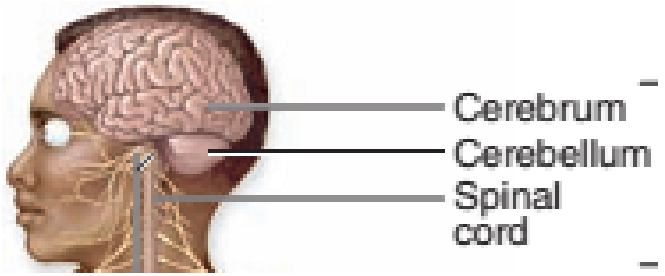
Histology of Cerebrum

BY DR.ZAHID SARFARAZ
A/P ANATOMY KGMC

Cerebrum



Is the largest part of the brain.

In humans

Cerebrum is the largest and best-developed of the five major divisions of the brain.

Cerebrum is made up of the two cerebral hemispheres (the outer layers of grey matter),

And the underlying regions of white matter.

Functions

- As the center of sensory perception, memory, thoughts and judgement

- Also functions as the center of voluntary motor activities

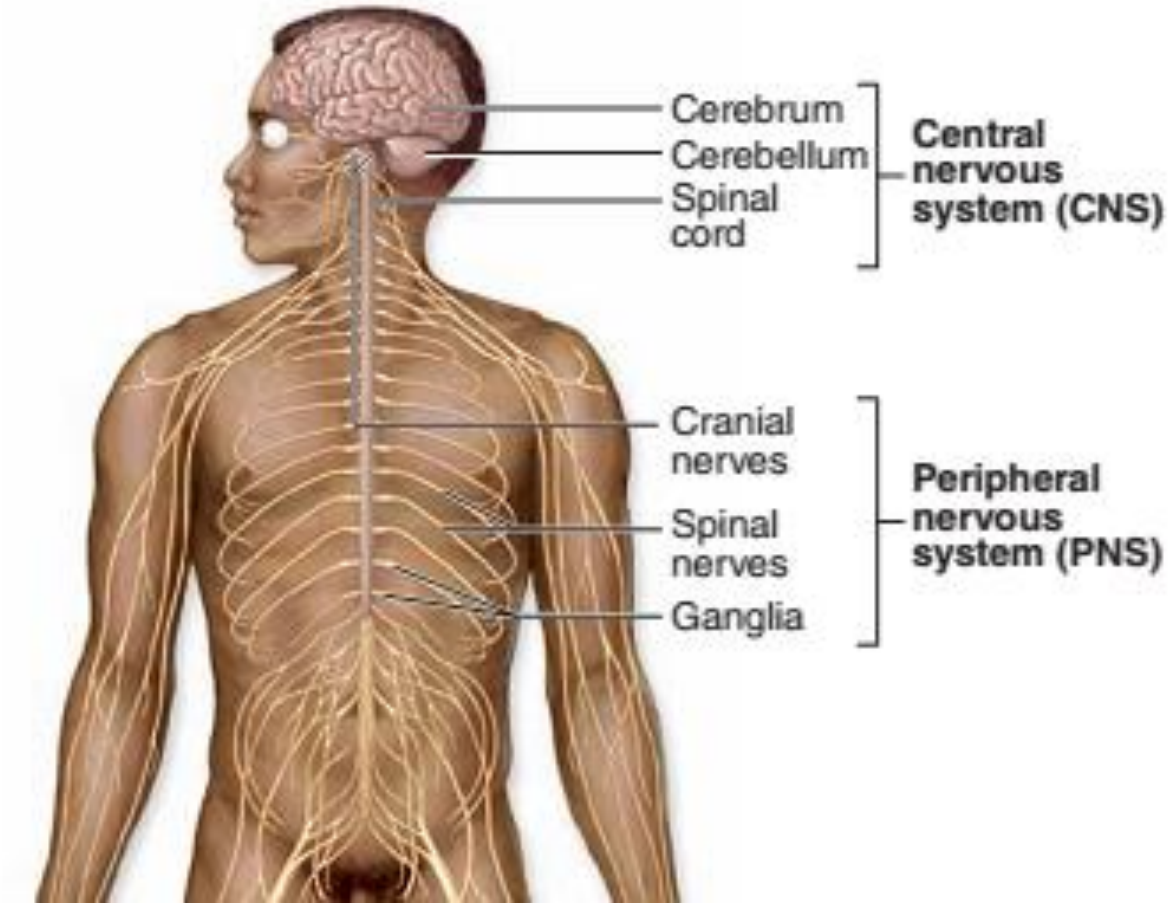
Nervous system has two major divisions:

Central nervous system (CNS), consisting of

- Brain and
- Spinal cord

Peripheral nervous system (PNS) , composed of

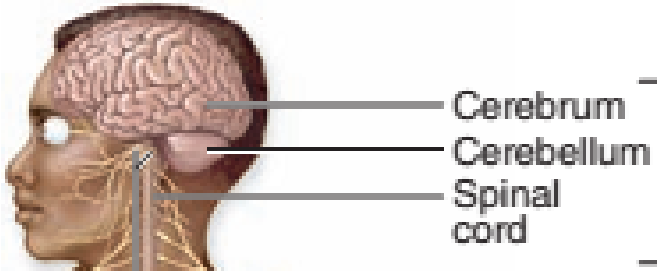
- Cranial, spinal nerve
- Peripheral nerves conducting impulses to and from the CNS (sensory and motor nerves, respectively) and
- Ganglia that are small groups of nerve cells outside the CNS.

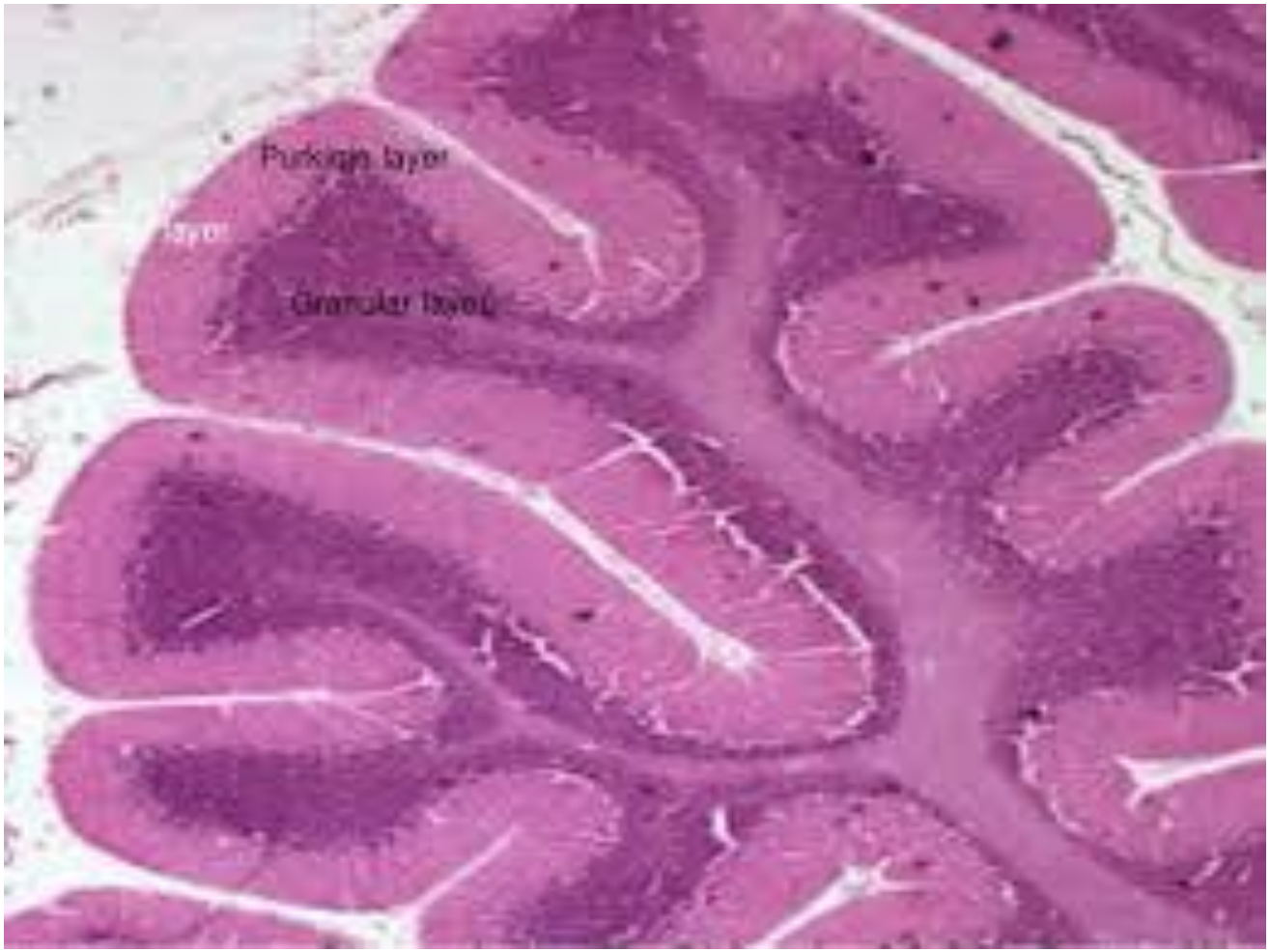


INTRODUCTION

- Human nervous system, by far the most complex system in the body
- Is formed by a network of many billion nerve cells (neurons)
- All assisted by many supporting cells called glial cells

