MED437
KING SAUD UNIVERSITY

ANATOMY
Team 437

NERVOUS SYSTEM

Text in pink was only found in the girls' slides

Text in blue was only found in the boys' slides

Text in red is considered important

The Dr.'s comments in class are written in green

Please check our Editing File before studying this lecture

At the end of the lecture, students should be able to:

- ✓**List the subdivisions of the nervous system.**
- ✓**Define the terms: grey matter, white matter, nucleus, ganglion, tract and nerve.**
- ✓**Define neurons and neuroglia.**
- ✓**List the major parts of the brain.**
- ✓**Identify the external and internal features of spinal cord.**
- ✓**Enumerate the cranial nerves.**
- ✓**Describe the parts and distribution of the spinal nerve.**
- ✓**Define the term dermatome.**
- ✓**List the structures protecting the central nervous system.**

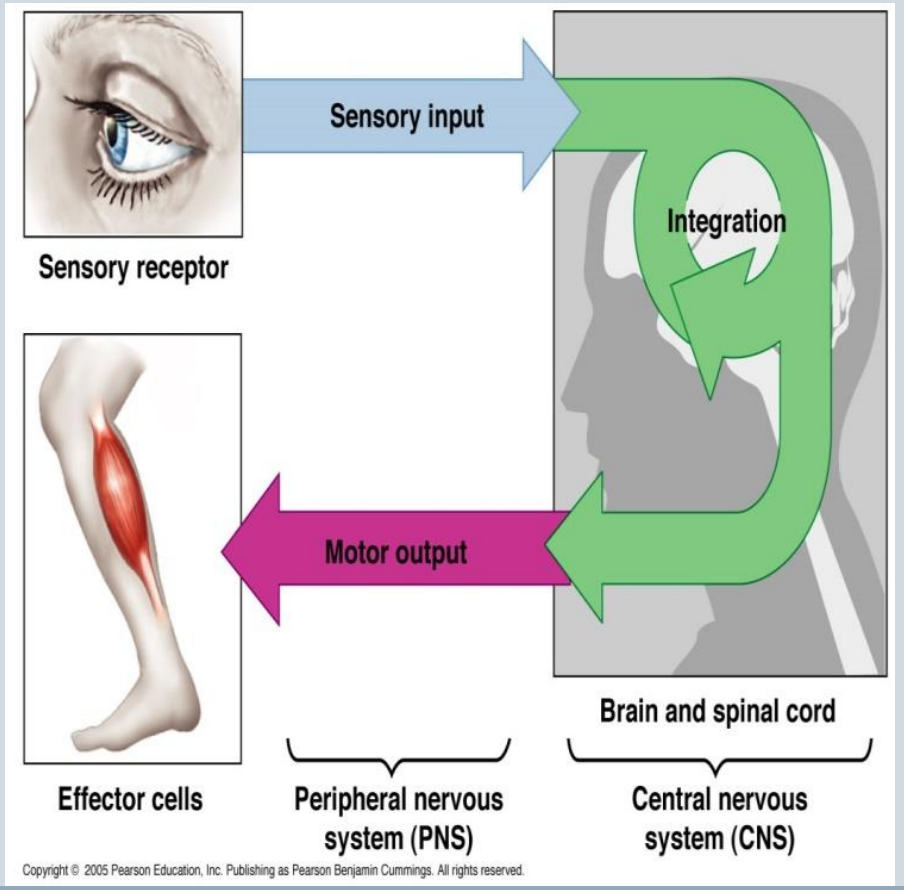
1-sensory input: sends the information to brain(ascendant).
2-integration(pentagon): analyses in the brain.
3-motor output(feedback): from the brain to the body to do the action(descending).

The nervous system has 3 functions:

1- Collection of Sensory Input:
Identifies changes occurring inside and outside the body by using sensory receptors.
These changes are called stimuli.

2- Integration:
Processes, analyses & interprets these changes and makes decisions

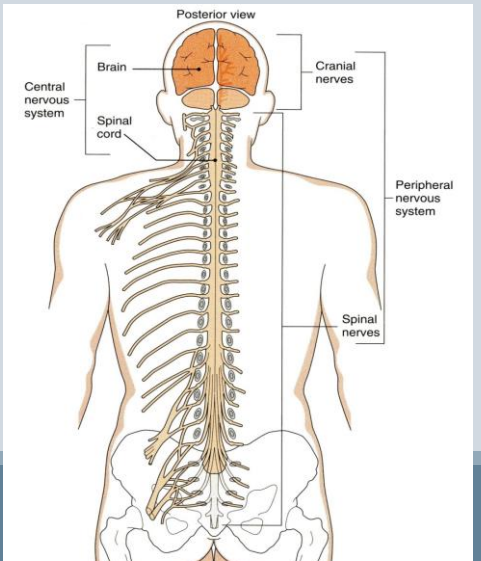
3-Motor Output (Effects a response):
It then effects a response by activating muscles or glands (effectors) via motor output



Organization

STRUCTURAL

- Central Nervous System (CNS)
  - Brain & Spinal Cord
- Peripheral Nervous System (PNS)
  - Nerves & Ganglia
    - Cranial nerves
    - Spinal nerves

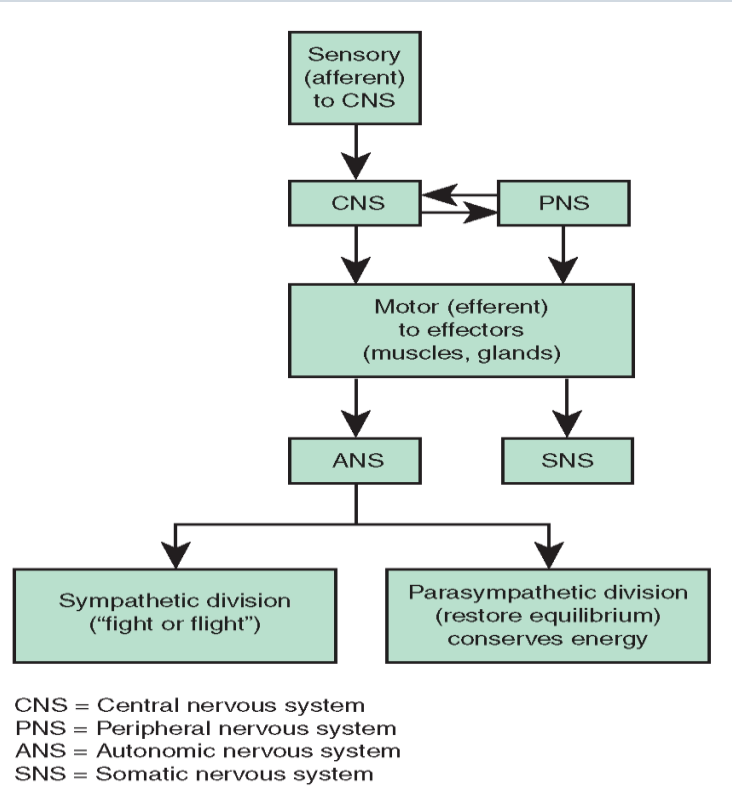


1-Peripheral Nervous System is everything outside the CNS.
2-cranial nerves: goes out from the brain.
3-spinal nerves: goes out from spinal cord.

FUNCTIONAL

- Sensory Division (Afferent)
- Motor Division (Efferent)
  - Autonomic (visceral)
  - Somatic

