

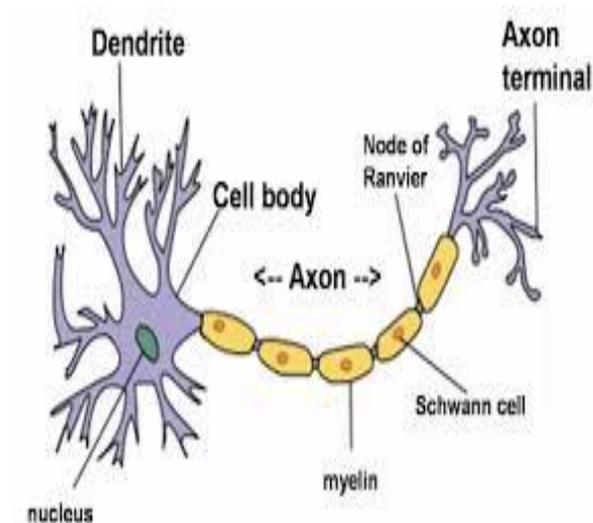
CNS
Spinal cord& Brain stem
LAB 1

DR. Heba Hassan Abd Elgawad

The spinal cord

- Internal structure of the spinal cord:
- The spinal cord contains a central canal in the middle that is surrounded by central grey matter and outer white matter.

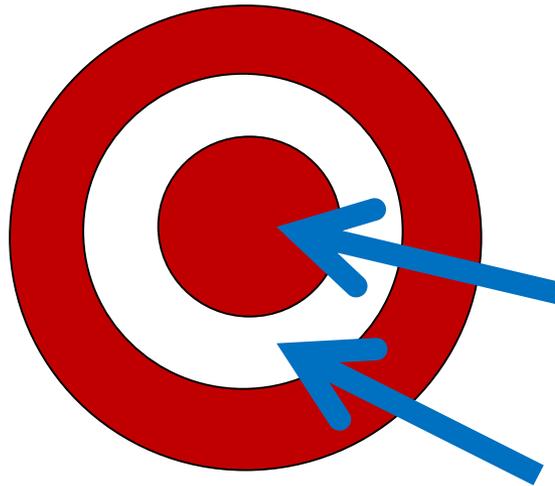
Grey matter	Bodies of nerve cells, dendrites, unmyelinated axons and neuroglia.
White matter	Many myelinated axons (form tracts which convey information into & out of CNS), few unmyelinated axons & neuroglia



The histological methods used in the study of the CNS:

- Routine stains such as **H & E** (*myelin not stained*).
- Myelin methods (**osmic acid**): white matter stains strongly, the grey matter remaining unstained.
- Immunohistochemical techniques using **antibodies** against proteins
- *Heavy metal impregnation (silver)*

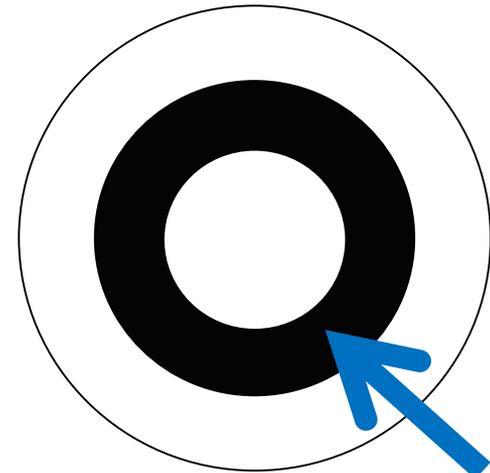
H&E



Axon

Myelin

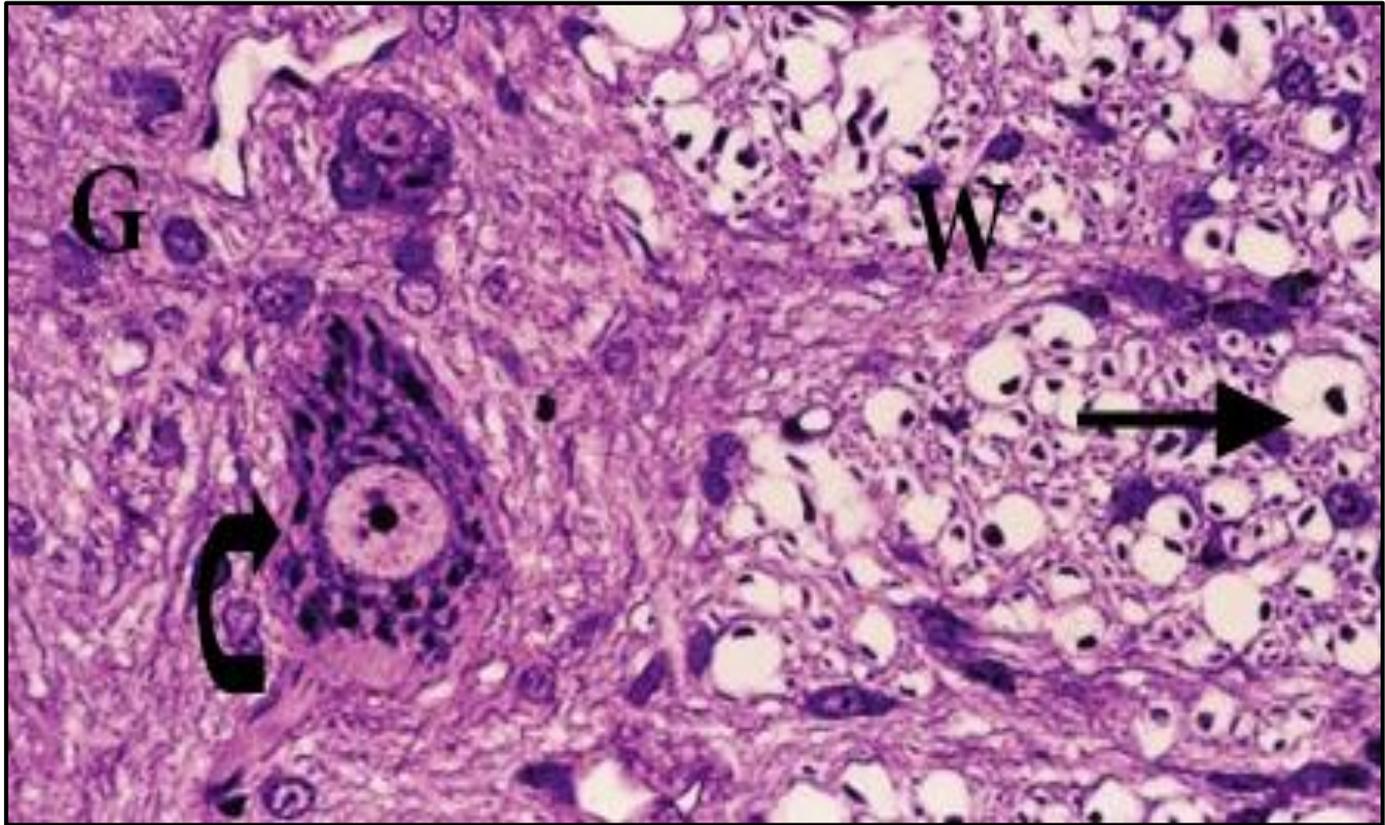
Osmic acid



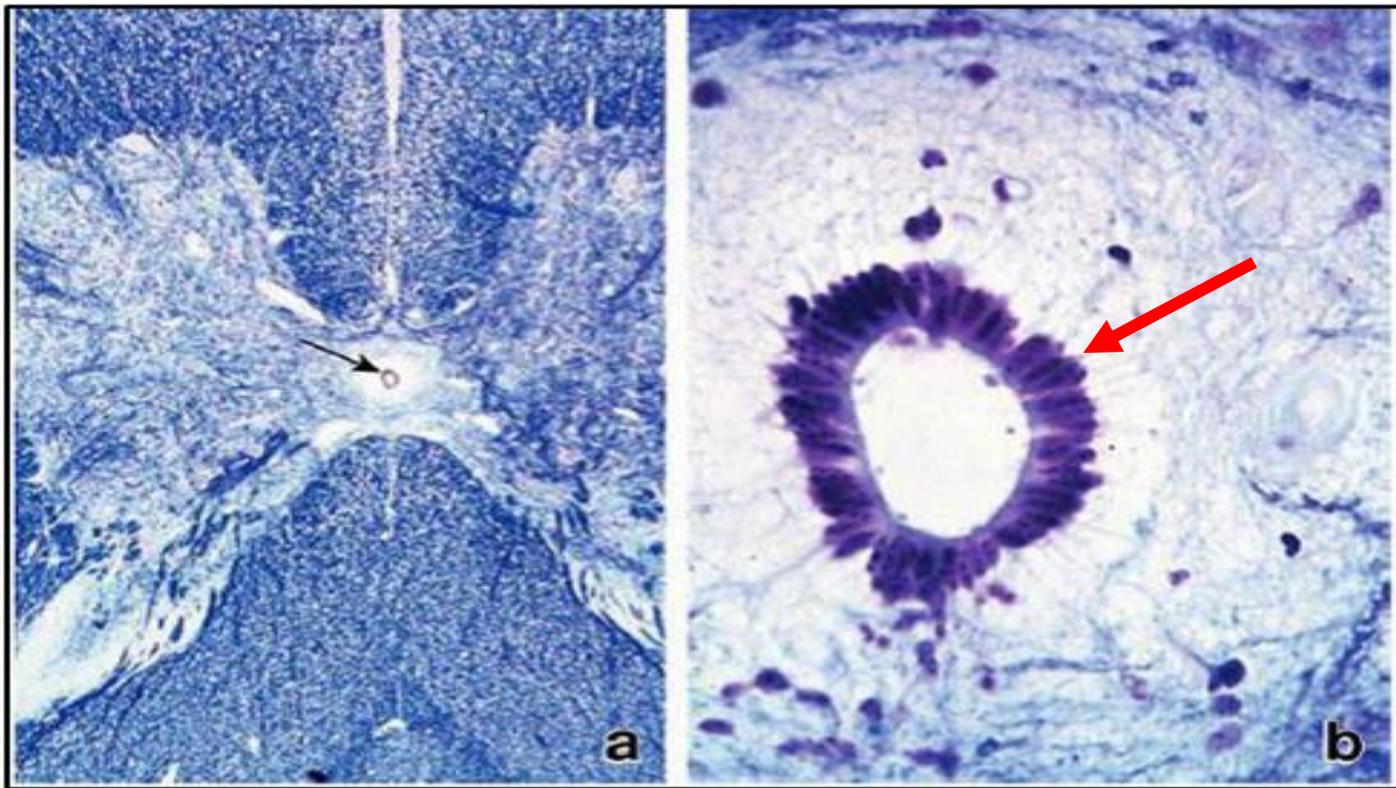
Myelin

In section stained with **H&E** nerve fiber appears as •
eosinophilic dot of the axon surrounded by unstained
zone (myelin sheath).

