Structure of The Cell Membrane

Transport of Substances through Cell Membrane

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BİRUNİ ÜNİVERSİTESİ
Bilimin Geleceği

Objectives

- To inform about the structure of cell membrane
- To describe the ways of transporting substances from cell membrane

The Cell

- A cell consists of membrane, cytoplasm and nucleus.

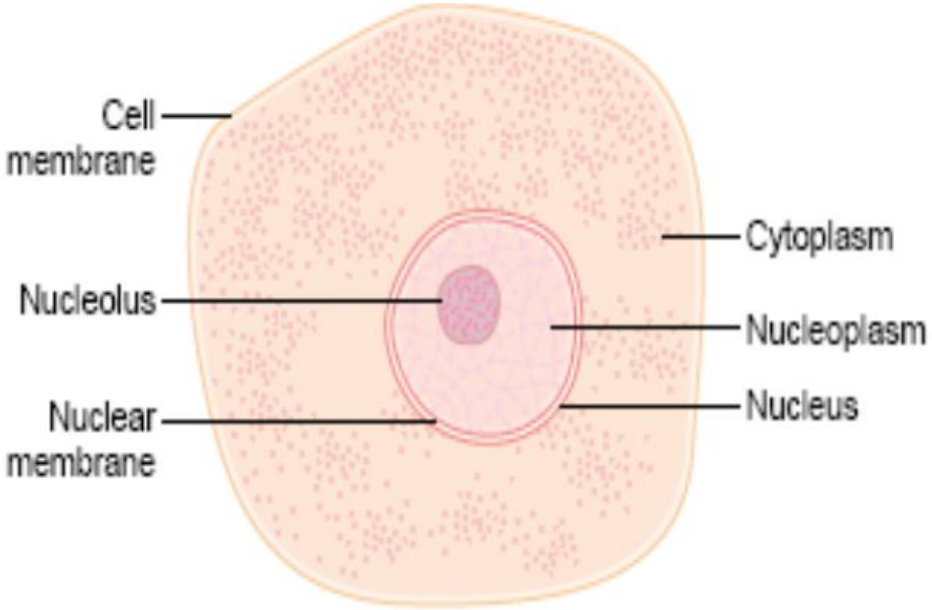


Figure 2–1

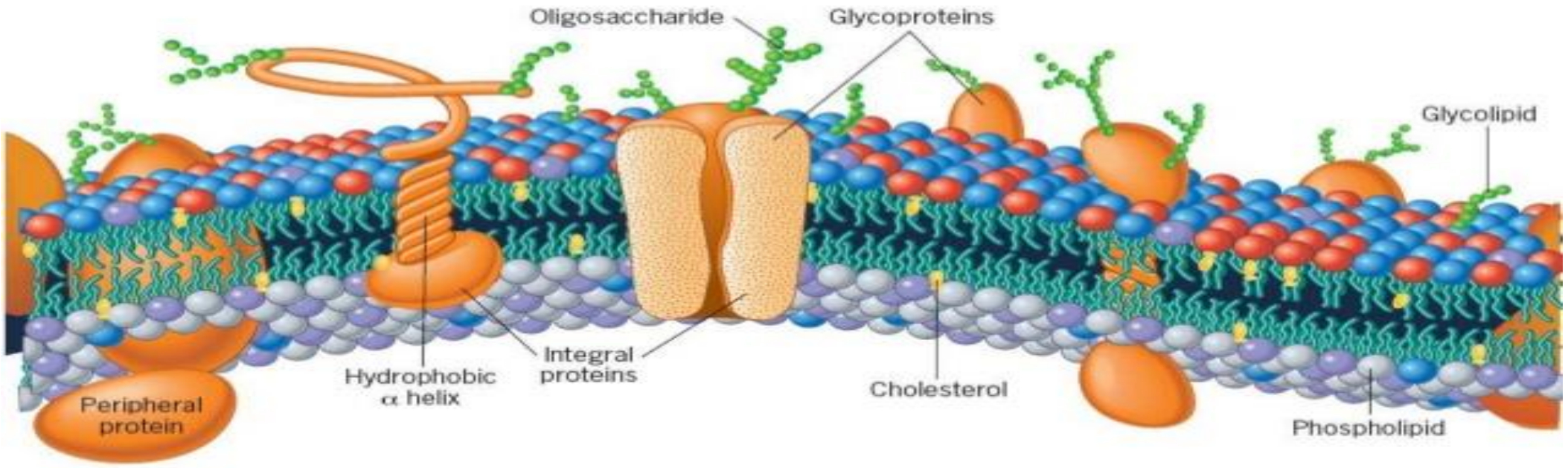
Structure of the cell as seen with the light microscope.

The Cell Membrane

- Structural support for the cell,
- Barrier between the cells,
- Regulation of subtance flow (Semi-permeable),
- Cell to cell communication

Membrane Composition

Membranes are composed of lipids, proteins and carbohydrates.



Lipids

- Lipids form the core of all membranes.
- Membranes contain three types of lipid: **Phosholipids**, **cholesterol** and **glycolipids**.
- Phospholipids consist of a hydrophilic head and 2 hydrophobic fatty acid tails.

