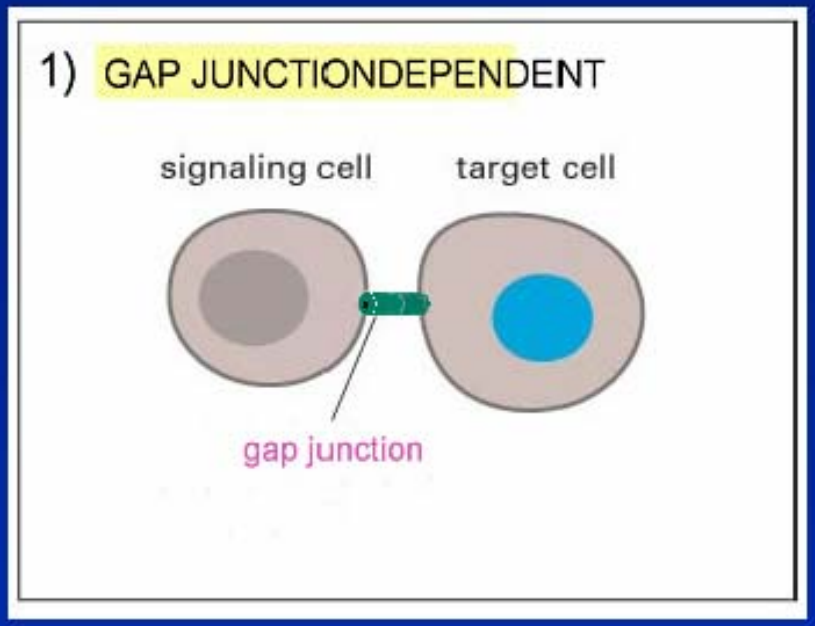
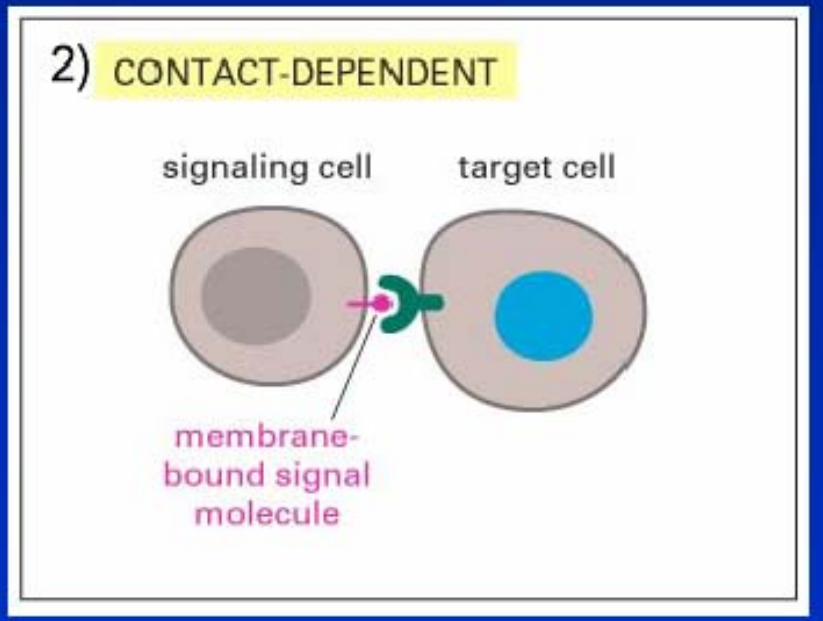
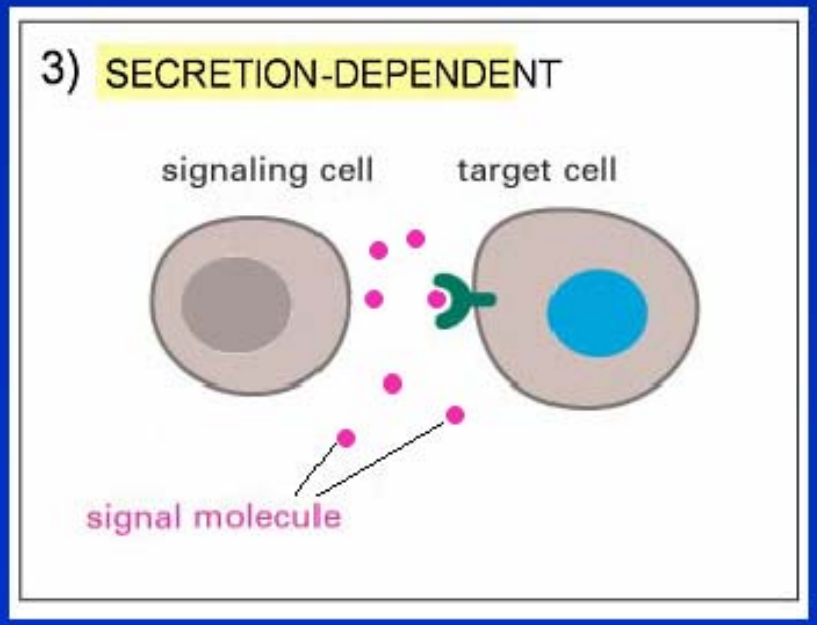
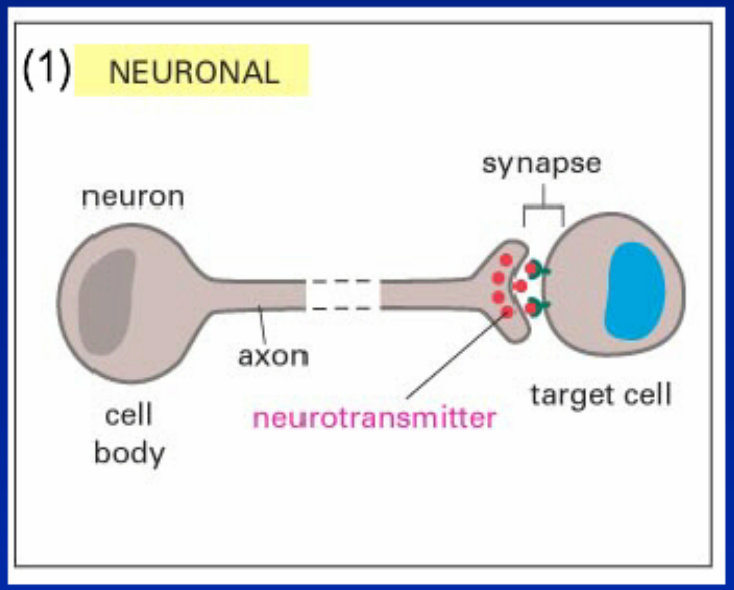
Cellular signalisation

