Section 8.3
Cell Transport

Make sure you pay attention to pictures
I Can...

• **LS 1.7** I can develop models explaining the passive and active movement of molecules (including water) into or out of the cell.

• **LS 1.7** I can analyze experimental data showing the movement of materials from high concentration to low concentration, or vice versa.
Key Questions

1. Describe how molecules enter and leave a cell without the use of the cell’s energy.
2. Describe the two major types of active transport.
Vocabulary

• Homeostasis
• Diffusion
• Facilitated diffusion
• Aquaporin
• Osmosis
• Isotonic
• Hypertonic
• Hypotonic
• Osmotic pressure
Passive Transport

• Every cell lives in a liquid environment.

• Cells maintain homeostasis by regulating the movement of substances in and out.

• **Homeostasis**- state of relatively constant internal physical and chemical conditions

• The movement of molecules across the cell membrane without using cellular energy is called *passive transport*. 
Passive Transport

• Particles will move high $\rightarrow$ low
• Particles move \textit{with/along/down} the gradient
• No energy

1. Diffusion
2. Facilitated Diffusion
   • Ex. Osmosis
Diffusion

- **Diffusion** - the process by which particles move from an area where they are more concentrated to an area where they are less concentrated (high concentration to low concentration).

- *Equilibrium* is reached when the concentration of a substance on both sides of the cell membrane is the same.
  - Once at equilibrium, molecules continue to move in both directions.
  - There is no further net change in the concentration on either side.

- Diffusion depends on random molecule movements (does NOT use energy).
Facilitated Diffusion

- The molecules that pass most easily through the cell membrane are small and uncharged.

- Proteins in the cell membrane act as carriers, or channels, making it easy for certain molecules to cross.

- Ex. Red blood cells have protein carriers that allow glucose to pass through

- Facilitated Diffusion- molecules that cannot directly diffuse across the cell membrane pass through special protein channels

- Fast and specific to certain molecules

- Does NOT require any energy
Osmosis- Ex. of Facilitated Diffusion

• Water molecules cannot easily diffuse through the cell membrane
  • because the lipids in the membrane are hydrophobic

• **Aquaporins**- channel proteins that allow water to pass through

• **Osmosis**- diffusion of water through a selectively permeable membrane
  • Water moves from high to low concentration
Lower concentration of sugar molecules  
Higher concentration of sugar molecules  

Sugar  
Barrier  

Water level rises on side with the more concentrated solution
Osmosis

- **Isotonic** - “same strength”
- **Hypertonic** - “above strength”
- **Hypotonic** - “below strength”

“Strength” refers to the amount of solute, NOT the water.
Osmotic Pressure

• The net movement of water into or out of a cell produces a force known as **osmotic pressure**.

• Cells are almost always **hypertonic** to freshwater.
  • Because cells contain salts, sugars, proteins, etc.
  • Freshwater will move into the cell, causing it to swell and sometimes burst.
  • Cells in large organisms are not in danger of bursting because most of them do not come in contact with freshwater...cells are bathed in blood or other isotonic solutions.
Osmotic Pressure

• What happens when cell do come in contact with freshwater?

• Fish and frog eggs lack water channels...so water moves into the cell so slowly that osmotic pressure is not a problem.

• Bacteria and plant cells are surrounded by tough cell walls. Cell walls prevent the cells from expanding, even with tremendous osmotic pressure. Increased osmotic pressure does make the plant cells extremely vulnerable to cell wall injuries.
## The Effects of Osmosis on Cells

<table>
<thead>
<tr>
<th>Solution</th>
<th>Isotonic solution outside the cell</th>
<th>Hypertonic solution outside the cell</th>
<th>Hypotonic solution outside the cell</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Animal Cell</strong></td>
<td><img src="image" alt="Diagram" /></td>
<td><img src="image" alt="Diagram" /></td>
<td><img src="image" alt="Diagram" /></td>
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<tr>
<td><strong>Plant Cell</strong></td>
<td><img src="image" alt="Diagram" /></td>
<td><img src="image" alt="Diagram" /></td>
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</tbody>
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**Legend**
- Isotonic: No net change in water movement.
- Hypertonic: Water moves out of the cell.
- Hypotonic: Water moves into the cell.
Active Transport

• Particles will move low → high
• Particles move *against* the gradient
• Requires energy

1. Molecular Transport
2. Bulk Transport
   • Endocytosis (phagocytosis and pinocytosis)
   • Exocytosis
# Active Transport

<table>
<thead>
<tr>
<th>Molecular Transport</th>
<th>Bulk Transport</th>
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</thead>
<tbody>
<tr>
<td>• small molecules are carried across by <em>protein pumps</em></td>
<td>• Larger molecules and clumps of materials</td>
</tr>
<tr>
<td>• Ex. calcium, potassium, and sodium</td>
<td>• Sometimes involves changes to the shape of the cell membrane</td>
</tr>
<tr>
<td>• Enables cells to concentrate substances in a particular location</td>
<td>• Two types: endocytosis and exocytosis</td>
</tr>
<tr>
<td>• Cells spend a considerable portion of their energy on molecular transport</td>
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</table>
Endocytosis

• The process of taking materials into the cell by means of infoldings, or pockets, in the cell membrane
• The pocket breaks loose from the cell membrane and forms a vesicle
• Can be used for larger molecules, clumps or food, even whole cells

• Two types- phagocytosis and pinocytosis
Endocytosis

• **Phagocytosis**
  - Extensions of cytoplasm surround a particle and package it within a food vacuole
  - The cell then engulfs it
  - Ex. White blood cells use this to remove damaged or foreign cells and destroy them
  - Ex. Amoebas use this method for taking in food

• **Pinocytosis**
  - Cells take up liquid from the surrounding environment
  - Tiny pockets form along the cell membrane, fill with liquid, and pinch off to form vacuoles
Exocytosis

• Cells release large amounts of material

• Vacuole fuses with the cell membrane to release its contents

• Ex. Removal of water using a contractile vacuole
The End 😊