

جامعة الانبار

كلية : الصيدلة

قسم : الصيدلة

اسم المادة باللغة العربية: بايولوجيا الانسان

اسم المدة باللغة الإنكليزية: **Human Biology**

المرحلة: الاولى

التدريسي: أ.م.د. مهذ عبدالمجيد محمد

عنوان المحاضرة باللغة العربية: النسيج العصبي

عنوان المحاضرة باللغة الإنكليزية: **Nervous Tissue**

محتوى المحاضرة:

(NERVOUS TISSUE)

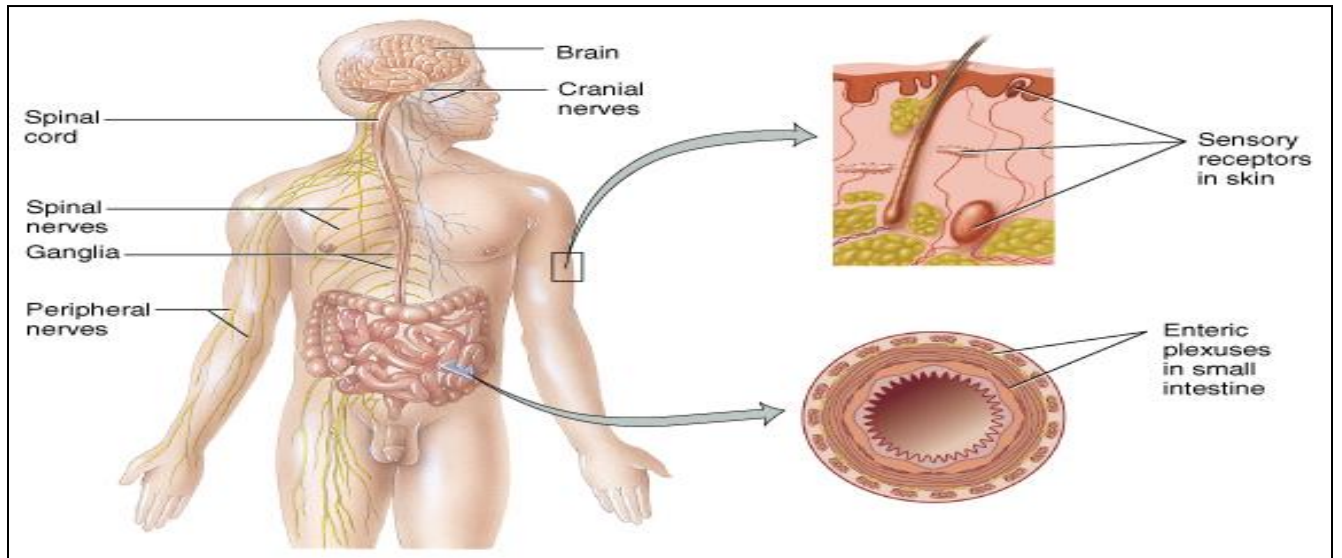
Nervous Tissue controls and integrates all body activities within limits that maintain life.

Three basic functions:

1. Sensing changes with sensory receptors (Fullness of stomach or sun on your face).
2. Interpreting and remembering those changes.
3. Reacting to those changes with effectors (Muscular contractions, glandular secretions).

Major Structures of the Nervous System:

Brain, cranial nerves, spinal cord, spinal nerves, ganglia, enteric plexuses and sensory receptors.



Organization of the Nervous System:

- ❖ CNS is brain and spinal cord
- ❖ PNS is everything else

Nervous System Divisions:

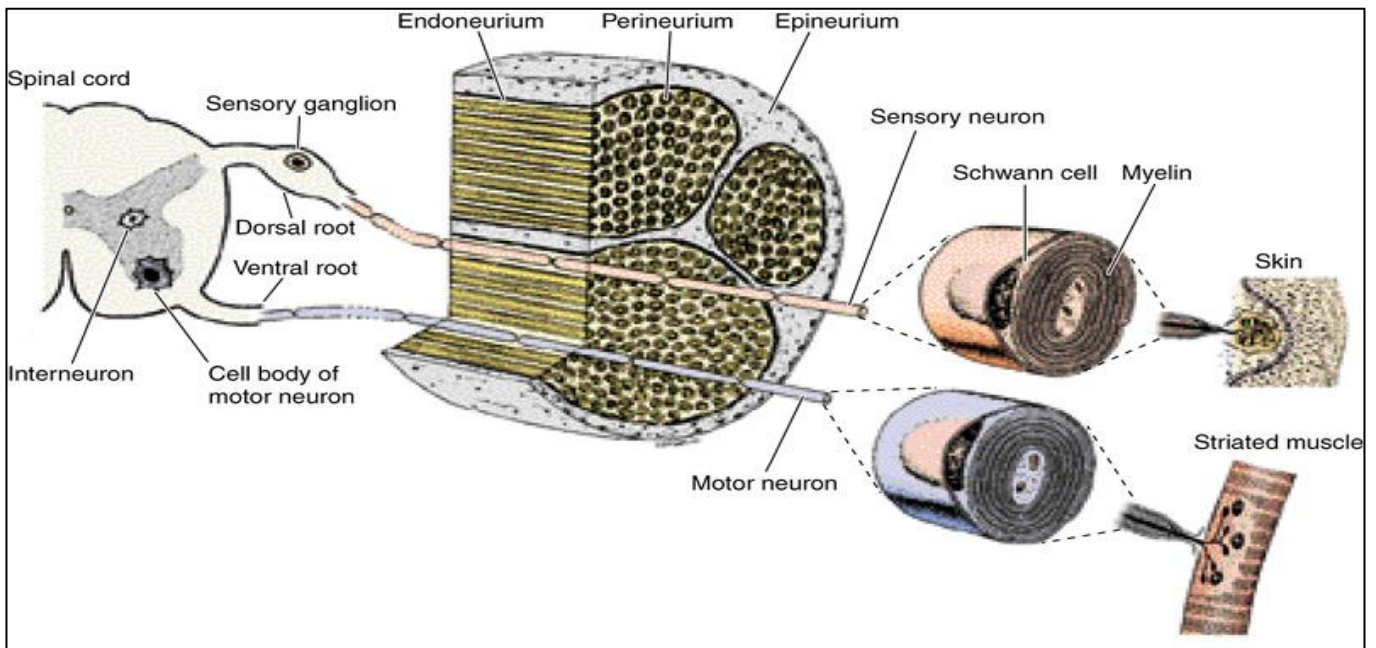
Central nervous system (CNS): Consists of the brain and spinal cord.

