

Al-Mustaqbal University college
Department of pharmacy



1 st Class, 2 st Semester

Histology

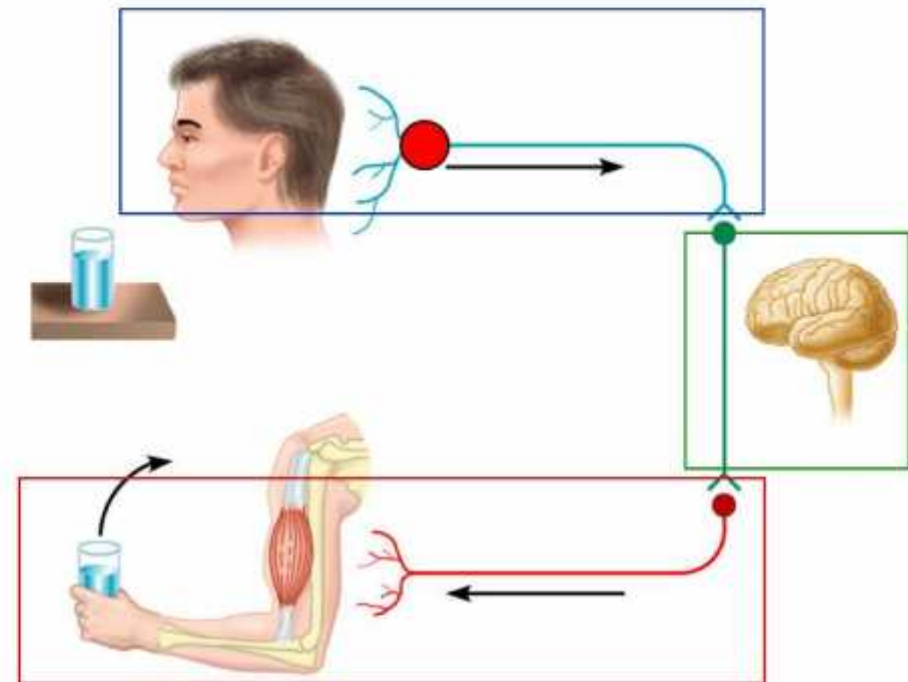
Lab 7 : histology of nervous system.

Asst. Lec. Mariam A. Ali



Nervous Tissue

- Controls and integrates all body activities within limits that maintain life
- Three basic functions
 1. sensing changes with **sensory receptors**
 2. **interpreting** and remembering those changes
 3. **reacting** to those changes with effectors





- Nervous system divided into:
 - Central nervous system (CNS)
Brain and spinal cord
 - Peripheral nervous system (PNS)
 - Cranial and spinal nerves – locate outside the CNS.



2 types of cell

- i) Neurons (nerve cells)
- ii) Supporting cells

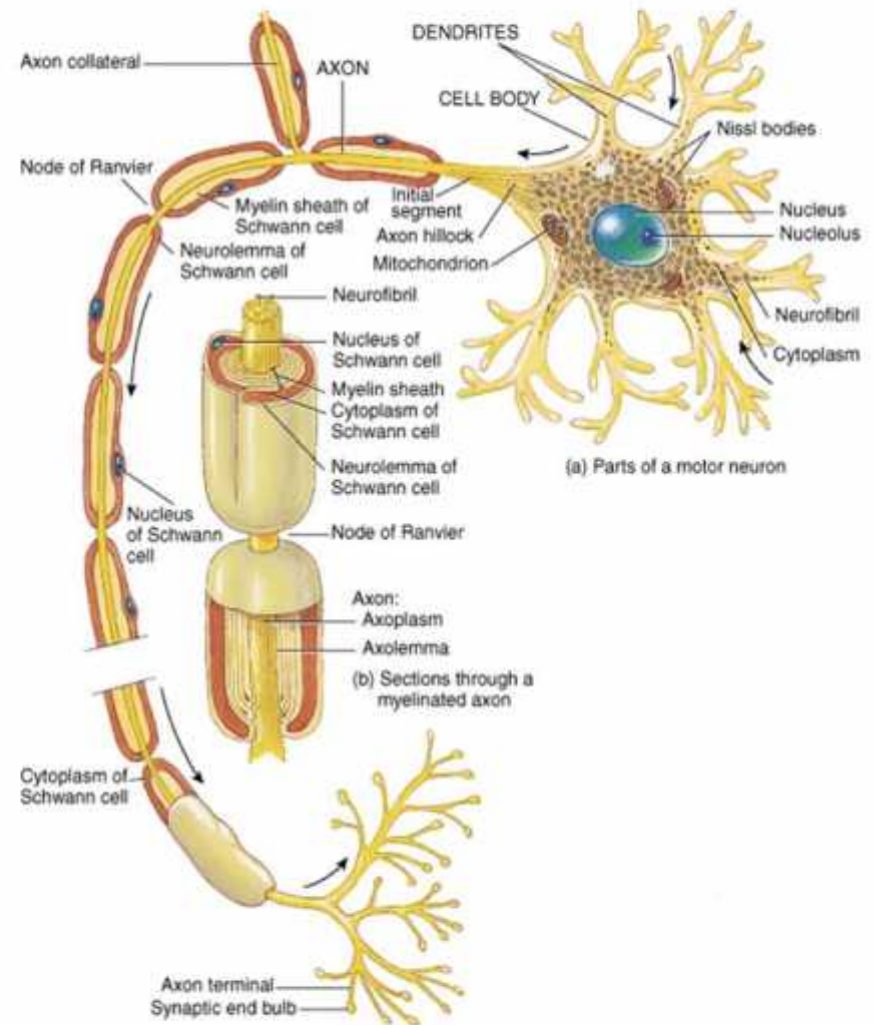
Functions of neurons

- 1) specialized to **receive stimuli** and to **conduct electrical impulses** to other parts of the system.
- 2) Arranged as an integrated **communications network**, with several neurons in a chain-like fashion involved in sending impulses from one part of the system to another.

