

# **Spinal cord**

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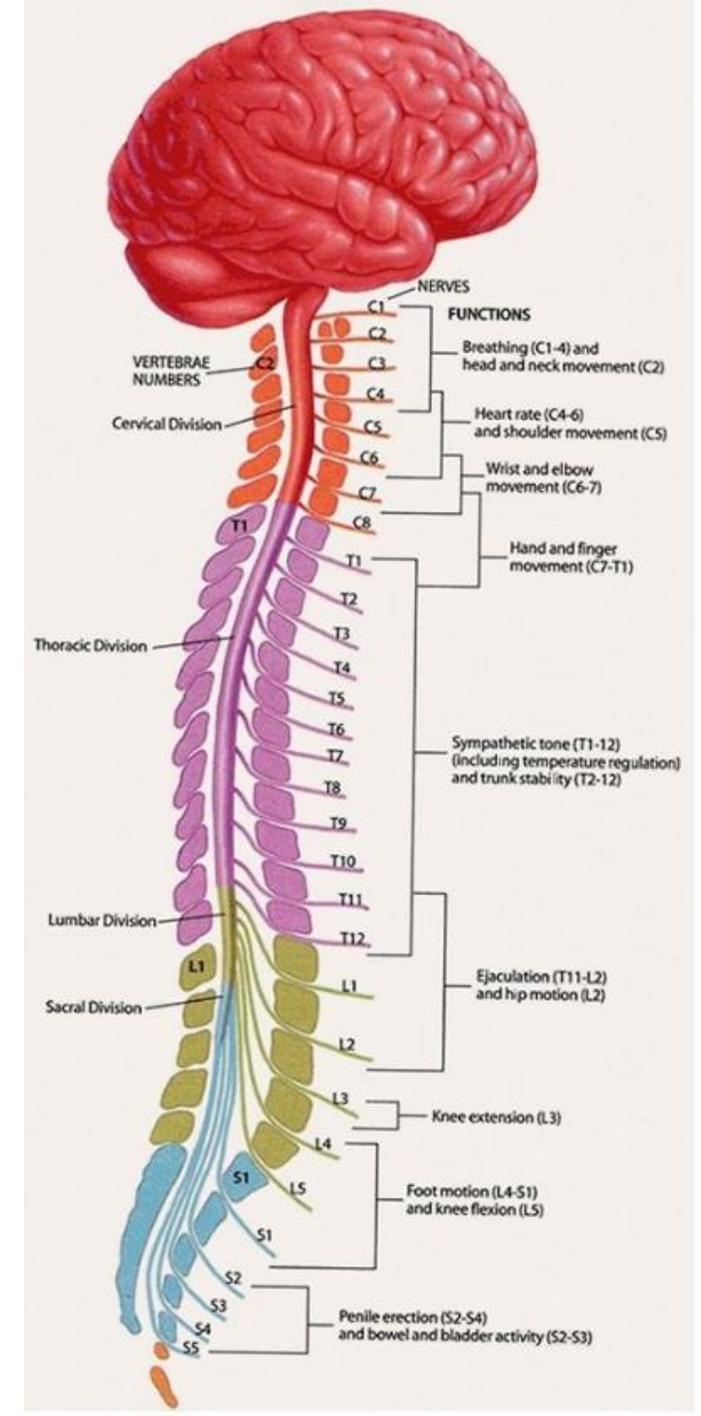
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# Lecture ILOs/ Objectives

- **By the end of this lecture the student will be able to:**
  - 1. Outline the gross anatomy of spinal cord**
  - 2. Identify general organization of spinal nerves and plexuses**
  - 3. Describe the structure of spinal nerves**
  - 4. Understand Internal structure of the spinal cord**

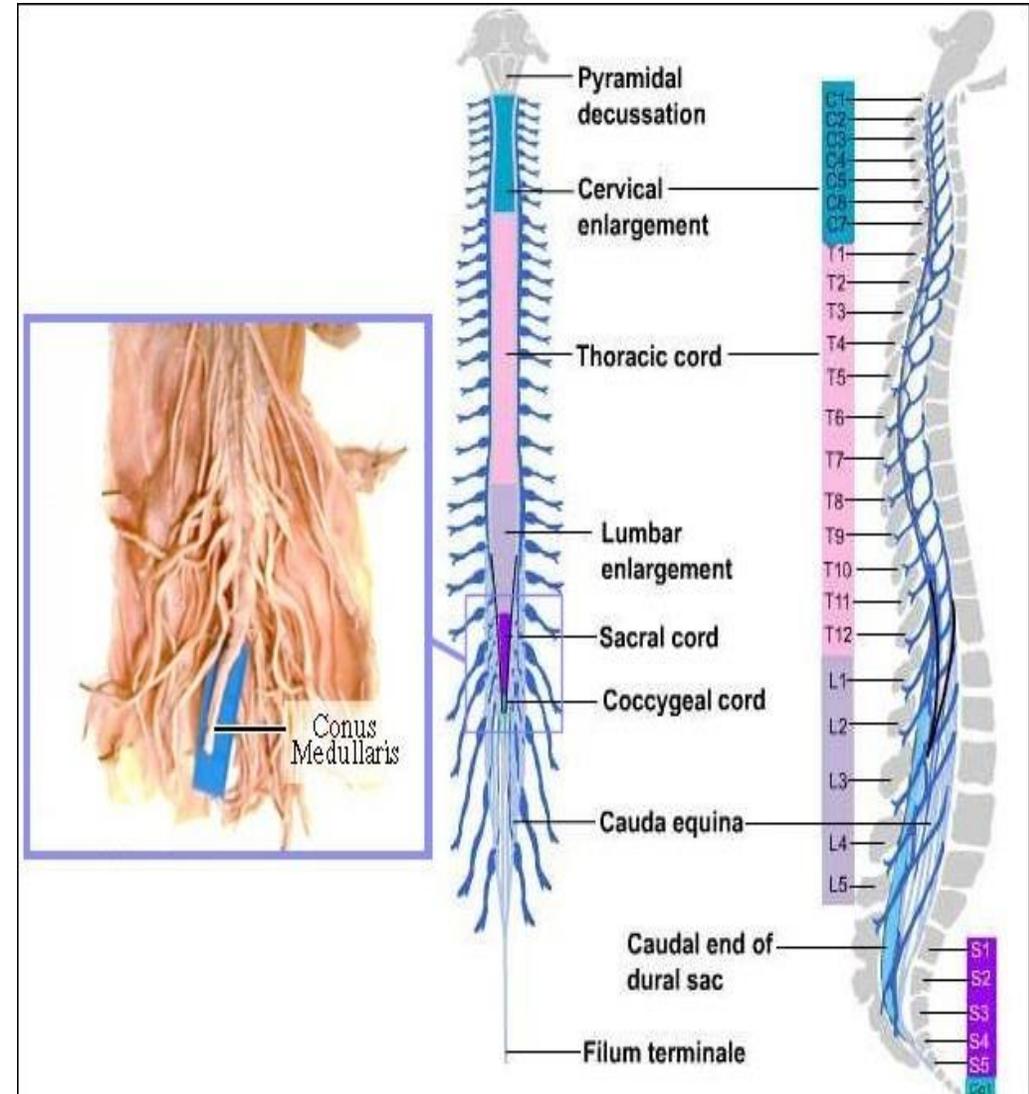
# Gross Anatomy: Location:

