

A stylized tree with a blue trunk and yellow branches, set against a black background. The trunk is a solid blue sphere at the bottom, with a thin yellow stem extending upwards. The branches are a complex, branching network of yellow lines, resembling a tree or a neural network. The background is solid black.

Señalización celular II

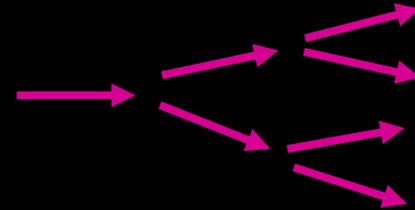
Flavio Zolessi

Propiedades básicas de los sistemas de transducción intracelular de señales

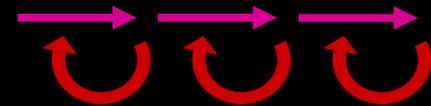
A - Reacciones encadenadas



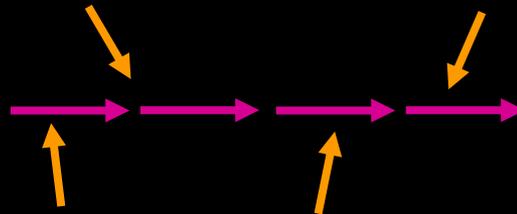
B - Amplificación de la señal



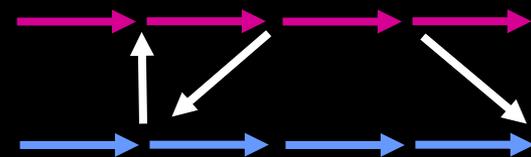
C - Reversibilidad de cada reacción



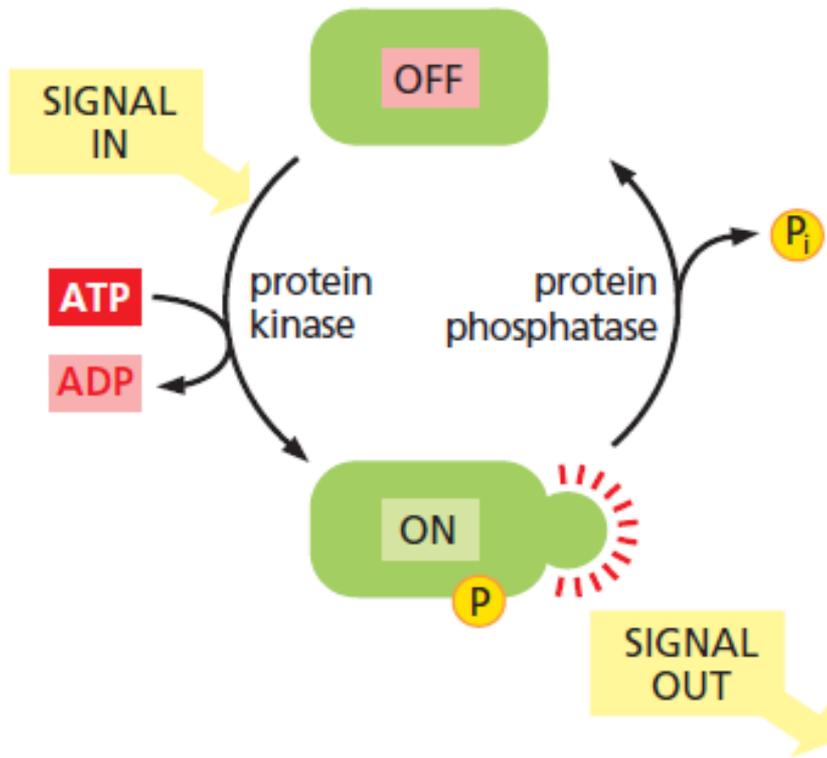
D - Regulación



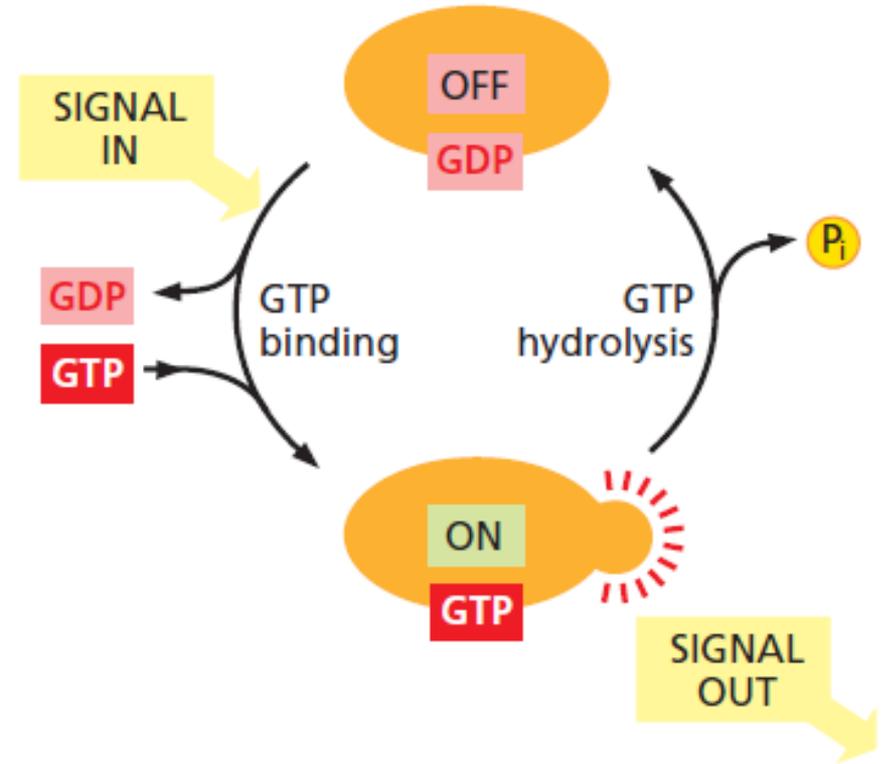
E - Intercomunicación entre vías
("crosstalk")



Switches moleculares: fosforilación y proteínas G

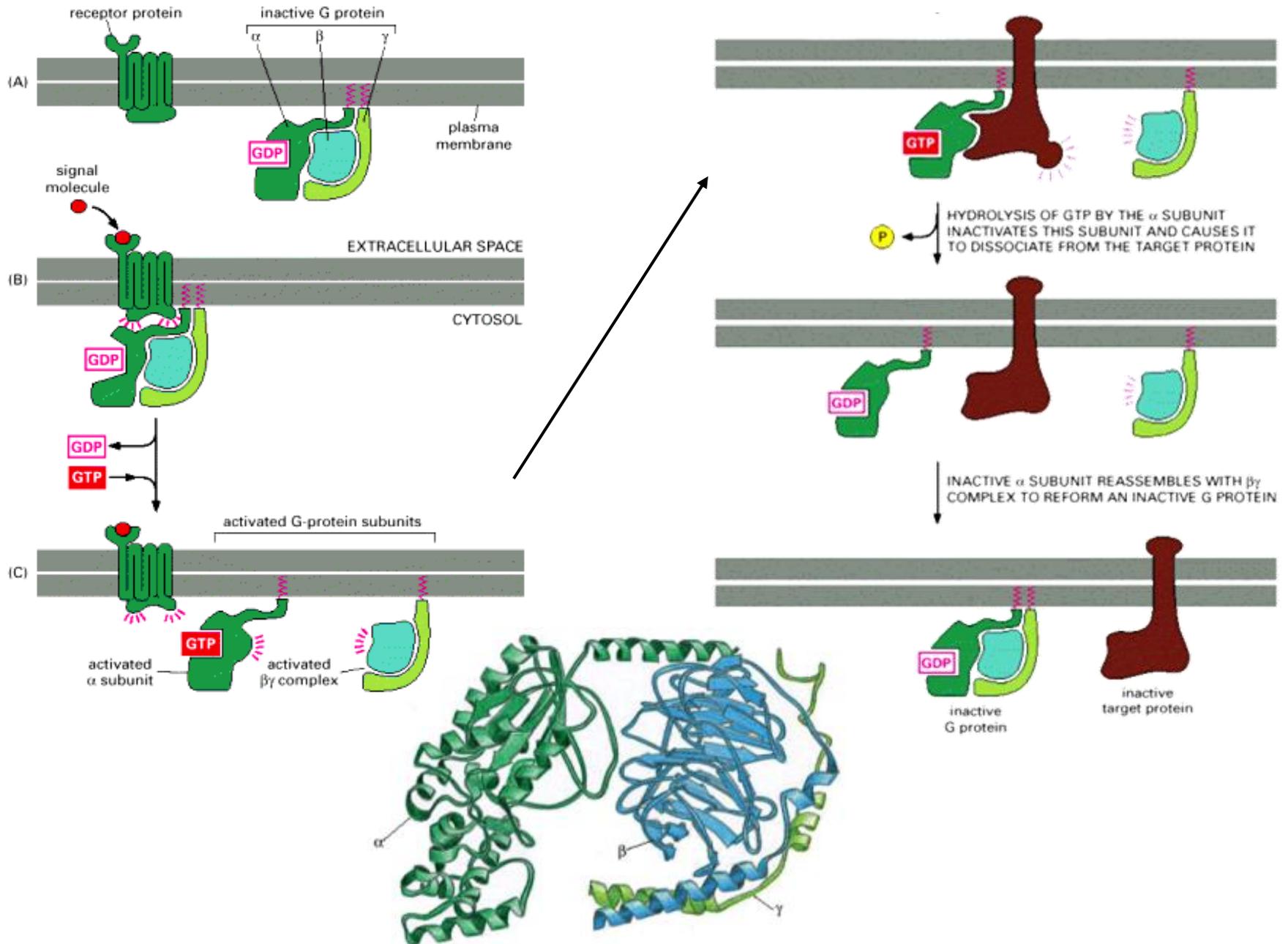


(A) SIGNALING BY PHOSPHORYLATION

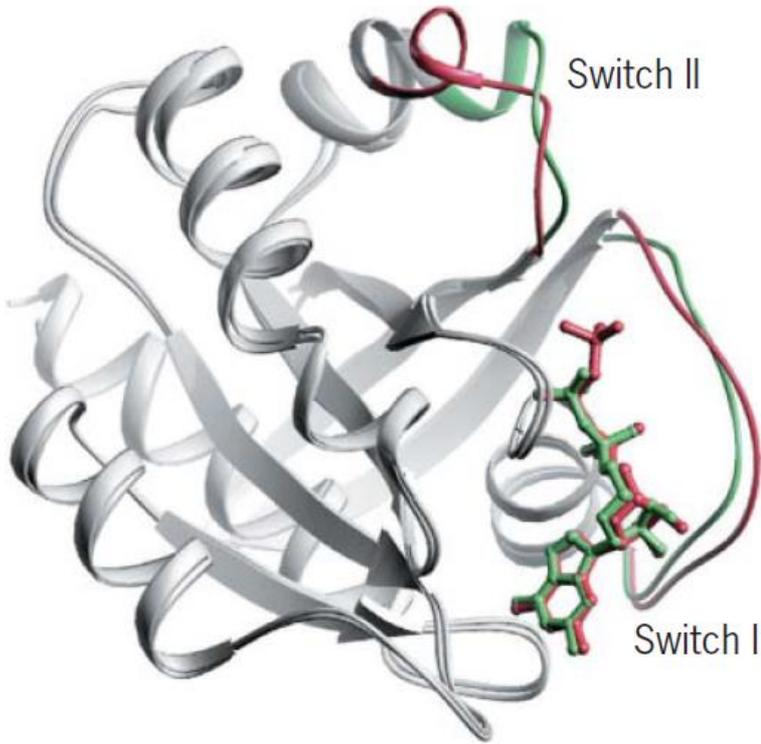


(B) SIGNALING BY GTP BINDING

Proteínas G heterotriméricas

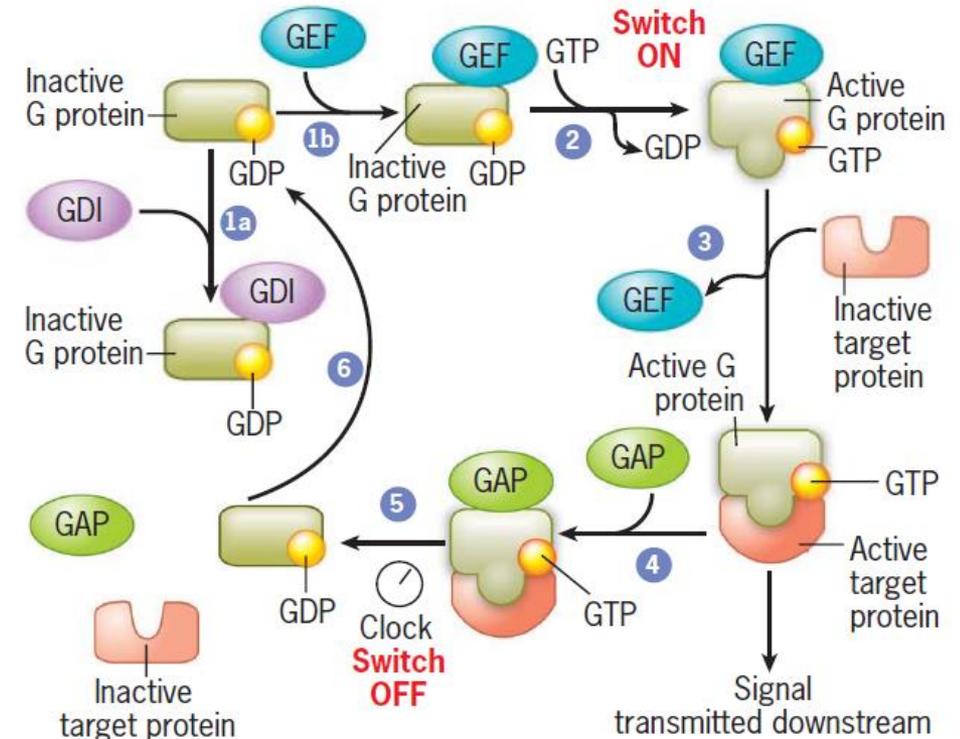


Proteínas G monoméricas



(a)

