chapter 1 Cell Structure and Function

lesson 1 Cells and Life

Grade Seven Science Content Standard. 1.a. Students know cells function similarly in all living organisms.

Before You Read

Think about living things such as plants and animals. How are plants and animals different from nonliving things? Write your ideas on the lines below. Then read the lesson to learn of early ideas about cells.

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MAIN Idea

Cells are the smallest unit of life.

What You'll Learn

- the development of the cell theory
- the characteristics of life
- why water is important for a cell
- the four basic substances of a cell

Read to Learn

Early Ideas About Cells

To see most cells, you must have some type of device to enlarge it. Human eyes cannot see things that are that small. There was once a time when no one knew that cells existed. This is because most cells are too small to see. Because people could not see cells, they did not know what living things were made from.

Early Microscopes

A **light microscope** uses light and one or more lenses to enlarge an image. Microscopes changed scientists' beliefs about living things.

Even when a light microscope is used, most parts of a cell are too small to see. Light microscopes can only enlarge images up to about 1,500 times their actual size. However, in the 1930s, the electron microscope was invented. An electron microscope can enlarge images 100,000 times or more. With electron microscopes, scientists can see most of the structures inside a cell. ☑

Study Coach

Use an Outline As you read, make an outline to summarize the information in the lesson. Use the main headings in the lesson as the main headings in the outline. Complete the outline with the information under each heading.

Reading Check

1. Compare What is a difference between light microscopes and electron microscopes?

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The Cell Theory

When scientists discovered cells, they still had much to learn about how cells relate to living things. In the 1830s, a German scientist observed that all plant parts are made of cells. Around the same time, another German scientist observed the same thing about animals. Nearly two decades later, a German physician proposed that all new cells came from cells that already exist. Together, these ideas became known as **cell theory**. The ideas of the cell theory are listed below.

1. All organisms are made of one or more cells.
2. The cell is the smallest unit of life.
3. All new cells come from cells that already exist.

Reading Check

2. Identify What was learned about cells in the 1830s?

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Academic Vocabulary

respond (rih SPAHND) (verb) to act or do something in reaction to something else

Characteristics of Life

Living things may be made of one cell or many cells. Either way, scientists agree that all living things have six characteristics in common. Living things are:

- organized,
- respond,
- grow and develop,
- reproduce,
- maintain certain internal conditions, and
- use energy.

How are cells organized?

Every cell contains structures. Each structure has its own special job. For example, some structures store food. The cell uses food for energy.

Cells in an organism work together in special ways. For example, nerve systems are made up of nerve cells that work together. One job of the nerve system is to send messages to the brain.

How do organisms respond?

All organisms are able to respond in various ways. If someone throws a ball at you, you might try to catch it. This is because you are able to respond to changes in your environment. Your body responds in other ways too. For example, your heart rate speeds up or slows down as needed to deliver the right amount of oxygen to each cell. Your body can also respond to an invasion by a virus or bacterium. There are cells in your body that can recognize these invaders and respond with different processes to get rid of them.

Think it Over

3. Apply Name two ways you respond to your environment.

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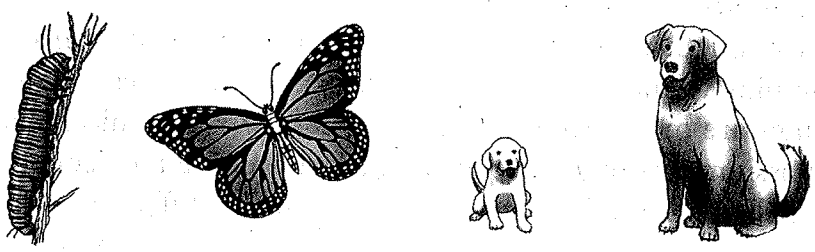
How do organisms grow and develop?

All organisms grow and develop. When an organism grows, it increases in size. Organisms made of many cells usually grow by adding cells. Organisms that are only one cell grow when that cell increases in size.

Development includes all the changes that occur in an organism. For example, you might be able to play a sport or an instrument that you could not ten years ago. As shown below, some organisms go through dramatic changes, such as a caterpillar changing into a butterfly or a puppy growing up to be a dog.



Picture This

4. Explain to a partner the differences between a caterpillar and a butterfly or a puppy and a dog.

Why do organisms reproduce?

You read earlier in this lesson that all new cells come from cells that already exist. The same is true for organisms. In order for living things to continue to exist, they must reproduce, or create offspring similar to themselves. Not every individual needs to reproduce, but some of each type of organism must do so.

What is homeostasis?

