

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ



Introduction

MID | Lecture 1

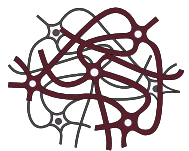
إِنِّي تَوَكَّلْتُ عَلَى اللَّهِ رَبِّي وَرَبِّكُمْ مَا مِنْ دَابَّةٍ إِلَّا هُوَ آخِذٌ بِنَاصِيَتِهَا إِنَّ رَبِّي عَلَى صِرَاطٍ مُسْتَقِيمٍ

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ANATOMY



رحلة اليقين مع سورة يس

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

يس (١) وَالْقُرْآنِ الْحَكِيمِ (٢)

يس: هذه الحروف وغيرها من الحروف المقطعة في أوائل السور فيها إشارة إلى إعجاز القرآن؛ فقد وقع به تحدي المشركين، فعجزوا عن معارضته، وهو مركب من هذه الحروف التي تتكون منها لغة العرب. فدلَّ عجز العرب عن الإتيان بمثله -مع أنهم أفصح الناس- على أن القرآن وحي من الله.

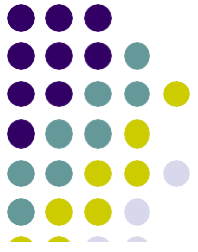
وَالْقُرْآنِ الْحَكِيمِ: هذا قسم من الله تعالى بالقرآن الحكيم، الذي وصفه الحكمة، وهي وضع كل شيء موضعه، وضع الأمر والنهي في الموضع اللائق بهما، ووضع الجزاء بالخير والشر في محلها اللائق بهما، فأحكامه الشرعية والجزائية كلها مشتملة على غاية الحكمة. ومن حكمة هذا القرآن، أنه يجمع بين ذكر الحكم وحكمته، فينبه العقول على المناسبات والأوصاف المقتضية لترتيب الحكم عليها.



“اللهم إني أسألك فهم النبيين، وحفظ المرسلين، وإلهام الملائكة المقربين، اللهم اجعلنا من الذين يستمعون القول
فيتبعون أحسنه، ويسر علينا حفظ ما نتعلمه وفهمه والعمل به”

The Nervous System

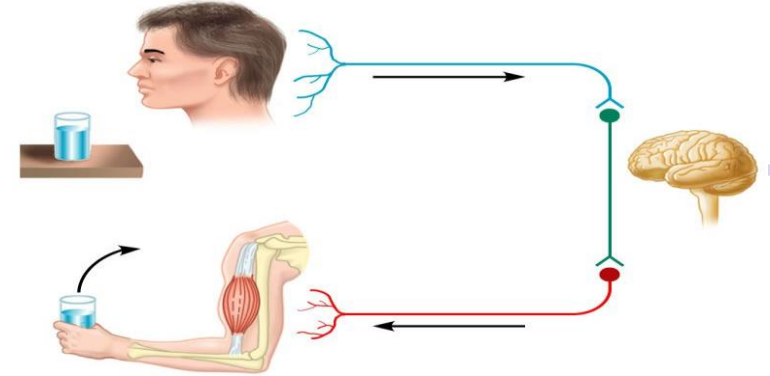
- A network of billions of nerve cells linked together in a highly organized fashion to form the rapid control center of the body.



Basic Functions of the Nervous System

1. Sensation / إحساس

- Monitors changes/events occurring in and outside the body (**critical for all organisms, as it is essential for survival**). Such changes are known as *stimuli* and the cells that monitor them are *receptors*.



- ✓ **Sensory signals** are transmitted from the **periphery toward the central nervous system** via specialized structures known as **receptors**.
- ✓ **Receptors detect both external and internal stimuli.**
 - **Internal receptors**, such as baroreceptors located in blood vessels, monitor physiological parameters like blood pressure and relay this information to the CNS. **Following transmission, sensory input is integrated to generate appropriate responses;** for example, an increase in blood pressure can elicit vasodilation.
 - **Somatic sensations** encompass modalities such as touch, pressure, and vision, whereas **autonomic sensations** originate from internal organs, these sensations do not necessarily reach the level of conscious perception.

- Somatic pressure refers to stimuli applied to the body's surface, such as touch or mechanical force on the skin.



Basic Functions of the Nervous System

2. Integration

- The parallel processing and interpretation of sensory information to determine the appropriate response

3. Reaction

- Motor output.
The activation of muscles or glands (typically via the release of neurotransmitters (NTs))

- ✓ Motor responses are initiated by **signals transmitted from the central nervous system (CNS) to the periphery**, these structures that respond to these signals are called **effectors**.
- ✓ Effectors include **skeletal muscles**, which contract, and **glands**, which secrete their products.
- ✓ **Somatic motor pathways** control voluntary, conscious movements of skeletal muscles, whereas **autonomic motor pathways** regulate the activity of cardiac muscle, smooth muscle, and glands.

Nervous Tissue

- ✓ The four basic types of tissue in the body are epithelial tissue, connective tissue, muscle tissue, and nervous tissue.



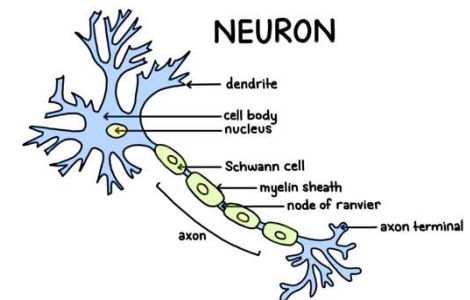
- Highly cellular
- 2 cell types

1. Neurons

- Functional, signal conducting cells **which is essential for controlling bodily functions.**
- Do not divide
 - ✓ A neuron is an individual nerve cell, distinct from a nerve, which is a bundle of axons surrounded by connective tissue.
- Long lived
 - ✓ A neuron consists of a cell body, dendrites, and an axon, some axons may extend up to one meter in length.
- High metabolic activity
- Electrically excitable

2. Neuroglia

- Support, nourish, and protect neurons
- Divide
- Smaller cells but they greatly outnumber neurons by about 5 to 50
- 6 types of supporting cells: (4 are found in the CNS, and 2 are found in the PNS. *Next slide..*)



Neuroglia

Cell Type	Location	Main Functions
Oligodendrocytes	CNS	<ul style="list-style-type: none"> • Make the myelin sheath around axons
Astrocytes (star-shaped cells)	CNS	<ul style="list-style-type: none"> • Help in forming the blood-brain barrier . Astrocytes wrap their processes around capillaries in the CNS, providing structural support and protecting nervous tissue by regulating the entry of substances from the blood. • Act as a buffer for excess neurotransmitters
Ependymal Cells	CNS	<ul style="list-style-type: none"> • Line the ventricles (hollow space in the brain) • Line the central canal of the spinal cord
Microglia	CNS	<ul style="list-style-type: none"> • Immune cells of the nervous system (originate from monocytes)
Schwann Cells	PNS	<ul style="list-style-type: none"> • Form myelin sheath in the peripheral nervous system
Stellate Cells	PNS	<ul style="list-style-type: none"> • Provide support outside the CNS

✓ Monocytes are bone marrow-derived cells that circulate in the bloodstream. After entering tissues, they differentiate into resident macrophages. These cells are called Langerhans cells in the skin, Kupffer cells in the liver, and microglia in the central nervous system (CNS).

