Transport through the cell membrane

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Simple diffusion

- Non- polar, uncharged, lipid soluble and high membrane permeability (O_2, steroid hormone, CO_2)
- Rate is linear

Facilitated diffusion

Ion leak channels specific ions , open

Voltage gated channels open based on membrane potential

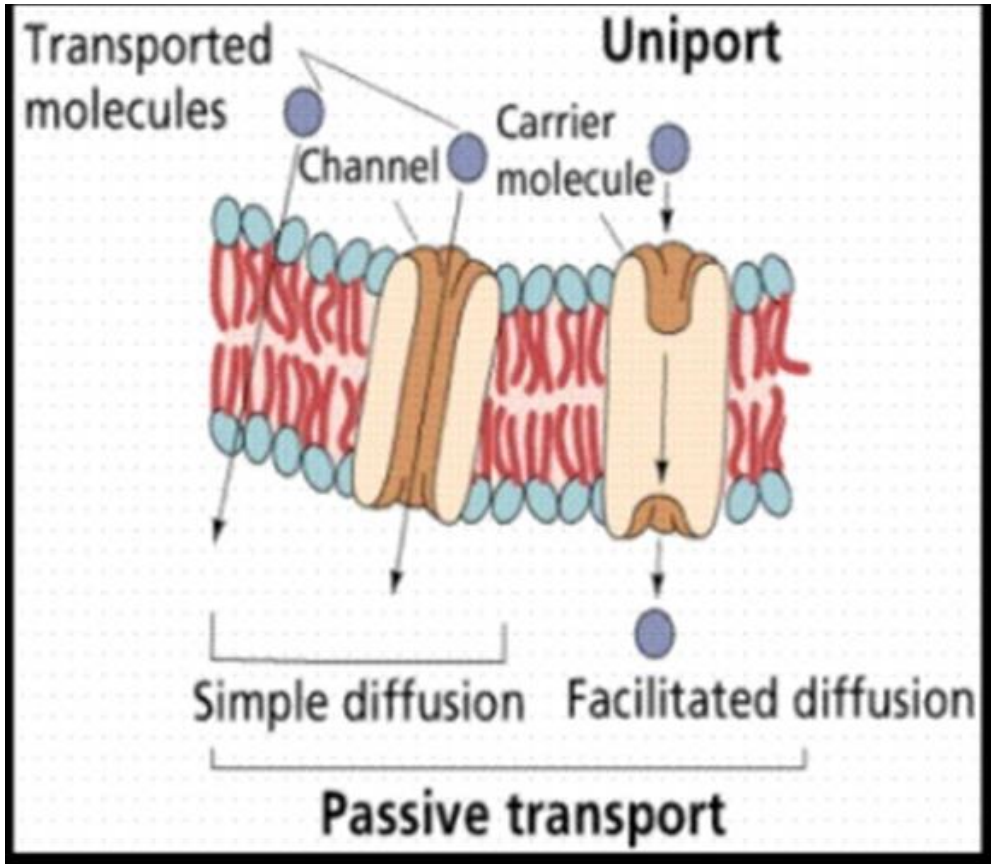
Ligand gated channels open in response to the binding of chemical messenger