Morphology of **typical neuron**

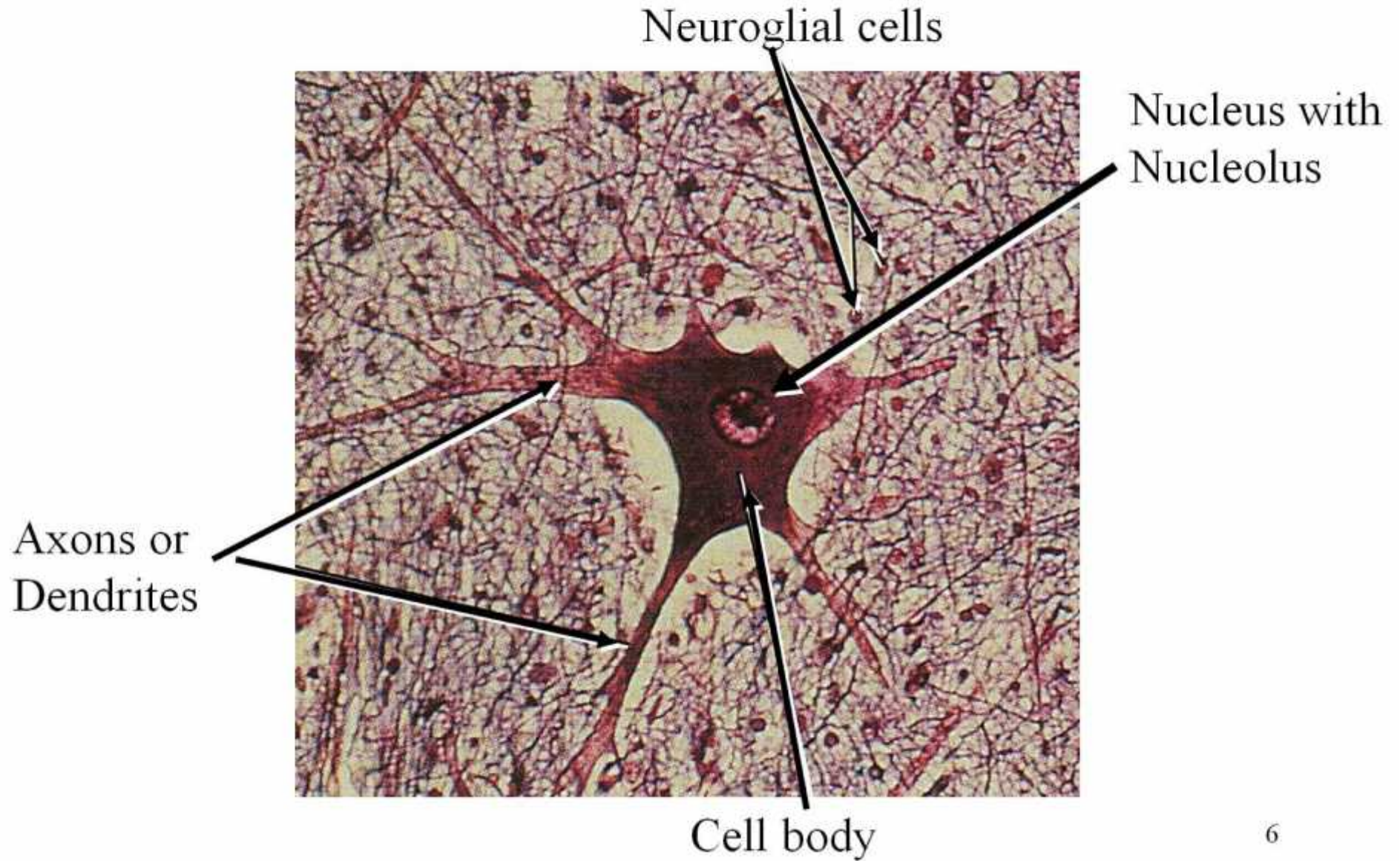


- **Neuron** functional cell of the nervous tissue.
- Cell body or perikaryon - contains the nucleus – regulates the functioning of the neuron.
 - Numerous dendrites and a single axon.
 - Contains Nissl bodies in the cytoplasm
 - Axon hillock- no Nissl bodies
- **Axon** – cellular process (extension) – carries impulses away from the cell body.
- **Dendrites** – cellular process (extension) – carries impulses toward the cell body





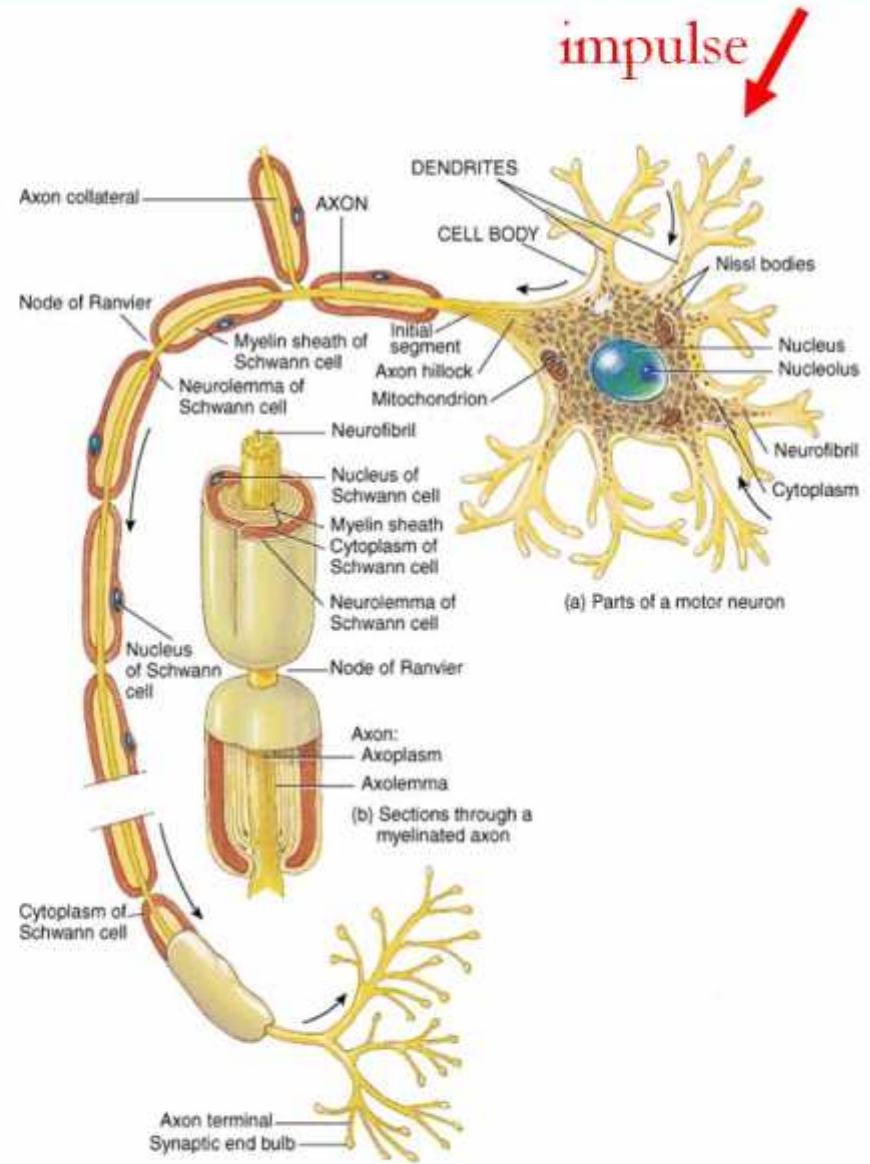
Parts of a Neuron





Dendrites

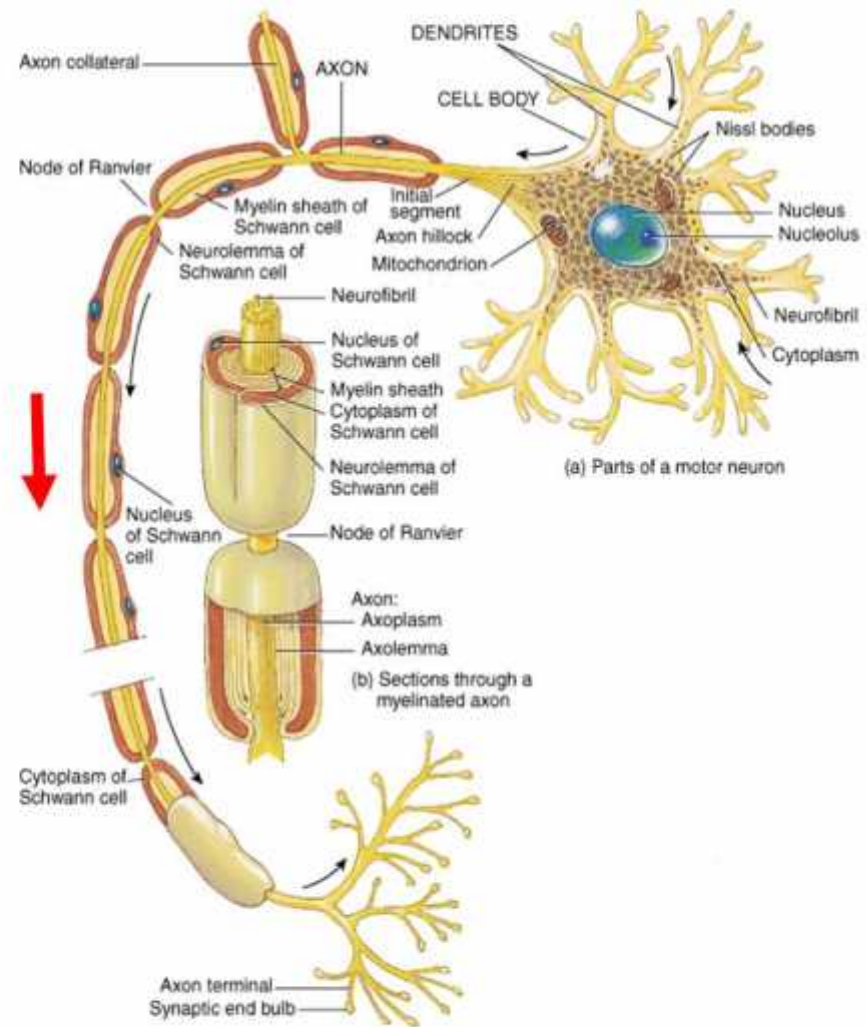
- Conducts impulses towards the cell body
- Typically short, highly branched & unmyelinated
- Surfaces specialized for contact with other neurons
- Contains neurofibrils & Nissl bodies





Axons

- Conduct impulses **away from cell body**
- Long, thin cylindrical process of cell
- Arises at **axon hillock**
- Impulses arise from initial segment (**trigger zone**)
- Side branches (**collaterals**) end in fine processes called axon terminals
- Swollen tips called **synaptic end bulbs** contain vesicles filled with neurotransmitters





