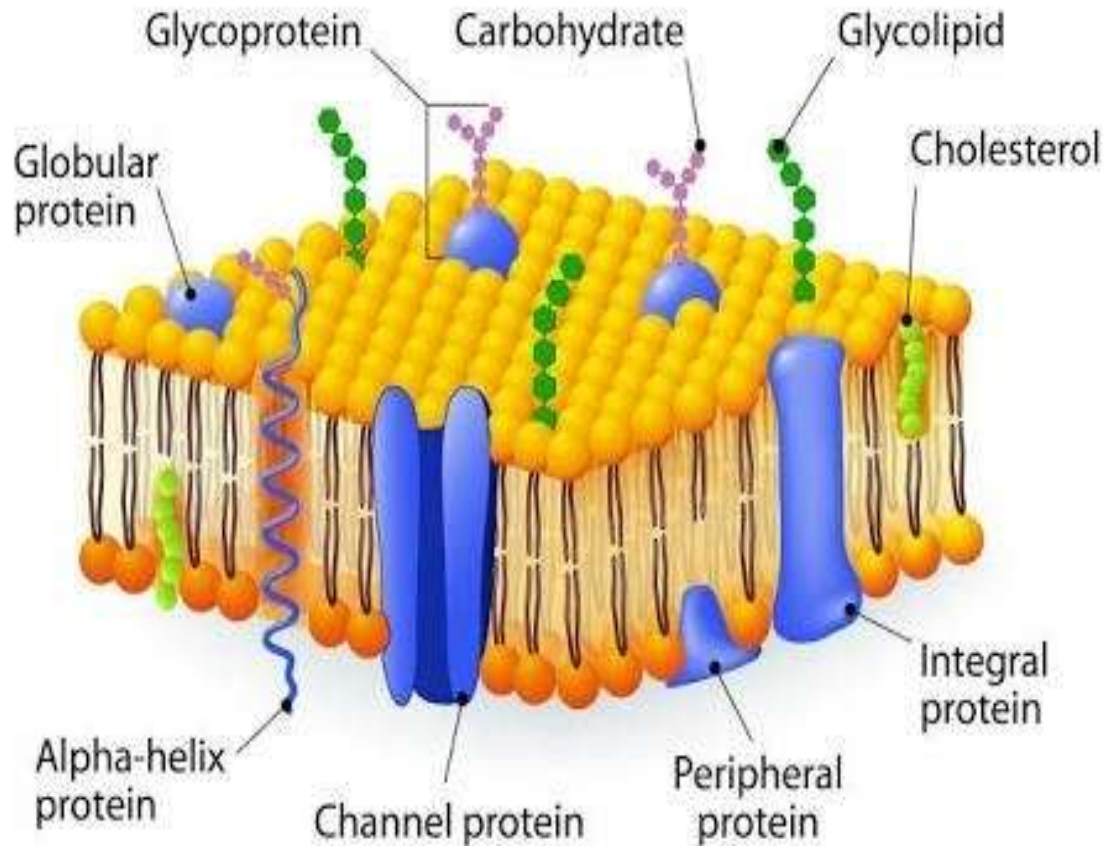


TRANSPORT ACROSS MEMBRANE



CELL MEMBRANE

<https://goo.gl/images/qoM1qk>

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No. of slides 19*

OBJECTIVES

- **To know different types of membrane transport**
- **To understand characteristic features of each**