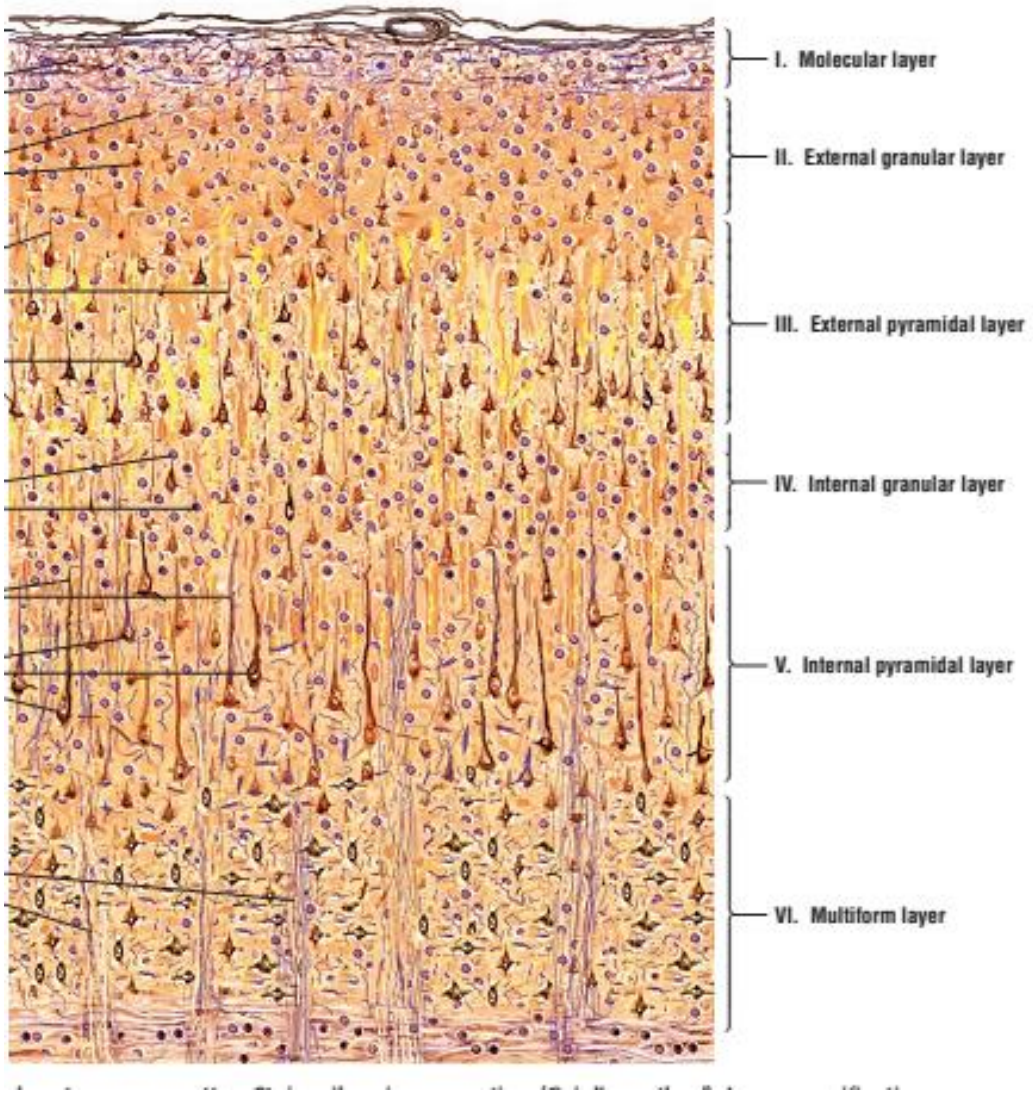
Cerebrum





Cerebral Cortex: Gray Matter

- Different cell types that are present in the gray matter of the cerebral cortex are distributed in six layers.
- With one or more cell types predominant in each layer.

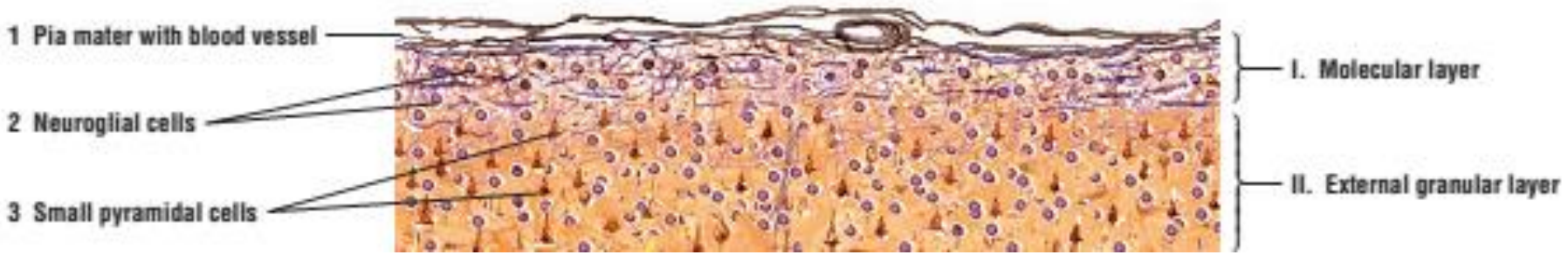


Molecular layer

- Most superficial is the **molecular layer (I).**
  Is contain the delicate connective tissue of the brain, the **pia mater .**

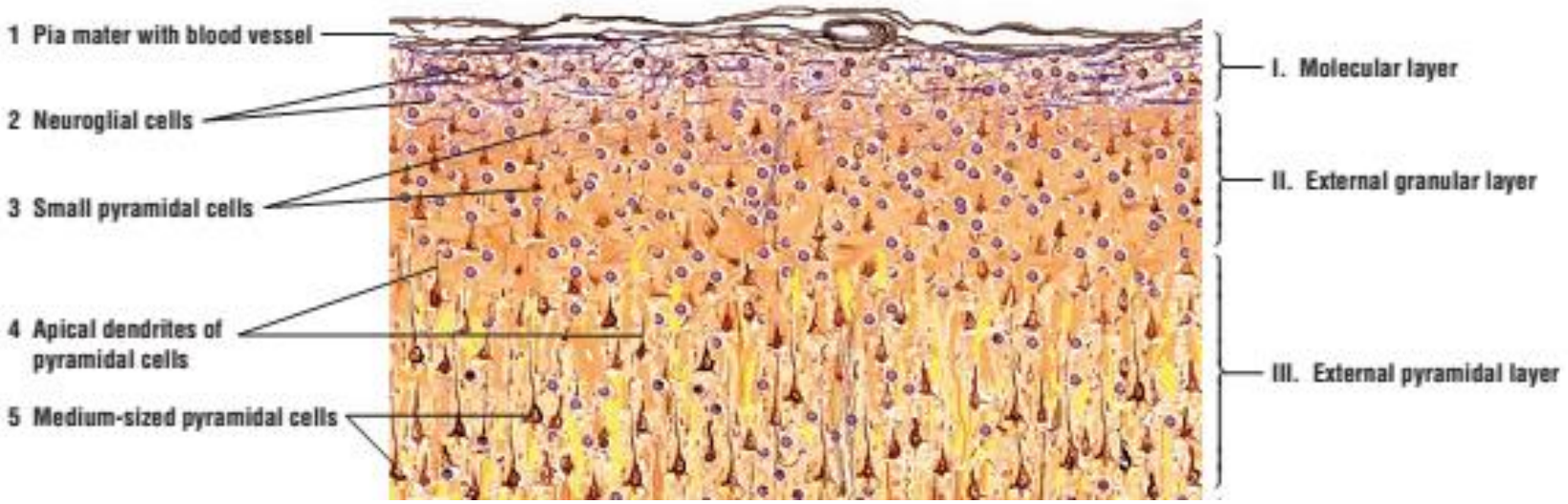
- Below to molecular layer (I) is composed predominantly of **neuroglial cells** and horizontal cells of Cajal.

