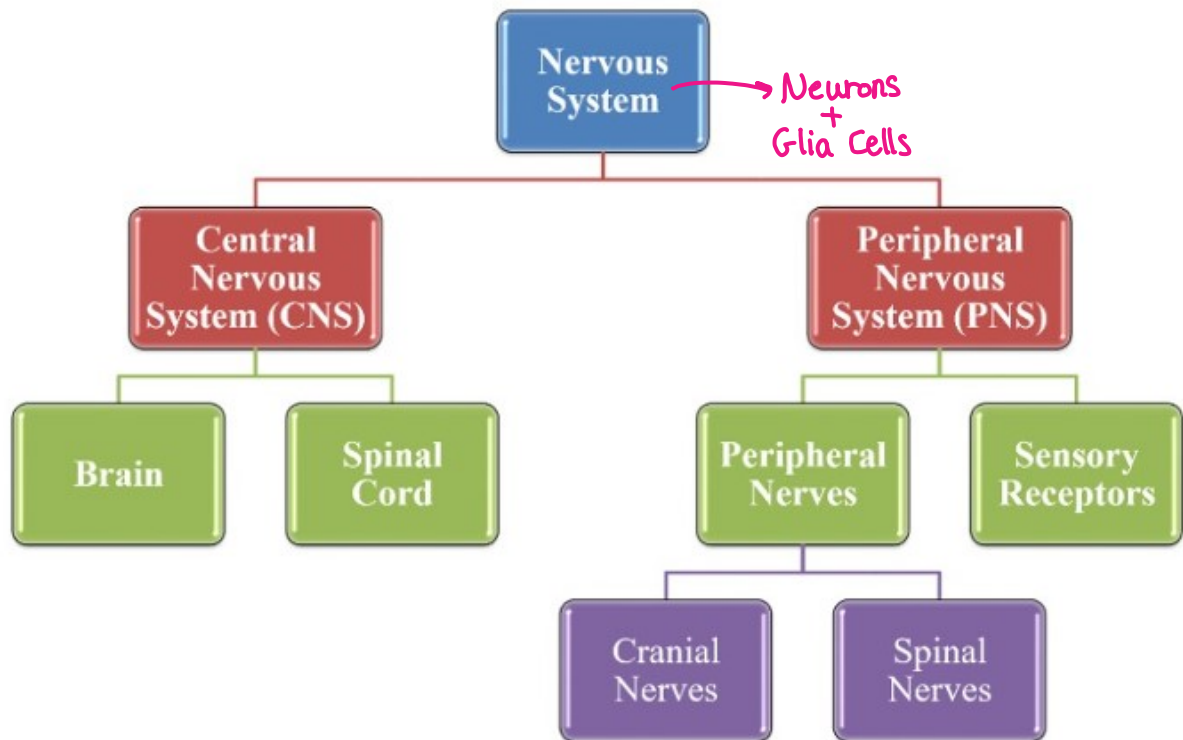


Nervous Tissue

Done by: Rama Alwraikat

Divisions of the Nervous System



* Functions of The Nervous System (the most complex system in the body)

- Reception & Perception of sensory information
- Controlling muscular action & glandular activity by neurons
- Thinking, learning, memory, emotions, behavior & decision making

* Neurons → the structural & functional units of the nervous system

- conduct electrical impulses by connecting with other neurons (Excitable Cells)
 - formed of a cell body (soma, somata, perikaryon) & Cell processes
 - Axon
 - Dendrites
- nucleus ← → Cytoplasm

* Nucleus → Round, centrally located, pale staining, prominent nucleolus & Barr bodies (in females - inactive X-Chromosome)

* Cytoplasm → Lysosomes, Golgi complex, Mitochondria & Centrioles → cell division in the immature neurons

- Contains
 ↓
 around the nucleus
 ↓
 Axon, dendrites & cell body

* Nissl Bodies → RER + free ribosomes

- in the cell body / proximal part of the dendrites

* Cytoskeleton \rightarrow contains Neurofilaments in the body & processes

* Inclusion Bodies \rightarrow contain Glycogen & lipids granules & Lipofusion granules

* Types of Axon Branches \rightarrow Collateral Branches
 \rightarrow Terminal Branches
 \rightarrow Varicosities (axon terminal Bulbs)

