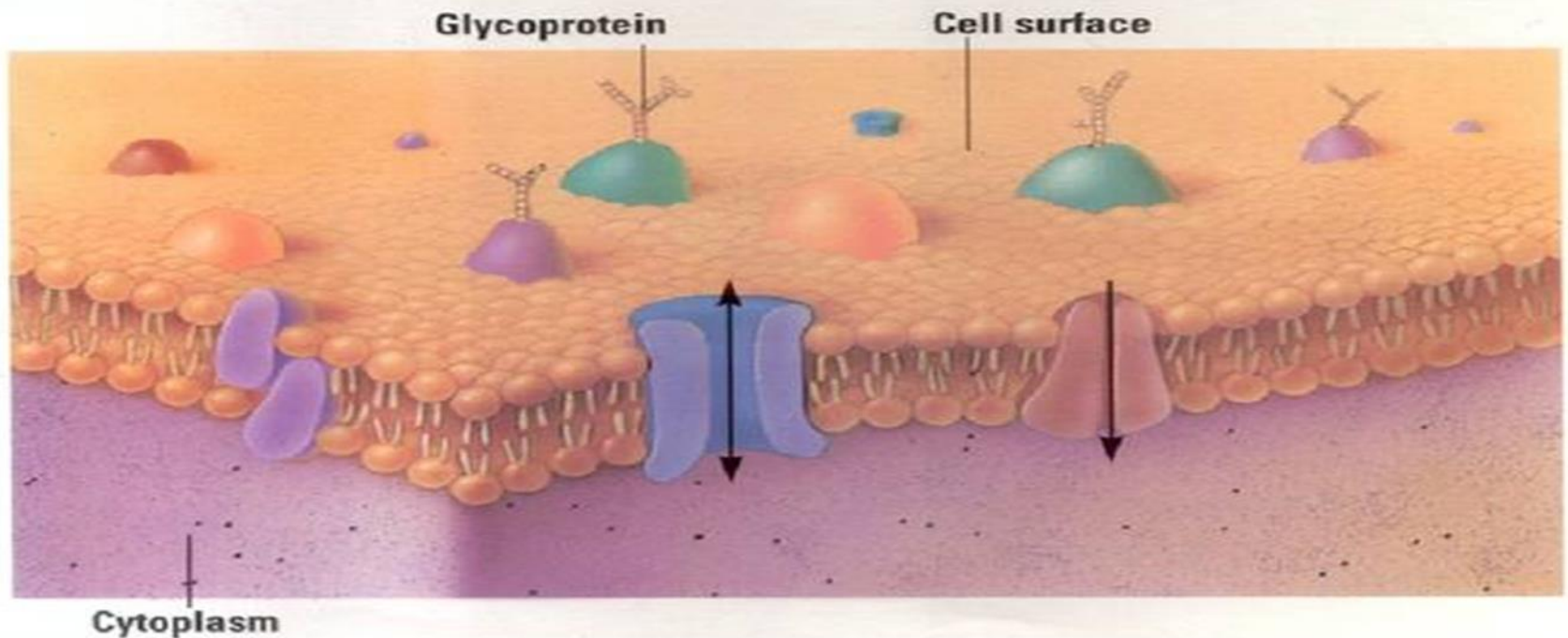


Plasma Membrane Structure and Functions

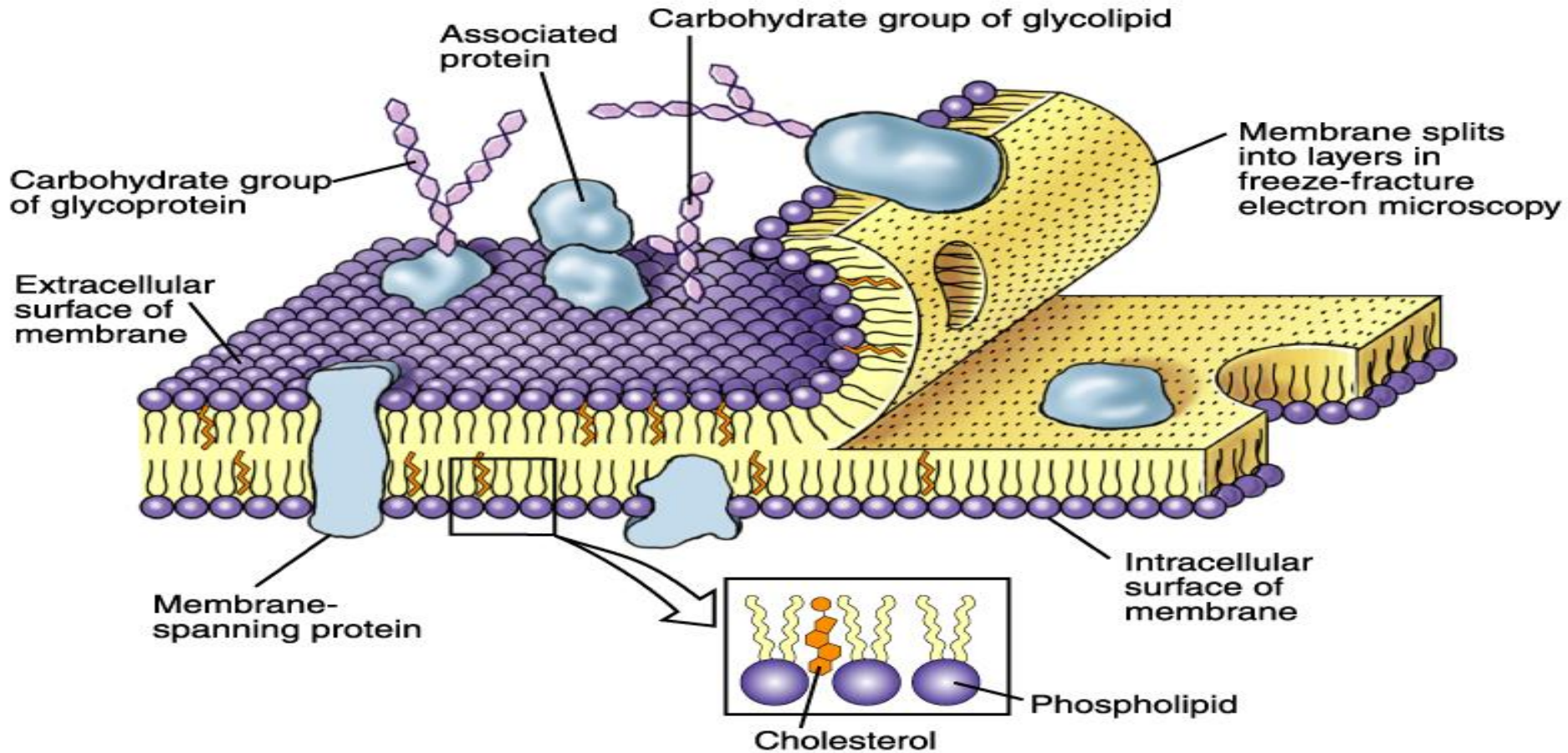


| Membrane Structure | <i>Function</i> |
|-----------------------------|--|
| Phospholipid Bilayer | <ul style="list-style-type: none"> ■ The phospholipids are arranged in a bilayer, with their polar, hydrophilic phosphate heads facing outwards, and their non-polar, hydrophobic fatty acid tails facing each other in the middle of the bilayer. ■ This hydrophobic layer acts as a barrier to all but the smallest molecules (oxygen & Carbon Dioxide), effectively isolating the two sides of the membrane. ■ Phospholipids can exchange position in the horizontal plane but not the vertical. |
| Integral Proteins | <ul style="list-style-type: none"> ■ Usually span from one side of the phospholipid bilayer to the other. ■ Proteins that span the membrane are usually involved in transporting substances across the membrane (more detail below) |
| Peripheral Proteins | <ul style="list-style-type: none"> ■ These proteins sit on one of the surfaces (peripheral proteins). They can slide around the membrane very quickly and collide with each other, but can never flip from one side to the other. ■ Proteins on the inside surface of plasma membrane are often involved in maintaining the cell's shape, or in cell motility. ■ They may also be enzymes, catalysing reactions in the cytoplasm. |
| Glycoproteins | <ul style="list-style-type: none"> ■ Usually involved in cell recognition which is part of the immune system. They can also acts as receptors in cell signaling such as with hormones. |
| Cholesterol | <ul style="list-style-type: none"> ■ Binds together lipid in the plasma membrane reducing its fluidity as conferring structural stability |

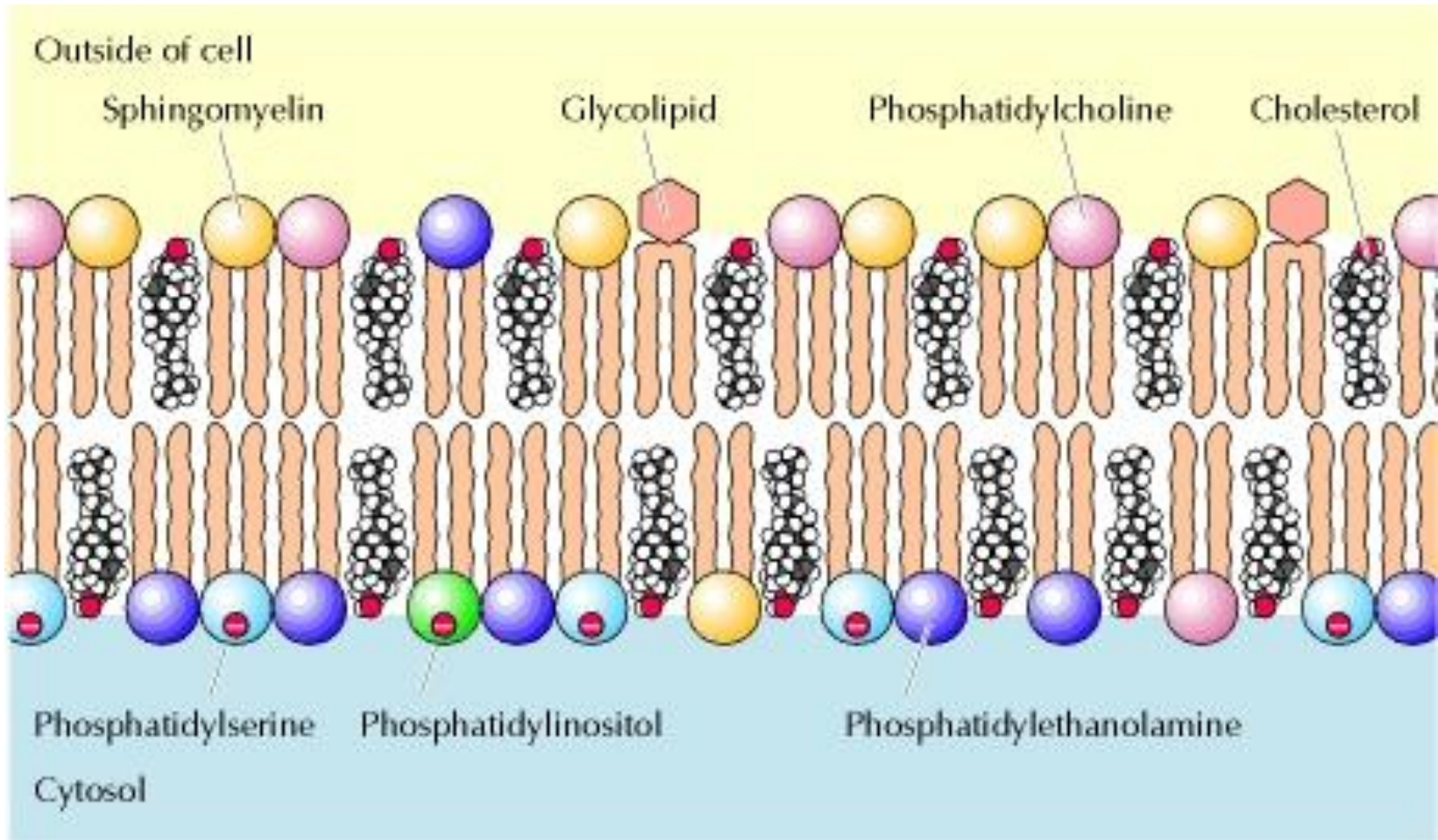
Function

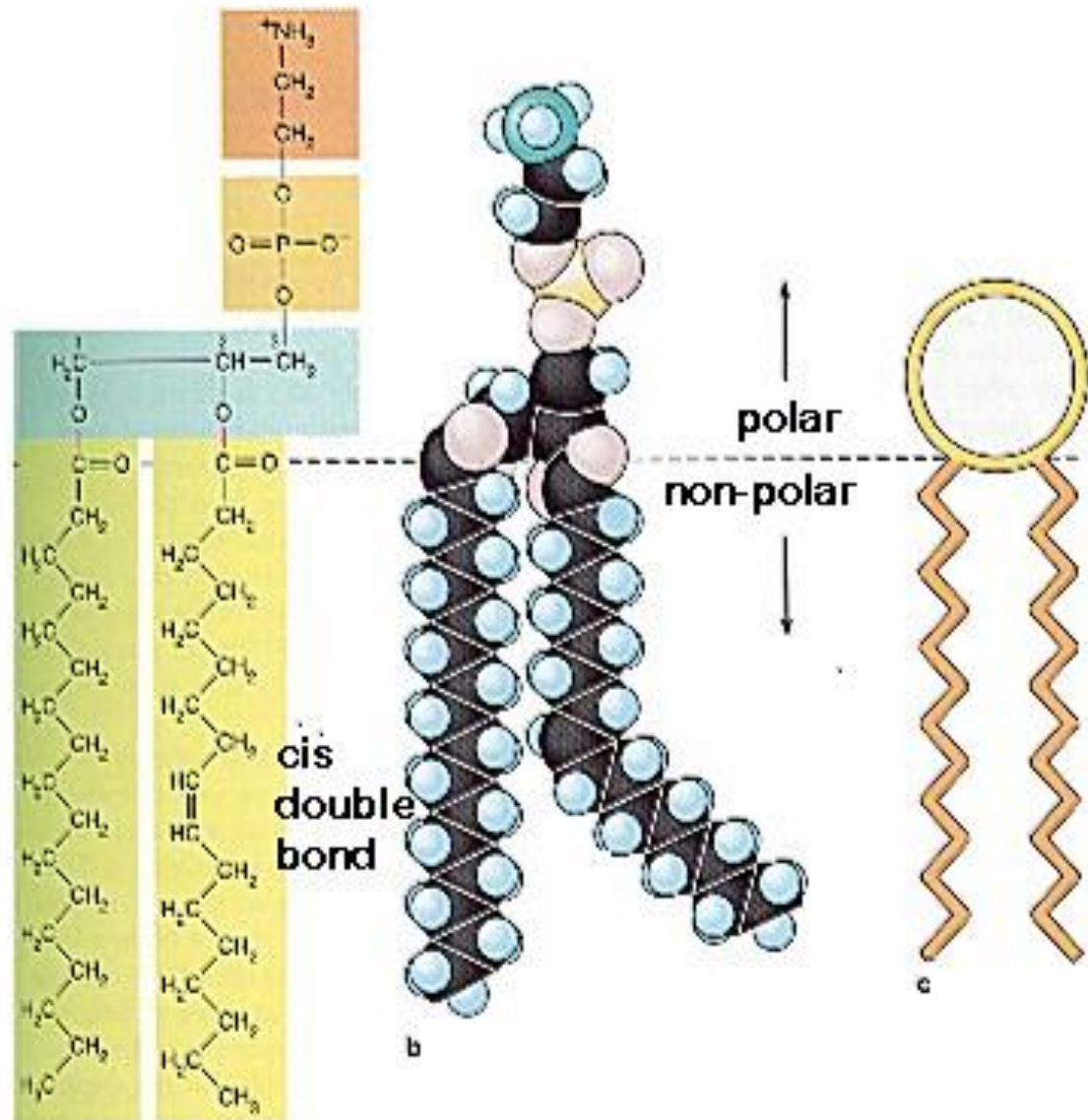
- Separating Intracellular from Extracellular Compartment.
- Control passage of particles.
- Other functions related to the functional proteins.