Helpful Video



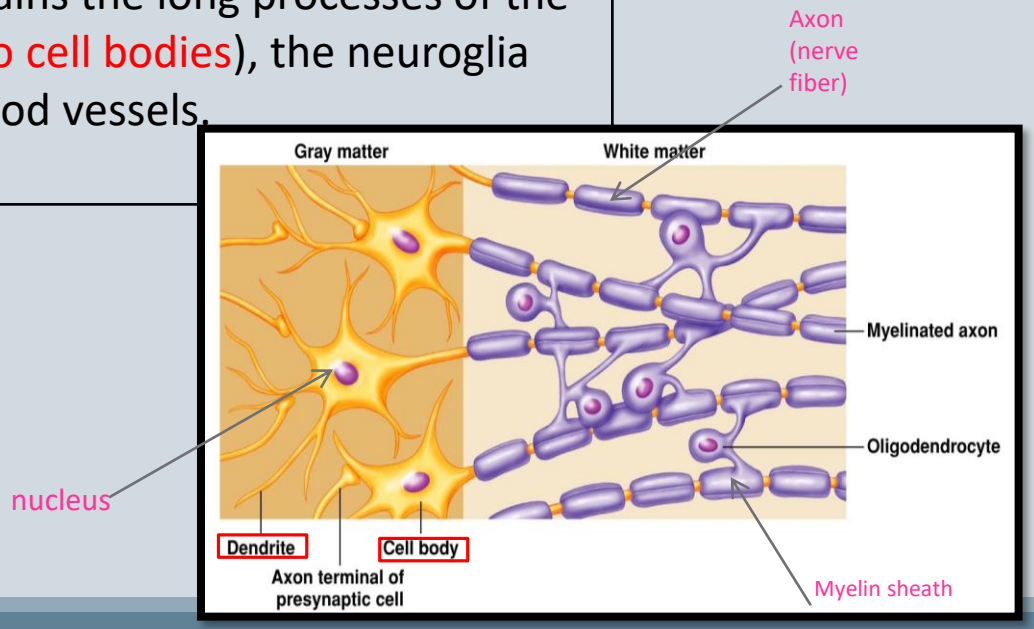
NERVOUS TISSUE

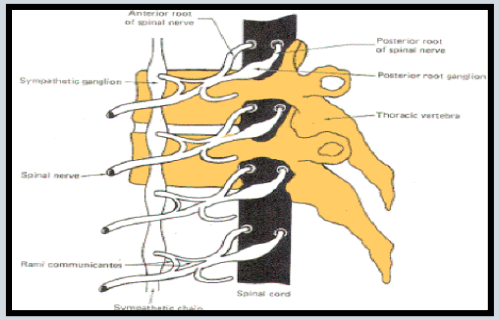
Nervous tissue consists of Nerve cells (Neurons) and supporting cells (Neuroglia).

Nervous tissue is organized as:

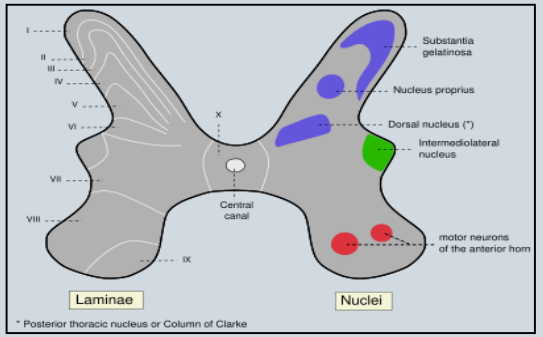
Grey matter	White matter
which contains the cell bodies & the short processes of the neurons, the neuroglia and the blood vessels.	which contains the long processes of the neurons (no cell bodies), the neuroglia and the blood vessels.

1-neurons are made of dendrites, cell body and axon.
2-grey matter: contains the cell body and dendrites.
3-white matter: contains the axons and they call it white matter because of the myelin that covers the axon.
4-مايلين تساعد في تسريع نقل الاشارات العصبية.



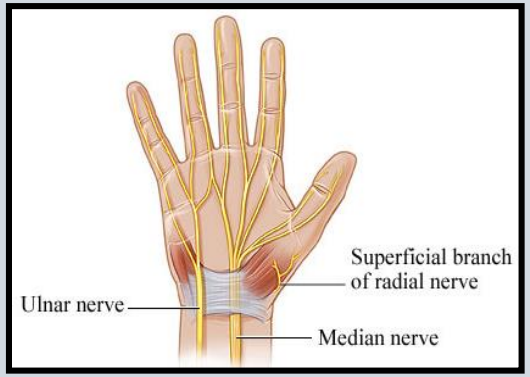


Ganglion
A group of neurons <u>outside</u> the CNS

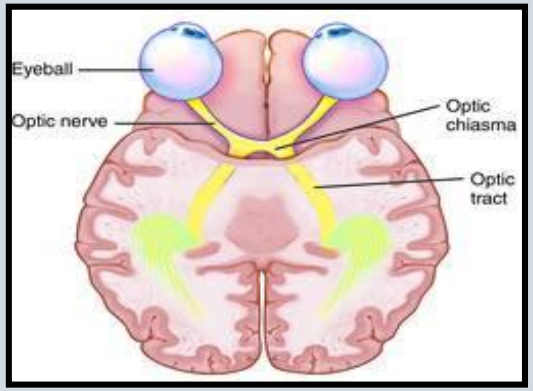


Nucleus
A group of neurons <u>within</u> the CNS

We can set a location by using these terms



Nerve
A group of nerve fibers (axons) <u>outside</u> the CNS



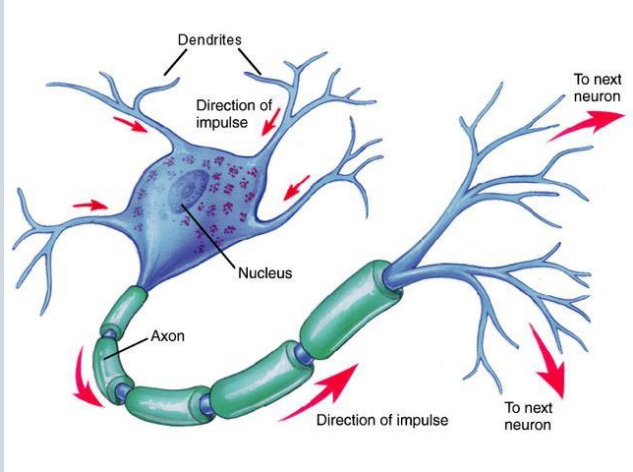
Tract
A group of nerve fibers (axons) <u>within</u> the CNS

This slide is from the boys' lecture.

NEURONS

The definition:

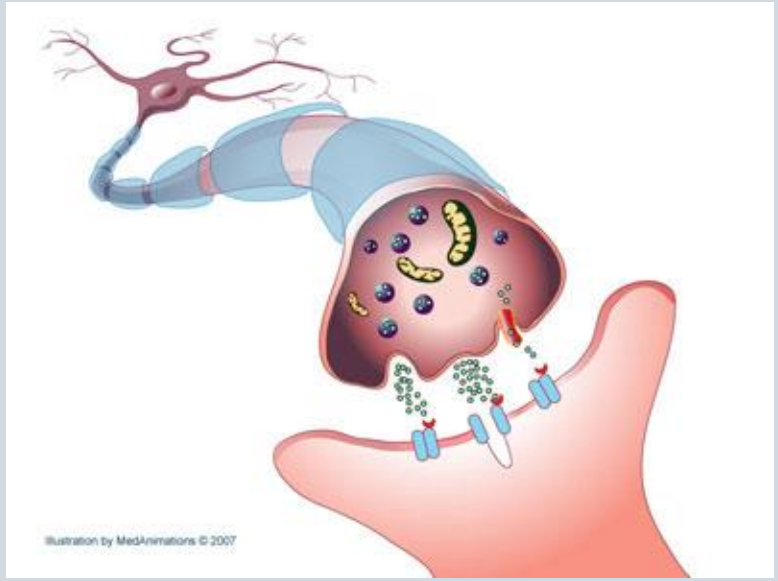
- It is the basic structural (anatomical), functional and embryological unit of the nervous system.
- The human nervous system is estimated to contain about 10^{10} neurons.
- The functions of the neuron is to receive incoming information from sensory receptors or from other neurons and to transmit information to other neurons or effector organs.



This slide is from the boys' lecture.

NEURONS

- Information is passed between neurons at specialized regions called synapses
- There is a single cell body from which a variable number of branching processes emerge.
- Most of these processes are receptive in function and are known as dendrites.
- One of the processes leaving the cell body is called the axon which carries information away from the cell body.
- At the end of the axon, specializations called terminal buttons occur.
- Here information is transferred to the dendrites of other neurons.

