

# Biology

# Nervous system

The nervous system is responsible for communication between different regions of the body, it is divided into:

**CNS (central nervous system) = brain + spinal cord**

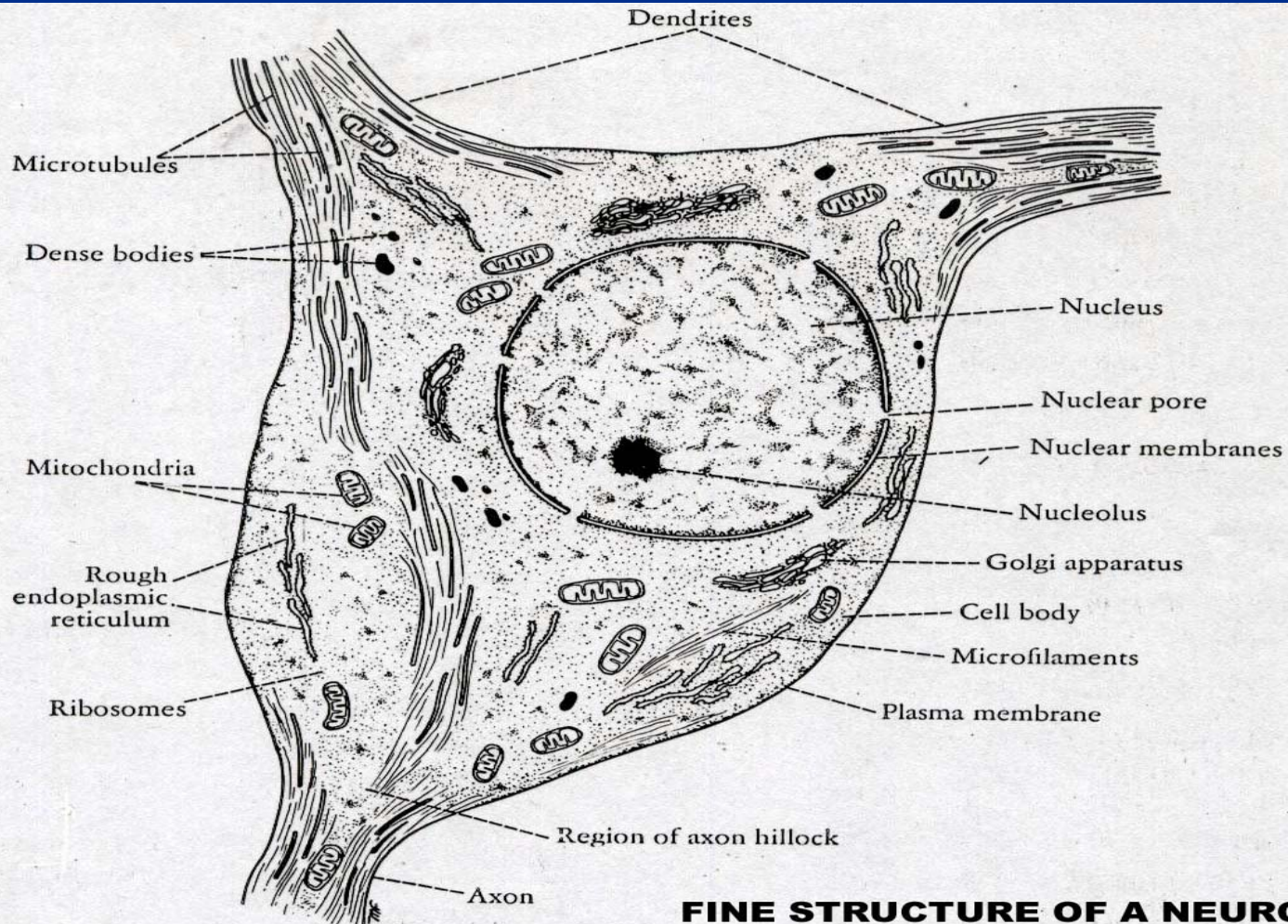
**PNS (peripheral nervous system) = nerves running between the CNS & other tissues.**

Nervous tissue consists of two major cell types: neurons and neuroglia.

# The Neuron:

Is the main functional unit of the nervous system, it consists of:

## 1. Cell body (perikaryon)

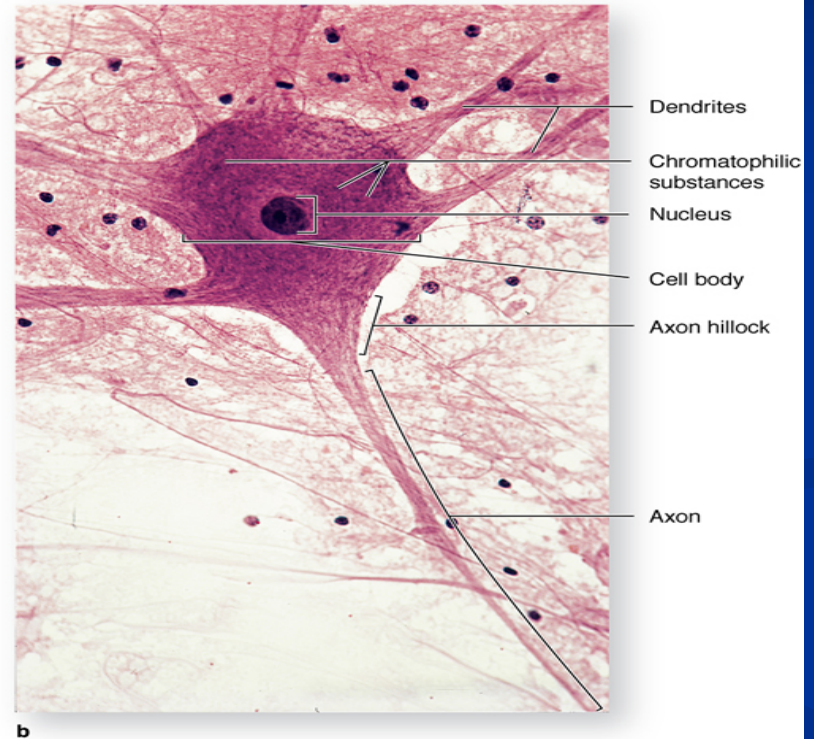
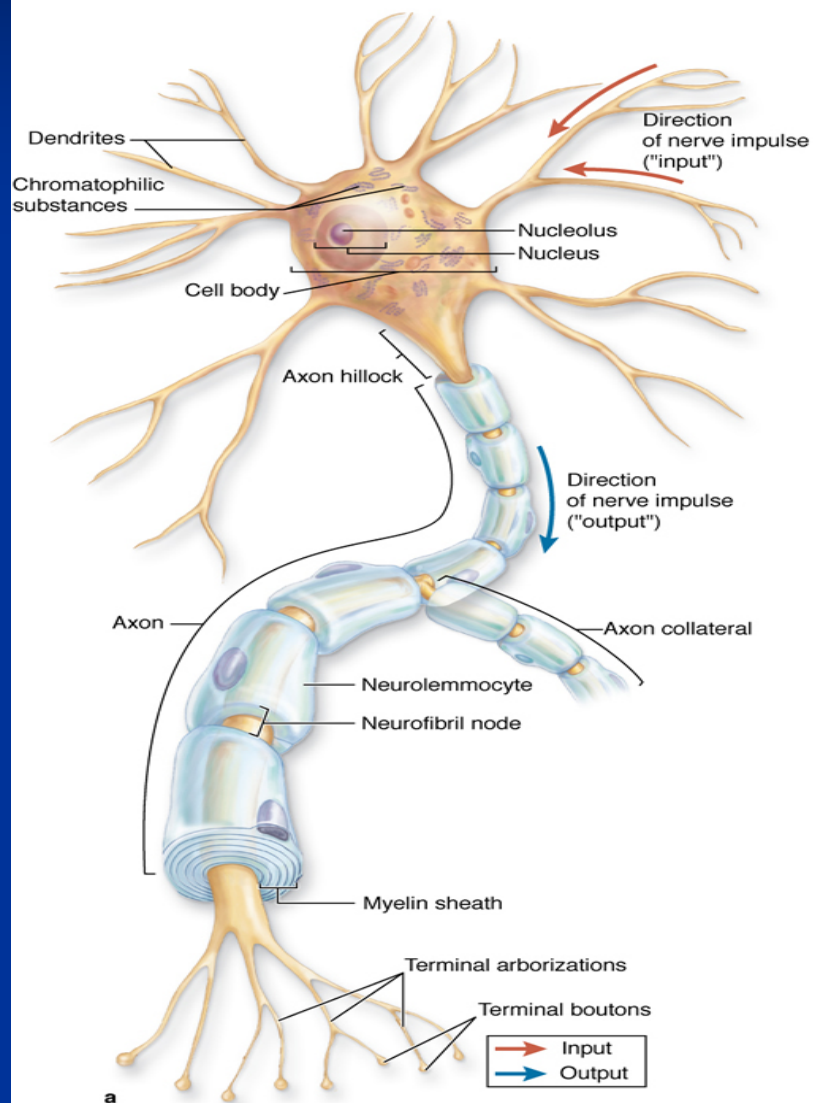


**FINE STRUCTURE OF A NEURON**

# 2. Axon

## 3. Dendrites

### 4. Terminal button



## Types of the Neurons:

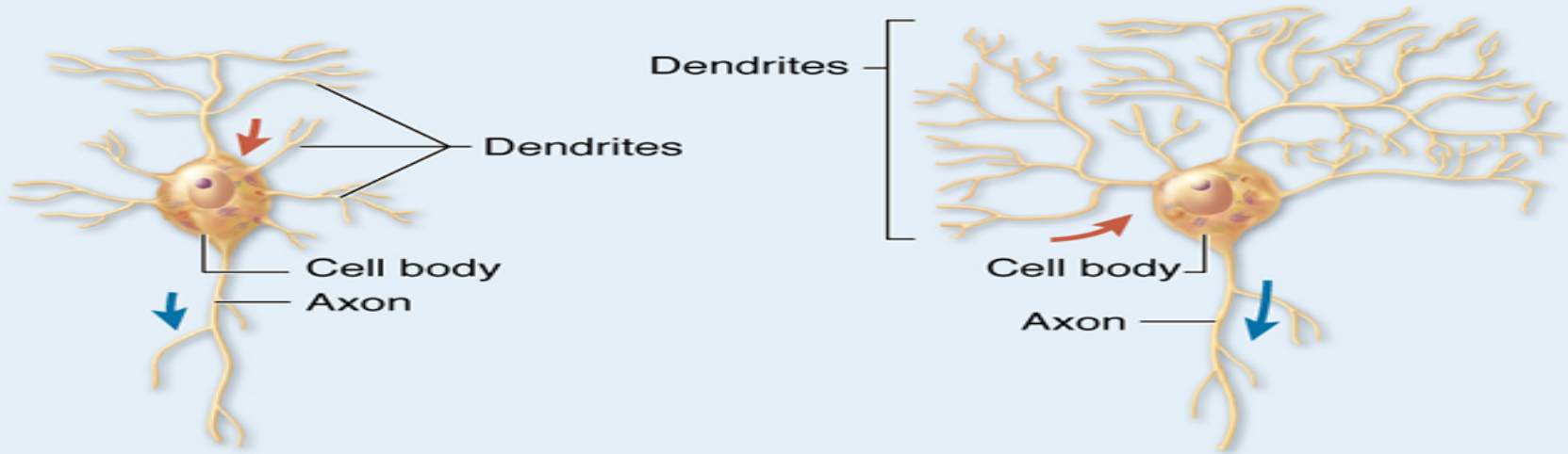
**Multipolar (motor) neurons** : have large cell body + large axon + many dendritic processes.

**Unipolar (pseudounipolar) (sensory)** : cell body + one large process divided into 2 branches, one is axon & other is dendrite.

