

MEMBRANE TRANSPORT

Q. Illustrate a detailed account of type & mechanism of membrane transport.

Ans Introduction → The plasma membrane acts as a semipermeable membrane barrier between the cell & extracellular environment. It is highly selective and it ensures that essential molecules like glucose, amino acids, lipids, can easily enter the cells & the best compounds to enter the cells. The plasma membrane allows the cell to maintain a constant internal environment called homeostatic. The transport across the membrane may be passive or active. It may occur through the phospholipid bilayer or by the help of specific integral protein called permease or transport proteins.

TYPE OF MEMBRANE TRANSPORT - It is of four types -

- (i) Active transport
- (ii) Facilitated transport
- (iii) Passive transport
- (iv) Bulk transport

[1] PASSIVE TRANSPORT - It is a type of passage in which atom or molecule crossing a membrane moves down its concentration gradient. It involves no metabolic energy. It is of two types -

- a) Diffusion
- b) Osmosis

a) DIFFUSION → Diffusion is the movement of atom & molecule of substances from place of their higher diffusion pressure or conc. to the place of lower diffusion pressure or conc.

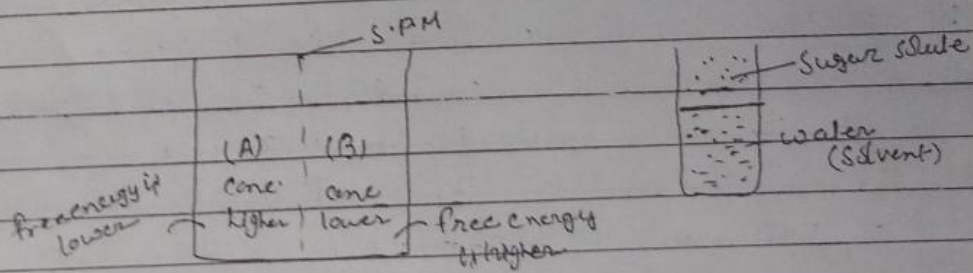
In simple diffusion, mole. of gases & small molec. of ethanol enter the cells by crossing the P.M. without the help of any permease. In this process small mole. of in aqueous solution dissolve into the phospholipid bilayer.

process it and then dissolved into the aqueous soln. on the opposite site. In relative rate of diffusion across the phospholipid bilayer is proportional to the conc. gradient.

b) OSMOSIS → It is the special type of diffusion in which the solvent mole. migrate across a semipermeable membrane from the side of low solute conc. to the side of high solute conc. The process in which the water mole. enter into the cell is known as endosmosis and while the reverse process is called named as exosmosis.

Mechanism of osmosis

(i) Pure water has the highest chemical potential concentration. Solution have the lower chemical potential. In such condition when two solution of different conc. or a solution and its solvent are separate by the semipermeable membrane, solvent mole. can pass through pores of P.M. to the solution mole.



(2) FACILITATED → It is a type of diffusion across the cell membrane which is along the conc. gradient but requires the presence of permeases. They do not require energy unlike carrier protein for their functioning. They provide a passage to only specific substances and are often stereo specific.

Such type of transport is known as in case of Glucose, Nucleoside & several amino acids.

ACTIVE TRANSPORT → This mode of transport involves expenditure of the metabolic

energy obtain from ATP. It is the most common method of salt absorption in plant cells; in animal cells, it is known in a case of Ca^{2+} , K^{+} , Na^{+} , I^{-} , $Urea$, $Dugan$ & amino acids.

Mechanism of active transport → It is mediated by two types of devices -

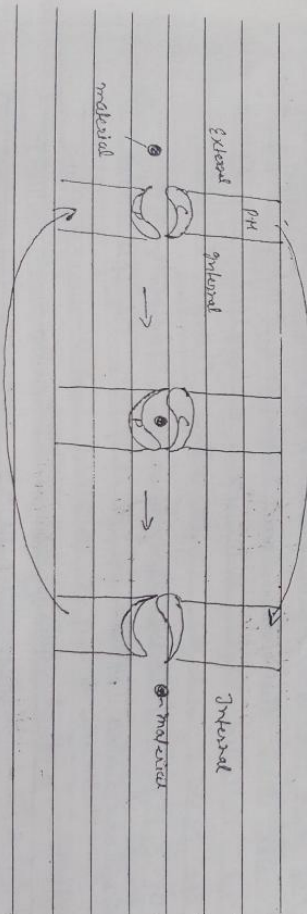
(i) Carrier Channels (ii) Gated Channels

Protein

(i) Carrier Channels → The carrier channel, an carrier protein

or integral protein particles of the cell membrane which have the affinity for specific solute particles.

