



**Escuela de Verano 2006
Curso Células Cancerosas
Facultad de Medicina**

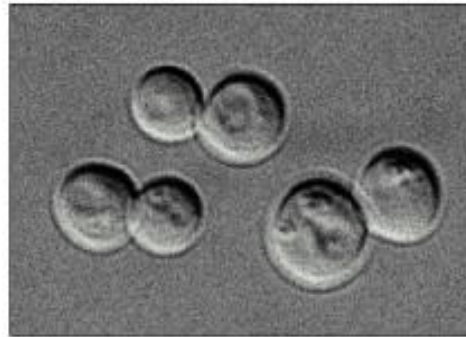


Comunicación intercelular y señalización

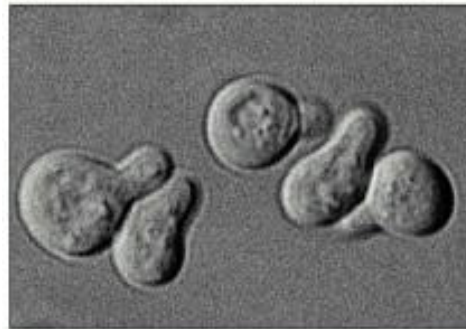
Héctor R. Contreras M.

*Programa de Fisiología y Biofísica
Instituto de Ciencias Biomédicas
Facultad de Medicina. Universidad de Chile*

Comunicación intercelular



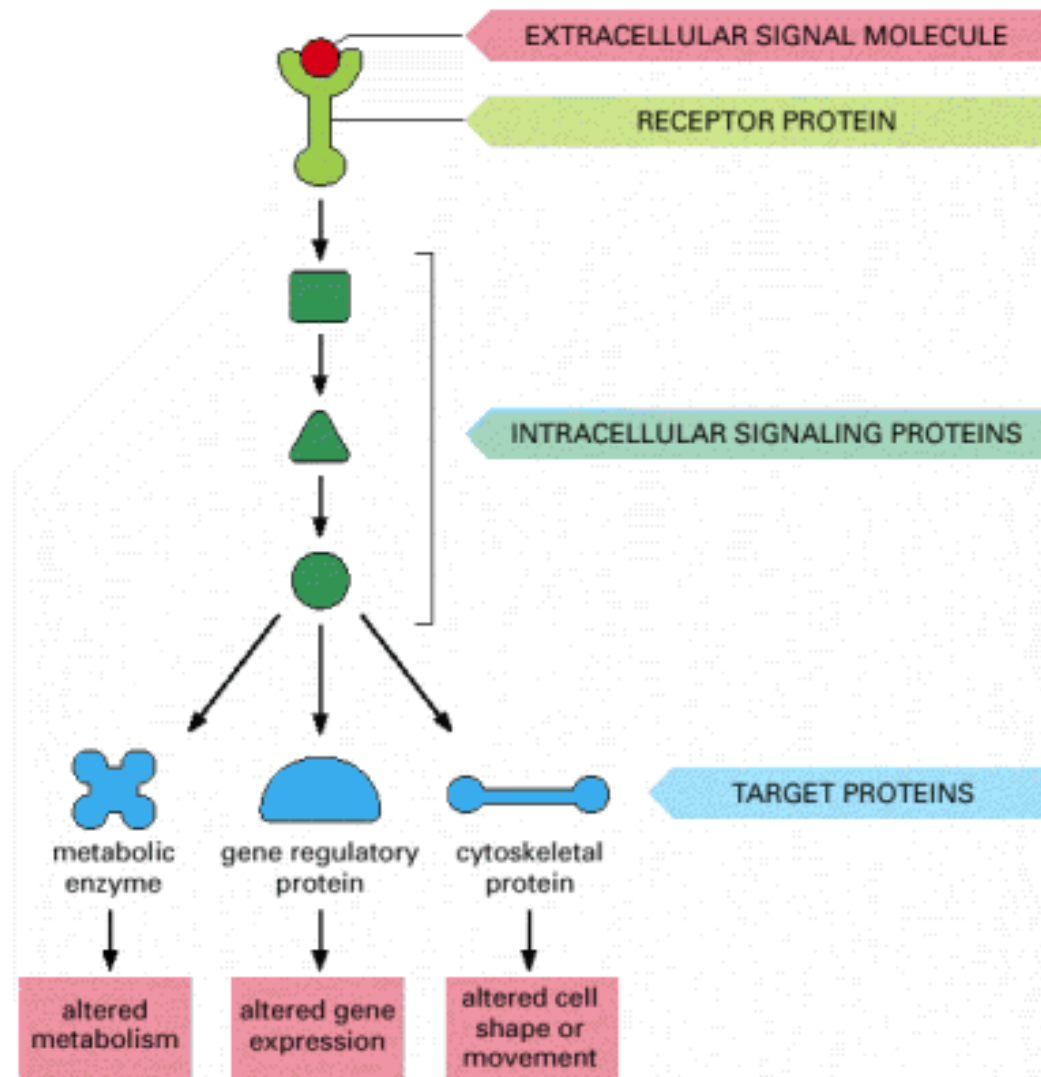
(A)



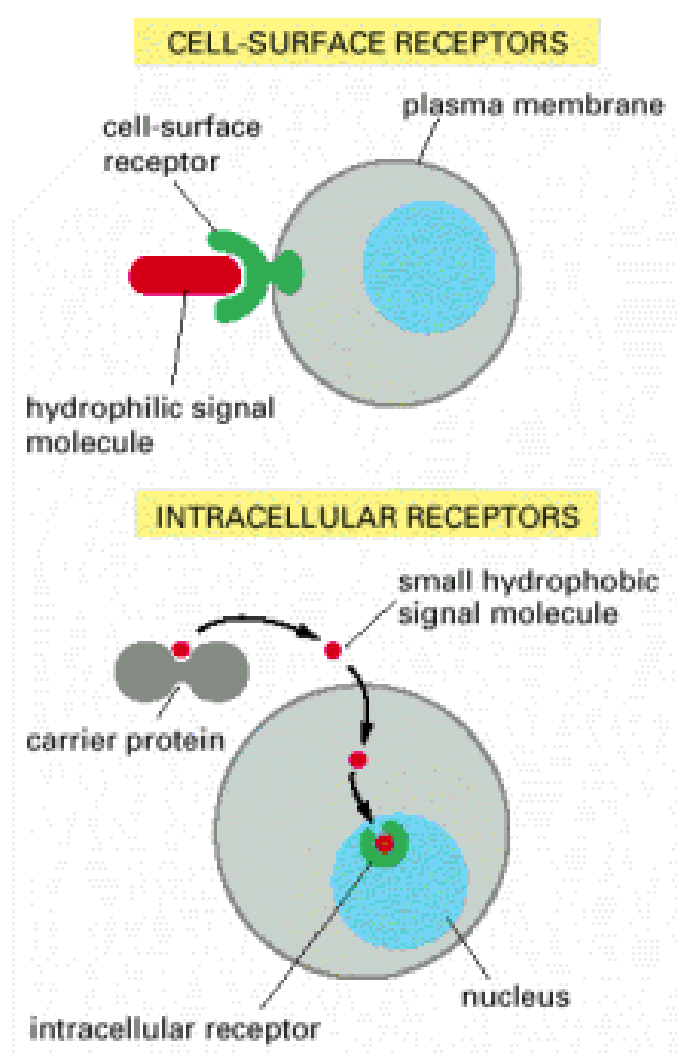
(B)

