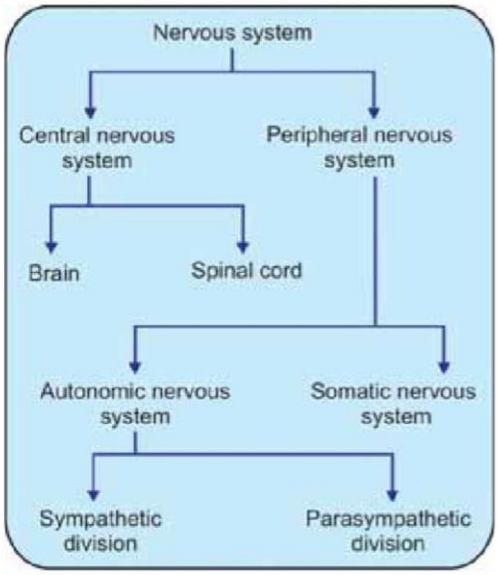
NERVOUS SYSTEM

Nervous system controls all the activities of the body. the nervous system is divided into two parts.

- Central nervous system(CNS)
- Peripheral nervous system(PNS)



Nervous tissue (Histology of nervous system)

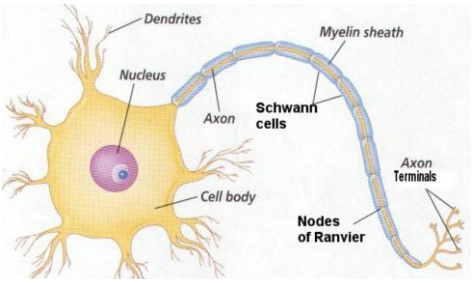
• Human nervous system is the most complex system in the human body it consists of :

- 1.Nerve cells (neurons)
- 2.Neruoglia(Glial cells)
- 3.Nerve fibers.

Nerve cells (neurons). Neuron: is defined as the structural and functional unit of the nervous system

STRUCTURE OF NEURON Each neuron is made up of three parts:

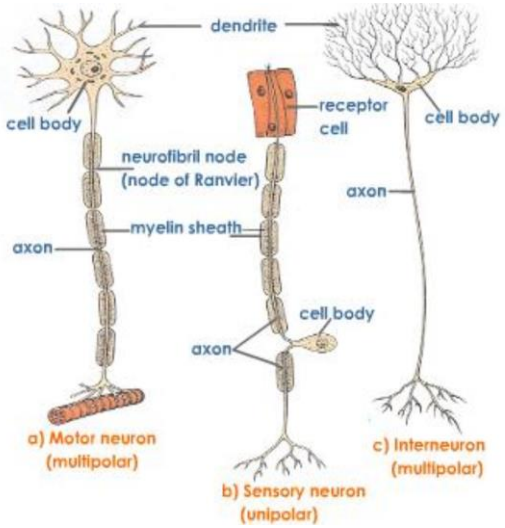
- Nerve cell body(soma)
- Dendrite
- Axon



CLASSIFICATION OF NEURON

I. Depending upon number of poles

- **Unipolar neurons** that have only one pole from which, both the axon and dendrite arise
- **Bipolar neurons** which have two poles. Axon arises from one pole and dendrites arise from the other pole.
- **Multipolar neurons** which have many poles. One of the poles gives rise to the axon and, all the other poles give rise to dendrites.



II. Depending upon function

- **Sensory neurons** (afferent neurons): which carry the sensory impulses from periphery to the central nervous system.
- **Motor neurons** (efferent neurons) which carry the motor impulses from central nervous system to the peripheral effector organs like muscles, glands, blood vessels, etc.
- **Interneurons** – between sensory & motor neurons in the CNS

Neuroglia(Glial Cells).

These cells cells have supporting and protective functions in the the nervous tissue .

• The neuroglia in CNS :

1. Astrocytes (the most abundant type of glial cells) have supporting function and controlling ionic and chemical environment of neurons .

2. Oligodendrocytes produce the myelin sheath for axon in the the central nervous system .

3. Ependymal cells found in the central nervous system which facilitate movement of cerebral spinal fluids .

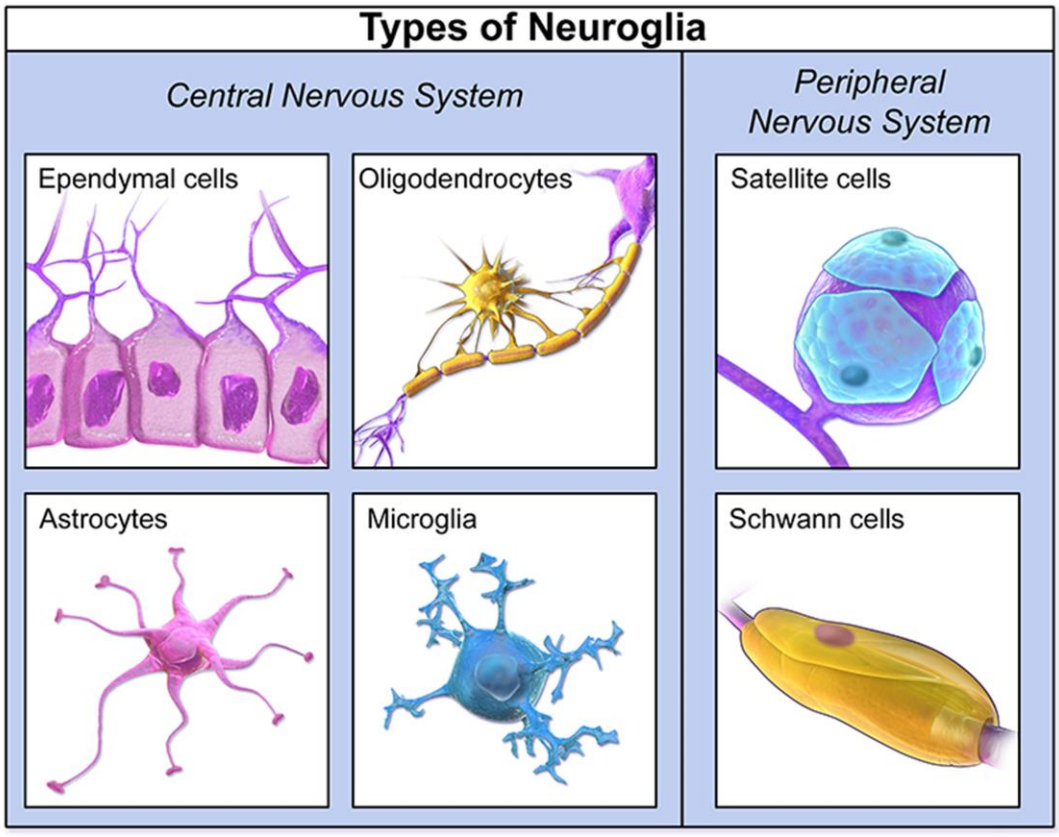
4. Microgli a have phagocytic function .

• The neuroglia in PNS

1-satellite cells

2. Schwann cells(neurolemma**)** produce produce myelin sheath in the the peripheral nervous system .

- The myelin sheath is produced by oligodendrocytes in the central nervous system and by Schwann cells in the peripheral nervous system



Synapses

Synapse is the junction between the two neurons. It is not the anatomical continuation. But, it is only a physiological continuity between two nerve cells.

ANATOMICAL CLASSIFICATION: Synapse is formed by axon of one neuron ending on the cell body (dendrite or axon of the next neuron) .

Depending upon the ending of axon, the synapse is classified into three types:

1-**Axoaxonic** synapse in which axon of one neuron terminates on axon of another neuron

2- **Axodendritic** synapse in which axon of one neuron terminates on dendrite of another neuron

3- **Axosomatic** synapse in which axon of one neuron ends on soma (cell body) of another neuron.

