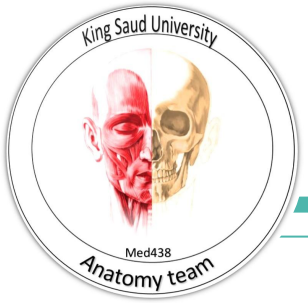


MED438
KING SAUD UNIVERSITY

NERVOUS SYSTEM

Foundation block - Anatomy - Lecture 3

Reviewed by Razan AlRabah & Khalid Alkhani

Objectives

Color guide :
Only in boys slides in **Green**
Only in girls slides in **Purple**
important and doctors note in **Red**
Extra information in **Blue**

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

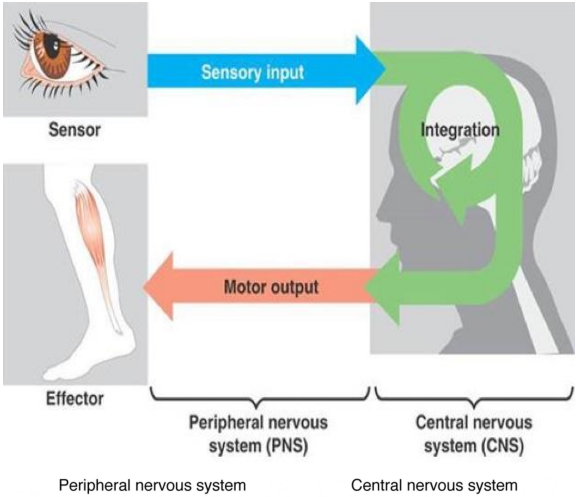
- List the subdivisions of the nervous system.
- Define the terms: grey matter, white matter, nucleus,ganglion, tract and nerve.
- List the parts of the brain.
- Identify the external and internal features of spinal cord.
- Enumerate the cranial nerves.
- Describe the parts and distribution of the spinal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

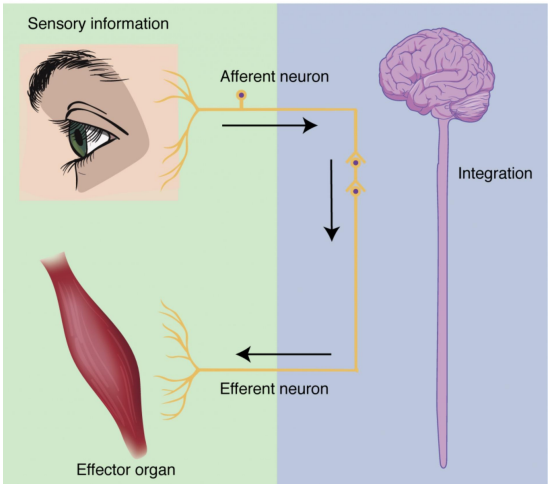
Functions of The Nervous system

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

2-Integration(التنسيق والمعالجة): (CNS) processes, analyses and interprets changes, then makes decisions.

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





Structural organization

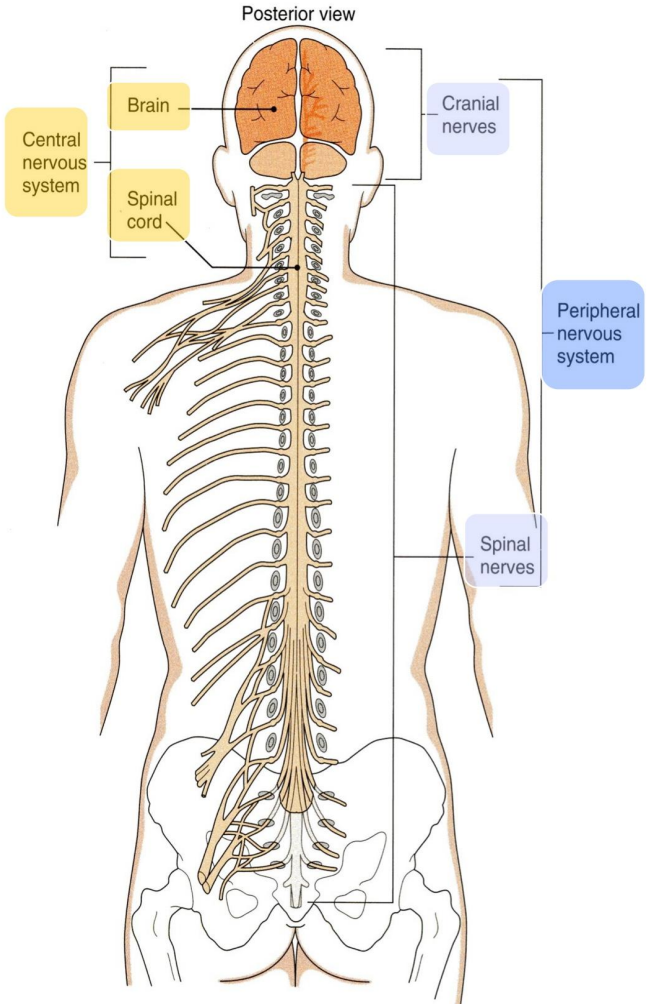
-Central nervous system (CNS):

