

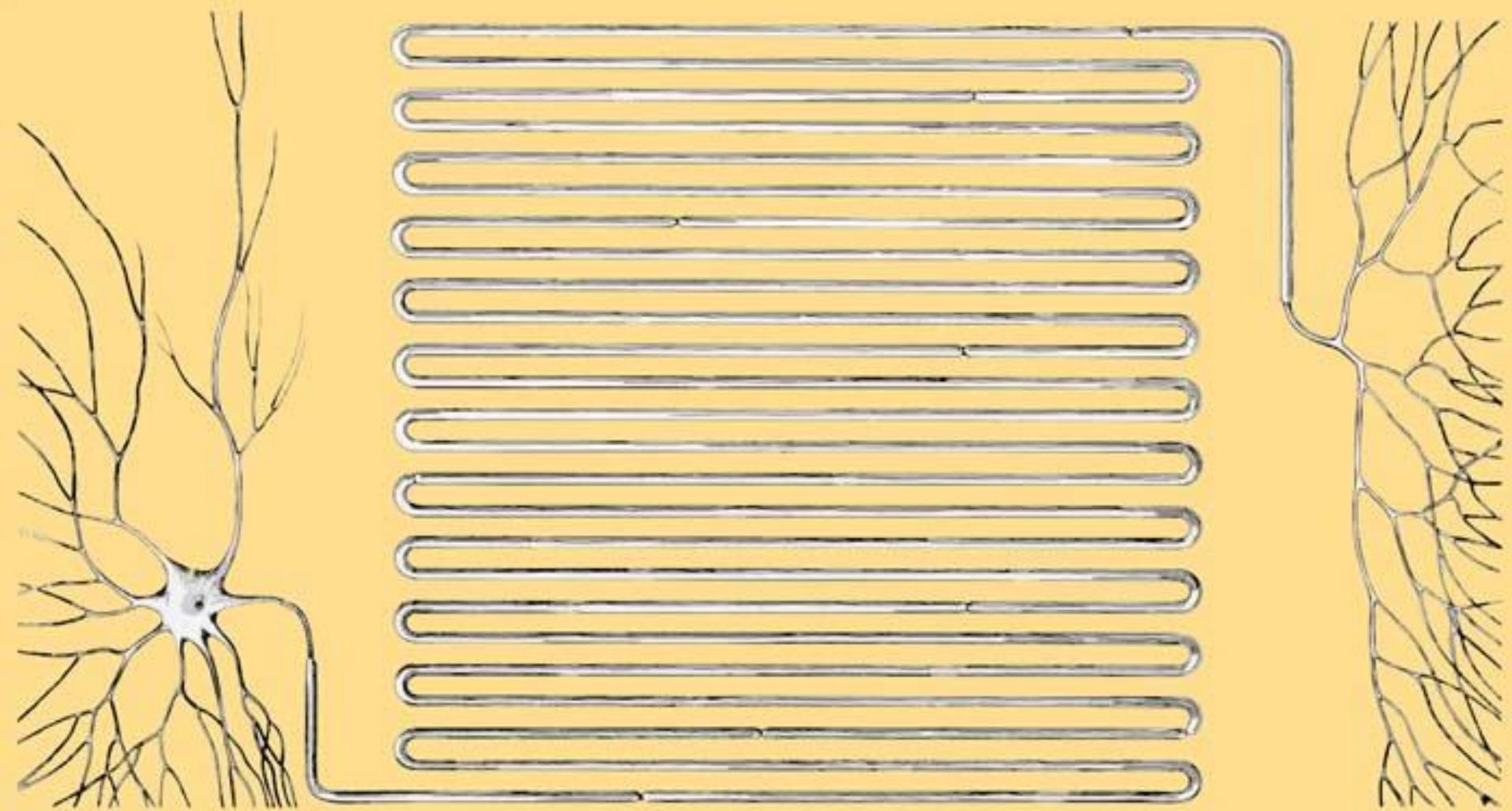
# Las células del sistema nervioso II

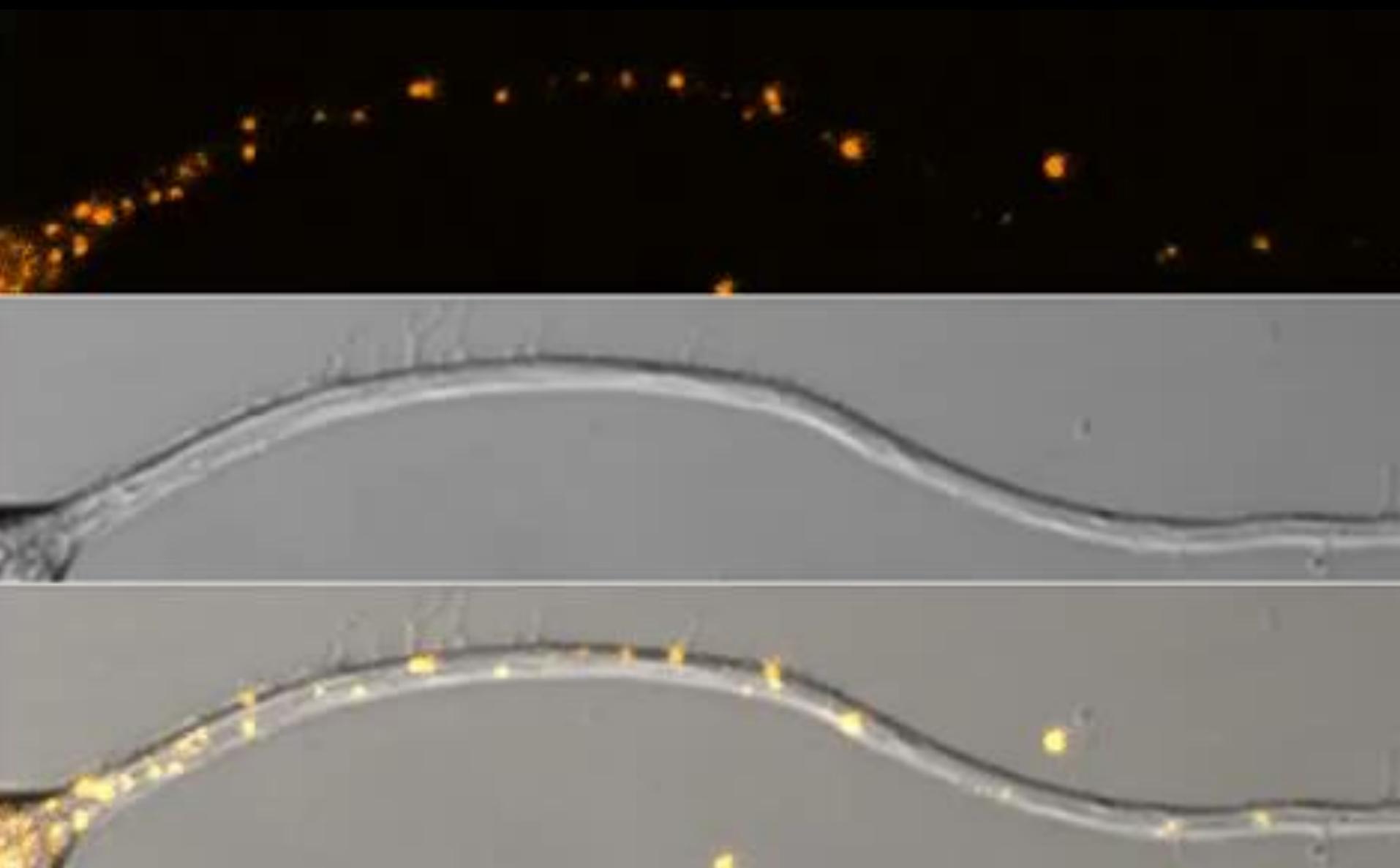
Sinapsis

Diferenciación neuronal

Flavio Zolessi

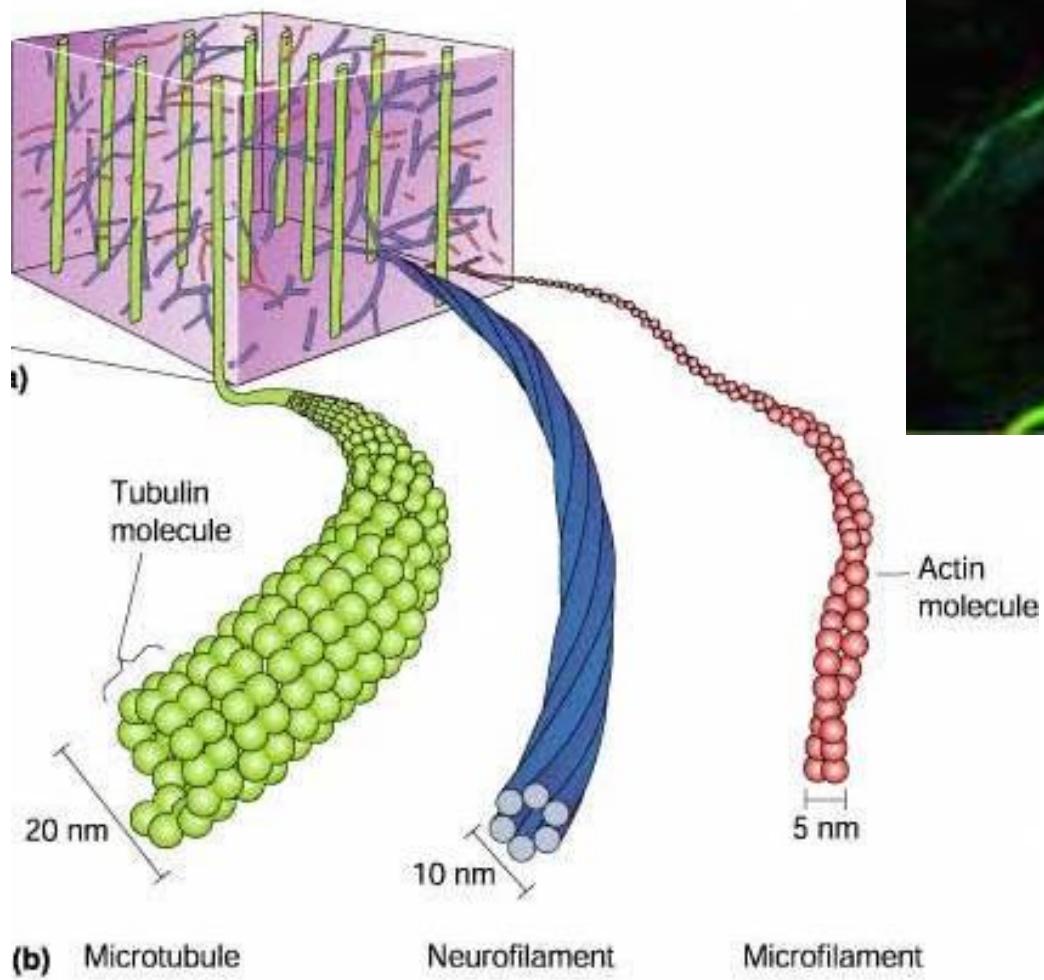
# El axón: conductor del impulso nervioso



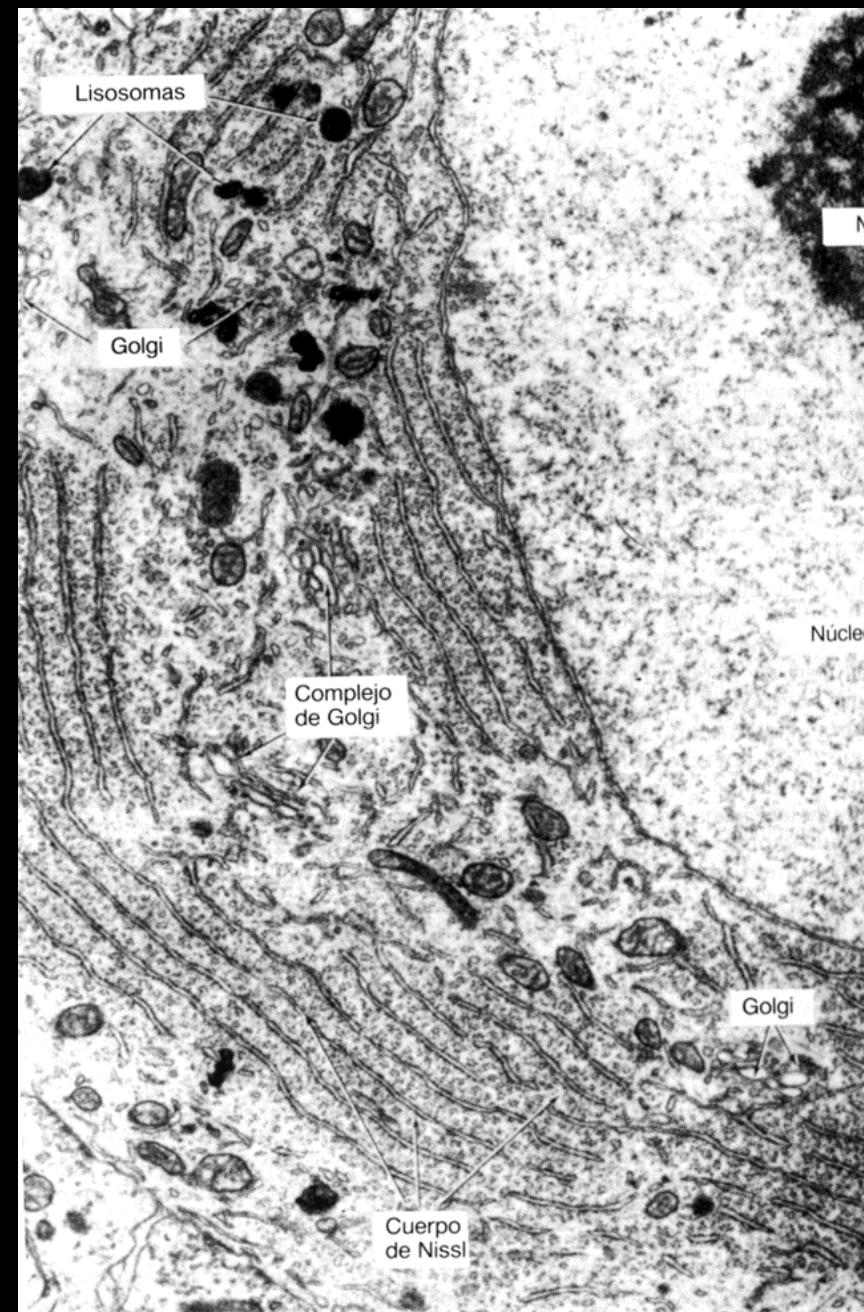
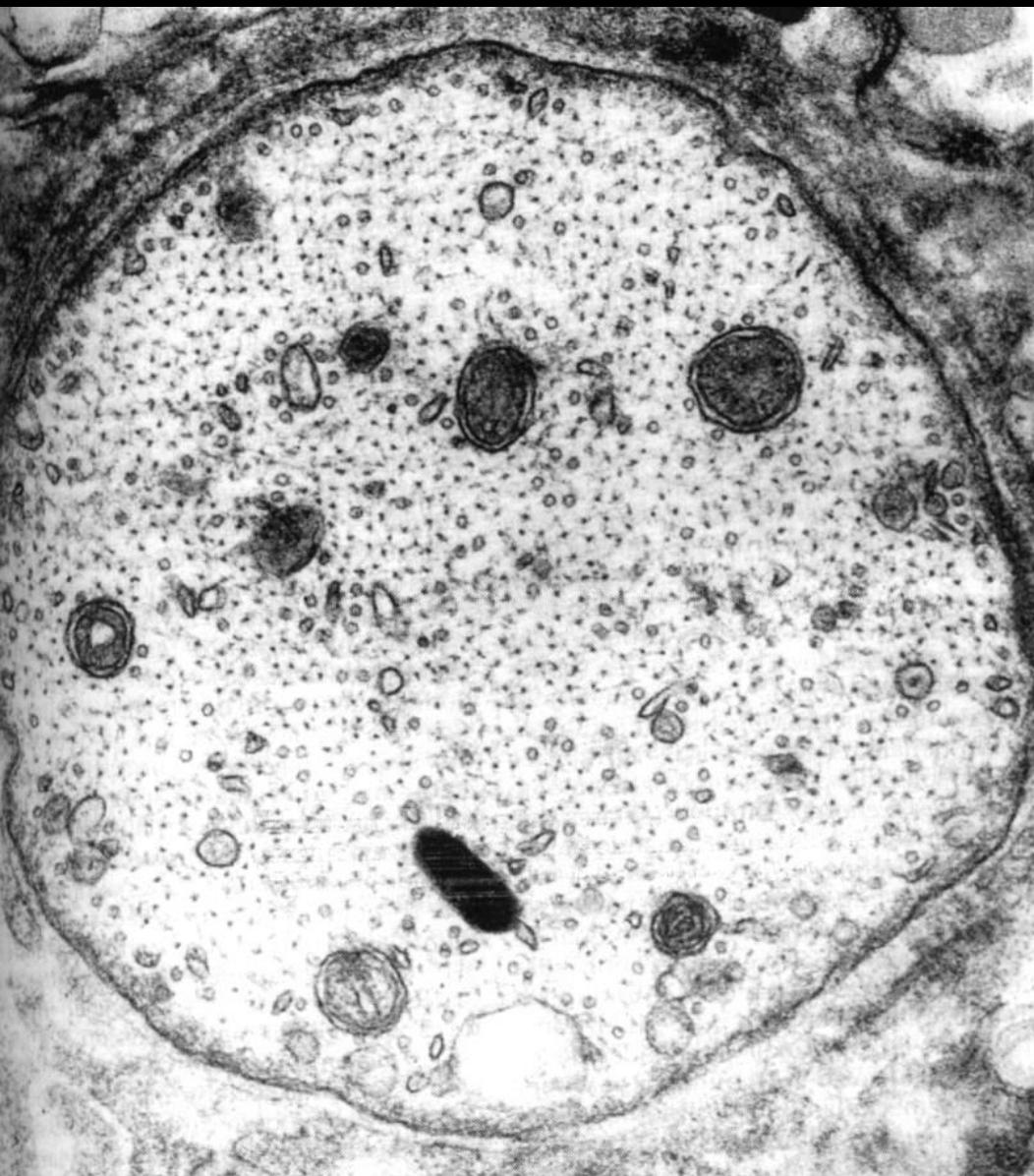