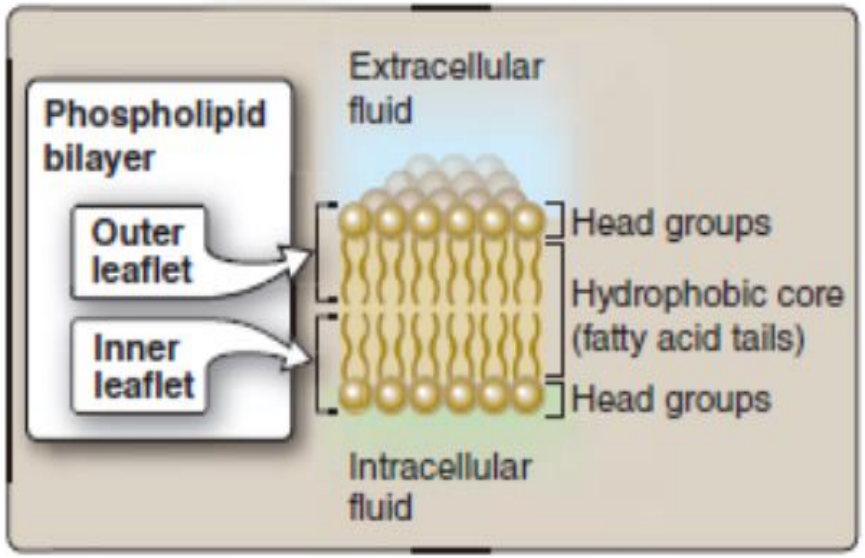
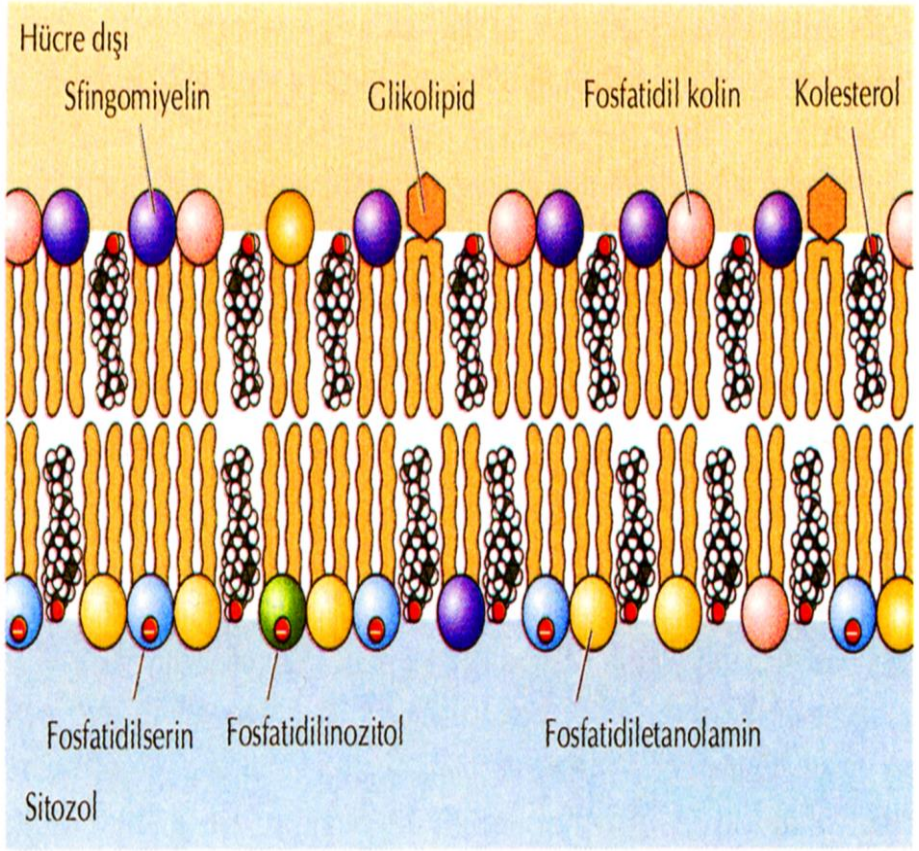


Figure 1.3
Membrane lipid bilayer.

Lipid components of plasma membrane



- The most common phospholipids in the membrane:**Phosphatidylserine**, **phosphotidylethanolamine**, **phosphatidylcholine**, **phosphatidylinositol** and **sphingomyelin**.

- **Glycolipids** serve as receptors or antigens.

Cholesterol

- Cholesterol has an important role in determining the fluidity of membrane.
- It decreases the fluidity of membrane.
- It makes membrane stronger and more rigid.

