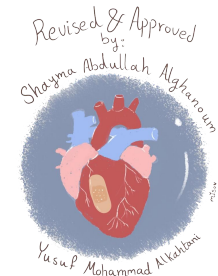
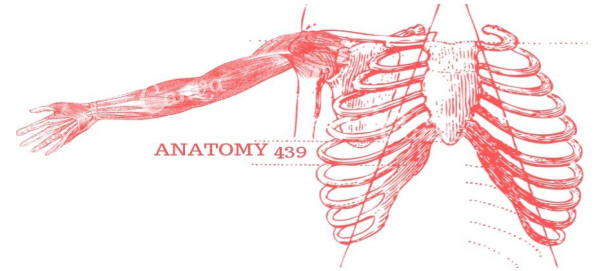


Lecture 3:

NERVOUS SYSTEM

- **Red** : important
- **Pink** : in girls slides only
- **Blue** : in male slides only
- **Green** : notes, Extra



OBJECTIVES

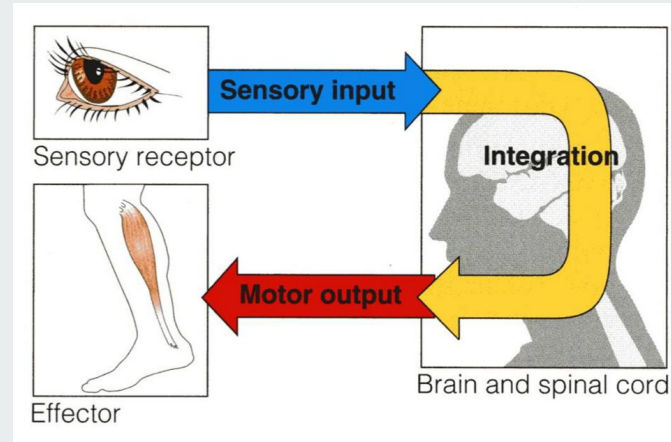
- List the subdivisions of the nervous system
- Define the terms: grey matter, white matter, nucleus, ganglion, tract and nerve.
- List the parts of the brain.
- Identify the external and internal features of spinal cord.
- Enumerate the cranial nerves
- Describe the parts and distribution of the spinal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

Functions of nervous system:

1- Collection of sensory input : Identifies changes occurring inside and outside the body (**stimuli**) by using sensory receptors.

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

3- Effects a response: by activating muscles or glands (effectors) via **motor output**.

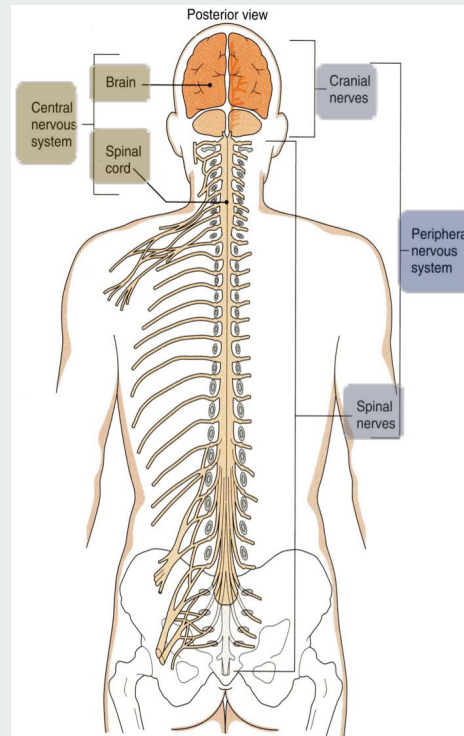
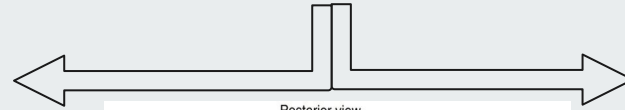


Structural Organization

Central Nervous System
(CNS)

