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QNO: 1

What are the different mechanisms through which drug cross the cell membrane, discuss in detail.

ANSWER:-

The movement or translocation of drug from one side of biological barrier to other, is called biotransport and the mechanism underlying the transfer of drug across biological barriers are called the transport mechanism.

TRANSPORT MECHANISMS:-

The major transport mechanism are:

- 1- Passive diffusion
- 2- Carrier Mediated transport
 - A. Facilitated diffusion
 - B. Active transport

TRANSPORT MECHANISMS:-**TRANSPORT**

Active process/transport

- Primary Transport
- Secondary Transport

Passive process/transport

- Simple diffusion
- Facilitated diffusion
- Osmosis

About Cell Membrane

All cells have a cell membrane.

FUNCTIONS:-

- a. Controls what enters and exits the cell to maintain an internal structure
- b. Protective function
- c. Selective permeability
- d. Absorptive function
- e. Excretory function
- f. Exchange of gases
- g. Maintenance of shape and size of the cell.

ACTIVE TRANSPORT:-

To move substances against a concentration or electrochemical gradient, a cell must use energy. Active transport mechanisms do just this, expending energy (often in the form of ATP) to maintain the right concentrations of ions and molecules in living cells.

OR

The drug molecules move from region of low concentration

ion against the concentration gradient.

• PRIMARY ACTIVE TRANSPORT:-

These are found in all living organisms and require an energy source, such as ATP for the translocation of the cations.

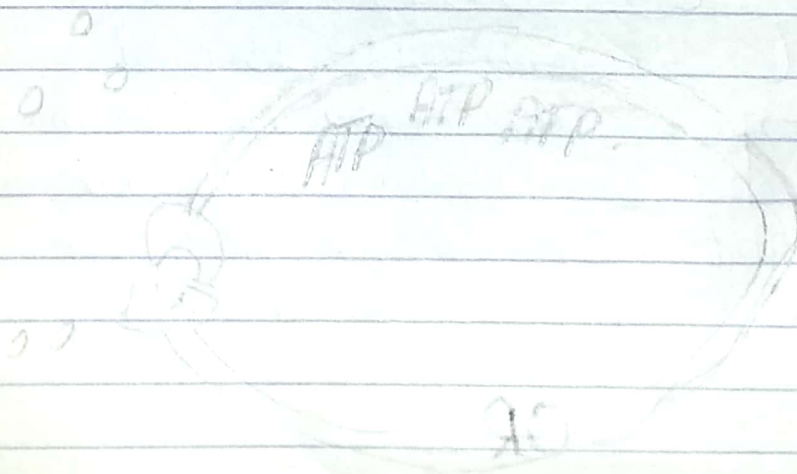
• These transporters, since utilize ATP are also referred to as ATP Pases.

OR

• Energy obtained directly by hydrolysis of ATP.

• They mediate only efflux of solutes from cytoplasm either to extracellular fluids or into intracellular organelle.

• E.g P-glycoprotein transporter.



SECONDARY ACTIVE TRANSPORT:-

They utilize a secondary source of energy such as trans-membrane electro-chemical gradient of either Na^+ or H^+ to translocate small organic molecule e.g glucose and amino acids etc.

OR

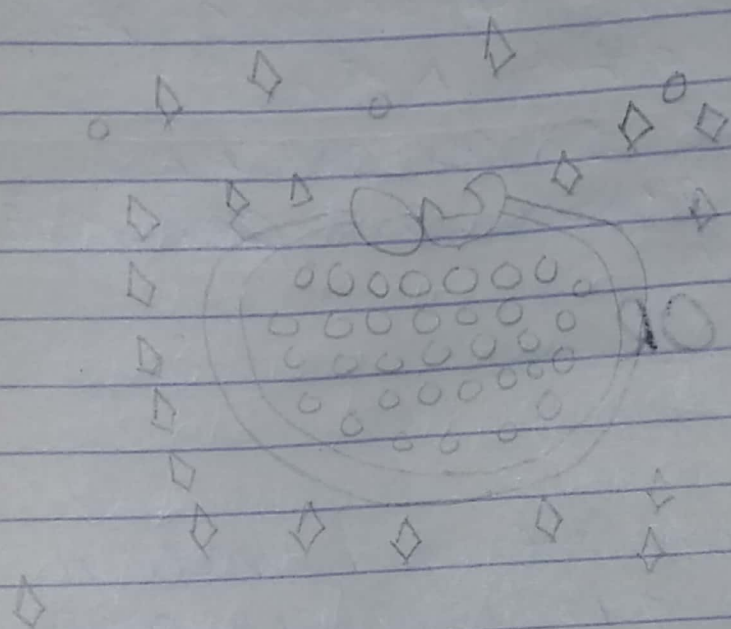
• SYMPORT

- Carrier moves the substrate A against its concentration gradient by utilizing energy from down hill movement of another substrate B in same direction.

• ANTI PORT

- Carrier moves substrate A against its concentration gradient and is energized by downhill movement of another substrate B in opposite direction.

