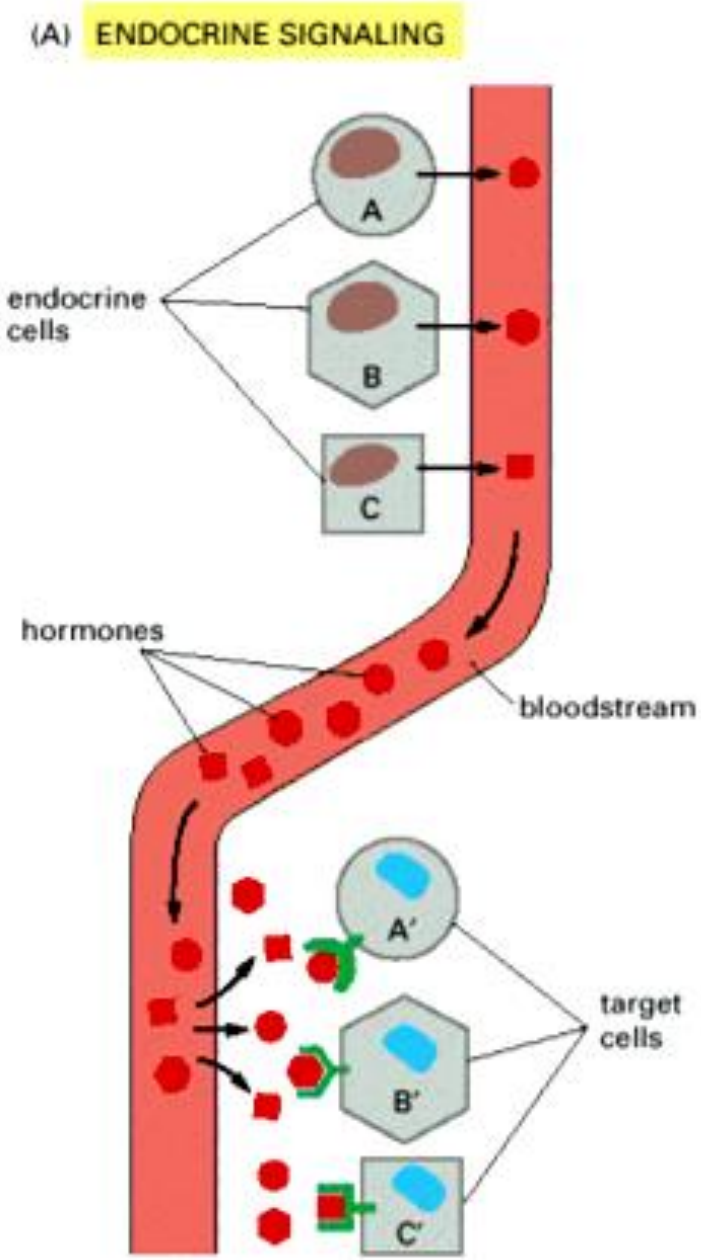
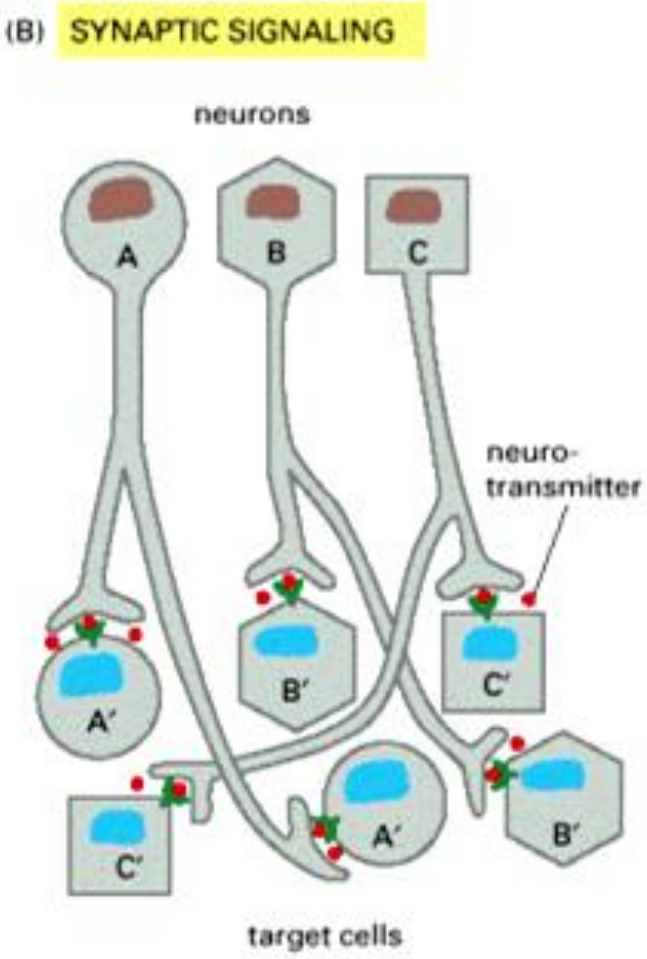
Las células del sistema nervioso I

