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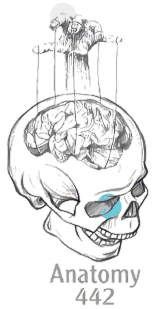


Nervous System

Lecture 3

Color index:

Main text

Red: important

Pink: in girls slides only

Blue: in boys slides only

Green: Doctors notes

Grey: Extra info

Objectives

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

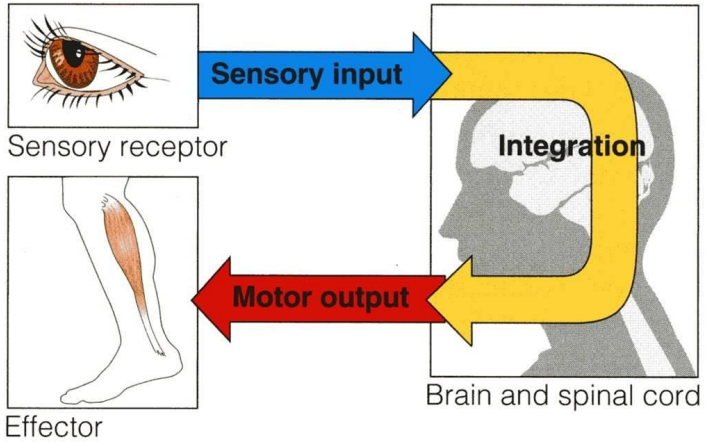
- List the subdivisions of the nervous system
- Define the terms: grey matter, white matter, nucleus, ganglion, tract and nerve.
- List the parts of the brain.
- Identify the external and internal features of spinal cord.
- Enumerate the cranial nerves
- Describe the parts and distribution of the spinal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

The nervous system has three functions:

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

1. **Integration:**
   Processes, analyses and interprets these changes and makes decisions.

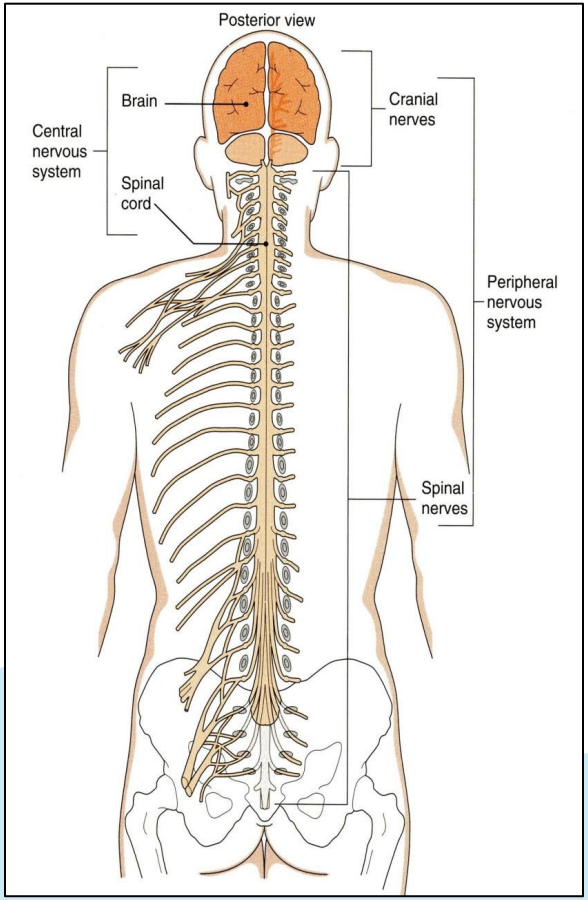
1. **Effects a response**
   by activating muscles or glands (effectors) via motor output.



Structural Organization

Central nervous system (CNS):

