

# Introduction to Anatomy



**1<sup>st</sup> Year Medical Students**

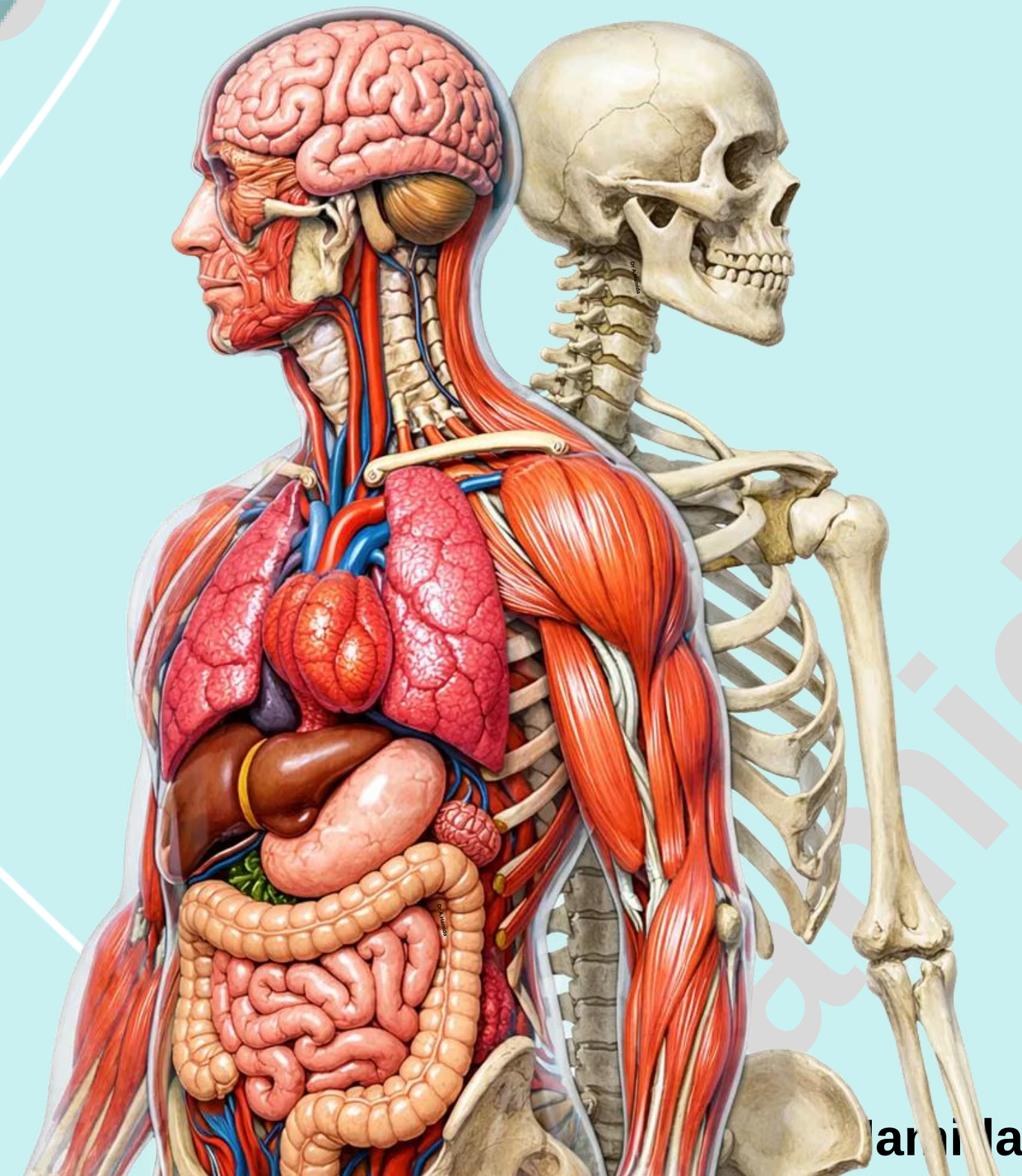
**2025-2026  
Second Semester**

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Hamida

# Course Outline:

**1** Introduction and Terminology

**2** Skeletal System

**3** Cardiovascular System

**4** Lymphatic System

**5** Nervous System

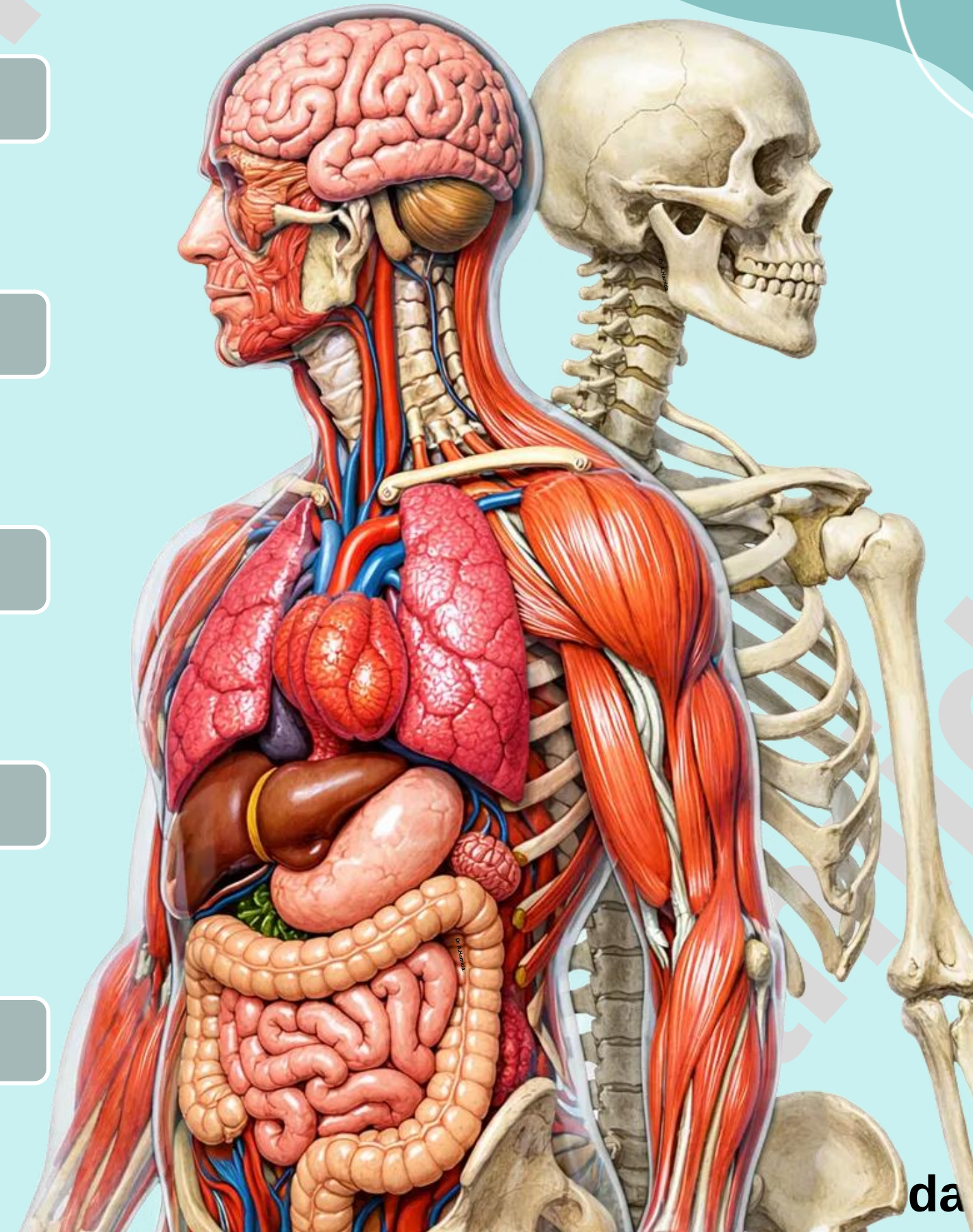
**6** Muscular System

**7** Respiratory System

**8** Digestive System

**9** Urinary System

**10** Endocrine System



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Gross  
lecture-8

# Nervous System



Dr A.Hamida

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# Nervous System

## ❖ Divisions of the Nervous System

➤ Anatomically, the nervous system is divided into two parts:

### 1. Central Nervous System (CNS),

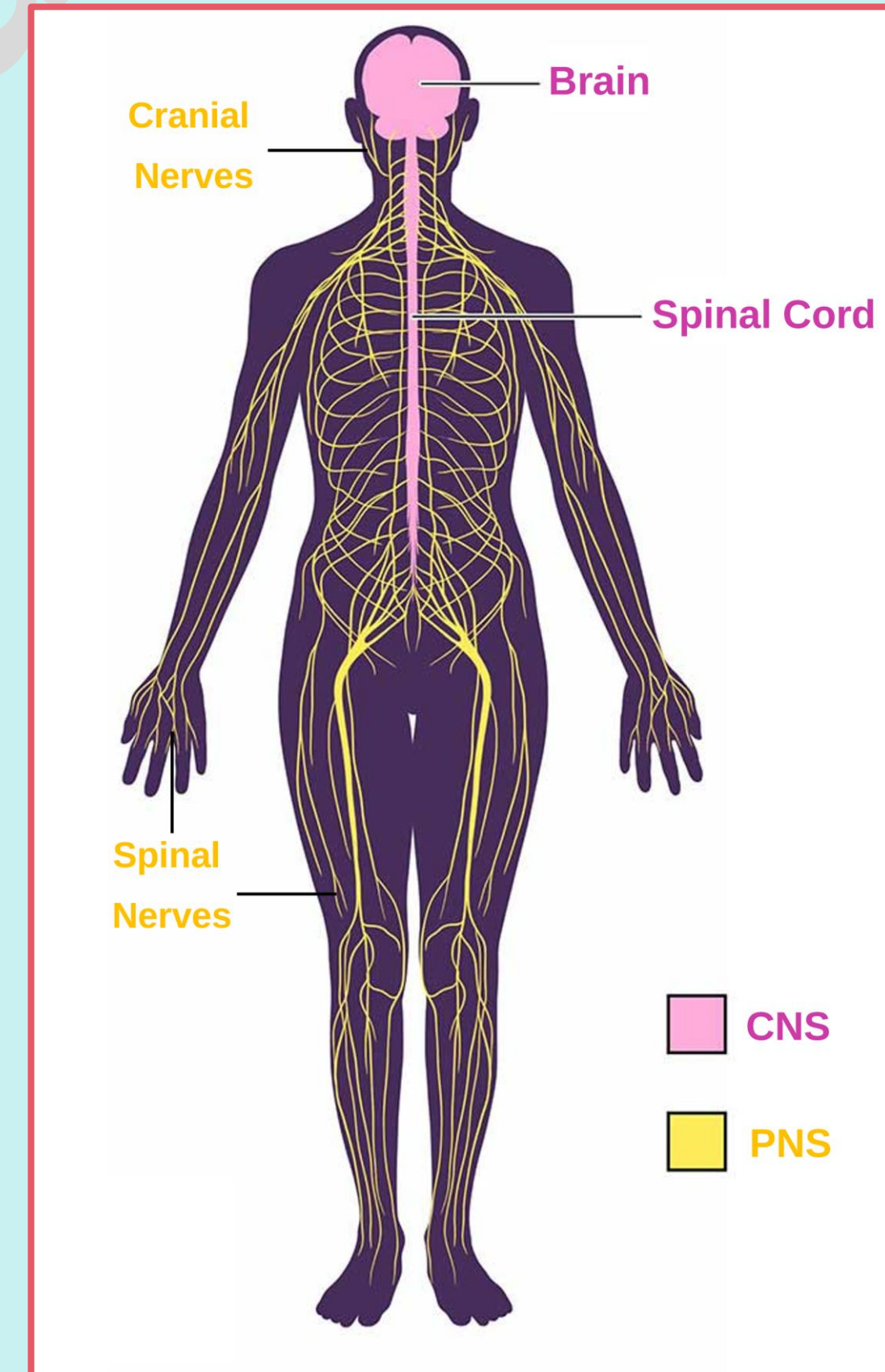
consists of:

- i. **Brain** (located in the cranial cavity)
- ii. **Spinal Cord** (located in the vertebral canal)

### 2. Peripheral Nervous System (PNS),

consists of nerves that exit from CNS:

- i. **Cranial nerves** (exit from the brain)
- ii. **Spinal nerves** (exit from the spinal cord)



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## Nervous System

### System Outline:

5.1

**Nervous Tissue**

5.2

**Central Nervous System - Brain**

5.3

**Central Nervous System - Spinal Cord**

5.4

**Peripheral Nervous System**

# Nervous System

## 3. CNS- Spinal Cord



# 5.3 Nervous System- CNS-Spinal Cord

## Lecture Outline:

5.3.1

**External Features of the Spinal Cord**

5.3.2

**Internal Features of the Spinal Cord**

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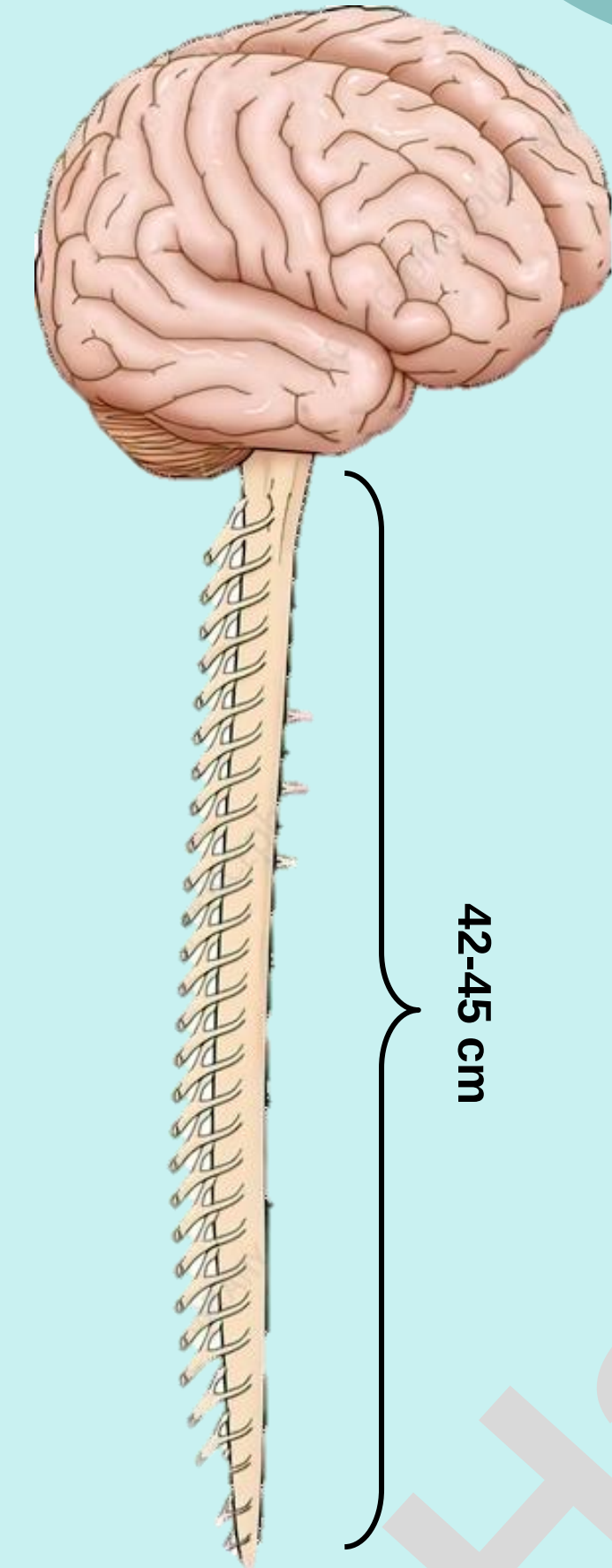
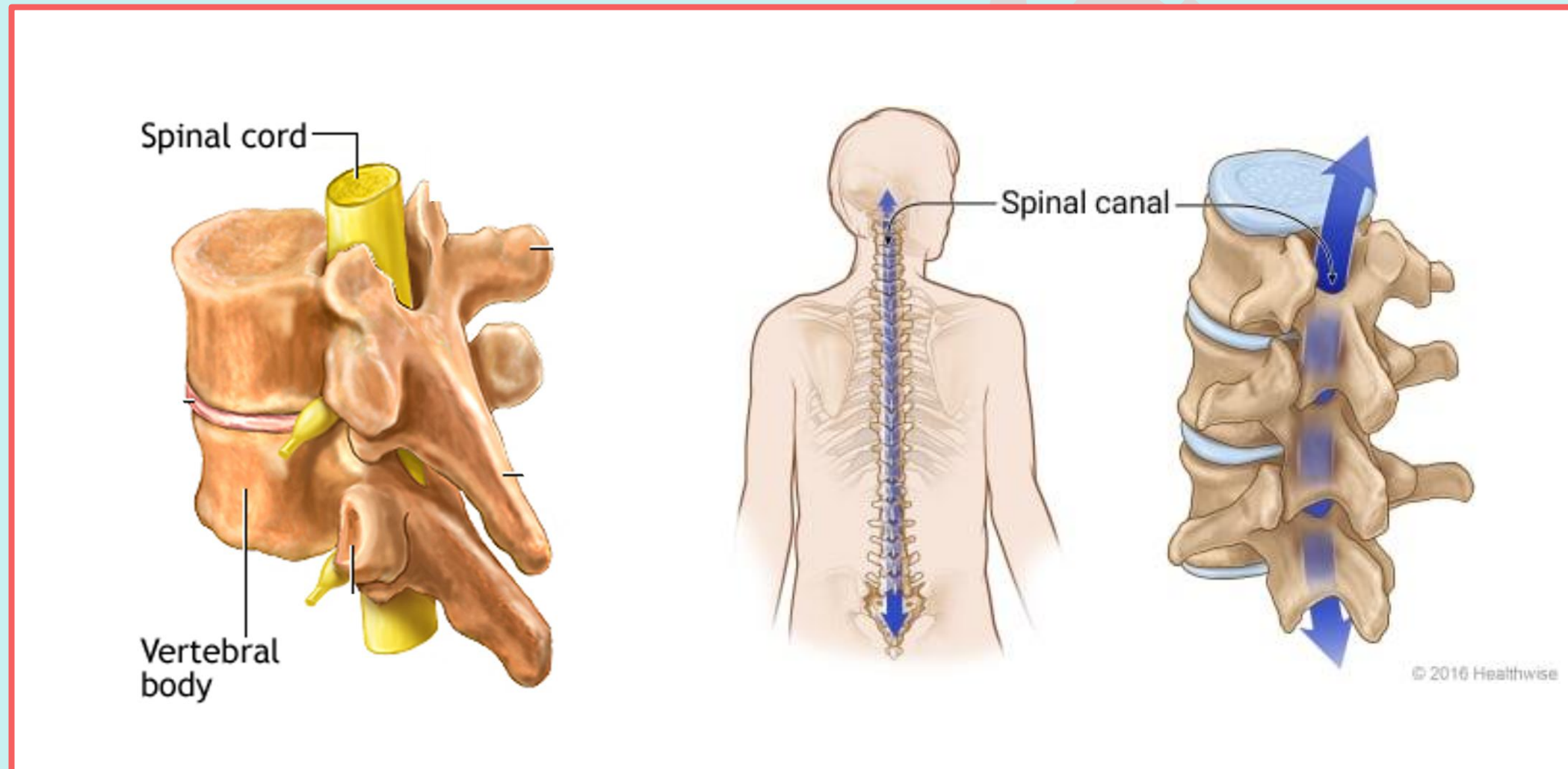
**CNS-Neuronal Pathways**

