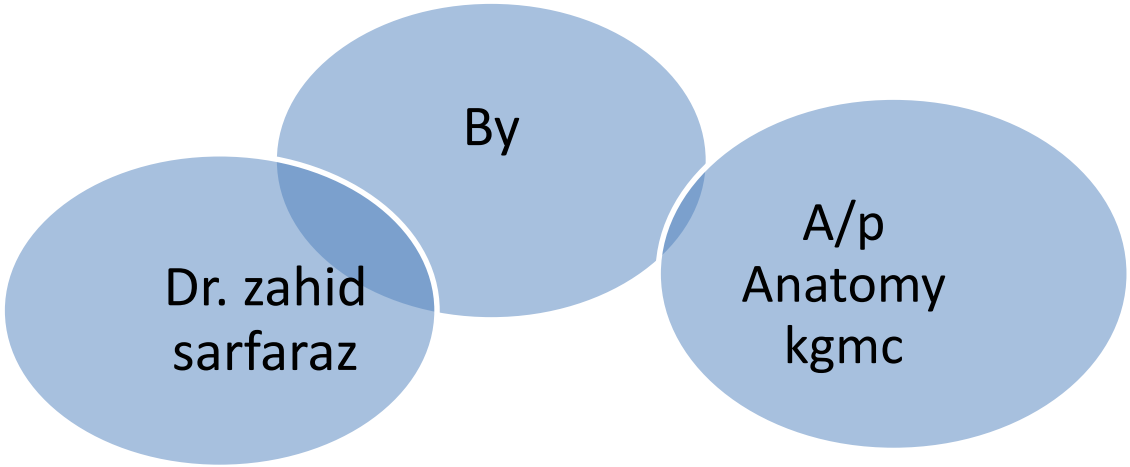
Dorsal column-medial lemniscal pathway Ascending Tracts of Spinal cord -1



White Matter

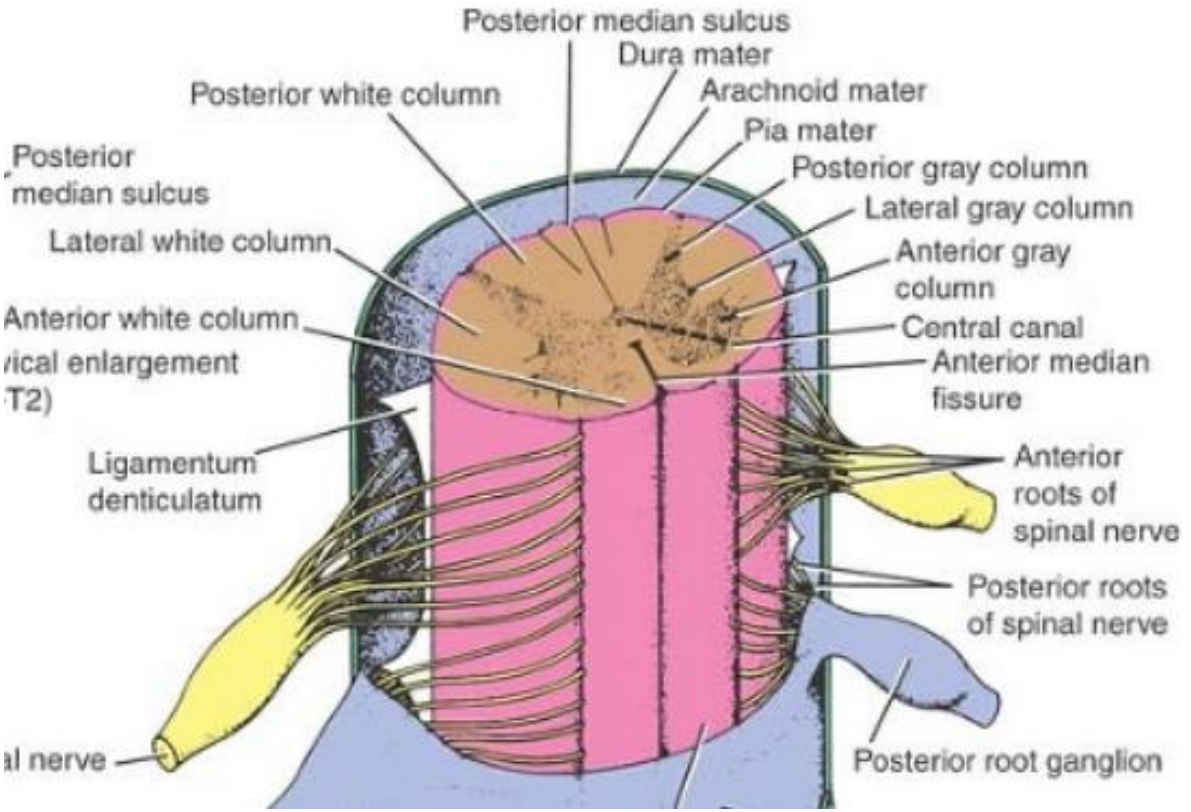
- Divided into anterior, lateral, and posterior white columns or funiculi .

Anterior column on each side lies between the midline

- And the point of emergence ofthe anterior nerve roots

Lateral column lies between the emergence of the anterior nerve roots and the entry of the posterior nerve roots

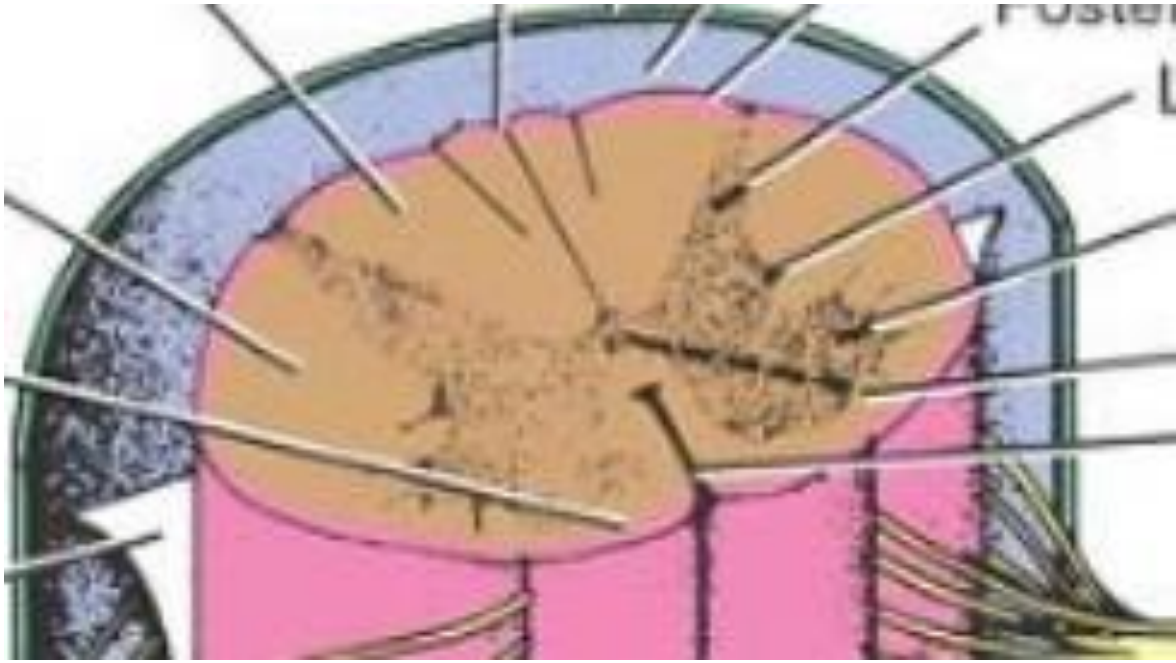
Posterior column lies between the entry of the posterior nerve roots and the midline.