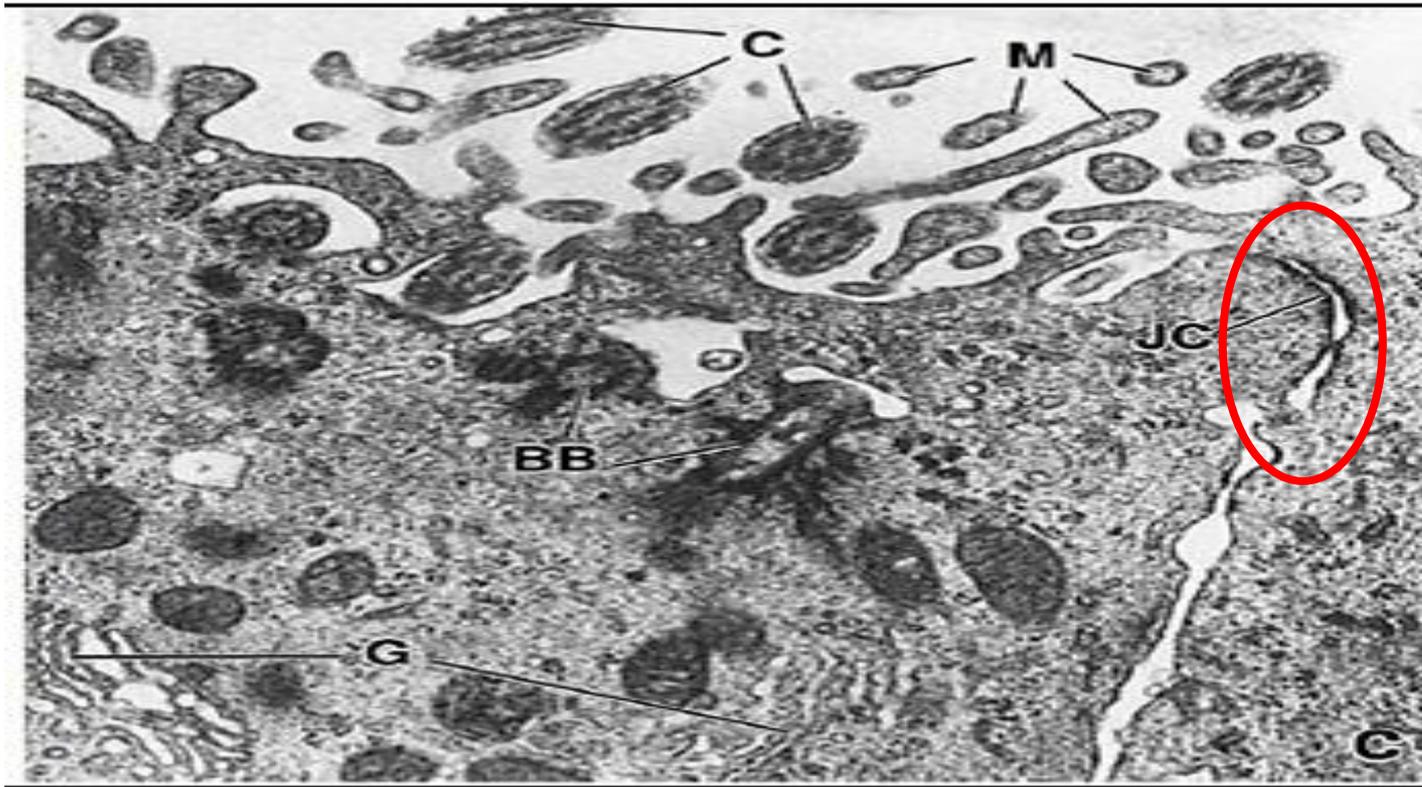
In section stained with **osmic acid**, only myelin sheath •
is stained and appears as black circle.



- Cross section of the grey (G) and white (W) matter of the spinal cord. Notice the neurons (curved arrow) of the grey matter and the myelinated nerve fibers (arrow) of the white matter.



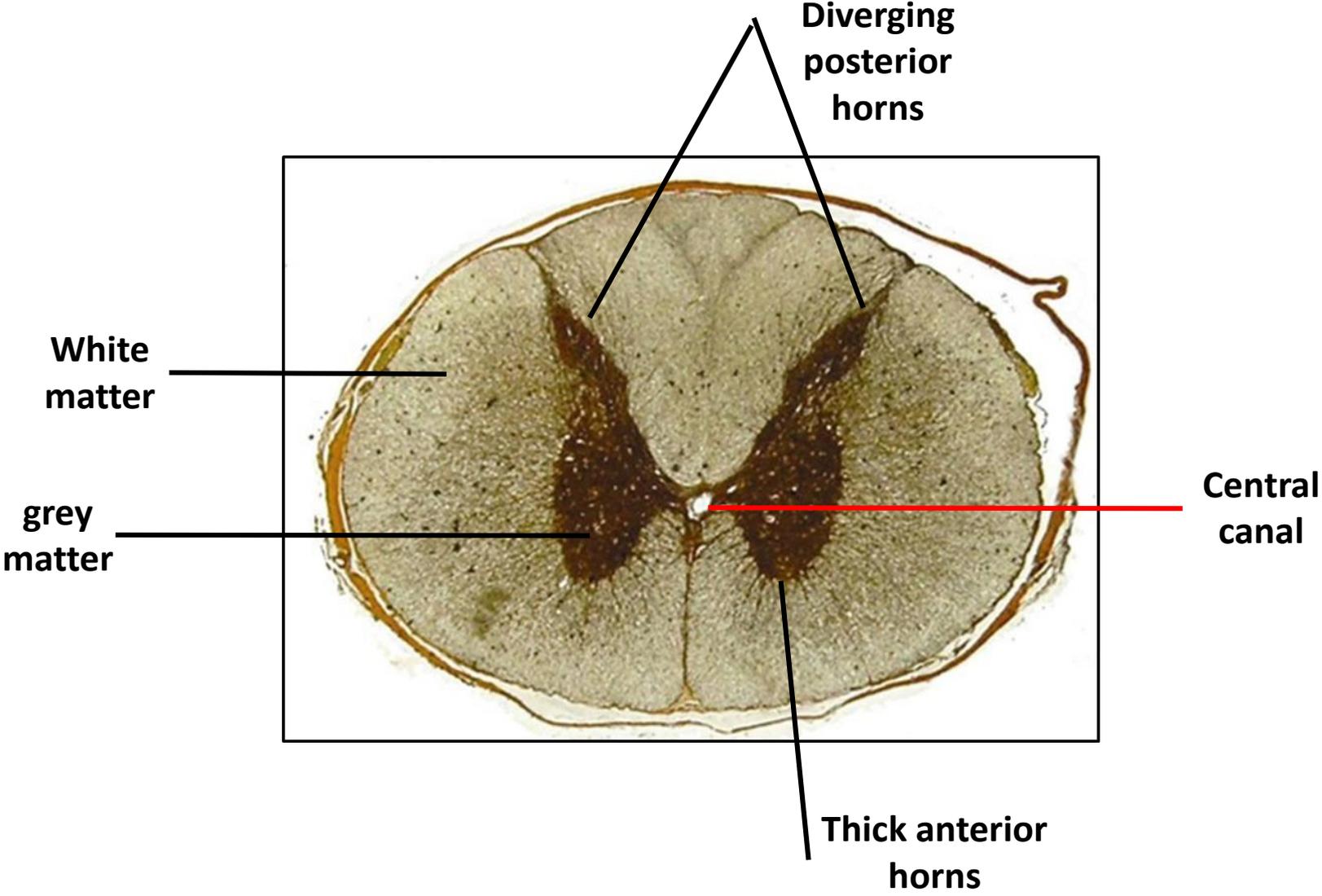
- Photomicrograph of the central region of the spinal cord stained with toluidine blue. The *arrow* points to the central canal.
- b) At higher magnification, ependymal cells, which line the central canal, consist of single layer of columnar cells.



- c) Electron micrograph shows portion of the apical region of two ependymal cells. They are joined by junctional complex (*JC*). The apical surface has cilia (*C*) and microvilli (*M*).

	Cervical	Thoracic	Lumbar
Shape	Oval	Round	Oval
Central canal	More anterior	Slight anterior	Central
Posterior horns	Thin & diverging	Thin & parallel	Thick & parallel
Anterior horns	Thick	Thin & parallel	Thick & parallel
Lateral horns	-----	Present	Present (L1-L3) only
White matter	Abundant	Large compared to grey matter	Very little compared to grey matter

Spinal cord at cervical segment (silver stain)

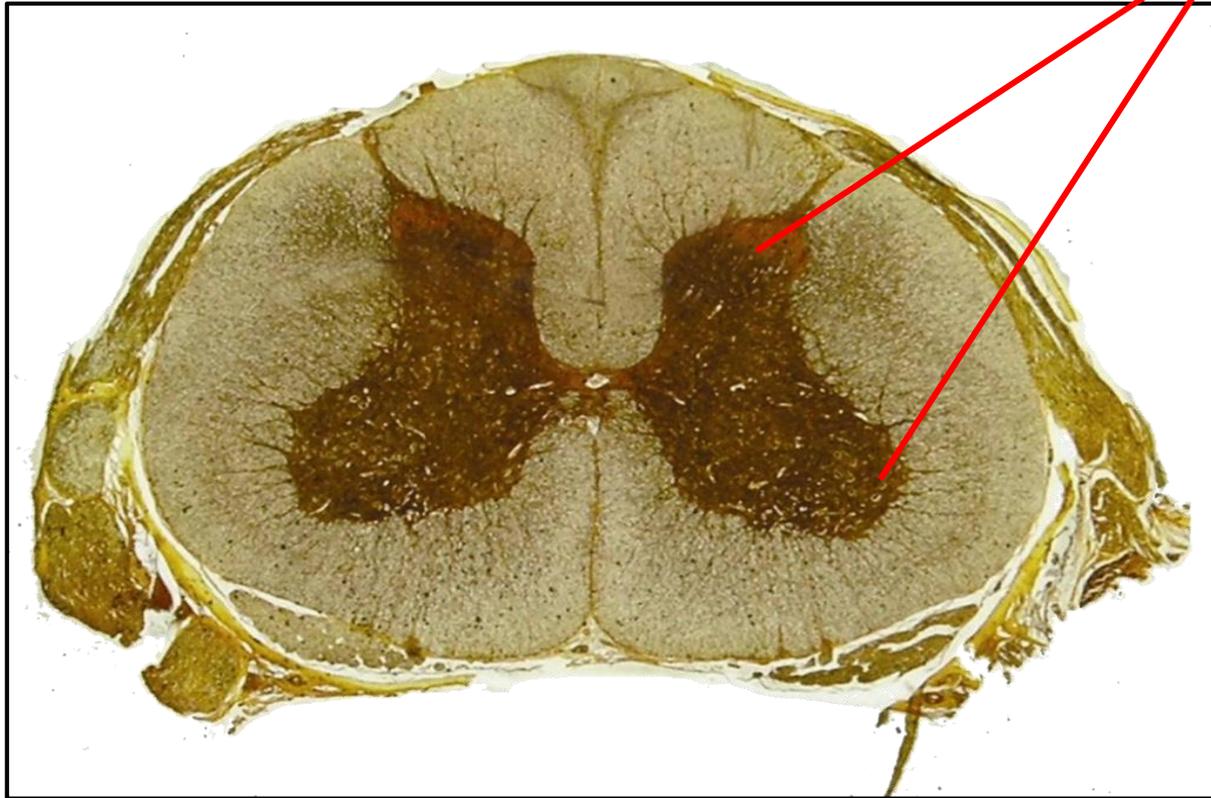


Spinal cord at thoracic segment (silver stain)



