Ascending tracts 1

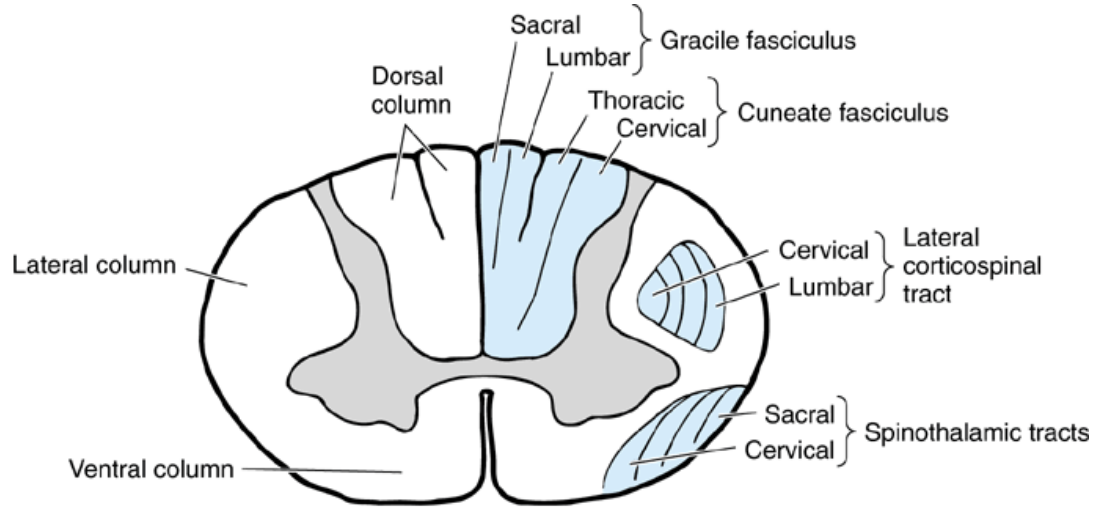
Dr Ashraf Sadek *PhD, MD, MRCPCH*

Assistant Professor of anatomy and embryology

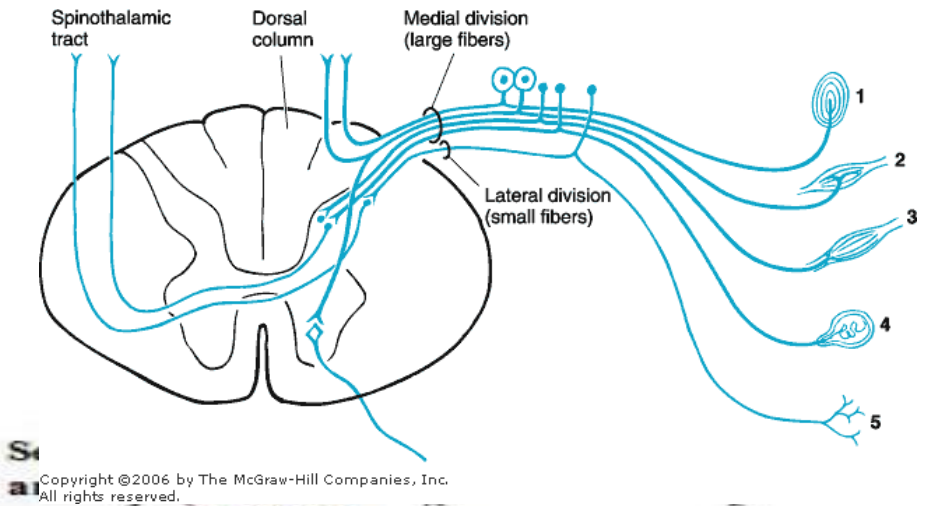
Gracile & Cuneate tracts
Posterior column tracts
conscious proprioception

- **conscious proprioception(sense of position, sense of movement and sense of vibration)**

- **Fine touch (tactile discrimination, tactile localization and sterognosis)**
- Gracile carry from **lower** part of body below T6
- Cuneate carry from **upper** part of body above T6
- Occupy posterior white column gracile is medial while the cunate is lateral

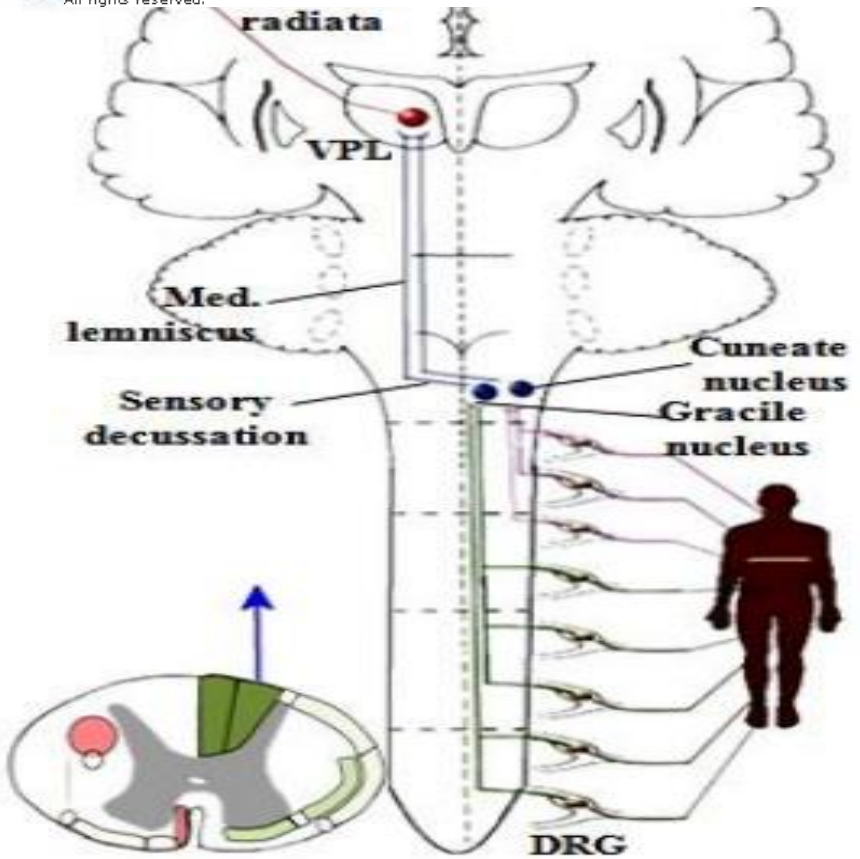


First Neuron: Dorsal Root Ganglion cells which are pseudounipolar.
Their peripheral processes carry sensations from deep receptors (in muscles, tendons & joints).
Their central processes pass to the spinal cord via the dorsal root.
Fibers from the lower part of the body (below T6) ascend medially in the dorsal column forming the gracile tract.
Fibers from the upper part of the body (above T6) ascend laterally in the dorsal column forming the cuneate tract.
Lamination: sacral fibers are most medial & cervical fibers are most lateral.

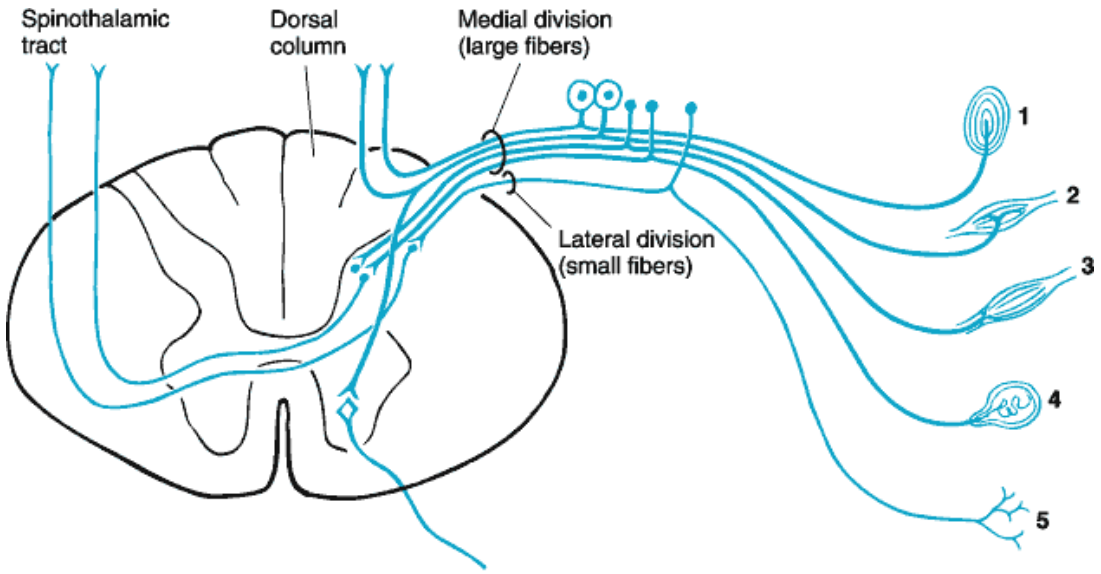


Second Neuron: Gracile & Cuneate Nuclei of the medulla oblongata.
Axons of these nuclei cross the median plane (forming the internal arcuate fibers (sensory decussation). Fibers ascend in brain stem as the medial lemniscus in the opposite side to reach the thalamus
Some cervical fibers end on the accessory cuneate nucleus (posterior to the cuneate nucleus), its axons (cuneo-cerebellar fibers) pass to the cerebellum.

Third Neuron: Ventral posterolateral Nucleus of thalamus (VPLN).Axons of these cells pass through posterior limb of internal capsule, then through corona radiata to reach sensory area of cerebral cortex.