They combined with the solute particles on the surface of one form carrier state translate. It undergoes conformational changes with the help of energy. In the complete stage the carrier particles transport the solute to the other side of the membrane where it is released. The carrier is freed & reverts to its original state for binding its another solute particles.



(ii) Gated channels → The cell membrane contains channel for

the transport of solute but remains

closed by gate. These channels are used for both diffusion & active transport. The opening & closing of gate are formed by two methods.

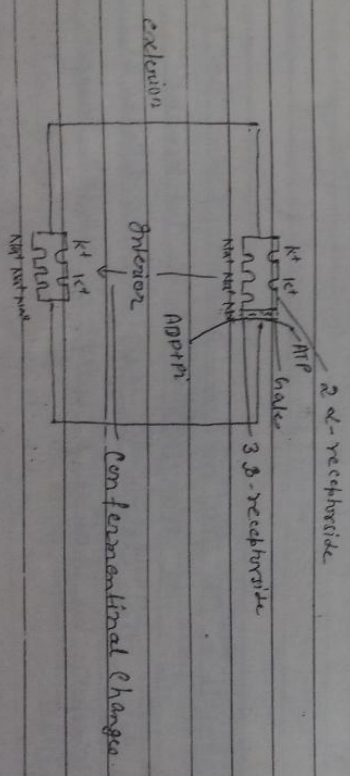
(i) Voltage gating → Change in electric potential & change the cell membrane results in opening & closing of channel gates. For ex- absence of negative charge on the inner side, state of sodium channel to open and allows transport of sodium from extracellular fluid to the cell the reverse reverse charge closes the gate.

(ii) Chemical gating → In this case the specific chemical combined with the channel proteins to change its cells it opens & closes the gate ex- Calcium channel, Acetyl choline channel.

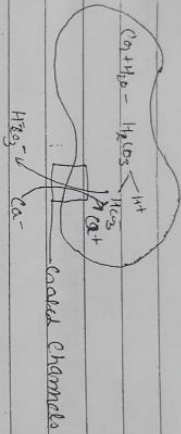
Example of gated channels - Sodium potassium exchange

Na⁺K⁺ pump → It operate in most body cells.

The carrier protein is formed of a large α -subunit & a small β -subunit. The inner side of large α -subunit has three ATPase receptor side for sodium ion one side for ATPase activity. The outside of this unit has two receptor side for Potassium (K^+) ions. The carrier bind the with three sodium ions ($3Na^+$) from cell interior and 2 K^+ from extracellular fluid. The carrier undergoes conformational changes it help of energy & allow 3 sodium ions (Na^+) into the extracellular fluid & 2 K^+ into the cell interior.



Q] CALCIUM PUMP \rightarrow It pumps the calcium ions (Ca^{2+}) out of the cell. Inside the cytosol, it has been located in cell like lysosomes. In another side calcium formed are located in membrane of the endoplasmic reticulum. It transport the Ca^{2+} from the cytosol to the interior of the cytoplasm reticulum & endoplasmic reticulum.



b] PROTON PUMP OR H⁺ PUMP \rightarrow The lysosomal membrane containing ATP-dependent H⁺

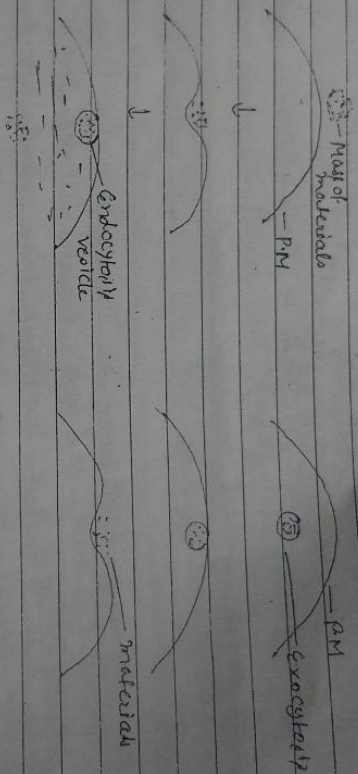
pump that transport the proton from cytosol into the lumen of the lysosomes, keeping the interior of the lysosome very acidic.

Proton pump also occur in mitochondria and chloroplast where they participate in the generation of ATP. The scheme of proton pump was given by Dezardt & Co-workers (1986).

[4] BULK TRANSPORT \rightarrow It is the mode of transport of large quantity of material. macromolecules involve the chemical stimulus folding & fusion of membrane to produce the cycle called coated vesicle. The transport occur both inwardly.

There are two types of bulk transport
 a] Endocytosis \rightarrow It is the process of bulk transport by which the material taken place extracellular material by which of coated vesicle called endocytic vesicles.

1) Exocytosis → It is bulk transport of materials from
 inside to the outside with the help of
 exocytic vesicle.



Exocytosis

Exocytosis

