SECTION 2

The Necessities of Life

Would it surprise you to learn that you have the same basic needs as a tree, a frog, and a fly?

In fact, almost every organism has the same basic needs: water, air, a place to live, and food.

READING WARM-UP

Objectives

- Explain why organisms need food, water, air, and living space.
- Describe the chemical building blocks of cells.

Terms to Learn

producer	lipid
consumer	phospholipid
decomposer	ATP
protein	nucleic acid
carbohydrate	

READING STRATEGY

Discussion Read this section silently. Write down questions that you have about this section. Discuss your questions in a small group.

Water

You may know that your body is made mostly of water. In fact, your cells and the cells of almost all living organisms are approximately 70% water. Most of the chemical reactions involved in metabolism require water.

Organisms differ greatly in terms of how much water they need and how they get it. You could survive for only about three days without water. You get water from the fluids you drink and the food you eat. The desert-dwelling kangaroo rat never drinks. It gets all of its water from its food.

Air

Air is a mixture of several different gases, including oxygen and carbon dioxide. Most living things use oxygen in the chemical process that releases energy from food. Organisms living on land get oxygen from the air. Organisms living in water either take in dissolved oxygen from the water or come to the water's surface to get oxygen from the air. The European diving spider in **Figure 1** goes to great lengths to get oxygen.

Green plants, algae, and some bacteria need carbon dioxide gas in addition to oxygen. These organisms produce food and oxygen by using photosynthesis (FOHT oh SIN thuh sis). In *photosynthesis*, green organisms convert the energy in sunlight to energy stored in food.

Reading Check **What process do plants use to make food?** (*See the Appendix for answers to Reading Checks.*)

Figure 1 *This spider surrounds itself with an air bubble that provides the spider with a source of oxygen underwater.*

A Place to Live

All organisms need a place to live that contains all of the things they need to survive. Some organisms, such as elephants, require a large amount of space. Other organisms may live their entire life in one place.

Space on Earth is limited. So, organisms often compete with each other for food, water, and other necessities. Many animals, including the warbler in **Figure 2**, will claim a particular space. After claiming a space, they try to keep other animals away.

Figure 2 *A warbler's song is more than just a pretty tune. The warbler is protecting its home by telling other warblers to stay out of its territory.*

Food

All living things need food. Food gives organisms energy and the raw materials needed to carry on life processes. Organisms use nutrients from food to replace cells and build body parts. But not all organisms get food in the same way. In fact, organisms can be grouped into three different groups based on how they get their food.

Making Food

Some organisms, such as plants, are called producers. **Producers** can make their own food. Like most producers, plants use energy from the sun to make food from water and carbon dioxide. Some producers get energy and food from the chemicals in their environment.

producer an organism that can make its own food by using energy from its surroundings

consumer an organism that eats other organisms or organic matter

decomposer an organism that gets energy by breaking down the remains of dead organisms or animal wastes and consuming or absorbing the nutrients

Taking Food

Other organisms are called **consumers** because they must eat (consume) other organisms to get food. The frog in **Figure 3** is an example of a consumer. It gets the energy it needs by eating insects and other organisms.

Some consumers are decomposers. **Decomposers** are organisms that get their food by breaking down the nutrients in dead organisms or animal wastes. The mushroom in **Figure 3** is a decomposer.

Figure 3 *The frog is a consumer. The mushroom is a decomposer. The green plants are producers.*

Putting It All Together

Some organisms make their own food. Some organisms get food from eating other organisms. But all organisms need to break down that food in order to use the nutrients in it.

Nutrients are made up of molecules. A *molecule* is a substance made when two or more atoms combine. Molecules made of different kinds of atoms are *compounds*. Molecules found in living things are usually made of different combinations of six elements: carbon, hydrogen, nitrogen, oxygen, phosphorus, and sulfur. These elements combine to form proteins, carbohydrates, lipids, ATP, and nucleic acids.

Proteins

Almost all of the life processes of a cell involve proteins. **Proteins** are large molecules that are made up of smaller molecules called *amino acids*.

Making Proteins

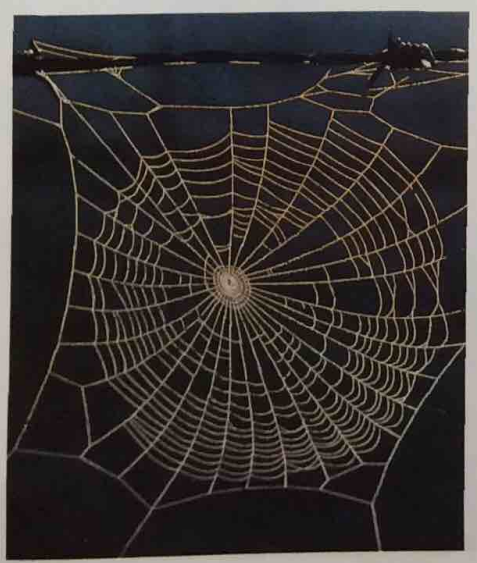
Organisms break down the proteins in food to supply their cells with amino acids. These amino acids are then linked together to form new proteins. Some proteins are made up of only a few amino acids, but others contain more than 10,000 amino acids.

