

Tkáň nervová

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

Buňky nervové tkáně

- neurony
- buňky gliové (neuroglie)

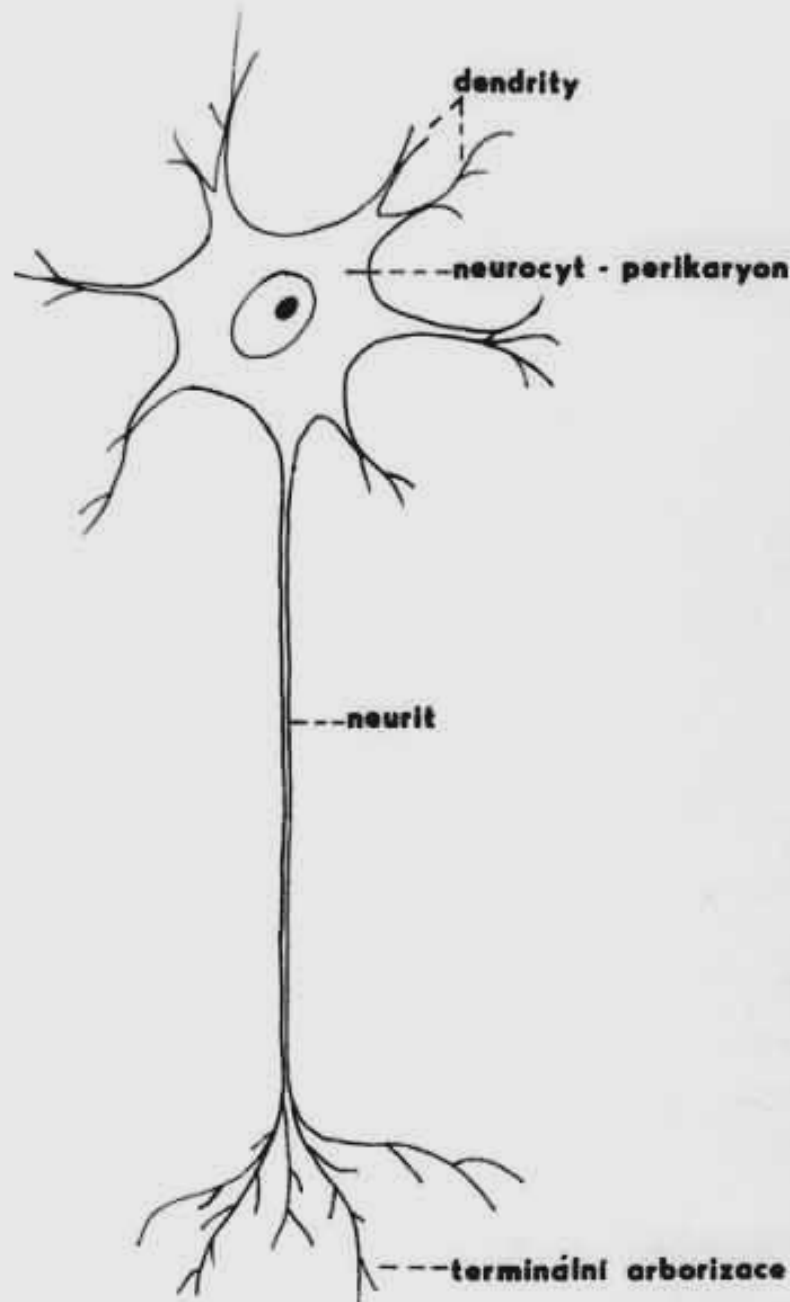
Mezibuněčná hmota

- velmi malé množství
- proteoglykany
(brevikan, neurokan, fofakan, versikan)
- kolagen III a IV (PNS)



Neurony

NEURON



dendrity

neurocyt
(perikaryon,
tělo neuronu)

axon (neurit)

terminální
arborizace

Membránový potenciál

klidový membránový potenciál -65 až -70 mV

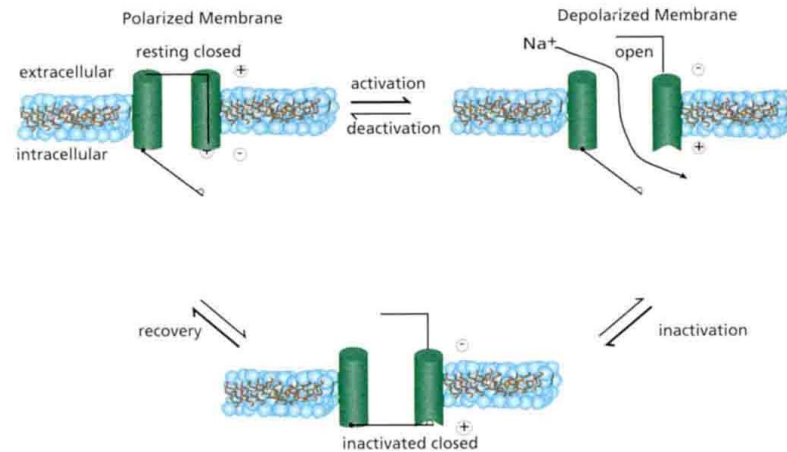
- depolarizace nad -50 mV (Na^+ , Ca^{++} do buňky) = excitace**
- hyperpolarizace pod -70 mV (K^+ z buňky, Cl^- do buňky) = inhibice**

propagace změny membránového potenciálu = impuls

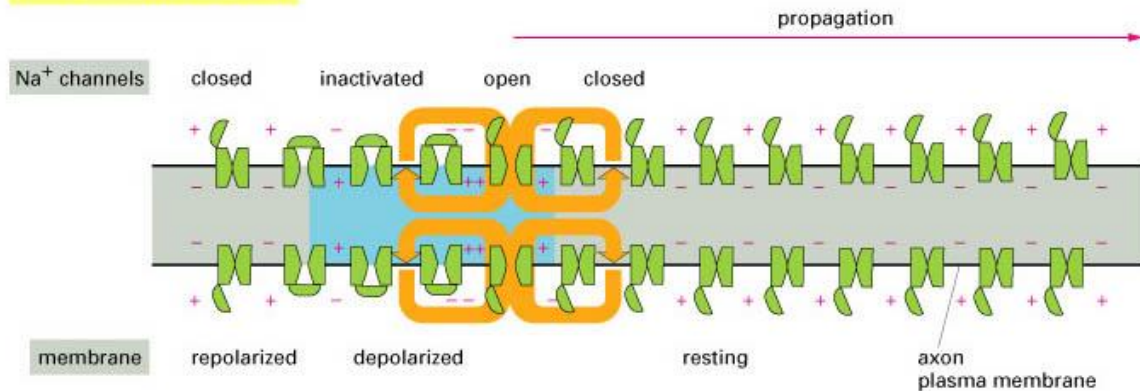
- excitační/inhibiční potenciál - na dendritech a těle, šíření s dekrementem a všemi směry**
- akční potenciál - pouze na axonech, šíření bez dekrementu a pouze celulifugálně, k vybavení potřebná sumace asi 200 impulsů, dojde ke krátkodobé depolarizaci na $+30$ až $+50$ mV**

Akční potenciál

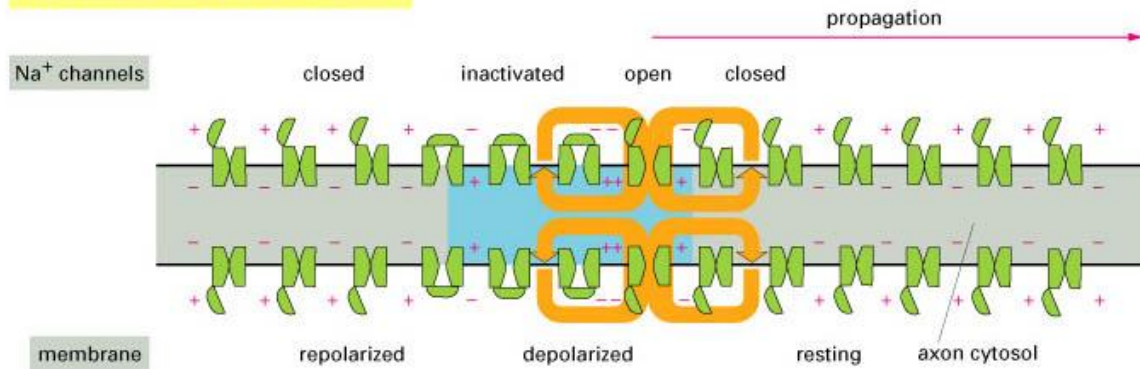
Voltage-Gated Ion Channel: Activation States



(B) instantaneous view at $t = 0$



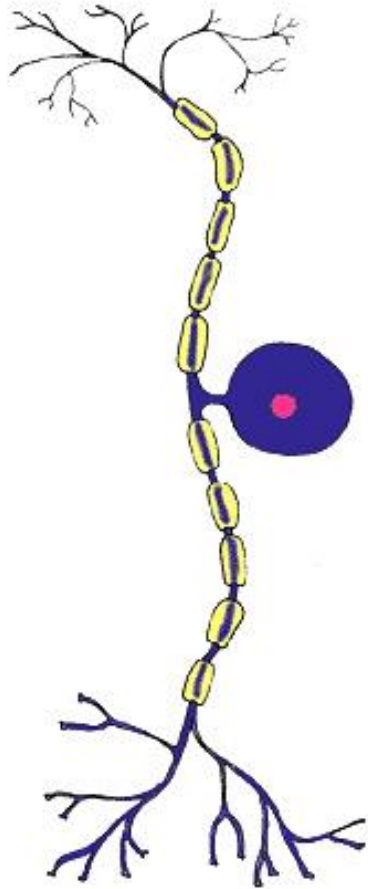
instantaneous view at $t = 1 \text{ msec}$



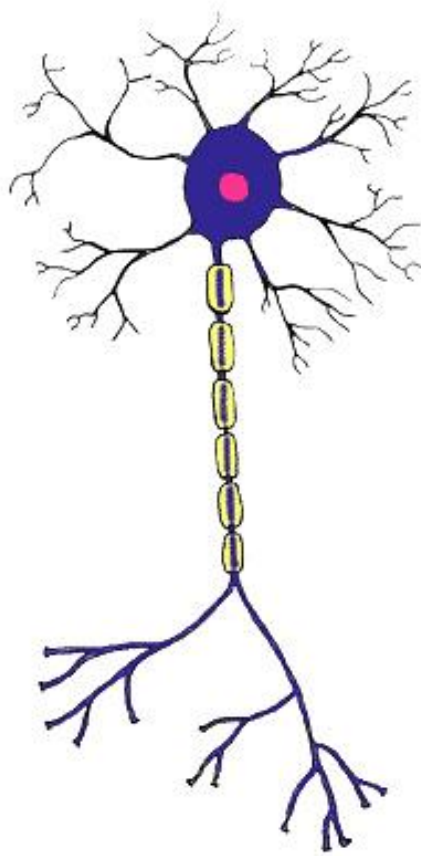
Klasifikace neuronů

- podle počtu výběžků

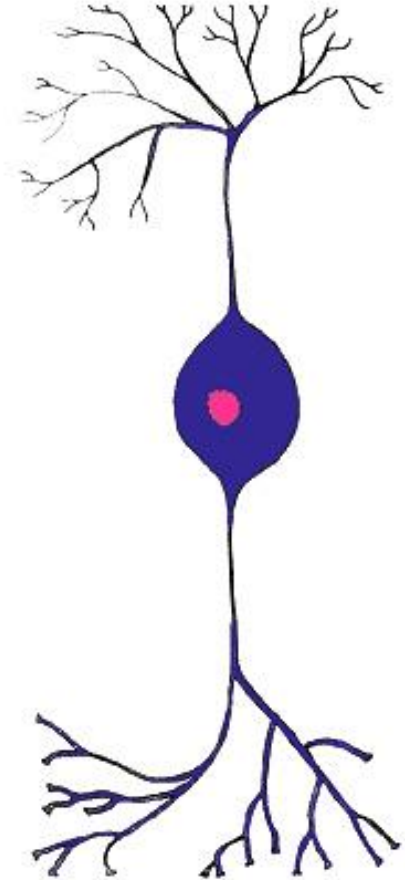
- bipolární
- multipolární
- pseudounipolární



PSEUDOUNIPOLÁRNÍ



MULTIPOLÁRNÍ



BIPOLÁRNÍ

Klasifikace neuronů

-podle délky axonu

-Golgiho typ I

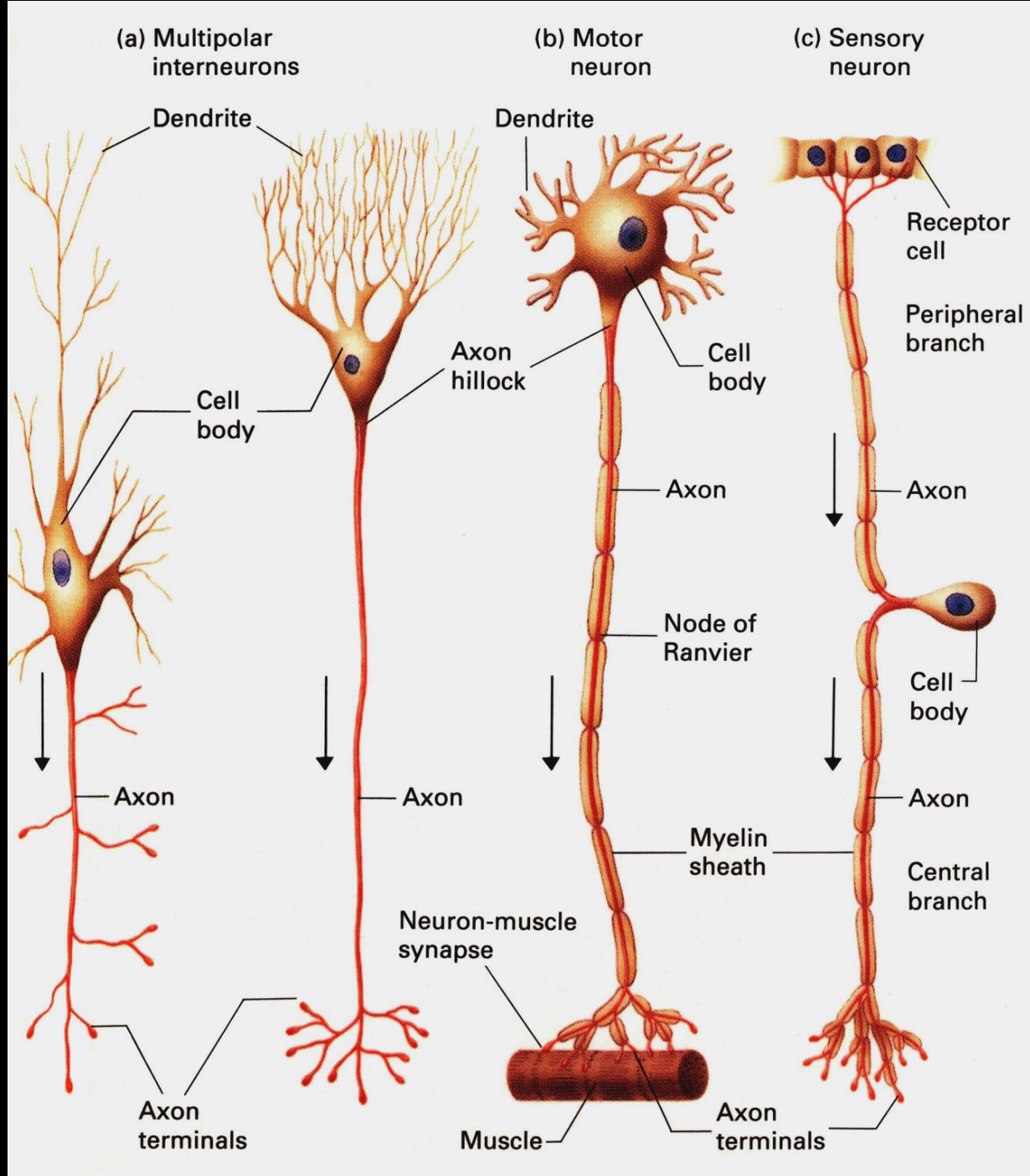
-Golgiho typ II

-podle funkce

- aferentní (senzitivní)

- eferentní (motorické)

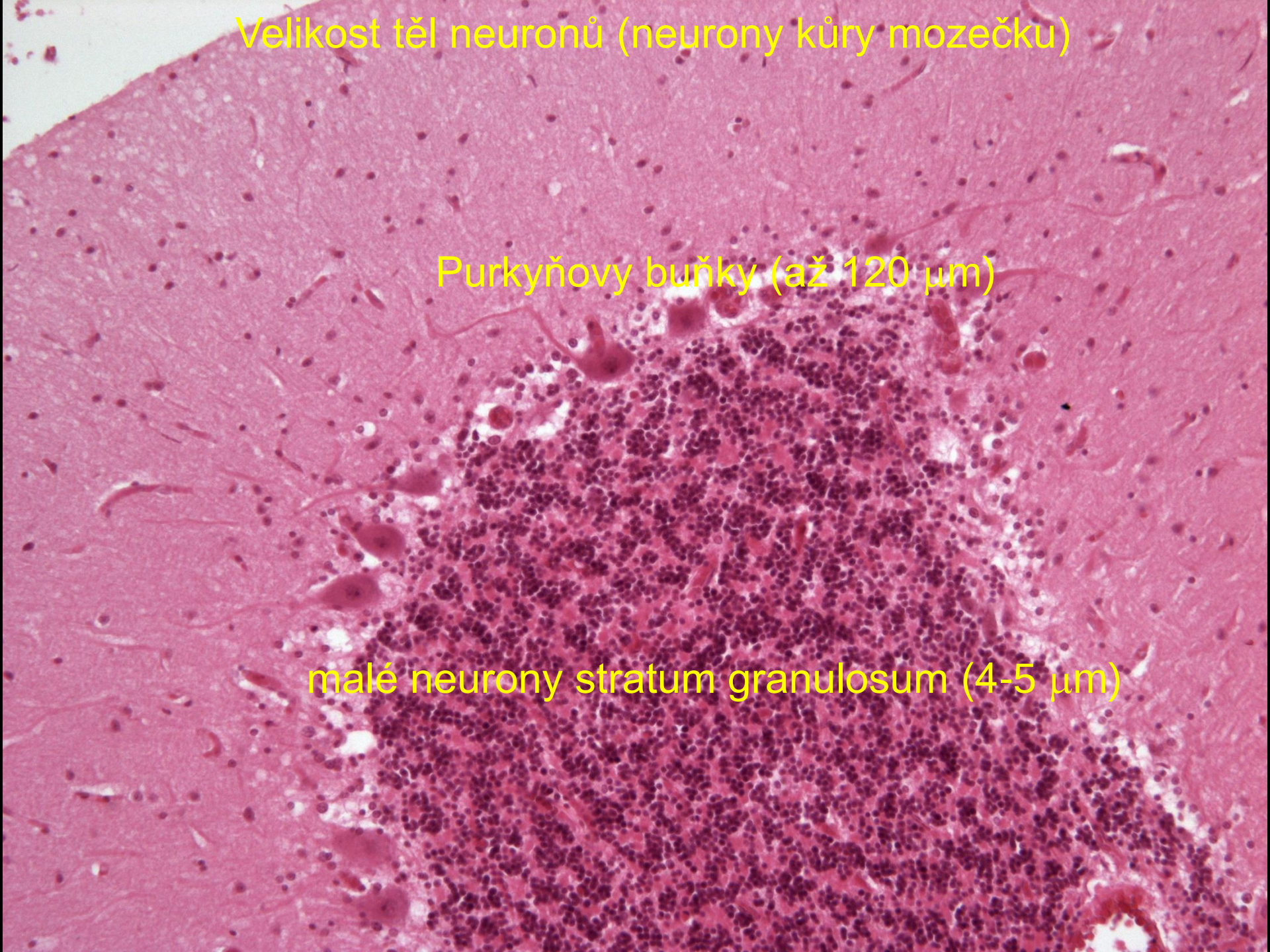
- interneurony



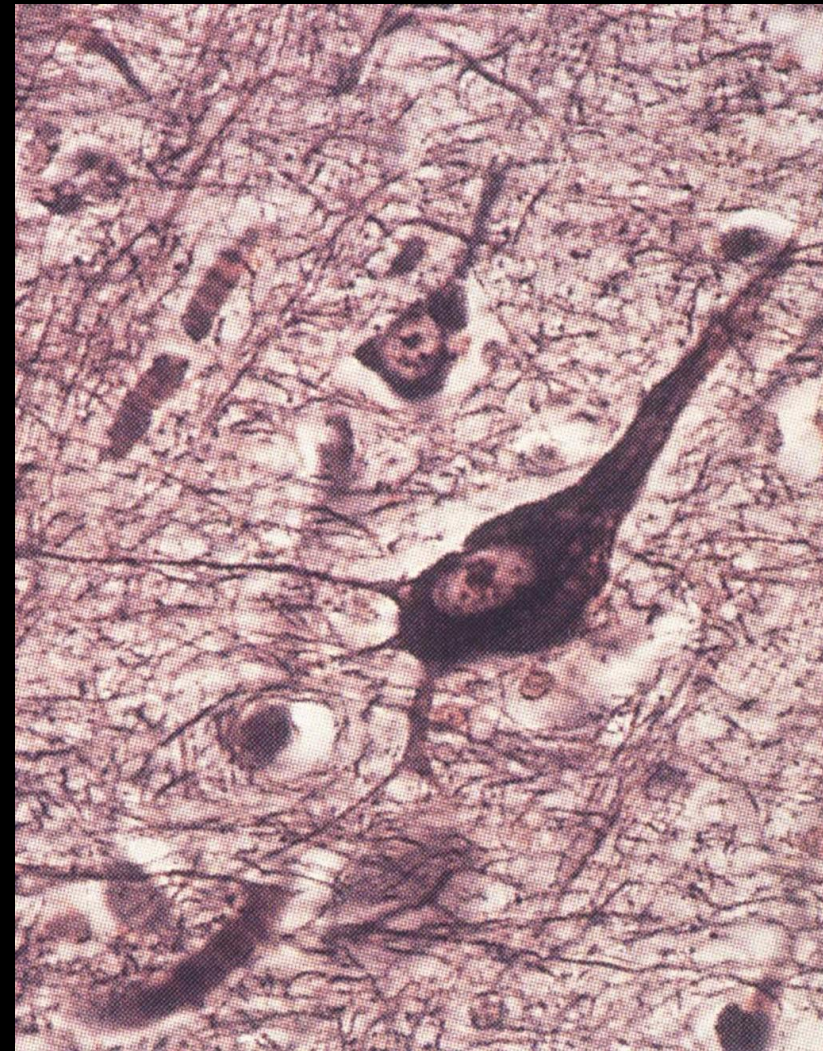
Velikost těl neuronů (neurony kůry mozečku)

Purkyňovy buňky (až 120 μm)

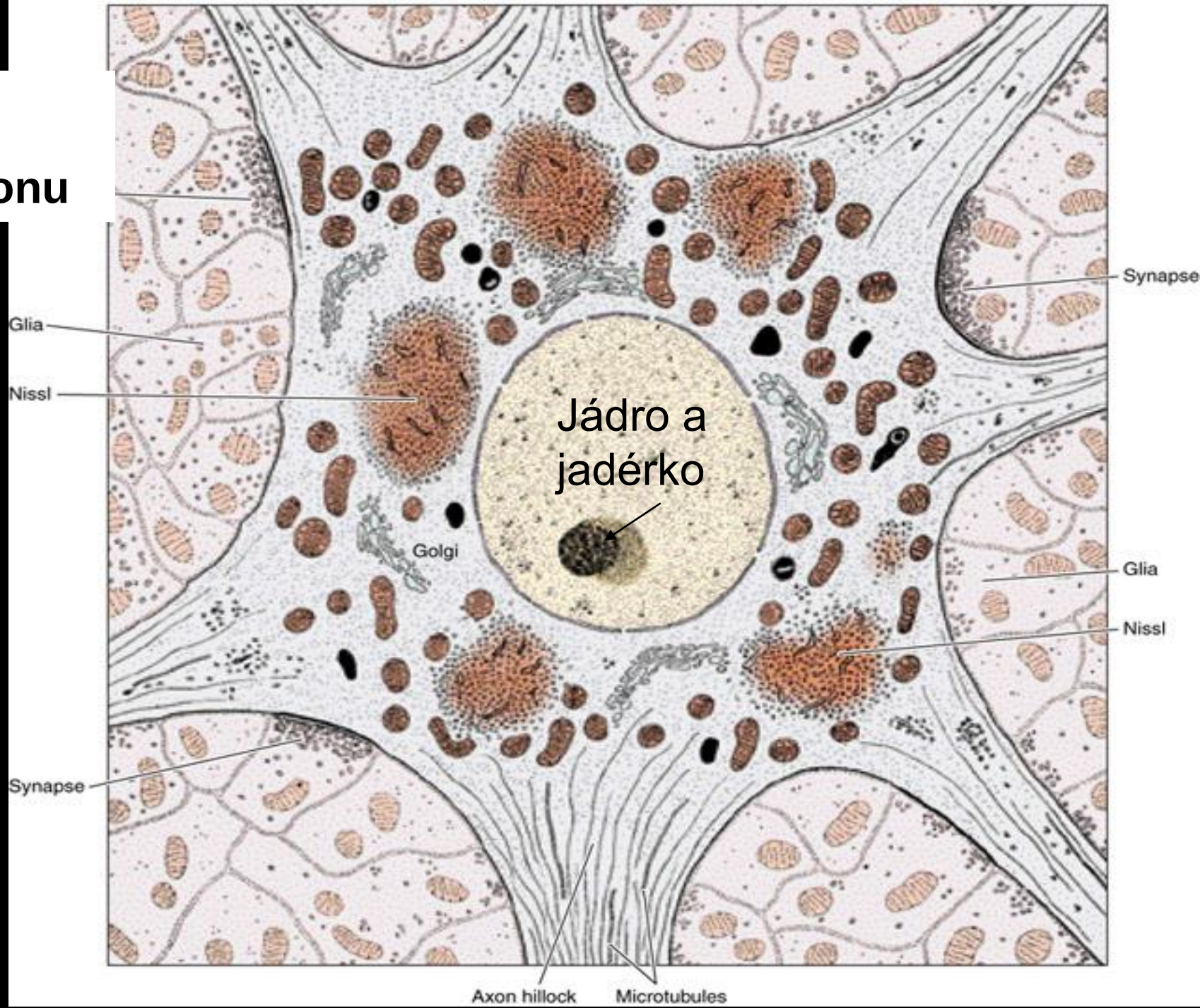
malé neurony stratum granulosum (4-5 μm)

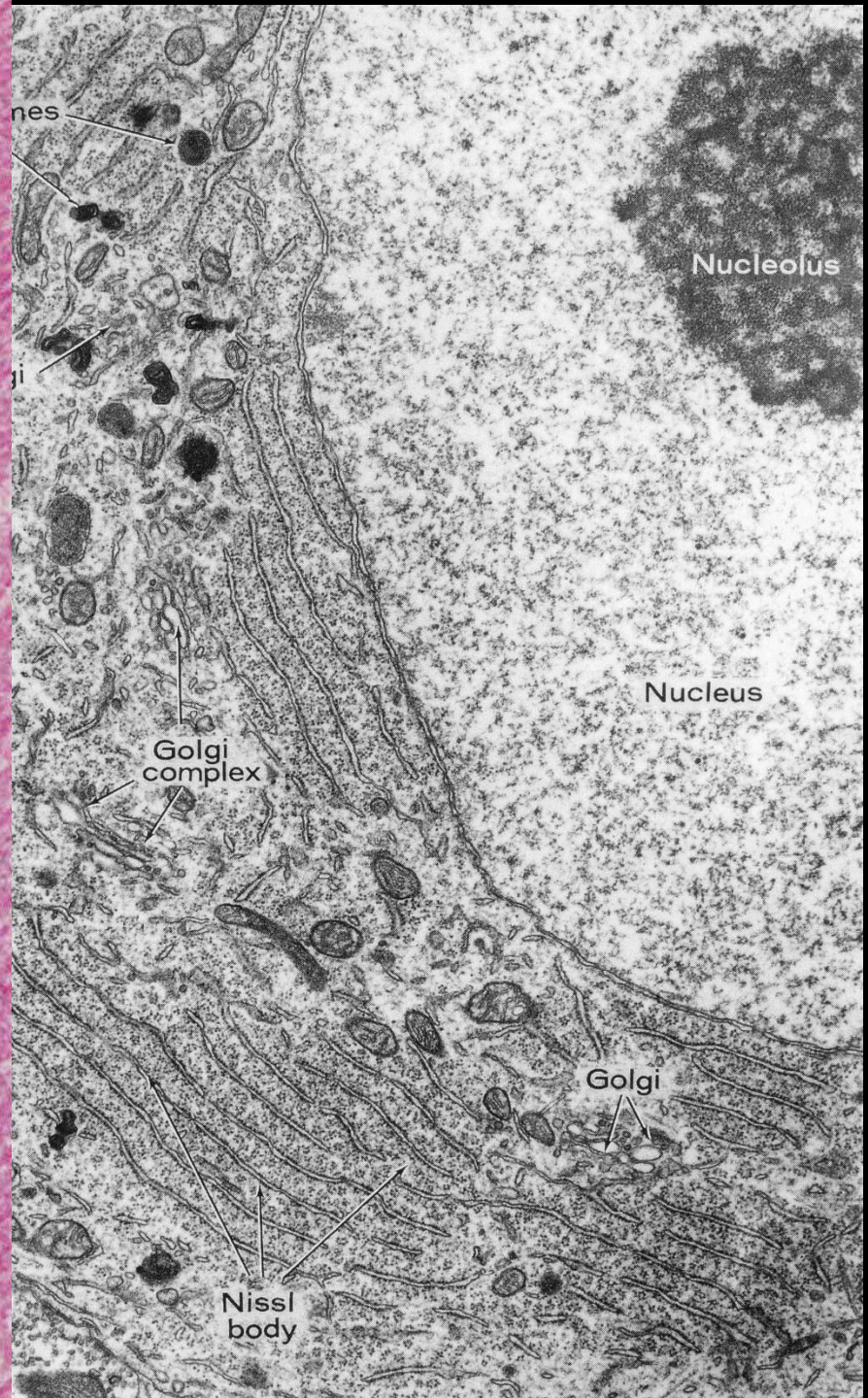
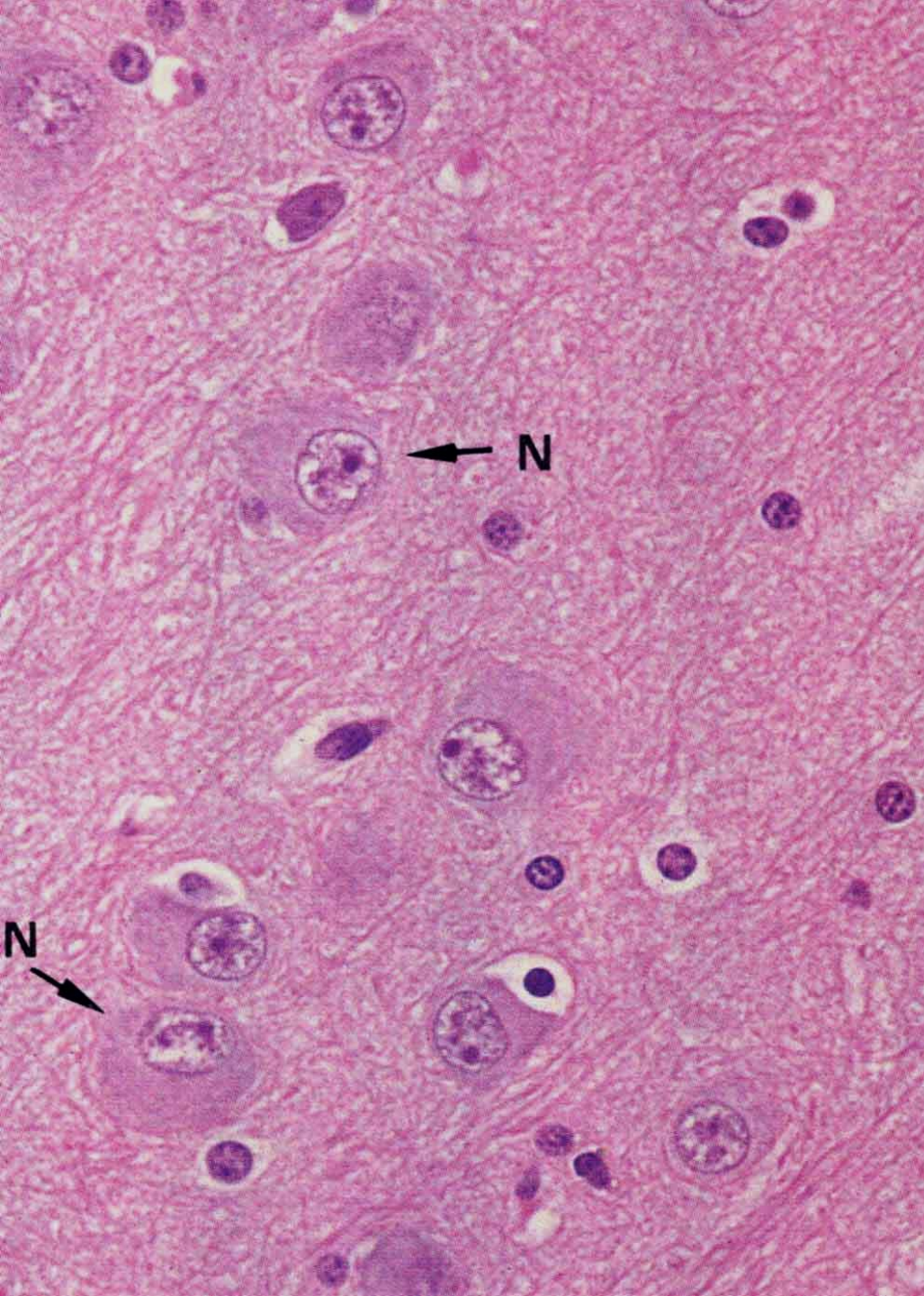


Tvary těl neuronů



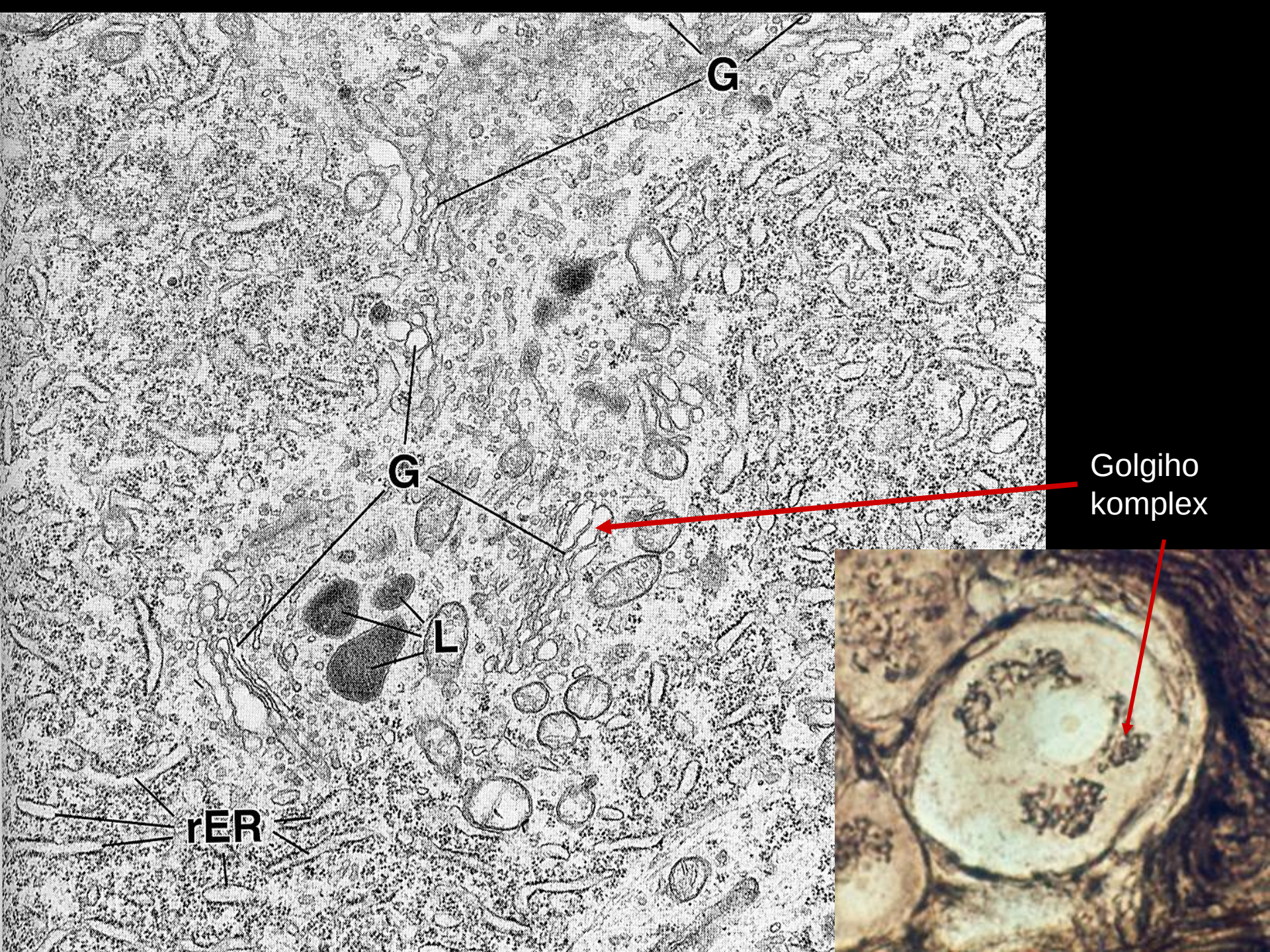
Tělo neuronu



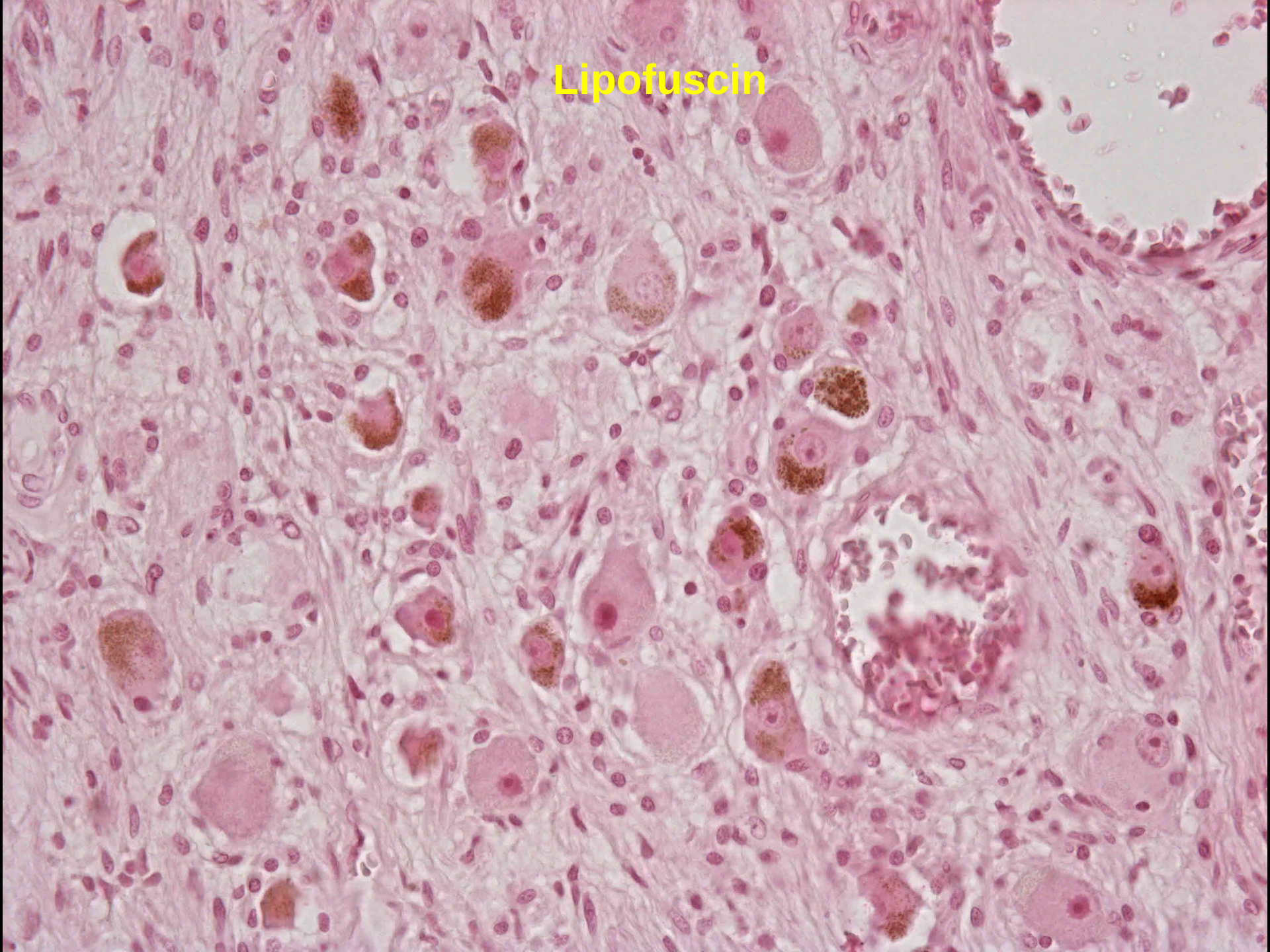


Nisslova substance (tělíska)

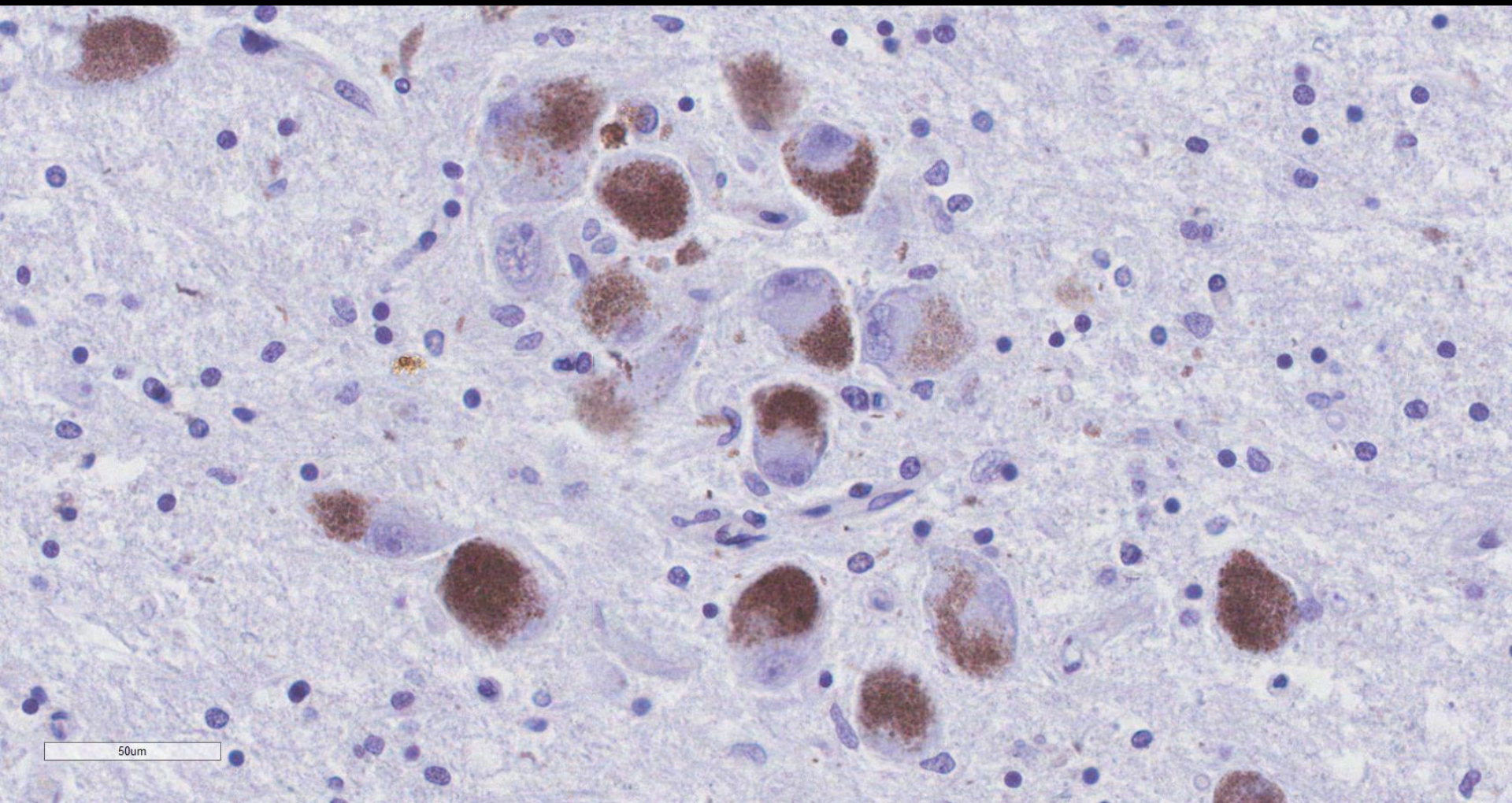




Lipofuscin

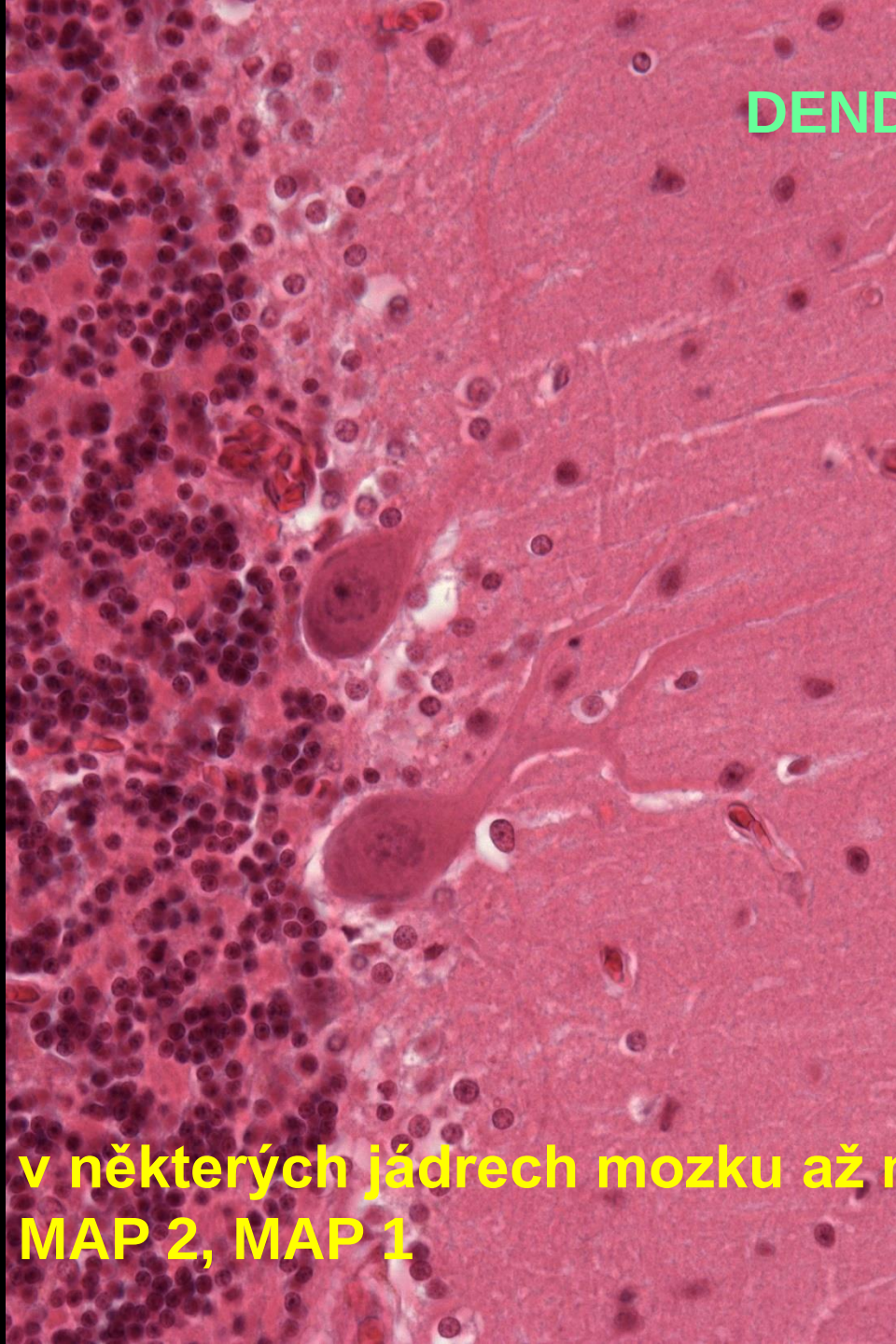


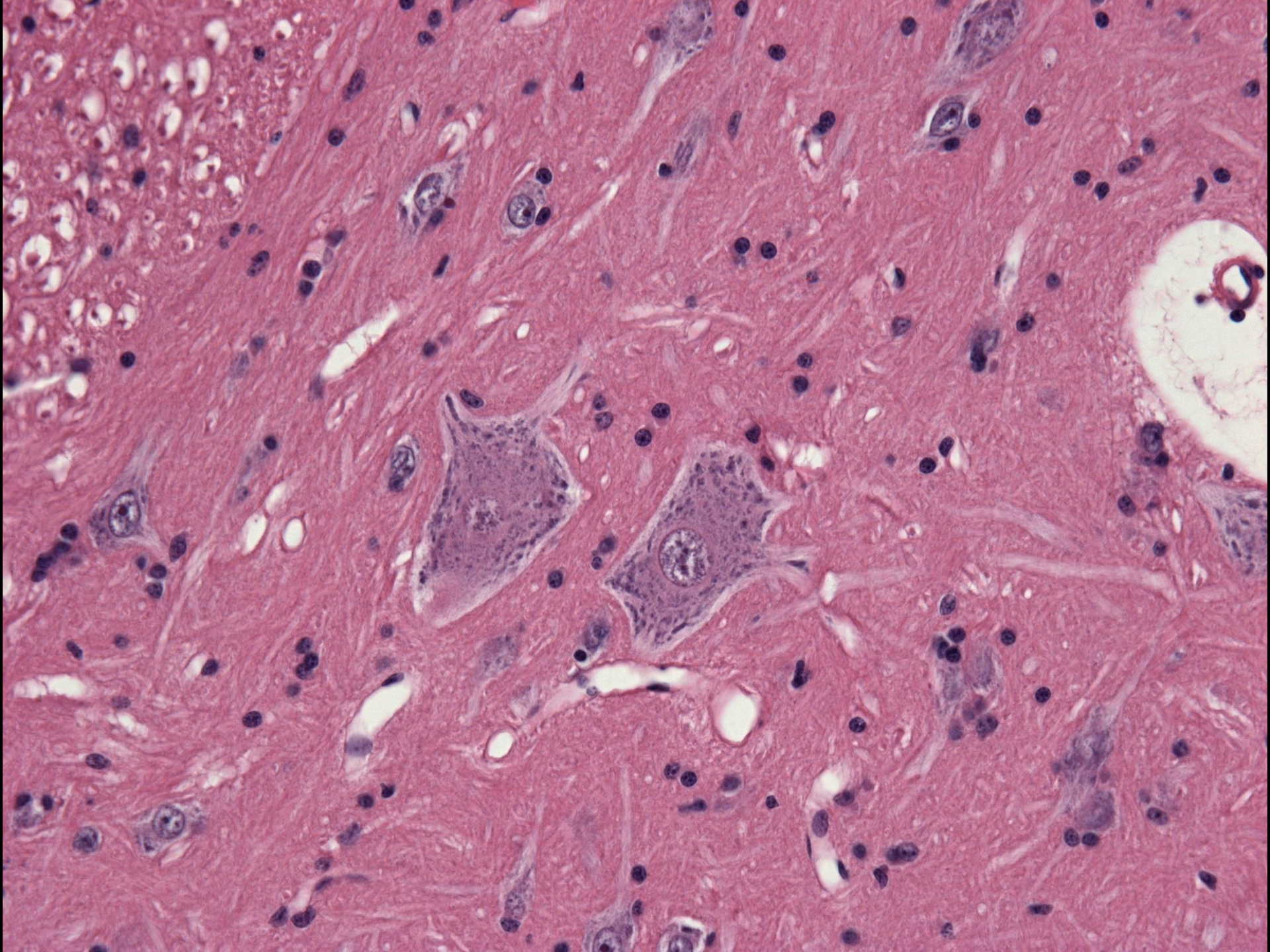
Melanin



DENDRITY

v některých jádrech mozku až milimetrové délky
MAP 2, MAP 1







AXON (NEURIT)

A

NS

N

b

odstupový konus

iniciální segment

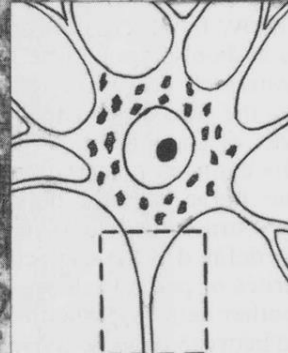
vlastní axon

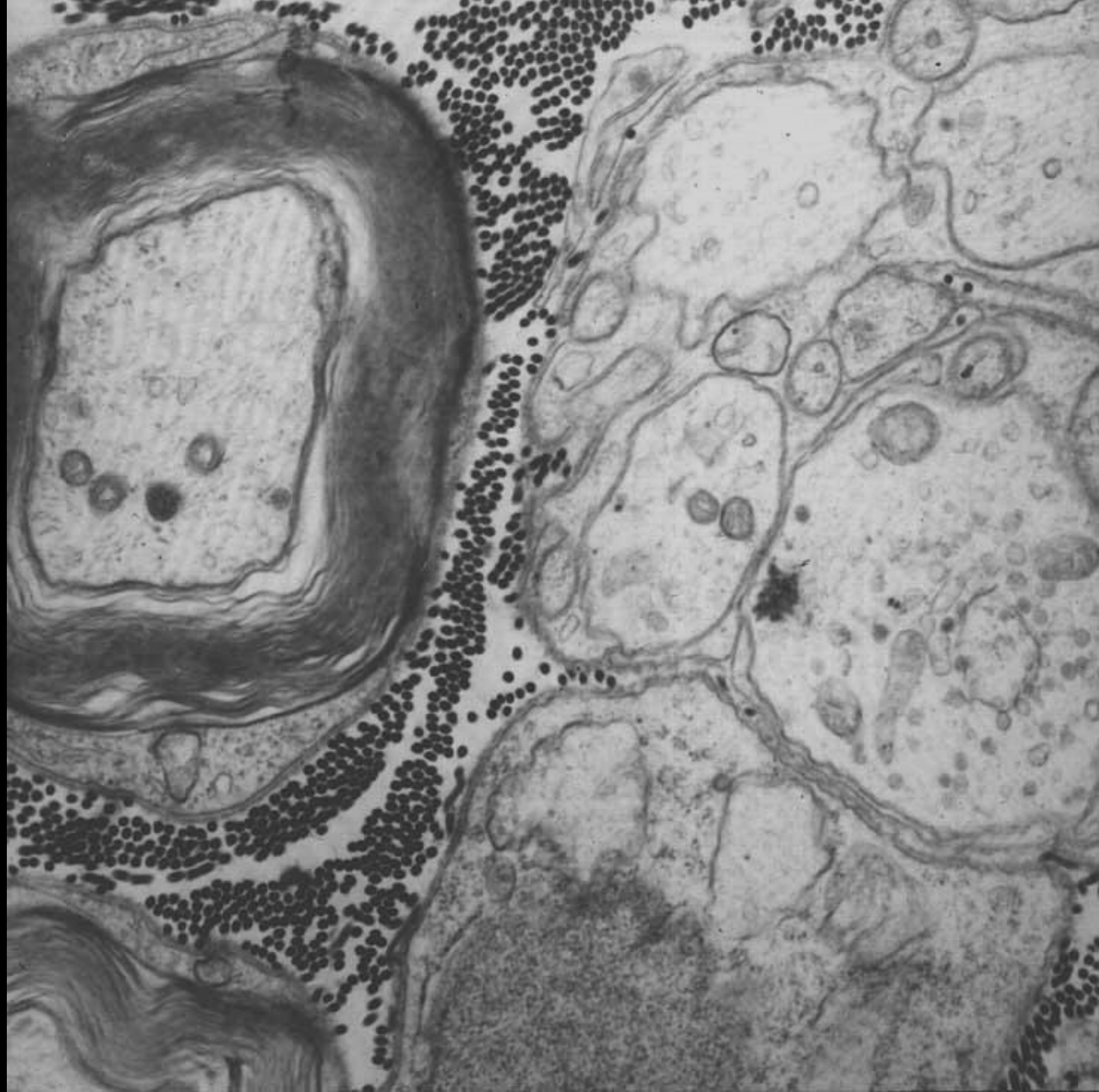
Axon
hillock

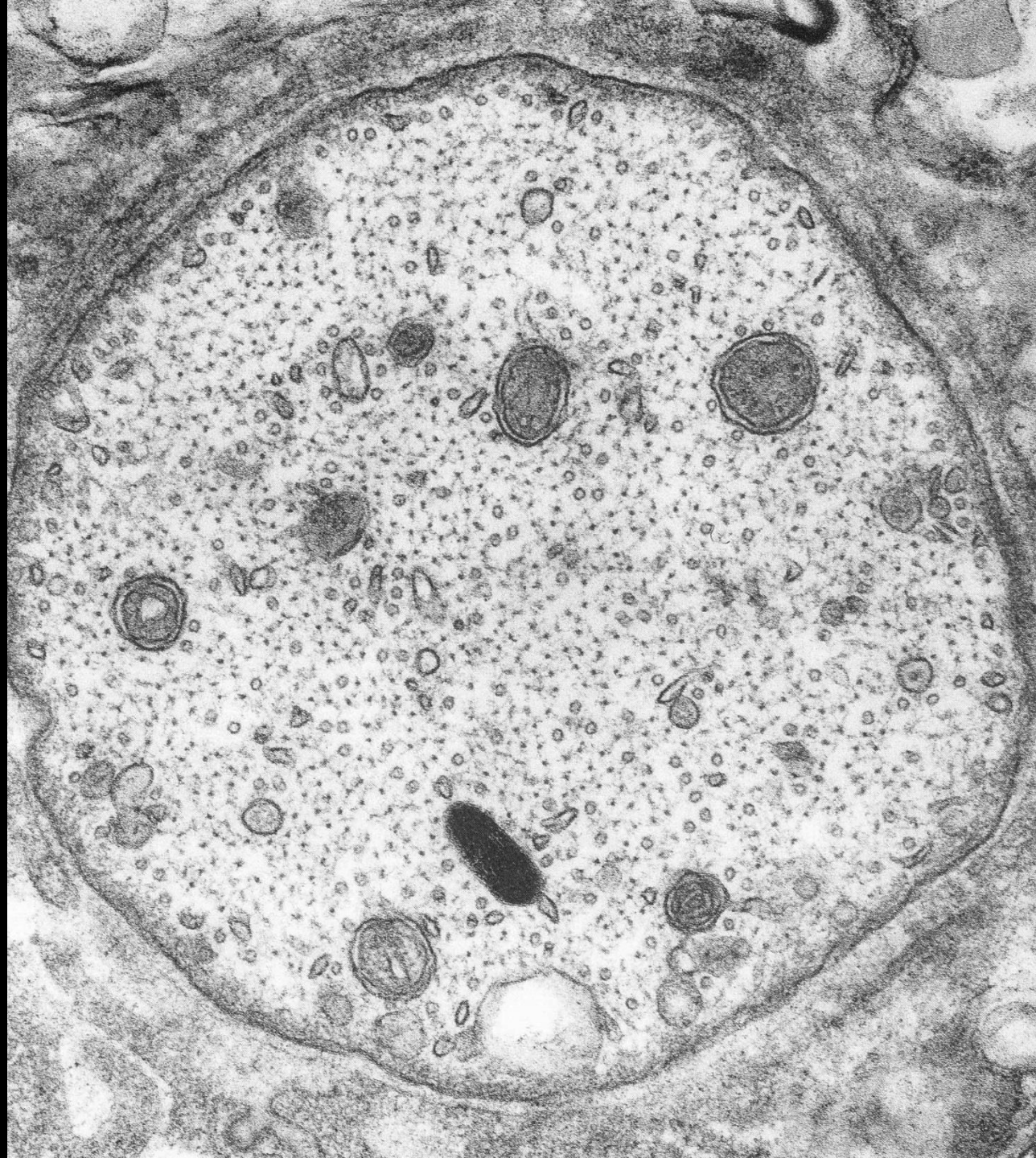
MT

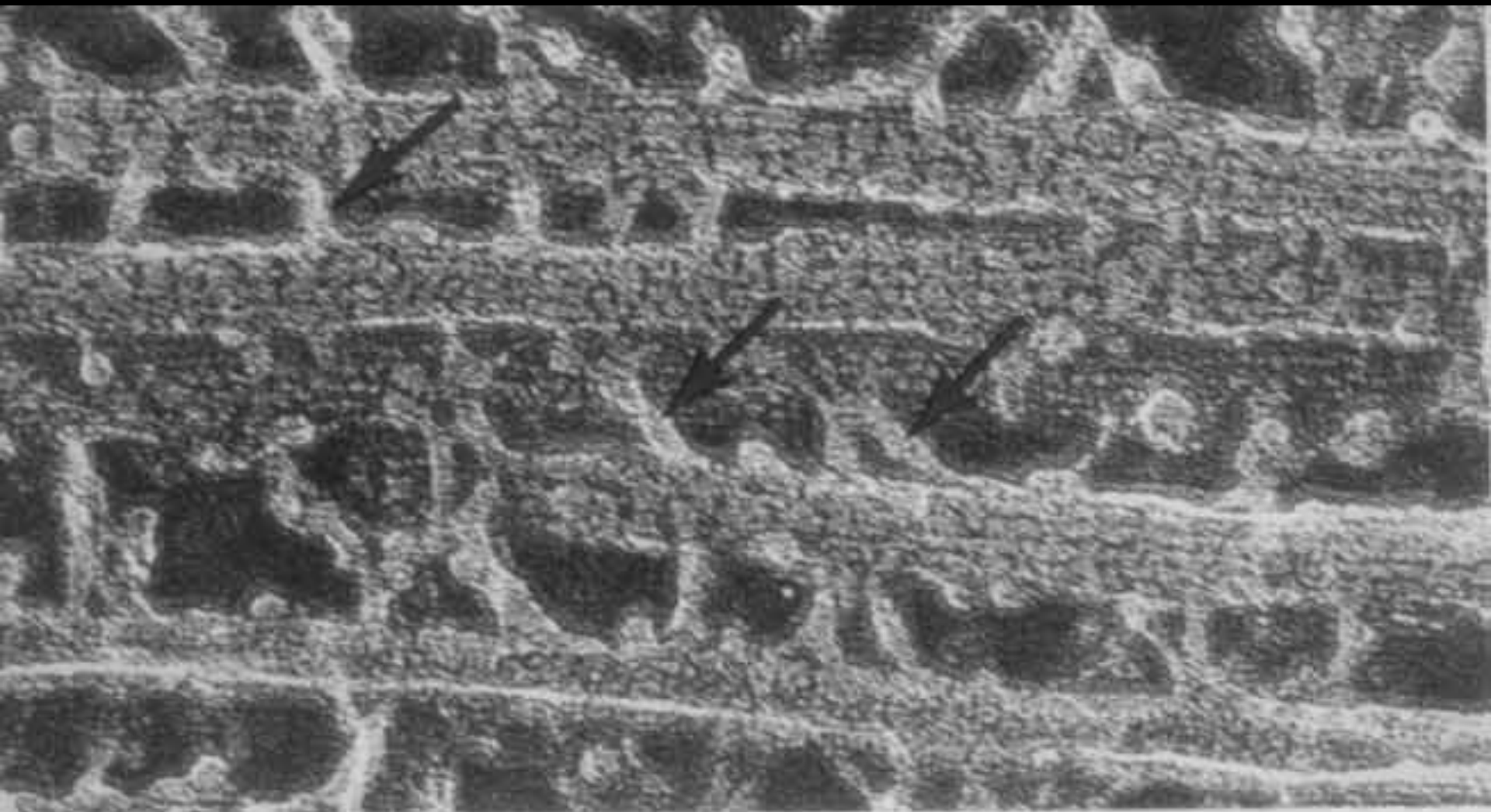
Initial
segment

AE









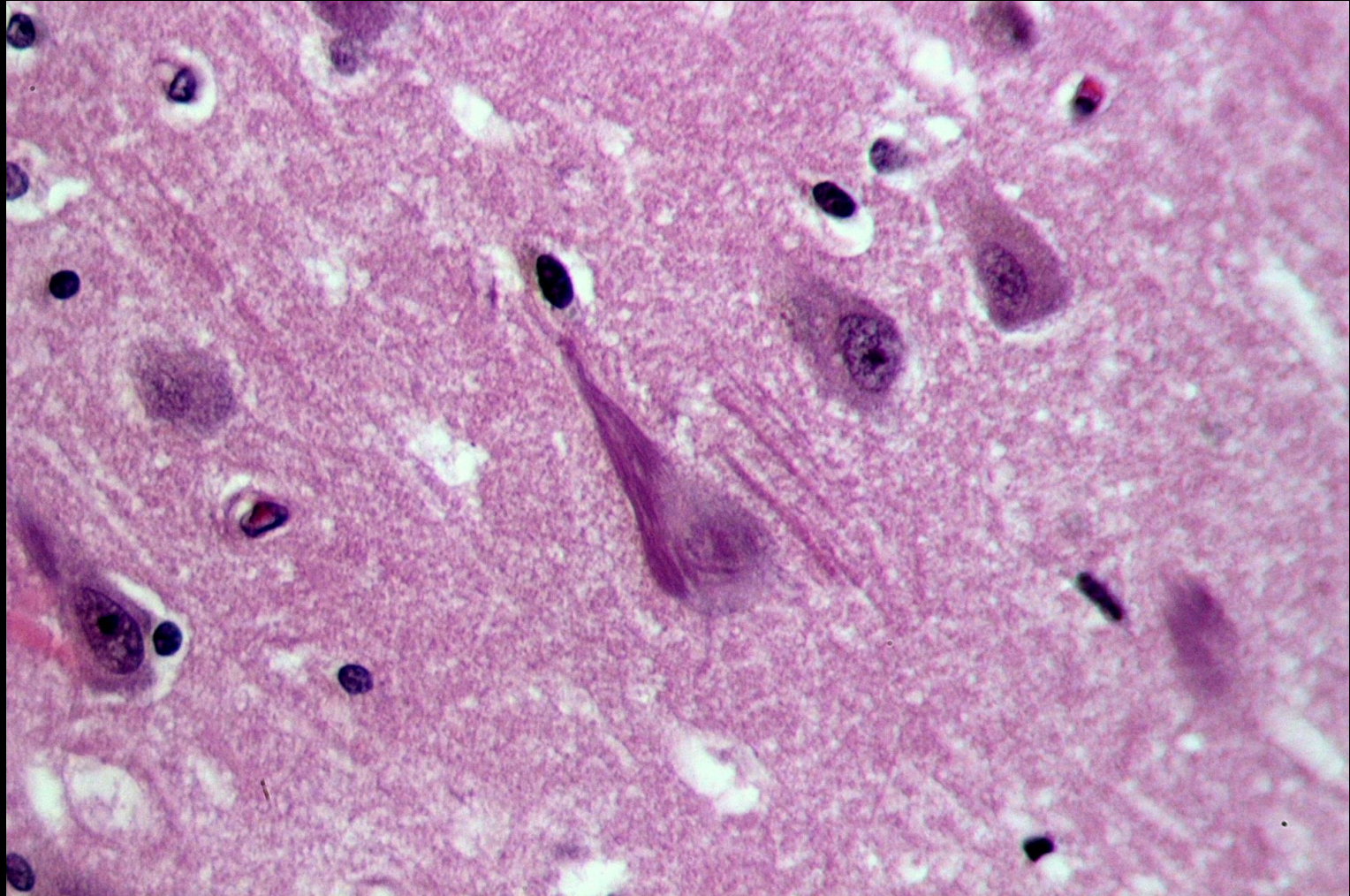
MAP 1 **MAP τ**

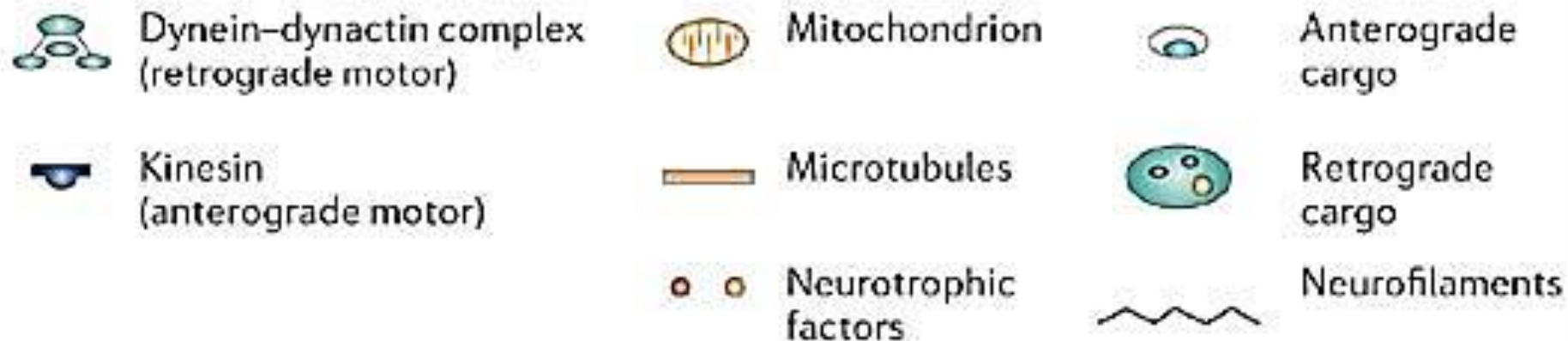
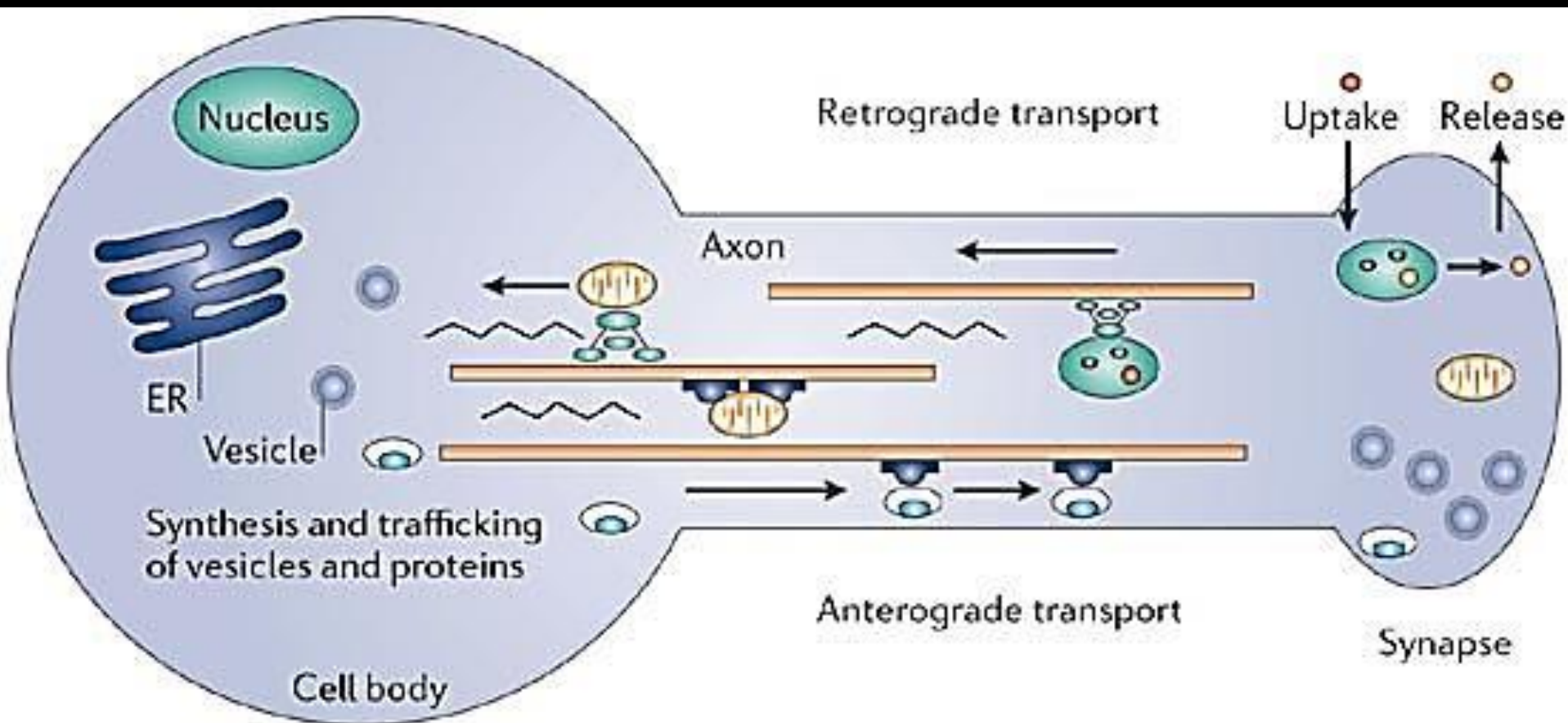
100 nm

kinesin (anterográdne)

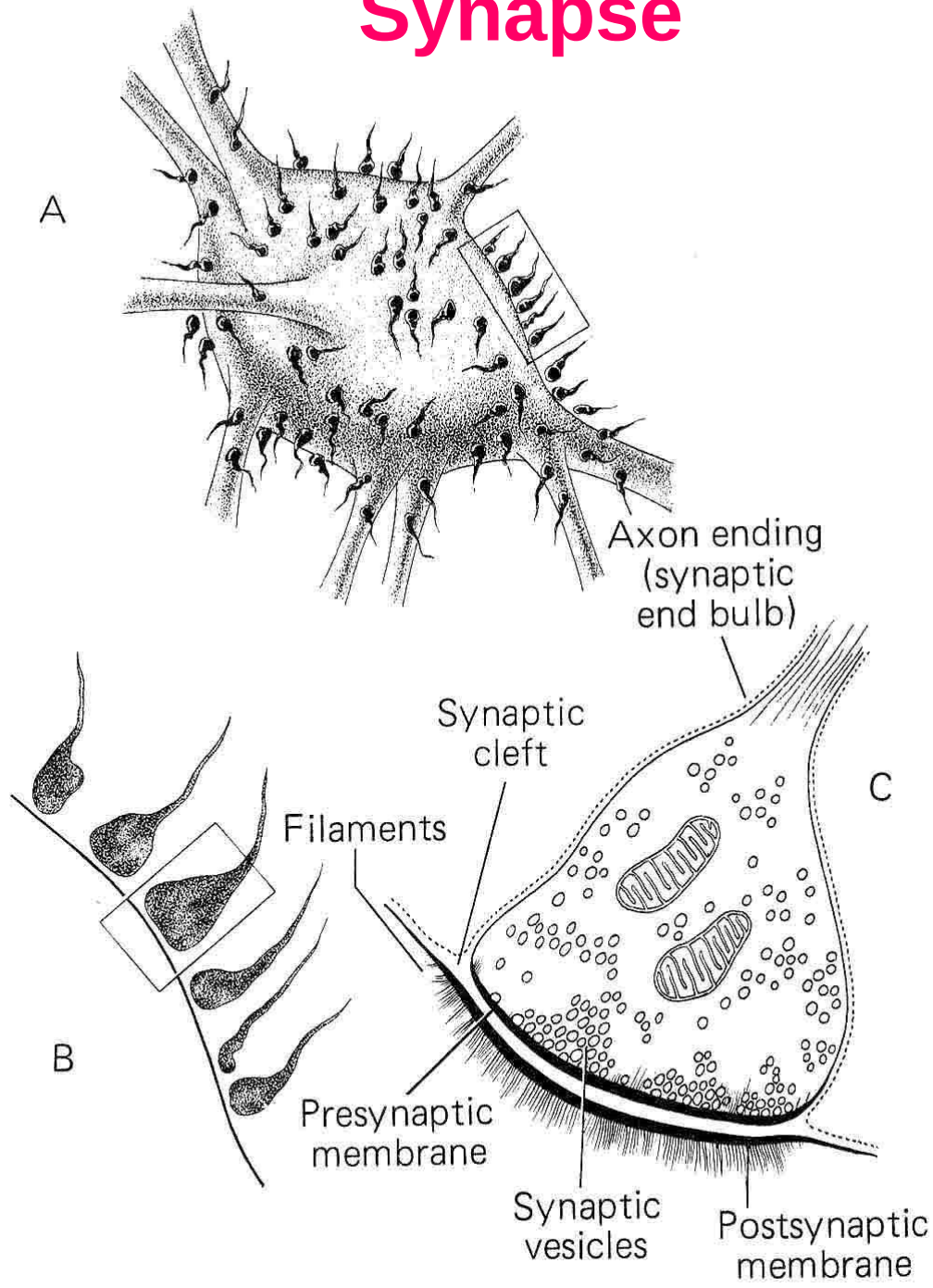
dynein (retrográdne)

Tau, protein asociovaný s mikrotubuly (MAP), tvoří nerozpustná filamenta, která se akumulují jako tzv. neurofibrilární spleť (neurofibrillary tangles, NFT) u Alzheimerovy nemoci

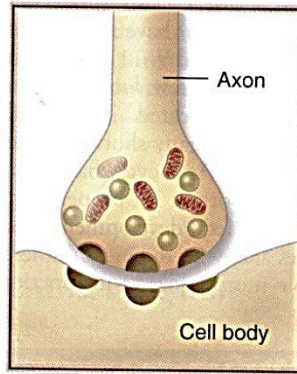




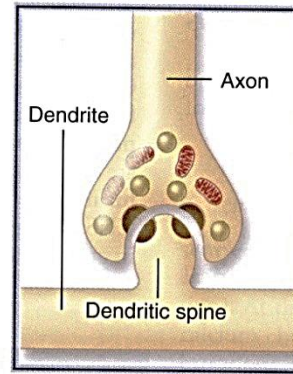
Synapse



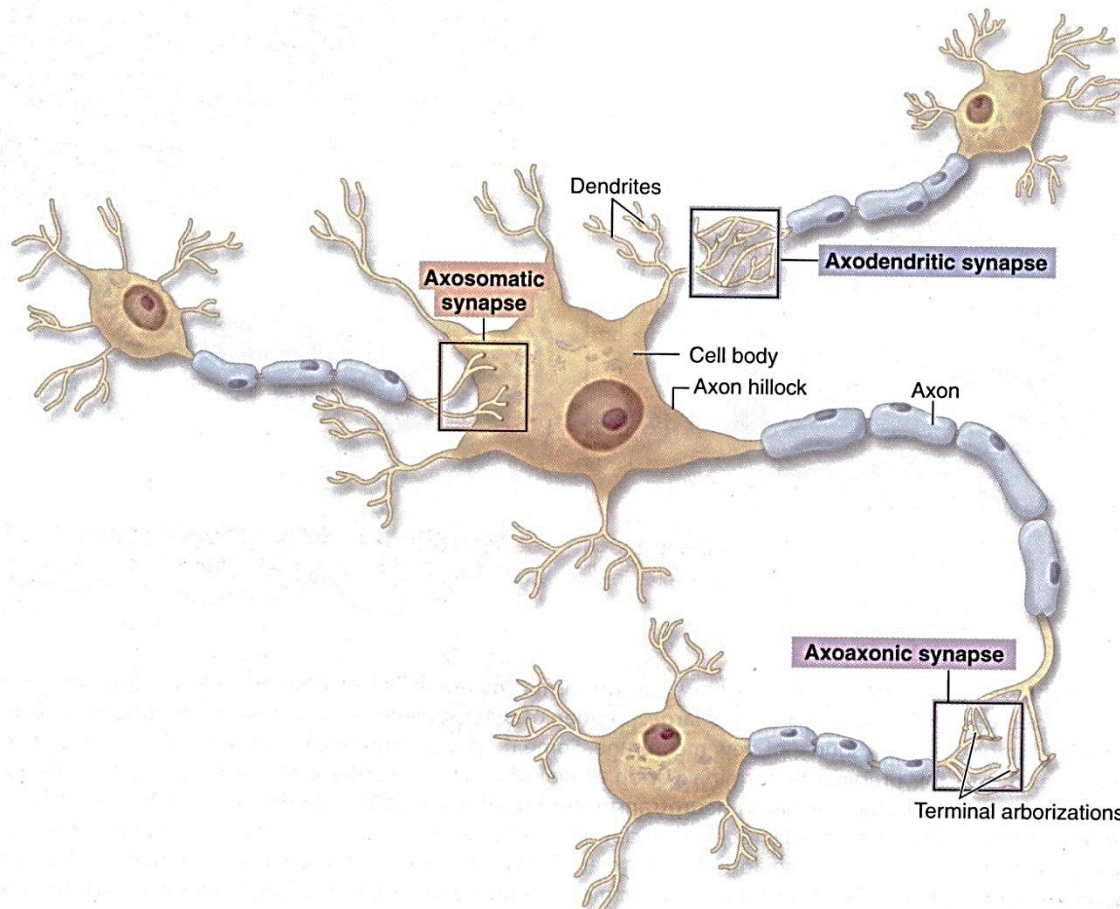
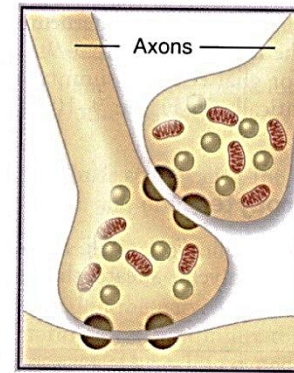
Axosomatic synapse

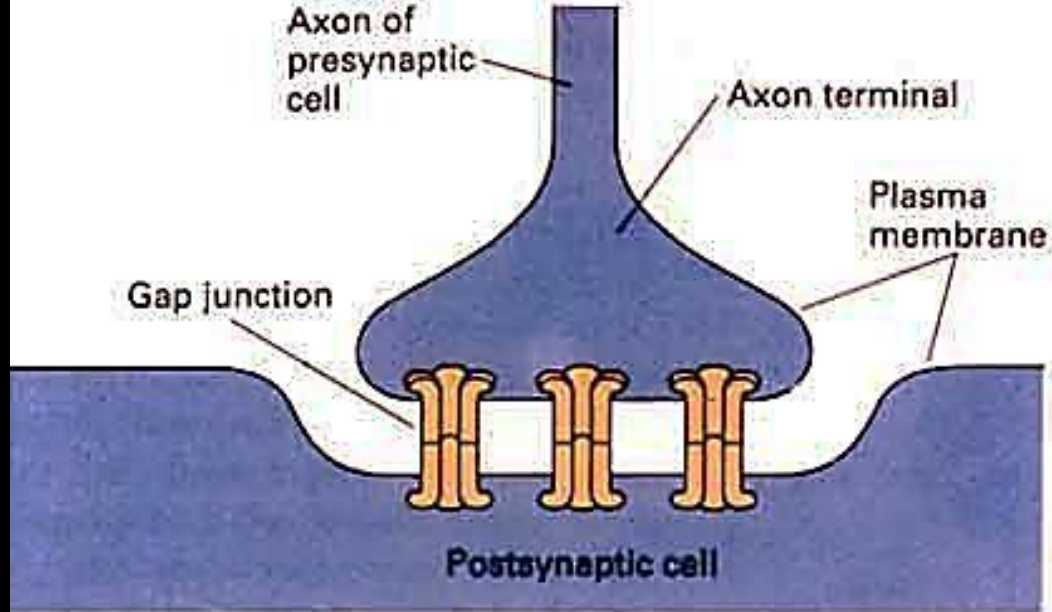


Axodendritic synapse

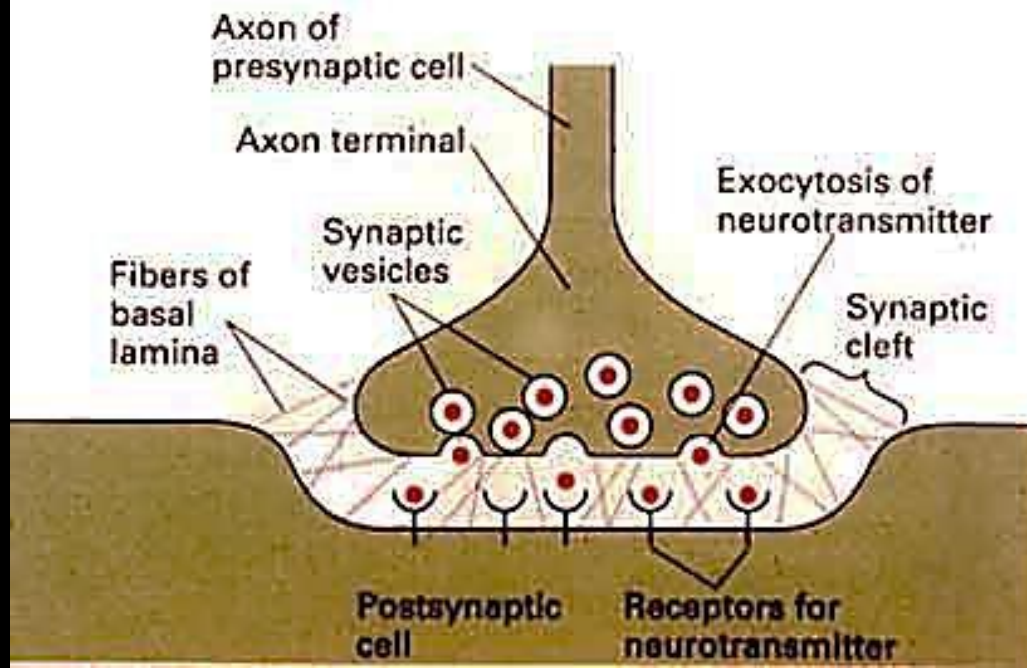


Axoaxonic synapse





Chemical synapse



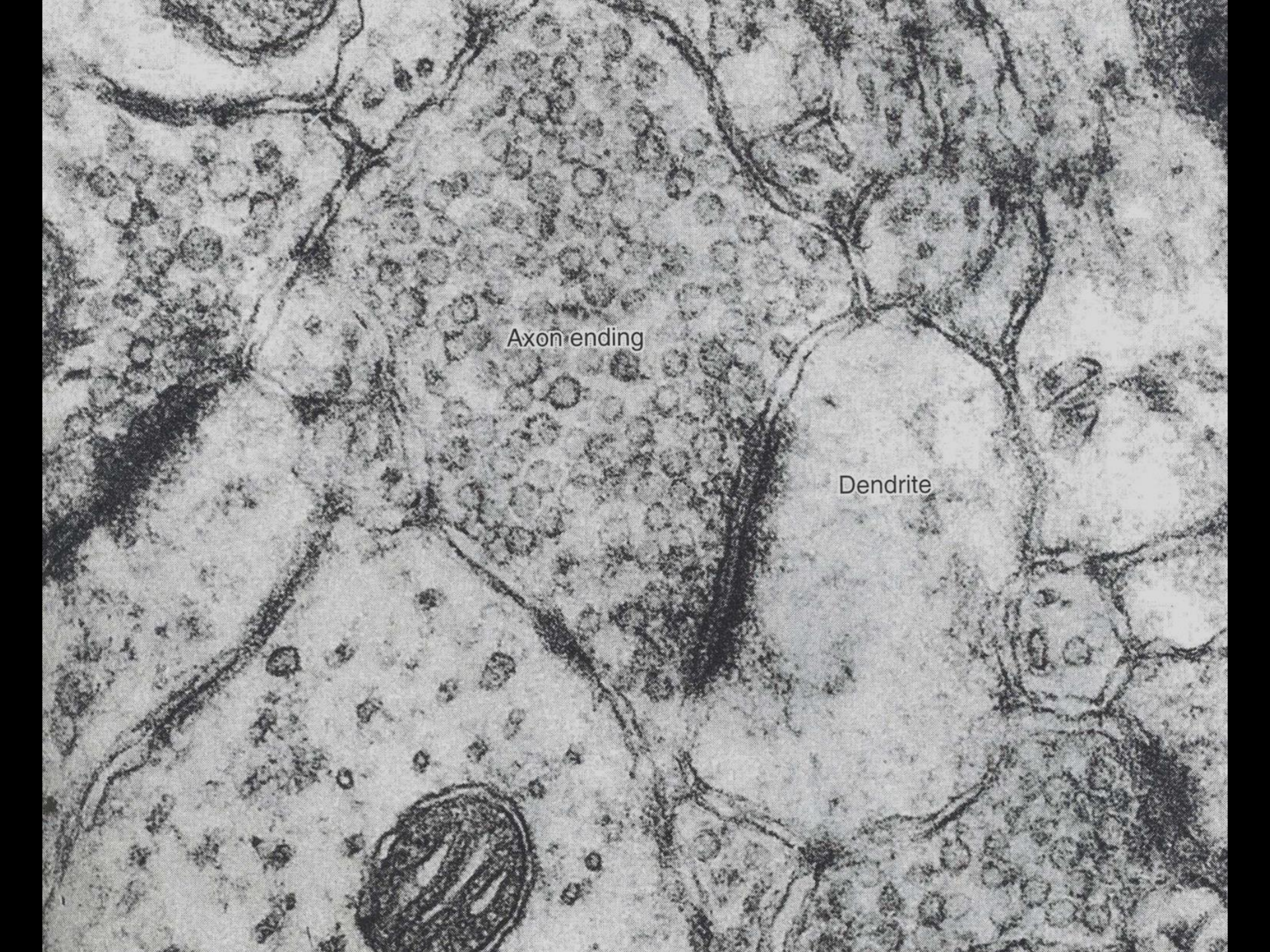
mediátory v CNS

acetylcholin
adrenalin
noradrenalin
serotonin
glutamát
dopamin
glycin
GABA
histamin



mediátory v PNS

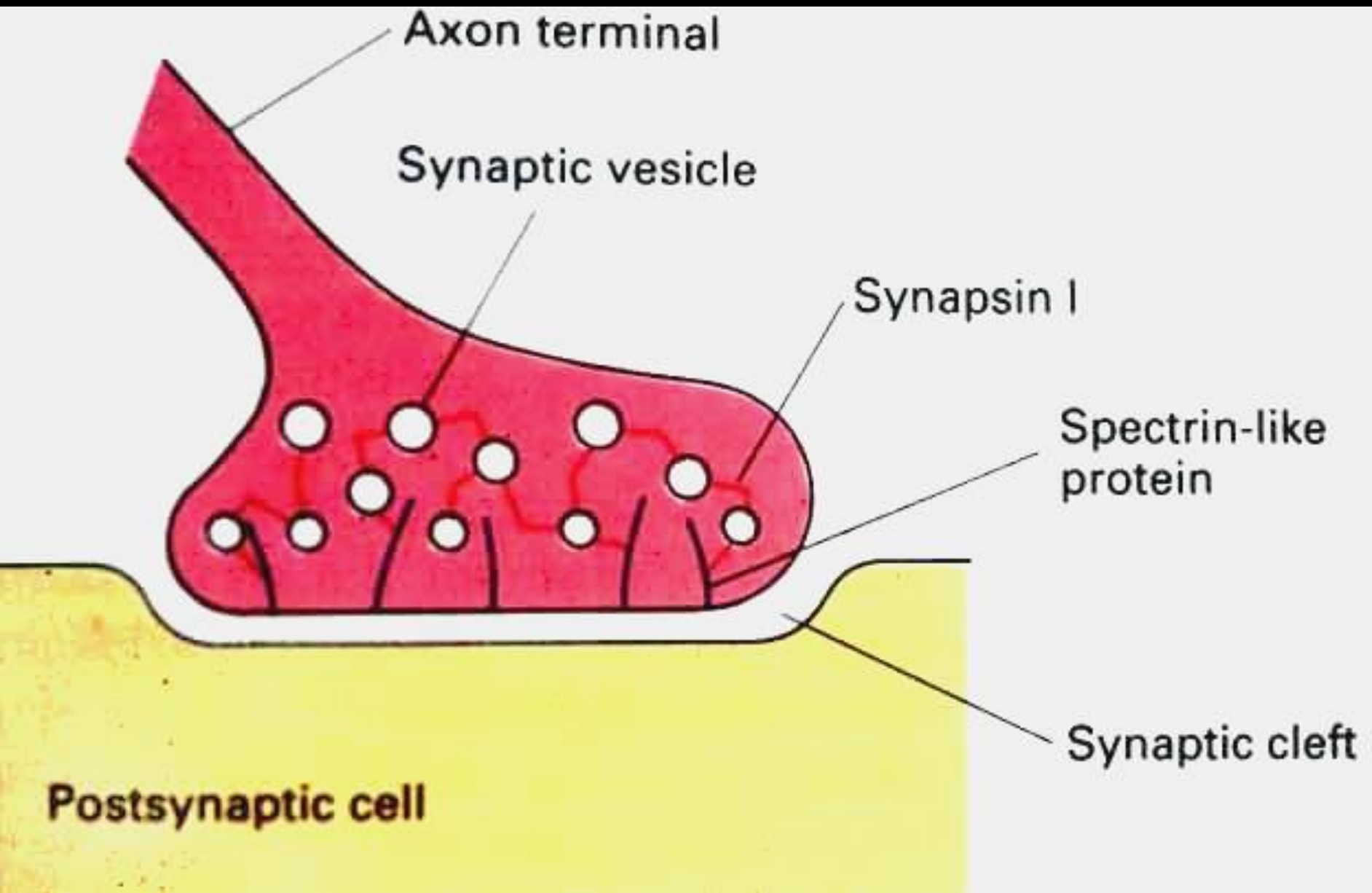
acetylcholin
noradrenalin
histamin
dopamin
serotonin

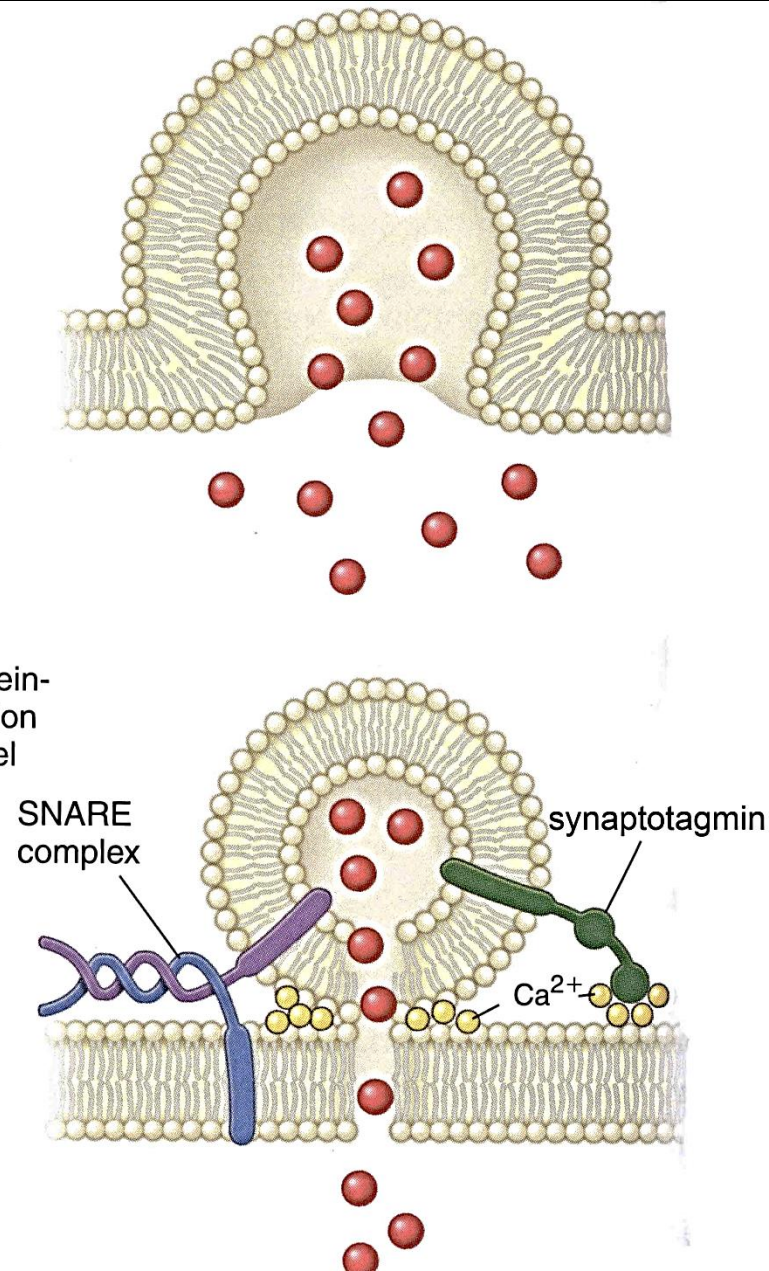
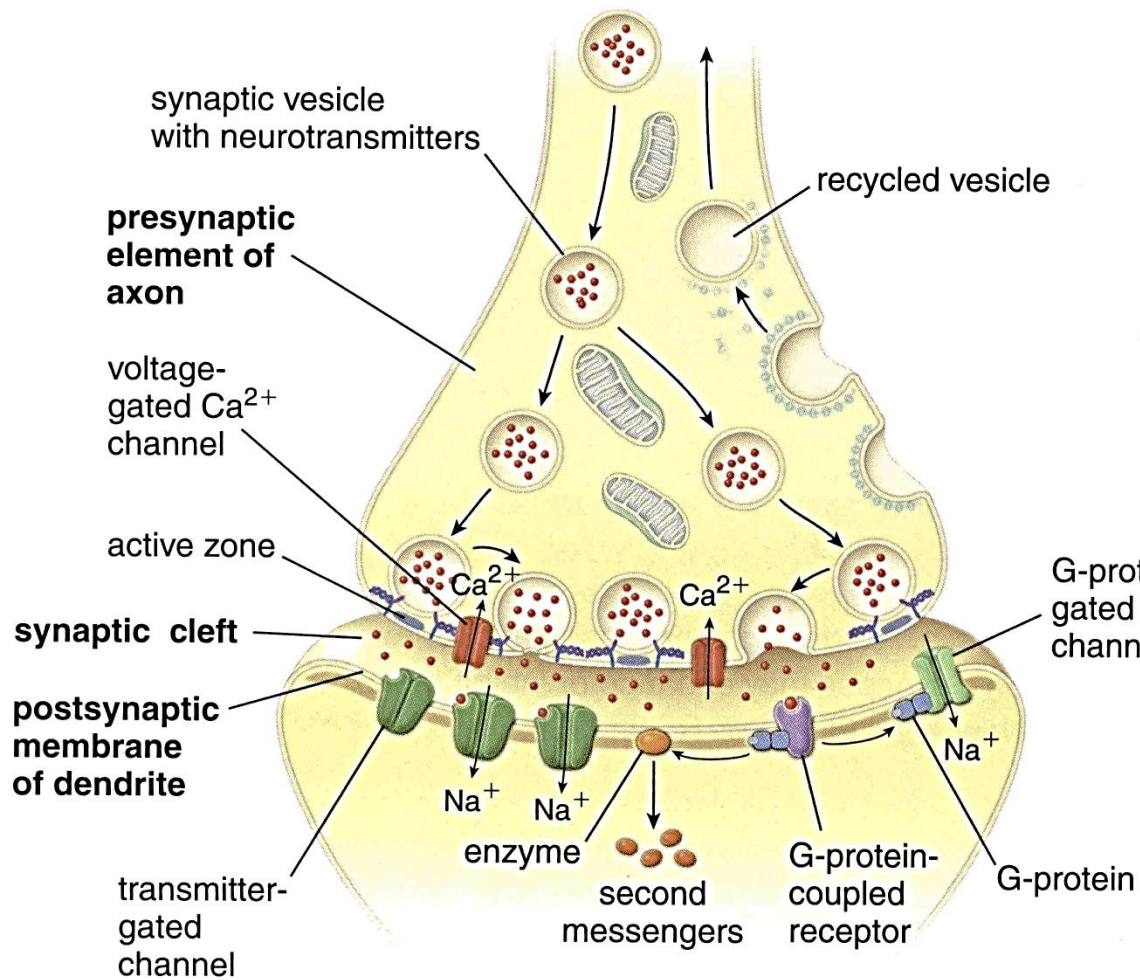


This electron micrograph shows a synapse between an axon ending and a dendrite. The axon ending, on the left, is filled with numerous small, clear synaptic vesicles. The dendrite, on the right, is a larger, more electron-dense structure. A synaptic cleft is visible between them. A mitochondrion is present in the lower-left corner. Labels 'Axon ending' and 'Dendrite' are placed near their respective structures.

Axon ending

Dendrite

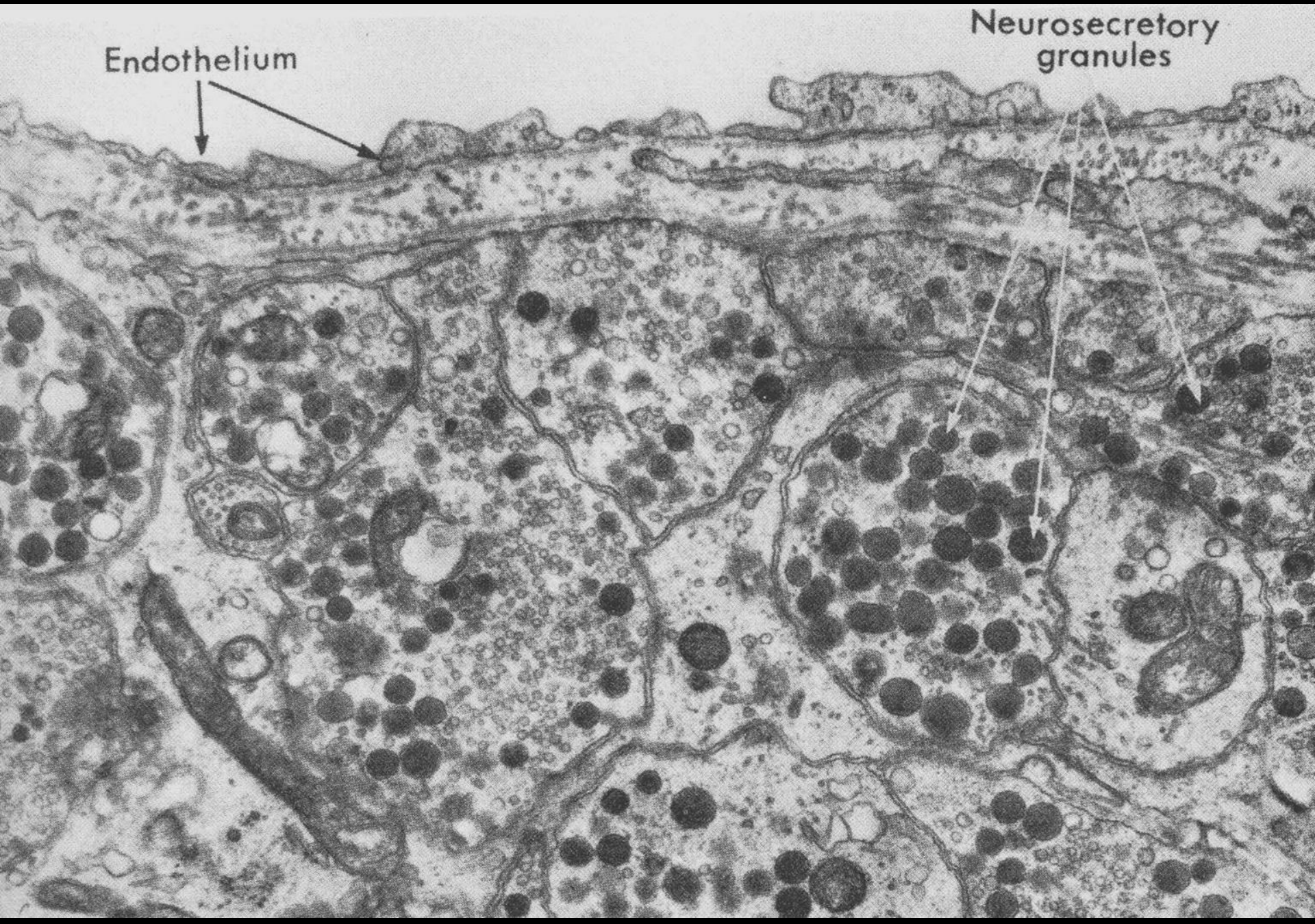




PŘÍKLADY INAKTIVACE MEDIÁTORU A UVOLNĚNÍ RECEPTORU

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

Neurosekreční granula (neurohypofýza)



Gliové buňky (neuroglie)

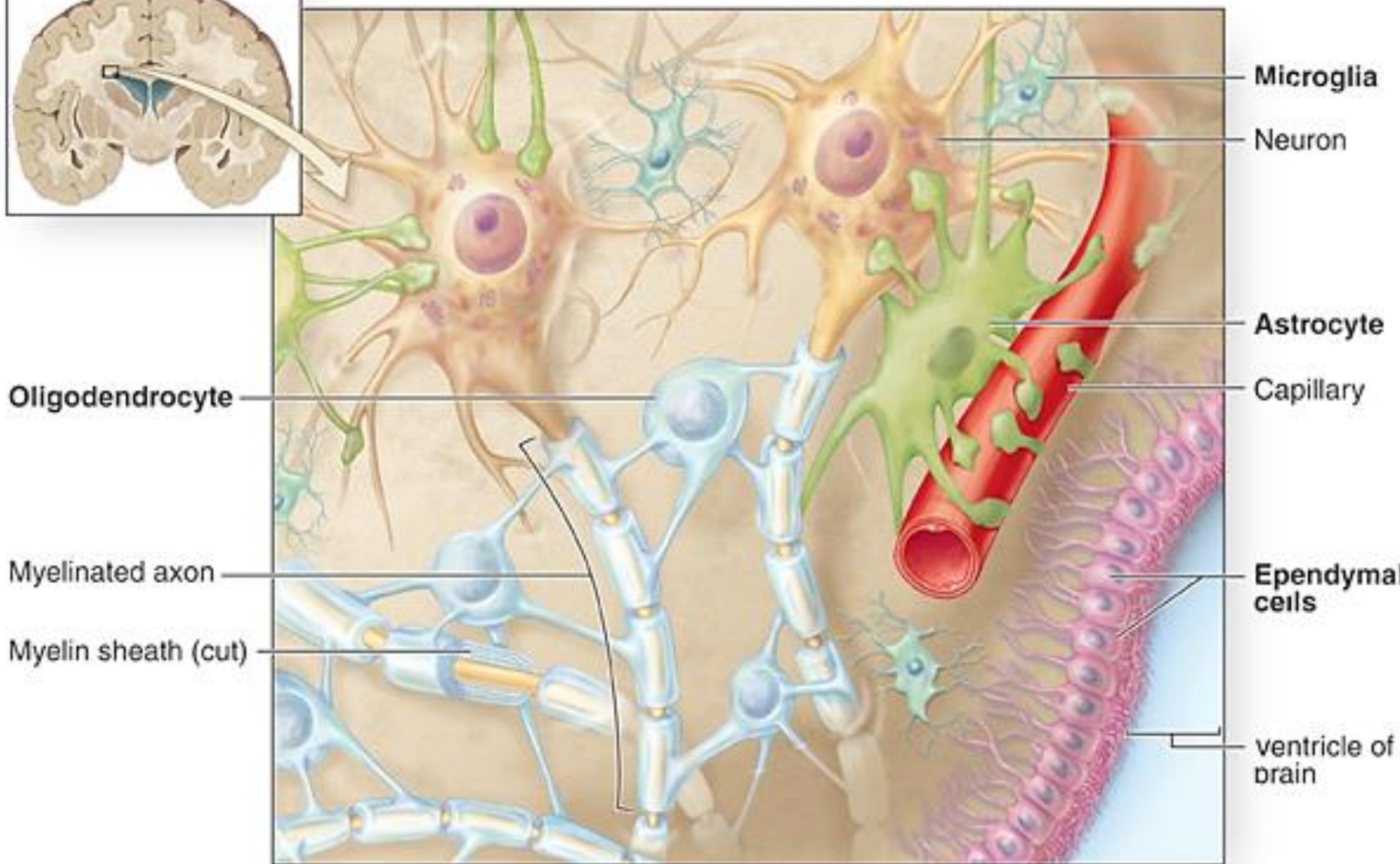
neuronům poskytují

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

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

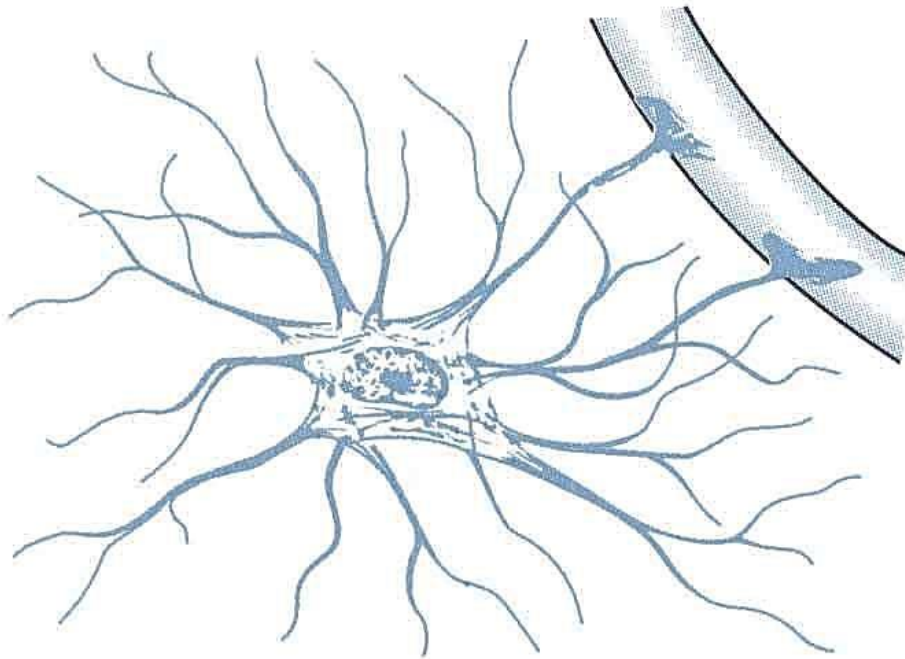
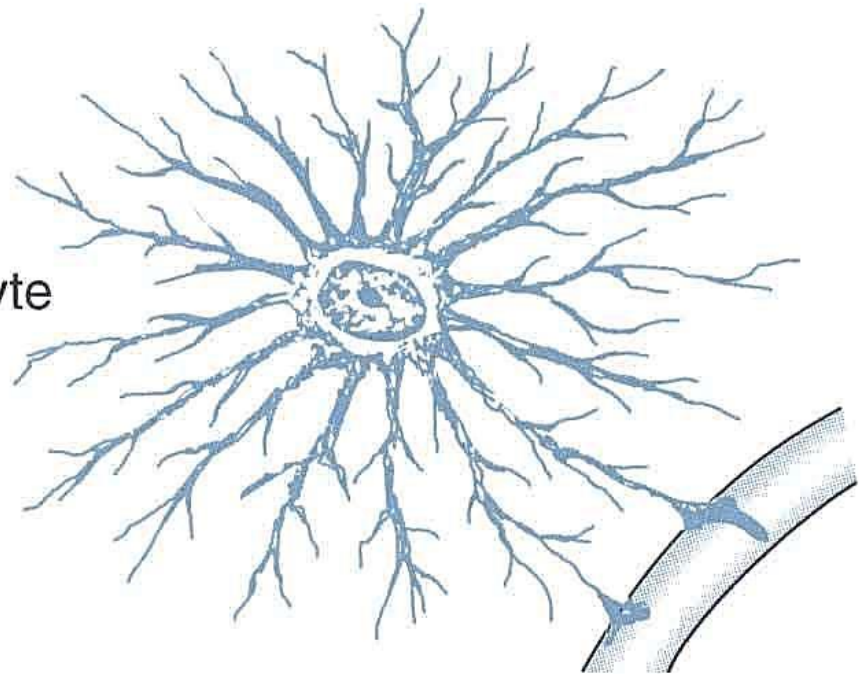
- 2. neuroglie **PNS**
 - 1. Schwannovy b. — (myelinizace axonů v **PNS**)
 - 2. satelitové b. — cerebrospinální ganglia
 - vegetativní
 - "



A = fibrilární astrocyty
O = oligodendrocyty
M = mikroglie

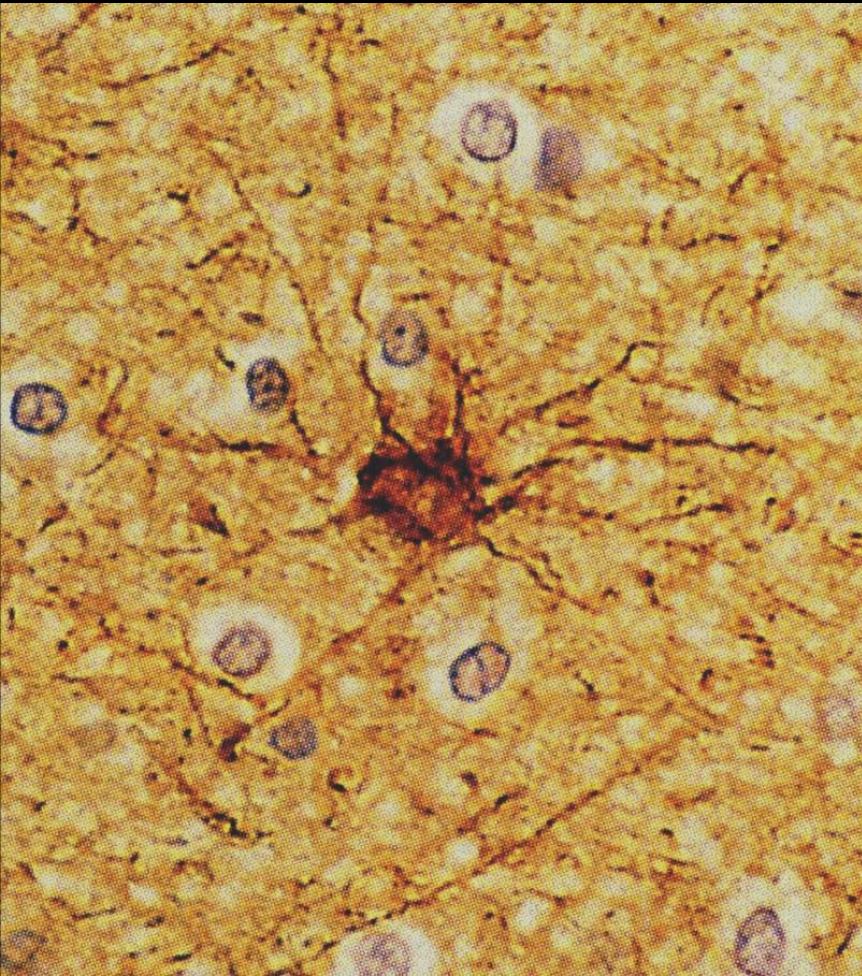


Protoplasmic astrocyte

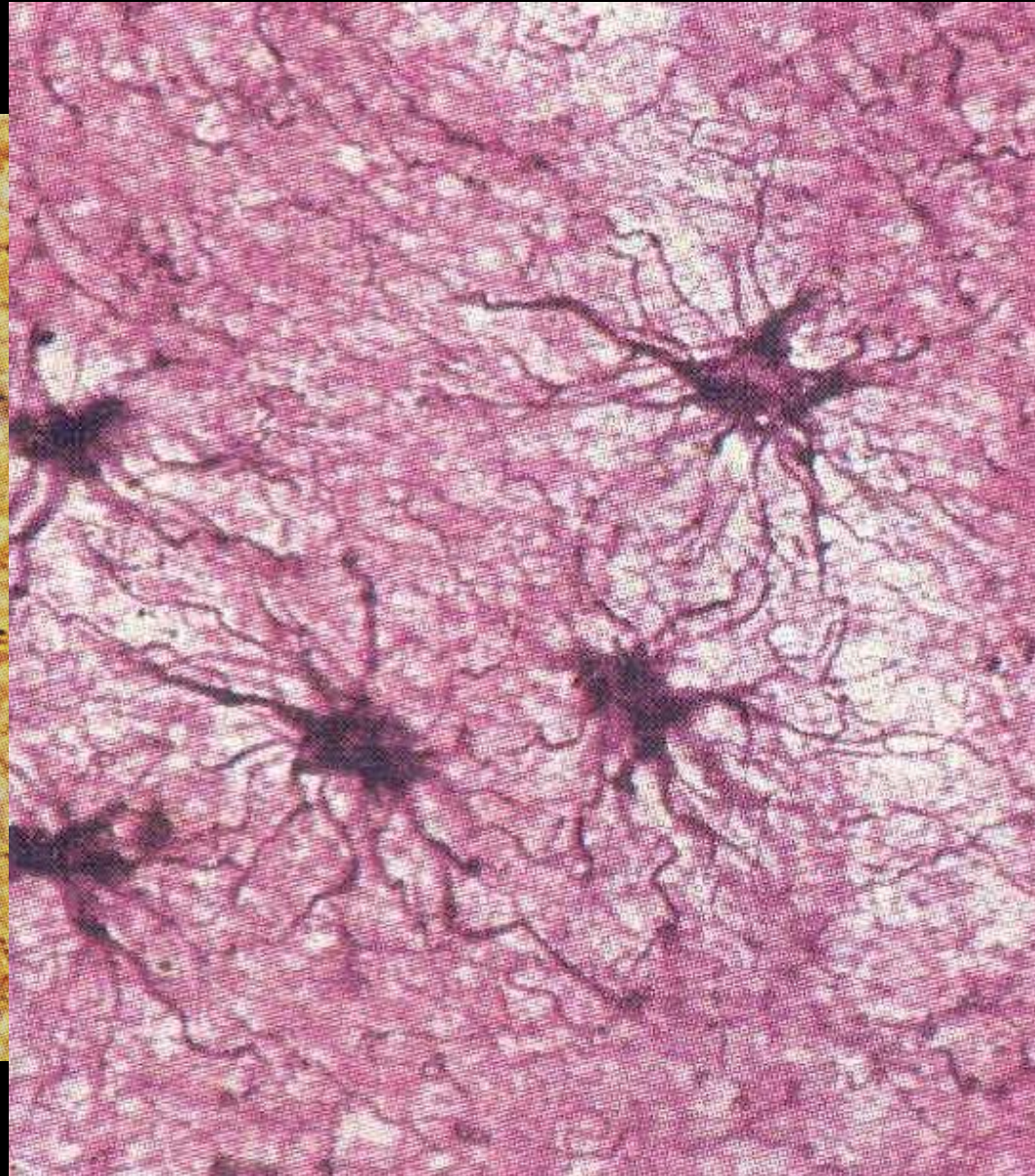


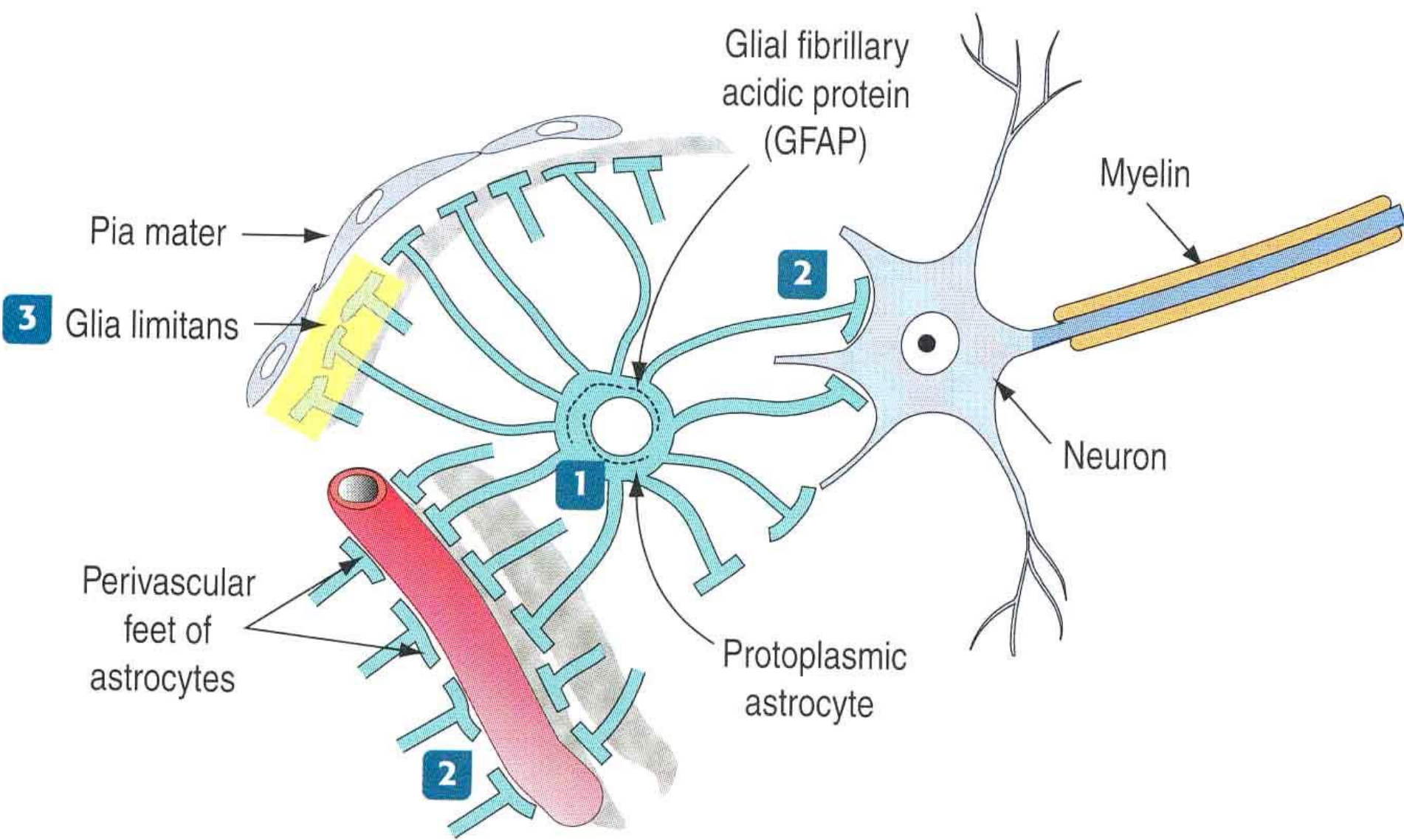
Fibrous astrocyte

GFAP imunohistochemie

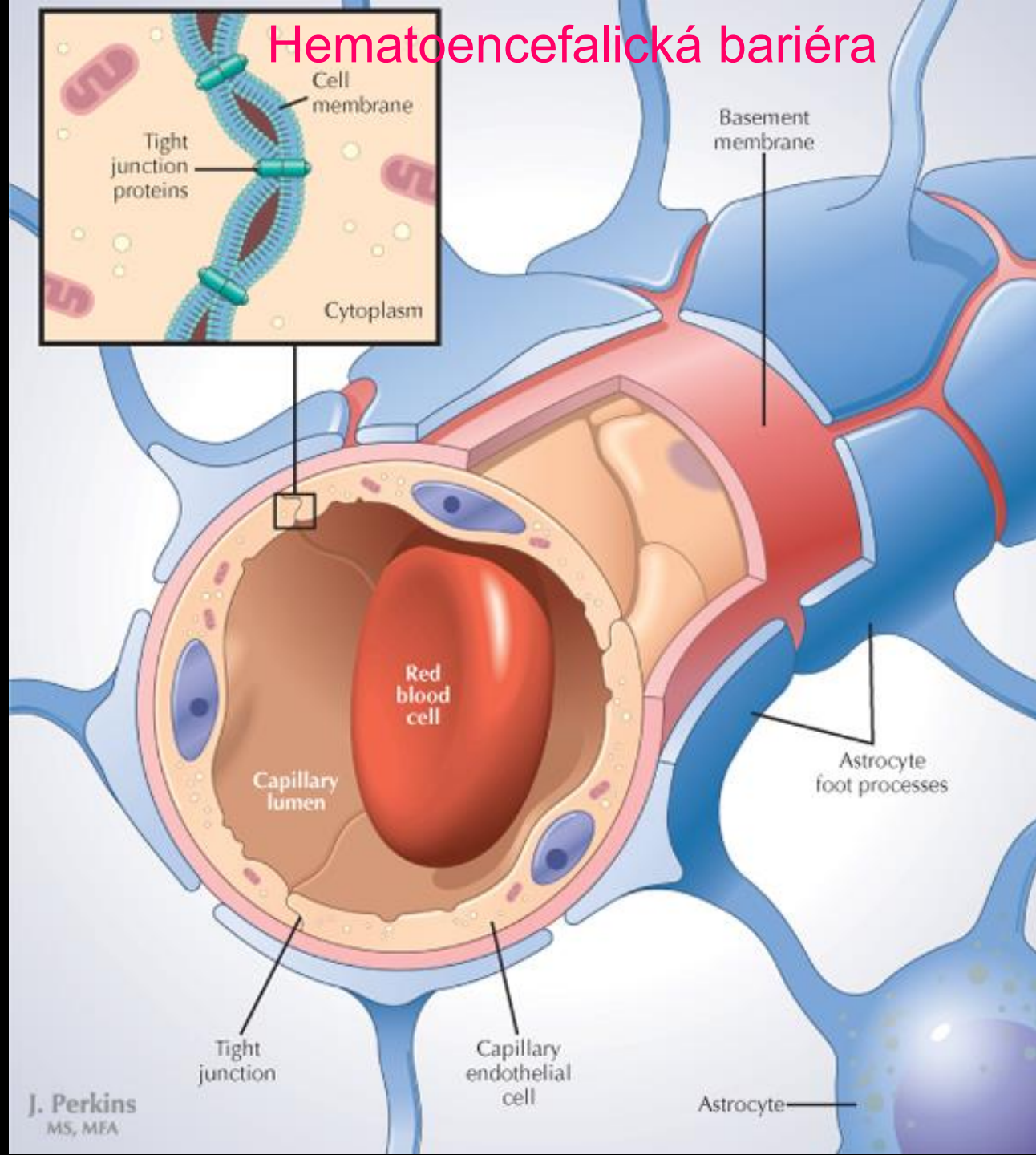


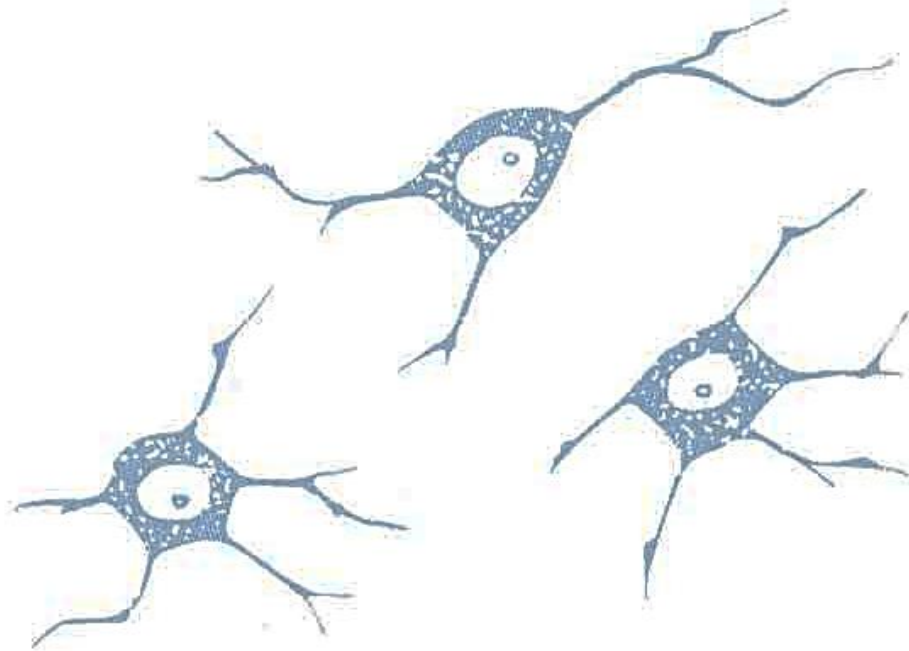
impregnace



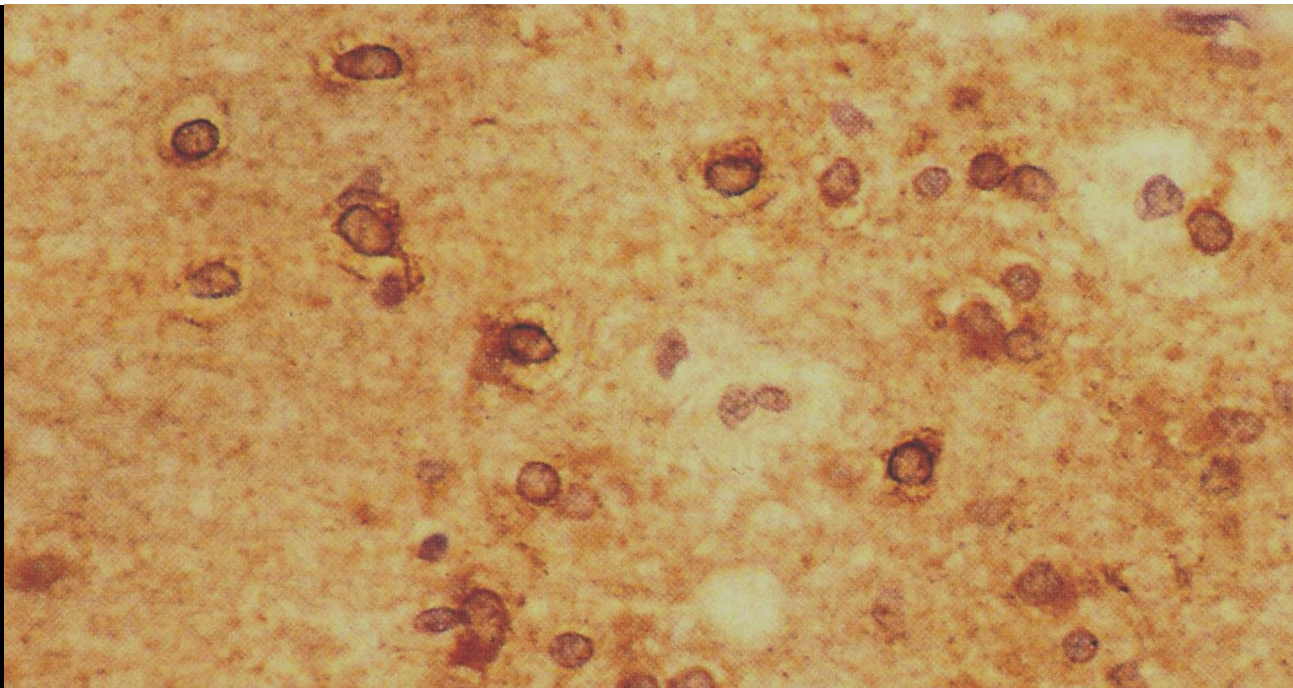


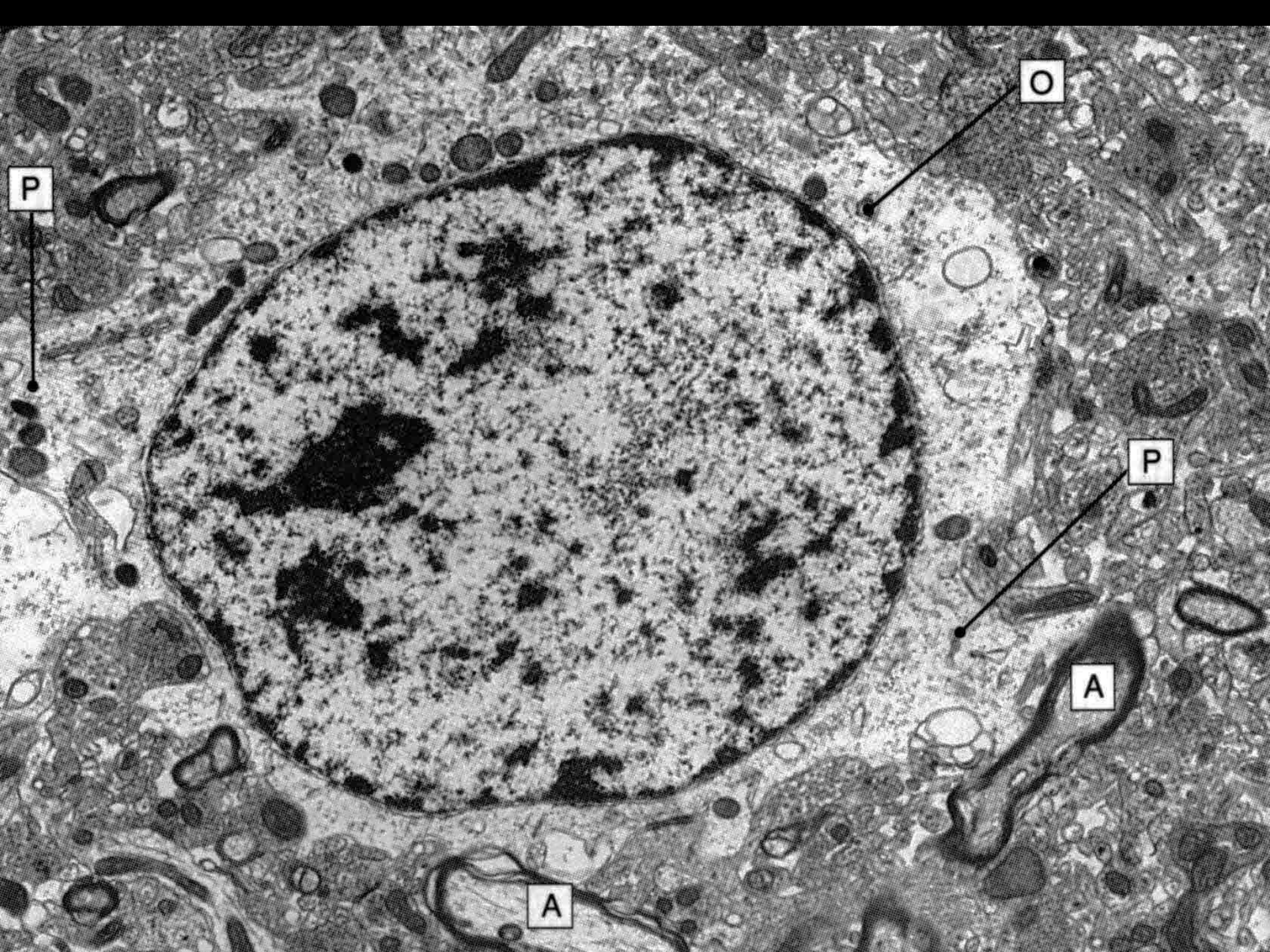
Hematoencefalická bariéra



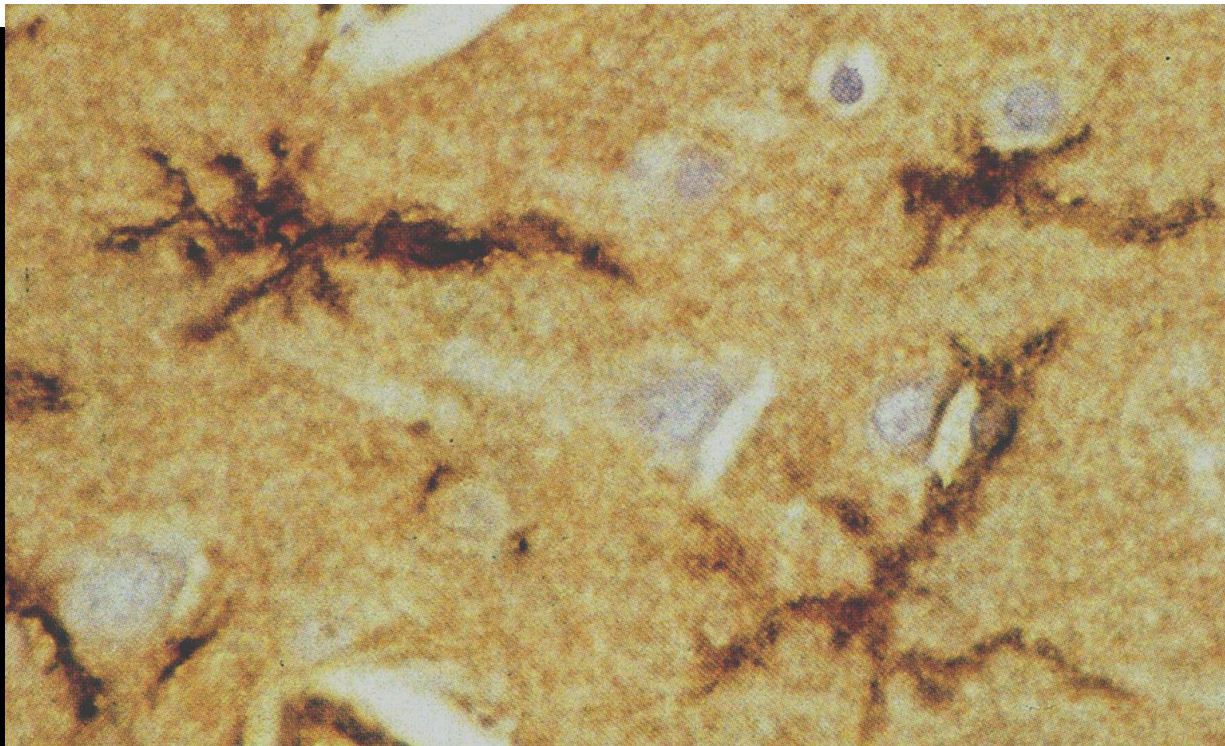
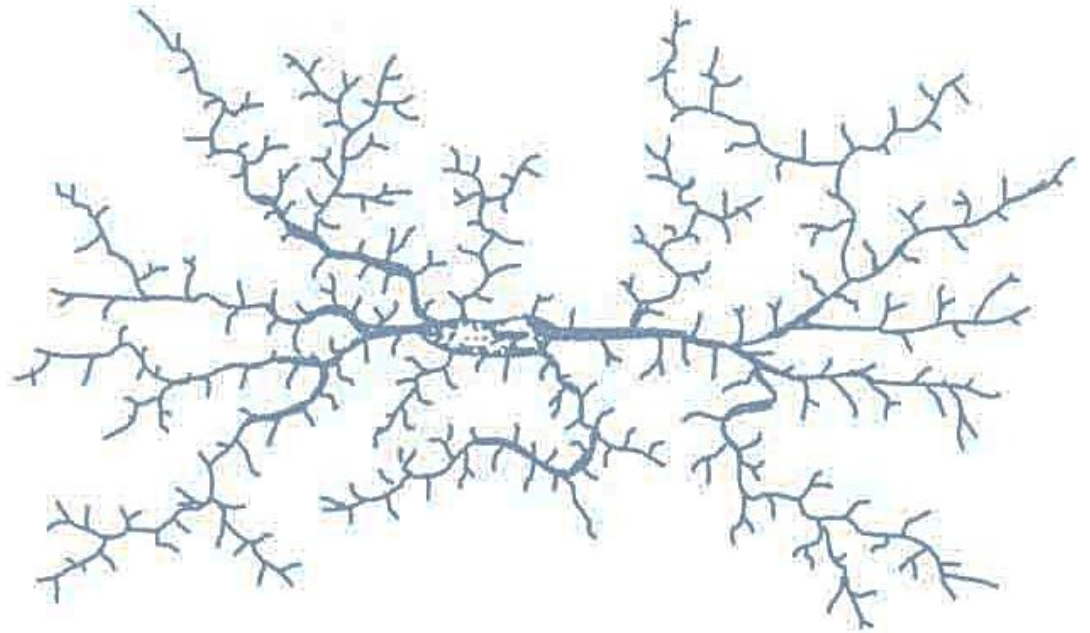


Oligodendrocytes



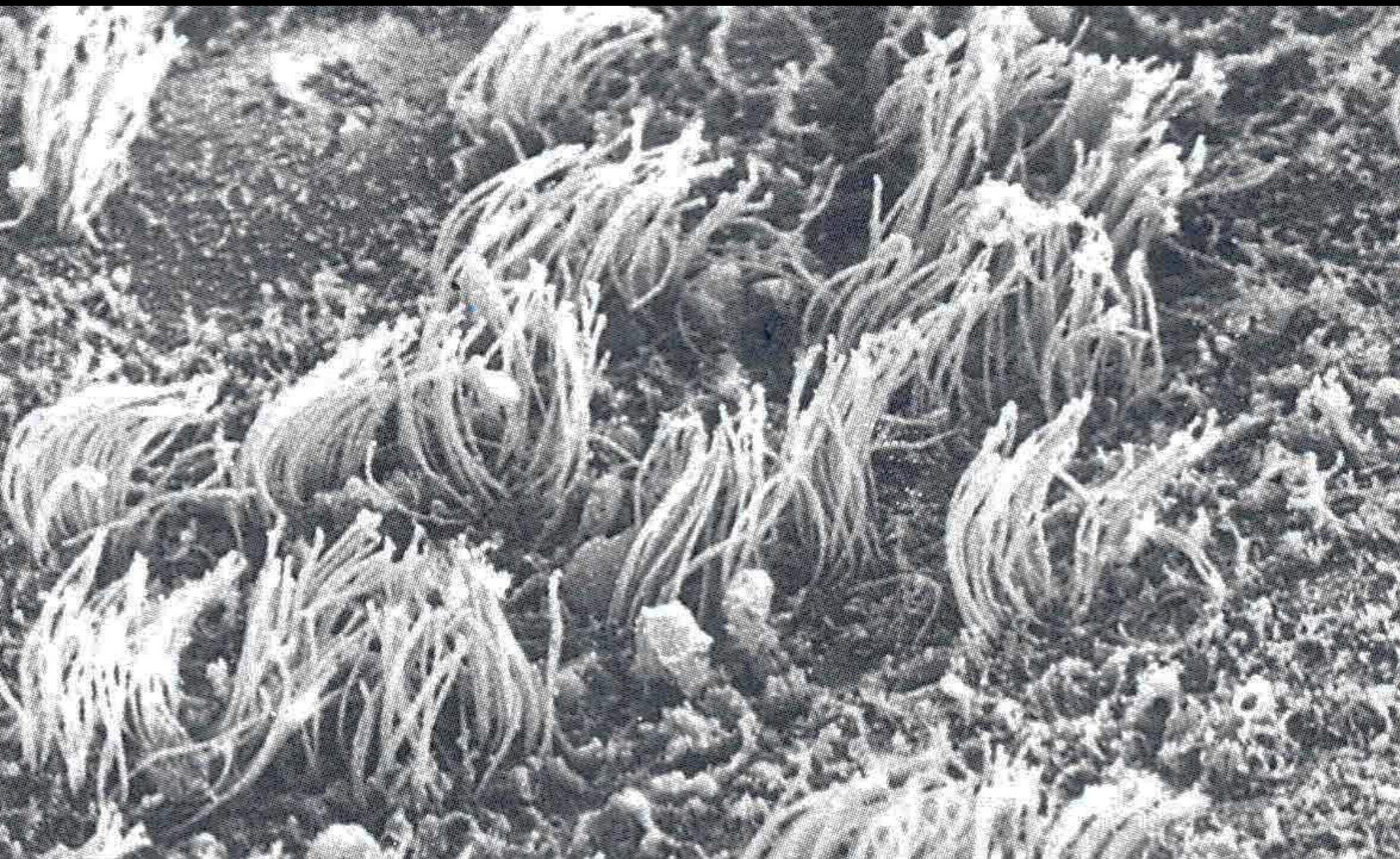


Microglia



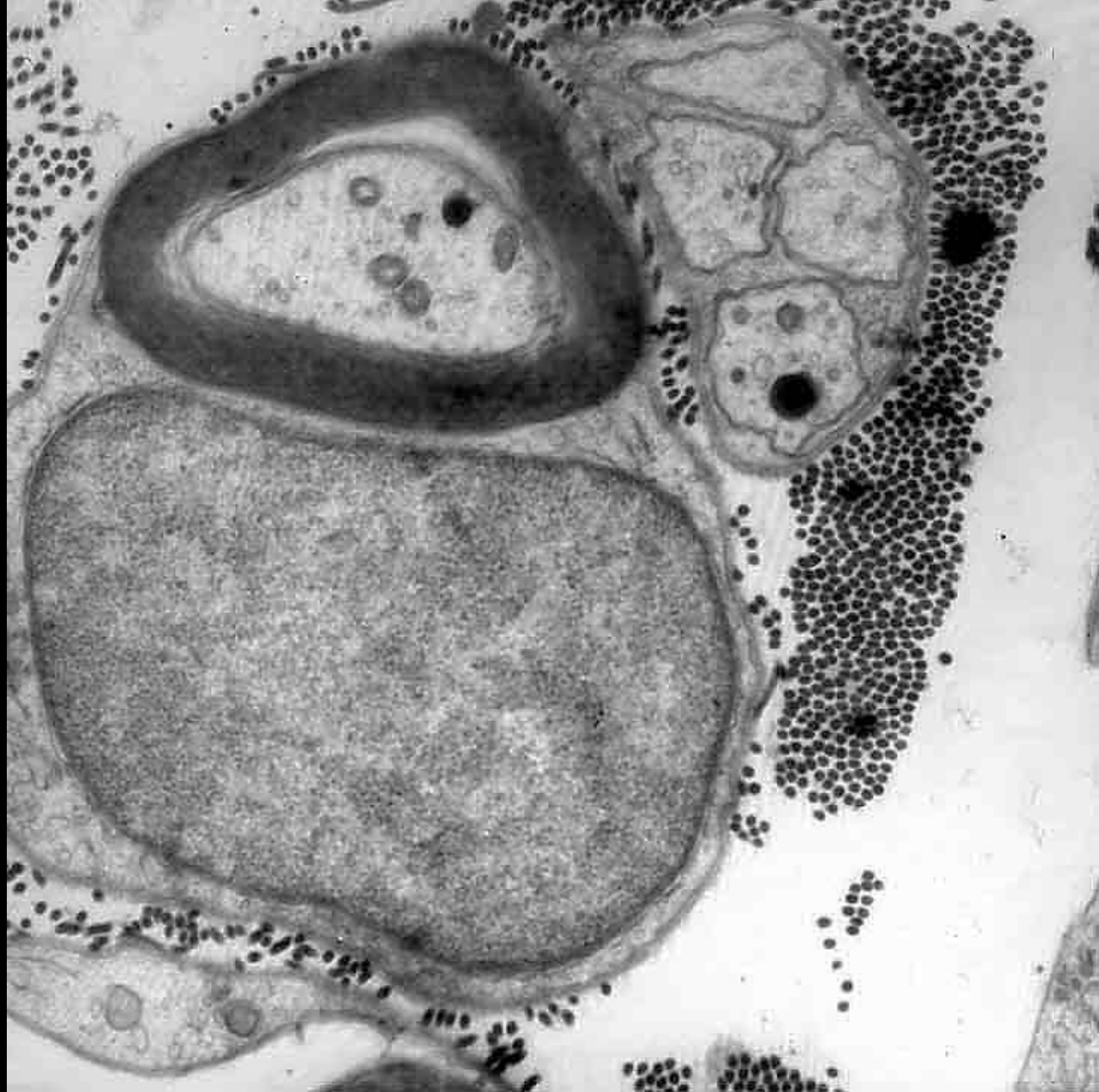
Ependymové buňky



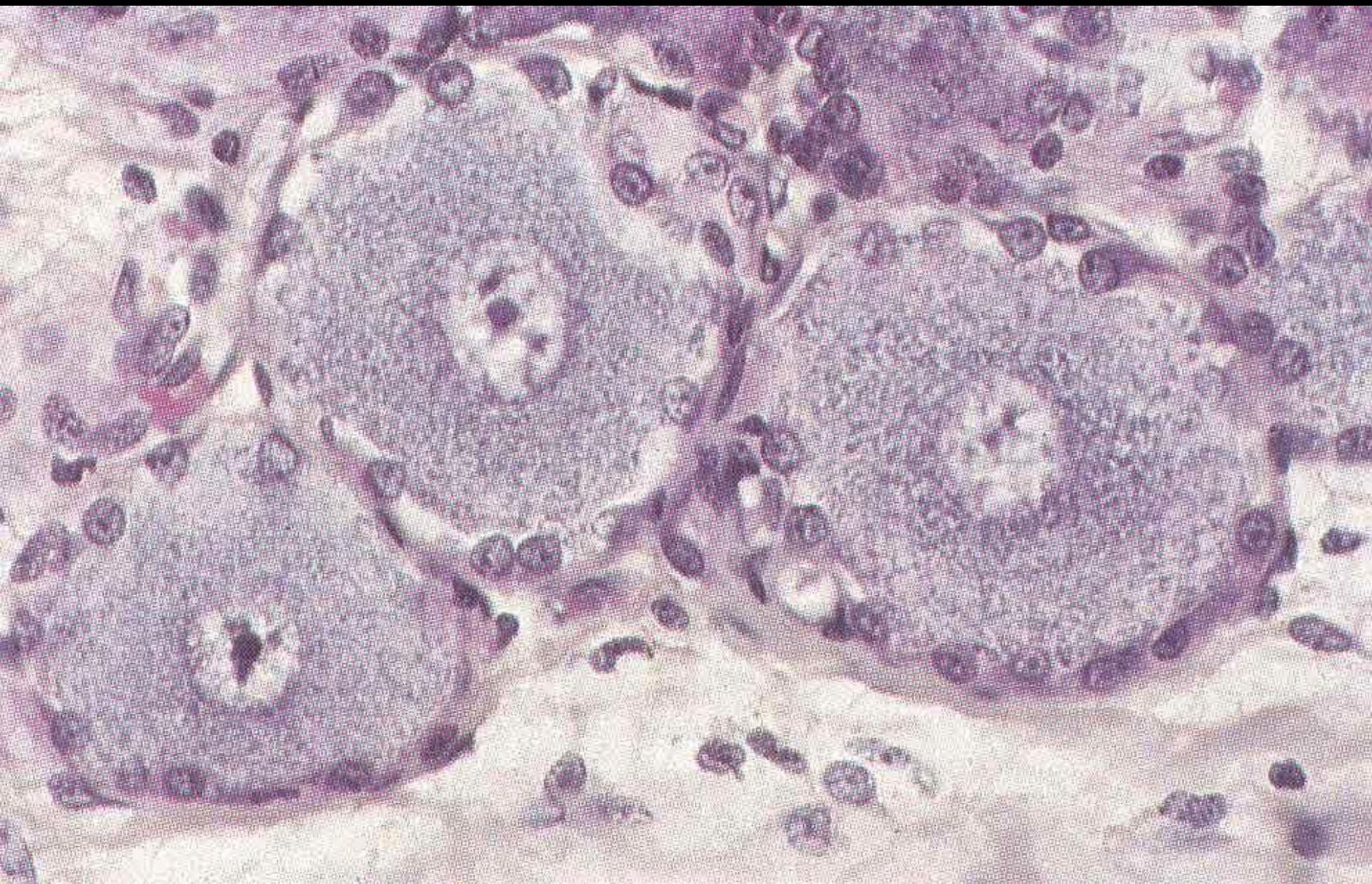


Schwannovy buňky

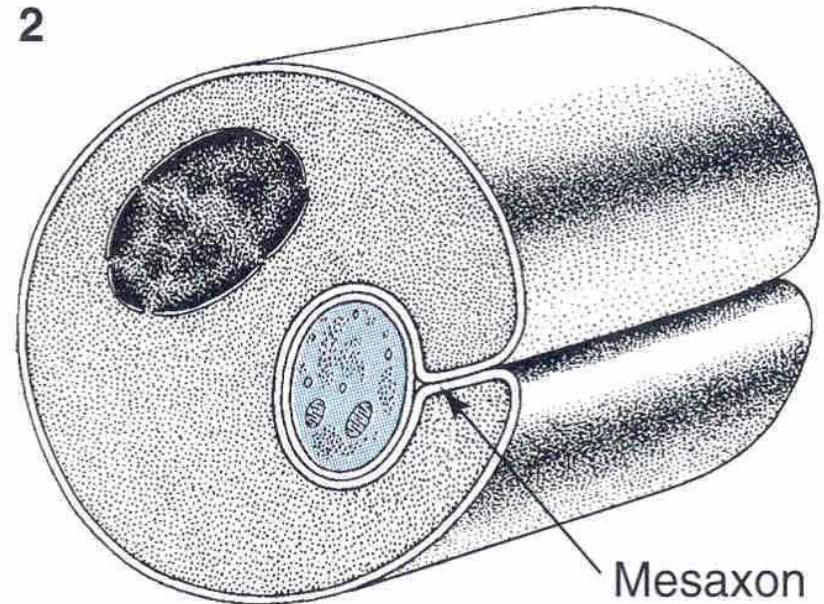
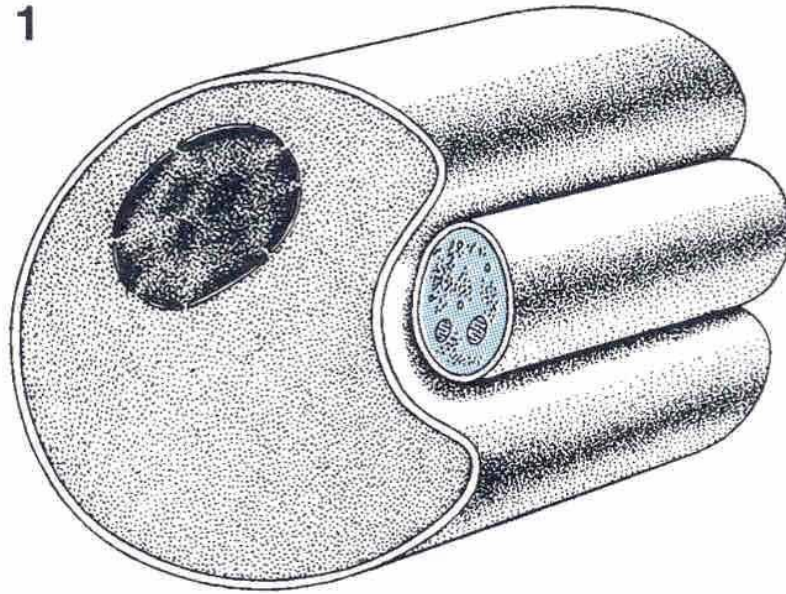




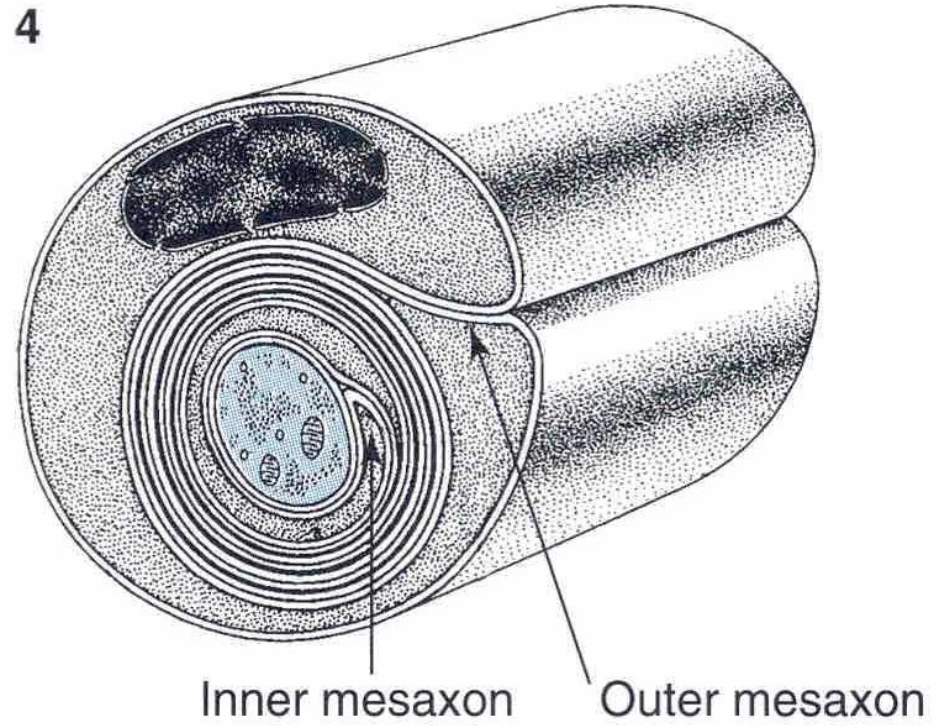
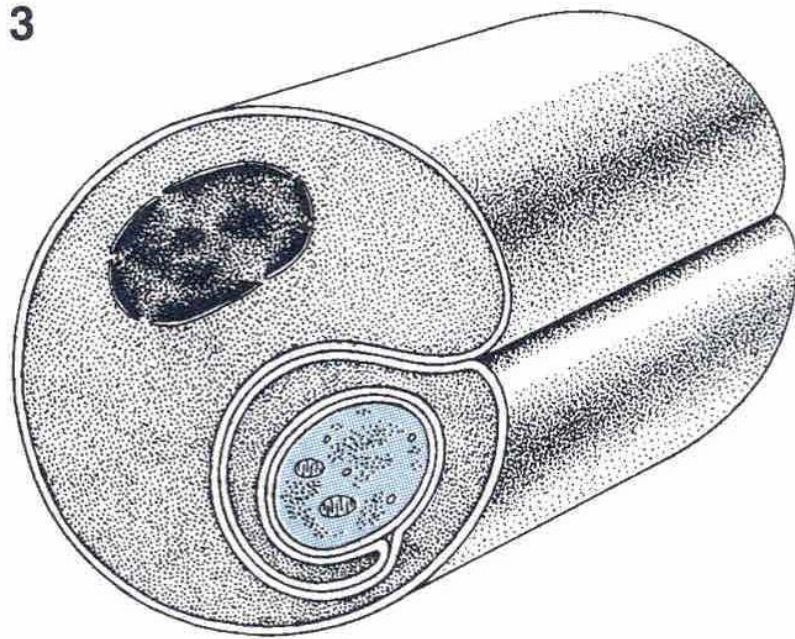
Satelitové buňky

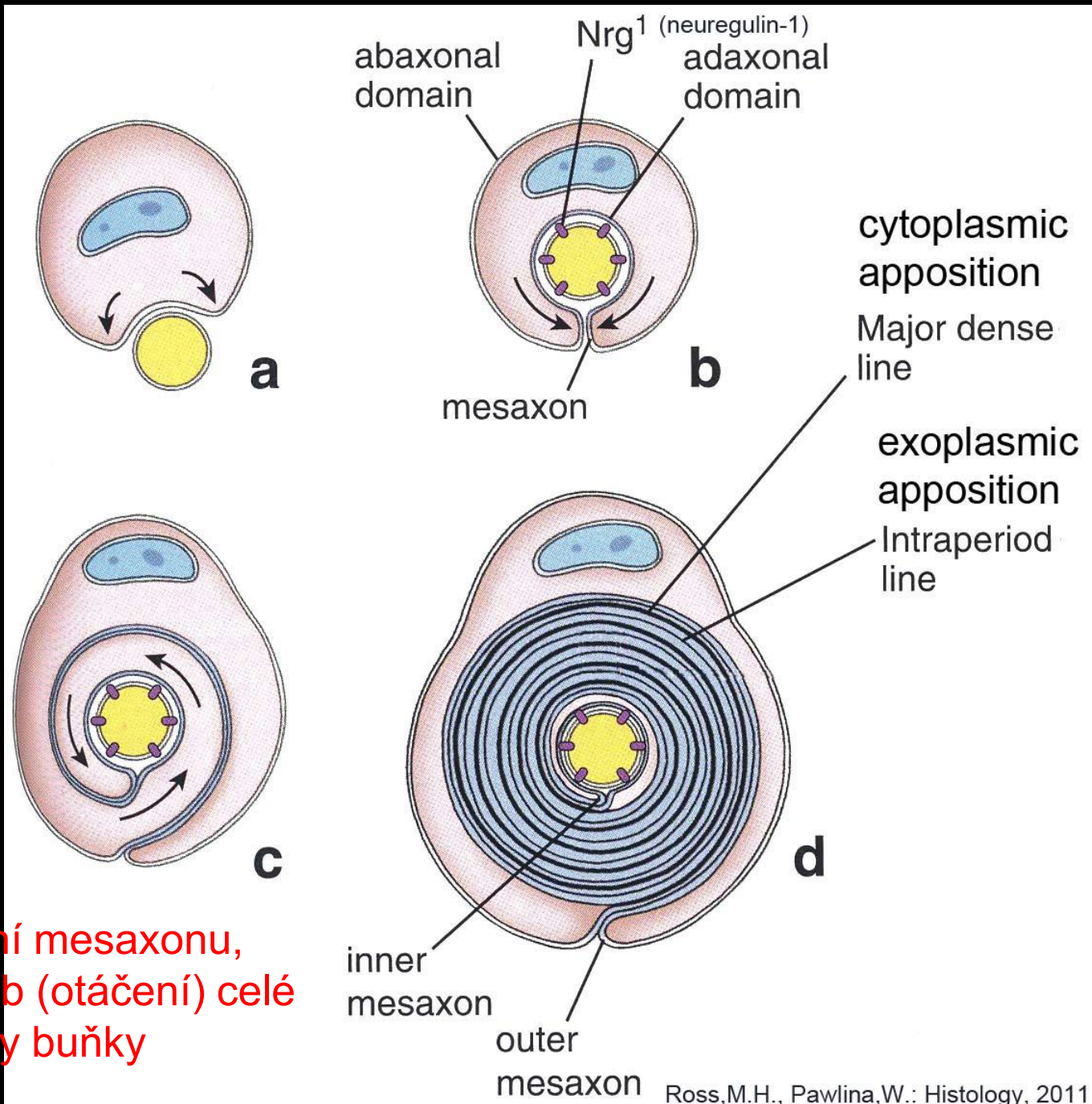


Myelinizace

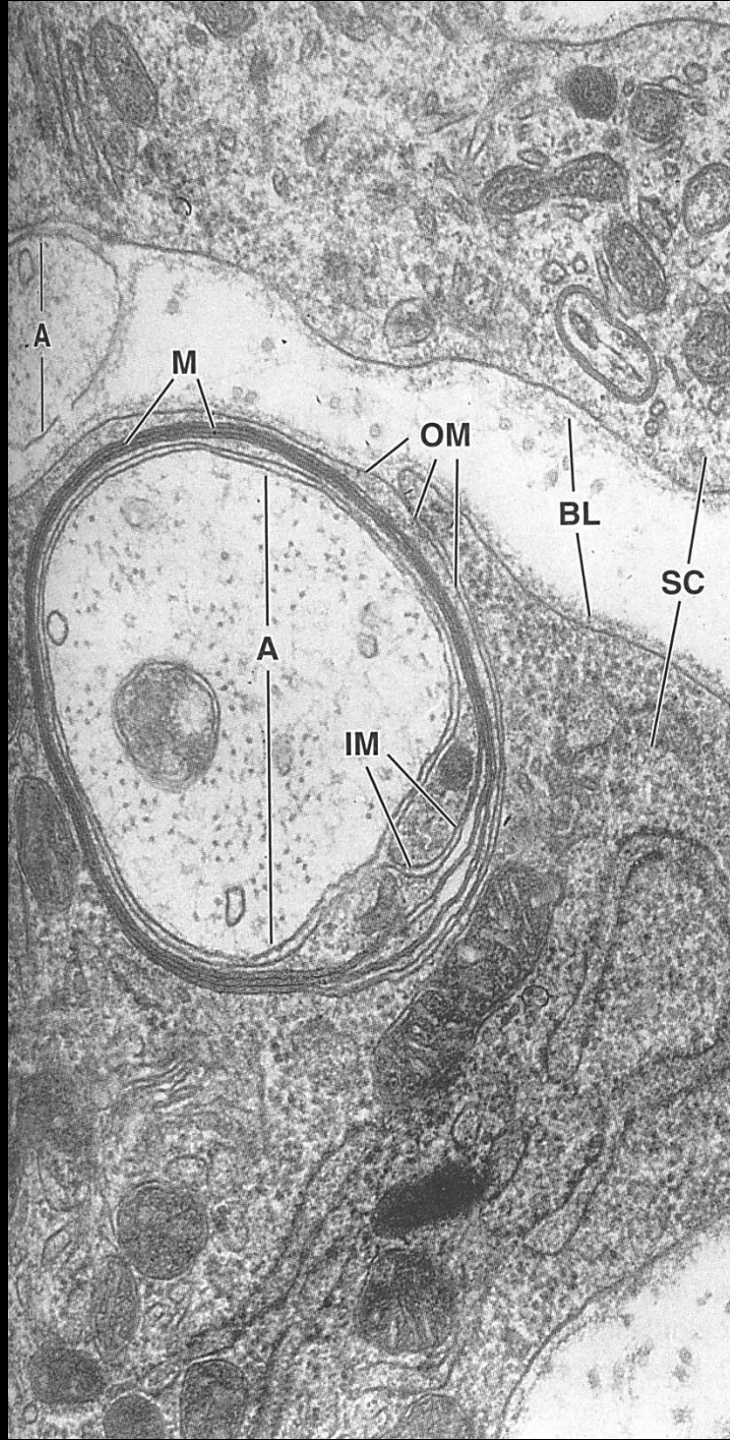


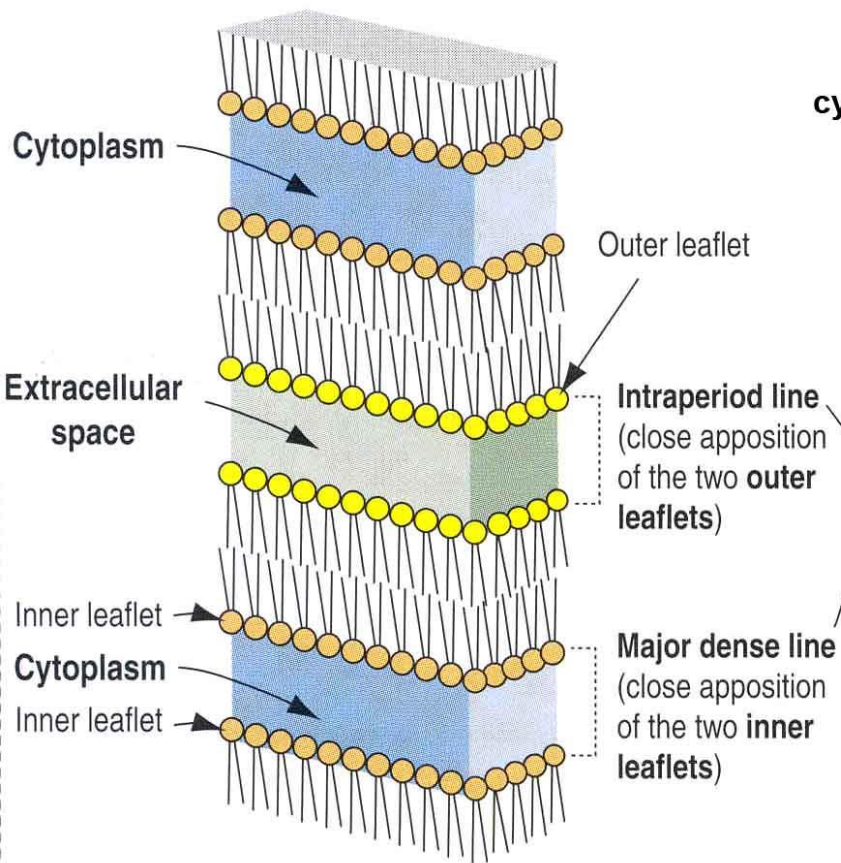
- axon produkuje neuregulin-1 v množství úměrném své tloušťce, Schwannova buňka vnímá signál receptorem ErbB
- receptory zprostředkovaná adheze mezi axonem a Schwannovou buňkou (NCAM)





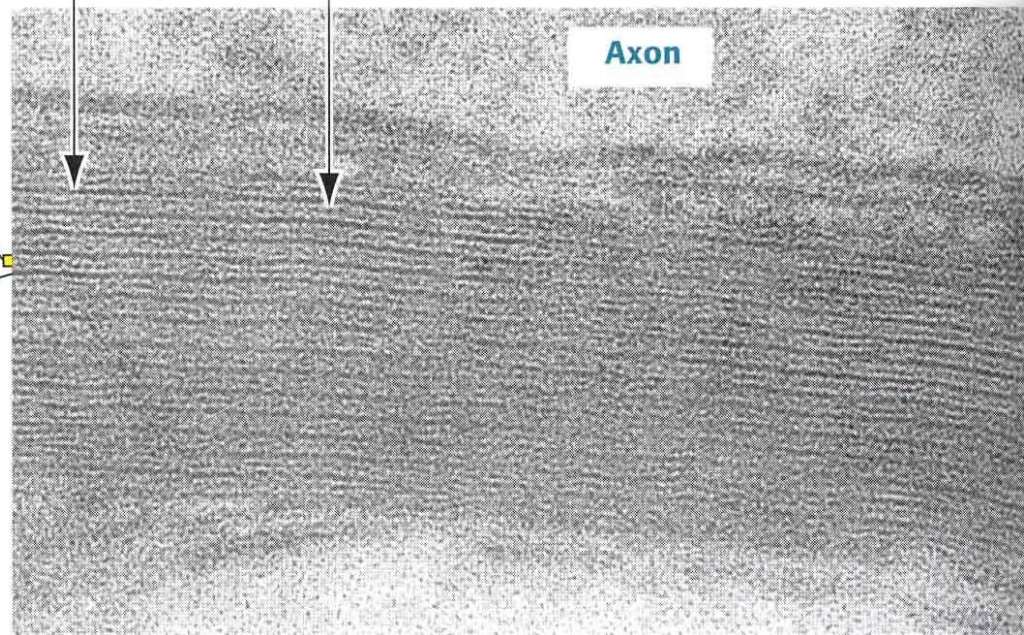
prodlužování mesaxonu,
nikoliv pohyb (otáčení) celé
Schwannovy buňky

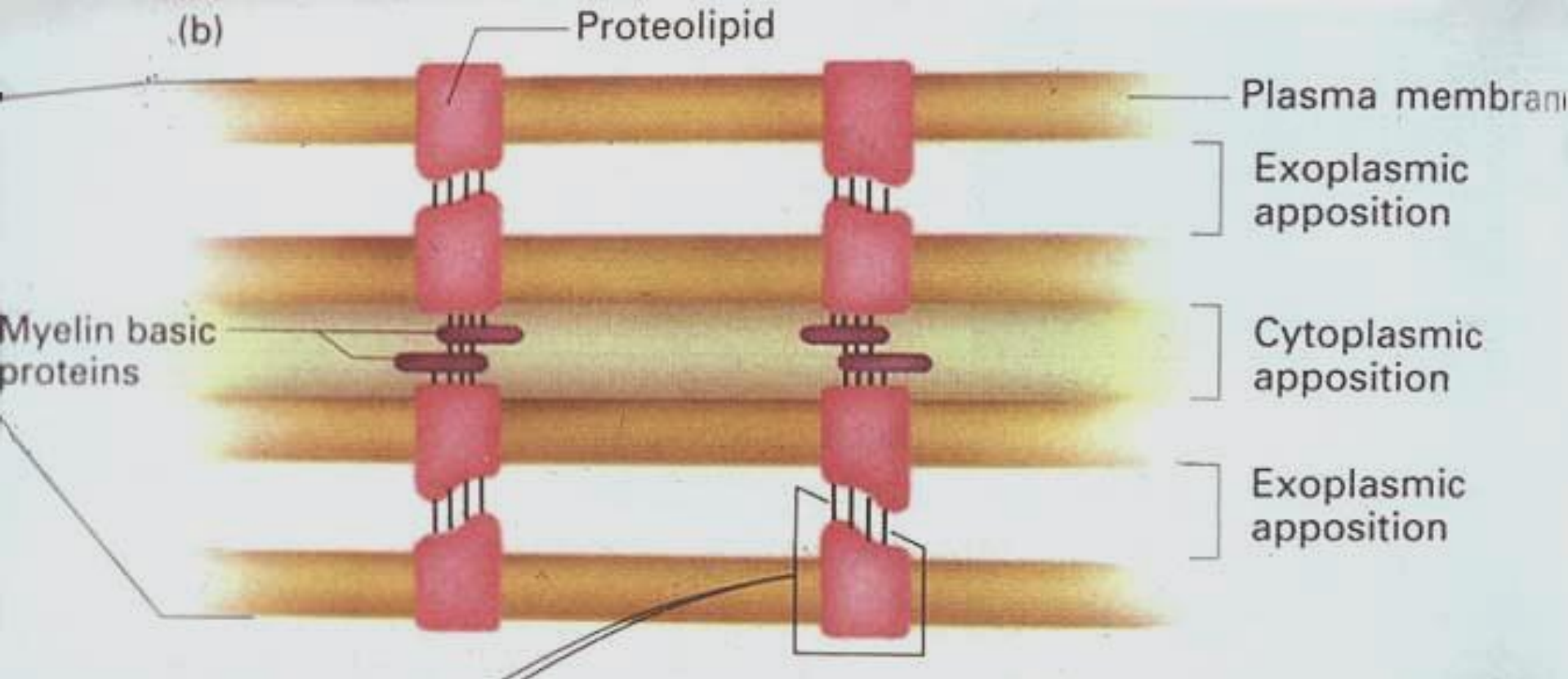




cytoplasmic apposition

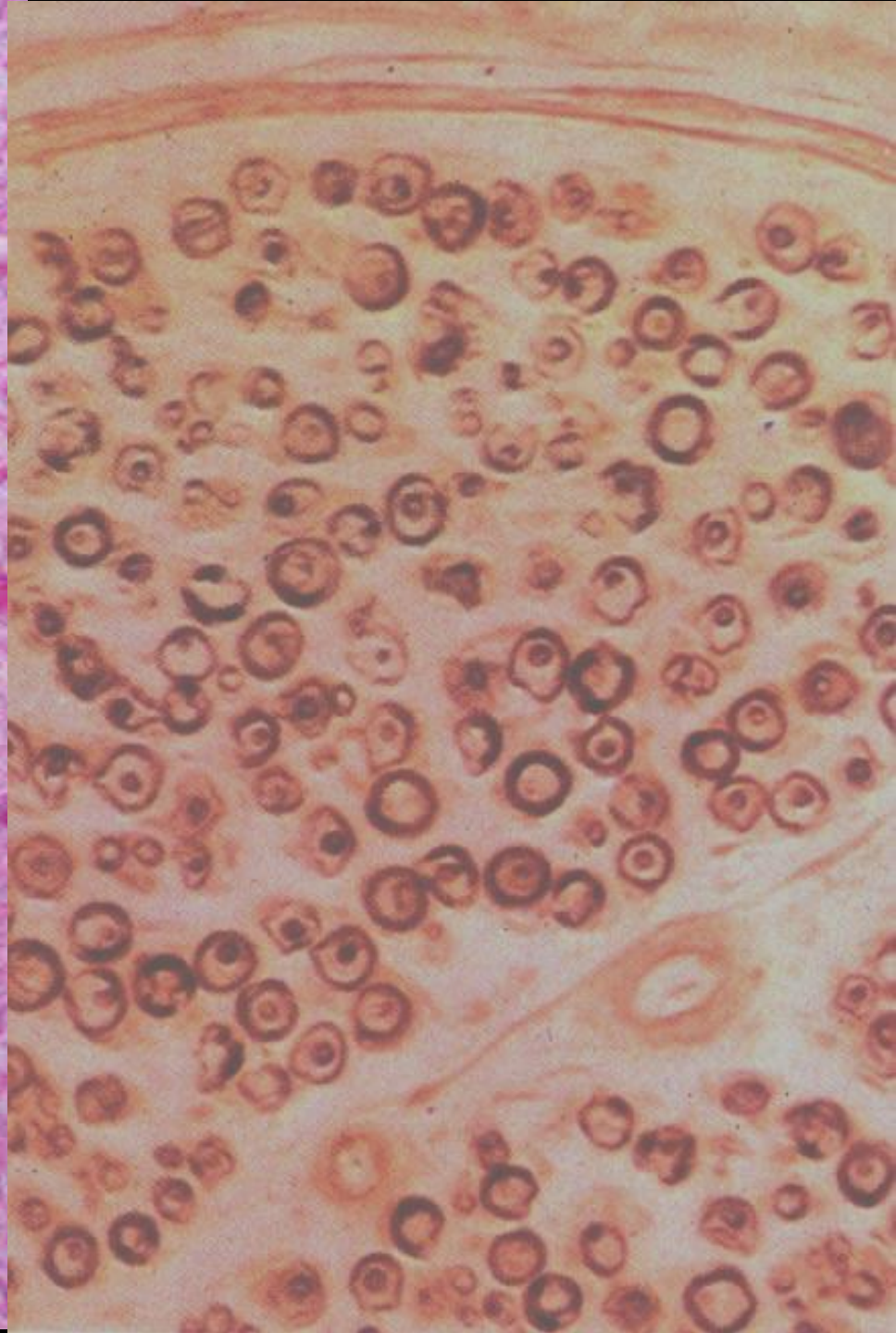
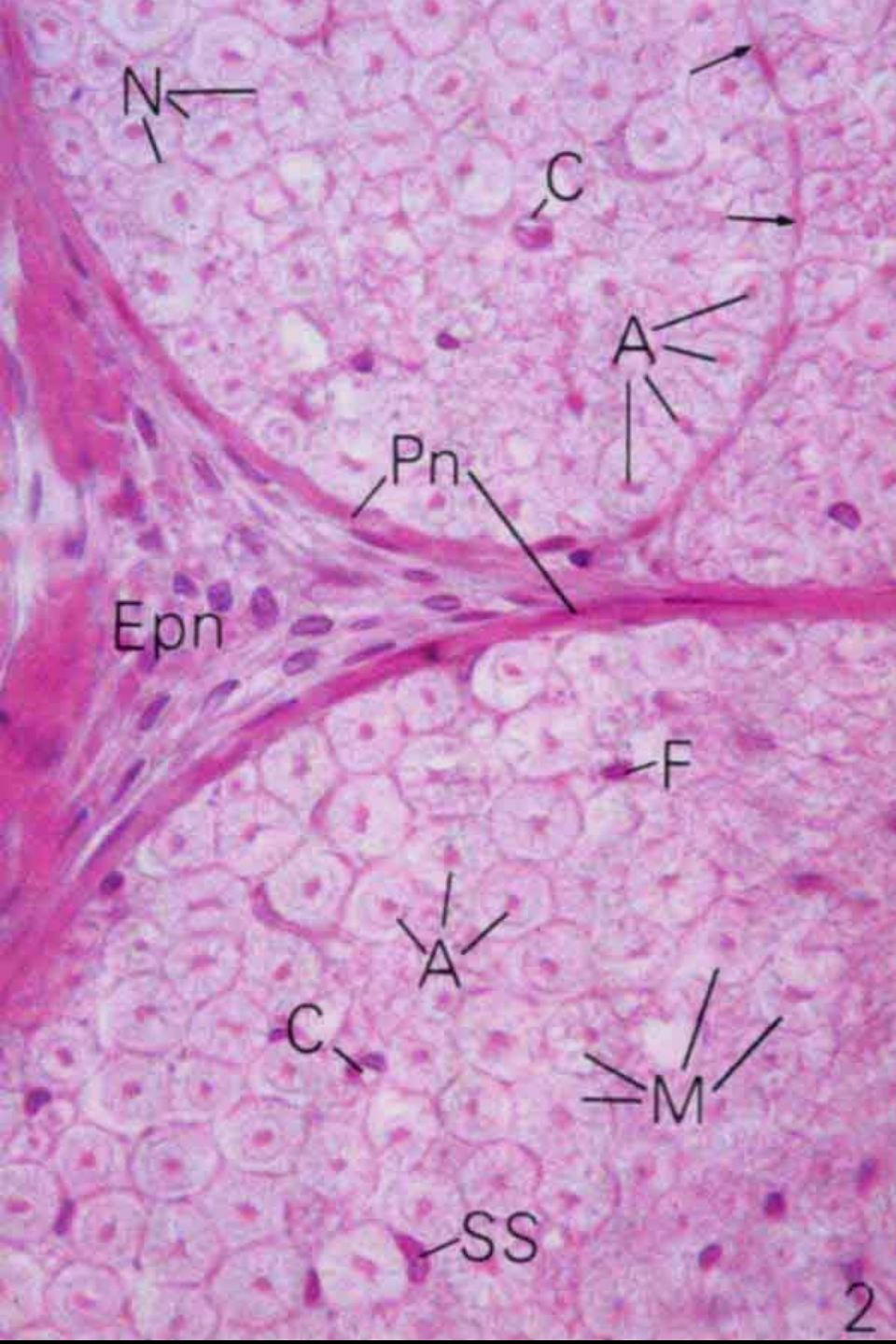
exoplasmic apposition

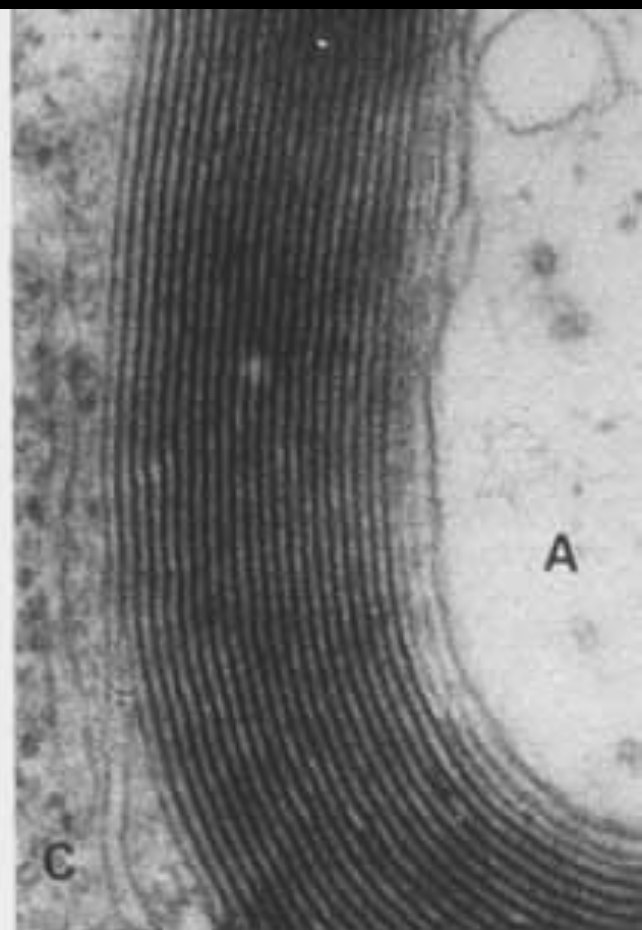
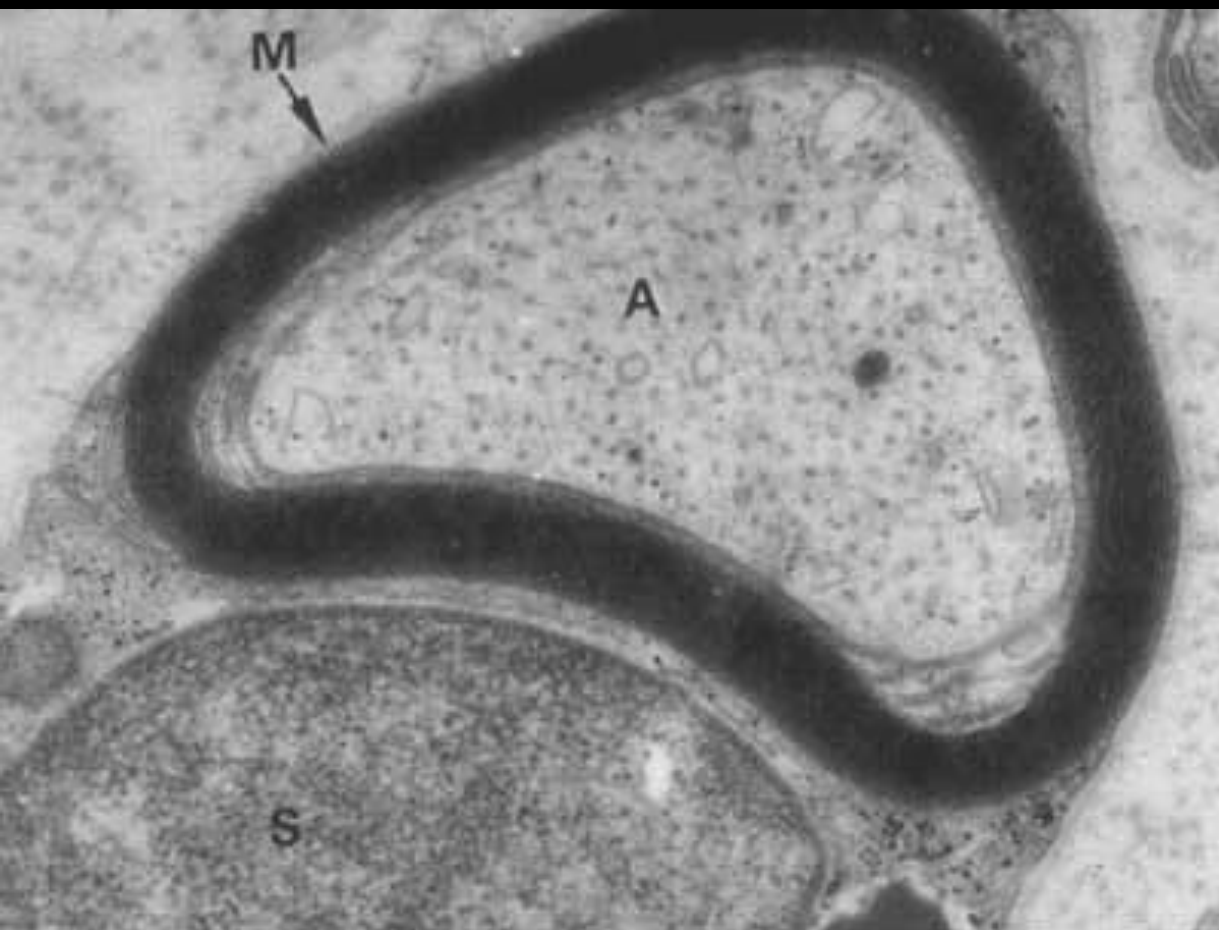


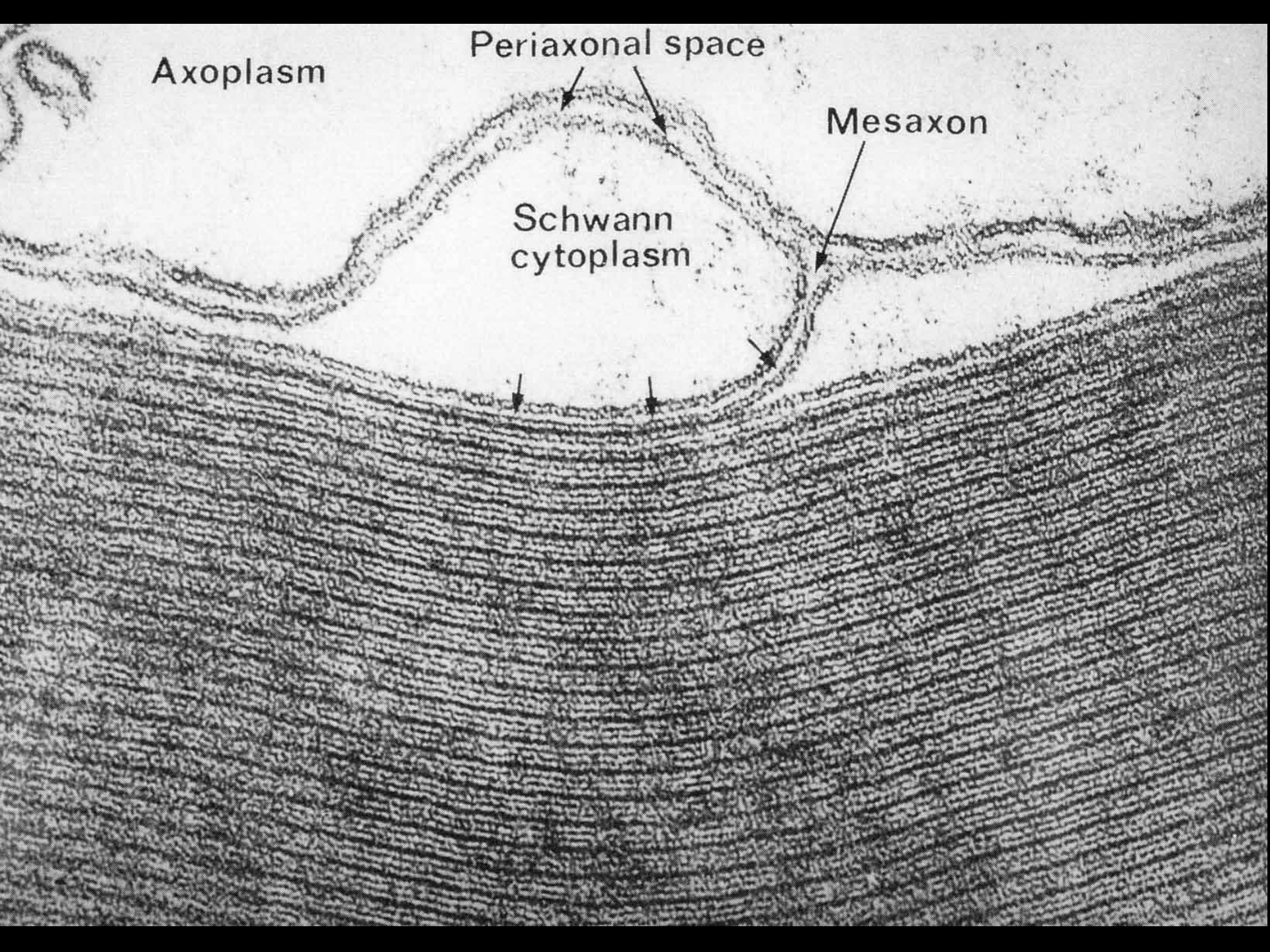


- bazický protein myelinu a oligodendrocytový glykoprotein myelinu (pouze CNS) - cytoplasmatická apozice
- proteolipidový protein 1 – exoplasmatická apozice

destrukce těchto struktur vede k DEMYELINIZACI







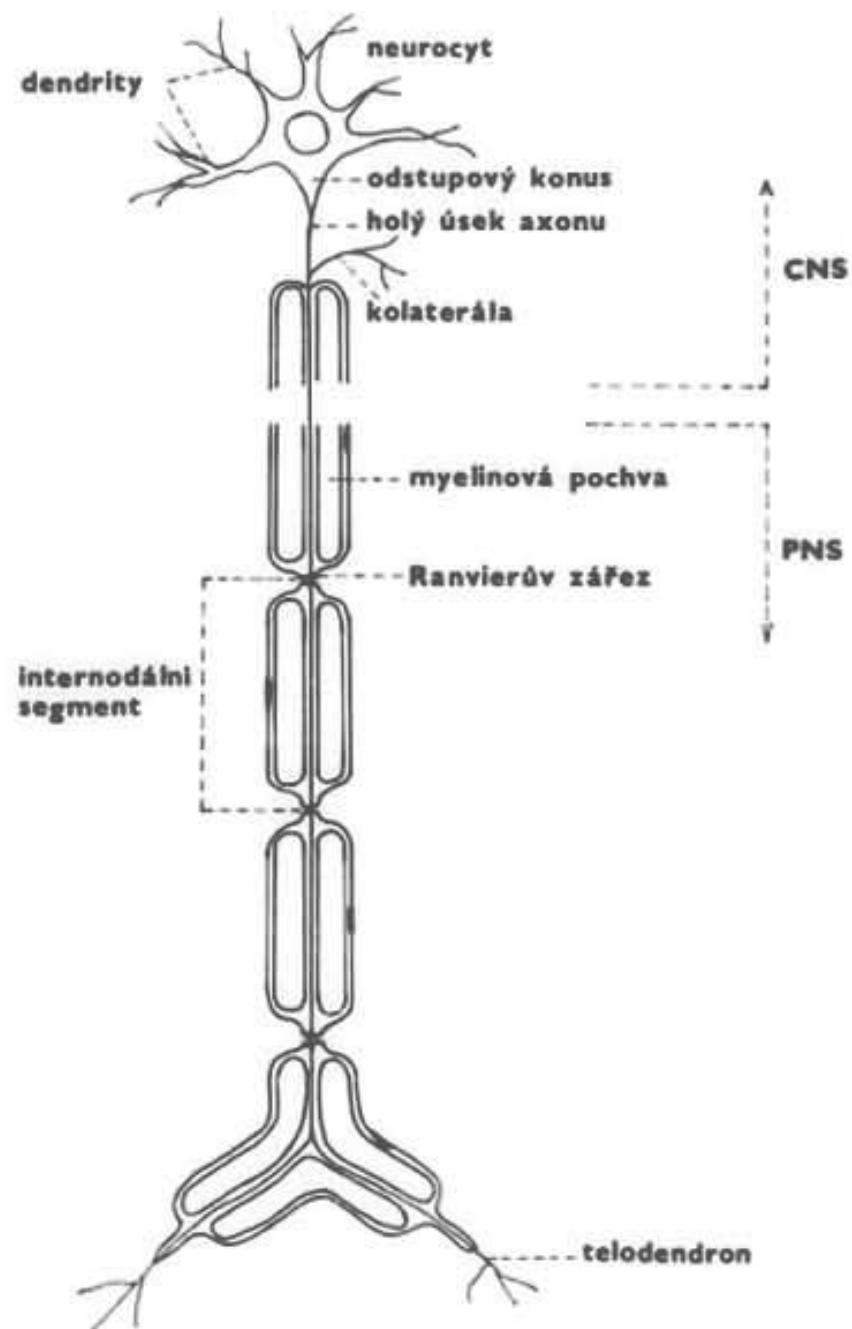
Axoplasm

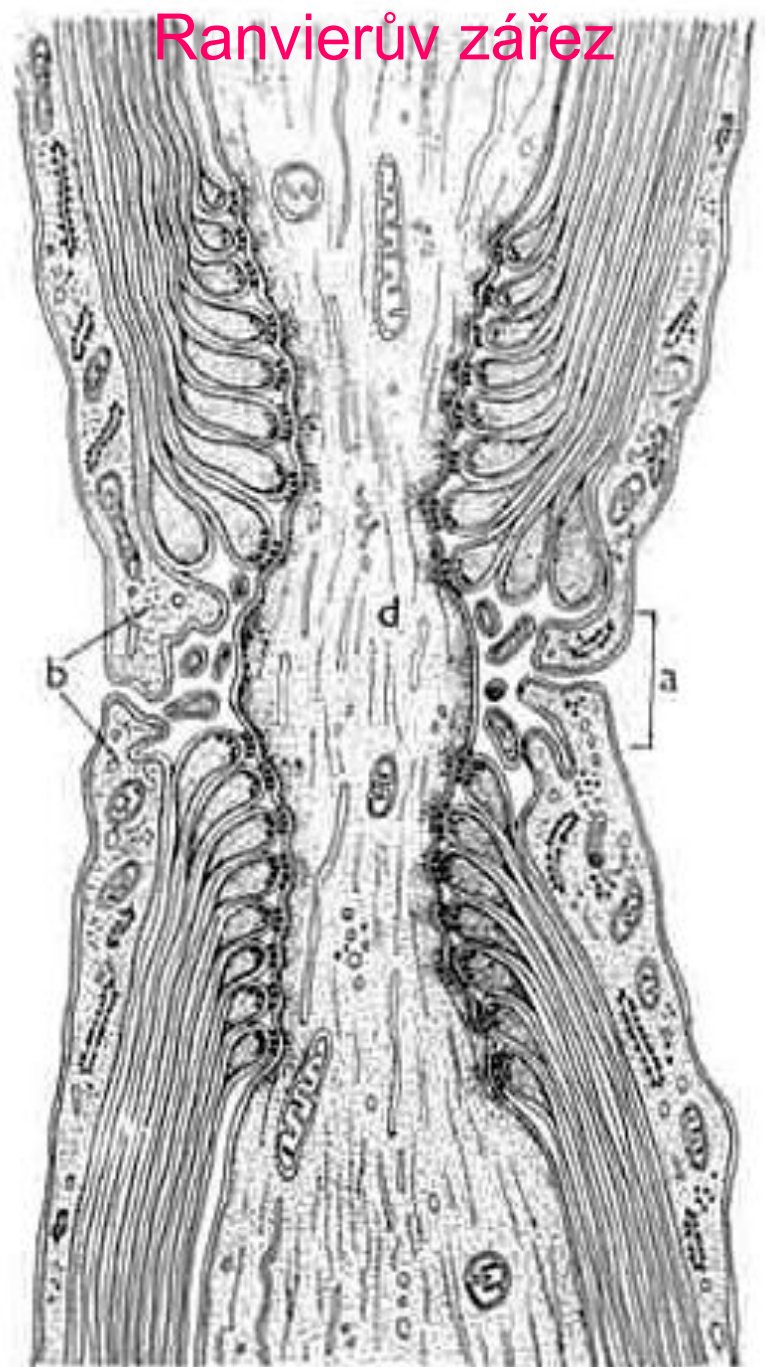
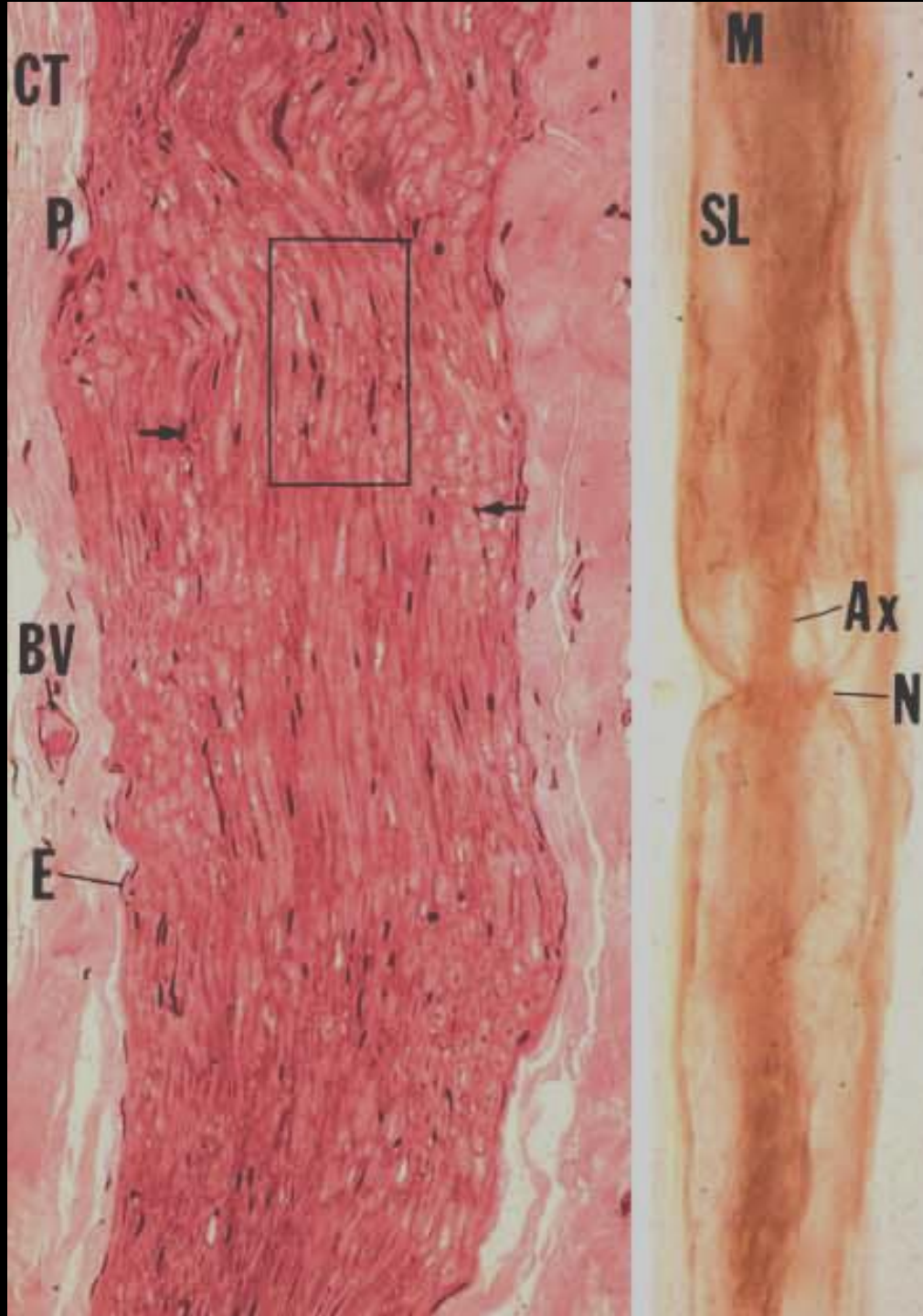
Periaxonal space