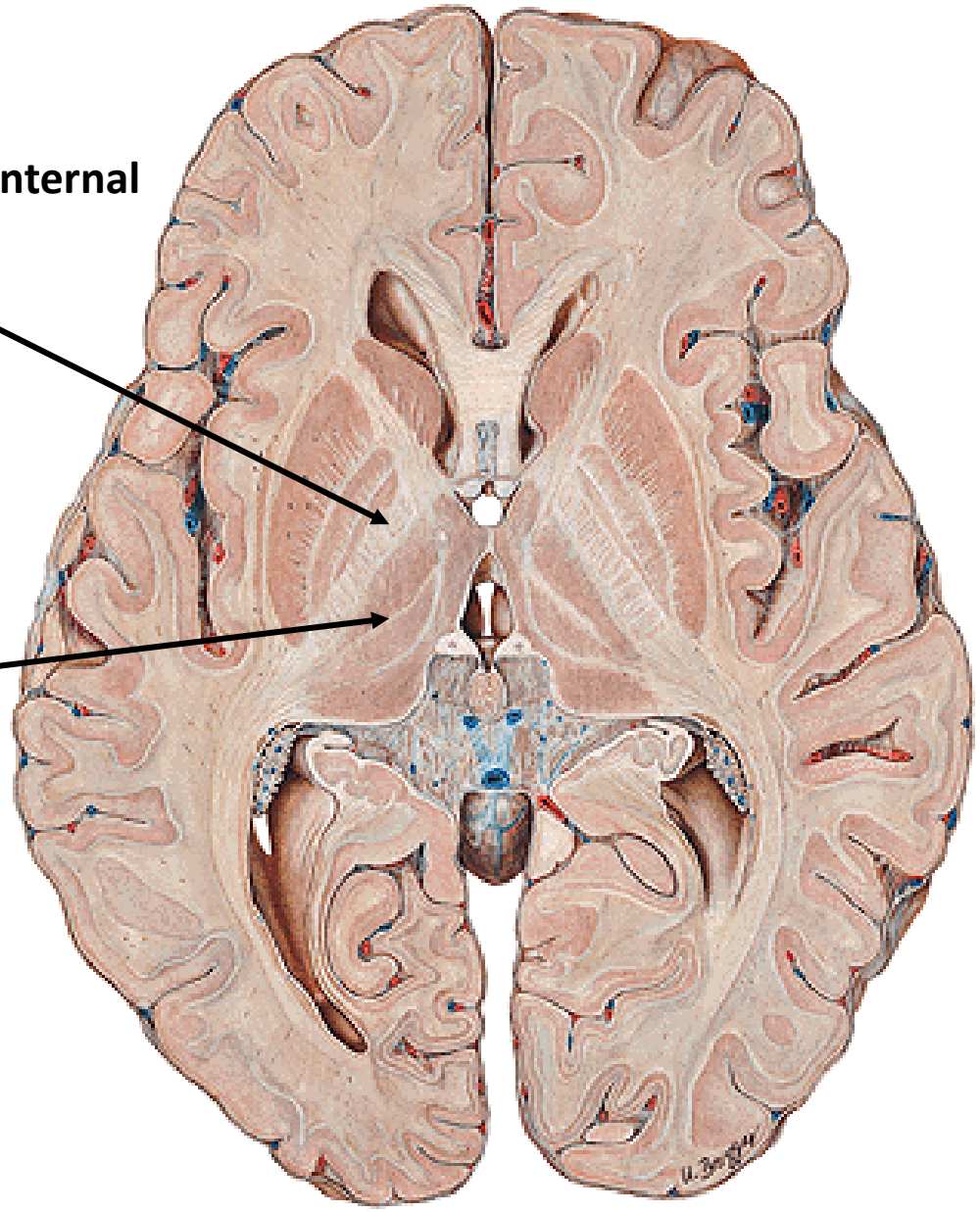


- Formed by central process of dorsal root ganglia , fibers enter spinal cord via dorsal root
- Lamination : coccygeal& sacral fibers are most medial and cervical are lateral
- End in gracile and cuneate nuclei in medulla

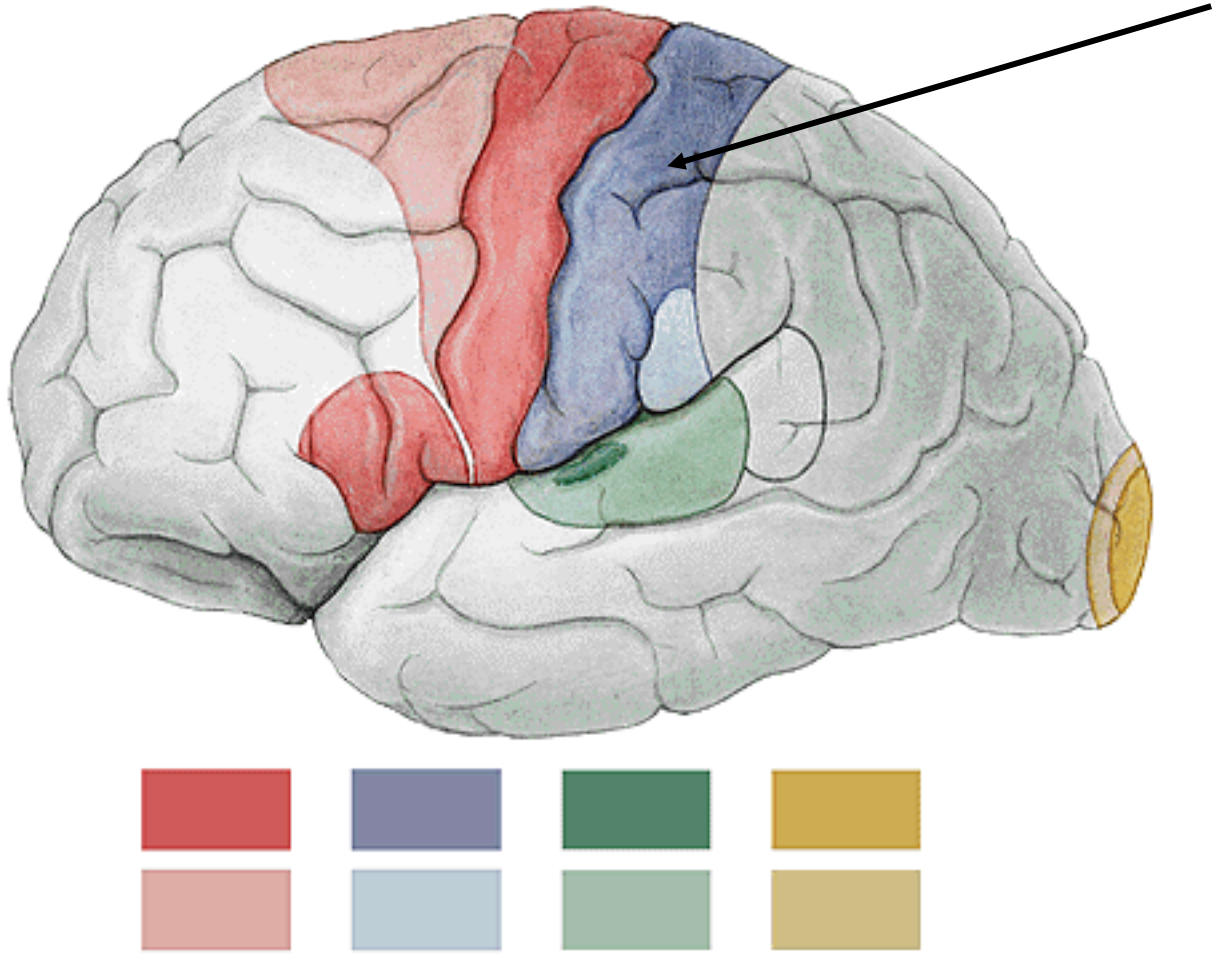


Posterior limb of internal capsule

thalamus

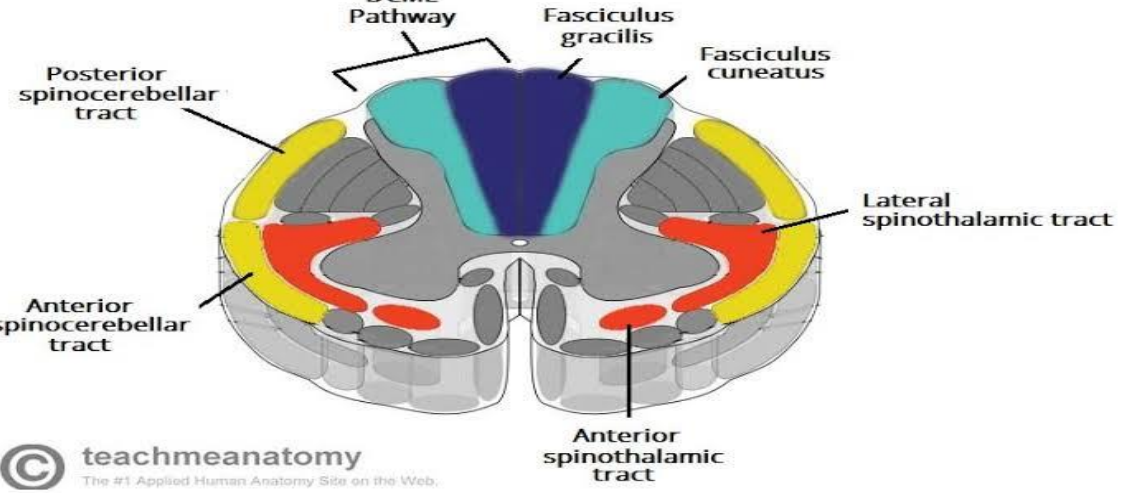


Sensory area



Unconscious Proprioception (to the cerebellum)

Posterior spinocerebellar	• Carries proprioception from lower limb& trunk
Anterior spinocerebellar	• Carries proprioception from lower limb
Spino-olivary	• Carries from upper and lower limbs



Spino- cerebellar tracts

- **Posterior spino cerebellar tract**
- **Carries proprioception from the lower limb & trunk.**
- **The central processes of DRG cells enter the spinal cord via the dorsal root to end on ipsilateral Clarke's nucleus.**
- **The tract ascends ipsilaterally in the lateral white column, posterior to the anterior spinocerebellar tract enters the ipsilateral cerebellum via the inferior cerebellar peduncle (ICP).**

