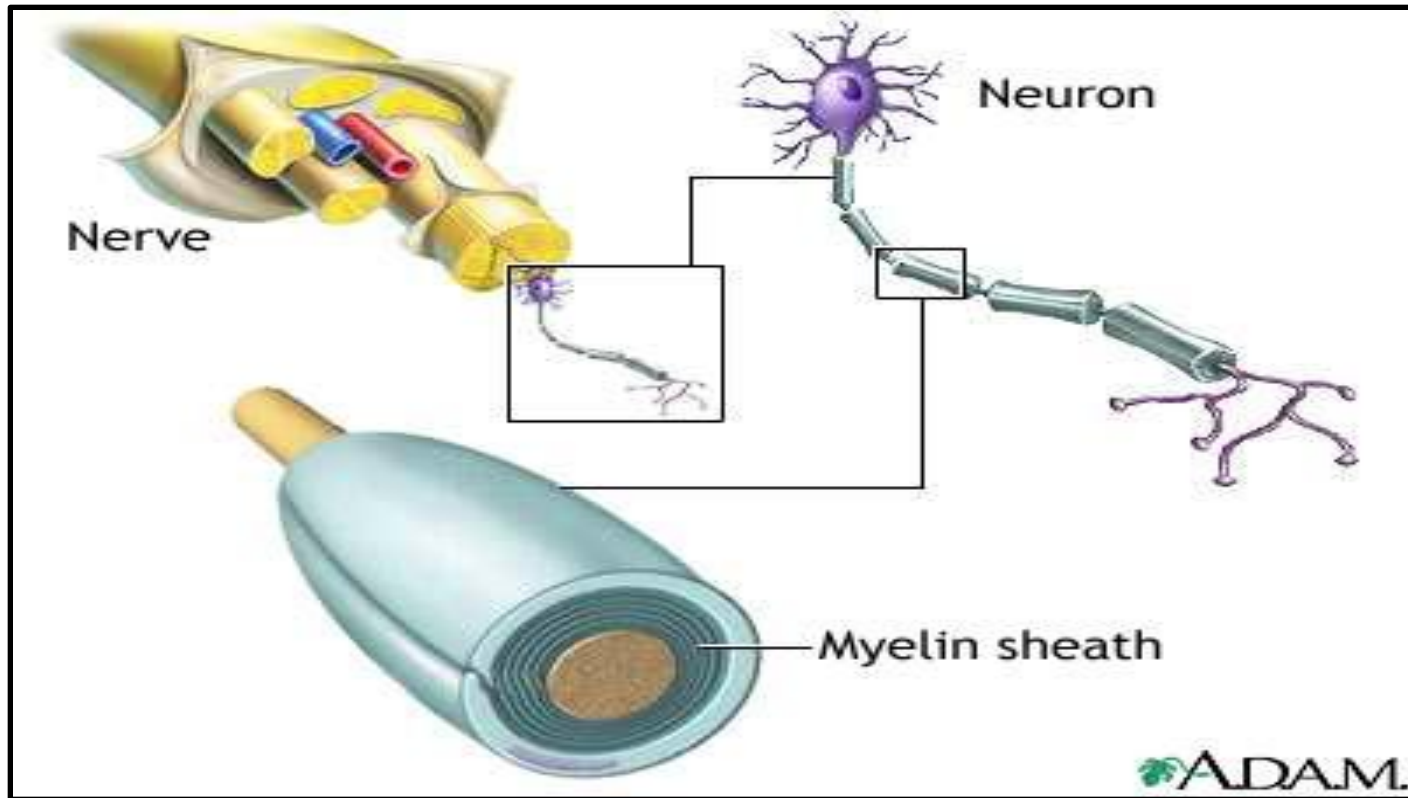


# NERVOUS TISSUE-2



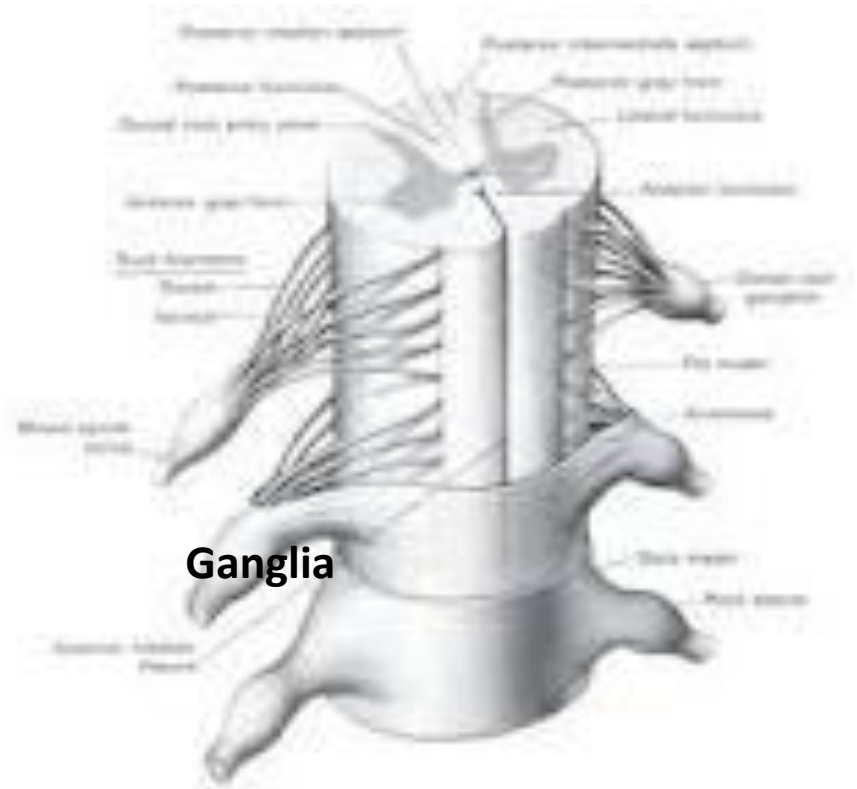
By  
**Dr. Heba Sharaf Eldin**  
Associate Professor of Histology & Cell Biology

# GANGLIA

- Ganglion is a collection of **nerve cell bodies** and nerve fibers located *outside the CNS*.
- **Types of ganglia**

**1-Cranio-spinal ganglia**

**2-Autonomic ganglia**



# Types of ganglia

**1-Cranio-spinal (Sensory):** impulses from ganglia to C.N.S.

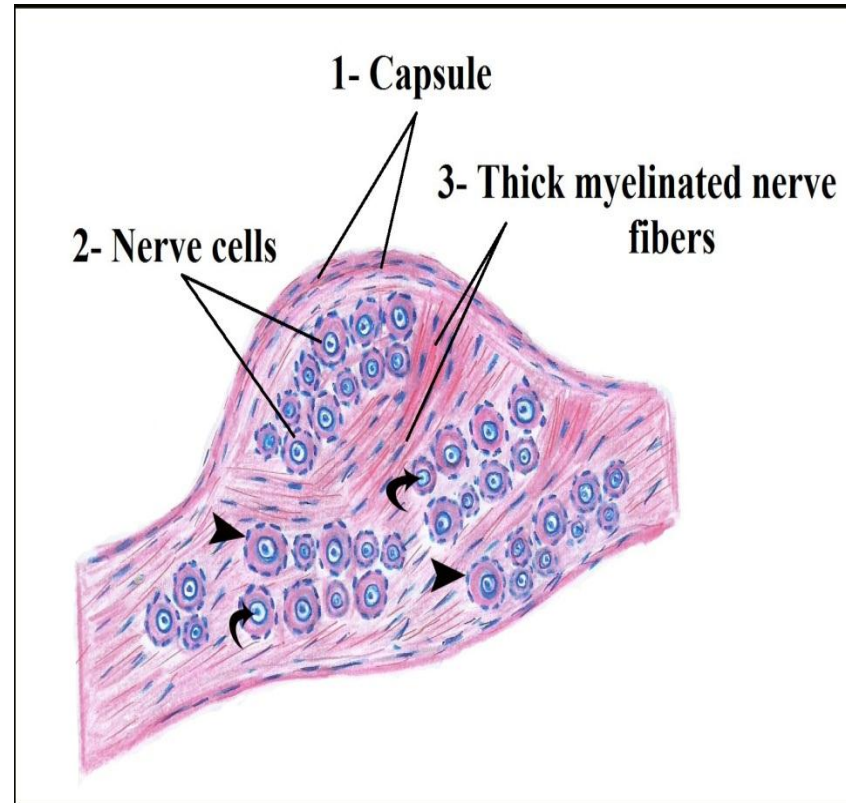
- Cranial ganglia: present in path of cranial nerves.
- Spinal ganglia: present in path of spinal nerves.

