

HATAHET ANATOMY



Nervous system

Lecture: 18-20

Pages: 18

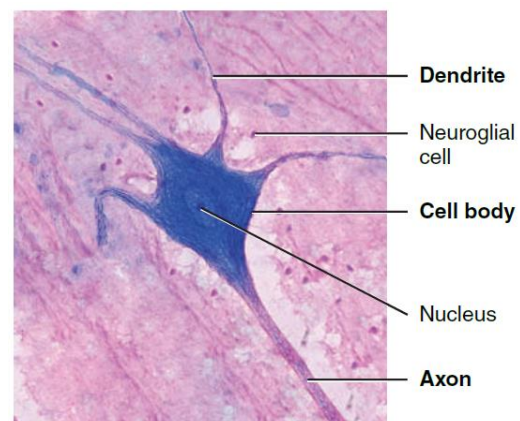
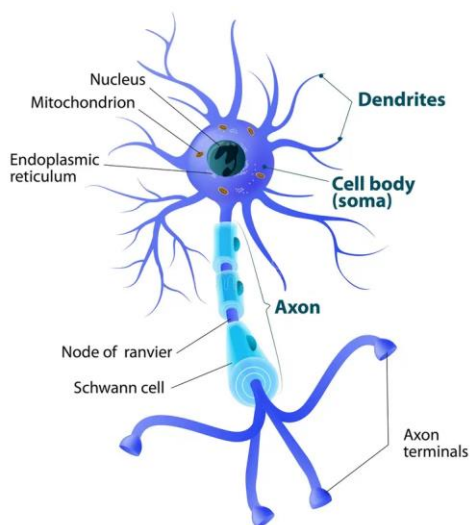
Lecture 18-20: Nervous System

Introduction of Nervous system

Cells of Nervous system

➤ Neurons (Nerve cells)

- the cells that can generate & propagate action potential by converting stimuli into nerve impulse
- Anatomy of a neuron:
 - **Cell body (Soma)**, the enlarged proximal part of the neuron, contains some structures:
 - ① **Nucleus**, synthesizes proteins and Nissle bodies
 - ② **Nissle bodies**, small granules in the ER of neuron, they give a blue-colored appearance when stained
 - ③ **Mitochondria**, a lot of them
 - **Neurites**, the tapered extensions coming out of cell body, they can be off 2 types:
 - ① **Dendrites**, they transmit AP to the cell body
 - ② **Axon**, transmits AP away from the cell body, axon is devoid from Nissle bodies
 - **Axon hillock**, the articulation point between body and axon, it is the most excitable point in the axon
 - **Myelin sheaths**, sheaths surrounding the axon to protect it, and based on the presence of it, nerves can have:
 - ① **Myelinated axons**
 - ② **Unmyelinated axons**
 - **Nodes of Ranvier**, nodes between each 2 consecutive Schwann cells
 - **Axon terminals**, the terminal branches of the axon
 - **Synaptic knobs**, the end bulbs of each axon terminal that communicate with another neuron or a target organ



➤ Neuroglia (Glial cells), smaller and more numerous cells that provide support and protection to the neurons

Types of Neurons

➤ Anatomical types

① Multipolar neurons

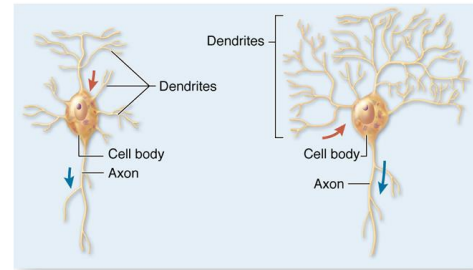
- have 1 axon and more than 2 dendrites
- the most common type of neurons in CNS

② Bipolar neurons

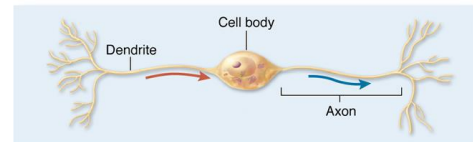
- have 2 processes: 1 axon & 1 dendrite
- found in: **(IMPORTANT)**
 - ① Retina
 - ② Olfactory epithelium
 - ③ Nuclei of Vestibulocochlear nerve (CN VIII)

③ Unipolar neurons

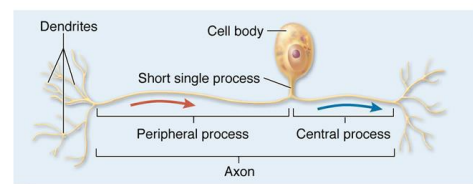
- has a singular short process that divide into 2 processes:
 - ① 1 process that goes into periphery to bring sensory stimulus
 - ② 1 process that goes into the CNS bringing motor information
- found in the Dorsal root ganglia



a Multipolar neurons



b Bipolar neuron



c Unipolar neuron

➤ Physiological types

① Sensory neurons

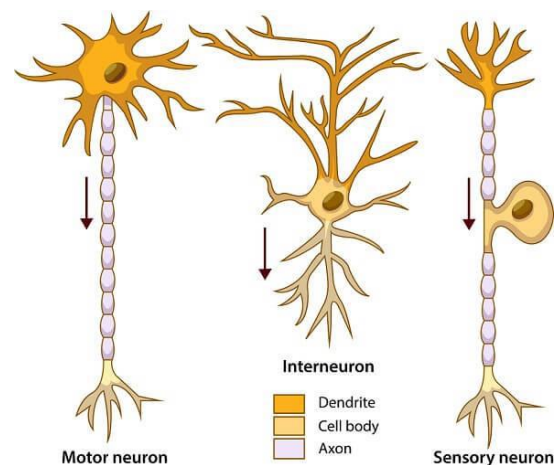
- carry sensory information from the periphery to CNS

② Motor neurons

- connects both sensory and motor neurons together

③ Intermediate neurons

- carry motor information from CNS to the periphery



Types of Neuroglia

① Astrocytes

- star-shaped cells with many cytoplasmic processes
- these processes have Perivascular feet to form the **Blood-Brain-Barrier (BBB)**

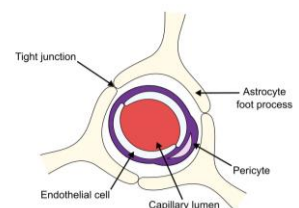
② Oligodendrocytes

- has a small cell body and long thin processes
- they form myelin sheath around CNS neurons; about 4 axons per 1 oligodendrocyte

③ Microglia

- the macrophages of the CNS

Blood-Brain Barrier



4 Ependyma

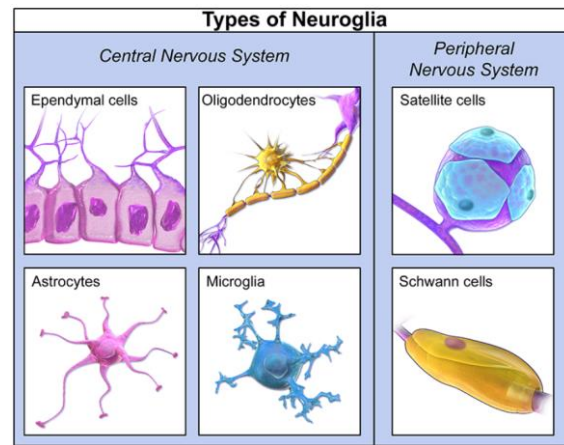
- simple cuboidal-to-columnar epithelial cells
- lines the ventricles of the brain
- produce CSF (Cerebrospinal fluid - سائل النخاع الشوكي)

5 Schwann cells

- the cells that myelinate axons of PNS
- enclose about 20 axons per 1 Schwann cell

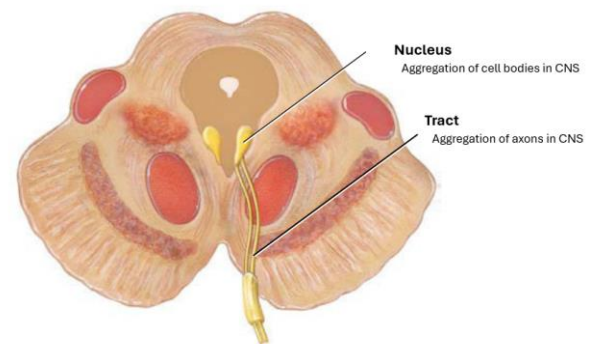
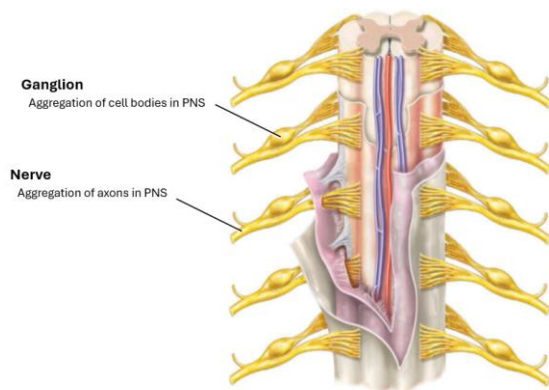
6 Satellite cells