	Dendrites	Axon
1	Mostly multiple branches	A single branch
2	Usually short	Usually the longest branch
3	Taper as they extend away from cell body	Has a fixed diameter
4	Branch profusely	<ul style="list-style-type: none"> No branches near cell body Collateral branches along course Terminal branches
5	Cytoplasm similar to the that in cell body	Axoplasm lacks Nissl bodies and Golgi complex
6	Not covered by a myelin sheath	Some are covered by a myelin sheath
7	Conduct impulse towards cell body	Conducts impulse away from cell body

* Bipolar:
 e.g: Olfactory neurons, Bipolar cells of the Retina & Sensory ganglia of the Vestibulocochlear nerve

* Pseudounipolar
 PNS \rightarrow sensory ganglia of some cranial nerves
 \rightarrow dorsal root ganglia of the spinal nerves
 CNS \rightarrow mesencephalic nucleus of the trigeminal nerve

* Projection Neurons e.g: Anterior Horn cells & Pyramidal Cells of Cerebral Cortex

* Local Circuit Neurons (Interneurons) e.g: smaller cells of the cerebral & cerebellar cortex

Classification of Neurons

According to Number of Branches

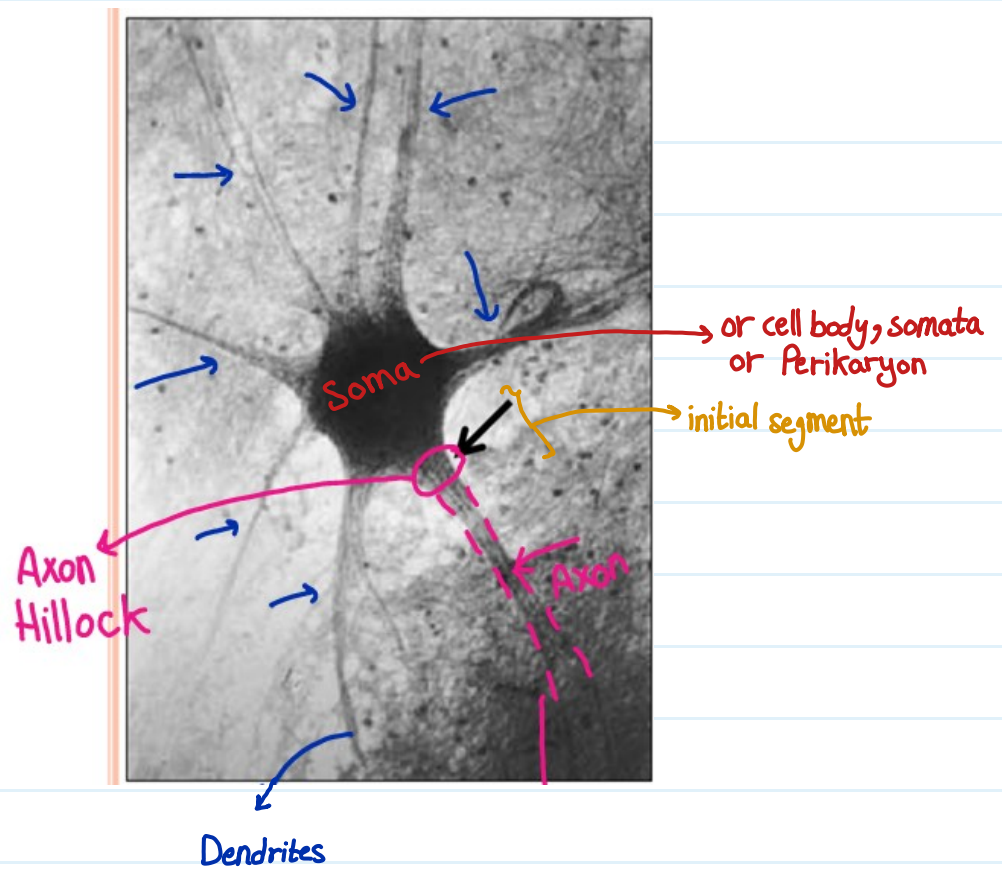
- Multipolar. e.g. \rightarrow Anterior horn cells of the spinal cord
- Bipolar.
- Pseudounipolar.

