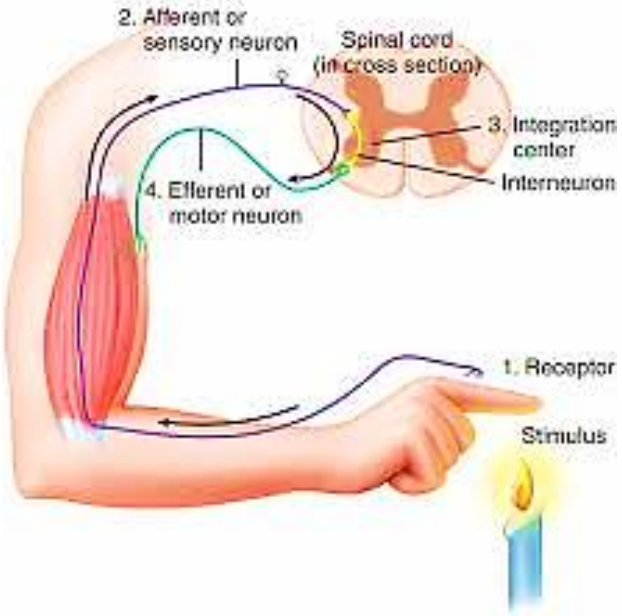
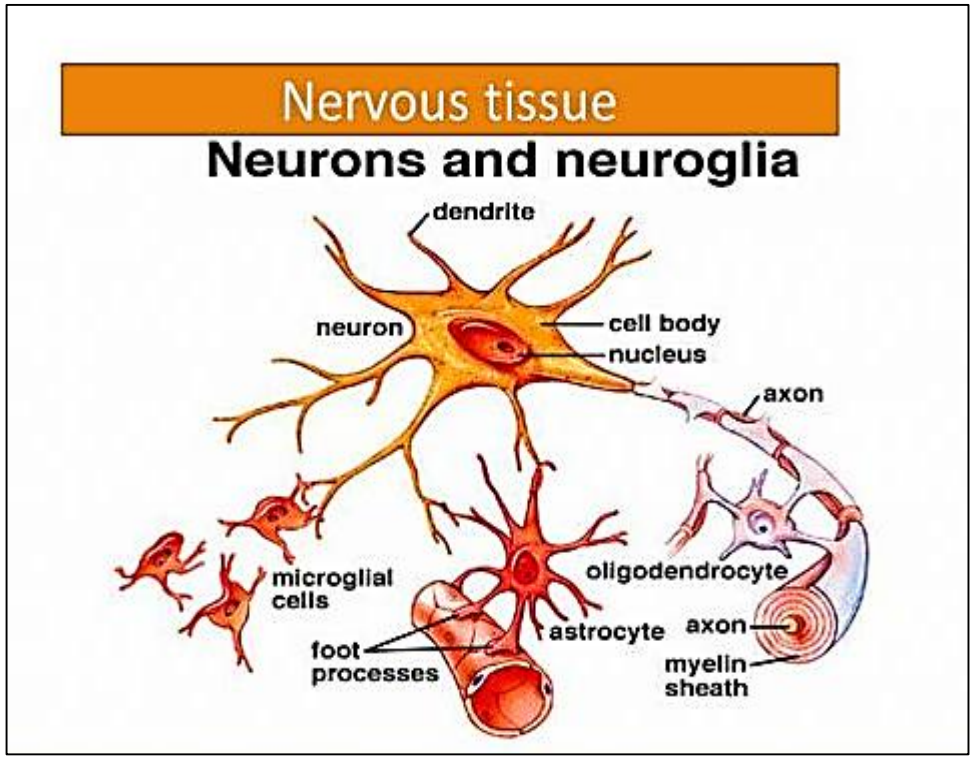
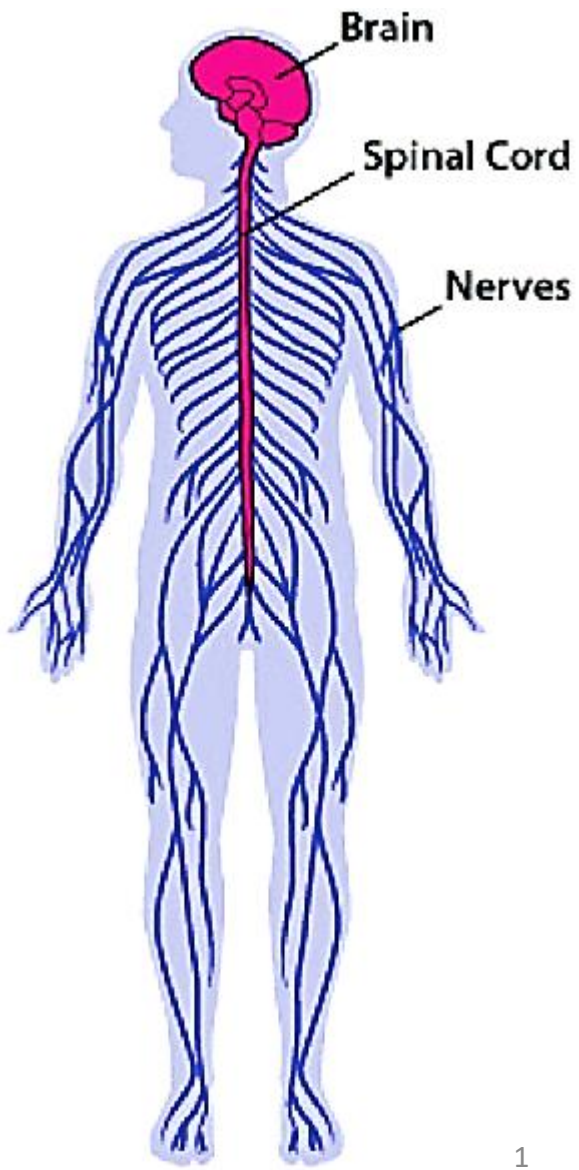
The Nervous Tissue
Nerve = Neuro….
Part II