- **White matter:** aggregations of myelinated and unmyelinated axons of many neurons (**there's no neuronal cell bodies**)
- **Gray matter:** contains neuronal cell bodies, dendrites, unmyelinated axons, axon terminals, and neuroglia

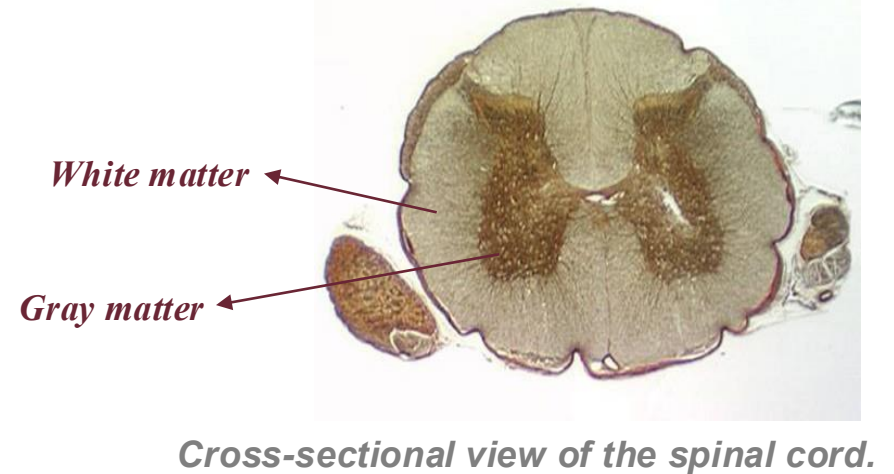
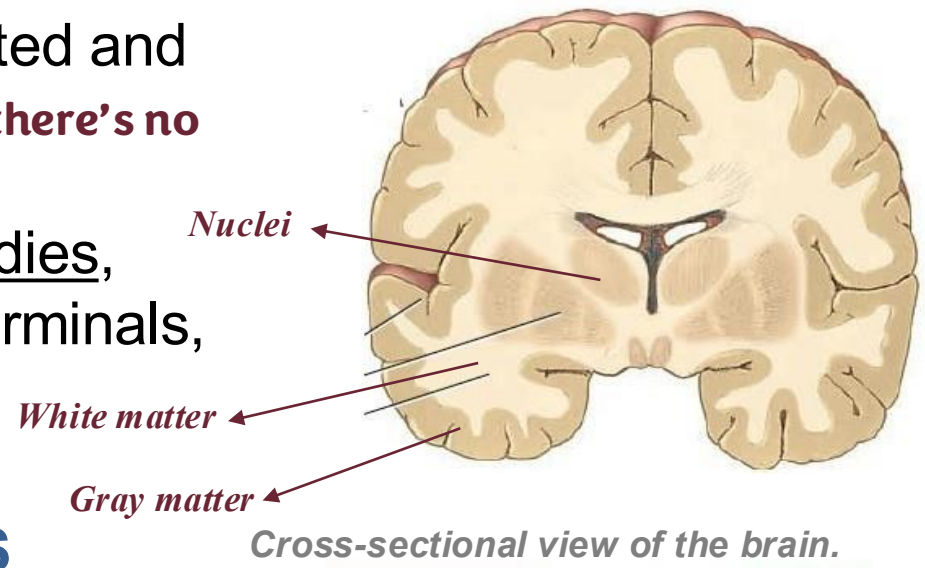
▪ **Nerves:** Bundles of processes in the **PNS** (**surrounded by connective tissue**) and **doesn't contain cells bodies**, For example, the median nerve in the cubital fossa consists of numerous axonal processes; upon sectioning, only these processes are observed, not neuronal cell bodies.

▪ **Tracts:** Bundles of processes in the **CNS** (No Connective tissue)

▪ **Ganglion:** cluster of nerve cell bodies in **PNS** such as **pterygopalatine ganglion**.

▪ **Nucleus:** cluster of nerve cell bodies in **CNS** (surrounded by white matter)

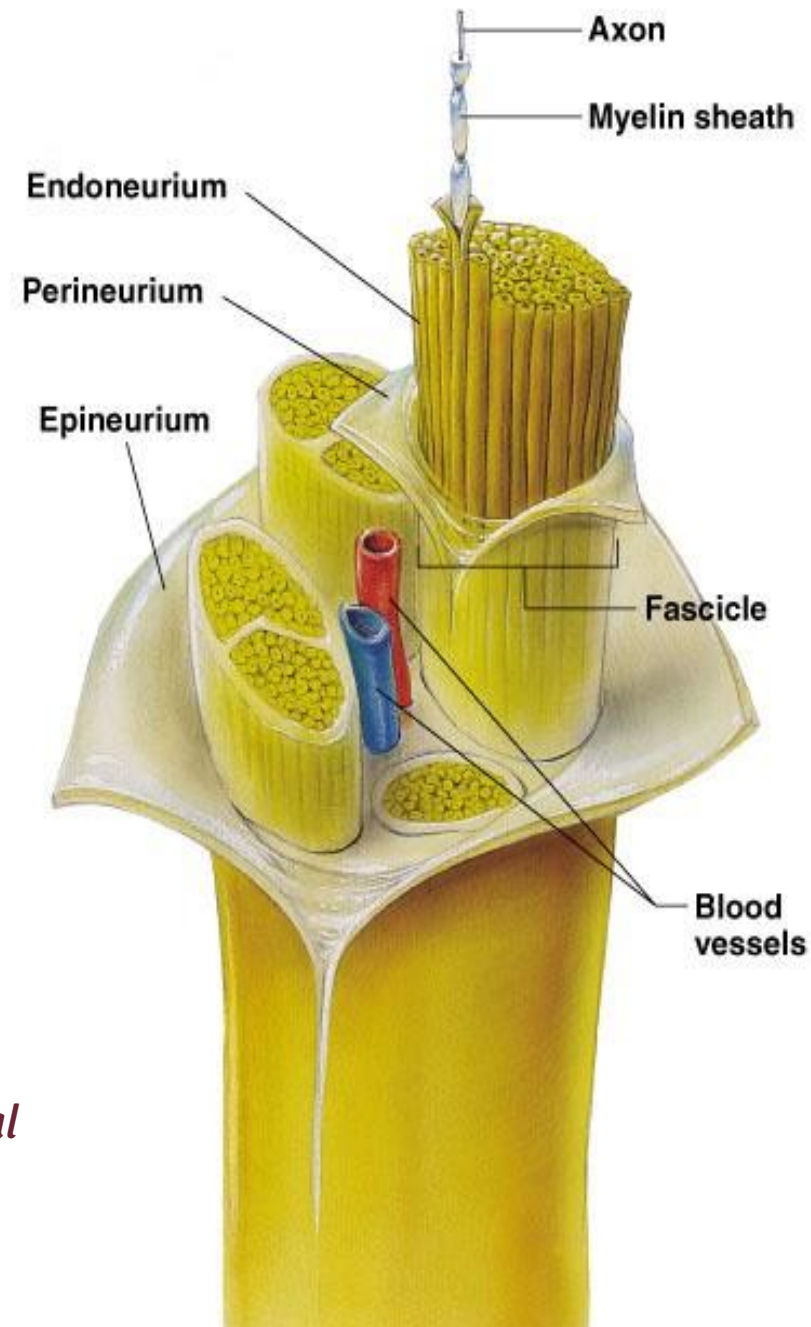
➤ If not surrounded (Cortex)



