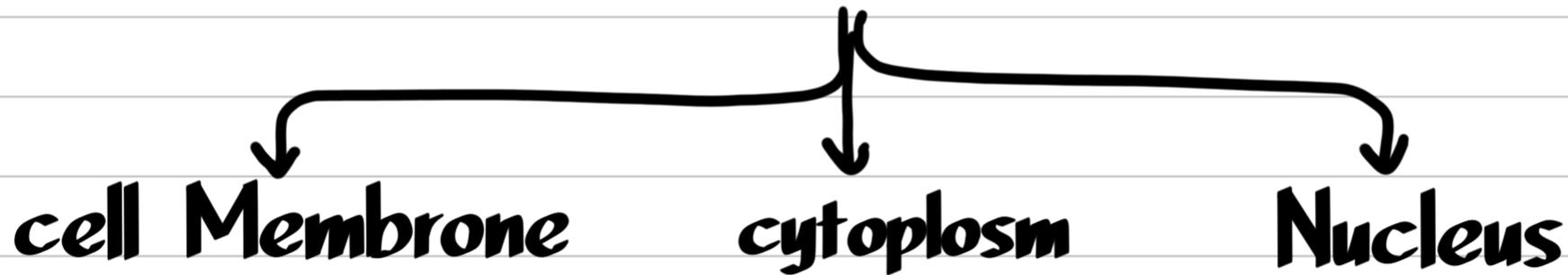


Cell Biology

Lecture 3

The Cell



cell Membrane

cytoplasm

Nucleus

organelles

- Living components
- Essential for the life of the cell.
- performs a special metabolic function.
- permanent structures.

Inclusions

- Nonliving materials.
- usually not essential.
- Do not carry out any specific metabolic function.
- permanent or temporary.

Matrix

- water 70%.
- Inorganic ions
↳ Na, K, Ca.
- Organic molecules.

Cell Membrane

The Outer limiting membrane which surrounds the cell and regulates the passage of materials into or out of the cell.

→ Plasma-membrane, plasmalemma, unit membrane.

LM

- very thin to be resolved

- Needs special stain

↳ PAS .

Silver .

EM

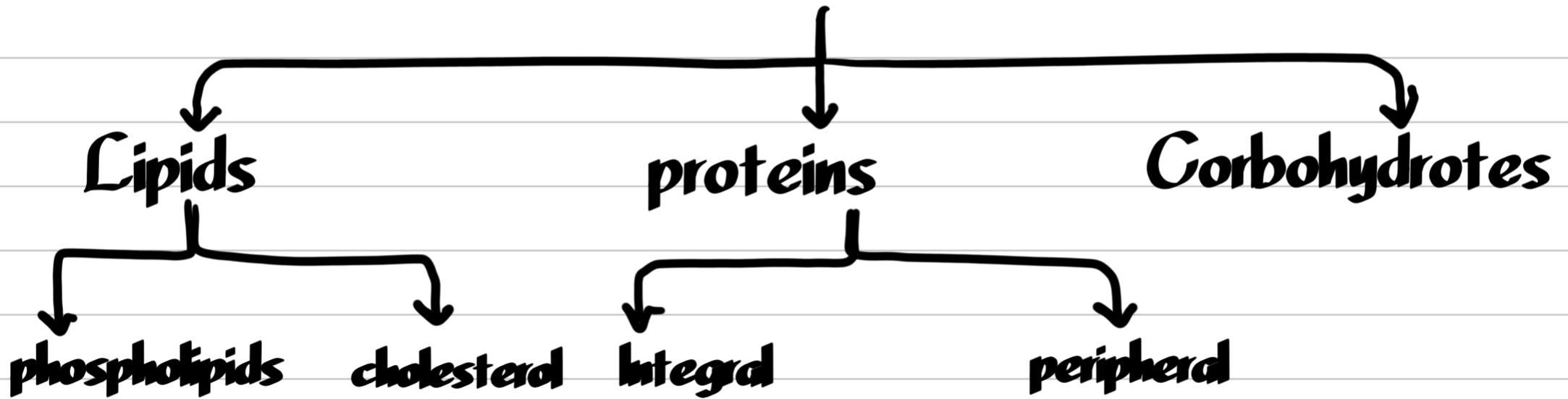
- 8 - 10 nm

- Trilamellar,

outer and inner dark (electron dense).