<https://youtu.be/SyJgz4P-Omo>

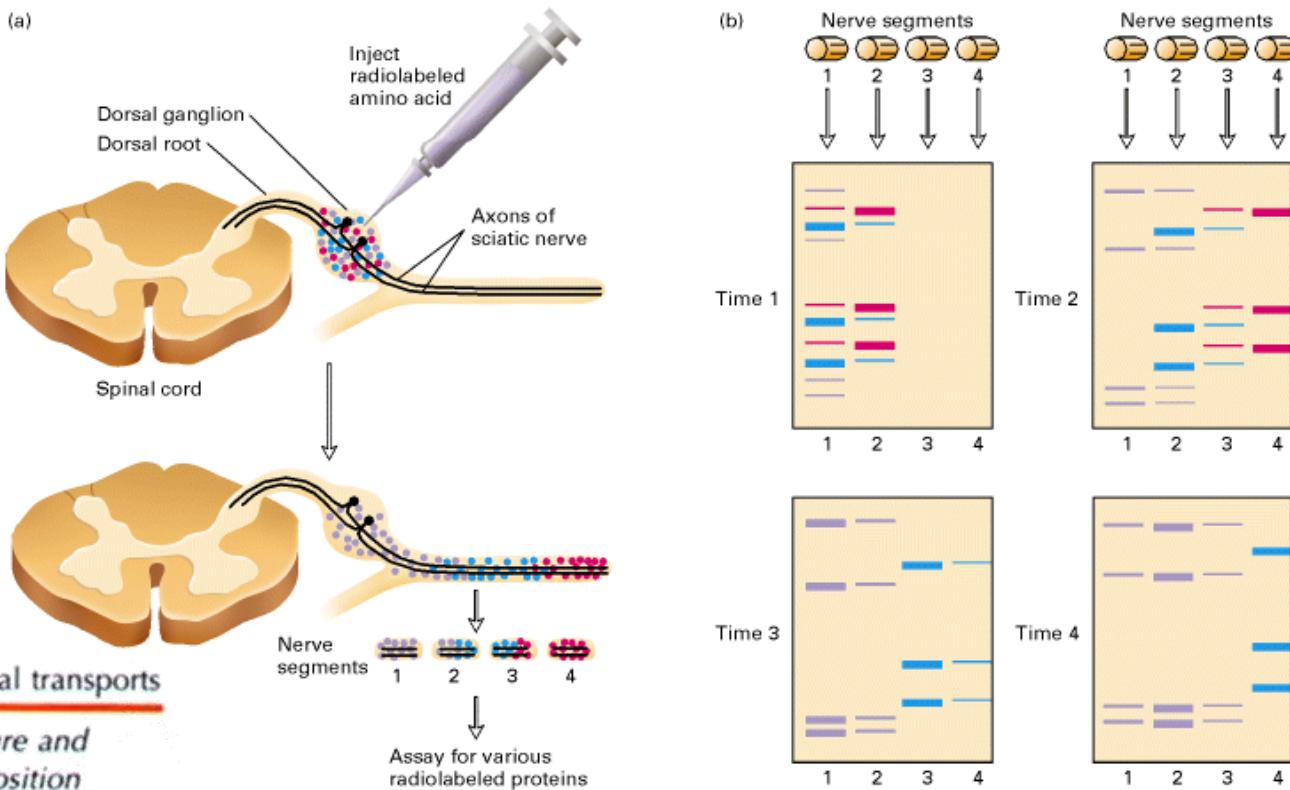
# El citoesqueleto neuronal



# Ultraestructura de axón y soma neuronal

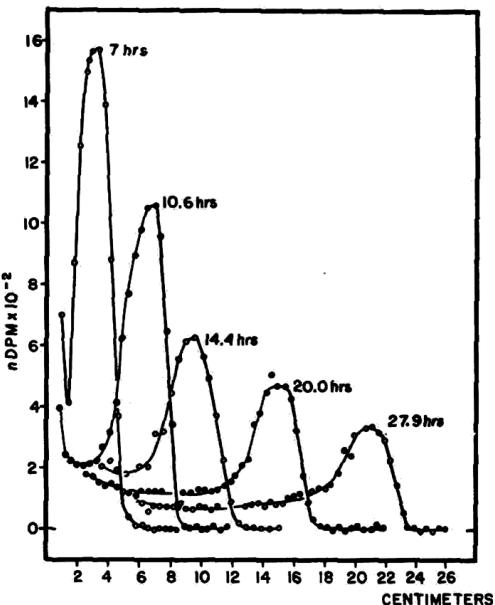


# Estudio de los mecanismos de transporte de proteínas en el axón

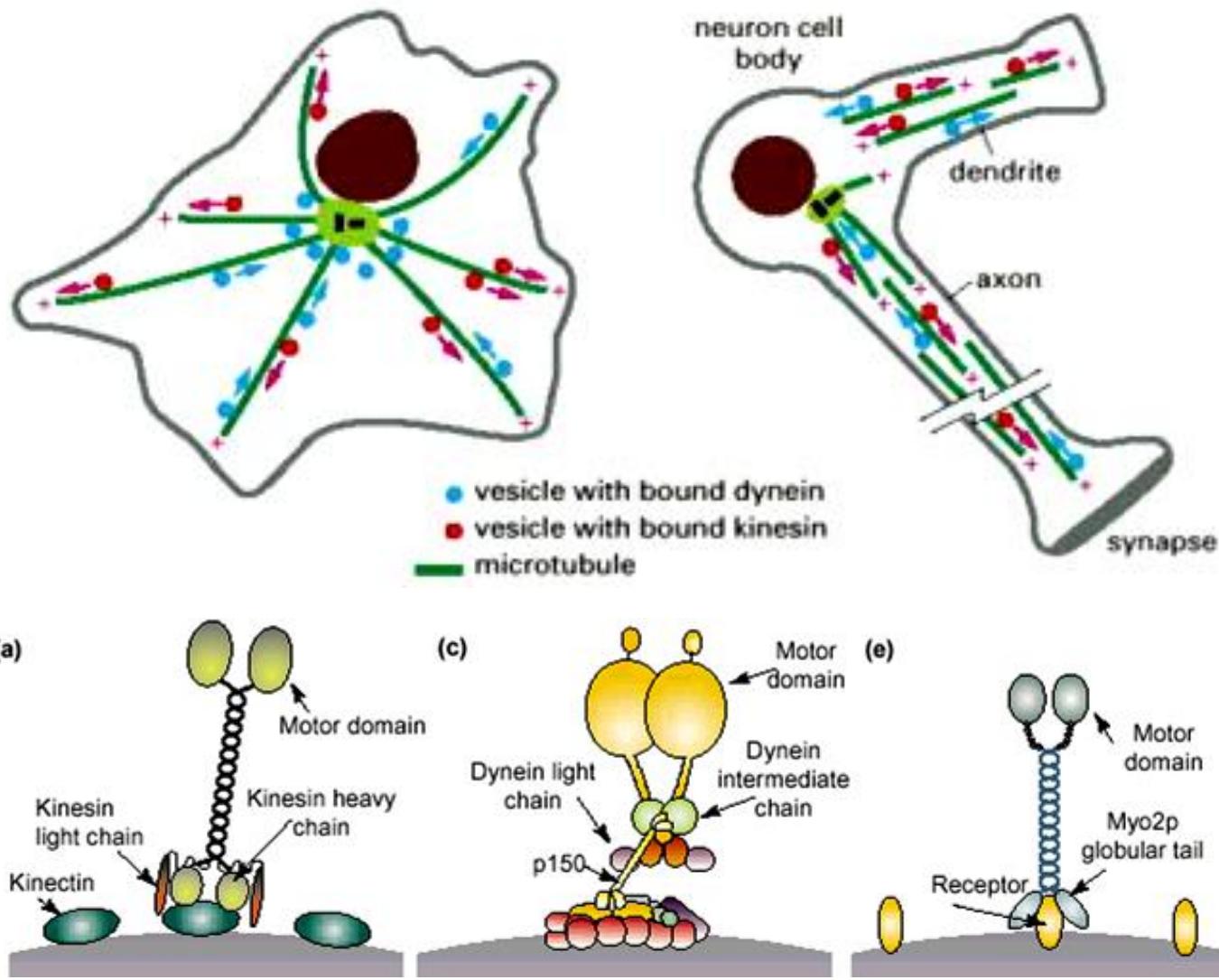


**TABLE 1.** Major rate components of axonal transports

Component	Rate (mm/day)	Structure and composition
<i>Fast transport</i>		
Anterograde	200–400	Small vesiculotubular structures, neurotransmitters, membrane proteins and lipids
Mitochondria	50–100	Mitochondria
Retrograde	200–300	Lysosomal vesicles and enzymes
<i>Slow transport</i>		
SCb	2–8	Microfilaments, metabolic enzymes, clathrin complex
SCa	0.2–1	Neurofilaments and microtubules



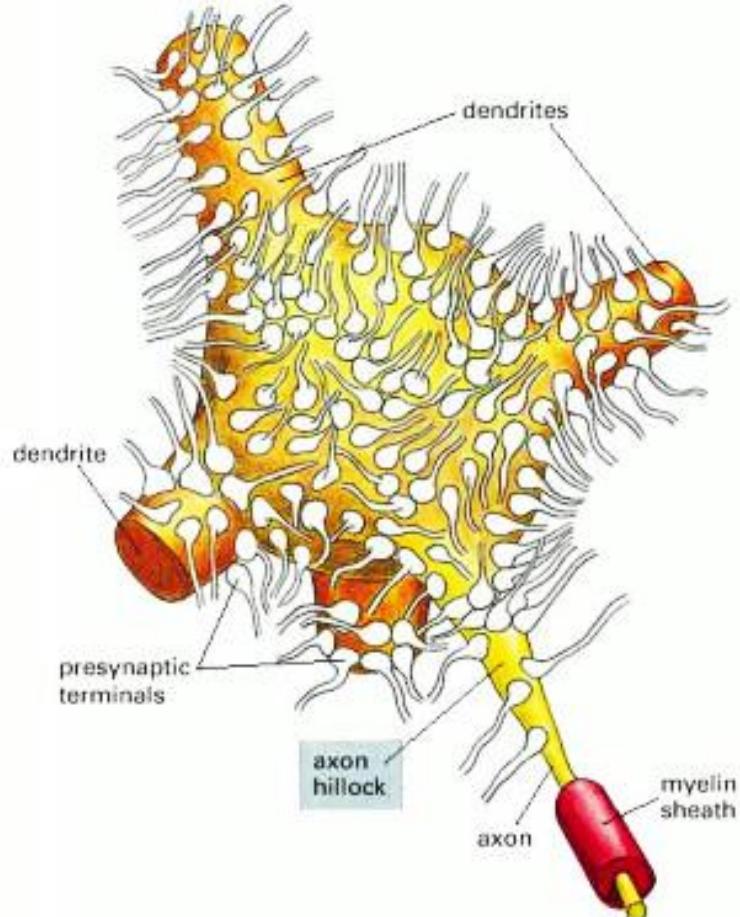
# Mecanismos del transporte axoplásmico



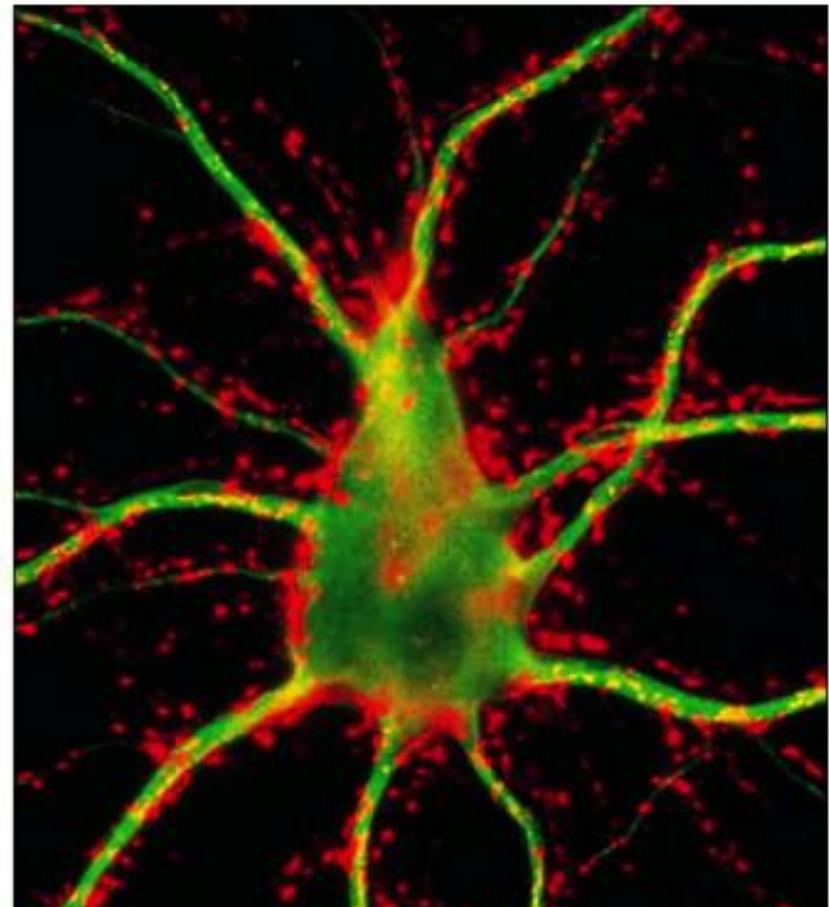
Video en próxima diapositiva: <https://youtu.be/tMKIPDBRJ1E>



