CENTRAL NERVOUS SYSTEM

The Spinal Cord
External & Internal Features

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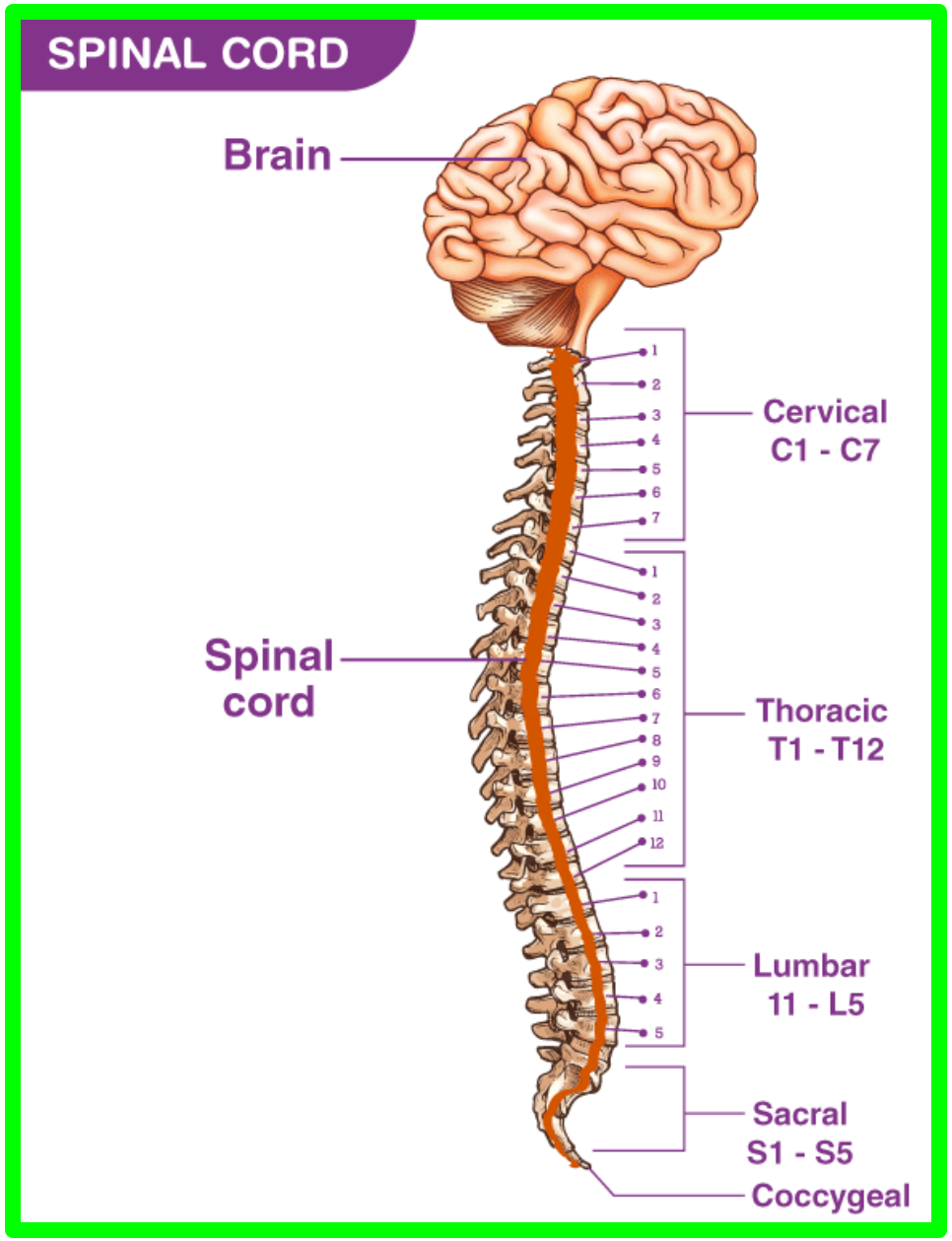
Spinal Cord

• EXTERNAL FEATURES

- ❑ It is the lower subdivision of the central nervous system.
- ✓ **Position:** It lies in the vertebral canal of the vertebral column.
- ✓ **Shape:** It is elongated, nearly cylindrical.
- ✓ **Length:** it has an average length of 45 cm in adult.
- ✓ **Beginning:** it begins just below foramen magnum at the upper end of the atlas as a continuation of the medulla oblongata.



Spinal Cord

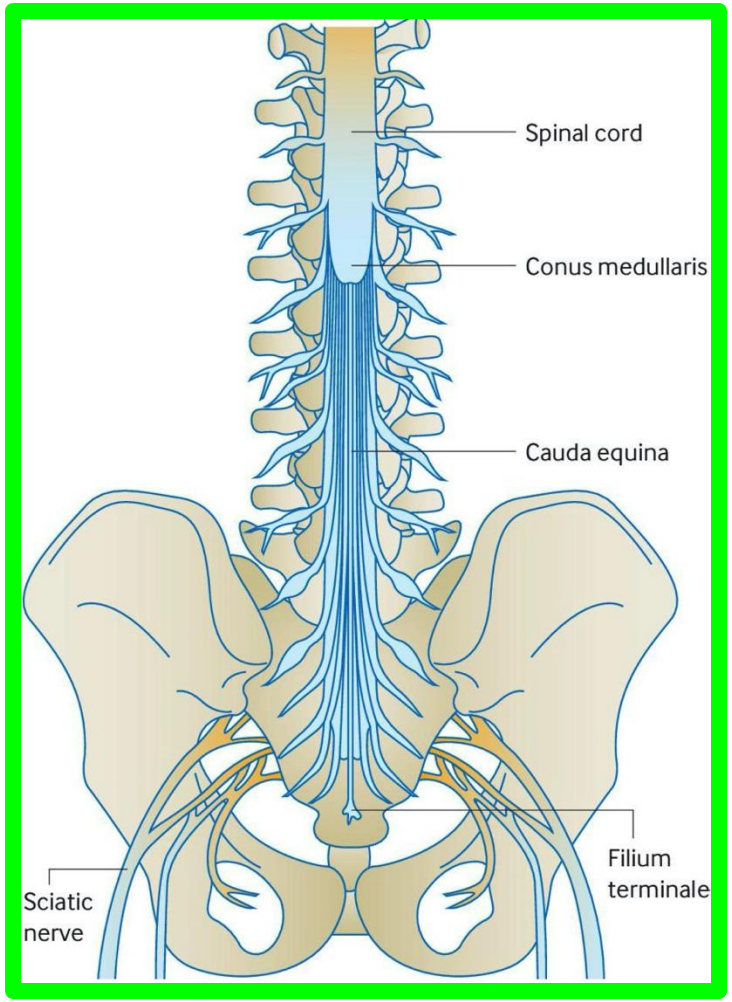
• EXTERNAL FEATURES

✓ Termination:

The lower end of the cord tapers to form the conus medullaris

The spinal cord varies with the age.

- **At the 3rd month of intrauterine life: it fills the whole vertebral canal.**
- **At Birth: It ends at the level of intervertebral disc of L3/L4.**
- **In the adult: It ends at the level of intervertebral disc of L1/L2; below this level, the vertebral canal contains the lumbar, sacral, and coccygeal nerves which form a bundle called Cauda Equina**



Spinal Cord

• EXTERNAL FEATURES

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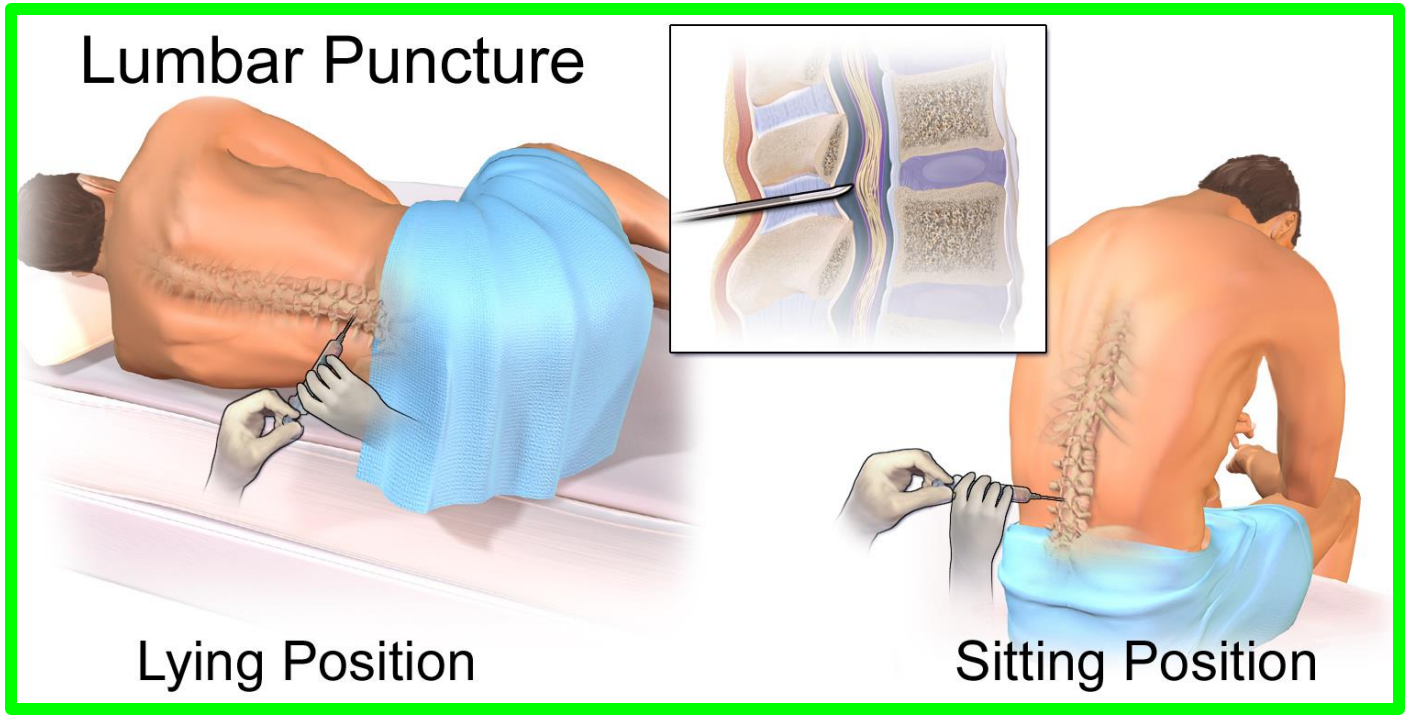
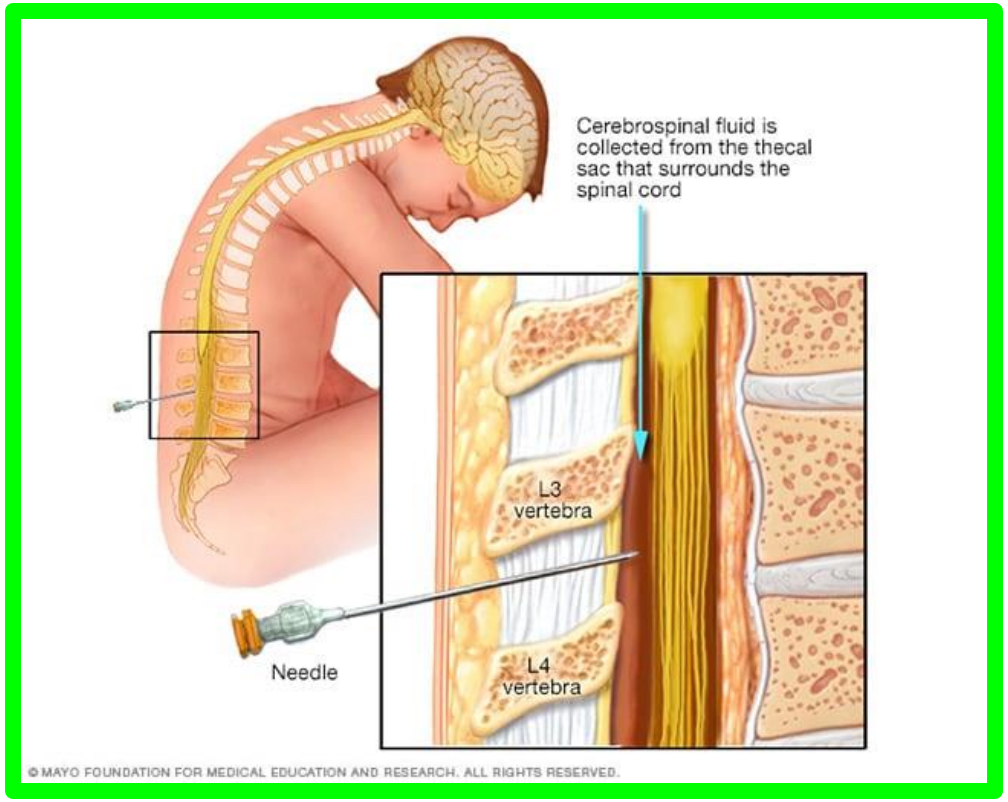
Tuesday 10 December 2024

- The difference between the length of the spinal cord and vertebral canal is due to the rapid growth of the vertebral column more than the spinal cord.
- Lumbar puncture is done at the intervertebral disc of L3/L4 to avoid injury of the spinal cord.





Spinal Cord

• EXTERNAL FEATURES

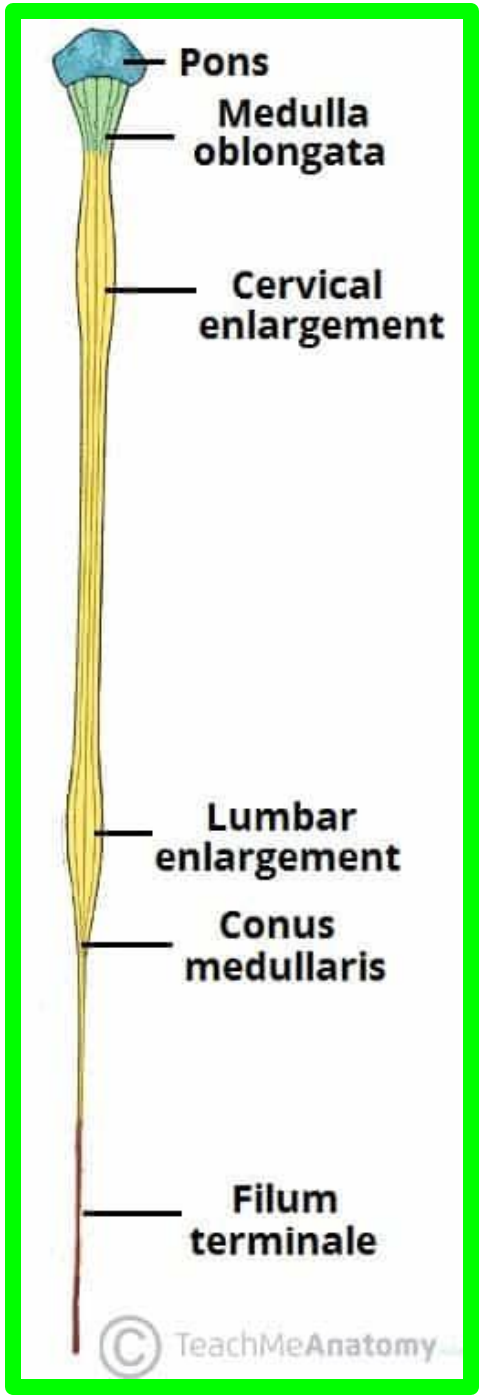
✓ **Enlargements (swelling) of the spinal Cord:**

A. Cervical enlargement:

- ❖ It presents at the region of the cervical part of the spinal cord
- ❖ It gives origin to the cervical and brachial plexuses to the upper limb.

B. Lumbosacral enlargement:

- ❖ It presents at the region of the lumbar and sacral parts of the spinal cord.
- ❖ This enlargement gives origin to the lumbar and sacral plexuses to the lower limb.



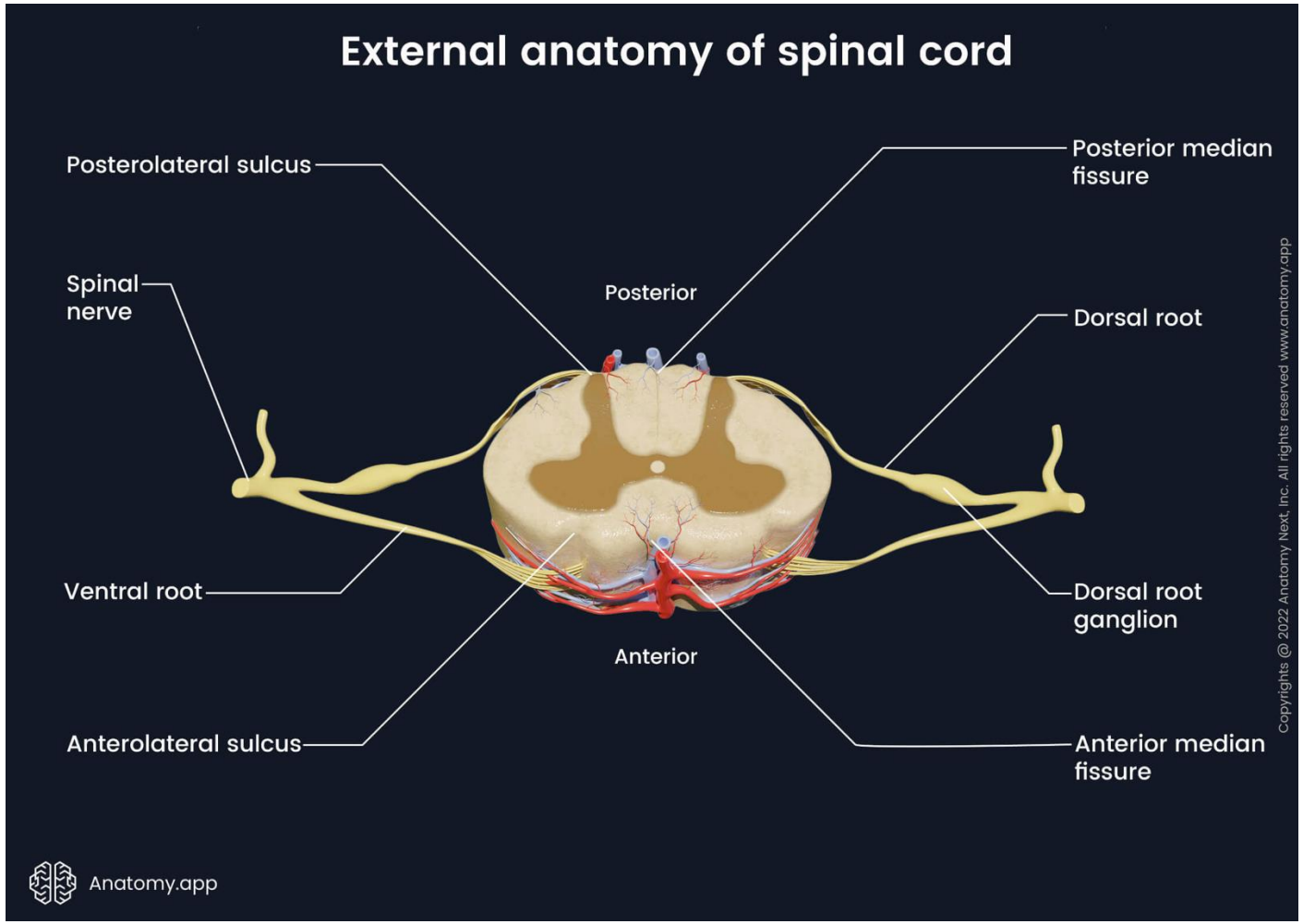
Spinal Cord

• EXTERNAL FEATURES

✓ **Surface:** there are Sulci in the outer surfaces

1. An anterior median fissure or sulcus which is relatively deep. It is occupied by the anterior spinal artery and anterior median vein.

2. A posterior median sulcus shallow. It is occupied by the posterior median vein.



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Tuesday 10 December 2024

Spinal Cord

• EXTERNAL FEATURES

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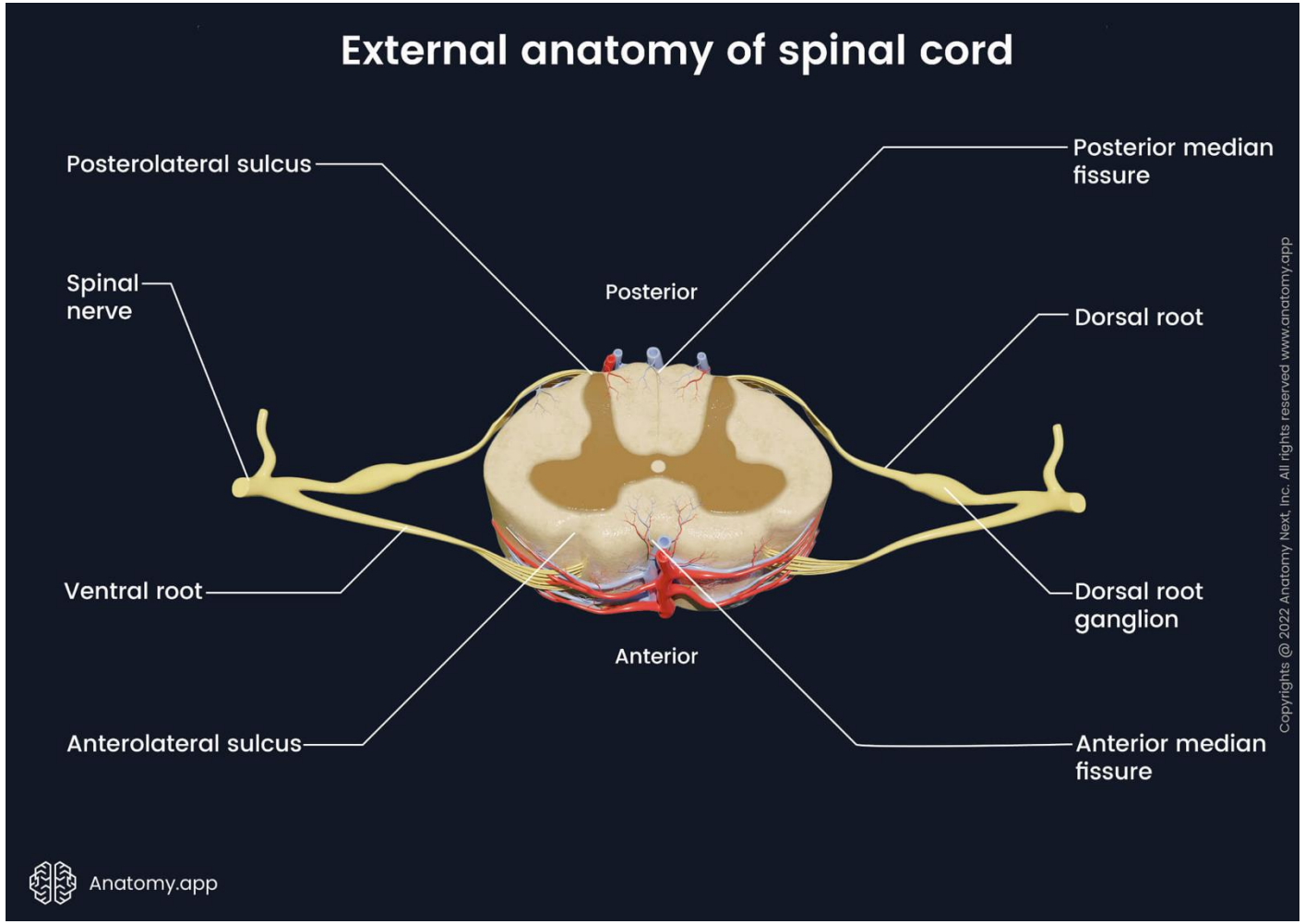
Tuesday 10 December 2024

3. 2 anterolateral sulci (one on each side) along the line of emergence of the ventral (motor) roots of the spinal nerves.

4. 2 posterolateral sulci (one on each side); at the line of attachment of the dorsal (sensory) roots of the spinal nerves.



Spinal Cord

• EXTERNAL FEATURES

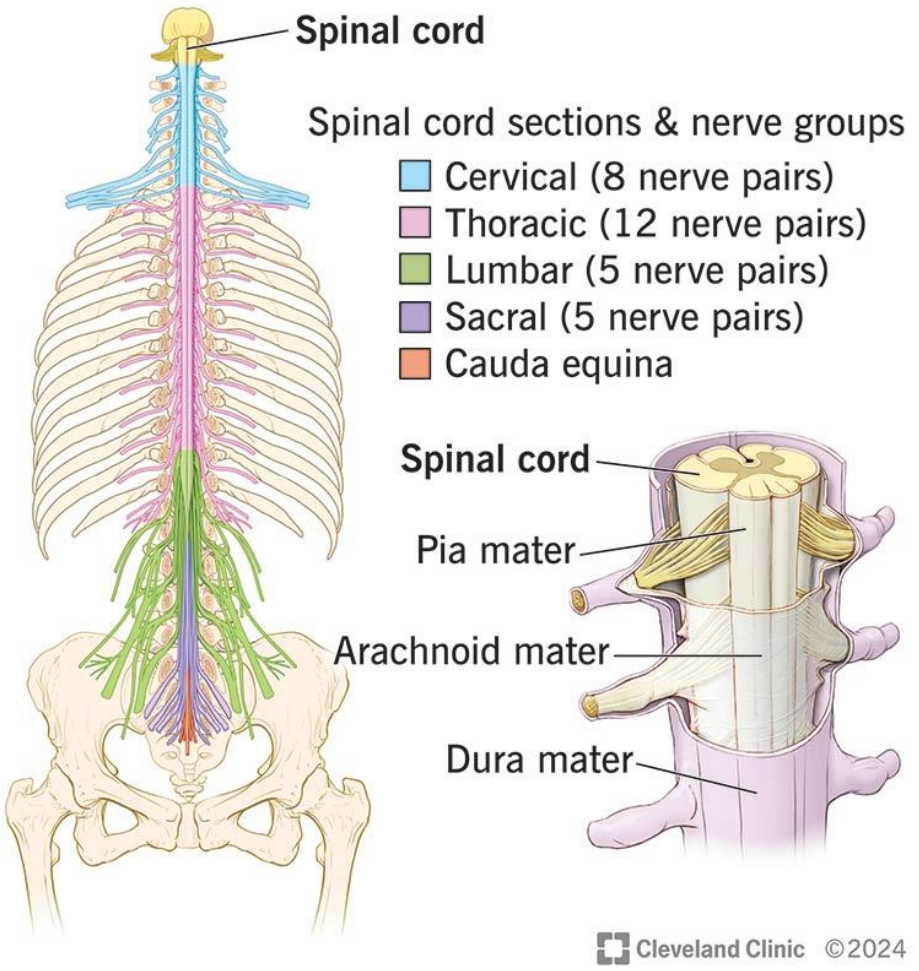
- **Spinal Cord Segments (Parts)**

❖ The spinal cord divides into segments.

❖ A segment is that part of the spinal cord which gives attachment to a pair of spinal nerves;

❖ These are 3l pairs and classified as follows:

- ✓ 8 cervical spinal segments.
- ✓ I2 thoracic spinal segments.
- ✓ 5 lumbar spinal segments.
- ✓ 5 sacral spinal segments
- ✓ I coccygeal spinal Segment.



Spinal Cord

• EXTERNAL FEATURES

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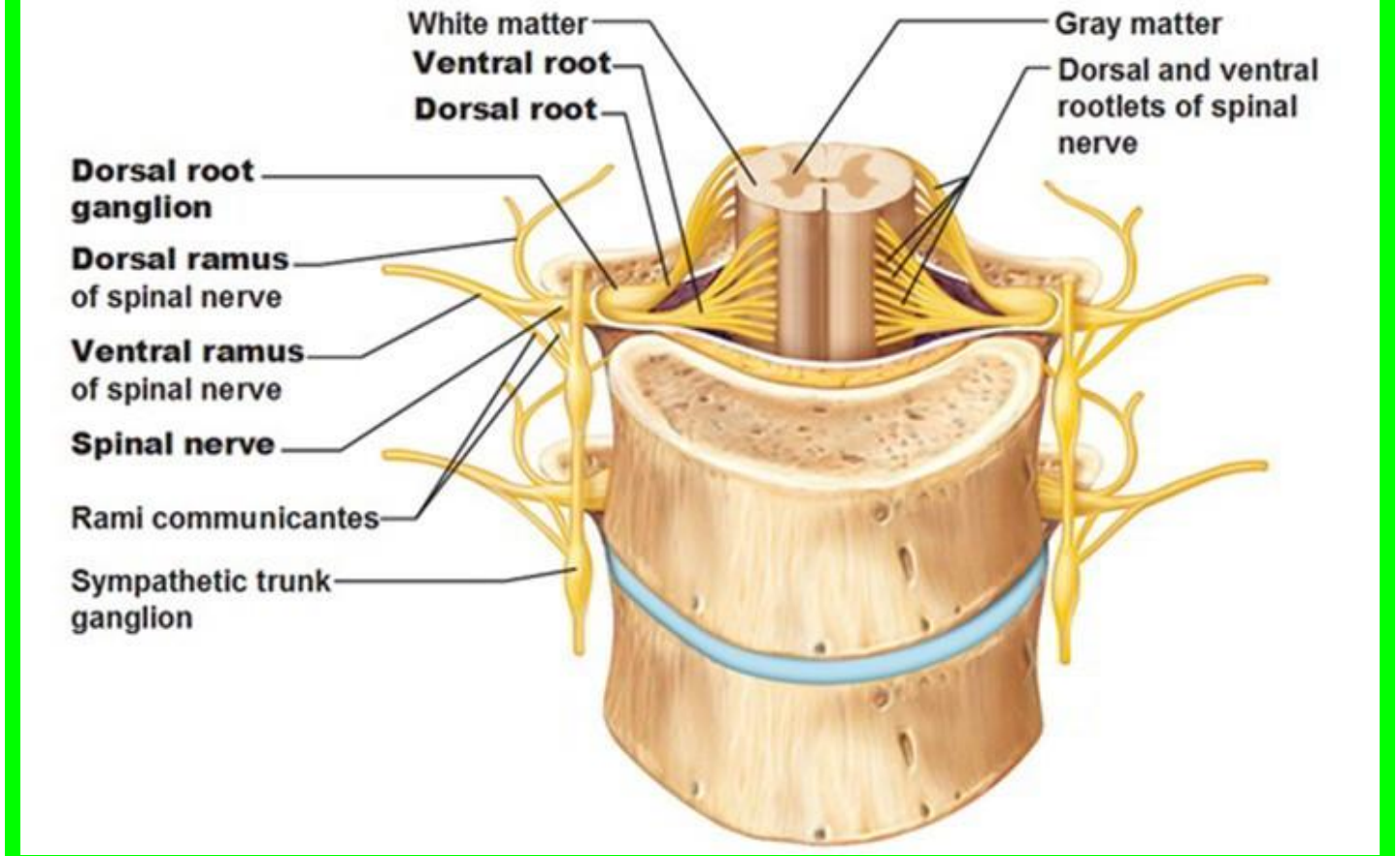
- **SPINAL NERVES**

➢ These are; 31 pairs corresponding in number to the spinal cord segments.

➢ Parts of the spinal nerve; each spinal nerve arises by 2 roots,

A. Ventral root of the spinal nerve: is motor as it is formed of the axon of the motor cells in the anterior and lateral horns.



Spinal Cord

• EXTERNAL FEATURES

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10
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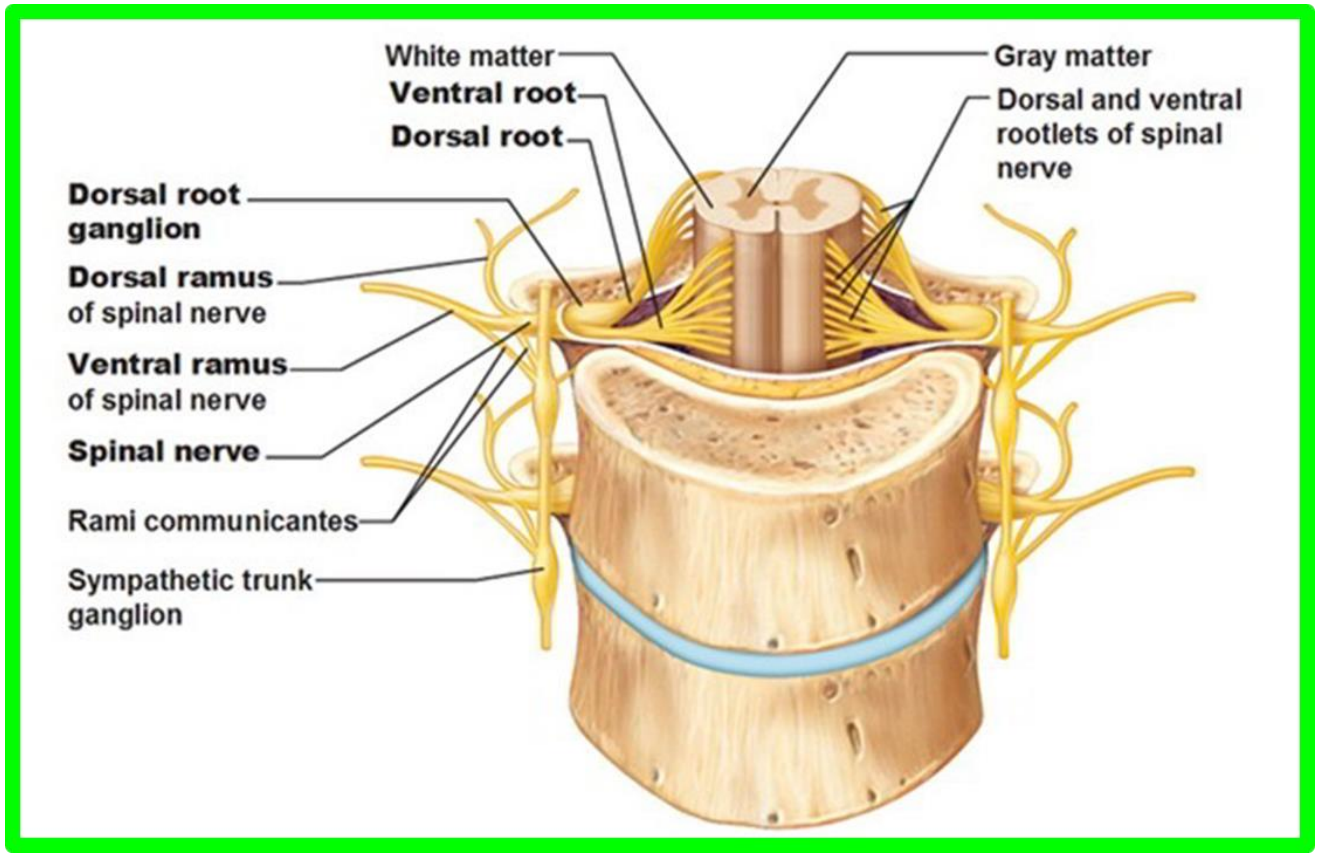
B. Dorsal root: is sensory. It is divided into;

1. **Medial part** enters the posterior white column and ascends as Gracile and Cuneate tracts.
2. **Lateral part** enters **the posterior horn** and ends in **the sensory nuclei**.

- The **2 roots unite together** at the **intervertebral foramen** to form the trunk of the spinal nerve (mixture of sensory and motor fibers).

- Just outside the intervertebral foramen, the trunk divides into **ventral** and **dorsal rami.**

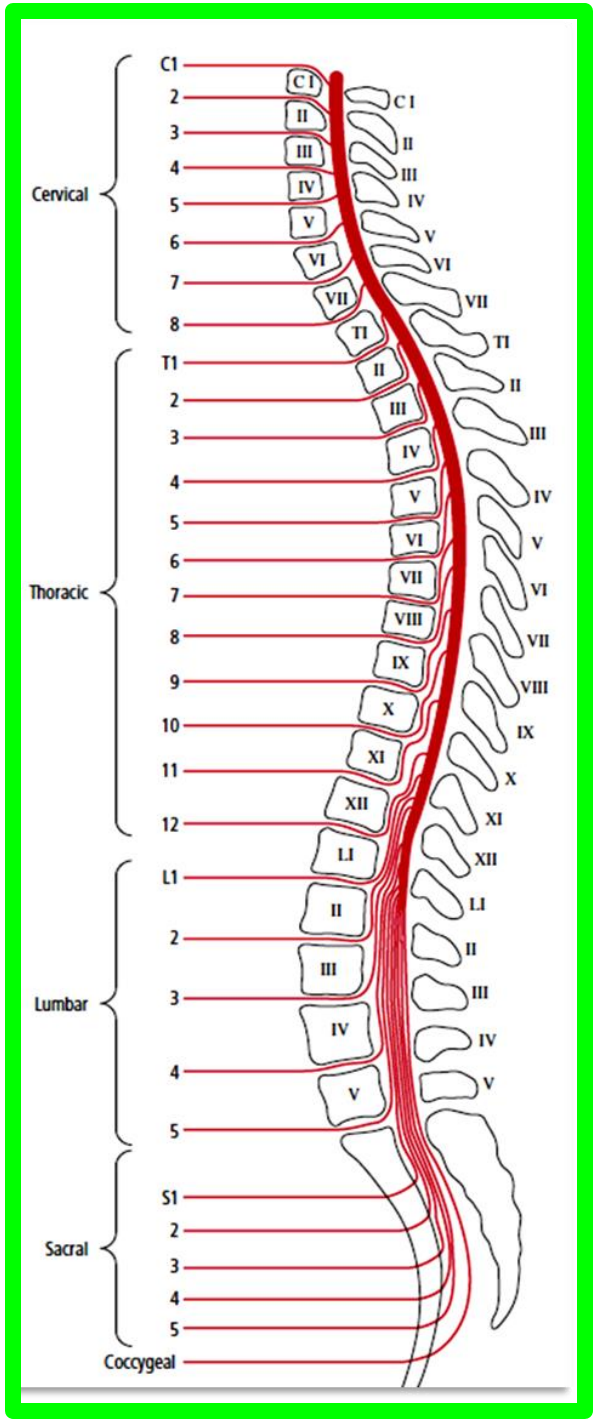


Spinal Cord

• EXTERNAL FEATURES

- **Relations of the segments and nerves to the vertebral column;**

1. The 8th cervical segment lies opposite 7th cervical vertebrae (Segment = vertebrae+1).
2. The 6Th thoracic segment lies opposite 4th thoracic vertebrae (Segment =Vertbrae + 2).
3. The 12Th thoracic segment lies opposite 9th thoracic vertebtae (Segment =Vertbrae + 3).
4. The lumbar segments lie opposite T10 and T11 vertebrae.
5. The sacral and coccegeal segments lie opposite T12 and L1 vertebrae.



Spinal Cord

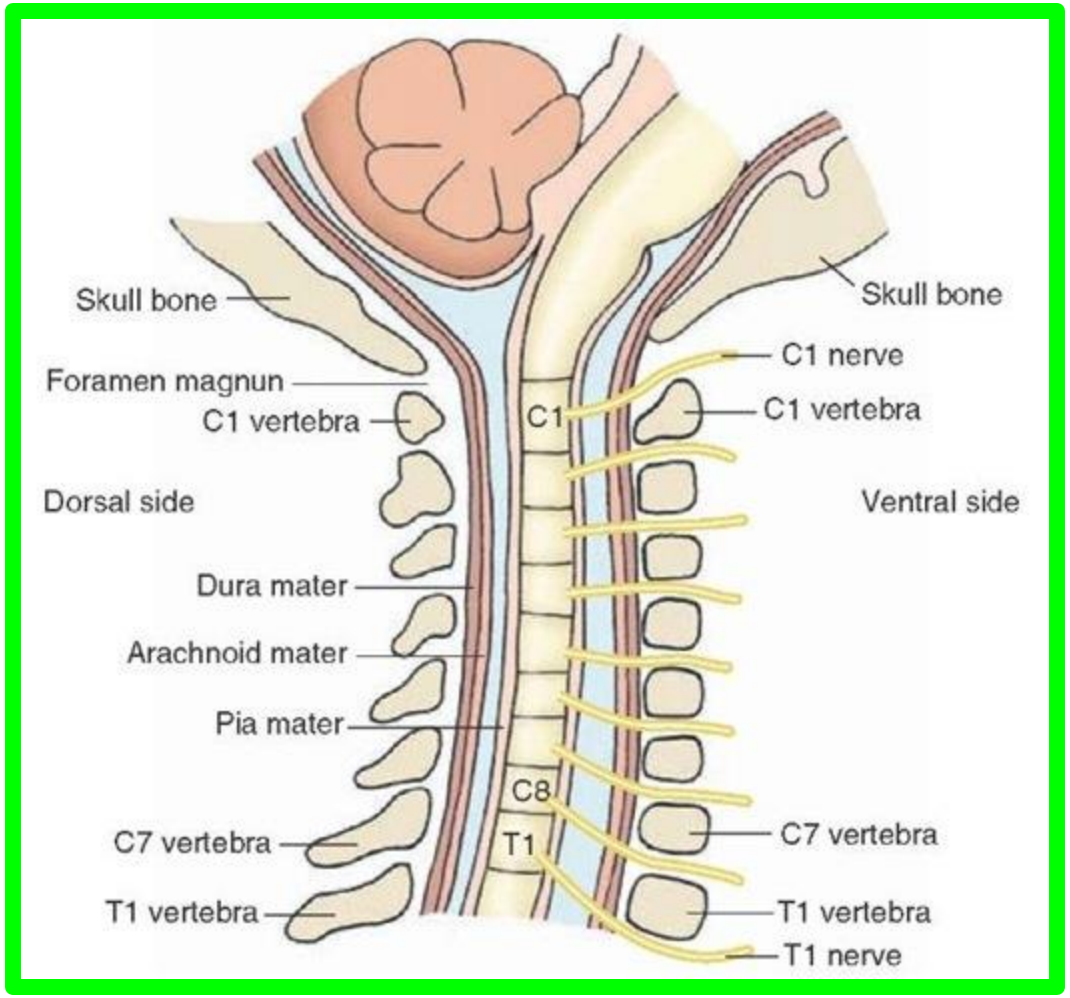
• EXTERNAL FEATURES

• Exit of the spinal nerves

1- Cervical nerves: each nerve from C1-7 leaves the vertebral canal through intervertebral foramen above the vertebra of the same number.

✓ C8 nerve leaves below C7 vertebra.

2- Thoracic and lumbar nerves; each leaves the vertebral canal below the vertebra of the same number.



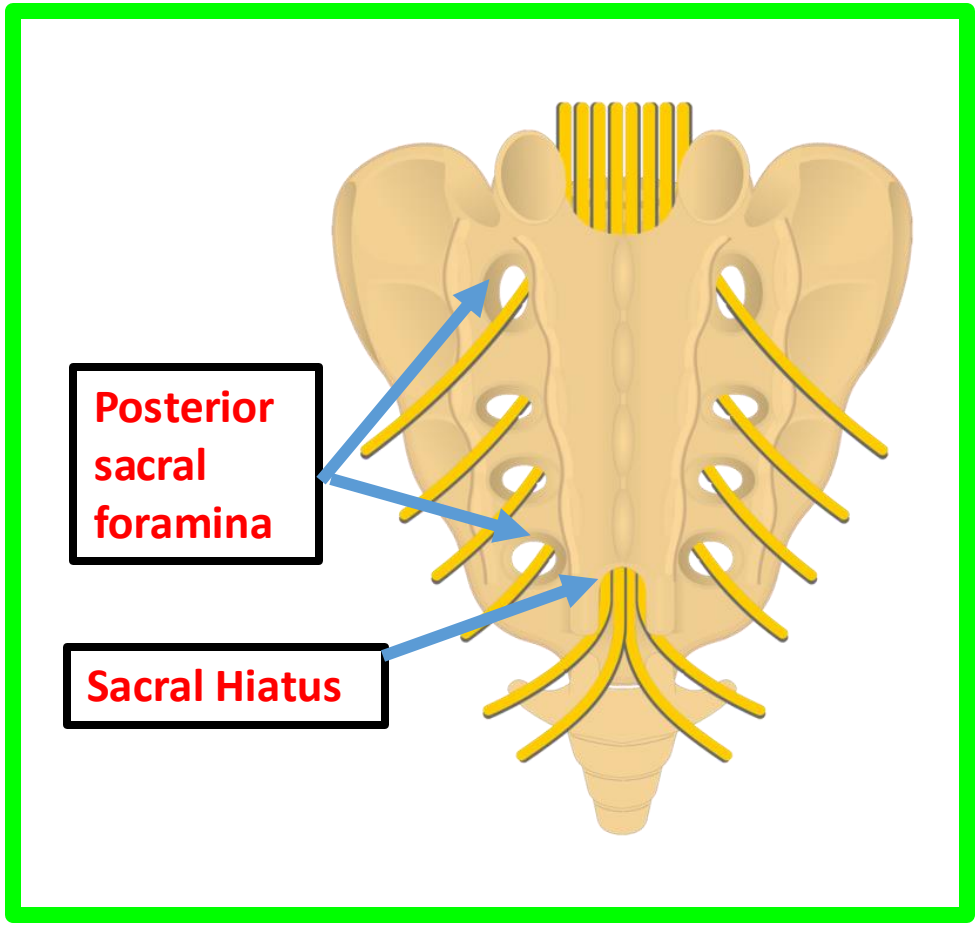
Spinal Cord

• EXTERNAL FEATURES

• Exit of the spinal nerves

3- Sacral 1- 4 nerves; leaves the vertebral canal through the anterior and posterior sacral foramina.

