

Color code:

- Important
- Term
- Female notes
- Male notes
- Extra explanation



Anatomy

Lecture 3:

Nervous System



هذا العمل لا يغني عن المصدر الأساسي للمذاكرة

Objectives



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.

Functions

- ▶ There are three functions for the nervous system:

1. Collection of Sensory Input.

- ▶ Identifies the changes (Stimuli)
- ▶ using a sensory receptor.
- ▶ The sensory here is (ears)

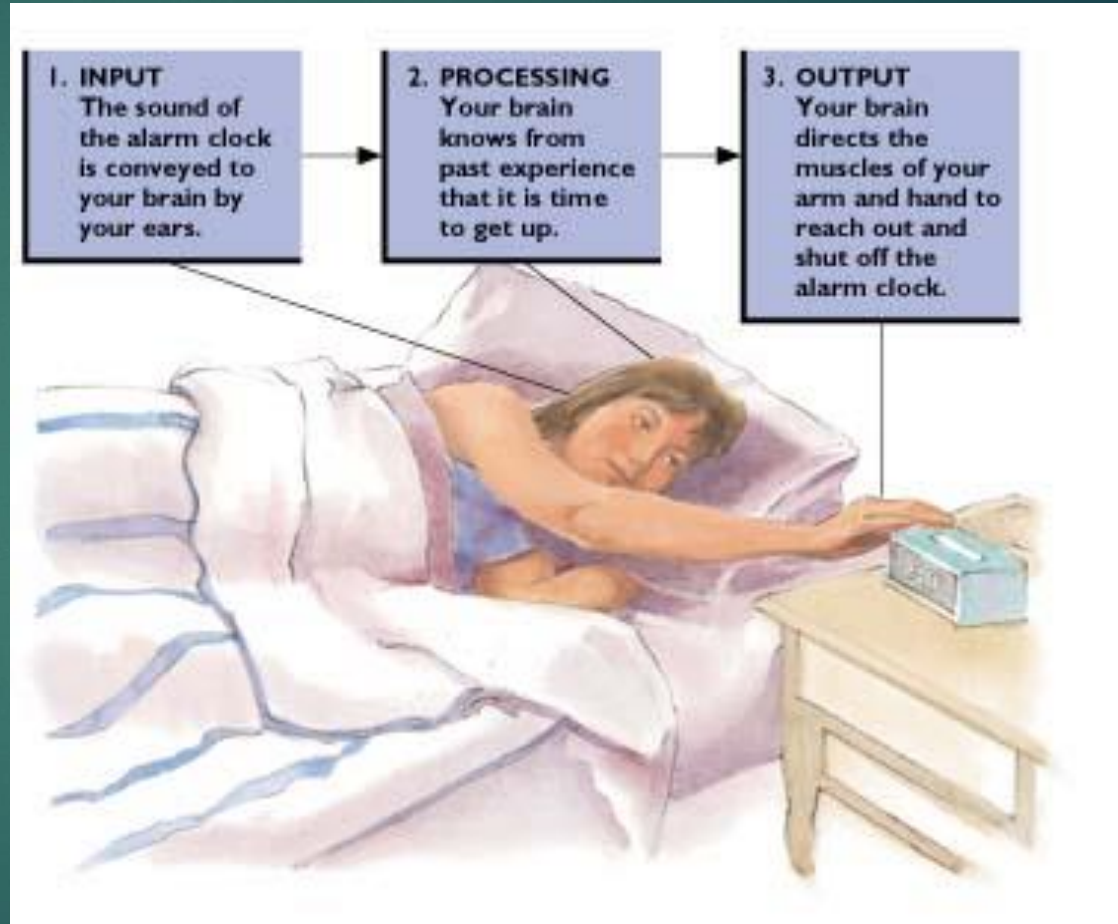
2. Integrations.