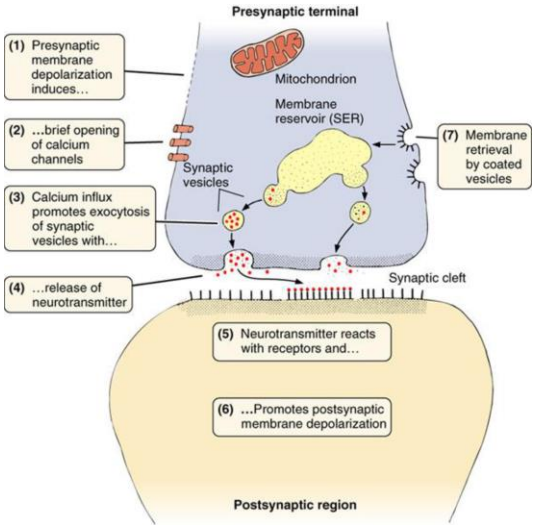
FUNCTIONAL CLASSIFICATION: functional contact between neurons or neurons and other effector cells (e.g. muscle cells) .

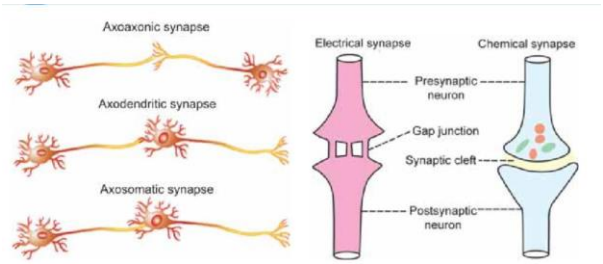
The synapse itself is formed formed by :

presynaptic terminal of axon that deliver the signal ;

synaptic cleft a thin intercellular space

postsynaptic terminal are region on the surface of another cell where anew new signal is generated.



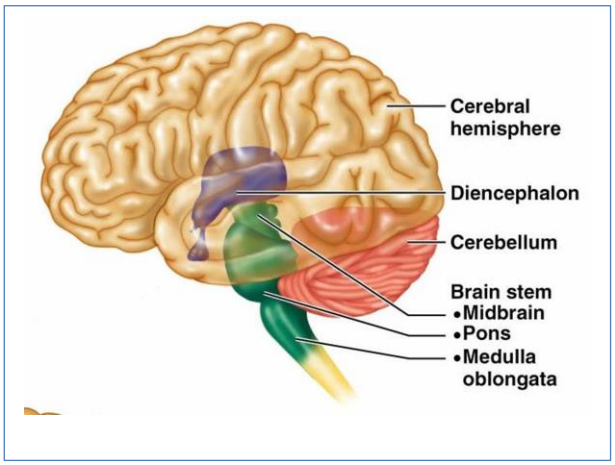


Central Nervous System

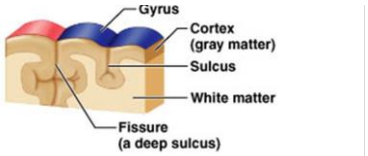
- **Brain & Spinal Cord**

1-Brain

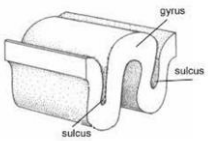
1. Cerebrum
2. Cerebellem
3. Brain stem – medulla oblongata, pons, midbrain

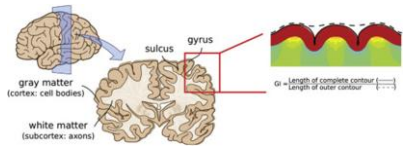


Cerebrum



- •Is the largest portion of the brain encompasses about two-thirds of the brain mass -
  - It consists of <u>two hemispheres</u> divided by a <u>fissure</u> – corpus callosum
  - It includes the cerebral cortex, the medullary body, and basal ganglia





• **cerebral cortex** is the layer of the brain often referred to as gray matter because it has cell

bodies and synapses not contain myelin sheath

- The cortex (thin layer of tissue) is gray because nerves in this area lack the white myelin sheath that makes most other parts of the brain appear to be white.
- The cortex covers the outer portion of the cerebrum and cerebellum
- The cortex consists of folded bulges called gyri that create deep furrows or fissures called sulcus.

