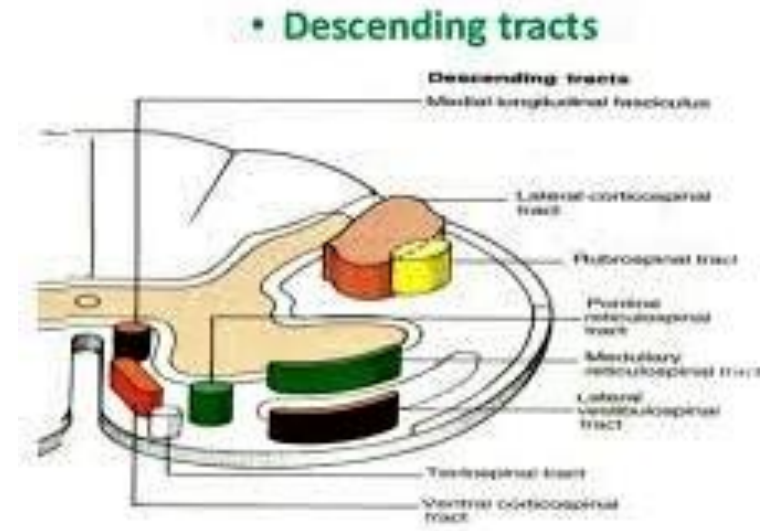
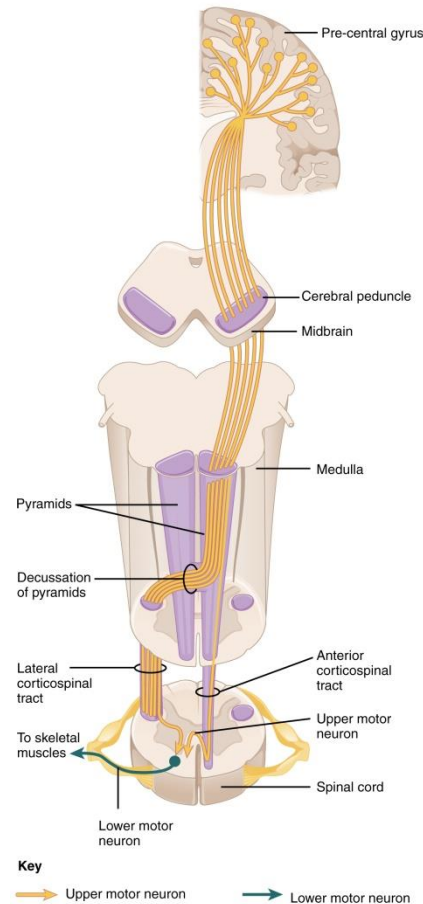
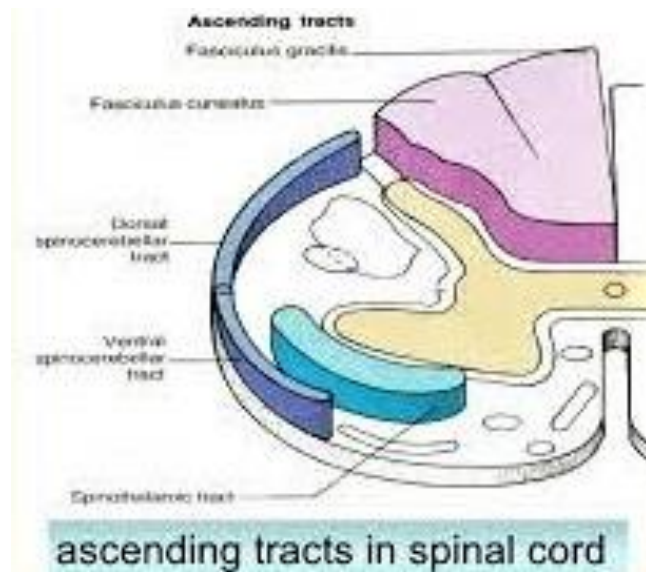


