MEDICINE
KING SAUD UNIVERSITY

بسم الله الرحمن الرحيم

ANATOMY
TEAM 436

Nervous System

THIRD LECTURE

KEY

- Doctor's slides
- Notes/extra explanation
- Important
- Only on boys'/girls' slides

هذا العمل لا يغني عن المصدر الأساسي للمذاكرة

Objectives

- List the subdivisions of the nervous system.
- Define the terms: grey matter, white matter, nucleus, ganglion, tract and nerve.
- Define the terms neurons, neuroglia
- 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.

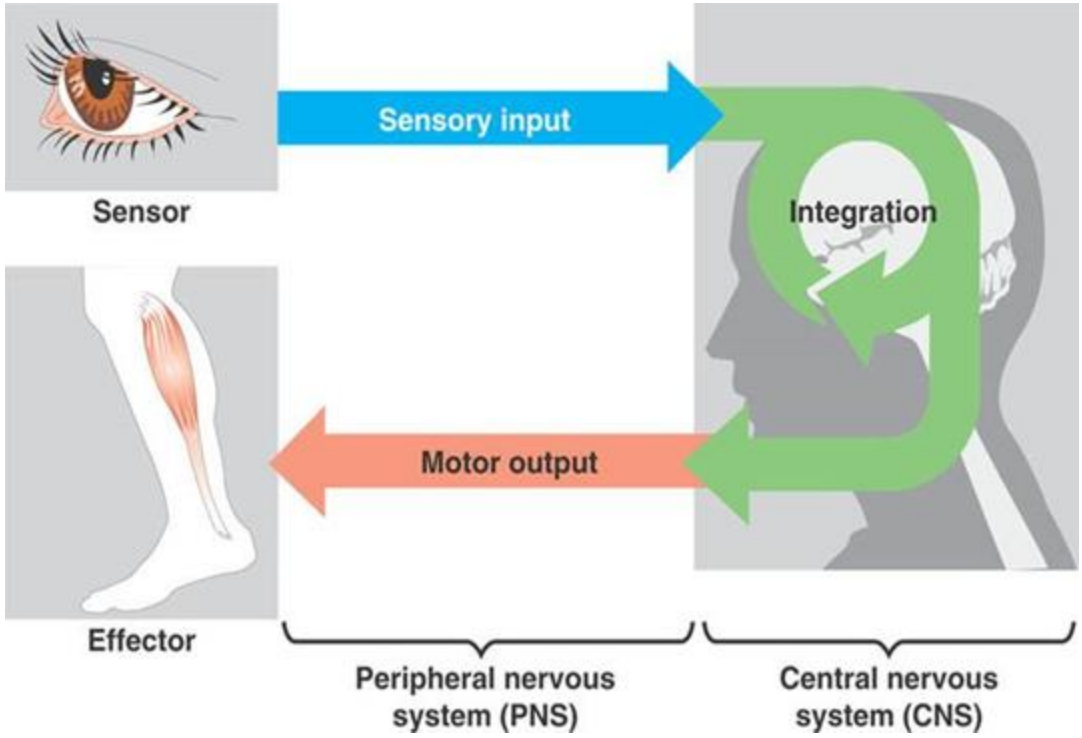
Functions of The Nervous System:

Objective 1: List the subdivision of the nervous system.

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

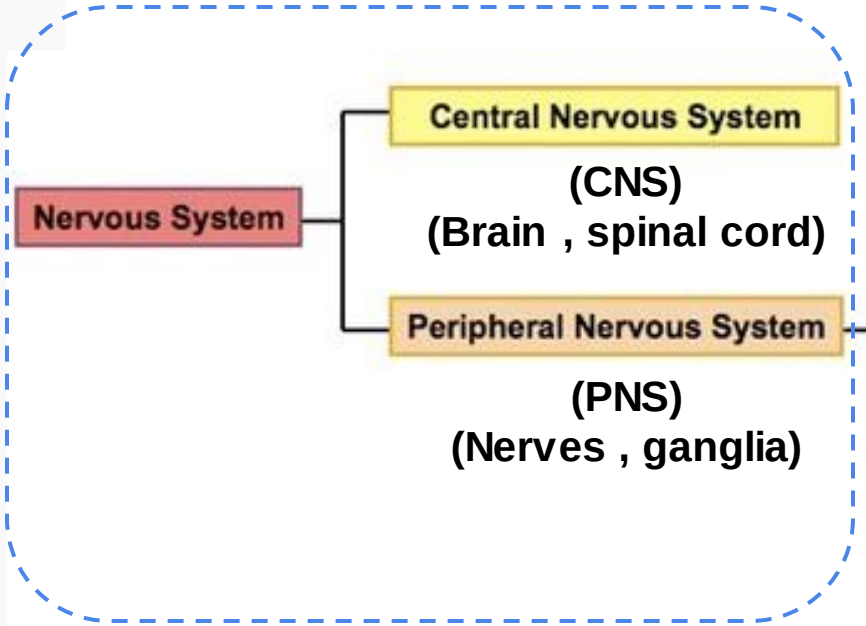
2- Integration: (CNS) Processes, analyses and interprets changes, then makes decisions.

3- Effects a response: (PNS) by activating <u>muscles</u> or <u>glands</u> (effectors) via **motor output**.