- layers and a middle light (electron lucent).

Cell Membrane



phospholipids bilayer

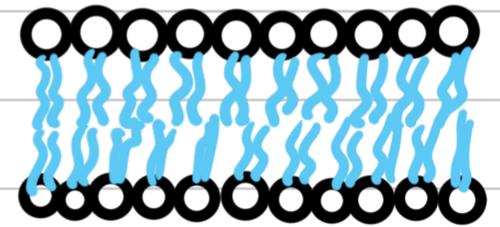
consists of

- two long non-polar hydrophobic fatty acid chains (tail).
- charged hydrophilic phosphate part (head).

- double layer (bilayer)

→ tails directed toward the center of the membrane.
(away from water).

→ heads directed outward
(contacting the water).



Cholesterol

→ in both leaflets at varying densities among the closely-packed phospholipid fatty acids.

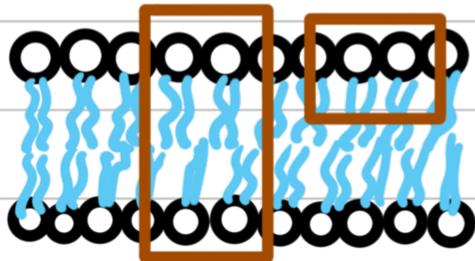
- restricting their movements and modulating the fluidity.

- Membrane proteins -

Integral proteins

- Incorporated within the lipid bilayer

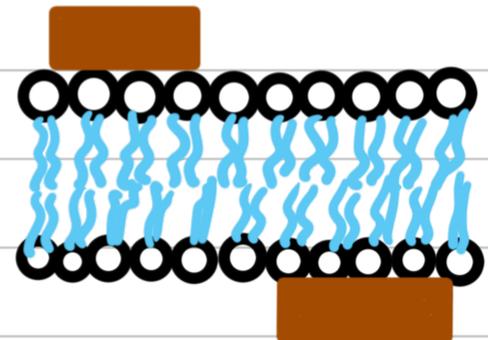
Can be extracted only by using detergents.



