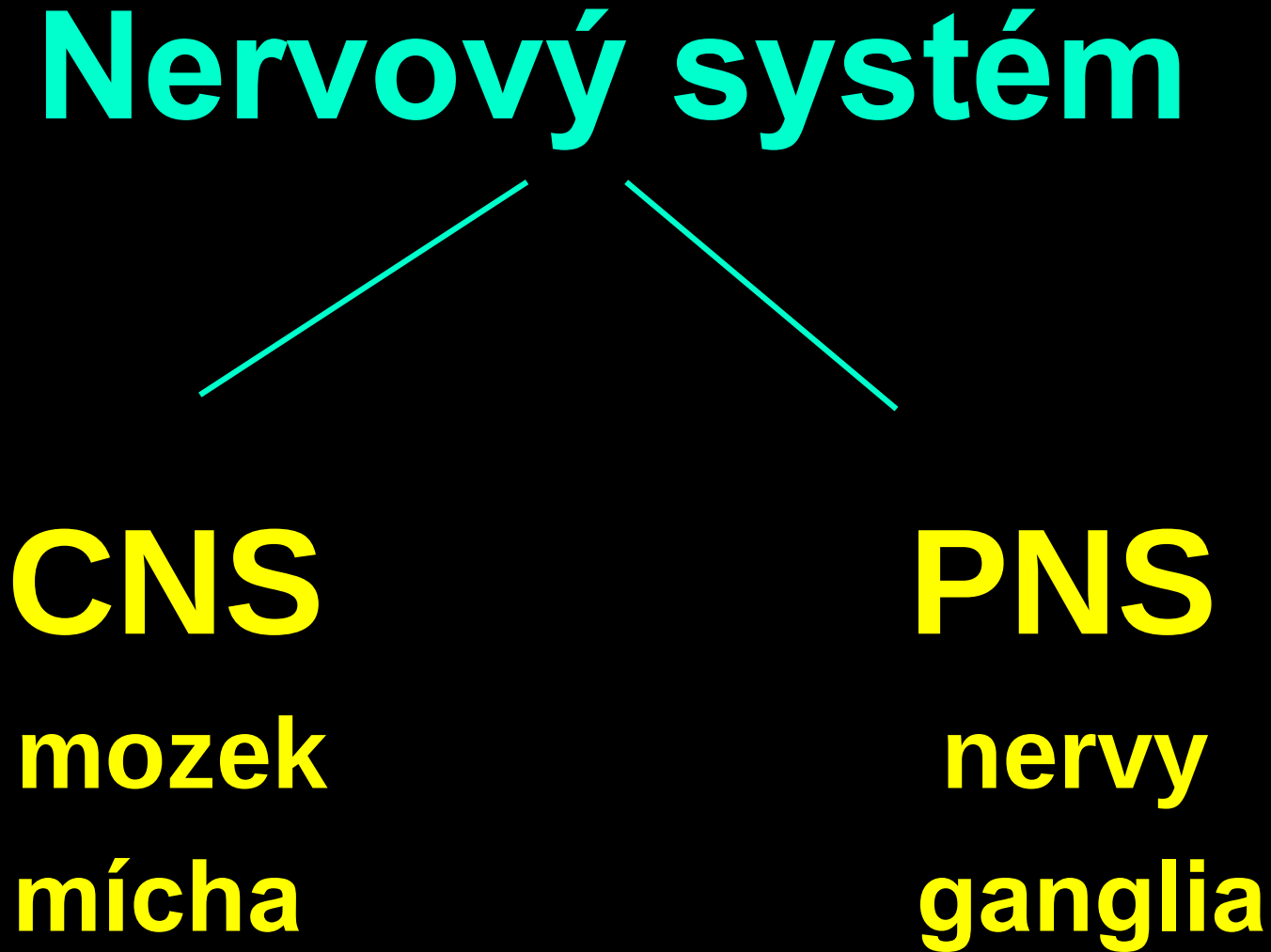


Nervový systém



```
graph TD; A[Nervový systém] --> B[CNS]; A --> C[PNS]; B --> D[mozek]; B --> E[mícha]; C --> F[nervy]; C --> G[ganglia];
```

CNS

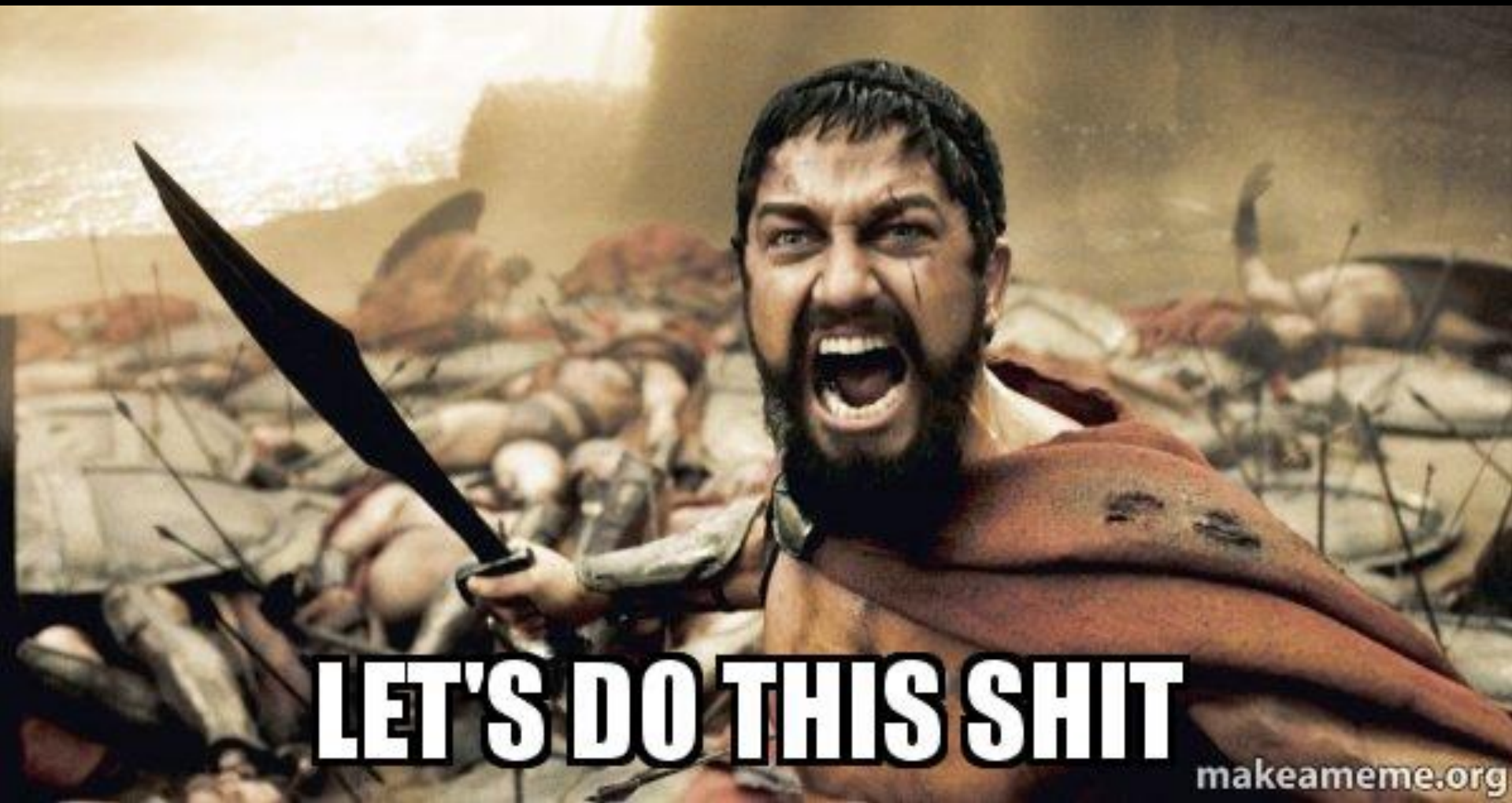
mozek

mícha

PNS

nervy

ganglia



makeameme.org



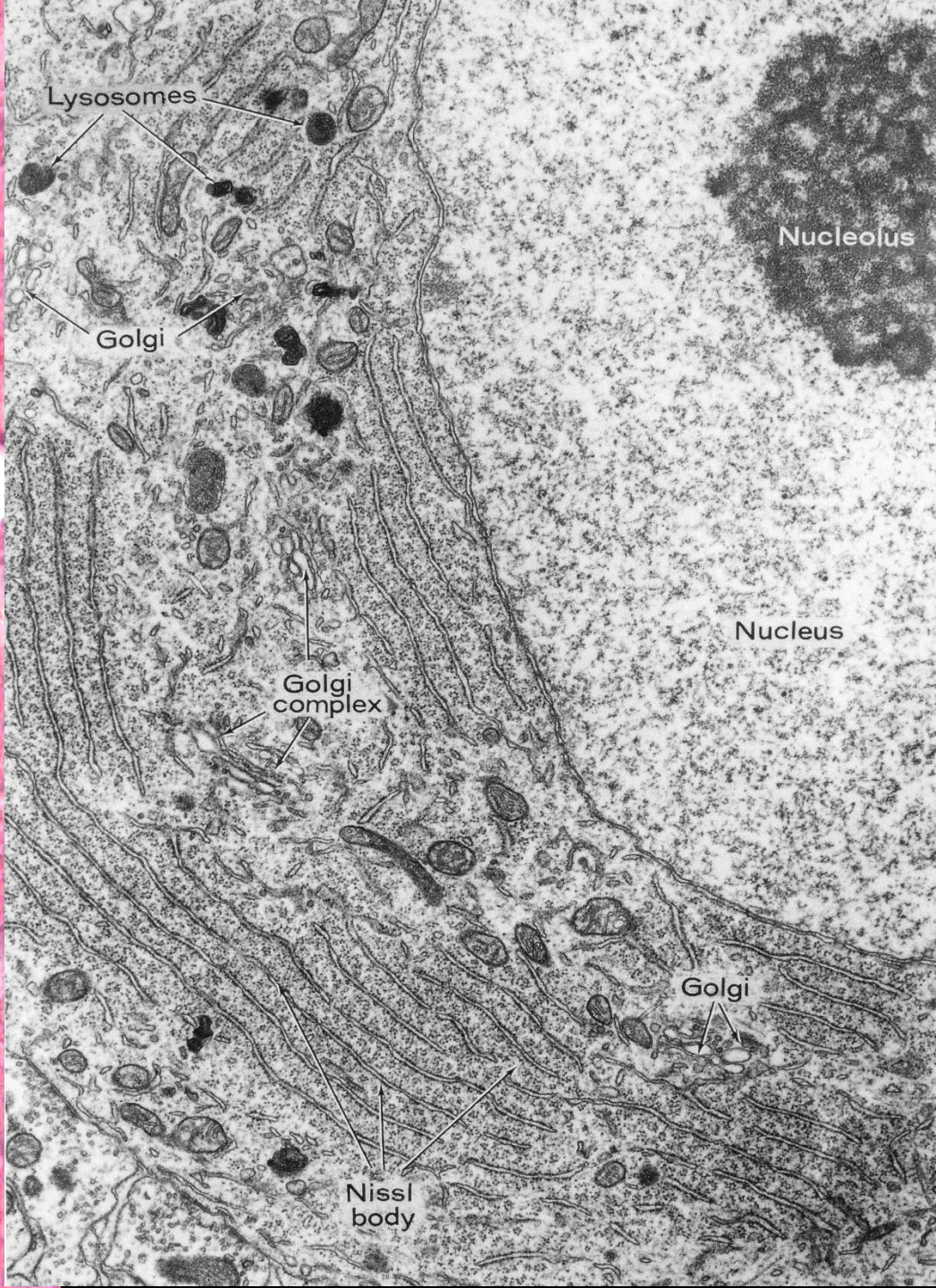
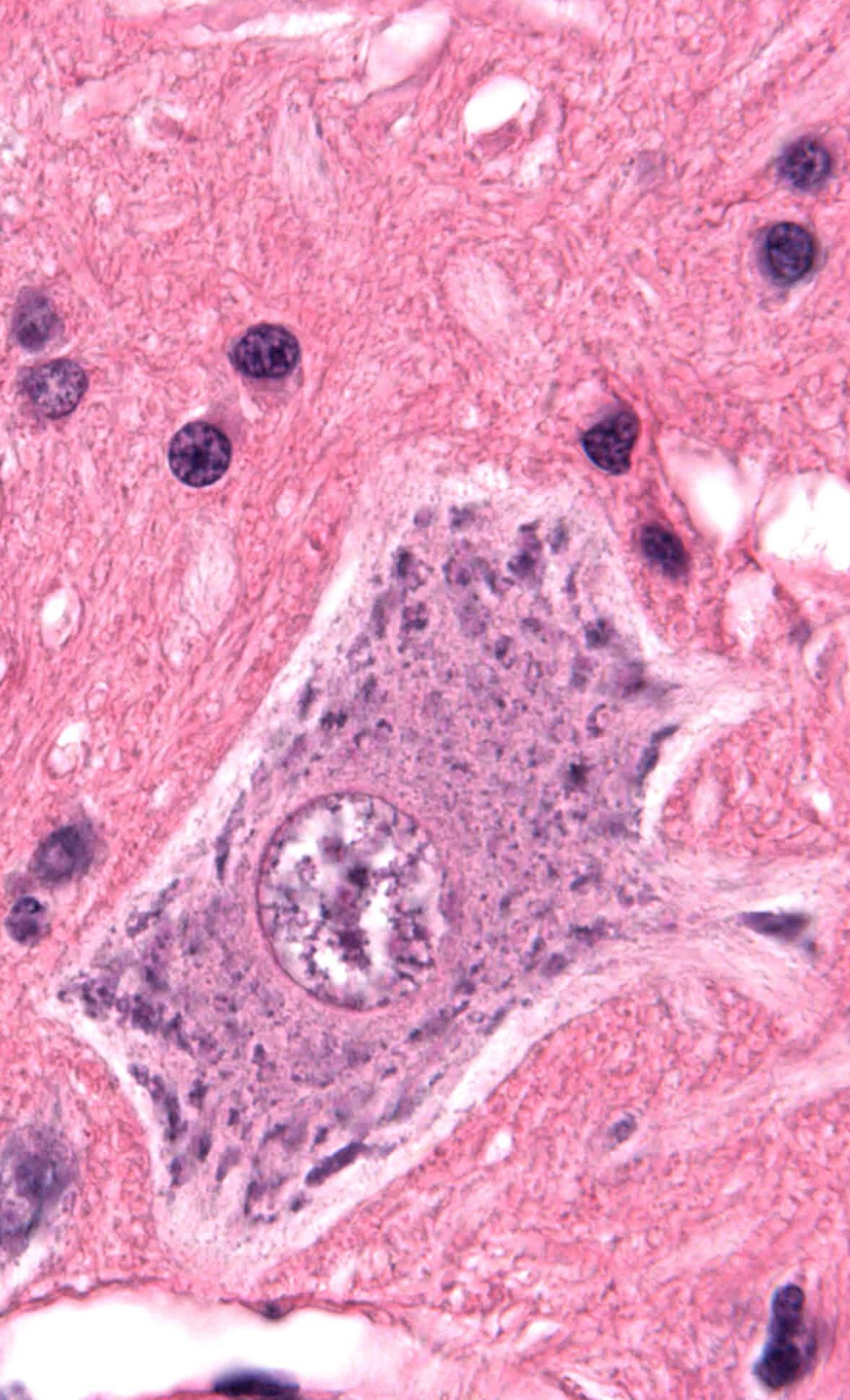
Buňky nervové tkáně

- neurony
- gliové buňky (neuroglie)

Extracelulární matrix

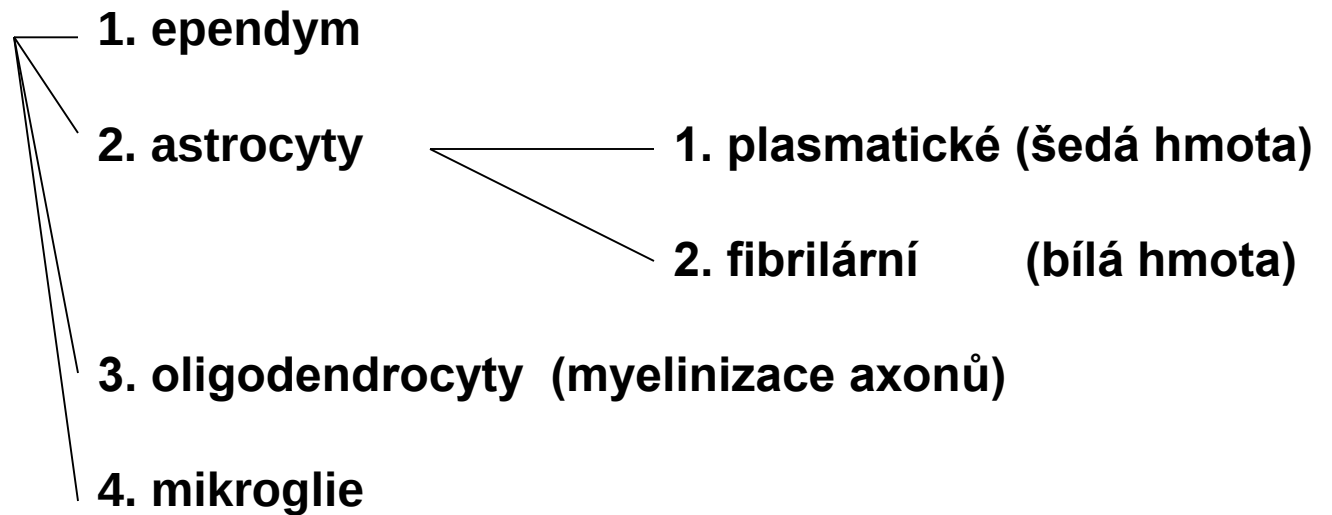
- zanedbatelné množství



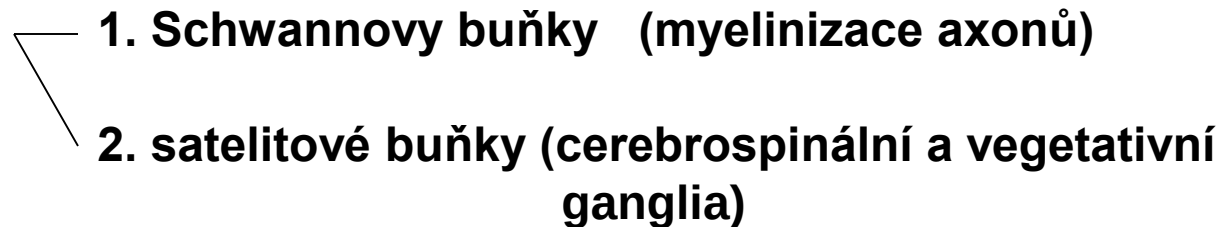


NEUROGLIE

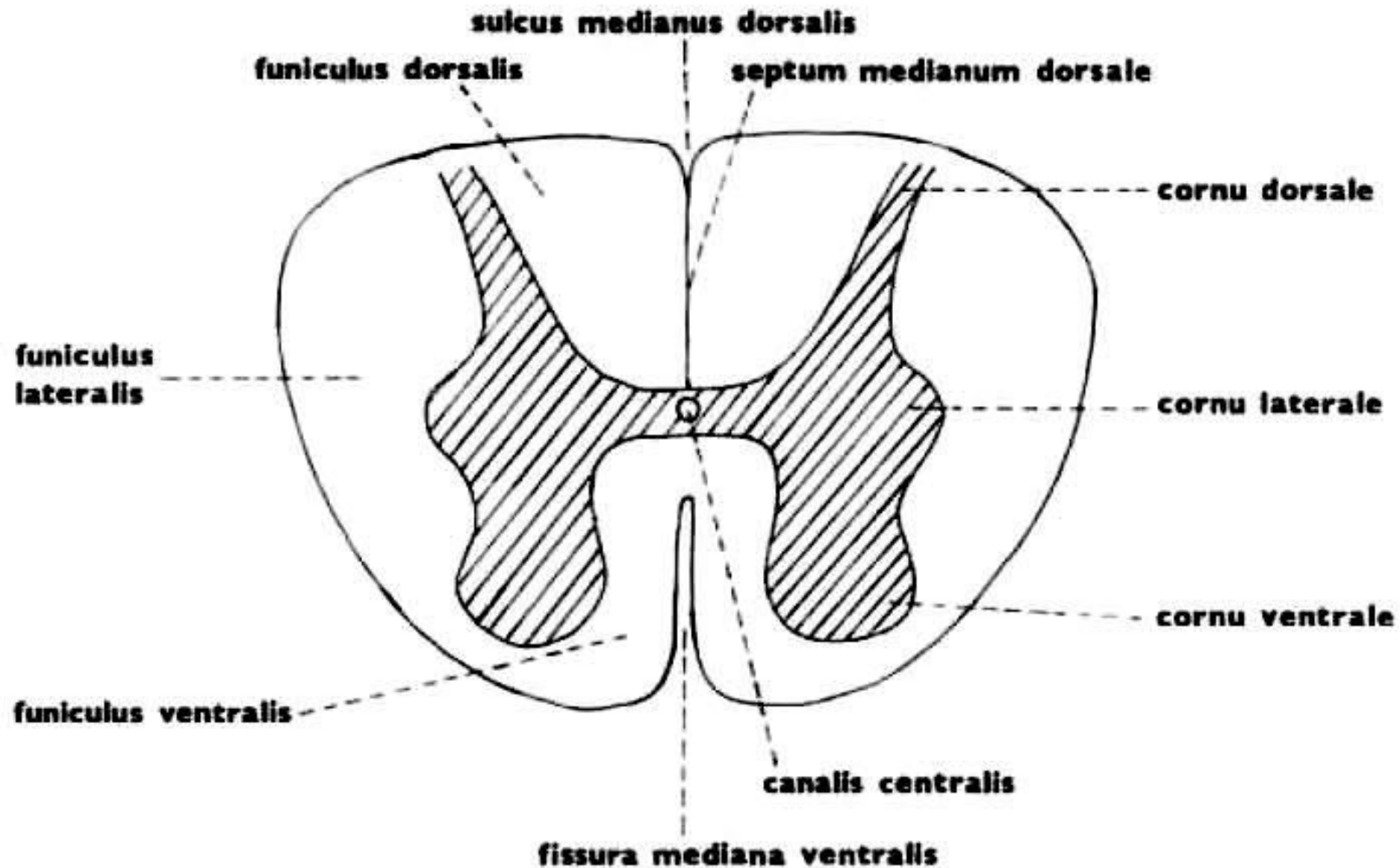
1. Neuroglie v CNS



2. Neuroglie v PNS

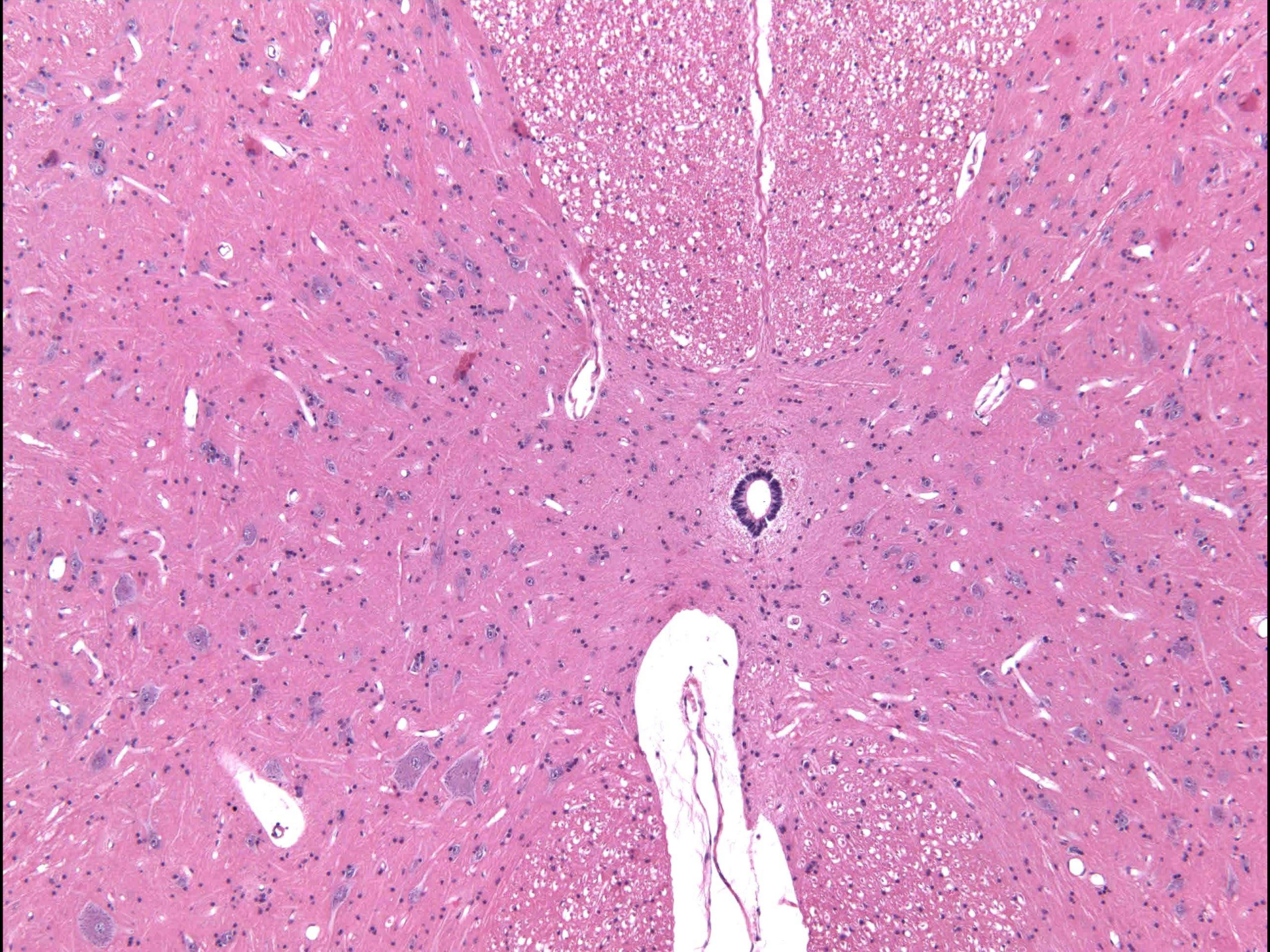


MEDULLA SPINALIS

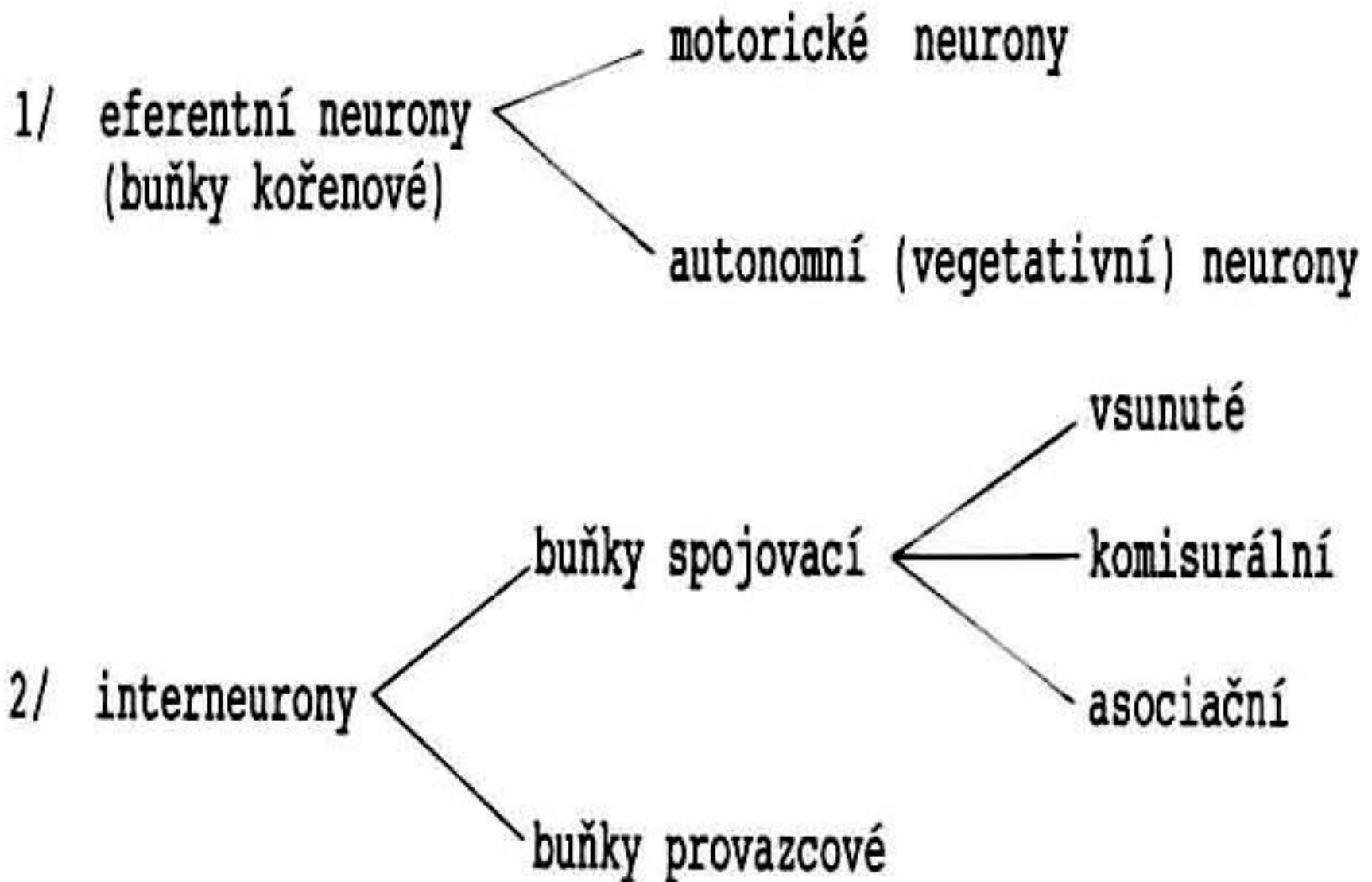


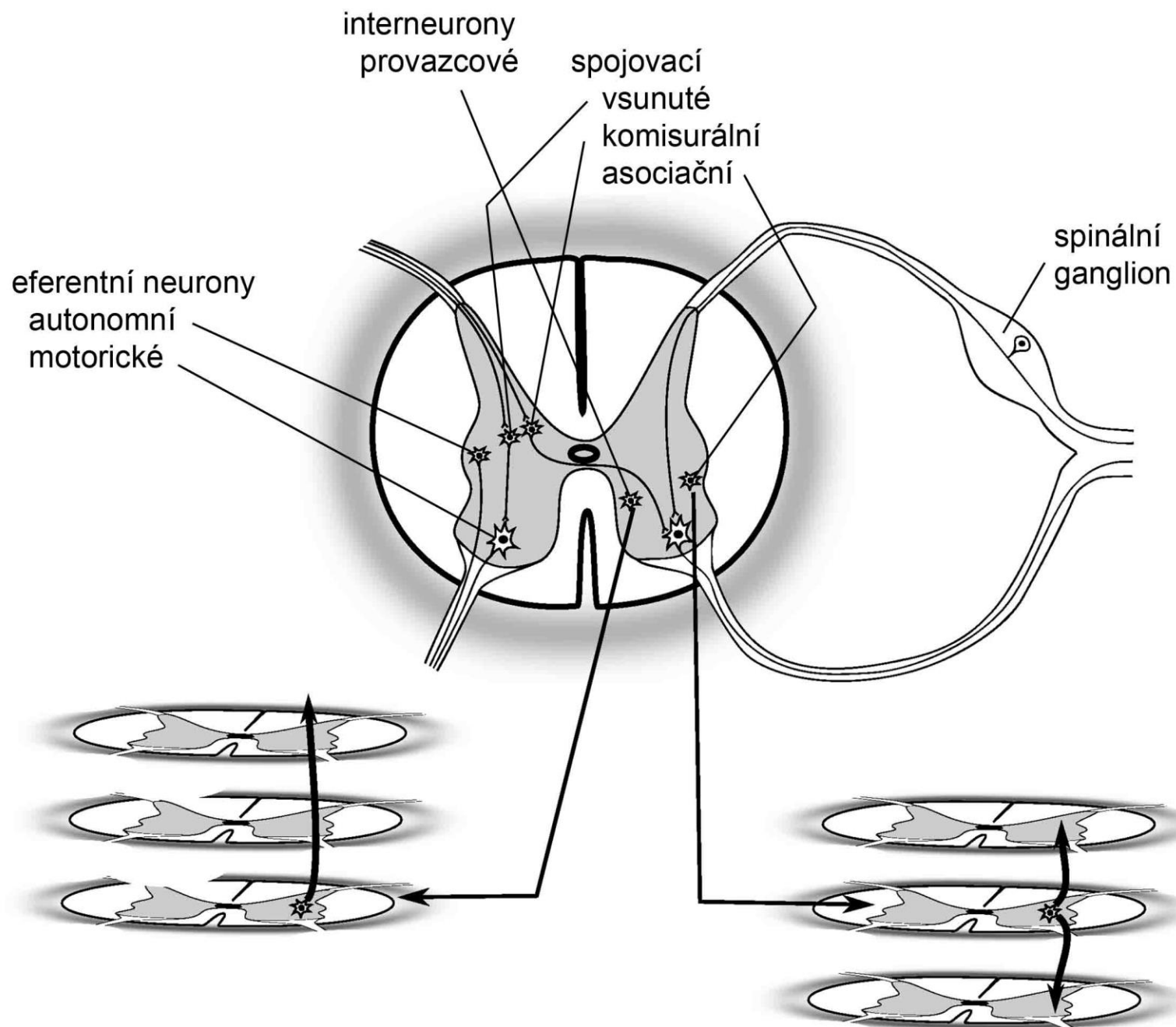


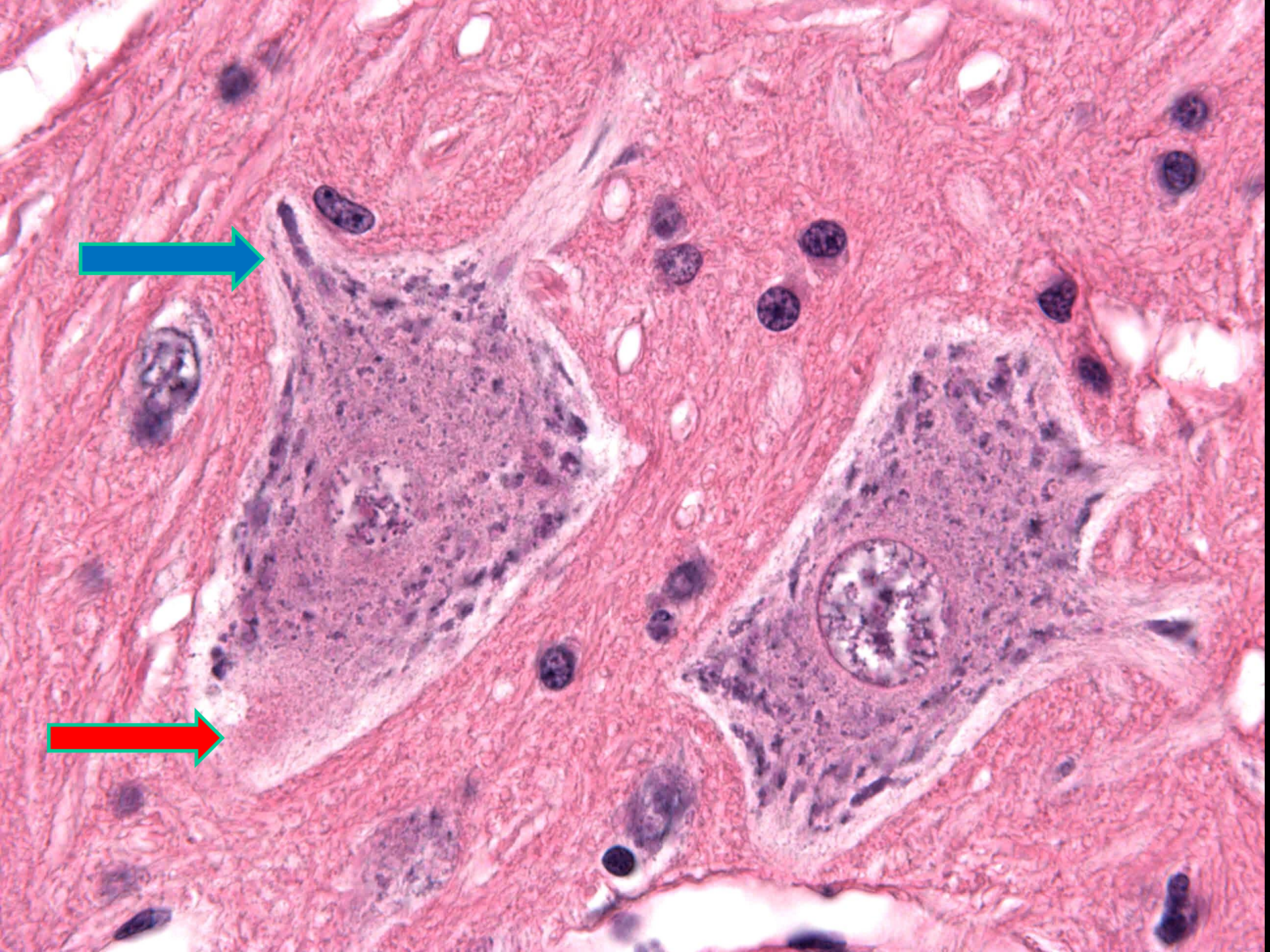
impregnace AgNO_3

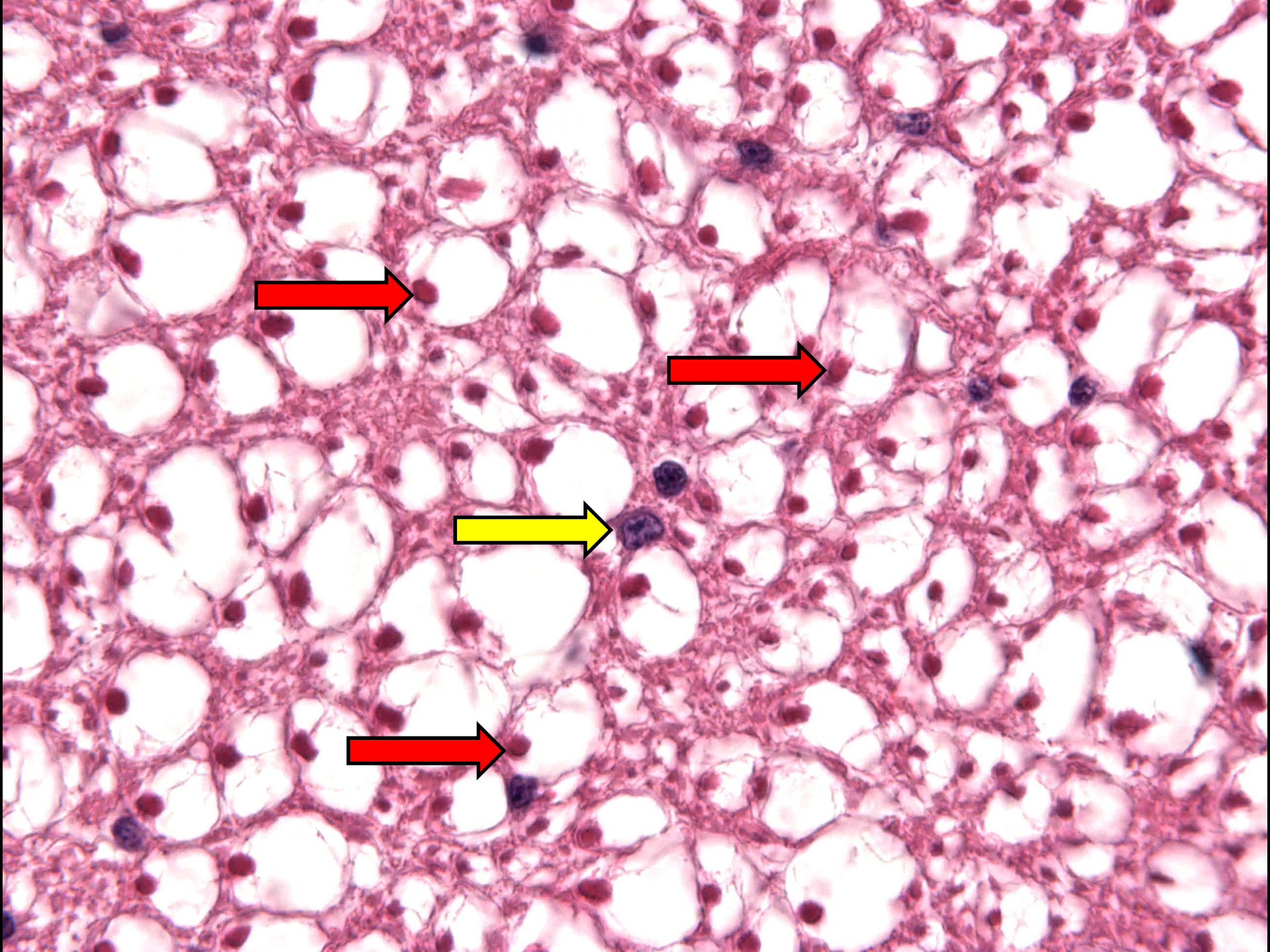


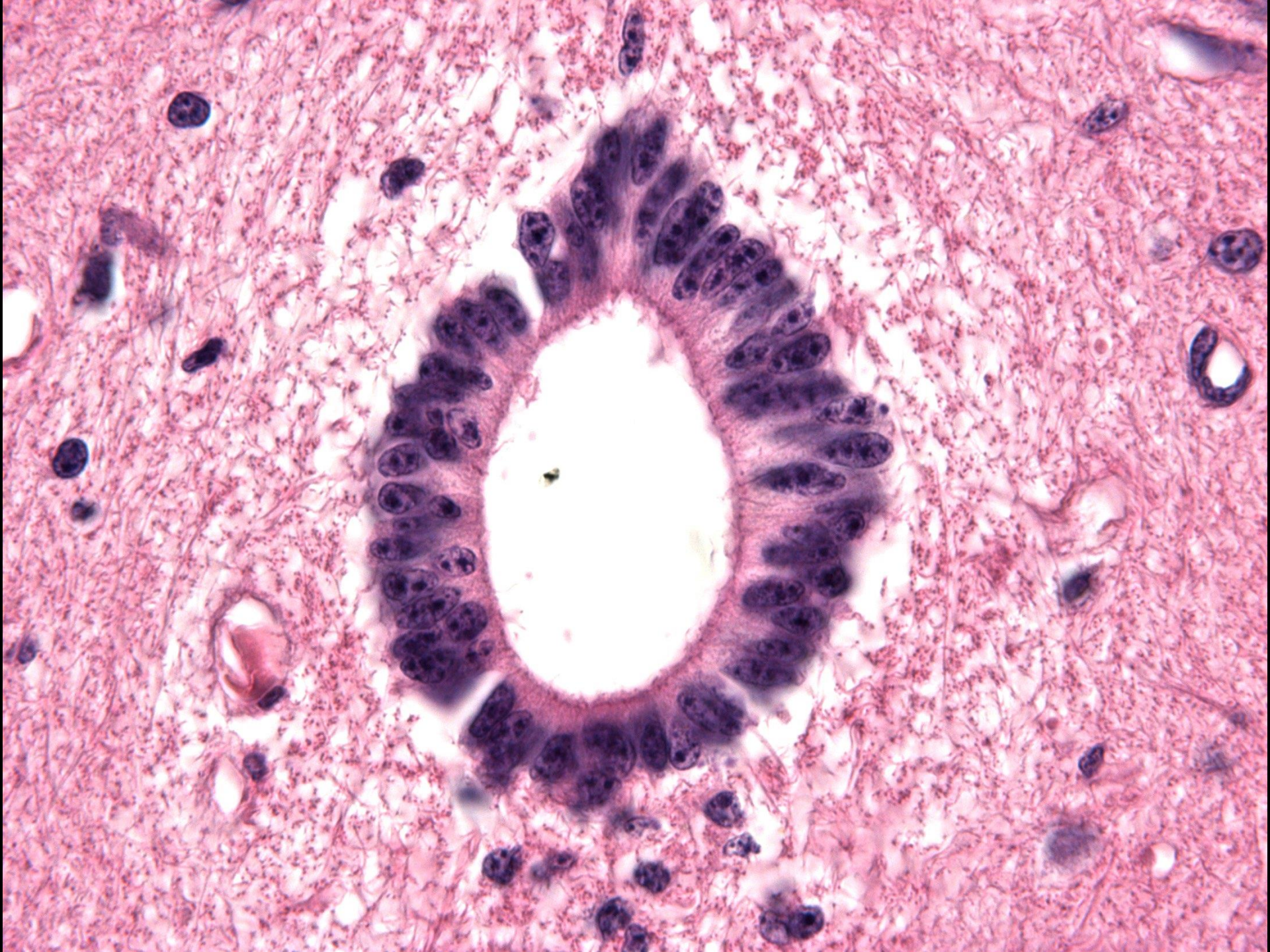
Typy neuronů v míše











Mozeček (cerebellum)

