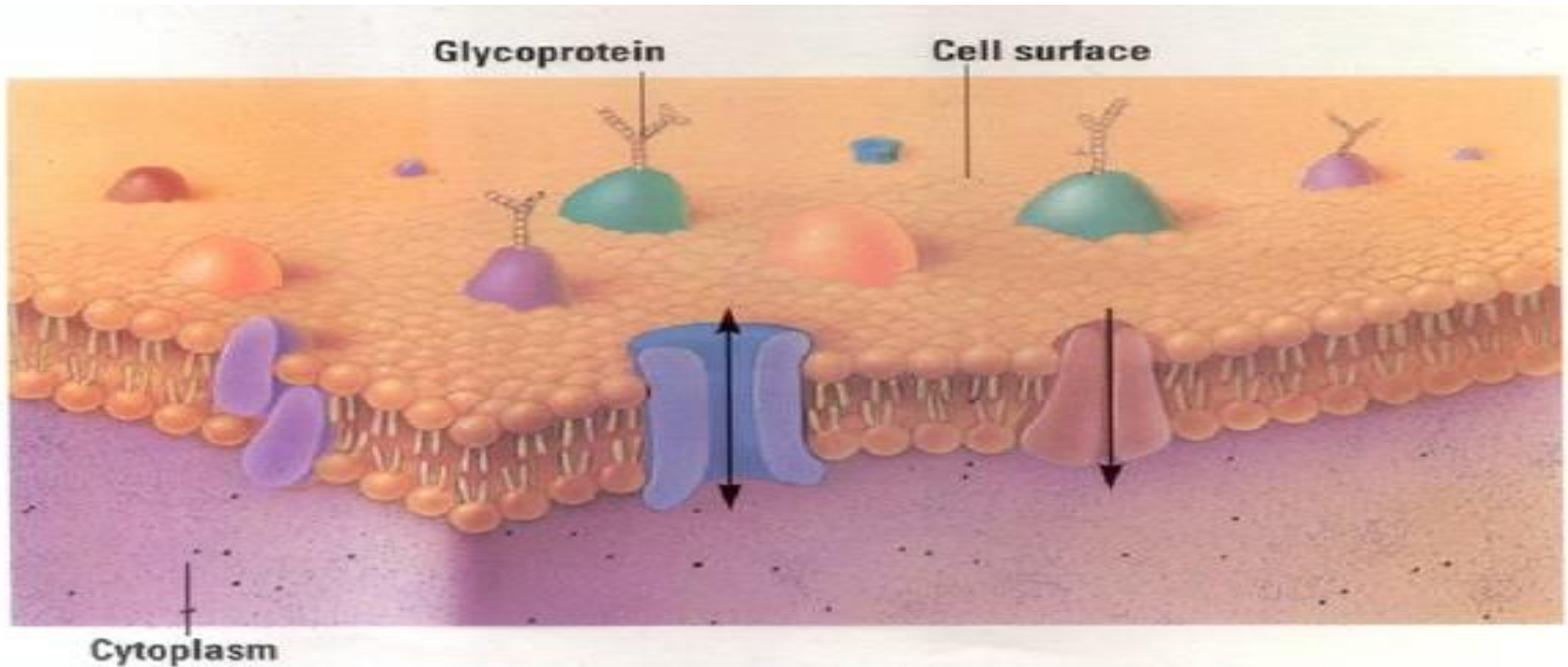


# Structure of Plasma membrane

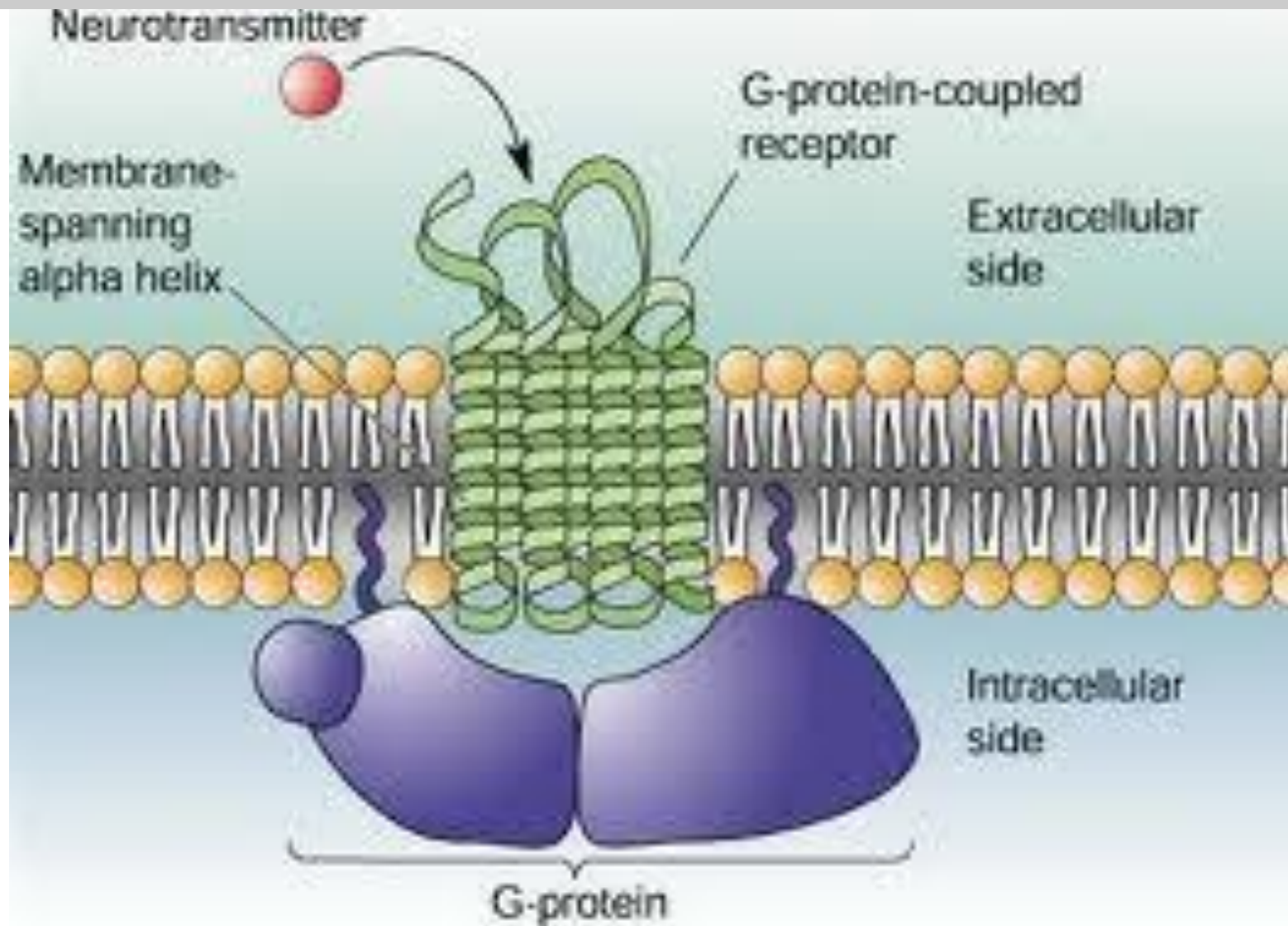


