Internal feature of spinal cord

BY

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A/P ANATOMY KGMC

Central and Peripheral Nervous Systems

- Nervous system is divided into two main parts

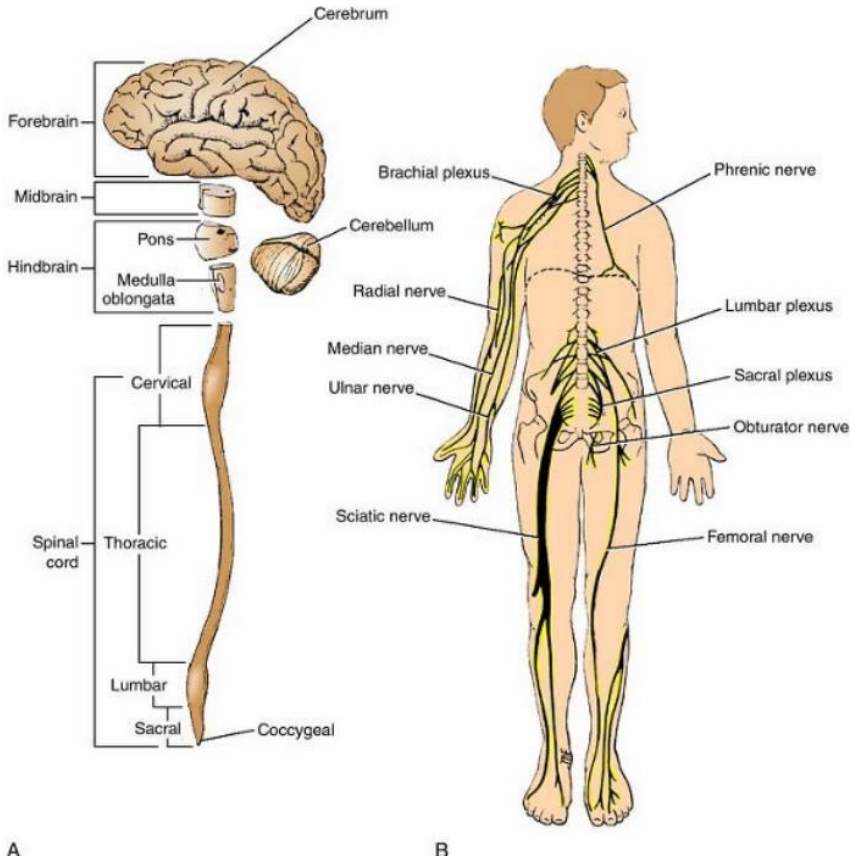
For purposes of description

the central nervous system

- Consists of the brain and spinal cord

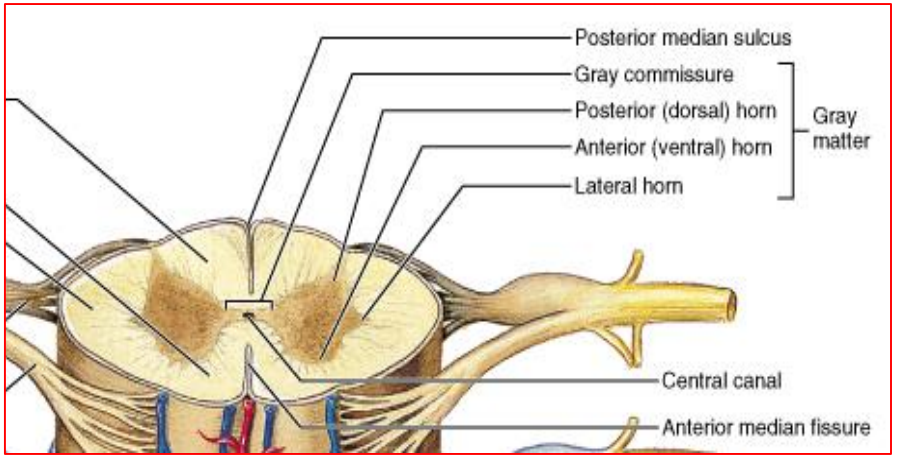
And the peripheral nervous system

- which consists of the cranial and spinal nerves and their associated ganglia.



Central and Peripheral Nervous Systems

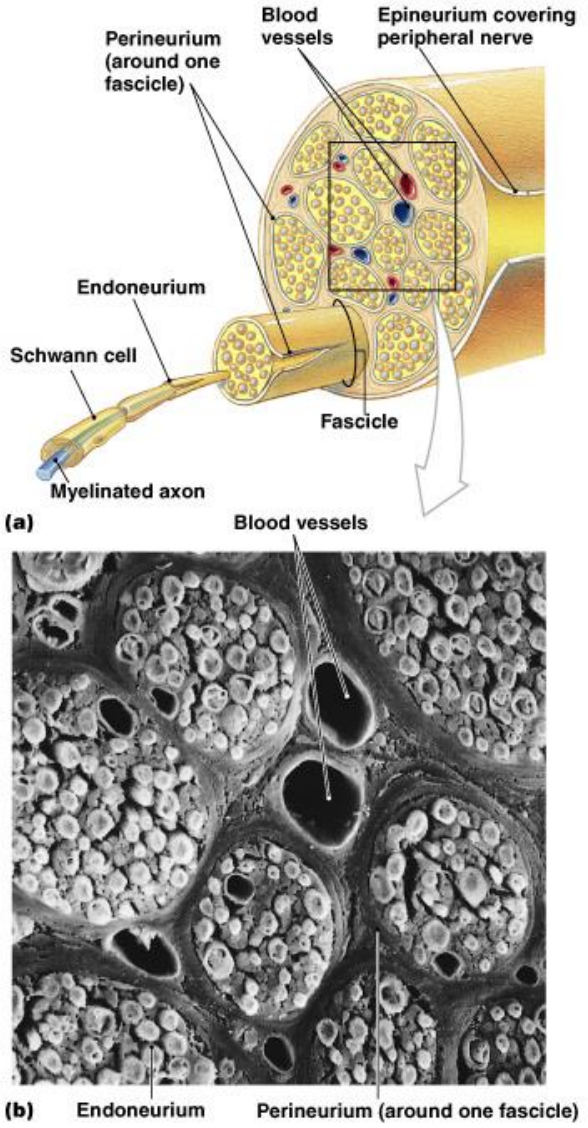
- Interior of the spinal cord is organized into gray and white matter.
- Gray matter consists of nerve cells embedded in neuroglia; it has a gray color.
- White matter consists of nerve fibers embedded in neuroglia
- It has a white color due to the presence of lipid material in the myelin sheaths of many of the nerve fibers.