Structural Classification of Neurons

- Based on number of processes found on cell body

1. **multipolar** = several dendrites & one axon

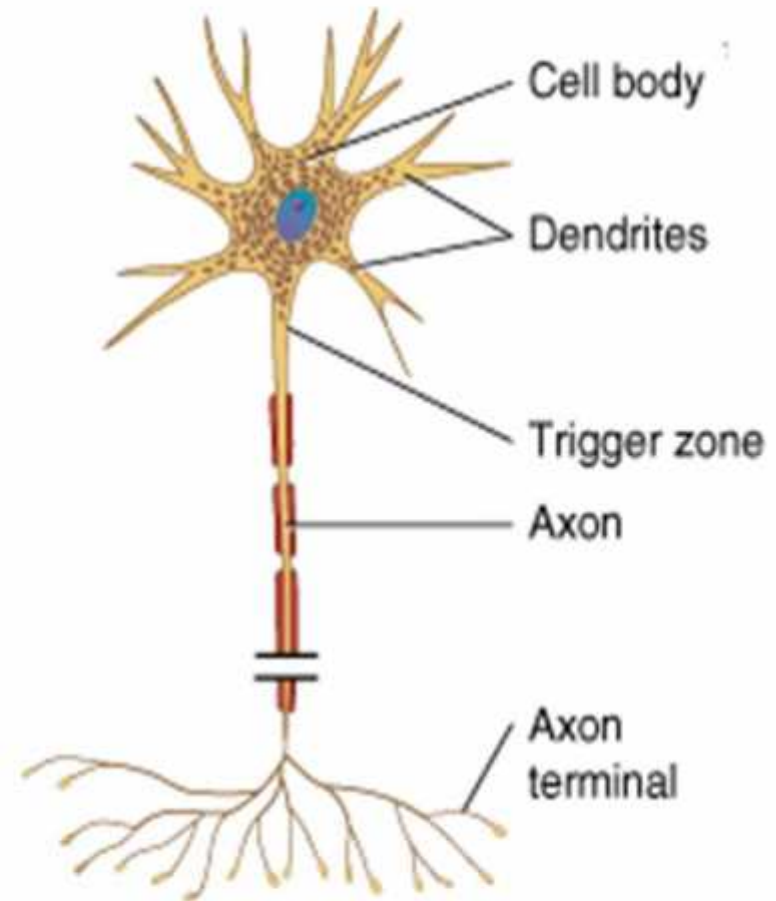
- most common cell type

2. **bipolar** neurons = one main dendrite & one axon

- found in retina, inner ear & olfactory

3. **unipolar** neurons = one process only (develops from a bipolar)

- are always sensory neurons

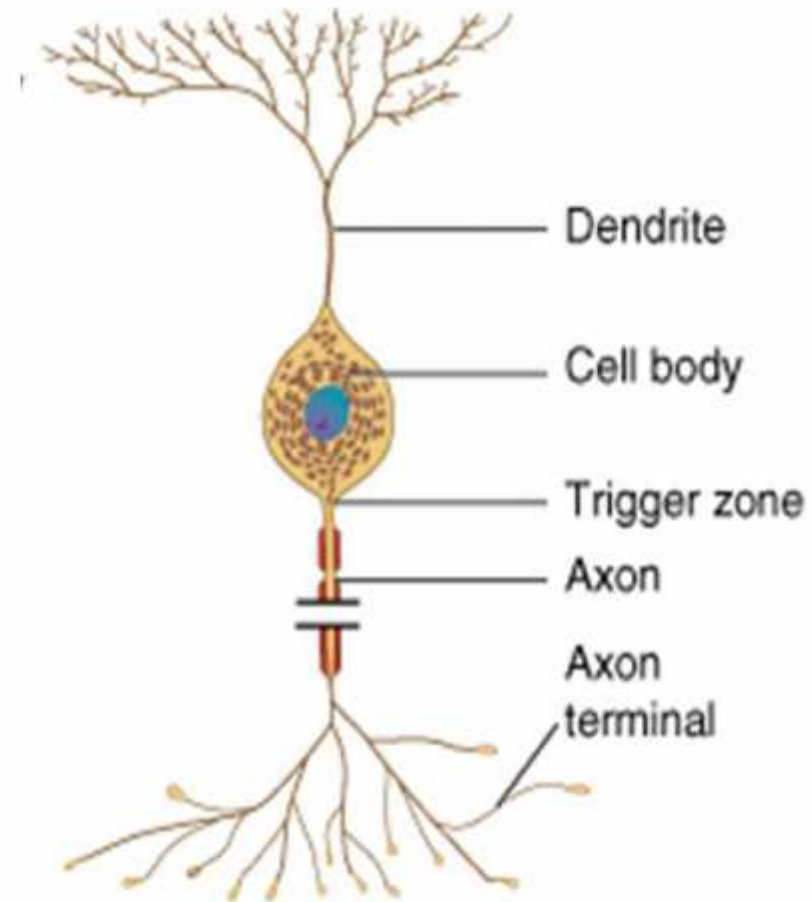


(a) Multipolar neuron



Structural Classification of Neurons

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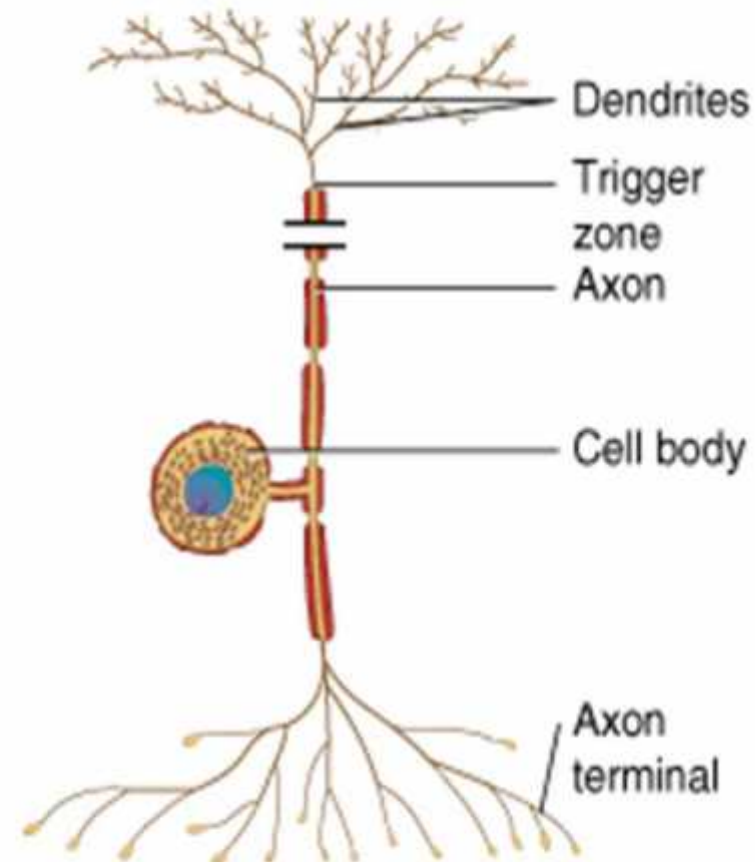


(b) Bipolar neuron



Structural Classification of Neurons

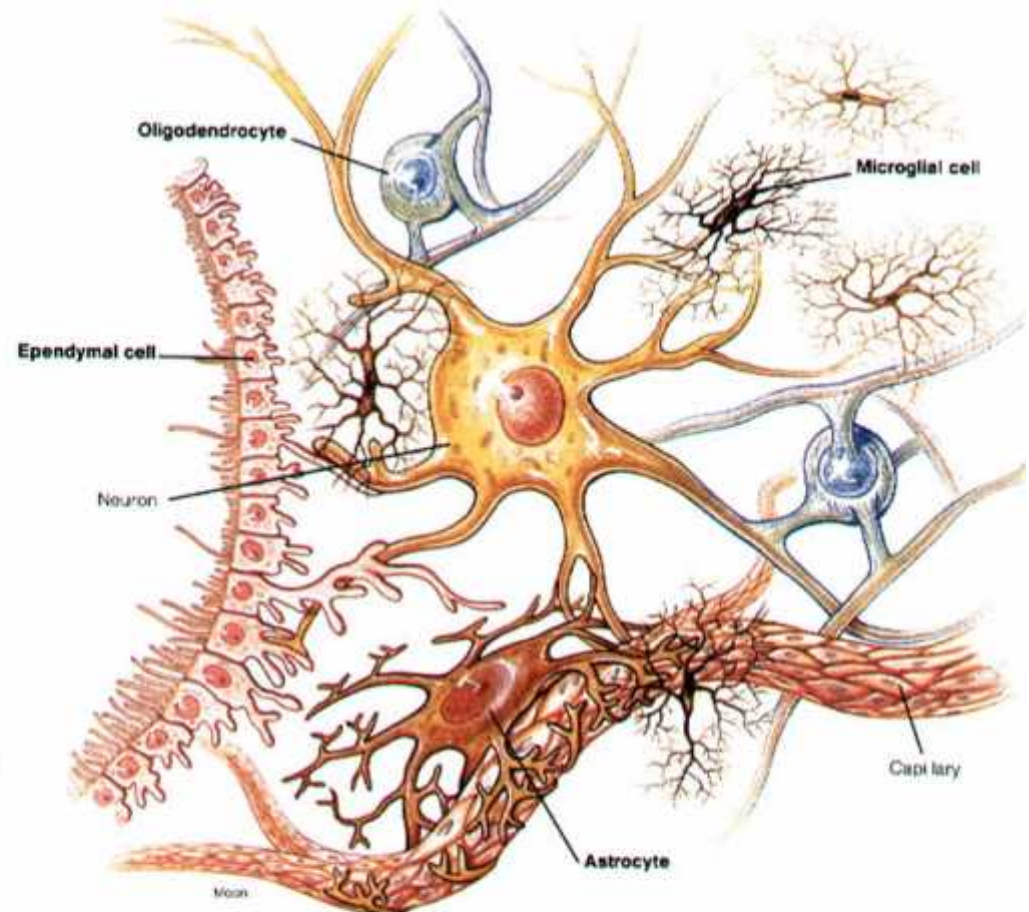
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(c) Unipolar neuron