**2-Autonomic (motor):** impulses from C.N.S. to ganglia.

- sympathetic
- parasympathetic (intramural ganglia). (located within the walls of organs, specifically in the gastrointestinal tract)

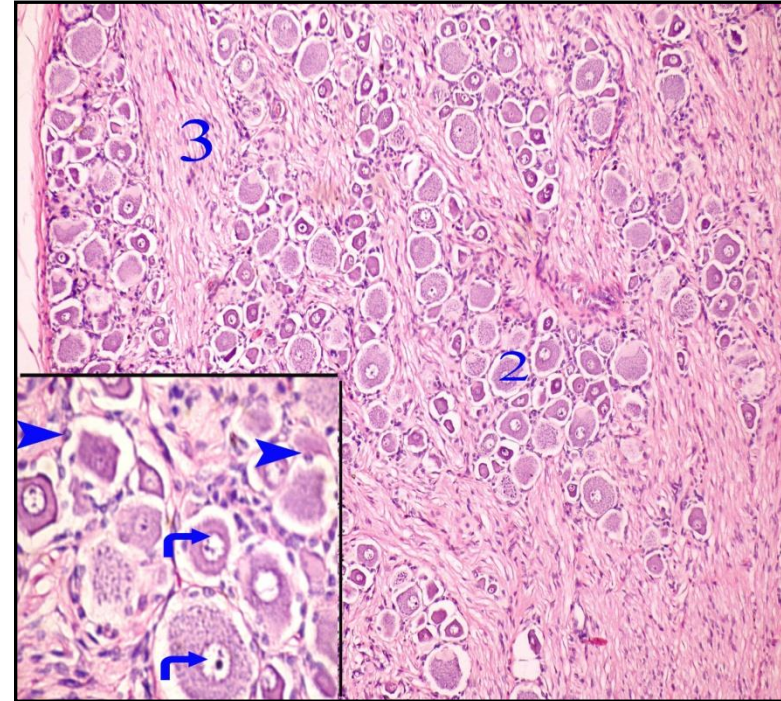
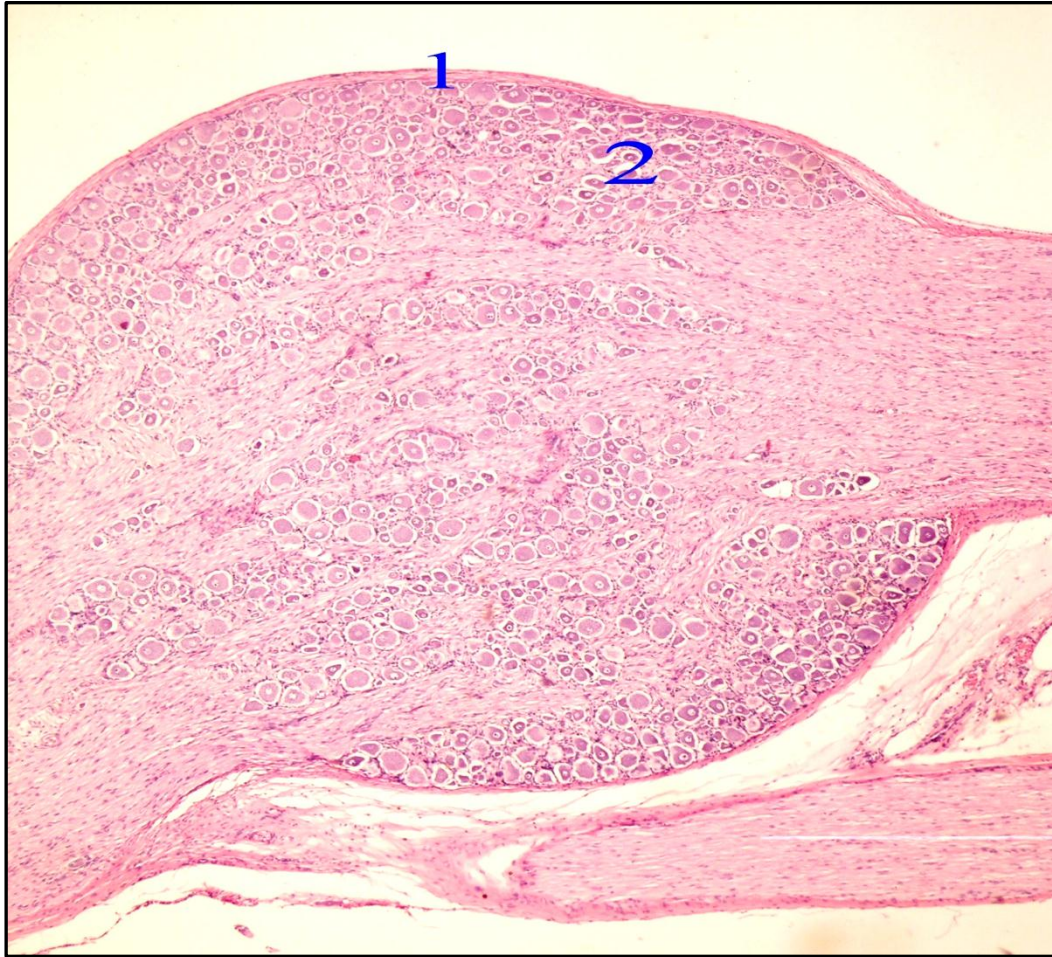
# 1-Cranio-spinal ganglia

- **The capsule** is thick (1).
- **The nerve cells** (2) are **pseudounipolar** cells. Their cell bodies, mainly large but some are small.
  - They contain central rounded pale nucleus with prominent nucleolus (➡).
  - They are arranged in groups.
  - The cells are surrounded by **complete layer** of small cuboidal cells (satellite or capsular cells) (➤).
- **Thickly myelinated nerve fibers** are present between the cell groups (3).



- Pseudo-unipolar nerve cells
- Thick myelinated nerve fibers

# Spinal ganglia (H&E)



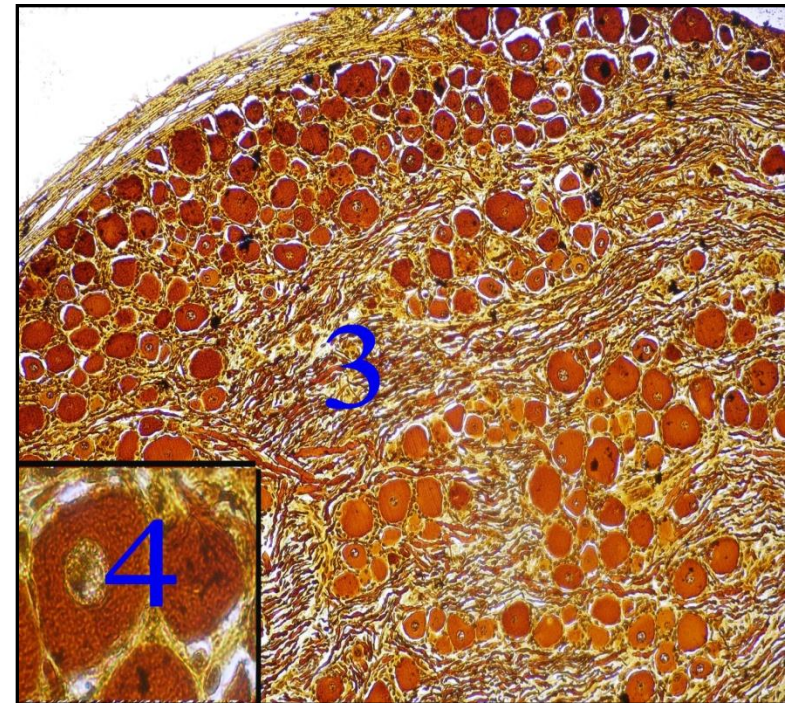
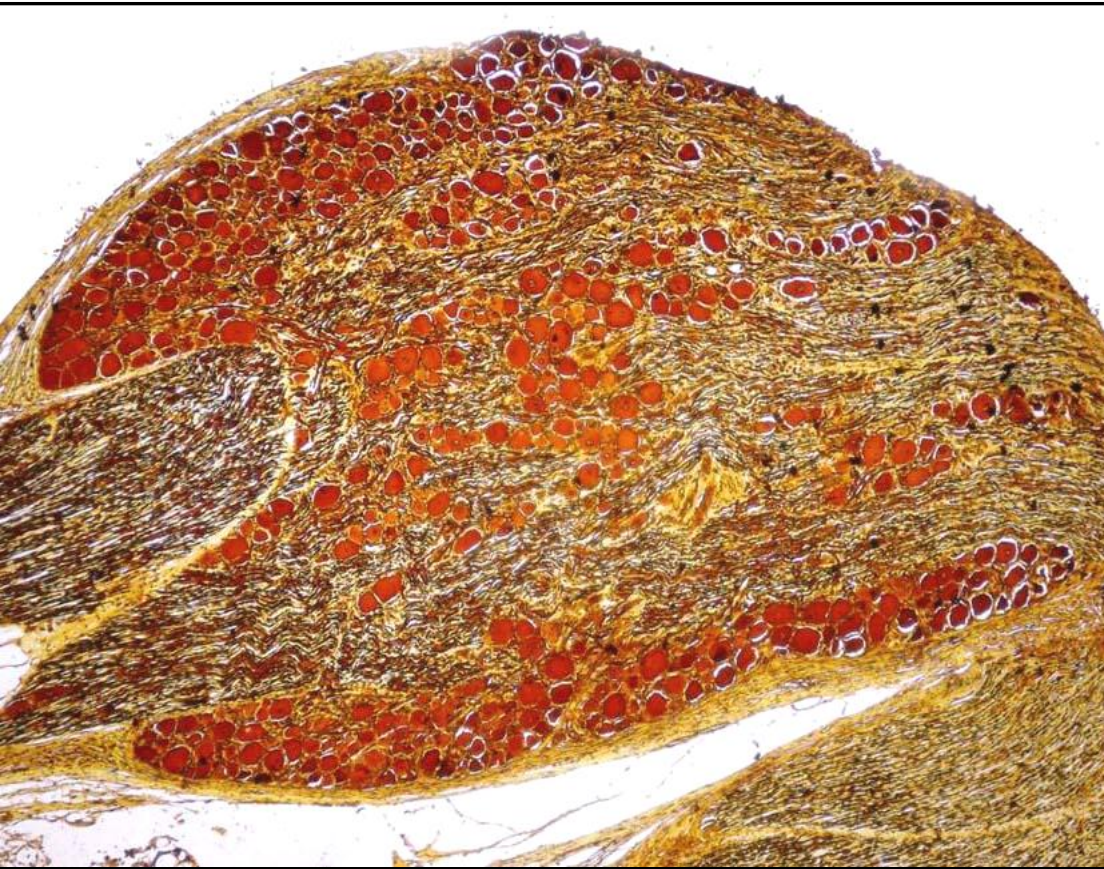
1- capsule