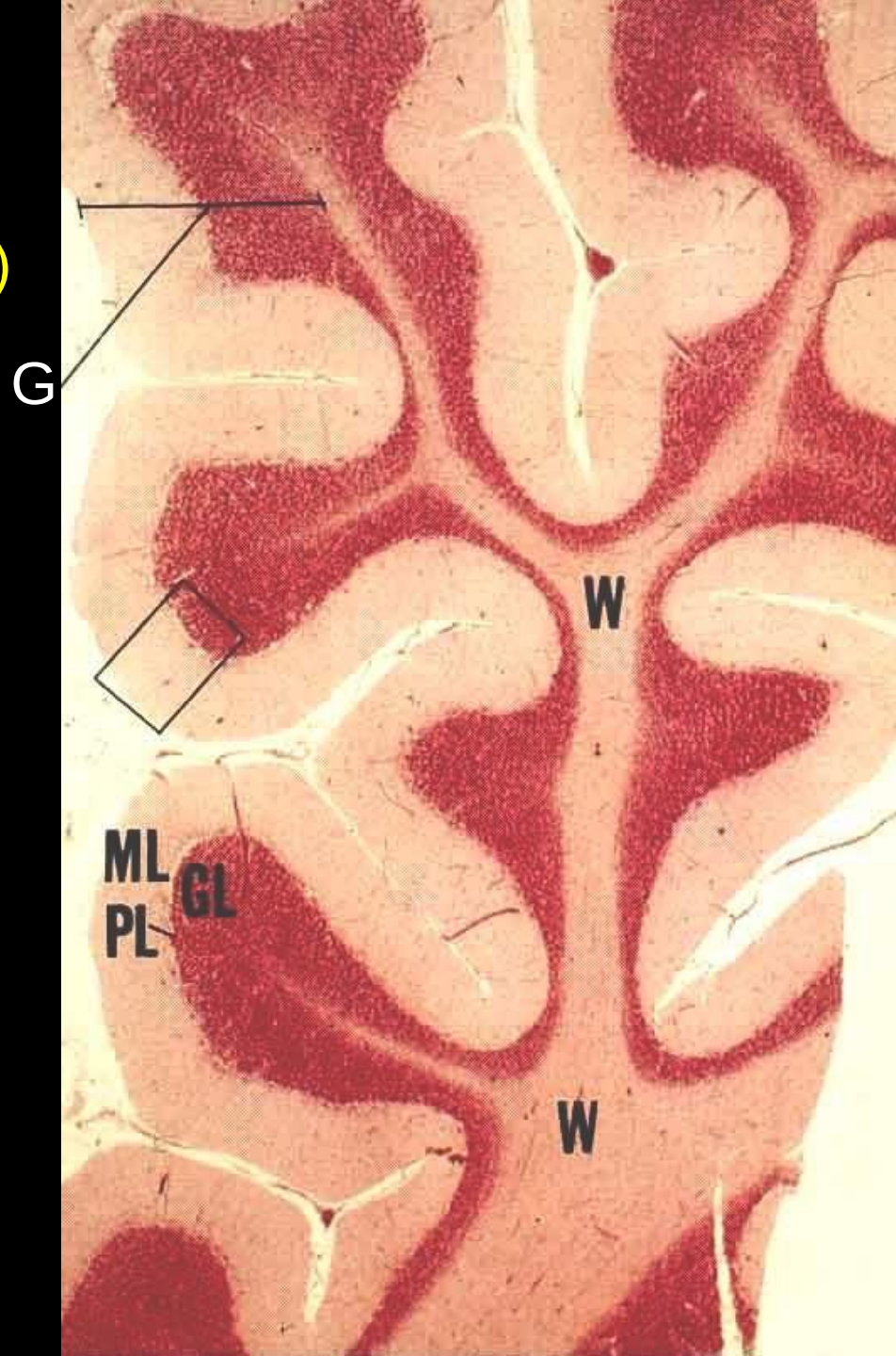
G = šedá hmota

ML = stratum moleculare

PL = stratum gangliosum
(vrstva Purkyňových buněk)

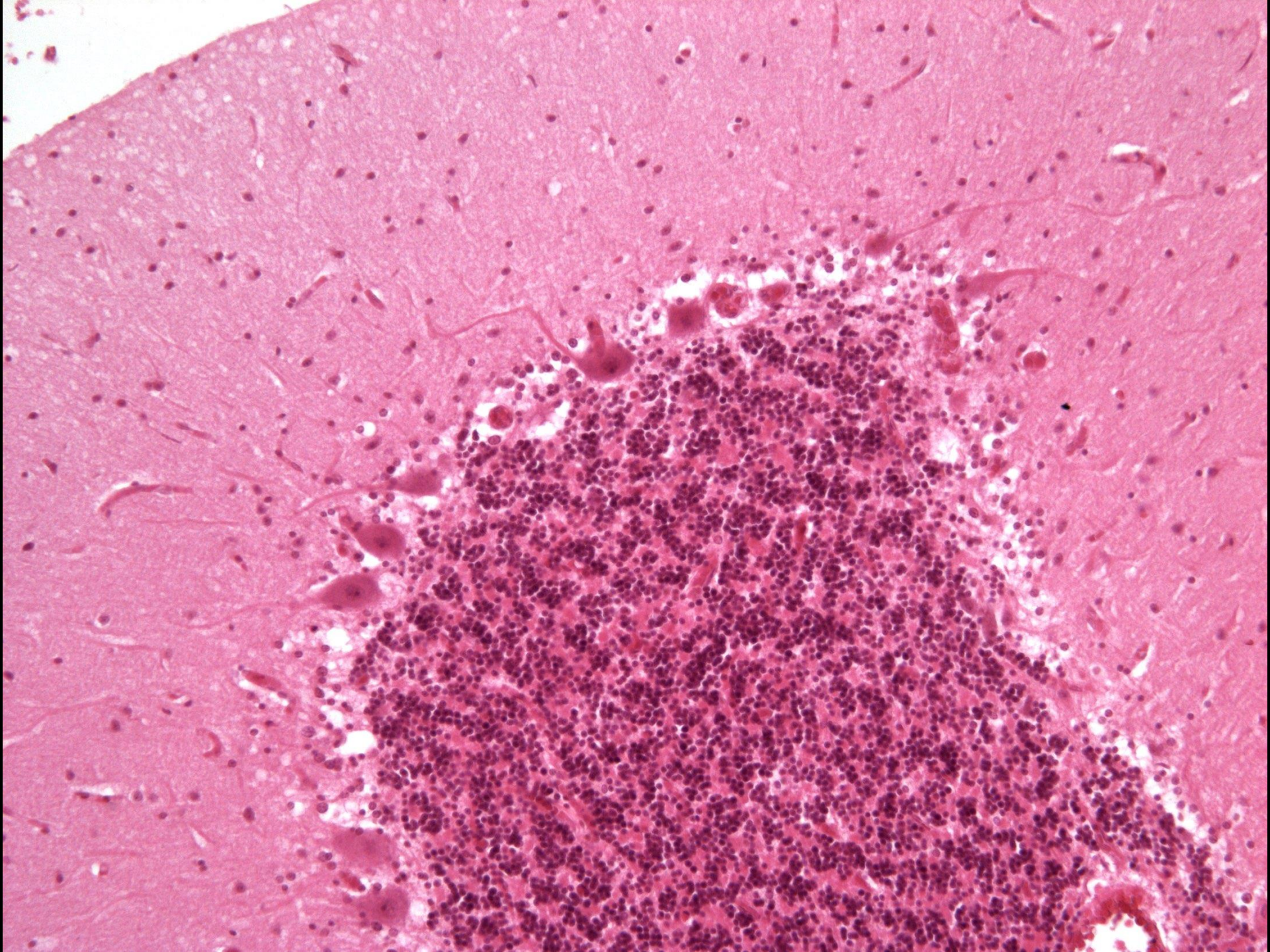
GL = stratum granulosum

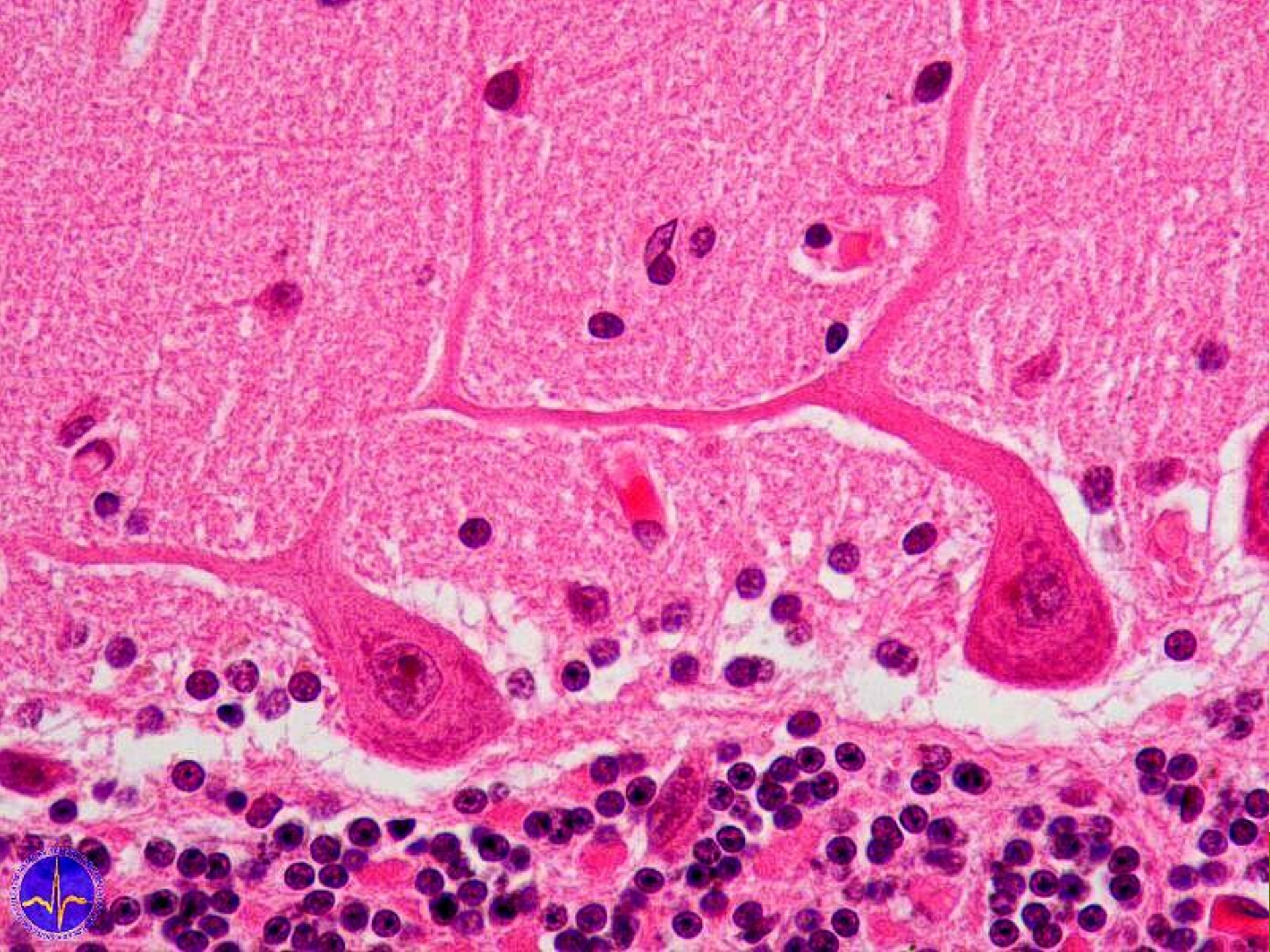
W = bílá hmota









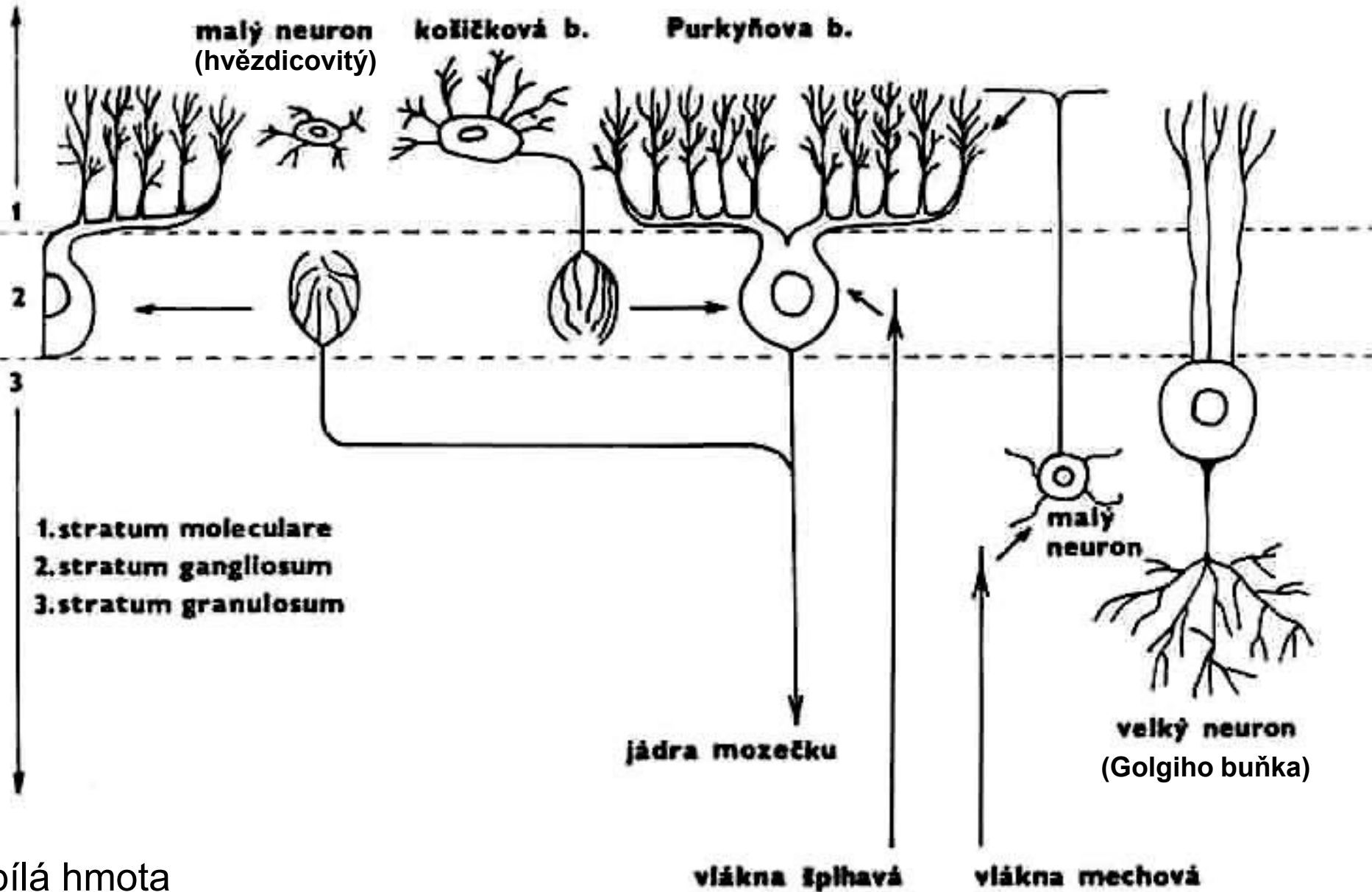


KŮRA MOZEČKU

malý neuron
(hvězdčovitý)

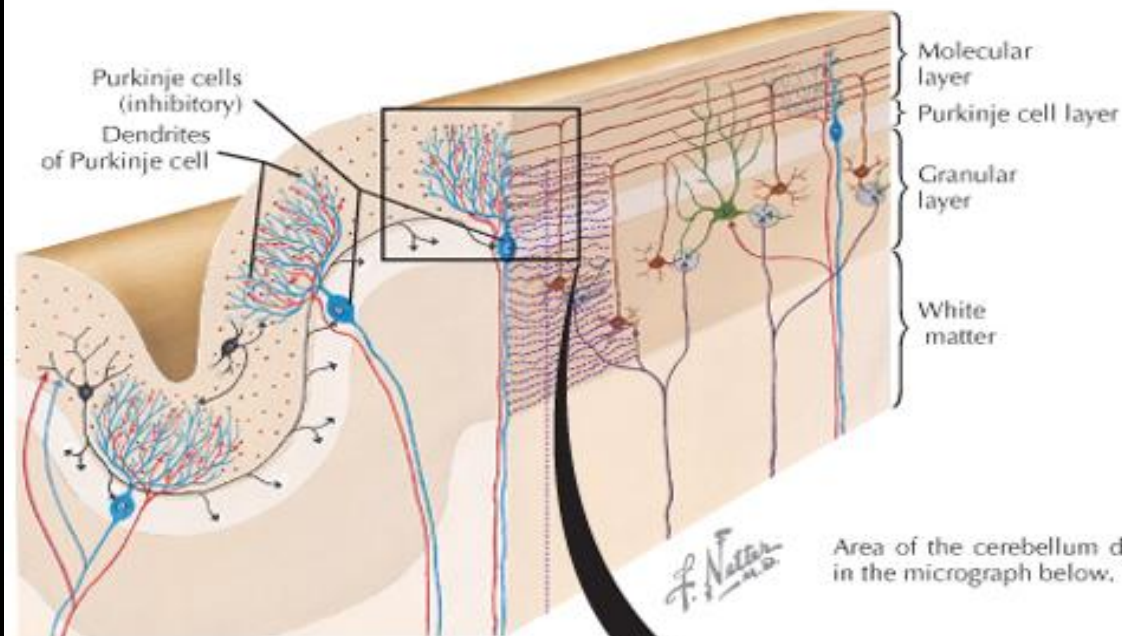
kožičková b.

Purkyňova b.



bílá hmota

► **Types of neurons in the cerebellar cortex.**



Area of the cerebellum delineated by the rectangle is seen in the micrograph below.



► **Immunocytochemical staining of Purkinje cells in the cerebellar cortex.** An antibody to parvalbumin selectively labels Purkinje cells, so that their cell bodies, basal axons, and elaborate apical fan-like dendritic tree are clear. 135 $\times$. Immunoperoxidase-diaminobenzidine. (Courtesy of Dr. K. G. Baimbridge)

MY CEREBELLUM



WHEN I WALK INTO A WALL

makeameme.org

Mozečkový glomerulus



Golgiho neuron



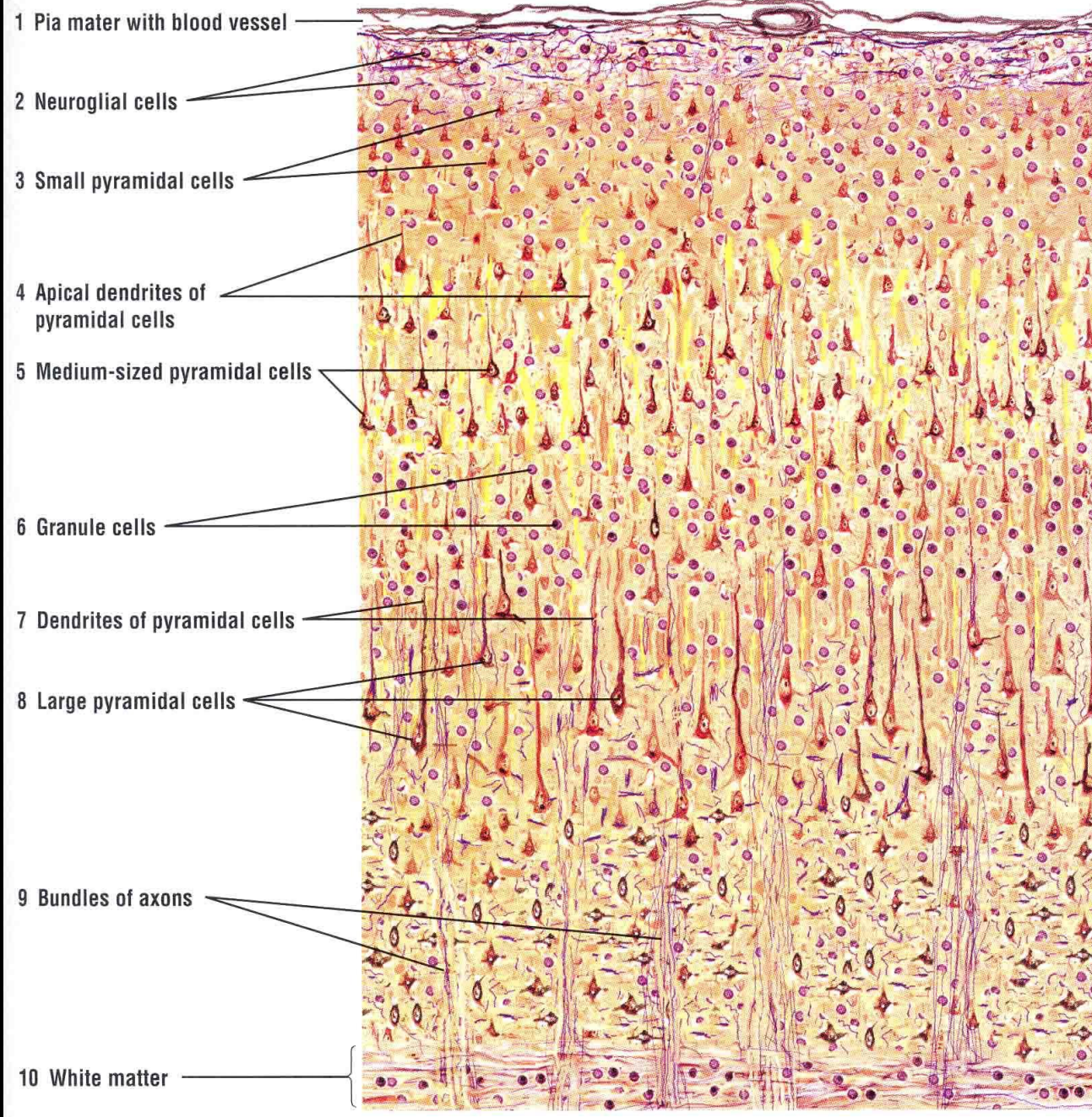
50 μ m



Koncový mozek (telencephalon)

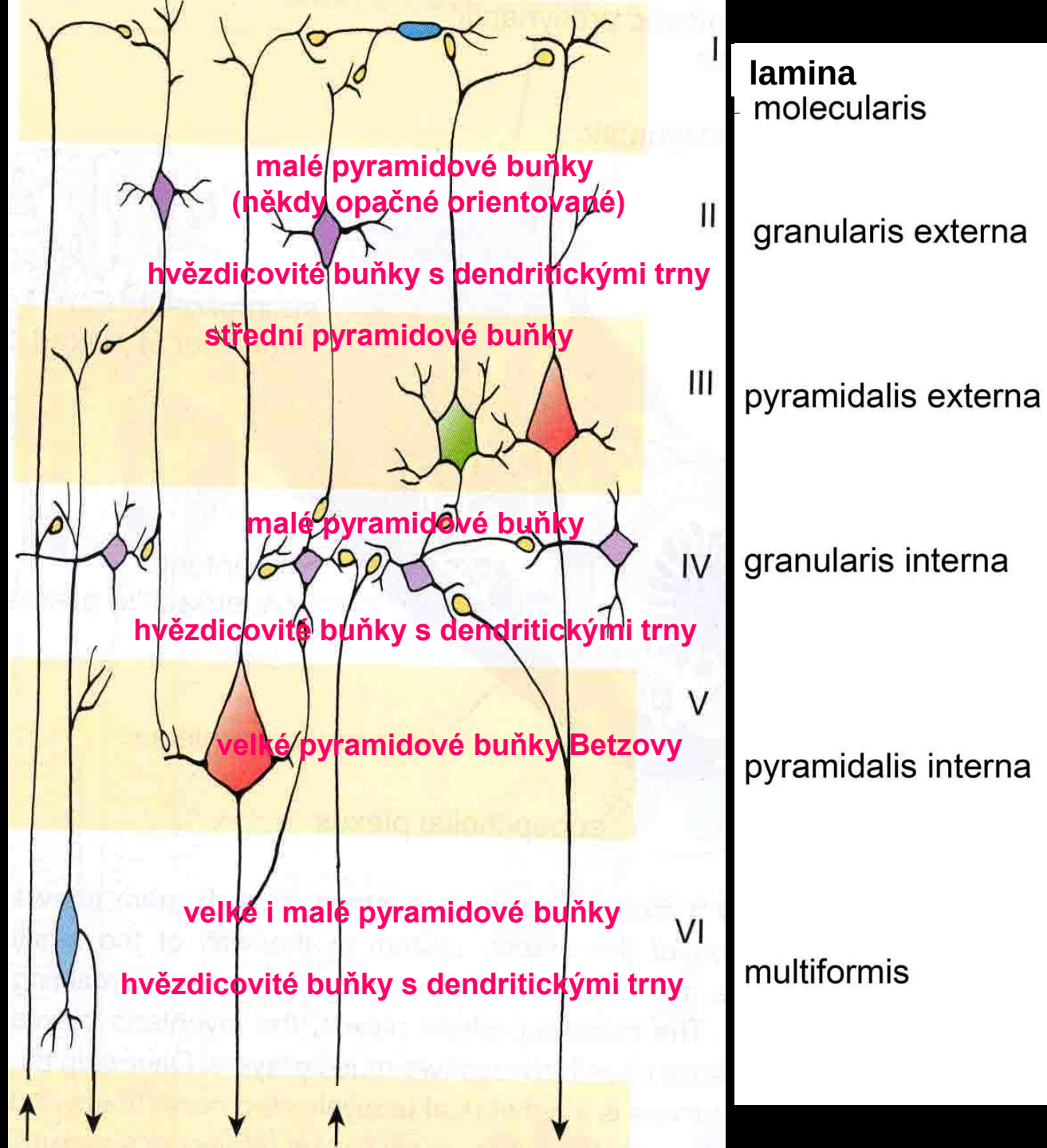


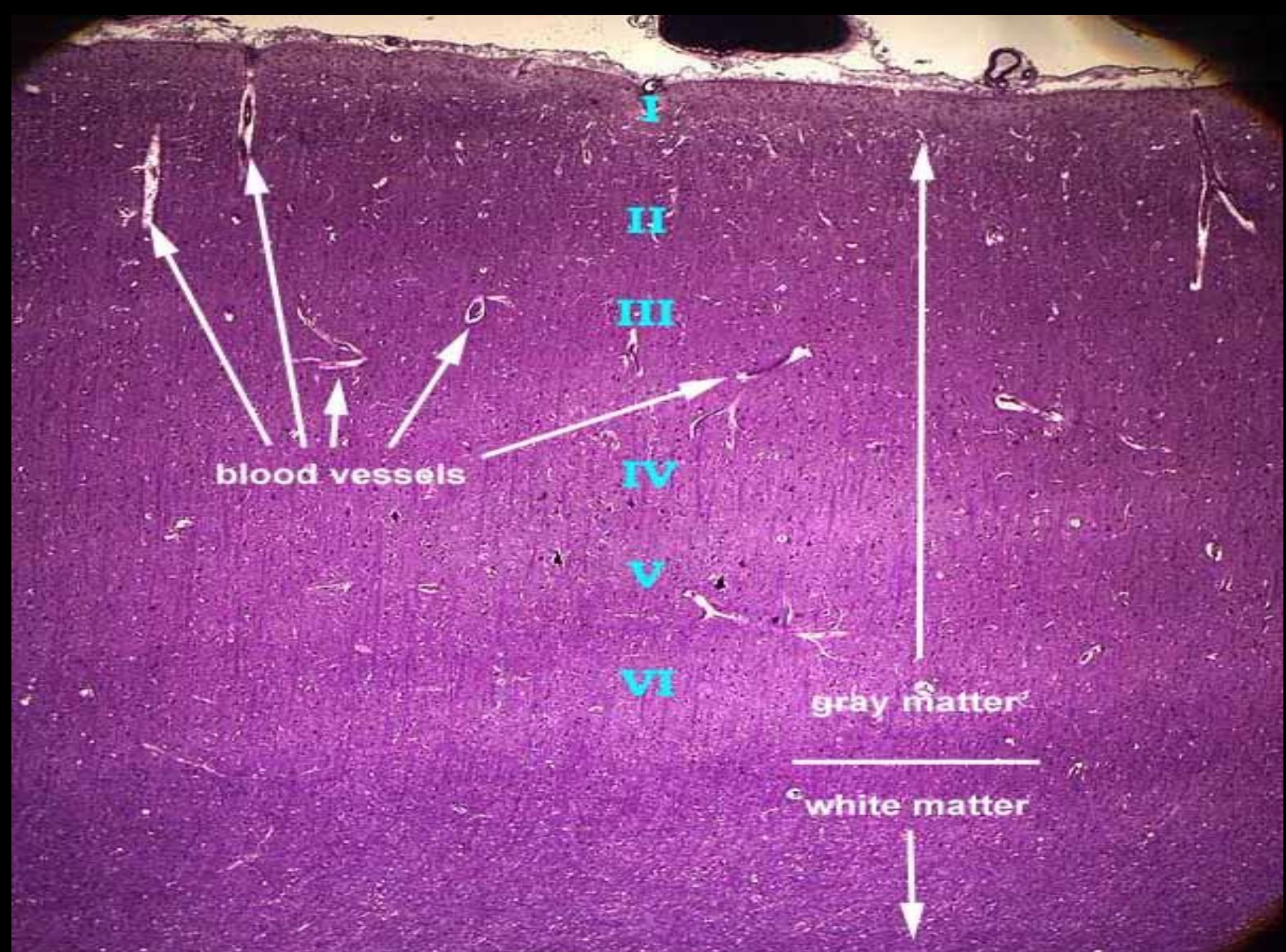




kůra
(šedá hmota)

bílá hmota





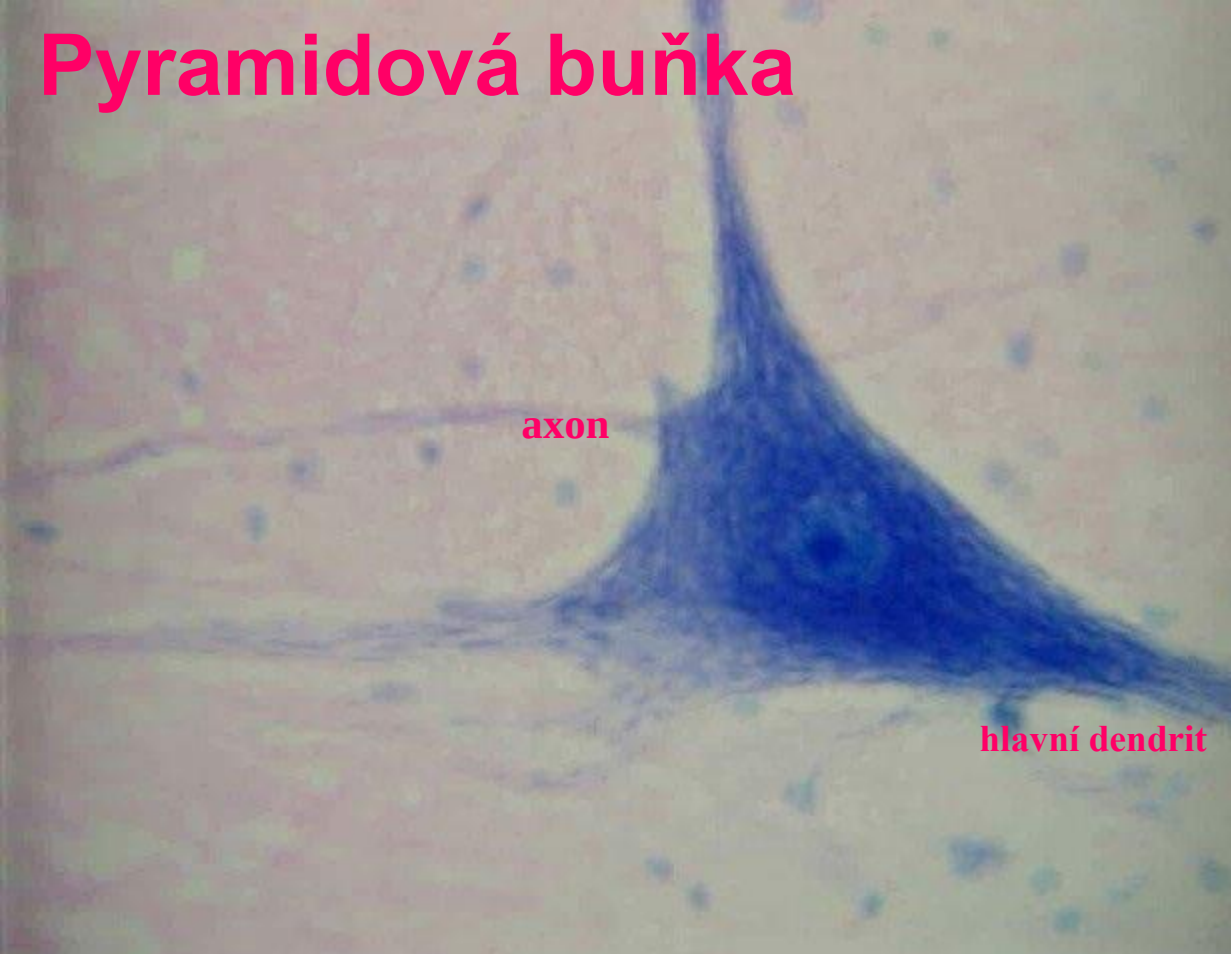
Neurony mozkové kůry

- **excitační** (60 – 70 %, dendrity s dendritickými trny, glutamát)
 - pyramidové (eferentní neurony)
 - hvězdicovité s dendritickými trny (interneurony)
- **inhibiční** (30 – 40 %, interneurony, hladké dendrity, GABA)
 - buňky se synaptickými kontakty na těle nebo proximálních dendritech (košíčkové)
 - hnízdové košíčkové
 - velké košíčkové
 - malé košíčkové
 - drápkaté
 - buňky se synaptickými kontakty na distálních dendritech
 - dvojité kyticové
 - bipolární
 - neurogliaformní
 - chomáčkové
 - Cajalovy-Retziusovy
 - Martinottiho
 - buňky se synaptickými kontakty na axonech (svícnové)

Your neurons when you start learning about neurons:

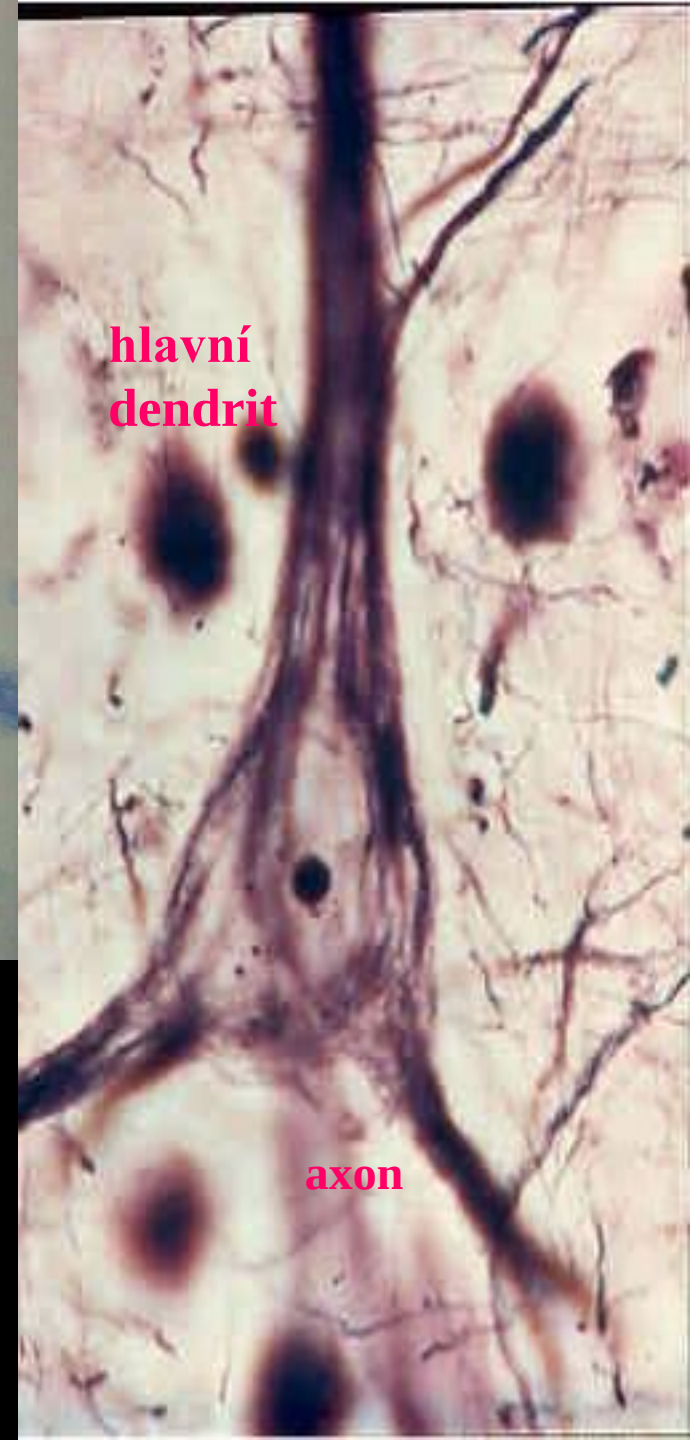


Pyramidová buňka

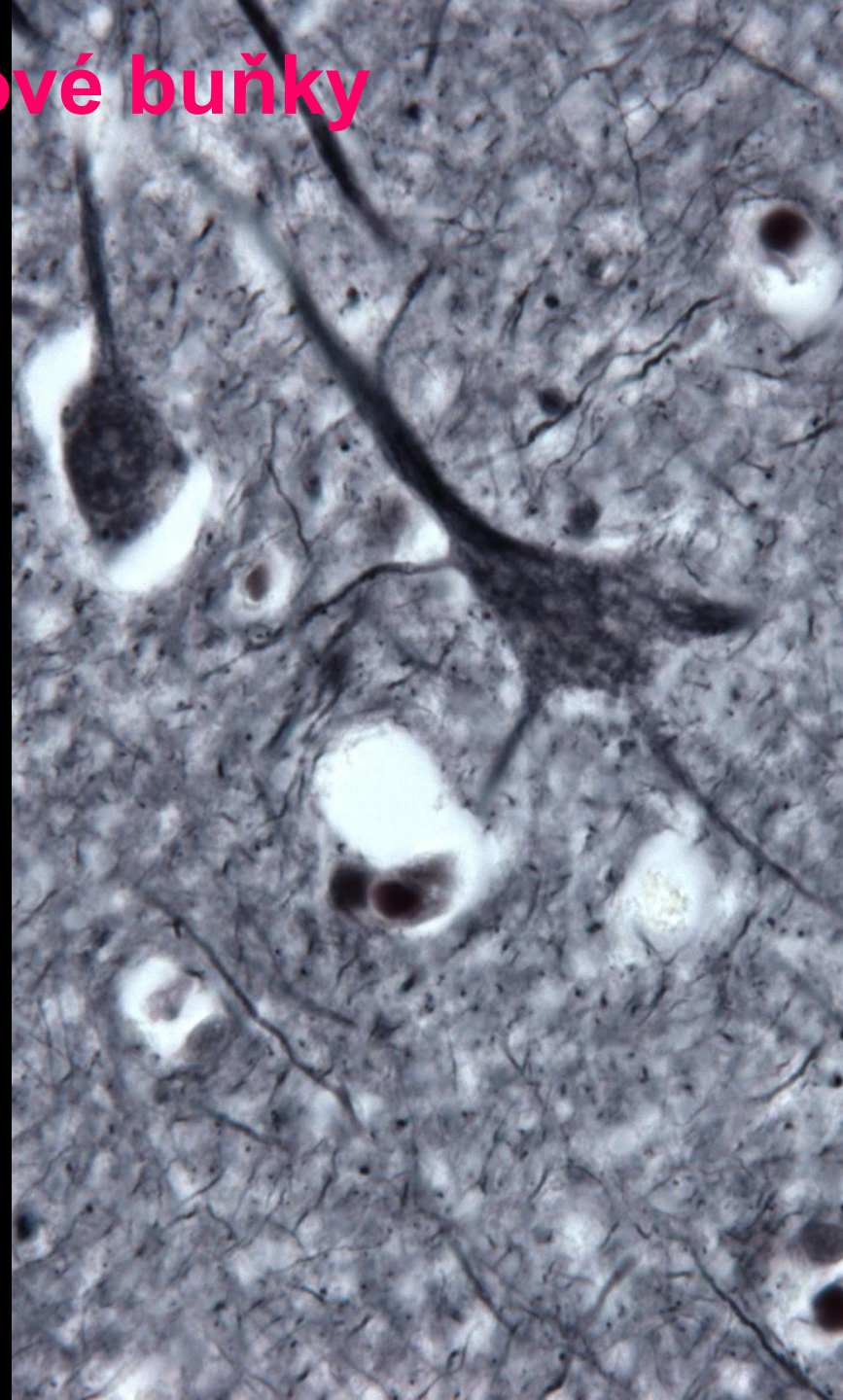
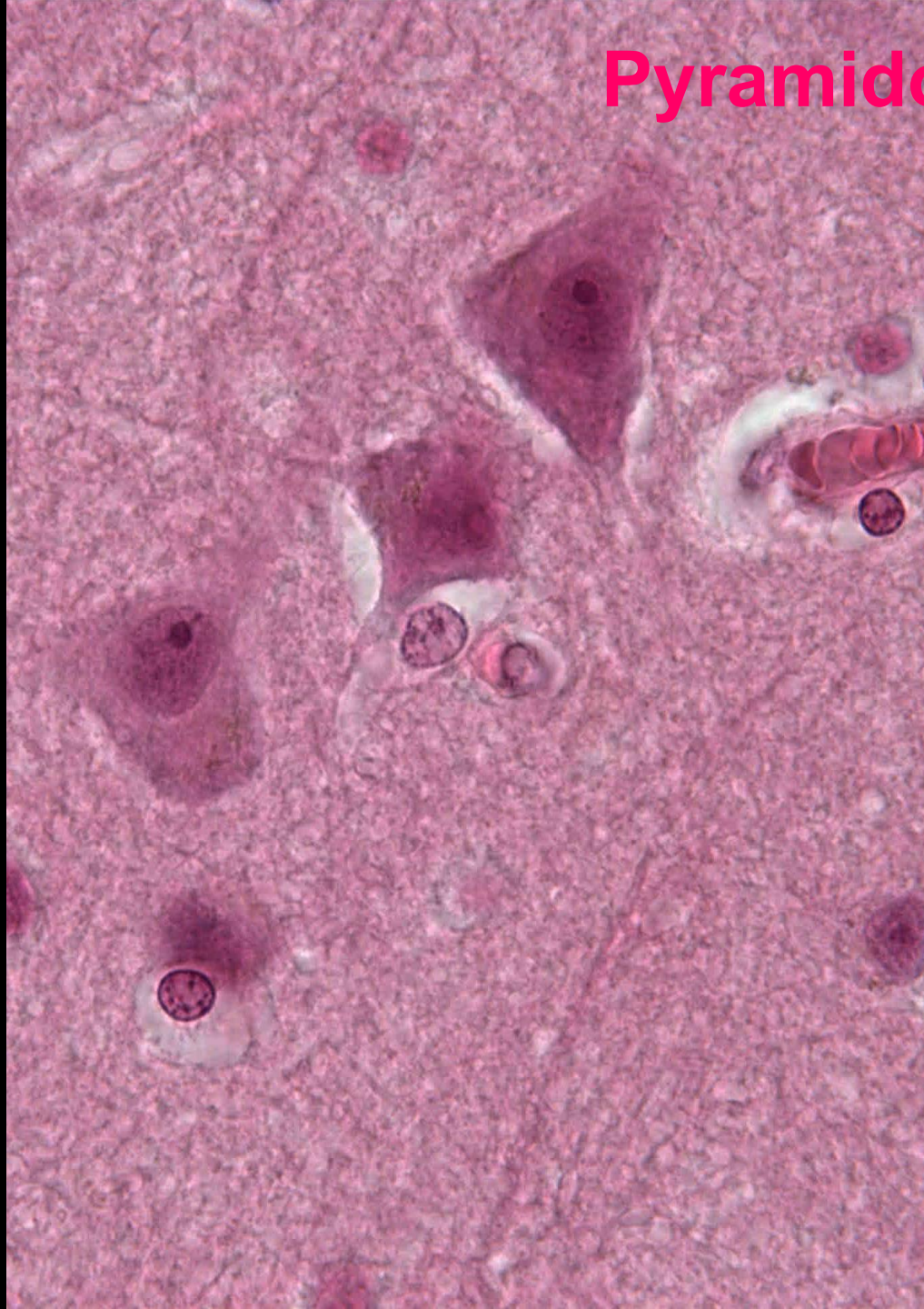


imunocytochemický průkaz intermediálních
filament, NF protein

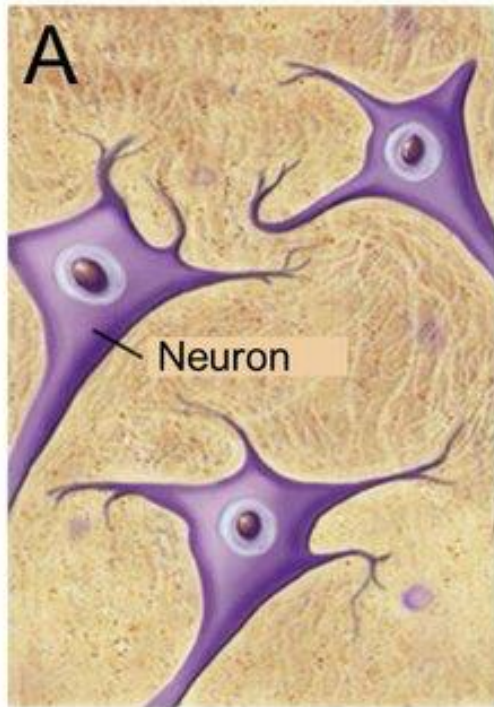
impregnace stříbrem



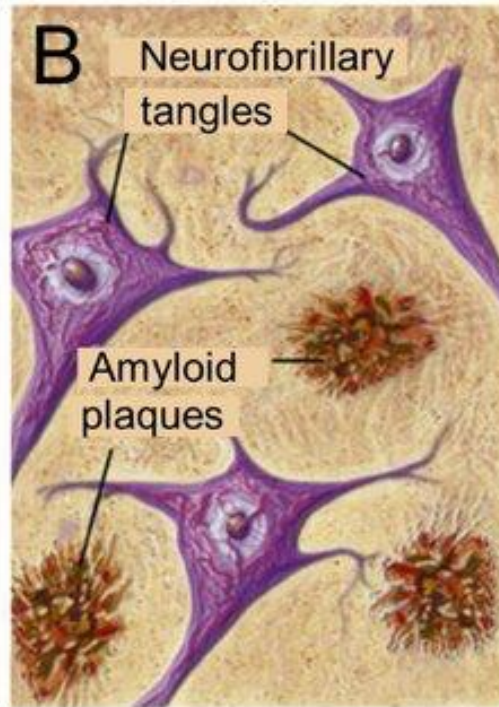
Pyramidové buňky



Normal

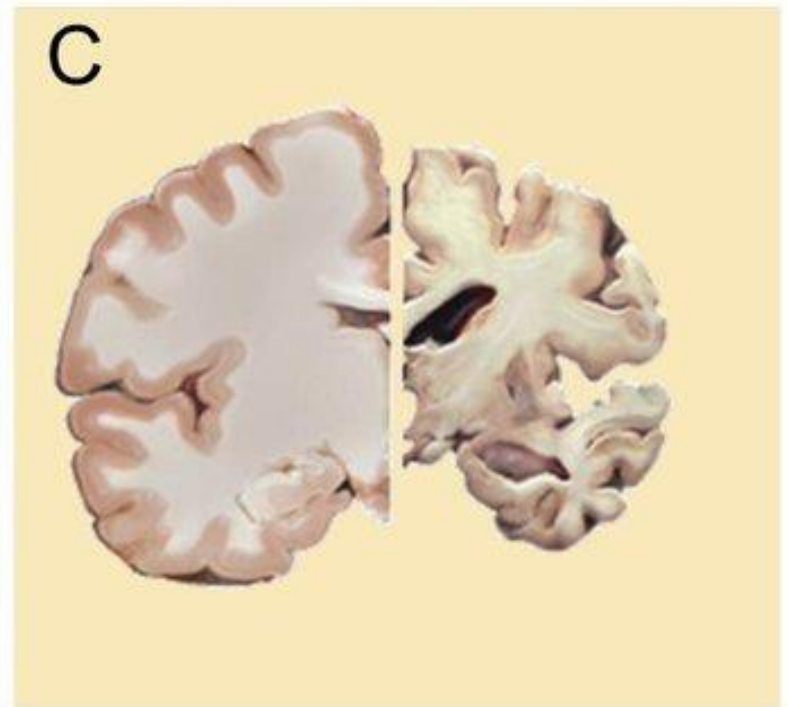


Alzheimer's disease

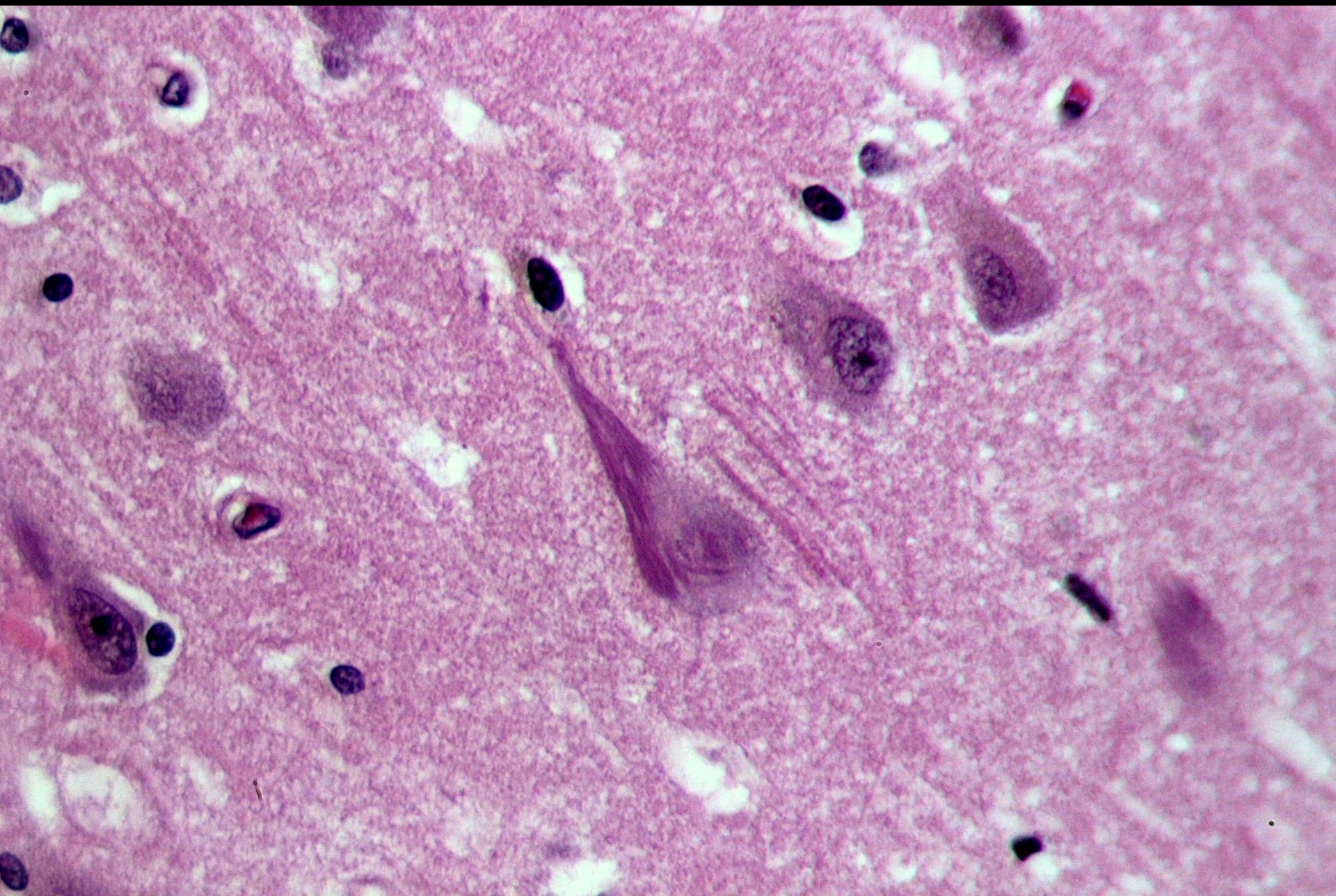


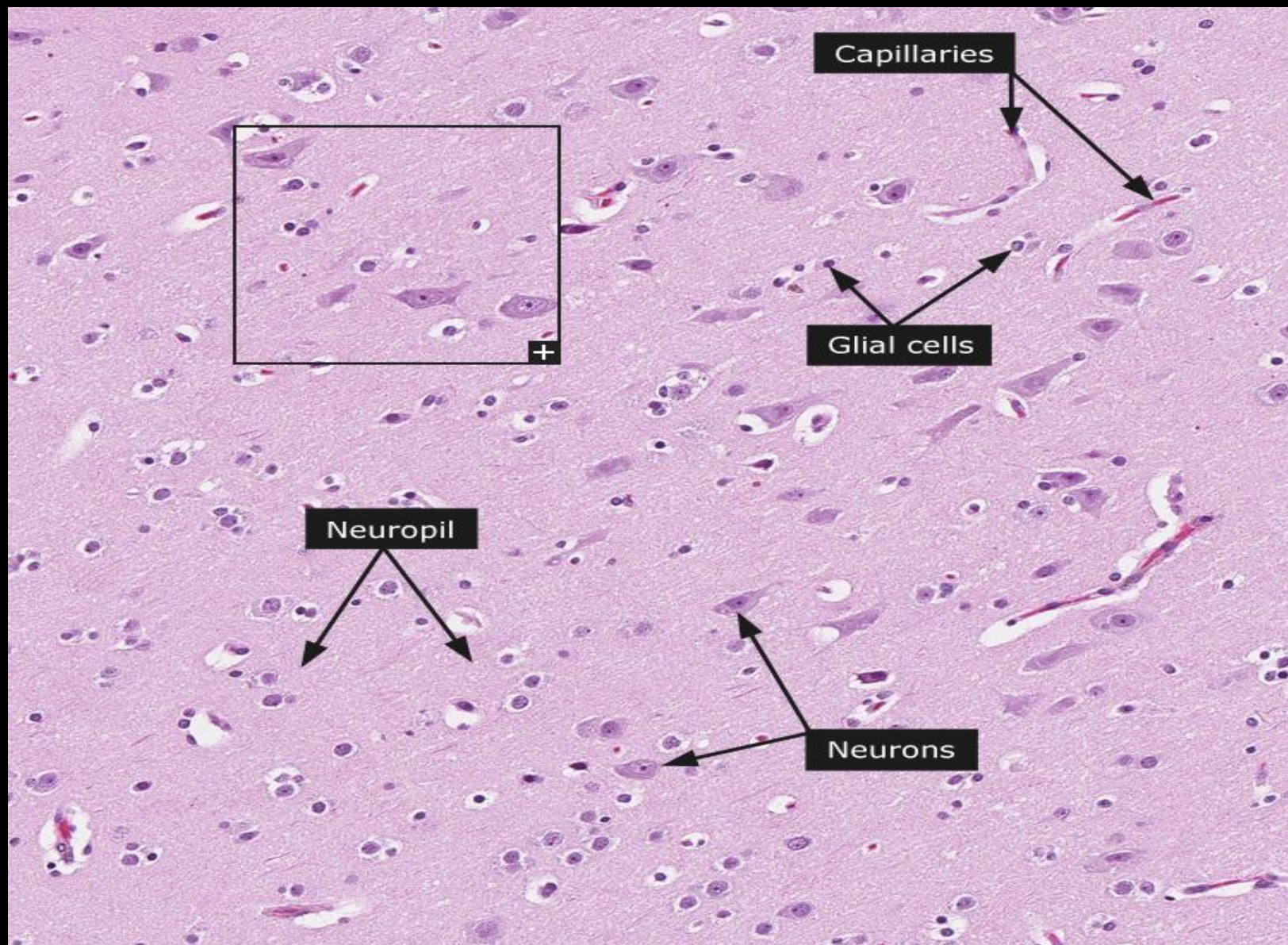
Healthy Brain

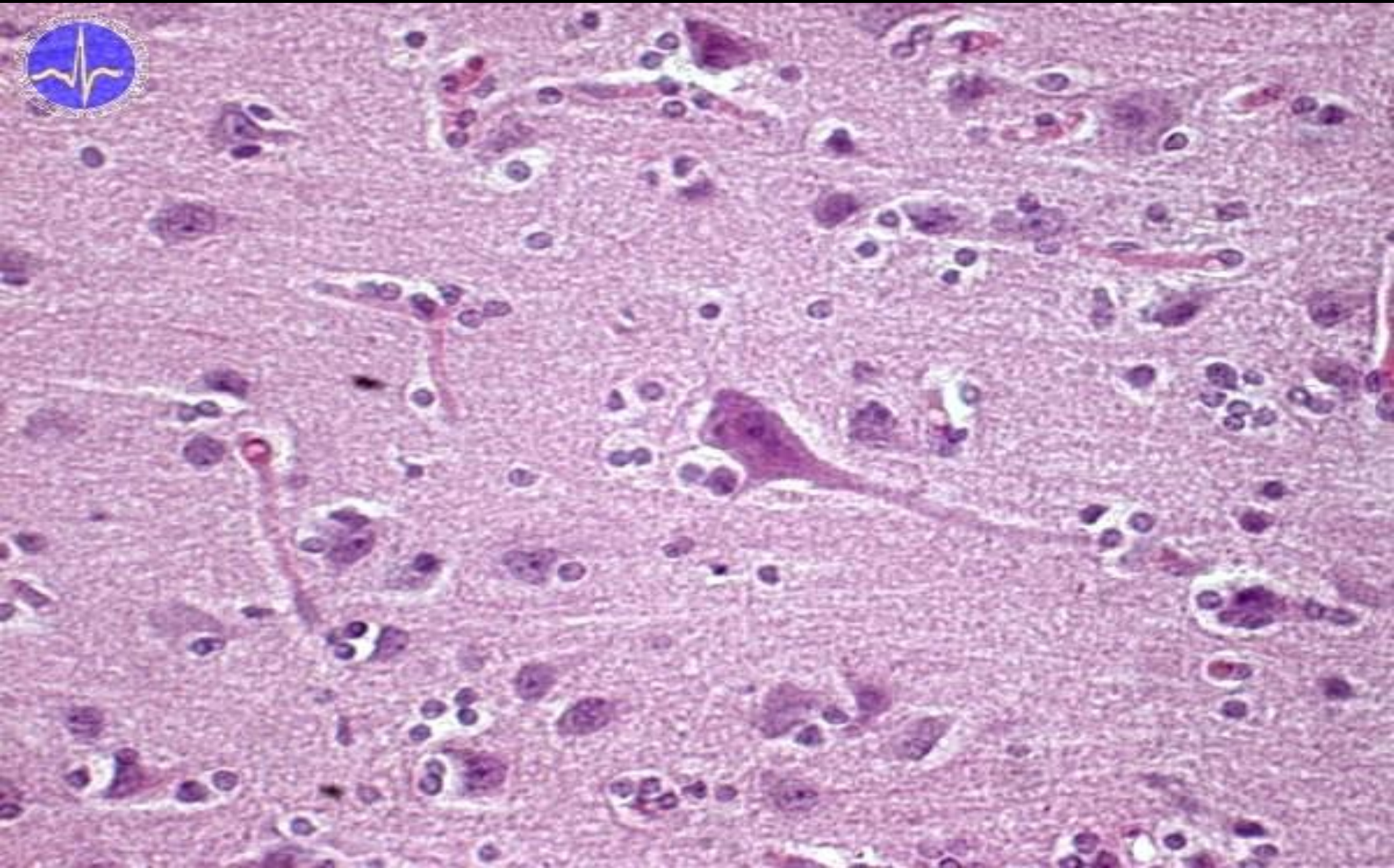
Severe Alzheimer's

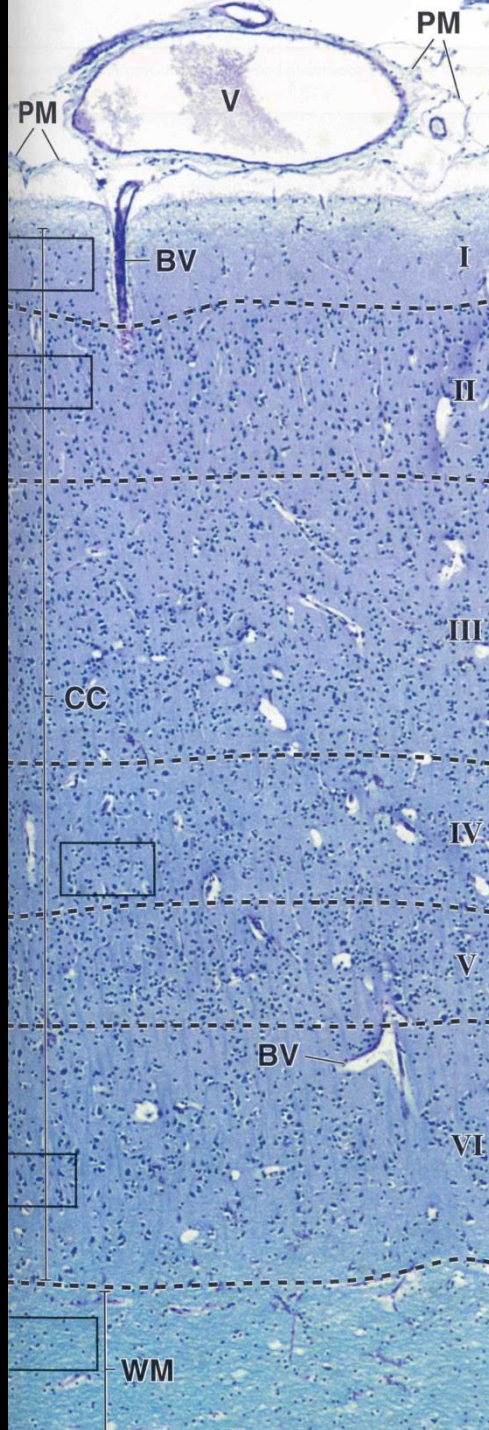


MAP tau









Výskyt inhibičních interneuronů v jednotlivých vrstvách:

Cajalovy-Retziusovy, heterogenní skupina malých interneuronů

košíčkové, dvojité kyticové, bipolární, chomáčkové, Martinottiho, svícnové

košíčkové, dvojité kyticové, bipolární, chomáčkové, svícnové

drápkaté košíčkové, dvojité kyticové, bipolární, chomáčkové, Martinottiho,

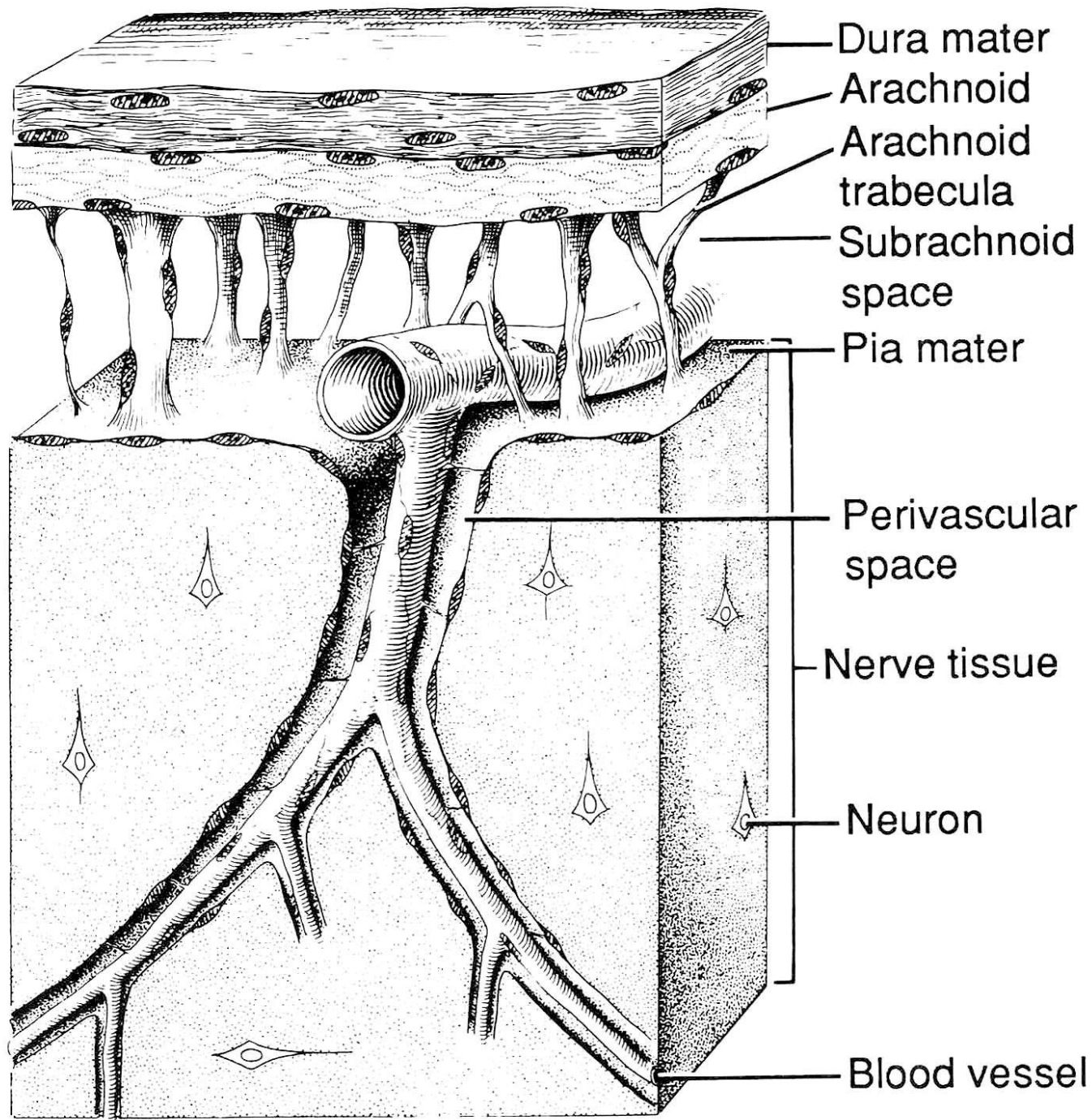
košíčkové, Martinottiho, dvojité kyticové, svícnové

košíčkové, bipolární, chomáčkové, Martinottiho

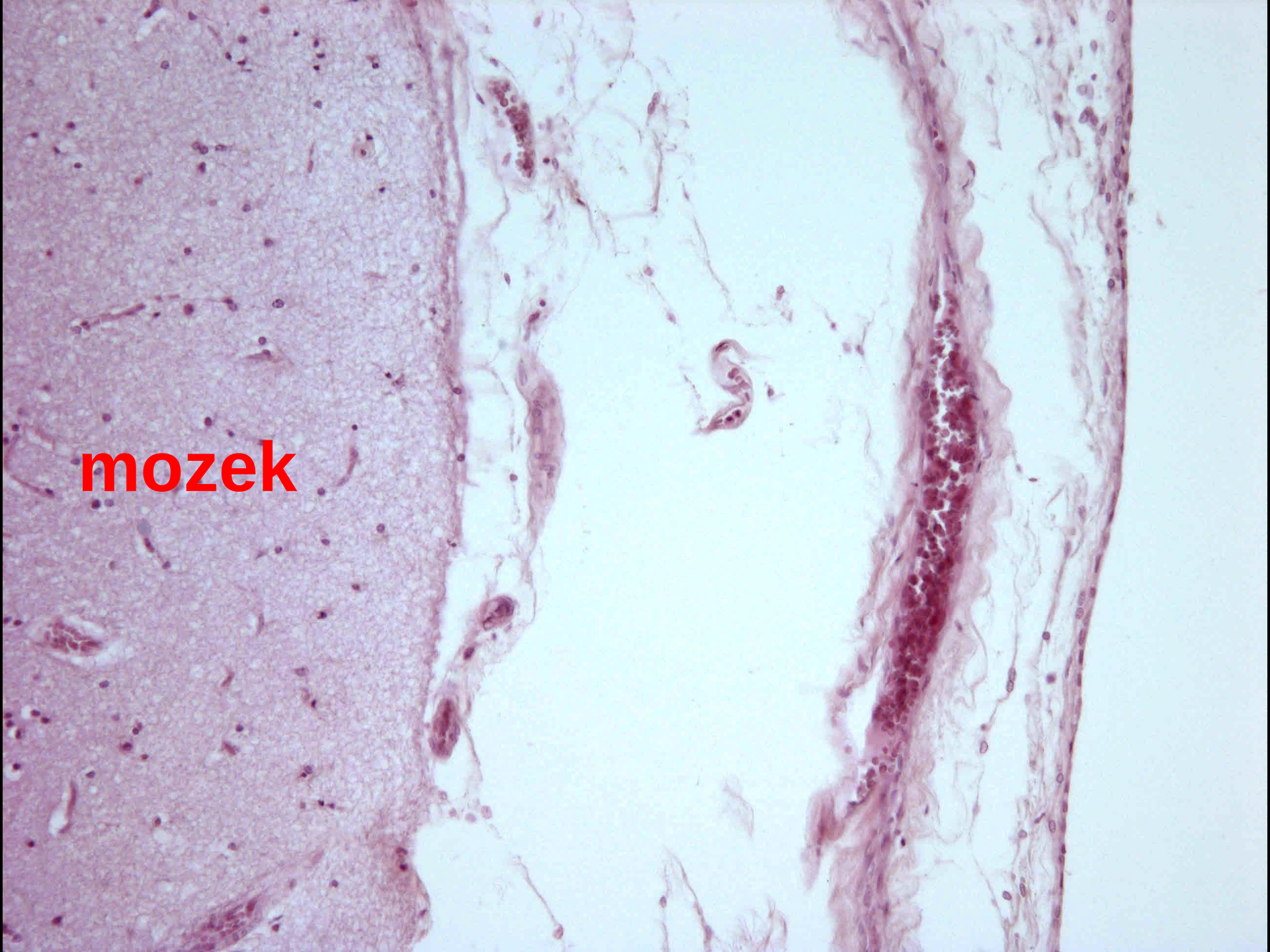
Mozková komora



Meningy (mozkomíšní obaly, pleny)