4- The 5th sacral and coccygeal nerves leave the canal through the sacral hiatus



Spinal Cord

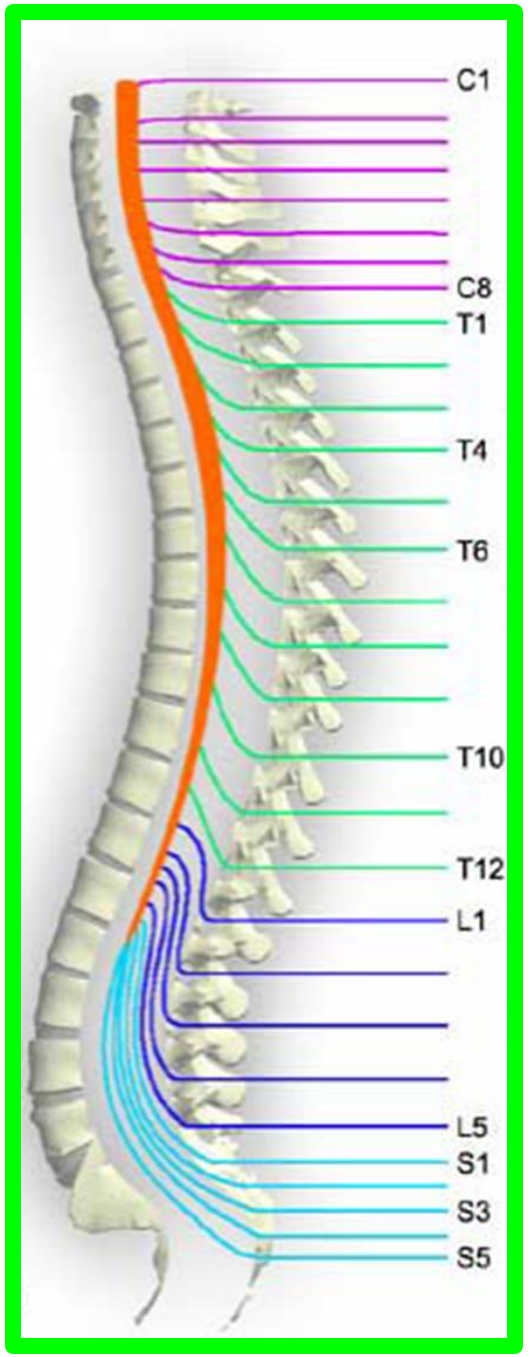
• EXTERNAL FEATURES

- The lower lumbar, sacral and coccygeal are longer and more vertical forming the cauda equina.

- Cauda equine lies in the subarachnoid space.

N.B; the lower nerve roots are longer and more oblique because the spinal cord is shorter than the vertebral canal.

The cervical spinal nerves pass horizontally
The thoracic spinal nerves pass slightly oblique



Spinal Cord

• EXTERNAL FEATURES

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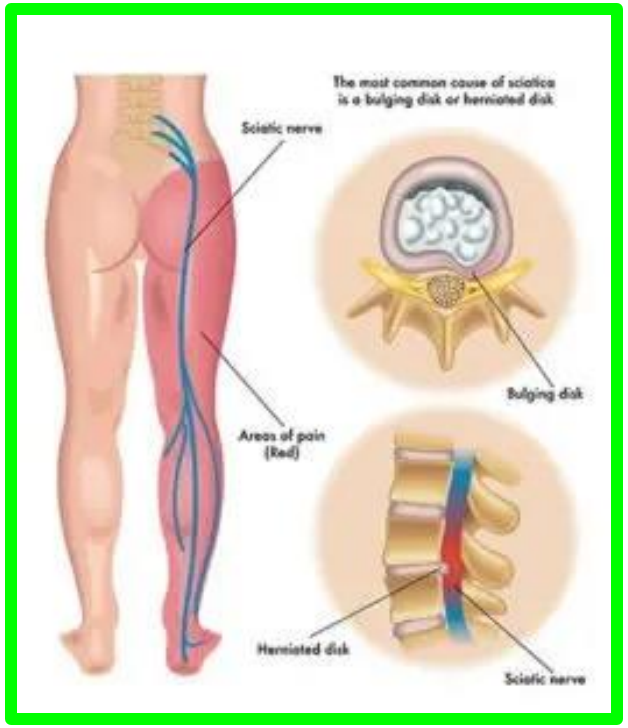
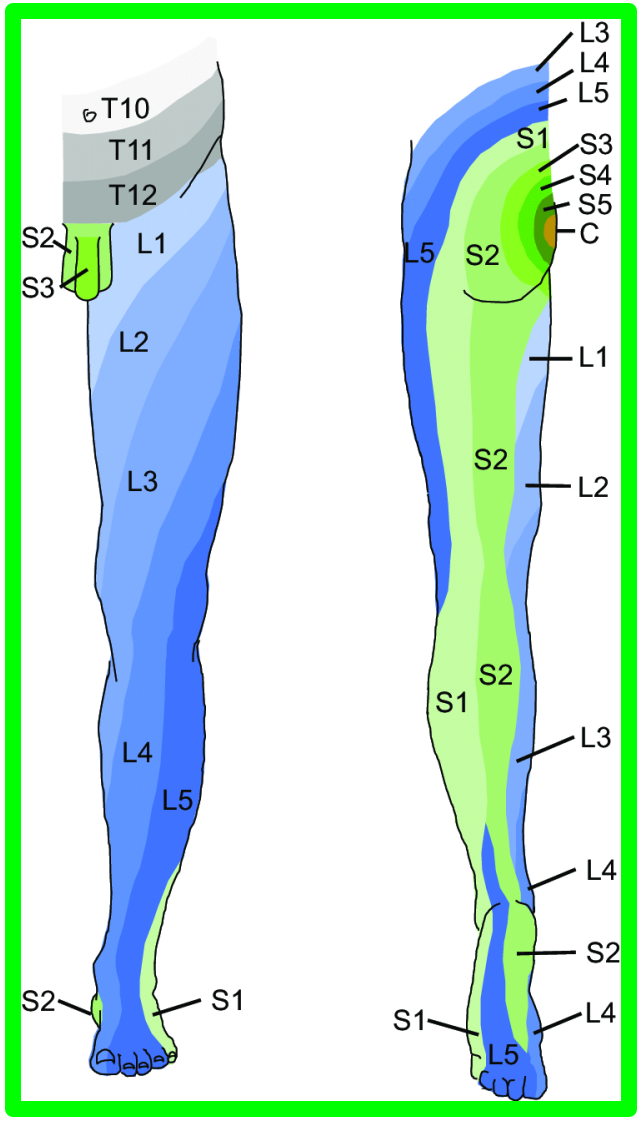
- **Dermatome** is the area of the skin supplied by the single spinal nerve.
- **Lumbago: pain in the lower back** due to press on the sacral nerve by prolapse of the inter-vertebral disc . This pain is radiated to the lower limb with weakness of muscles and loss of sensation **(Sciatica).**





Spinal Cord

• INTERNAL STRUCTURE

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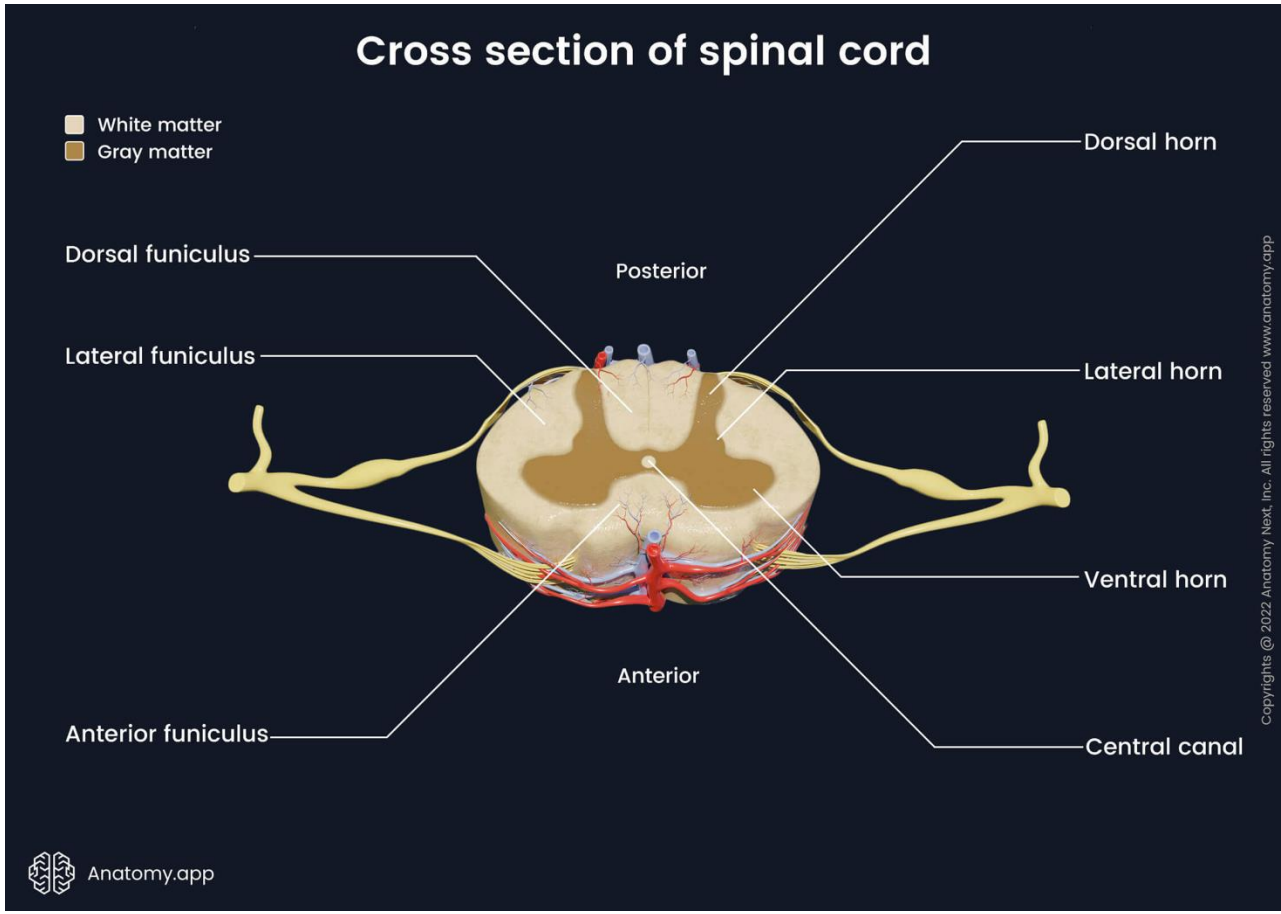
- The cord has a narrow lumen which is called the central canal.
- This canal contains cerebrospinal fluid
- The cord is formed of grey (inner) and white (outer) matter.