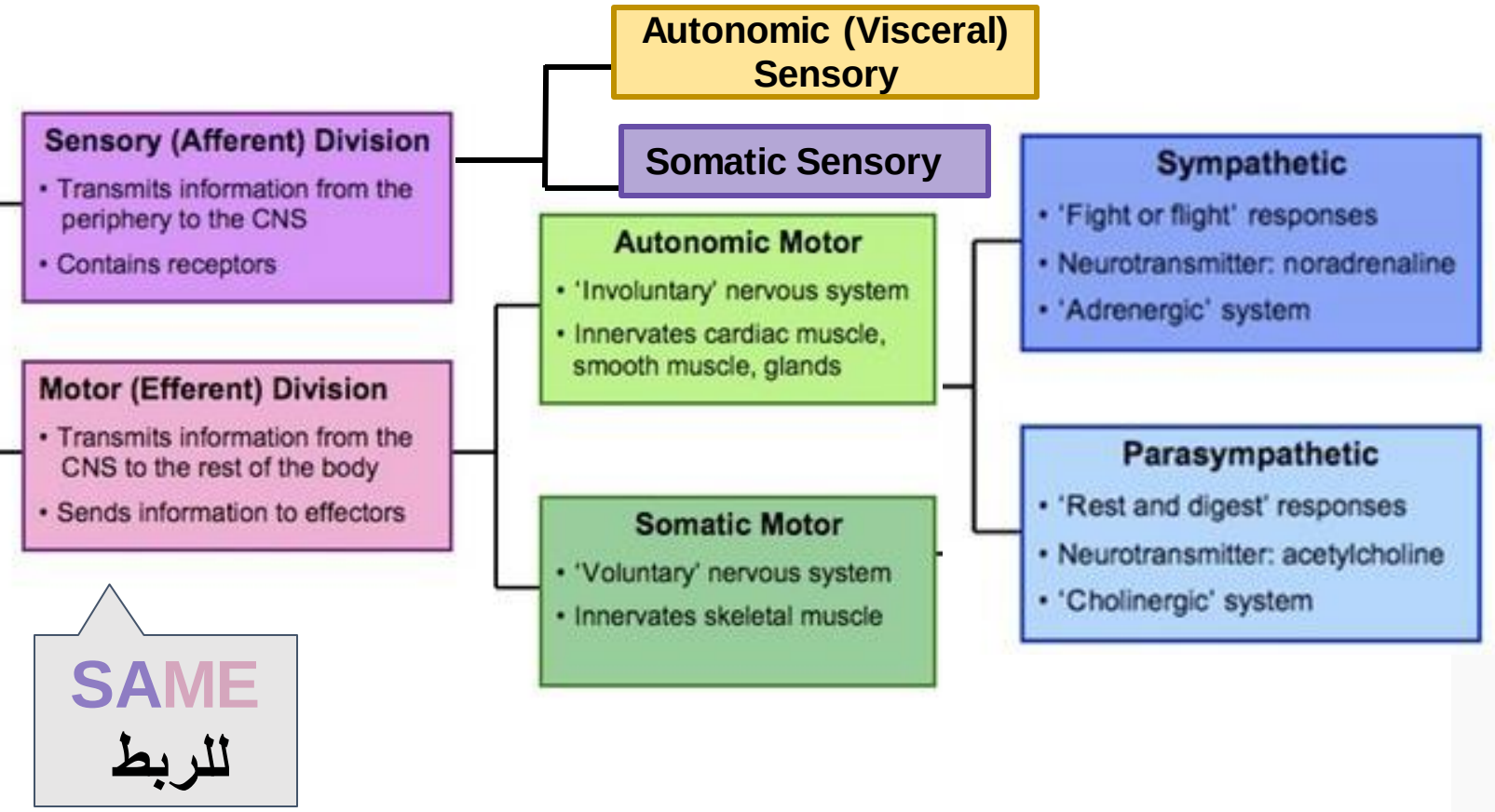


Objective 1: List the subdivision of the nervous system.

Structural organisation:



Functional Organisation:

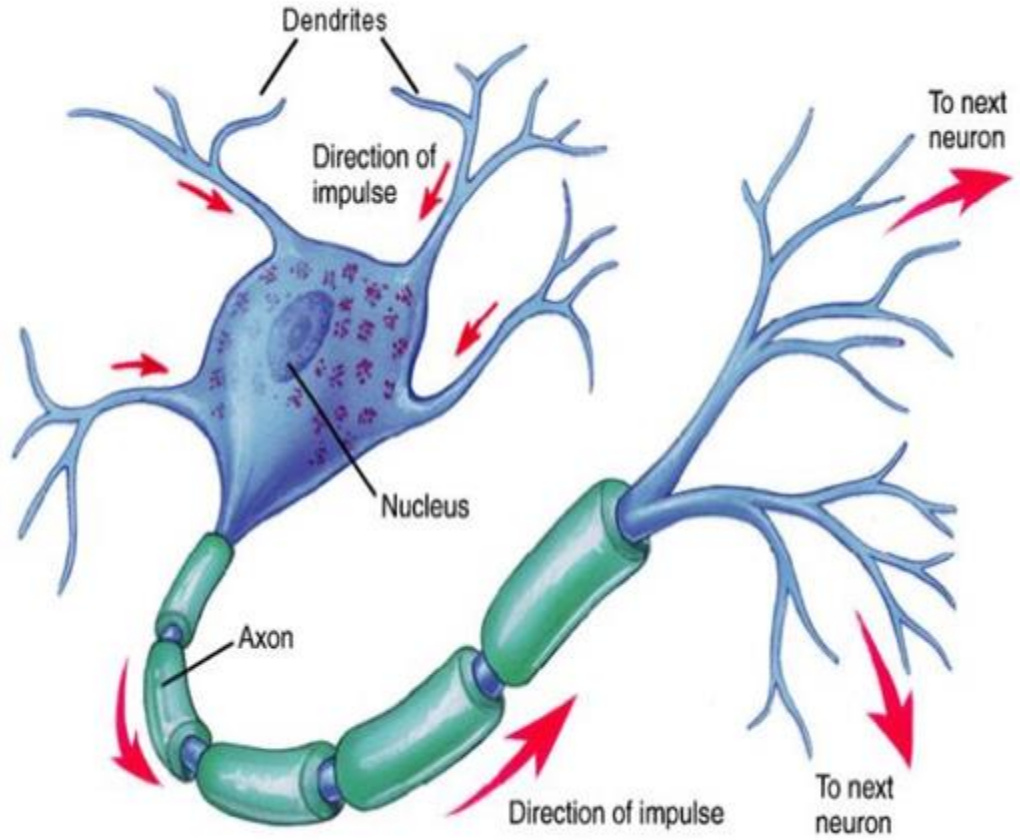


SAME
للربط

NEURONS

Objective 3: Define the terms neurons, neuroglia

- *They are the basic structural (anatomical), functional, and embryological units of the nervous system.*
- *A human's nervous system contains about 10^10 neurons.*



Functions:

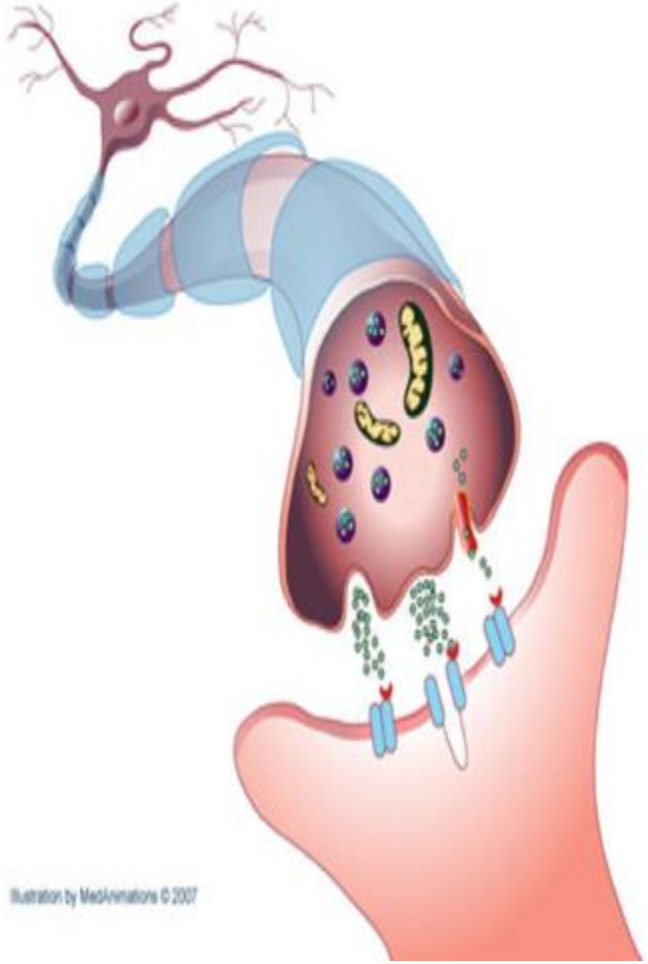
1- Receive information from sensory receptors or other neurons.

2- Transmit information to other neurons or effector organs.