According to Termination of Axon

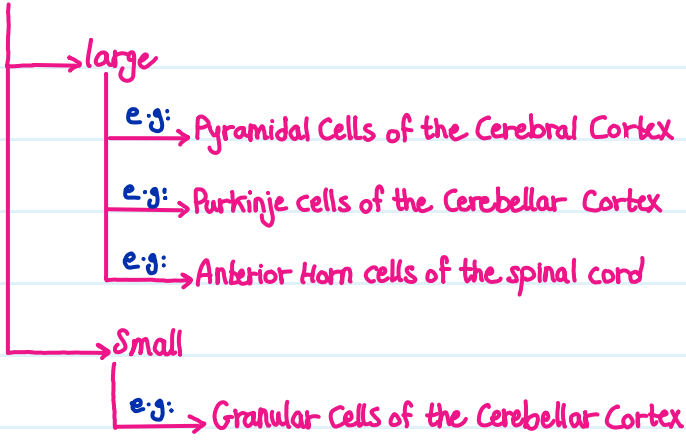
- Projection neurons.
- Local circuit (interneurons).

According to Function

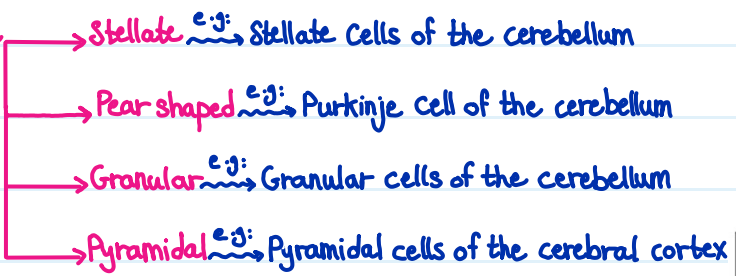
- Motor. e.g. \rightarrow Anterior Horn cells & Autonomic neurons
- Sensory. e.g. \rightarrow Neurons of the dorsal root ganglia



* Classification of Axon according to Size

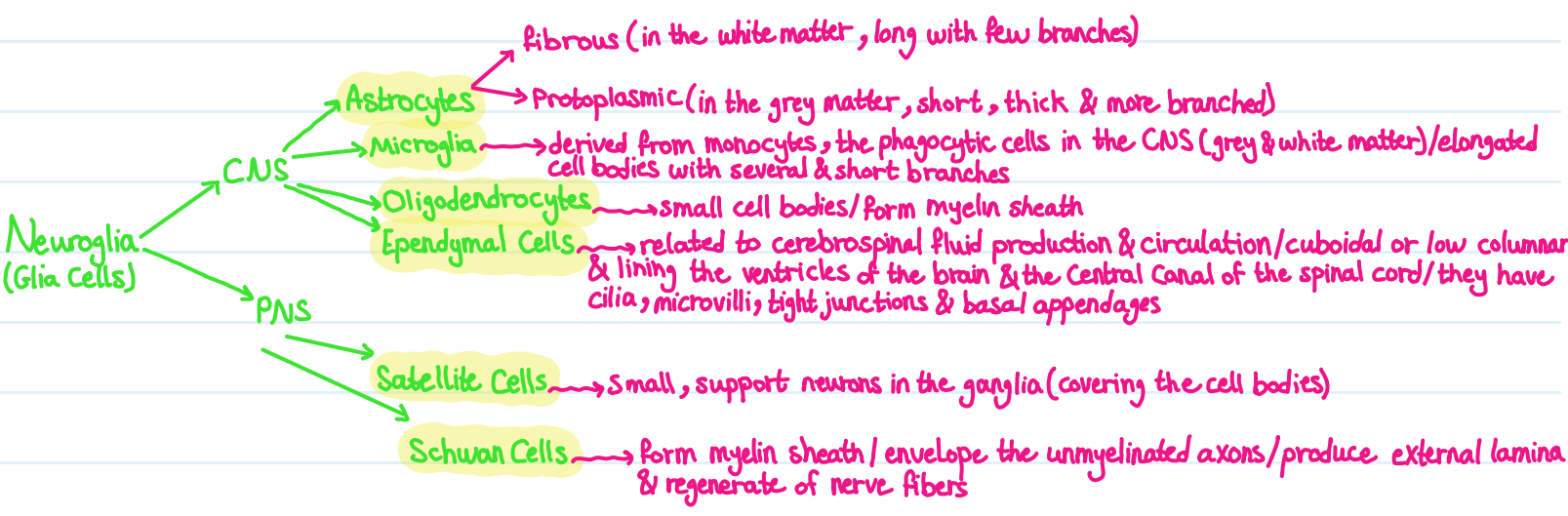


* According to Shape



Purkinje Cells	Feature	Pyramidal Cells
Cerebellar cortex	Location	Cerebral cortex
Large Pear shaped	Cell Body	Large Pyramidal
Multipolar	Type	Multipolar
Motor	Function	Motor
Projection	Termination of Axon	Projection