Spinal Cord

• INTERNAL STRUCTURE

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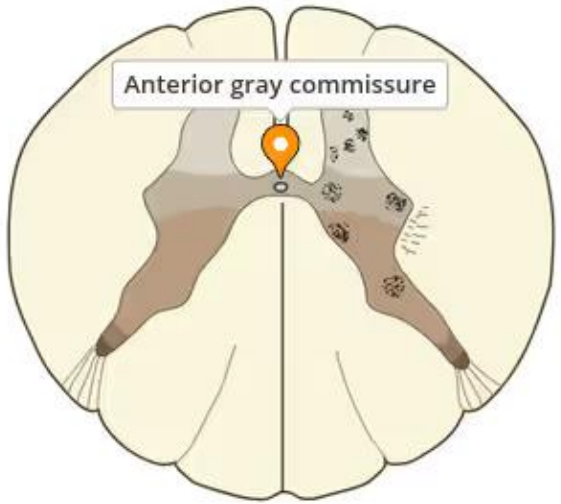
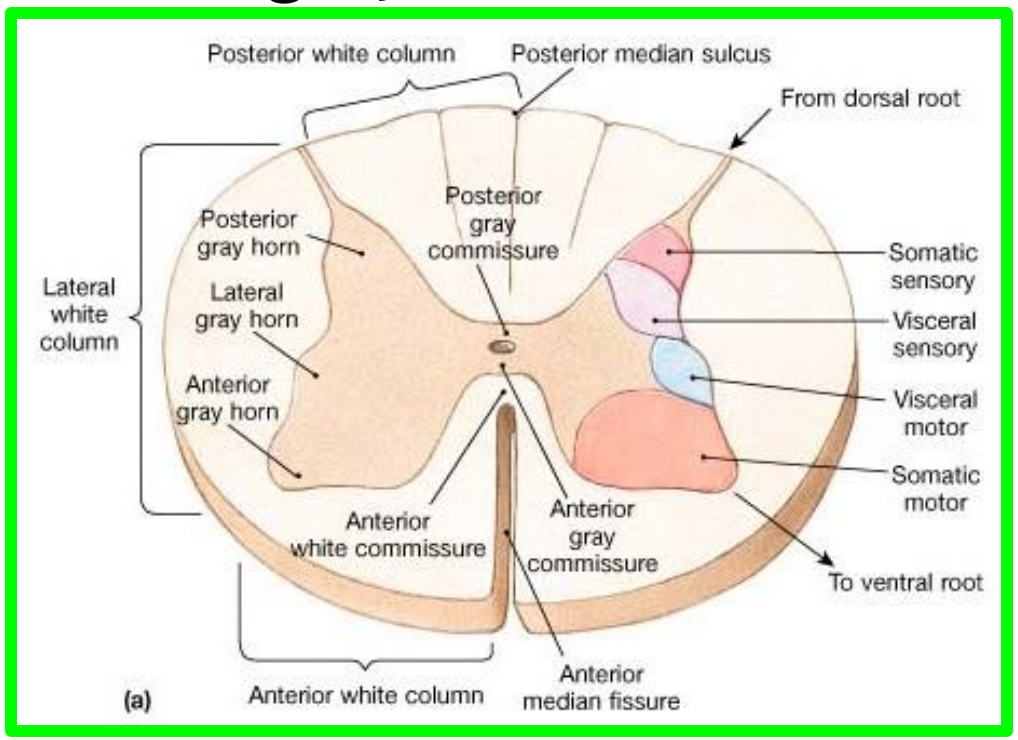
❖ The two halves of the cord are interconnected by 3 commissures across the median plane;

1- **Anterior grey commisure:** anterior to the central canal.
2- **Posterior grey commisure:** posterior to the central canal.
3- **Anterior white commisure:** anterior to the anterior grey commissure.





Spinal Cord

- INTERNAL STRUCTURE

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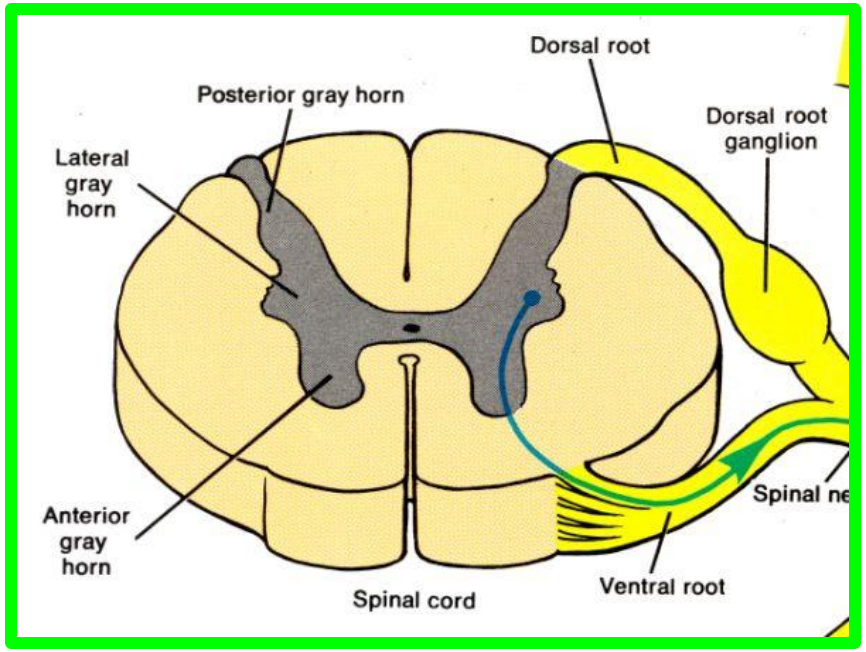
A. Grey Matter of the Cord

- ✓ In a transverse section, the grey matter of the spinal cord appears H-shaped.
- ✓ It is formed of 2 anterior horns and 2 posterior horns.
- ✓ Lateral horns present in the thoracic and upper 2 or 3 lumbar segments.
- ✓ Along the whole cord, each of the anterior, posterior and lateral horns is known as the anterior, posterior and lateral columns.



Spinal Cord

- INTERNAL STRUCTURE

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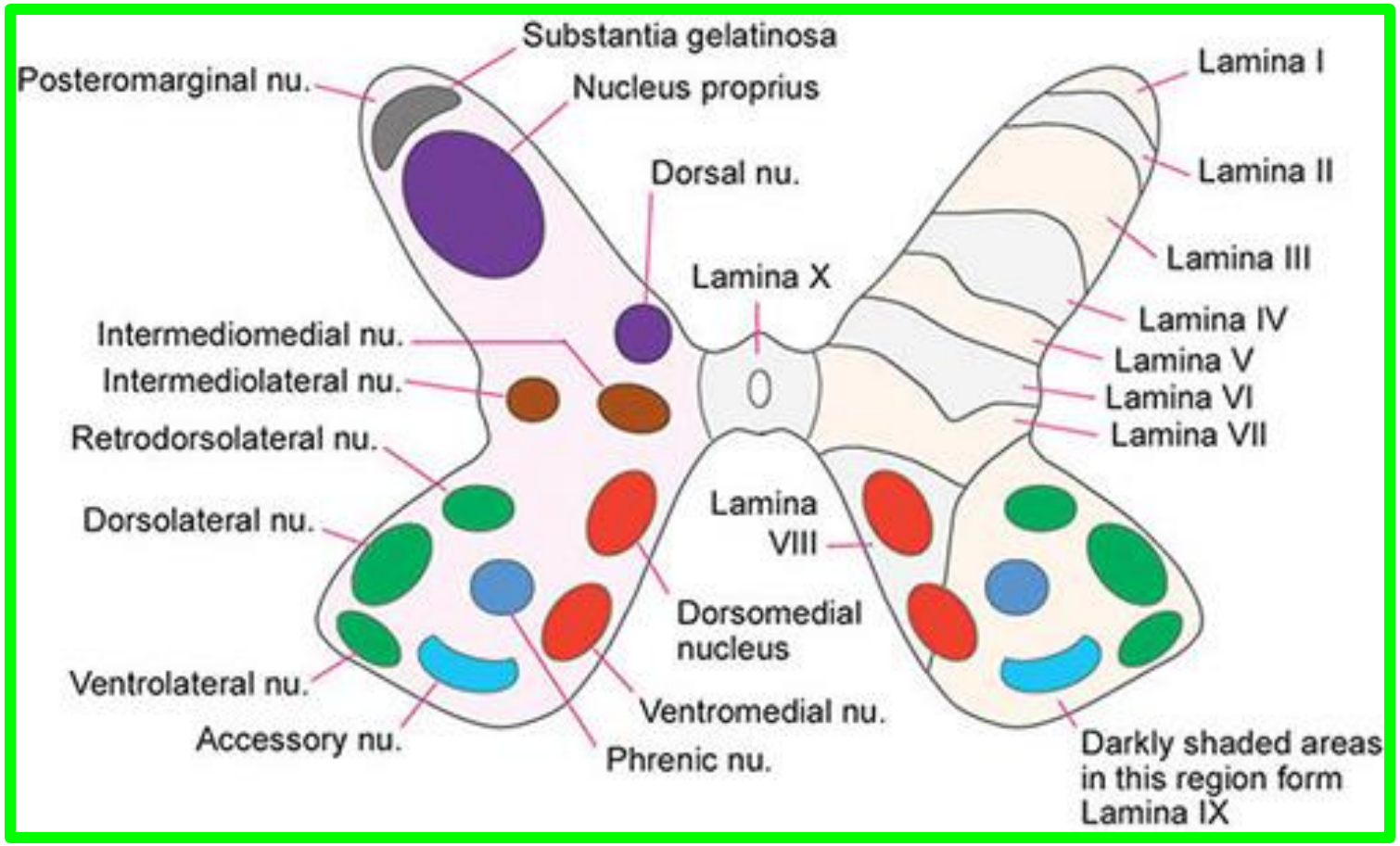
1. Anterior Horn of the Cord

- This column is motor.
- They are arranged into three groups of motor nuclei:

1. Medial group found in all segment of the spinal cord.
   - ✓ They supply the muscles of the trunk.



Spinal Cord

- INTERNAL STRUCTURE

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Tuesday 10 December 2024
20

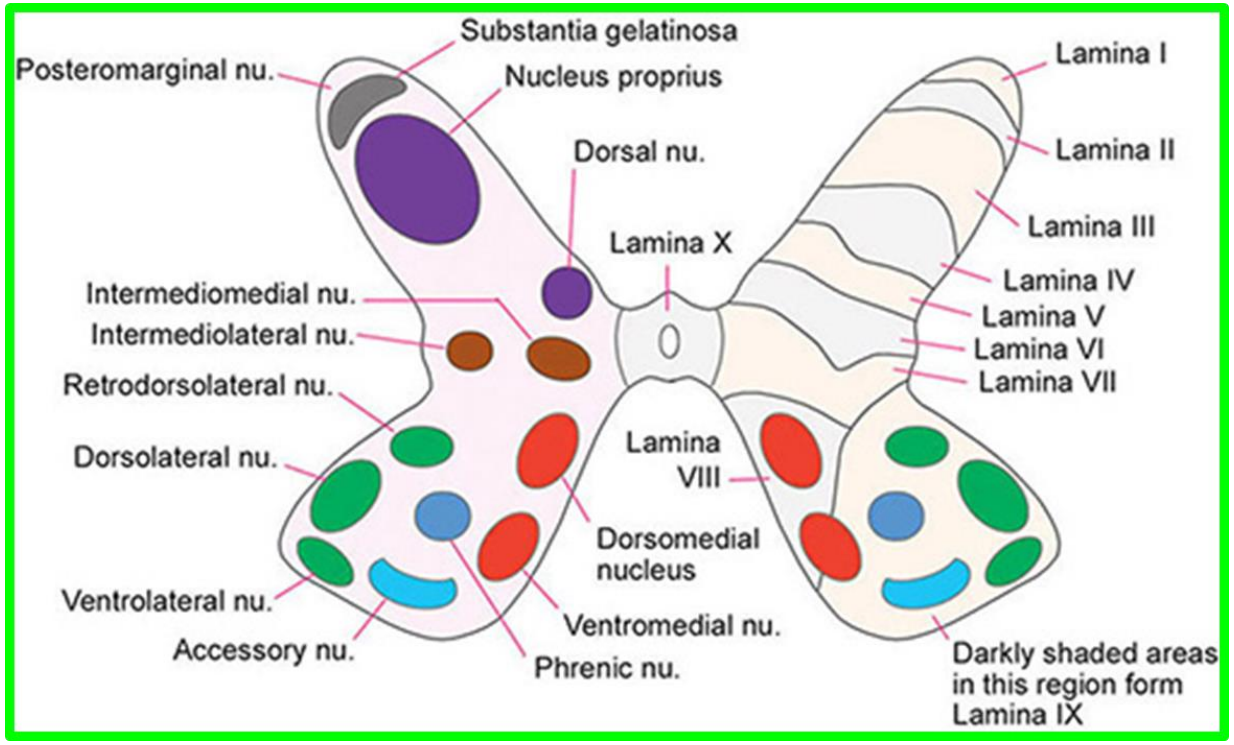
2. Lateral group present in the cervical, lumbar and sacral regions.

