

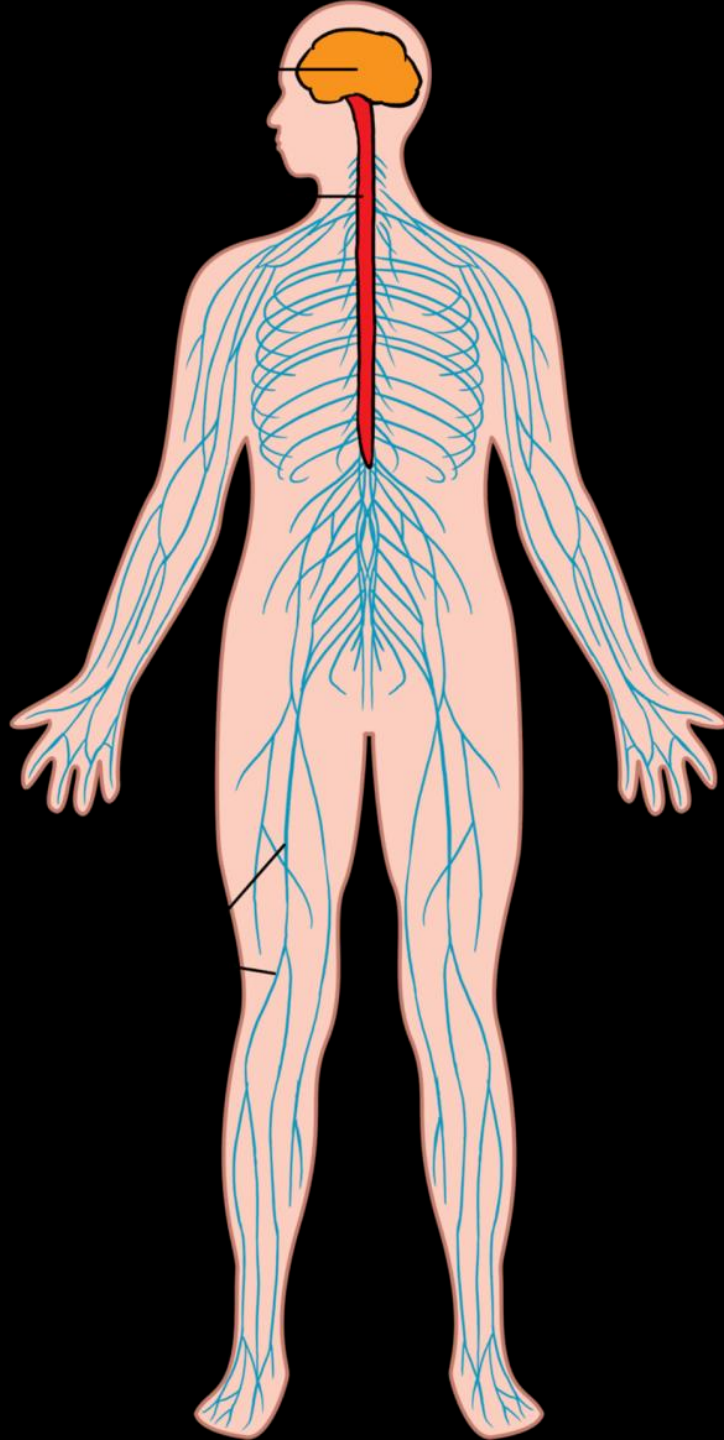
Tkáň nervová

Tkáň nervová

tkáň složena z buněk vybavených většinou dlouhými výběžky, které vytvářejí sítě a okruhy schopné přijímat, zpracovávat, tvořit a vést nervové impulsy.

CNS: mozek, mícha

PNS: nervy, ganglia
(kolekce těl nervových
buněk mimo CNS)



Buňky nervové tkáně

-neurony

-buňky gliové (neuroglie)

Mezibuněčná hmota

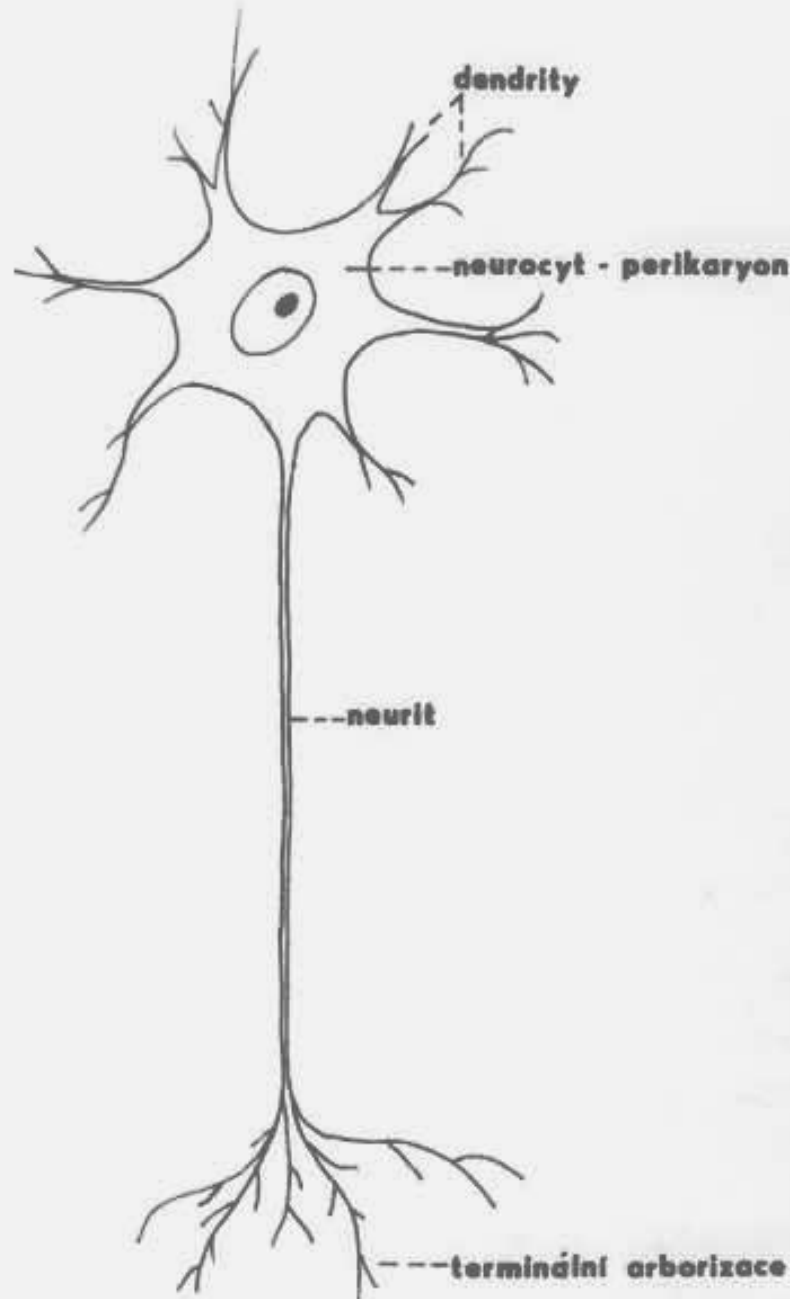
-velmi malé množství

CNS <<< PNS



Neurony

NEURON



dendrity

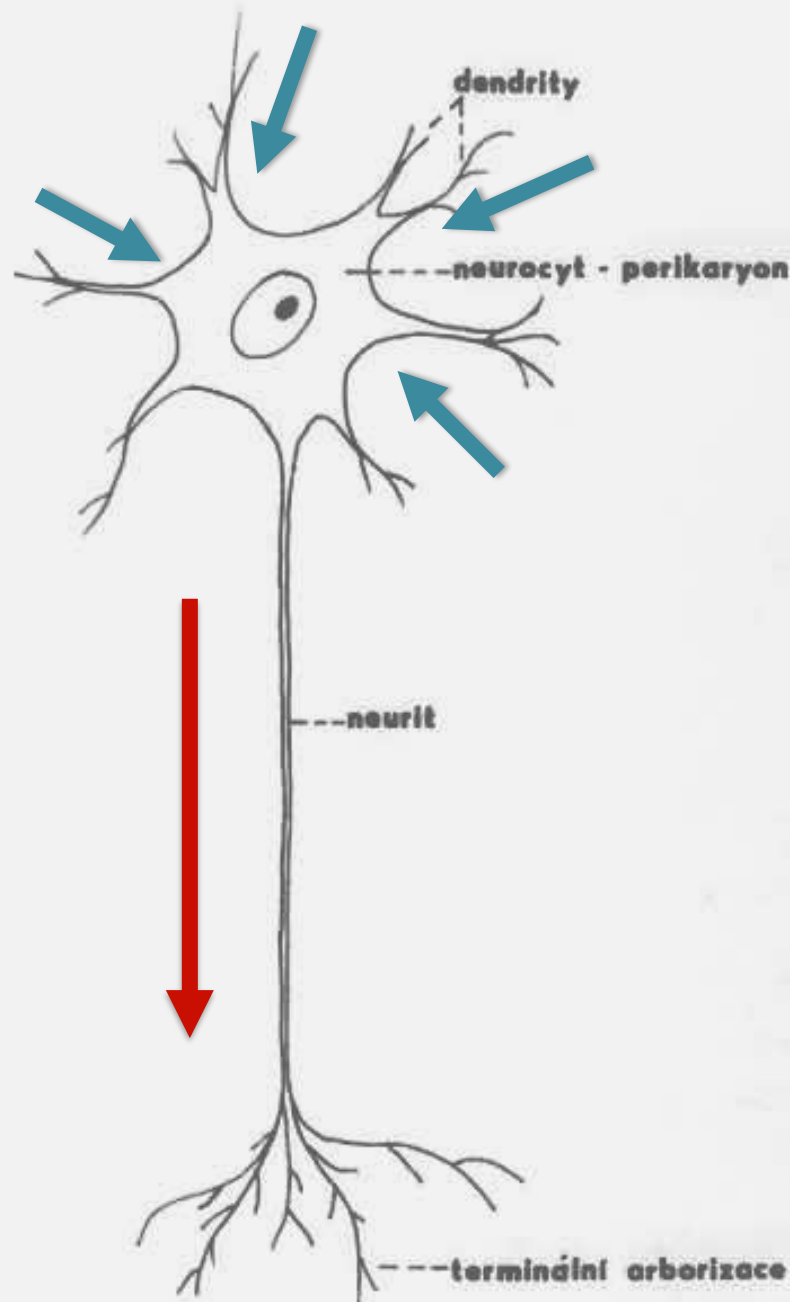
neurocyt
(perikaryon,
tělo neuronu)

axon (neurit)

terminální
arborizace

Neurony

NEURON

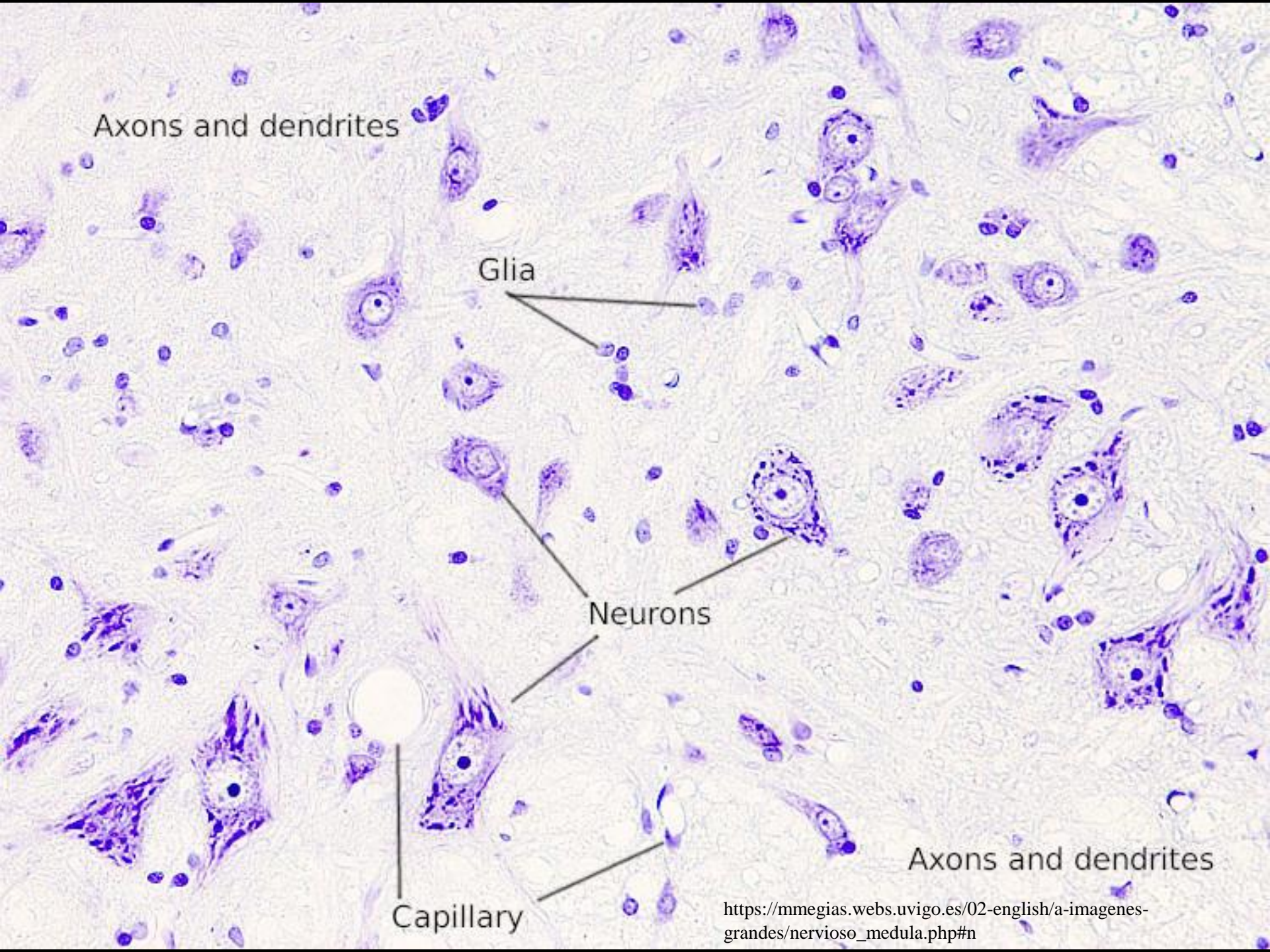


dendrity

neurocyt
(perikaryon,
tělo neuronu)

axon (neurit)

terminální
arborizace



Axons and dendrites

Glia

Neurons

Capillary

Axons and dendrites

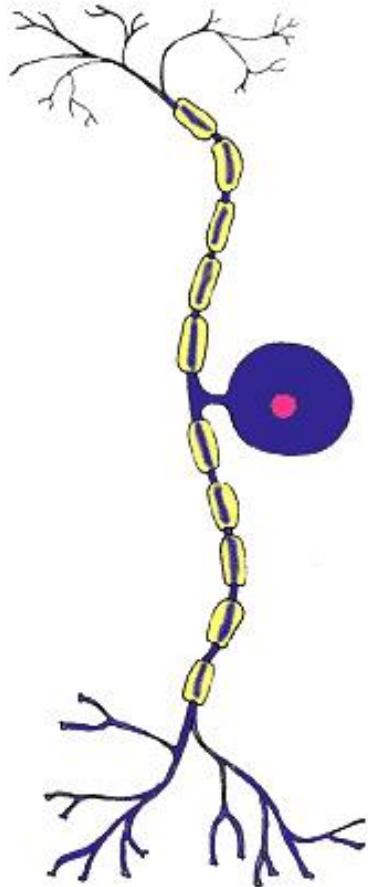
Klasifikace neuronů

- podle počtu výběžků

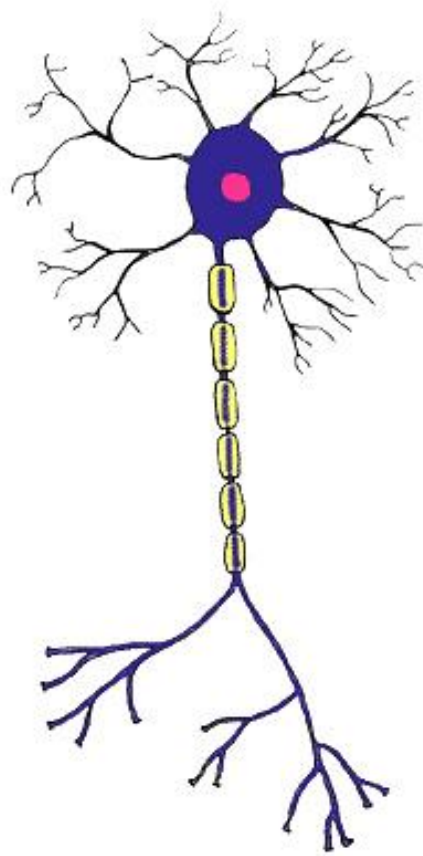
- bipolární

- multipolární

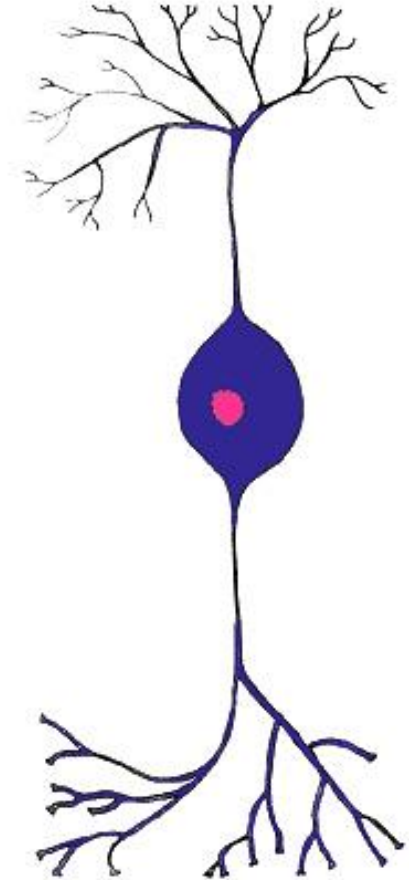
- pseudounipolární



PSEUDOUNIPOLÁRNÍ



MULTIPOLÁRNÍ



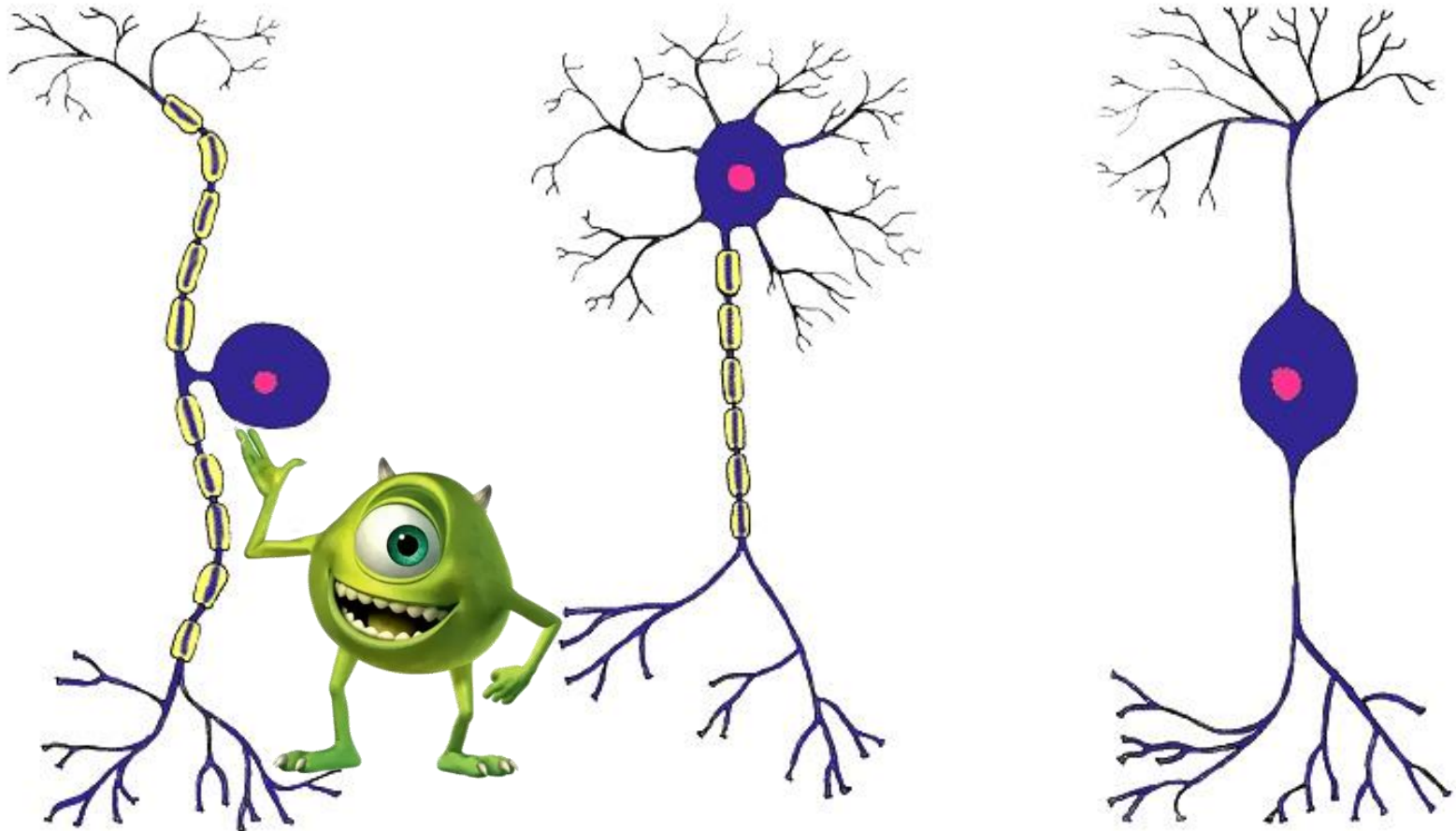
BIPOLÁRNÍ

Klasifikace neuronů

- podle počtu výběžků

- bipolární
- multipolární
- pseudounipolární

unipolární???



PSEUDOUNIPOLÁRNÍ

MULTIPOLÁRNÍ

BIPOLÁRNÍ

Klasifikace neuronů

- podle délky axonu
- Golgiho typ I
- Golgiho typ II

- podle funkce:

Senzorické

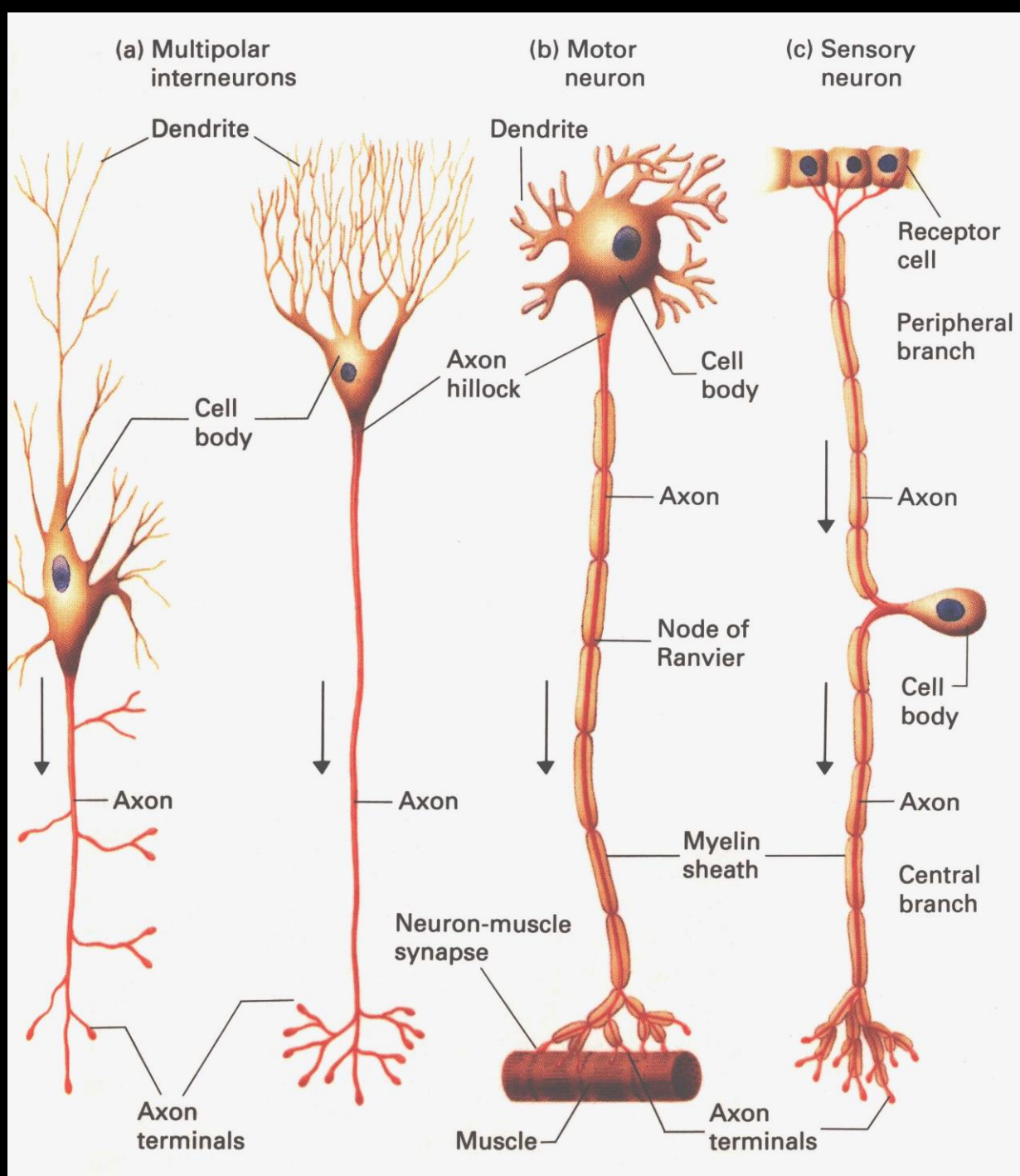
- aferentní

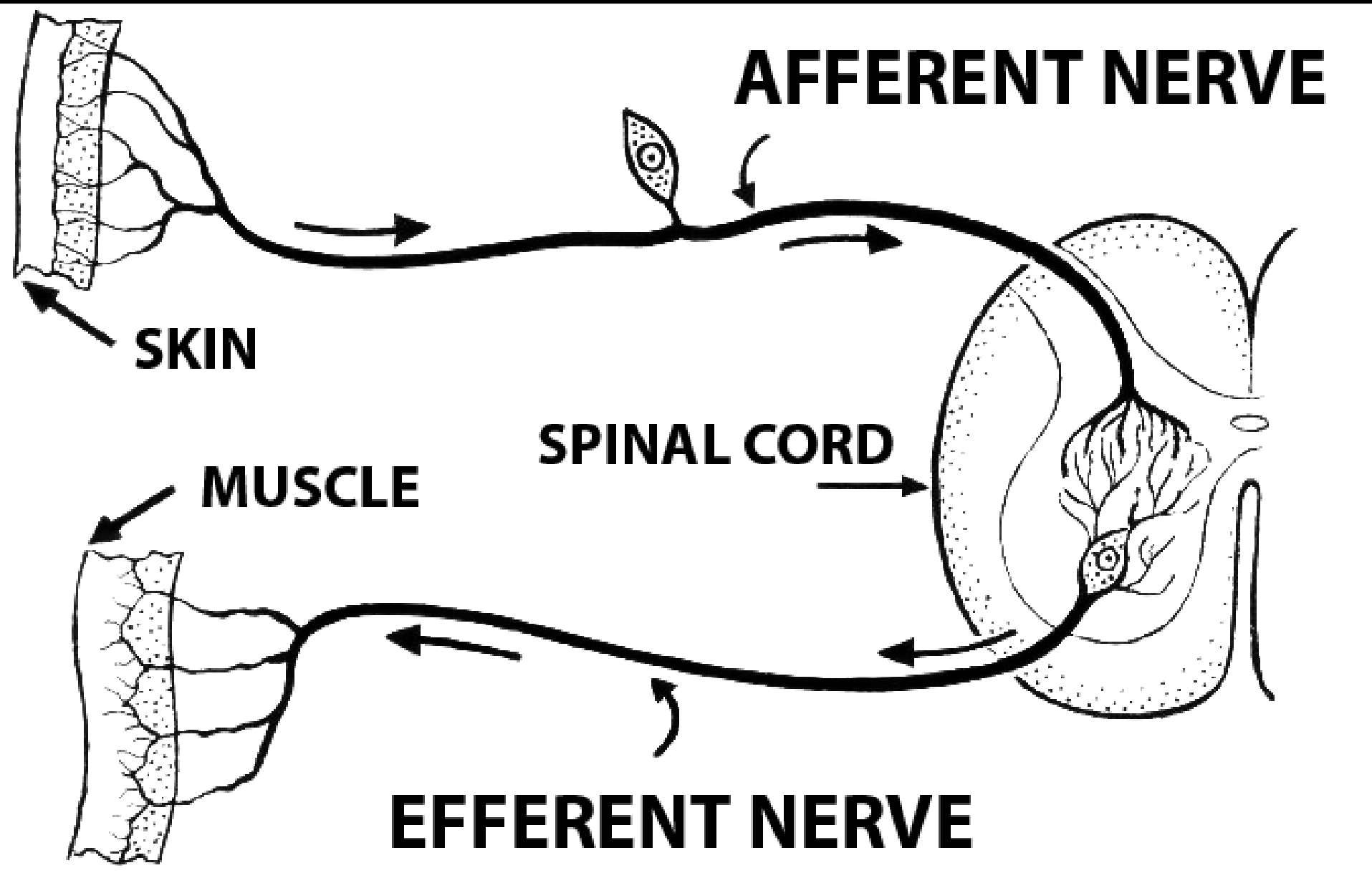
Motorické

- eferentní

Interneurony

- propojení

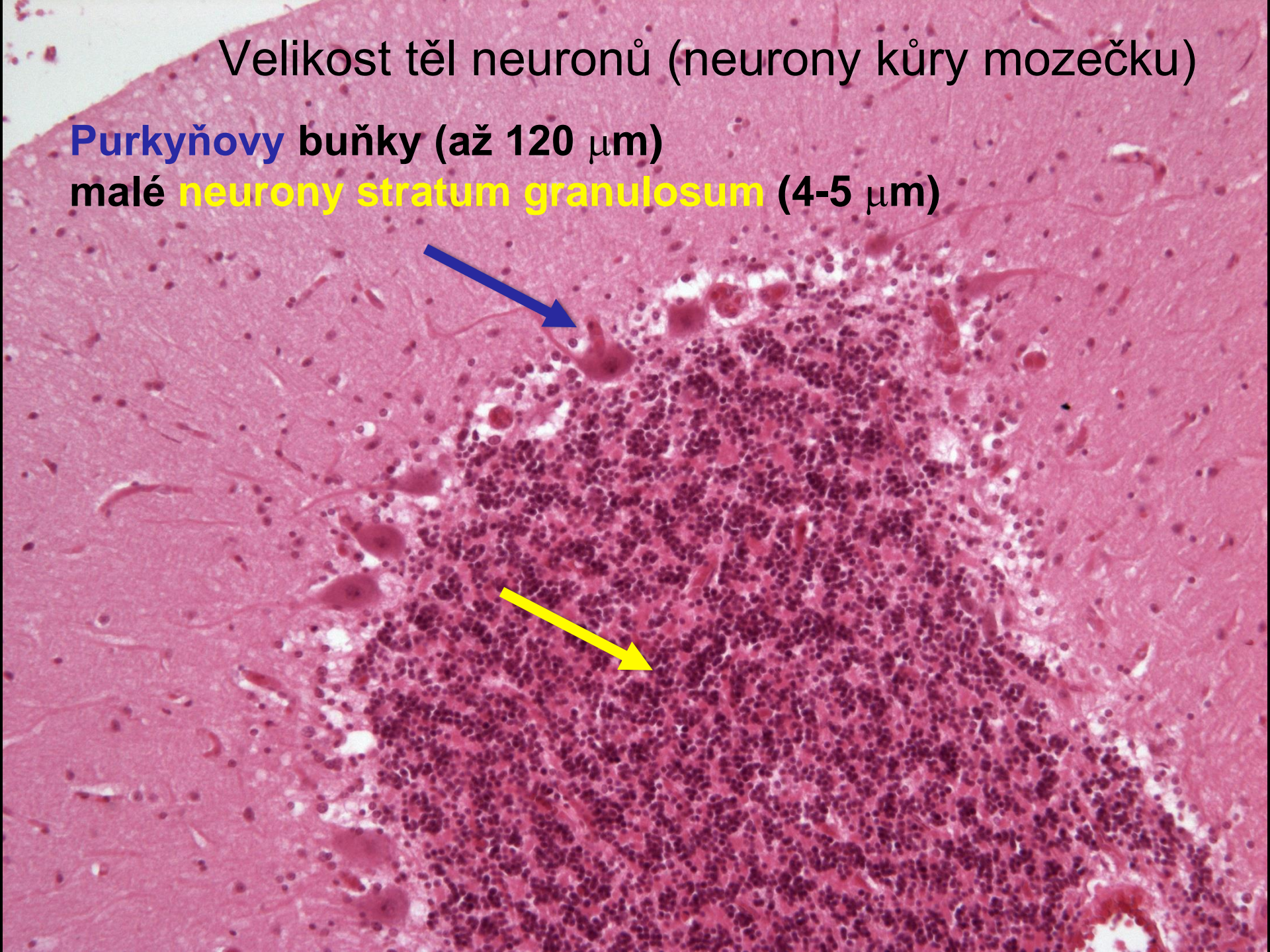




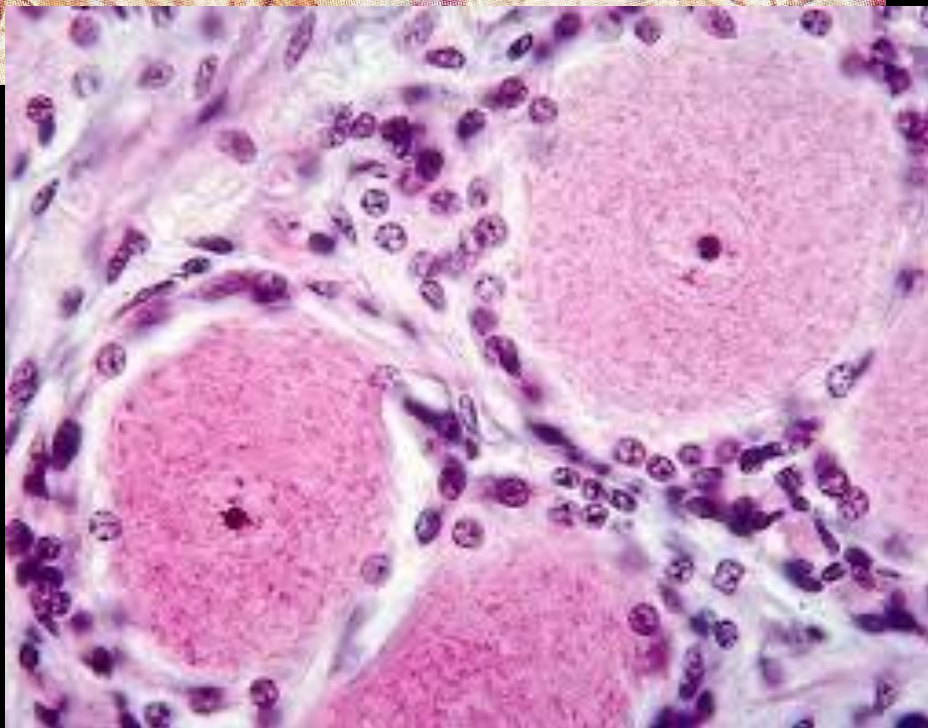
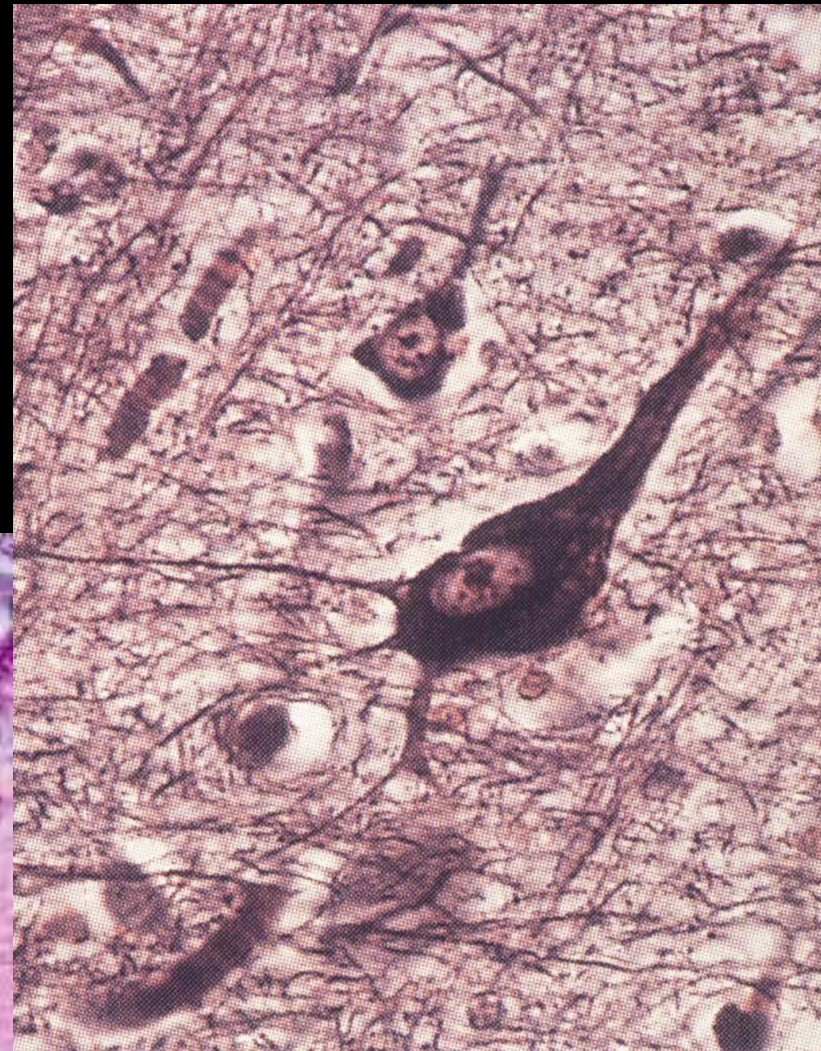
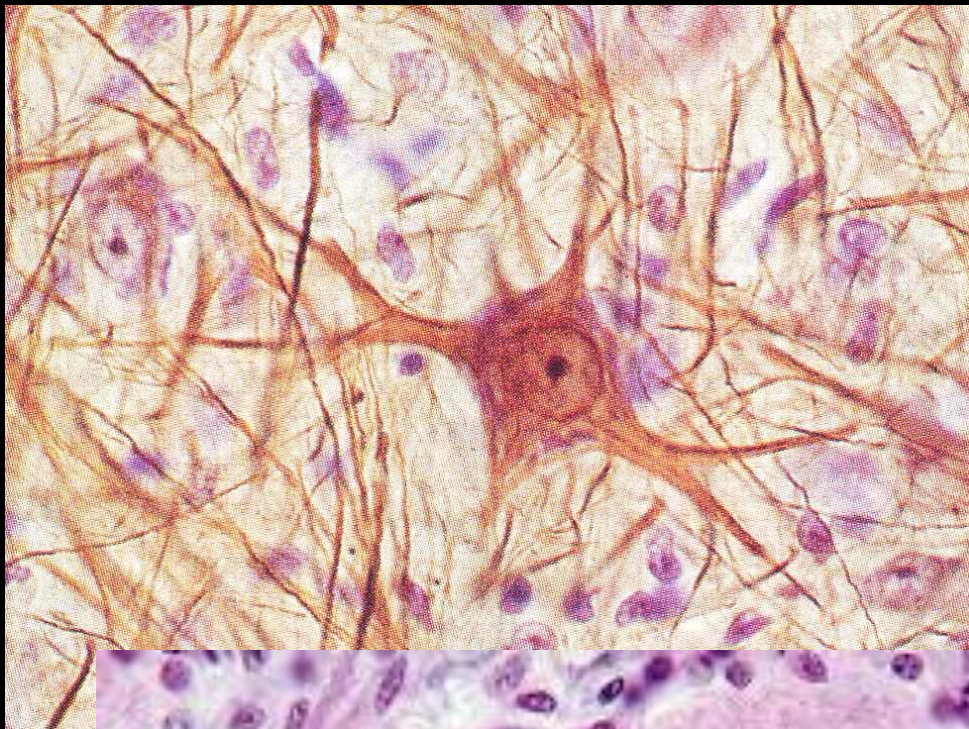
Velikost těl neuronů (neurony kůry mozečku)

Purkyňovy buňky (až 120 μm)

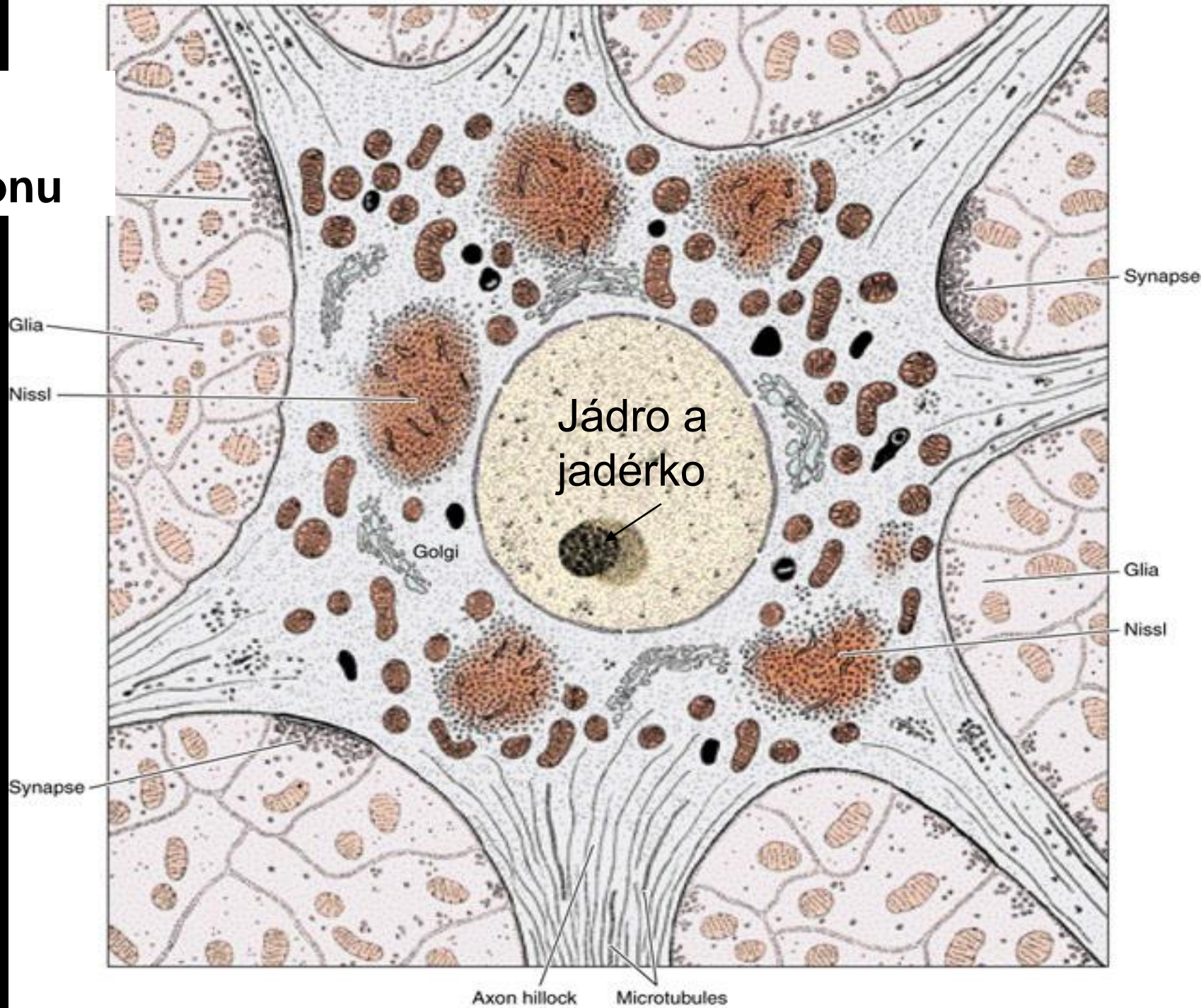
malé neurony stratum granulosum (4-5 μm)

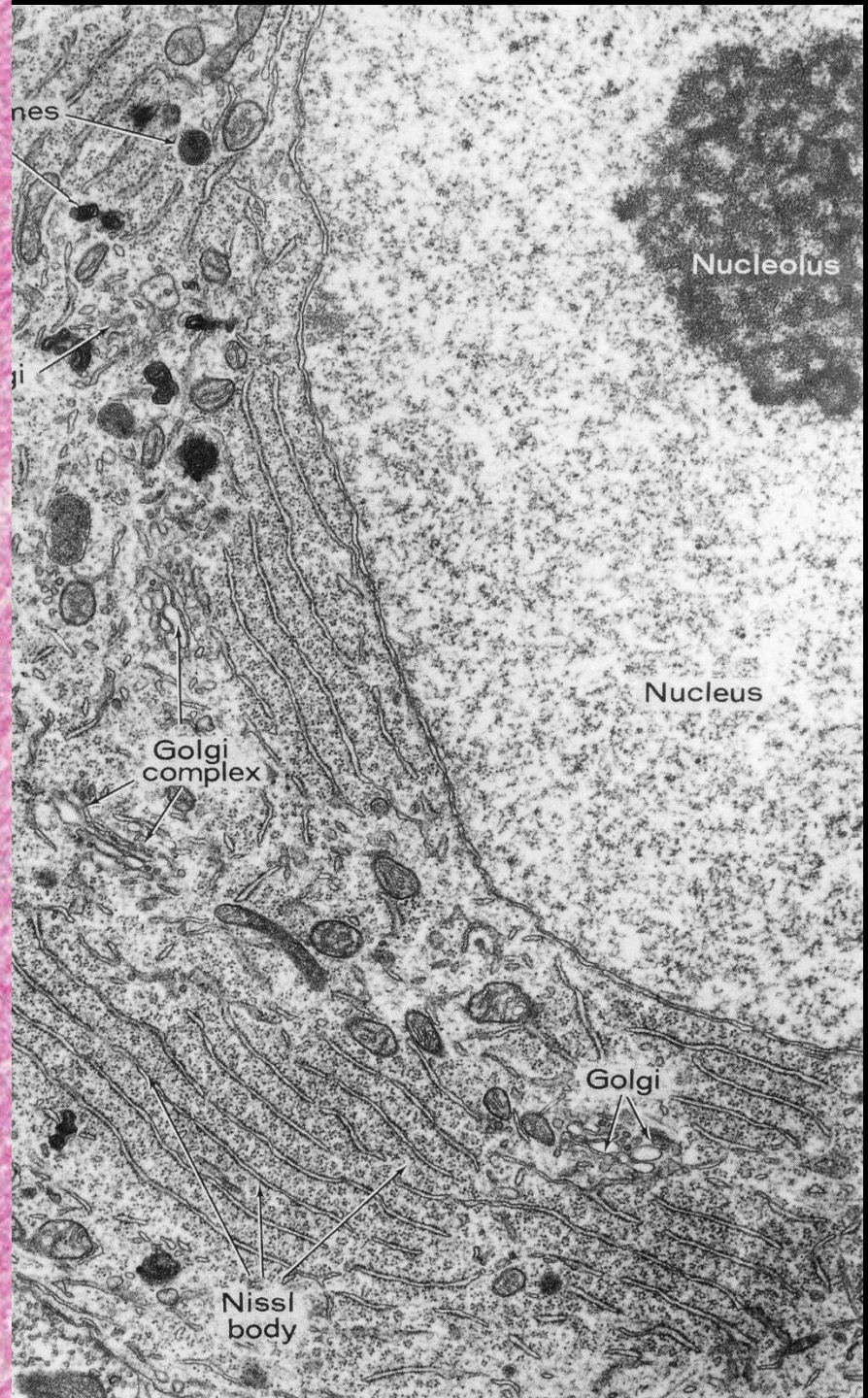
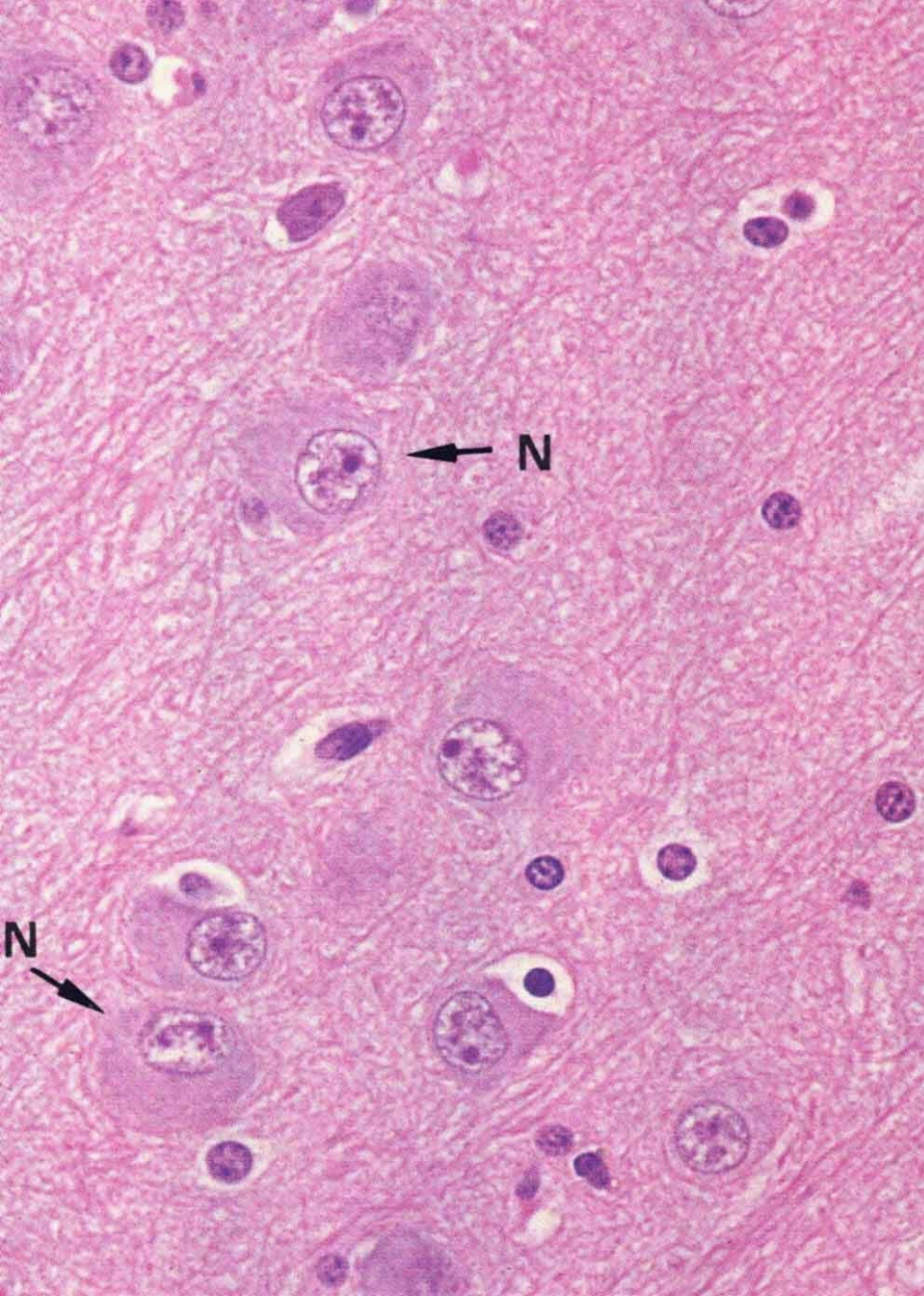


Tvary těl neuronů

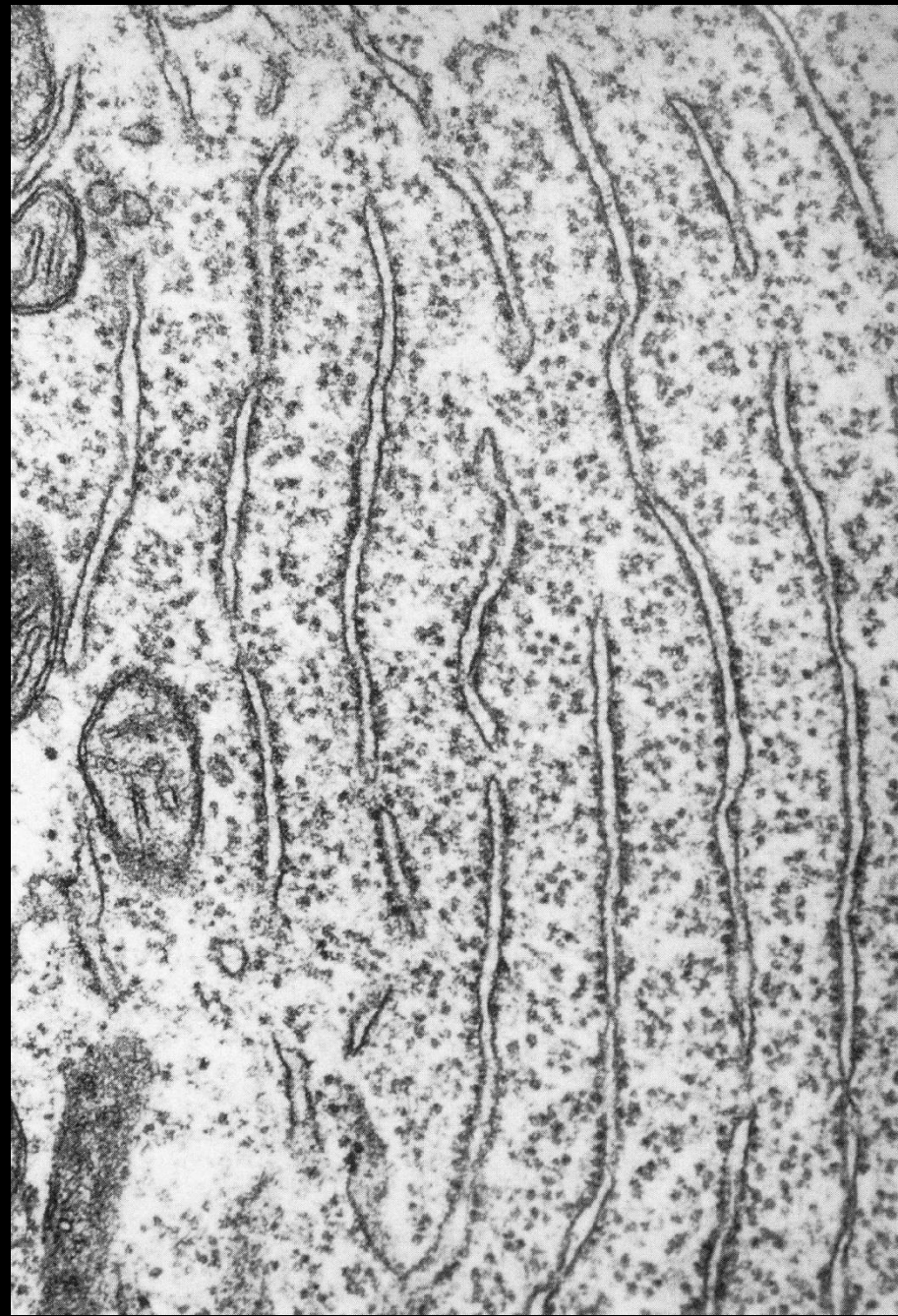
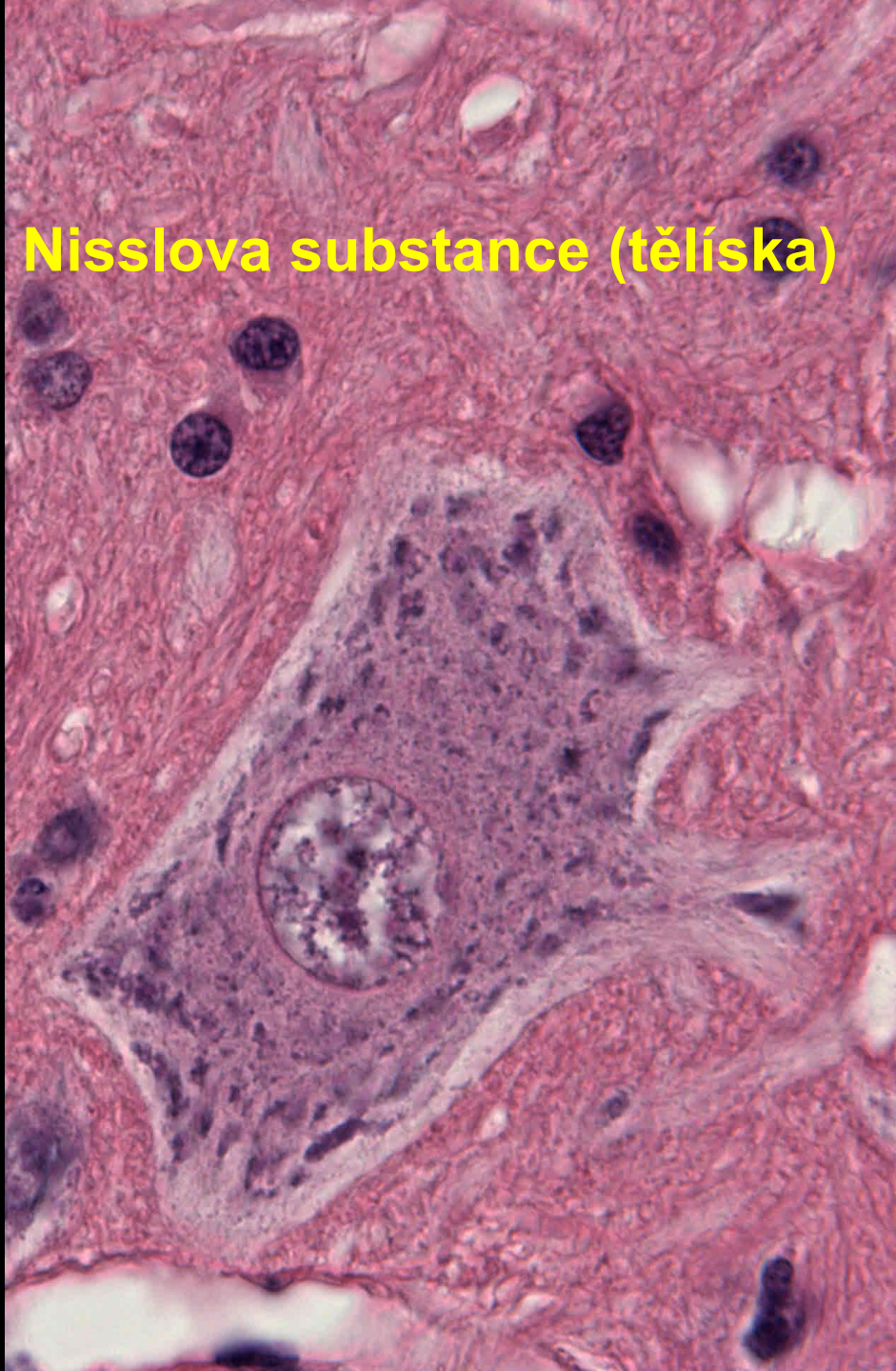


Tělo neuronu

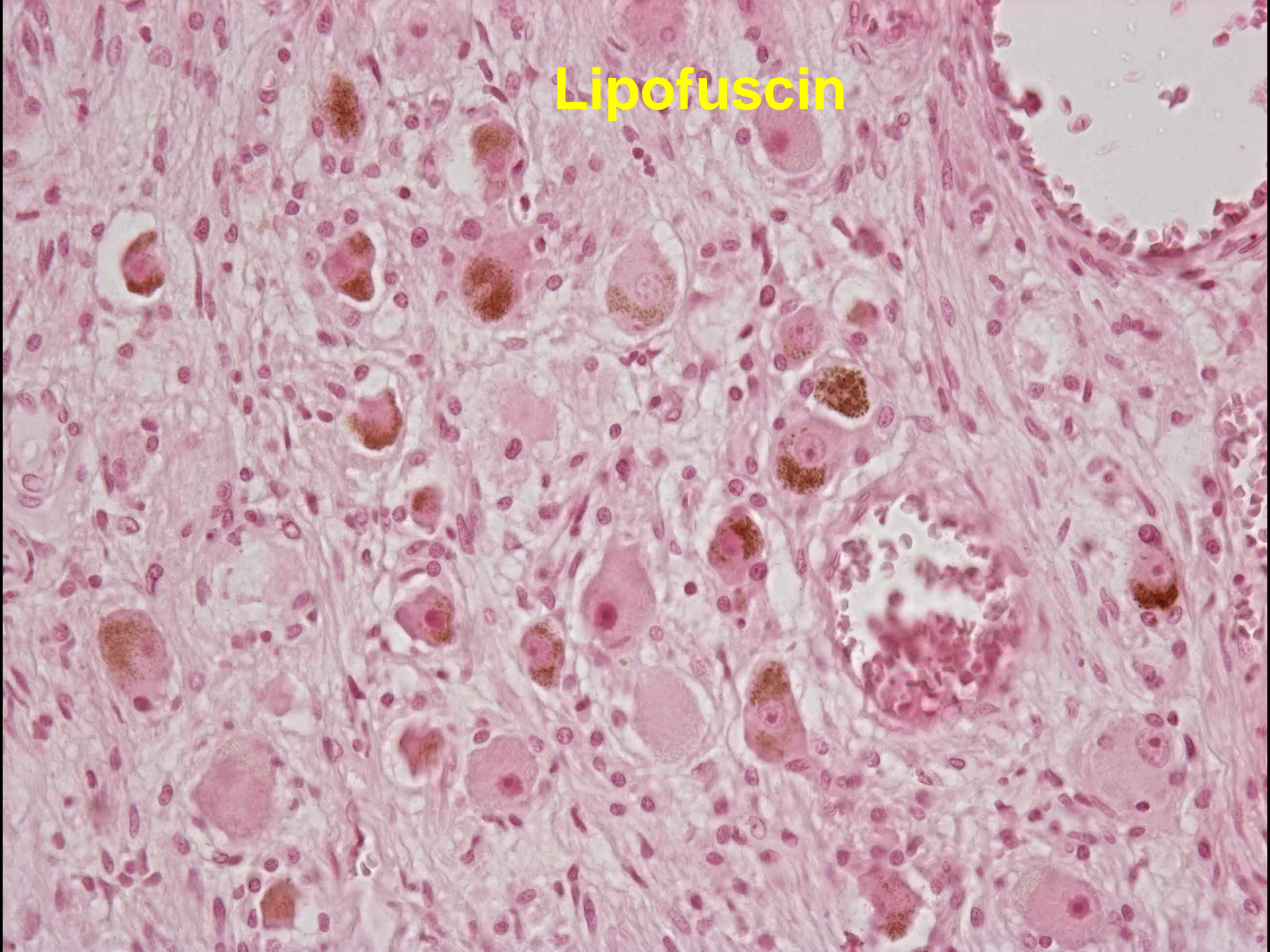




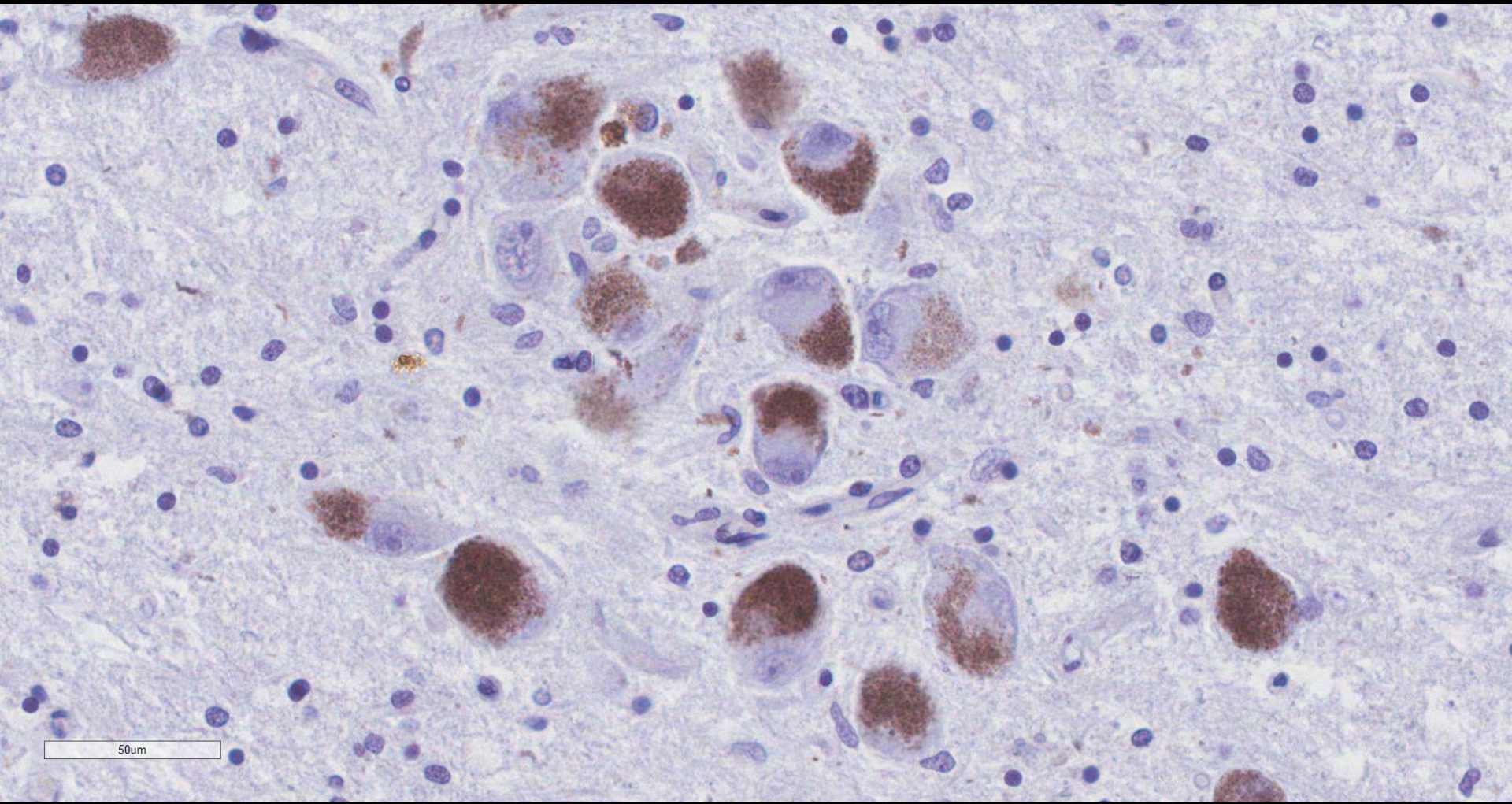
Nisslova substance (tělíska)