10 μm

Signaling pathway activated by an extracellular signal molecule

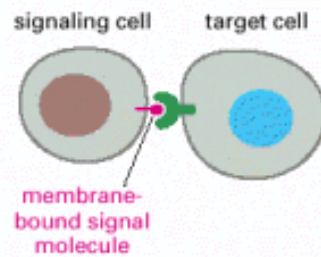


Cell-surface receptor or intracellular receptor

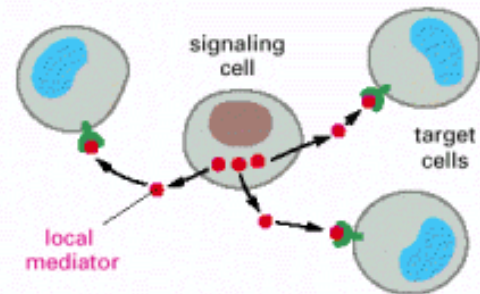


Forms of intracellular signaling

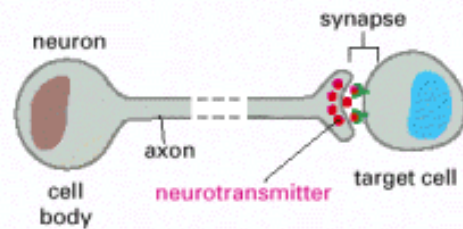
(A) CONTACT-DEPENDENT



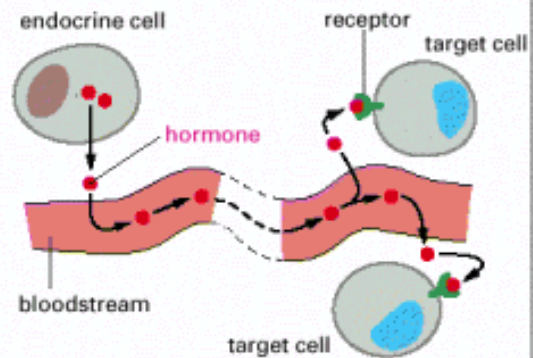
(B) PARACRINE



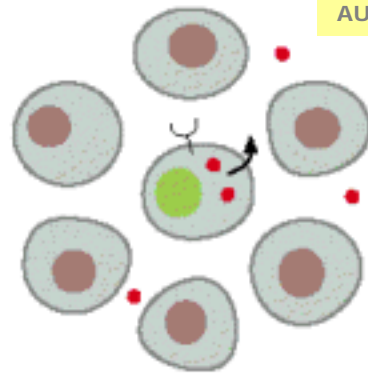
(C) SYNAPTIC



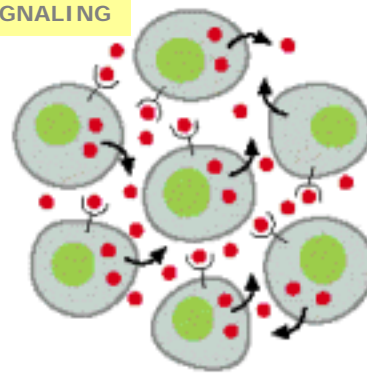
(D) ENDOCRINE



AUTOCRINE SIGNALING

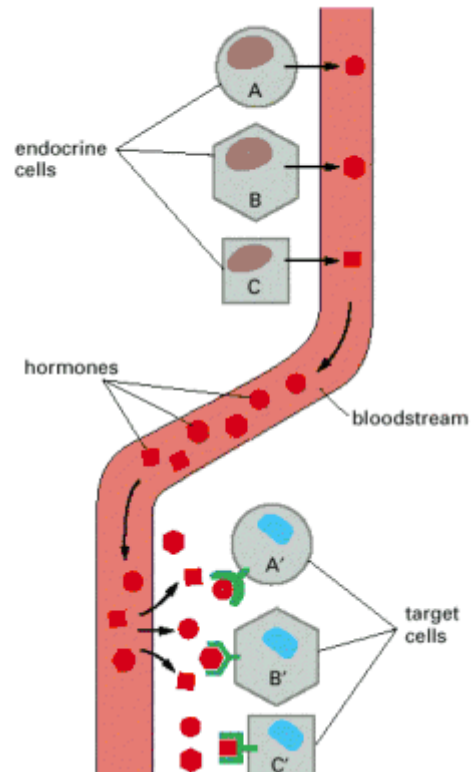


A SINGLE SIGNALING CELL
RECEIVES A WEAK AUTOCRINE
SIGNAL

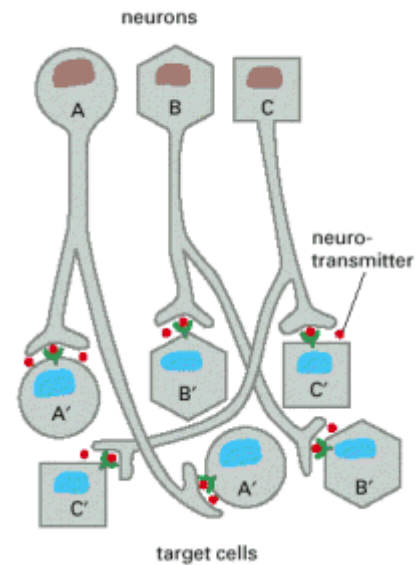


IN A GROUP OF IDENTICAL SIGNALING
CELLS, EACH CELL RECEIVES A STRONG
AUTOCRINE SIGNAL

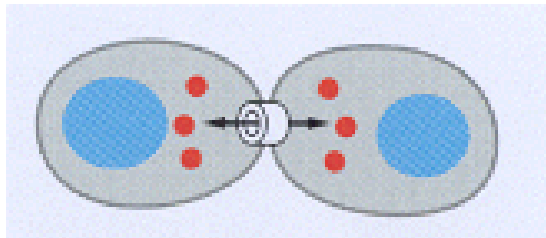
(A) ENDOCRINE SIGNALING



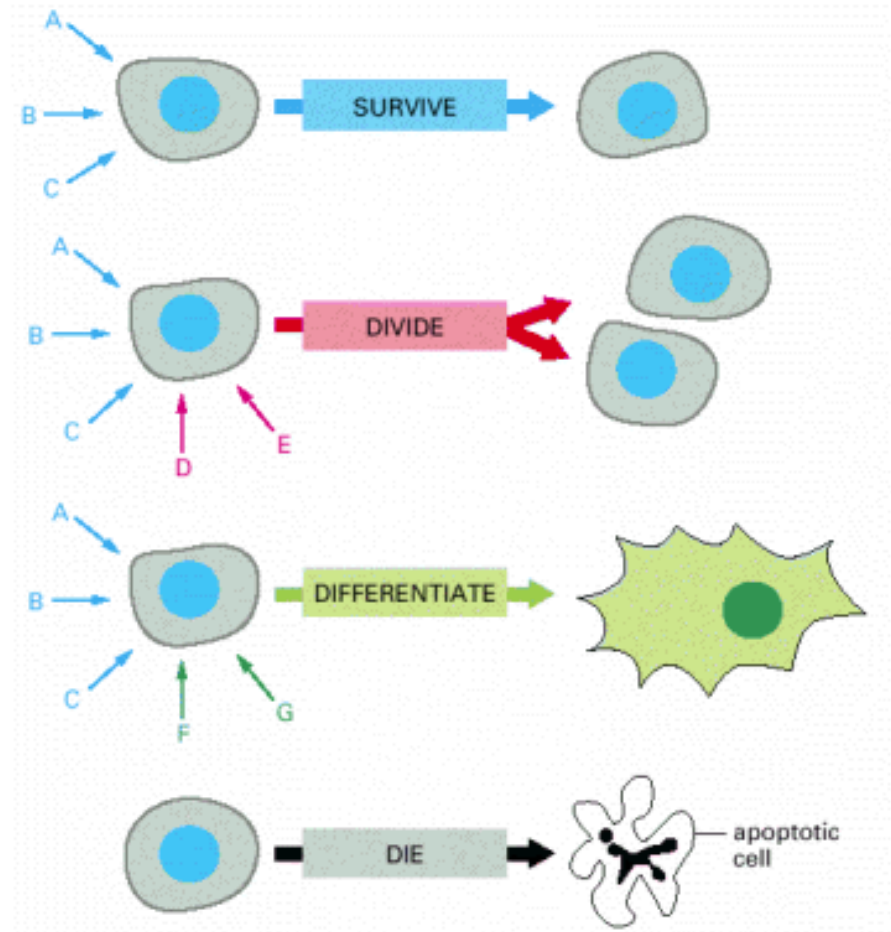
(B) SYNAPTIC SIGNALING

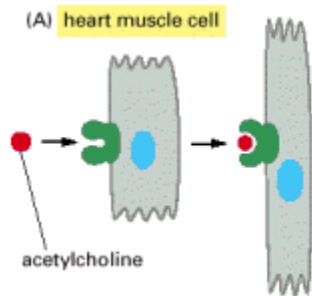


Multiple extracellular signals

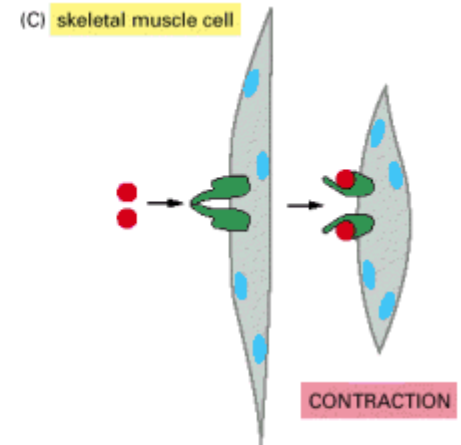
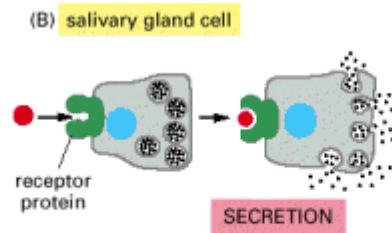


Signaling via gap junction



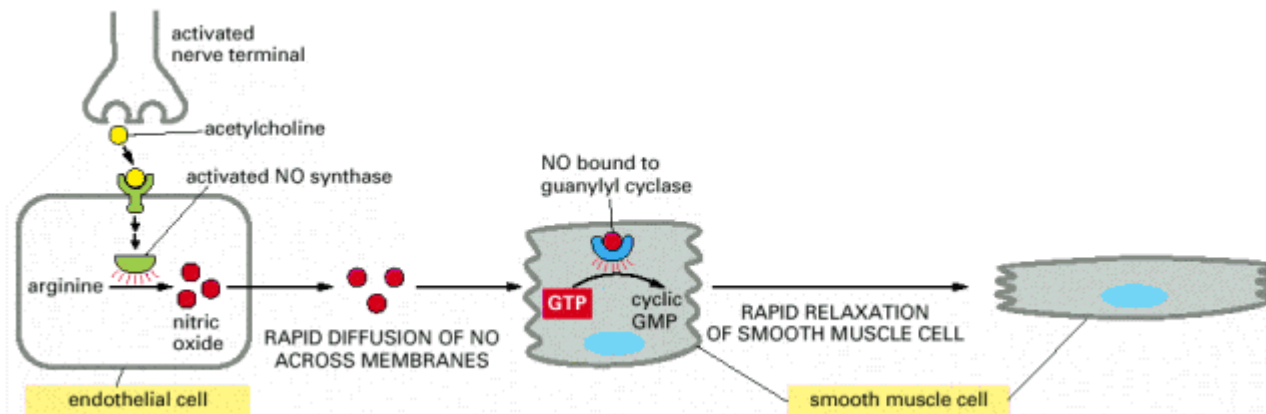
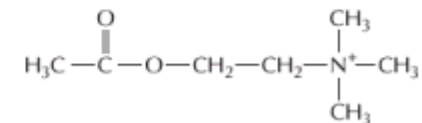