White Matter

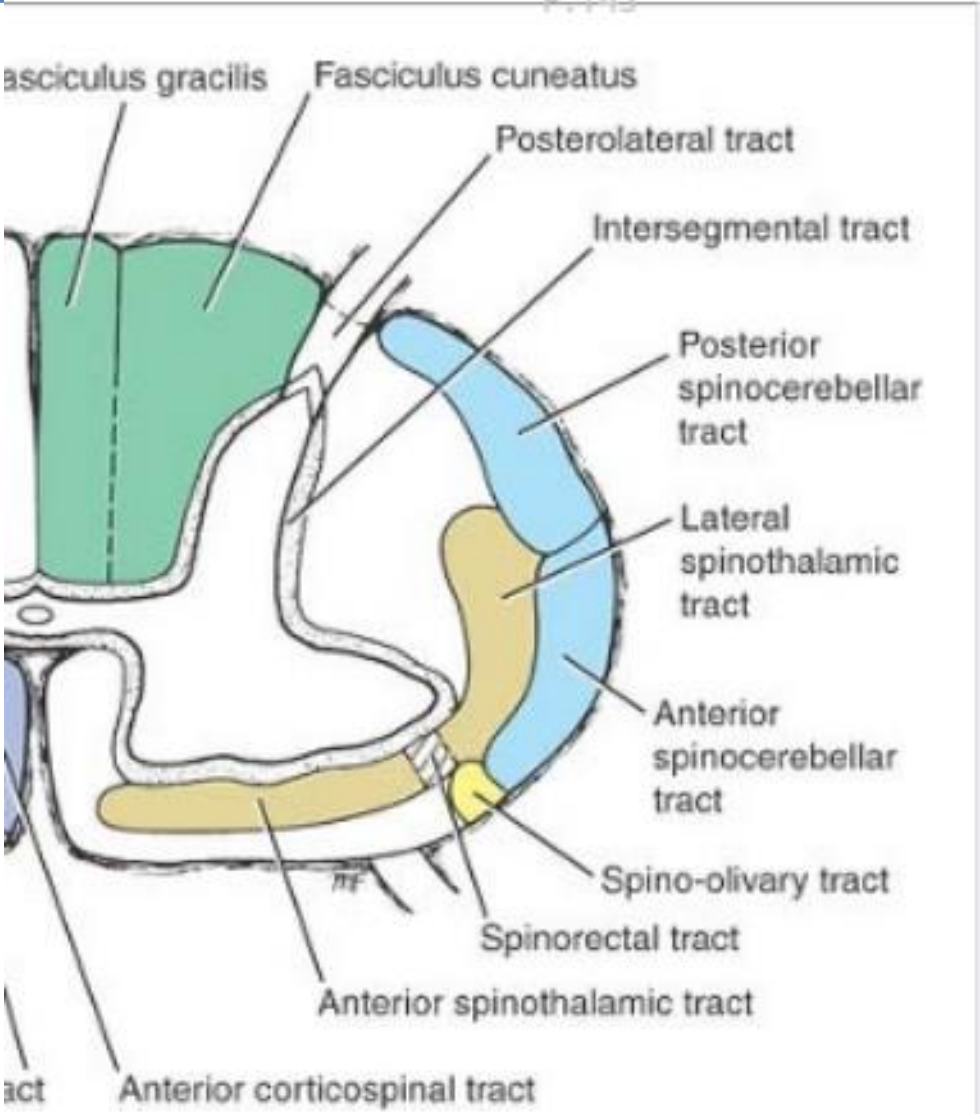
Structure

- Consists of a mixture of nerve fibers, neuroglia.
- It surrounds the gray matter
- And its white color is due to the high proportion of myelinated nerve fibers.



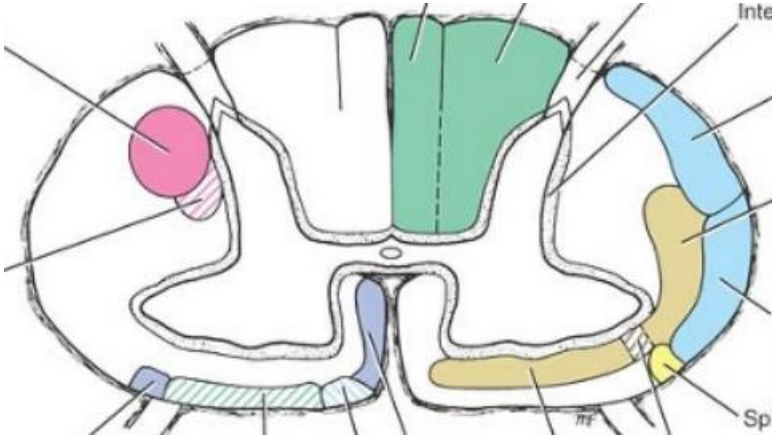
Ascending Tracts of the Spinal cord

- On entering the spinal cord
- the sensory nerve fibers of different sizes and functions are sorted out
- And segregated into nerve bundles or tracts in the white matter



Ascending Tracts of the Spinal cord

- Some of the nerve fibers serve to link different segments of the spinal cord
- while others ascend from the spinal cord to higher centers
- And thus connect the spinal cord with the brain.
- It is the bundles of the ascending fibers that are referred to as the ascending tracts.



Ascending tracts

Are also known as somatosensory pathways or systems.

- Functionally

Divided into the type of information they transmit – conscious or unconscious:

- **Conscious tracts** – comprised of the dorsal column-medial lemniscal pathway and the anterolateral system.
- **Unconscious tracts** – comprised of the spinocerebellar tracts.

Ascending Tracts of the Spinal cord

- This tract conduct afferent information
- Information may be divided into two main groups

(1) Exteroceptive information

which originates from outside the body, such as pain, temperature, and touch

(2) Proprioceptive information

which originates from inside the body, for example, from muscles and joints.

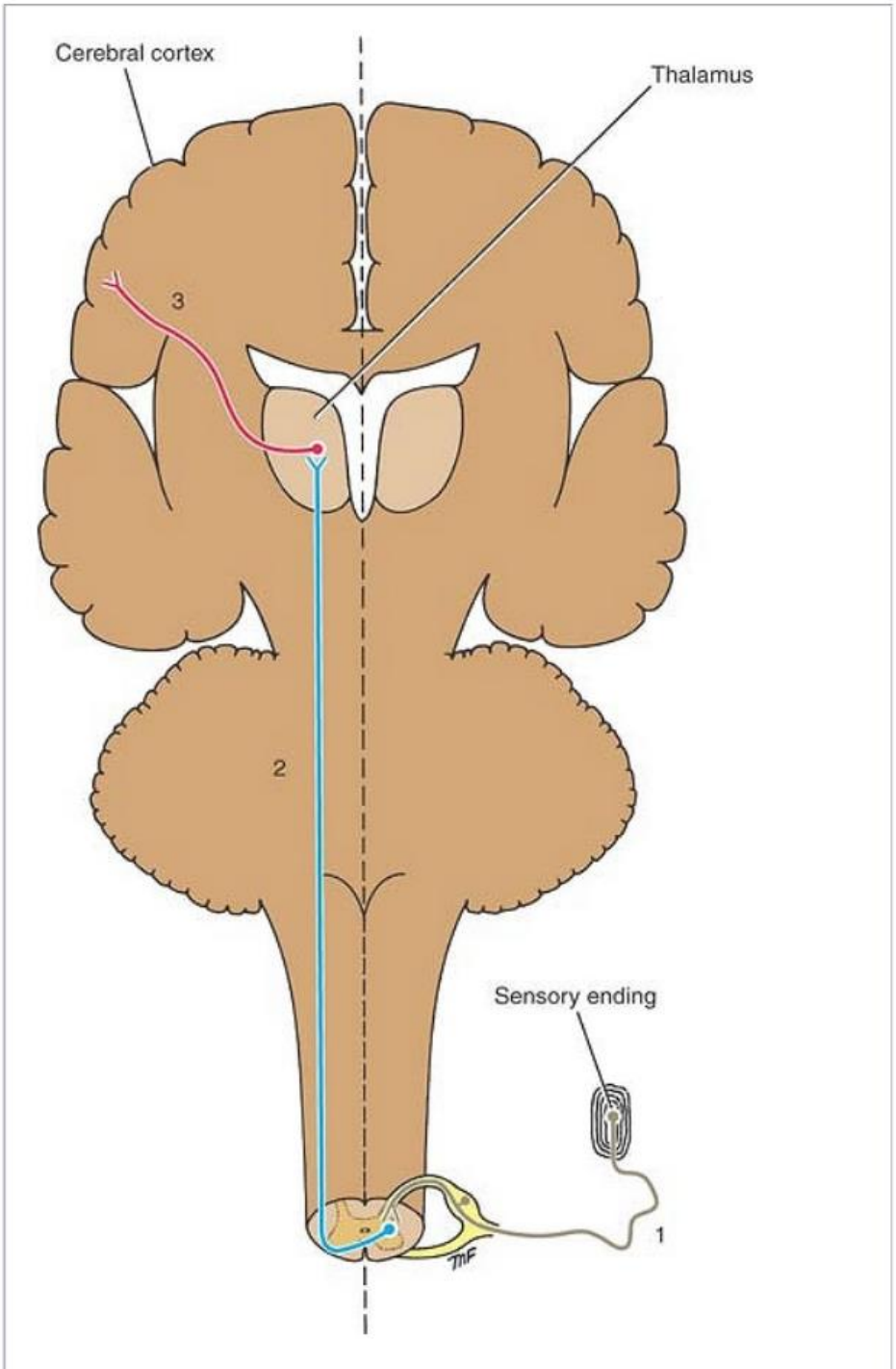
Anatomical Organization

- General information from the peripheral sensory endings is conducted through the nervous system by a series of neurons.