- ✓ **Neuronal processes include dendrites and axons. Both are cellular extensions; however, they differ in function.**
- ✓ **Dendrites conduct signals toward the cell body, whereas the axon conducts signals away from the cell body.**

- A bundle of processes in the PNS is a **nerve**.
- Within a nerve, each axon is surrounded by an **endoneurium**
- Groups of fibers are bound together into bundles (fascicles) by a **perineurium**
- All the fascicles of a nerve are enclosed by a **epineurium**

Note: The central nervous system does not contain connective tissue. Instead, its supportive and structural functions are provided by neuroglial cells.



تَوَكَّلْ عَلَى اللَّهِ كَفَىٰ لَنَا إِلَهًُّا
وَكَلِيًّا

Organization of the Nervous System

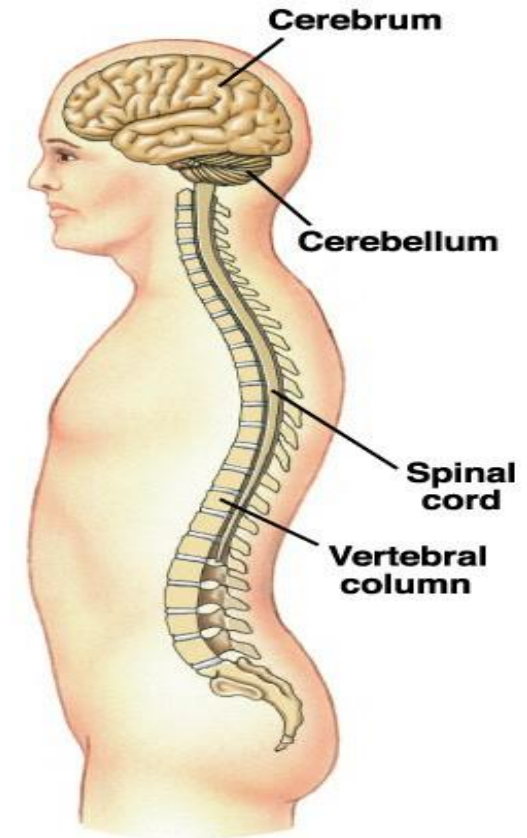
- Anatomical divisions:

1. Central Nervous System

- The brain + the spinal cord
 - The center of integration and control

2. Peripheral Nervous System

- The nervous system outside of the brain and spinal cord
- Consists of:
 - 31 **pairs of** Spinal nerves
 - Carry info to and from the spinal cord
 - 12 **pairs of** Cranial nerves
 - Carry info to and from the brain



- ✓ spinal nerves are identified by a letter and a number corresponding to their region and order along the spinal cord. For example, C5 refers to the fifth cervical spinal nerve.
- ✓ Although there are 33 vertebrae in the vertebral column, there are only 31 pairs of spinal nerves, because not every vertebra corresponds to a spinal nerve, particularly in the sacral and coccygeal regions

Olfactory, Optic, Oculomotor, Trochlear, Trigeminal, Abducens, Facial, Vestibulocochlear, Glossopharyngeal, Vagus, Accessory, and Hypoglossal

Brain

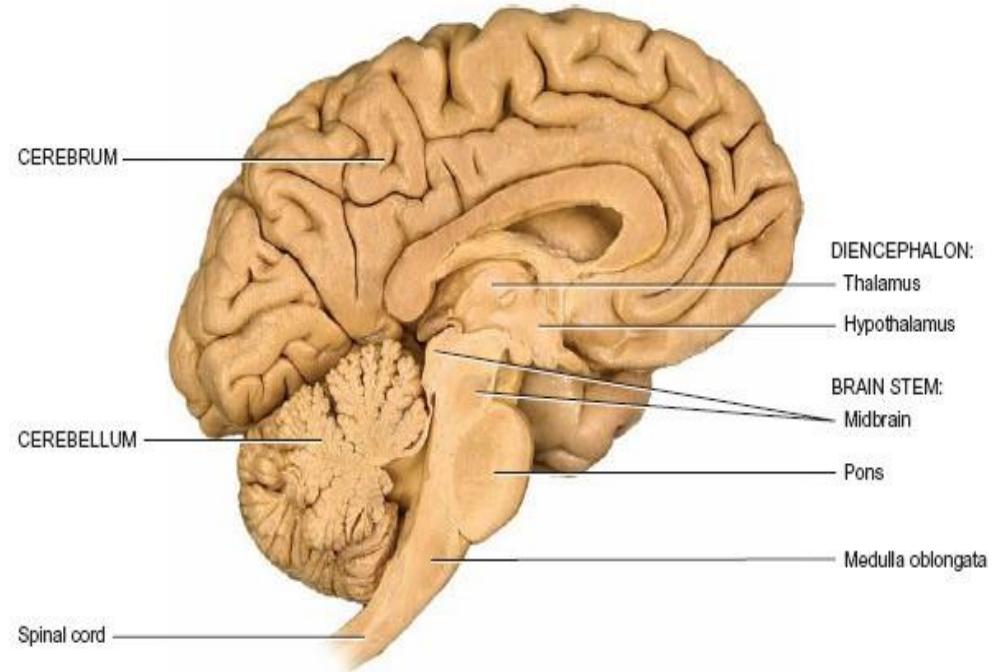


- **Forebrain:** (Prosencephalon)
- Cerebrum: (Telencephalon) **located peripherally**
- Diencephalon **located centrally and serves as a central control region of the body**
- Thalamus
- Hypothalamus
- Epithalamus
- Subthalamus

- **Midbrain:**
(Mesencephalon)