NEURONS

Objective 3: Define the terms neurons, neuroglia

- *Information is passed between neurons at specialized regions called synapses*
- *Processes branch out of a single cell (neuron) body, they are receptors, also known as Dendrites.*
- *The branched process that carries information away from the cell body is called an Axon.*
- *At the end of the axon, specializations called terminal buttons occur, which transfer information to other Dendrites of other neurons.*



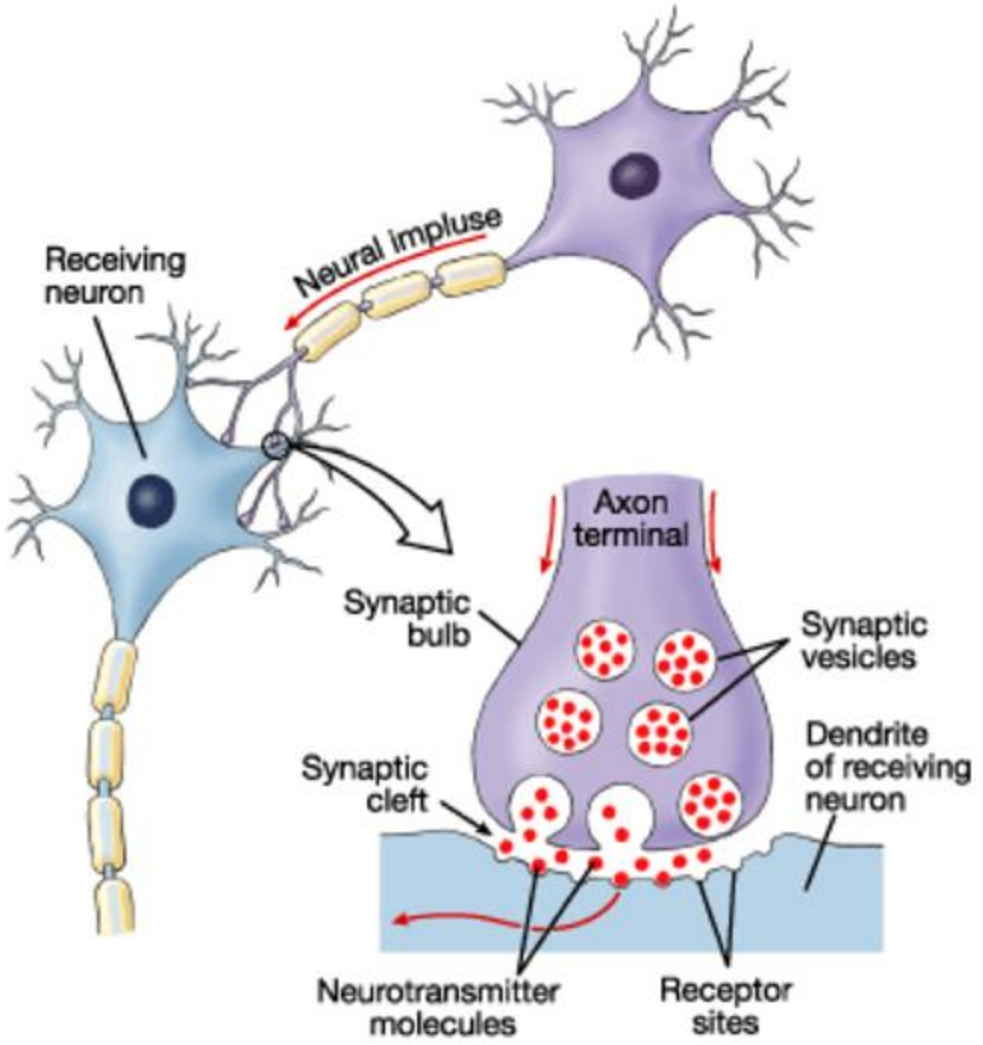
NEURONS

Objective 3: Define the terms neurons, neuroglia

- *Transmission of information between neurons almost always occurs by chemical rather than electrical means.*
- *The action potential releases chemicals called neurotransmitters that are stored in synaptic vesicles in the presynaptic ending.*

Function:

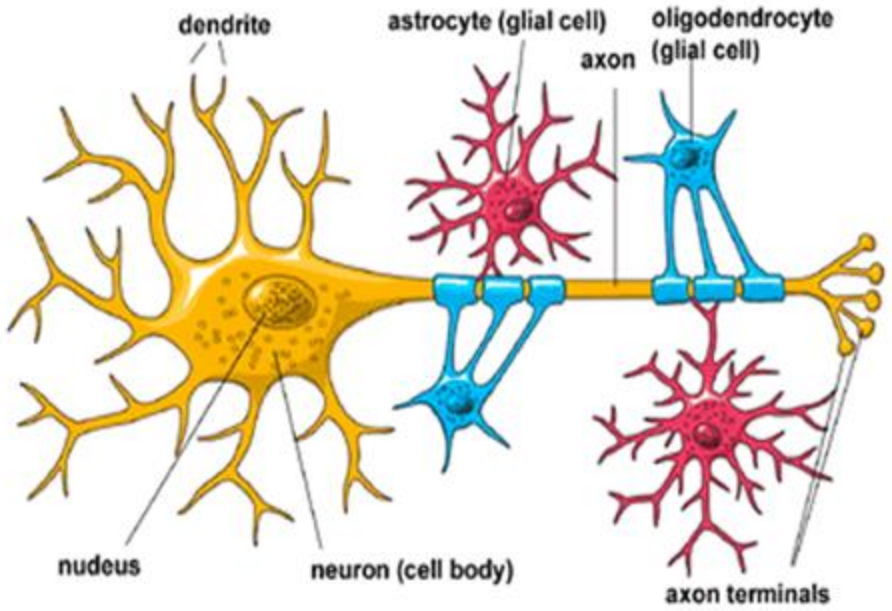
Neurotransmitters diffuse across the narrow gap between pre- and post-synaptic membranes to bind to the receptors on the postsynaptic cell.



NEUROGLIA (Glia)

Objective 3: Define the terms neurons, neuroglia

- *It is the other major cellular component of the nervous system, in the form of connective tissue.*
- *Unlike neurons, neuroglia do not have a direct role in information processing but they are essential for the normal functions of nerve cells.*



They are three types:

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.*

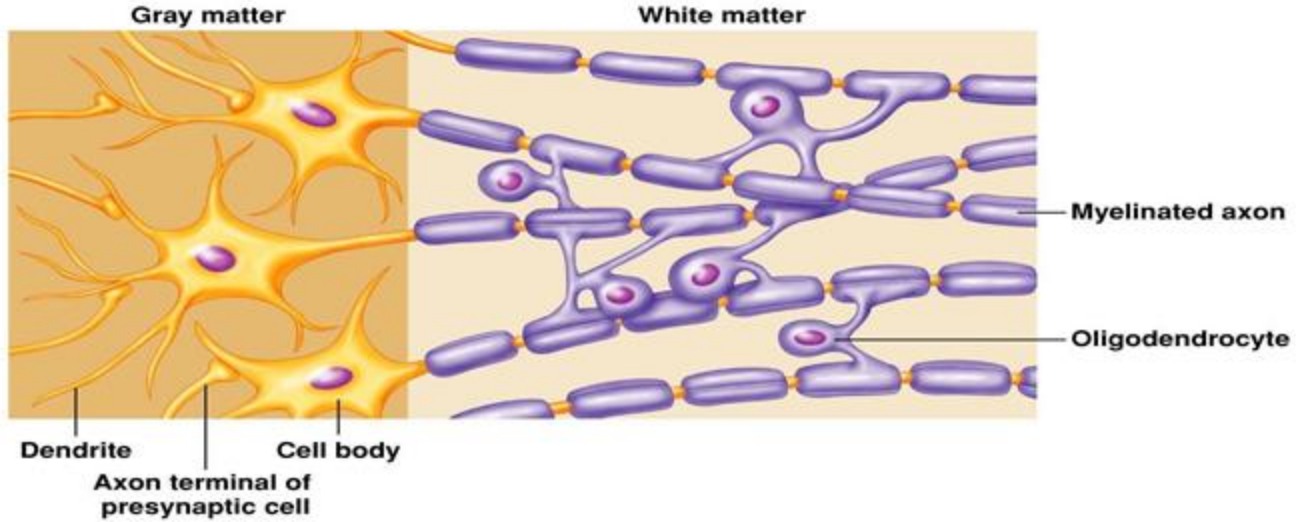
Astrocytes

- *They provide biochemical support for endothelial cells that form the blood–brain barrier.*

Nervous Tissue consists of Nerve cells (neurons) + Supporting cells (neuroglia).

It is organised into white matter and grey matter.