TYPES OF MEMBRANE TRANSPORT

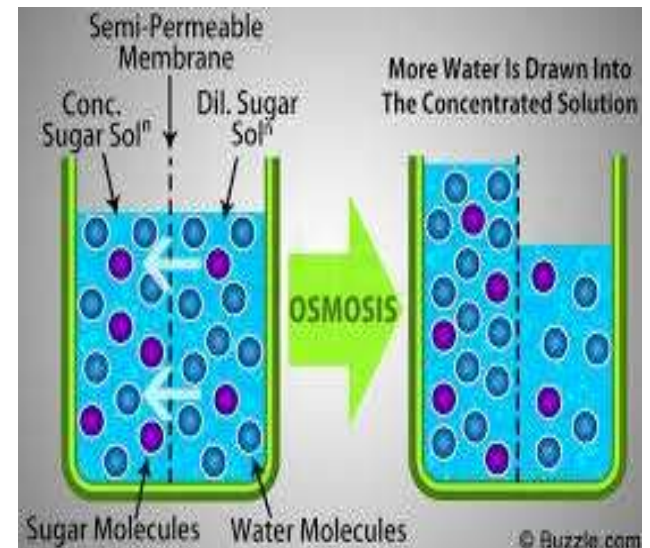
- **Passive Transport – energy independent**
- **Active Transport – energy dependent**

PASSIVE TRANSPORT

- **Slow process**
- **Direction of net flux – high to low concentration**
- **Occurs through the lipid bilayer or through carrier proteins**
- **Includes – Osmosis , Simple diffusion , Facilitated diffusion**

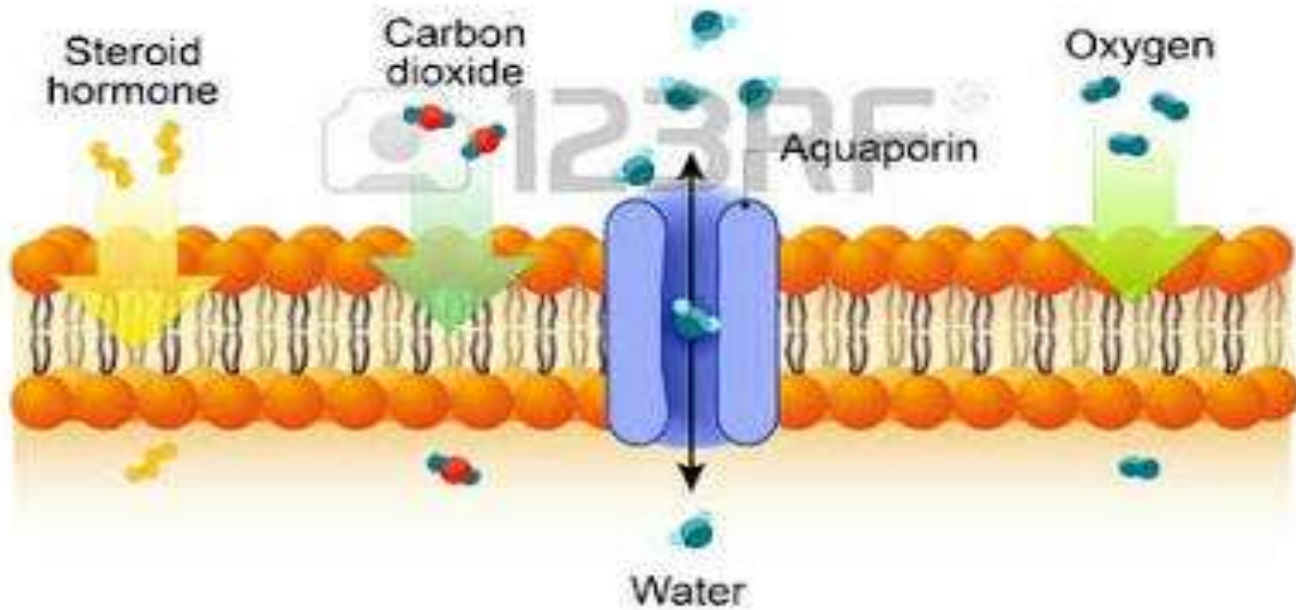
OSMOSIS

- Net diffusion of water from a region of high water concentration to a region of low water concentration when the movement of solute is prevented.
- Occurs either through the lipid bilayer or through integral protein water channel called “Aquaporin”.