- It occupies the upper part of the vertebral canal extending, in the adult, from the foramen magnum to **the lower border of the first lumbar vertebra.**
- In the early embryonic life, the spinal cord fills the whole length of the vertebral canal.
- Then by the end of the 3<sup>rd</sup> month the vertebral column grows faster than the spinal cord.
- At birth, the spinal cord ends at the level of **the 3<sup>rd</sup> lumbar vertebra.**

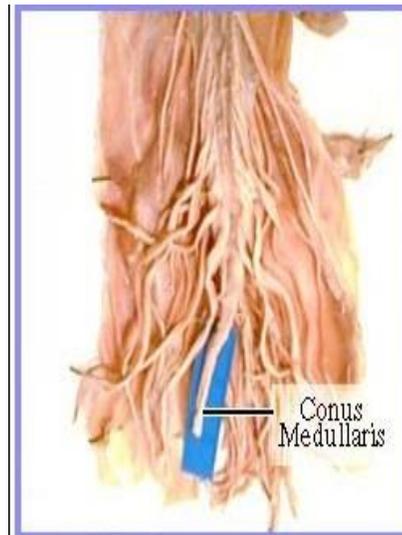
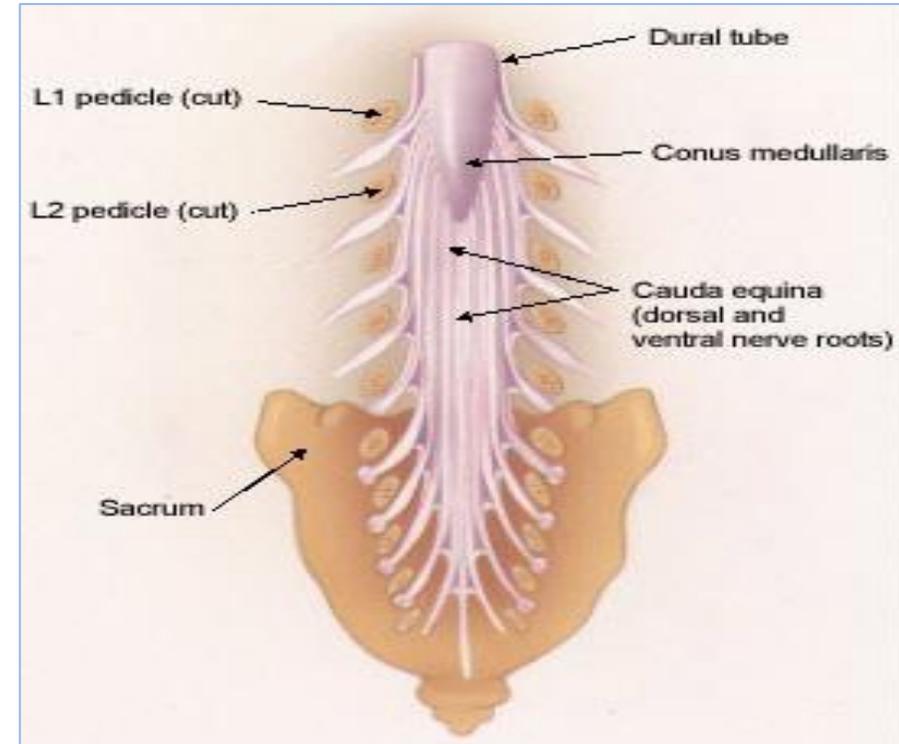


# Shape and Length:

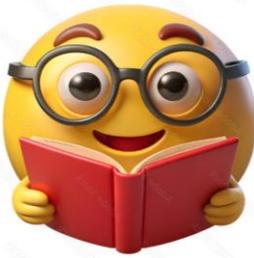
- Cylindrical in shape, 1 cm in diameter.
- its length is about 45 cm in males and 42 cm in females.
- Has two enlargements along its length; cervical and lumbar.
- The **cervical enlargement** extends from the 2<sup>nd</sup> cervical to the first thoracic.
- the **lumbar enlargement** extends from the 9<sup>th</sup> thoracic to the 12<sup>th</sup> thoracic vertebra.
- It is divided into 31 segments
- (8 cervical, 12 thoracic, 5 lumbar, 5 sacral and 1 coccygeal ).