2-Pseudo-unipolar nerve cells  
groups

3-Thick myelinated nerve fibers

→ **Satellite cells**

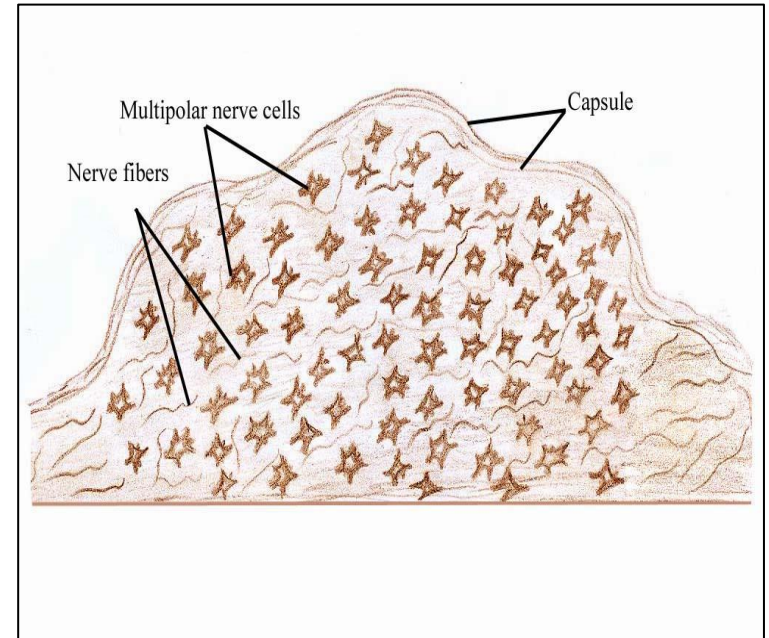
# Spinal ganglia (silver)



# Sympathetic ganglia

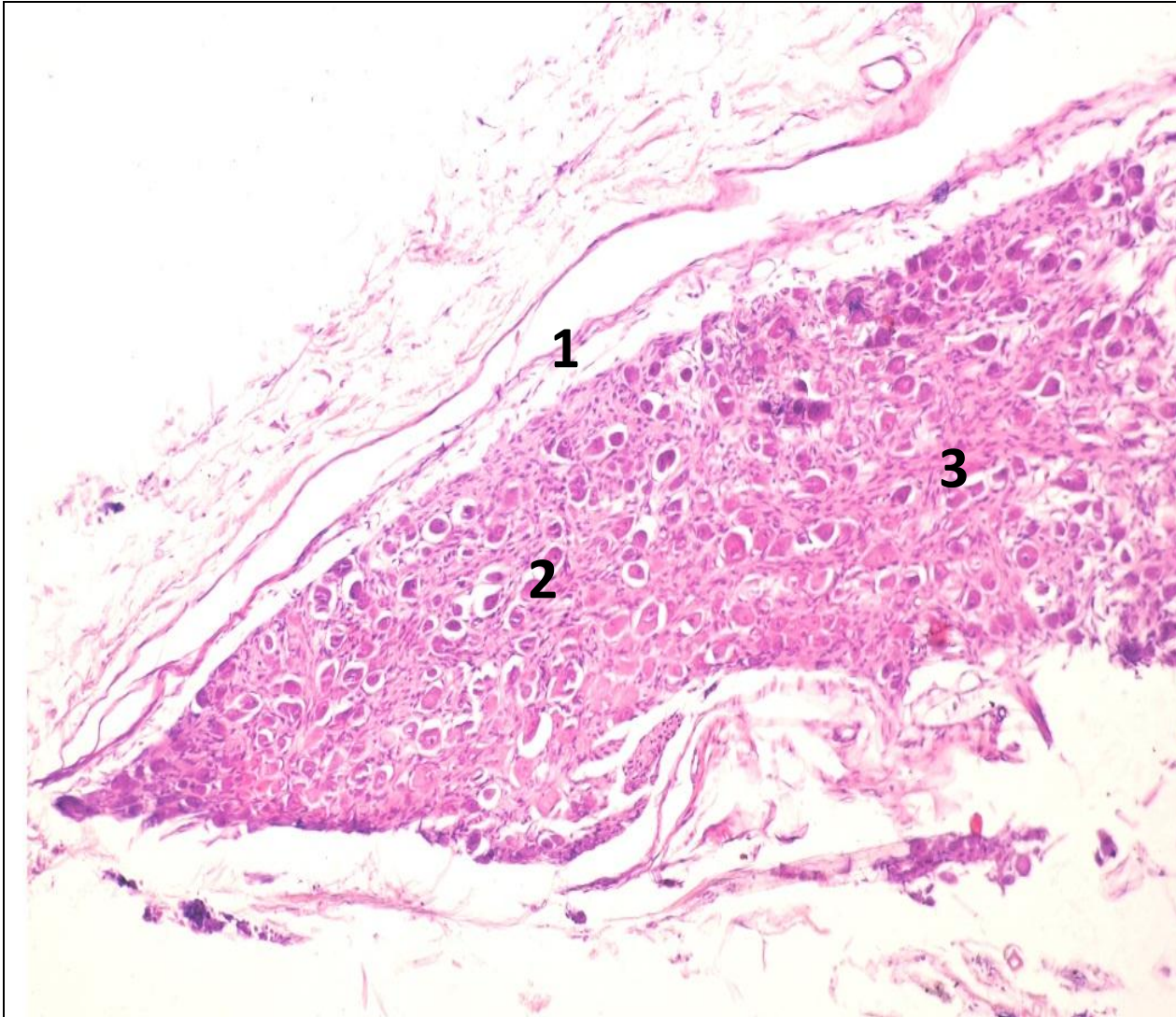
The ganglion is covered with thin CT **capsule**.

- **The nerve cells** are small, of equal size, multipolar and star shaped cells.
- Each cell contains eccentric rounded pale nucleus with prominent nucleolus.
- The nerve cells are **numerous and scattered all over the ganglia**.
- The cell is surrounded by **incomplete layer of satellite cells**.
- The nerve cells are separated by thin or **non myelinated nerve fibers**.



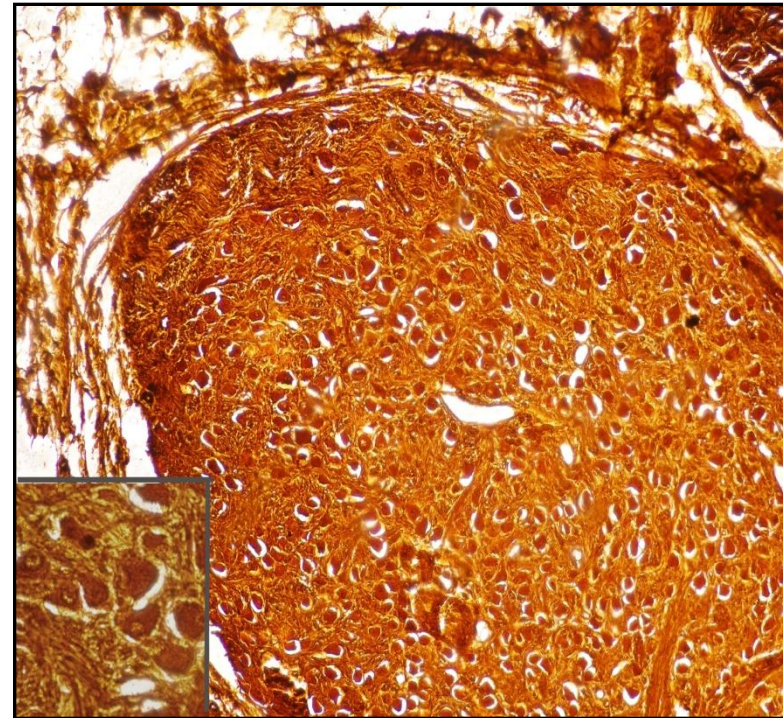
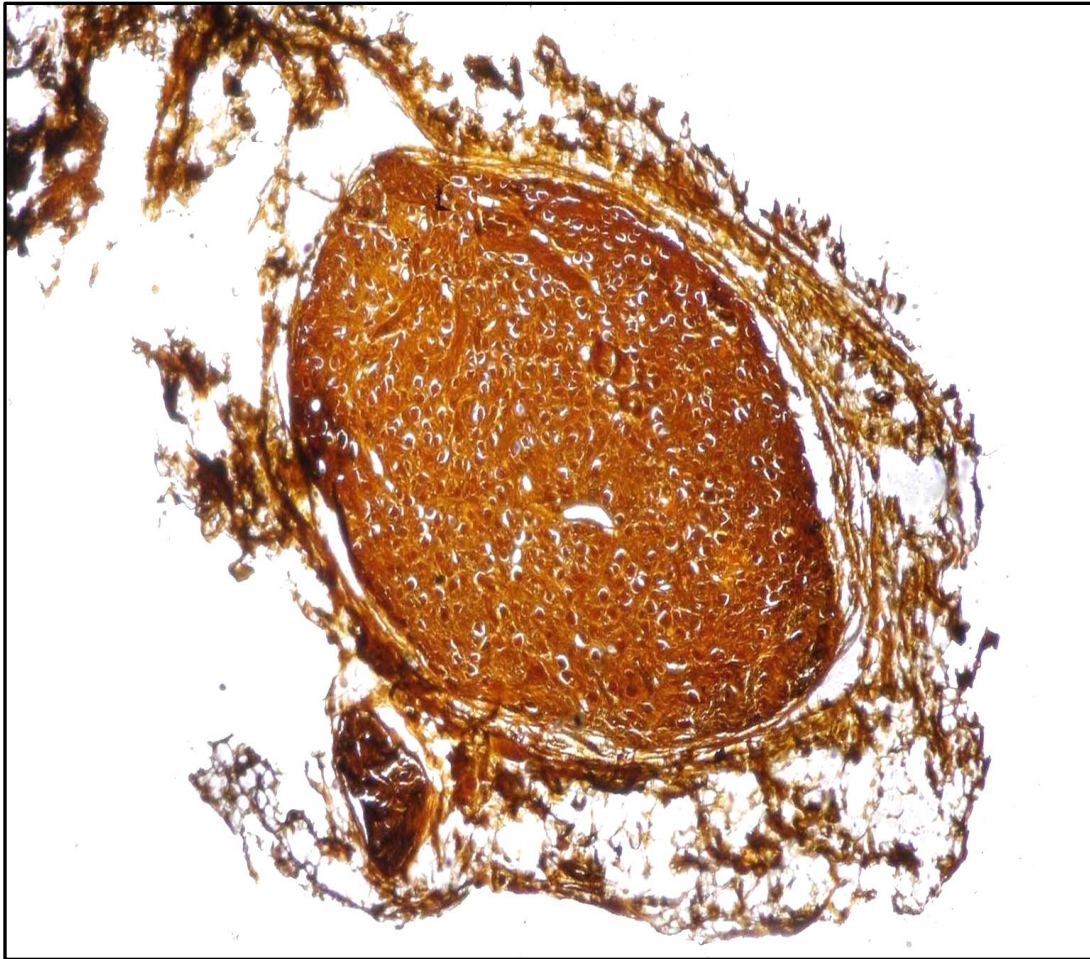
multipolar nerve cells  
unmyelinated nerve fibers

