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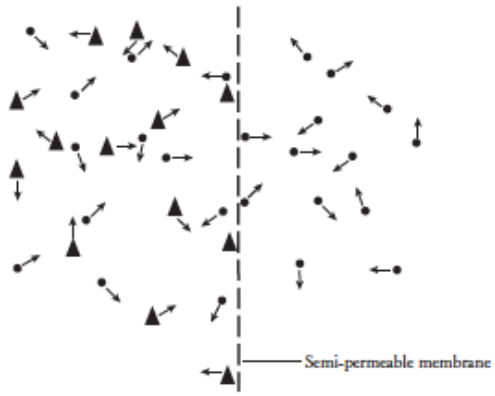
Membrane Structure and Function POGIL

Why?

Advertisements for sports drinks, such as Gatorade, Powerade, and Vitaminwater seem to be everywhere. All of these drinks are supposed to help your body recover and replenish lost electrolytes, fluids and vitamins after exercise. But how do the essential molecules contained in these drinks and food get into cells to quickly help you recover after exercise?

Model 1 – Simple Diffusion



1. How many different types of molecules are shown in Model 1?

2. Count and record the number of triangles and circles found on each side of the membrane.

   Triangles = _____ Circles = _____

3. Which shape is larger?

4. Describe the direction of the movement of the molecules in Model 1.

5. Which molecules are able to pass through the semi-permeable membrane? Justify your answer.

6. If your left this "system" for an extended period of time, and then viewed it again, would you expect to find any changes in the concentrations of the molecules on either side of the membrane? Justify your answer.

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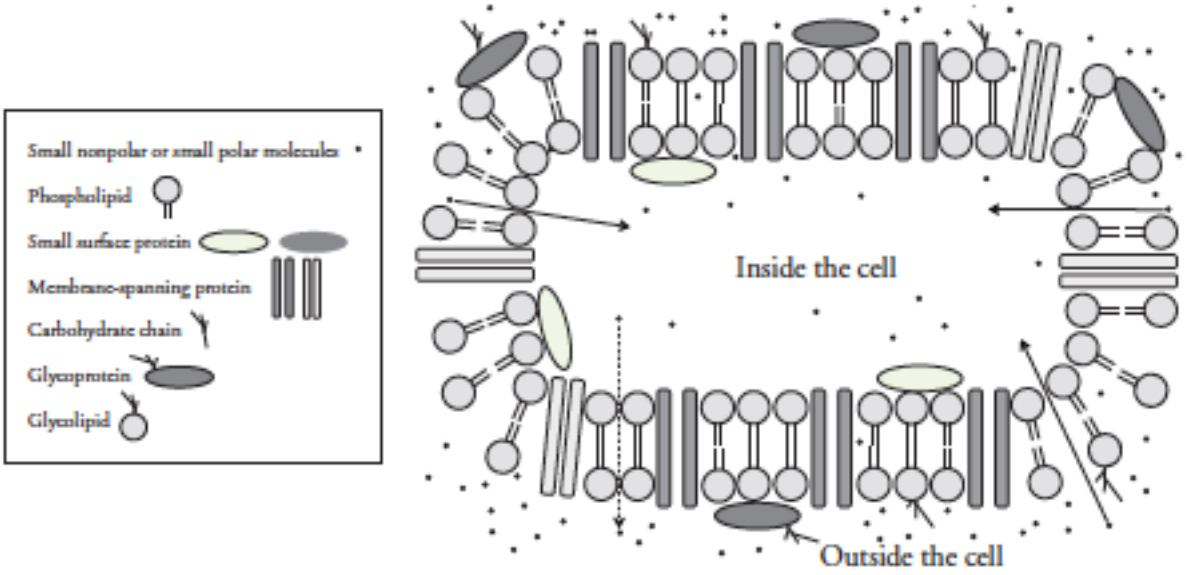
Model 2 – The Selectively Permeable Cell Membrane



1. What two major types of biological molecules compose the majority of the cell membrane in model 2?

2. How many different protein molecules are found in Model two?

3. What is the difference between the position of the surface proteins and the membrane-spanning proteins?

4. What types of molecules are shown moving across the membrane?

5. Where exactly do these molecules pass through?

6. How does the concentration of the small molecules inside the cell compare to the molecules outside the cell?

7. Because particles move randomly, molecules tend to move across the membrane in both directions. Does the model indicate that the molecules are moving in equal amounts in both directions? Justify your answer using complete sentences. (*Hint: Look at the arrows)*

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Read This!

When there is a difference in concentration (amount) of a particular molecule on either side of a membrane, a ***concentration gradient*** exists. Molecules move along (down) the concentration from high to low concentration until a state of ***equilibrium*** (equal on both sides of membrane) is reached. At that point, there is no more movement in one direction. The molecules will continue to randomly move across the membrane. The movement of molecules along the concentration gradient is called ***diffusion***.