Brain

Spinal cord



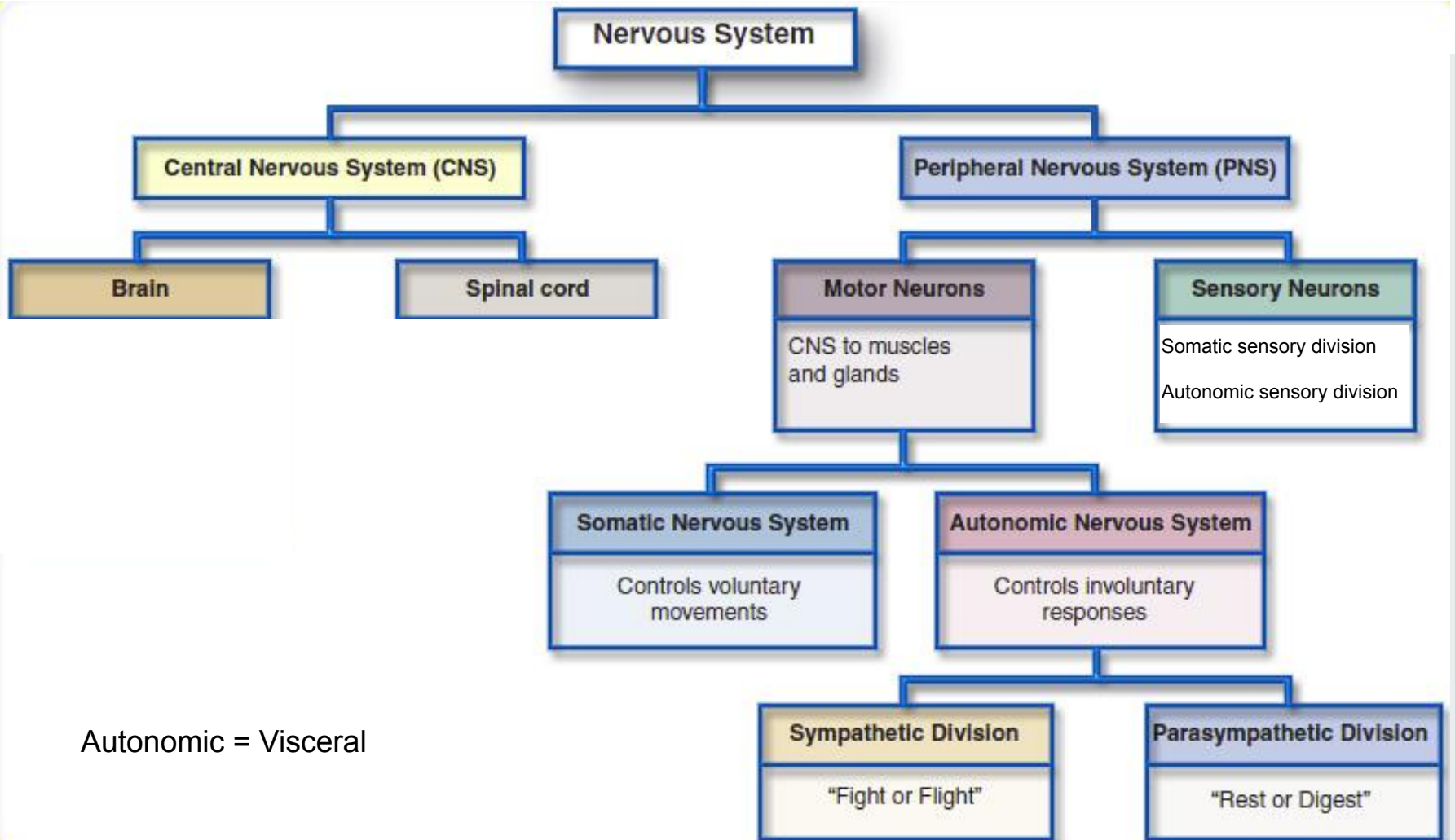
Peripheral Nervous System
(PNS)

Nerves

ganglia

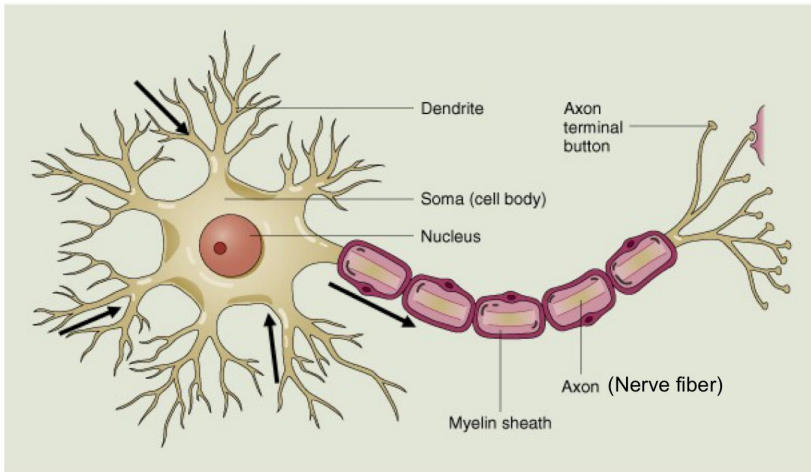
cranial

spinal



Nervous tissue consists of:

- 1- nerve cells (neurons)
- 2- supporting cells (neuroglia)

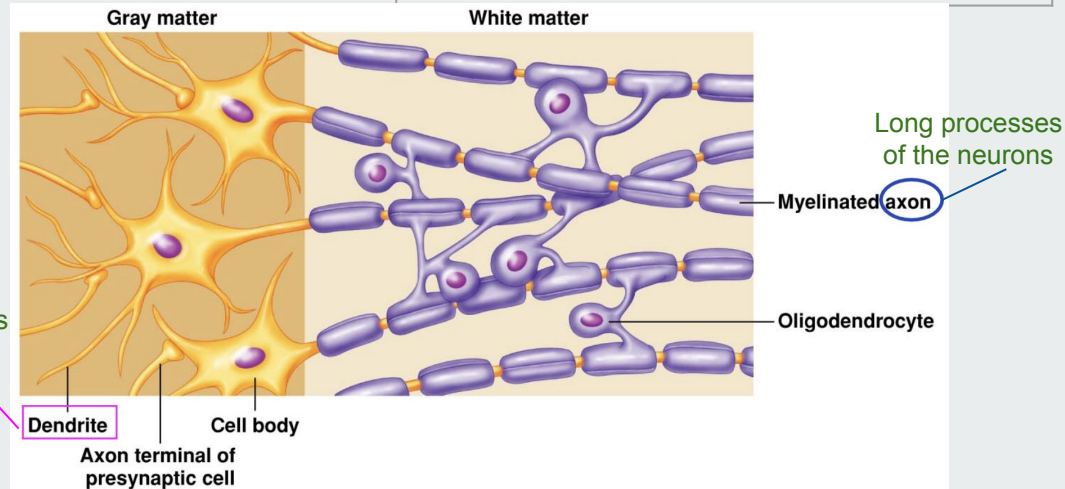


A typical multipolar neuron

Nervous tissue is organized as:

- 1- gray matter
- 2- white matter

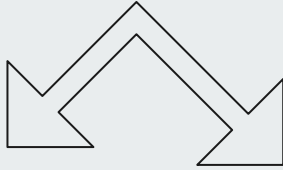
<u>Gray matter</u>	<u>White matter</u>
Contain cell bodies	No cell bodies
short processes of the neurons	long processes of the neurons
neuroglia	
blood vessels	



short processes of the neurons

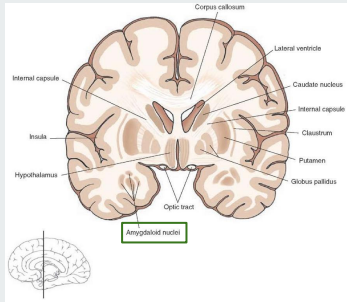
Long processes of the neurons

Within the CNS



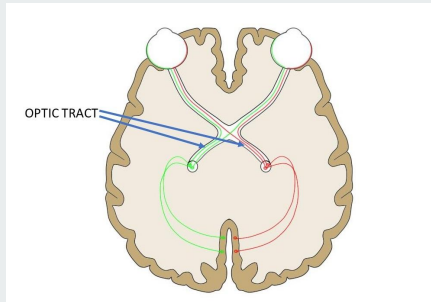
Nuclei

A group of neurons within the CNS.

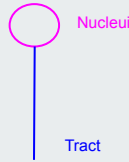


Tract

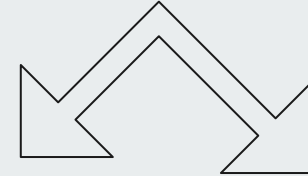
A group of nerve fibers (axons) within the CNS.



CNS

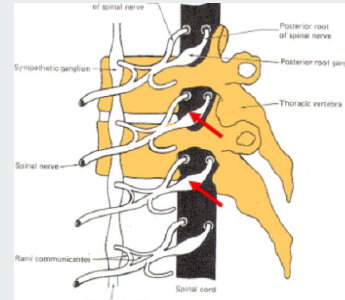


Outside the CNS



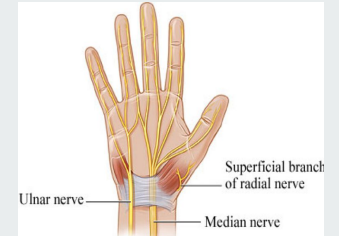
Ganglia

A group of neurons outside the CNS.



Nerve

A group of nerve fibers (axons) outside the CNS



PNS



The Brain

The brain is a large mass of nervous tissue located in the cranial cavity.

It has **four** major regions:

1- Cerebellum

2- Cerebrum

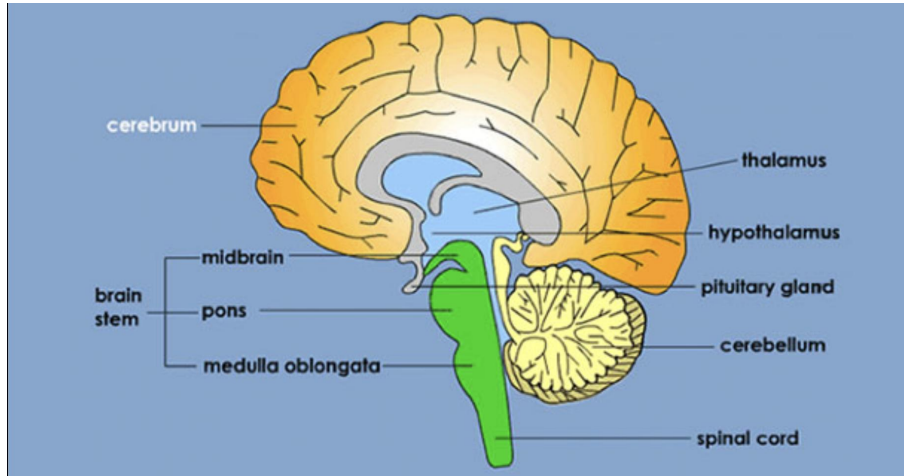
- 2 Cerebral hemispheres

3- Diencephalon

- Thalamus
- Hypothalamus
- Subthalamus
- Epithalamus

4- Brainstem

- Midbrain
- Pons
- Medulla oblongata



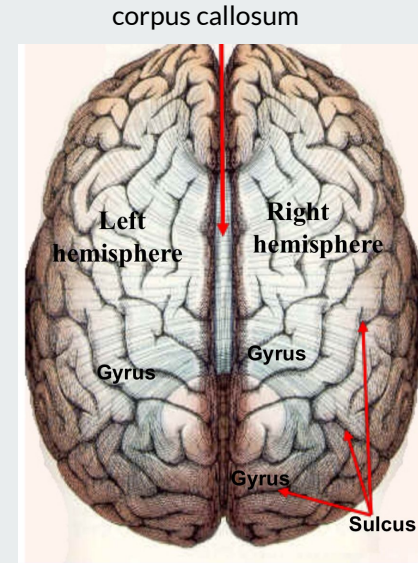
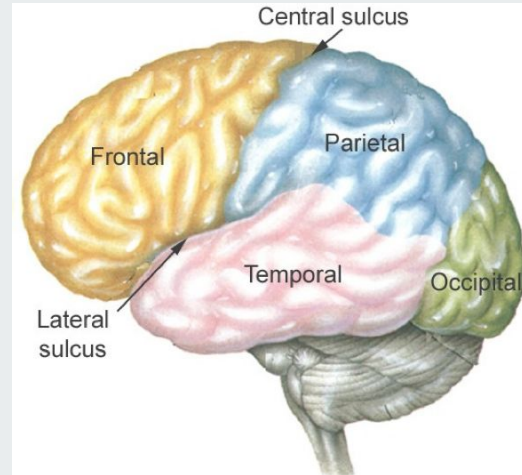
Cerebrum

The largest part of the brain, 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** (plural: **gyrus**).
- separated by grooves called **sulci** (plural: **sulcus**).