- flat cells surrounding cell bodies of neurons
- they contribute in nerve nourishment and repair



★ Important definitions of the Nervous system:

- ♦ **Nucleus** → aggregation of cell bodies in the CNS
- ♦ **Ganglion** → aggregation of cell bodies in the PNS
- ♦ **Tract (Fasciculus)** → aggregation of axons in the CNS
- ♦ **Nerve** → aggregation of axons in the PNS



Divisions of Nervous system

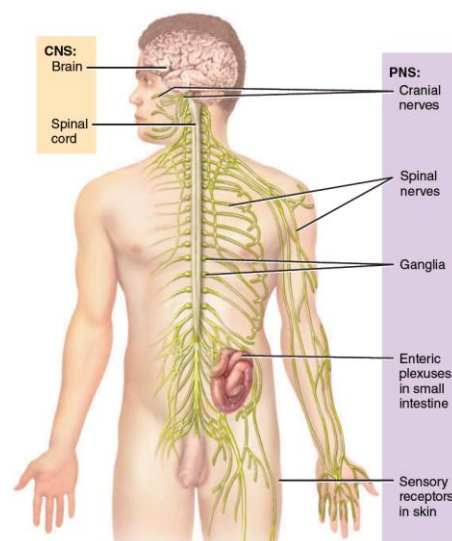
Divisions

➤ Central Nervous System (CNS),

- composed of: Brain & Spinal cord
- both are protected by Bones and Meninges (السحايا)

➤ Peripheral Nervous System (PNS)

- composed of: Peripheral nerves & Ganglia
- Peripheral nerves are further divided into:
 - ♦ 12 pairs of Cranial nerves
 - ♦ 31 pairs of Spinal nerves



Subdivisions

➤ Central Nervous System (CNS)

➤ Peripheral Nervous System (PNS)

[1] Somatic Nervous System (SNS)

- controls the Skeletal muscles: Thoracic wall, Abdominal wall, Pelvic wall, Upper limbs, Lower limbs
- can be both Sensory & Motor:

① **Sensory** → Sensation, can be:

- **General sensations:** Temperature, Pain, Tactile, Touch
- **Special sensations** “الحواس الخمسة”: Vision, Taste, Smell, Hearing, **Balance**

② **Motor** → Skeletal muscles

[2] Autonomic Nervous System (ANS)

- controls the viscera (organs)
- can be both Sensory & Motor:

① **Sensory** → the decrease of O₂ concentration in tissues, the increase in blood volume in CNS,

② **Motor** → divided into:

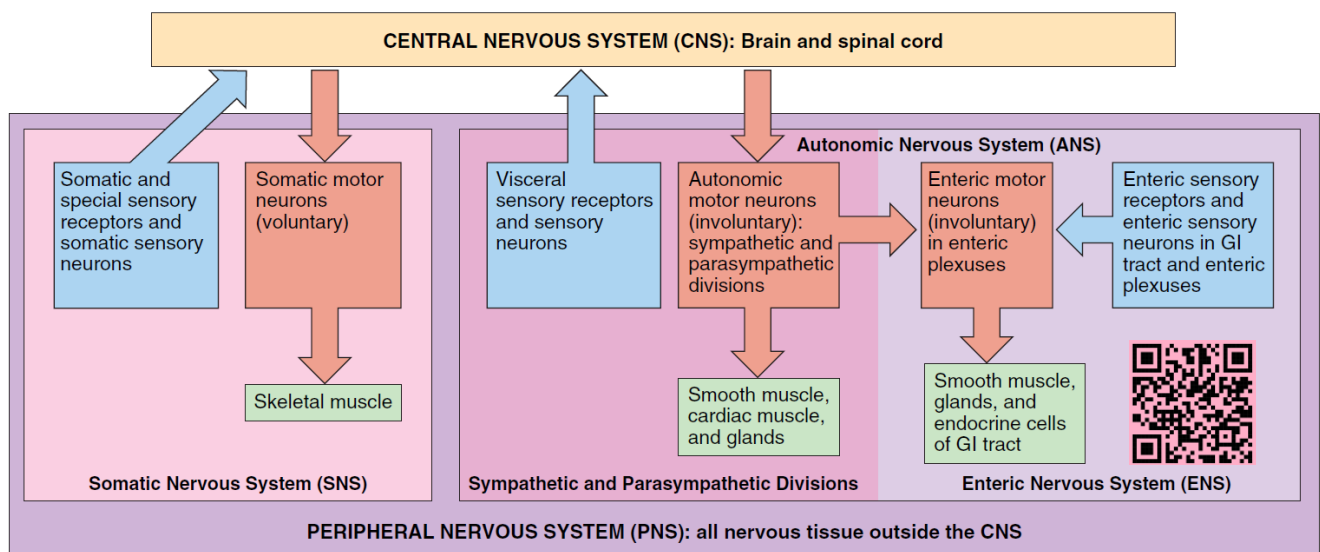
- **Sympathetic “Fight or Flight”**, activates in emergencies
- **Parasympathetic “Rest and Digest”**, activates to conserve energy

[3] Enteric Nervous System (ENS)

- controls the activity of the GIT
- can act independently from the CNS
- can be:

① **Sensory** → senses any stretch or ulceration on the GIT

② **Motor** → controls the smooth muscles & glands of GIT



Anatomy of Nervous system (General)

Embryology

The fetal brain is divided into 3 major part; all are formed by the WALLS of the neural tube:

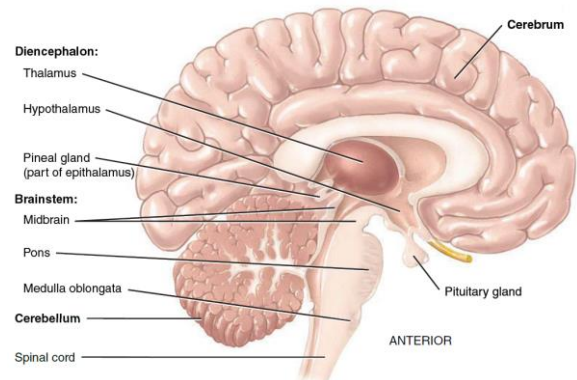
1) **Forebrain (Prosencephalon)**, composed of:

- A. **Cerebrum**
- B. **Diencephalon**

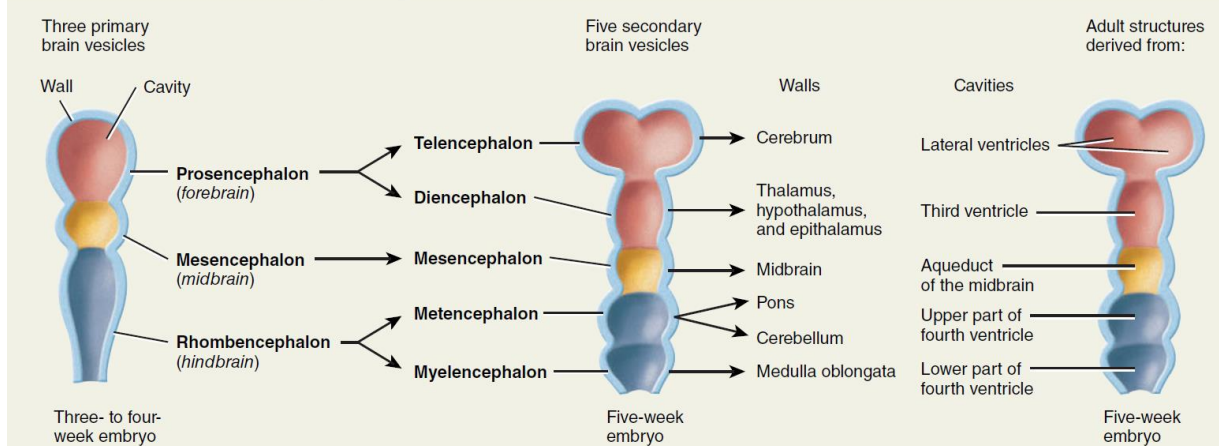
2) **Midbrain (Mesencephalon)**, composed of (**Midbrain**)

3) **Hindbrain (Rhombencephalon)**, composed of:

- A. **Pons**
- B. **Medulla oblongata**
- C. **Cerebellum**



Development of the Brain



Anatomy

The human brain is divided into 3 major part:

1) **Cerebrum**, the largest part of the brain, composed of 2 **Hemispheres**; Right & Left

