The tracts in white matter of spinal cord

Short

Fasciculi proprii	Lissauer's	Comma shaped	Septo–marginal
Around the grey matter of all segments	Axons of cells of PRG in all segments	Between gracile& cuneate tracts	Around the posterior septum

- ascending or descending tracts
- begin and terminate in the spinal cord
- function:–
  association and coordination of the different movements of the body with each other.

Long

ascending tracts (sensory)

- sensation from all the body except the head
  trigeminal nerve (cranial V) ← The sensations from the head are carried by

divided into three categories according to their termination:

reach cerebral cortex (C.C.)

- known to carry conscious sensations
- opposite side (crossed)
  any lesion in one of them leads to loss of sensation on the opposite side

They are four tracts:

1- Lateral spinothalamic

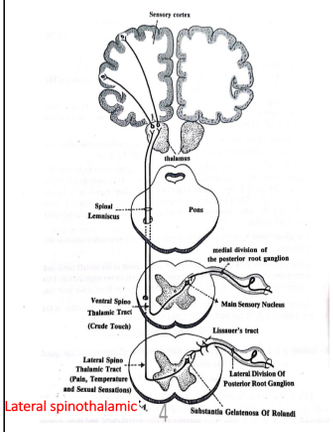
present in all segments
carries pain
temperature
sexual sensation.

1- It arises as axons of the cells of substantia gelatinosa of rolandi of the opposite side
2- cross in front of central canal
3- ascend separately in the opposite side of spinal cord and medulla.
4- in pons it joins ventral spinothalamic to form spinal leminiscus
5- It ends in P.L.V.N. of thalamus

2- Ventral (anterior) spinothalamic.

in all segments
carries crude touch

1- It arises as axons of the cells of main sensory nucleus of the opposite side
2- cross in front of central canal
3- ascend separately in the opposite side of spinal cord and medulla.
4- in pons it joins ventral spinothalamic to form spinal leminiscus
5- It ends in P.L.V.N. of thalamus

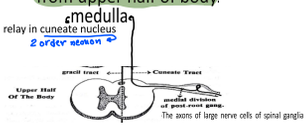


Lateral spinothalamic

substantia gelatinosa of rolandi
It arises as axons of the cells of

4- Cuneate tract

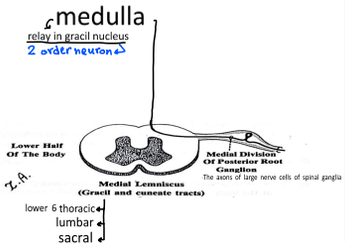
in all cervical and upper thoracic of spinal cord
It carries → proprioceptive sensation
→ fine touch
from upper half of body.
→ medulla
relay in cuneate nucleus
2 order neuron



→ upper 6 thoracic
→ cervical

3- Gracil tract

in all segments of spinal cord
It carries → proprioceptive sensation
→ fine touch
from lower half of body.
→ medulla
relay in gracil nucleus
2 order neuron



lower 6 thoracic
lumbar
sacral

reach cerebellum

- (spinocerebellar pathway)
- These tracts do not reach C.C.
- but carry sensation to cerebellar cortex of the same side for coordination (uncrossed) except anterior spinocerebellar.
  - Lesion in one of them dose not lead to loss of sensation but leads to loss of coordination.

They are four tracts:

1- Dorsal (posterior) spinocerebellar

arises as axons of clark nucleus
same side to cerebellum.
carries proprioceptive sensation
from lower part of body

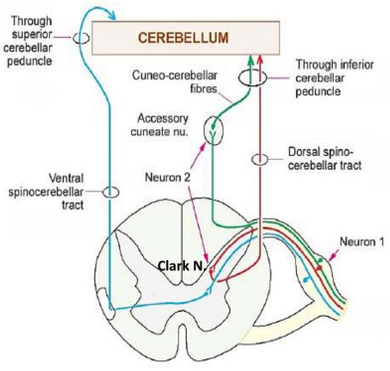
2- Ventral (anterior) spinocerebellar:

arises as axons of clark nucleus
other side to cerebellum.
carries proprioceptive sensation
from lower part of body

3- Cuneocerebellar.

4- Rostral spinocerebellar.

tracts are the upper extremity homologs and ventral of the dorsal spinocerebellar tracts



reach brain stem

1- Spino-tectal

arises as axons of main sensory nucleus of opposite side
cross in front of central canal
ascend to end in superior colliculus of midbrain.
It carries spinovisual reflexes.

2- Spino-olivary:

arises as axons of main sensory nucleus of opposite side
cross in front of central canal
ascend to end in olivary nucleus in medulla
then enter the cerebellum
It carries proprioceptive sensation

descending tracts (motor)

- All voluntary movements are done by nerve impulse starting from cerebral cortex to Anterior Horn nuclei of spinal cord or motor nuclei of cranial nerves then go to skeletal muscle.
- This pathway is divided into upper and lower motor neuron.
- The axons of upper motor neuron reach lower motor neuron through long descending tracts.
- The lower motor neuron includes anterior horn nuclei of the spinal cord and motor cranial nuclei of the brain stem.