Ras



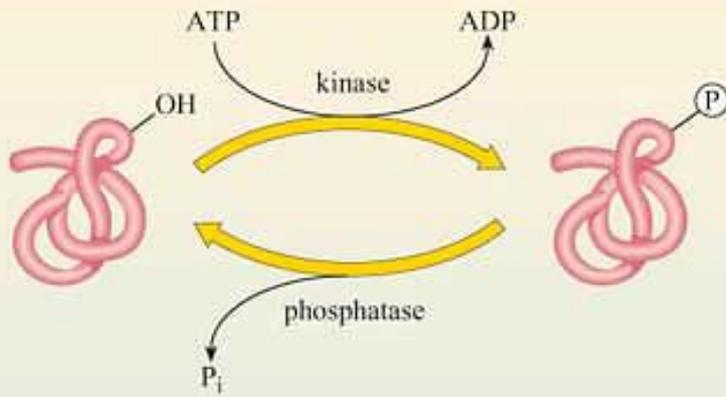
(b)

GEF: factor de intercambio de GTP

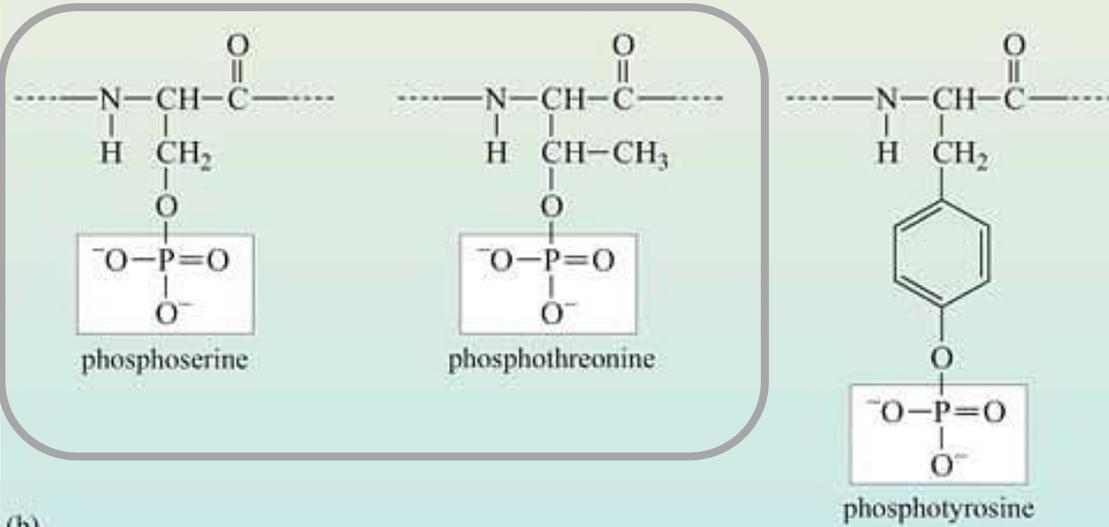
GAP: proteína activadora de GTPasa

GDI: inhibidor de la disociación de GDP

Fosforilación de proteínas

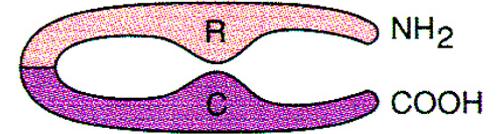


(a)

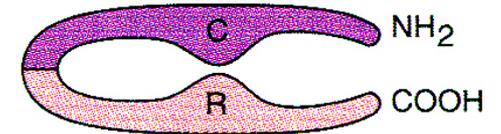


(b)

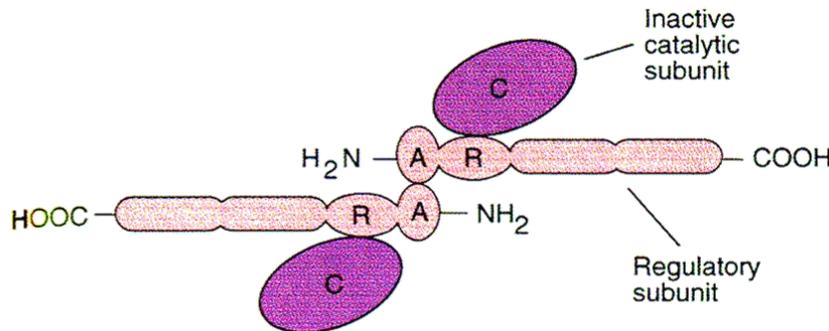
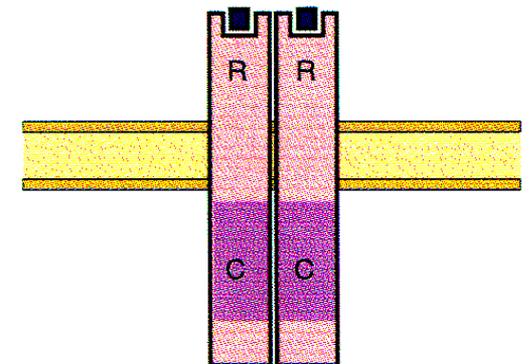
Protein kinase C



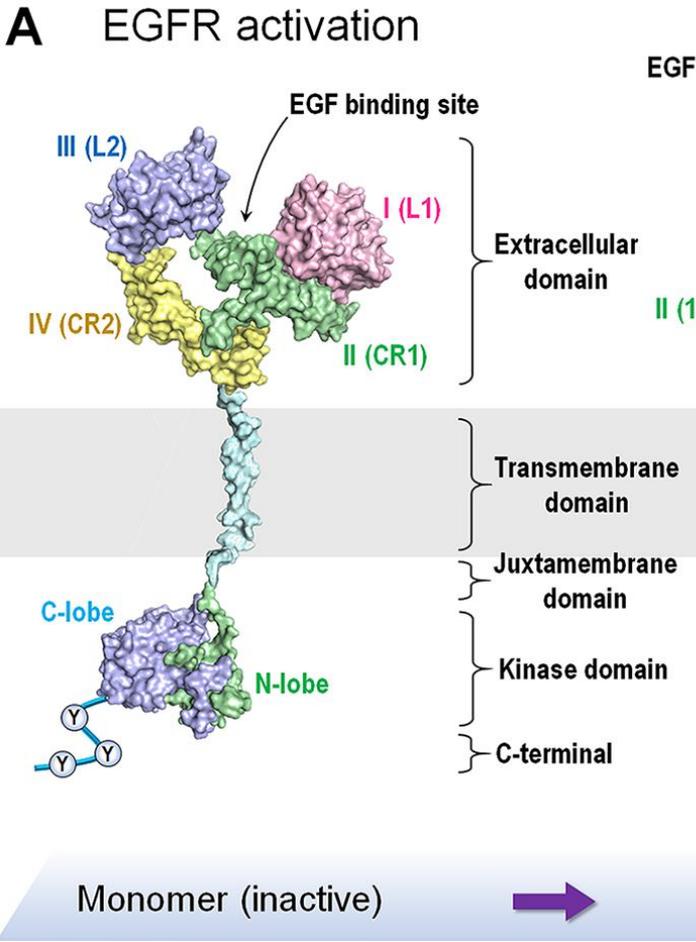
Ca²⁺/Calmodulin-dependent protein kinase



Tyrosine protein kinase



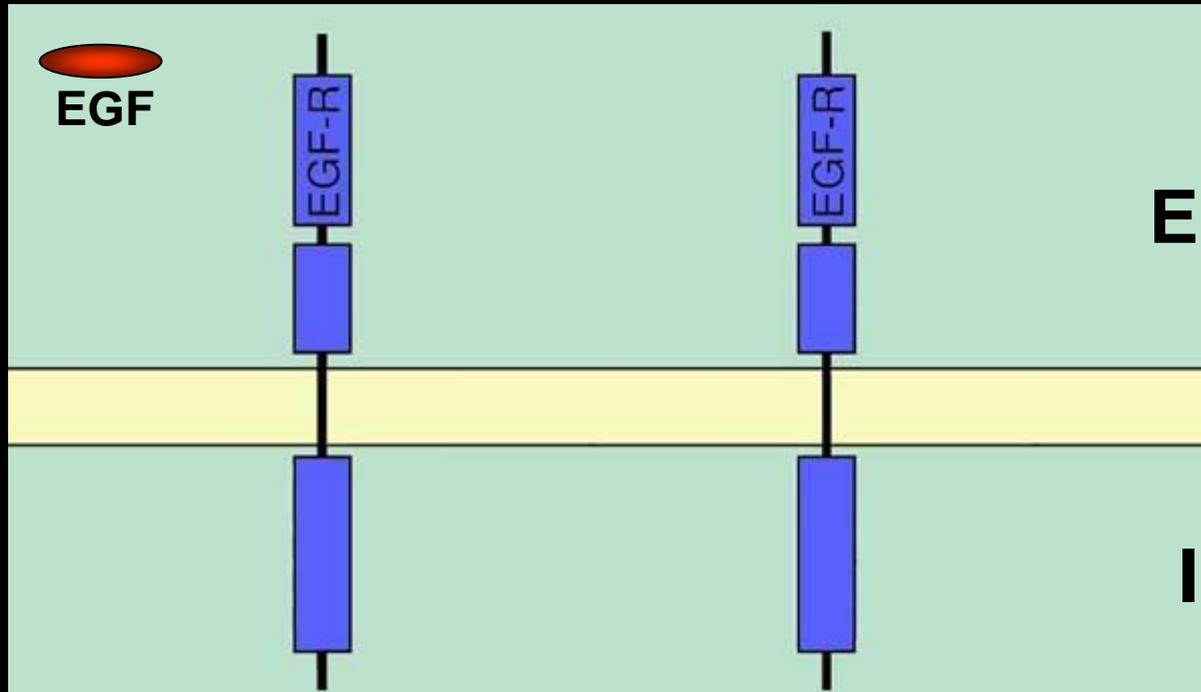
Activación de receptores tirosina-kinasa: EGFR



Nussinov et al., 2019; <https://doi.org/10.1371/journal.pcbi.1006658>

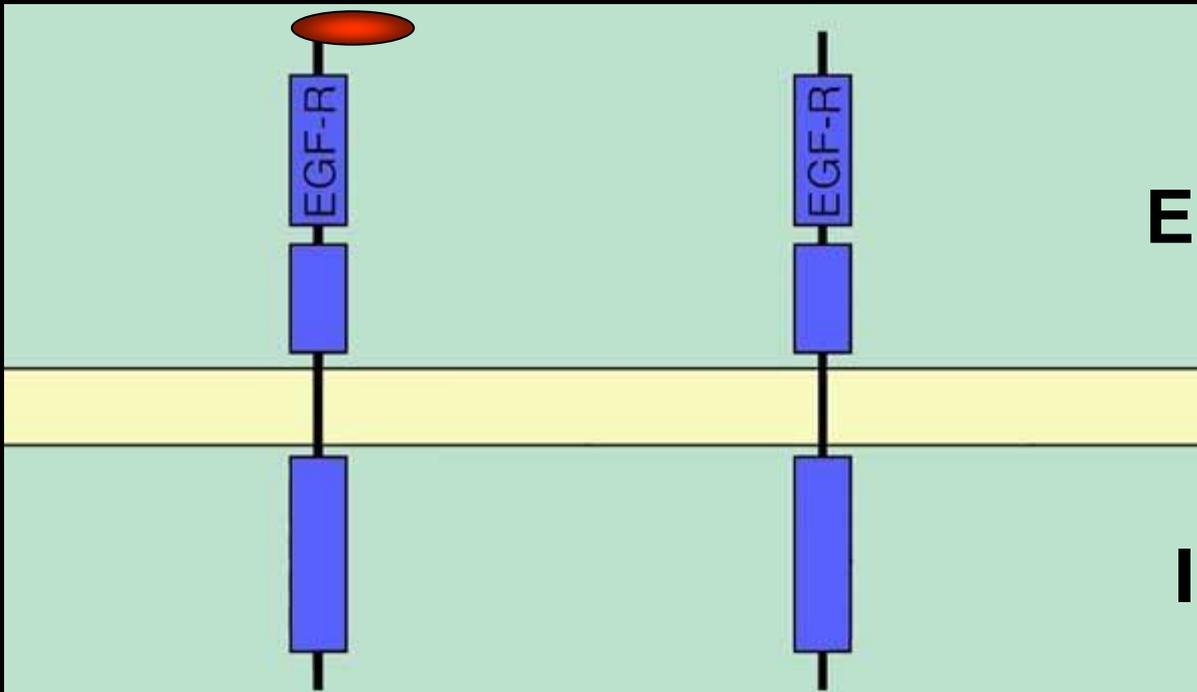
Activación de receptores tirosina-quinasa