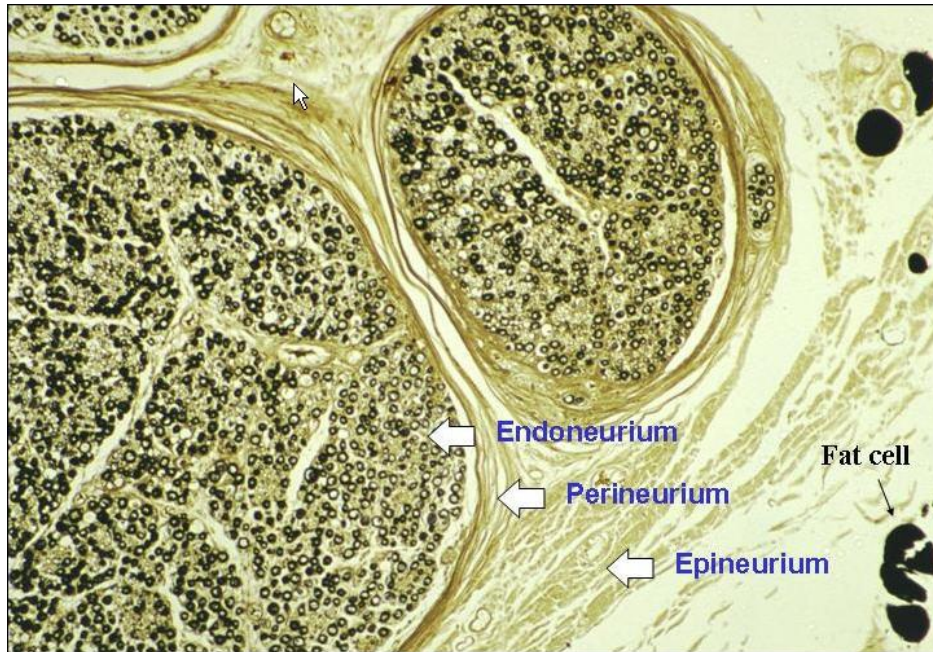
Peripheral nervous system (PNS): Consists of cranial and spinal nerves that contain both sensory and motor fibers. Connects CNS to muscles, glands & all sensory receptors

Peripheral Nerves (Nerve Trunk):

It is formed of groups of nerve fibers surrounded by a CT sheath.

- 1- Epineurium:** Dense fibrous connective tissue sheath covering the nerve trunk from outside.
- 2- Perineurium:** Cellular sheath surrounding each bundle of nerve fibers (nerve fascicle).
- 3- Endoneurium:** Thin layer of reticular fibers surrounding each nerve fiber separately





Subdivisions of the PNS

❖ Somatic (voluntary) nervous system (SNS):

1. Neurons from cutaneous and special sensory receptors to the CNS.
2. Motor neurons to skeletal muscle tissue.

❖ Autonomic (involuntary) nervous systems (ANS):

3. Sensory neurons from visceral organs to CNS
4. Motor neurons to smooth & cardiac muscle and glands
 - Sympathetic division (speeds up heart rate)
 - Parasympathetic division (slow down heart rate)

❖ Enteric nervous system (ENS)