Central and Peripheral Nervous Systems

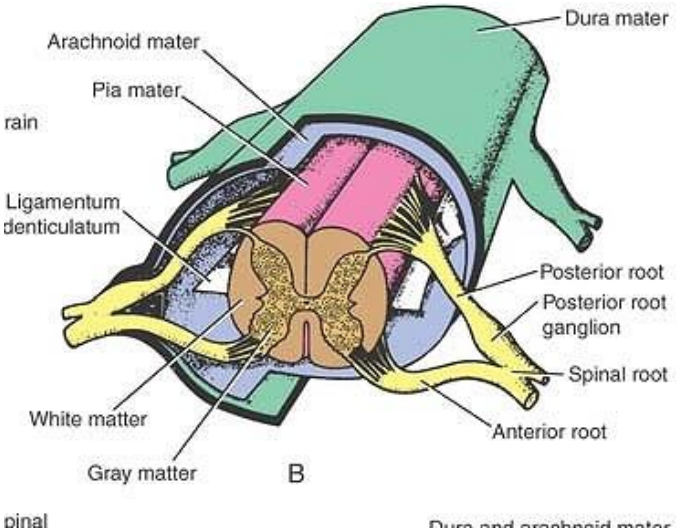
In the peripheral nervous system,

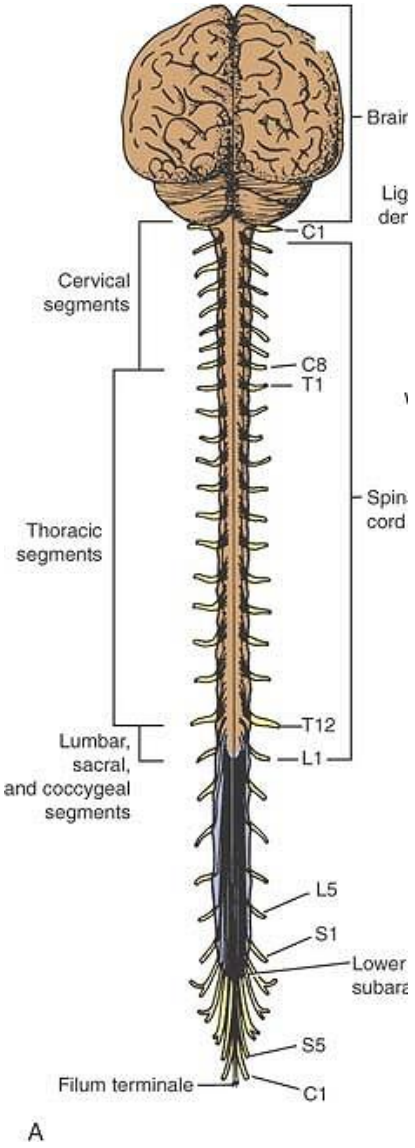
- the cranial and spinal nerves, which consist of bundles of nerve fibers or axons
- Conduct information to and from the central nervous system.
- Although the nerves are surrounded by fibrous sheaths as they run to different parts of the body, they are relatively unprotected and are commonly damaged by trauma.



SPINAL CORD

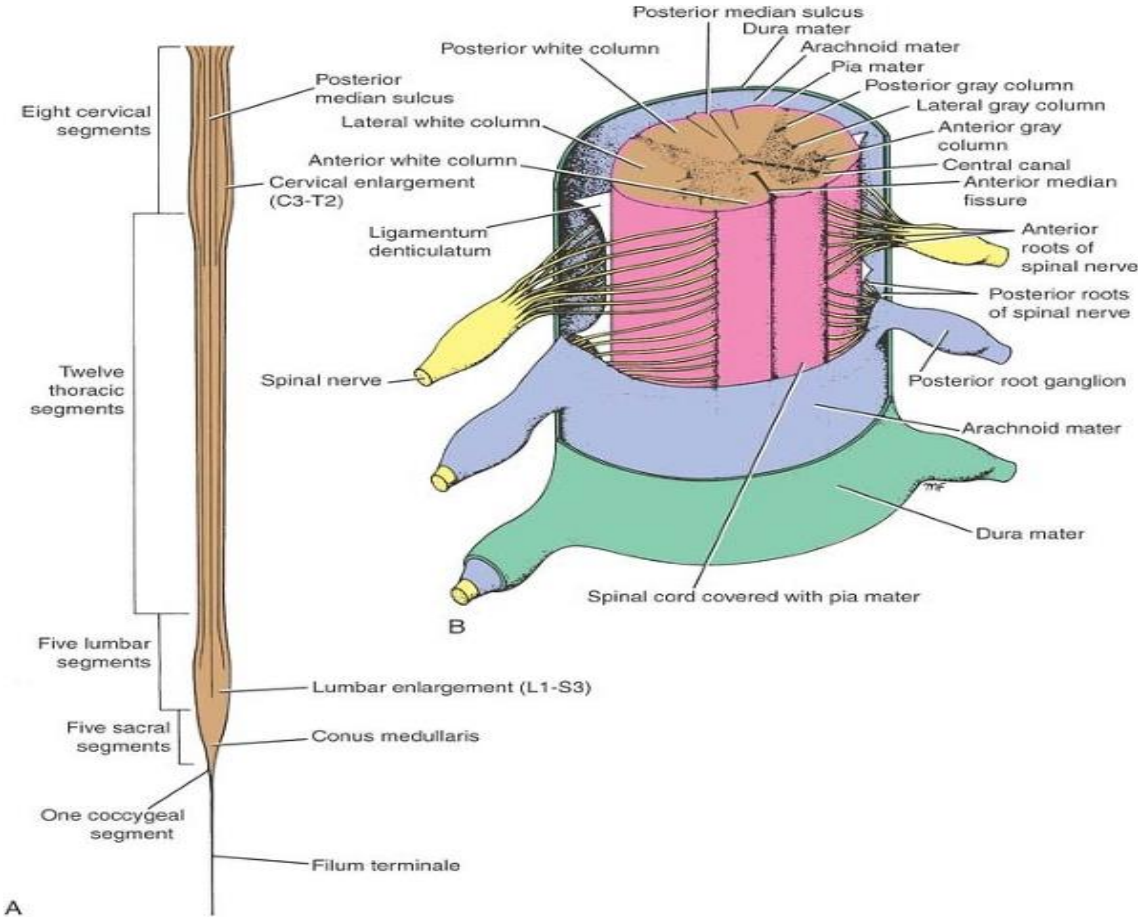
- Spinal cord is situated within the vertebral canal of the vertebral column
- And is surrounded by three meninges
- Dura mater
- Arachnoid mater
- And the pia mater. . Spinal cord is roughly cylindrical
- Begins superiorly at the foramen magnum in the skull
- where it is continuous with the medulla oblongata of the brain