External granular layer (II)

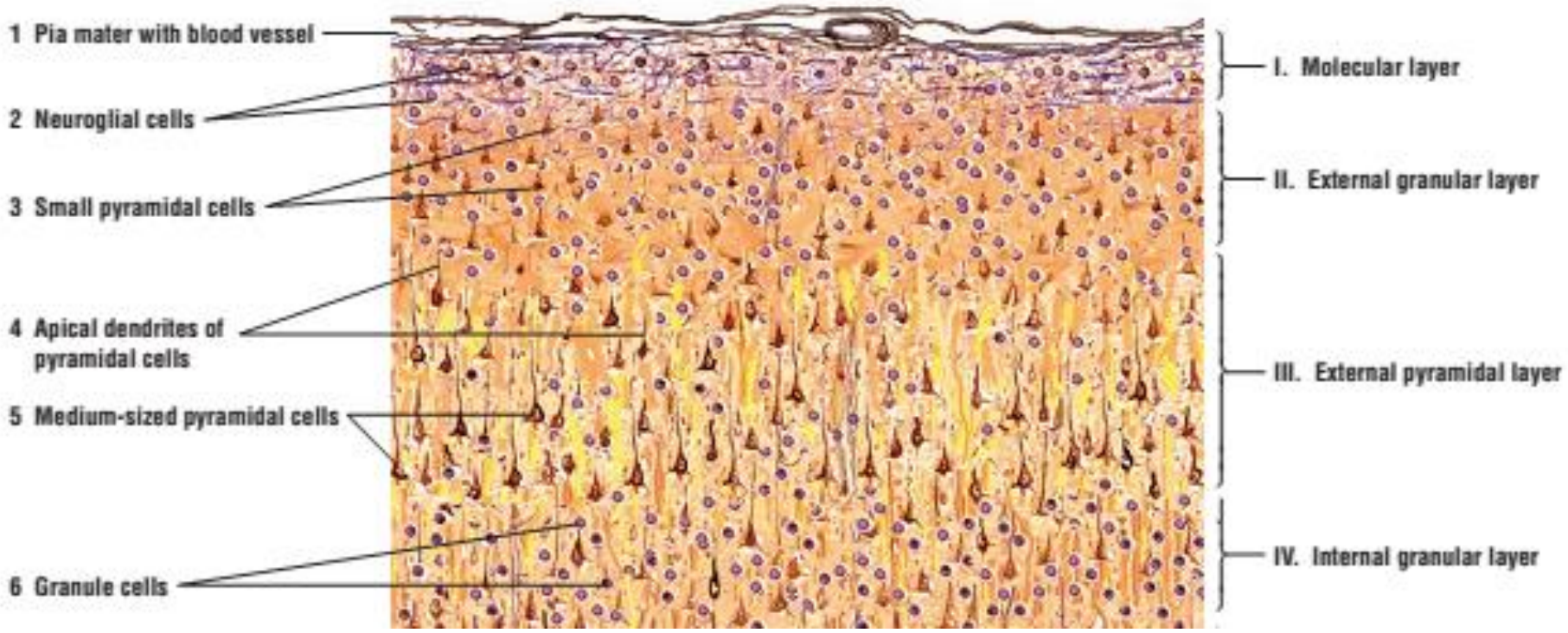


- Contains mainly different types of neuroglial cells and **small pyramidal cells (3).**

External pyramidal layer (III)

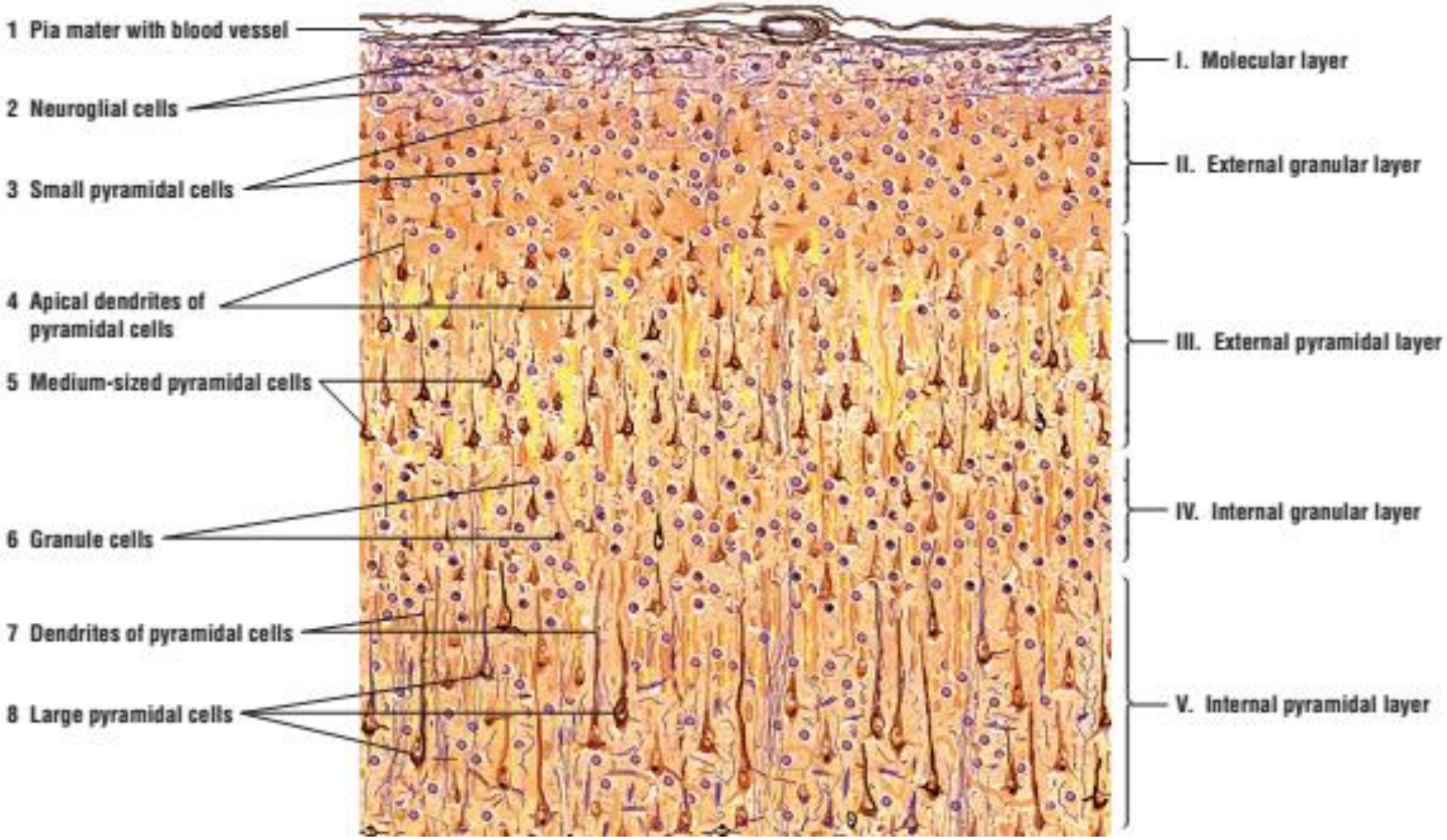


- Note that the pyramidal cells get progressively larger in successively deeper layers of the cortex.
- The **apical dendrites** of the **pyramidal cells (4, 7)** are directed toward the periphery of the cortex,
- whereas their axons extend from the cell bases below.
- In the **external pyramidal layer (III), medium-sized pyramidal cells (5)** predominate.