Brain & spinal cord

-Peripheral nervous system (PNS):

<u>Nerves</u> & Ganglia

-Cranial nerves
-Spinal nerves

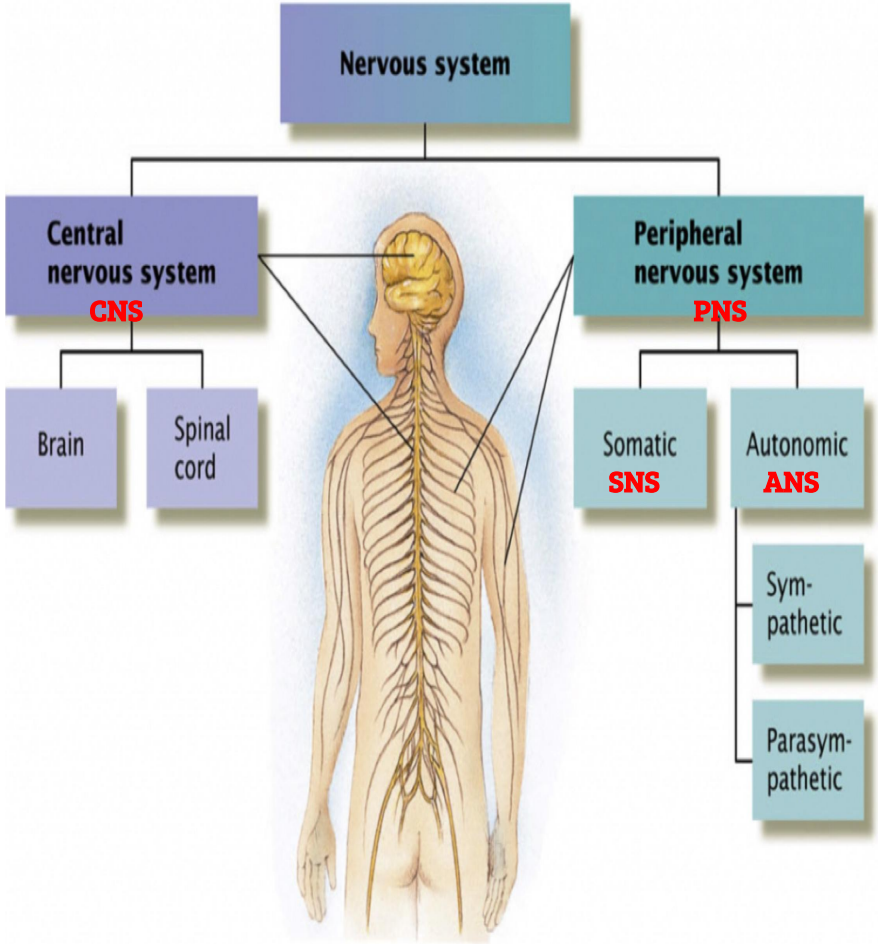


Functional Organization

-Sensory division (afferent)

-Motor division (Efferent)

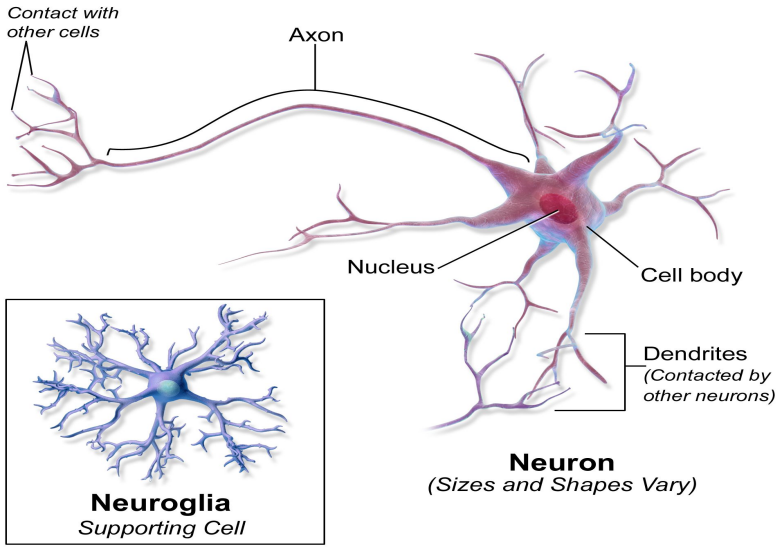
- autonomic(visceral)
- Somatic



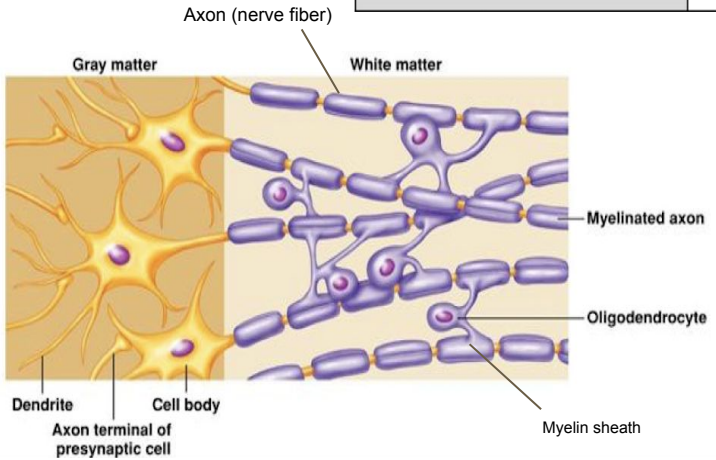
Nervous Tissue

Nervous Tissue consists of:
Nerve cells (neurons) + Supporting cells (neuroglia).
Which are organised into white matter and grey matter.