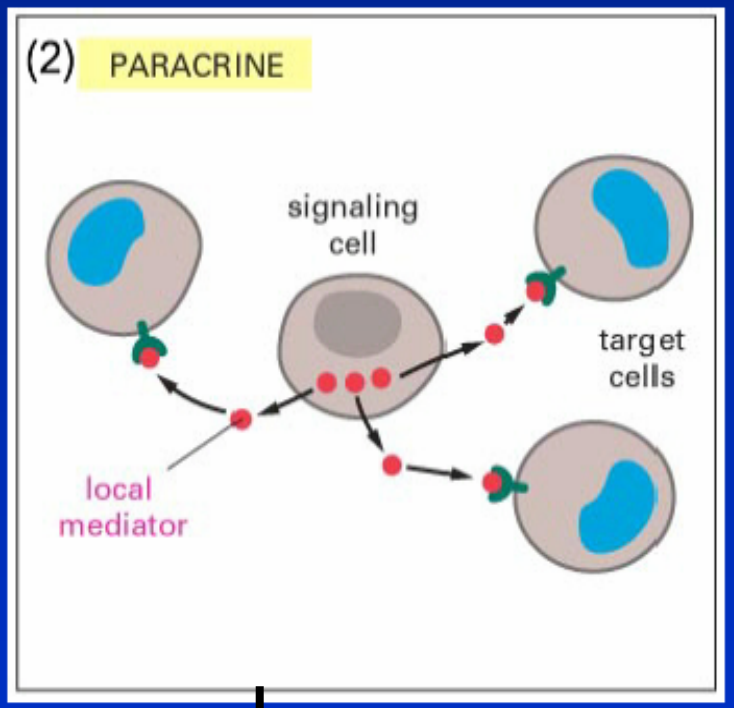




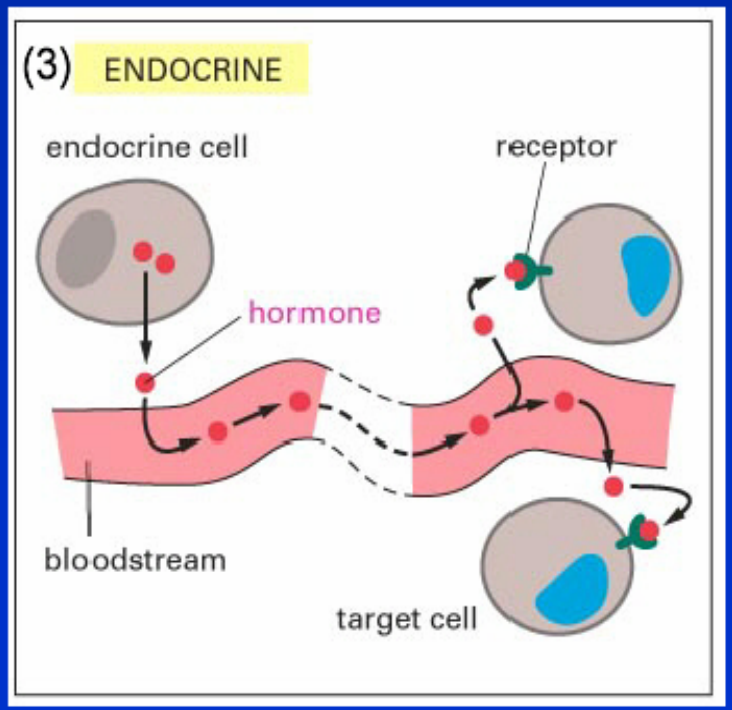


Cellular signalisation





autocrine



Receptors:

Specificity – structure

Affinity – low conc. Effective.

Can be saturated

Reversible ligand binding

Specific response of the cell

Classification of receptors:

Localization:

-Intracellular

cytosolic

nuclear

-Plasmamembrane

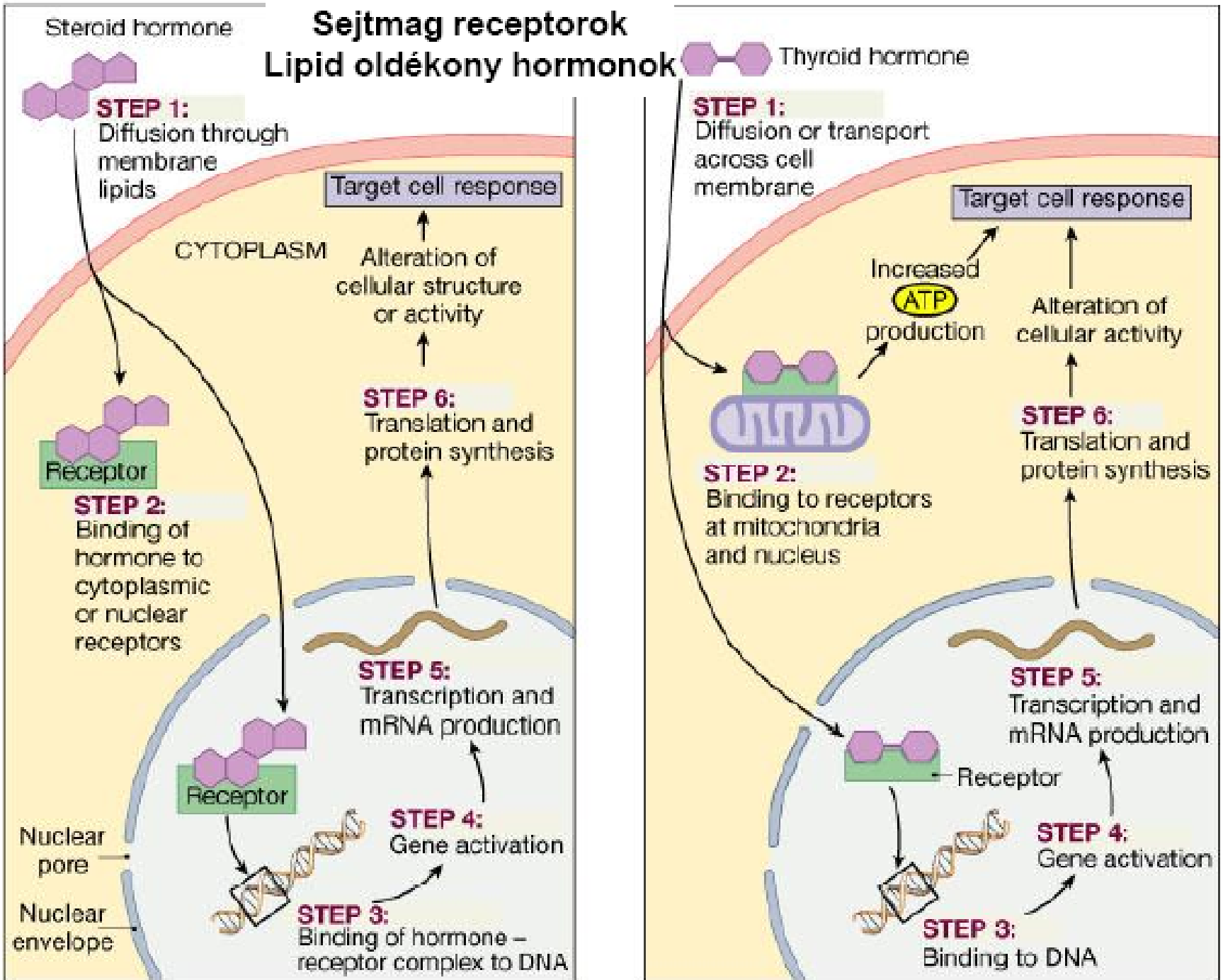
Mechanism of signalisation:

-Ion channel

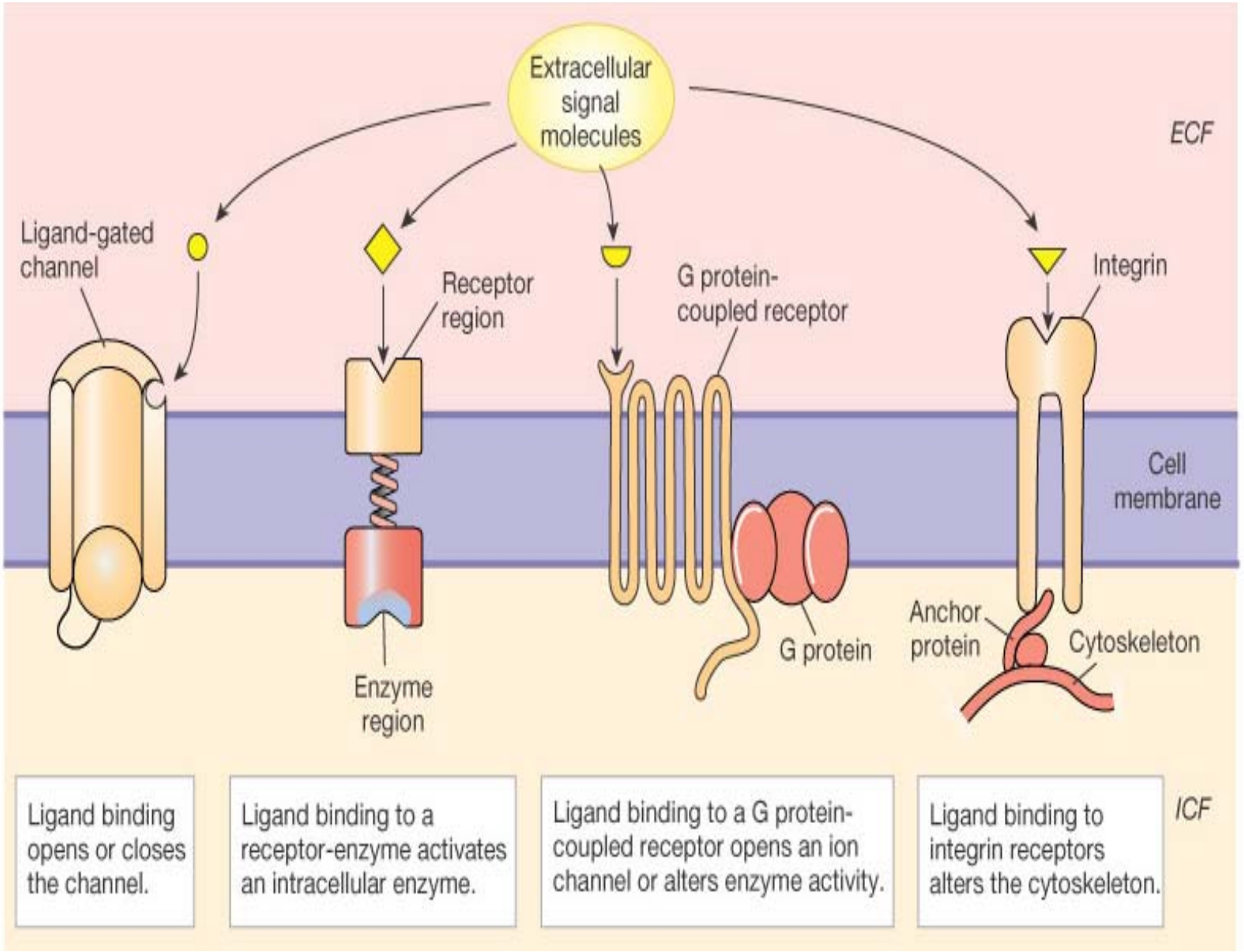
-G protein-coupled

-Catalytic activity

Sejtmag receptorok
Lipid oldékony hormonok

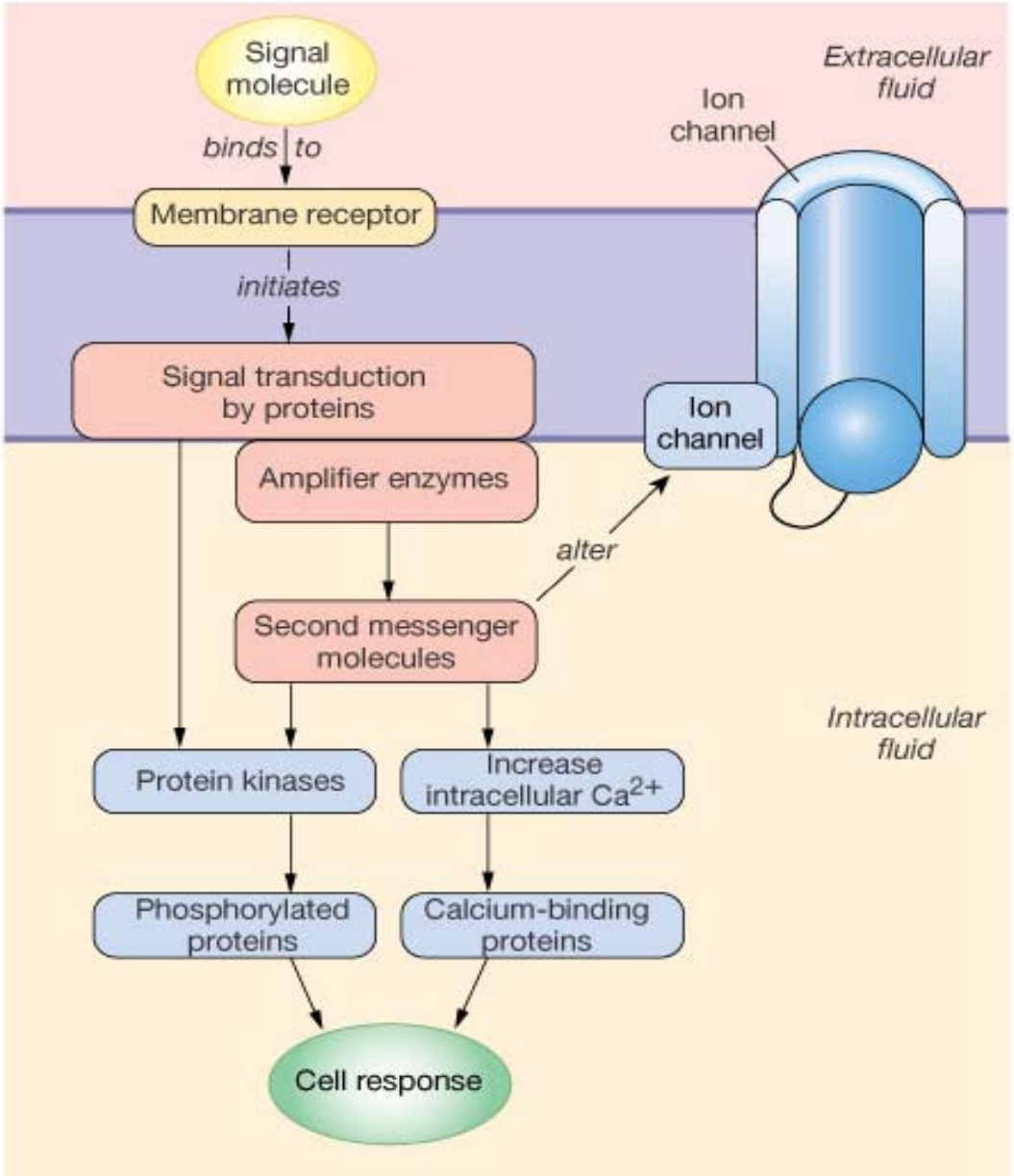


Membrane Receptor Classes



Signal Transduction

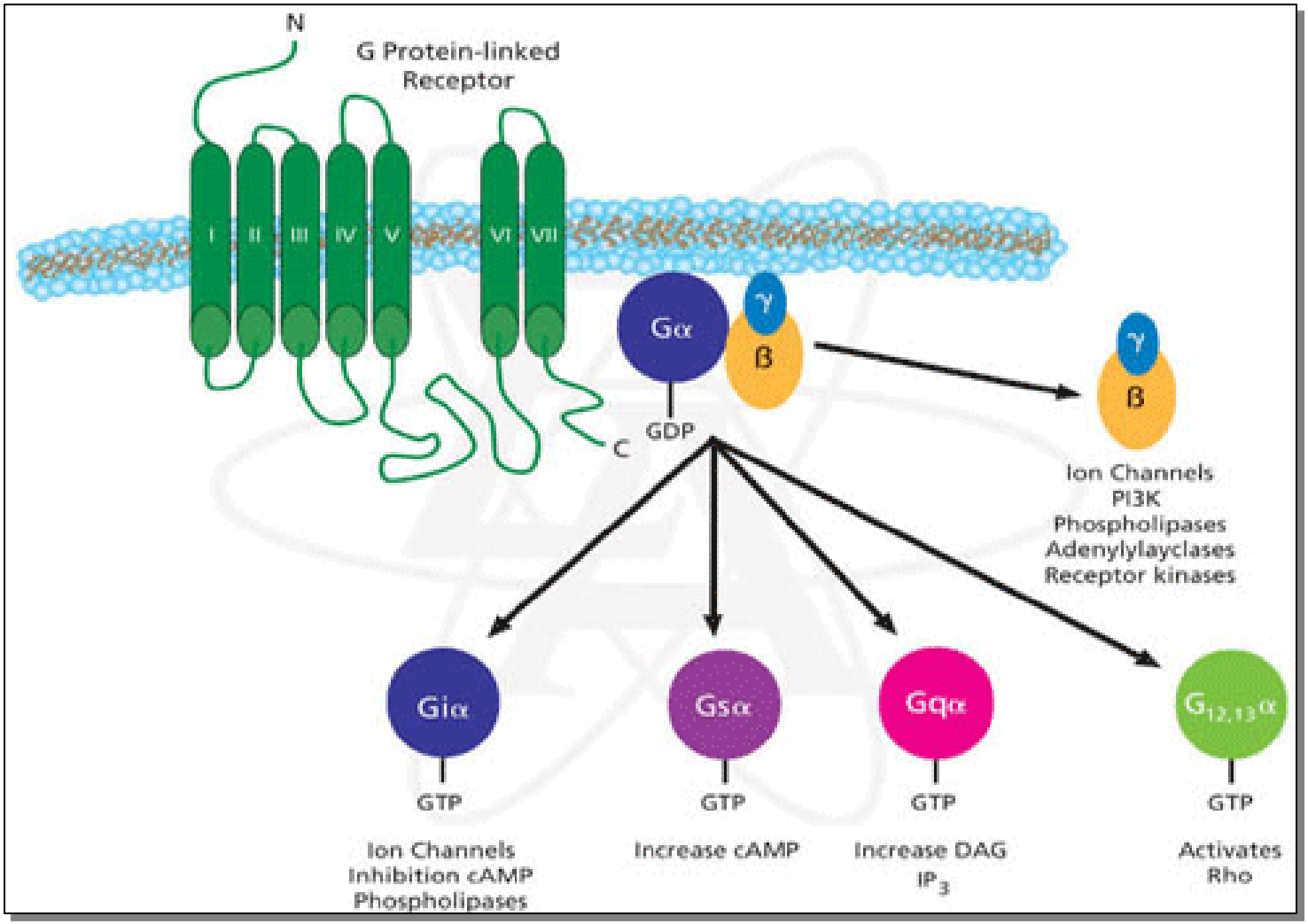
- Protein kinase
- Second messenger
- Activate proteins
  - Phosporylation
  - Bind calcium
- Cell response



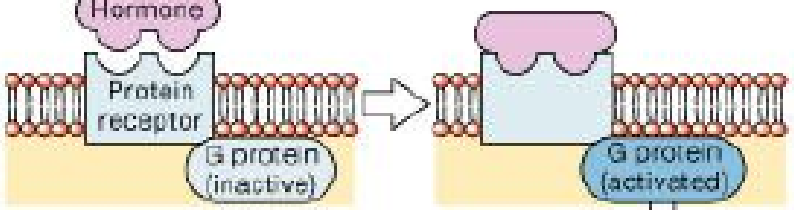
Second Messengers: G Proteins

- Two main types of systems: *enzyme-linked* and *G protein-linked*
- G-protein linked receptors are transmembrane proteins that loop 7 times through the plasma membrane
- Receptor activates G protein, which binds GTP
- When inactive, G protein is bound to GDP (guanosine diphosphate)
- G proteins interact with *adenylyl cyclase*, which makes cAMP
  - G_s stimulates adenylyl cyclase
  - G_i inhibits adenylyl cyclase
- When the hormone binds to a stimulatory receptor, the G protein releases GDP and binds to GTP
- Binding of the G protein to GTP enables it to activate adenylyl cyclase