2) **Diencephalon**, includes: (**Thalamus**, **Hypothalamus**, **Subthalamus**, **Epithalamus**)

3) **Brain stem**, the poster-inferior part of the brain, composed of

- A. **Midbrain**
- B. **Pons**, the bridge that connects cerebrum & cerebellum
- C. **Medulla oblongata**, the superior part of the spinal cord

4) **Cerebellum**, the posterior part of the brain

Protective layers

➤ Bones

- ❶ **Cranial bones**, the bones of the skull that covers and protects the brain
- ❷ **Vertebral column**, the 33 vertebrae that protects the spinal cord

➤ Meninges (السحايا)

- the CT protective layers of the CNS (Brain & Spinal cord)
- it encloses a fluid-filled sac (the CSF)
- these 3 layers are:

❶ Dura mater

- ♦ the most external layer
- ♦ avascular double-layered membrane:

- A. **Periosteal layer**, the external layer that touches the periosteum of calvarian bones
- B. **Meningeal layer**, the internal thick layer, it is continuous with the spinal cord through the foramen magnum, this layer has 3 foldings called (**Dural Reflections**), **they restrict the rotatory displacement of the brain**, these are:

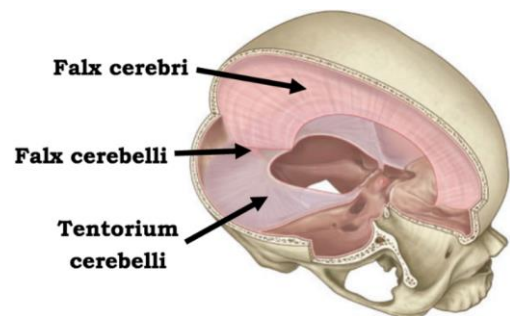
- ❶ **Falx cerebri**, between the 2 cerebral hemispheres, extends between crista galli to cerebellum
- ❷ **Falx cerebelli**, between the 2 cerebellar hemispheres
- ❸ **Tentorium cerebelli**, between occipital lobe and cerebellum

❷ Arachnoid mater

- ♦ the intermediate layer
- ♦ it attaches to the pia mater via web-like trabeculae

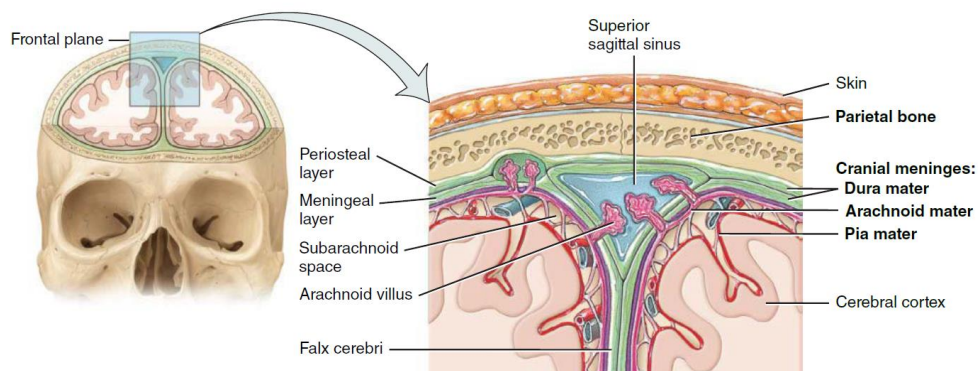
❸ Pia mater

- ♦ the innermost layer
- ♦ it is a delicate layer that follows the grooves of the brain
- ♦ highly vascular layer, supported mainly by the **Middle meningeal artery**



➤ Meningeal spaces

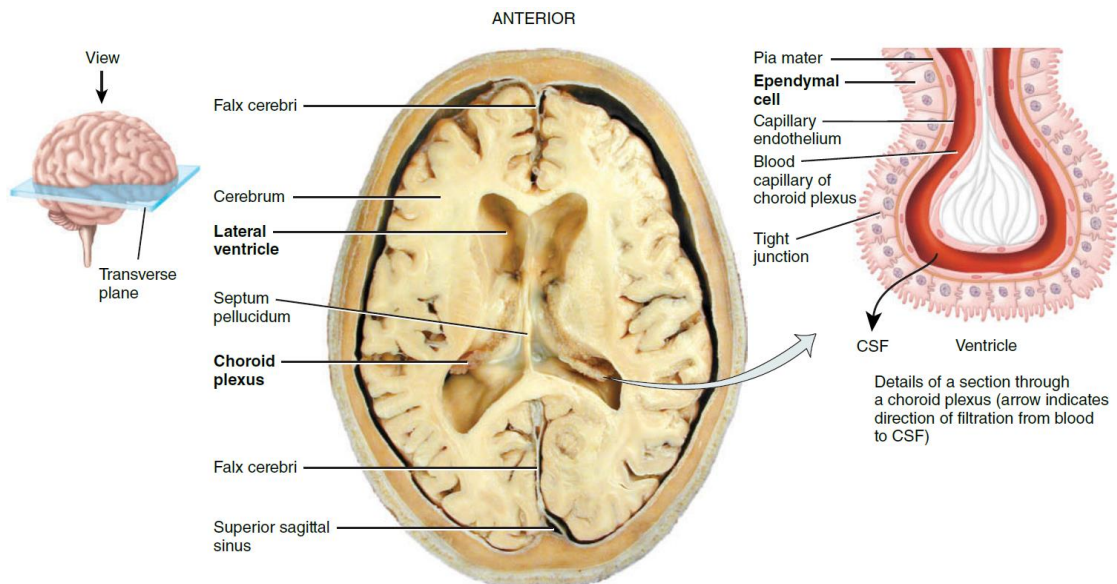
- ❶ **Epidural space (Potential space)**, located between dura mater & cranial bones
- ❷ **Subdural space (Potential space)**, located between arachnoid mater & dura mater
- ❸ **Subarachnoid space (Physiological space)**, located between pia mater & arachnoid mater, filled with CSF



- **Arachnoid villi**: invaginations of subarachnoid space into the ventricular system & dural venous sinuses

➤ Cerebrospinal Fluid (CSF)

- CSF is a clear colorless liquid that protects the brain and spinal cord
 - produced by a network of capillaries lined by ependymal cells called (**Choroid plexus**)
 - functions in: ① Mechanical protection ② Exchanging nutrients and wastes ③ Bearing the brain weight (2 kg → 50 g)
- **Blood-CSF-Barrier (BCB)**: a protective barrier formed by the tight junction between the ependymal cell



➤ Ventricular system of brain

- Ventricular system is composed of 4 CSF-filled cavities within the brain
- lined by ependymal cells
- these 4 ventricles are:

① Lateral ventricles

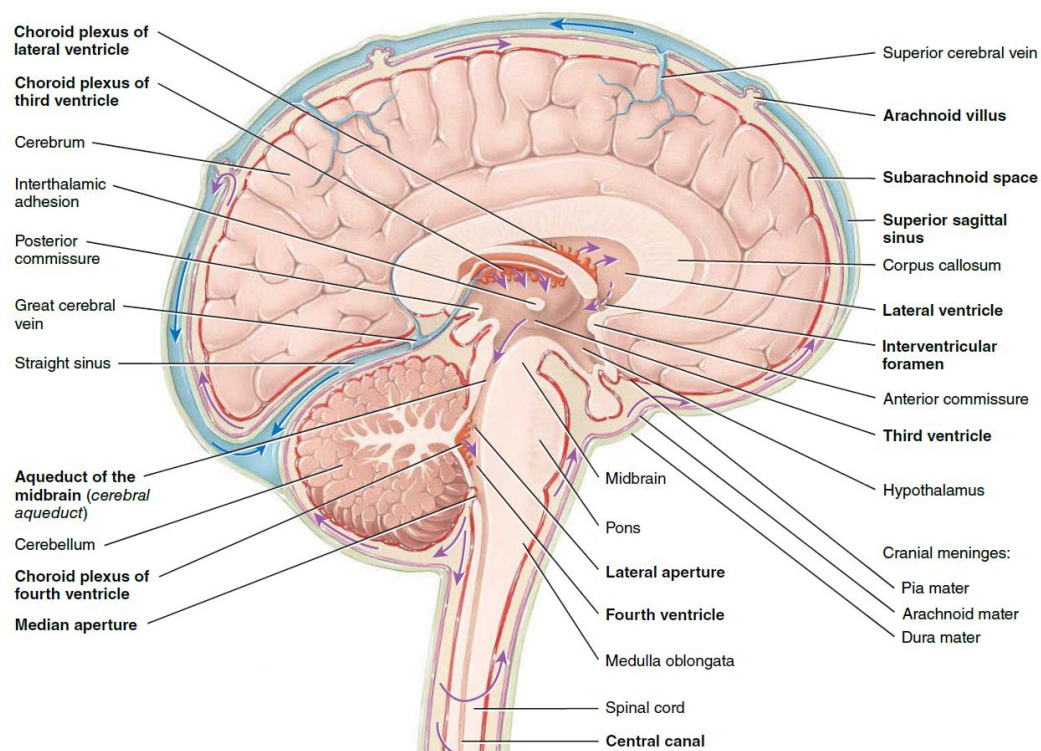
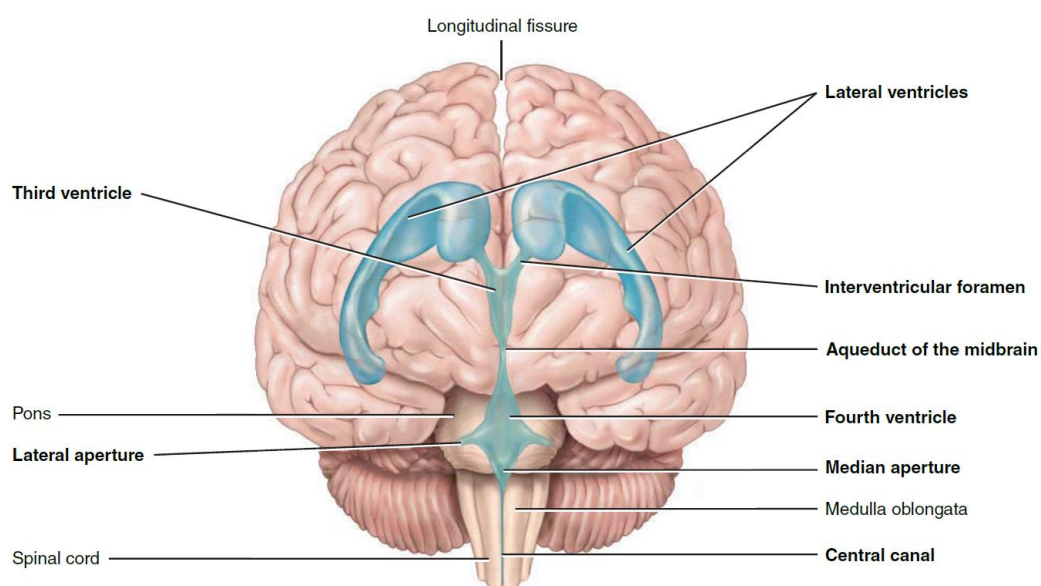
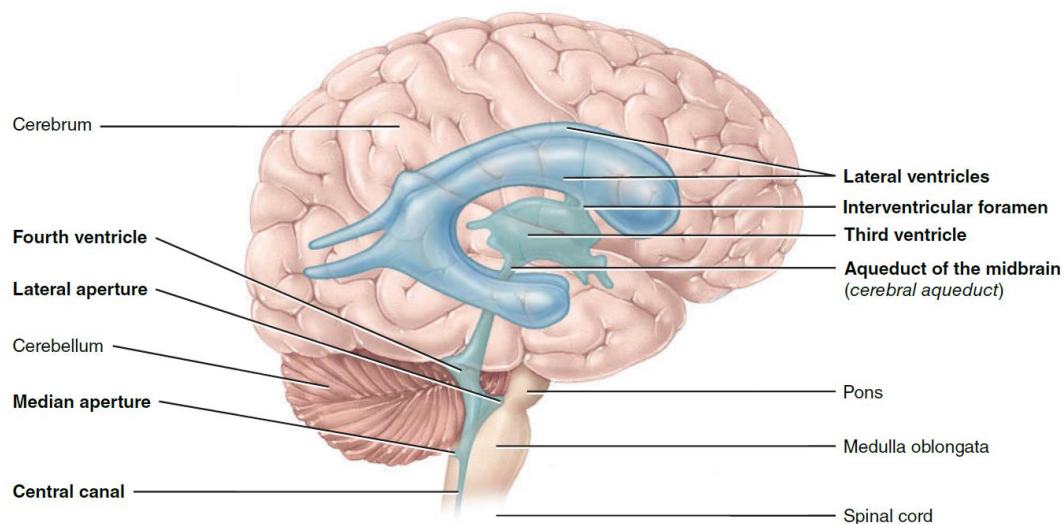
- ♦ two (Right & Left) C-shaped ventricles
- ♦ located in and supply the cerebral hemispheres
- ♦ consist of: **Anterior horn, Posterior horn, Inferior horn**
- ♦ both communicate with the 3rd ventricle through the (**Interventricular foramina**)
- ♦ separated by the (**Septum pellucidum**)

② Third ventricle

- ♦ singular ventricle within the diencephalon
- ♦ located at the midline between the 2 masses of thalamus
- ♦ communicates with the 4th ventricle via the (**Cerebral aqueduct**)
- ♦ boundaries:
 - Lateral walls → Masses of thalamus
 - Floor/Base → Hypothalamus

③ Fourth ventricle

- ♦ located between Pons and medulla oblongata anteriorly & cerebellum posteriorly
- ♦ contains 3 foramina for drainage of CSF in its roof, they communicate with the Subarachnoid space:
 - 1 median foramen "Foramen of Magendie"
 - 2 lateral foramina "Foramina of Luschka"



Anatomy of Nervous system (Brain)

Cerebrum

- Cerebrum is the largest part of the brain
- composed of two hemispheres (Right & Left), divided by the longitudinal fissure
- cerebrum extends over the **Anterior cranial fossa**, **Middle cranial fossa**, and **Tentorium cerebelli**

➤ Internal structure of Cerebrum

❶ Outer Layer (Cerebral Cortex)

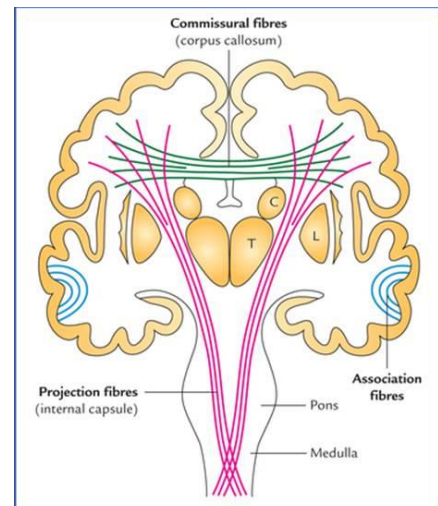
- ♦ composed of **Grey matter**, formed mainly of cell bodies
- ♦ characterised by folds: Gyri (elevations) & Sulci (depressions), this increases surface area
- ♦ it is the highest integrative and regulatory center of the nervous system

❷ Inner Layer

- ♦ composed of **White matter**, formed mainly of myelinated axons
- ♦ 3 types of fibers of white matter:

- ① **Association fibers**, connect gyri within the same hemisphere
- ② **Commissural fibers**, connect gyri from one hemisphere to the other one, 3 parts:
 - A. **Corpus callosum**, the largest, located above Septum pellucidum
 - B. **Anterior commissure**
 - C. **Posterior commissure**

- ③ **Projection fibers (Internal capsule)**, connect the cerebral cortex and subcortical structures like (**diencephalon, cerebellum, brainstem, spinal cord**). They form descending & ascending tracts



- **Basal nuclei**: cluster of subcortical nuclei deep within the cerebral hemispheres; a grey matter within white matter

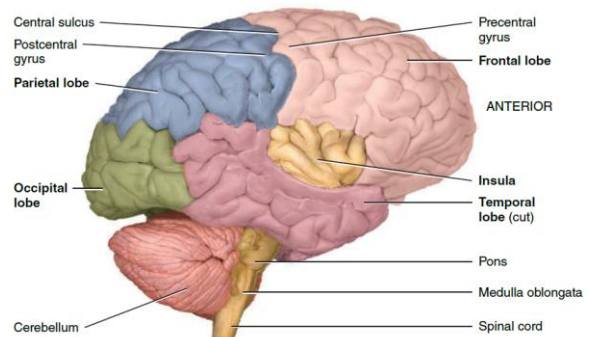
➤ External structure of Cerebrum

❶ Main Lobes

- A. **Frontal lobe**
- B. **Parietal lobe**
- C. **Occipital lobe**
- D. **Temporal lobe**
- E. **Insula**, embedded within Frontal & Temporal lobes

❷ Main Sulci

- A. **Central sulcus**, separates Frontal lobe & Parietal lobe, found between Precentral gyrus & Postcentral gyrus
- B. **Lateral sulcus**, separates Parietal lobe & Temporal lobe
- C. **Parieto-occipital sulcus**, separates Parietal lobe & Occipital lobe



