

CHAPTER 4 The Cell in Action

SECTION 2 **Cell Energy**

BEFORE YOU READ

After you read this section, you should be able to answer these questions:

- How do plant cells make food?
- How do plant and animal cells get energy from food?

National Science Education Standards

LS 1c, 4c

How Does a Plant Make Food?

The sun is the major source of energy for life on Earth. Plants use carbon dioxide, water, and the sun’s energy to make food in a process called **photosynthesis**. The food that plants make gives them energy. When animals eat plants, the plants become sources of energy for the animals.

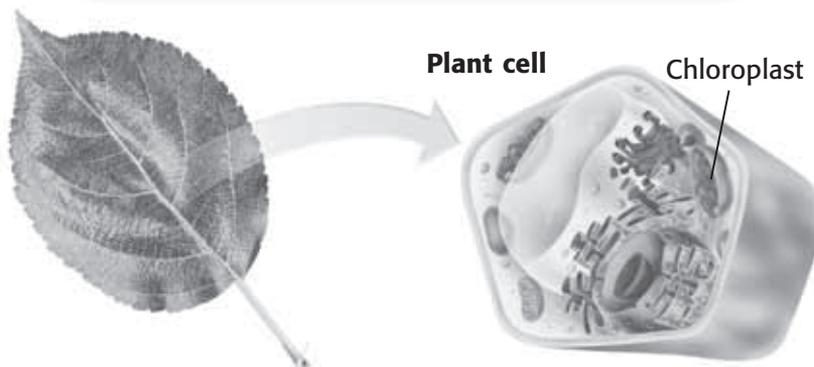
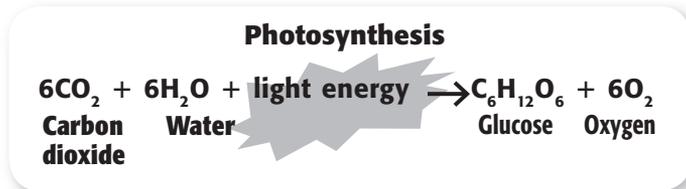
Plant cells have molecules called *pigments* that absorb light energy. Chlorophyll is the main pigment used in photosynthesis. Chlorophyll is found in chloroplasts. The food plants make is a simple sugar called *glucose*. Photosynthesis also produces oxygen. ✓



Compare As you read this section, make a Venn Diagram to compare cellular respiration and fermentation.



1. Identify In which cell structures does photosynthesis take place?



Photosynthesis takes place in chloroplasts. Chloroplasts are found inside plant cells.

TAKE A LOOK

2. Identify What two materials are produced during photosynthesis?

SECTION 2 Cell Energy *continued*

STANDARDS CHECK

LS 1c Cells carry on the many functions needed to sustain life. They grow and divide, thereby producing more cells. This requires that they take in nutrients, which they use to provide energy for the work that cells do and to make the materials a cell or an organism needs.

Word Help: function
to work

Word Help: energy
the capacity to do work

3. Identify Name two ways cells can get energy from food.

TAKE A LOOK

4. Identify What two materials are needed for cellular respiration?

5. List What three things are produced during cellular respiration?

How Do Organisms Get Energy from Food?

Both plant and animal cells must break down food molecules to get energy from them. There are two ways cells get energy: cellular respiration and fermentation.

During **cellular respiration**, cells use oxygen to break down food. During **fermentation**, food is broken down without oxygen. Cellular respiration releases more energy from food than fermentation. Most eukaryotes, such as plants and animals, use cellular respiration.

What Happens During Cellular Respiration?

When you hear the word *respiration*, you might think of breathing. However, cellular respiration is different from breathing. Cellular respiration is a chemical process that happens in cells. In eukaryotic cells, such as plant and animal cells, cellular respiration takes place in structures called *mitochondria*.

Recall that to get energy, cells must break down glucose. During cellular respiration, glucose is broken down into carbon dioxide (CO₂) and water (H₂O), and energy is released. This energy is stored in a molecule called *ATP* (adenosine triphosphate). The figure below shows how energy is released when a cow eats grass.