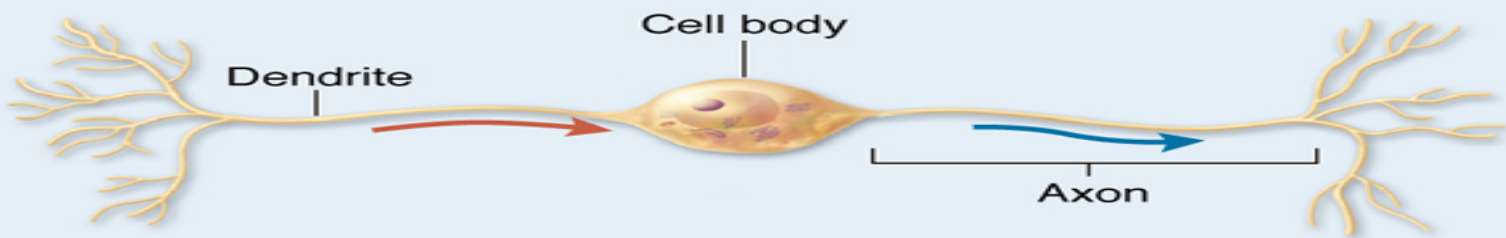
**Bipolar** : simple cells provide local communications within the CNS having 2 main processes of equal size one axon & other dendrite.

# Neurons are of 3 types:

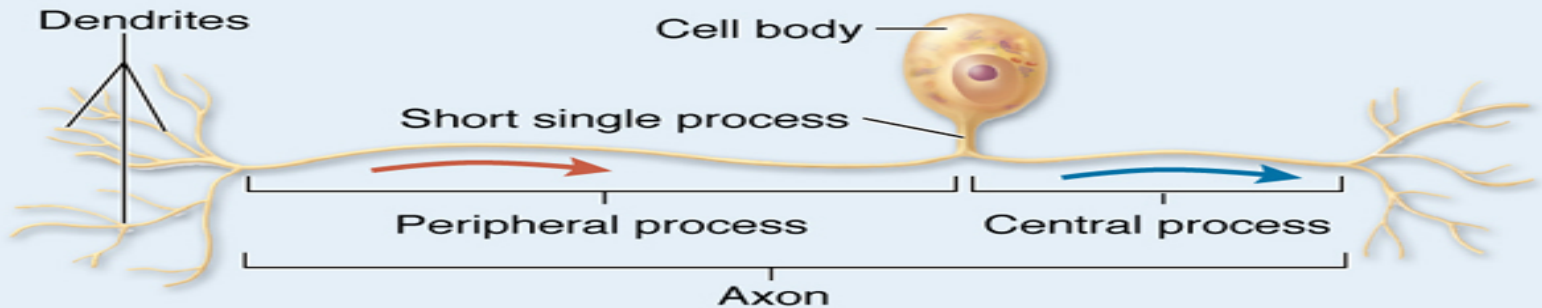
- Sensory (afferent)
- Motor (efferent)
- Interneuron