mozek



mícha

50 μm

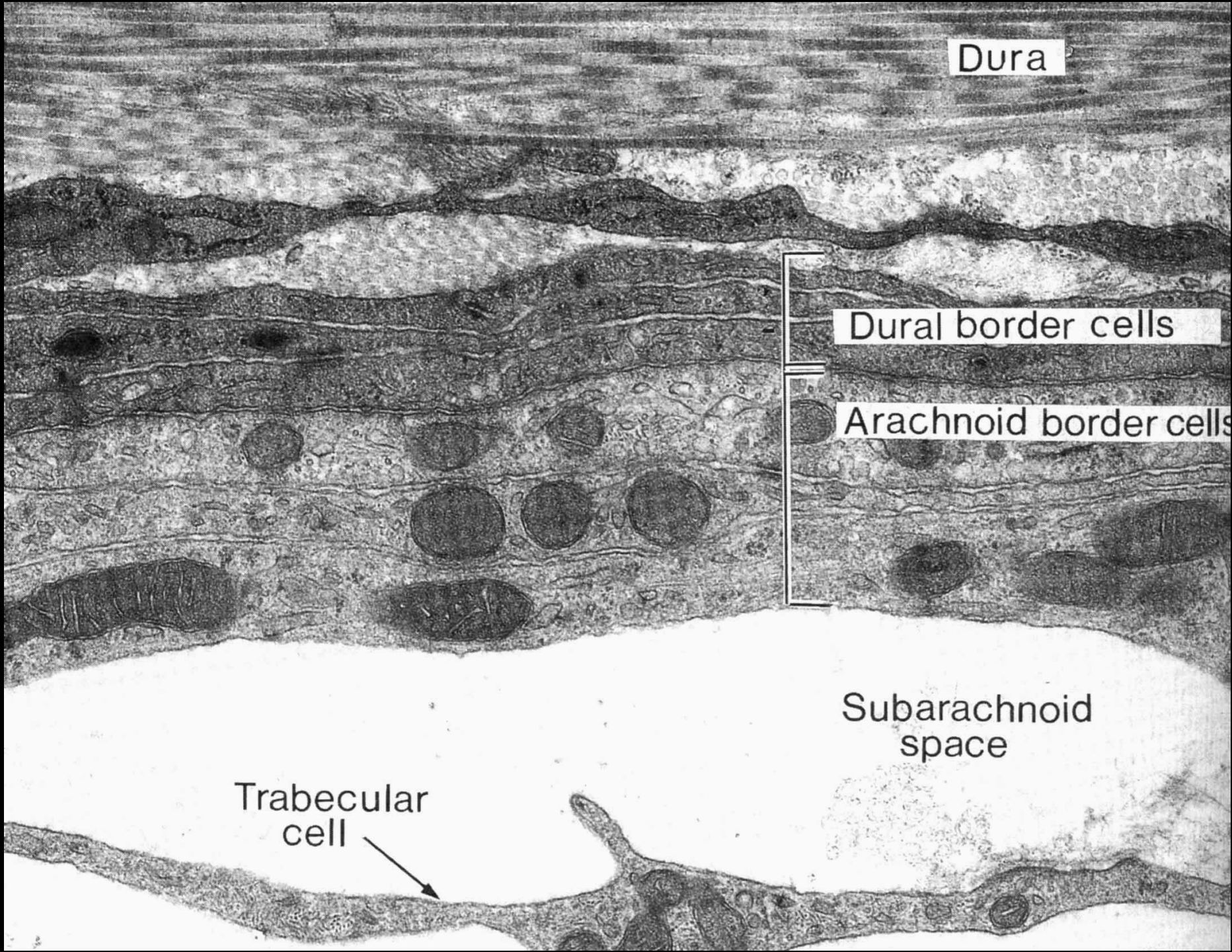
Dura

Dural border cells

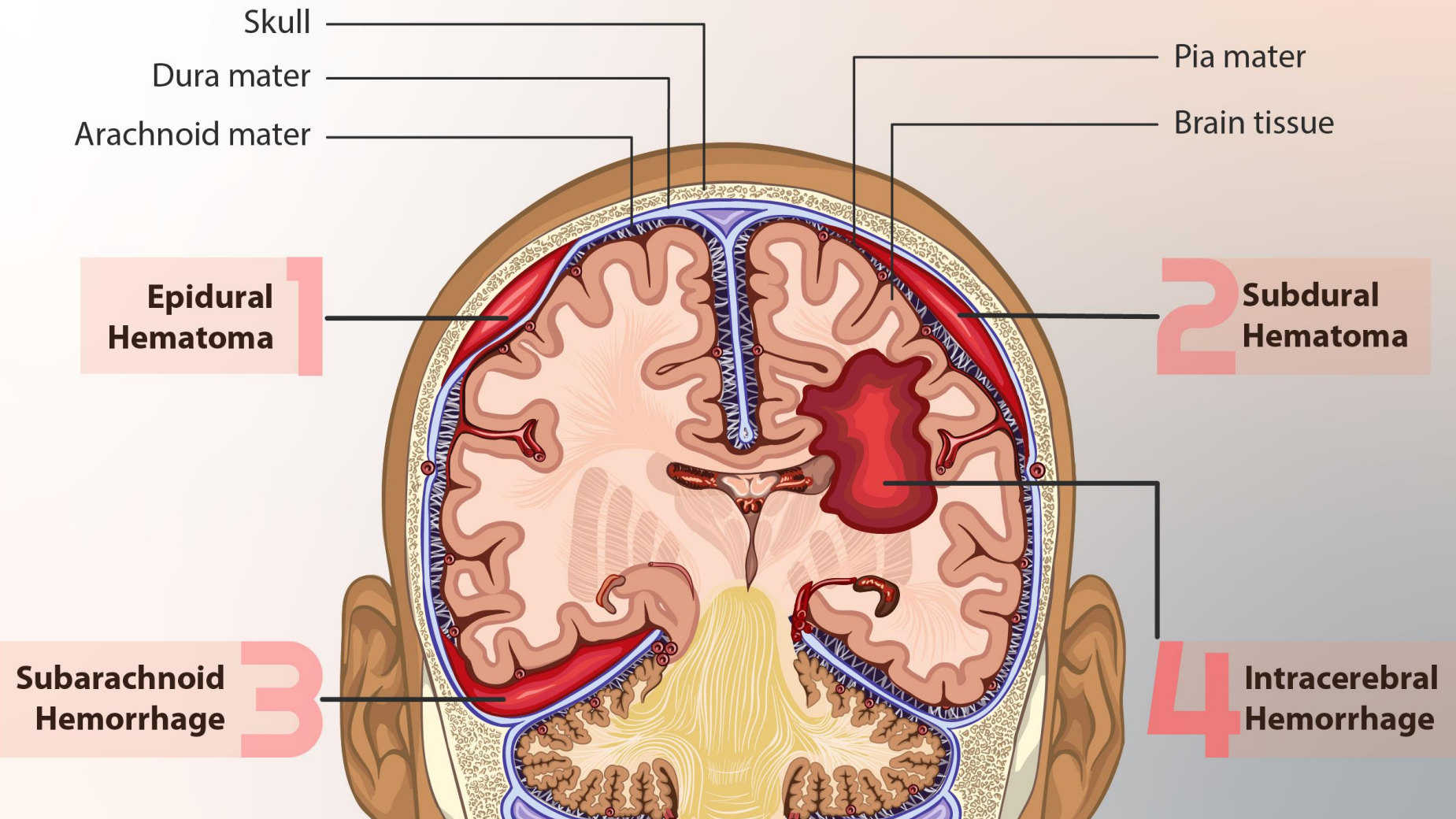
Arachnoid border cells

Subarachnoid
space

Trabecular
cell

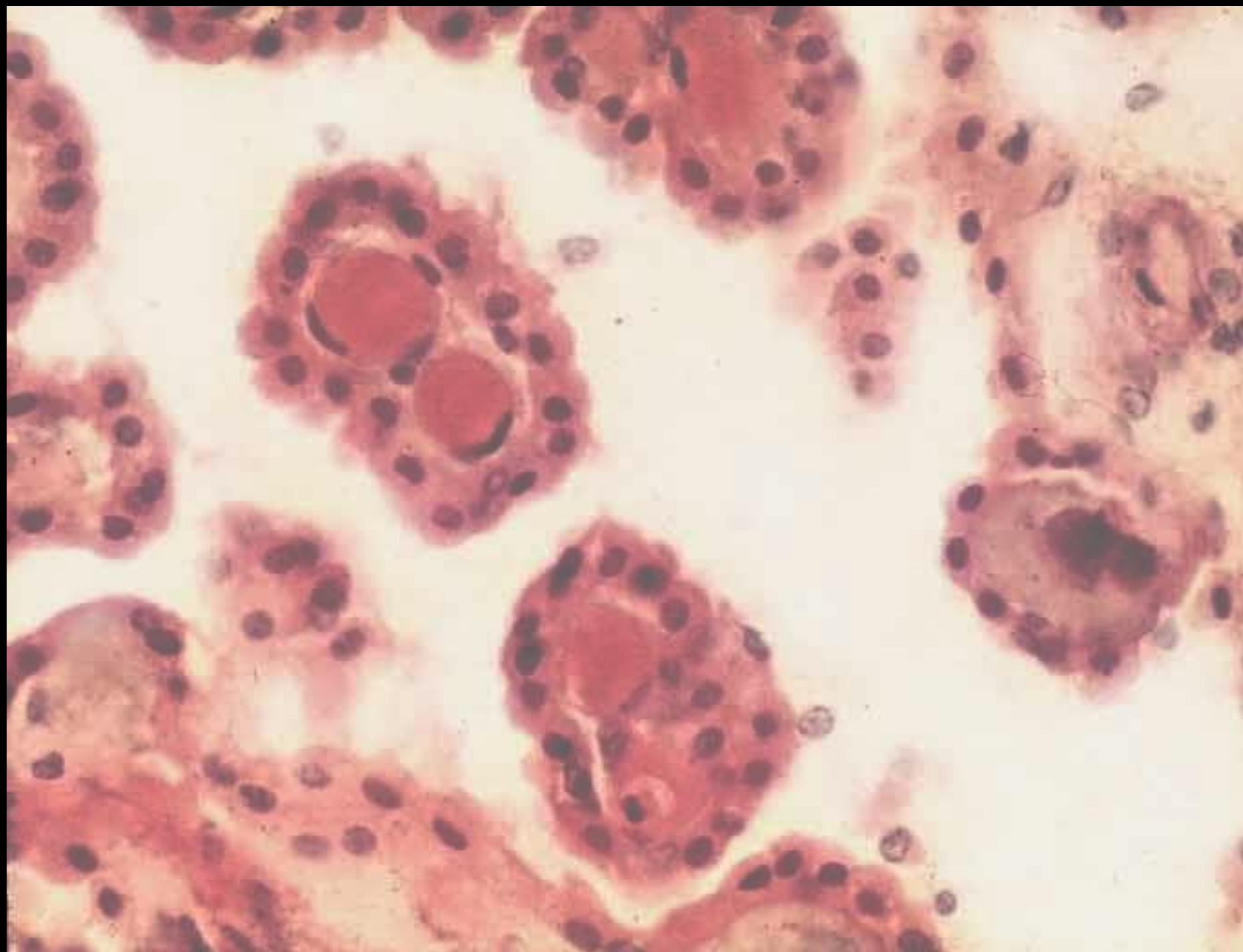


Types of brain hemorrhage

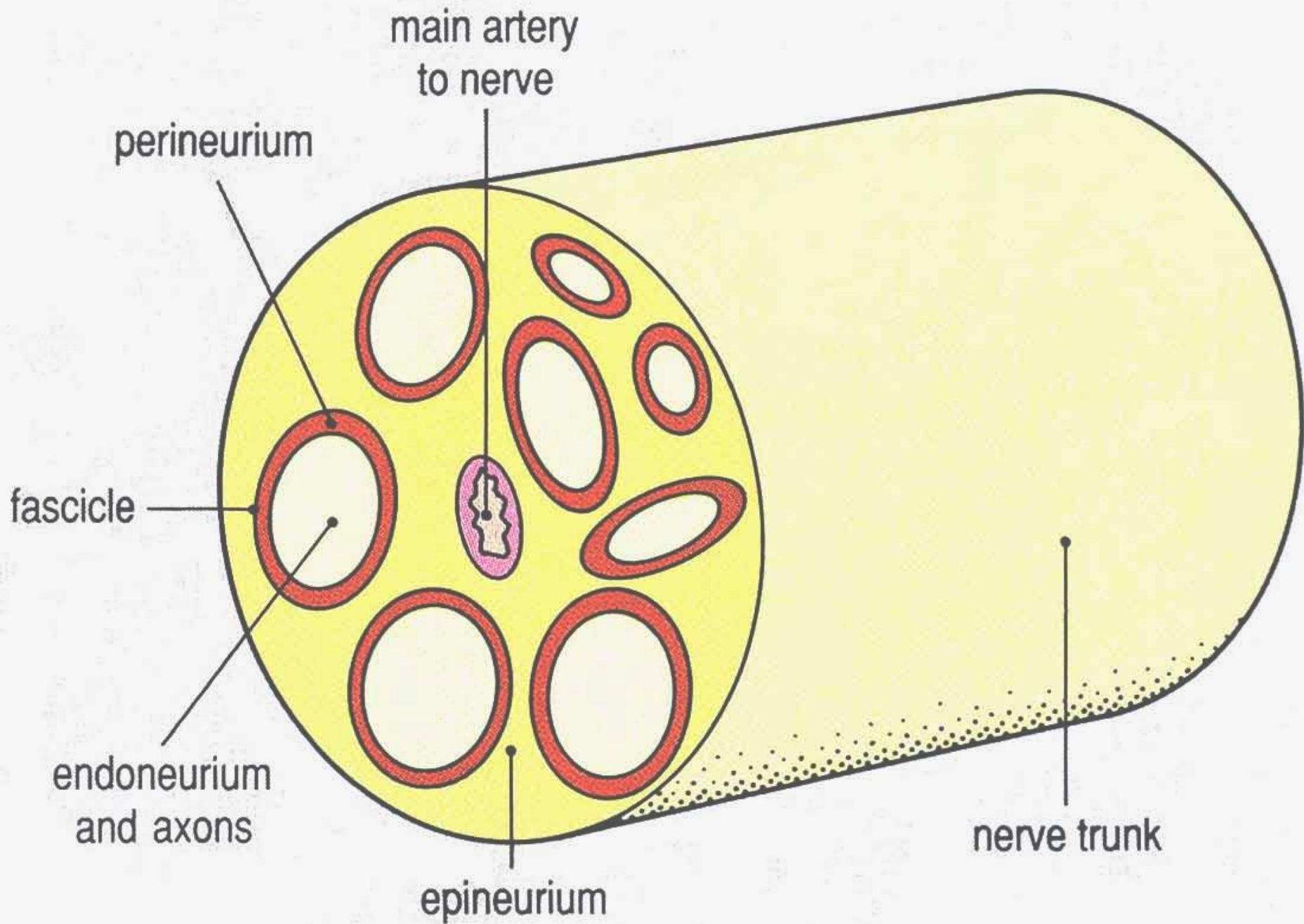


Plexus choroideus

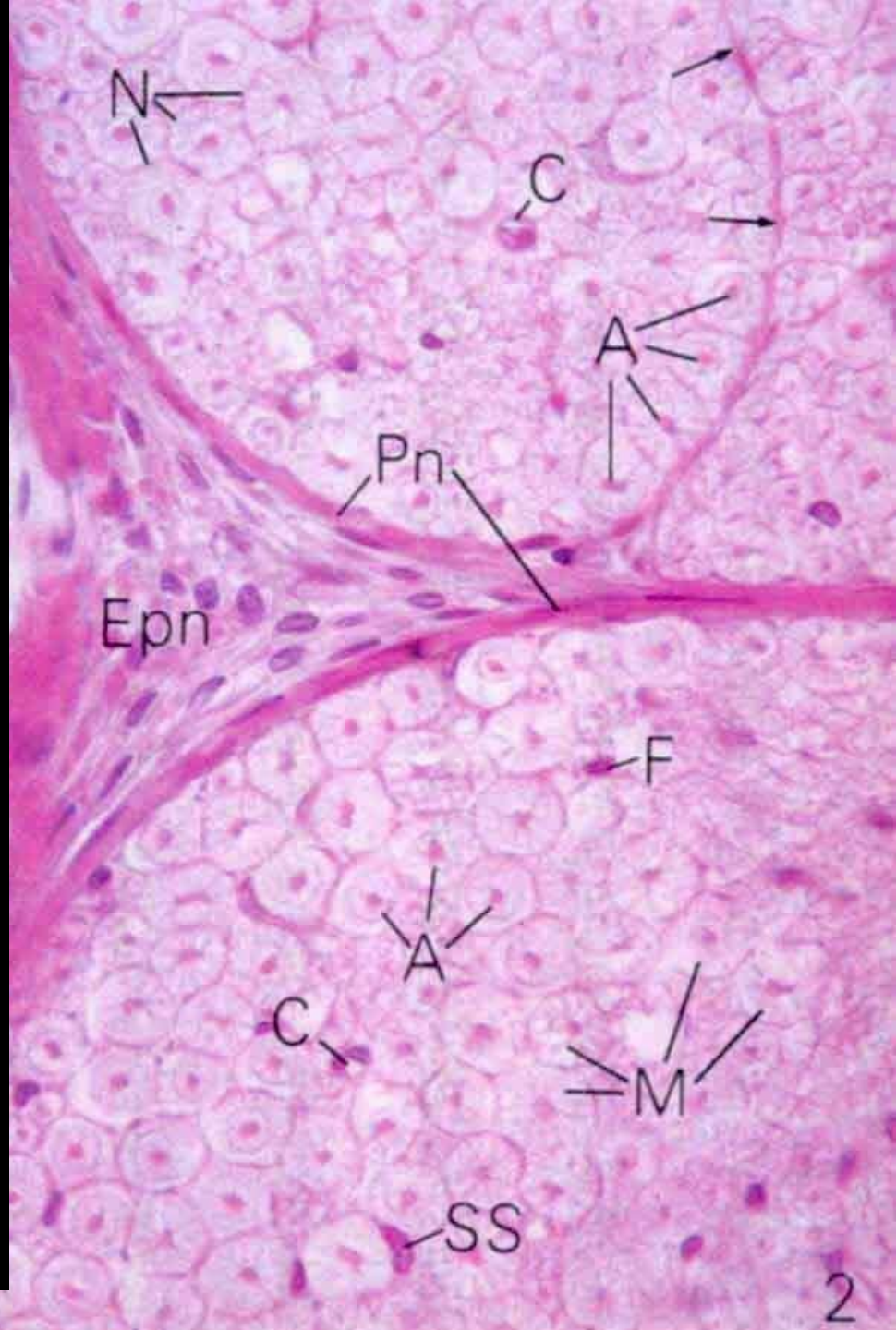
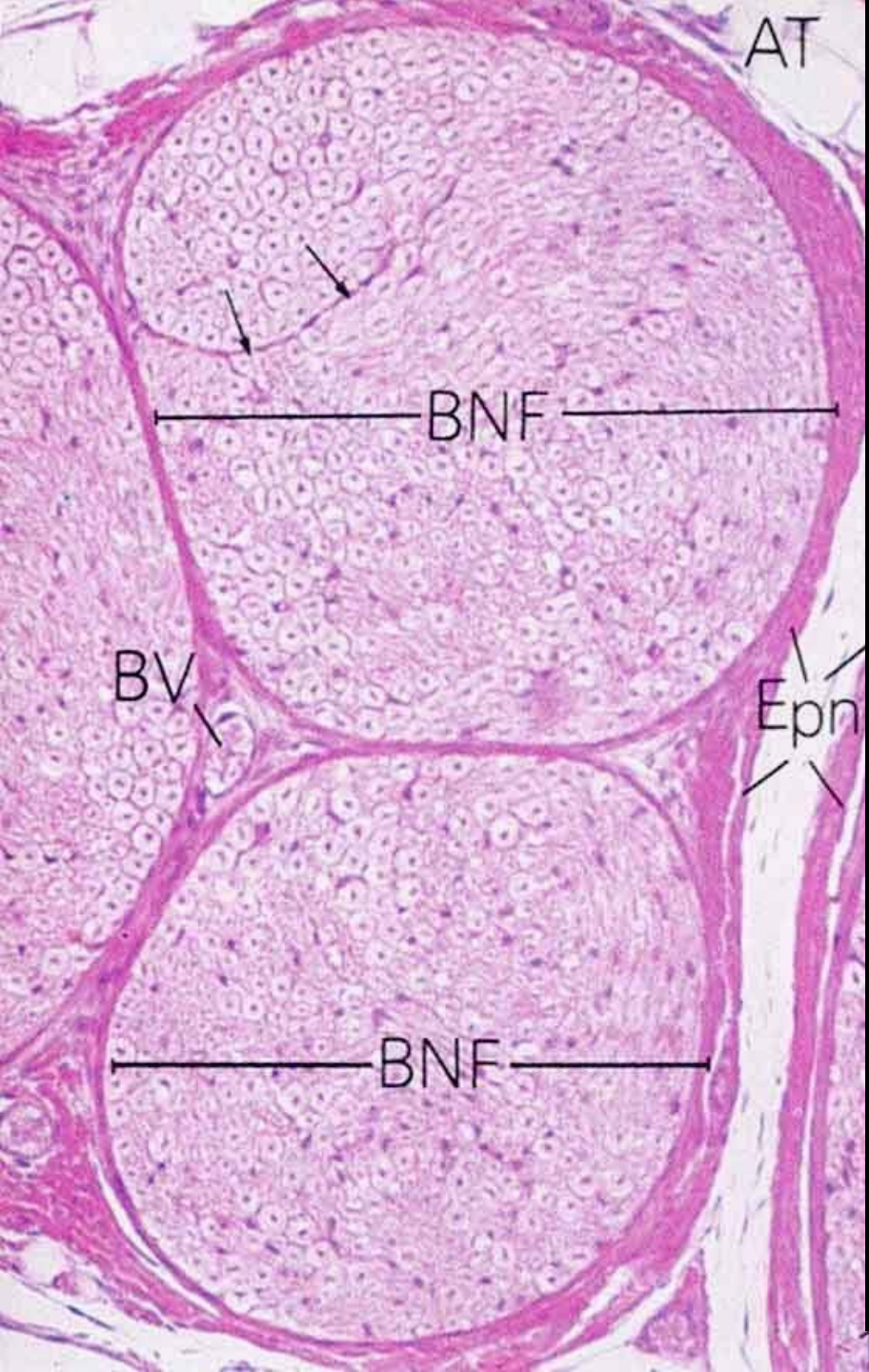




Periferní nervy





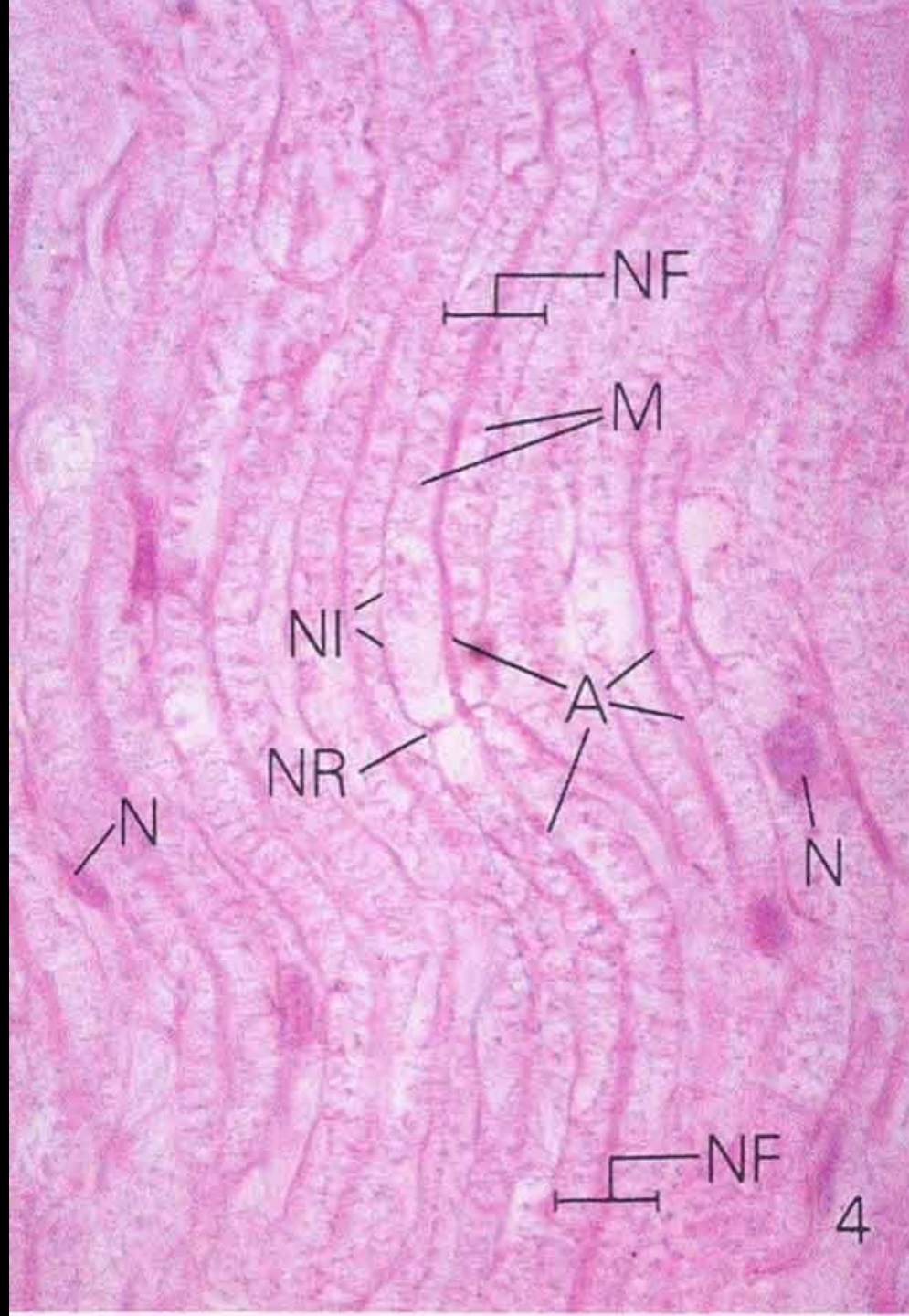




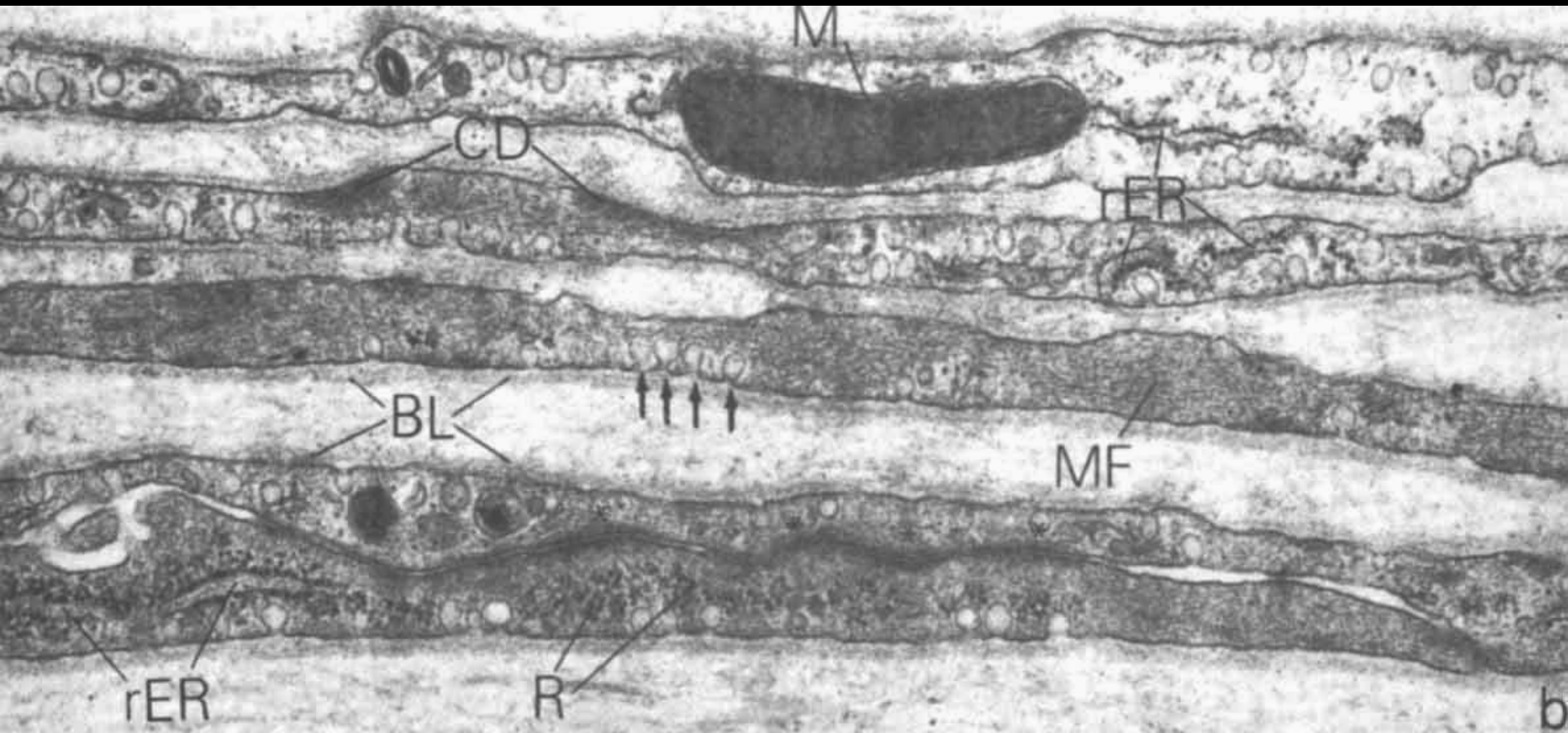
S = Schwannovy buňky

F = fibroblasty



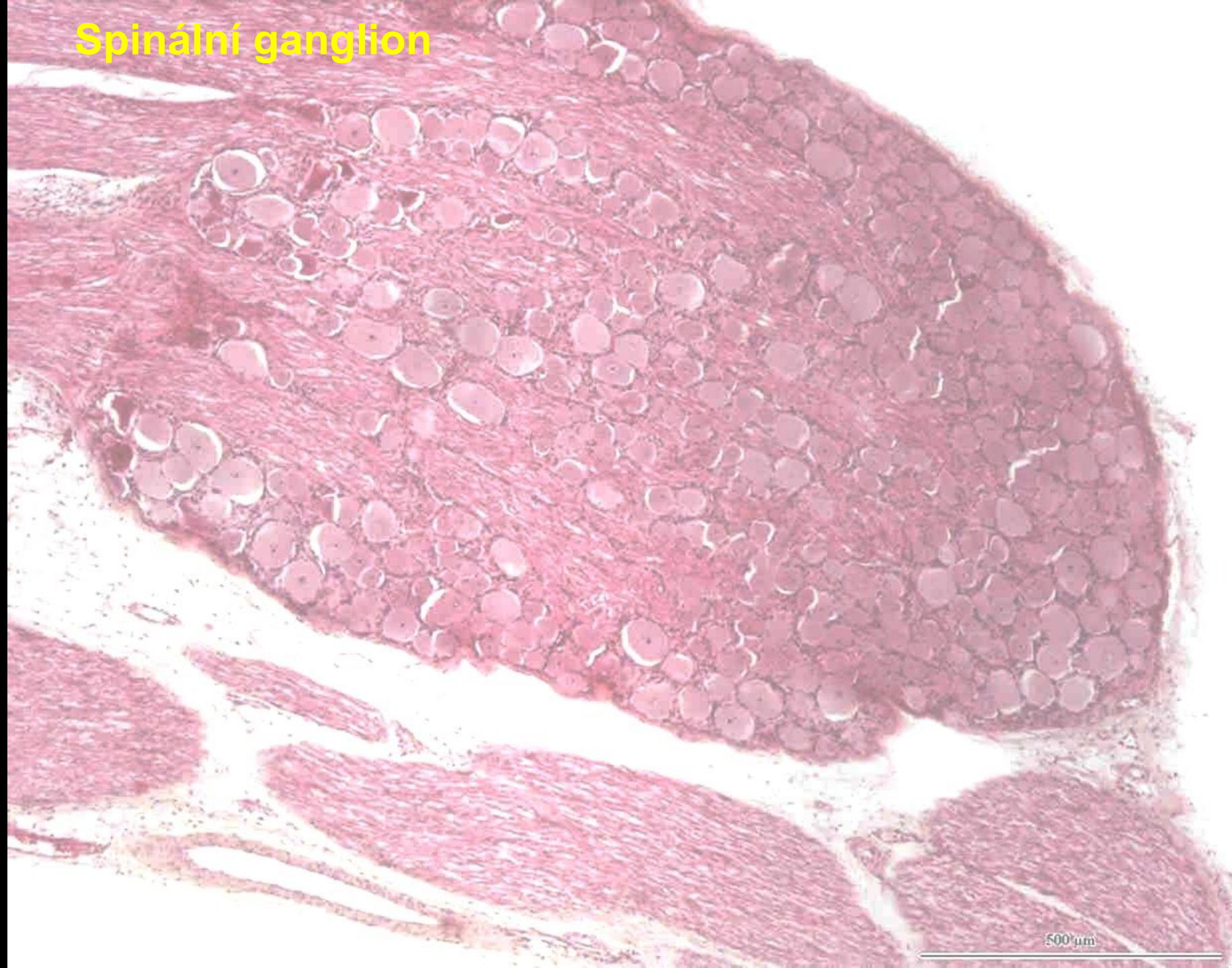


Perineurium



Ganglia

Spinální ganglion



500 μm

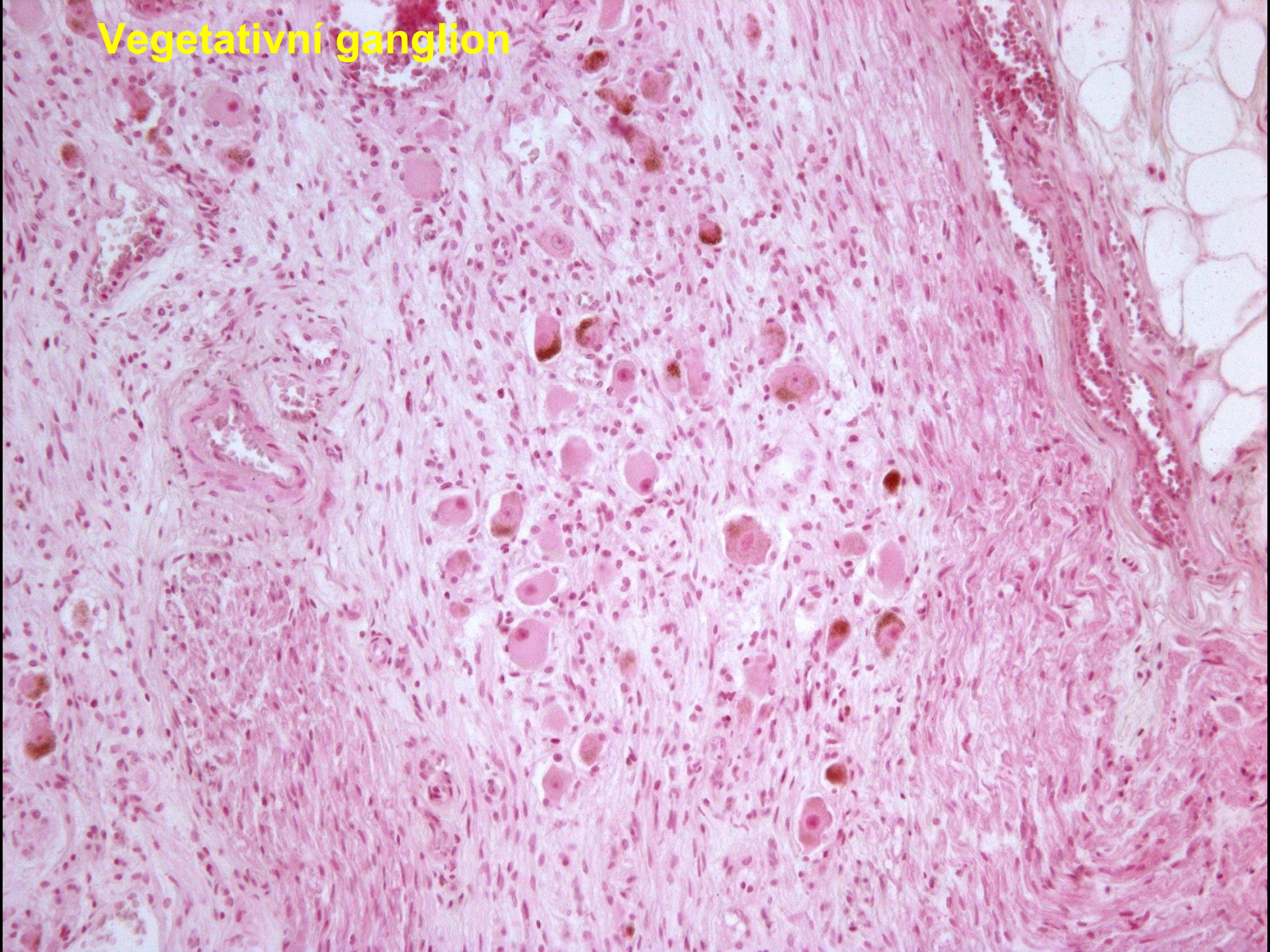


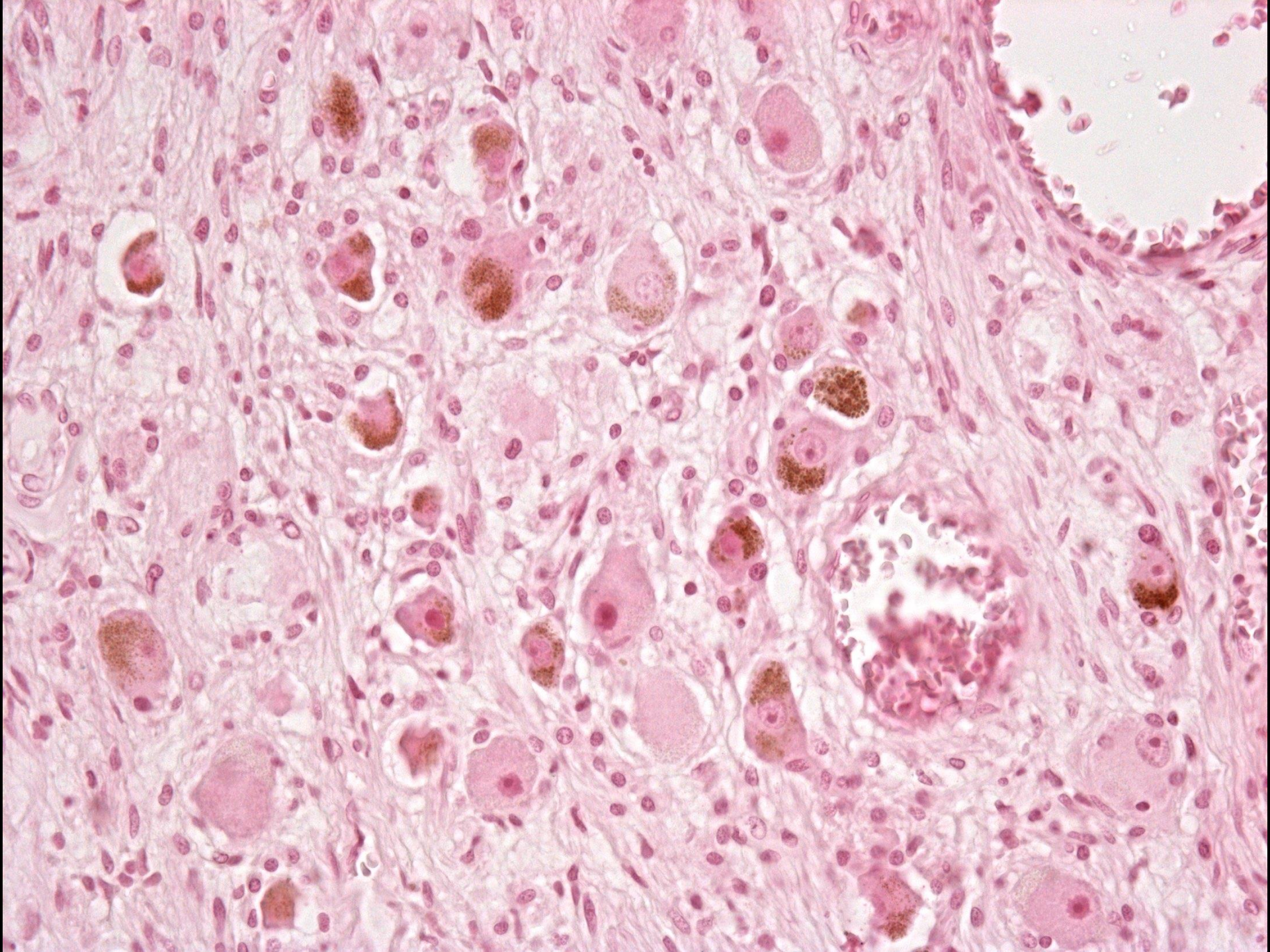
100 μ m



satelitové buňky

Vegetativní ganglion



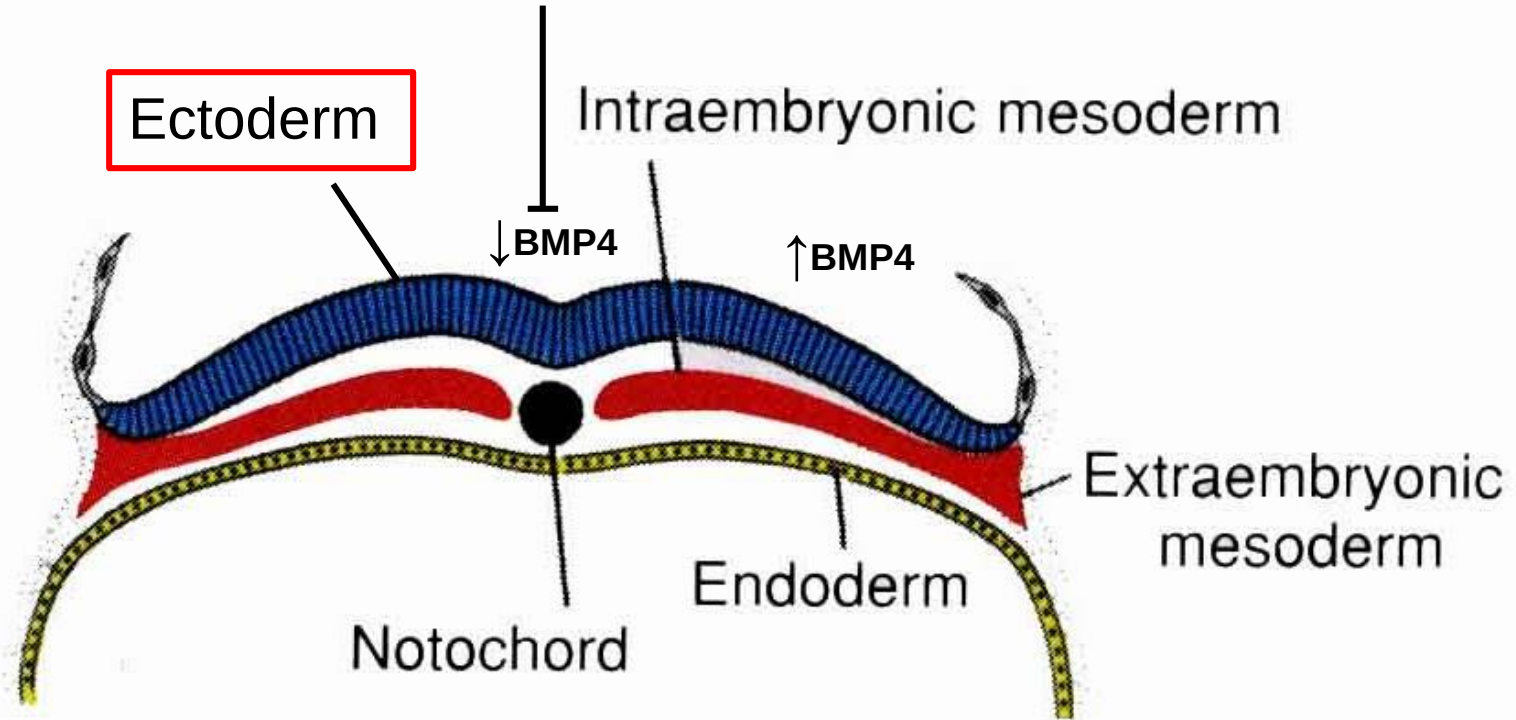


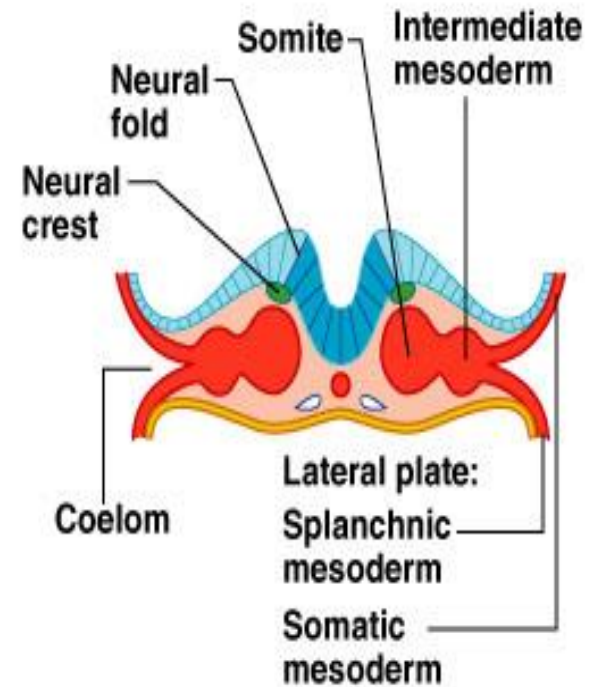
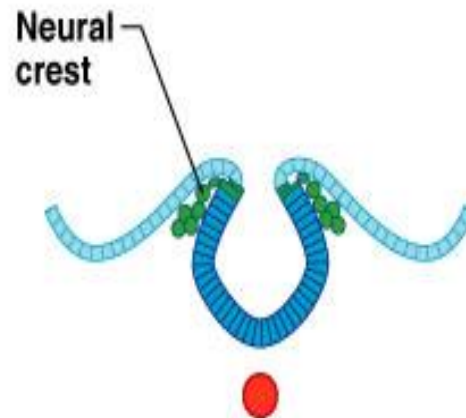
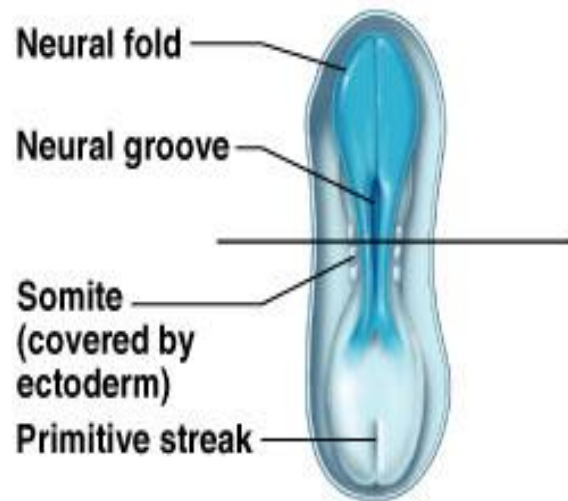