Grey Matter	White Matter
Cell Bodies	No cell bodies
Short process of the neurons	Long process of the neurons
Neuroglia	Neuroglia
Blood Vessels	Blood vessels



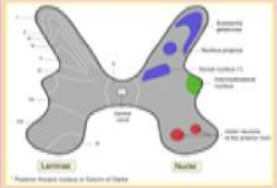
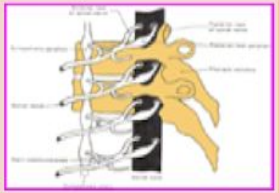
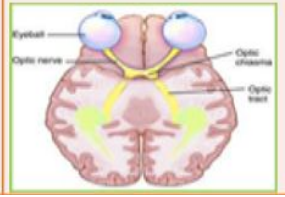
Neural Tissue



Always remember that ..

- **Nucleui:**
  Is a group of neurons within the CNS.
- **Ganglia:**
  Is a group of neurons outside the CNS.

- **Tract:**
  Is a group of nerve fibers (axons) within the CNS.
- **Nerve:**
  Is a group of nerve fibers (axons) outside the CNS.

	Inside CNS	Outside CNS
Group of neurons	Nuclei 	Ganglia 
Group of nerve fibers (axons)	Tract 	Nerve 

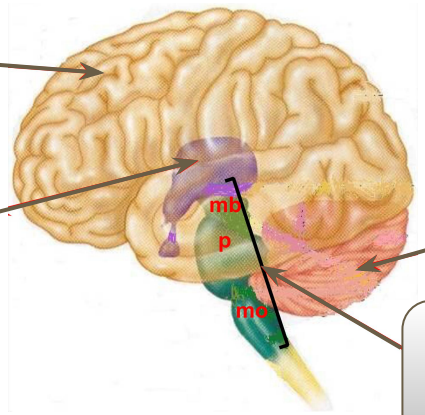
The Brain

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

It has four major regions:

Cerebrum:
Has 2 cerebral hemispheres

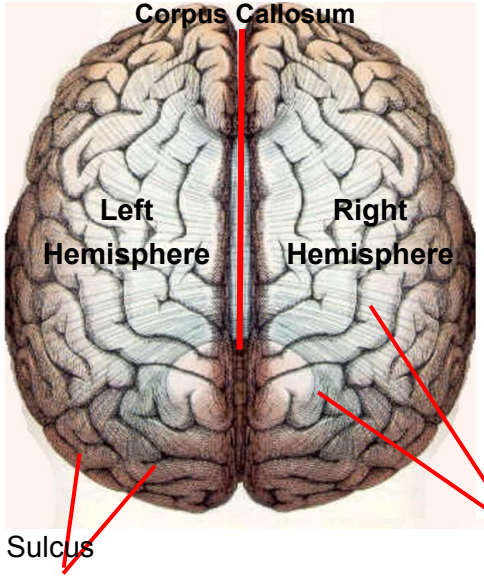
Diencephalon:
- Thalamus
- Hypothalamus
- Subthalamus
- Epithalamus



Cerebellum

Brainstem:
- Midbrain
- Pons
- Medulla oblongata

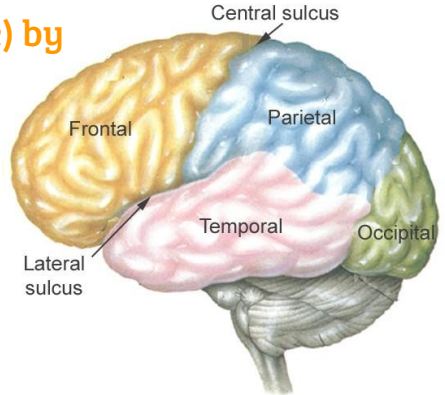
Cerebrum



- 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, separated by grooves called sulci.