Señal
Receptor



Activación de receptores tirosina-quinasa

Señal
Receptor

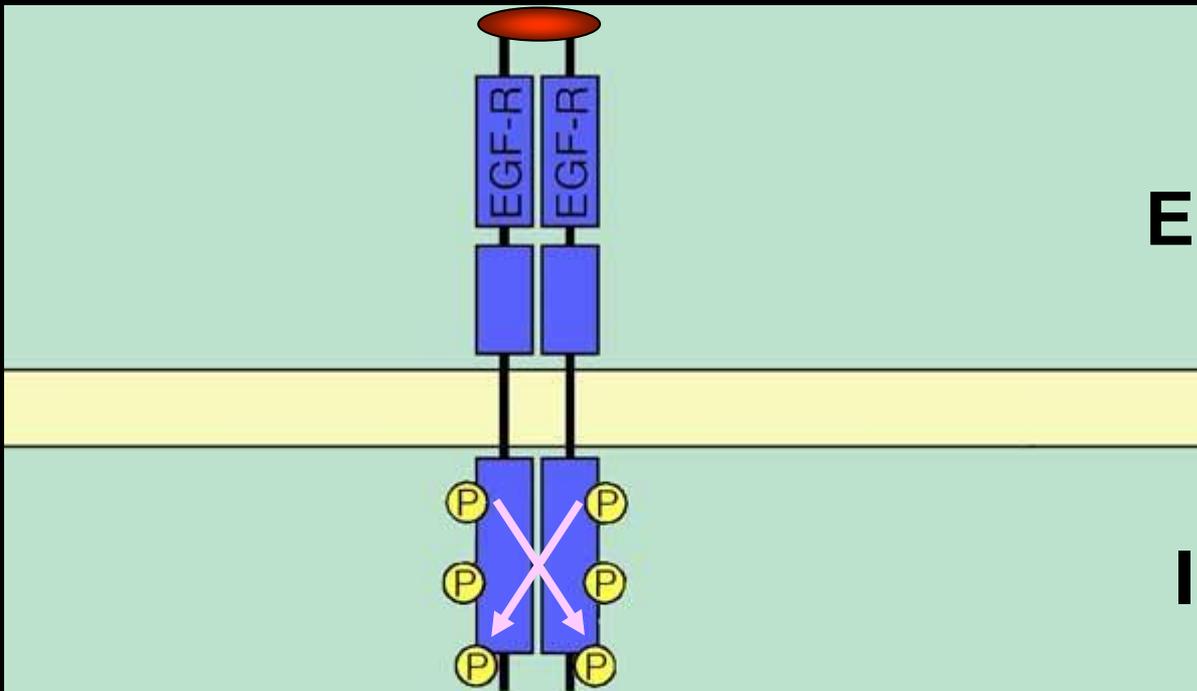


Activación de receptores tirosina-quinasa

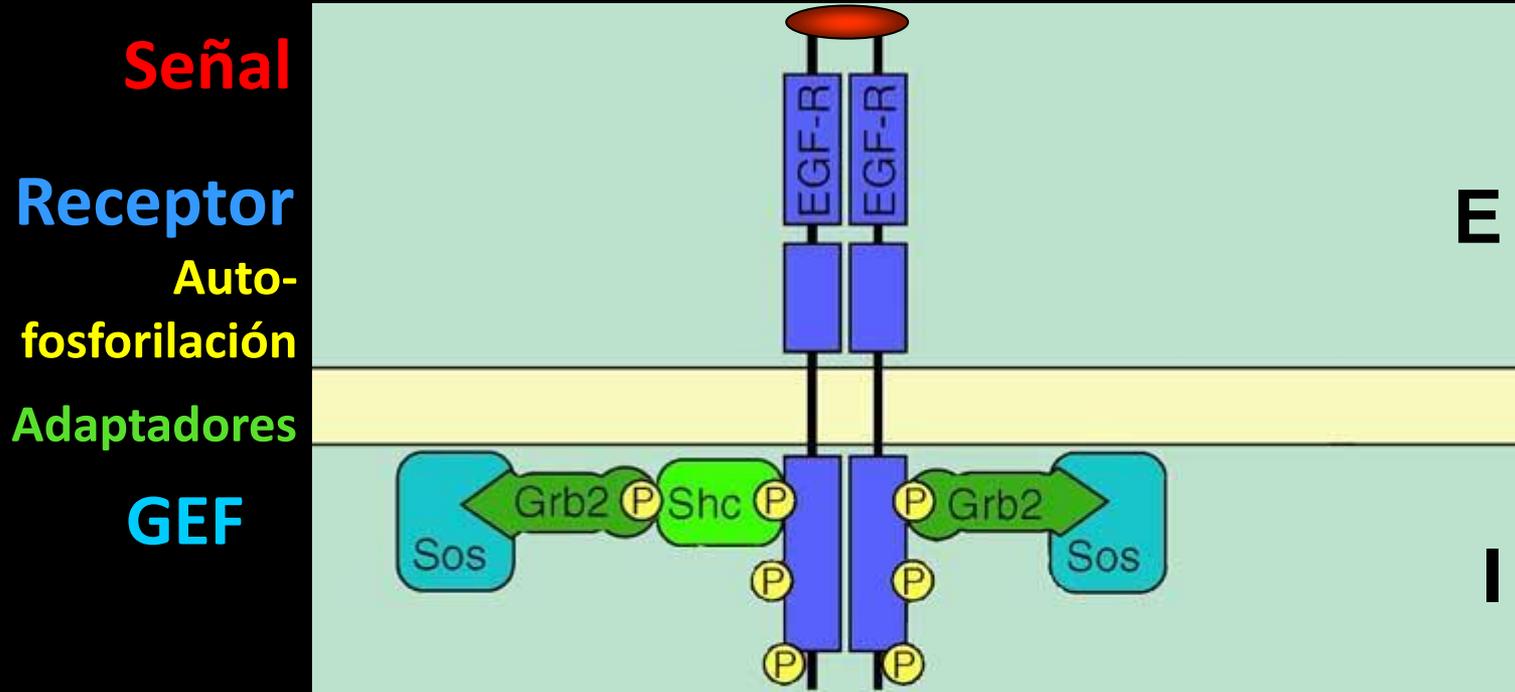
Señal

Receptor

Auto-
fosforilación



Activación de receptores tirosina-quinasa



Activación de receptores tirosina-quinasa

Señal

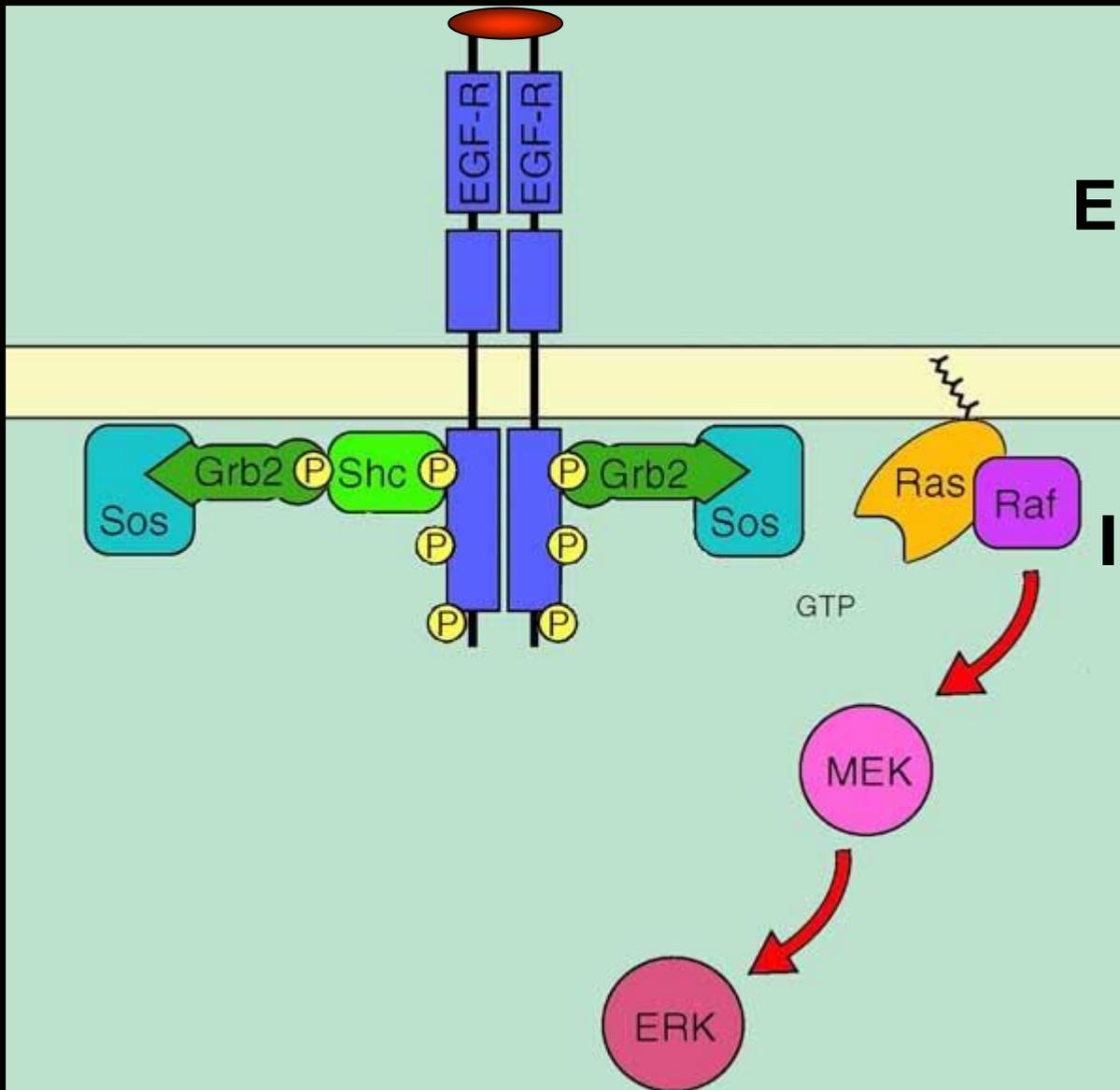
Receptor

Auto-fosforilación

Adaptadores

GEF

Cascada de fosforilación



Prot. G monomérica

MAPKKK

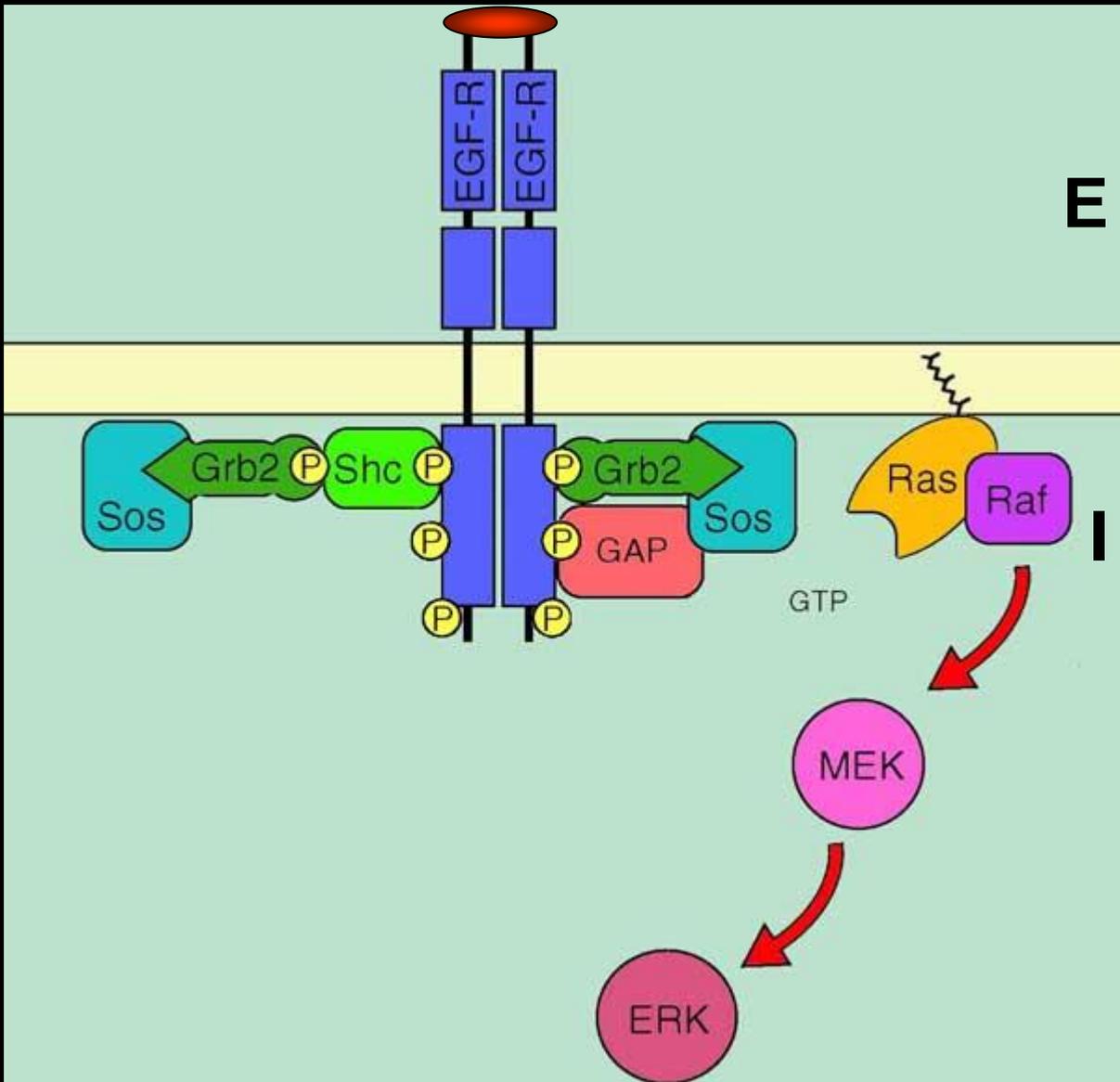
MAPKK

MAPK

Activación de receptores tirosina-quinasa

Señal
Receptor
Auto-fosforilación
Adaptadores
GEF