# Sinapsis



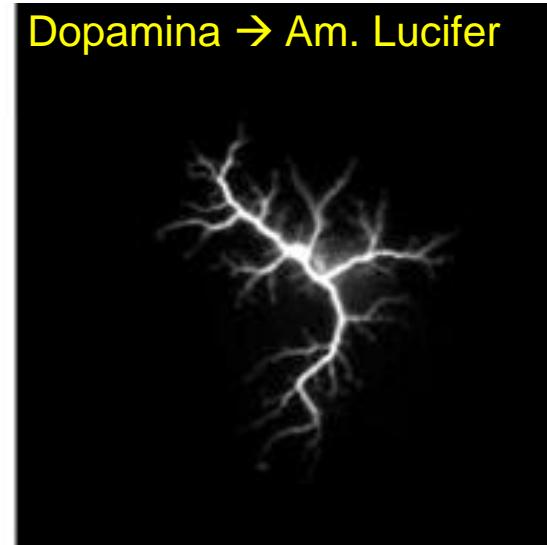
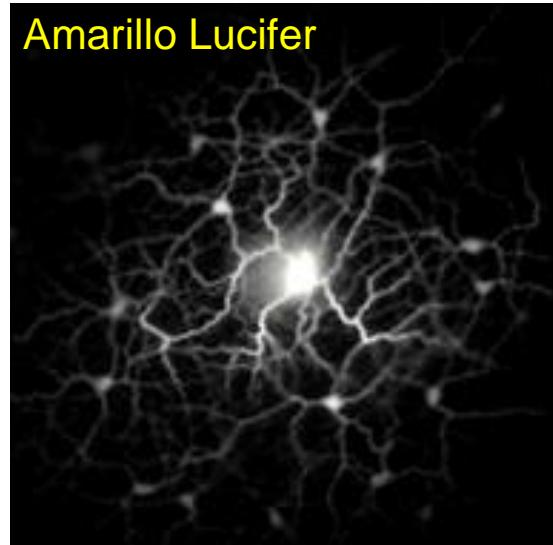
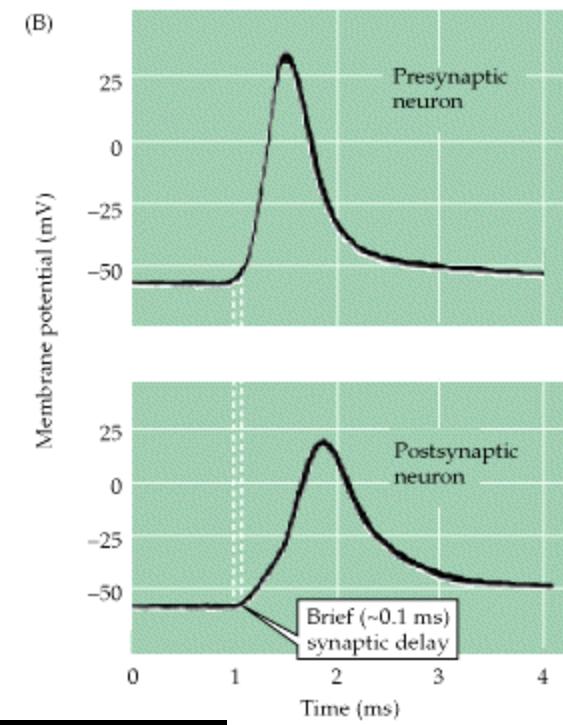
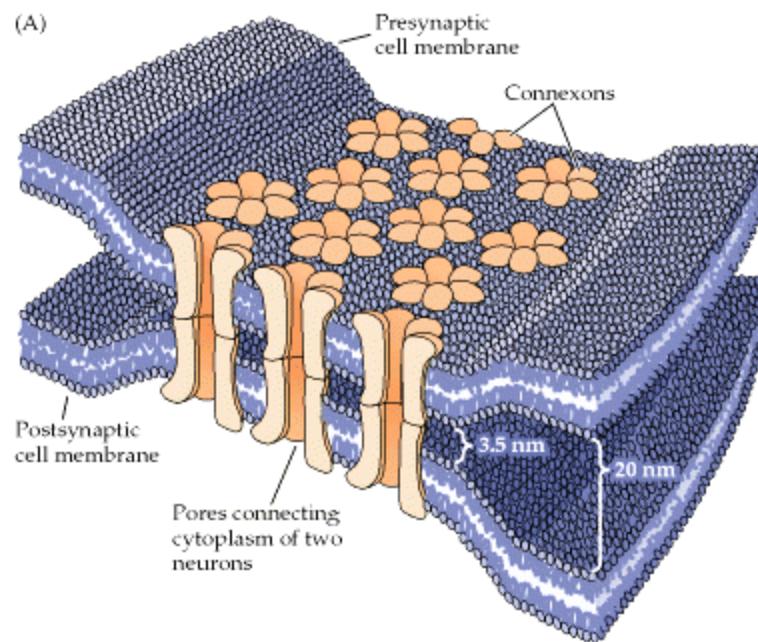
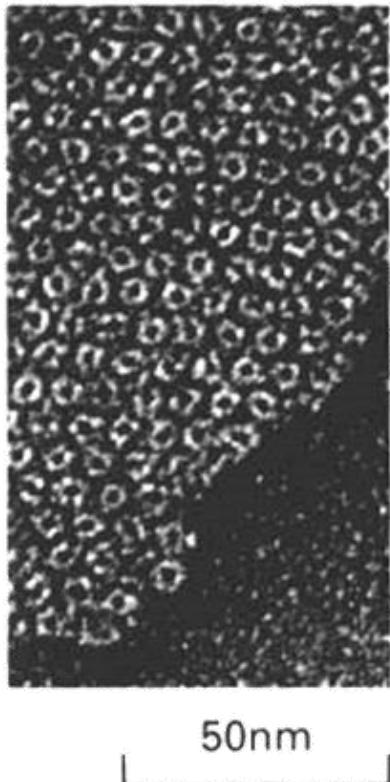
(A)



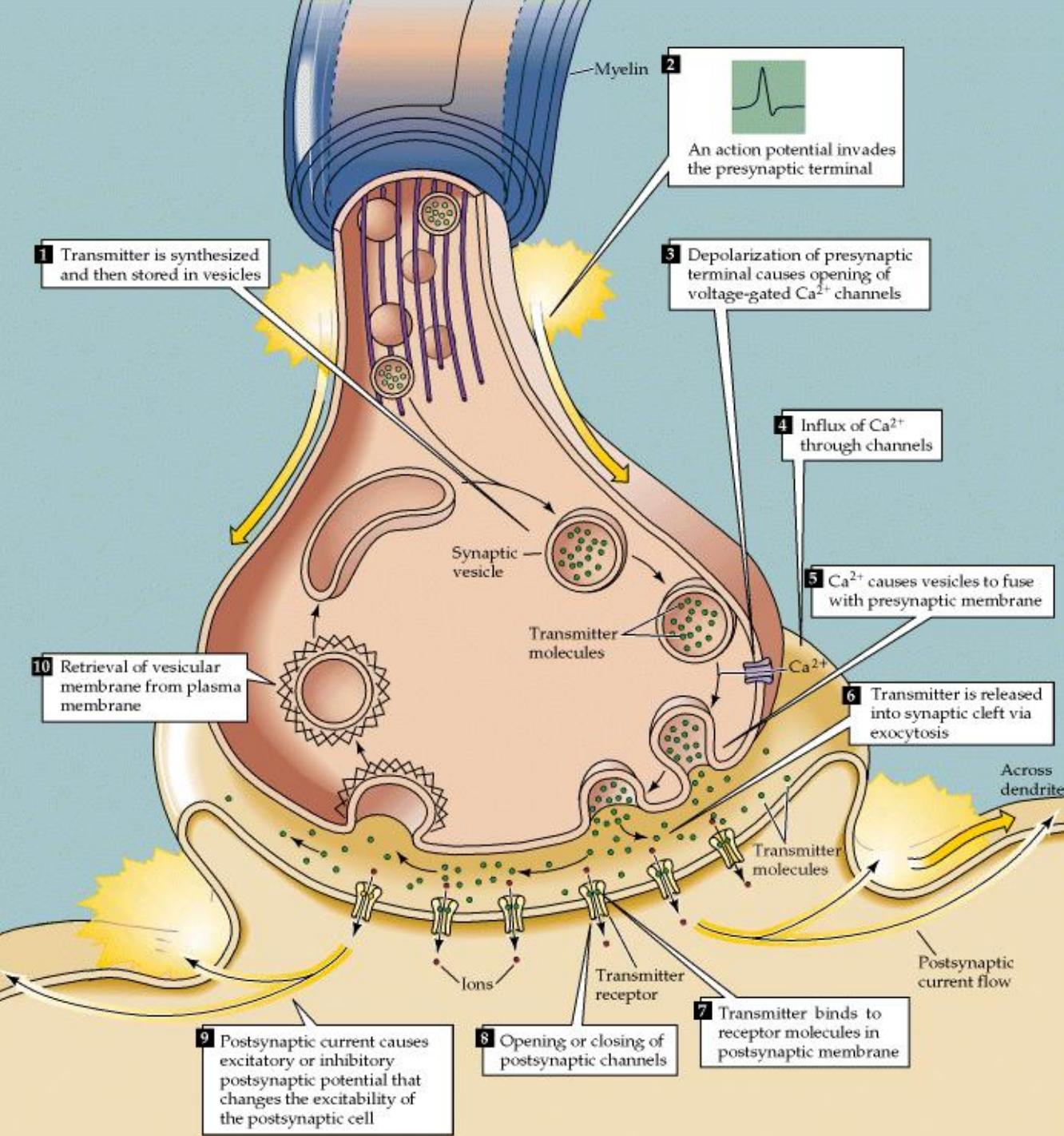
(B)

**$10^{11}$  neuronas -----  $10^{14}$  sinapsis!!**

# Sinapsis eléctrica



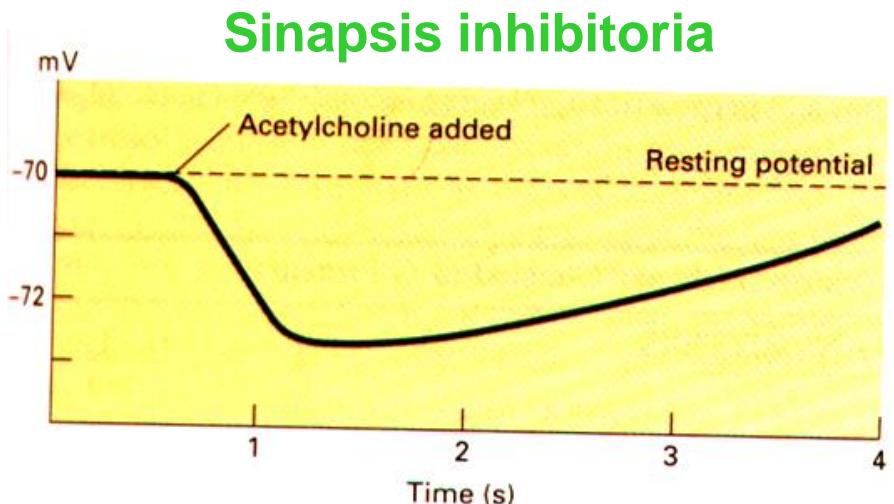
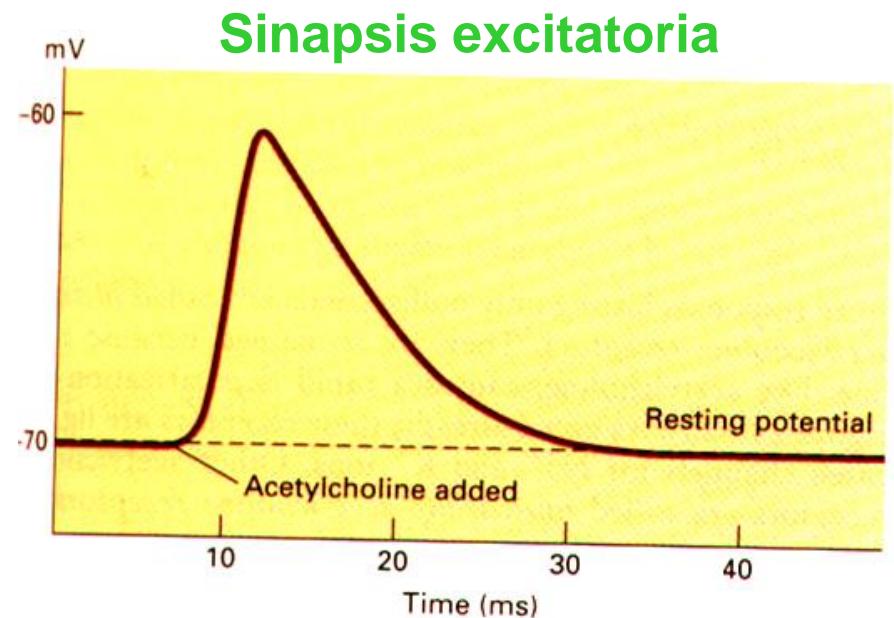
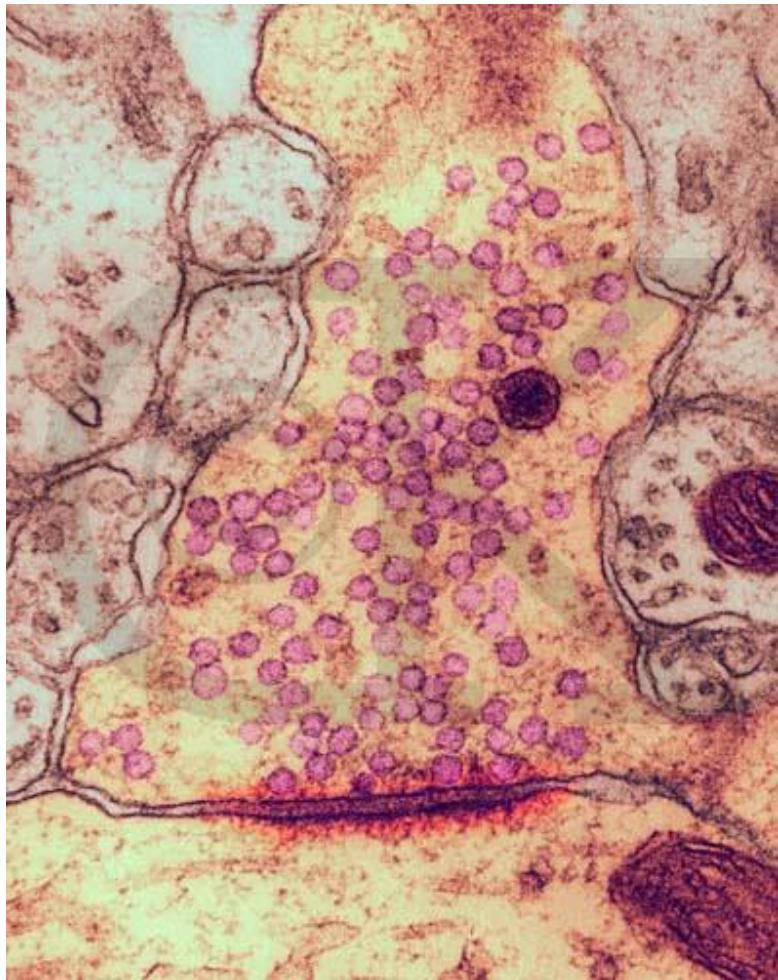
# Sinapsis química



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www.digitalfrog.com

<https://youtu.be/4rZMLIZslb0>

# Sinapsis química



# Sinapsis química : Neurotrasmisores y receptores

## NEUROTRASMISORES

Moléculas pequeñas:

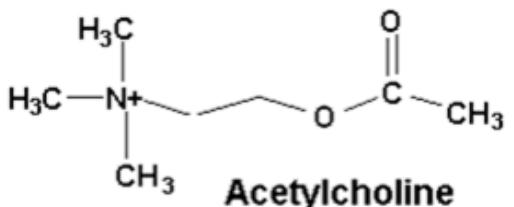
Acetilcolina

Serotonina

Dopamina

Glutamato

GABA

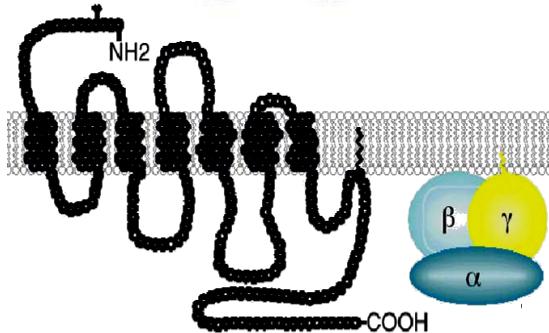
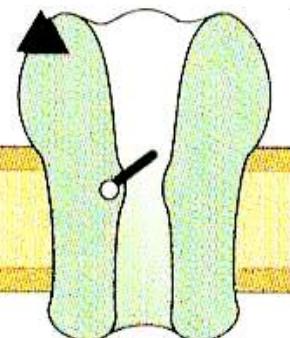