Lipids in Plasma membrane

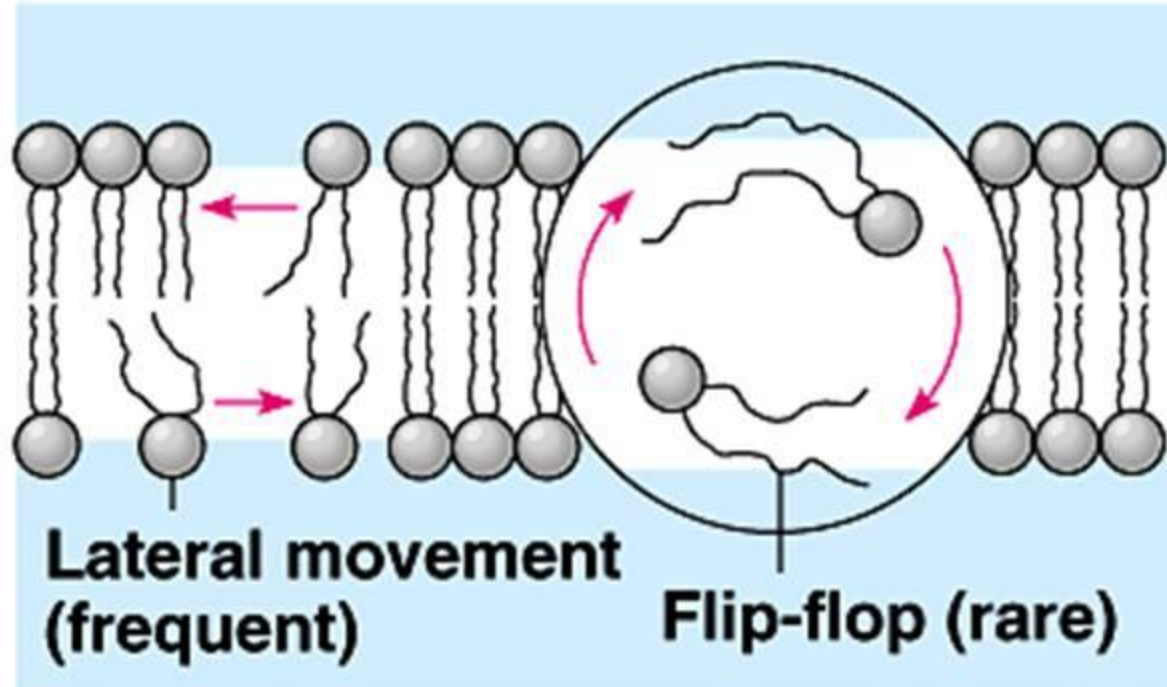


Lipid Functions in Plasma membrane



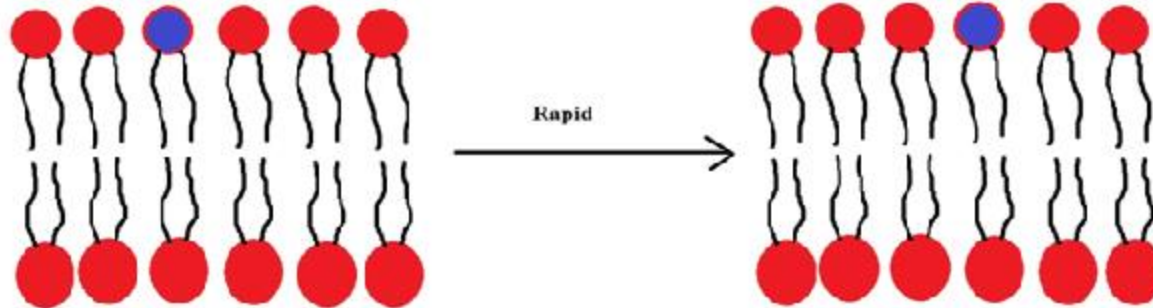


Movements of lipid molecules

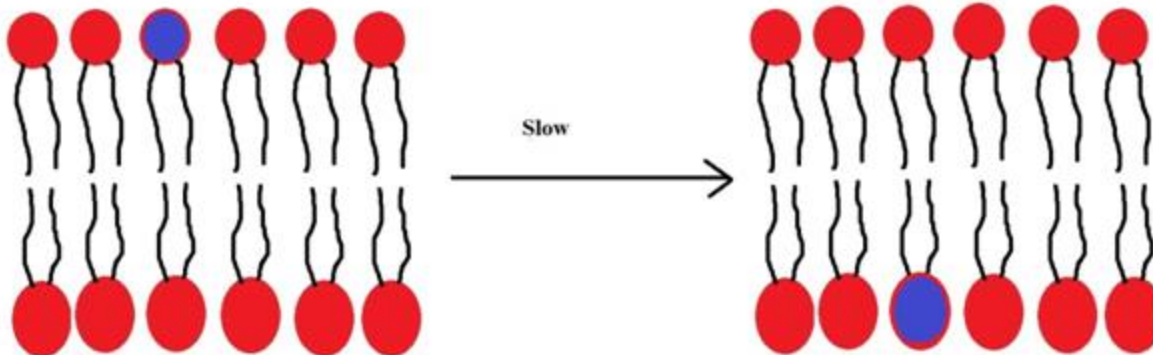


(a) Movement of phospholipids

Movements of lipid molecules

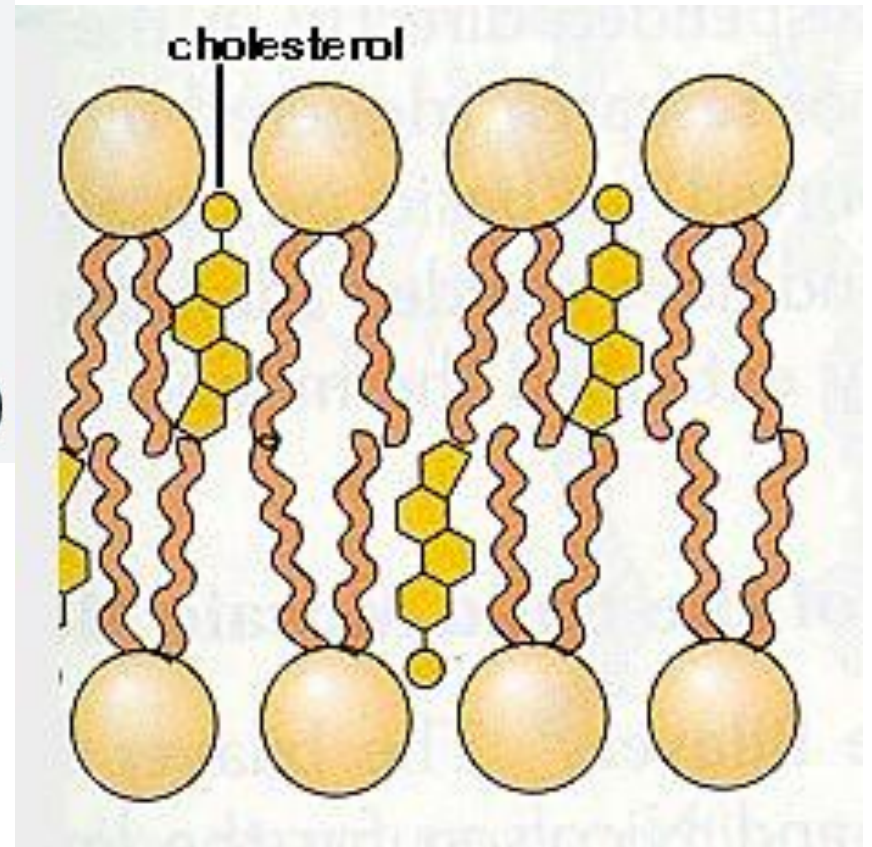
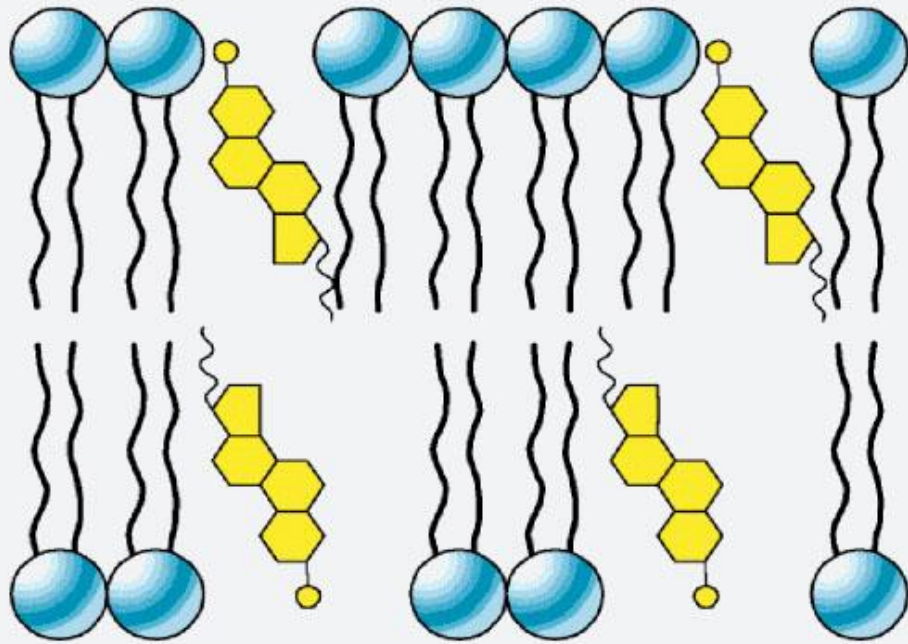


Lateral Diffusion



Flip Flop Diffusion

Cholesterol in plasma membranes



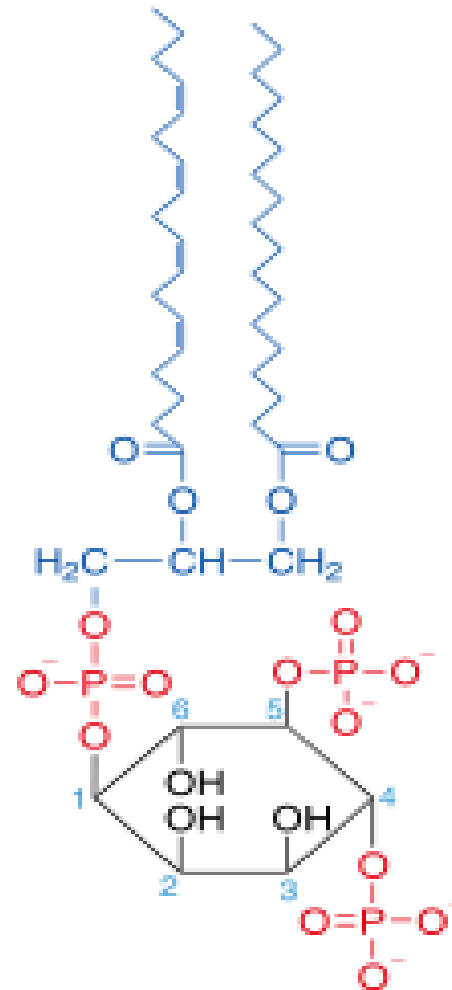
Cholesterol in plasma membranes

- Increase integrity of cell membrane forming about 30% of the lipid bilayer structure.
- Cholesterol helps to separate phospholipids, so the fatty acid chains can't pack together and crystallize >> (important for keeping fluidity at low temperature).
- Maintaining flexibility and consistency of plasma membrane.
(at higher temperature decreasing fluidity and maintaining functional and healthy level of fluidity)

Functional Phospholipids in plasma membranes

Follow the Link:

https://en.wikipedia.org/wiki/Phosphatidylinositol_4,5-bisphosphate

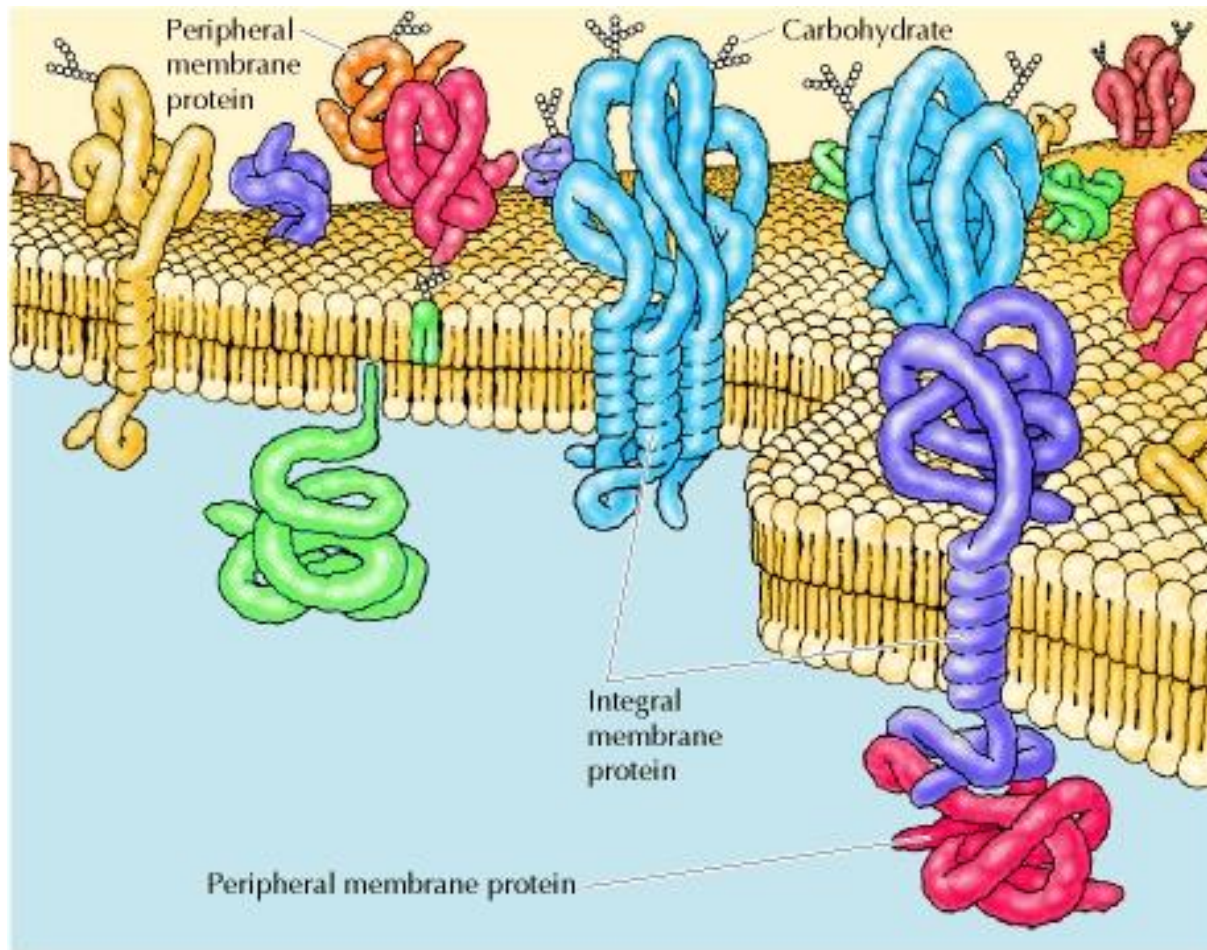


**Phosphatidylinositol 4,5-bisphosphate
(PIP2)**

Summary: Lipids in Plasma membrane

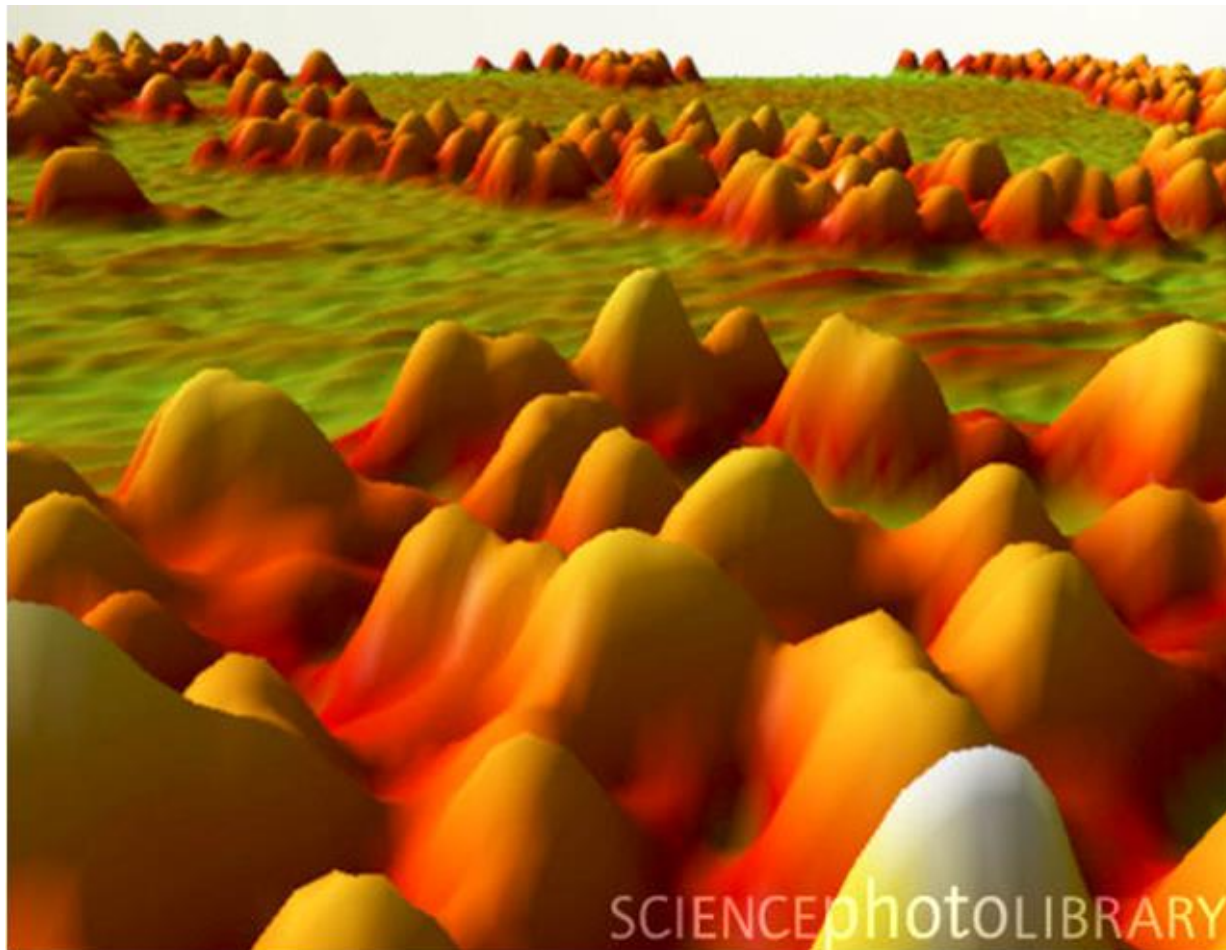
- <https://www.youtube.com/watch?v=KGTcgShKJpw>

Proteins in plasma membranes

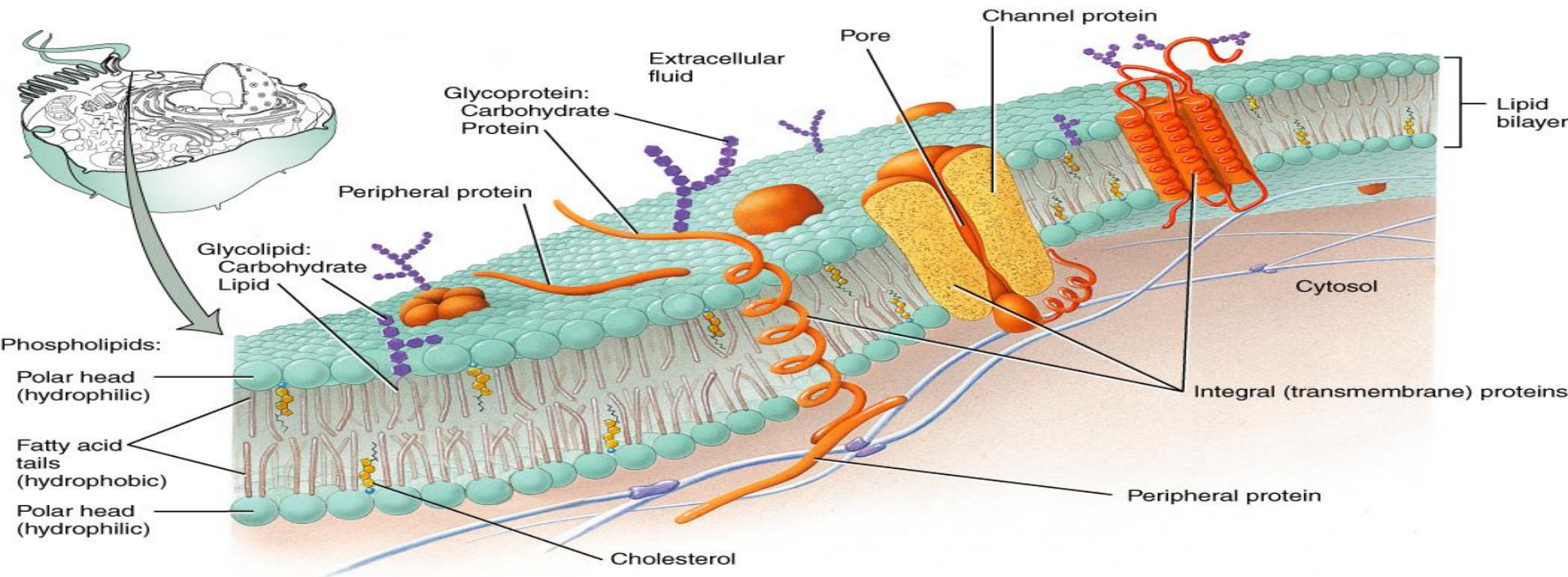


| Membrane Structure | <i>Function</i> |
|-----------------------------|--|
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Proteins in plasma membranes



Protein functions in plasma membranes

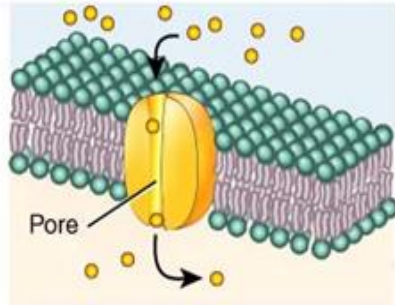


Protein functions in plasma membranes

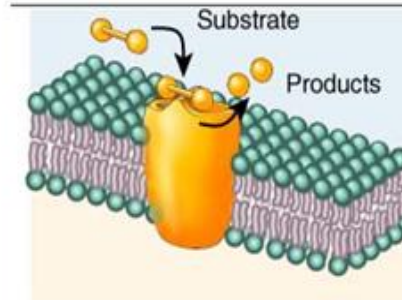
□ Extracellular fluid

■ Plasma membrane

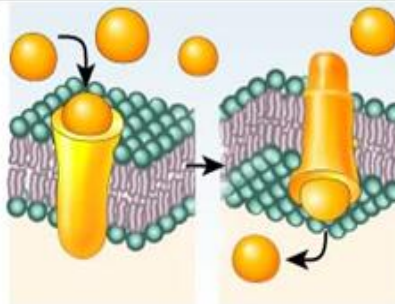
□ Cytosol



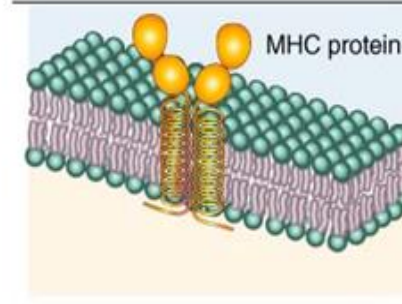
Ion channel
Allows specific ion (●) to move through water-filled pore. Most plasma membranes include specific channels for several common ions.



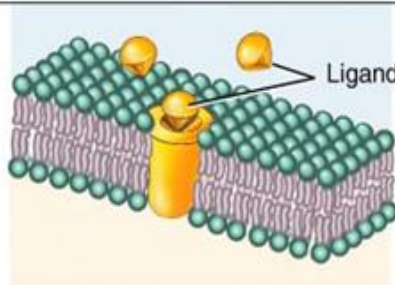
Enzyme
Catalyzes reaction inside or outside cell (depending on which direction the active site faces). For example, lactase protruding from epithelial cells lining your small intestine splits the disaccharide lactose in the milk you drink.



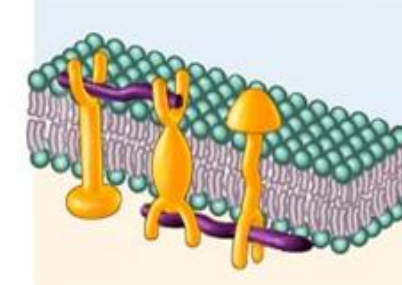
Transporter
Transports specific substances (●) across membrane by changing shape. For example, amino acids, needed to synthesize new proteins, enter body cells via transporters.



Cell Identity Marker
Distinguishes your cells from anyone else's (unless you are an identical twin). An important class of such markers are the major histocompatibility (MHC) proteins.

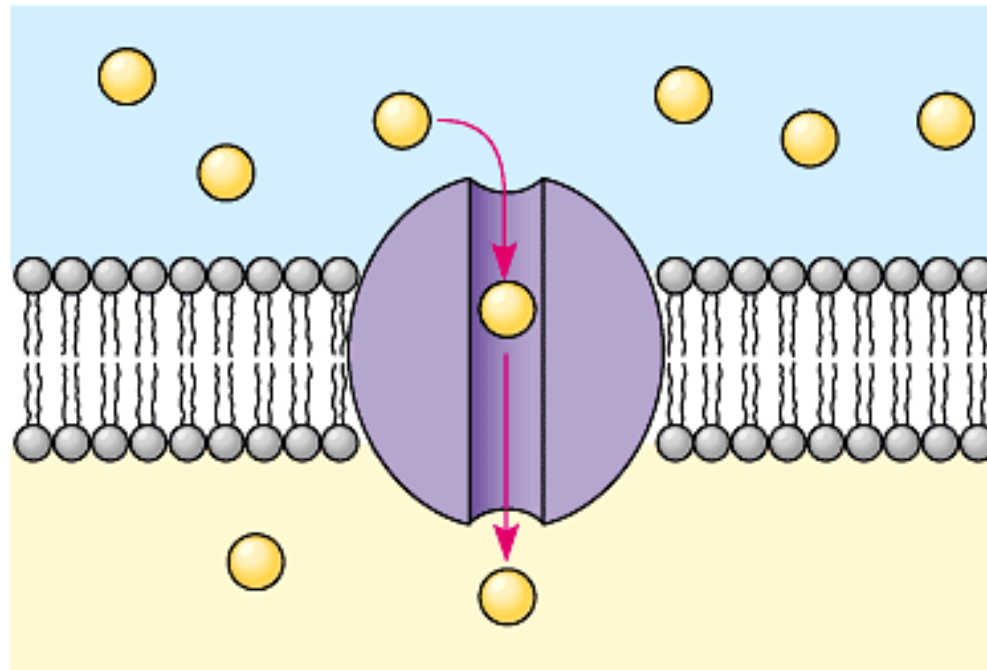


Receptor
Recognizes specific ligand (◊) and alters cell's function in some way. For example, antidiuretic hormone binds to receptors in the kidneys and changes the water permeability of certain plasma membranes.



Linker
Anchors filaments inside and outside to the plasma membrane, providing structural stability and shape for the cell. May also participate in movement of the cell or link two cells together.