T
GAP

Cascada de fosforilación

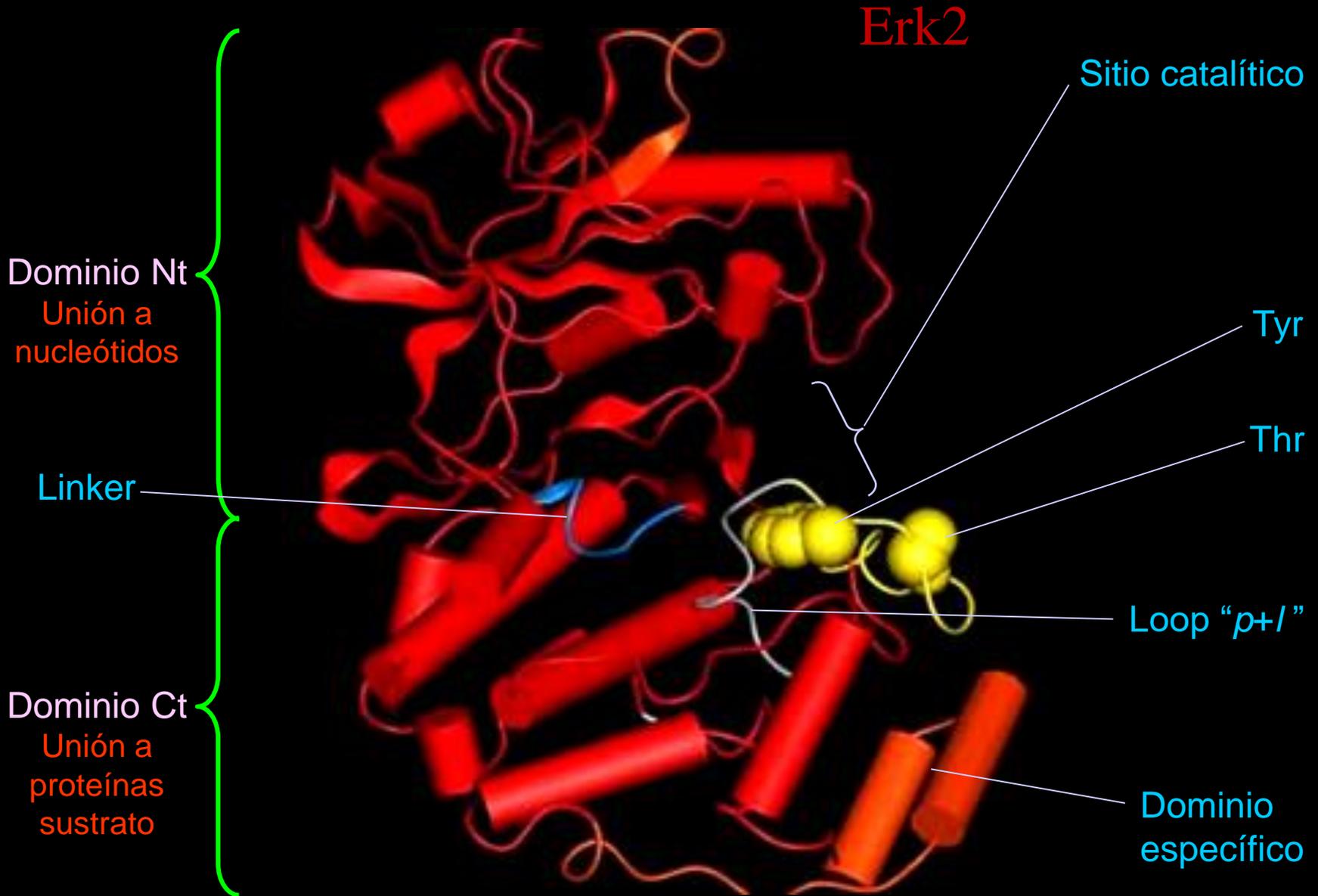


Prot. G monomérica
MAPKKK

MAPKK

MAPK

Estructura de la MAPK Erk2 (inactiva)

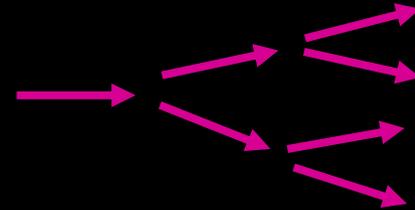


Propiedades básicas de los sistemas de transducción intracelular de señales

A - Reacciones encadenadas



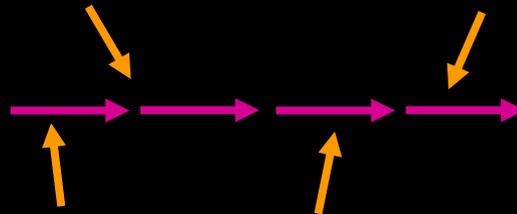
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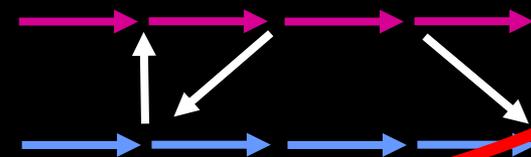
C - Reversibilidad de cada reacción



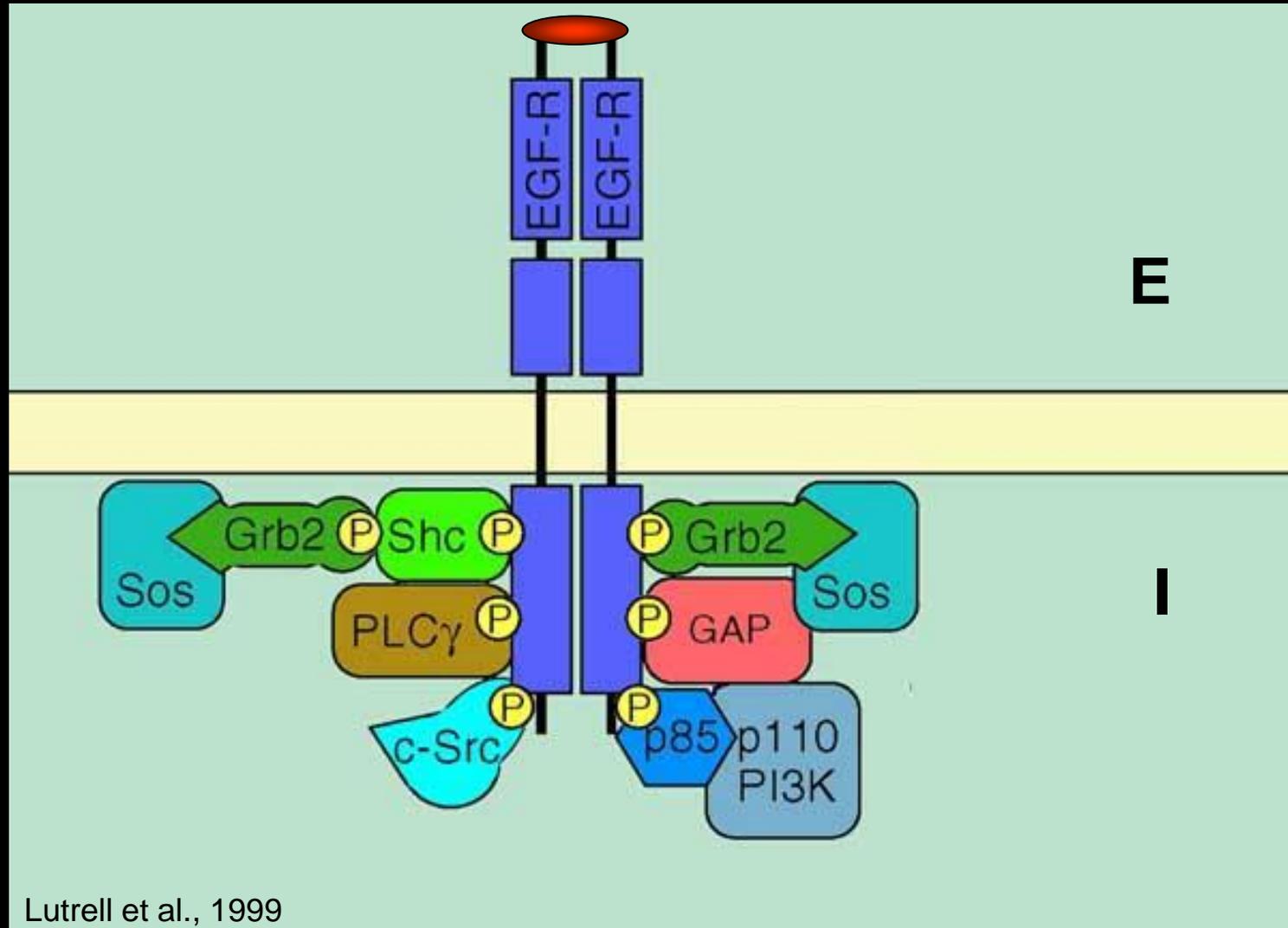
D - Regulación



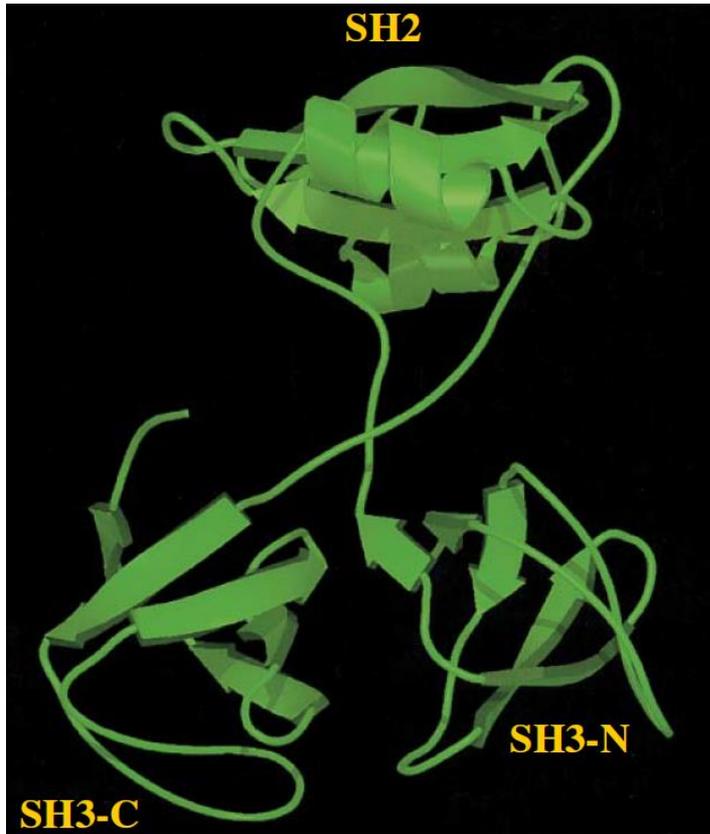
E - Intercomunicación entre vías
("crosstalk")