**a** Multipolar neurons



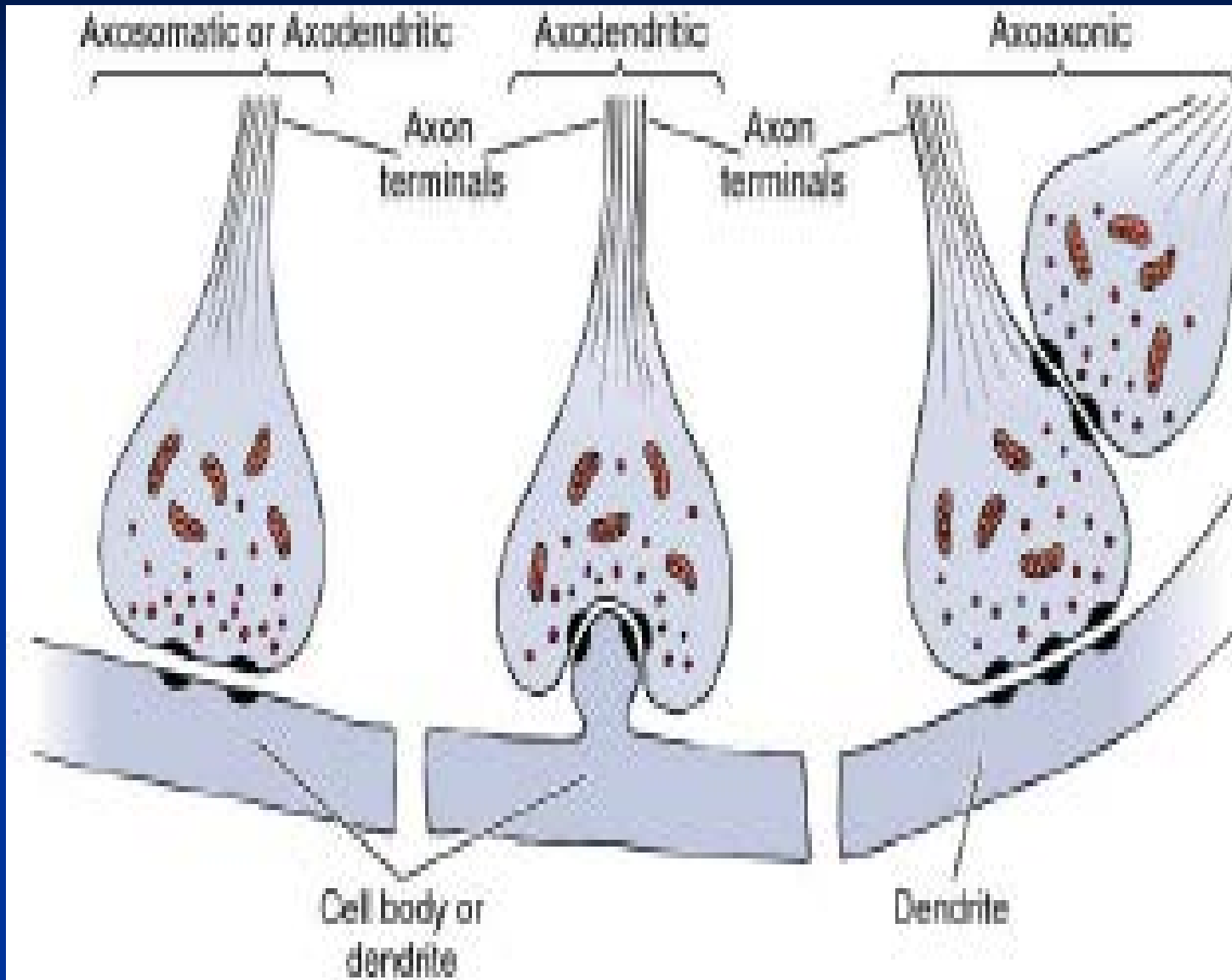
**b** Bipolar neuron



**c** Unipolar neuron



# Synapses:





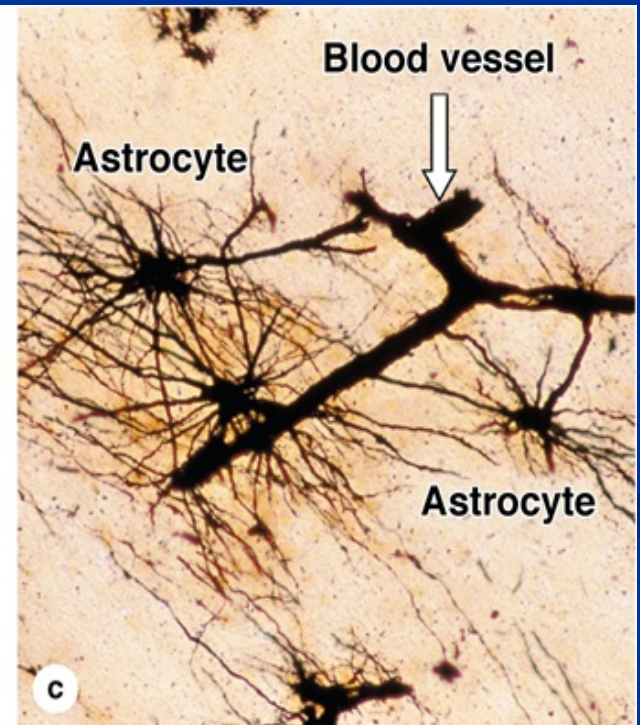
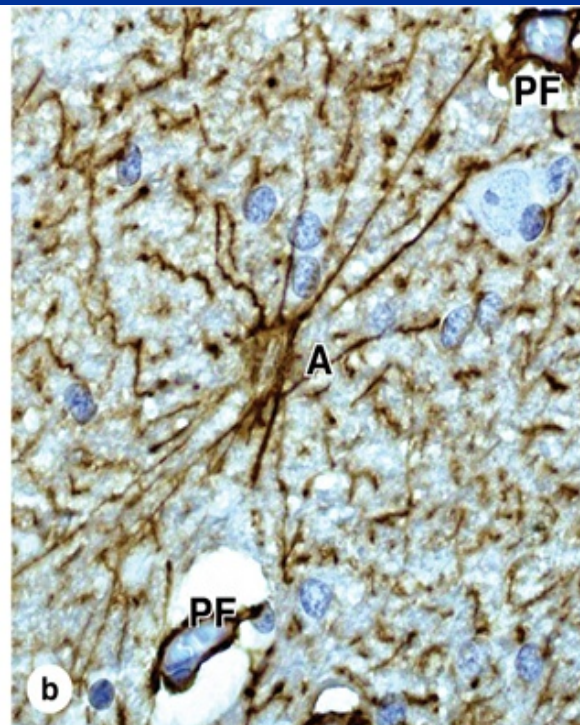
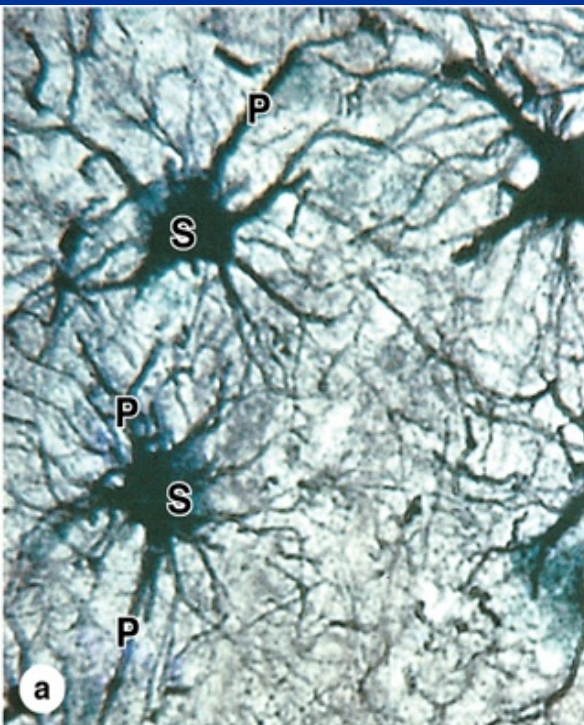
# Neuroglia:

- They outnumber neurons by about 10 to 1 in the brain . More than half the volume of the human nervous system is composed of supporting neuroglial cells.

- In the CNS (brain & the spinal cord) there are 4 types of supporting cells:
- **1. Astrocytes:** stellate-shaped cells with fine processes radiating in all directions.
- **a.** Astrocytes provide nutritional support to neurons and prevent most substances from entering the brain from the bloodstream except oxygen, carbon dioxide, glucose, and essential amino acids can cross.
- **b.** Astrocytes give structural support to hold neurons in place and also scavenge dead cells after an injury to the brain.

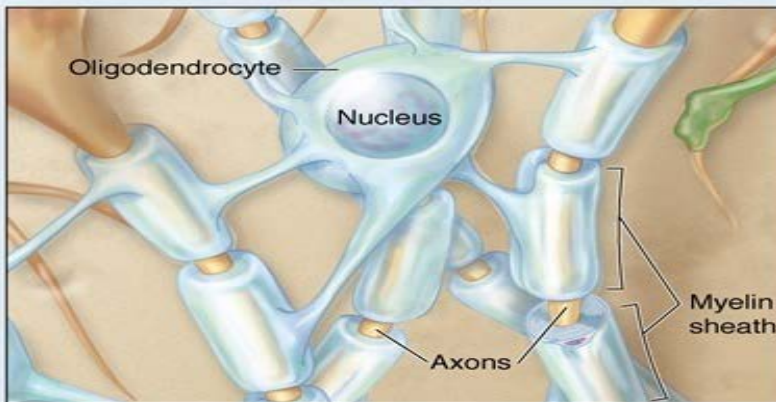
- c. Processes from astrocytes called “end feet” adhere to the blood vessels of the brain and secrete chemical signals that induce (cause) the formation of tight junctions between the endothelial cells which line the blood vessels.