Cerebrum is divided by deeper sulci into 4 lobes:

- Frontal
- Parietal (one on each side)
- Temporal (one on each side)
- Occipital



TISSUE OF THE CEREBRAL HEMISPHERES

1- Gray matter (cortex):

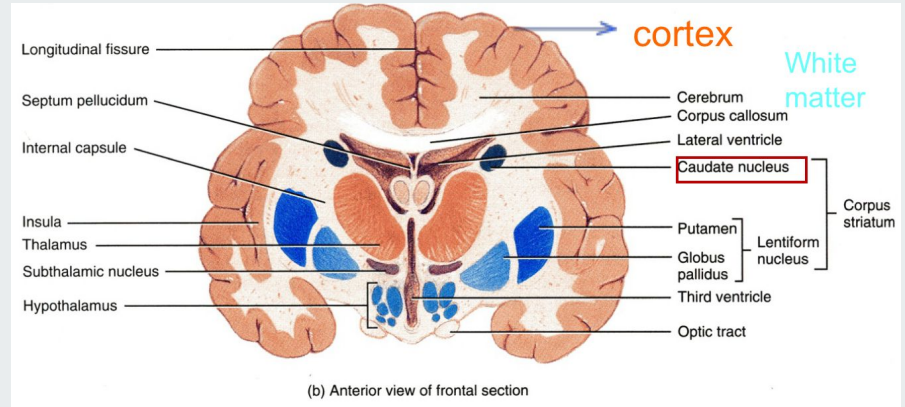
- It is the outermost layer.

2- White matter:

- located in the deeper layer.
- composed of fiber tracts (bundles of nerve fibers).
- carries impulses to and from the cortex.

3- Basal nuclei

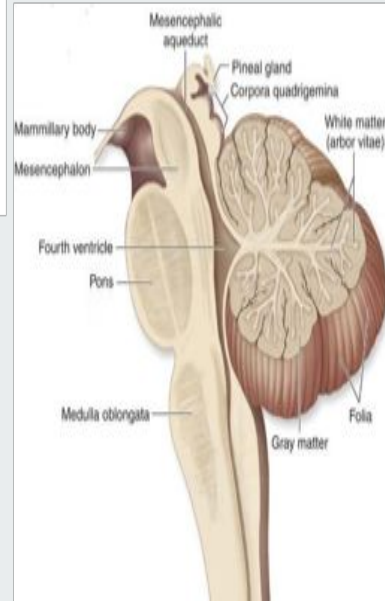
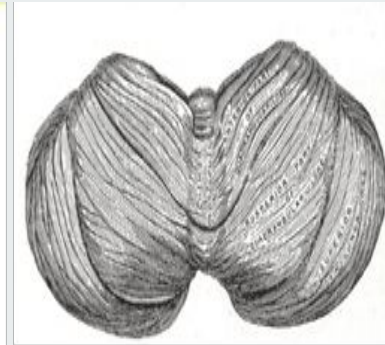
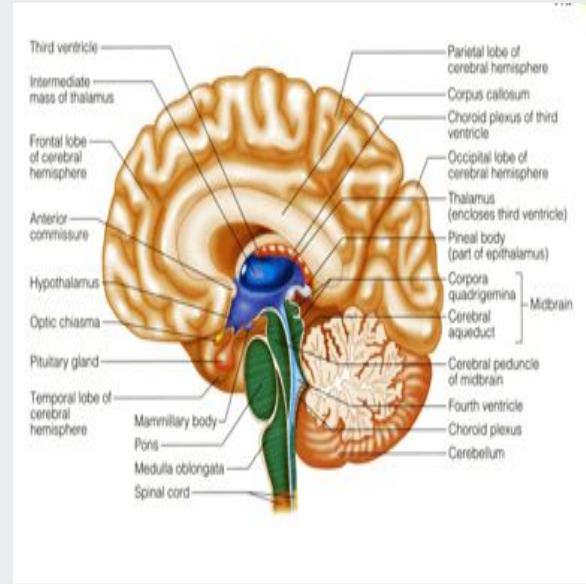
- Located deep within the white matter.
- They are masses of grey matter.
- They help the motor cortex in the regulation of voluntary motor activities.



CEREBELLUM

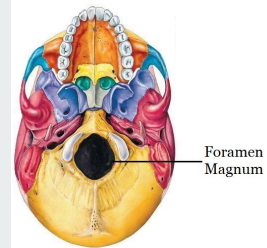
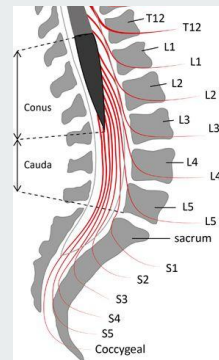
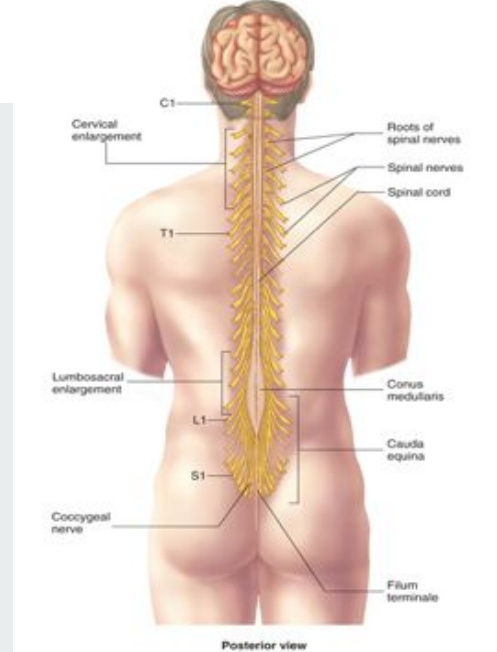
The **cerebellum** has 2 hemispheres and a convoluted surface. It has an outer cortex of gray matter and an inner region of white matter.