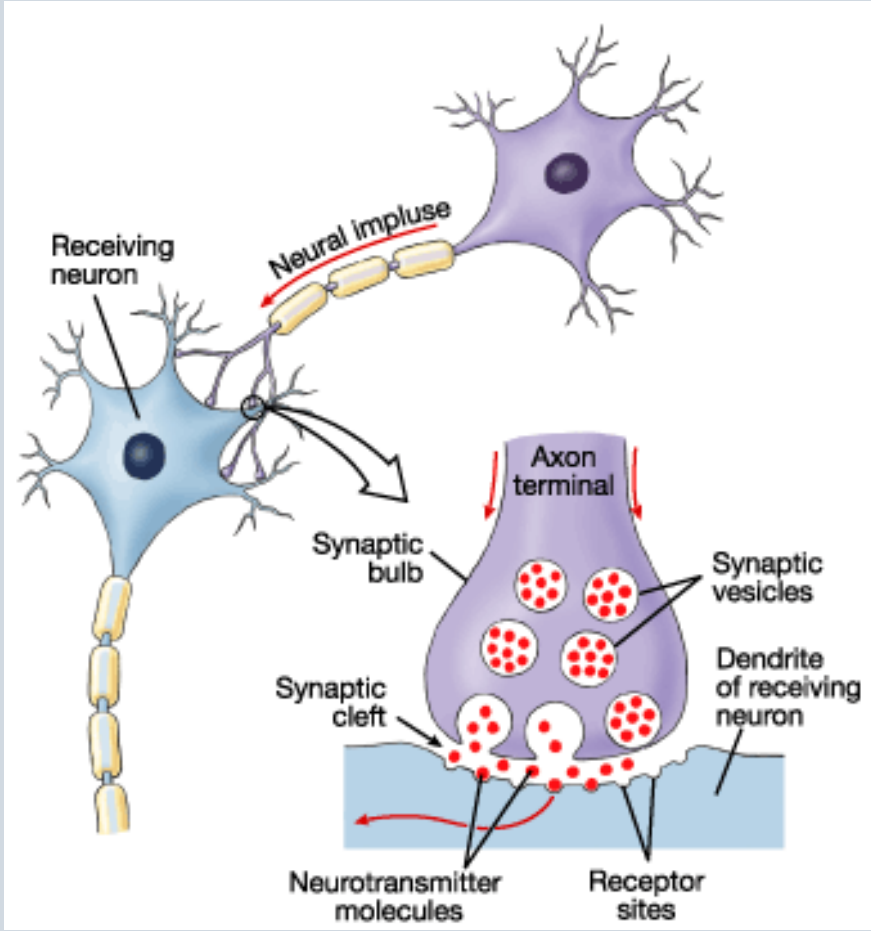


Helpful Video

This slide is from the boys' lecture.

NEURONS

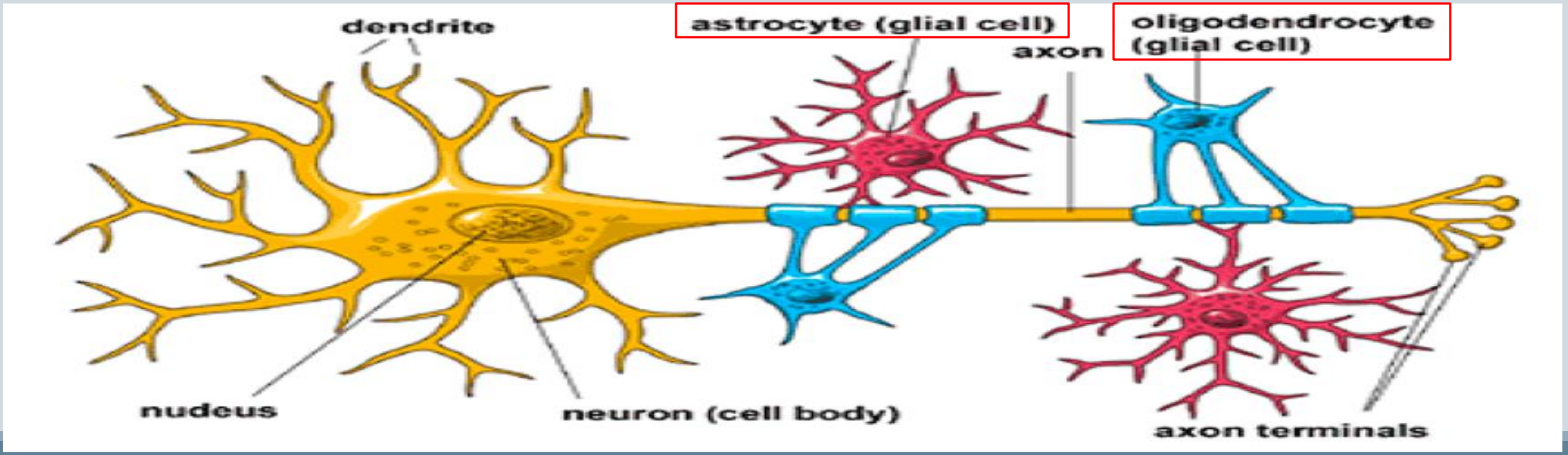
- Transmission of information between neurons almost always occurs by chemical rather than electrical means.
- Action potential causes release of specific chemical that are stored in synaptic vesicles in the presynaptic ending.
- These chemicals are known as neurotransmitters and diffuse across the narrow gap between pre- and postsynaptic membranes to bind to receptors on the postsynaptic cell.



This slide is from the boys' lecture.

NEUROGLIA

- Neuroglia, or glia cells constitute the other major cellular component of the nervous system.
- It is a specialized connective tissue for the nervous system.
- Unlike neurons, neuroglia do not have a direct role in information processing but they are essential for the normal functioning of nerve cells.



This slide is from the boys' lecture.

Three main types of Neuroglial cells are recognized:

Oligodendrocytes	• *They form the myelin sheath that surrounds many axons, which increases the rate of conduction (transmission).*
Microglia	• *They have a phagocytic role in response to nervous system damage.*
Astrocytes	• *They provide biochemical support for endothelial cells that form the blood–brain barrier.*

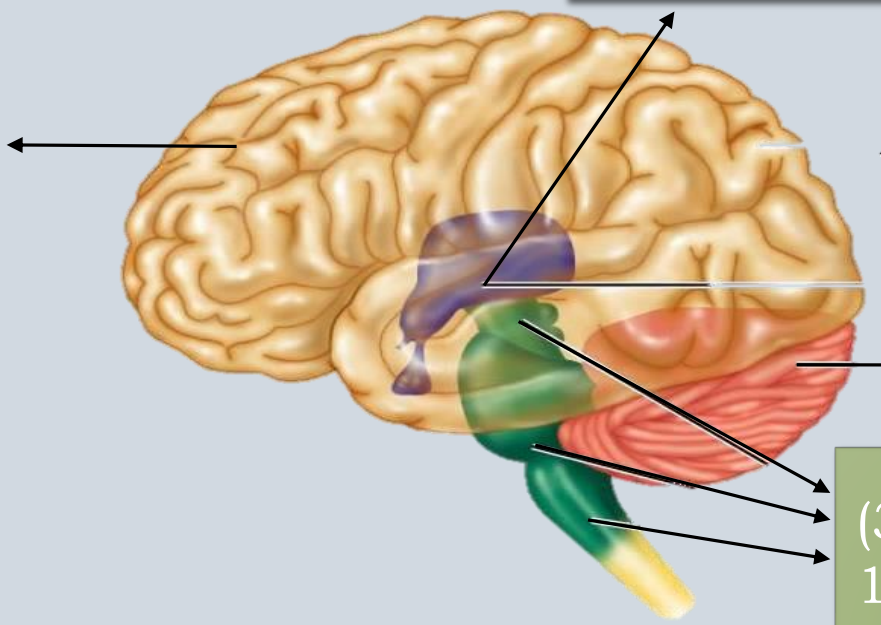
The Brain

- Large mass of nervous tissue located in the cranial cavity.
- Has four major regions:

(2) Diencephalon

1.Thalamus
2.Hypothalamus,
3. Subthalamus
4. Epithalamus

(1) Cerebrum
2 Cerebral hemisperes



(4) Cerebellum

(3) Brain Stem
1-Midbrain
2-Pons
3-Medulla Oblongata

Cerebrum

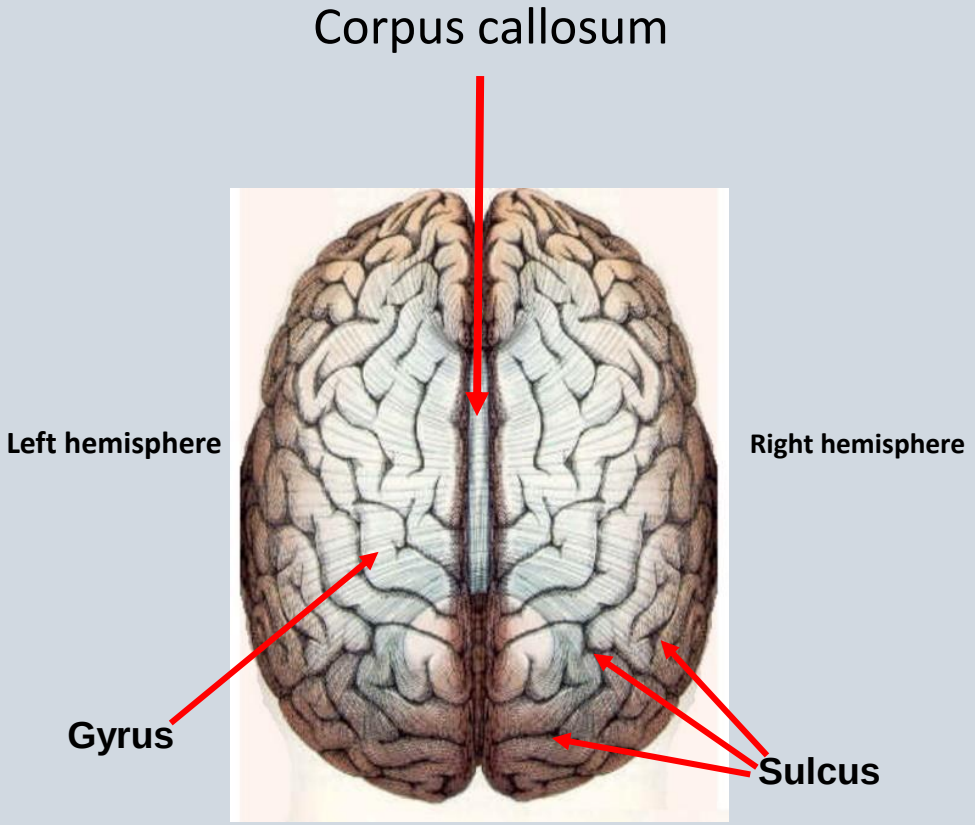
The largest part of the brain, and has two hemispheres.