x Glia Cells → non-excitabile cells
 → much smaller than neurons but they outnumber them
 → comprise up to half the volume of the brain & spinal cord



another functions of Astrocytes

- provide nutrients for neurons
- recycle neurotransmitters
- replace damaged tissue by scar
- forming External & Internal Glial limiting membranes the protect the nervous tissue

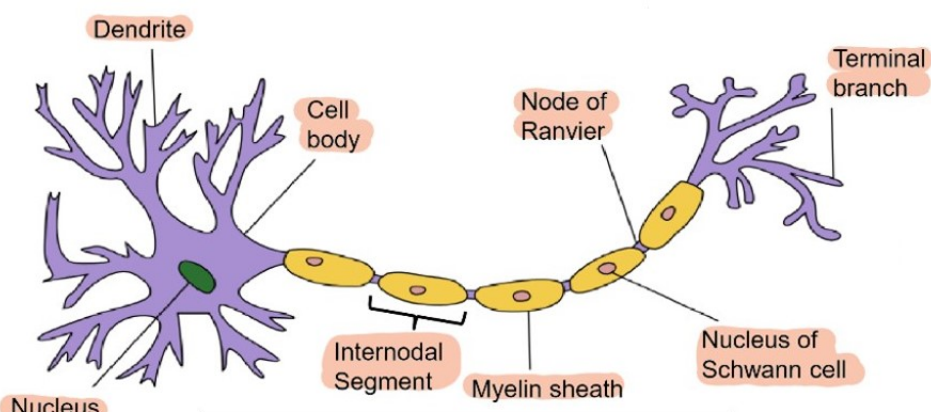
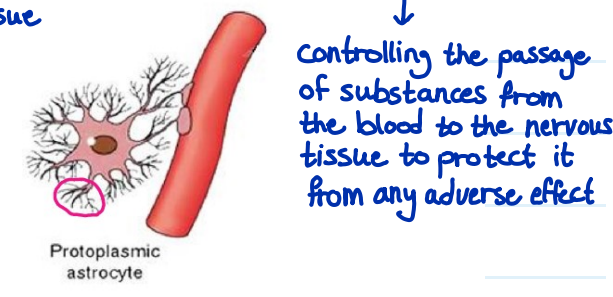
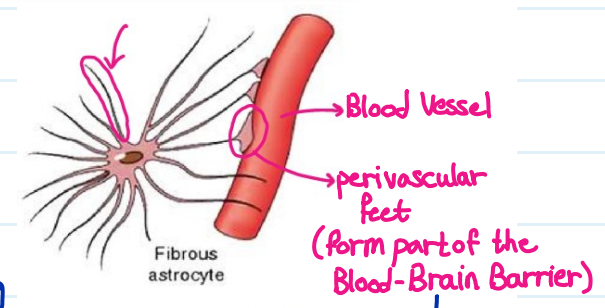
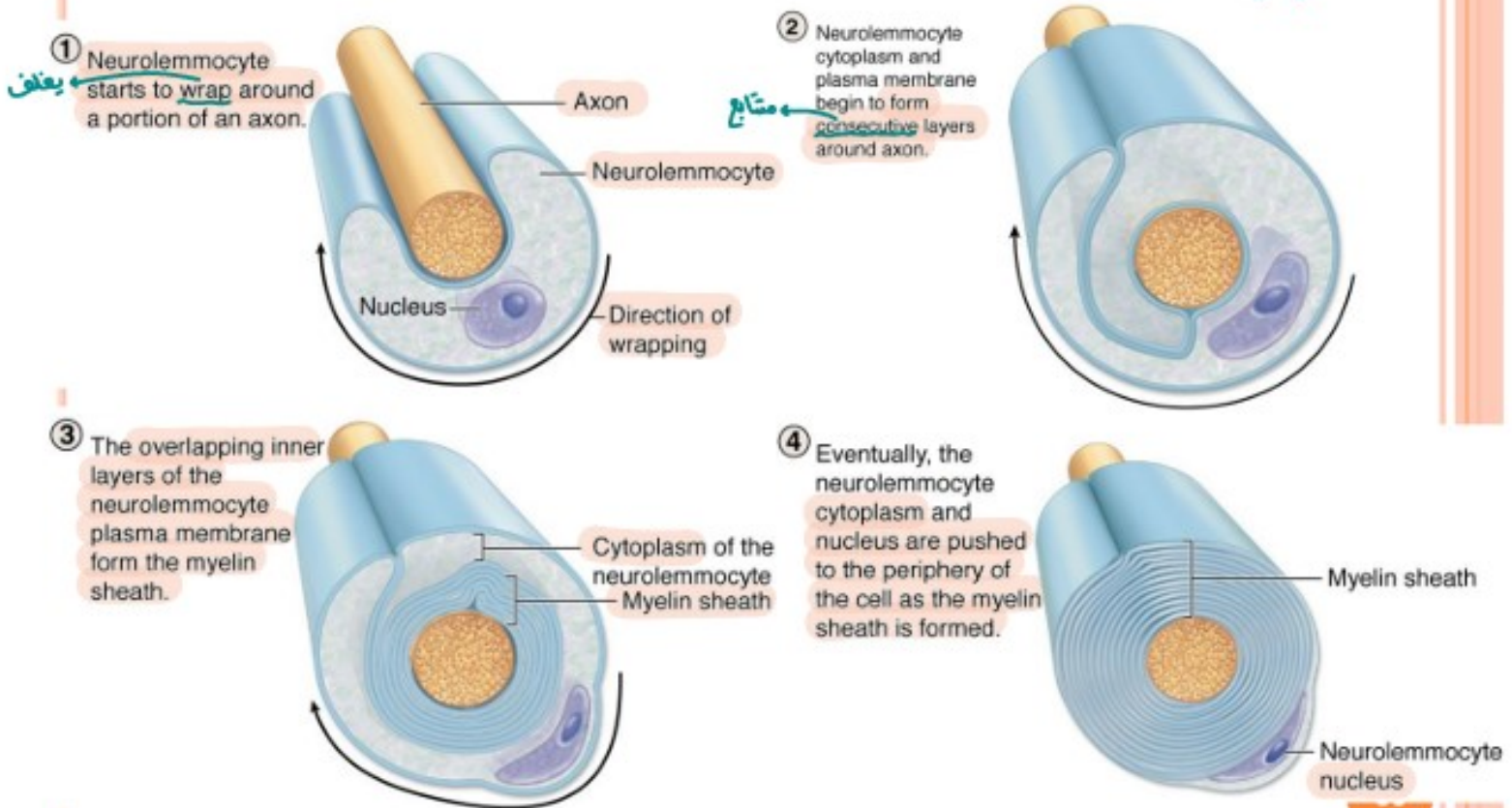