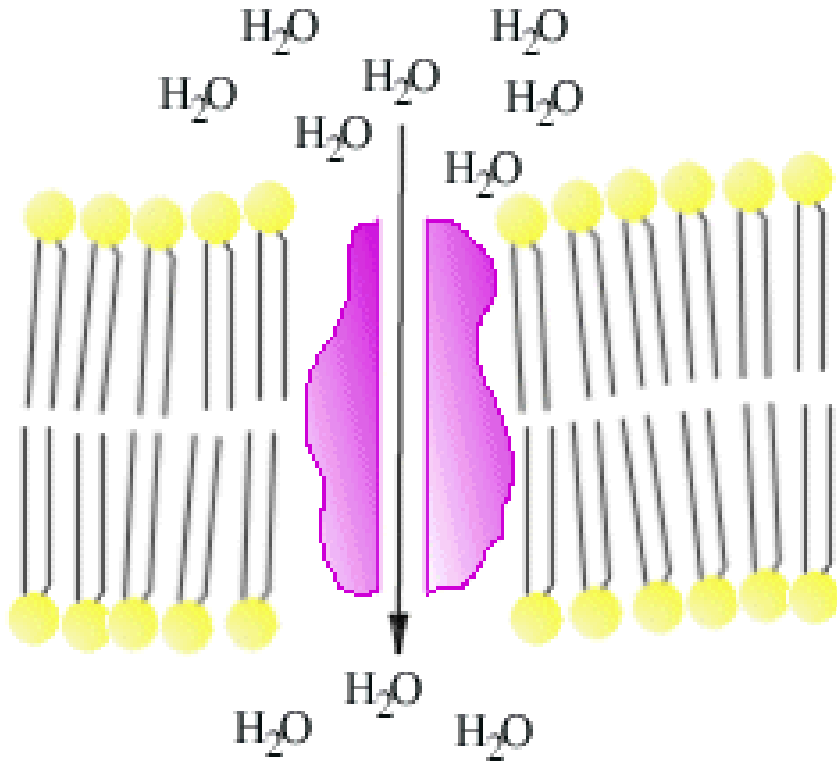
Channels



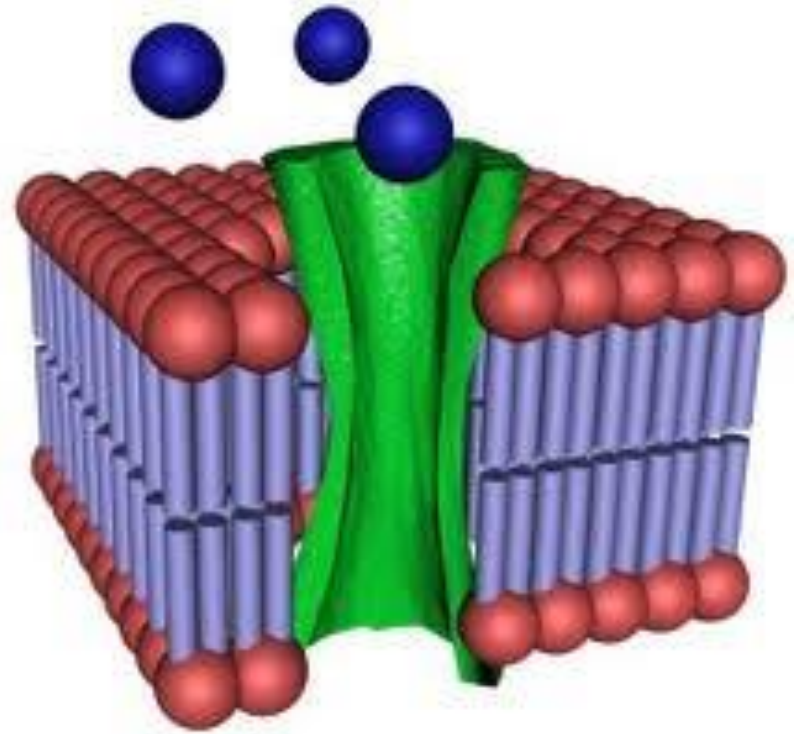
(a)

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Channels

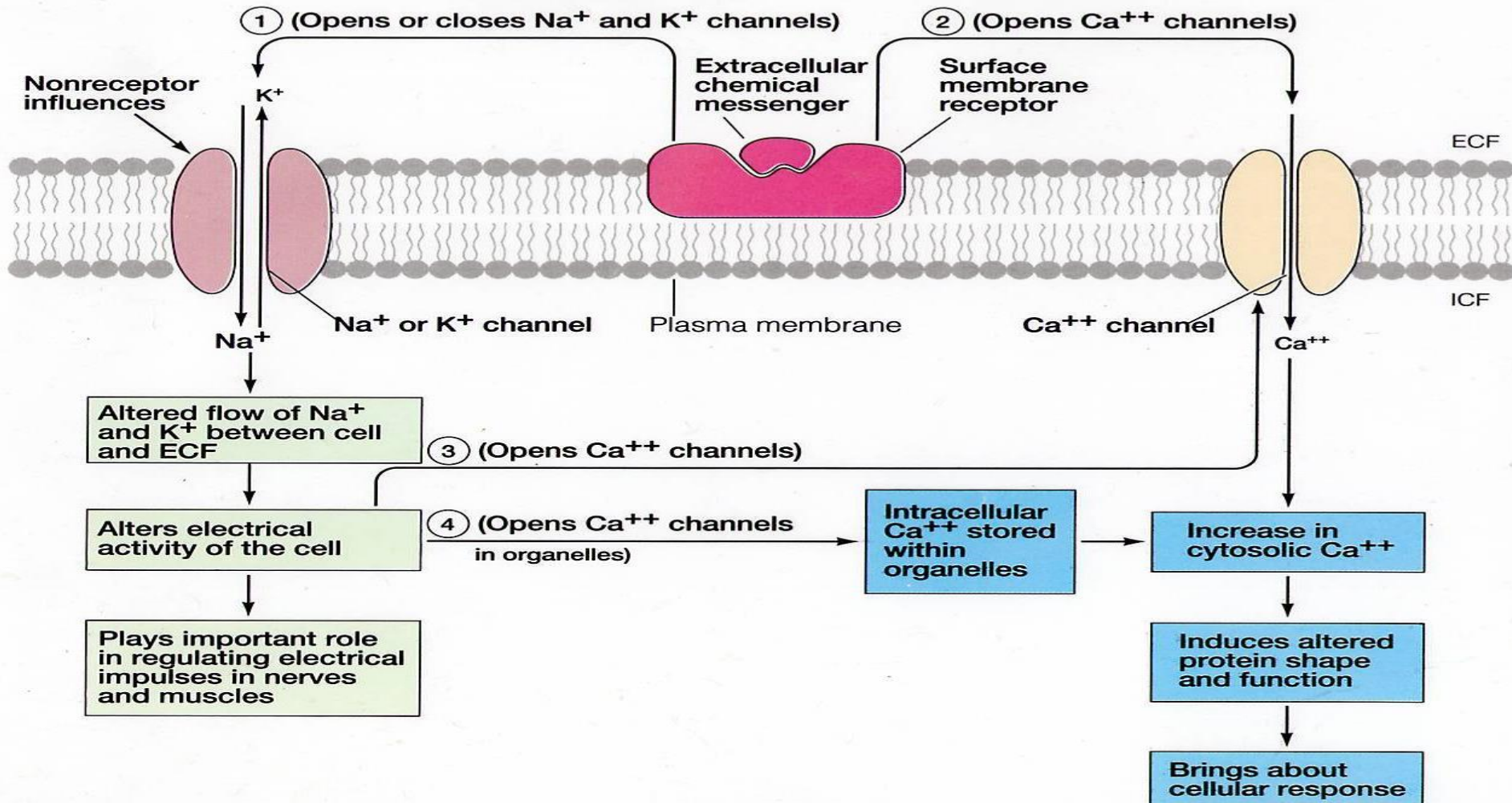


Diffusion through a protein channel

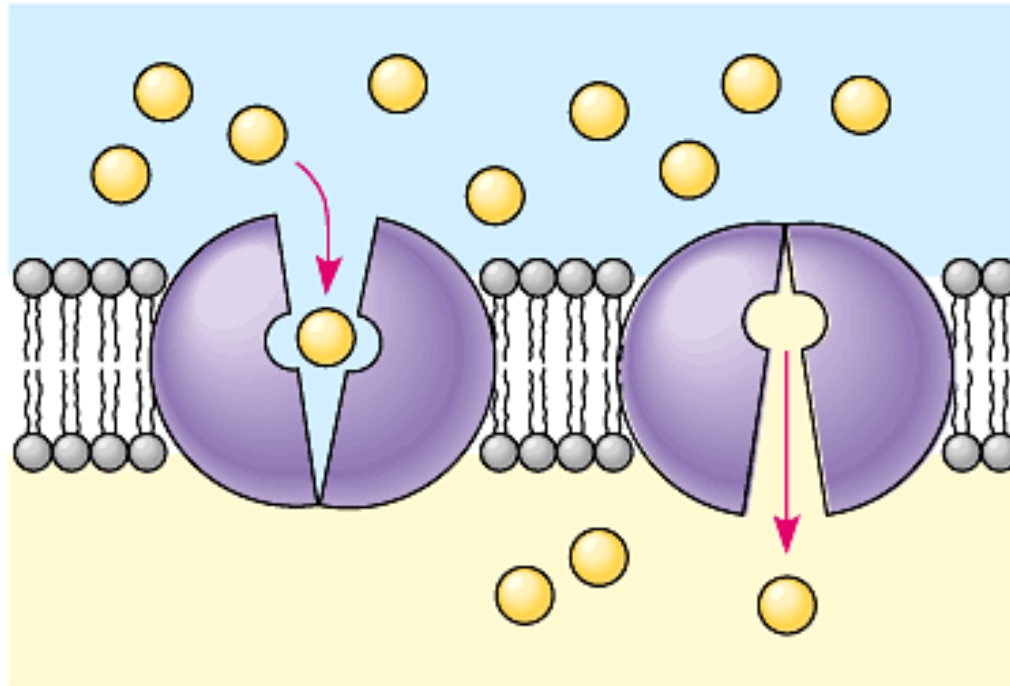


Chemical gated Channels

Postreceptor Event: Channel Regulation



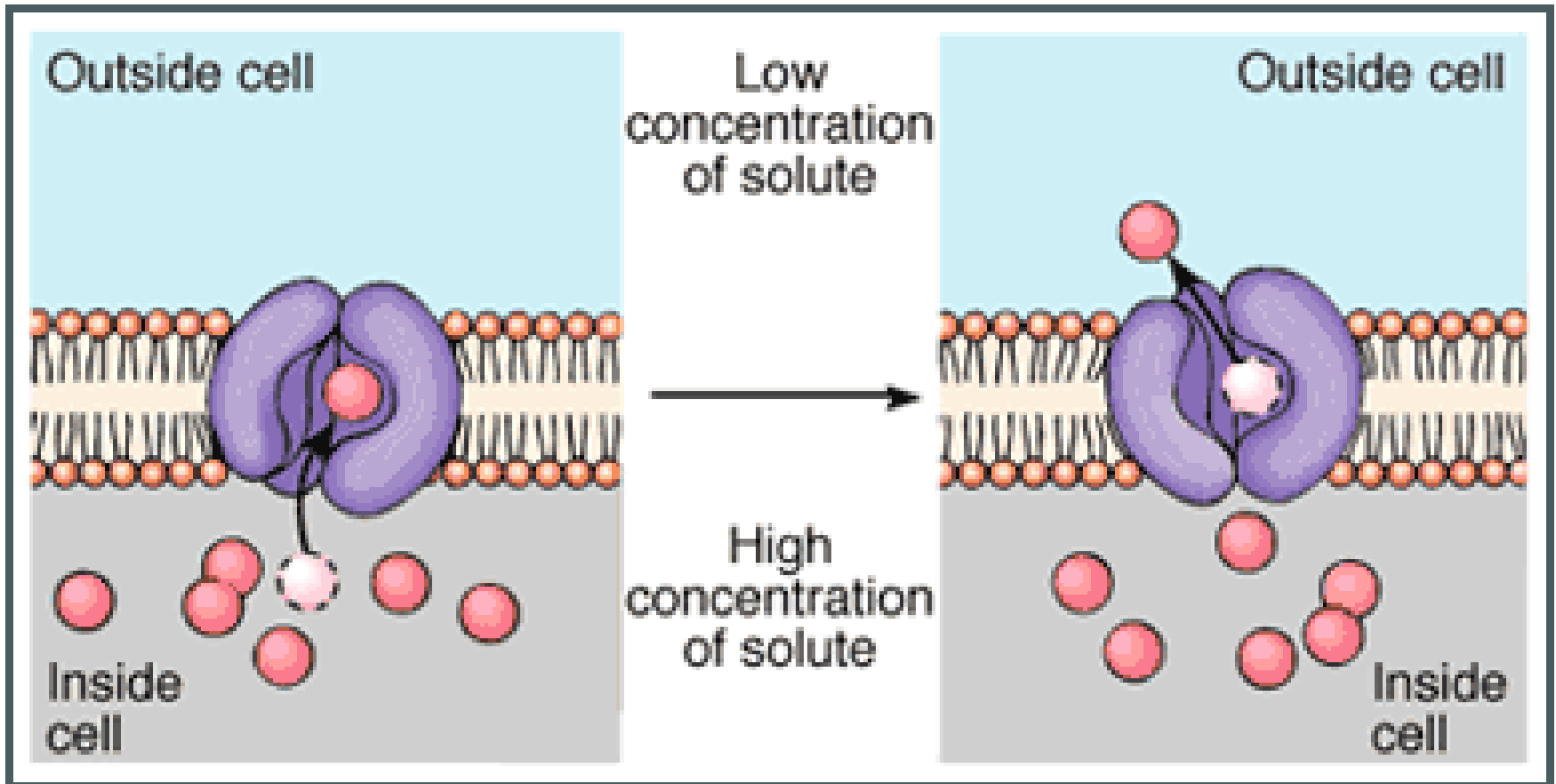
Carriers (Transporters)



(b)

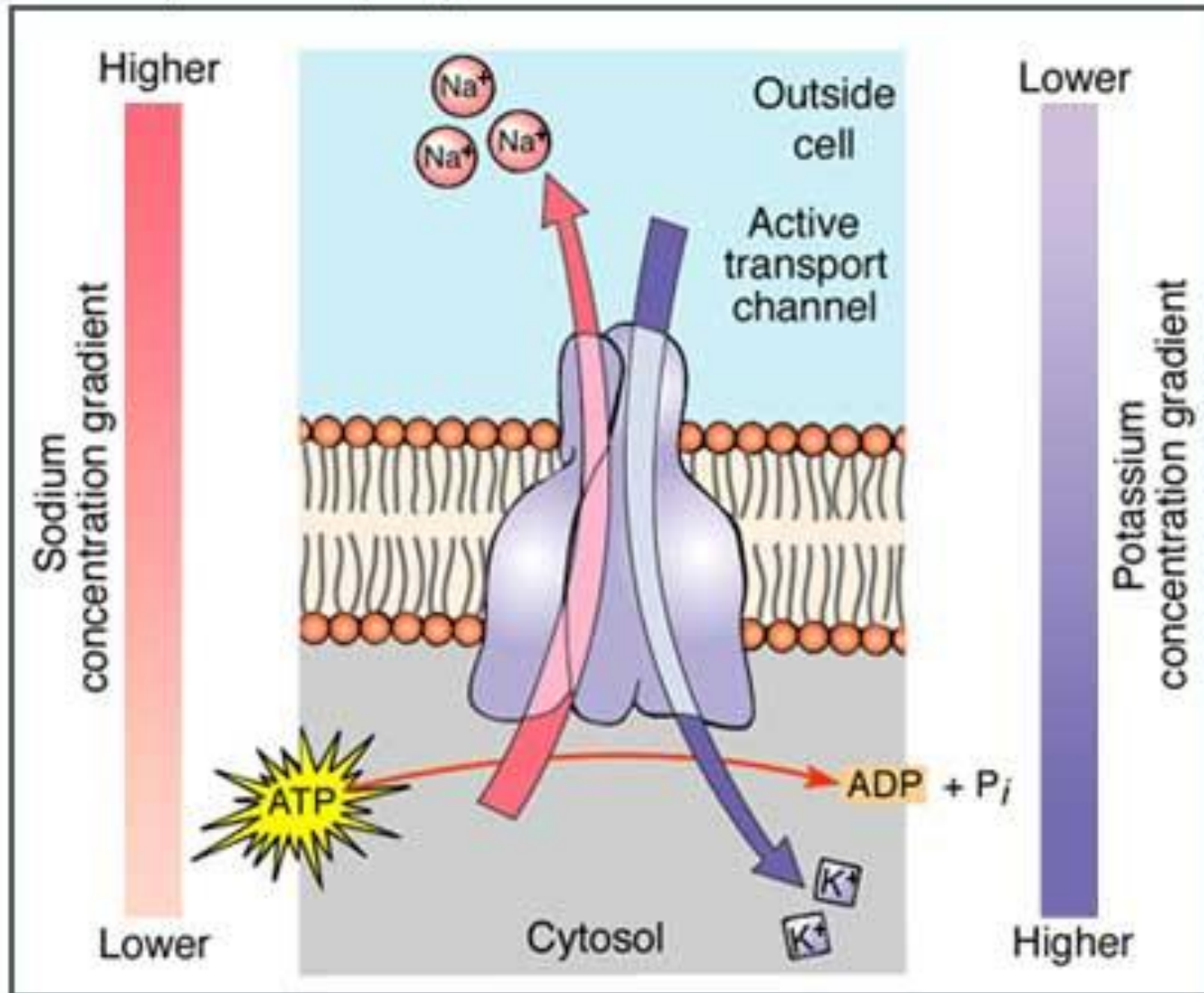
Carriers (Transporters)

