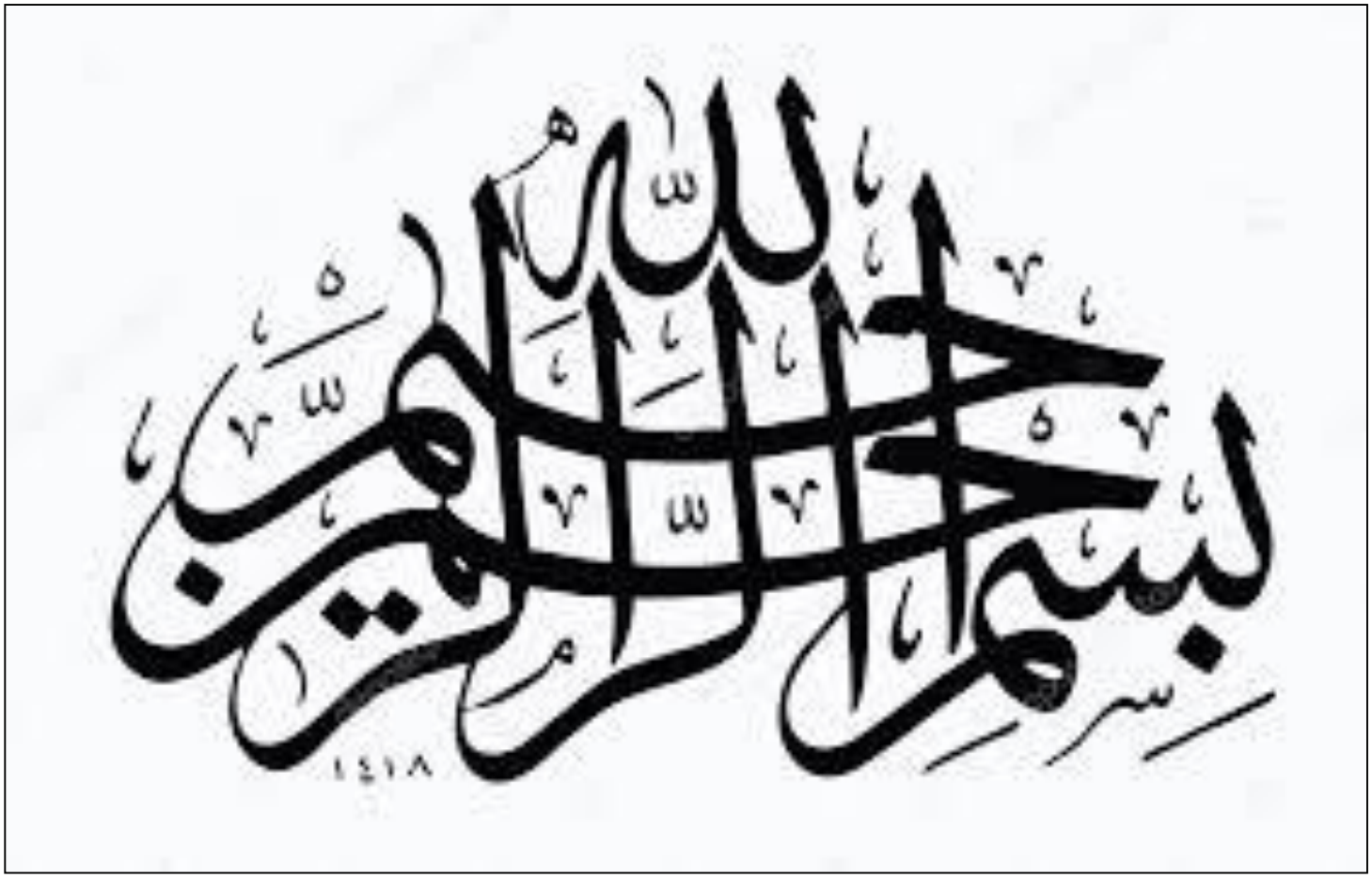

بسم الله الرحمن الرحيم
١٤١٨

The only person you should try to be better than...

is the person you were yesterday.

QUOTEDIARY.ME

SPINAL CORD

PHYSIOLOGICAL ANATOMY

LECTURE 1

LEARNING OBJECTIVES

Describe the spinal cord regions.

Discuss the spinal meninges.

Discuss the spinal spaces.

Outline the organization of Gray and White matter.

Describe the functions of the spinal cord.

What is spinal cord?

The **spinal cord** is a long, tubular bundle of nervous tissue and support cells that extends from the brain (the medulla oblongata specifically).

The brain and spinal cord together make up the **central nervous system.**

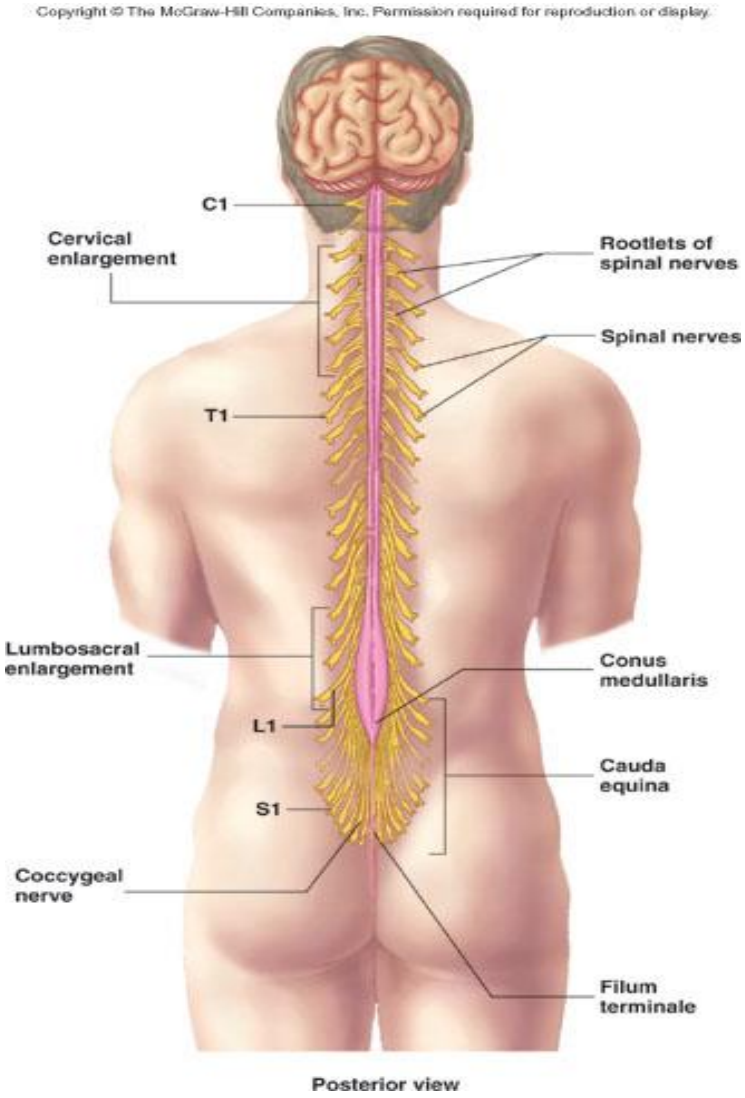
DIMENSIONS OF SPINAL CORD

Extends from **foramen magnum** to space between the **first** and **second lumbar vertebrae**

