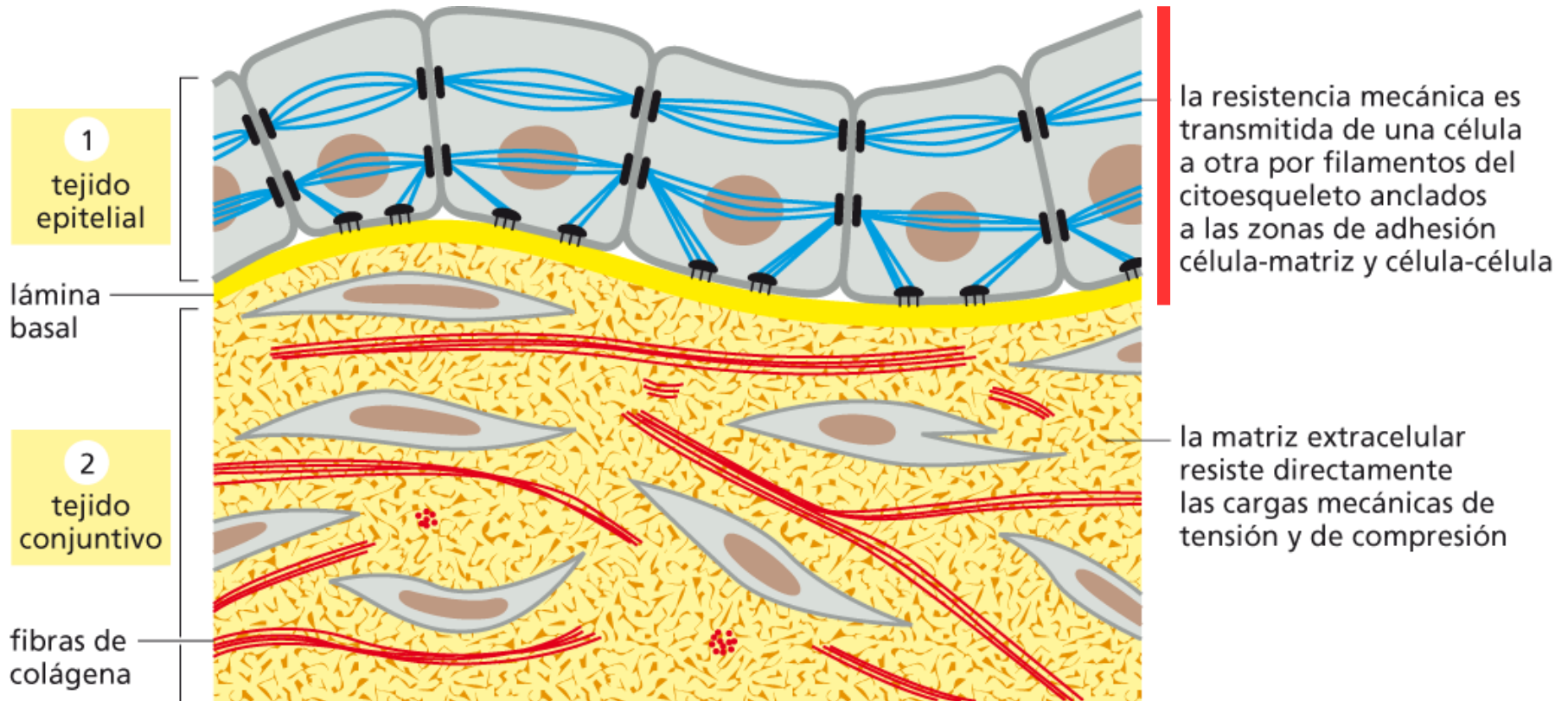


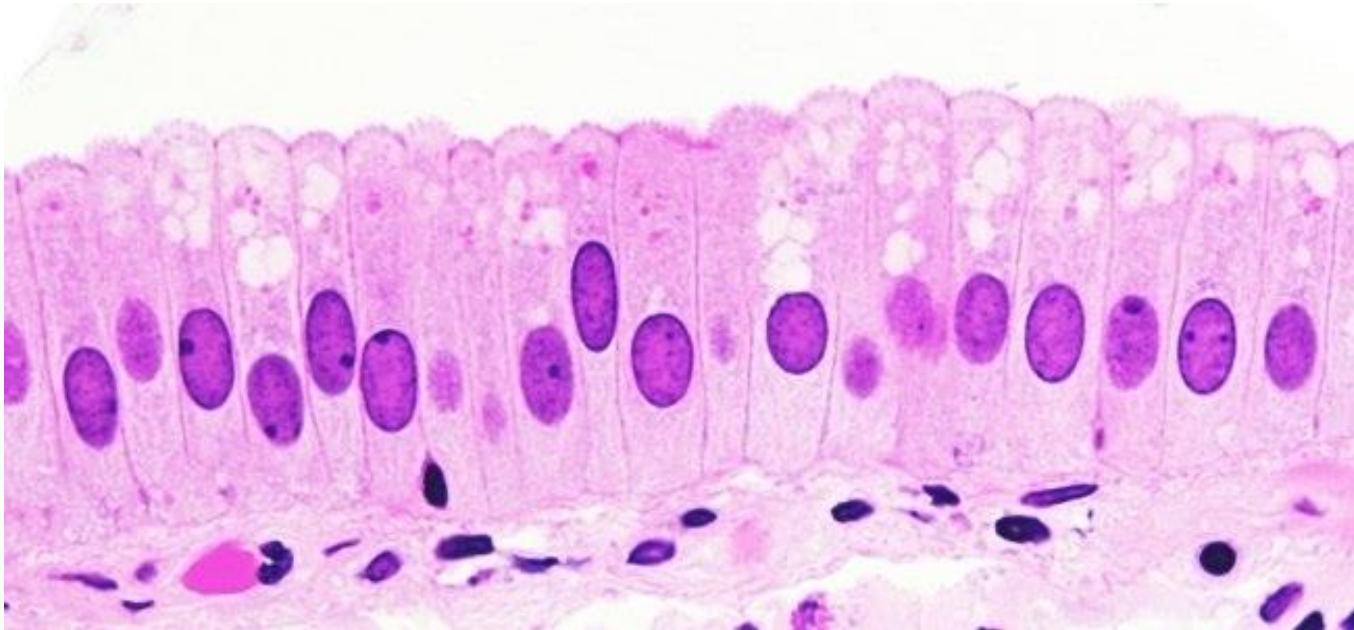
Adhesión y polaridad celular



Gonzalo Aparicio

Células epiteliales





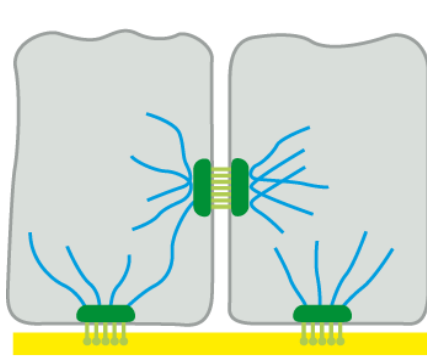
Gran densidad celular

Poca matriz extracelular

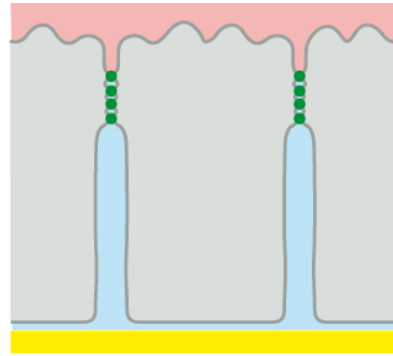
Tejido avascular

Uniones célula-célula y célula matriz

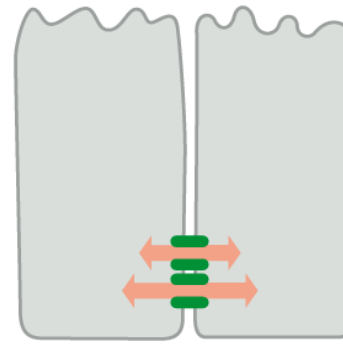
Marcada polaridad estructural y funcional



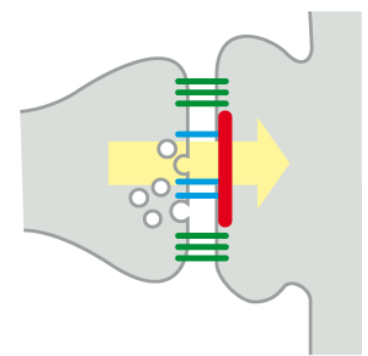
(A) UNIONES DE ANCLAJE



(B) UNIONES OCLUSIVAS



(C) UNIONES FORMADORAS DE CANAL



(D) UNIONES TRANSMISORAS DE SEÑAL

UNIONES DE ANCLAJE

Zonas de anclaje de filamentos de actina

1. uniones célula-célula (uniones adherentes)
2. uniones célula-matriz (adhesiones célula-matriz asociadas a actina)

Zonas de anclaje de filamentos intermedios

1. uniones célula-célula (desmosomas)
2. uniones célula-matriz (hemidesmosomas)

UNIONES DE OCLUSIÓN

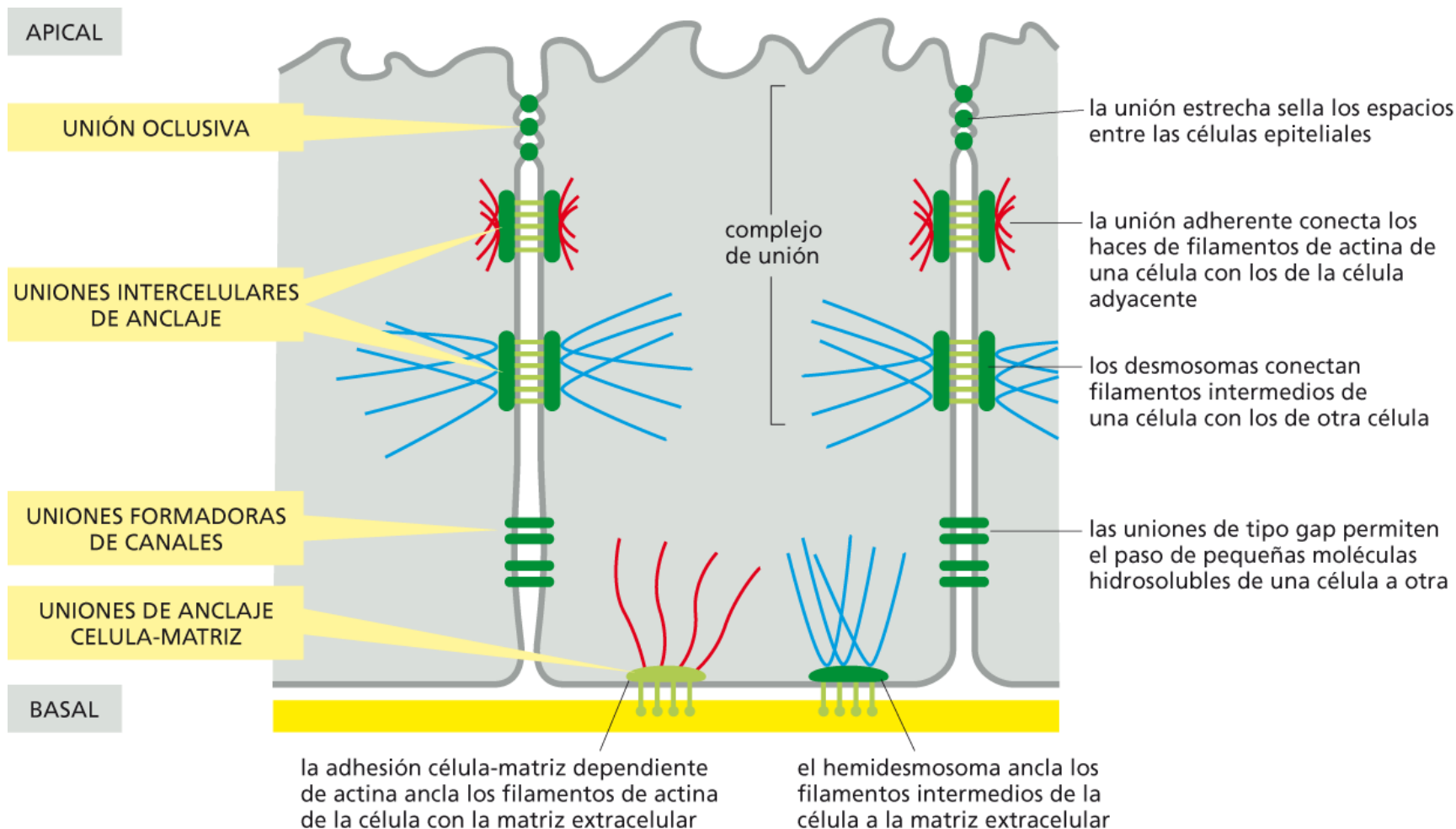
1. uniones estrechas (en vertebrados)
2. uniones septadas (en invertebrados)

UNIONES FORMADORAS DE CANAL

1. uniones de tipo gap (en animales)
2. plasmodesmos (en vegetales)

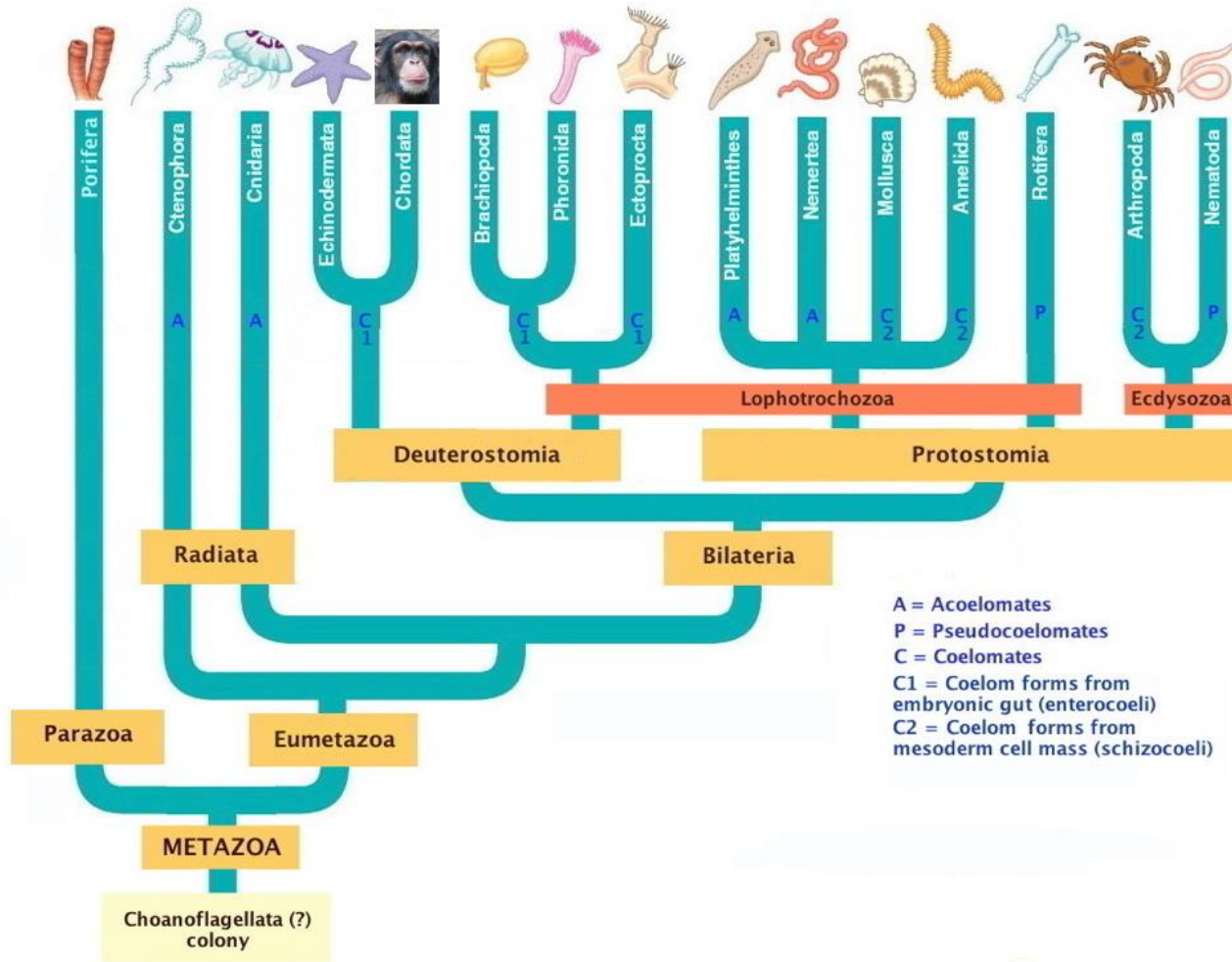
UNIONES TRANSMISORAS DE SEÑAL

1. sinapsis químicas (en el sistema nervioso)



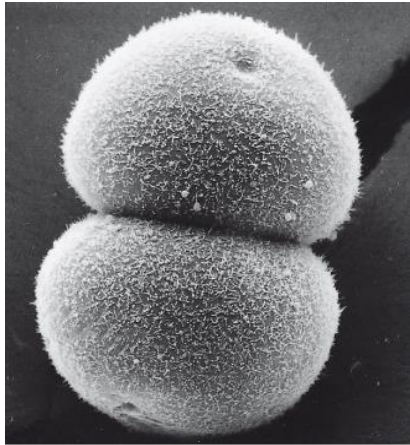
UNIÓN	PROTEÍNA TRANSMEMBRANA DE ADHESIÓN	LIGANDO EXTRACELULAR	ELEMENTO RELACIONADO DEL CITOESQUELETO	PROTEÍNAS DE ANCLAJE INTRACELULAR
<i>Célula-célula</i>				
unión adherente	cadherina (cadherina clásica)	cadherina en células adyacentes	filamentos de actina	α -catenina, β -catenina, placoglobina (γ -catenina), p120-catenina, vinculina, α -actinina
desmosoma	cadherina (desmogleína, desmocolina)	desmogleína y desmocolina en células adyacentes	filamentos intermedios	placoglobina (γ -catenina), placofilina, desmoplaquina
<i>Célula-matriz</i>				
adhesión célula-matriz unida a actina	integrina	proteínas de matriz extracelular	filamentos de actina	talina, vinculina, α -actinina, filamina, paxilina, quinasa de adhesión focal (FAK)
hemidesmosoma	integrina $\alpha_6\beta_4$, colágena de tipo XVII (BP180)	proteínas de matriz extracelular	filamentos intermedios	plectina, distonina (BP230)