D. **Calcarine sulcus**, located on the medial surface of the occipital lobe, responsible for **Visual interpretation**

E. **Longitudinal fissure**, separates between the 2 cerebral hemisphere

③ Main Gyri

A. Precentral gyrus

- ♦ it is the **primary motor area**
- ♦ controls voluntary movement on the opposite/contralateral side of the body; because nerve fibers from the precentral gyrus cross over to the opposite side within the **Pyramids of Brainstem**, a process called (**Decussation**)

B. Postcentral gyrus

- ♦ it is the **primary sensory area**
- ♦ receives inputs for: (Pain, Temperature, Touch, Pressure) from the opposite/contralateral side of the body

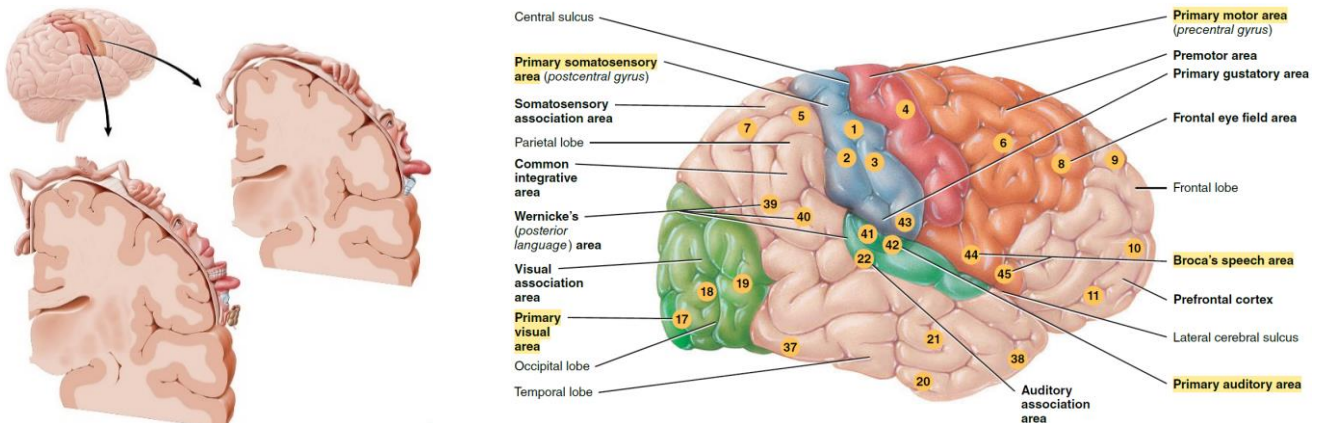
④ Homunculus

- ♦ the diagram that represents the sensory and motor areas scattered across precentral & postcentral gyri
- ♦ has 2 divisions:

- ① **Motor homunculus**
- ② **Sensory homunculus**

- ♦ has 3 main properties:

- ① **Inverted** → the upper part of the body is located at the lower part of cerebral cortex
- ② **Contralateral** → the right side of cerebral cortex controls the left side of the body
- ③ **Disproportional to size** → large organs have small areas (**Hand Vs Trunk**)



⑤ Functional regions of cerebrum

- Motor area**, in the precentral gyrus in the **frontal lobe**, anterior to the central sulcus
- Sensory area**, in the postcentral gyrus in the **parietal lobe**, posterior to the central sulcus
- Auditory area**, manages sound interpretation, located in the superior **temporal lobe**
- Visual area**, manages vision interpretation, located on medial aspect of the **occipital lobe**
- Motor Speech area "Broca's area"**, responsible for speech production & comprehension, located in the **frontal lobe**

Diencephalon

- Diencephalon is hidden by the cerebrum
- It consists of:

1 Thalamus

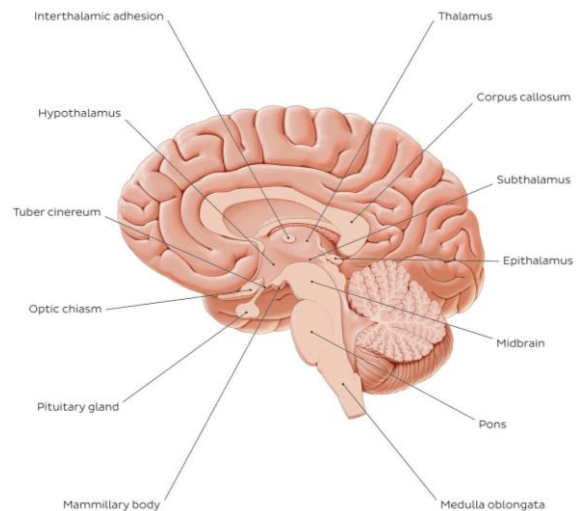
- ♦ paired oval G-shaped masses of gray matter organized into numerous nuclei; grey matter within white matter
- ♦ occupies 80% of the diencephalon
- ♦ functions as a vital relay station for sensory pathways
- ♦ about 70% of human brains have a bridge of grey matter joins the two thalami, called (**Interthalamic connection**)

2 Hypothalamus

- ♦ lies antero-inferior to the thalamus
- ♦ regulates and coordinates ANS activities:
 - ① controls body temperature
 - ② contains the feeding and thirst centers
 - ③ secretes several neurohormones:
 - **Hypothalamus-releasing hormones** → controls pituitary gland secretion
 - **Vasopressin (ADH)** → increase water reabsorption in kidneys, stored in posterior pituitary gland
 - ④ links between the nervous system & endocrine systems via the (**Pituitary gland** - الغدة النخامية)

3 Subthalamus

- ♦ **Epithalamus**, contains the **Pineal gland** (الغدة الصنوبرية) which controls the **Circadian cycle** (الساعة البيولوجية)

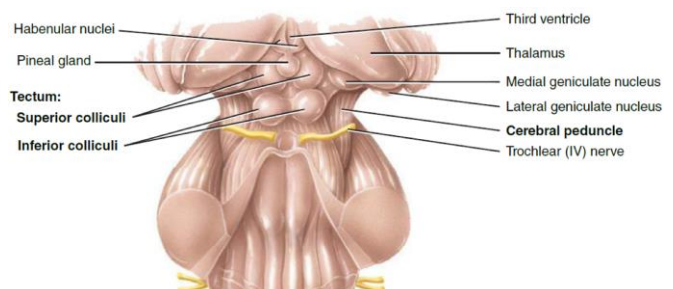
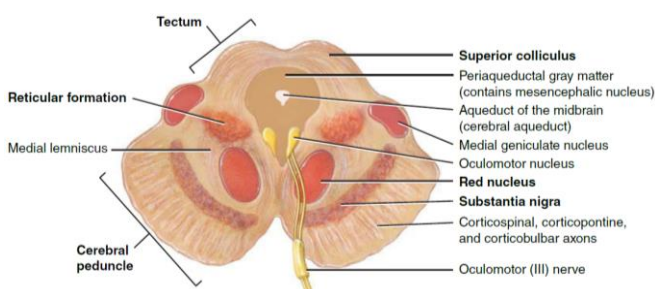
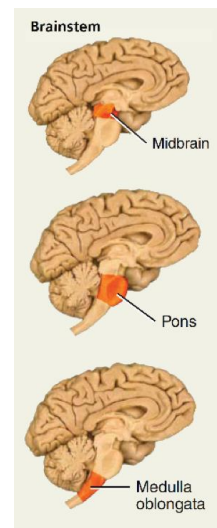


Brainstem

- composed of: (**Midbrain, Pons, Medulla Oblongata**)
- main functions of the brainstem:
 - ① contains vital functional centres: (**Cardiovascular center & Respiratory centre**)
 - ② a conduit (passageway) for all ascending (sensory) and descending (motor)
 - ③ contains the nuclei of 10 out of 12 cranial nerves; all except **CN-I & CN-II**

➤ Midbrain

- ♦ located in the superior part of the brain stem
- ♦ connects the Forebrain and Hindbrain
- ♦ houses the nuclei of cranial nerves: **III & IV**



- ♦ Anatomy of Midbrain; composed of: (Tectum & Peduncles) and between them lies the Cerebral aqueduct

❶ **Tectum**, the posterior part, consists of:

- Superior colliculi
- Inferior colliculi

❷ **Cerebral Peduncles**, the anterior part, consists of:

- Anterior part → **Crus cerebri**
- Middle part:
 - **Substantia Nigra**, controls the subconscious muscular motor activity "السلام الملكي"
 - **Red nucleus**, controls the voluntary muscle movement
- Posterior part → **Tegmentum**

*****Note:** Diseases that affect the red nucleus or substantia nigra will cause **Parkinson disease**

➤ Pons

- ♦ located in the middle part of the brainstem, anterior to the cerebellum
- ♦ houses the nuclei of cranial nerves: **V, VI, VII, half VIII**
- ♦ contains bundles of axons connecting the 2 **cerebellar** hemispheres