Facilitated diffusion

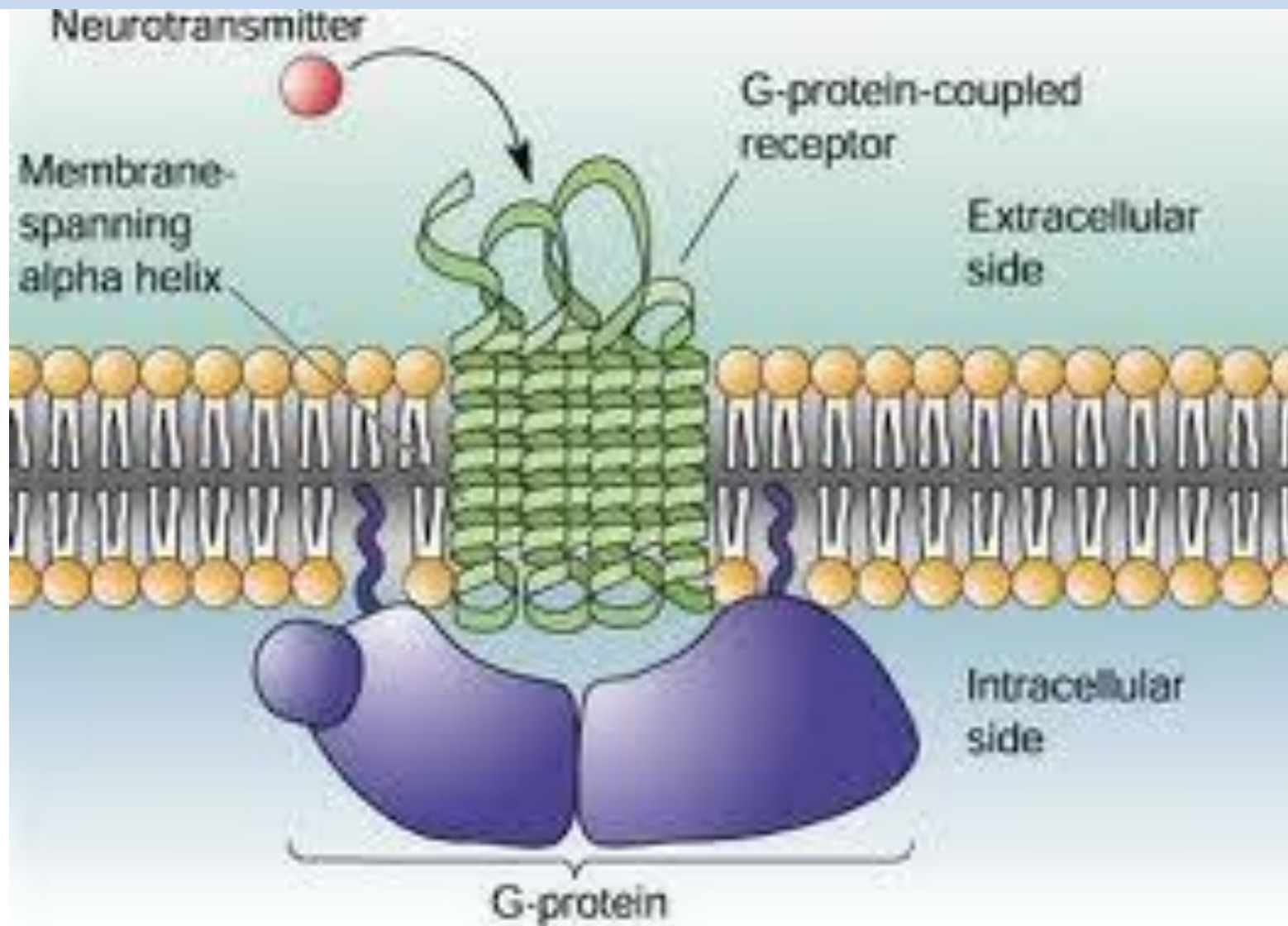


ATP dependent Carriers

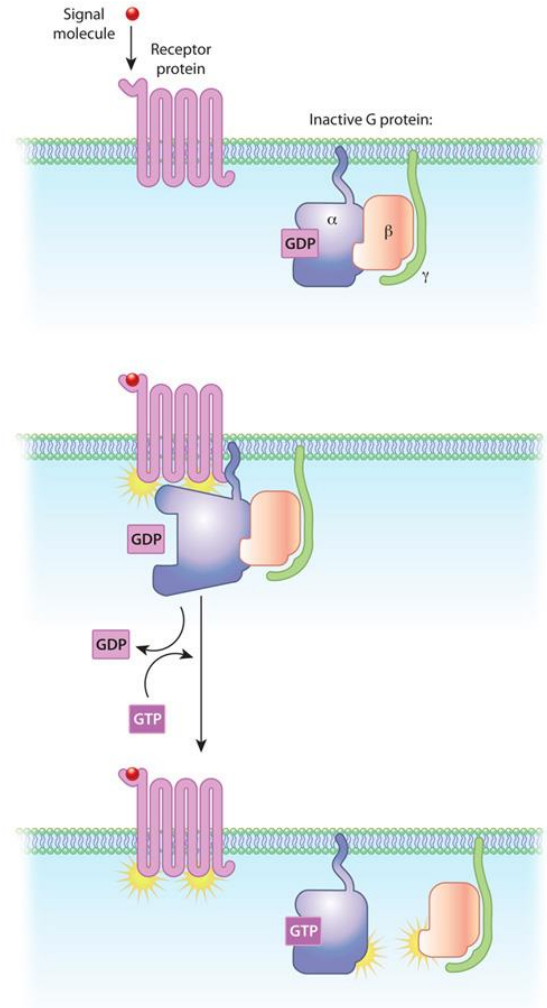
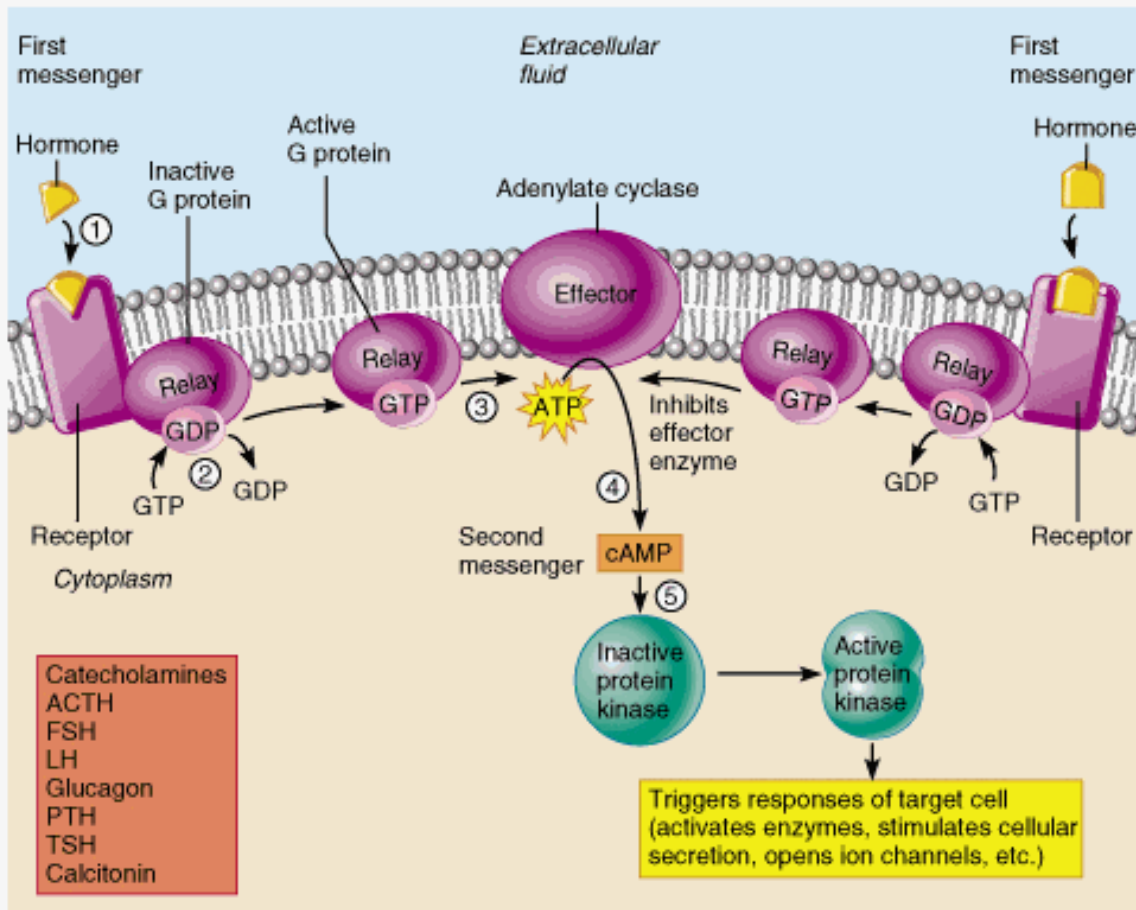
Sodium-potassium pump