SPINAL CORD

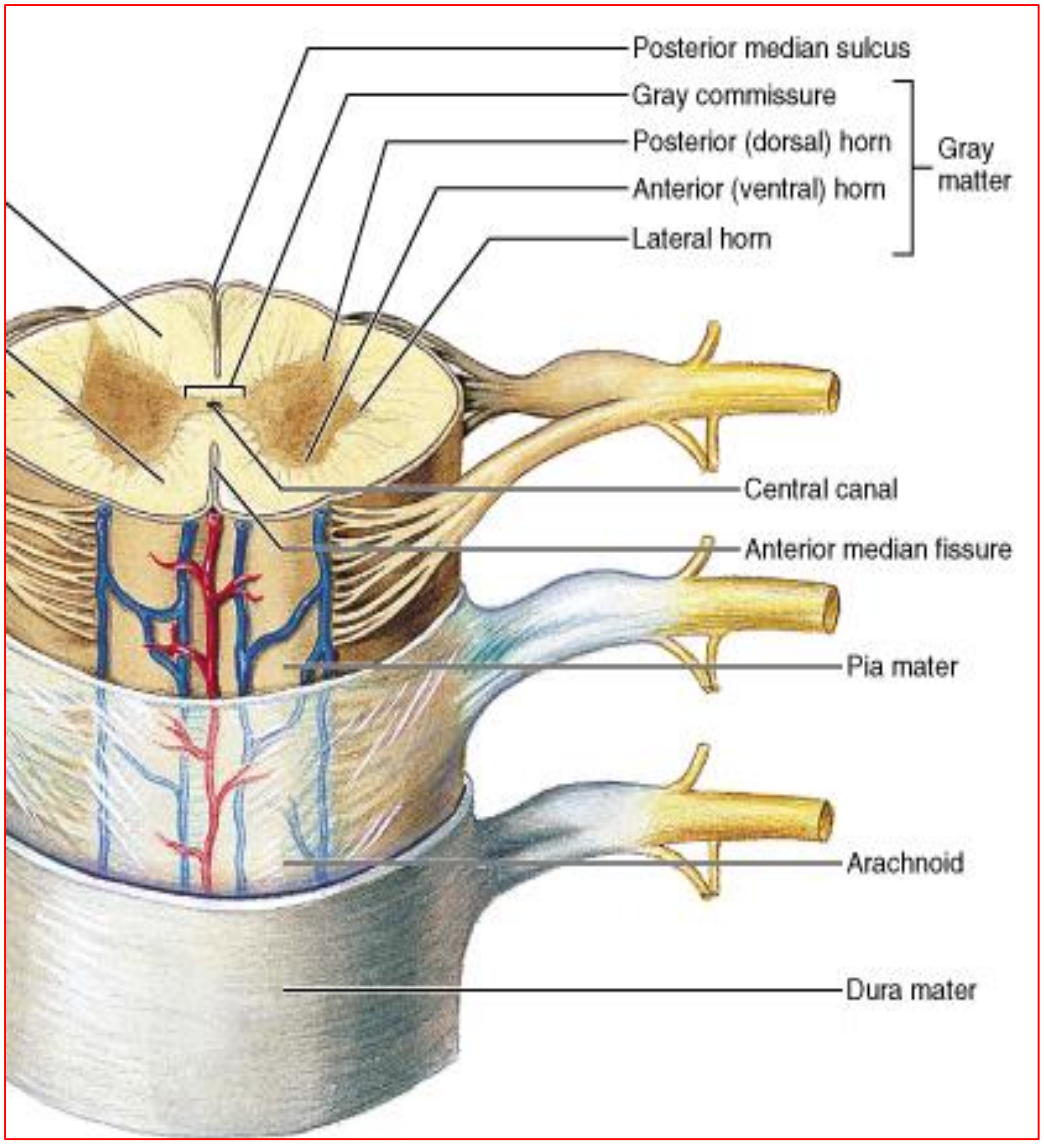
- It terminates inferiorly in the lumbar region.
- Below, the spinal cord tapers off into the conus medullaris
- From the apex of which a prolongation of the pia mater, the filum terminale, descends to attach to the back of the coccyx
- Along the entire length of the spinal cord are attached 31 pairs of spinal nerves by the anterior or motor roots and the posterior or sensory roots
- Each root is attached to the cord by a series of rootlets, which extend the whole length of the corresponding segment of the cord.
- Each posterior nerve root possesses a posterior root ganglion, the cells of which give rise to peripheral and central nerve fibers.



Cross-sectional anatomy

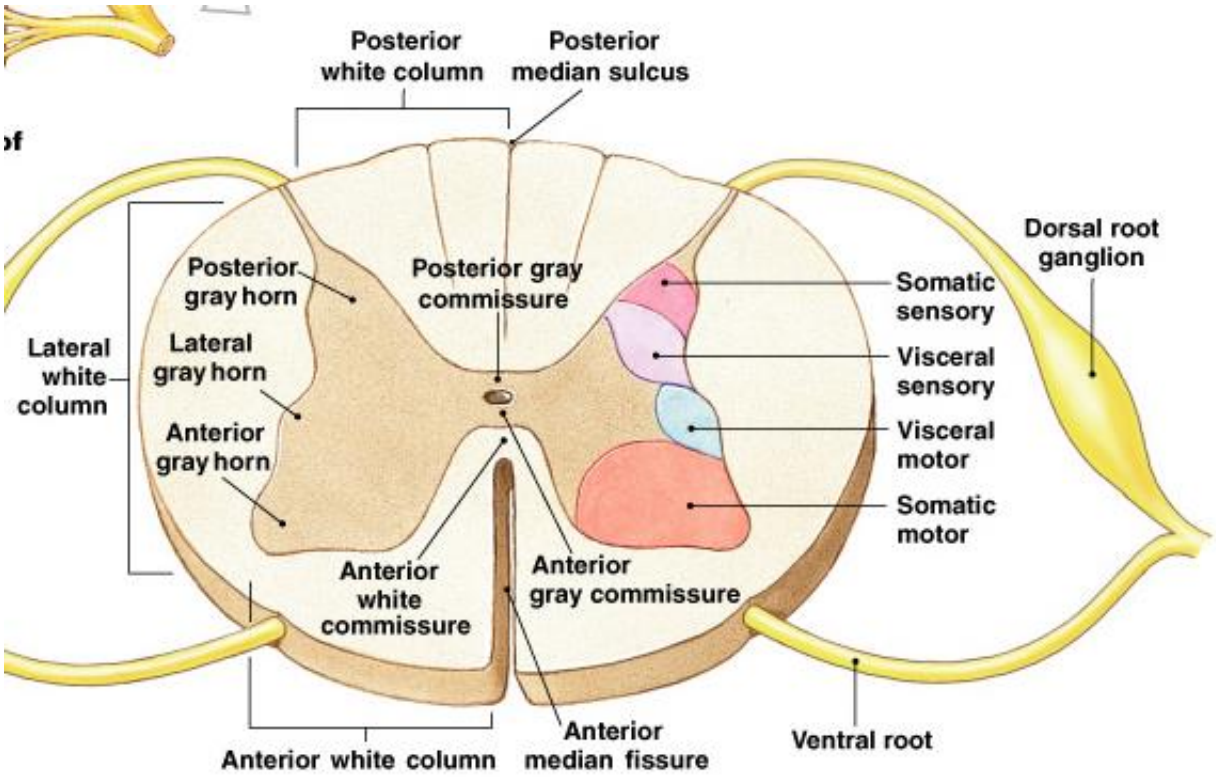
Gray matter

- Cell bodies, neuroglia
  - Posterior horns (sensory, all interneurons)
  - Lateral horns (autonomic, T1-L2)
  - Anterior horns (motor, cell bodies of somatic motor neurons)
- Spinal roots
  - Ventral (somatic & autonomic motor)
  - Dorsal Sensory



Gray Matter: Organization

- Dorsal half – sensory roots and ganglia
- Ventral half – motor roots
- Dorsal and ventral roots fuse laterally to form spinal nerves
- Four zones are evident within the gray matter – somatic sensory (SS), visceral sensory (VS), visceral motor (VM), and somatic motor (SM)

