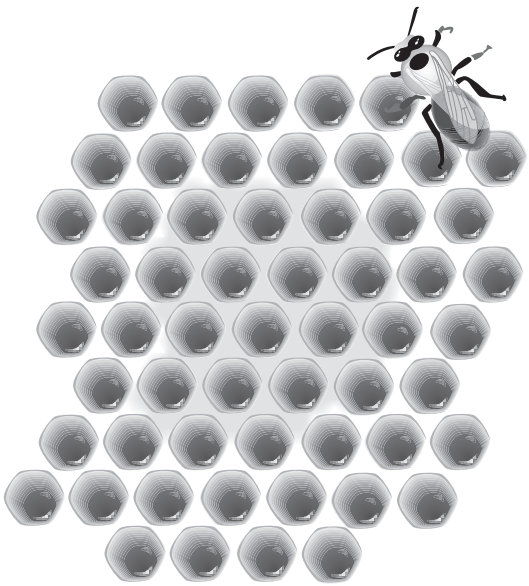
Read to Learn

Mark the Text

Identify Main Ideas As you read, highlight the main ideas under each heading. After you finish reading, review the main ideas of the lesson.

Understanding Cells

The cells that make up all living things are very small. Early scientists did not have the tools to see cells until the invention of the microscope. More than 300 years ago, Robert Hooke built a microscope. He used it to look at cork. He saw small openings in the cork similar to the honeycomb shown in the figure below. The openings reminded him of the small rooms, called cells, where monks lived. Hooke named these small structures cells.



Visual Check

1. Identify The small openings of the honeycomb look most like which of the following? (Circle the correct answer.)

a. cells

b. plants

c. tiny animals

Think it Over

2. Define What are the three principles of the cell theory?

Key Concept Check

3. Explain how scientists' understanding of cells developed.

Visual Check

4. Identify Match the scientist with his part of the cell theory. Draw a line from the scientist to his observation.

Reading Check

5. Define What are macromolecules?

The Cell Theory

Scientists made better microscopes. They looked for cells in places such as pond water and blood. The newer microscopes made it possible for scientists to see different structures inside cells. A scientist named Matthias Schleiden (SHLI dun) looked at plant cells. Another scientist, Theodore Schwann, studied animal cells. Later, Rudolf Virchow (VUR koh) said all cells come from cells that already exist. The observations made by these scientists, shown in the table below, became known as the cell theory. *The* **cell theory** *states that all living things are made of one or more cells, cells are the smallest unit of life, and all new cells come from cells that already exist.*

Cell Theory Matchup

Scientist	Observation
1. Theodore Schwann	**a.** By studying plants, he determined that all living things are made of one or more cells.
2. Rudolf Virchow	**b.** By studying animals, he determined that all living things are made of one or more cells.
3. Matthias Schleiden	**c.** All new cells come from cells that already exist.

Basic Cell Substances

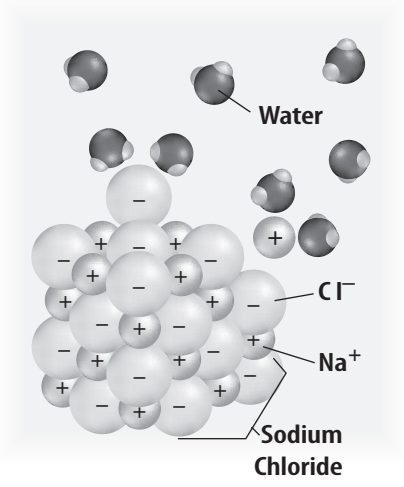
The cell theory raised more questions for scientists. Scientists began to look into what cells are made of. *Cells are made of smaller parts called* **macromolecules** *that form when many small molecules join together.*