Receptors

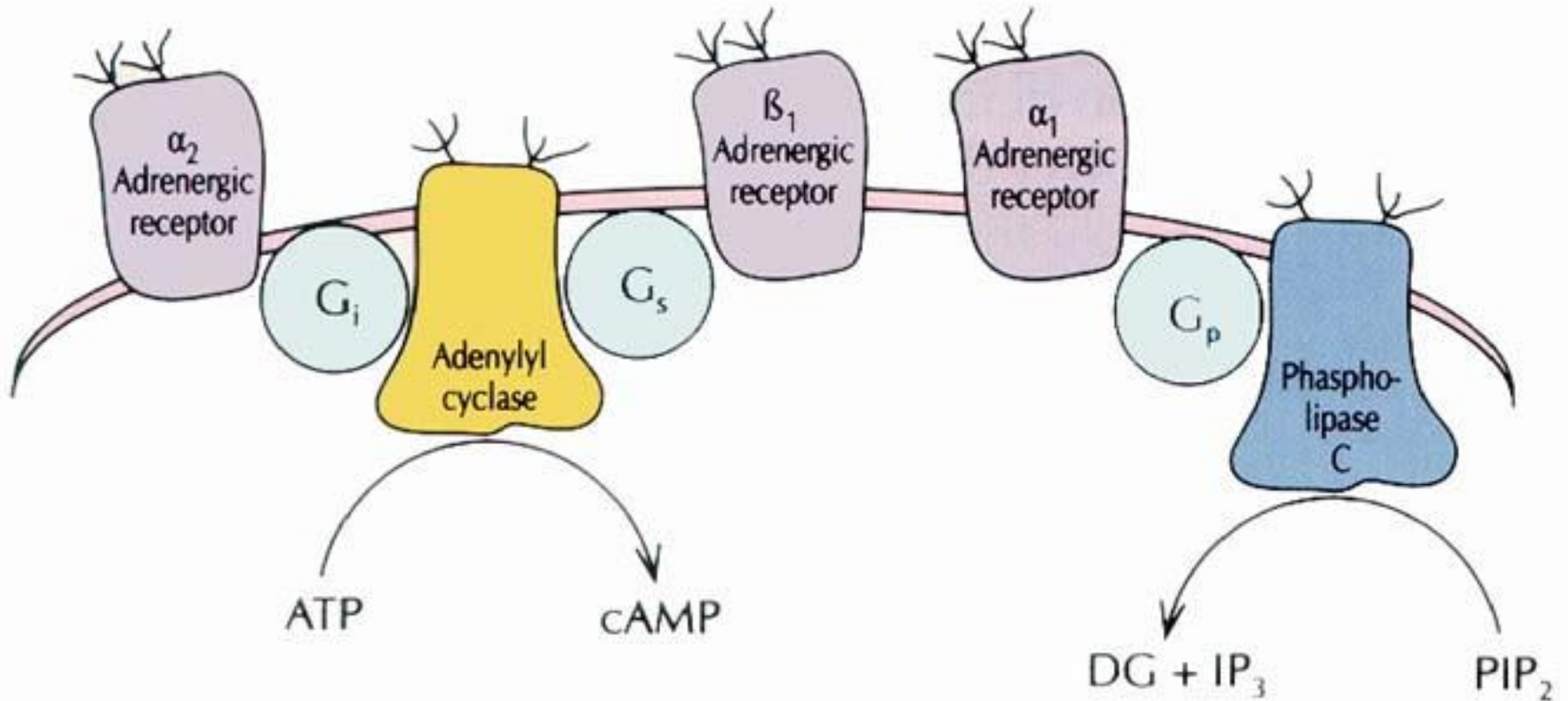


Receptors & G proteins



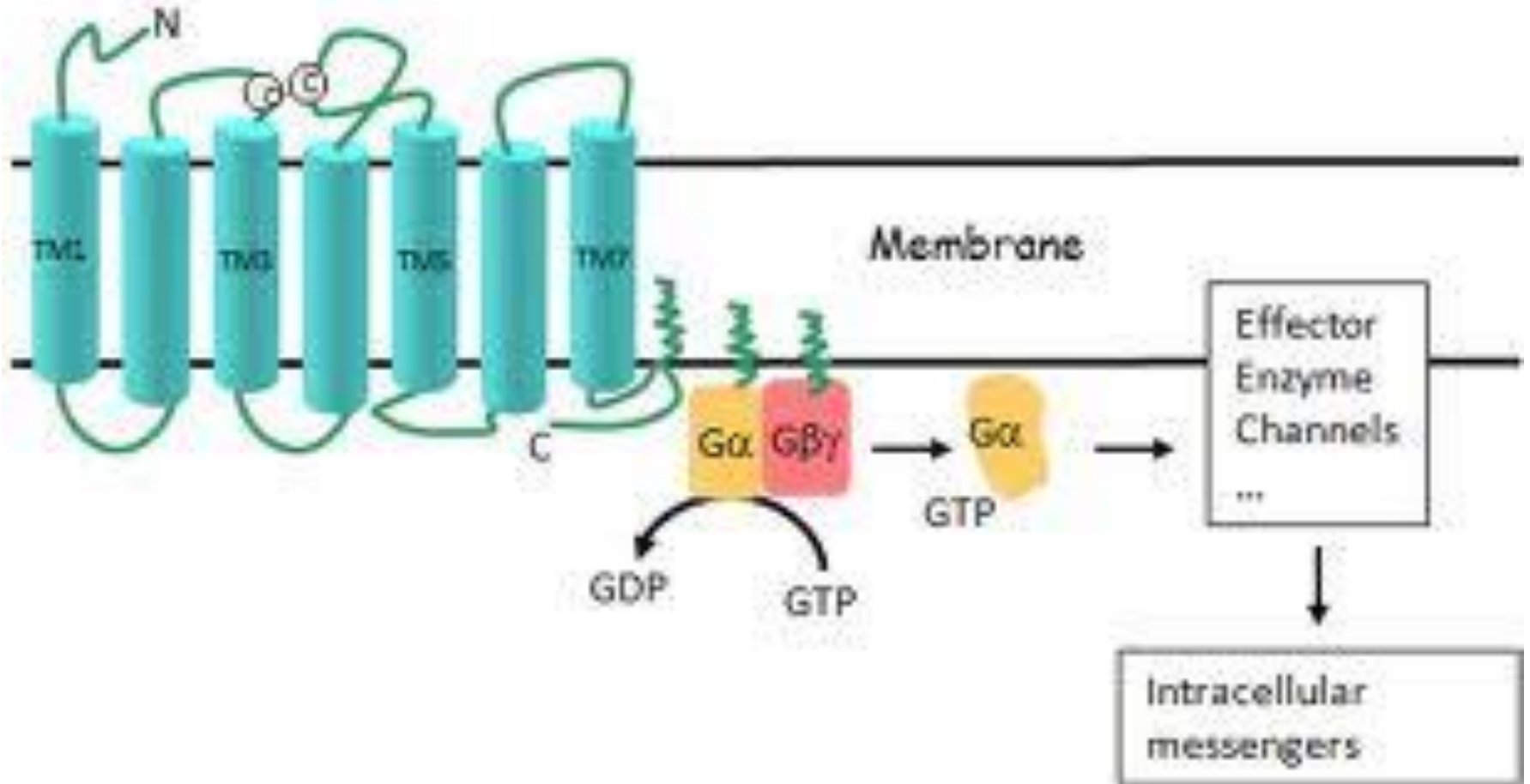
(a)

