RAMA UNIVERSITY

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FACULTY OF ENGINEERING &TECHNOLOGY
DEPARTMENT OF BIOTECHNOLOGY

Liposomes

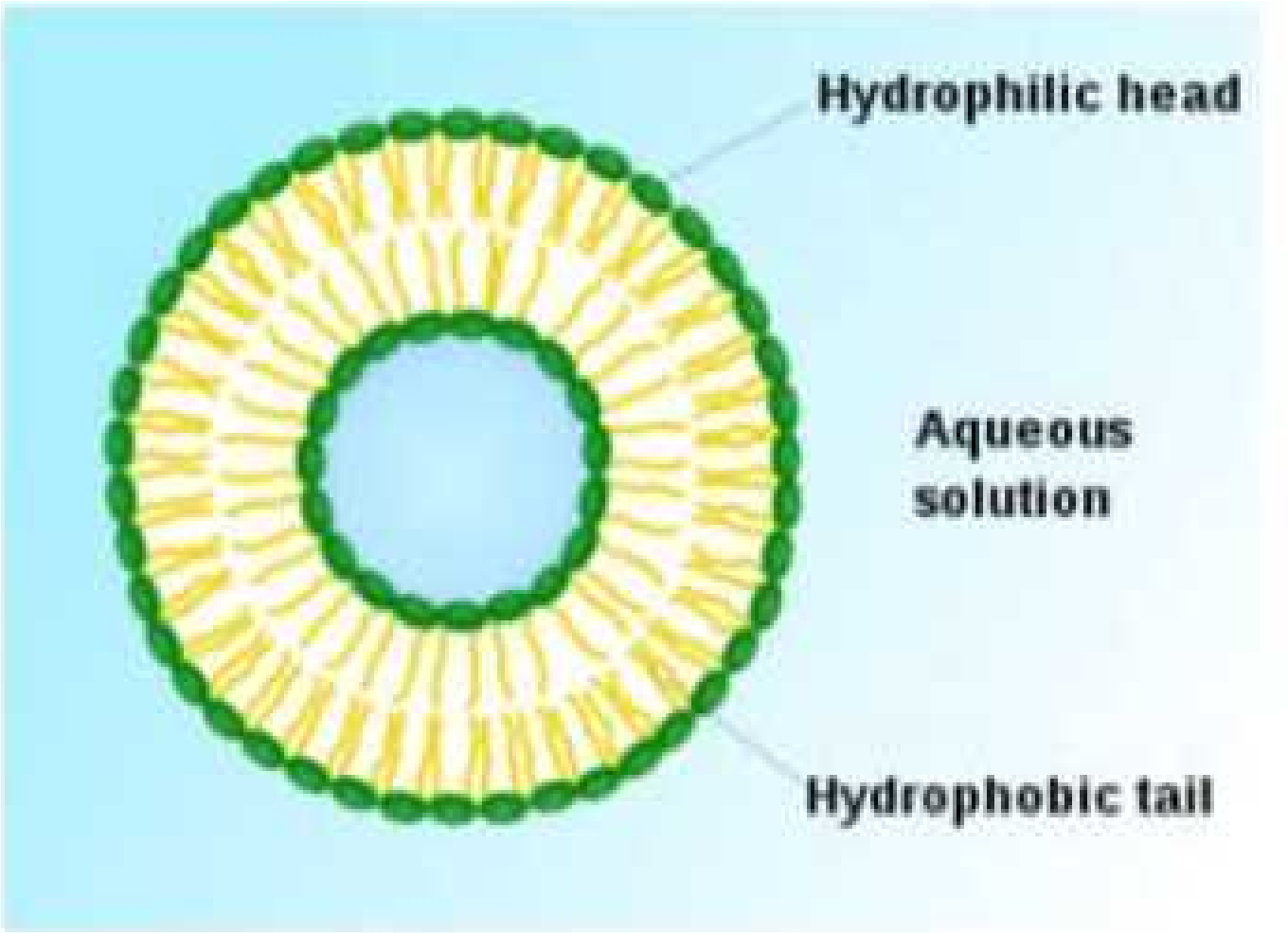
Liposomes are small artificial vesicles of spherical shape that can be created from cholesterol and natural non-toxic phospholipids.

Liposomes are intracellular vesicles that can be used to transport substances such as nutrients and drugs

(i) into the cell,

(ii) out of the cell, and

(iii) between different parts of a cell.