Lipofuscin



Neuromelanin

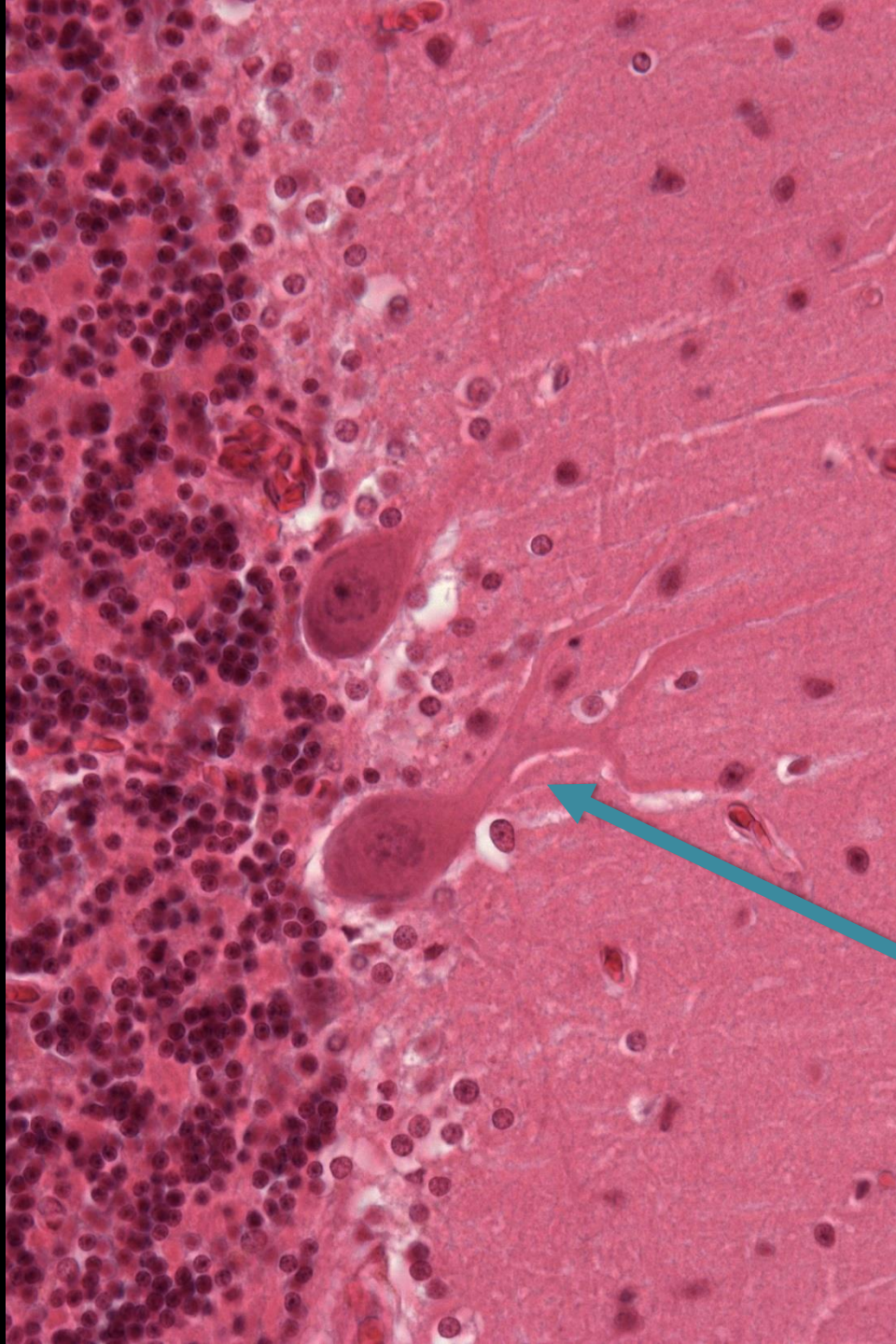


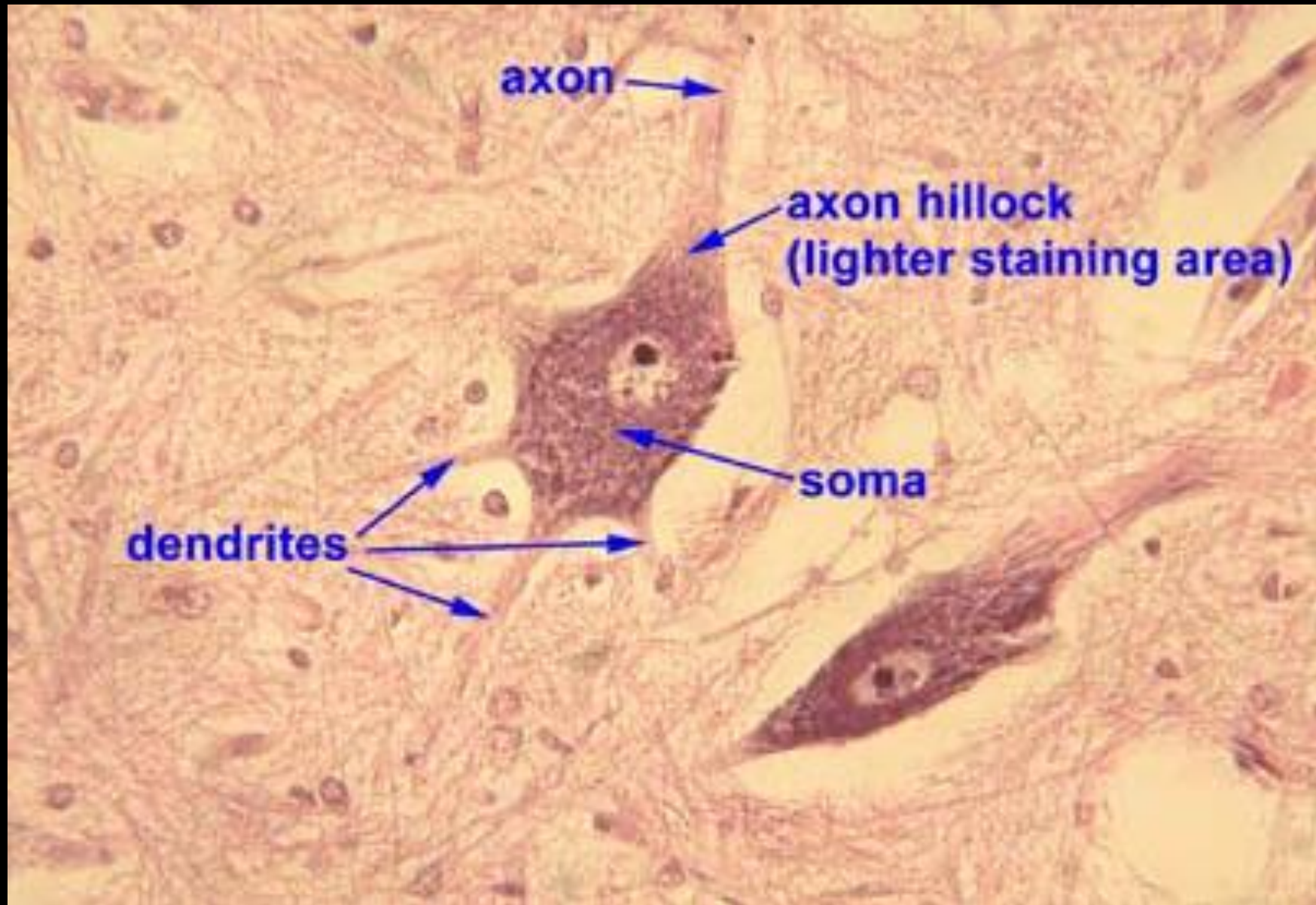
DENDRITY

kratší výběžky, ale
v některých
jádrech mozku až
milimetrové délky

MAP 2, MAP 1

- větví se
- obsahují GER
- vedou signály do
těla neuronu



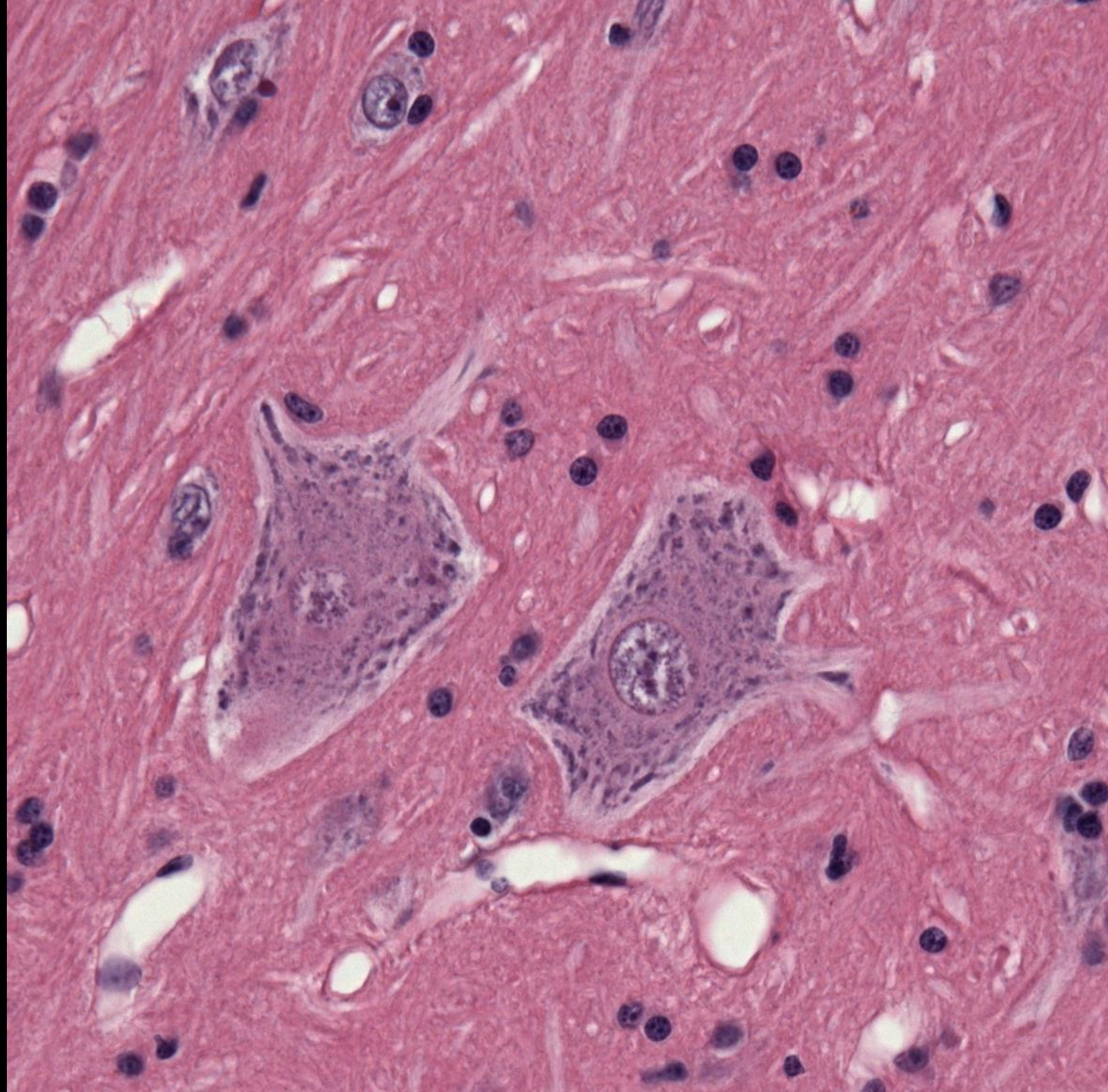


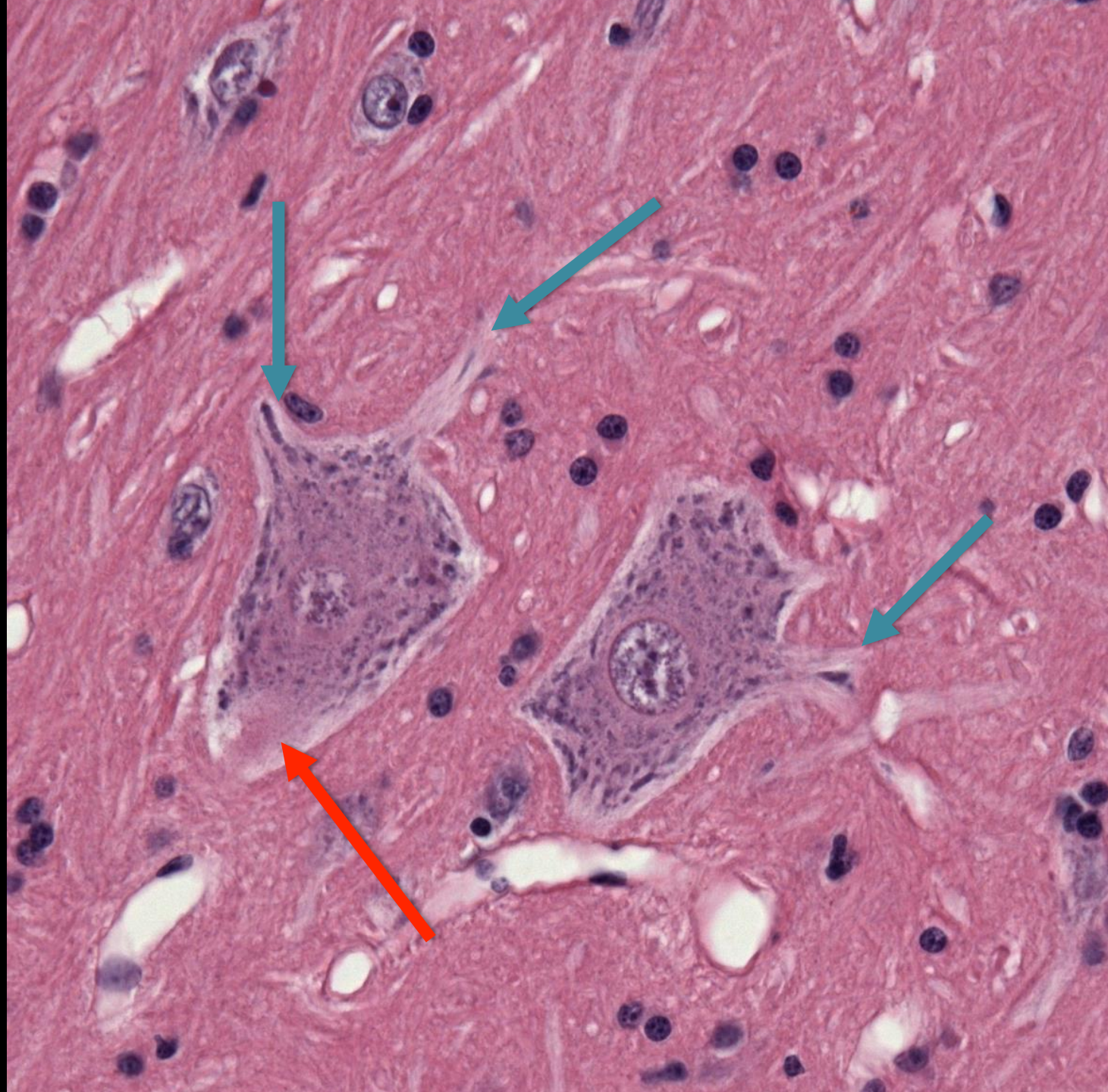
axon →

**axon hillock
(lighter staining area)** →

soma →

dendrites →
→
→







Dendrite

Axon

Spine

Synapse

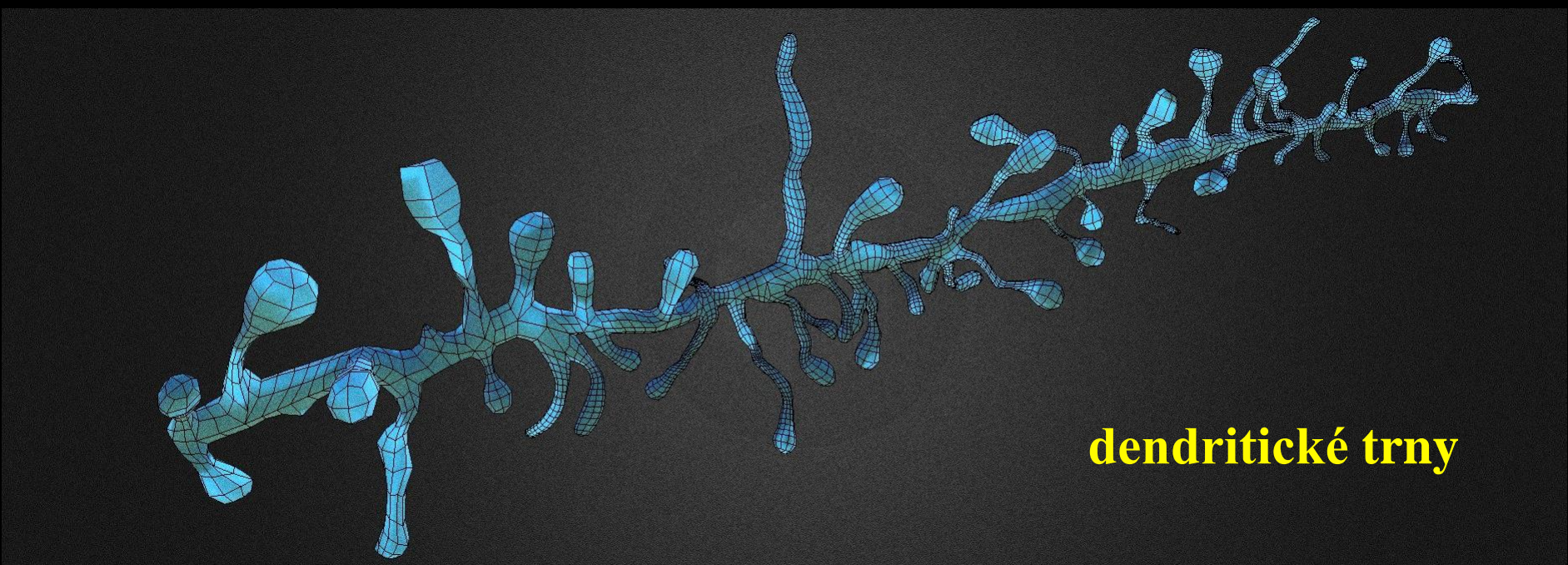
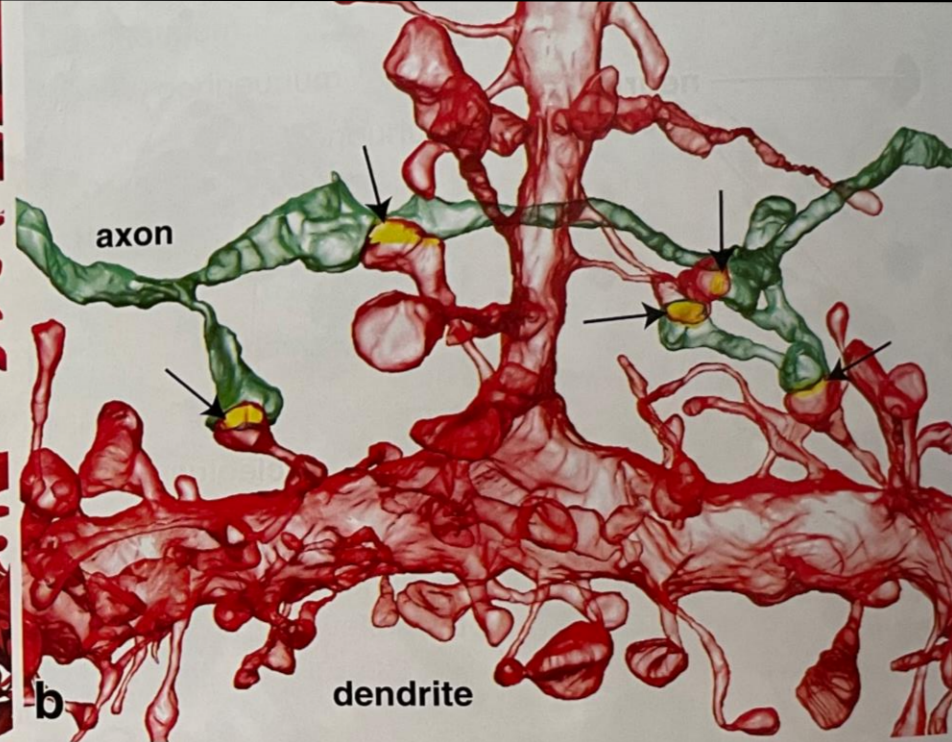
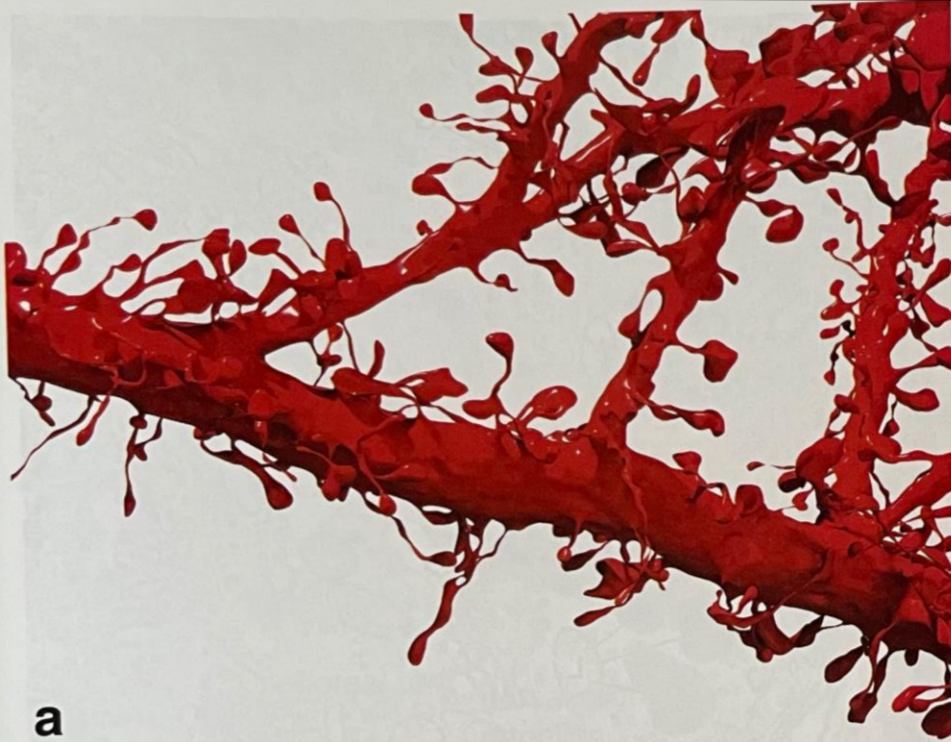
Spine

Axon

Dendrite

Synapse

Spine



AXON

A

NS

N

b

odstupový konus

iniciální segment

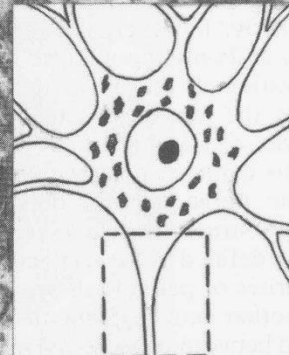
vlastní axon

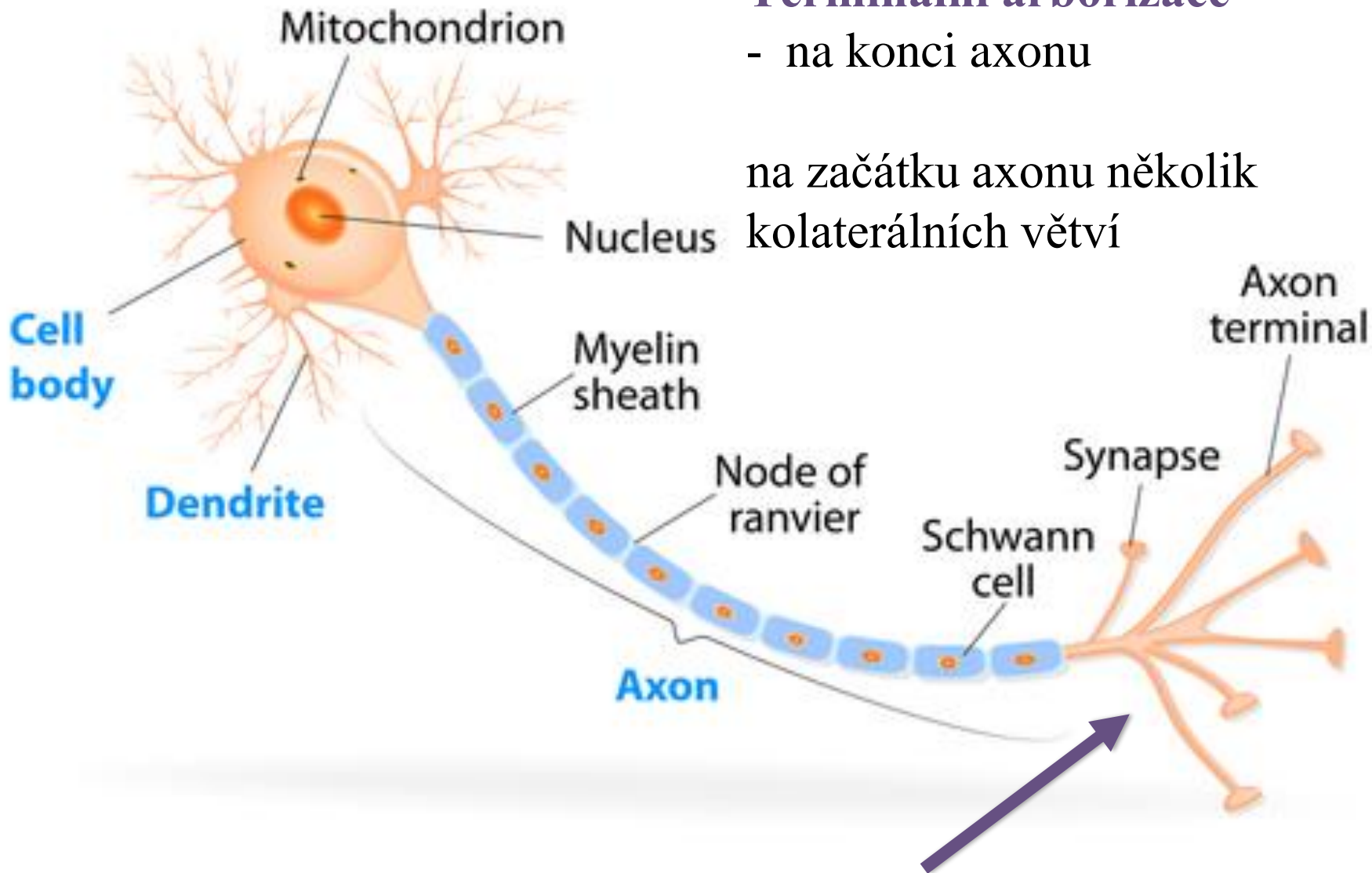
Axon
hillock

MT

Initial
segment

AE



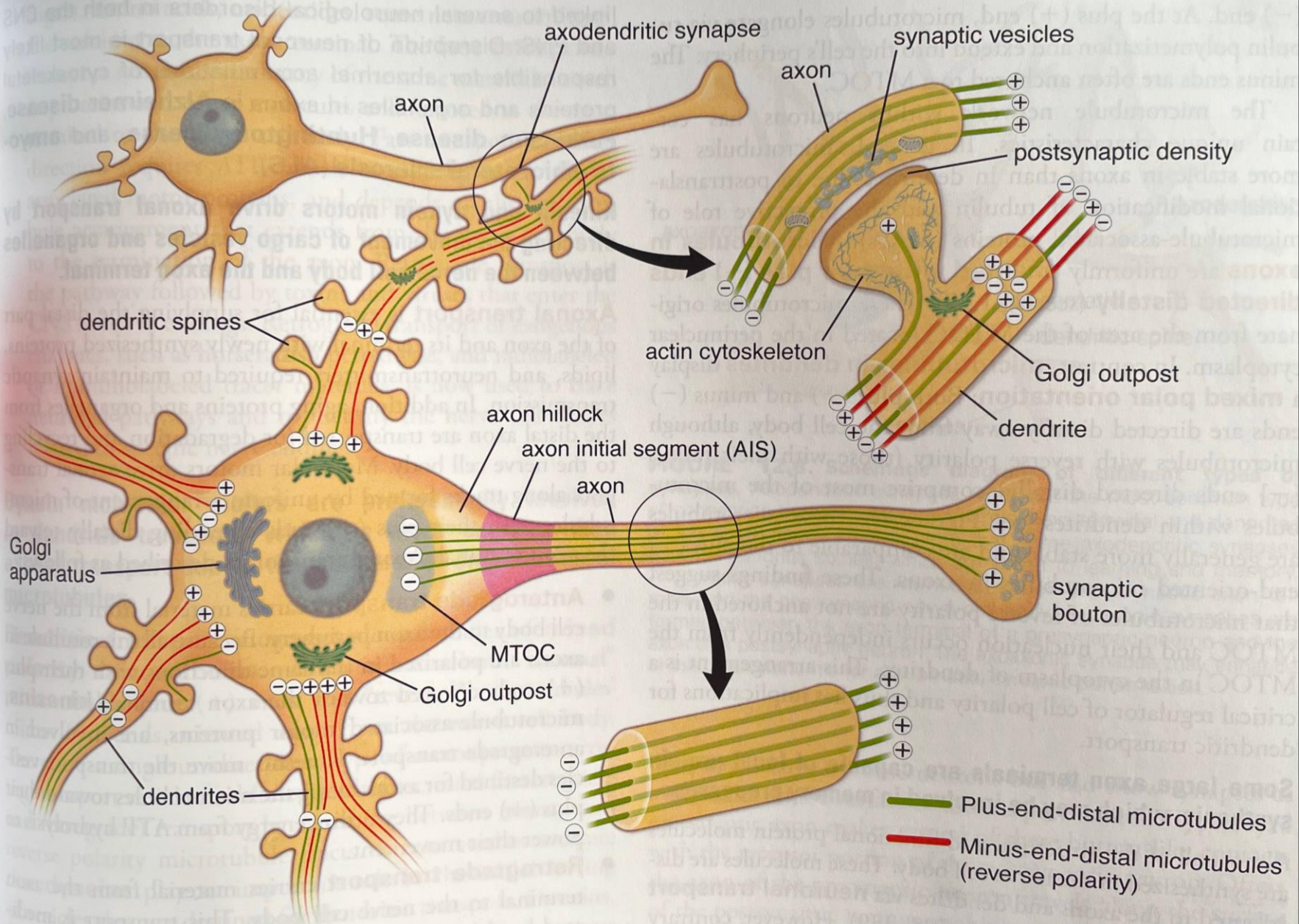


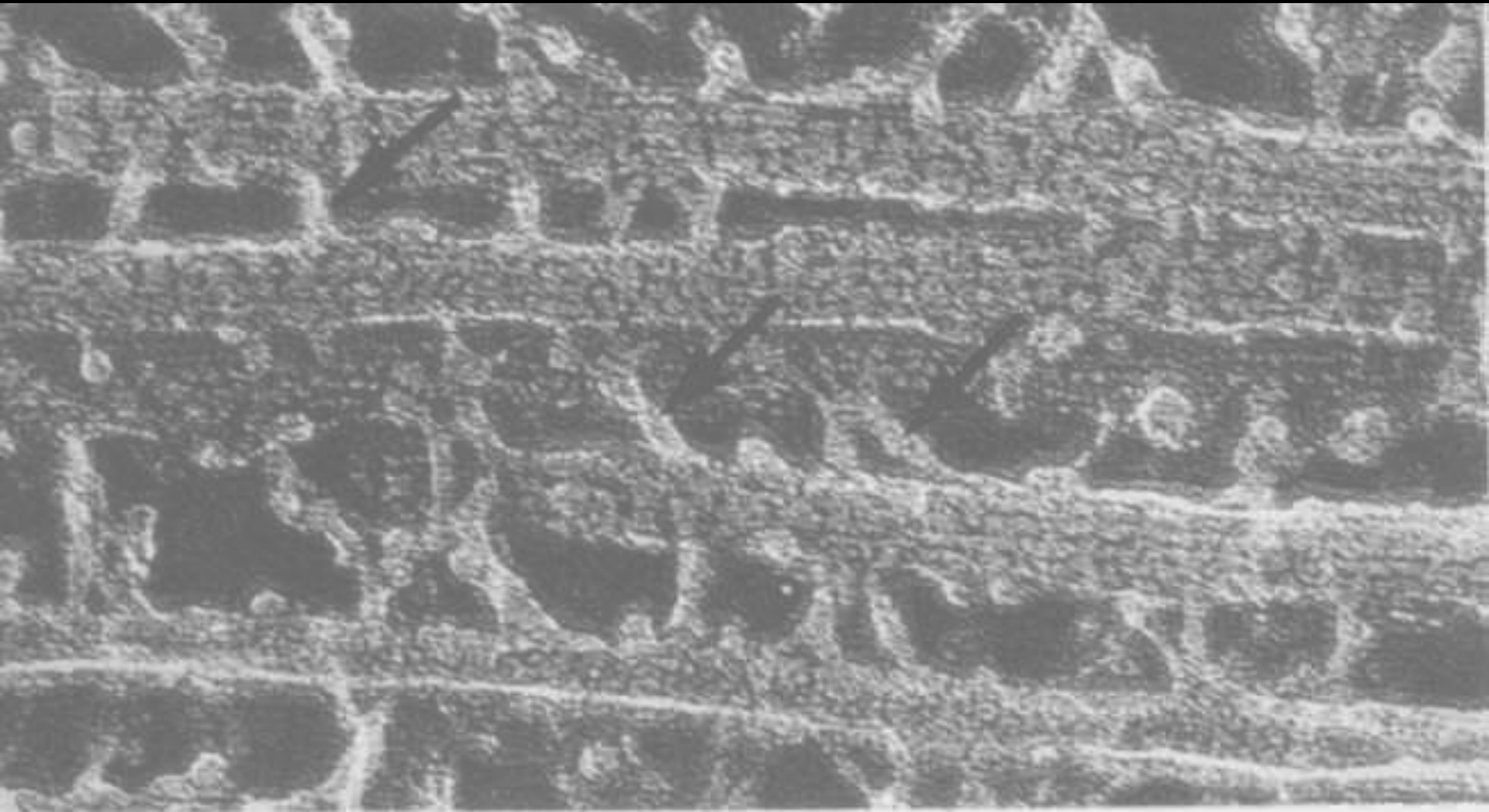
Terminální arborizace

- na konci axonu

na začátku axonu několik kolaterálních větví

Neurotubuly (mikrotubuly)



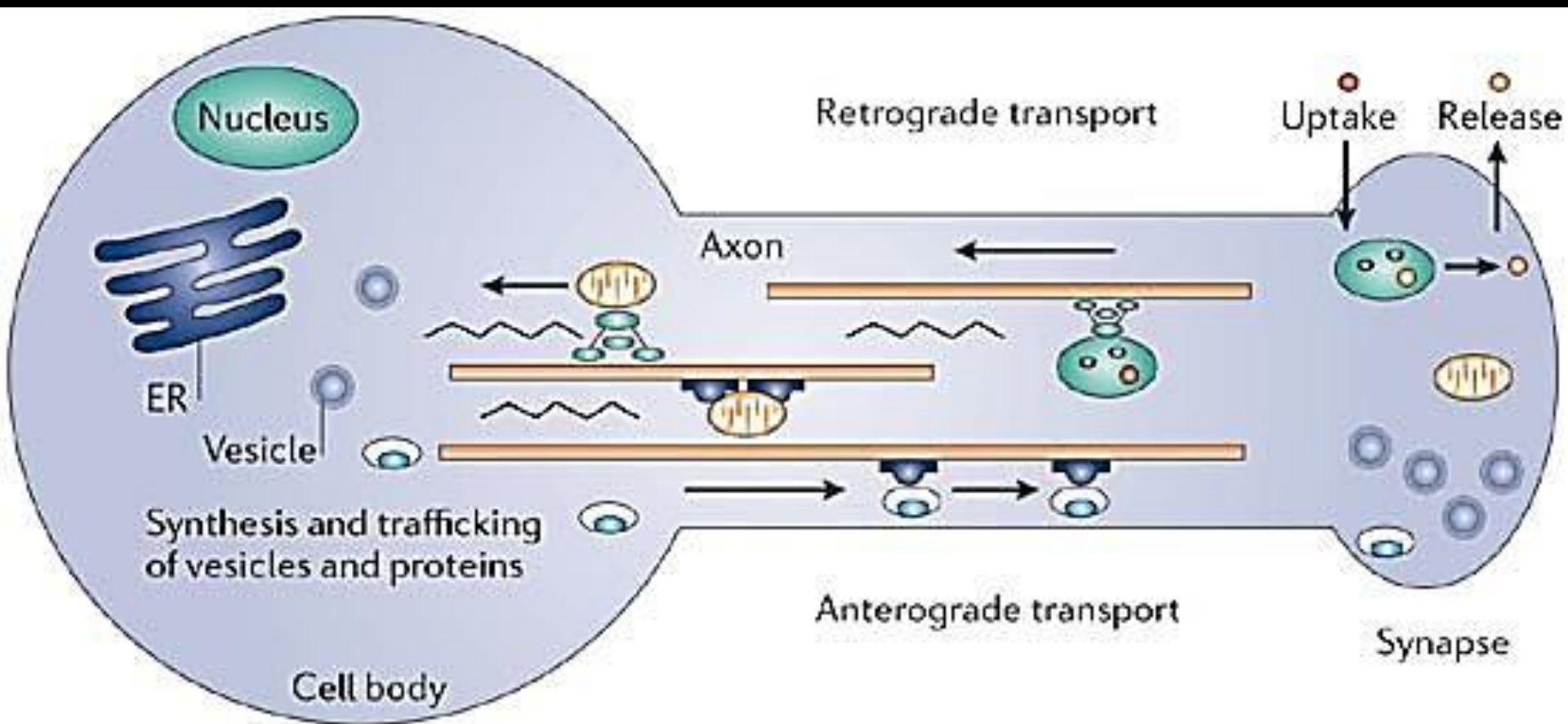


MAP 1 **MAP τ**

100 nm

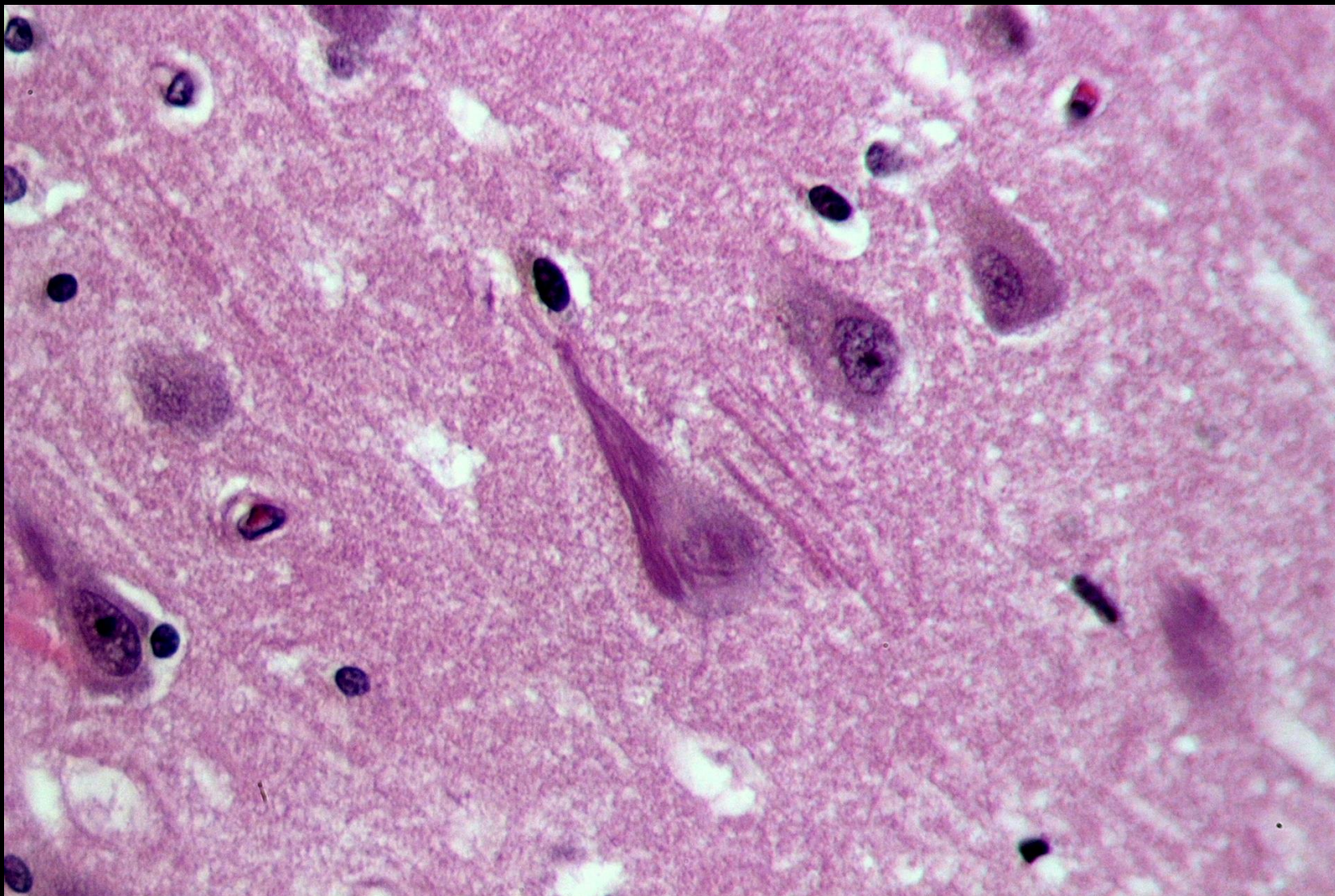
kinesin (anterográdne)