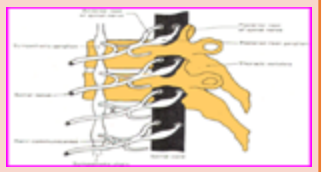
Grey Matter	White Matter
Cell Bodies	No cell bodies
Short process of the neurons	Long process of the neurons
Neuroglia	Neuroglia
Blood Vessels	Blood vessels



Note:
Process refers to the projections from the cell body (dendrite and axon).

Objective 2: Define the terms: grey matter, white matter, nucleus, ganglion, tract and nerve.

Remember…

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

Objective 4:
List the parts of the brain.

The Brain

Large mass of **nervous tissue** located in the **cranial cavity**.
It has four major regions.

1- 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 (elevation),** separated by grooves called **sulci.**

Divided by deeper sulci, into **4 lobes:**

- Frontal
- Parietal
- Temporal
- Occipital

2- Diencephalon:

It has four parts:

- Thalamus.
- Hypothalamus.
- Subthalamus.
- Epithalamus.

Located between the cerebrum and brainstem.

Function:

Regulates visceral activities and the autonomic nervous system.

3- Brainstem:

It has three parts:

- Midbrain
- Pons
- Medulla oblongata

Function:

1-Produces rigidly programmed autonomic behaviors.

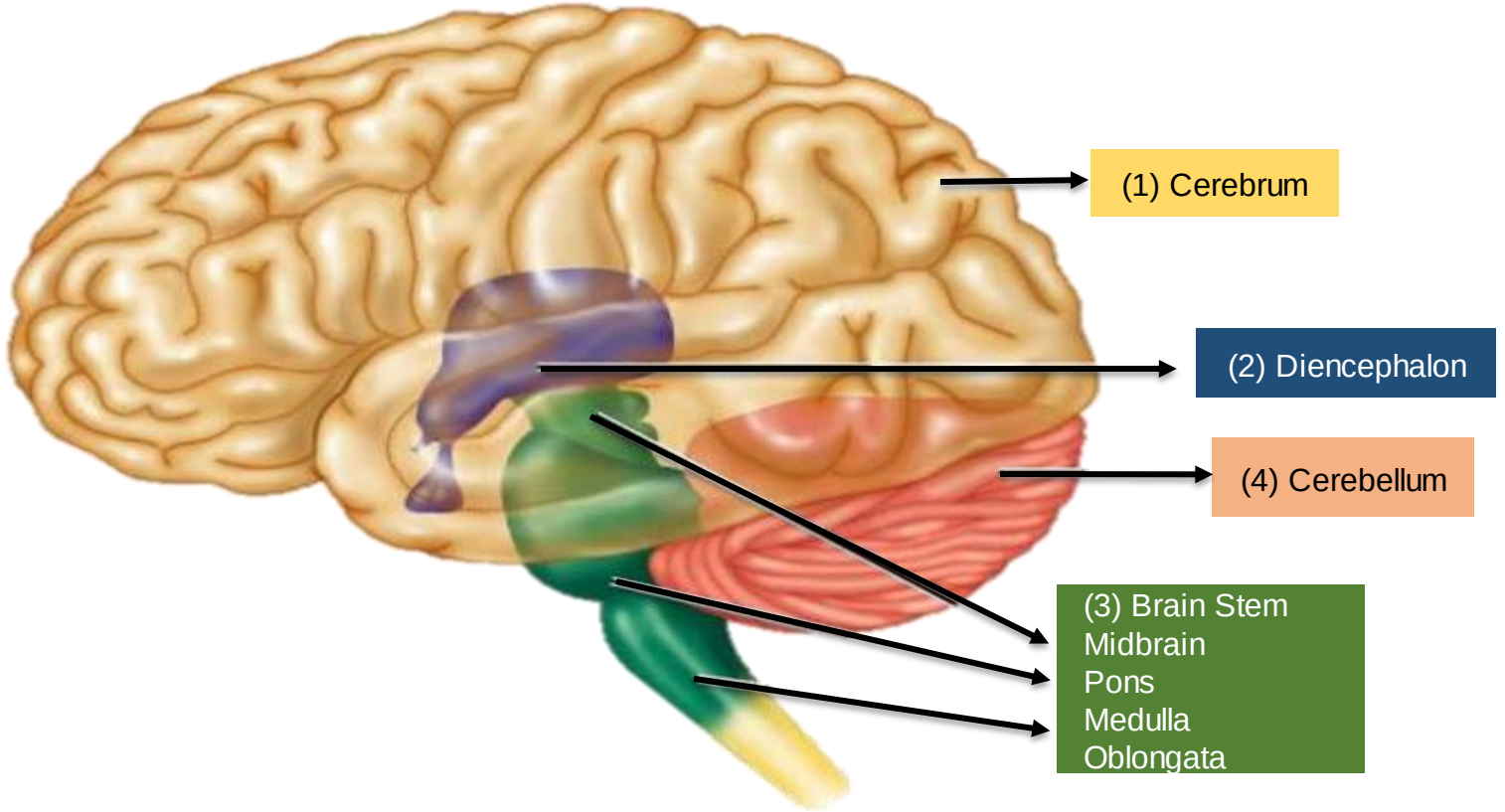
2-Provides pathway for tracts running between higher and lower neuronal centers.

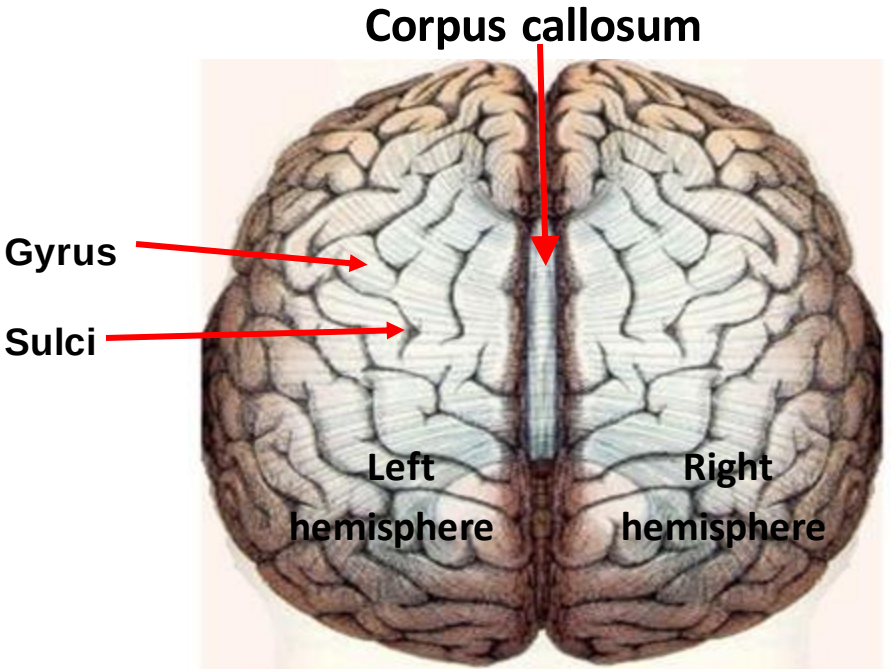
4-Cerebellum

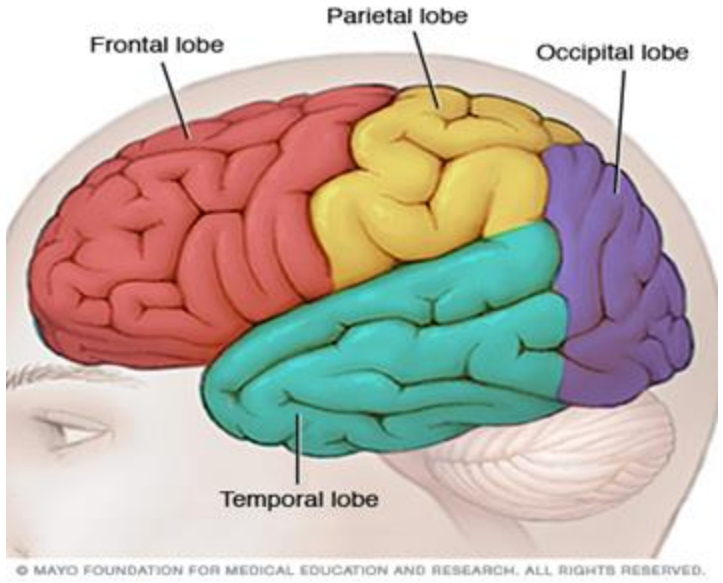
- Has 2 hemispheres and a convoluted surface.
- It has an outer cortex of gray matter and an inner region of white matter.
- It provides **precise coordination for body movements and helps to maintain equilibrium.**

Objective 4: List the parts of the brain.

