NAME:_____

Modeling Membrane Structure and Osmosis

Living cells are surrounded by a cell membrane. The structure of the membrane allows it to function as a *selectively permeable* barrier separating the cell's internal cytoplasm from the outside environment. The currently accepted model of structure for this membrane is referred to as the fluid-mosaic model. The major components of the cell membrane are :

a. **Phospholipids**- are arranged in a double layer. These phospholipids are composed of a phosphate head region, which face the watery environment inside and outside the cell. The hydrocarbon tails of each layer face one another away from the watery environmental.
b. **Membrane proteins**- there are two main types of proteins in the membrane, peripheral and integral. Proteins in the membrane may serve as transport proteins, chemical receptors, enzymes, and regulators of cell to cell recognition, cell connections, and attachment sites for cytoskeletal structures
    a. **Integral proteins** span the distance of the lipid bilayer.
    b. **Peripheral proteins** are not embedded and are loosely attached to the surface of the membrane.

This *selectively permeable* membrane is important in the cell's ability to maintain homeostasis or the condition of equilibrium. Collectively, the components of the cell membrane allow it to be selectively permeable, allowing small, uncharged particles to move by passive transport through the membrane preventing the passage of large or charge substances. Large or charged substances must have a special pathway through the membrane.

Water will move through the membrane with relative ease f*rom an area of high water concentration to an area of low water concentration*. In comparing two solutions, a solution is said to be **hypertonic** if it contains a higher concentration of solutes than another. The solution with the smaller number of dissolved substances (or solutes) is called **hypotonic**. When comparing two solutions that are of equal solute concentration, they are referred to as **isotonic.** Hypertonic solutions have lower water concentrations and will gain water from hypotonic solutions. Cells placed in distilled water, for example, will gain water as water moves through the selectively permeable membrane from an area of high water concentration to an area of lower water concentration. Under these conditions, animal cells will burst, but plant cells do not because of the presence of a cell wall. Cells placed in a solution of syrup for example, will lose water as water moves through the selectively permeable membrane from an area of high water concentration to an area of lower water concentration. Animal cells will shrink, and the membrane of a plant cell will pull away from the cell wall or undergo plasmolysis.

Purpose:

In this activity, you will model and demonstrate your understanding of the structure of the cell membrane and the effects of the membrane's permeability to water.

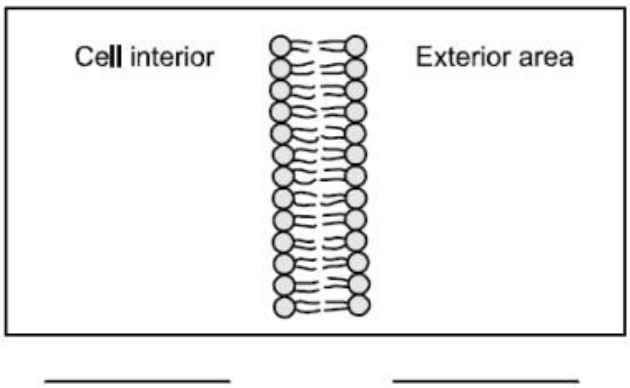
1. Use the manipulatives and the definitions above to build a cell membrane. Have it checked before you draw it in the space below. Label the phospholipids and both types of proteins.

2. Use the sugar and water molecules to model a hypertonic solution. Draw it below.

3. Use the sugar and water molecules to model a hypotonic solution. Draw it below.

Conclusion Questions:

4. Sketch in solute and water molecules in the figure below to represent an **isotonic** condition.



5. Using the information you have, predict what will occur for each cell and condition listed:

Cell Type	If Placed in this Solution	Predicted Results
Liver Cell (Animal Cell)	Hypotonic	
Onion cell (Plant Cell)	Hypertonic	
Cheek cell (Animal Cell)	Isotonic	
Red blood cell (Animal Cell)	hypertonic	
Potato cell (Plant Cell)	hypertonic	

Read each question and circle the best answer to the following multiple choice question. After each question, EXPLAIN why that is the right answer.

1. A red blood cell placed in distilled water will swell and burst due to the movement of
    a. Salt from the distilled water diffusing into the red blood cell
    b. Water molecules moving by osmosis into the red blood cell
    c. Water from the red blood cell moving into the distilled water
    d. Salt from the red blood cell moving into the distilled water

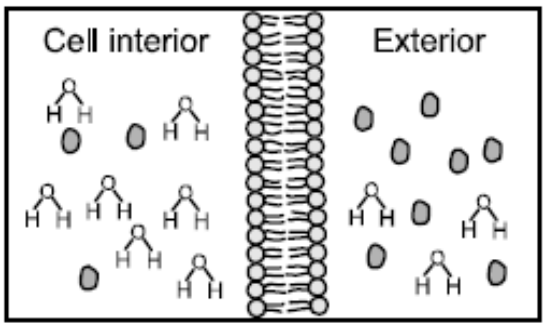
Explanation:

2. Which of the following terms is most closely associated with the selective permeability of the cell membrane?
    a. Hydrolysis
    b. Hypothesis
    c. Homeostasis
    d. Homologous

Explanation:

3. A cell that has deformity or irregularities in transport proteins may not be able to
    a. Allow water to enter the cell
    b. Prevent carbon dioxide from entering the cell
    c. Move small particles out of the cell
    d. Move large particles into the cell

Explanation:



4. Which of the following is a true statement regarding the above situation?
    a. The exterior is hypotonic
    b. There will be a net movement of water out of the cell.
    c. This diagram could be of an animal cell in distilled water
    d. The cell's internal solution is hypotonic.

Explanation: