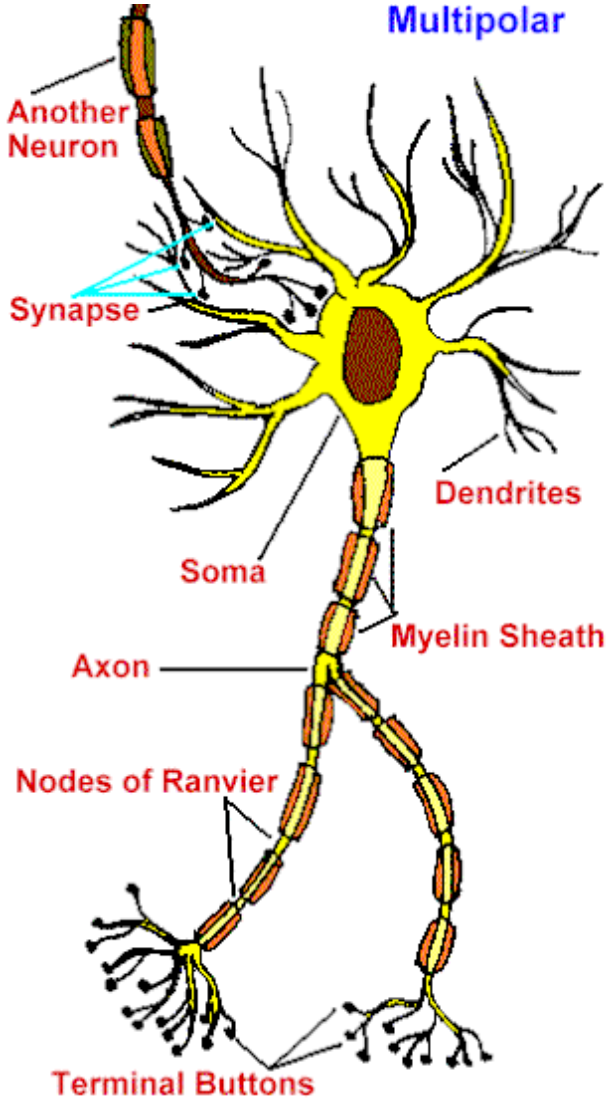
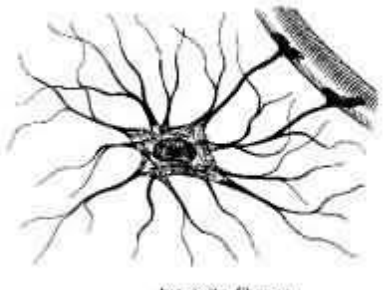
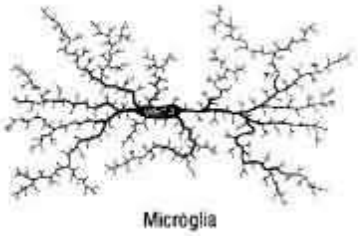
Nervová tkáň a nervový systém

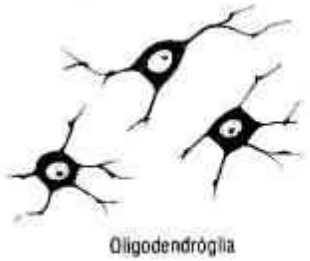
- **neurony**



- **neuroglie**
  - centrální
    - astrocyty
    - oligodendrocyty
    - mikroglie
    - ependym
  - periferní
    - Schwannovy buňky
    - satelitní buňky

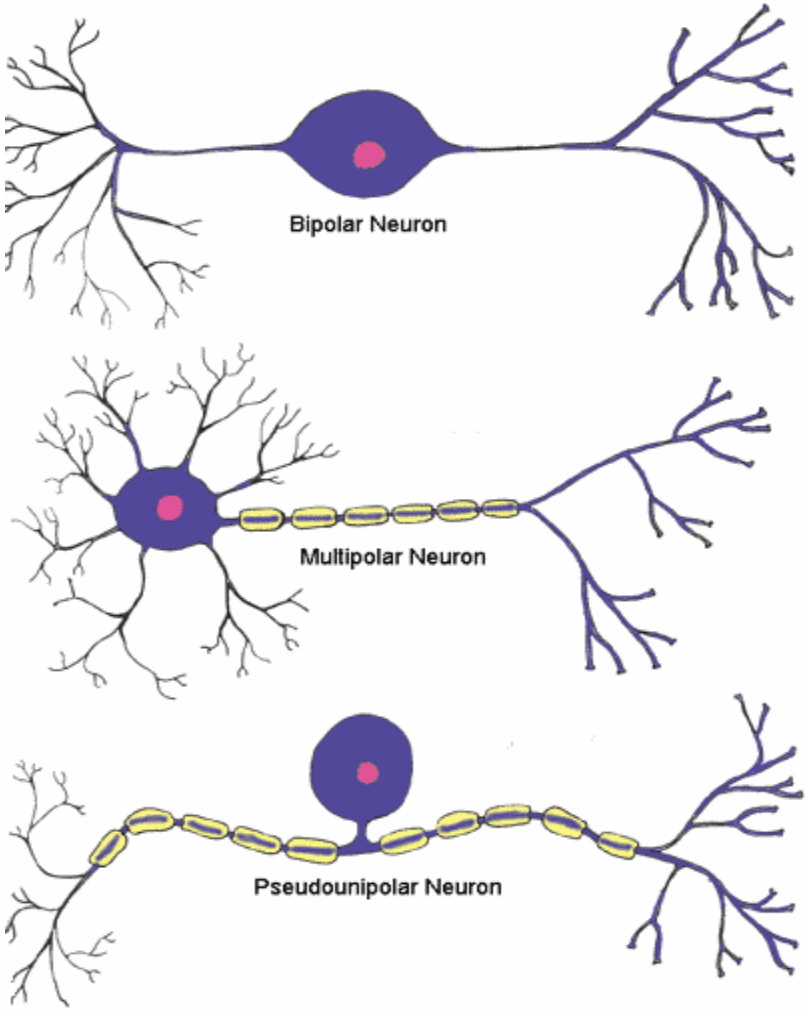




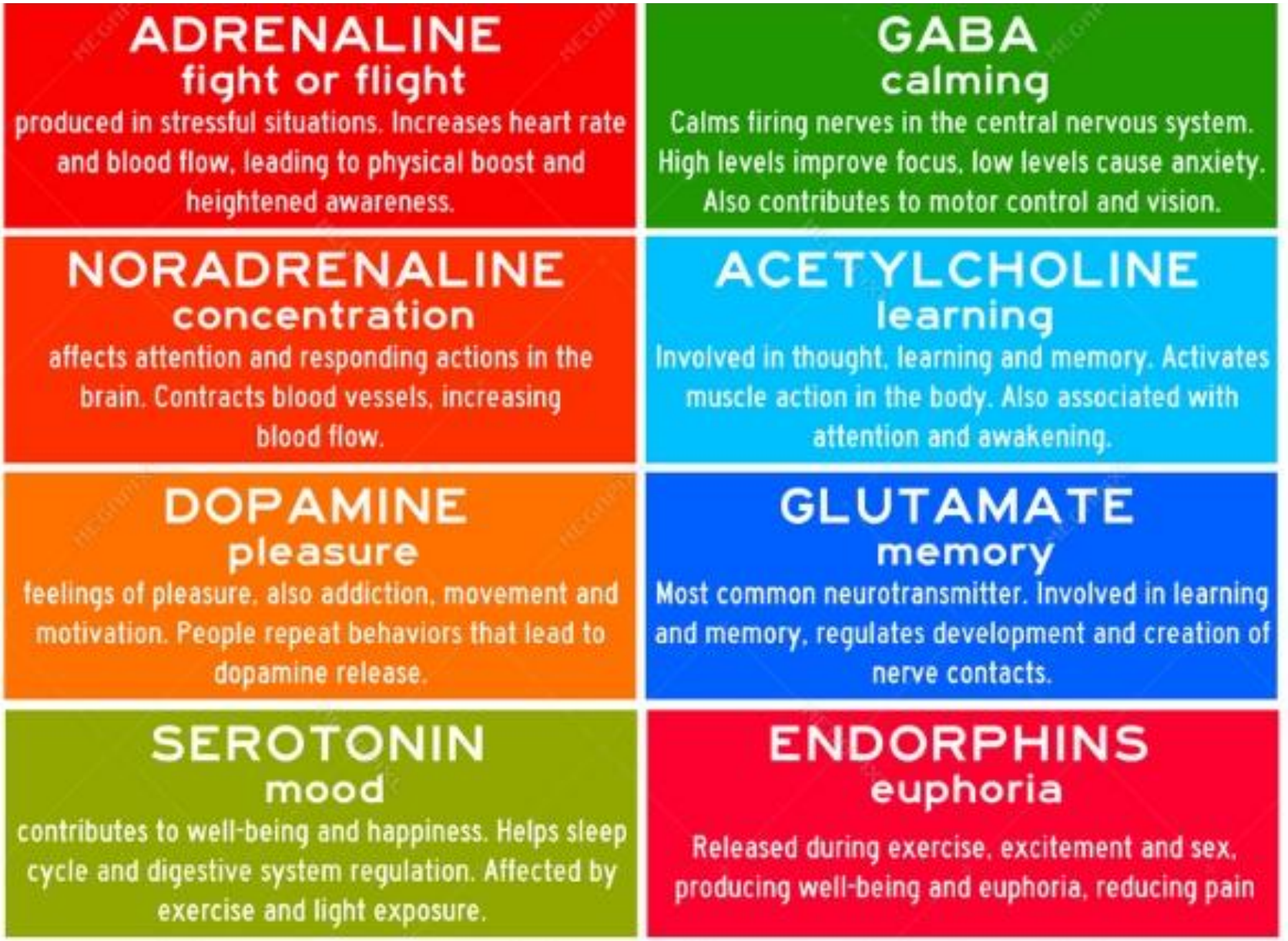


Neuron - klasifikace

- podle ***počtu výběžků***
  - apolární
  - unipolární
  - pseudounipolární
  - bipolární
  - multipolární
  - anaxonální
- podle ***délky axonu***
  - Golgi typ I /axon až 1 m/
  - Golgi typ II - s krátkým axonem
- podle ***typu neurotransmiteru***
  - ACh, aminokyseliny (glutamát, GABA, glycin), monoaminy (serotonin, katecholaminy – dopamin, noradrenalin, adrenalin), neuropeptidy (somatostatin, enkefalin, endorfin, CCK), NO, adenosin

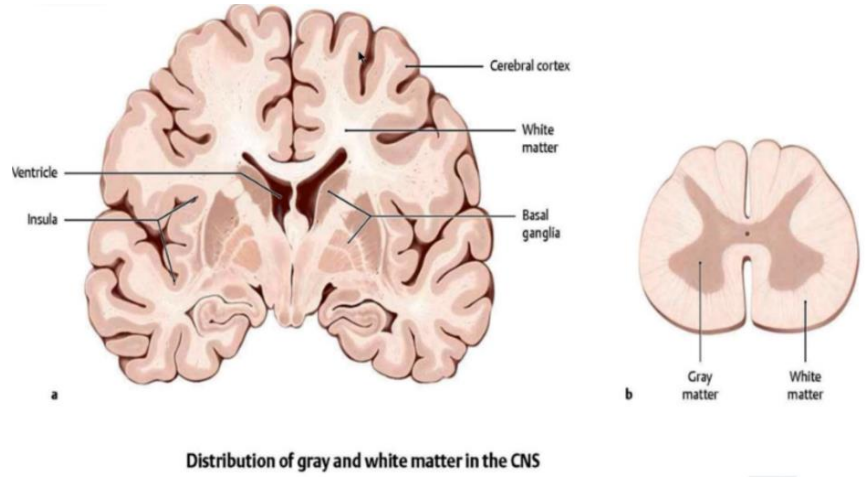


NEUROTRANSMITERY

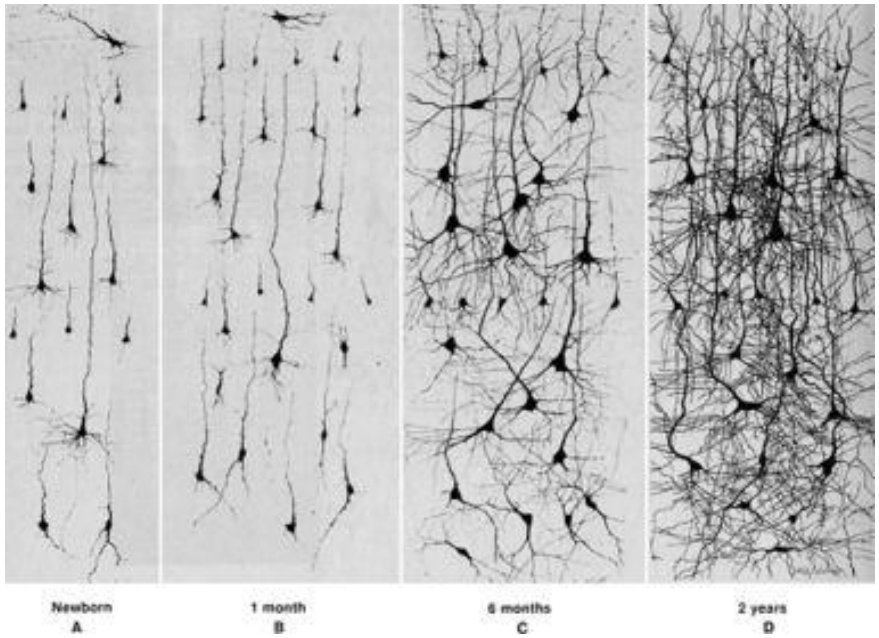


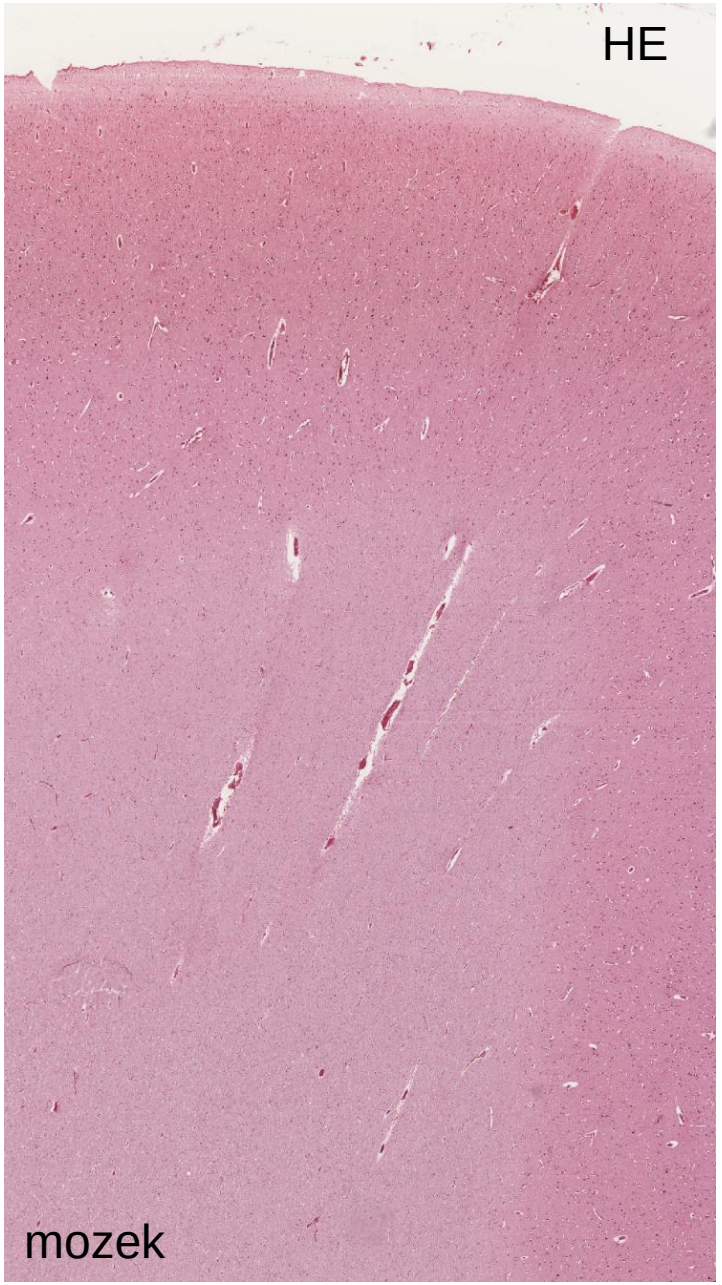
Nervový systém - CNS a PNS

CNS – mozek, mozkový kmen, mozeček, mícha
PNS – hlavové a míšní nervy, ganglia



Distribution of gray and white matter in the CNS

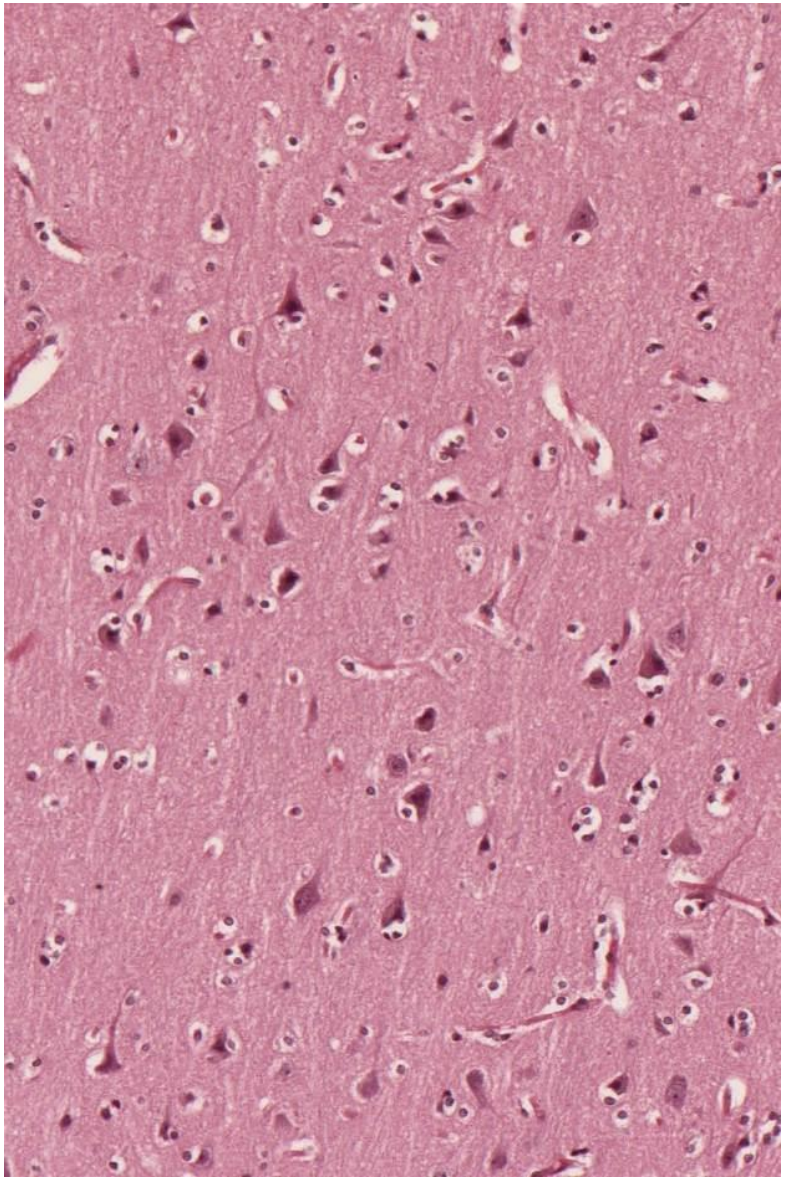




CNS – mozek

- **šedá hmota**

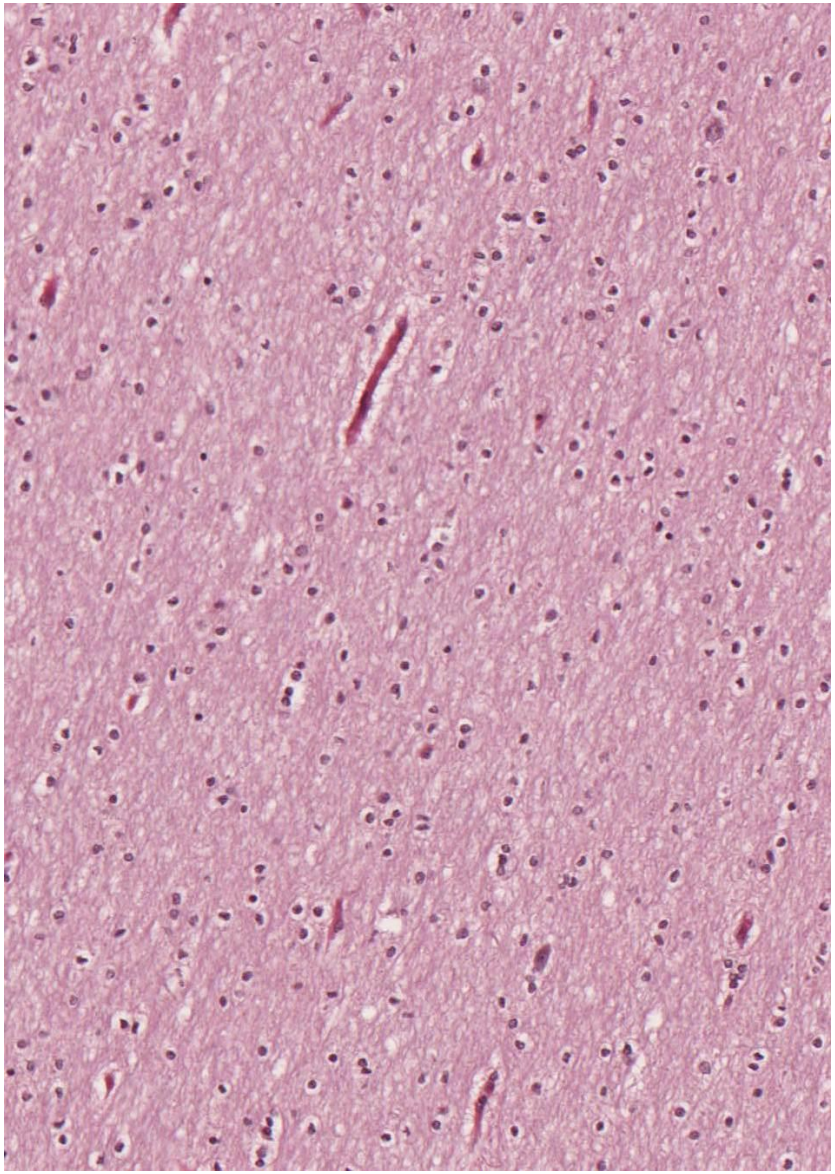
perikarya neuronů, nerv. výběžky, glie (plazmatické astrocyty, mikroglie), cévy



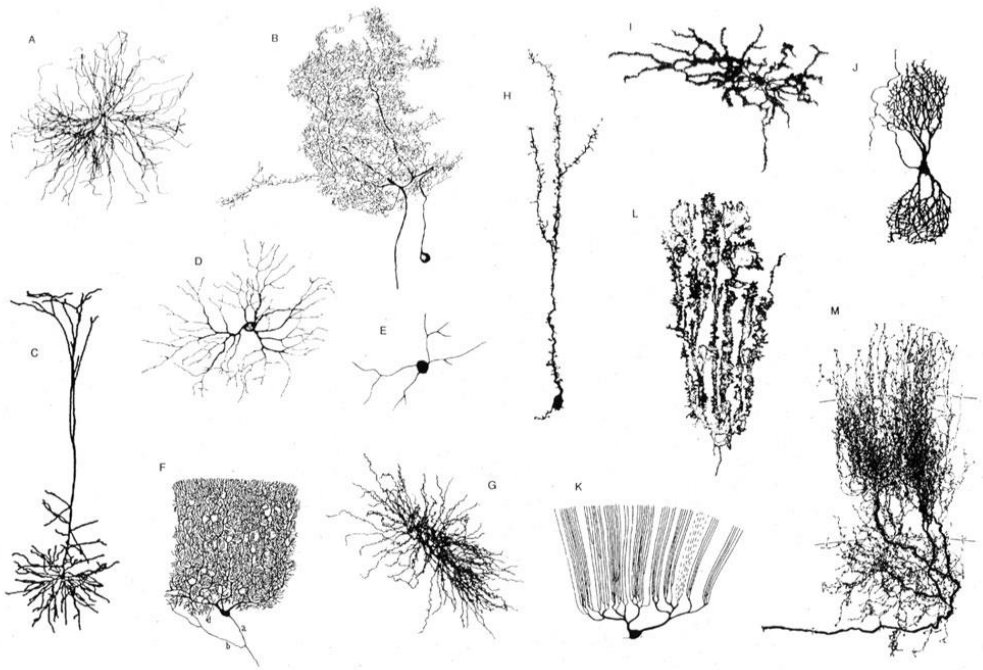
HE

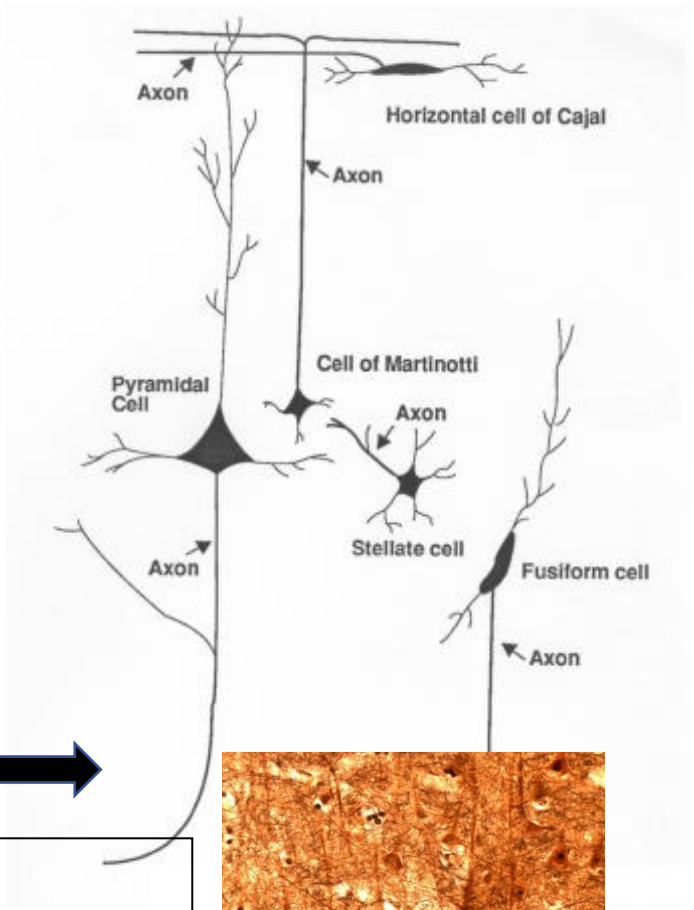
- **bílá hmota**

myelinizované axony, glie (oligodendrocyty, fibrilární astrocyty, mikroglie), cévy



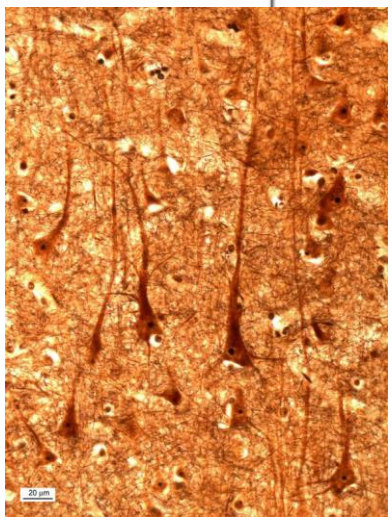
CNS - *cortex cerebri* – typy neuronů



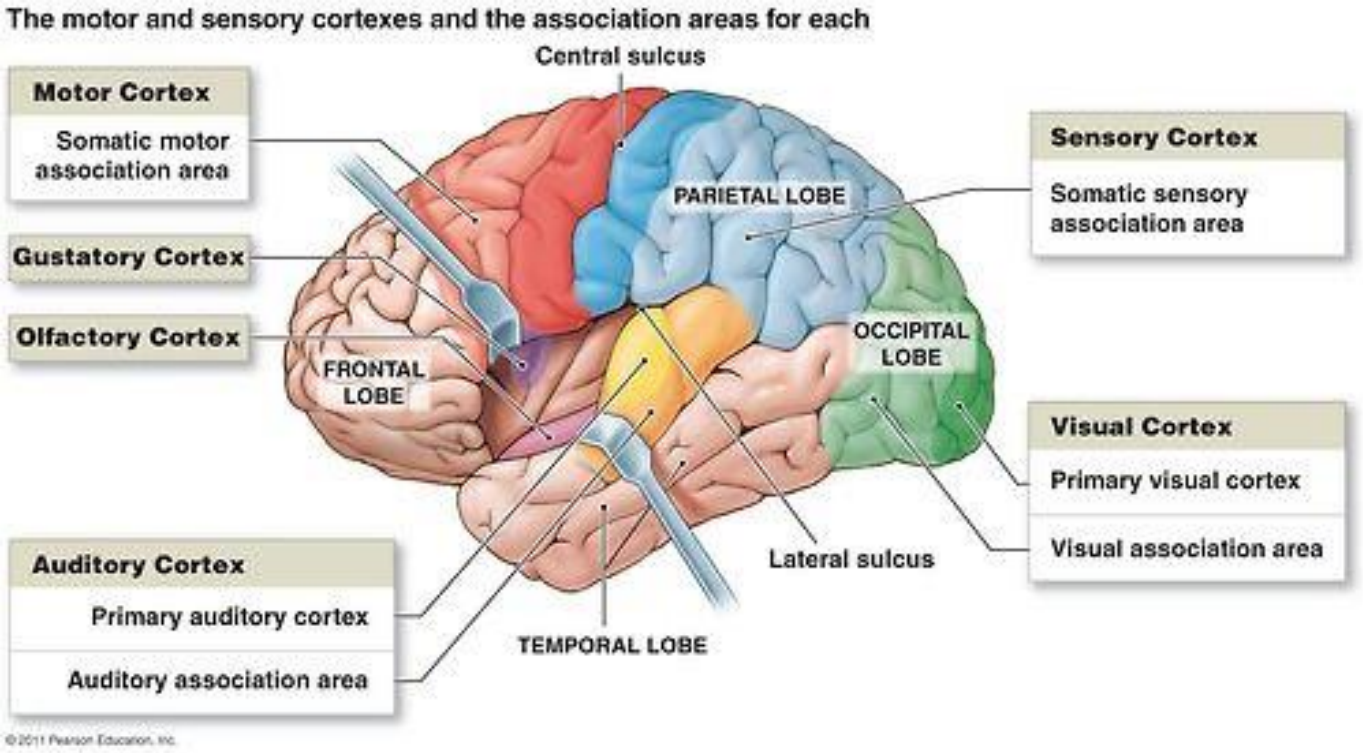


https://www.janelia.org/lab/spruston-lab/research/cellular-diversity-hippocampus

- pyramidové buňky
- zrnité (granulární) buňky
- vřetenovité buňky
- horizontální (Cajal) buňky
- vertikální (Martinotti) buňky

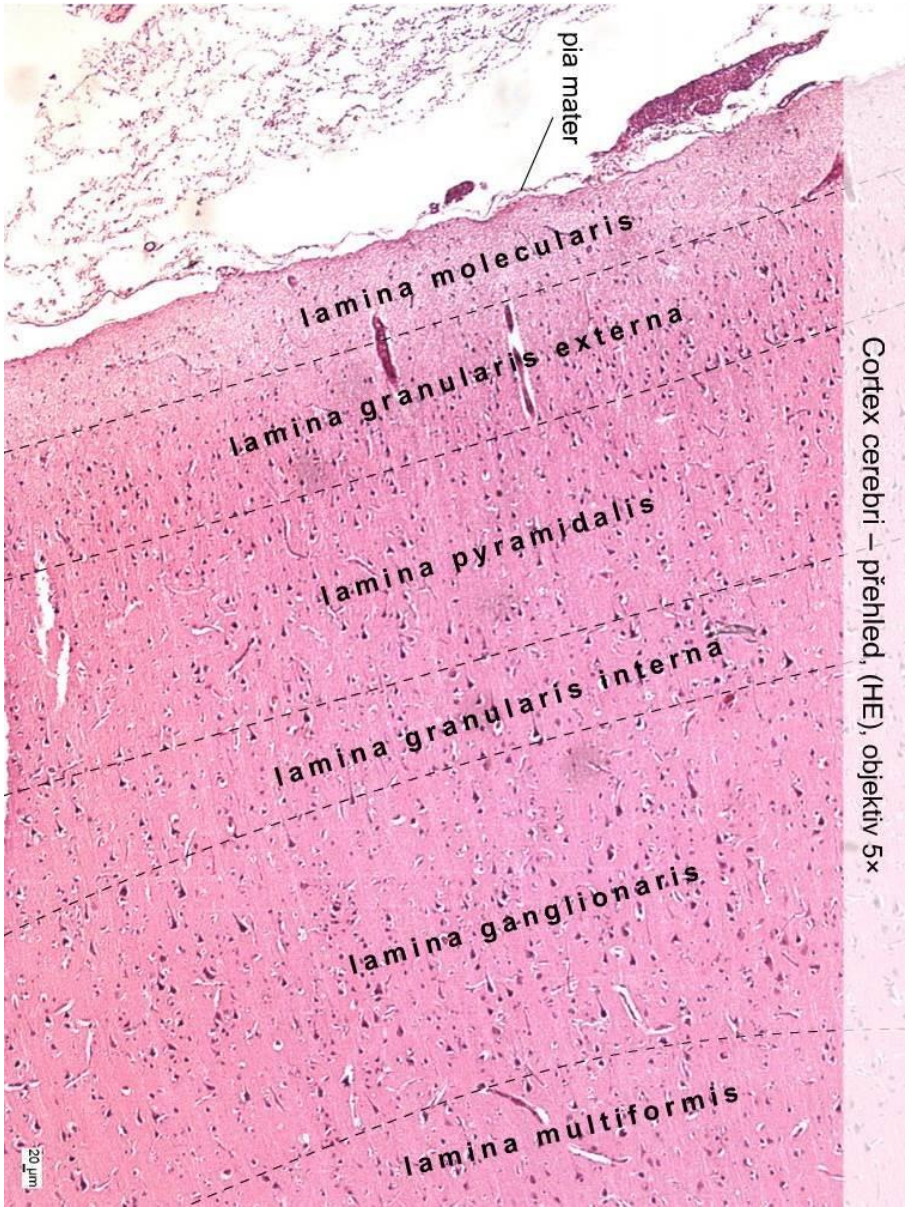


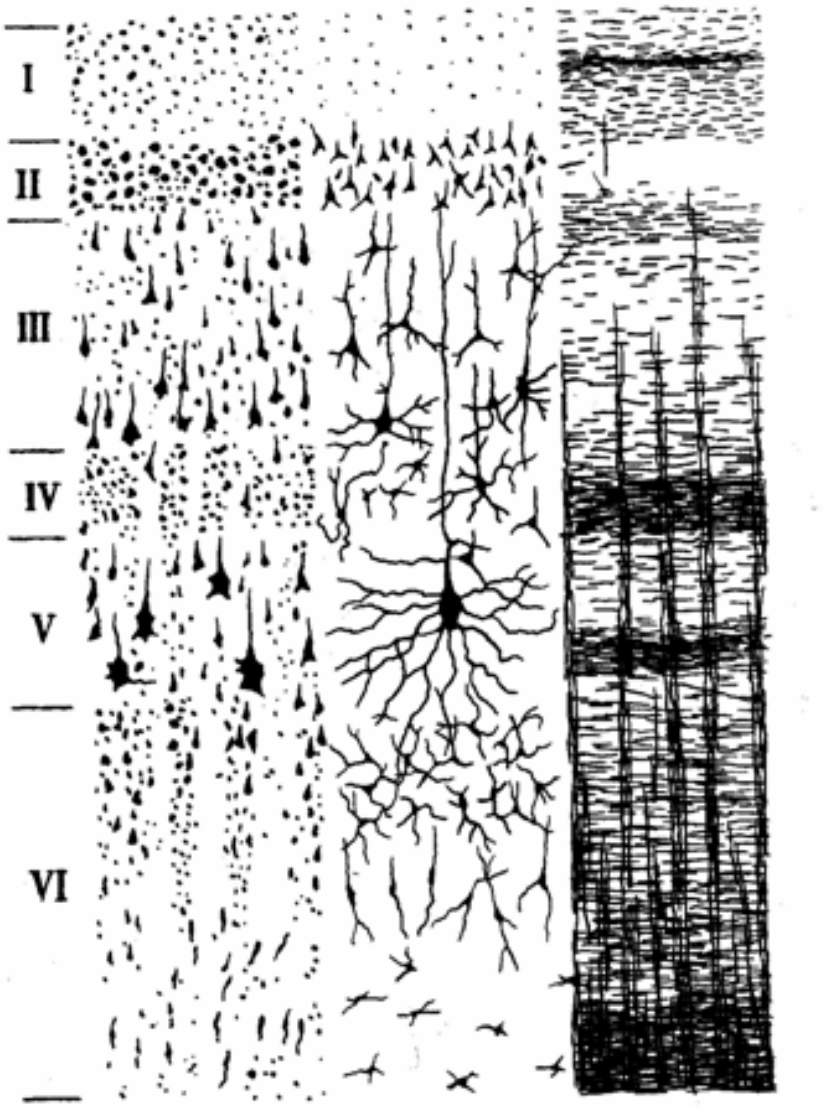
CNS - *cortex cerebri*



- **isocortex** -11/12 povrchu, vývojově mladší, typických 6 vrstev
  - homotypický cortex
  - heterotypický cortex
- **allocortex** – 1/12, vývojově starší, stavebně jednodušší

CNS - *isocortex cerebri*

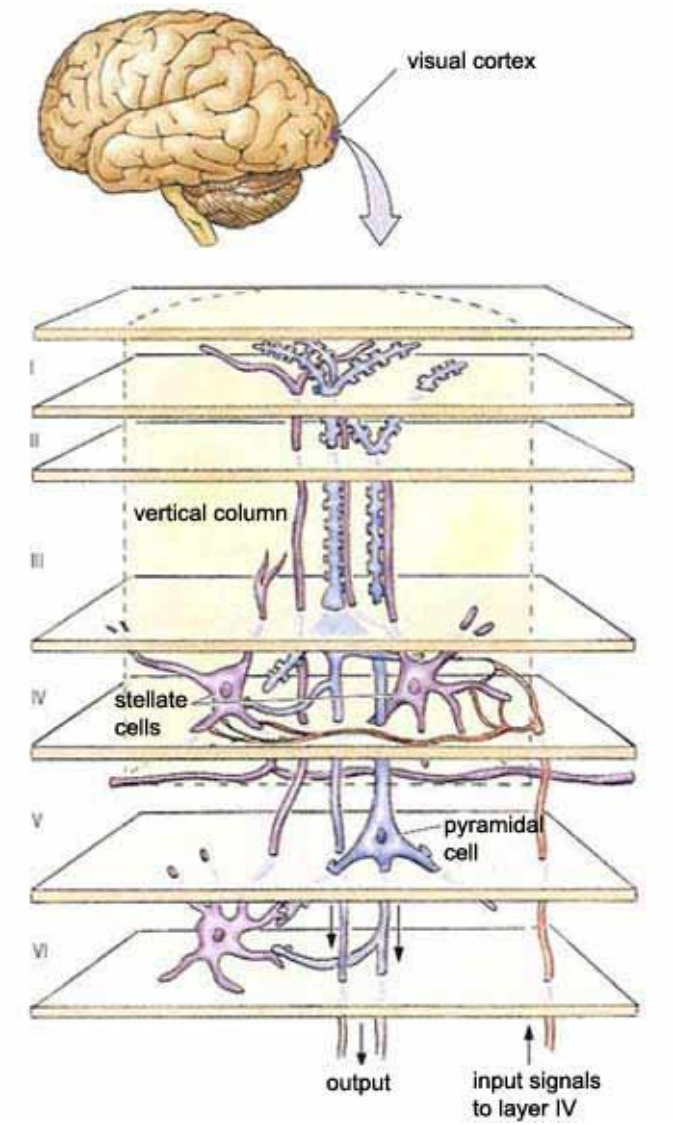




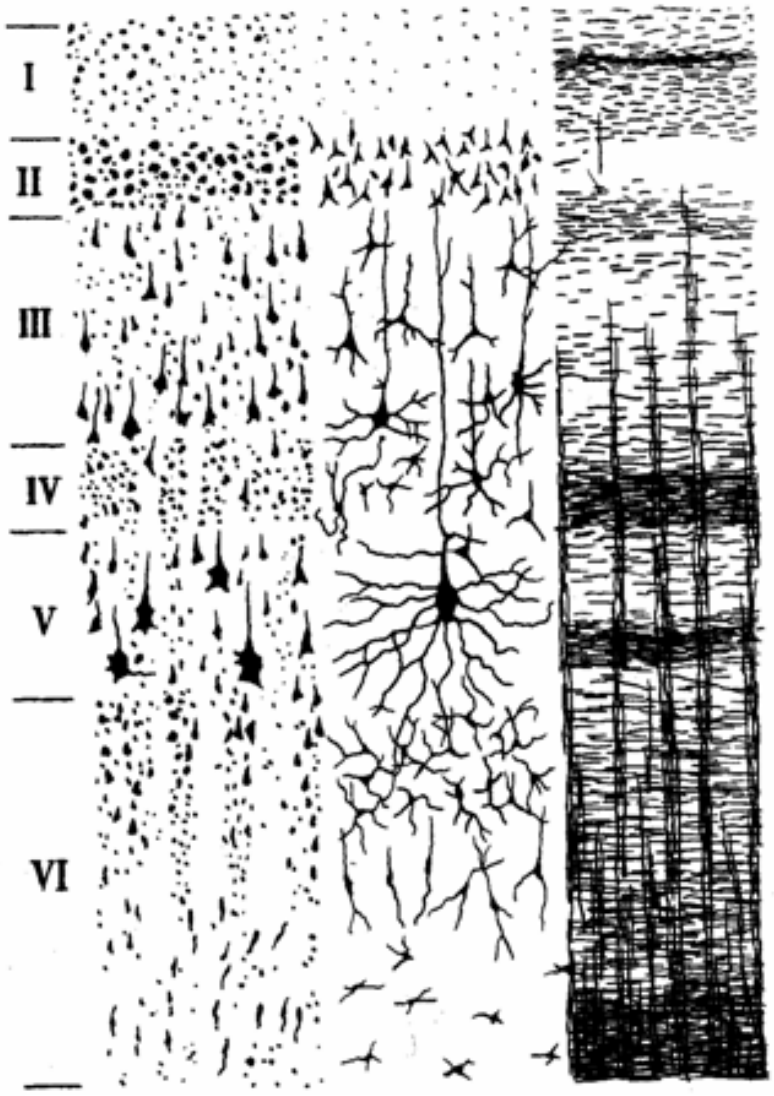
tloušťka: **1.5-5 mm**, plocha: 0.20-0.25 m^2

CNS - *cortex cerebri - isocortex*

sensorická

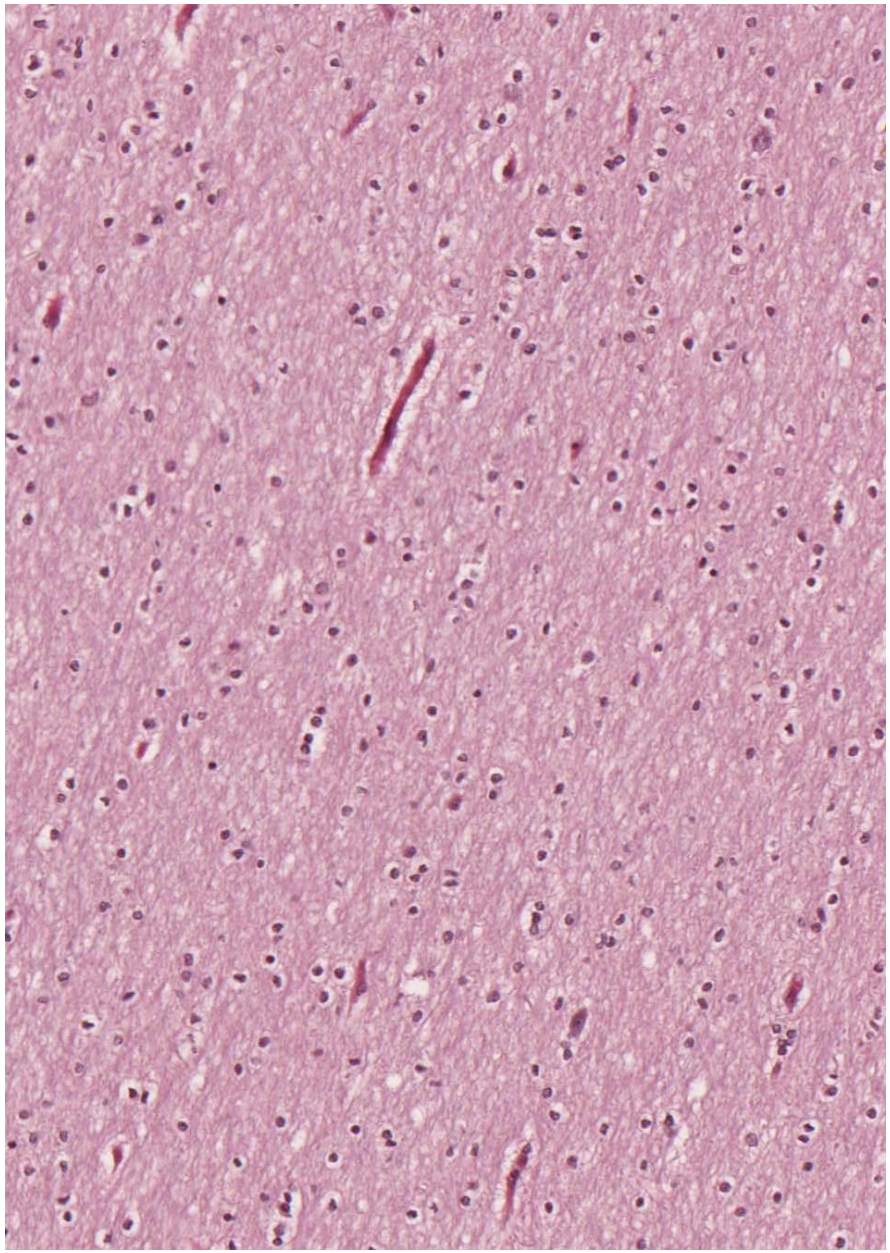


motorická



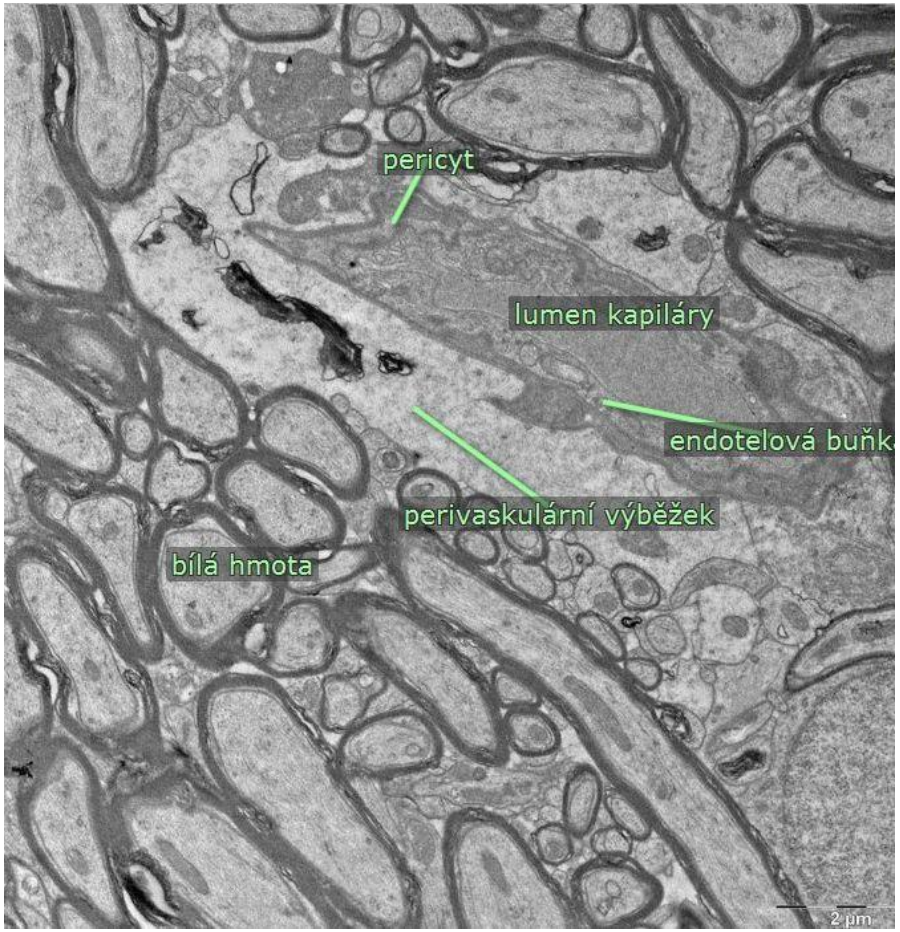
cytoarchitektonika, myeloarchitektonika

CNS – bílá hmota



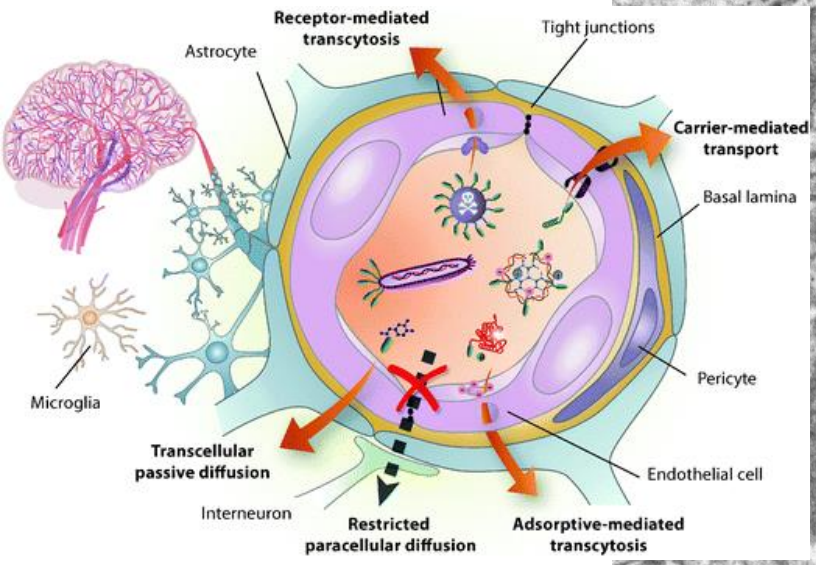
výběžky neuronů, neuroglie, cévy

bílá hmota (TEM) - HEB v šedé i v bílé hmotě



Hemato-encephalická bariéra (HEB)

perivaskulární nožky astrocytů



endotelové buňky

ery

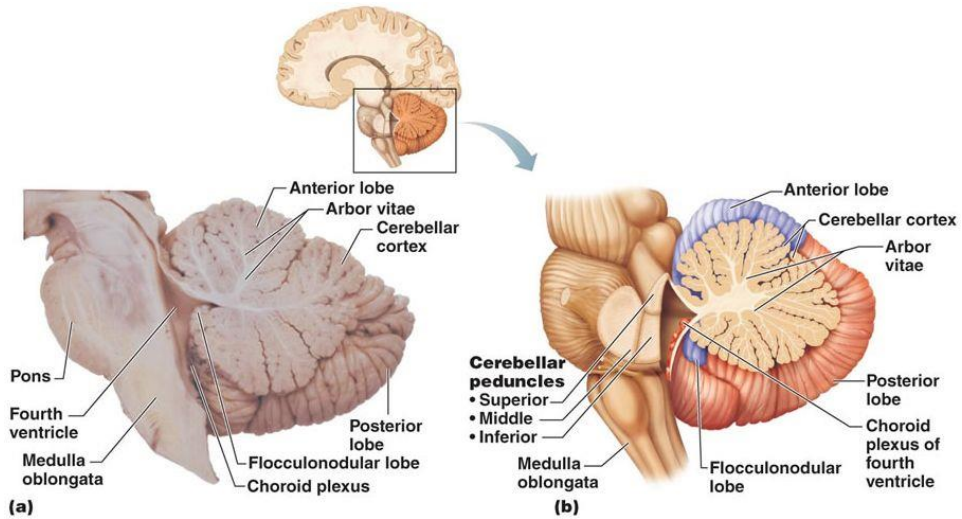
mikroglie

neuropil

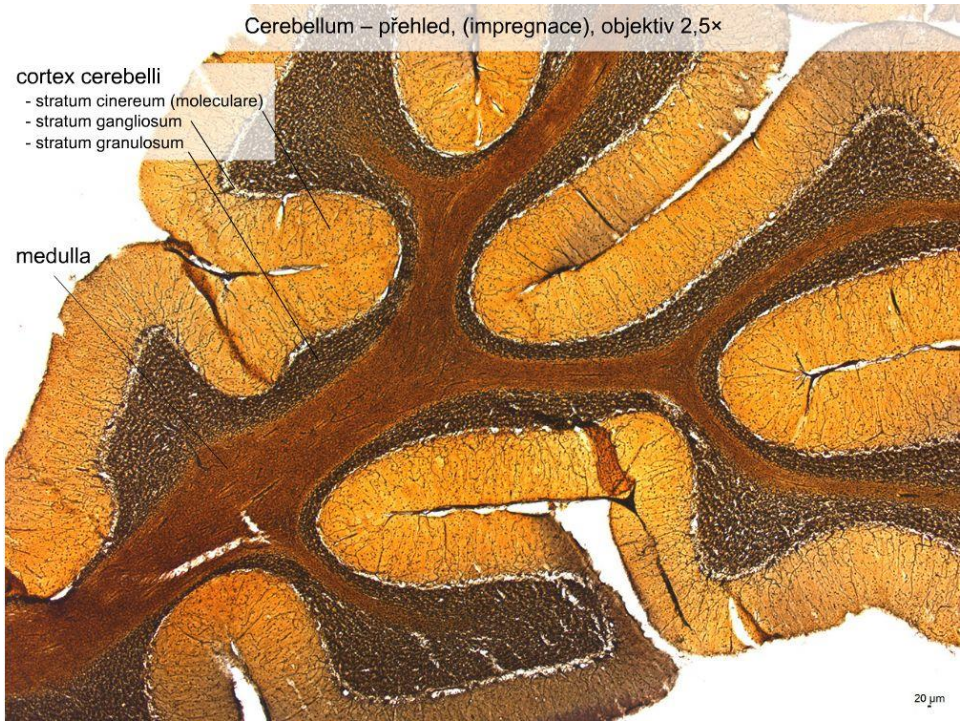
2 µm

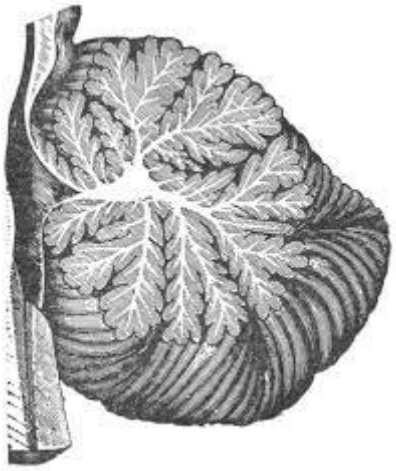
☆ pericyt

CNS - mozeček (*cerebellum*)



2 hemisféry
vermis - nepárové





arbor vitae

Mozeček (*cerebellum*)

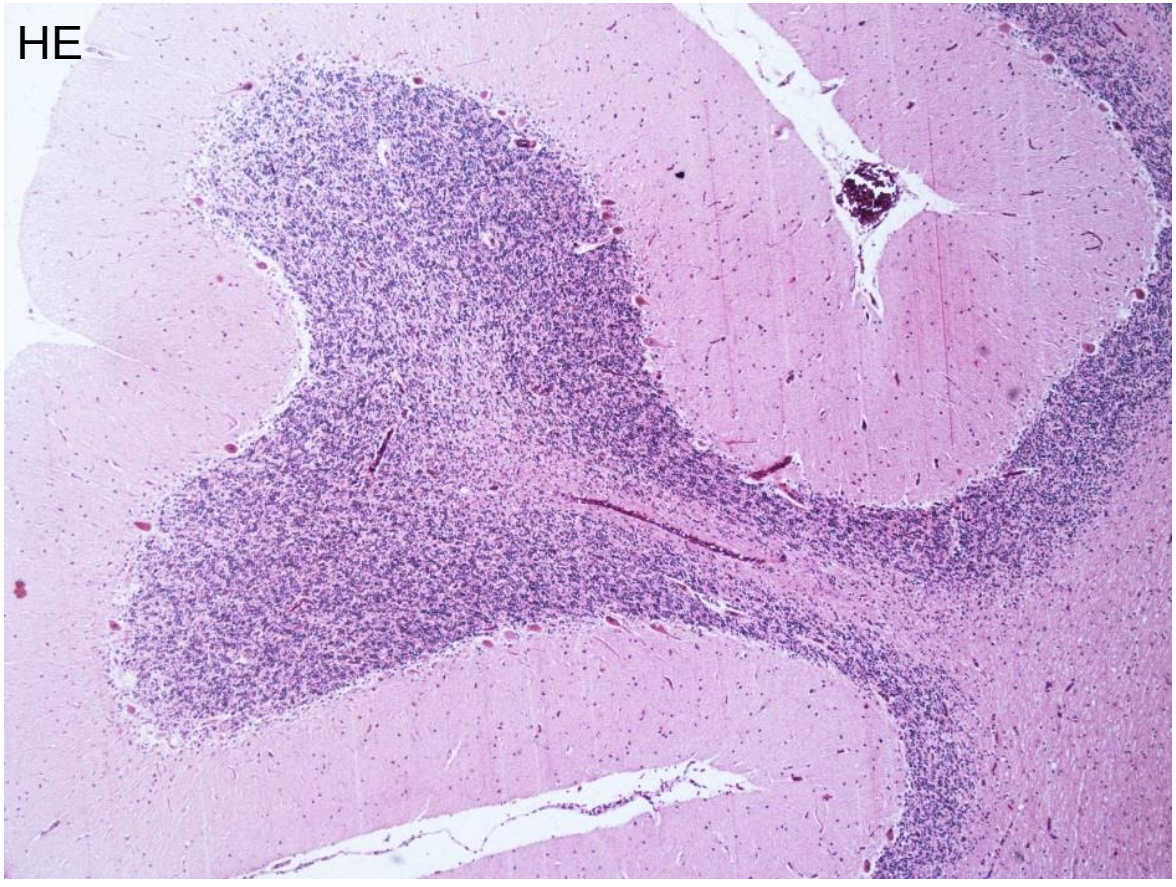
Kůra mozečku (cortex cerebelli)

Stratum moleculare - košíčkové a hvězdicovité buňky
Stratum gangliosum - Purkyňovy buňky
Stratum granulosum - malé a větší zrnité multipolární neurony