DECREASED RATE AND FORCE OF CONTRACTION

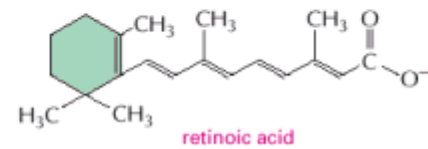
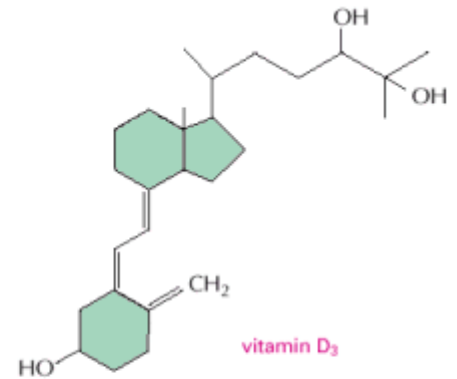
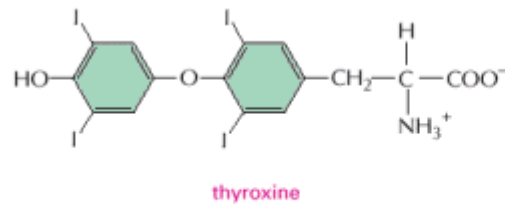
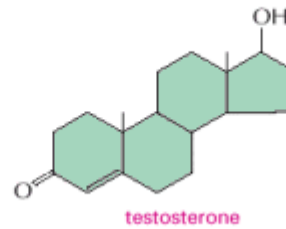
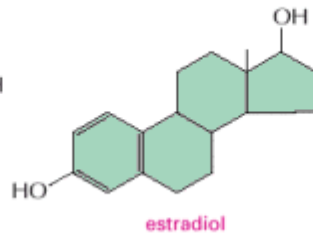
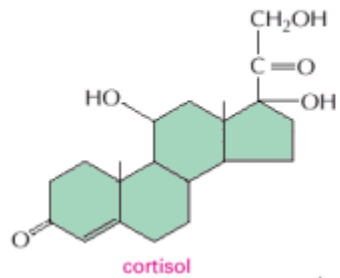


Responses induced by the neurotransmitter acetylcholine

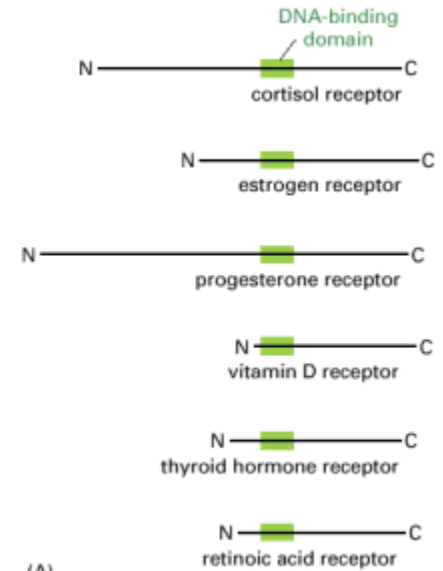
(D) acetylcholine



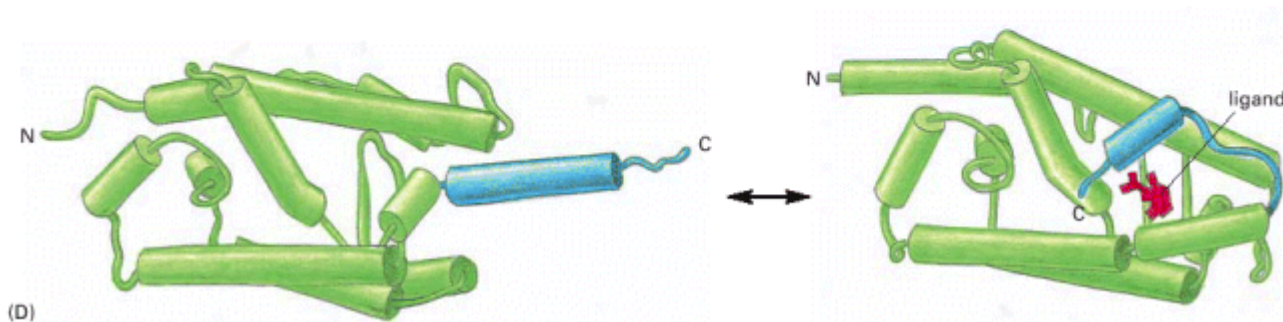
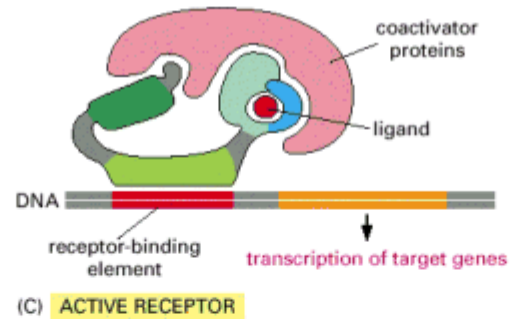
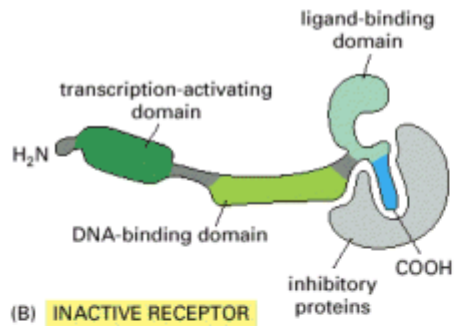
Signaling molecules that bind to nuclear receptor



RECEPTORES ESTEROIDALES

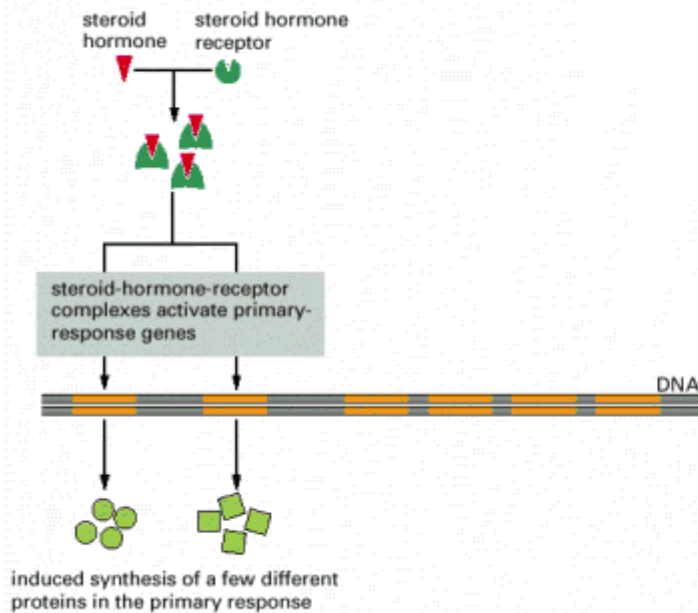


(A)