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



Spinal Cord

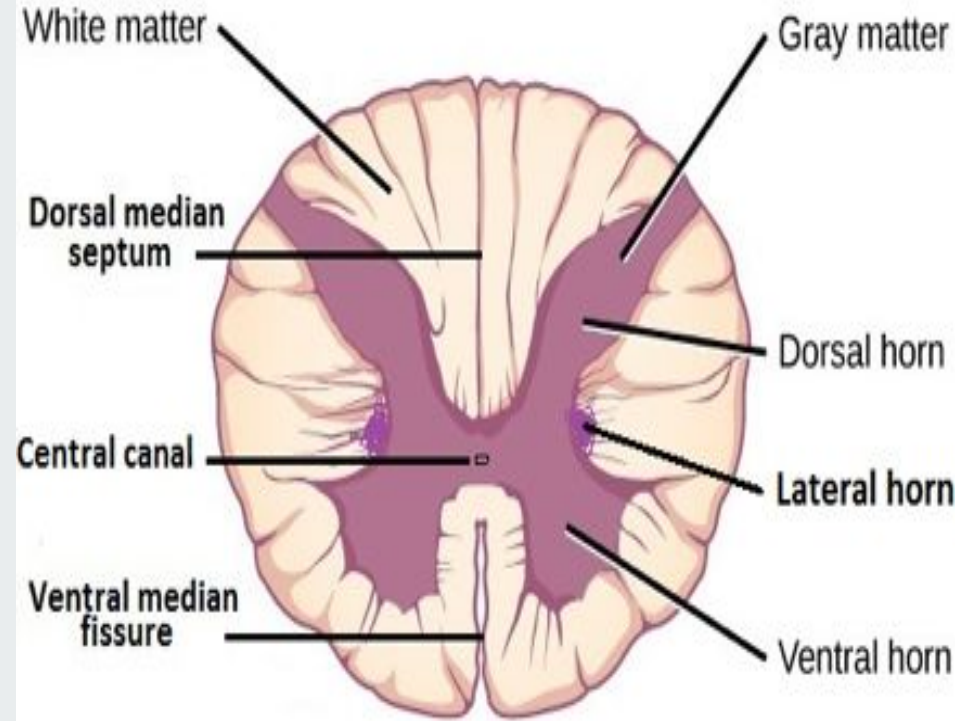
- It is a two-way conduction pathway to the brain and a major reflex center.
- 42-45 cm long, cylindrical in shape, lies within the vertebral canal.
- Extends from **foramen magnum** to **L2 vertebra**.
- Continuous above with **medulla oblongata**.
- Caudal tapering end is called **conus medullaris**. It's in the (CNS) if it's damaged, it's never regenerated
- 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**. (تشبه ذيل الحصان) It's in the (PNS) if it's damaged, it can be regenerated.



Cross Section of Spinal cord

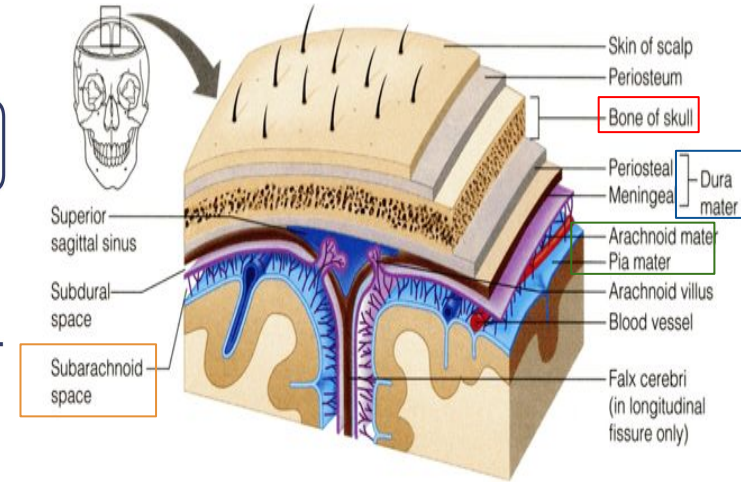
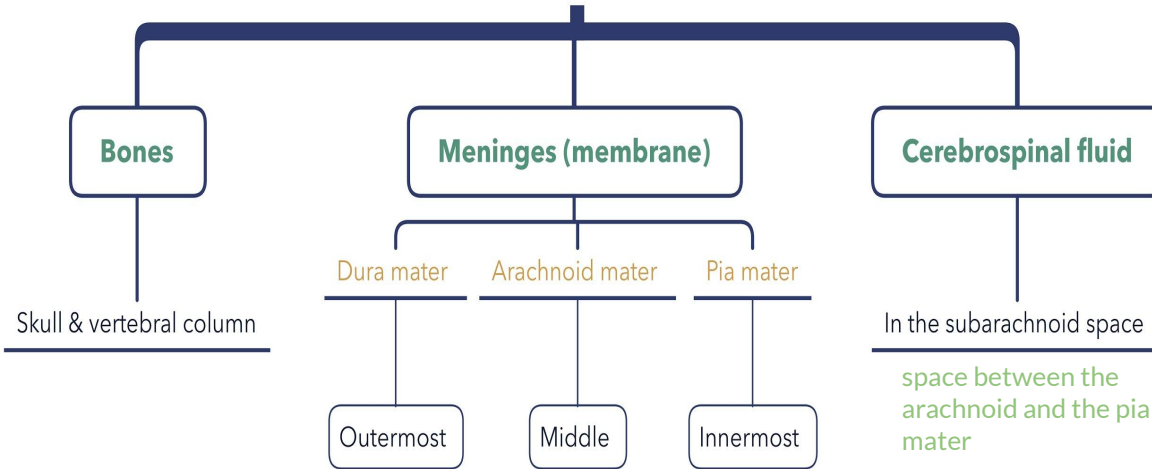
The spinal cord is incompletely divided into two equal parts