1. Look back at Models 1 and 2. Which particles are moving by diffusion across the membranes shown? How do you know this these are the particles moving via diffusion?

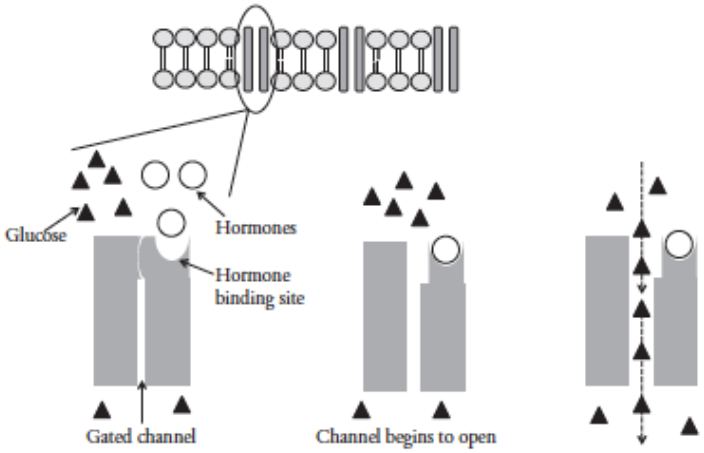
2. Using all the information in the previous models and questions, circle the correct response to correctly fill in each blank.

    a. Diffusion is the movement of molecules from an area of (low/high) concentration to an area of (low/high) concentration.

    b. The molecules will continue to move along this (semi-permeable membrane/concentration gradient) until they reach (diffusion/equilibrium)

    c. Once equilibrium is reached, molecules will continue to move across a membrane (randomly/in one direction).

Model 3 – Facilitated Diffusion



1. Which part of the cell membrane is shown in more detail in Model 3? Look back at Model 2 if needed.

2. What is the gap between the proteins called?

3. What type of molecules attach to the protein?

4. Explain in detail what happened that allowed the glucose molecules to pass through.

5. Why do you think the type of protein channel in Model 3 is called a gated channel?

6. To **facilitate** means to help. Explain why this type of diffusion is called facilitated diffusion.

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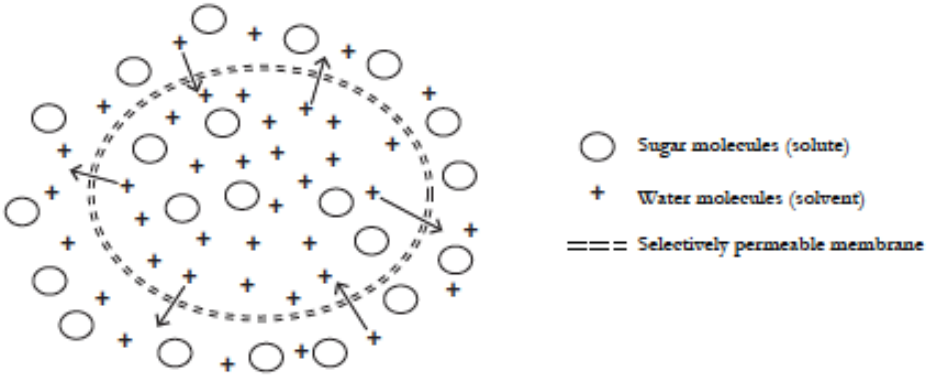
Model 4 – Movement of Water In and Out of Cells



1. Consider the size of the sugar and water molecules in Model 4. Which molecules in the diagram are able to move through the selectively permeable membrane?

2. Complete the table below by counting the molecules in Model 4.

	Inside the Cell	**Outside the Cell**
Number of Sugar Molecules		
Number of Water Molecules		
Ratio of water to sugar		

3. Consider the arrows indicating movement of water across the membrane?

    a. In which direction are water molecules moving – into or out of the cell?

    b. Are more water molecules moving into or out of the cell?

4. Applying what you already know about the random movement of molecules, what will eventually happen to the concentration on both sides of the membrane?

5. The definition of diffusion is the movement of molecules across a membrane from an area of high concentration to an area of low concentration. According to this definition, is the cell in Model 4 undergoing diffusion? Explain.

6. In the cell diagram in Model 4, where is the higher concentration of **water** – inside or outside of the cell.

7. Is the cell in Model 4 undergoing diffusion if you consider the concentration of **water** on either side of the selectively permeable membrane? Explain.