Las cadherinas se restringen a las metazoos

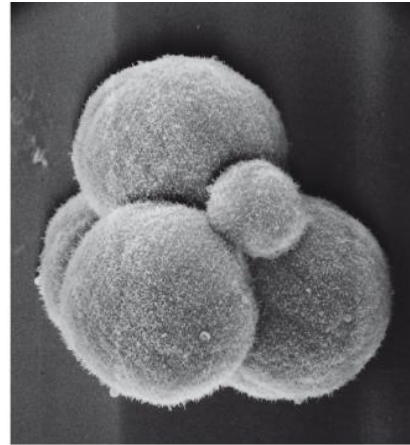


Cell Surface Changes during Preimplantation Development in the Mouse

PATRICIA G. CALARCO AND CHARLES J. EPSTEIN

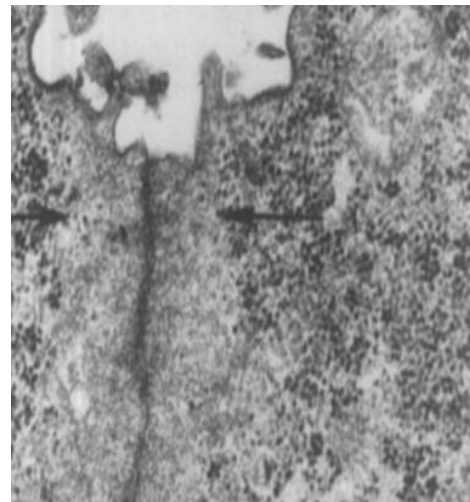


1,5 días
2 células

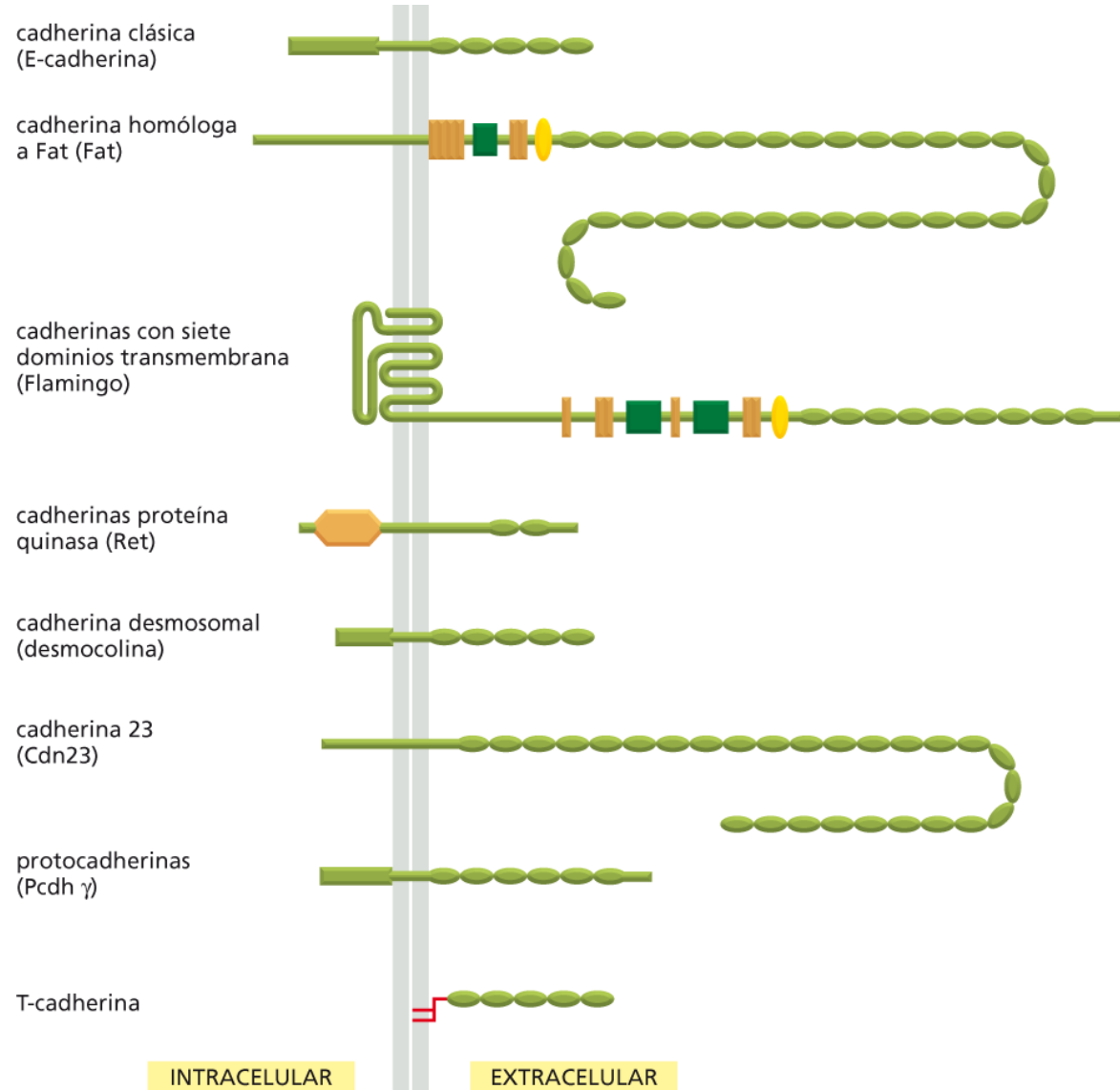


3,5 días
32 células

10 μ m



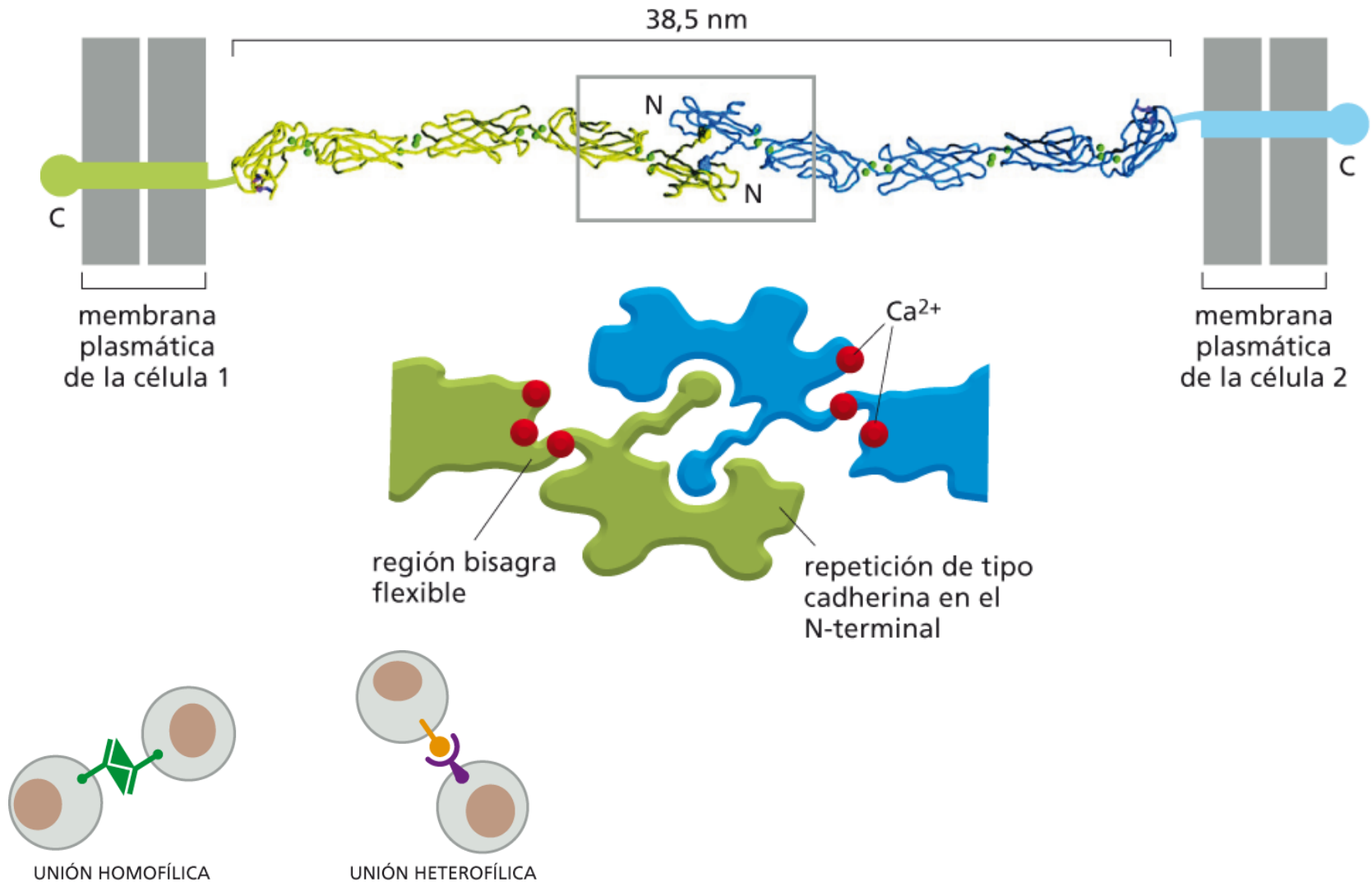
Superfamilia de Cadherinas (+180 miembros en humanos)

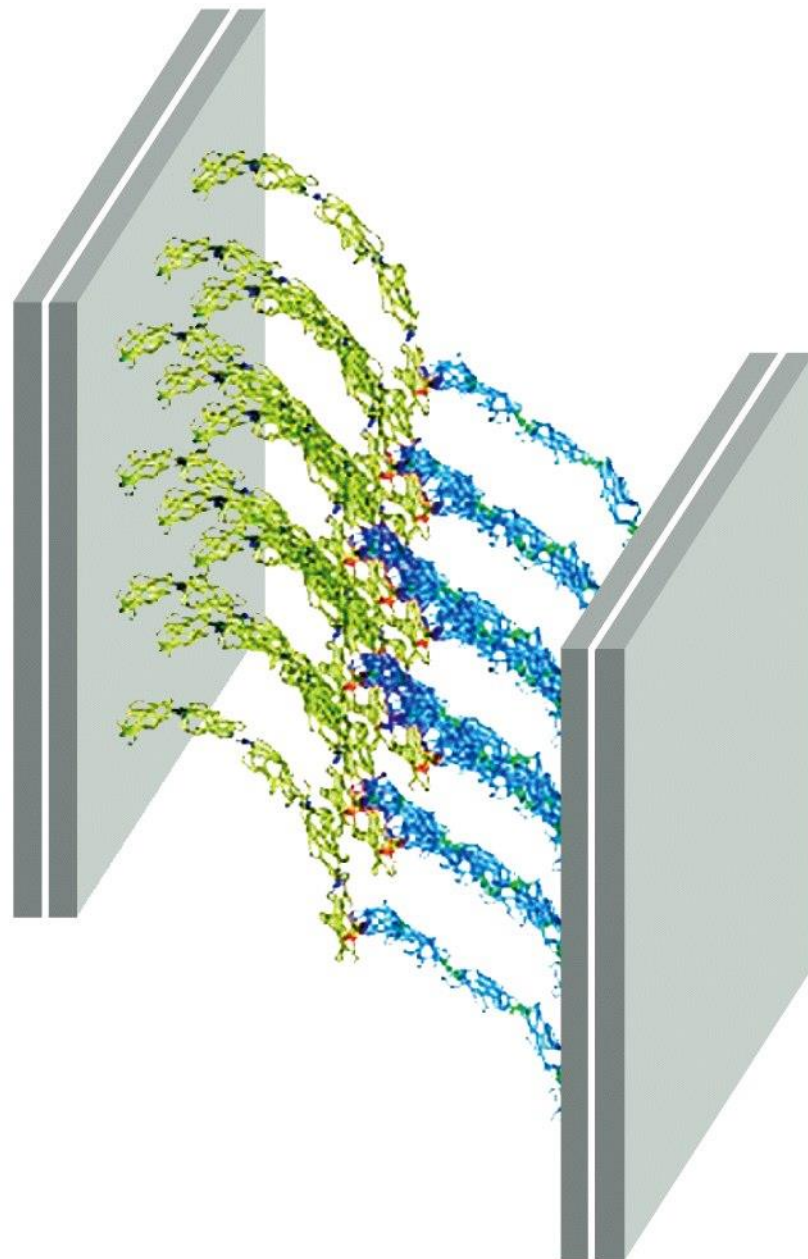
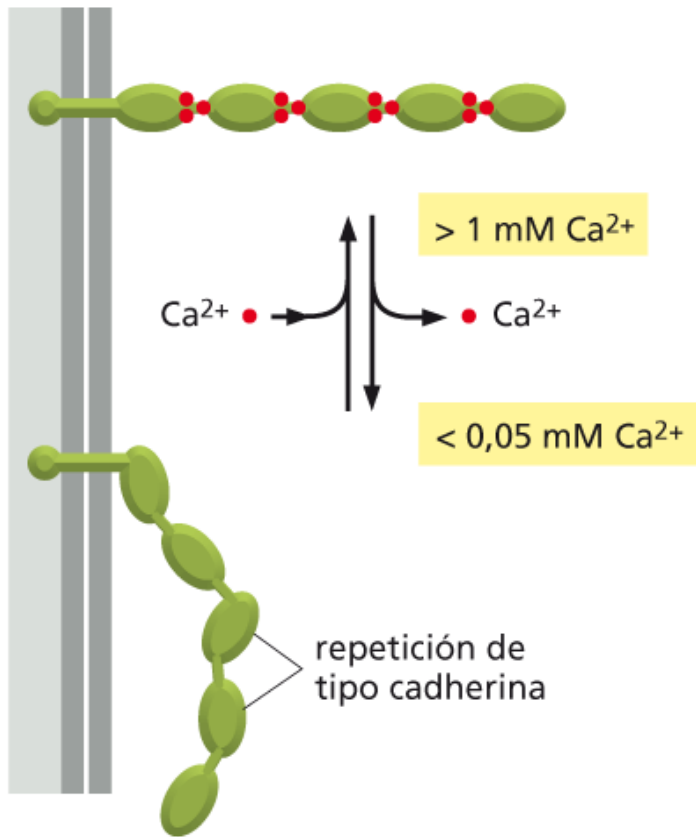


Superfamilia de Cadherinas

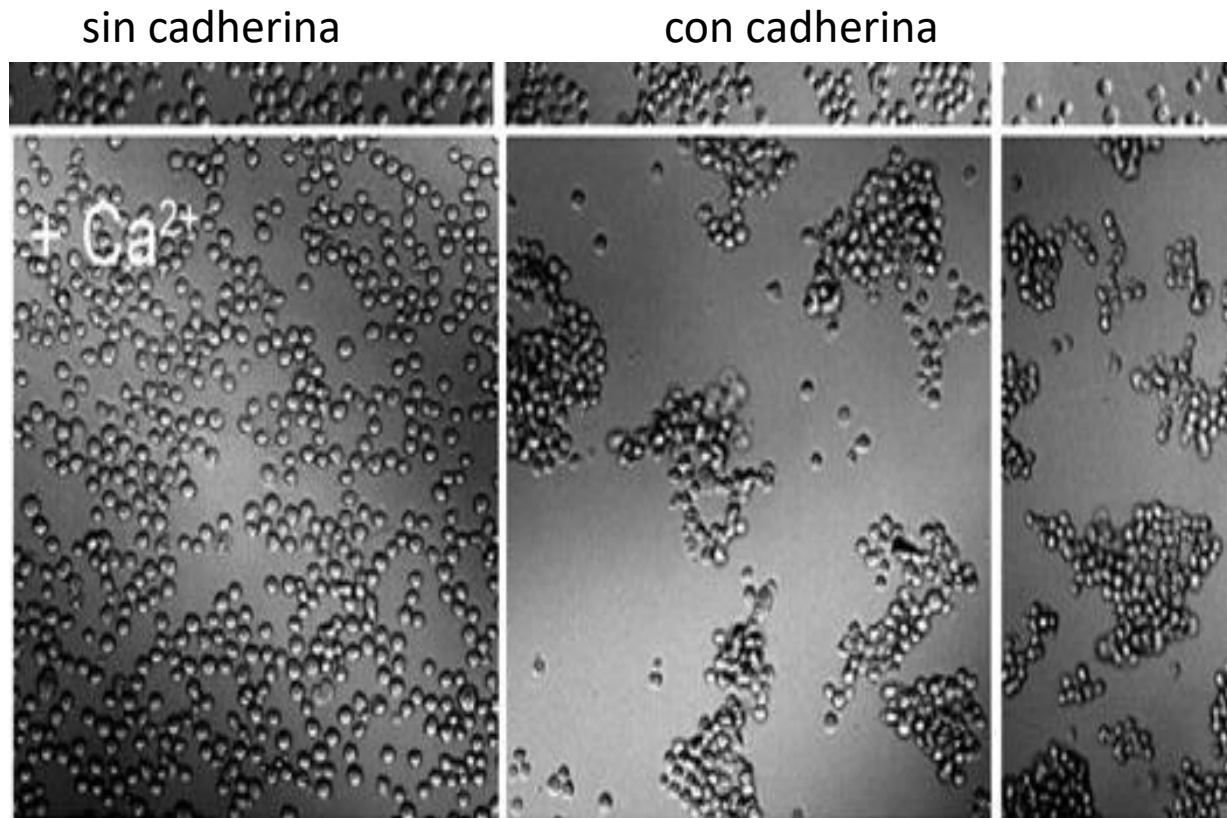
DENOMINACIÓN	LOCALIZACIÓN PRINCIPAL	TIPO DE UNIÓN ASOCIADO	FENOTIPO RESULTANTE CUANDO SE HA INACTIVADO EN RATÓN
<i>Cadherinas clásicas</i>			
E-cadherina	varios epitelios	uniones adherentes	muerte en el estadio de blastocisto; los embriones no son capaces de llevar a cabo la compactación
N-cadherina	neuronas, corazón, músculo esquelético, cristalino y fibroblastos	uniones adherentes y sinapsis químicas	los embriones mueren a causa de defectos cardíacos
P-cadherina	placenta, epidermis, epitelio de la glándula mamaria	uniones adherentes	desarrollo anormal de la glándula mamaria
VE-cadherina	células endoteliales	uniones adherentes	desarrollo vascular anormal (apoptosis de las células endoteliales)
<i>Cadherinas no clásicas</i>			
Desmocolina	piel	desmosomas	trastorno que produce vesículas en la piel
Desmogleína	piel	desmosomas	trastorno que produce vesículas en la piel a consecuencia de la pérdida de la adhesión intercelular de los queratinocitos
T-cadherina	neuronas, músculo, corazón	ninguno	desconocido
Cadherina 23	oído interno, otros epitelios	uniones entre esterocilios en células con pelos sensoriales	sordera
Fat (en <i>Drosophila</i>)	epitelios y sistema nervioso central	uniones transmisoras de señal (polaridad de células planar)	aumento del tamaño de los discos imaginales y tumores; polaridad de células planar interrumpida
Fat1 (en mamíferos)	varios epitelios y sistema nervioso central	hendidura del diafragma del glomérulo renal y otras uniones	pérdida de hendidura del diafragma; trastornos en cerebro y ojo
α , β y γ -protocadherinas	neuronas	sinapsis químicas y membranas no sinápticas	degeneración neuronal
Flamingo	epitelios sensoriales y otros epitelios	uniones intercelulares	células con polaridad planar interrumpida; defectos en el tubo neural

Unión homofílica





Rol del Ca^{2+} en la adhesión mediada por cadherinas



Adhesión selectiva y movimientos dirigidos

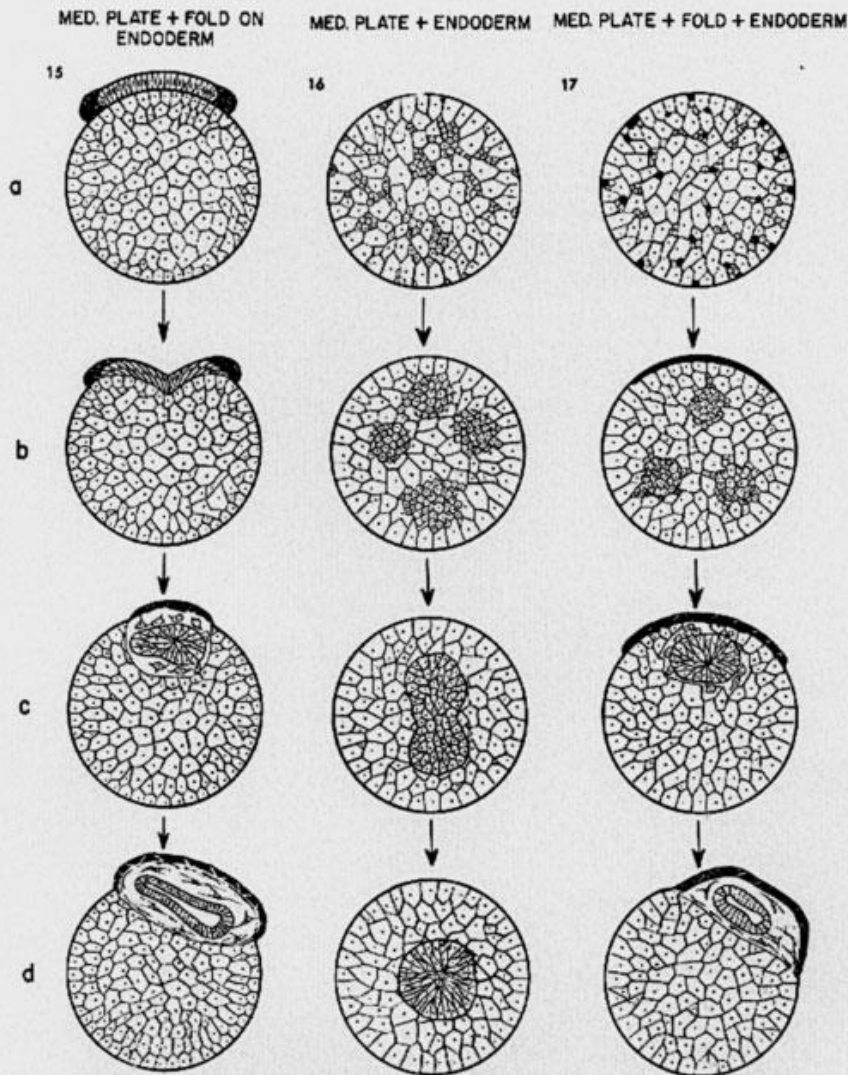
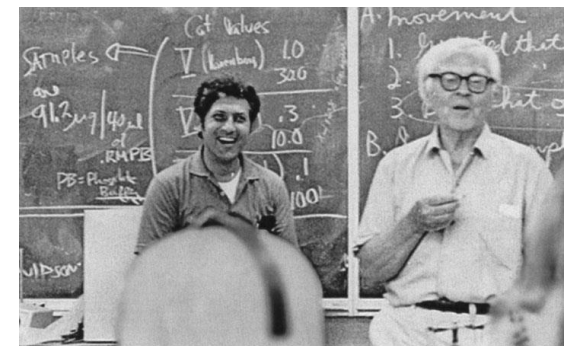
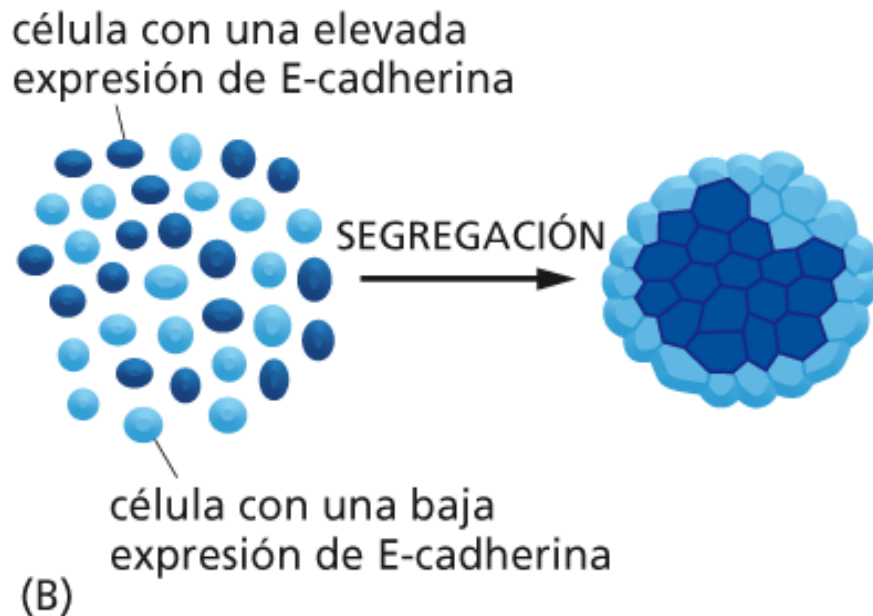
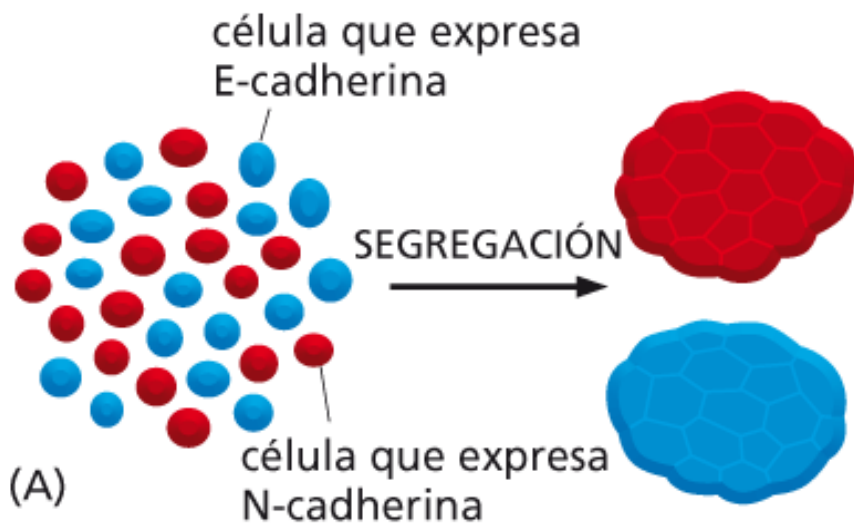


Fig. 15. When neural fold and medullary plate are combined with endoderm, invagination of the medullary material is incomplete and the developing epidermis and mesoderm prevent isolation of the neural tissue. Figure 16. When dissociated cells of medullary plate and endoderm are mixed, the former move centripetally to produce a core of neural tissue lacking a neurocoel. Figure 17. The addition of neural fold produces epidermis and mesenchyme which prevent central allocation of the neural tissue and promote neurocoel formation.

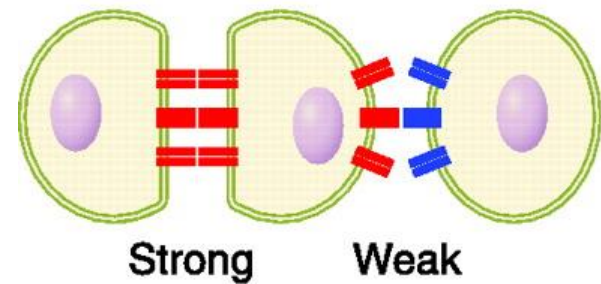
“The tissue segregation becomes complete because of the emergence of a selectivity of cell adhesion: homologous cells when they meet remain permanently united to form functional tissues, whereas a cleft develops between certain non-homologous tissues.”