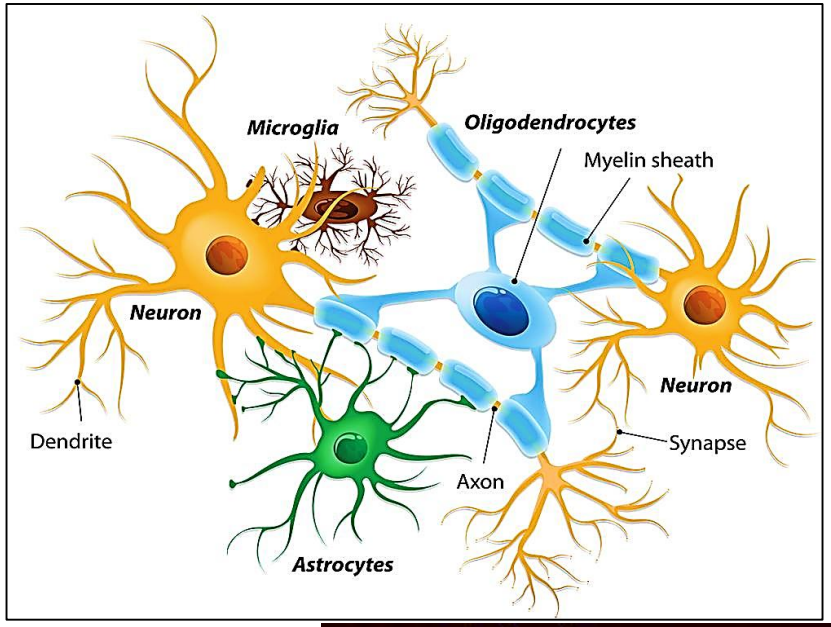






Neuroglia

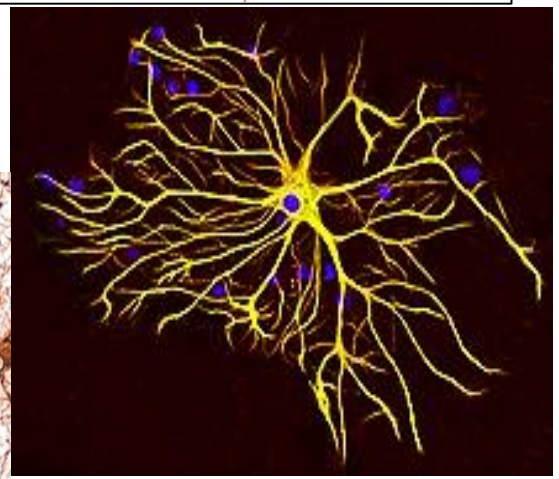
- They are supporting cells of the nervous system
- Branching cells that bind the neurons together and with blood vessels



- The can be demonstrated by

1- immunohistochemical stains using antibodies against glial fibrillary acid protein

2- Gold / silver impregnation technique



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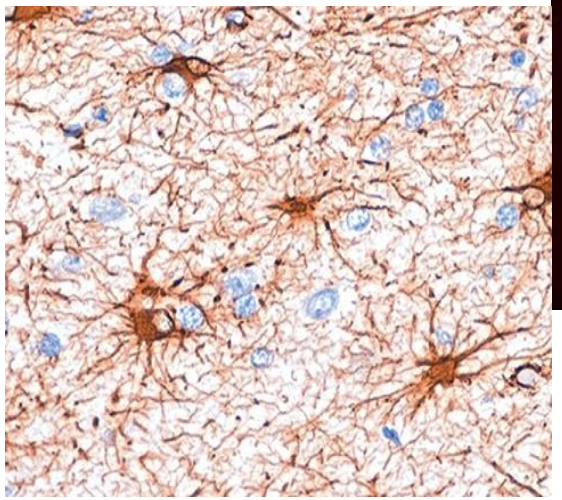
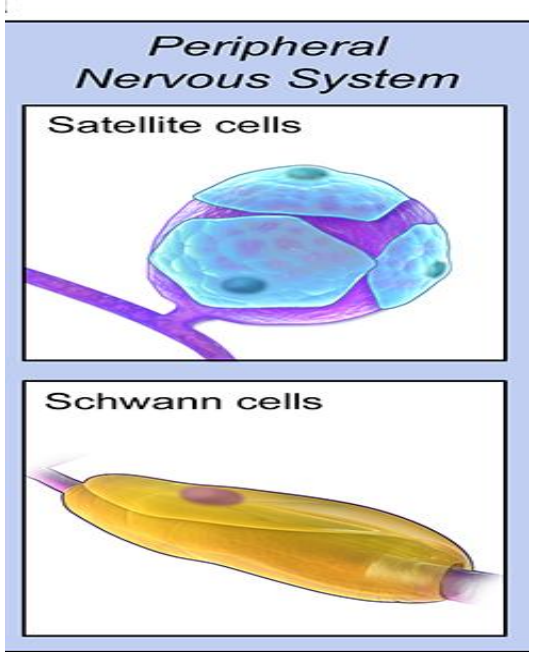