1. Brain
2. Spinal cord

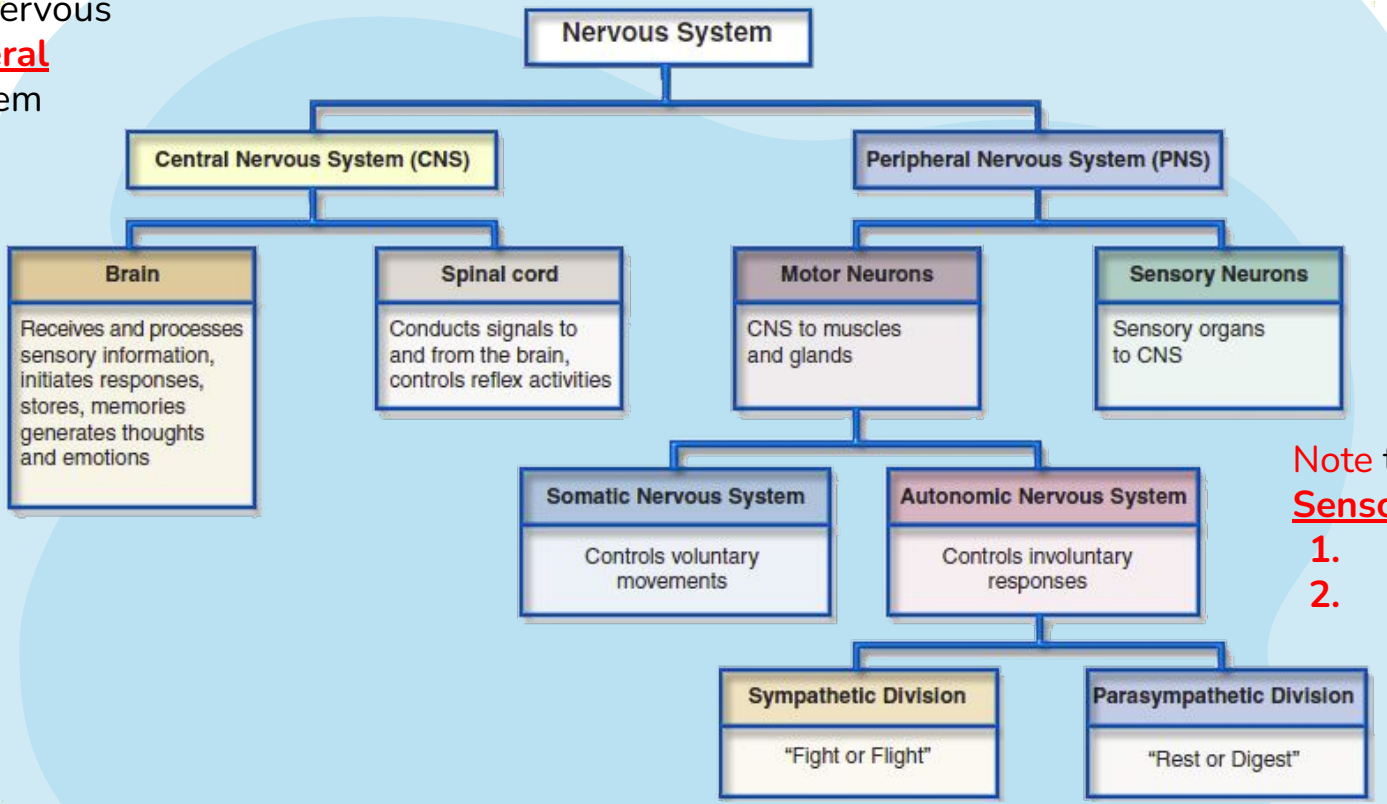


Peripheral nervous system (PNS):

1. Nerves (Spinal, Cranial)
1. Ganglia

Functional Organization

Note: Sometimes they call the **Autonomic** nervous system **Visceral** nervous system



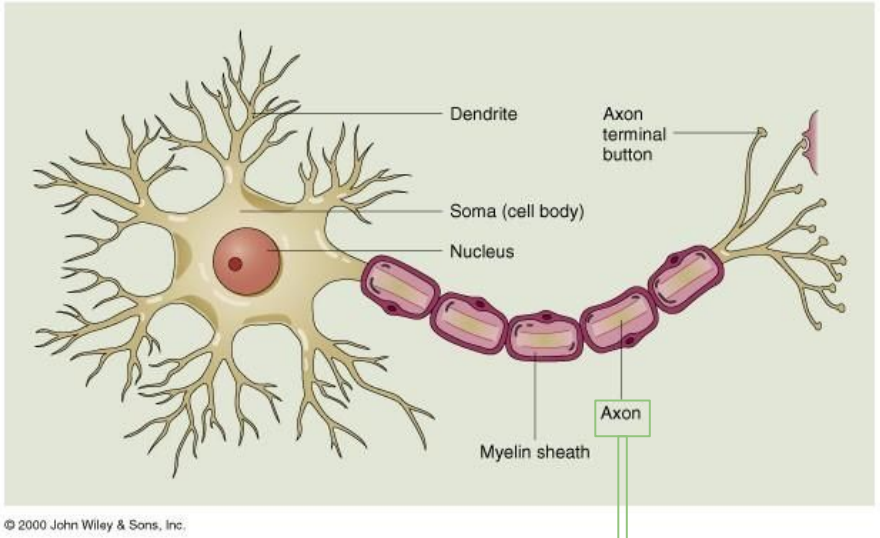
Note that the **Sensory** also has:

1. **Somatic**
2. **autonomic**

Nervous tissue

Nervous tissue consists of:

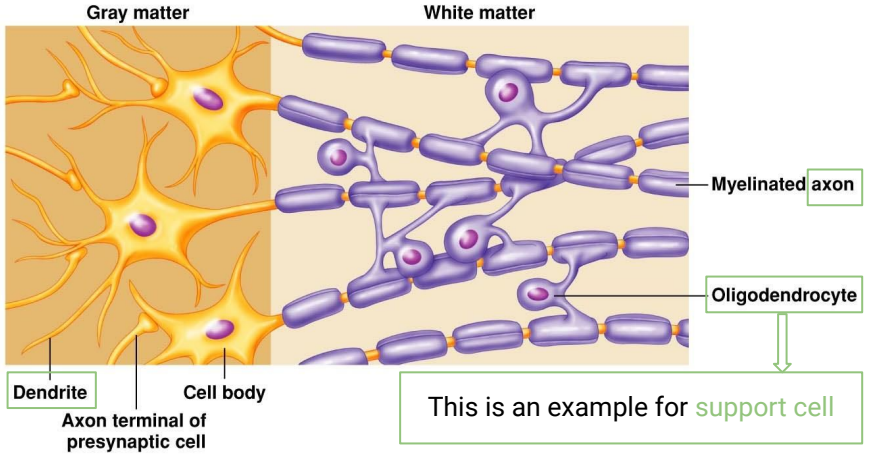
1. Nerve cells (Neurons)
2. Supporting cells (Neuroglia)