Receptors & G proteins

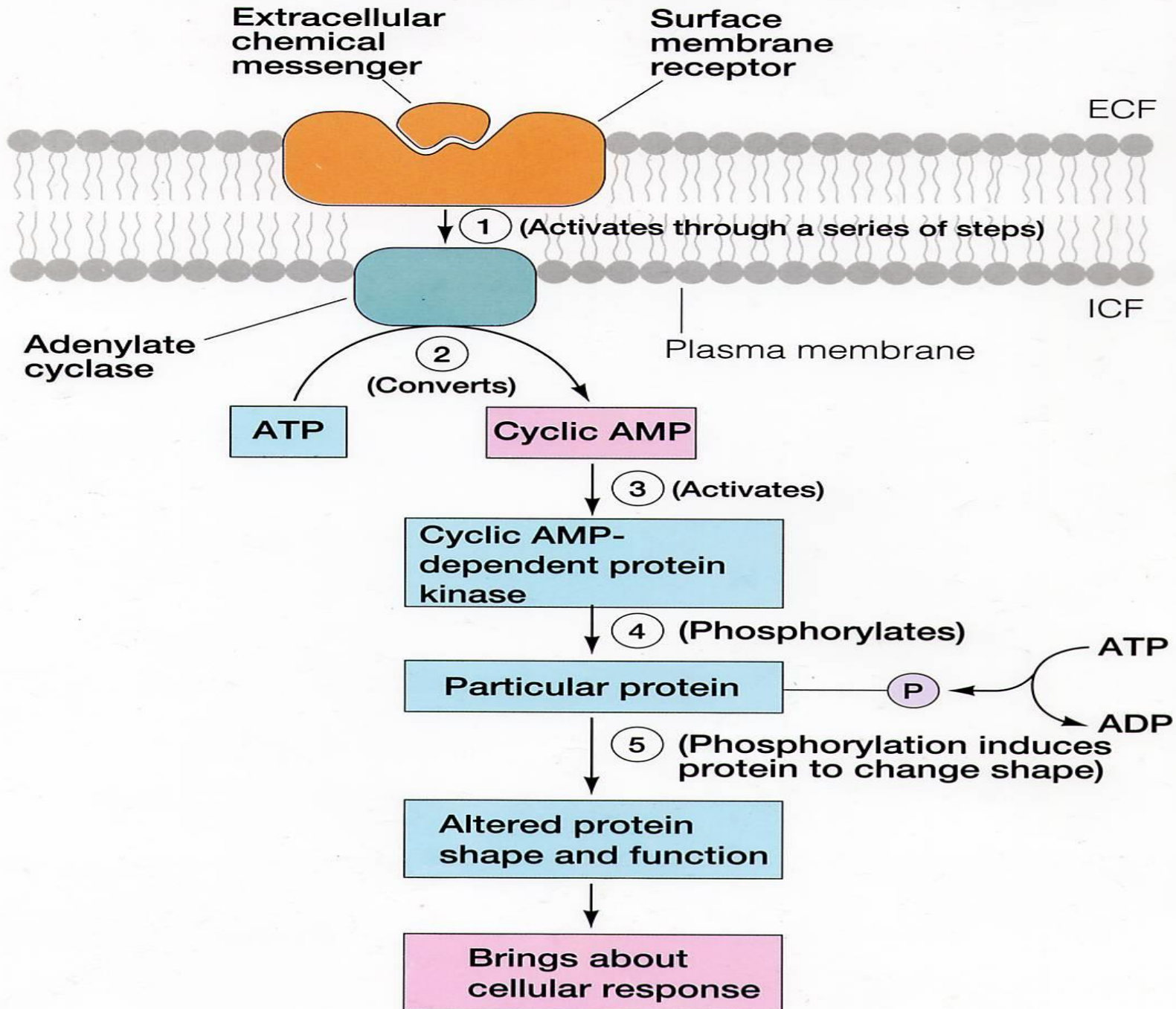


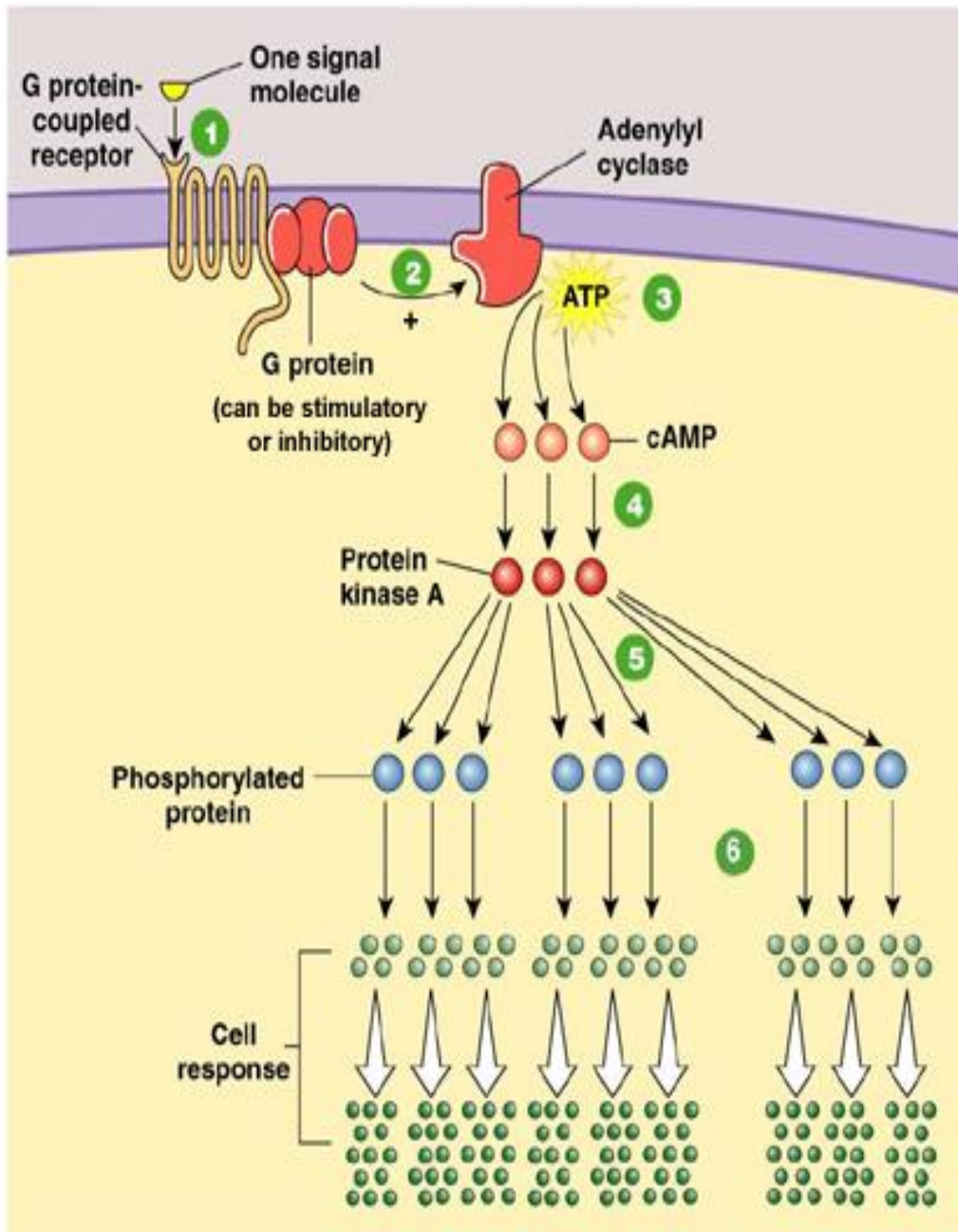
Enzymes

Receptors & Enzymes

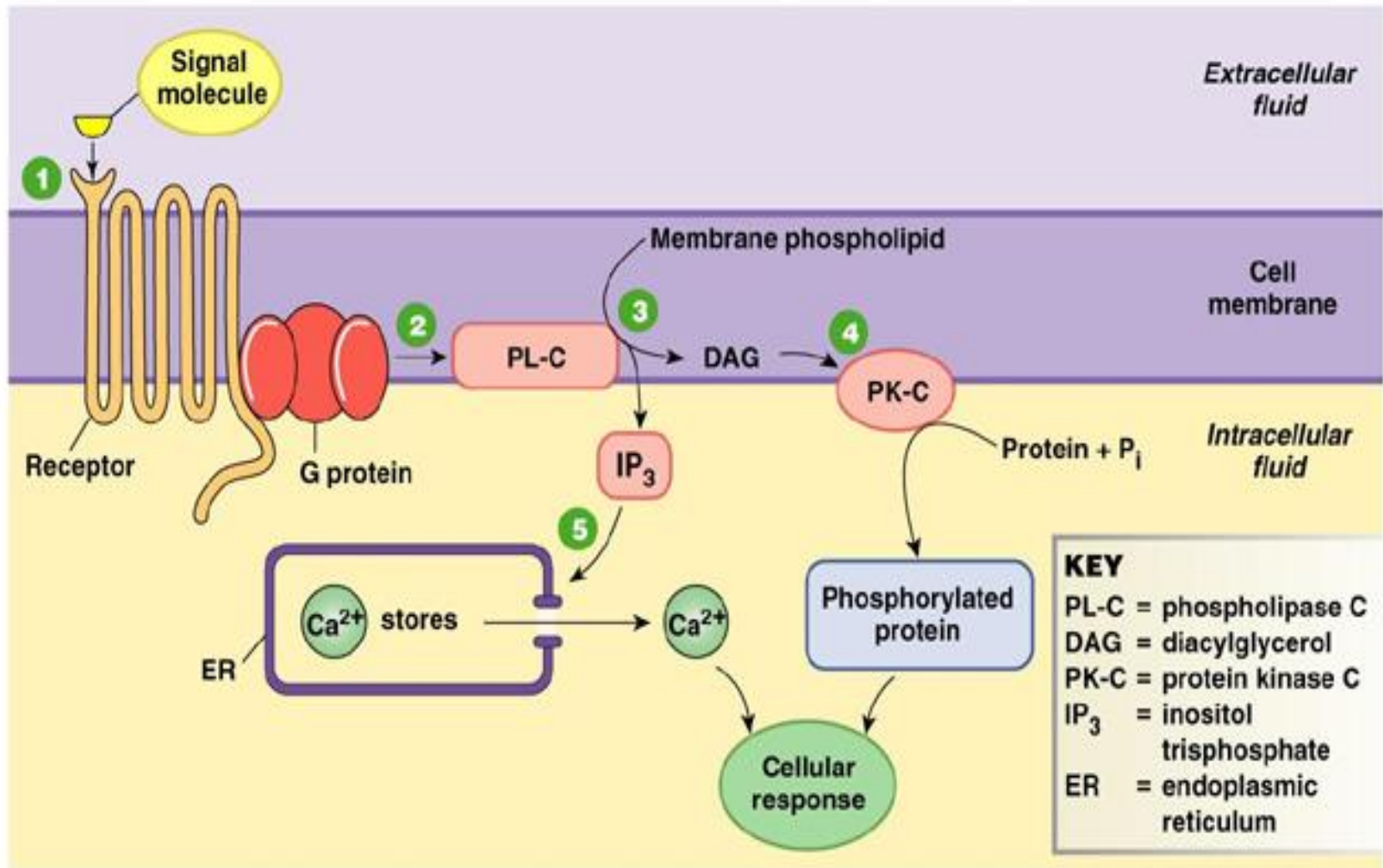


Postreceptor Event: Cyclic AMP Second Messenger System





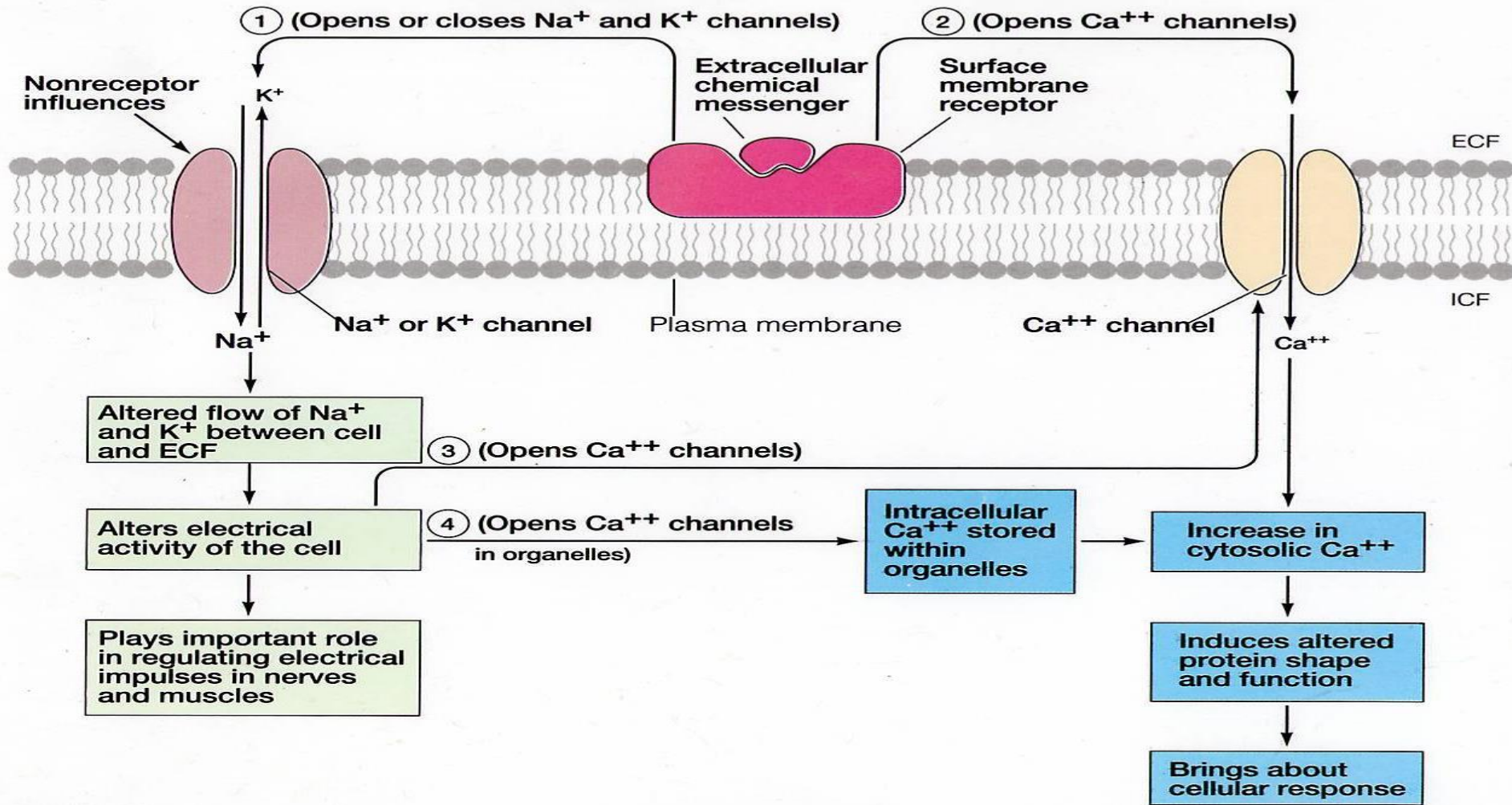
- 1** Signal molecule binds to G protein-linked receptor, which activates the G protein.
- 2** G protein turns on adenylyl cyclase, an amplifier enzyme.
- 3** Adenylyl cyclase converts ATP to cyclic AMP.
- 4** cAMP activates protein kinase A.
- 5** Protein kinase A phosphorylates other proteins, leading ultimately to a cellular response.
- 6** Note how the initial signal is amplified.



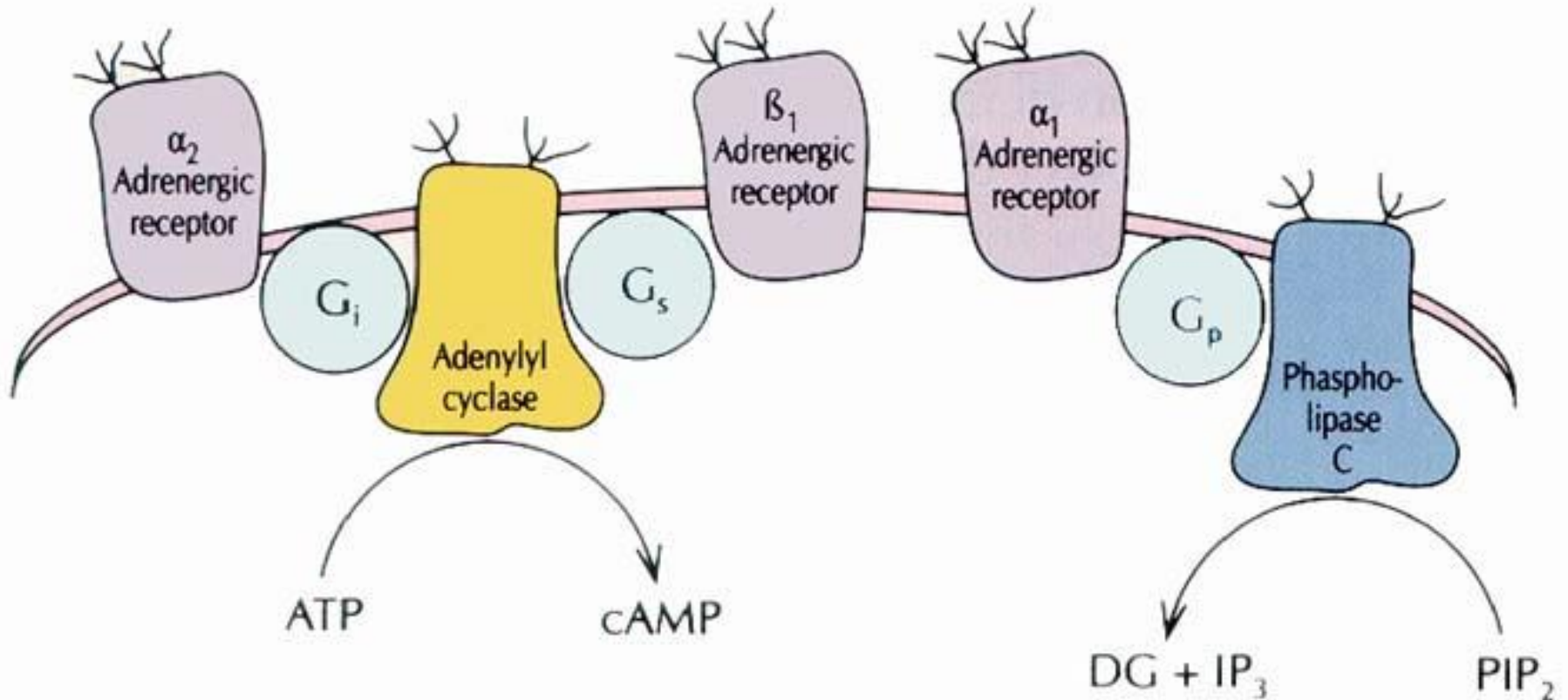
- 1 Signal molecule activates receptor and associated G protein.
- 2 G protein activates phospholipase C (PL-C), an amplifier enzyme.
- 3 PL-C converts membrane phospholipids into diacylglycerol (DAG), which remains in the membrane, and IP₃, which diffuses into the cytoplasm.
- 4 DAG activates protein kinase C (PK-C), which phosphorylates proteins.
- 5 IP₃ causes release of Ca²⁺ from organelles, creating a Ca²⁺ signal.