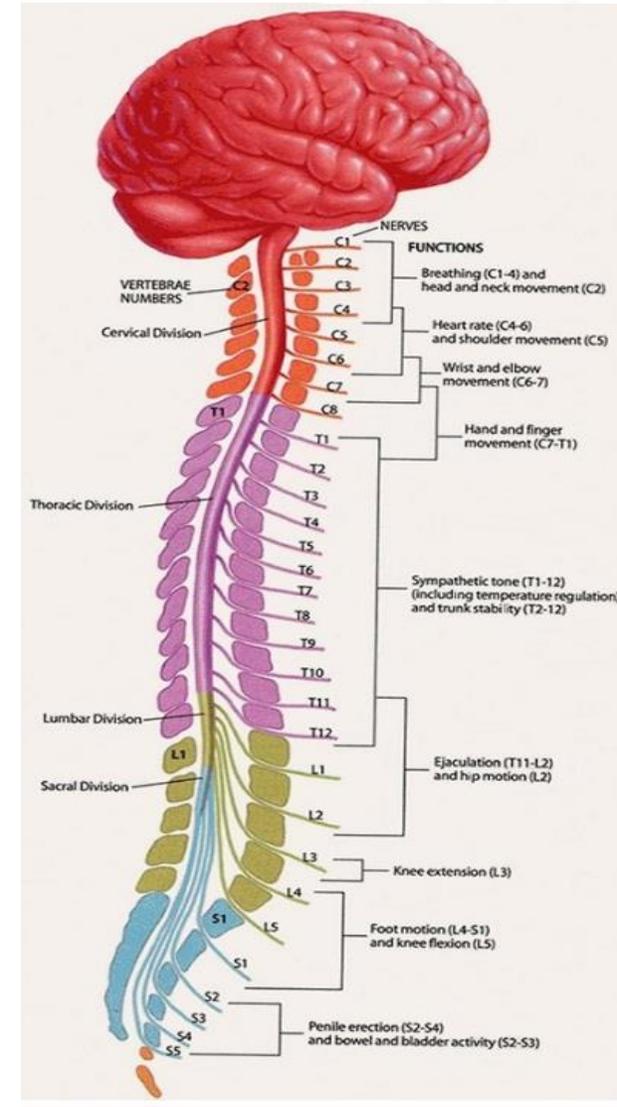
- The spinal cord is continuous above with the medulla oblongata at the spinomedullary junction.
- Its lower end is conical in shape, called **conus medullaris**.
- The **terminal ventricle** is the dilated terminal part of the central canal in the conus medullaris.
- The spinal cord is attached to the coccyx by a fibrous cord, called **filum terminale**.



# Relation Between the spinal cord and Vertebral column:



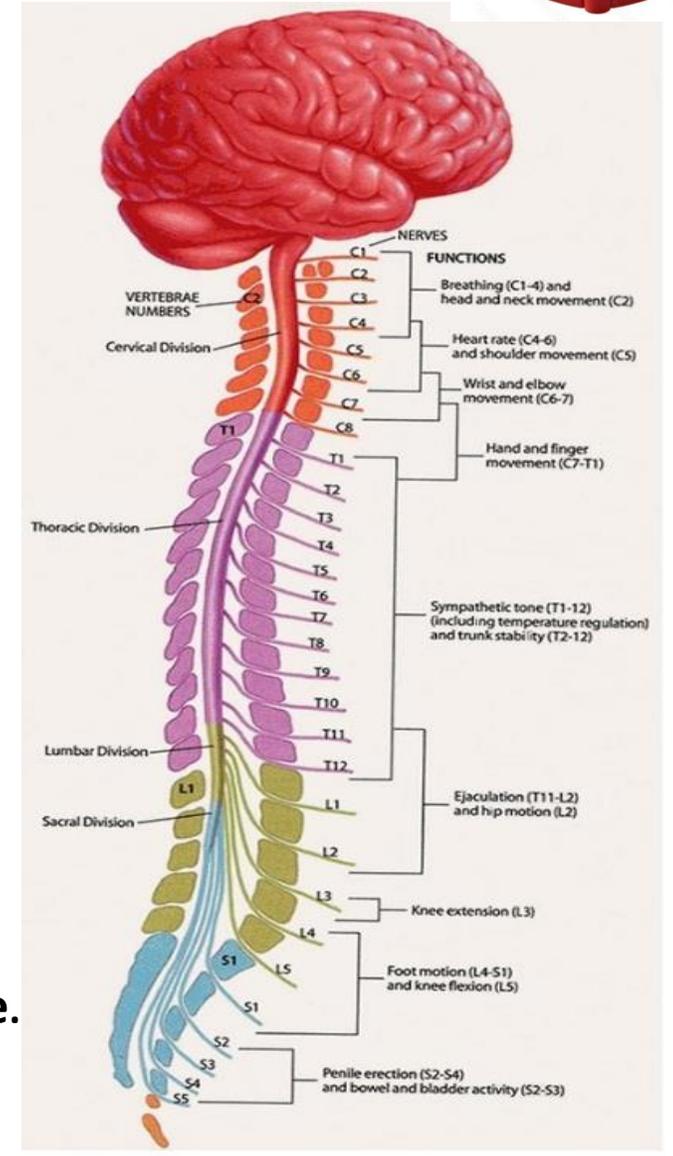
- The cord segments can be identified in the cervical and thoracic regions as follows: **In the cervical region**; add one to the vertebral number to obtain the segmental level (e.g. spine of 5th C.V. lies opposite the 6th cervical segment of the cord).
- **In the upper half of thoracic region**; add 2 to the vertebral number (e.g. 4<sup>th</sup> thoracic spine lies opposite the 6<sup>th</sup> thoracic segment).
- **In the lower half of thoracic region**; add 3 to the vertebral number (e.g. 9<sup>th</sup> thoracic spine lies opposite the 12<sup>th</sup> thoracic segment).
- **Lumbar segments** extend between T9 and T12 vertebrae
- The **sacral, coccygeal segments** are packed at the level of the 1<sup>st</sup> lumbar vertebra