peripheral proteins

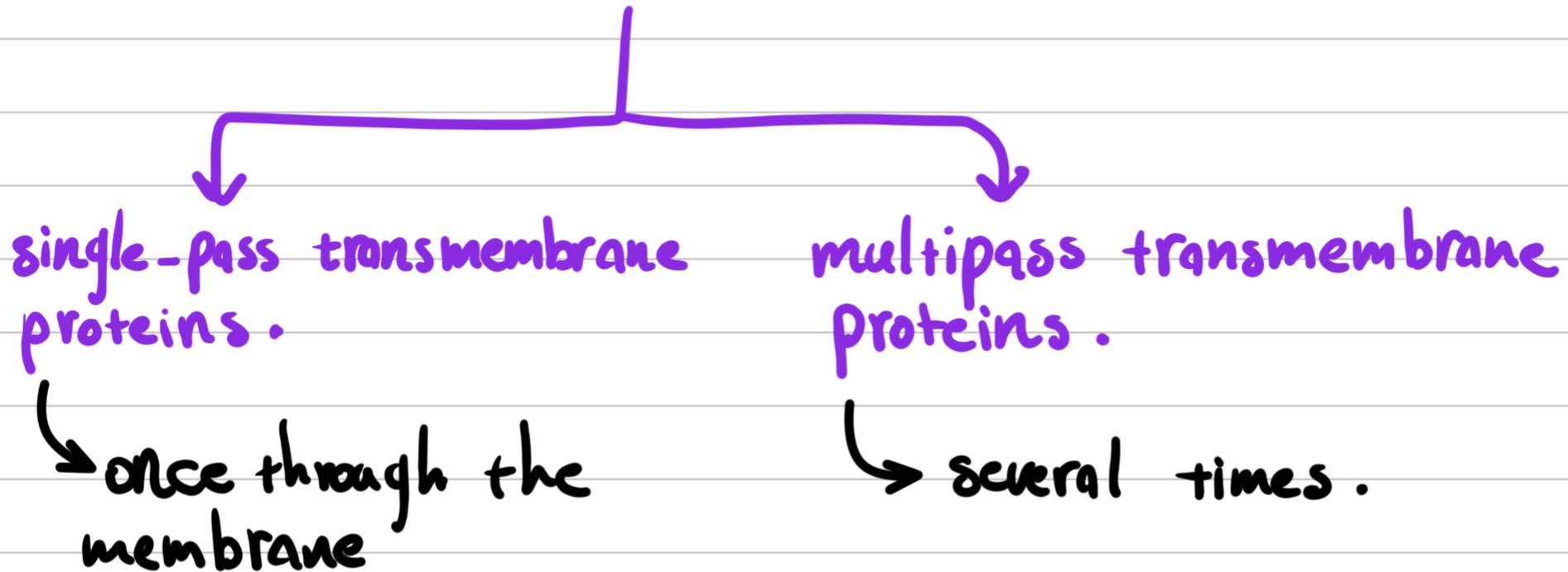
- Bound to one of the two membrane surfaces.

- Can be extracted from cell membranes with salt solutions.



Integral (proteins).

- proteins which span the entire cell membrane are called → transmembrane proteins.



Fluid mosaic model → It is proposed recently that lipids are present in the fluid phase at body temperature, while proteins are globular in shape and are floating and drifting

globules on the surface of lipid like floating iceberg in the sea.