# Control of Transport and activity of Enzymes

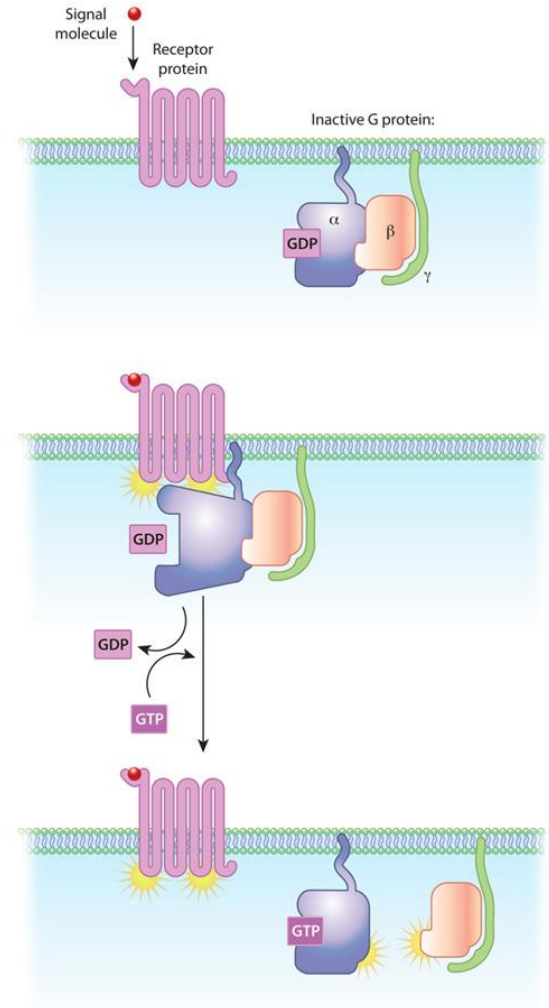