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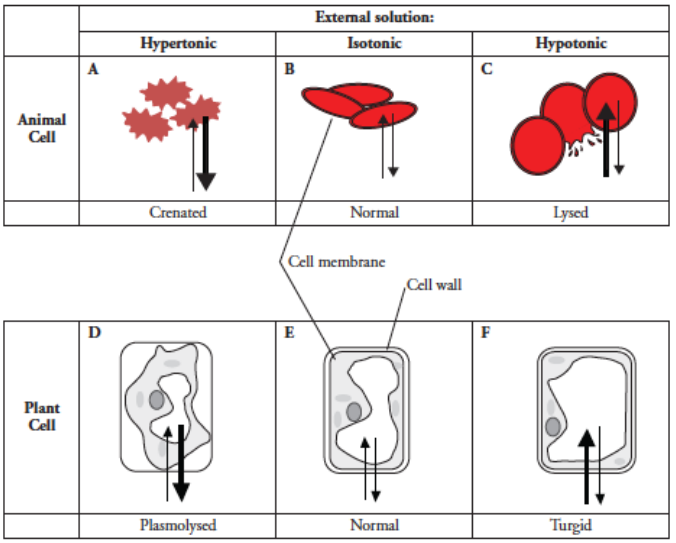
Read This!

> **Osmosis** is the movement of water from high water concentration to low water concentration across a semi-permeable membrane.

Model 5 – Osmosis in Plant and Animal Cells



1. The arrows in Model 5 shoe movement of water into and out of the cells. What does the thickness of the arrow indicate?

2. Consider the definition for osmosis and the movement of water from a dilute solution (high concentration of water) to a concentrated solution (low concentration of water). *Hint: When a solution is **diluted**, you have **LOTS of solvent (water) and little solute (molecules)**. When a solution is **concentrated**, you have **LOTS of solute (molecules) and little solvent (water)**.*

    a. Describe the concentration of the solution surrounding cells A and D (extracellular), relative to the concentration of the solution inside cells A and D (intracellular).

    b. Describe the concentration of the extracellular solution of cells C and F, relative to the intracellular solution of cells C and F

    c. Describe the concentration of the extracellular solution of the cells B and E, relative to the concentration of the intracellular solution B and E.

3. Using all the information in the previous model and questions, circle the correct response to correctly fill in each blank.

    a. A hypertonic solution is when there is (more/less/equal) solute outside the cell than inside the cell causing the solvent, water, to move (out/into/both ways) of the cell.

    b. A hypotonic solution is when there is (more/less/equal) solute outside the cell than inside the cell causing the solvent, water, to move (out/into/both ways) of the cell.

    c. An isotonic solution is when there is (more/less/equal) solute and solvent, water, outside the cell causing the solvent to move (out/into/both ways) in the cell.

4. Do you still think the cell in Model 4 undergoing diffusion if you consider the concentration of **water** on either side of the selectively permeable membrane? Explain.

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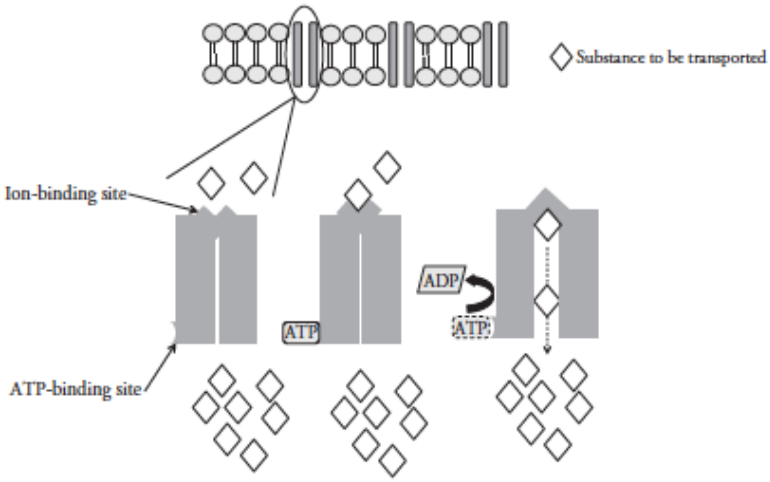
Model 6 – Active Transport



1. Which part of the cell membrane is shown in more detail in Model 6? Look back at Model 2 if needed.

2. What shape represents the substance being transported across the membrane in Model 6?

3. In which direction is the transported substance moving – from an area of high concentration to low or from an area of low concentration to high? Support your answer.

4. Is the substance being moved along (down) a concentration gradient? Justify your answer.

5. ATP is a type of molecule that can provide energy for biological processes. Explain how the energy is being used in Model 6.

6. The type of transport shown in Model 6 is **active transport**, while diffusion, facilitated diffusion, and osmosis are called passive transport. Given the direction of the concentration gradient in active and passive transport examples, explain why active transport requires energy from the cell.

Complete the table below to show the difference between active and passive transport.

	Active Transport	**Passive Transport**		
		Diffusion	**Facilitated Diffusion**	**Osmosis**
Requires energy input by the cell				
Water movement high to low concentration				
Molecules move along (down) a concentration gradient				
Moves molecules against (up) a concentration gradient				
Always involves channel proteins				
Molecules pass between phospholipids				
Moves large molecules				
Moves small nonpolar and polar molecules				