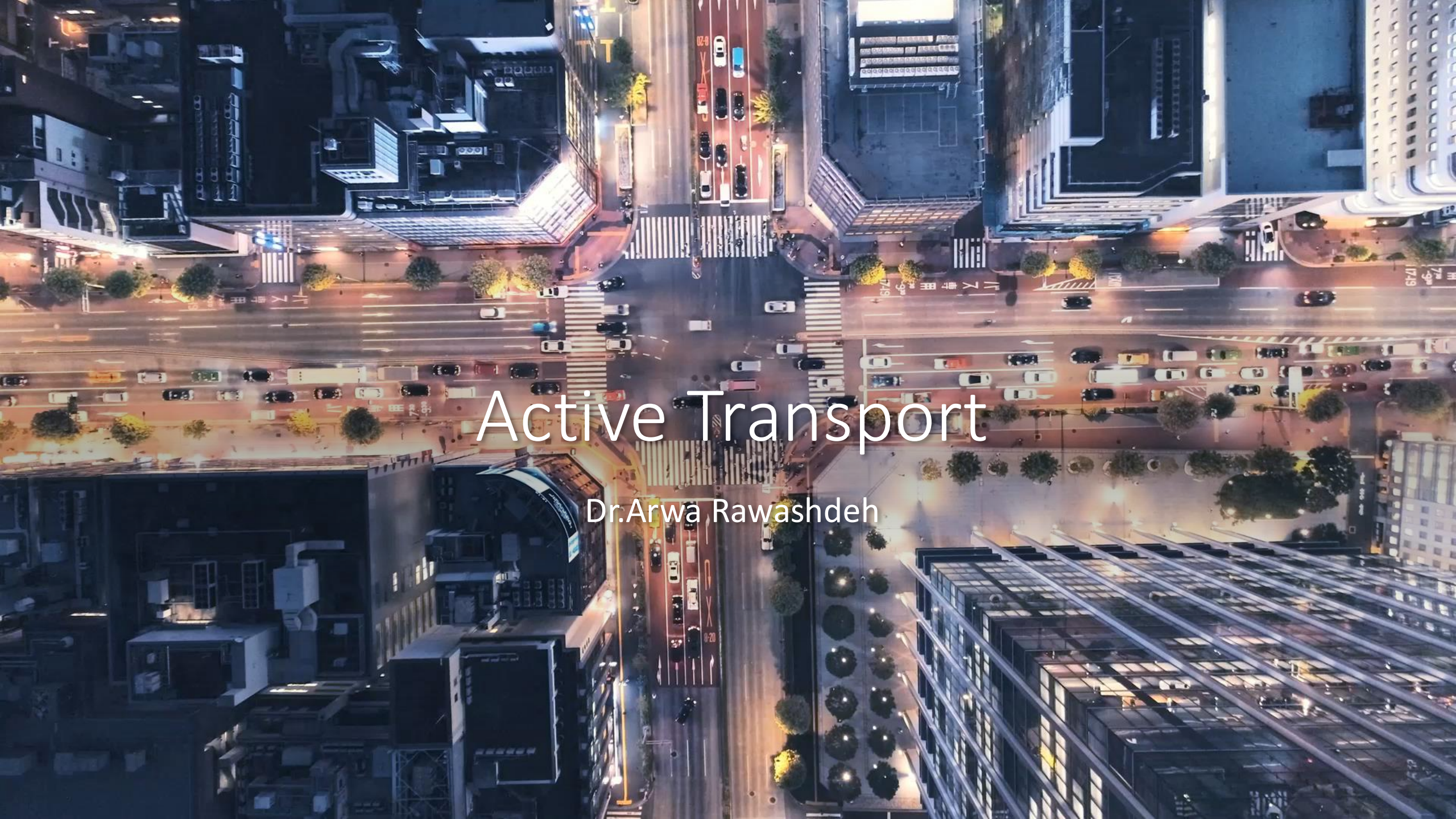
Carrier protein changing the shape of carrier

Rate can be never greater than transporter protein

Uniport

- **The movement of a single Substance.**
- **It requires no energy from the cell.**