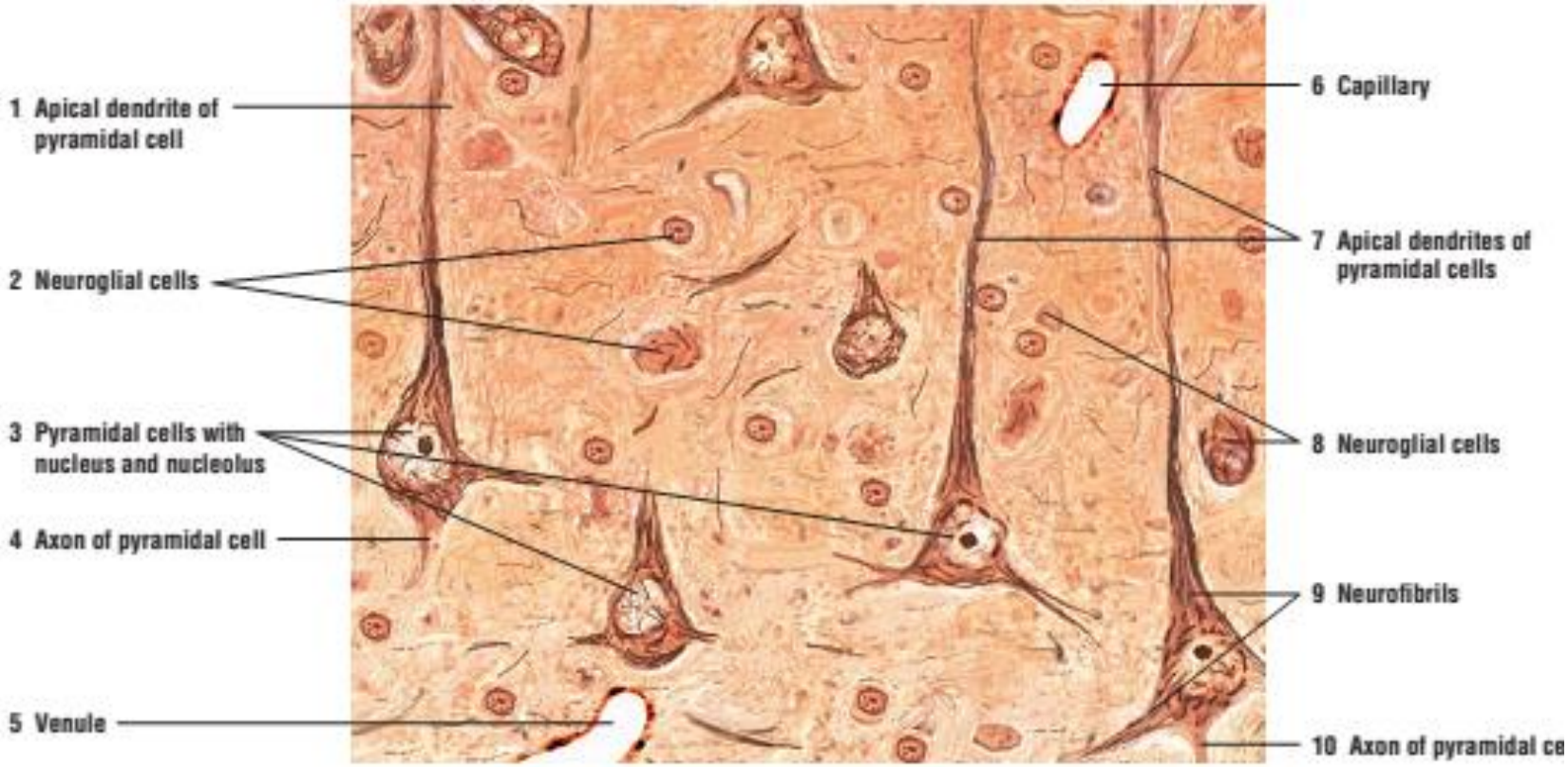
Internal granular layer (IV)

- Is a thin layer and contains mainly small **granule cells** some pyramidal cells
- And different neuroglia that form numerous complex connections with the pyramidal cells..



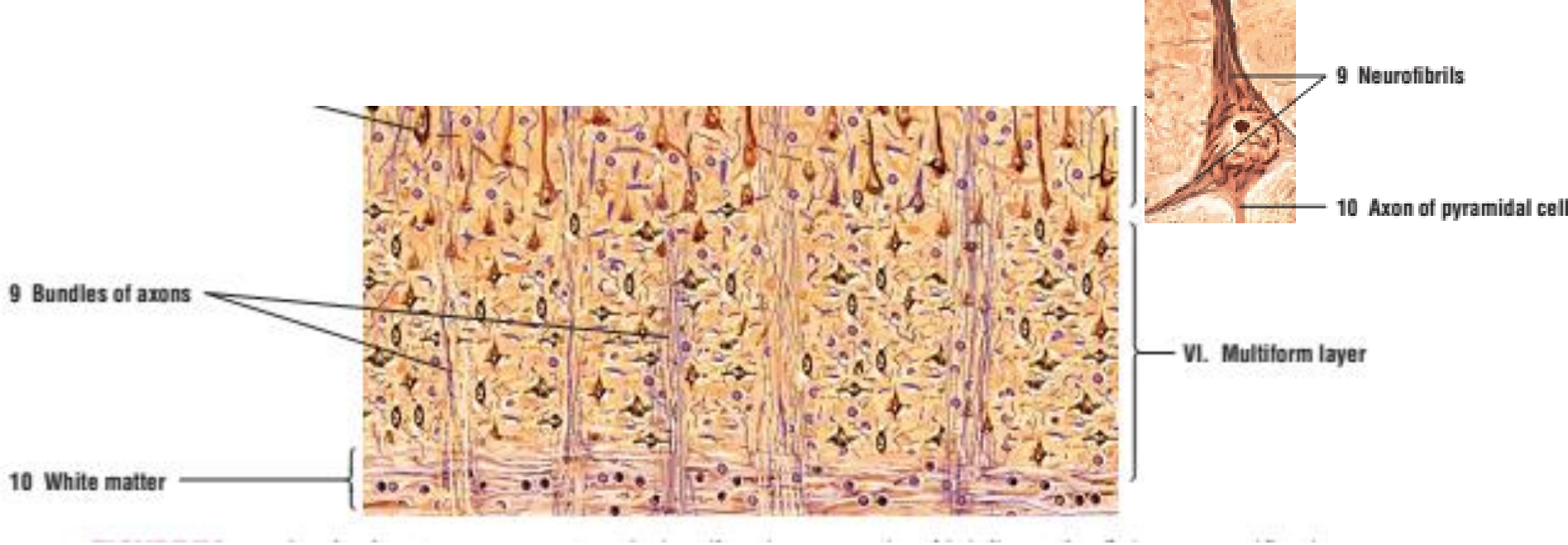
Internal pyramidal layer (V)

- Contains numerous neuroglial cells
- And the largest **pyramidal cells**
- especially in the motor area of the cerebral cortex.



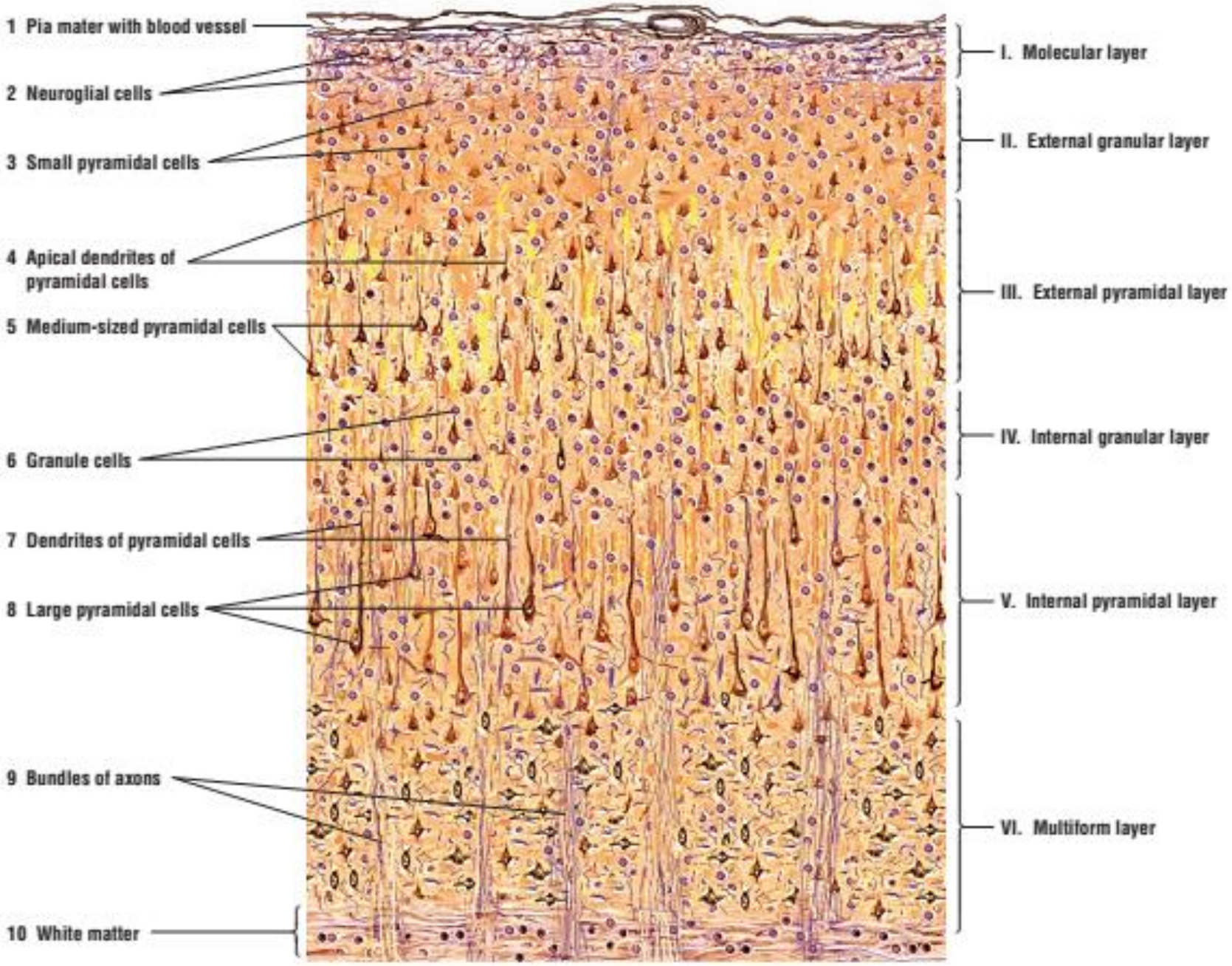
Layer V of the Cerebral Cortex

- A higher magnification of layer V of the cerebral cortex illustrates the large **pyramidal cells (3).**
- Note the typical large vesicular **nucleus (3)** with its prominent **nucleolus (3).**
- The silver stain also shows the presence of numerous **neurofibrils (9)** in the pyramidal cells (3).
- The most prominent cell processes are the **apical dendrites (1, 7)** of the pyramidal cells (3),
- Which are directed toward the surface of the cortex. The **axons (4, 10)** of the pyramidal cells (3) arise from the base of the cell body and pass into the white matter .
- The intercellular area is occupied by **neuroglial cells (2, 8)** in the cortex, small astrocytes, and blood vessels, **venule (5)** and **capillary (6).**



- The deepest layer is the **multiform layer (VI).**
- This layer is adjacent to the **white matter** of the cerebral cortex.