# Spinal nerves :



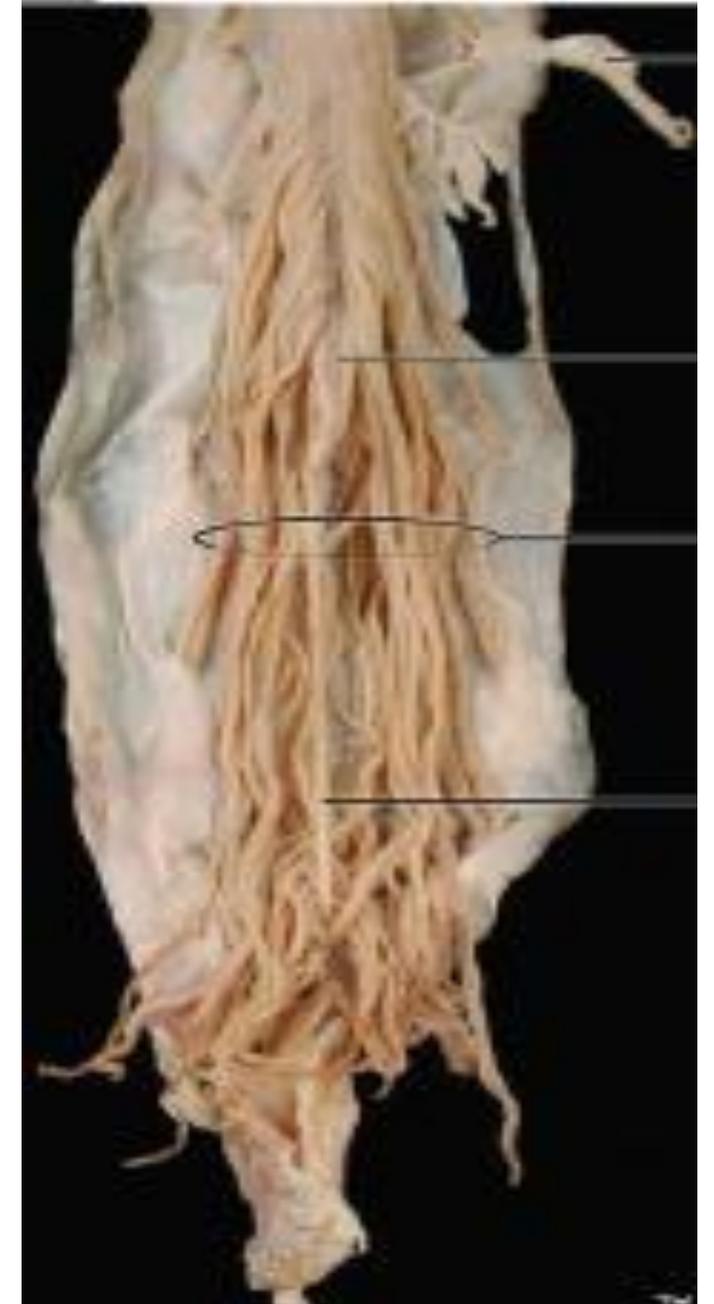
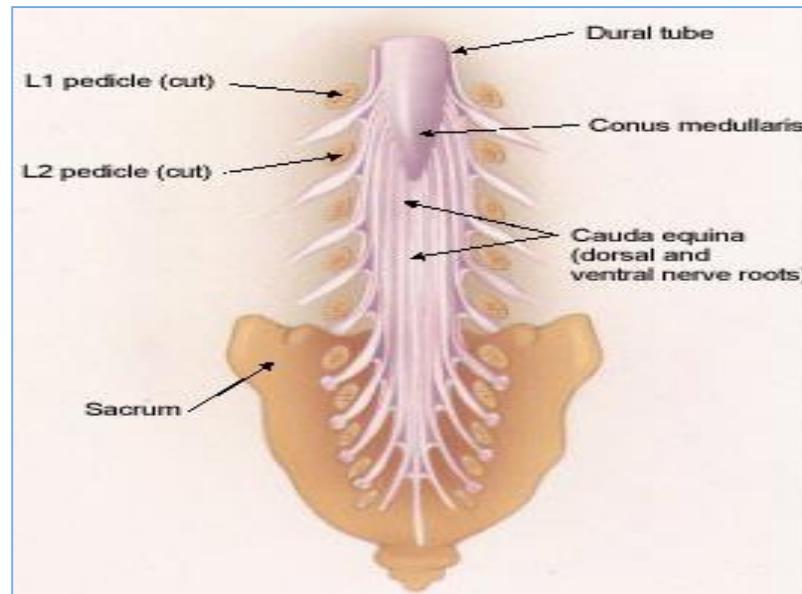
- They are 31 pairs emerge from the corresponding spinal cord segments.
- They leave the vertebral canal through the intervertebral foramina except:
- C1 emerges above the posterior arch of the atlas.
- C2 emerges between the arches of atlas and axis vertebrae.
- From S1-S4 emerge through the sacral foramina.
- S5 and the coccygeal nerves emerge through the sacral hiatus.
- \* The cervical nerves from C1-C7 leave the vertebral canal above the corresponding vertebrae.
- \* C8 emerges between the C7 and T1 vertebrae.
- \* The thoracic and lumbar nerves emerge below the corresponding vertebrae.



The lower part of the vertebral canal below the lower end of the cord is filled with the *cauda equina*.

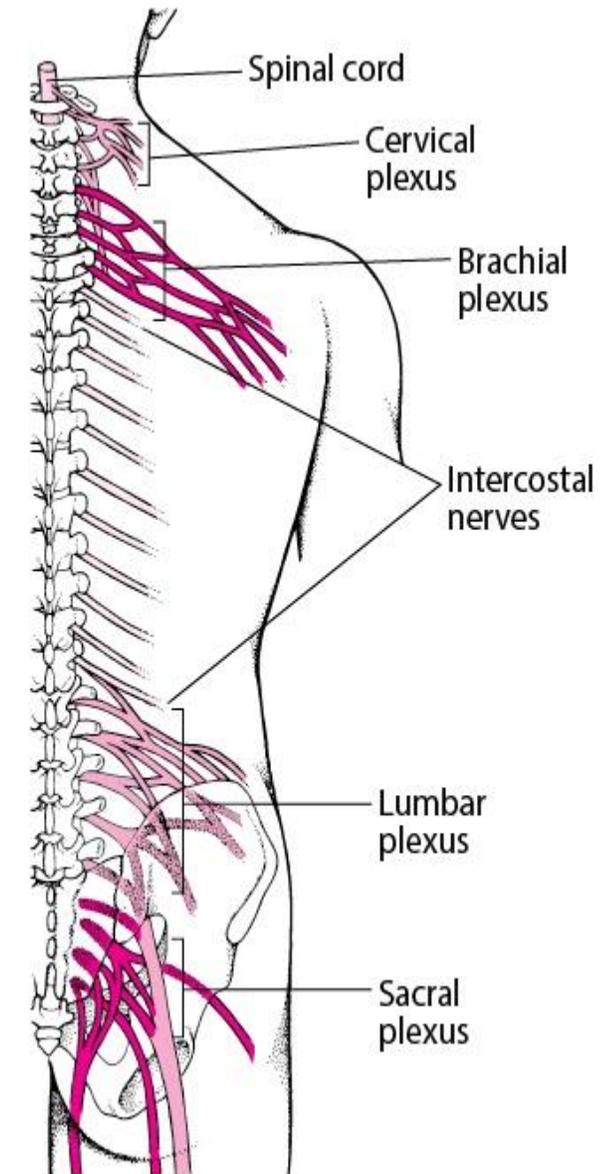
### Constituents of cauda equina:

- 1) Roots of lumbar, sacral and coccygeal nerves .
- 2) Filum terminale.
- 3) Terminal part of the anterior spinal artery and radicular arteries.