Divided (each hemisphere) by **deeper** sulci, into 4 lobes:

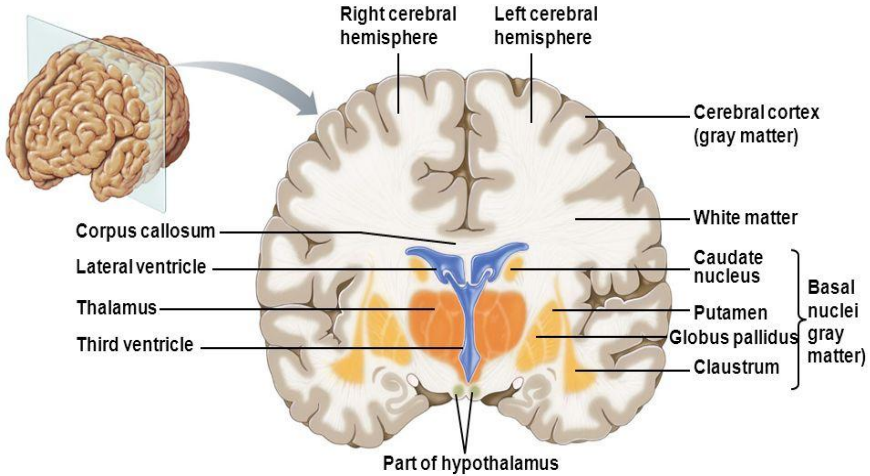
1. Frontal
2. Parietal
3. Temporal
4. Occipital



Note: the cerebrum is folded in order to give more surface space and increase the number of neurons.

Tissue of The Cerebral Hemispheres

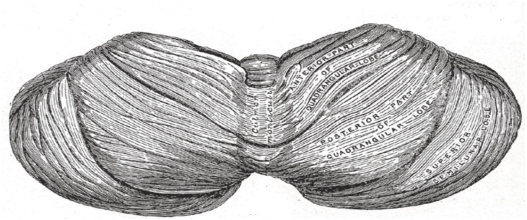
- Outermost layer is called **gray matter** or **cortex**.
- Deeper located is the **white matter**, composed of **fiber tracts** (bundles of nerve fibers), carrying impulses to and from the cortex.
- Located deep within the **white matter** are **masses of grey matter** called the **basal nuclei** .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

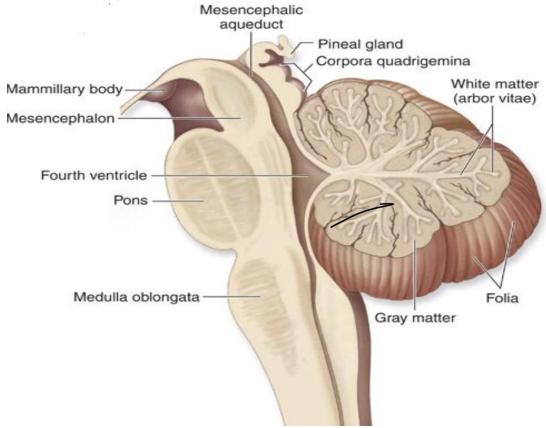


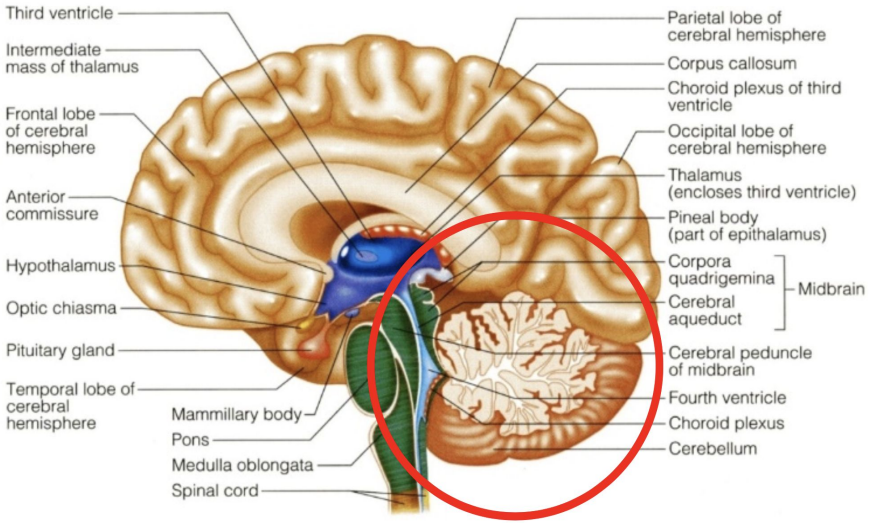
Important note :(Basal nuclei) can called also (Basal ganglia)

Cerebellum

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**.





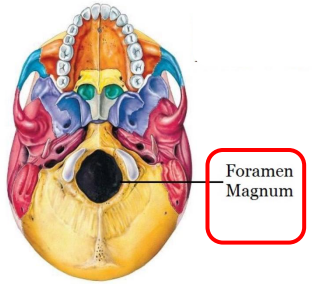


Cerebllum

Spinal cord

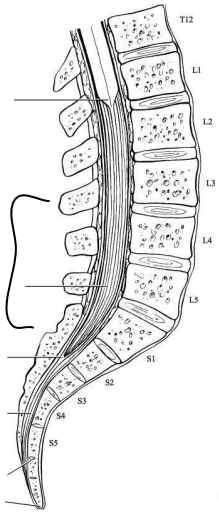
- It is a two-way conduction pathway to the brain & a major reflex center.
- 42-45 cm long, cylindrical shape(اسطواني), lies within the vertebral canal.
- Extends from foramen magnum (فتحة أسفل الجمجمة) to L2 vertebra