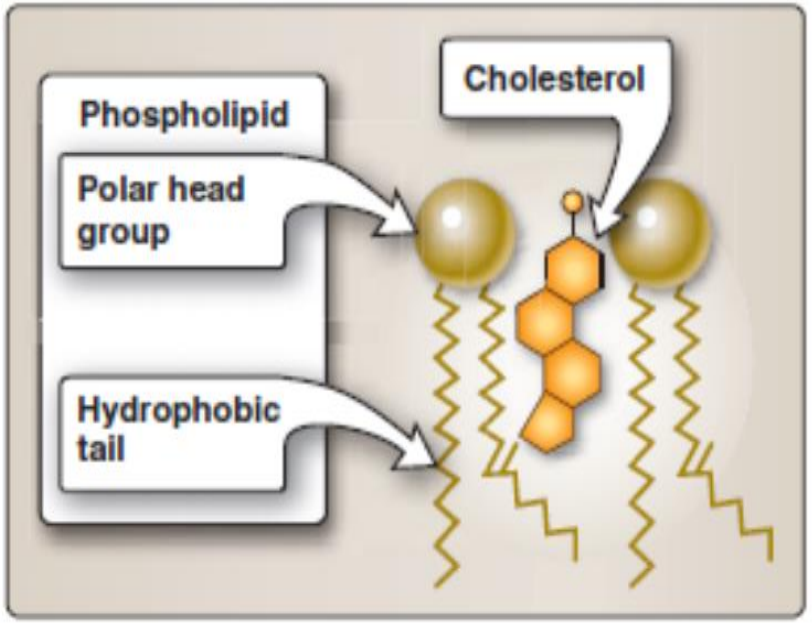
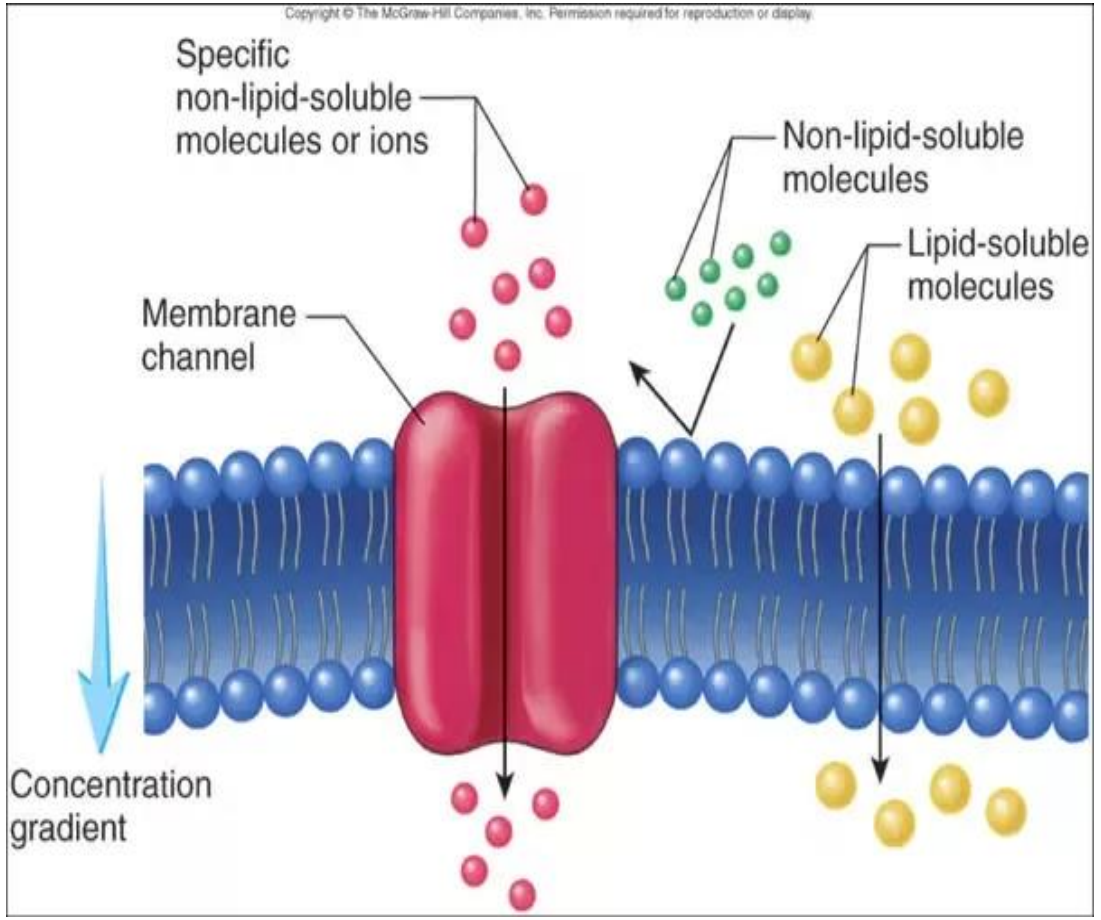


Figure 1.4
Cholesterol location with the membrane.

Phospholipid Bilayer

- Impermeable large polar molecules such as glucose and ions,
- Oxygen, carbon dioxide, benzene, alcohol and urea such as small polar molecules can easily pass through the membrane-These substances are lipid-soluble.