It is around **45 cm (18 in) in men** and around **43 cm (17 in) long in women**

varying width, ranging from **1/2 inch** thick in the **cervica**l and **lumbar** regions to **1/4 inch thick in the thoracic** area

SPINAL CORD

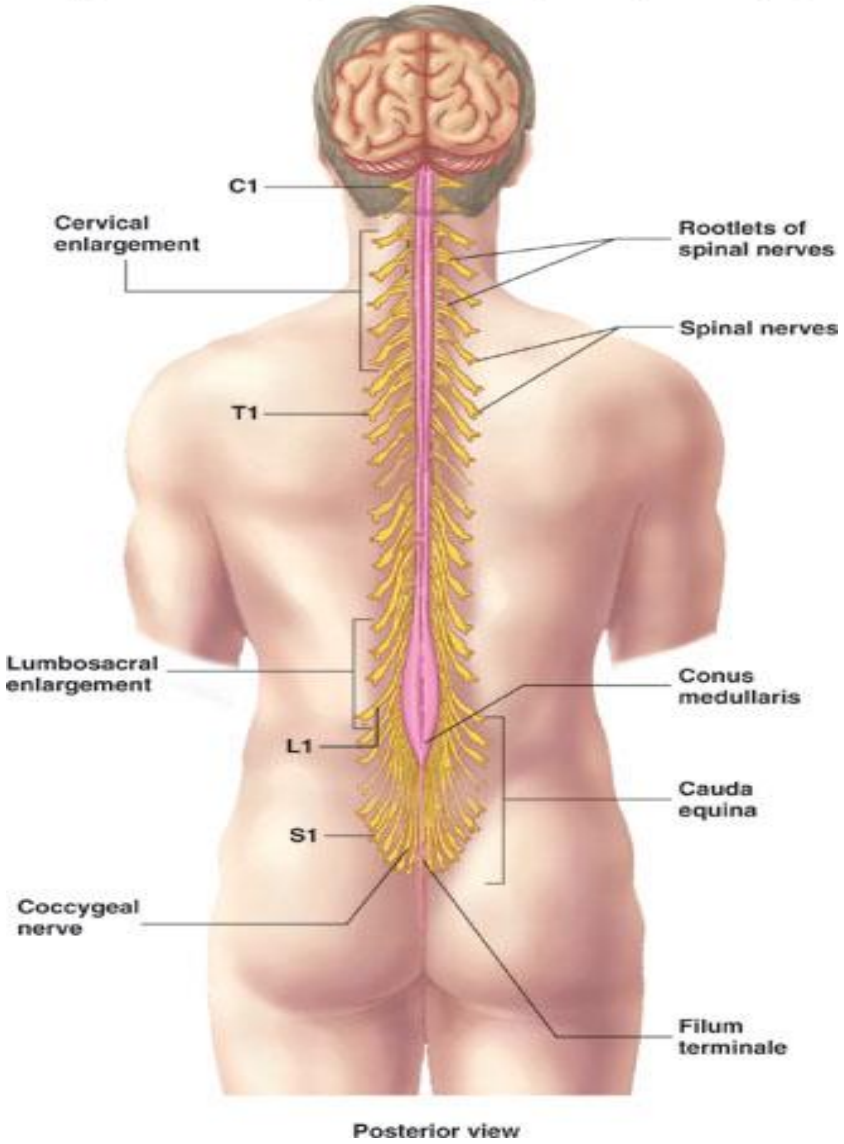


- Runs through the vertebral canal

- Regions

  - **Cervical**
  - **Thoracic**
  - **Lumbar**
  - **Sacral**
  - **Coccygeal**

SPINAL CORD



Posterior view

31 pairs of spinal nerves

All are **Mixed Nerves**

Not uniform in diameter

Cervical enlargement supplies upper limbs

Lumbar enlargement supplies lower limbs

Conus medullaris- tapered inferior end

Ends between L1 and L2

Cauda equina - origin of spinal nerves extending inferiorly from conus medullaris

SPINAL CORD….

- **Nerves** exit directly from the spinal cord in upper vertebral column
- **Nerves** from the lower vertebral column pass further down the column before exiting

- Terminal portion of the spinal cord is called the **Conus Medullaris**
- **Pia mater** continues as an extension called the **Filum Terminale that** anchors cord to Coccyx.