Second Messengers: G Proteins

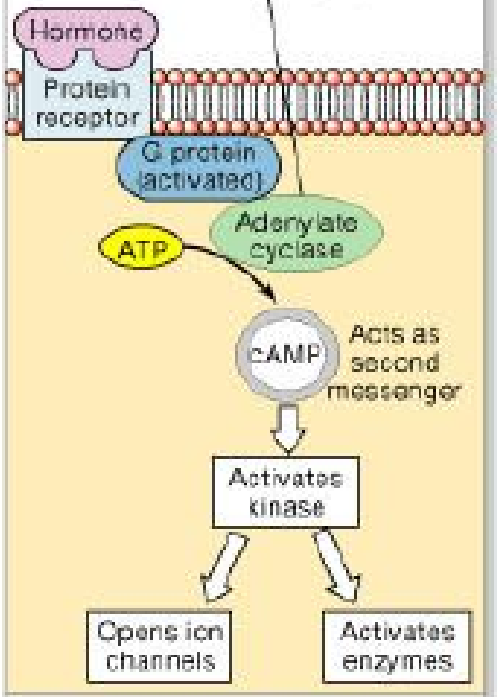


G-protein-kapcsolt receptorok



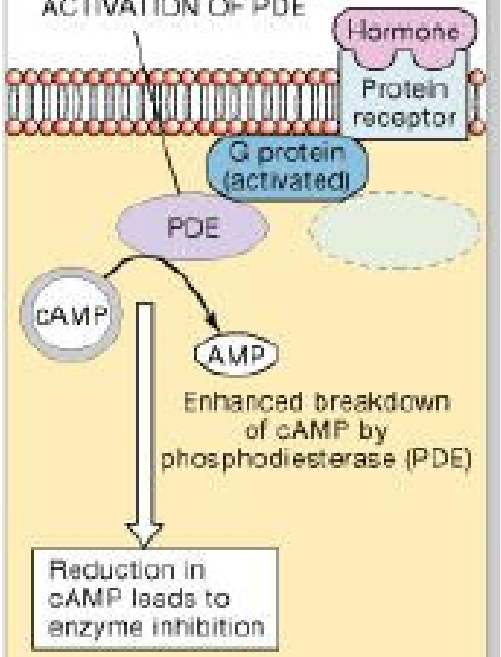
EFFECTS ON cAMP LEVELS

ACTIVATION OF ADENYLATE CYCLASE



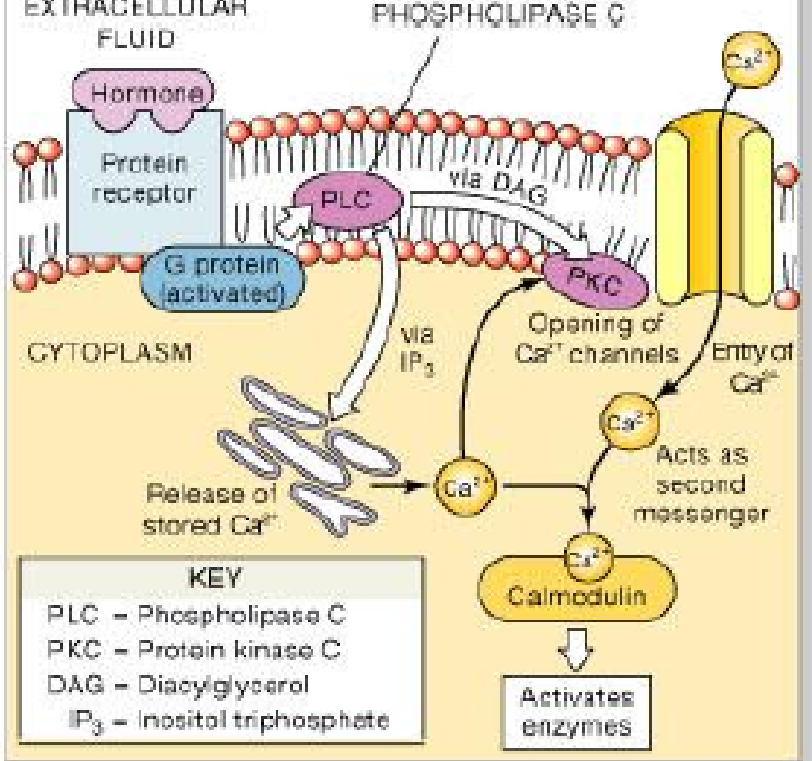
Examples:
- Epinephrine and norepinephrine (β receptors)
- Calcitonin
- Parathyroid hormone
- ADH, ACTH, FSH, LH, TSH
- Glucagon