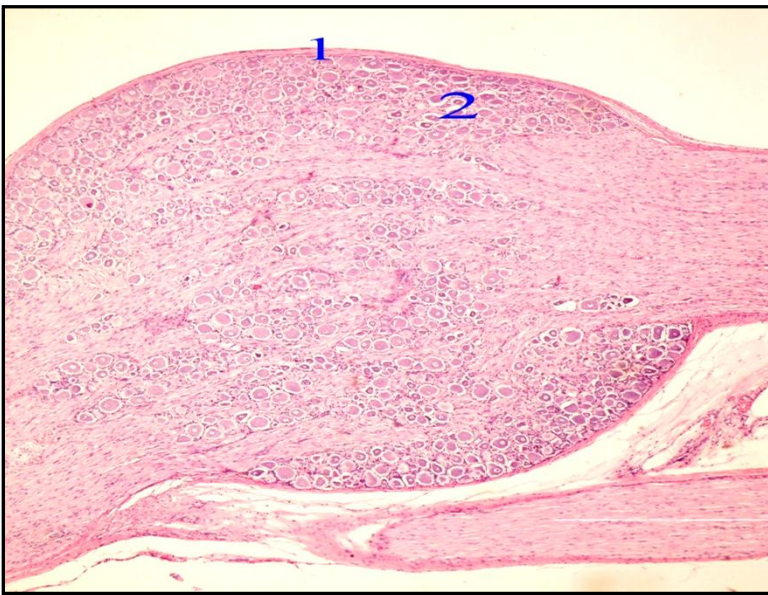
# Sympathetic ganglia ( H&E)



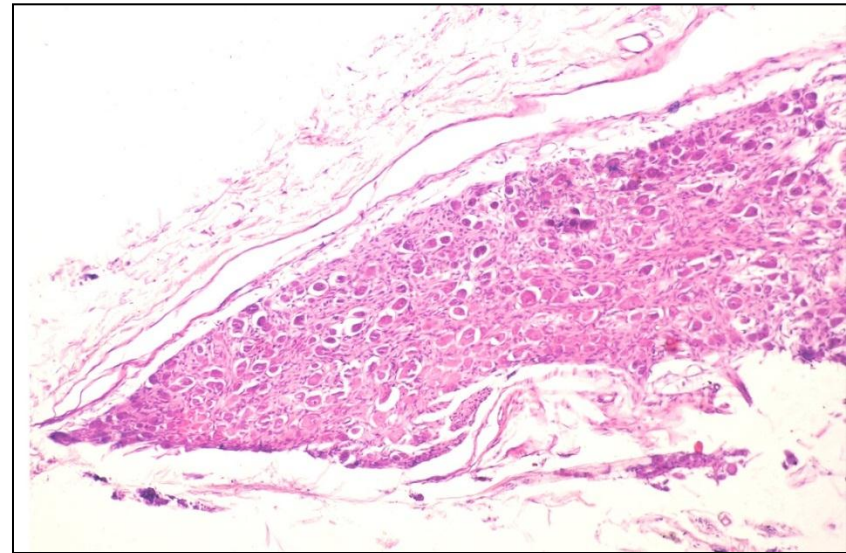
- 1- capsule
- 2-multipolar nerve cells
- 3-unmyelinated nerve fibers

# Sympathetic ganglia ( silver)

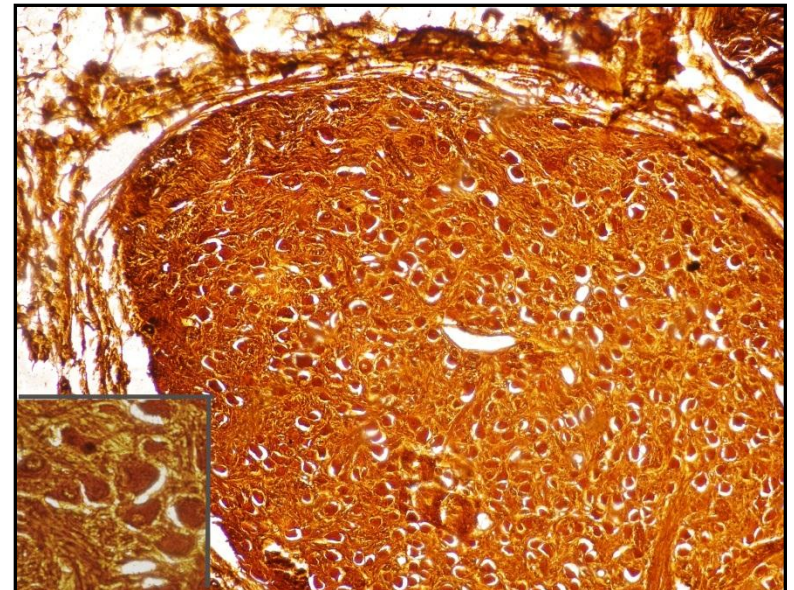
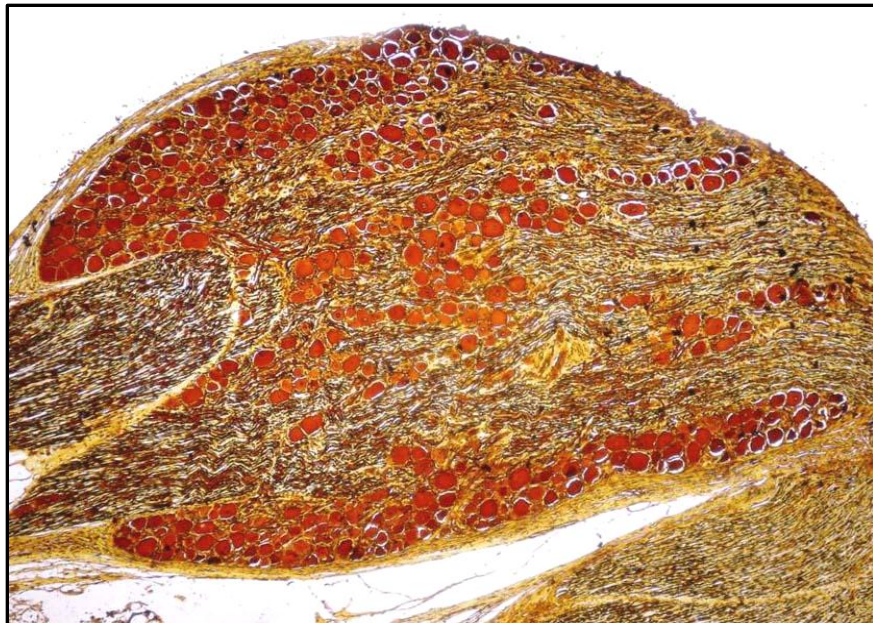




**Cranio-spinal ganglia**



**Sympathetic ganglia**



# Differences between Cranio-spinal and Autonomic ganglia

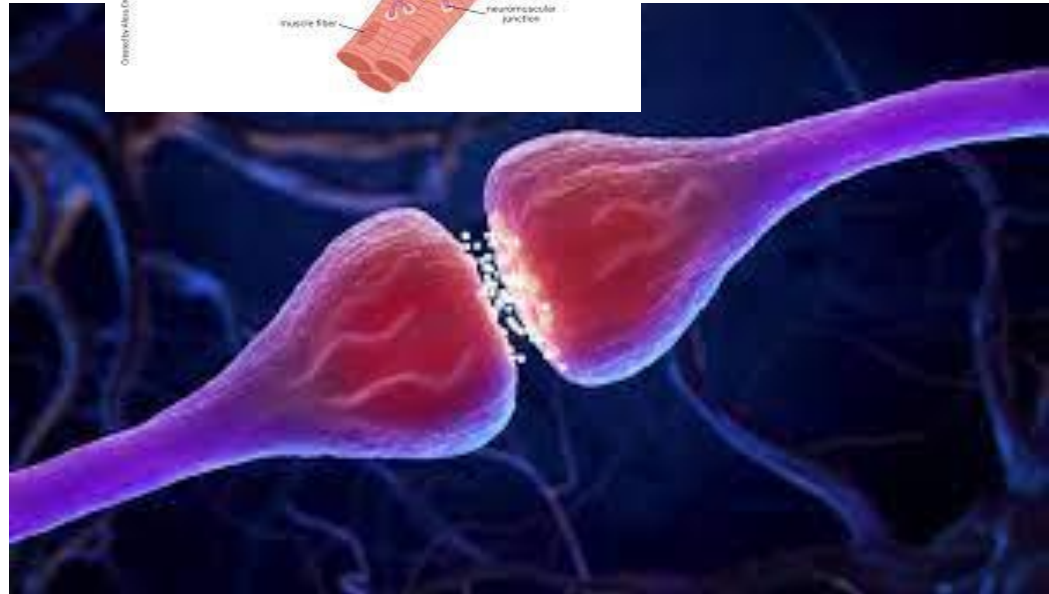
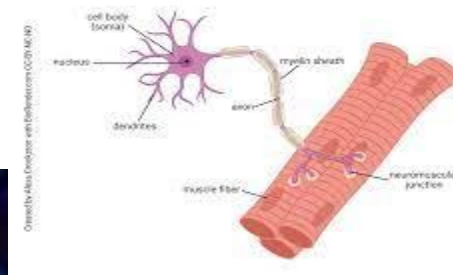
Structure	Cranio-spinal ganglia	Autonomic ganglia e.g. Sympathetic ganglia
<b>1-Capsule</b>	<b>Thick</b>	<b>Thin</b>
<b>2-Nerve cells</b>	<b>pseudounipolar.</b>	<b>multipolar.</b>
<b>3-Size</b>	<b>large</b>	<b>small</b>
<b>4-Number</b>	<b>few.</b>	<b>numerous</b>
<b>5-Arrangement</b>	<b>groups.</b>	<b>scattered.</b>
<b>6-Nucleus</b>	<b>central.</b>	<b>eccentric.</b>
<b>7-Satellite cells</b>	<b>complete layer.</b>	<b>incomplete layer.</b>
<b>8- Nerve fibers</b>	<b>thickly myelinated.</b>	<b>non myelinated.</b>

# SYNAPSE

- Site of contact between **two neurons** or between **neurons and other effector cells**.
- Nerve impulse is transmitted in one direction.
- **Types of Synapses:**

A- According to **site of contact** between two neurons.