- **Examples.**
  - **Simple diffusion.**
  - **Facilitated diffusion.**





Active Transport

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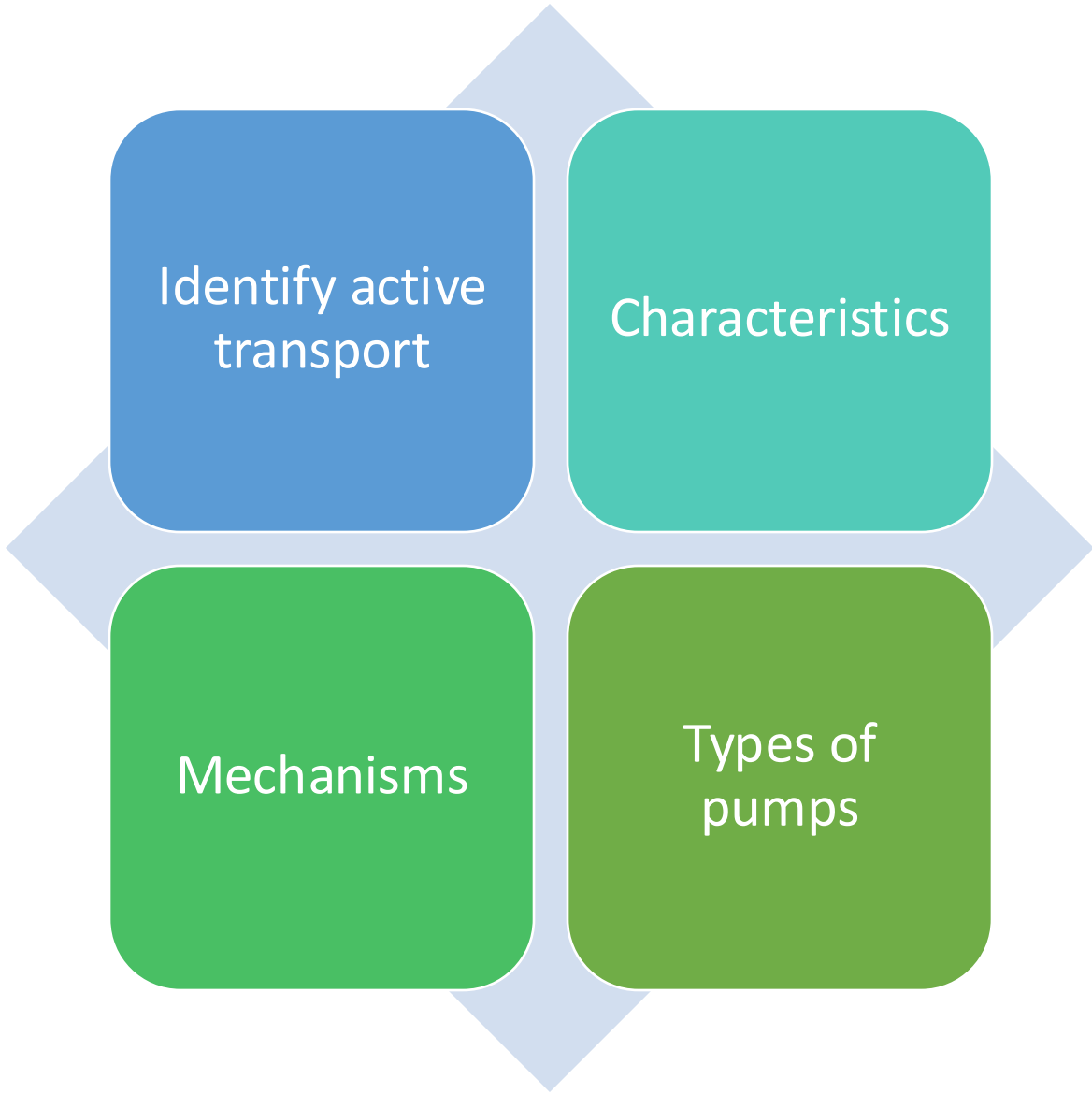
Objectives