All organisms must keep the right amount of food and water in their cells. They also need to keep the temperature of their body within a certain range. This is the process of maintaining homeostasis. **Homeostasis** (hoh mee oh STAY sus) is when the internal environment is kept within certain limits. These limits are not the same for all organisms. For example, some fish can live only in freshwater, while others need the salt water of the ocean.

Organisms have many different methods for maintaining homeostasis. A human will die if his or her body temperature changes more than a few degrees. Therefore, human bodies sweat, shiver, or change the flow of blood to try to maintain a body temperature of about 37°C. ☑

Reading Check

5. List three ways that human bodies maintain a healthy body temperature.

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Where does energy come from?

All living cells use energy. Our cells get energy from the food that we eat. The energy in food began in the light energy that comes to Earth from the Sun. The Sun is the origin of the energy used by most organisms on Earth. ☑

Reading Check

6. Explain How do humans get energy?

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Chemistry of a Cell

When you were younger, you might have played with some kind of building blocks. You probably made many things using different sizes and shapes of blocks. In a similar way, a cell can make different things using atoms and molecules as its building blocks.

You might recall from another science class that atoms combine to make molecules. Most of the molecules in living things are made from six kinds of atoms—sulfur, nitrogen, potassium, hydrogen, oxygen, and carbon. The molecules in cells can combine in many ways to make different substances. Organisms use these substances for thousands of different functions.

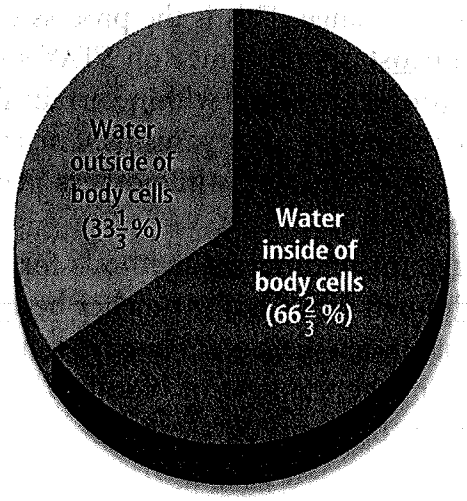
Academic Vocabulary
function (FUNK shun) (noun) purpose

How do cells use water?

Water is important for all living things. About two-thirds of your body's mass is water, as shown in the chart below. Most of that water is inside cells, and the rest surrounds cells. Water dissolves many kinds of molecules. This makes it possible for blood, which is mostly water, to transport substances throughout your body. The water that surrounds cells is important too. It insulates your body, which helps maintain homeostasis.

Picture This

7. Highlight the type of water that insulates your body.



What are cells made from?

You already know that cells are made partly from water. Cells also contain carbohydrates, proteins, nucleic acids, and lipids. Those substances are called macromolecules. Macromolecules are complex molecules. They are usually made of long chains of smaller molecules.

Proteins are needed for almost everything that cells do. A **protein** is made of molecules called amino acids, which are linked together in a folded chain.

Nucleic (noo KLAY ihk) **acids** are made of long chains of molecules called nucleotides. One kind of nucleic acid is deoxyribonucleic (dee AHK sih ri boh noo klay ihk) acid (DNA). DNA contains the genetic information of a cell. The information stored in the DNA is used to make another nucleic acid called ribonucleic (ri boh noo KLAY ihk) acid (RNA). RNA it is used to make proteins.

Lipids are large molecules that do not dissolve in water. The main kinds of lipids are fats, steroids, phospholipids (fahs foh LIH pids), and waxes. The functions of lipids are described in the table below.

Types of Lipids

Name	Function
Fats	stores large amounts of chemical energy
Steroids	basis of many hormones
Phospholipids	important part of cell membranes
Waxes	regulates the amount of sugar in the blood of animals with backbones

Carbohydrates are made of one or more sugar molecules. They are sources of energy for cells. They also make up part of a cell's structure. Both sugars and starches are carbohydrates.

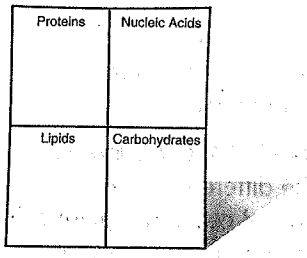
What have you learned about cells and life?

The cell is the smallest unit of a living organism. Cells need water to survive as do all living things. The four basic substances of cells are proteins, nucleic acids, lipids, and carbohydrates.

FOLDABLES™

A Record Information

Make a concept Foldable, as illustrated, to learn about proteins, lipids, carbohydrates, and nucleic acids. Fold lengthwise and write *The Cell* on the front of the Foldable.



Picture This

8. Highlight the type of lipids that stores energy.