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**CNS-Meninges**

## 5.3 Nervous System- CNS-Spinal Cord

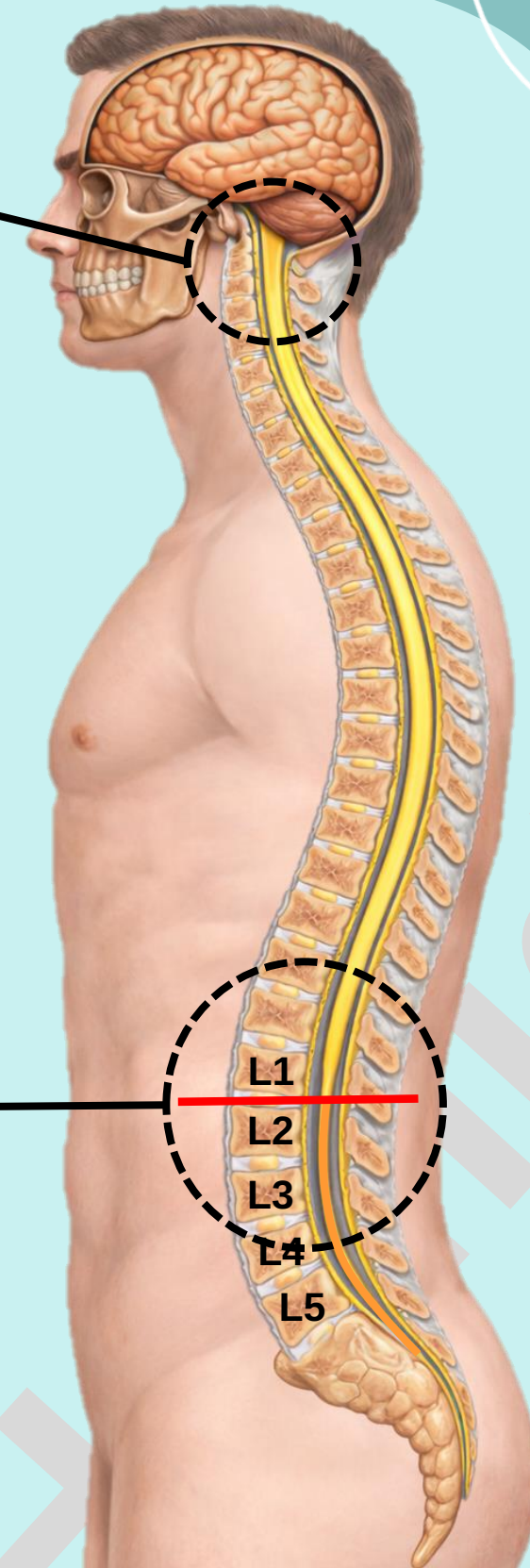
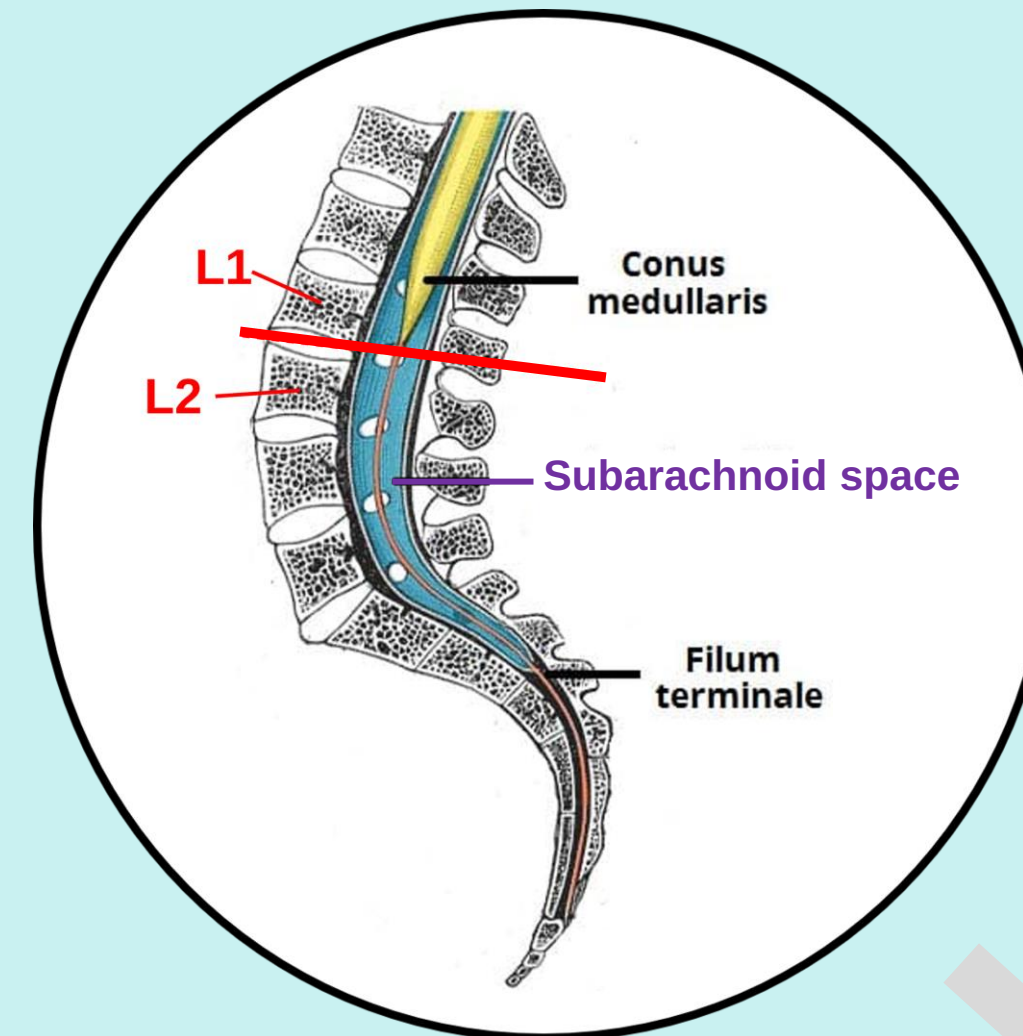
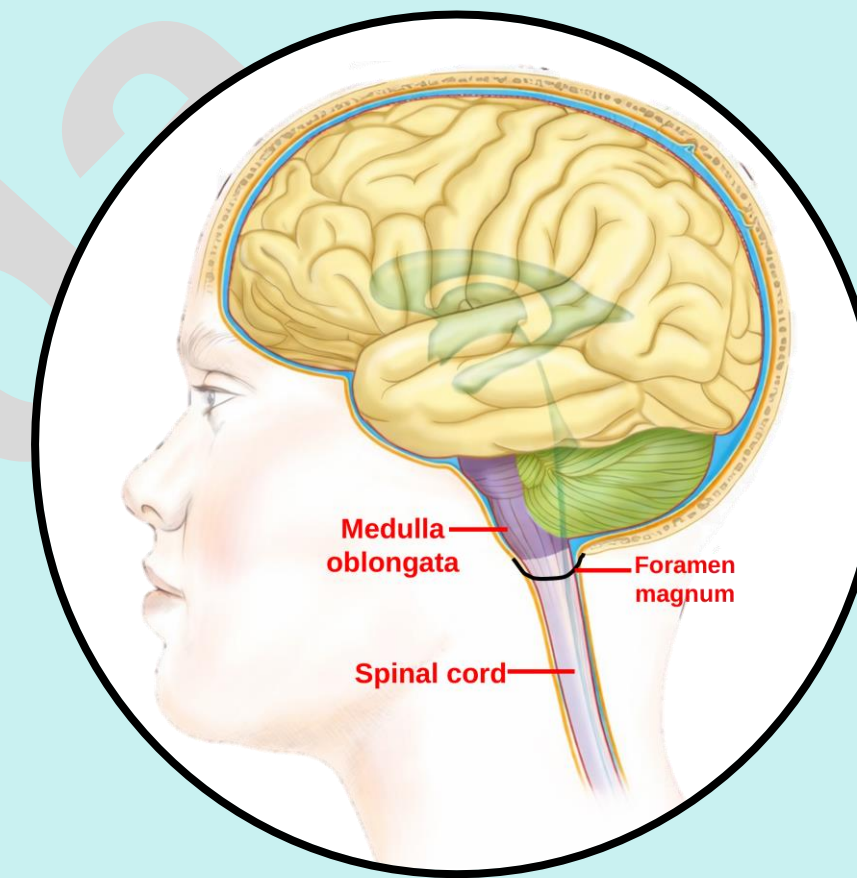
- It is the lower elongated part of the central nervous system.
- It is cylindrical in shape located inside the vertebral canal (spinal canal).
- It measures about 42 - 45 cm in length.



## External Features of the Spinal Cord

### ❖ Anatomical Course of the Spinal Cord

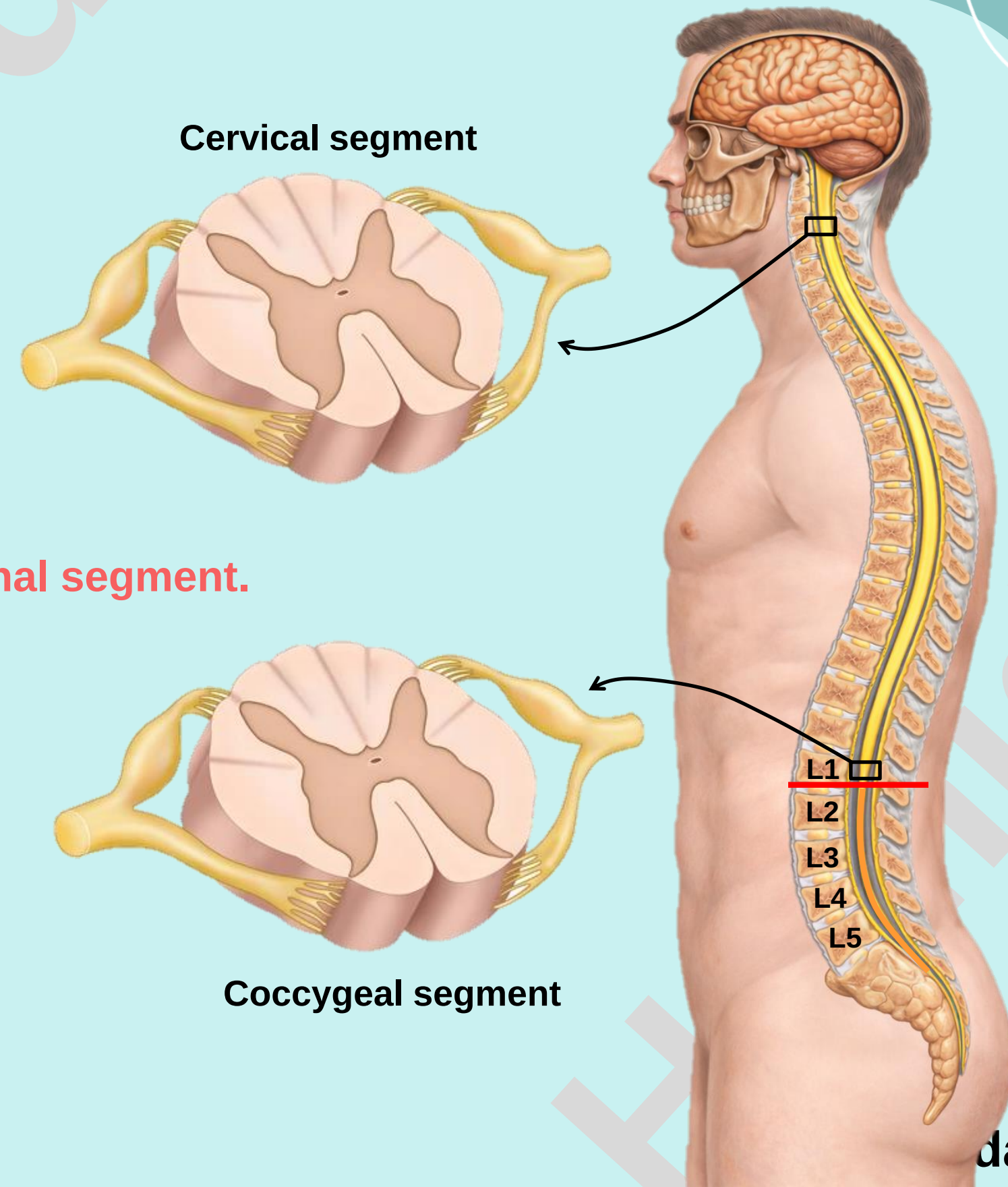
- Starts at the foramen magnum at the base of the skull as a continuation of the medulla oblongata.
- Spinal cord terminates between L1 and L2 vertebrae in adults.
  - Because the spinal cord ends at L2, it occupies only about two-thirds of the vertebral canal.
- Its lower end tapers into a cone-like shape forming the conus medullaris
- The apex of conus medullaris continues downwards as a thin, thread-like filament called filum terminale, which attaches the end of the spinal cord to the tip of the coccyx.