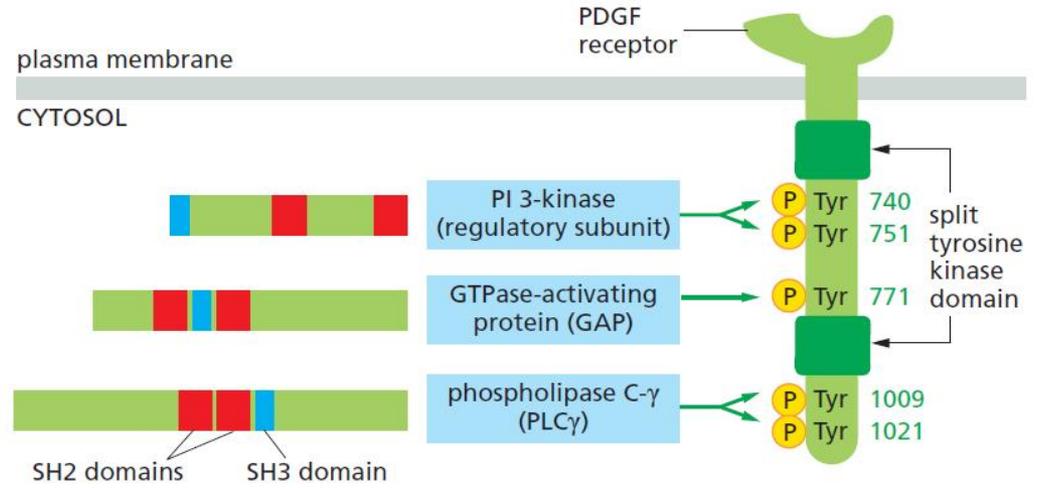
Vías de transducción activadas directamente por receptores tirosina-quinasa



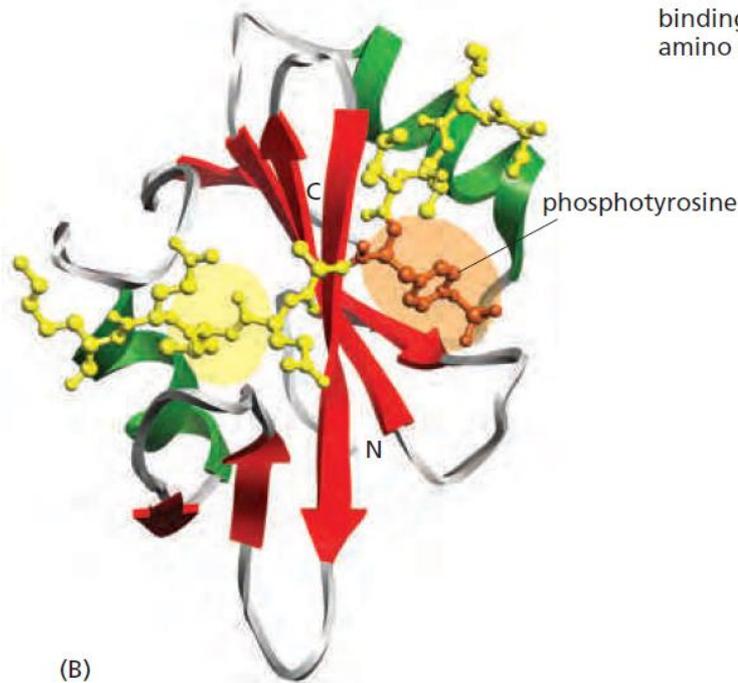
Proteínas adaptadoras “modulares”: dominio SH2



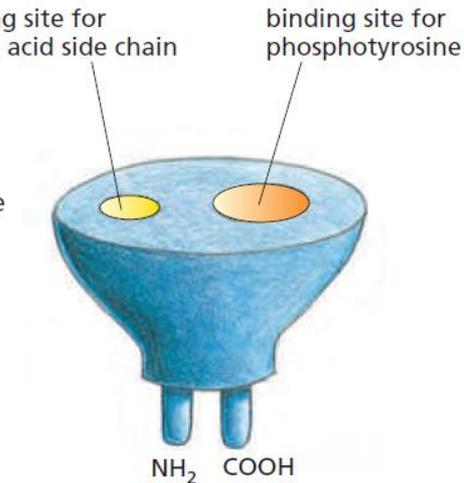
Grb2



(A)

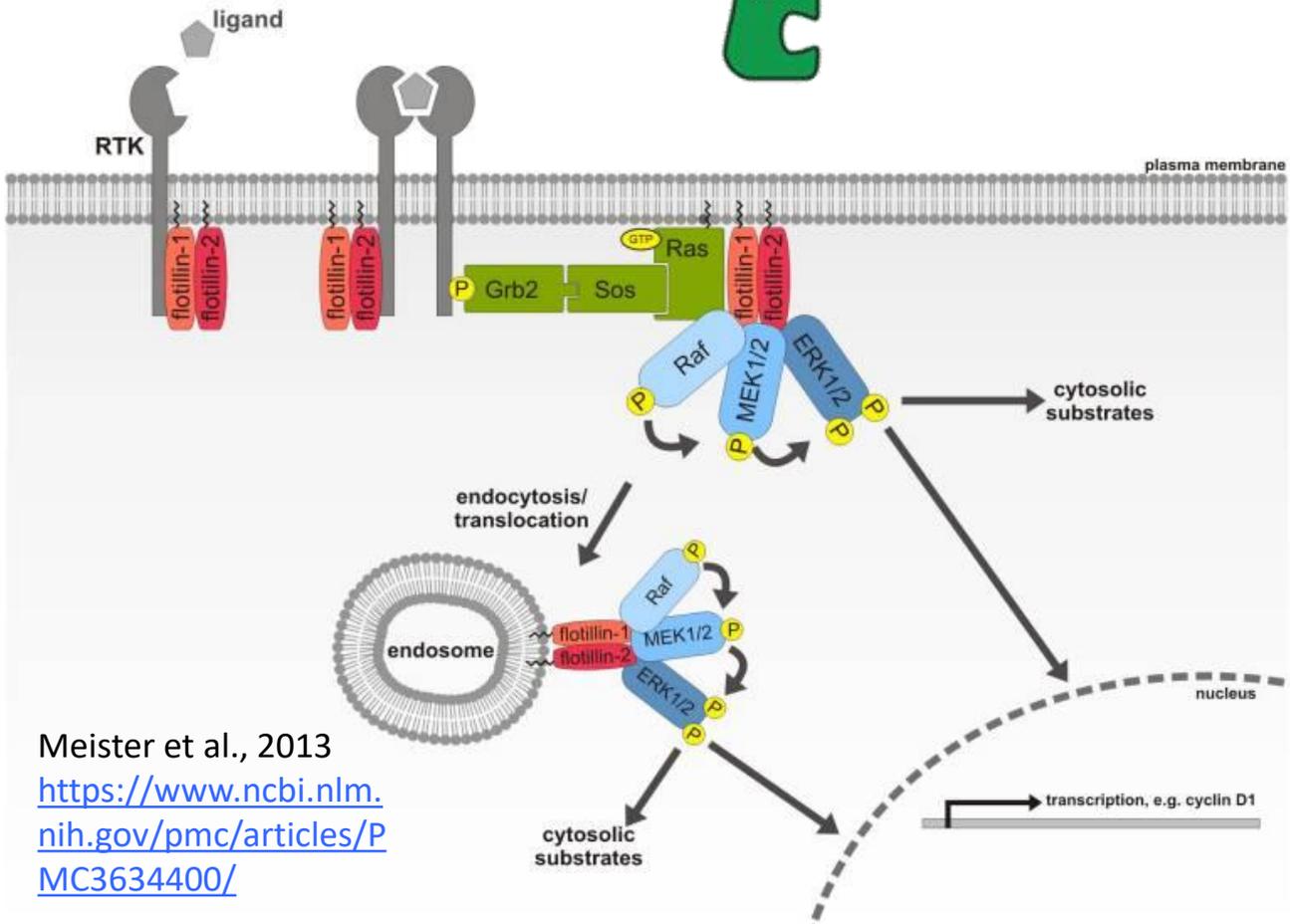
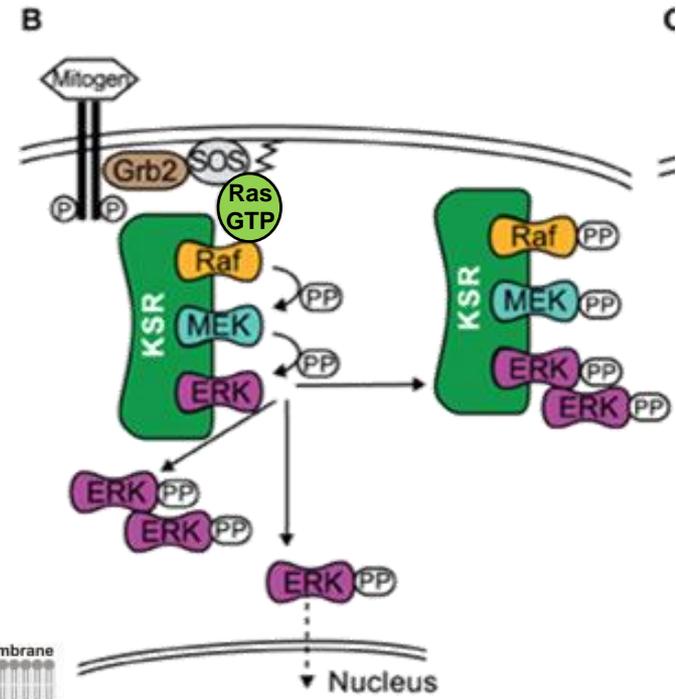
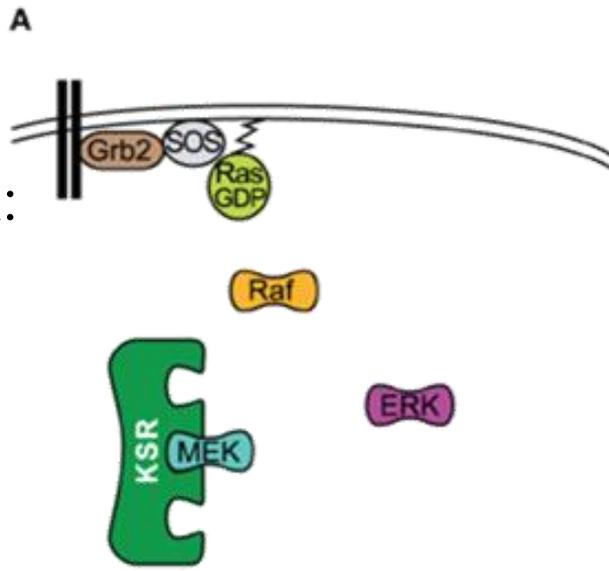


(B)



(C)

Módulos
MAPKKK/MAPKK/MAPK:
Proteínas “scaffold” y
adaptadores locales



Witzel et al., 2012
<https://www.frontiersin.org/articles/10.3389/fphys.2012.00475/full>