Estructura y función básicas de neuronas y células gliales

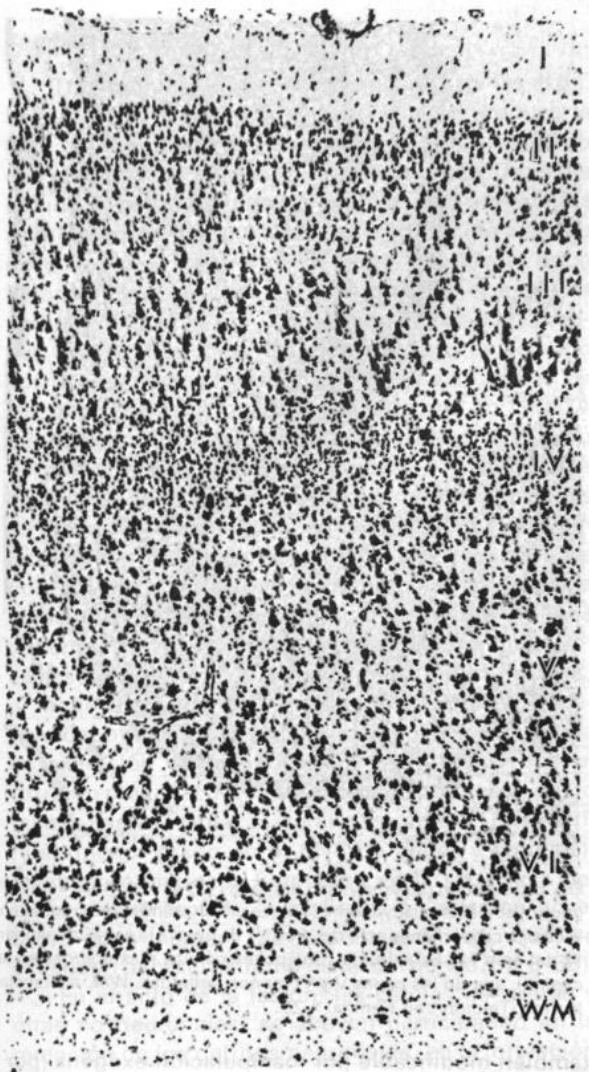
Flavio Zolessi

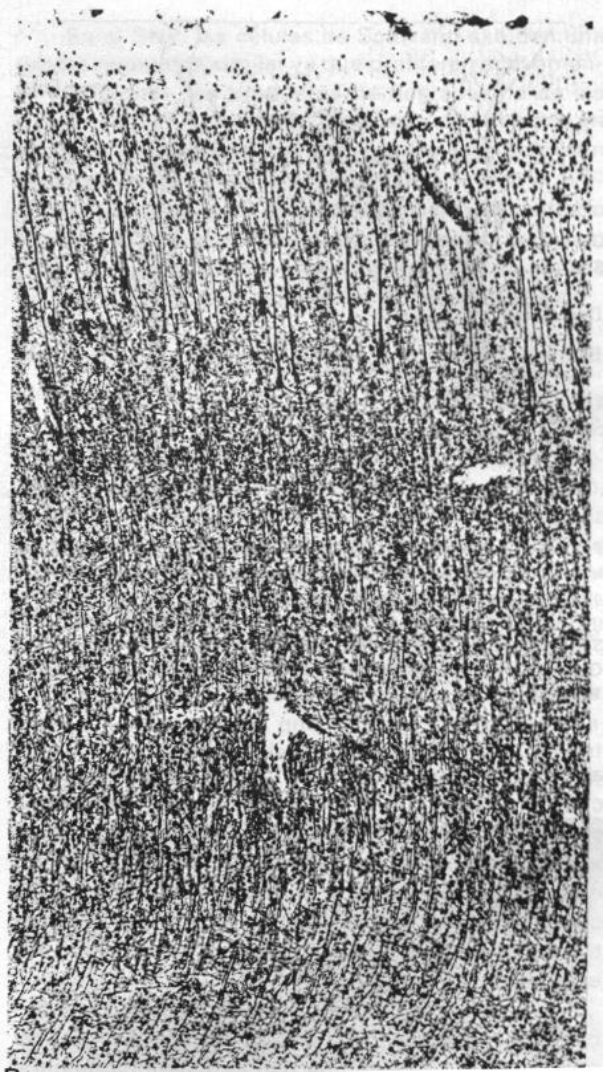
Comunicación intercelular a distancia

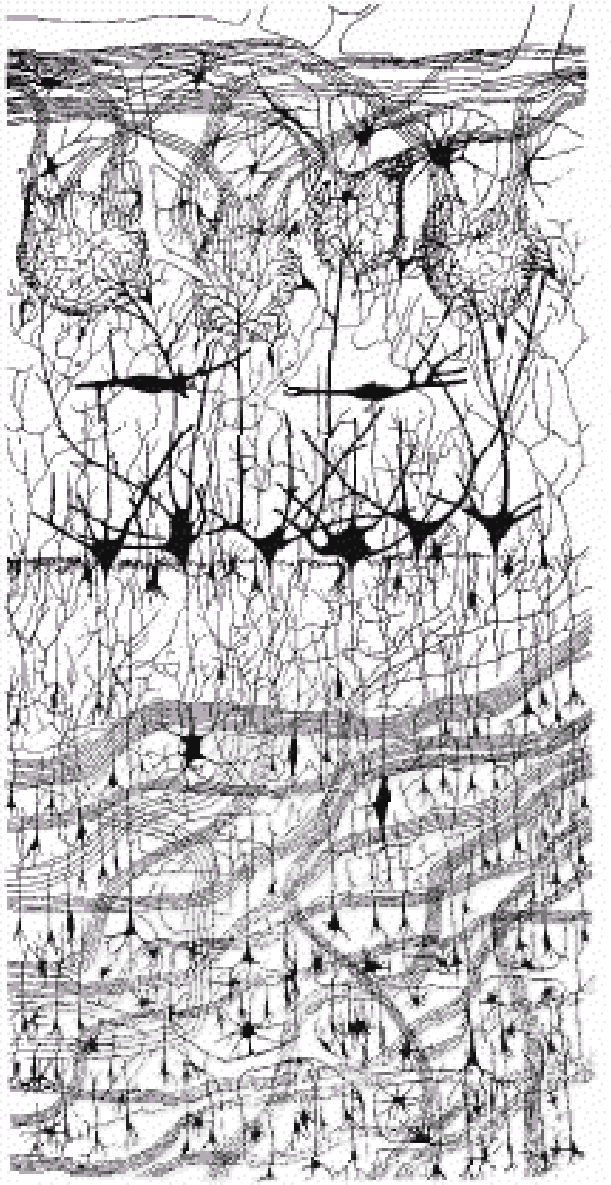




Complejidad del tejido nervioso en animales superiores

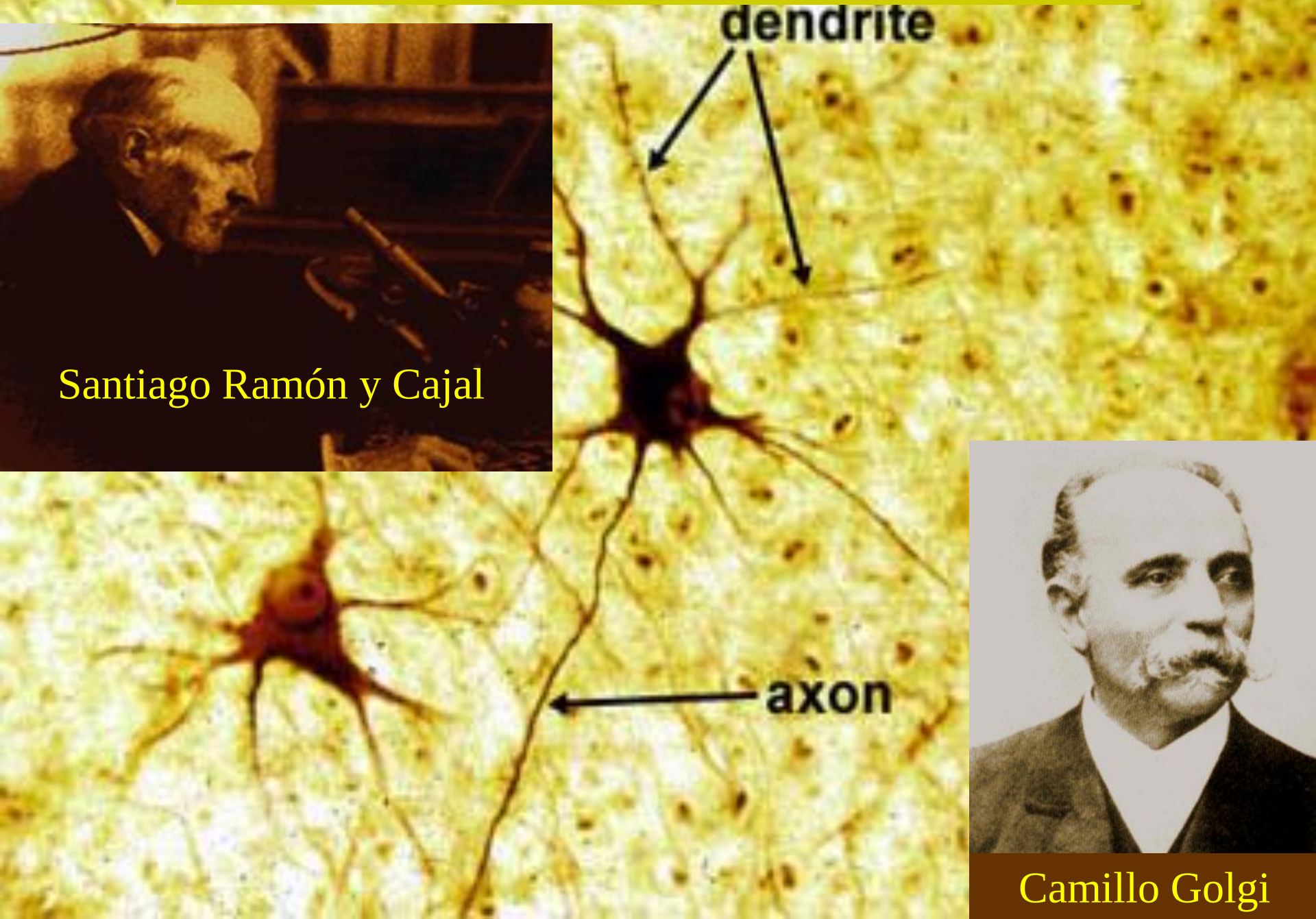




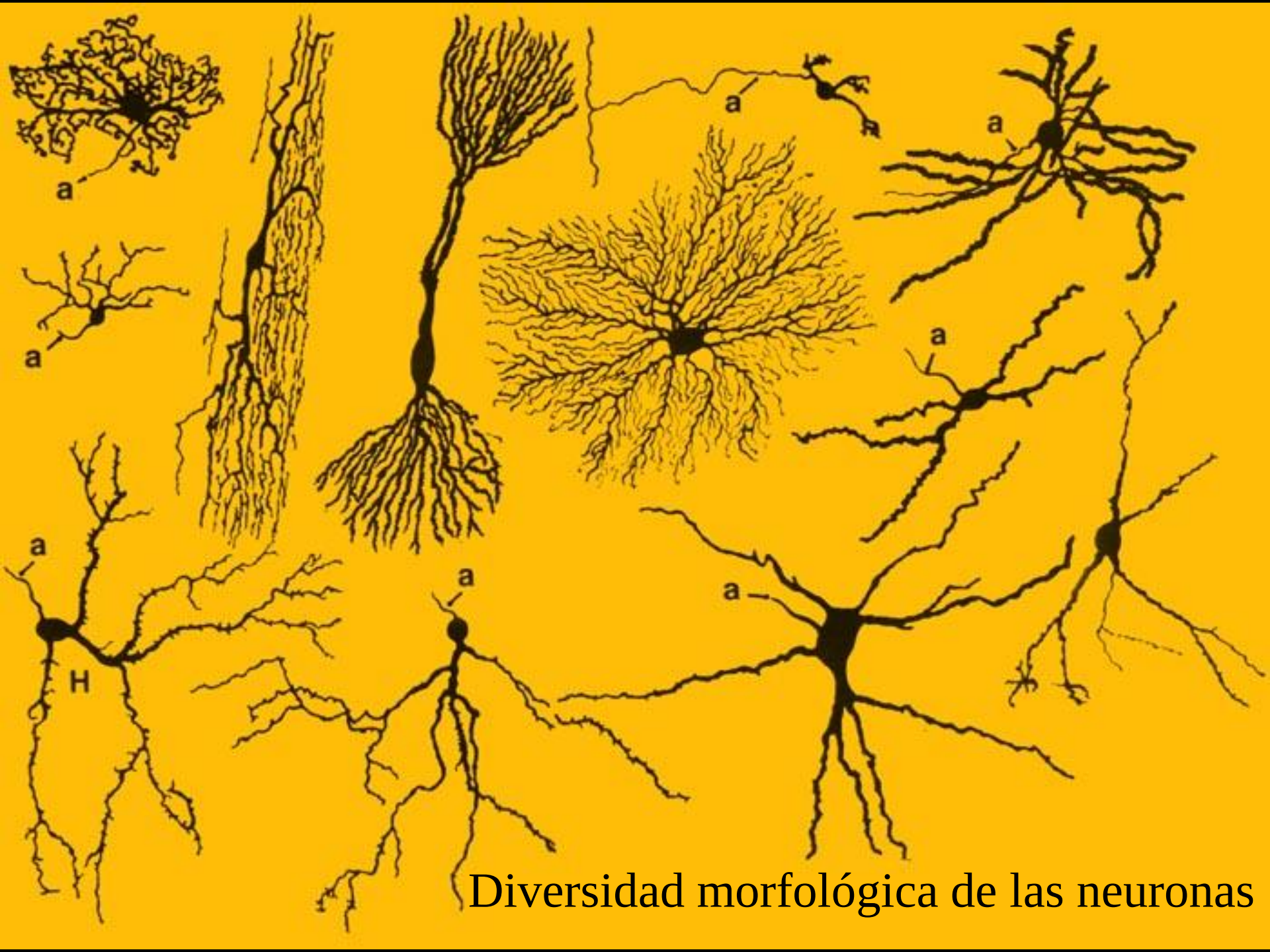


1906: Premio Nobel en Medicina y Fisiología

Santiago Ramón y Cajal



Camillo Golgi



Diversidad morfológica de las neuronas

Neuroglia

Todas las células del tejido nervioso que NO son neuronas

Astrocitos: (SNC) Fibrosos
Protoplasmáticos
} Homeostasis del SN
Barrera hemato-encefálica