1. Involuntary sensory & motor neurons control GI tract
2. Neurons function independently of ANS & CNS

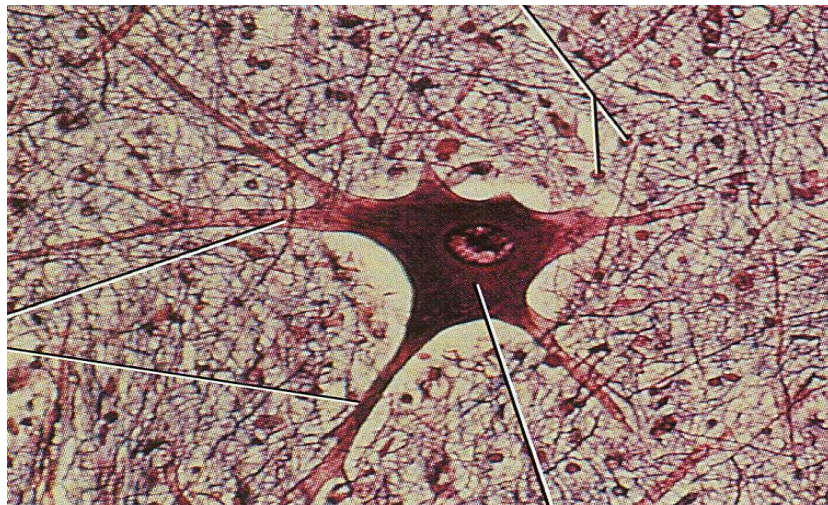
Neurons: Functional unit of nervous system, have capacity to produce action potentials electrical excitability, composed of:

1. Cell body:

- Single nucleus with prominent nucleolus
- Nissl bodies (chromatophilic substance)
- Rough ER & free ribosomes for protein synthesis
- Neurofilaments give cell shape and support
- Microtubules move material inside cell
- Lipofuscin pigment clumps (harmless aging)