# Organization of spinal nerves and plexuses

- **Cervical plexus**
- The ventral rami of the upper 4 cervical nerves
- Gives cutaneous branches to the neck, phrenic nerve to the diaphragm and muscular branches to some muscles of neck and back.
- **Brachial plexus**
- The ventral rami of the lower 4 cervical (C 5, 6, 7 & 8 ) and 1<sup>st</sup> thoracic nerve (Th.1)
- Supply the muscles and joints of the upper limb.
- **lumbar plexus**
- The ventral rami of upper 4 lumbar nerves
- Supplies the lower part of anterior abdominal wall, the groin and forms one of the main nervous pathways supplying the lower limb.
- **Sacral plexus**
- The ventral rami of the 4<sup>th</sup> and 5<sup>th</sup> lumbar nerves and the ventral rami of the upper 4 sacral nerves.
- Supply the lower limb, pelvic muscles, pelvic viscera and perineum.

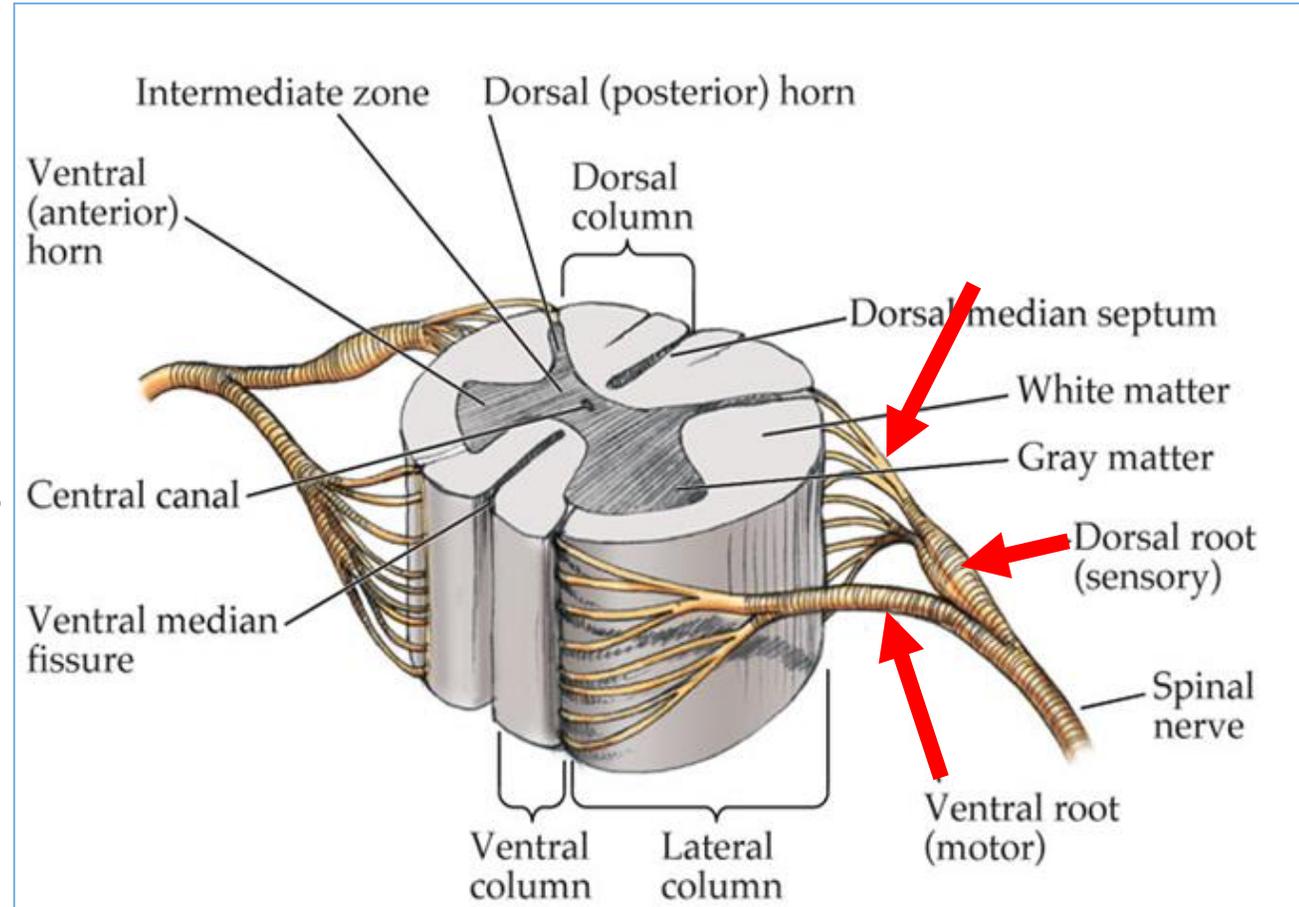


## Sulci of spinal cord

- **1) Anterior median fissure;** related to the anterior spinal artery.
- **2) Posterior median sulcus;** continuous with the dorsal median septum.
- **3) Two anterolateral sulci;** from which motor rootlets of the spinal nerves emerge.
- **4) Two posterolateral sulci;** into which sensory rootlets of the spinal nerves enter

## Structure of spinal nerve

- **Each spinal nerve is formed of:**
  - Ventral motor root**
  - Dorsal sensory root that contains a dilatation called dorsal root ganglia**