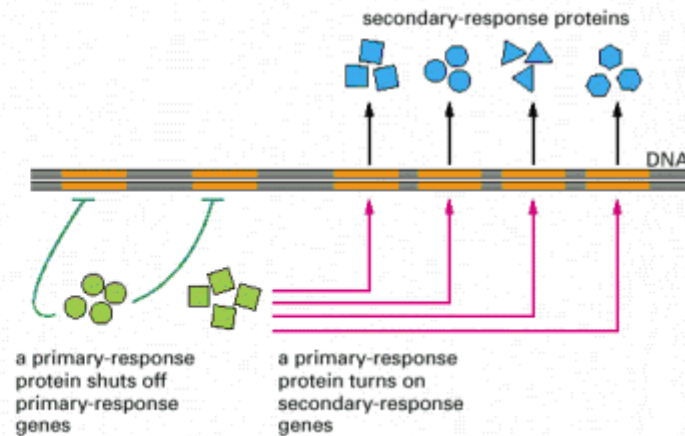


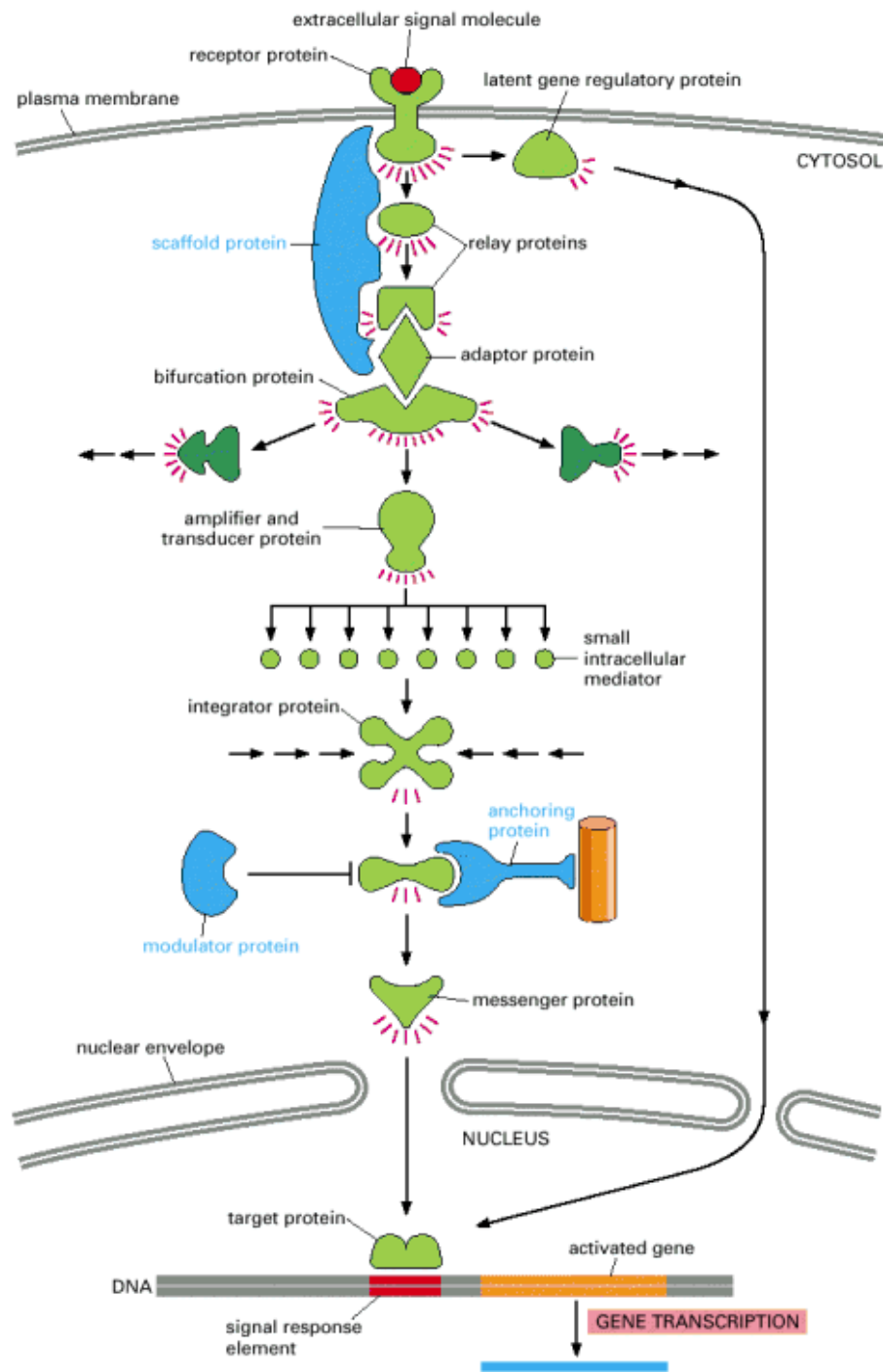
Responses induced by the activation of a nuclear hormone receptor

(A) **EARLY PRIMARY RESPONSE TO STEROID HORMONE**

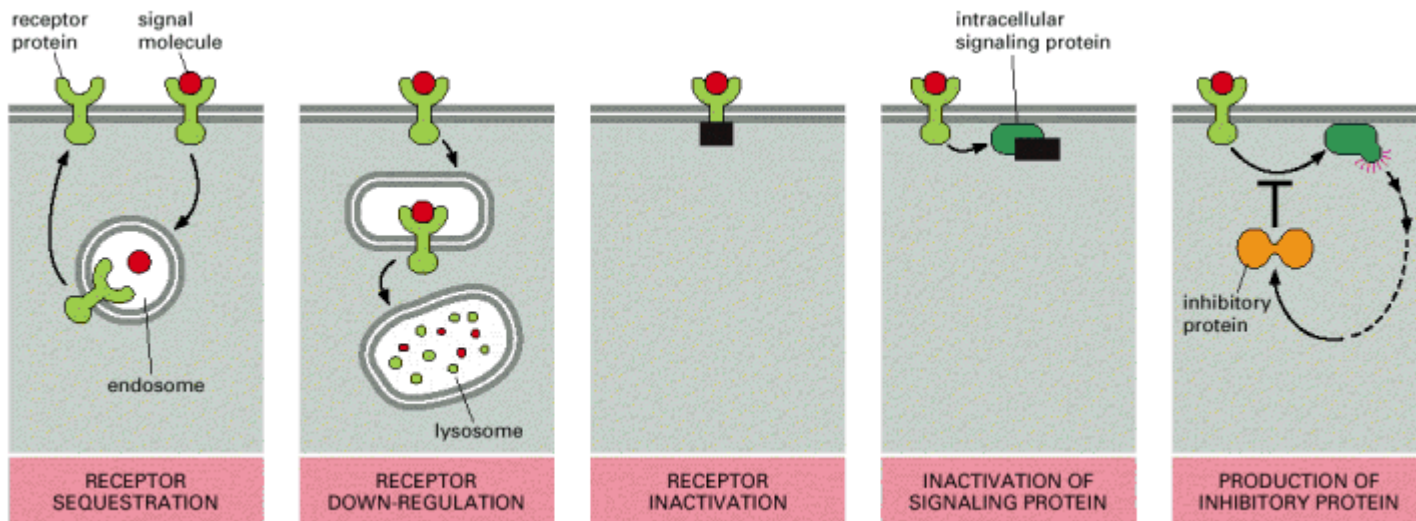


(B) **DELAYED SECONDARY RESPONSE TO STEROID HORMONE**





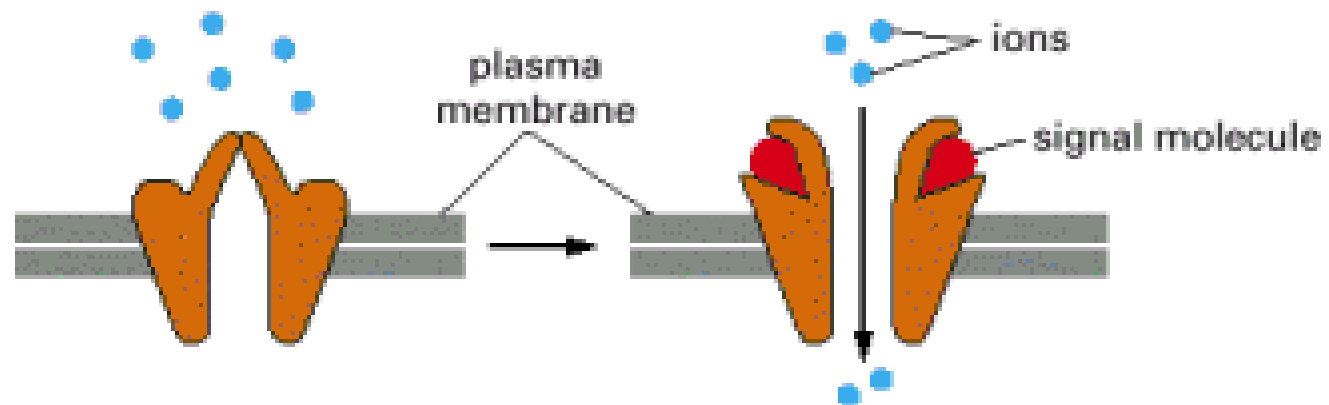
Five ways in which target cells can become desensitized to a signal molecule



Receptores de superficie celular y señalización intracelular

- Receptores tipo canales iónicos
- Receptores unidos a proteína G
- Receptores tipo enzima