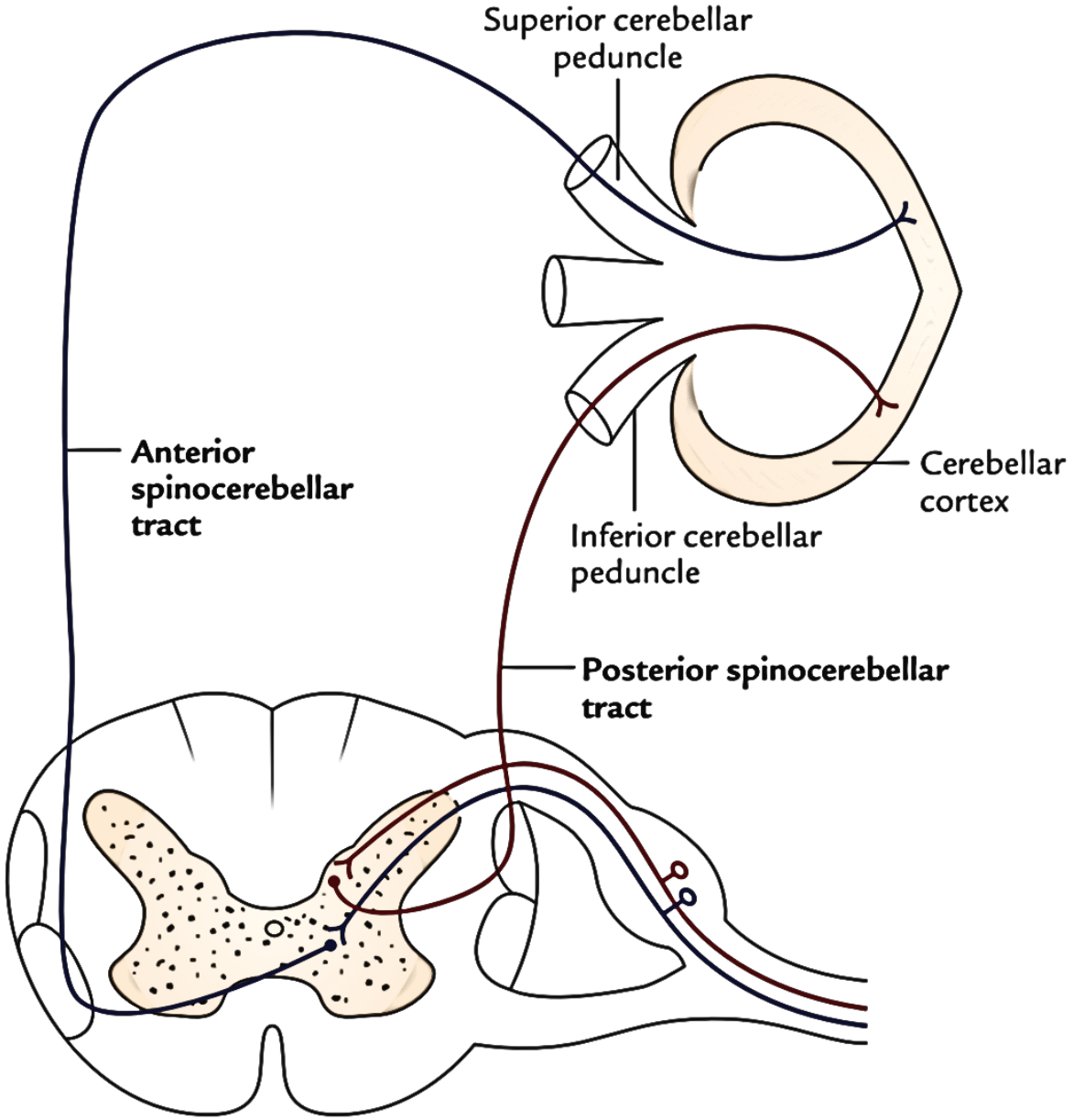
- **Anterior spinocerebellar tract**
- **Carries proprioception from the lower limb.**
- **The central processes enter the spinal cord via the dorsal root to end on Clarke's nucleus. -**

Axons forming the tract mostly decussate but few remain ipsilateral.

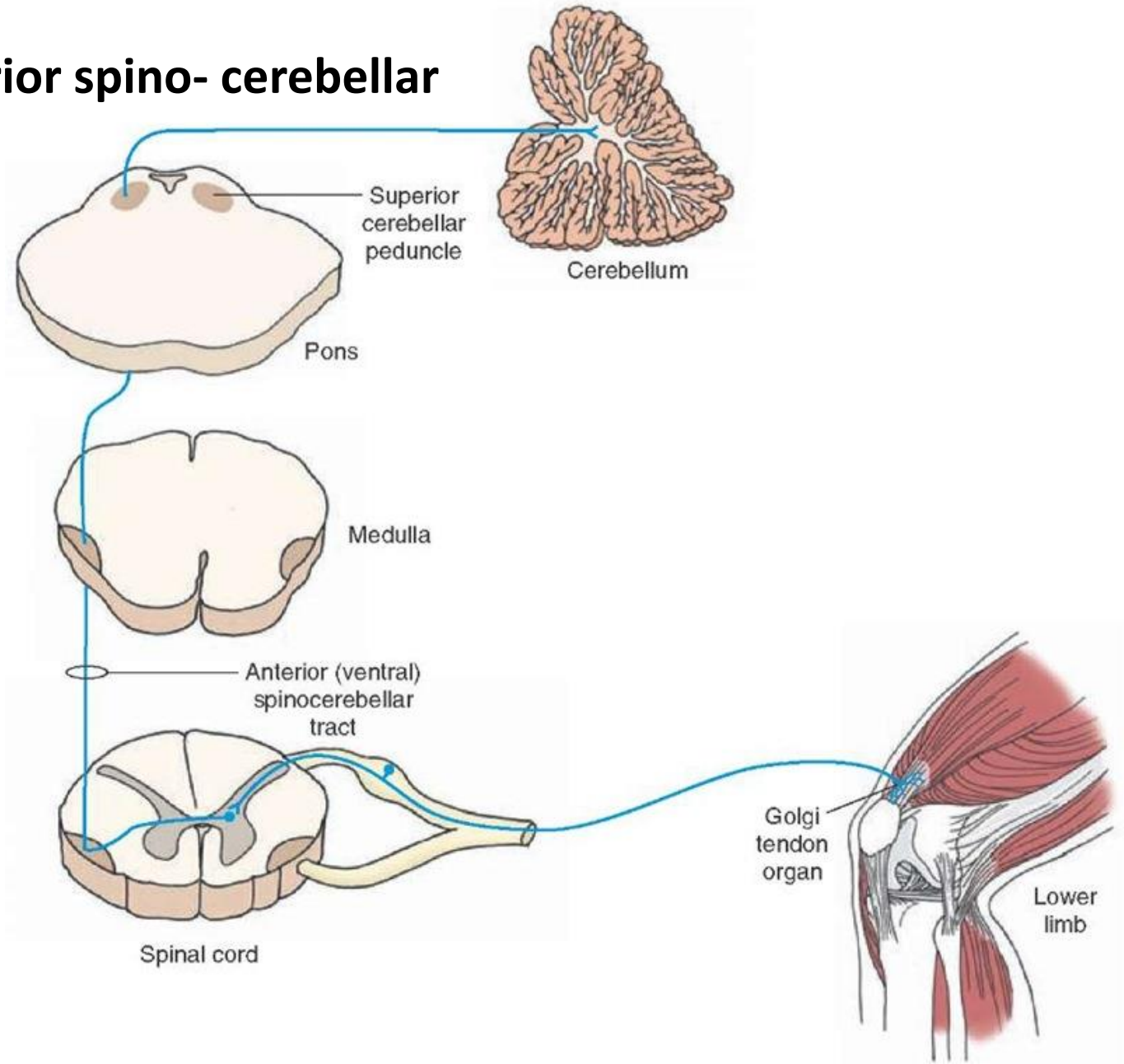
then cross again to reach the ipsilateral cerebellum

They enter the cerebellum via the superior cerebellar peduncle (SCP)