CAUDA EQUINA

It forms → spinal cord stops growing in length at about **age four**

even though the **vertebral column continues to lengthen until adulthood** →

→ **sacral spinal nerves actually originate in upper lumbar region**

Spinal Meninges

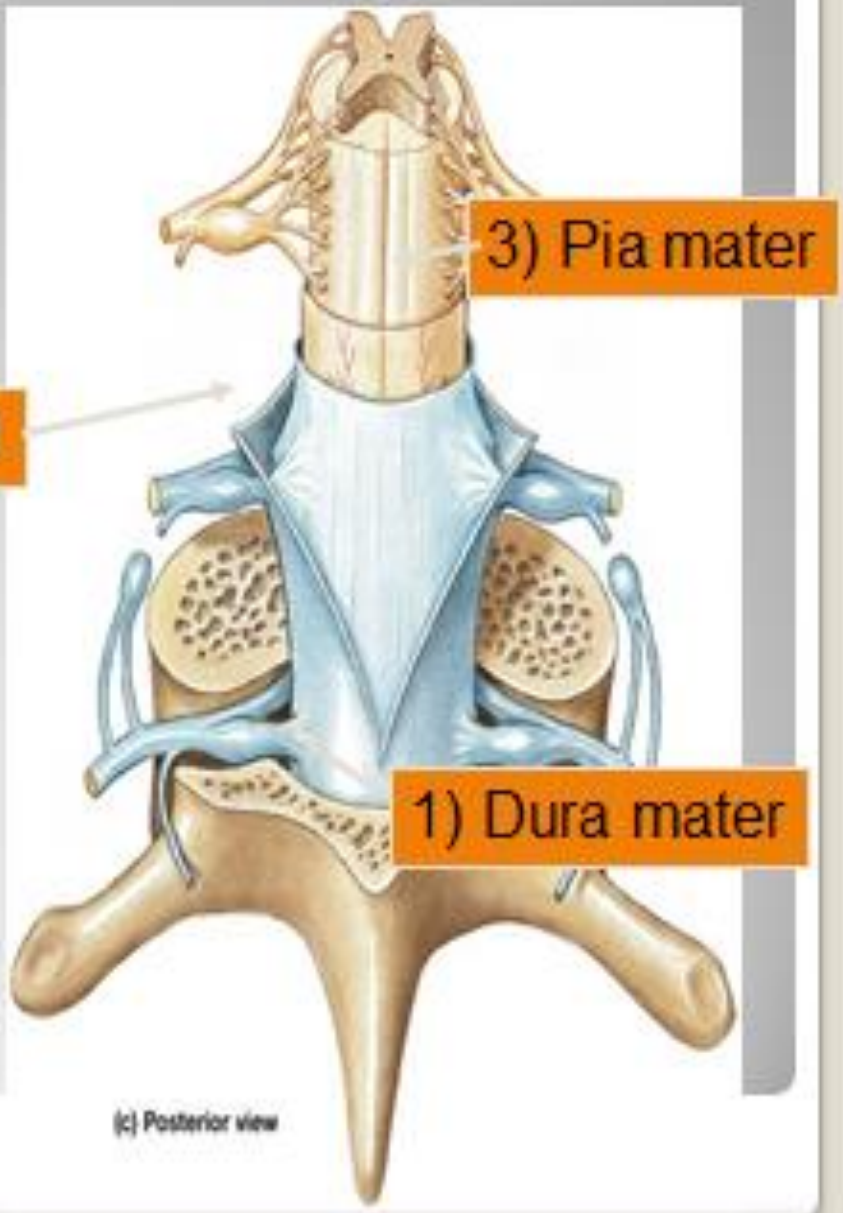
Three membranes surround all of CNS

1) Dura mater - "tough mother", strong

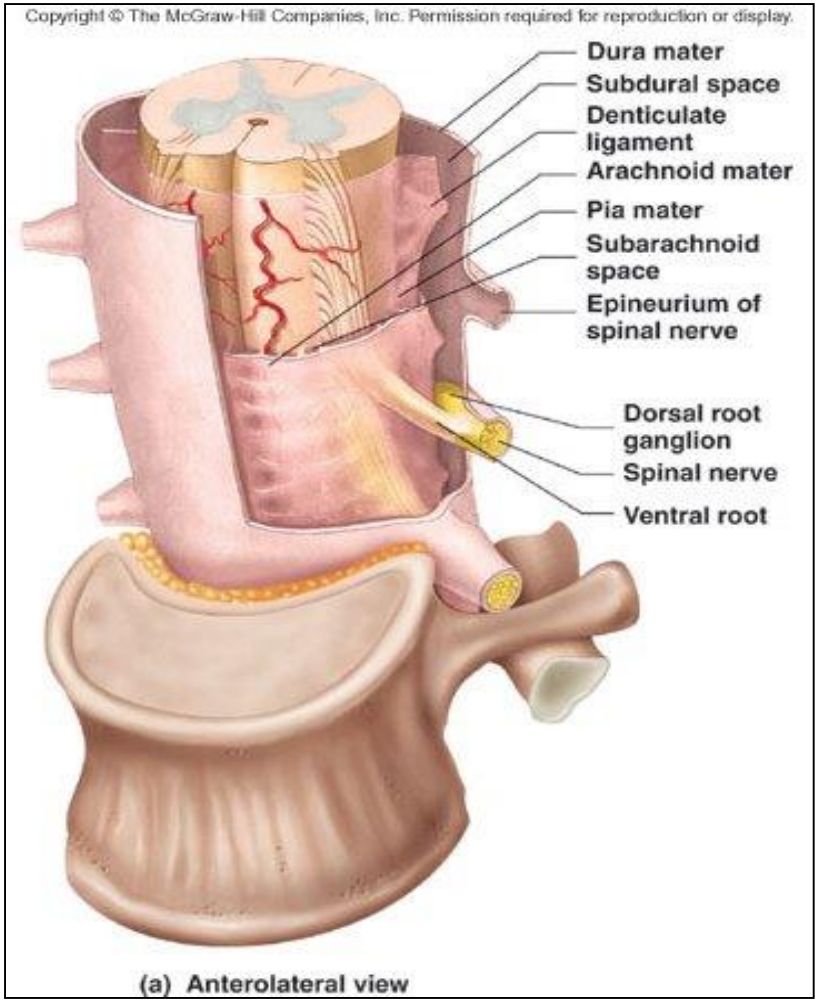
2) Arachnoid - spidery looking, carries blood vessels, etc.

Subarachnoid space

3) Pia mater - "delicate mother", adheres tightly to surface of spinal cord



MENINGES



Connective tissue membranes

Dura mater outermost layer continuous with epineurium of spinal nerves

Arachnoid mater thin and delicate

Pia mater bound tightly to the surface

Forms **Filum Terminale**

- Anchors spinal cord to coccyx
- Forms denticulate ligaments that attach spinal cord to Arachnoid and Dura mater