Diagrams







Cerebral Hemisphere

Objective 4: List the parts of the brain.

TISSUE OF THE CEREBRAL HEMISPHERES

- The outermost (lateral) layer is called **gray matter** or **cortex.**
- The deeper layer is called **white matter (or medulla)**, 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.

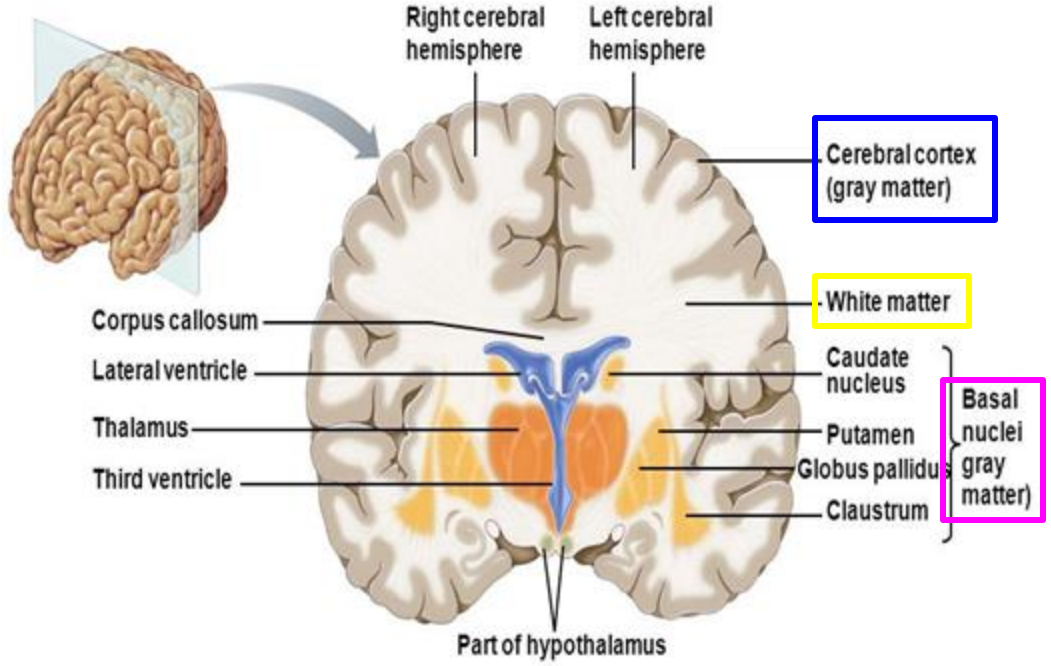
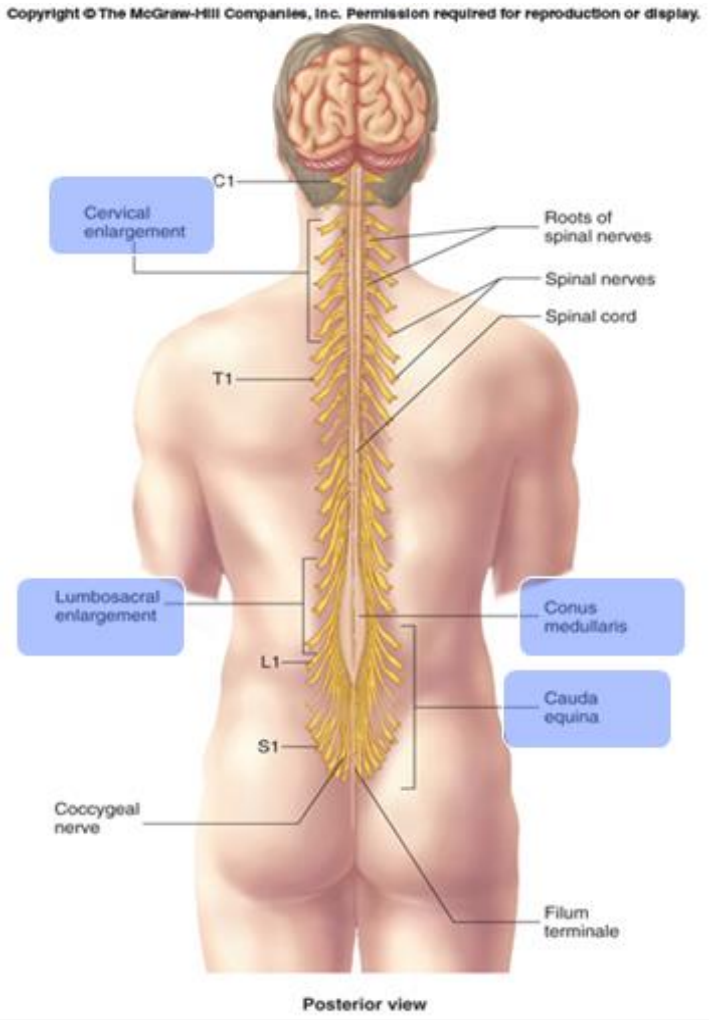


Fig. 5-14a, p. 154

Spinal Cord

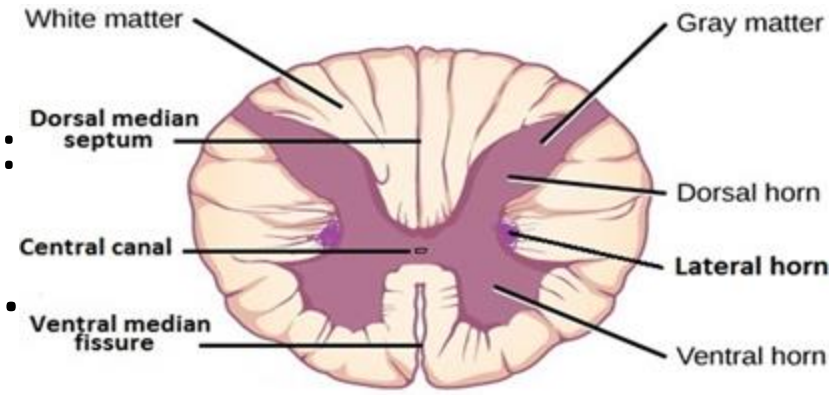
Objective 5: Identify the external and internal features of spinal nerve.

- It is a two-way conduction pathway to the brain & a major reflex center.
- 42-45 cm long, cylindrical shape, lies within the vertebral canal.
- Extends from **foramen magnum** to **L2 vertebra.**
- **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.**
- Has 2 enlargements: **cervical** and **lumbosacral.**
- **cervical enlargement and lumbosacral enlargement**
- وهم أكثر سماكة لأنه يتفرع منهم nerves تغذي الأطراف العلوية والسفلية.
- Gives rise to 31 pairs of **spinal nerves.**
- Group of spinal nerves at the end of the spinal cord is called **cauda equina.**
- **End of spinal cord: conus medullaris.**
- **End of spinal nerves: cauda equina.**



Cross Section of Spinal Cord

Objective 5: Identify the external and internal features of spinal nerve.