**Thin parallel
anterior &
posterior horns**

Spinal cord at lumbar segment (silver stain)



**Thick parallel
anterior &
posterior horns
(boot shaped)**

Forebrain
(cerebrum)

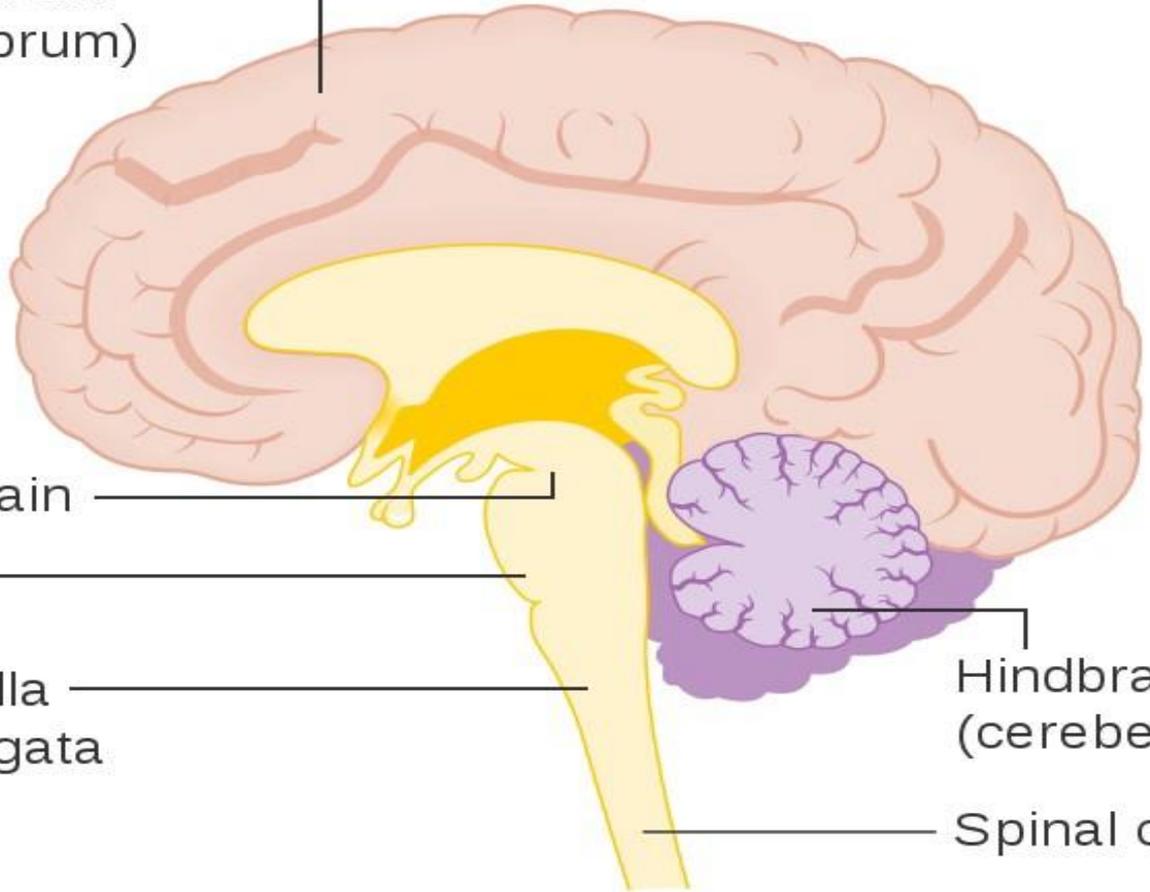
Midbrain

Pons

Medulla
oblongata

Hindbrain
(cerebellum)

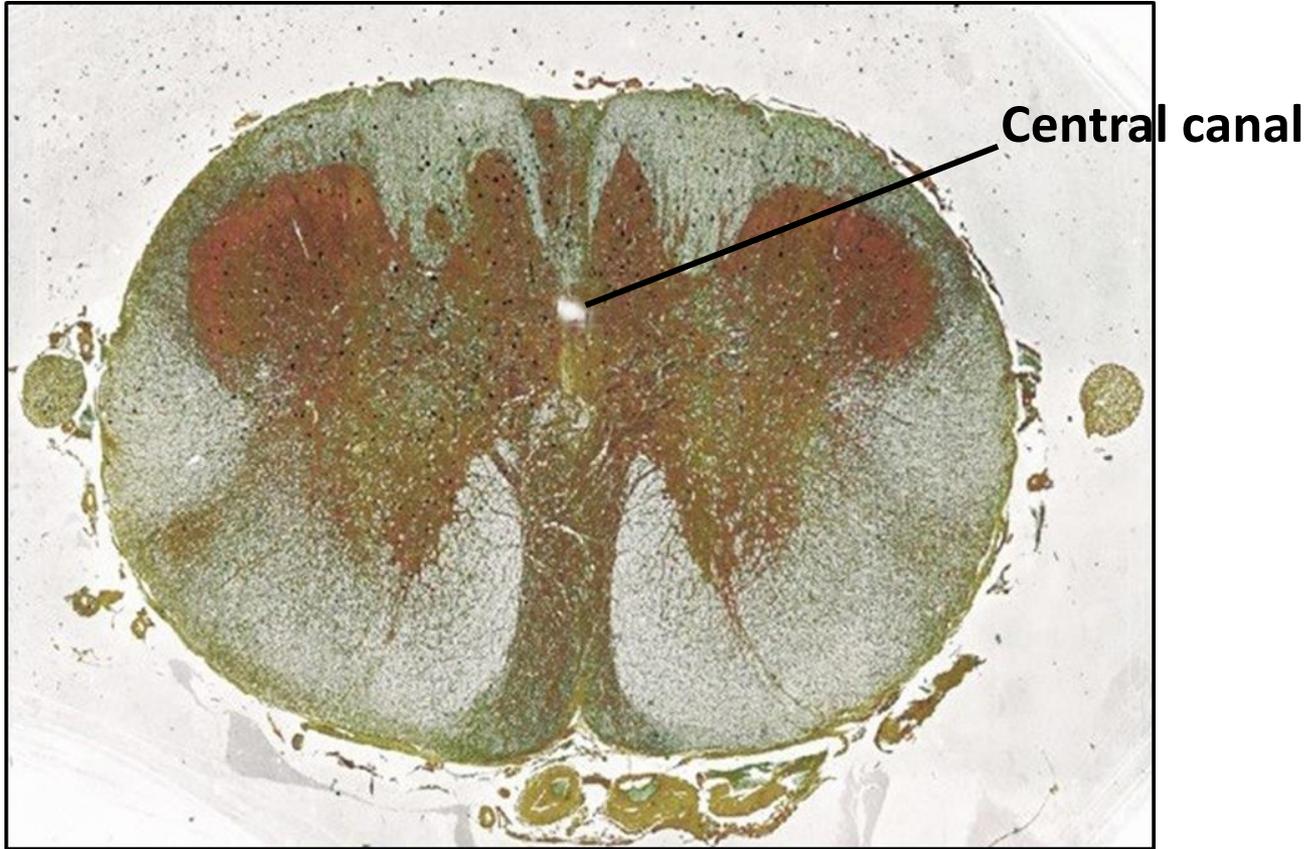
Spinal cord



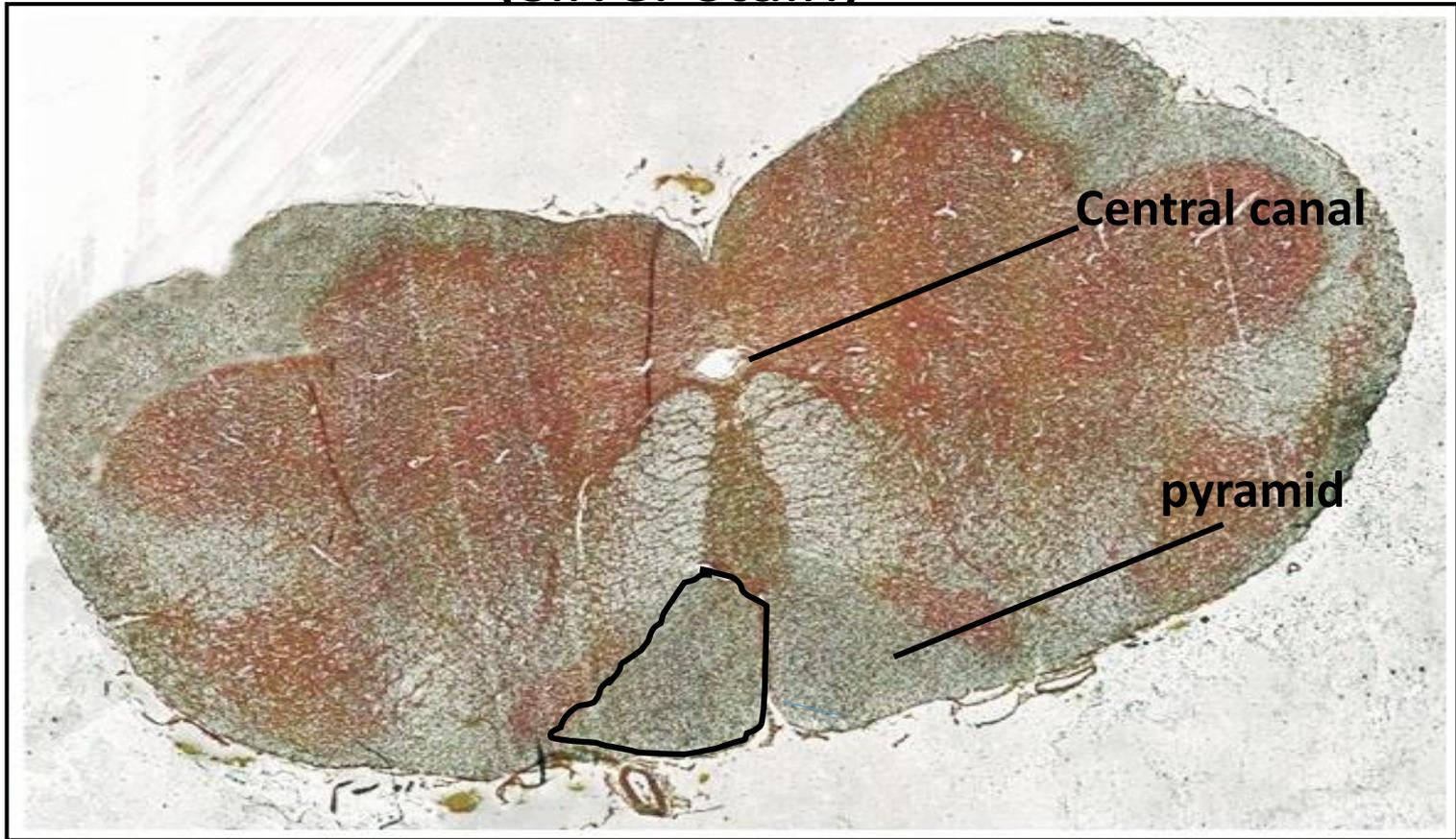
Medulla oblongata

- Levels of the medulla oblongata:
- Closed medulla oblongata:
 - a- Lower part which contains motor (pyramidal) decussation
 - b- Upper part which contains sensory decussation
- Open medulla oblongata

