Essential Knowledge

ESSENTIALS	RELATION TO TOPIC
Cell membranes are selectively permeable due to their stx	Cell membranes are composed of phospholipid bylayer that is *both* hydrophobic and hydrophilic which allows for only desired substances to pass
Growth, reproduction, & dynamic homeostasis require that cells create and maintain internal environments that are different from their external environments	Without maintaining a balanced internal environment the cell may die from shriveling up or exploding
Growth & dynamic homeostasis are maintained by their constant movement of molecules across membranes	Cells communicate through membranes which may include receiving signals and materials, or sending off waste or signals of their own as hormones or electricity
Eukaryotic cells maintain internal membranes that partition the cell into specialized regions	Eukaryotic cells have organelles specialized for tasks made from the membrane such as the mitochondria and golgi body

Big Ideas

Big Idea 2: Biological systems utilize free energy and molecular building blocks to grow, to reproduce and to maintain dynamic homeostasis (**Energy**).

Big Ideas (cont)

Relates to Big Idea 1: Evolution

> Processes such as diffusion, and communication did not always exist and were selected as environmentally advantageous so organisms with the trait survived to pass down this genetic information

Relates to Big Idea 3: Infromation

> Cells share information through process of cell signal communication seen as hormones, and proteins that can trigger or stop cell processes such as transcription and replication. Observed in Cell Cycle communication

Relates to Big Idea 4: Systems

> Organism body systems use cell communication to trigger specific events to occur, such as the electrochemical gradient associated with the nervous system's nerve cells and the uses of hormonal communication among cells in the Endocrine System

Vocabulary

→ diffusion	→ water potential(ψ)
→ osmosis	→ osmoregulation
→ plasmolysis	→ cell wall
→ ampiphatic	→ electrochemical gradient
→ exocytosis	→ endocytosis
→ phagocytosis	→ cell junctions
→ hypotonic	→ hypertonic
→ isotonic	→ fluid mosaic model
→ selective permeability	→ surface area
→ concentration gradient	→ aquaporin
→ channel protein	→ osmotic pressure
→ solute	→ nuclear envelope
→ facilitated diffusion	→ transmembrane protein
→ active transport	→ carrier protein

Vocabulary (cont)

→ golgi body	→ tonicity
→ plasma membrane	→ passive transport

Related Labs

LAB NAME	LAB QUESTION
Investigation 4 Diffusion and Osmosis	What causes plants to wilt if they are not watered?
Investigation 11 Transpiration	What factors including environmental variables, affect the rate of transpiration in plants?

PASSIVE AND ACTIVE TRANSPORT

All cells need to move materials in and out of the cell. There are two types of transport that cells carry out: PASSIVE and ACTIVE

PASSIVE	ACTIVE
→ When small particles move from a high to a low concentration, it is called passive transport. This is the normal flow of materials.	→ When small particles move from a low to a high concentration, it is called active transport. This is AGAINST the normal flow of materials
→ There are two types of passive transport. Osmosis is when water is moving high to low through a cell membrane, and diffusion is when all other small particles move from high to low concentration.	→ This type of transport requires ATP or energy

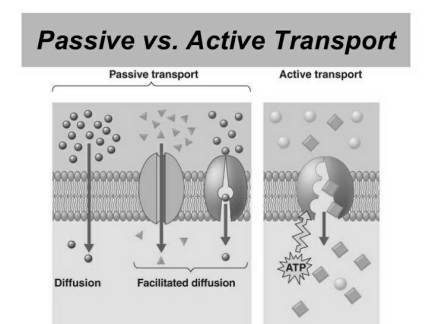
PASSIVE AND ACTIVE TRANSPORT (cont)

→ This type of transport does NOT require ATP or energy	→ If large particles need to enter or leave the cell, they require special types of active transport called endocytosis and exocytosis
→ Cells getting rid of CO2	→ Endocytosis occurs when a cell needs to bring in large particles. Think about “endo” sounding like “in the” cell
→ Cells taking in O2 for cellular respiration	→ Exocytosis occurs when a cell needs to take out large particles. Think about “exo” sounding like “exiting” the cell. This is how the Golgi ships proteins out of the cell
→ Water moving across the cell membrane when needed or as a waste product	→ cells brining in large food particles, cells releasing waste, white blood cells “eating” pathogens

Cell Signaling

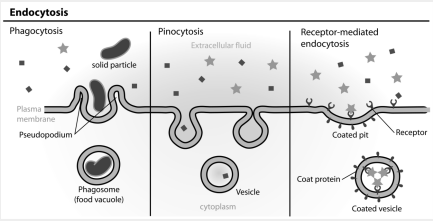
Direct Contact	*Paracrine Signaling*	*Synaptic Signaling*	*Endocrine Signaling*
Cell/cell junction, gap junctions	localized only	Occurs in neurons	Long distance and long term
	example-growth factors	**example**-neurotransmitters	**example**-hormones