INHIBITION OF ADENYLATE CYCLASE; ACTIVATION OF PDE



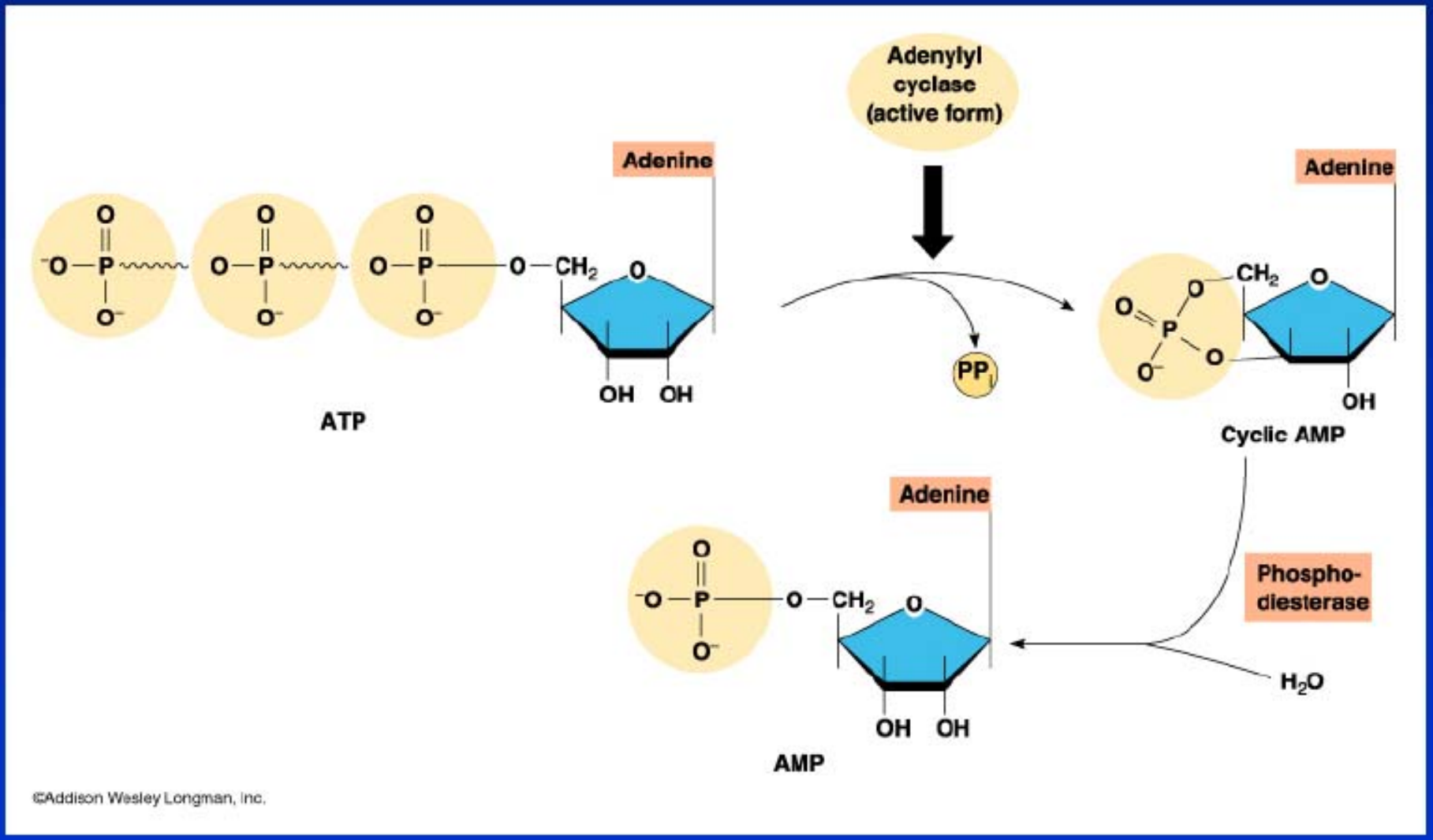
Examples:
- Epinephrine and norepinephrine (α_2 receptors)

EFFECTS ON Ca^{2+} LEVELS



Examples:
- Epinephrine and norepinephrine (α_1 receptors)
- Oxytocin
- Regulatory hormones of hypothalamus
- Several eicosanoids