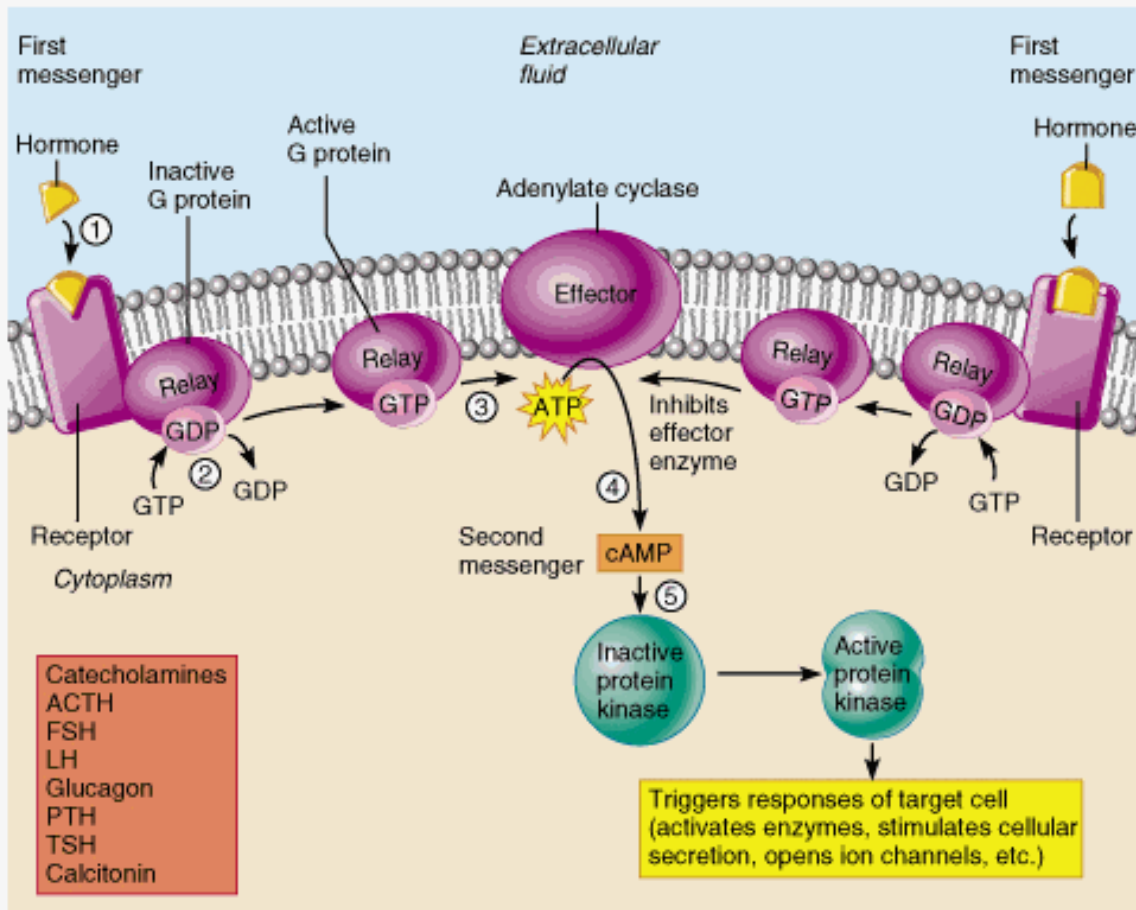
**Table 3.1 Transport of Materials Into and Out of Cells**