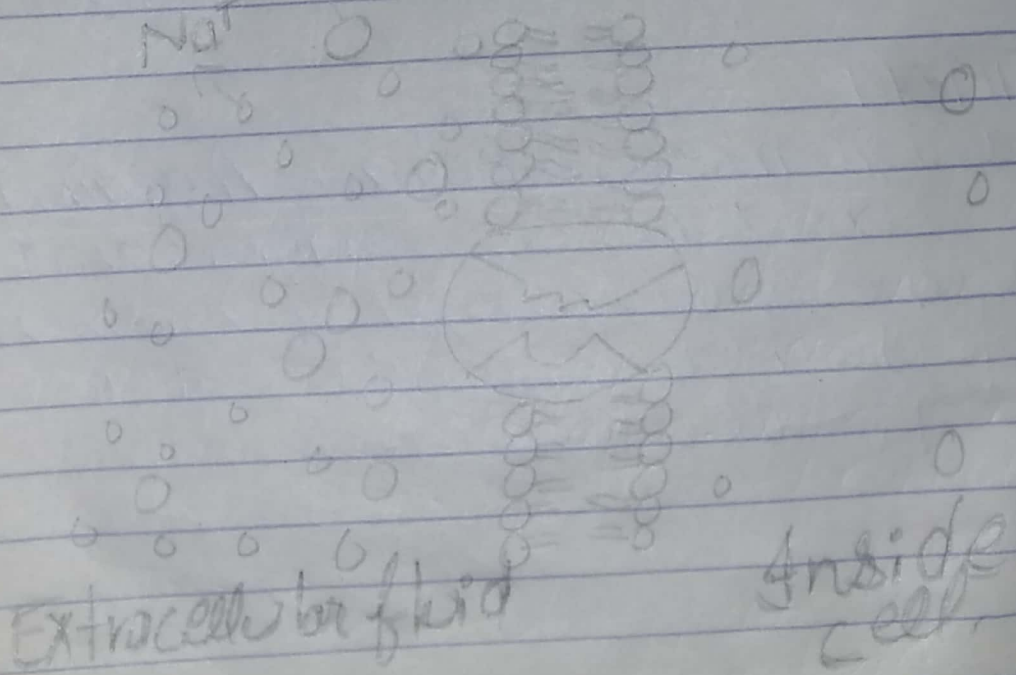
SYMPORT:-



ANTI PORT:-

Amino acid

Na⁺



Inside cell

Extracellular fluid

PASSIVE TRANSPORT:-

• substance are allowed to cross the cell membrane without any input of energy.

OR

Passive transport is a movement of ions and other atomic or molecular substances across cell membrane without need of energy input. Unlike active transport, it does not require an input of cellular energy because it is instead driven by the tendency of the system to grow in entropy.

• SIMPLE DIFFUSION:-

- ~~MO~~ Diffusion of a substance may occur either passively (called passive diffusion) or may require some carrier protein, which facilitates diffusion (called facilitated diffusion)

• SIMPLE DIFFUSION:-

• Lipophilic substances can enter cells easily because they diffuse through the lipid portion of the membrane.

- Examples are fatty acids, steroids, alcohol, oxygen, carbon dioxide and urea.

• CHANNEL - MEDIATED DIFFUSION:

- Membrane channels are transmembrane proteins.
- Only 0.8nm in diameter.
- Used by ions, very small water-soluble compounds.
- Much more complex than simple diffusion.
 - Are there enough channels available?
 - Size and charge of the ions effects which channels it can pass through.

• FACILITATED DIFFUSION:-

- Large polar molecules such as glucose and amino acids, cannot diffuse across the phospholipid bilayer. Also ions such as Na or Cl cannot pass.
- These molecules pass through proteins channels instead.
- Diffusion through these channels is called facilitated diffusion.

LIPID DIFFUSION:-

- Hydrophobic Lipid substance are dissolved in this manner.
- O_2 , CO_2 , N_2 unionized substances.

AQUEOUS DIFFUSION:-

- Most biological membranes are water permeable.
- In gut, cells are joined tight epithelial junction, water soluble substances of LMW.
- $Urea$, alcohol.

OSMOSIS:-

Osmosis is the process of moving water across a semi permeable membrane towards ion or solute rich region in a solution.

TONICITY:-

Ability of a solution to affect fluid volume and pressure within a cell.

- depends on concentration and permeability of solute

• ISOTONIC SOLUTION:-

Solutions with the same solute concentration as that of the cytosol; normal saline.

• HYPOTONIC SOLUTION:-

Lower concentration of nonpermeating solutes than that of the cytosol (high water concentration).
• Cells absorb water, swell and may burst (lyse).

• HYPERTONIC SOLUTION:-

Has higher concentration of nonpermeating solutes than that of the cytosol (low water concentration).
• Cells lose water + shrivel (crenate).

ENDOCYTOSIS:-

It is the process by which the large number of particles are taken into the cell with forming the vesicle.

It is classified into:

1. PHAGOCYTOSIS:-

It is a process by which the large number of particles are engulfed into the cell.

2. PINOCYTOSIS:-

It is a process by which the large number of particles which are soluble in water are taken the cell.

BULK FLOW:-

The movement of large number of ions, molecule or particles that are dissolved or carried in a medium such as a fluid or air is called bulk flow.

• Rate of bulk transport is determined by the differences in hydrostatic pressure or air pressure.

eg 1- Flow of blood within the vessels.

2- Movement of air into and out of the lungs.

• FILTRATION:-

Filtration is the process of separating suspended solid matter from a liquid, by causing the latter to pass through the process poses of some substance, called a filter. The liquid which has passed through the filter is called the filtrate.

Filtration is extremely important to keep things like water, chemicals, and pharmaceuticals clean, pure and free of contaminants. If it wasn't for filtration, we might not have safe drinking water, because it plays a crucial role in eliminating sediment, sand, gravel, carbon, and other suspended particles.

• Filtration is used water treatment.

• The three main types of filtration are mechanical, biological, and chemical filtration.

CARRIER MEDIATED TRANSPORT:-

In carrier-mediated transport, two different species can be transported at the same time, giving a coupled transport, in which the membrane contains a carrier which can only lead to transport when two different species present themselves at the same time.

Carrier-mediated transport of some molecules are helped across the membrane by a membrane component. For example:

Glucose is transported by a glucose carrier channel mediated. Movement of small, polar molecules along its concentration gradient by a carrier protein.