Células ependimarias (SNC) — Recubrimiento de ventrículos

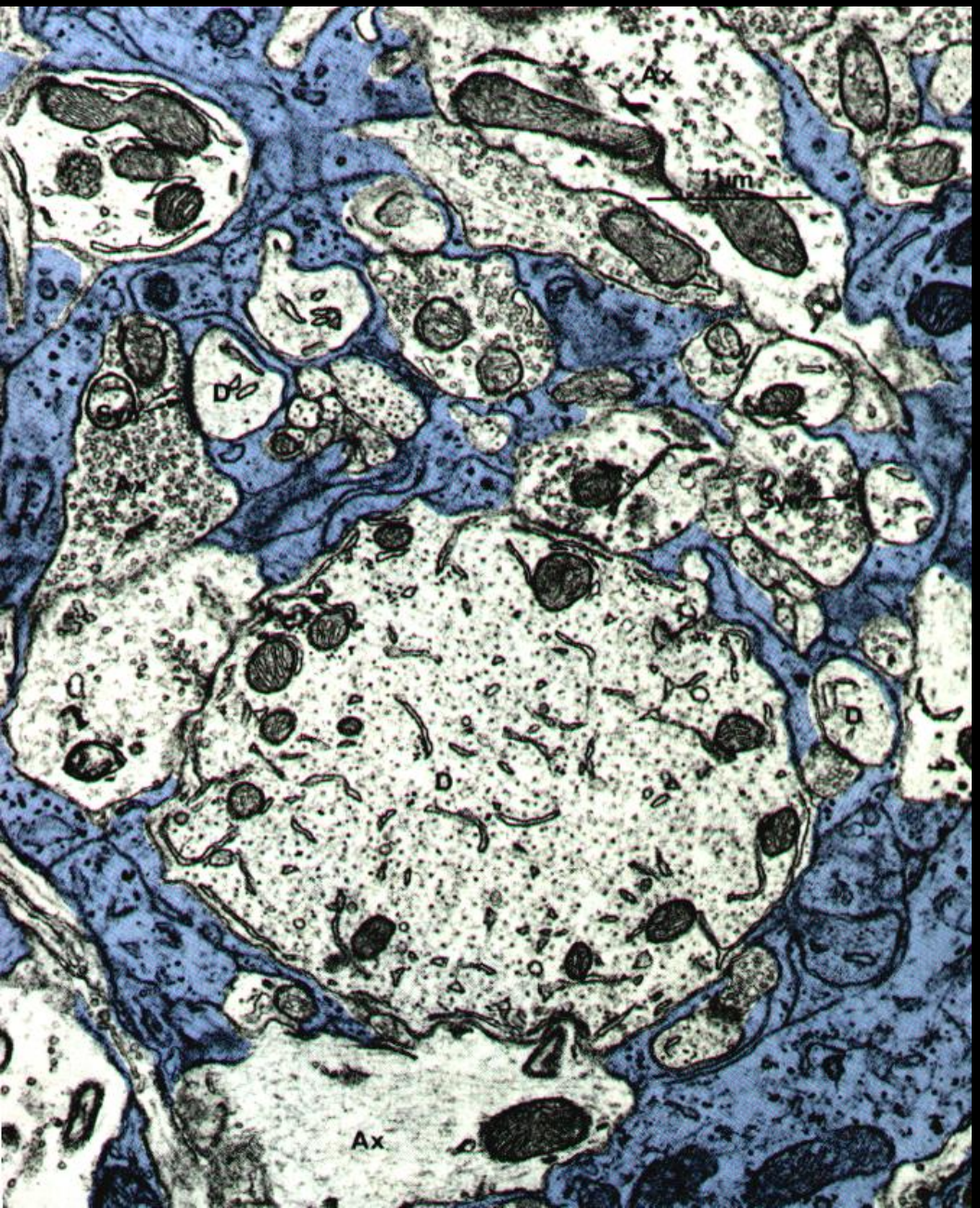
Microglia (SNC) — Fagocitosis

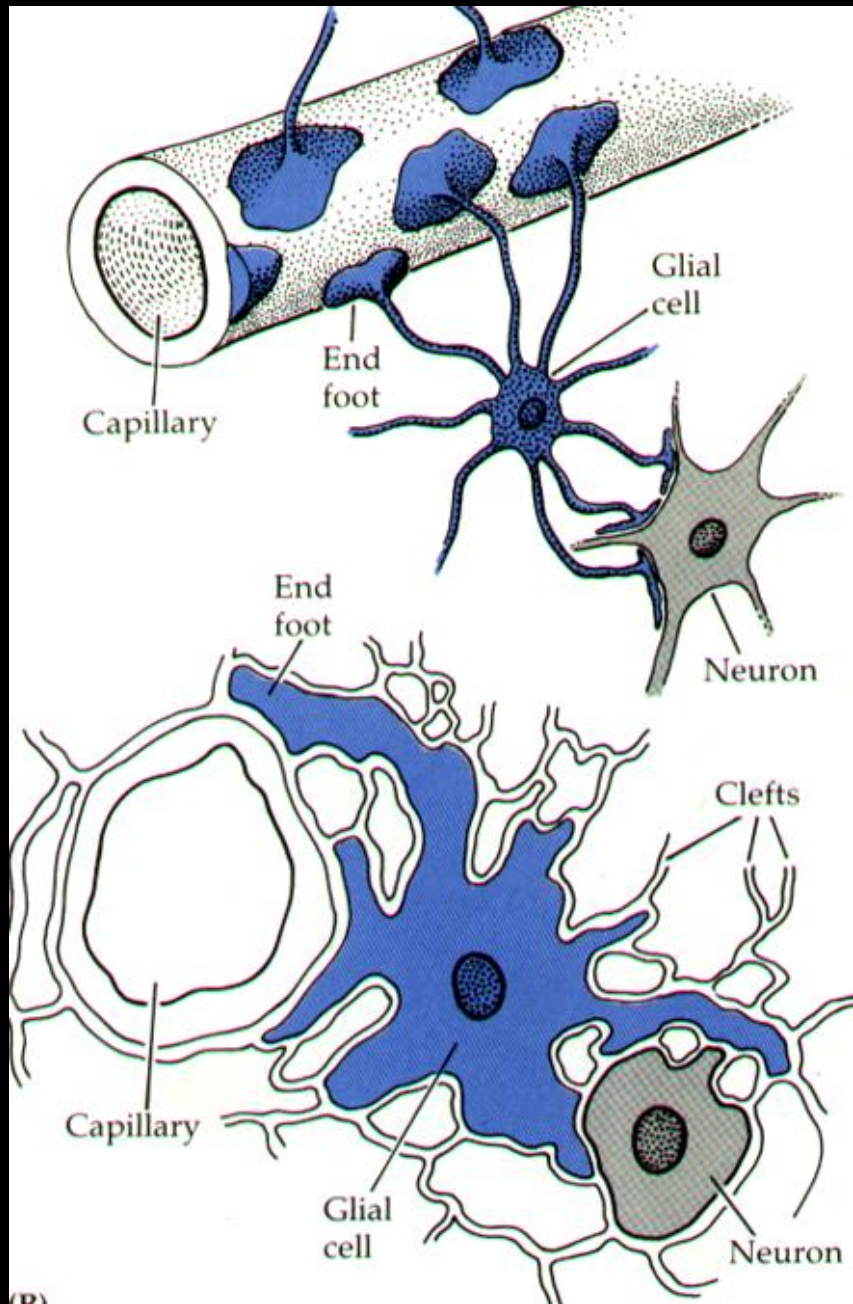
Oligodendrocitos (SNC)
Células de Schwann (SNP)
} Formación de vainas de mielina

Celulas satélite (SNP) — Protección de somas neuronales

Glias radiales (SNC) — Progenitores neurales/soporte en migración neuronal

Astrocitos


Ax
1 µm
Syn
D
Ax
Syn
D
D
Ax


Glial cell
End foot
Capillary
Neuron
End foot
Clefts
Capillary
Glial cell
Neuron

Ejercicio 1:

¿Cuántas neuronas hay en el cerebro?

Grupo 1 - ¿Cuántas en el cerebro humano?
Grupo 2 - ¿En otras especies?
Grupo 3 - ¿Cómo se calcula?
Grupo 4 - ¿Tiene este número relación con la cognición?

Zoom

ID de reunión: 741 345 6826
Contraseña: neurona

https://us04web.zoom.us/j/7413456826?pwd=dUdkdmVweGFLTlliUGNMZkE2R2h5Zz09

Brief Communication

2518 • The Journal of Neuroscience, March 9, 2005 • 25(10):2518–2521

Isotropic Fractionator: A Simple, Rapid Method for the Quantification of Total Cell and Neuron Numbers in the Brain

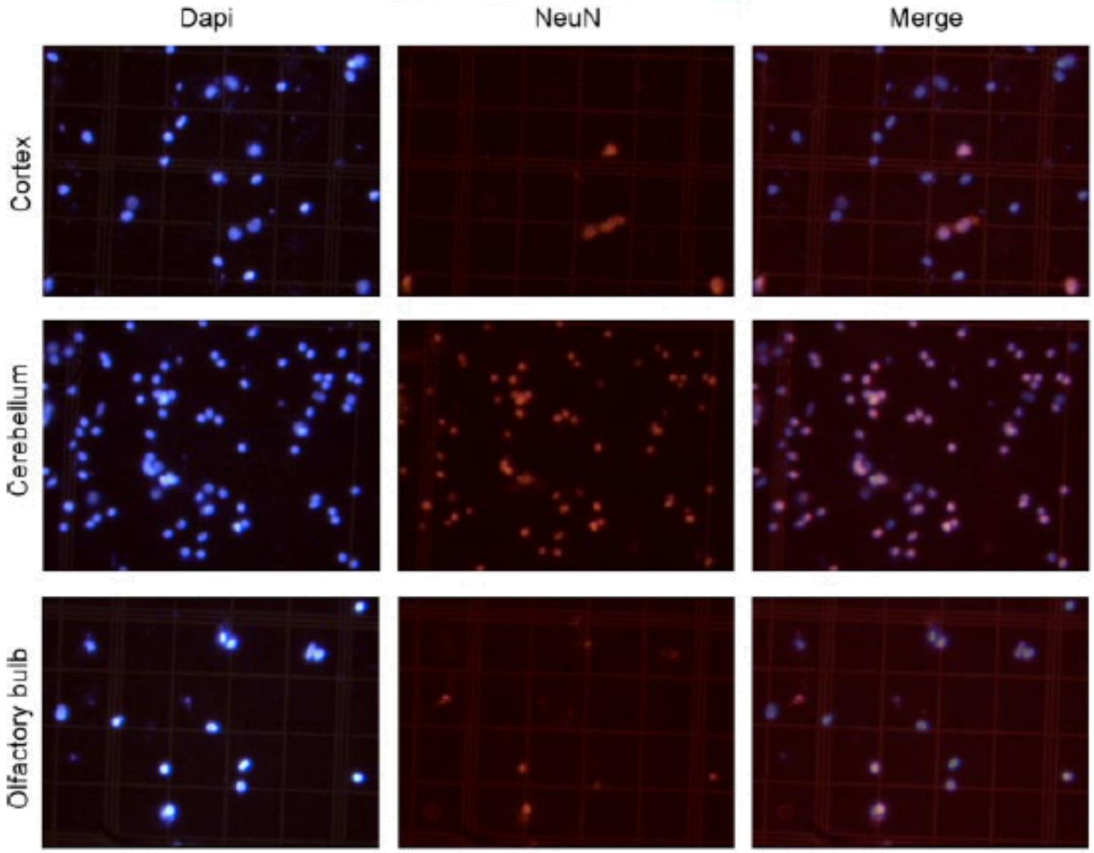
https://www.jneurosci.org/content/25/10/2518

Suzana Herculano-Houzel and Roberto Lent

Departamento de Anatomia, Instituto de Ciências Biomédicas, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil

1. Fix brain tissue
2. Homogenize
3. Collect homogenate
4. Centrifugate 10'
5. Remove supernatant → 6. Add DAPI: count nuclei in supernatant
7. Suspend nuclei in exact volume (Vol) of DAPI, PBS: **isotropic suspension** → 8. Count aliquots: **total cell number = dens nuclei x Vol**
9. Stain sample for NeuN → 10. Count aliquots: determine Fr NeuN+

Total neuron number = Fr NeuN+ x Total cell number

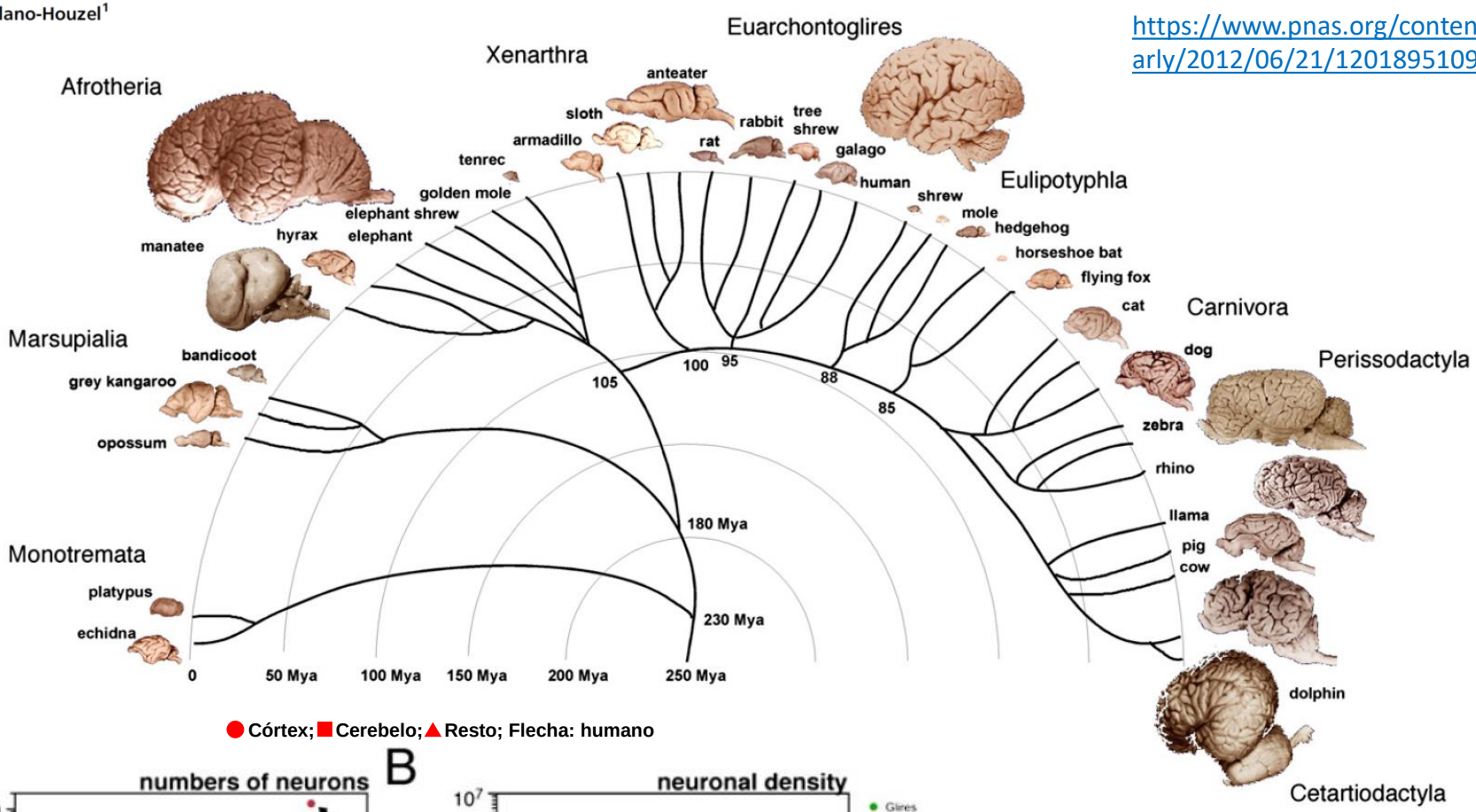


The remarkable, yet not extraordinary, human brain as a scaled-up primate brain and its associated cost