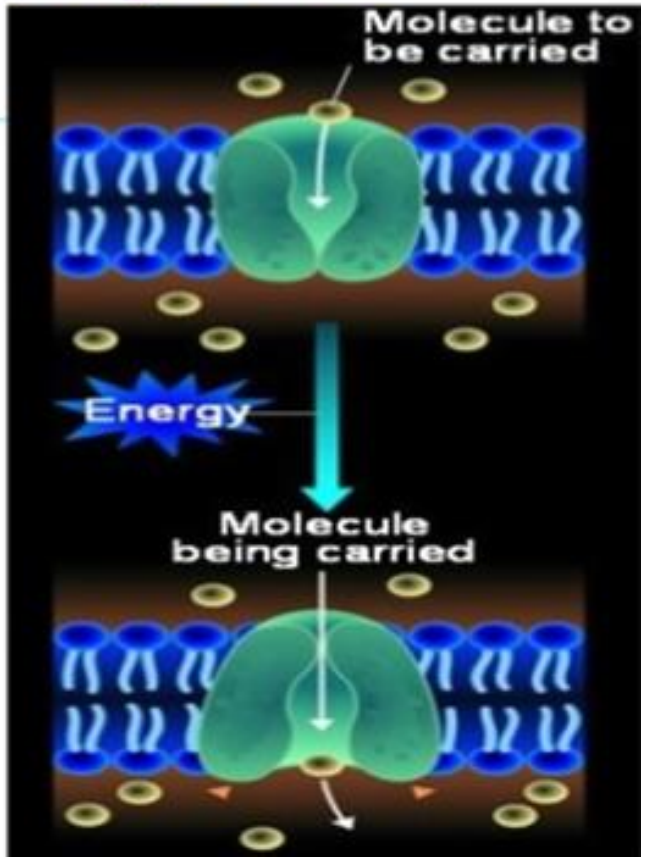

Identify active transport
Characteristics
Mechanisms
Types of pumps

What is active transport?

Active transport is the transport of substances from a region of lower concentration to higher concentration using energy, usually in the form of ATP.

Examples: Na, K and Ca active transport.