Hydrophilic head
Aqueous solution
Hydrophobic tail

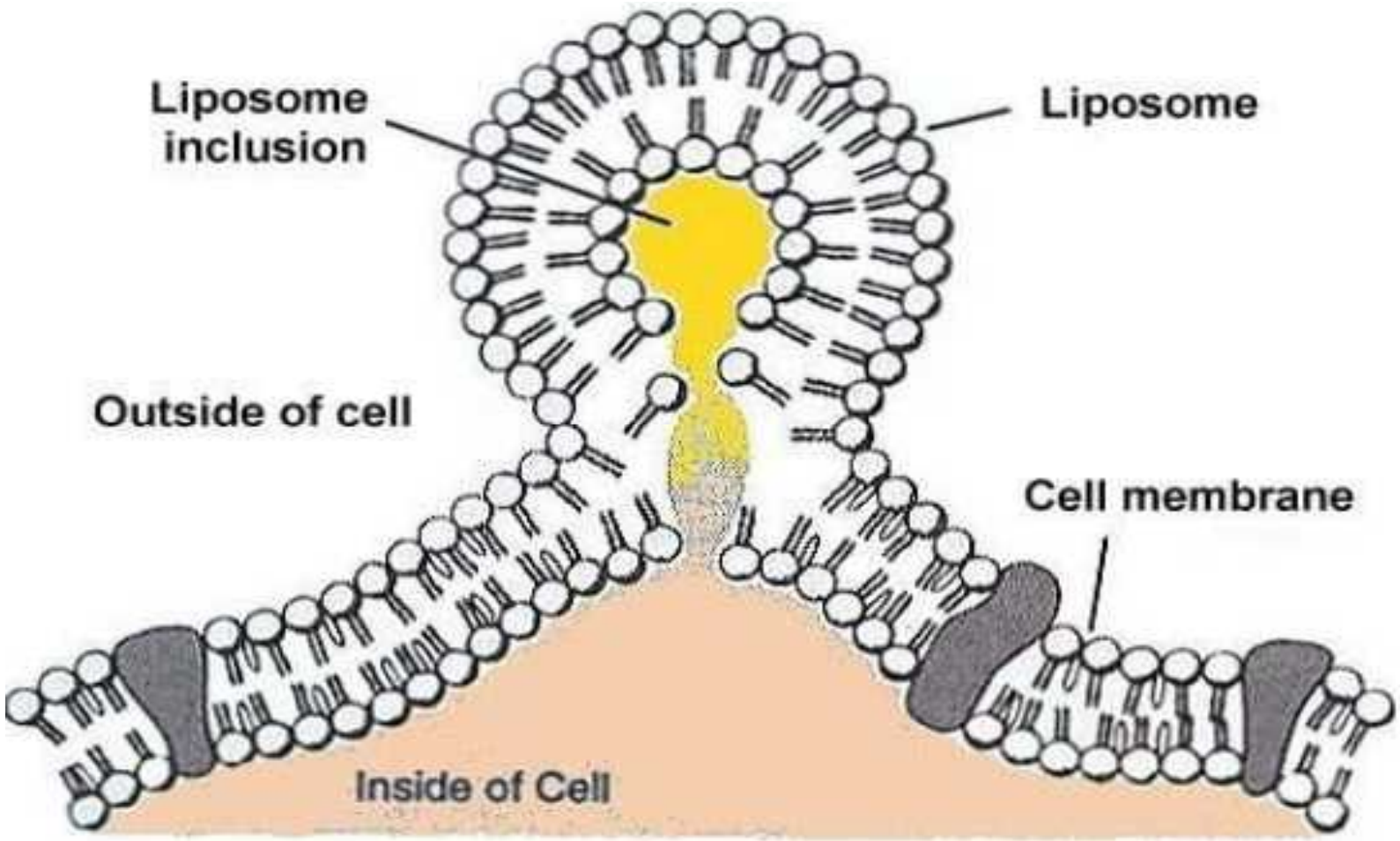
Transport using liposomes

Usually liposomes are formed by "pinching off" a part of the lipid bilayer of the cell membrane.

Here is an image of a liposome being incorporated into a cell.

It is transporting the yellow matter into the cell.

The external layer of the liposome will be incorporated into the cell membrane of the acceptee cell.



Acceptance of liposome into cell

Sodium-potassium pump

The Na+ K+ pump is an electrogenic transmembrane P- type ATPase first discovered in 1957 and situated in the outer plasma membrane of the cells; on the cytosolic side.

The P-type ATPases are enzyme that forms a phosphorylated intermediate (E1P) by autophosphorylation of Asp residue during ion transport.

During Autophosphorylation process, P-type ATPases transfer the γ-phosphate group from ATP in the E1-ATP conformation to the active site in the E1P configuration.