SPACES

Epidural

- External to Dura
- Anesthetics injected here
- Fat-fill

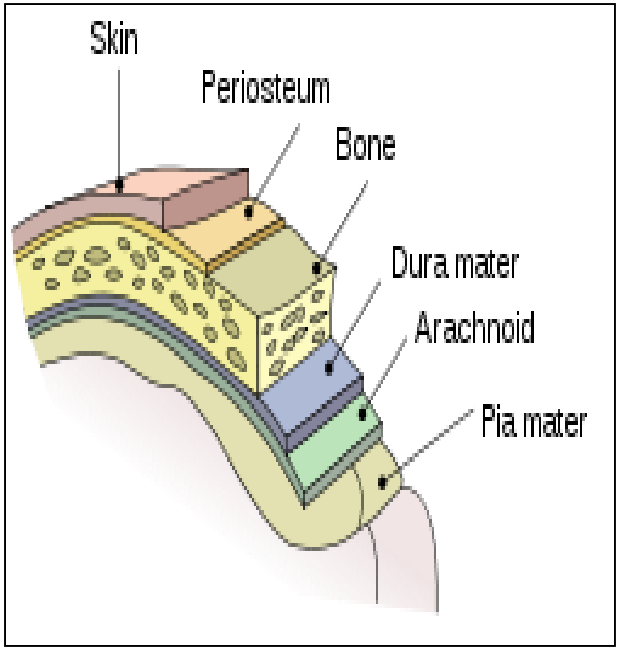
Subdural space

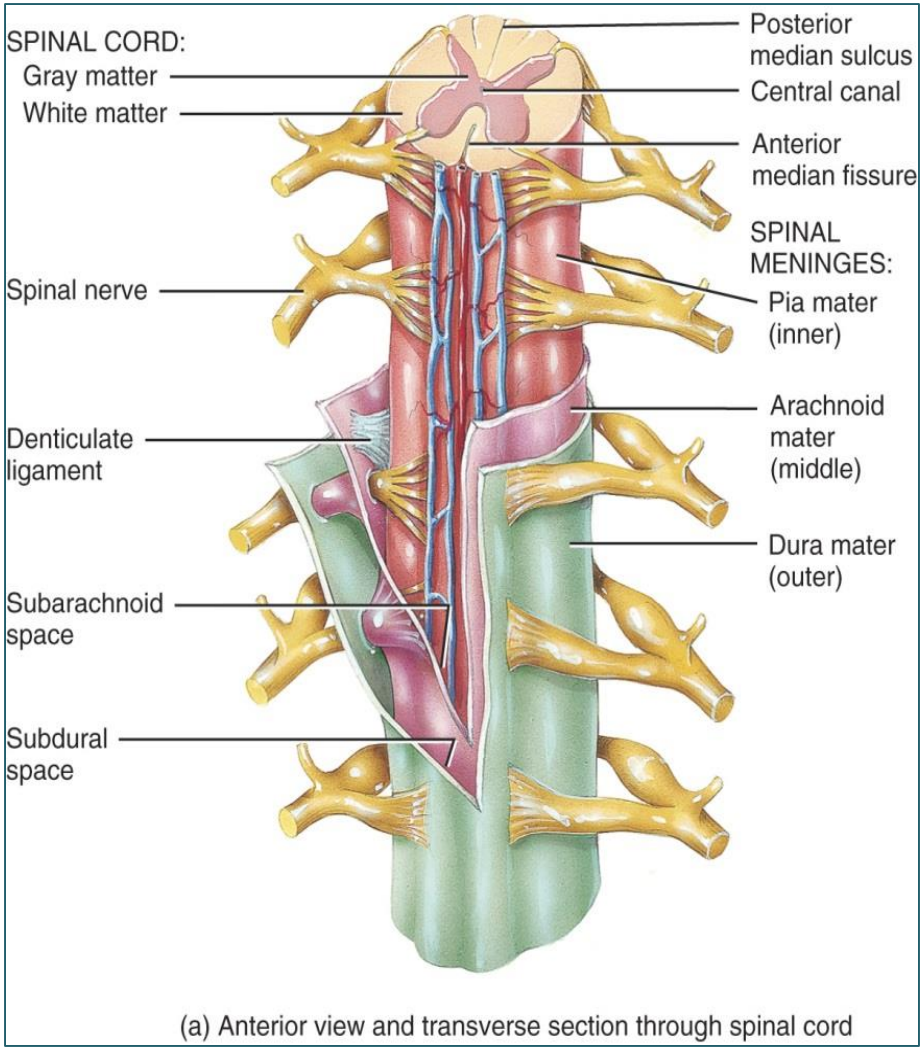
artificial or potential space created by trauma

Subarachnoid

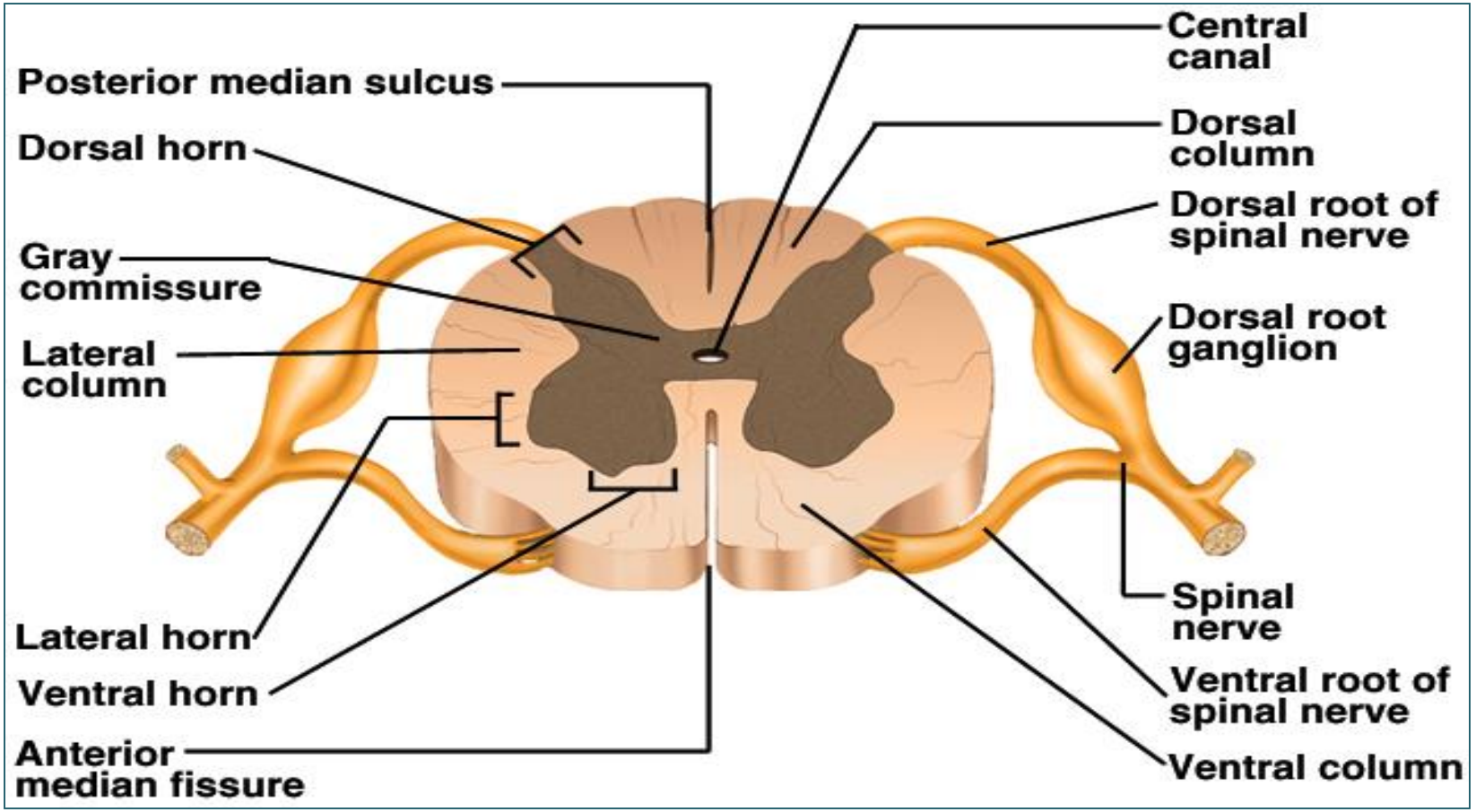
between pia and arachnoid
Filled with CSF