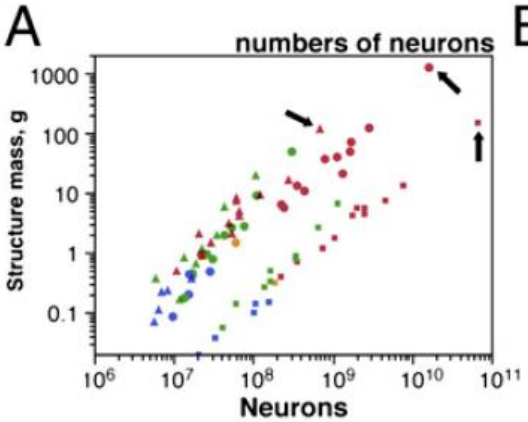
PNAS | June 26, 2012 | vol. 109 | suppl. 1 | 10661–10668

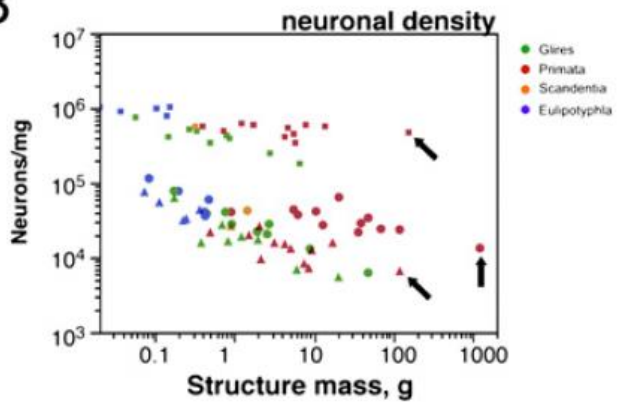
Suzana Herculano-Houzel[1]

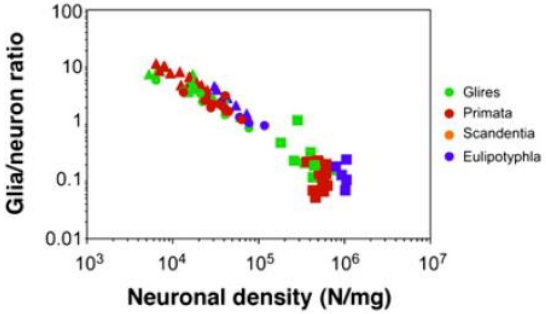
https://www.pnas.org/content/early/2012/06/21/1201895109



● Córtex; ■ Cerebelo; ▲ Resto; Flecha: humano







Neuronas

Número estimado en el cerebro humano: 8.6×10^{10}

Sensoriales: colectan impulsos desde receptores en la periferia hacia el sistema nervioso central (SNC)

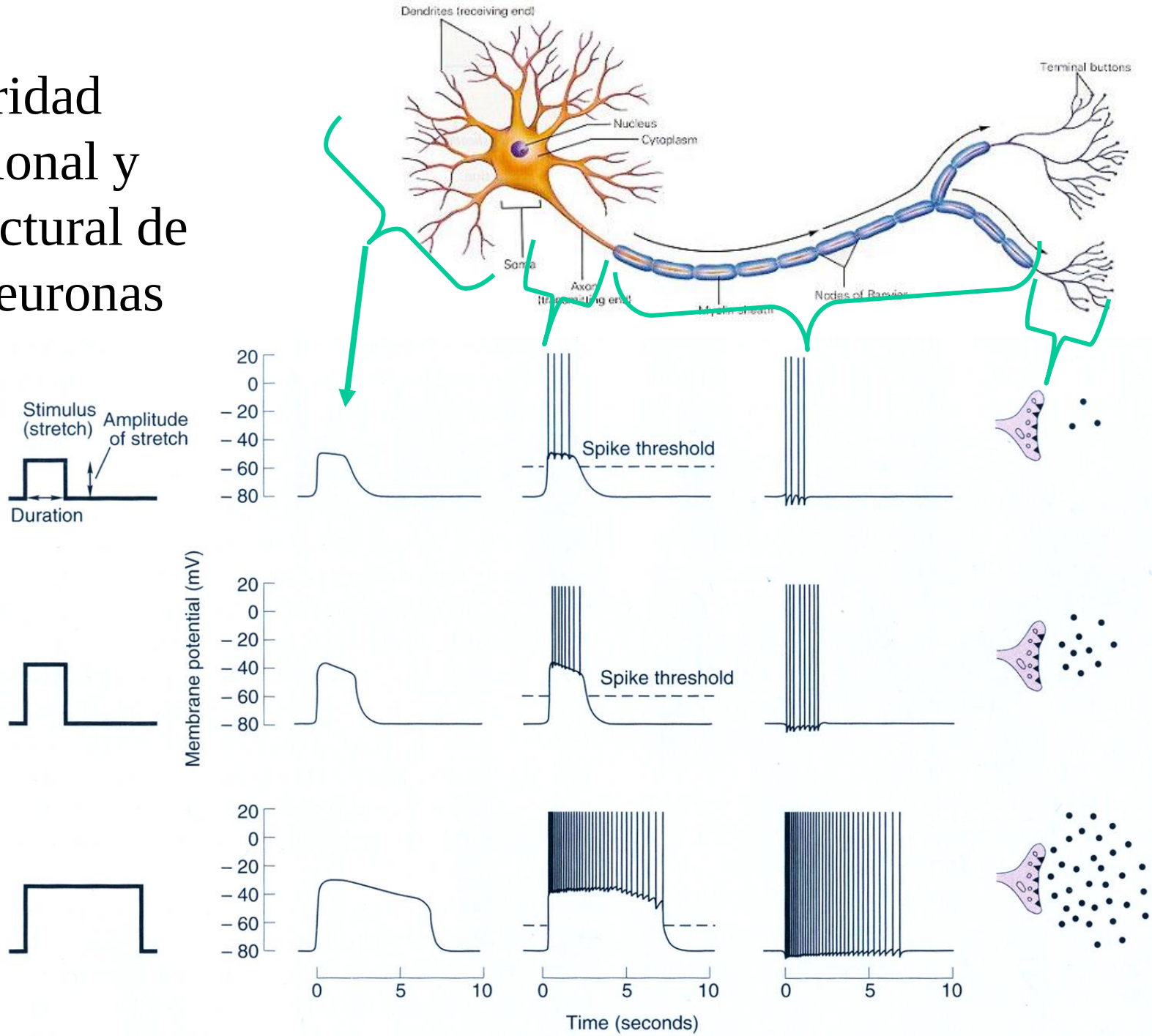
Motoras: emiten impulsos desde el SNC hacia células efectoras

Interneuronas: red interpuesta entre neuronas sensoriales y motoras.

99.98% de todas son interneuronas.

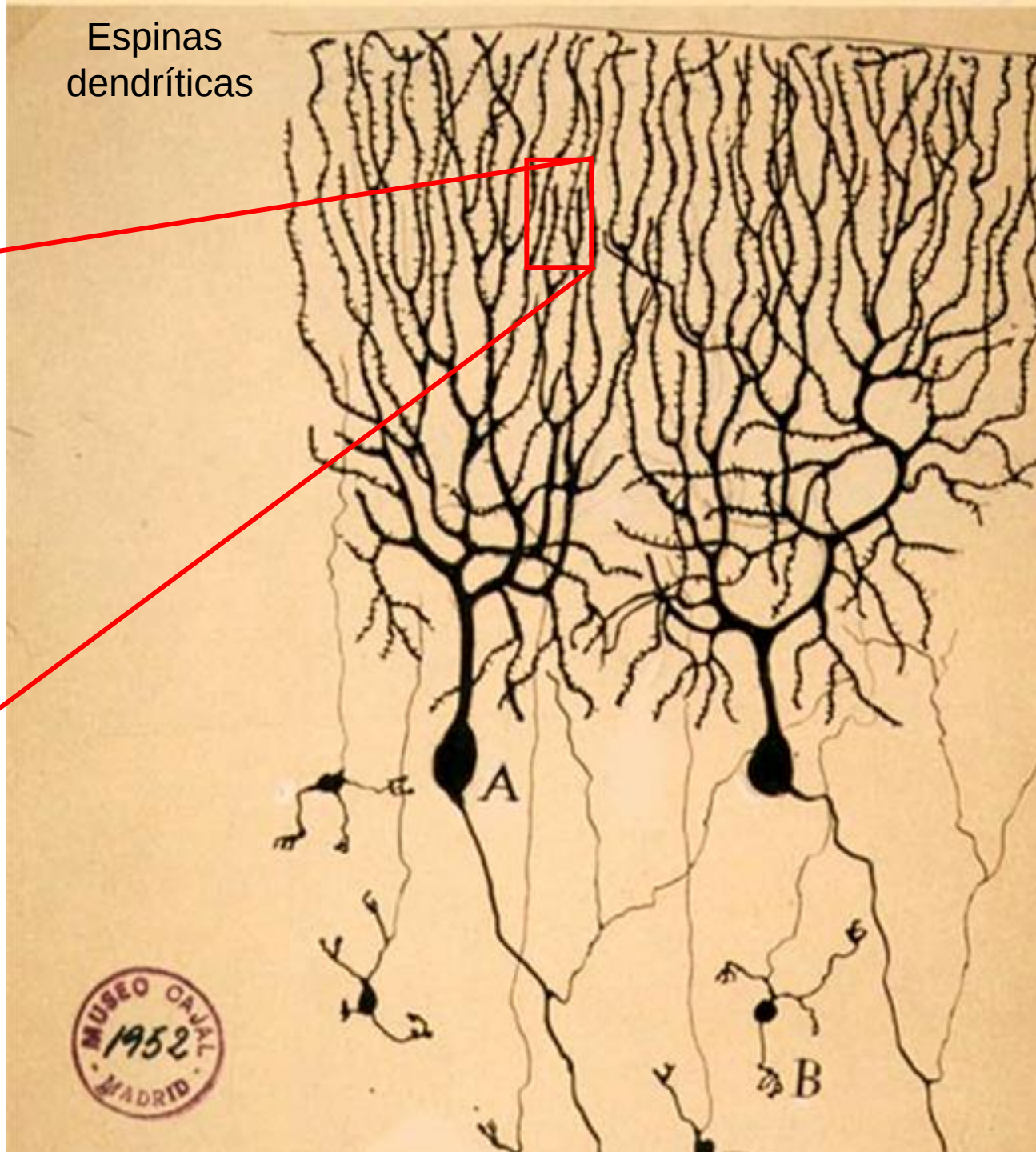
Número estimado de células gliales
en el cerebro humano: $\approx$ neuronas