Axon, also called nerve fibre

Nervous tissue is organized as:

Gray matter	White matter
Contains cell bodies	No cell bodies
Short processes of the neurons (Dendrite)	Long processes of the neurons (Axons)
Neuroglia	
Blood vessels	



This is an example for support cell

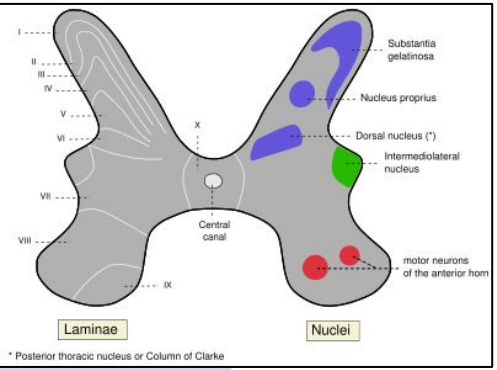
Remember

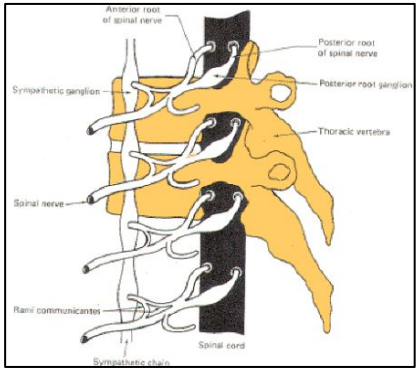
A group of neurons within the CNS is called a **nuclei**

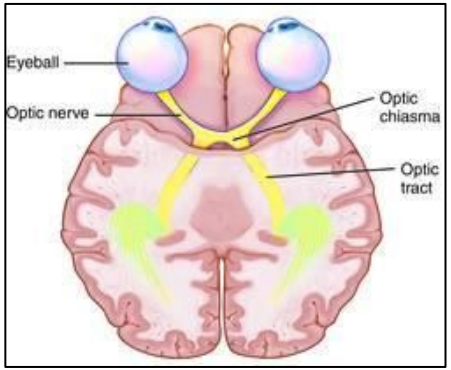
A group of neurons outside the CNS is called a **ganglia**

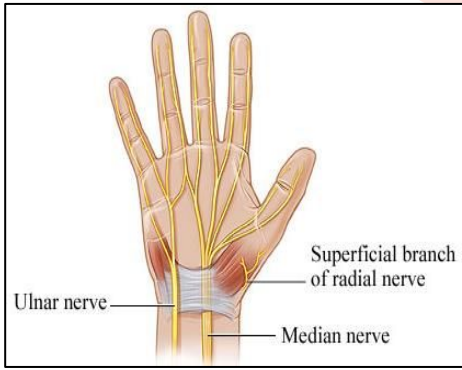
A group of nerve fibers (axons) within the CNS is called a **tract**

A group of nerve fibers (axons) outside the CNS is called a **nerve**









Note: Nuclei is a plural form, and Nucleus is the singular form

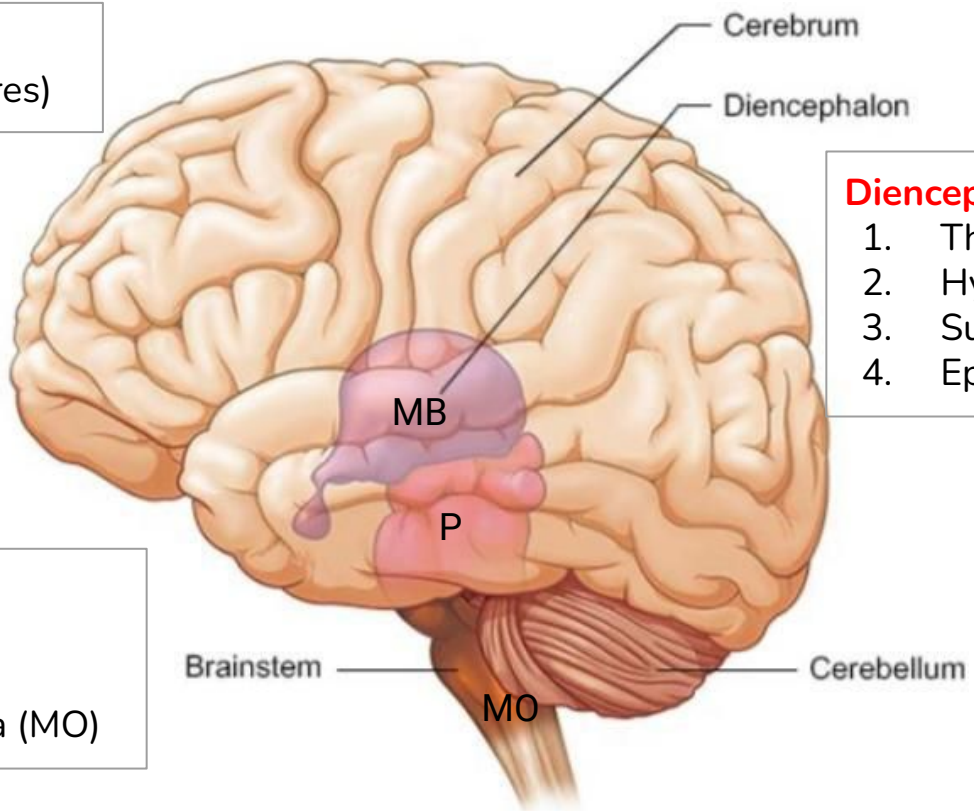
Note: Ganglia is a plural form, and Ganglion is the singular form