The **CNS** processes, analyses and interprets the changes and make a decision

3. Motor Output.

- ▶ It effects response by the muscle or glands (effectors).
- ▶ The effectors here is (the muscle of your (hand and arm))

Give a response according to the type of stimulation



ORGANIZATION

1) STRUCTURAL

Central Nervous System (CNS)

Peripheral Nervous System (PNS)

Brain & Spinal Cord

Nerves & Ganglia

2) Functional

AUTONOMIC (VISCERAL) nervous system

PNS

SOMATIC Nervous system

SENSORY DIVISIONS (AFFERENT)

MOTOR DIVISIONS (EFFERENT)

SENSORY DIVISIONS (AFFERENT)

MOTOR DIVISIONS (EFFERENT)

SYMPATHATIC (FIGHT OR FLIGHT)

PARASYMPATHATIC (REST AND RELAX)

STILL DIDN'T GET IT ? [CLICK HERE](#)

NERVOUS TISSUE

Nervous tissue is organized as :

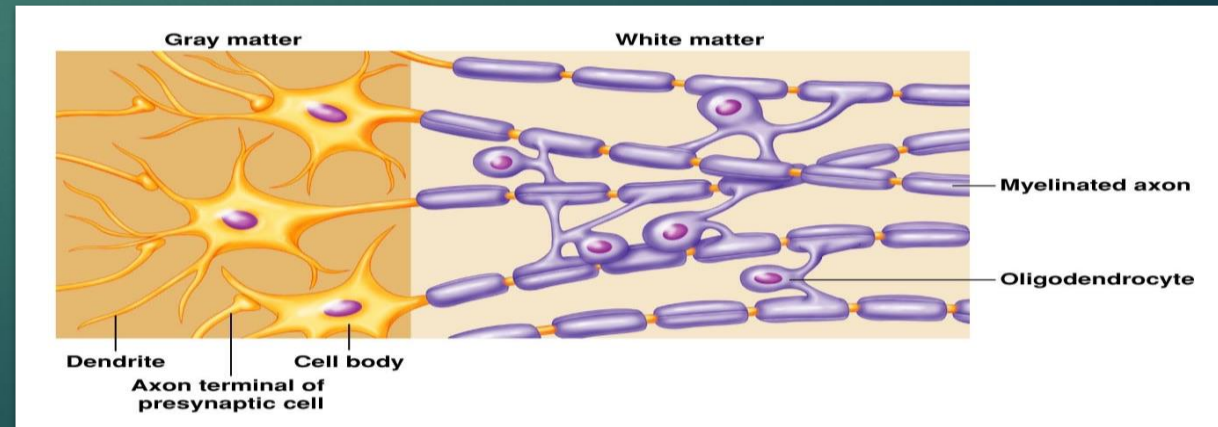
1) **Gray matter**: which contains the cell bodies and the short **processes** of the neurons, the neuroglia and the blood vessels.

2) **White matter**: which contains the long **processes** of the neurons (**no cell bodies**), the neuroglia and the blood vessels.

كلمة **processes**

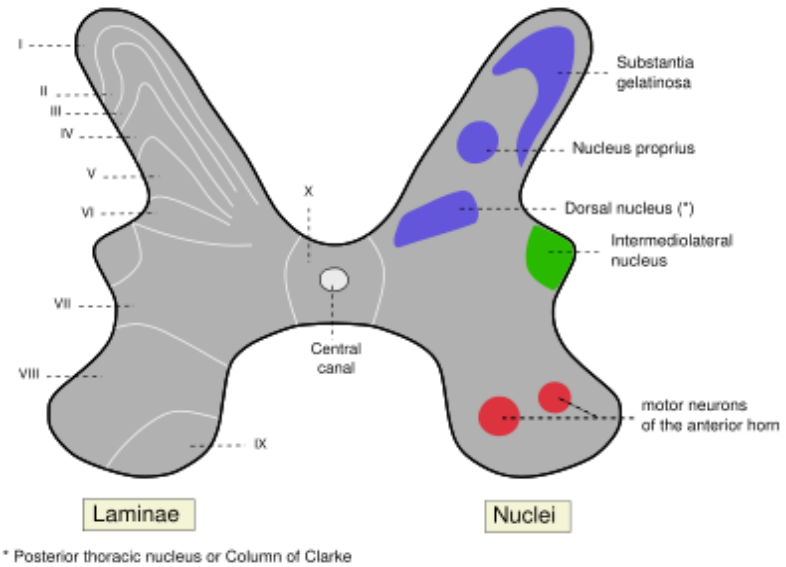
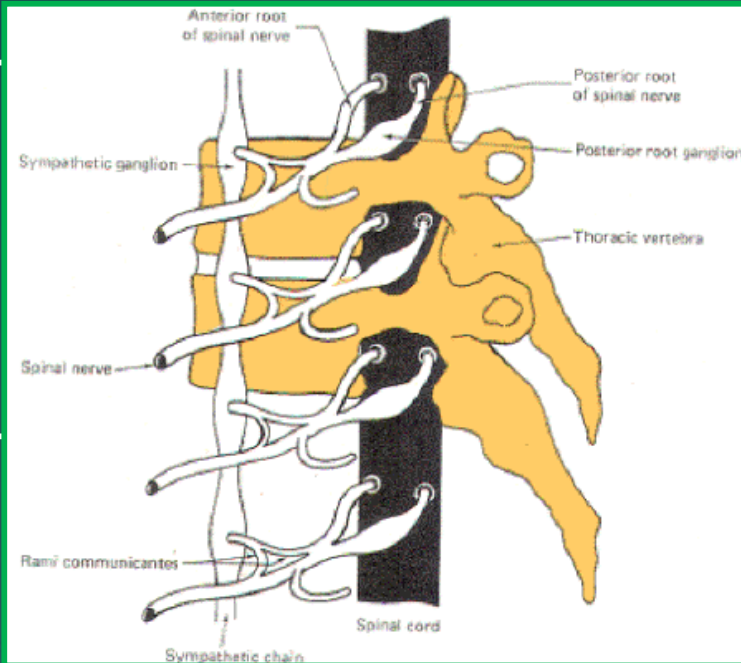
لا تعني إجراءات أو عمليات
بروسس هنا تعني امتدادات سواء
الدين درايتس في السل بودي أو الأكسن
في الوايت ماتر

