

CHAPTER 4 The Cell in Action

SECTION 1

# Exchange with the Environment

### BEFORE YOU READ

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

- How do cells take in food and get rid of wastes?
- What is diffusion?

National Science Education Standards  
LS 1a, 1c

## Where Do Cells Get the Materials They Need?

What would happen to a factory if its power were shut off or its supply of materials never arrived? What would happen if the factory couldn't get rid of its garbage? Like a factory, an organism must be able to get energy and raw materials and get rid of wastes. These jobs are done by an organism's cells. Materials move in and out of the cell across the cell membrane. Many materials, such as water and oxygen, can cross the membrane by diffusion.

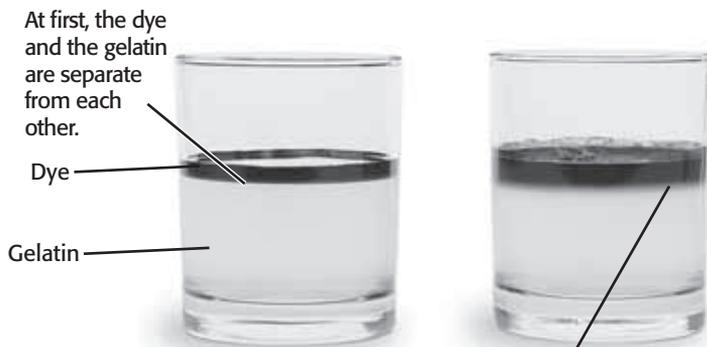


**Compare** As you read, make a chart comparing diffusion and osmosis. In your chart, show how they are similar and how they are different.

## What Is Diffusion?

The figure below shows what happens when dye is placed on top of a layer of gelatin. Over time, the dye mixes with the gelatin. Why does this happen?

Everything, including the gelatin and the dye, is made of tiny moving particles. Particles tend to move from places where they are crowded to places where they are less crowded. When there are many of one type of particle, this is a high concentration. When there are fewer of one kind of particle, this is a low concentration. The movement from areas of high concentration to areas of low concentration is called **diffusion**. ✓



### READING CHECK

1. **Define** What is diffusion?

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### TAKE A LOOK

2. **Identify** How do dye particles move through the water?

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**SECTION 1** Exchange with the Environment *continued*

### Critical Thinking

**3. Apply Concepts** Which of the following has a higher concentration of water molecules—200 molecules of water, or a mixture of 300 molecules of water and 100 molecules of food coloring? Explain your answer.

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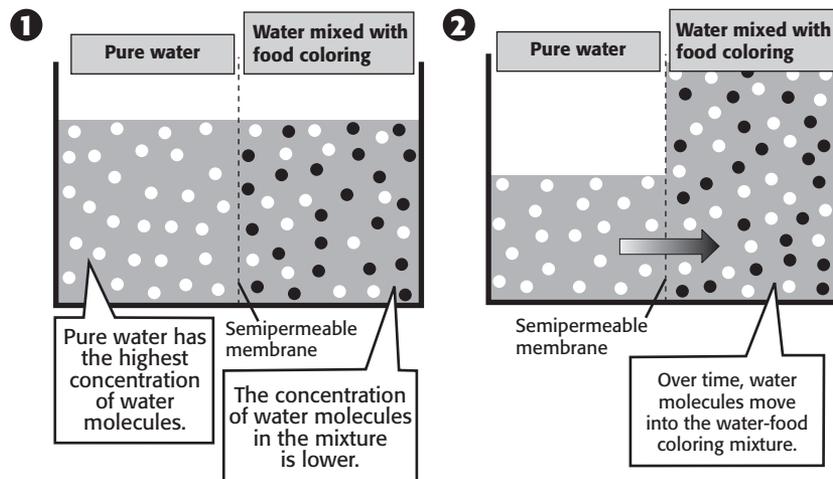
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### DIFFUSION OF WATER

Substances, such as water, are made up of particles called *molecules*. Pure water has the highest concentration of water molecules. This means that 100% of the molecules are water molecules. If you mix another substance, such as food coloring, into the water, you lower the concentration of water molecules. This means that water molecules no longer make up 100% of the total molecules.

The figure below shows a container that has been divided by a membrane. The membrane is *semipermeable*—that is, only some substances can pass through it. The membrane lets smaller molecules, such as water, pass through. Larger molecules, such as food coloring, cannot pass through. Water molecules will move across the membrane. The diffusion of water through a membrane is called **osmosis**.

#### Osmosis



### TAKE A LOOK

**4. Explain** Why does the volume of liquid in the right-hand side of the container increase with time?

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A cell membrane is a type of semipermeable membrane. This means that water can pass through the cell membrane, but most other substances cannot. The cells of organisms are surrounded by and filled with fluids. These fluids are made mostly of water. Water moves in and out of a cell by osmosis. ✓

### READING CHECK

**5. Identify** How does water move into and out of cells?

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**SECTION 1** Exchange with the Environment *continued***How Do Small Particles Enter and Leave a Cell?**

Small particles, such as sugars, can cross the cell membrane through passageways called *channels*. These channels in the cell membrane are made of proteins. Particles can travel through these channels by passive transport or by active transport.

During **passive transport**, particles move through the cell membrane without using energy from the cell. During passive transport, particles move from areas of high concentration to areas of lower concentration. Diffusion and osmosis are examples of passive transport.

During **active transport**, the cell has to use energy to move particles through channels. During active transport, particles usually move from areas of low concentration to areas of high concentration. ✓

**How Do Large Particles Enter and Leave a Cell?**

Large particles cannot move across a cell membrane in the same ways as small particles. Larger particles must move in and out of the cell by endocytosis and exocytosis. Both processes require energy from the cell.

**Endocytosis** happens when a cell surrounds a large particle and encloses it in a vesicle. A *vesicle* is a sac formed from a piece of cell membrane.

**Endocytosis**

- 1 The cell comes into contact with a particle.



- 2 The cell membrane begins to wrap around the particle.



- 3 Once the particle is completely surrounded, a vesicle pinches off.

**Exocytosis** happens when a cell uses a vesicle to move a particle from within the cell to outside the cell. Exocytosis is how cells get rid of large waste particles.

**Exocytosis**

- 1 Large particles that must leave the cell are packaged in vesicles.



- 2 The vesicle travels to the cell membrane and fuses with it.



- 3 The cell releases the particle to the outside of the cell.

**READING CHECK**

6. **Identify** What is needed to move particles from areas of low concentration to areas of high concentration?

**TAKE A LOOK**

7. **Identify** Label the vesicle in the figure.

# Section 1 Review

NSES LS 1a, 1c

## SECTION VOCABULARY

<p><b>active transport</b> the movement of substances across the cell membrane that requires the cell to use energy</p> <p><b>diffusion</b> the movement of particles from regions of higher density to regions of lower density</p> <p><b>endocytosis</b> the process by which a cell membrane surrounds a particle and encloses the particle in a vesicle to bring the particle into the cell</p>	<p><b>exocytosis</b> the process in which a cell releases a particle by enclosing the particle in a vesicle that then moves to the cell surface and fuses with the cell membrane</p> <p><b>osmosis</b> the diffusion of water through a semipermeable membrane</p> <p><b>passive transport</b> the movement of substances across a cell membrane without the use of energy by the cell</p>
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**1. Compare** How is endocytosis different from exocytosis? How are they similar?

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**2. Explain** How is osmosis related to diffusion?

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**3. Compare** What are the differences between active and passive transport?

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**4. Identify** What structures allow small particles to cross cell membranes?

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**5. Apply Concepts** Draw an arrow in the figure below to show the direction that water molecules will move in.