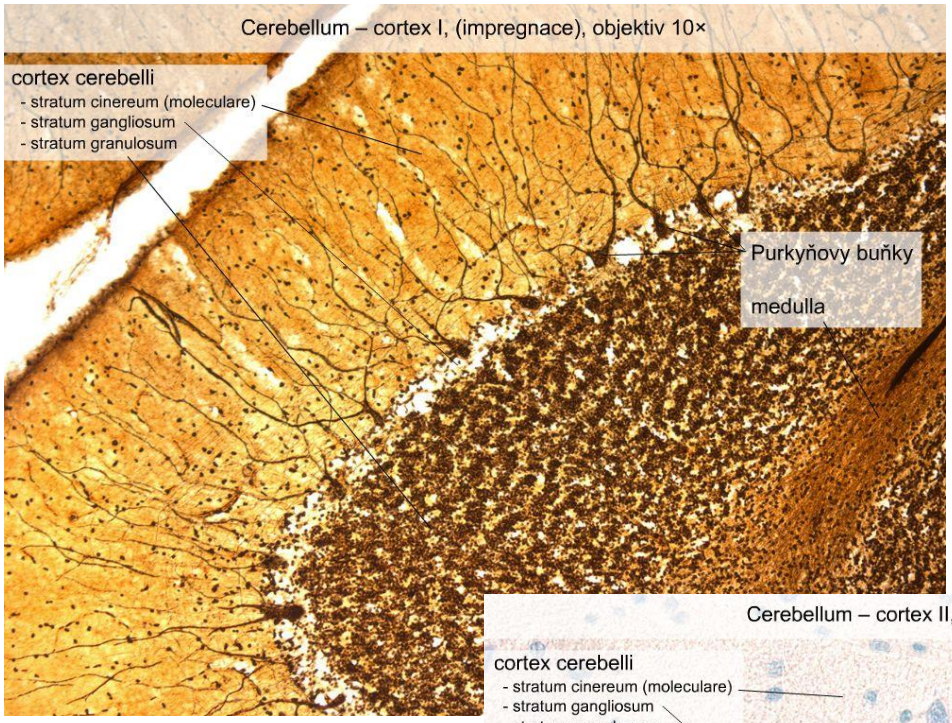
Bílá hmota mozečku

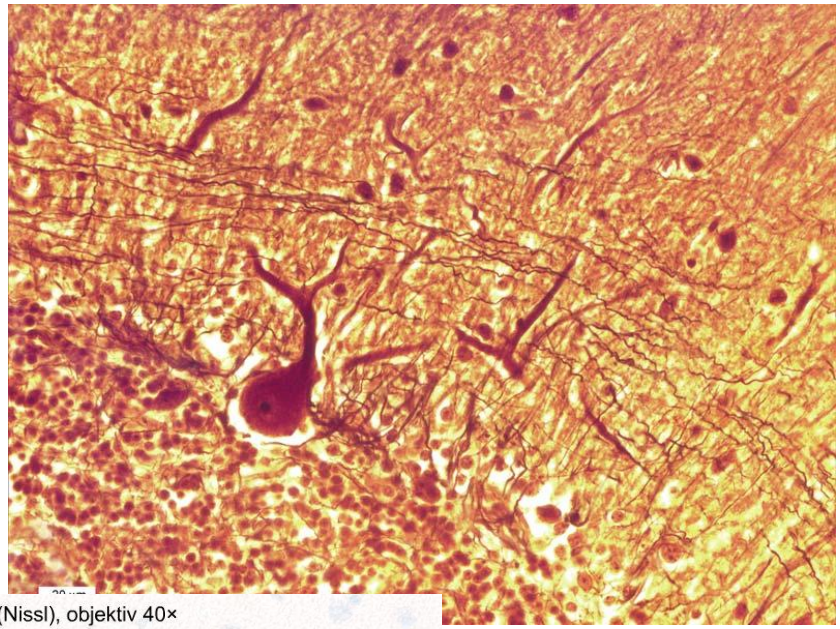
Eferentní vlákna – neurity Purkyňových buněk
Aferentní - mechová (synapse: *glomeruli cerebellares*) a šplhavá

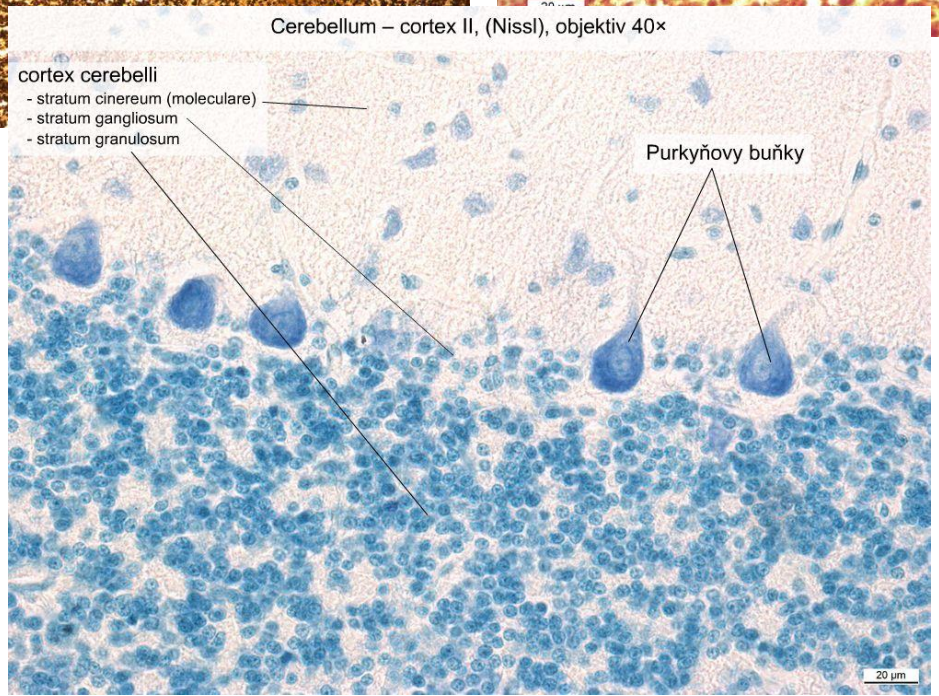
Jádra mozečku



Mozeček (*cerebellum*)

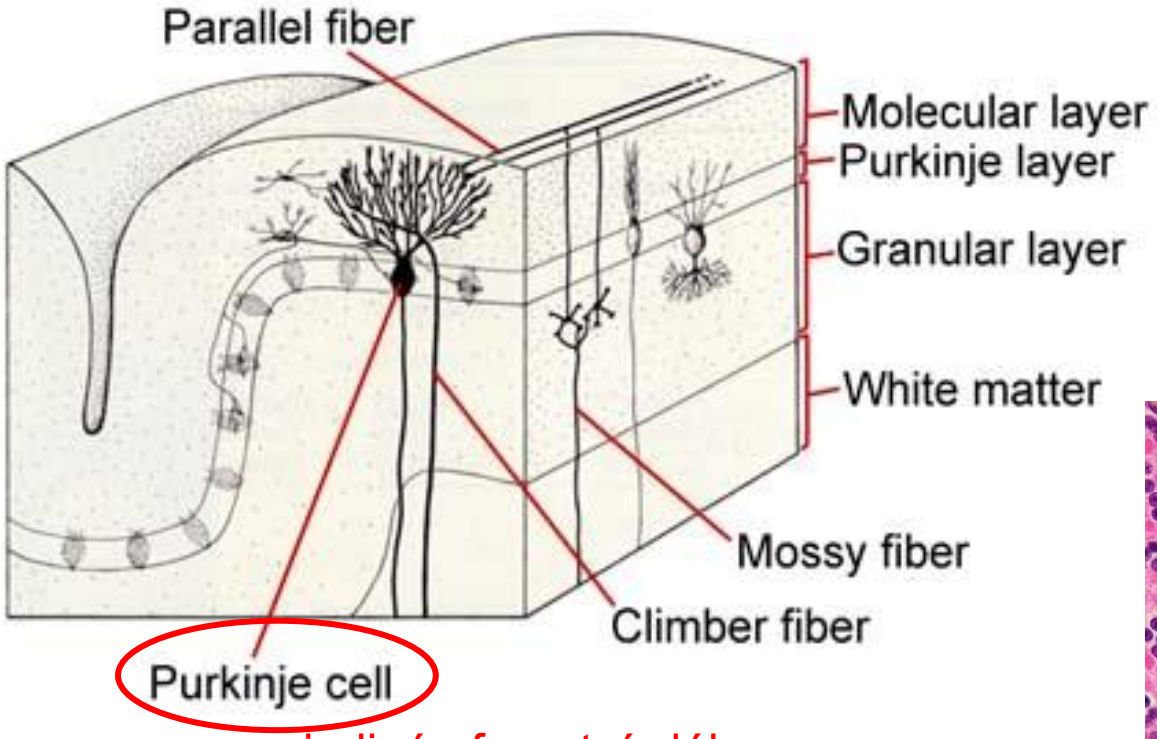






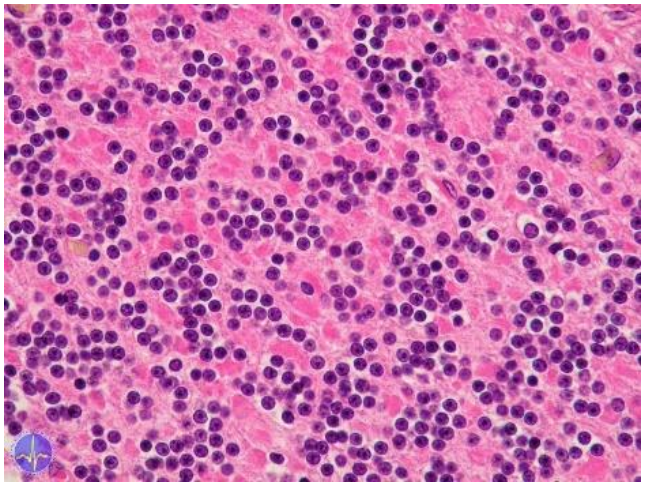
50% všech neuronů CNS

Mozeček - zapojení neuronů



- jediná eferentní vlákna

stratum granulosum -
glomeruli cerebellares

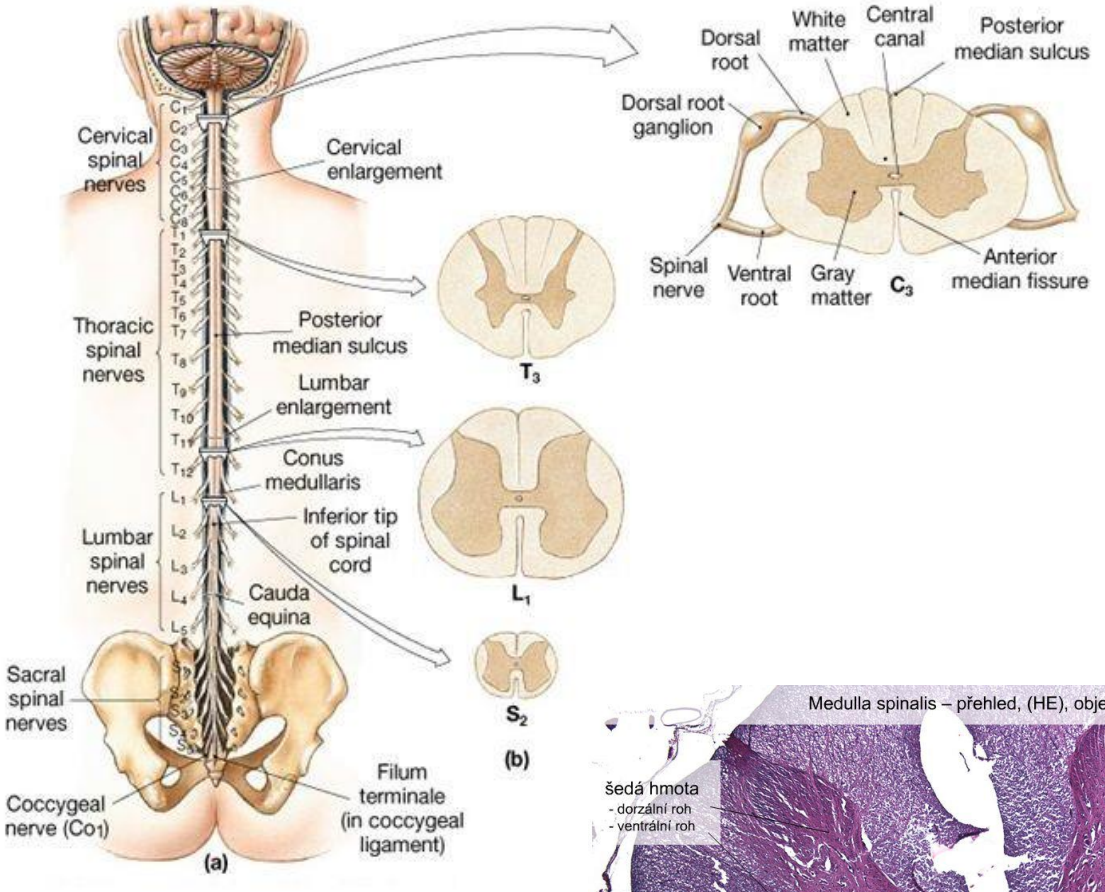


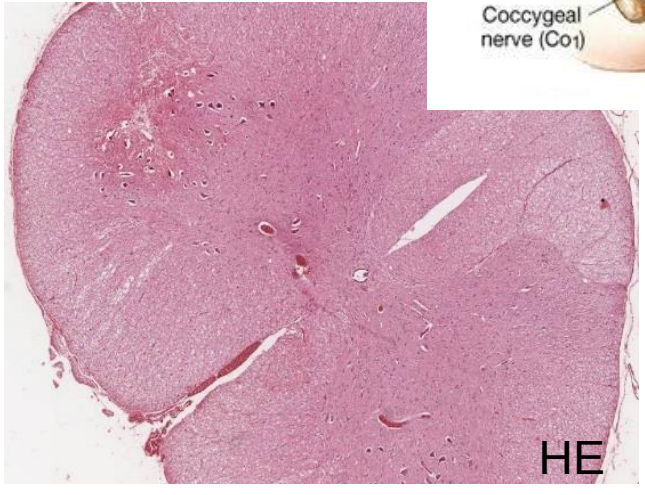
košíčkové buňky
malé zrnité (granulární) neurony } interneurony

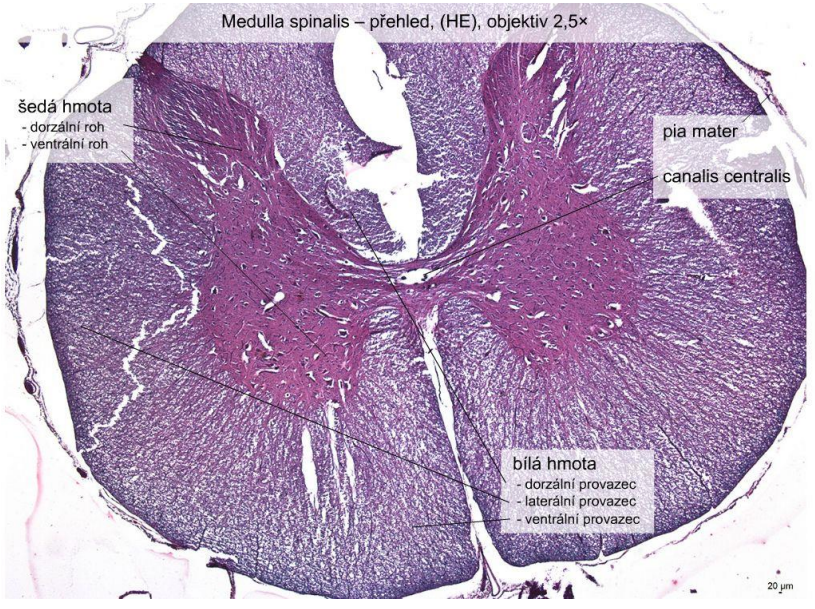
→ kooperace Purkyňových buněk (inhibiční neurony - koordinace pohybů, udržování rovnováhy, jemná motorika)

CNS – mícha (*medulla spinalis*)

- C1-L2
- 40-45 cm
- průměr se snižuje směrem dolů: 13 mm - 6,4 mm
- *intumescentia cervicalis*
- *intumescentia lumbalis*
- míšní segmenty (8C, 12Th, 5L, 5S, 1-3Co)

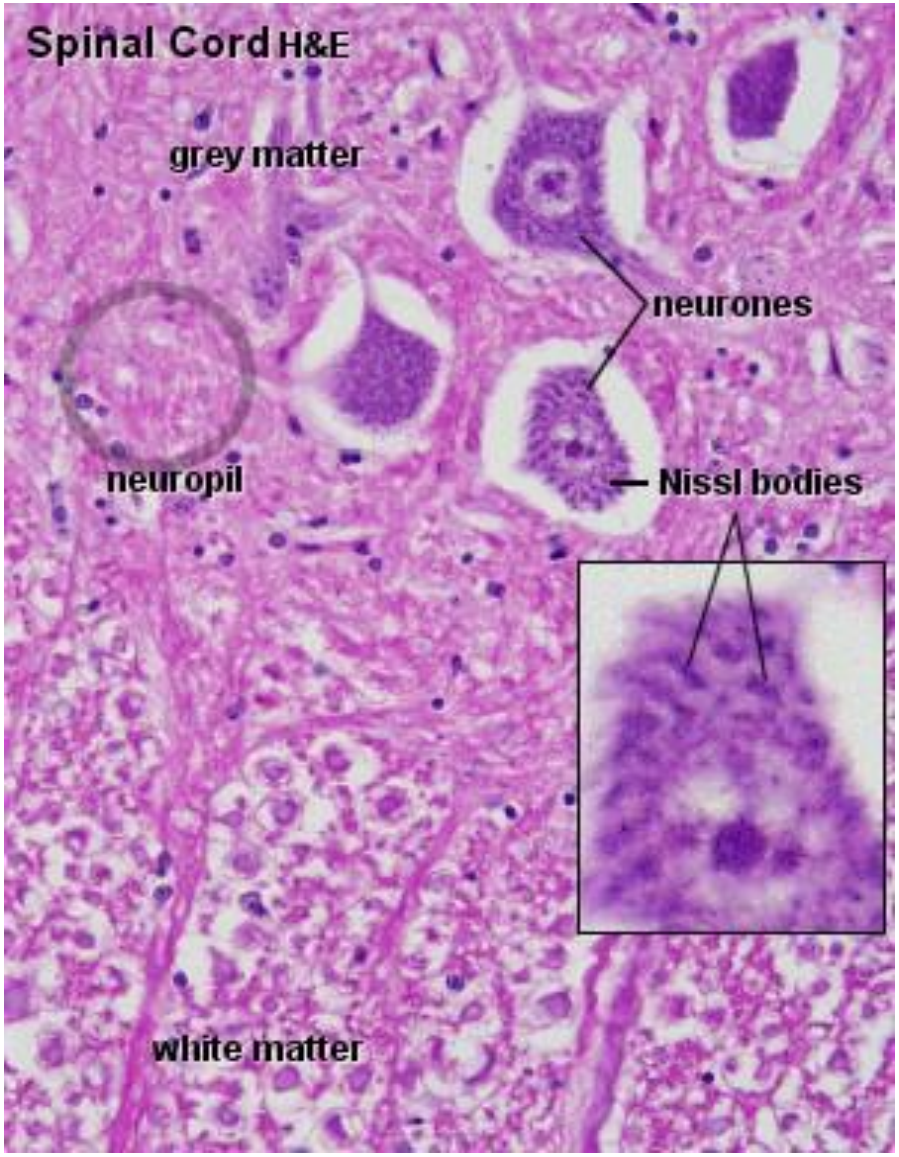


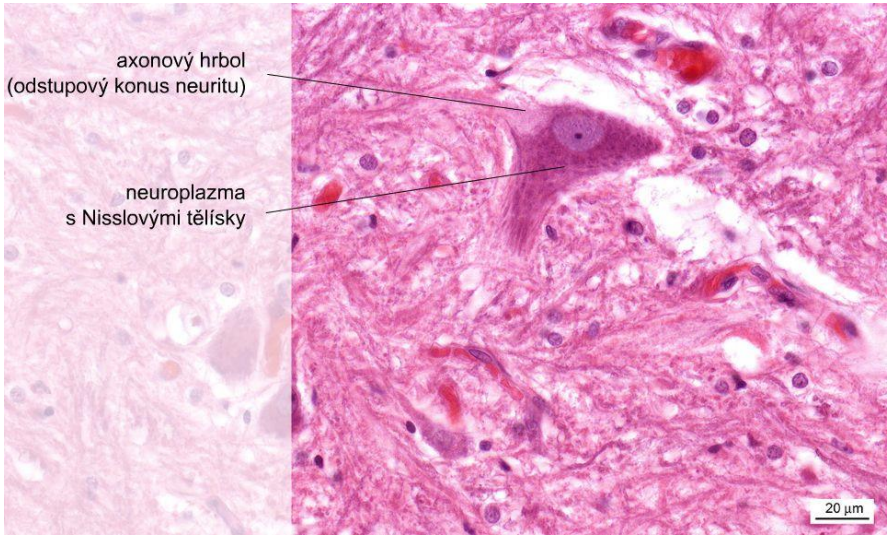




Medulla spinalis

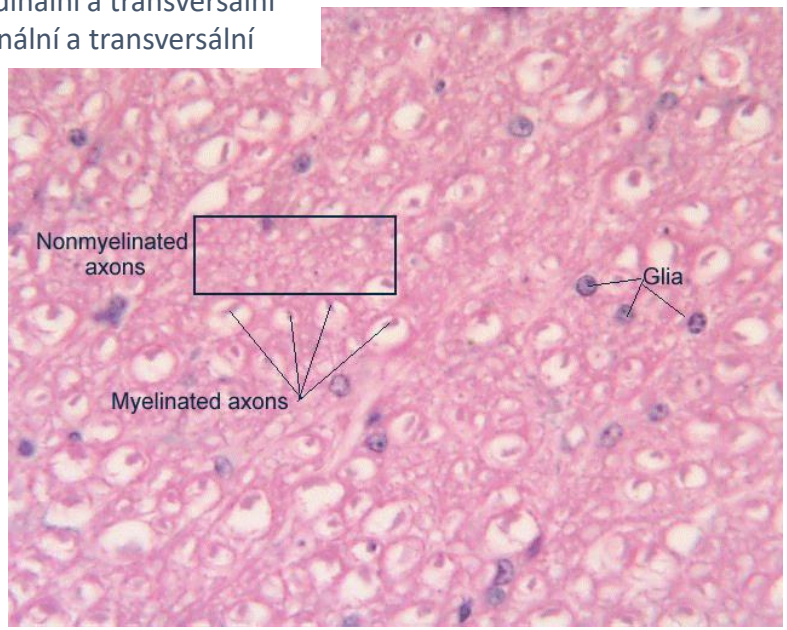
- **Šedá hmota míšní**
  - ***Cellulae radiculares*** (kořenové buňky)
    - somatomotorické a visceromotorické
  - ***Interneurony***
    - vsunuté, komisurální, asociační
  - ***Cellulae funiculares*** (buňky provazců)
    - v ncl.proprius a ncl. thoracicus