SPINAL CORD IS PROTECTED BY VERTEBRAE, MENINGES AND CSF



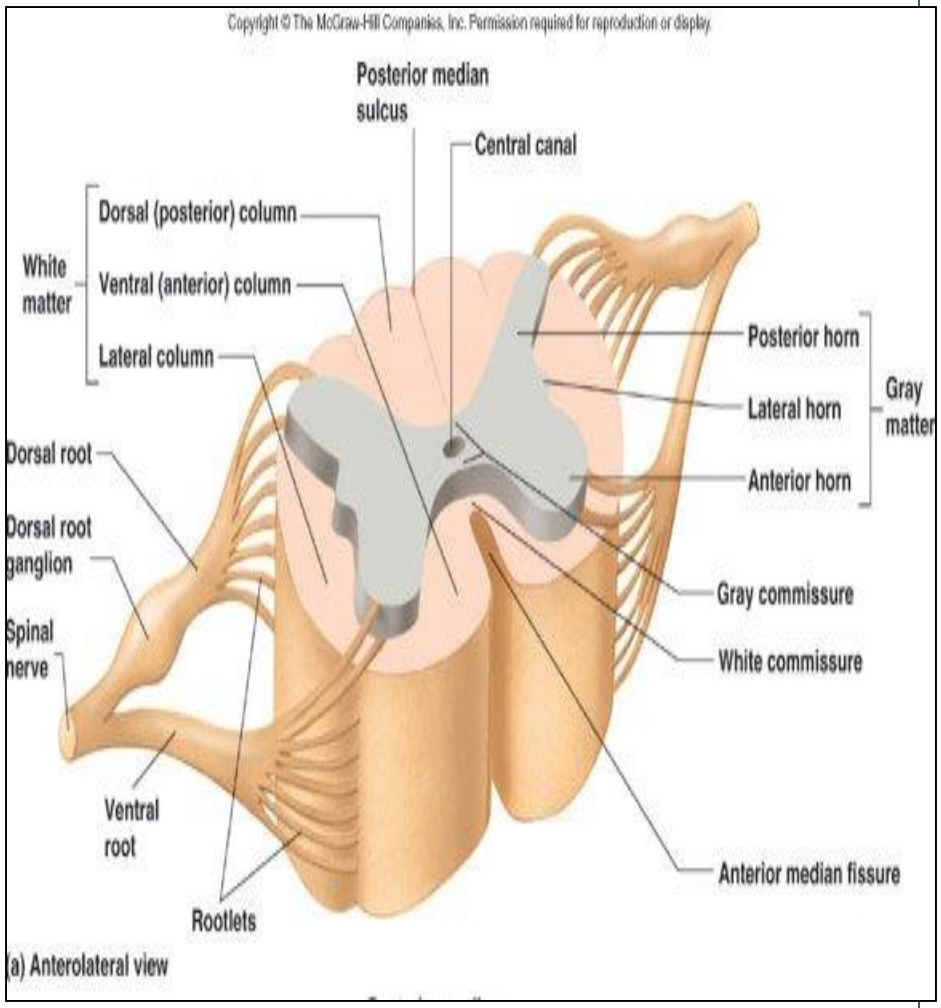


Cross-sectional anatomy of the spinal cord



- Central area of gray matter shaped like a butterfly and surrounded by white matter in 3 columns

CROSS SECTION OF SPINAL CORD



Anterior median fissure and posterior median sulcus

deep clefts partially separating left and right halves

Gray matter neuron cell bodies, dendrites, axons; integrates sensory and motor information

Divided into *horns*

Posterior (dorsal) horn

Anterior (ventral) horn

Lateral horn

White matter

Myelinated axons

three *columns* (funiculi)

Ventral

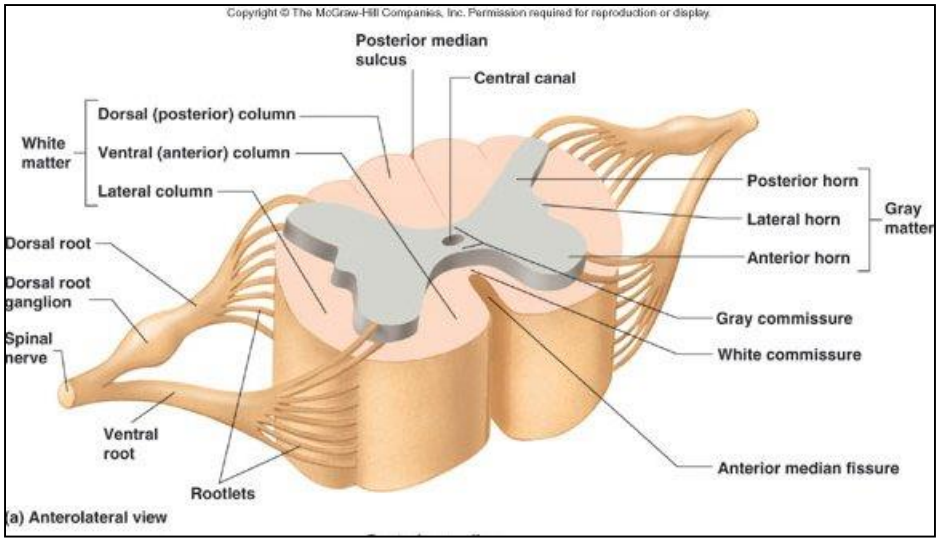
Dorsal

lateral

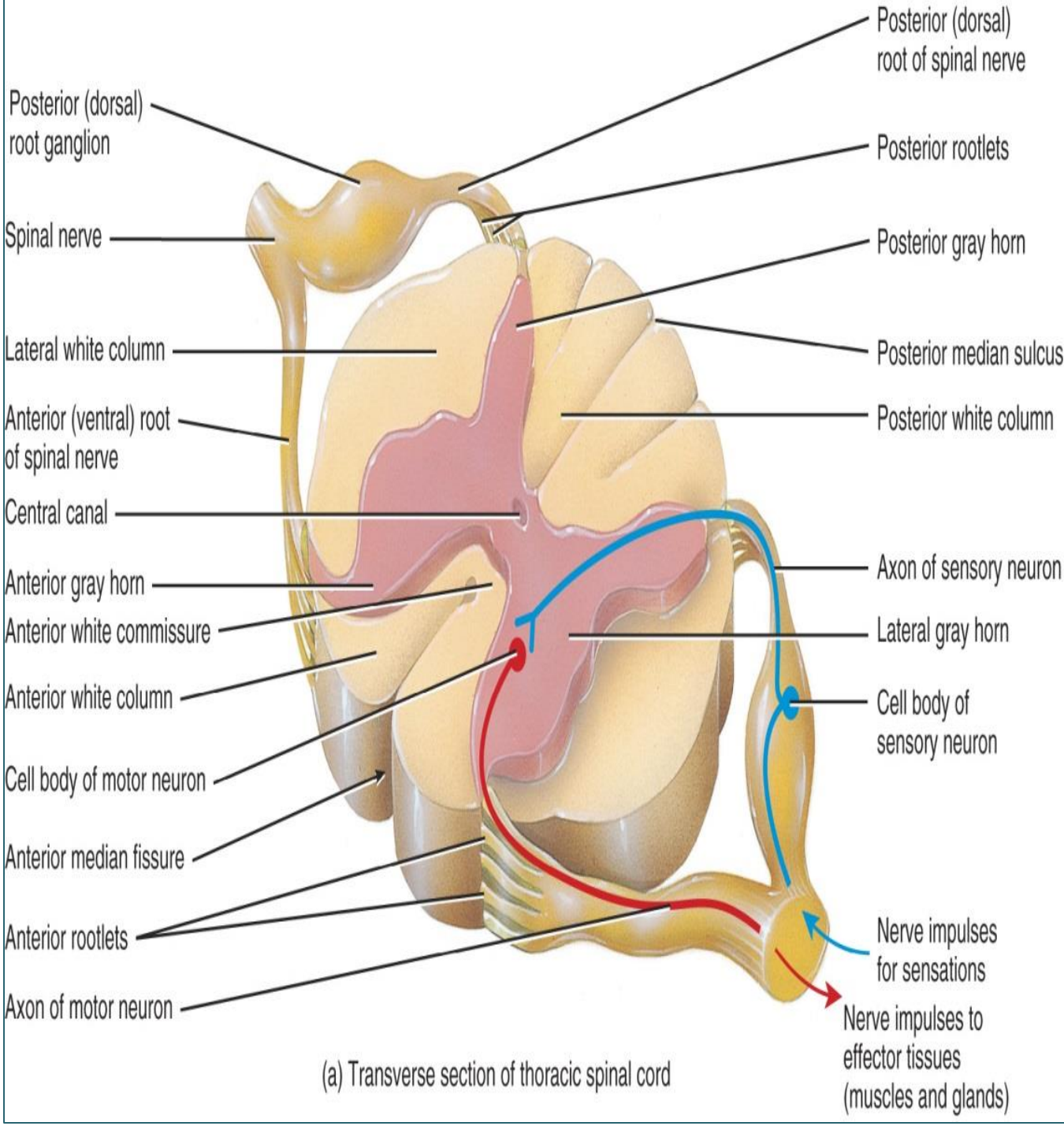
Each of these divided into sensory or motor tracts