Spinal Cord - 2



Dr. Shantanu Mallick MD

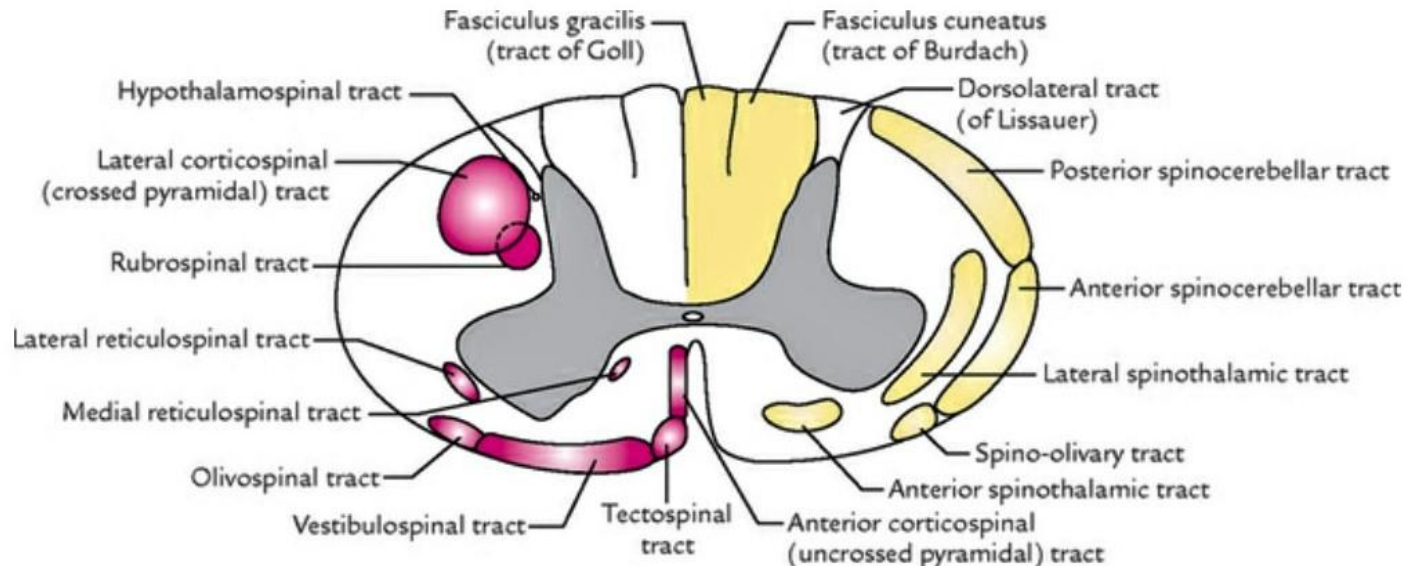
Tracts / Fasciculi / Lemnisci

- Tracts are the collections of nerve fibres within the central nervous system, which have same origin, course and termination.
- Sometimes tracts are referred to as *fasciculi* when they are in bundles.
- Also tracts are referred to as *lemnisci* when they look like ribbons
- Tracts are named after the names of masses of grey matter connected by them and first term denotes the origin and the second term denotes the termination grey matter.
- Example:
 - **Corticospinal tract**: tract arising in cerebral cortex and terminating in the spinal cord.
 - **Spinothalamic tract**: tract arising from spinal cord and terminating in the thalamus.
- Classification of tracts:
 - Descending tracts
 - Ascending tracts



Descending & Ascending tracts

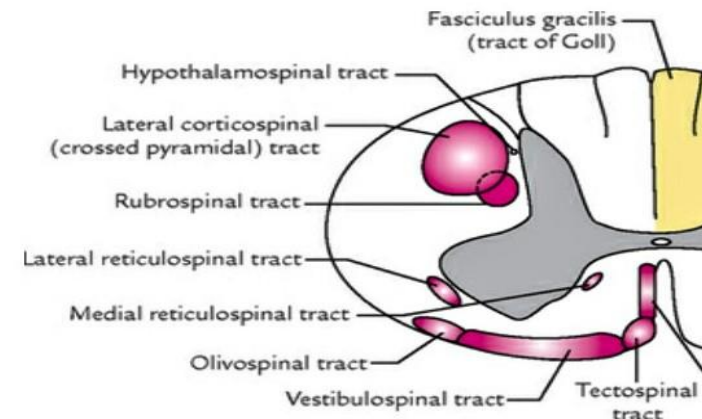
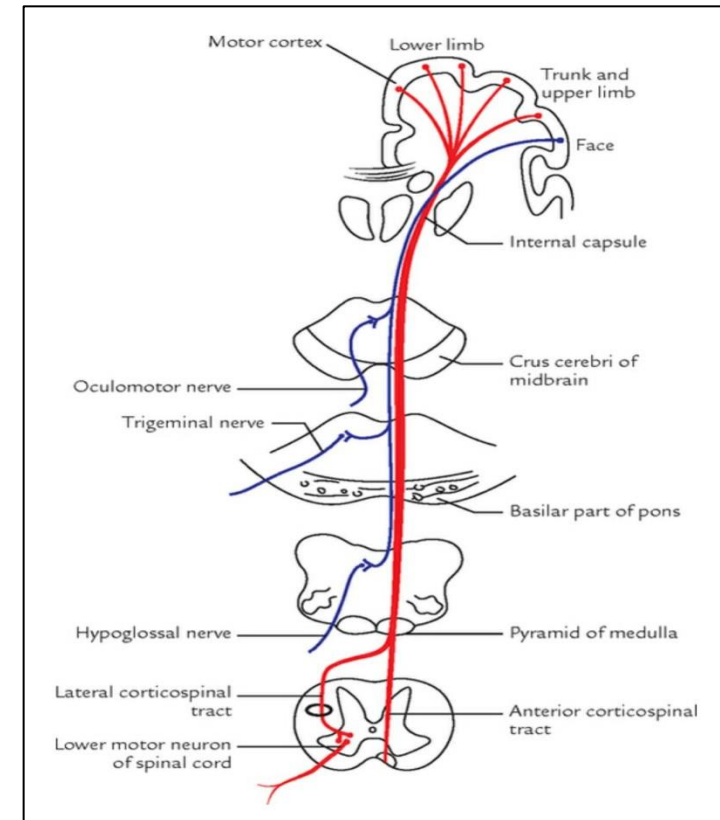
Column	Descending tracts	Ascending tracts
Anterior white column	Anterior corticospinal, Vestibulospinal, Tectospinal, Medial reticulospinal	Anterior spinothalamic tract
Lateral white column	Lateral corticospinal, Rubrospinal, Lateral reticulospinal, Hypothalamospinal	Lateral spinothalamic, Anterior spinocerebellar, Posterior spinocerebellar, Spinotectal
Posterior white column		Fasciculus gracilis (tract of Goll), Fasciculus cuneatus (tract of Burdach)



Corticospinal tracts (Pyramidal tract):

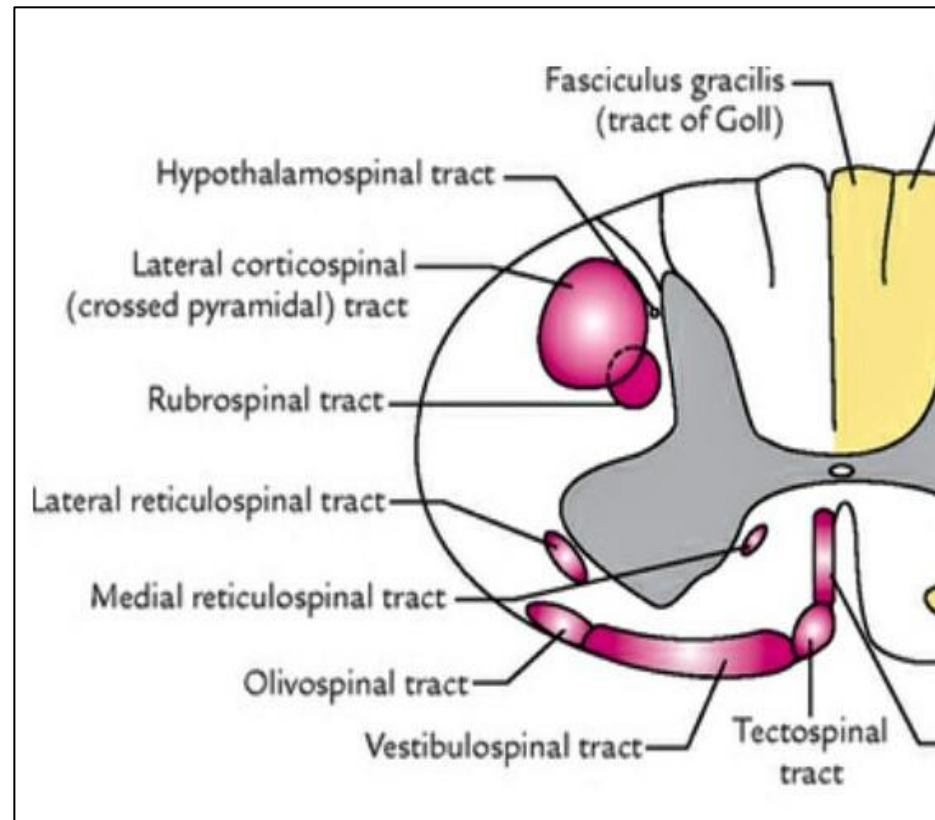
- Lateral and anterior corticospinal tracts mediate voluntary motor activities
- Pyramidal tract consists of about one million fibres
- **Origin:** cerebral cortex
- **Course:**
 - fibres pass through corona radiata, internal capsule, crus cerebri, ventral part of pons and pyramids of medulla. In the lower part of medulla almost 75% fibres cross to the opposite side at the pyramidal decussation and descend in the lateral white column of the spinal cord as the lateral corticospinal tract.
 - The uncrossed fibres descend in the anterior white column of the spinal cord as the anterior corticospinal tract.
- **Termination:** most of the fibres of both anterior and lateral corticospinal tract terminate by synapsing with the interneurons which then connect to the motor neurons of anterior horn

Descending tracts



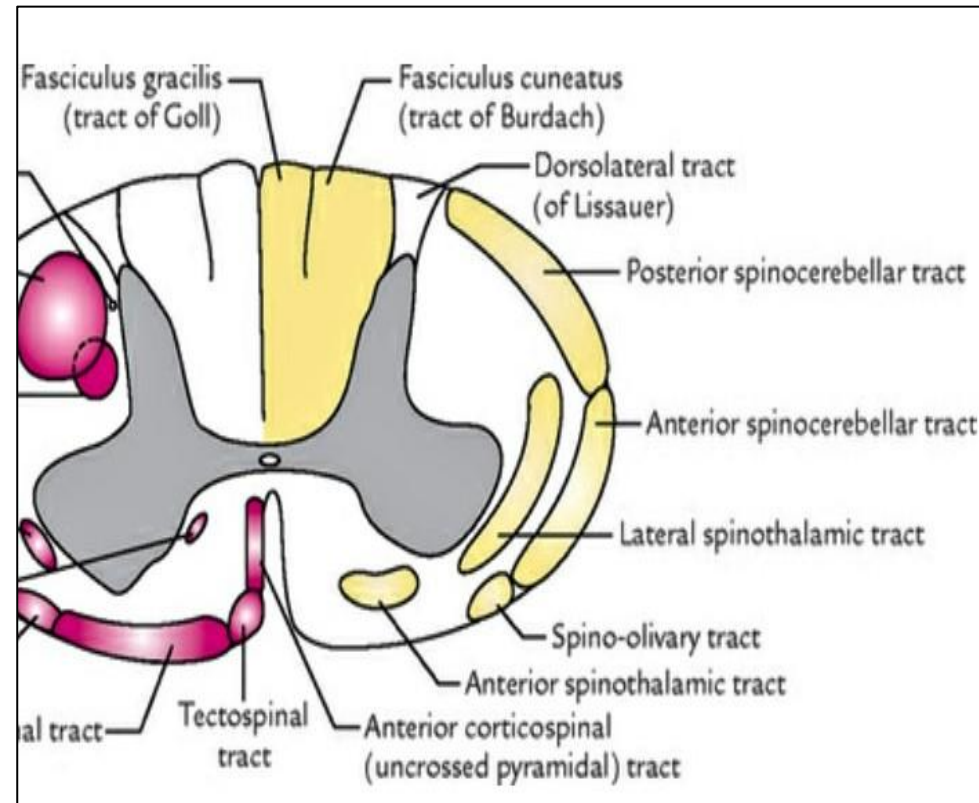
- **Rubrospinal tract:**
 - It facilitates the activity of the flexor muscles and inhibits the activity of the extensor antigravity muscles
- **Reticulospinal tract:** (facilitatory or inhibitory influence on skeletal muscles)
 - Lateral reticulospinal tract
 - Medial reticulospinal tract
- **Hypothalamospinal tract**
 - These fibres terminates at the lateral horn cells of T1 to L2 spinal segments, which are responsible for **sympathetic outflow**.
 - These fibres also terminates at the lateral horn cells of S2, S3 and S4 spinal segments, which are responsible for **parasympathetic outflow**.

Descending tracts



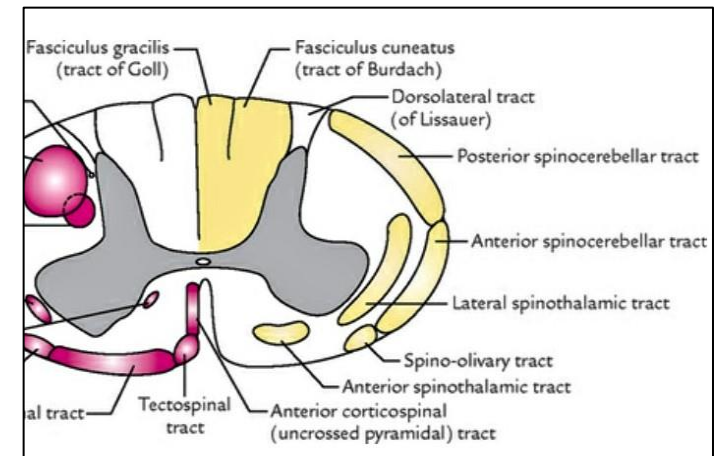
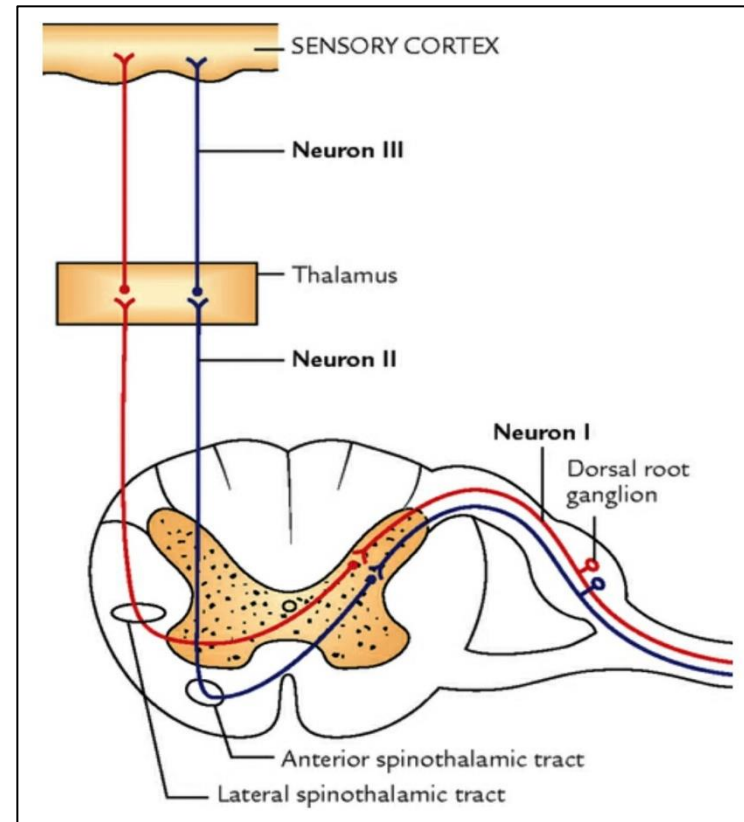
- The ascending tracts carry the impulses from the periphery to the brain through spinal cord
- The important ascending tracts fall into the following three types:
 - Tracts concerned with “*pain, crude touch & temperature*” sensations
 - Lateral and anterior spinothalamic tract
 - Tracts concerned with “*fine touch and conscious proprioception*”
 - Fasciculus gracilis and fasciculus cuneatus
 - Tracts concerned with “*unconscious proprioception and muscular coordination*”
 - Anterior and posterior spinocerebellar tracts