## External Features of the Spinal Cord

### ❖ Spinal Segments

- Like the vertebral column, the spinal cord is also segmented (though the segments are not visible externally)
- The spinal cord is made up of 31 spinal segments: (8 cervical, 12 thoracic, 5 lumbar, 5 sacral, 1 coccygeal)
- Each pair of spinal nerves (right and left) is attached to the spinal segment.
- Due to relative shortening of the spinal cord as compared to the vertebral canal, the spinal segments lie above their corresponding vertebral level.



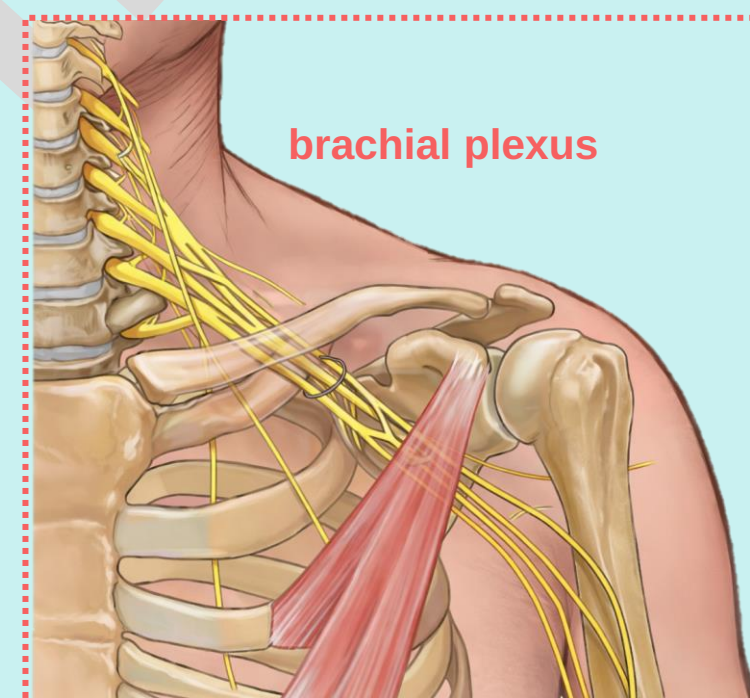
**Nerve Plexus:** is a network of interconnected spinal nerves.

## ❖ Enlargements of the Spinal Cord

- The spinal cord is not uniform in diameter; there are two points of enlargement along its course due to origin of nerve plexuses.
- The two enlargements are as follows:

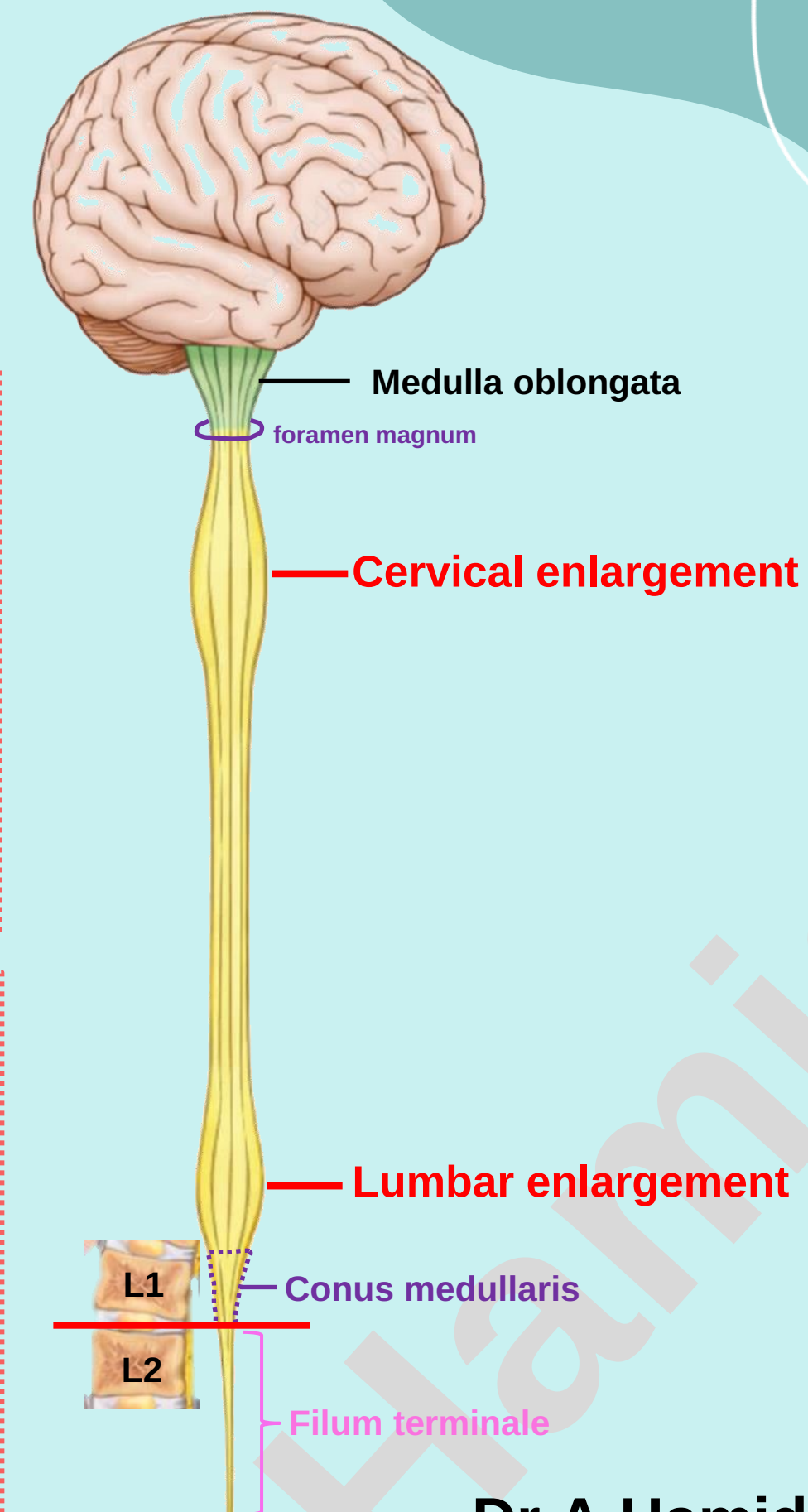
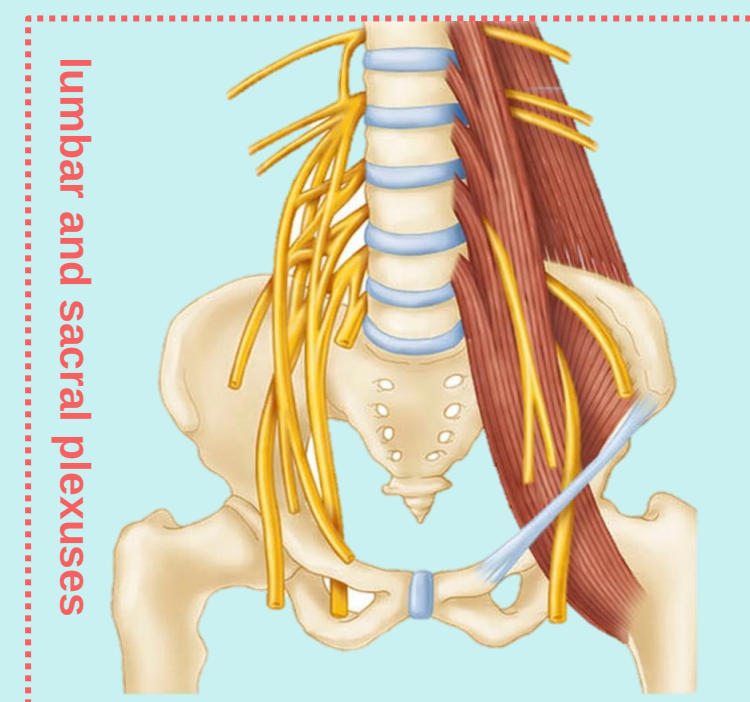
### 1. Cervical Enlargement:

- It represents the origin of the brachial plexus, which supplies the upper limb.
- The nerves arising from C5 to T1 spinal segments form the brachial plexus.