Brain

The brain is a large mass of nervous tissue located in the cranial cavity. It has **four major regions**:

Cerebrum (المخ):

- (2 Cerebral hemispheres)



Diencephalon (الدماغ البيني):

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

Brainstem (جذع الدماغ):

1. Midbrain (MB)
2. Pons (P)
3. Medulla oblongata (MO)

Cerebellum (المخيخ):

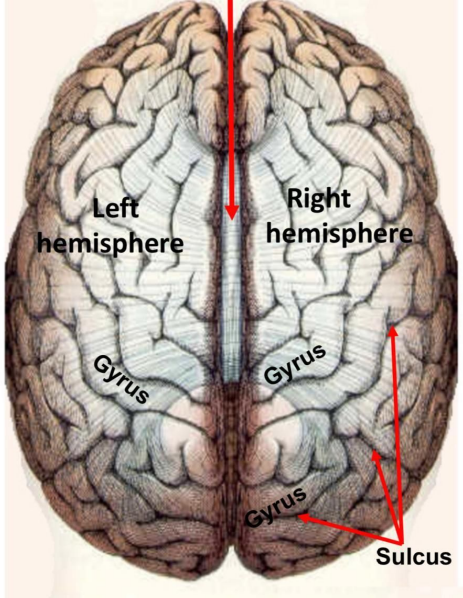
CEREBRUM

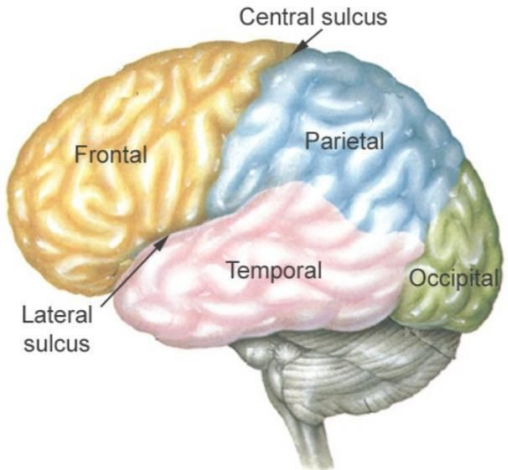
- The largest part of the brain, has two hemispheres
- The cerebral hemispheres are connected by a thick bundle of nerve fibers called corpus callosum
- The surface shows ridges of tissue, called gyri, separated by grooves called sulci

Note: One ridge called Gyrus
And one groove called Sulcus

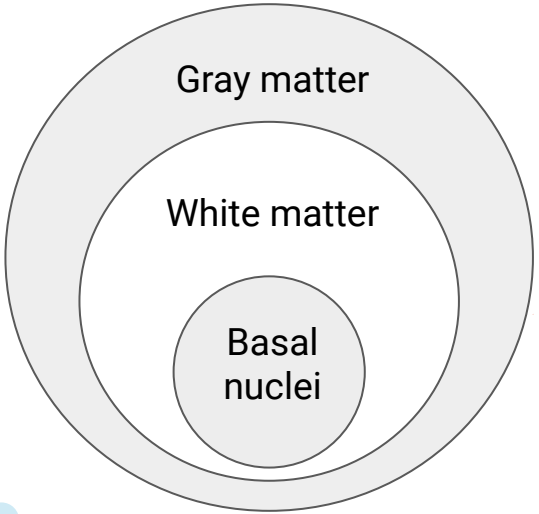
Cerebrum divided by deeper sulci, into 4 lobes (each hemisphere):

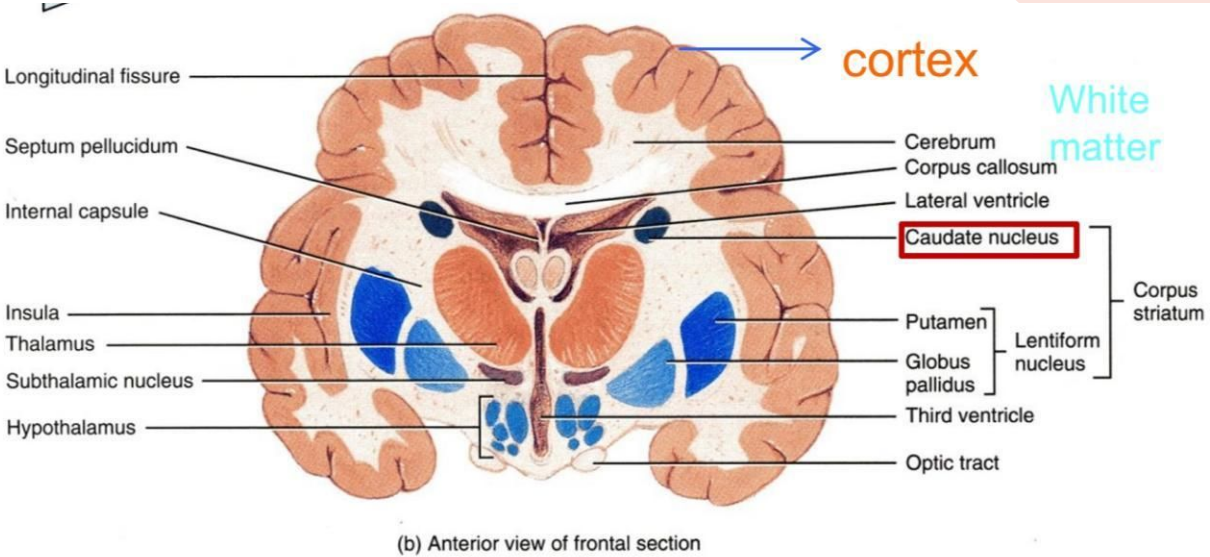
- Frontal
- Parietal
- Temporal
- Occipital