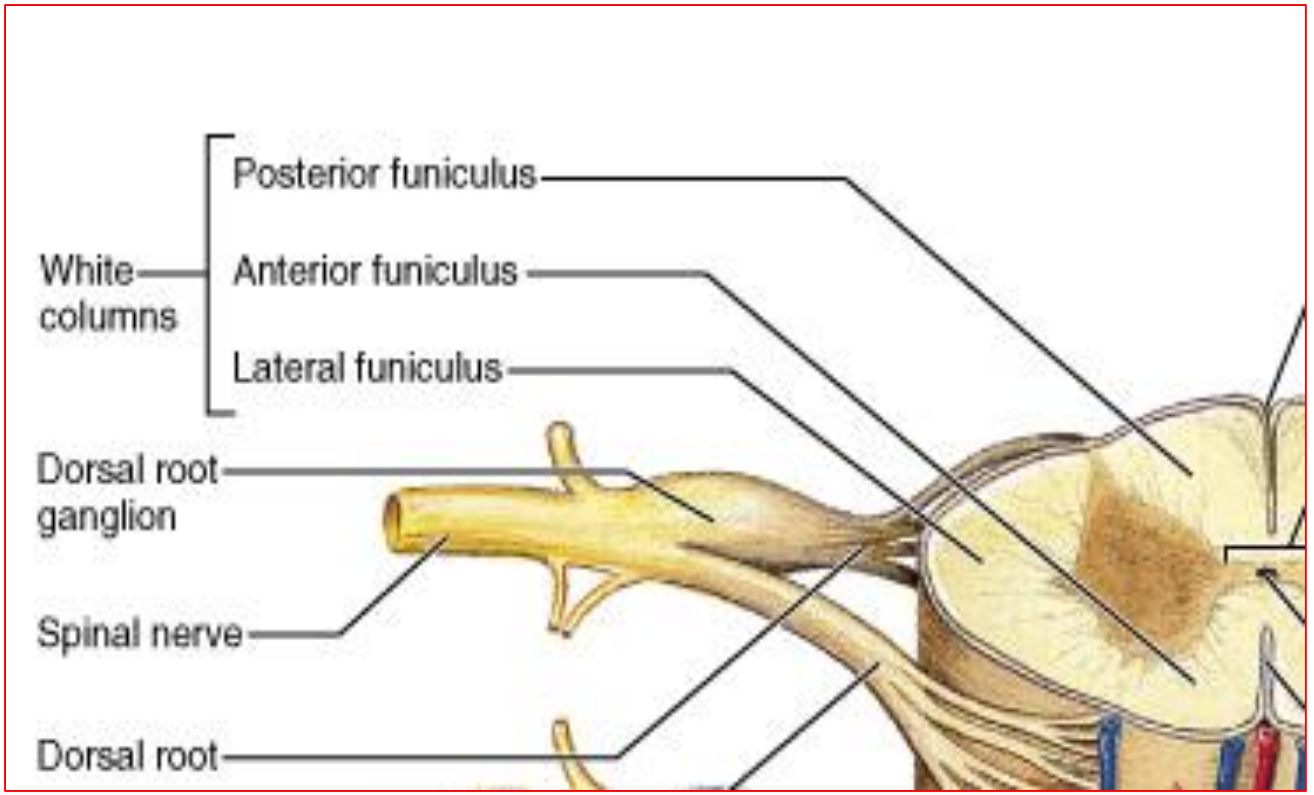


(a) Sectional view of spinal cord

Cross-sectional anatomy

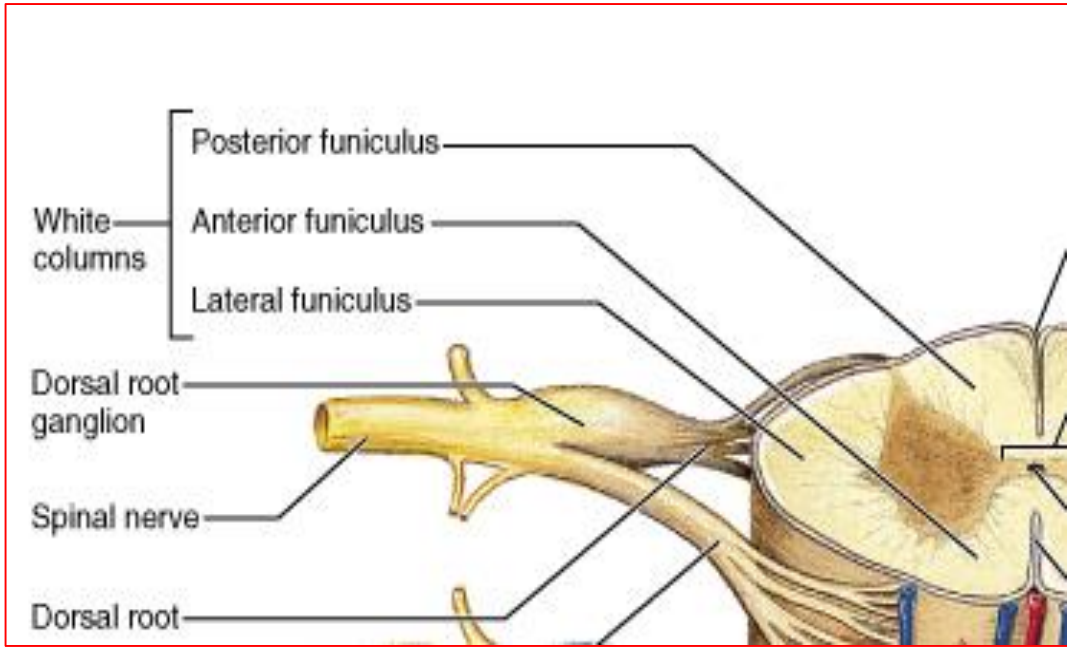
White matter

- 3 funiculi
- (posterior, lateral, anterior)
- contain
  - Ascending, descending, transverse tracts
  - All tracts are paired
  - Most cross over (decussate) at some point