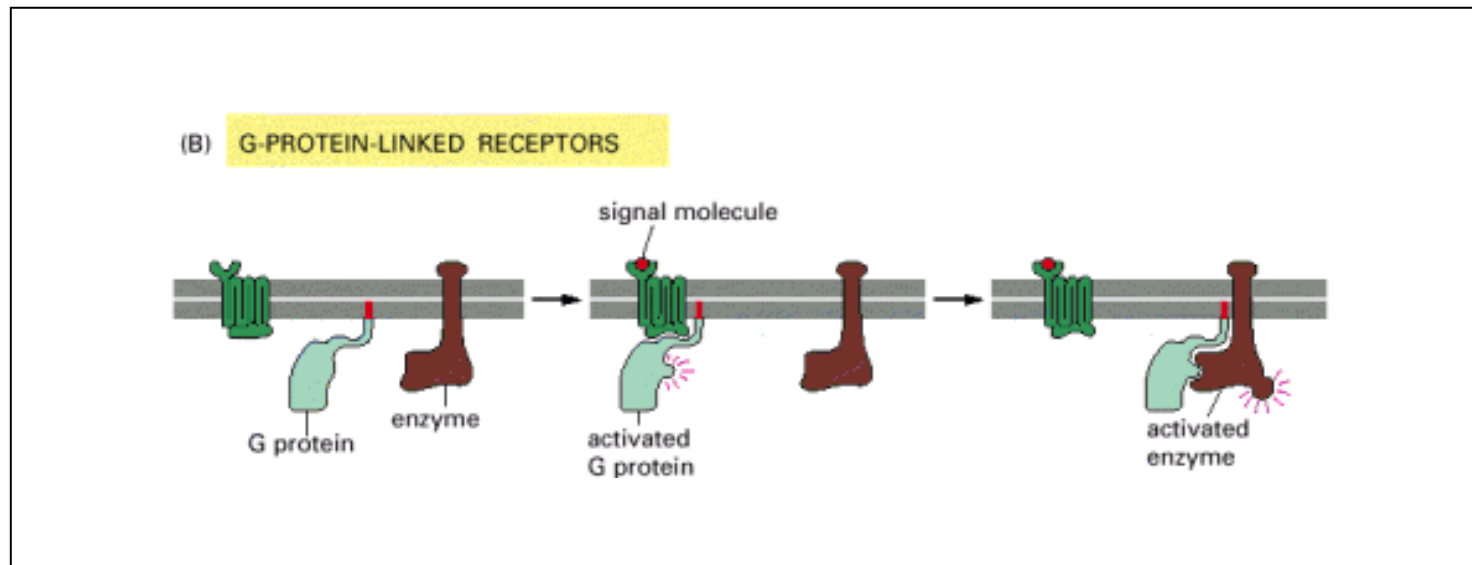
(A) ION-CHANNEL-LINKED RECEPTORS



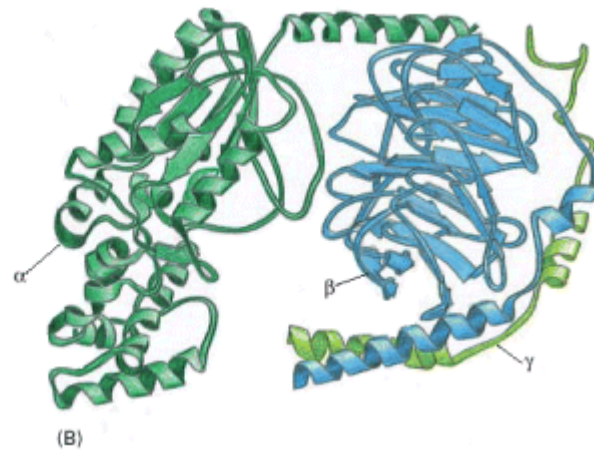
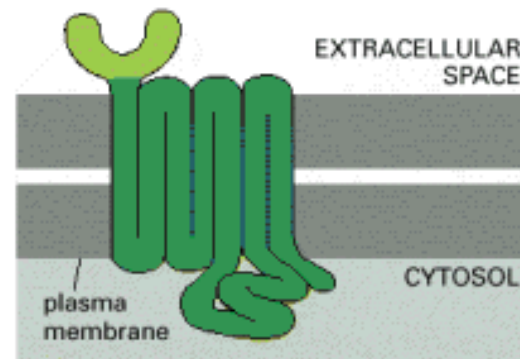
Receptores de superficie celular y señalización intracelular

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- Receptores tipo enzima

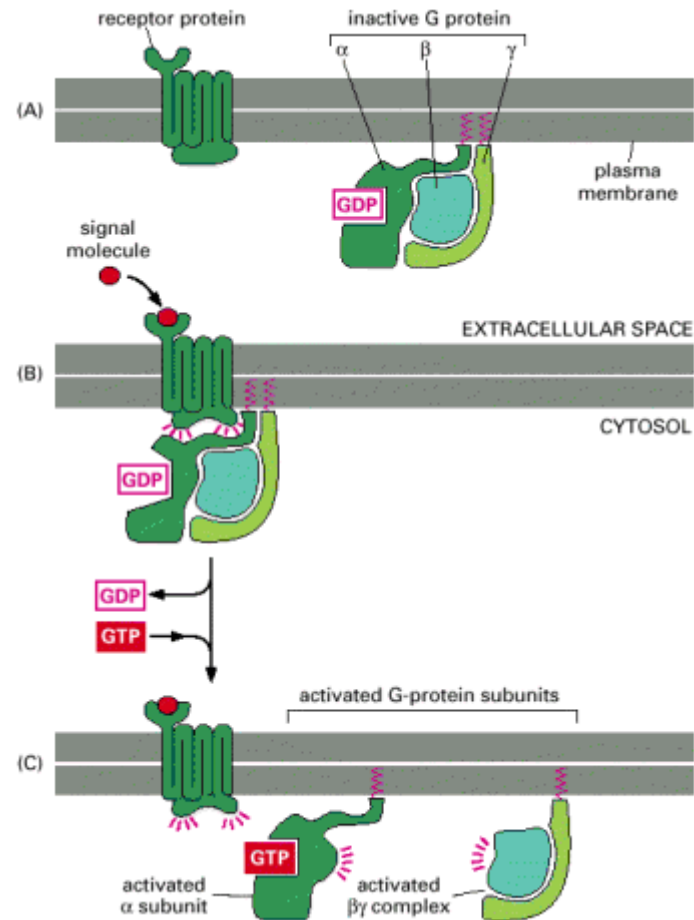
Receptores unidos a proteína G

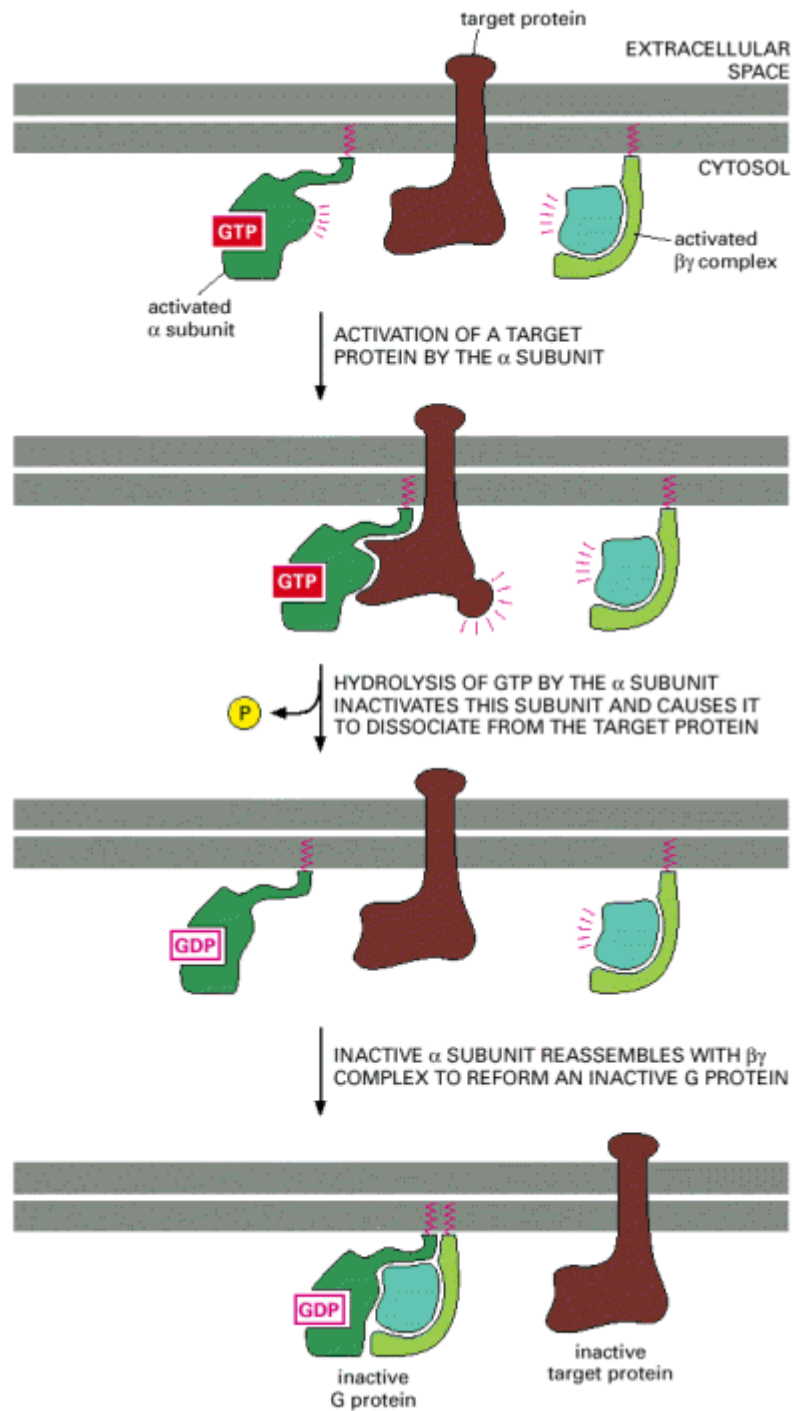


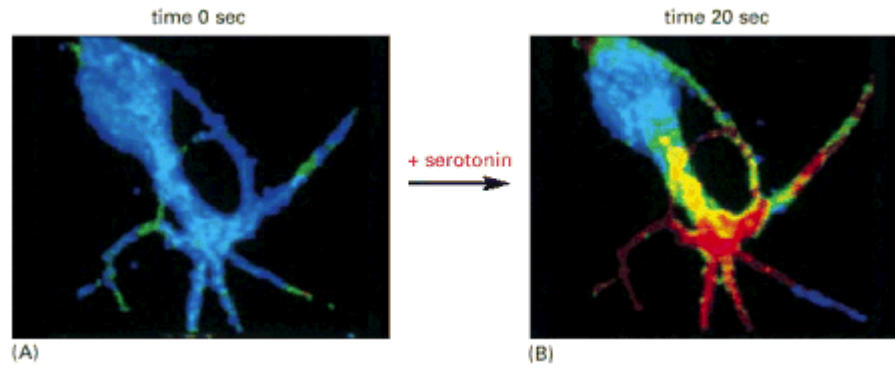
A G-protein-linked receptor



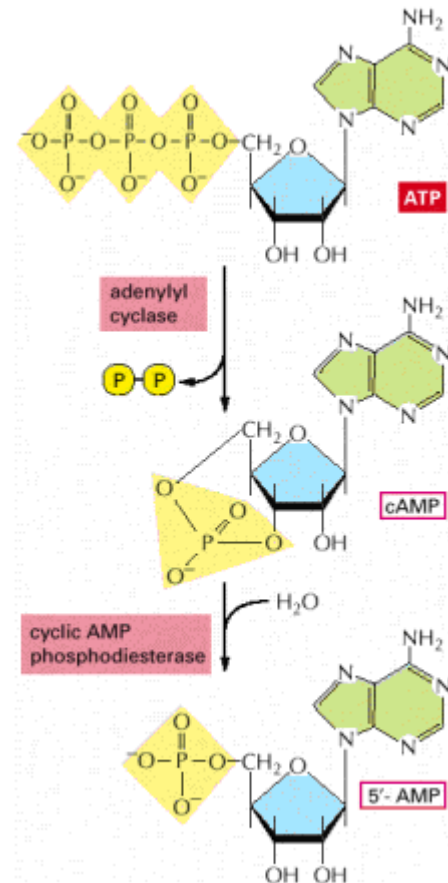
The disassembly of an activated G-protein into two signaling components