Proteins

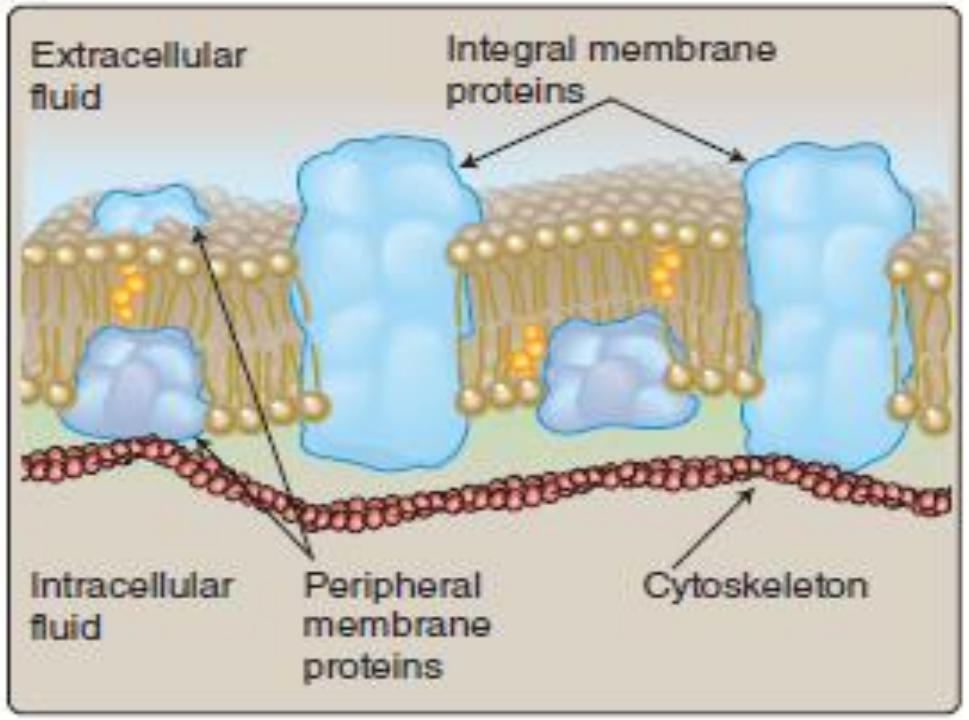
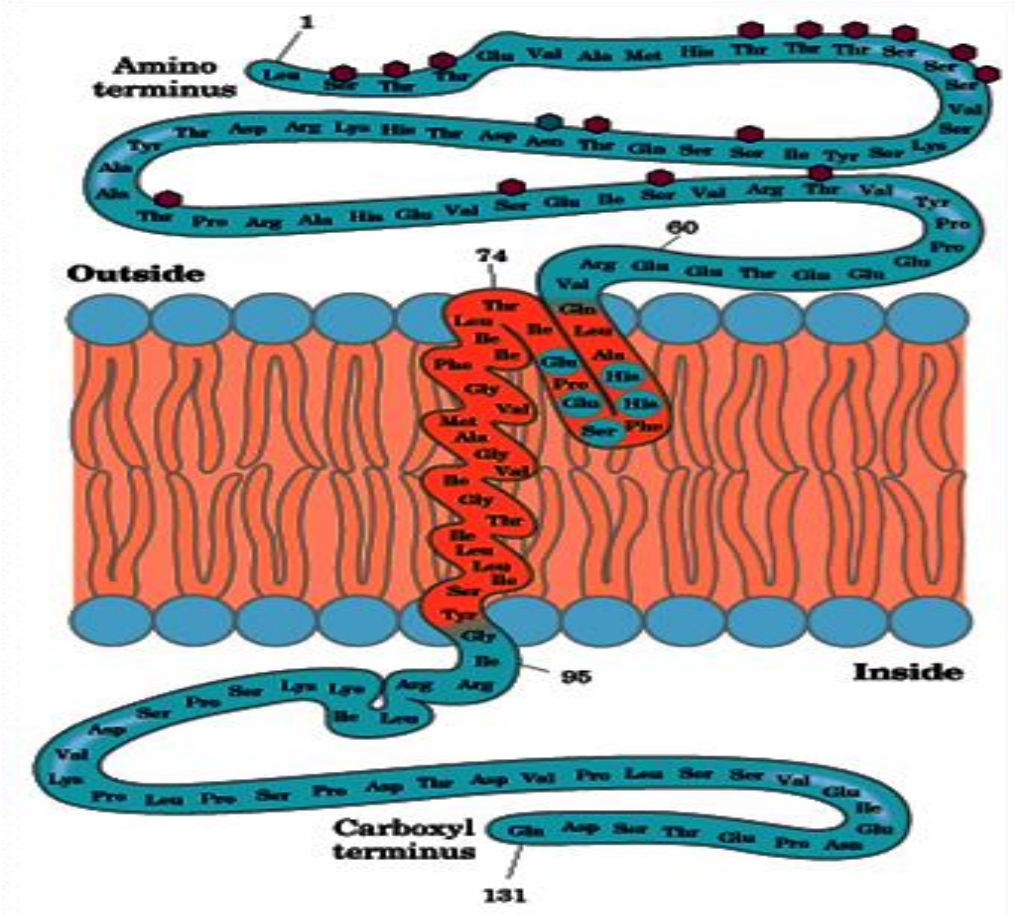
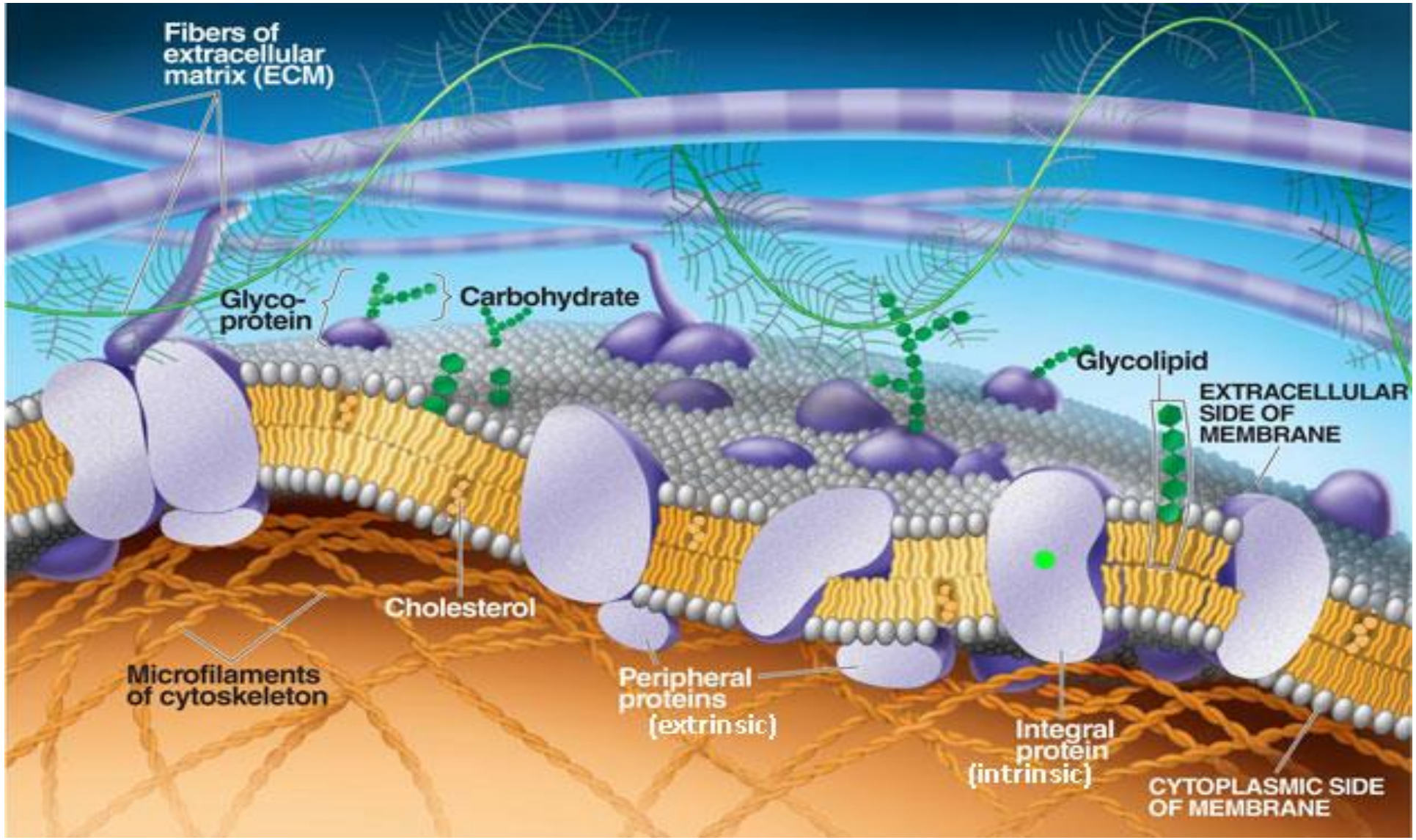


Figure 1.5
Membrane proteins.