# Fixation of the spinal cord:

- The spinal cord is supported and fixed by:

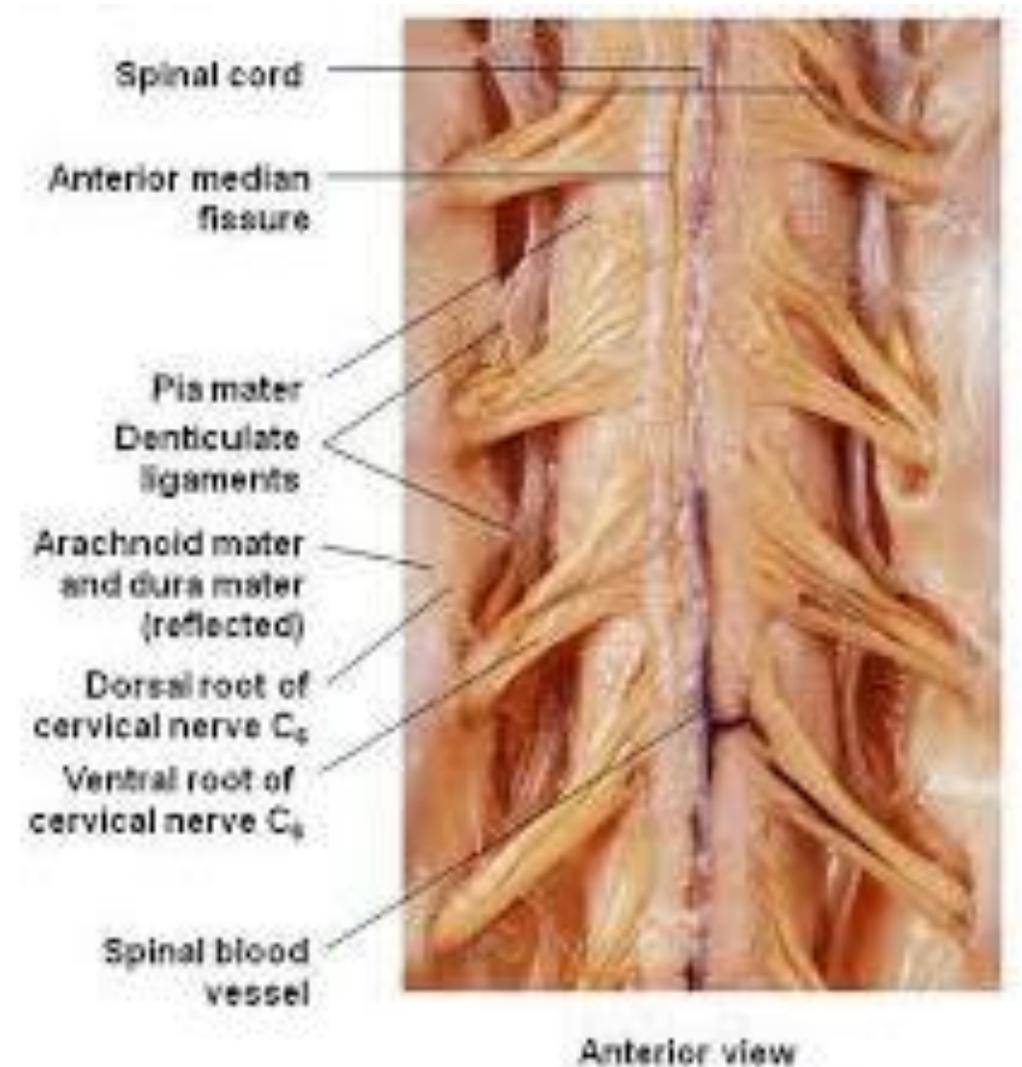
## 1)Denticulate ligament

The pia mater gives 42 ligaments (21 on each side). They project from the side of the pia mater like teeth , so called **ligamentum denticulata**.

## 2)Filum terminale.

3)Spinal nerve roots which provide the **strongest Fixation** of the cord to the vertebral canal.

4)Fixation of its dura to the foramen magnum.



# Internal structure of the spinal cord:

The adult spinal cord is composed of:

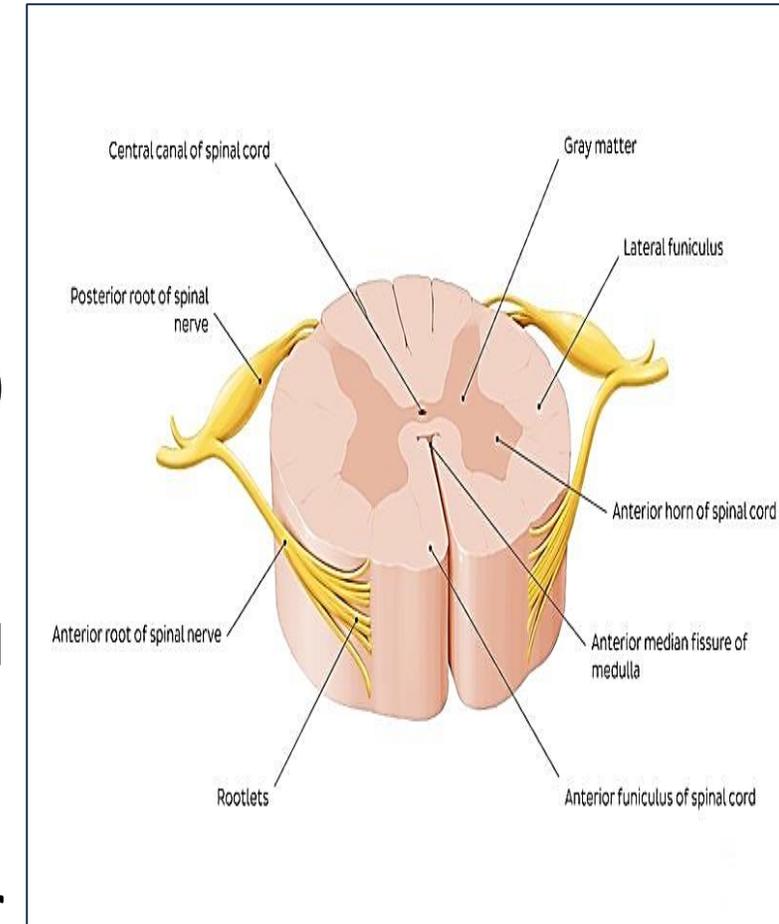
a. Central H- shaped grey matter

b. Peripheral white matter

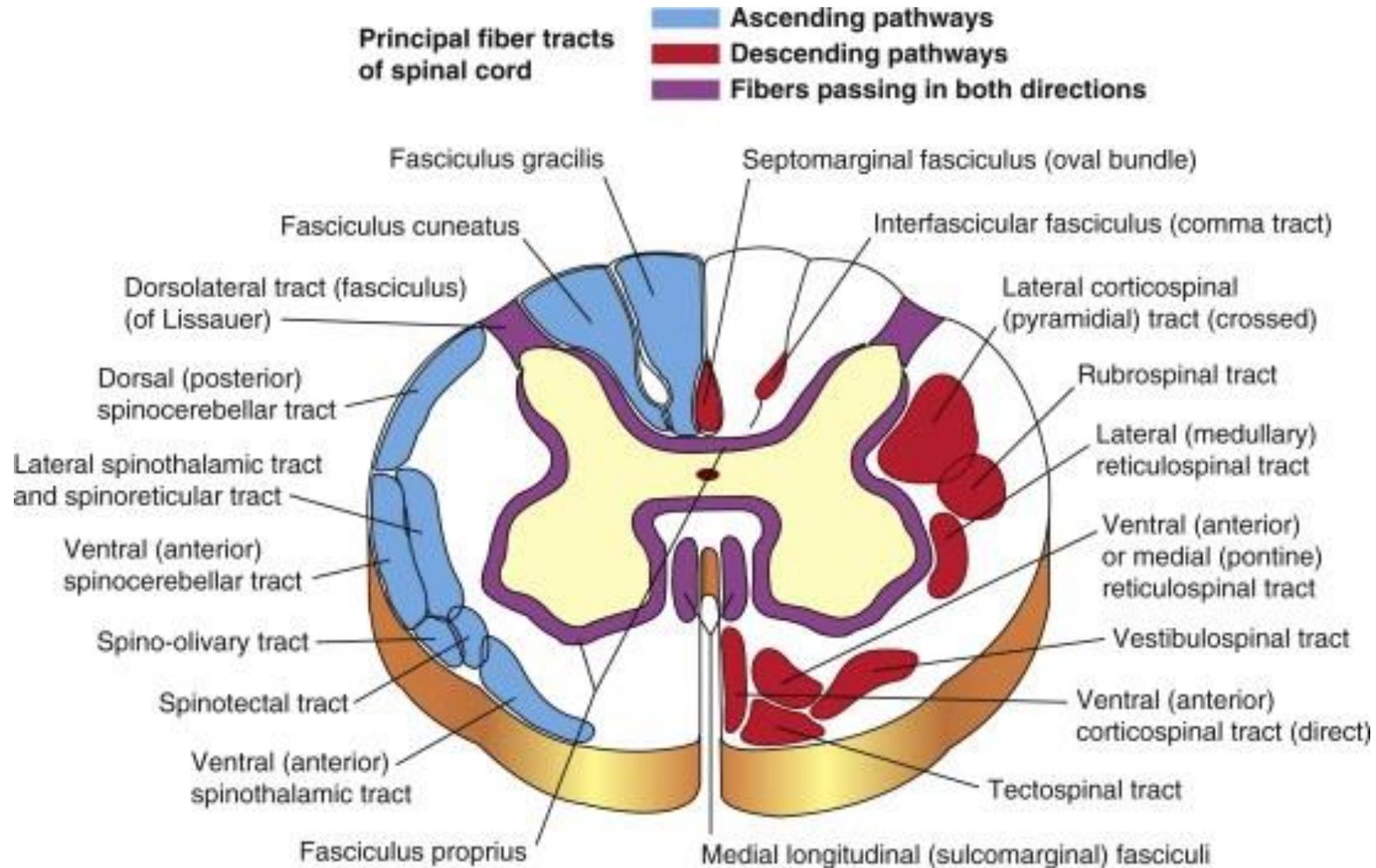
The cord is divided into two halves by the anterior (ventral) median fissure and posterior (dorsal) median septum.

The white matter surrounds the central grey matter and contains Short tracts and Long tracts.

The white matter is divided into two halves. Each half is further subdivided by the dorso-lateral and ventro-lateral sulci into three columns; **Dorsal, lateral and ventral columns.**