Fig.17: Nodes of Ranvier and internodal segments.

- **Node of Ranvier:** the part of the axon that's not covered by a myelin sheath.
- **Internode:** the segment between 2 adjacent nodes of Ranvier.
 ↳ Benefit: to increase velocity of Nerve impulse

Processes of Myelination

The process is the same in CNS but by Oligocytes



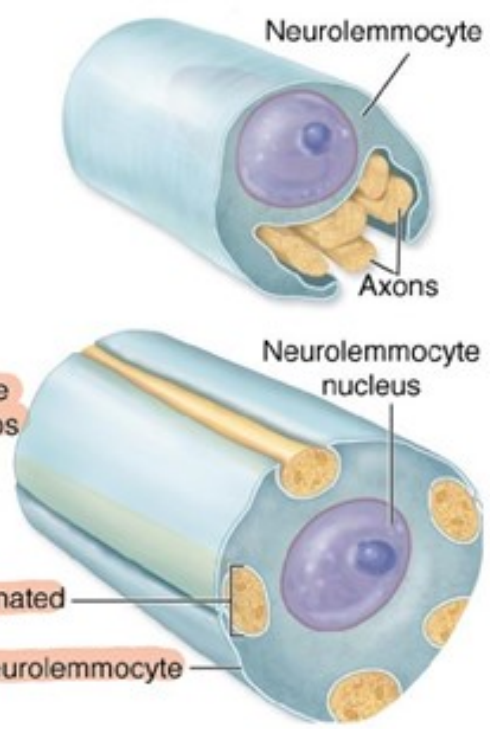
Myelin sheath = multiple layers of cell membrane

from Phospholipids (White Color)