B- According to **mode of transmission** of impulse.



# According to site of contact between two neurons

## 1- *Axodendritic*

(commonest)

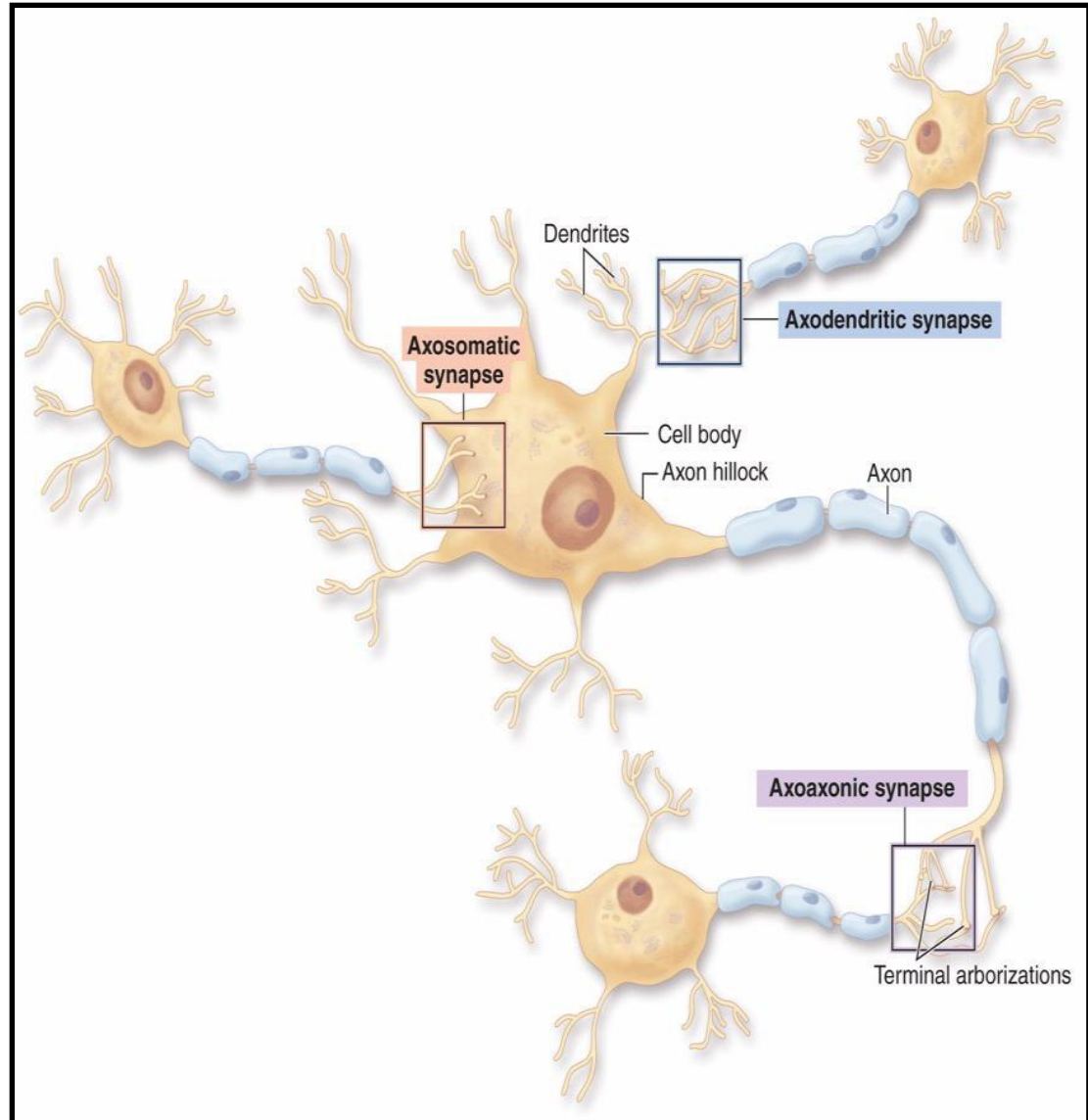
between axon and dendrite.

## 2- *Axosomatic*

between axon and body.

## 3- *Axoaxonic* (rarest)

between 2 axons.



# According to mode of transmission of nerve impulse

## ***1- Chemical synapse*** (commonest)

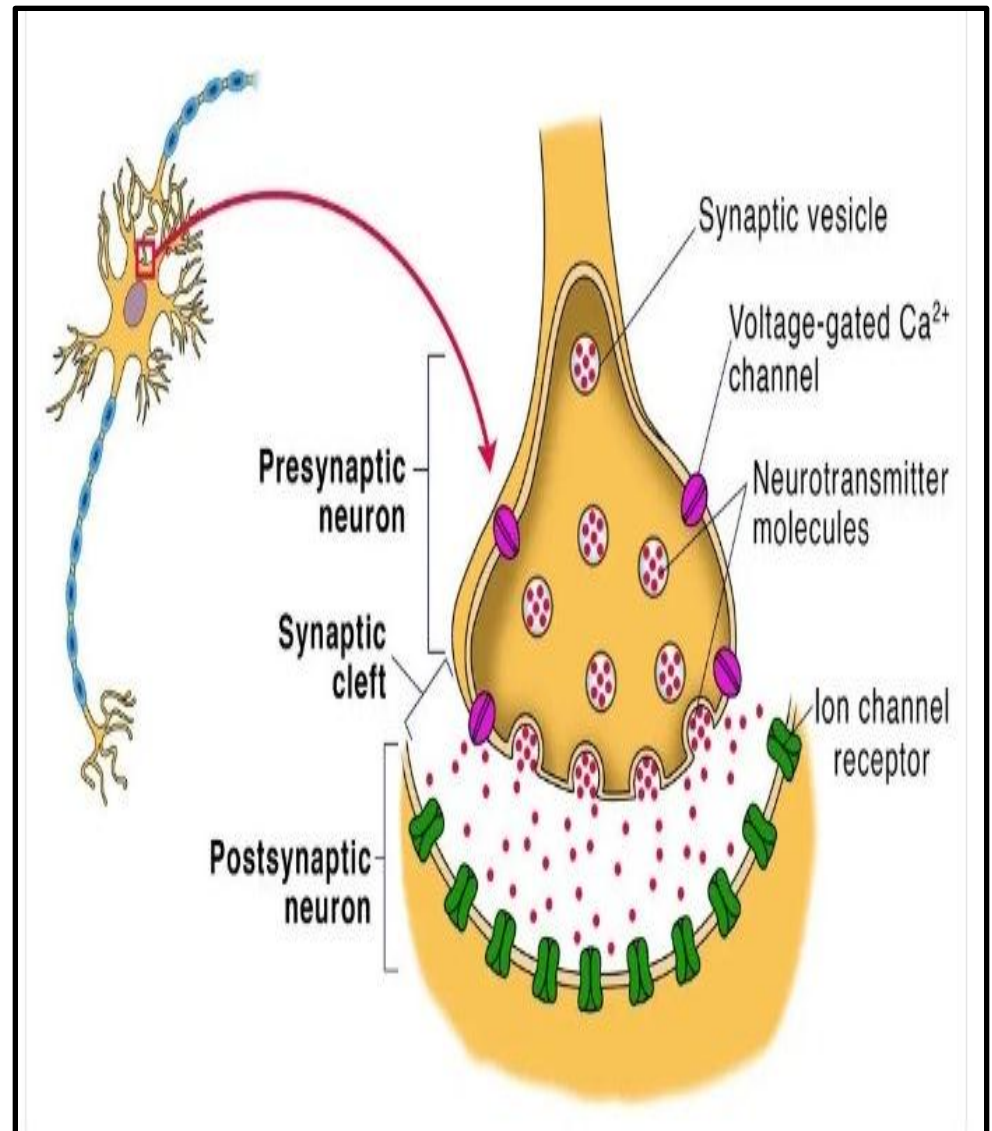
Chemical messenger transmit impulses from one neuron to other.