ORGANOGENEZE NERVOVÉHO SYSTÉMU

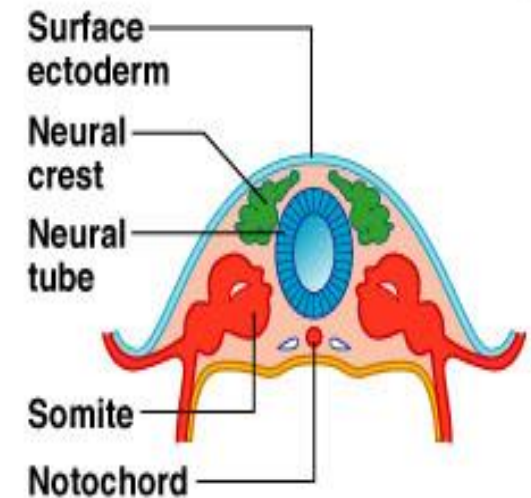
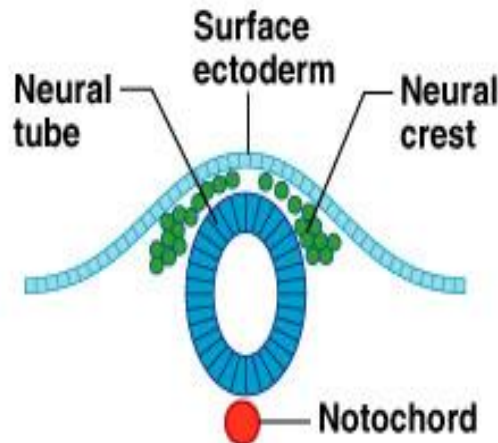
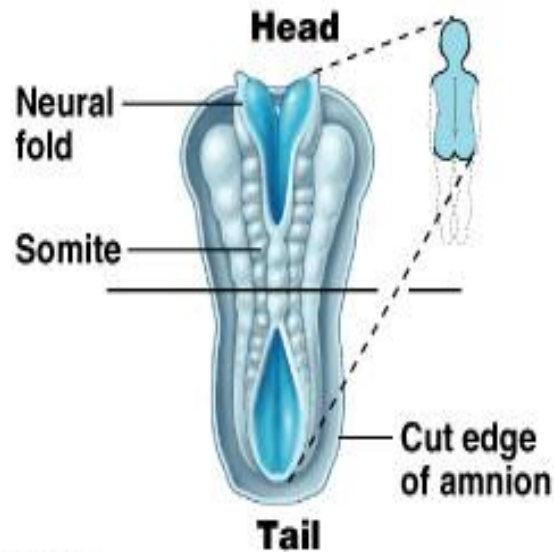
VÝVOJ NERVOVÉ TRUBICE, HISTOGENEZE NERVOVÉ TKÁNĚ

↑ FGF-8, noggin, chordin, follistatin
(v primitivním uzlu a později v
prechordální plotence a chordě)

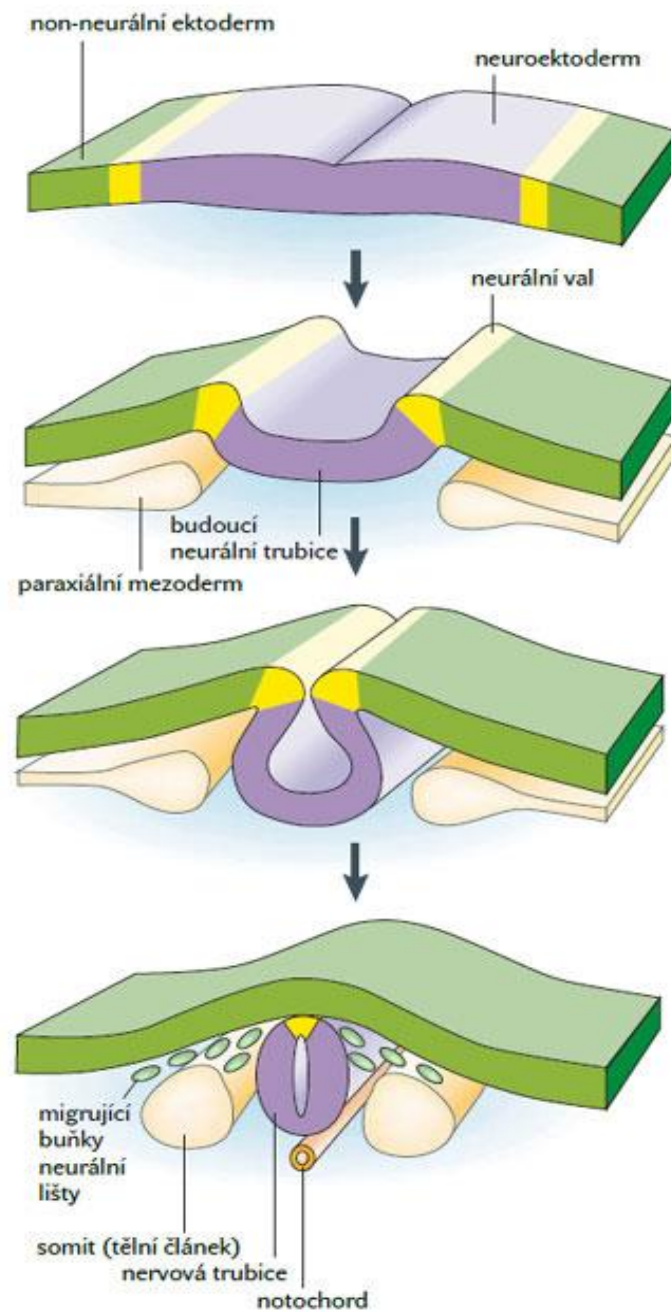
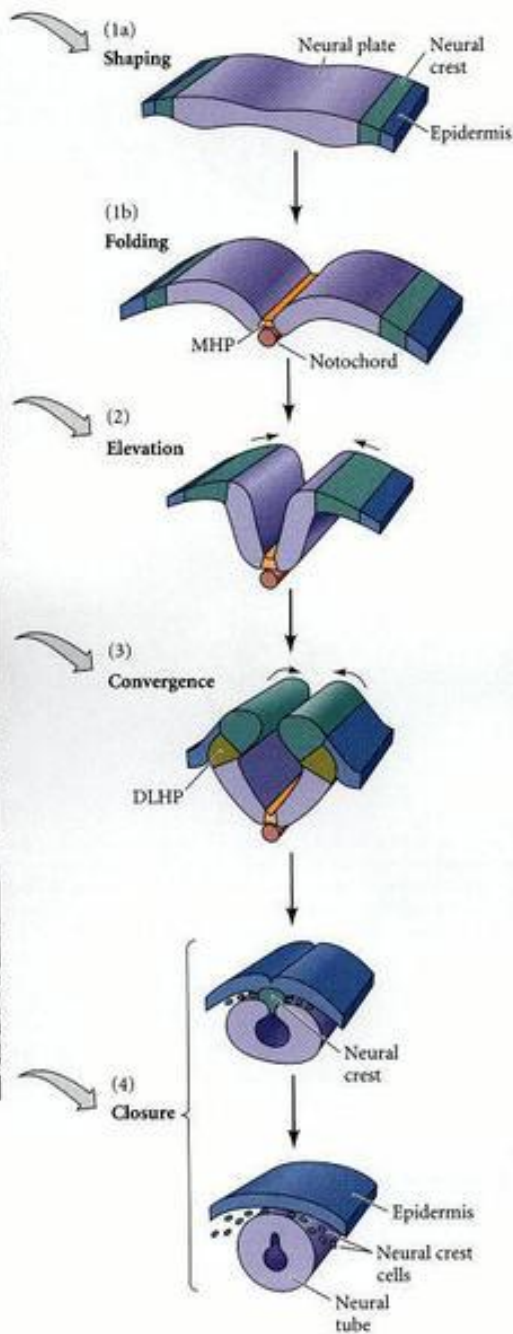
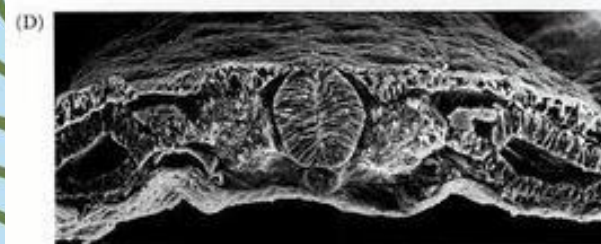
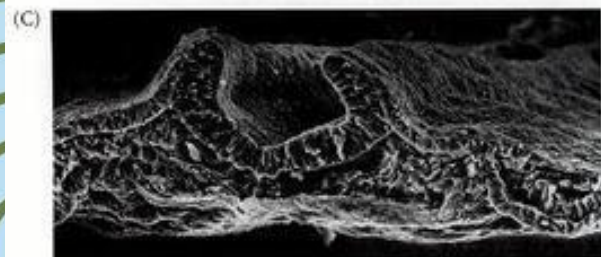
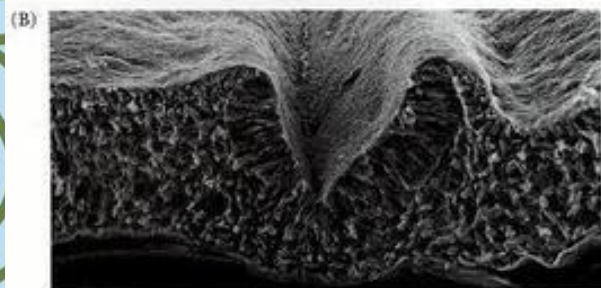




(c) 20 days



(d) 22 days



Oropharyngeal membrane

A

Primitive streak

15 Days

B

Prechordal plate

Neural plate
n. ploténka

Notochordal process

Primitive streak

18 Days

Prechordal plate

C

Neural plate

Regressing primitive streak

19 Days

Cloacal membrane

Oropharyngeal membrane

D

Prechordal plate

Neural groove
n. brázda

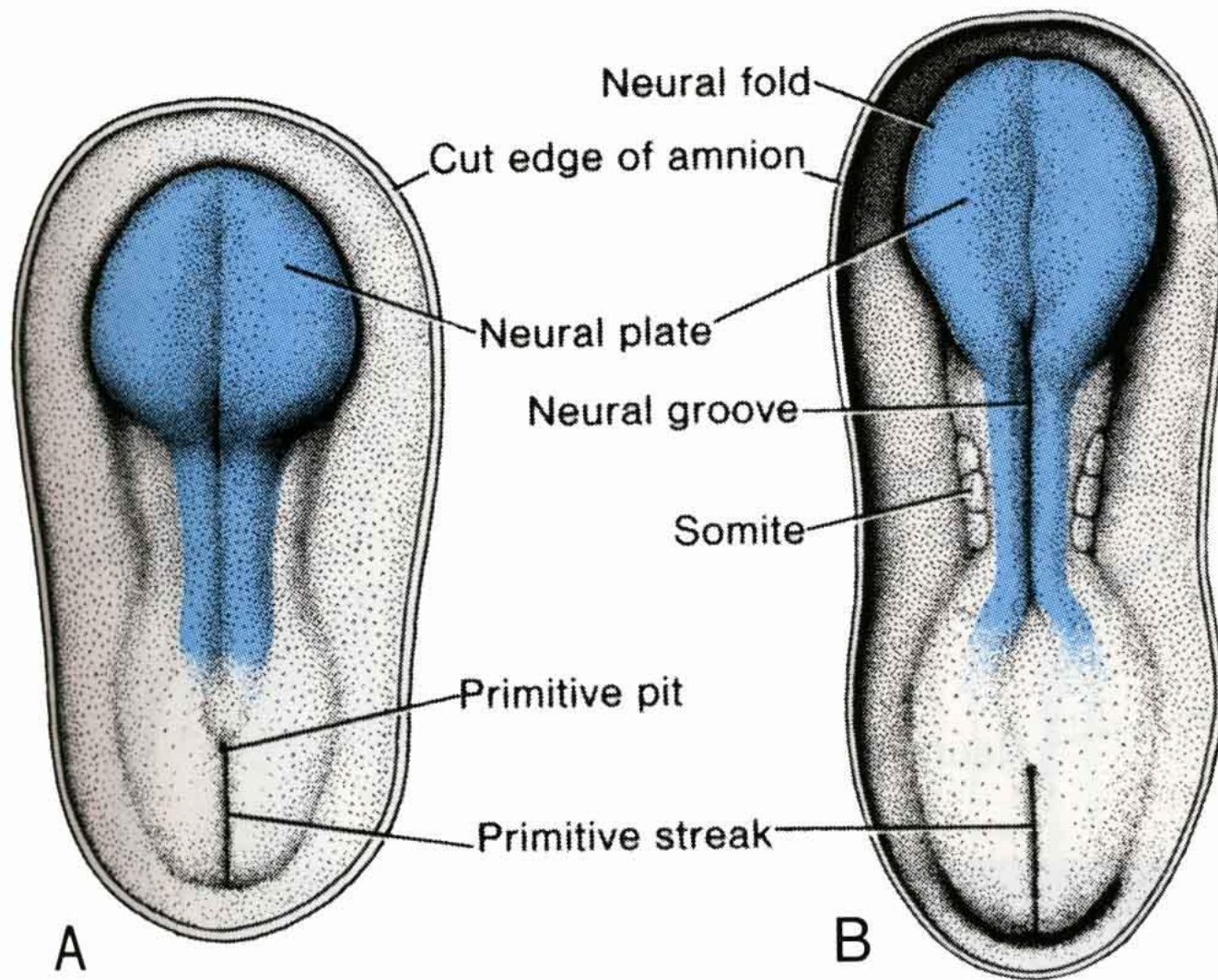
Notochord

n. val
Neural fold

Regressing primitive streak

Cloacal membrane

20-21 Days

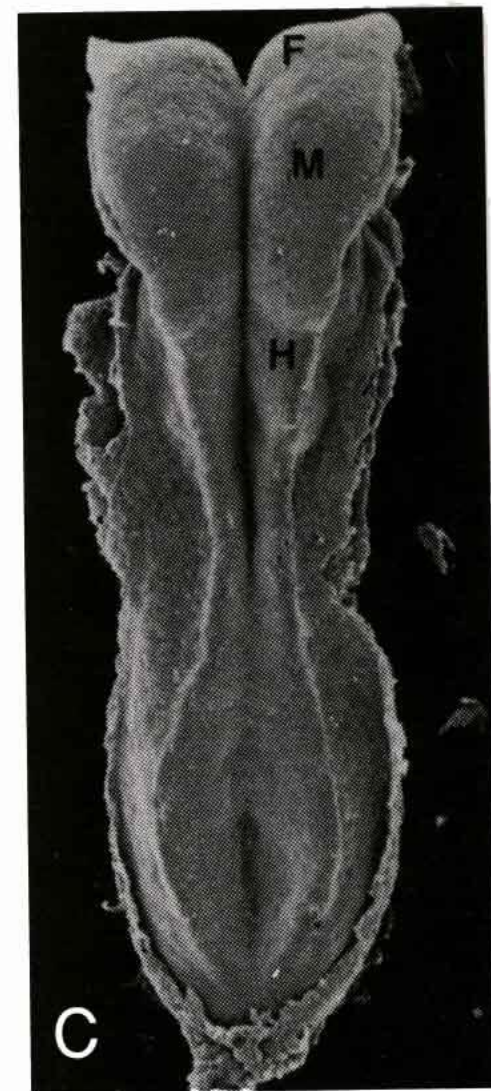


A

19th day

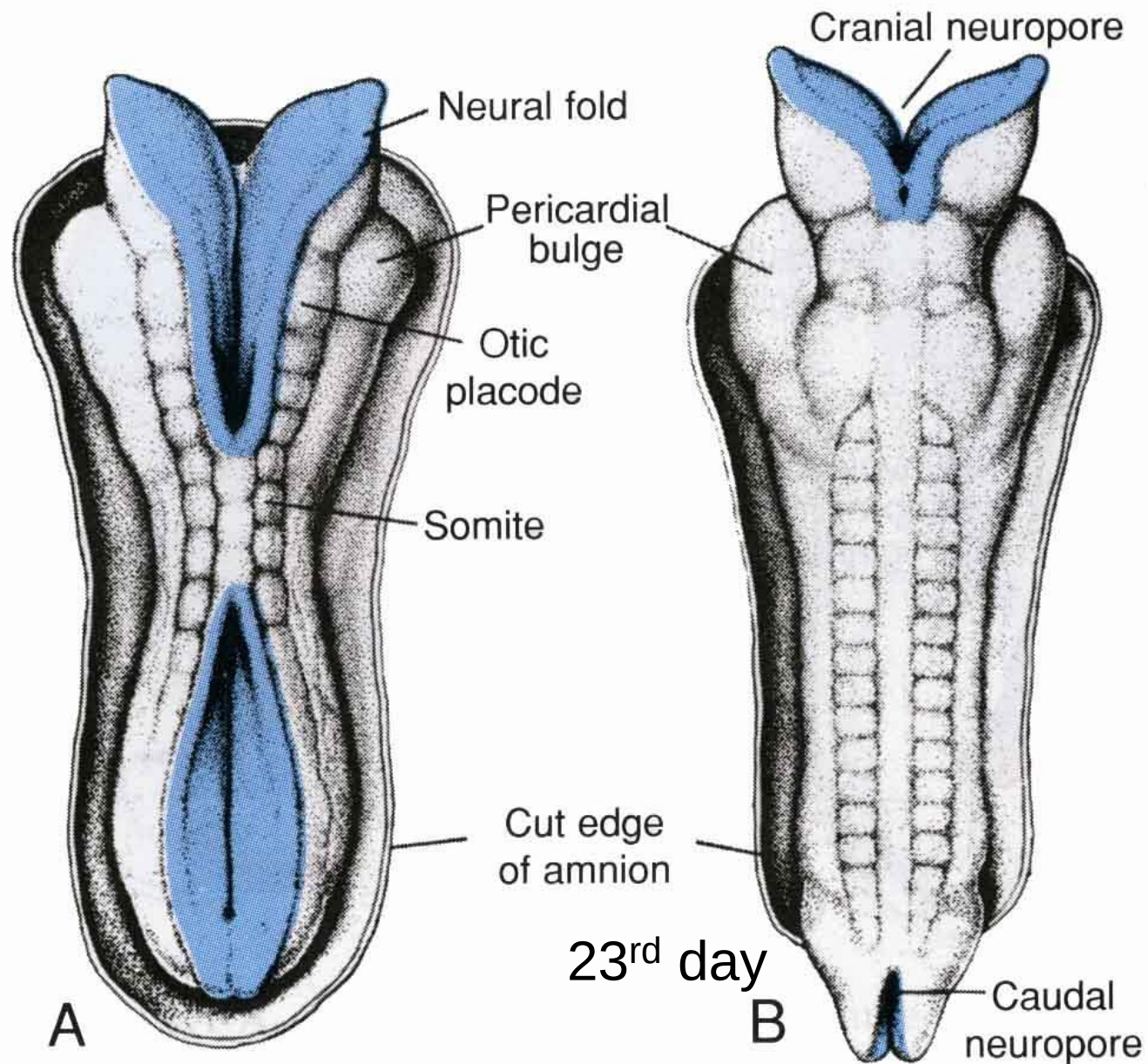
B

20th day

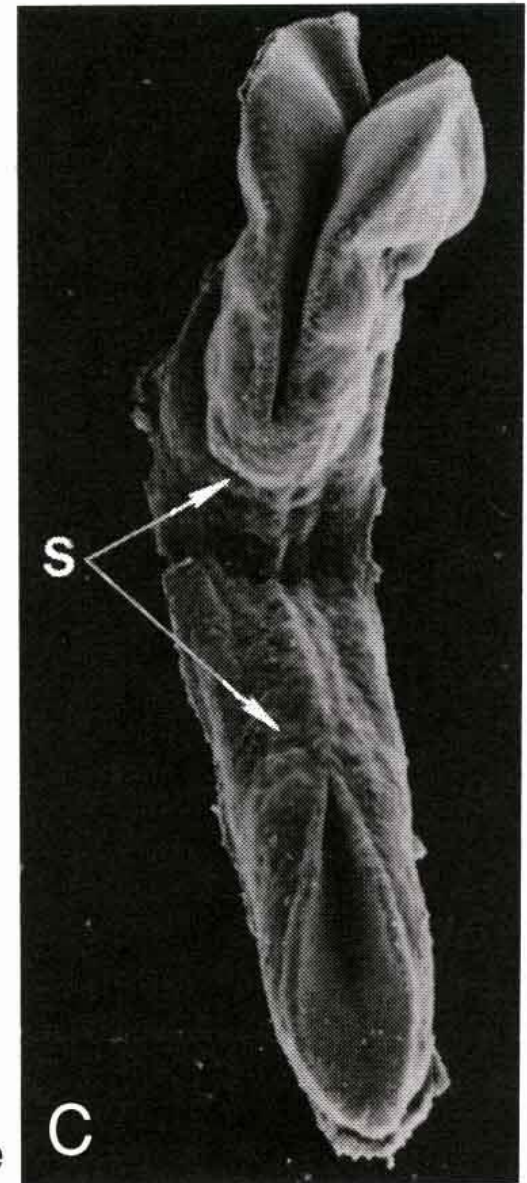


C

uzávěr 24. – 25. den

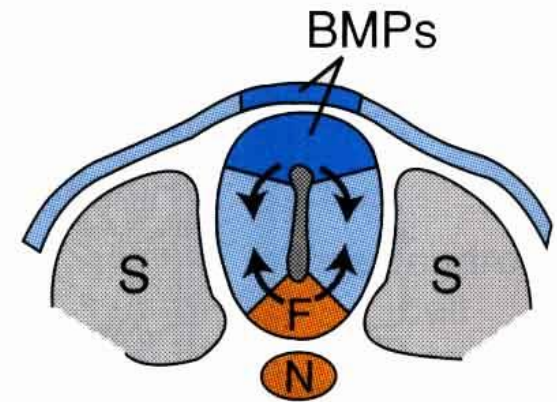
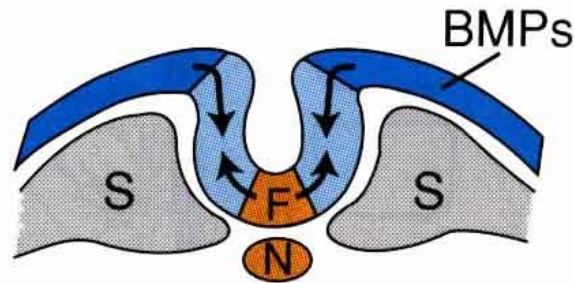
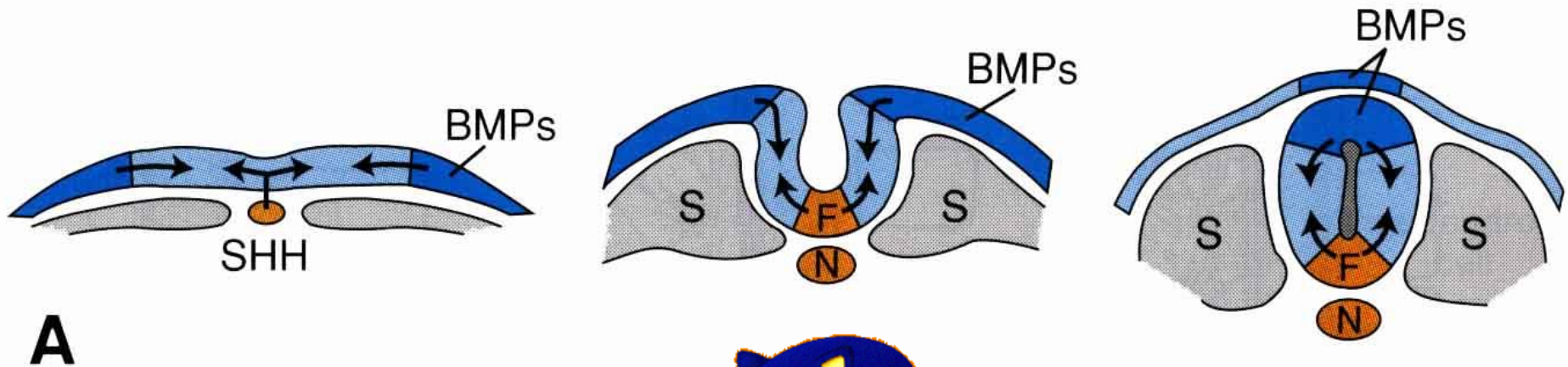