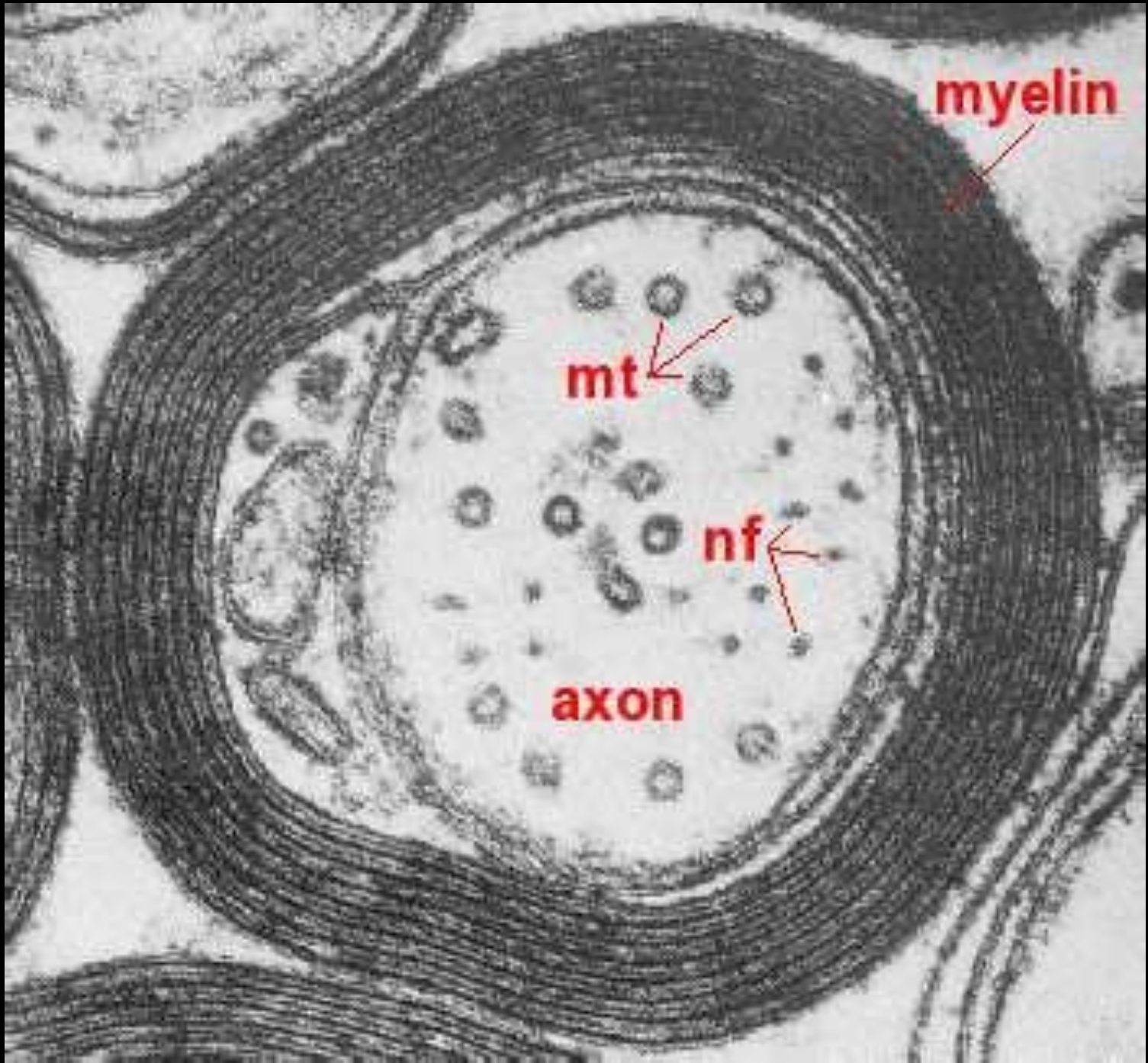
dynein (retrográdne)

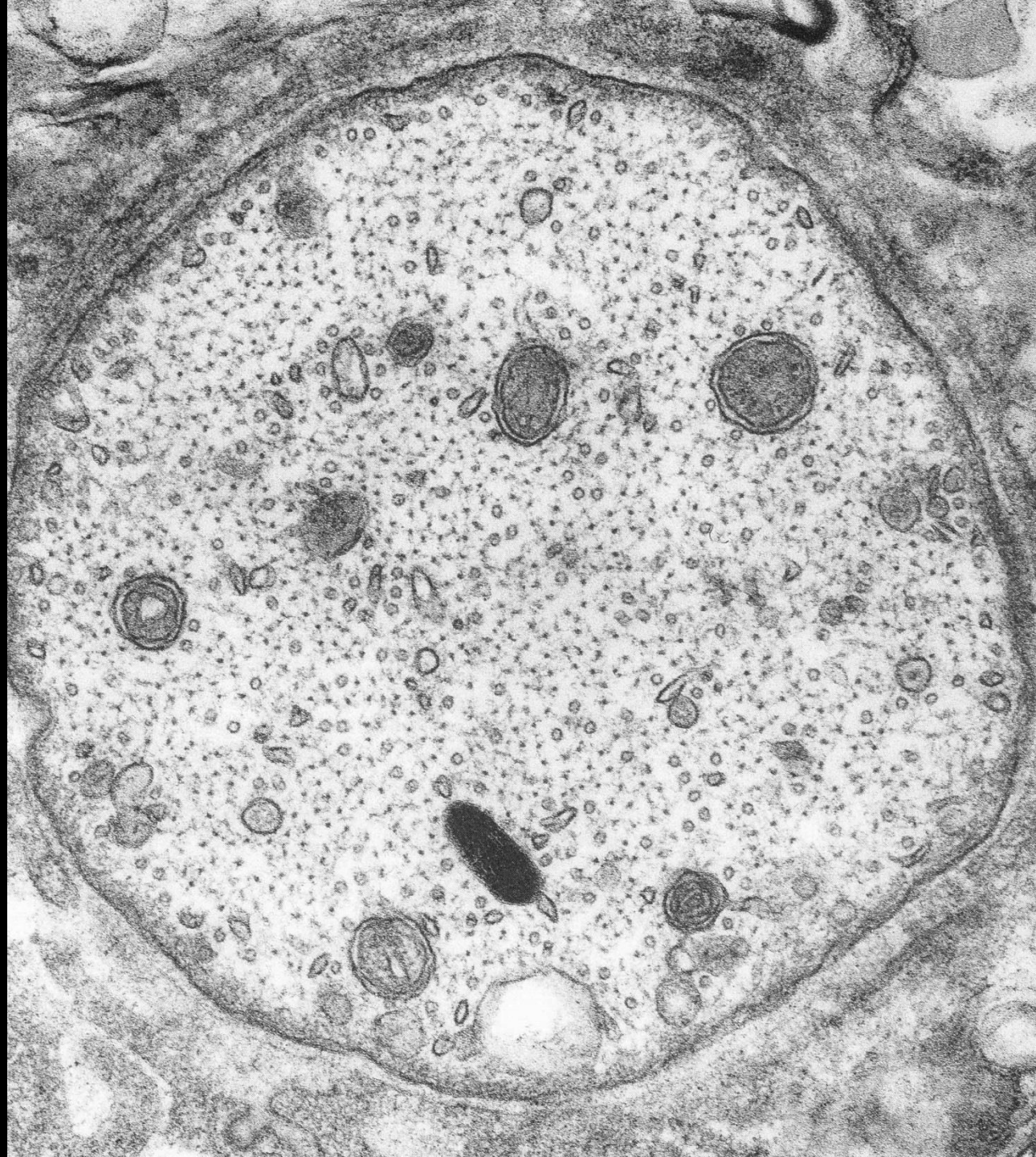


	Dynein–dynactin complex (retrograde motor)		Mitochondrion		Anterograde cargo
	Kinesin (anterograde motor)		Microtubules		Retrograde cargo
			Neurotrophic factors		Neurofilaments

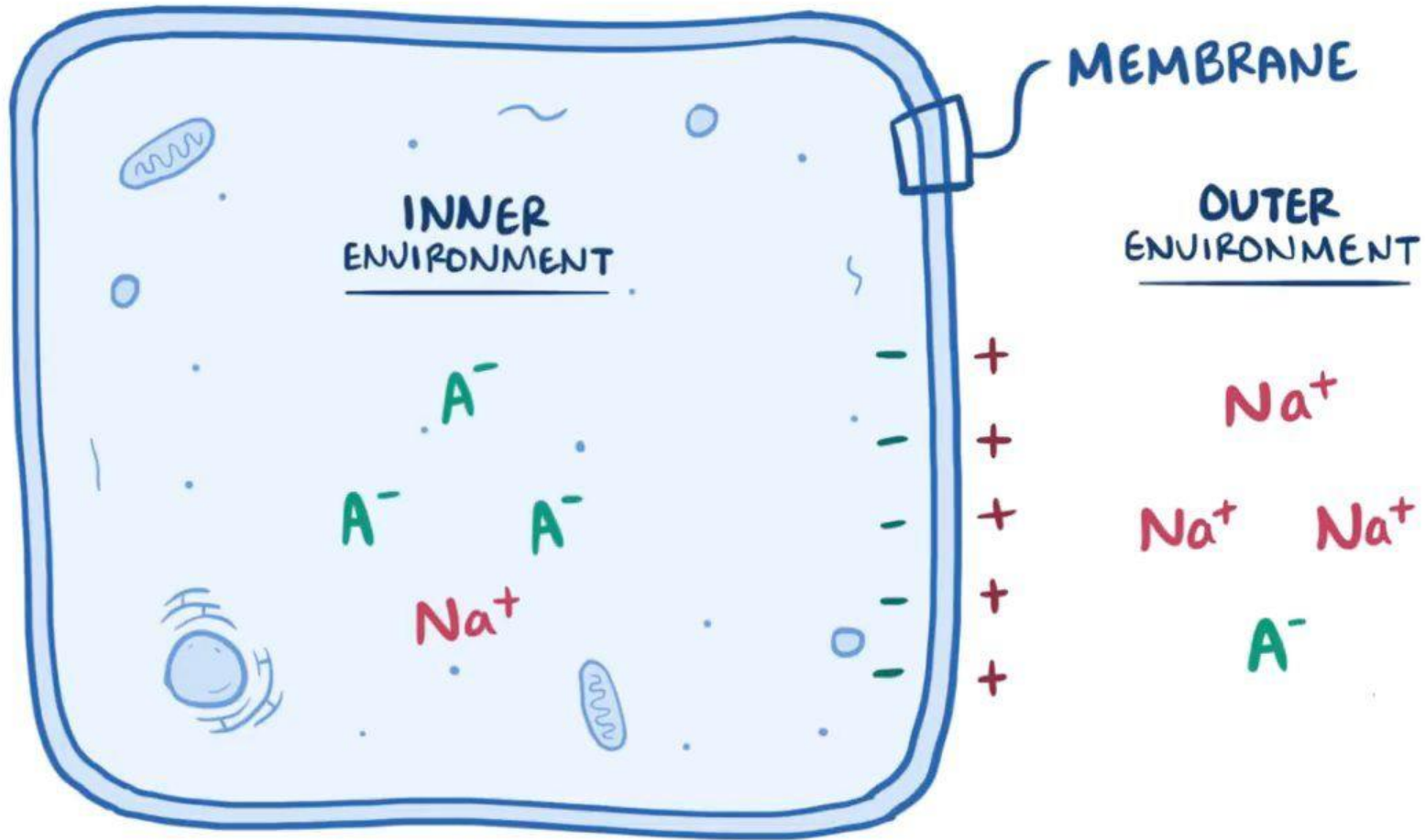
MAP Tau, protein asociovaný s mikrotubuly (podporuje sestavení a stabilitu mikrotubulů), tvoří nerozpustná vlákna, která se hromadí jako neurofibrilární spleti při Alzheimerově chorobě







Membránový potenciál



Membránový potenciál

klidový membránový potenciál -65 až -70 mV

-depolarizace nad -50 mV (Na^+ , Ca^{++} do buňky) = **excitace**

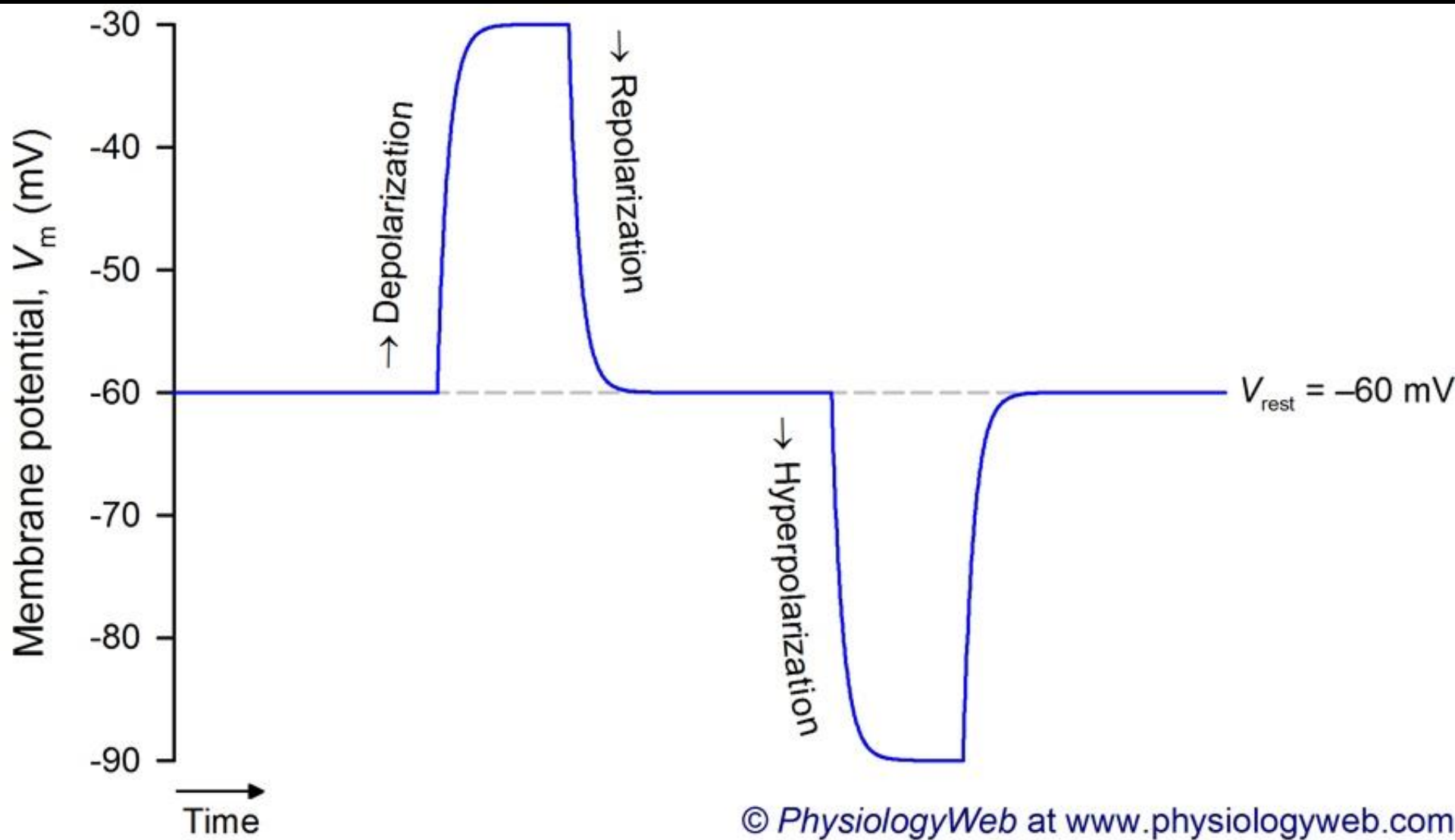
-hyperpolarizace pod -70 mV (K^+ z buňky, Cl^- do buňky) =

inhibice

propagace změny membránového potenciálu = **impuls**

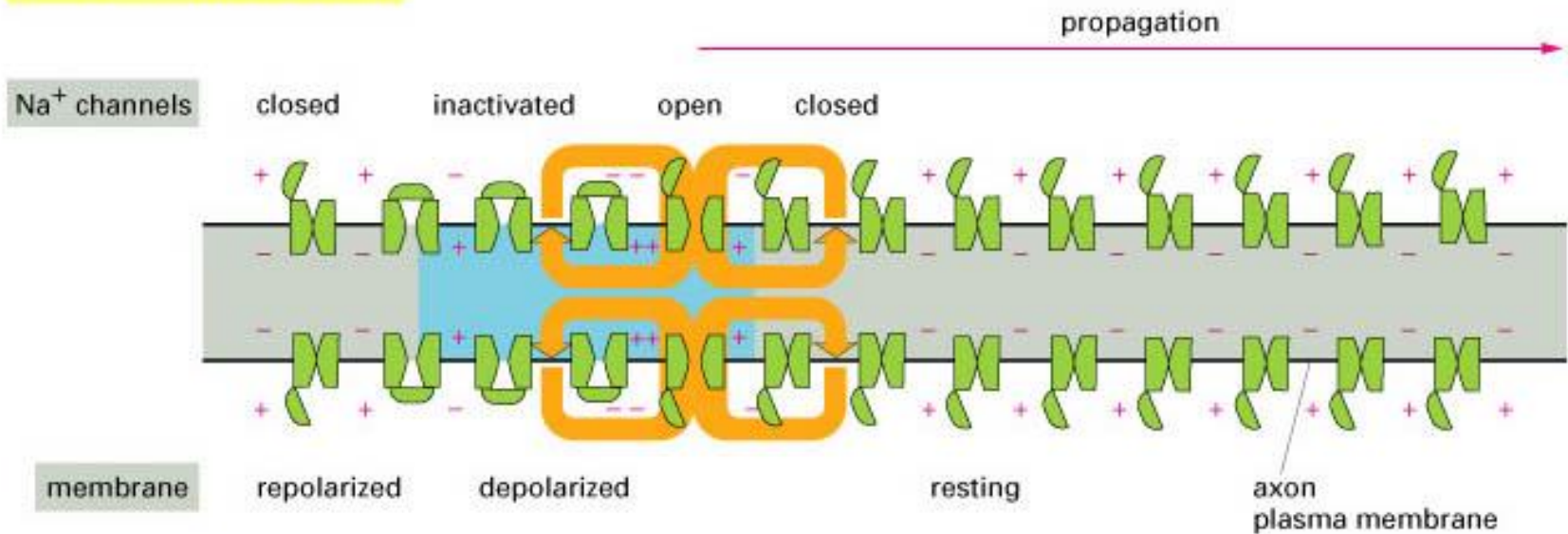
- excitační/inhibiční potenciál - na dendritech a těle, šíření s dekrementem a všemi směry

- akční potenciál - pouze na axonech, šíření bez dekrementu a pouze celulifugálně, k vybavení potřebná sumace asi 200 impulsů, dojde ke krátkodobé depolarizaci na $+30$ až $+50$ mV

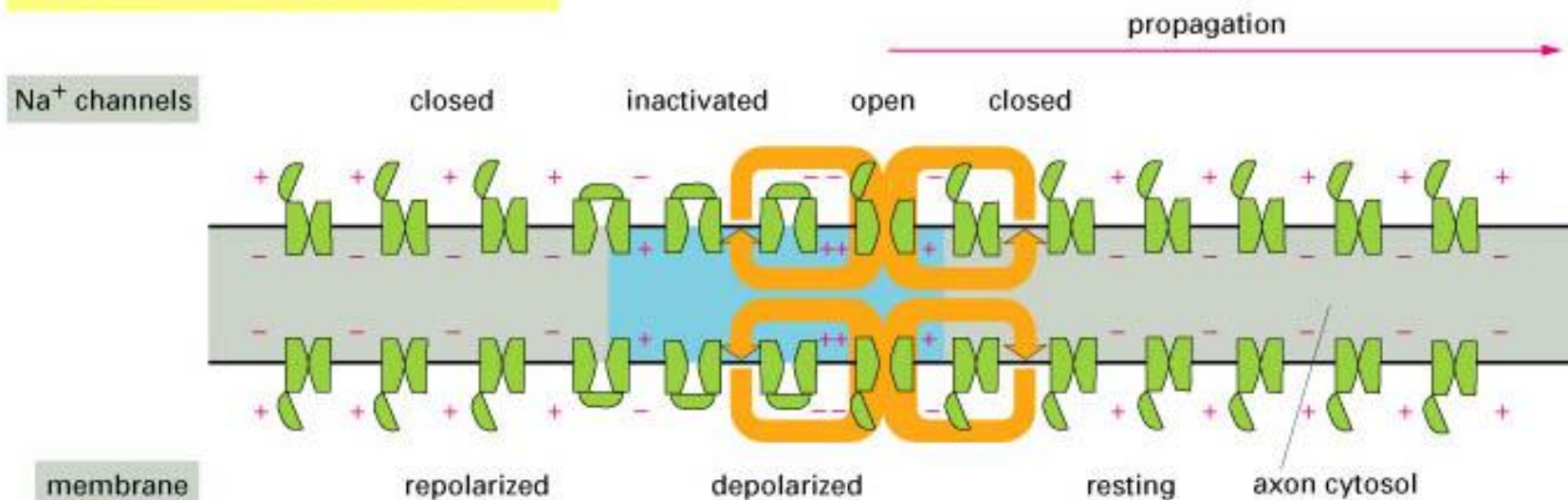


Akční potenciál

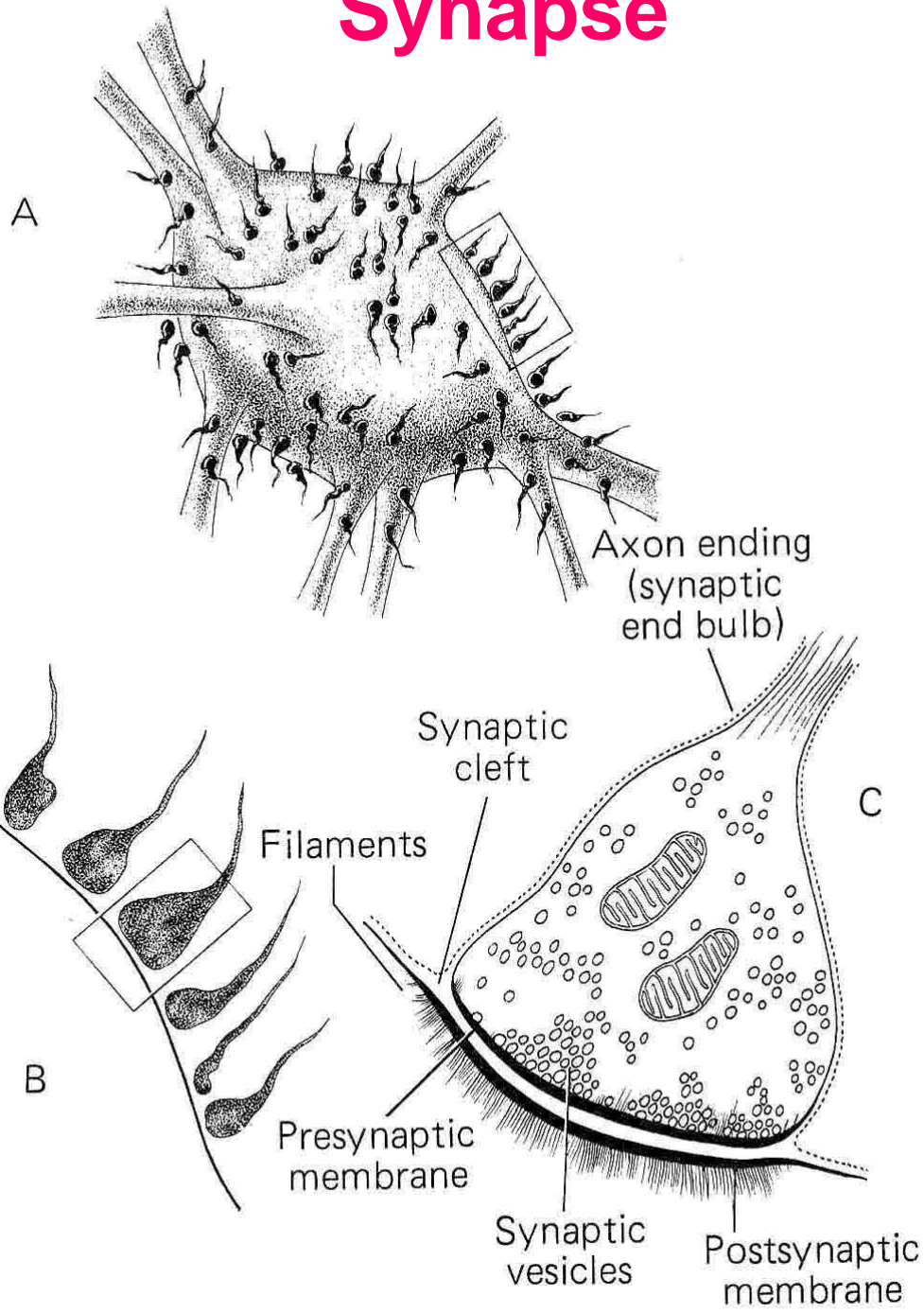
(B) instantaneous view at $t = 0$



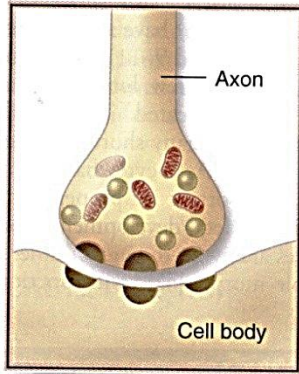
instantaneous view at $t = 1$ msec



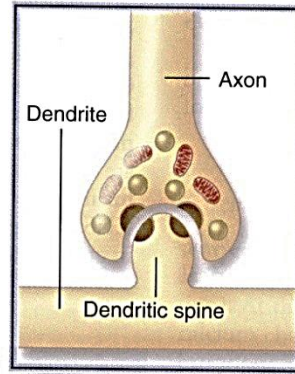
Synapse



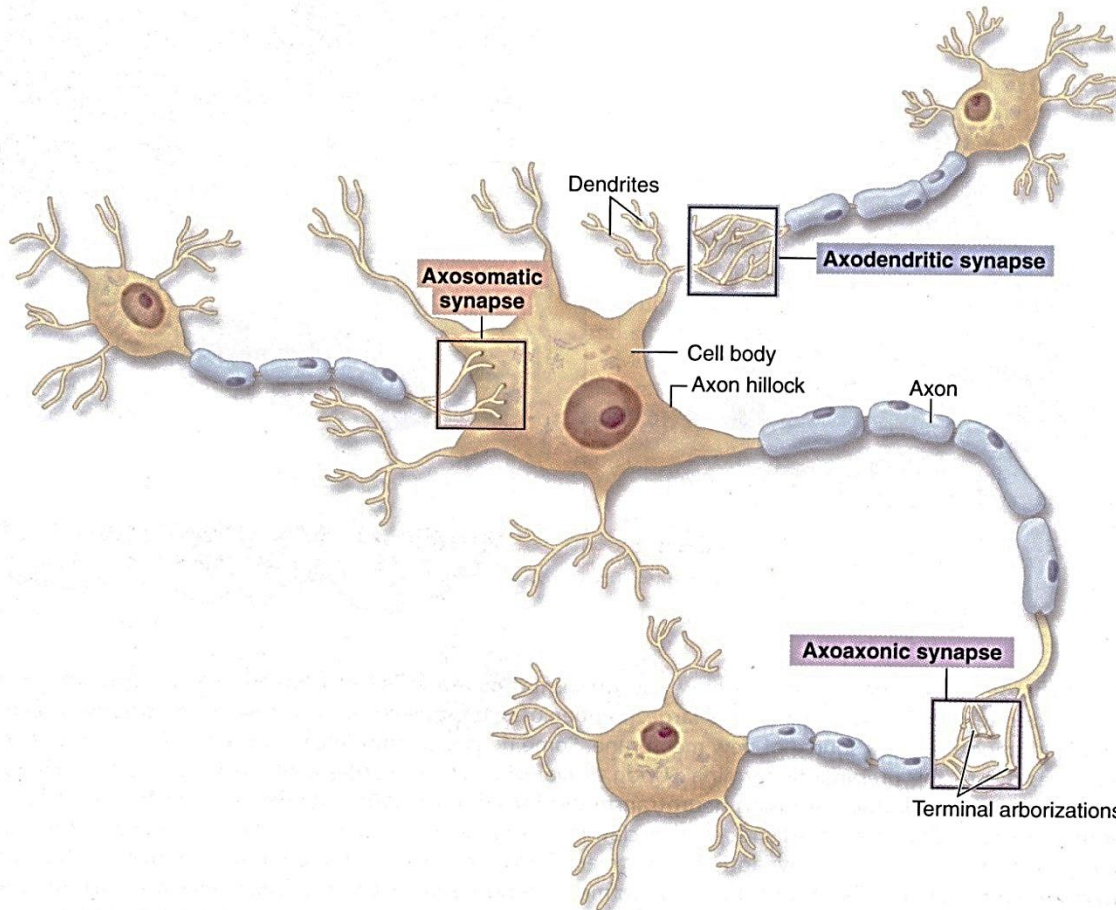
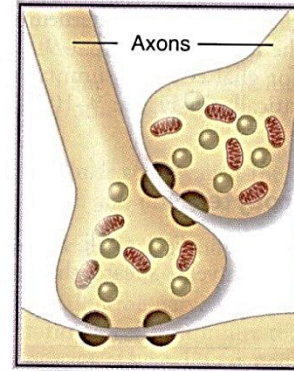
Axosomatic synapse

