

**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

7. List 3 ways in which active transport differs from the process of diffusion across a cell membrane.

- i. goes from area of less  $\square$  to area of greater  $\square$
- ii. requires carrier protein
- iii. requires expenditure of energy

8. List 2 ways in which facilitated transport differs from active transport.

- i. goes from area of greater  $\square$  to area of lesser  $\square$
- 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
a. 85% solvent, 15% solute	b. 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**

Side A  
20% Protein  
4% Glucose  
75% water

Side B  
2% Glucose  
98% Water



- 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**

11. 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 a) hypertonic solution b) **hypotonic solution** c) isotonic solution d) osmotic solution

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

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### Part C – Long Answer

1. (next page)
2. The Fluid Mosaic Model of the cell membrane structure is mainly composed of a double layer of phospholipids, making up the fluid part of the cell membrane. Within the phospholipid bilayer, are proteins and carbohydrates partly or wholly embedded to make up the mosaic or solid part of the membrane. The proteins attached to the membrane make it selectively permeable.
3. The cell membrane is described as selectively permeable because the proteins in the membrane allow certain or specific molecules to enter the cell and some molecules of the same size not to enter the cell. The difference between being selectively permeable and semi-permeable is selectively permeable only allows certain types of molecules to enter the cell and size is not a basis, while semi-permeable membrane allows molecules to go through as long as they fit through the membrane. One example of semi-permeable is a plant cell wall.
4.
  - a.) Diffusion is the movement of particles from area of higher concentration to lower concentration for equal distribution of particles within a certain solution.
  - b.) 3 examples of molecules that can get in or out of cell by diffusion are lipid soluble molecule like cholesterol, water and gas such as oxygen.
  - c.) These molecules all
5. 3 Factors that affect the rate of diffusion across a cell membrane are:
  - Increase in temperature because higher temperature tends to cause molecules to move faster, therefore, moving from high concentration to low concentration easily.
  - Increase in concentration gradient because the greater the difference of concentration, the easier the molecules can get from high concentration to low concentration.
  - Decrease in the size of the diffusing molecules because the smaller the molecules, the better chance of getting through the tiny holes of the cell membrane or the pores in order to get from high concentration to low concentration.
6.
  - a.) Osmosis is the net movement of water molecules from area of higher concentration to lower concentration through a selectively permeable membrane.
  - b.) Osmosis and diffusion are similar because both require movement of particles from area of high concentration to low concentration. They are different because osmosis is the special case of diffusion that involves only water particles and has to go through a selectively permeable membrane in the process.
7.
  - a.) Facilitated Transport, also known as Facilitated Diffusion, uses protein carriers in cell membrane to allow lipid-soluble molecules like glucose and amino acid to go through the cell membrane. The molecules go from high concentration to low and require no

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11. We do not swell and pop when we go for a swim even if we are hypotonic to the water of the swimming pool because
- 12.
- a.) Surface area to volume ratio simply is the amount of surface of the cell membrane compared to a certain volume of cytoplasm.
  - b.) The SA:V ratio is very important to cells because if there is less cell membrane for a certain volume of cytoplasm, then nutrients and wastes won't be able to come in and out of the cell fast enough to carry out vital processes in the cell.
  - c.) It is better to have a high SA:V ratio because this allows enough materials to get in and wastes out of the cell, making it easier to carry out important cell activities because of larger surface area of membrane for the amount of cytoplasm in the cell.
  - d.) To optimize the SA:V ratio, cells can divide, slow down their metabolism or change shape to long and thin rather than round and thick.
- 13.
- a.) (next page)
  - b.) The cells must be cultured in approximately 1.34% salt in water so they won't either shrink or swell.
  - c.) The cells in the 1.5% salt solution lose mass because the cells were hypotonic to the salt solution, therefore, by going through osmosis, the water transfers from the cell to the salt solution to reach equal tonicity with the cell.
  - d.) Glucose would enter the cell by both facilitated and active transport through protein carriers.