Neuropéptidos

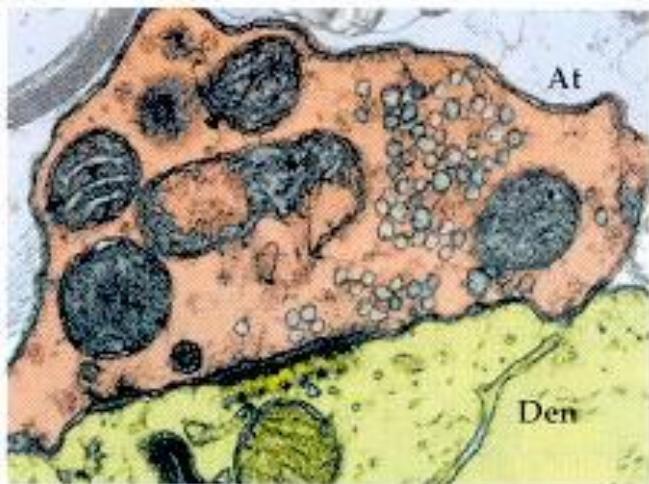
## RECEPTORES

Ionotrópicos

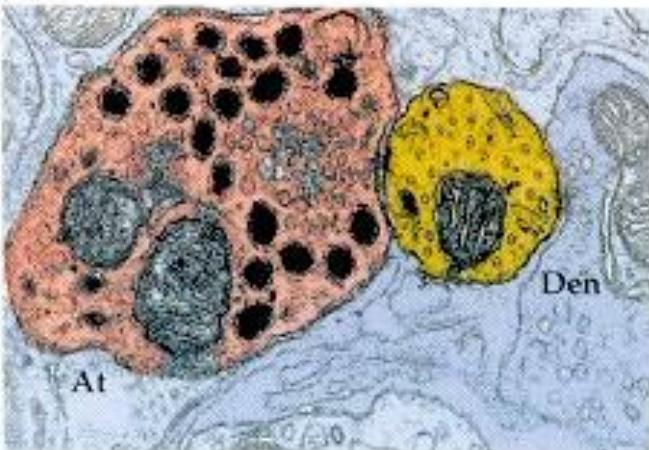
Metabotrópicos



(A)



(B)



しびれ



<https://youtu.be/st9ijj98KpM>

しひれ

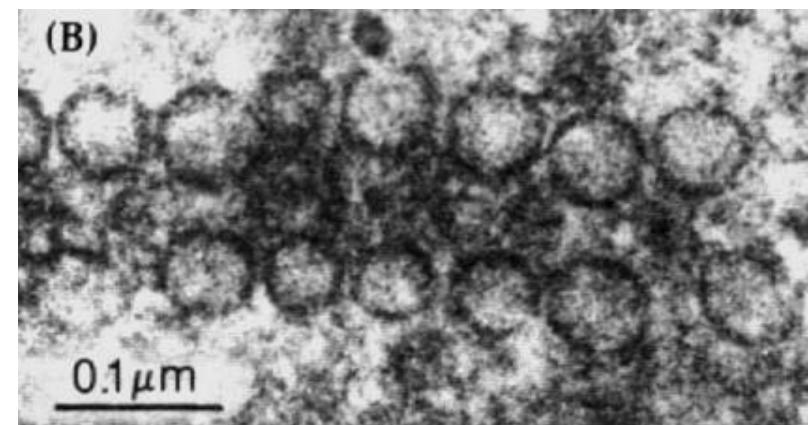
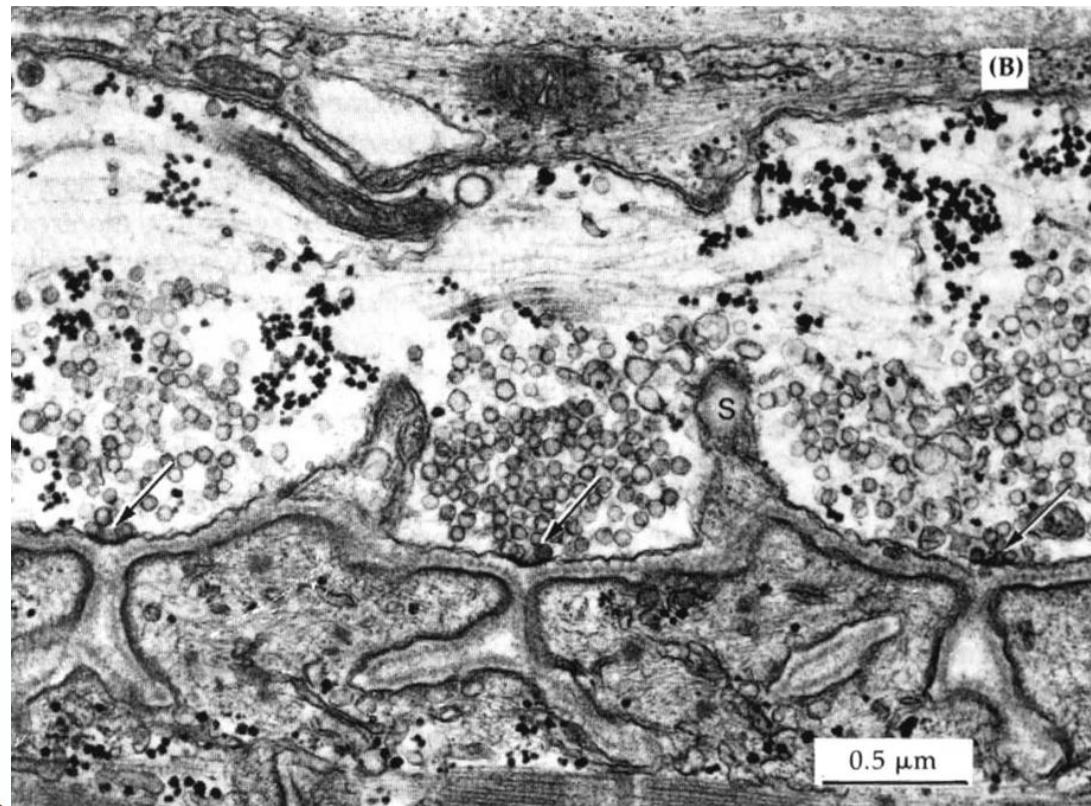
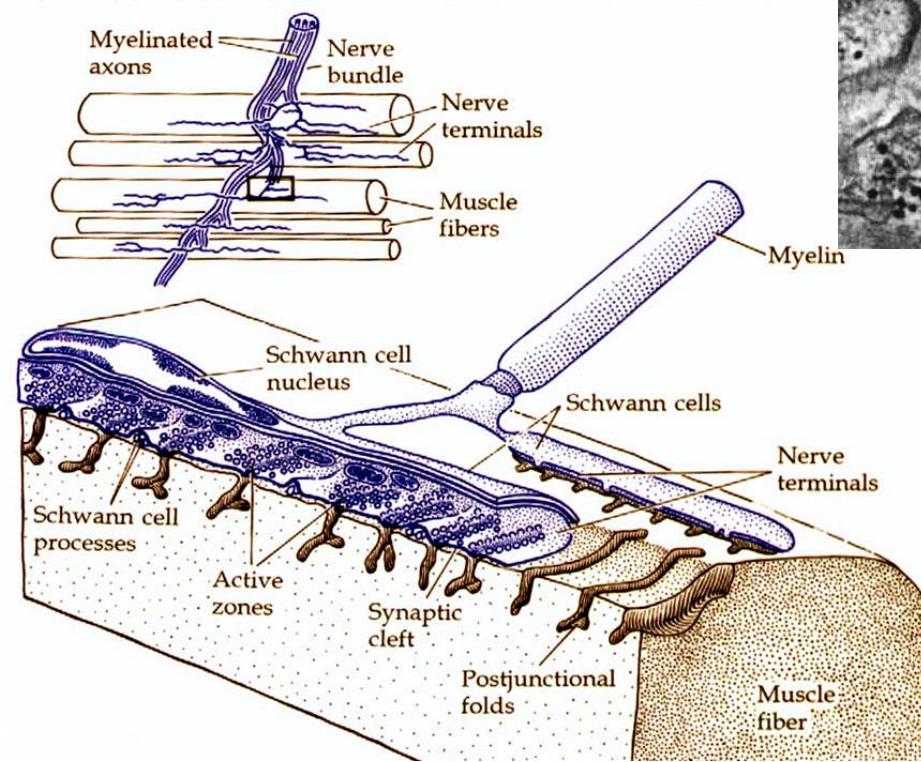
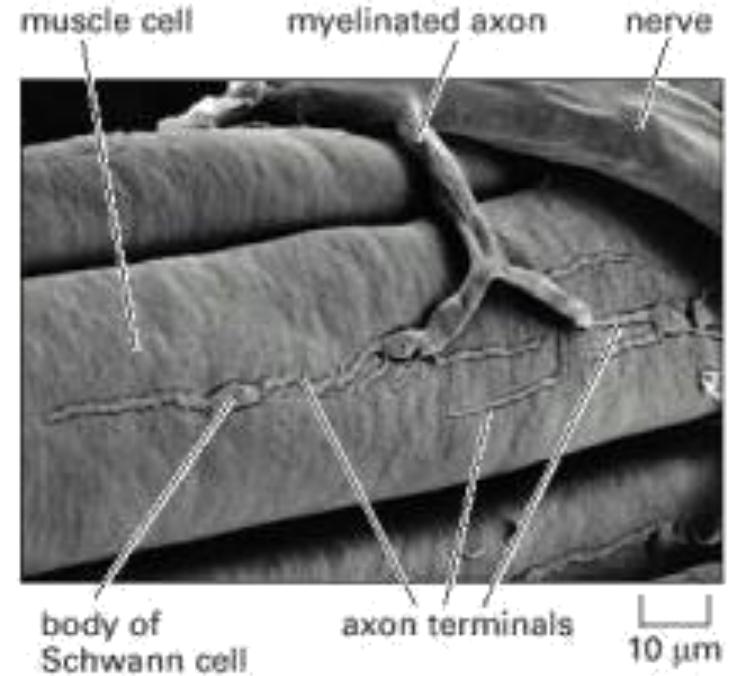
=

“shibire”

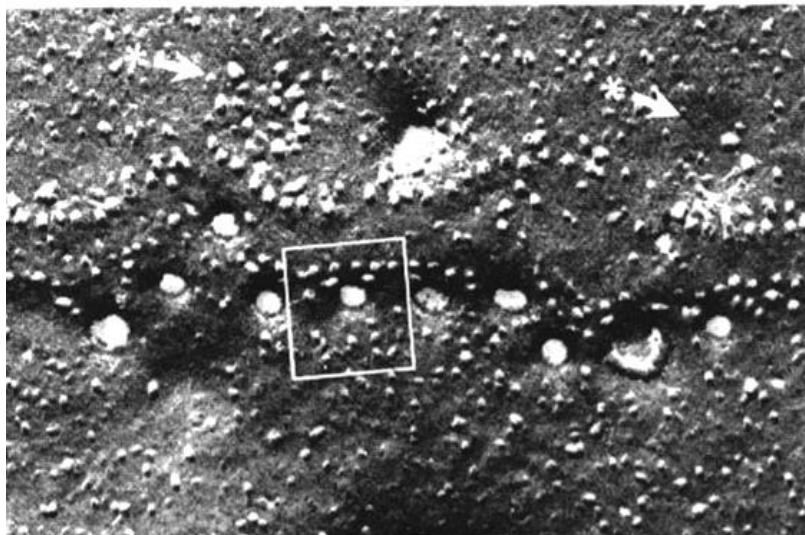
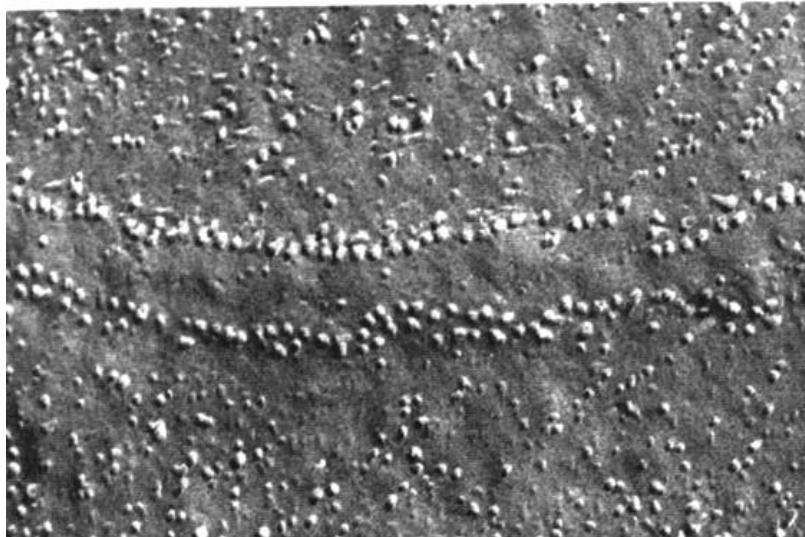
# ¿Qué les pasa a las moscas *shibire*?

- 1- ¿Qué significa la palabra y qué función está fallando?
- 2- ¿Qué células están involucradas en el proceso?
- 3- ¿Qué mecanismo molecular está evidenciando?
- 4- ¿Por qué el efecto es reversible?