- There are two types of proteins which are known integral and peripheral proteins.

Integral Membrane Protein





Peripheral Membrane Proteins

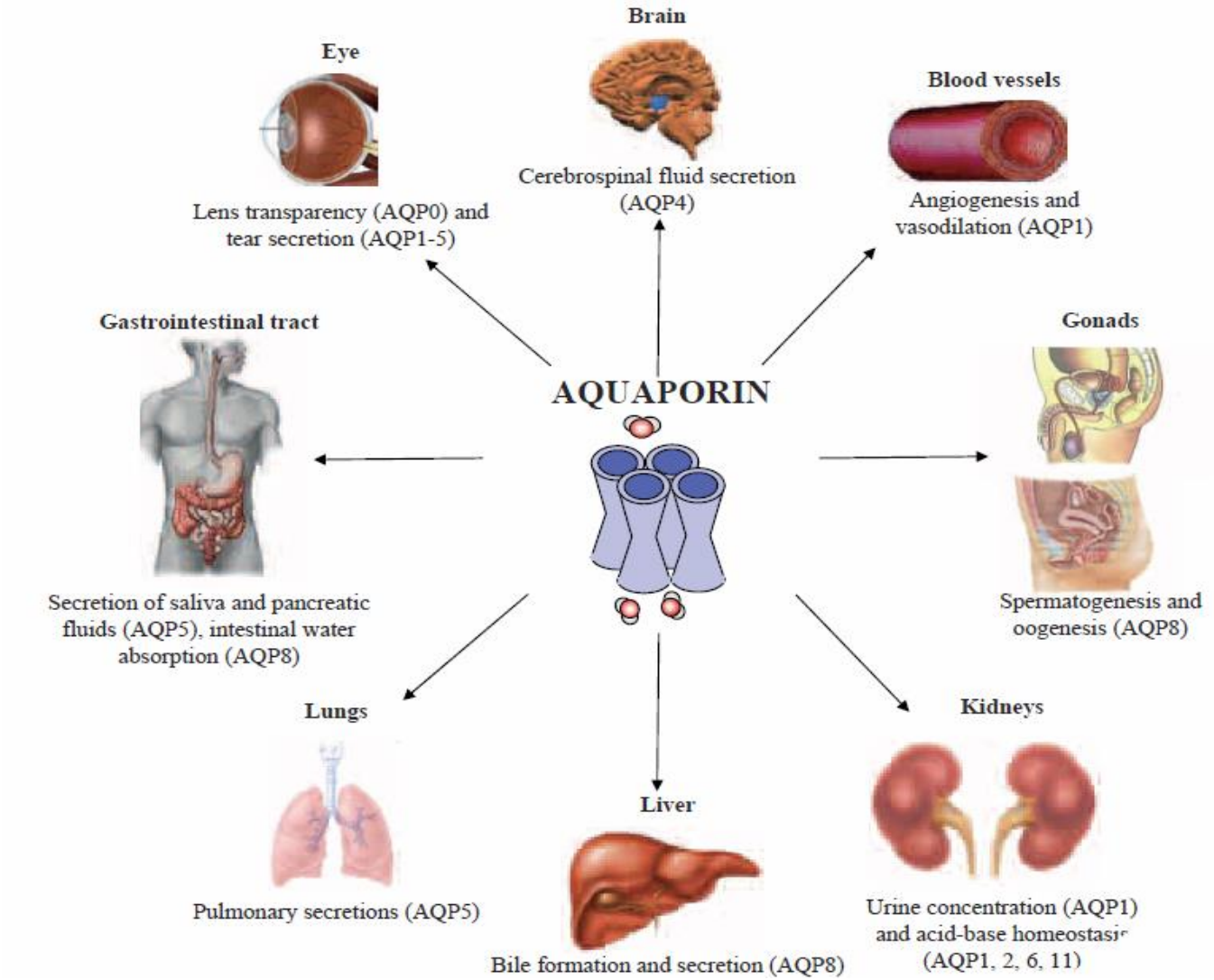
Functions Of Cell Membrane Proteins

- Pores,
- Channels,
- Pumps,
- Carrier proteins,
- Reseptors,
- Antigens

Table 1.2: Approximate Transit Rates for Pores, Channels, and Carriers

Pathway	Example	Molecule(s) Moved	Transit Rate (Number/s)
Pores	Aquaporin-1	H_2O	3×10^9
Channels	Na^+ ClC1	Na^+ Cl^-	10^8 10^8
Carriers	Na^+-K^+ ATPase	Na^+, K^+	3×10^2

PORES


Brain
Eye
Blood vessels
Cerebrospinal fluid secretion (AQP4)
Lens transparency (AQP0) and tear secretion (AQP1-5)
Angiogenesis and vasodilation (AQP1)
Gastrointestinal tract
Gonads
AQUAPORIN
Secretion of saliva and pancreatic fluids (AQP5), intestinal water absorption (AQP8)
Spermatogenesis and oogenesis (AQP8)
Lungs
Kidneys
Liver
Pulmonary secretions (AQP5)
Urine concentration (AQP1) and acid-base homeostasi
(AQP1, 2, 6, 11)
Bile formation and secretion (AQP8)