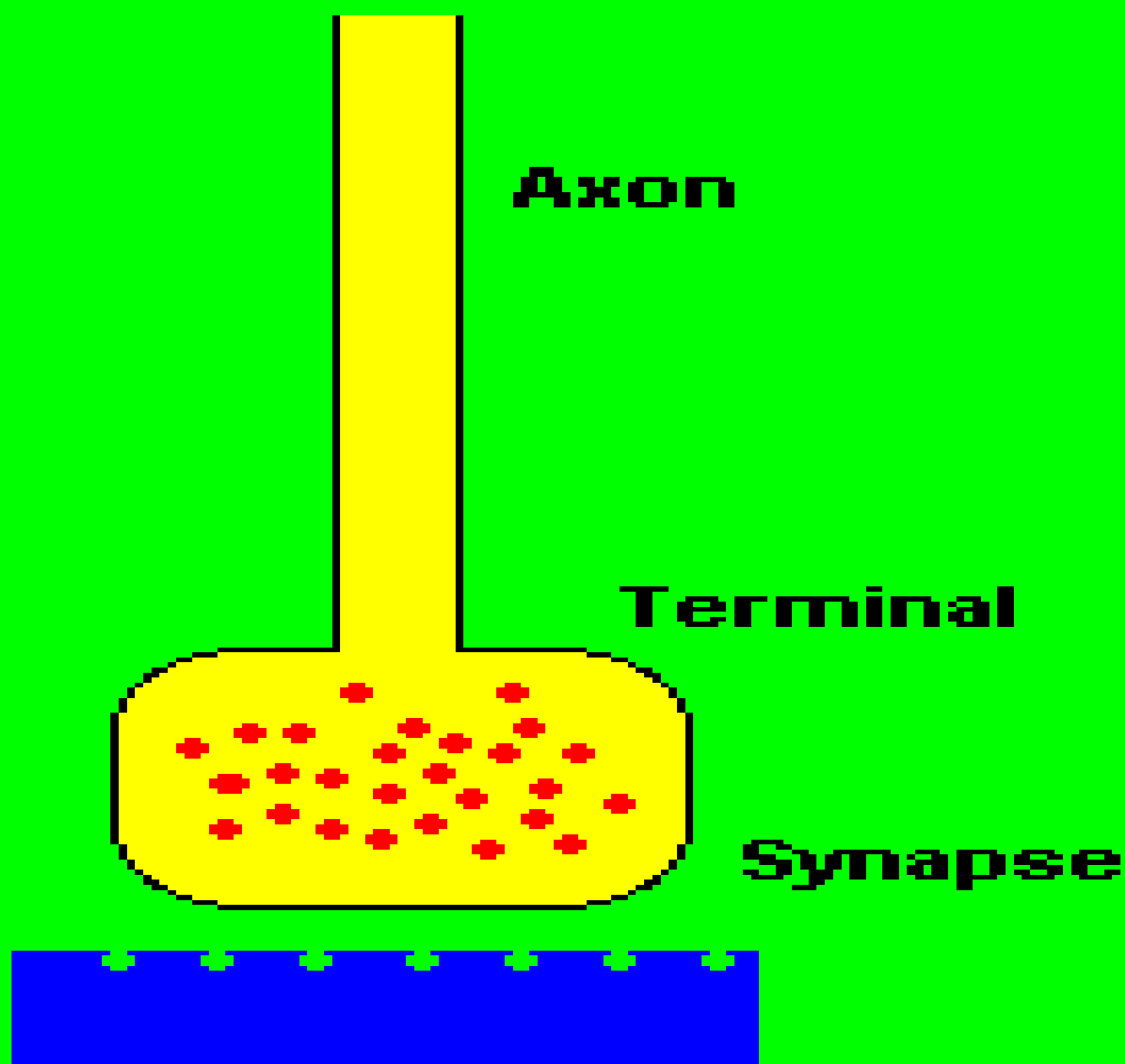
## ***2- Electrical synapses***

Direct electrical transmission of impulses from one neuron to other through gap junctions.

# Structure

- Pre-synaptic terminal
- Synaptic cleft (gap)
- Post-synaptic terminal



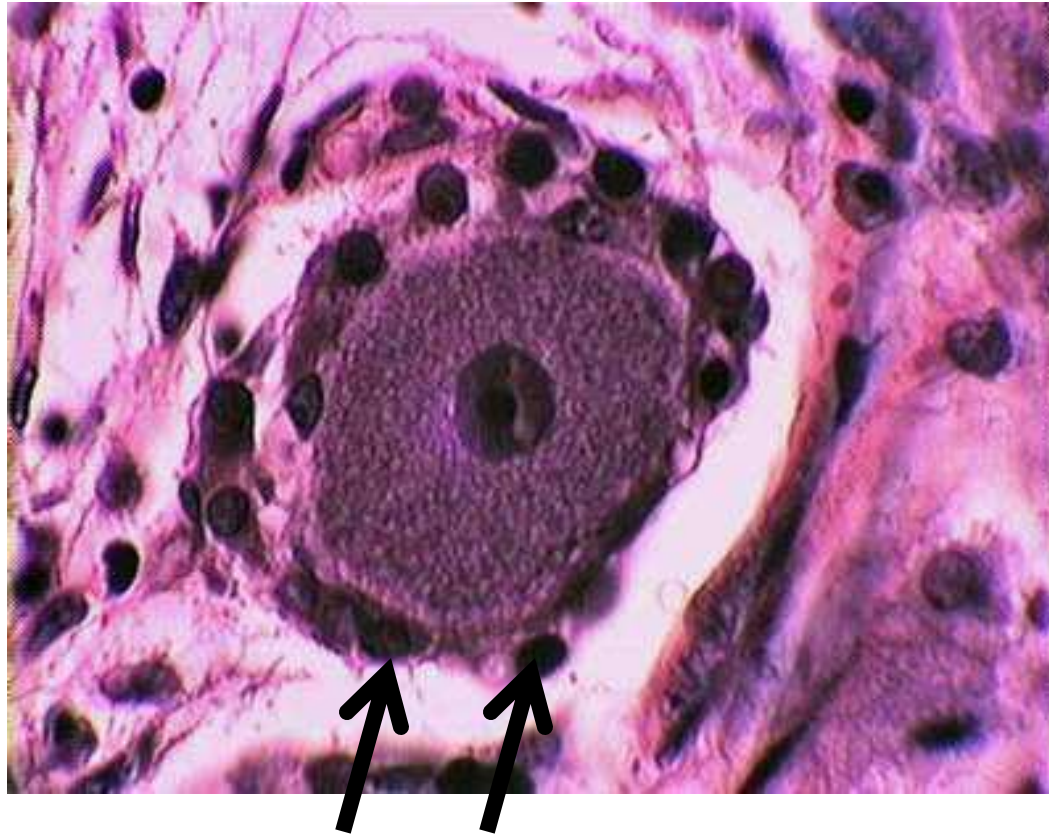


- Neurotransmitters are liberated at **pre-synaptic** membrane act on **post-synaptic** membrane across **synaptic cleft** to transmit nerve impulse in one direction.
- Axon terminal delivers impulses at synapse.
- **Terminal branches** of axon are expanded **end bulbs** devoid of myelin sheath.
- **Cytoplasm** of end bulbs contains numerous **mitochondria and vesicles** of neurotransmitters.
- **Axolemma** at synapse: **presynaptic membrane**.
- **Intercellular space** between pre and post synaptic membranes.
- Contain tissue fluid.
- Surface of other neuron receives impulses.
- Cell membrane called **post-synaptic membrane**.
- Cell membranes at pre- and post-synaptic regions are **thicker**

# The Neuroglia

- They are 10 times **more than** the neurons in the nervous system.
- **Site:**
  - In **CNS**. (Astrocytes, Oligodendrocytes, Microglia, Ependymal cells)
  - In **PNS**. (neurolemmal cells, satellite cells in nerve ganglia and Muller cells in retina).
- **Function of neuroglia:**
  - Supportive.
  - Form myelin sheath.
  - Nutritive.
  - Defense.
  - Regenerative.
  - Share in blood-brain barrier (BBB).
  - Secrete CSF.

# Neuroglia in PNS



satellite cells in nerve ganglia

# Neuroglia in CNS

## Types:

- 1- Astrocytes
- 2- Oligodendrocytes
- 3- Microglia
- 4- Ependymal cells

## Origin:

- Astrocytes, oligodendrocytes and ependymal cells are **ectodermal**.
- Microglia are **mesodermal**.

## Stain:

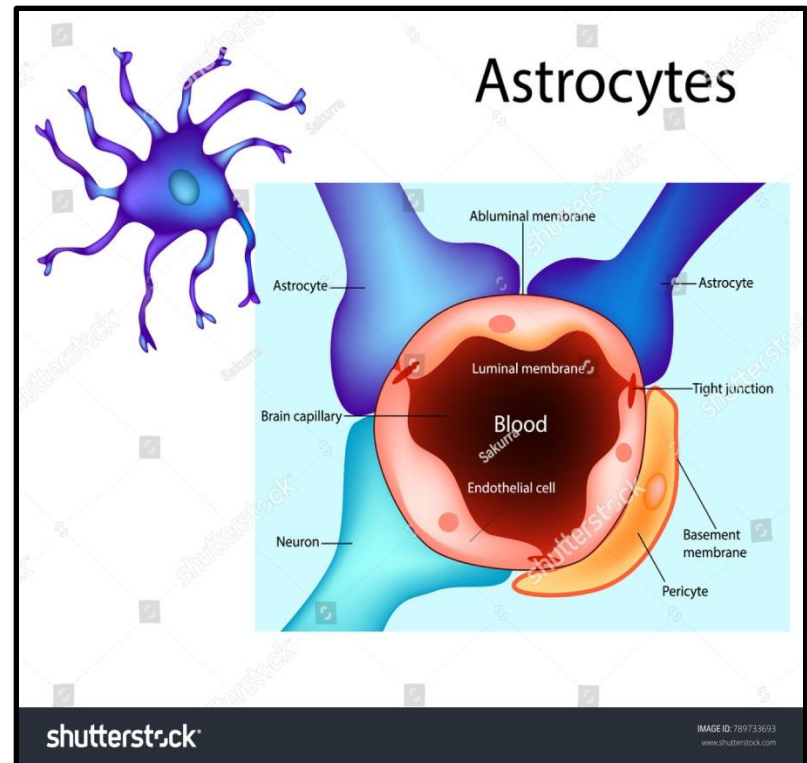
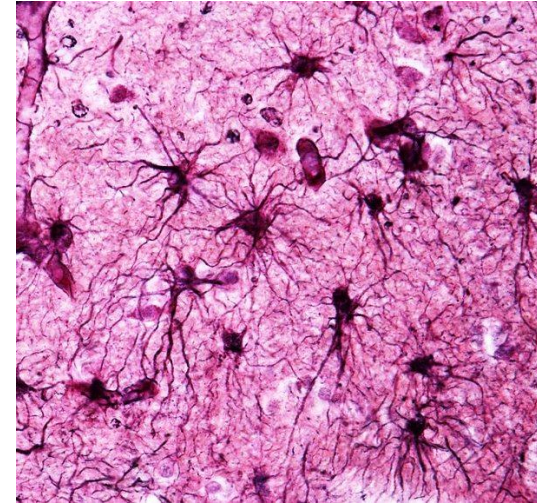
silver or gold impregnation.