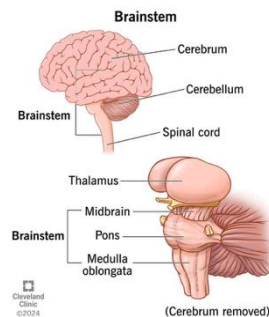
- **Hindbrain:** (Rhombencephalon)

- Pons
- Medulla oblongata
- Cerebellum



➤ **During development, the nervous system arises from the neural tube, with a cephalic (cranial) end developing into the brain and a caudal end developing into the spinal cord.**

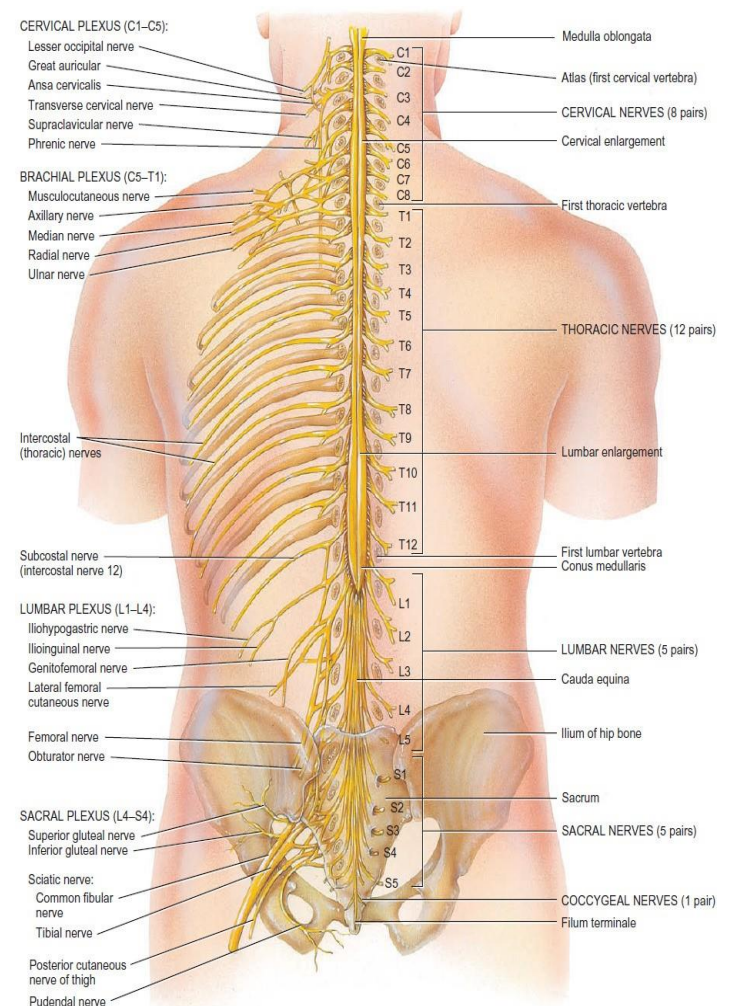
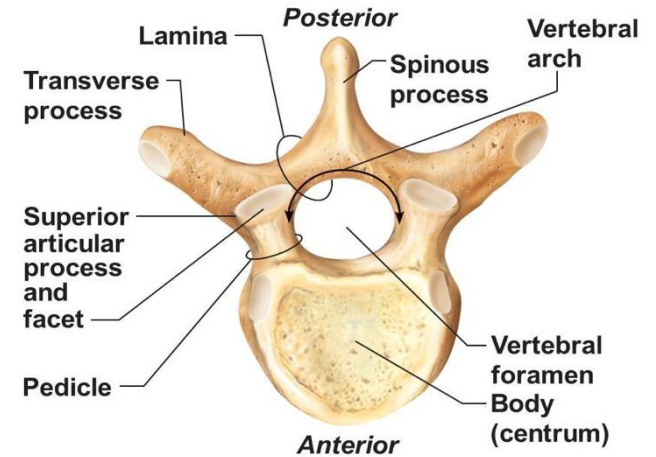
➤ **The brainstem, comprising the *medulla oblongata, pons, and midbrain*, is grouped together because of their similar structural and some functional characteristics, for example it contains ascending and descending tracts and houses the nuclei of ten cranial nerves, which are embedded within its structure.**



- **Also it contains vital centers in the brainstem controlling breathing and heart rate.**