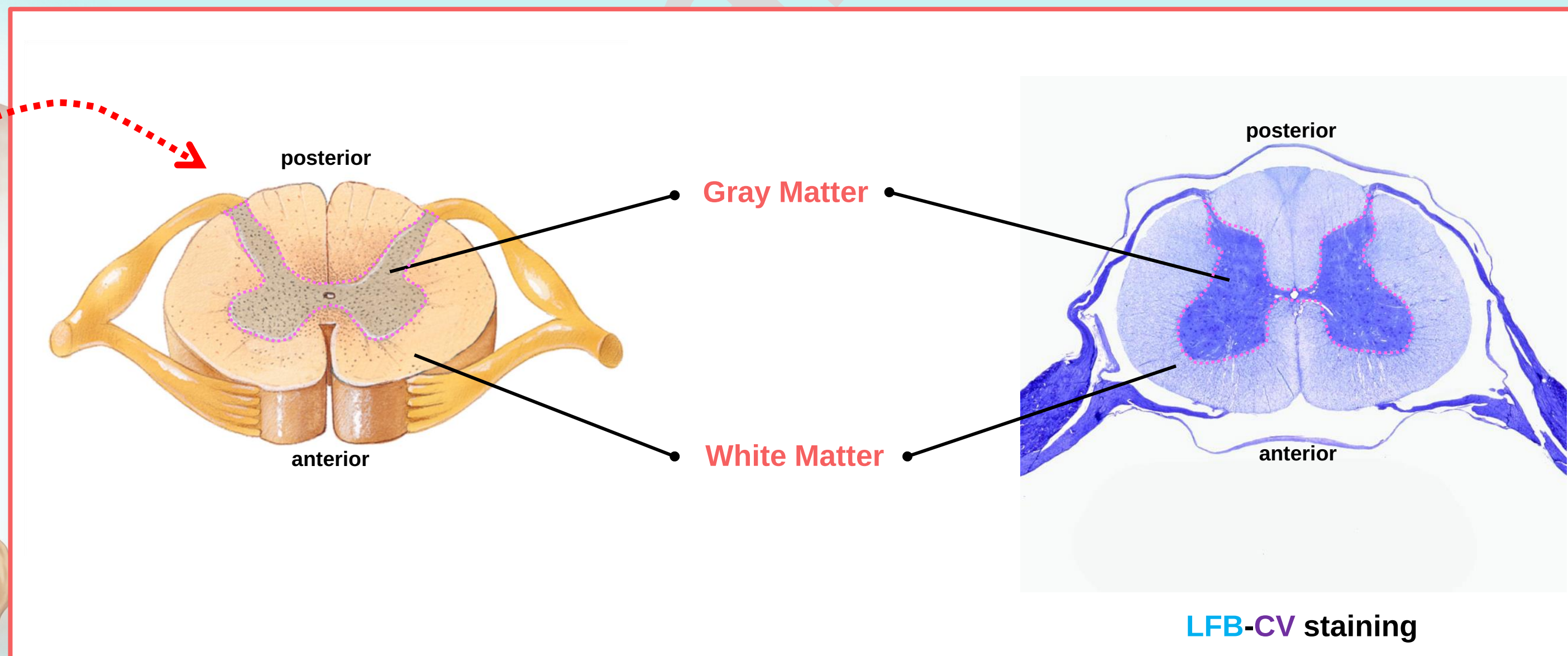
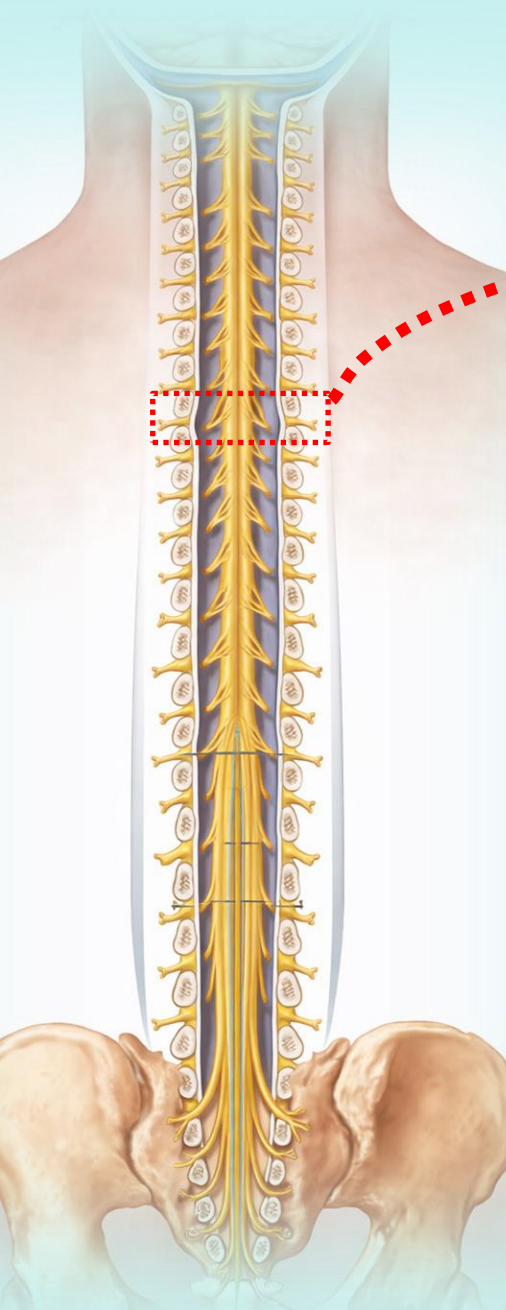
### 2. Lumbar Enlargement (Lumbosacral enlargement):

- It represents the origin of the lumbar plexus and sacral plexus, which supply lower limb.
- The nerves arising from L2 to S3 spinal segments contribute to the lumbar and sacral plexuses.



## Internal Features of the Spinal Cord

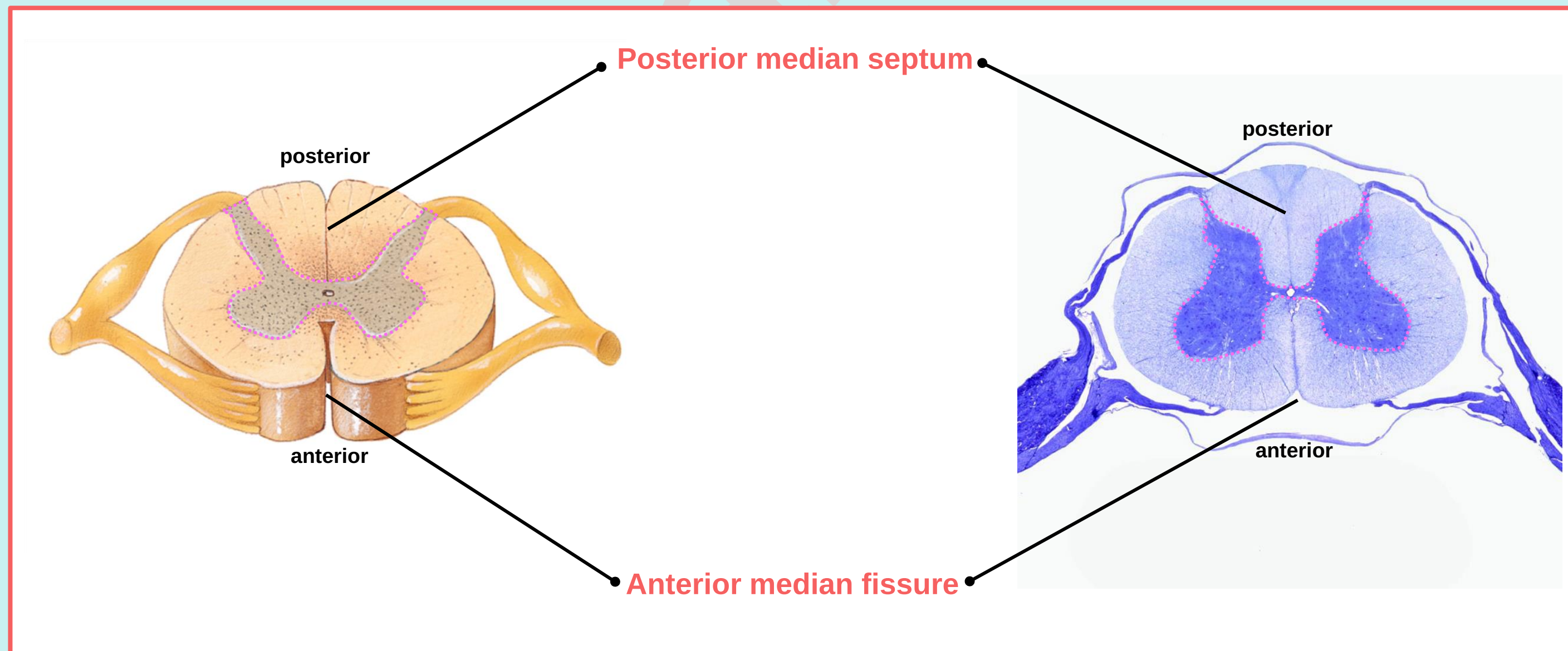
- The cross-section of the spinal cord shows:
- Inner core of gray matter made up of cell bodies.
  - Peripheral zone of white matter made up of fiber tracts.



## Internal Features of the Spinal Cord

➤ The cross-section of the spinal cord shows:

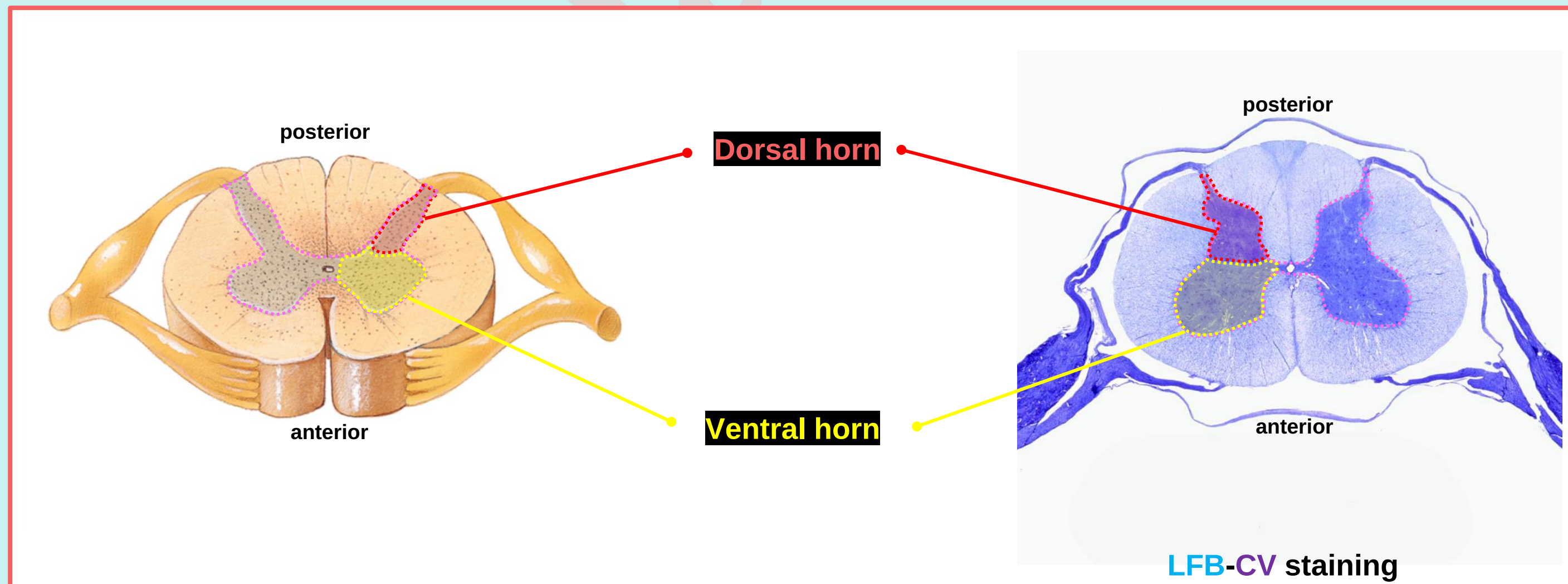
- **Anterior median fissure**: a deep longitudinal groove on the anterior surface of the spinal cord, that separates the right and left halves of the anterior white column.
- **Posterior median septum**: a thin partition extending from the posterior surface of the spinal cord to the grey commissure. It partially divides the posterior white column into right and left halves.