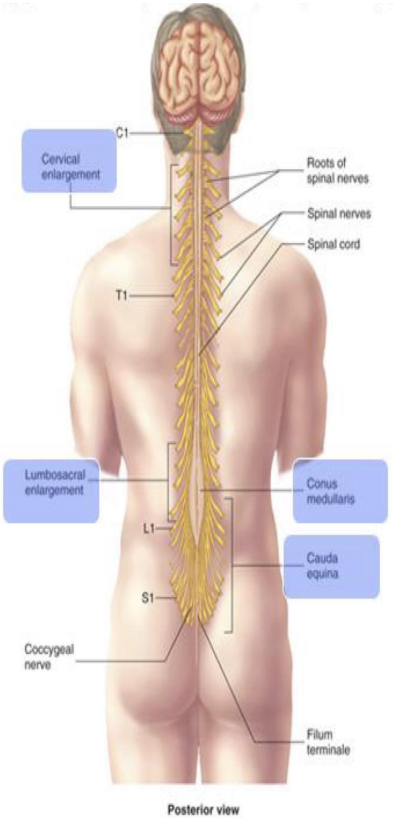
  Note : The spinal cord is extended to L2 vertebra but in children it extends to L3 vertebra because their vertebral column is smaller/shorter.
- Continuous above with medulla oblongata.
- Caudal tapering end is called conus medullaris. It's in the (CNS) if it's damaged, it's never regenerated
- Has 2 enlargements: cervical and lumbosacral (عشان منطقة الأطراف).
- 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 regentrat



conus medullaris
نهاية الحبل الشوكي

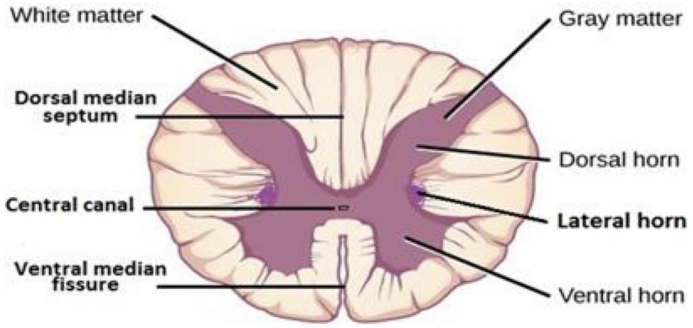
cauda equina
امتداد الأعصاب بعد
نهاية الحبل الشوكي





Helpful video
https://youtu.be/qB6WPr5Jhc4

Cross Section of Spinal Cord



It is incompletely divided into two equal parts:

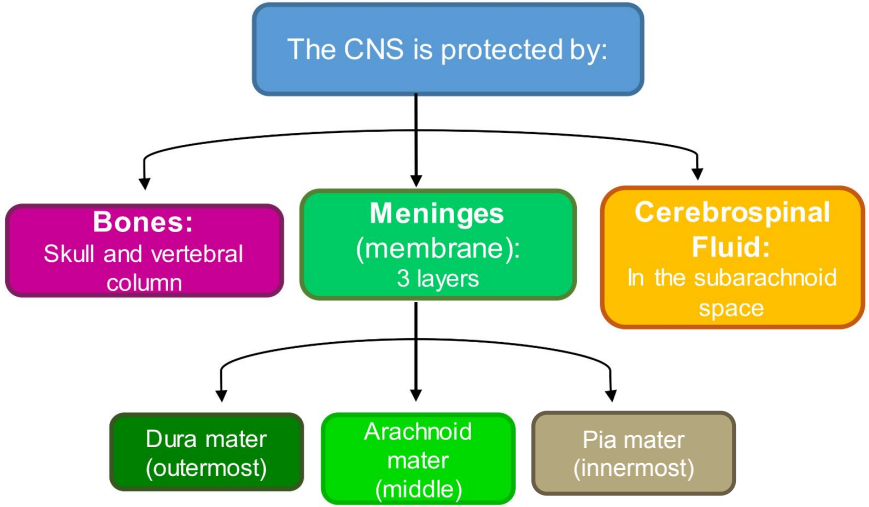
- anteriorly by a short, shallow median fissure.
- posteriorly by a deep, narrow median septum.

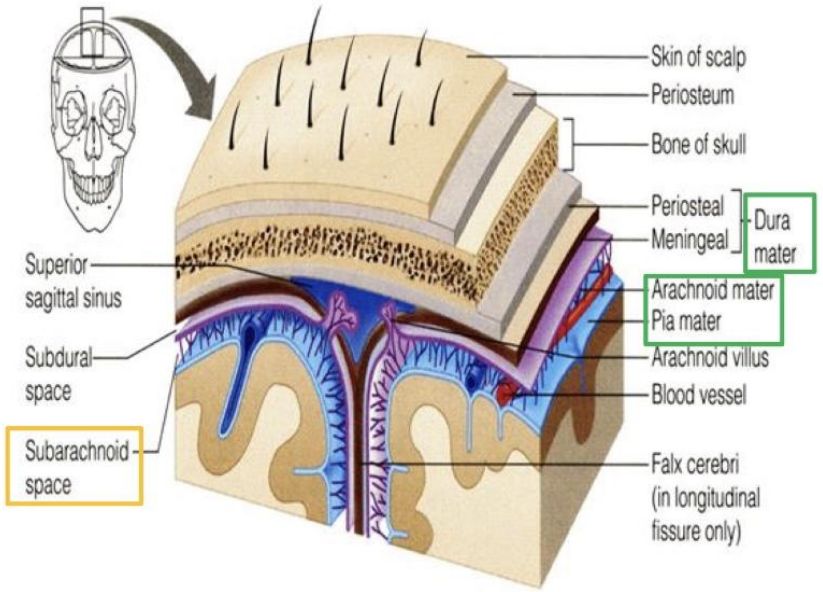
It is composed of **grey matter** in the center surrounded by **white matter**.
(cerebrum و cerebellum عكس ال)

