

Cell Energy Transport and Use

Key Words

active transport:	process in which energy is used to transport materials across the cell membrane
cellular respiration:	process in which glucose is broken down in the presence of oxygen to supply a cell with energy
fermentation:	process in which glucose is broken down in the absence of oxygen to supply a cell with energy

KEY IDEAS

Active transport is the use of energy to move substances across the cell membrane. Cellular respiration and fermentation are two processes that supply cells with the energy needed for active transport.

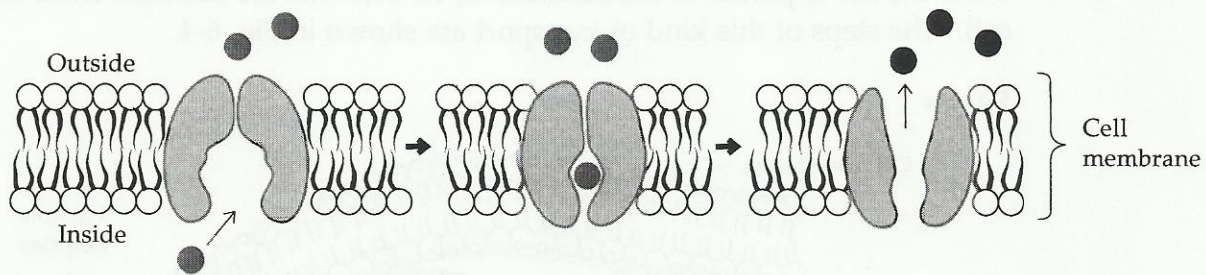
Have you ever baked bread? If so, you probably added yeast to the bread dough. After some time passed, you may have noticed that the dough had risen. Did you wonder why this happened? If you thought the yeast caused the change, you were correct. Yeast breaks down a sugar in the flour. As the sugar breaks down, it releases gas bubbles into the dough. The gas bubbles cause the dough to expand, or rise. In this lesson, you will find out more about processes that release energy from food.

You may recall that diffusion is a process in which molecules move from an area of higher concentration to an area of lower concentration. Sometimes molecules need to move in the opposite direction. They need to get from an area of lower concentration to an area of higher concentration. In such cases, energy is needed to move the molecules across the cell membrane. Processes in which energy is used to move a substance across the cell membrane are called **active transport** (AK-tihv TRANS-port). There are two types of active transport.

In one type of active transport, molecules are carried across the cell membrane. Energy is used to change the shape of the membrane and pull the molecules through it. This kind of active transport is used to move molecules both into and out of the cell.

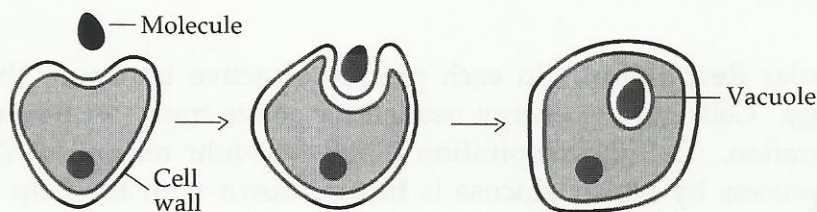
Fig. 6-1 shows one way molecules are moved through the cell membrane by active transport. This type of transport is similar to passive transport through carrier proteins. However, in this type of active transport, molecules move from an area of low concentration to an area of high concentration.

Fig. 6-1



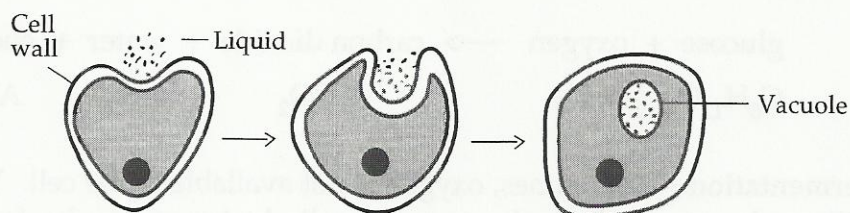
Another type of active transport is used to take large molecules into a cell. The cell membrane forms a sac around the molecule. Once the molecule is surrounded, the sac breaks away from the cell membrane and moves into the cytoplasm. The sac forms a vacuole. The vacuole stores the molecule for use by the cell. This process is shown in Fig. 6-2.