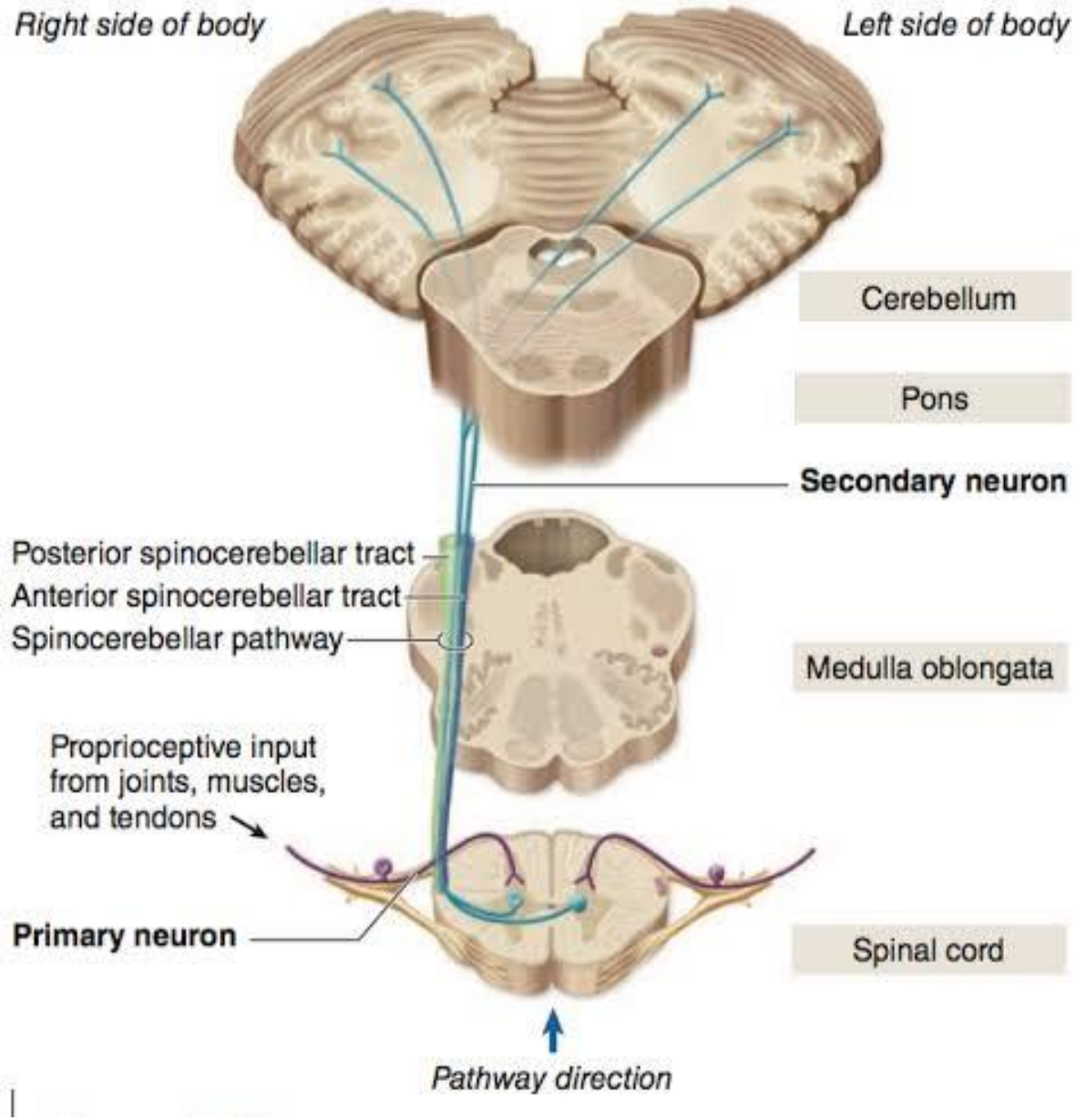
Spino cerebellar tracts

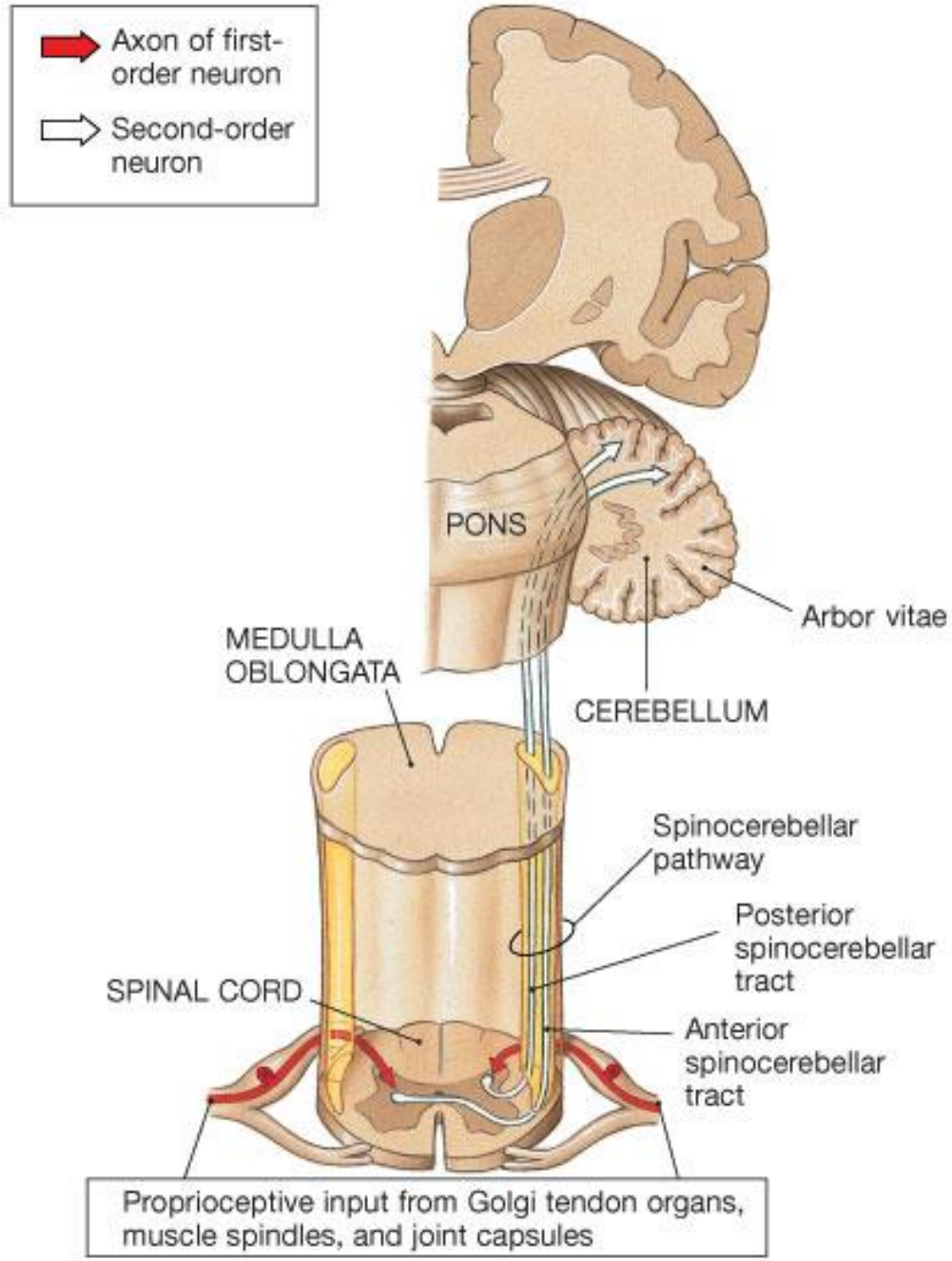


anerior spino- cerebellar

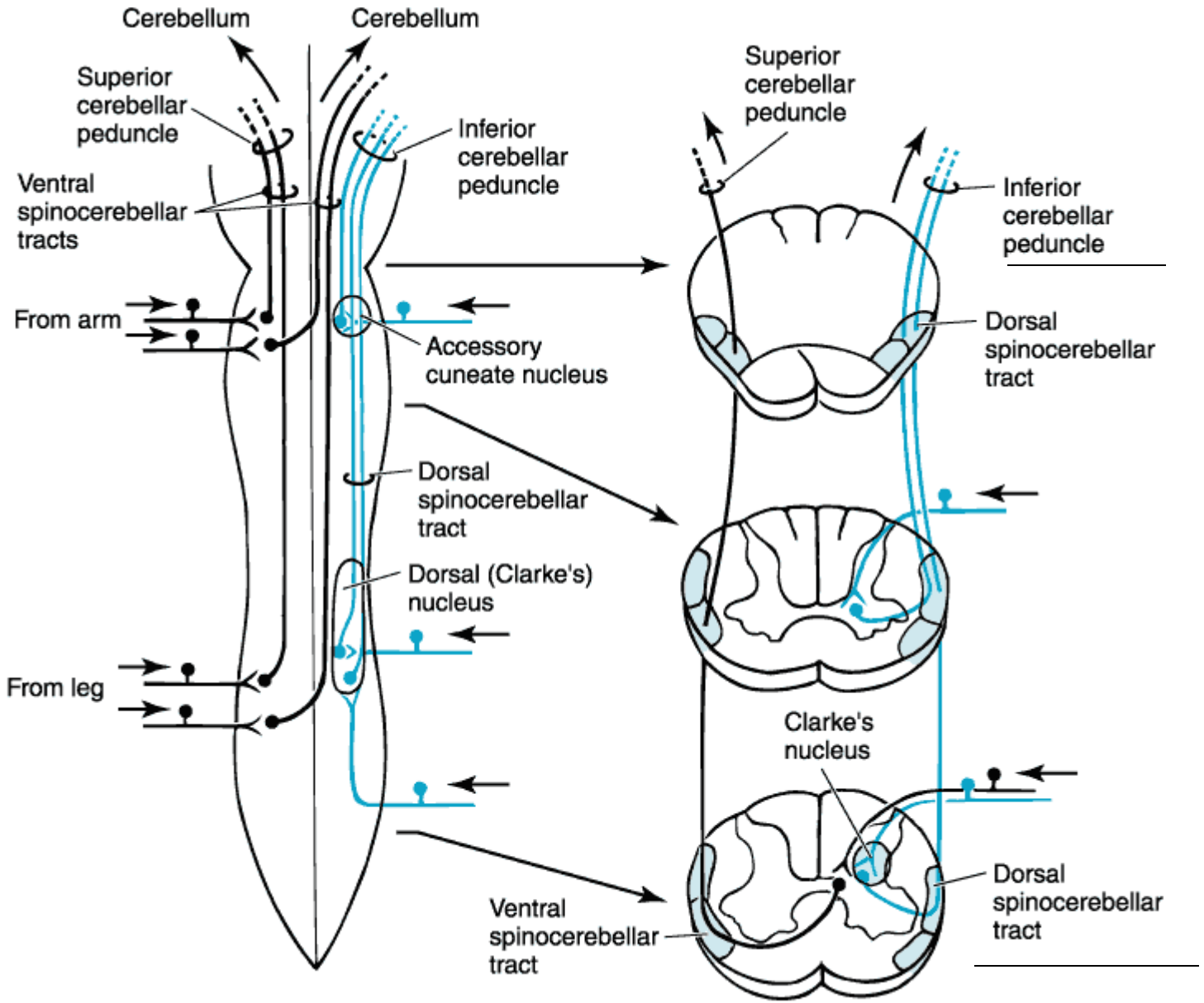


posterior spinocerebellar



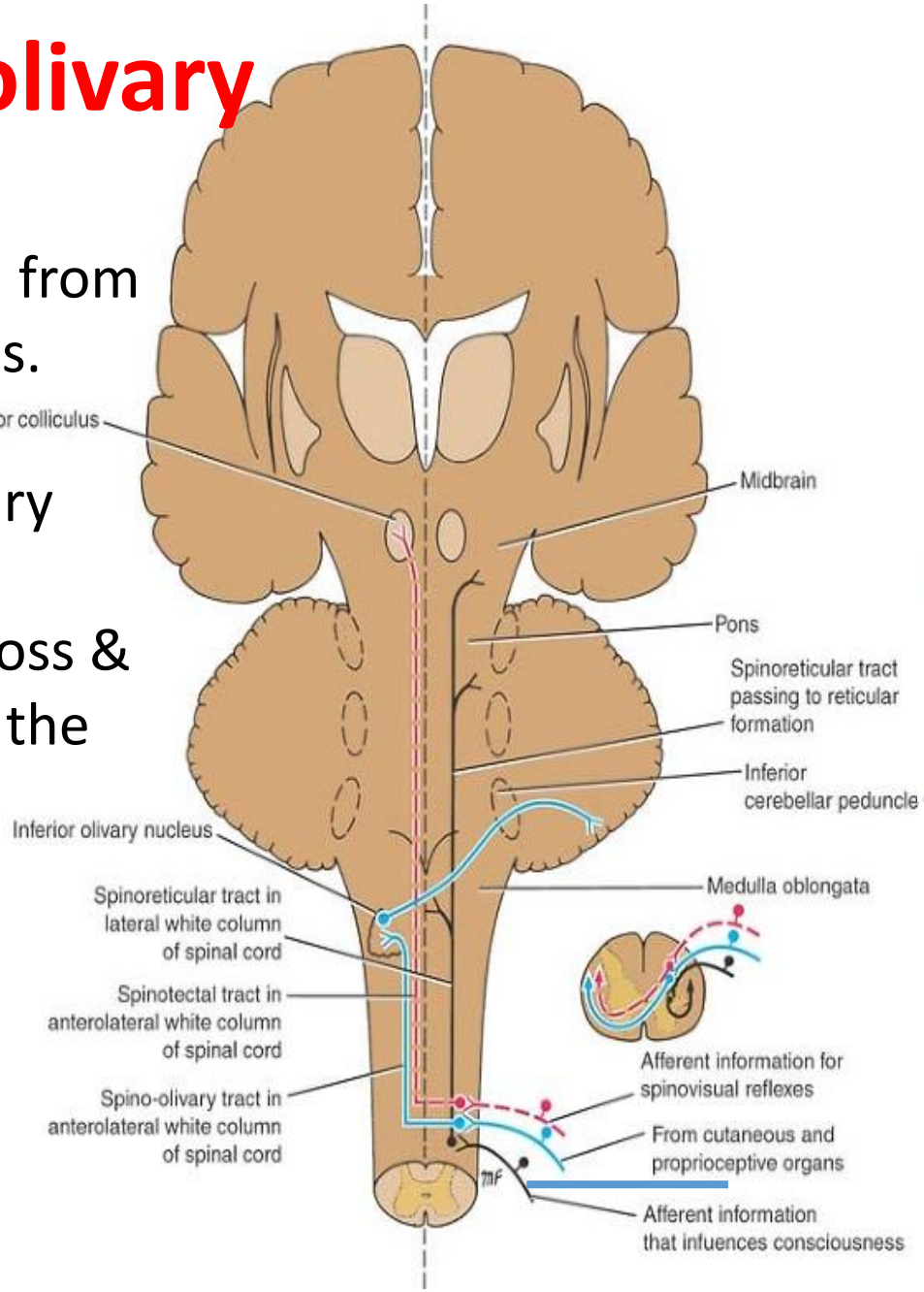


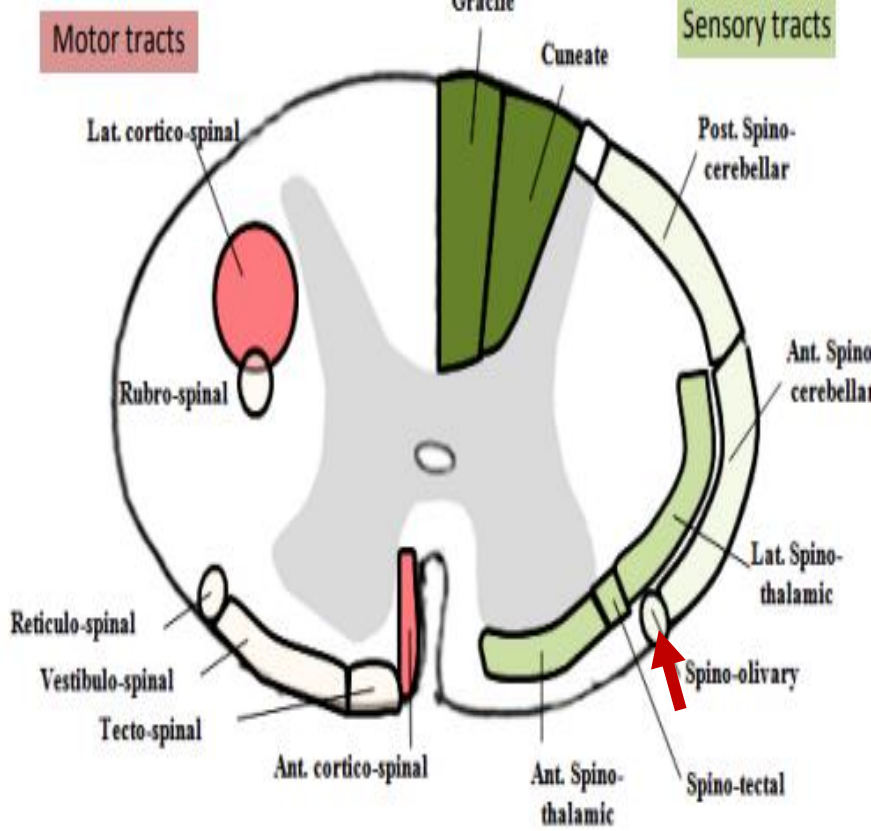
(d) Spinocerebellar pathway



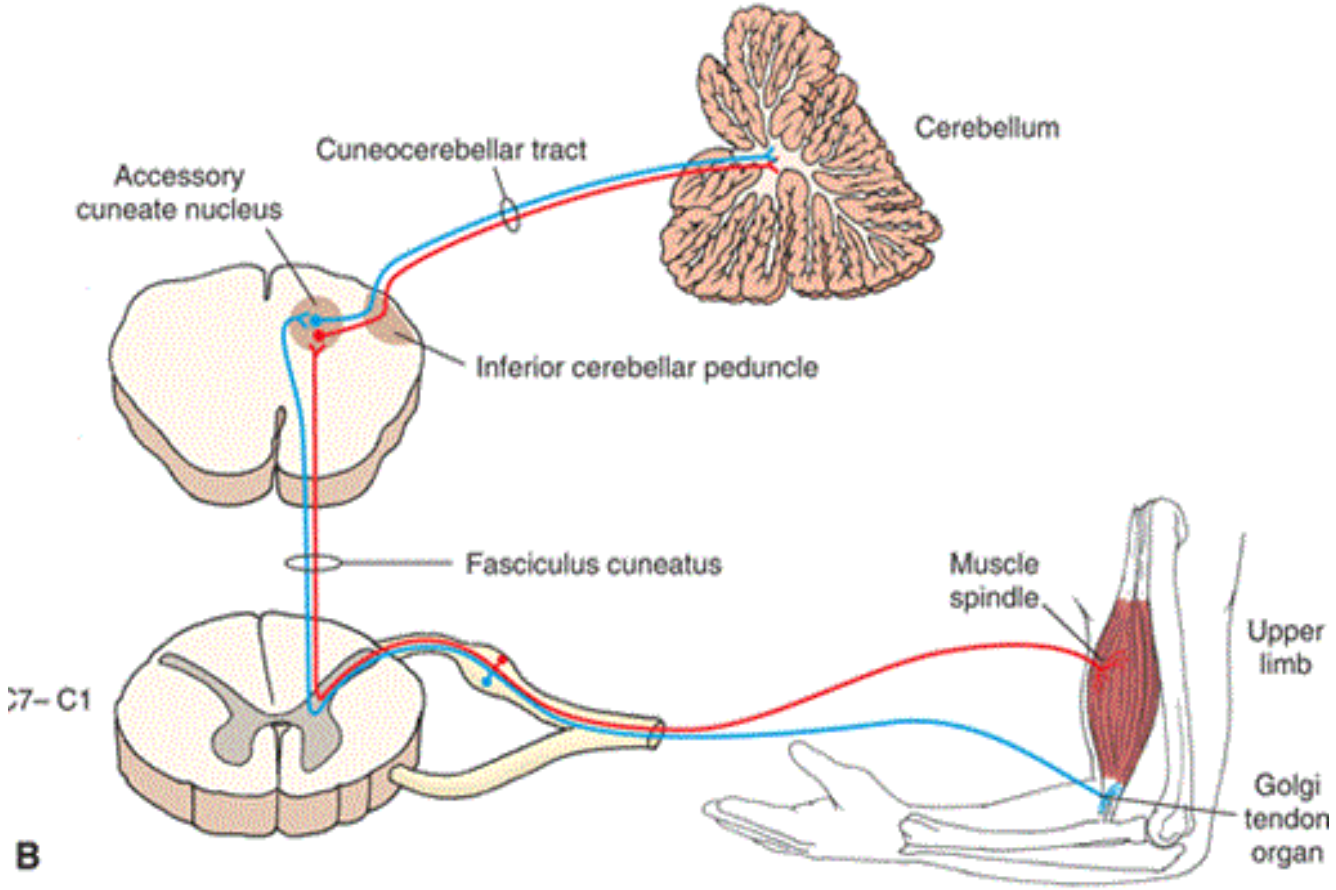
Spino-olivary

- It carries proprioception from both upper & lower limbs.
- Fibers cross
- End in contralateral olivary nucleus
- Olivocerebellar fibers cross & pass via the ICP to reach the ipsilateral cerebellum.