The multiform layer (VI) contains intermixed cells of varying shapes and sizes, such as the fusiform cells, granule cells, stellate cells, and cells of Martinotti.
Bundles of axons (9) enter and leave the white matter (10).

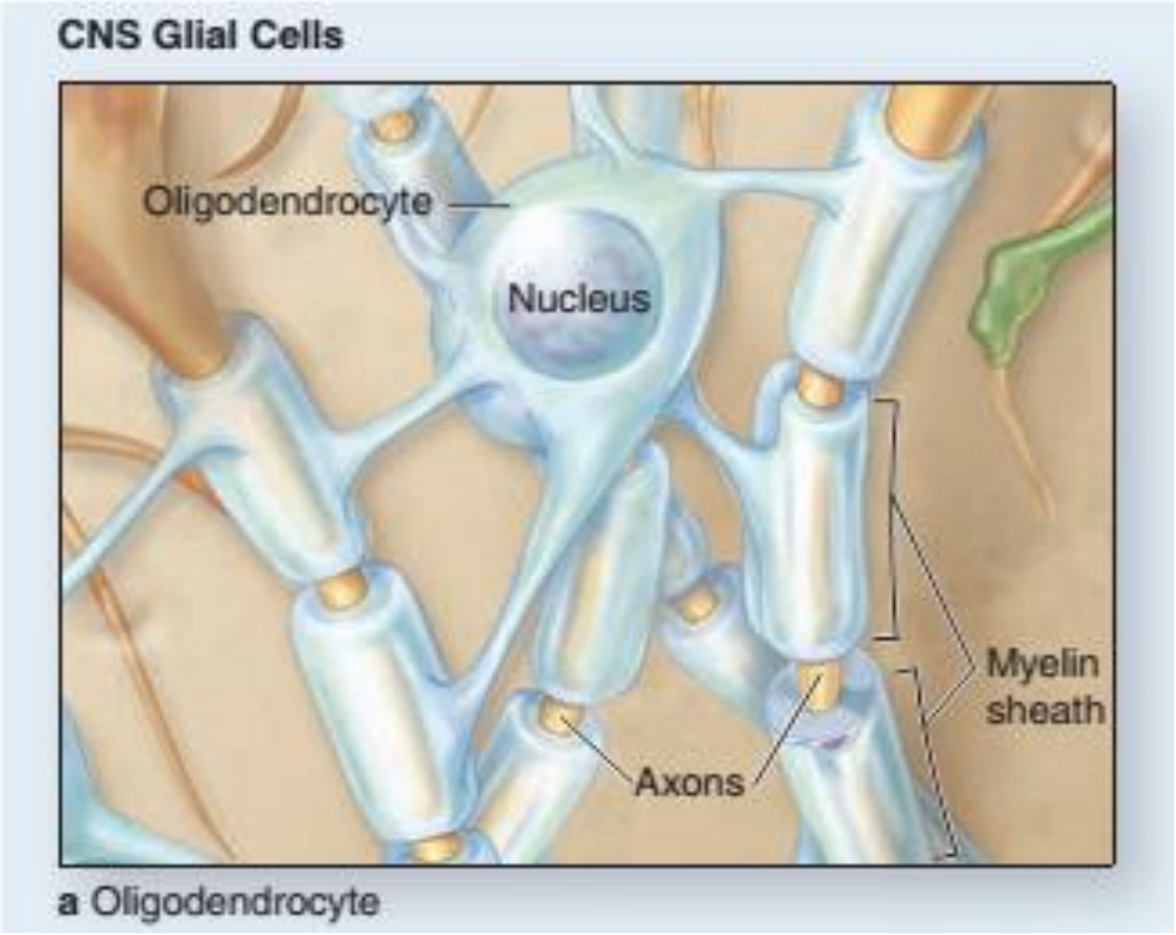

1 Pia mater with blood vessel
2 Neuroglial cells
3 Small pyramidal cells
4 Apical dendrites of pyramidal cells
5 Medium-sized pyramidal cells
6 Granule cells
7 Dendrites of pyramidal cells
8 Large pyramidal cells
9 Bundles of axons
10 White matter
I. Molecular layer
II. External granular layer
III. External pyramidal layer
IV. Internal granular layer
V. Internal pyramidal layer
VI. Multiform layer

- **White and Gray Matter**
  - Gray matter contains neurons, dendrites, and neuroglia
  - Site of synapse between neurons and dendrites in gray matter
  - White matter contains only myelinated axons, unmyelinated axons, and neuroglia

There are six kinds of glial cells

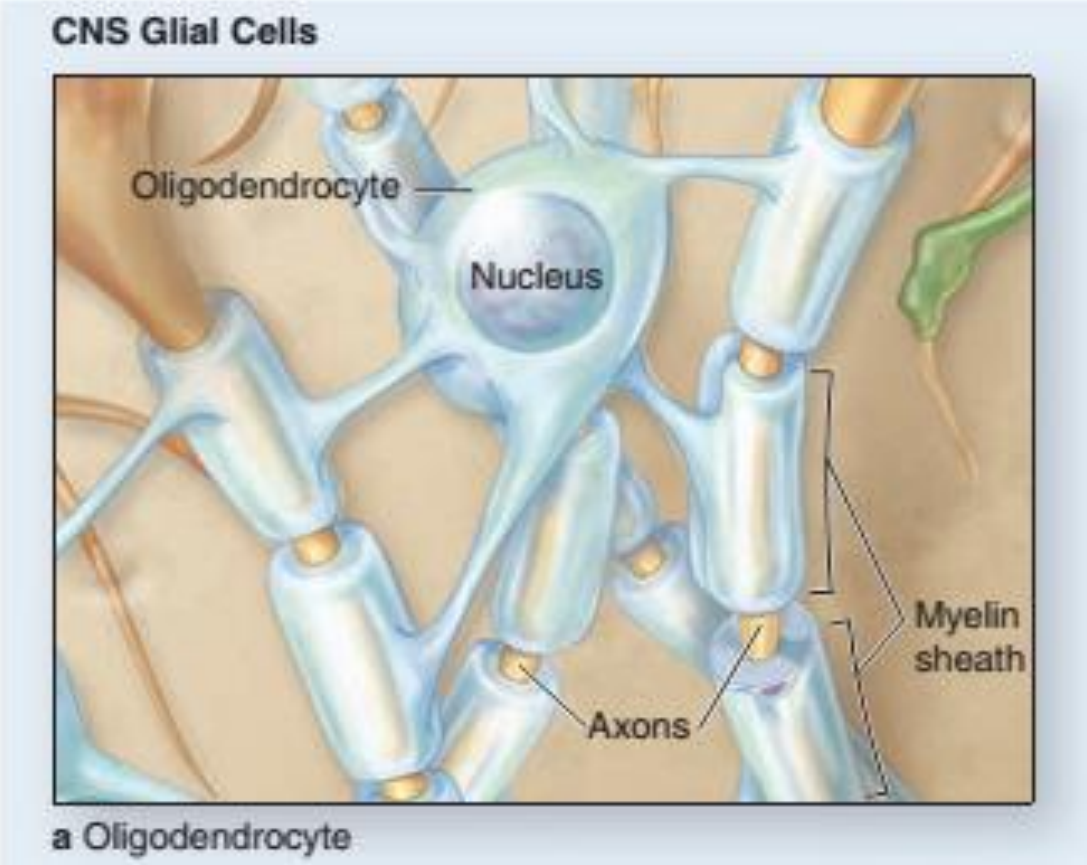
1- Oligodendrocytes

- Produce the myelin sheaths around axons
- That provide the electrical insulation for neurons in the CNS
- Oligodendrocytes extend sheet like processes that wrap around parts of several axons, producing myelin sheaths .