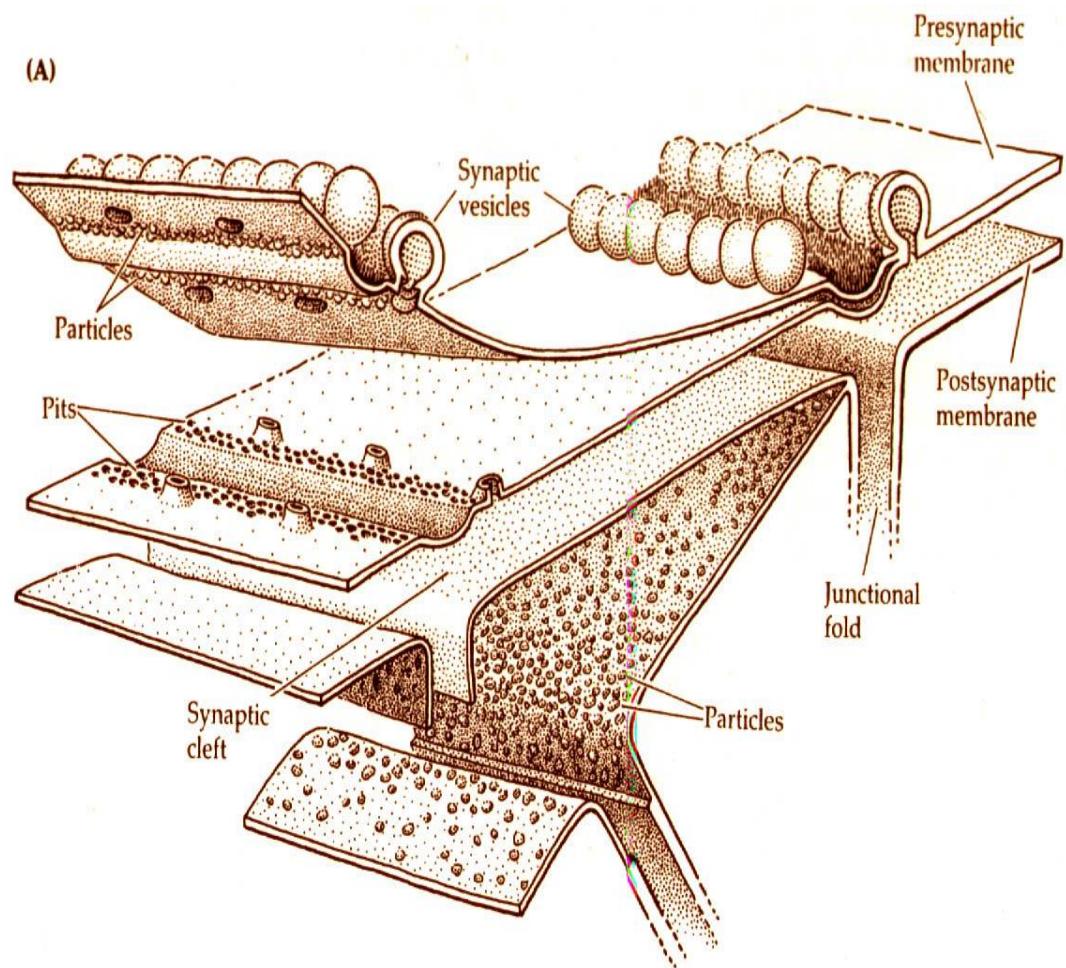
# La sinapsis neuromuscular

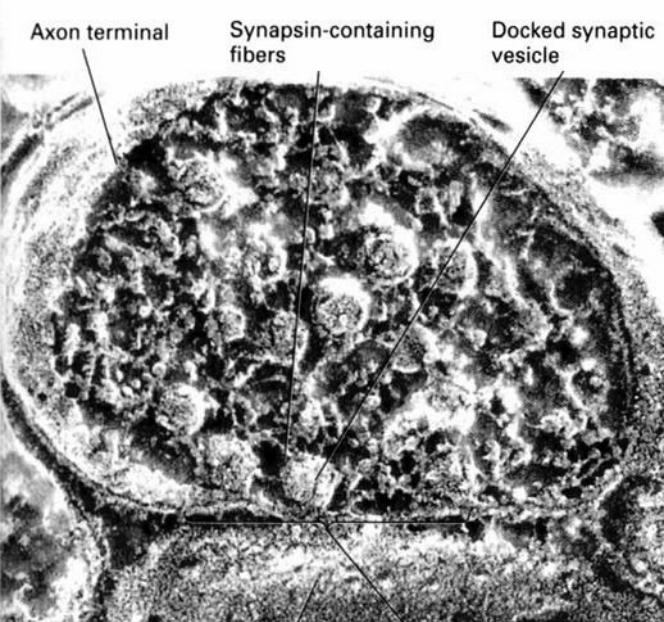


# Las vesículas sinápticas y la liberación del neurotrasmisor

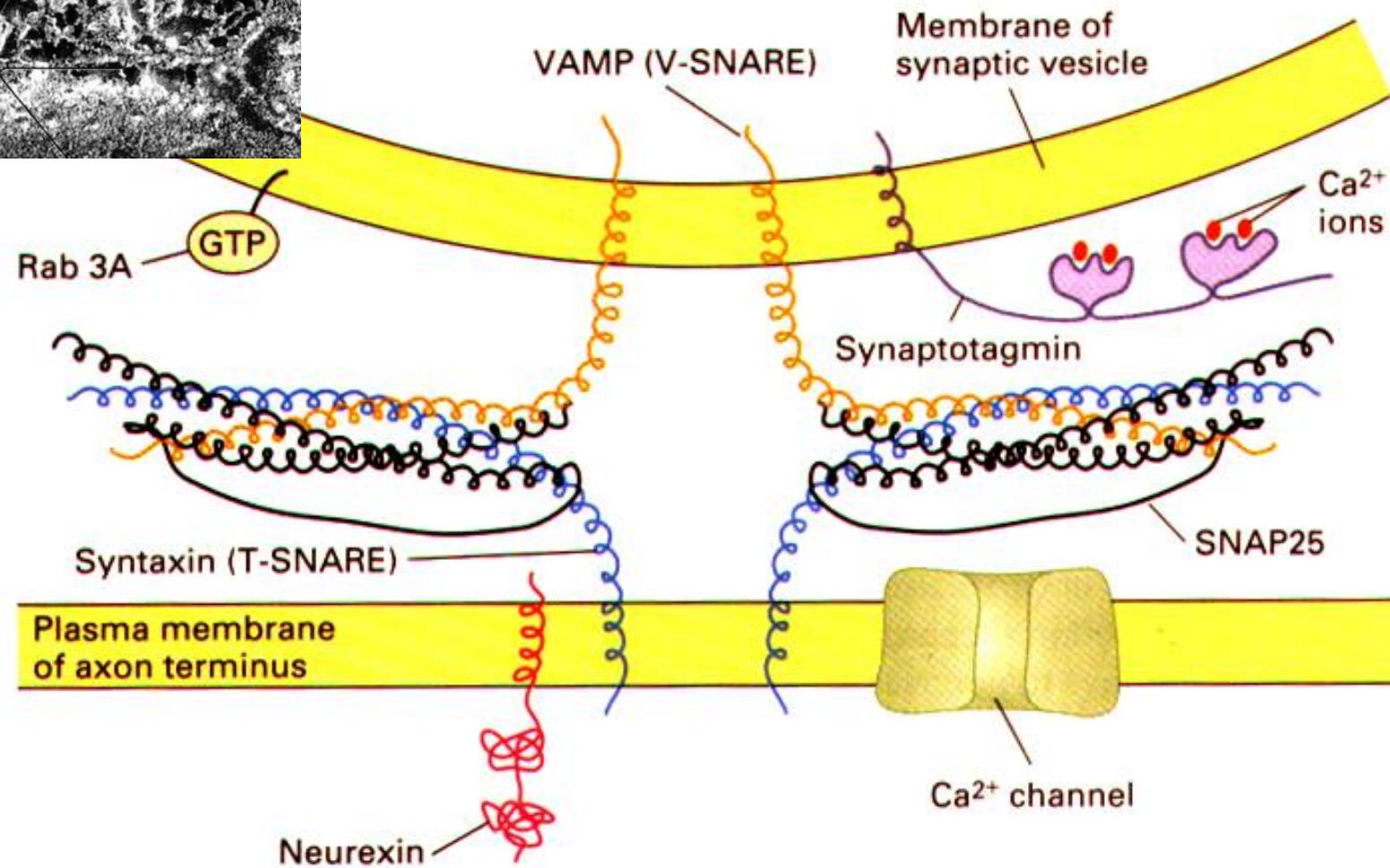


Heuser y Reese, 1989

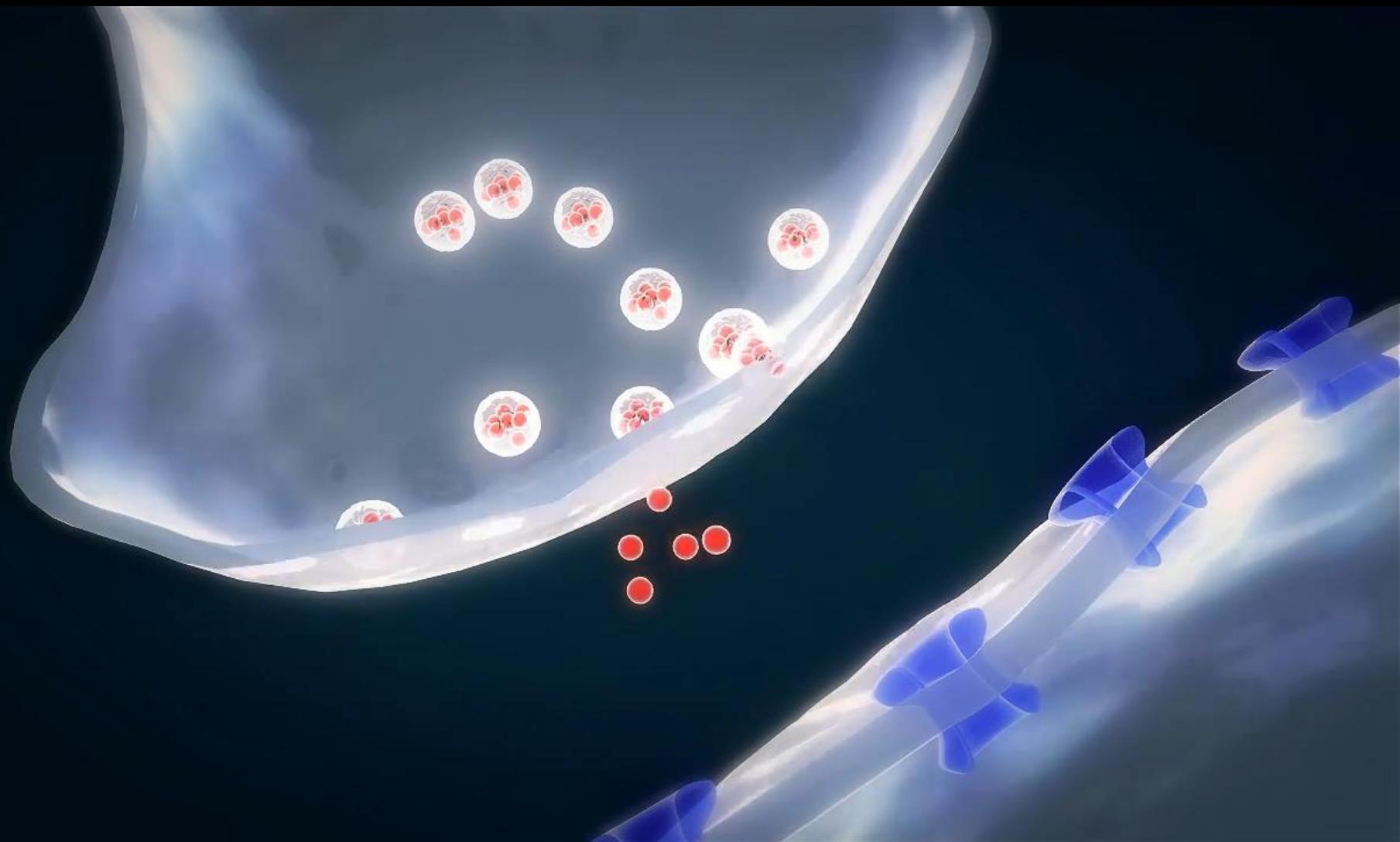




# Las vesículas sinápticas y la liberación del neurotrasmisor



# SNAREs, $\alpha$ SNAP y NSF



<https://youtu.be/jQJAIPuqt4Q>

# Dinámica de las vesículas sinápticas

(A)

FM1-43, 5 min → lavado

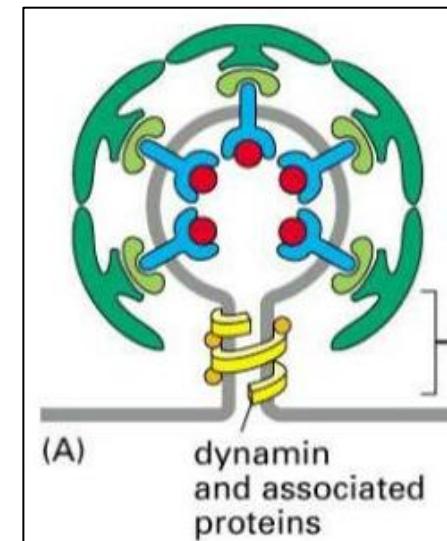
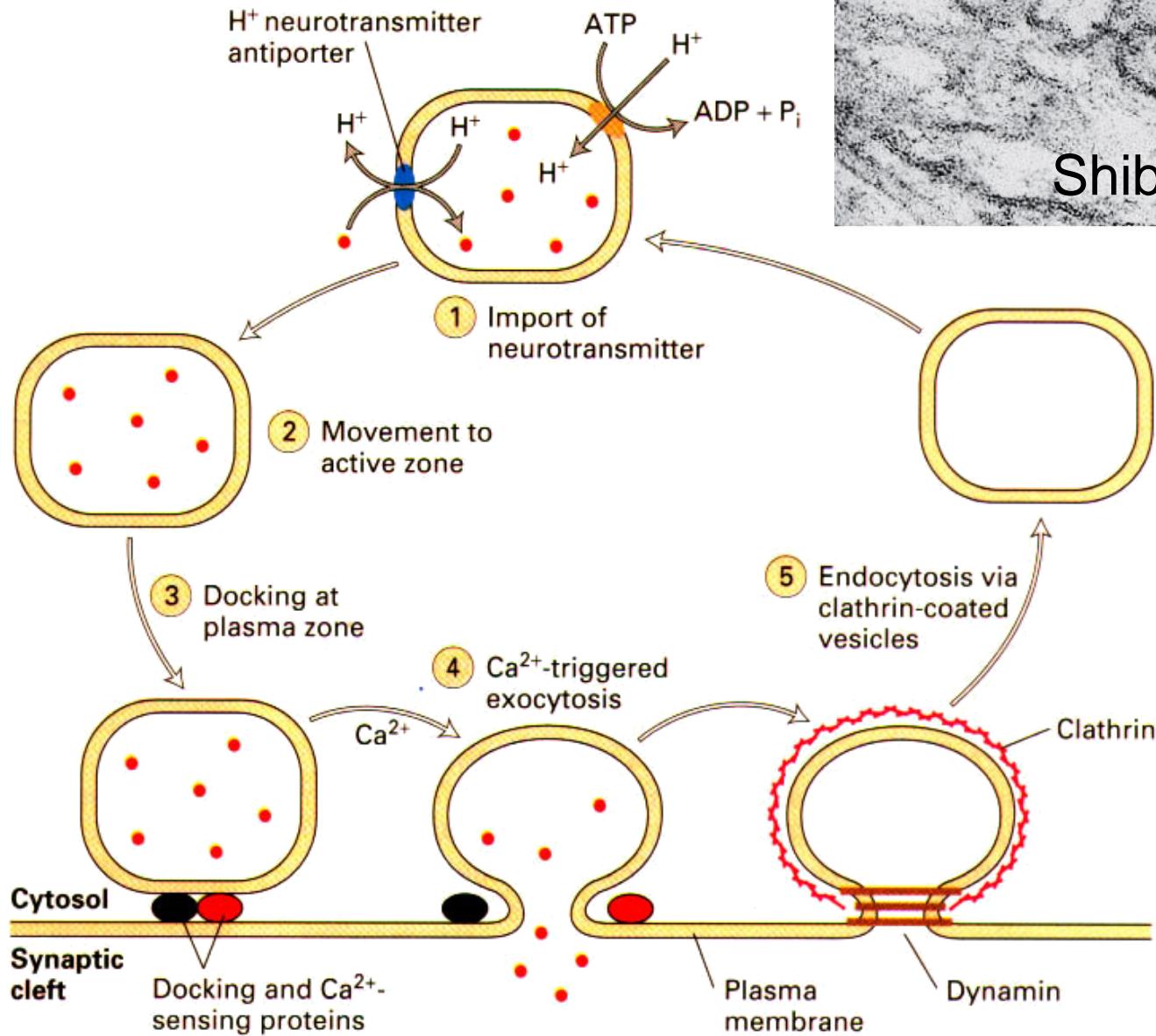
(B)

FM1-43, 5 min + estimulación → lavado

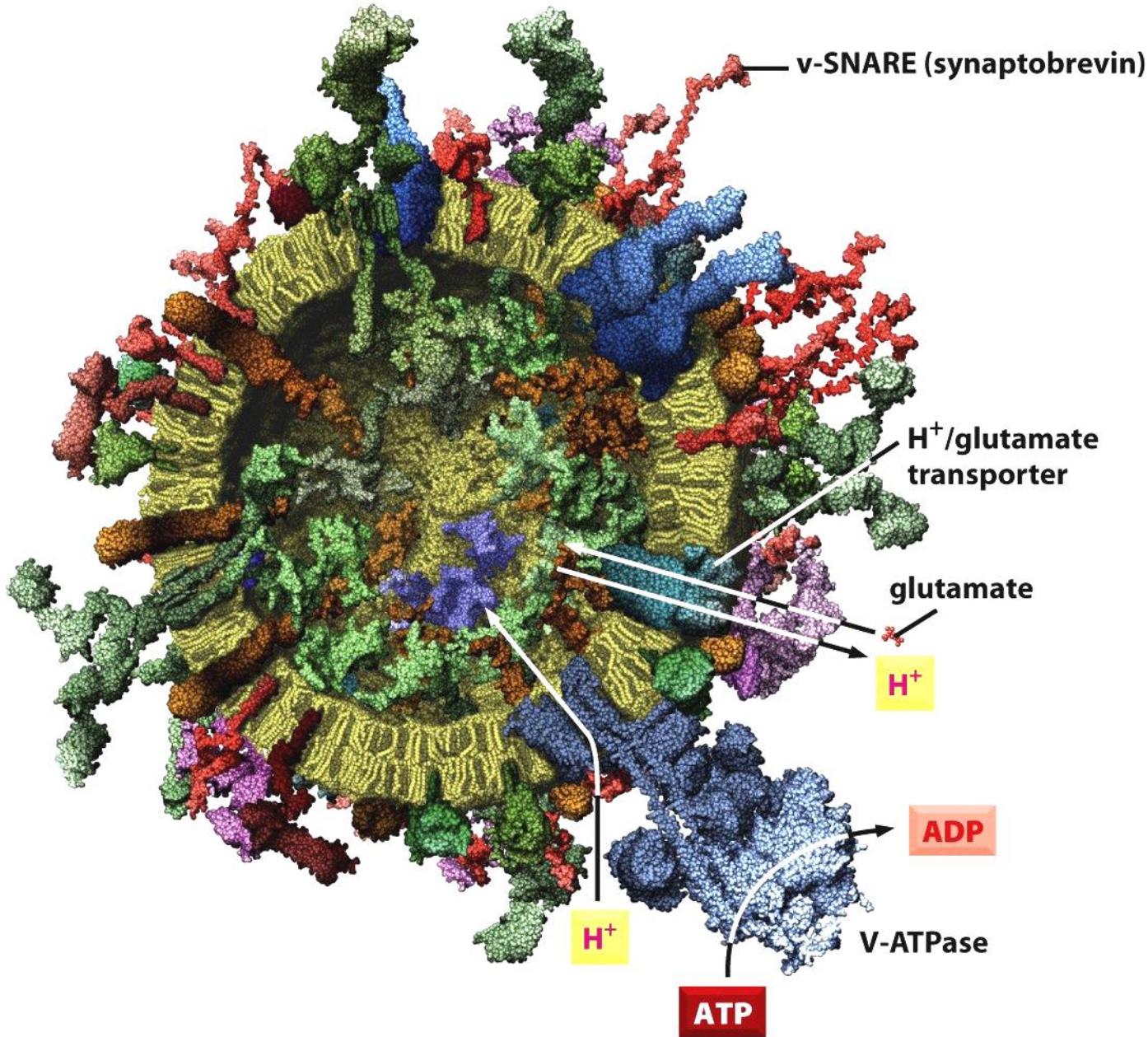
(C)