Polaridad funcional y estructural de las neuronas



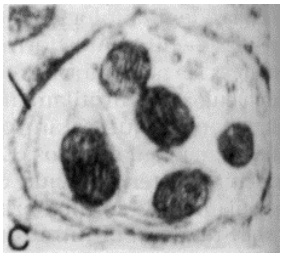
Polaridad molecular de las neuronas

Dendritas

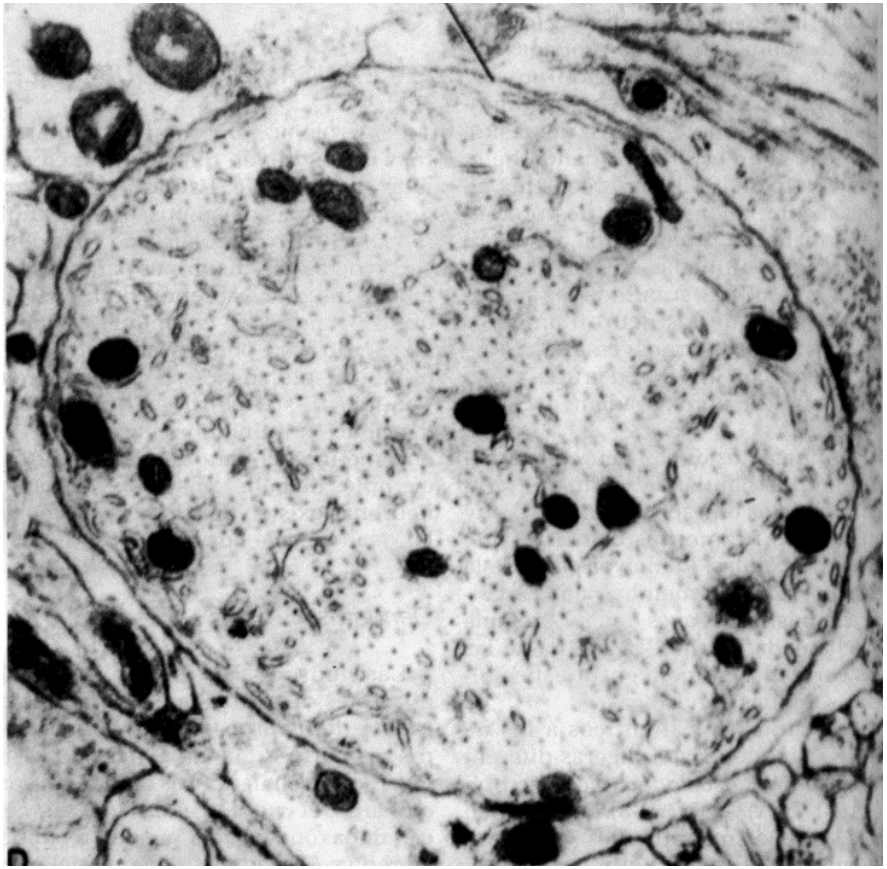


Dendritas

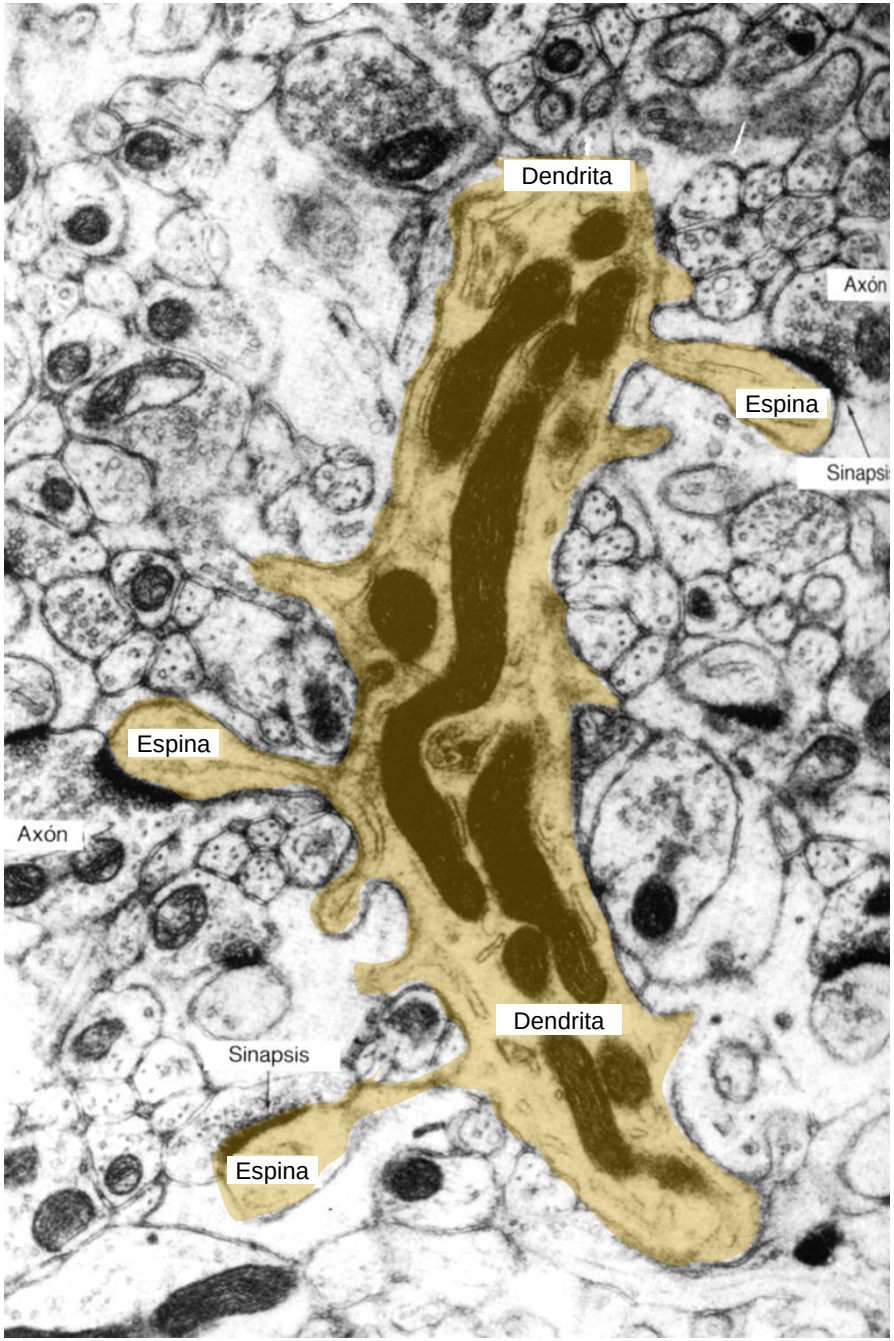
Extremo