Neuroglial Cells

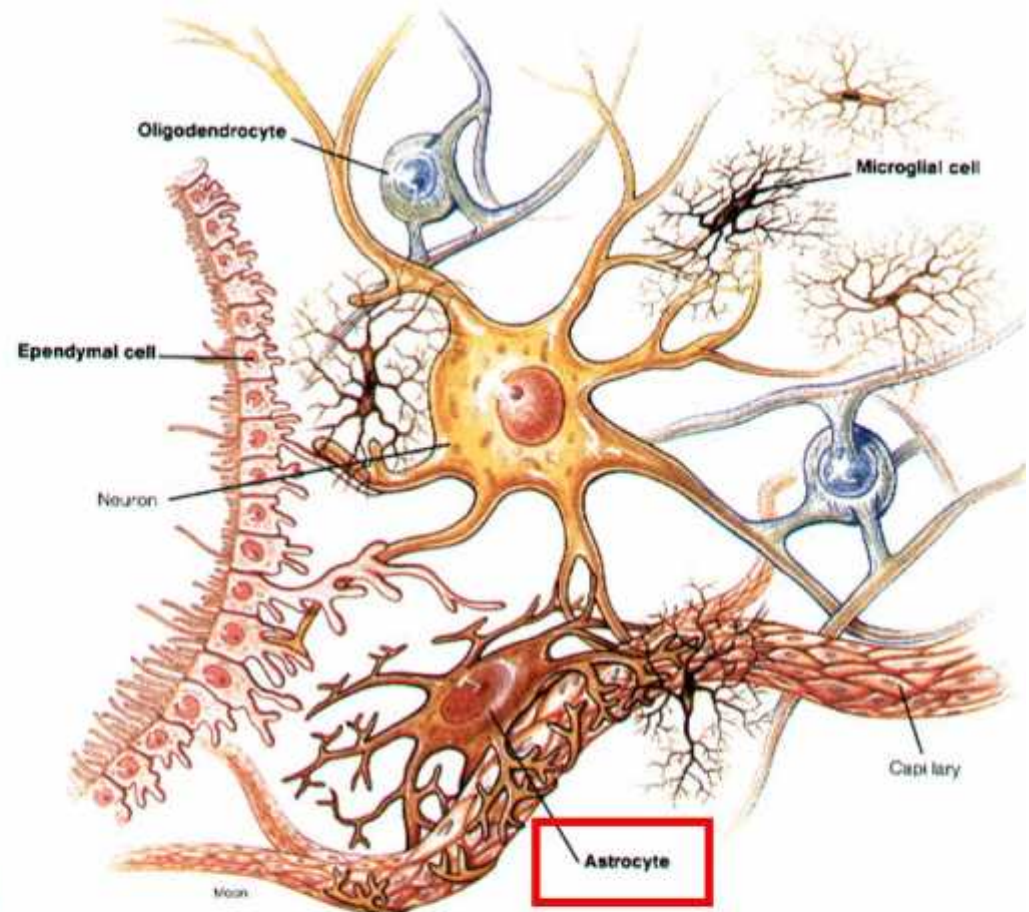
- Half of the volume of the CNS
- Smaller cells than neurons
- 50X more numerous
- Cells can **divide**
 - rapid mitosis in tumor formation (gliomas)
- 4 cell types in **CNS**
 - astrocytes, oligodendrocytes, microglia & ependymal
- 2 cell types in **PNS**
 - schwann and satellite cells





Neuroglial Cells (CNS): Astrocytes

- Star-shaped cells
- Form **blood-brain barrier** by covering blood capillaries
- **Metabolize neurotransmitters**
- Regulate **K⁺ balance**
- Provide **structural support**