# 1- Astrocytes

- Ectodermal.
- Shape:
  - star-shaped
  - multiple long processes.
- **foot-like expansions** attach to wall of capillaries.

Share in blood –brain barrier

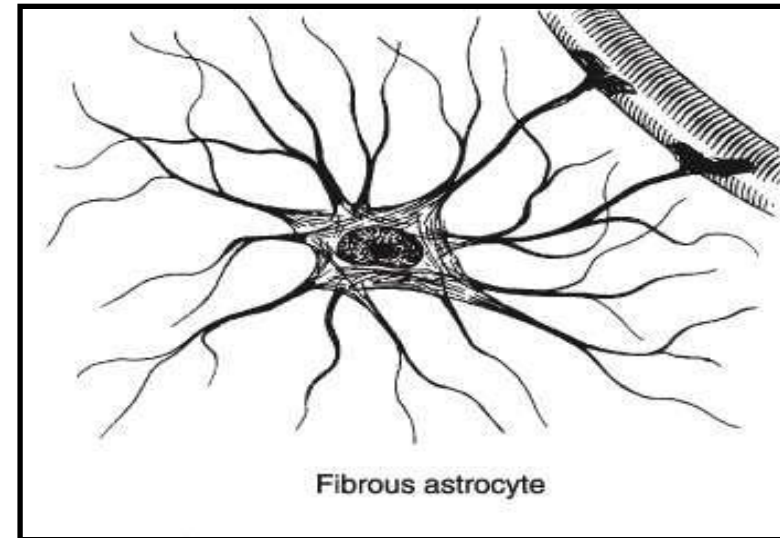
- **Nucleus:** single, central, rounded, pale, fine chromatin.
- **Cytoplasm:** and contains the usual organoids, inclusions, intermediate filaments and lysosomes called *gliosomes*.



# Types of Astrocytes

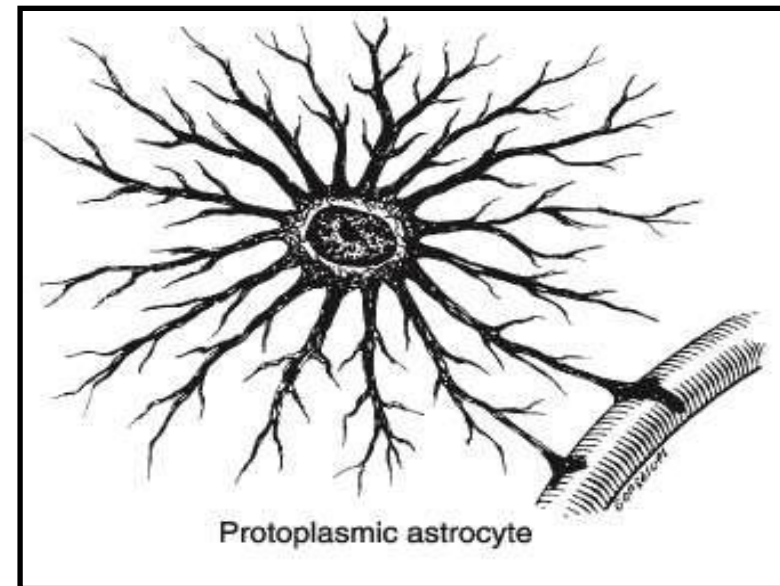
## a) Fibrous astrocytes:

- in white matter of CNS.
- long thin **smooth** processes.
- cytoplasm contains dense bundles of filaments.



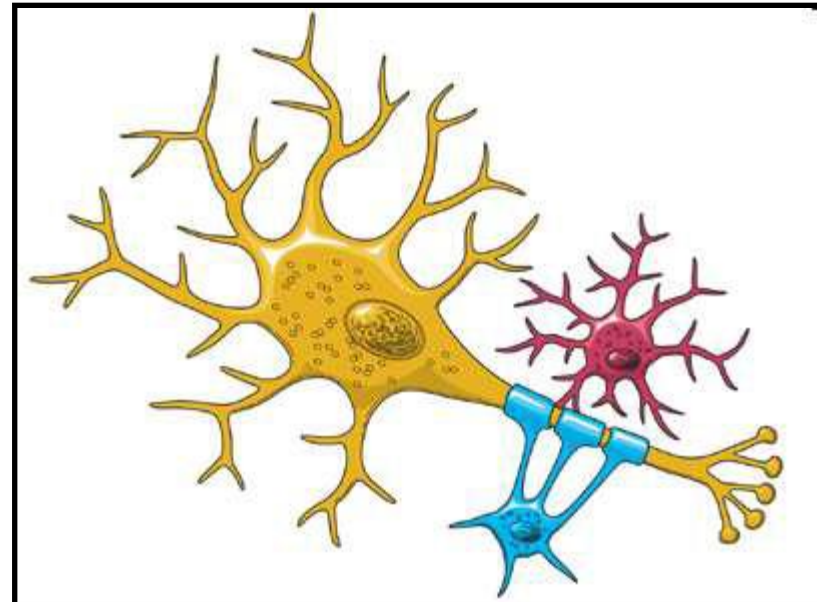
## b) Protoplasmic astrocytes:

- in gray matter of CNS.
- short thick **branched** processes.
- cytoplasm granular (gliosomes) with little filaments.



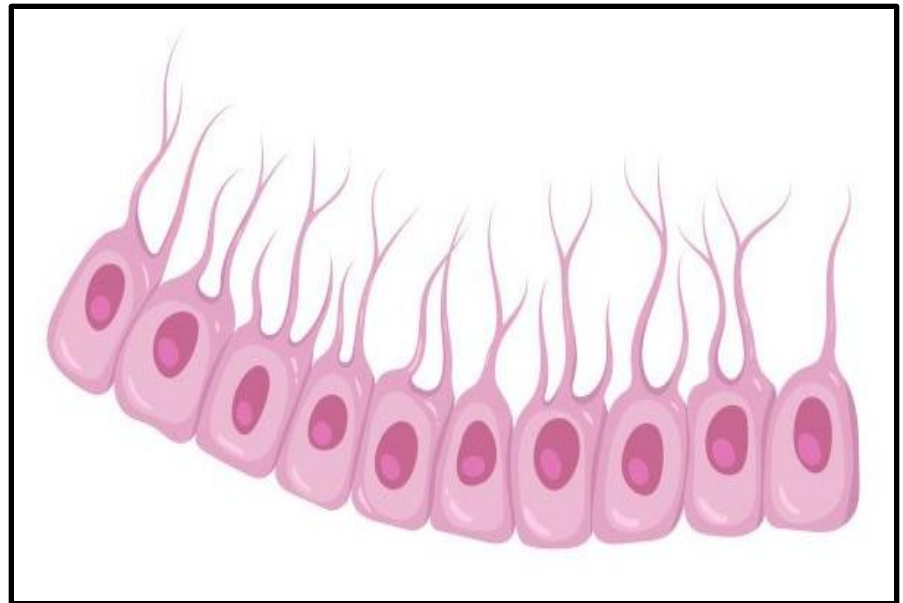
## 2- Oligodendrocytes

- ectodermal.
- **Size:** smaller than astrocytes.
- **Site:** in white and grey matter of CNS.
- **Shape:** few short processes wrap around axons in CNS producing myelin sheath.
- **Nucleus:**  
single, central, oval, small.
- **Cytoplasm:**  
scanty forming thin rim.



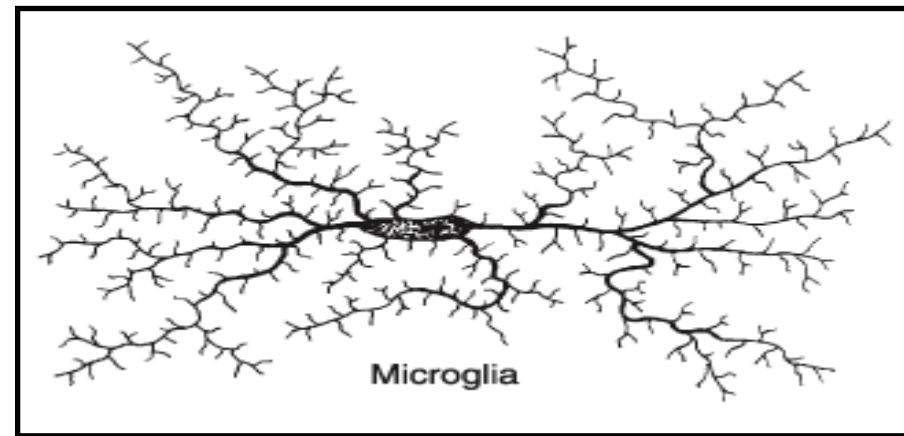
### 3- Ependymal cells

- simple columnar epithelial cells
- line choroid plexus, brain ventricles and central canal of spinal cord.
- ciliated to facilitate movement of C.S.F.