## Internal Features of the Spinal Cord

### ❖ Gray Matter

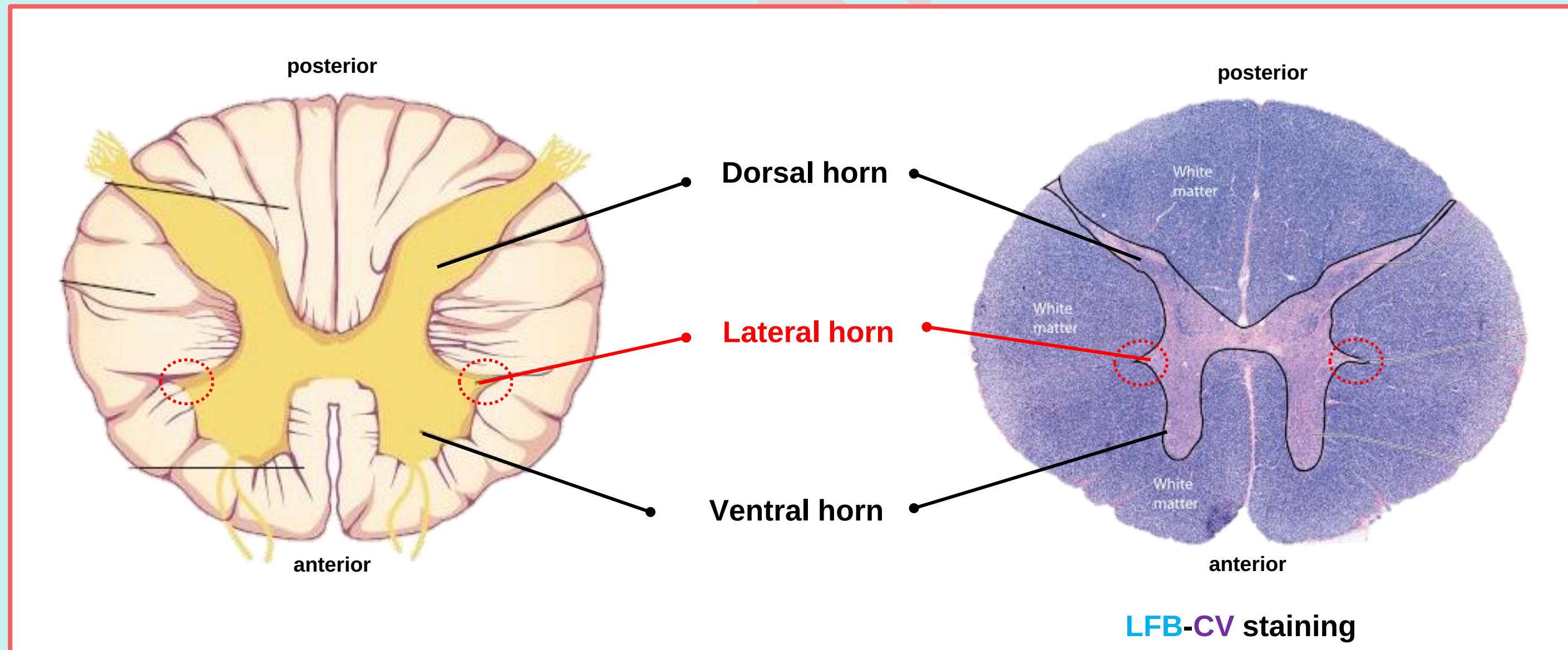
- In cross section, the gray matter is seen as an H-shaped (or butterfly-shaped) column, extending throughout the length of the spinal cord.
- It consists of two horns:
  1. **Posterior (dorsal) horns:** Contain neurons that receive somatic sensory input.
  2. **Anterior (ventral) horns:** Contain cell bodies of somatic motor neurons that supply skeletal muscles.



## Internal Features of the Spinal Cord

### ❖ Gray Matter

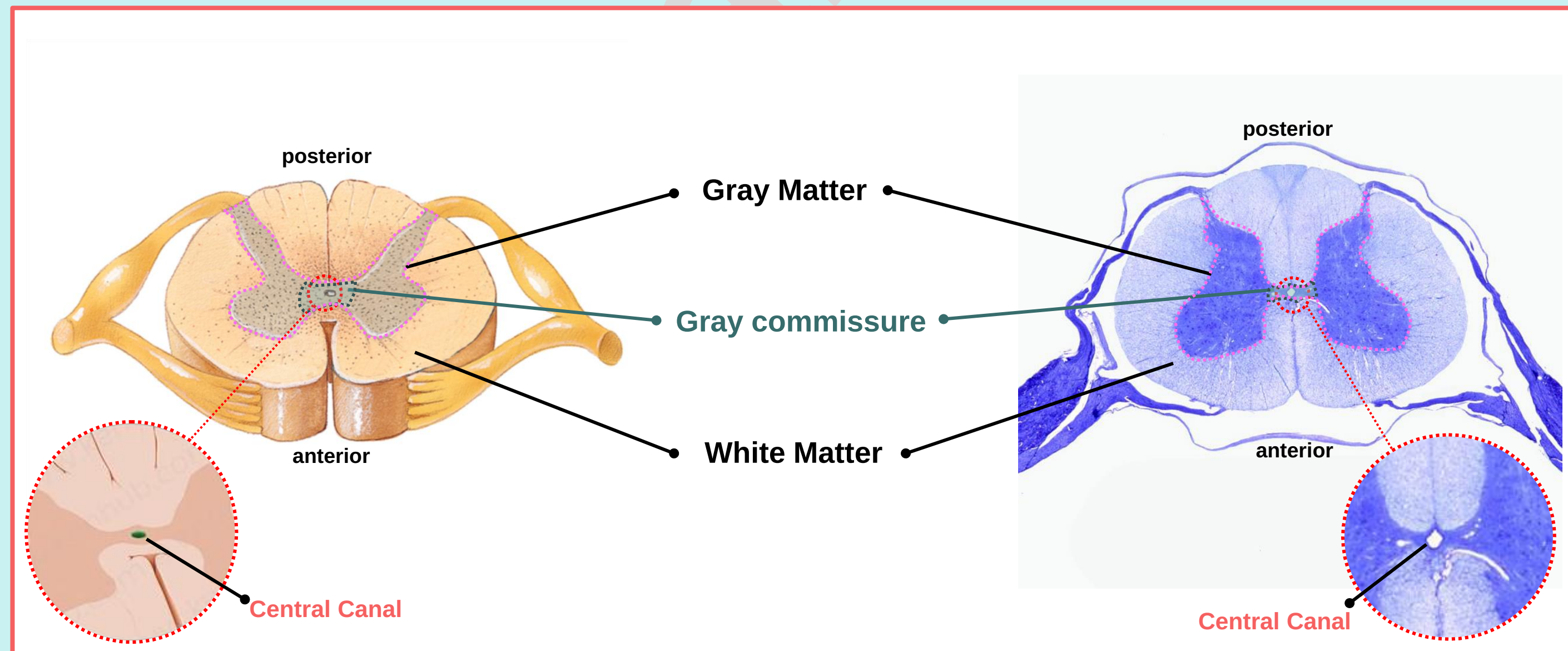
- **Lateral gray horns:** present only in the thoracic and upper two lumbar segments (T1 to L2) and contain cell bodies of autonomic (sympathetic) neurons.



## Internal Features of the Spinal Cord

### ❖ Gray Matter

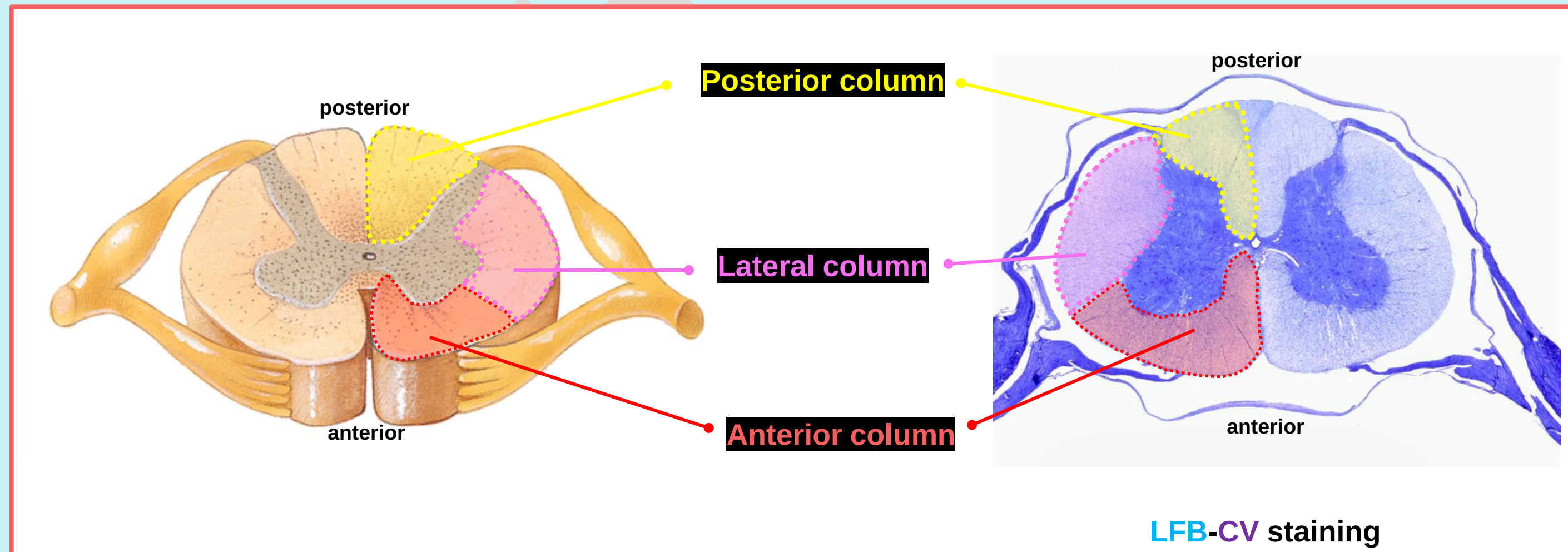
- A narrow bridge of gray matter connecting the right and left halves of the spinal gray matter known as gray commissure, it contains the central canal.
- **Central canal:** a canal runs through the length of the spinal cord and contains the cerebrospinal fluid.