Ascending tracts



Ascending tracts

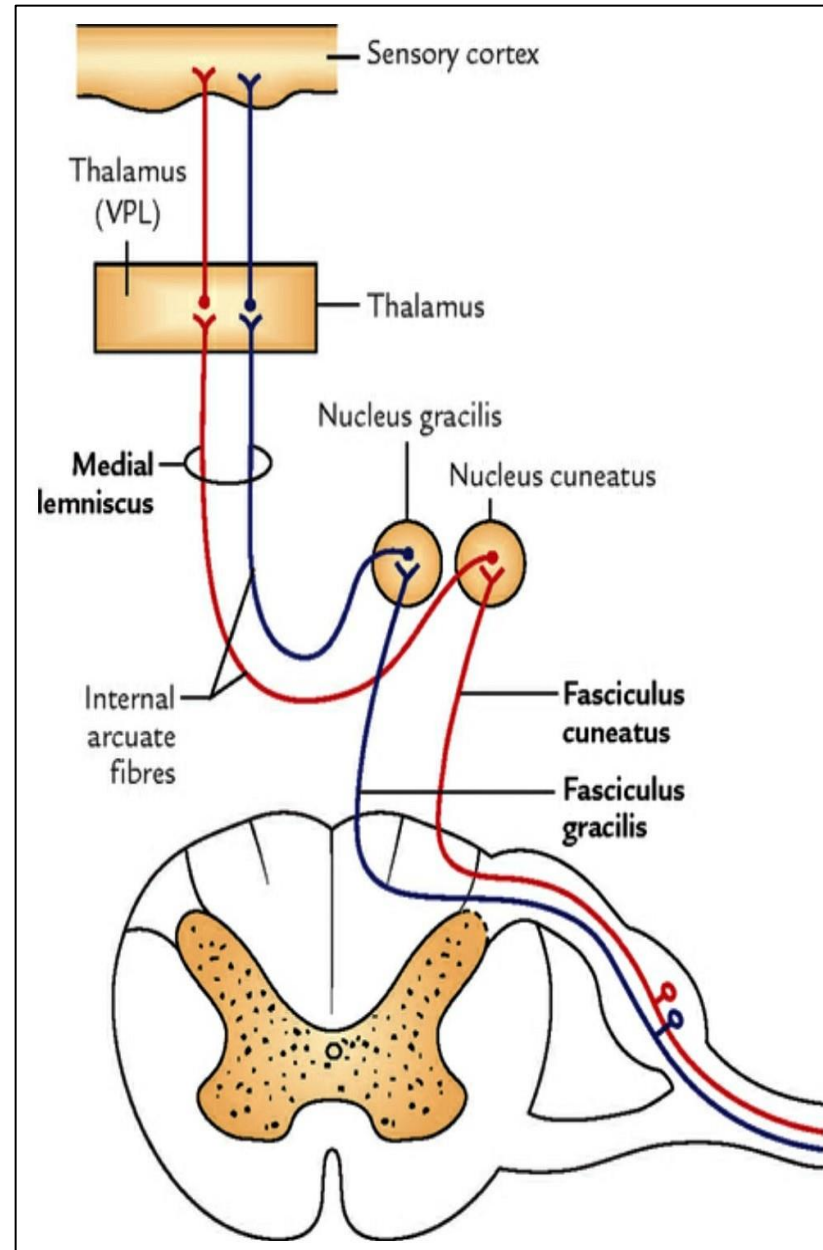
- Cell bodies of the first order sensory neurons (pseudounipolar neurons) of both lateral and anterior spinothalamic tract lie in the **dorsal root ganglia (DRG)** of the spinal nerves.
- In the cord the fibres ascend one or two segments as dorsolateral tract of Lissauer at the tip of the posterior horn and then synapse with cell of substantia gelatinosa.
- Lateral spinothalamic tract:**
 - Second order neurons from the substantia gelatinosa cross to the opposite side and ascend up as lateral spinothalamic tract, which is just lateral to the opposite lateral horn. They terminate in the "*ventral posterolateral*" nucleus (VPL) of the thalamus.
 - Third order neurons project to the sensory cortex
 - It carries pain and temperature sensation
- Anterior spinothalamic tract:**
 - Second order neuron cross to the opposite side and ascend as ventral spinothalamic tract which is just in front of the anterior horn.
 - It carries crude touch and pressure sensation