- anteriorly by a short, shallow median fissure
- posteriorly by a deep narrow median septum.
- It is composed of **grey matter** in the center surrounded by **white matter**. عكس cerebrum and cerebellum
- The arrangement of grey matter resembles the shape of the letter **H**, having two posterior, two anterior and two lateral horns/columns



Protection Of The CNS

CNS protected by:

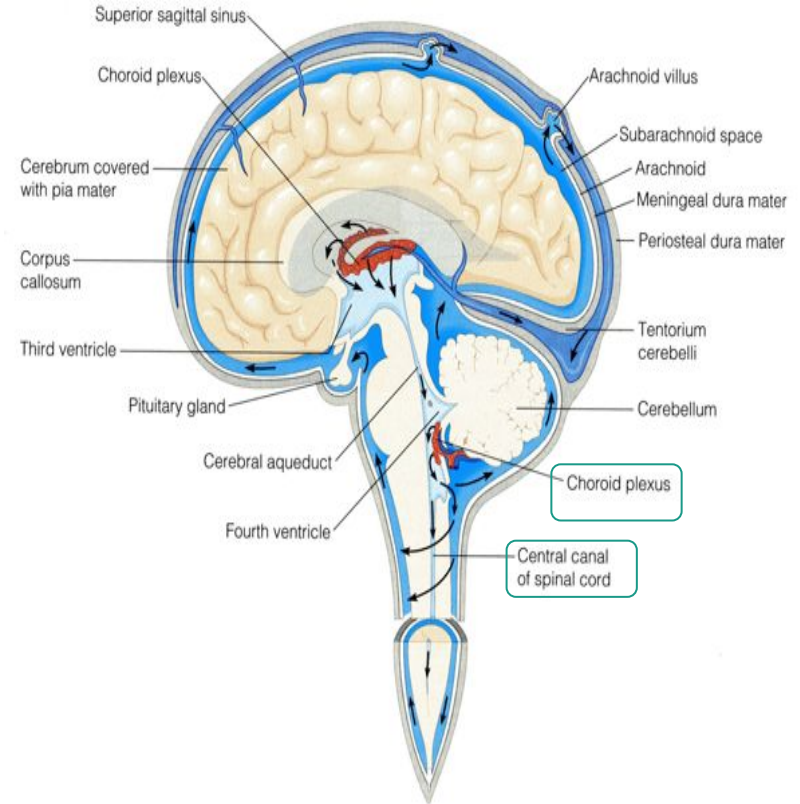


CEREBROSPINAL FLUID

CSF is constantly produced by the choroid plexuses inside the ventricles of brain.

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.

CSF is constantly drained into the dural sinuses through the arachnoid villi.



Peripheral Nerves

May Be:

Mixed

Motor

Sensory

Divided into two
Types

Spinal

- 31 pairs
- Attached to spinal cord.
- Named and numbered according to the region of the spinal cord.

Cranial

- 12 pairs
- Attached to brain.
- Named and numbered from 1-12.

Cranial Nerves

12 Pairs

5 pairs are motor:

- oculomotor n.(3rd)
- trochlear n.(4th)
- abducens n.(6th)
- accessory n.(11th)
- hypoglossal n.(12th)

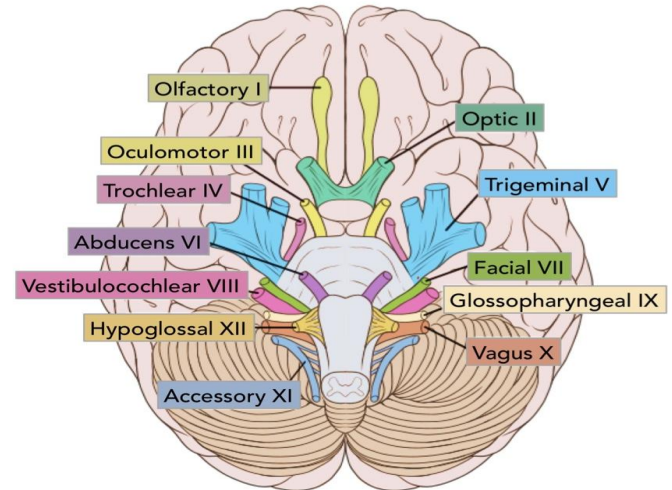
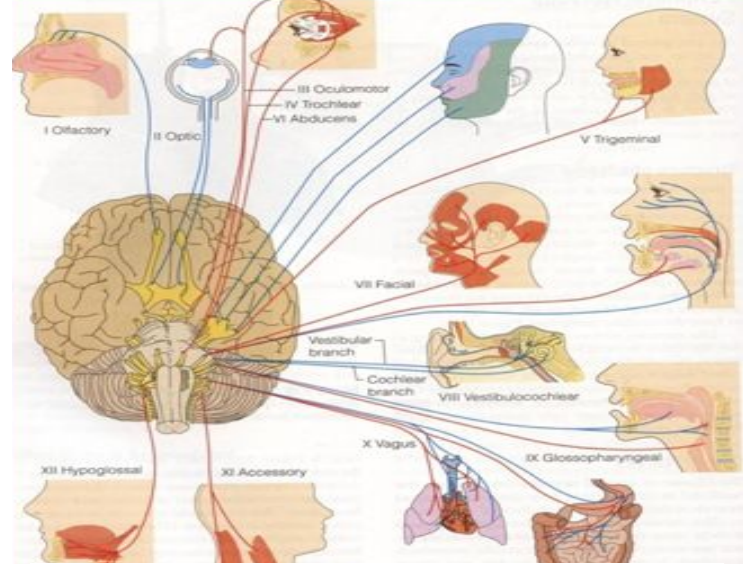
4 pairs are mixed:

- trigeminal n.(5th)
- facial n.(7th)
- glossopharyngeal n.(9th)
- vagus n.(10th)

Try **يا فيصل** glass of pharyngeal in **Vegas**

3 pairs are sensory:

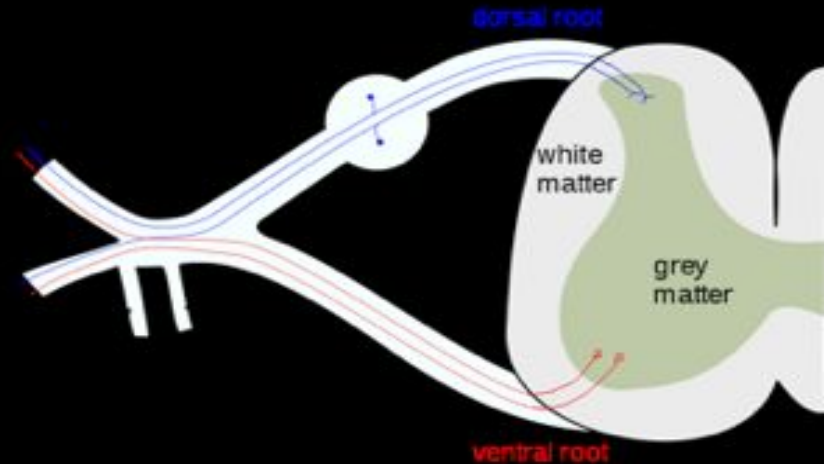
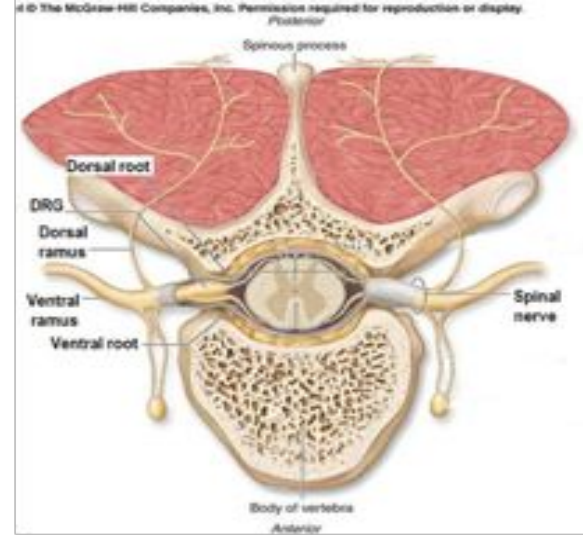
- olfactory n.(1st)
- optic n.(2nd)
- vestibulocochlear n.(8th)



Spinal Nerve

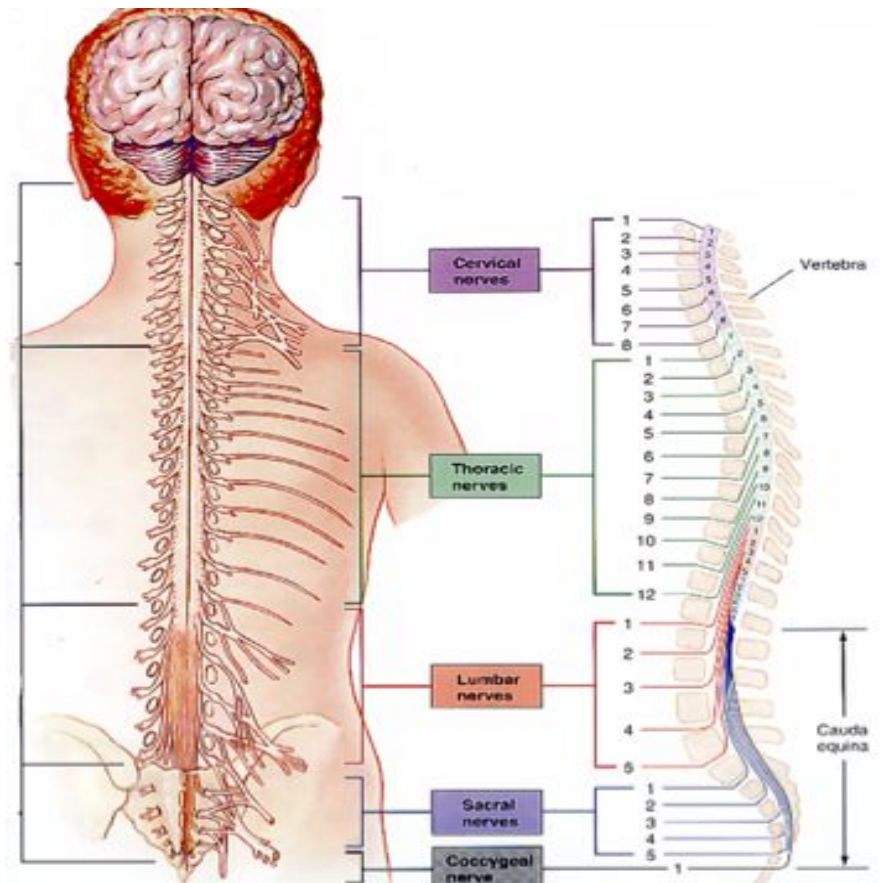
31 pairs

- Each spinal nerve is attached by **two roots**:
- **dorsal (sensory)** للتذكر كلها S
- **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** (Ramus: a branch, such as a branch of a blood vessel or nerve)
- The rami (ramus is singular) Contain both sensory and motor fibers