- Astrocytes are of 2 types:
- a. fibrous astrocytes found in the white matter of brain.
- b. protoplasmic astrocyte found in the gray matter of brain.

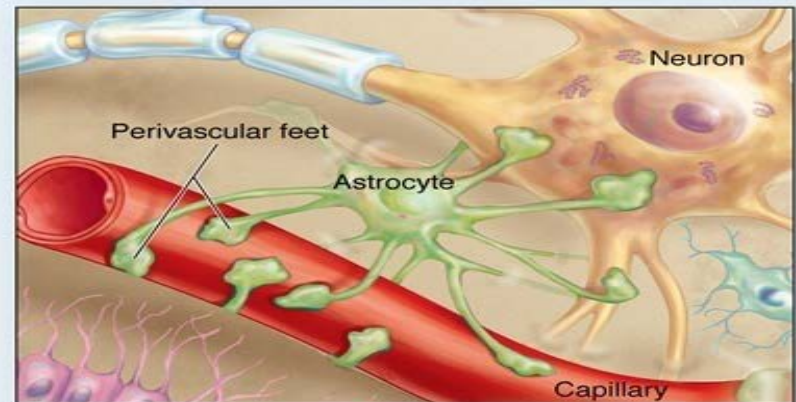


- 2. Oligodendrocytes:
- 3. Ependymal cells:
- 4. Microglia cells:

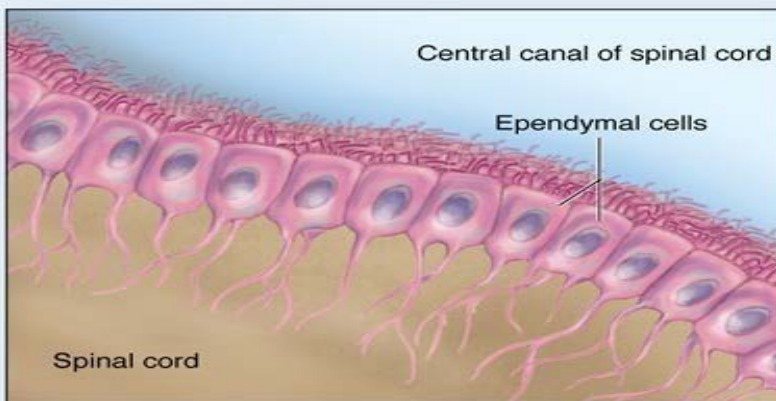
**CNS Glial Cells**



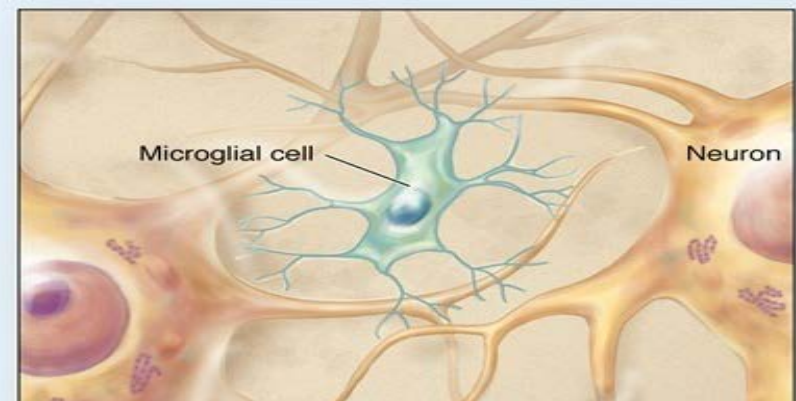
**a** Oligodendrocyte



**b** Astrocyte



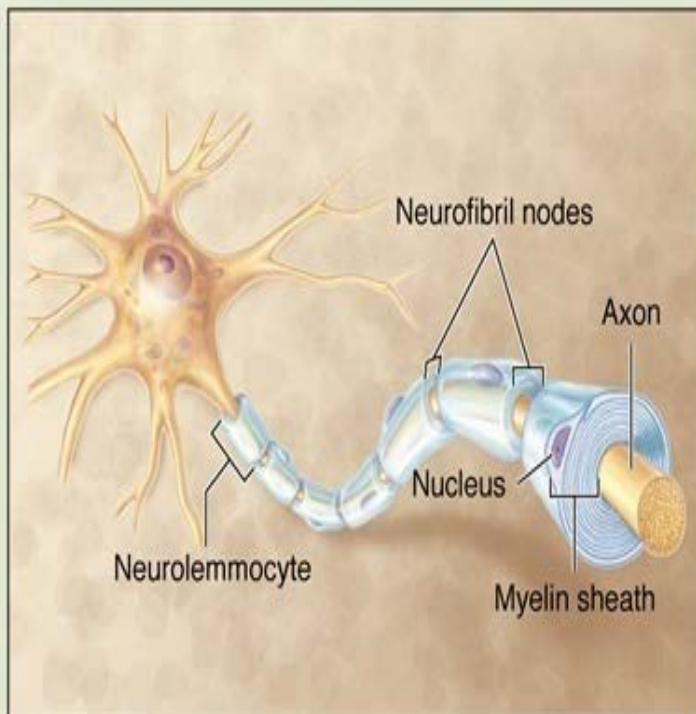
**c** Ependymal cells



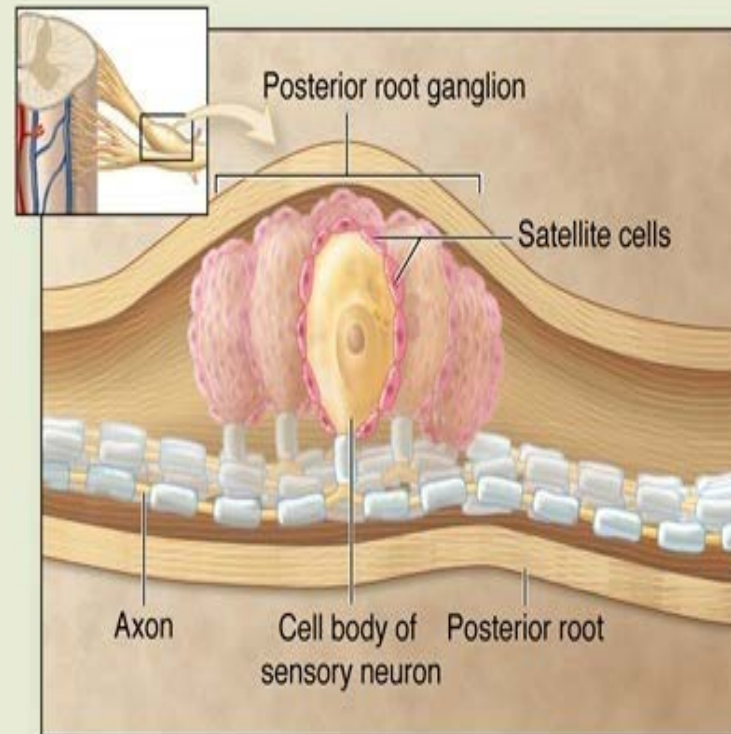
**d** Microglial cell

- In PNS:
- 5. Schwann cell (neurolemmocytes):
- 6. Stellate cells of ganglia:

### PNS Glial Cells



e Neurolemmocytes

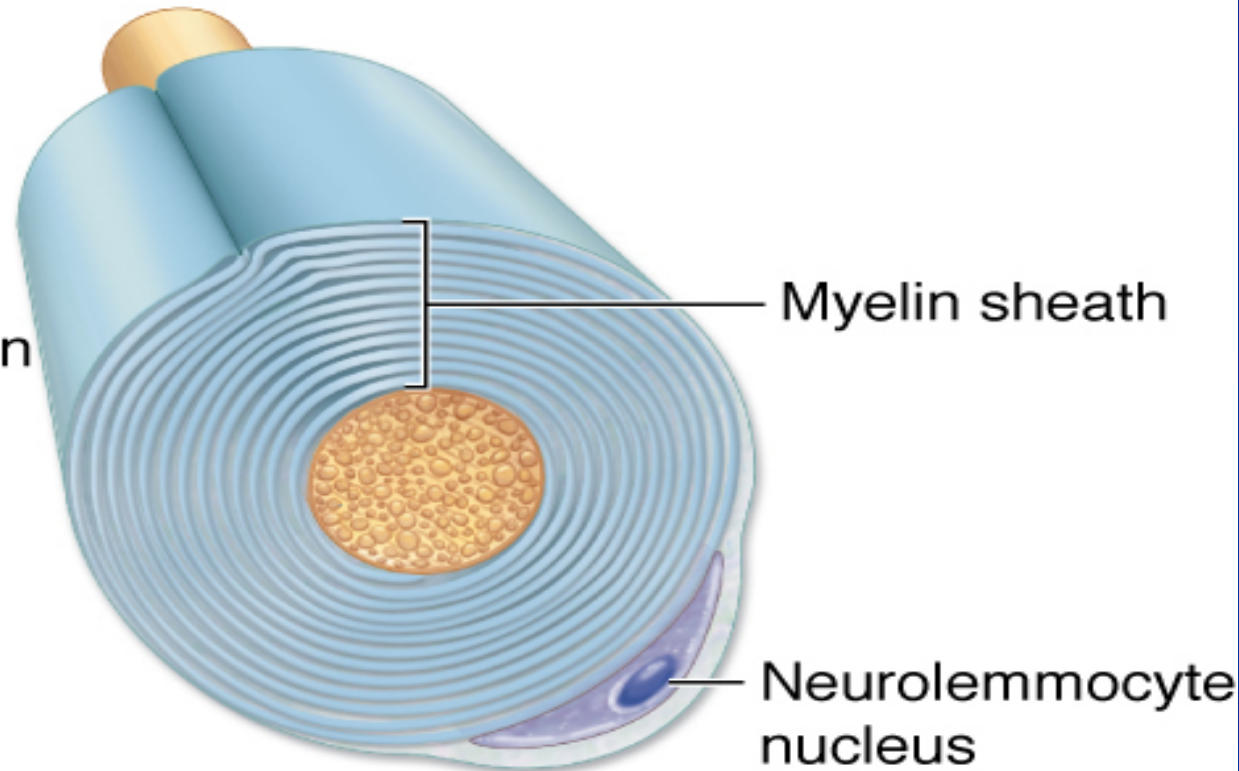


f Satellite cells

- **The peripheral nervous system**
- The main components of the peripheral nervous system are the nerves, ganglia and nerve endings.
- **Nerves:-** are bundles of nerve fibers surrounded by a series of connective tissue sheaths.
- **Nerve fibers:-**

- There are 2 types of nerve fibers:
- **Myelinated nerve fibers:**

④ Eventually, the neurolemmocyte cytoplasm and nucleus are pushed to the periphery of the cell as the myelin sheath is formed.