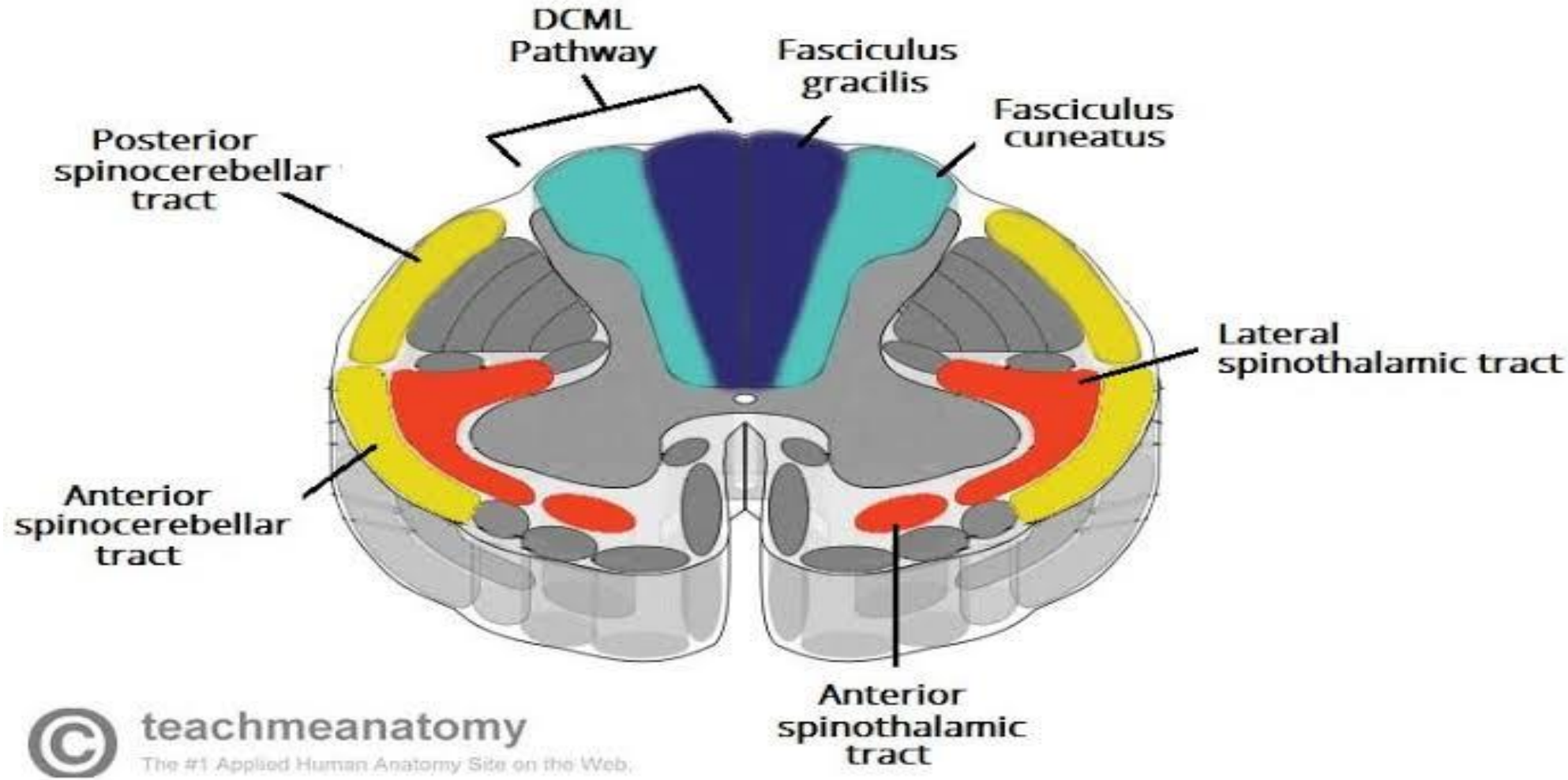


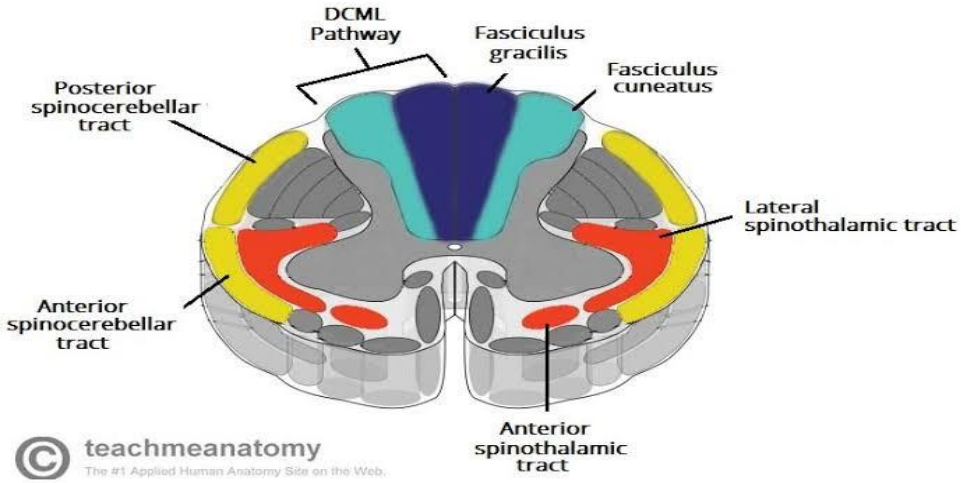
Collaterals from cuneate tract



- ❑ Proprioception from upper limb to accessory cuneate nucleus
- ❑ Fibers from accessory cuneate form external arcuate fibers (Cuneocerebellar tract)
- ❑ Reach ipsilateral cerebellum via the ICP

- Unconsciousness Proprioception from upper limb is carried by spino olivary and Cuneocerebellar tracts.
- Unconsciousness Proprioception from lower limb is carried by spino olivary and spinocerebellar tracts.