Fig. 6-2



The cell can take in liquids through a similar type of active transport. As shown in Fig. 6-3, the cell membrane forms tiny sacs. These sacs fill up with liquids in the environment outside the cell. Once full, the sacs move into the cytoplasm and form a vacuole. The vacuole stores the liquids for use by the cell.

Fig. 6-3

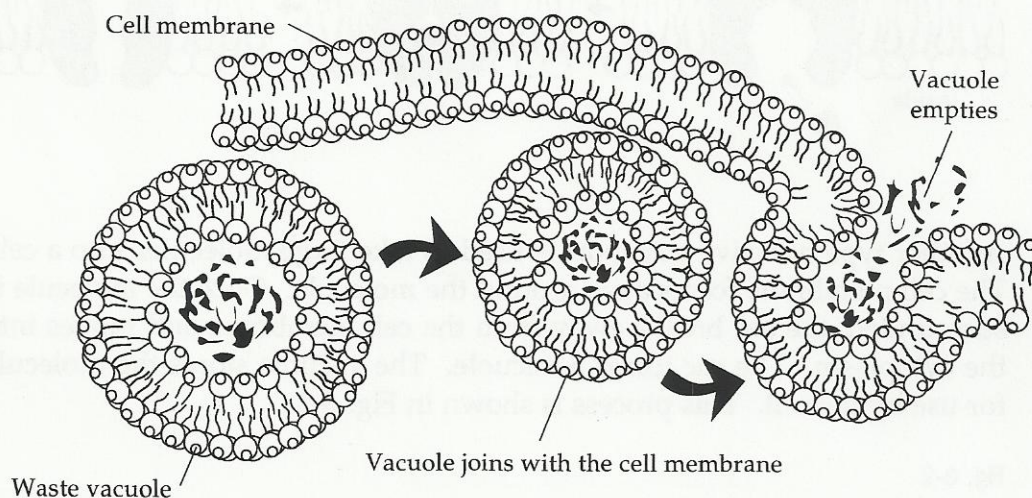




1. What is active transport? _____

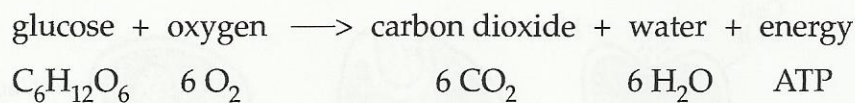
Materials can exit a cell in a similar manner. The cell stores its waste materials in a vacuole. The sac of wastes attaches to the cell membrane. Once the sac is joined to the membrane, its contents are released from the cell. The steps of this kind of transport are shown in Fig. 6-4.

Fig. 6-4



Cellular Respiration. In each process of active transport, the cell uses energy. Cells get the energy needed for active transport through cellular respiration. **Cellular respiration** (SEHL-yoo-luhr rehs-pih-RAY-shuhn) is the process by which glucose is broken down with the help of oxygen. Glucose is a type of sugar found in food. Plants and a few other organisms make their own glucose. Animals obtain glucose from the organisms they eat. All organisms need to break down glucose to gain energy. This process of cellular respiration occurs in the mitochondria of a cell. Recall from Lesson 3 that mitochondria are organelles that supply the cell with energy.

During cellular respiration, oxygen combines with glucose. Through a series of steps, the glucose is broken down. Water and carbon dioxide are released as waste products. The energy that is released forms high-energy molecules called ATP. The cell can directly use the energy in the ATP.



Fermentation. Sometimes, oxygen is not available to the cell. Yet, the cell still needs energy. In such cases, the cell obtains energy by fermentation. **Fermentation** (FER-mehn-TAY-shuhn) is the process by which glucose is broken

down without the help of oxygen. Fermentation occurs in the cytoplasm of a cell. During fermentation, a compound called lactic acid is released as a waste product. Energy is also released. As with cellular respiration, energy-rich molecules of ATP are produced. However, fermentation produces fewer ATP molecules than cellular respiration does.