Oligodendrocytes

- These are the predominant glial cells in CNS white matter
- which is white because of the lipid concentrated .
- The processes and sheaths are not visible by routine light microscope



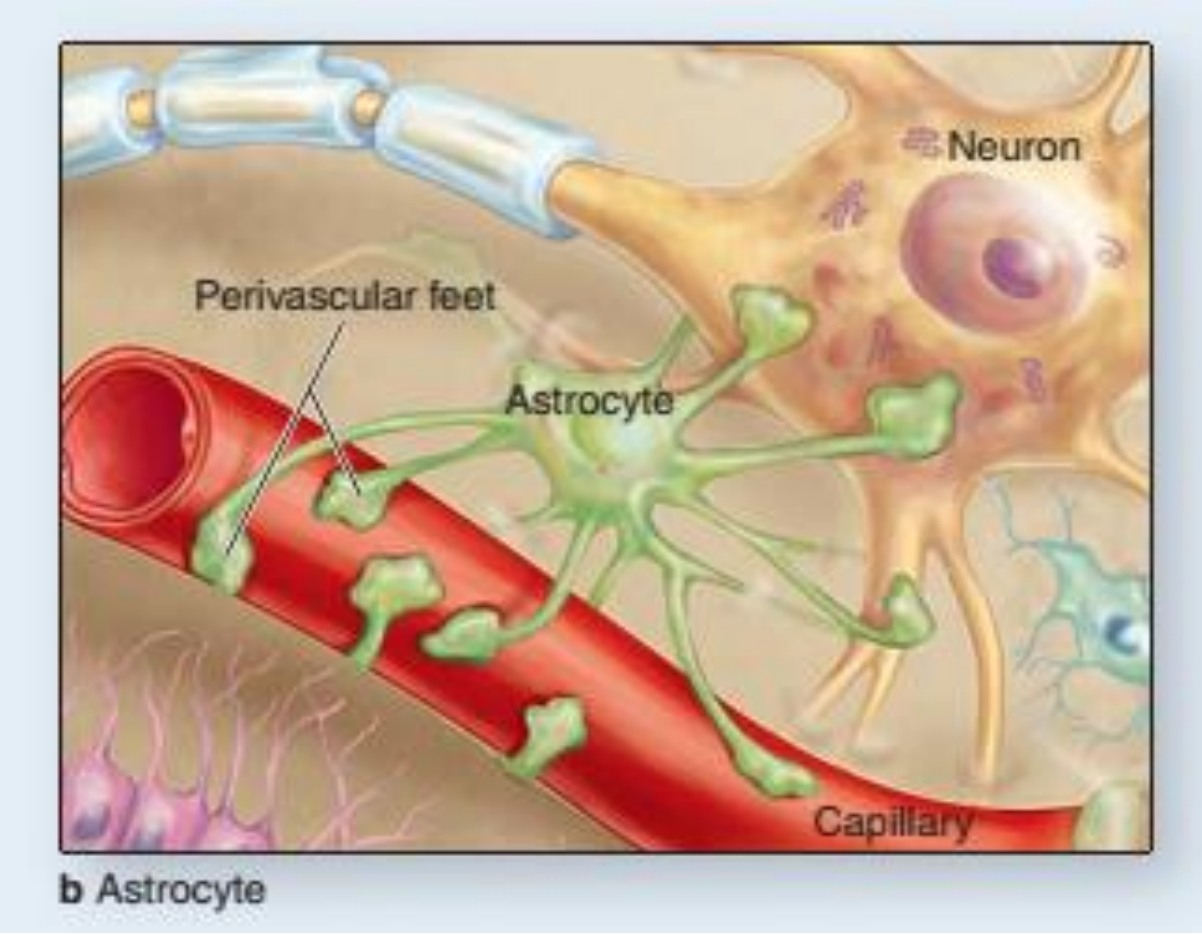
Astrocytes

- Astrocytes have a large number of radiating processes and are also unique to the CNS.

- And most diverse structurally and functionally.

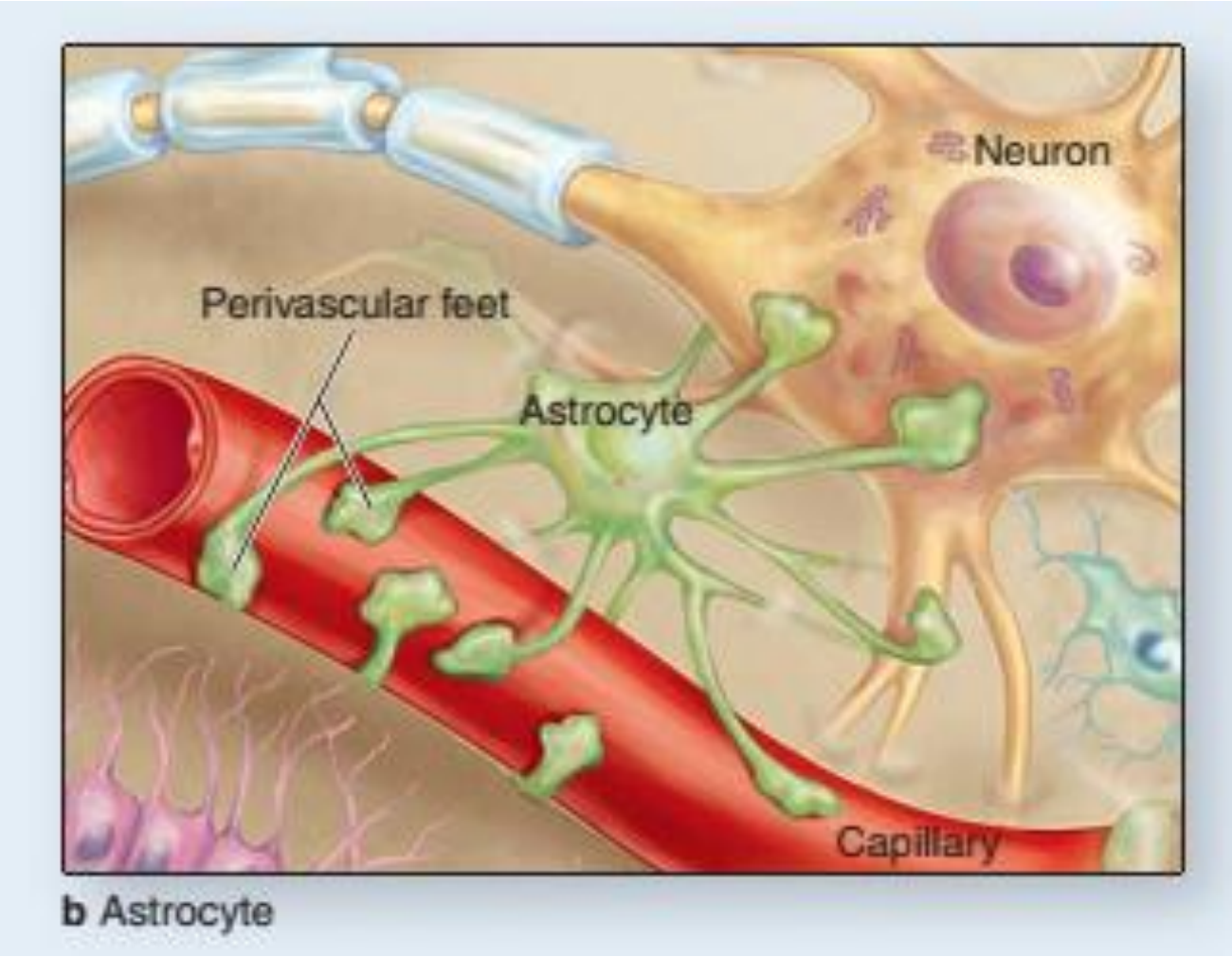
- These with long processes are called fibrous astrocytes and are typical in white matter;

- those with many shorter, branched processes are called protoplasmic astrocytes and predominate in the gray matter.



Astrocytes

- The larger processes of all astrocytes are reinforced with bundles of intermediate fiaments made of glial firillary acid protein (GFAP)
- which serves as a unique marker for astrocytes,
- the most common source of brain tumors.



Ependymal Cells

❖Ependymal cells are columnar or cuboidal cells
❖that line the ventricles of the brain and central canal of the spinal cord.