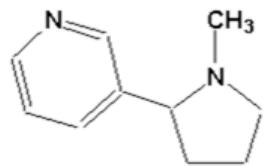
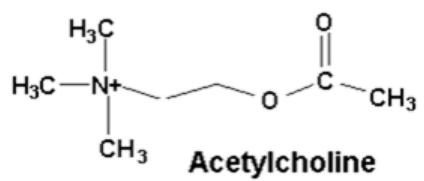
FM1-43, 5 min + estimulación → lavado → estimulación → lavado

# Dinámica de las vesículas sinápticas



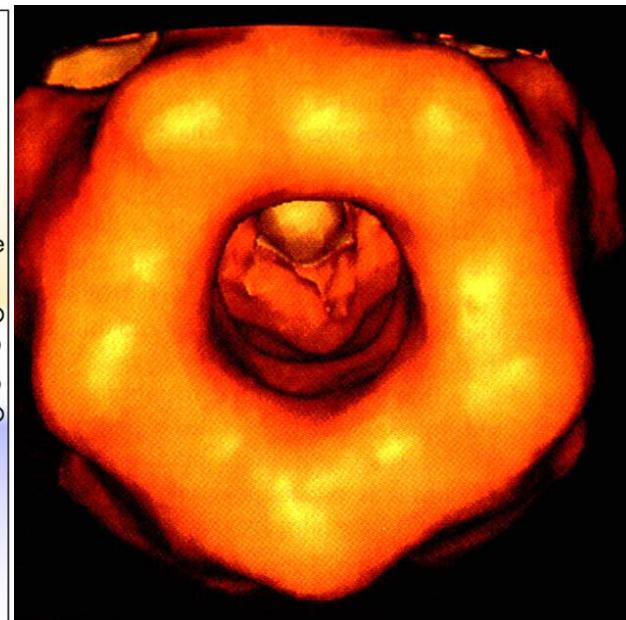
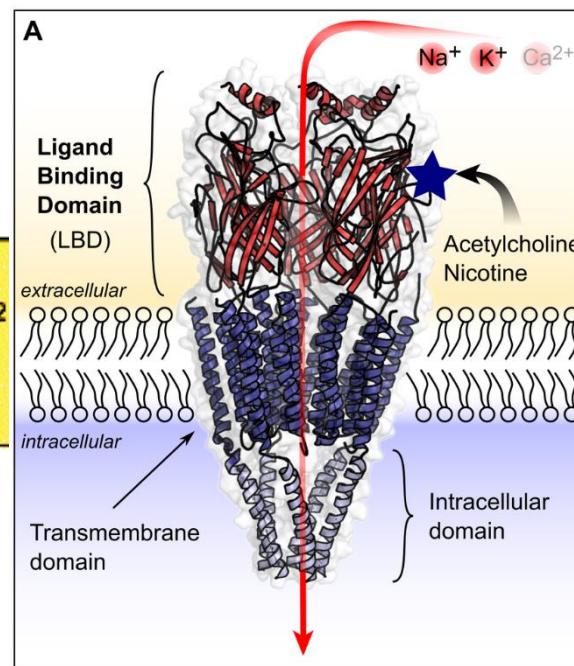
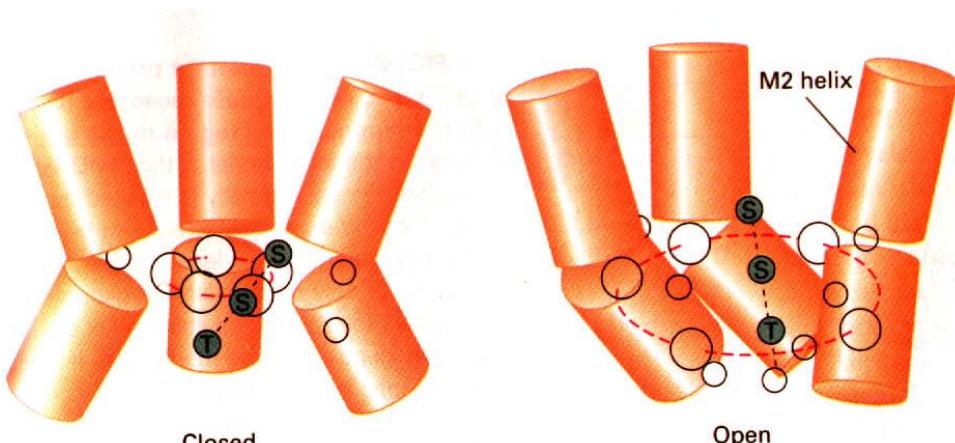
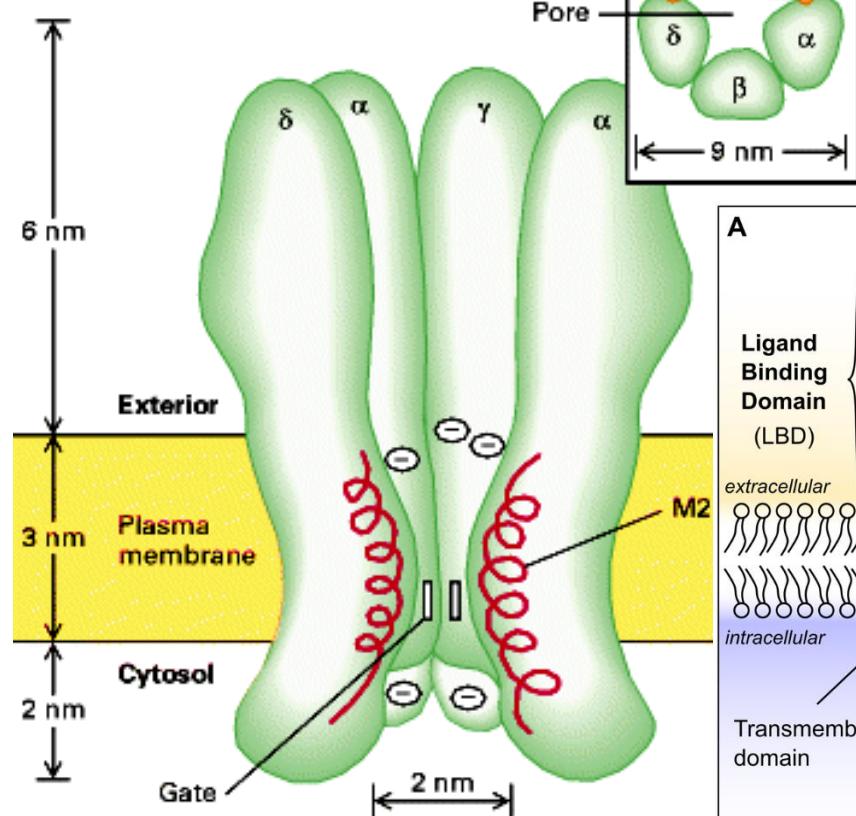
# Estructura de una vesícula sináptica





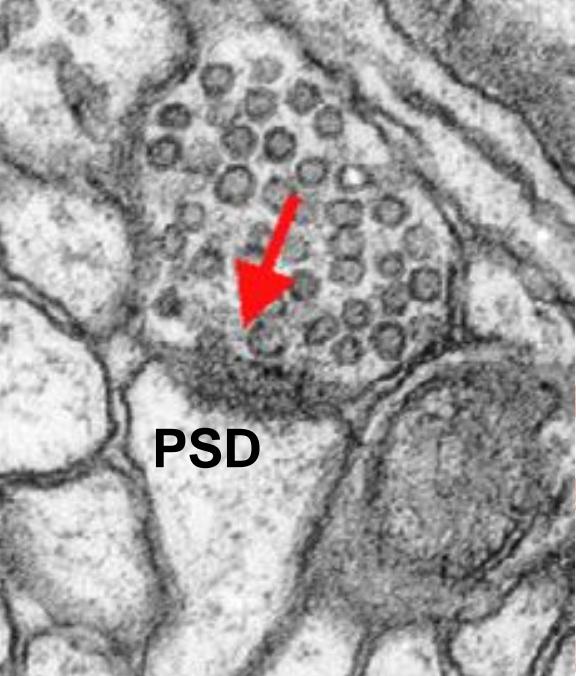
# El receptor nicotínico de acetilcolina

(a) Nicotine (55 mg/kg)