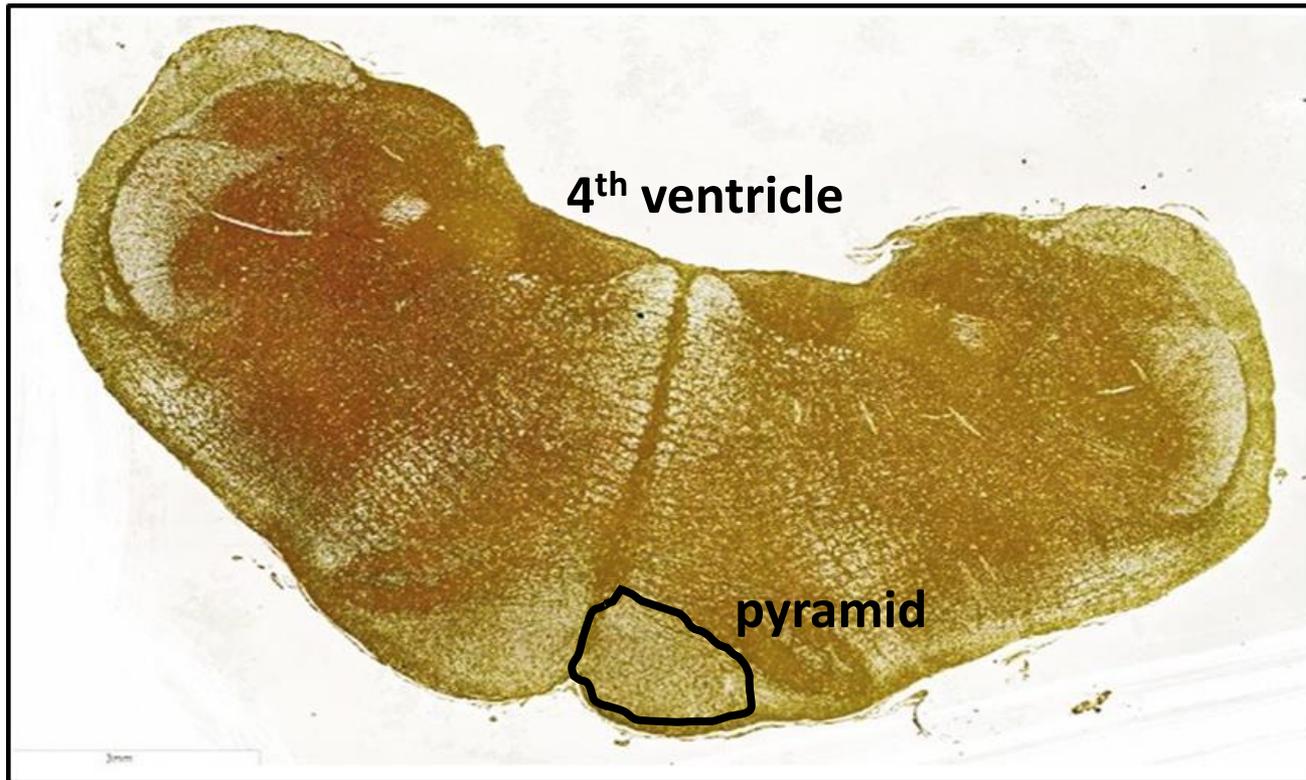
Closed medulla oblongata (motor decussation) (silver stain)



Closed medulla oblongata (sensory decussation) (silver stain)



Open medulla oblongata (silver stain)



CNS lab 2

DR. Heba Hassan Abd Elgawad

The midbrain

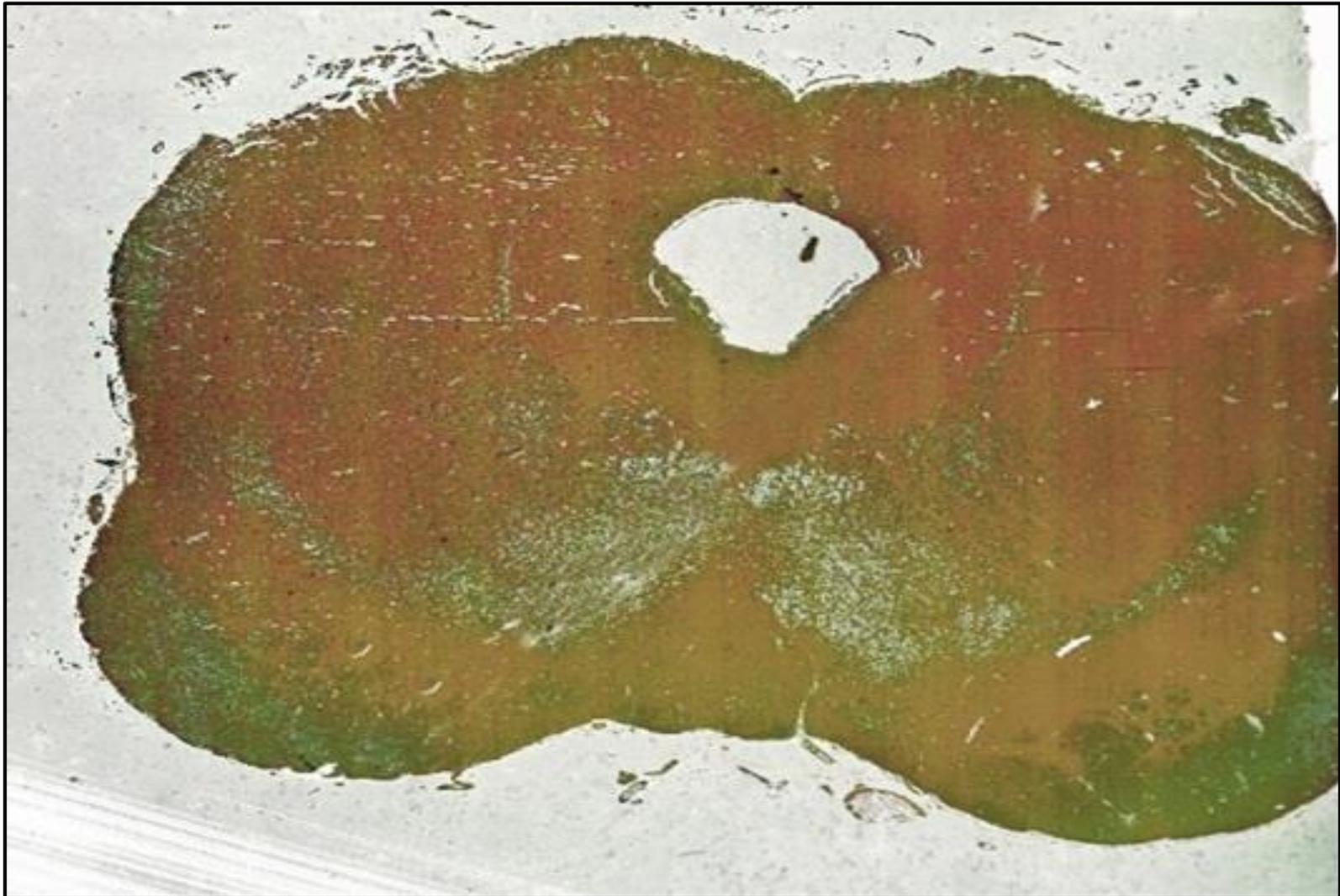
❖ Levels of the midbrain:

1. Midbrain at the level of inferior colliculus.
2. Midbrain at the level of superior colliculus.

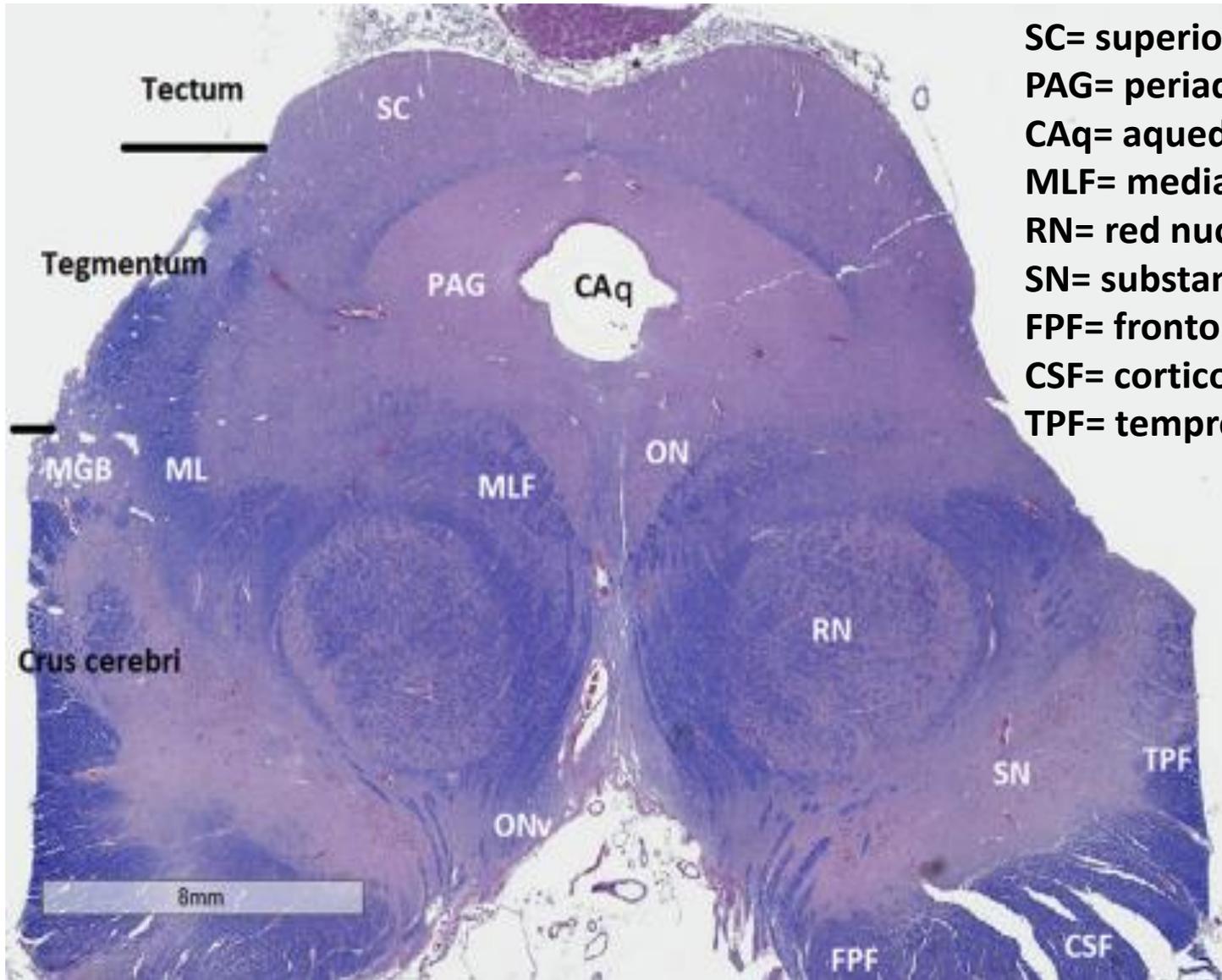
Midbrain at the level of inferior colliculus.
Quadrangular shaped of aqueduct of Sylvius