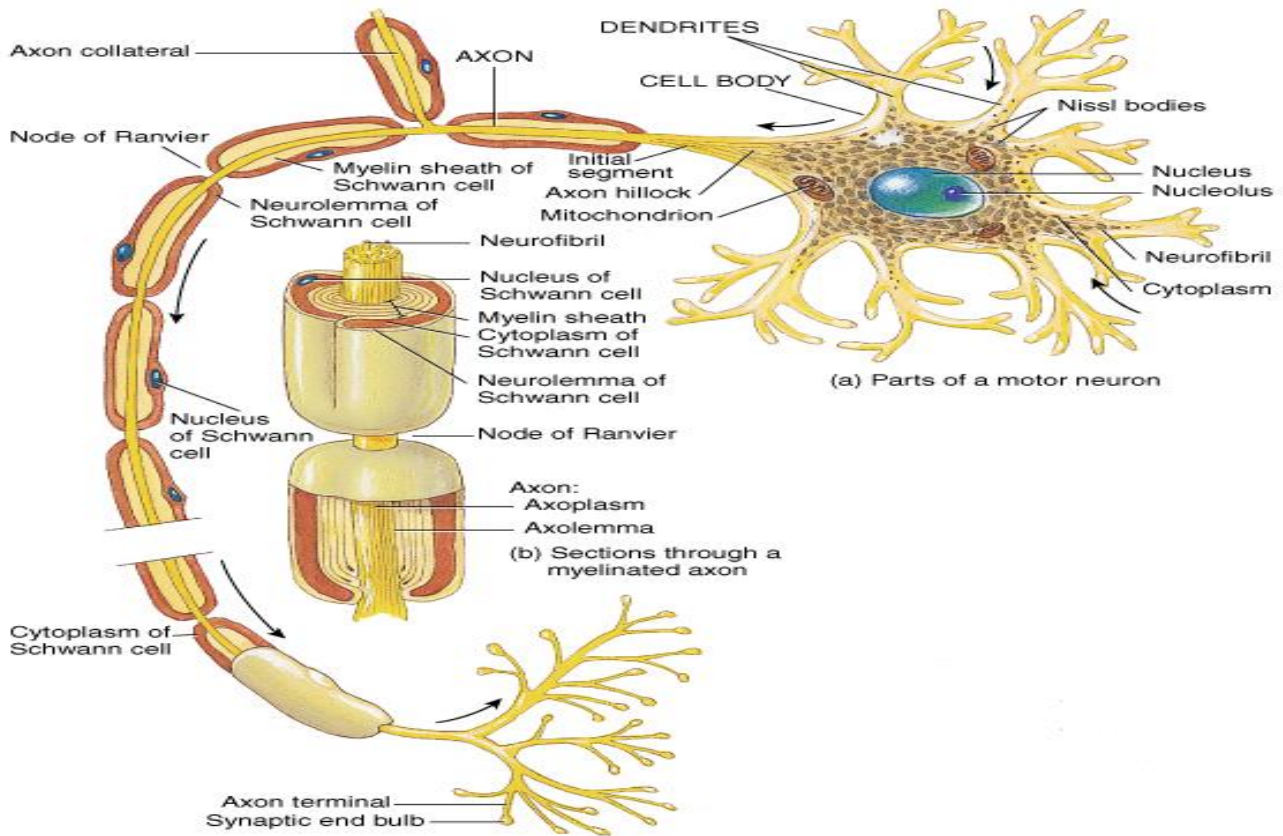
2. Cell processes = dendrites & axons

- 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

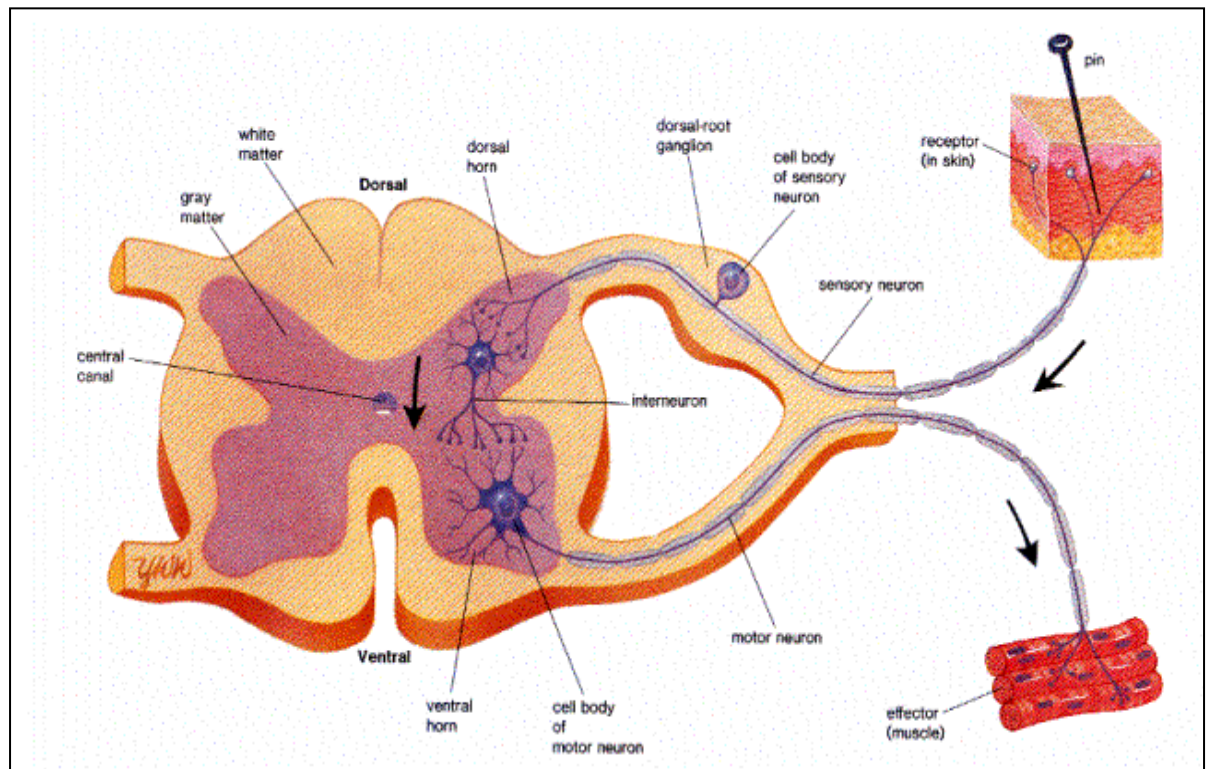
- ❖ Conduct impulses away from cell body
- ❖ Long, thin cylindrical process of cell
- ❖ Arises at axon hillock
- ❖ Impulses arise from initial segment (trigger zone)
- ❖ Swollen tips called synaptic end bulbs contain vesicles filled with neurotransmitters

Comparison between Axons and dendrites:

Characteristics	Axon	Dendrite
1. Direction of impulse	Conduct N. impulse away from the cell	Conduct N. impulse to the cell
2. Number	Single	Usually Multiple Single in uni or bipolar
3. Length	Long	Shorter
4. Thickness	Thin with constant diameter	Thick at origin, tapers towards its end
5. Branching	Does not branch except at its termination	Many branches
6. Origin	From axon hillock	From any part of the cell
7. Organelles present	Neurofibrils, mitochondria. No Nissl's granules	Neurofibrils, mitochondria & Nissl's granules
8. Surrounding structures	Surrounded by Neurilemma or myelin sheath	No surrounded by a sheath

Functional Classification of Neurons:

- ❖ **Sensory (afferent) neurons:** transport sensory information from skin, muscles, joints, sense organs & viscera to CNS
- ❖ **Motor (efferent) neurons:** send motor nerve impulses to muscles & glands
- ❖ **Interneurons (association) neurons:** connect sensory to motor neurons, 90% of neurons in the body, Sensory, Motor, and interneurons