DCML
Pathway
Fasciculus
gracilis
Fasciculus
cuneatus
Posterior
spinocerebellar
tract
Lateral
spinothalamic tract
Anterior
spinocerebellar
tract
Anterior
spinothalamic
tract
© teachmeanatomy
The #1 Applied Human Anatomy Site on the Web.



Antero lateral system (Spino-thalamic)

Lateral Spino-thalamic Tract

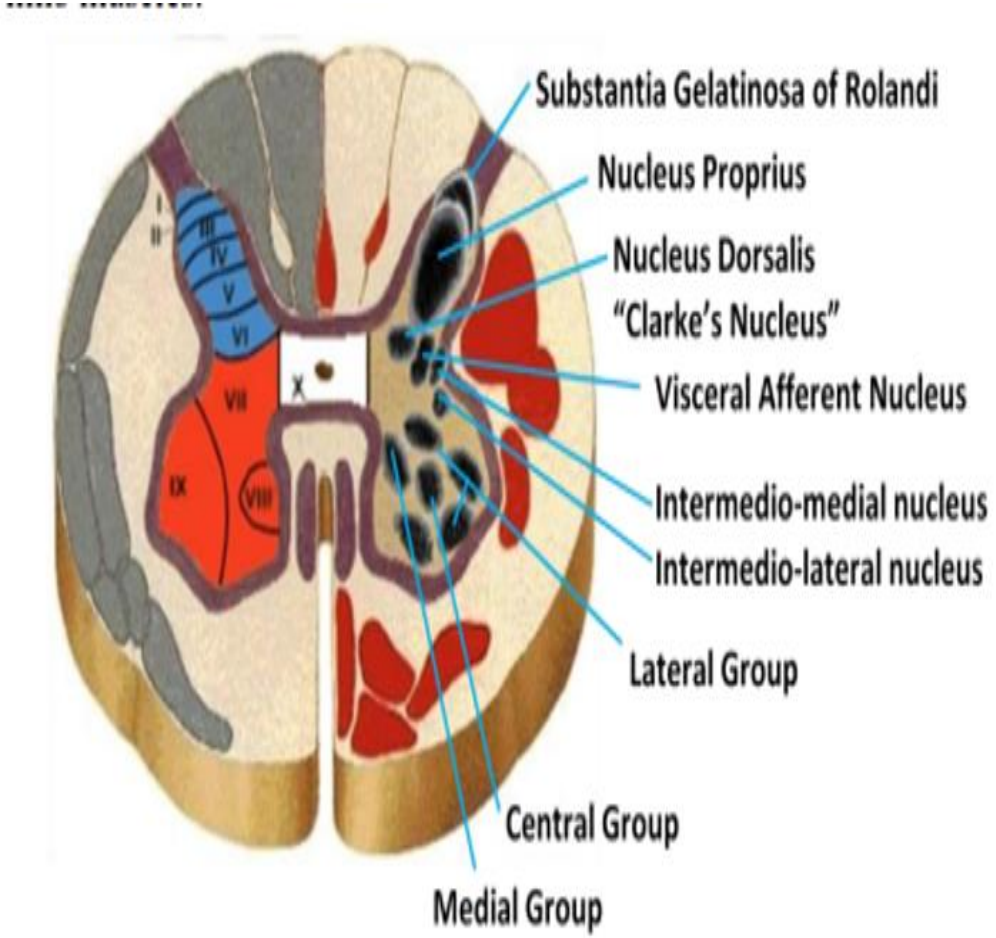
Pain pathway

Ventral spino-thalamic tract

Pathway of touch & pressure

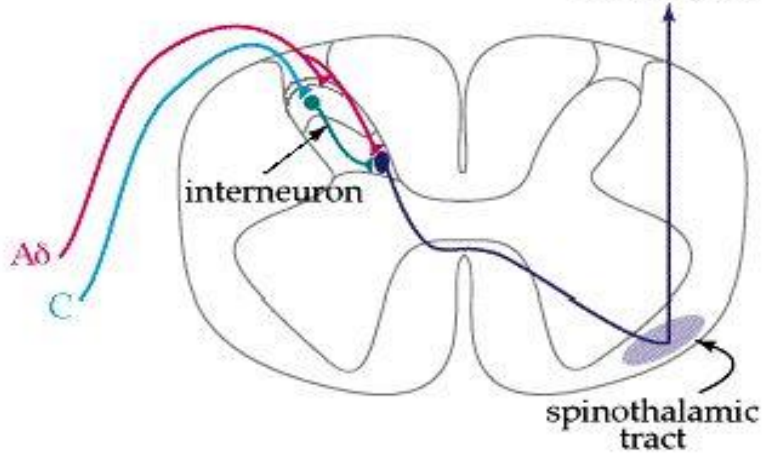
Lateral Spino-thalamic Tract

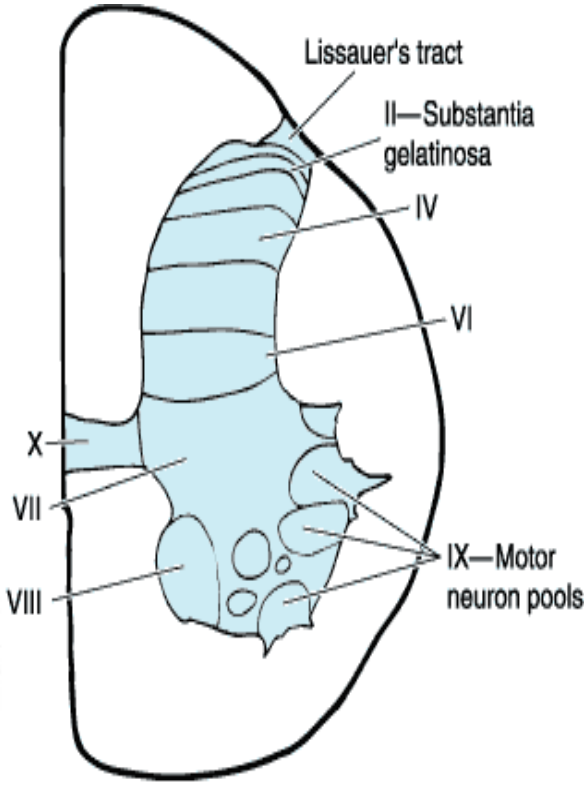
- Carries pain and temperature , it lies in lateral white column
- Begins from lamina I,IV, VIII
- Lamination cervical fibers are medial
- End on VPL of thalamus

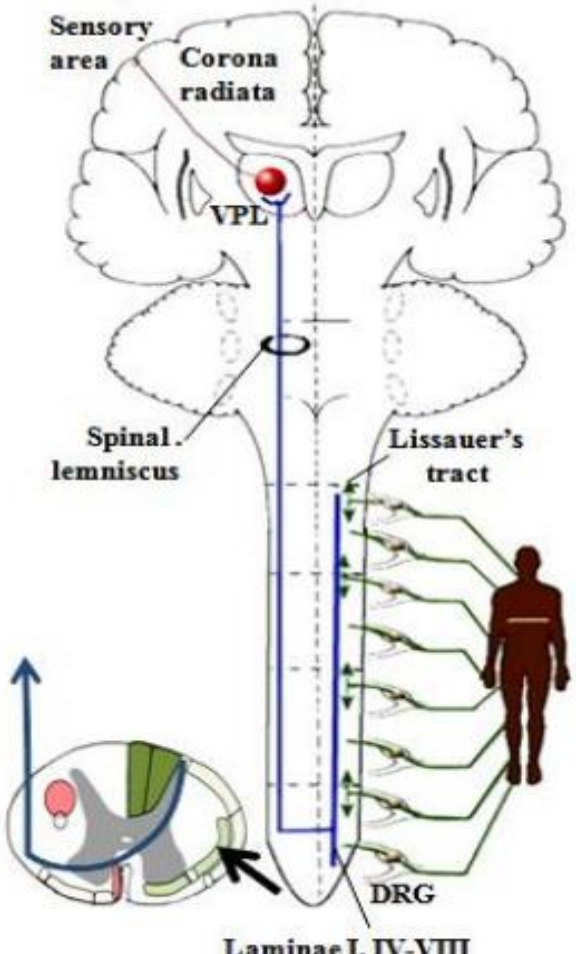


Pain pathway

Lateral Spino-thalamic Tract







First neuron ; Dorsal root ganglion cells (pseudounipolar) Their peripheral processes carry pain & temperature sensations from the receptors (free nerve endings in skin).

Their central processes enter the spinal cord via the dorsal root and divide into ascending & descending branches for few segments, These fibers run in the dorsolateral (Lissauer's) tract which lies over the apex of the dorsal horn.