Schwann cells and the unmyelinated fiber

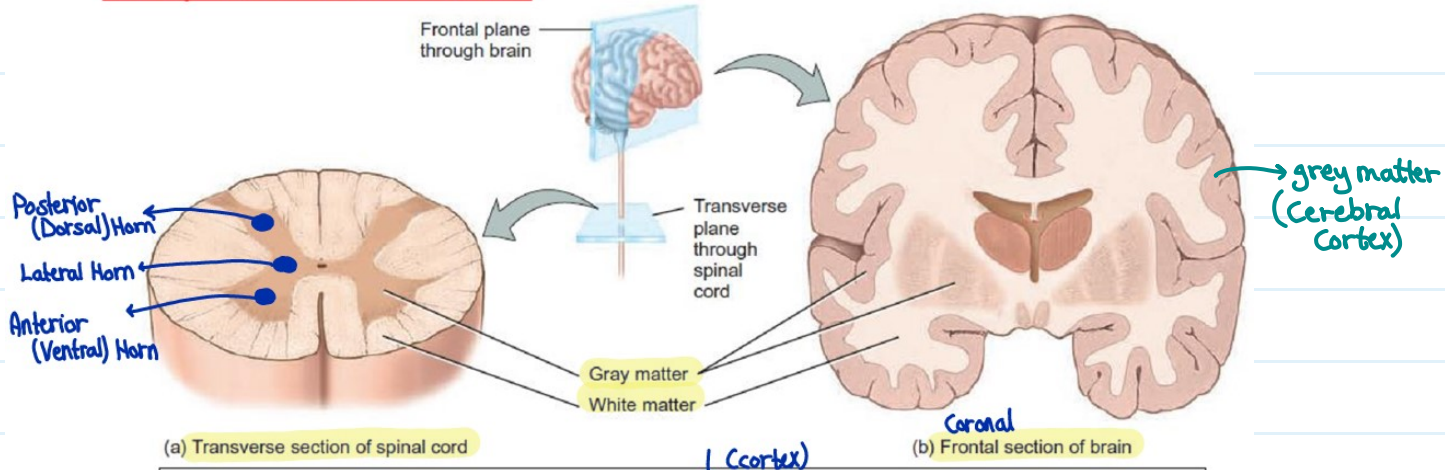
Unmyelinated axons

- 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. *↳ not multiple layers*



The unmyelinated axons in the CNS are surrounded by nothing and run free in the nervous tissue.

Gray vs White matter



(a) Transverse section of spinal cord
 (b) Frontal section of brain
 Fig.18: Gray matter is generally the outer layer in the brain and the white matter is deep. In the spinal cord, the arrangement is opposite.

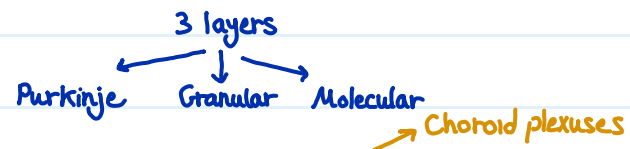
- Gray matter = cell bodies of neurons (mostly) + initial part of the axons + dendrites + glia cells.
- White matter = myelinated and unmyelinated nerve fibers + glia cells.