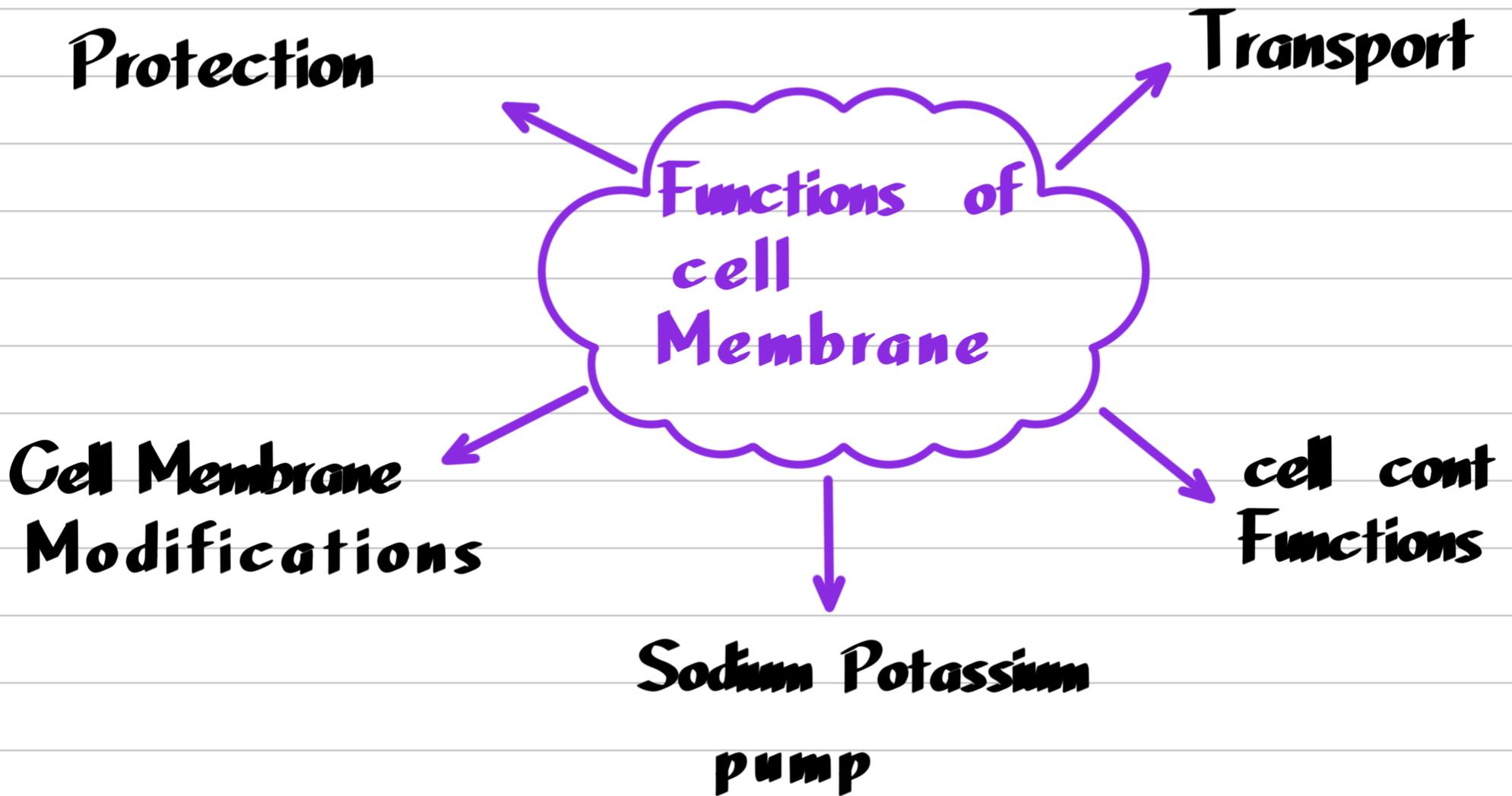
Carbohydrates

↳ glycoproteins → attach to proteins.
↳ glycolipids → attach to lipids.

– Both are present only on external surface of cell membrane to form the cell coat glycoalyx.

Cell coat Functions.