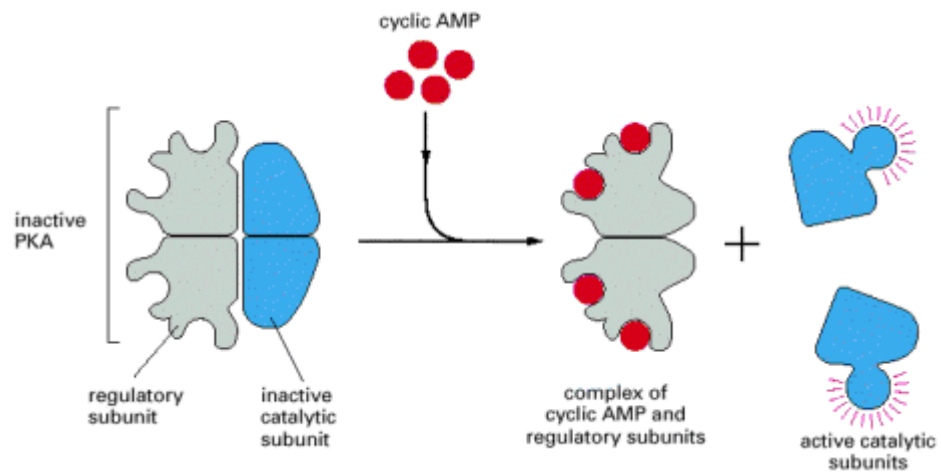




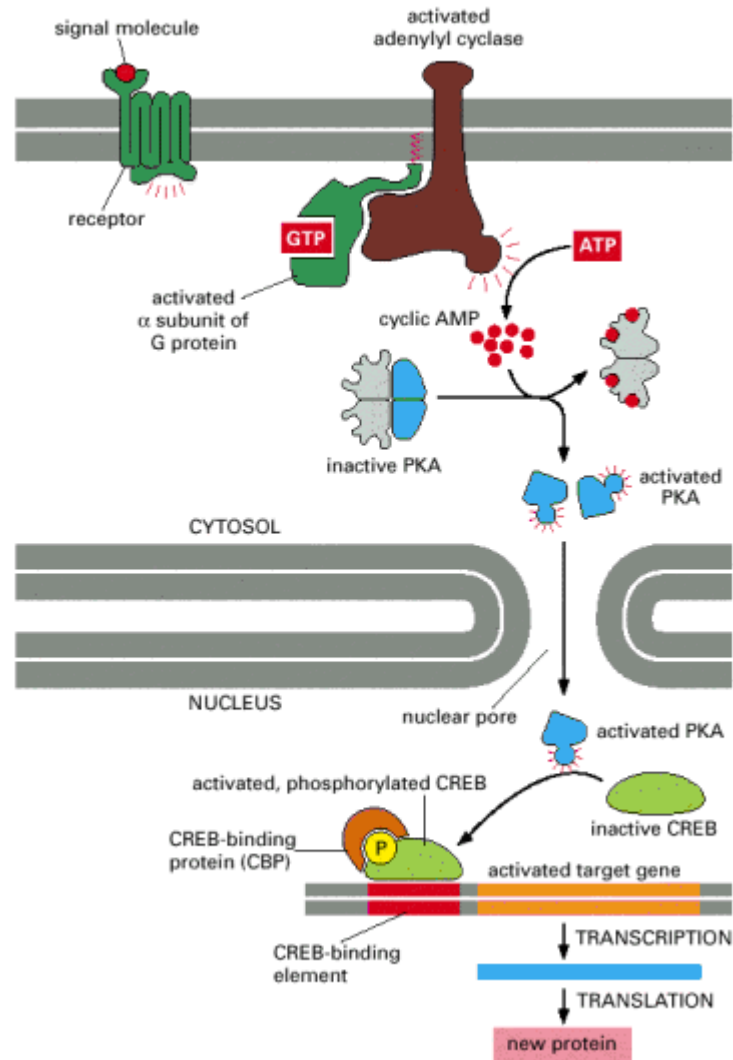
The synthesis and degradation of cyclic AMP (cAMP)



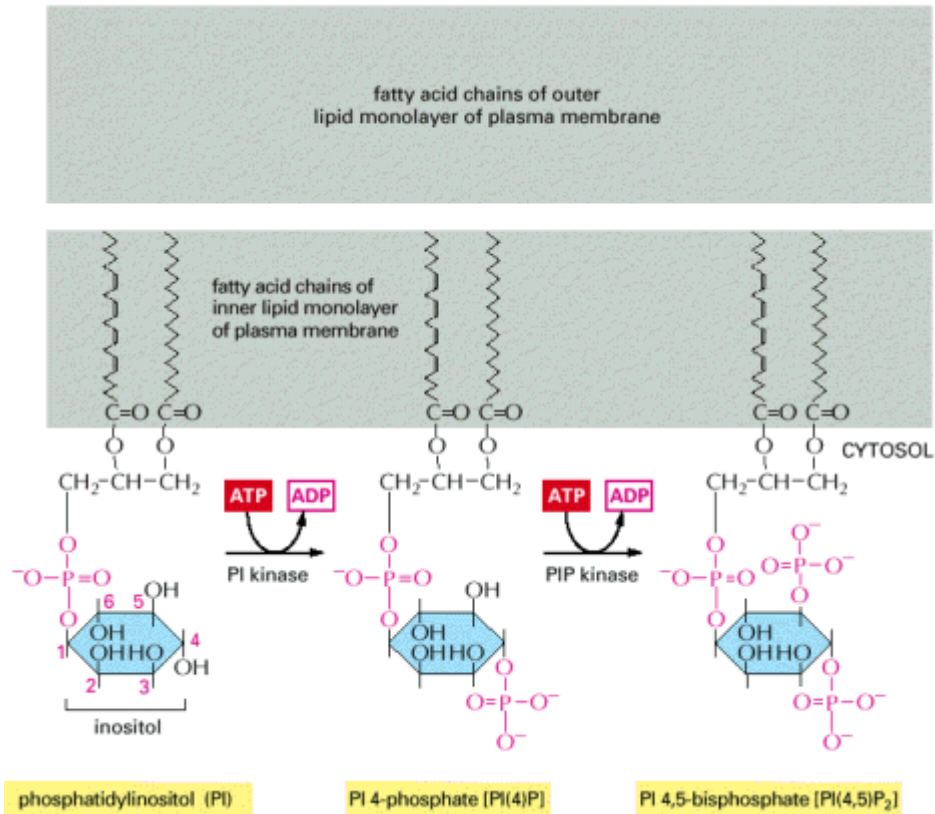
The activation of cAMP-dependent protein kinase (PKA)



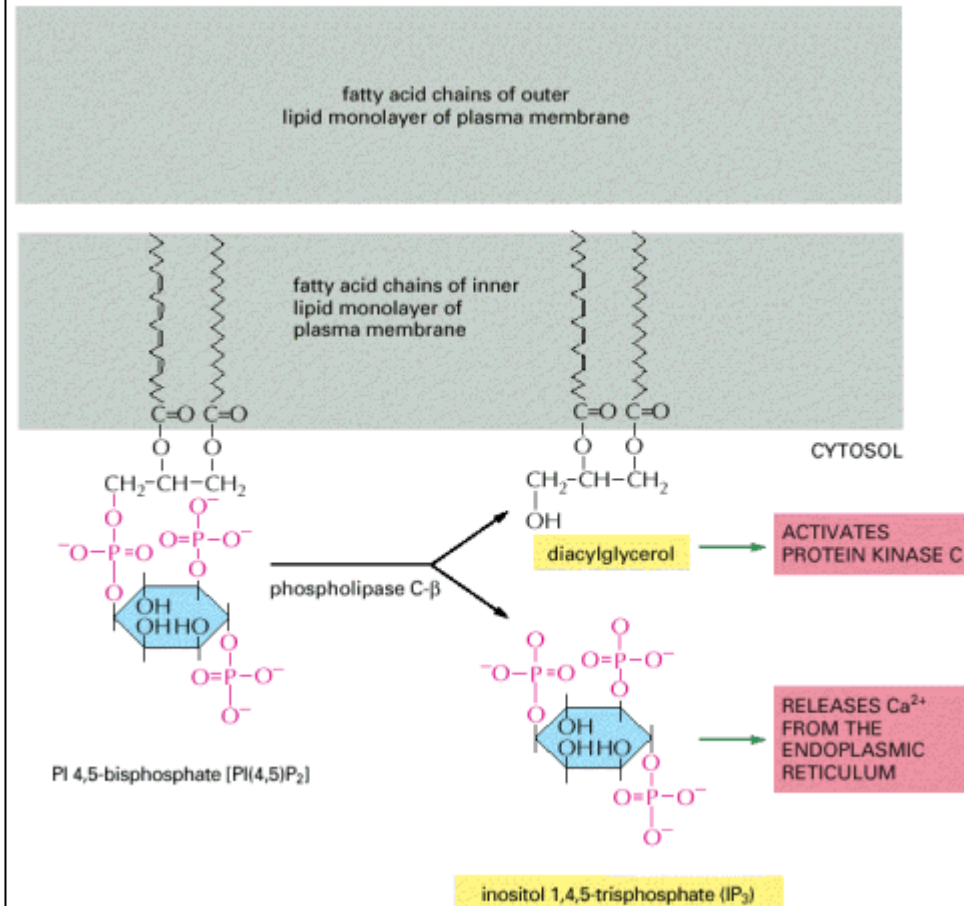
How gene transcription is activated by a rise in cyclic AMP concentration