They end on neurons in many Laminae of the grey matter of the spinal cord mainly **Lamina I & IV – VIII**

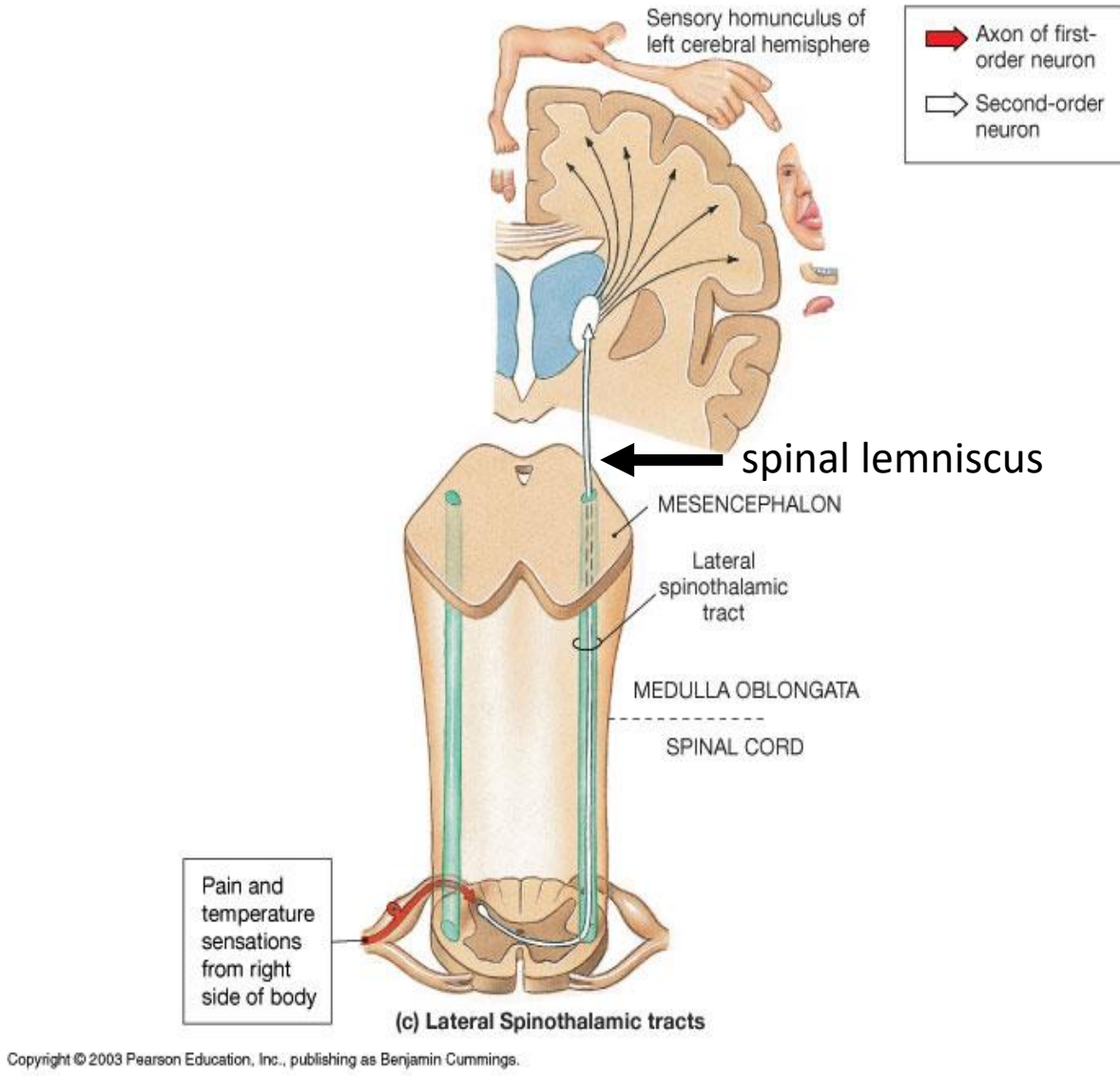
Second neuron :

Neurons in Laminae I, IV-VIII of grey matter of spinal cord. Axons of these neurons cross to the opposite side in the ventral commissure & ascend in the lateral white column as the lateral spinothalamic tract. As the tract ascends, its fibers are laminated so that cervical fibers are most medially and sacral fibers most laterally.

The tract ascends in the brain stem as the **spinal lemniscus.**

It reaches the thalamus where it ends on VPLN of thalamus.

Third neuron :Axons of VPLN pass in posterior limb of internal capsule to reach sensory area



Ventral spinothalamic

- Carries touch and pressure, lies in anterior white column
- Begins from lamina IV- VII
- Cervical fibers are medial
- End on VPL

Pathway of crude touch & pressure

First neuron :Peripheral processes of these cells carry touch & pressure from the receptors &Central processes of dorsal root ganglia enter spinal cord via dorsal root end on lamina IV-VII

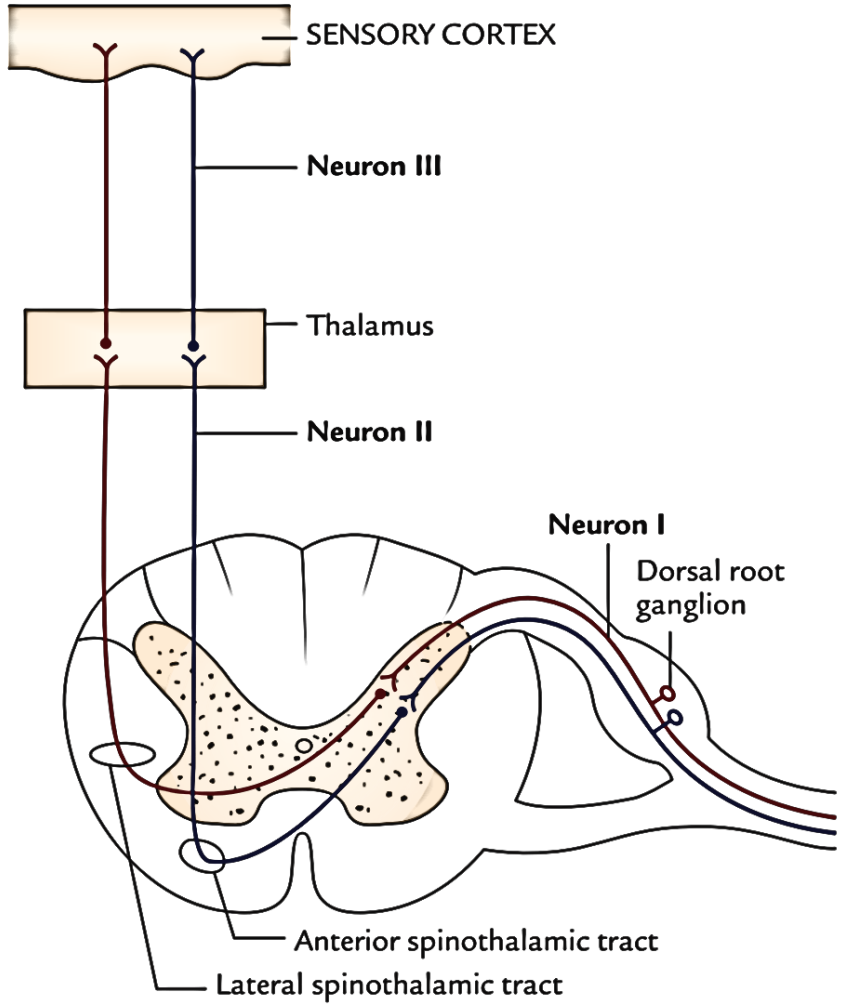
Second neuron :

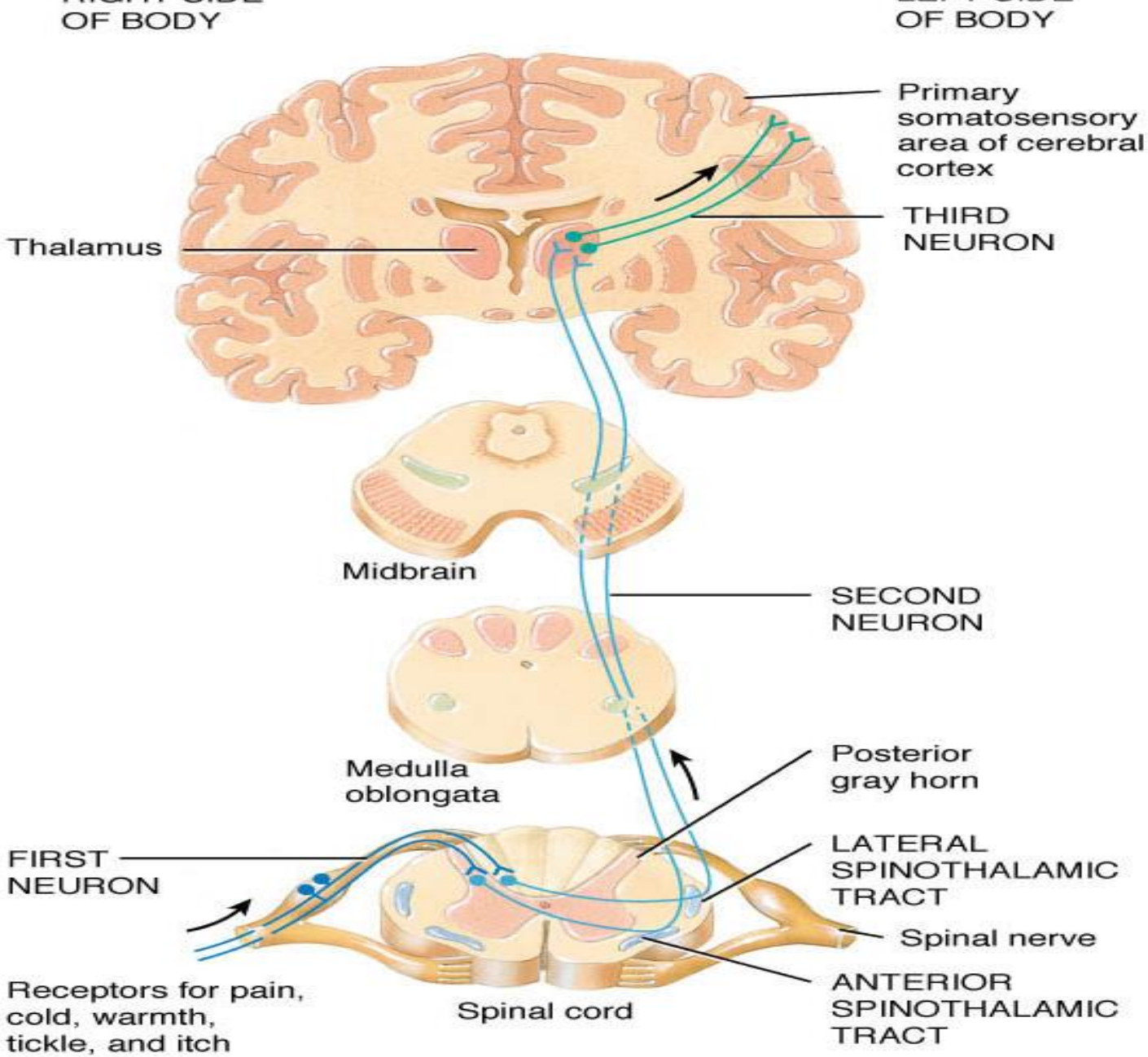
- Axons of lamina cross in ventral white column ascend as ventral spinothalamic tract, cervical fibers are medial
- Ascends in brain stem , joins medial lemniscus
- Reach VPL of thalamus

Third neuron :

- fibers of VPL Pass in posterior limb of internal capsule
- Reach sensory area of cerebral cortex

- **Note: Not all spinothalamic fibers end on VPLN of thalamus, some fibers end on intralaminar nuclei and midline nuclei. These fibers are probably involved in arousal behavior.**