<b>Transport Process</b>	<b>Description</b>	<b>Substances Transported</b>
<b>Osmosis</b>	Movement of water molecules across a selectively permeable membrane from an area of higher water concentration to an area of lower water concentration.	Solvent: water in living systems.
<b>Diffusion</b>	Random mixing of molecules or ions due to their kinetic energy. A substance diffuses down a concentration gradient until it reaches equilibrium.	
<b>Diffusion through the lipid bilayer</b>	Passive diffusion of a substance through the lipid bilayer of the plasma membrane.	Nonpolar, hydrophobic solutes: oxygen, carbon dioxide, and nitrogen; fatty acids, steroids, and fat-soluble vitamins; glycerol, small alcohols; ammonia. Polar molecules: water and urea.
<b>Diffusion through membrane channels</b>	Passive diffusion of a substance down its electrochemical gradient through channels that span a lipid bilayer; some channels are gated.	Small inorganic solutes, mainly ions: $K^+$ , $Cl^-$ , $Na^+$ , and $Ca^{2+}$ . Water.
<b>Facilitated Diffusion</b>	Passive movement of a substance down its concentration gradient via transmembrane proteins that act as transporters; maximum diffusion rate is limited by number of available transporters.	Polar or charged solutes: glucose, fructose, galactose, and some vitamins.
<b>Active Transport</b>	Transport in which cell expends energy to move a substance across the membrane against its concentration gradient through transmembrane proteins that act as transporters; maximum transport rate is limited by number of available transporters.	Polar or charged solutes.
<b>Primary active transport</b>	Transport of a substance across the membrane against its concentration gradient by pumps; transmembrane proteins that use energy supplied by hydrolysis of ATP.	$Na^+$ , $K^+$ , $Ca^{2+}$ , $H^+$ , $I^-$ , $Cl^-$ , and other ions.
<b>Secondary active transport</b>	Coupled transport of two substances across the membrane using energy supplied by a $Na^+$ or $H^+$ concentration gradient maintained by primary active transport pumps. Antiporters move $Na^+$ (or $H^+$ ) and another substance in opposite directions across the membrane; symporters move $Na^+$ (or $H^+$ ) and another substance in the same direction across the membrane.	Antiport: $Ca^{2+}$ , $H^+$ out of cells. Symport: glucose, amino acids into cells.
<b>Transport In Vesicles</b>	Movement of substances into or out of a cell in vesicles that bud from the plasma membrane; requires energy supplied by ATP.	
<b>Endocytosis</b>	Movement of substances into a cell in vesicles.	
<b>Receptor-mediated endocytosis</b>	Ligand-receptor complexes trigger infolding of a clathrin-coated pit that forms a vesicle containing ligands.	Ligands: transferrin, low-density lipoproteins (LDLs), some vitamins, certain hormones, and antibodies.
<b>Phagocytosis</b>	"Cell eating"; movement of a solid particle into a cell after pseudopods engulf it to form a phagosome.	Bacteria, viruses, and aged or dead cells.
<b>Pinocytosis</b>	"Cell drinking"; movement of extracellular fluid into a cell by infolding of plasma membrane to form a pinocytic vesicle.	Solute in extracellular fluid.
<b>Exocytosis</b>	Movement of substances out of a cell in secretory vesicles that fuse with the plasma membrane and release their contents into the extracellular fluid.	Neurotransmitters, hormones, and digestive enzymes.