CHANNELS

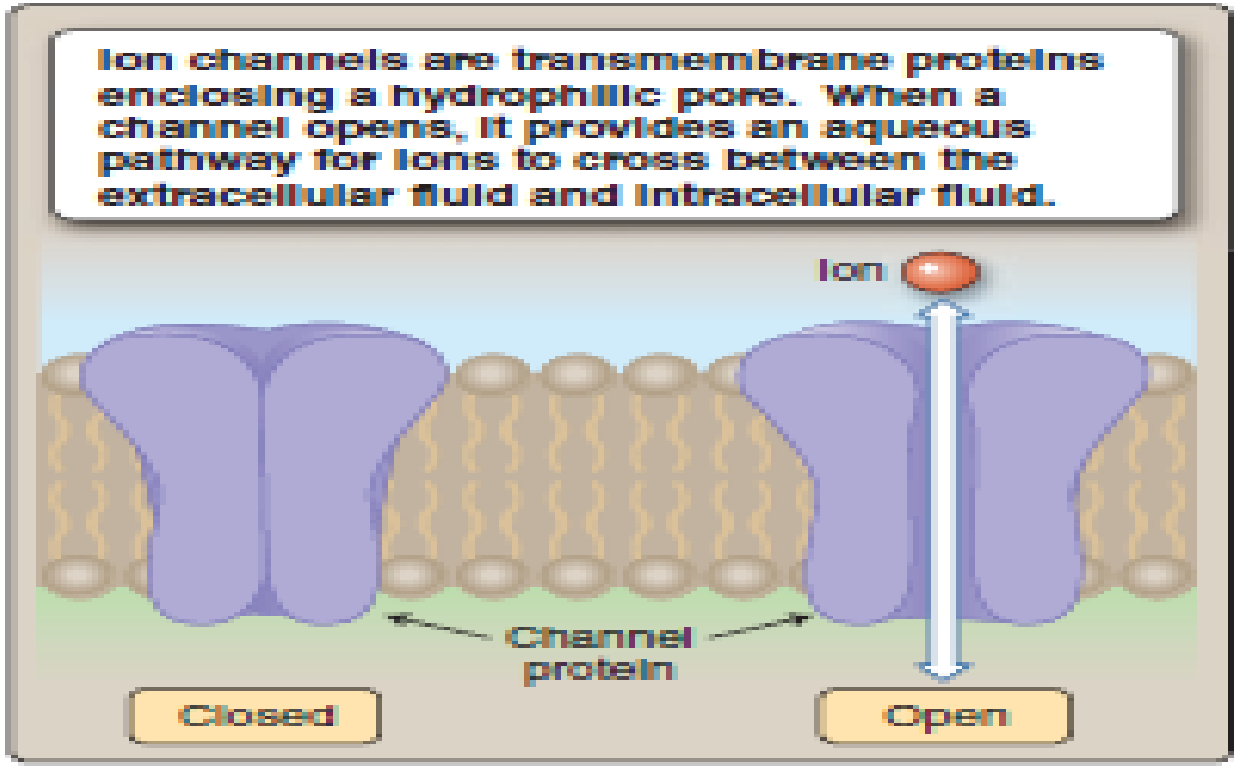
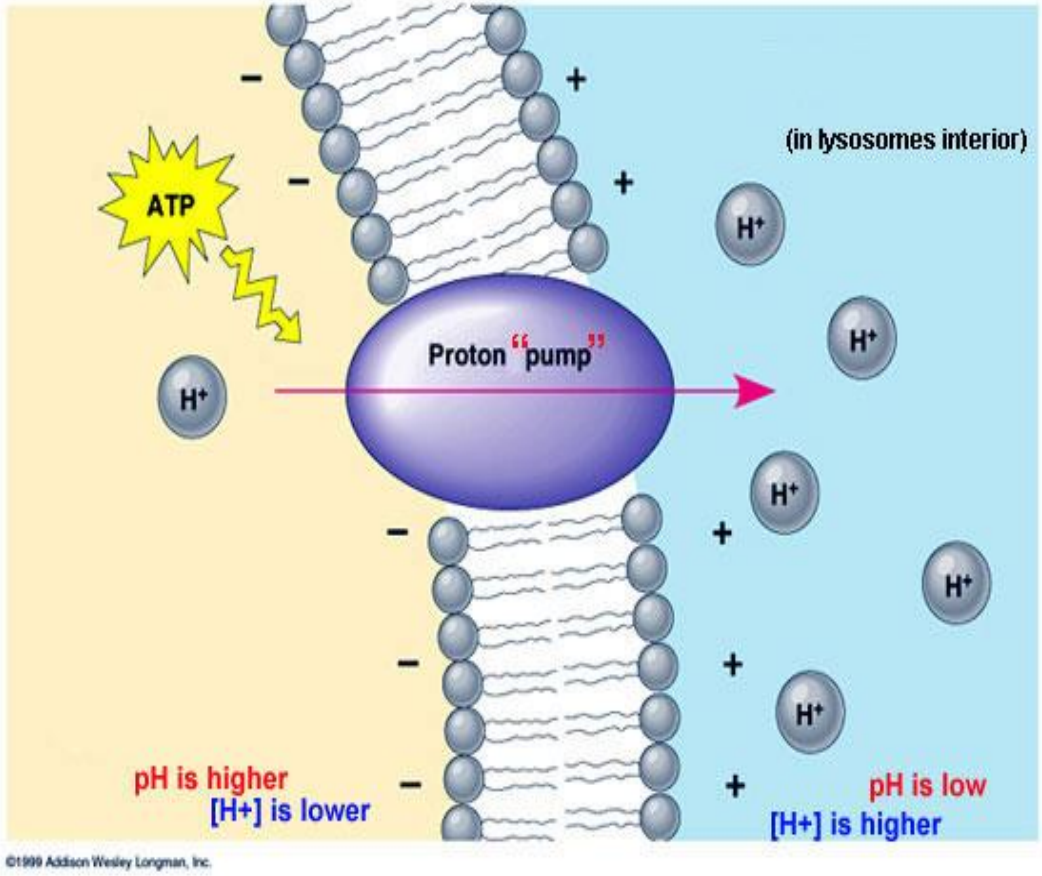