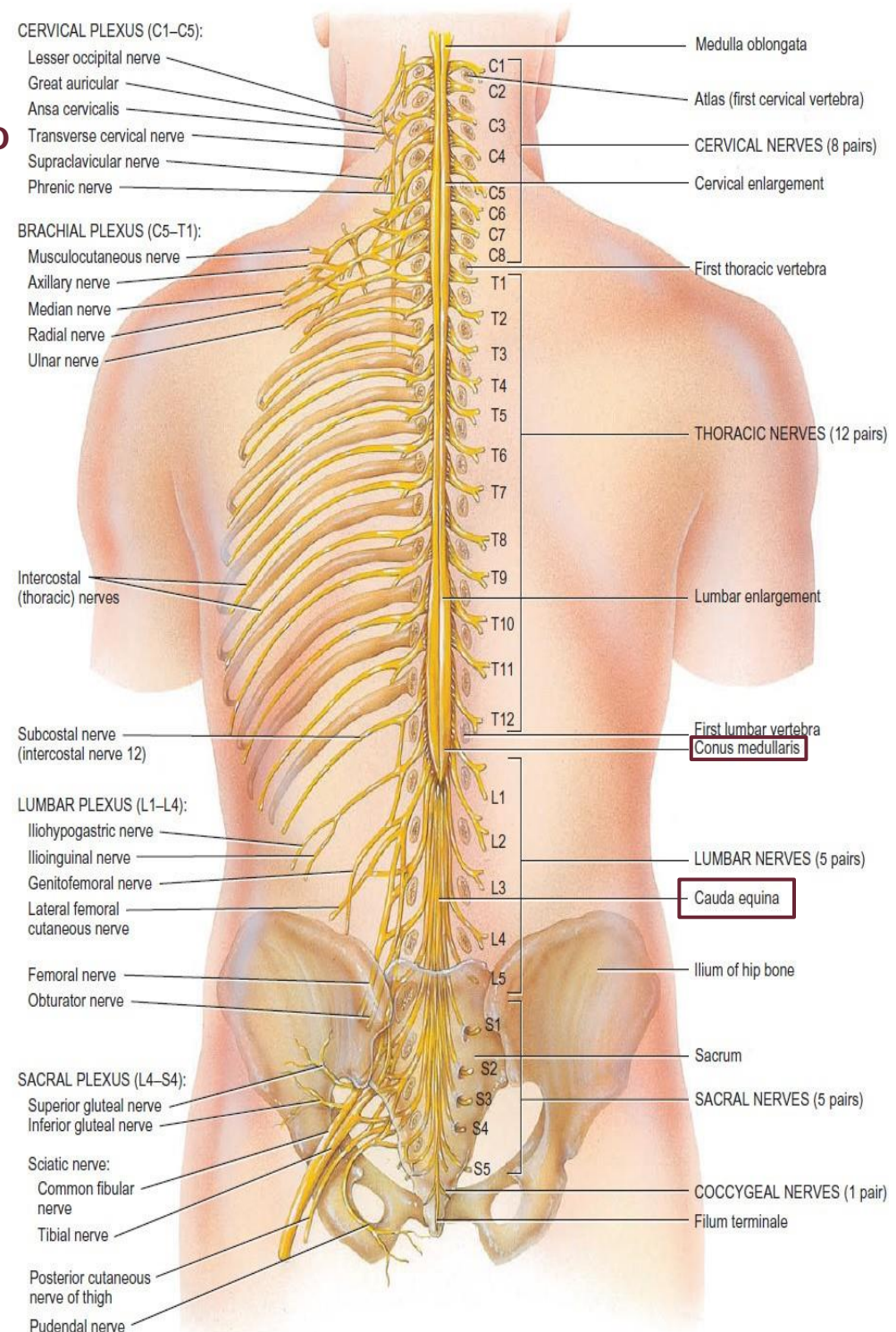
External anatomy of Spinal Cord

- Runs through the vertebral canal
 - protected in the vertebral canal: a bony canal formed by vertebral foramina arranged above each other
- Extends from foramen magnum to second lumbar vertebra (between L1 and L2, beneath L2 spinal cord can't be found)
- Regions (31 segments), each region is named after its corresponding nerve that emerge from a specific intervertebral foramen -not its truly level- :
 - Cervical (8) - despite that cervical vertebrae are 7
 - Thoracic (12)
 - Lumbar (5)
 - Sacral (5)
 - Coccygeal (1)
- Gives rise to (31) pairs of spinal nerves
 - All are *mixed* nerves
 - Sacral and coccygeal nerves' roots are **longer**



External anatomy of Spinal Cord

- Not uniform in diameter, **proportioned to the function:**
 - Cervical enlargement **especially the lower segments of the cervical region (C5 - C8)** : supplies upper limbs (**brachial plexus**)
 - Lumbar enlargement: supplies lower limbs
- Flattened slightly anteriorly and posteriorly
- length of the adult spinal cord ranges from 42 to 45 cm (**upper 2/3**)
- **Conus medullaris** - tapered inferior end (conical structure)
 - Ends between L1 and L2
- **Cauda equina** (**horse tail appearance**) - origin of spinal nerves extending inferiorly from conus medullaris (**lower 1/3**).



Meninges السحايا

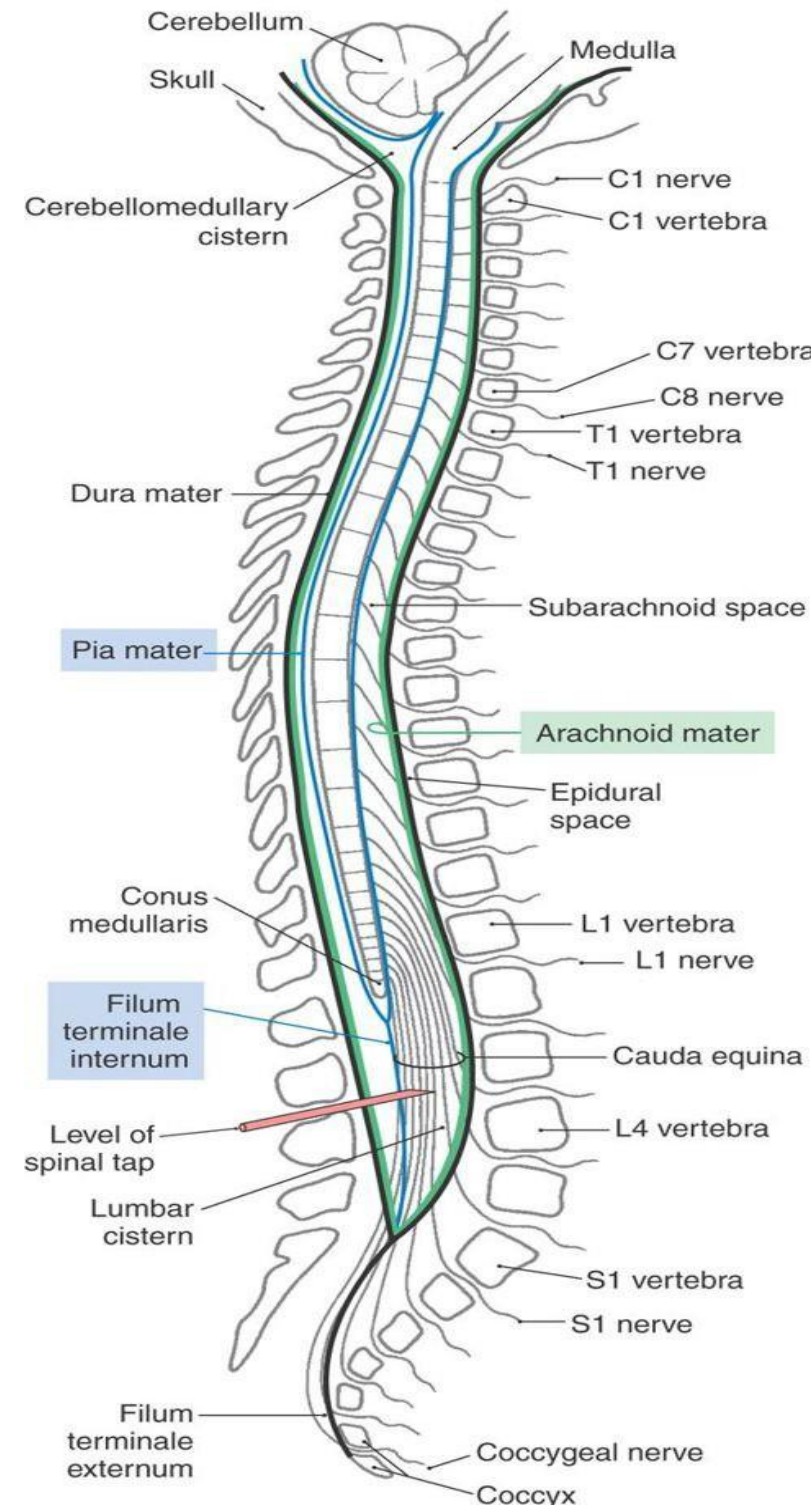
- Connective tissue membranes

- **Dura mater:**

- ❑ Outermost layer (in the inner surface of the bones); continuous with epineurium of the spinal nerves
- ❑ Dense irregular connective tissue
- ❑ from the level of the foramen magnum to S2 vertebra, in order it forms a dural sac.
- ❑ Closed caudal end is anchored to the coccyx by the **filum terminale externum**, which contribute to the stability of the spinal cord.