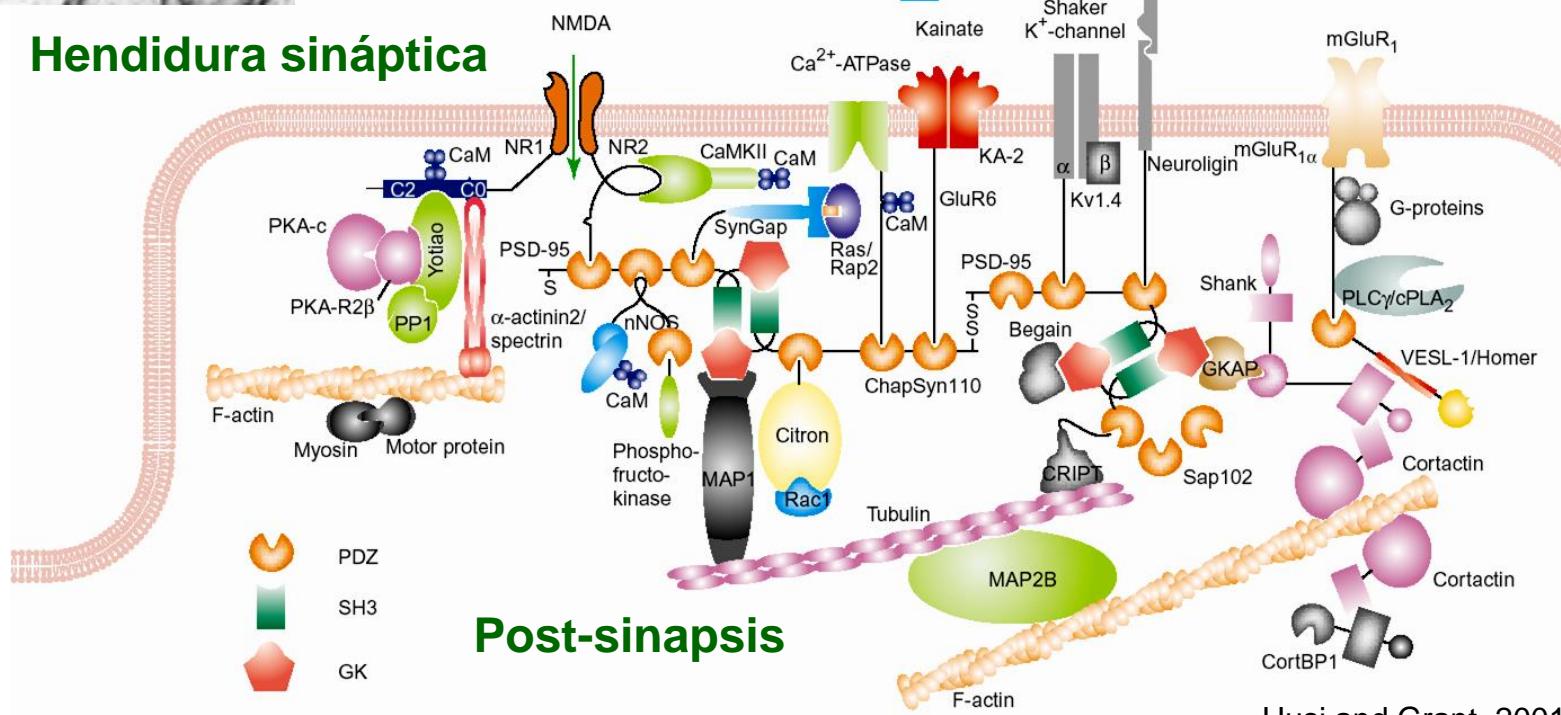


# Organización molecular de la densidad post-sináptica

PSD



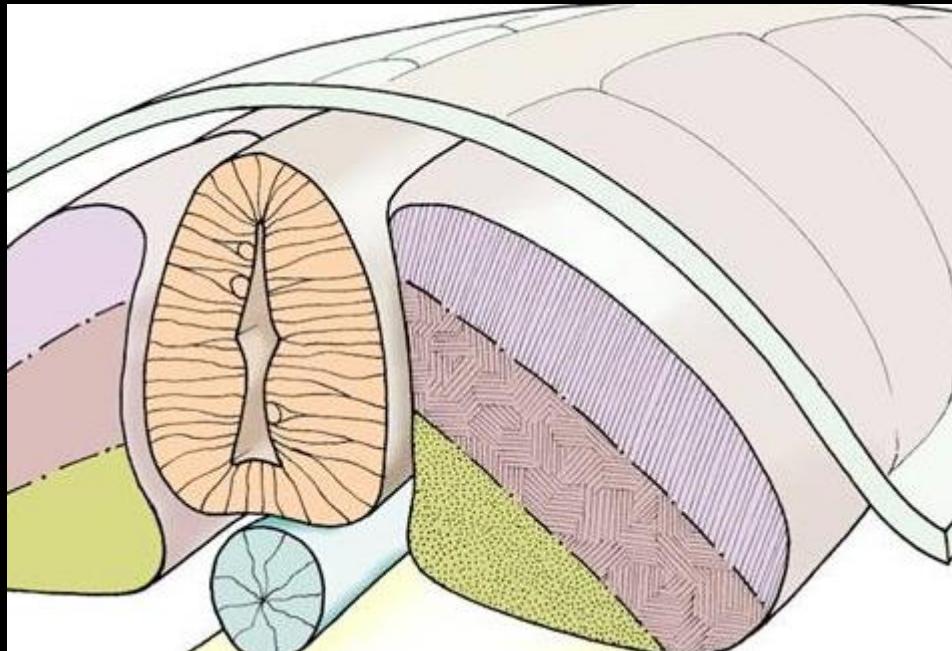
Hendidura sináptica



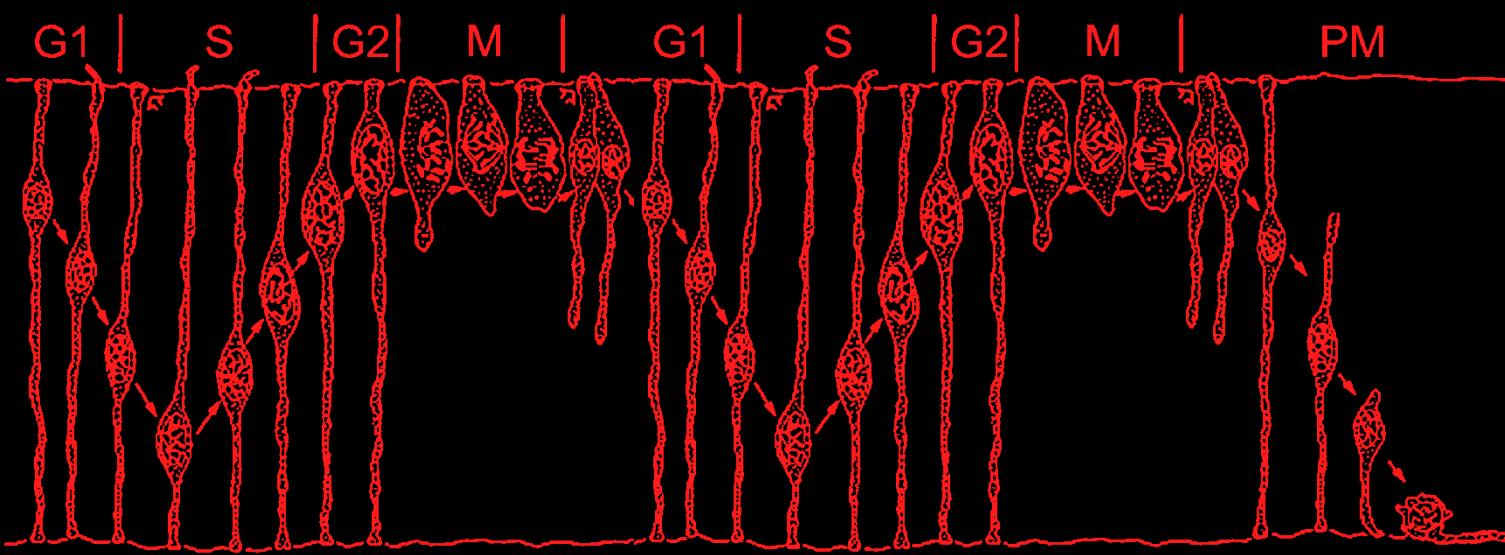
Husi and Grant, 2001

# Diferenciación neuronal

# El neuroepitelio y la Migración Nuclear Intercinética



Dave  
Lyon,  
Jon  
Clarke



<https://youtu.be/mQqhzi7h-5A>

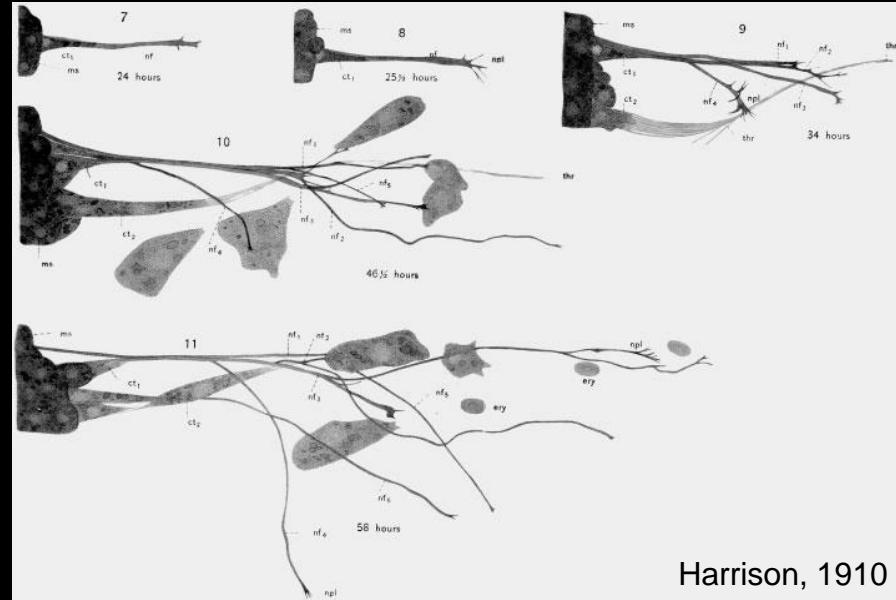
# Estudios de polarización y crecimiento axonal en cultivo



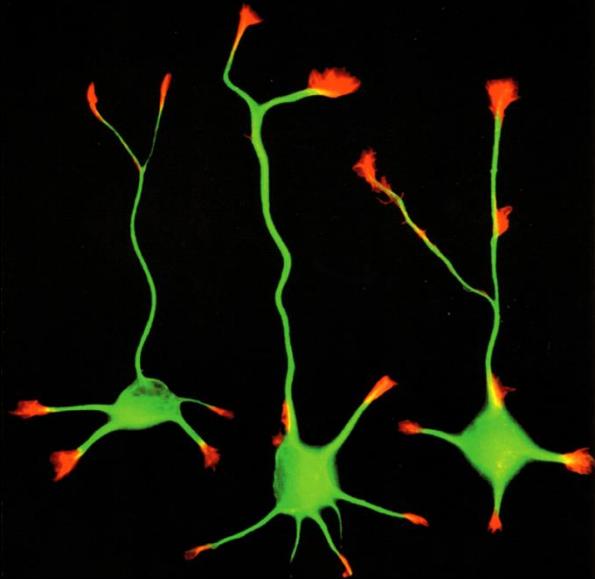
Ross G. Harrison



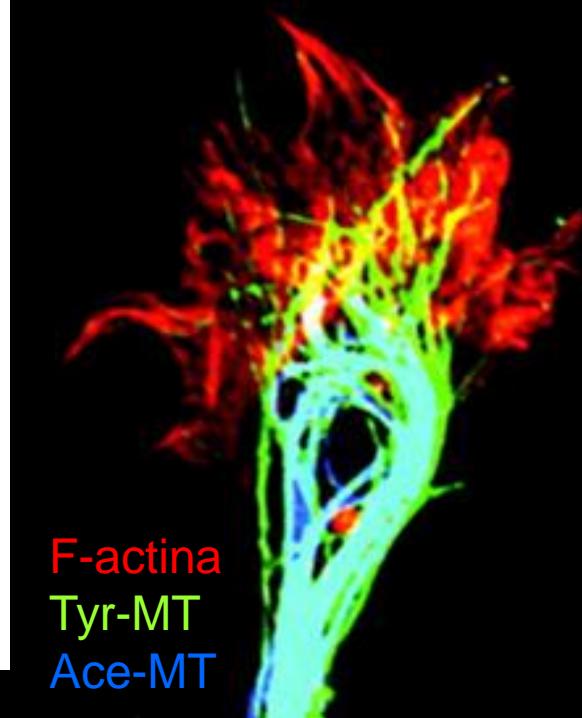
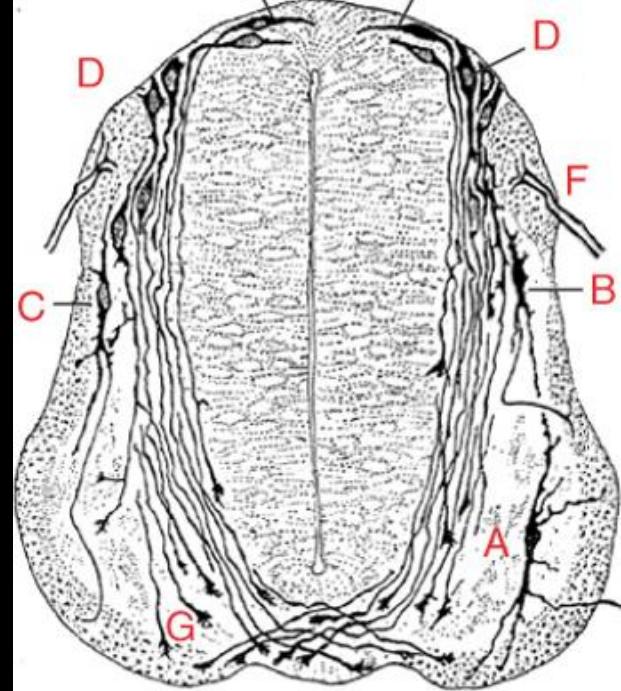
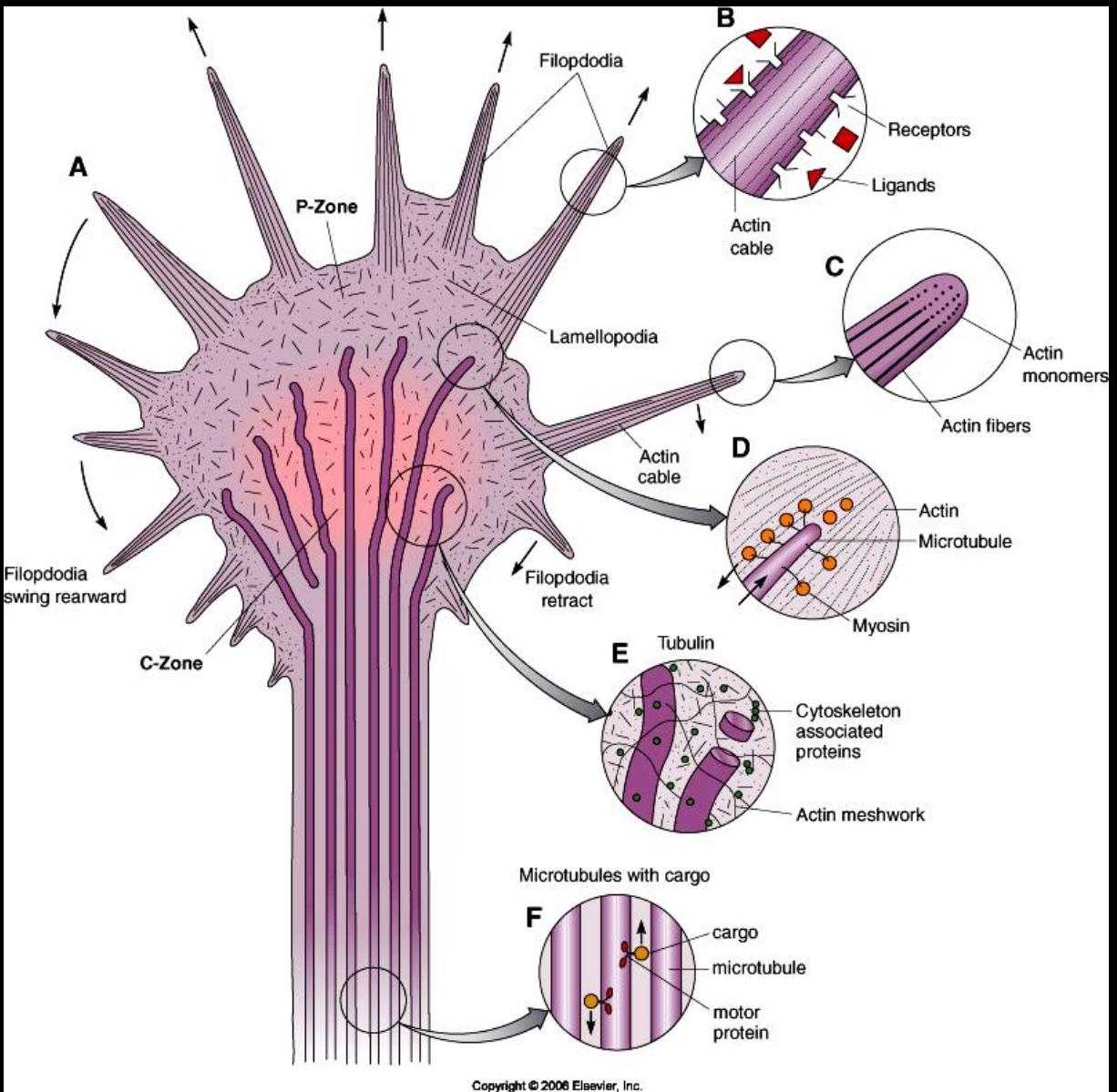
Gary Banker