- 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.
- 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

Peripheral Nerves (PNS)

May be sensory, motor or mixed

Cranial:

- 12 pairs,
- attached to brain
- named & numbered from 1-12

Spinal:

- 31 pairs
- attached to spinal cord
- named and numbered according to the region of the spinal cord

Cranial Nerves

Objective 6: Enumerate the cranial nerves.

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

	name	type	num.	function غير مطلوبين به فقط ادرجته 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

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

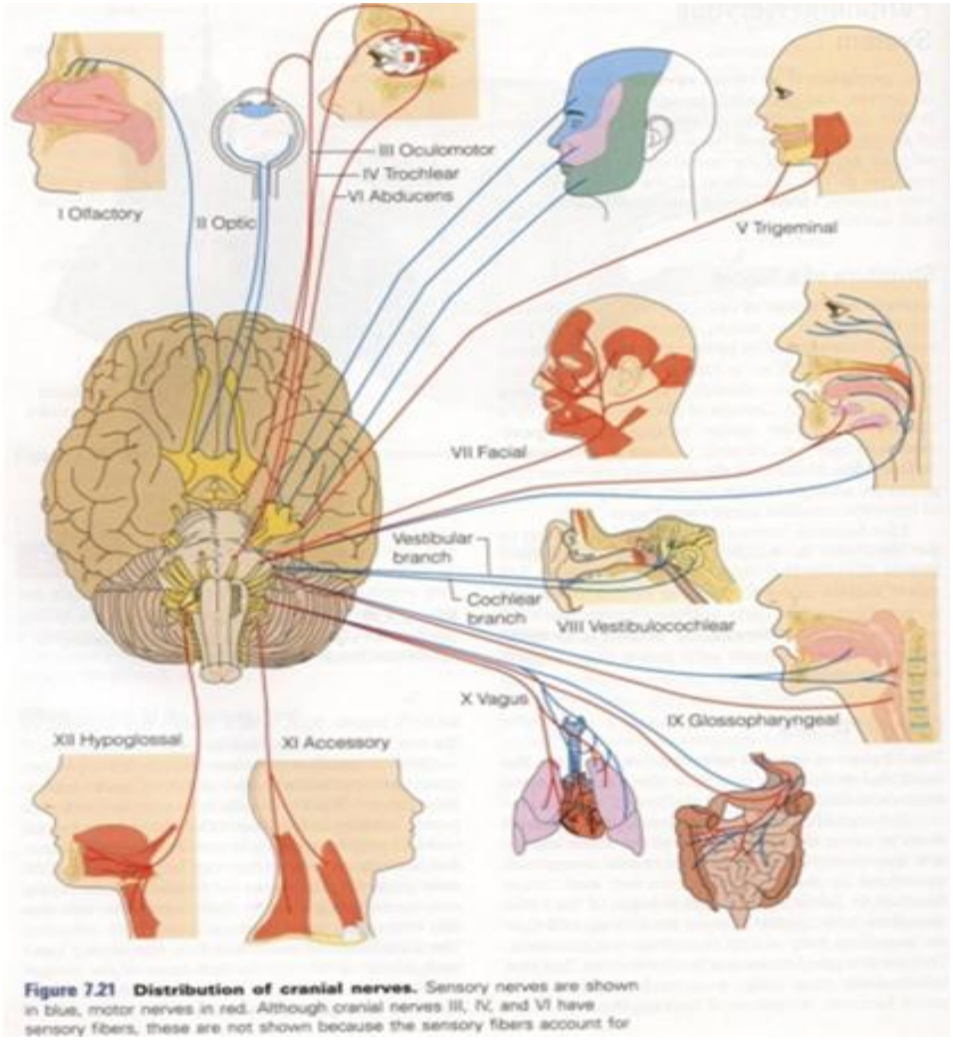


Figure 7.21 **Distribution of cranial nerves.** Sensory nerves are shown in blue, motor nerves in red. Although cranial nerves III, IV, and VI have sensory fibers, these are not shown because the sensory fibers account for

(EXTRA) More Mnemonics to memorize the name, number and type of cranial nerve:

<u>These two should be memorized together.</u>

On Old Olympus Towering Top,
A Fin And German Viewed A Hop

Some Say Marry Money But My Brother Says Big Brains Matter More

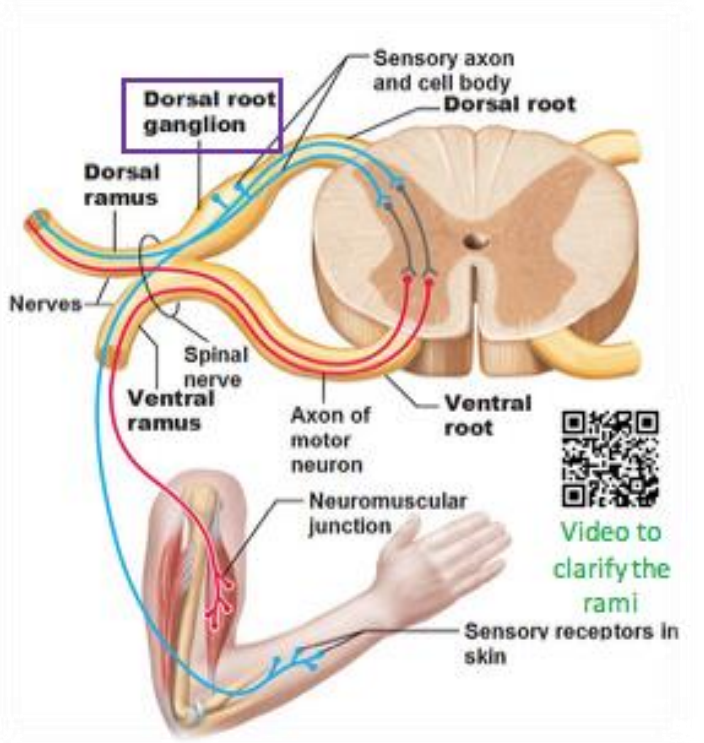
Number	Name		Type	
1	On	Olfactory	Some	Sensory
2	Old	Optic	Say	Sensory
3	Olympus	Occulomotor	Marry	Motor
4	Towering	Trochlear	Money	Motor
5	Top	Trigeminal	But	Both
6	A	Abducent	My	Motor
7	Fin	Facial	Brother	Both
8	And	Acoustic (Vestibulocochlear)	Says	Sensory
9	German	Glossopharyngeal	Big	Both
10	Viewed	Vagus	Brains	Both
11	A	Accessory	Matter	Motor
12	Hop	Hypoglossal	More	Motor

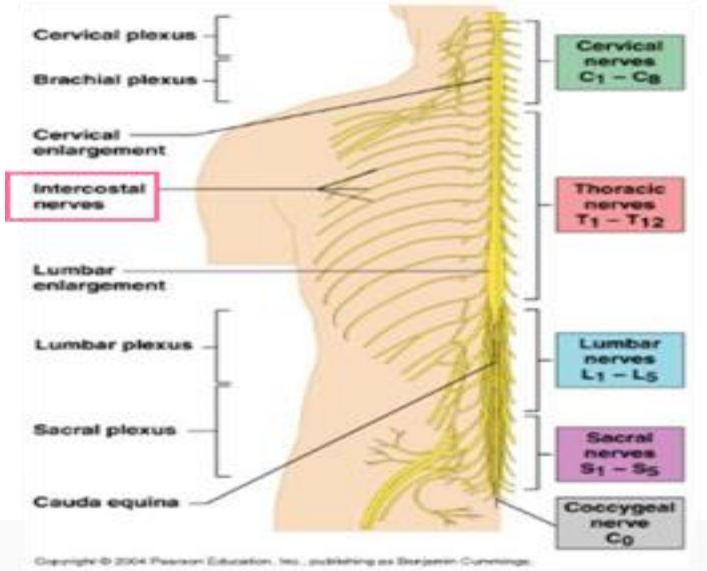
Objective 7: Describe the parts and distribution of the spinal nerve.