Mesaxon

Schwann
cytoplasm

Multipolární neuron s dlouhým axonem

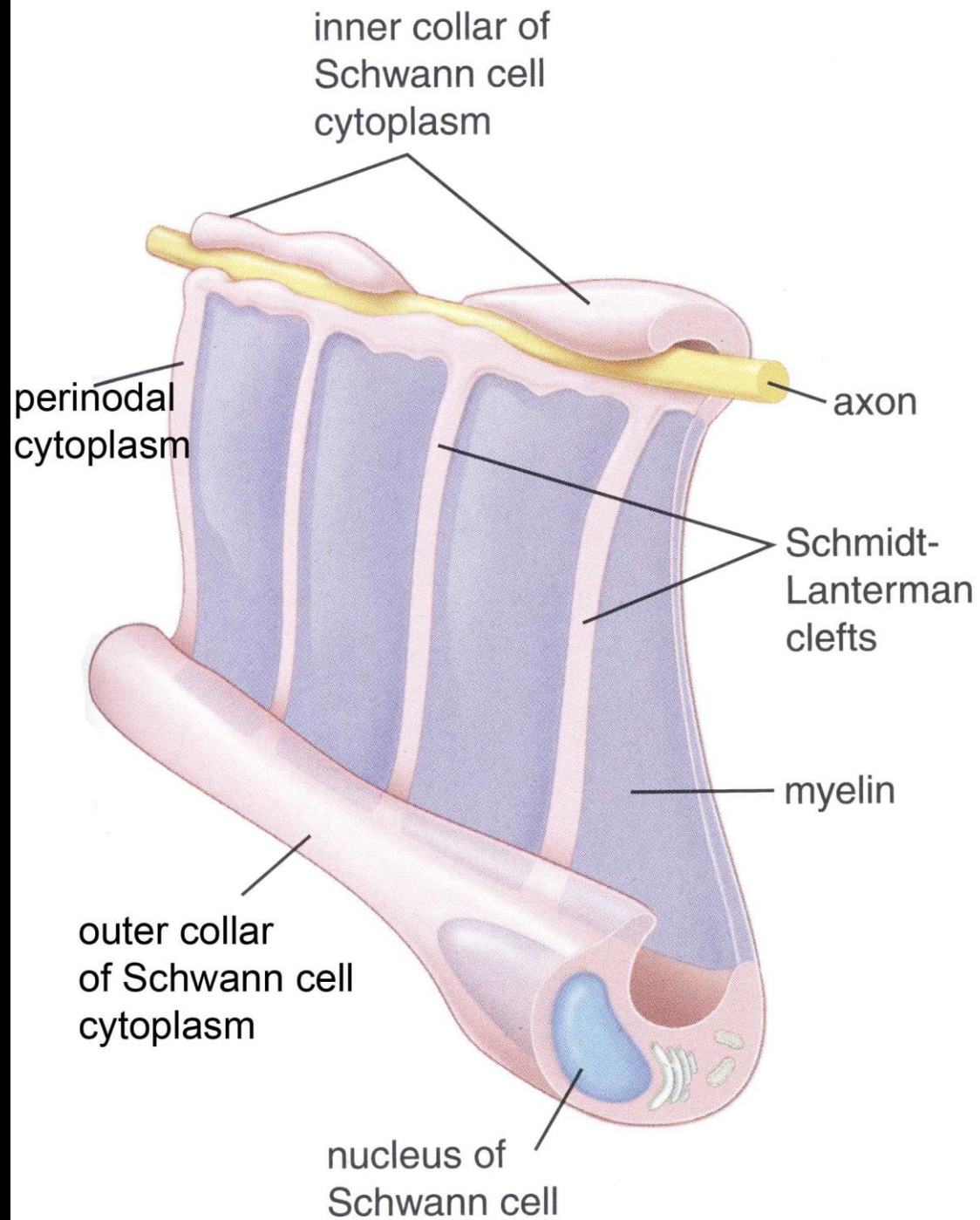


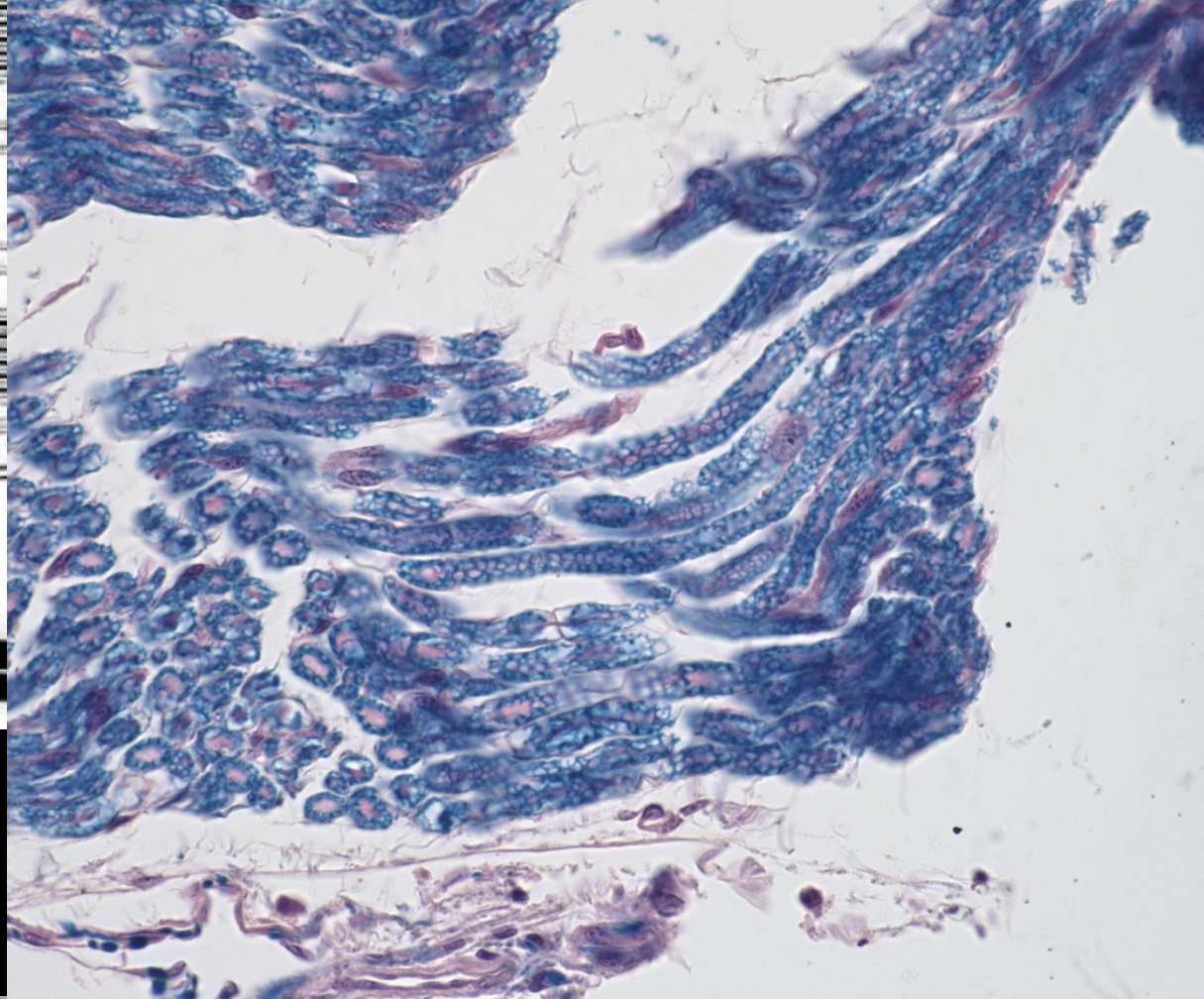
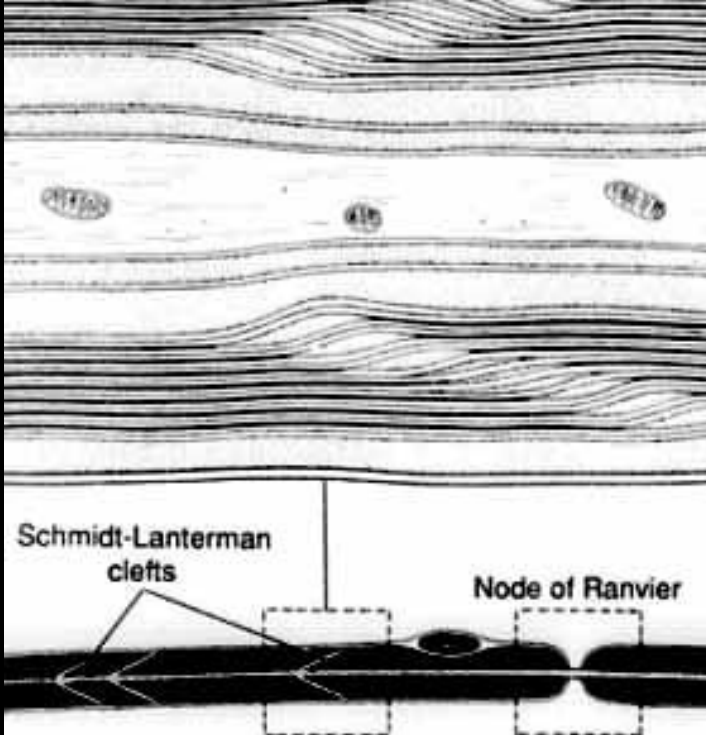


zevní límec

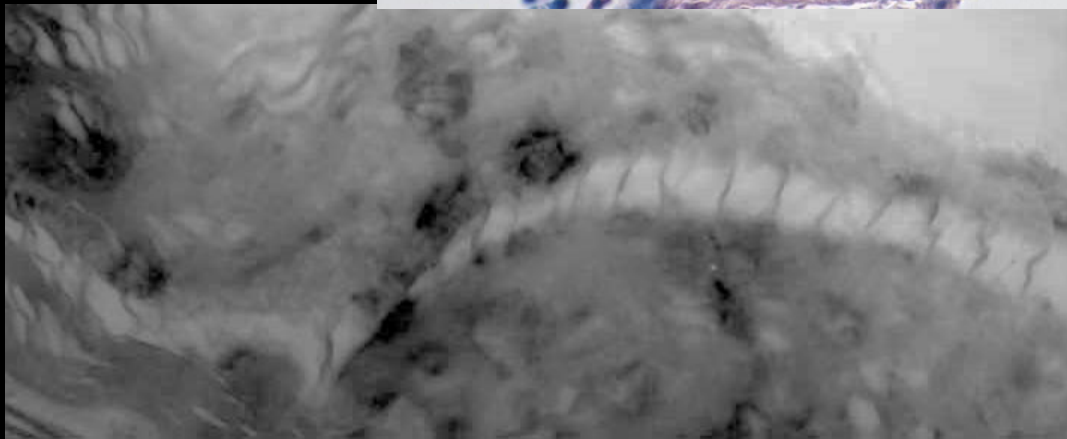
vnitřní límec



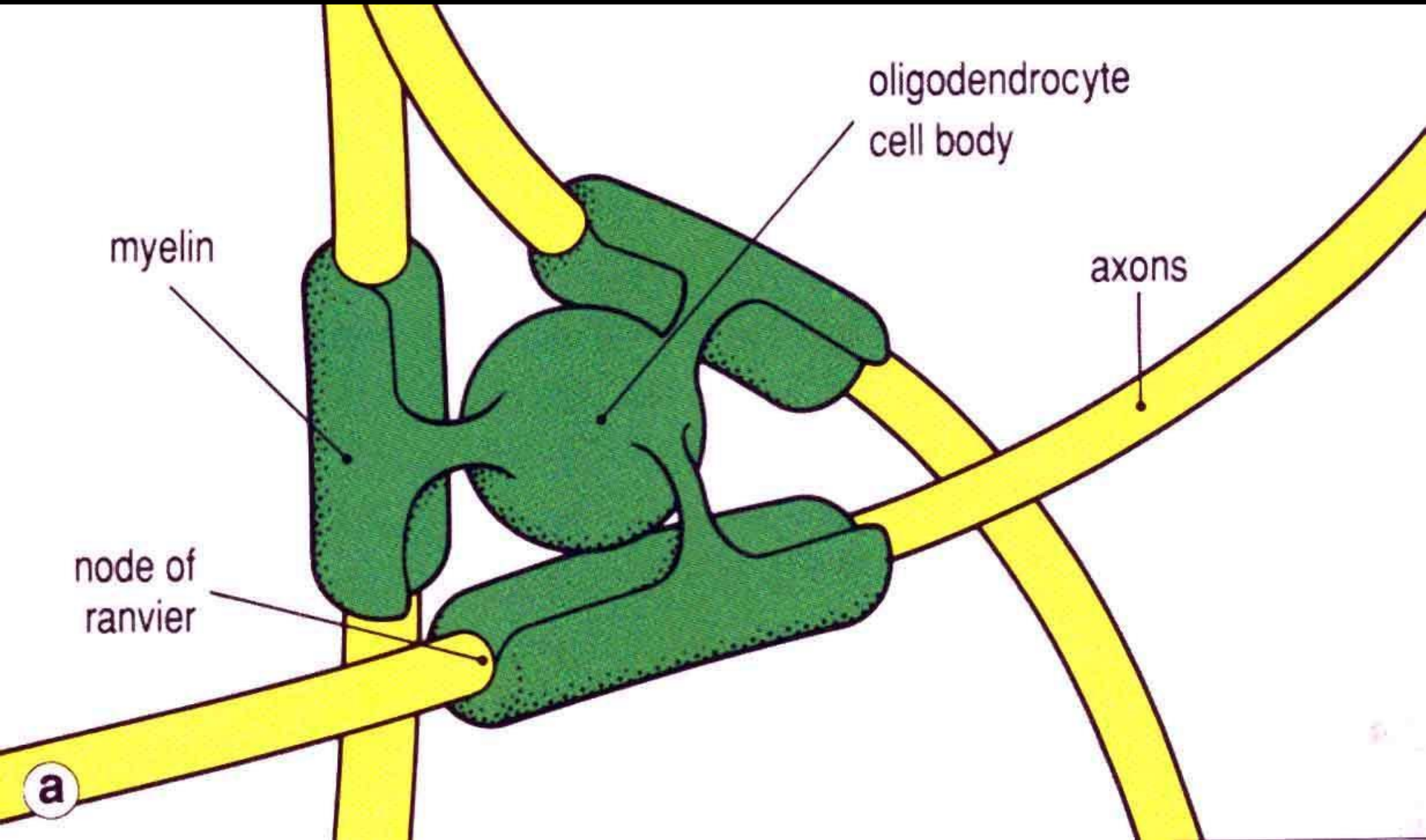


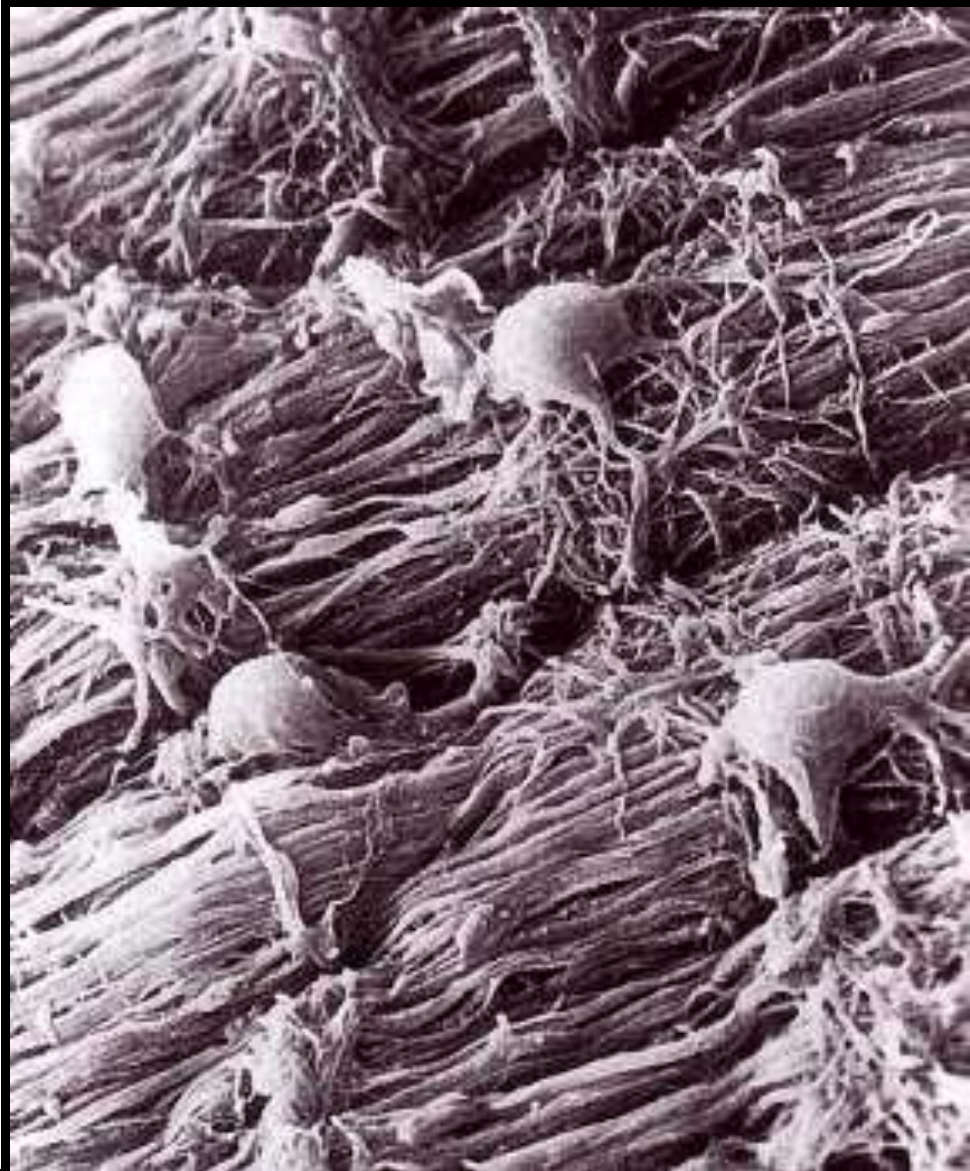
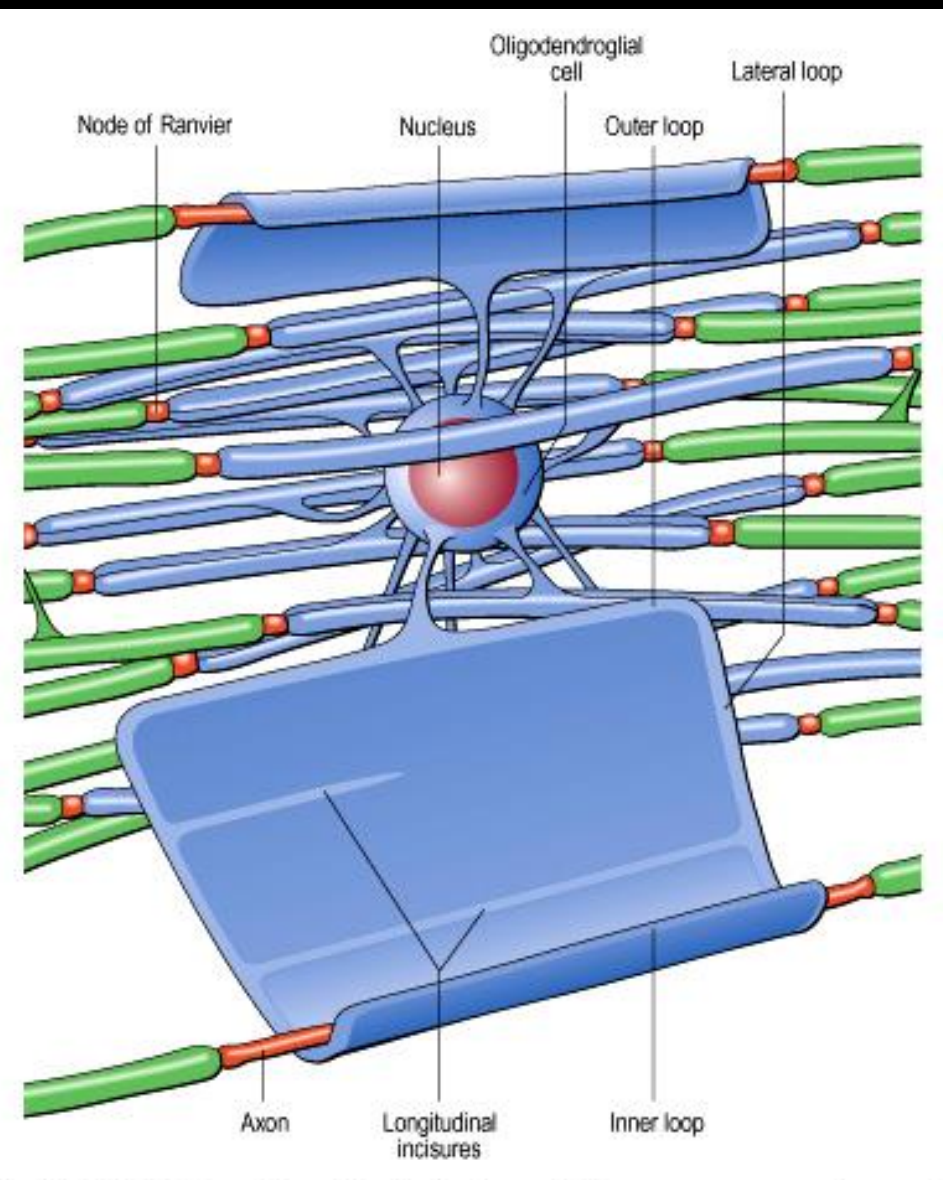


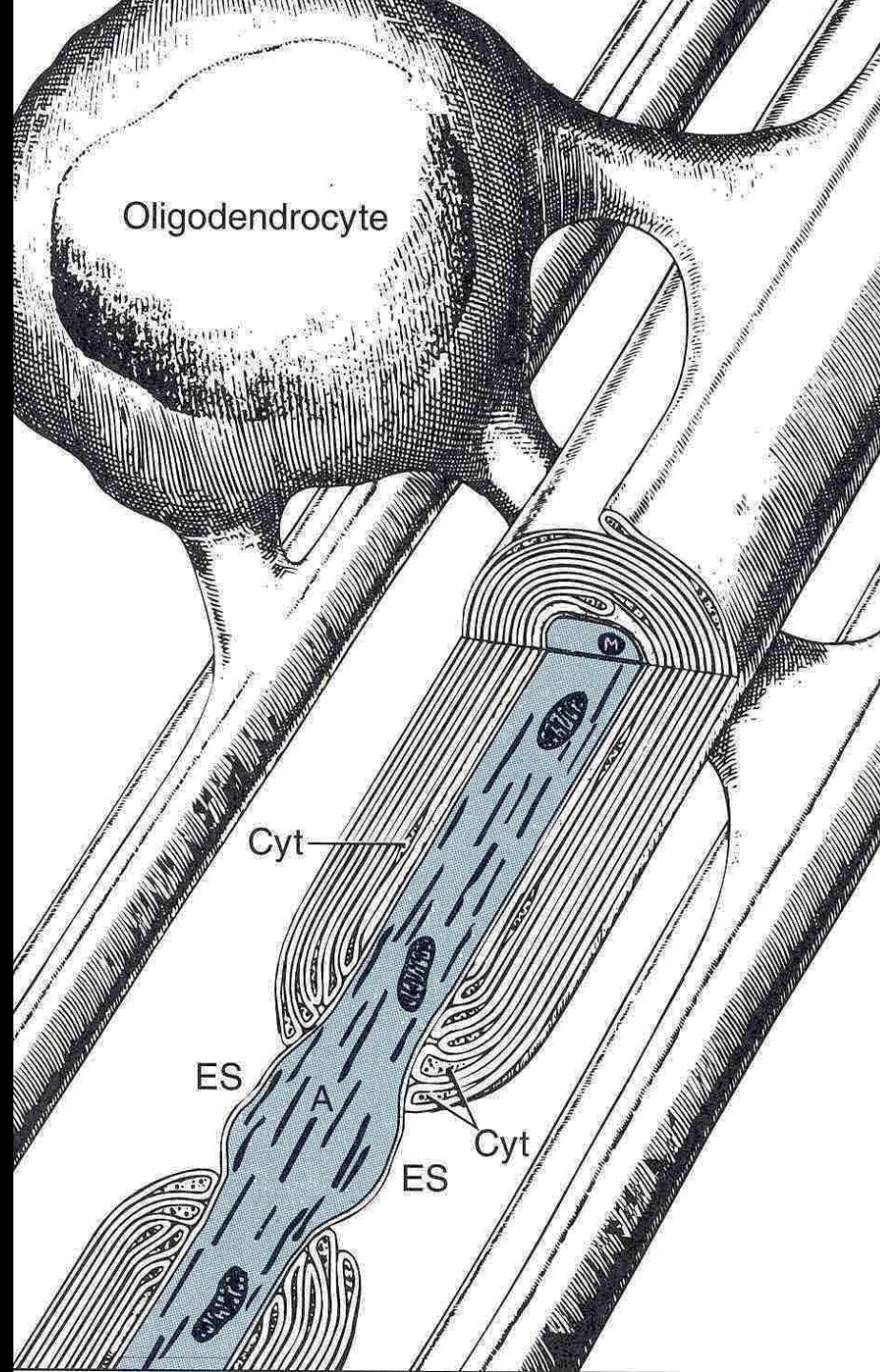
Schmidt –
Lanternmanovy
štěrbiny



Myelinizace v CNS







Nemyelinizované axony