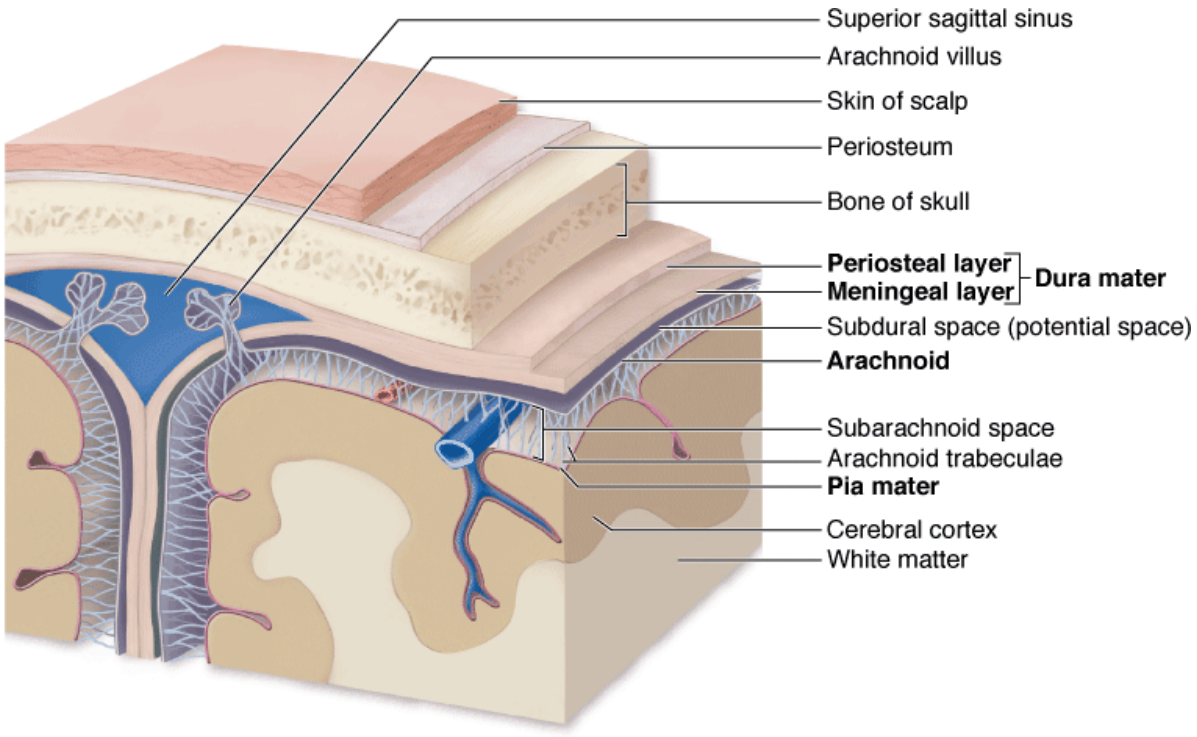


Medulla spinalis – bílá hmota

endogenní vlákna – longitudinální a transversální
exogenní vlákna – longitudinální a transversální



Mozkomíšní obaly - meningy

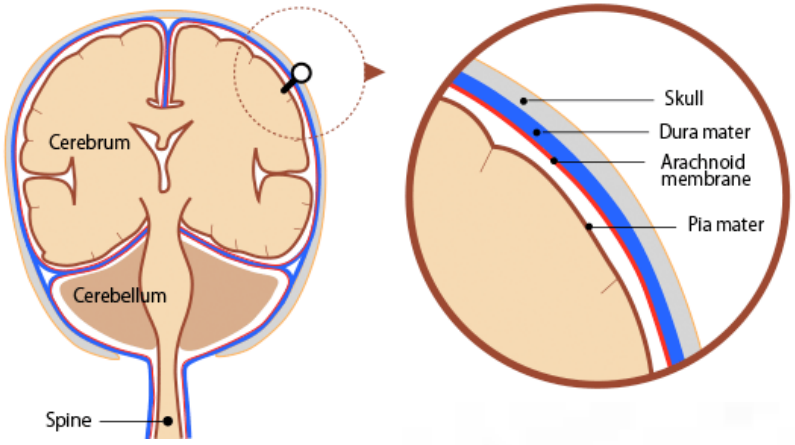


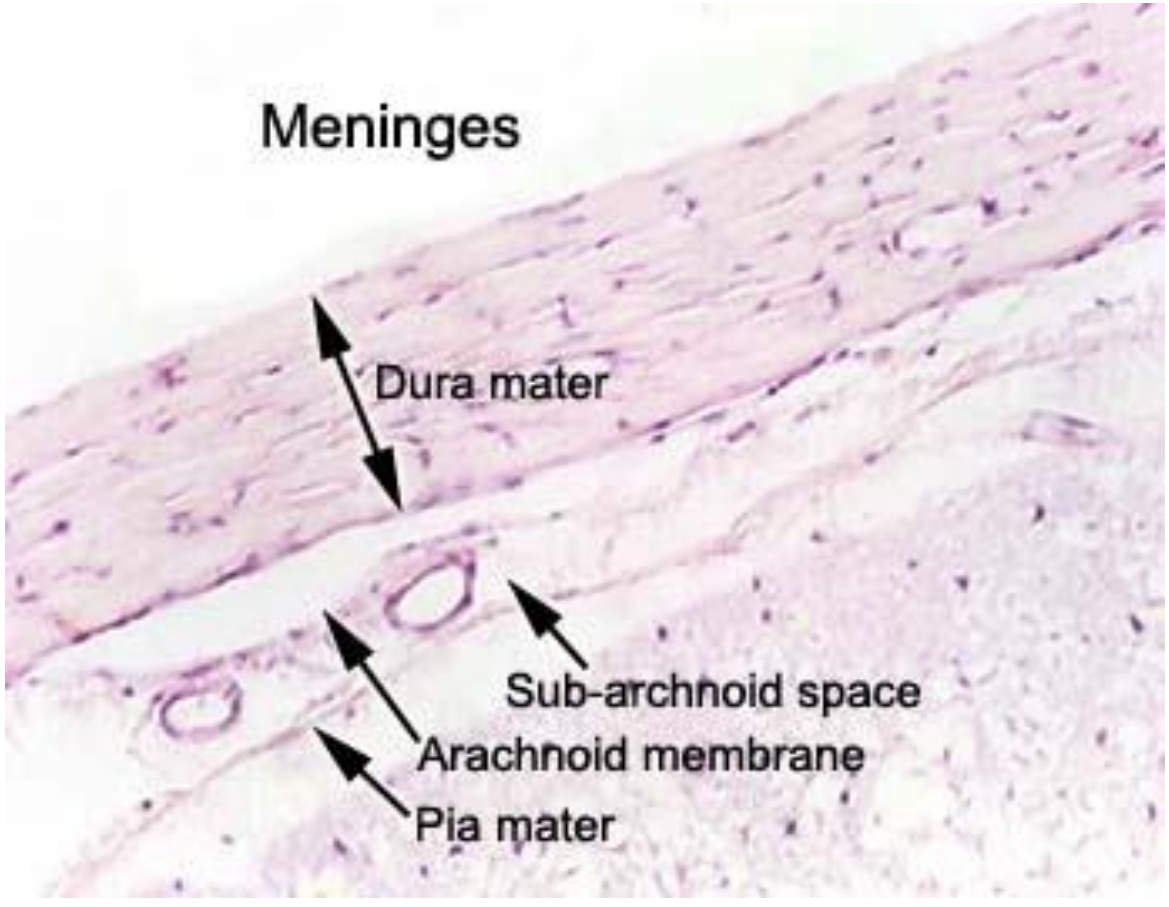
- **Dura mater**
  - endosteální vrstva (periostální)
  - meningeální vrstva

  v určitých místech obě vrstvy odděleny – venózní sinusy
- **Arachnoidea** – jemná, bez cév
  - vazivo
  - síť jemných trabekul

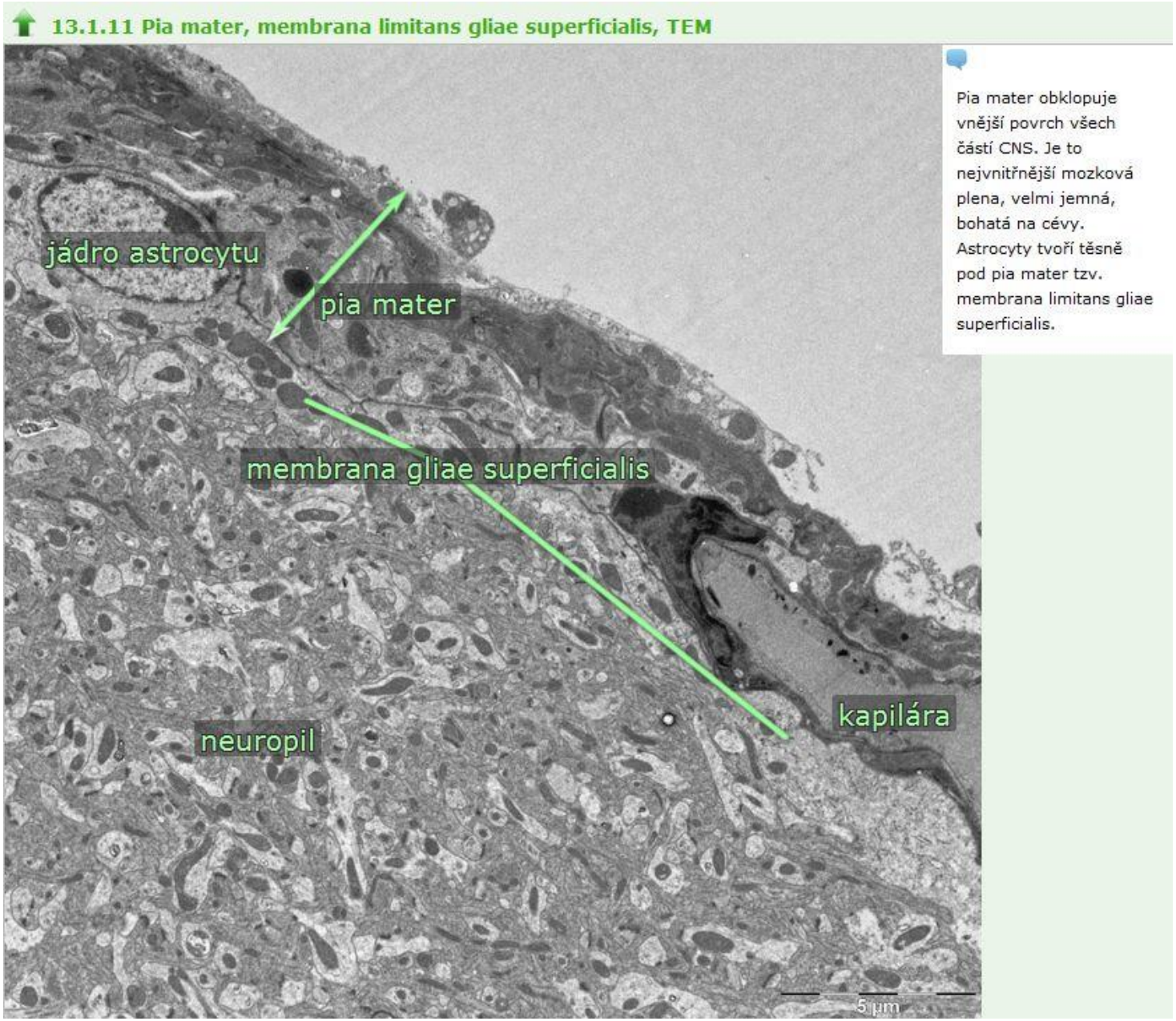
  v subarachnoidálním prostoru jsou četné cévy, prostor je vyplněn mozkomíšním mokem
- **Pia mater** – velmi vaskularizovaná jemná blána

Mozkomíšní obaly - meningy



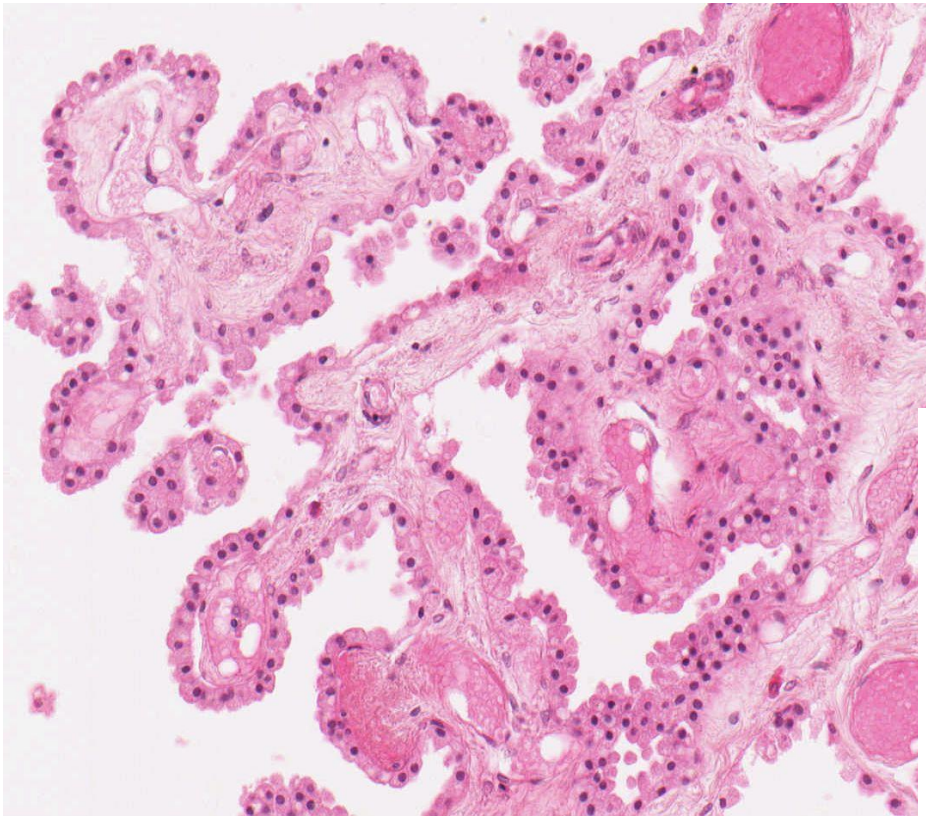


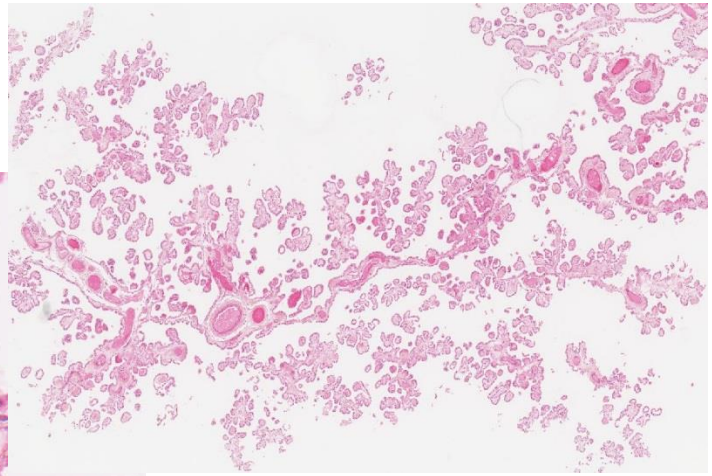
Mozkomíšní obaly – meningy, *membrana gliae superficialis*

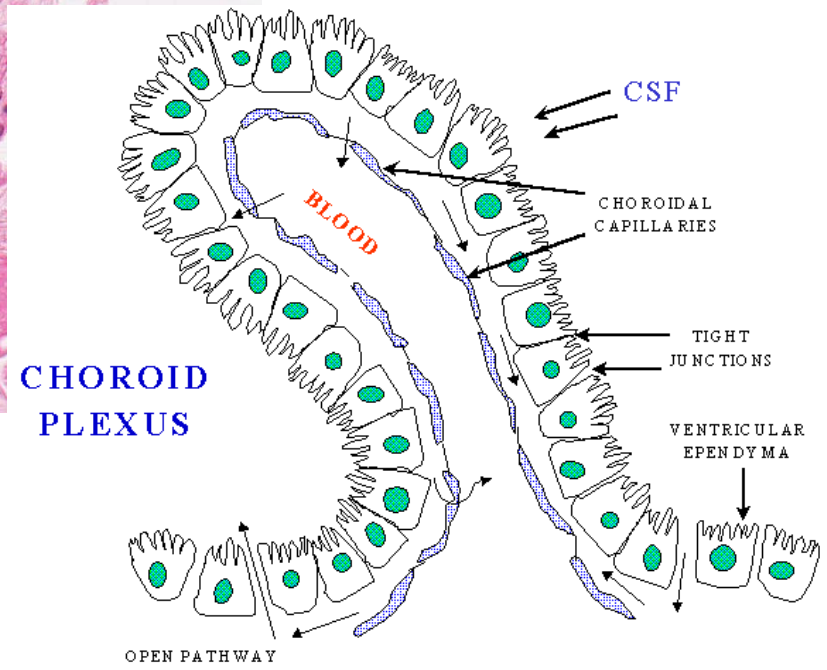


Plexus choroideus (v mozkových komorách)