• **Medullary body** – is the white matter of the cerebrum and consists of myelinated axons

- Commisural fibers – conduct impulses between the hemispheres and form corpus callosum
- Projection fibers – conduct impulse in and out of the cerebral hemispheres
- Association fibers – conduct impulses within the hemispheres

• **Basal ganglia** – masses of gray matter in each hemisphere which are involved in the control of voluntary muscle movements

Cerebellum

- The portion of the brain (located in the back of the brain) which helps coordinate movement, such as balance, posture, movement and muscle coordination
- The term cerebellum is from "latin meaning" the little brain.It is a part of the hindbrain situated in the posterior cranial fossa.
- It is also present behind the pons and medulla ablongata,seperated from two structures by the cavity of fourth ventricle.

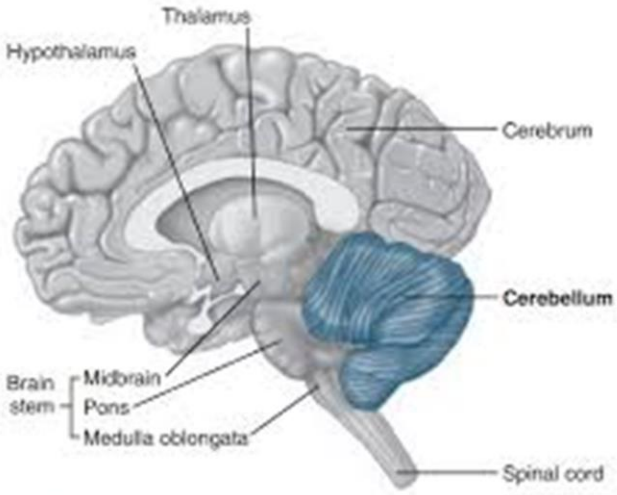
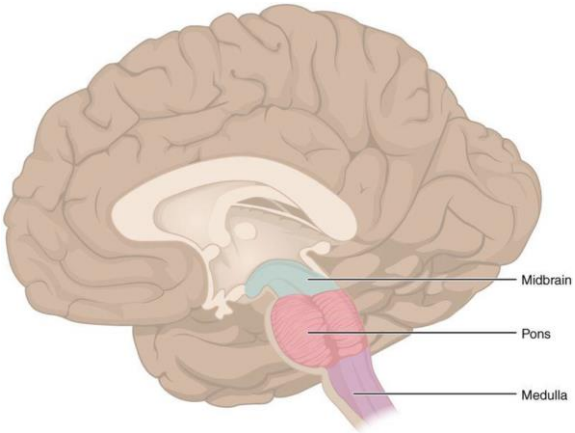


FIGURE 12-1 Structures of the brain.

BRAINSTEM

- Located between the spinal cord & cerebrum
- Central gray matter surrounded by white matter fibres
- consist from :- Midbrain, Pons, Medulla Oblongata



The Midbrain

- Located between the diencephalon and pons

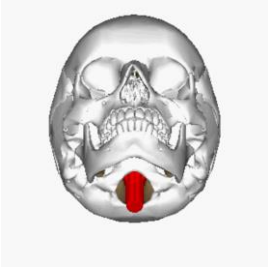
The Pons

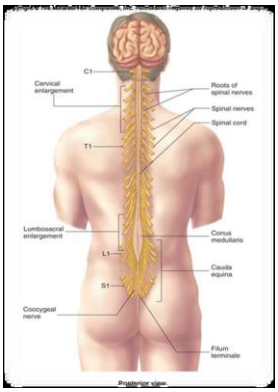
- Located between the midbrain & medulla oblongata

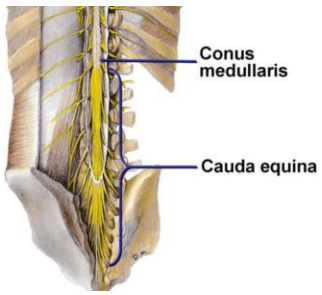
The Medulla Oblongata

- Connects the spinal cord to pons
- Spinal cord connection is approximately at the level of foramen magnum