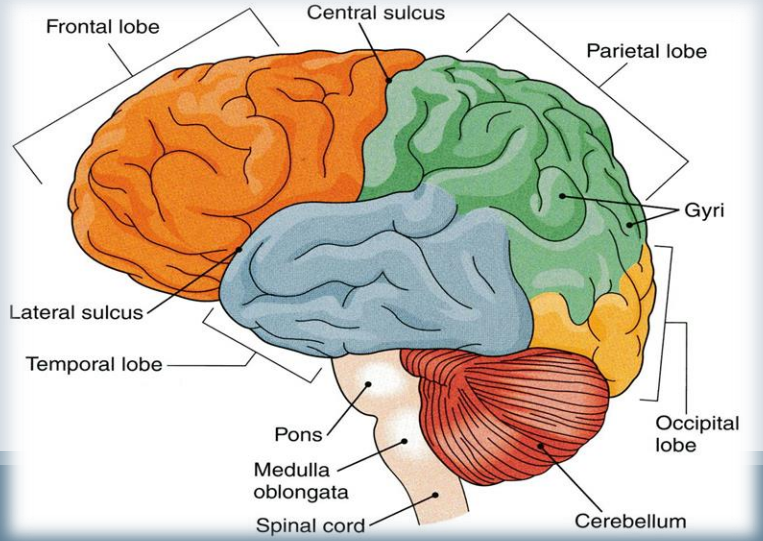
The cerebral hemispheres are connected by a thick bundle of nerve fibers called corpus callosum.

The surface shows ridges of tissue, called gyri (singular: gyrus), separated by grooves called sulci (singular: sulcus).

Divided into 4 lobes by deeper grooves (sulci).

- Frontal lobe
- Parietal lobe
- Temporal lobe
- Occipital lobe (The visual processing center)

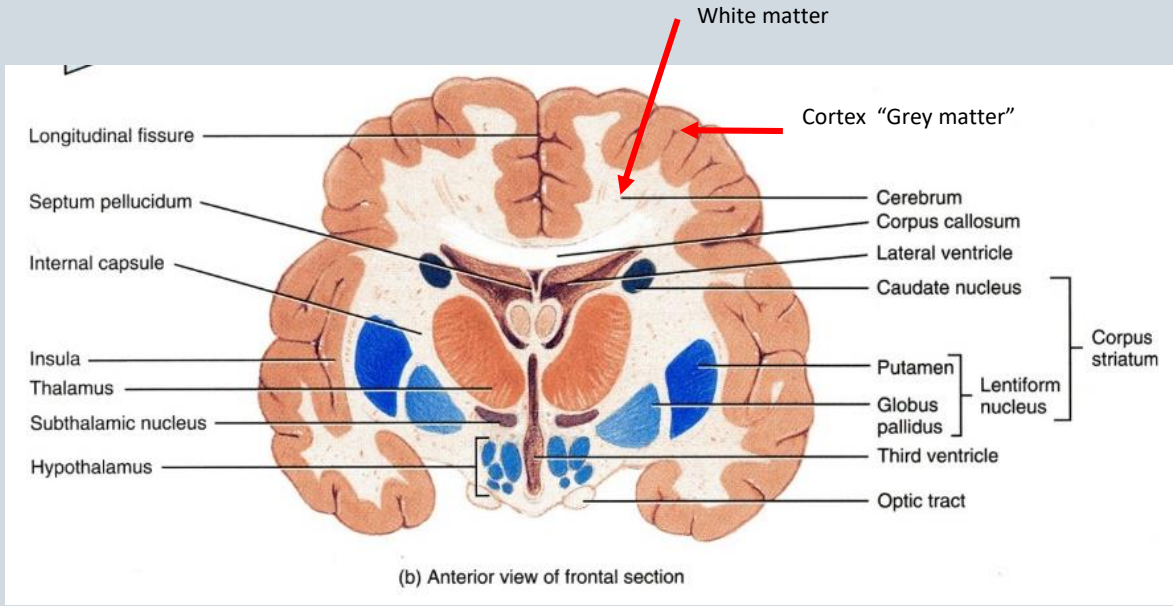




- The Lobes are named after the bones that covers them.

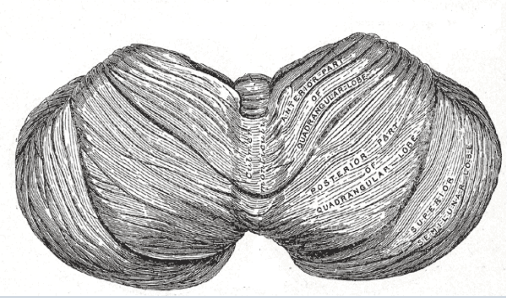
Tissue of Cerebral Hemispheres

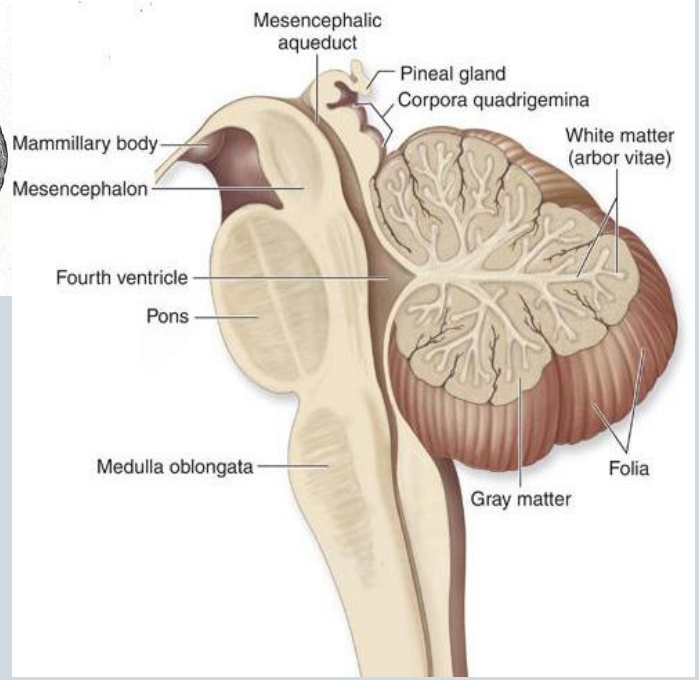
- The outermost layer is called gray matter or cortex.
- Deeper is located the white matter, composed of fiber tracts (bundles of nerve fibers)
  - ❖ Carrying impulses to and from the cortex.
- Located deep within the white matter are masses of grey matter called the basal nuclei .
  - ❖They help the motor cortex in the regulation of voluntary motor activities