2

Types of neuroglia

1- Neuroglia in PNS



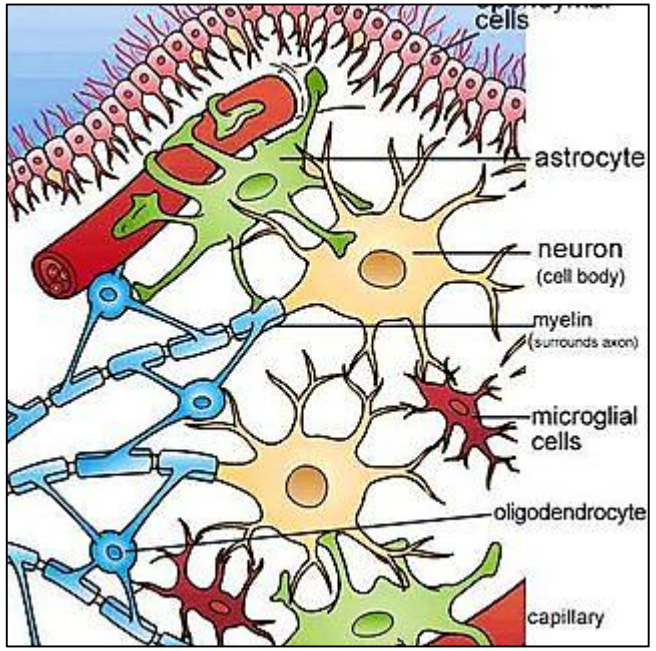
Satellite cells

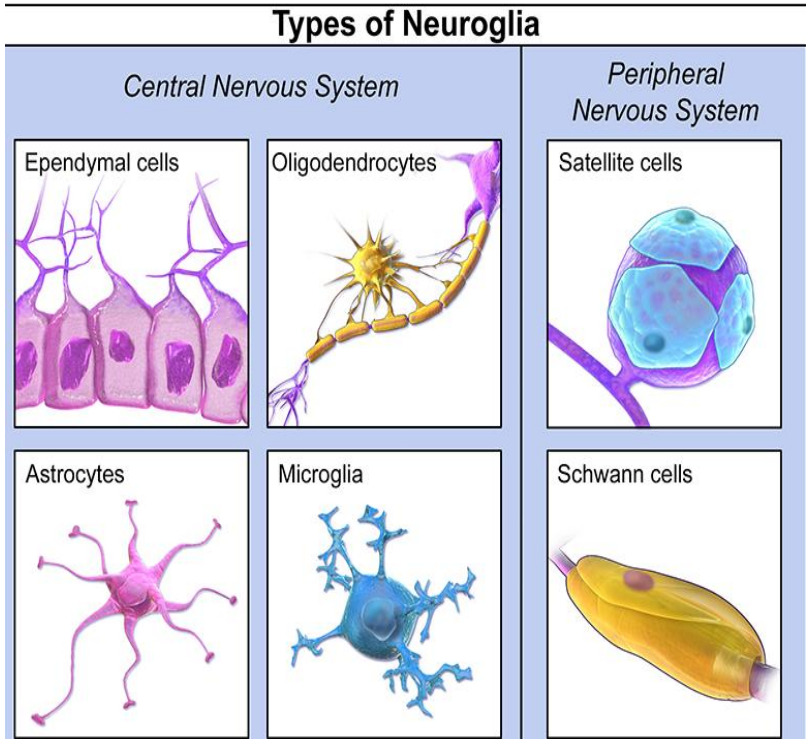
Found around nerve cell bodies in Ganglia

Schwan cells

Found around axons of peripheral nerves

Types of neuroglia



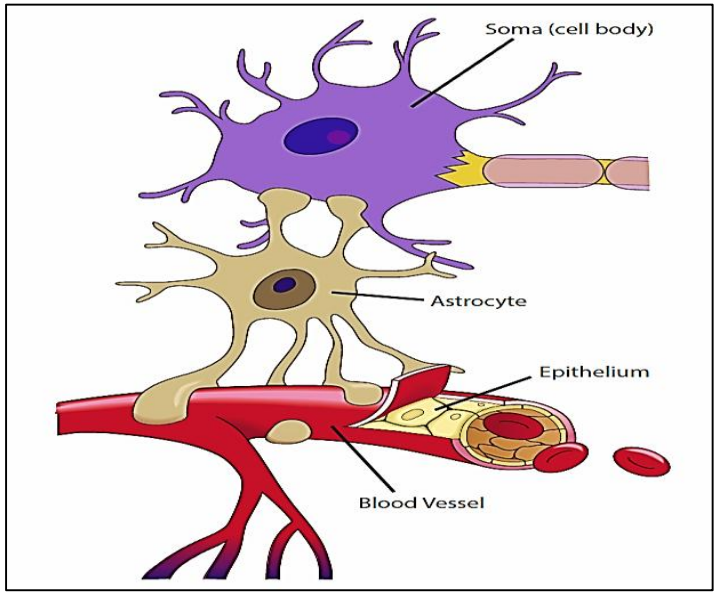


2- Neuroglia in CNS

- **Asrtrocytes**
- **Microglia**
- **Oligodendrocytes**
- **Ependymal cells**

1- Astrocytes = Macroglia

Large, star shaped cells, have multiple process each ends by **foot like expansion on the surface of the blood vessels**



Function:

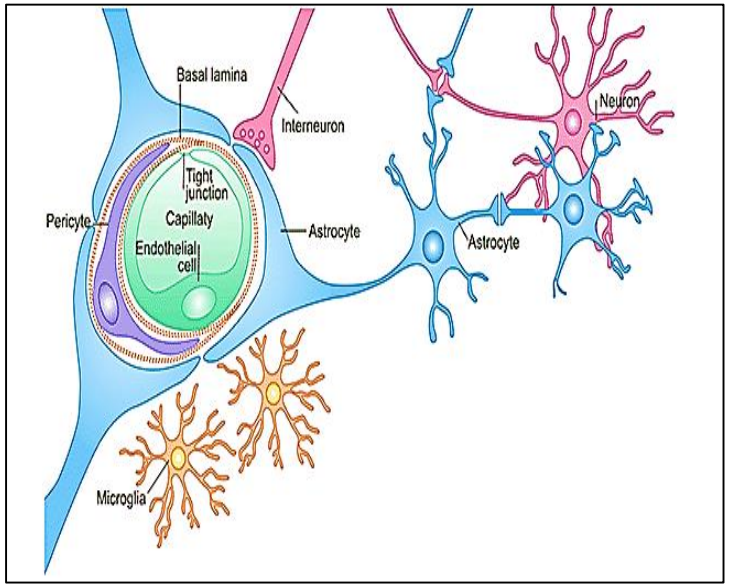
1-Support: processes provide structural support for neurons

2- Nutrition& ion levels : through connection with B.V.