* The Extracellular Space

- very small space that fills the gap between neurons & glia cells & it's filled with fluid
- provides a pathway for the passage of ions & molecules
- contains a network of the processes of neurons & glia cells (Neuropil)
- continuous with CSF in the subarachnoid space externally & ventricles/central canal internally

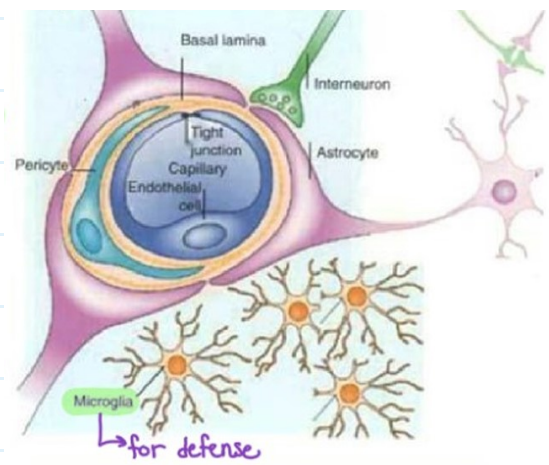
* the largest neurons in the cerebral cortex ~> multipolar pyramidal cells

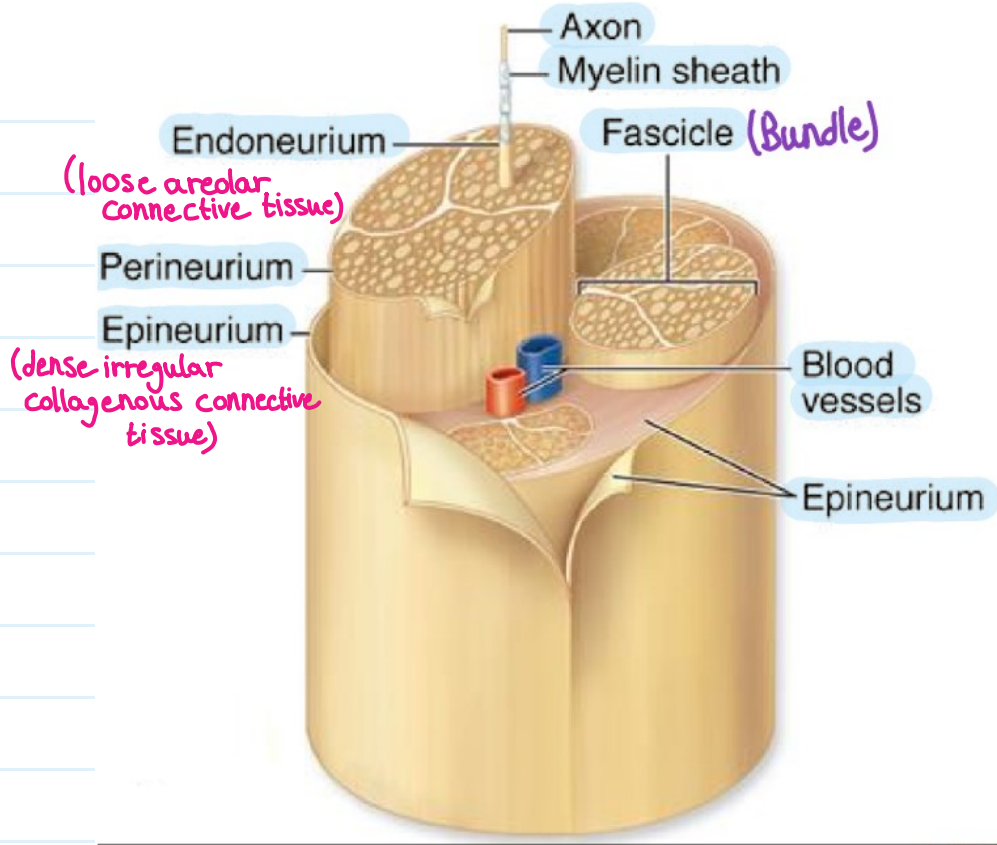
* the outer grey matter of the cerebellum ~> Cerebellar Cortex



Blood Brain Barrier ~> present in all parts of the brain except Choroid plexuses and Hypothalamus

- Composed of
- Pericytes
 - Perivascular feet of astrocytes
 - Basal Lamina
 - Capillary endothelium





Peripheral nerve.