❖ the apical ends of ependymal cells have cilia,
❖which facilitate the movement of cerebrospinal flid (CSF), and long microvilli,
which are likely involved in absorption.
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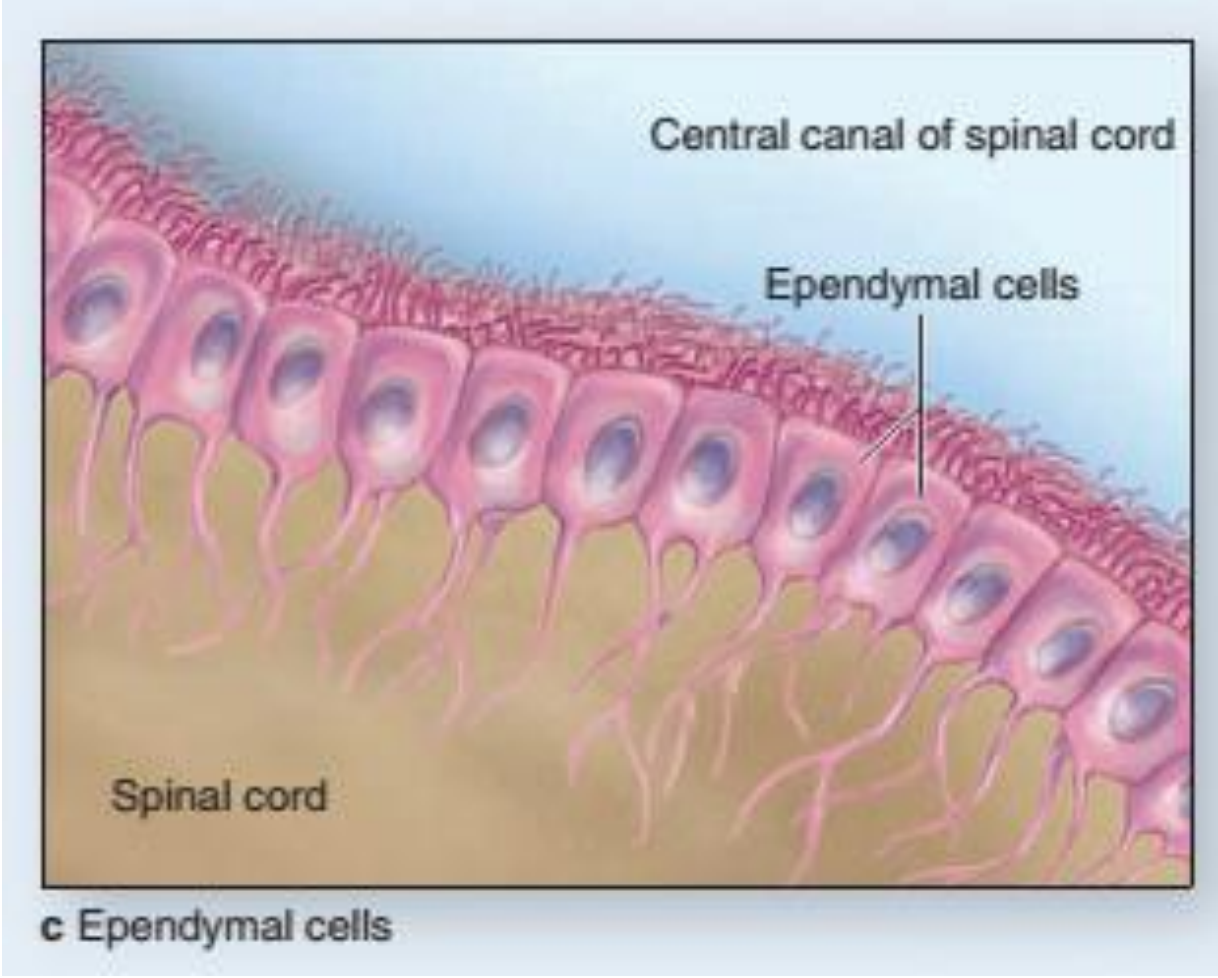


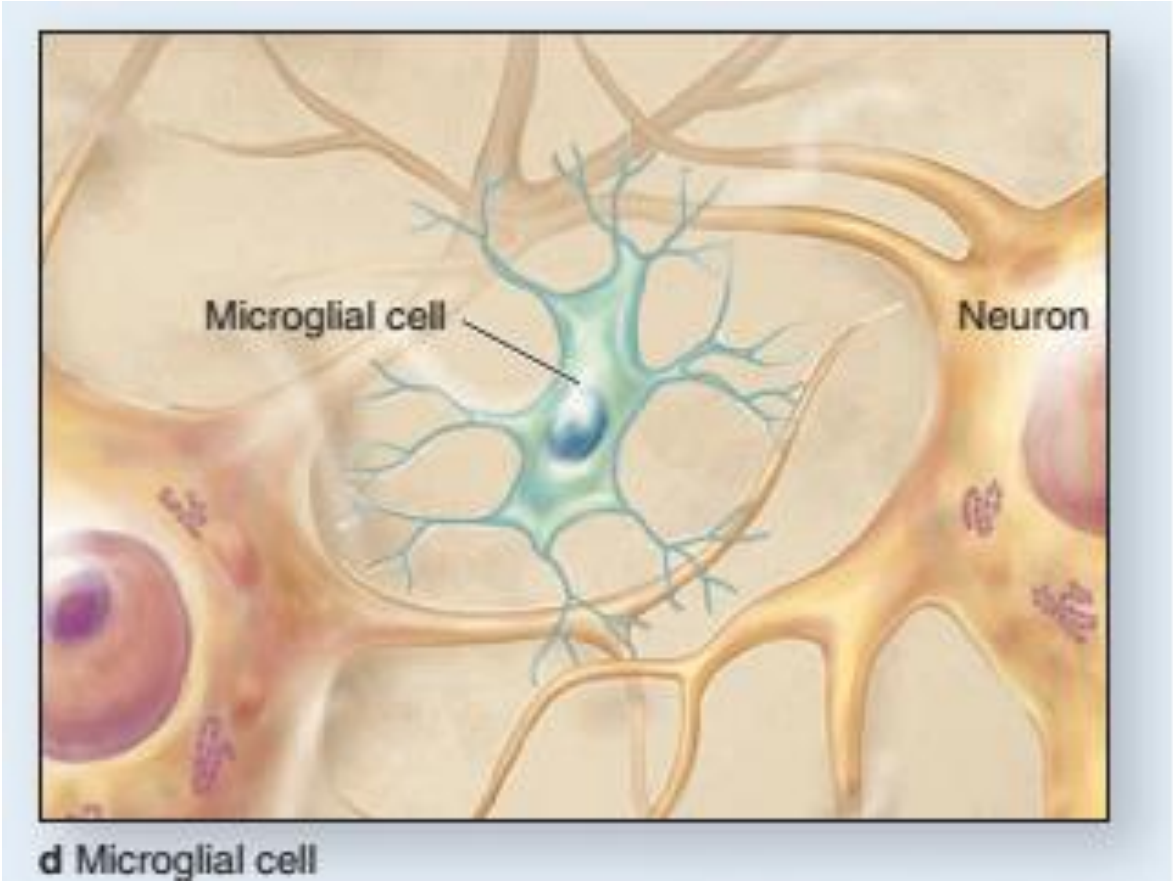
c Ependymal cells

Microglia

- Less numerous than oligodendrocytes or astrocytes

- Microglia are small cells with short irregular processes
- Evenly distributed throughout gray and white matter .

Unlike other glial cells, microglia migrate through the neuropil, scanning the tissue for damaged cells and invading microorganisms.

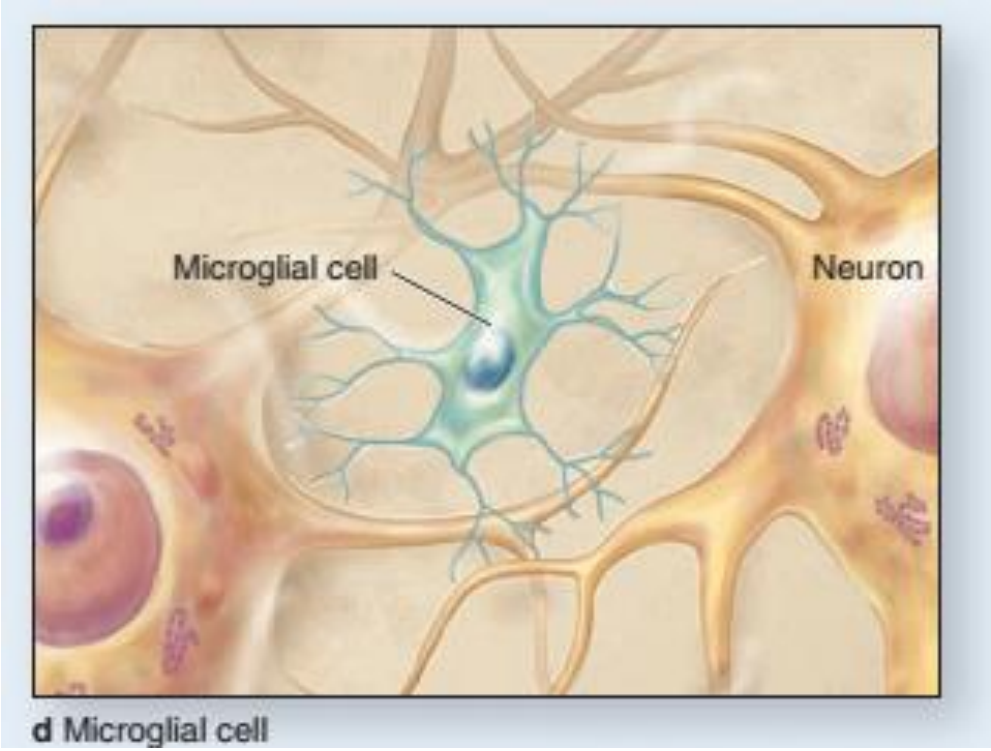


Microglia

- They secrete a number of immunoregulatory cytokines and constitute the major mechanism of immune defense in the CNS.