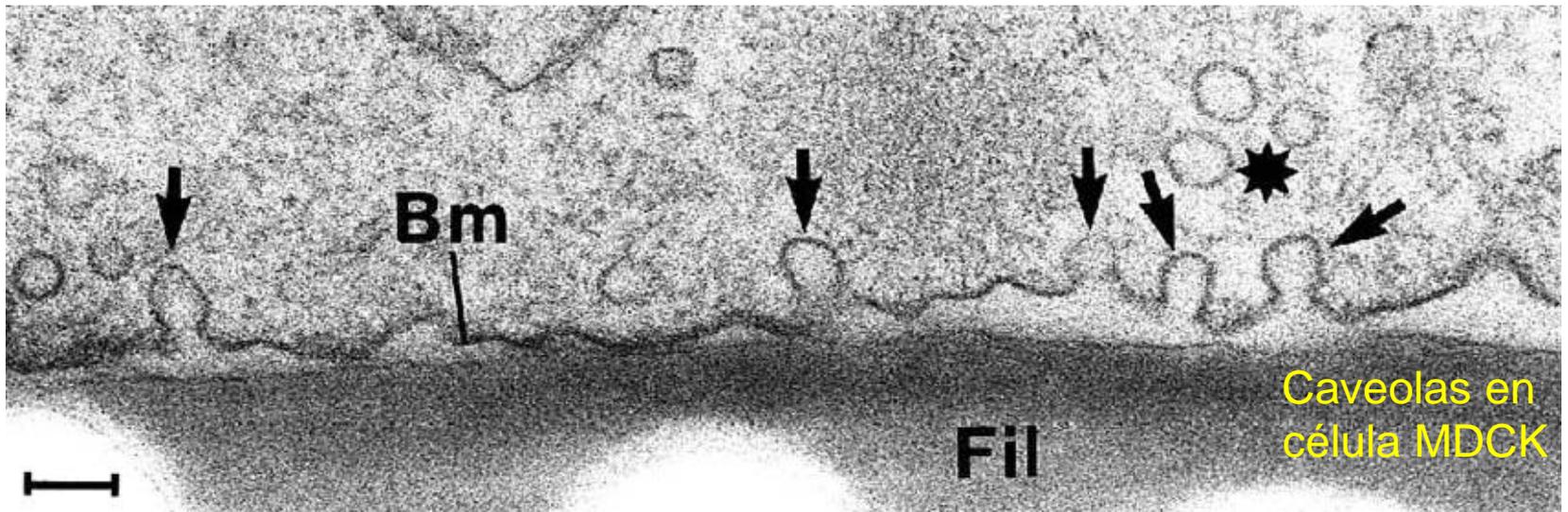
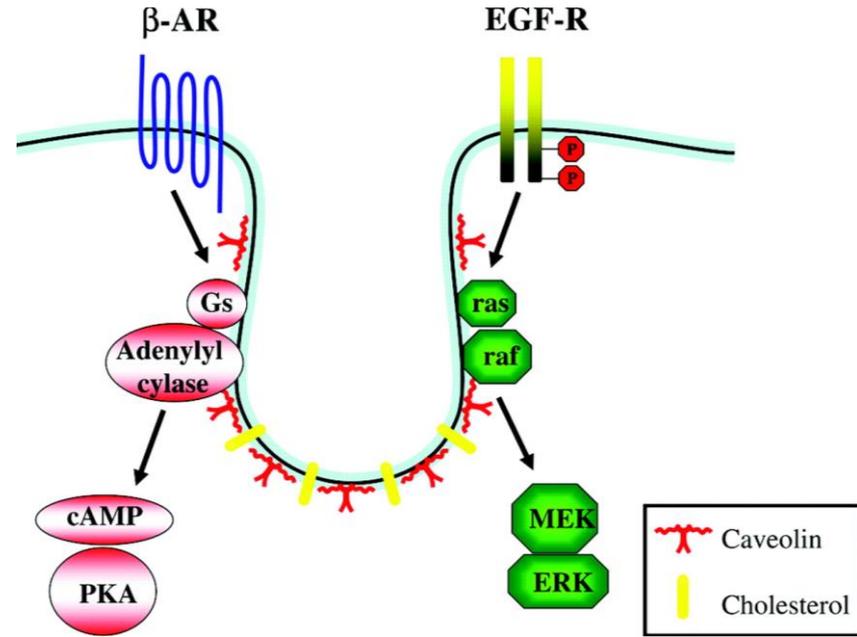
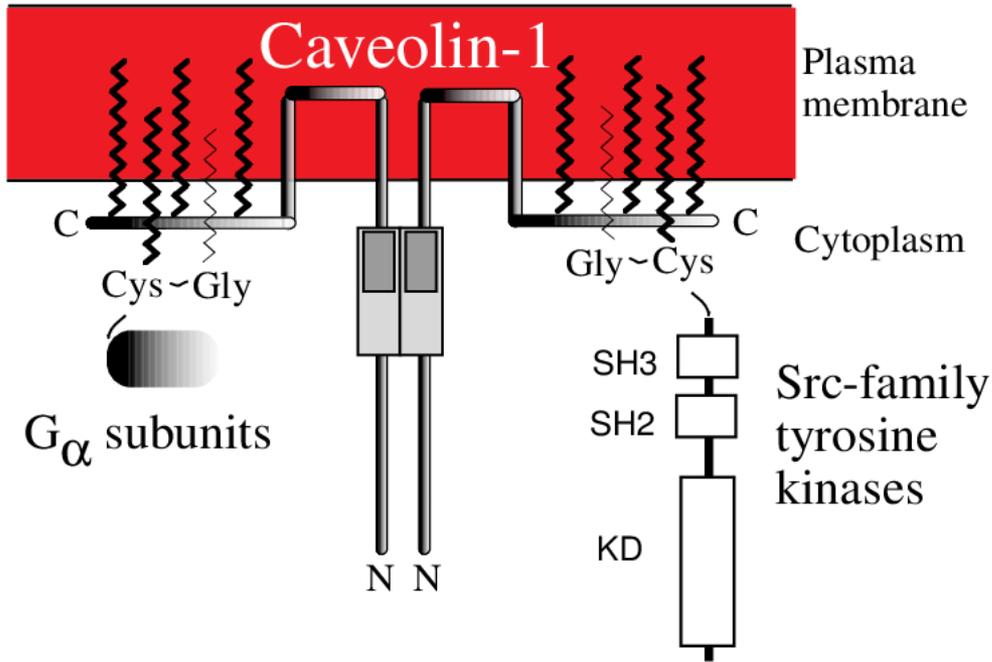
KSR:
 Kinase
 Suppressor
 of Ras

Meister et al., 2013
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3634400/>

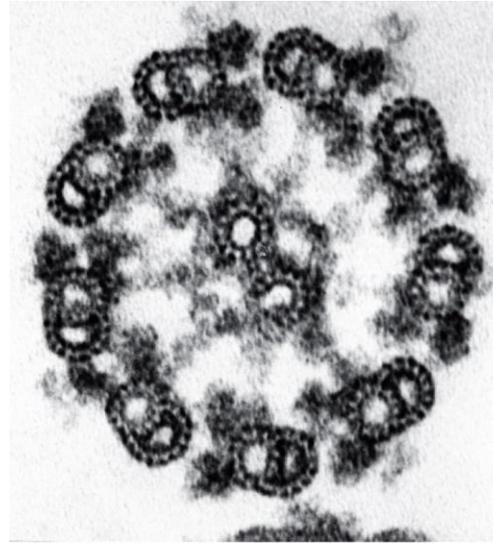
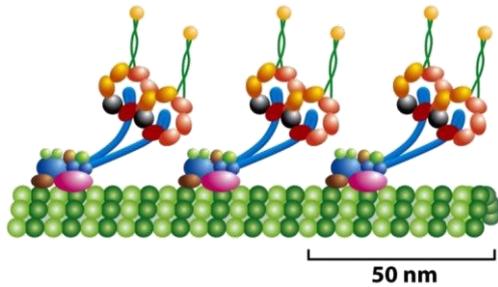
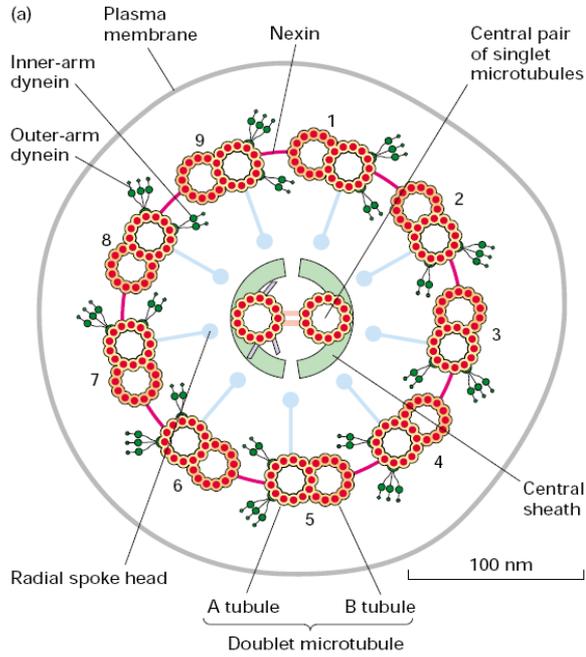
Caveolas

Caveolina-1
en células
Caco-2

Caveolas

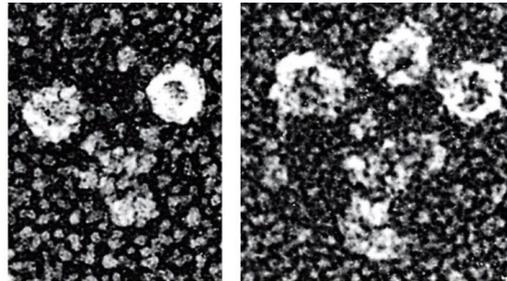
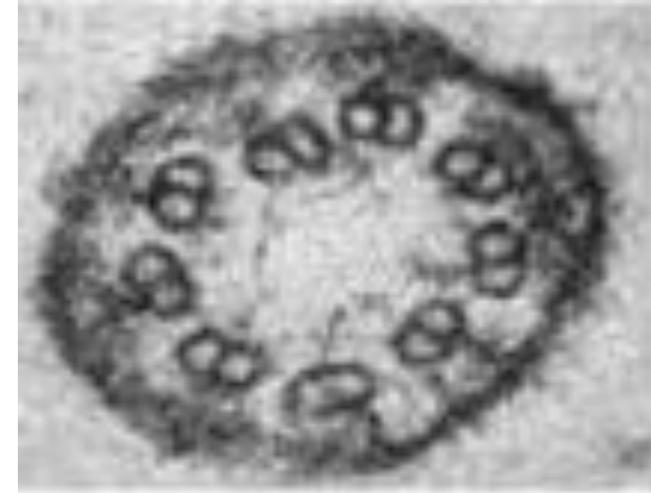