Fasciculus gracilis (**tract of Goll**) and Fasciculus cuneatus (**tract of Burdach**)

- These two tracts occupy the posterior white column where tract of Goll being medial to the tract of Burdach
- Cell bodies of the **first order neuron** lie in the DRG of spinal nerve and the central processes continue in the posterior white column and fasciculus gracilis and fasciculus cuneatus.
- Fibres from coccygeal, sacral, lumbar and lower thoracic segments ascend through tract of Goll where as fibres from upper thoracic and cervical ascend through tract of Burdach.
- All these fibres terminate in “nucleus gracilis and nucleus cuneatus” in medulla.
- **Second order neurons** from medulla undergo decussation and turn upwards as a flat tract (medial lemniscus) to terminate in “**ventral posterolateral nucleus**” (VPL) of the thalamus.
- **Third order neurons** from thalamus project into the sensory cortex.
- They carry the sensation of **conscious proprioception, two point tactile discrimination and vibration**

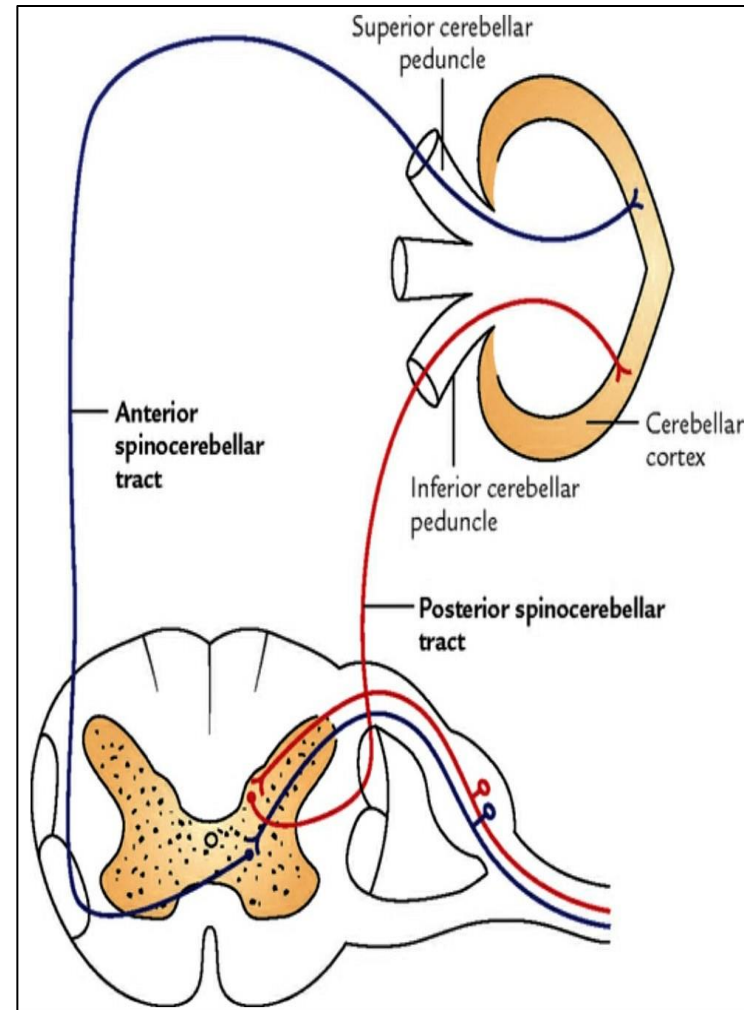
Ascending tracts



Spinocerebellar tract: Located on the lateral white column of and divided into two tracts

- Posterior spinocerebellar tract and Anterior spinocerebellar tract
- First order neuron lies in DRG and the central processes relay in the nucleus dorsalis (Clarke's column).
- **Posterior spinocerebellar tract**
 - Second order neurons from nucleus dorsalis pass to the dorsolateral part of the white column on the same side and ascend as posterior spinocerebellar tract.
 - These fibres enter into the cerebellum through inferior cerebellar peduncle and terminate in the ipsilateral cerebellar cortex.
- **Anterior spinocerebellar tract**
 - Second order neurons from nucleus dorsalis cross to the opposite side anterolateral part of white column and ascend as anterior spinocerebellar tract.
 - These fibres enter the cerebellum through superior cerebellar peduncle and terminate in the ipsilateral cerebellar cortex.
- They carry unconscious proprioceptive sensation from spinal cord to cerebellum and play an important role in muscular coordination.