Cross Section of Spinal Cord

- **Commissures**: connections between left and right halves
- **Gray matter** with central canal in the center
- **White matter** on outside
- **Roots**
  - Spinal nerves arise as rootlets then combine to form dorsal and ventral roots
  - Dorsal and ventral roots merge laterally and form the spinal nerve



- Roots connect spinal nerves to spinal cord
- Dorsal root- sensory neurons
- Ventral root- motor neurons



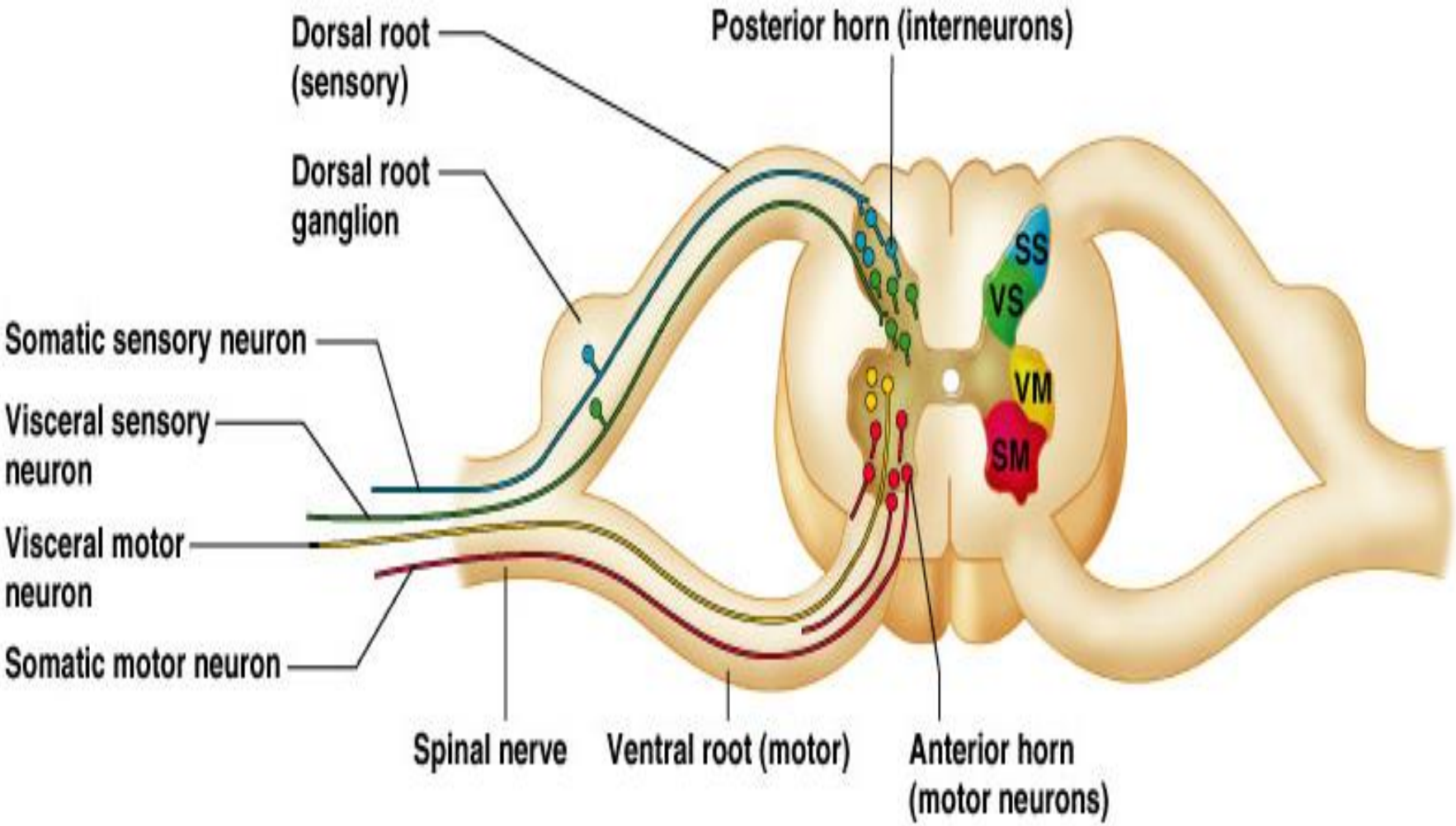

Dorsal root (sensory)
Dorsal root ganglion
Somatic sensory neuron
Visceral sensory neuron
Visceral motor neuron
Somatic motor neuron
Posterior horn (interneurons)
SS
VS
VM
SM
Spinal nerve
Ventral root (motor)
Anterior horn (motor neurons)

Figure 12.31

ORGANIZATION OF SPINAL CORD GRAY MATTER

Based on the type of neurons/cell bodies located in each horn, it is specialized further into 4 regions

- **Somatic sensory** (SS) - somatic sensory neurons
- **Visceral sensory** (VS) - visceral sensory neurons
- **Visceral motor** (VM) - visceral motor neurons
- **Somatic motor** (SM) - somatic motor neurons