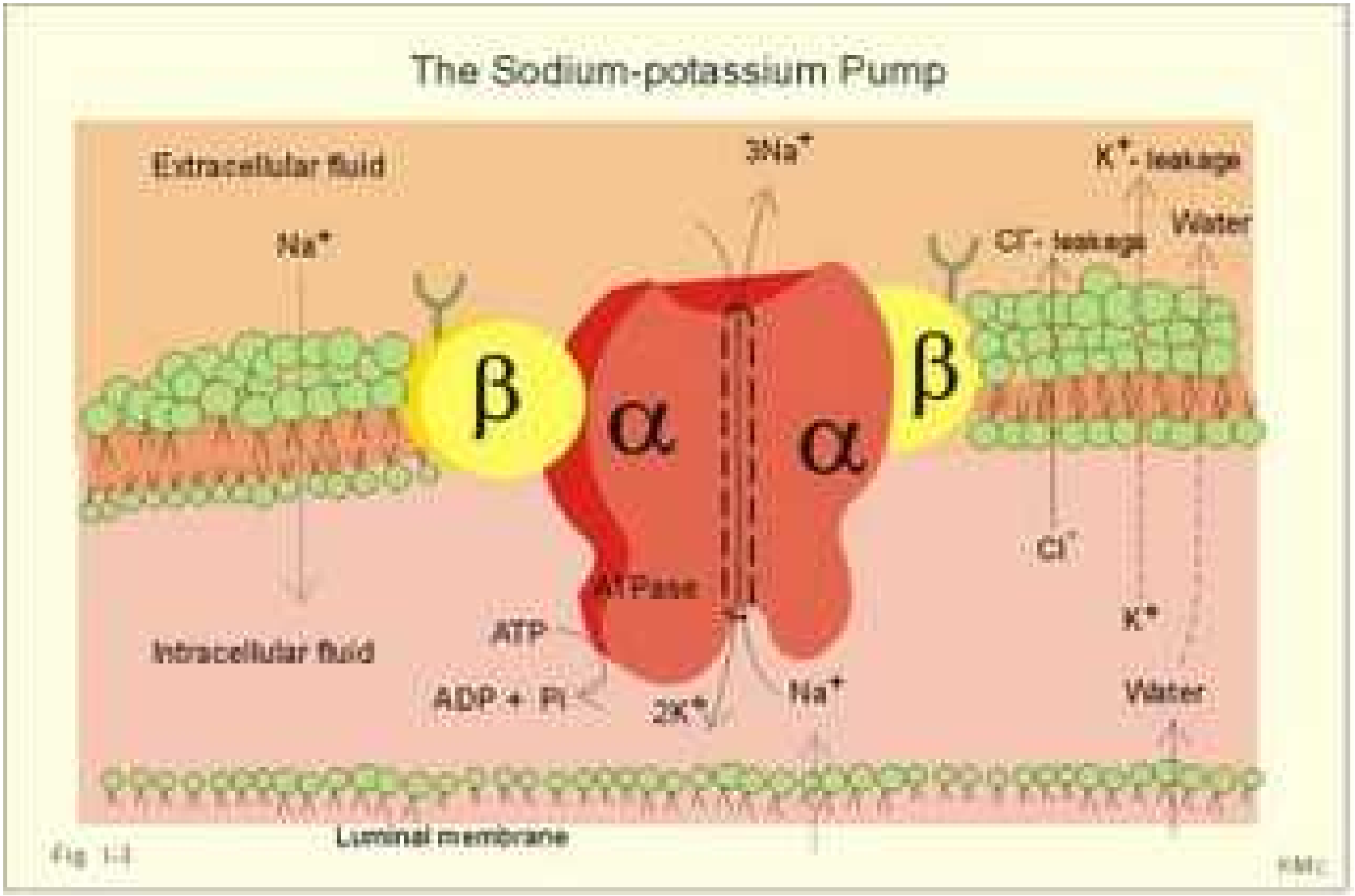
The Na+ K+ ATPase pumps 3 Na+ out of the cell and 2K+ that into the cell, for every single ATP consumed.
The plasma membrane is a lipid bilayer that arranged asymmetrically, containing cholesterol, phospholipids, glycolipids, sphingolipid, and proteins within the membrane. The Na+K+-ATPase pump helps to maintain osmotic equilibrium and membrane potential in cells.

Structure

Structurally, the Na+ K+ ATPase is composed of a catalytic alpha subunit and an auxiliary beta subunit. Some Na-K ATPases include a subunit that is tissue-specific and belongs to the FXYD protein family.

The alpha subunit contains a transmembrane region which is composed of 10 helices, referred to as MA1-M10. Within these ten helices, ion binding sites, specifically three binding sites that bind to Na+ in the E1 state and two binding sites that bind to K+ in the E2 state.

The structure of the Na-K ATPase is composed of three sites. Site one and two overlaps within both the E1 and E2 state. However, site three is exclusively in the E1 state and is between the M5, M6, and M8 transmembrane helices, which bind to Na+ and catalyze H+ transport as well, dependent on the Na+, K+, and H+ concentrations


The Sodium-potassium Pump
Extracellular fluid
3Na+
K+ - leakage
Na+
Cl- - leakage
Water
β
α
α
β
Cl-
ATPase
K+
ATP
Intracellular fluid
ADP + Pi
2K+
Na+
Water
Luminal membrane

Mechanism

The typical cycle occurs in several steps. First, the pump binds ATP and three sodium ions from the cytoplasm.

The ATP then phosphorylates the pump and it shifts in shape, creating an opening towards the outside of the cell.

The sodium is released and two potassium ions are picked up.

Finally, the phosphate is cleaved off and the pump shifts back, releasing the potassium inside the cell