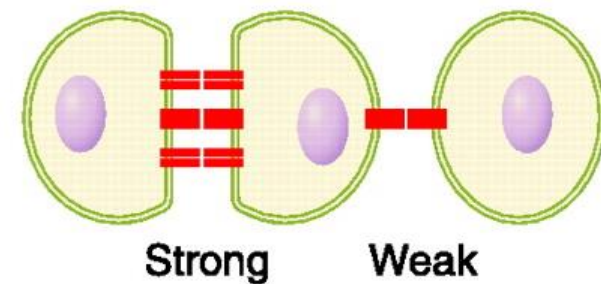
Townes and Holtfreter (1955)



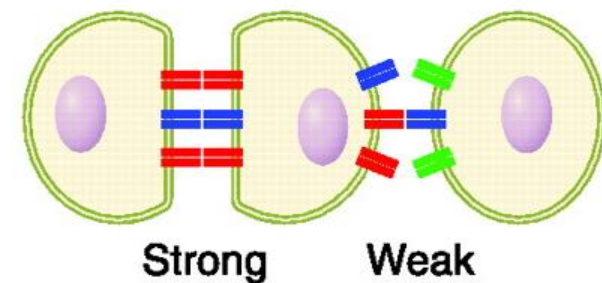
1. Qualitative difference



2. Quantitative difference

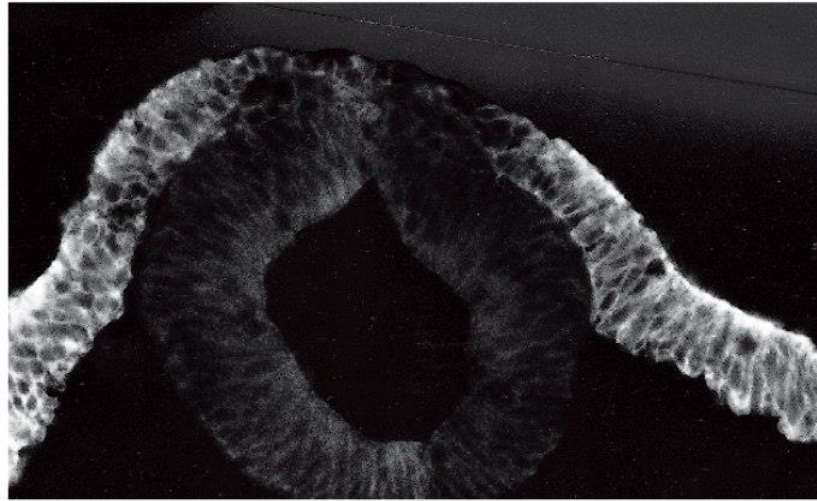


3. Combinatory difference



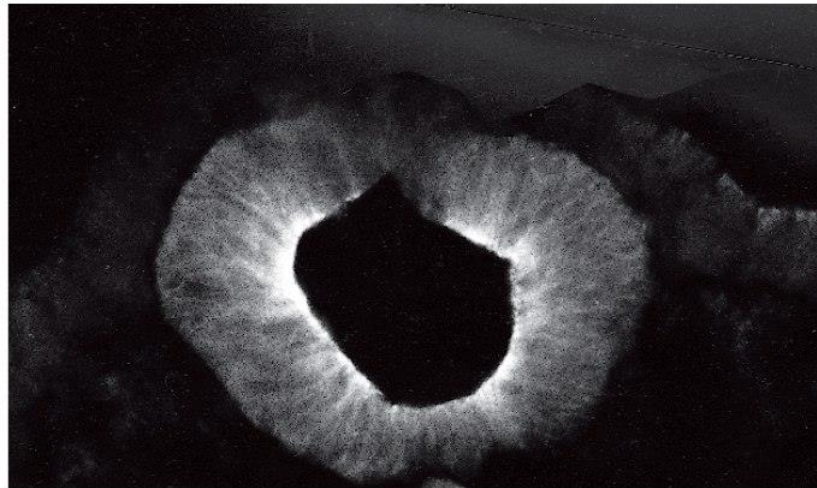
Expresión diferencial de cadherinas

E-cadherina



(A)

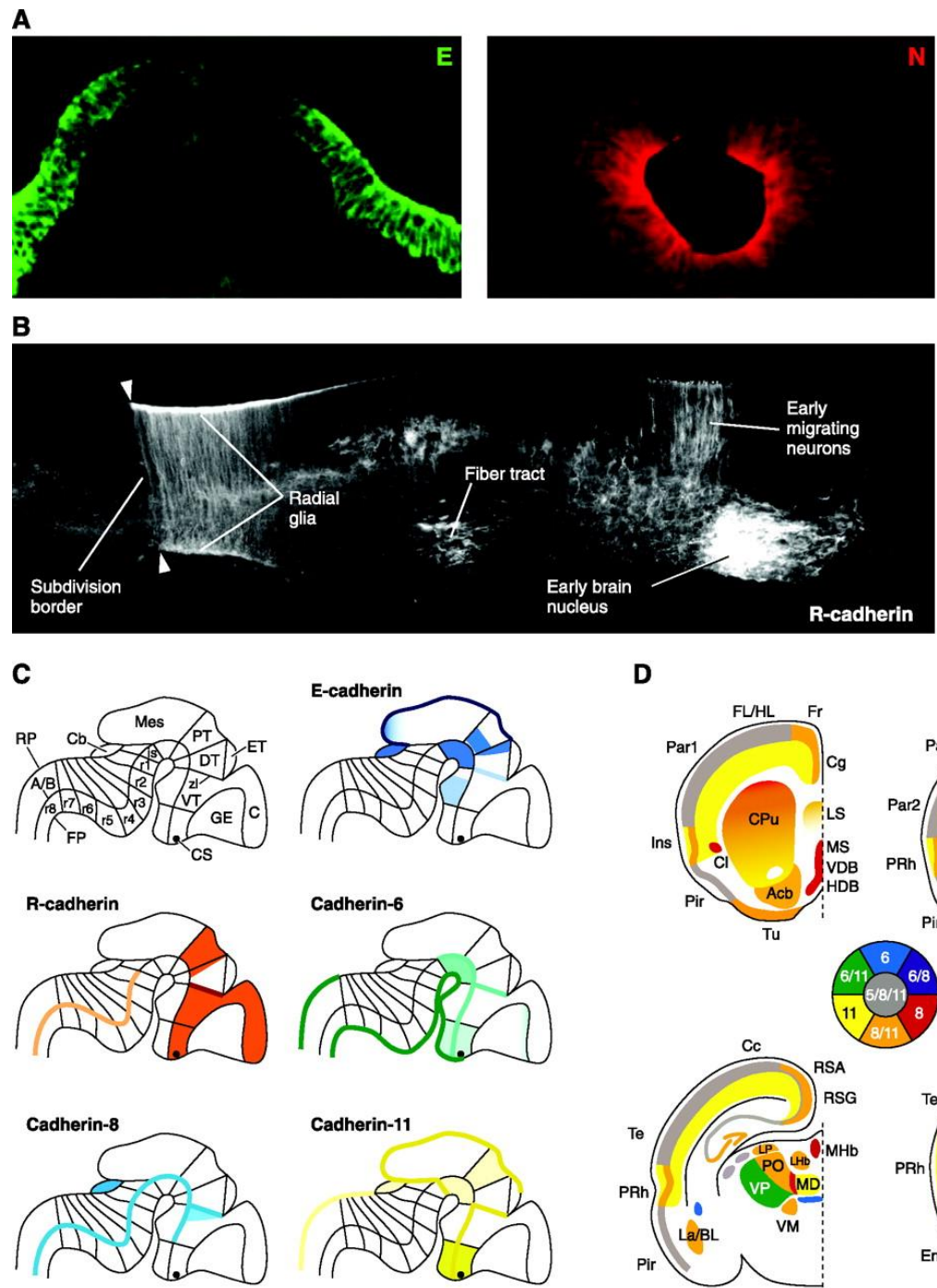
N-cadherina

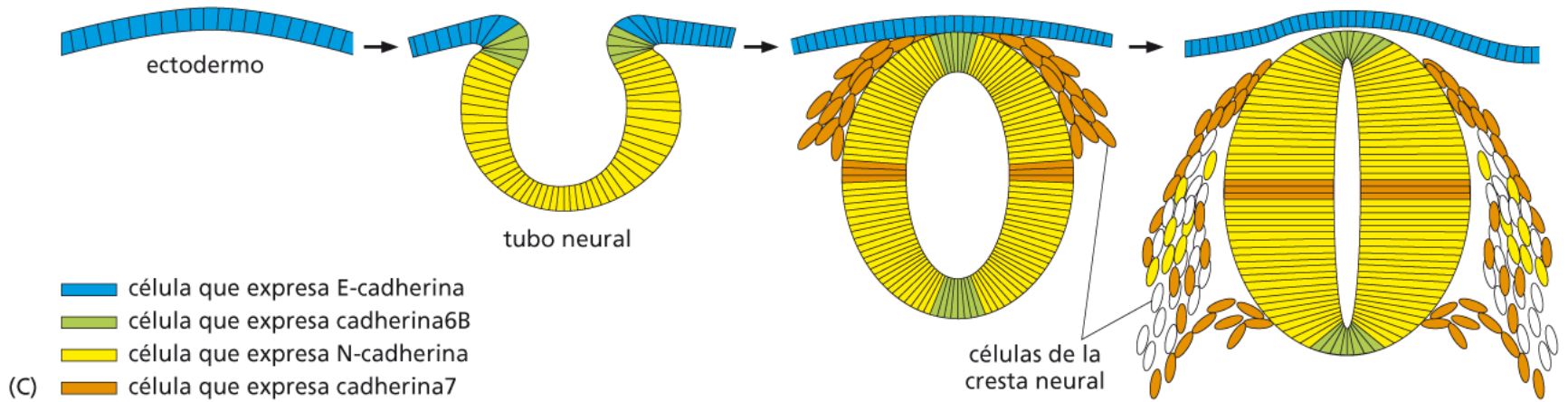


(B)

100 μm

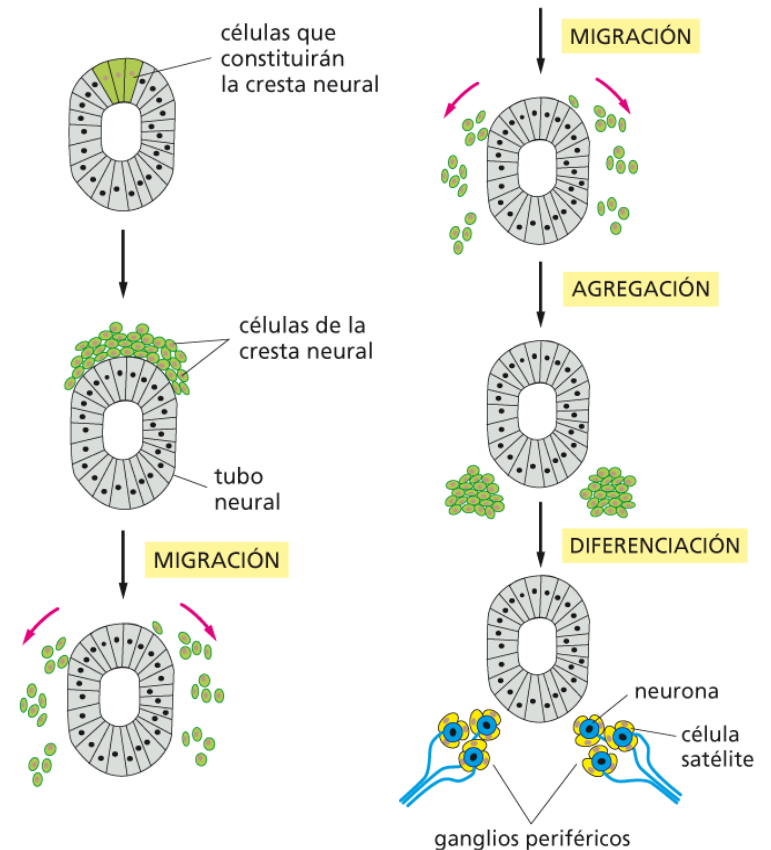
Expresión diferencial en el sistema nervioso



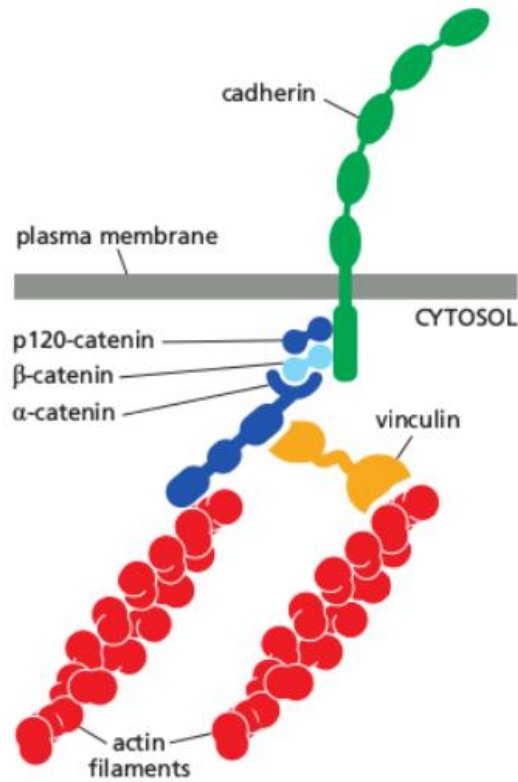


Cresta neural: Transición epitelio- mesénquima

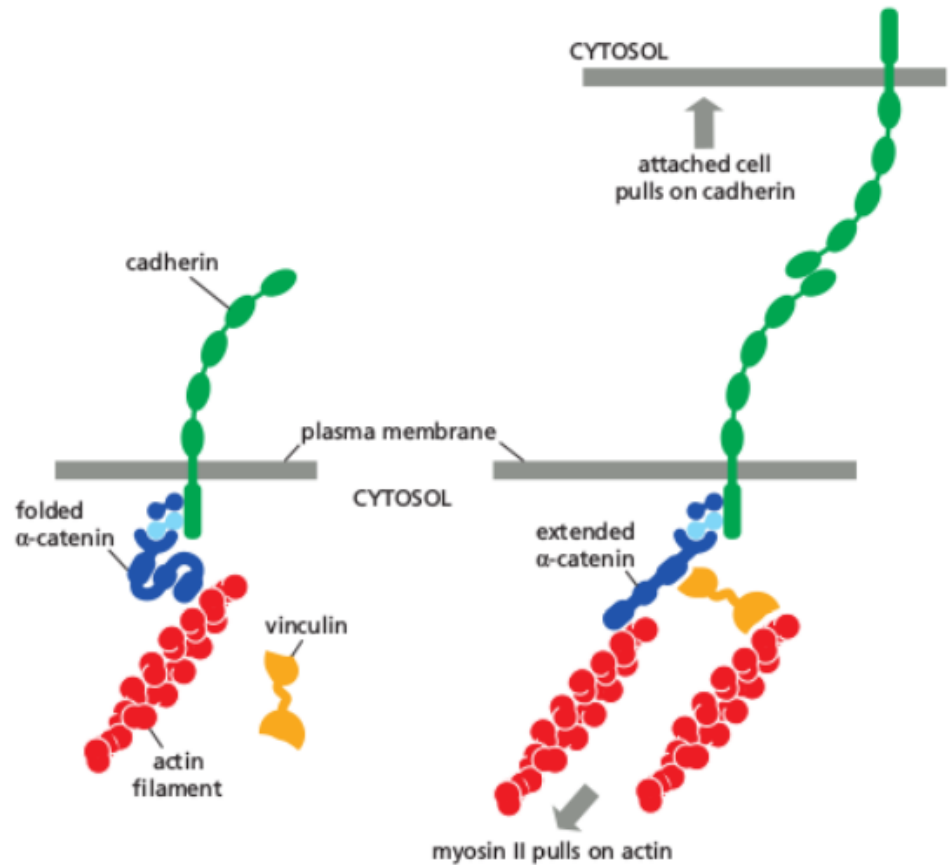
↓ Cadherina

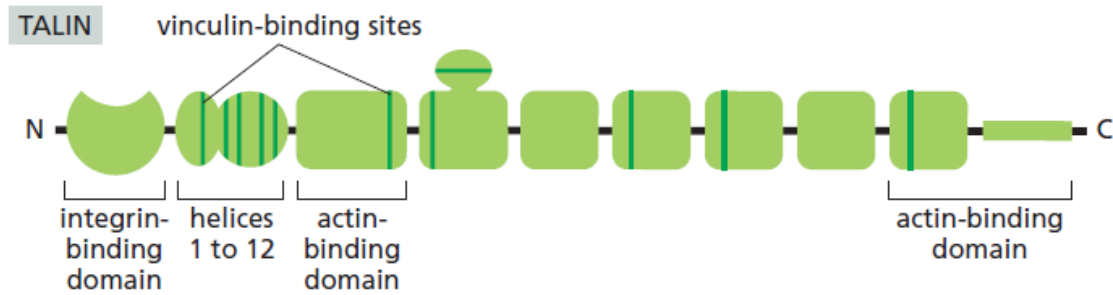


Dominio intracelular: asociación con el citoesqueleto

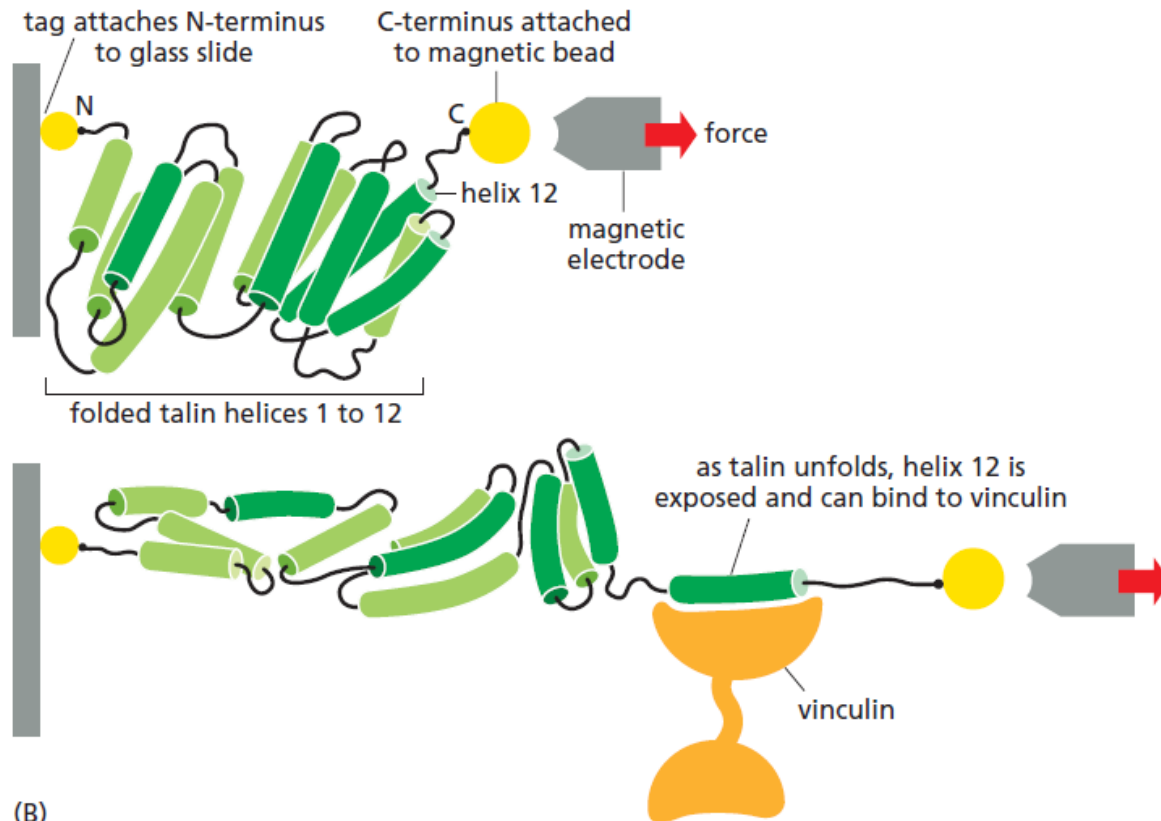


(A) NO TENSION



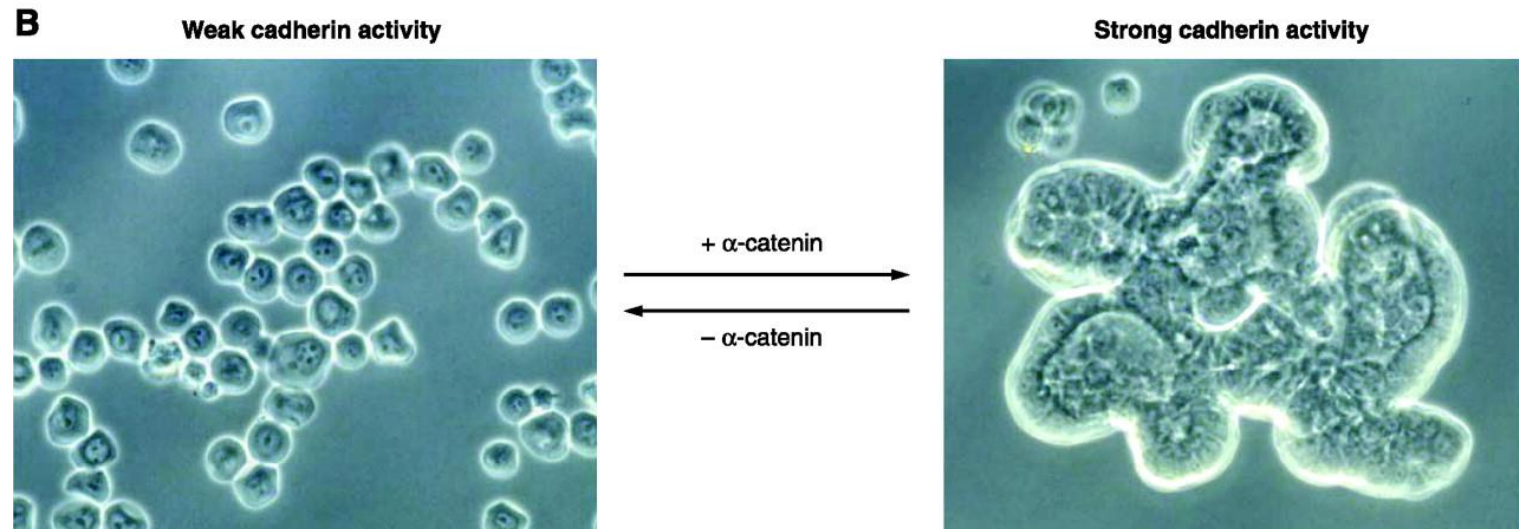
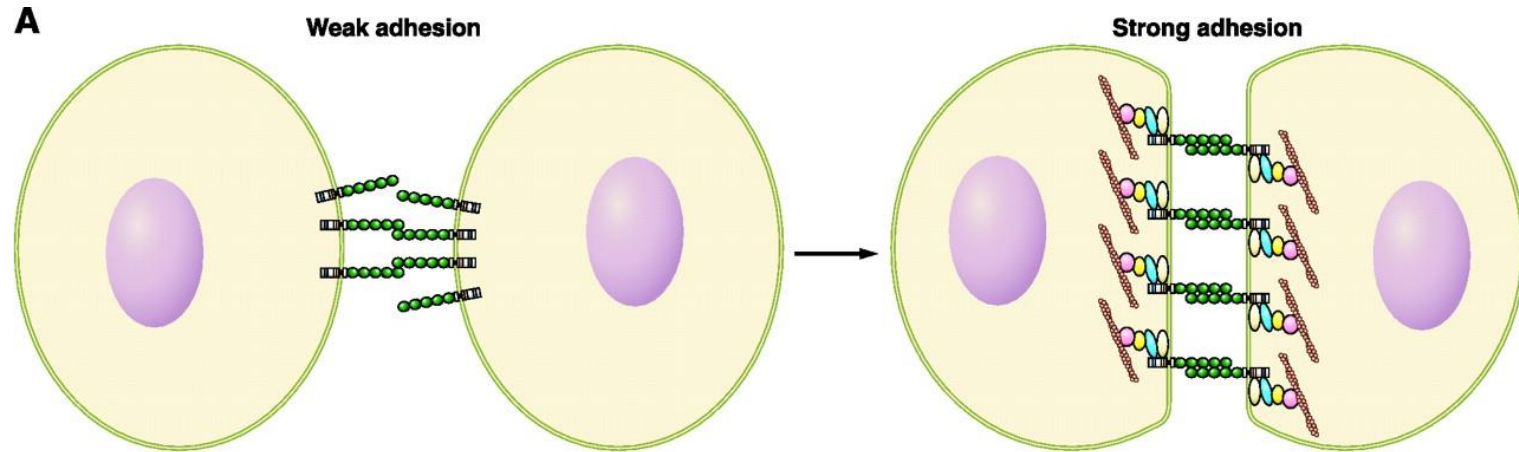


(A)