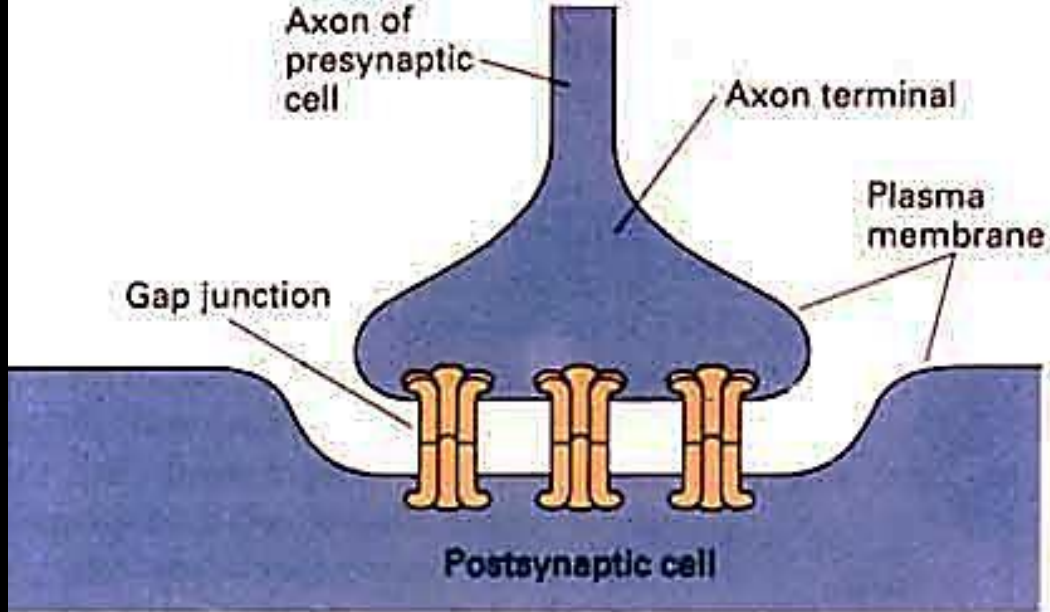


Axodendritic synapse

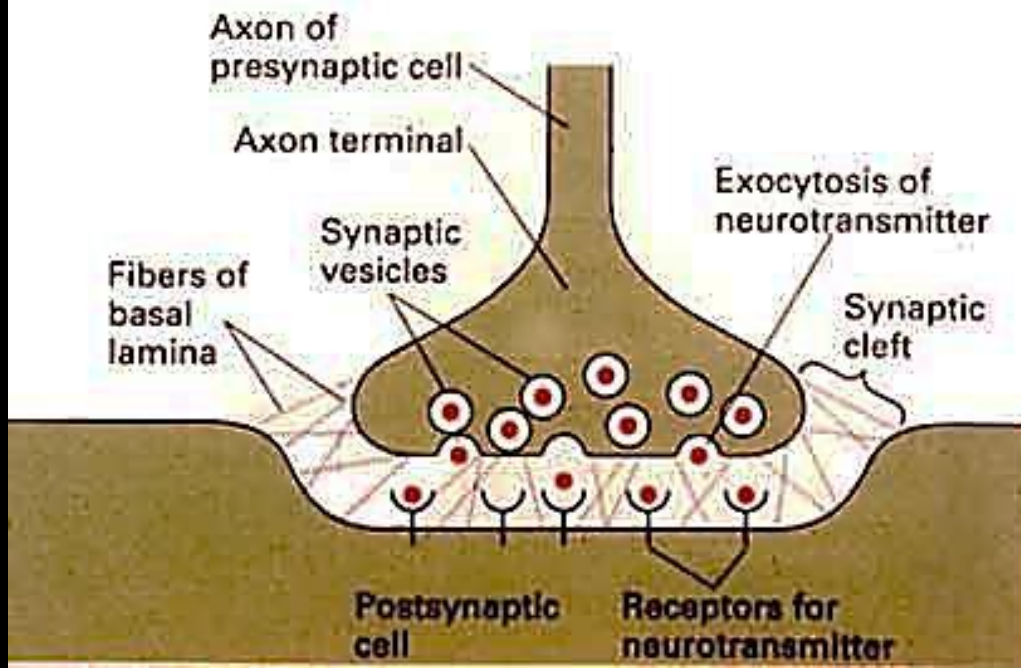


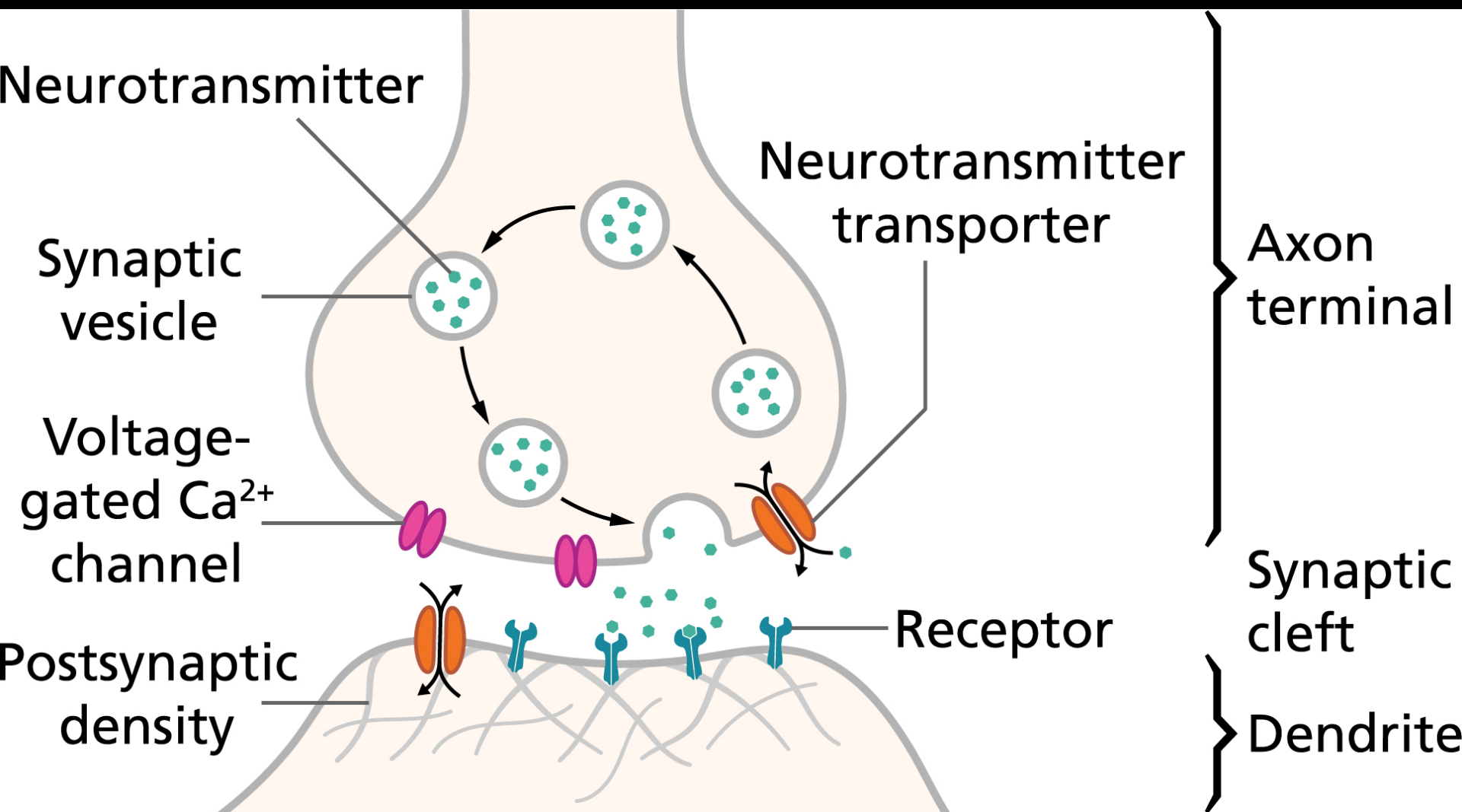
Axoaxonic synapse





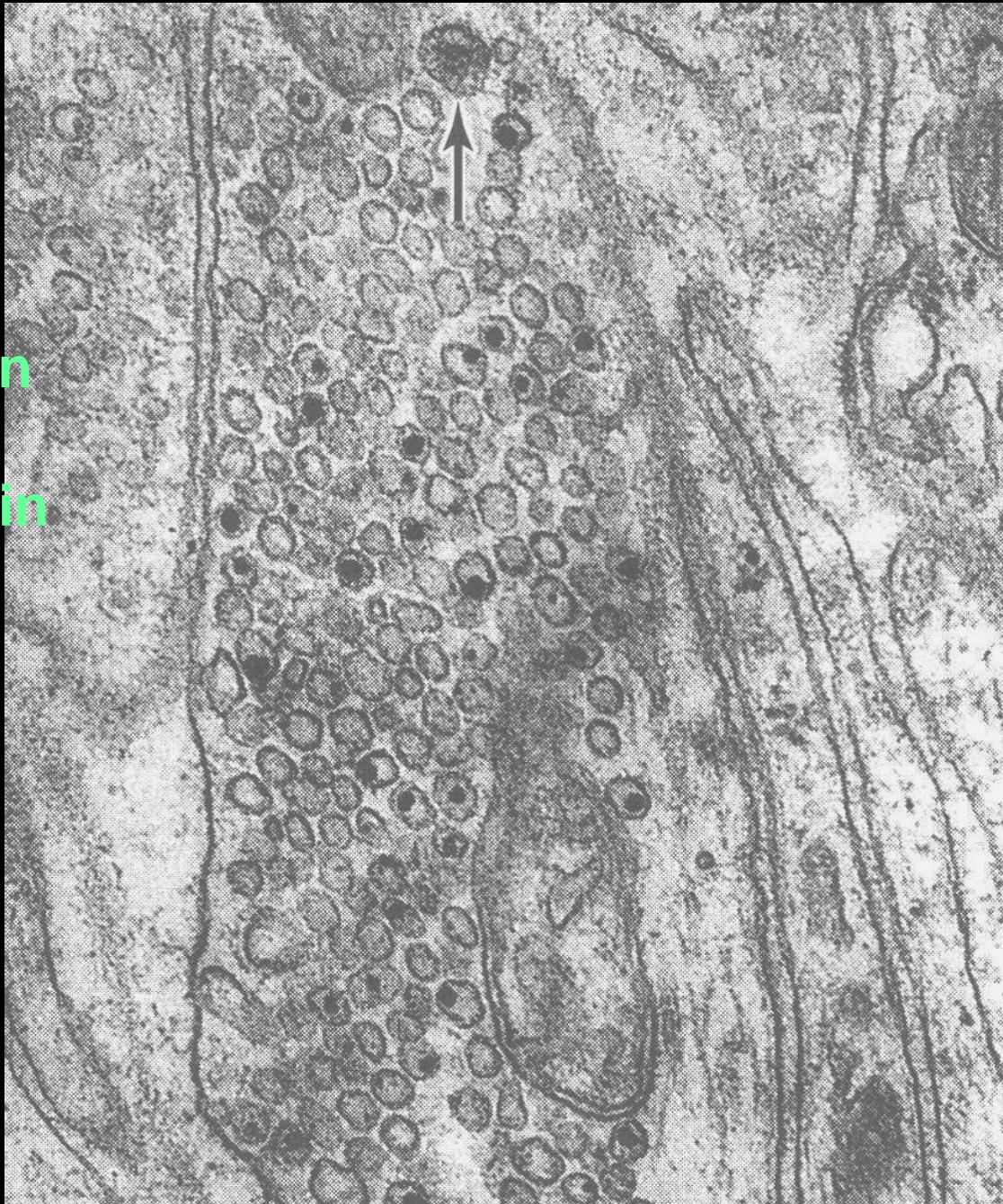
Chemical synapse





**mediátory
v CNS**

**acetylcholin
adrenalin
noradrenalin
serotonin
glutamát
dopamin
glycin
GABA
histamin**



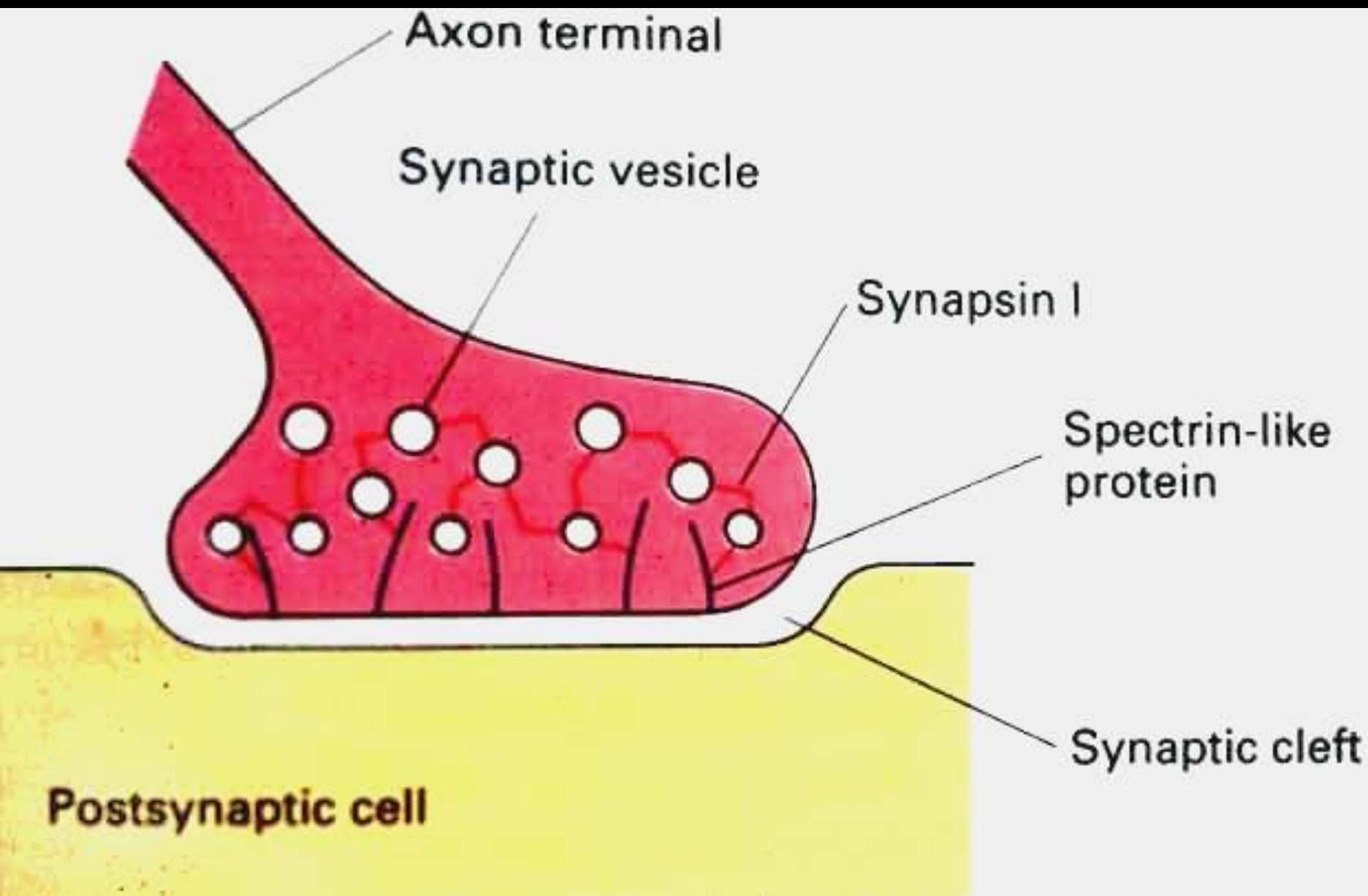
**mediátory
v PNS**

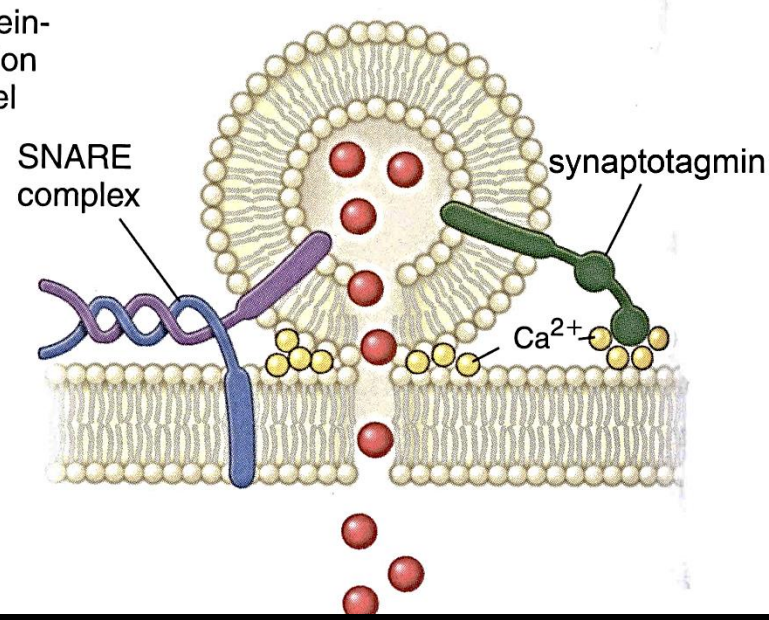
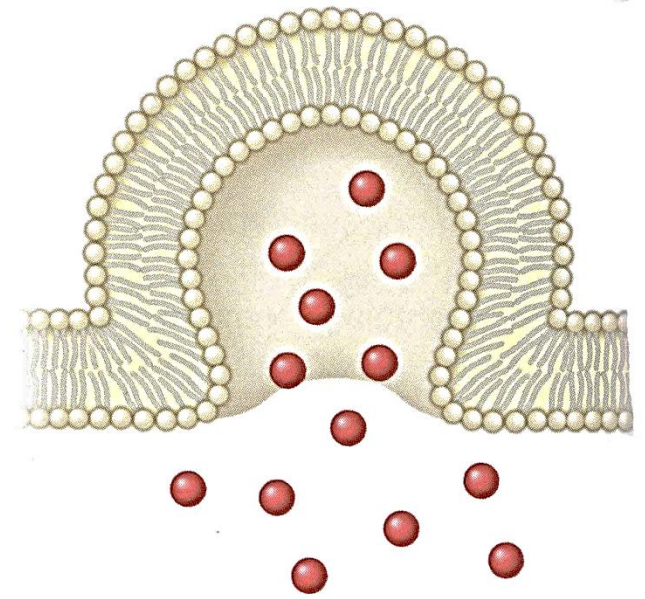
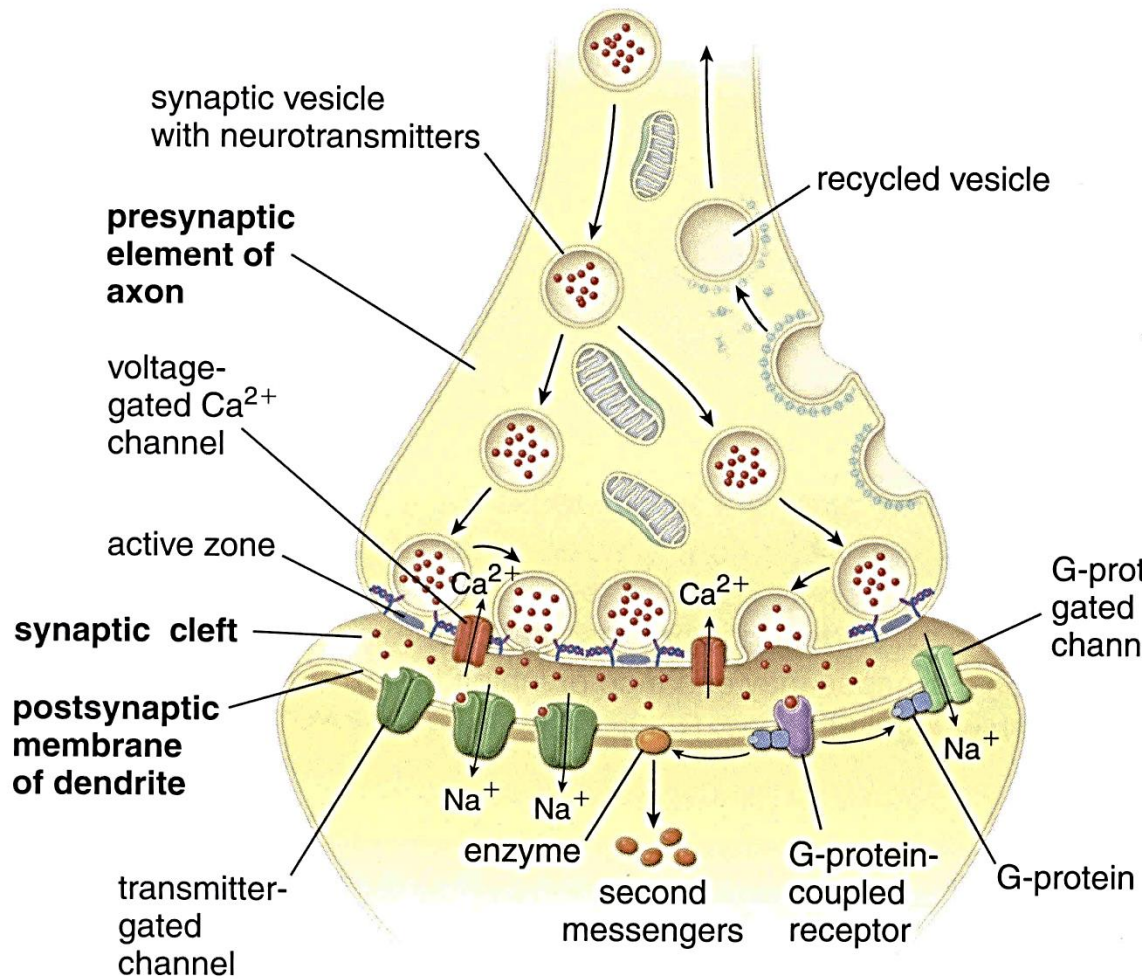
**acetylcholin
noradrenalin
histamin
dopamin
serotonin**

This electron micrograph shows a synapse between an axon ending and a dendrite. The axon ending is on the left, and the dendrite is on the right. The synaptic cleft is the space between them. Numerous small, clear vesicles are visible in the axon ending, and a larger, more complex structure is visible in the dendrite. The overall texture is granular and detailed, typical of electron microscopy.

Axon ending

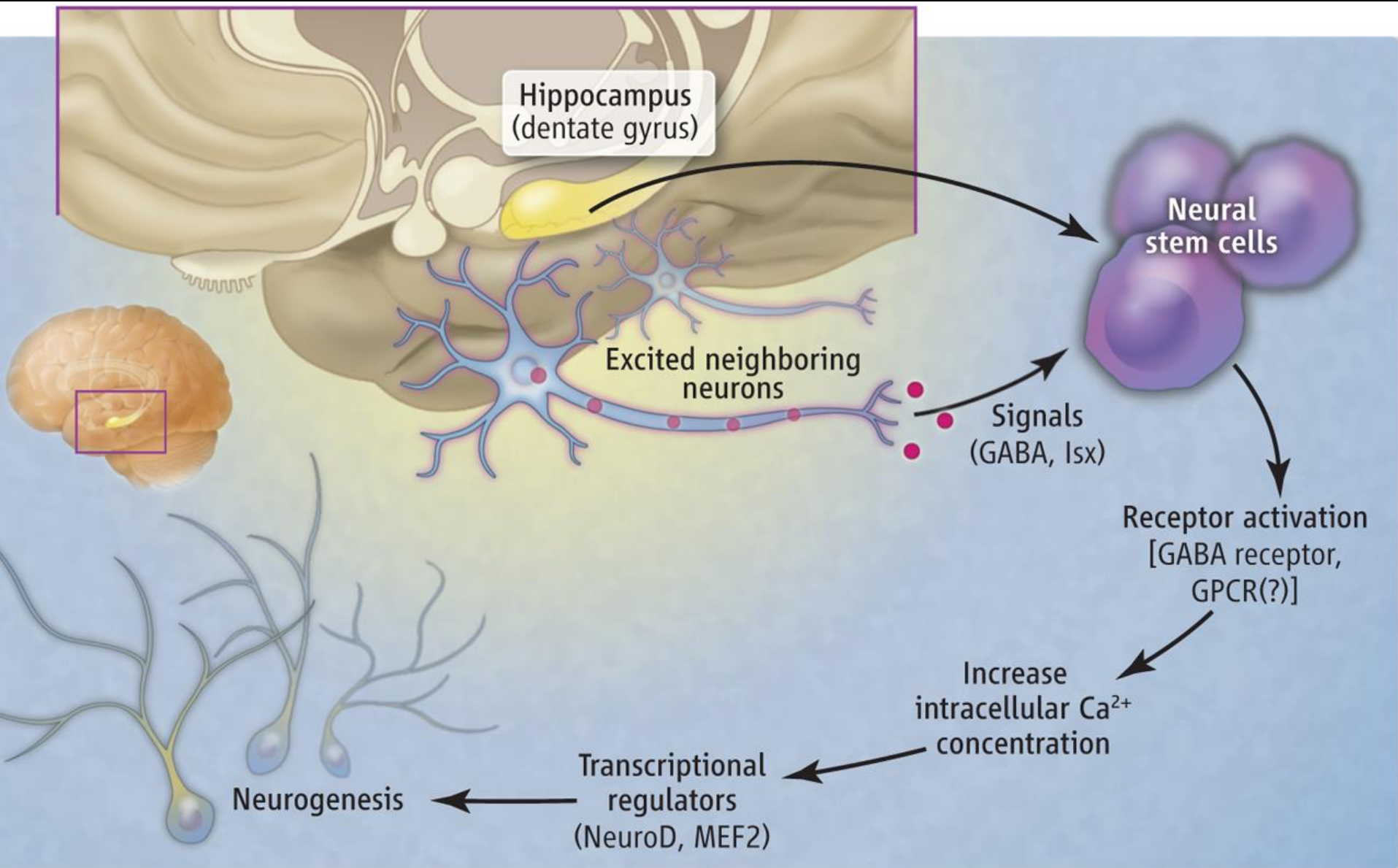
Dendrite





PŘÍKLADY INAKTIVACE MEDIÁTORU A UVOLNĚNÍ RECEPTORU

- acetylcholinesteráza v synaptické štěrbině
- zpětné vychytávání katecholaminů presynaptickou membránou a jejich rozklad monoaminoxidázou (MAO)
- COMT (katechol-O-metyltransferáza) v postsynaptickém neuronu



Gliové buňky (neuroglie)

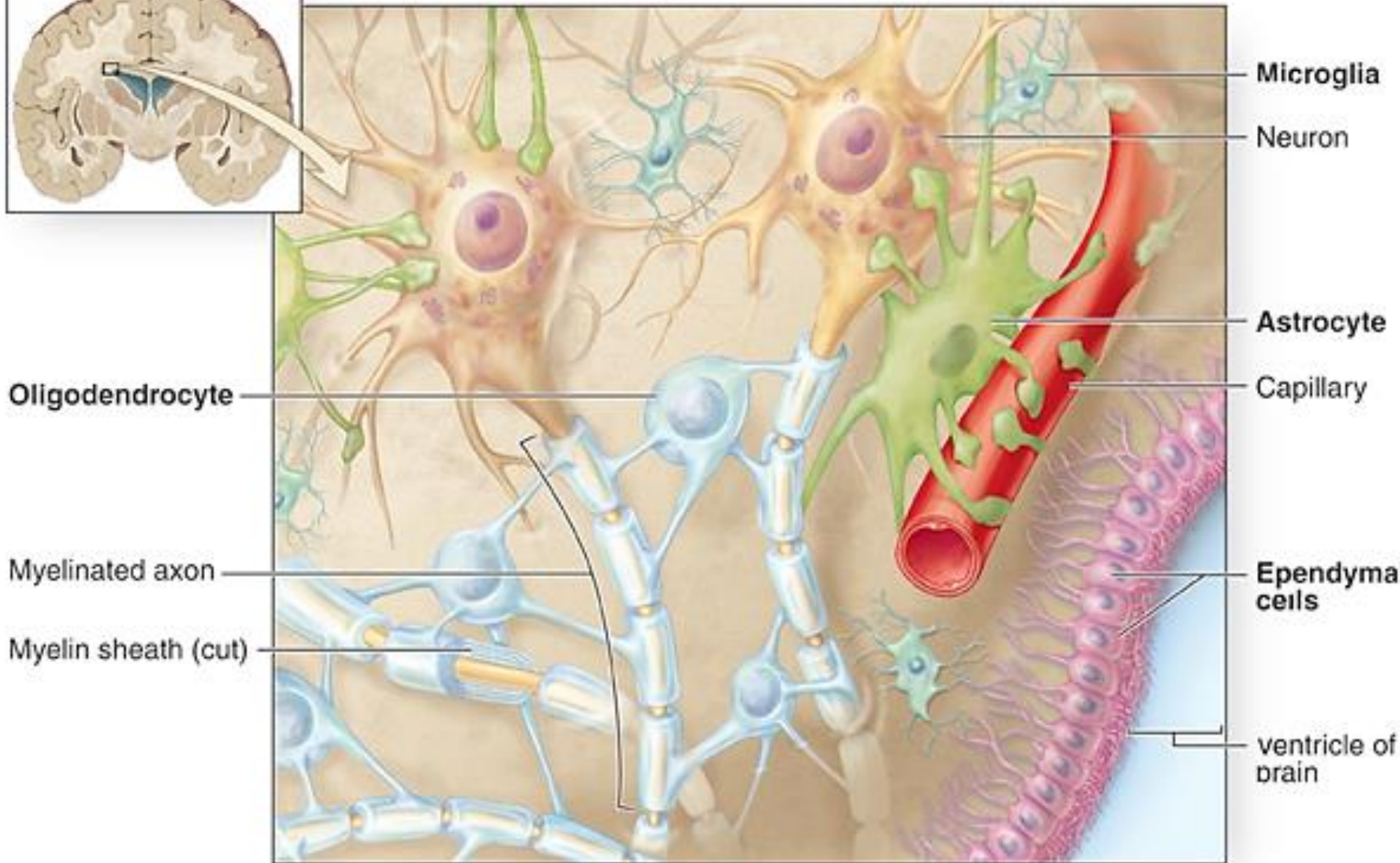
neuronům poskytují

- trofickou podporu (zásobu energie)
- mechanickou podporu a izolaci (bariéru)
- podporu při vytváření a udržování synapsí
- tzv. druhý klíč pro synaptický přenos (např. D-serin)
- produkci mezibuněčné hmoty a imunitní funkce

NEUROGLIE

- 1. neuroglie **CNS**
 - 1. ependym
 - 2. astrocyty
 - 1. plazmatické (šedá hmota **CNS**)
 - 2. fibrilární (bílá hmota **CNS**)
 - 3. oligodendroglie — (myelinizace axonů v **CNS**)
 - 4. mikroglie

- 2. neuroglie **PNS**
 - 1. Schwannovy b. — (myelinizace axonů v **PNS**)
 - 2. satelitové b. — cerebrospinální ganglia
 - vegetativní
 - "



Microglia

Neuron

Astrocyte

Capillary

Ependyma cells

ventricle of brain

Oligodendrocyte

Myelinated axon

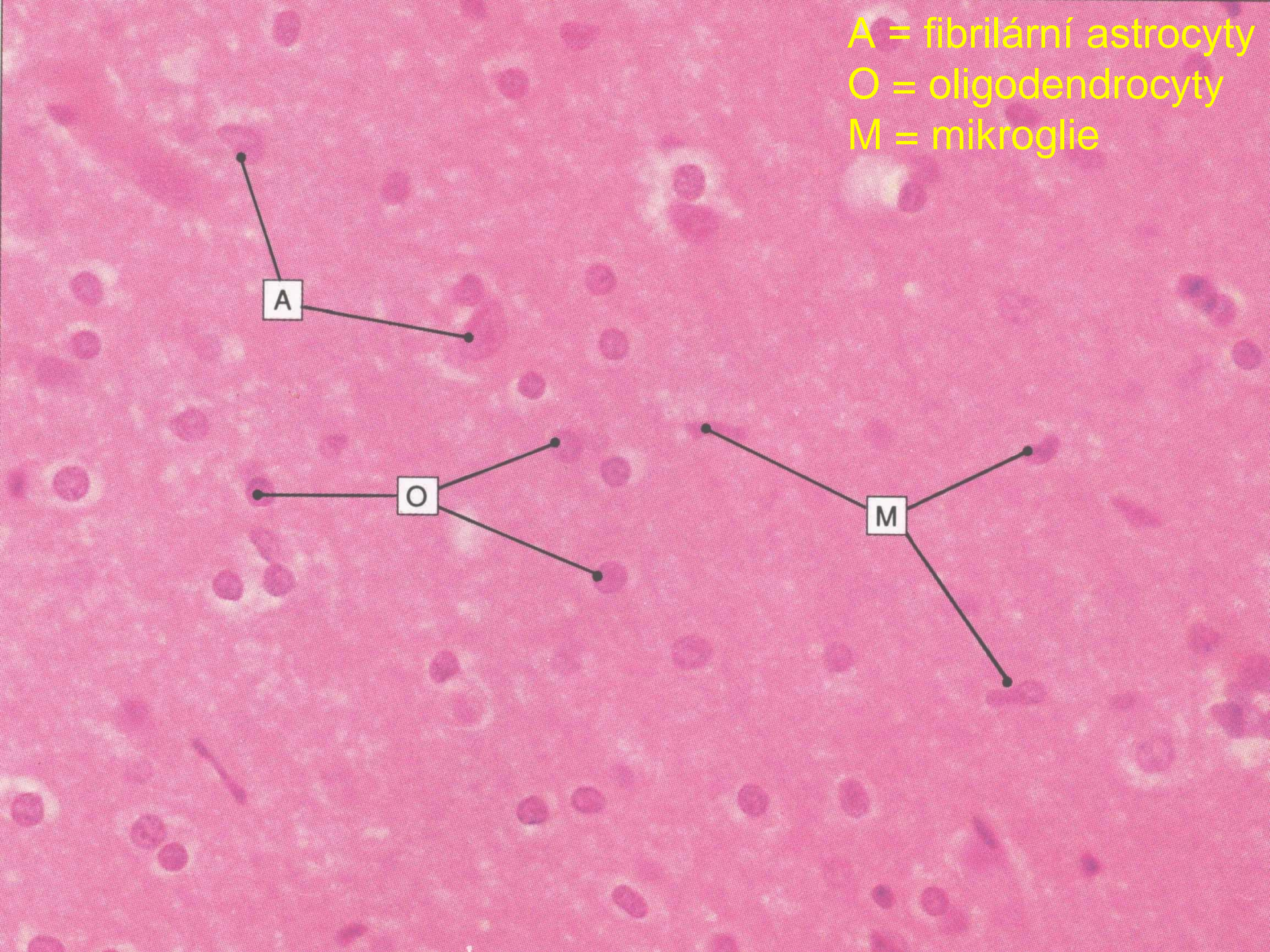
Myelin sheath (cut)

A = fibrilární astrocyty
O = oligodendrocyty
M = mikroglie

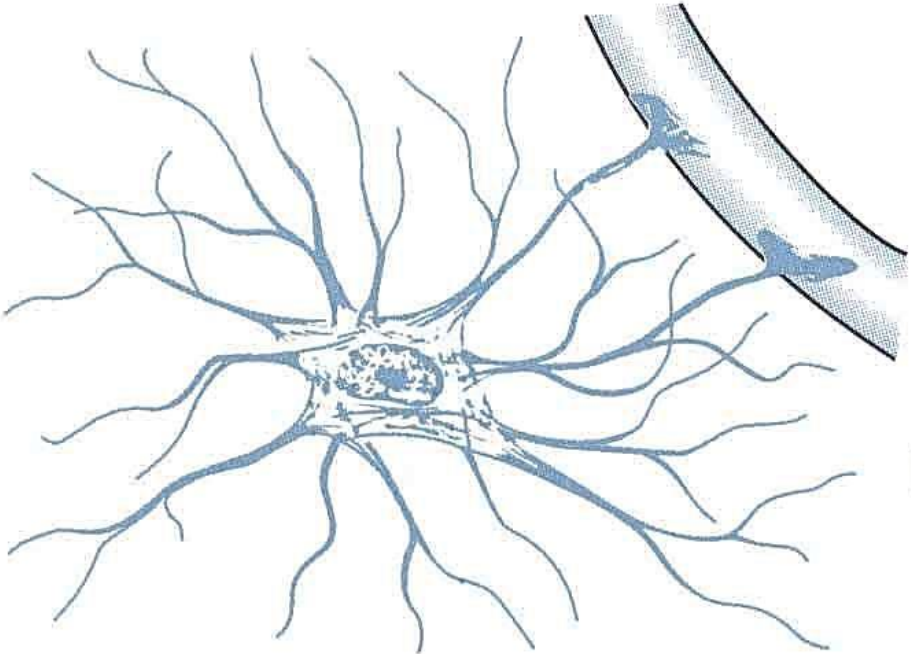
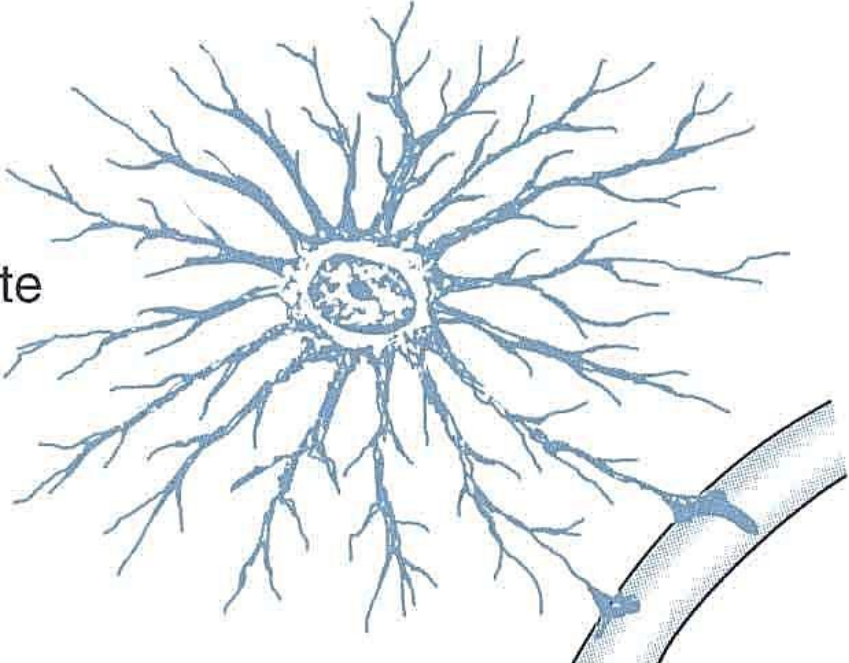
A