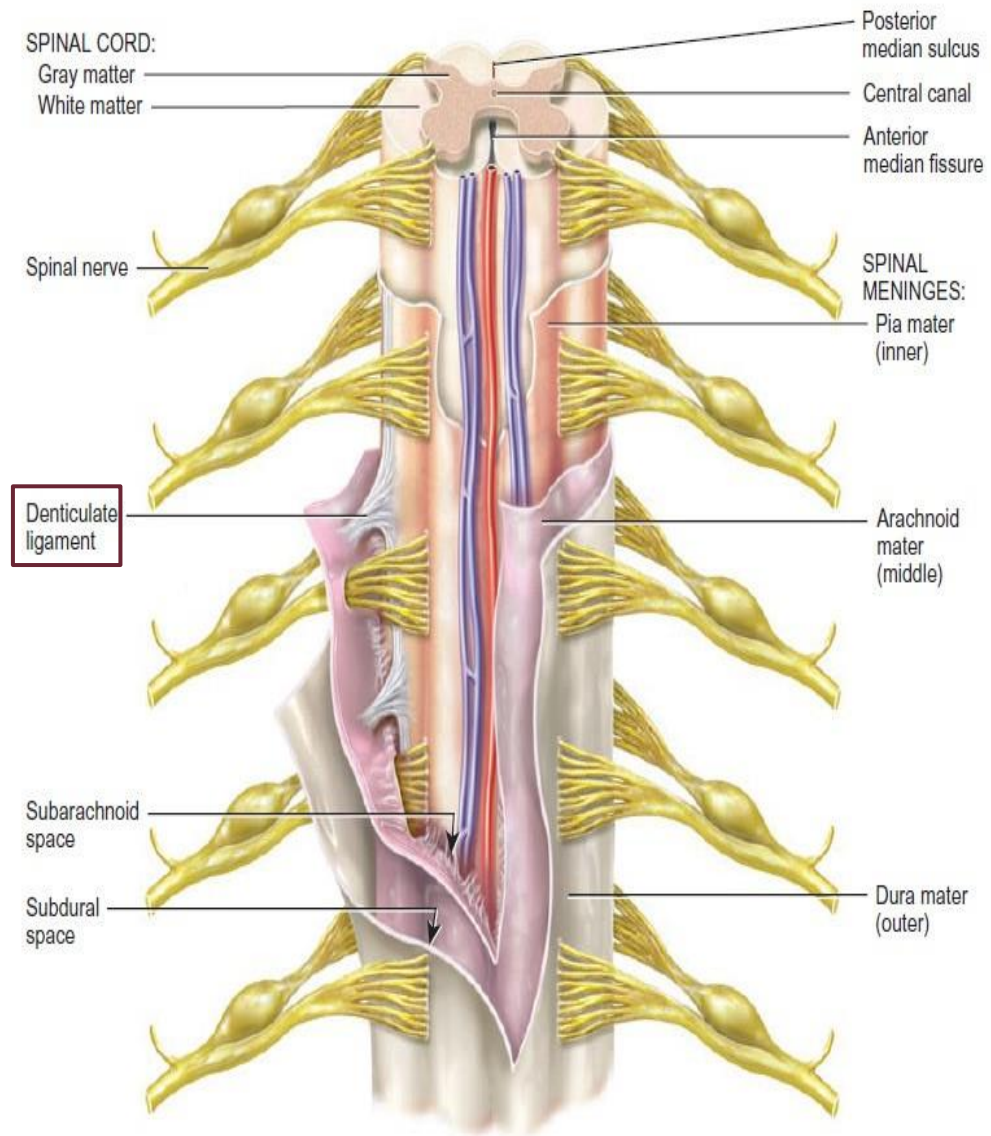
- **Arachnoid mater:**

- ❑ Thin web arrangement of delicate collagen and some elastic fibers.
- ❑ Adheres to the inner surface of the dura mater, **there is no true space.** Imagine that it lines the dural sac, ends at level of S2.