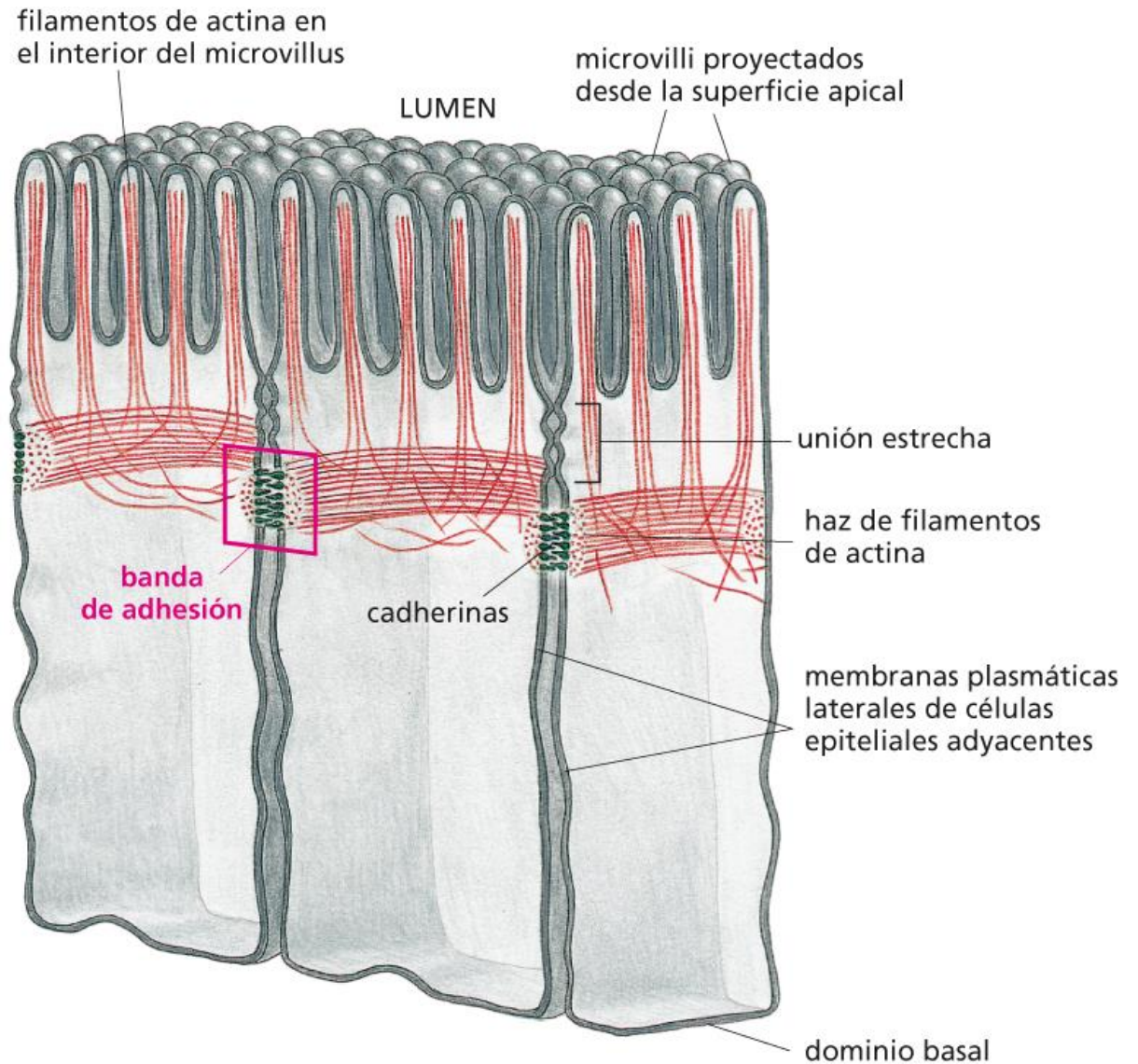
(B)

Modulación de la adhesión celular por componentes intracelulares

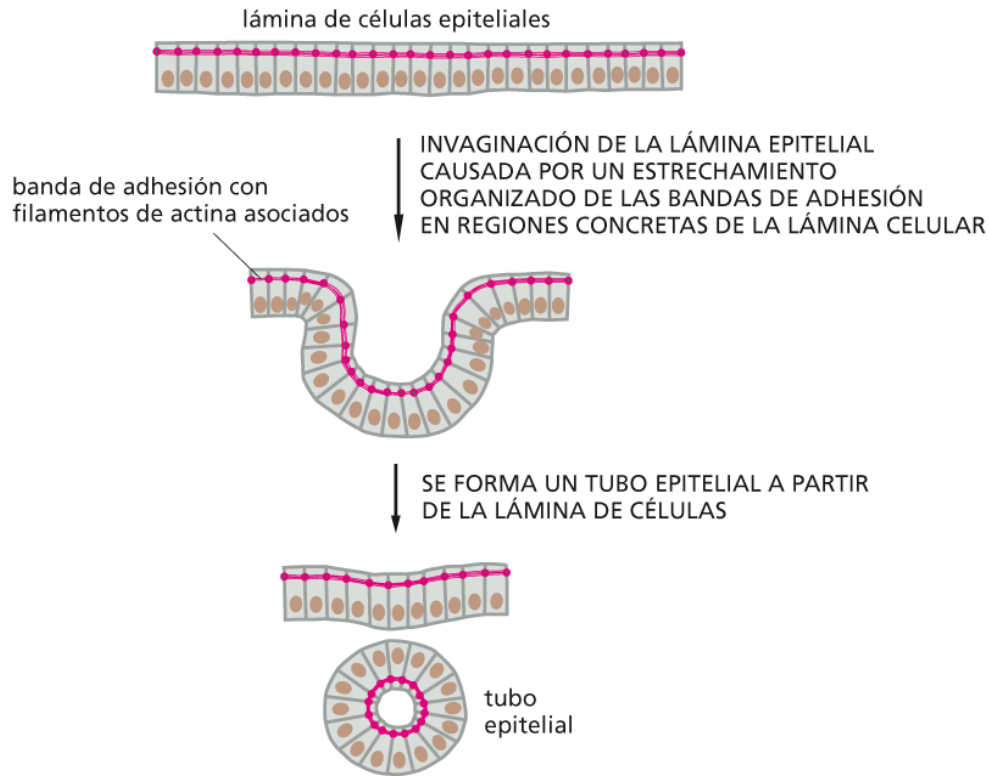


Línea celular de carcinoma de pulmón

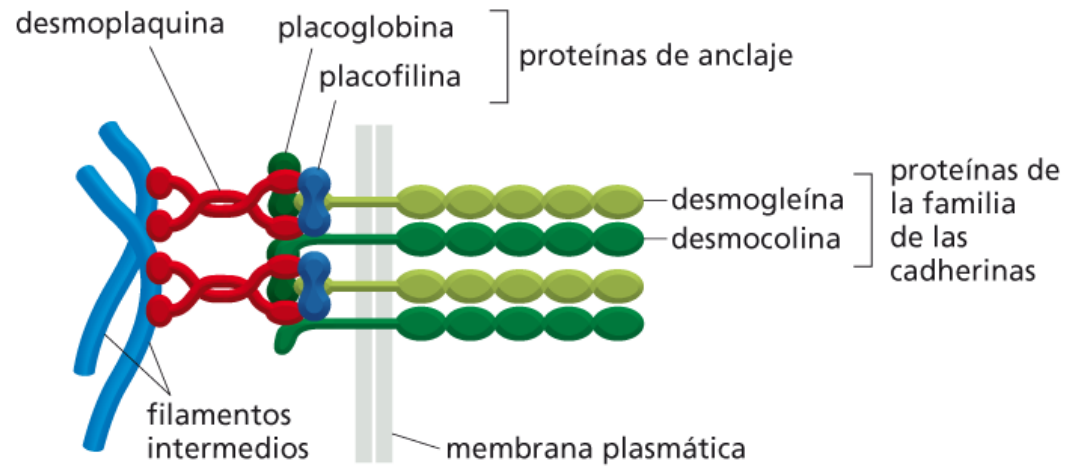
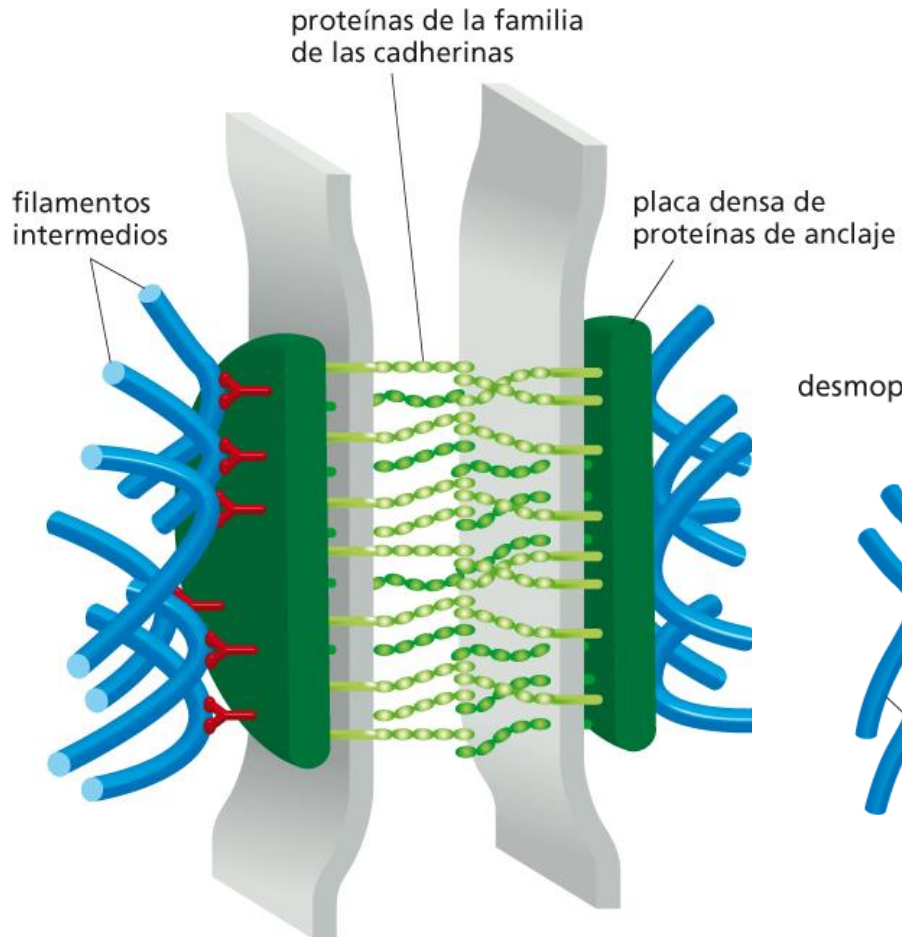
Cinturón de adhesión



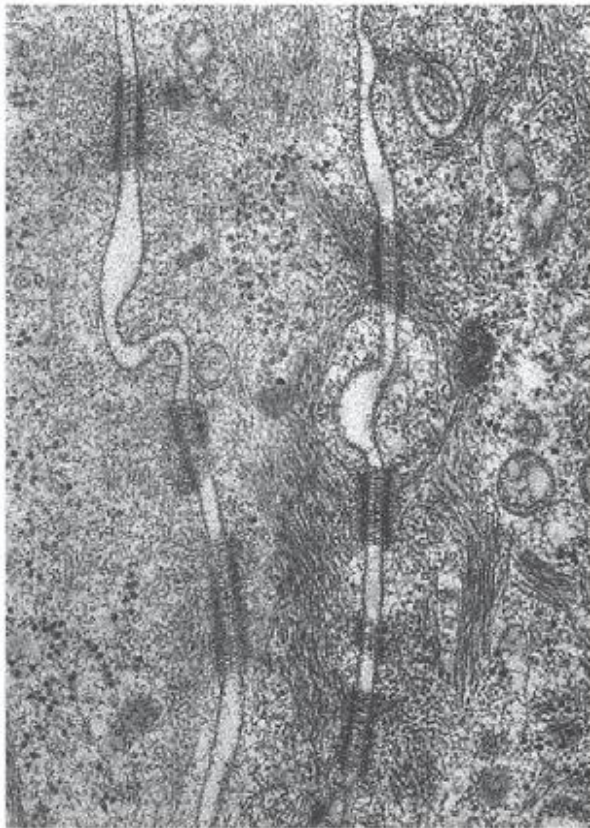
Ejemplo de coordinación adhesión célula-célula y citoesqueleto: cierre del tubo neural



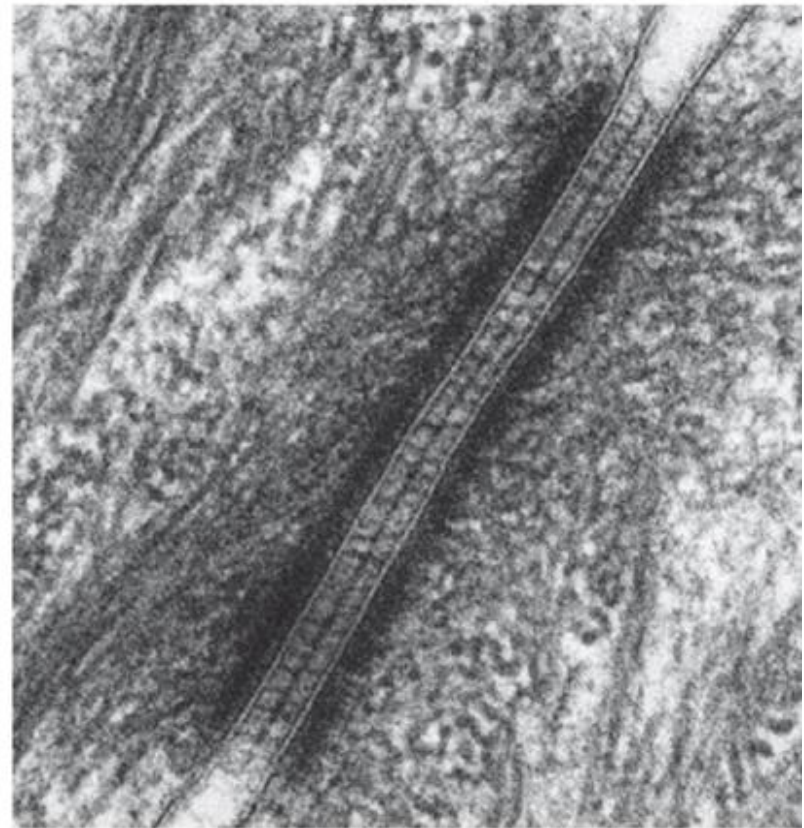
Desmosomas



Ultraestructura del desmosoma



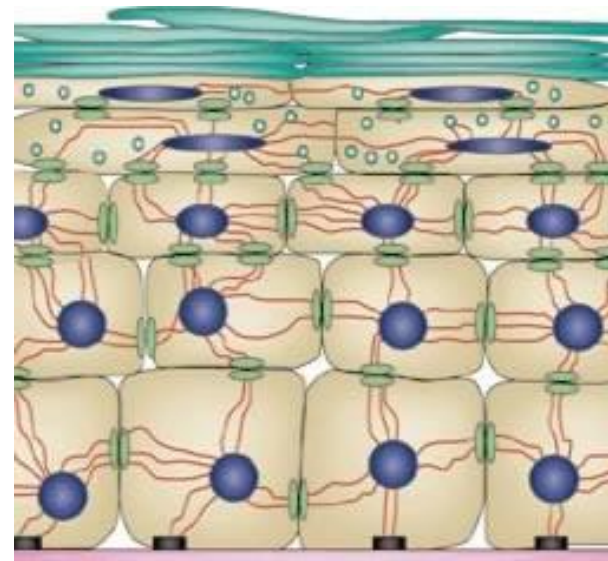
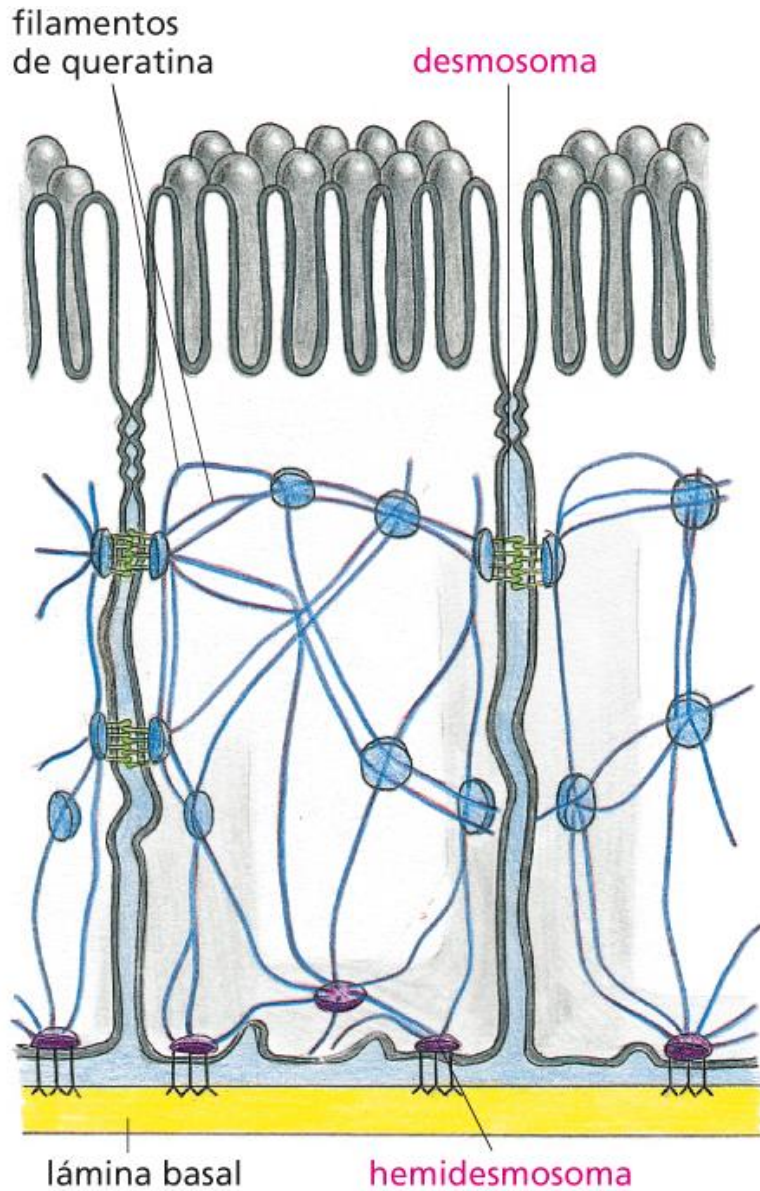
0,5 μm



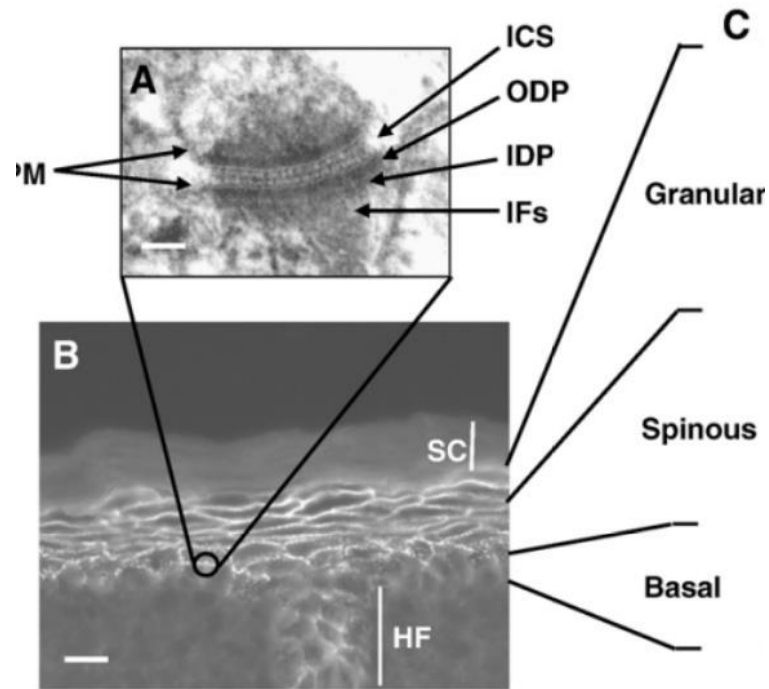
100 nm

(D)

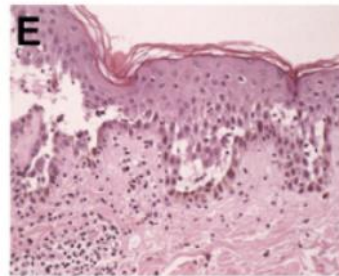
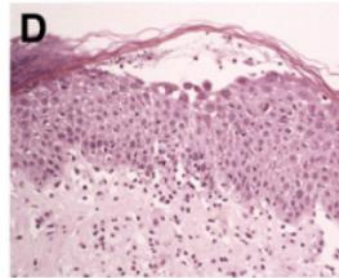
Resistencia mecánica