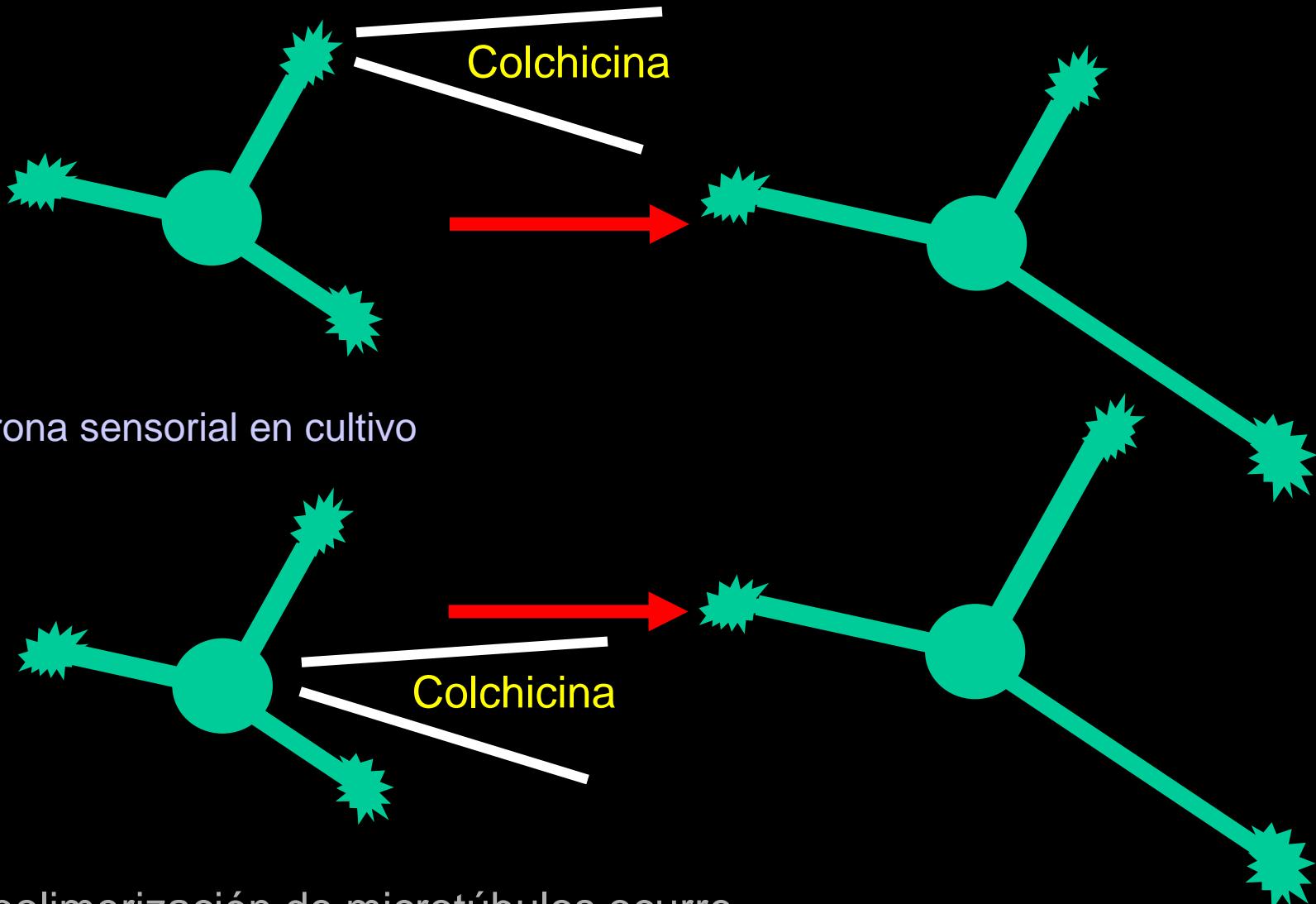
Harrison, 1910



# El cono de crecimiento



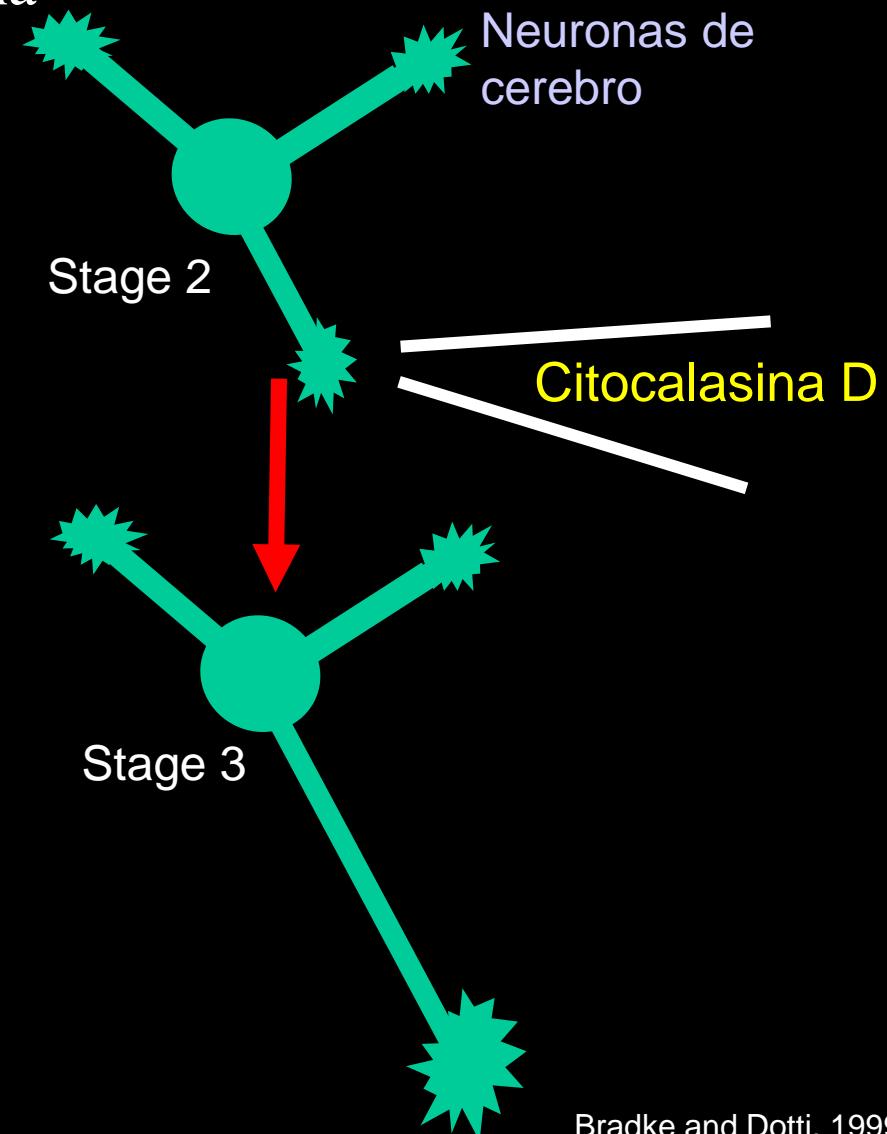
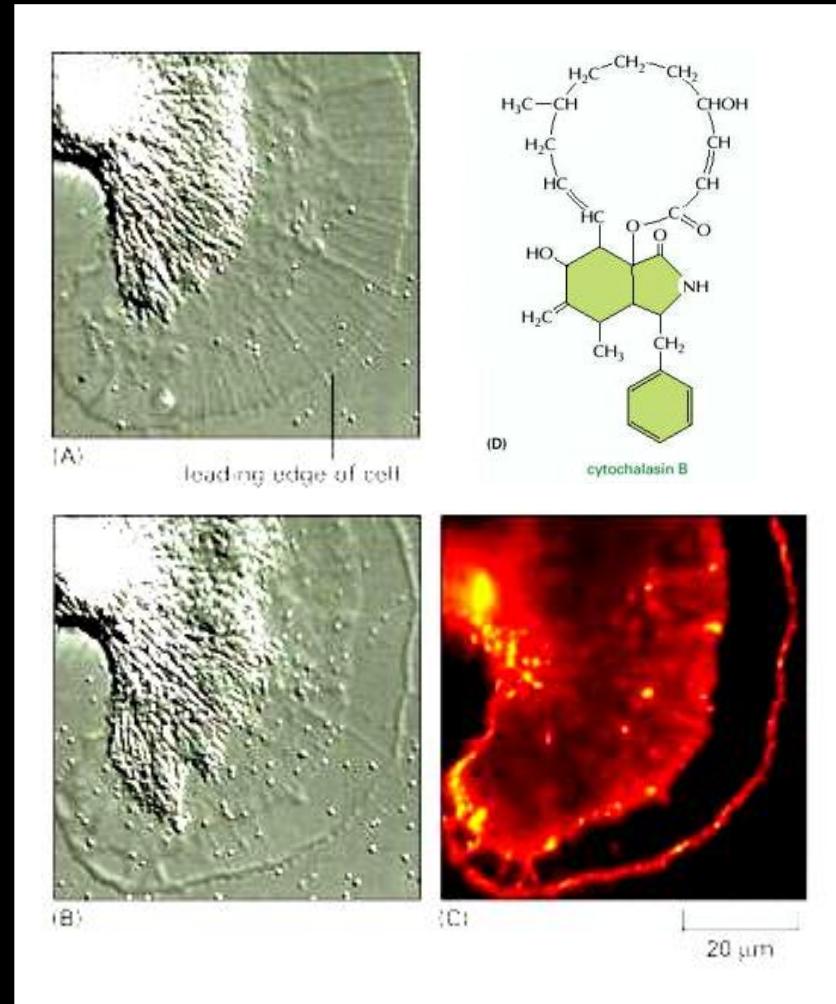
# Rol del citoesqueleto en la polarización neuronal: microtúbulos



La polimerización de microtúbulos ocurre  
en el extremo de la neurita

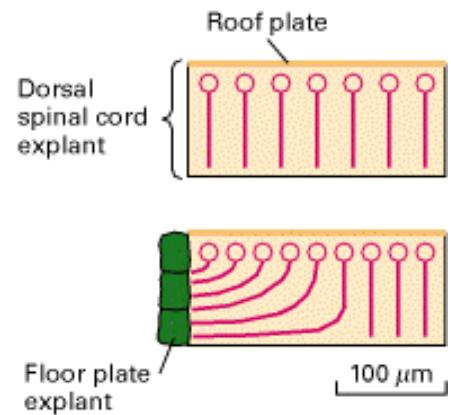
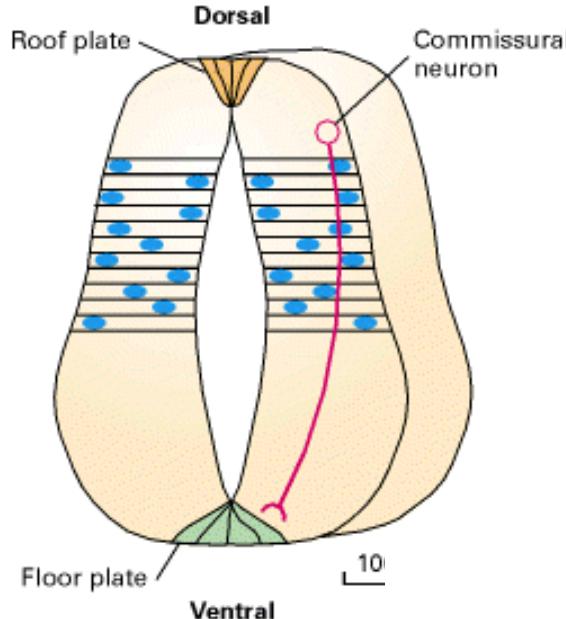
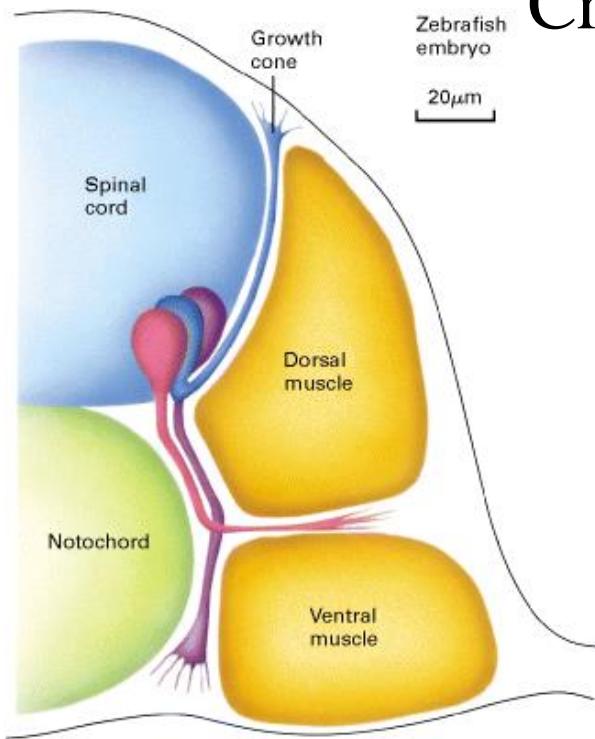
Bamburg et al., 1986

# Rol del citoesqueleto en la polarización neuronal: actina

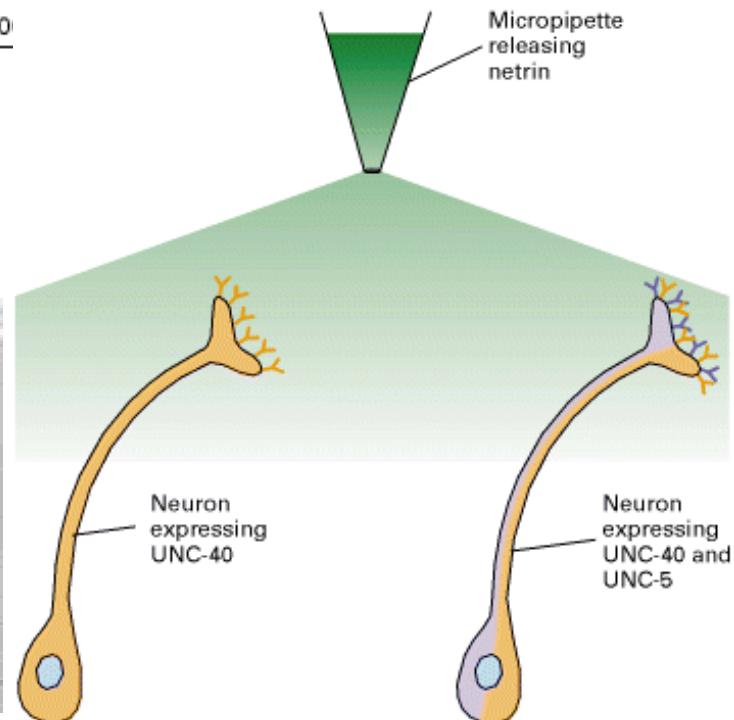
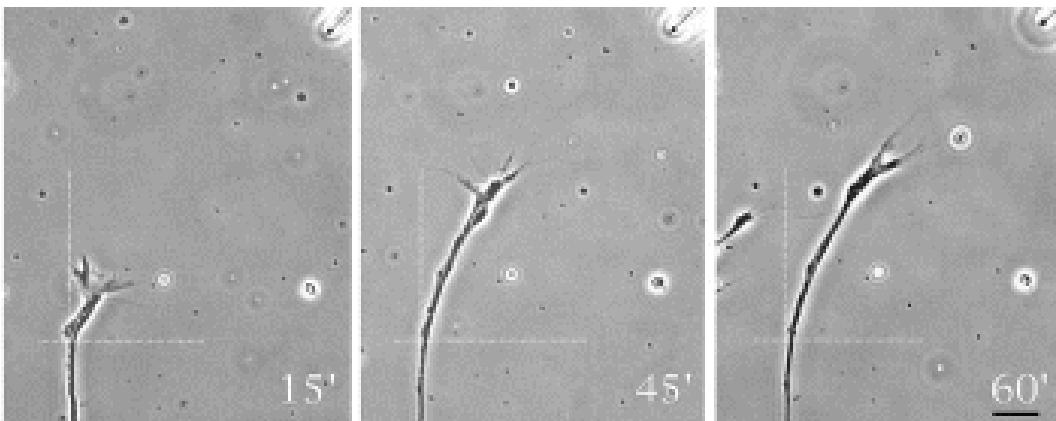


El crecimiento axonal requiere de la desestabilización de la actina

# Crecimiento y guía axonal

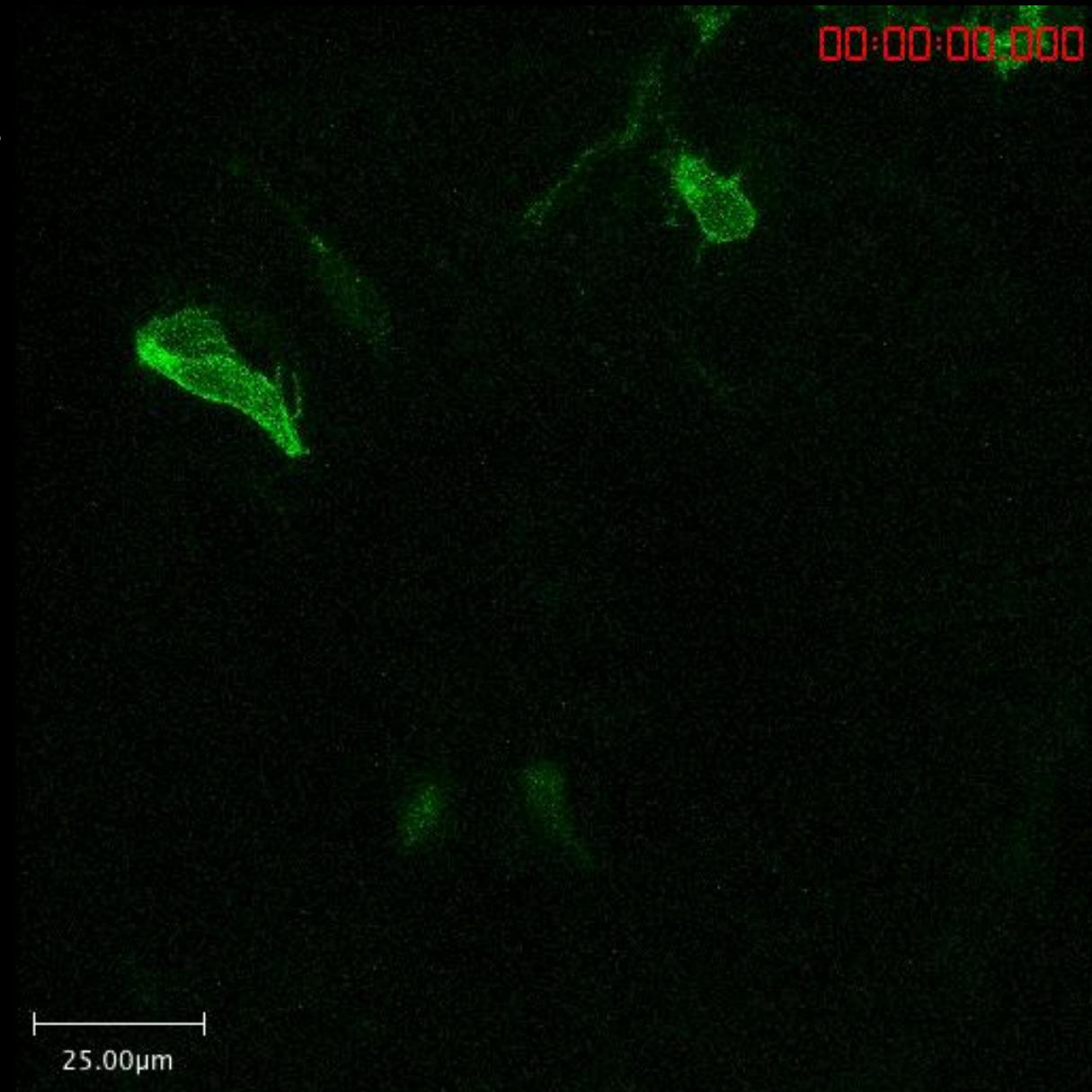
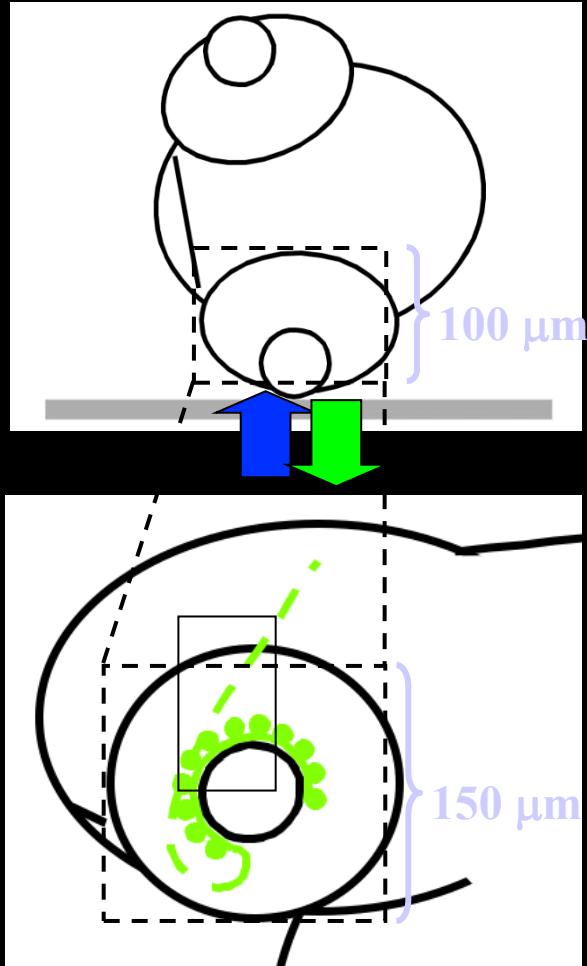


## Ensayo de giro axonal



# Diferenciación neuronal en la retina *in vivo*

ath5 gene  
Upstream seq:   
“Ath5:Gap-GFP”



<https://youtu.be/XlrRe1Q6DHM>