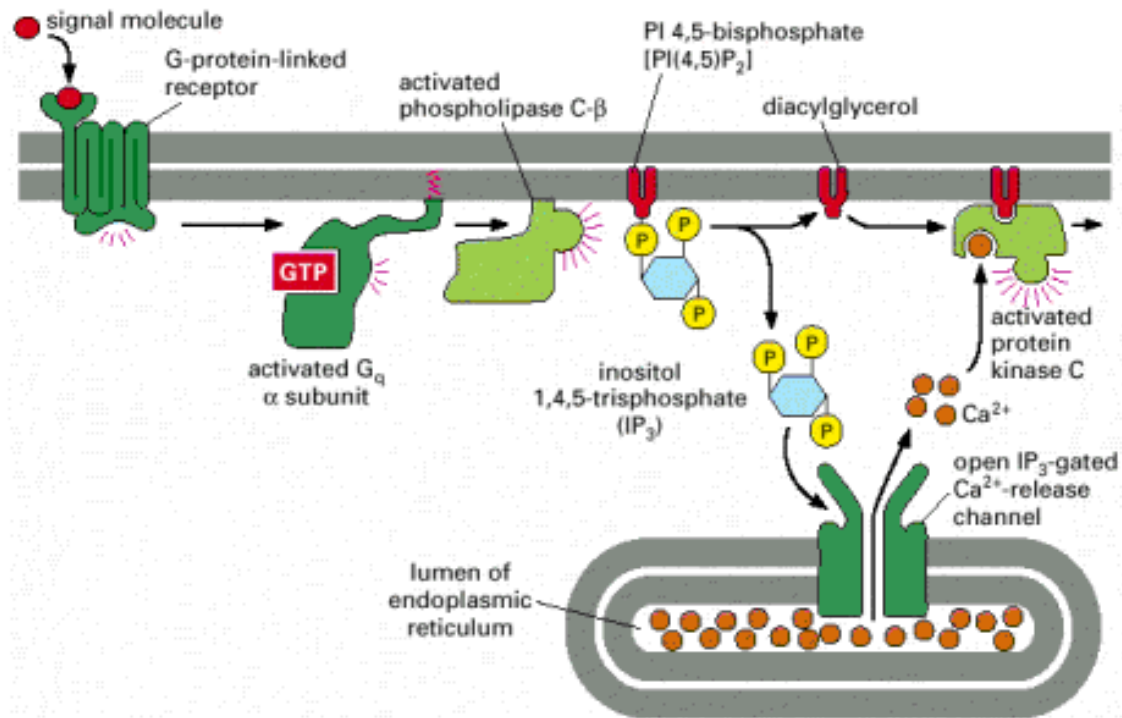
Three types of inositol phospholipds (phosphoinositides)



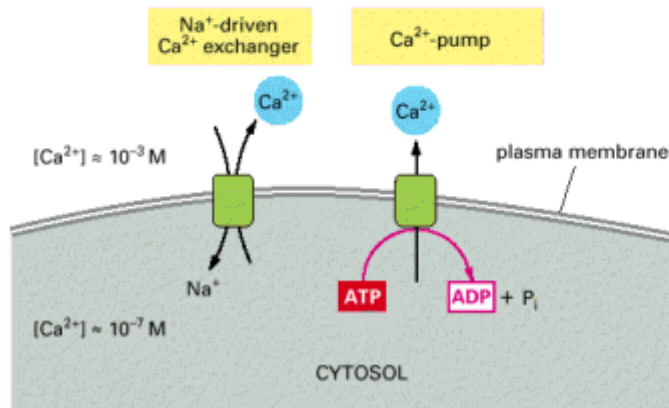
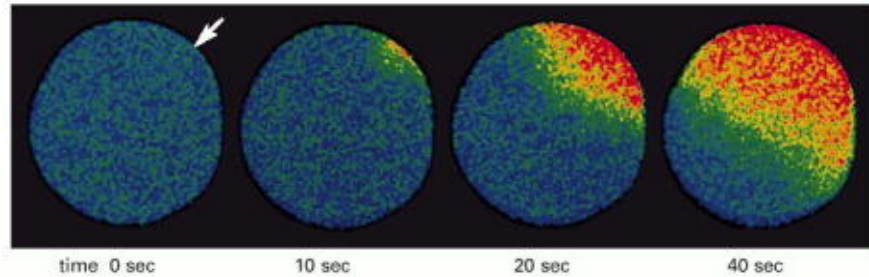
The hydrolysis of PI(4,5)P₂ by phospholipase C-β



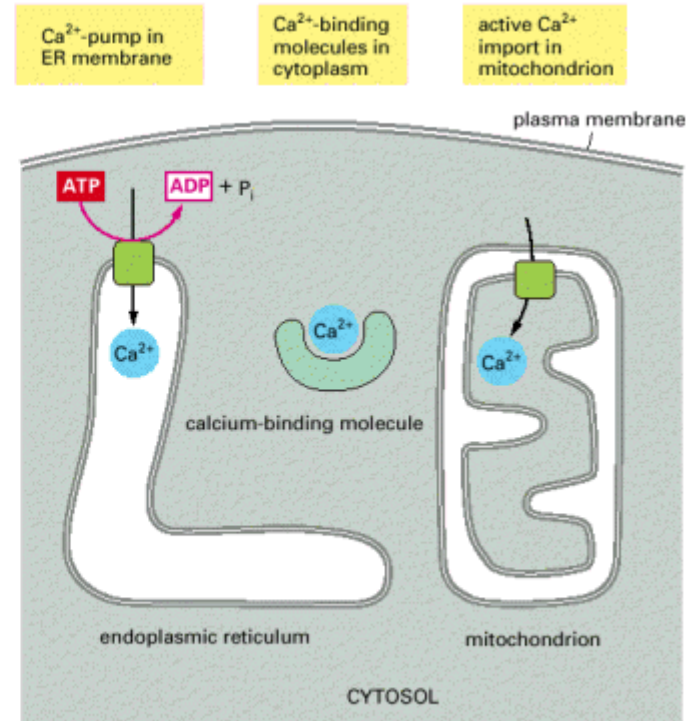
The inositol phospholipid pathway



Ca²⁺ functions as intracellular messenger



(A)

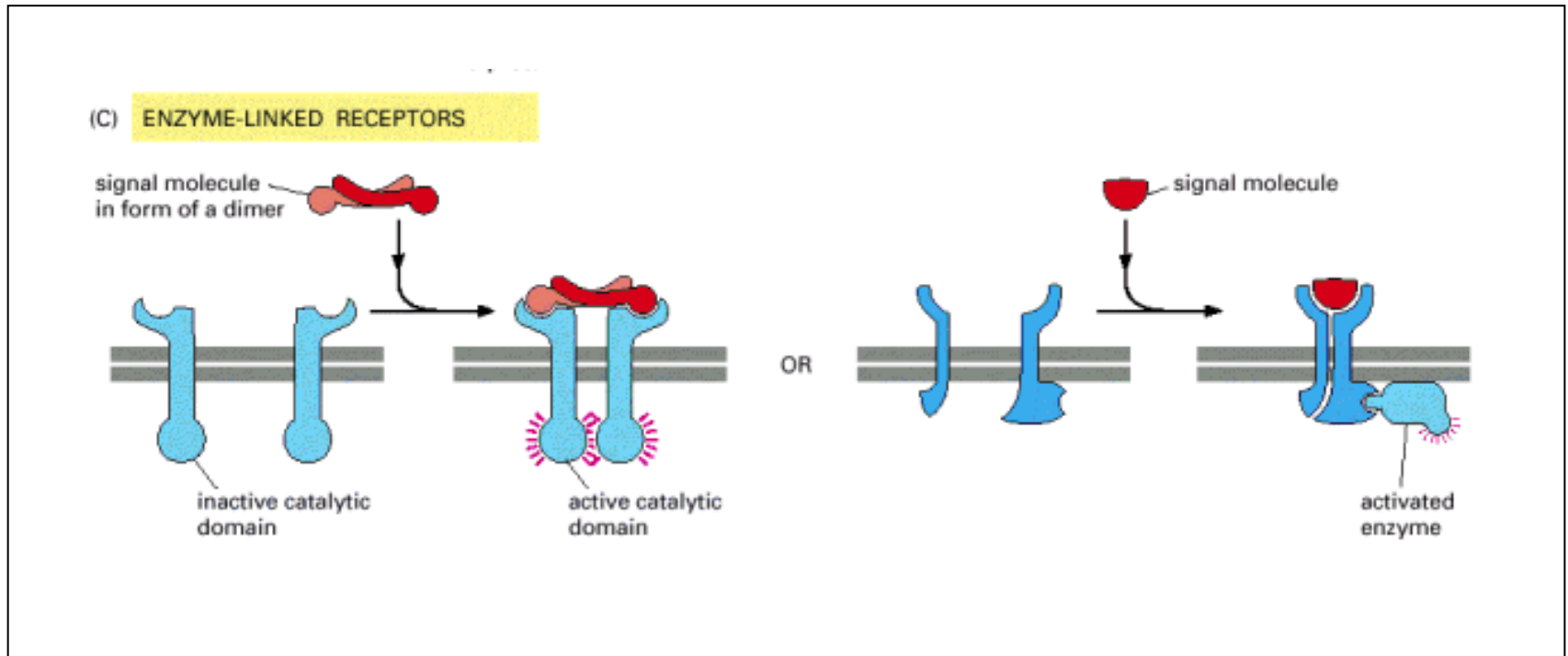


(B)