Desmosomas en la epidermis



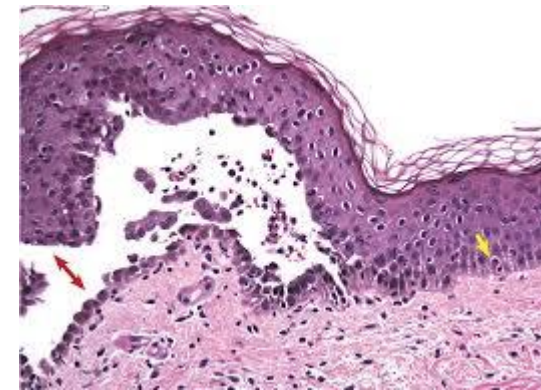
Pemphigus foliaceus
Anti-Dsg1



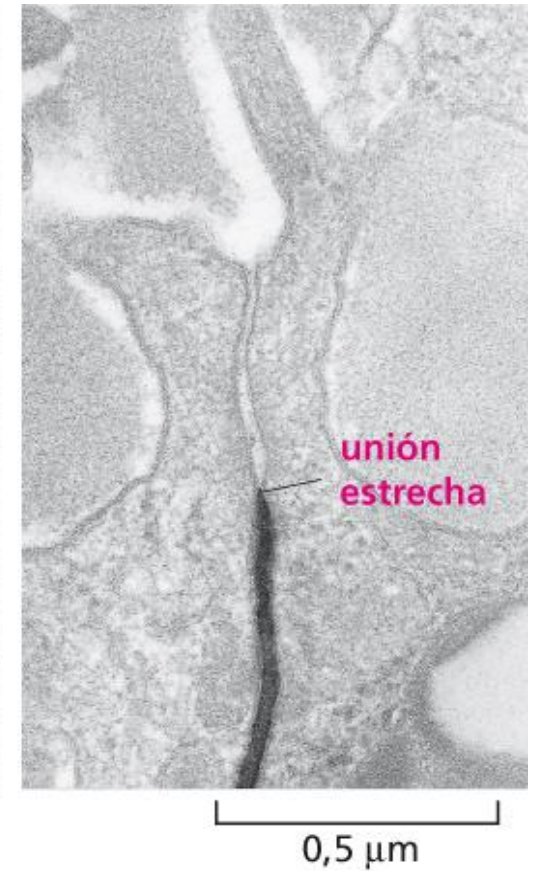
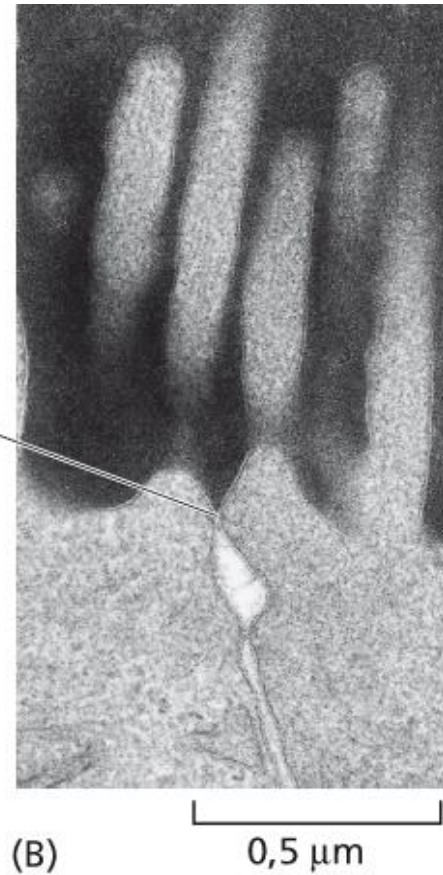
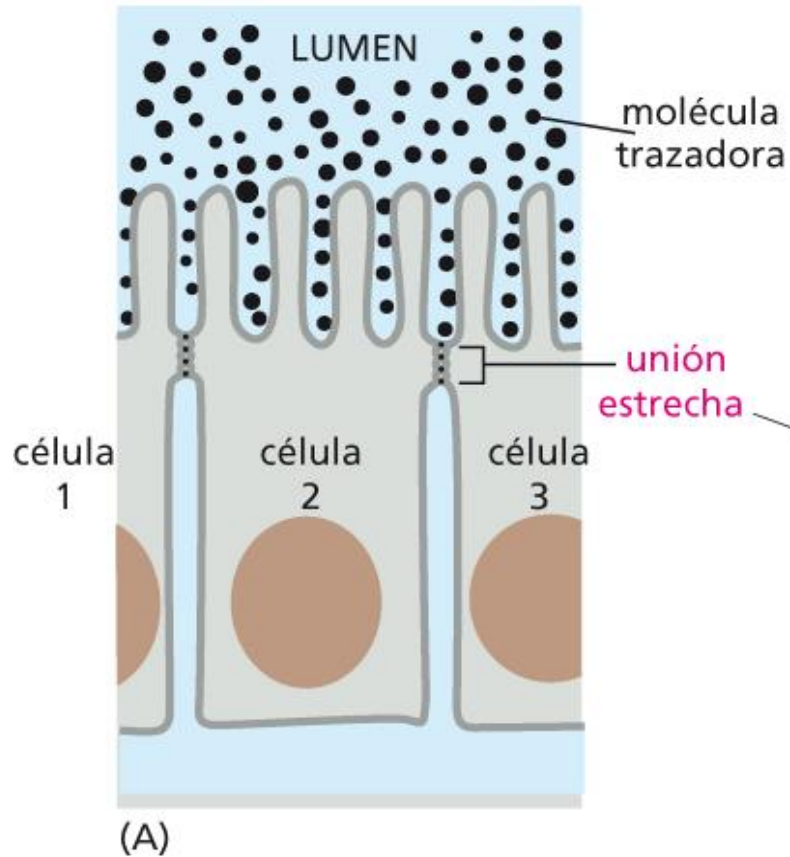
Pemphigus vulgaris –
mucocutaneous form
Anti-Dsg3 + Dsg1

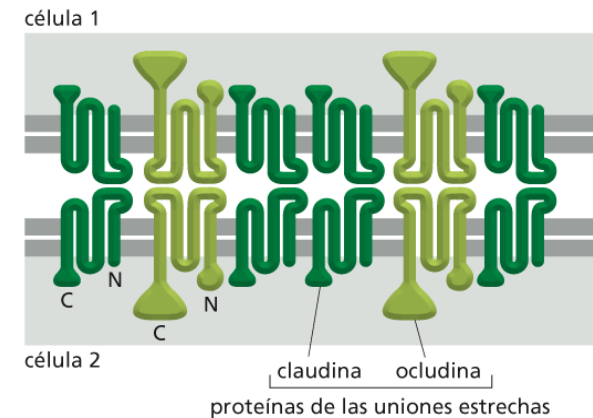
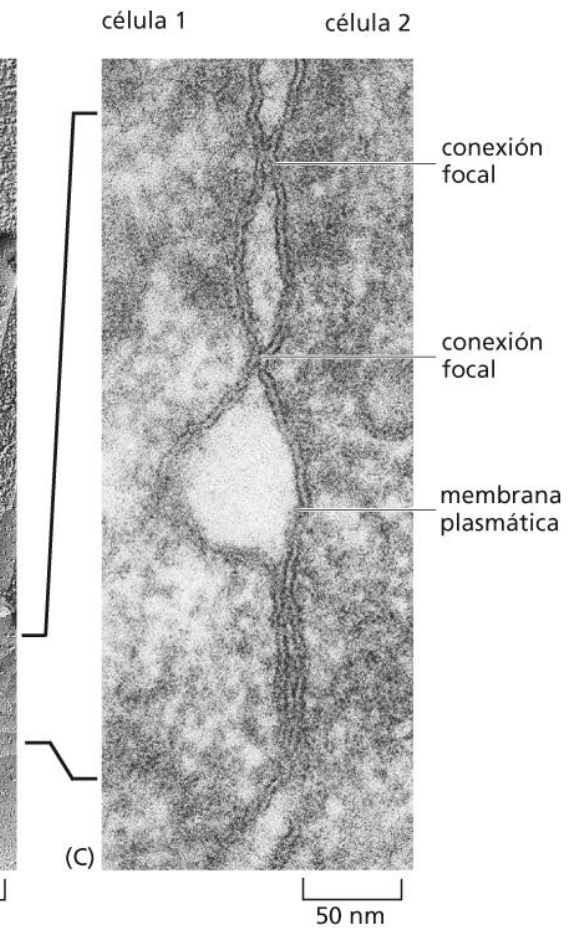
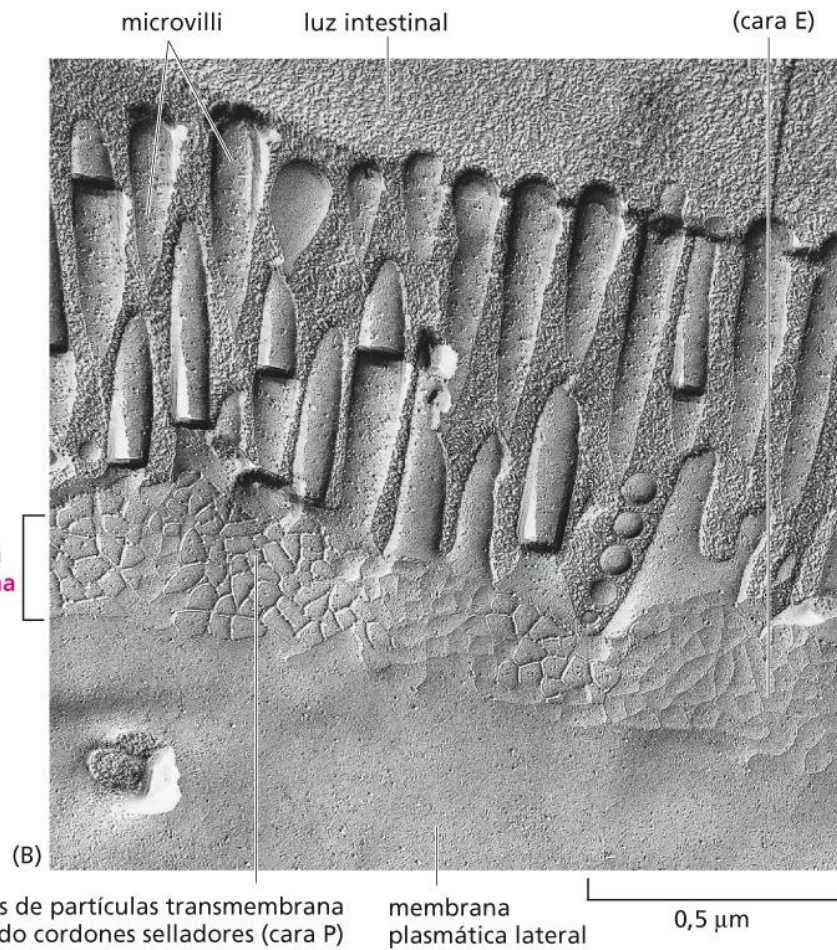
Desmogleína

Pénfigo



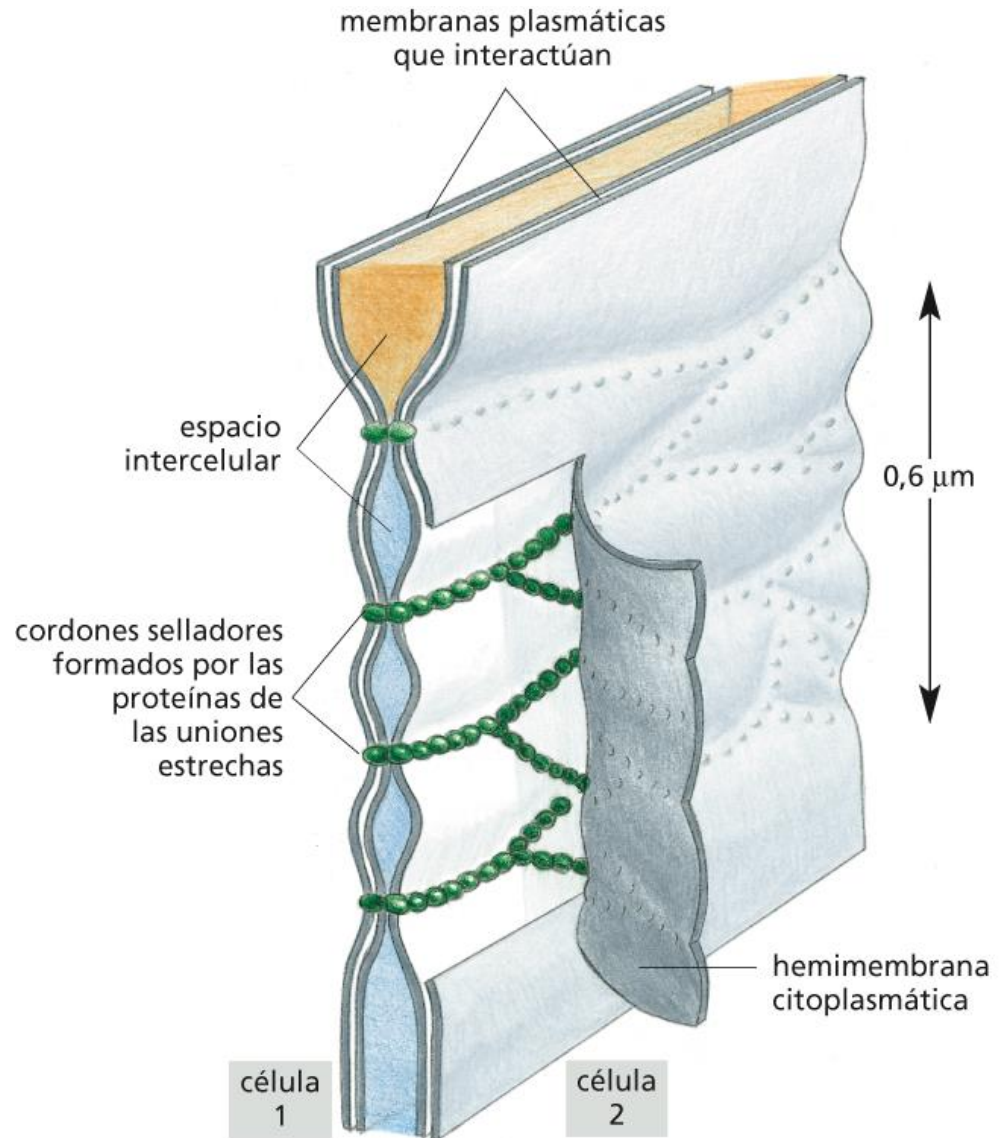
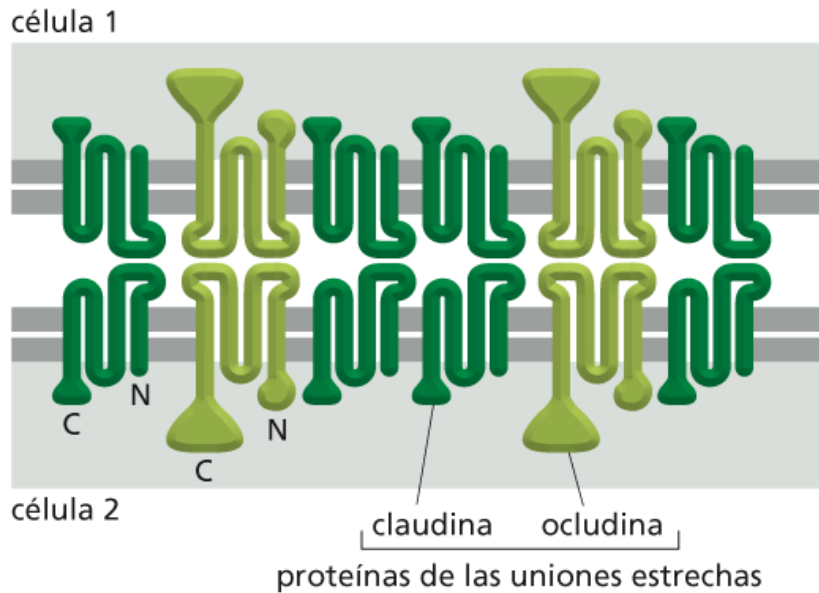
Uniones estrechas



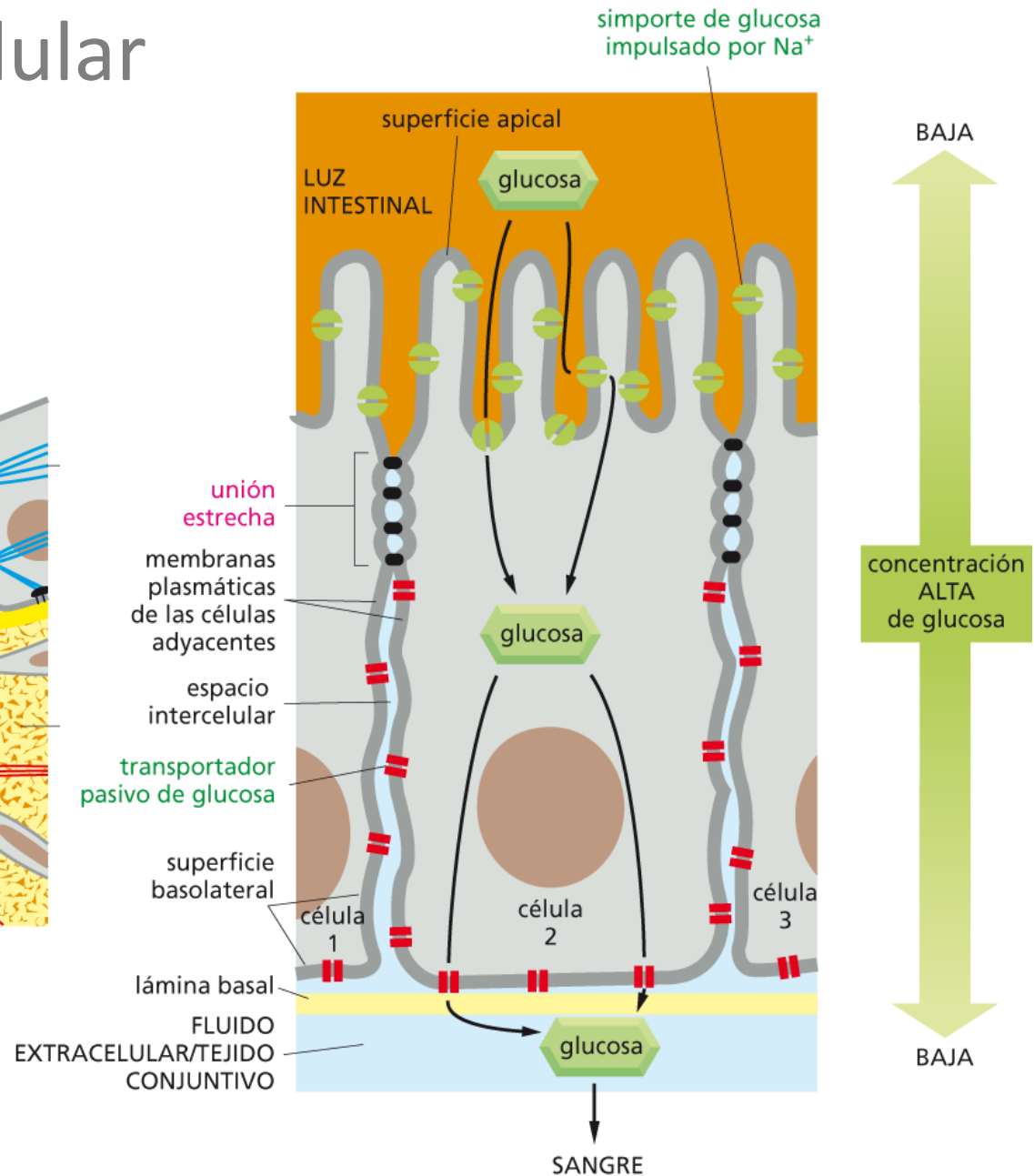
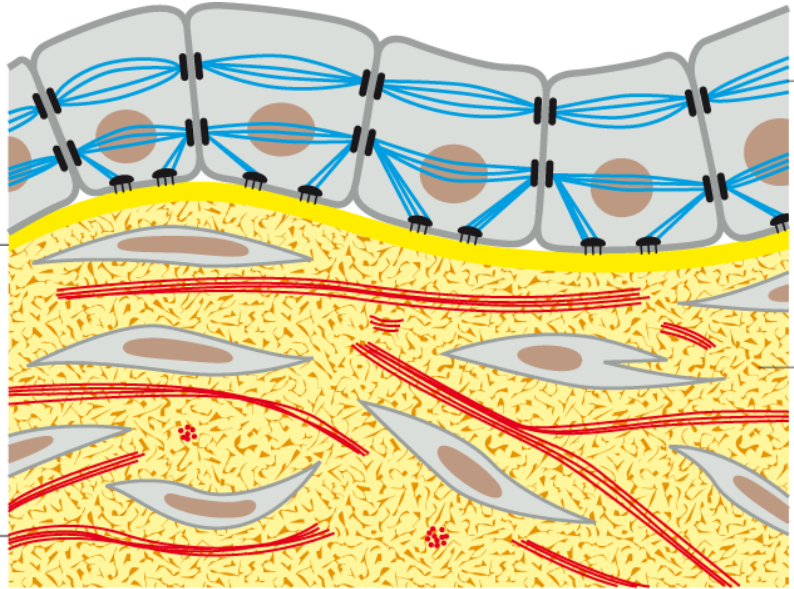


Familia de claudinas: 24 miembros en humanos

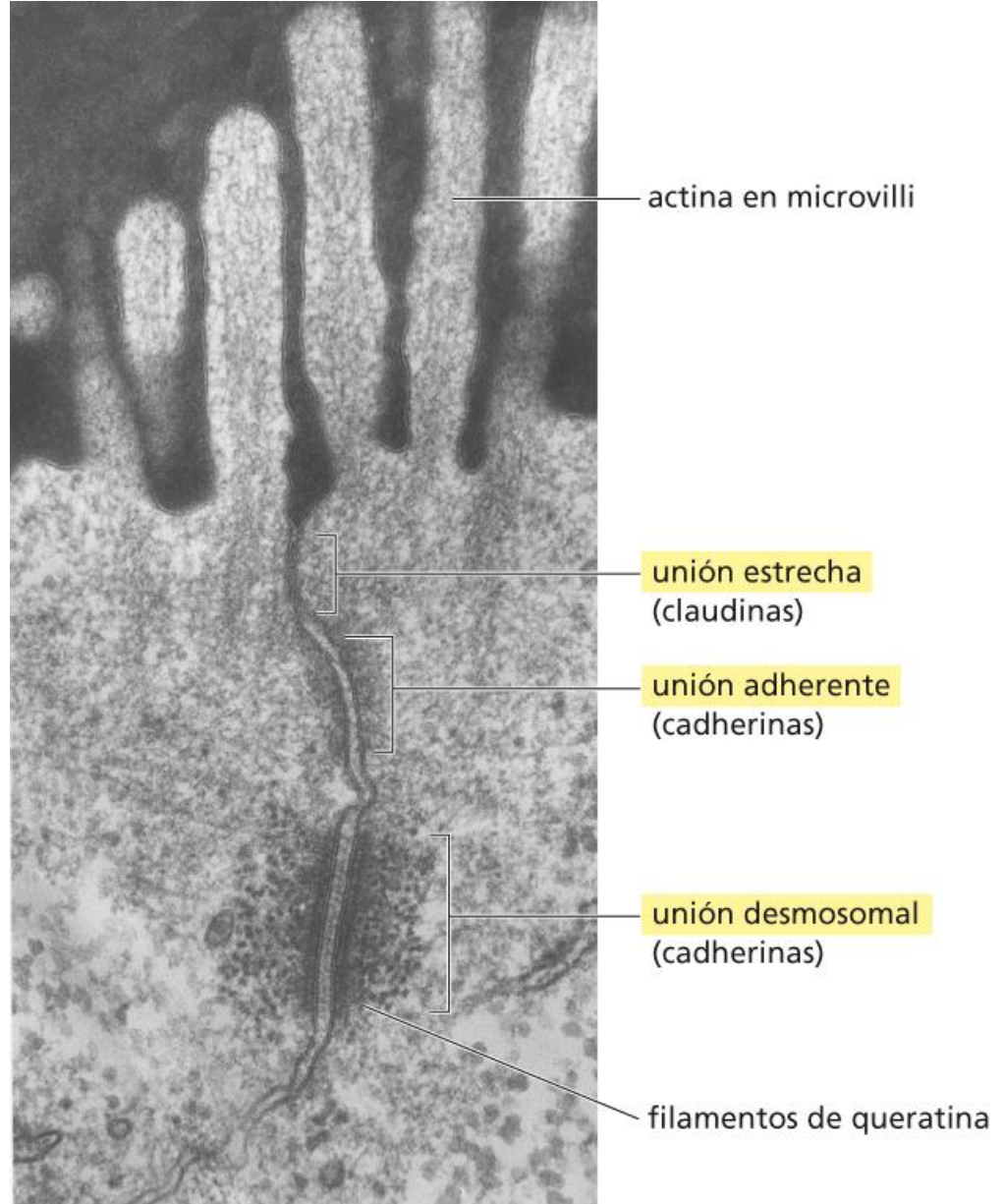
Regulación de la permeabilidad (transporte paracelular)