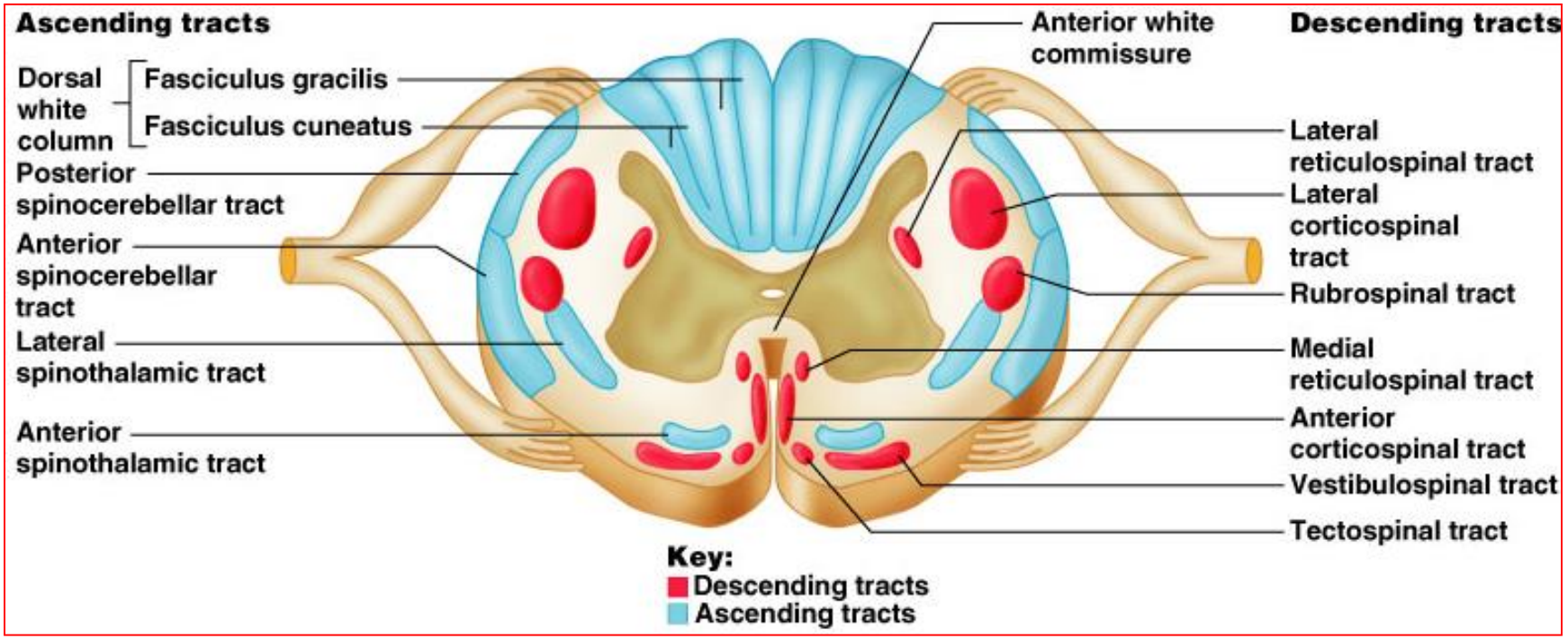


White Matter in the Spinal Cord

- Divided into three funiculi (columns) – posterior, lateral, and anterior
- Each funiculus contains several fiber tracts
  - Fiber tract names reveal their origin and destination
  - Fiber tracts are composed of axons with similar functions
- Pathways decussate (cross-over)
- Most consist of two or three neurons
- Pathways are paired (one on each side of the spinal cord or brain)

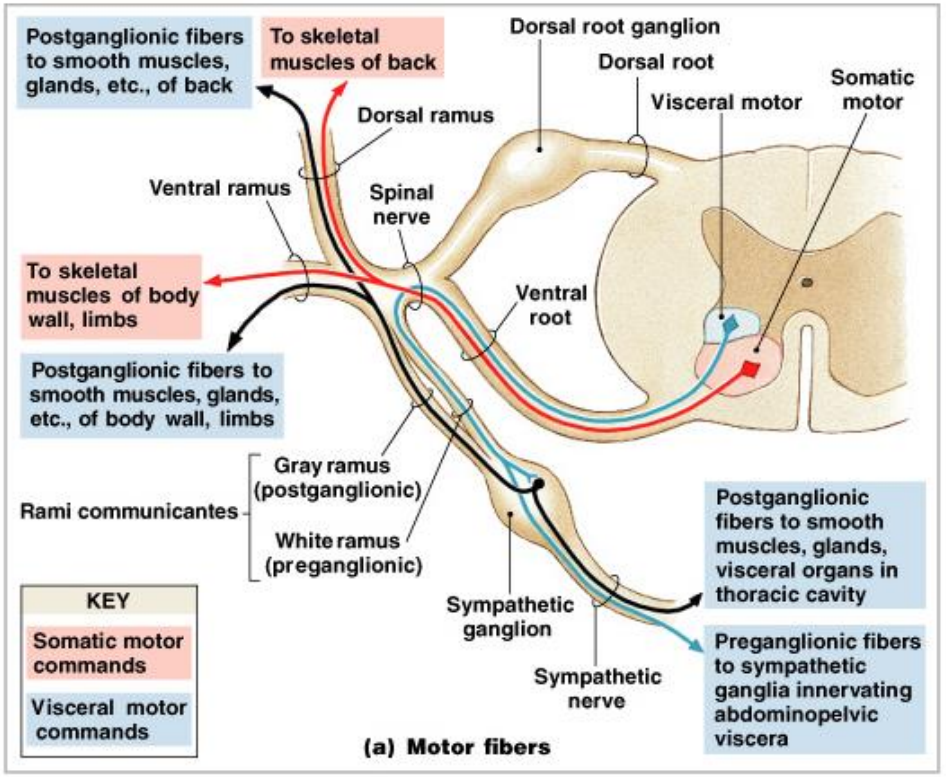


White Matter: Pathway Generalizations



Peripheral Distribution of Spinal Nerves

- Each spinal nerve connects to the spinal cord via two medial roots
- Each root forms a series of rootlets that attach to the spinal cord
- ***Ventral roots arise from the anterior horn*** and contain motor (efferent) fibers
- ***Dorsal roots arise from sensory neurons in the dorsal root ganglion*** and contain sensory (afferent) fibers