Cilias móviles y cilias primarias



Cilia móvil: 9+2

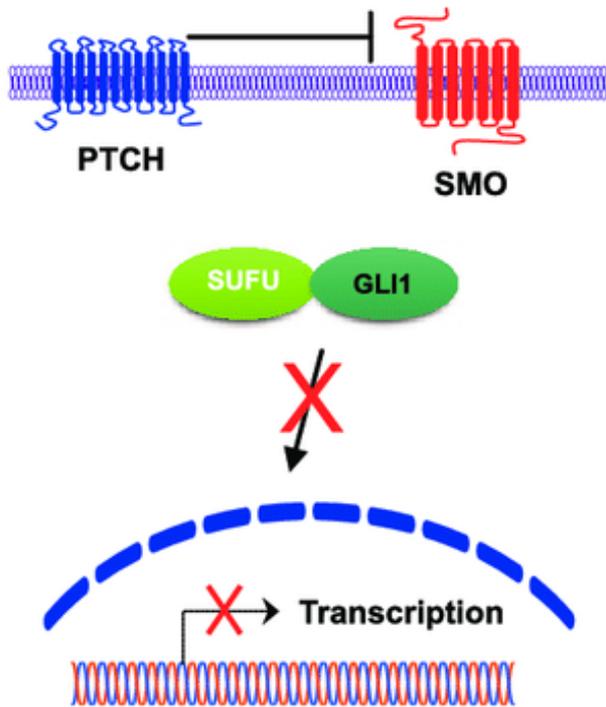
Cilia primaria: 9+0



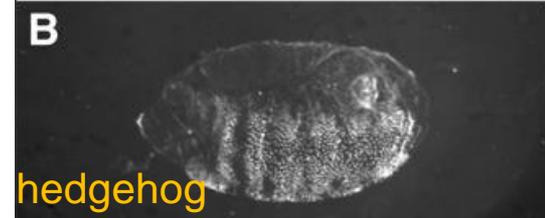
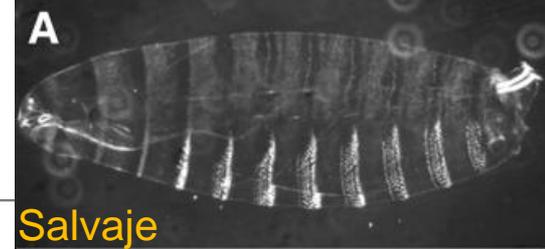
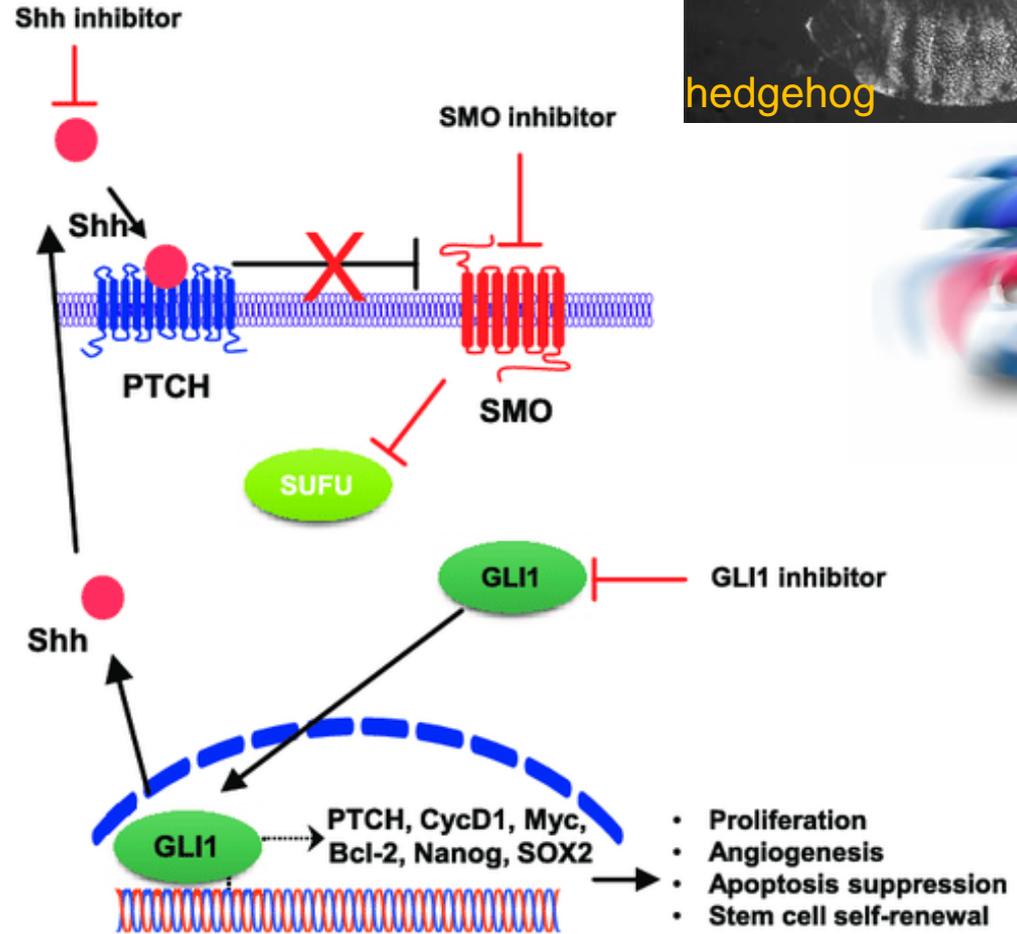
¿FUNCIÓN?

Vía de Sonic Hedgehog

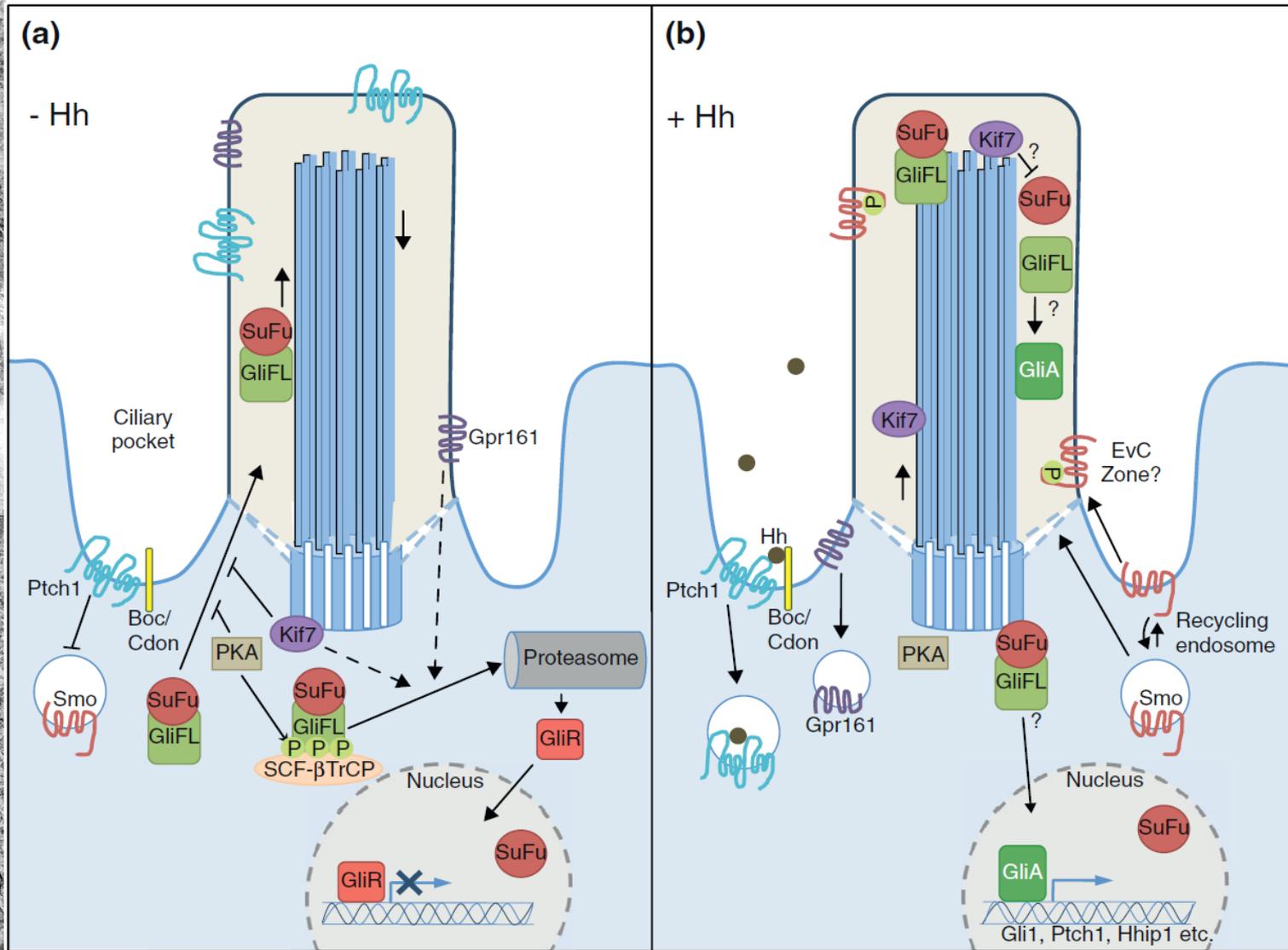
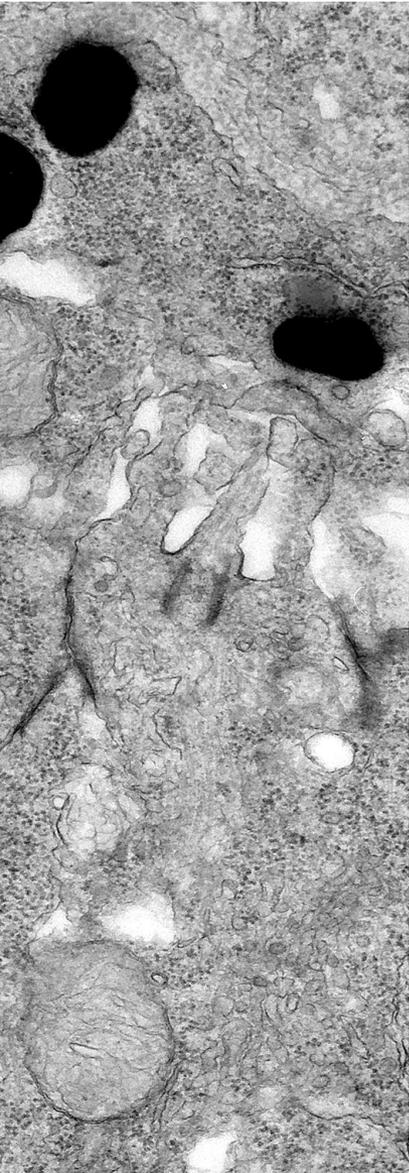
Inactive Shh signaling