22nd day

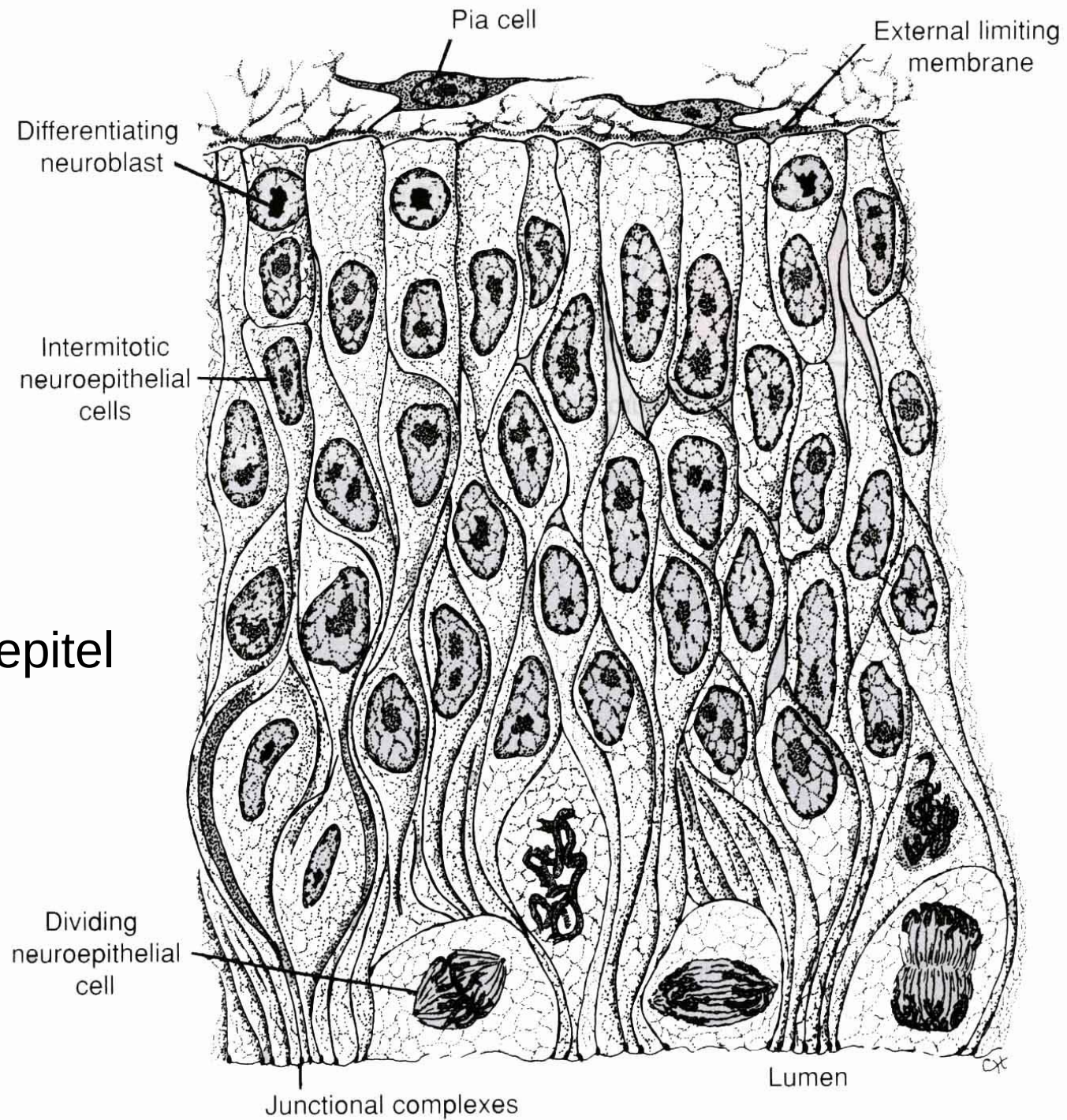


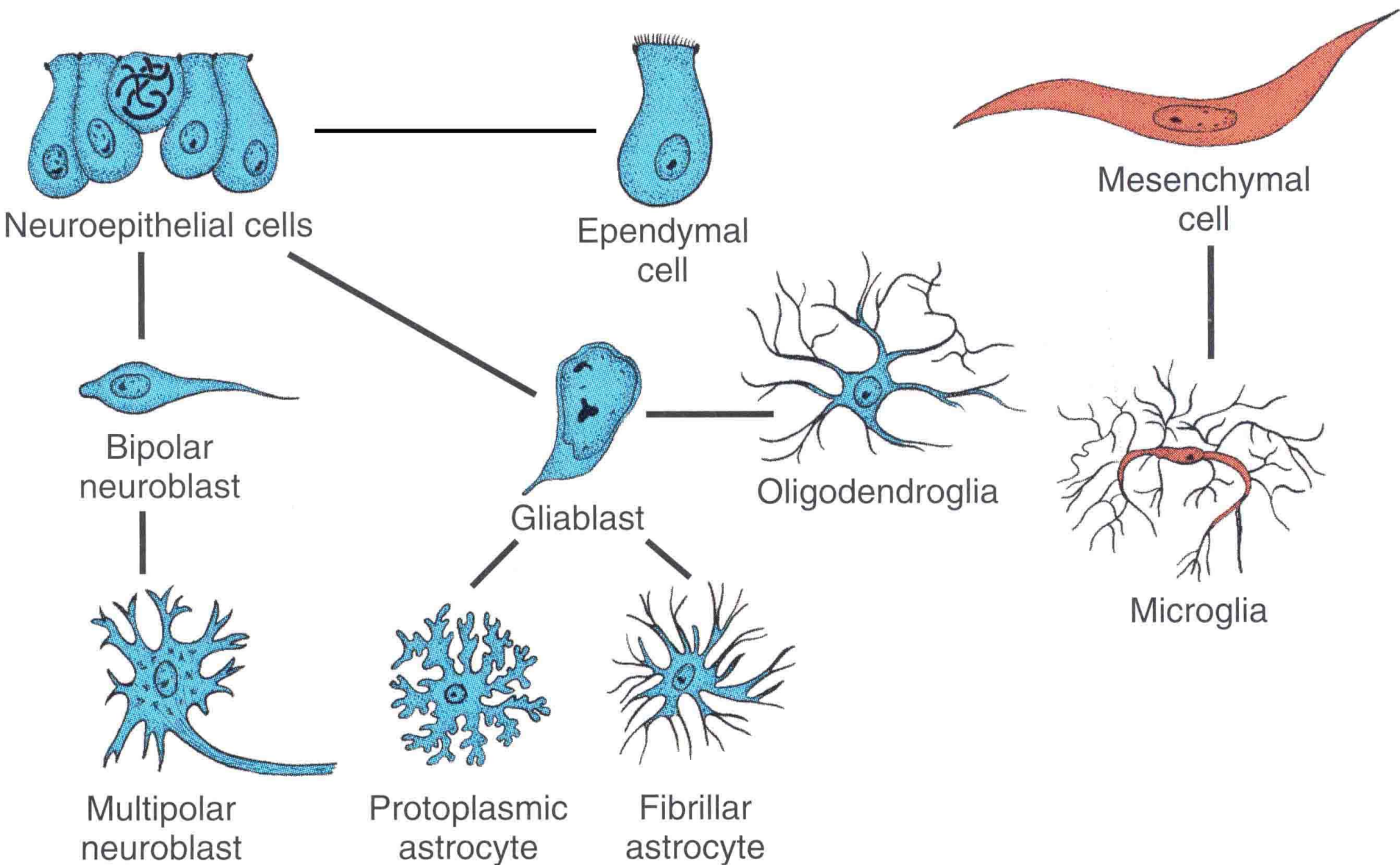
uzávěr 26. – 28. den

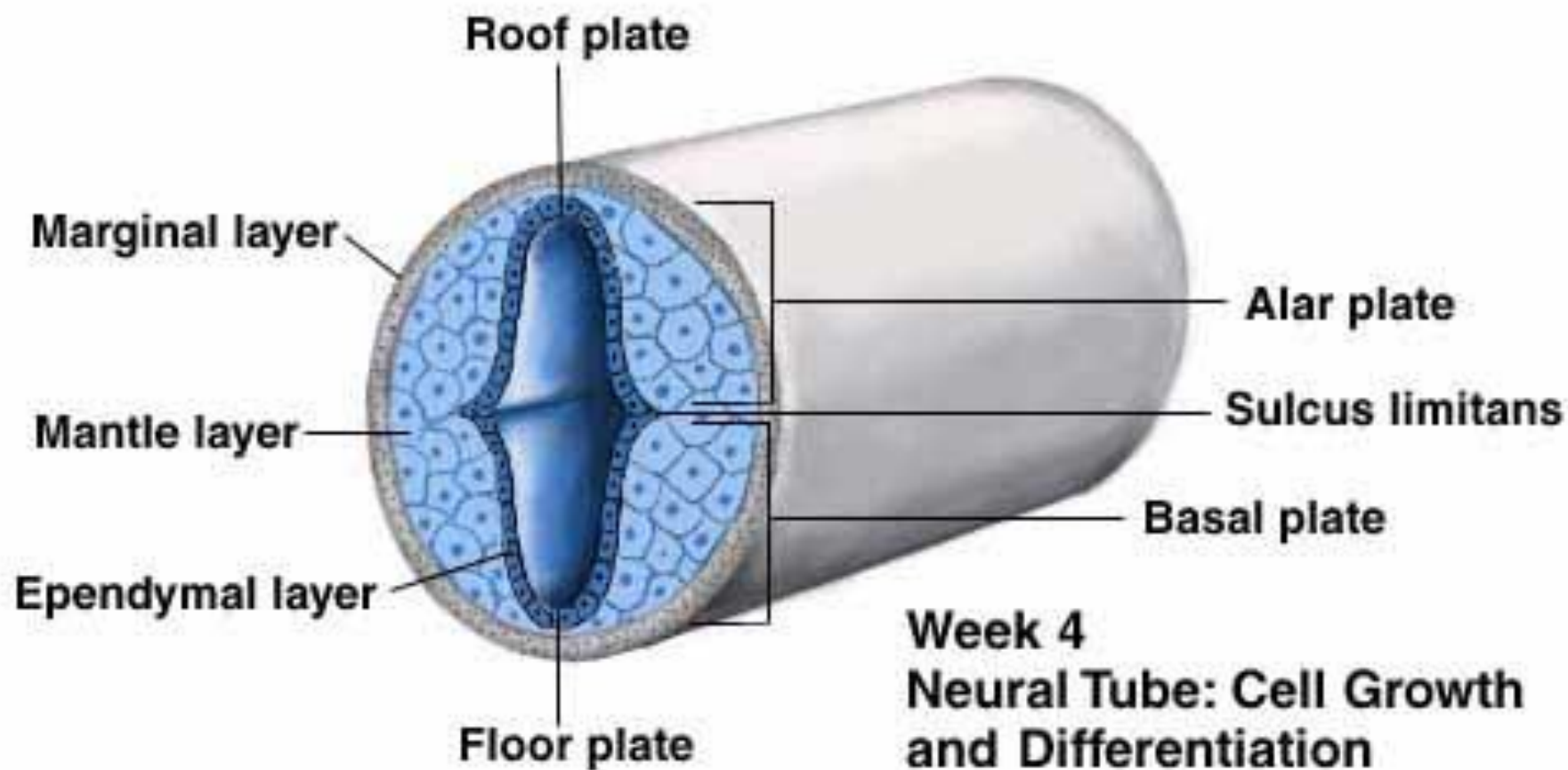
TGF- β

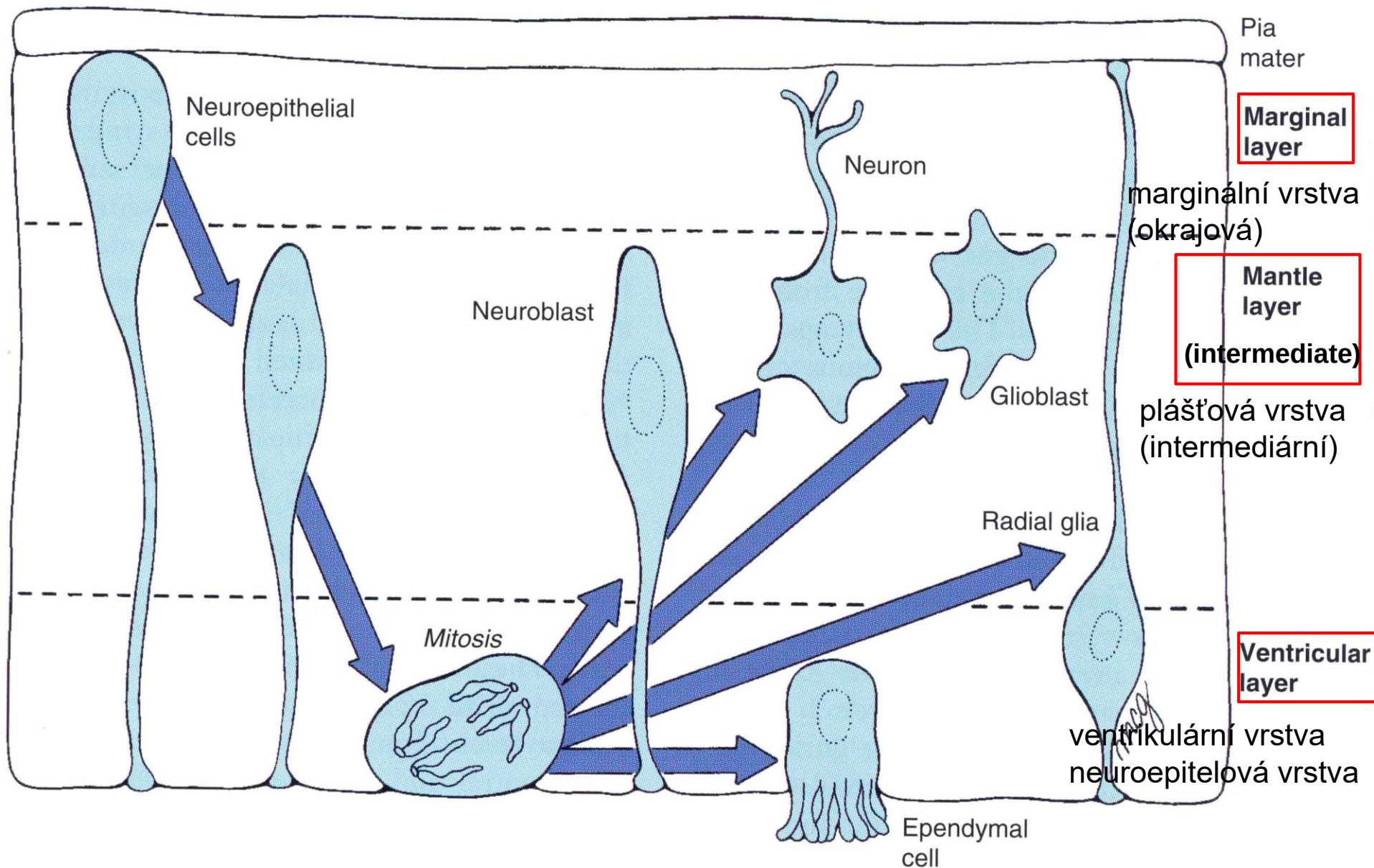


neuroepitel

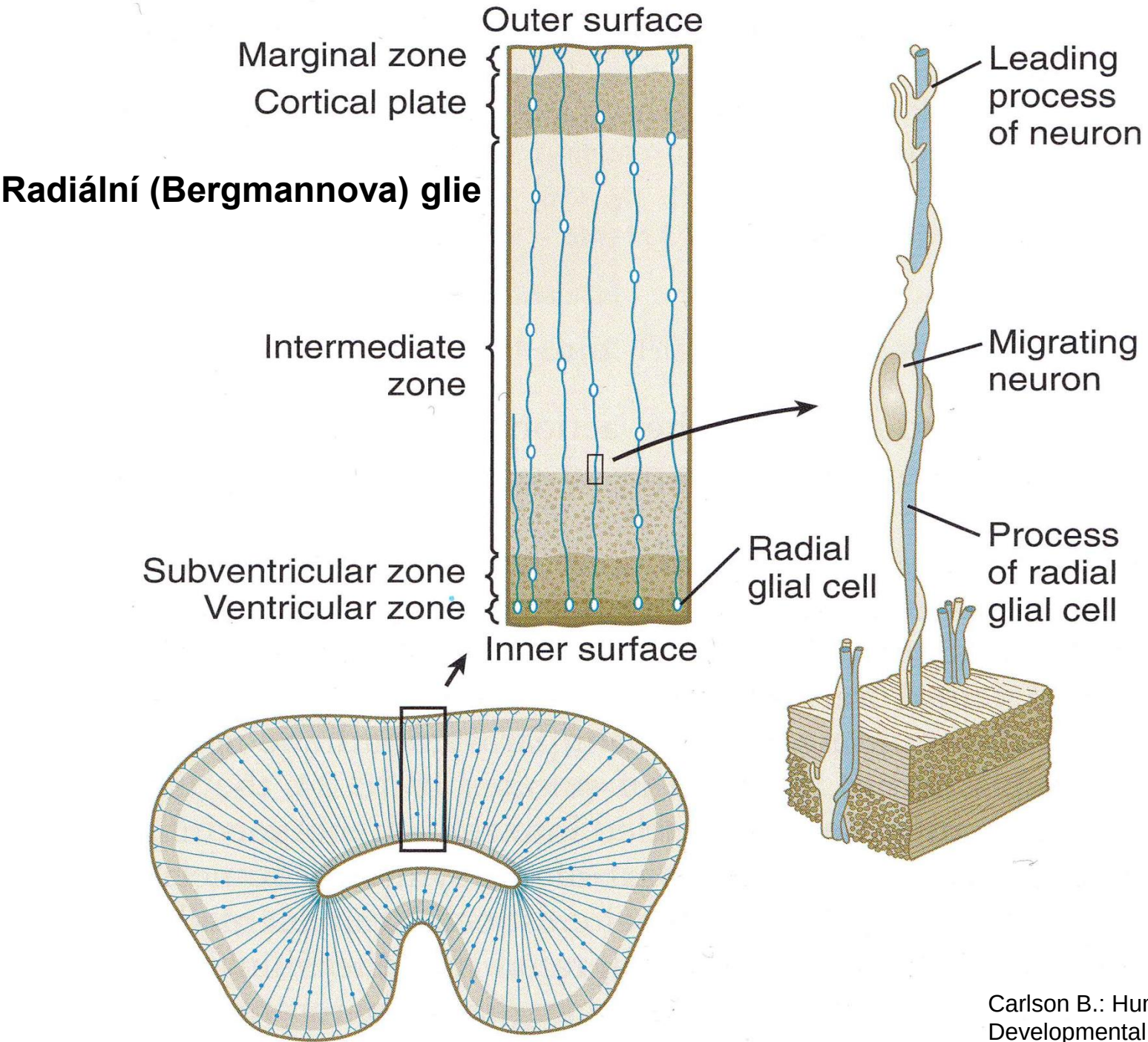


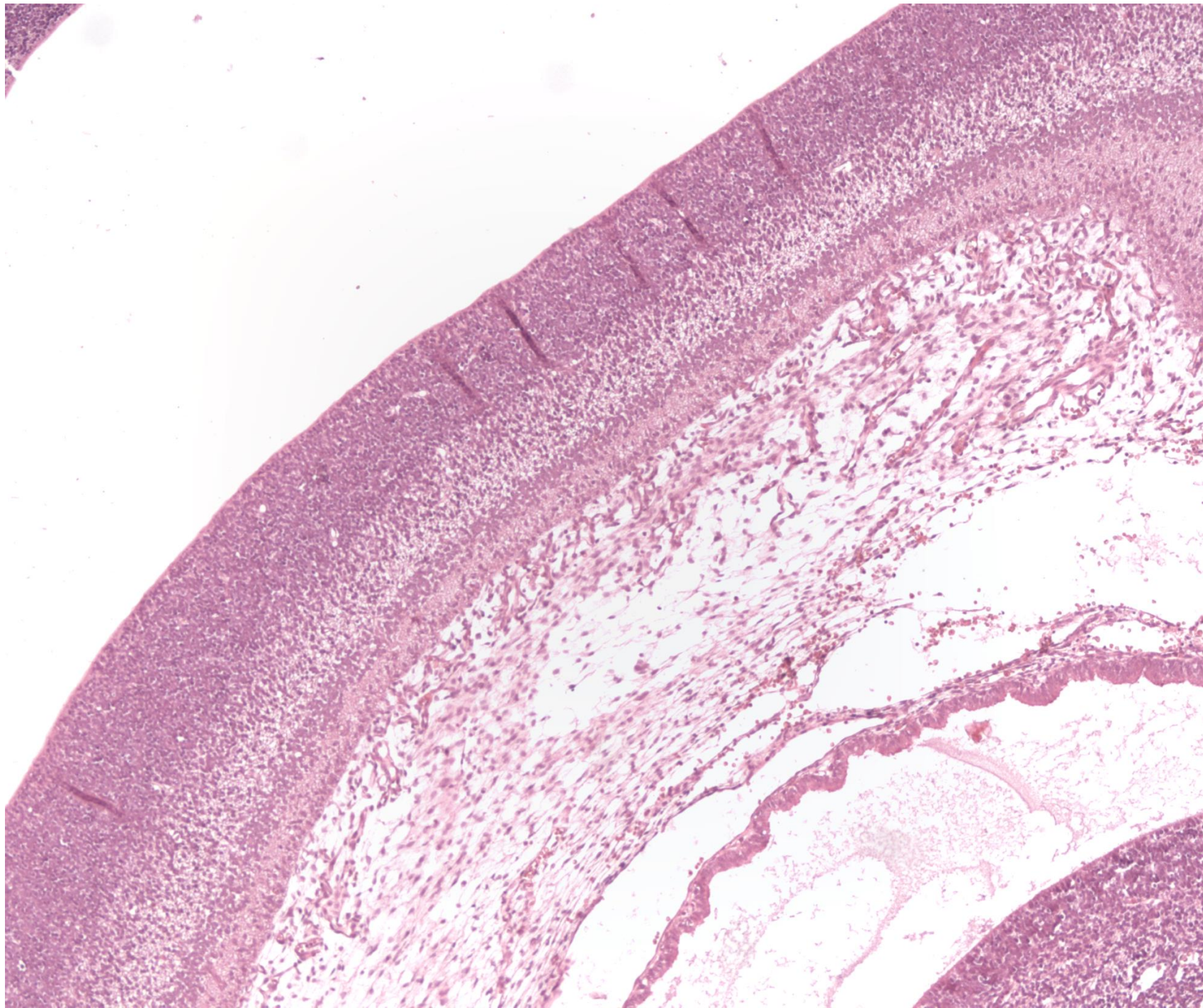






Radiální (Bergmannova) glie

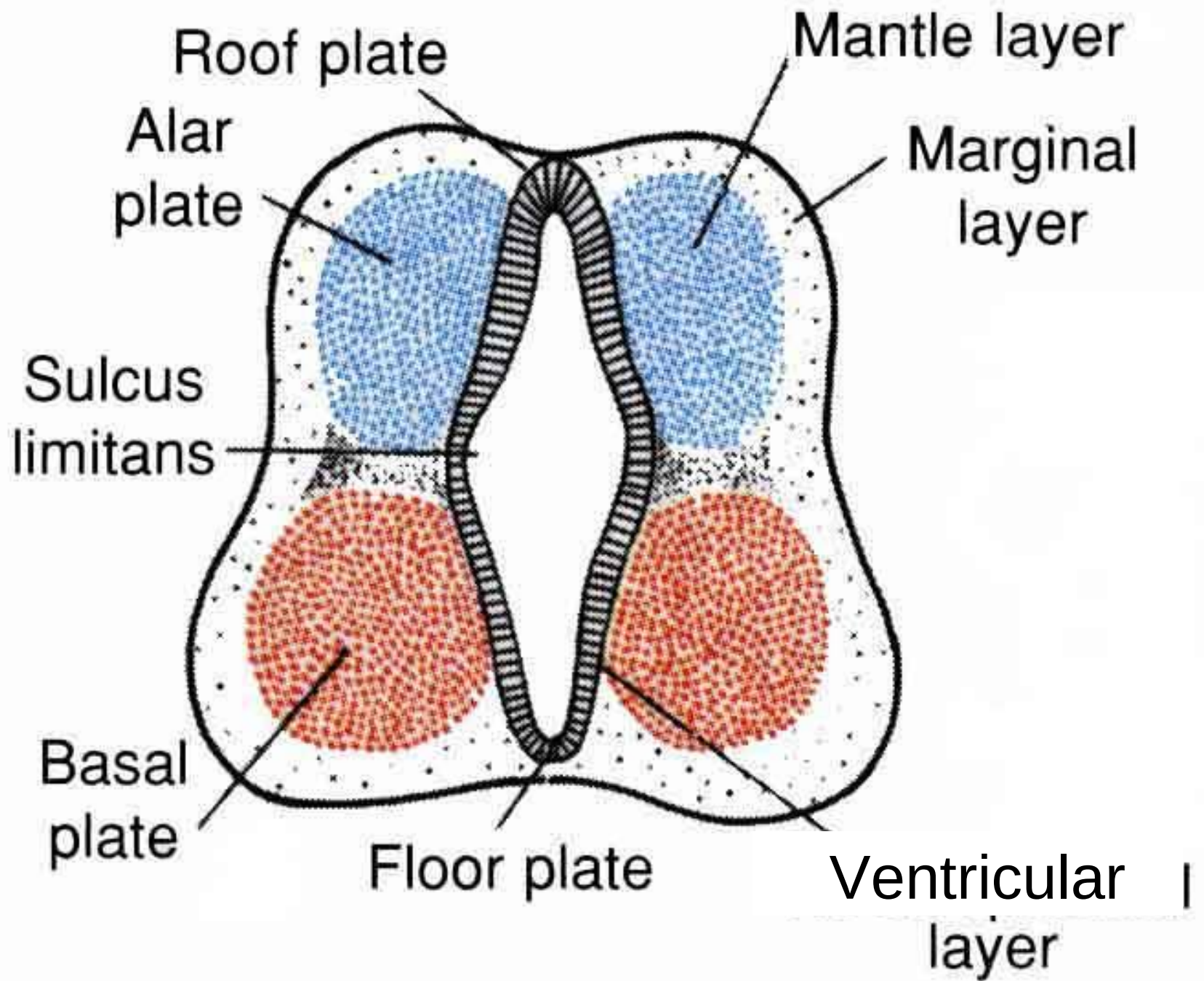


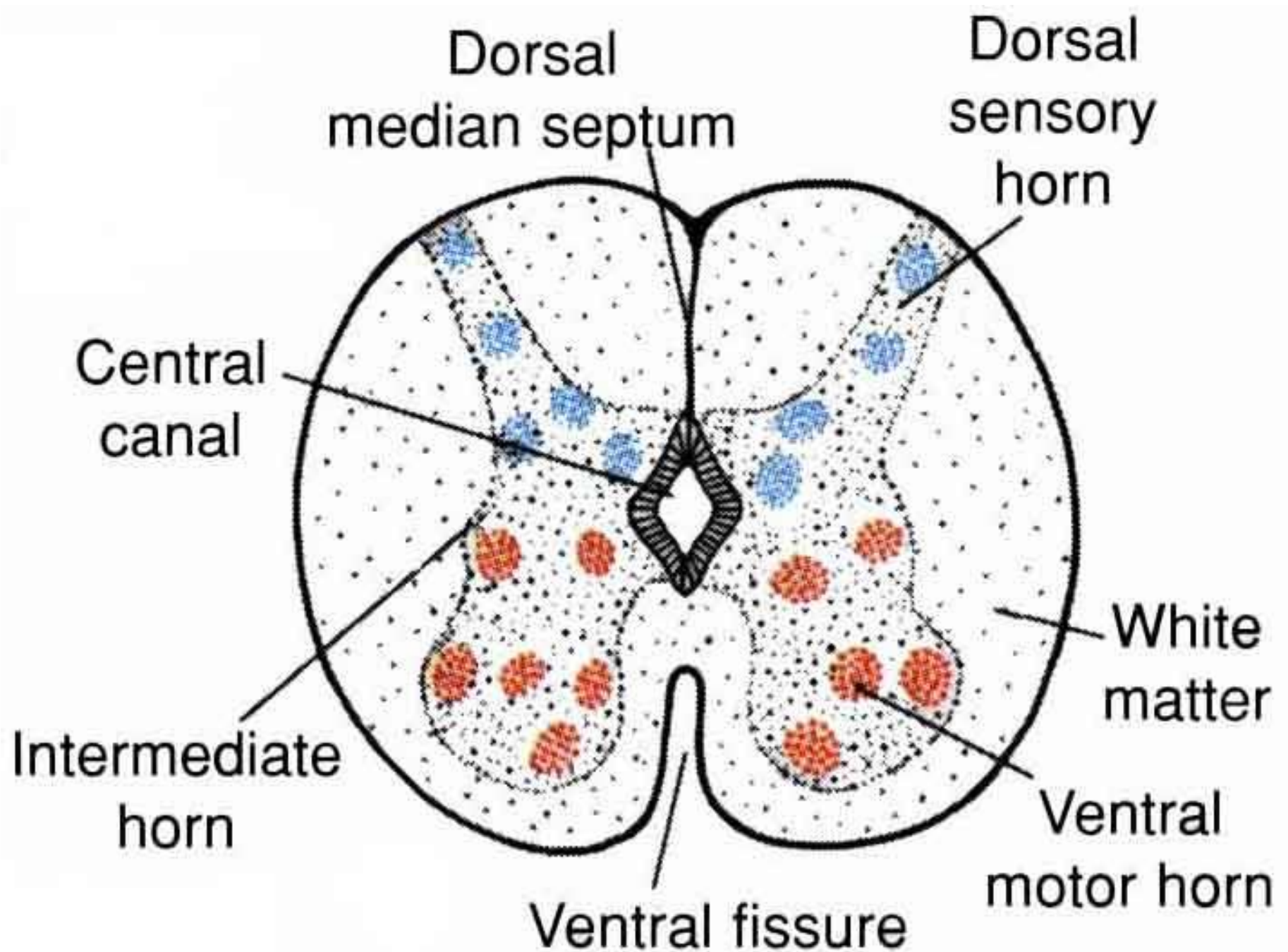


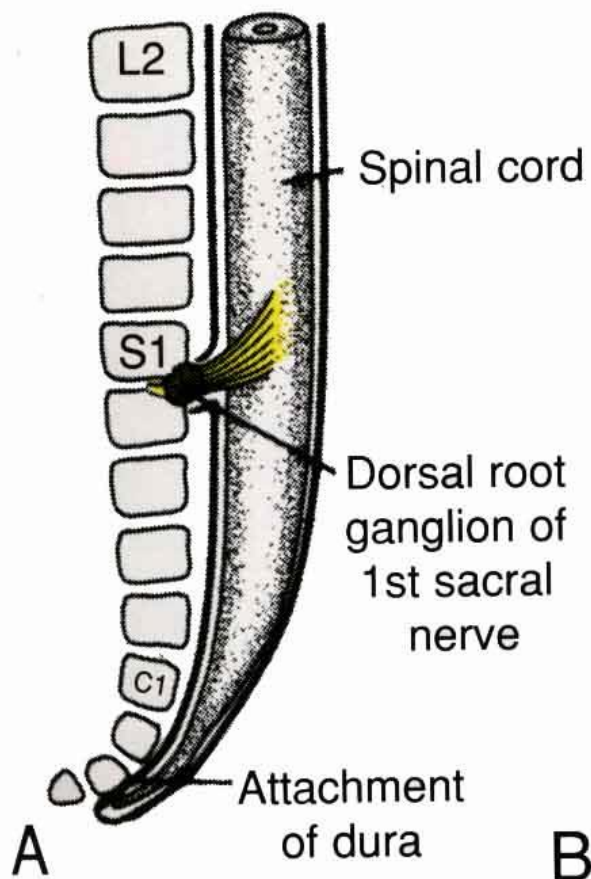
IT'S MONDAY

WAKE UP!

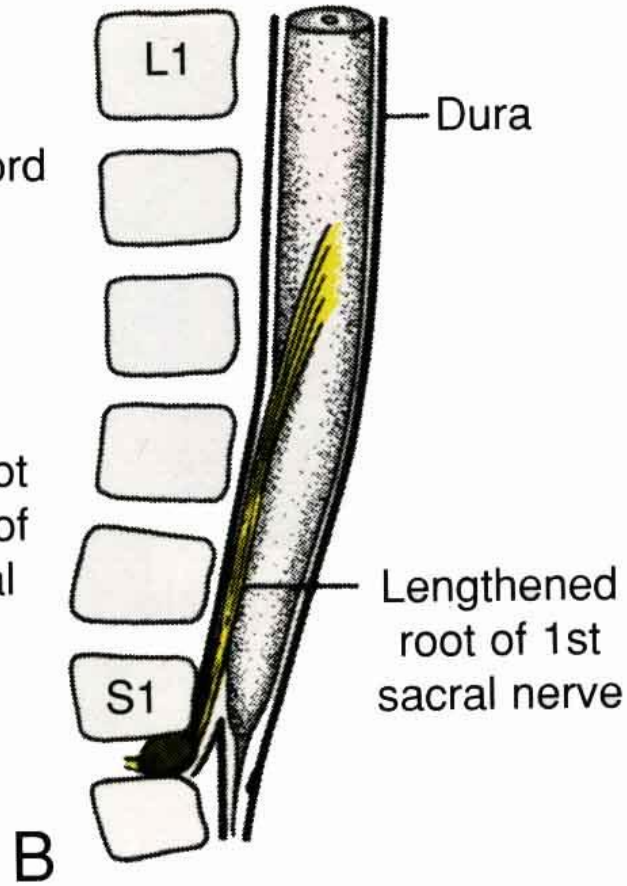
VÝVOJ MÍCHY A NEURÁLNÍ LIŠTY



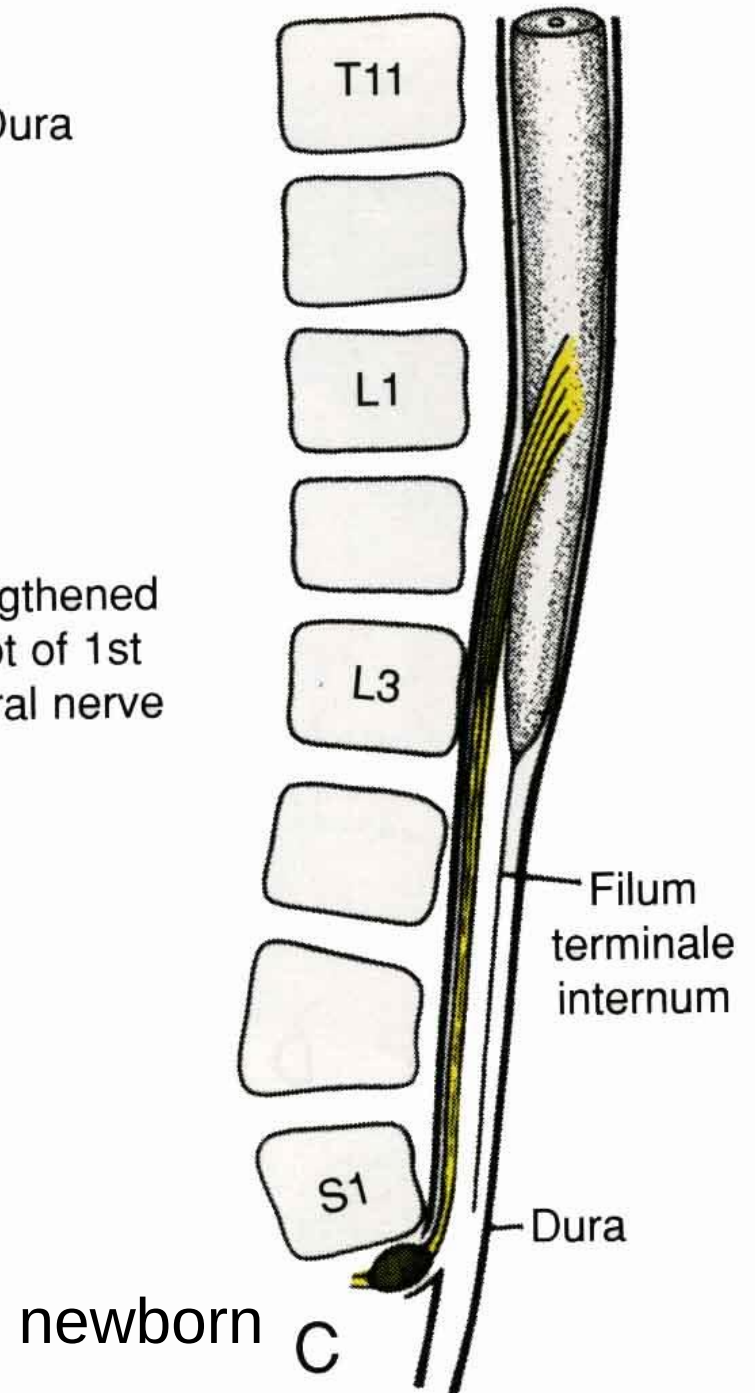




3rd month



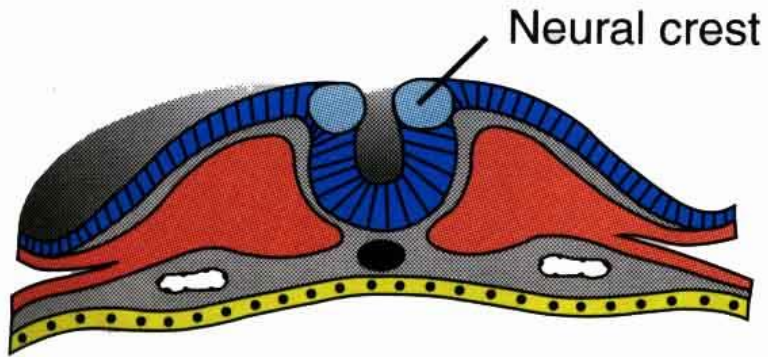
5th month



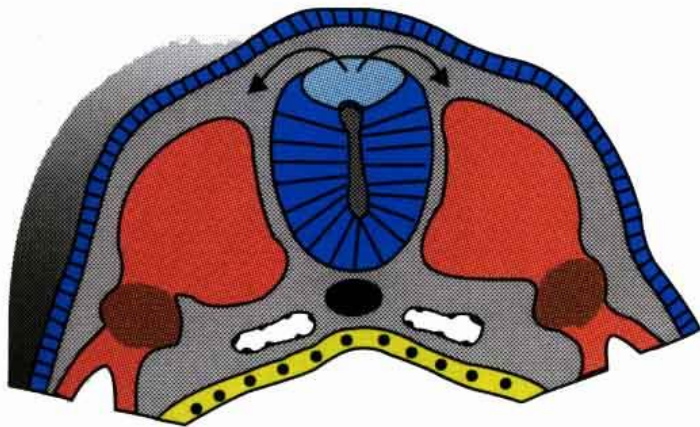
newborn

C

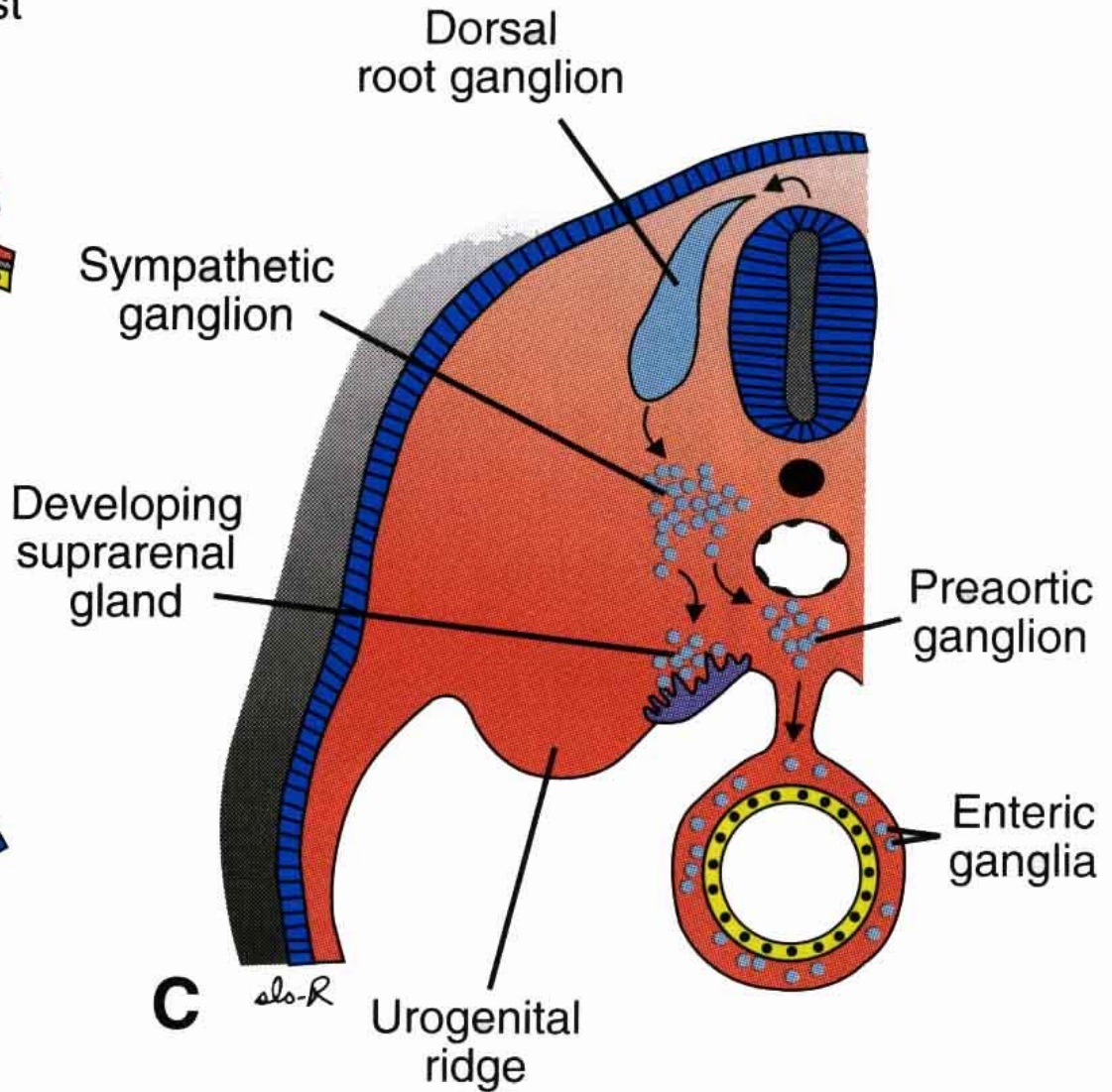
neurální lišta



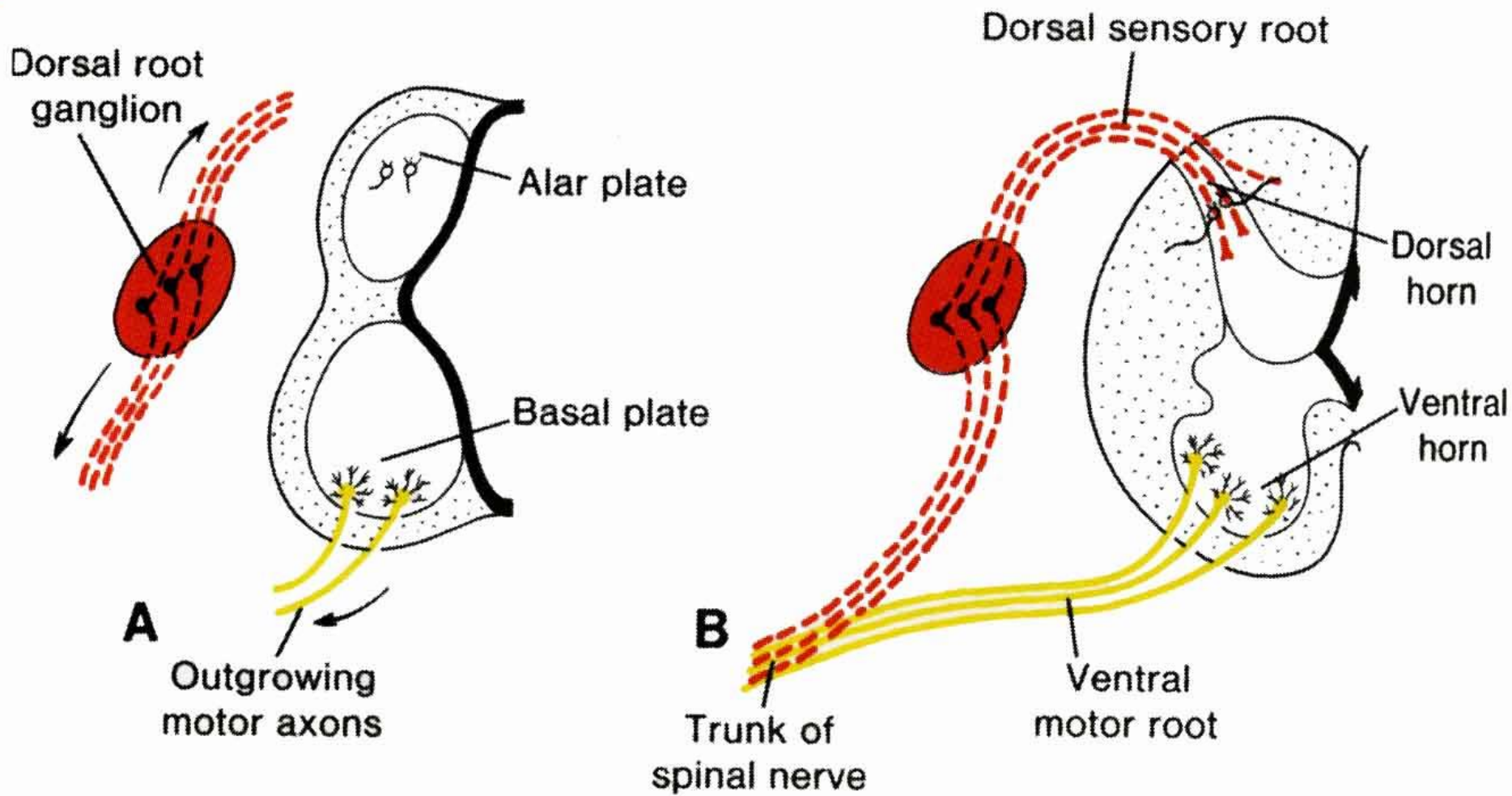
A



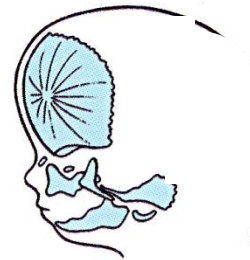
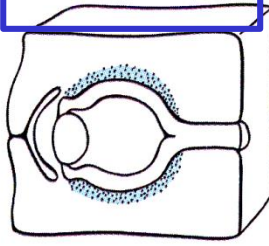
B



C

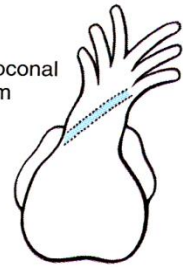


Cranial neural crest

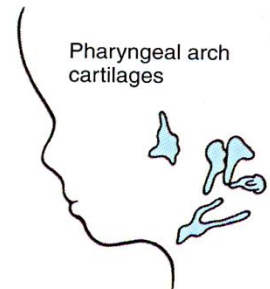


Dermal bones of skull

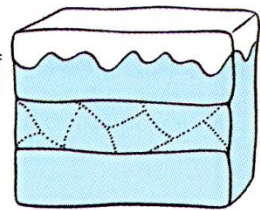
Truncoconal septum



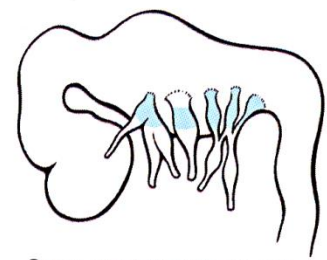
Pharyngeal arch cartilages



Dermis and hypodermis of face and neck



Odontoblasts

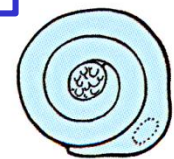


Some cranial nerve ganglia

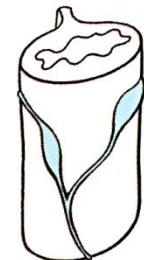
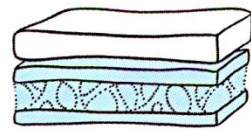
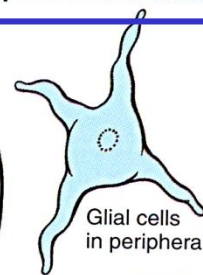
Cranial and spinal neural crest