1. sodium-potassium pump
2. Calcium pump
3. Potassium hydrogen pump

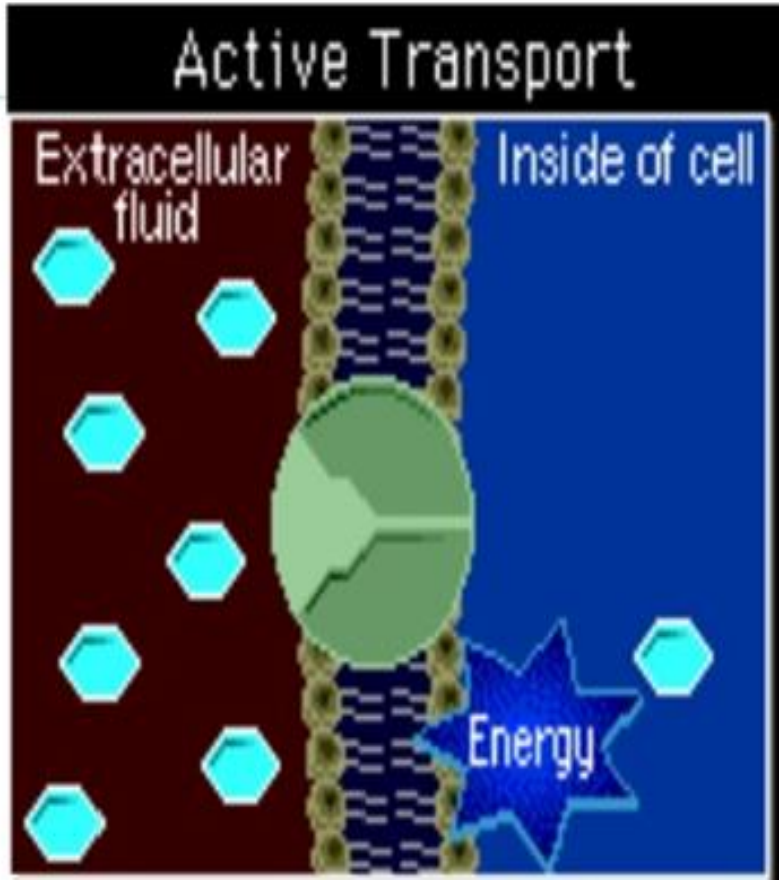


- Active transport involves the use of carrier proteins, like those of facilitated diffusion, but these carrier proteins act as pumps, using the energy from splitting ATP to pump specific molecules against the concentration gradient

Why??

ACTIVE TRANSPORT - WHY ?

- Cells cannot rely solely on passive movement of substances across their membranes.
- In many instances, it is necessary to move substances against their electrical or chemical gradient to maintain the appropriate concentrations inside of the cell or organelle.



Pumps involved in ACTIVE TRANSPORT

1.Sodium-potassium pump

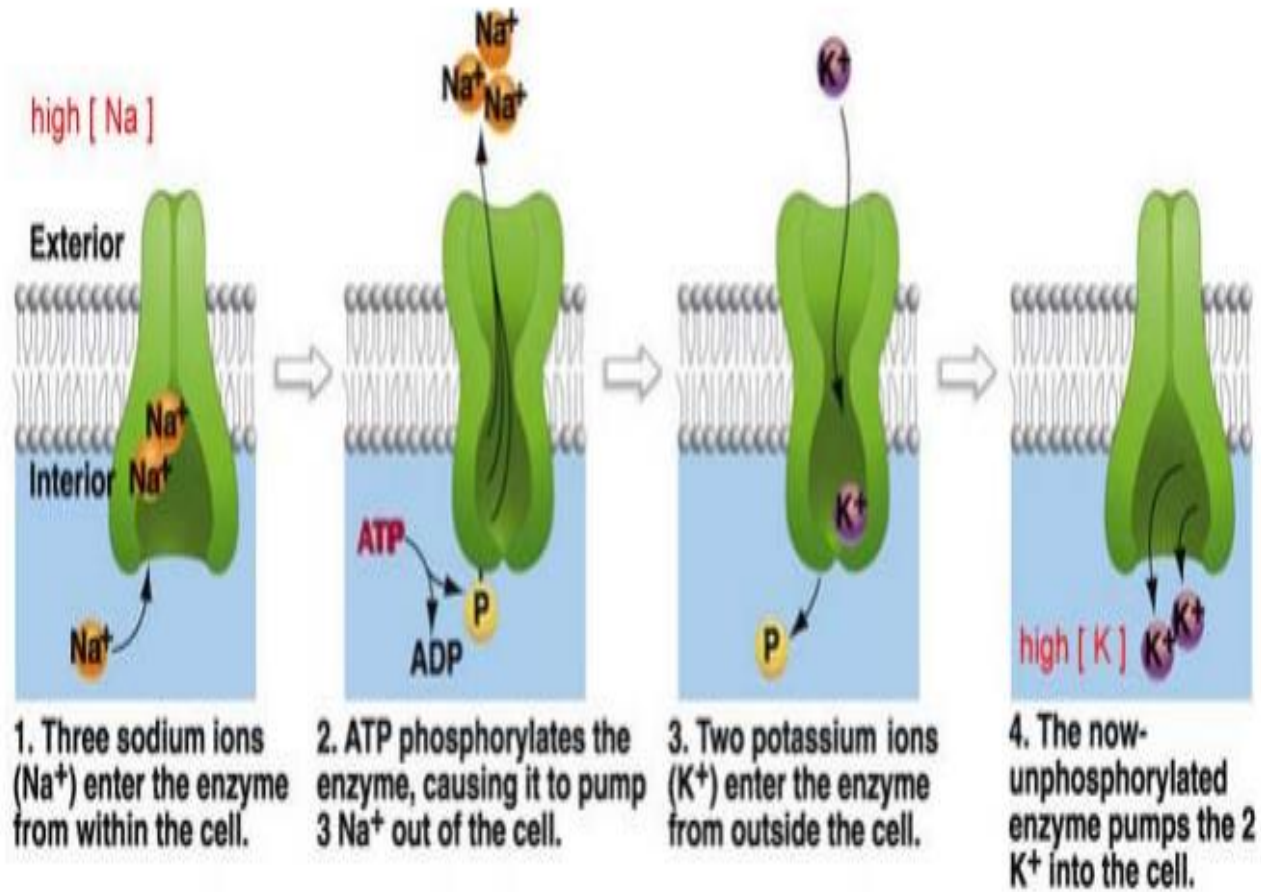
Found in many cells

2.Calcium pump

Found in membrane of Sarcoplasmic reticulum

3.Potassium hydrogen pump

Found in Gastrointestine cell membrane



Primary active transport

Primary active transport is the transport of substances uphill using energy (ATP hydrolysis)

It cause a conformational change that results in the transport of the molecule through the protein.