- Microglia do not originate from neural progenitor cells like other glia

- But from circulating blood monocytes, belonging to the same family as macrophages and other antigen-presenting cells.

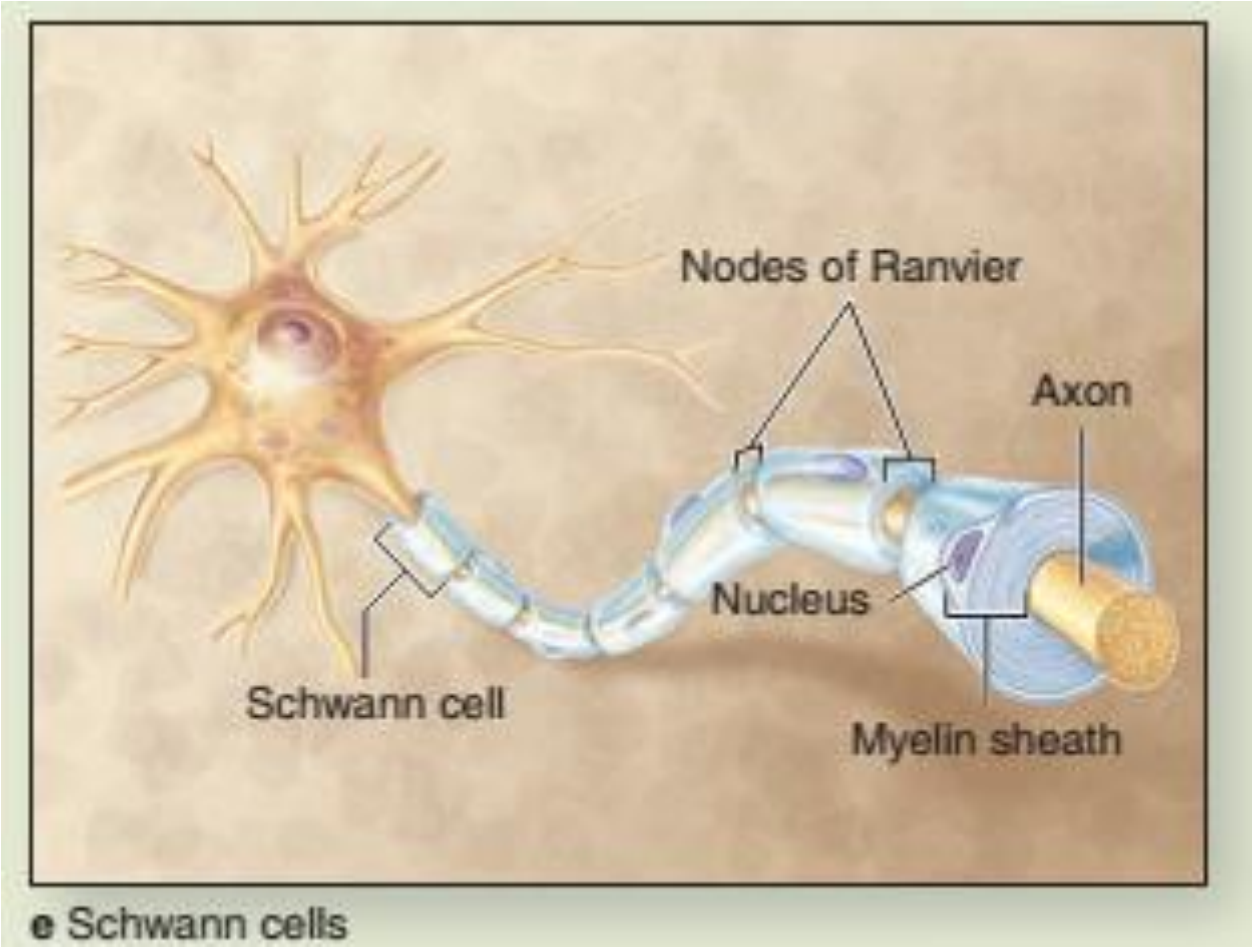


Schwann cells

❖Sometimes called neurolemmocytes

❖ Are found only in the PNS and differentiate from precursors in the neural crest.

❖ Schwann cells have trophic interactions with axons and importantly allow for their myelination, like the oligodendrocytes of the CNS

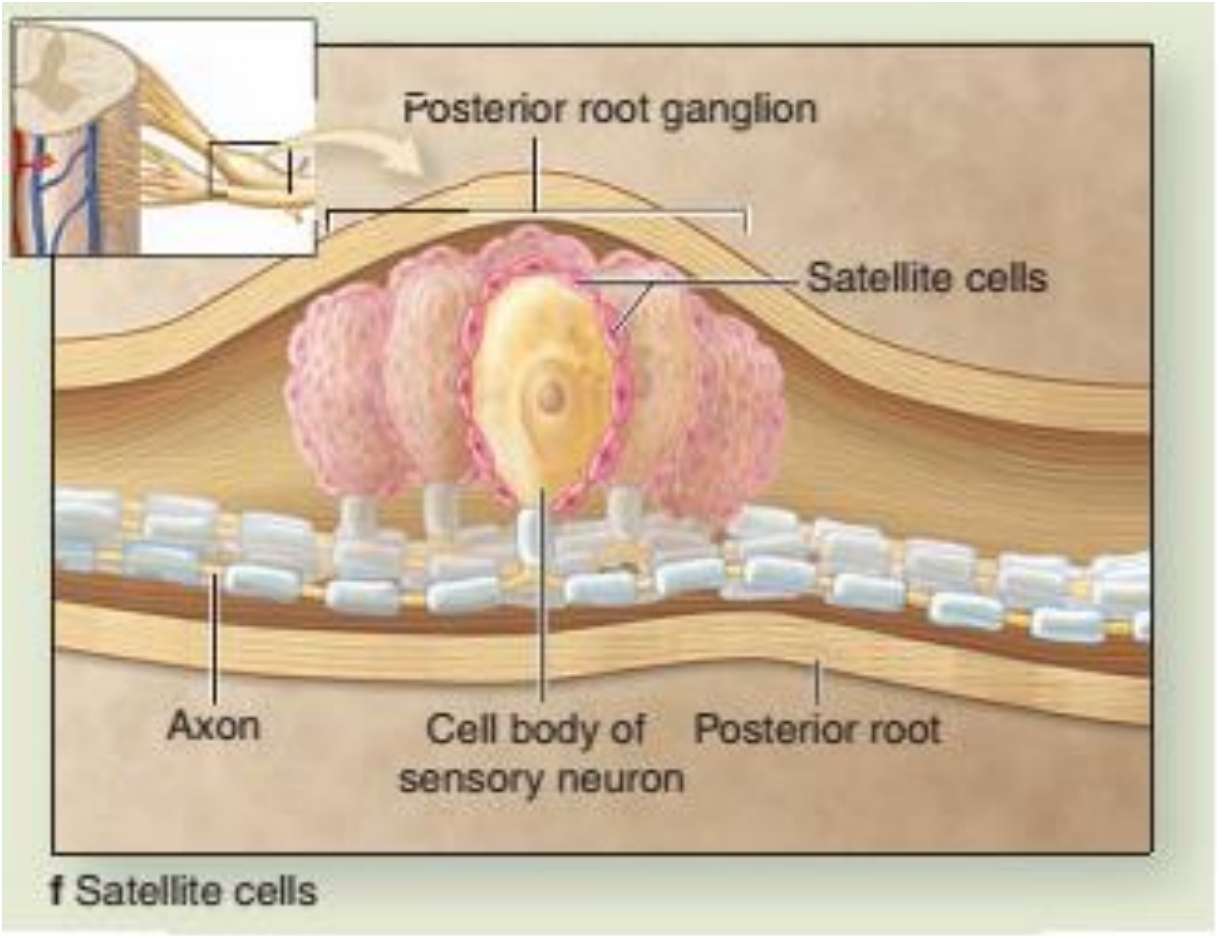


Satellite Cells of Ganglia

Derived from the embryonic neural crest

Small satellite cells form an intimate covering layer over the large neuronal cell bodies in the ganglia of the PNS

Satellite cells exert a trophic or supportive effect on these neurons, insulating, nourishing, and regulating their microenvironments.




Thank ALLAH!