(b) Anterior view of frontal section

CEREBLLUM

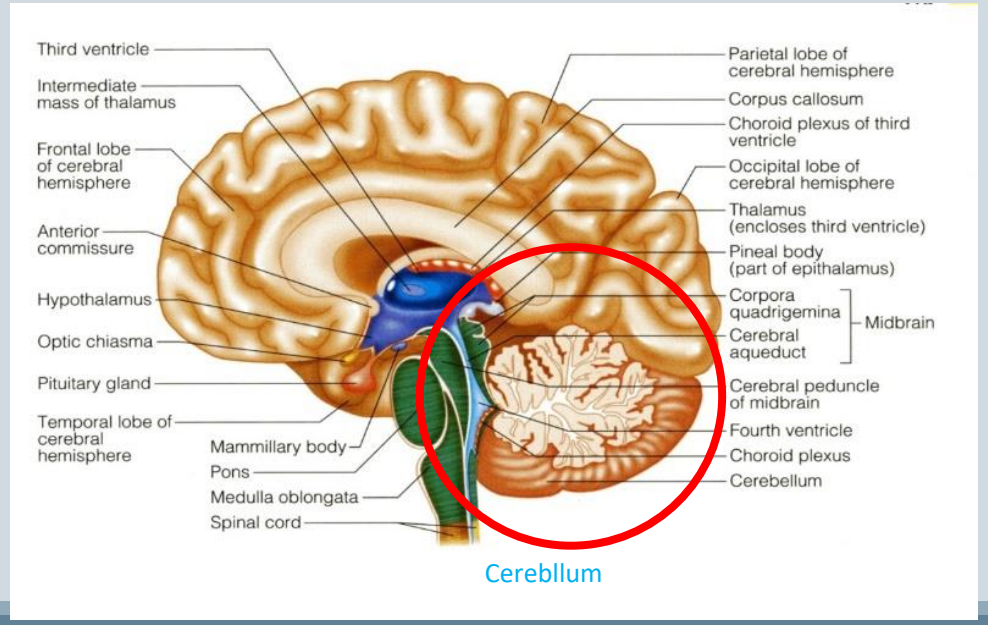




The cerebellum has 2 hemispheres and a convoluted surface.

It has an outer cortex made from gray matter and an inner region of white matter.

It provides precise coordination for body movements and helps maintain equilibrium.



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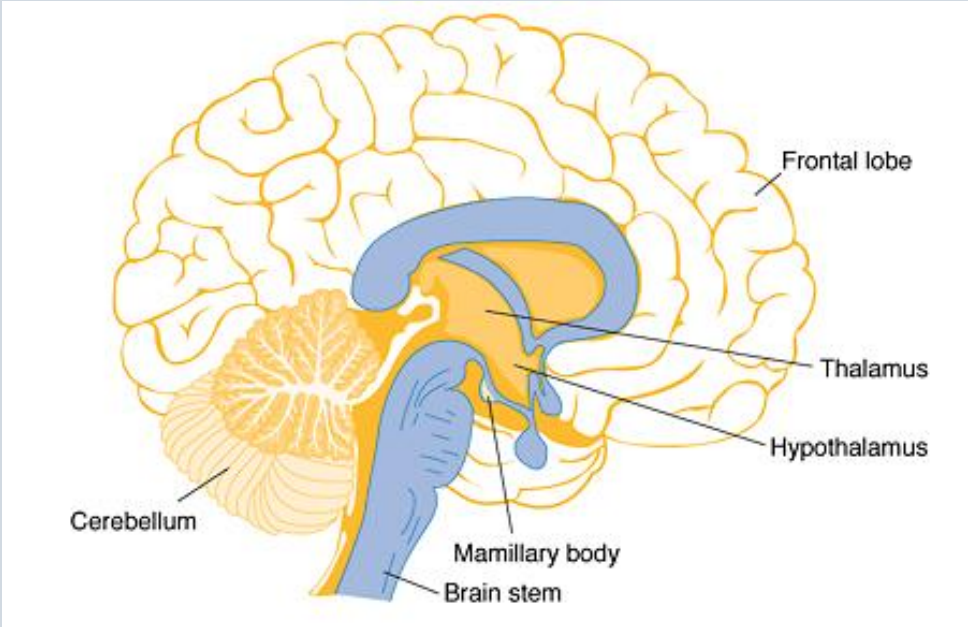
Diencephalon

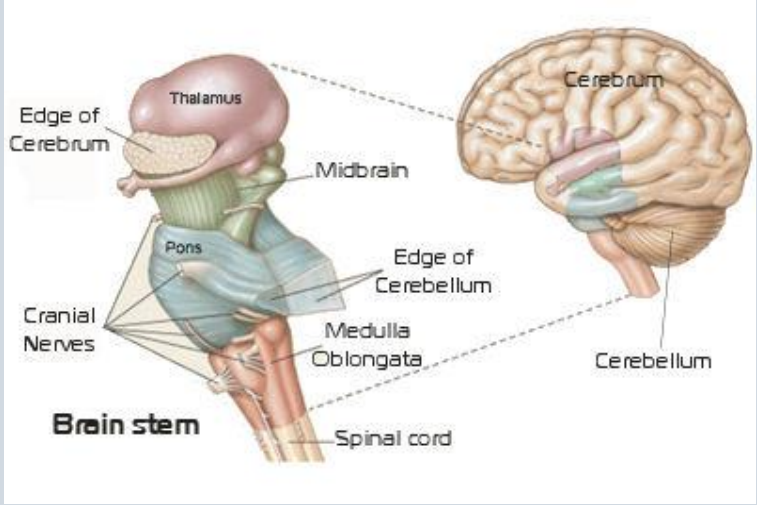
- Consists of four parts;
  - Thalamus
  - Hypothalamus
  - Subthalamus
  - Epithalamus
- Lies between the cerebrum and the brain stem.
- Regulates visceral activities and the autonomic nervous system.

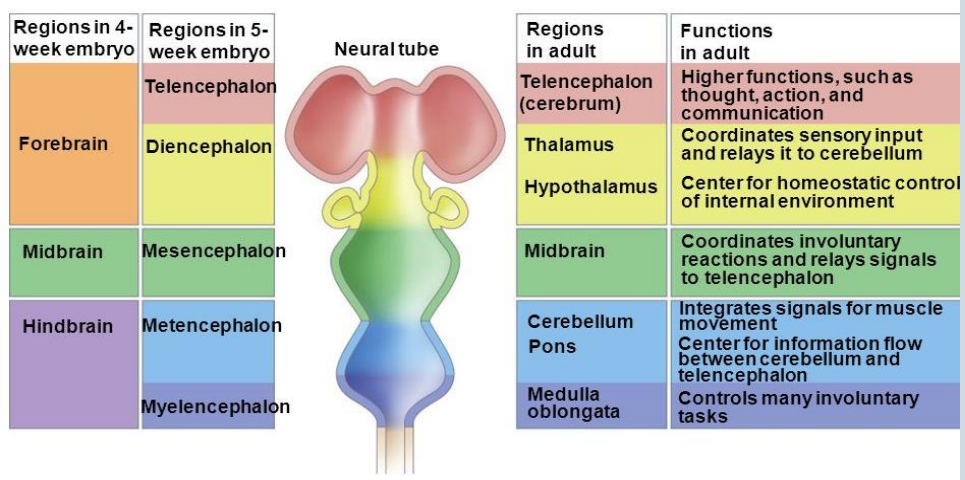


This slide is from the boys' lecture.

Brain stem

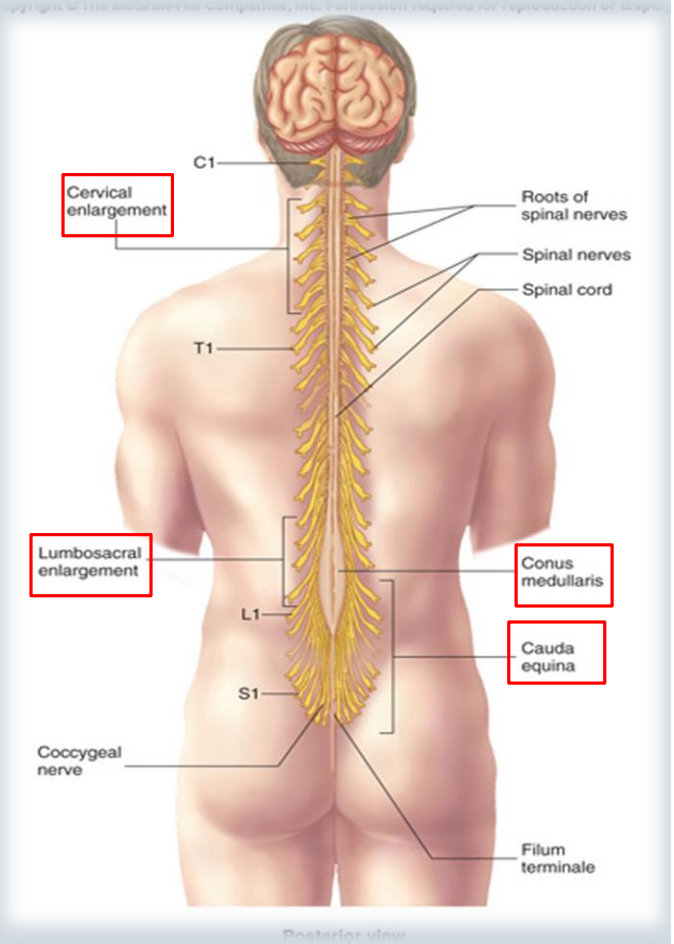
- Consists of three parts;
  - Midbrain
  - Pons
  - Medulla Oblongata
- Produces the rigidly programmed, autonomic behaviors necessary.
- Provides the pathway for fibers tracts running between higher and lower neuronal centers.