O

M

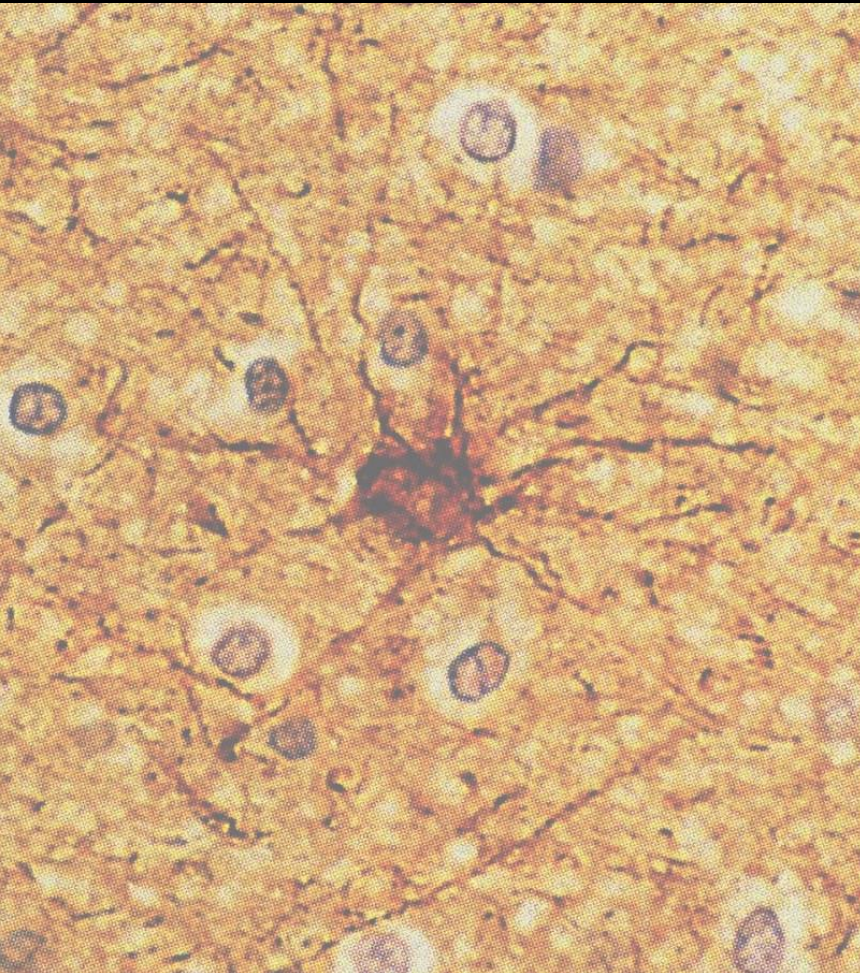


Protoplasmic astrocyte

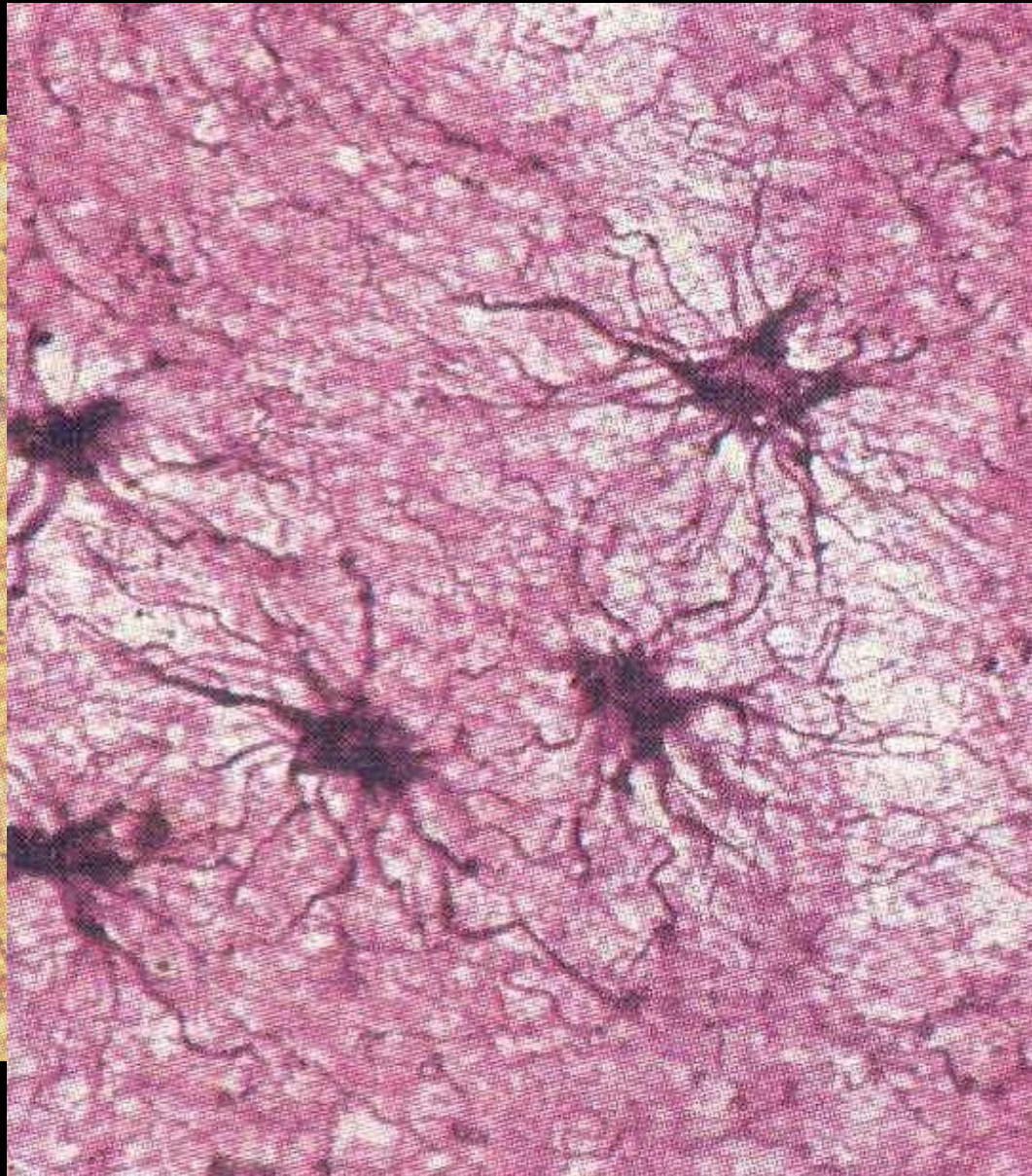


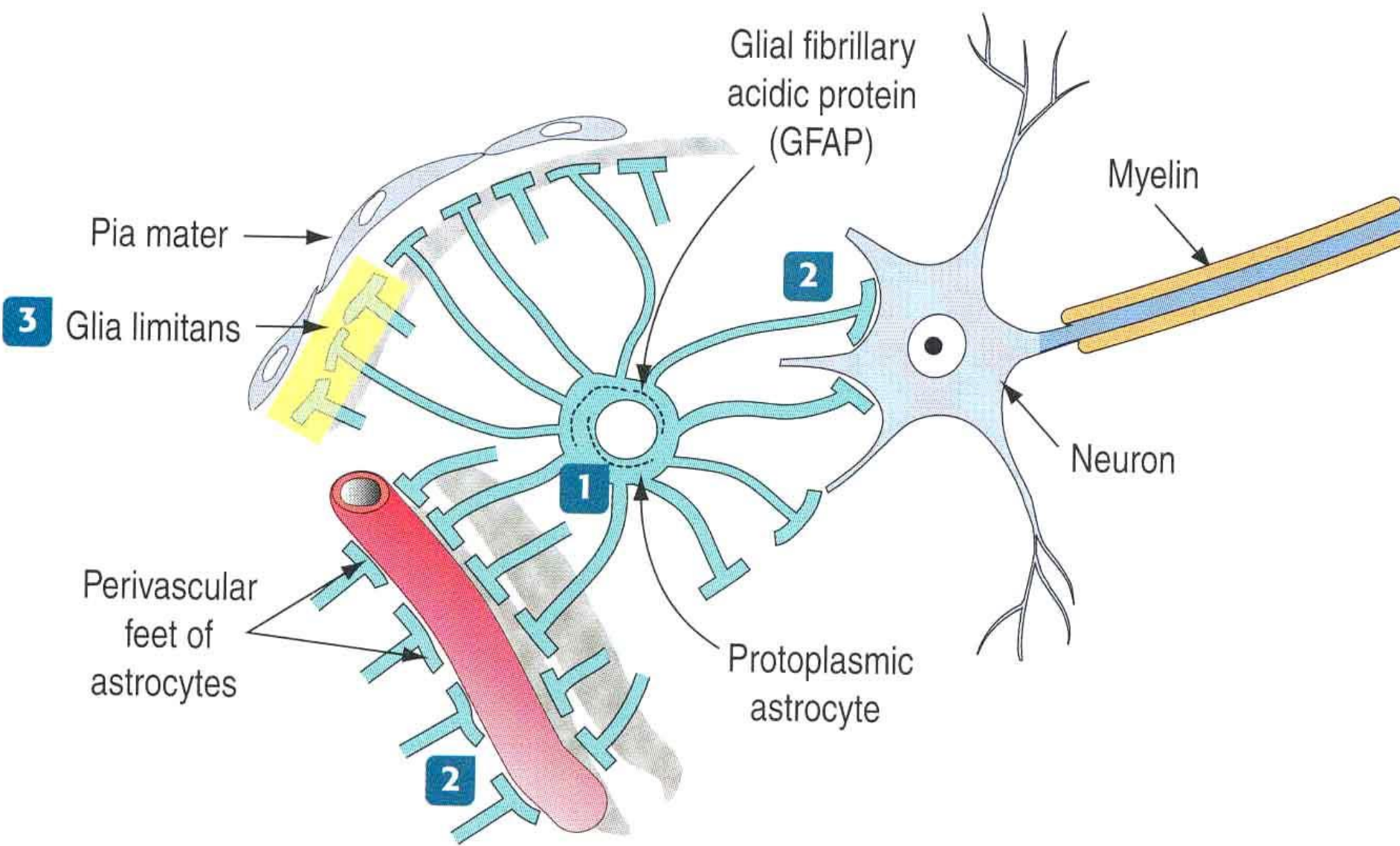
Fibrous astrocyte

GFAP imunohistochemie

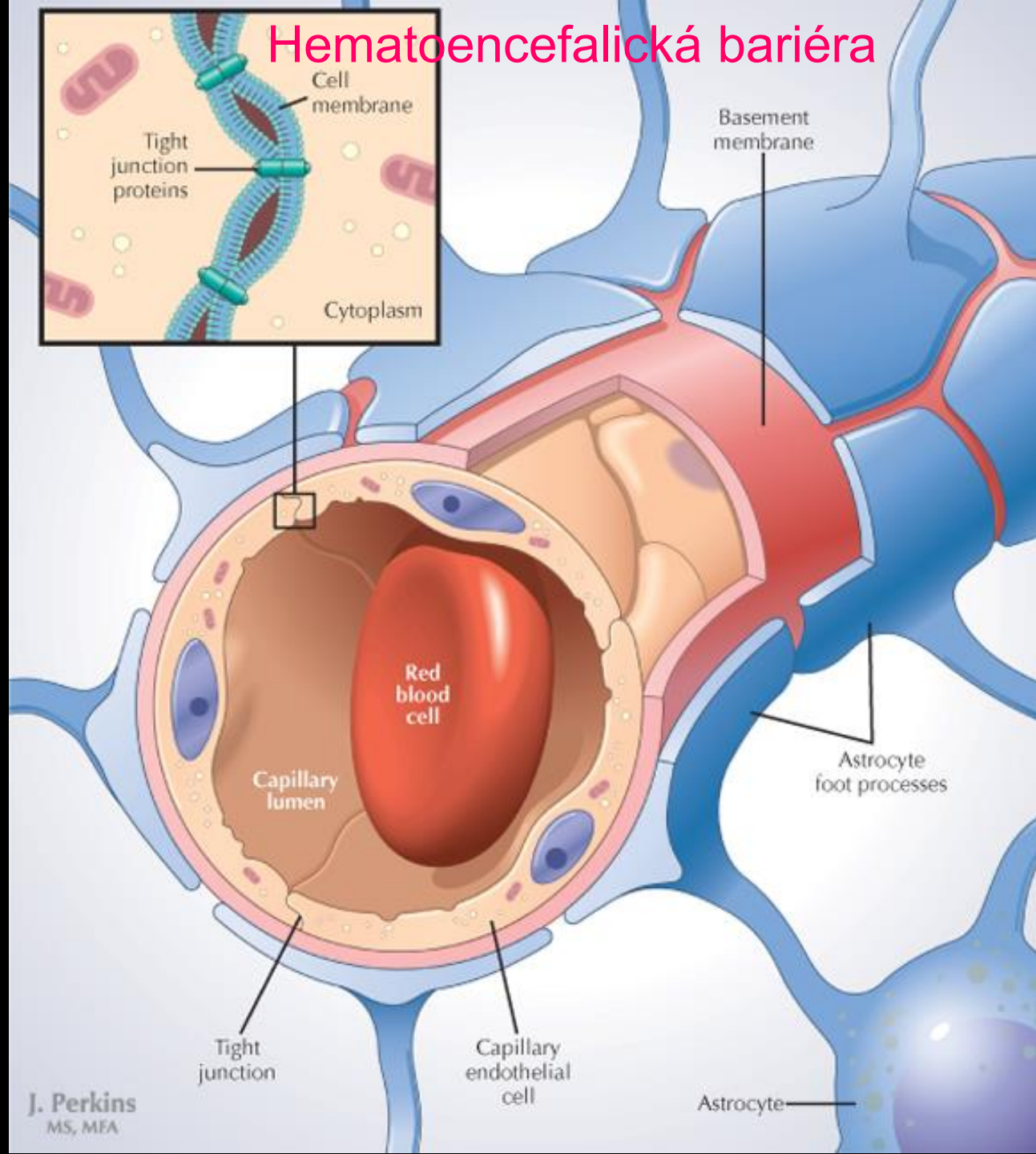


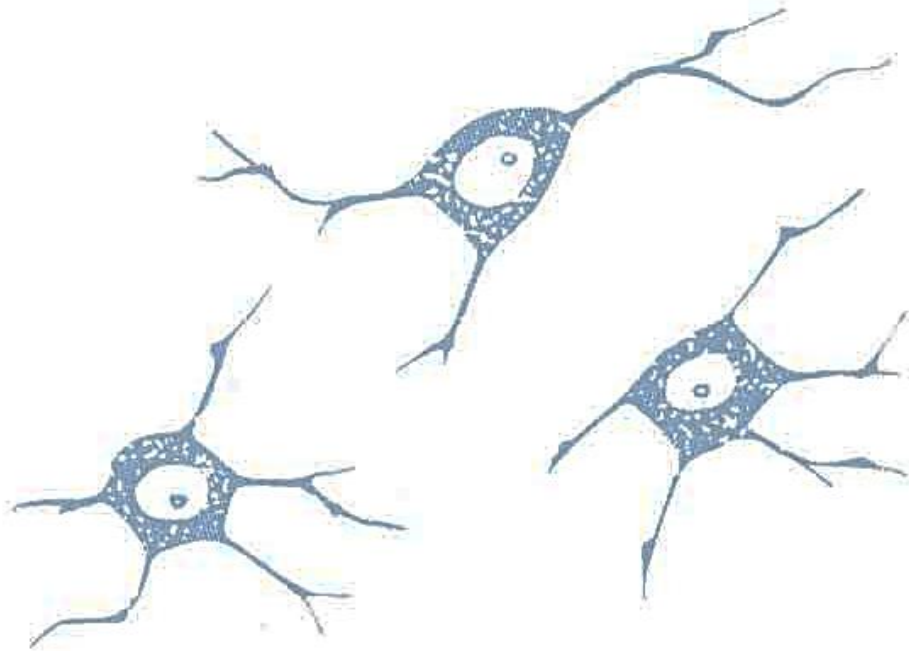
impregnace



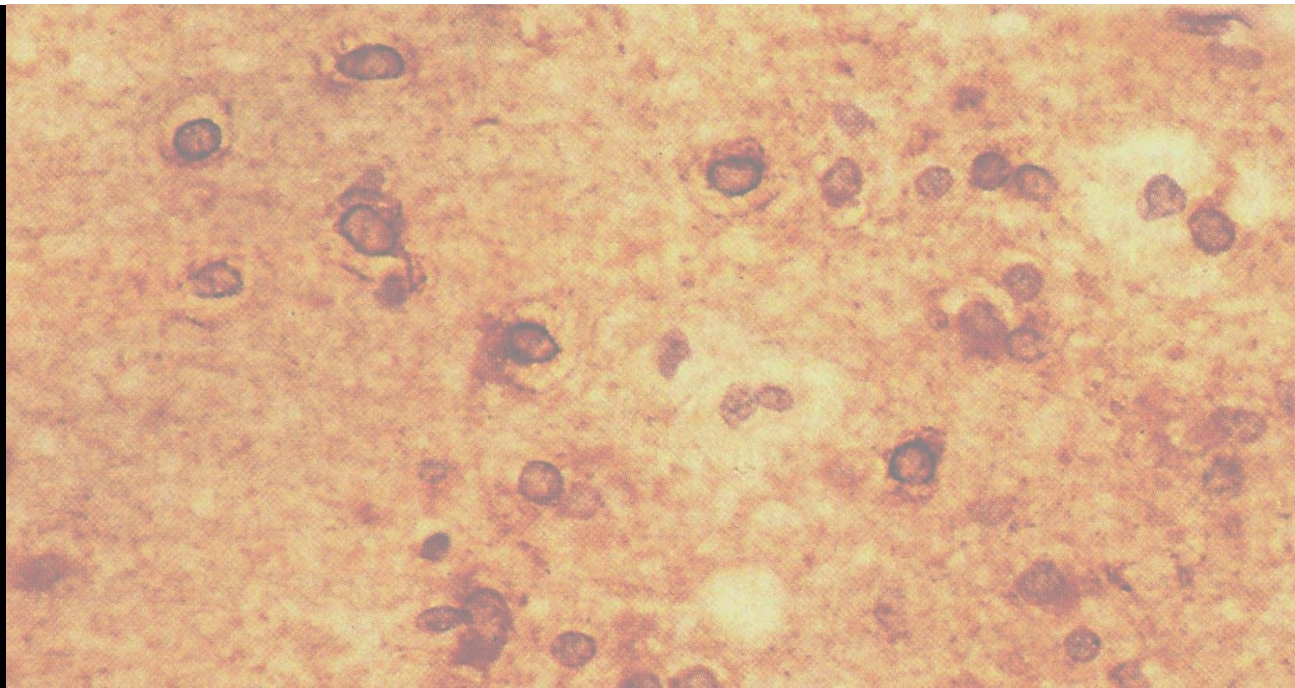


Hematoencefalická bariéra

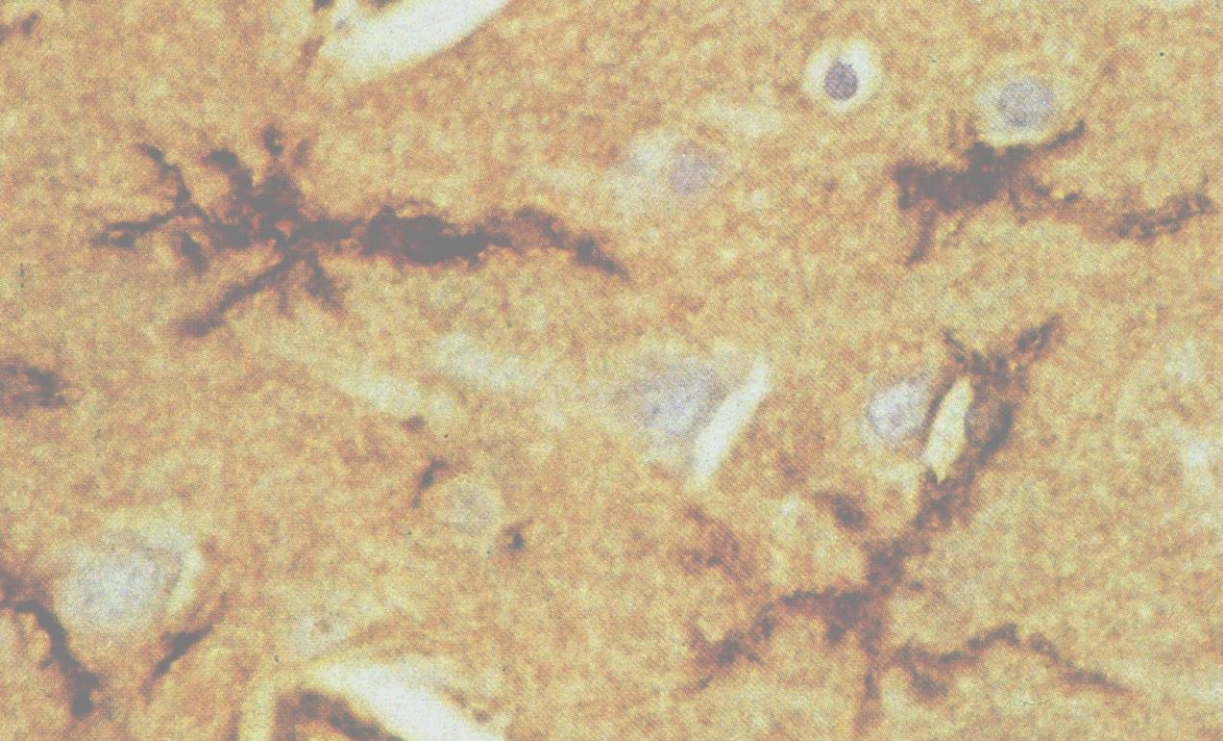
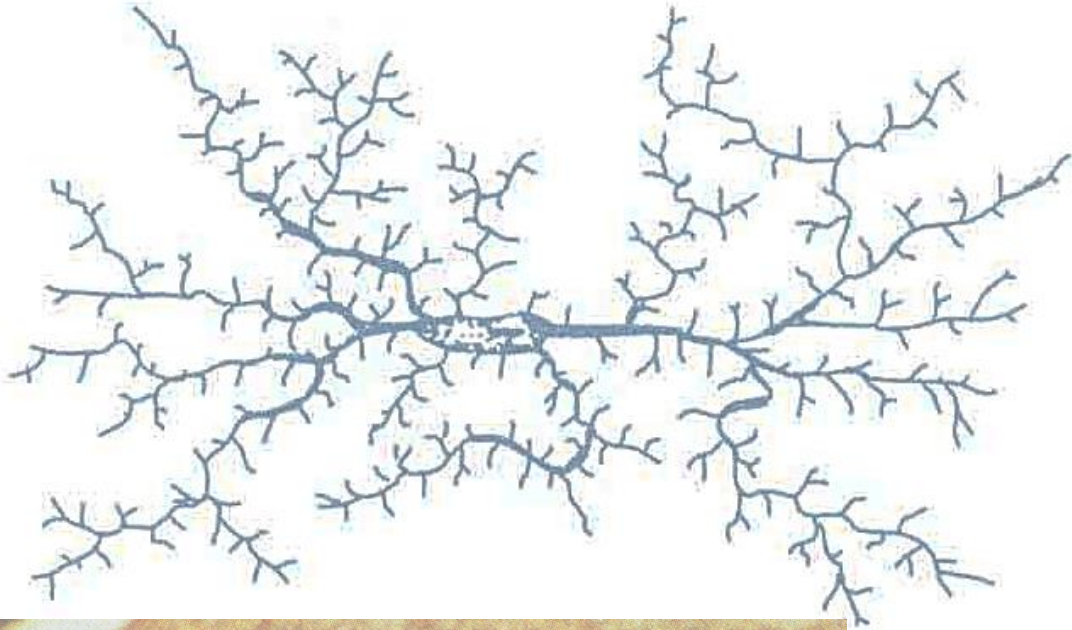




Oligodendrocytes

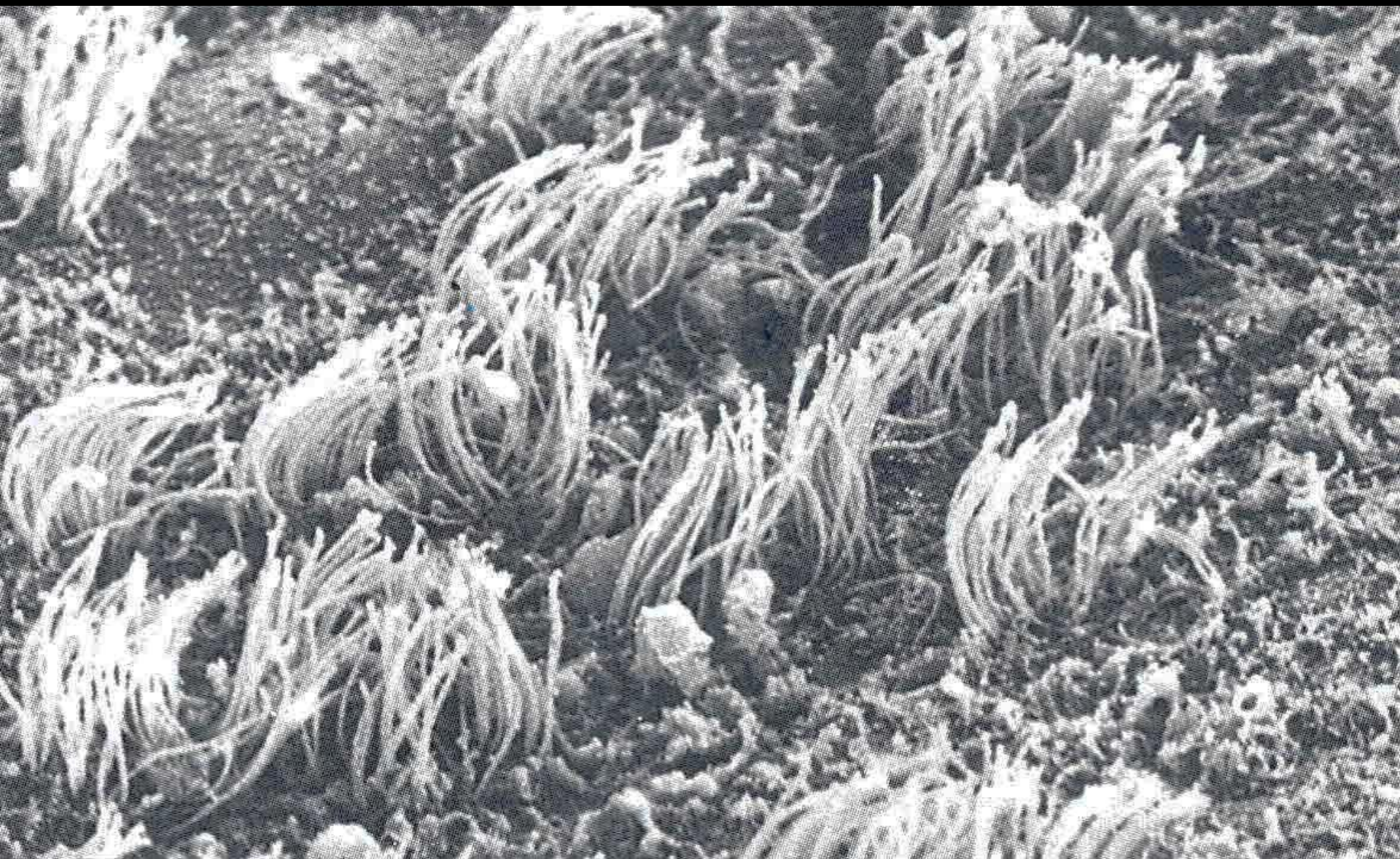


Microglia

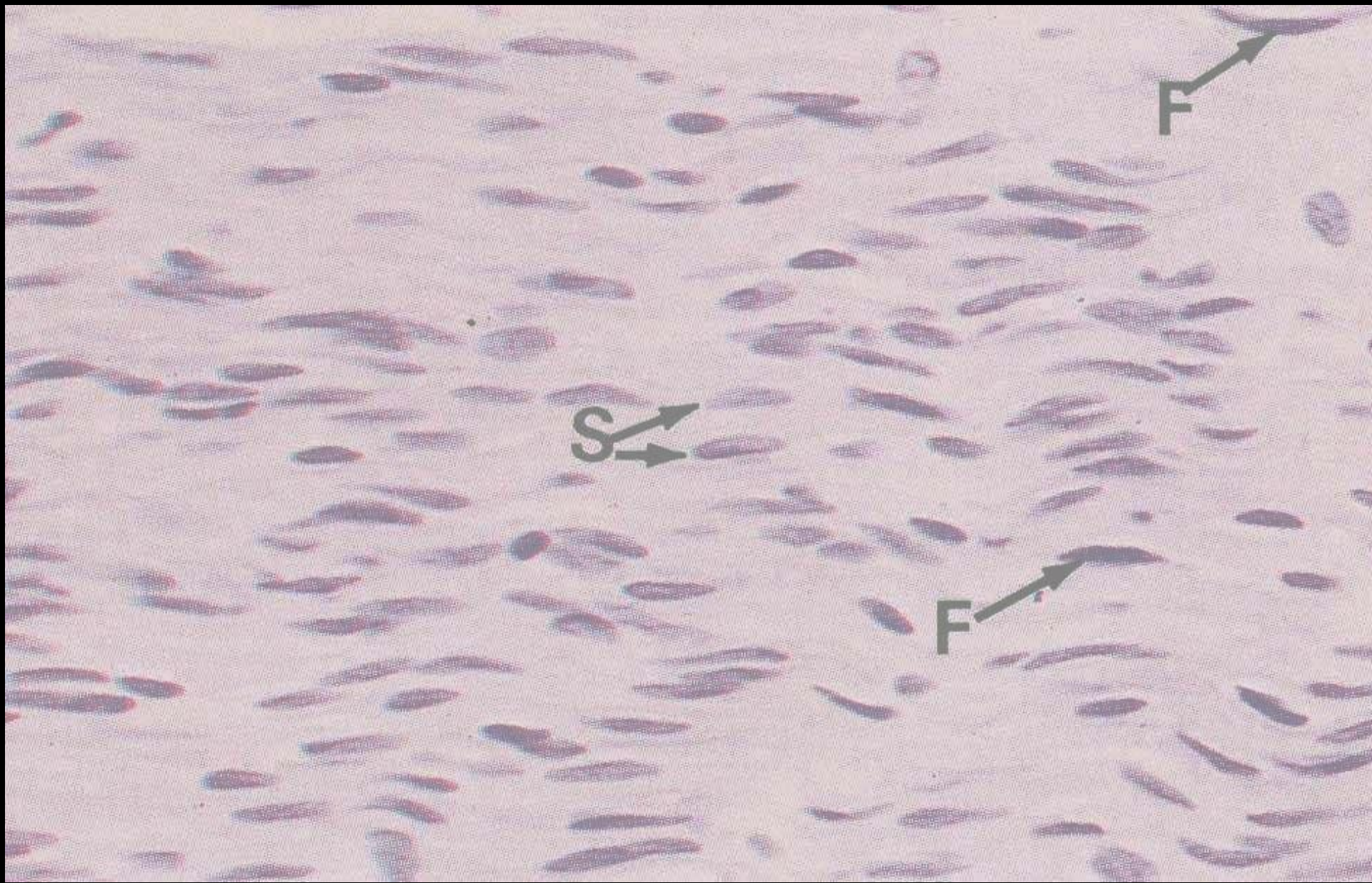


Ependymové buňky



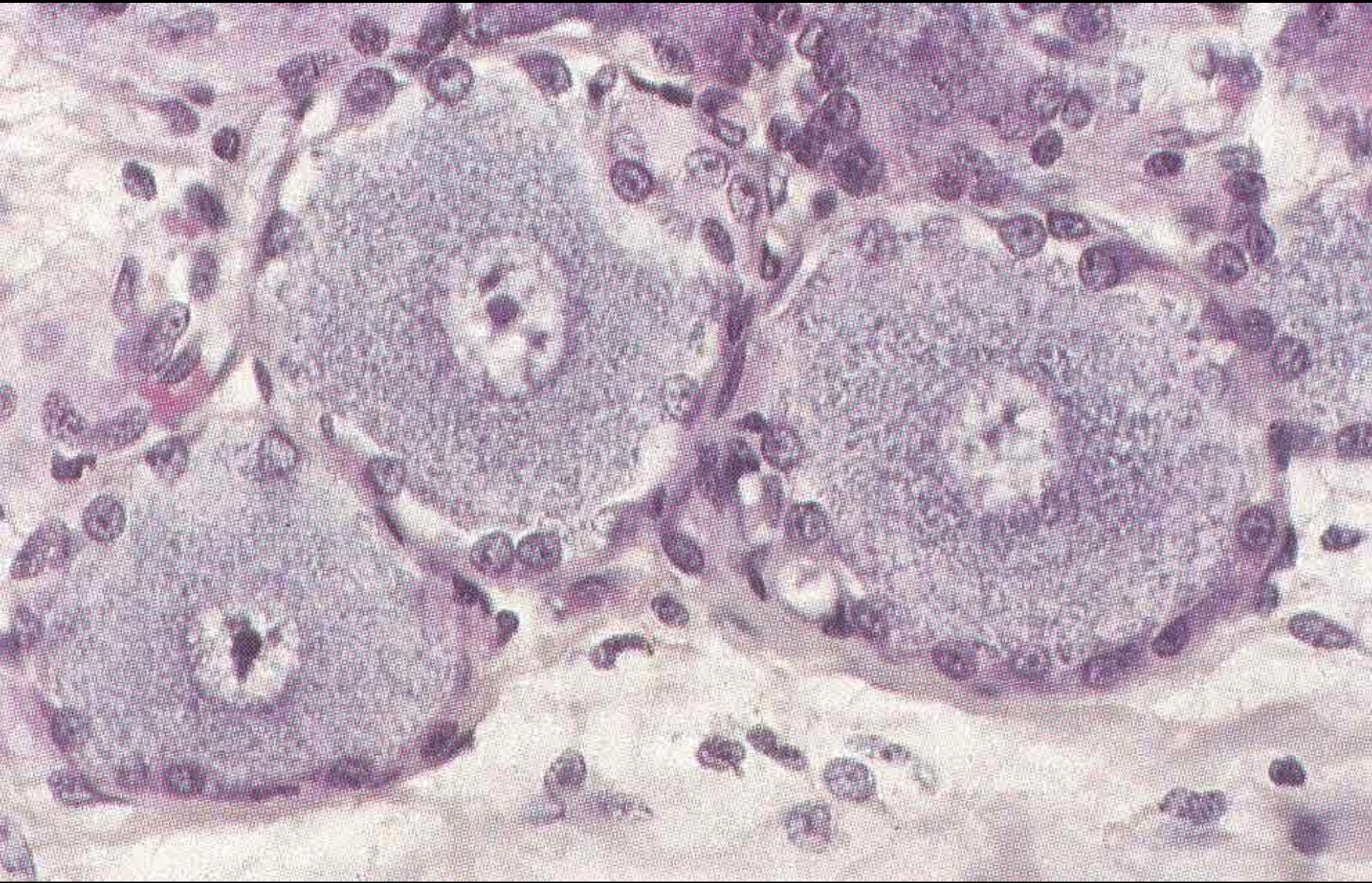


Schwannovy buňky

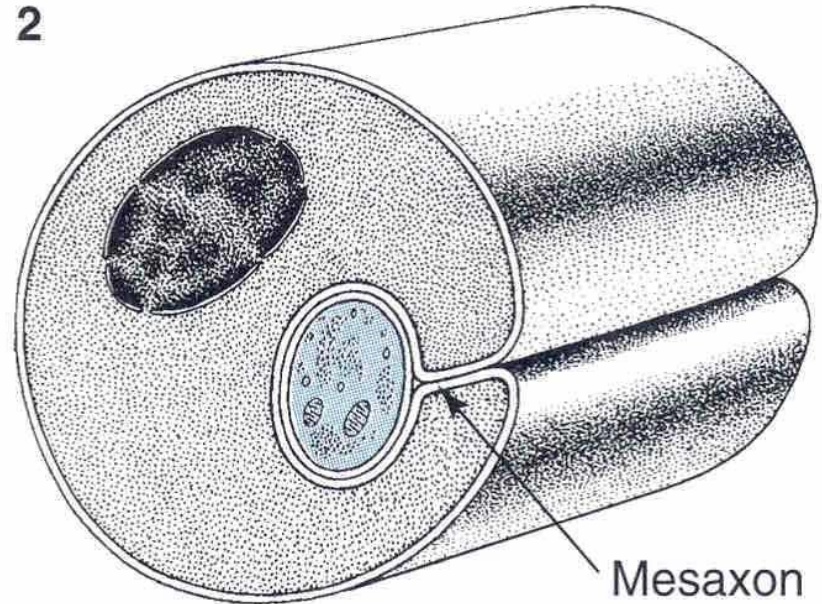
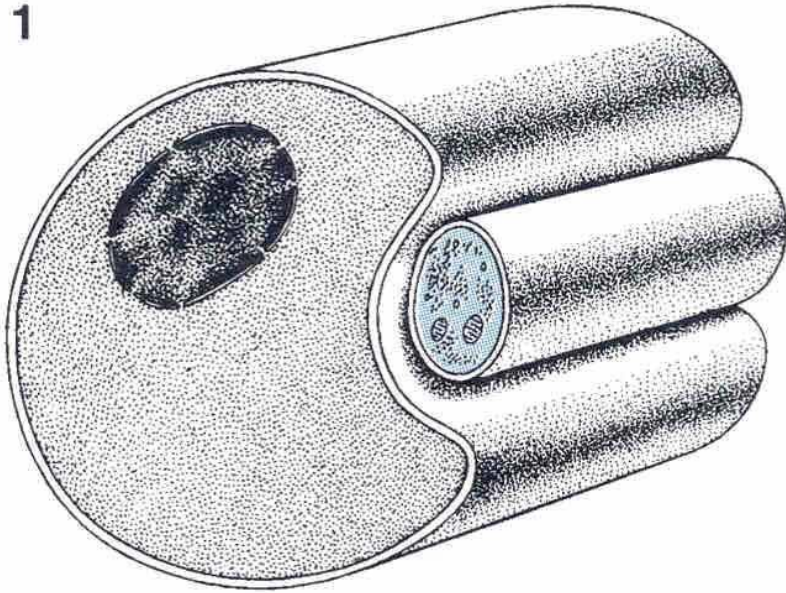