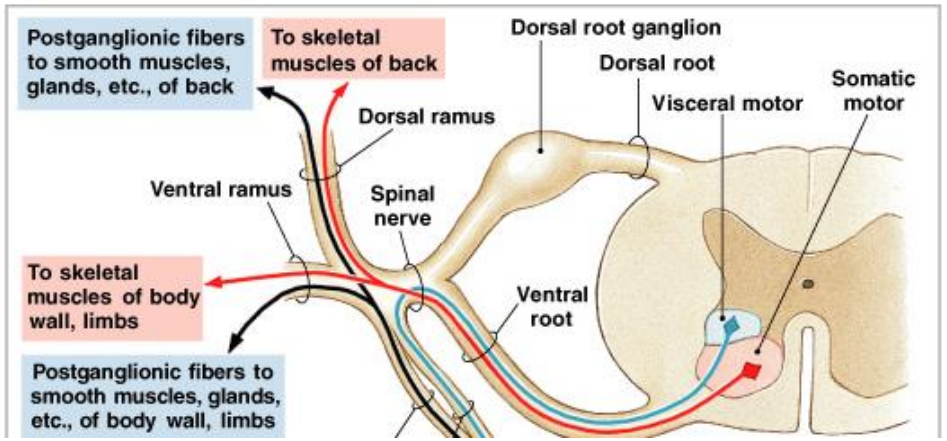


Spinal Nerves: Rami

- Short spinal nerves branch into three or four mixed, distal rami

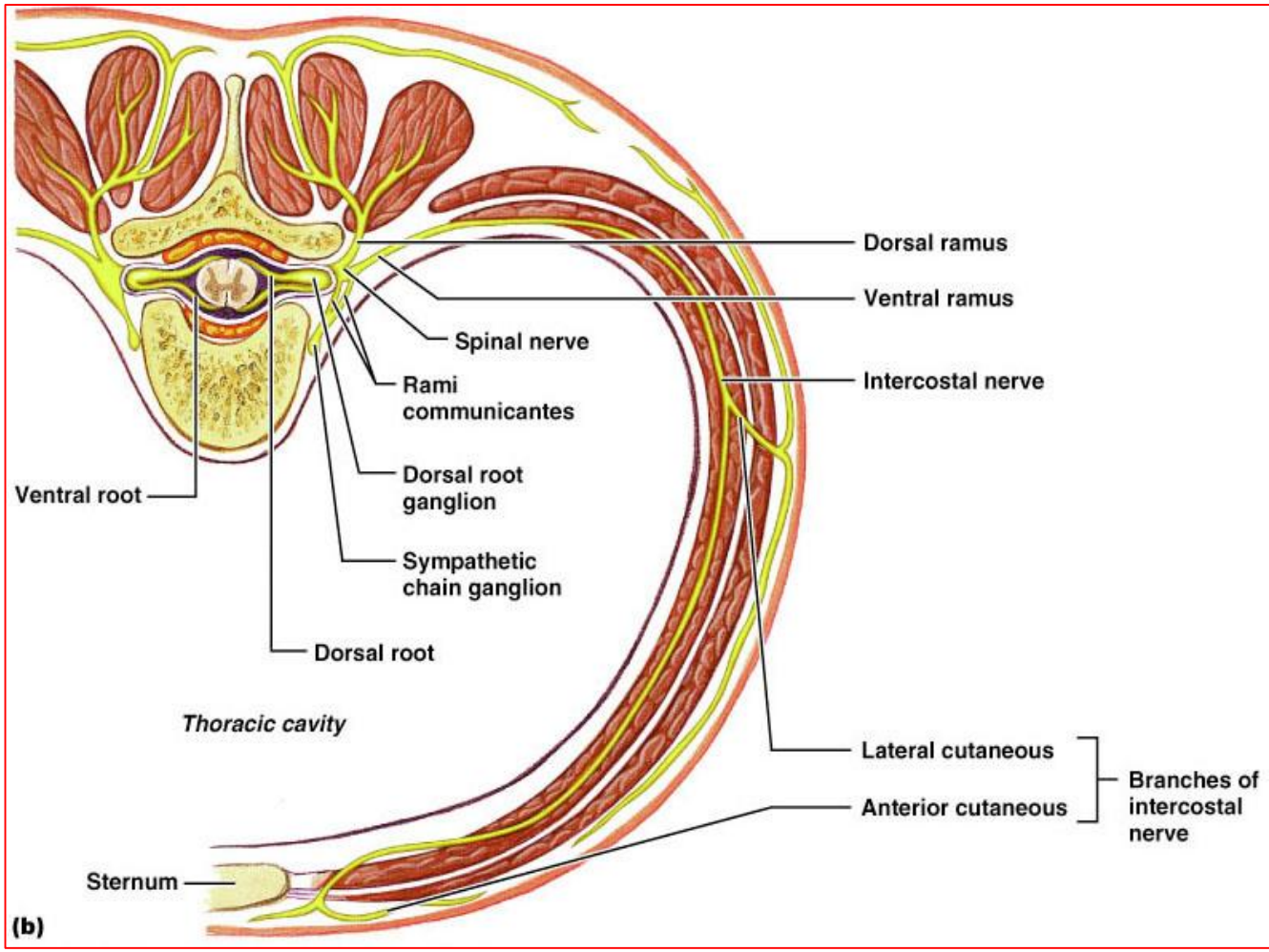
  - ❑ Small dorsal ramus – to back

  - ❑ Larger ventral ramus – to plexuses/intercostals And anterior abdominal wall

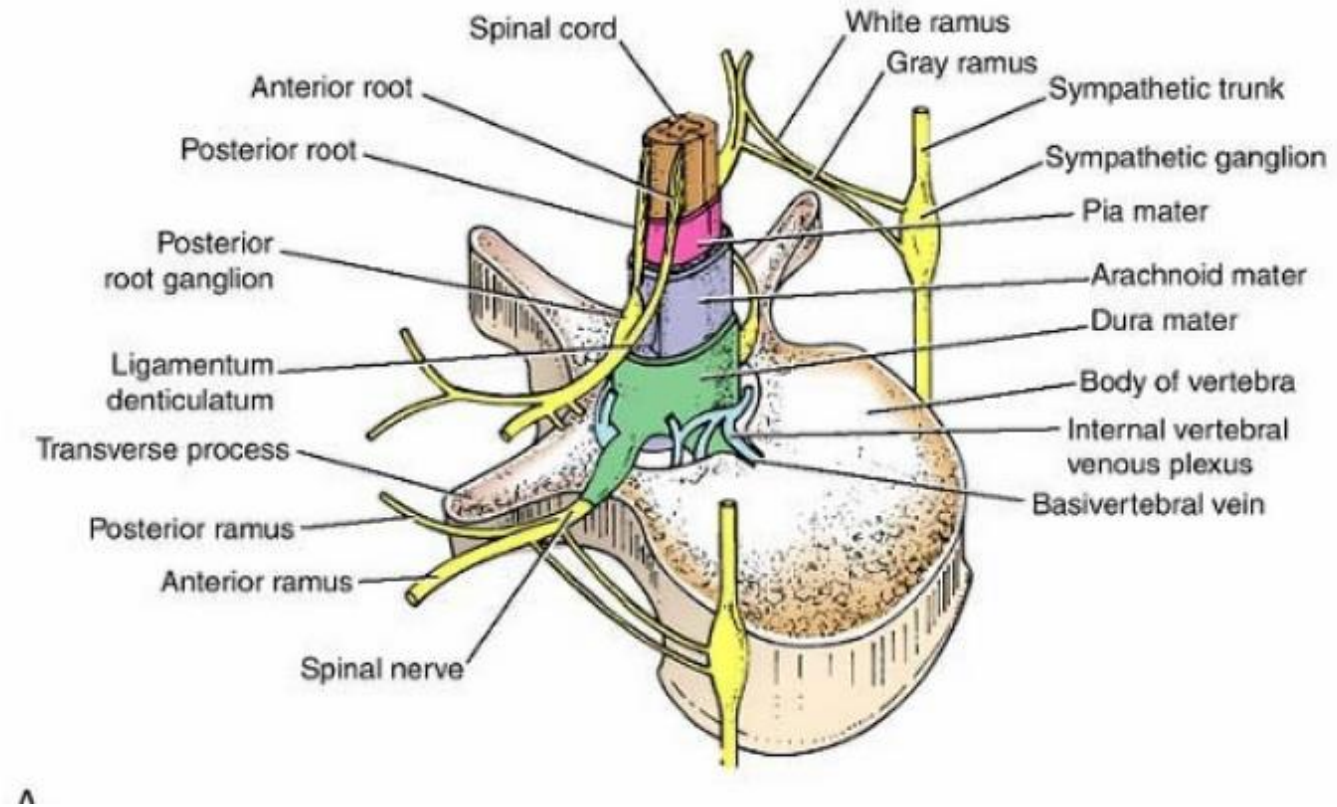


Spinal Nerve Innervation:

- The back is innervated by ***dorsal rami*** via several branches
- The thorax is innervated by ventral rami T_1-T_{12} as ***intercostal nerves***
- Intercostal nerves supply muscles of the ribs, anterolateral thorax, and abdominal wall



Sympathetic ganglion



Spinal Tap

- Spinal tap (lumbar puncture) may be performed to withdraw a sample of cerebrospinal fluid for

❑ Microscopic or bacteriologic examination or to
inject drugs to combat infection or induce anesthesia.

- Fortunately, the spinal cord terminates inferiorly at the level of the lower border of the first lumbar vertebra in the adult.
- (In the infant, it may reach inferiorly to the third lumbar vertebra.)
- The subarachnoid space extends inferiorly as far as the lower border of the second sacral vertebra.
- The lower lumbar part of the vertebral canal is thus occupied by the subarachnoid space, which contains the lumbar and sacral nerve roots and the filum terminale (the cauda equina).
- A needle introduced into the subarachnoid space in this region usually pushes the nerve roots to one side without causing damage.