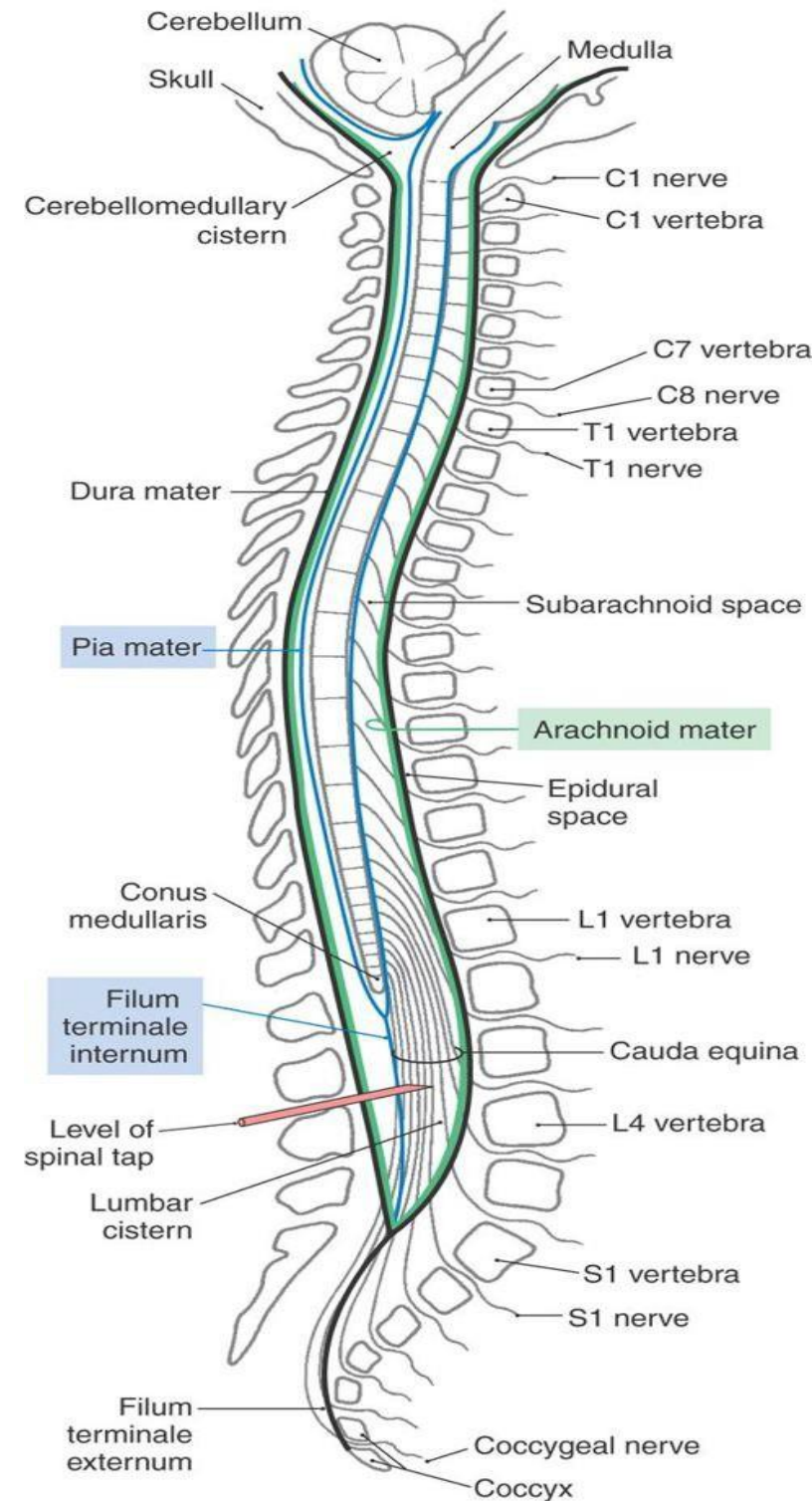
Meninges

- Connective tissue membranes
- **Pia mater:**
 - ❑ Bound tightly to surface
 - ❑ Thin transparent connective tissue layer that adheres to the surface of the spinal cord and brain, **it even lines the sulci.**
 - ❑ Forms the **filum terminale internum**, which also contribute to the stability of the spinal cord.
 - ❑ **Filum terminale = Filum terminale internum + filum terminale externum**
 - ❑ anchors spinal cord to coccyx
 - ❑ Forms the **denticulate ligaments - mainly in the sub-arachidonic space** - that attach the spinal cord to the arachnoid mater and inner surface of the dura mater



Spaces

- **Epidural:** space between the dura mater and the wall of the vertebral canal.
 - Anesthetics injected here (commonly used for labor pain).
 - Fat-fill: energy reservoir and cushioning effect.
- **Subdural space:** normally little amount of serous fluid (potential space)
- **Subarachnoid:** between pia and arachnoid
 - Filled with CSF (cushioning effect, thermo-regulation, ...)
 - Lumbar puncture (diagnostic advantage)
 - supracristal line, as a landmark
 - L3-L4 vertebra (in this level the dural sac still can be found, but not the spinal cord, which prevent injuring the spinal cord)

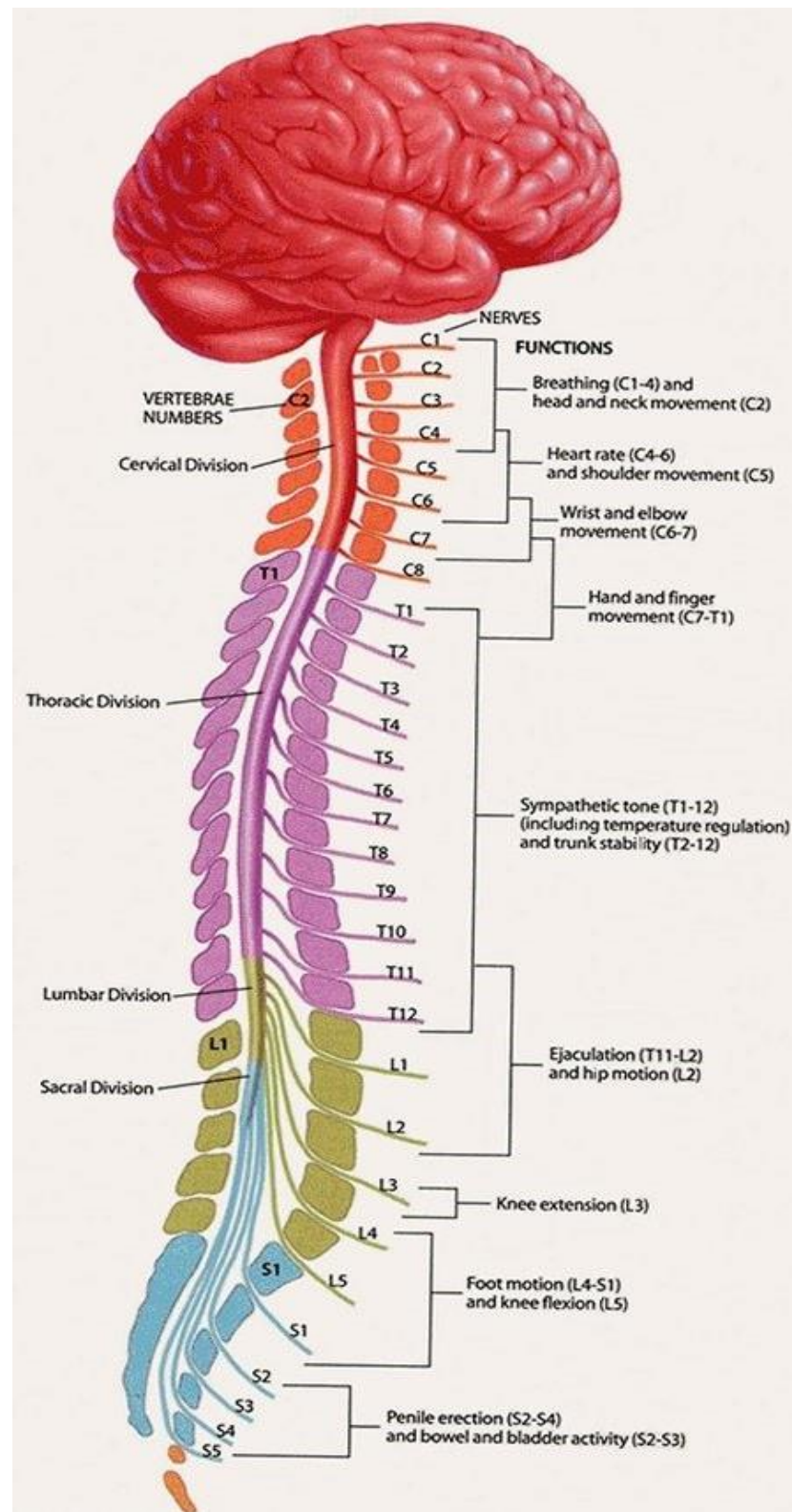


Spinal cord segment

- The segments of the spinal cord are not in line with the corresponded vertebrae and the difference increases as we go downward.
- The roots increase in length as you go downward.
- Every spinal nerve emerges from the spinal column through the intervertebral foramen under its corresponding vertebra
- first 7 cervical nerves pass above their corresponding vertebrae.