Consists of three neurons .

First neuron

- Has its cell body in the posterior root ganglion of the spinal nerve.
- A peripheral process connects with a sensory receptor ending,
- whereas a central process enters the spinal cord through the posterior root to synapse on the second-order neuron.



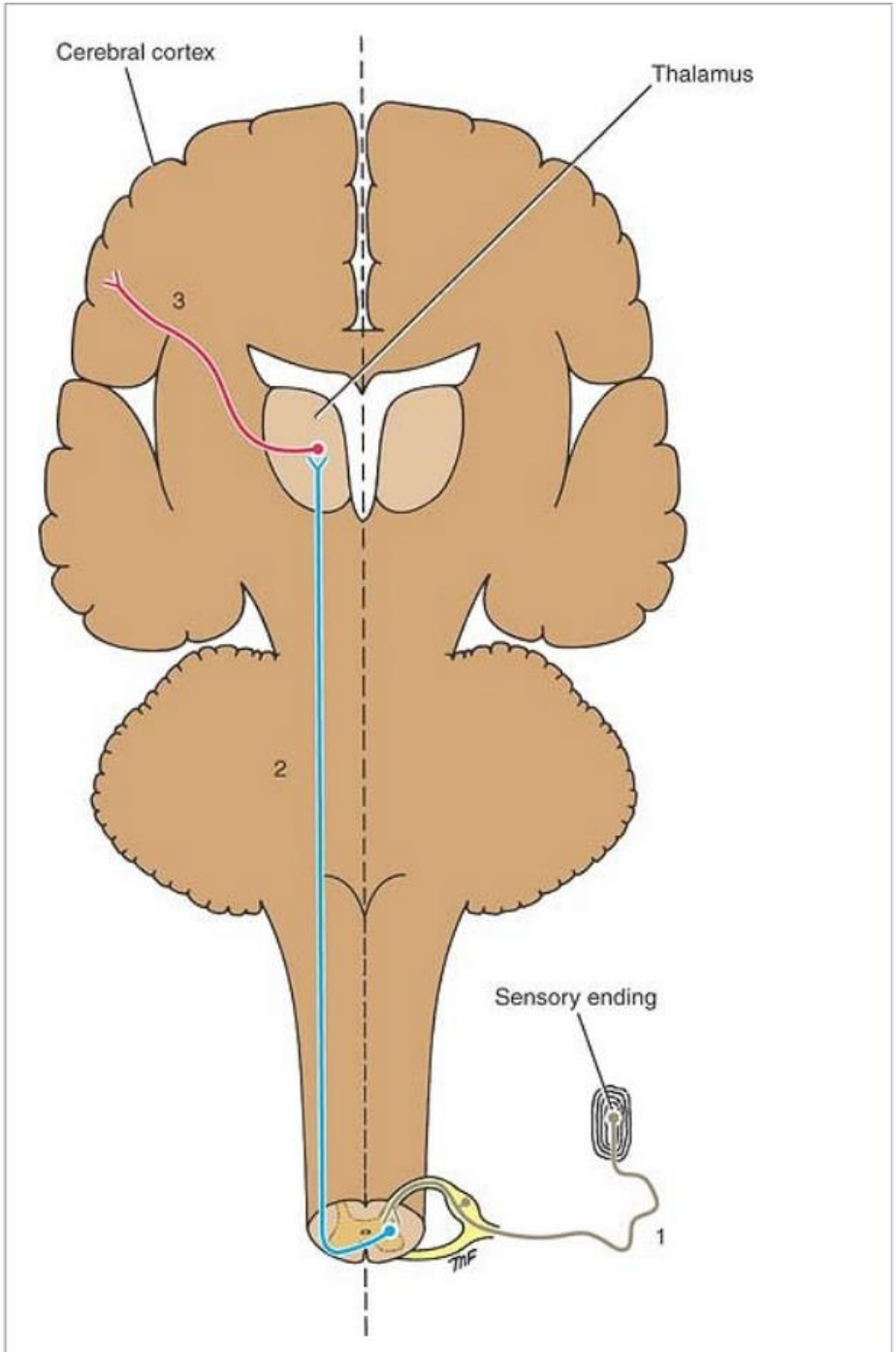
Anatomical Organization

Second-order neuron gives rise to an axon

- That decussates (crosses to the opposite side)
- And ascends to a higher level of the central nervous system
- where it synapses with the third-order neuron

Third-order neuron is usually in the thalamus

- And gives rise to a projection fiber
- That passes to a sensory region of the cerebral cortex .
- This three-neuron chain is the most common arrangement
- but some afferent pathways use more or fewer neurons.



Anatomical Organization

- Many of the neurons in the ascending pathways branch and give a major input into the reticular formation,
- Which in turn, activates the cerebral cortex, maintaining wakefulness.
- Other branches pass to motor neurons and participate in reflex muscular activity.