↳ Cell Adhesion ↳ Cell Recognition ↳ Cell Immunity



Membrane Transport

passive processes

Active processes

simple Diffusion
Facilitated Diffusion
Osmosis

Active Transport

Vesicular Transport

channel mediated

Carrier mediated

primary

Secondary

Endocytosis

Exocytosis

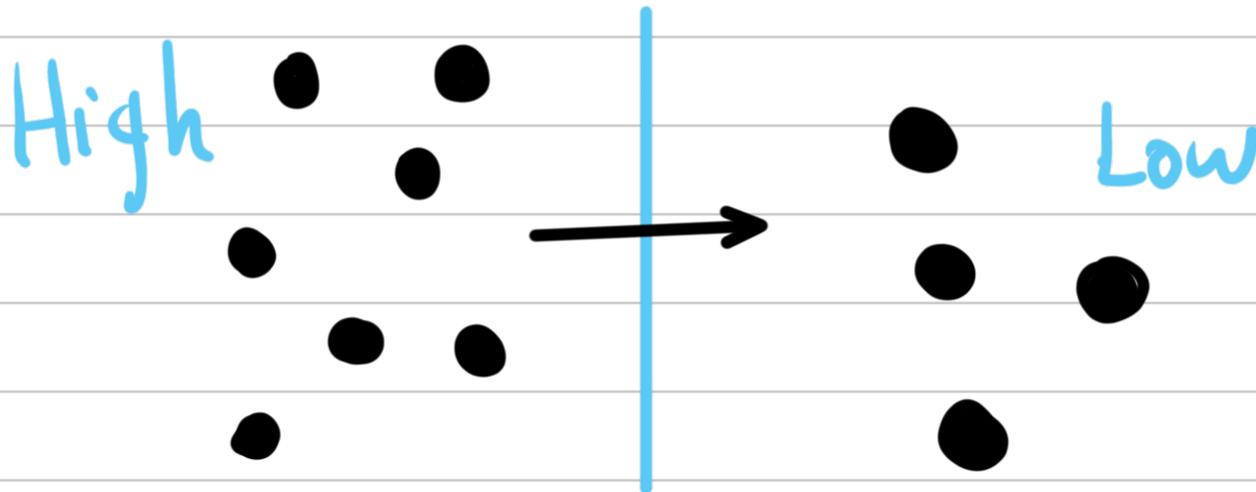
Gated
ungated

symport antiport

passive processes

↳ Movement of substances down a concentration gradient due to the kinetic energy of the substance.

– No need energy.



Simple Diffusion

- small, nonpolar substances.

example →

O₂ and CO₂
between blood
and body tissues.

Facilitated Diffusion

- ions and small polar molecules down.

↳ channel protein.

Na⁺ channels

↳ carrier protein.

glucose carrier.

Osmosis

Diffusion of water across a selectively permeable membrane.

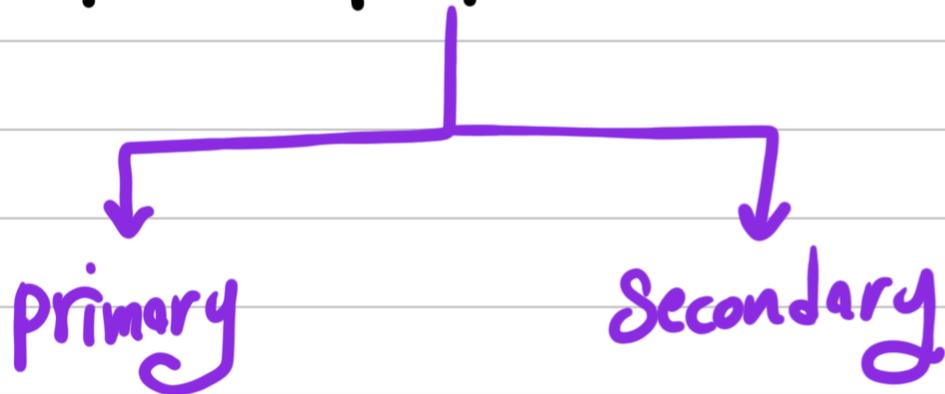
example: →

Solutes in capillaries "pulls" fluid from interstitial space back into blood.