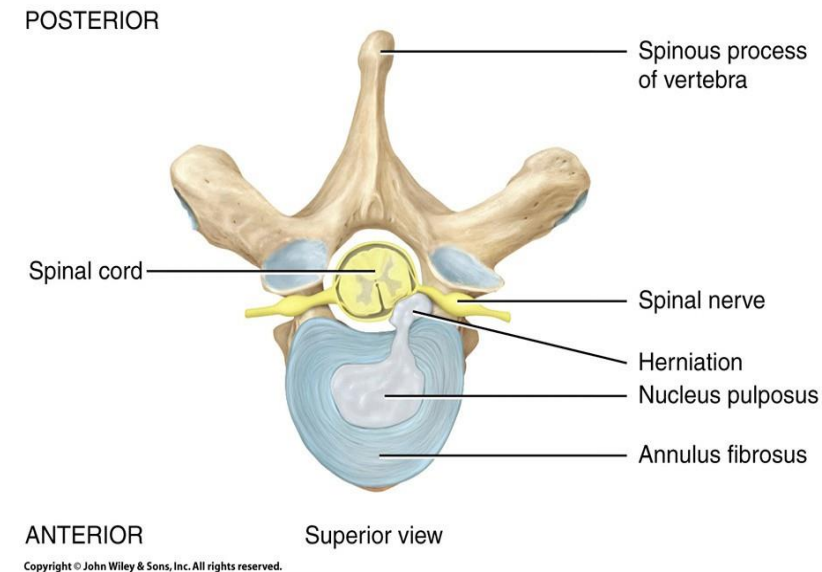
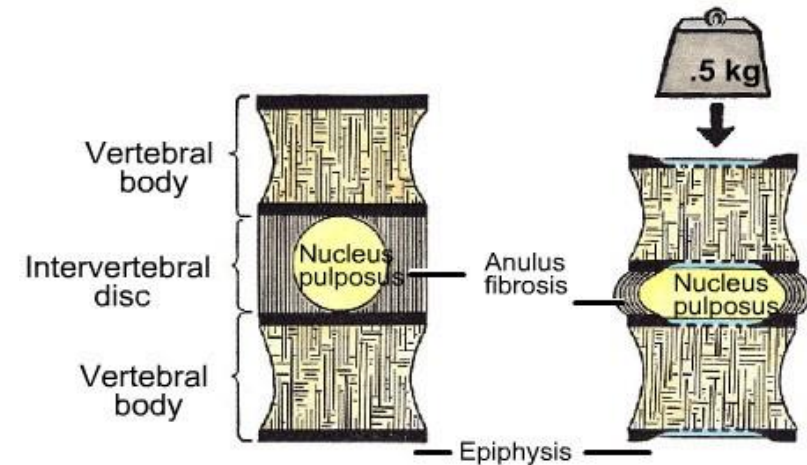
Spinous process	spinal cord segment
C7	C8
T3	T5
T9	T12
T10	L1-2
T11	L3-4
T12	L5
L1	S1-end

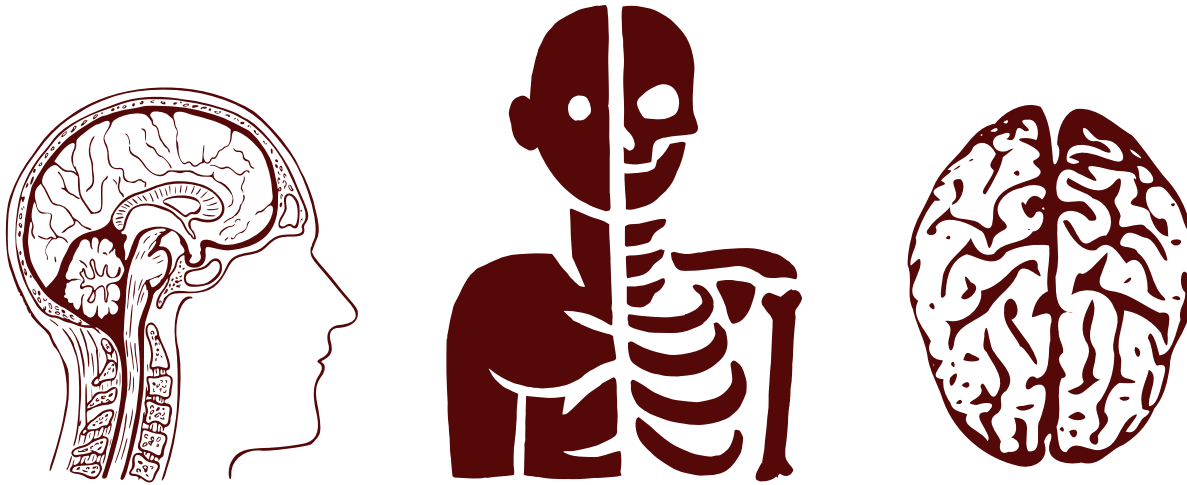
Because there are 8 cervical spinal segments but only 7 cervical vertebrae, the first seven nerves exit above their corresponding vertebrae, and C8 exits below C7.



Herniated Disc/ ruptured disc/ slipped disc

- Normally the Intervertebral discs:
 - a. The annulus fibrosus (peripherally): compose of fibrocartilage which contains collagen making it stronger, increasing its ability to bears tensile forces and weight, as 70% of the body weight is focused on the vertebral column.
 - b. Nucleus pulposus (centrally): Gelatinous (more water)
- protrusion (leakage) of the gelatinous nucleus pulposus through the annulus fibrosus of IV disc causes herniation, performing pressure on the nerve that emerges from the corresponding foramen, therefore pain, numbness, and sometimes paralysis.
- **Posterolateral direction: Thinner annulus fibrosus** (most common)
- **95% in L4/L5 or L5/S1**, but it can happen in any IV disc - even in the cervical IV discs -.





**ANATOMY
QUIZ
LECTURE 1**

1. <https://youtu.be/UR0h2JDoE8k?si=3U220ym5OBmGE0gW>

اللهم إن عمر عطية في ذمتك وحبل جوارك، فقه من فتنة القبر وعذاب النار، أنت أهل الوفاء والحق، فاغفر له وارحمه إنك أنت الغفور الرحيم.

الحياة لا تُعاش كلها بخطئٍ محكمة، ولا يليقُ بالروح أن تُعذب بسؤال: "وماذا لو؟" أحيانًا يكفي أن تترك الأبواب مواربة، أن تؤمن أن فوق كل تدبيرٍ تدبير، وأن الله لا يُسلمنا للضياع، وإن غفلنا. سلم أمورك لله، فهو أرحم بك من كل هذا الحذر، وكل هذا التوقع، وكل هذا التيه، دع قلبك يتوكل فما خاب عبدٌ قال: "ربي، تولّ أمري، فإني لا أحسن التدبير.



Click on the flower and watch the video, please 😊

"اللهم بلغنا رمضان بلوغًا يطهر نفوسنا، ويهذب قلوبنا، ويجعله شهر رحمة ومغفرة وعتق من النار."

For any feedback, scan the code or click on



Corrections from previous versions:

Versions	Slide # and Place of Error	Before Correction	After Correction
V0 → V1			
V1 → V2			