2- Spinal Cord



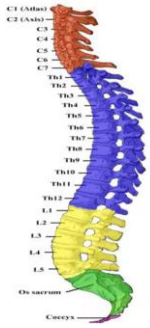




- Extends from foramen magnum to second lumbar vertebra.
- Gives rise to 31 pairs of spinal nerves
- Continuous above with the medulla oblongata.
- The tapered end inferior forms conus medullaris.
- It is connected to the coccyx by a non-neuronal cord called Filum Terminale.

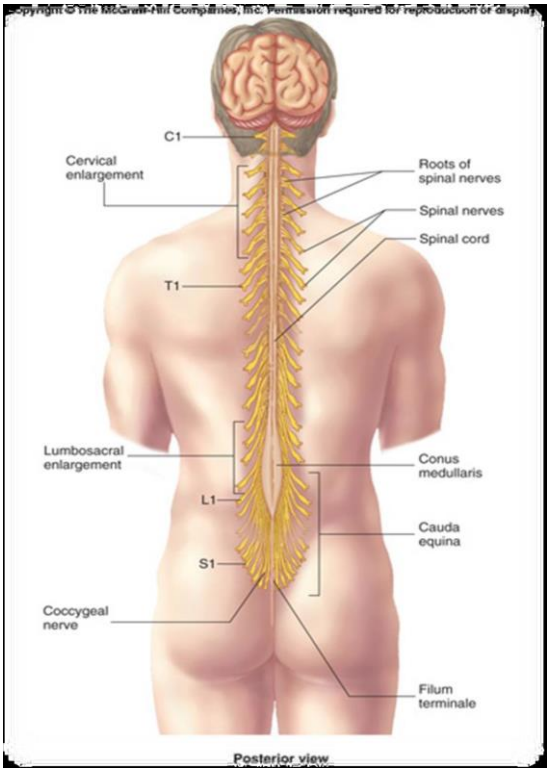
- The bundle of spinal nerves extending inferiorly from lumbosacral enlargement and conus medullaris surround the filum terminale and form cauda equina

- Segmented



  - 8 Cervical
  - 12 Thoracic
  - 5 Lumbar
  - 5 Sacral
  - 1 Coccygeal

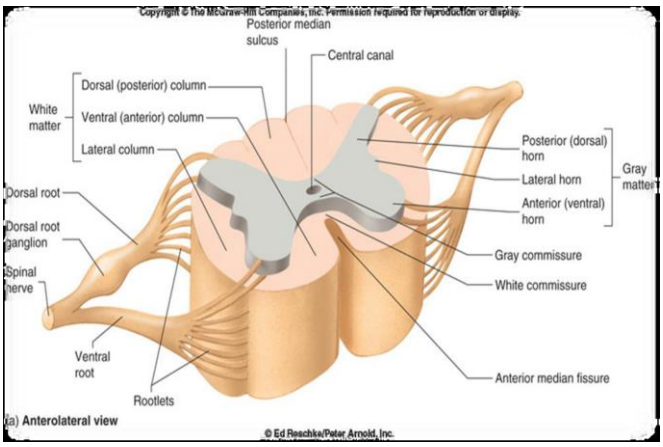
- Has two enlargements:
  - Cervical Enlargement: supplies upper limbs.
  - Lumbosacral Enlargement: supplies lower limbs.