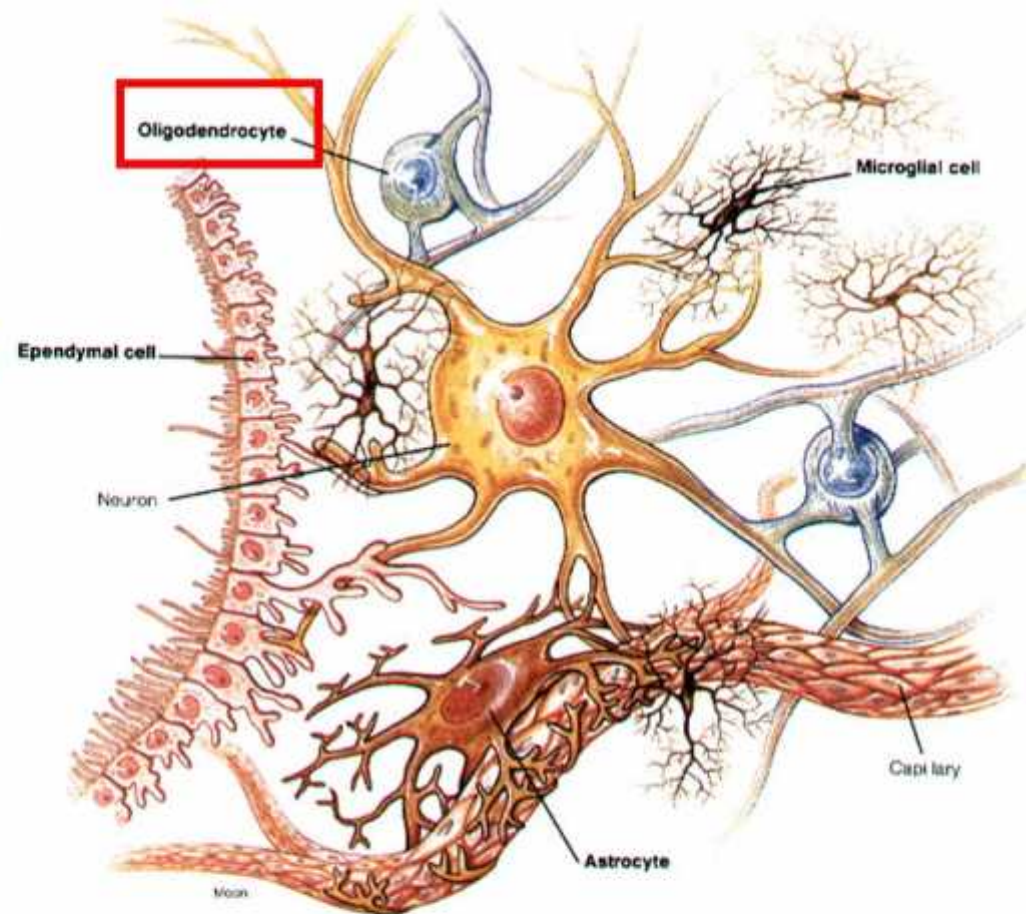




Neuroglial Cells (CNS): Oligodendrocytes

Most common glial cell type

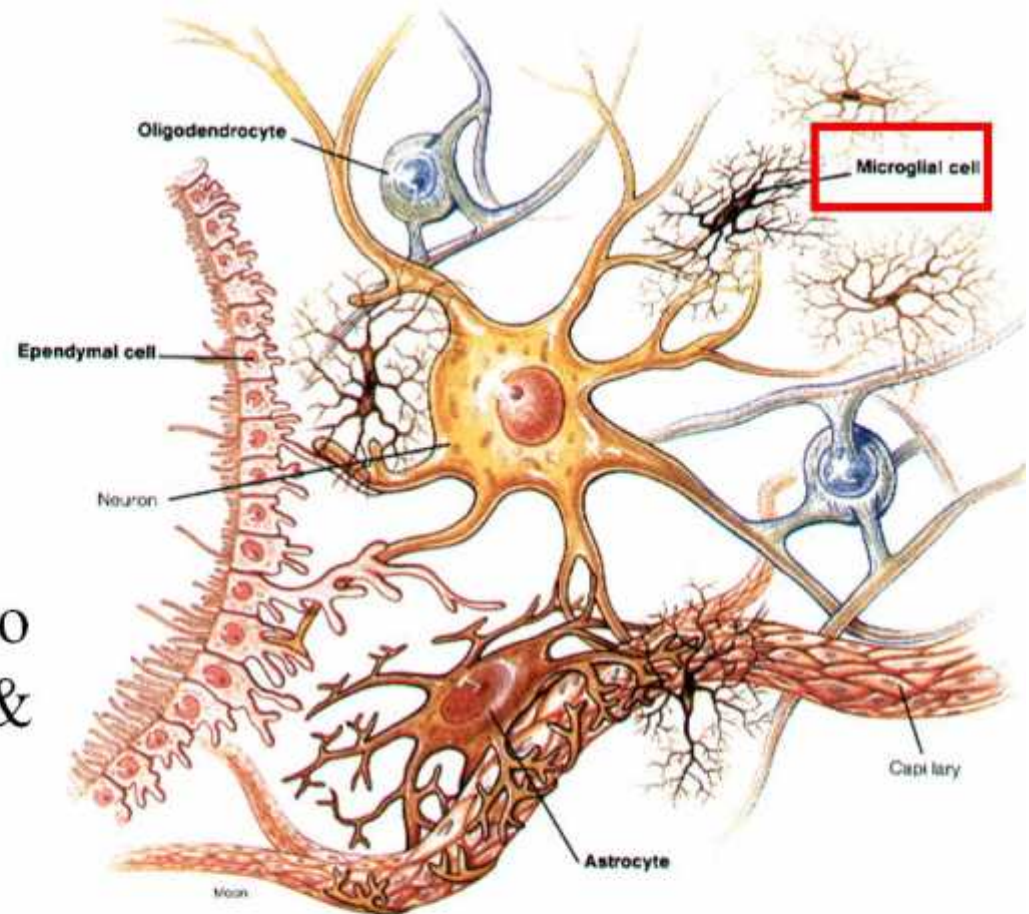
- Each forms **myelin sheath** around more than one axons in CNS
- Analogous to Schwann cells of PNS





Neuroglial Cells (CNS): Microglia

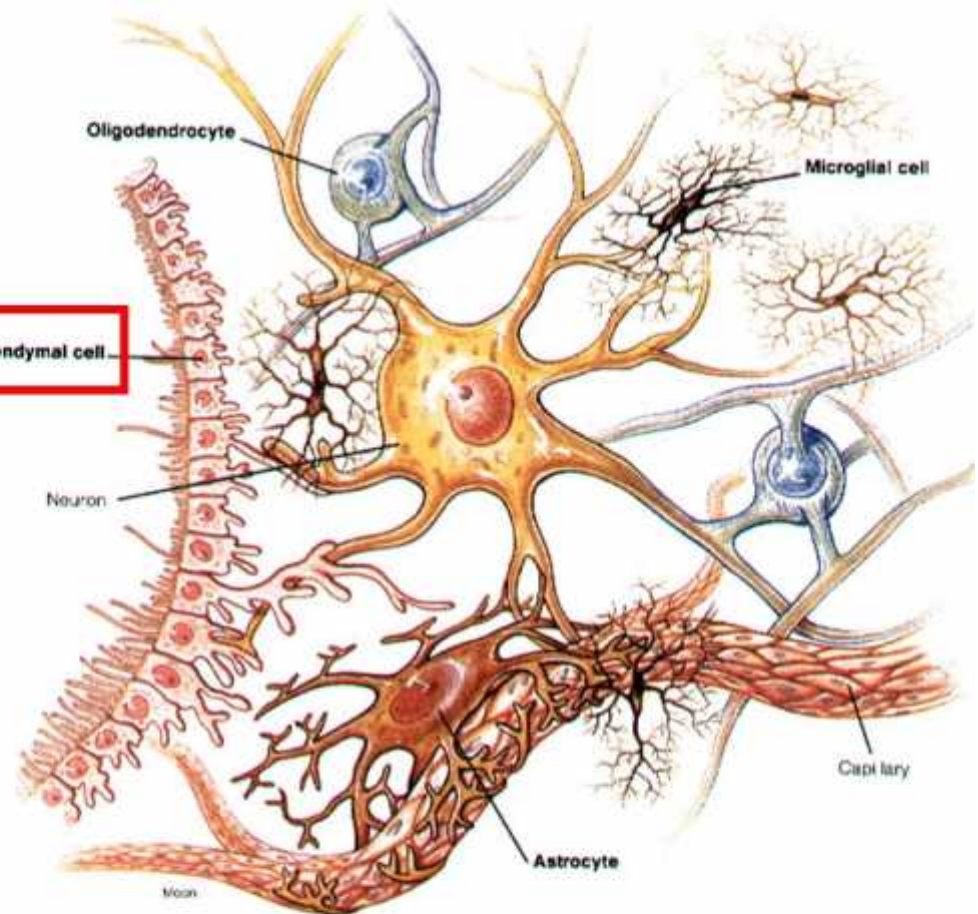
- Small cells found near blood vessels
- **Phagocytic role** -- clear away dead cells
- Derived from cells that also gave rise to macrophages & monocytes





Neuroglial Cells (CNS): Ependymal cells

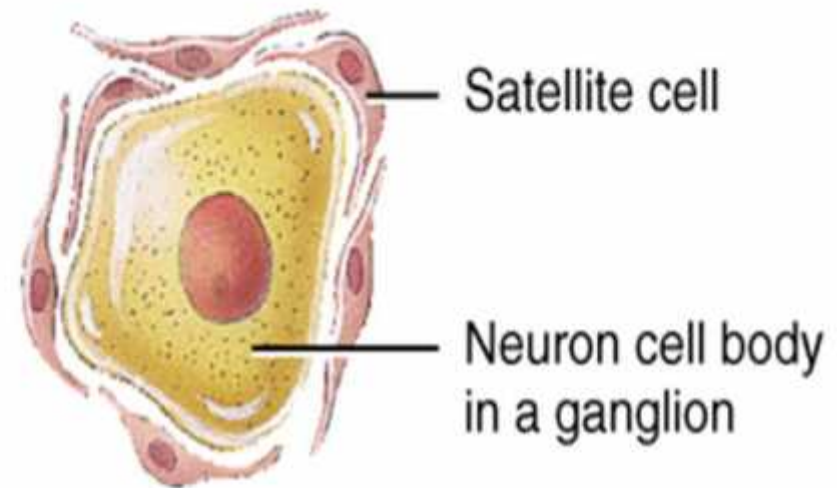
- Form epithelial membrane lining cerebral cavities & central canal
- Produce cerebrospinal fluid (CSF)





Neuroglial Cells (PNS): Satellite Cells

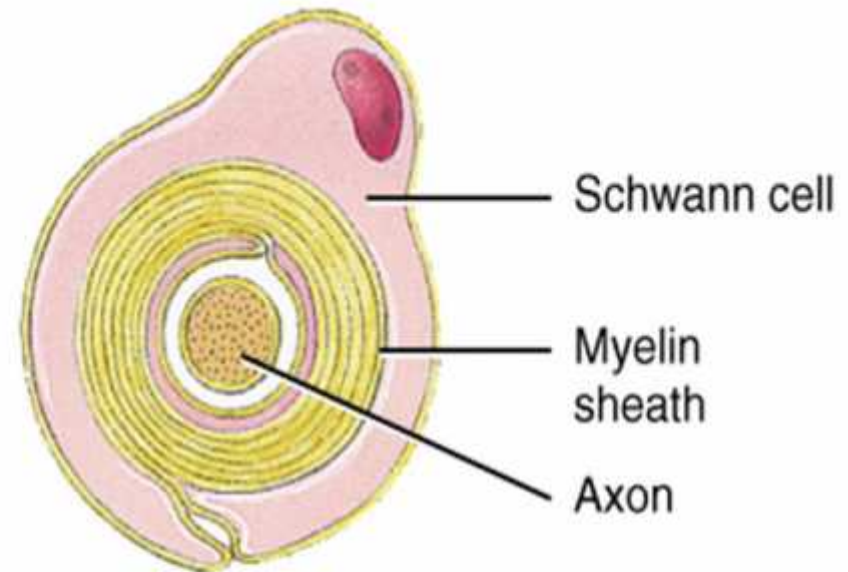
- Flat cells surrounding neuronal cell bodies in peripheral ganglia
- **Support neurons** in the PNS ganglia