# Receptors

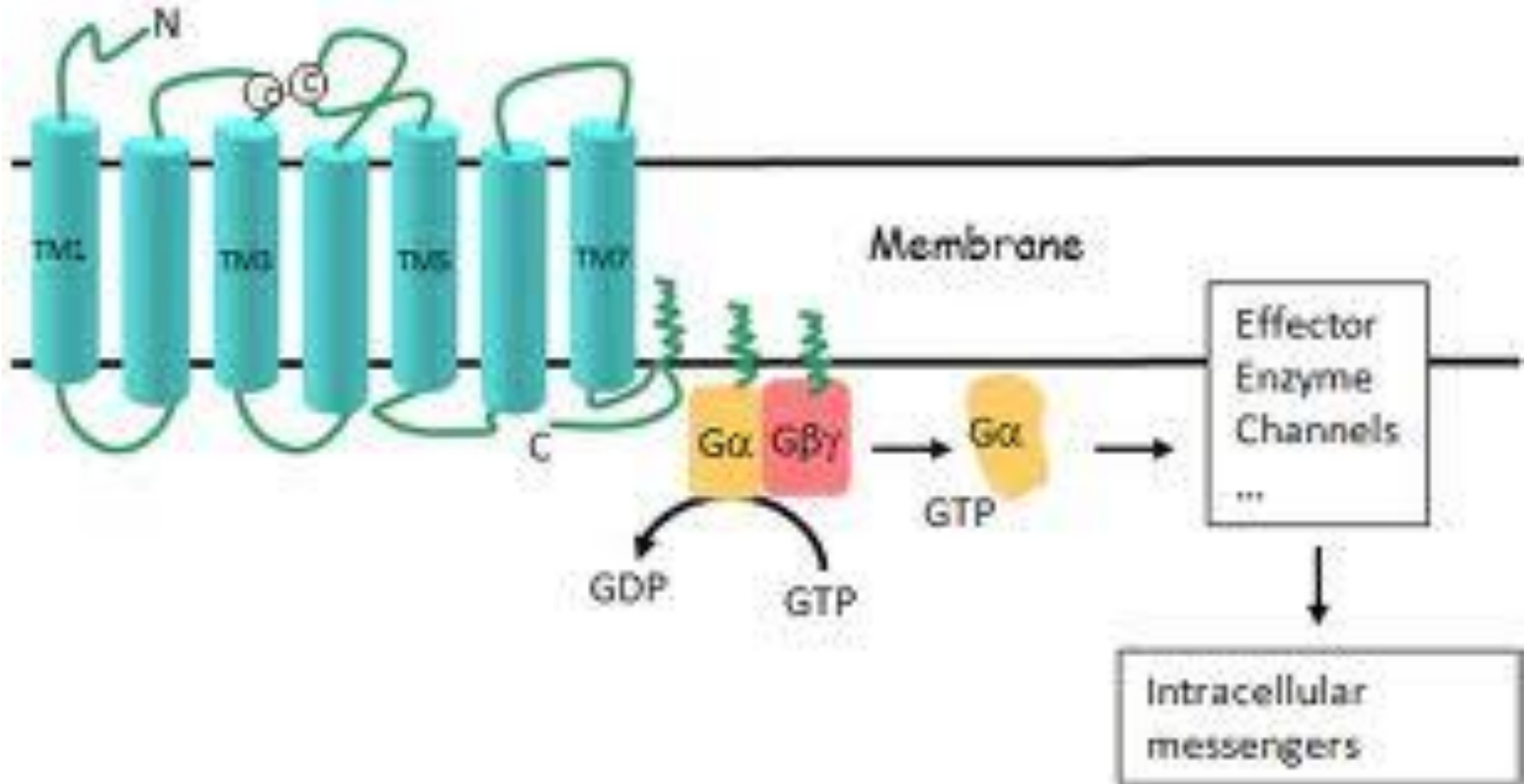