White Matter in the Spinal Cord

three funiculi (columns) –

posterior, lateral, and anterior

Columns contain 3 different types of fibers

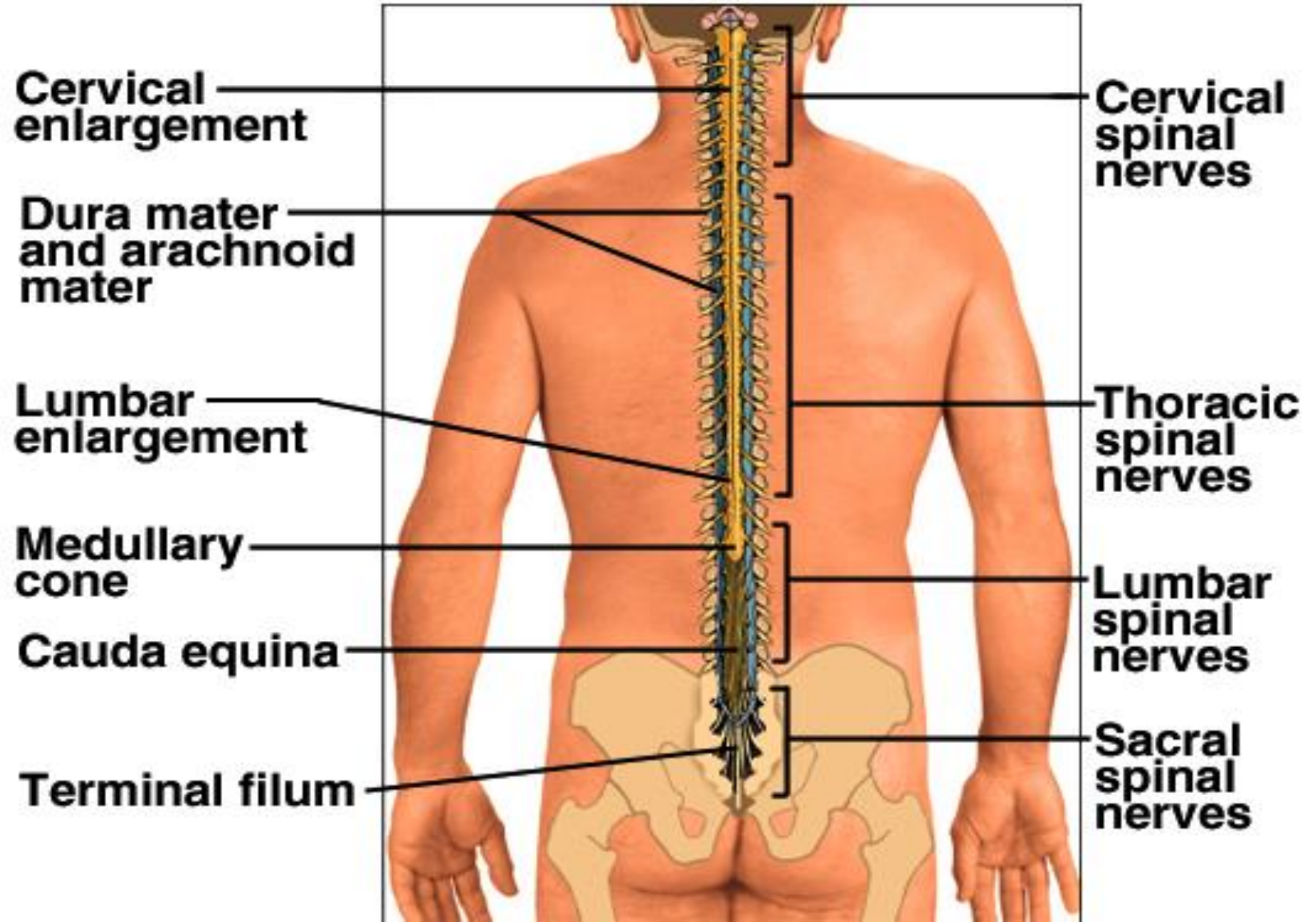
(Ascending, Descending and Transverse)

Fibers run in **three directions**

Ascending fibers - compose the sensory tracts

Descending fibers - compose the motor tracts

Commissural (transverse) fibers - connect opposite sides of cord


Cervical enlargement
Dura mater and arachnoid mater
Lumbar enlargement
Medullary cone
Cauda equina
Terminal filum
Cervical spinal nerves
Thoracic spinal nerves
Lumbar spinal nerves
Sacral spinal nerves

SPINAL SEGMENTS

- **31 segments** based on of 31 pairs of spinal nerves

- Each segment (**except the first cervical** and **coccygeal segments**) receives dorsal and ventral root filaments on each side

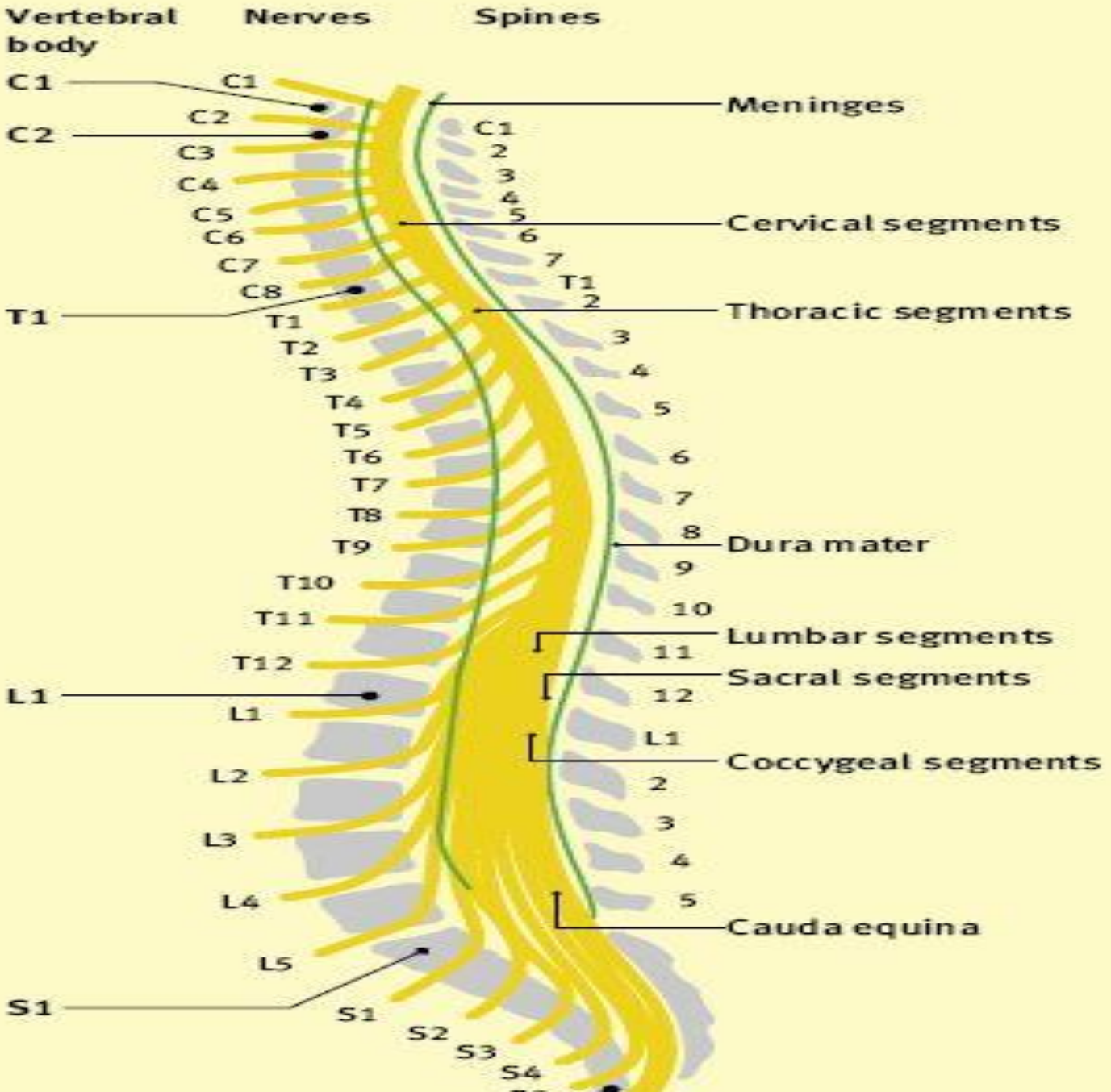
Cervical segments are the largest spinal cord segments