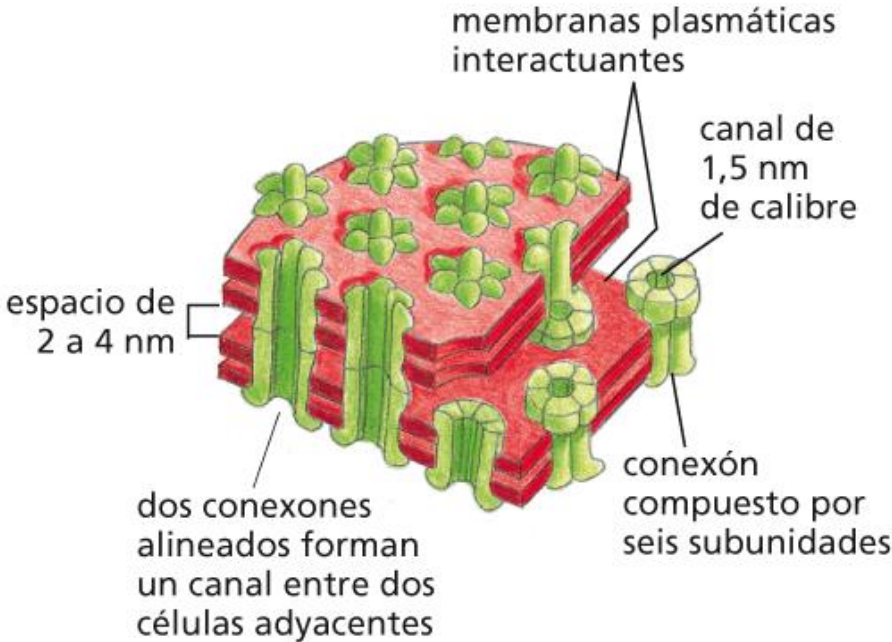
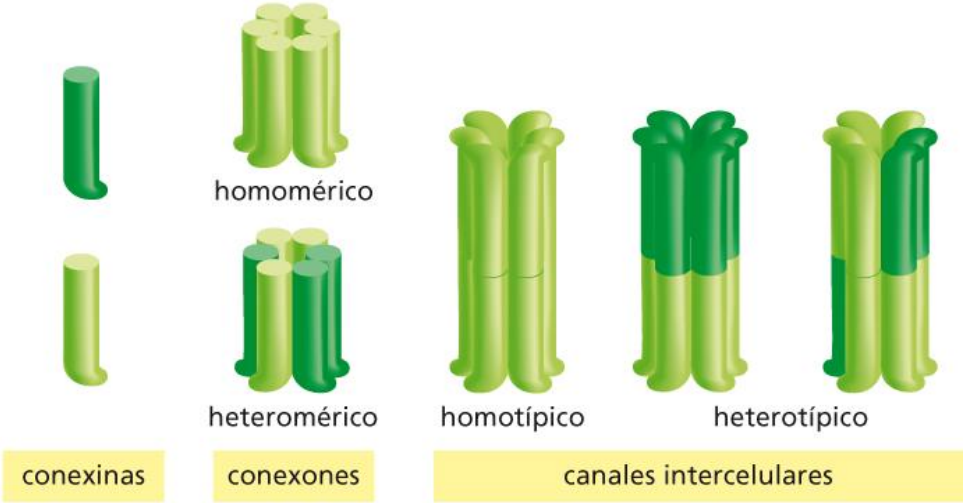
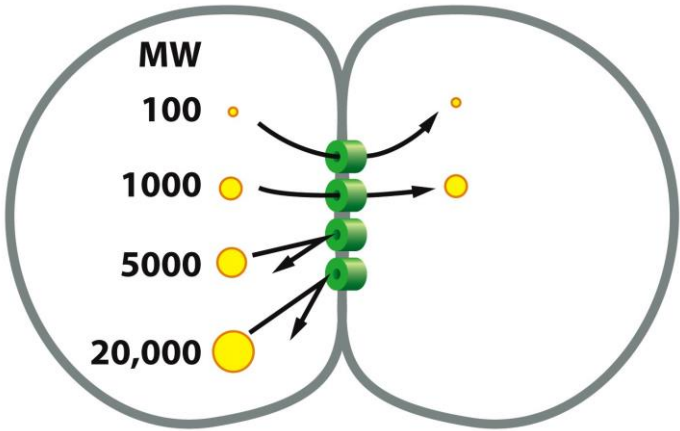
Transporte transcelular

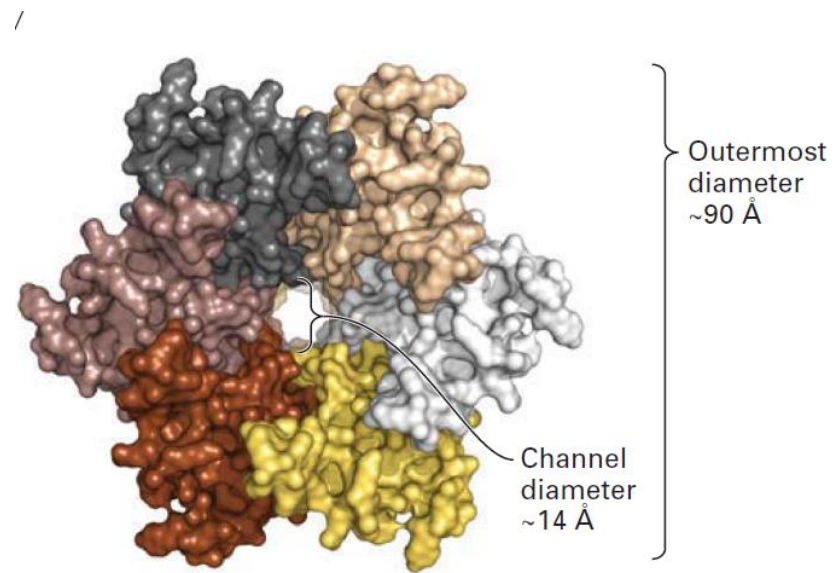
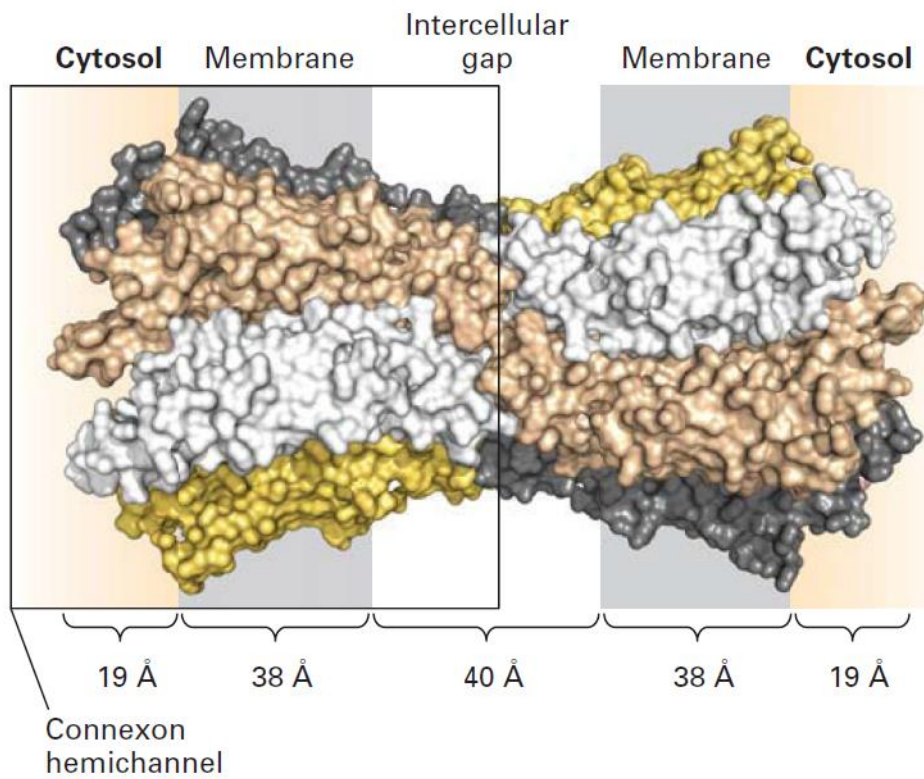


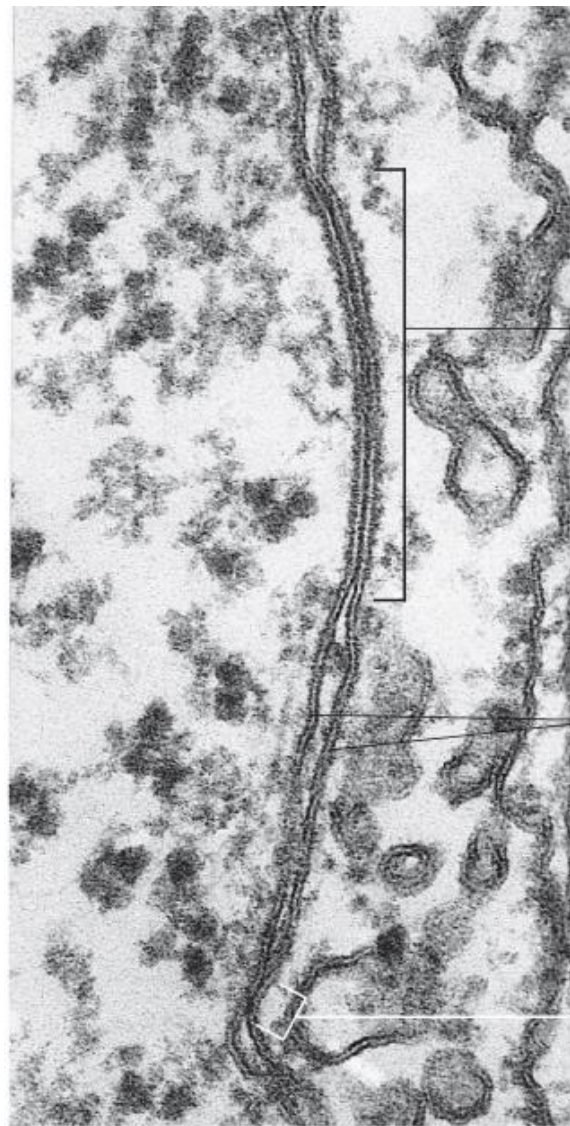
Complejos de adhesión célula-célula



Uniones comunicantes







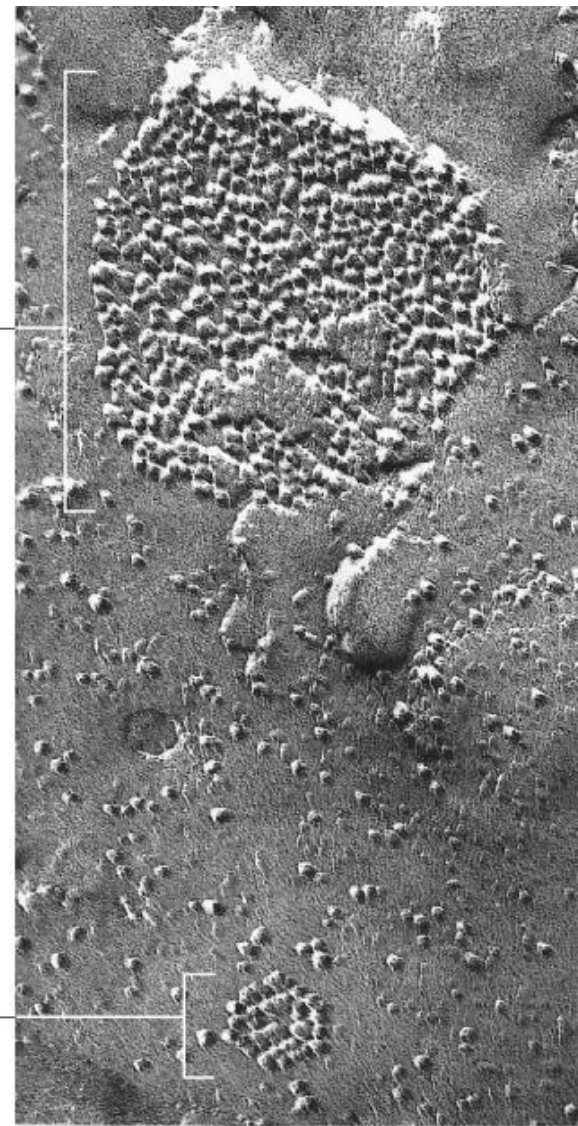
(A)

100 nm

unión
de tipo
gap grande

membranas

unión
de tipo
gap pequeña

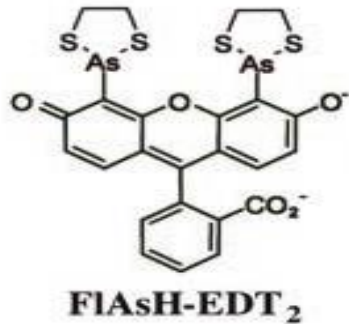


(B)

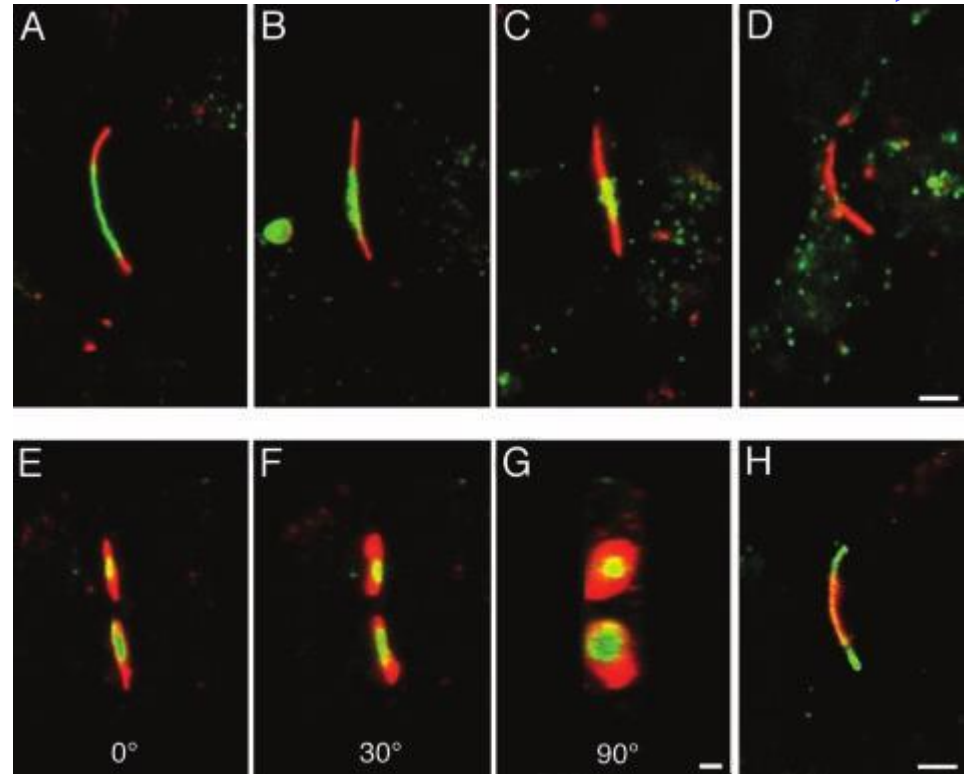
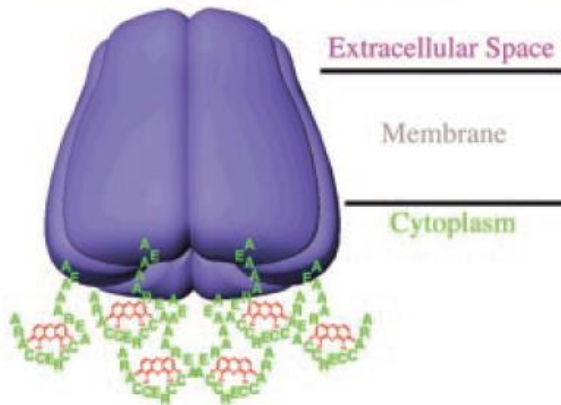
100 nm

Dinámica en las uniones comunicantes: Experimentos de *pulse-chase*

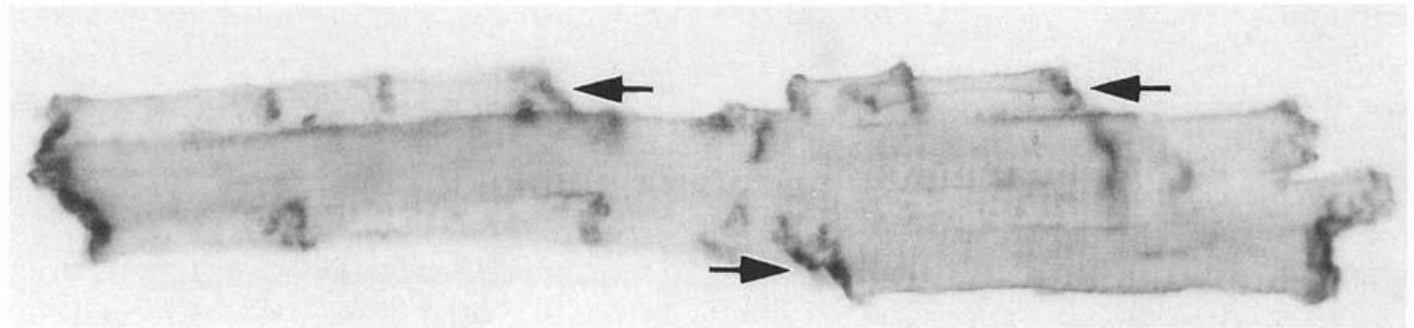
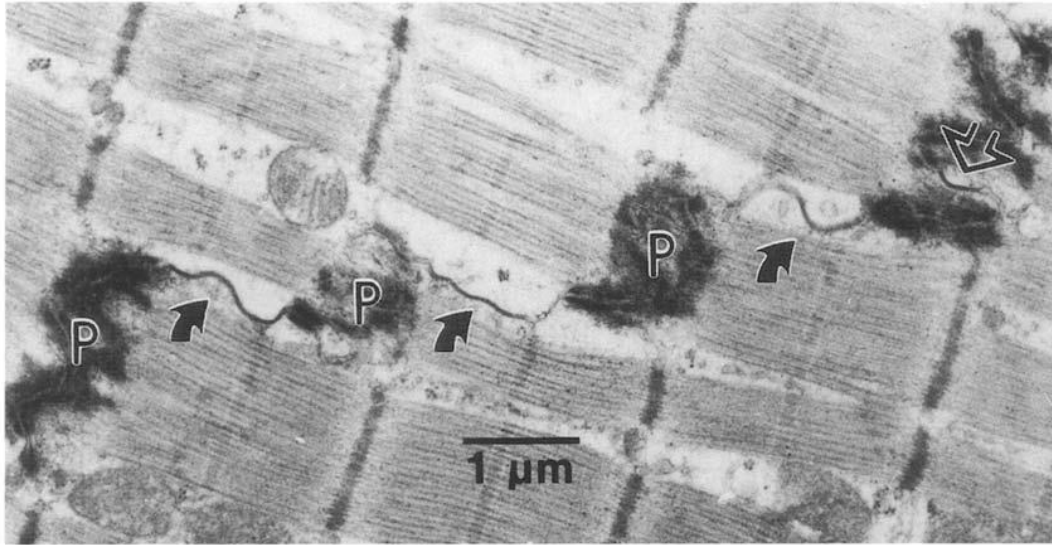
tiempo



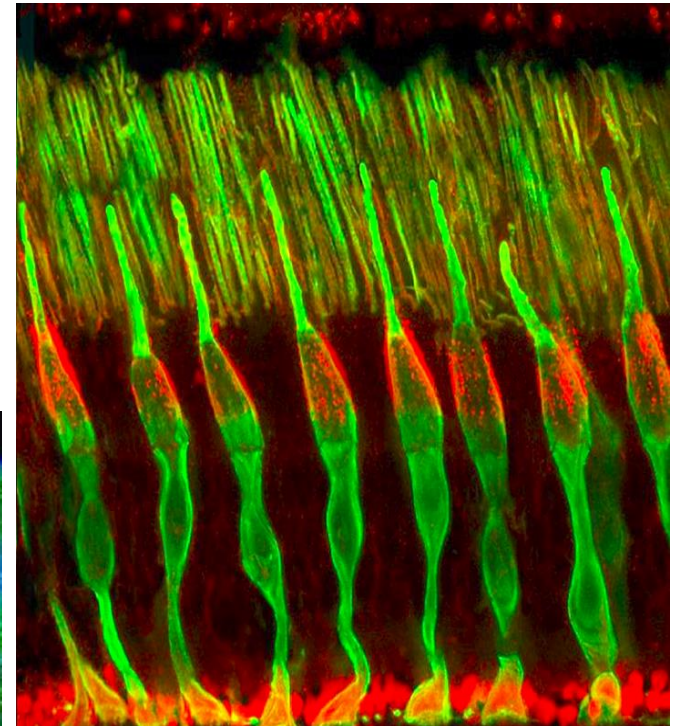
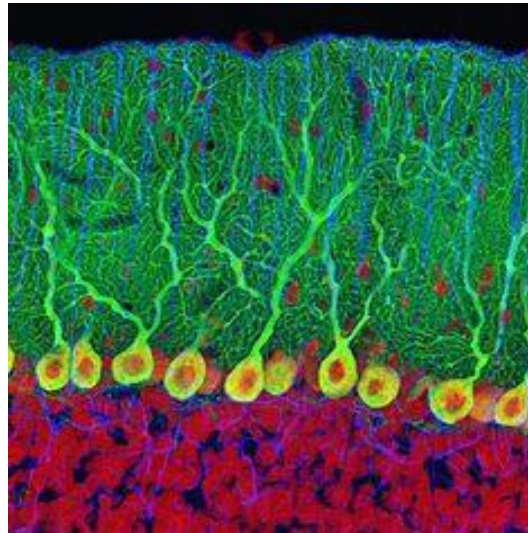
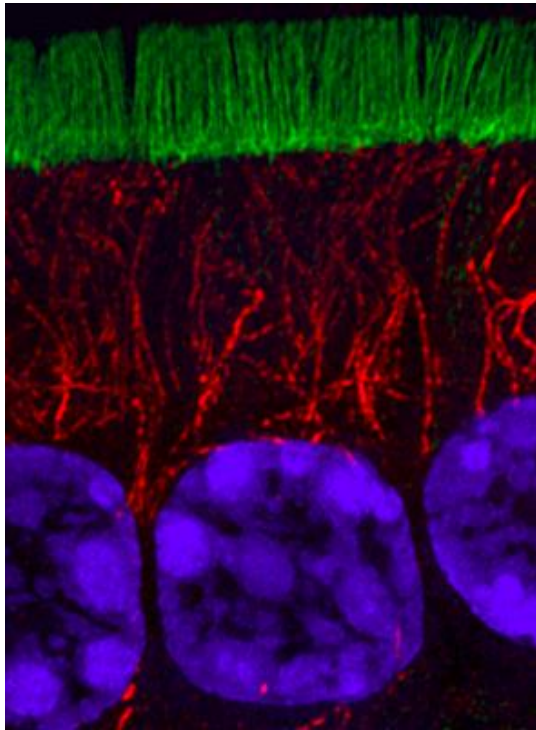
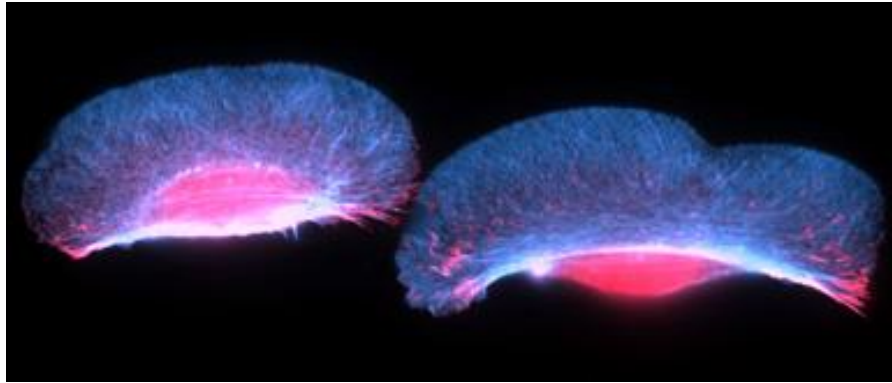
N terminus M1 E1 M2 CL M3 E2 M4 C terminus TC