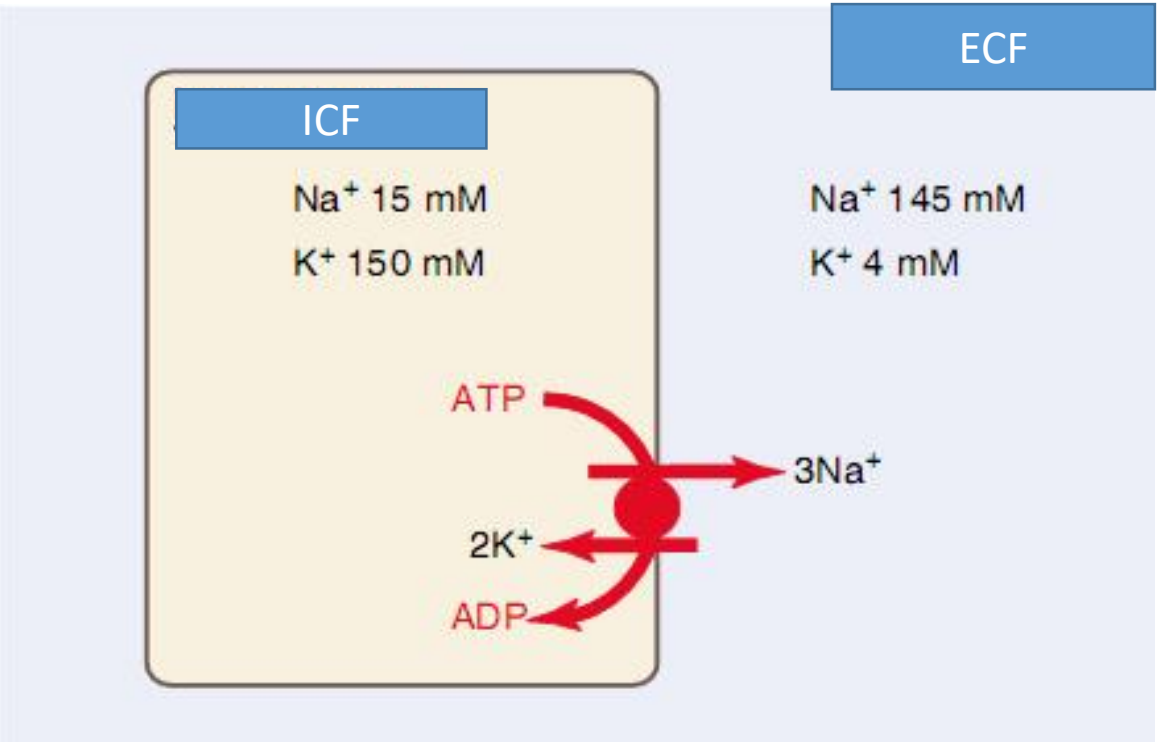
Figure 1.12
Ion channel opening.

PUMPS

- Na^{+}/K^{+} ATPase
- Ca^{+2}-ATPase
- H^{+}-ATPase



Na^+,K^+-ATPase (Sodium-Potasium Pump)



- Na, K-ATPases are found in all plasma membranes.

- The activity of this pump results in
  - -more K^+ dispersion in the ICF than in the ECF
  - -more Na^+ dispersion in the ECF than in the ICF.

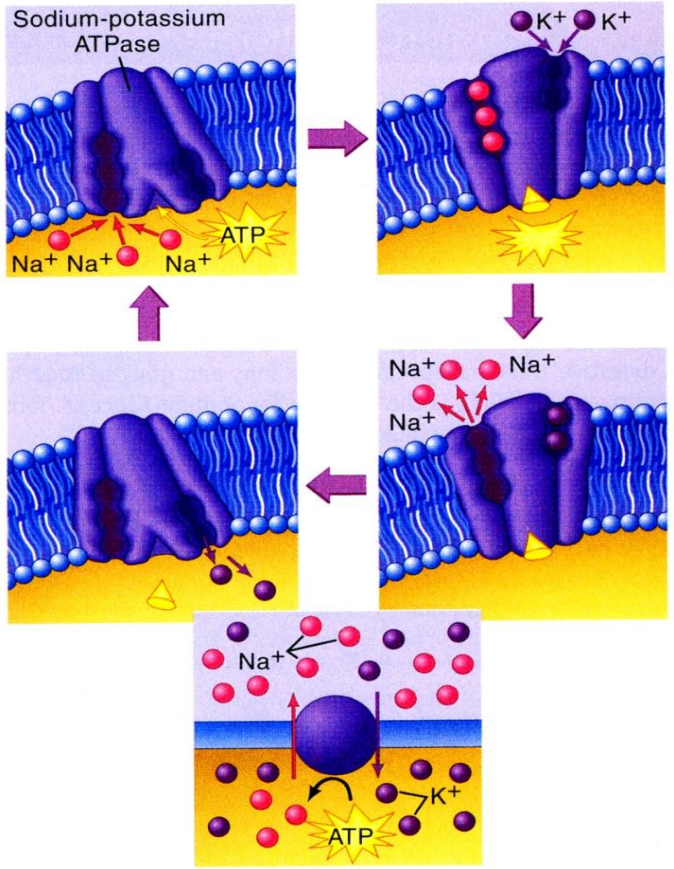
Na^+,K^+-ATPase (Sodium-Potasium Pump)

- This pump hydrolyses ATP molecule. It throws 3 Na^+ out of the cell while transfers 2 K^+ inside of the cell.

- The pump is responsible for maintaining [Na^+] and [K^+] differences.
- As well as creating a negative electrical potential within the cell.

- The activity of the pump is inhibited by oubain.

- It is an electrogenic pump; it provides movement of the positive charge out of the cell.