- White matter is **actually grey** but appears white due to myelin sheath produced by oligodendrocytes



Ganglion

A group of neurons outside the CNS

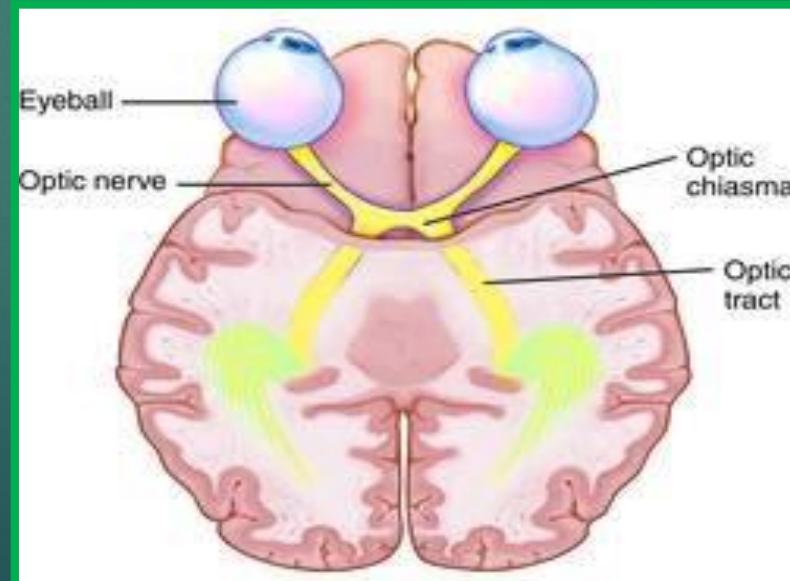
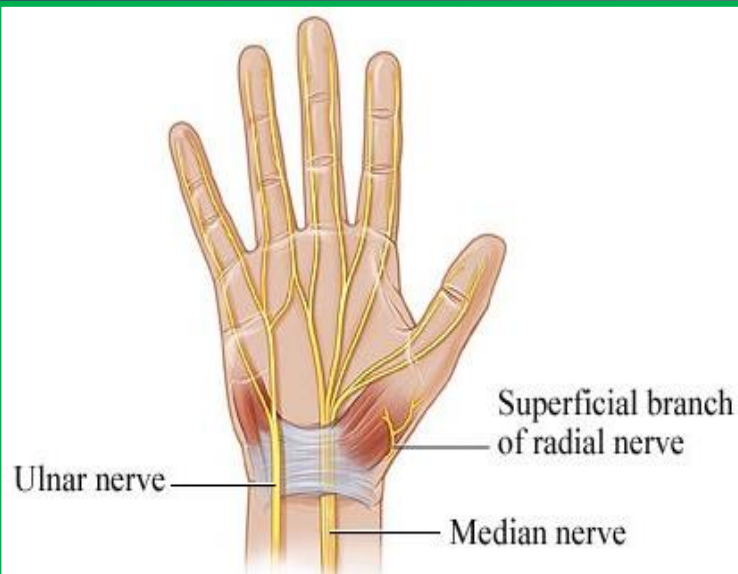


Nucleus

A group of neurons within the CNS

Nerve

A group of nerve fibers (axons) outside the CNS



Tract

A group of nerve fibers (axons) within the CNS

NEROUNS

It is a nerve cell that is the basic building block of the nervous system

Neurons transmission occur by chemical rather than electrical means.

Did you know that human nervous system is estimated to contain about 10^{10}

They use action potential to release chemicals that known as neurotransmitters: Ach and norepinephrine

FUNCTION

They receive incoming information from

A) Dendrites

B) Soma

C) Axon

A sensory receptors that bring electrical signals to the cell body

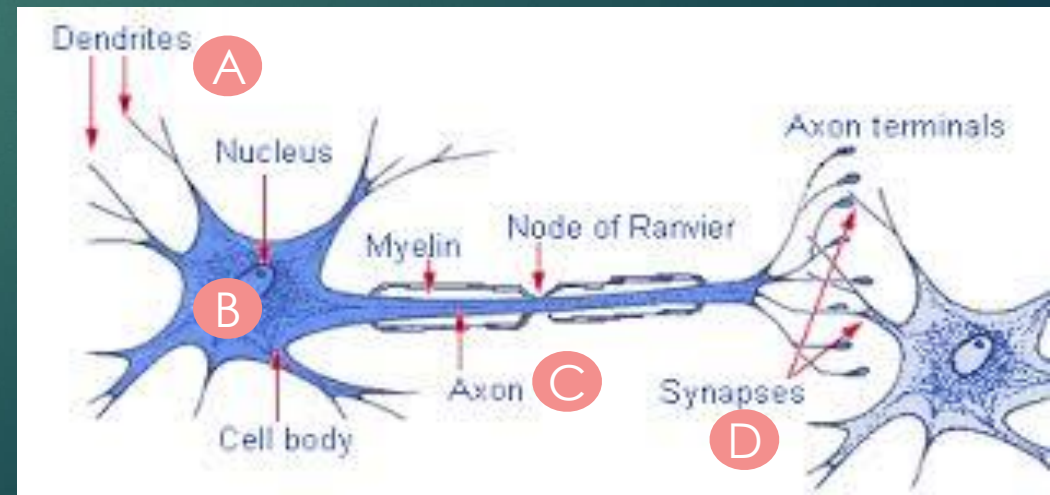
single cell body from which a variable number of branching processes emerge.

Take information and transmit it to other neuron or effector organs.

At the end of the axon, specializations called terminal buttons occur.

Now the information transferred to the dendrites of other neurons.

D) Synapses: specialized regions at which Information is passed between neurons.



It's the "housekeeper" because it performs functions such as clearing out debris and excess materials. Glial cells support neurons by providing support and nutrition

Function

Definition

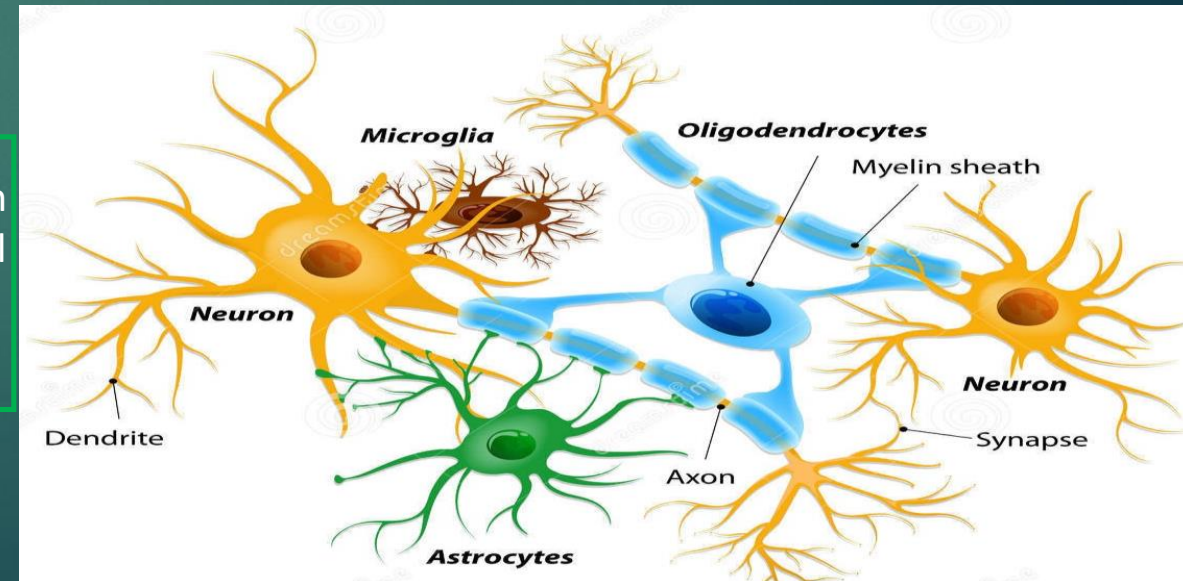
It's specialized connective tissue for the nervous system