Active Shh signaling



Las cilia como plataformas de señalización

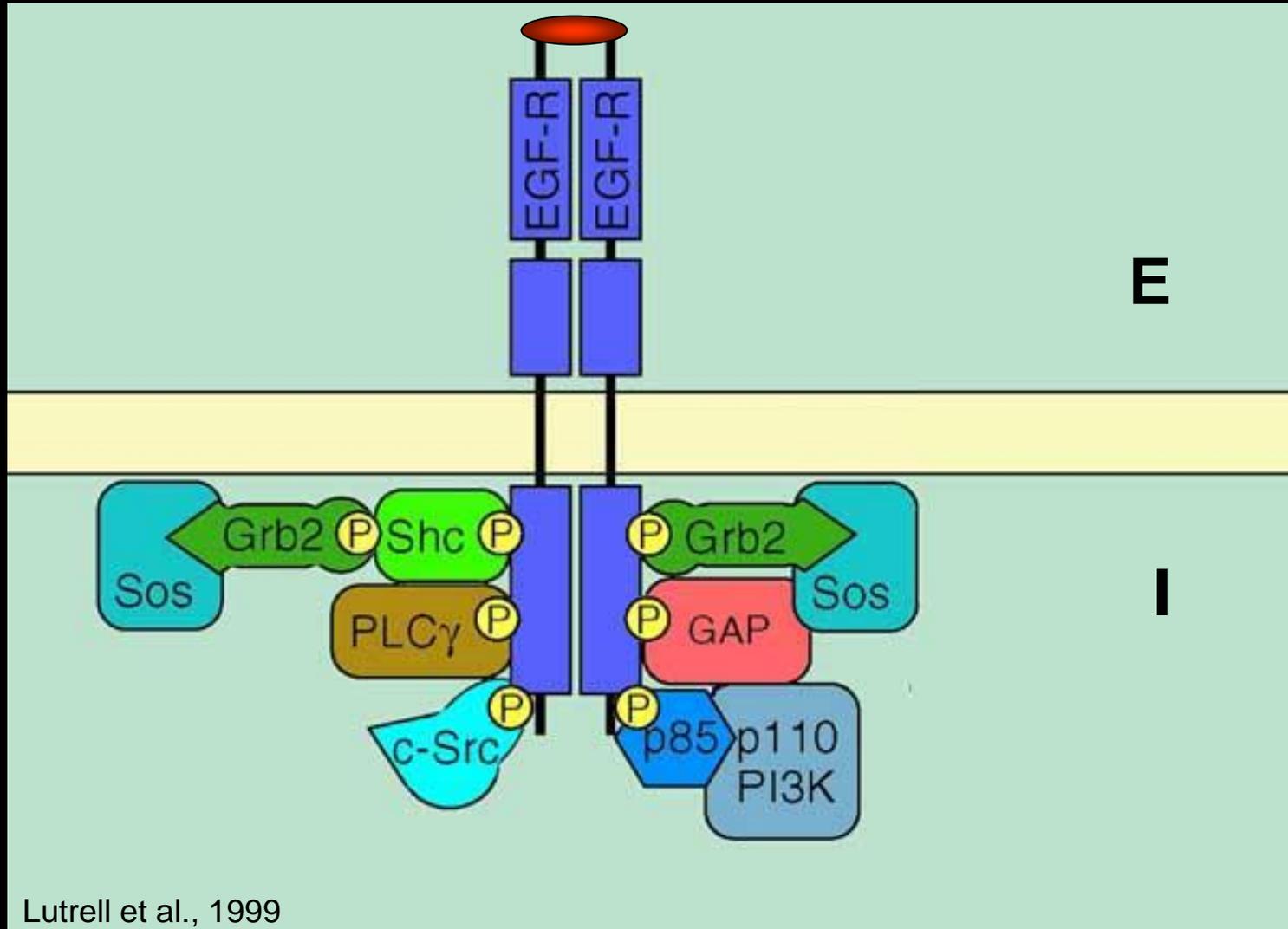


Nozawa et al., 2013

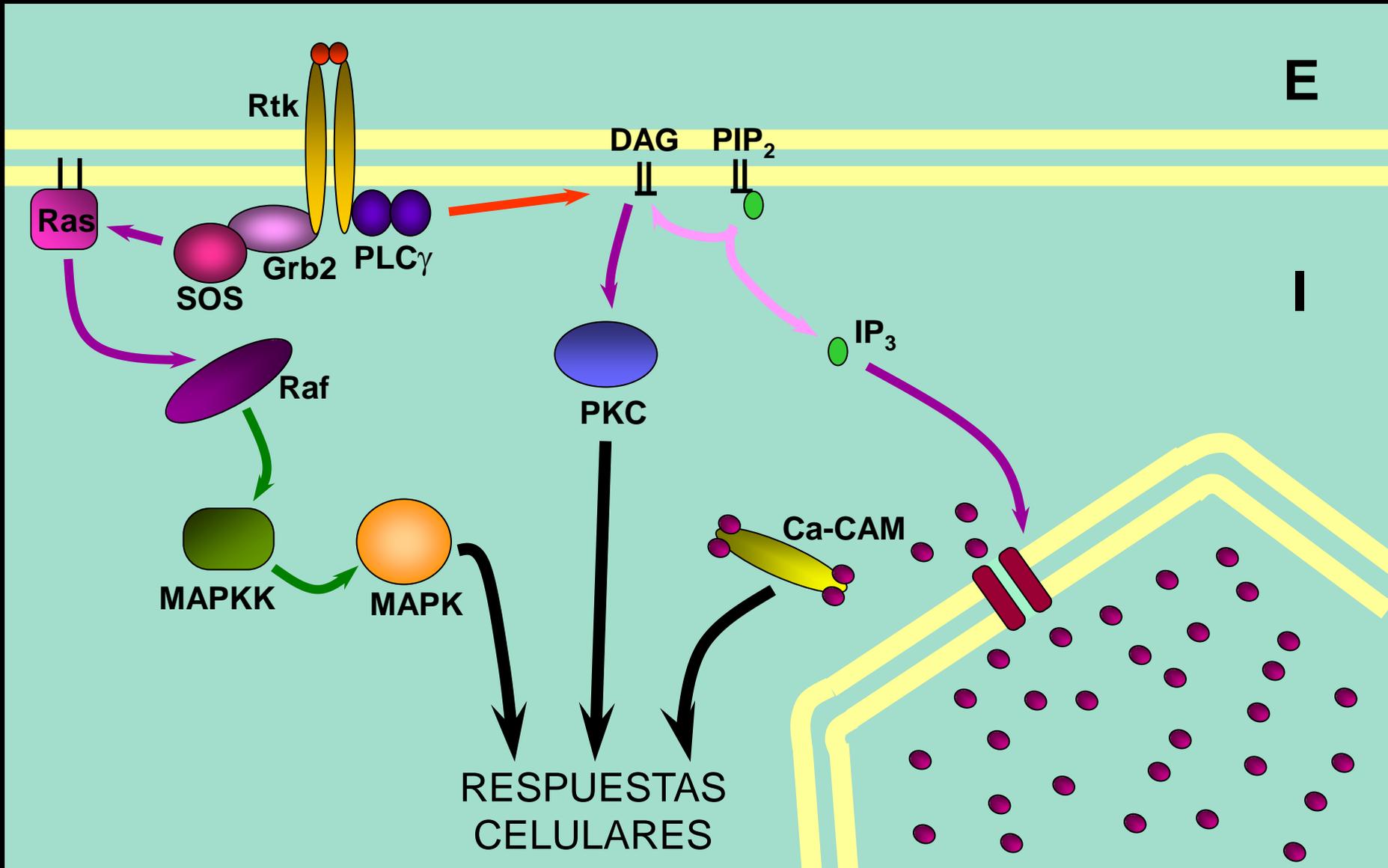
<http://europepmc.org/backend/ptpmcrender.fcgi?accid=PMC3913210&blobtype=pdf>

Cilia primaria en una célula de retina en desarrollo

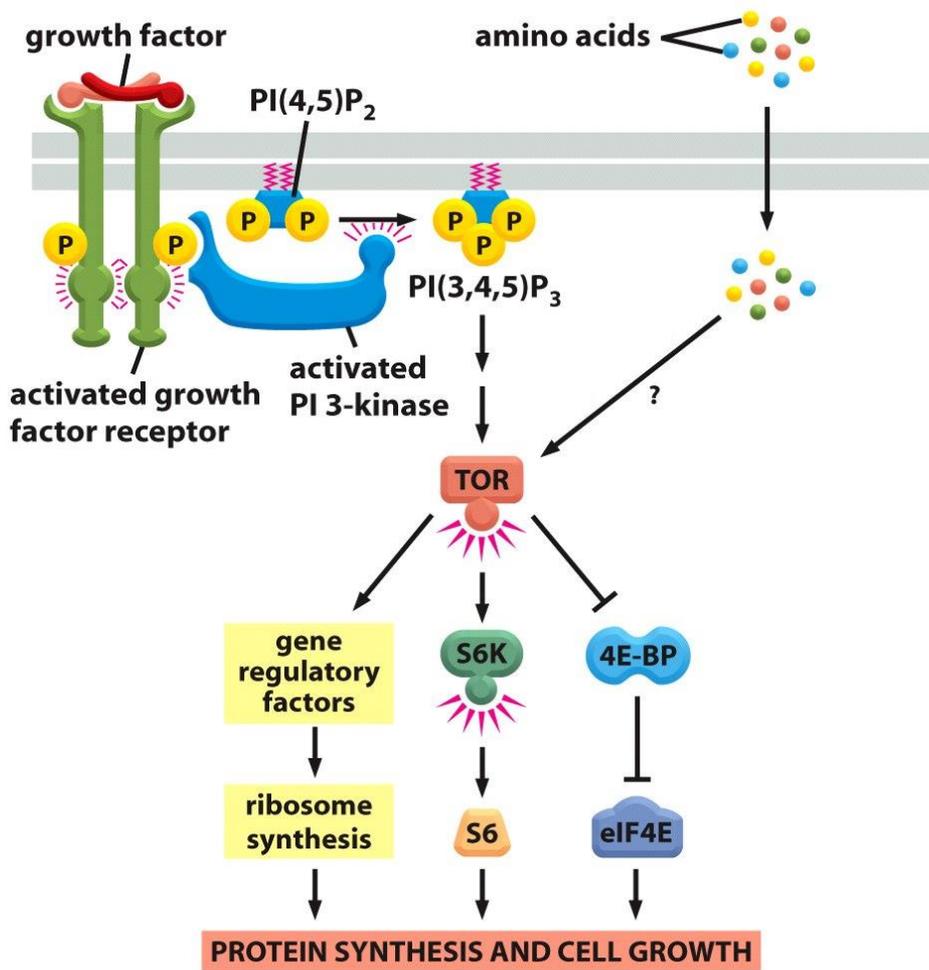
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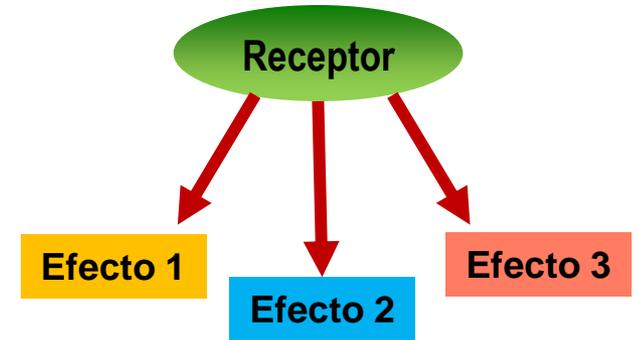
Intercomunicación entre vías de señalización



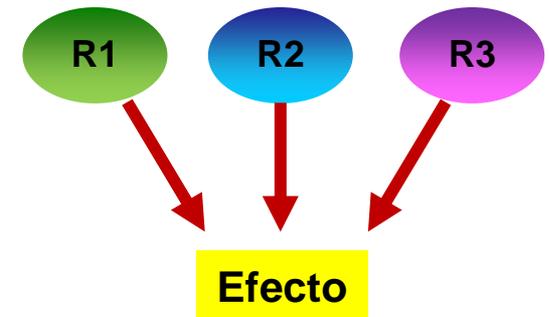
Intercomunicación entre vías de señalización



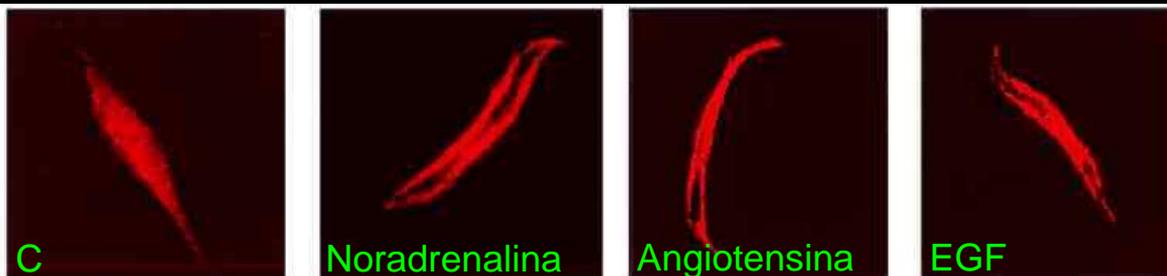
Divergencia:



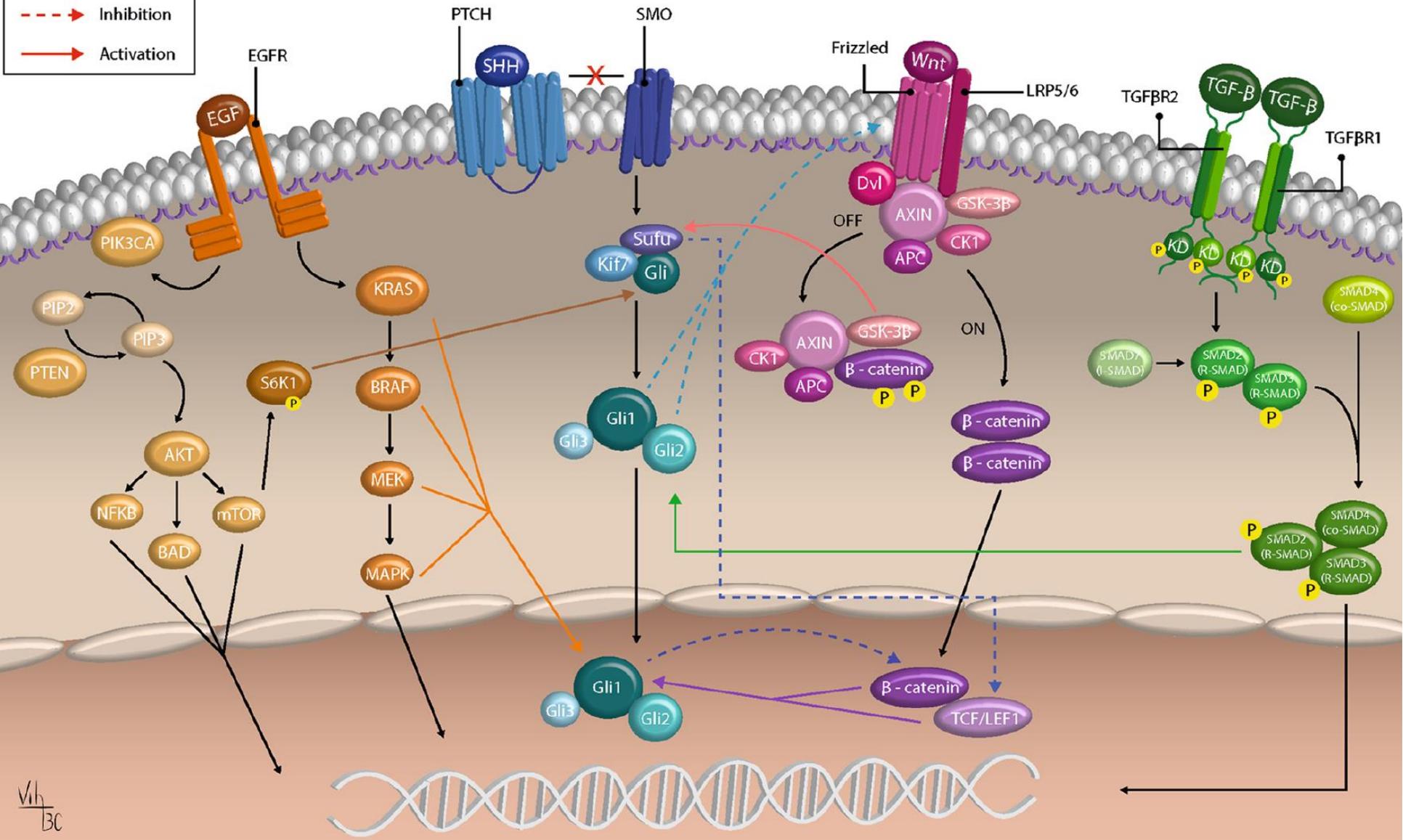
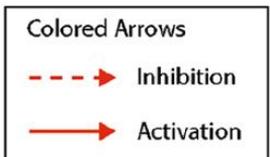
Convergencia:



Immunodetección de Ras en células musculares lisas en cultivo



Intercomunicación entre vías de señalización: vías importantes en cáncer (y desarrollo embrionario)



Vih BC