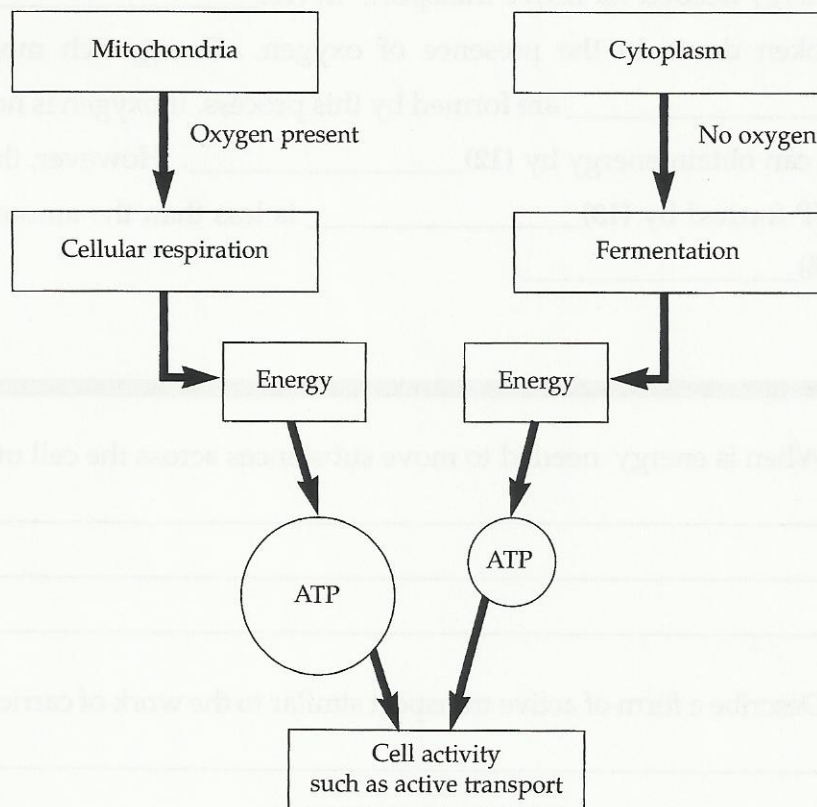
When you observe bread dough rise, you are seeing the result of fermentation. The yeast breaks down the glucose in the dough. Bubbles of carbon dioxide are released into the dough, causing it to expand.

✓ 2. What is fermentation? _____

✓ 3. How do the waste products of fermentation differ from those of cellular respiration? _____

Cellular respiration and fermentation are processes that release energy from glucose. ATP is a molecule that carries the energy until the cell needs it. Fig. 6-5 compares how cellular respiration and fermentation produce ATP molecules.

Fig. 6-5



**TAKE
ANOTHER
LOOK**

Check Your Understanding

Write a sentence explaining the connection between each pair of words.

4. active transport, cellular respiration _____

5. cellular respiration, fermentation _____

Complete the passage with the following terms: *active transport, ATP, cellular respiration, cytoplasm, energy, fermentation, less than, sac*. You may need to use some of the terms more than once.

The process in which energy is used to transfer a substance through the cell membrane is called (6) _____. Sometimes, (7) _____ is used to change the shape of the cell membrane. Then, the cell uses energy to form an (8) _____ around a molecule. The molecule is then drawn into the (9) _____ of the cell for future use.

Cellular respiration and fermentation are processes that supply a cell with the energy needed for active transport. In (10) _____, glucose is broken down in the presence of oxygen. Energy-rich molecules of (11) _____ are formed by this process. If oxygen is not present, a cell can obtain energy by (12) _____. However, the amount of ATP formed by (13) _____ is less than the amount formed by (14) _____.



15. When is energy needed to move substances across the cell membrane?

16. Describe a form of active transport similar to the work of carrier proteins.

17. How can materials exit a cell by active transport? _____

18. How does cellular respiration help organisms carry out their life processes? _____

19. How are cellular respiration and fermentation alike? How are they different? _____