ASCENDING TRACTS

Lat. spinothalamic

Ant. spinothalamic

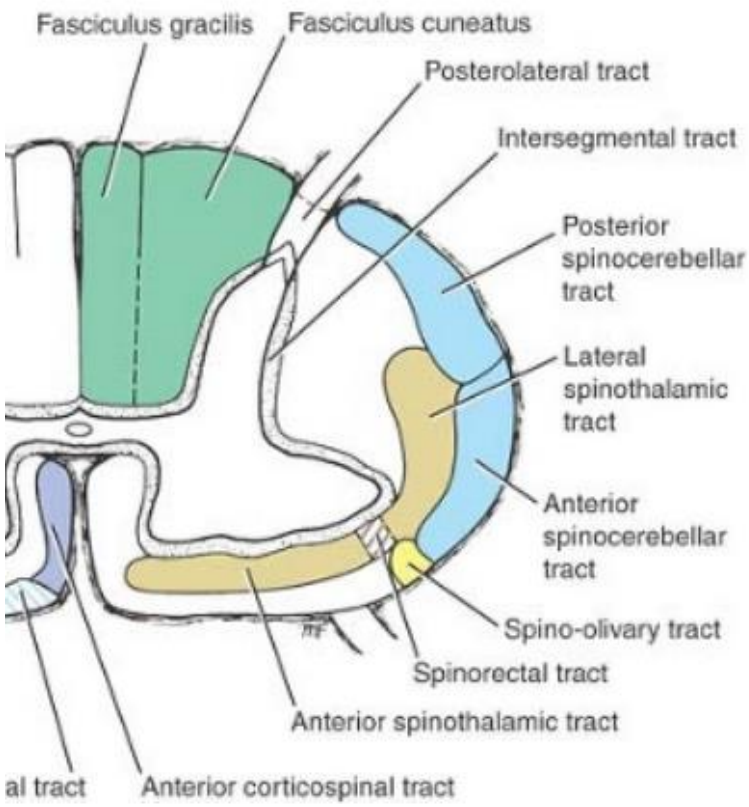
Fasciculi gracilis & cuneatus

Ant. & Post. Spinocerebellar

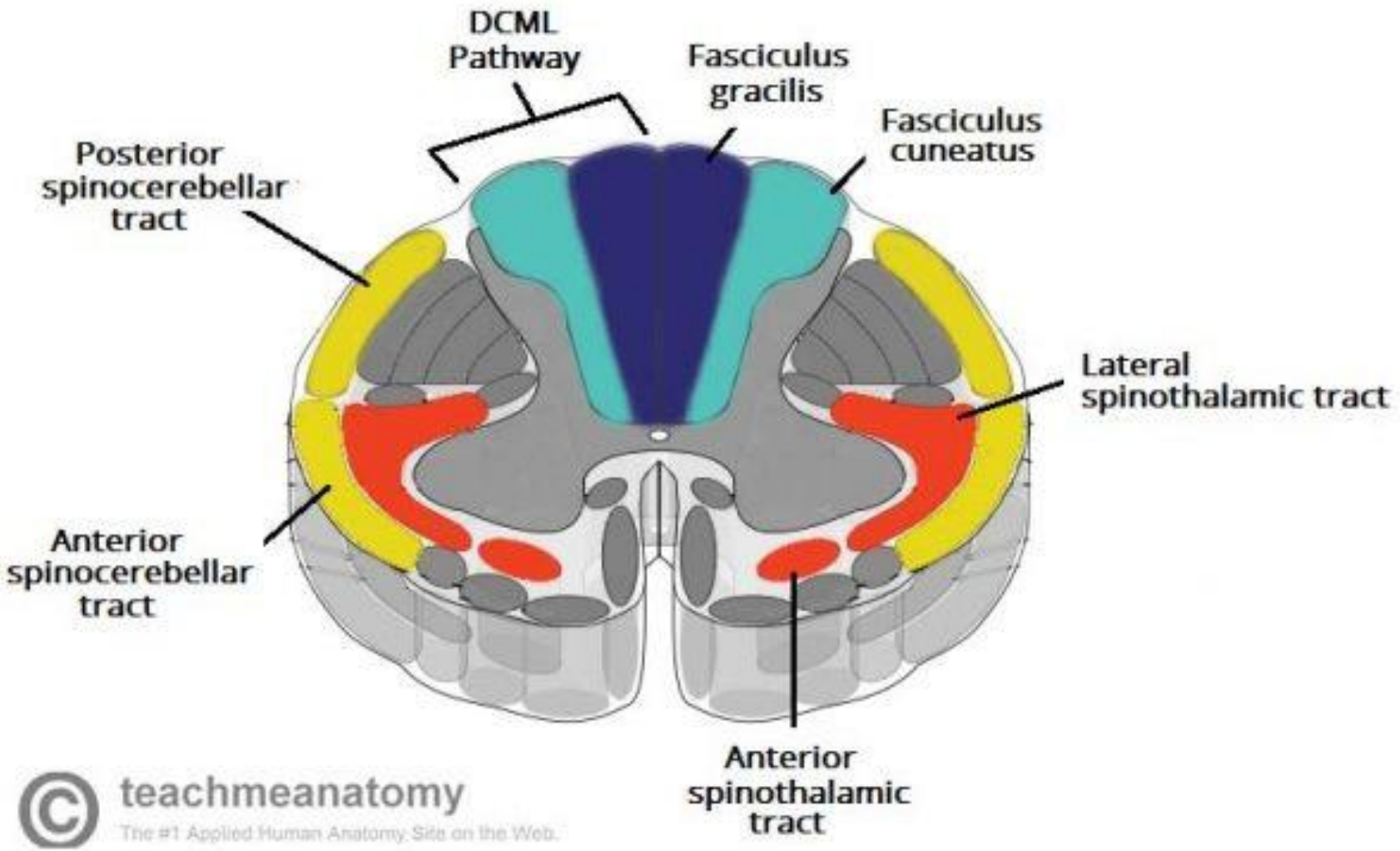
Spinotectal

spinoreticular

Spino-olivary



the midcervical level showing the general
l the descending tracts on the left.


DCML
Pathway
Fasciculus
gracilis
Fasciculus
cuneatus
Posterior
spinocerebellar
tract
Lateral
spinothalamic tract
Anterior
spinocerebellar
tract
Anterior
spinothalamic
tract
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Discriminative Touch, Vibratory Sense, and Conscious Muscle Joint Sense

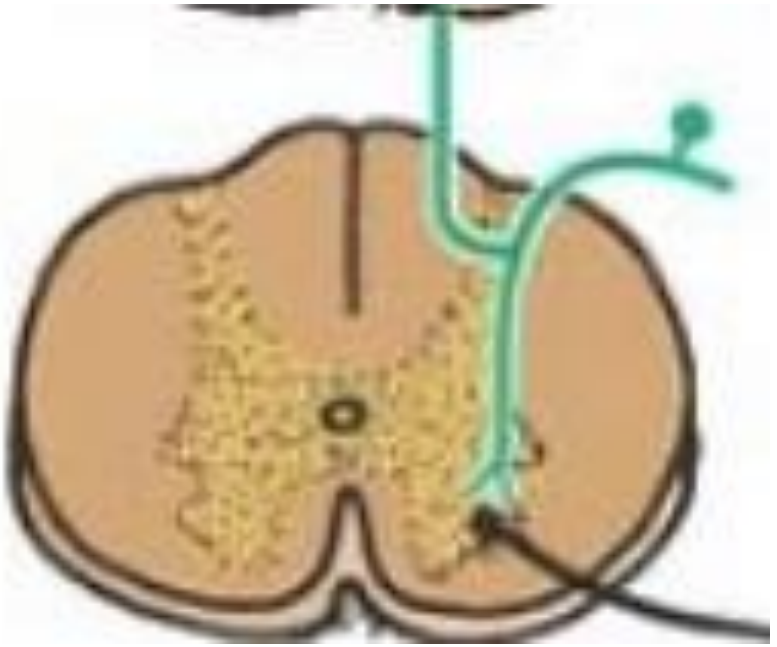
Posterior White Column:

(Fasciculus Gracilis and FasciculusCuneatus)(DCML)

The axons enter the spinal cord from the posterior root ganglion and pass directly to the posterior white column of the same side .

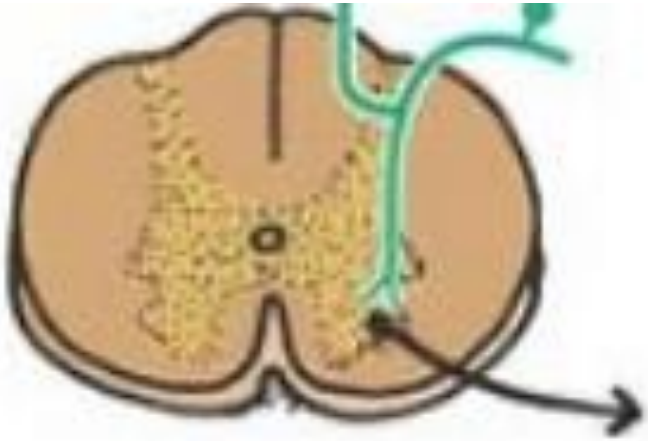
Here, the fibers divide into

- Long ascending
- And short descending branches.



Posterior White Column: Fasciculus Gracilis and Fasciculus Cuneatus

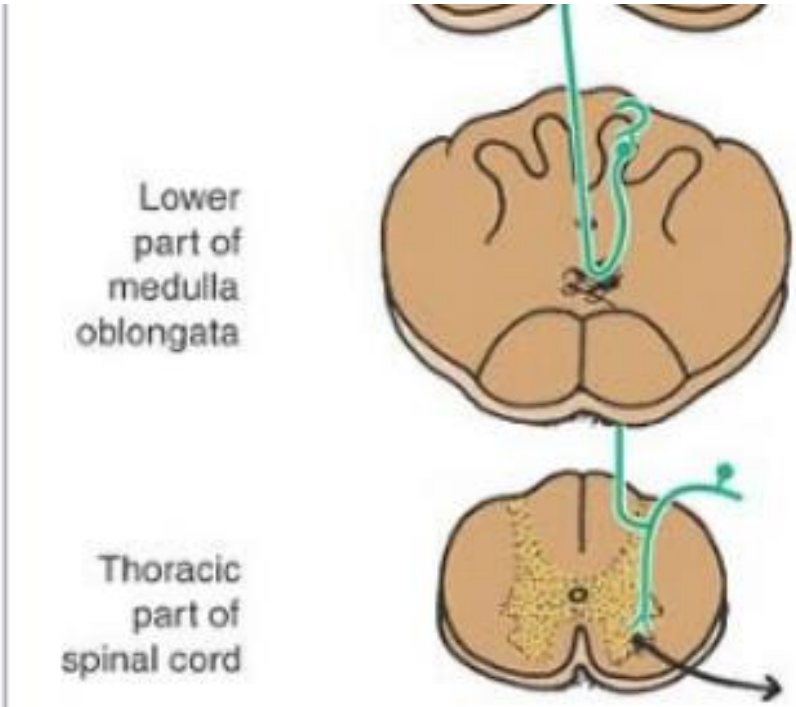
- The descending branches pass down a variable number of segments
- Giving off collateral branches that synapse with cells in the posterior gray horn, with internuncial neurons, and with anterior horn cells .
- It is clear that these short descending fibers are involved with intersegmental reflexes.