Neuroglia (Glial cells)

Types:

- 1) **Oligodendrocytes**: they form the myelin sheath, which increases rate of conduction.
- 2) **Microglia**: have a phagocytic role in response to nervous system damage.
- 3) **Astrocytes**: provide biochemical support for endothelial cells that form the blood-brain barrier

Neuroglia do not have a direct role in info processing but they are essential for the normal functioning of nerve cells.



هناك أنواع مختلفة أخرى من
النيوروكليا تساعد النيرون
لتحسين وتسريع الوظيفة.

CNS

THE BRAIN

Is a large mass of nervous tissue located in the cranial cavity

There are **FOUR MAJOR** regions:

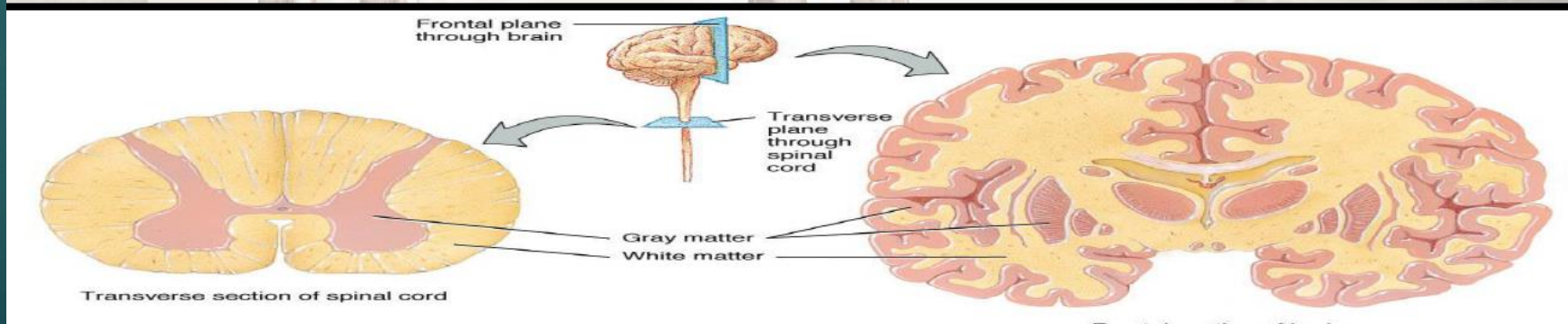
1) Cerebral hemisphere or (Cerebrum)	2) Diencephalon:	3) Cerebellum	4) Brain stem
<p>1)The largest part of the brain, and has <i>two hemispheres</i>.</p> <p>2)The cerebral hemispheres are connected by a thick bundle of nerve fibers called <i>Corpus Callosum</i>.</p> <p>The surface shows ridges of tissue, called <i>Gyri*</i>, separated by grooves called <i>Sulci</i>.</p>	<p>1)It divided into four parts:</p> <ul style="list-style-type: none">A) EpithalmusB) SubthalmusC) HypothalmusD) Thalmus <p>2)Location: Lies between the cerebrum and the brainstem</p> <p>3)Function: Regulates visceral activities and the autonomic nervous system</p>	<p>1)The cerebellum has 2 hemispheres and a convoluted surface.</p> <p>2)It has an outer cortex made from gray matter and an inner region of white matter.</p> <p>3)It provides precise coordination for body movements and helps maintain equilibrium.</p>	<p>1)It divided into three parts:</p> <ul style="list-style-type: none">A) MIDBRAINB) PonsC) Medulla oblongata <p>2)Functions:</p> <ul style="list-style-type: none">A)It produces the rigidly programmed, autonomic behaviors necessary. (e.g. Sleep cycle, Breathing and Heart Rate.)B) Provides the pathway for fibers tracts running between higher and lower neuronal centers.
<p>Divided into 4 lobes by deeper groves</p> <p>1) Parietal 2) Occipital 3) Temporal 4)Frontal</p>		<p>Function: In charge of maintaining equilibrium.</p>	

*Contains the functioning parts of the Cerebrum.