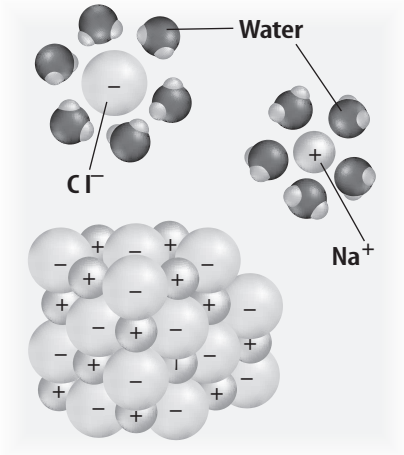
The Main Ingredient—Water

The main ingredient in every cell is water. Water makes up more than 75 percent of a cell. It is necessary for life. Water also surrounds cells. The water surrounding your cells helps to insulate your body. This helps your body maintain a stable internal environment, or homeostasis.

Water also is useful because it can dissolve other substances, such as salt (sodium chloride). For substances to move into and out of a cell, they must be dissolved in a liquid. In the figure below, the water molecules have a positive end and a negative end.

- The more negative end of a water molecule (−) can attract the positive part of another substance.
- The more positive end of a water molecule (+) can attract the negative part of another substance. With sodium chloride, the sodium (Na) ions and chloride (Cl) ions are more attracted by the water molecules. This attraction is similar to the attraction of magnets.





Think it Over

6. Compare How is the attraction of water molecules similar to the attraction of magnets?

_____

_____

_____

Visual Check

7. Identify Which part of the salt crystal is attracted to the oxygen in the water molecule?

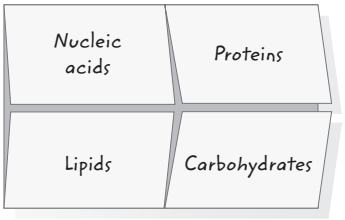
_____

_____

_____

FOLDABLES®

Make a four-page book to organize information about macromolecules in a cell.



Visual Check

8. Identify two macromolecules whose function is to provide support to a cell.

Macromolecules

All cells contain other substances besides water that help cells do what they do. There are four types of macromolecules in cells. They are nucleic acids, proteins, lipids, and carbohydrates. Each type of macromolecule has its own job, or function, in a cell. These functions range from growth and communication to movement and storage. The table below describes each macromolecule's function.

Macromolecules in Cells

	Nucleic Acids	Proteins	Lipids	Carbohydrates
Elements	carbon oxygen hydrogen nitrogen phosphorus	carbon oxygen hydrogen nitrogen sulfur	carbon oxygen hydrogen phosphorus	carbon hydrogen oxygen
Examples	DNA RNA	enzymes hair (horns, feathers)	fats oils	sugars starch cellulose
Function	• carry hereditary information • used to make proteins	• regulate cell processes • provide structural support	• store large amounts of energy • form boundaries around cells	• supply energy for cell processes • short-term energy storage • provide structural support

Nucleic Acids Both deoxyribonucleic (dee AHK sih ri boh noo klee ihk) acid (DNA) and ribonucleic (ri boh noo KLEE ihk) acid (RNA) are nucleic acids. **Nucleic acids** *are macromolecules formed when long chains of molecules called nucleotides* (NEW klee uh tidz) *join together*. Nucleic acids are important because they contain the genetic material of a cell. This information is passed from parents to offspring.

DNA includes instructions for cell growth, for cell reproduction, and for cell processes that enable a cell to respond to its environment. DNA is used to make RNA. RNA is used to make proteins.

The order of nucleotides in DNA and RNA is important. A change in the order of the nucleotides can change the information in a cell.

Reading Check

9. Name three instructions that DNA provides to a cell.

Proteins The macromolecules necessary for almost everything cells do are proteins. *A* **protein** *is a macromolecule made of long chains of amino acid molecules*. RNA contains instructions for joining amino acids together.

Cells have hundreds of proteins. Each protein has its own function. Some proteins help cells communicate with other cells. Other proteins move substances around inside cells. Some proteins help to break down nutrients in food. Other proteins, such as keratin (KER uh tun), which is found in hair, horns, and feathers, make up supporting structures.

