# CH 5 PASSIVE AND ACTIVE TRANSPORT

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## Objectives

- **Explain** how an equilibrium is established as a result of diffusion.
- **Distinguish** between diffusion and osmosis.
- **Explain** how substances cross the cell membrane through facilitated diffusion.
- **Explain** how ion channels assist the diffusion of ions across the cell membrane.

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## Diffusion

- **Passive transport** involves the movement of molecules across the cell membrane without an input of energy by the cell.
- **Diffusion** is the movement of molecules from an area of higher concentration to an area of lower concentration, driven by the molecules' kinetic energy until equilibrium is reached.

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## Diffusion, *continued*

- **Diffusion Across Membranes**
  - Molecules can diffuse across a cell membrane by dissolving in the phospholipid bilayer or by passing through pores in the membrane.

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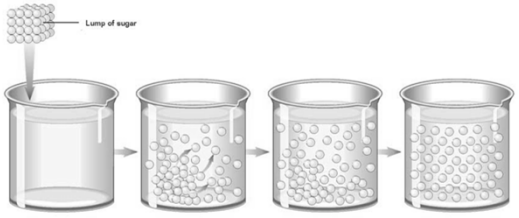
## Diffusion




If you drop a lump of sugar into a beaker of water, the sugar particles will diffuse and become evenly distributed throughout the water.

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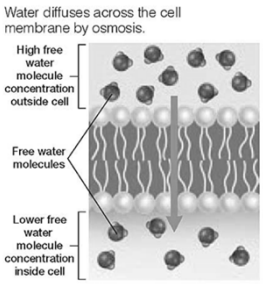
## Chapter 5

### Osmosis

- **Osmosis** is the diffusion of water across a membrane.









## Chapter 5

### Osmosis, *continued*

- **Direction of Osmosis**
  - The net direction of osmosis is determined by the relative solute concentrations on the two sides of the membrane.






## Chapter 5

### Osmosis, *continued*

- **Direction of Osmosis**
  - When the solute concentration outside the cell is higher than that in the cytosol, the solution outside is **hypertonic** to the cytosol, and water will diffuse out of the cell.






## Chapter 5

### Osmosis, *continued*

- **Direction of Osmosis**
  - When the solute concentrations outside and inside the cell are equal, the solution outside is **isotonic**, and there will be no net movement of water.






## Chapter 5

### Hypertonic, Hypotonic, Isotonic Solutions

| If the fluid outside the cell has... | Then outside fluid is... | Water diffuses... | Effect on cell |
|---|---|---|---|
| ...lower free water molecule concentration than cytosol | ...hypertonic. | ...out of cell. $H_2O$ | Cell shrinks. |
| ...higher free water molecule concentration than cytosol | ...hypotonic. | ...into cell. $H_2O$ | Cell swells. |
| ...same free water molecule concentration as cytosol | ...isotonic. | ...into and out of cell at equal rates. $H_2O$ | Cell stays same size. |






## Chapter 5

### Osmosis, *continued*

- **How Cells Deal With Osmosis**
  - To remain alive, cells must compensate for the water that enters the cell in hypotonic environments and leaves the cell in hypertonic environments.
  - **Contractile vacuoles** are organelles that regulate water levels in paramecia.

Chapter 5

## Facilitated Diffusion

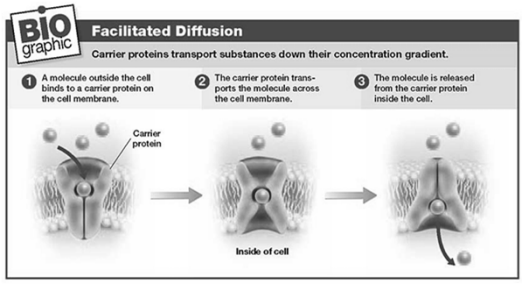
- In facilitated diffusion, a molecule binds to a carrier protein on one side of the cell membrane.
- The carrier protein then changes its shape and transports the molecule down its concentration gradient to the other side of the membrane.






Chapter 5

## Facilitated Diffusion









Chapter 5

## Diffusion Through Ion Channels

- **Ion channels** are proteins, or groups of proteins, that provide small passageways across the cell membrane through which specific ions can diffuse.

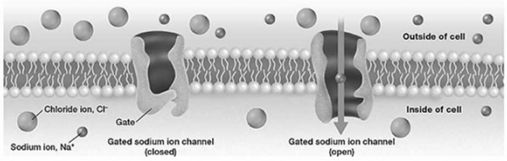





Chapter 5

## Ion Channels

Ion channels allow certain ions to pass through the cell membrane.









Chapter 5

## Objectives

- **Distinguish** between passive transport and active transport.
- **Explain** how the sodium-potassium pump operates.
- **Compare** endocytosis and exocytosis.






Chapter 5

## Cell Membrane Pumps

- **Active transport** moves molecules across the cell membrane from an area of lower concentration to an area of higher concentration.
- Unlike passive transport, active transport requires cells to expend energy.

## Chapter 5

### Cell Membrane Pumps, *continued*

- Some types of active transport are performed by carrier proteins called cell membrane pumps.






## Chapter 5

### Cell Membrane Pumps, *continued*

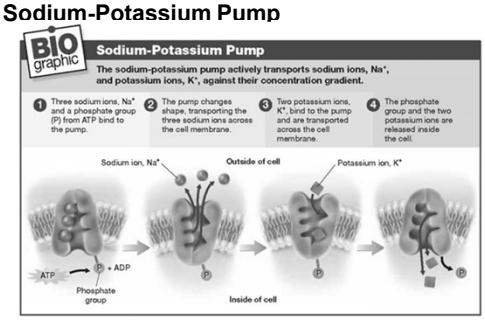
- **Sodium-Potassium Pump**
  - The **sodium-potassium pump** moves three $Na^+$ ions into the cell's external environment for every two $K^+$ ions it moves into the cytosol.
  - ATP supplies the energy that drives the pump.






## Chapter 5

### Sodium-Potassium Pump









## Chapter 5

### Movement in Vesicles

- **Endocytosis**
  - In **endocytosis**, cells ingest external materials by folding around them and forming a pouch.
  - The pouch then pinches off and becomes a membrane-bound organelle called a **vesicle.**






## Chapter 5

### Movement in Vesicles, *continued*

- **Endocytosis**
  - Endocytosis includes **pinocytosis**, in which the vesicle contains solutes or fluids, and **phagocytosis**, in which the vesicle contains large particles or cells.






## Chapter 5

### Movement in Vesicles, *continued*

- **Exocytosis**
  - In **exocytosis**, vesicles made by the cell fuse with the cell membrane, releasing their contents into the external environment.