# Receptors & G proteins



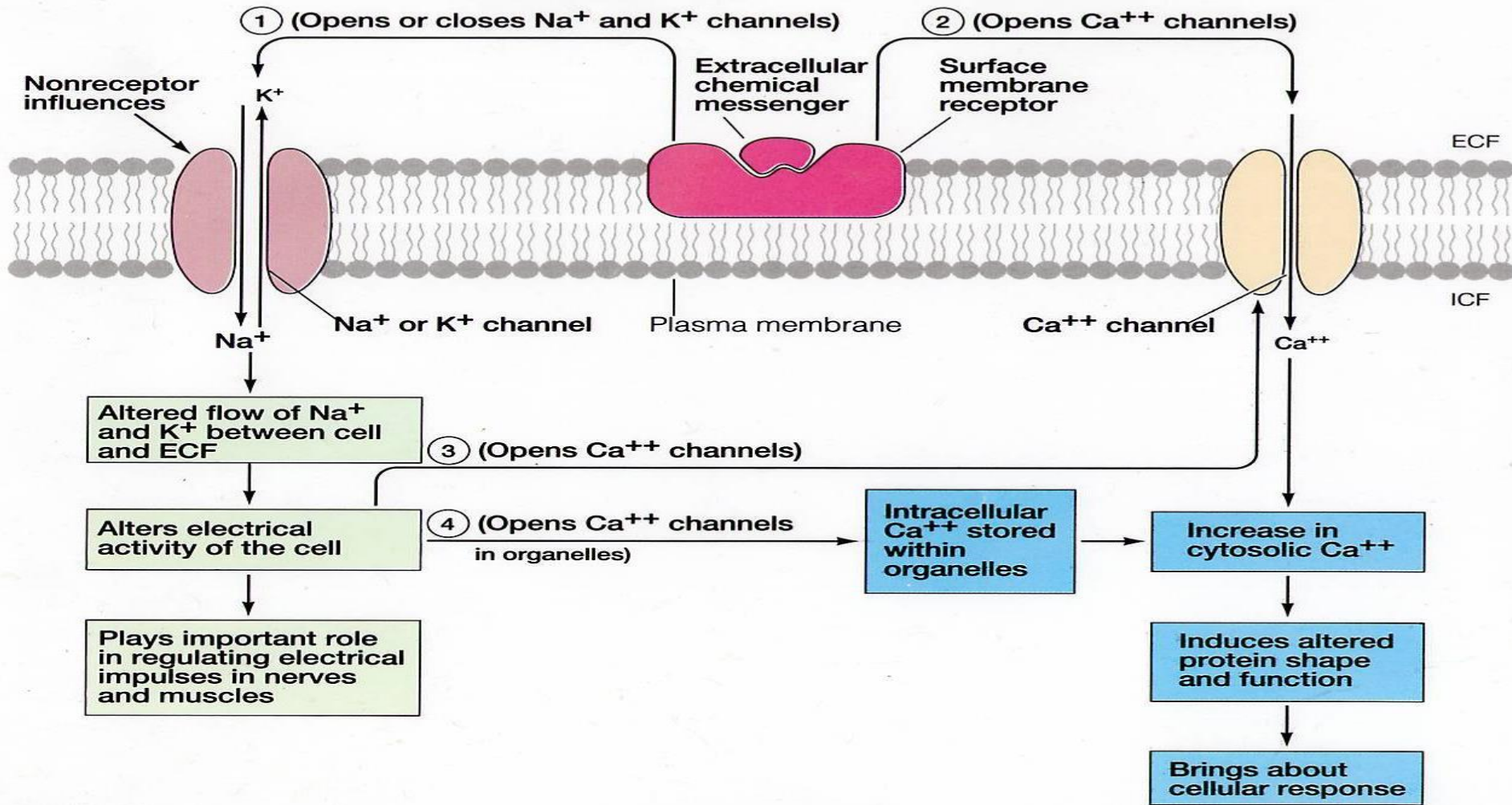
(a)