produkce mozkomíšního moku

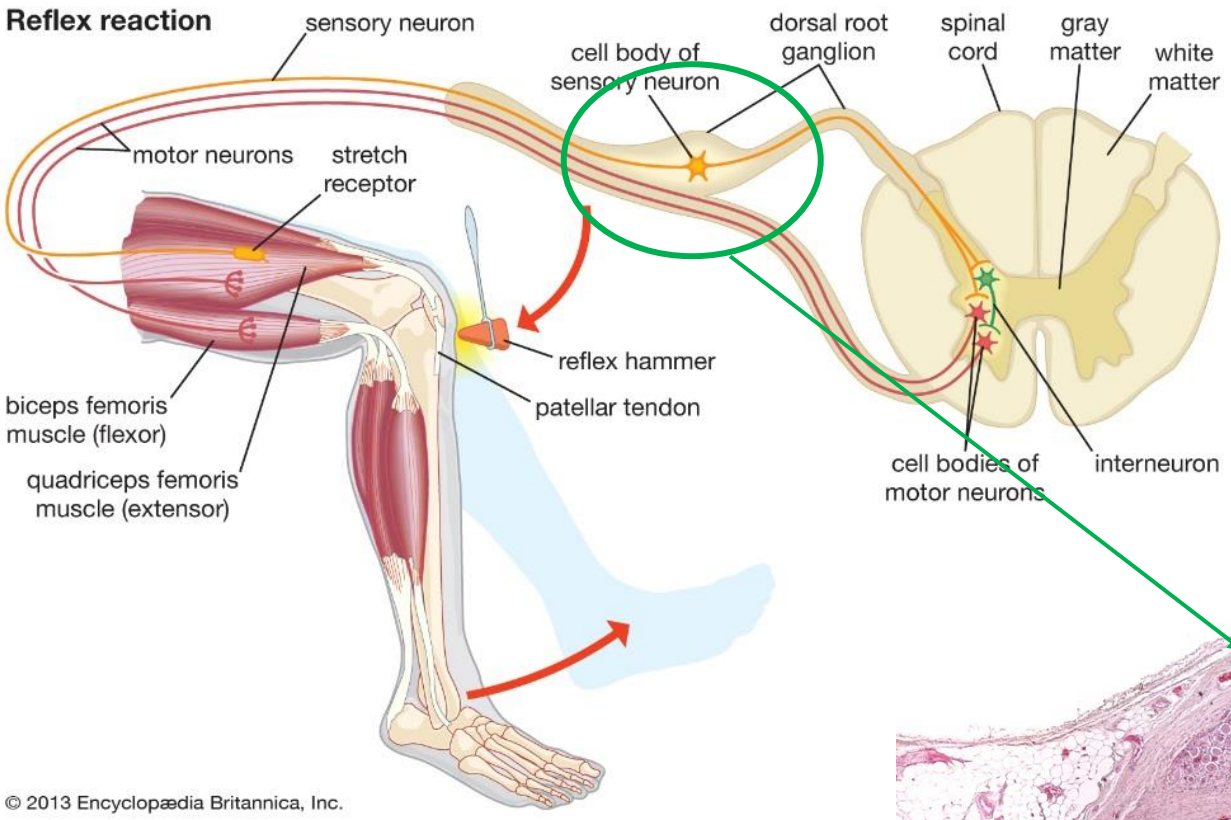


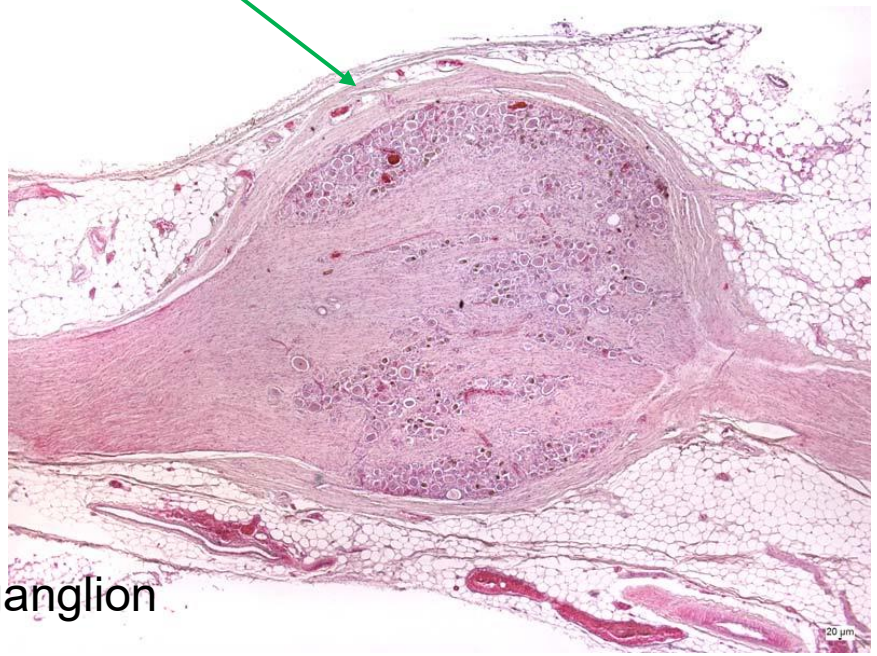




vaskularizovaná pia mater + ependym

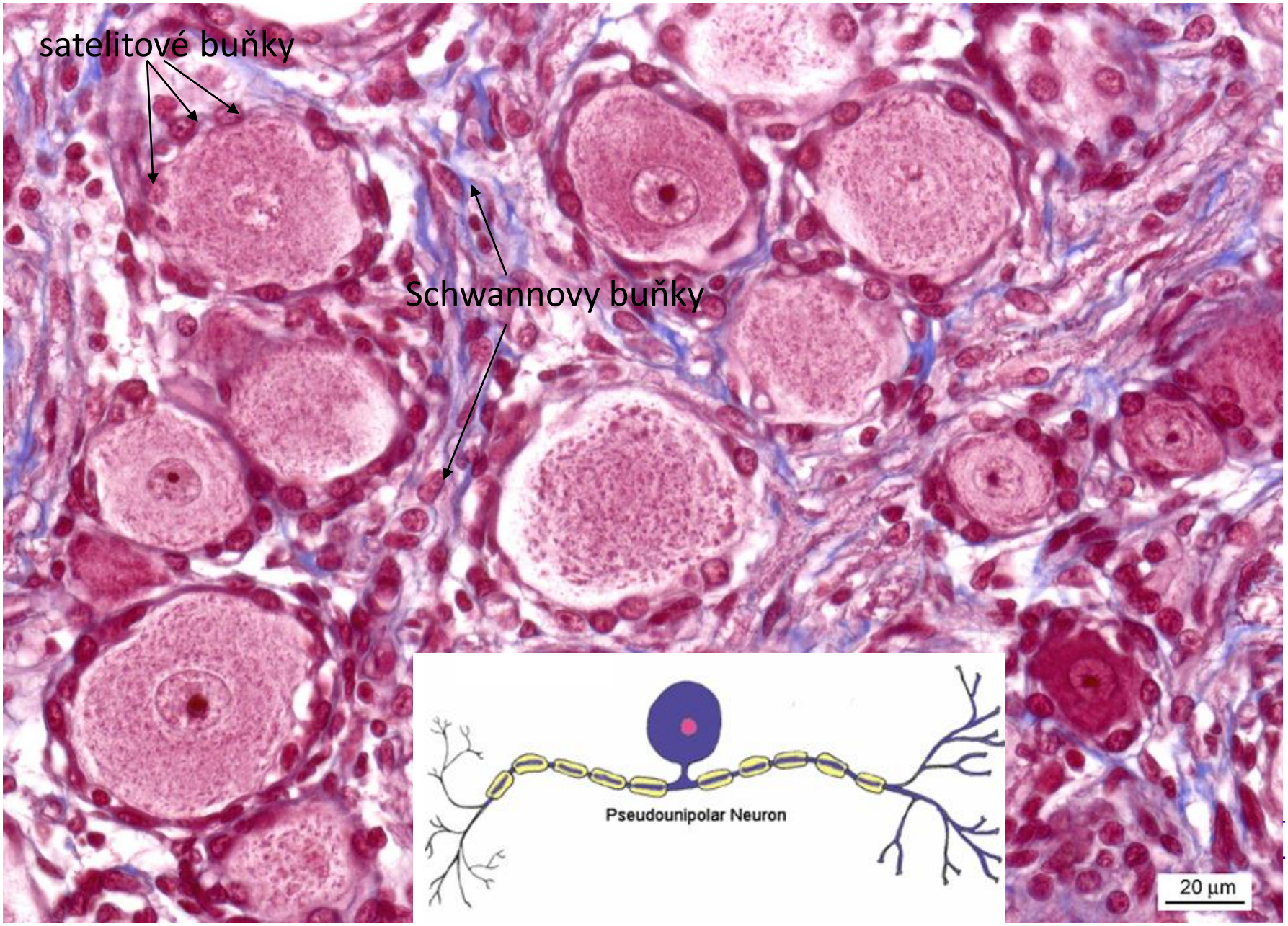
PNS – míšní ganglion (*ganglion spinale*)





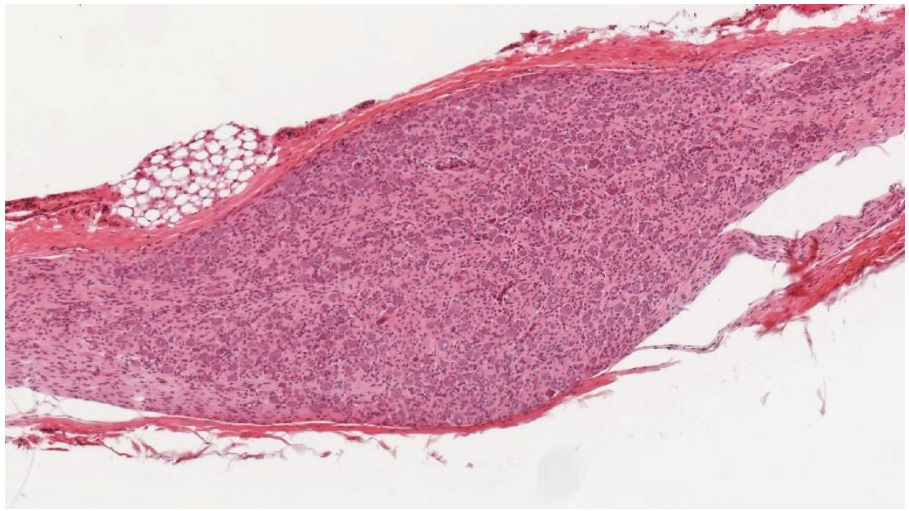
míšní ganglion

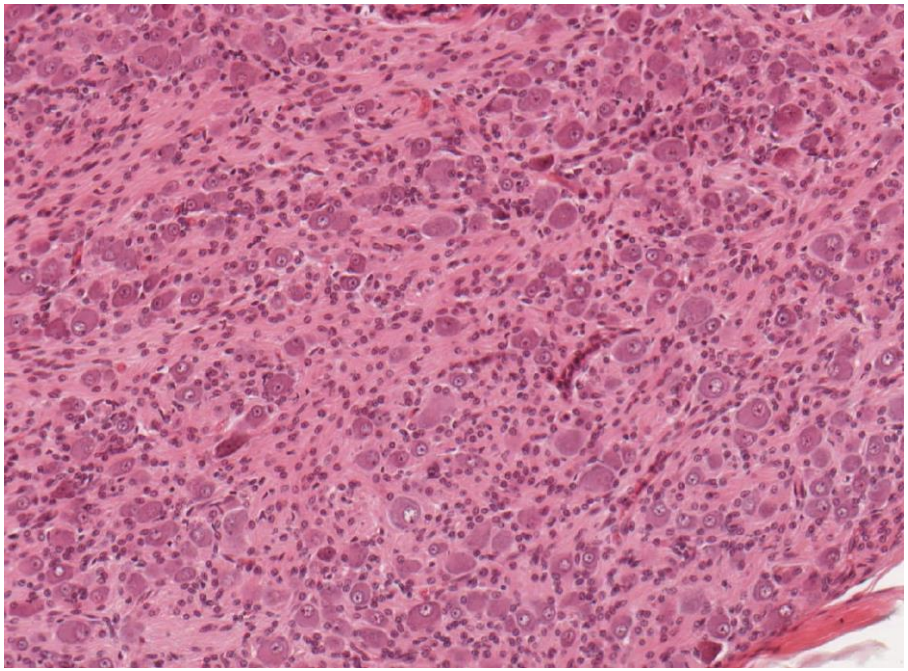
Ganglion spinale (DRG) – pseudounipolární neuron



Ganglia autonomní

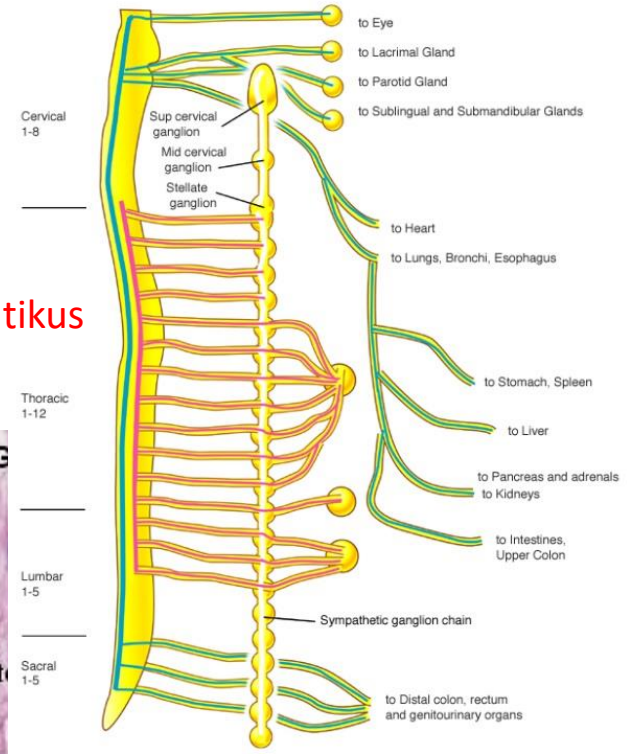
multipolární neurony a neuroglie

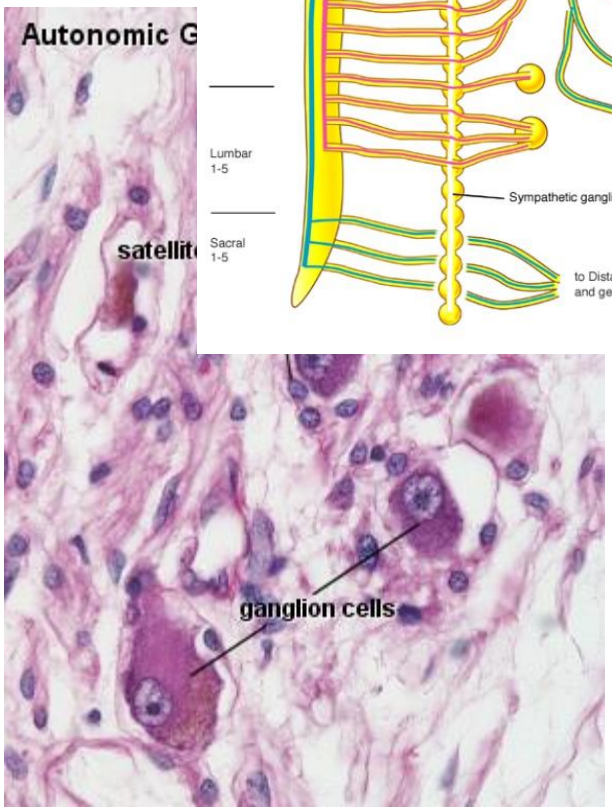




parasympatikus

sympatikus

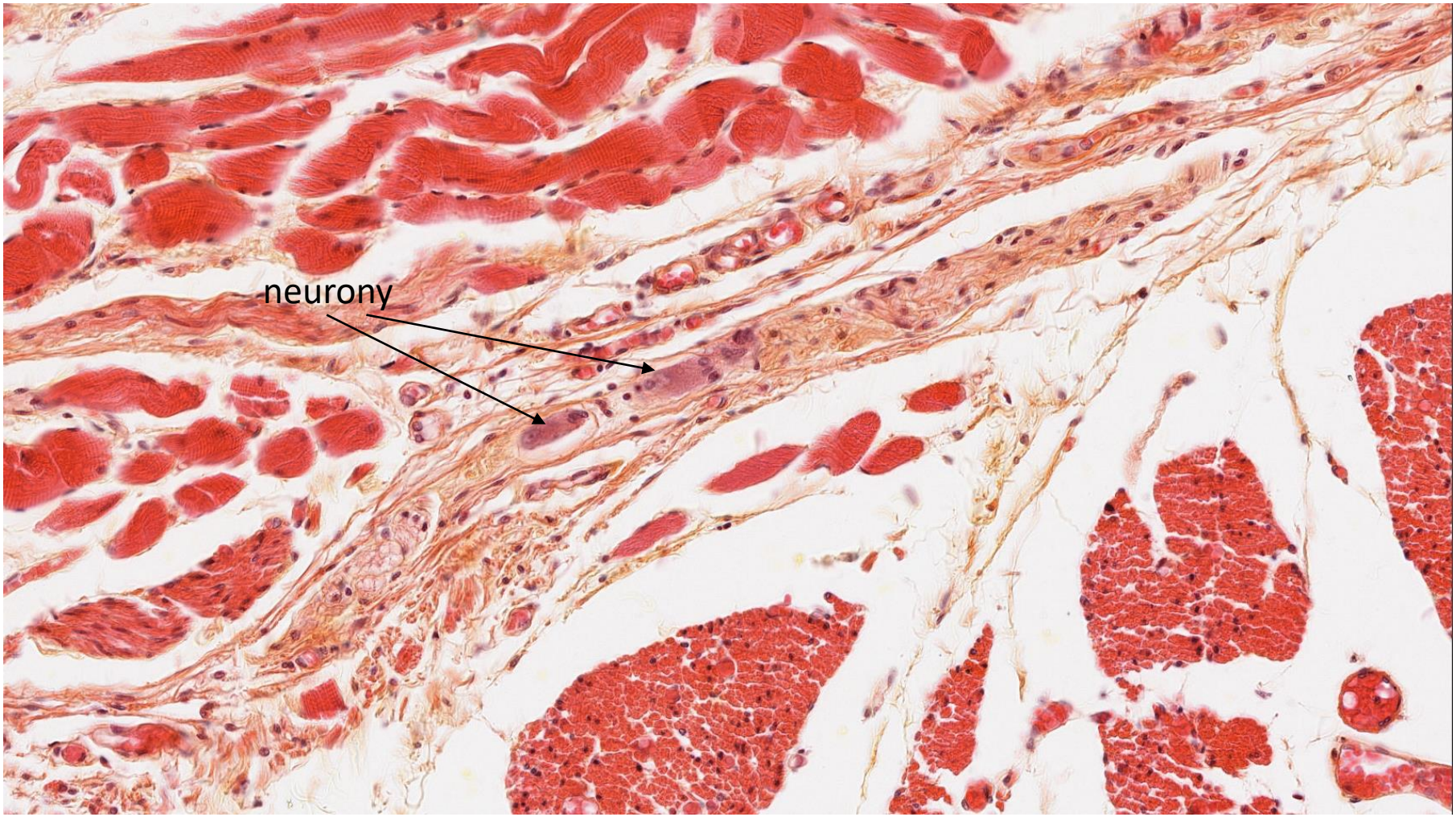




Ganglia autonomní

intramurální ganglia ve stěně vnitřních orgánů – př. *plexus myentericus* v *tunica muscularis externa*

jícen, HEŠ



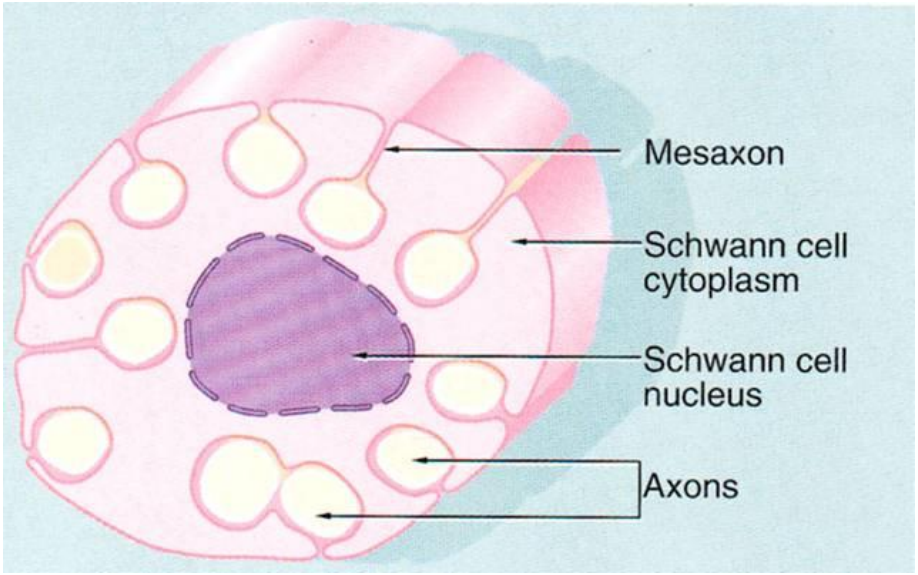
PNS – nervy - nervová vlákna

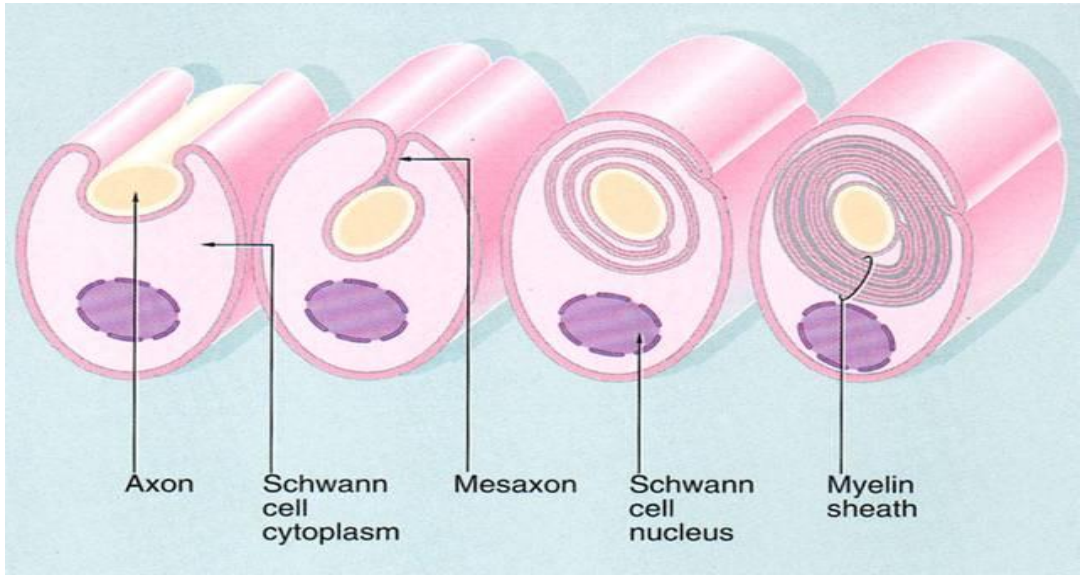
- nervové vlákno = axon + obal
- 2 typy nervových vláken:
  - ***nemyelinizovaná***

    jen *neurilema* (autonomní nervy - šedá vlákna Remakova)