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

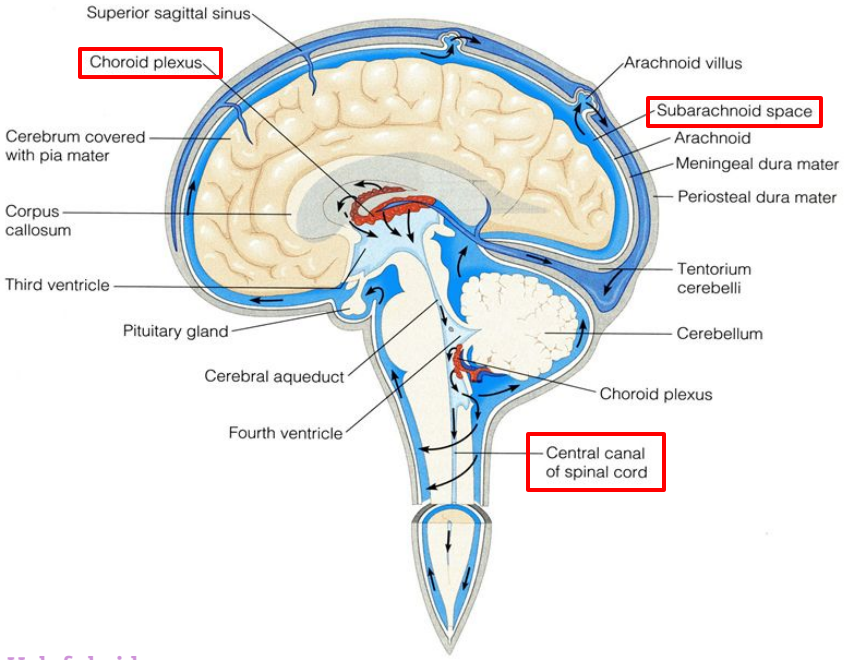
	The brain		Spinal cord
	Cerebrum	Cerebellum	
Cortex “outer layer”	Gray matter		White matter
Medulla “inner layer”	White matter		Gray matter

Protection of CNS:





Cerebrospinal Fluid (CSF)



Cerebrospinal Fluid (CSF) is constantly produced by the choroid plexuses inside the ventricles of brain.

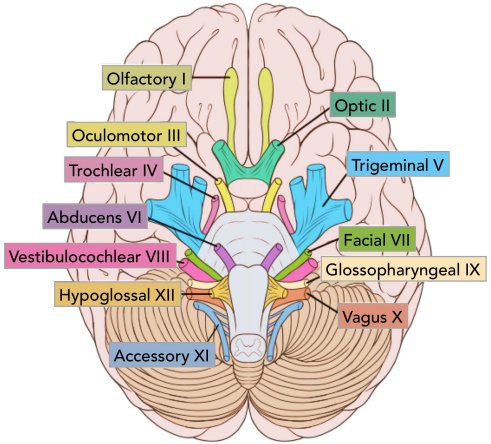
Most of the CSF drains from the ventricles into the subarachnoid space around the brain and spinal cord. A little amount flows down in the central canal of the spinal cord.

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

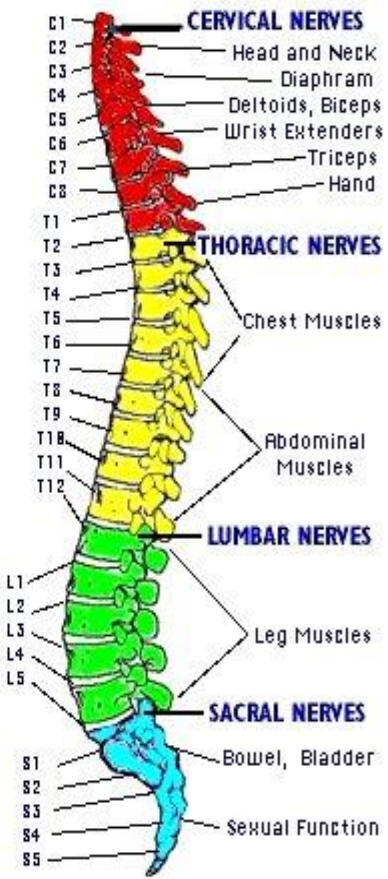
Helpful video
https://www.youtube.com/watch?v=7B1w6lDw-yM