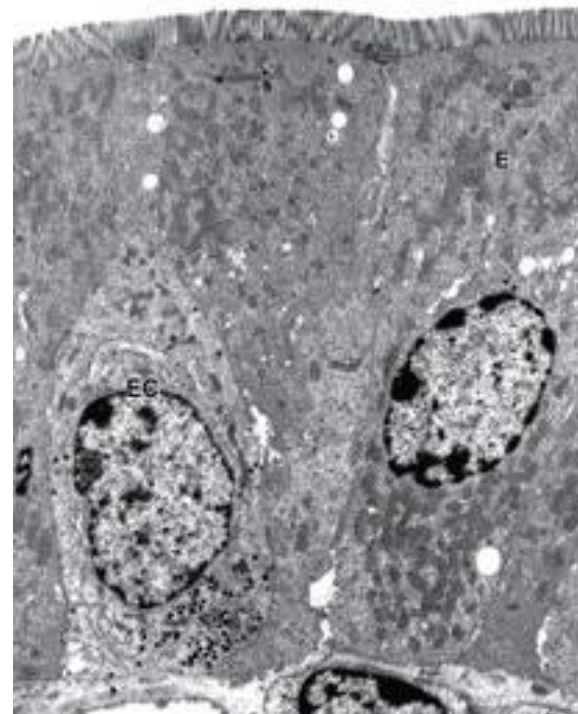
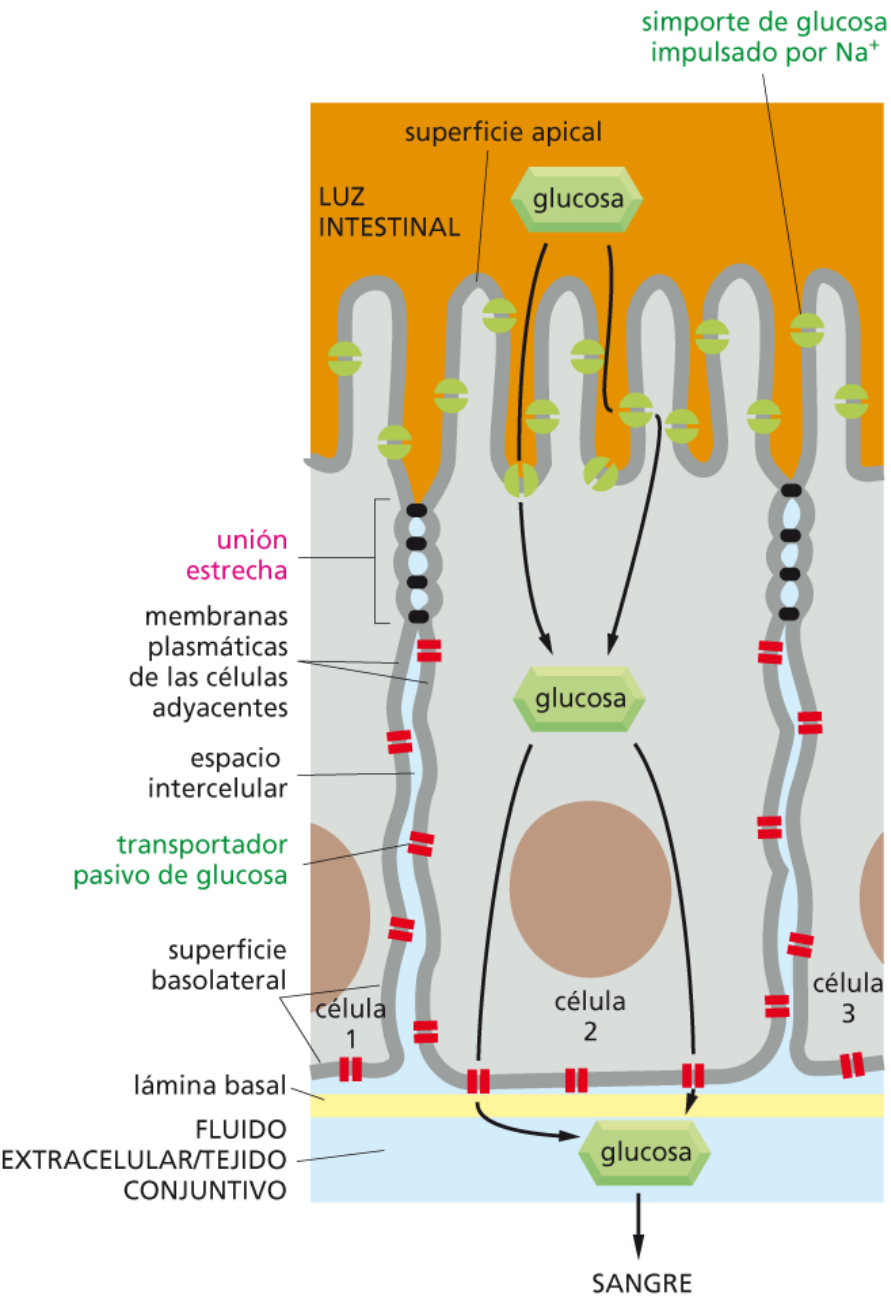


Uniones comunicantes en tejido muscular cardíaco



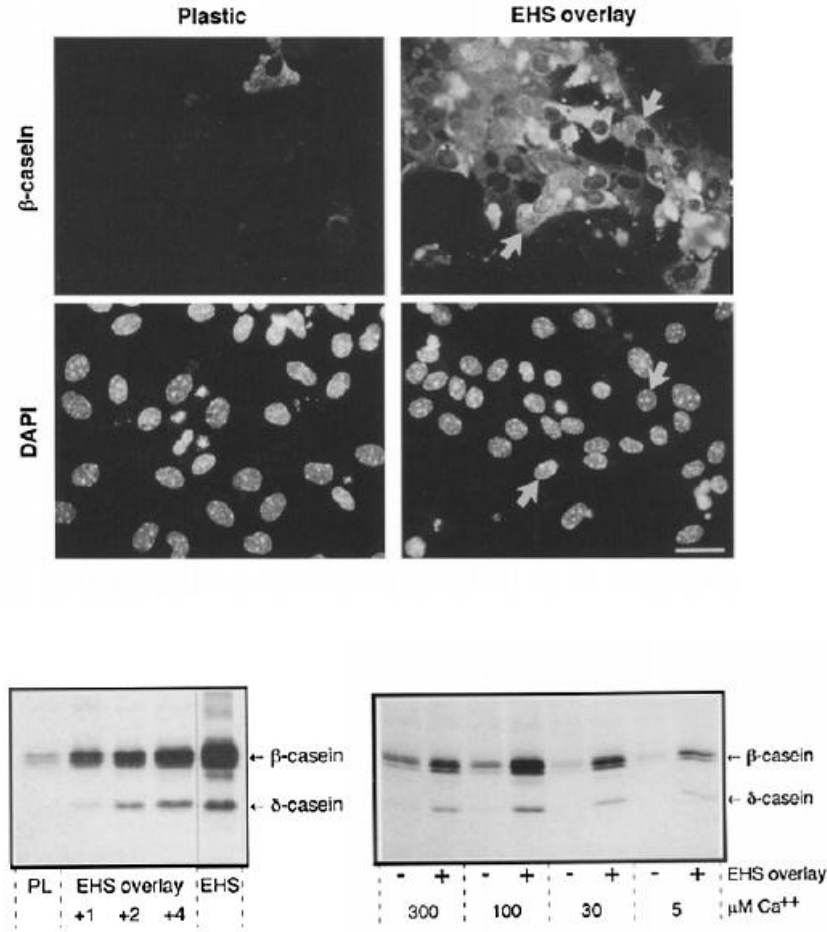
Polaridad celular





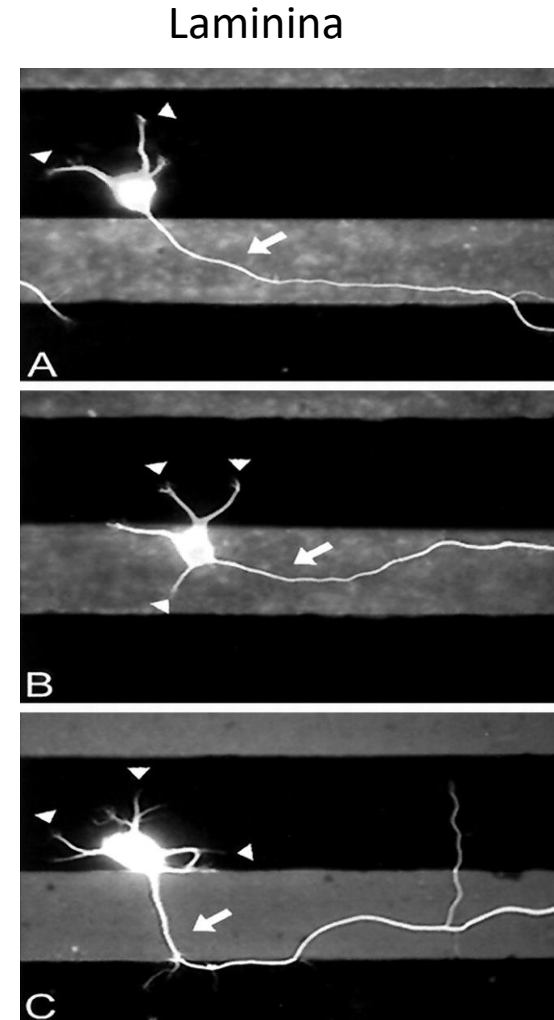
Señales extracelulares: lamina basal

Células epiteliales de la glándula mamaria



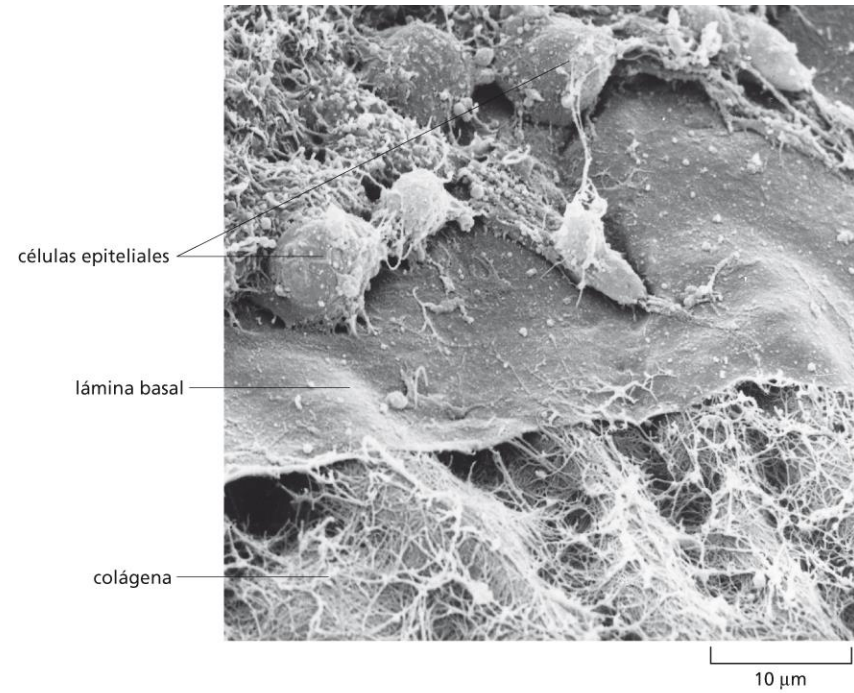
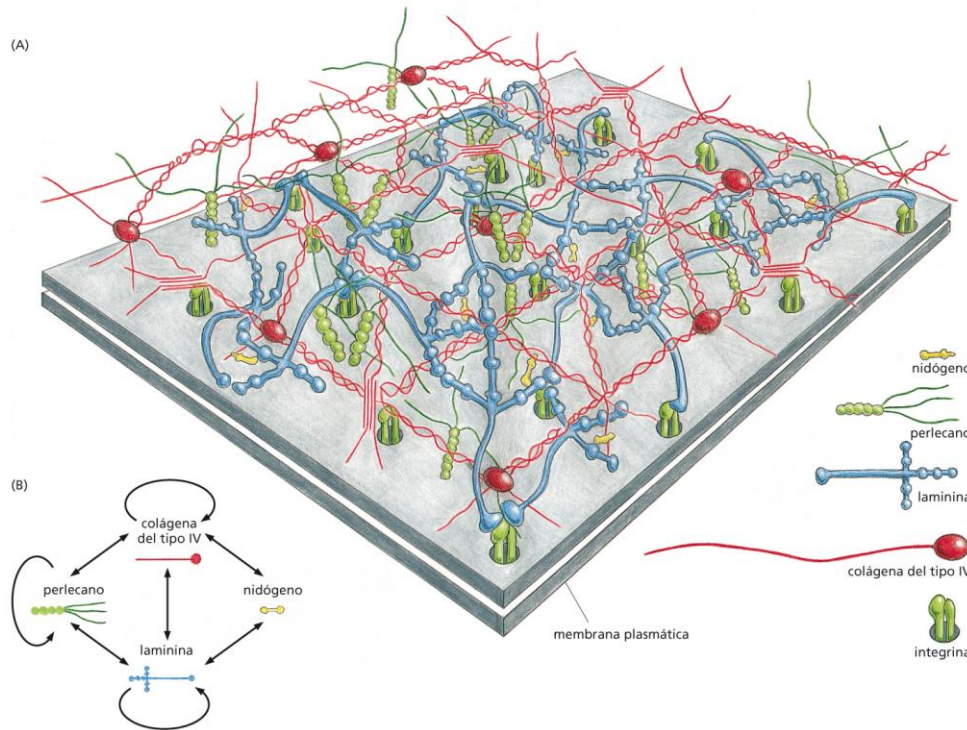
Streuli et al., 1995

Neuronas del hipocampo



Esch et al., 1999

Lámina basal



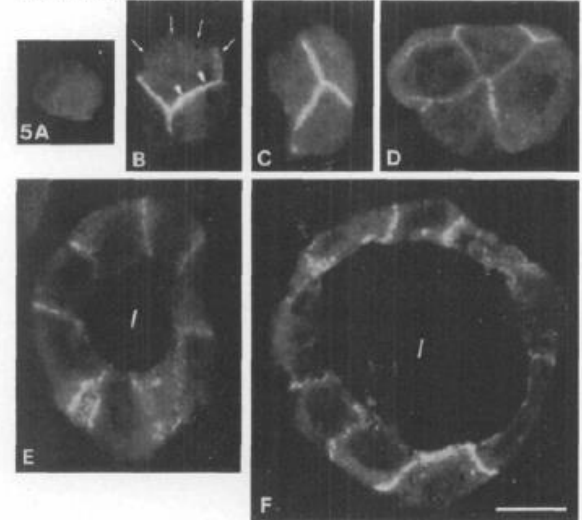
Contacto célula-célula

Steps in the morphogenesis of a polarized epithelium

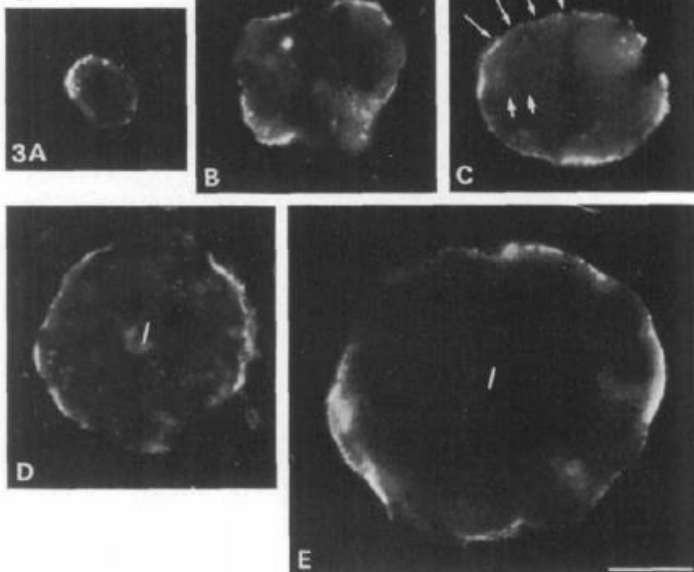
I. Uncoupling the roles of cell-cell and cell-substratum contact in establishing plasma membrane polarity in multicellular epithelial (MDCK) cysts

ALLAN Z. WANG¹, GEORGE K. OJAKIAN² and W. JAMES NELSON^{1,*}

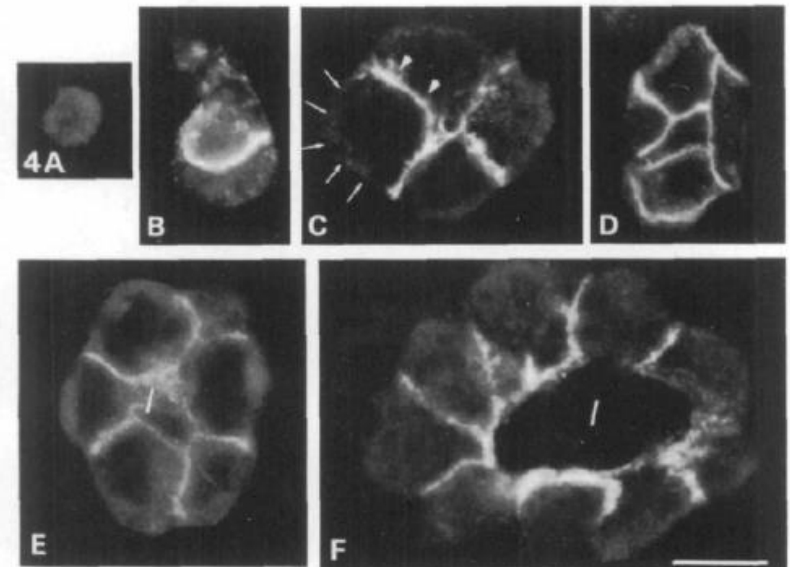
Uvomorulin



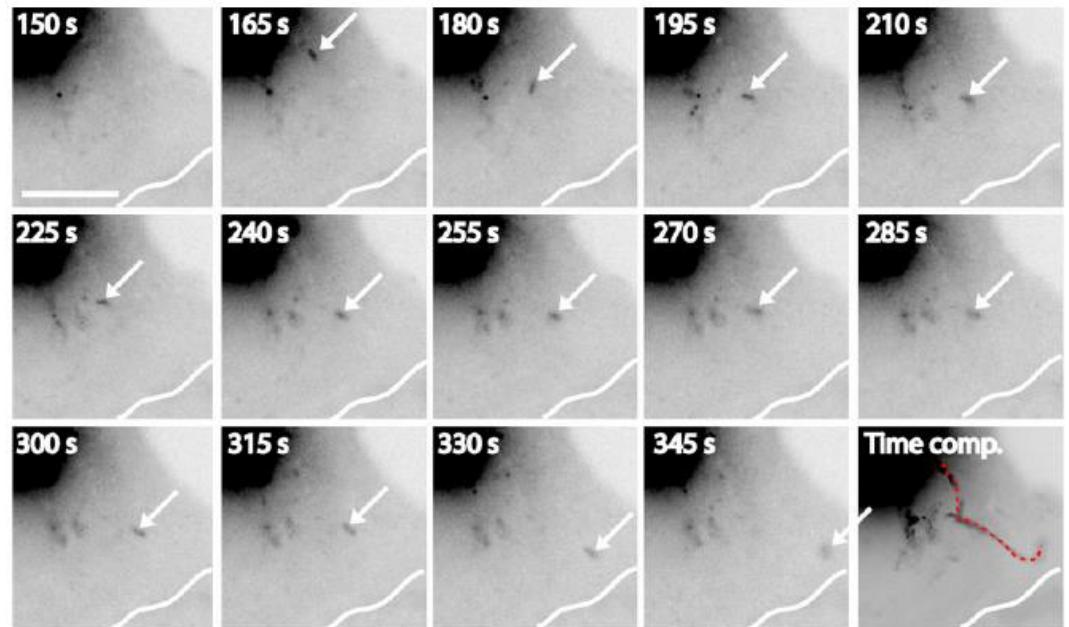
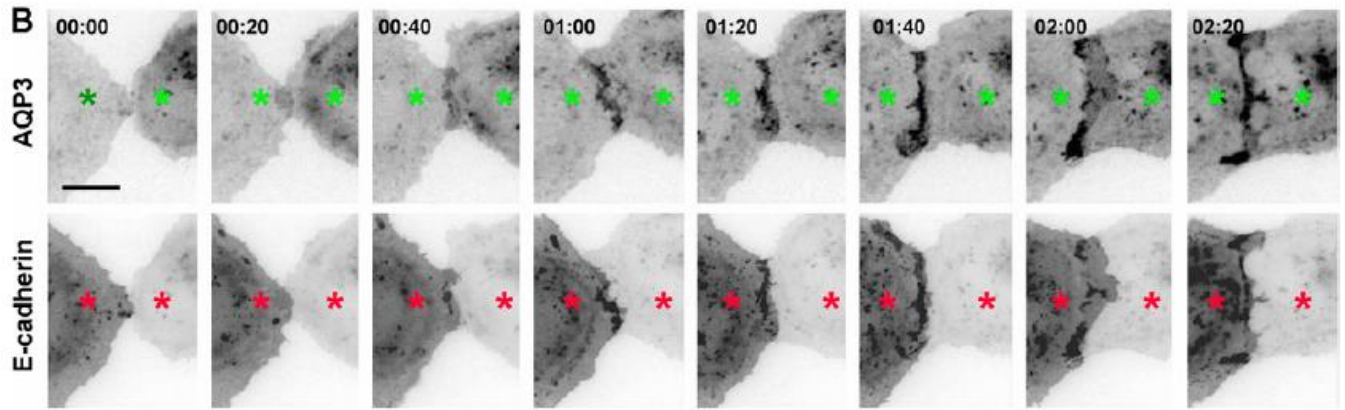
gp135