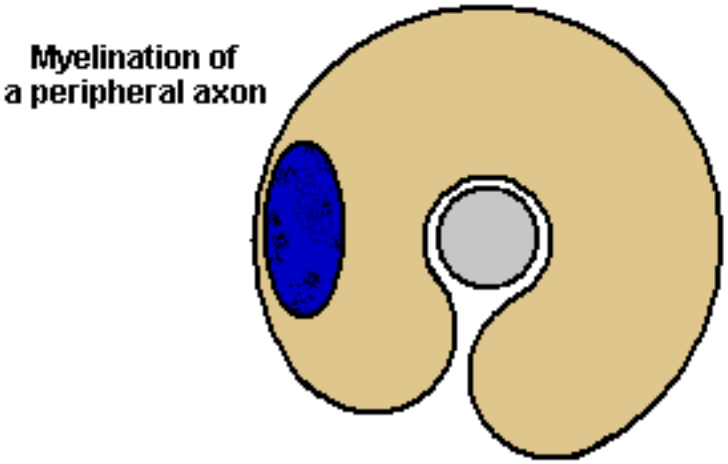
  - ***myelinizovaná***

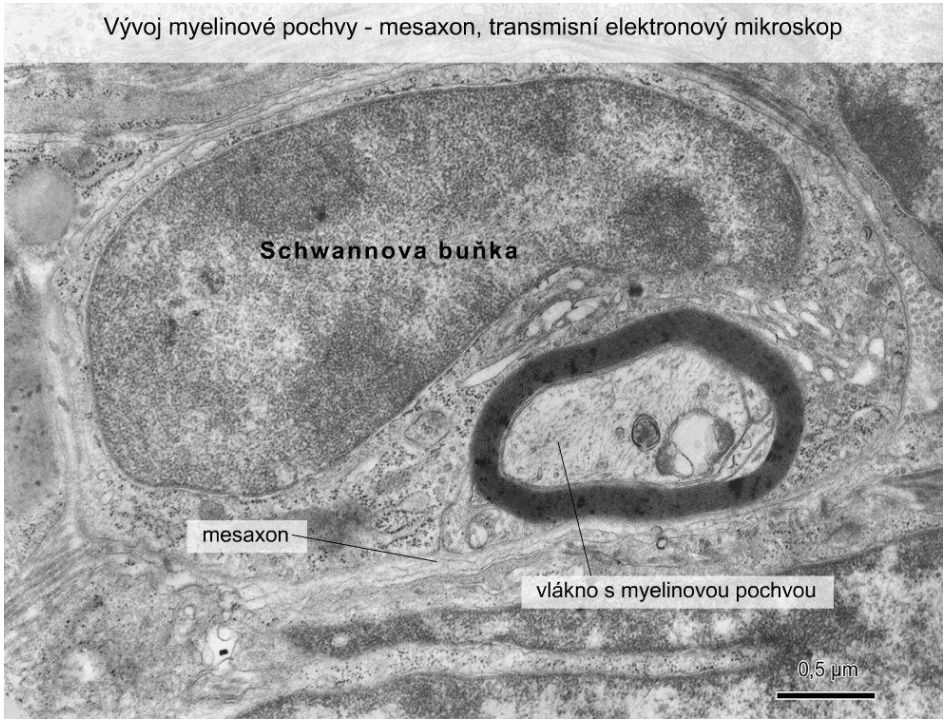
    Schwannova pochva (*neurilema*) + myelinová pochva (cerebrospinální nervy - bílá vlákna)