Receptors & Channels

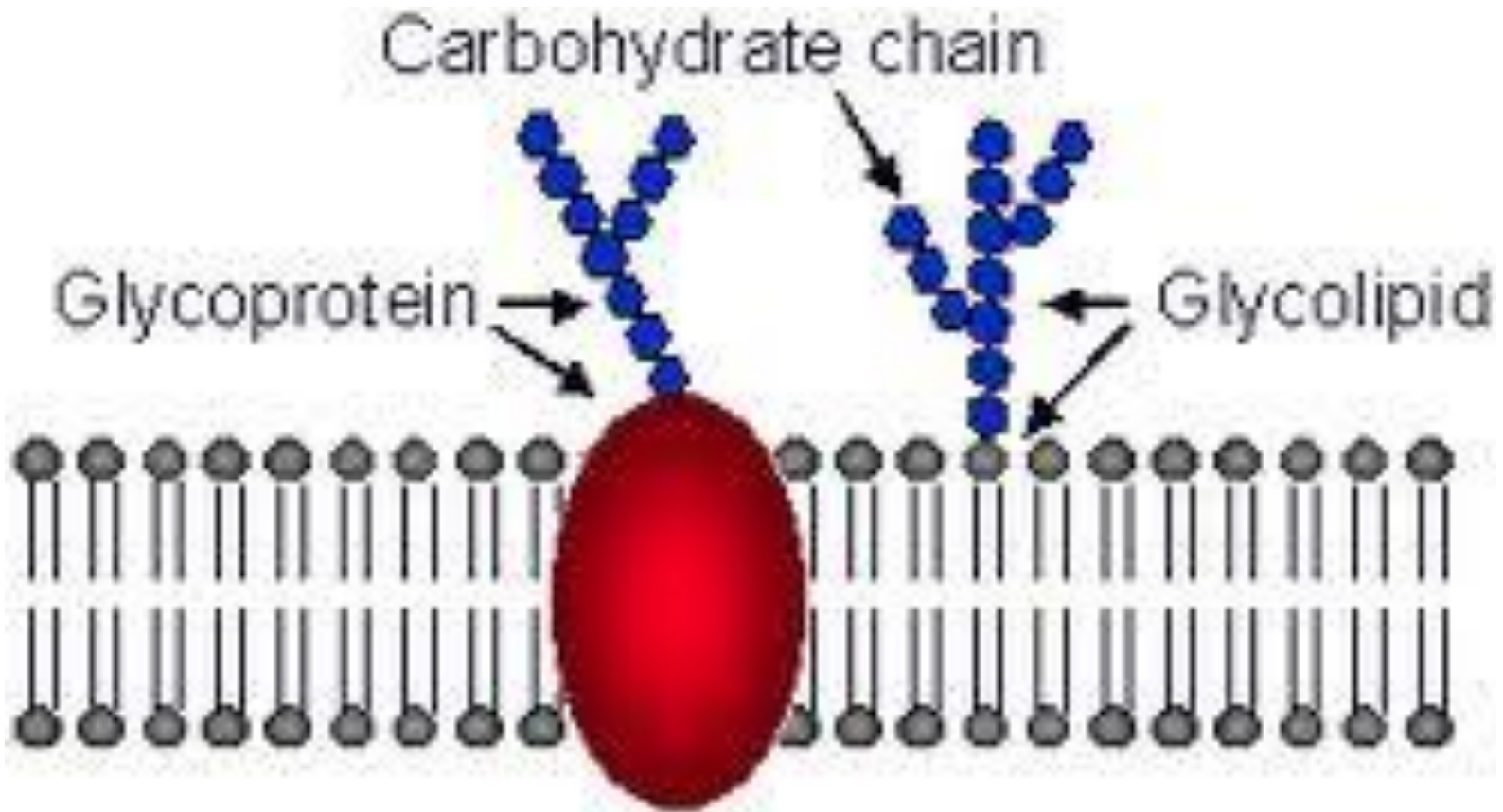
Postreceptor Event: Channel Regulation

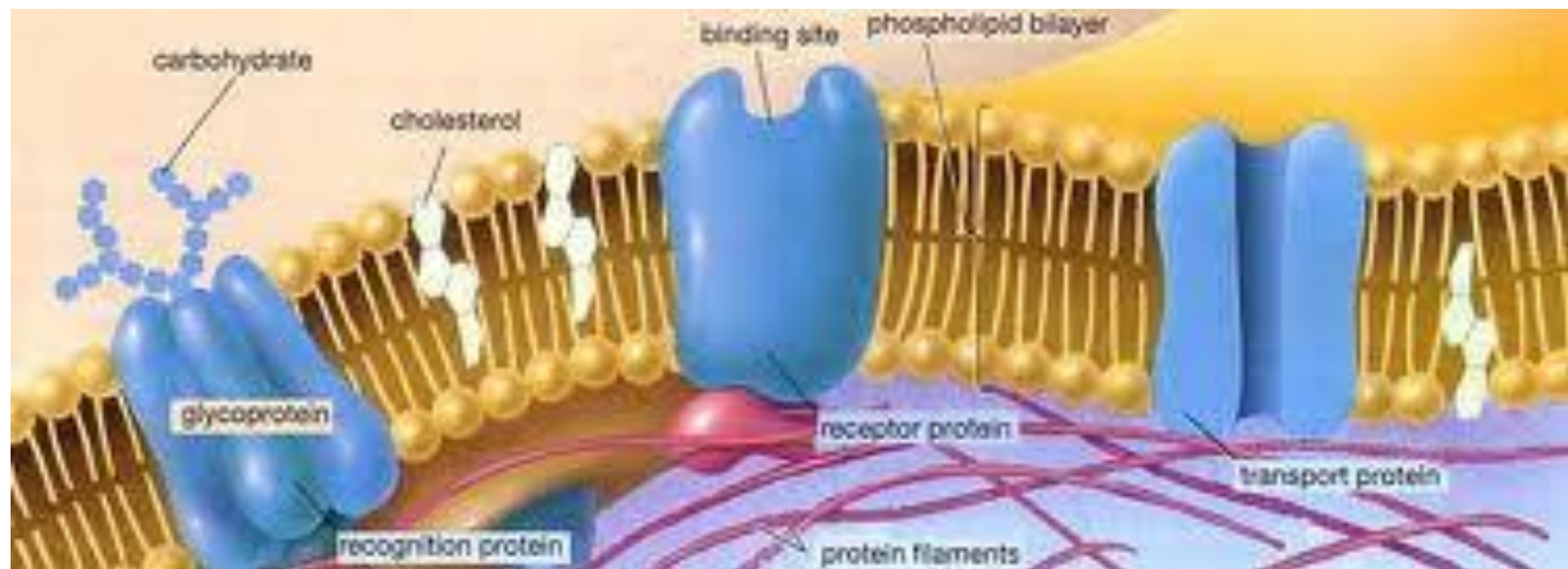


Receptors & G proteins

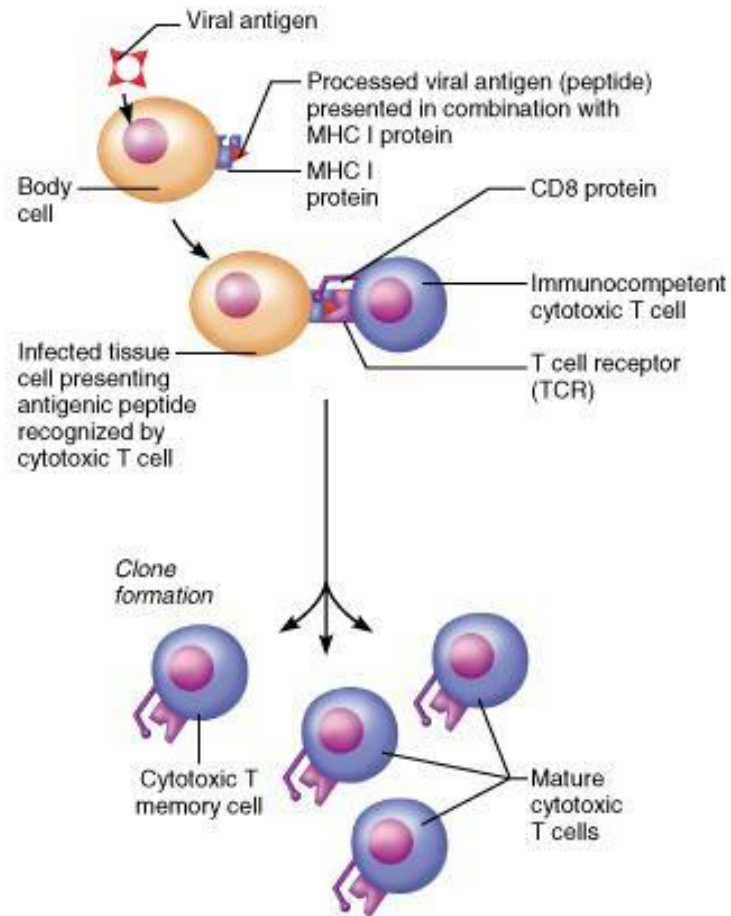


Cell Identity Markers



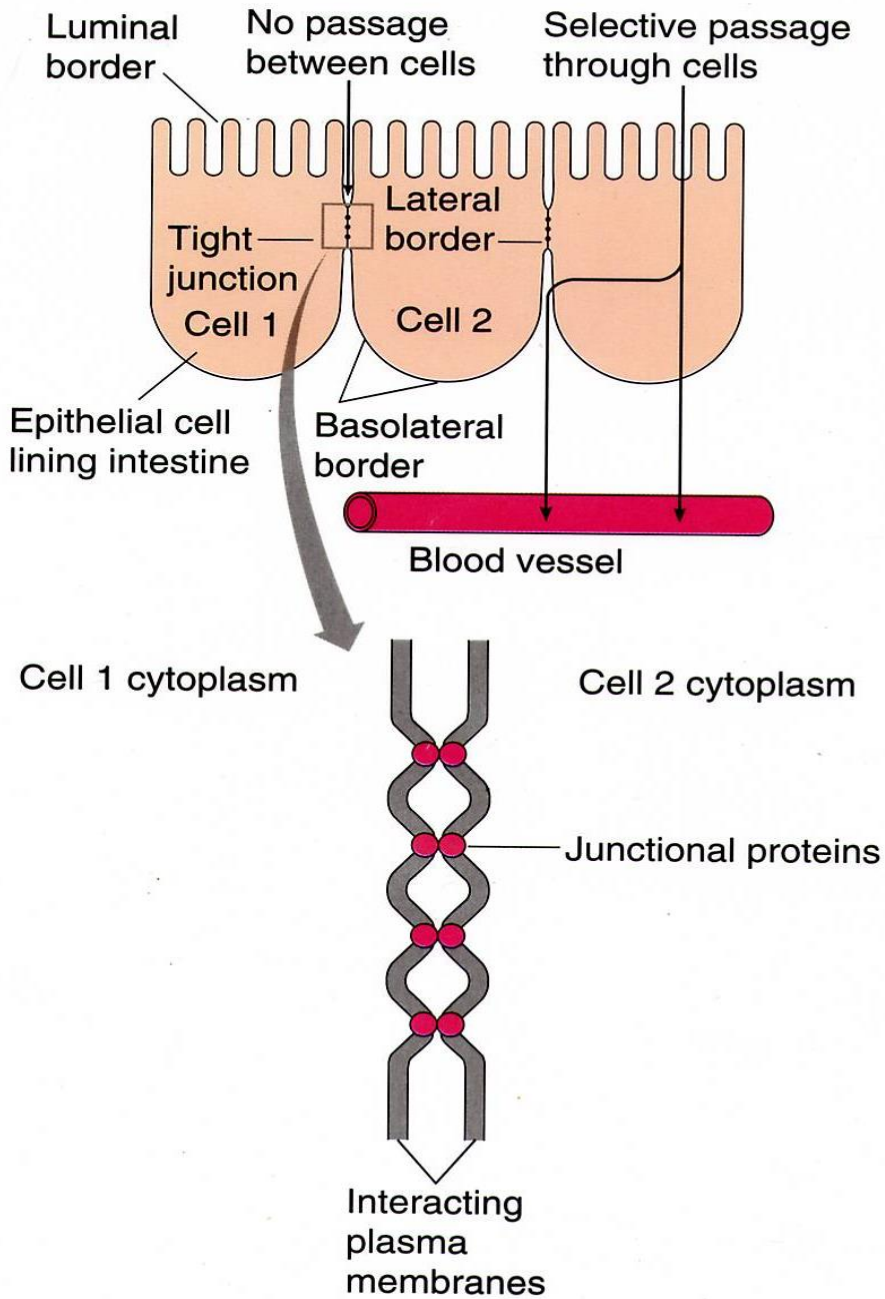


Cell Identity Markers

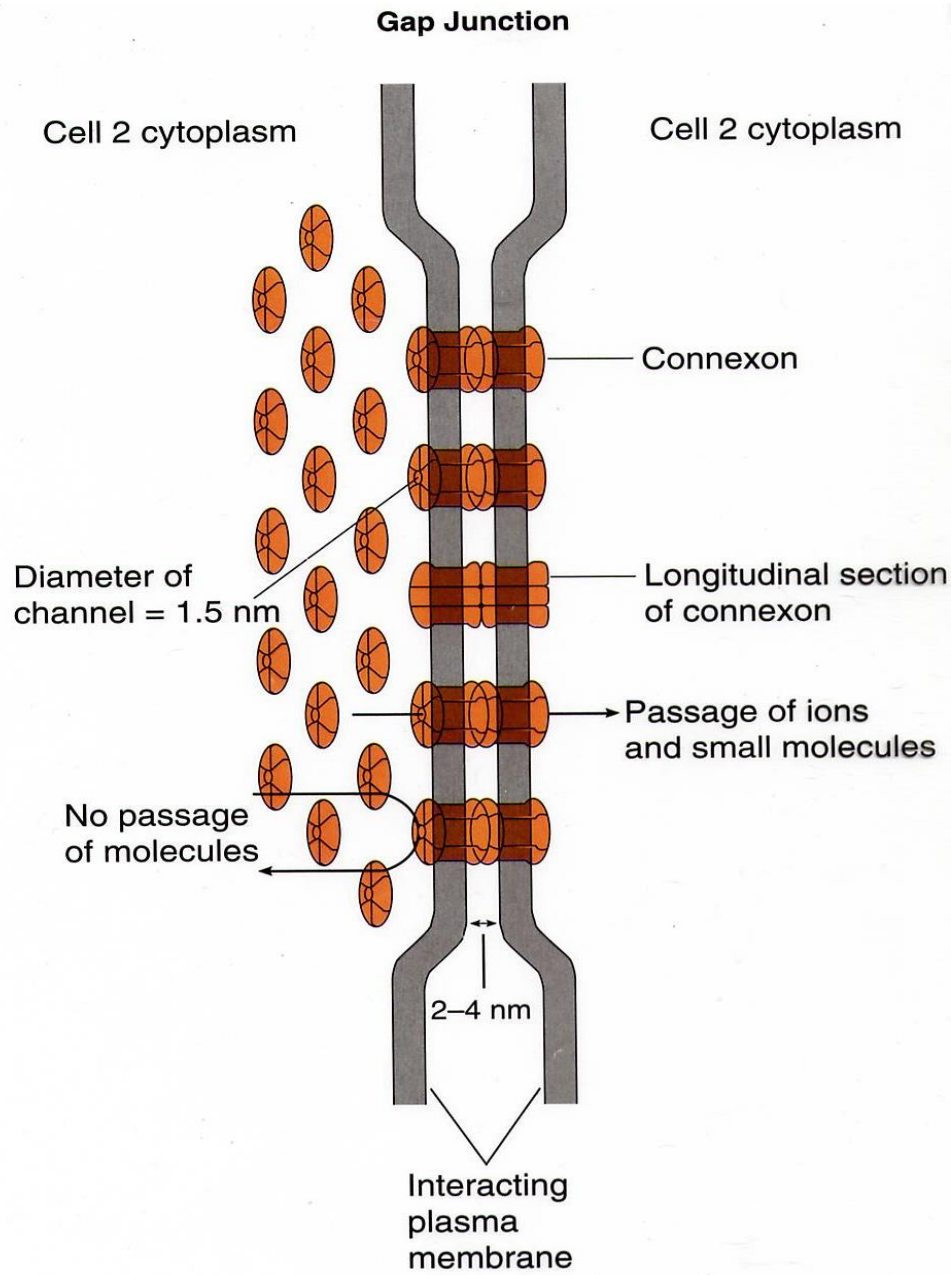


Linkers

Tight Junction

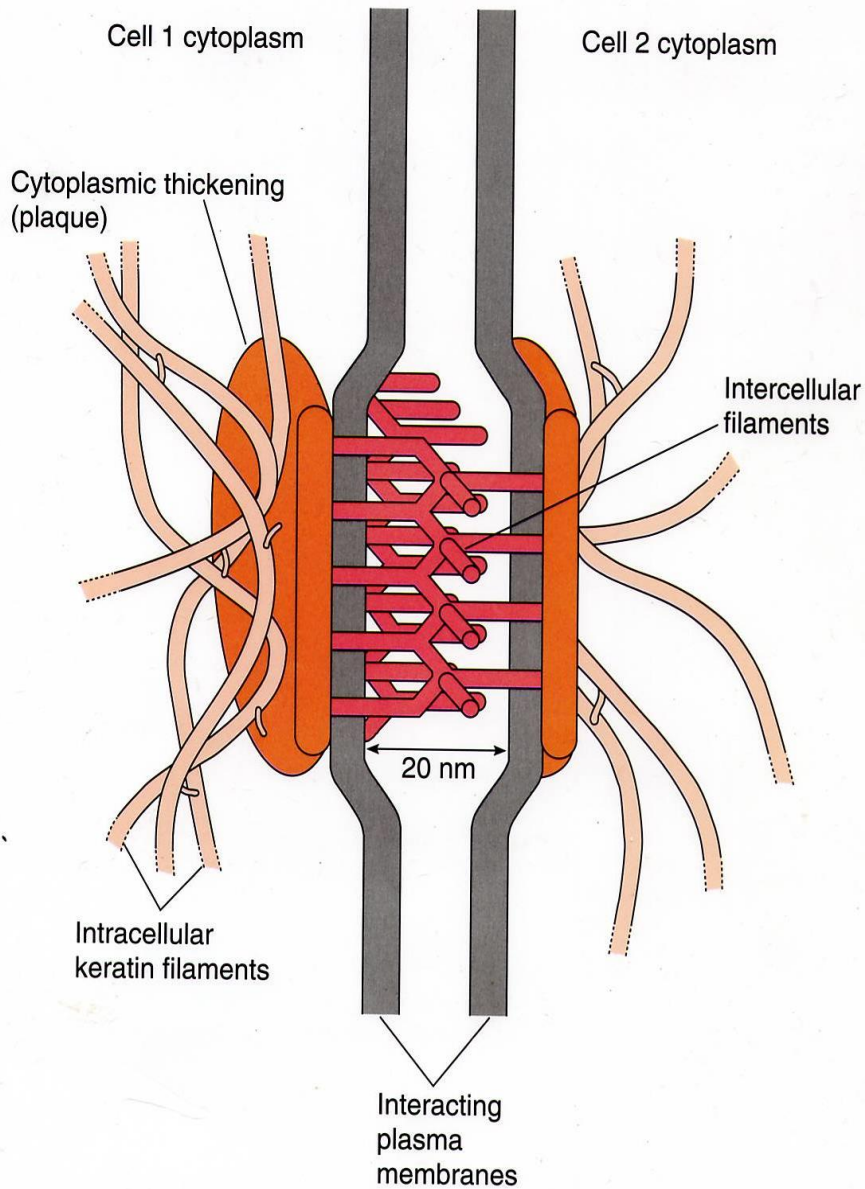


Tight Junction



Gap Junction

Spot Desmosome



Desmosome (Adhering Junction)

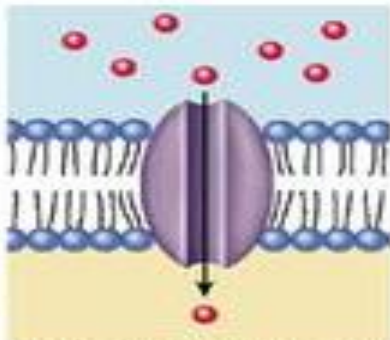
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Functions of Plasma Membrane Proteins

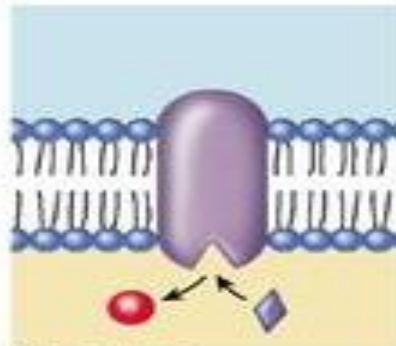
Outside

Plasma membrane

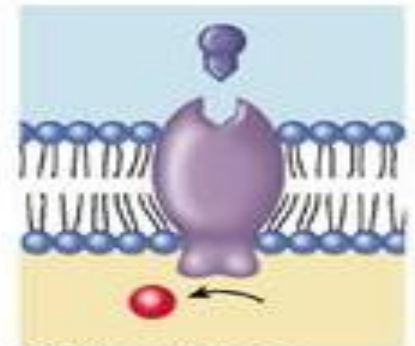
Inside



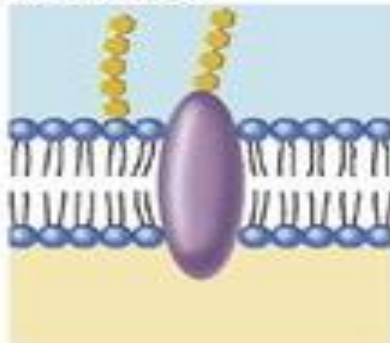
Selective transport channel



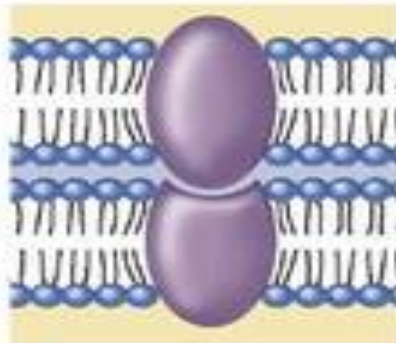
Enzyme



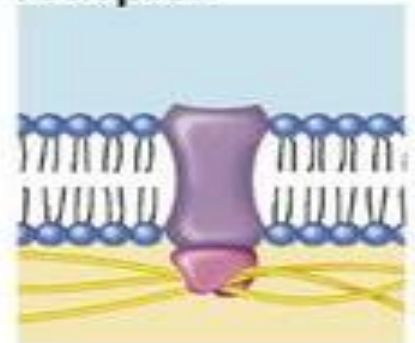
Cell surface receptor



Cell surface identity marker



Cell adhesion



Attachment to the cytoskeleton