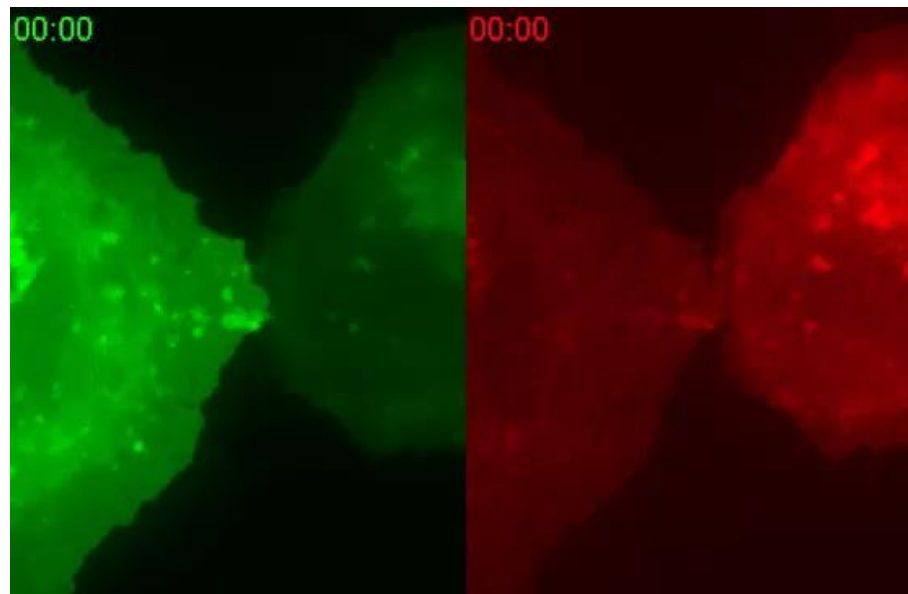


Na⁺K⁺-ATPase

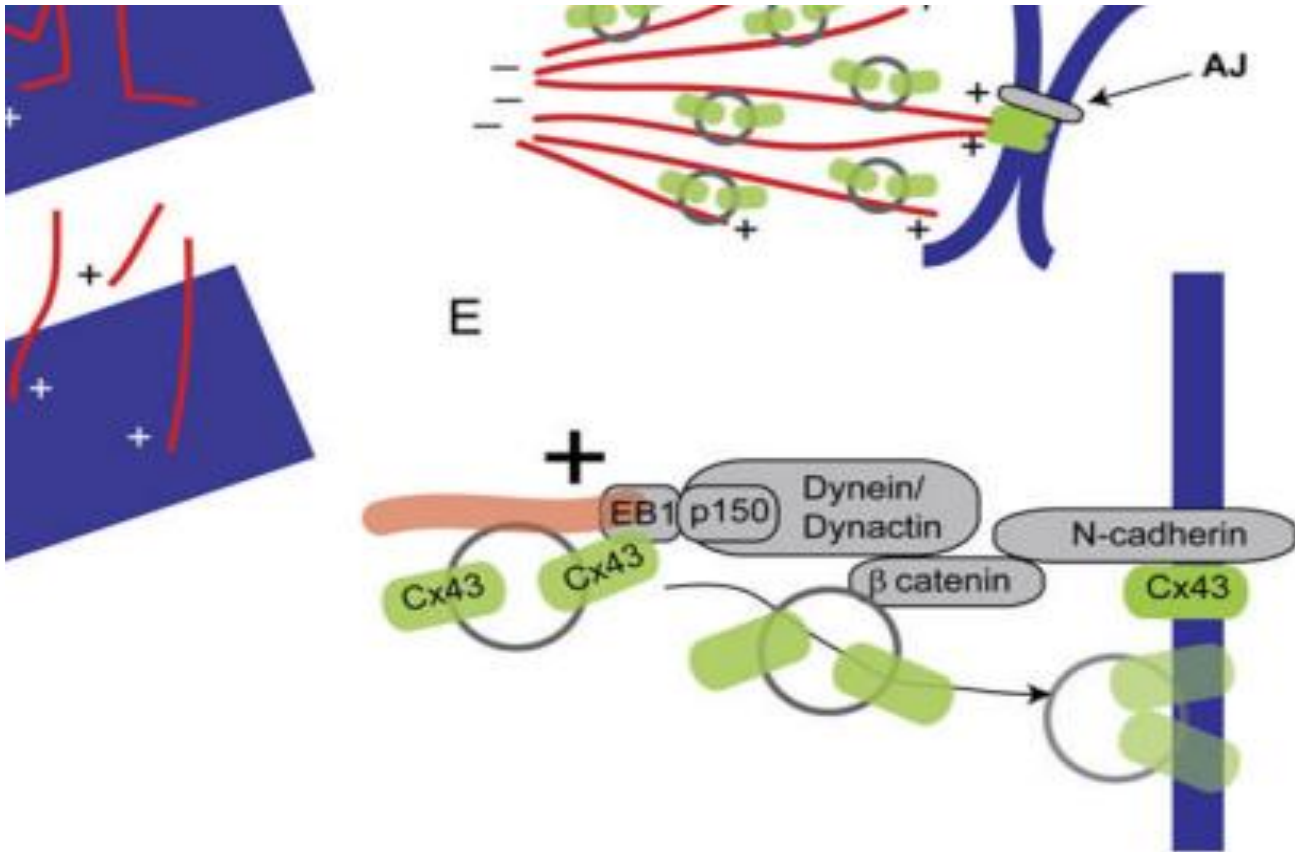


Experimentos de *time-lapse*: segregación de proteínas de membrana en las uniones adherentes

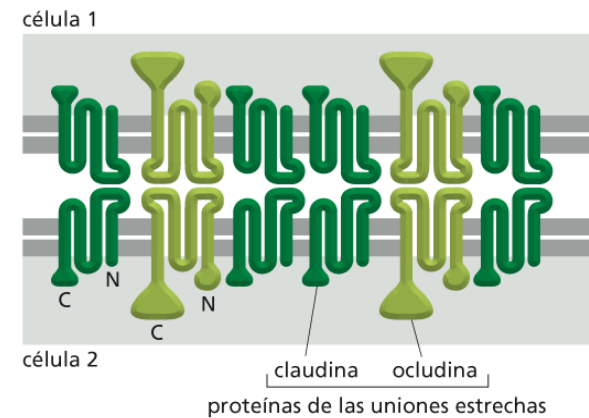
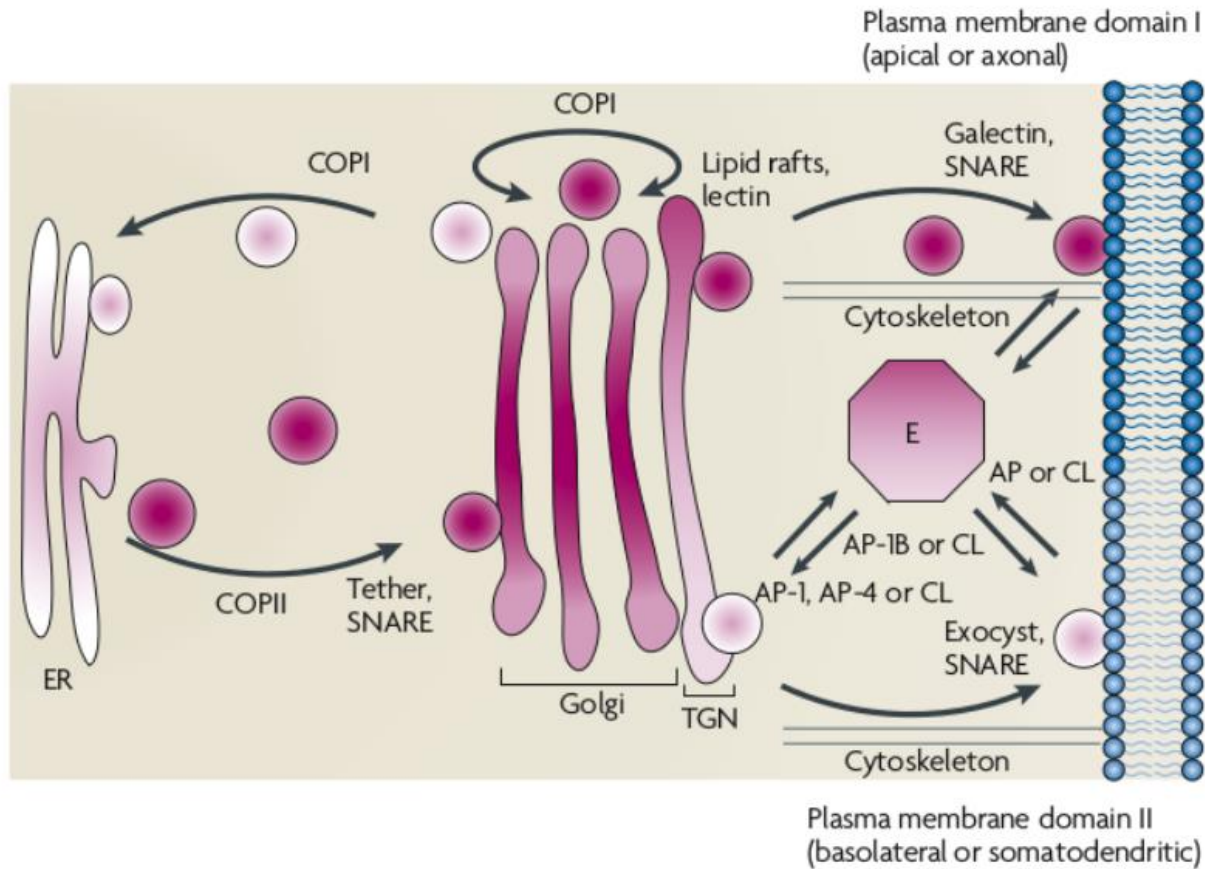




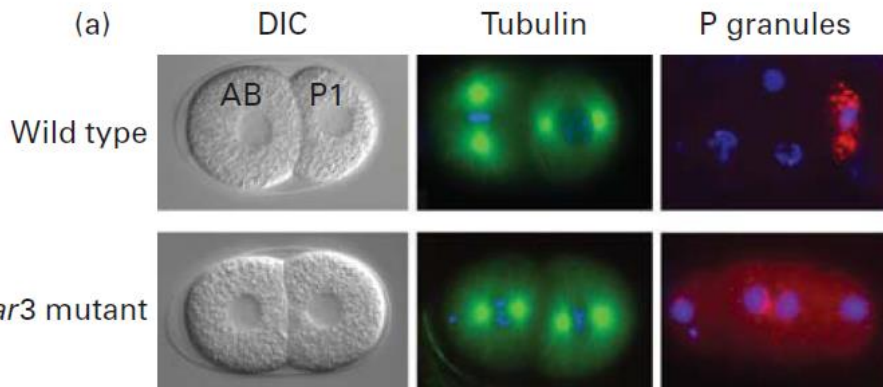
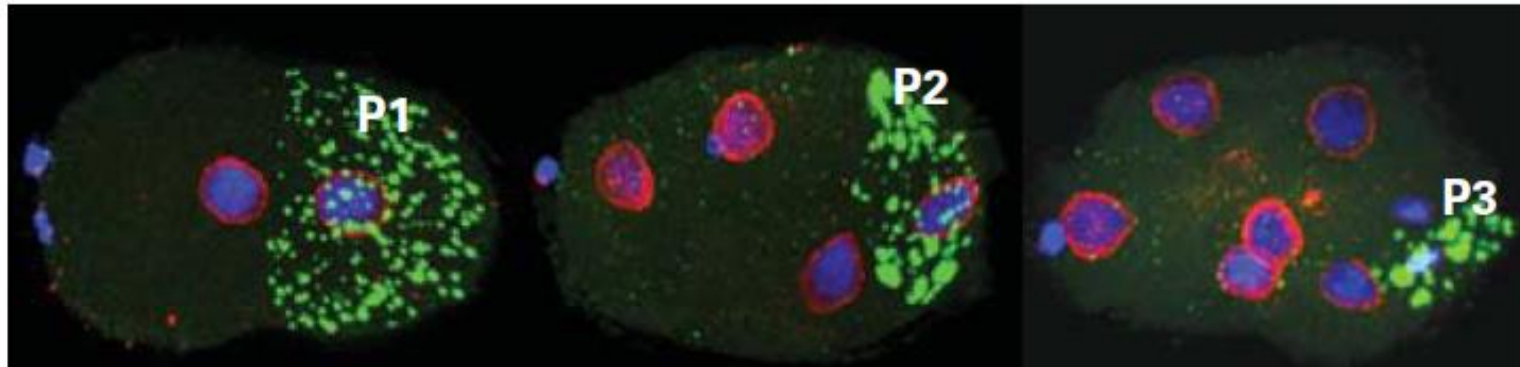
Asociación unión adherente-microtúbulos



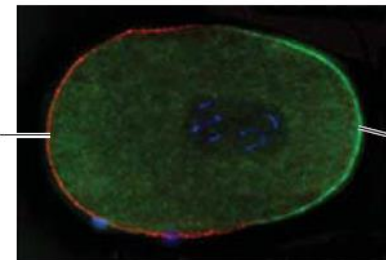
Secreción diferencial de proteínas



Señales intrínsecas: genes PAR (*partitioning defective*)



Anterior complex
(Cdc42, Par3, Par6,
aPKC)



Posterior factors
(e.g., Par1, Par2)

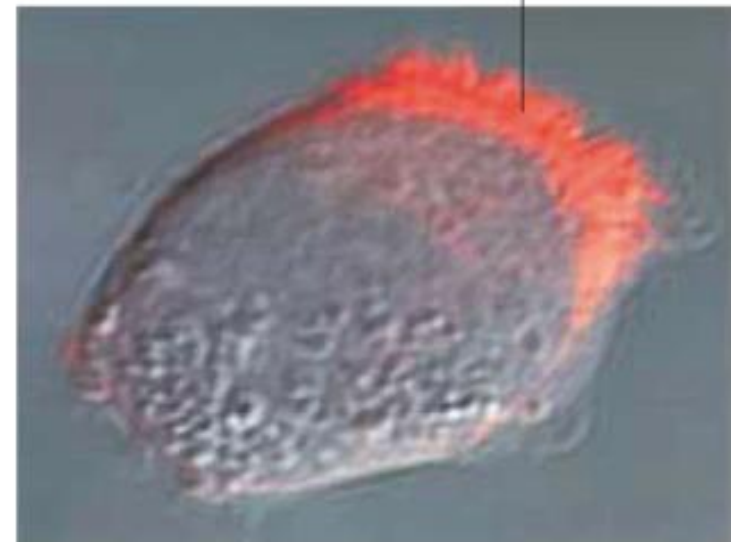
Señales intrínsecas: Complejos de polaridad ápico-basal

(A) CÉLULA NO POLARIZADA



LKB1 inactiva

(B) CÉLULA POLARIZADA

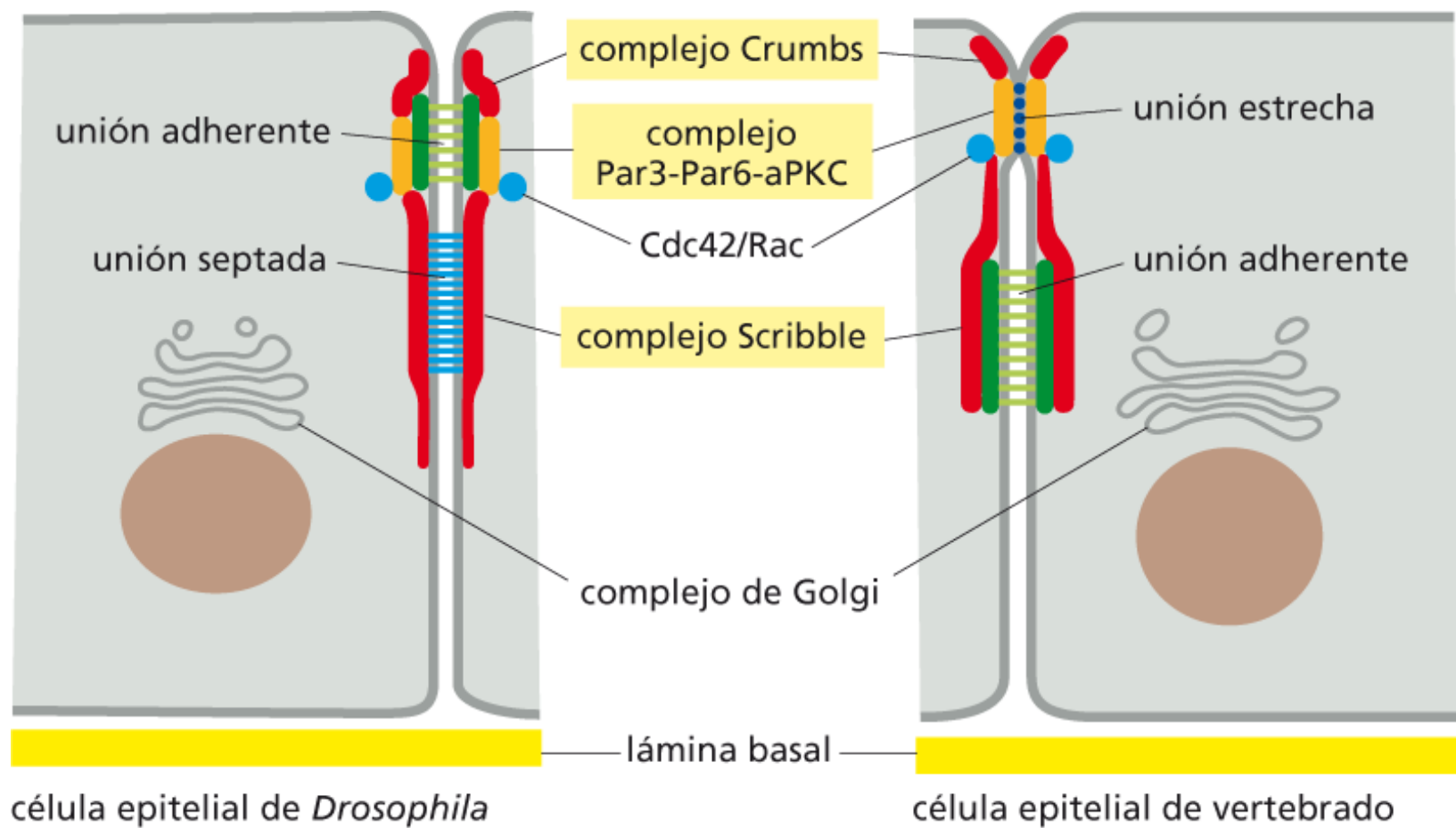


microvilli repletos de actina

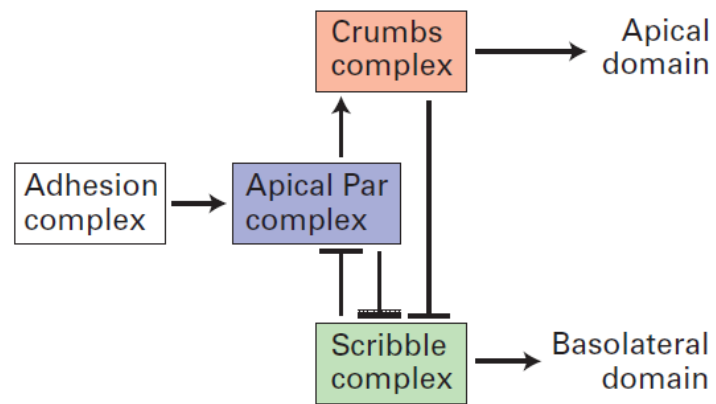
LKB1 activa

10 µm

Homólogo de Par4



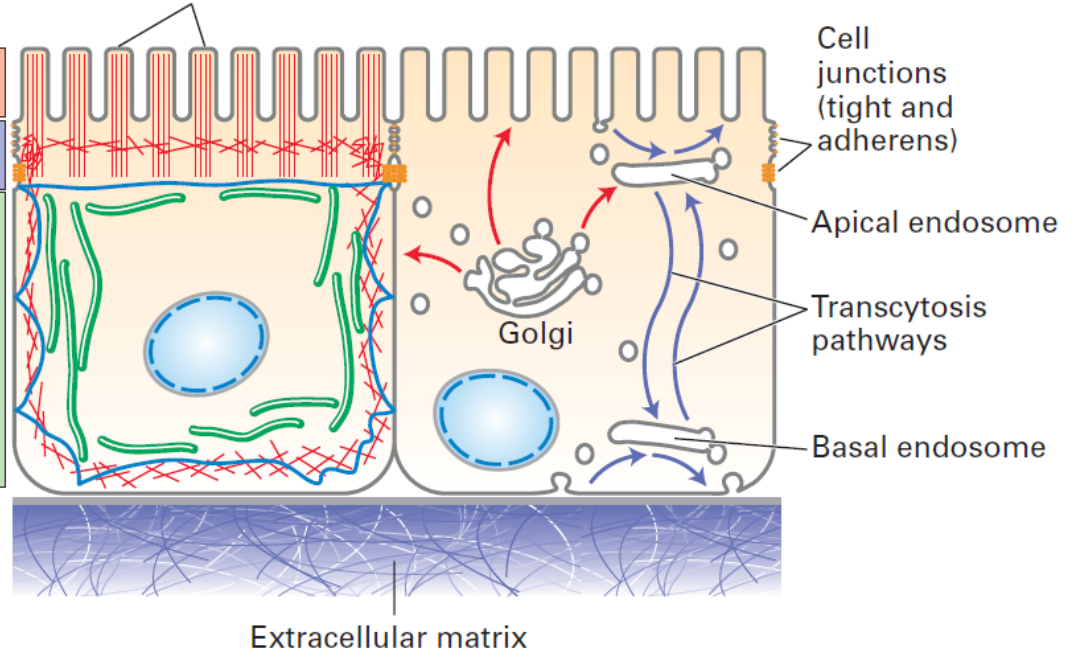
(a)



(b)

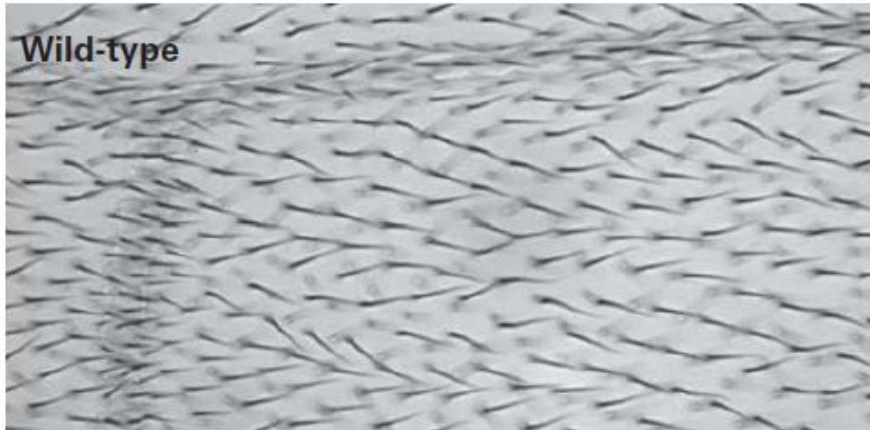
Microvilli

(c)

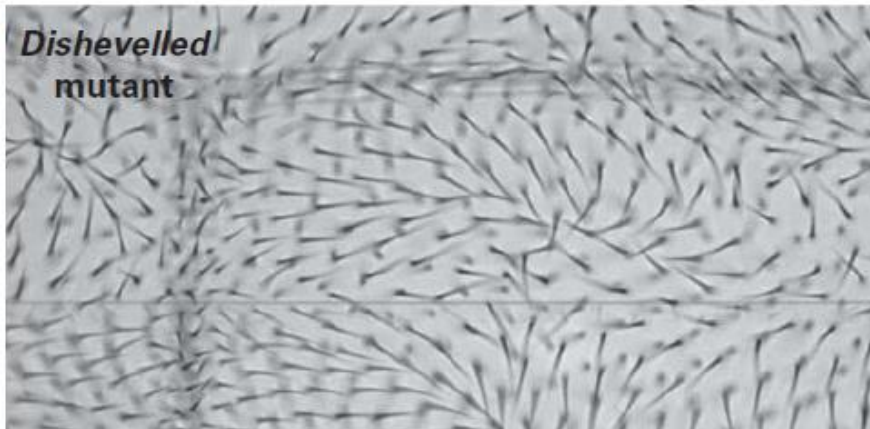


Polaridad celular planar (PCP)

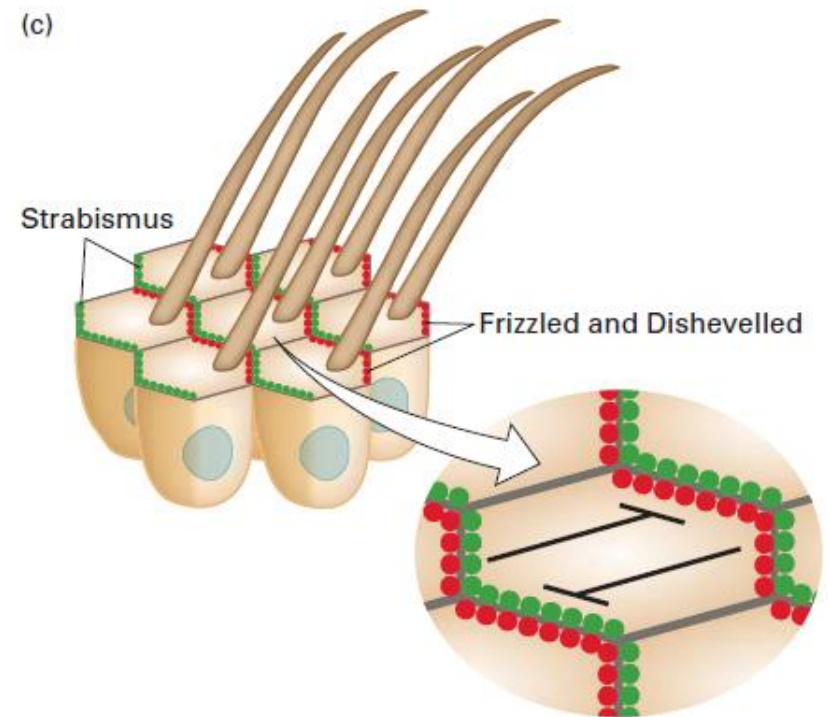
(a)



(b)



(c)



(d)