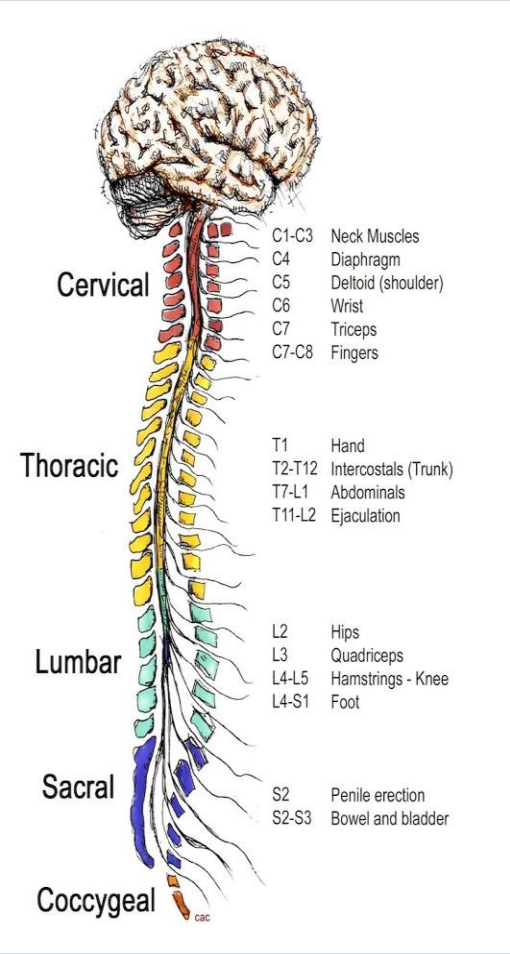




SPINAL CORD

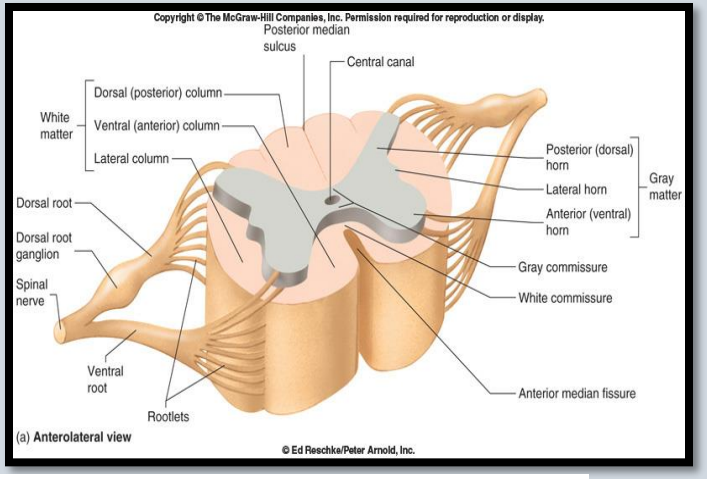
- It is a two-way conduction pathway to the brain & a major reflex center
- 42-45 cm long, cylindrical in shape, lies within the vertebral canal.
- Extends from foramen magnum to L2 vertebra
- Continuous above with medulla oblongata
- Caudal tapering end is called conus medullaris
- Has 2 enlargements: cervical and lumbosacral
- Gives rise to 31 pairs of spinal nerves
- Group of spinal nerves at the end of the spinal cord is called cauda equina

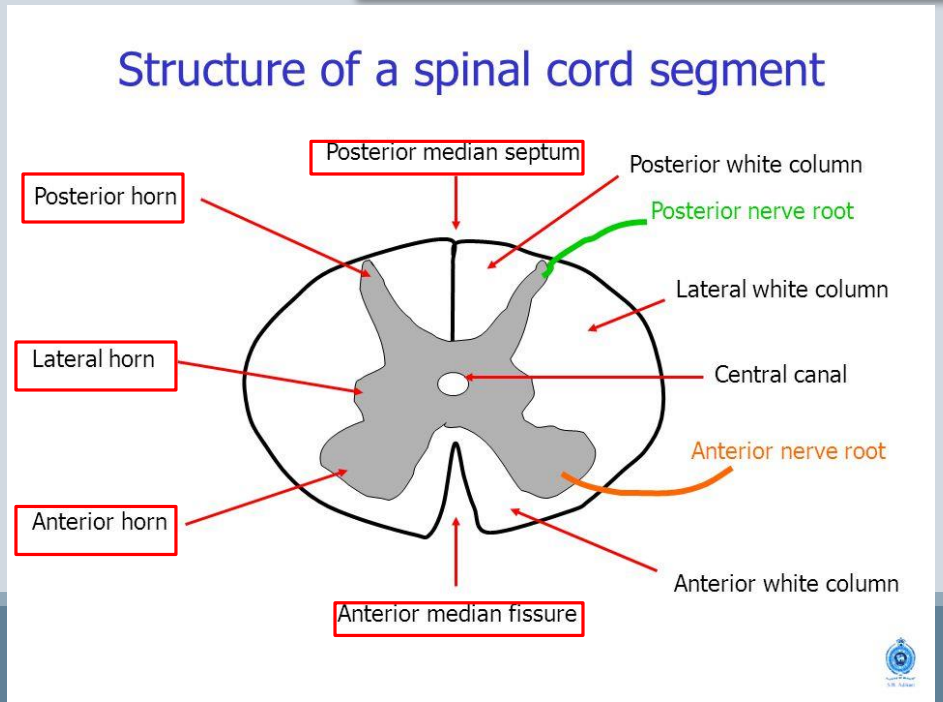




Cross Section Of Spinal Cord

- The spinal cord is incompletely divided into two equal parts, anteriorly by a short, shallow median fissure and posteriorly by a narrow septum, the posterior median septum.
- Composed of grey matter in the centre surrounded by white matter.
- The arrangement of grey matter resembles the shape of the letter H, having two posterior, two anterior and two lateral horns/columns.





Peripheral Nerves

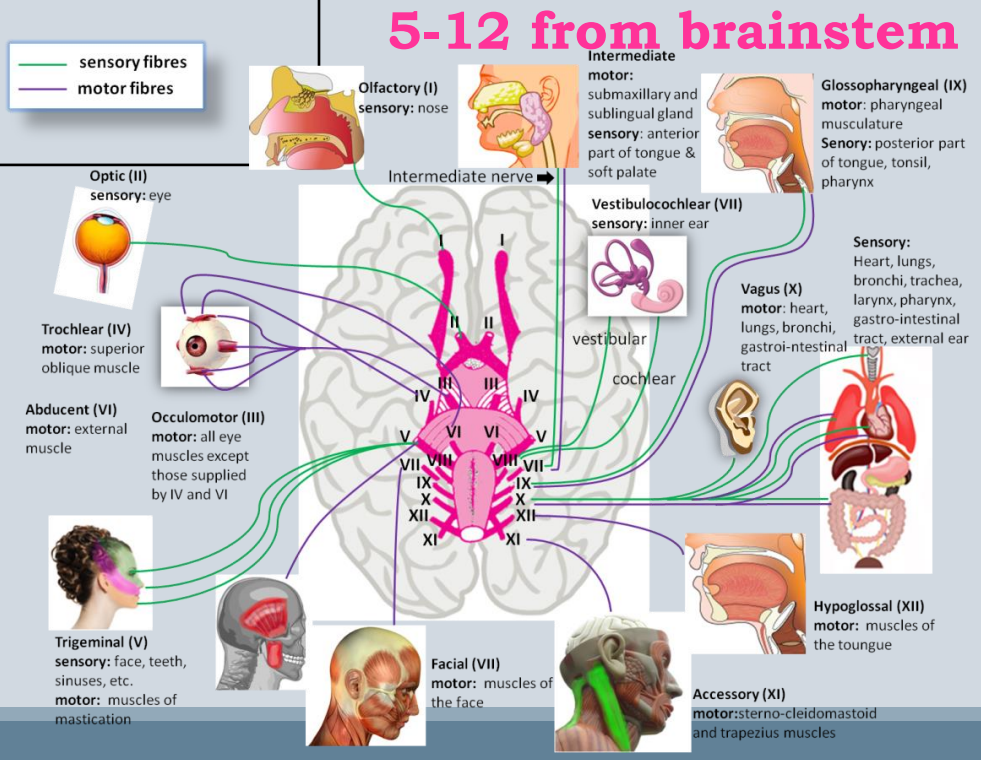
- May be SENSORY, may be MOTOR or could be MIXED
- Two TYPES:

❖ Cranial: 12 pairs, attached to brain, named, and numbered from 1-12 (from anterior to posterior)

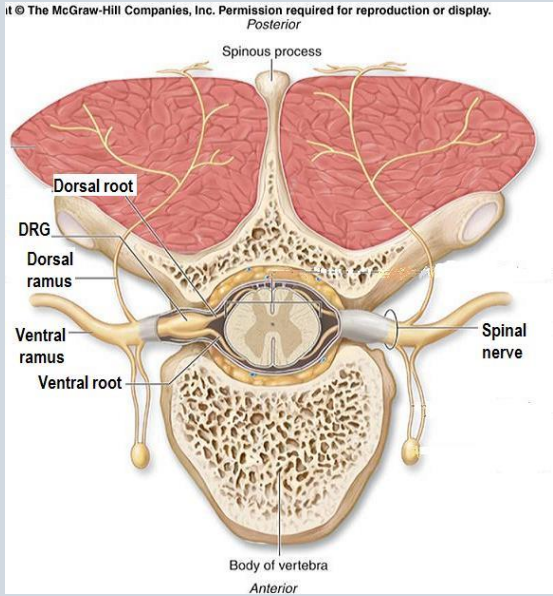
❖ Spinal: 31 pairs, attached to spinal cord named and numbered according to the region of the spinal cord.

Cranial Nerves

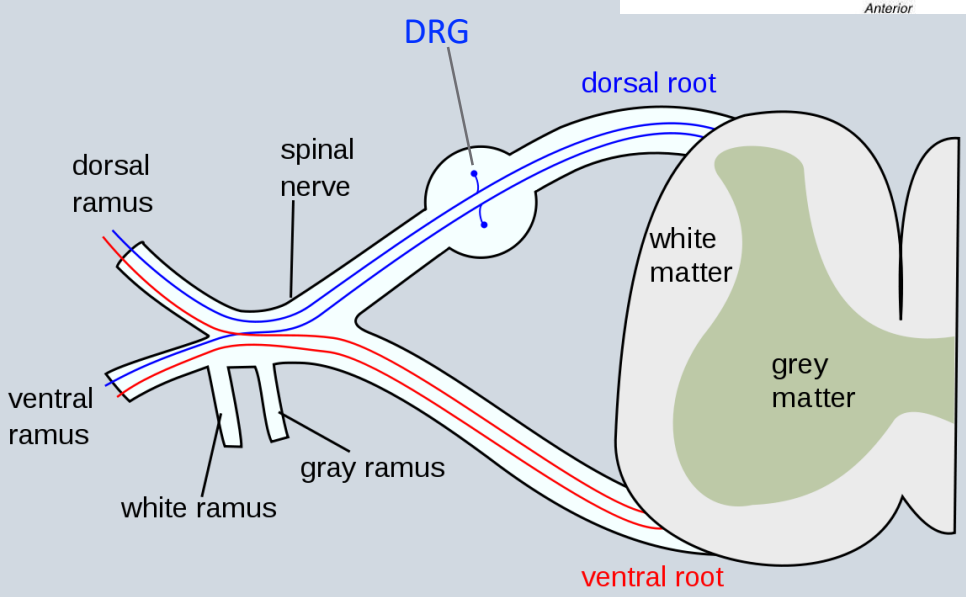
Mixed Nerves	Motor Nerves	Sensory Nerves
1. trigeminal n. (5th) 2. facial n. (7th) 3. glossopharyngeal n. (9th) 4. vagus n. (10th)	1. occulomotor n. (3rd) 2. trochlear n. (4th) 3. abducent n. (6th) 4. accessory n. (11th) 5. hypoglossal n. (12	1. olfactory n. (1st) 2. optic n. (2nd) 3. vestibulocochlear n. (8th)



Spinal Nerves & Nerve Plexuses

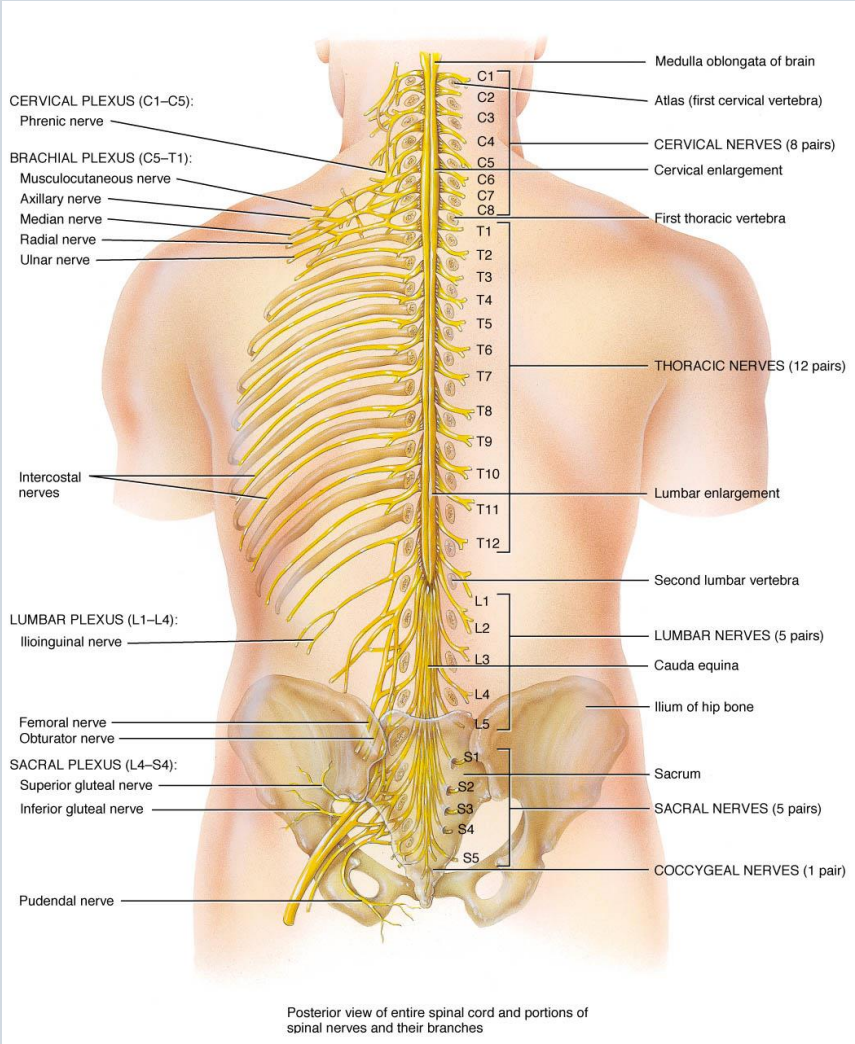


- 31 Pairs
- Each spinal nerve is attached by two roots:
  - Dorsal (sensory)
  - Ventral (motor)
    - ✓ Dorsal root bears a sensory ganglion (DRG)
- Each spinal nerve exits from the intervertebral foramen and divides into a dorsal and ventral ramus.
- The rami contain both sensory and motor fibers.



Spinal Nerves & Nerve Plexuses

- The dorsal rami are distributed individually.
  - Supply the skin and muscles of the back
- The ventral rami form plexuses
  - Except in thoracic region where they form the intercostal nerves
  - Supply the anterior part of the body