CARRIERS

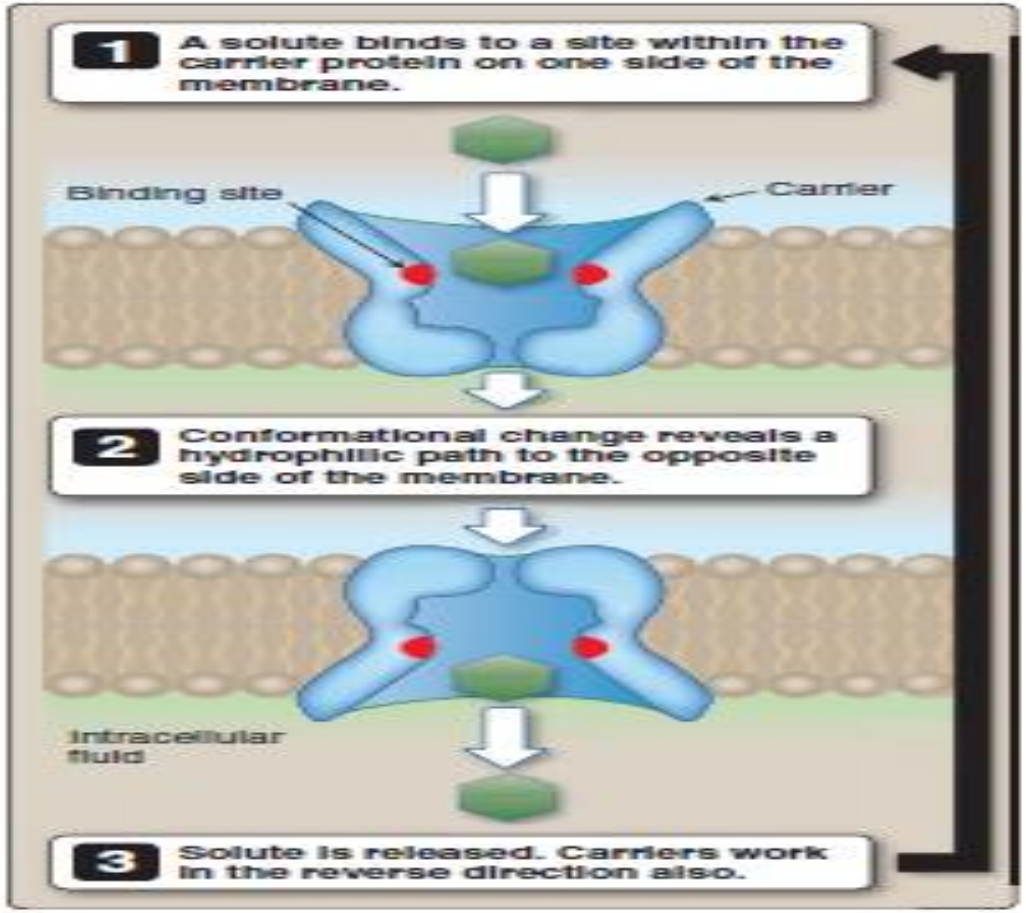
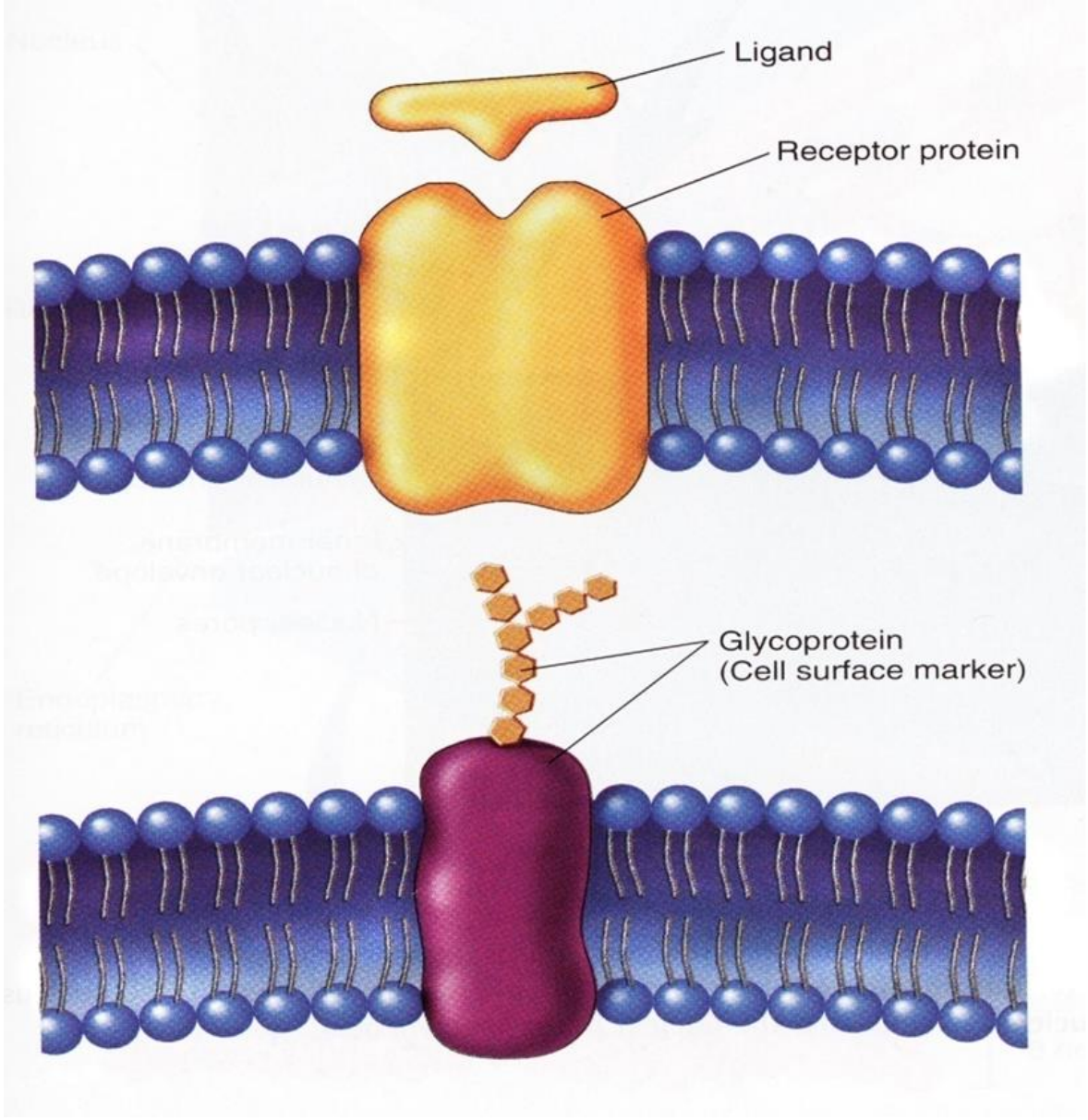


Figure 1.13
Model for transport by a carrier protein.

RESEPTOR AND ANTİGEN



Membrane Carbohydrates - Glycocalyx