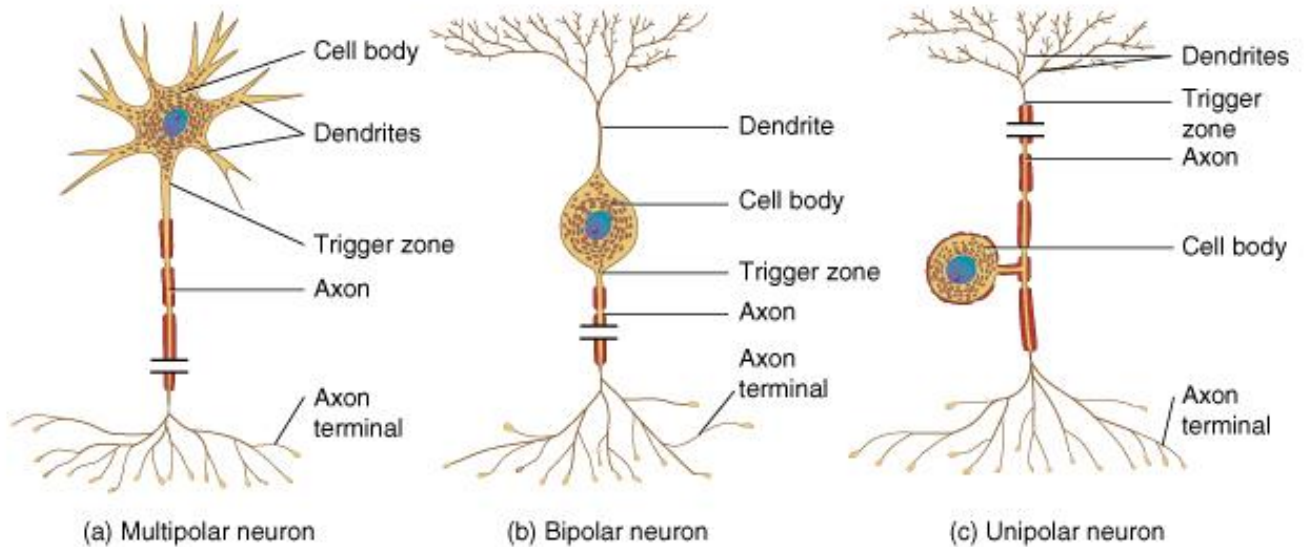


Structural Classification of Neurons:

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



GANGLIA

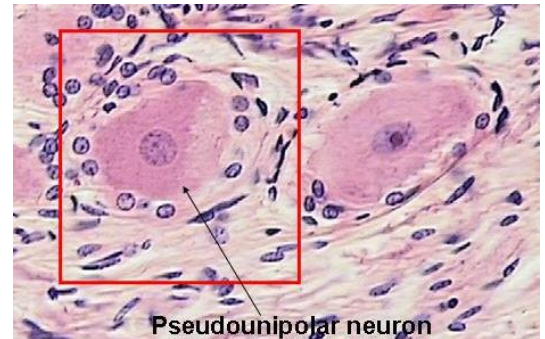
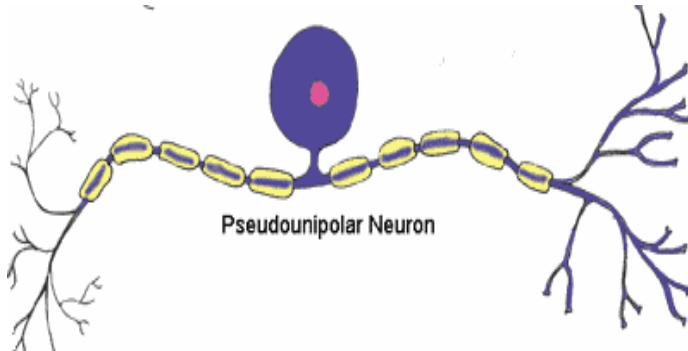
They are collections of nerve cell bodies, covered by a connective tissue capsule and lie outside the CNS in the pathway of nerves. There are of two types:

- I. **Cerebro-spinal ganglia:** (either **cranial** or **spinal**)
- II. **Autonomic ganglia** (either **sympathetic** or **parasympathetic ganglia**)

I. Cerebro-spinal ganglia

- Site Cranial and spinal sensory nerves
- {Size Larger, Shape Oval, Capsule Thick, Connective tissue septa(Thick, Parallel to the capsule)}
- **Cells ==>>>Pseudounipolar**

(Central nucleus, larger in size, few in number, surrounded by a definite layer of satellite cells, Arranged in groups)

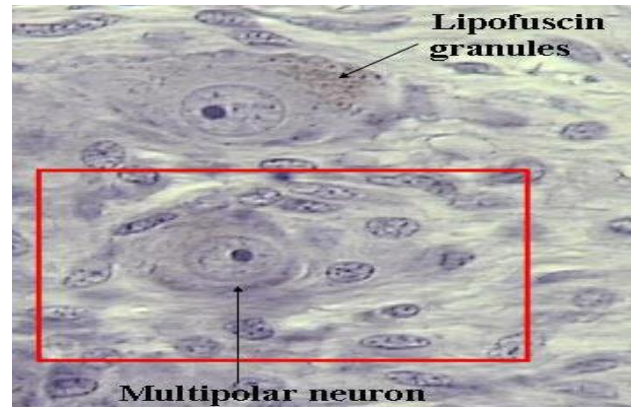
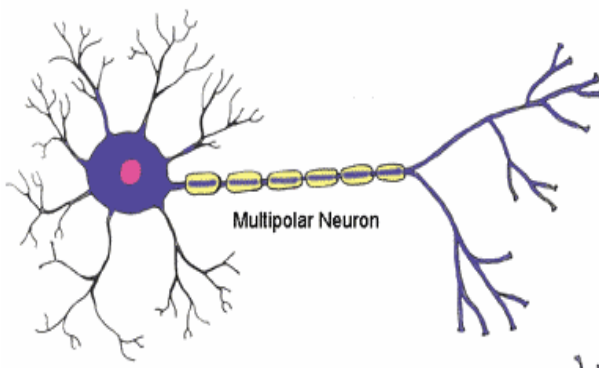