Ascending tracts



Applied anatomy

- Lumbar puncture
- Spinal anesthesia
- Epidural anesthesia
- Epidural analgesia
- Spinal cord injury
- Subacute combined degeneration of spinal cord (Vit B12 deficiency)
- Anterior spinal artery syndrome: thrombosis or compression



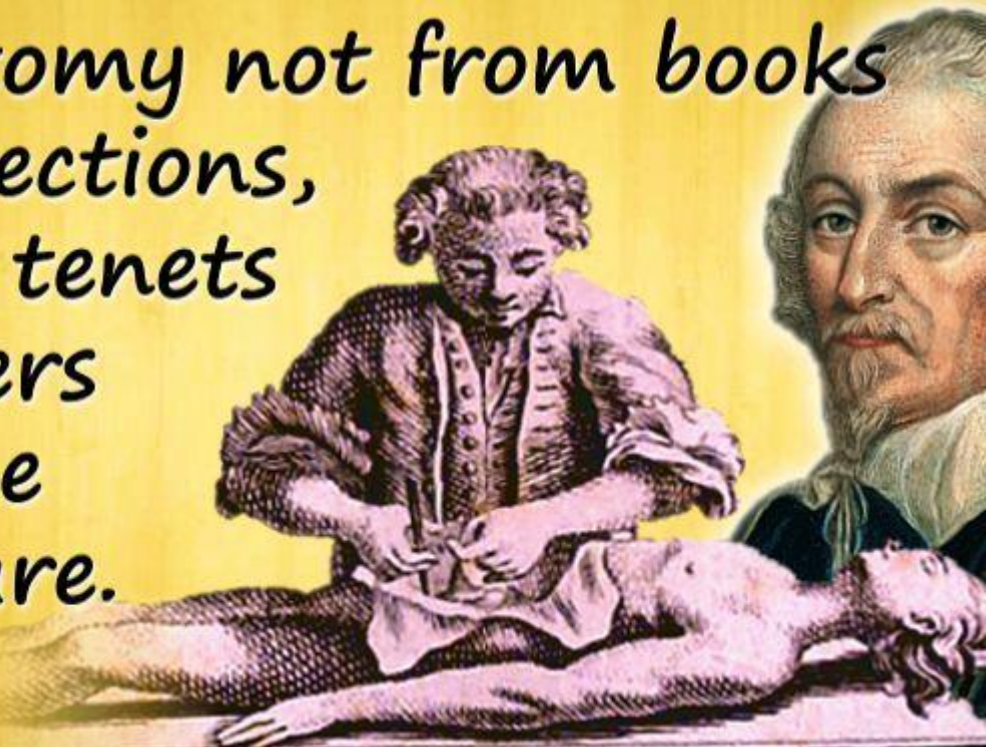
Applied anatomy

- Because of the decussation of corticospinal fibres in the medulla, one side of cerebral cortex controls the opposite half of the body where as cerebellum controls the same side of the body.
- Effects of the lesion of pyramidal tract:
 - Lesion above the level of decussation (upper motor neuron or **UMN**): loss of voluntary movements in the opposite half of the body. Due to increases activity of lower motor neurons (**LMN**), spastic paralysis is seen.
 - Lesion below the level of decussation: Paralysis of the same side of the body occurs which is flaccid paralysis.
- *Tabes dorsalis*: in syphilis posterior white column and posterior nerve roots get affected. Patient is not able to tell the position or movements of the lower limbs unless he/she sees them. That's why when they are asked to stand up on his their feet together with closed eyes, they stagger and fall as he can't maintain his position due to lack of proprioceptive information. (Romberg's sign)



I...learn...anatomy not from books
but from dissections,
not from the tenets
of Philosophers
but from the
fabric of nature.

—William Harvey



Thankyou