Neuroglial Cells (PNS): Schwann Cell

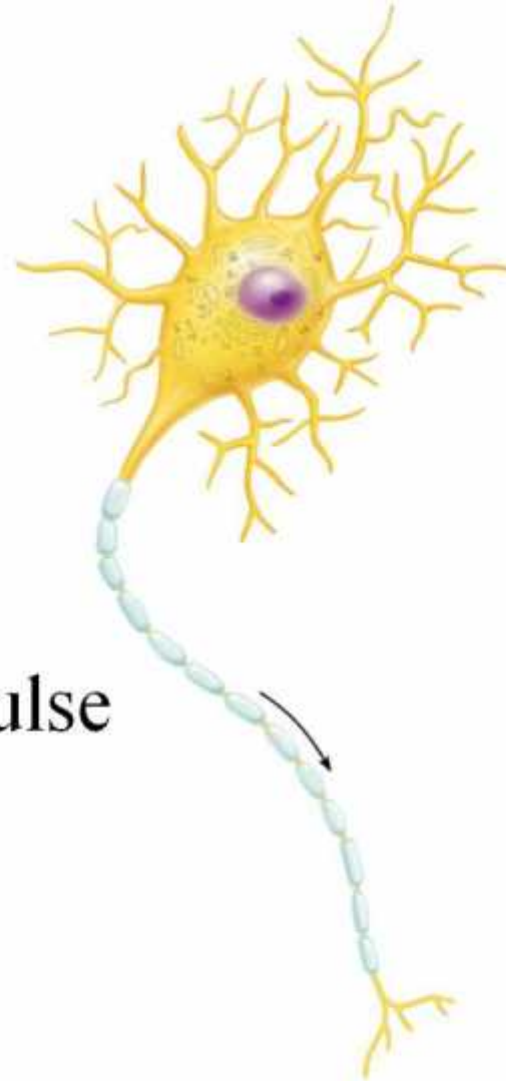
- Cells encircling PNS axons
- Each cell produces part of the myelin sheath surrounding an axon in the PNS





Myelination

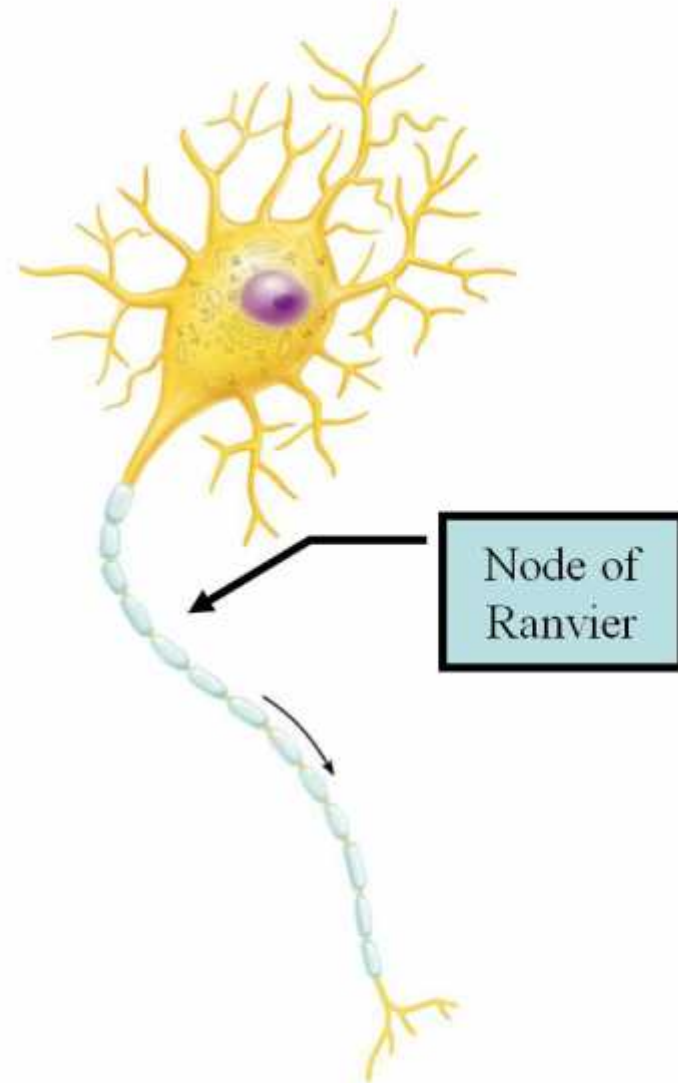
- Insulation of axon
- Increase speed of nerve impulse





Myelination: PNS

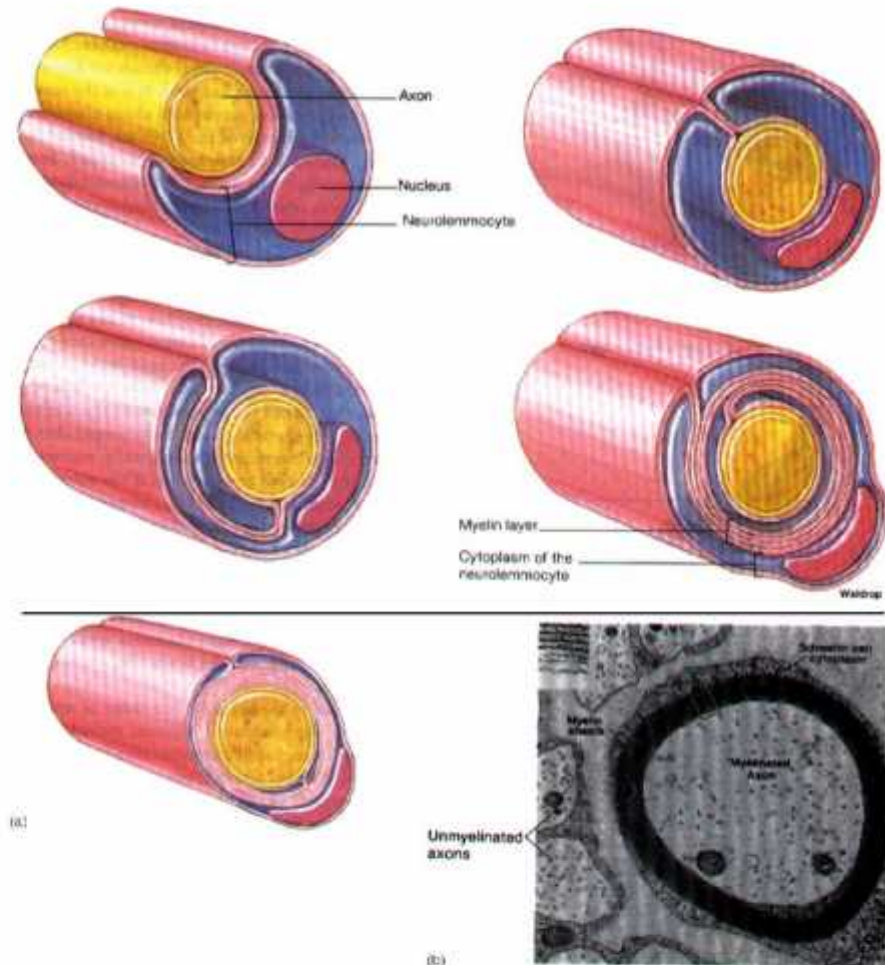
- All axons surrounded by a lipid & protein covering (**myelin sheath**) produced by **Schwann cells**
- **Neurilemma** is cytoplasm & nucleus of Schwann cell
 - gaps called **nodes of Ranvier**
- Myelinated fibers
- Unmyelinated fibers





Myelination: PNS

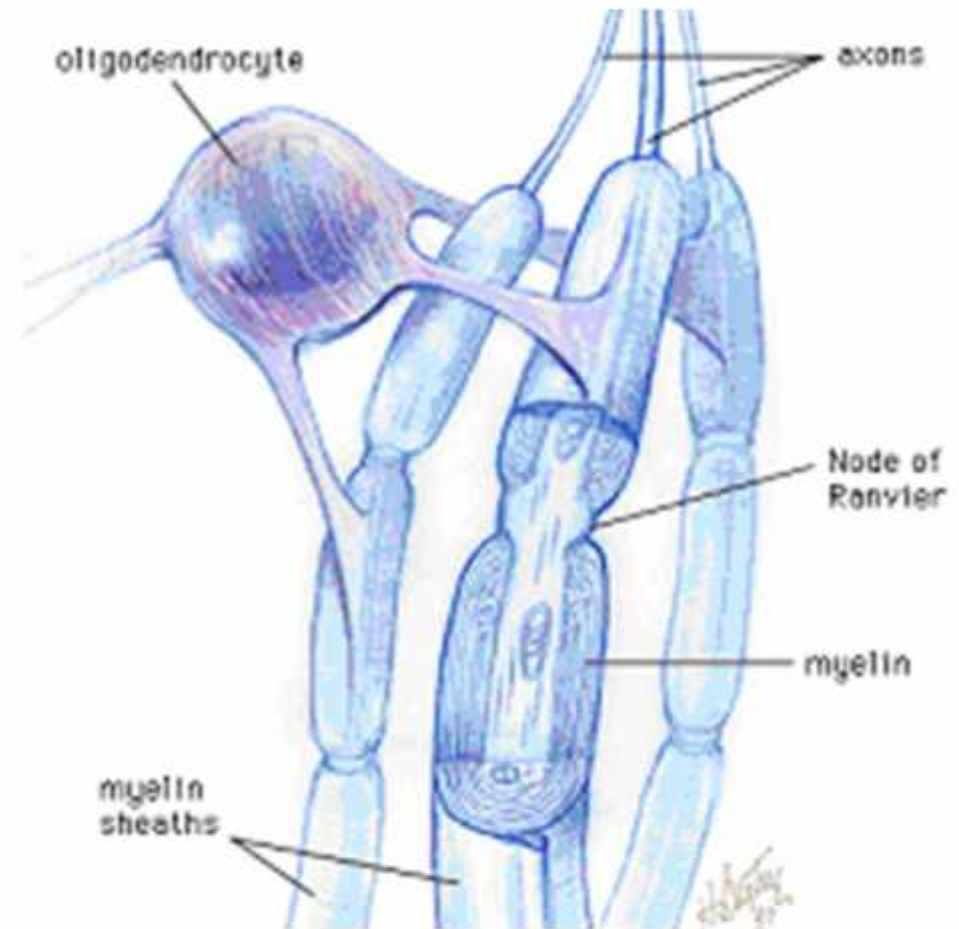
- **Schwann cells** myelinate (wrap around) axons in the PNS during fetal development
- Schwann cell cytoplasm & nucleus forms outermost layer of **neurolemma** with inner portion being the myelin sheath
- Tube guides growing axons that are repairing themselves