Eg. Na+-K+ pump.

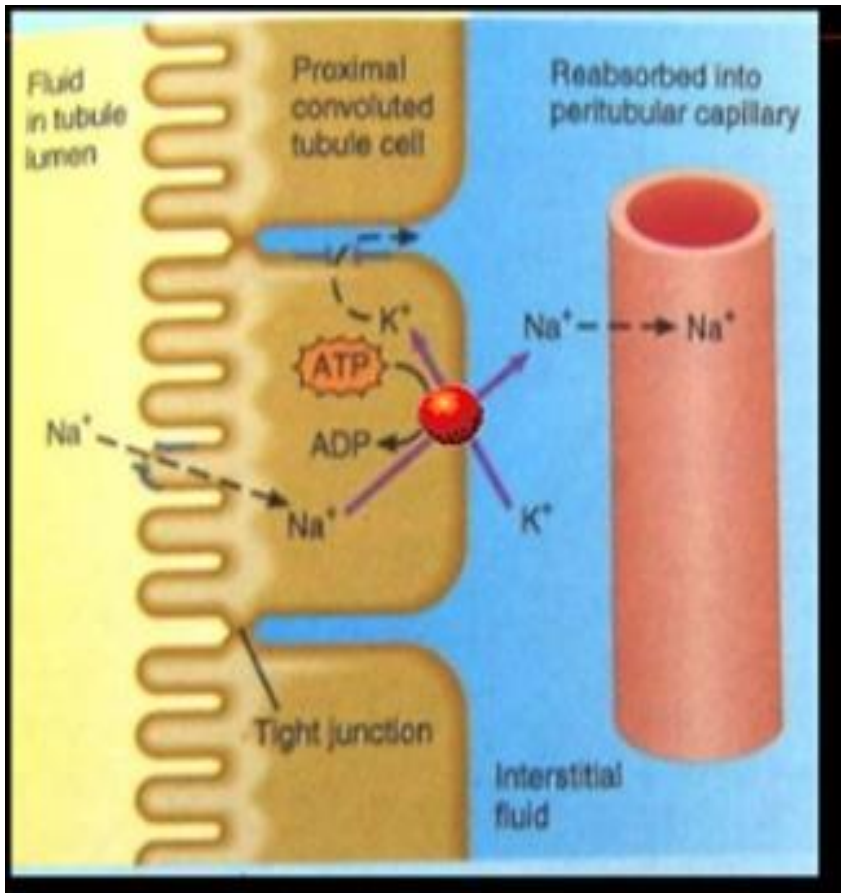
Functions of Na+K pump

1. It is responsible for maintaining the high K+ and low Na+ concentration inside the cell.

2. It maintains intracellular negativity.

3. Maintains cell volume.

4. Activate the Carrier protein.



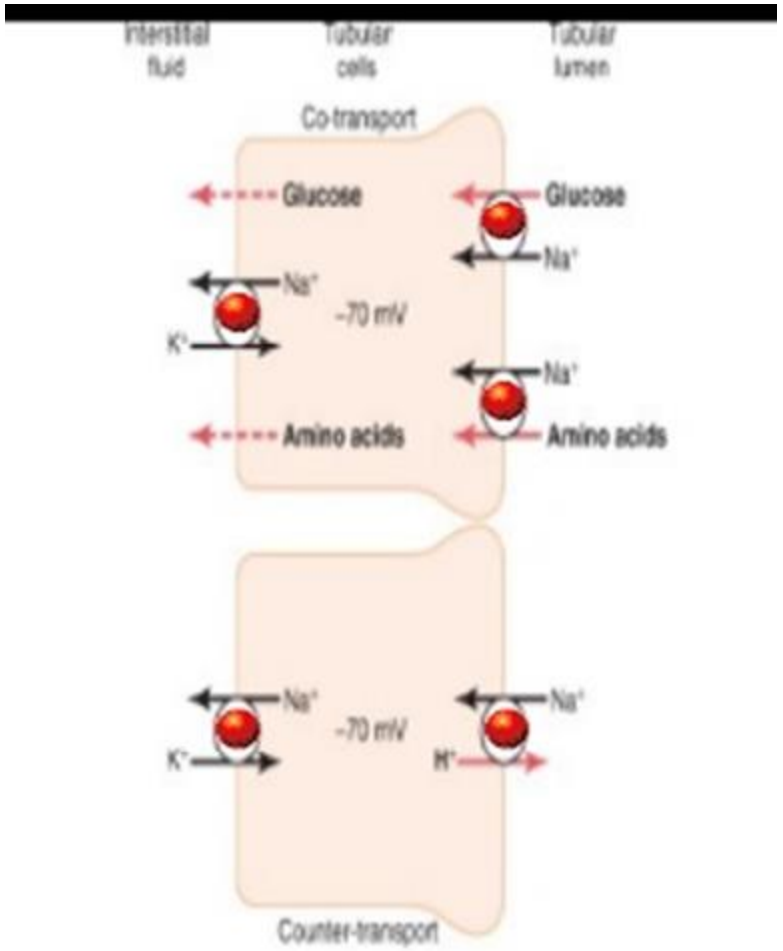
Secondary active transport

- The transport of substances against a concentration gradient involving energy to establish a gradient across the cell membrane, utilizes the gradient to transport a molecule of interest up its concentration gradient .

- THE TRANSPORT MAY BE
- In the same direction (SYMPORT)
- In the opposite direction (ANTIPORT)

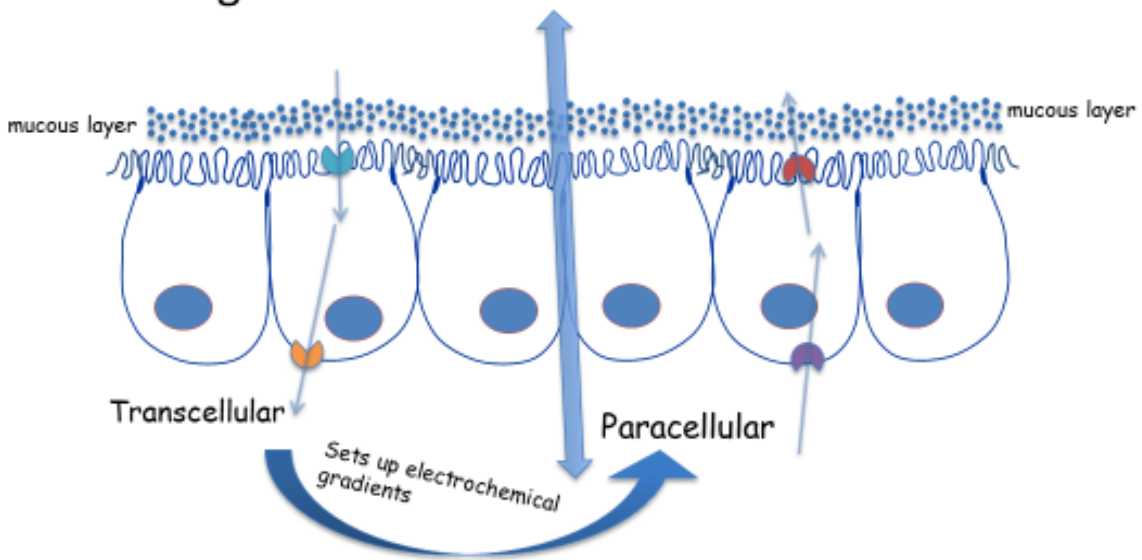
Symport (Co- transport)