Lipids *A* **lipid** *is a large macromolecule that does not dissolve in water*. Because lipids do not dissolve in water, they protect cells. Lipids also are a large part of the cell membrane. Lipids store energy for cells and help with cell communication. Cholesterol (kuh LES tuh rawl), phospholipids (fahs foh LIH pids), and vitamin A are lipids.

Carbohydrates *One sugar molecule, two sugar molecules, or a long chain of sugar molecules make up* **carbohydrates** (kar boh HI drayts). Carbohydrates store energy, provide structural support for cells, and help cells communicate. Sugars and starches are carbohydrates that store energy. Fruits contain sugars. Bread and pasta are mostly starch. The energy stored in sugars and starches can be released quickly through chemical reactions in cells. Cellulose is a carbohydrate in the cell walls of plants that provides support.

Reading Check

10. Identify three functions of proteins in cells.

Reading Check

11. Explain Why are lipids important to cells?

Key Concept Check

12. Name the basic substances that make up a cell.

Mini Glossary

carbohydrate: (kar boh HI drayt): one sugar molecule, two sugar molecules, or a long chain of sugar molecules

cell theory: states that all living things are made of one or more cells, the cell is the smallest unit of life, and all new cells come from preexisting cells

lipid: a large macromolecule that does not dissolve in water

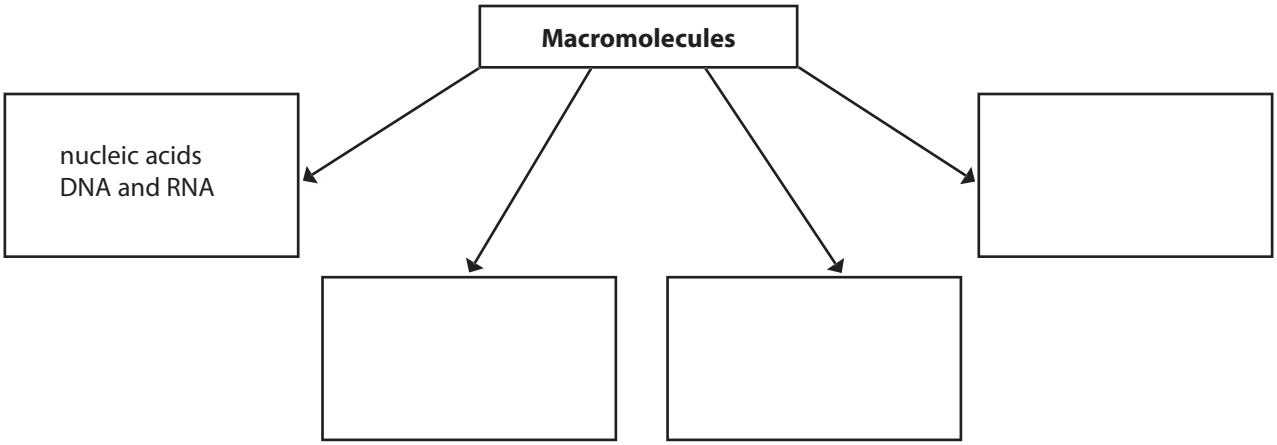
macromolecule: a substance that forms by joining many small molecules together

nucleic acid: a macromolecule that forms when long chains of molecules called nucleotides join together

protein: a long chain of amino acid molecules

1. Review the terms and their definitions in the Mini Glossary. Write a sentence that describes a lipid.

2. Fill in the chart below by identifying the different types of macromolecules and giving examples of each.



3. How did highlighting the main ideas in each section of this lesson improve your understanding of the cell?

What do you think NOW?

Reread the statements at the beginning of the lesson. Fill in the After column with an A if you agree with the statement or a D if you disagree. Did you change your mind?

Connect ED

Log on to ConnectED.mcgraw-hill.com and access your textbook to find this lesson's resources.

END OF LESSON