

Biology 12 - The Cell Membrane and Cell Wall Function

⇒ Part A: Definitions: Define the following terms, **IN YOUR OWN WORDS, IN AS FEW WORDS AS CLARITY ALLOWS.**

| | |
|-----------------------------|---|
| i. cell membrane | phospholipid and protein covering of every cell, controls what goes in and out of each cell |
| ii. diffusion | movement of molecules from region of greater concentration to region of lesser concentration. |
| iii. concentration gradient | the difference in concentration between two regions |
| iv. solute | the solid that is dissolved in a solution |
| v. solvent | the liquid that dissolves the solute in a solution |
| vi. osmotic pressure | the pressure of water moving across membranes caused by a concentration gradient. |
| vii. isotonic solution | solution that has same concentration of solute as the cells it surrounds |
| viii. hypertonic solution | solution that has greater concentration of solute as the cells it surrounds. Will cause cell to shrink |
| ix. hypotonic solution | solution that has lesser concentration of solute as the cells it surrounds. Will cause cells to burst |
| x. plasmolysis | shrinking of a plant cell (wilting) due to being place in a hypertonic solution. |
| xi. turgor pressure | hydrostatic pressure due to a plant cell being placed in hypotonic solution. Is pressure on inside of plant cell against the cell wall. |
| xii. facilitated transport | Carrier-mediated transport that works with the conc. gradient and requires no energy. |
| xiii. crenation | shrinking of animal cells placed in hypertonic solutions. |
| xiv. active transport | Carrier-mediated transport that works against the conc. gradient and requires energy. |
| xv. endocytosis | Cells bringing in materials by forming vesicle around substance outside the cell with the cell membrane. |
| xvi. phagocytosis | endocytosis of large particles (large enough to be seen with light microscope) |
| xvii. pinocytosis | “cell drinking” Endocytosis of small particles (small enough that an electron microscope is needed) |
| xviii. exocytosis | opposite of endocytosis. Vesicle inside cell fuses with cell membrane, depositing contents on the outside. |
| xix. glycolipid | carbohydrate attached to phospholipid on cell membrane. Often serves in cell identification and communication. |
| xx. Fluid Mosaic Model | Current model of membrane structure. A phospholipid fluid sea is embedded with a wide variety (“mosaic”) of protein molecules. |

Part B - Short Answers

- Diffusion is the movement of molecules from the area of greater concentration to the area of lesser concentration.
- Osmosis is the movement of water across a selectively permeable membrane.
- A cell is isotonic to a solution of 0.01% sugar.
 - What concentration would be hypertonic? >0.01%
 - What concentration would be hypotonic? <0.01%
- What happens to an animal cell in a hypotonic solution? it swells and bursts
 - What happens to an animal cell in a hypertonic solution? It loses water to medium -- shrivels up.
- Turgor pressure is best exemplified by placing a plant cell in a hypotonic solution.
- Give an example:
 - of diffusion in the body the movement of O₂ from the air sacs into the blood
 - of facilitated transport some sugars enter the cell more quickly than others
 - of active transport the [] of Na is greater outside a cell, the [] of K is greater inside a cell
- List 3 ways in which active transport differs from the process of diffusion across a cell membrane.

- i. goes from area of less[] to area of greater
- ii. requires carrier protein
- iii. requires expenditure of energy

8. List 3 ways in which facilitated transport differs from active transport.

- i. goes from area of greater [] to area of lesser []
- ii. does not require energy

9. Within each of the three pairs, choose the more concentrated solution:

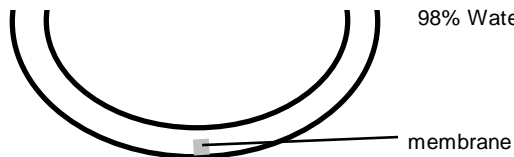
| Pairs | | Answer |
|--------------------------|--------------------------|--------|
| a. 80% water, 20% starch | b. 90% water, 10% starch | a |
| a. 5 g NaCl, 50 g water | b. 5 g NaCl, 25 g water | b |
| 85% solvent, 15% solute | 75% solvent, 25% solute | b |

10. Consider this diagram.

- a) Will the concentration of water stay the same on side A or become greater or less with time? **greater**
- b) Will the concentration of protein on side A stay the same or become greater or less with time? **less**
- c) Glucose will cross the membrane in which direction? **A to B**
- d) On which side will the hydrostatic pressure increase? **A**
- e) What will happen to the level of the solution on each side? **A will go up, B will go down**

Side A
20% Protein
4% Glucose
75% water

Side B
2% Glucose
98% Water



- f) Red blood cells neither gain nor lose water when put into 0.9% NaCl.
 - a) What term would you use to describe the tonicity of 0.9% NaCl for Red blood cells? **isotonic**
 - b) Are the solutions below hypertonic or hypotonic to red blood cells?
 - i) 15% NaCl **hypertonic**
 - ii) 0.001% NaCl **hypotonic**
- 12. A scientist notes that of three monosaccharides -- glucose, mannose, and galactose -- glucose enters cells much faster than the other two. What process is at work? **facilitated transport**
- 13. Answer true or false:

| | |
|--|---|
| a. If a plant cell is placed in salt solution, the central vacuole will shrink | T |
| b. If a red blood cell is placed in distilled water, it will shrink | F |
| c. If a plant cell is placed in distilled water, the cell membrane will move away from the cell wall | F |
| d. If a red blood cell is placed in a salt solution, salt will enter the cells, giving them a strange appearance | F |
| e. Crenation is to plasmolysis as hemolysis is to turgor pressure | T |

- 14. A small lipid molecule passes easily through the cell membrane. Which of these statements is the most likely explanation? a) a protein carrier must be at work **b) the cell membrane is partly composed of lipid molecules** c) the cell is expending energy to do this d) phagocytosis has enclosed this molecule in a vacuole
- 15. Which of these does not require an expenditure of energy? a) diffusion b) osmosis c) facilitated transport d) **none of these require energy**
- 16. The thyroid gland contains a high concentration of iodine. This is an example of a) passive transport b) **active transport** c) facilitated transport d) endocytosis
- 17. Cell drinking is synonymous with a) cell eating b) endocytosis c) phagocytosis d) **pinocytosis**
- 18. If a cell uses active transport to take in salts, then osmosis will follow and water will enter the cell a) **true** b) false
- 19. Which of the following substances would be taken into a cell by phagocytosis? a) dissolved gases b) **proteins** c) simple sugars d) steroid lipids
- 20. An animal cell will always take in water when placed in a) hypertonic solution b) **hypotonic solution** c) isotonic solution d) osmotic solution

⇒ **Answer the following questions on a separate sheet of paper**

- 1. Draw a diagram of three ways by which small molecules can enter cells. As an aid in distinguishing the three mechanisms, indicate the number of molecules on either side of the membrane.
- 2. An experiment is designed to study the mechanism of sucrose uptake by plant cells. Cells are immersed in a sucrose solution, and the pH of this surrounding solution is monitored with a pH meter. The measurements show that sucrose uptake by the plant cells raises the pH of the surrounding solution. The magnitude of the pH change is proportional to the starting concentration of sucrose in the extracellular solution. A metabolic poison that blocks the ability of the cells to regenerate ATP also inhibits the pH change in the surrounding solution. Explain these results.
- 3. If our cells and body fluids are hypertonic to the water of a swimming pool, then why do we not swell and pop when we go for a swim?