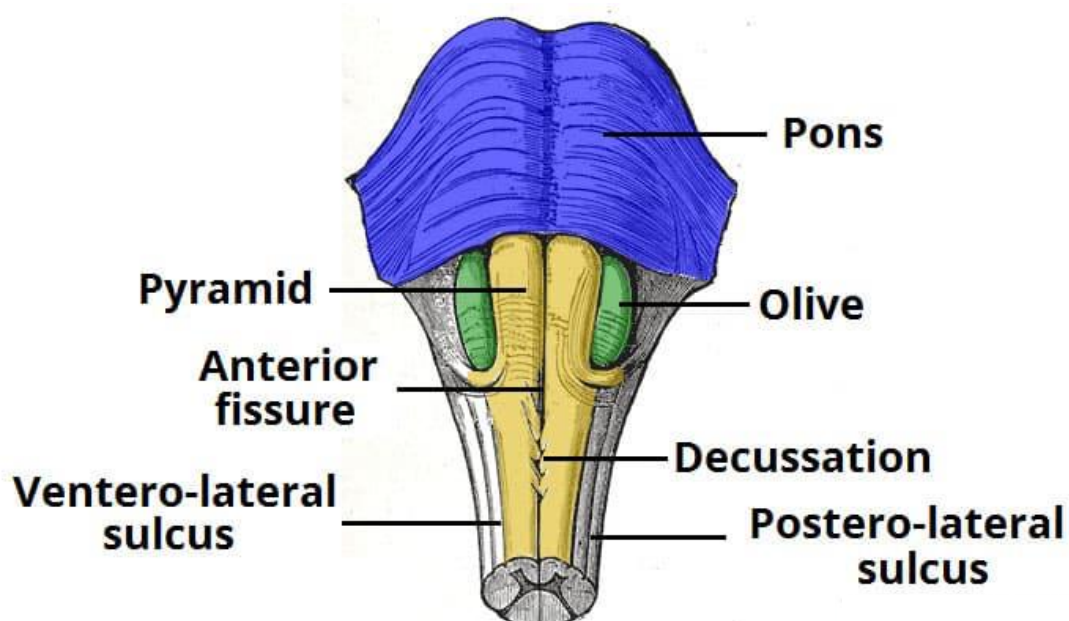
➤ Medulla oblongata

- ♦ located in the inferior part of the brainstem
- ♦ it is the transmission point between the brain and the spinal cord
- ♦ contains the nuclei of cranial nerves: **half VIII, IX, X, XI, XII**
- ♦ Anatomy of Medulla oblongata:

❶ **Anterior median fissure**

❷ **2 Lateral pyramids**, bundles of motor neurons of the precentral gyrus, where the (**Motor decussation**) occurs

❸ **2 Olives**, they contain the (**Inferior olivary nucleus**) which is important motor learning "معلم الفلافل"



Cerebellum

- Cerebellum (المخيخ) occupies $\frac{1}{10}$ of the brain's mass, yet houses half of the neurons
- located in the Posterior cranial fossa, beneath the Tentorium cerebelli
- functions of cerebellum:
 - ① coordination of muscle tone on the same side of the body; there will be 2 crossing-over “سالب السالب”
 - ② regulates posture and balance
 - ③ Proprioception, the awareness of the position and movement of the body

*****Note:** Proprioception is **90%** from Cerebellum and **10%** from **Occipital lobe**; because it contains the **Visual area**

• Anatomy of Cerebellum

① **Vermis (الدودة)**, the central constricted area between the 2 cerebellar hemisphere

② **Cerebellar lobes**

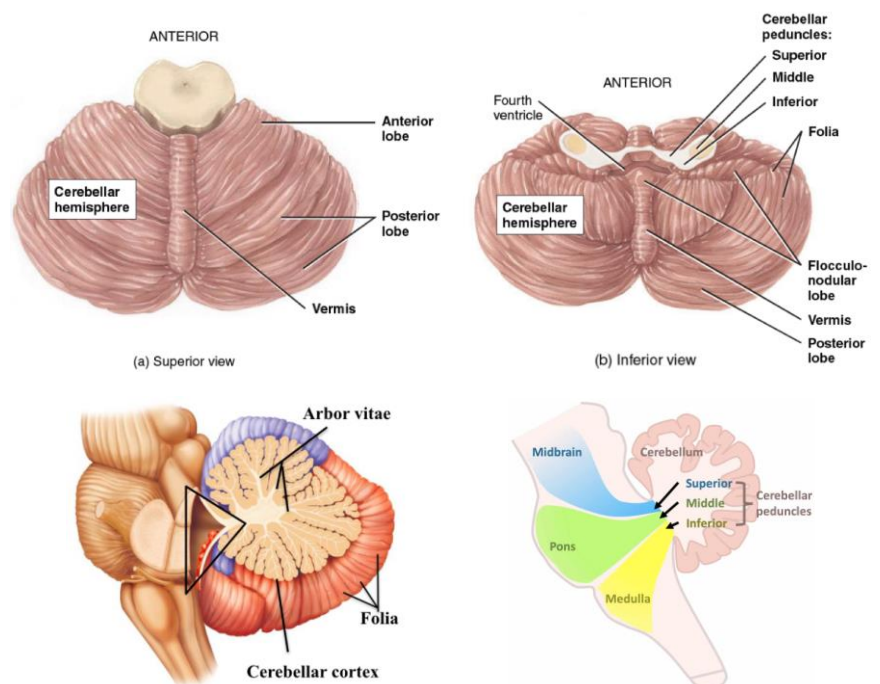
- Anterior lobe**
- Posterior lobe**
- Flocculonodular lobe**

③ **Grey matter (Folia)**

④ **White matter (Arbor vitae)**

⑤ **Cerebellar peduncles**

- Superior** → to Midbrain
- Middle** → to Pons
- Inferior** → to Medulla oblongata



★ Clinical correlation: Ataxia

- ❖ **Definition:** the lack of balance, muscle coordination, and impaired walking
- ❖ **Cause:** damage of the cerebellum
- ❖ **Diagnosis:** blind fold the patient and ask them to touch their nose with the tip of their fingers

Anatomy of Nervous system (Spinal cord)

Spinal meninges

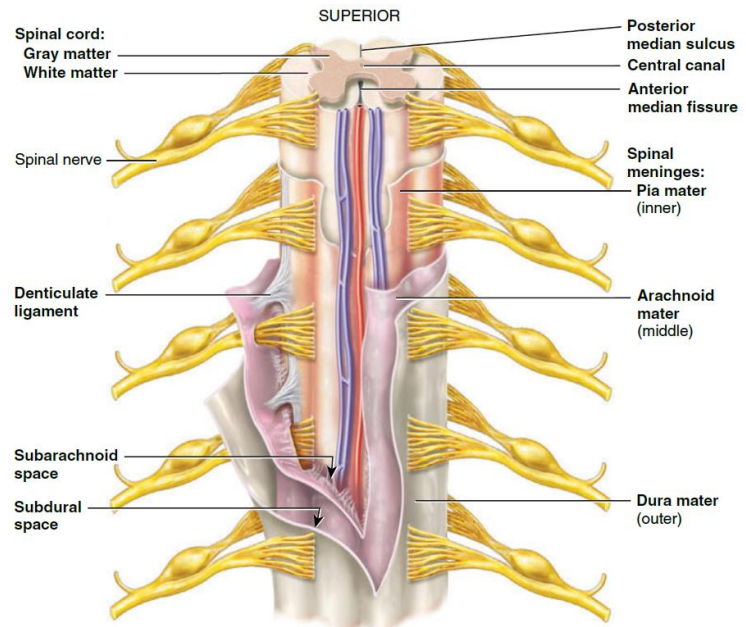
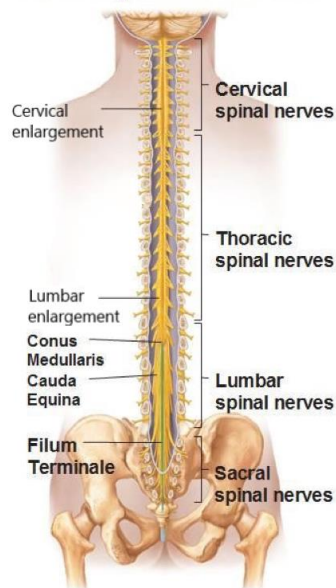
Protective layers of the spinal cord are similar to those of the brain: (Bone - Meninges - CSF)

- ① **Dura mater** → only the inner dural layer, the outer stops in medulla oblongata
- ② **Arachnoid mater**
- ③ **Pia mater** → has extensions called (**Denticulate ligaments**) that anchors the spinal cord laterally to other meninges