Midbrain at the level of superior colliculus.
Pear shaped of aqueduct of Sylvius



Midbrain at the level of superior colliculus.

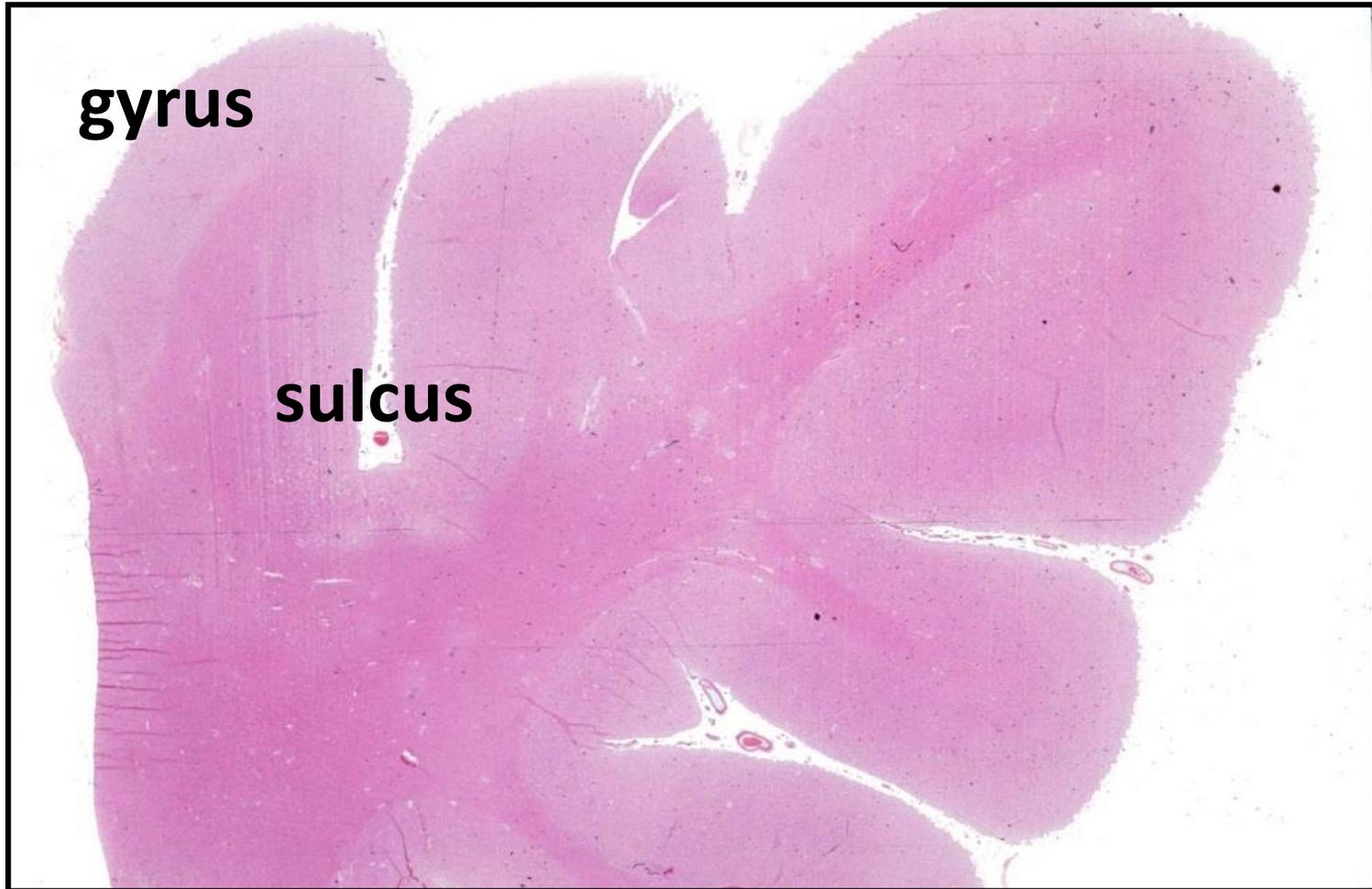


- SC= superior colliculus
- PAG= periaqueductal grey matter
- CAq= aqueduct of sylvius
- MLF= medial longitudinal bundle
- RN= red nucleus
- SN= substantia nigra
- FPF= frontopontine fibers
- CSF= corticospinal fibers
- TPF= temporopontine fibers

The cerebrum

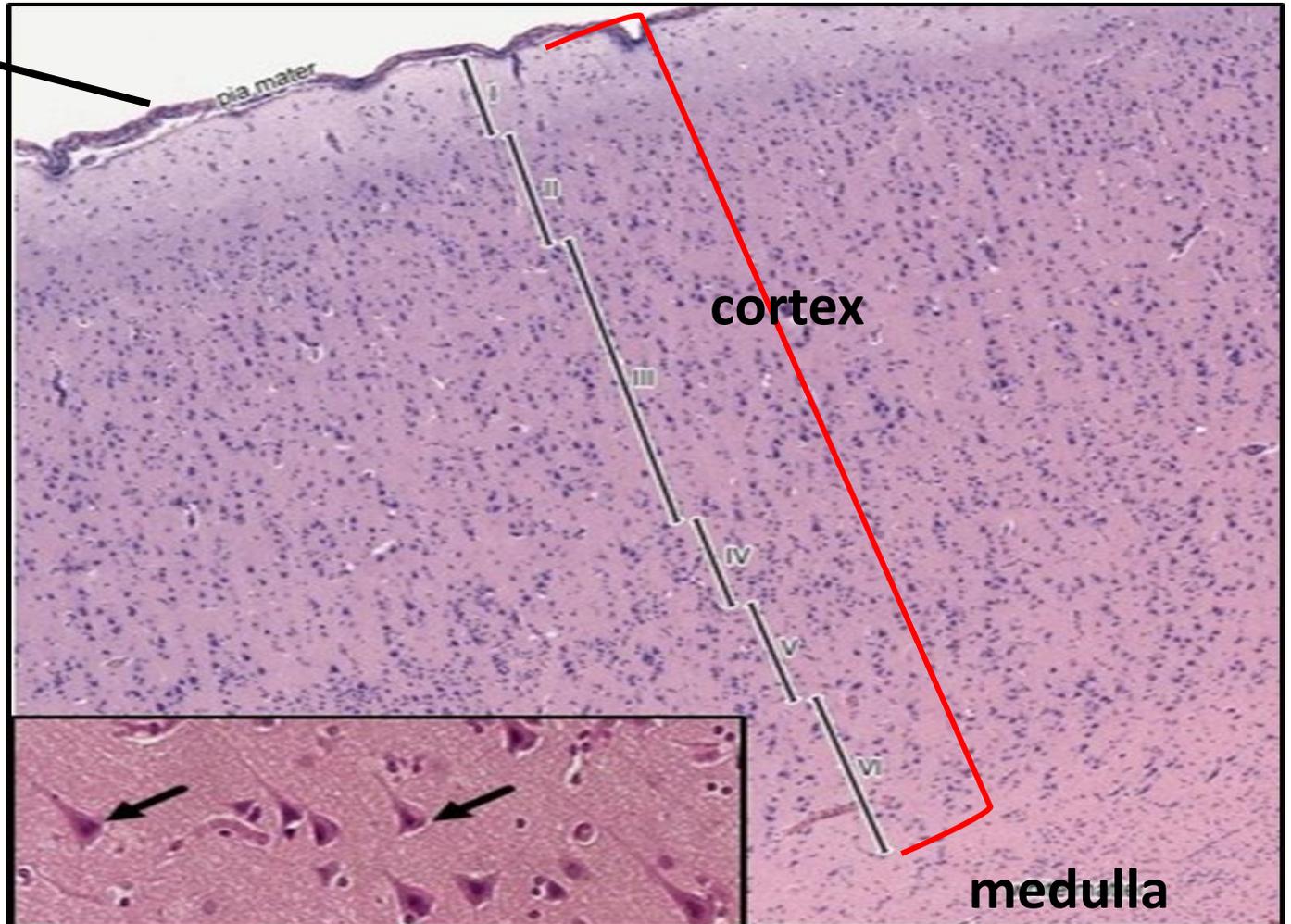
- **Histological structure of cerebral cortex:**
- The cerebral cortex (grey matter) consists of six layers which are:
- **Molecular layer:** consists mainly of parallel nerve fibers from cells of other deeper layers.
- **External granular layer:** contains small pyramidal cells and granular stellate cells.
- **External pyramidal layer:** contains medium sized pyramidal cells.
- **Internal granular layer:** contains granular stellate cells.
- **Internal pyramidal layer:** contains very large pyramidal cells.
- **Polymorphic cell layer:** contains nerve cells of different shapes (fusiform or spindle shaped) and nerve