Spinal Nerves

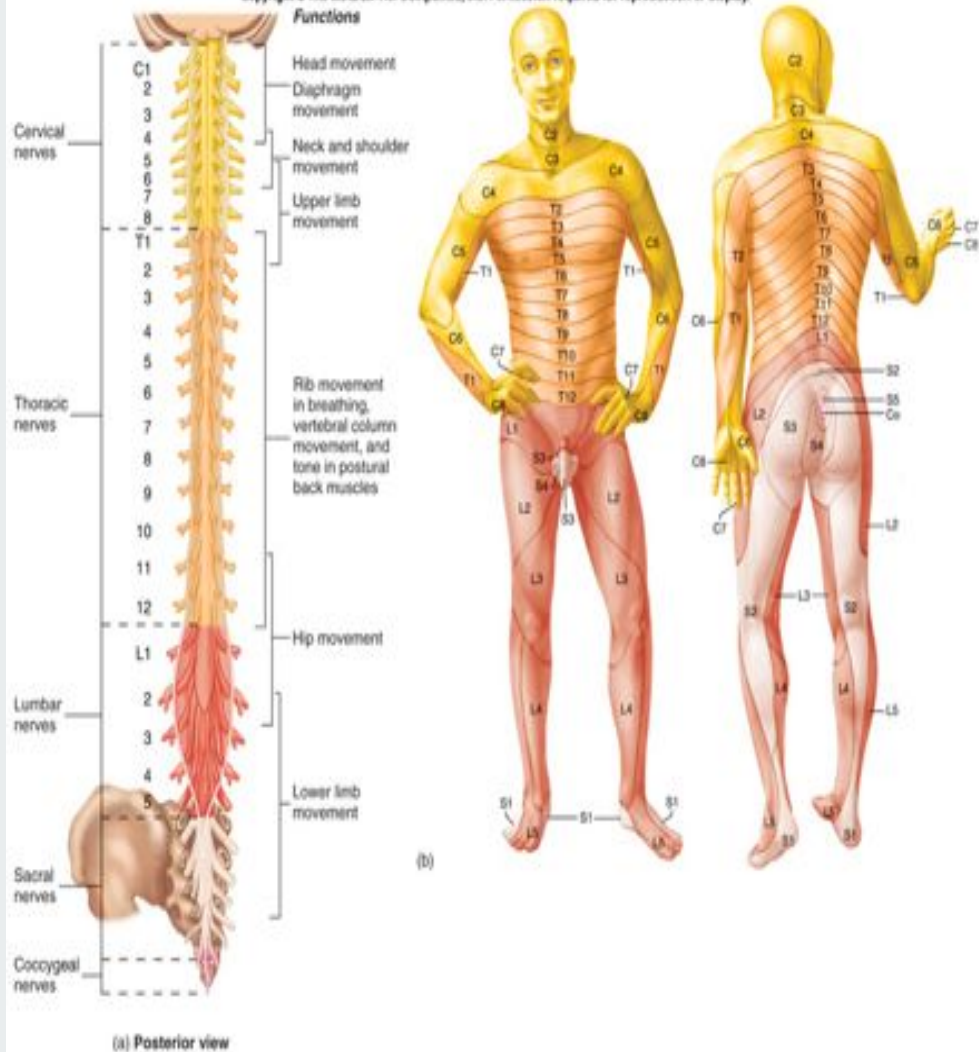
- The **dorsal rami** are distributed individually, supply the skin and muscles of the back
- the **ventral rami** form **plexuses** (except in thoracic region where they form the **intercostal nerves**), and supply the anterior part of the body



plexuses: a network of nerves or vessels in the body.

Dermatomes

The segment of skin supplied by a **segmental spinal nerve** is called a **'Dermatome'**



(a) Posterior view

(b)

MCQs

1- Cells that are responsible of supporting nerve cells are known as:

A- ganglia. B- neurons. C- neuroglia. D- Nuclei

2- Which part of the brain is connected by corpus callosum?

A- cerebrum. B- cerebellum. C- brainstem. D- diencephalon.

3- A group of nerve fibers (axons) outside the CNS is known as:

A- ganglia. B- tract. C- nerve. D-root.

4- _____ It is a two-way conduction pathway to the brain and major reflex center:

A- the brain B- the spinal cord C- motor neurons D- sensory neurons

5- The Cranial nerves have ___ Pairs That are Attached to the _____.

A- 31, brain B- 12, spinal cord C- 12, brain D- 31,spinal cord

C	B	C	A	C
5	4	3	2	1

MCQs

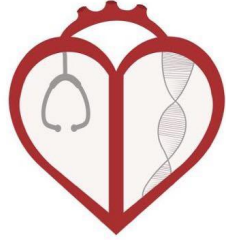
6- The segment of skin supplied by a segmental spinal nerve is called _____:

- A- the brain B- cranial nerves C- spinal nerve D- Dermatome

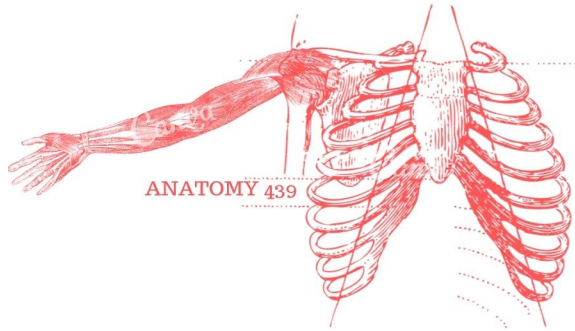
7- Peripheral Nerves that are named and numbered according to the region of the spinal cord _____.

- A- spinal nerve B- cranial nerve C- motor D- sensory

A	D
7	9



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