## Internal Features of the Spinal Cord

### ❖ White Matter

- Surrounds the central H-shaped mass of gray matter and consists mainly of myelinated axon fibers, giving it a white appearance.
- Each half of the spinal cord contains three white columns:
  1. **Anterior column:** between the anterior median fissure and the anterior horn.
  2. **Lateral column:** between the anterior and posterior horns.
  3. **Posterior column:** between the posterior median septum and the posterior horn



## Internal Features of the Spinal Cord

### ❖ White Matter

➤ Each column is made up of tracts which are either:

#### 1. Ascending Tracts (Sensory)

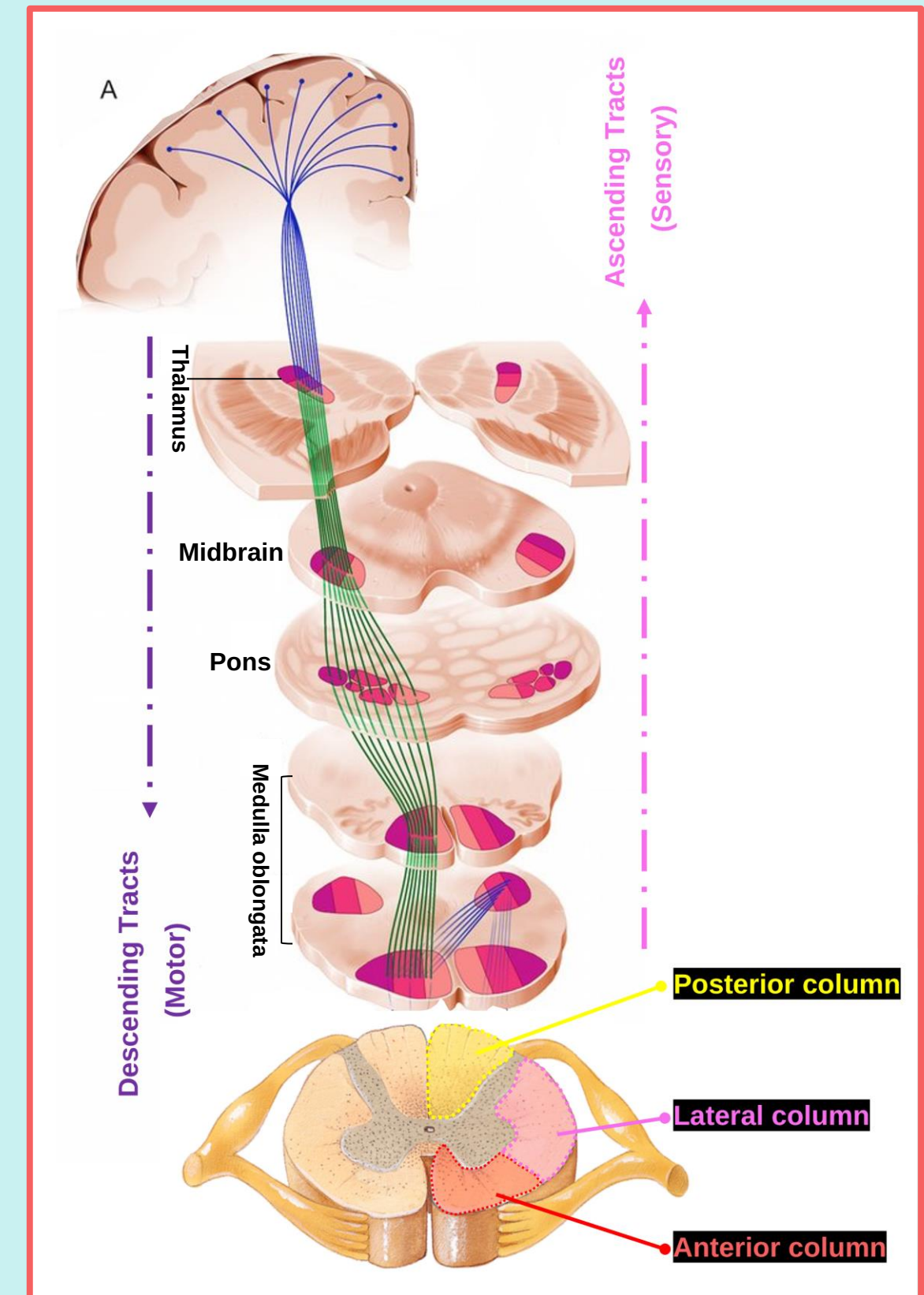
- These are neural pathways that transmit sensory information (touch, pain, pressure, vibration, and proprioception) from the spinal cord (enter through peripheral nerves) to the brain.

#### 2. Descending Tracts (Motor)

- These are neural pathways that transmit motor information from the brain to the spinal cord, which then sends signals to muscles and glands.

➤ Generally

- Posterior column: mainly made up of sensory (ascending) tracts.
- Anterior column: mainly contains motor (descending) tracts but also includes some sensory tracts.
- Lateral column: contains mixed tracts (both sensory and motor).



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# Nervous System- CNS - Neuronal Pathways

## ❖ Sensory Pathways (Three-Neuron Chain)

➤ Each sensory signal is transmitted by three-order neurons:

### 1. First-order neurons

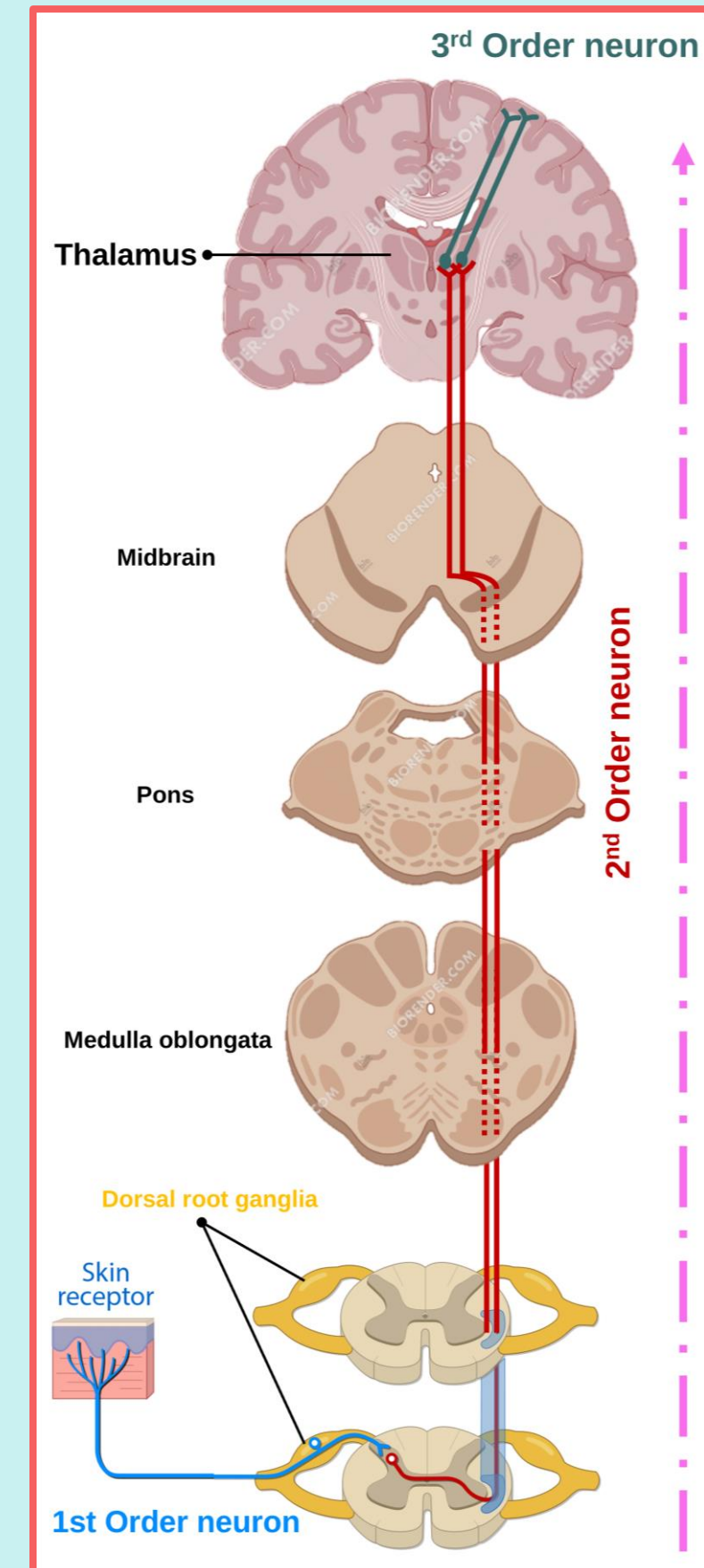
- Carry sensory signals from receptors in the skin (or other sensory organs) to the dorsal root ganglion, then their axons enter the spinal cord and synapse in the dorsal horn.

### 2. Second-order neurons

- Carry signals from the spinal cord to the thalamus.

### 3. Third-order neurons

- Carry signals from the thalamus to the sensory areas of the cerebral cortex (usually the primary somatosensory cortex).