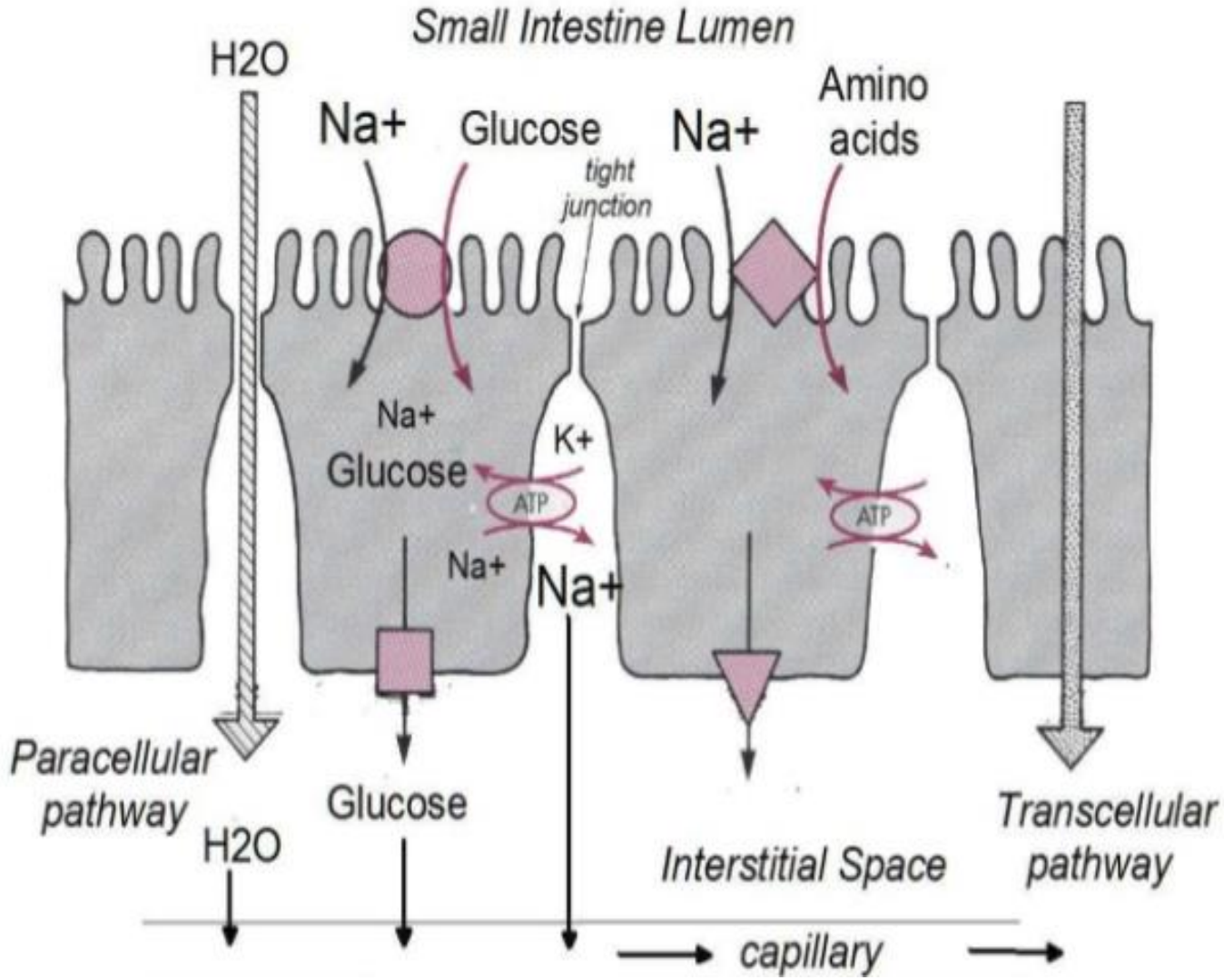
- **Transport of two substances using the energy produced by concentration difference developed by primary active transport**
- **Substances are moving in the same direction.**
- **Example: transport of amino acids, Glucose,**



Transepithelial Transport: Summary

MEMBRANE TRANSPORT drives TRANSCELLULAR transport of ions, which sets up ELECTROCHEMICAL GRADIENT to allow PARACELLULAR transport of fluid through TIGHT JUNCTIONS