Satelitové buňky

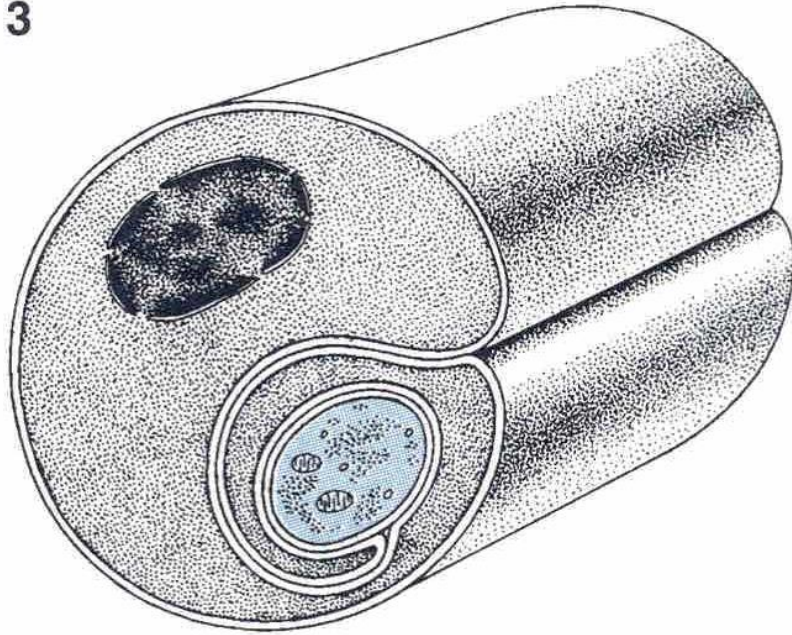


Myelinizace (PNS)

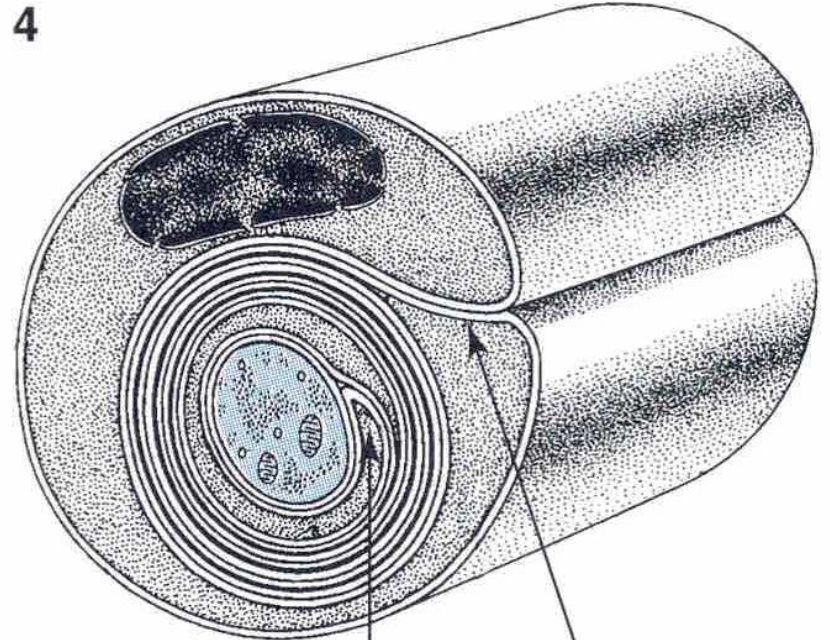


- axon produkuje neuregulin-1 v množství úměrném své tloušťce, Schwannova buňka vnímá signál receptorem
- receptory zprostředkovaná adheze mezi axonem a Schwannovou buňkou (NCAM)

3

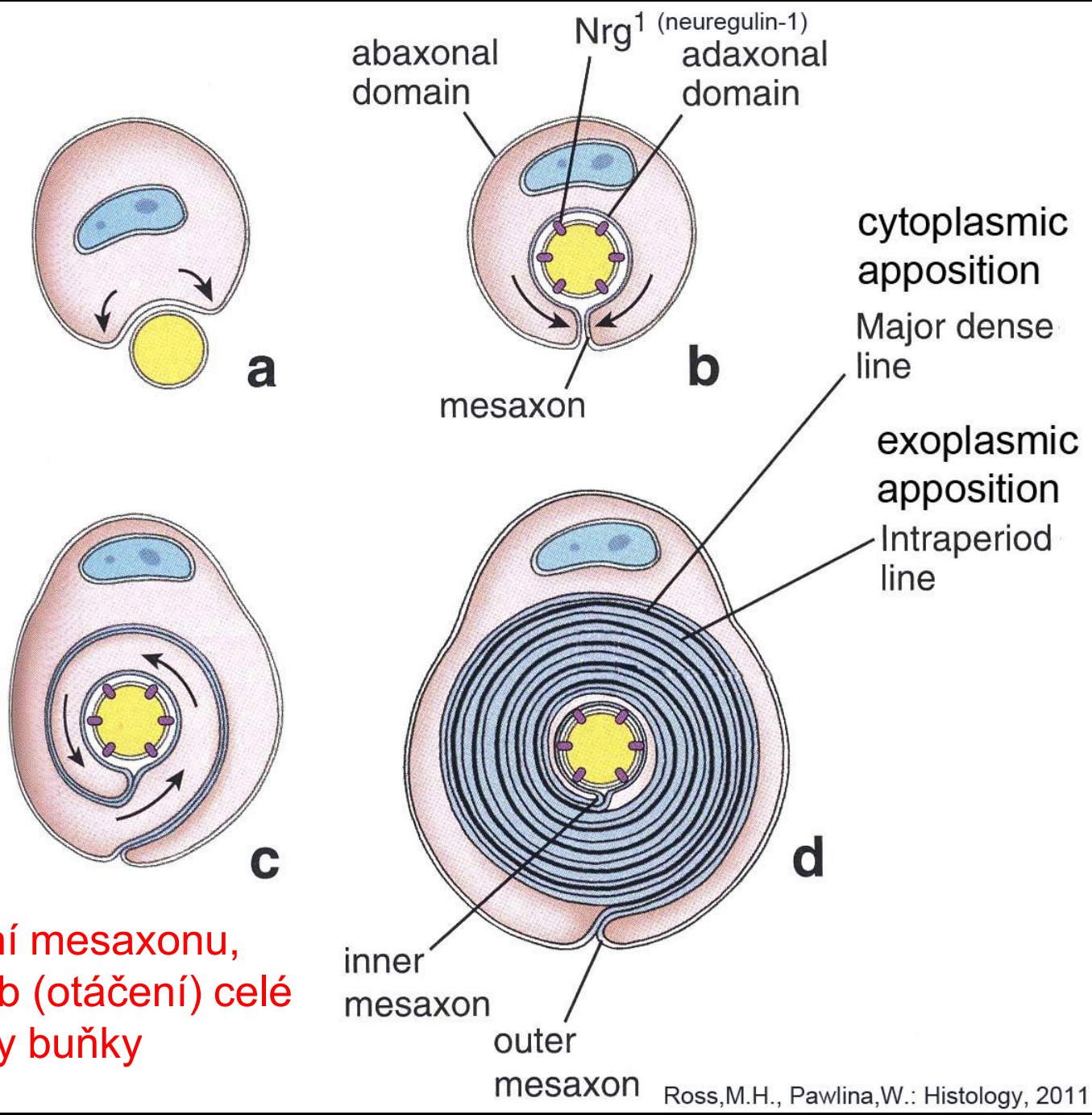


4

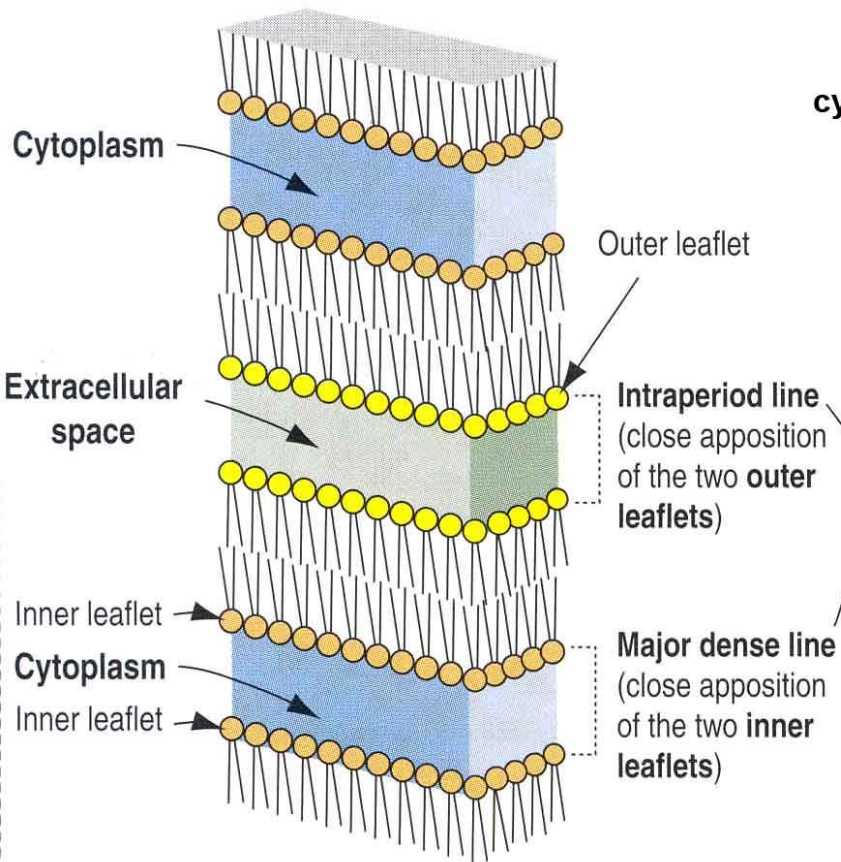


Inner mesaxon

Outer mesaxon

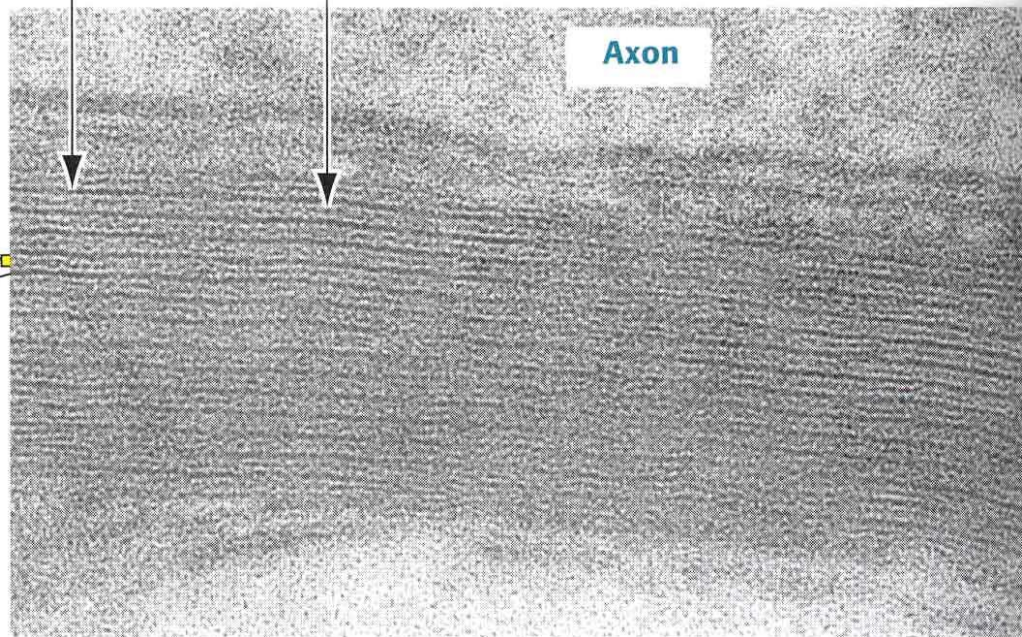


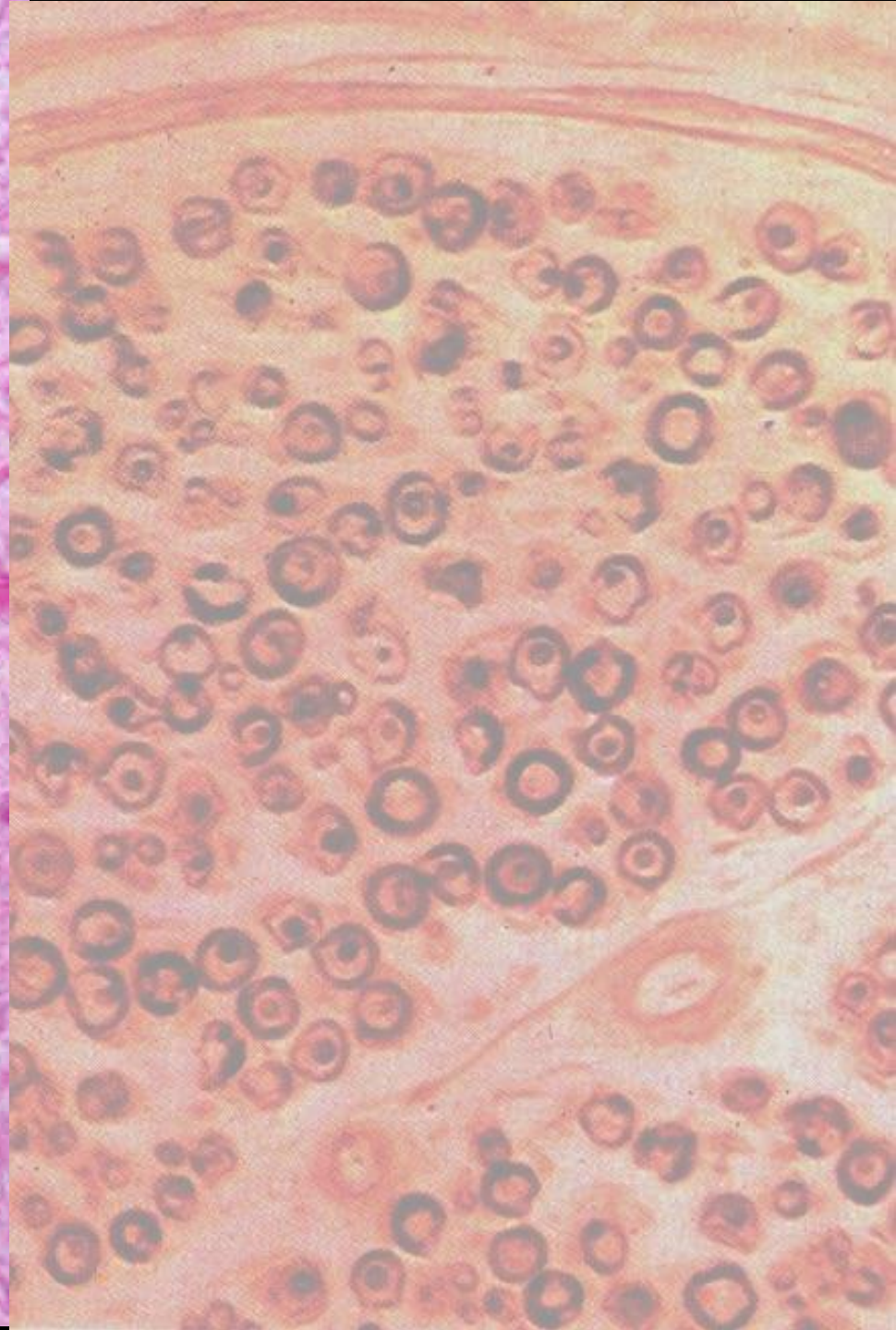
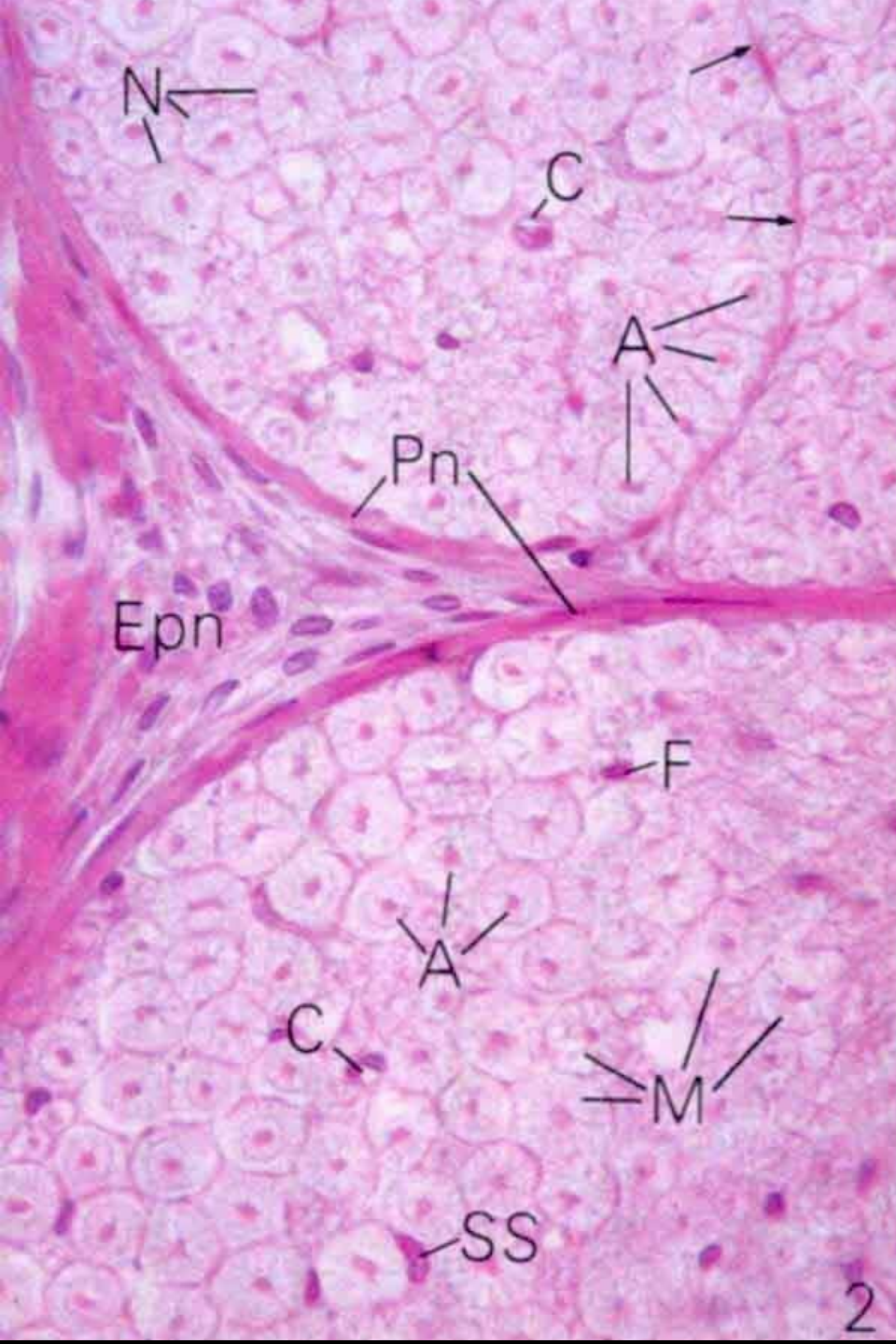
prodlužování mesaxonu,
nikoliv pohyb (otáčení) celé
Schwannovy buňky

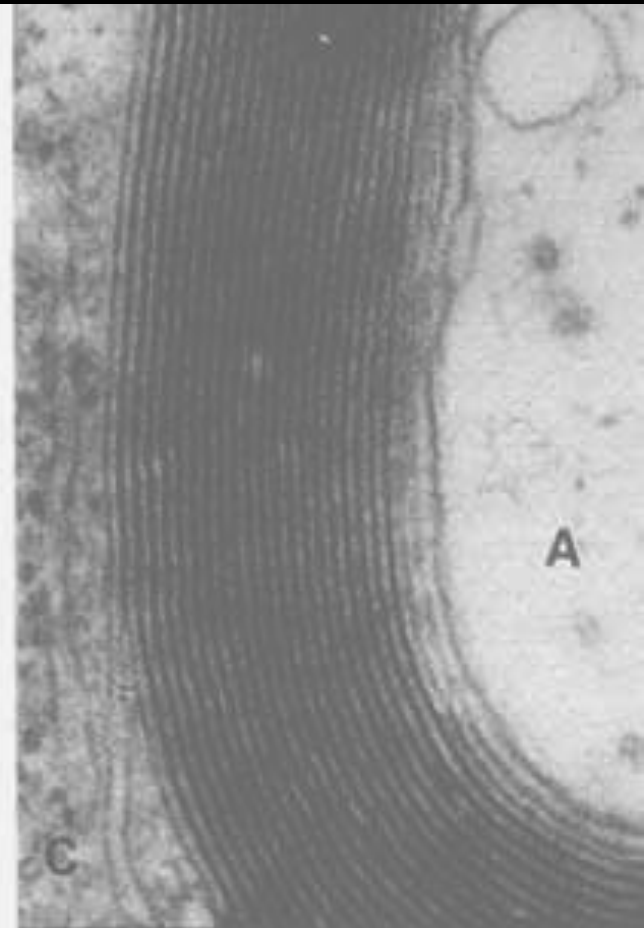
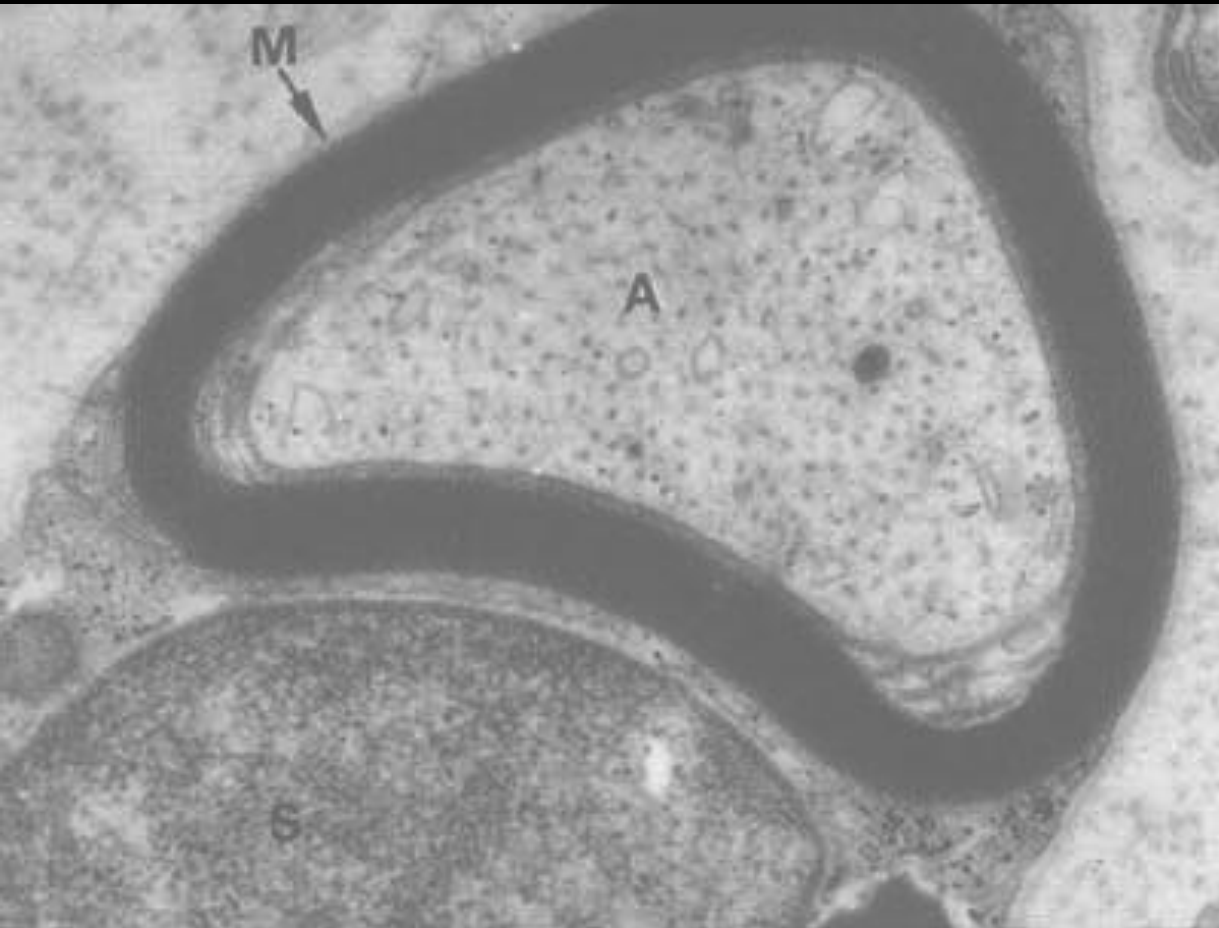