TISSUE OF THE CEREBRAL HEMISPHERES



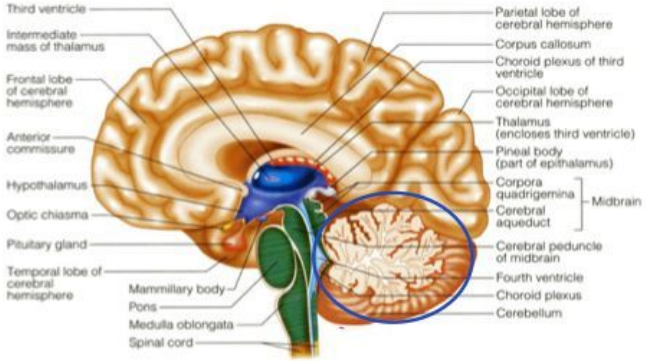


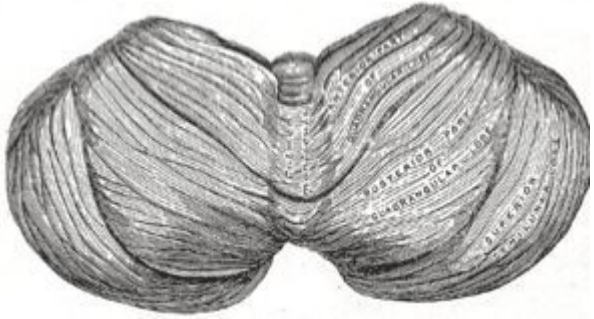
(b) Anterior view of frontal section

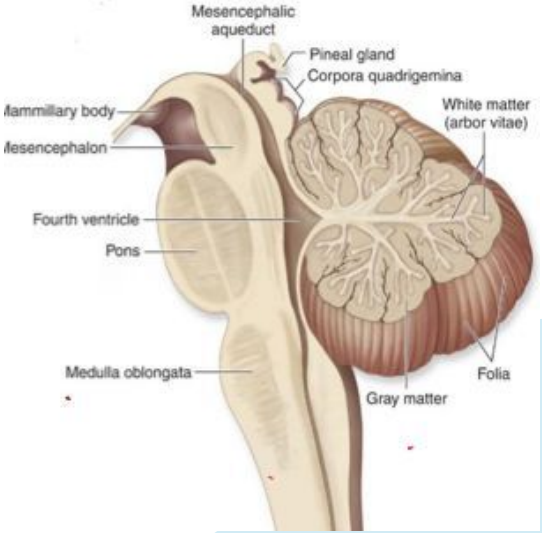
- The outermost layer is called gray matter or cortex
- Deeper is located the white matter, composed of fiber tracts (bundles of nerve fibers), carrying impulses to and from the cortex
- Located deep within the white matter are masses of grey matter called the basal nuclei . They help the motor cortex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

CEREBELLUM

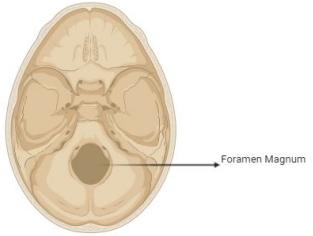
- The cerebellum (Like the cerebrum) has 2 hemispheres and a convoluted surface.
- It has an outer cortex of gray matter and an inner region of white matter (Also like the cerebrum).
- It provides precise coordination for body movements and helps to maintain equilibrium.

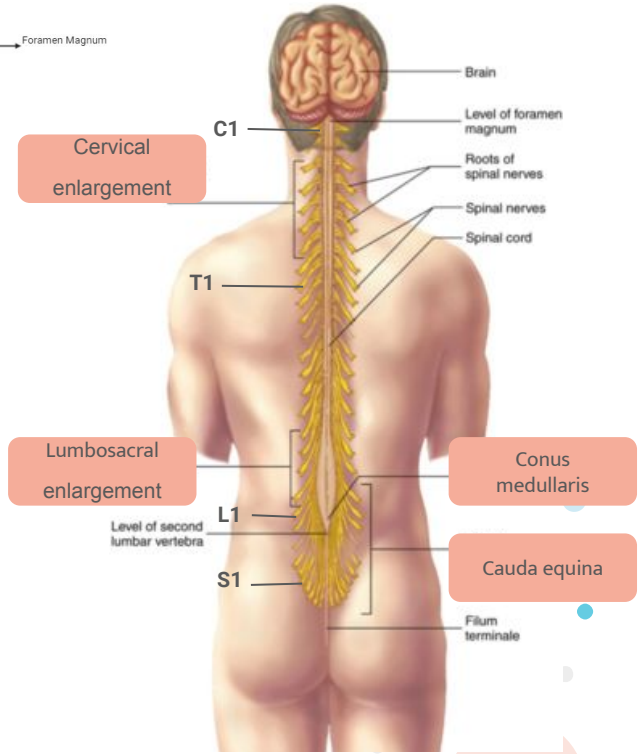






Spinal cord





- 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 (عشان عضلات اليد) and lumbosacral (عشان عضلات القدم) .
- Gives rise to 31 pairs of spinal nerves .
- Group of spinal nerves at the end of spinal cord is called cauda equina (يشبه ذيل الحصان)