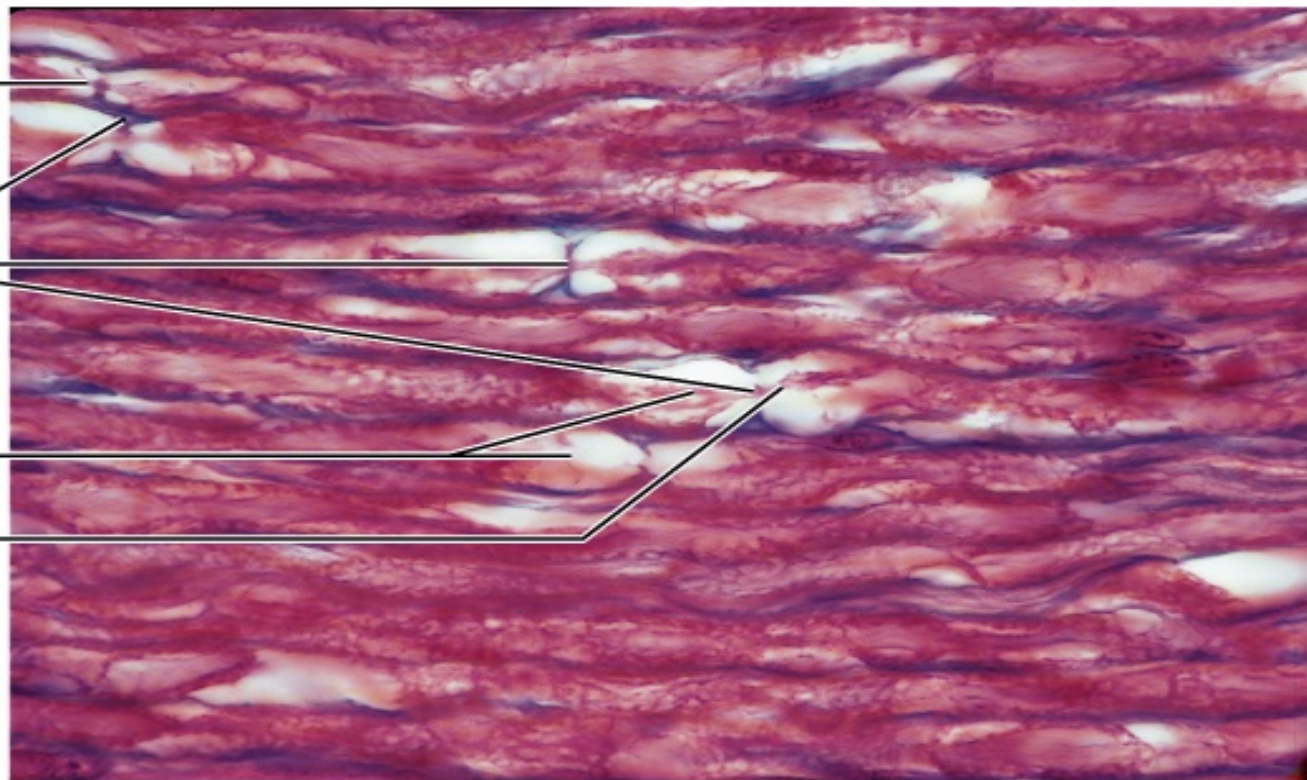


Axon

Nodes of  
Ranvier

Myelin sheath

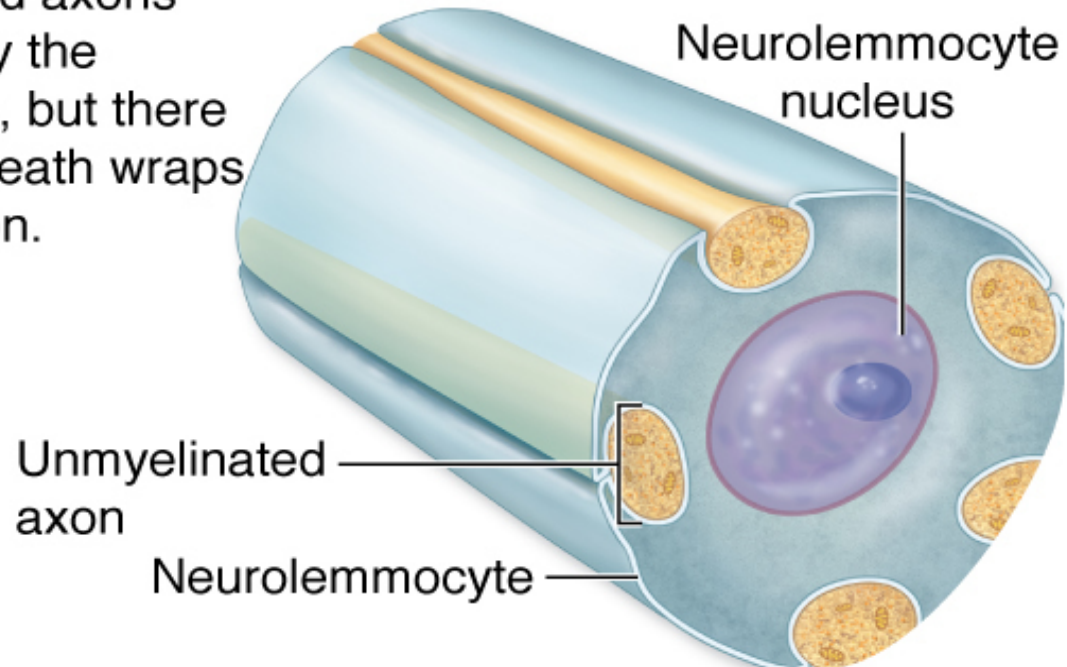
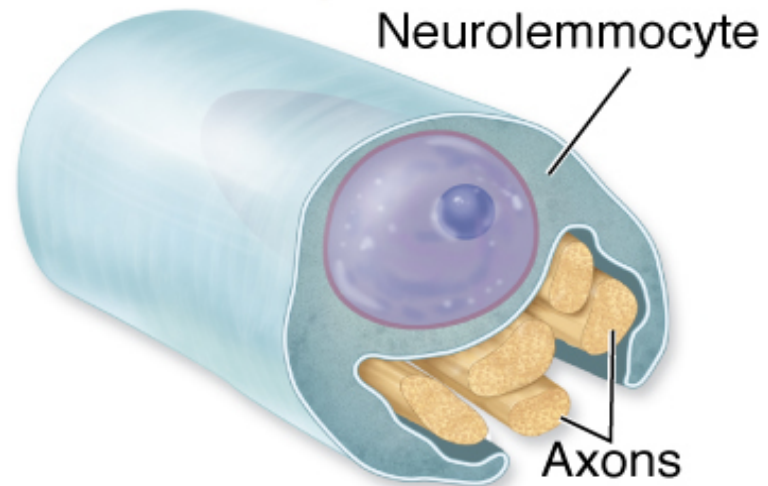
Axon