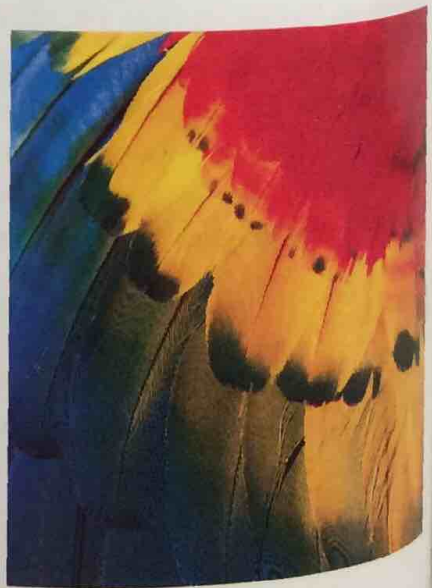
Proteins in Action

Proteins have many different functions. Some proteins form structures that are easy to see, such as those in **Figure 4.** Other proteins are very small and help cells do their jobs. Inside red blood cells, the protein hemoglobin (HEE moh GLOH bin) binds to oxygen to deliver and release oxygen throughout the body. Some proteins protect cells. Other proteins, called *enzymes* (EN ZIEMZ), start or speed up chemical reactions in cells.

protein a molecule that is made up of amino acids and that is needed to build and repair body structures and to regulate processes in the body

Figure 4 *Spider webs, hair, horns, and feathers are all made from proteins.*





SCHOOL to HOME

Pen a Menu

WRITING SKILL With a parent, write a menu for a favorite meal. Using Nutrition Facts labels, find out which items on your menu include proteins, carbohydrates, and fats. Try making the meal.

ACTIVITY

Figure 5 *The extra sugar in a potato plant is stored in the potato as starch, a complex carbohydrate.*

Carbohydrates

Molecules made of sugars are called **carbohydrates.** Cells use carbohydrates as a source of energy and for energy storage. An organism's cells break down carbohydrates to release the energy stored in them. There are two kinds of carbohydrates—simple carbohydrates and complex carbohydrates.

carbohydrate a class of energy-giving nutrients that includes sugars, starches, and fiber; contains carbon, hydrogen, and oxygen

Simple Carbohydrates

Simple carbohydrates are made up of one sugar molecule or a few sugar molecules linked together. Table sugar and the sugar in fruits are examples of simple carbohydrates.

Complex Carbohydrates

When an organism has more sugar than it needs, its extra sugar may be stored as complex carbohydrates. *Complex carbohydrates* are made of hundreds of sugar molecules linked together. Plants, such as the potato plant in **Figure 5,** store extra sugar as starch. When you eat mashed potatoes, you are eating a potato plant's stored starch. Your body then breaks down this complex carbohydrate to release the energy stored in the potato.

Reading Check **What is the difference between simple carbohydrates and complex carbohydrates?**

MATH PRACTICE

How Much Oxygen?

Each red blood cell carries about 250 million molecules of hemoglobin. How many molecules of oxygen could a single red blood cell deliver throughout the body if every hemoglobin molecule attached to four oxygen molecules?

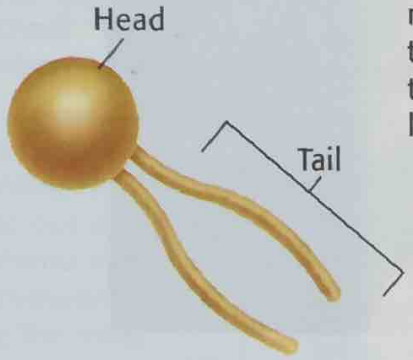
QUICK LAB

Starch Search

1. Obtain several **food samples** from your teacher.
2. Put **a few drops of iodine** on each sample. Record your observations. **Caution:** Iodine can stain clothing.
3. When iodine comes into contact with starch, a black substance appears. Which samples contain starch?