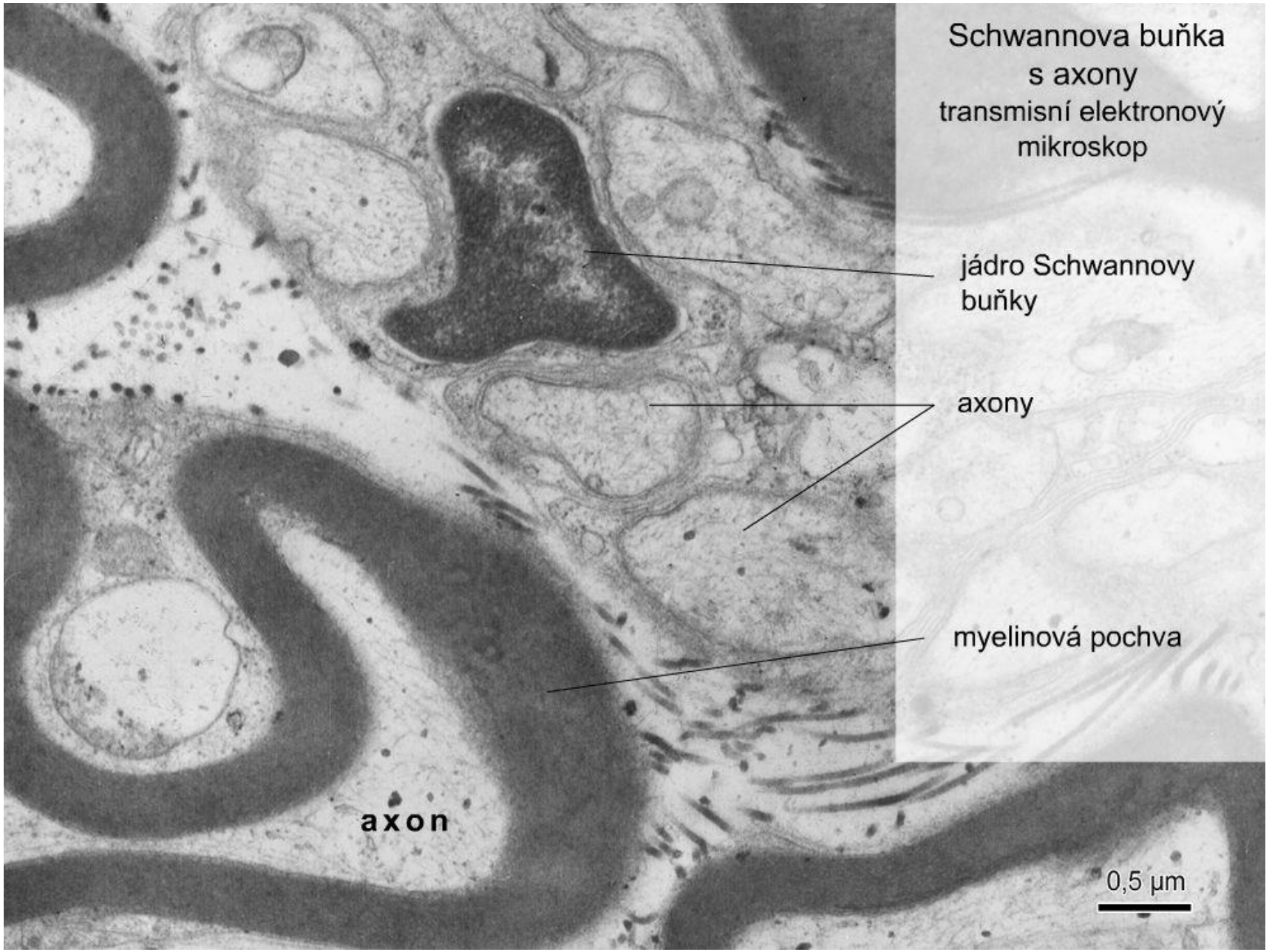


PNS - nervová vlákna – tvorba myelinu

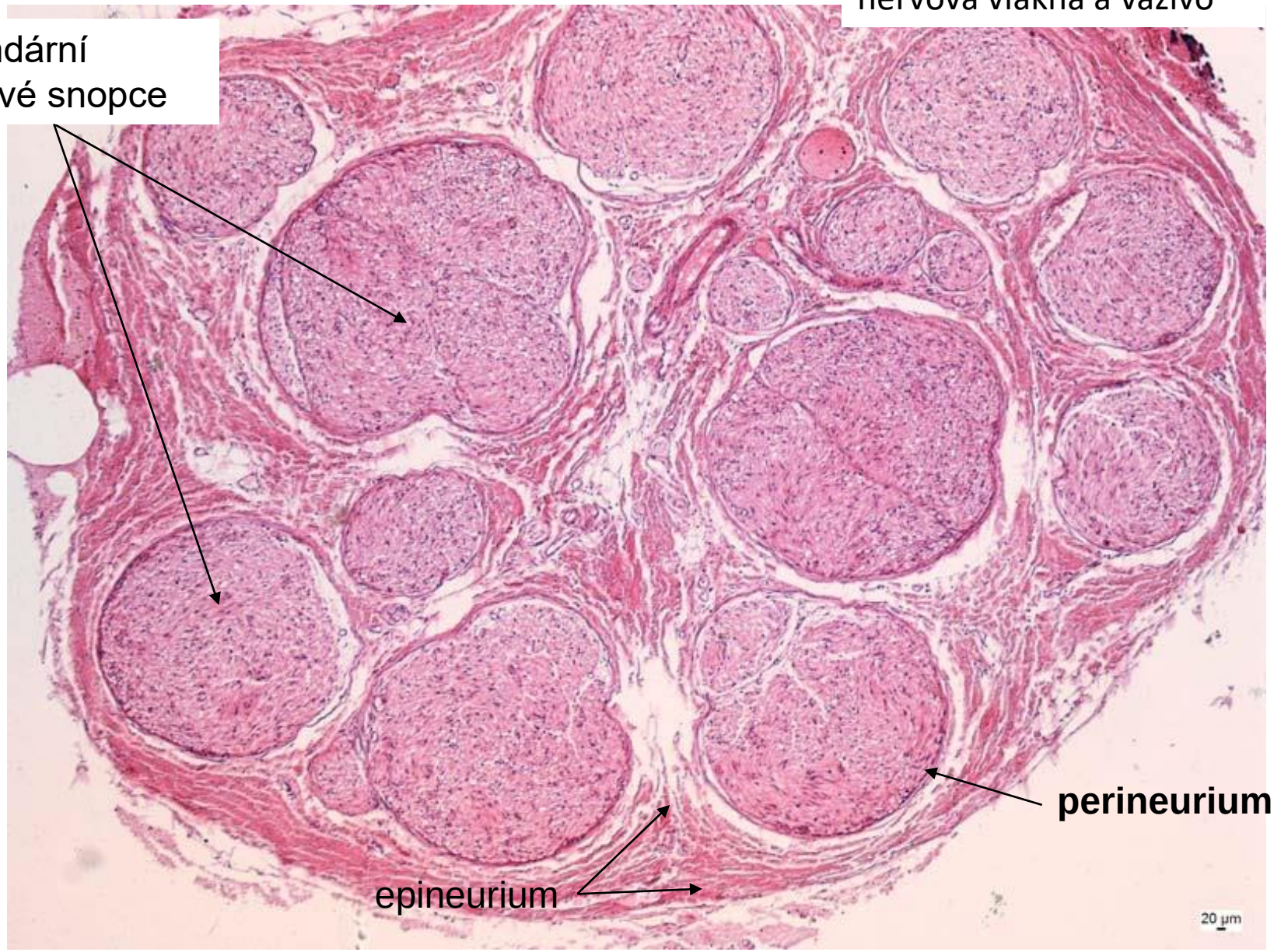




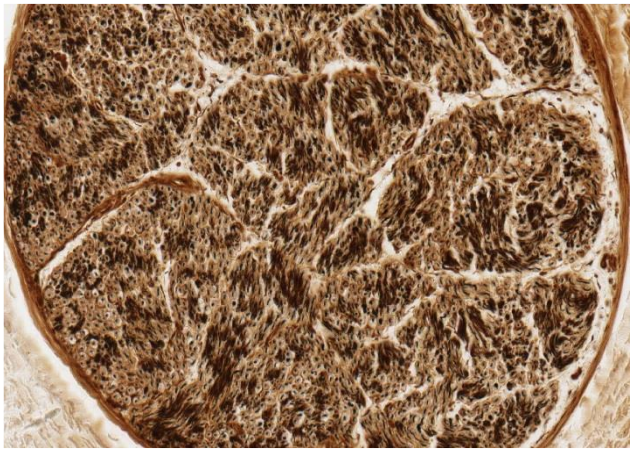
PNS - nervová vlákna



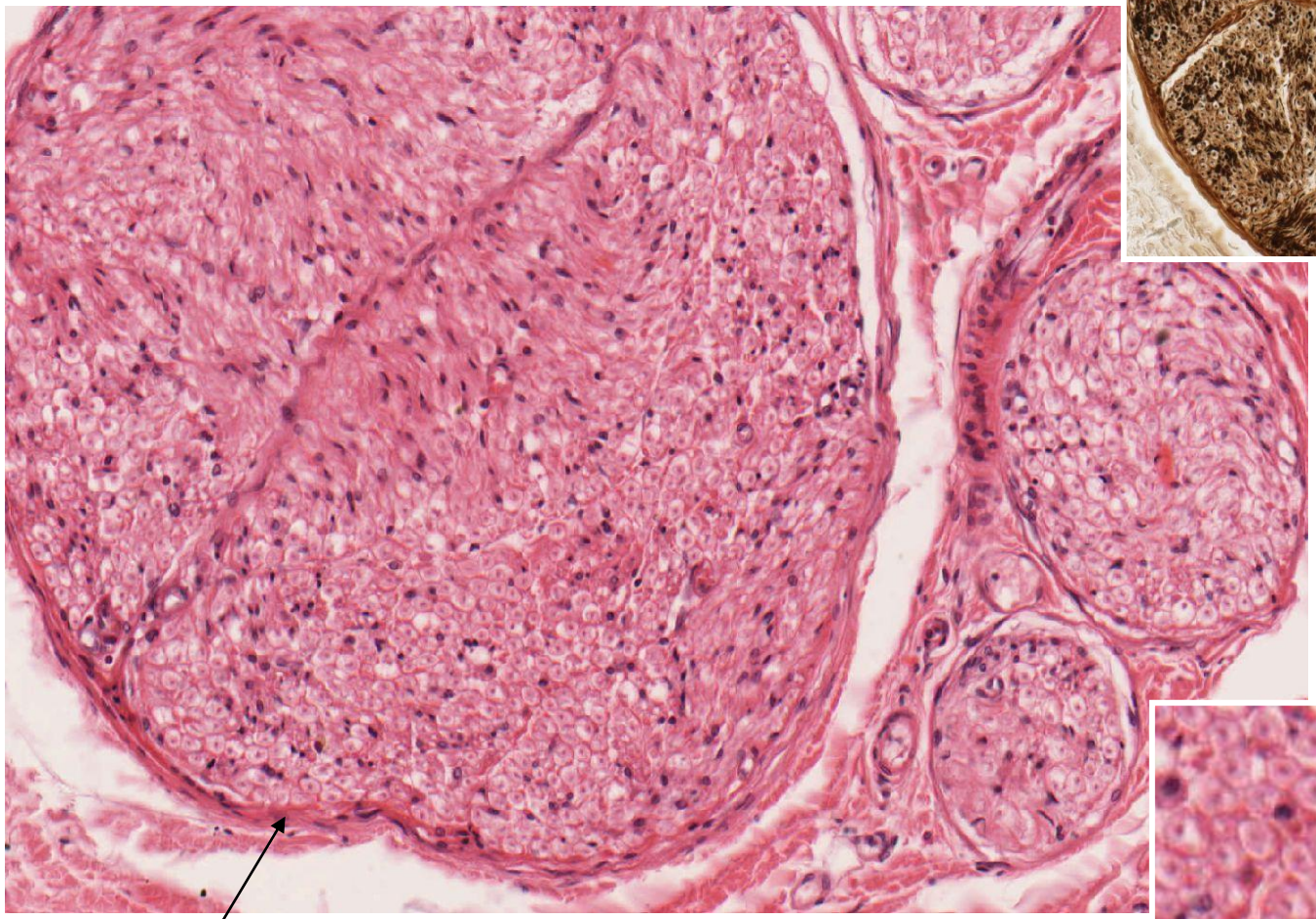
Periferní nerv



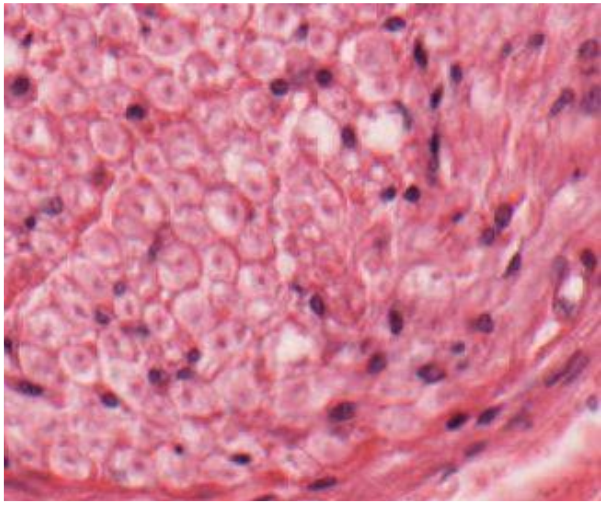
Periferní nerv



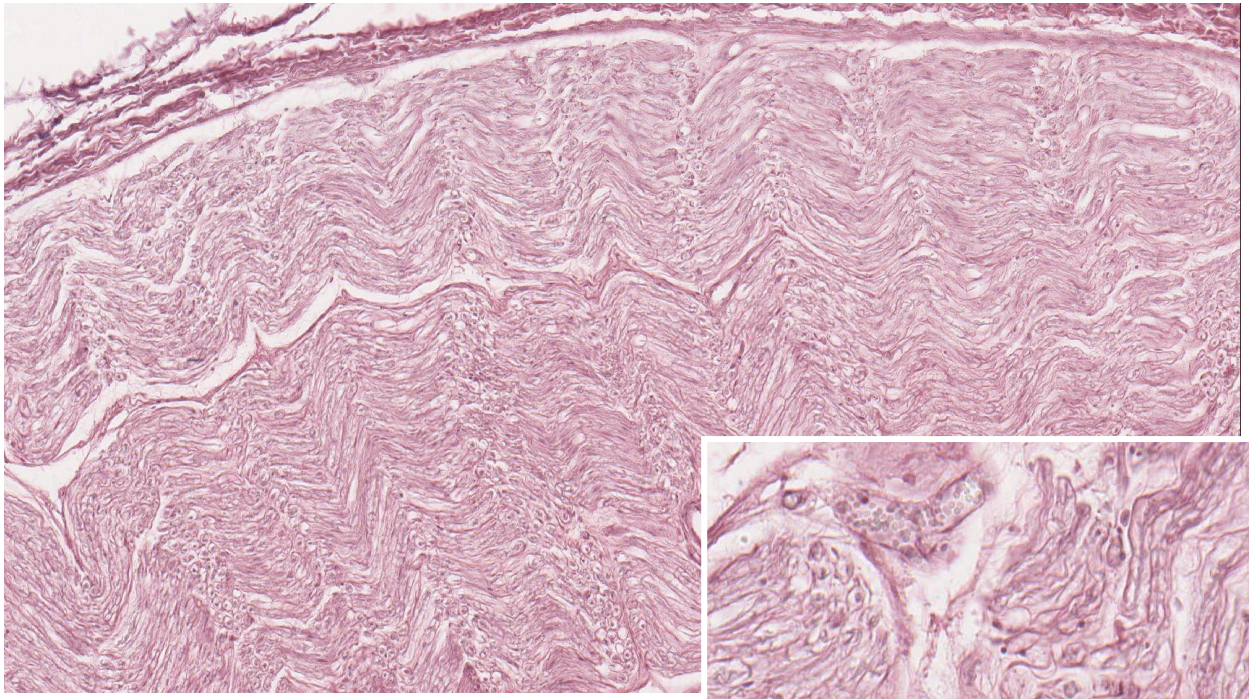
impregnace

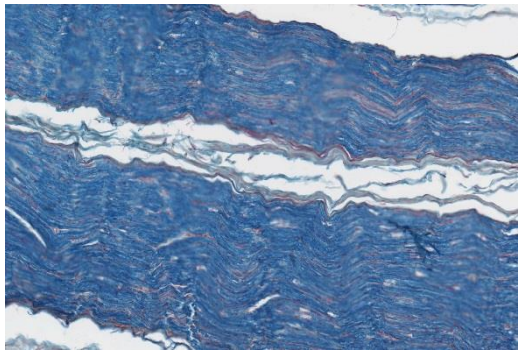


perineurium

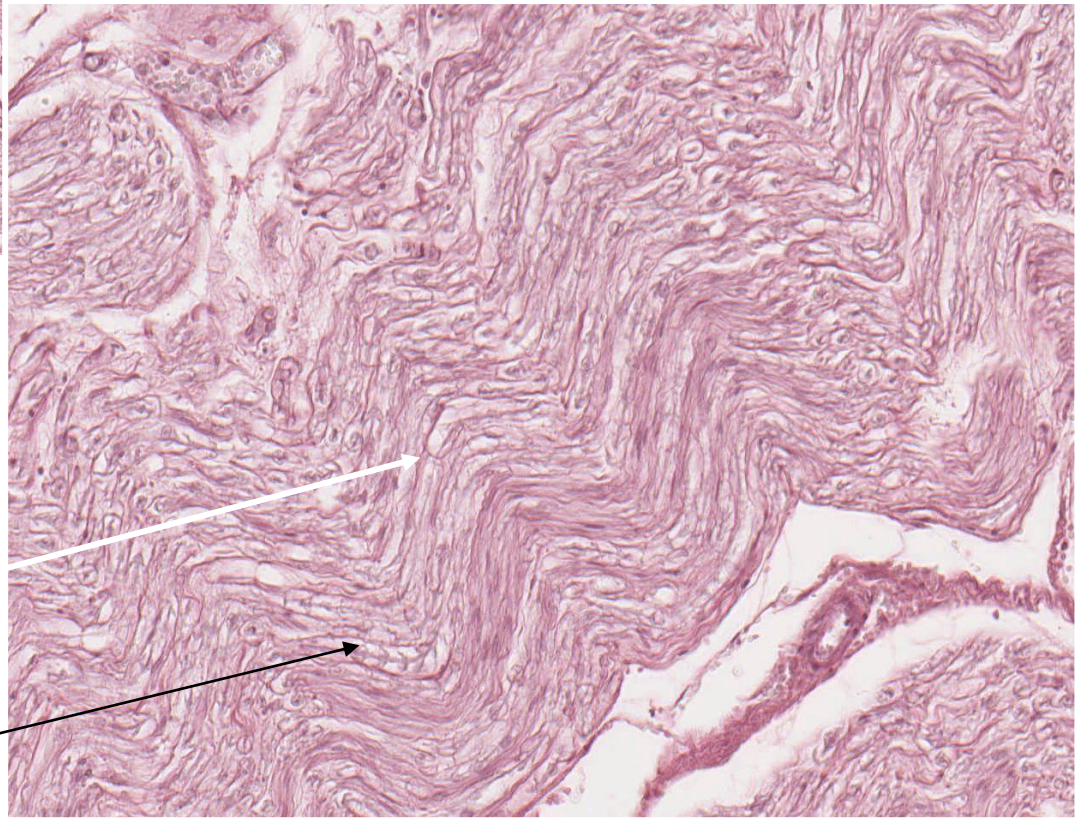


Periferní nerv





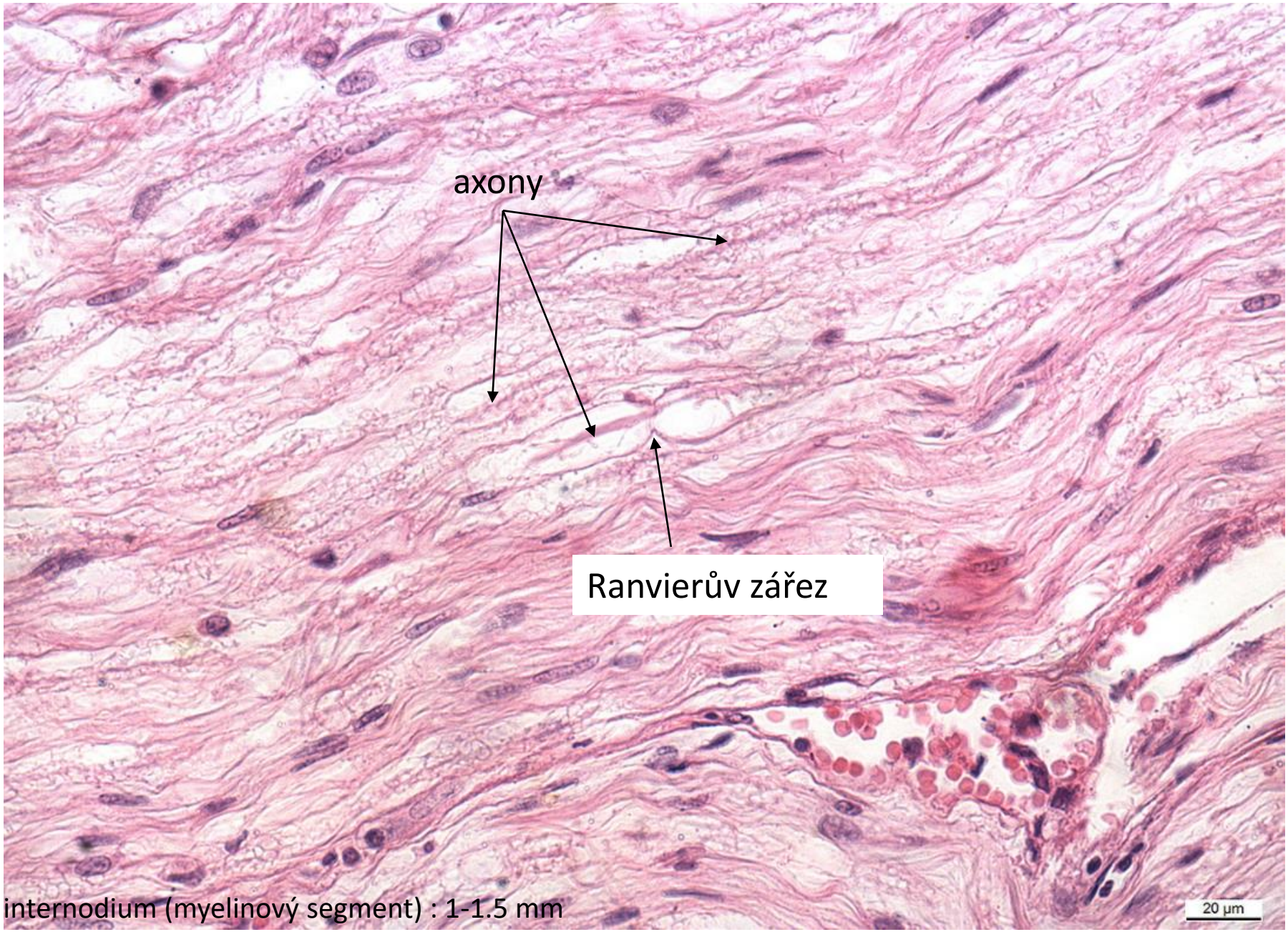
barvení na myelin - luxolová modř



Ranvierův zářez

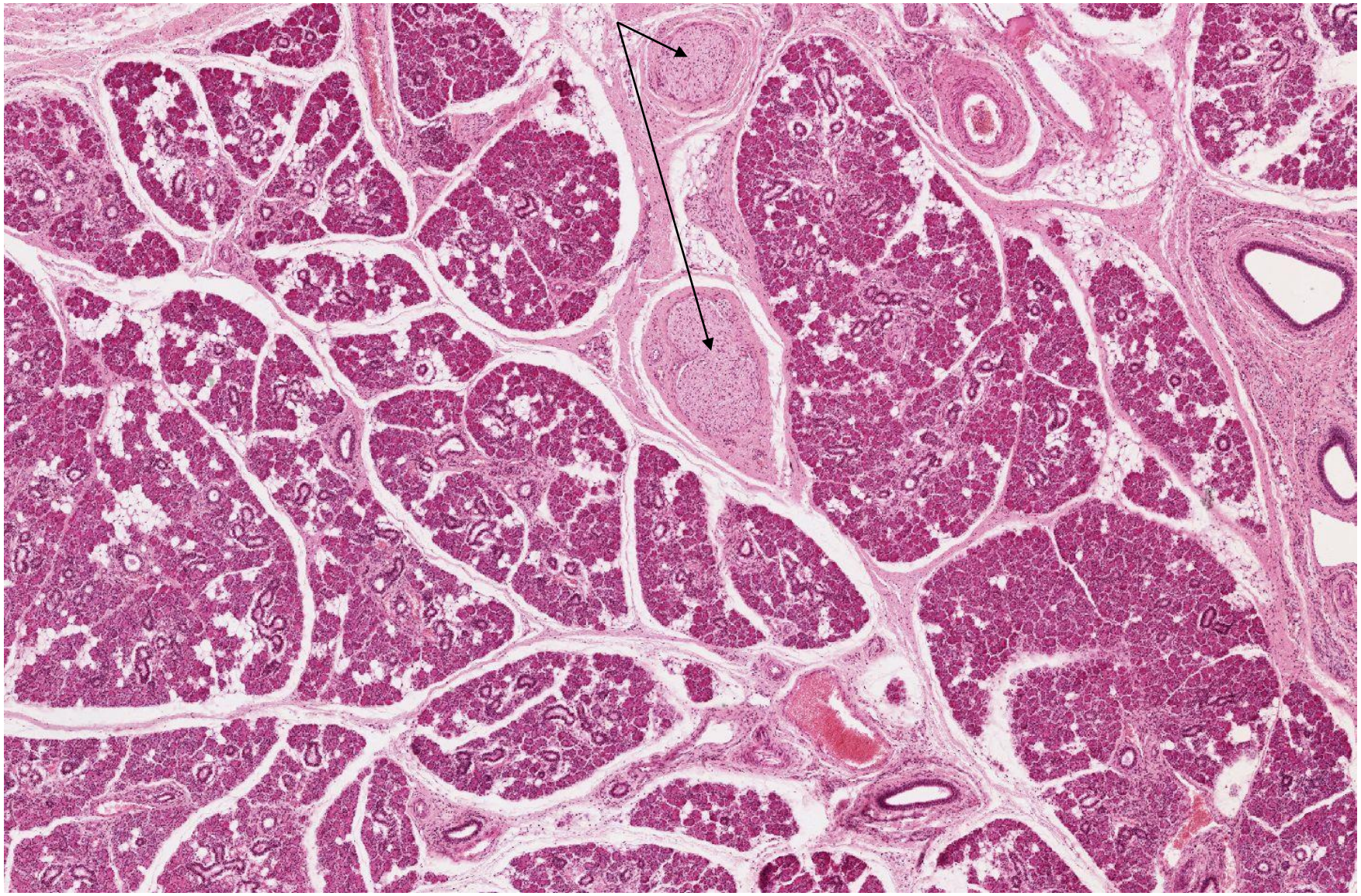
Schmidt-Lantermanovy náručky

Periferní nerv – podélný řez



internodium (myelinový segment) : 1-1.5 mm

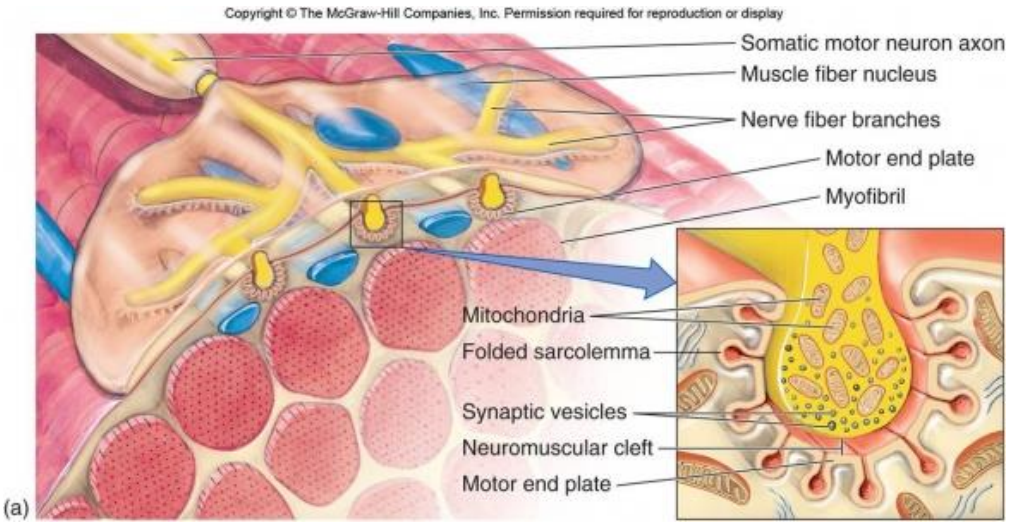
Periferní nervy – ve tkáních

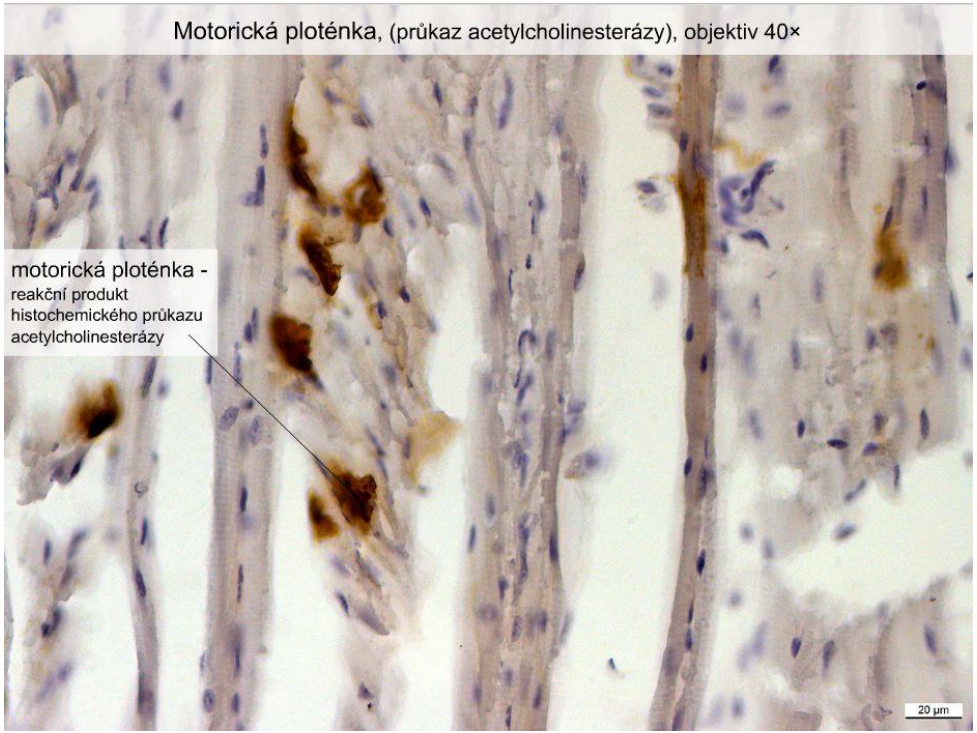


glandula parotis

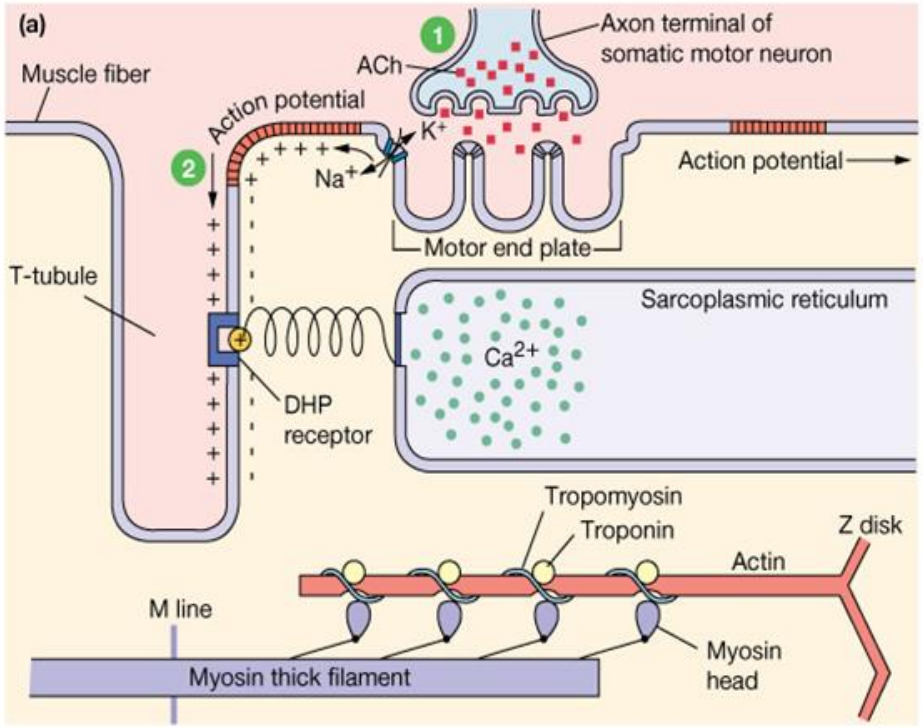
Motorická ploténka

speciální velkoplošná synapse





Motorická ploténka - funkce



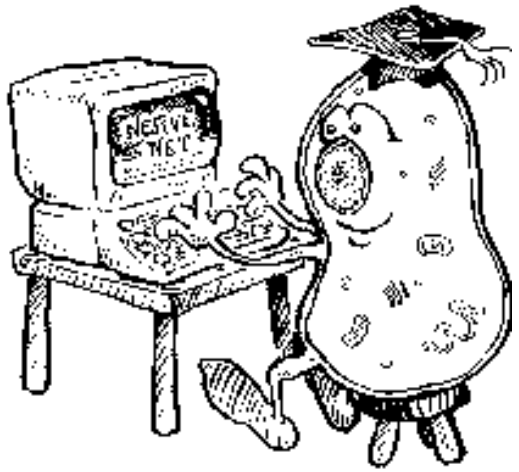
1. Somatic motor neuron releases ACh at neuro-muscular junction.
2. Net entry of Na^+ through ACh receptor-channel initiates a muscle action potential.

Motorická jednotka – soubor všech svalových vláken, která inervačně náleží k jednomu motoneuronu,
např. okohybné svaly – 3-5 svalových vláken na 1 motoneuron,
mm. glutei – 100-200 svalových vláken na 1 motoneuron

$AuCl_2$

Nervový systém

- 75. Cortex cerebri
- 76. Cortex cerebri /impregnace/
- 77. Cerebellum /impregnace/
- 78. Cerebellum /Nisslova substance/
- 79. Medulla spinalis
- 80. Plexus choroideus
- 81. Ganglion spinale
- 82. Ganglion spinale /impregnace/
- 83. Ganglion vegetativní
- 84. Periferní nerv – příčně
- 85. Periferní nerv – příčně /myelin/
- 86. Periferní nerv – podél
- 87. Periferní nerv – podél /myelin/



Děkuji Vám za pozornost.
Jana Dumková

otázky a komentáře na:
jdumkova&med.muni.cz