* Ganglion → collection of neurons outside the CNS
 ↳ Sensory ↳ Autonomic

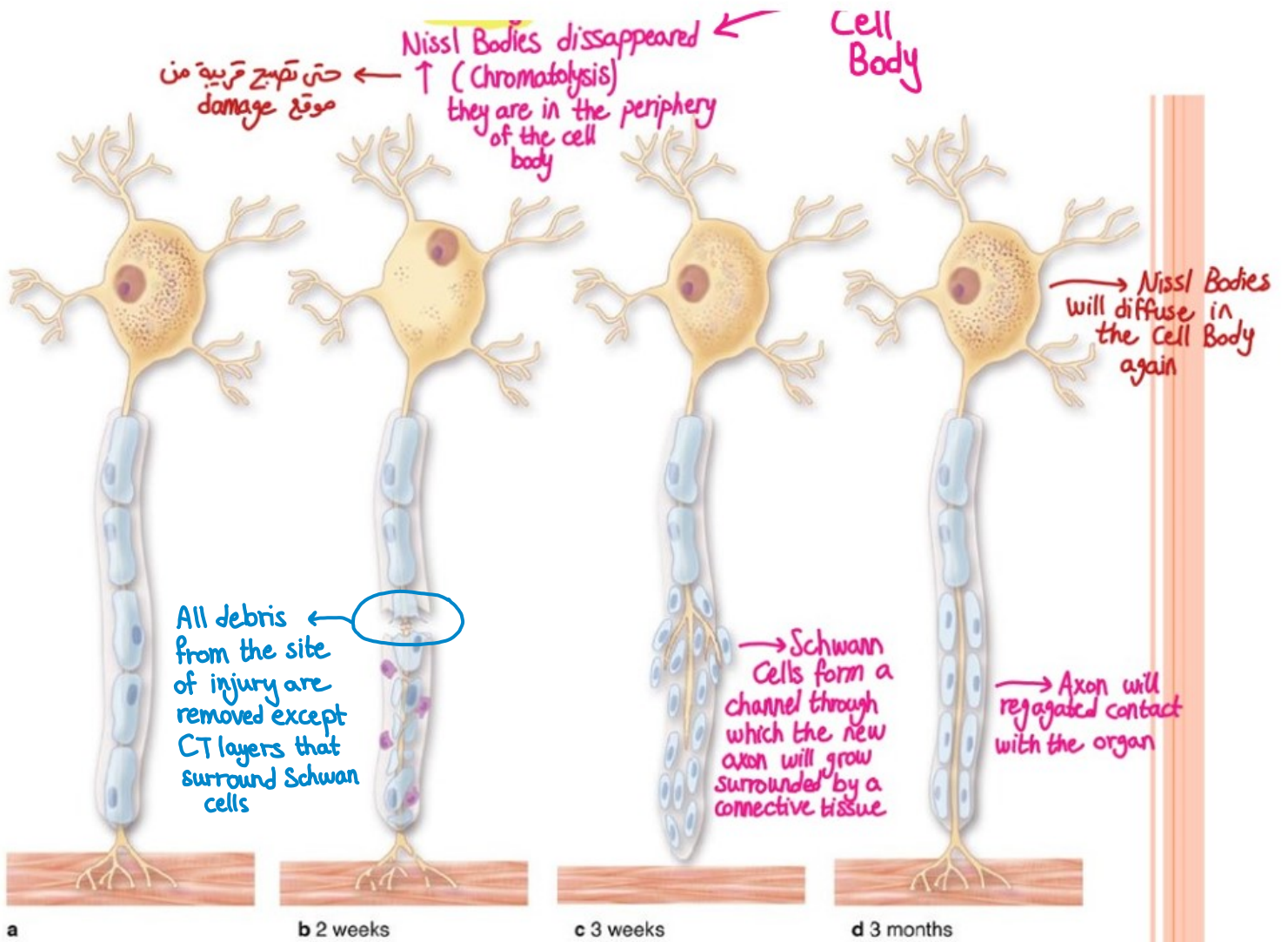
	Sensory	Autonomic
Location	Dorsal root ganglia of the spinal nerves and some cranial nerves.	Small dilation in autonomic nerves and within the wall of some organs.
Capsule	Distinct.	Not well developed. May merge with CT of the organ in which it's contained. <i>(not distinct)</i>
Type of neuron	Pseudounipolar. <i>(Single Neuron)</i>	Multipolar.
Function	Receives sensory nerves and sends sensory information to CNS. <i>(sensation)</i>	Relay station for autonomic stimuli. <i>(Preganglionic & postganglionic Neurons)</i>

Type of Glia cells

Satellite Cells

Satellite Cells

postganglionic Neurons



: Repair of a peripheral nerve.

Blank lined writing area for student response.