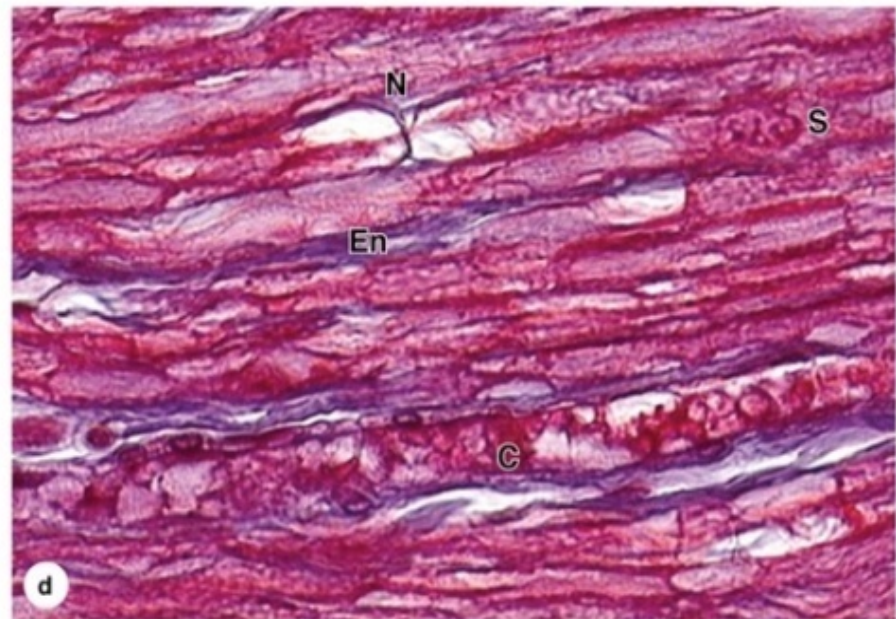
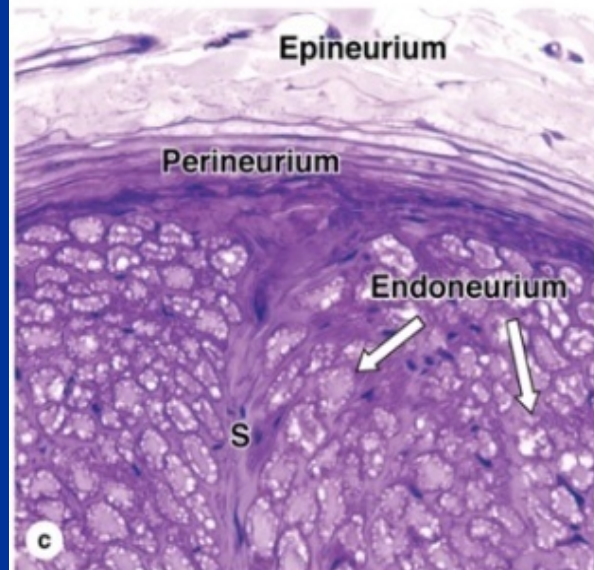
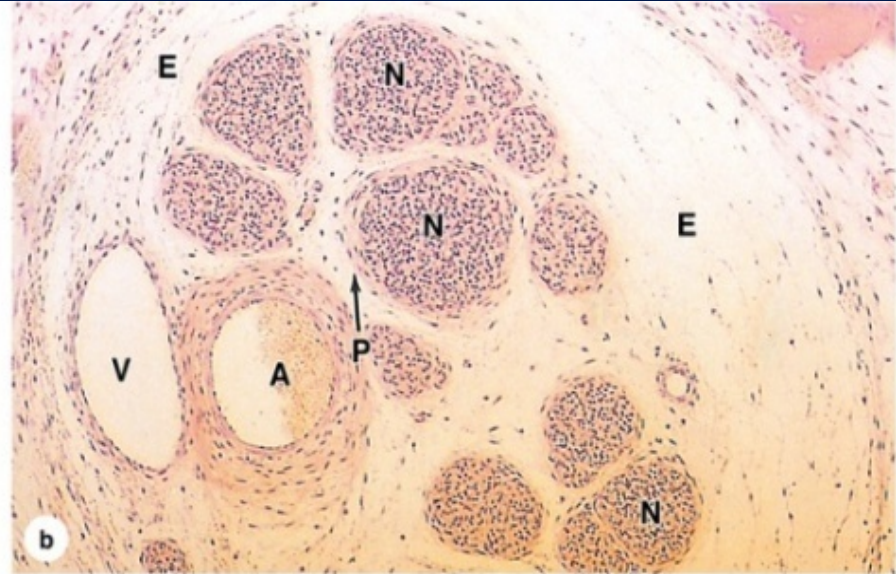
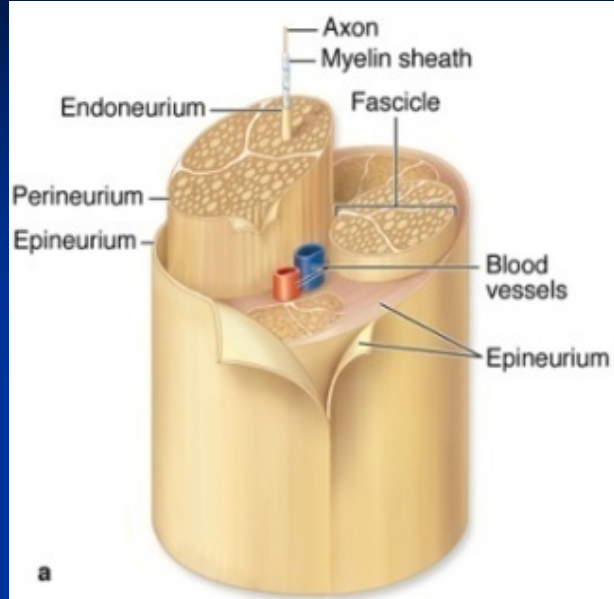
# ■ unmyelinated nerve fibers:

## Unmyelinated axons

- ① Neurolemmocyte starts to envelop multiple axons.
- ② The unmyelinated axons are enveloped by the neurolemmocyte, but there are *no* myelin sheath wraps around each axon.



# ■ Peripheral nerves:



# Clinical notes:

1. Demyelinating Diseases
2. Guillain-Barre syndrome (GBS)

## WHAT GUILLAIN-BARRÉ SYNDROME DOES TO A NERVE

NORMAL NERVE



DAMAGED MYELIN





# 3. Multiple sclerosis (MS)

## MULTIPLE SCLEROSIS

IMMUNE-MEDIATED  
INFLAMMATORY DEMYELINATING  
DISEASE OF THE CENTRAL  
NERVOUS SYSTEM

CLUMSINESS  
AND MUSCLE  
WEAKNESS

OPTIC  
NEURITIS

PARESTHESIAS

LHERMITTE  
SIGN

ONSET BETWEEN  
15 AND 50 YEARS  
OF AGE

TX OPTIONS INCLUDE  
CORTICOSTEROIDS, BETA  
INTERFERONS 1A AND 1B,  
& GLATIRAMER ACETATE

# 4. Injured fibers in peripheral nerves



*Thank you*