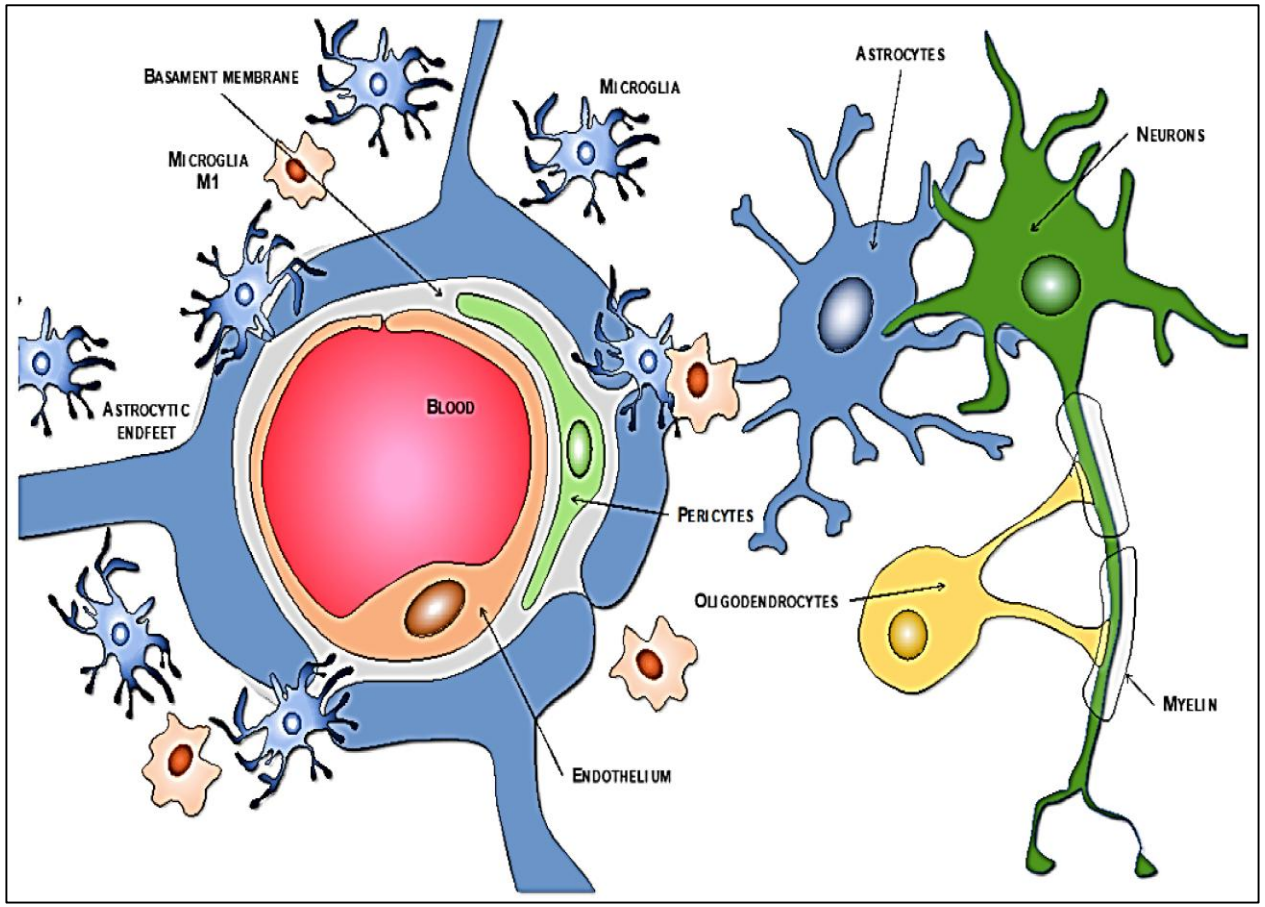
3- Metabolic function: excess neurotransmitters formed by the neurons are cleared either **by uptake by astrocytes** or **by degradation by specific enzyme** to maintain brain function & prevent overstimulation

4- Formation of blood brain barrier : astrocytes end -feet

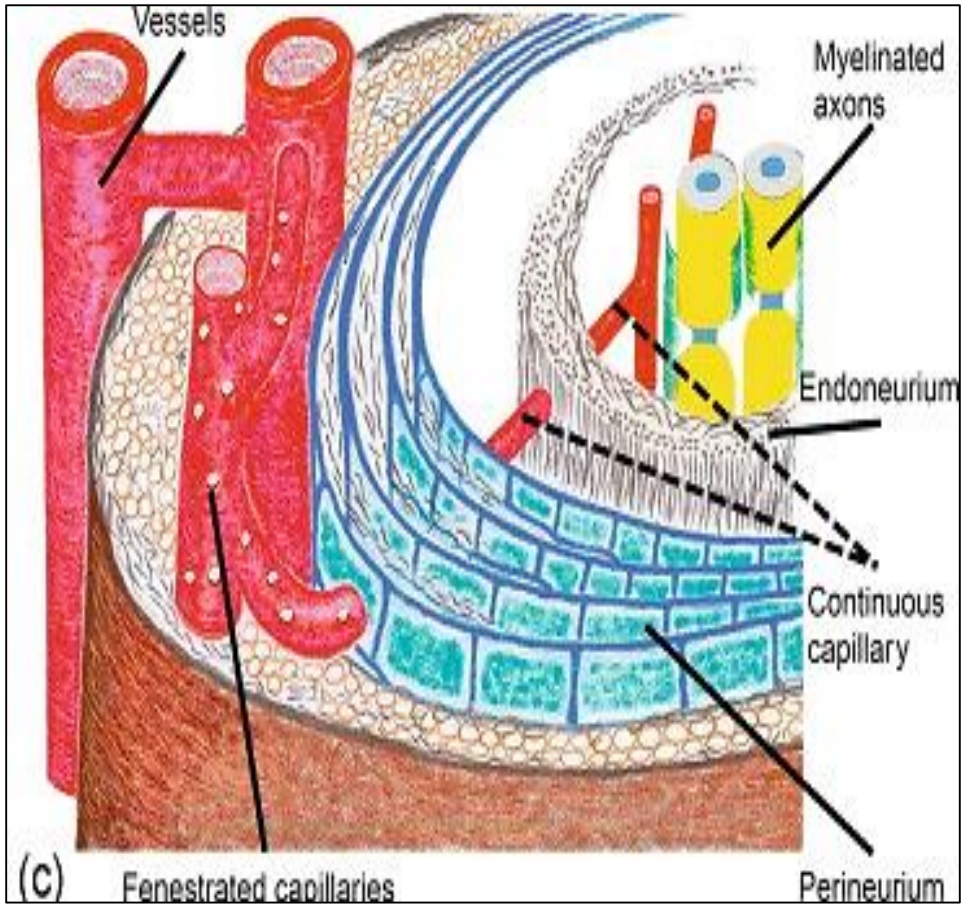
5- Store glycogen : the only cell that store glycogen in the brain



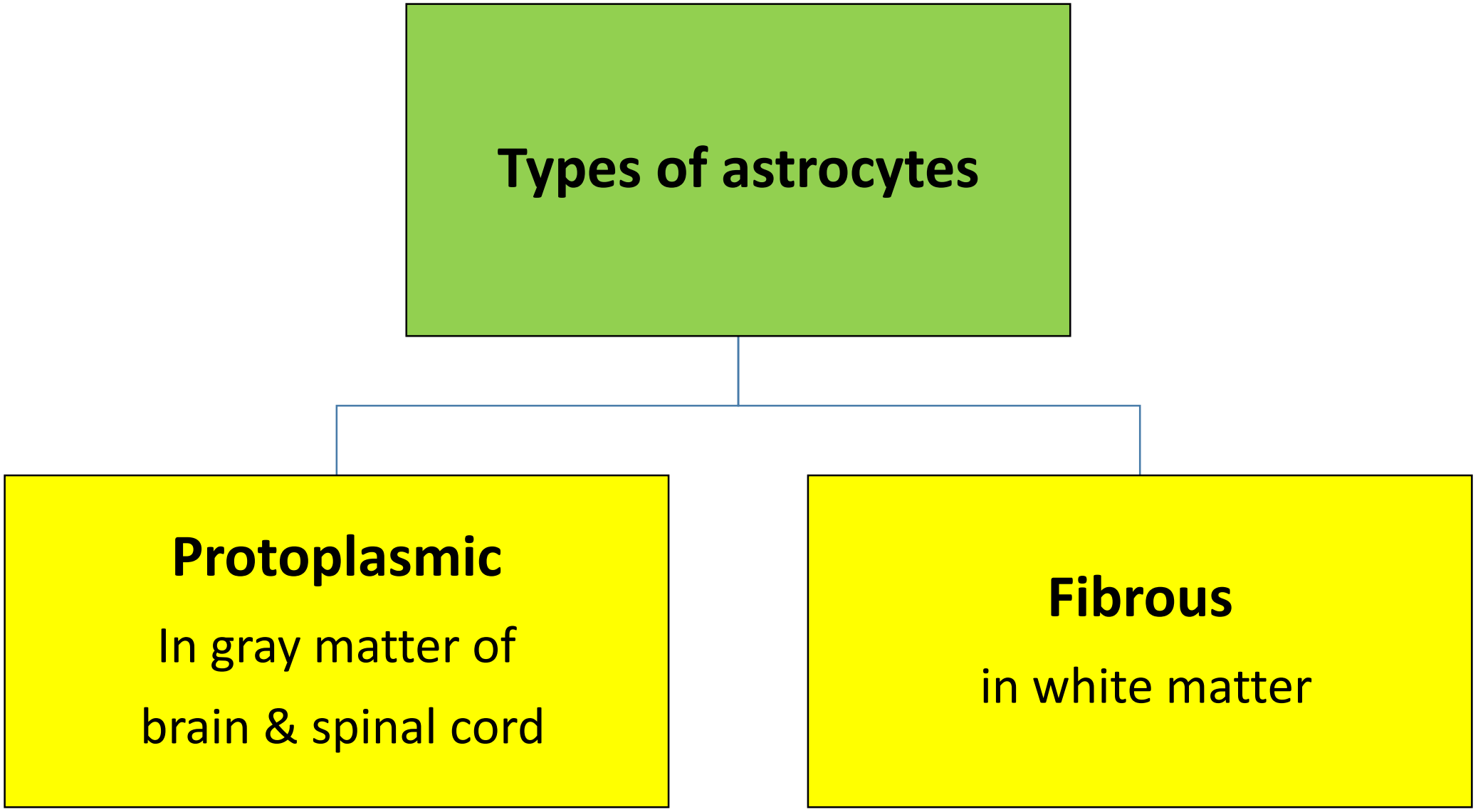
Blood brain Barrier



Blood brain barrier

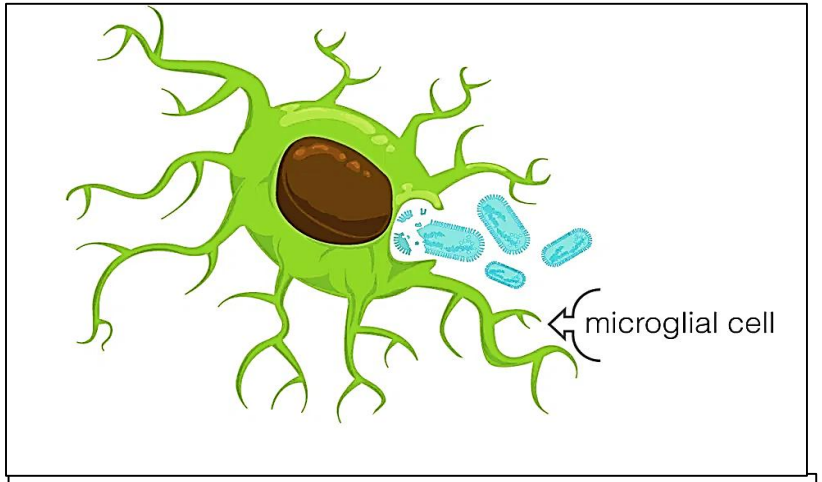


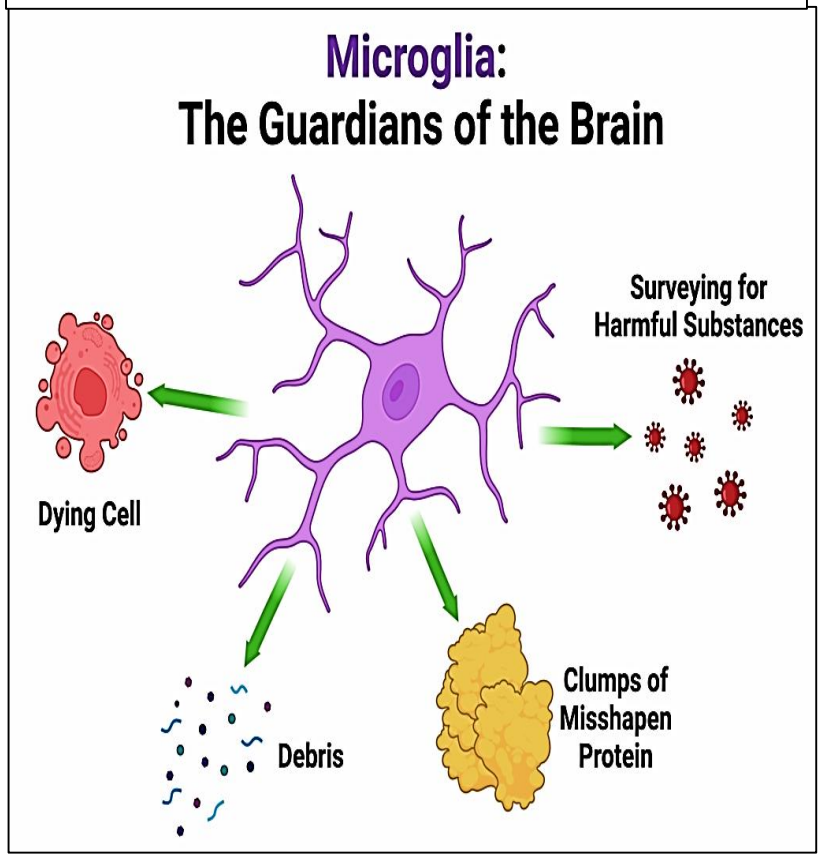
Blood nerve barrier


Types of astrocytes
Protoplasmic
In gray matter of
brain & spinal cord
Fibrous
in white matter

2- Microglia

- Small, oval cells have processes . The cell body & the processes have minute spines
- They are originate **from blood monocytes** i.e. member of the mononuclear phagocyte system = mesodermal in origin