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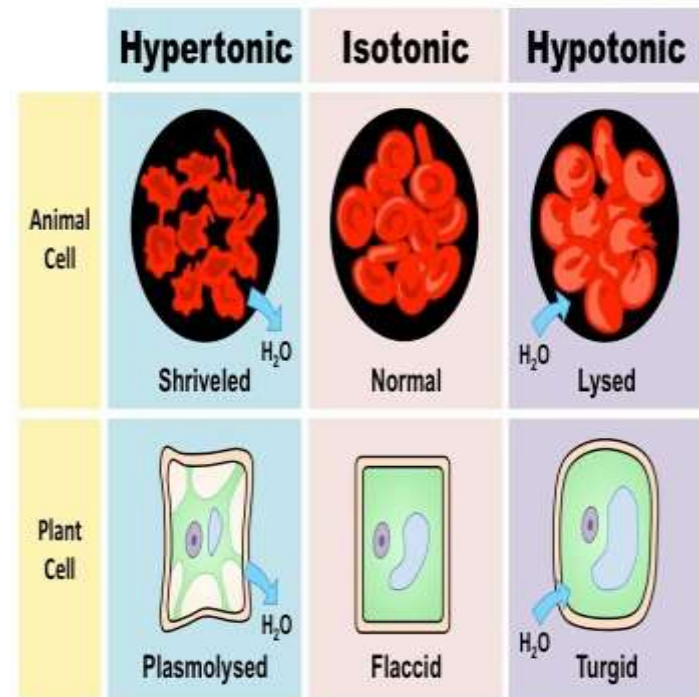
AQUAPORIN



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OSMOSIS AND CELLS

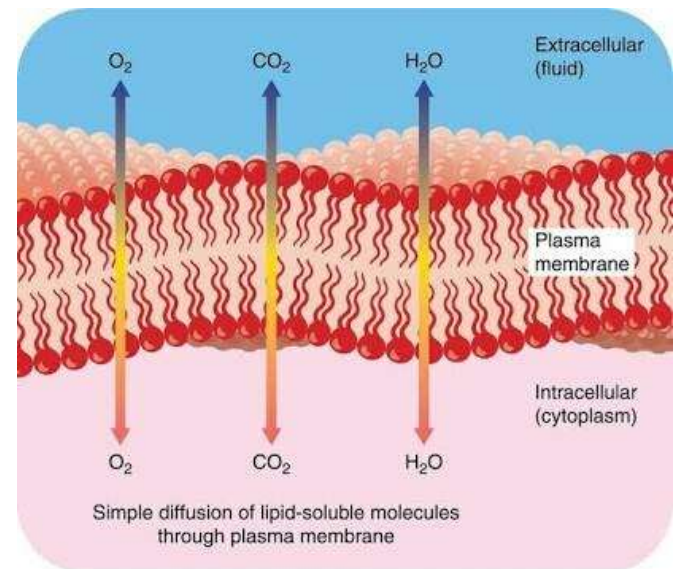
- Important because large volume changes caused by water movement disrupt normal cell function
- Cell shrinkage or swelling-
 - Hypertonic-cell shrinks
 - Isotonic-cell neither swells nor shrinks
 - Hypotonic-cell swells



<https://goo.gl/images/q5bNWB>

SIMPLE DIFFUSION

- **Allows uniform distribution of molecules across the membrane**
- **Occurs through the lipid bilayer**
- **Typical molecules using pathway Non-polar : O₂, CO₂, fatty acids, steroids**
- **These molecules have similar permeabilities when different cells are compared**



<https://goo.gl/images/1SnZNc>

FACILITATED DIFFUSION

- **Allows uniform distribution of molecules across the membrane**
- **Occurs through Transmembrane carrier proteins**
- **Typical molecules using pathway – Ions : Na^+ , K^+ , Cl^- , Ca^{2+} ; Polar molecules : glucose**
- **These molecules have different permeabilities when different cells are compared**