Posterior White Column

Long ascending fibers travel upward in the posterior white column as the fasciculus gracilis and fasciculus cuneatus .

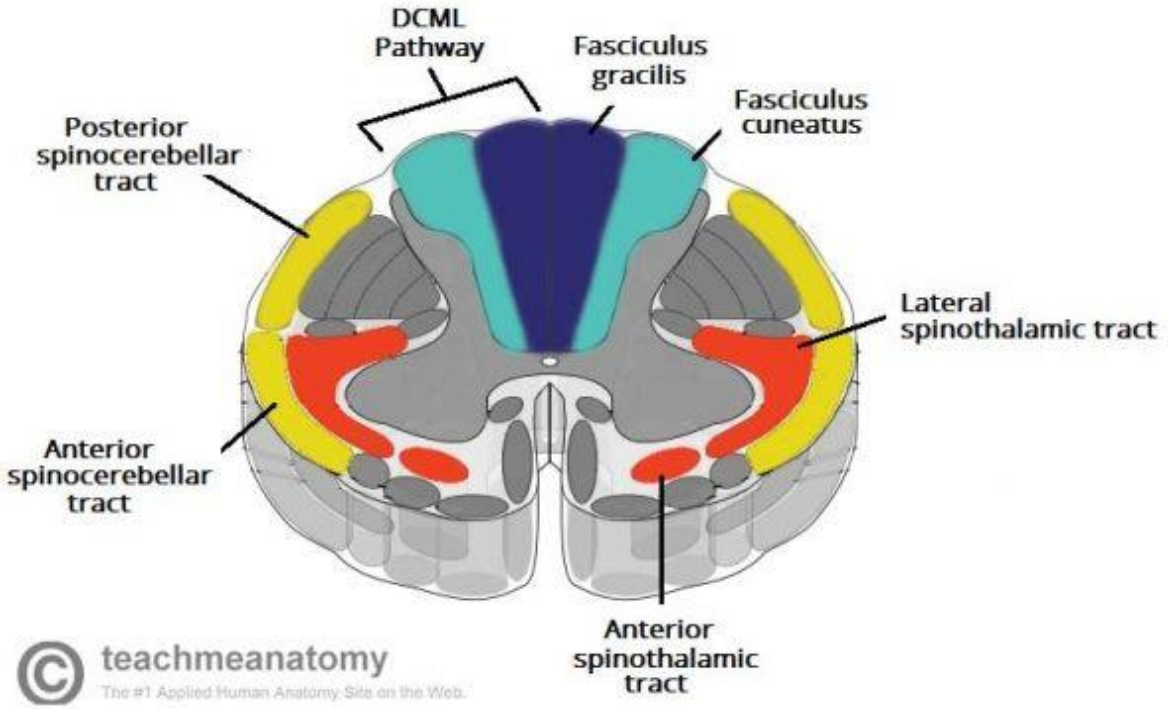
- The fasciculus gracilis is present throughout the length of the spinal cord
- And contains the long ascending fibers from the sacral, lumbar, and lower six thoracic spinal nerves.



Posterior White Column

The fasciculus cuneatus

- Is situated laterally in the upper thoracic and cervical segments of the spinal cord
- And is separated from the fasciculus gracilis by a septum.
- The fasciculus cuneatus contains the long ascending fibers from the upper six thoracic and all the cervical spinal nerves.

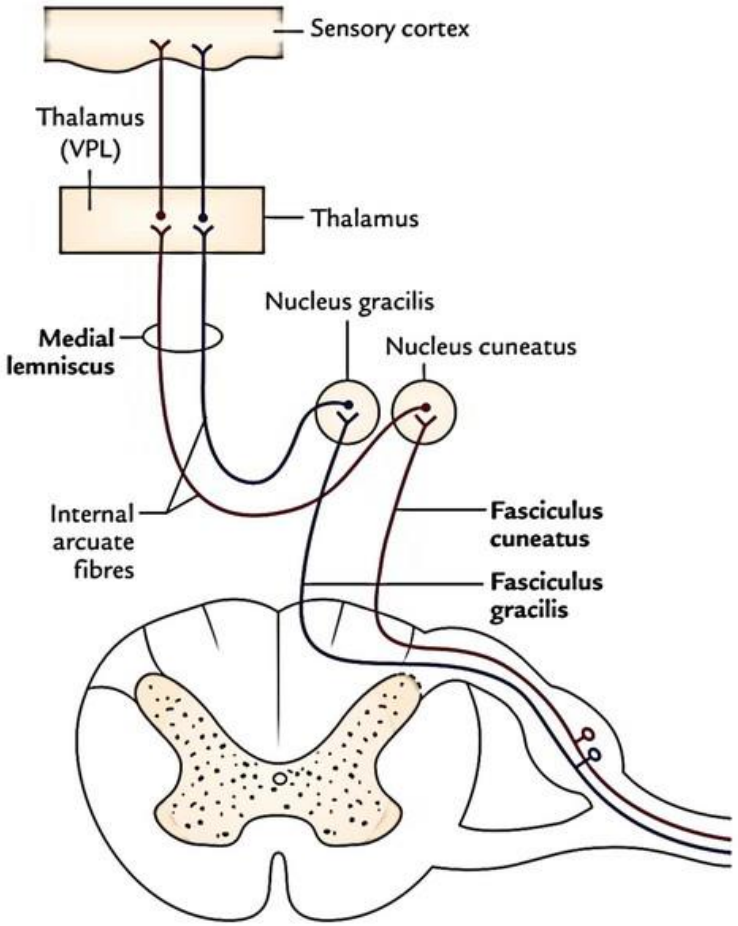


Posterior White Column (DCML)

- Fibers of the fasciculus gracilis and fasciculus cuneatus
- Ascend ipsilaterally

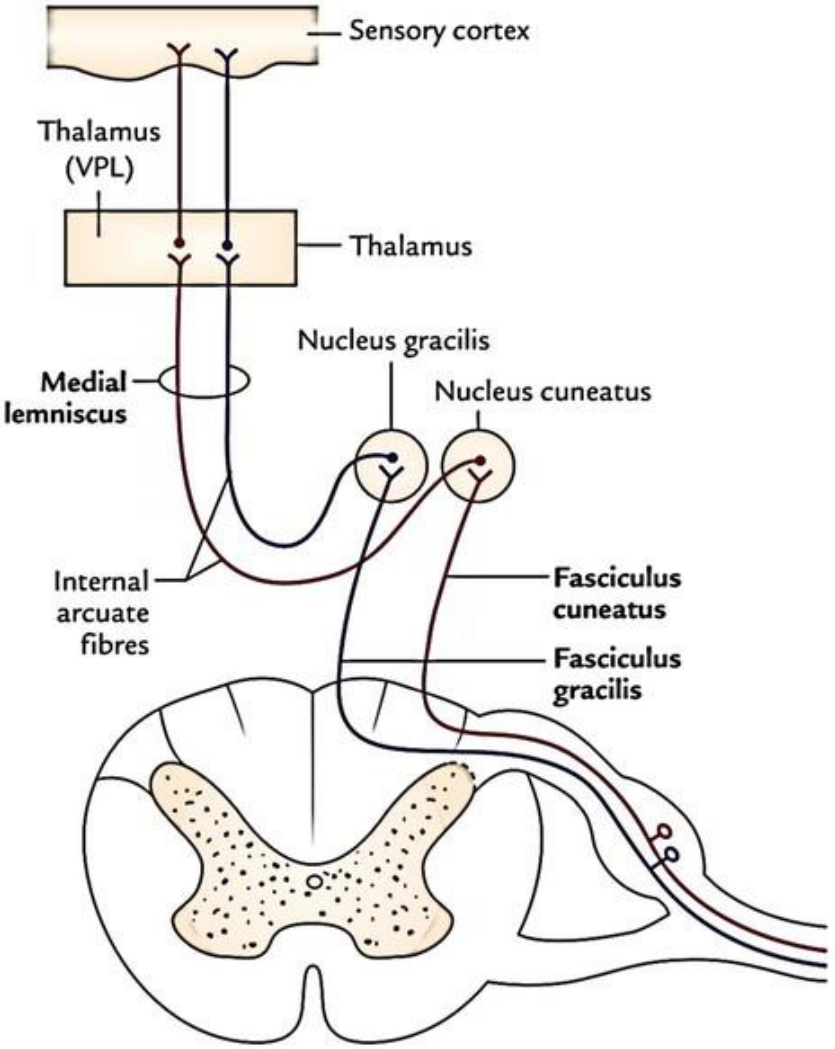
Terminate

- By synapsing on the second-order neurons in the nuclei gracilis and cuneatus of the medulla oblongata .