*For further information about Diencephalon: [CLICK HERE](#)

Cross Section of The Brain and Spinal Cord

	The Brain		Spinal Cord
	Cerebrum	Cerebellum	
Cortex "Outer layer "	Gray mater	Gray mater	White mater
Medulla "Inner layer"	White mater	White mater	Gray mater
Extra Note	<p>The basal nuclei: are masses of grey matter located deep within the white matter. They help the motor cortex in the regulation of voluntary motor activities</p>	<p>Cerebellum has the function of providing precise coordination for body movements and helps maintain equilibrium</p>	<p>The arrangement of gray matter resembles the shape of the letter H, having 2 posterior, 2 anterior and 2 lateral horns</p>



*This slide has been taken from 434 anatomy's team work

CNS

Spinal Cord

Is a 42-45 cm long cylindrical bundle of nerve fibers and associated tissue which continuous above with medulla oblongata and lies within the vertebral canal

It is a two-way conduction pathway to the brain & a major reflex center

Extends from **foramen magnum*** to **L2 vertebra**

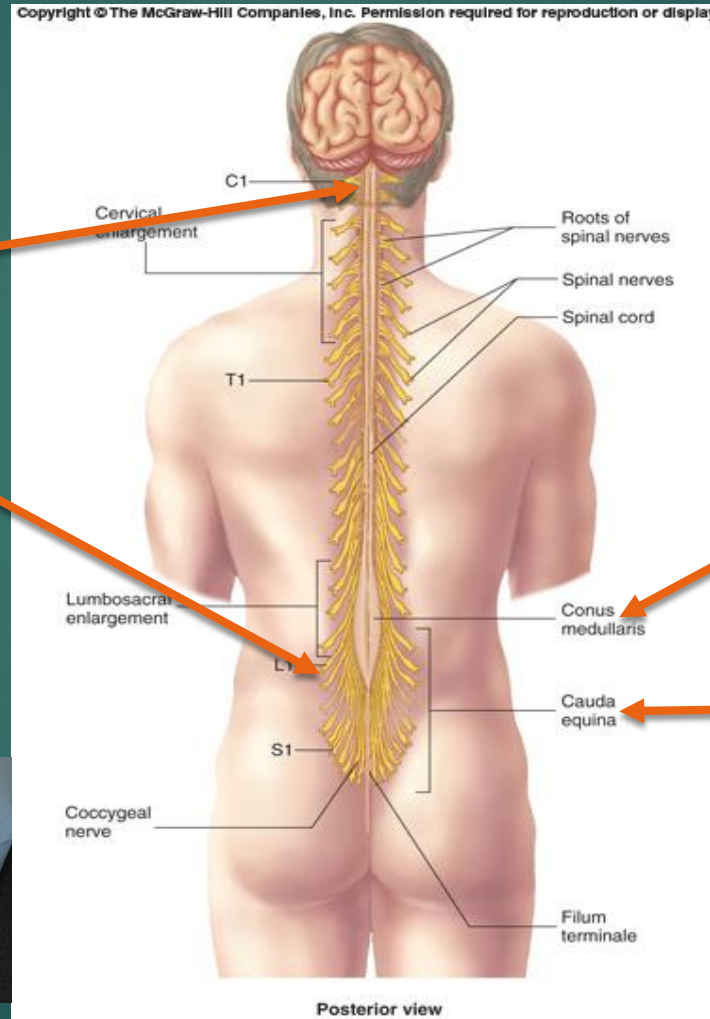
Has 2 enlargements: **cervical** and **lumbosacral**

EXTRA INFORMATION

During an **epidural** the painkiller will be injected into the small part of your back, apparently in the disc between L2 and L3

WHY?

Because the end of spinal cord is at L1.



Gives rise to 31 pairs of **spinal nerves**

Caudal tapering end is called **conus medullaris**

Group of spinal nerves at the end of the spinal cord is called **cauda equina**

EXTRA INFORMATION

Why is there a group of spinal nerves at the end of the spinal cord? Because these nerves give supply to the upper & lower limbs. (would have more white & gray matter)

*Foramen magnum is the largest groove in the skull

PNS

May be sensory, motor or mixed (both sensory and motor)

It divided into two

CRANIAL (brain nerves)

A) 12 pairs B) Named and numbered from 1 -12

TO MAKE IT EASY: MEMORIZE THIS due to numbers

Oh, Oh, Oh, To Take A Family Vacation!