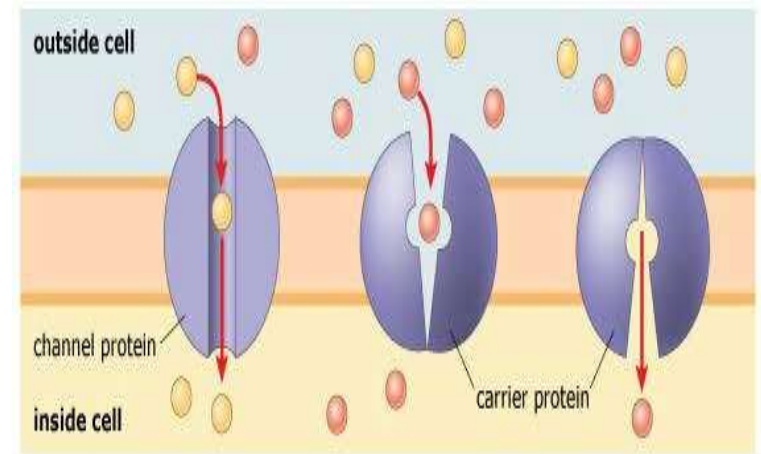
TRANSMEMBRANE CARRIER PROTEINS

1. Channel mediated (Protein channel)-

- Allows ions to move through narrow water soluble pore
- Different channels for different ions ; K^+ channel narrowest

2. Carrier mediated (Carrier Protein) -

- Allows polar molecules (glucose) to move through specific carrier proteins
- Undergoes conformational change during the process

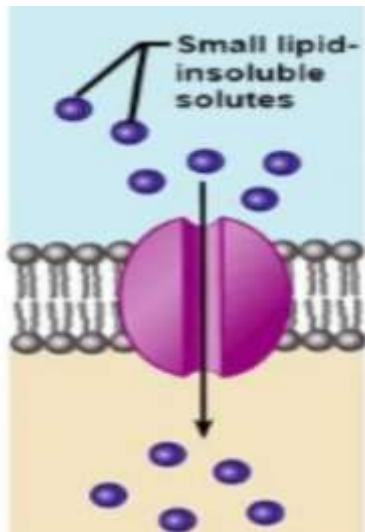


Adapted from *Biology* by Campbell and Reece © 2008 Pearson Education, Inc.

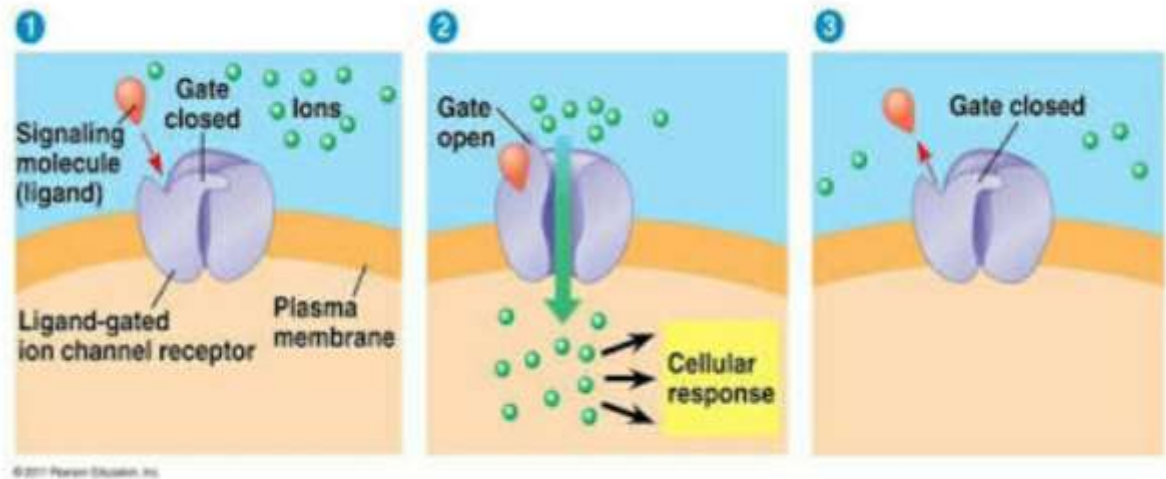
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CHANNEL MEDIATED