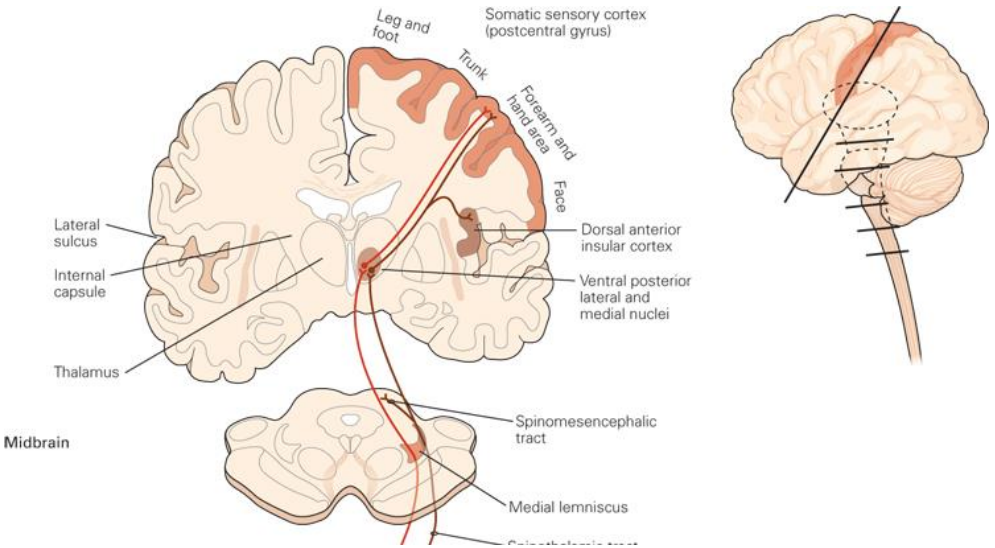
Posterior White Column

- Axons of the second-order neurons, called the internal arcuate fibers
- Sweep anteromedially around the central gray matter and cross the median plane
- Decussating with the corresponding fibers of the opposite side in the sensory decussation .
- The fibers then ascend as a single compact bundle, the medial lemniscus, through the medulla oblongata, the pons, and the midbrain
- Terminate by synapsing on the third-order neurons in the ventral posterolateral nucleus of the thalamus.



Posterior White Column

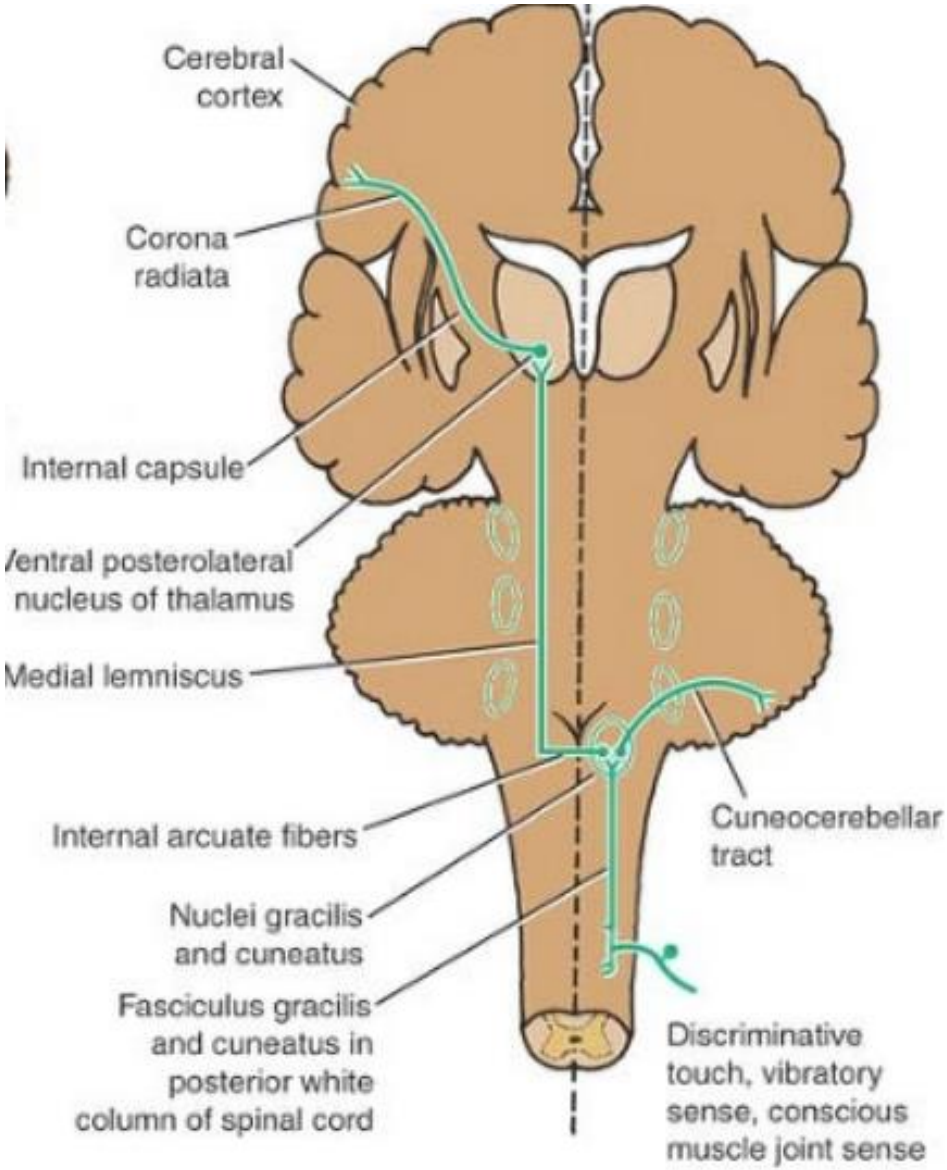
- The axons of the third-order neuron
- leave and pass through the posterior limb of the internal capsule
- And corona radiata to reach the somesthetic area in the postcentral gyrus of the cerebral cortex .



- In this manner
- the impressions of touch with fine gradations of intensity, exact localization, and two-point discrimination can be appreciated.
- Vibratory sense and the position of the different parts of the body can be consciously recognized

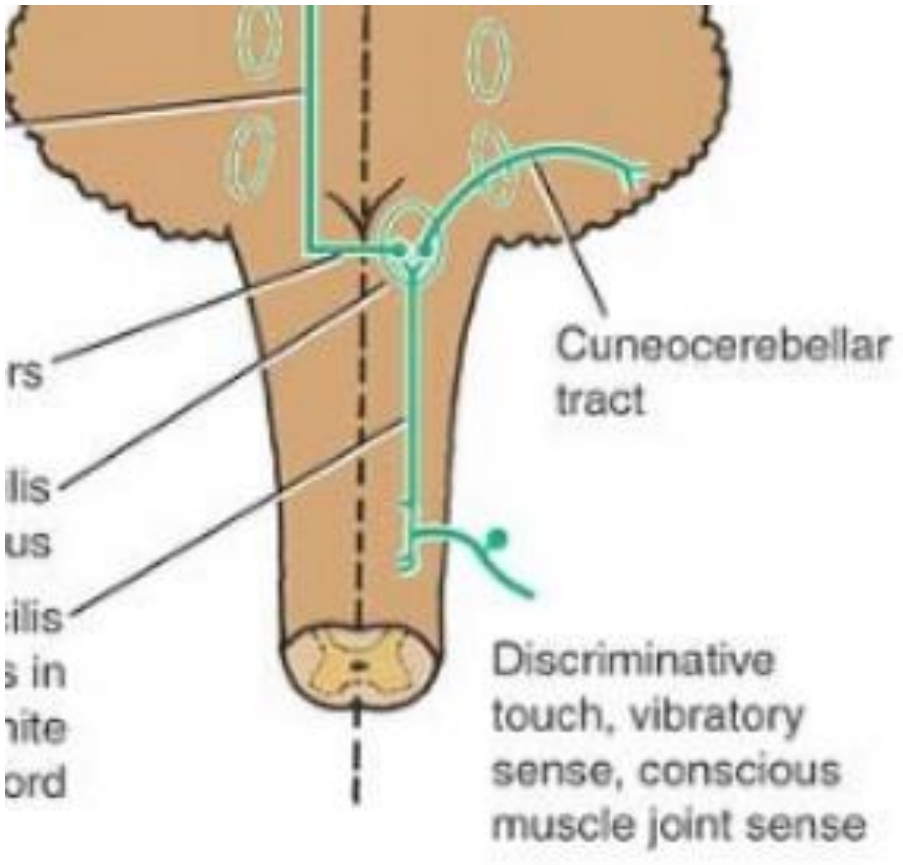
fasciculus cuneatus

- Many fibers in the fasciculus cuneatus from the cervical and upper thoracic segments
- Terminated on the second-order neuron of the nucleus cuneatus,
- As the axons of the second-order neurons to enter the cerebellum through the inferior cerebellar peduncle of the same side .