Cellular respiration

$$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + \text{energy (ATP)}$$

Glucose Oxygen Carbon dioxide Water

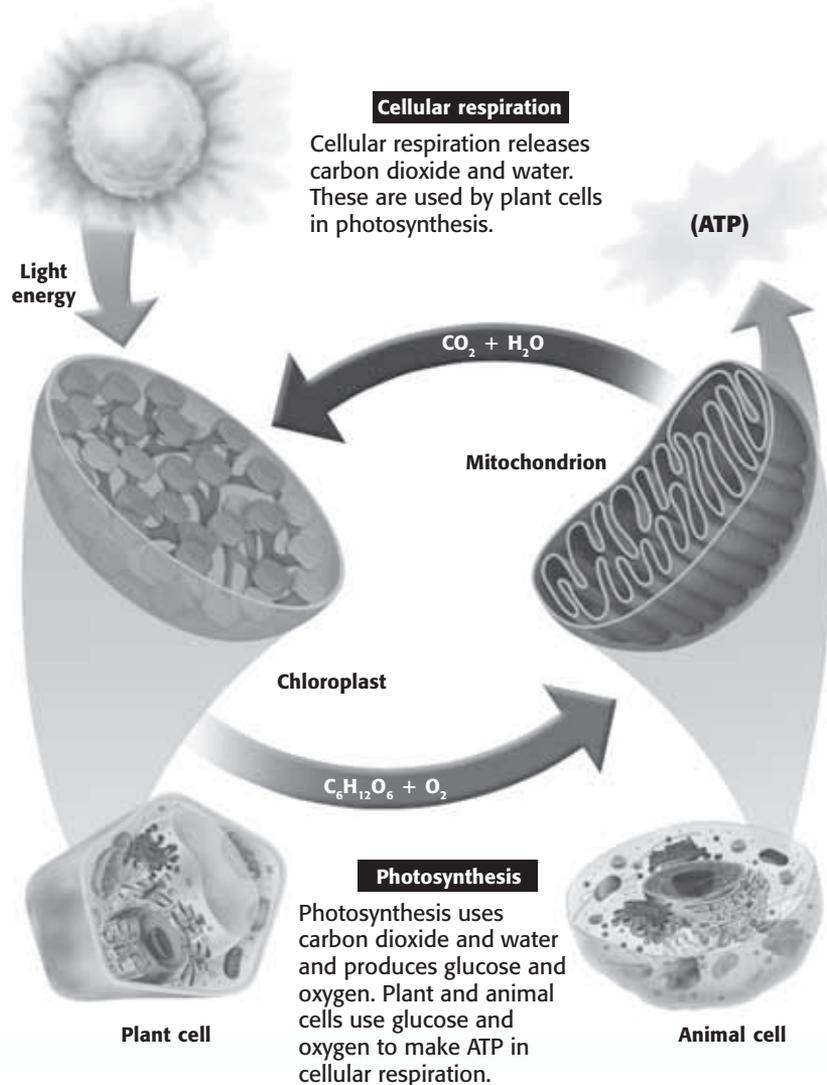
Mitochondria

Animal cell

The mitochondria in the cells of this cow will use cellular respiration to release the energy stored in the grass.

SECTION 2 Cell Energy *continued*

The Connection Between Photosynthesis and Cellular Respiration



Critical Thinking

6. Apply Concepts What would happen if oxygen were not produced during photosynthesis?

TAKE A LOOK

7. Complete Plant and animal cells use glucose and oxygen to make _____

How Is Fermentation Different from Cellular Respiration?

During fermentation, cells break down glucose without oxygen. Some bacteria and fungi rely only on fermentation to release energy from food. However, cells in other organisms may use fermentation when there is not enough oxygen for cellular respiration.

When you exercise, your muscles use up oxygen very quickly. When cells don't have enough oxygen, they must use fermentation to get energy. Fermentation creates a byproduct called *lactic acid*. This is what makes your muscles ache if you exercise too hard or too long.

Say It

Research Use the school library or the Internet to research an organism that uses fermentation. What kind of organism is it? Where is it found? Is this organism useful to humans? Present your findings to the class.

Section 2 Review

NSES LS 1c, 4c

SECTION VOCABULARY

cellular respiration the process by which cells use oxygen to produce energy from food

fermentation the breakdown of food without the use of oxygen

photosynthesis the process by which plants, algae, and some bacteria use sunlight, carbon dioxide, and water to make food.

1. **Identify** What kind of cells have chloroplasts?

2. **Explain** How do plant cells make food?

3. **Explain** Why do plant cells need both chloroplasts and mitochondria?

4. **Apply Concepts** How do the processes of photosynthesis and cellular respiration work together?

5. **Compare** What is one difference between cellular respiration and fermentation?

6. **Explain** Do your body cells always use cellular respiration to break down glucose? Explain your answer.