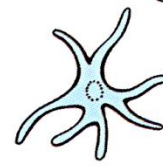
Schwann cells



Glial cells in peripheral ganglia

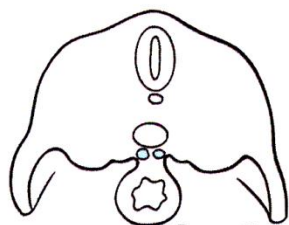


Enteric ganglia

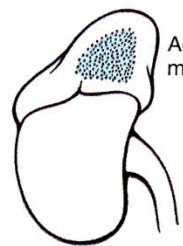


Melanocytes

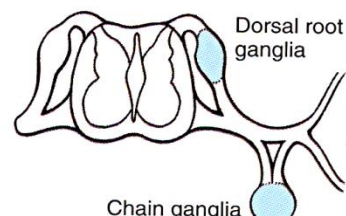
Spinal neural crest



Preaortic ganglia



Adrenal medulla

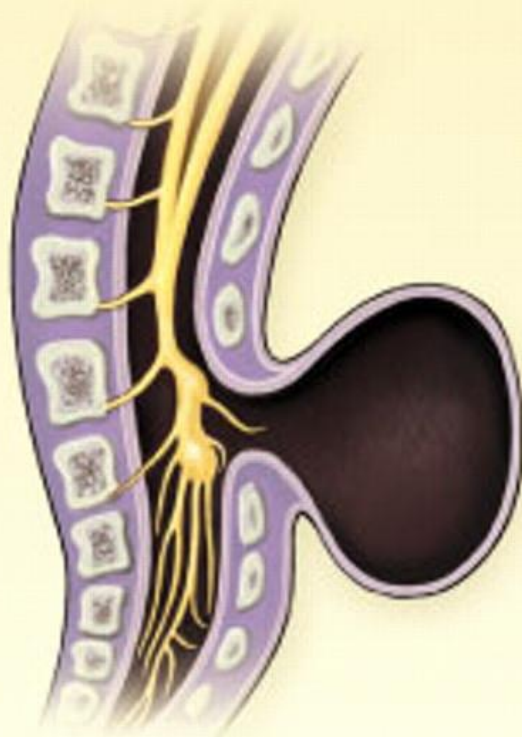


Dorsal root ganglia

Chain ganglia



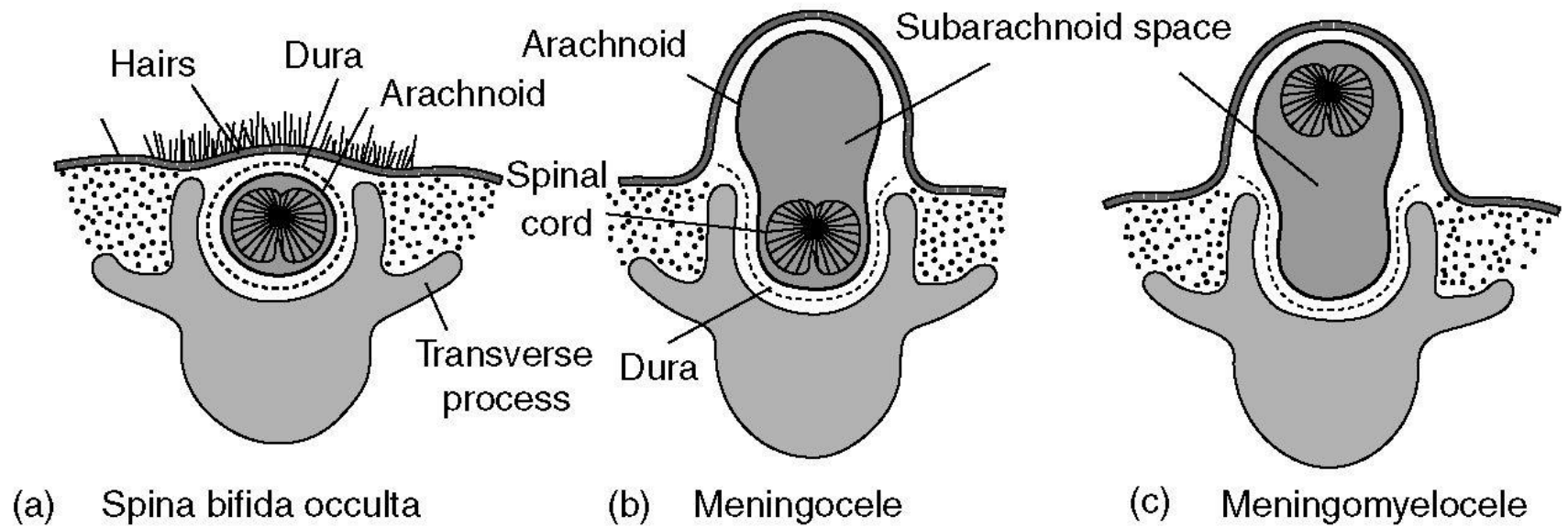
Spina bifida occulta



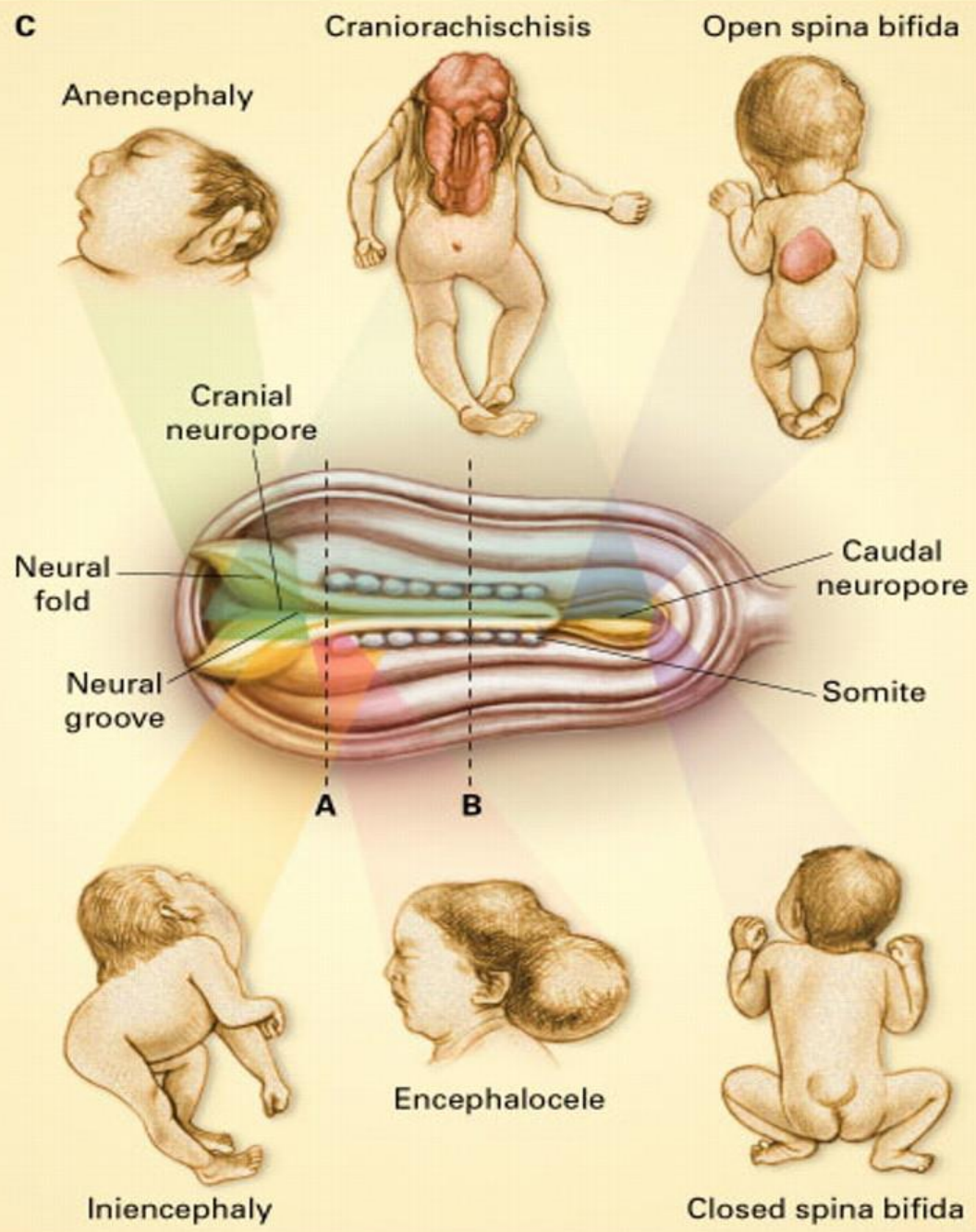
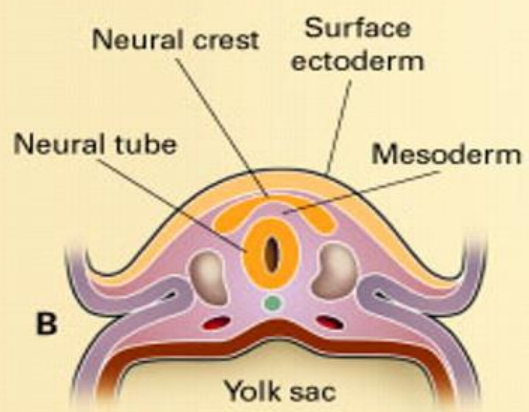
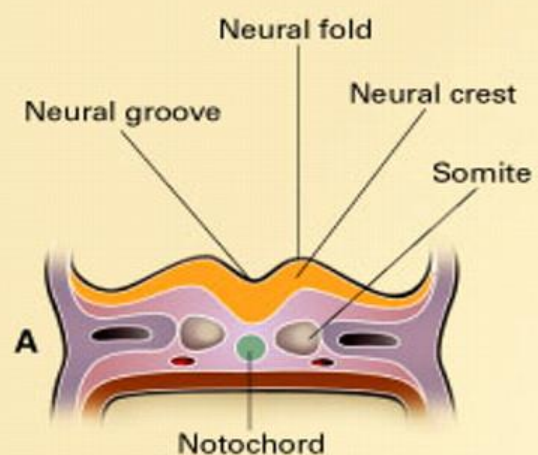
Meningocele



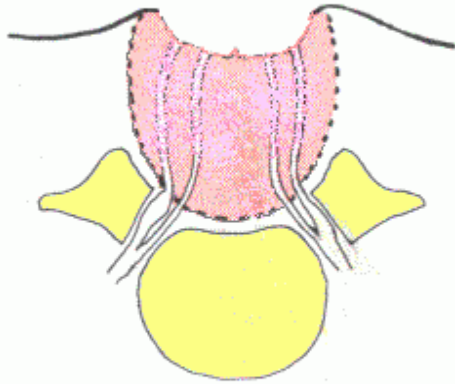
Myelomeningocele



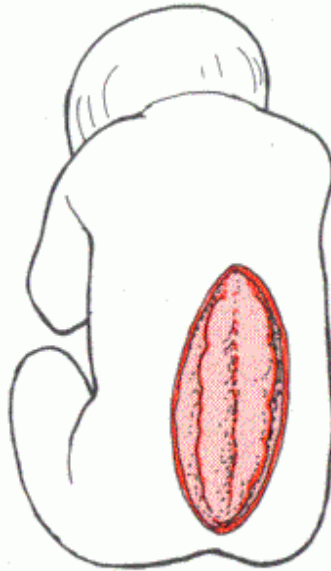
spina bifida cystica



MYELOSCHISIS



**Missing: Roof plate
Vertebral arch
Skin**

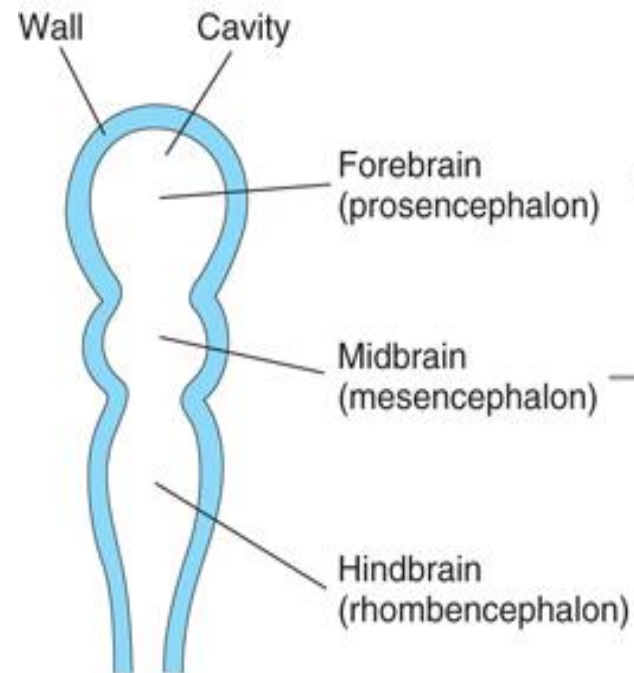


VÝVOJ MOZKU

4. týden

3 primární mozkové váčky

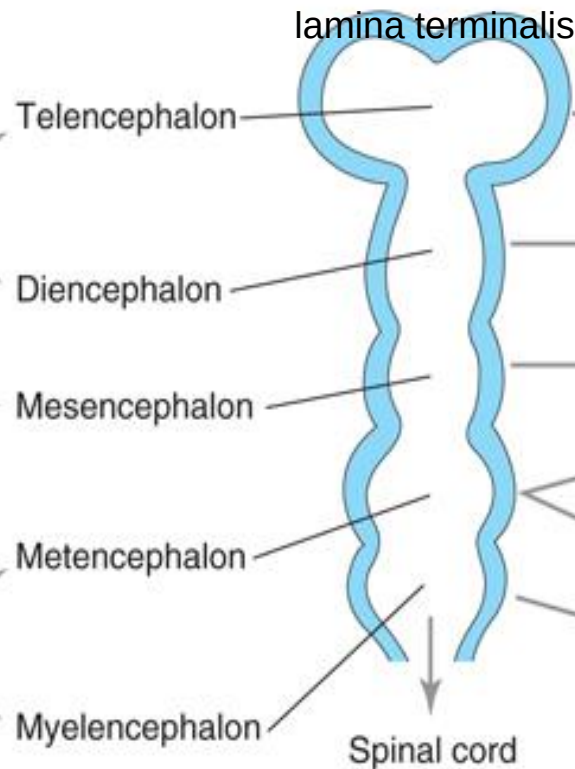
3 Primary vesicles



5. týden

5 sekundárních mozkových váček

5 Secondary vesicles



Adult derivatives of

Walls

Cavities

Cerebral hemispheres

Lateral ventricles

Thalami, etc.

Third ventricle

Midbrain

Aqueduct

Pons

Upper part of fourth ventricle

Cerebellum

Medulla oblongata

Lower part of fourth ventricle

temenní ohnutí

Cephalic flexure

Rhombencephalon
(hindbrain)

týlní ohnutí

Cervical
flexure

Mesencephalon
(midbrain)

Optic
vesicle

Cranial and
spinal sensory
ganglia

Prosencephalon
(forebrain)

Spinal
cord

A

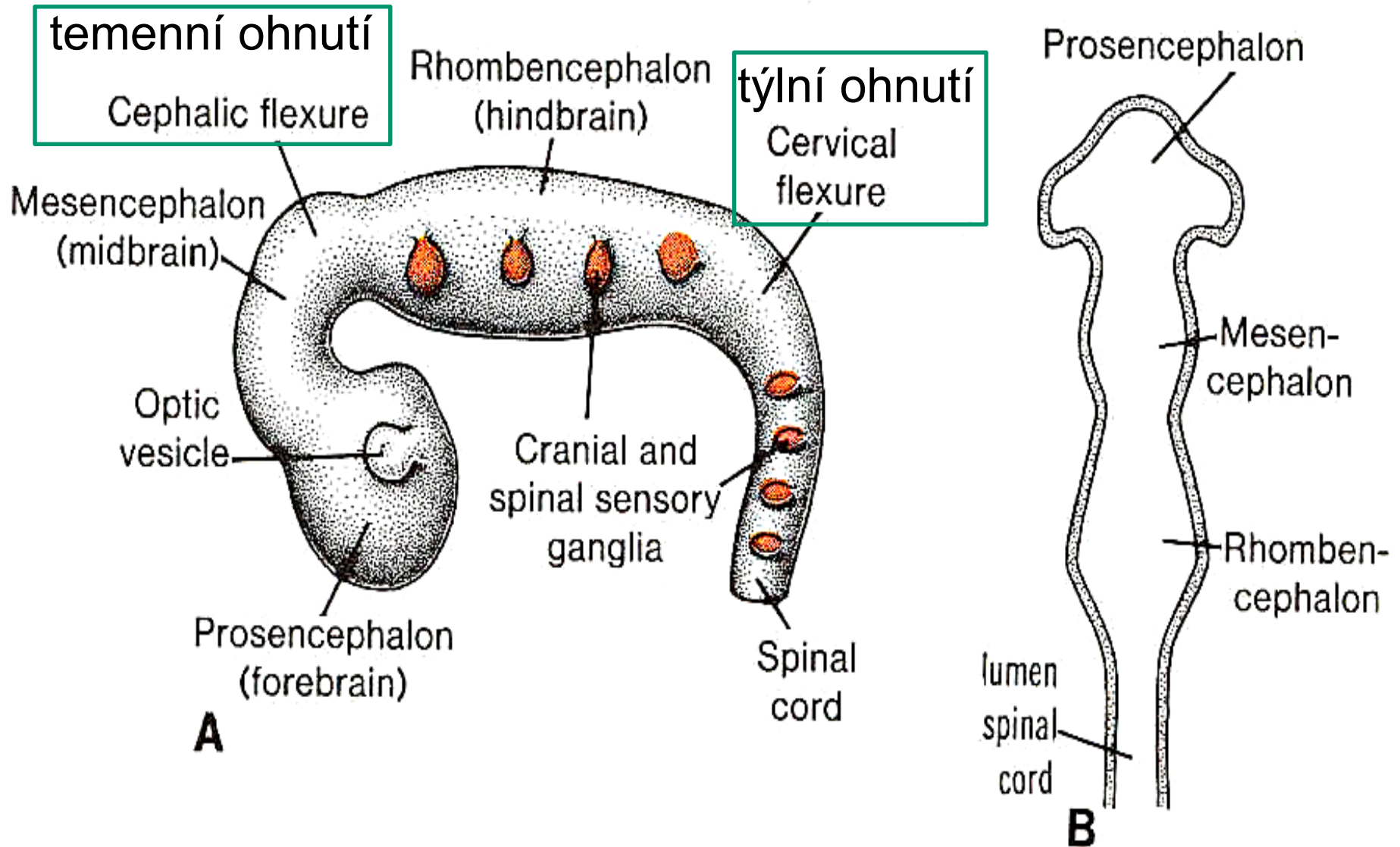
Prosencephalon

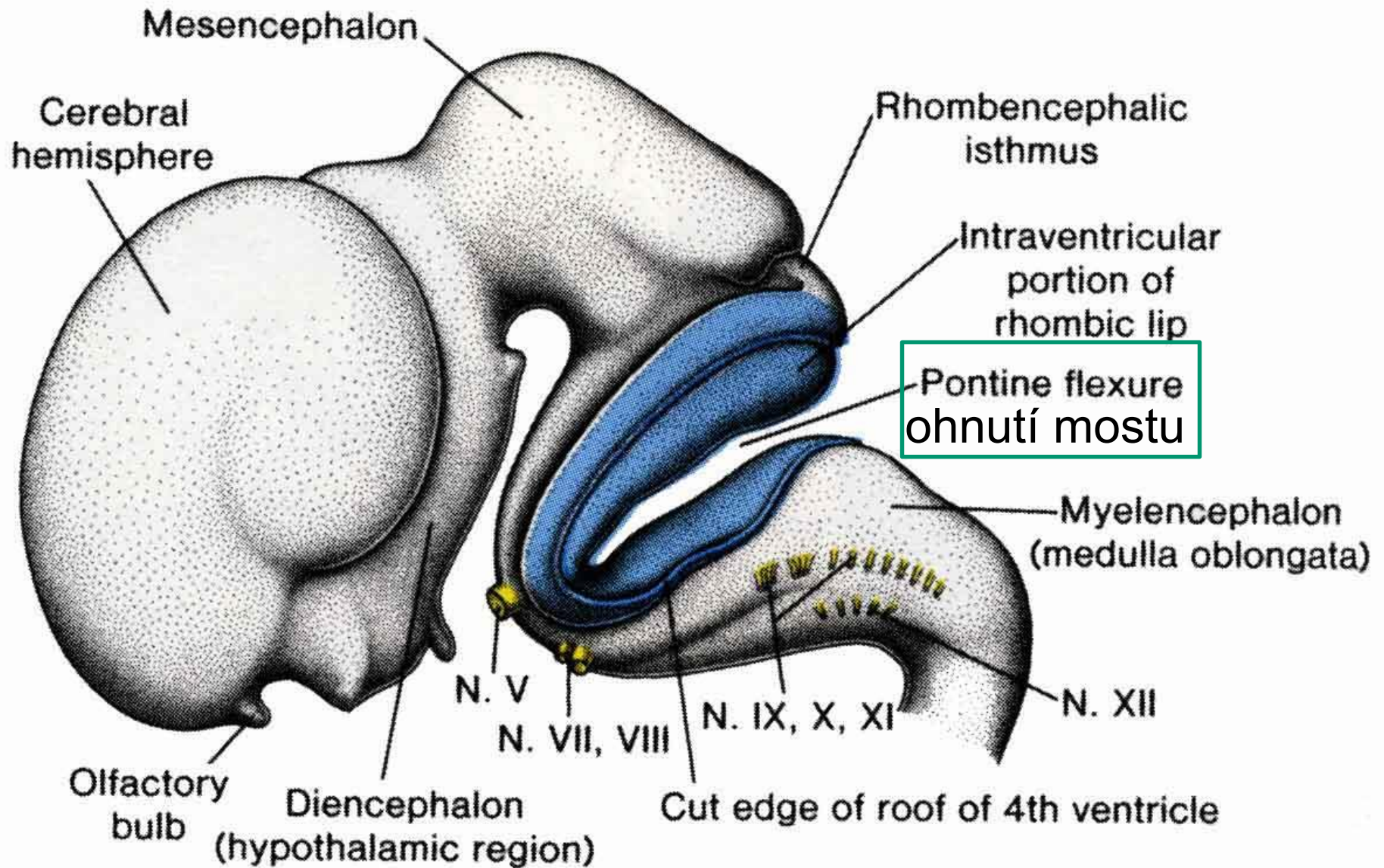
Mesen-
cephalon

Rhomben-
cephalon

lumen
spinal
cord

B





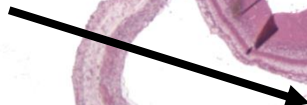
8th week

Lateral ventricle

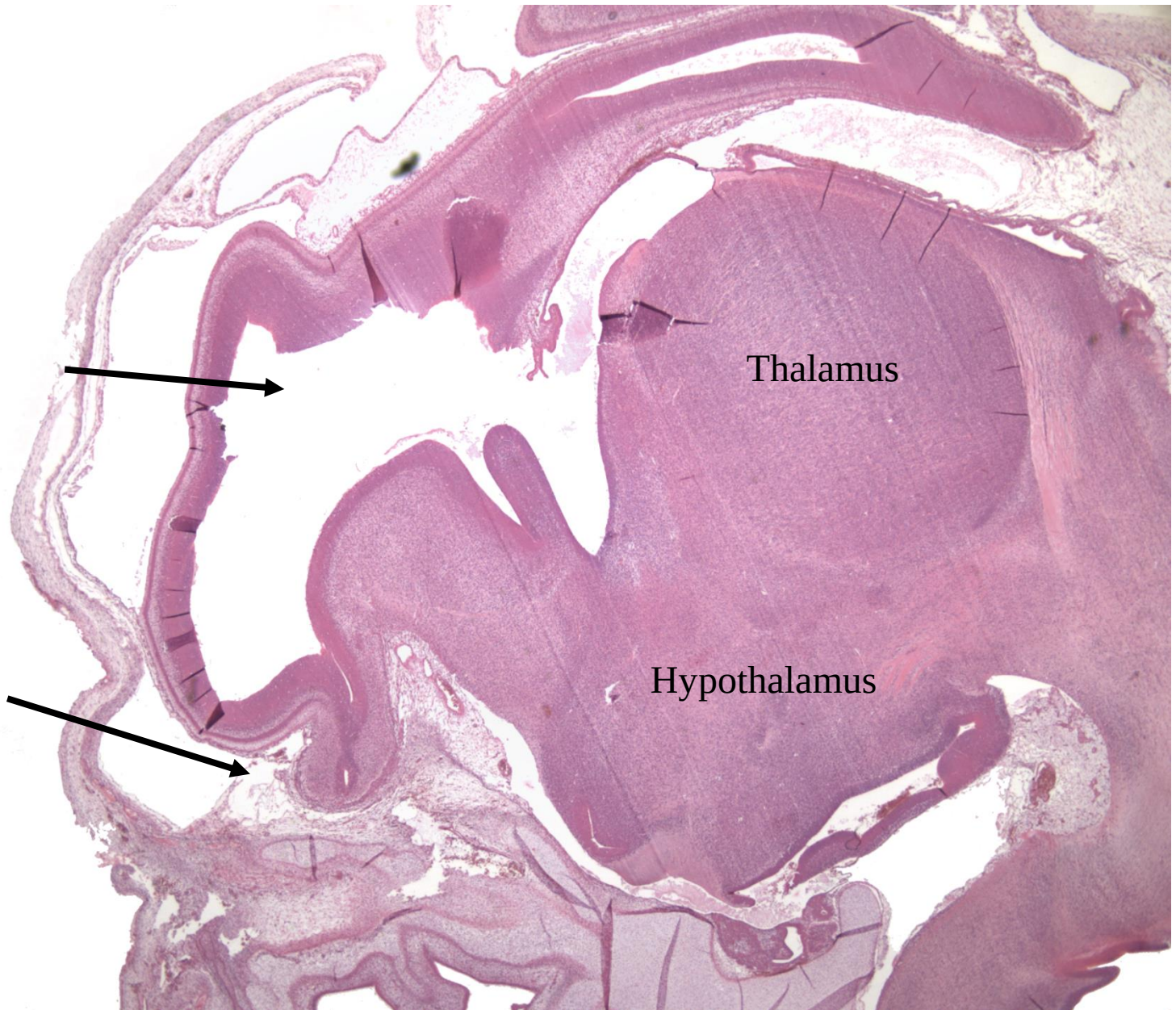


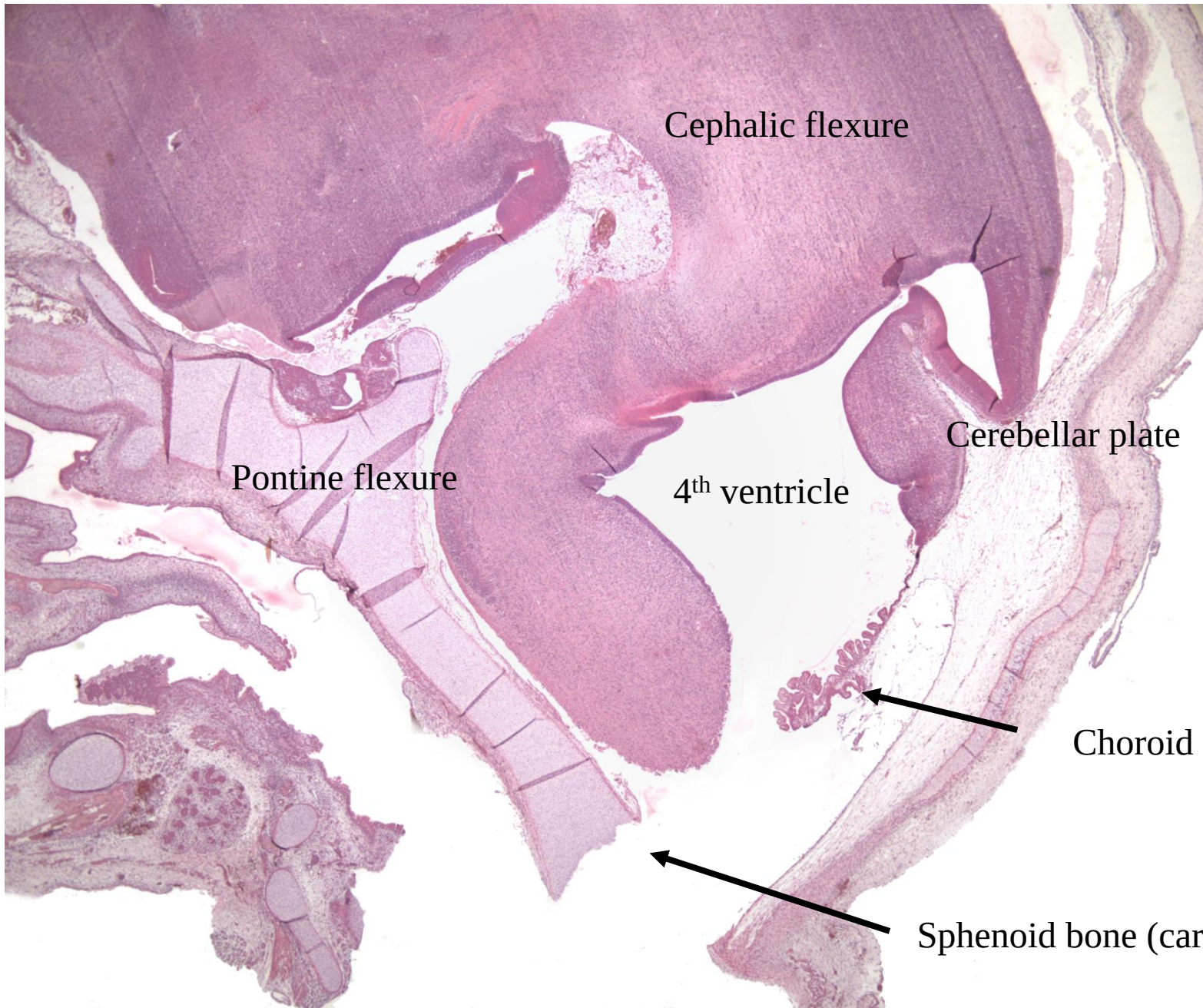
Thalamus

Olfactory bulb



Hypothalamus





Cephalic flexure

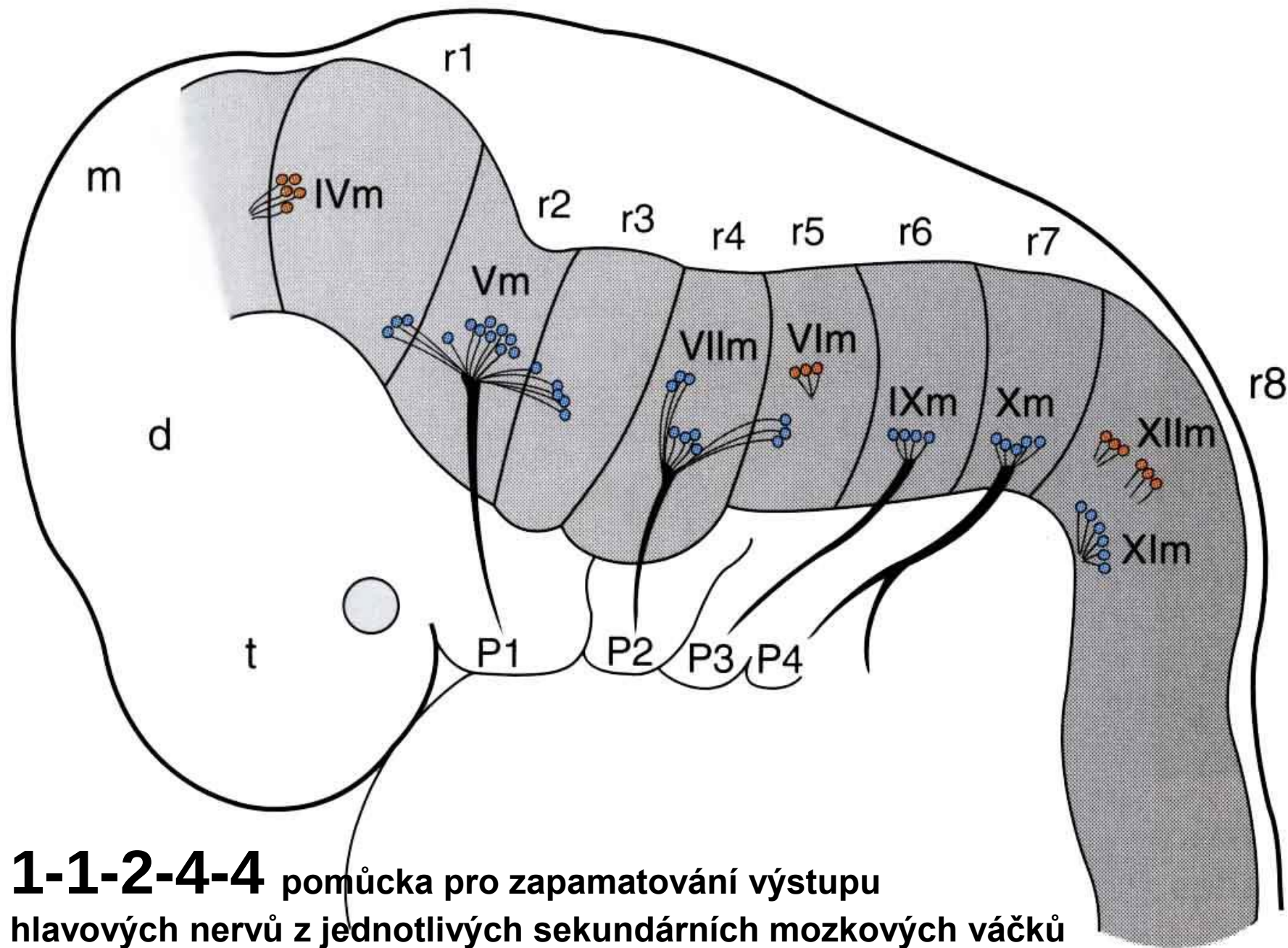
Cerebellar plate

Pontine flexure

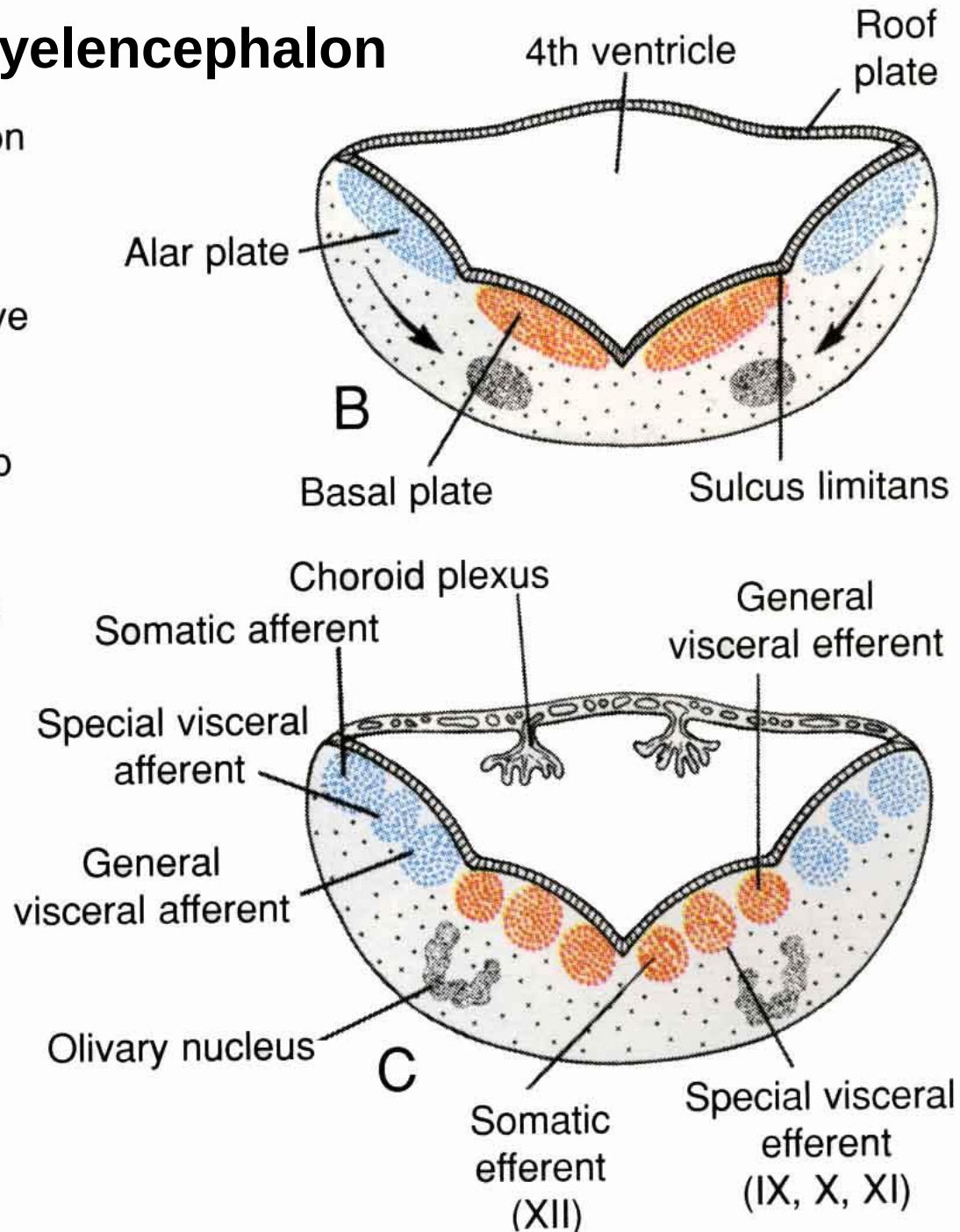
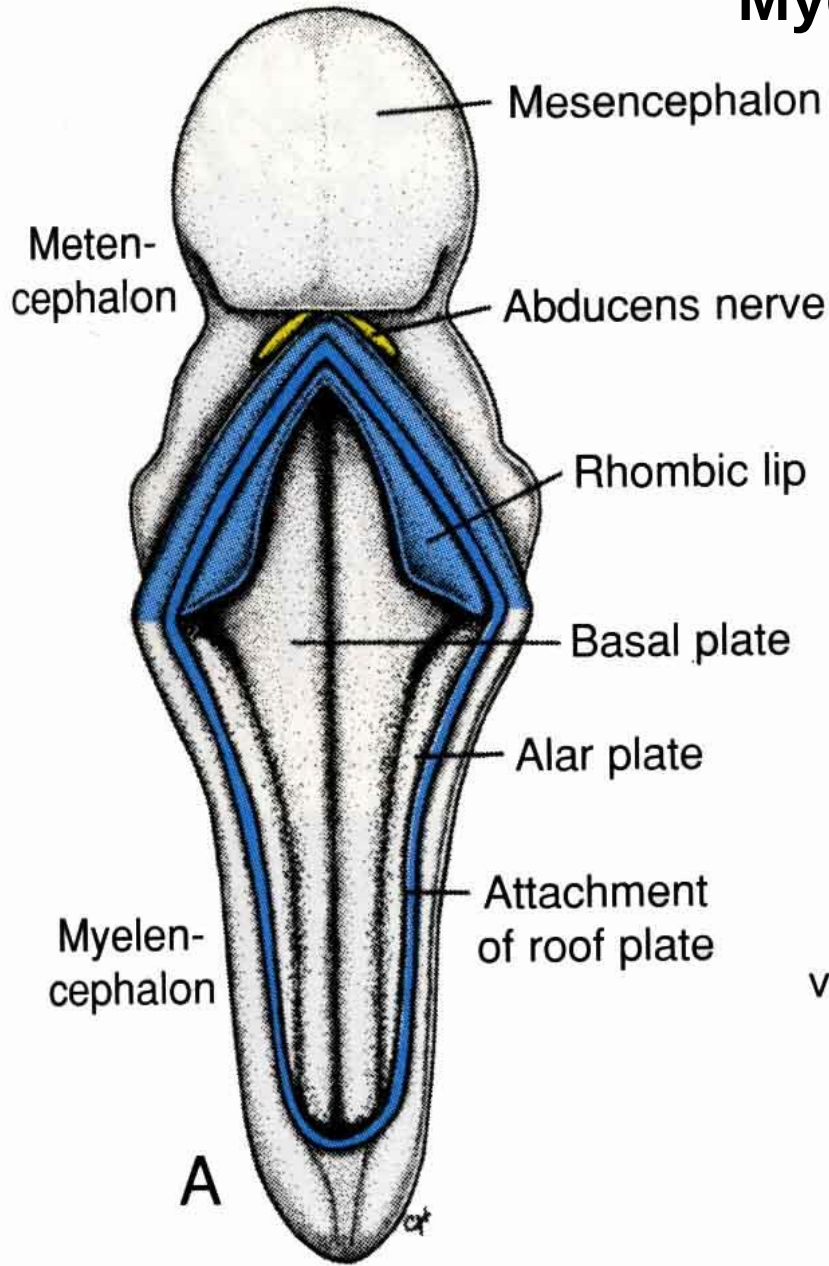
4th ventricle

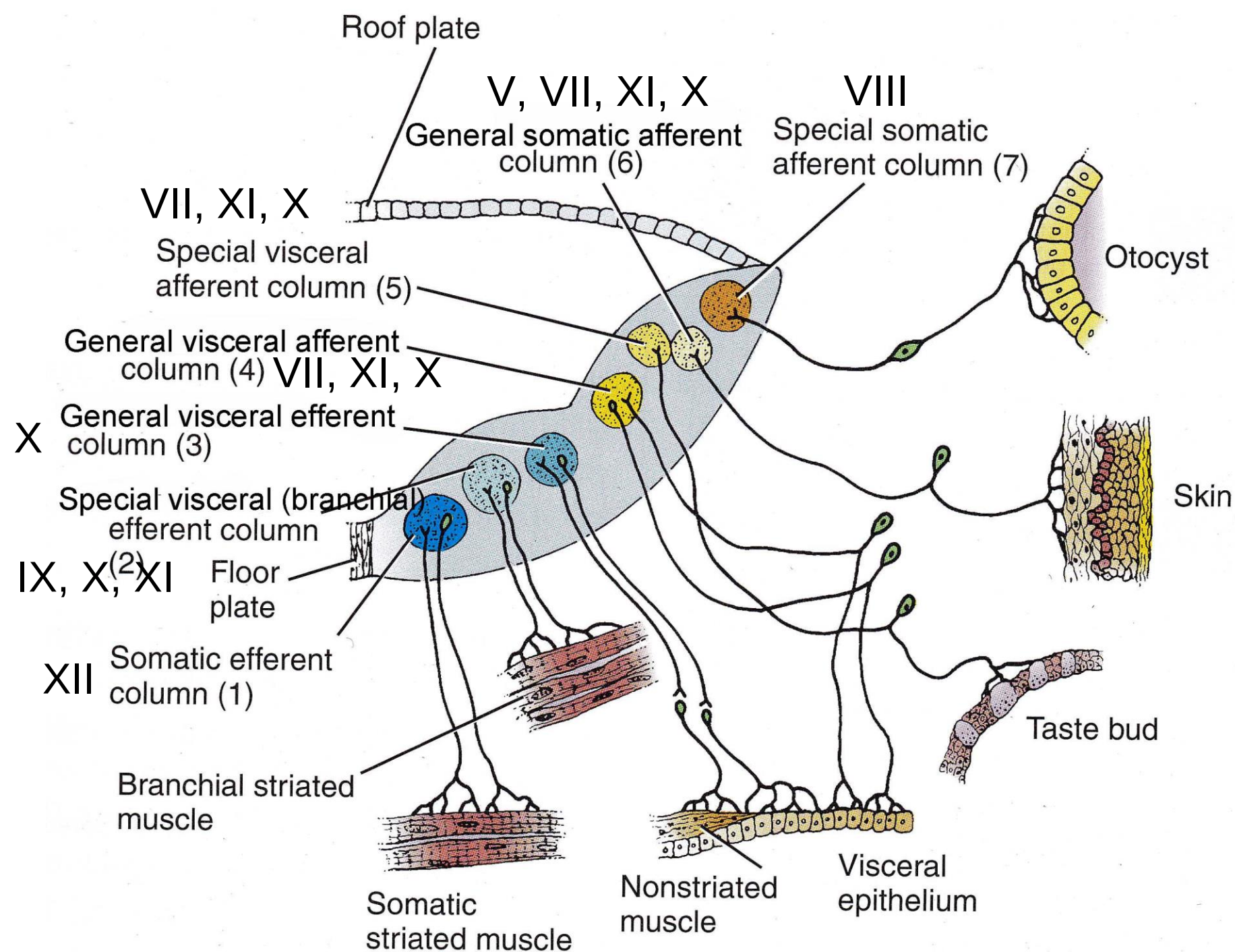
Choroid plexus

Sphenoid bone (cartilaginous)