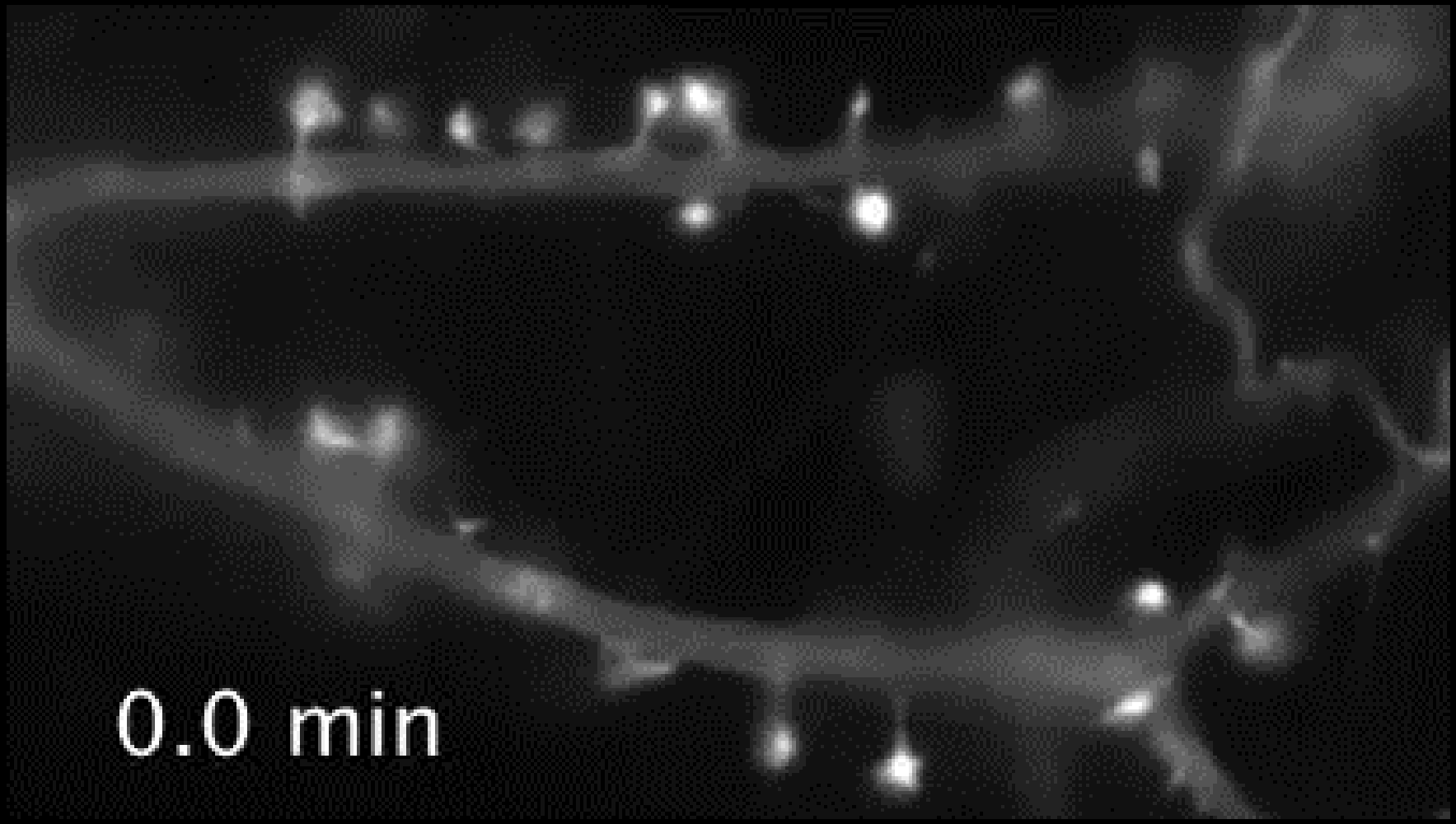
Base



Neuropilo

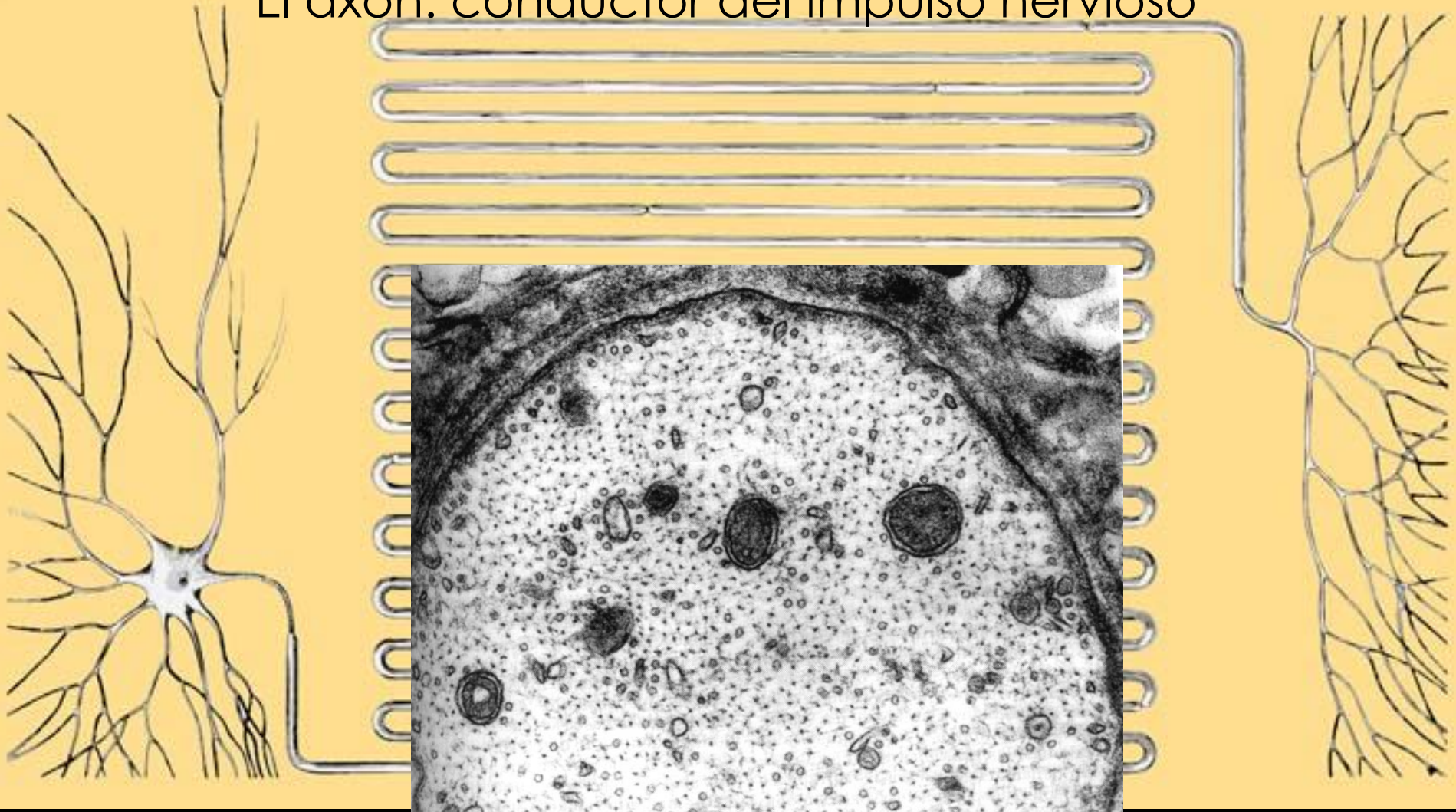


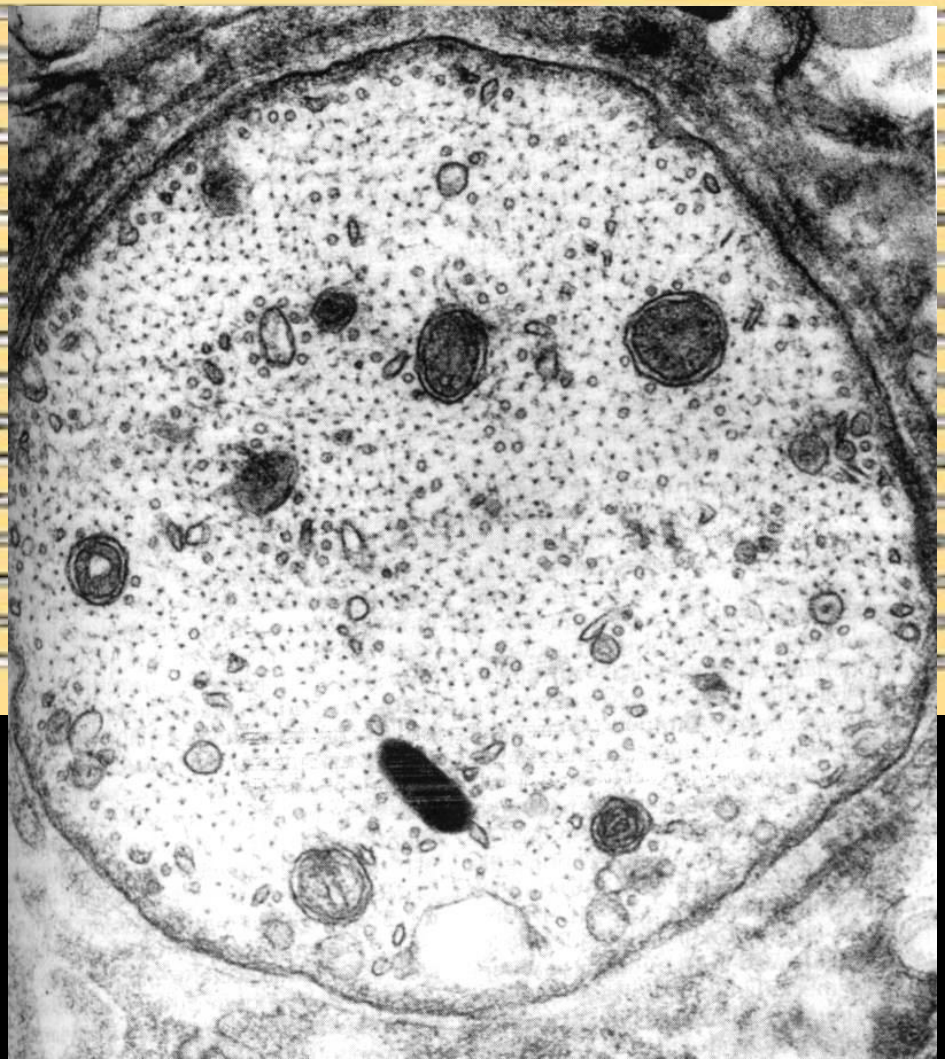
Dinámica de la actina en espinas dendríticas



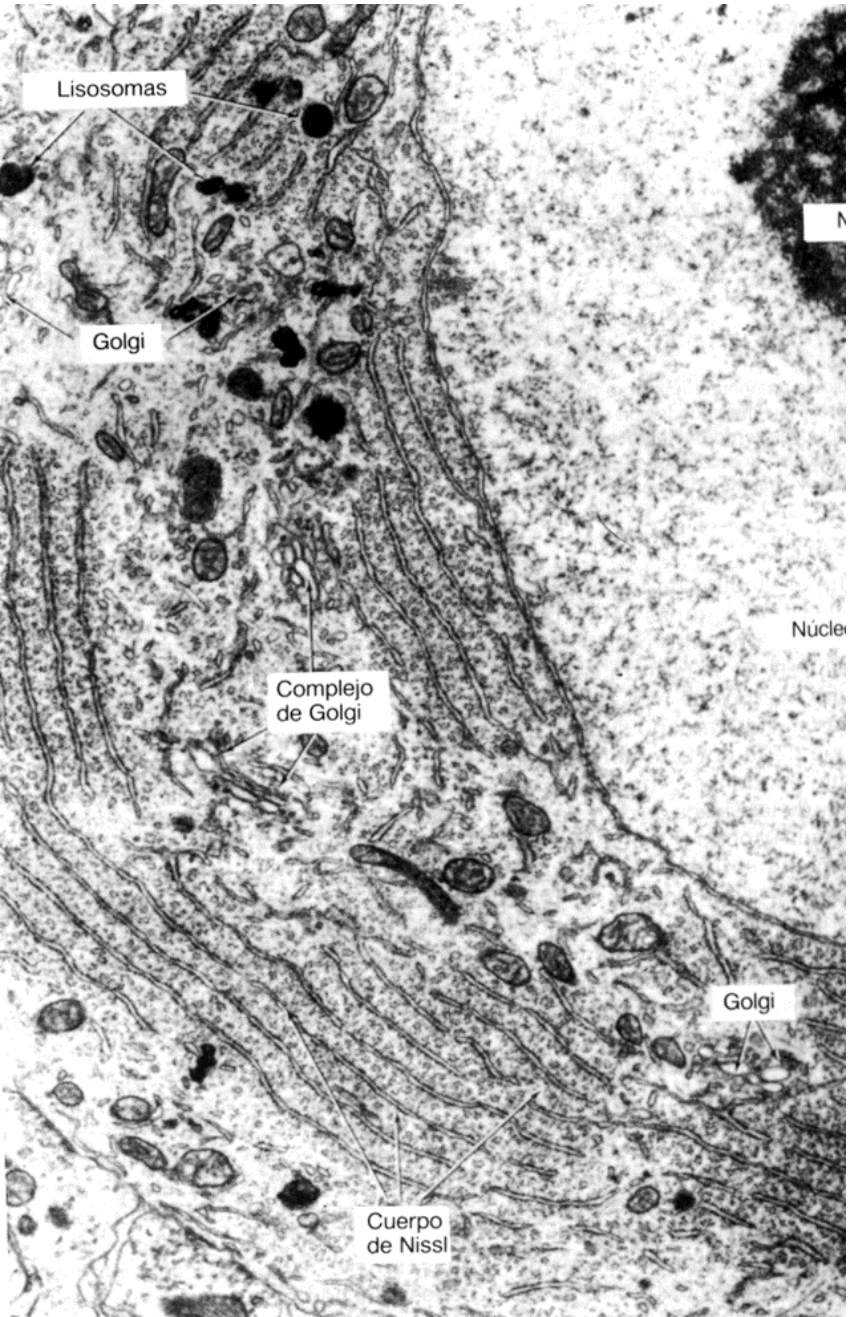
https://www.youtube.com/watch?v=Cjjdky96ubc