✓ They supply the muscles of the Limbs.

3- Central group present only in the cervical region. Its axon runs in;

A. Phrenic nerve from C 3, 4, 5.
It supplies the diaphragm.

B. Spinal root of accessory nerve from the upper 5 or 6 cervical segments.
It supplies the sternomastoid and trapezius muscles.



Spinal Cord

- INTERNAL STRUCTURE

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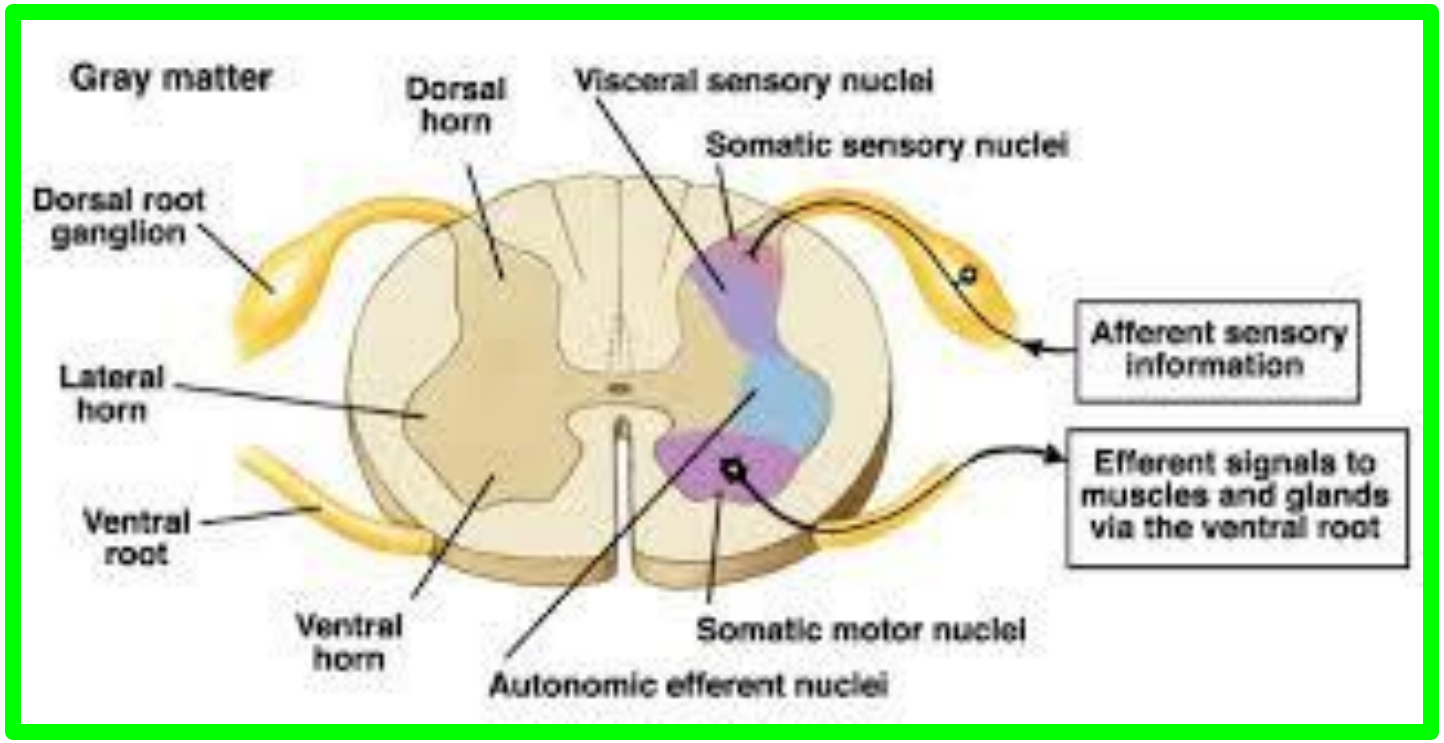
2. Lateral Horn of the Cord

❖ It contains motor cells that give rise to preganglionic autonomic fibers;

A. Sympathetic nucleus present in all thoracic and upper 2 or 3 lumbar segments.

B. Parasympathetic nucleus present in the 2nd, 3rd and 4th sacral segments.



Spinal Cord

• INTERNAL STRUCTURE

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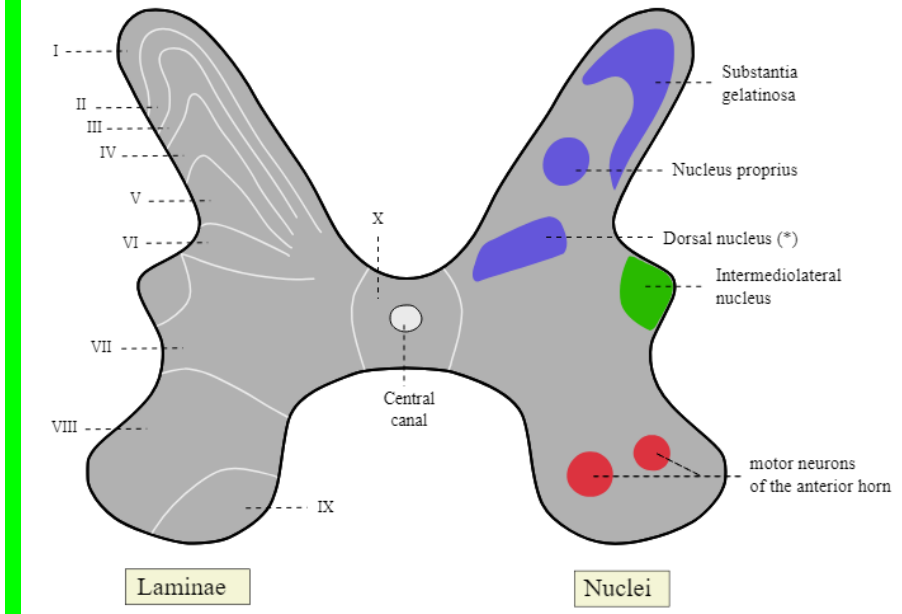
3. Posterior Horn of the Cord

❖ This horn (column) is sensory.

1. Substantia gelatinosa of Rolandi (S.G.R) found in all segment.

- ✓ Group of cells which are present at the tip of the posterior horn.
- ✓ They form cell station for pain and temperature sensation.
- ✓ It gives origin to the lateral spinothalamic tract.

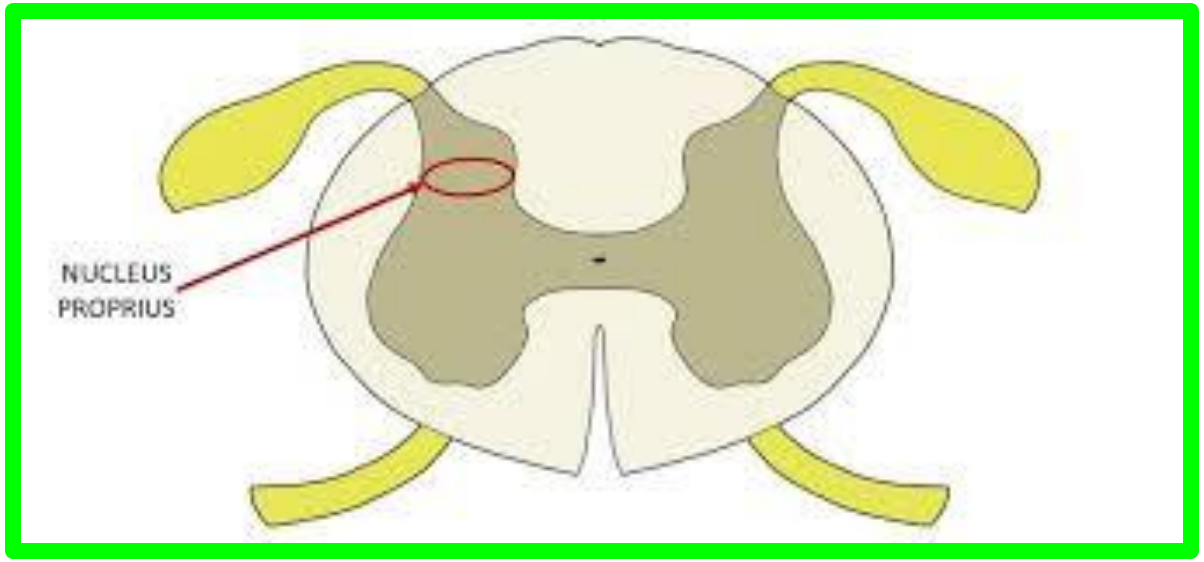


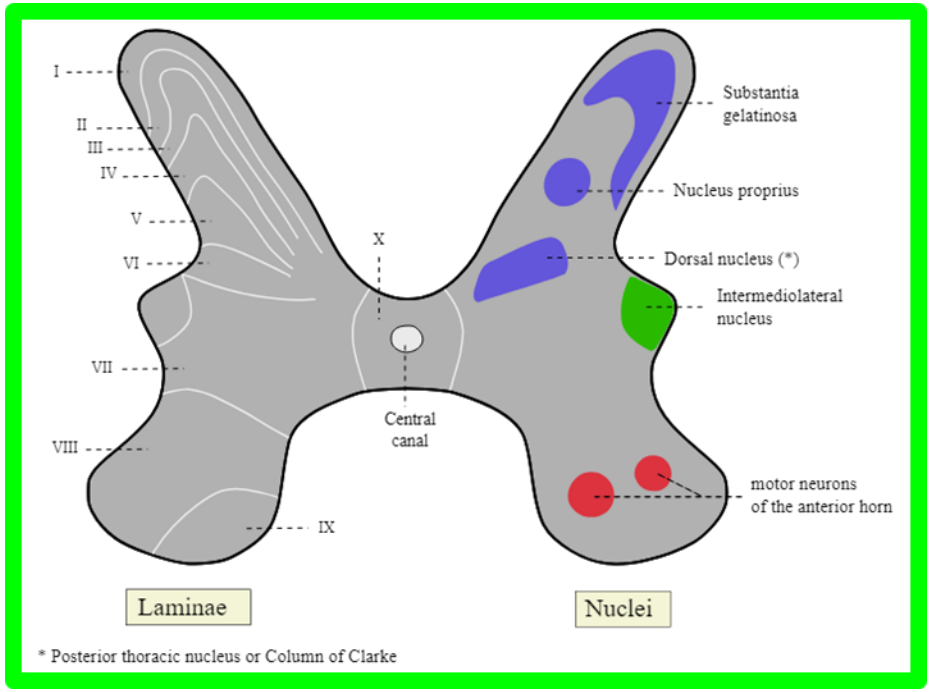
Spinal Cord

- INTERNAL STRUCTURE

2- Nucleus proprius found in all segment of the spinal cord:

- ✓ Group of cells which are present in the middle of the posterior horn.
- ✓ They form cell station for light pressure and touch sensation.
- ✓ It gives origin to the anterior spinothalamic tract.