Spinal Nerves and Nerve Plexus:

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 and divides into dorsal and ventral ramus.
- The rami (one = 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.





Objective 8: Define the term dermatome.

Dermatomes:

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

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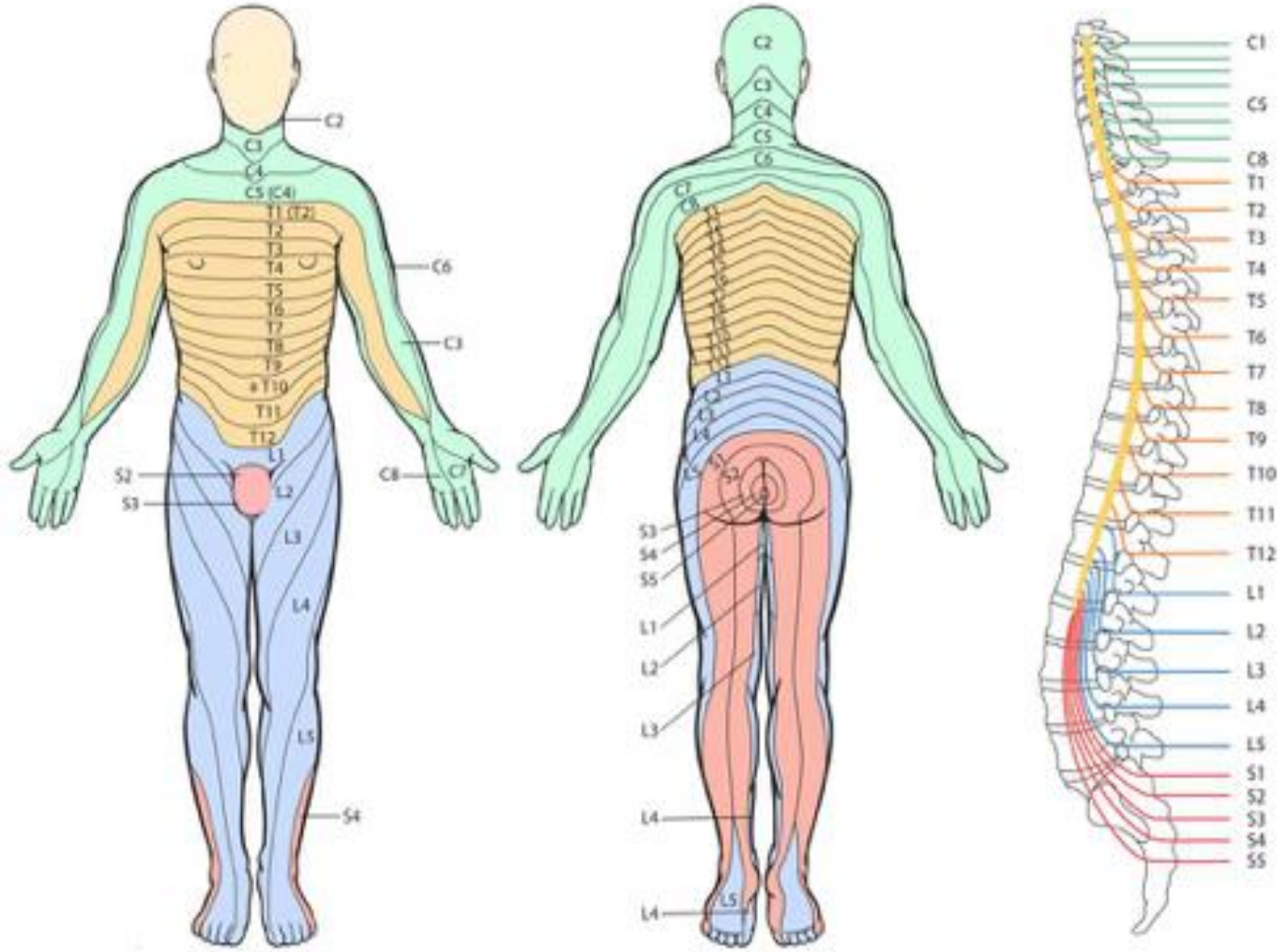
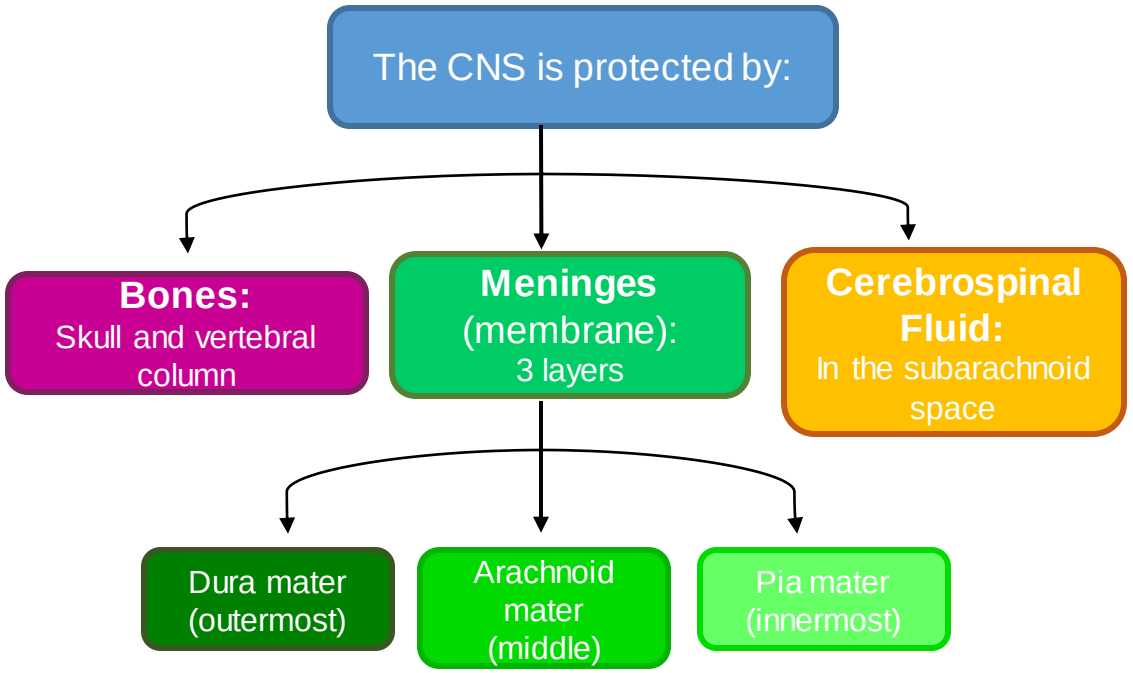
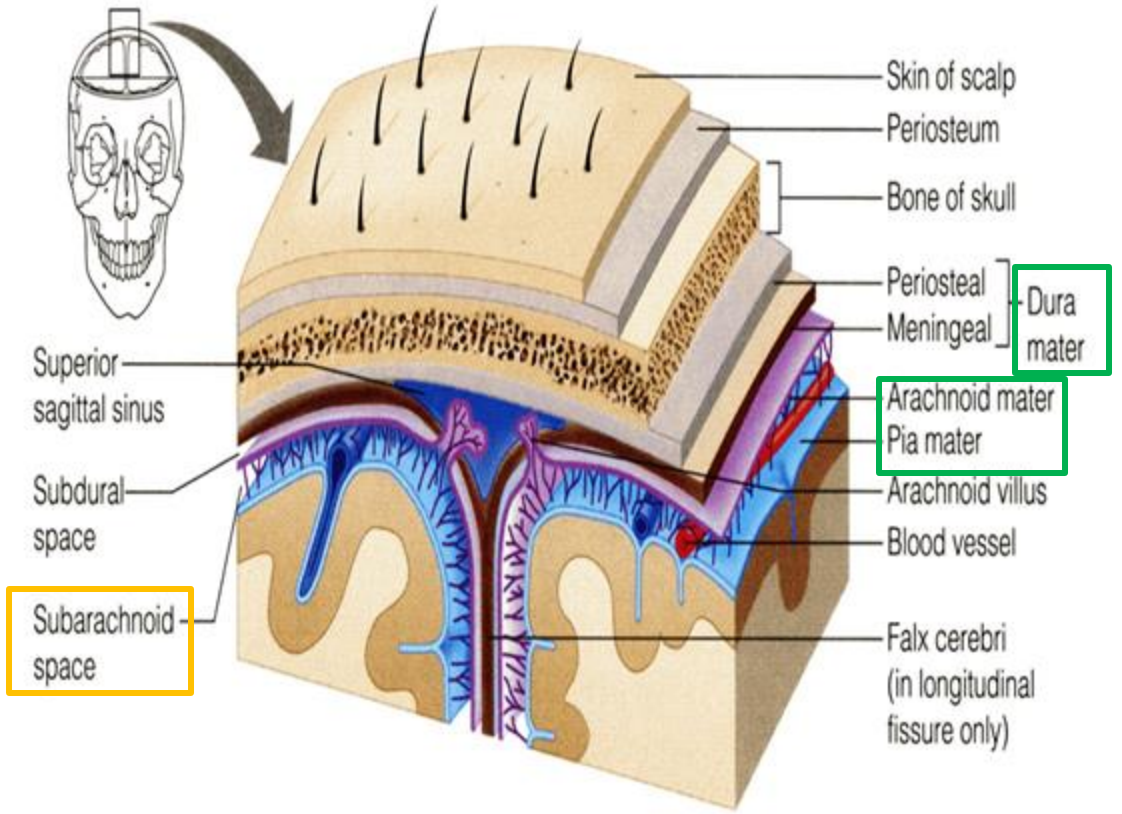