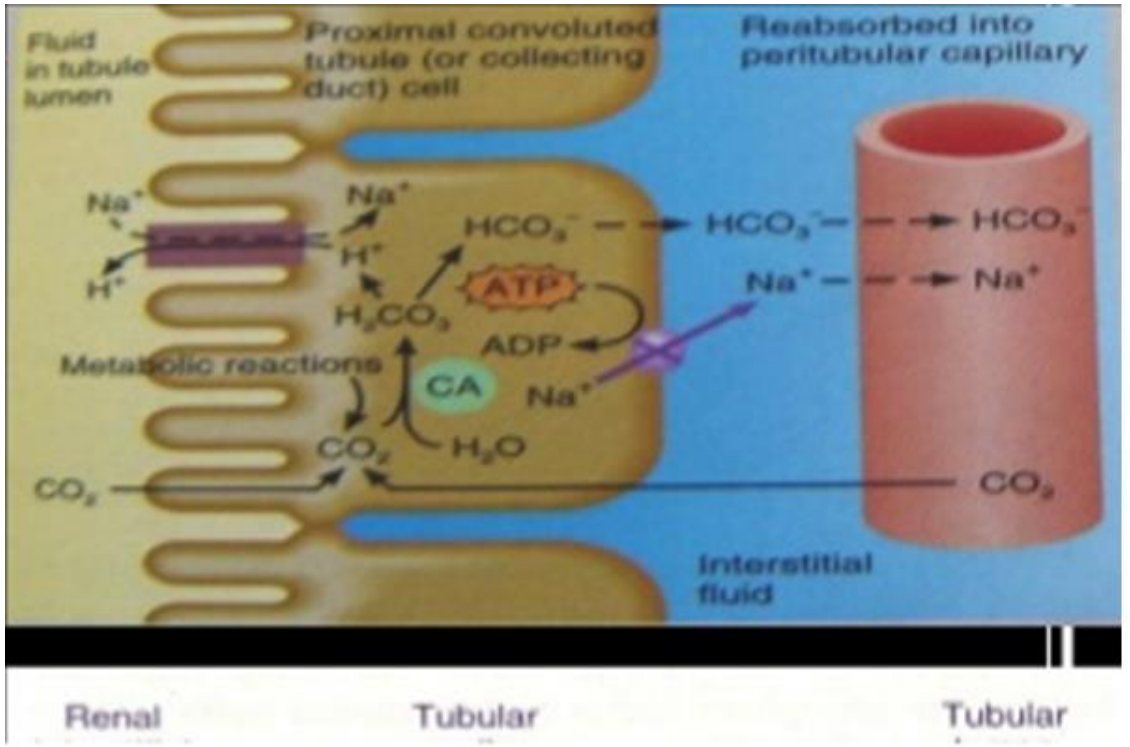

Small Intestine Lumen
H2O
Na+
Glucose
Na+
Amino acids
tight junction
Na+
Glucose
K+
ATP
ATP
Na+
Na+
Paracellular pathway
Glucose
H2O
Interstitial Space
Transcellular pathway
capillary

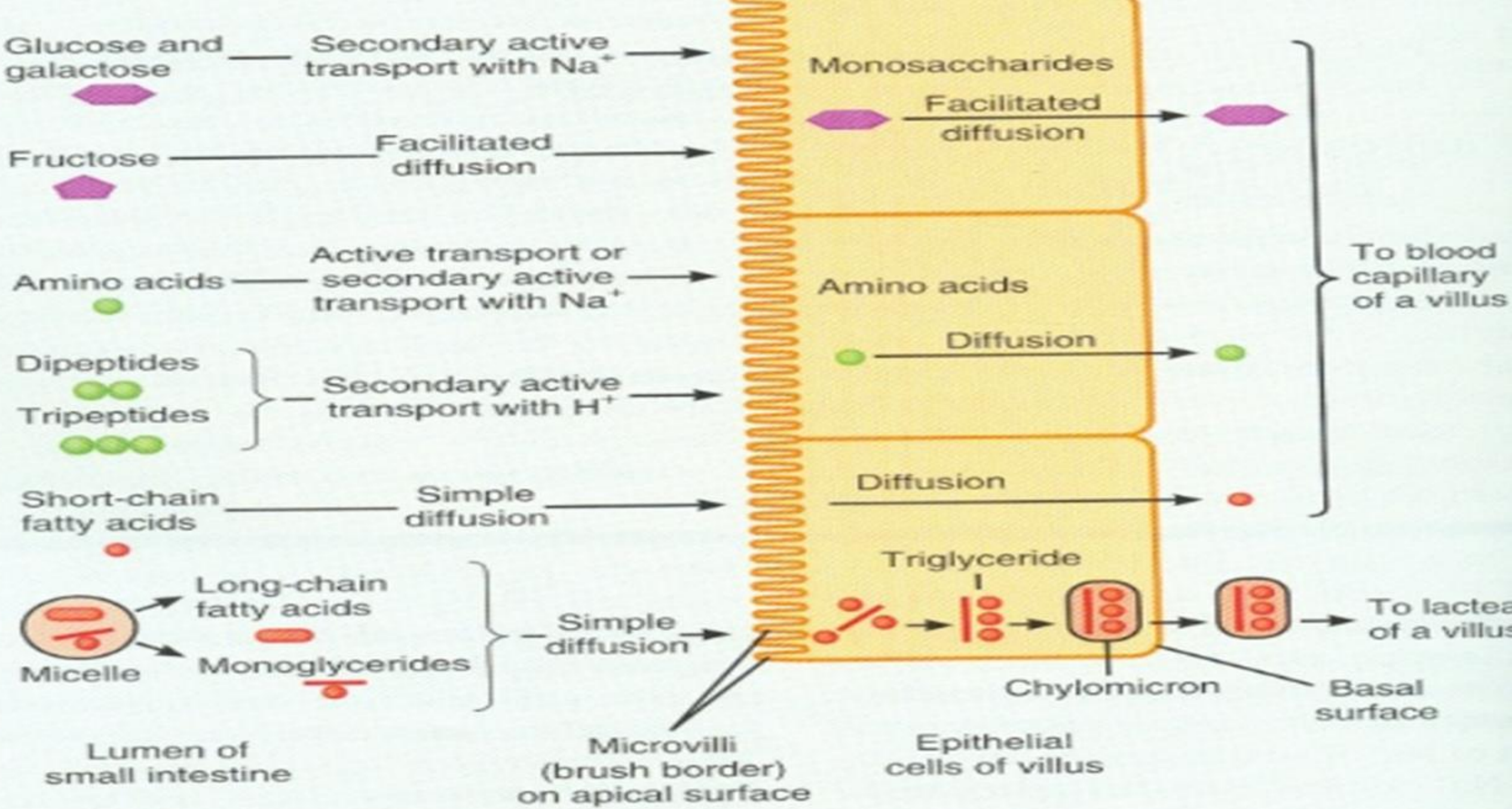
Anti port (Counter- Transport)

In this process, the two substances move across the membrane in opposite directions.

Example:

Exchange of H+ and Na+ in Renal tubule.





Mechanisms for movement of nutrients through epithelial cells of the villi