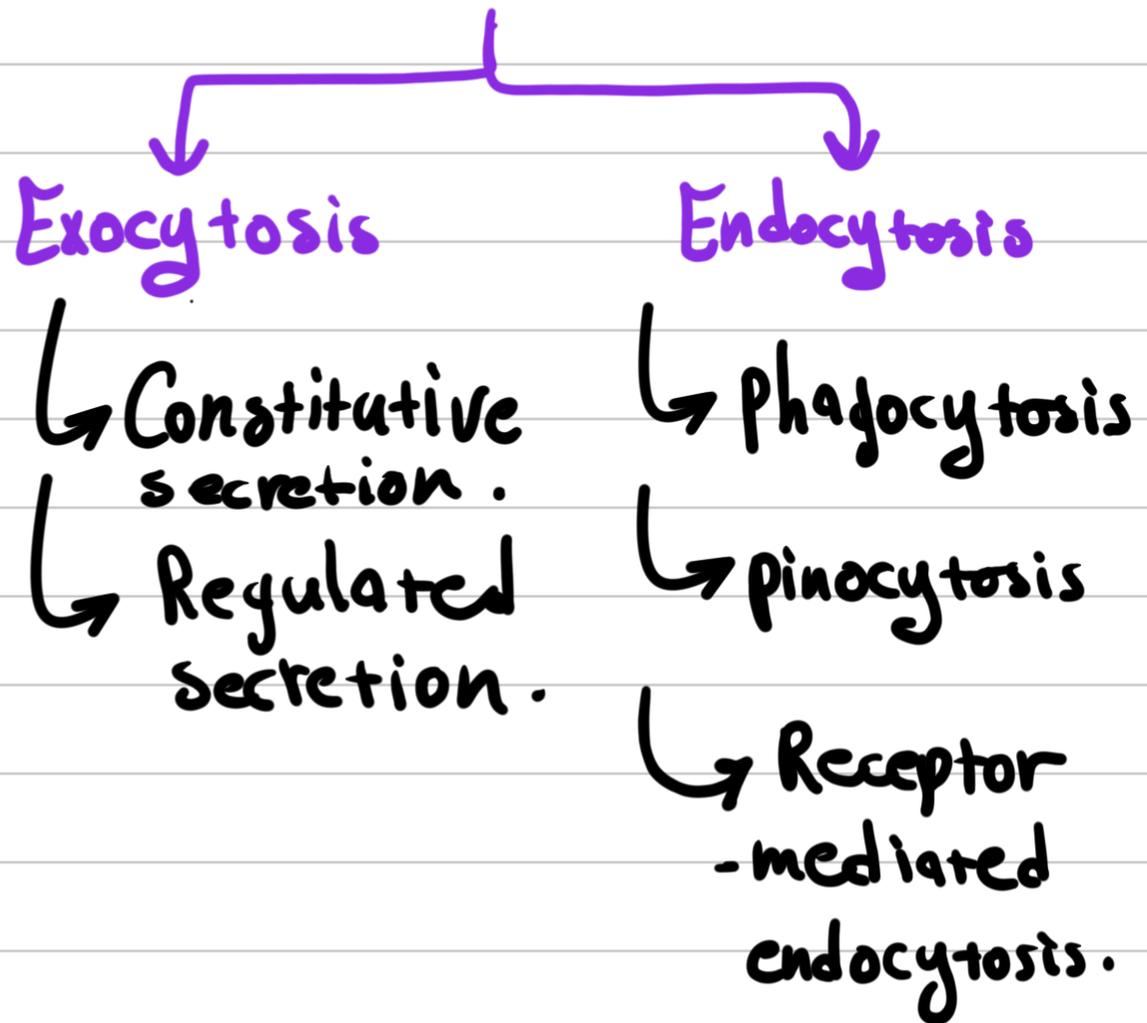
Active processes

Active Transport

- transport of ions or small molecules.
- Against a concentration gradient by transmembrane protein pumps.



Vesicular Transport



primary → Na^+ / K^+ pump moves.

- Na^+ out of the cell.

- K^+ into the cell.

Secondary

→ **symport** (same direction)
 $\text{Na}^+ / \text{glucose}$ transport.

→ **Antiport** (opposite direction)
 Na^+ / H^+ transport.

Exocytosis

- constitutive secretion

proteins are secreted immediately after their synthesis.

- immunoglobulins in plasma.

- procollagen in fibroblasts.

- Regulated secretion

cells concentrate secretory proteins and transiently store them in secretory vesicles within the cytoplasm.

- endocrine cells (hormones)
- exocrine cells (enzymes).
- neurons (neurotransmitter).

Endocytosis

→ phagocytosis (cell eating),

ex: white blood cell engulfing a bacterium.

→ pinocytosis (cell drinking).

ex: endothelium of blood vessels and in smooth muscle cells.

→ Receptor-mediated: (allow specific substance to enter the cell)

ex: uptake of cholesterol into cells.

- Clathrin-dependent endocytosis.

Cell Membrane Modifications

```
graph TD; A[Cell Membrane Modifications] --- B[Microvilli]; A --- C[Cilia]; A --- D[Flagella]; A --- E[Cell junctions];
```

Microvilli

long finger-like projections on the surface of certain cells.

Cilia

hair-like processes on the free surface of certain cells

Flagella

resemble cilia in general structure but are longer and present only in spermatozoa.

Cell.

junctions
they connect adjacent cells together.