Formation of cAMP



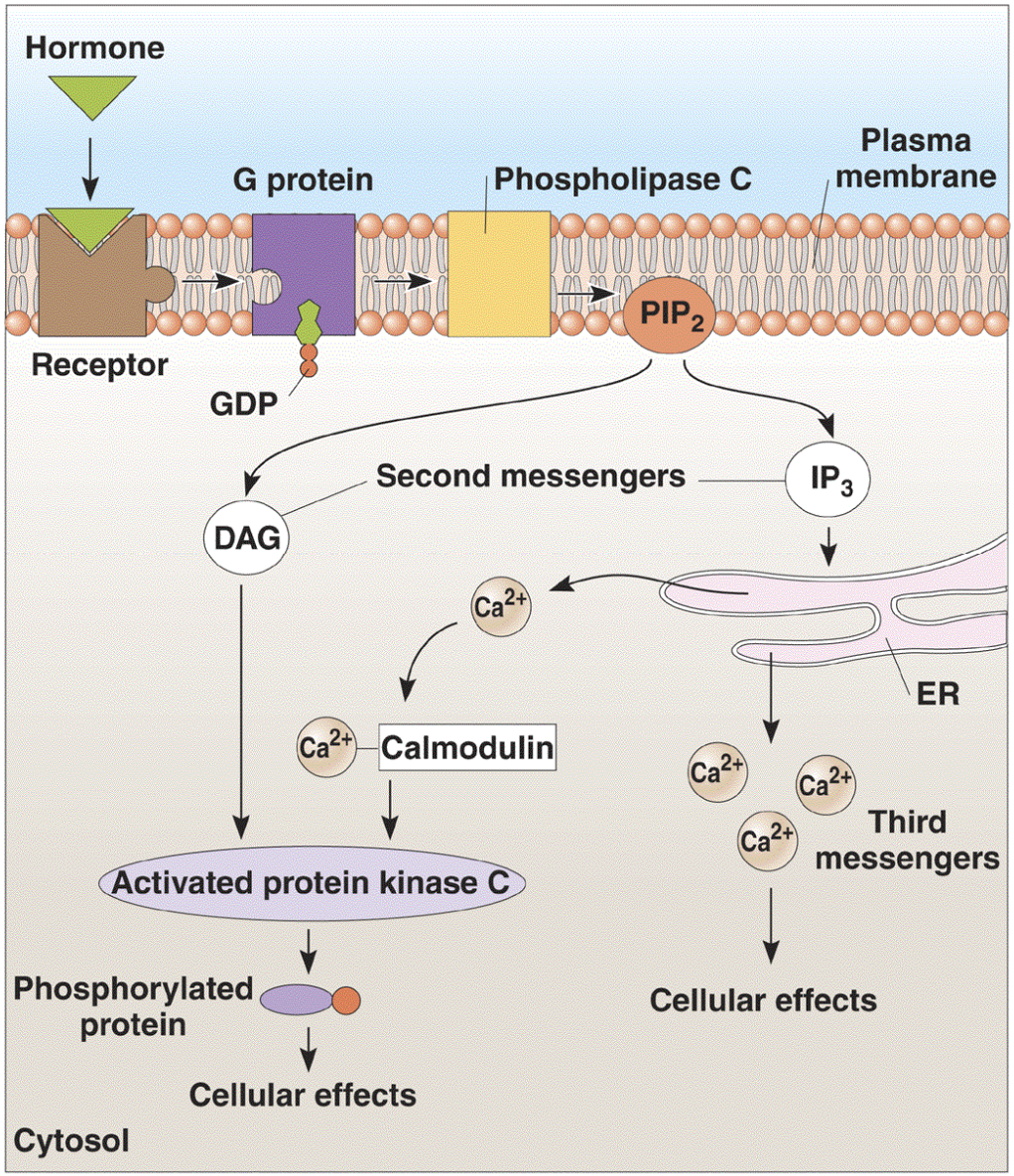
Calcium Ions

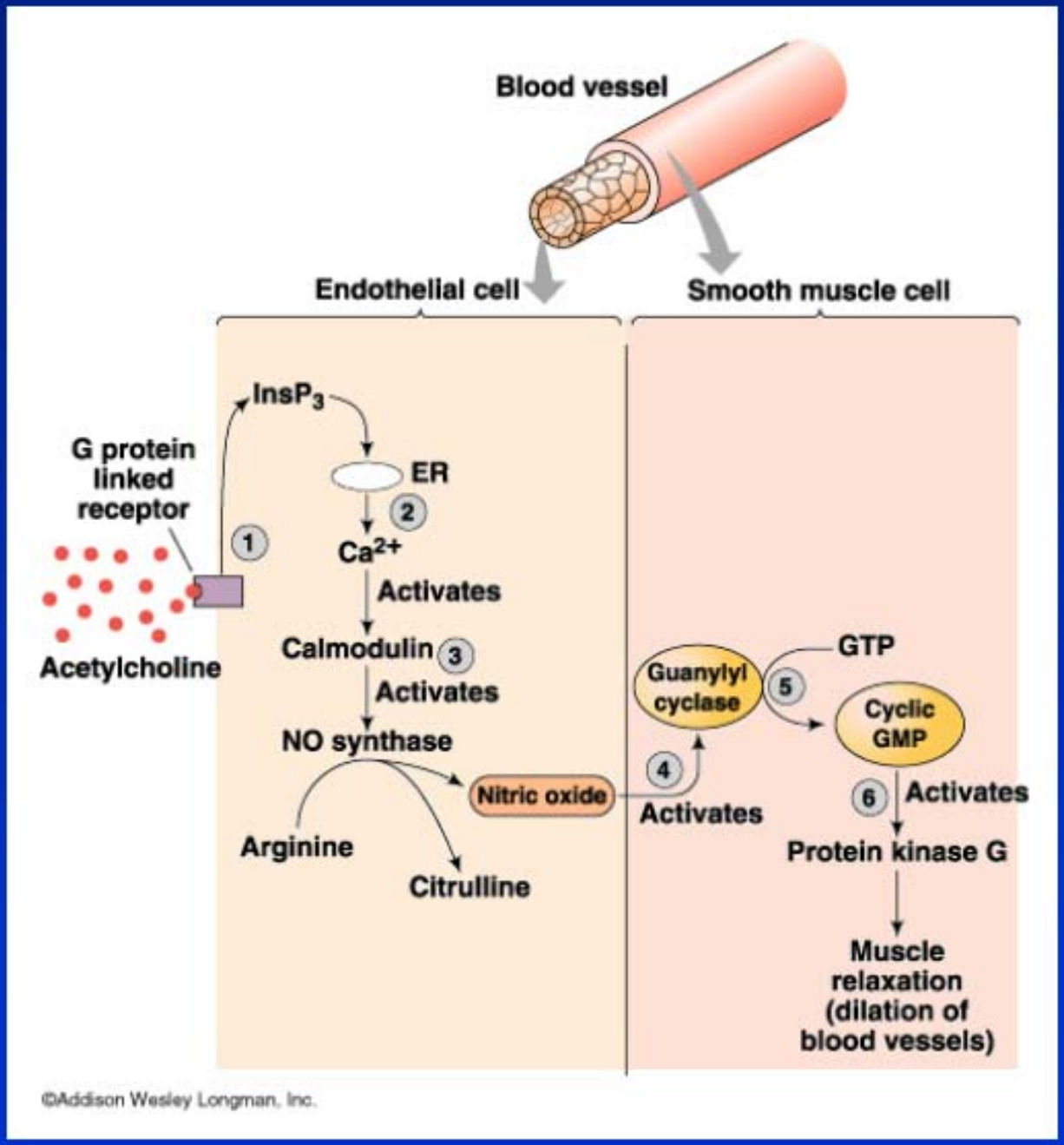
- Calcium ions can act as second messengers
- The non-stimulated cytoplasmic calcium concentration is very low; some stimulation events cause transient elevation of intracellular calcium
- Calcium can bind proteins and regulate cellular function as a result
- One example of such calcium – protein binding is the calcium-calmodulin (CaM) complex

IP_3 and DAG

- Phospholipid products can act as second messengers
- Phosphatidyl inositol 4,5 bisphosphate is split into inositol trisphosphate (IP_3) and diacylglycerol (DAG)
- IP_3 causes the release of Ca^{++} from the ER
- DAG goes on to activate protein kinase C (PKC) along with the Ca^{++} - CaM complex
- PKC in turn phosphorylates protein that go on to generate various cellular effects

Solomon/Berg/Martin, Biology, 6/e
Figure 47.10




Blood vessel
Endothelial cell
Smooth muscle cell
G protein linked receptor
Acetylcholine
1
InsP3
ER
2
Ca2+
Activates
Calmodulin
3
Activates
NO synthase
Arginine
Citrulline
Nitric oxide
4
Activates
Guanylyl cyclase
5
GTP
Cyclic GMP
6
Activates
Protein kinase G
Muscle relaxation (dilation of blood vessels)
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