Cranio-spinal ganglia

- Nerve fibers , Thick, myelinated and parallel to the capsule , Synapses Not present, Function Sensory

II. Autonomic ganglia:

- (Site Sympathetic chain parasympathetic nerves , Size smaller, Shape rounded , Capsule Thin, CT septa, Thinner, run irregular along the ganglion)



Cells of autonomic ganglia:

{**Multipolar**, Stellate cells (eccentric nucleus, small in size, Numerous, surrounded by an incomplete capsule of satellite cells, Scattered all over)

Neuroglia: supporting CT of nervous system

Neuroglia
supporting CT of nervous system



Neuroglia proper

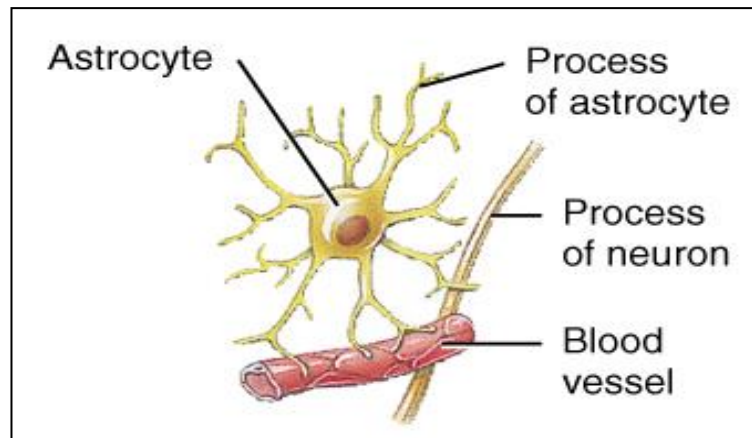
1. Macroglia (astrocytes)
2. Microglia
3. Oligodendroglia

Modified neuroglia

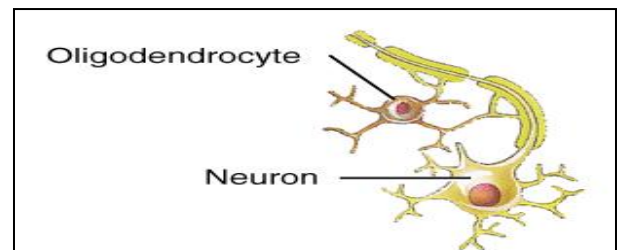
1. Schwann cells
2. Satellite cells

- 4 cell types in CNS: (astrocytes, oligodendrocytes, microglia & ependymal)
- 2 cell types in PNS: (schwann and satellite cells)

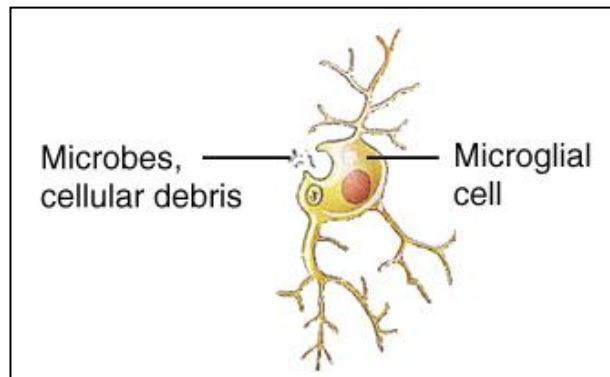
Astrocytes : (Star-shaped cells, Form blood-brain barrier by covering blood capillaries, Metabolize neurotransmitters, Regulate K⁺ balance, Provide structural support)



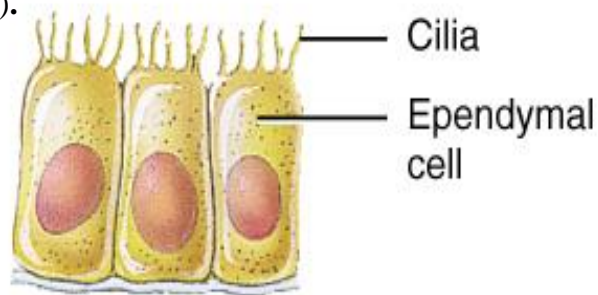
Oligodendrocytes: (Most common glial cell type, each forms myelin sheath around more than one axons in CNS, Analogous to Schwann cells of PNS)



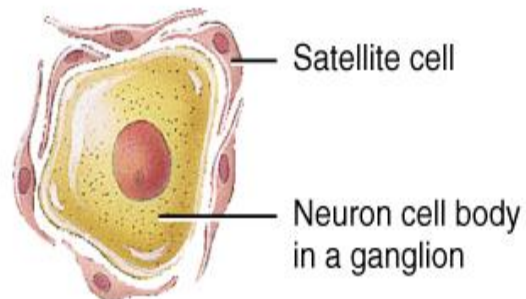
Microglia: (Small cells found near blood vessels, Phagocytic role -- clear away dead cells, Derived from cells that also gave rise to macrophages & monocytes)



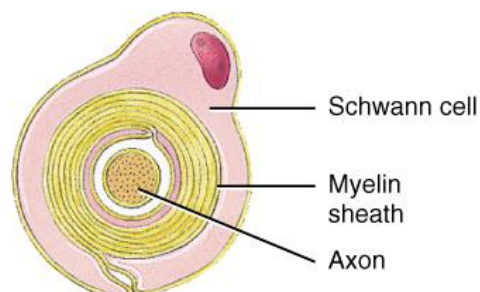
Ependymal cells: (Form epithelial membrane lining cerebral cavities & central canal, Produce cerebrospinal fluid (CSF)).

