

### Essential Knowledge

#### ESSENTIALS

#### RELATION TO TOPIC

Cell membranes are selectively permeable due to their stx

Cell membranes are composed of phospholipid bilayer 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: Information

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( $\psi$ )

→ osmosis → osmoregulation

→ plasmolysis → cell wall

→ amphipathic → 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

→ When small particles move from a high to a low concentration, it is called passive transport. This is the normal flow of materials.

#### ACTIVE

→ 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



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### 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 CO<sub>2</sub>

→ Endocytosis occurs when a cell needs to bring in large particles. Think about "endo" sounding like "in the" cell

→ Cells taking in O<sub>2</sub> 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 bringing in large food particles, cells releasing waste, white blood cells "eating" pathogens

### Cell Signaling

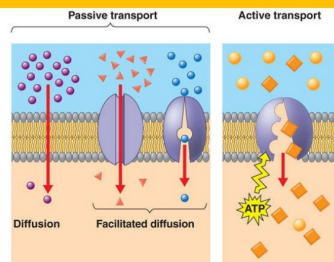
Direct Contact	Paracrine Signaling	Synaptic Signaling	Endocrine Signaling
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Cell/cell junction, gap junctions	localized only	Occurs in neurons	Long distance and long term
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<b>example-</b> growth factors	<b>example-</b> -neurotra nsmitters	<b>example-</b> hormones
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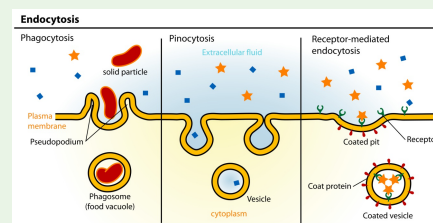
### Diagrams

#### Passive vs. Active Transport



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

### Endocytosis Diagram



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

### Answer Key

QUES TION	ANSWER	REASONING
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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
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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
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3	C	Osmosis is the diffusion of water according to the concentration gradient that does not require energy
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### Answer Key (cont)

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 <sup>+</sup> to the outside of the cell and the transport of two K <sup>+</sup> ions to the inside with protein pumps that utilize ATP.
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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!
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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
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### 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

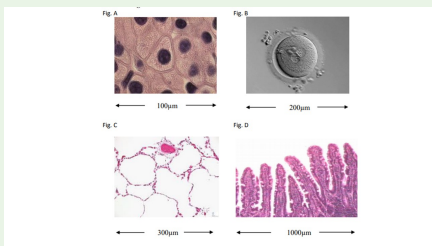
For each of the three transport types you choose,

- 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.
- 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.
  - 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.
  - Explain how surface area to volume ratio can place a limit on the maximum size of a cell.
  - 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?
- Extracellular Model
  - Phospholipid Model
  - Cellular Model
  - 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.
- hypertonic
  - in equilibrium
  - isotonic
  - hypertonic
- 3 Osmosis is a process that
- moves water molecules from an area of higher concentration to an area of lower concentration, using energy
  - involves the active transport of dissolved solids
  - equalizes the concentration of particles by the movement of water molecules
  - continues until the medium on each side of the membrane has become hypertonic

- 4 The sodium-potassium pump usually pumps
- potassium out of the cell
  - sodium into the cell
  - potassium into the cell
  - 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

### 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
- solution X was salt water
  - solution Y contained killer protozoans
  - solution Y was salt water
  - solution X was distilled water
- 6 The protozoans in solution X shriveled because
- golgi bodies in the test organisms lost their function
  - their membranes were more permeable to the passage of water than the organisms in Y
  - osmotic pressure failed to operate
  - a disproportionate amount of water diffused from the protozoans

*Key is on the last page*