Number of vertebrae: 33
Number of spinal nerves: 31

Cross section of spinal cord

The spinal cord is incompletely divided into two equal part:

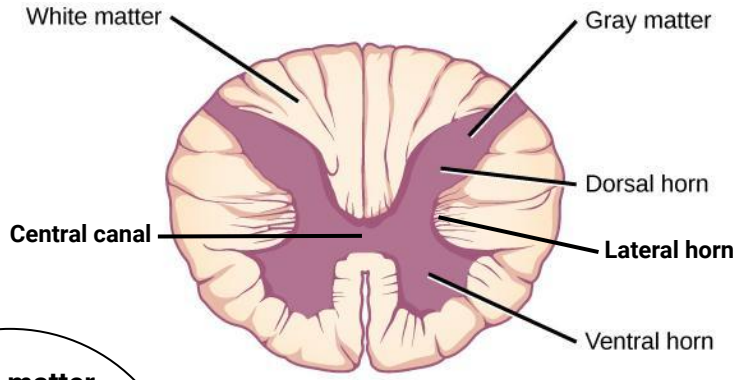
- Anteriorly by a short, shallow median fissure.
- Posteriorly by deep narrow median septum.

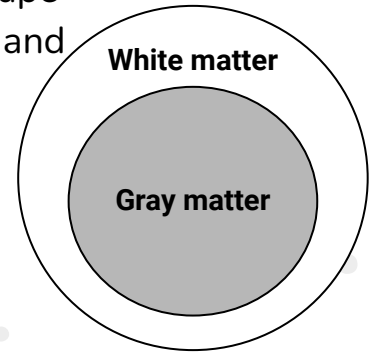
It is composed of grey matter in centre surrounded by white matter.

(cerebrum and cerebellum عكس)

The arrangement of grey matter resembles the shape of the letter H, having two posterior, two anterior, and two lateral horns/columns.

(the lateral horn is not found in all of the spinal cord)

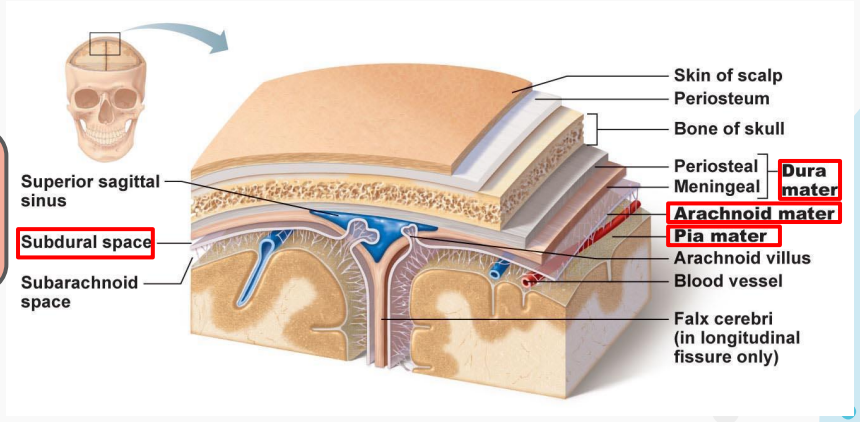




Protection of the CNS

The CNS is protected by:

- **Bones** — Skull and the vertebral column
- **Meninges** (membranes) 3 layers:
  - **Dura mater** (outermost)
  - **Arachnoid mater** (middle)
  - **Pia mater** (innermost)
- **Cerebrospinal fluid (CSF)** in the subarachnoid space