Spinal Cord

- INTERNAL STRUCTURE

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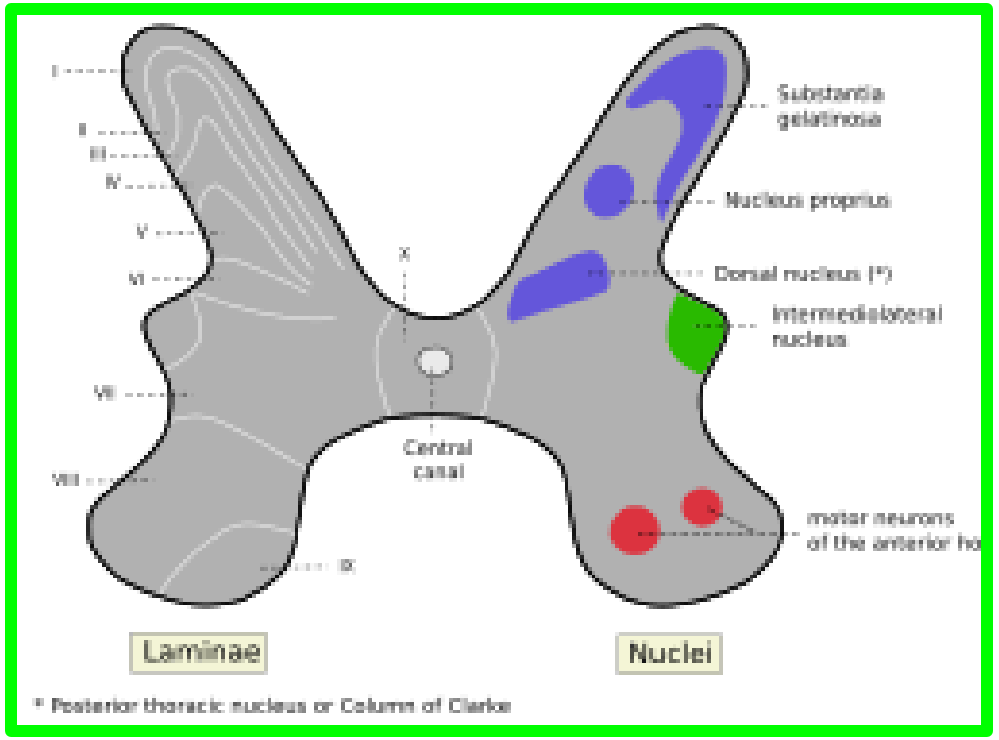
3- Clark's nucleus (dorsalis nucleus):

- ✓ It present at the base of the posterior horn (in the thoracic and upper lumbar region).
- ✓ They form cell station for proprioceptive impulses.
- ✓ It gives origin to the anterior and posterior spinocerebellar tracts.



Spinal Cord

- INTERNAL STRUCTURE

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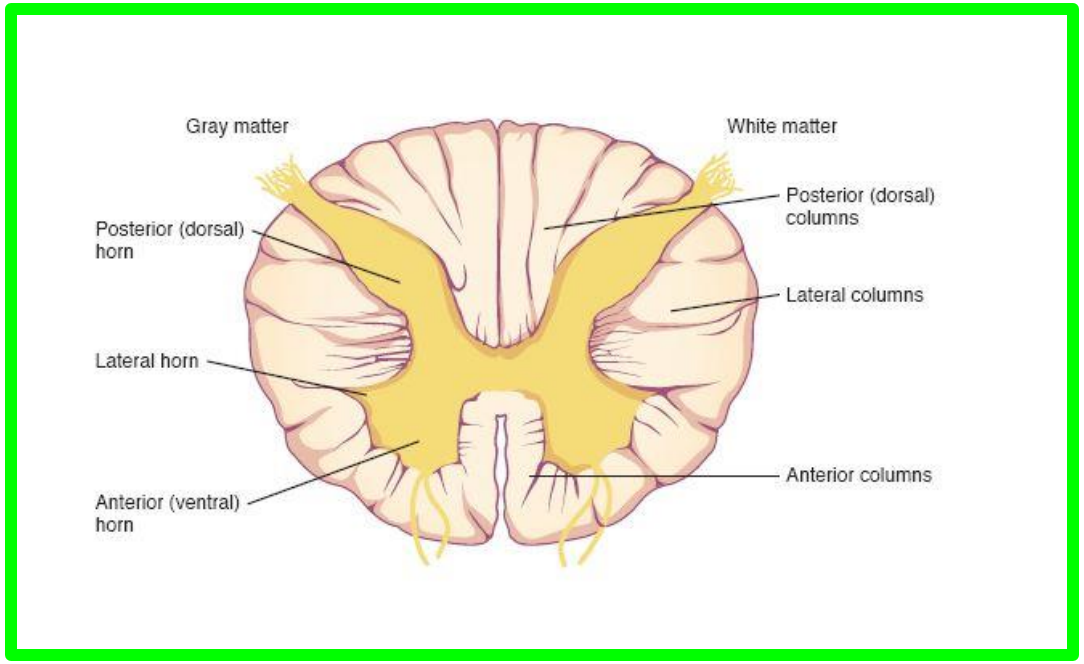
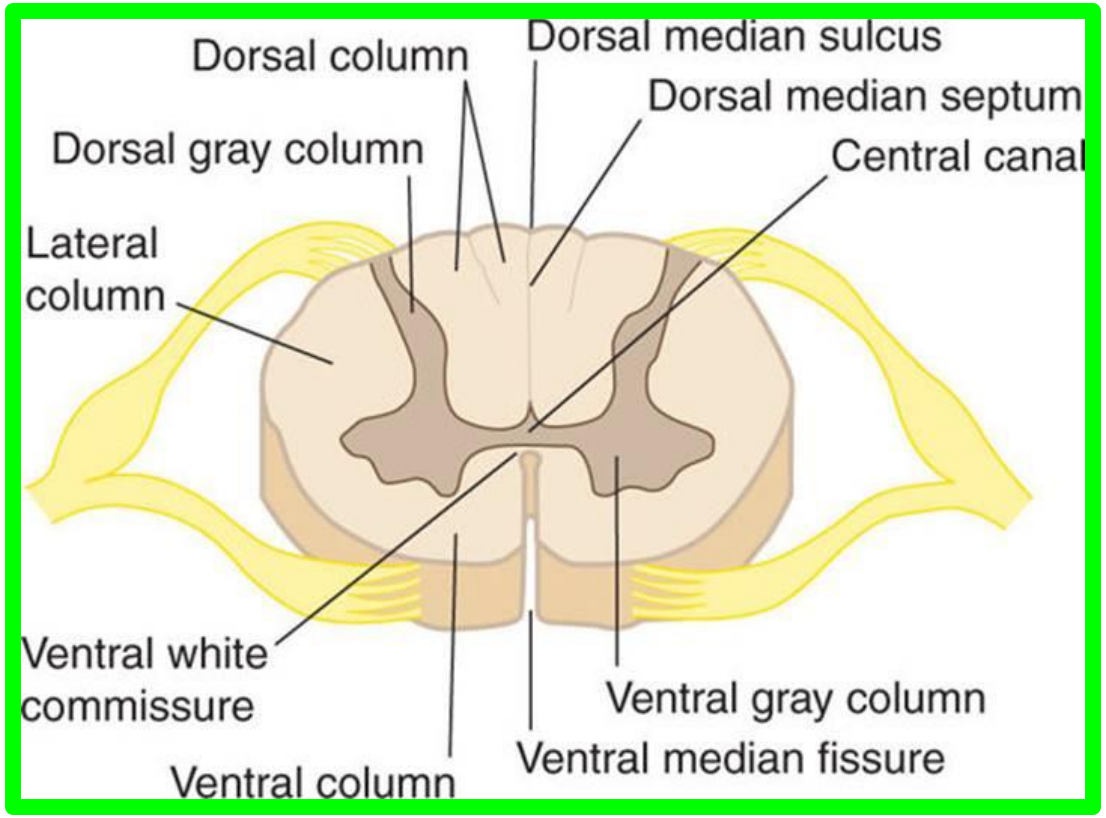
B. White Matter of the Cord

✓ In a transverse section, the white matter is differentiated into 3 white columns on each side:

1.Posterior column: which lies between the posterior median septum and the attachment of the dorsal nerve root.

- It contains the ascending tracts only.





Spinal Cord

• INTERNAL STRUCTURE

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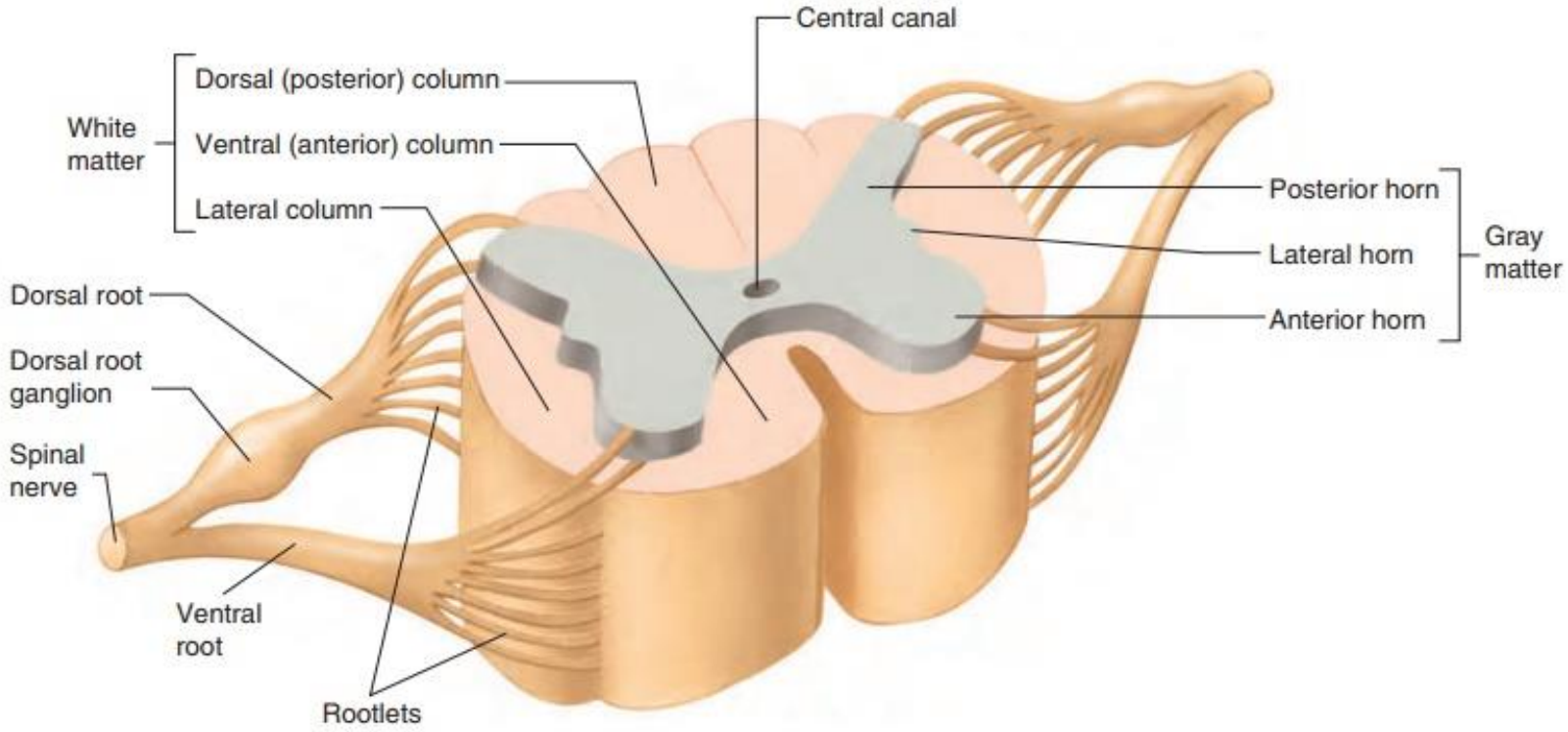
2. Lateral column: which lies lateral to both anterior and posterior horns.

✓ It contains the ascending and descending tracts.

3. Anterior column: which lies between the anterior median fissure and the attachment of ventral nerve roots of the spinal nerves.



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