Cuneocerebellar tract

- This pathway is referred to as Cuneocerebellar tract
- And the fibers are known as the posterior external arcuate fibers.
- Function of these fibers is to convey information of muscle joint sense to the cerebellum.

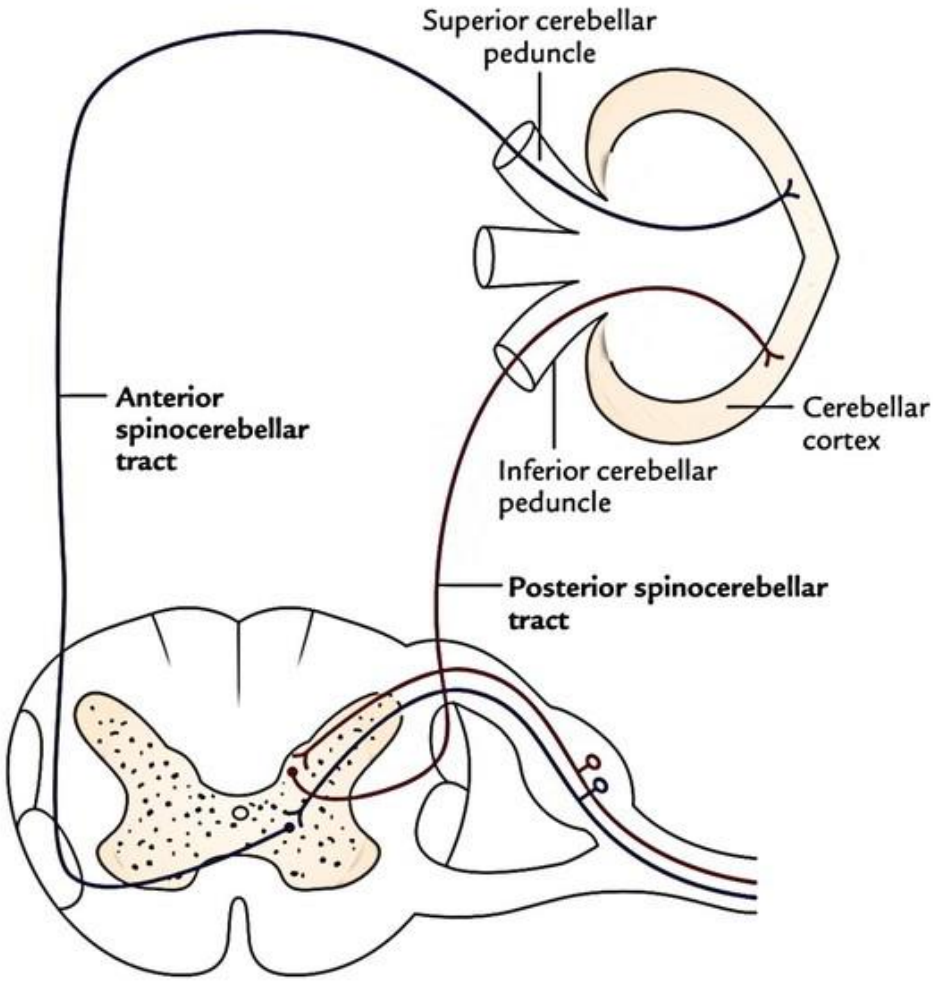


Muscle Joint Sense Pathways to the Cerebellum

Posterior Spinocerebellar Tract

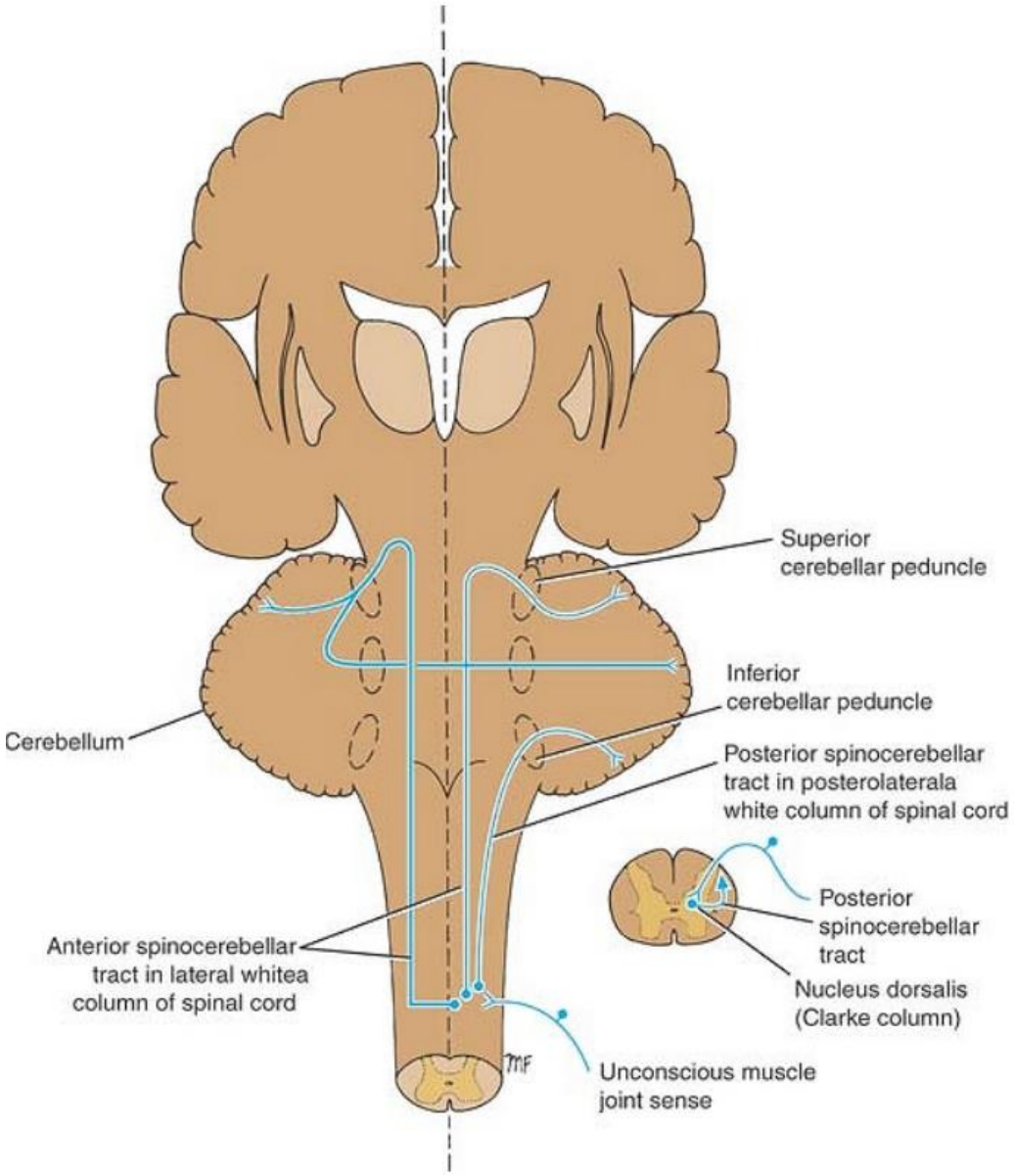
The axons entering the spinal cord from the posterior root ganglion

- Enter the posterior gray column
- Terminate by synapsing on the second-order neurons at the base of the posterior gray column .



Posterior Spinocerebellar Tract

- These neurons are known collectively as the nucleus dorsalis (Clarke's column).
- Axons of the second-order neurons enter the posterolateral part of the lateral white column on the same side
- Ascend as the posterior spinocerebellar tract to the medulla oblongata.
- Here the tract joins the inferior cerebellar peduncle
- Terminates in the cerebellar cortex .



Posterior Spinocerebellar Tract

Note

that it does not ascend to the cerebral cortex.