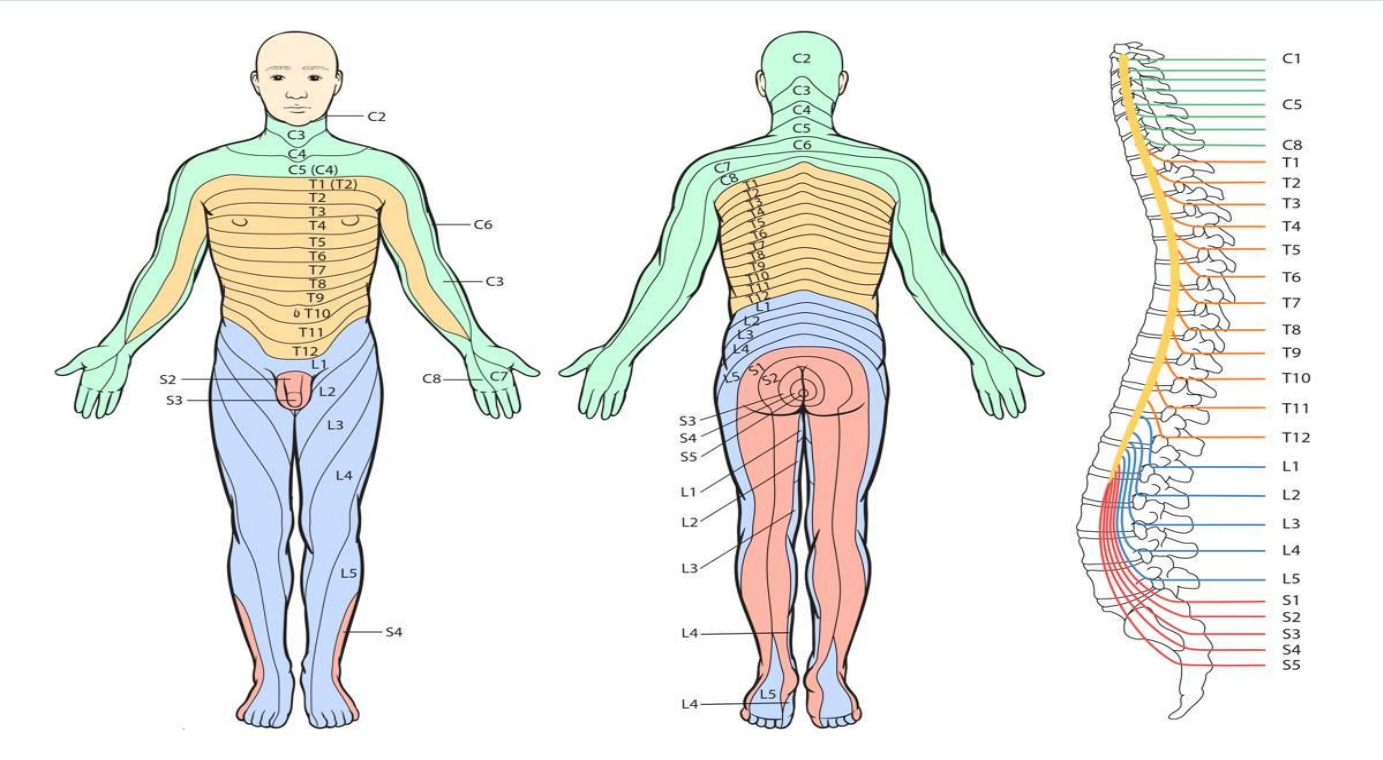


Posterior view of entire spinal cord and portions of spinal nerves and their branches

Dermatome

Dermatome is a segment of skin supplied by one spinal nerve.

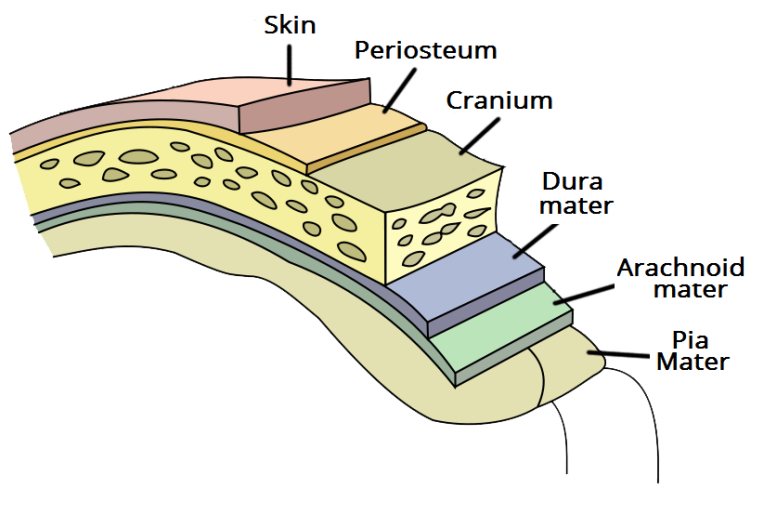
كل عصب مختص بجزء محدد بالجسم

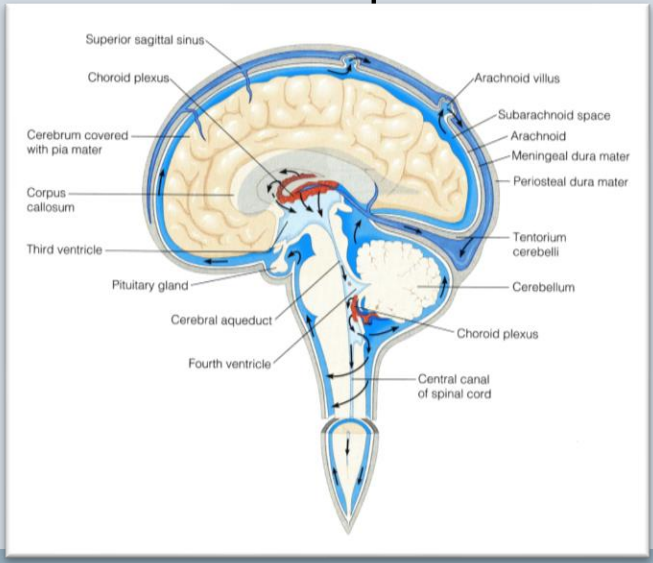


Protection Of CNS

The CNS Is Protected By:

- Skull and the vertebral column (Bones)
- Meninges (membranes):
    1. dura mater (outermost).
    2. arachnoid mater (middle).
    3. pia mater (innermost).
- Cerebrospinal fluid in the subarachnoid space.





Cerebral Fluid

- CSF is constantly produced by the choroid plexuses inside the ventricles of brain.
- CSF is constantly drained into the Dural sinuses through the arachnoid villi.
- Most of the CSF drains from the ventricles into the subarachnoid space around the brain and spinal cord. A little amount flows down in the central canal of the spinal cord.
- Between the Arachnoid mater and the pia mater.

Q6:Which statement(s) of the following is TRUE?

1. Nucleus is a group of neurons within the PNS
2. In the Brain, grey matter located in the centre and surrounded by white matter.
3. Oligodendrocytes they form the myelin sheath that surrounds many neuronal axons, which increase the rate of conduction.
4. Diencephalon provides the pathway for fibers tracts running between higher and lower neuronal centers.
5. Information is passed between neurons at specialized regions called synapses
6. Cerebrum provides precise coordination for body movements and helps maintain equilibrium.
7. Each spinal nerve exits from the intervertebral foramen and divides into a dorsal and ventral ramus.
8. The dorsal rami form plexuses .
9. Dermatome is a segment of skin supplied by one spinal nerve.
10. CSF is produced by the choroid plexuses inside the ventricles of brain.
11. The rami contain only sensory fibers.
12. CSF is drained into the dural sinuses through the arachnoid villi.

Answers : 1-F 2-F 3-T 4-F 5-T 6-F 7-T 8-T 9-T 10-T 11-F 12-T

Extra questions

Q1:Whats is the form of protection that the CNS uses that involves membranes?

A-skull and vertebral column

B-Cerebrospial fluid

C-Dermatomes

D-Meninges

Q2:Where can we find the cell body of a nervous cell?

A-Grey matter

B-white matter

C-both

D-axon

Q3:How many pairs of neurons originate from the spinal cord?

A-23

B-12

C-19

D-31

Q4:The surface shows ridges of tissue separated by grooves called:

A: gyri

B: cortex

C: sulci

D: Insula

Q5:Neuroglial cells are responsible for the transfer of information:

A-TRUE
B-FALSE

- Answers:
- 1-D
- 2-A
- 3-D
- 4-C
- 5-B

Team Members

Faisal Fahad Alsaif (Team leader)

Abdulrahman Sulaiman ALDawood
Fahad aldhowaihy
Abdullah AlMeaither
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Saleh abdullah almoaiqel
Abdulaziz Mohammed Alabdulkareem
Abdulmajeed Khaled Alwardi
Abdulaziz Ibrahim Aldrgam
Akram alfandi
saud Abdulaziz alghufaily
Mohammed Alquwayfili
ali alammari
Sultan alfuhaid
Zeyad Alkhenizan

Fahad alshughaithry
saad aloqile
Abduljabbar Alyamani
Mohammed Alomar
Abdullah alsergani
Abdullah alqarni
Fahad alshugaithry
Mohammed Alomar
Yazeed Aldossari

Lamia Alkuwaiz (Team leader)

Abeer Alabduljabbar
Afnan Almustafa
Alanoud Alessa
Albandari Alshaye
Alfahadah Alsaleem
Layan Alwatban
Majd Albarrak
Norah Alharbi
Rawan Alharbi
Rinad Alghoraiby
Wafa Alotaibi
Wejdan Albadrani

Good Luck