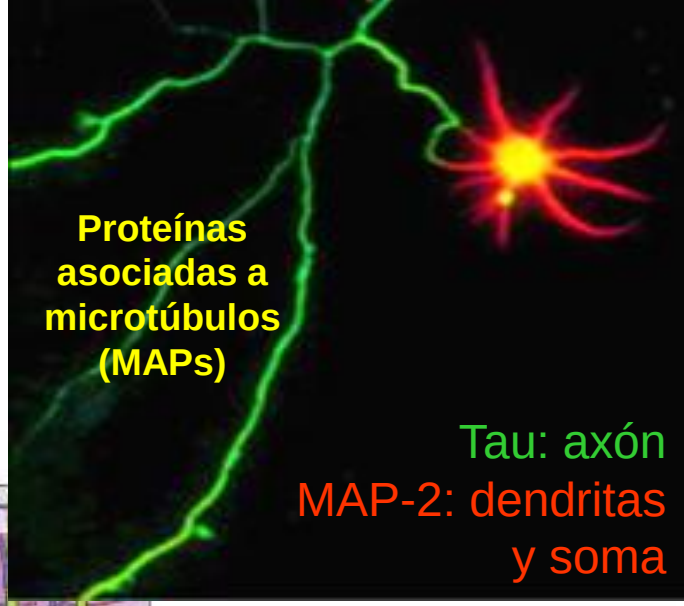
El axón: conductor del impulso nervioso

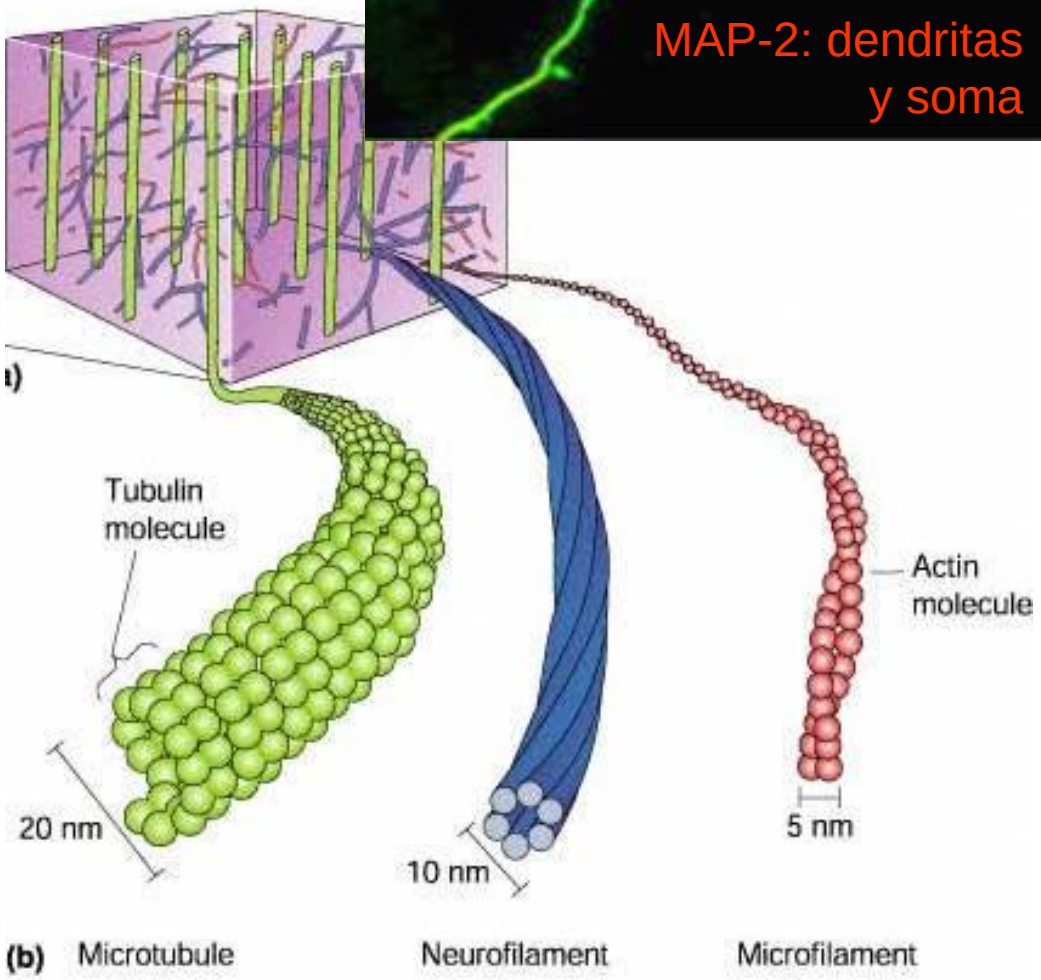


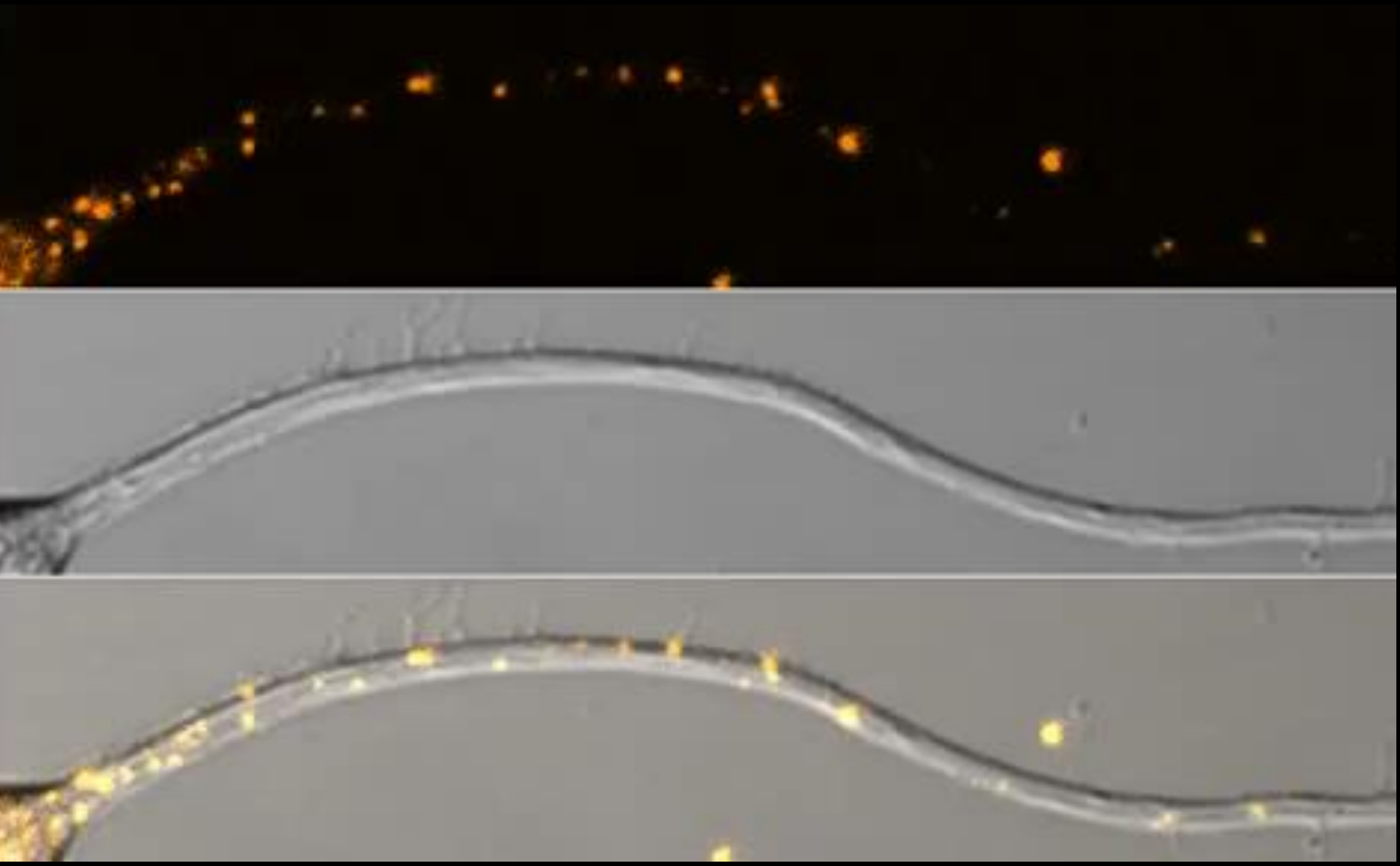


Mantenimiento de la estructura neuronal



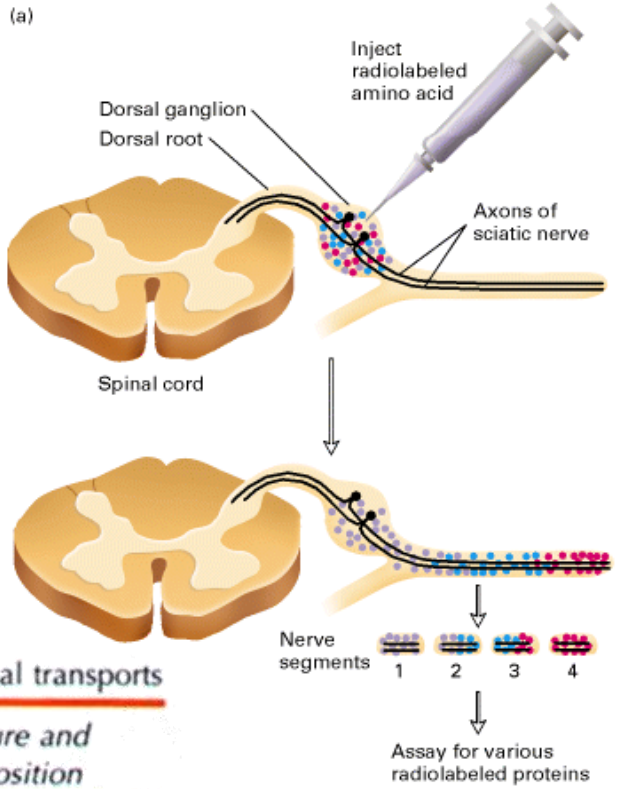






https://youtu.be/SyJgz4P-Omo

Estudio de los mecanismos de transporte de proteínas en el axón



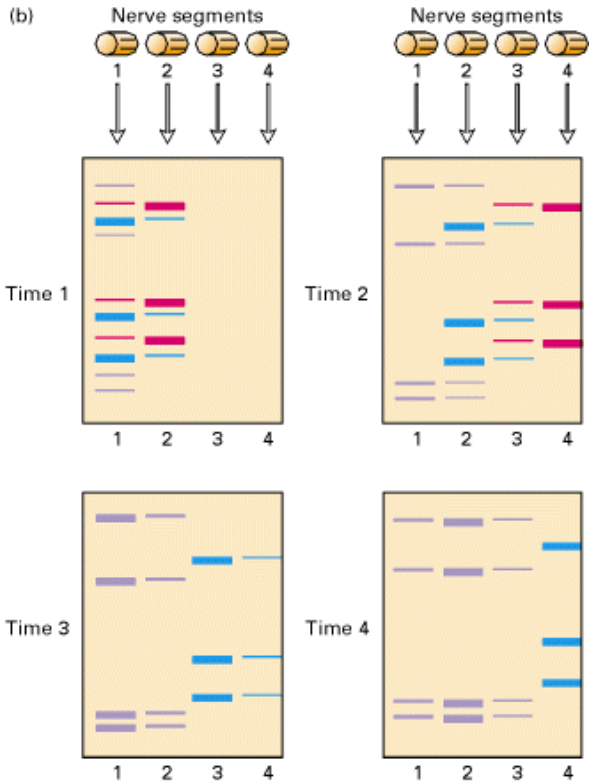
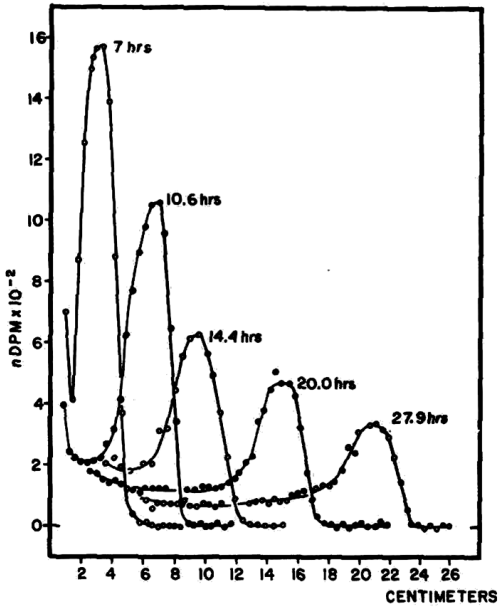
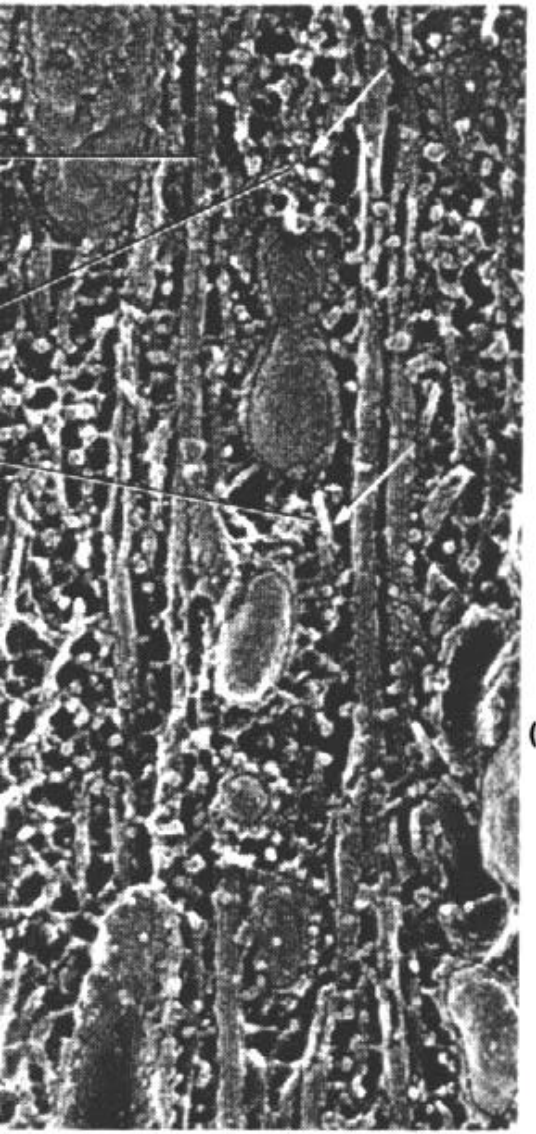


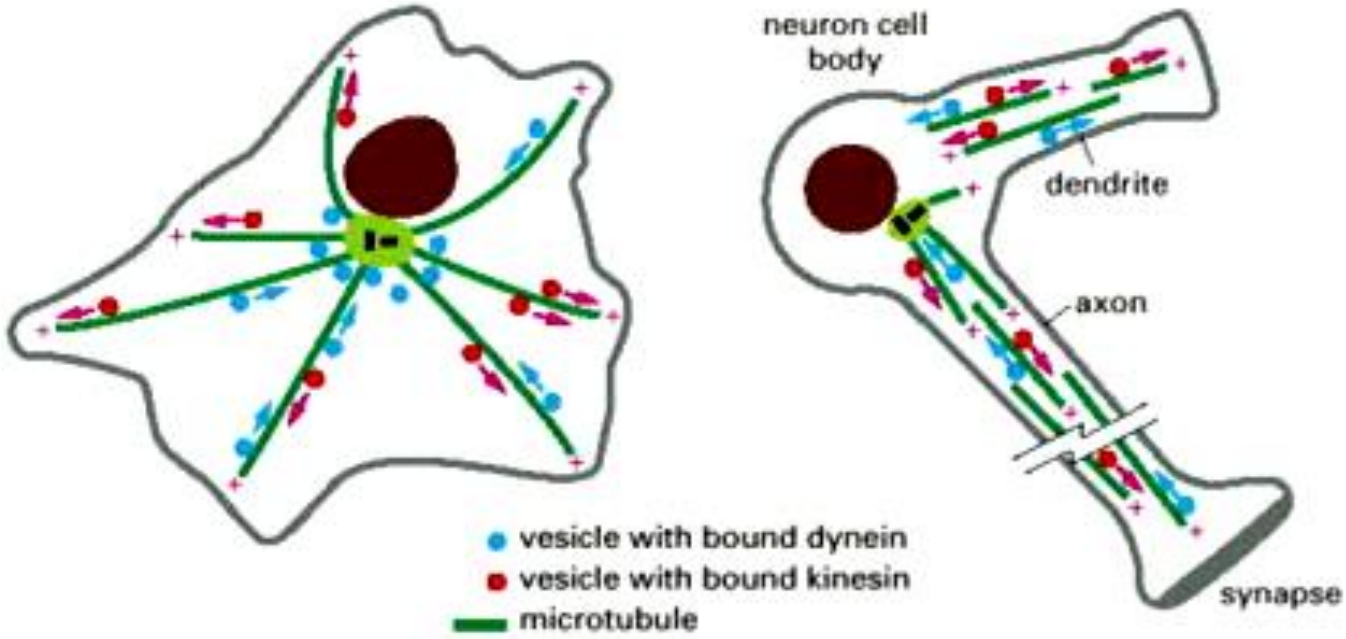
TABLE 1. Major rate components of axonal transports