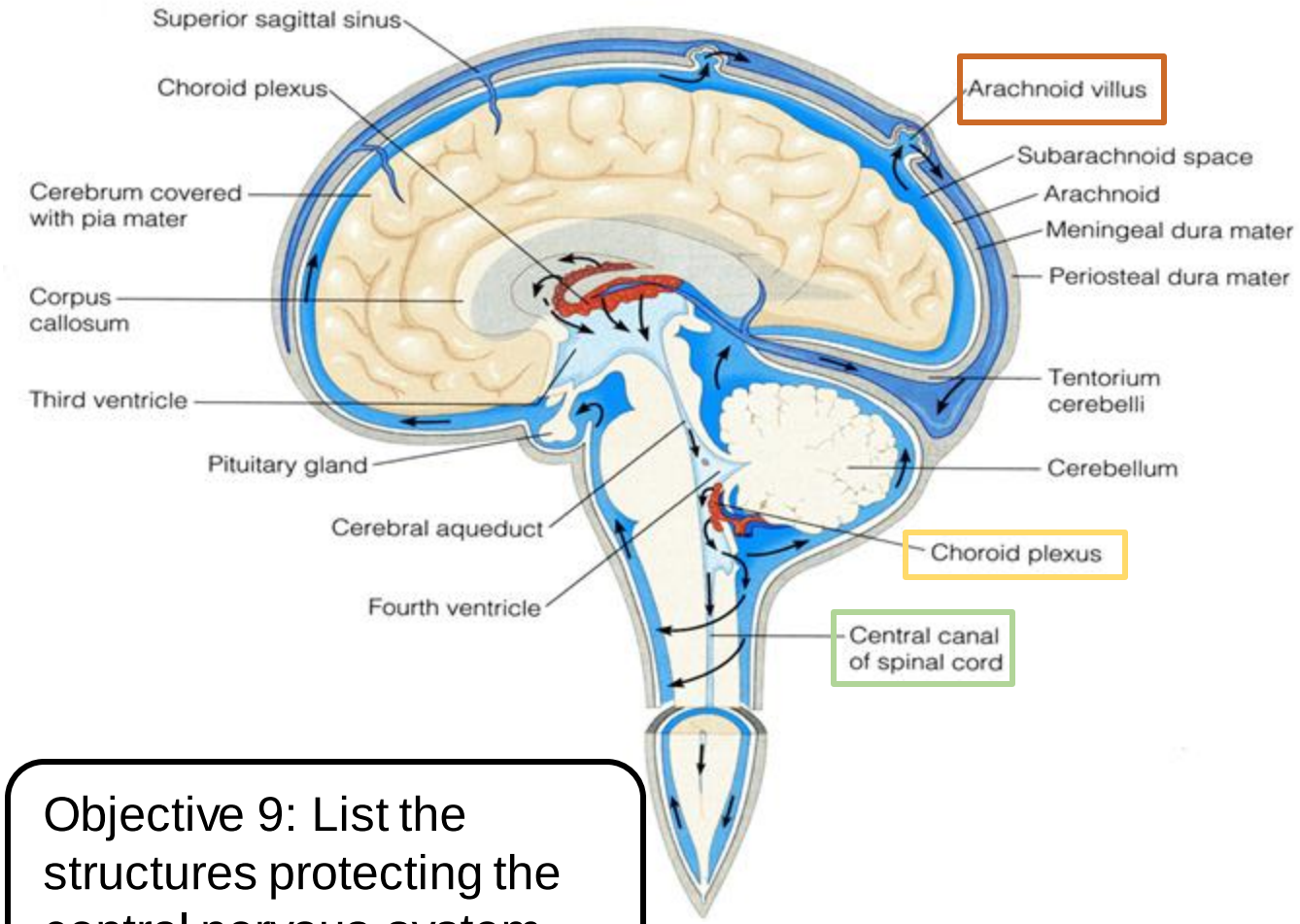
Protection of CNS:

Objective 9: List the structures protecting the central nervous system.





Cerebrospinal Fluid



Objective 9: List the structures protecting the central nervous system.

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 subarachoid 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.

Notes:

- **Cerebrospinal fluid** يمتص الصدمات
- **Central canal** الزائد من السائل ينزل الى ال

Test Yourself: (True or False)

1. Nucleus is a group of neurons within the PNS.
2. In the Brain, grey matter is located in the centre and surrounded by white matter.
3. Oligodendrocytes form the myelin sheath that surrounds many neuronal axons, which increase the rate of conduction.
4. Diencephalon provides the pathway for fibre tracts running between higher and lower neuronal centres.
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 fibres.
12. CSF is drained into the dural sinuses through the arachnoid villi.

Helpful Links

Online Tests

- https://www.onlineexambuilder.com/anatomy-nervous-system/exam-36310
- https://www.onlineexambuilder.com/nervous-system/exam-36516

Videos

- https://www.youtube.com/watch?v=qPix_X-9t7E (General Review)
- https://www.youtube.com/watch?v=KnD16gwpCz8 (Spinal Cord)

Websites

- http://www.getbodysmart.com/index.htm
- http://www.innerbody.com/

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