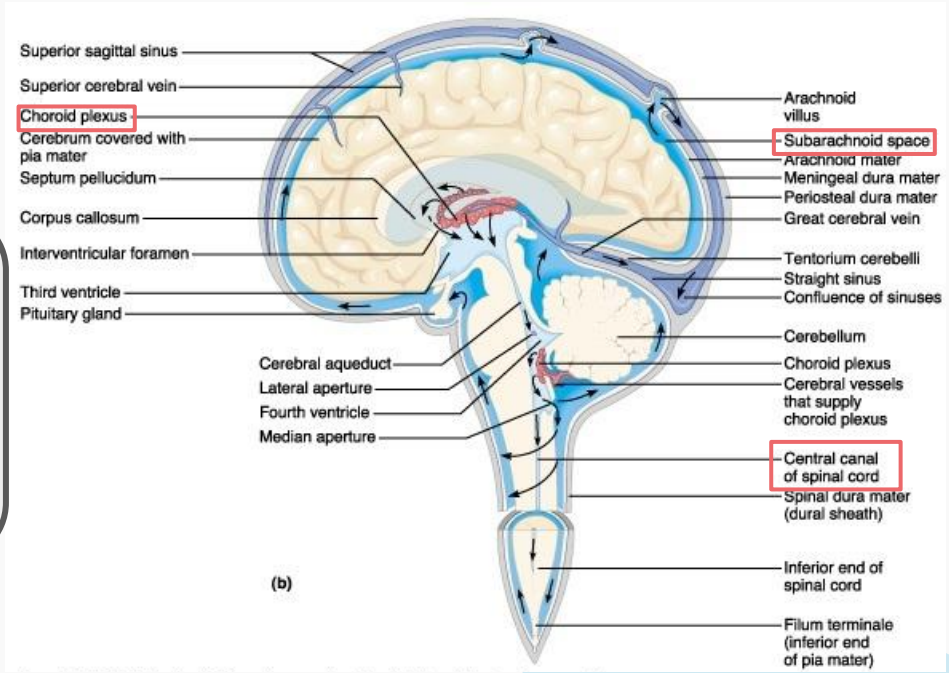


Cerebrospinal Fluid (CSF)

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

2- 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.

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

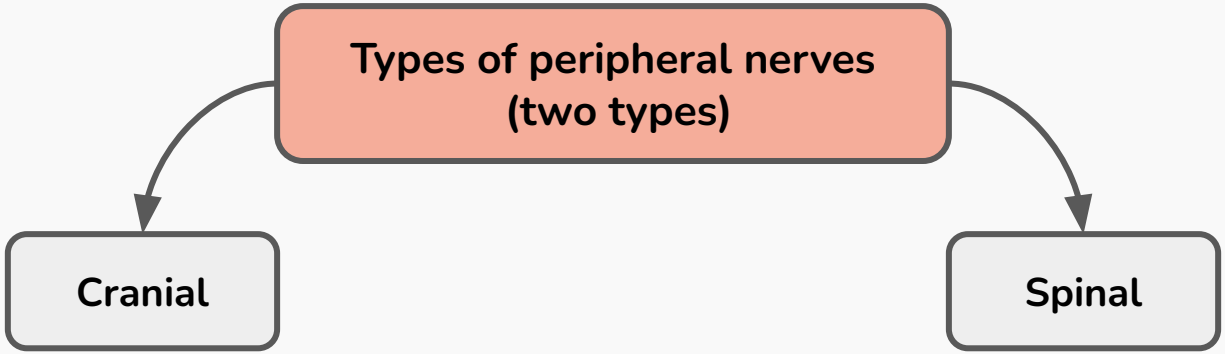


Helpful video

Peripheral Nerves

May be sensory, motor or mixed.

43 nerve pairs



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

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

(I) 1, (II) 2, (III) 3, (IV) 4, (V) 5, (VI) 6, (VII) 7, (VIII) 8, (IX) 9, (X) 10, (XI) 11, (XII) 12

Cranial nerves
12 pairs

CRANIAL NERVES MNEMONICS :
S-SENSORY , B-BOTH , M-MOTOR
SOME SAYS MONEY MATTERS BUT MY BROTHER SAYS BIG BRAIN MATTERS MOST
THE PAIRS:
ON OCCASION OUR TRUSTY TRUCK ACTS FUNNY VERY GOOD VEHICLE ANY HOW

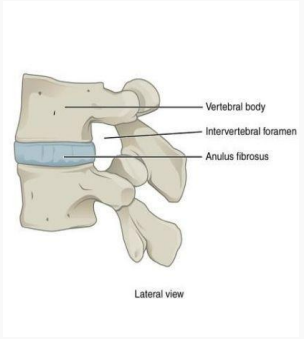
Mixed (4 pairs)
- trigeminal n. (5th)
- facial n. (7th)
- glossopharyngeal n. (9th)
- vagus n. (10th)

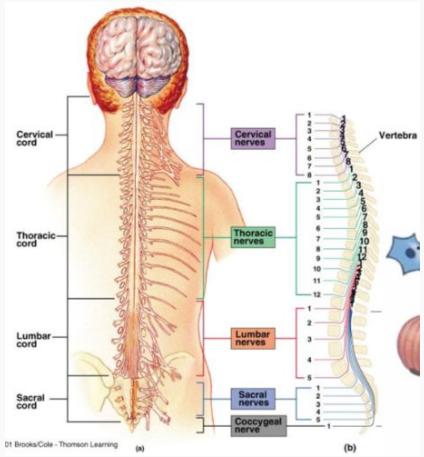
Motor (5 pairs)
- oculomotor n. (3rd)
- trochlear n. (4th)
- abducens n. (6th)
- accessory n. (11th)
- hypoglossal n. (12th)

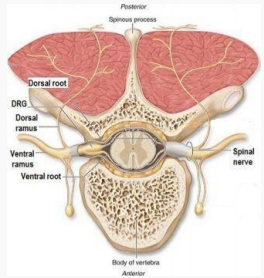
Sensory (3 pairs)
- olfactory n. (1st)
- optic n. (2nd)
- vestibulocochlear n. (8th)

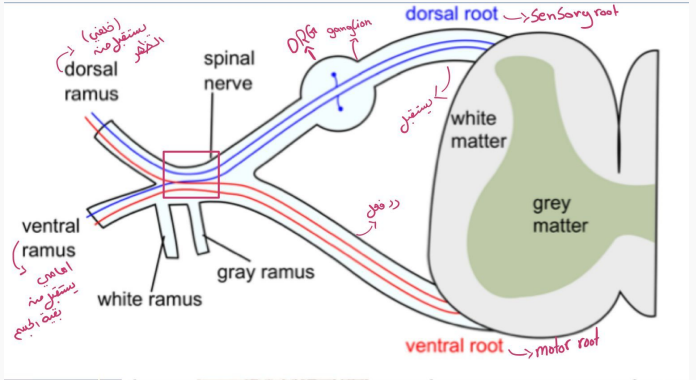
Spinal nerves and Nerve Plexuses

- 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.
- 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.