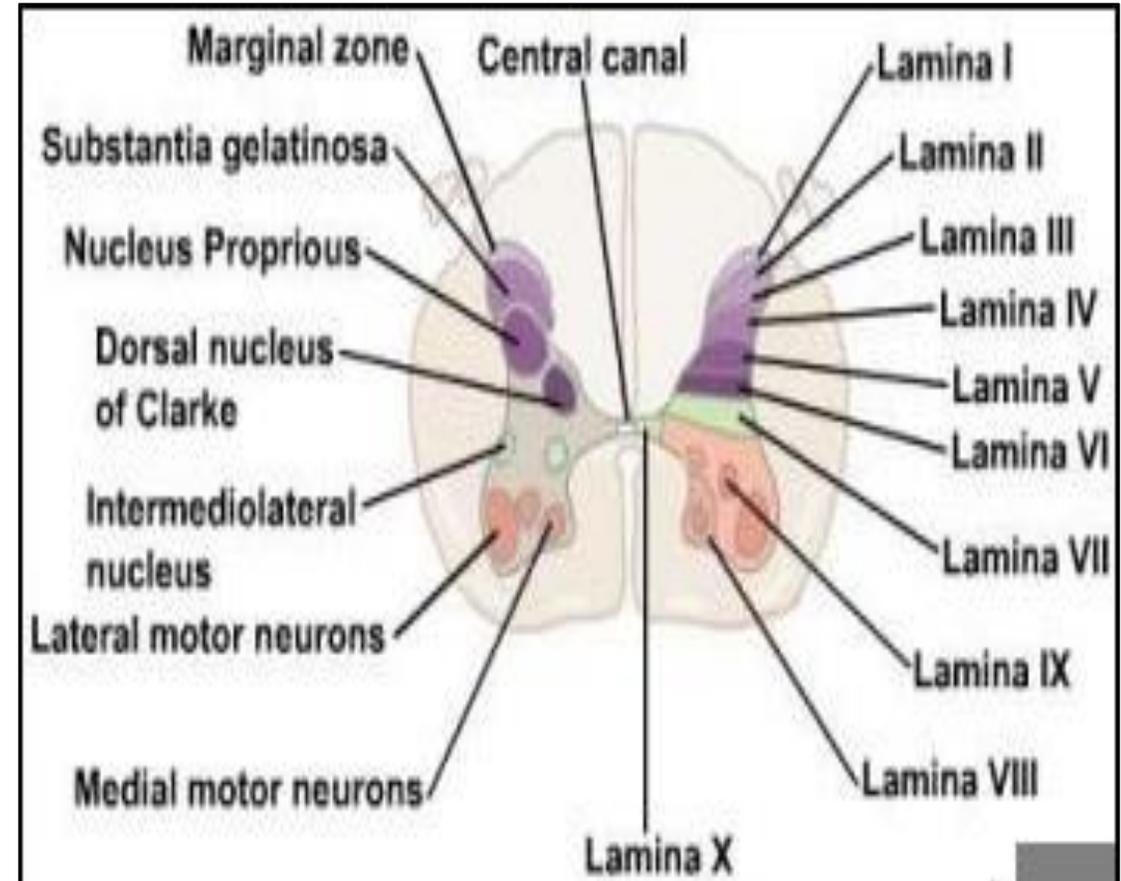
# White matter of spinal cord



(b)

# Grey matter of the spinal cord:

- The grey matter of the spinal cord is central H shaped
- Formed of:
- a. Ventral motor horn
  - b. Dorsal sensory horn
  - c. Central gray commissure with the central canal in its center.
- The cells of grey matter are arranged into definite groups or nuclei.



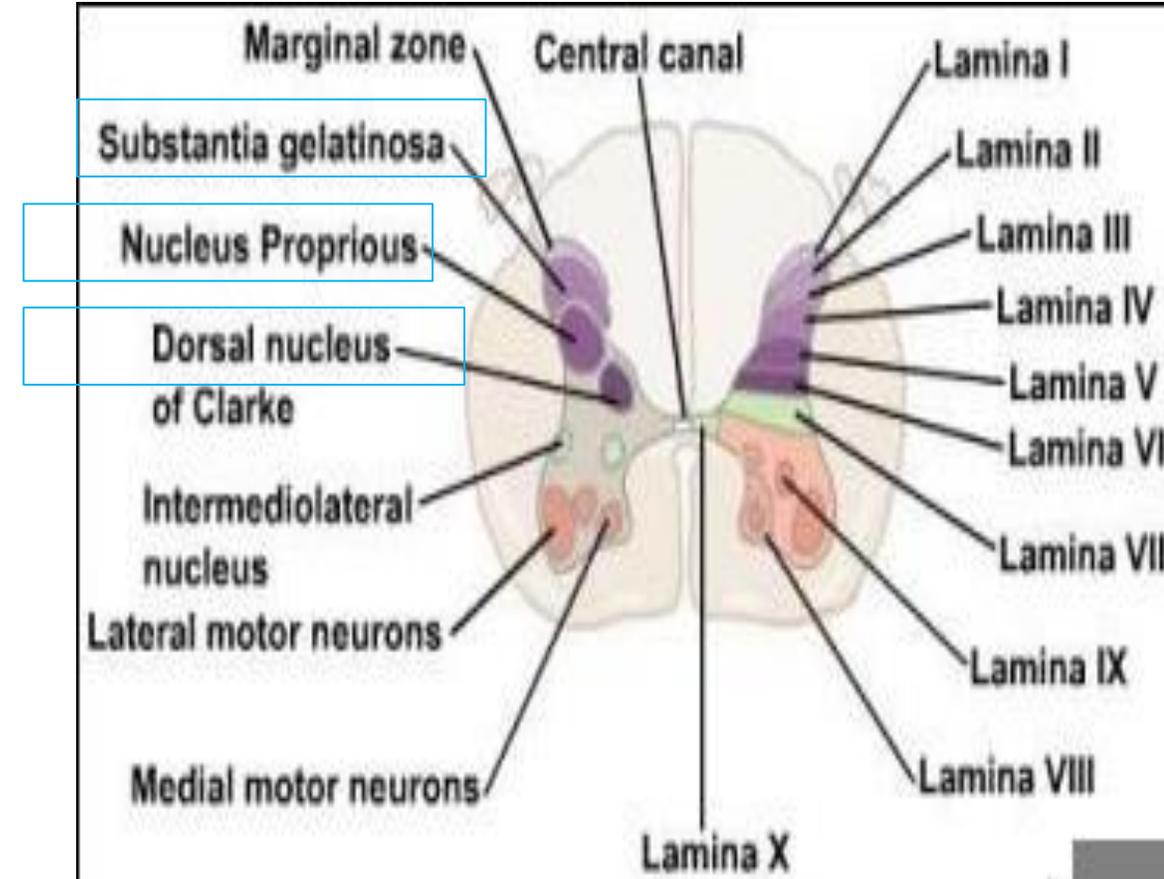
# Important nuclei of posterior horn of the spinal cord:

## ❖ **Substantia gelatinosa of Rolandi:**

in the sensory pathway of pain and temperature from the body below the head to the cerebrum

## ❖ **nucleus proprius:** in the sensory pathway of crude touch from the body below the head to the cerebrum:

## ❖ **Dorsal nucleus of Clarke:** in the Pathways of unconscious proprioception from the body to the cerebellum:



## REFERENCES

Snell's Clinical Neuroanatomy:

Snell, R. S. (2010). *Clinical neuroanatomy*. Lippincott Williams & Wilkins.

**Gray's Anatomy For Students:**

**Veeramani, R., & Holla, S. J. (Eds.). (2019). *Gray's Anatomy For Students: Second South Asia Edition E-Book*. Elsevier Health Sciences.**

THANK

YOU!