# 4-Microglia

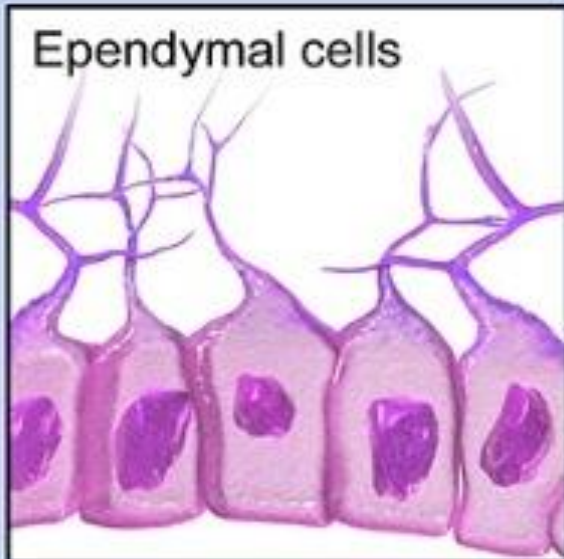
- **Mesodermal** in origin from monocytes.
- **Cells:** small elongated with processes and spines.
- **Nucleus:** single central oval dense.
- **Cytoplasm:** basophilic and contains the usual cell inclusion and organoids especially **lysosomes**.



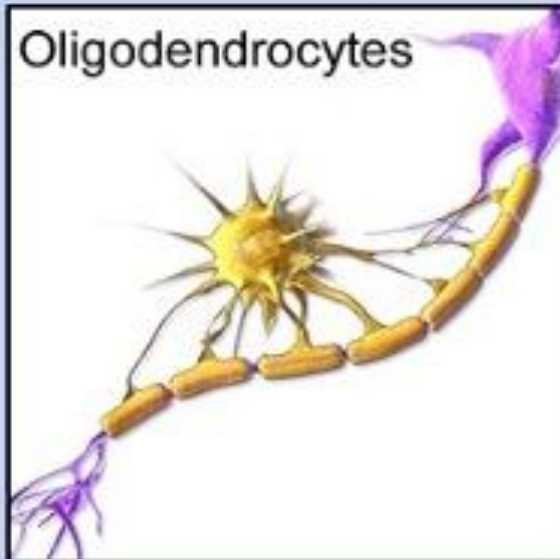
# Types of Neuroglia

## *Central Nervous System*

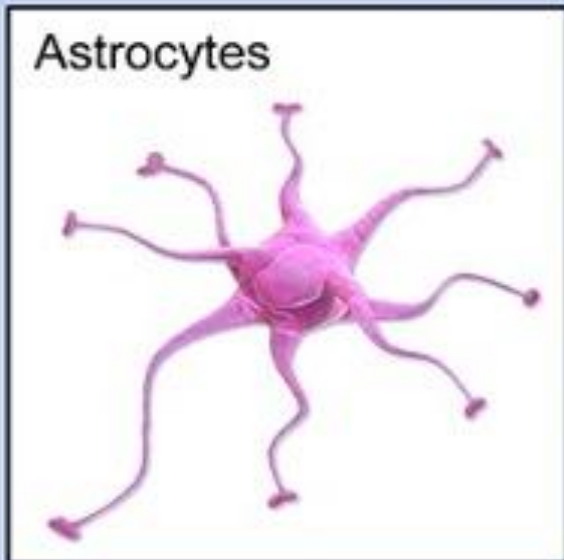
Ependymal cells



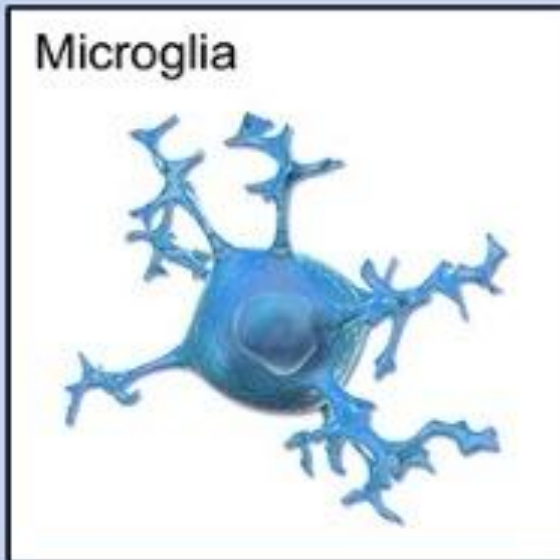
Oligodendrocytes



Astrocytes

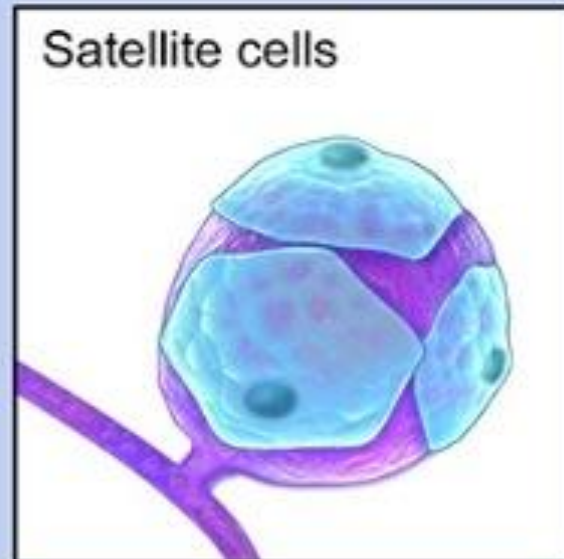


Microglia

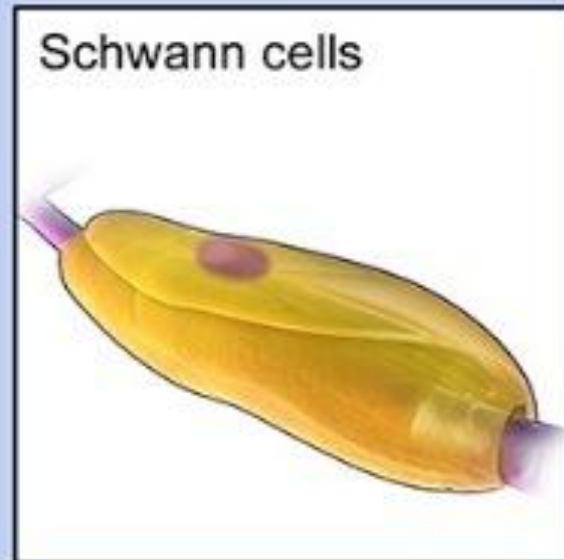


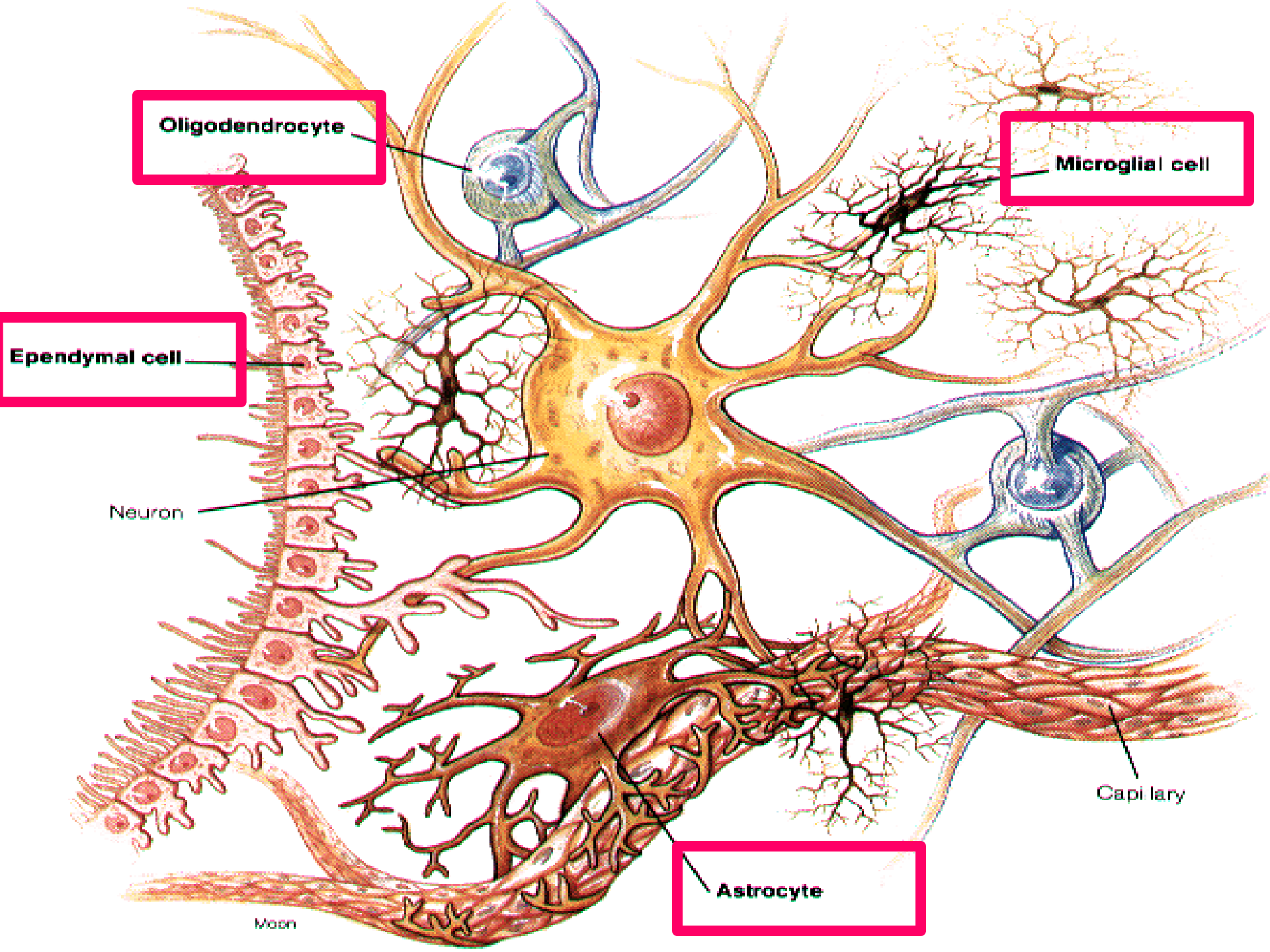
## *Peripheral Nervous System*

Satellite cells



Schwann cells





Oligodendrocyte

Microglial cell

Ependymal cell

Neuron

Capillary

Astrocyte

Moon

Thank  
you