# Receptors

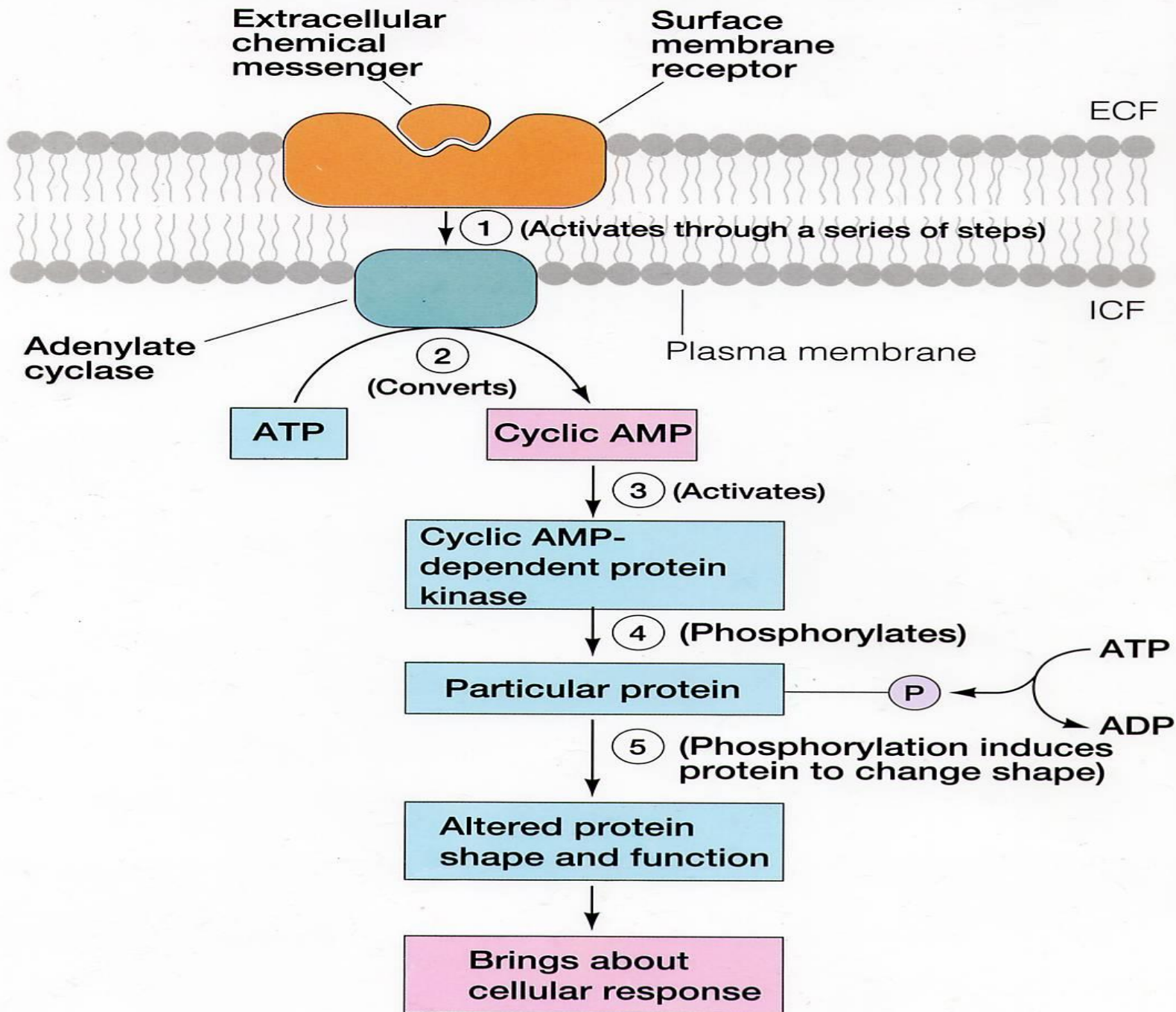


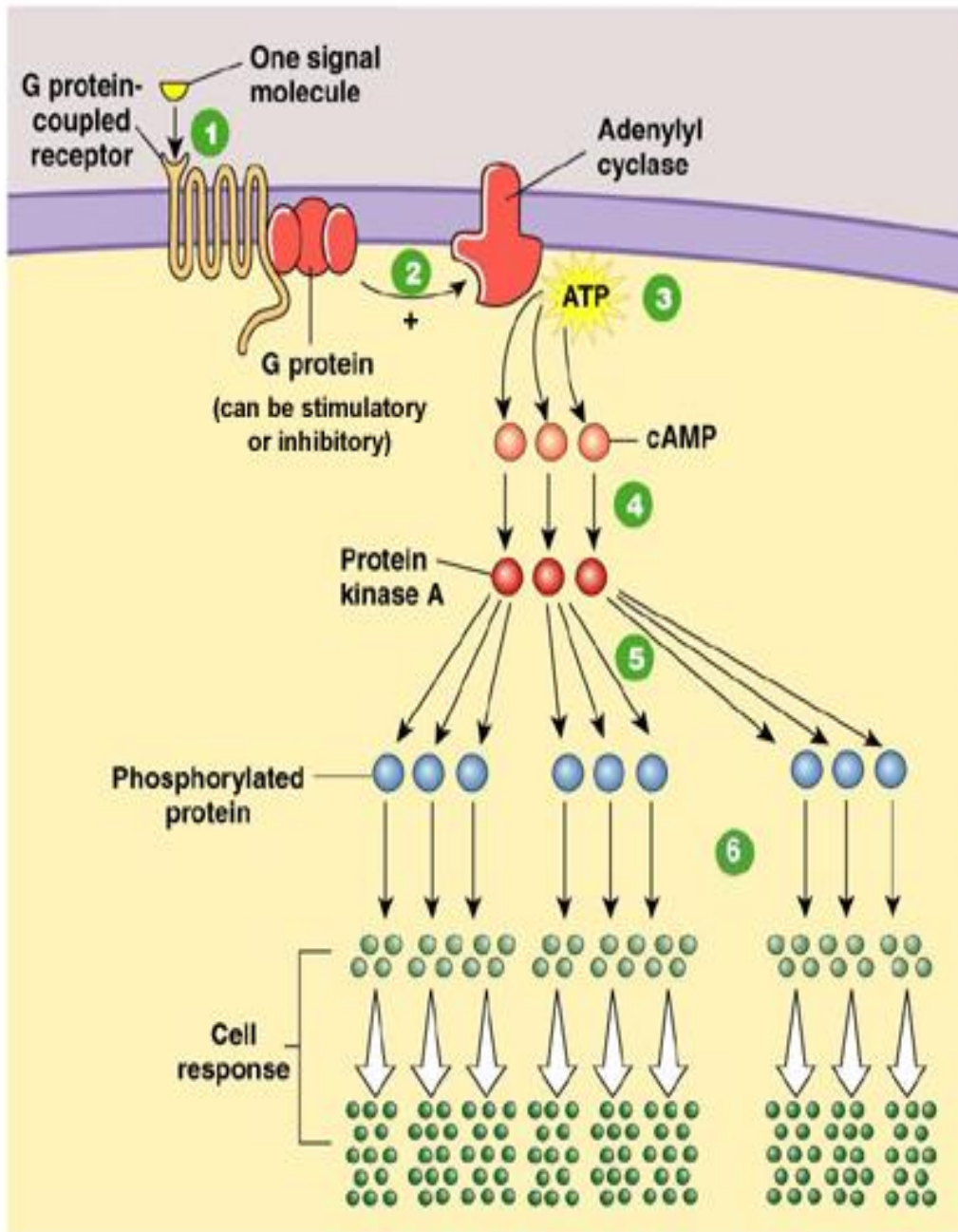
# Receptors & Channels

## Postreceptor Event: Channel Regulation

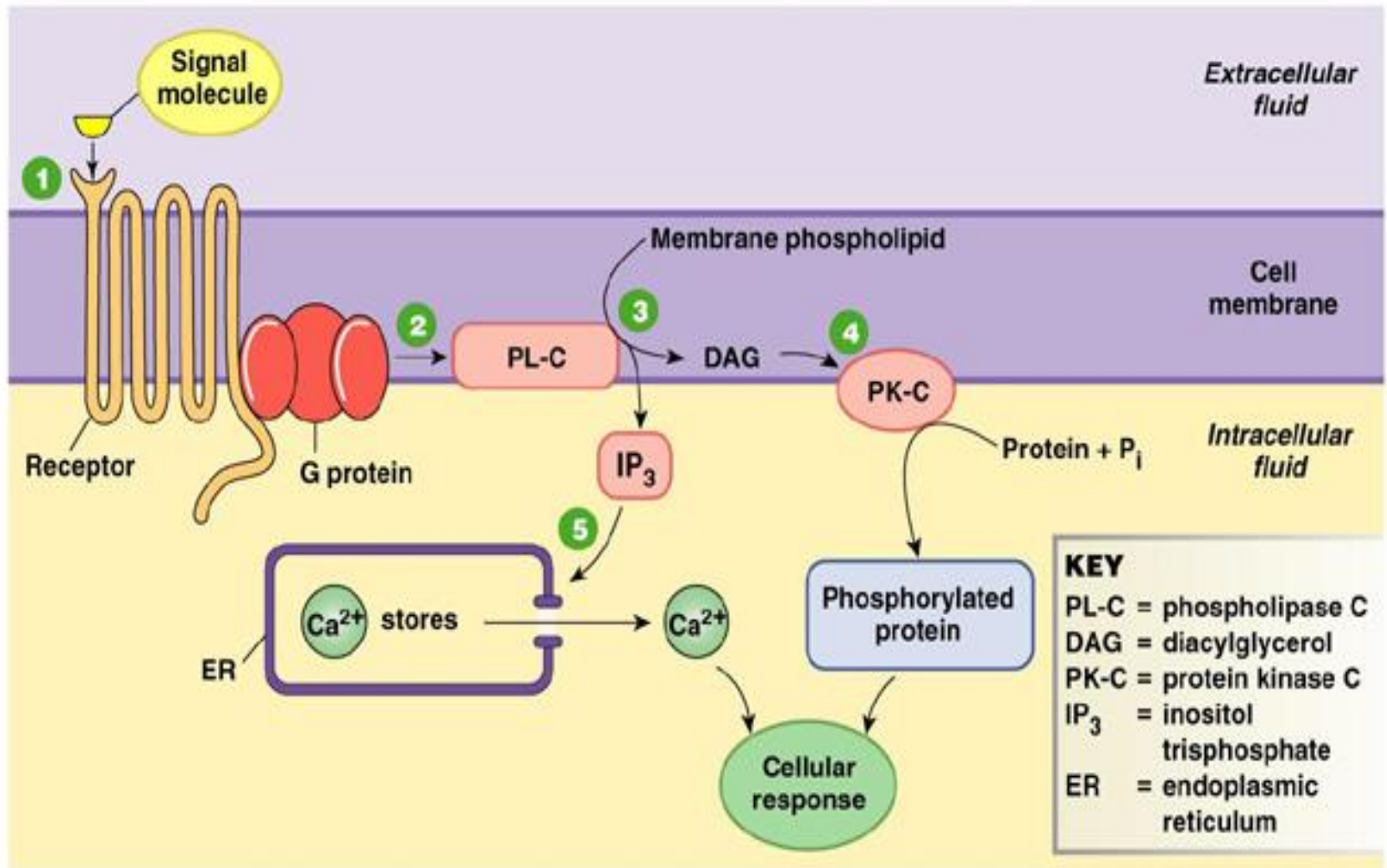


# Postreceptor Event: Cyclic AMP Second Messenger System





- 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 IP<sub>3</sub>, which diffuses into the cytoplasm.
- 4 DAG activates protein kinase C (PK-C), which phosphorylates proteins.
- 5 IP<sub>3</sub> causes release of Ca<sup>2+</sup> from organelles, creating a Ca<sup>2+</sup> signal.