Peripheral Nerves

- May be sensory, motor or mixed.
- Two types:



Cranial	Spinal
12 pairs	31 pairs
Attached to the brain	Attached to the spinal cord
Named & numbered from 1-12	Named & numbered according to the region of the spinal cord

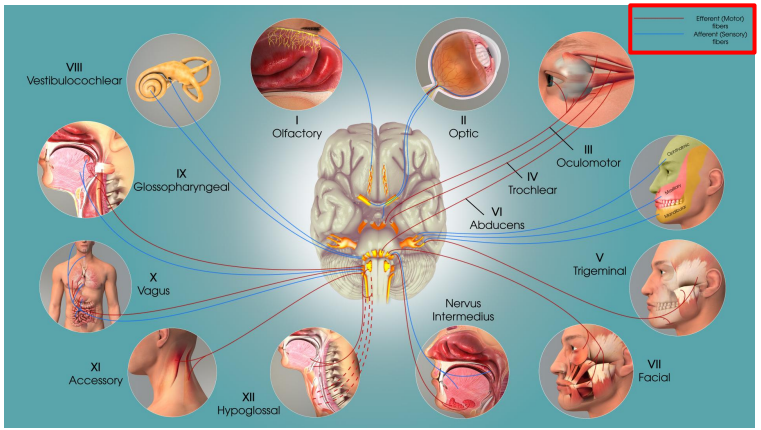


Cranial Nerves

- 12 pairs: 3 pairs are sensory, 5 pairs are motor, and 4 pairs are both.

	name	type	num.	function غير مطلوبين به فقط لزوجته للفهم والربط*
O	Olfactory n.	S	1	Smell
O	Optic n.	S	2	Sight
V	Vestibulocochlear n.	S	8	Auditory
T	Trigeminal n.	B	5	Facial sensation and chewing
F	Facial n	B	7	Facial expression
G	Glossopharyngeal n.	B	9	Swallowing, taste and salvia
V	Vagus n.	B	10	Control of PNS e.g. smooth muscles of GI tract
O	Occulomotor n.	M	3	Moves eyelid and eyeball
T	Trochlear n.	M	4	Moves eyeballs
A	Abducent n.	M	6	Moves eyeballs
A	Accessory n.	M	11	Moving head & shoulders, swallowing
H	Hypoglossal n.	M	12	Tongue muscles - speech & swallowing

S=sensory , B=both , M=motor



TO MAKE IT EASY: MEMORIZE THIS due to numbers
Oh, Oh, Oh, To Take A Family Vacation!
Go Vegas After Hours

Note: functions are extra information.

(EXTRA) Mnemonics to memorise cranial nerves

CRANIAL NERVE MNEMONIC

S = Sensory M = Motor B = Both

O Olfactory	O On	S Some
O Optic	O Old	S Say
O Oculomotor	O Olympus	M Marry
T Trochlear	T Towering	M Money
T Trigeminal	T Tops	B But
A Abducens	A A	M My
F Facial	F Finn	B Brother
A Acoustic	A And	S Says
G Glossopharyngeal	G German	B Bad
V Vagus Nerve	V Viewed	B Business
S Spinal	S Some	M Marry
H Hypoglossal	H Hops	M Money

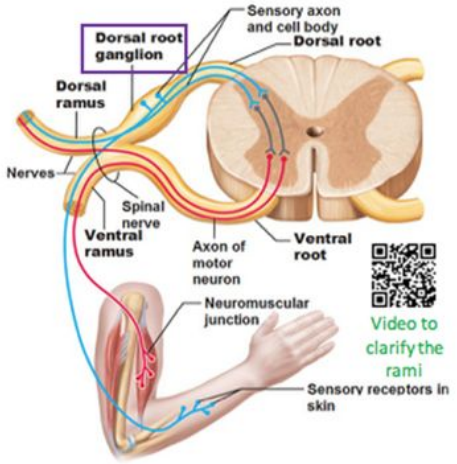
@doctordconline

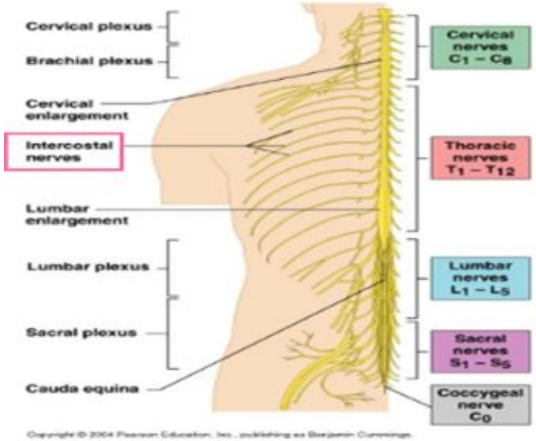
On	Olfactory (CN*I)	Sensory	Some
Occasion	Optic (CN II)	Sensory	Say
Our	Oculomotor (CN III)	Motor	Marry
Trusty	Trochlear (CN IV)	Motor	Money
Truck	Trigeminal (CN V)	Both**	But
Acts	Abducens (CN VI)	Motor	My
Funny	Facial (CN VII)	Both	Brother
Very	Vestibulocochlear (CN VIII)	Sensory	Says
Good	Glossopharyngeal (CN IX)	Both	Big
Vehicle	Vagus (CN X)	Both	Brains
Any	Accessory (CN XI)	Motor	Matter
How	Hypoglossal (CN XII)	Motor	More