Go Vegas After Hours

❖ 12 pairs

❖ 4 pairs are mixed

- ❖ trigeminal n. (5th) → Facial sensation and chewing
- ❖ facial n. (7th) → Facial expression
- ❖ glossopharyngeal n. (9th) → Swallowing, taste and saliva
- ❖ vagus n. (10th) → Control of PNS e.g. smooth muscles of GI tract

❖ 5 pairs are motor

- ❖ oculomotor n. (3rd) → Moves eyelid and eyeball
- ❖ trochlear n. (4th) → Moves eyeballs
- ❖ abducent n. (6th) → Moves eyeballs
- ❖ accessory n. (11th) → Moving head & shoulders, swallowing
- ❖ hypoglossal n. (12th) → Tongue muscles - speech & swallowing

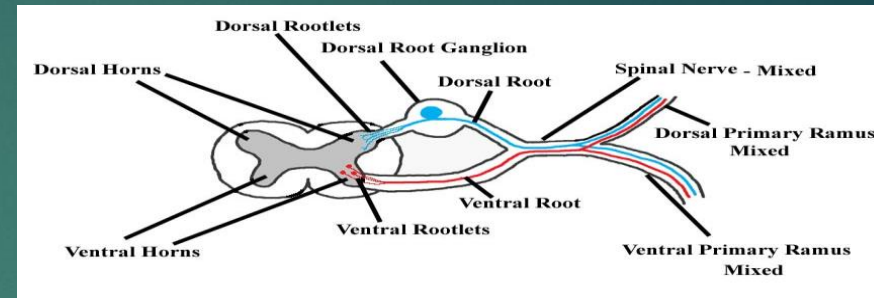
❖ 3 pairs are sensory

- ❖ olfactory n. (1st) → Smell
- ❖ optic n. (2nd) → sight
- ❖ vestibulocochlear n. (8th) → Auditory

SPINAL (spinal cord nerves)

A) 31 pairs B) Named and numbered according to the region of Spinal Cord

Each spinal nerve is attached by two roots:



1) DORSAL root
(SENSORY)

2) VENTRAL root
(MOTOR)

Dorsal root bears a sensory ganglion

Each spinal nerve exits from the intervertebral foramen and divides into a dorsal and ventral ramus

1-Dorsal Rami:

Distributed individually
Supply the skin and the muscles of the back

2-Ventral Rami:

Form plexuses **except in thoracic region**
where intercostal nerves are formed
Supply the anterior part of the body

The rami contain both sensory and motor fibers

Q1: Which statement(s) of the following is CORRECT?



- 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.

Q2:What's the difference between the Ventral ramus & Ventral root?

Ventral ramus is mixed.
Ventral root is motor

Q3: What's the difference between the Dorsal ramus & Dorsal root?

Dorsal ramus is mixed.
Dorsal root is sensor.

✓	✗
<i>Oligodendrocytes they form the myelin sheath that surrounds many neuronal axons, which increase the rate of conduction.</i>	<i>Nucleus is a group of neurons within the PNS</i>
<i>Information is passed between neurons at specialized regions called synapses</i>	<i>In the Brain, grey matter located in the center and surrounded by white matter.</i>
	<i>Cerebrum provides precise coordination for body movements and helps maintain equilibrium.</i>
	<i>Diencephalon provides the pathway for fibers tracts running between higher and lower neuronal centers.</i>

What is Dermatome ?



It is the segment of the skin supplied by one spinal nerve

Protection of CNS

1) BONE STRUCTURE

Skull and the vertebral column

2- Meninges (membrane)

Composed of three layers

Dura mater (The outermost membrane)

The thickest layer

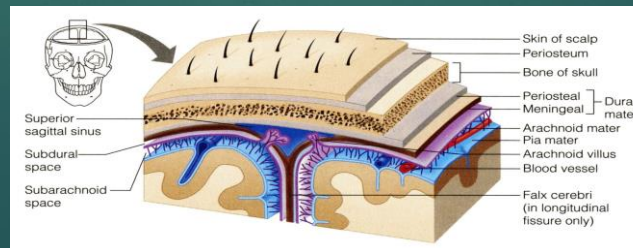
Arachnoid mater (The middle membrane)

Pia mater (the innermost membrane)

3- Cerebrospinal fluid (CSF)

Found in subarachnoid space

Usually used to diagnose some diseases.