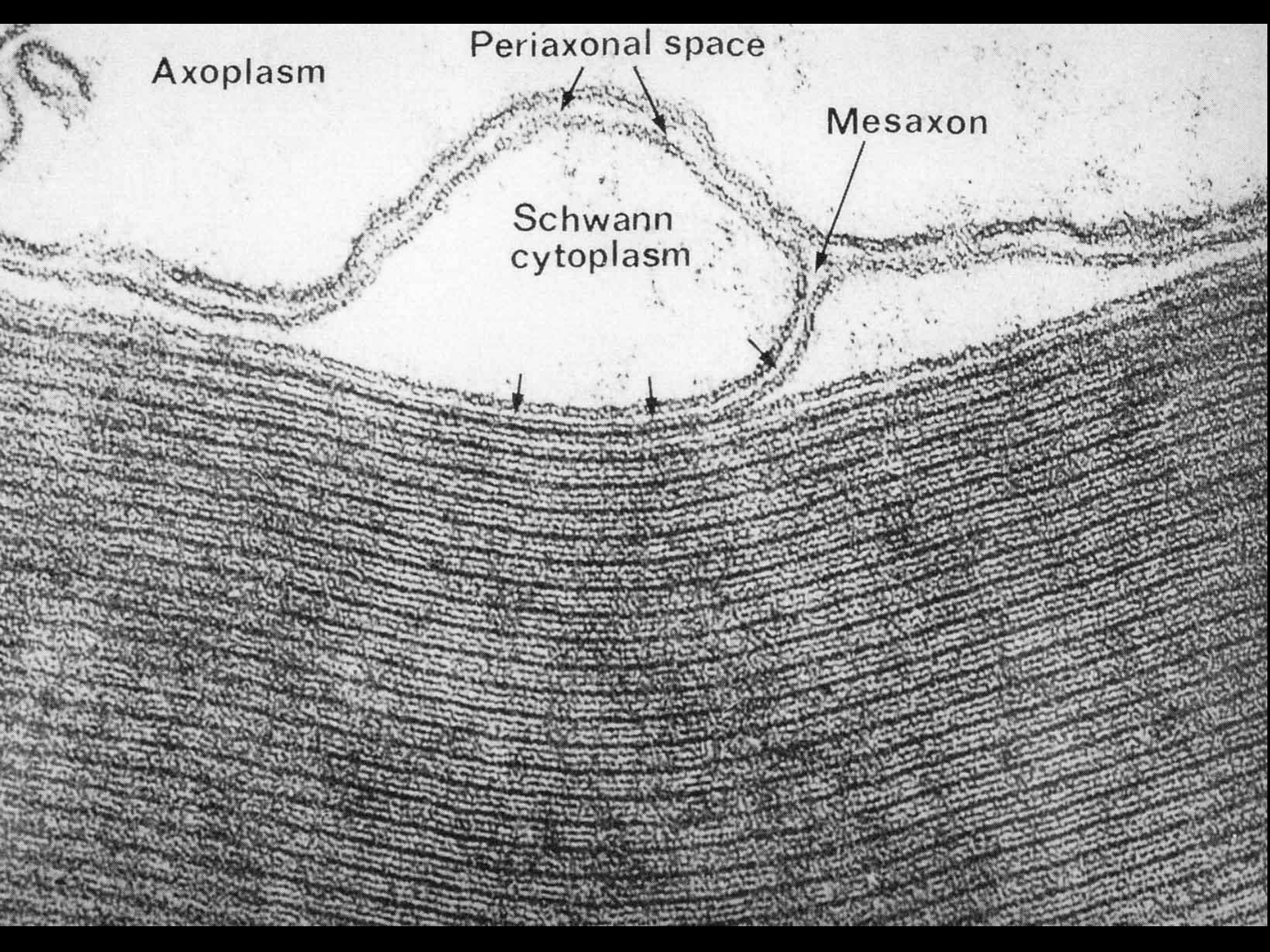
cytoplasmic apposition

exoplasmic apposition









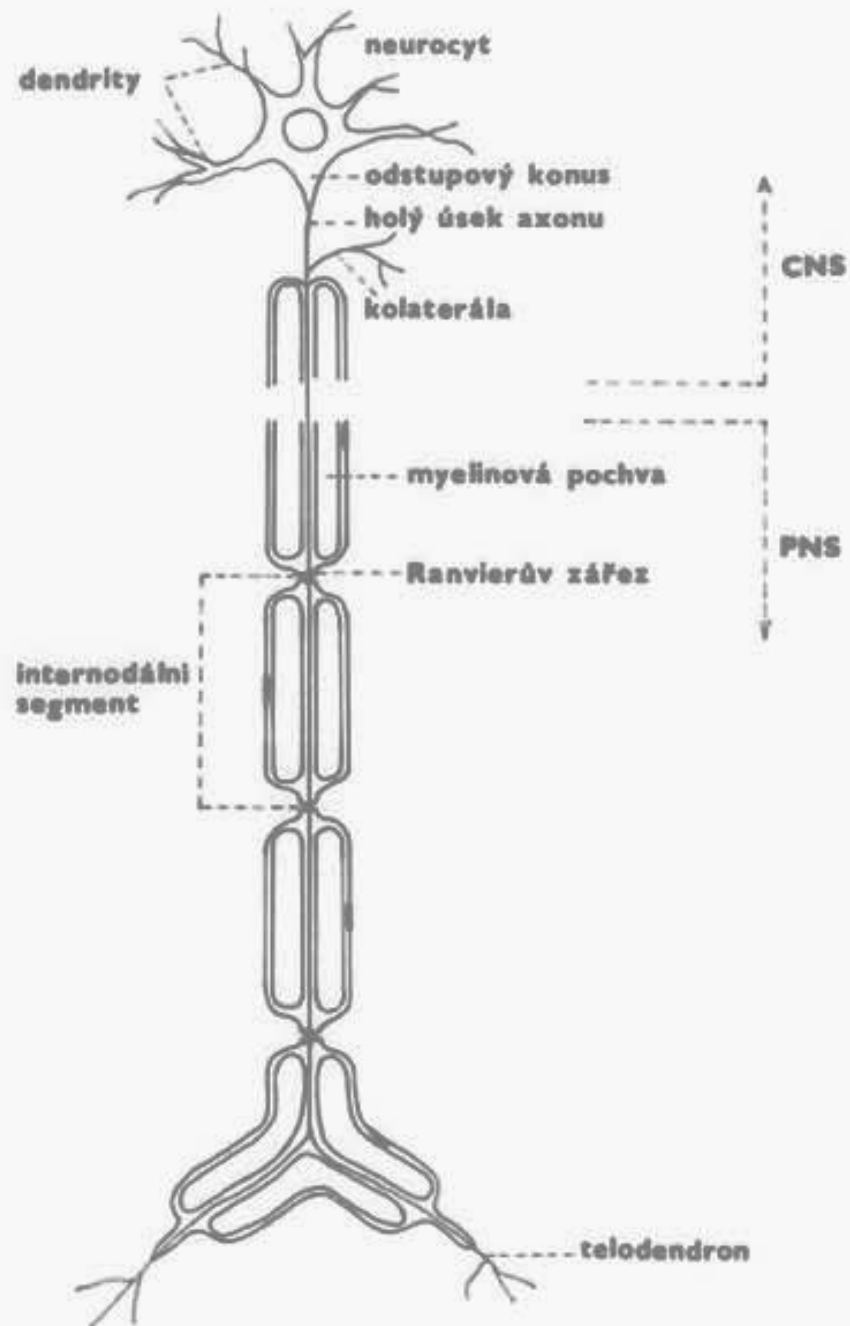
Axoplasm

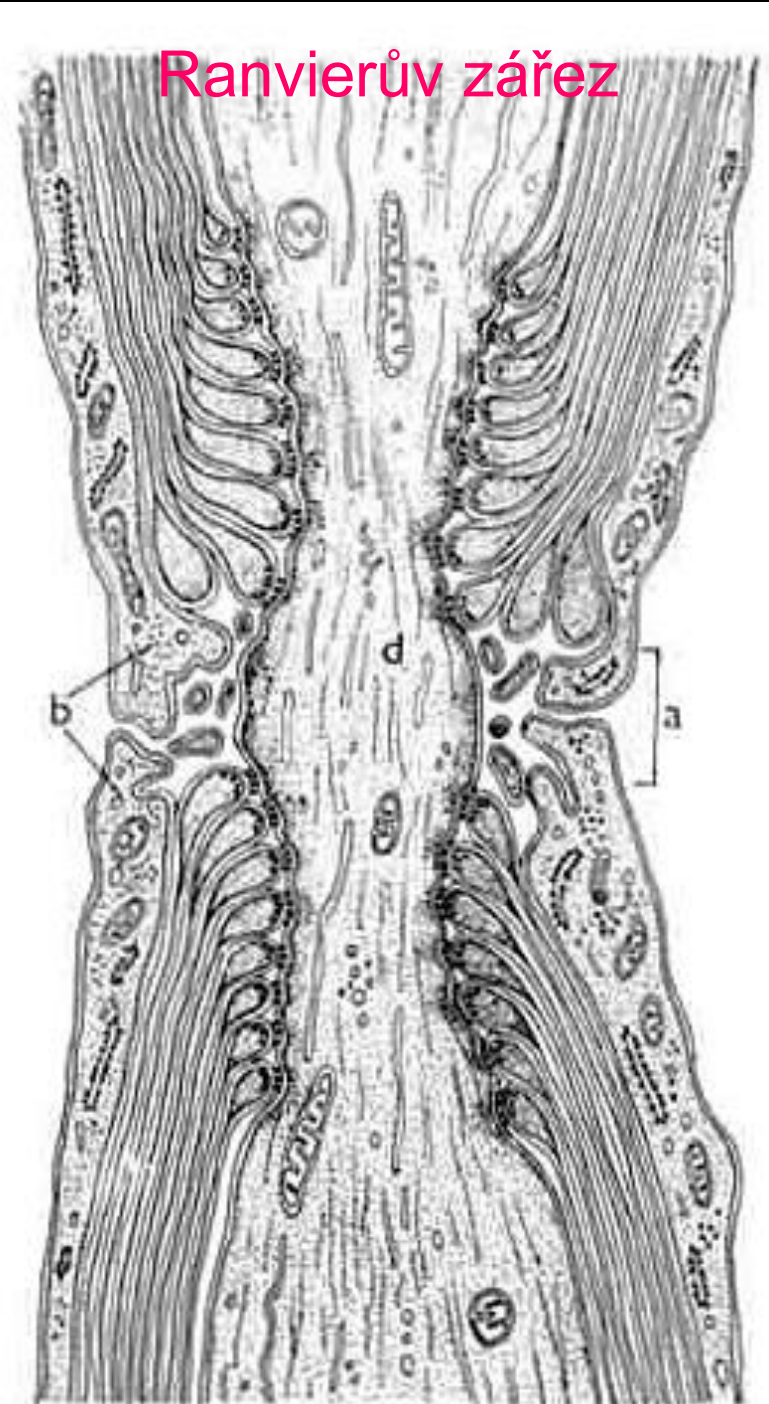
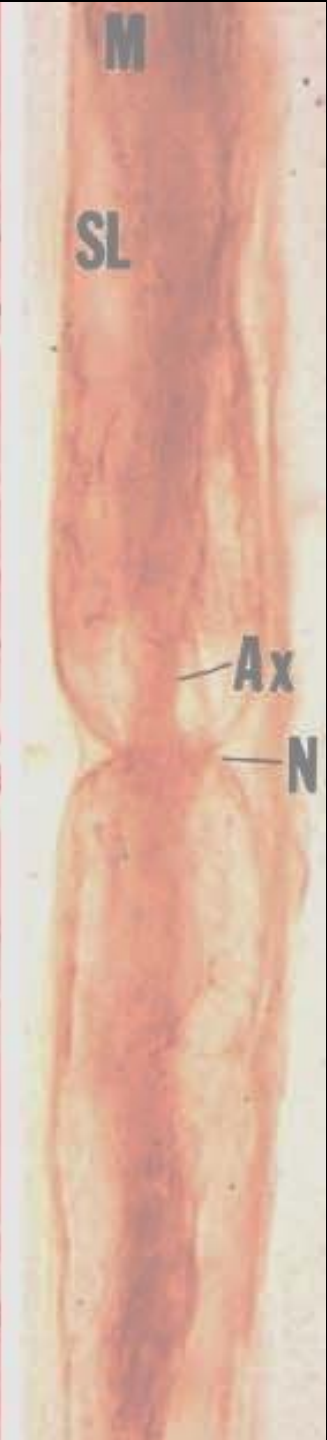
Periaxonal space

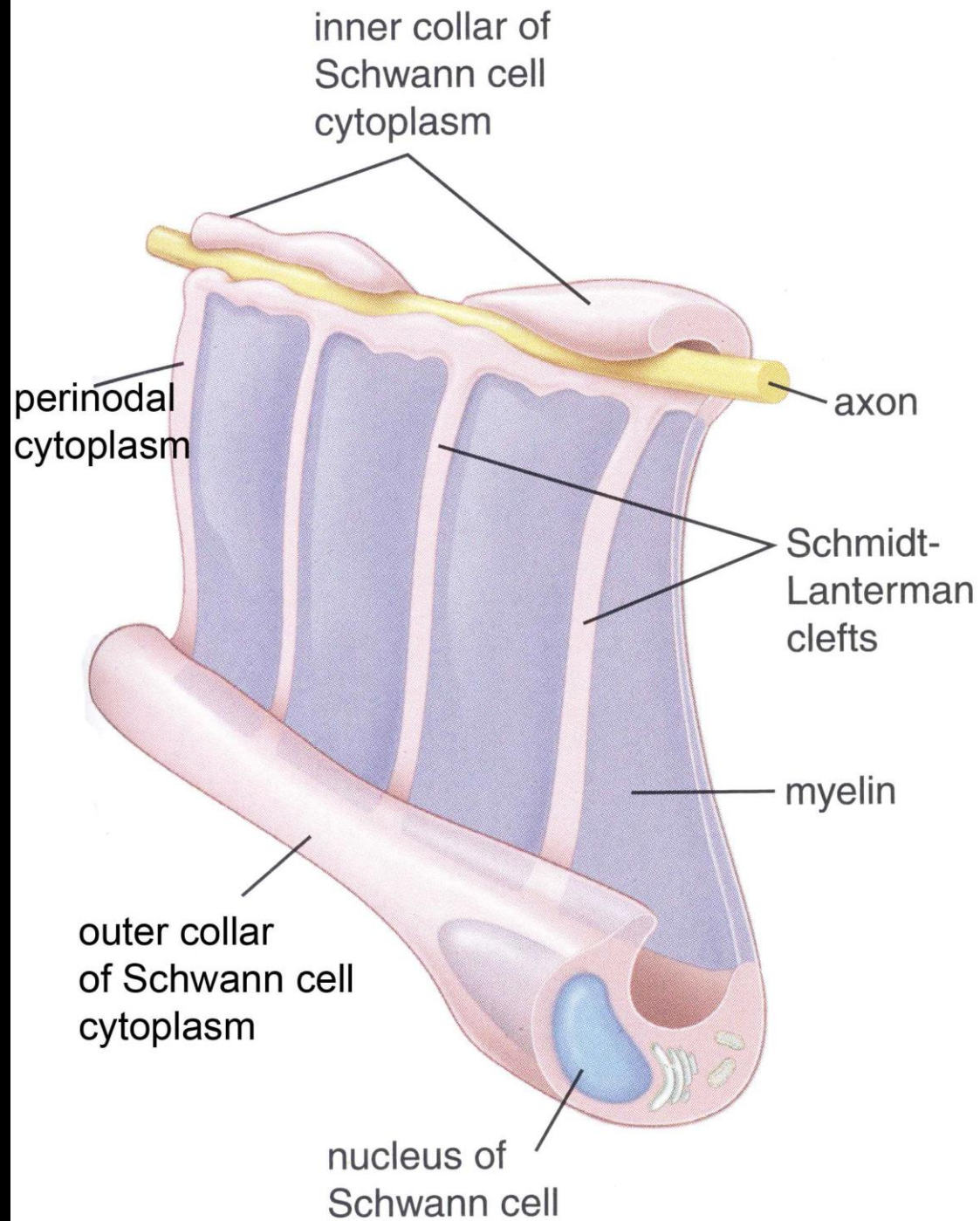
Mesaxon

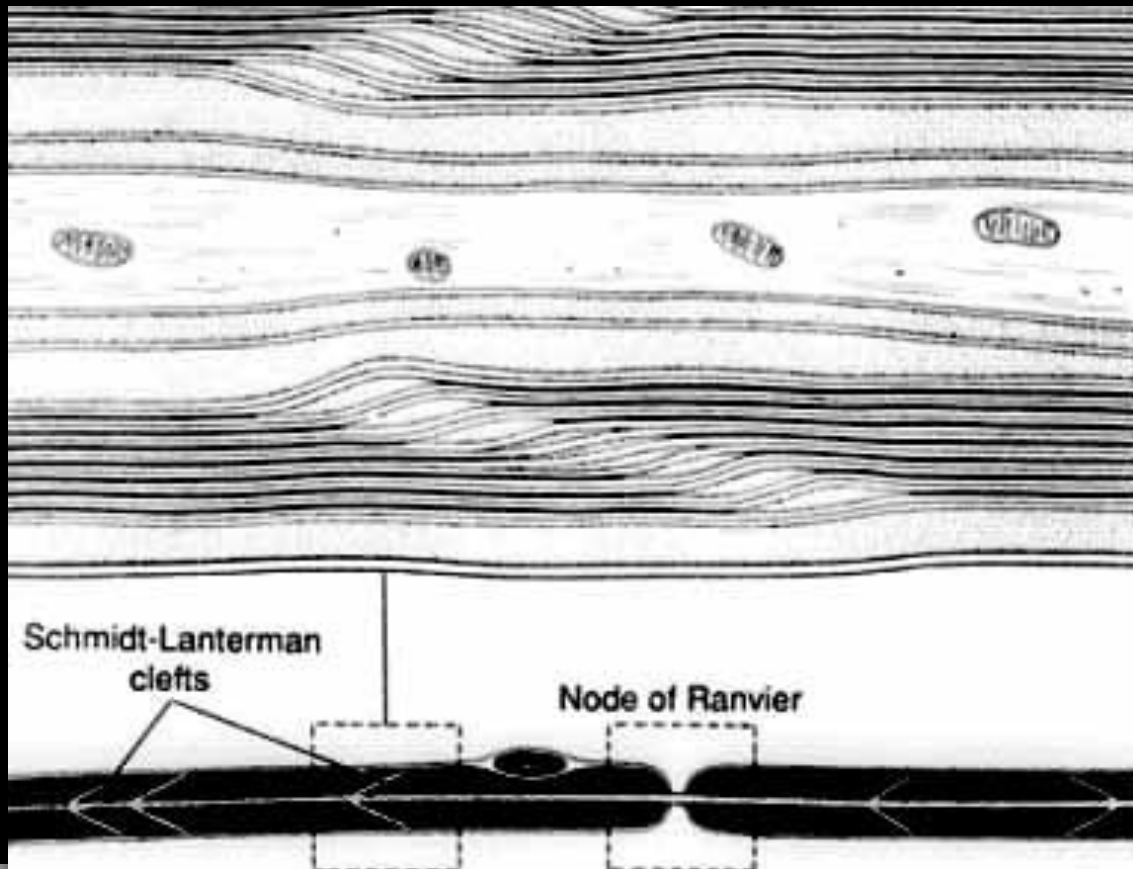
Schwann
cytoplasm

Multipolární neuron s dlouhým axonem





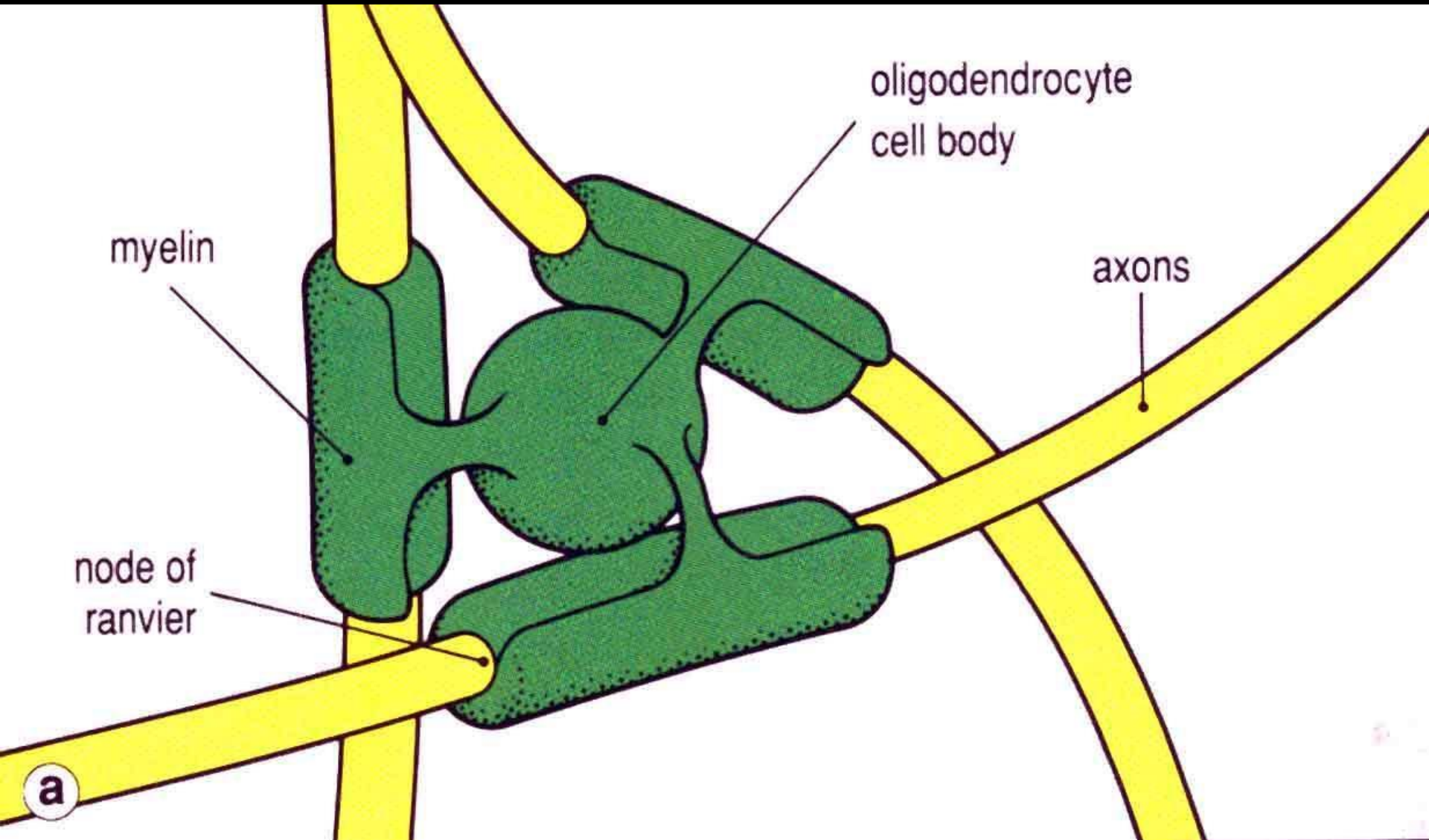


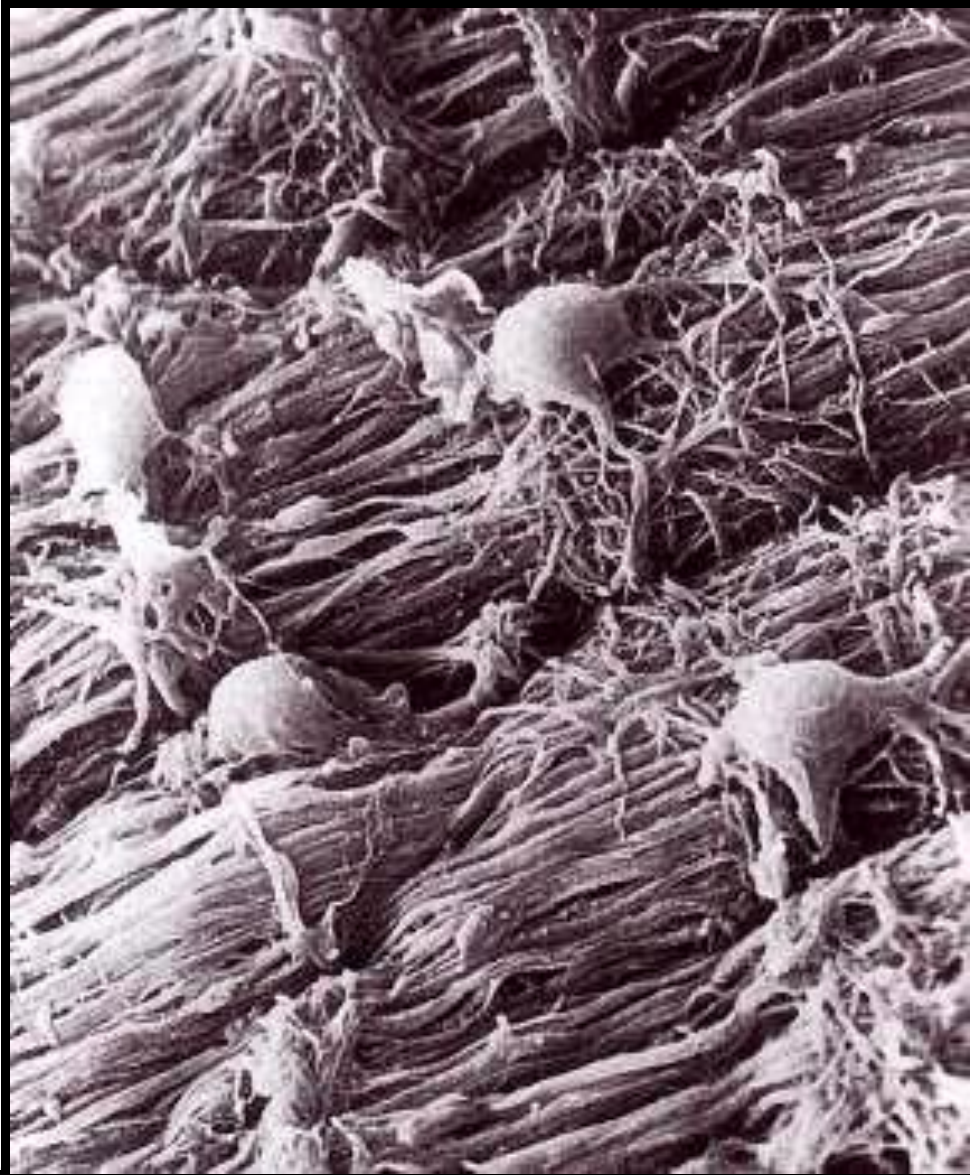
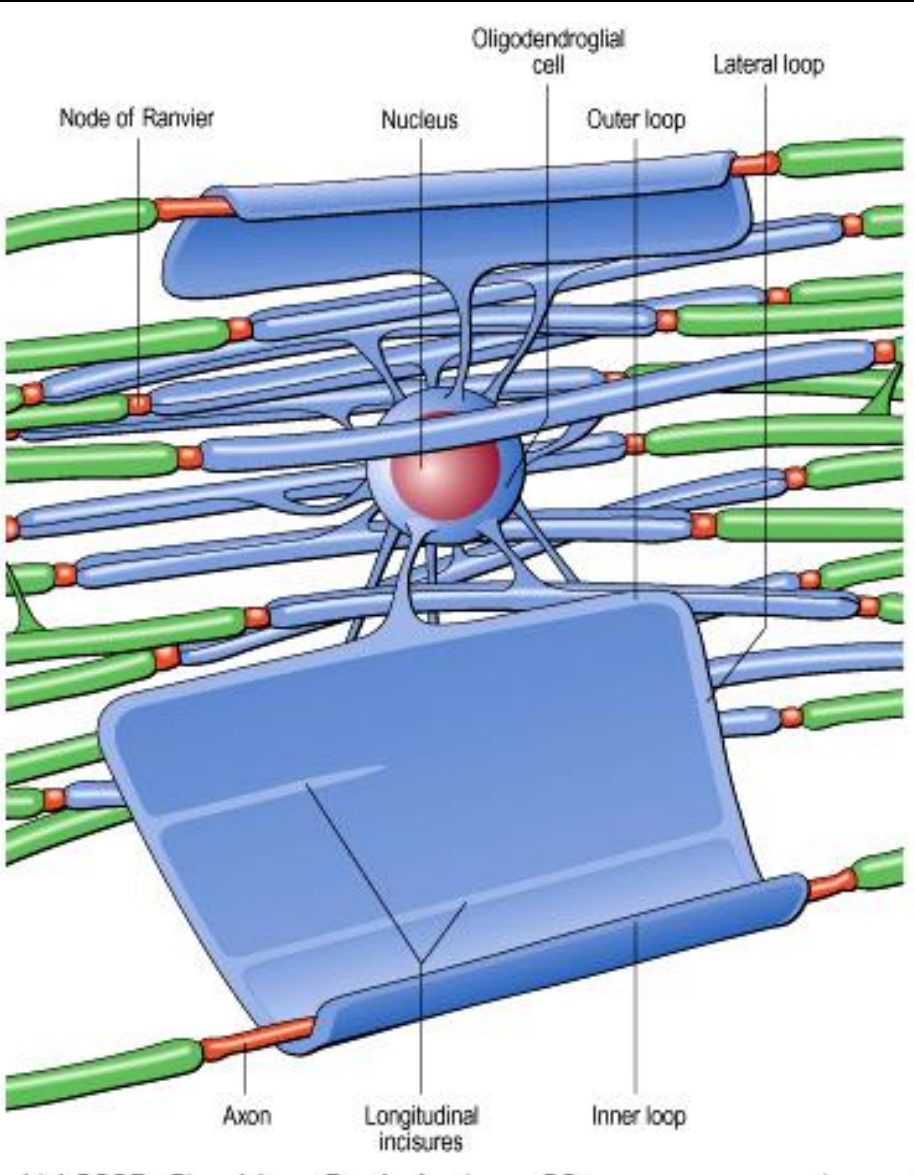


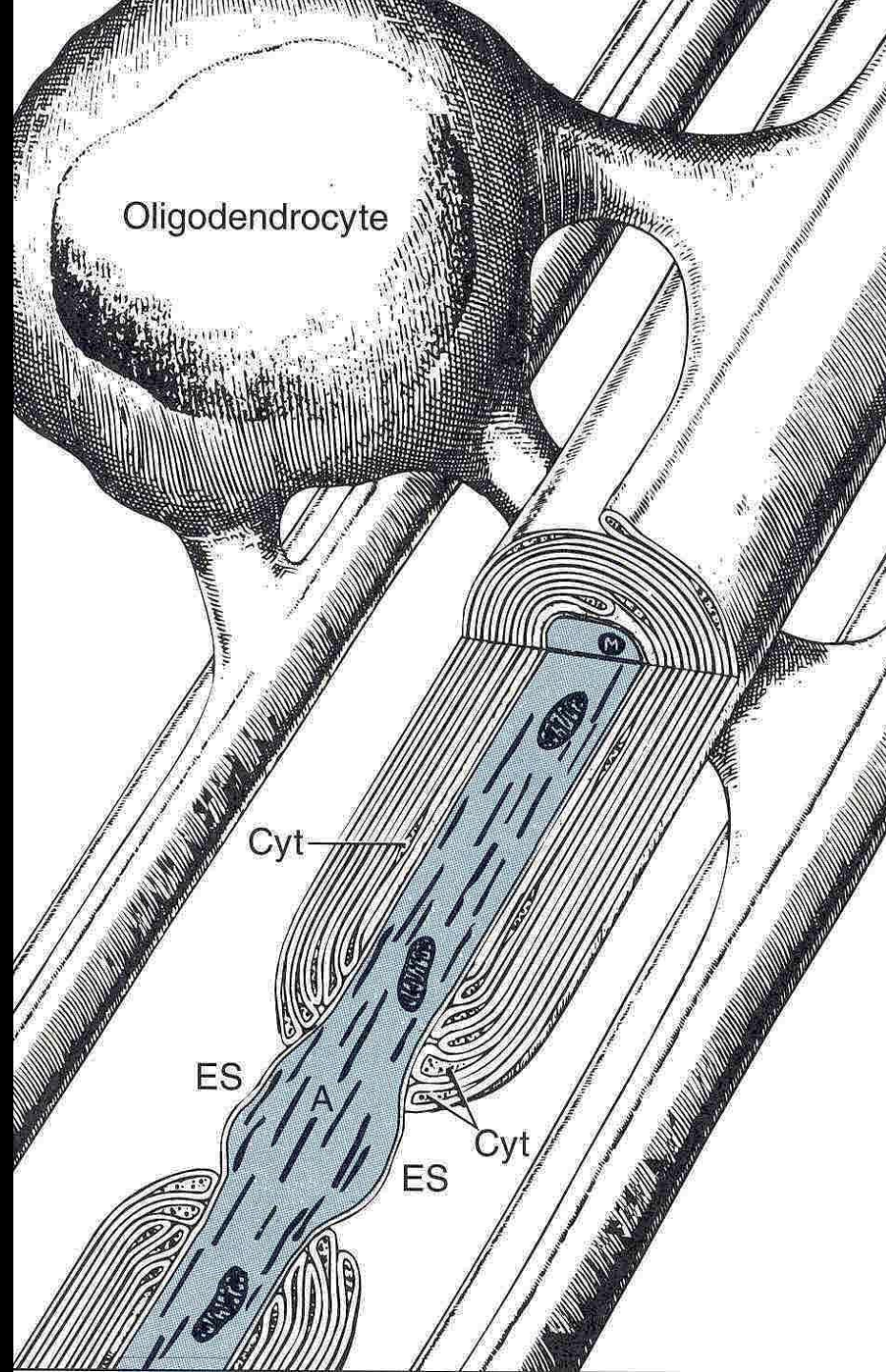
Schmidt – Lantermanovy štěrby

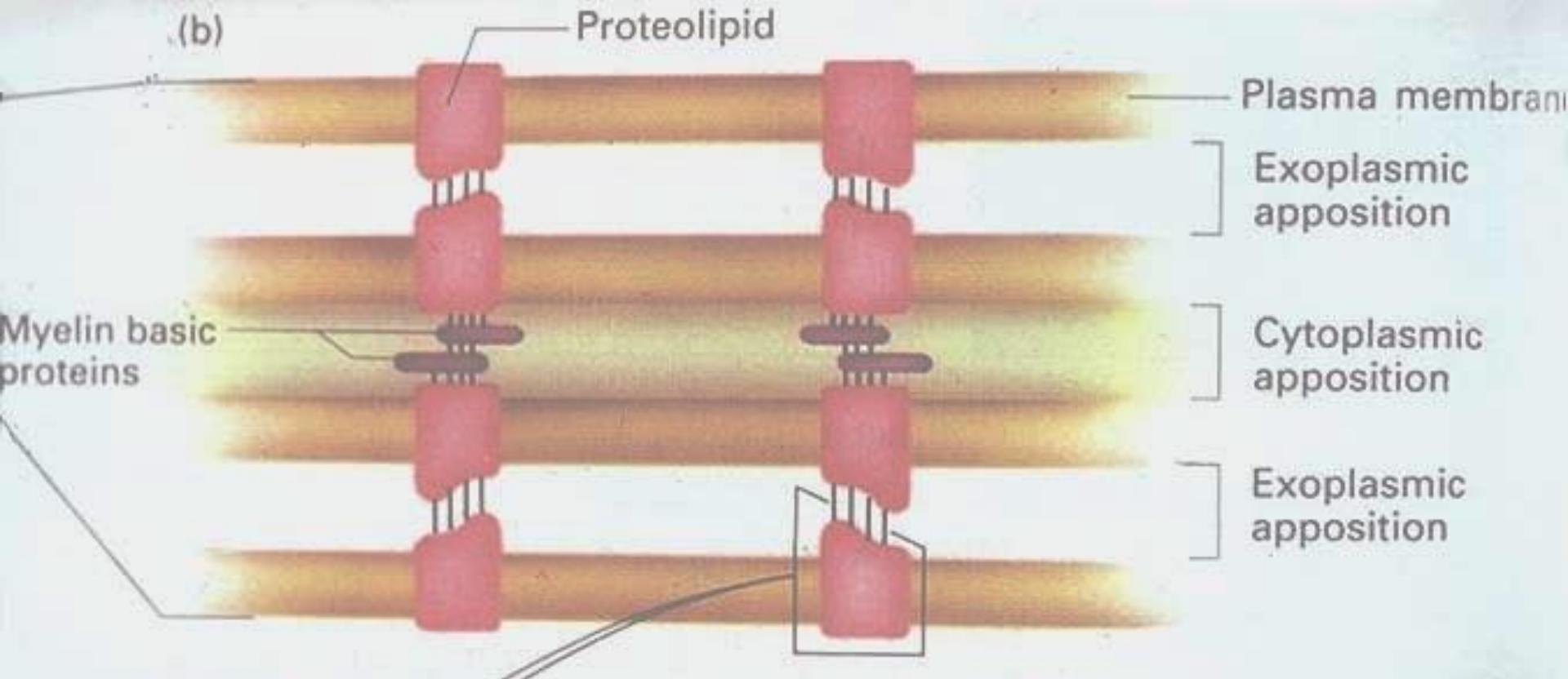


Myelinizace v CNS





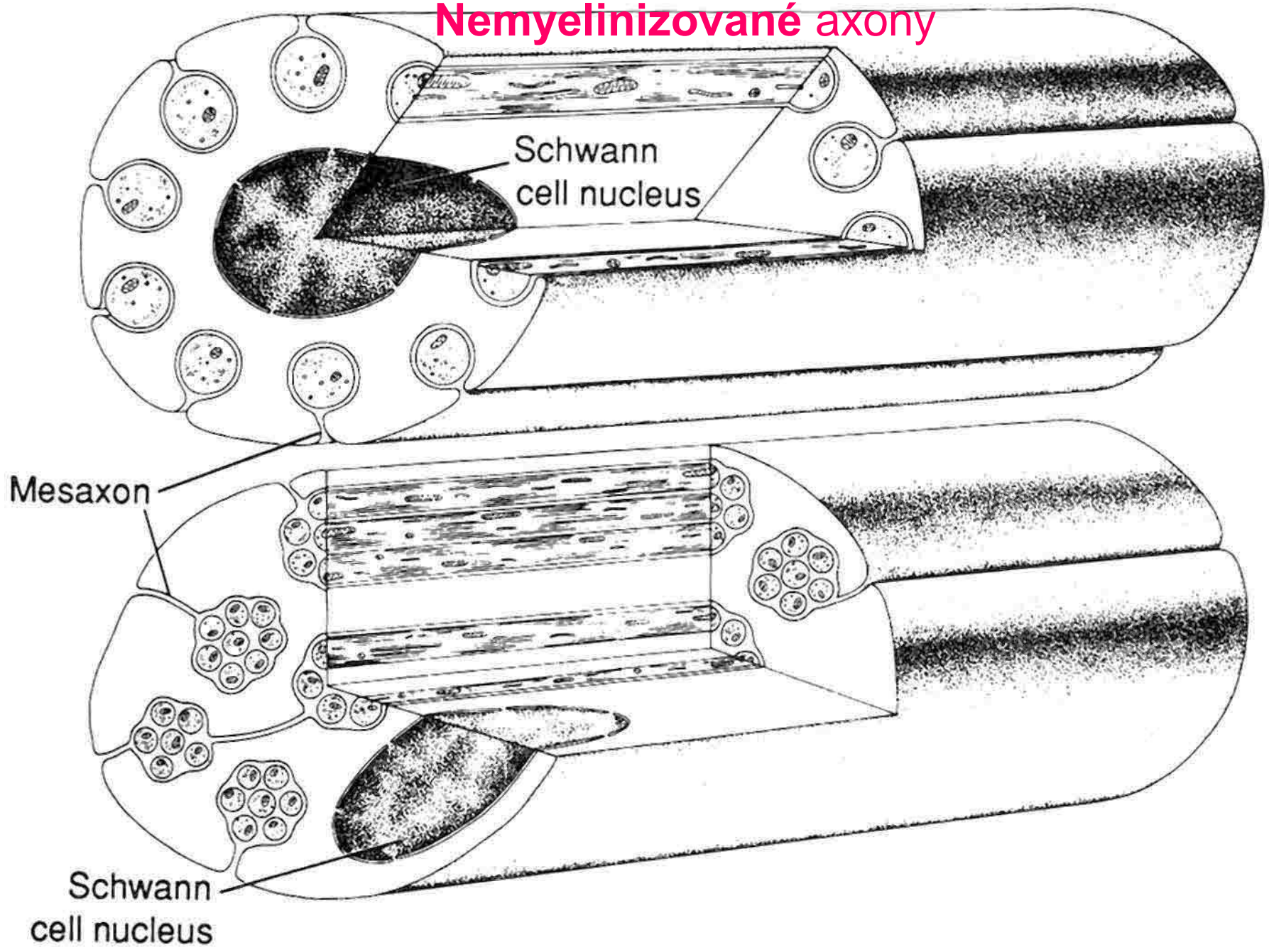




- bazický protein myelinu a oligodendrocytový glykoprotein myelinu (pouze CNS) - cytoplasmatická apozice
- proteolipidový protein 1 – exoplasmatická apozice

destrukce těchto struktur vede k DEMYELINIZACI

Nemyelinizované axony



PNS