- All other glial cells are ectodermal in origin



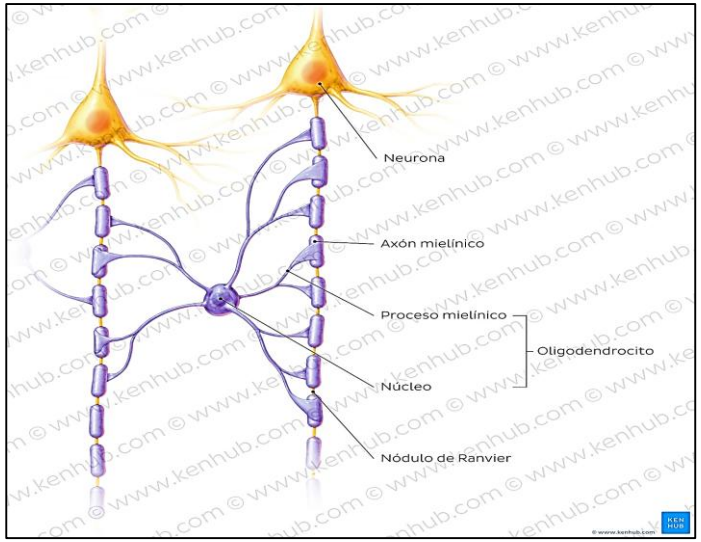


- **Function:**

Phagocytosis of bacteria, apoptotic and malignant cells, dead neuron

- it is the **immune cells** of the CNS

3- Oligodendrocytes

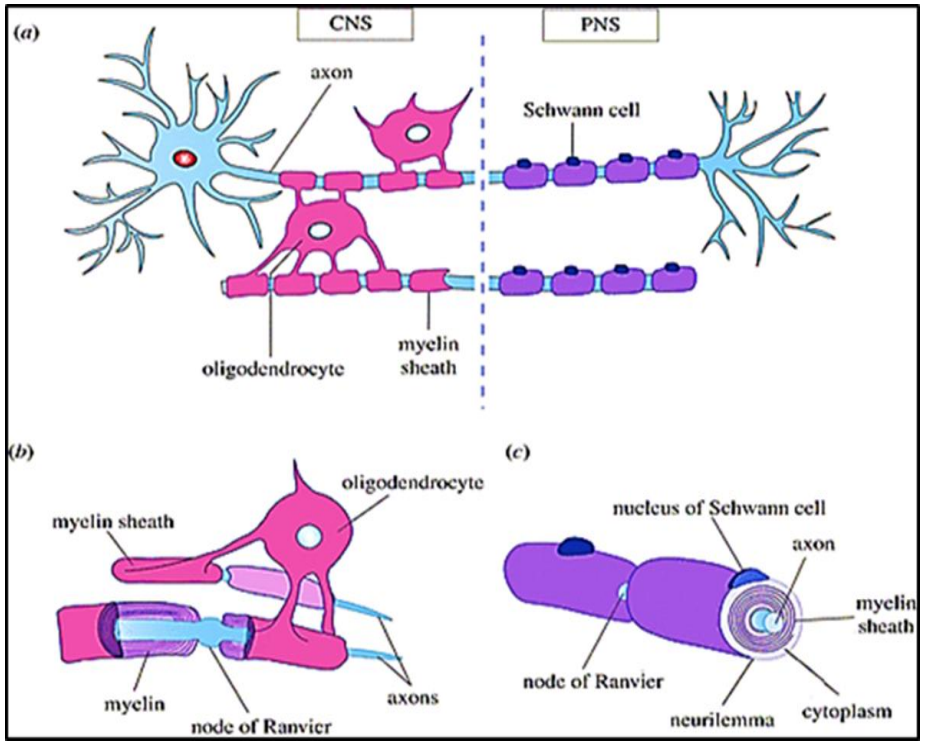


- Small cells with few short processes (4-6) that wrap around axons of neurons in CNS (white matter) where majority of axonal myelination occur (forming myelin sheath)