Diagrams



https://www.slideshare.net/ToniFoley/24-cell-membrane-and-transport by Toni Foley

Endocytosis Diagram



https://en.wikipedia.org/wiki/Endocytosis

Answer Key

QUESTION	ANSWER	REASONING
1	D	The fluid-mosaic model is the universally agreed upon model of the cell because it represents the fluidity of the phospholipid composed cell membrane
2	A	A hypertonic solution is one in which the solute concentration is higher and therefore due to a desire for an isotonic situation water will be drawn towards the high containing of solutes
3	C	Osmosis is the diffusion of water according to the concentration gradient that does not require energy
4	C	The sodium-potassium pump exchanges sodium ions for potassium ions across the plasma membrane of animal cells. It accomplishes the transport of three Na+ to the outside of the cell and the transport of two K+ ions to the inside with protein pumps that utilize ATP.
5	A	Solution X is salt water because the water in the cell was drawn out in attempts to balance with the exterior salt content. Remember that SALT SUCKS!
6	D	The protozoans lost water and shriveled up due to the fact that water was diffused out of the cell through osmosis in an attempt to maintain equal conditions

FRQ 1

1. Cells transport substances across their membranes. Choose three of the following four types of cellular transport.

→ Osmosis
→ Active Transport
→ Facilitated Diffusion
→ Endocytosis/Exocytosis

For each of the three transport types you choose,

a) Describe the transport process and explain how the organization of cell membranes functions in
the movement of specific molecules across membranes; and

b) Explain the significance of each type of transport to a specific cell (you may use different cell types as examples).

FRQ 2

2. During microscopic examination of human tissue samples, a student observed the following at different magnifications. In some cases, individual cells were clearly visible (A and B). In others, the magnification was too low to clearly visualize individual cells although the dark patches of nuclei are visible in fig C.

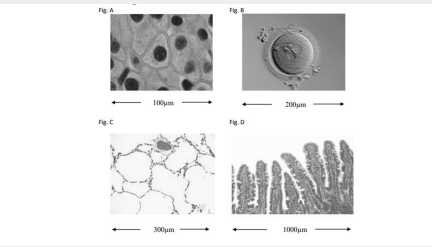
a. Identify the image that contains a cell or cells with the lowest surface area to volume ratio. Explain your reasoning and provide a sample calculation to illustrate this.

b. Identify an image that shows a tissue that is ideally suited for the exchange of materials with the environment. Justify your response and suggest the role this tissue may have in the organism.

c. Explain how surface area to volume ratio can place a limit on the maximum size of a cell.

d. Describe how you could model that the rate of exchange of materials is affected by surface area to volume ratio. (Option – support your written response with clearly labeled diagrams).

FRQ 2 Figures



Multiple Choice Practice Questions

1 What is the current model of cell membranes?

- **A** Extracellular Model
- **B** Phospholipid Model
- **C** Cellular Model
- **D** Fluid-mosaic Model

2 If a solution outside a cell is more concentrated so that the cell loses water to its environment, the external solution is said to be _____ to the cell contents.

- **A** hypertonic
- **B** in equilibrium
- **C** isotonic
- **D** hypertonic

3 Osmosis is a process that

- **A** moves water molecules from an area of higher concentration to an area of lower concentration, using energy
- **B** involves the active transport of dissolved solids
- **C** equalizes the concentration of particles by the movement of water molecules
- **D** continues until the medium on each side of the membrane has become hypertonic

4 The sodium-potassium pump usually pumps

- **A** potassium out of the cell
- **B** sodium into the cell
- **C** potassium into the cell
- **D** only a potassium and sugar molecule together

Use the information below and your knowledge of biology to answer questions 5 through 6 which follow the reading passage

Each student in a biology laboratory received two solutions. One solution was distilled water. The other was a salt solution with concentrations of salts slightly greater than that of a living cell. The solutions were labeled X and Y, respectively. The students were instructed to place some fresh-water protozoans in each of the solutions and to identify the solutions on the basis of their observations. The protozoans in solution X shriveled. Those in solution Y swelled up and burst.

Multiple Choice Practice Questions (cont)

5 These results indicate that

- **A** solution X was salt water
- **B** solution Y contained killer protozoans
- **C** solution Y was salt water
- **D** solution X was distilled water

6 The protozoans in solution X shriveled because

- **A** golgi bodies in the test organisms lost their function
- **B** their membranes were more permeable to the passage of water than the organisms in Y
- **C** osmotic pressure failed to operate
- **D** a disproportionate amount of water diffused from the protozoans

Key is on the last page

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