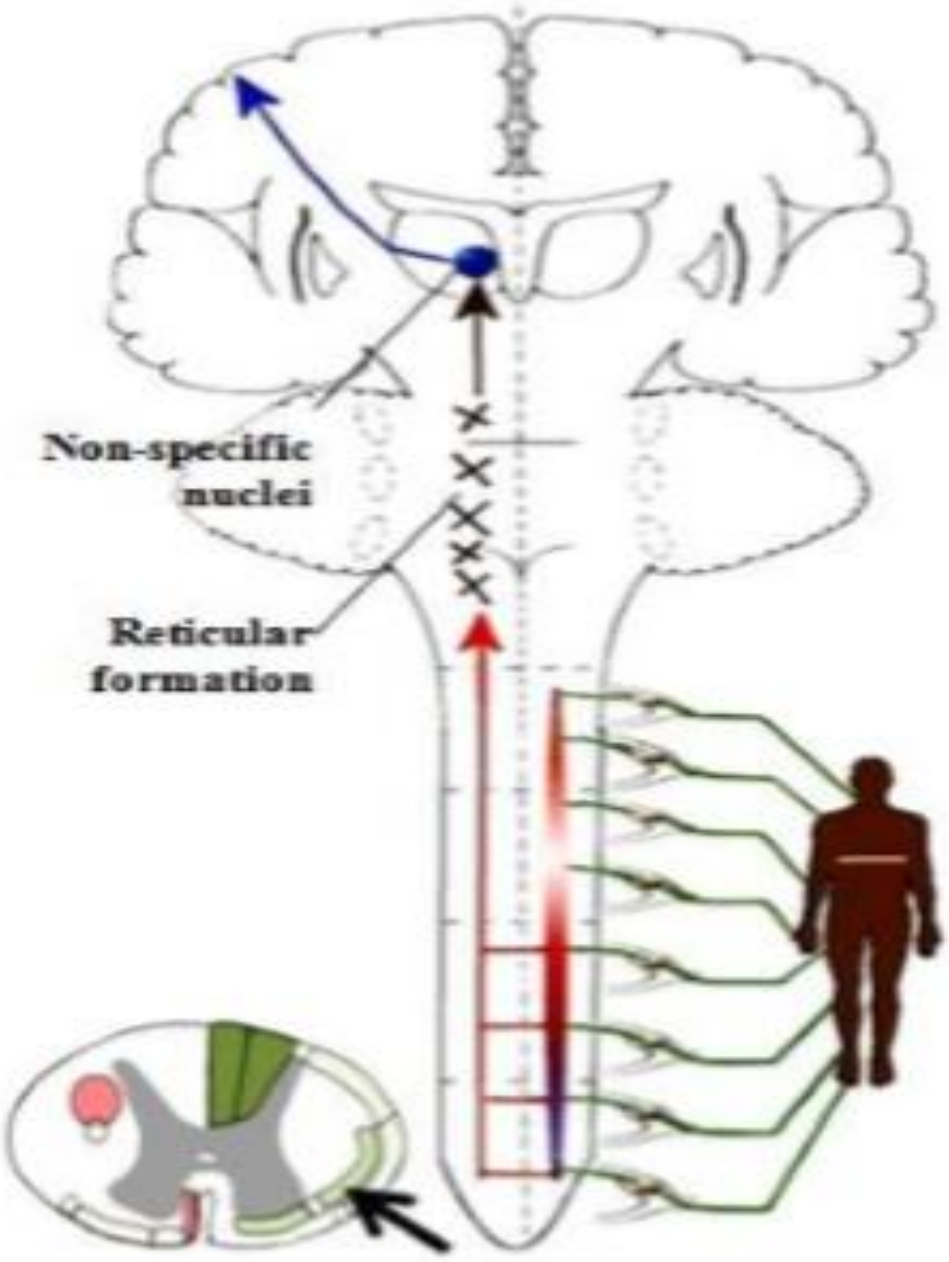


(b) Anterolateral (spinothalamic) pathways

Other Ascending Tracts

Spino- reticular

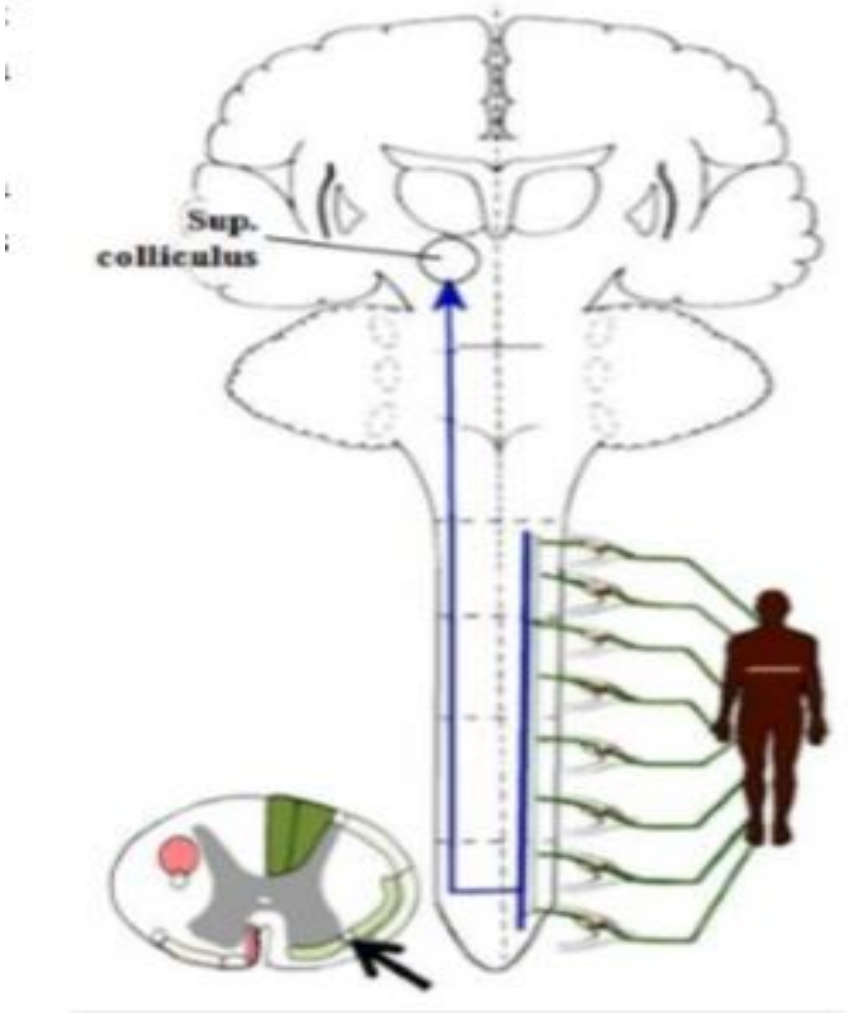
- In lateral & ventral white column
- Mostly crossed
- End in pontine and medullary reticular formation
- Route for slow dull pain



Other Ascending Tracts

Spino-tectal

- In lateral white column
  - mostly Crossed
  - End in superior colliculus of mid brain
  - Head turning towards source of pain



Pain &temperature from the face

is carried by the trigeminal nerve.

1. First Neuron is Trigeminal Ganglion (formed of pseudounipolar cells as DRG)
2. Second Neuron is Spinal Nucleus of Trigeminal. Its axons cross to opposite side forming trigemino-thalamic tract which ascends to end on the ventral posteromedial nucleus (VPMN) of thalamus
3. Third Neuron is VPMN of thalamus whose axons pass in internal capsule, then the corona radiata to reach sensory area of face in cerebral cortex.

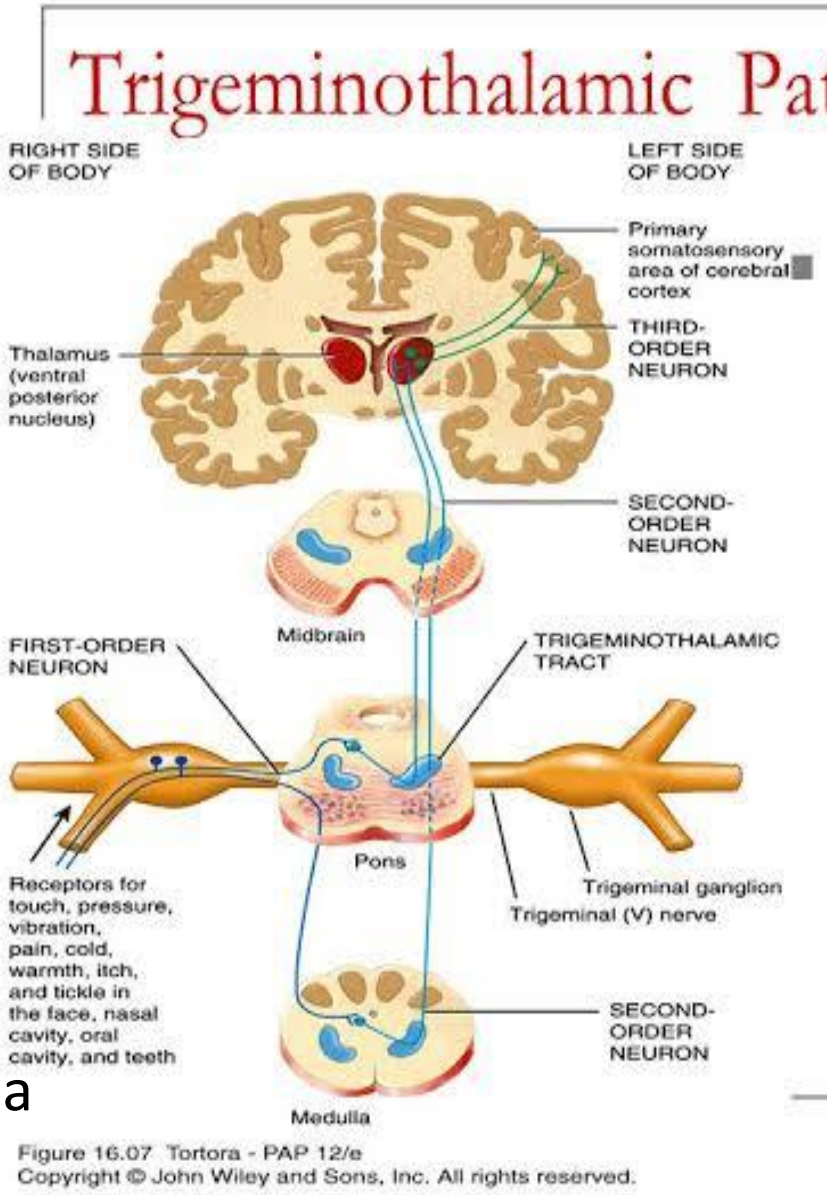


Figure 16.07 Tortora - PAP 12/e

Conveys nerve impulses for most somatic sensations from the face, nasal cavity, oral cavity and teeth to the cerebral cortex.

Thank you