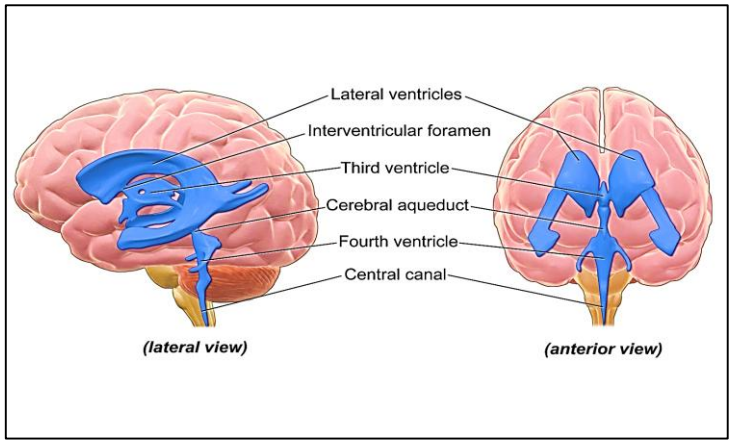
- The cell processes can myelinate multiple axons

(unlike Schwan cells that myelinate single axon)

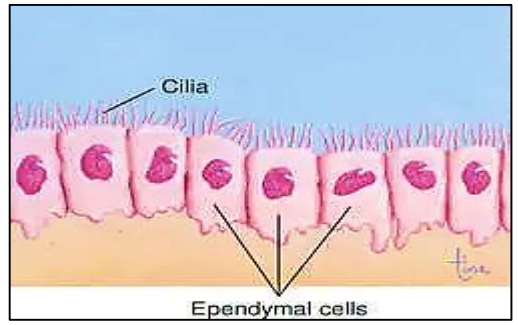
- Function: **Formation of myelin sheath in CNS**



4- Ependymal cells

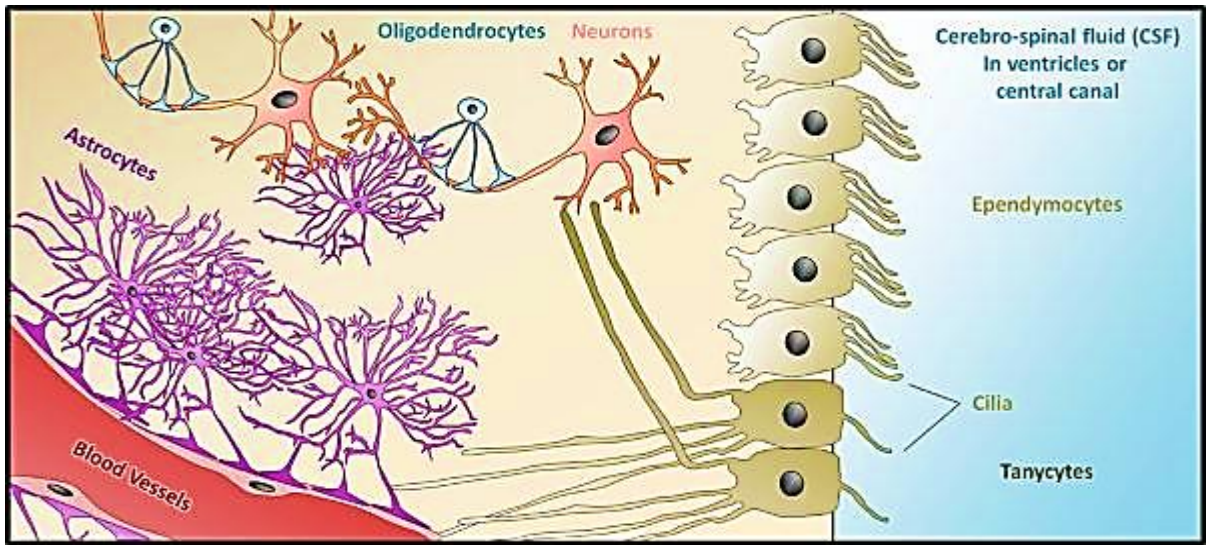


- Epithelial – like Cuboidal cell
- The apical surface have microvilli & few cilia
- Their basal surfaces have infoldings without true basement membrane needed for ion transport
- Line the brain ventricles & central canal of the spinal cord



Function:

- Production of cerebrospinal fluid
- Cilia help in circulation of CSF
- Microvilli help in absorption
- Form part of blood –CSF barrier



Neuroglial Cell Types & Function

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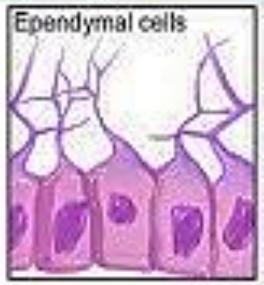
Central Nervous system

Astrocytes

Maintain blood brain barrier -controlling the levels of neurotransmitter around synapses, -regulate ion, and providing metabolic support.

Ependymal cells



Line spinal cord & ventricles of the brain. -involved in producing cerebrospinal fluid (CSF).

Oligodendrocytes

Myelinate CNS axons, provide structural framework

Microglia

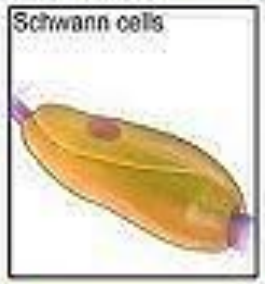
Brain's immune cells -Remove dead cells and pathogens by phagocytosis

Peripheral Nervous system

Satellite cells

Surround neuron cell bodies in ganglia. Regulate neurotransmitter levels

Schwann cells



Myelinate neurons in PNS. maintenance and regeneration of neurons after injury

Comparison between neuron & neuroglia

Neuron	Neuroglia
Large	Small
Transmit nerve impulse	Do not transmit nerve impulse
Not able to divide	Able to divide
Form synapse	Do not form synapse