1. Leak channel- continuously open
2. Gated channel- opens for a fraction of a second due to some stimulus



Leak channel

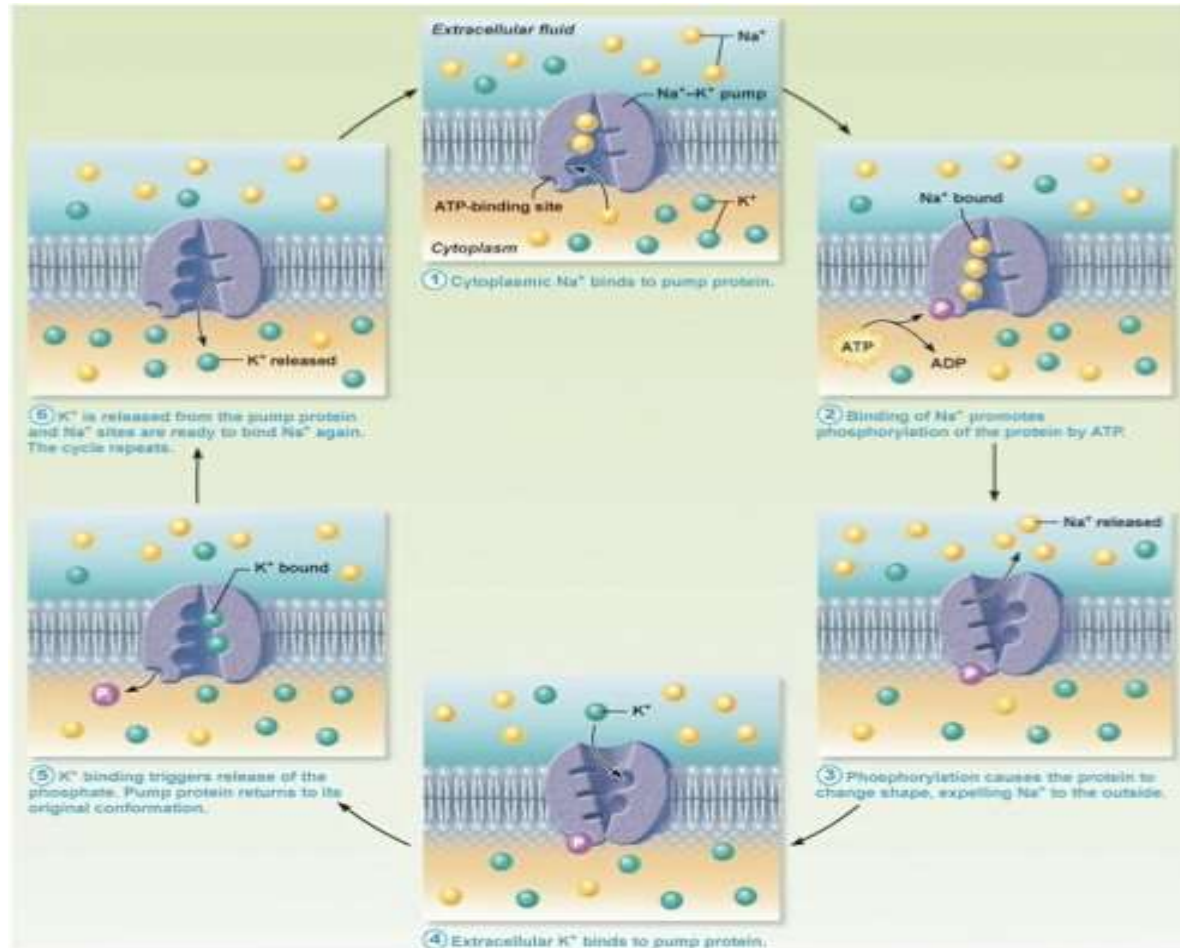


Gated channel

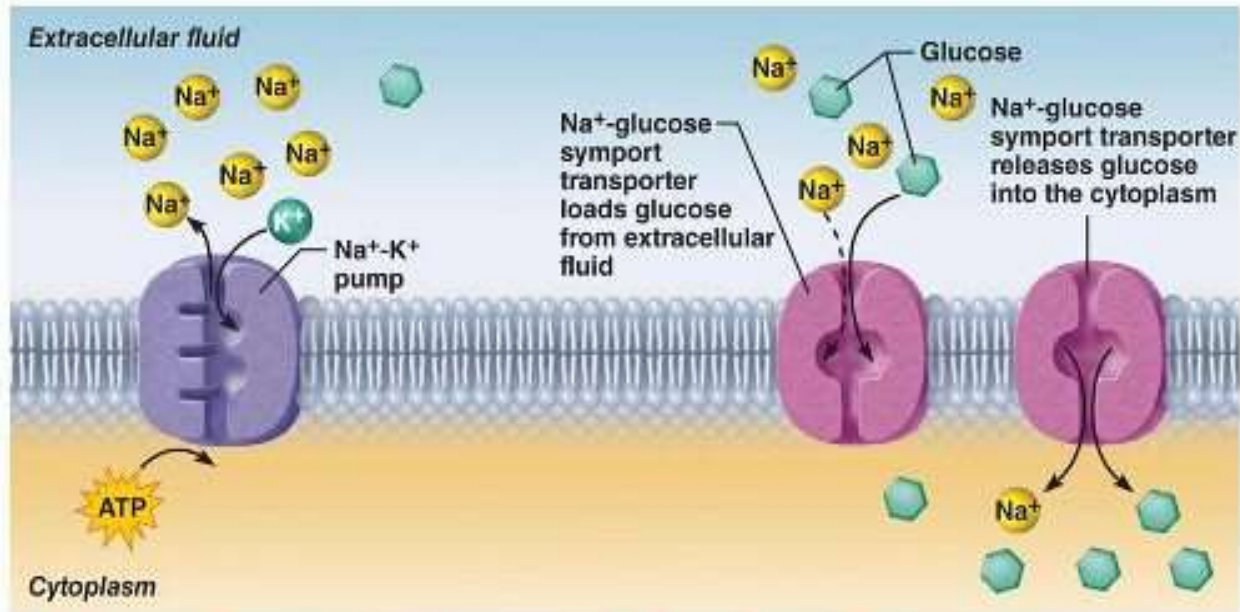
ACTIVE TRANSPORT

- **Source of energy – ATP and Ion concentration gradient**
- **Fast process**
- **Occurs through Transmembrane carrier proteins often referred to as “Pumps”**
- **Direction of net flux – low to high concentration**
- **Uneven distribution of molecules across the membrane**
- **Types – Primary Active Transport (ATP) , Secondary Active Transport (Ion gradient)**

PRIMARY ACTIVE TRANSPORT



SECONDARY ACTIVE TRANSPORT



① Primary active transport
The ATP-driven $\text{Na}^+\text{-K}^+$ pump stores energy by creating a steep concentration gradient for Na^+ entry into the cell.