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## Nervous System- CNS - Neuronal Pathways

### ❖ Motor Pathways (Two-Neuron Chain)

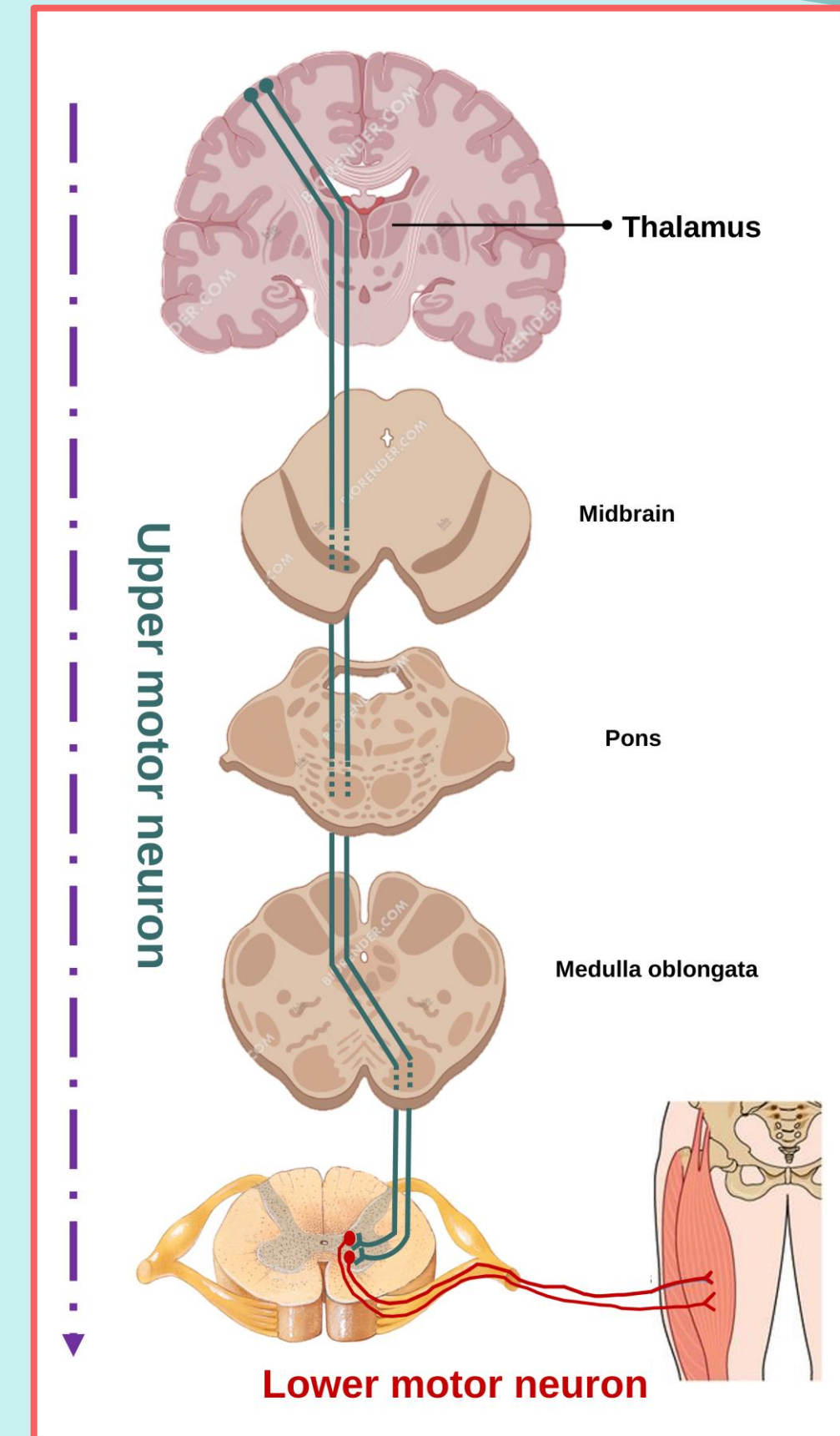
➤ Each motor signal is transmitted by two motor neurons

#### 1. Upper motor neuron (UMN)

- Carries signals from the motor areas of the cerebral cortex to motor neurons in the ventral horn of the spinal cord.

#### 2. Lower motor neuron (LMN)

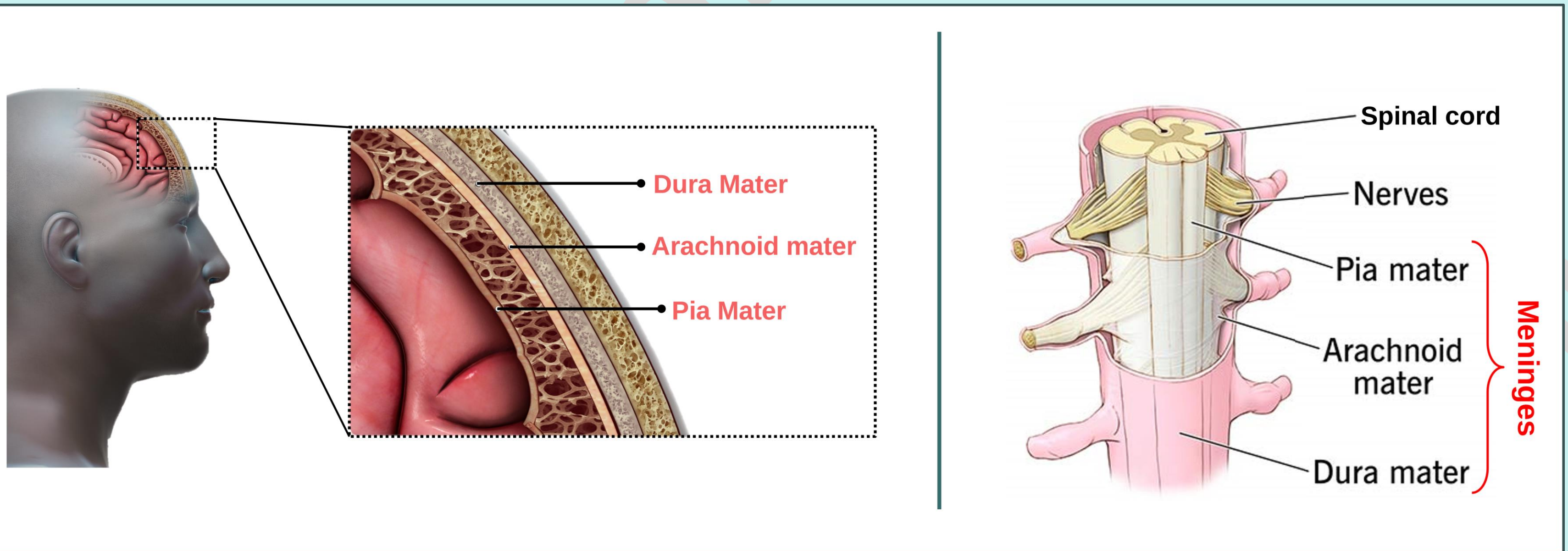
- Carries signals from the ventral horn of the spinal cord to skeletal muscles.



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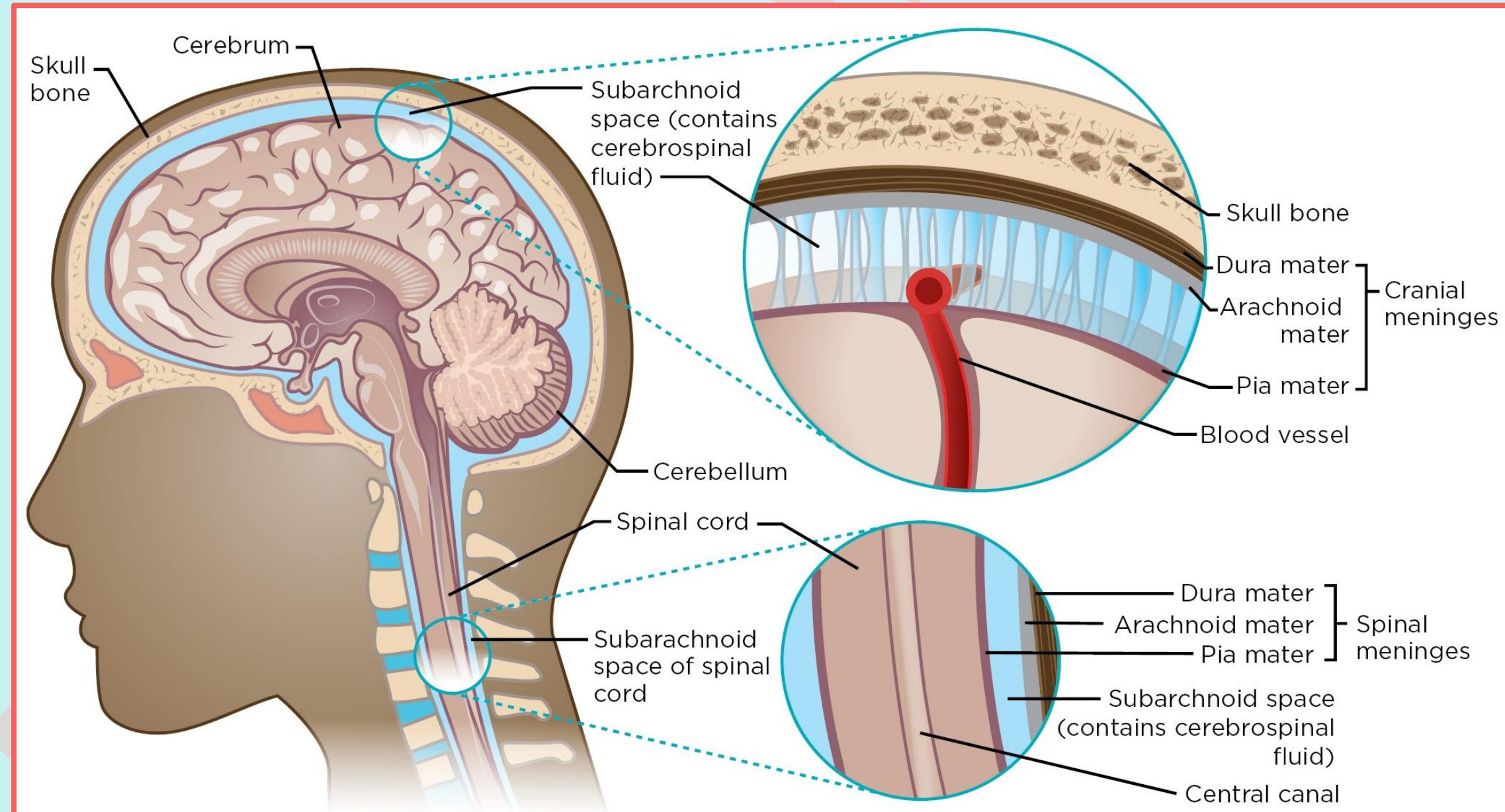
# Nervous System- CNS - Meninges

- The meninges are the membranous coverings of the brain and spinal cord.
- There are three layers of meninges, (from superficial to deep):
  1. **Dura mater:** Thick outer layer directly beneath the bones of the skull and vertebral column.
  2. **Arachnoid mater:** Middle layer lying just beneath the dura mater.
  3. **Pia mater:** Thin, transparent, vascular membrane closely adherent to the surface of the brain and spinal cord



## ➤ Subarachnoid space

- Located between the arachnoid and pia mater.
- The subarachnoid space around the brain is continuous with that around the spinal cord.
- Filled with cerebrospinal fluid (CSF), which enters from the ventricular system.



## Clinical Correlation



### Meningitis

- It is an inflammation of the meninges.
- Symptoms typically include fever, headache, and neck stiffness.
- Most commonly caused by viral or bacterial infections.
- To determine the causative agent, a lumbar puncture is performed.

### Lumbar Puncture

- A medical procedure used to collect CSF by inserting a needle into the spinal canal below L2, usually between L3 and L4 or between L4 and L5