Cerebrum stained with H&E



cerebrum stained by H&E

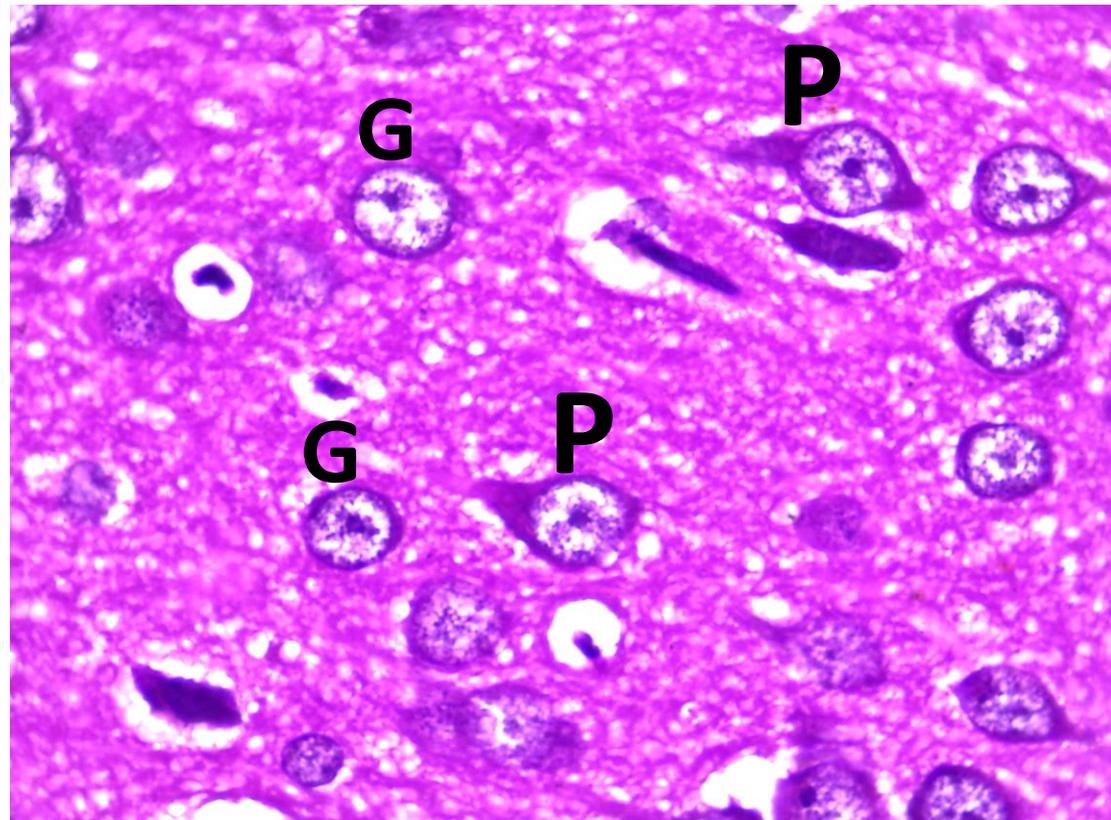
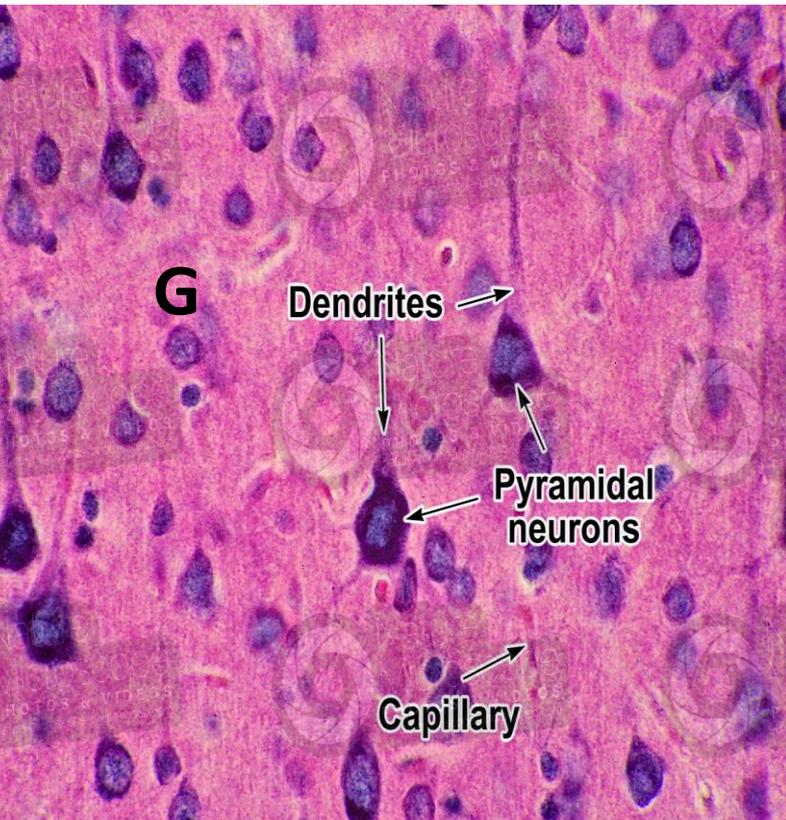
Pia matter



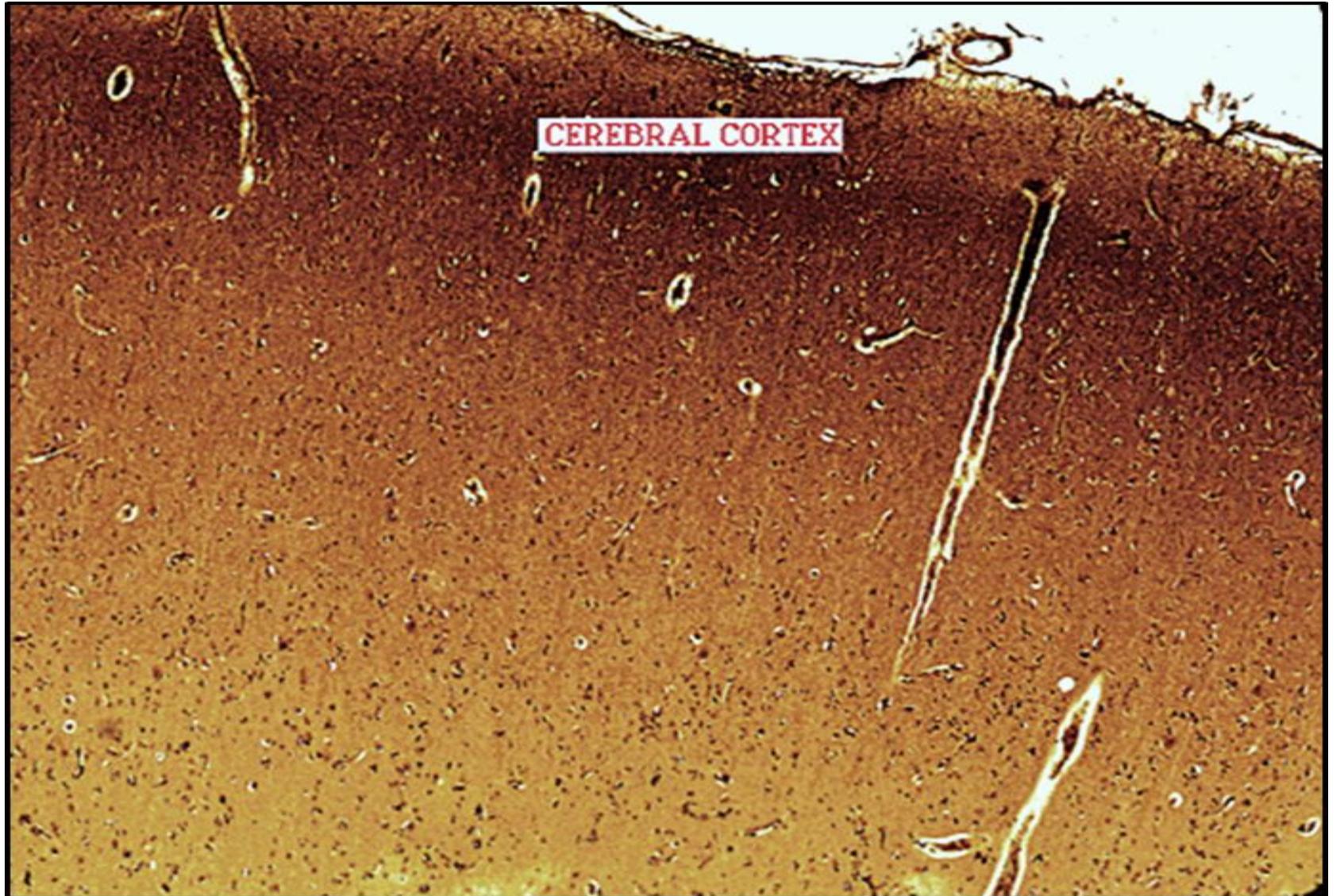
large pyramidal
cells pointed by
the arrow