- The long descending tracts are classified into:

I- Pyramidal tracts: that include:

1) **Cortico-spinal tract** → to spinal cord

2) **Cortico-bulbar** (cortico nuclear) → to cranial nerve nuclei of opposite side

- Medial corticobulbar tract end in motor nuclei of 3,4,6 cranial nerves
- Lateral corticobulbar tract end in motor nuclei of 5,7,9,10,11,12 cranial nerves

→ **Cortico-spinal tracts**

Origin:
Betz cells and pyramidal nerve cells from motor cerebral cortex (mainly motor area 4, precentral gyrus)

Pathway (Course):
1- In the cerebral hemisphere; The fibers descend into the corona radiate.
2- In the internal capsule; They descend in the posterior limb.
3- In the midbrain; they descend in the **middle** part of the cerebral peduncle.
4- In the pons; the fibers form separate bundles descending in the ventral part of the pons (basis pontis) separated by the transverse pontine fibers.
5- In the upper part of the medulla oblongata; the fibers collect again forming the pyramid.
6- In the lower part of the medulla;
a- 80%- 85% of the fibers of the pyramid cross to the opposite side in the motor decussation and forming Lateral cortico-spinal tract in the spinal cord.
b- 15- 20% of the fibers of the pyramid descend on the same side forming the anterior cortico-spinal tract in the spinal cord.

7- In the spinal cord; the fibers gradually diminish in size as it descends.

a- Lateral cortico-spinal tract (crossed pyramidal tract) descends in the lateral column of the white matter to relay in the anterior horn cells (AHC) of the same side.

b- Anterior cortico-spinal tract (direct pyramidal tract) descends in the anterior column of the white matter of cervical and upper thoracic. Its fibers cross the middle line to relay in the anterior horn cells of the opposite side before its termination.

II- Extra–pyramidal tracts; that includes 4 single tracts and 2 paired tracts:

1) Rubrospinal tract.

2) Olivospinal tract.

3) Sulco-marginal tract (join ventral vestibulo spinal tract medial longitudinal bundle or fasciculus in brain stem)

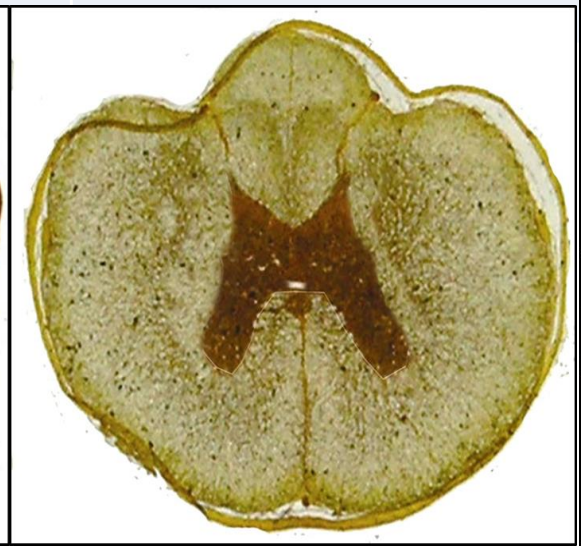
4) Tecto-spinal tract.

5) Lateral & ventral (anterior) reticulo-spinal tracts

6) Lateral & ventral (medial) vestibulo-spinal tracts

	Cervical	Lower Thoracic	Lumbar
Shape	Oval	Round	Oval
Central canal	More anterior	Slight anterior	Central
Posterior horns	Thin & diverging	Thin & parallel	Thick & parallel
Anterior horns	motor neuron كبير وثخين Thick	Thin & parallel	Thick & parallel
Lateral horns	----------	present	Present (L1-L3) only
White matter		Large compared to grey matter	Very little compared to grey matte

Grey matter



Region	Grey Matter	White Matter
Cervical	All motor, sensory, and commissural nuclei (except Clark's nucleus (only present in C8)	Abundant; contains almost all short and long tracts
Upper Thoracic	The posterior horns contain **Clark`s nucleus** in addition to the same nuclei in the cervical region while the anterior horns contain **the medial nuclei only.** It has lateral horns which contain **sympathetic nuclei**.	Same as cervical, except (threeextrapyramidal tracts) olivospinal, ventral vestibulospinal, and tectospinal tracts that are absent.
Lower Thoracic	The posterior horns contain **Clark`s nucleus** in addition to the same nuclei in the cervical region while the anterior horns contain the **medial nuclei only**. It has lateral horns which contain **sympathetic** nuclei.	Same as cervical, except for absence of olivospinal, ventral vestibulospinal, tectospinal, comma-shaped, cuneate, and direct pyramidal tracts. Septomarginal short tract appears.
Lumbar	All motor, sensory, and commissural nuclei	Same as lower thoracic, except for the absence of the posterior spinocerebellar tract.