External anatomy

- **Conus medullaris**, tapering cone-shaped end of grey matter
- **Filum terminale**, an inferior extension of the pia mater from conus medullaris, it anchors the spinal cord to the **Coccyx**
- **Cauda equina** (**Ponytail** - ذيل الفرس), the lowest part of the spinal cord where roots of spinal nerves emerges
- **Spinal enlargements**, Cervical for upper limbs & Lumbar for lower limbs

The Spinal Cord



Internal anatomy

➤ Anterior median fissure & Posterior median sulcus

➤ White matter

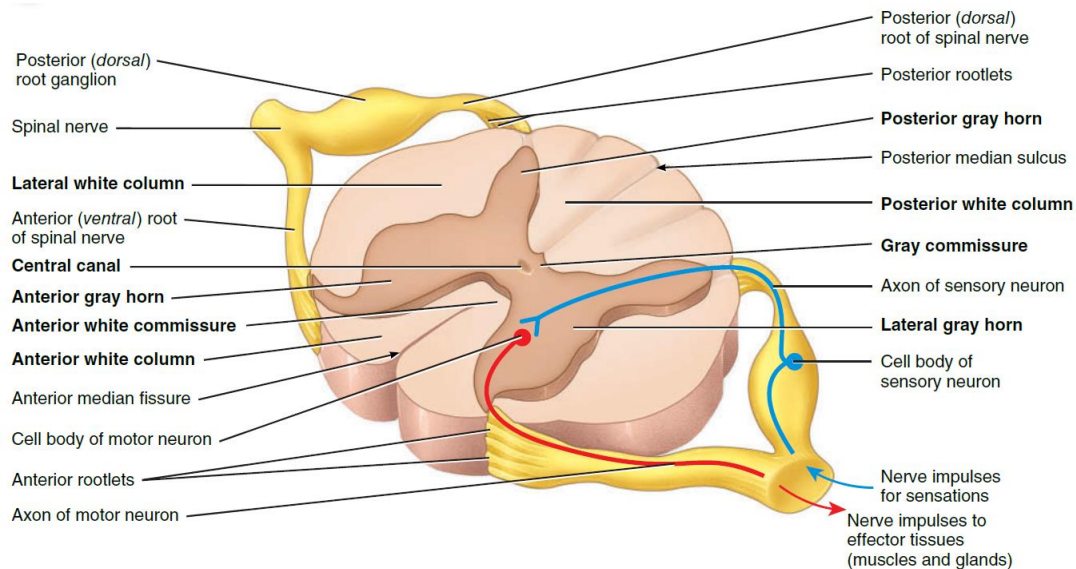
- arranged into columns: **Anterior (Ventral)**, **Posterior (Dorsal)**, **Lateral**
- contains the Sensory (Ascending) & Motor (Descending) tracts

➤ Grey matter

- butterfly (H-shaped) structure
- arranged into horns:
 - ➊ **Anterior (Ventral)**, contain nuclei of motor parts of spinal nerves
 - ➋ **Posterior (Dorsal)**, contain nuclei for sensory parts of the spinal nerves
 - ➌ **Lateral**, contain nuclei for motor parts of ANS, found only in the thoracic, upper lumbar, sacral segments
- **Grey commissure**, a grey matter area that connects the 2 sides of the butterfly together, it houses the (**Central canal**) which communicates with the 4th ventricle and filled with circulating CSF

***Note: The ANS nerves are:

- ♦ Sympathetic → T1 - L2
- ♦ Parasympathetic → S2 - S4 & Vagus nerve (CN-X)



Peripheral nerves

➤ Spinal nerves

- We have 31 pairs of spinal nerves originating from spinal segments:

- ♦ 8 pairs of **Cervical nerves** (C1 - C8)
- ♦ 12 pairs of **Thoracic nerves** (T1 - T12)
- ♦ 5 pairs of **Lumbar nerves** (L1 - L5)
- ♦ 5 pairs of **Sacral nerves** (S1 - S5)
- ♦ 1 pair of **Coccygeal nerves** (Co1)

- at the age of 5, SC stops growing but the VC doesn't, so:

- ♦ **in children** → spinal cord is at the level of L4-L5
- ♦ **in adults** → spinal cord is at the level of L1-L2

- because the VC grows faster than spinal cord, each vertebra doesn't have to align with a corresponding spinal segment:

- ♦ **C1 - C8** → exit above the corresponding intervertebral foramen
- ♦ **T1 - Co1** → exit below the corresponding intervertebral foramen

- SO, we define the spinal segments by the root exiting this specific segment and NOT the intervertebral foramen

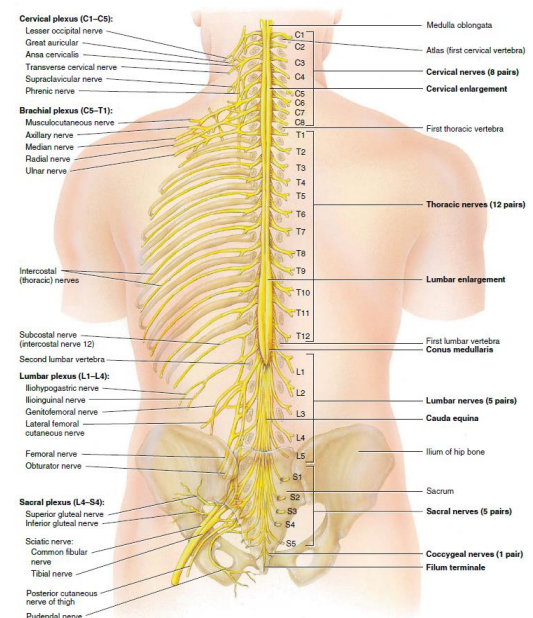
- The anterior rami of all spinal nerves form networks called (**Plexuses**), except for the anterior rami of thoracic spinal (**intercostal**) nerves

T2 - T12, which travel directly to muscles & skin they innervate, these plexuses are:

- ♦ **Cervical plexus** (C1 - C5) → supplies all Infrahyoid muscles & the Digastric muscle
- ♦ **Brachial plexus** (C5 - T1) → supplies the Upper limbs
- ♦ **Lumbar plexus** (L1 - L4) → supplies the Lower limbs
- ♦ **Sacral plexus** (L4 - L5 and S1 - S4) → supplies the Lower limbs, too!

★ Clinical correlation: Lumbar puncture

- ❖ **Definition:** the process of obtaining a CSF sample from the spinal cord by the FNA (Fine Needle Aspiration)
- ❖ **Location:** at the end level of L4



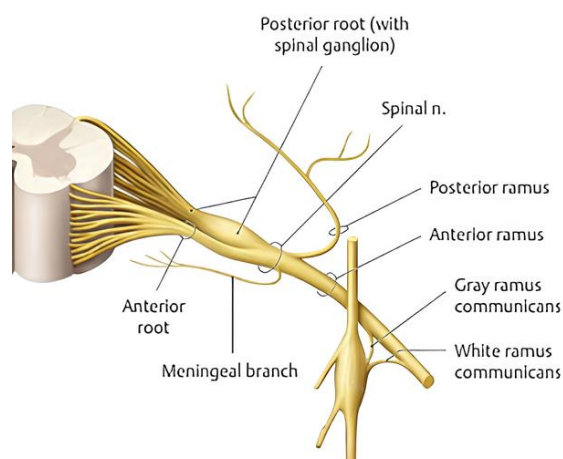
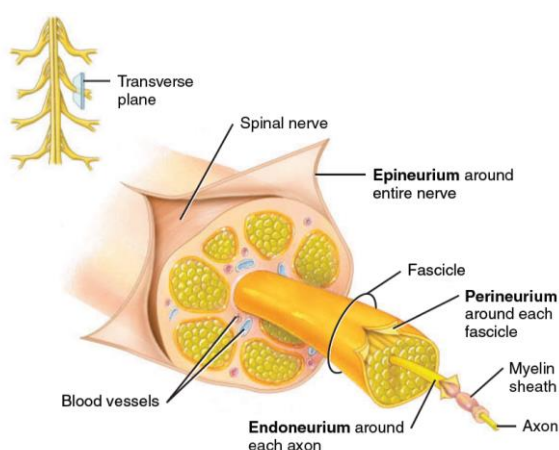
الصورة مش كلها مطلوبة :) بس اللي بحكيه بالفديو

- each spinal nerve in the body has CT coverings, these are:

- ❶ **Endoneurium**, encloses each nerve fiber (axon)
- ❷ **Perineurium**, surrounds groups of axons (Fascicle)
- ❸ **Epineurium**, covers the entire nerve

- Anatomy of Spinal nerves:

- ❶ **Ventral root**, contains axons of the motor neurons
- ❷ **Dorsal root**, contains axons of the sensory neurons
- ❸ **Ventral ramus**, supplies the anterolateral muscles of the trunk plus both upper and lower limbs
- ❹ **Dorsal ramus**, supplies the muscles of the back
- ❺ **Meningeal branch**, innervates the meninges within spinal canal
- ❻ **Dorsal root ganglia**, aggregation of Pseudounipolar neurons, located in the dorsal root



➤ Cranial nerves

- We have 12 pairs of cranial nerves that originate from the brain
- they carry both sympathetic & parasympathetic innervations to head and neck, EXCEPT for the Vagus nerve which extends to reach the abdomen as well
- classification of Cranial nerves:

❶ Sensory

- ◆ **Olfactory (CN I)** → Smell
- ◆ **Optic (CN II)** → Vision
- ◆ **Vestibulocochlear (CN VIII)** → Hearing and Equilibrium

❷ Motor

- ◆ **Oculomotor (CN III)** → Movement of extraocular muscles
- ◆ **Trochlear (CN IV)** → Movement of extraocular muscles
- ◆ **Abducens (CN VI)** → Movement of extraocular muscles
- ◆ **Accessory (CN XI)** → has 2 parts:
 - ❶ **Cranial division**, joins the Vagus nerve
 - ❷ **Spinal division**, innervates both: Sternocleidomastoid & Trapezius
- ◆ **Hypoglossal (CN XII)**, supplies muscles of the tongue, EXCEPT for the Palatoglossus muscle

③ Mixed

♦ Trigeminal (CN V): divides into 3 branches:

- ① Ophthalmic nerve V₁
- ② Maxillary nerve V₂
- ③ Mandibular nerve V₃, the largest branch

♦ Facial (CN VII)

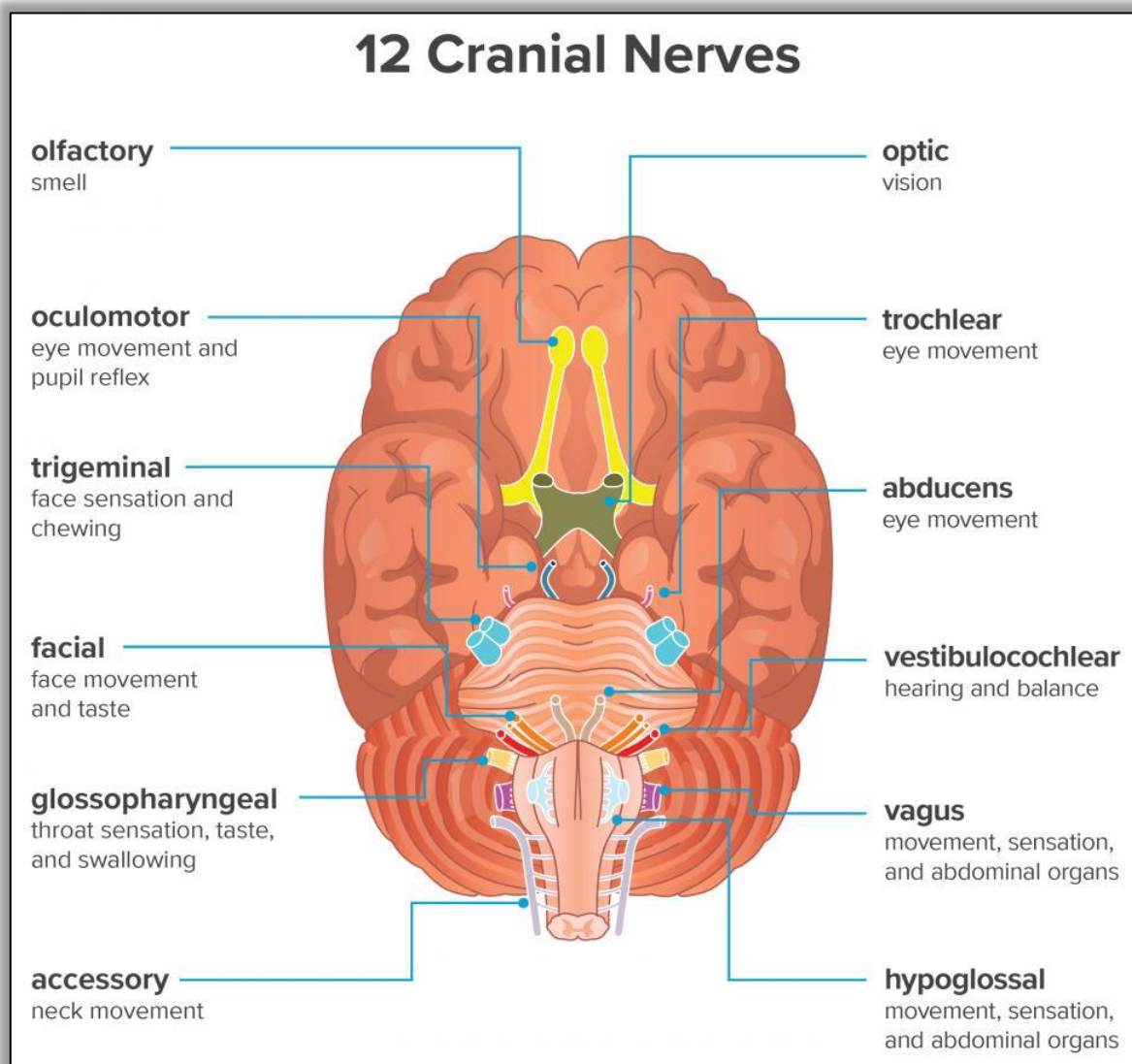
- provides general sensation of the anterior $\frac{2}{3}$ of the tongue
- has the (**Chorda tympani**) branch that carries taste sensations of the anterior $\frac{2}{3}$ of the tongue
- innervates the muscles of facial expression

♦ Glossopharyngeal (CN IX)

- carries general & taste sensations of the posterior $\frac{1}{3}$ of the tongue
- it is the only nerve in the **entire body** to carry ALL types of nerves: (Motor, Sensory, General, Specific, Mixed)

♦ Vagus (CN X)

- carries parasympathetic innervation to the thoracic and abdominal organs
- extends up to the proximal $\frac{2}{3}$ of the transverse colon "Midgut"



Spinal nerves to memorize

Dr. Anas said these are important and are **TO BE MEMORIZED** 😞 [Origins are not to be memorized]

NERVE	ORIGIN	DISTRIBUTION
Axillary (AK-si-lar-ē)	C5–C6	Deltoid and teres minor muscles; skin over deltoid and superior posterior aspect of arm
Median	C5–T1	Flexors of forearm, except flexor carpi ulnaris: the ulnar half of the flexor digitorum profundus, and some muscles of the hand (lateral palm); skin of lateral two-thirds of palm of hand and fingers
Radial	C5–T1	Triceps brachii, anconeus, and extensor muscles of forearm; skin of posterior arm and forearm, lateral two-thirds of dorsum of hand, and fingers over proximal and middle phalanges
Ulnar	C8–T1	Flexor carpi ulnaris, ulnar half of the flexor digitorum profundus, and most muscles of the hand; skin of medial side of hand, little finger, and medial half of ring finger

NERVE	ORIGIN	DISTRIBUTION
Femoral	L2–L4	Largest nerve arising from the lumbar plexus, distributed to the flexor muscles of hip joint and extensor muscles of knee joint, and to skin over anterior and medial aspect of thigh and medial side of leg and foot
Obturator (OB-too-rā-tor)	L2–L4	Adductor muscles of hip joint; skin over medial aspect of thigh
Sciatic (sī-AT-ik)	L4–S3	Actually two nerves—tibial and common fibular—bound together by common sheath of connective tissue; it splits into its two divisions, usually at the knee (see below for distributions); as it descends through the thigh, sends branches to hamstring muscles and the adductor magnus
Tibial (TIB-ē-al)	L4–S3	Gastrocnemius, plantaris, soleus, popliteus, tibialis posterior, flexor digitorum longus, and flexor hallucis longus muscles; branches in foot are medial plantar nerve and lateral plantar nerve
Common fibular (FIB-ū-lar)	L4–S2	Divides into a superficial fibular and a deep fibular branch
Superficial fibular		Fibularis longus and fibularis brevis muscles; skin over distal third of anterior aspect of leg and dorsum of foot
Deep fibular		Tibialis anterior, extensor hallucis longus, fibularis tertius, and extensor digitorum longus and extensor digitorum brevis muscles; skin on adjacent sides of great and second toes

العصب الوحيد اللي الدكتور ركز عليه هو **الماسكيولوكوتانيوس**، بس هذا لا يعني انه الباقي مش مطلوبات

Biceps brachii is innervated by the **Musculocutaneous nerve** (C5 - C6)