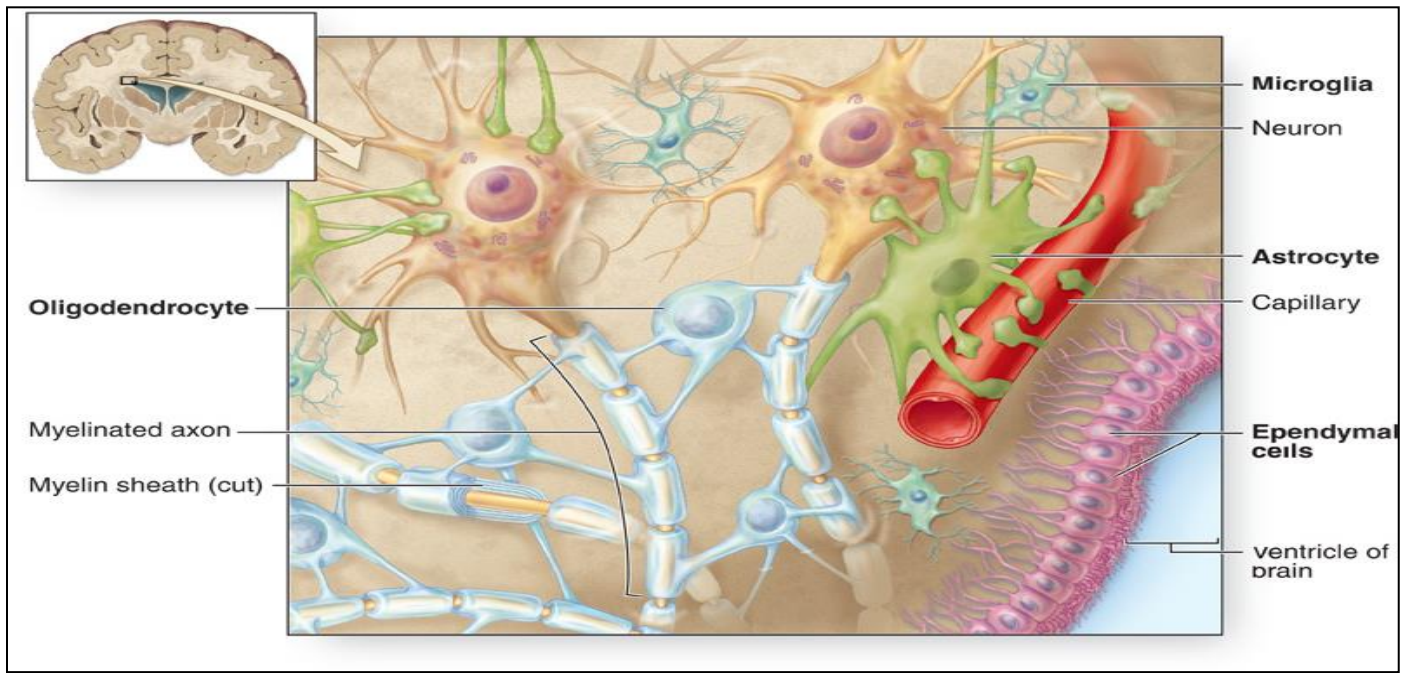


Satellite Cells: (Flat cells surrounding neuronal cell bodies in peripheral ganglia, Support neurons in the PNS ganglia).



Schwann cell: (Cells encircling PNS axons, each cell produces part of the myelin sheath. surrounding an axon in the PNS).