Spinal Nerves and Nerve Plexuses

Made up of **31 pairs,** each spinal nerve is attached to two roots: **dorsal (sensory)** and **ventral (motor).**

- Dorsal roots bear a ***sensory ganglion (DRG)***.
- Each spinal nerve exits from the ***intervertebral foramen*** which is then divided into dorsal and ventral **ramus**.
- The rami **(single = ramus)** contain both sensory and motor fibers, **roots have pure nerves, but trunks have mixed nerves**.
- The **dorsal rami** are distributed individually supply the skin and muscles of the **back.**
- The ventral rami form plexuses **(ضفائر)** (except in thoracic region where they form intercostal nerves), which supply the **anterior** part of the body.

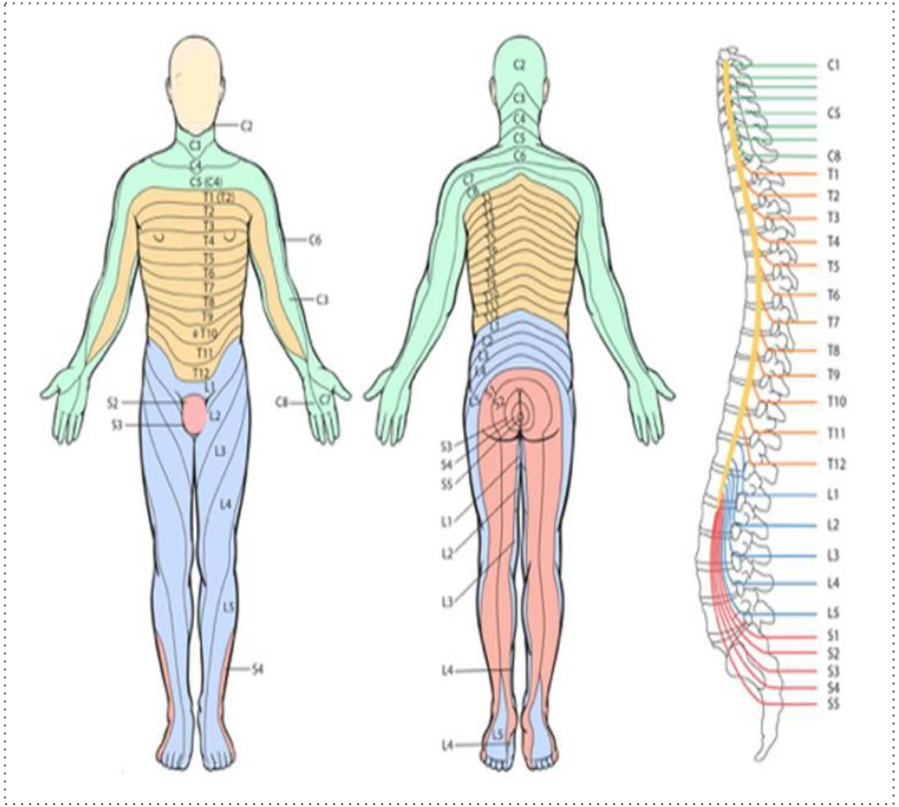




Dermatomes:

The segment of skin supplied by a segmental spinal nerve is called “Dermatome”

كل جزء من الحبل الشوكي مختص بجزء محدد من الجلد كل من هذه الأعصاب ينقل الإحساس (بما في ذلك الألم) من الجلد إلى الدماغ

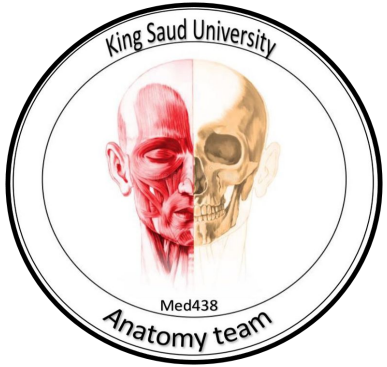


Test Yourself... (True or False)

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. CSF is drained into the dural sinuses through the arachnoid villi.
4. Cerebrum provides precise coordination for body movements and helps maintain equilibrium.
5. Each spinal nerve exits from the intervertebral foramen and divides into a dorsal and ventral ramus.
6. The dorsal rami form plexuses .
7. Dermatome is a segment of skin supplied by one spinal nerve.
8. CSF is produced by the choroid plexuses inside the ventricles of brain.
9. The rami contain only sensory fibers.

Answers : 1-F(CNS) 2-F(spinal cord) 3-T 4-F(Cerebellum) 5-T 6-F(ventral) 7-T 8-T 9-F(both sensory and motor)

A special thanks to the 436 anatomy team, who inspired our work.



Good luck to you all

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