Myelination: CNS

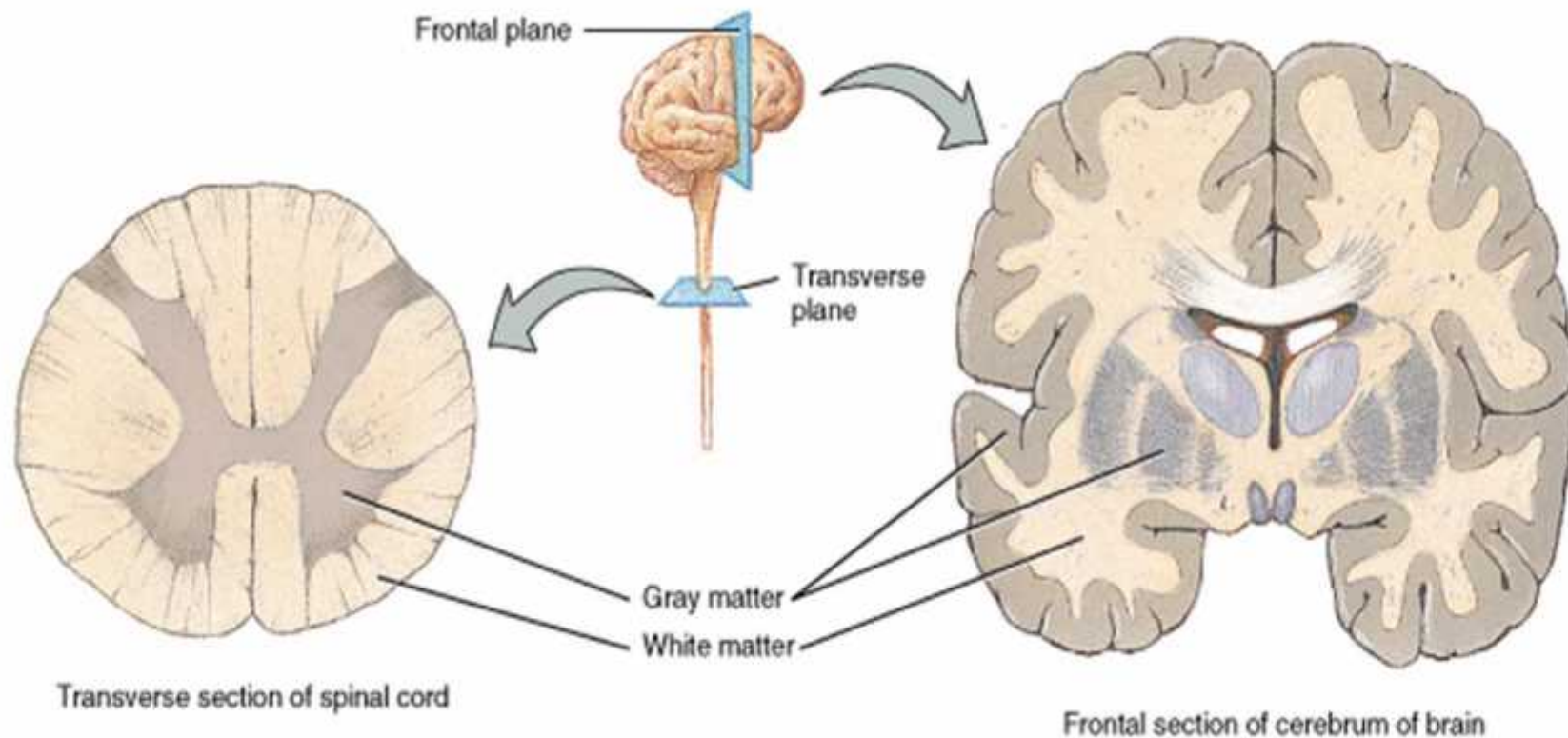
- **Oligodendrocytes** myelinate axons in the CNS
- Broad, flat cell processes wrap about CNS axons, but the cell bodies do not surround the axons
- No **neurilemma** is formed
- **Little regrowth** after injury is possible due to the lack of a distinct tube or neurilemma





Gray and White Matter

- **White matter** = myelinated processes (white in color)
- **Gray matter** = nerve cell bodies, dendrites, axon terminals, bundles of unmyelinated axons and neuroglia (gray color)



Myelin – formation & function

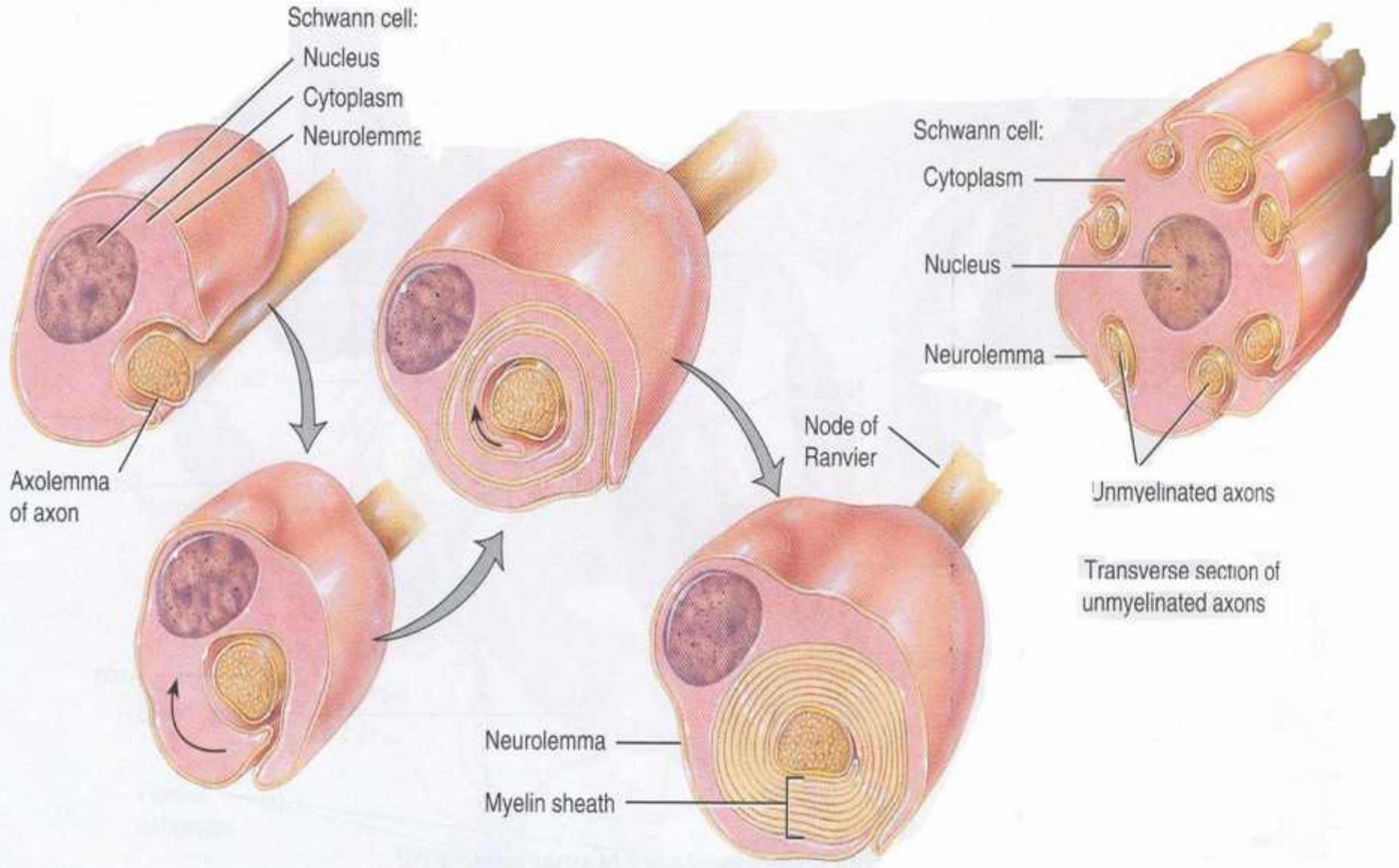


- Whitish, fatty (protein-lipid), segmented sheath around most long axons
- Its function:
 1. Protection of the axon
 2. Electrically insulating fibers from one another
 3. Increasing the speed of nerve impulse transmission