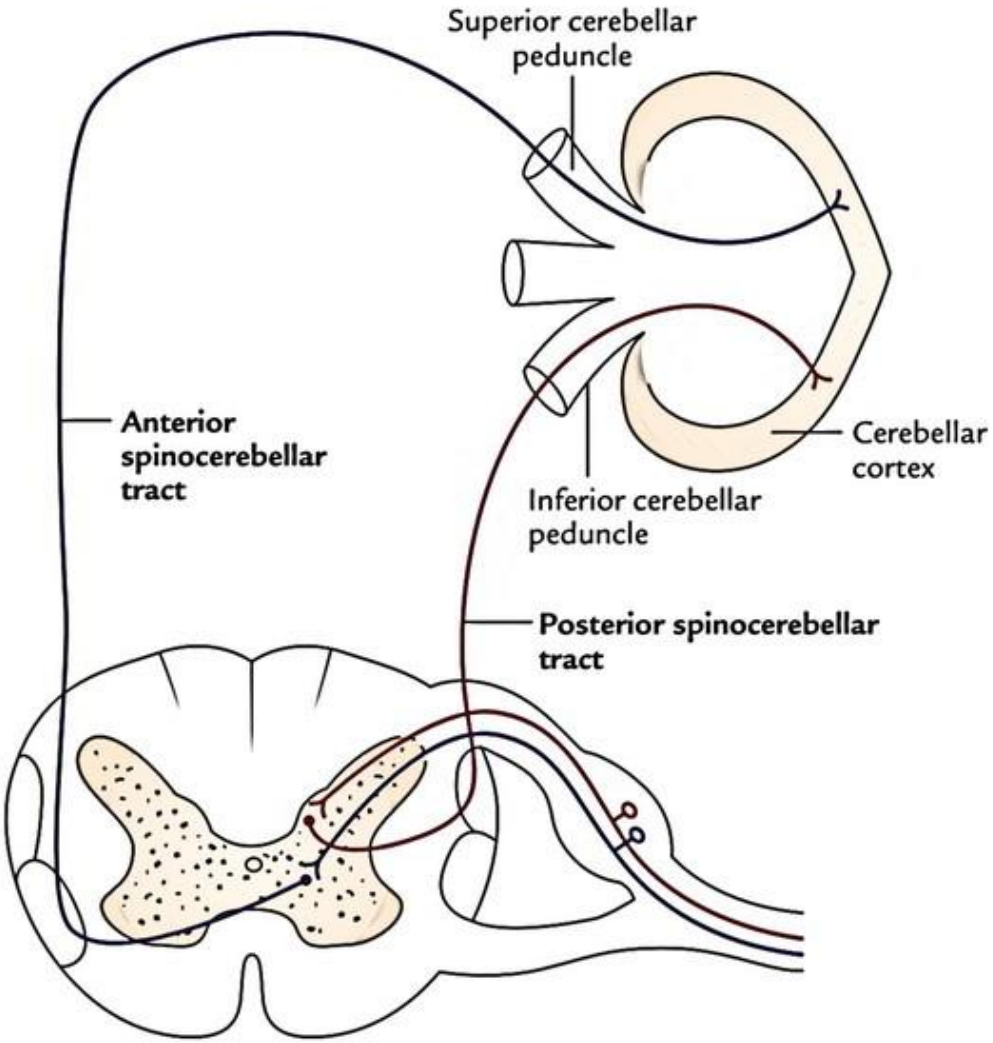
- Because the nucleus dorsalis (Clarke's column) extends only from the eighth cervical segment caudally to the third or fourth lumbar segment

Posterior Spinocerebellar Fibers

- Receive muscle joint information from the muscle spindles, tendon organs
- And joint receptors of the trunk and lower limbs.
- This information concerning tension of muscle tendons
- And the movements of muscles and joints is used by the cerebellum in the coordination of limb movements and the maintenance of posture.

Anterior Spinocerebellar Tract

- The axons entering the spinal cord
- From the posterior root ganglion terminate by synapsing with the second-order neurons in the nucleus dorsalis
- At the base of the posterior gray column



Anterior Spinocerebellar Tract

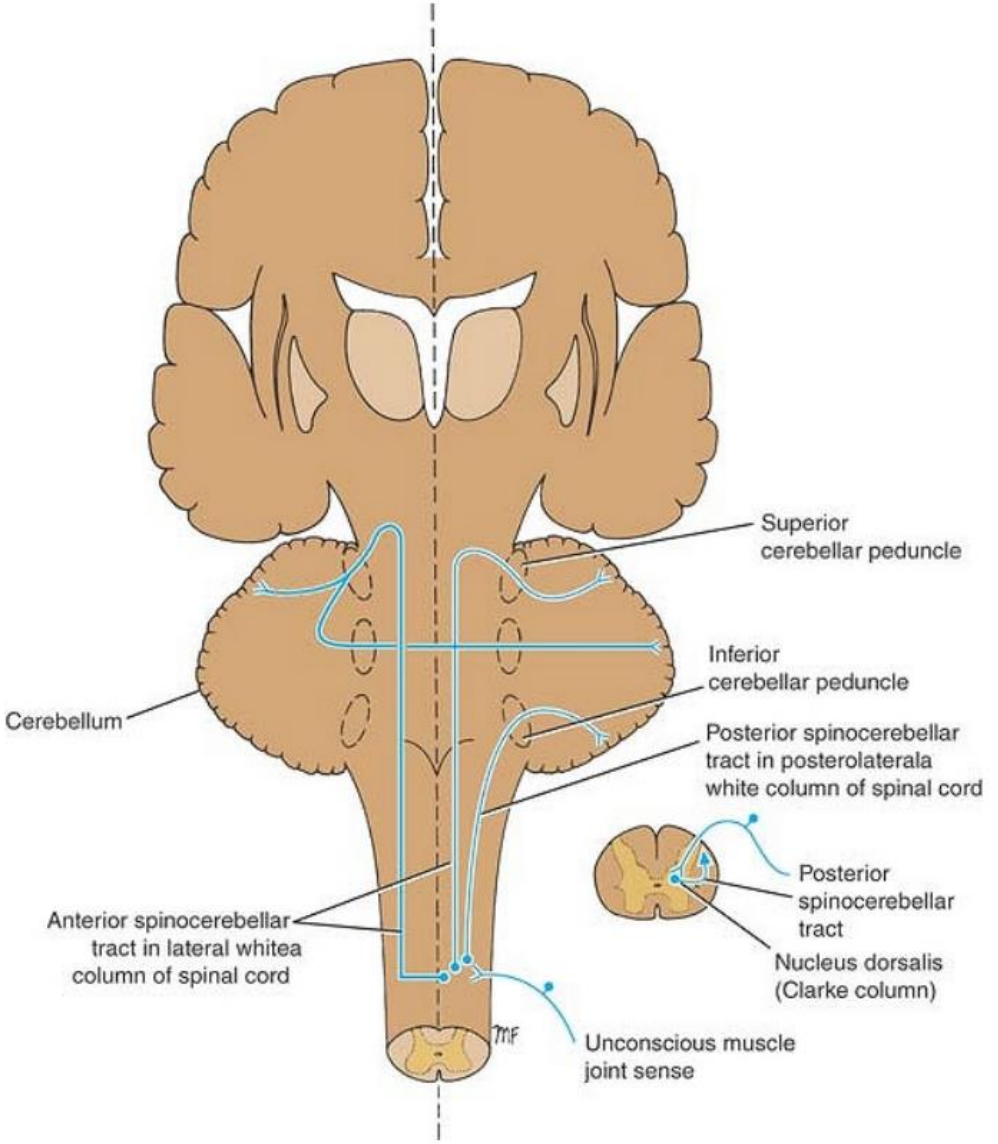
- Axons of the second-order neurons cross to the opposite side

Ascend

As the anterior spinocerebellar tract in the contralateral white column

Minority of the axons ascend

- As the anterior spinocerebellar tract in the lateral white column of the same side .
- The fibers, having ascended through the medulla oblongata and pons, enter the cerebellum through the superior cerebellar peduncle
- Terminate in the cerebellar cortex.
- It is believed that those fibers that crossed over to the opposite side in the spinal cord cross back within the cerebellum .



Anterior Spinocerebellar Tract Function

- It conveys muscle joint information from the muscle spindles, tendon organs, and joint receptors of the trunk and the upper and lower limbs.
- It is also believed that the cerebellum receives information from the skin and superficial fascia by this tract.

thank you!