CROSS SECTION OF SPINAL CORD

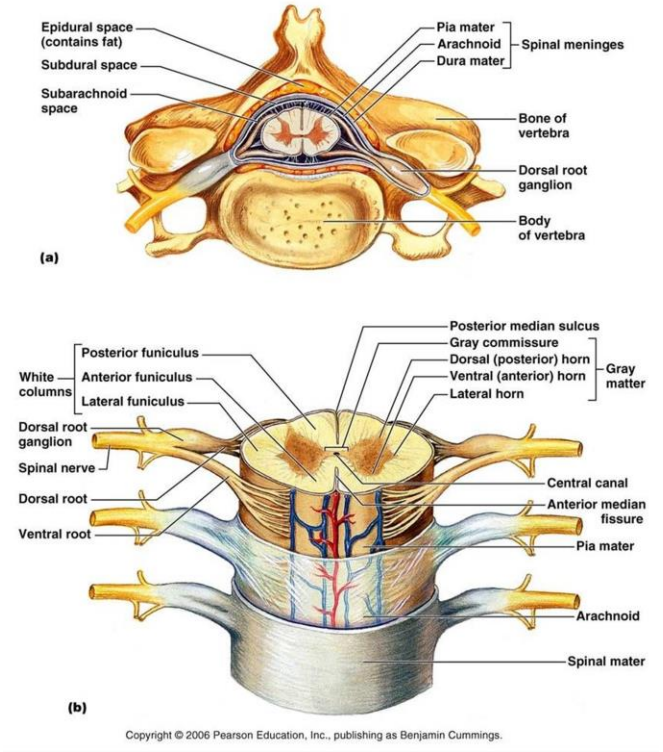
The spinal cord is incompletely divided into two equal parts, anteriorly by a short, shallow median fissure and posteriorly by a deep narrow septum, the posterior median sulcus.

- Composed of grey matter in the center surrounded by white matter supported by neuroglia.
- Commissures: connections between left and right halves
  - Gray with central canal in the center
  - White
- Roots: spinal nerves arise as rootlets then combine to form roots
  - Dorsal (posterior) root has a ganglion
  - Ventral (anterior)
  - Two roots merge laterally and form the spinal nerve



GREY MATTER

- The arrangement of grey matter in the spinal cord resembles the shape of the letter H.
- Having:
  - two posterior
  - two anterior
  - two lateral horns/columns.
- Consists of:
  - nerve cell bodies and their processes
  - neuroglia
  - blood vessels



WHITE MATTER

- Consists of mixture of nerve fibers, neuroglia and blood vessels.
- White color is due to high proportion of myelin sheath to nerve fibers
- The white matter of the spinal cord is arranged in columns/funiculi; anterior, posterior and lateral.
- The nerve fibers are arranged as bundles, running vertically through the cord.

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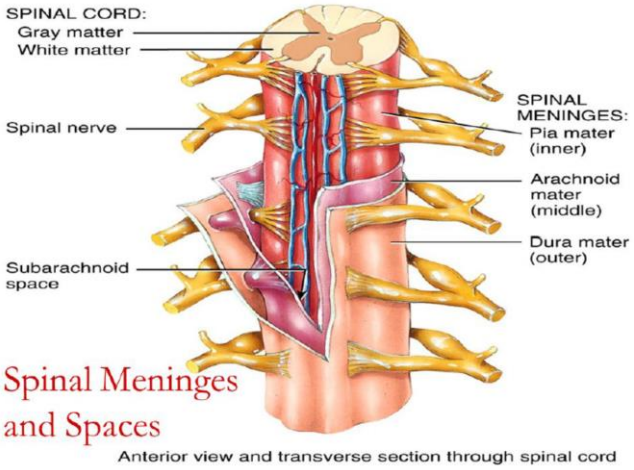
Meninges

Meninges are the three coverings around the brain & spine and help cushion, protect, and nourish the brain and spinal cord.

1. **dura mater-** (outer layer, thick ,strong)
2. **arachnoid mater**-(middle layer , thin)
3. **pia mater**-(internal layer, thin, attached to the surface of spinal cord and brain)



• cerebrospinal fluid, which buffers, nourishes, and detoxifies the brain and spinal cord, flows through the subarachnoid space, between the arachnoid mater and the pia mater

Spaces

Epidural: Contains blood vessels, connective tissue and fat.

Subdural: Contains serous fluid

Subarachnoid: Contains CSF and blood vessels within web-like strands of arachnoid tissue