Receptores de superficie celular y señalización intracelular

- Receptores tipo canales iónicos
- Receptores unidos a proteína G
- Receptores tipo enzima

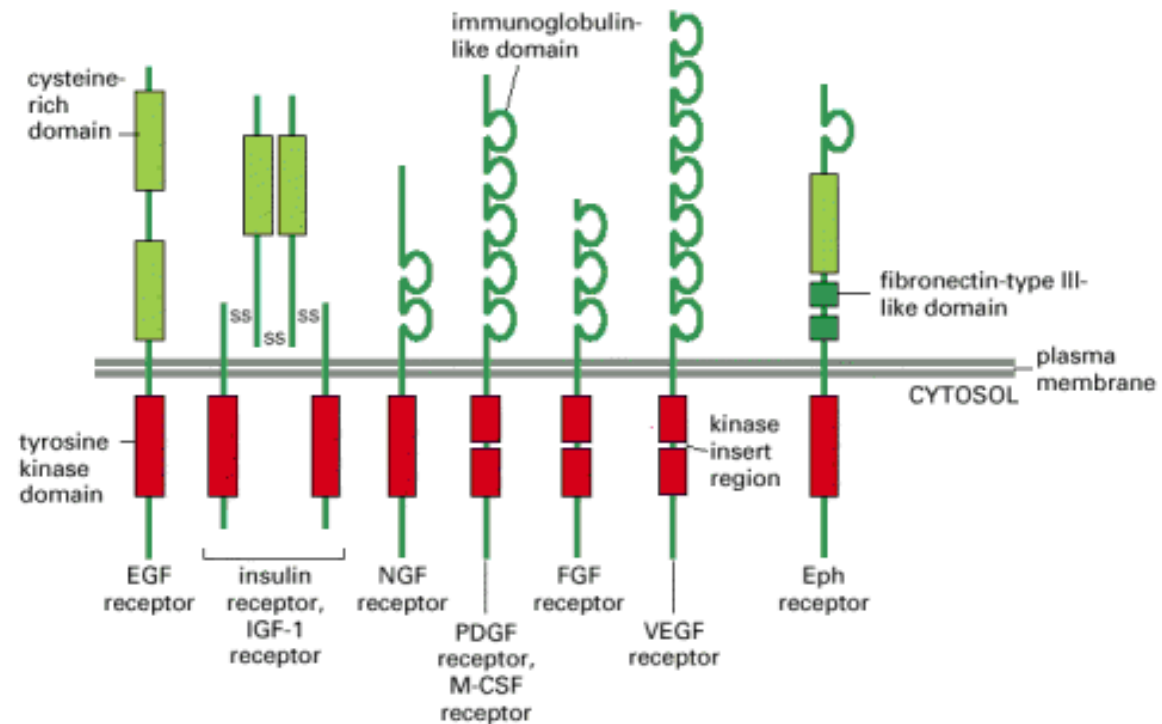
Receptores tipo enzima (Enzyme-linked receptors)



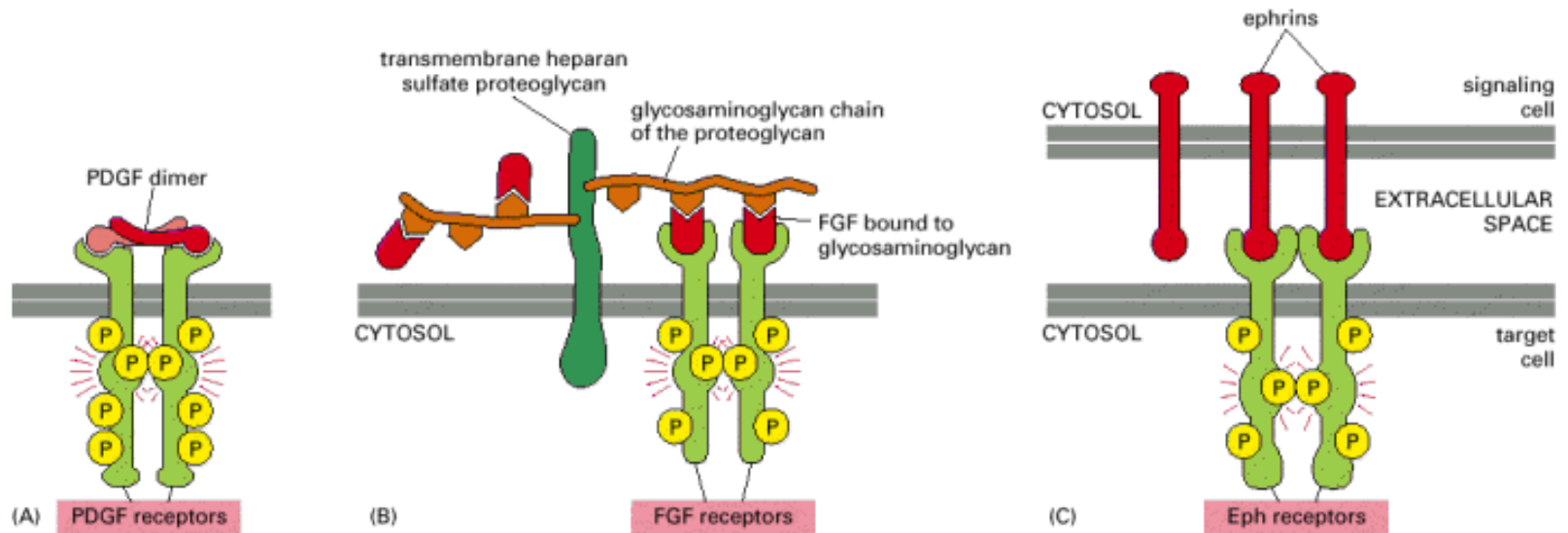
Receptores tipo enzima (Enzyme-linked receptors)

- Tirosine kinase receptor
- Tirosine-kinase-asociated receptors
- Receptorlike tirosine phosphatases
- Receptor serine/threonine kinases
- Receptor guanylyl cyclases
- Histidine-kinase-associated receptor

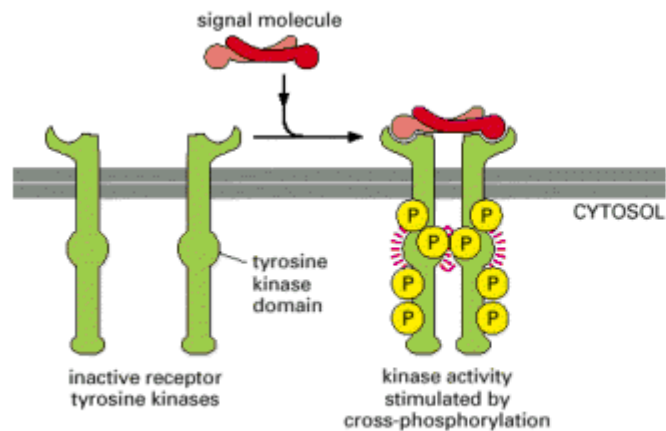
SEVEN SUBFAMILIES OF RECEPTOR TYROSINE KINASE



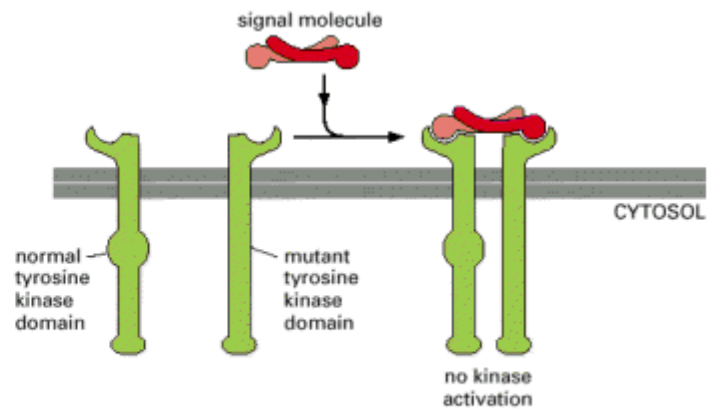
Three ways in which signaling proteins can cross-link receptor chains



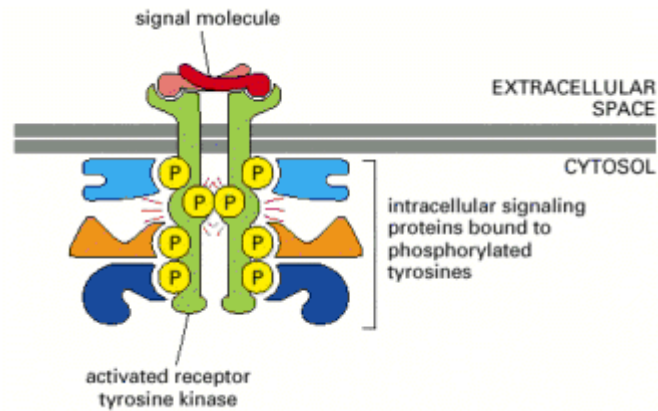
Tyrosine Kinase



(A) NORMAL RECEPTOR ACTIVATION



(B) DOMINANT-NEGATIVE INHIBITION BY MUTANT RECEPTOR



FIVE PARALLEL INTRACELLULAR SIGNALING, PATHWAYS ACTIVATED BY G-PROTEIN-LINKED RECEPTOR, RECEPTOR TYROSINE KINASES OR BOTH