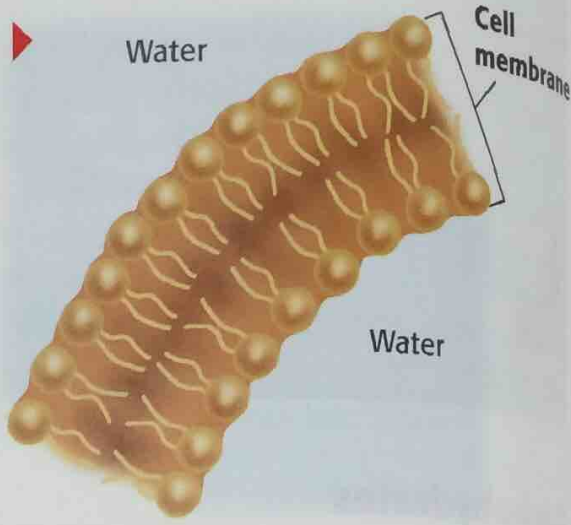
Figure 6 Phospholipid Membranes

The head of a phospholipid molecule is attracted to water, but the tail is not.



Phospholipid molecule

When phospholipid molecules come together in water, they form two layers.



lipid a type of biochemical that does not dissolve in water; fats and steroids are lipids

phospholipid a lipid that contains phosphorus and that is a structural component in cell membranes

ATP adenosine triphosphate, a molecule that acts as the main energy source for cell processes

Lipids

Lipids are compounds that cannot mix with water. Lipids have many important jobs in the cell. Like carbohydrates, some lipids store energy. Other lipids form the membranes of cells.

Phospholipids

All cells are surrounded by a cell membrane. The cell membrane helps protect the cell and keep the internal conditions of the cell stable. **Phospholipids** (FAHS foh LIP idz) are the molecules that form much of the cell membrane. The head of a phospholipid molecule is attracted to water. The tail is not. Cells are mostly water. When phospholipids are in water, the tails come together, and the heads face out into the water. **Figure 6** shows how phospholipid molecules form two layers in water.

Fats and Oils

Fats and oils are lipids that store energy. When an organism has used up most of its carbohydrates, it can get energy from these lipids. The structures of fats and oils are almost the same, but at room temperature, most fats are solid, and most oils are liquid. Most of the lipids stored in plants are oils. Most of the lipids stored in animals are fats.

Reading Check **What is one difference between oils and fats?**

ATP

Adenosine triphosphate (uh DEN uh SEEN trie FAHS FAYT), also called ATP, is another important molecule. **ATP** is the major energy-carrying molecule in the cell. The energy in carbohydrates and lipids must be transferred to ATP, which then provides fuel for cellular activities.

CONNECTION TO Social Studies

Whaling In the 1900s, whales were hunted and killed for their oil. Whale oil was often used as fuel for oil lamps. Most of the oil taken from whales was taken from their fat, or *blubber*. Some whales had blubber over 18 in. thick, producing over 40 barrels of oil per whale. Research whether anyone still hunts whales or uses whale oil. Make a presentation to the class on your findings.

Nucleic Acids

Nucleic acids are sometimes called the blueprints of life because they have all the information needed for a cell to make proteins. **Nucleic acids** are large molecules made up of molecules called *nucleotides* (NOO klee oh TIEDZ). A nucleic acid may have thousands of nucleotides. The order of those nucleotides stores information. DNA is a nucleic acid. A DNA molecule is like a recipe book entitled *How to Make Proteins*. When a cell needs to make a certain protein, the cell gets information from the order of the nucleotides in DNA. This order of nucleotides tells the cell the order of the amino acids that are linked together to make that protein.

nucleic acid a molecule made up of subunits called *nucleotides*

SECTION Review

Summary

- Organisms need water for cellular processes.
- Organisms need oxygen to release the energy contained in their food.
- Organisms must have a place to live.
- Cells store energy in carbohydrates, which are made of sugars.
- Proteins are made up of amino acids. Some proteins are enzymes.
- Fats and oils store energy and make up cell membranes.
- Cells use molecules of ATP to fuel their activities.
- Nucleic acids, such as DNA, are made up of nucleotides.

Using Key Terms

For each pair of terms, explain how the meanings of the terms differ.

1. *producer* and *consumer*
2. *lipid* and *phospholipid*

Understanding Key Ideas

3. Plants store extra sugar as
   - **a.** proteins.
   - **b.** starch.
   - **c.** nucleic acids.
   - **d.** phospholipids.
4. Explain why organisms need food, water, air, and living space.
5. Describe the chemical building blocks of cells.
6. Why are decomposers categorized as consumers? How do they differ from producers?
7. What are the subunits of proteins?

Math Skills

8. Protein A is a chain of 660 amino acids. Protein B is a chain of 11 amino acids. How many times more amino acids does protein A have than protein B?

Critical Thinking

9. **Making Inferences** Could life as we know it exist on Earth if air contained only oxygen? Explain.
10. **Identifying Relationships** How might a cave, an ant, and a lake each meet the needs of an organism?
11. **Predicting Consequences** What would happen to the supply of ATP in your cells if you did not eat enough carbohydrates? How would this affect your cells?
12. **Applying Concepts** Which resource do you think is most important to your survival: water, air, a place to live, or food? Explain your answer.