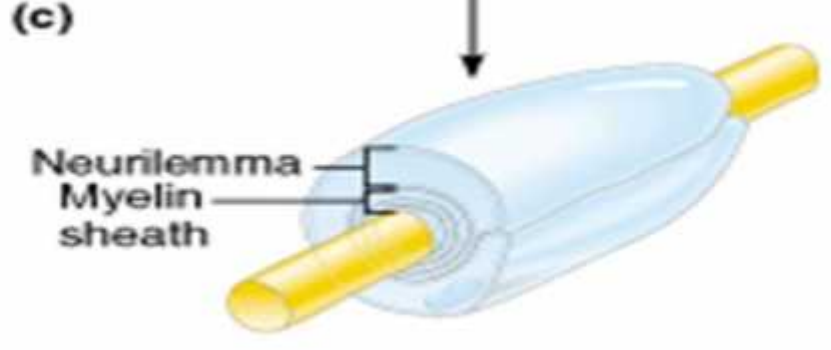
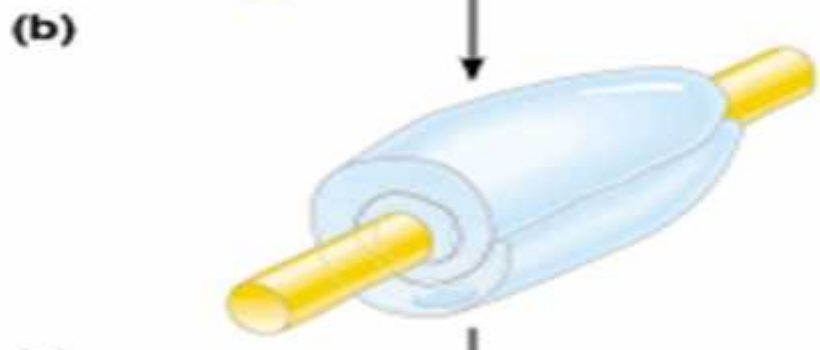
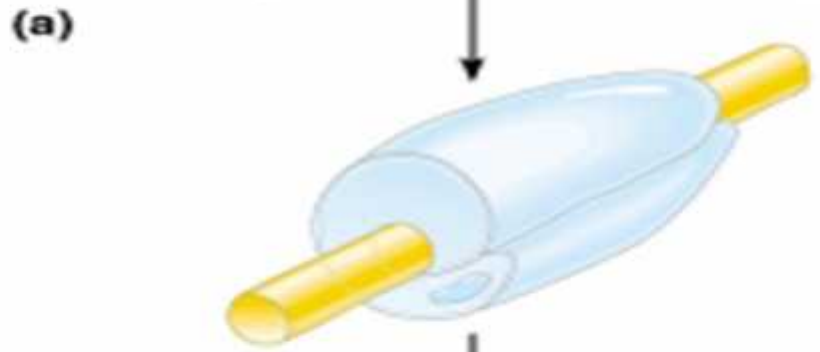
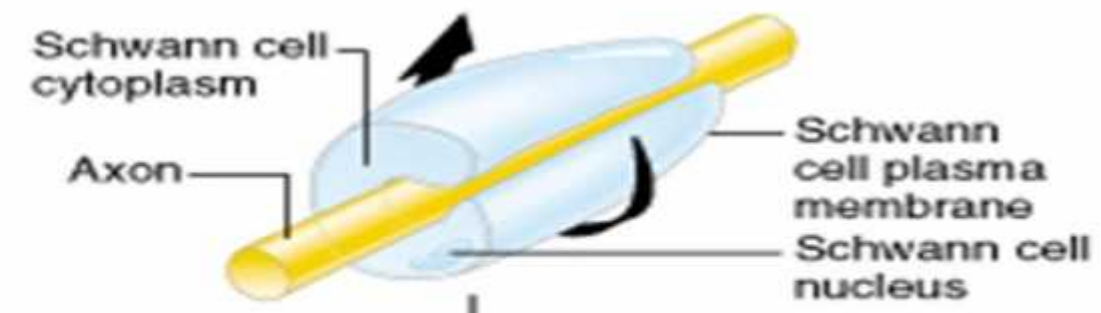
2 types of neuroglia produce myelin

- CNS= Oligodendrocyte
- PNS= Schwann cells





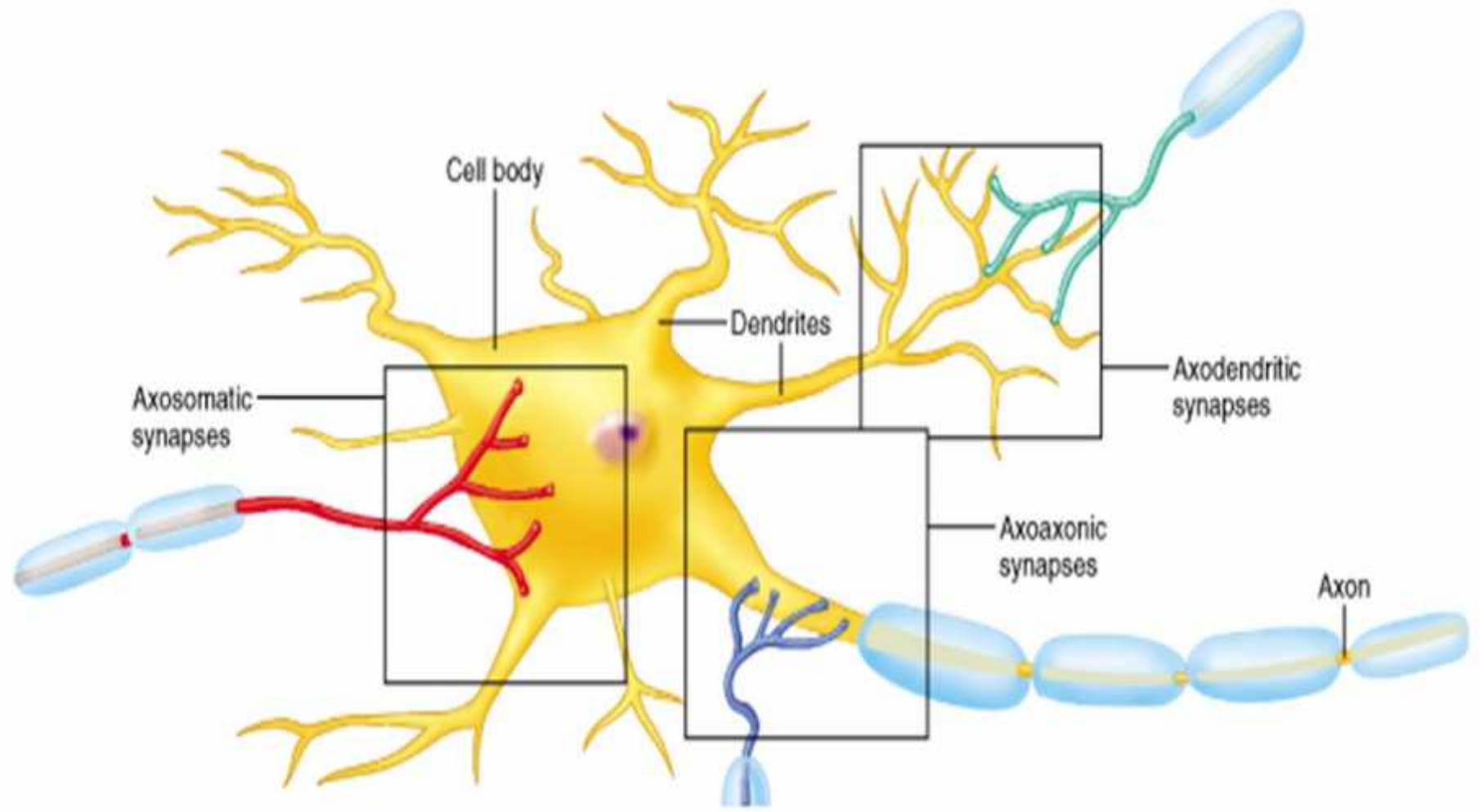
(a) Transverse sections of stages in the formation of a myelin sheath



Synapse



- The region where the terminals come close to another cell and transmit the impulse
- A junction that mediates information transfer from one neuron:
 - To another neuron
 - To an effector cell
- Presynaptic neuron - conducts impulses toward the synapse
- Postsynaptic neuron - transmits impulses away from the synapse



(a)