P= pyramidal cells

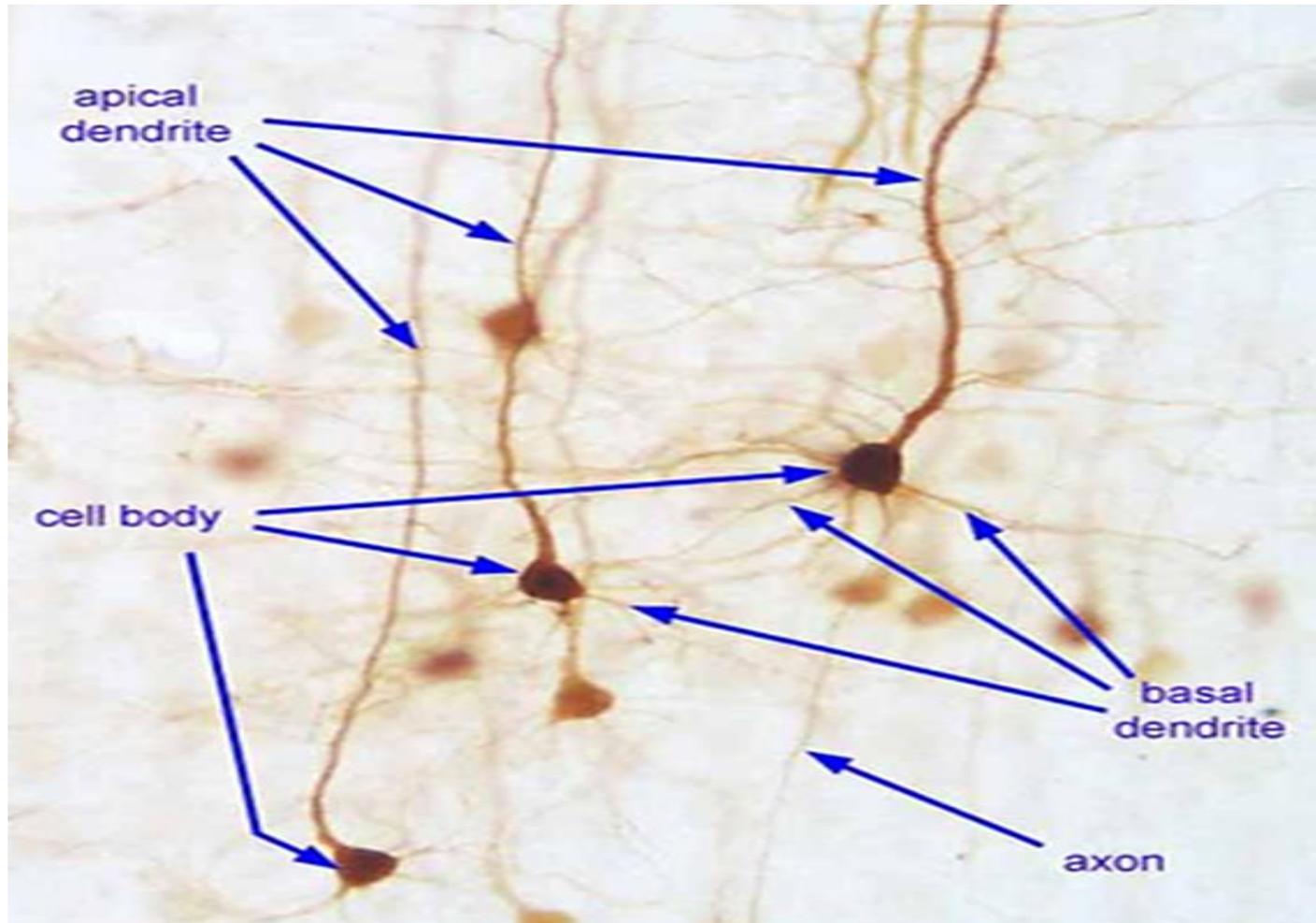
G= granule cells



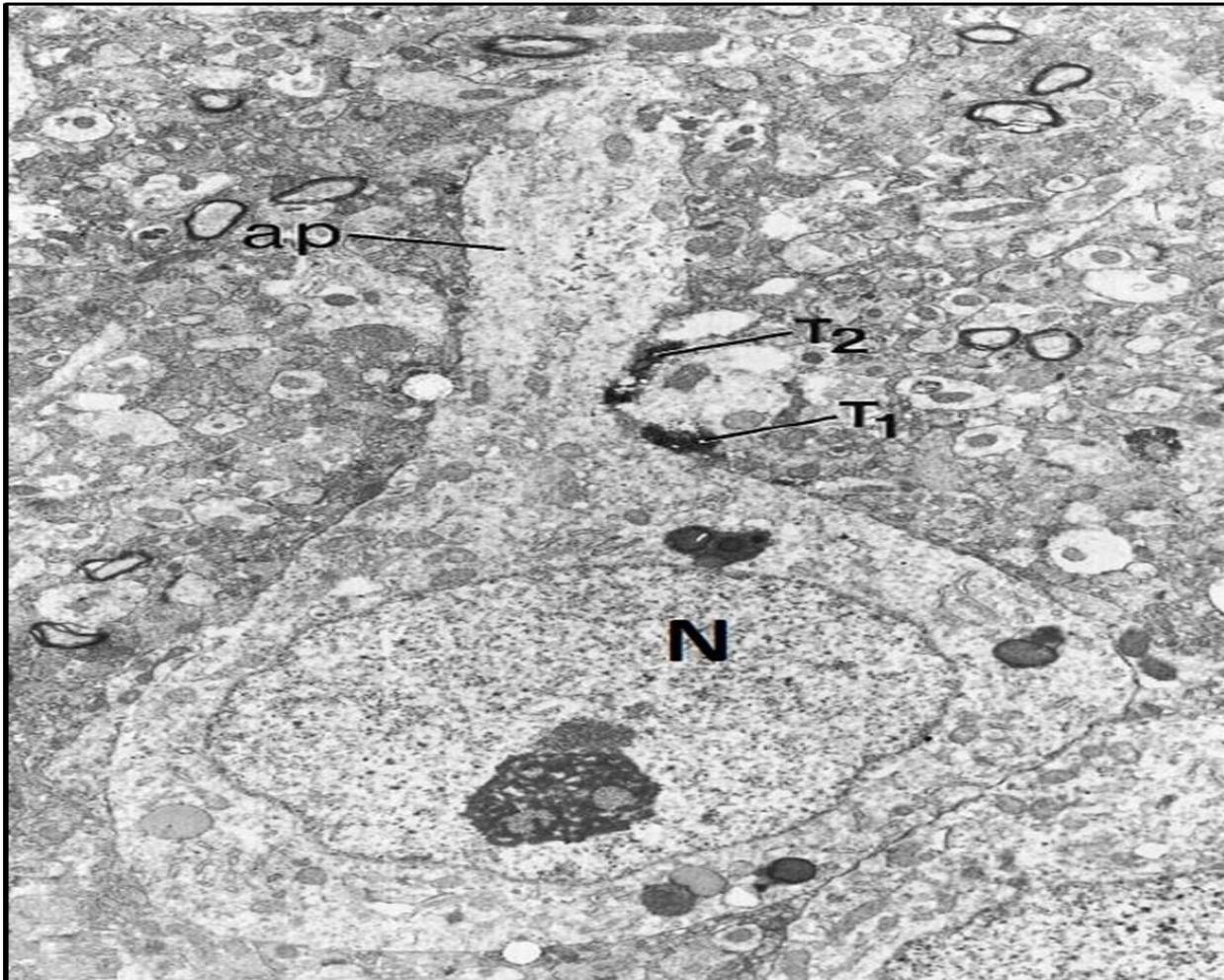
A microscopic picture shows the cerebrum stained by silver



Pyramidal cells (silver stain)



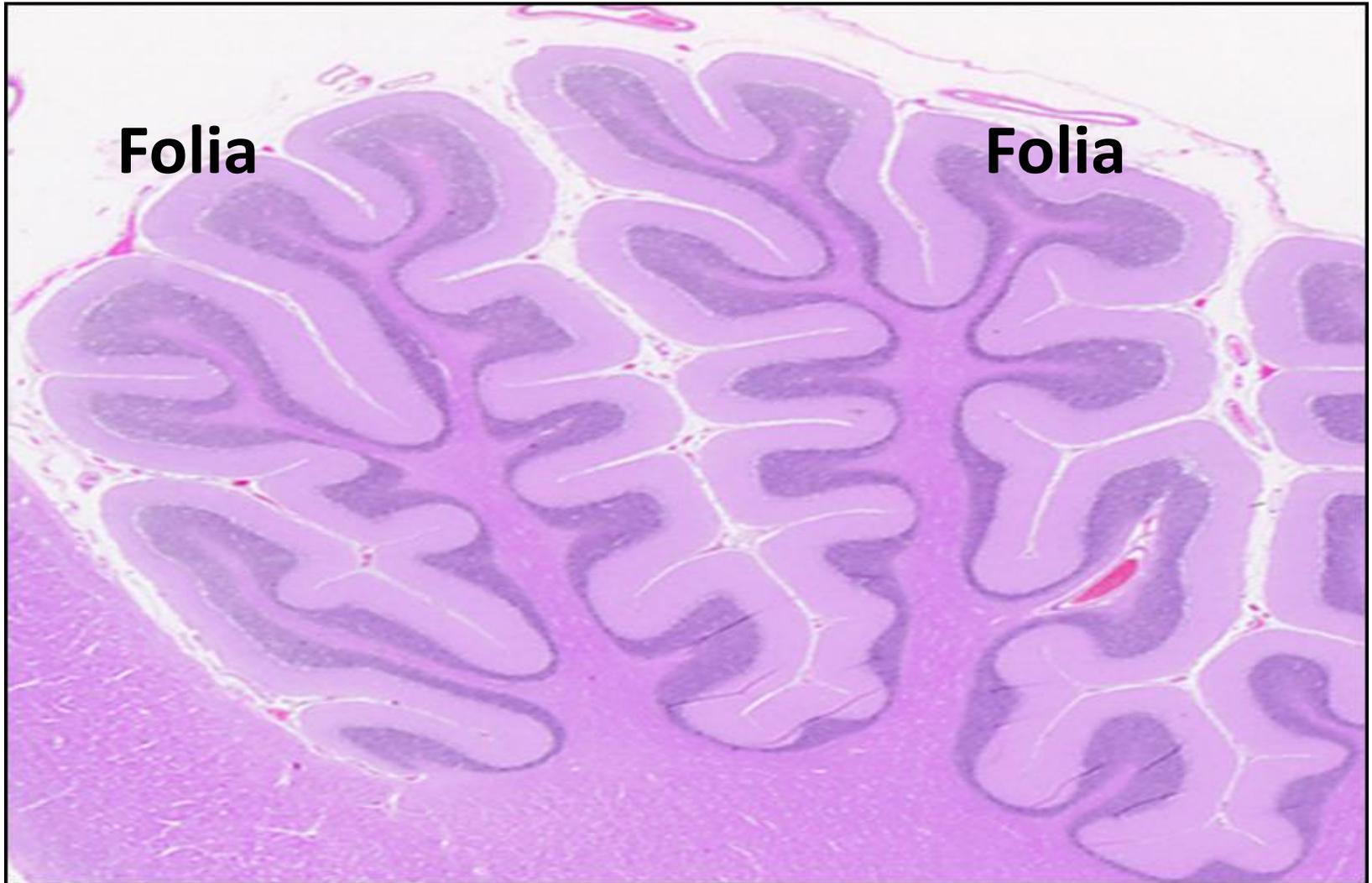
An electron micrograph shows a pyramidal neuron having euchromatic nucleus (N) with prominent nucleolus. An apical dendrite (ap) and synaptic terminals (T1&T2) can be seen.