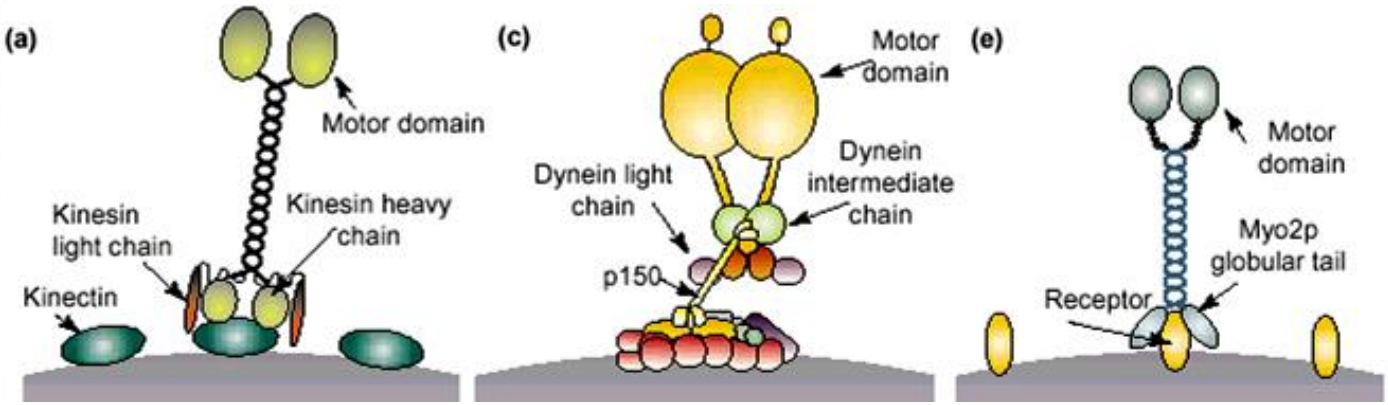
Component	*Rate (mm/day)*	*Structure and composition*
Fast transport		
Anterograde	200–400	Small vesiculotubular structures, neurotransmitters, membrane proteins and lipids
Mitochondria	50–100	Mitochondria
Retrograde	200–300	Lysosomal vesicles and enzymes
Slow transport		
SCb	2–8	Microfilaments, metabolic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

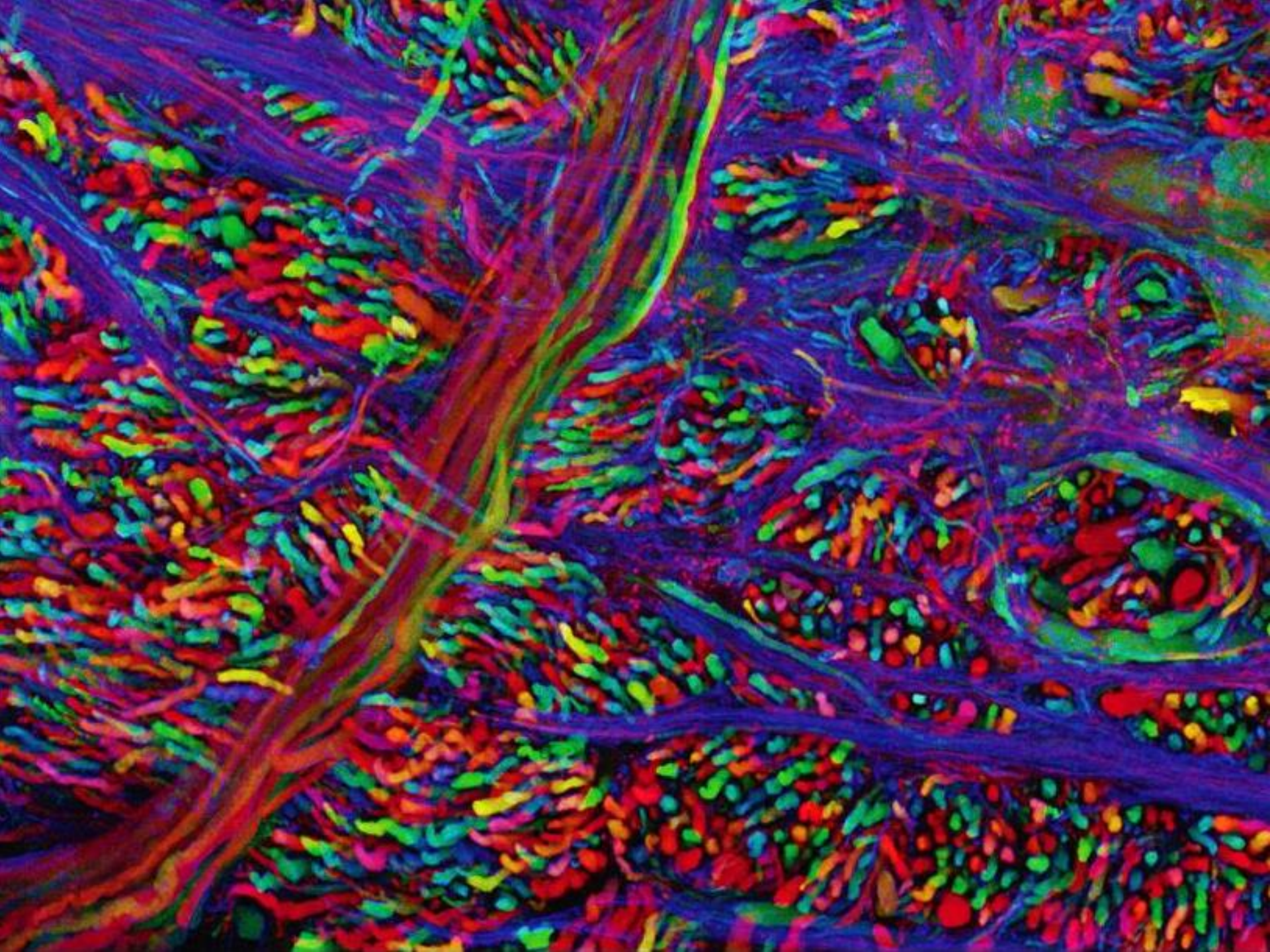


Mecanismos del transporte axoplásmico







Video en próxima diapositiva: https://youtu.be/tMKlPDBRJ1E

Un día en la vida de una proteína motora...