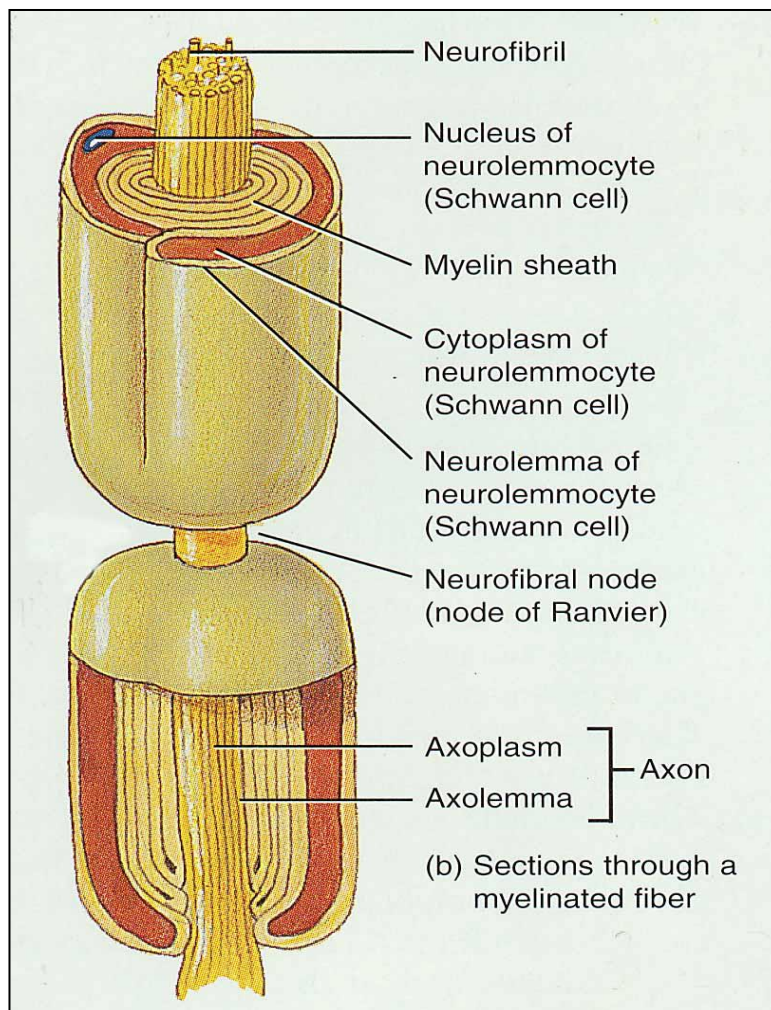




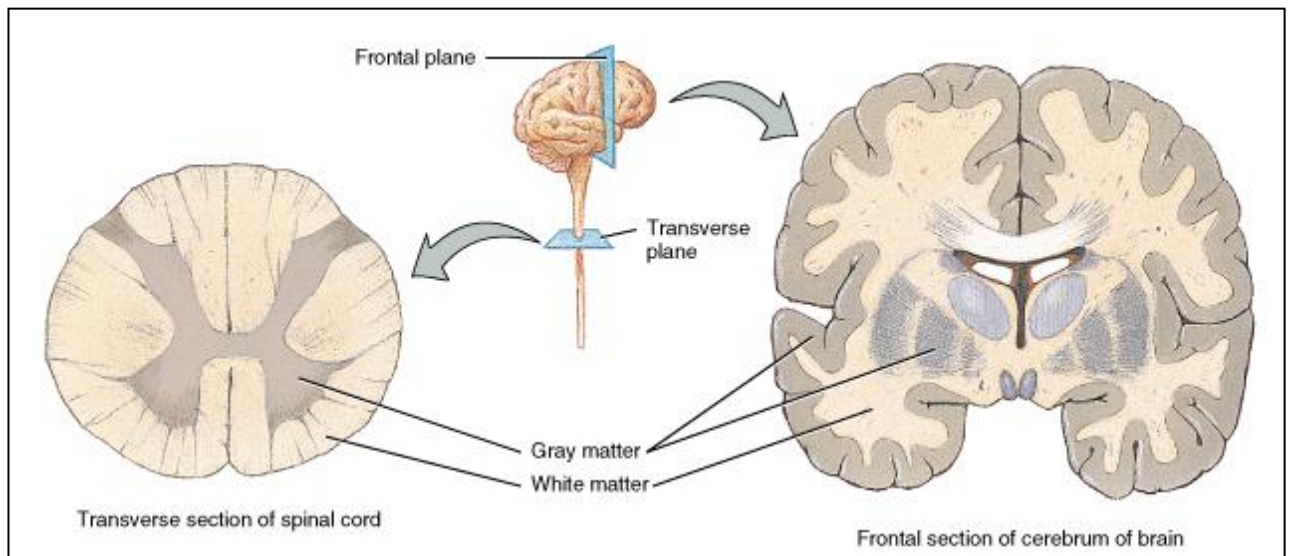
Axon Coverings in PNS:

All axons surrounded by a lipid & protein covering (myelin sheath) produced by Schwann cells. Neurilemma is surrounded cytoplasm & nucleus of Schwann cell : gaps called nodes of Ranvier

- **Myelinated fibers:** appear white,
 - jelly-roll like wrappings made of lipoprotein = myelin
 - acts as electrical insulator
 - speeds conduction of nerve impulses
- **Unmyelinated fibers:**
 - slow, small diameter fibers
 - only surrounded by neurilemma but no myelin sheath wrapping



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).
 - In the spinal cord = gray matter forms an H-shaped inner core surrounded by white matter.
 - In the brain = a thin outer shell of gray matter covers the surface & is found in clusters called nuclei inside the CNS.

Signal Transmission at Synapses: Two Types of synapses

- **Electrical:**
 - Ionic current spreads to next cell through gap junctions.
 - Faster, two-way transmission & capable of synchronizing groups of neurons
- **Chemical:**
 - One-way information transfer from a presynaptic neuron to a postsynaptic neuron.