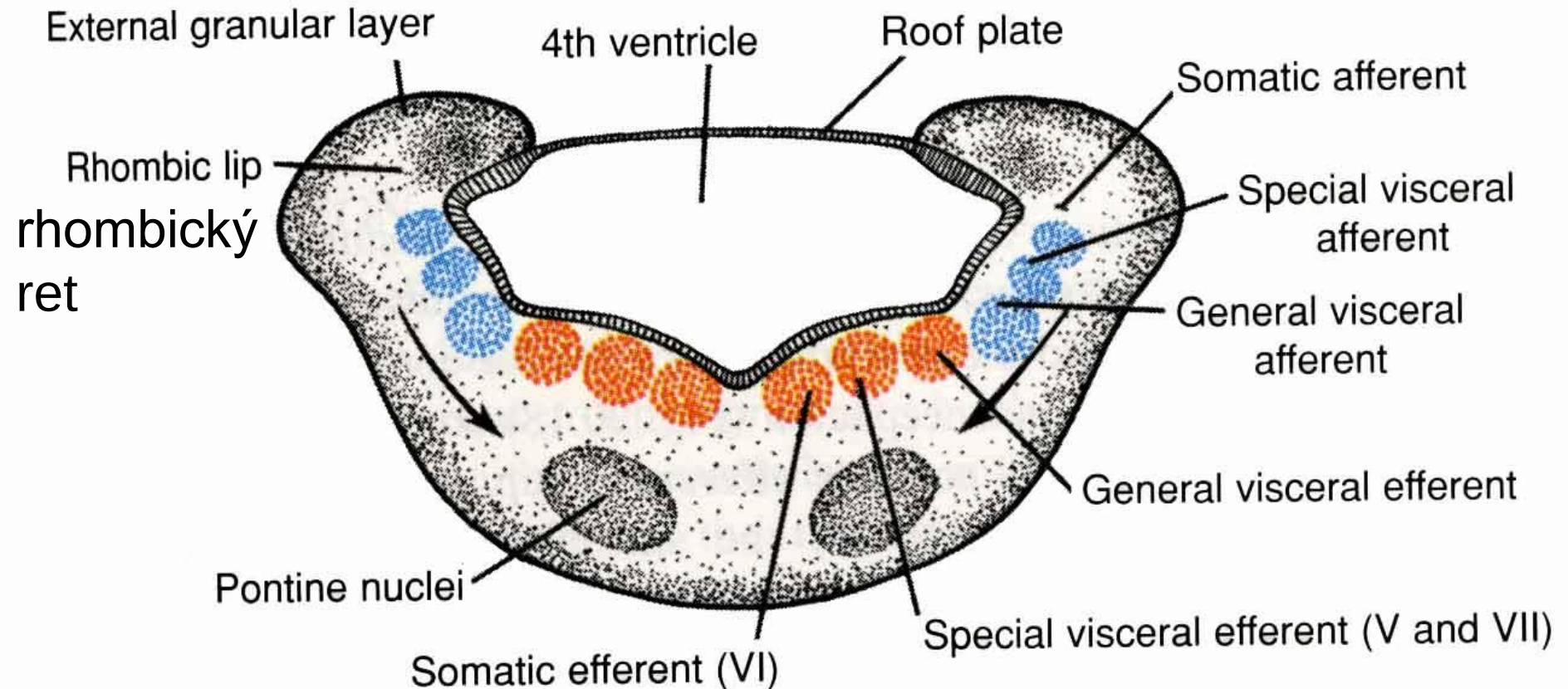


Myelencephalon

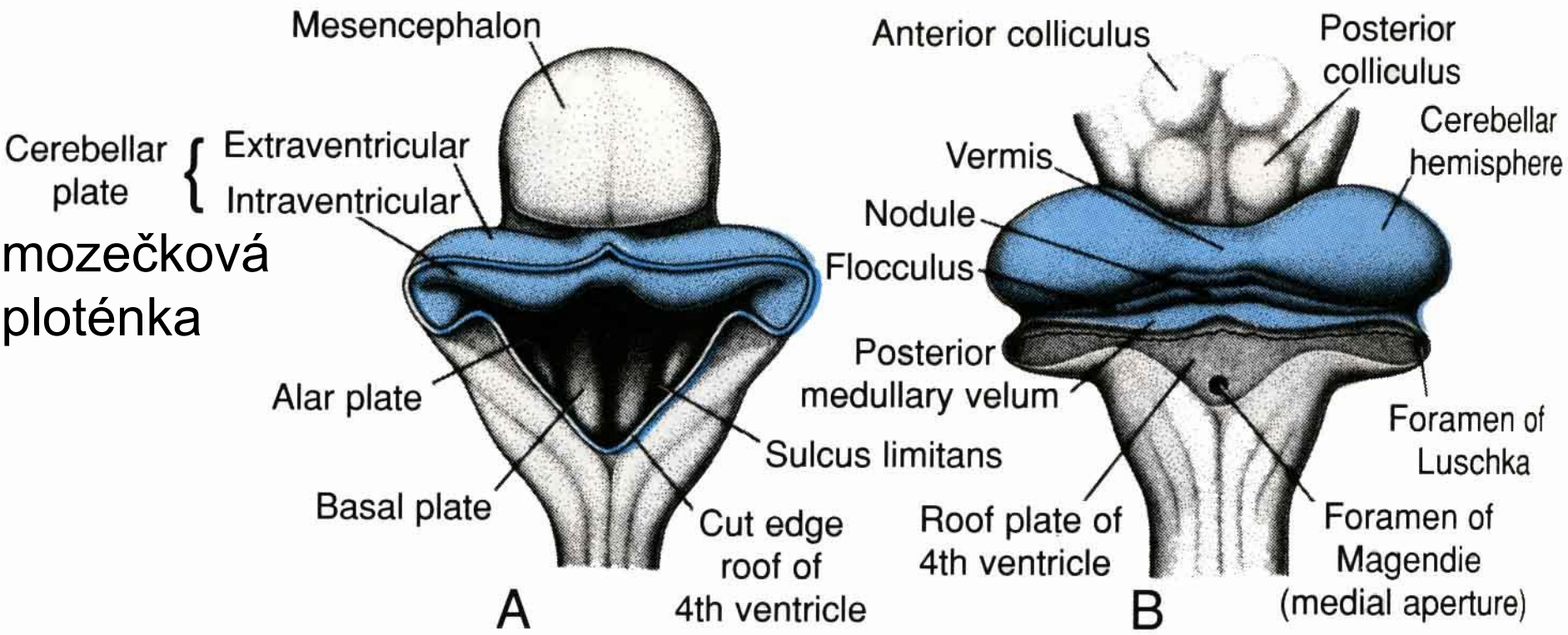




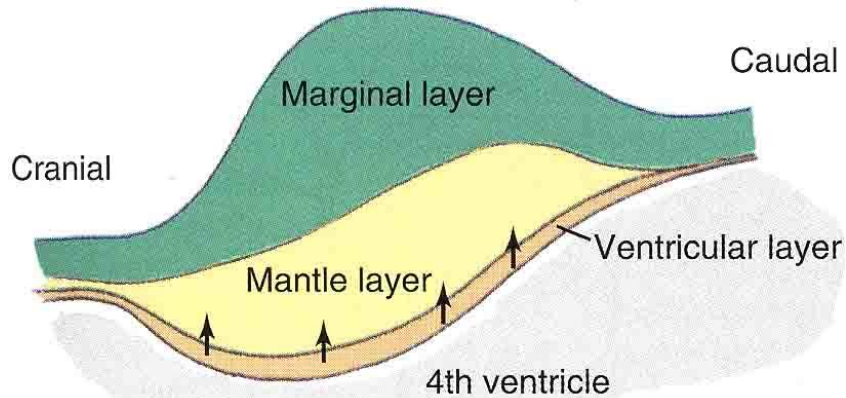
Metencephalon



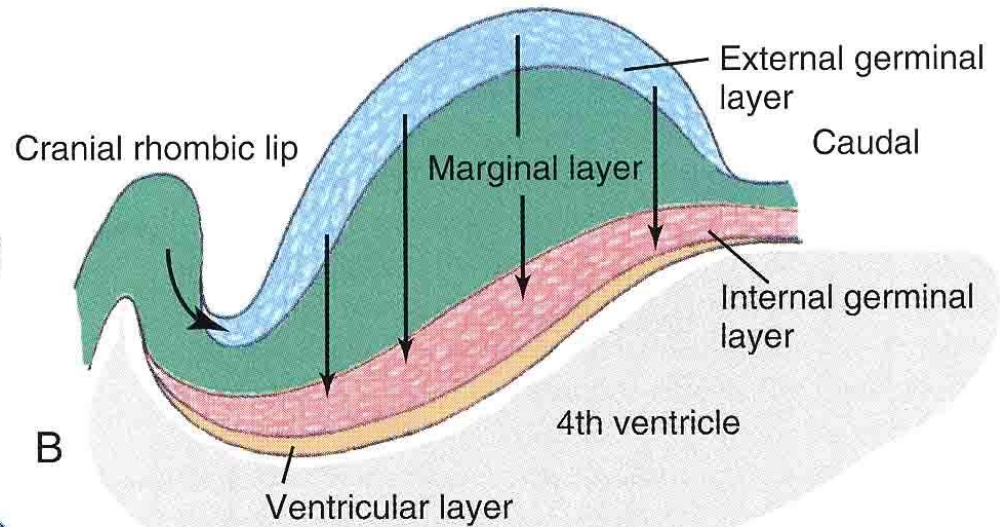
mozečková
ploténka



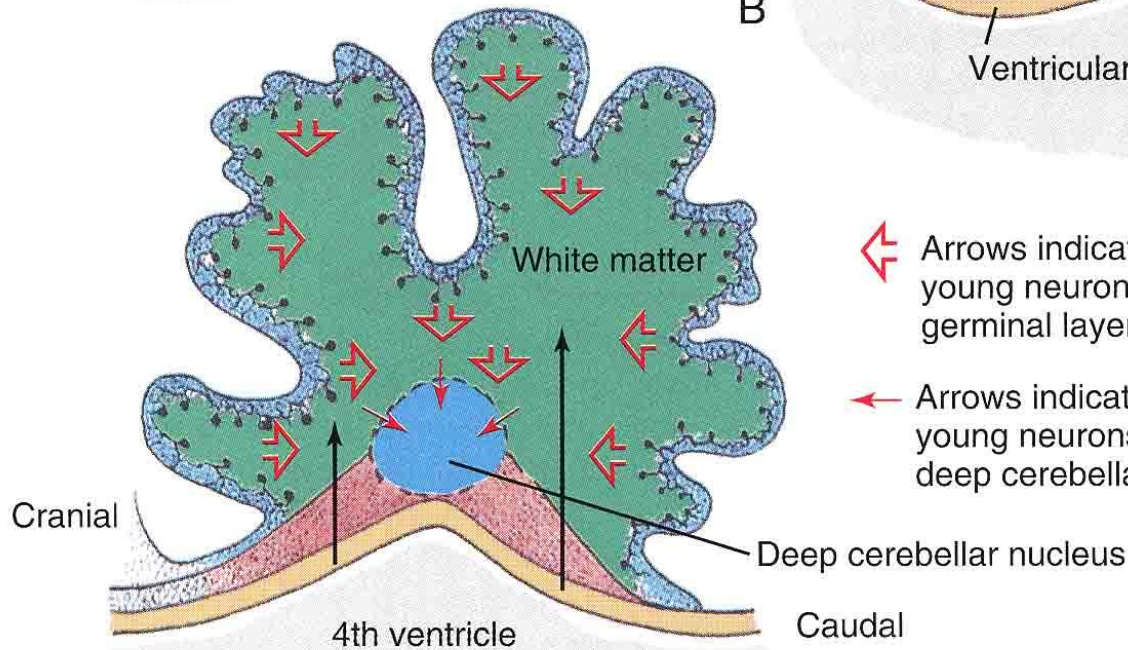
Parasagittal sections through the roof of the 4th ventricle



A



B

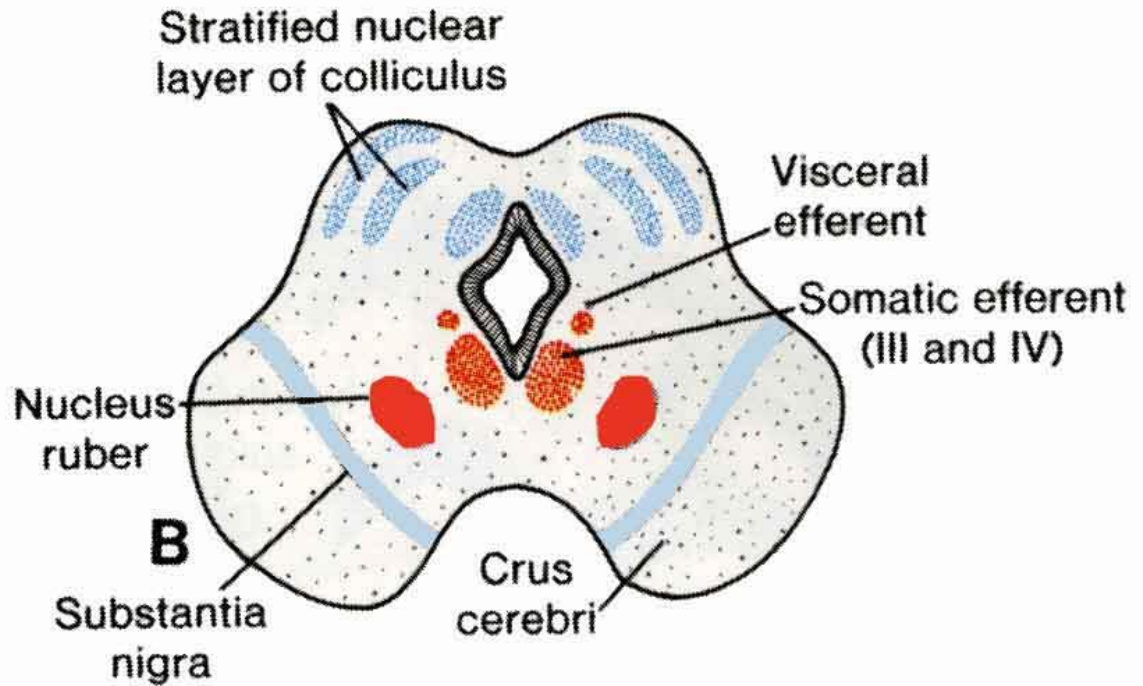
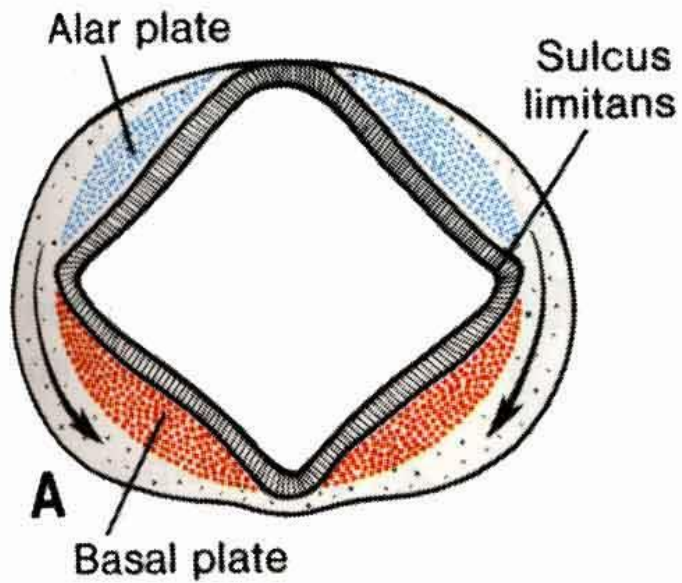


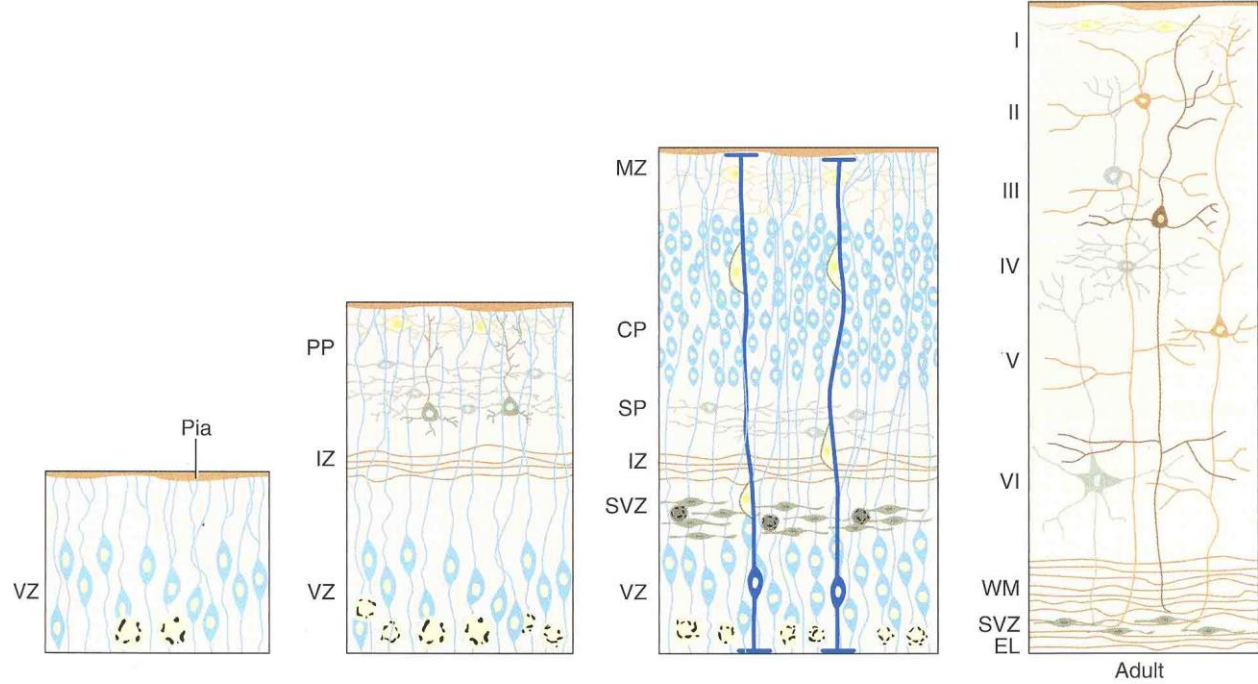
C

⇐ Arrows indicate directions of migrating young neurons from external germinal layer into white matter

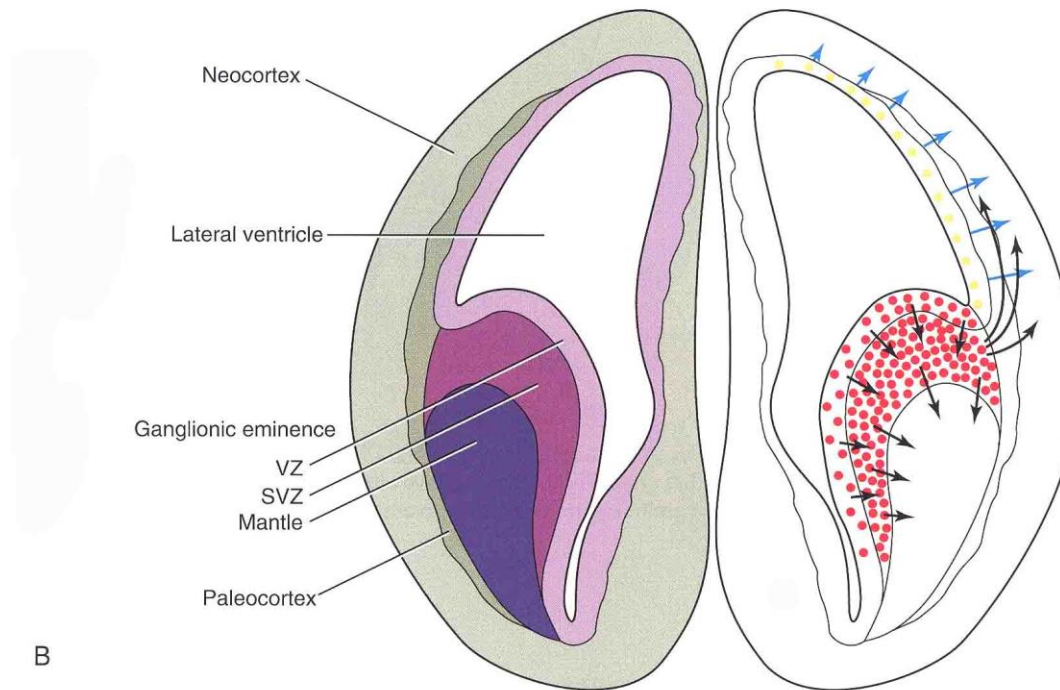
⇐ Arrows indicate continuing migration of young neurons from white matter into deep cerebellar nucleus on each side

Mesencephalon



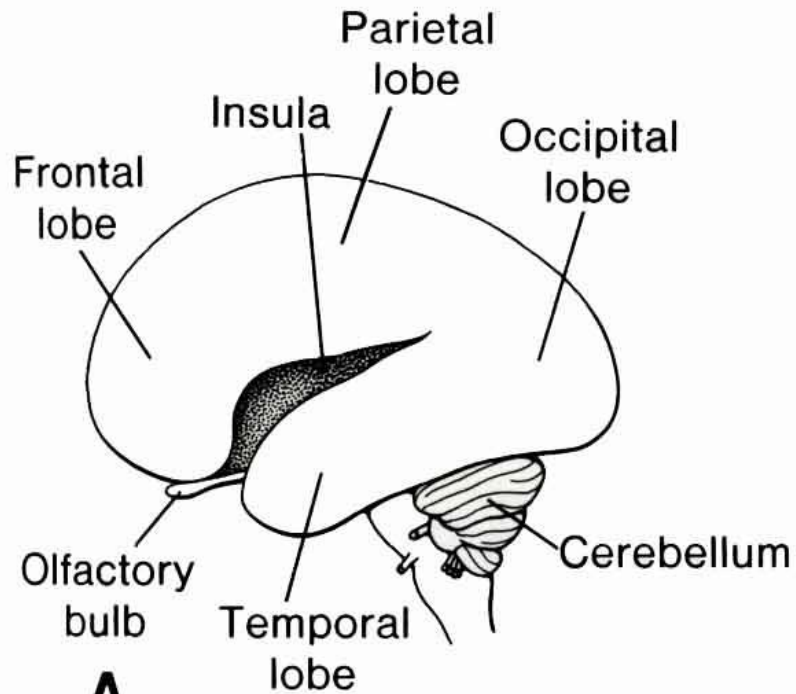


A



B

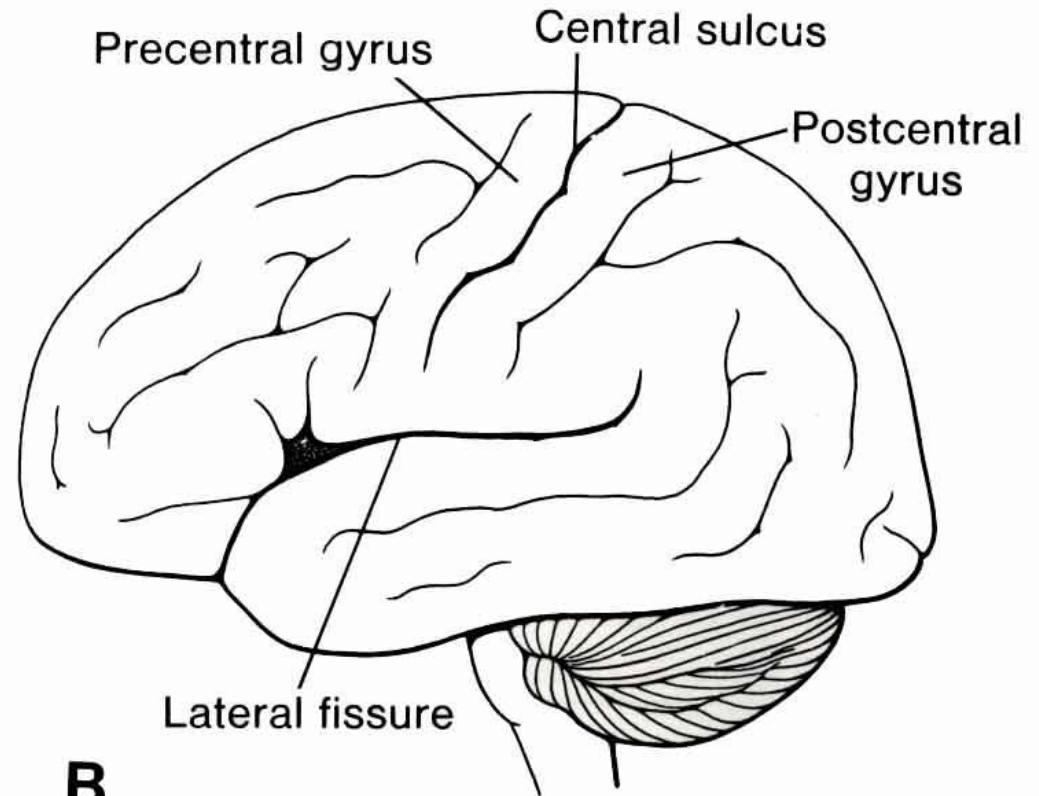
Lobace



A

7 months

Gyrifikace



B

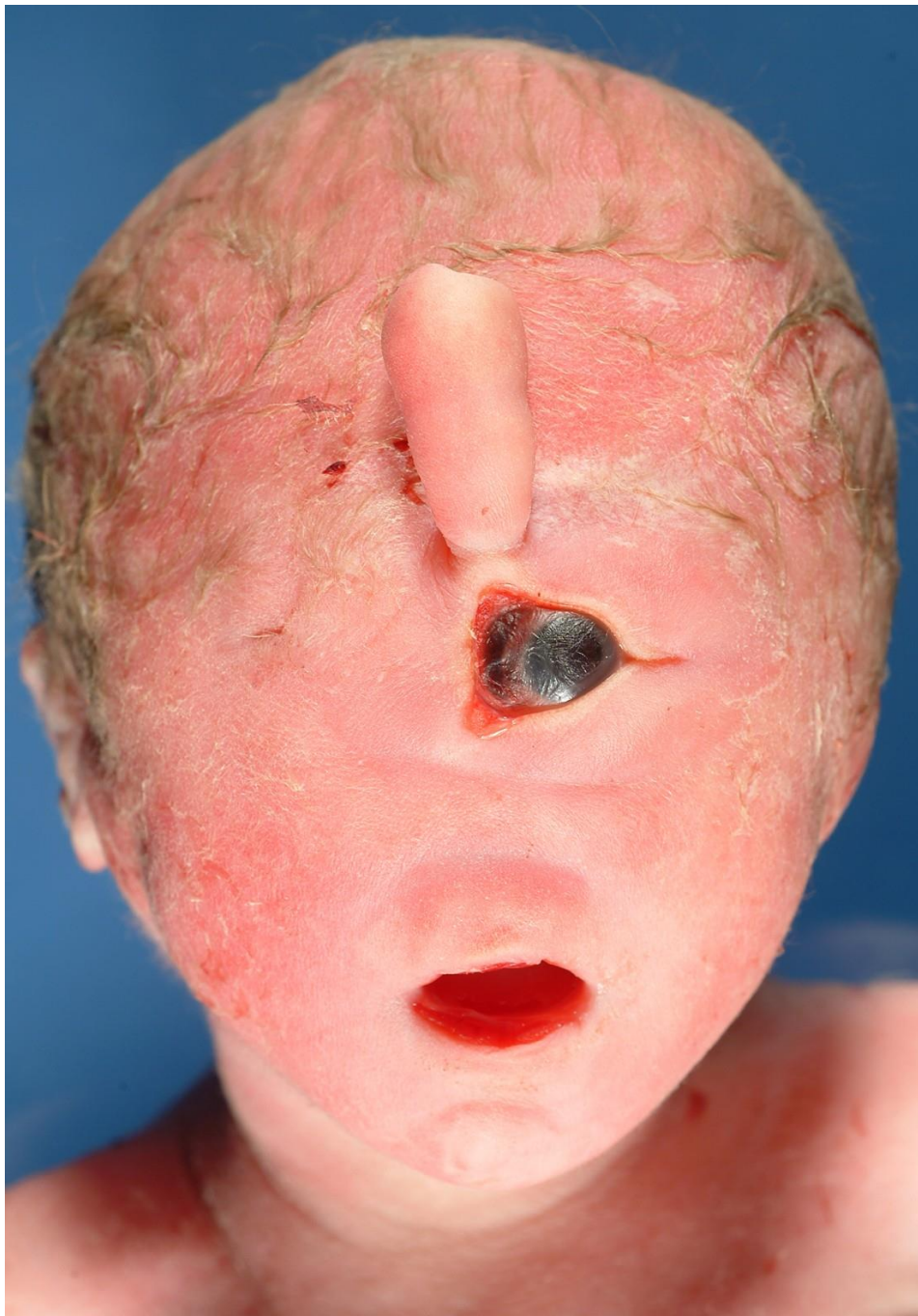
9 months



encefalokéla



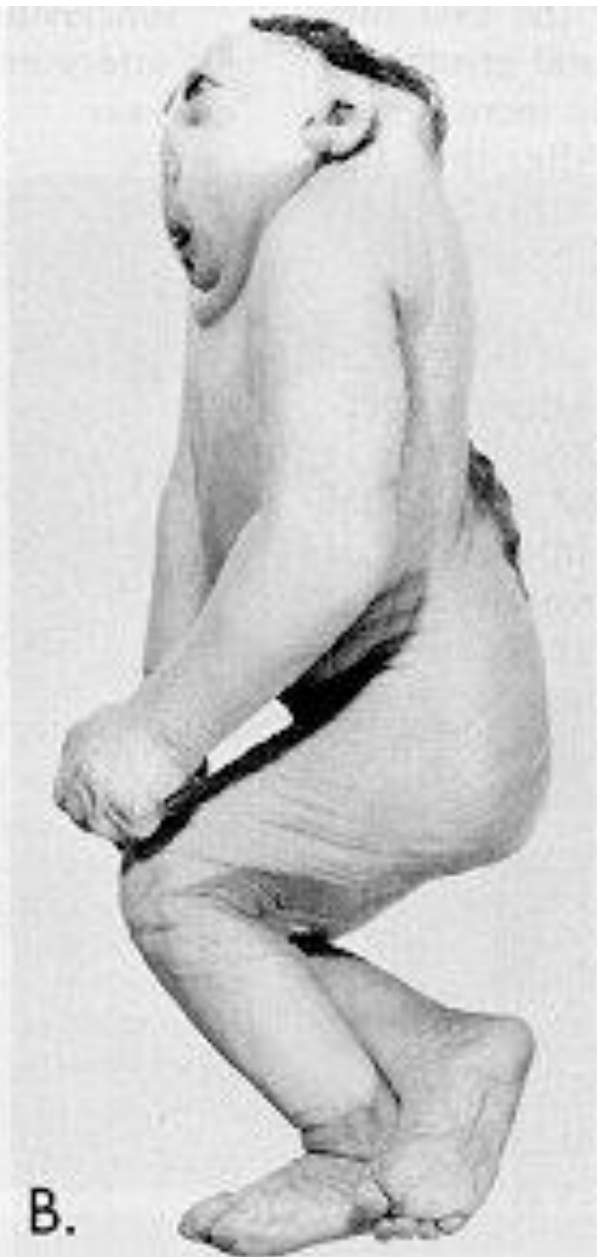
holoprosencefalie



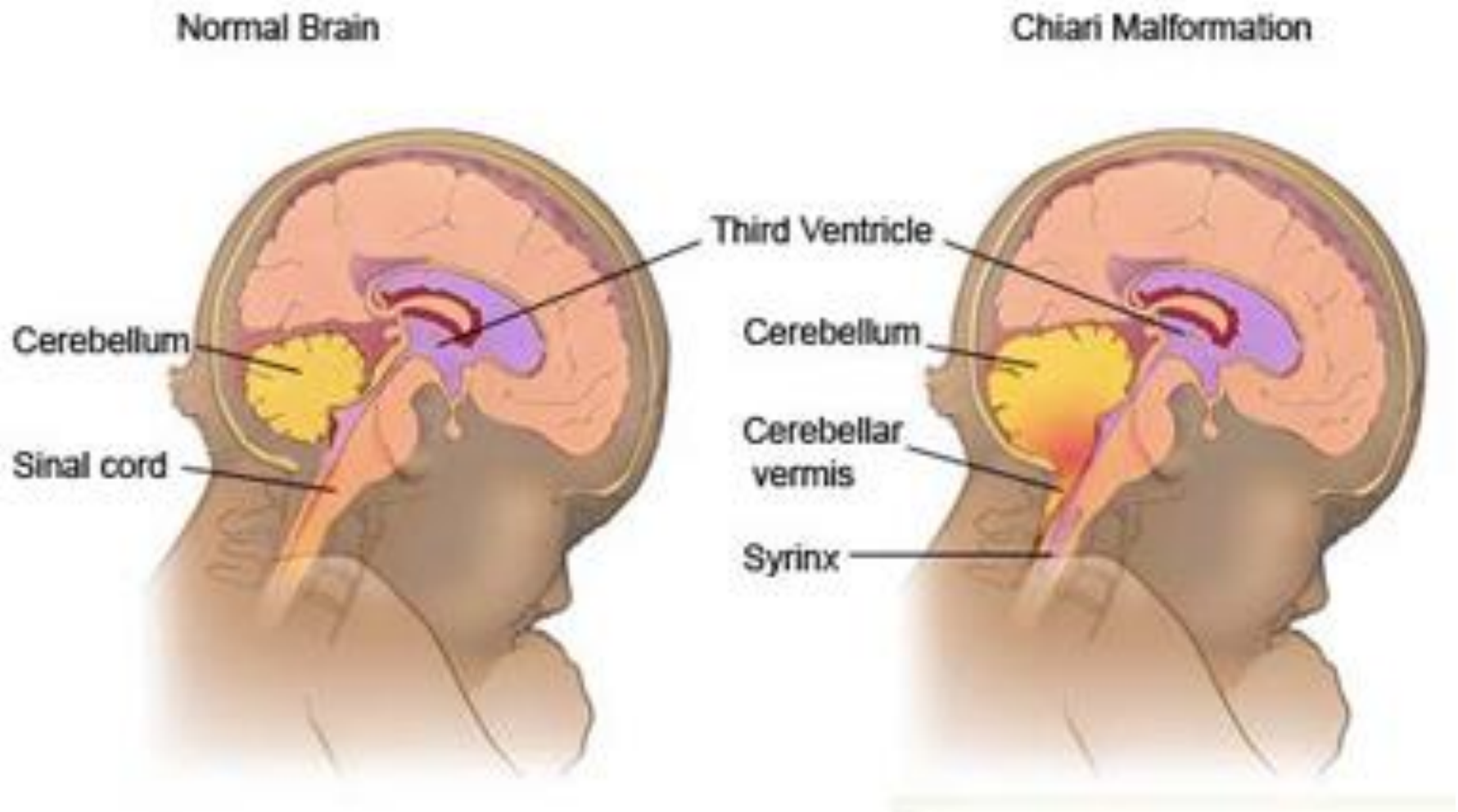
Anencefalie



kranioschíza



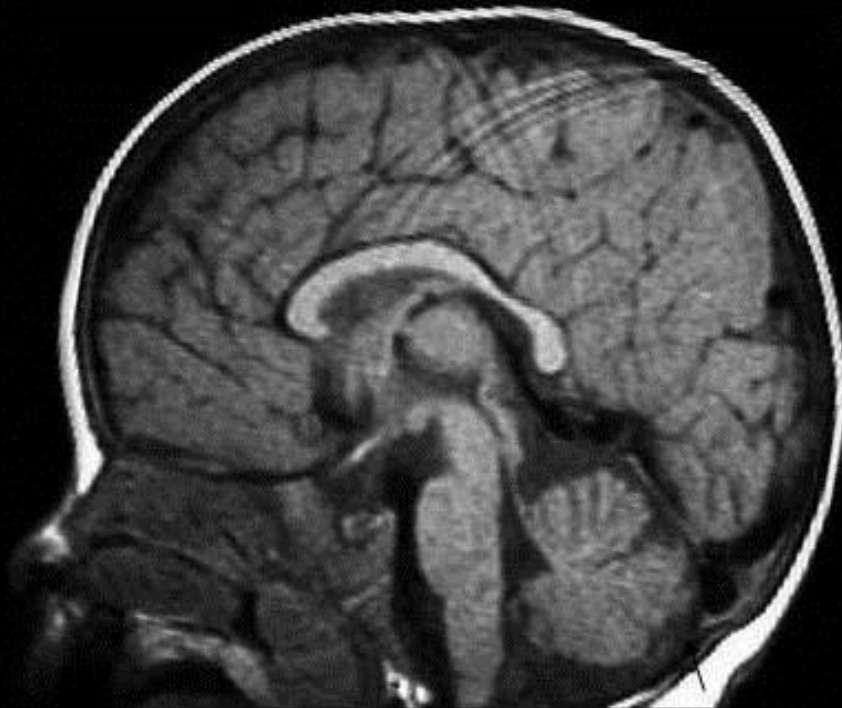
Chiari (Arnold-Chiari) malformace



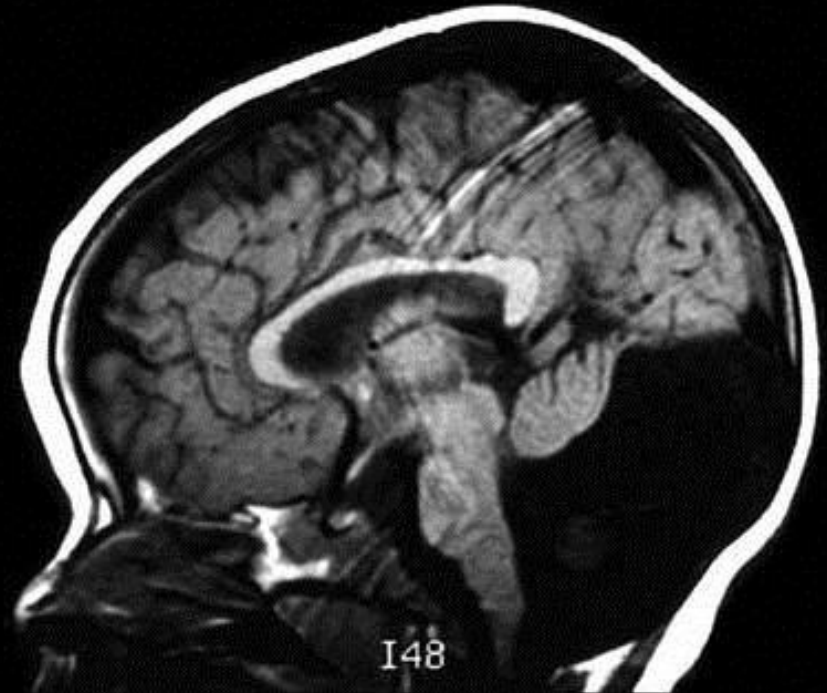
- **dystopie** mozečku a oblongáty **do páteřního kanálu**, která se klinicky projevuje hydrocefalem.



Normal



Dandy-Walker Malformation



kompletní nebo parciální **agenese vermis mozečku**
cystická **dilatace** čtvrté komory mozkové
zvětšení zadní jámy lební

THANK YOU



FOR YOUR ATTENTION