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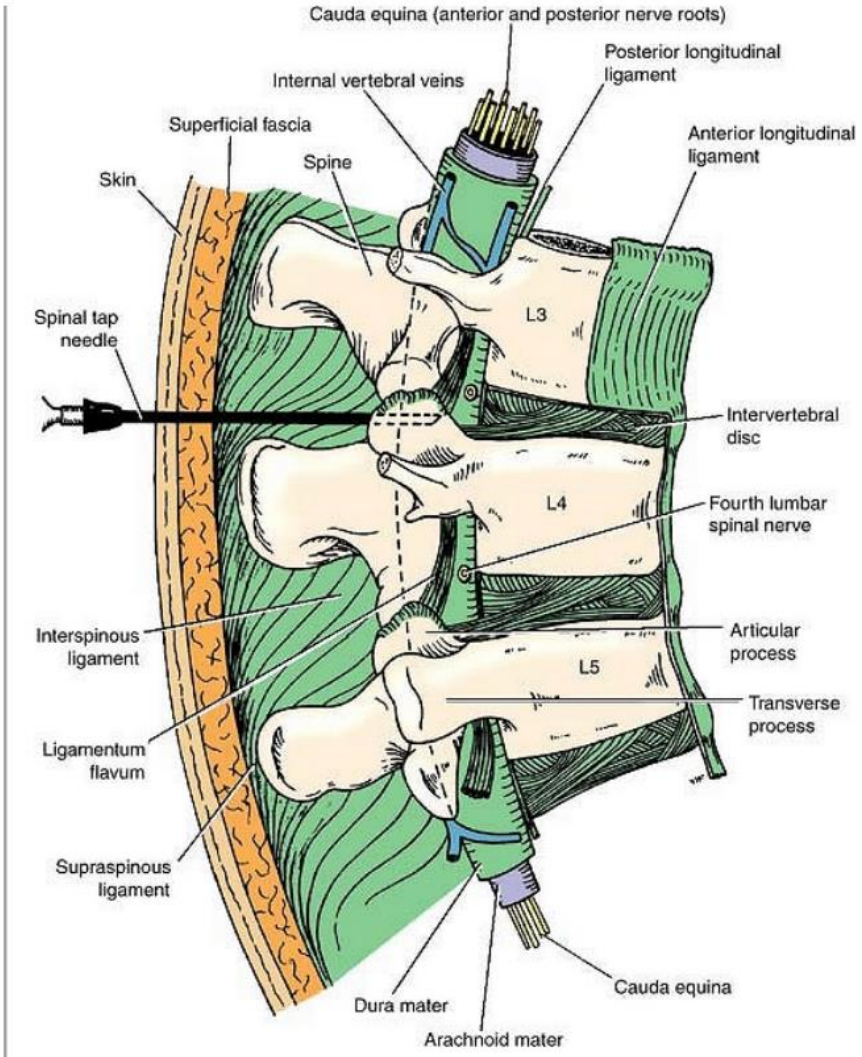
Spinal Tap

- With the patient lying on his or her side or in the upright sitting position, with the vertebral column well flexed
- An imaginary line joining the highest points on the iliac crests passes over the fourth lumbar spine.
- Using a careful aseptic technique and local anesthesia, the physician passes the lumbar puncture needle, fitted with a stylet, into the vertebral canal above or below the fourth lumbar spine.



Spinal Tap

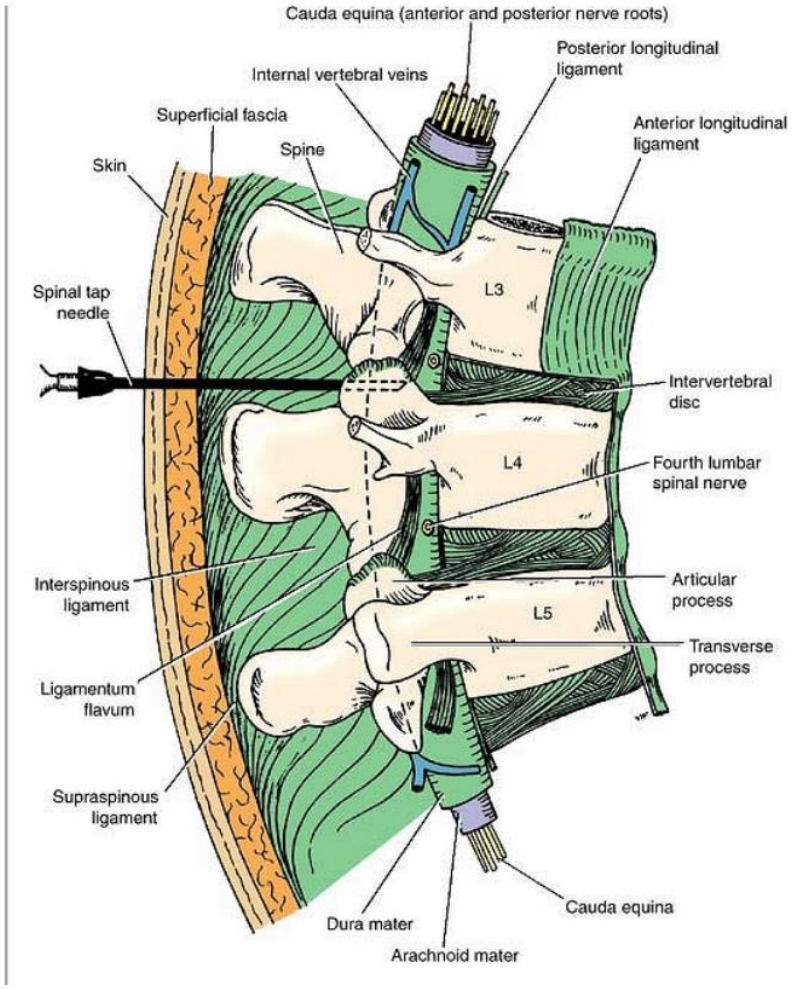
- The needle will pass through the following anatomical structures before it enters the subarachnoid space:

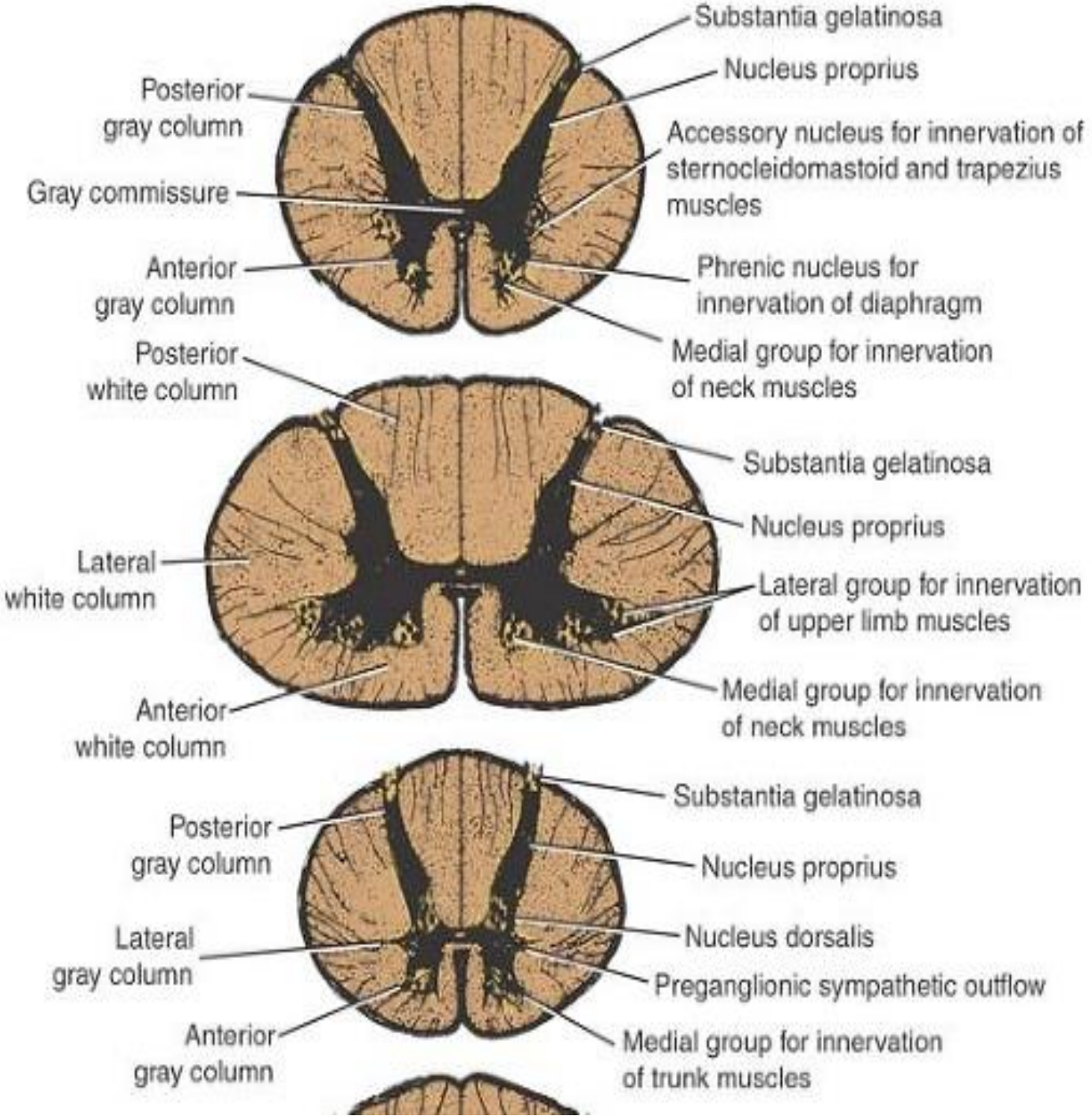
- (a) skin, (b) superficial fascia, (c) supraspinous ligament,

  (d) interspinous ligament, (e) ligamentum flavum, (f) areolar

  tissue containing the internal vertebral venous plexus,

  (g) dura mater, and (h) arachnoid mater.




Third cervical segment
Substantia gelatinosa
Nucleus proprius
Posterior gray column
Accessory nucleus for innervation of sternocleidomastoid and trapezius muscles
Gray commissure
Anterior gray column
Phrenic nucleus for innervation of diaphragm
Medial group for innervation of neck muscles
Posterior white column
Sixth cervical segment
Substantia gelatinosa
Nucleus proprius
Lateral white column
Lateral group for innervation of upper limb muscles
Medial group for innervation of neck muscles
Anterior white column
Substantia gelatinosa
Posterior gray column
Nucleus proprius
Sixth thoracic segment
Lateral gray column
Nucleus dorsalis
Preganglionic sympathetic outflow
Anterior gray column
Medial group for innervation of trunk muscles

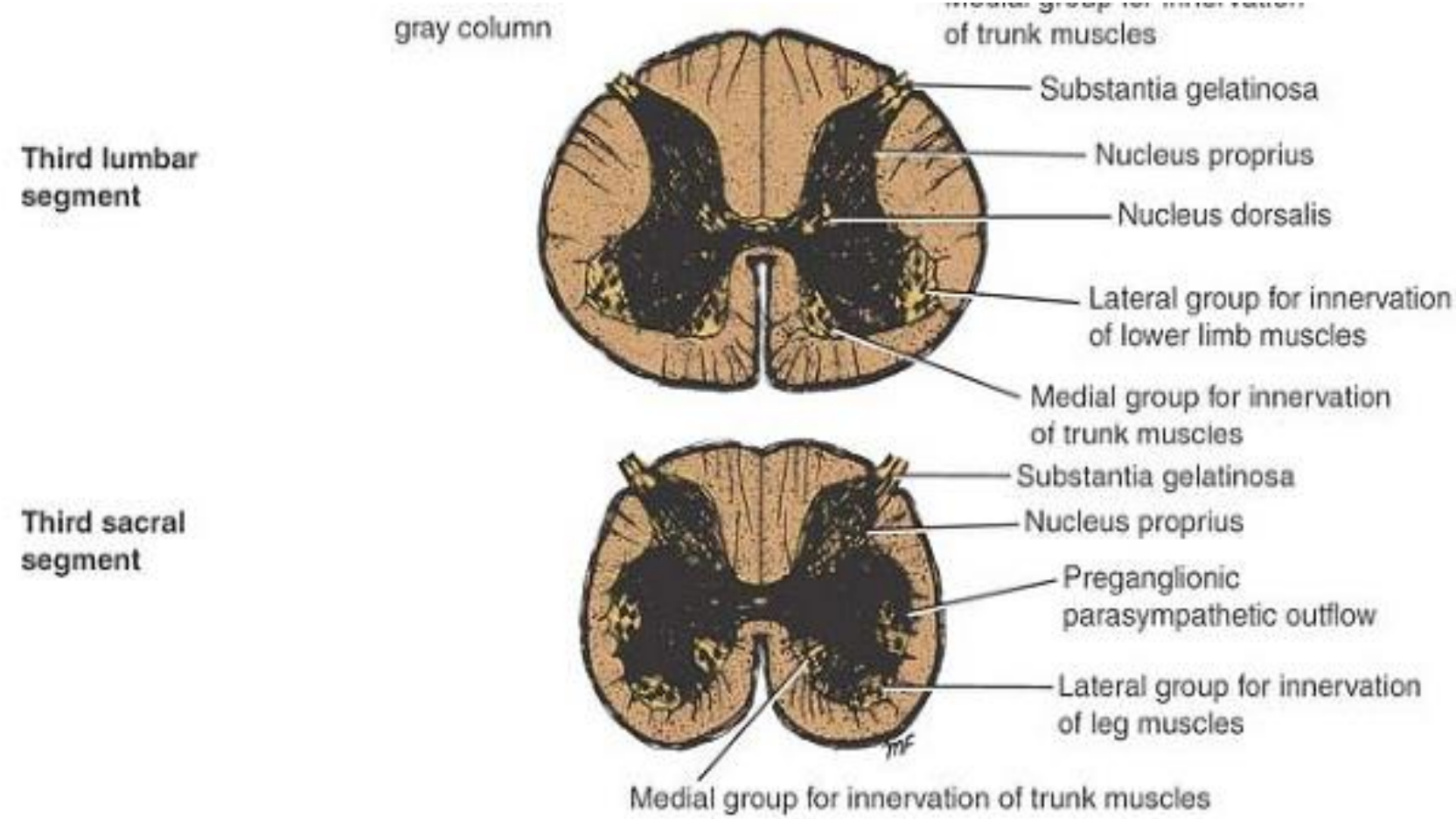


Figure 4-6 Transverse sections of the spinal cord at different levels showing the arrangement of the gray matter and white matter.

The **nucleus proprius** is a group of large nerve cells situated anterior to the substantia gelatinosa throughout the spinal cord (Figs. 4-6, 4-7, 4-8, 4-9 and 4-10). This nucleus constitutes the main bulk of cells present in the posterior

THANK YOU