CEREBRAL FLUID

A

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

B

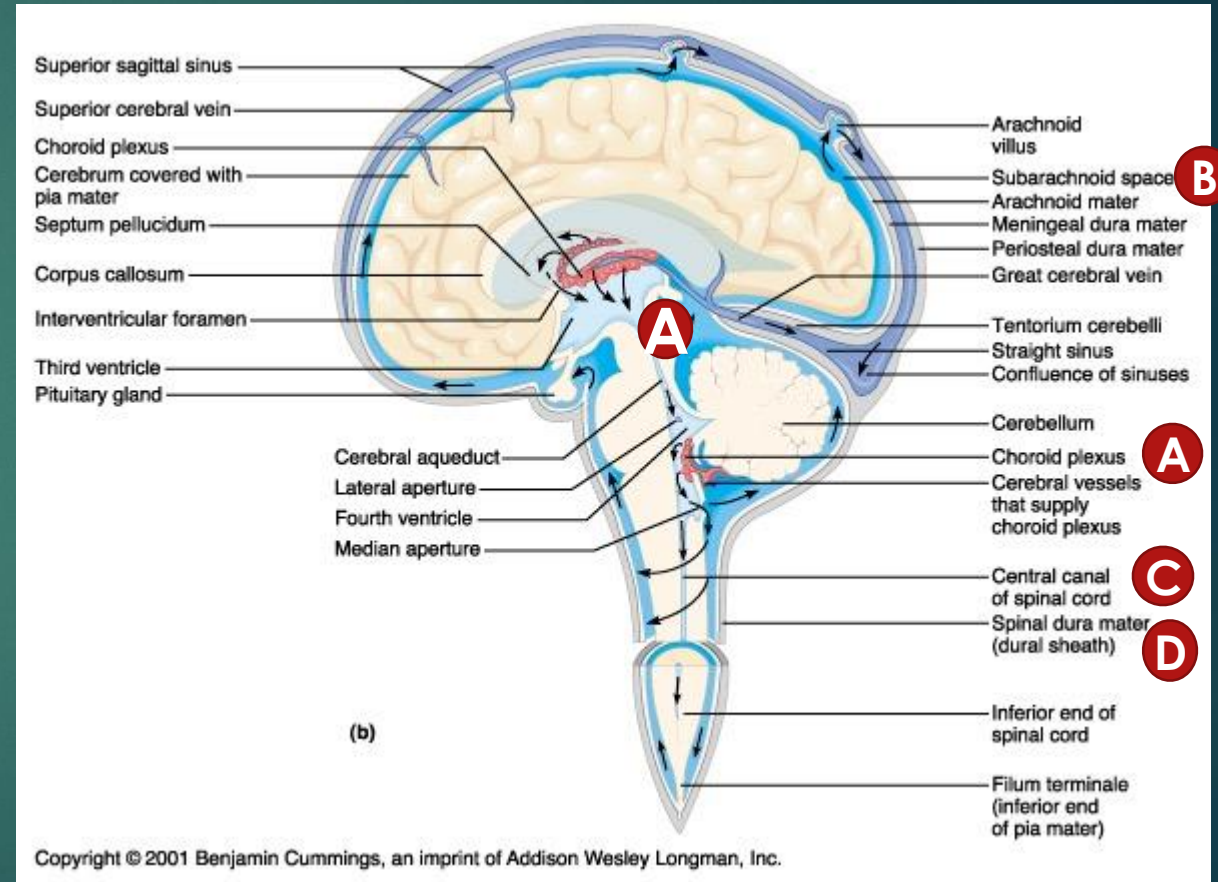
Most of the CSF drains from the ventricles into the **subarachnoid space** around the brain and spinal cord.

C

A little amount flows down in the **central canal** of the spinal cord.

D

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



***Plexuses** is a network of nerves or vessels in the body.

*The **ventricular system** is a set of four interconnected cavities (ventricles) in the brain, where the (CSF) is produced.

Some websites that can help you with Anatomy :

www.Innerbody.com

<https://www.biodigitalhuman.com/default.html>

<http://www.medicalmnemonics.com/cgi-bin/browse.cfm>

<http://www.getbodysmart.com/index.htm>

<https://www.onlineexambuilder.com/anatomy-nervous-system/exam-36310>

<https://www.onlineexambuilder.com/nervous-system/exam-36516>

Apps that you can download :

- ❖ Essential Skeleton 3.
- ❖ Skeletal System 3D Anatomy Lt.
- ❖ Anatomy Learning 3D Atlas.

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Fahad AlAbdulateef
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Ibrahim AlSuhaim