

## Tracts of white matter

### I. Ascending tracts (sensory): includes 3 main groups:

<b>A. Lemniscal system:</b> lie in the <b>dorsal column</b> -carries <b>conscious</b> proprioception (from deep structures such as muscles & joints) to the <b>cerebral cortex</b> :	<b>B. Unconscious</b> proprioceptive tracts ( <b>to cerebellum</b> ): lie superficially in the <b>lat. Column</b> :	<b>C. Anterolateral system:</b> lie in the <b>ant. and lat. columns</b> -carries <b>exteroception</b> :
<b>1. Gracile tract</b> [lower body proprioception] <b>2. Cuneate tract</b> [upper body proprioception]	<b>1. Two spino-cerebellar tracts</b> (Post. & Ant.). <b>2. Spino-olivary tract.</b>	<b>1. Lat. Spinothalamic tract</b> [pain & temp]. <b>2. Ant. spinothalamic tract</b> [crude touch]. <b>3. Spino-reticular tract.</b> <b>4. Spino-tectal tract.</b>



Tract	Function	* Receptors	* 1 <sup>st</sup> neuron:			2 <sup>nd</sup> Neuron				* 3 <sup>rd</sup> Neuron:
(Lateral Spinothalamic Tract) 2 <sup>nd</sup> Neuron	Pathway for pain & temperature from body	:Free nerve endings in skin.	Begin	Entry	End	Source	Crossing	Lamination	Ascending + endings	VPLN of thalamus. Axons of VPLN of thalamus pass in posterior limb of internal capsule, then through corona radiata to reach sensory area of cerebral cortex.
			DRG cells (pseudo unipolar). Their peripheral processes carry pain & temperature sensations from the receptors	* 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 II & III (Substantia gelatinosa of Rolandi).	الخلايا يلي انتهت عندها 1 <sup>st</sup> neuron	Axons of these neurons cross to the opposite side in the ventral white commissure & ascend in the lateral white column as the lateral spinothalamic tract (medial to the ant. Spinocerebellar tract)	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.	

Tract	Function	* Receptors	* 1 <sup>st</sup> neuron:	2 <sup>nd</sup> Neuron	* 3 <sup>rd</sup> Neuron:
trigemino-thalamic tract	Pain & temperature from the face: is carried by the trigeminal nerve.		is Trigeminal Ganglion (formed of pseudounipolar cells as DRG).	is Spinal Nucleus of Trigeminal. Its axons cross to opposite side forming trigemino-thalamic tract (lemniscus) which ascends to end on the ventral posteromedial nucleus (VPMN) of thalamus.	VPMN of thalamus whose axons pass in internal capsule, then the corona radiata to reach sensory area of face in cerebral cortex.

Tract	Function		* Receptors	* 1 <sup>st</sup> neuron:	2 <sup>nd</sup> Neuron			* 3 <sup>rd</sup> Neuron:
(Ventral Spinothalamic Tract) 2 <sup>nd</sup> neuron	Path way for crude touch & pressure			Dorsal root ganglion cells. The peripheral processes of these cells carry touch & pressure from the receptors & their central processes enter the spinal cord via the dorsal root to end on neurons in several laminae of the grey matter of spinal cord mainly (Lamina IV –VII) (Main sensory nucleus).	Neurons in laminae IV - VII	تألف من نفس حكي اول وحدة كيس هون بتعمل crossing ventral white commissure	ascends in the spinal cord & brain stem where it joins the spinal lemniscus & accompanies it to the thalamus to end on VPLN of thalamus.	VPLN of thalamus. نفس حكي اول وحدة .. تكرار * 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.

Pathway	Function	Receptors	1 <sup>st</sup> order neuron	2 <sup>nd</sup>	3 <sup>rd</sup>
(Posterior column - Dorsal column tract) (Gracile & Cuneate tracts) <b>* 1<sup>st</sup> Neuron</b>	<b>Pathway of conscious</b> proprioception & fine touch ** Proprioception (deep sensations): 1. Sense of position. 2. Sense of movement. 3. Sense of vibration. ** Fine touch (complex touch): 1. Tactile discrimination. 2. Tactile localization. 3. Stereogno	(in muscles, tendons & joints).	(Gracile & cuneate tract): DRG cells which are pseudounipolar. * Their peripheral processes carry sensations from deep receptors * 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. <b>Lamination: sacral fibers are most medial &amp; cervical fibers are most lateral.</b> ** N.B: * During their ascent, the fibers send collateral branches that end on the dorsal horn of spinal cord. * These form the septo-marginal tract (from Gracile) & Comma-shaped tract (from cuneate). * Some cervical fibers end on the accessory cuneate nucleus (posterior to the cuneate nucleus) & its axons (cuneo-cerebellar fibers) pass to the cerebellum.	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 to reach the thalamus	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.

Four tracts carry <b>unconscious</b> proprioception to <b>cerebellum</b> (For coordination of movement)			
<b>1. Posterior spinocerebellar tract:</b>	<b>2. Anterior spinocerebellar tract:</b>	<b>3. Spino-olivary Tract:</b>	<b>4. Collaterals from cuneate tract:</b>
* Carries proprioception from the <b>lower limb &amp; trunk</b> .	* Carries proprioception from the <b>lower limb</b> .	* It carries proprioception from <b>both</b> upper & lower limbs.	* Carry proprioception from <b>the upper limb</b> to the <b>accessory cuneate nucleus of the medulla</b> .
* The central processes of <b>DRG</b> cells enter the spinal cord via the dorsal root to end on ipsilateral Clarke's nucleus.	* The central processes enter the spinal cord via the dorsal root to end on Clarke's nucleus.		
* The tract <b>ascends ipsilaterally</b> in the lateral white column, posterior to the anterior spinocerebellar tract & enters <b>the ipsilateral cerebellum</b> via the inferior cerebellar peduncle ( <b>ICP</b> ).	* Axons forming the tract <b>mostly decussate</b> but few remain ipsilateral.  * They enter the cerebellum via the superior cerebellar peduncle ( <b>SCP</b> ) after <b>crossing again</b> to reach the <b>ipsilateral cerebellum</b> .	* Its fibers <b>cross</b> & ascend at the junction of lateral & ventral white columns to end on the <b>contralateral olivary nuclei</b> .  * Olivocerebellar <b>fibers cross</b> & pass via <b>the ICP</b> to reach the <b>ipsilateral cerebellum</b> .	* Axons of the accessory cuneate nucleus form <b>the external arcuate fibers (Cuneocerebellar tract)</b> which reach the <b>ipsilateral cerebellum</b> via the <b>ICP</b> .

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## Other Ascending Tracts

### 1. Spino-reticular Tract

- \* Its fibers ascend in the lateral & ventral white columns where it is intermingled with the spino-thalamic tracts.
- \* Most fibers cross to the opposite side & ascend to end on neurons of the ponto-medullary reticular formation.

### 2. Spino-tectal Tract

- \* Most fibers cross to the opposite side & ascend in the lateral white column to end in the superior colliculi of the midbrain.
- \* The spino-tectal tract is concerned with spino-visual reflexes (head turning towards source of pain stimulus).