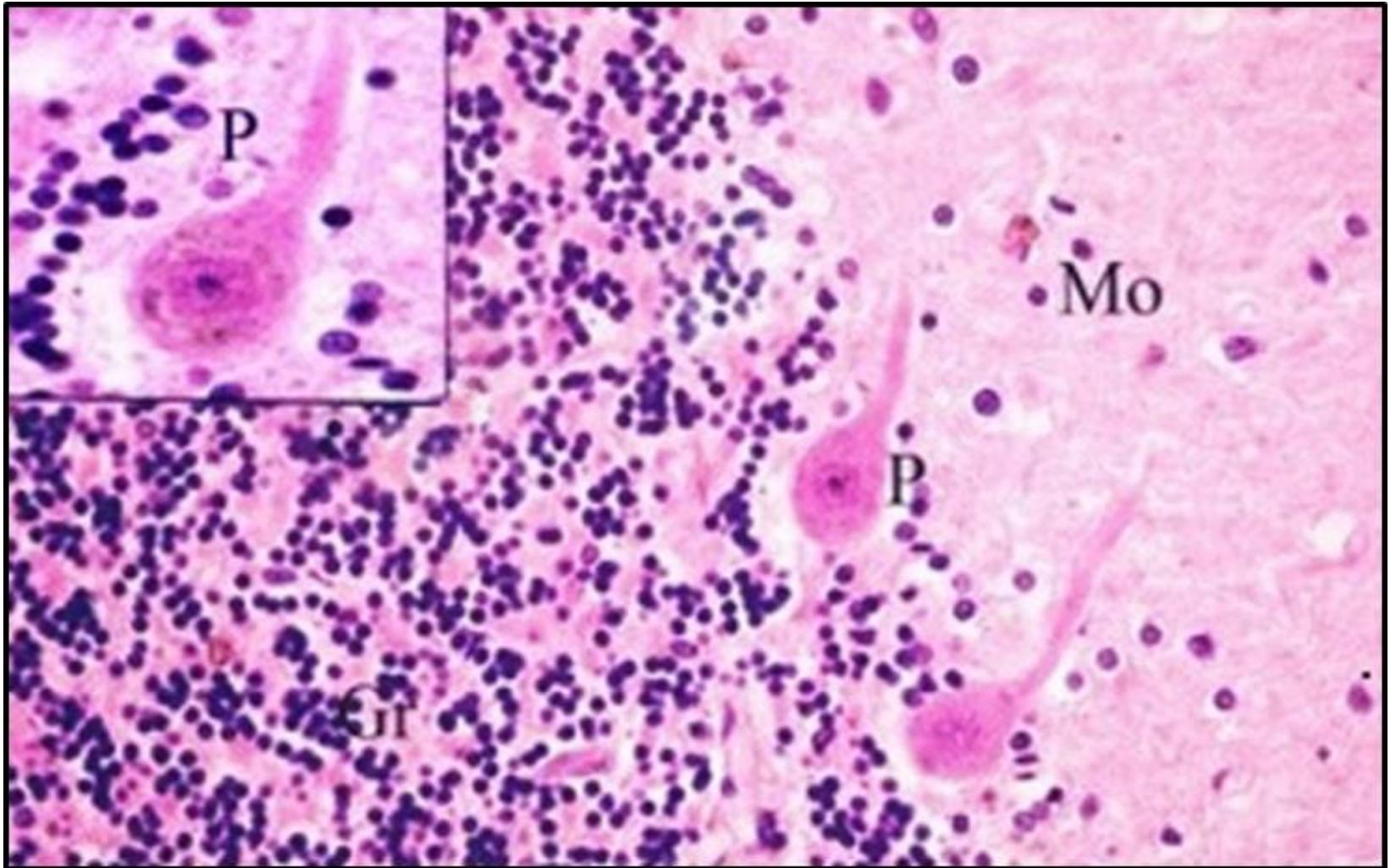
The cerebellum

- The cerebellar cortex can be divided into three layers:
 - **1- Molecular layer**
 - **2- Purkinje cell layer**
 - **3- Granular layer:** highly cellular layer

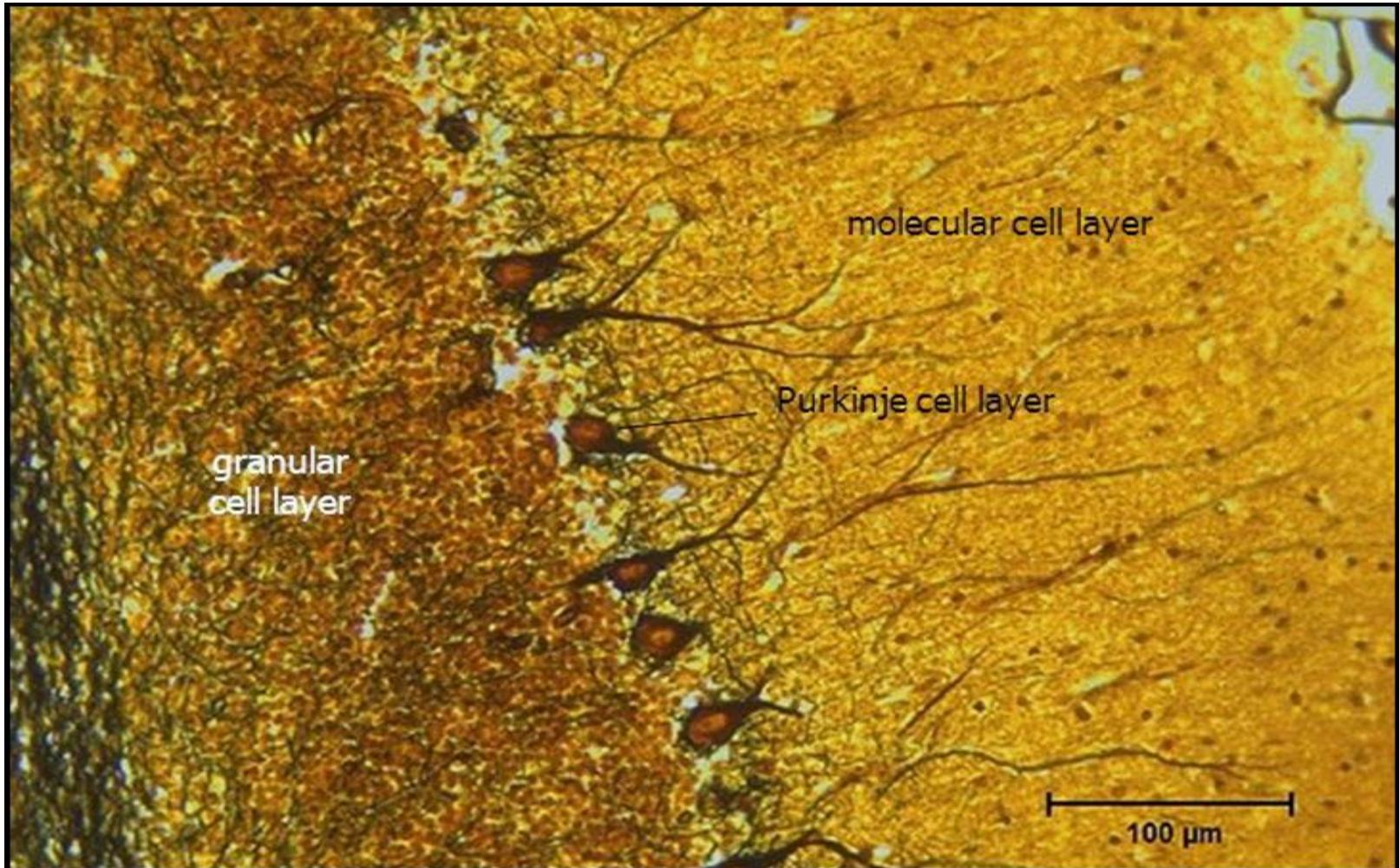
Cerebellum stained with H&E



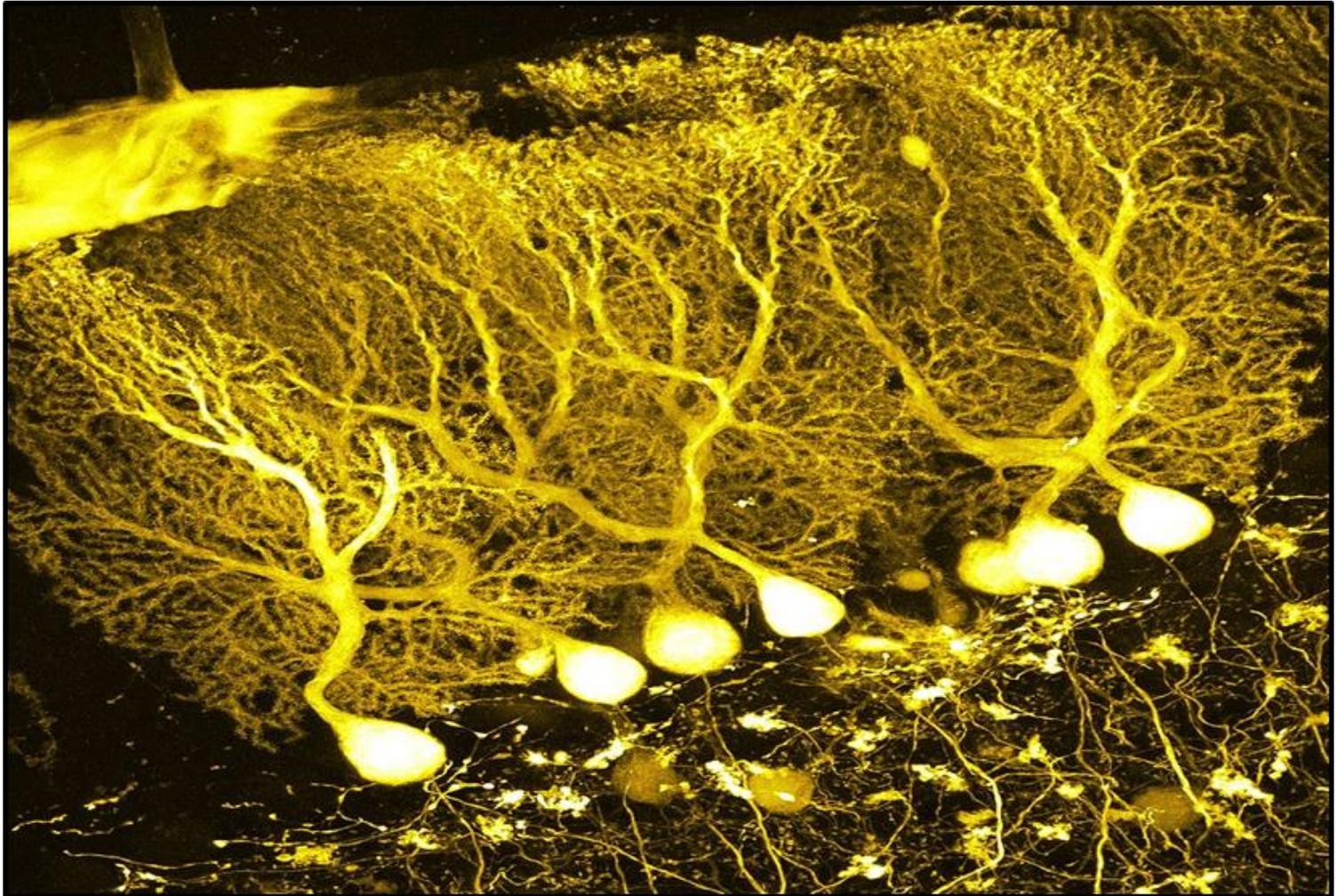
A microscopic picture shows the cerebellar cortex stained by H&E (N.B: Mo= molecular layer, P= Purkinje cell layer, Gr= granule cell layer)



Microscopic picture shows cerebellar cortex stained by silver



A confocal microscope image shows Purkinje cells with arborizations of their dendrites



An electron micrograph of a blood capillary in the brain. (blood brain barrier)