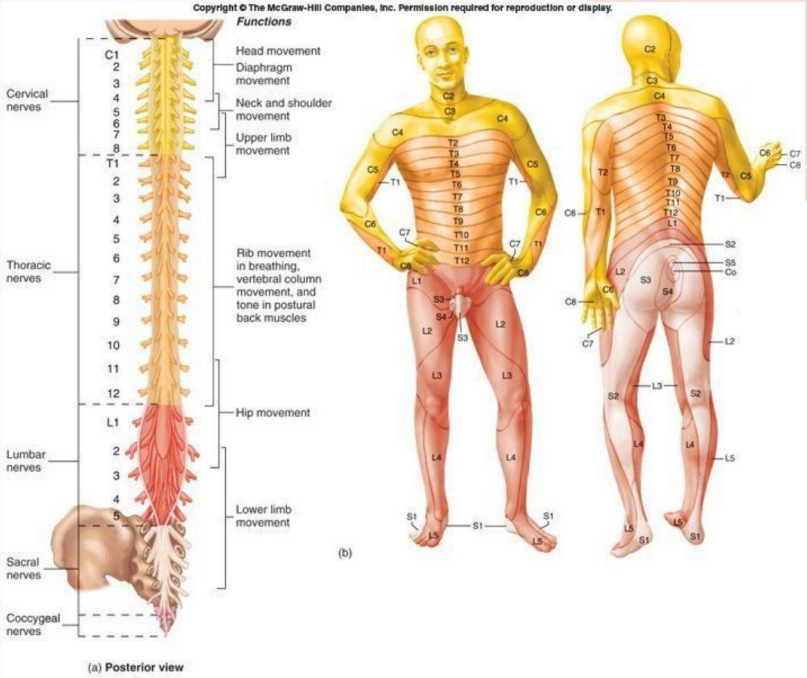






Dermatomes

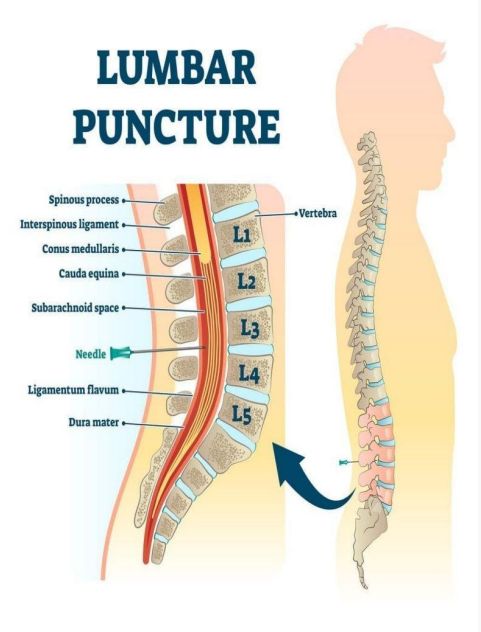
The segment of skin supplied by a segmental spinal nerve is called a ‘Dermatome’



THIS SLIDE IS IN GIRLS SLIDES ONLY

Diagnostic Lumbar Puncture

- It is one of the most commonly performed invasive tests in clinical medicine.
- Lumbar puncture (LP) occurs between L3-L4 vertebrae for CSF collection.
- It is essential for the diagnosis of inflammatory and infectious disease of the nervous system (as meningitis) and in cases of subarachnoid haemorrage.



MCQs:

1- The brain can be protected by:

A- meninges | B- cerebrospinal fluid | C- skull | D- all of above

2-From where is CSF produced?

A- Skull | B- Subarachnoid | C- Choroid plexuses | D- dural sinuses

3- How many are motor nerves in cranial nerves?

A- 3 pairs | B- 4 pairs | C- 5 pairs | D- 6 pairs

4- Where is central sulcus located between?

A- parietal and occipital | B-temporal and frontal | C- temporal and occipital | D- Frontal and parietal

5- What are masses of grey matter located deep within white matter in the brain called?

A- Basal nuclei | B- Brain stem | C- Pons | D- Choroid plexuses

6- Which one of these forms plexuses?

A- Dorsal root | B- Ventral root | C- Dorsal ramus | D- Ventral ramus

1- D
2- C
3- C
4- D
5- A
6- D

Team Leaders

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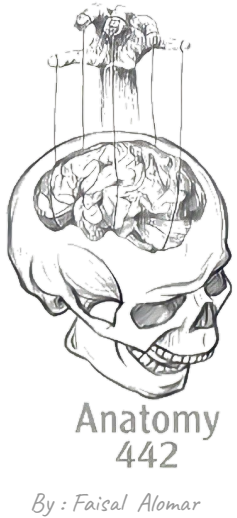

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