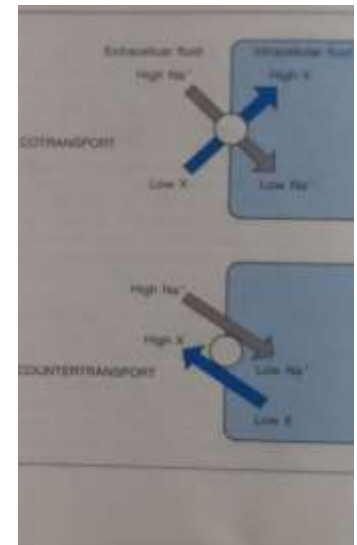
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② Secondary active transport
As Na^+ diffuses back across the membrane through a membrane cotransporter protein, it drives glucose against its concentration gradient into the cell.

<https://goo.gl/images/PSfEXR>

CARRIERS

1. **Co-transport / Symport carrier –**
 - **Allows inward (into the cell) movement of Sodium ions and solutes**
2. **Counter transport / Antiport carrier –**
 - **Allows outward (out of the cell) movement of solutes. Sodium ions move into the cell**



Human Physiology
Vander Sherman Luciano
Vth ed.

VESICULAR TRANSPORT

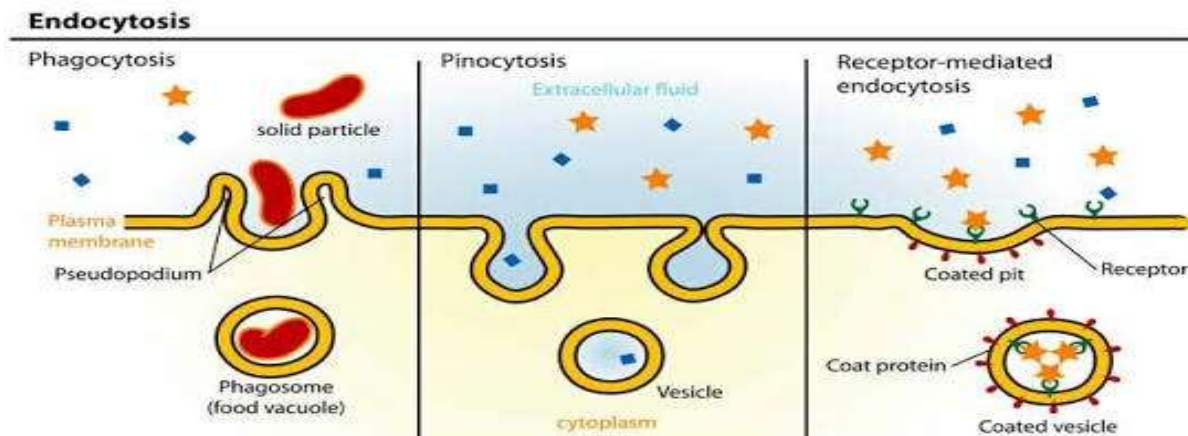
- **Transport of large particles and macromolecules irrespective of concentration gradient via vesicles**
- **Needs ATP**
- **Types – Endocytosis (Phagocytosis , Pinocytosis , Receptor mediated endocytosis) and Exocytosis**

ENDOCYTOSIS

- **Involves formation of intracellular membrane bound vesicles containing small volume of extracellular fluid**
- **Vesicles are formed due to foldings in the plasma membrane forming small pockets that pinch off from the membrane**

ENDOCYTOSIS-TYPES

1. **Phagocytosis (cell eating)** – cell membrane extends around – bacteria and damaged tissues ; e.g. microbes engulfed by WBC
2. **Pinocytosis (cell drinking)** – Plasma membrane in-folds forming a vesicle containing nutrients ; e.g. nutrient absorption in the small intestine
3. **Receptor - mediated endocytosis** – vesicle has receptors for specific substances (ligands) ; e.g. uptake of iron and insulin



EXOCYTOSIS

- **Membrane_bound vesicle in the cytoplasm fuses with cell membrane and substance is released to the outside**
- **Vesicle_membrane then becomes part of cell membrane**
- **E.g. Hormone secretion , Neurotransmitter release , Mucus secretion etc.**