Spinal Segments…

- Spinal nerves emerging from **rostral** levels of thoracic cord provide **motor innervation to back and intercostal muscles** (axial muscles)

- The spinal nerves emerging from **caudal** thoracic levels innervate **abdominal muscles in addition to axial muscles**

sac to vertebral bodies and spines



Spinal Segments…

- **Thoracic segments** are smaller than cervical segments because they contain a smaller amount of gray and white matter
- A **lateral horn**, that contains intermediolateral cell column (IML) is present in all thoracic segments
- The **IML** of thoracic and lumbar spinal cord contains preganglionic sympathetic neurons

Lumbar Segments

circular in transverse sections

- **IML** cell column- at levels **T1 - L2 → entire sympathetic innervation of body**
- L1 and L2 are like those located at lower thoracic levels
- L3 to L5 **do not** contain IML
- provide **motor innervation** to large muscles in lower extremities

Sacral segments

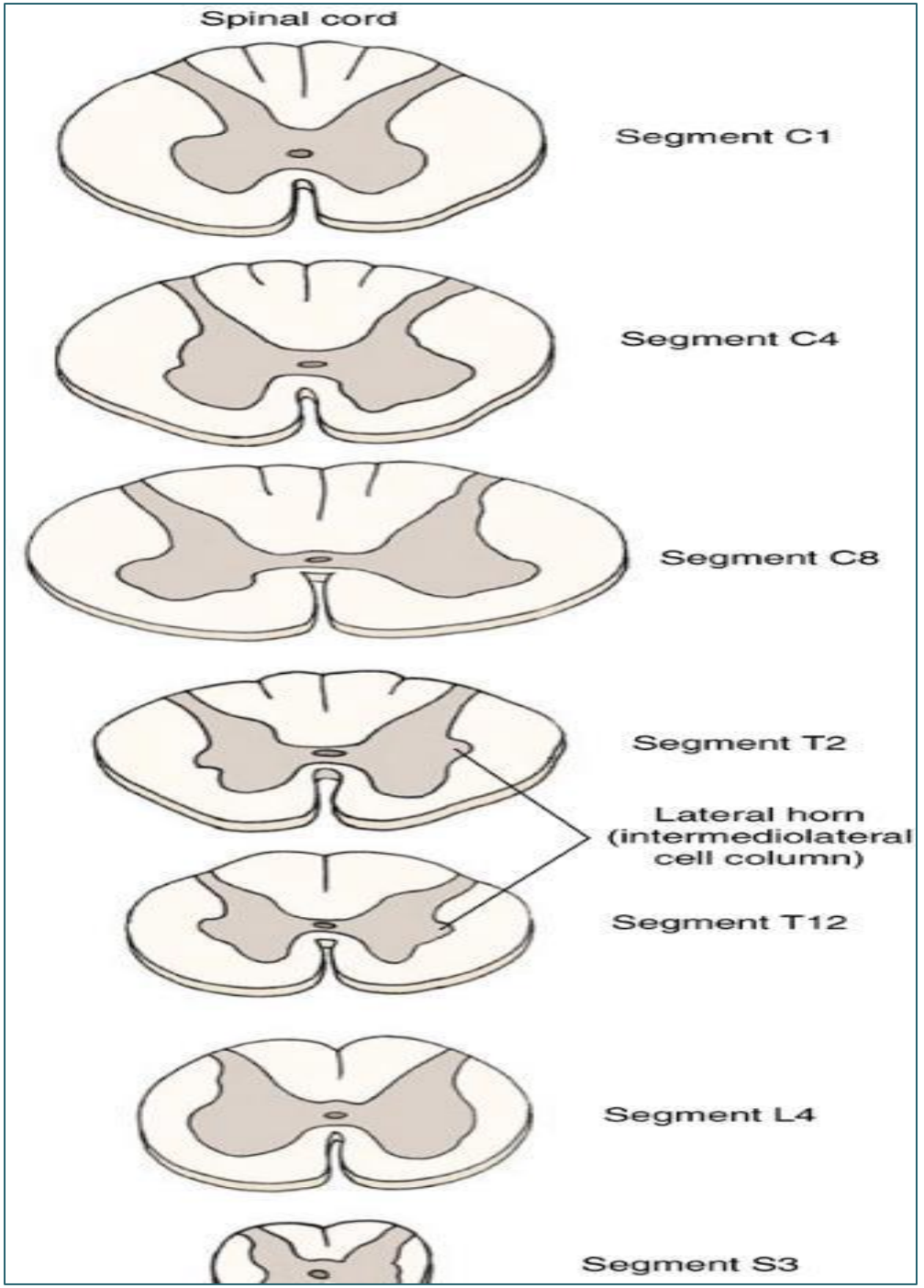
are small, small amounts of white matter and more gray matter

- The **IML** of sacral segments **S2-S4** contains the **parasympathetic preganglionic neurons**

Coccygeal segments resemble the sacral segments

Fig: Spinal cord segments.

Cervical segments are the largest segments.
The thoracic and sacral segments are relatively small.
Note the presence of intermediolateral cell column (IML) in the thoracic and sacral segments.



FUNCTIONS OF THE SPINAL CORD

Conduction

bundles of fibers passing information up & down spinal cord

Locomotion

repetitive, coordinated actions of several muscle groups

central pattern generators are pools of neurons providing control of flexors and extensors (walking)

Reflexes

involuntary, stereotyped responses to stimuli

remove hand from hot stove (withdrawal)


Any
questions
VectorStock


Thank
you