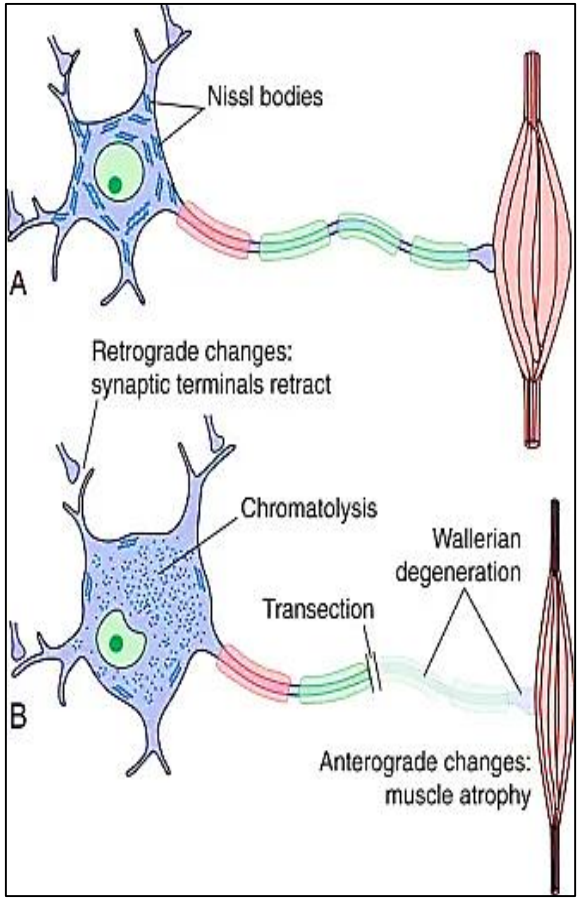
Chromatolysis

Changes occur in the neuron as a result of injury or damage to the axon

- Degeneration and permanent loss of neuron will lead to atrophy of the innervated muscle
- **The feature of chromatolysis include:**

1- Swelling of the nerve cell body : the cell body becomes enlarged as a result of breakdown of r-ER & ribosomes which will cause disruption in protein synthesis

2- Loss of Nissl bodies: the Nissl bodies disperses throughout the cytoplasm leading to loss of its characteristic staining



3- Relocation of the nucleus: the nucleus move to the periphery i.e. eccentric

Regeneration of nerve fiber particular in PNS

The process involves the following:

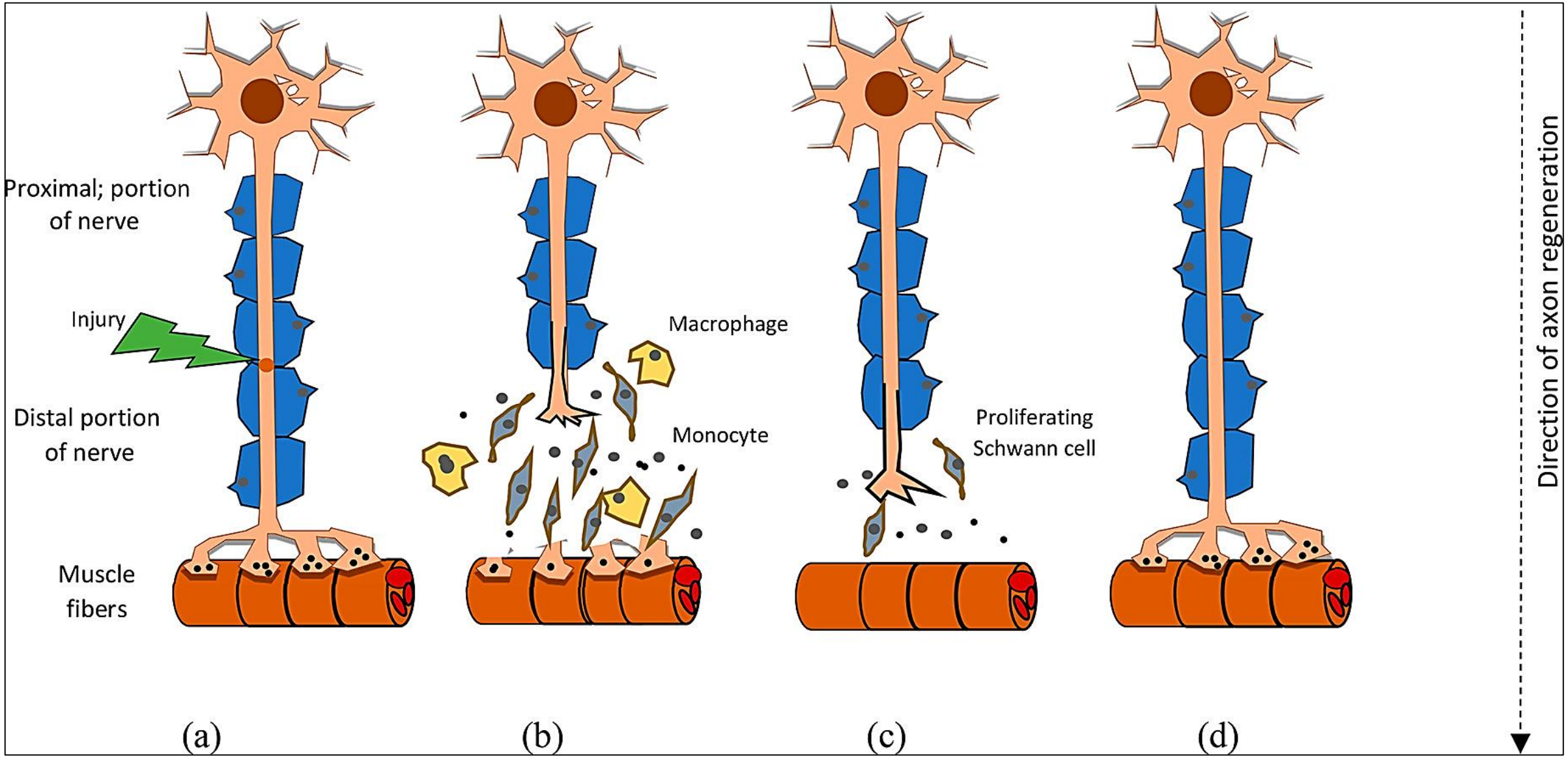
1- Wallerian degeneration: 2-3 days After injury the distal part of the axon (part away fro the cell body) degenerates, clearing the way for regeneration

2- Schwan cell activation: nearby Schwan cells proliferate and form a regeneration tube for the axon to follow

3- Axon growth : neurites (sprouts) grow from the proximal segment toward its target, typically guided by Schwan cells and extracellular matrix proteins

4- Re-Innervation : once axon reaches its target (ms., sensory receptor) it can reestablish synaptic connections

Wallerian degeneration is essential for repair in PNS but is not effective in CNS due to several factors like lack of support from glial cells



Regeneration of nerve fiber

Thank you