

# "Spinal Cord (Part 1/4)"

## » General Structure

### > Shape and Location:

- Roughly cylindrical.
- Begins at the foramen magnum in the skull.
- Continuous with the medulla oblongata.
- Terminates at the lower border of the first lumbar vertebra in adults.
- Ends at the upper border of the third lumbar vertebra in young children.
- Occupies the upper two-thirds of the vertebral canal.
- Surrounded by three meninges: dura mater, arachnoid mater, and pia mater.
- Protected by cerebrospinal fluid (CSF) in the subarachnoid space.

## » Enlargements

### > Cervical and Lumbar Enlargements:

- Cervical region: gives origin to the brachial plexus.
- Lower thoracic and lumbar regions: gives origin to the lumbosacral plexus.
- Inferiorly tapers into the conus medullaris.
- Filum terminale (prolongation of pia mater) attaches to the posterior surface of the coccyx.
- Anterior median fissure and posterior median sulcus present.

## » Spinal Nerves

### > Attachment:

- 31 pairs of spinal nerves attached by anterior (motor) roots and posterior (sensory) roots.
- Roots attached by a series of rootlets along the length of the corresponding segment.
- Posterior nerve root possesses a posterior root ganglion, with cells giving rise to peripheral and central nerve fibers.

## » Spinal Cord Structure

### > Composition

#### i) Gray Matter:

- Forms an inner core surrounded by an outer covering of white matter.
  - H-shaped on cross-section.
  - Anterior and posterior gray columns (horns) united by a gray commissure containing the central canal.
- Small lateral gray column or horn present in thoracic and upper lumbar segments.
  - Amount of gray matter related to the muscle innervated at that level.
  - Largest in cervical and lumbosacral enlargements (innervating upper and lower limb muscles).

#### • Components:

- Mixture of nerve cells and their processes, neuroglia, and blood vessels.
  - Nerve cells are multipolar.
- Neuroglia forms a network around nerve cell bodies and neurites.

## ii) White Matter

- Surrounds gray matter

- Division into Columns or Funiculi:

### Anterior White Column:

- Located between the midline and the point of emergence of the anterior nerve roots.

### Lateral White Column:

- Located between the emergence of the anterior nerve roots and the entry of the posterior nerve roots.

### iii) Posterior White Column:

- Located between the entry of the posterior nerve roots and the midline.

- Components:

- Mixture of nerve fibers, neuroglia, and blood vessels.

- Surrounds the gray matter.

- White color due to a high proportion of myelinated nerve fibers.

# Regions of Spinal Cord

**Table 4-1** Comparison of Structural Details in Different Regions of the Spinal Cord<sup>a</sup>

Region	Shape	White Matter	Gray Matter		
			Anterior Gray Column	Posterior Gray Column	Lateral Gray Column
Cervical	Oval	Fasciculus cuneatus and fasciculus gracilis present	Medial group of cells for neck muscles; central group of cells for accessory nucleus (C1–C5) and phrenic nucleus (C3–C5); lateral group of cells for upper limb muscles	Substantia gelatinosa present, continuous with Sp.N. of cranial nerve V at level C2; nucleus proprius present; nucleus dorsalis (Clarke column) absent	Absent
Thoracic	Round	Fasciculus cuneatus (T1–T6) and fasciculus gracilis present	Medial group of cells for trunk muscles	Substantia gelatinosa, nucleus proprius, and visceral afferent nucleus present.	Present; gives rise to preganglionic sympathetic fibers
Lumbar	Round to oval	Fasciculus cuneatus absent; fasciculus gracilis present	Medial group of cells for lower limb muscles; central group of cells for lumbosacral nerve	Substantia gelatinosa, nucleus proprius, nucleus dorsalis (Clarke column) at L1–L4, and visceral afferent nucleus present	Present (L1–L2 [3]); gives rise to preganglionic sympathetic fibers
Sacral	Round	Small amount; fasciculus cuneatus absent; fasciculus gracilis present	Medial group of cells for lower limb and perineal muscles	Substantia gelatinosa and nucleus proprius present	Absent; group of cells present at S2–S4, for parasympathetic outflow

<sup>a</sup>The information in this table is useful for identifying the specific level of the spinal cord from which a section has been taken.

(Reference: Snell's Clinical Anatomy Textbook)

## » Functions of White Matter structures

### 1) Fasciculus Gracilis

- Location: Medial part of the dorsal columns, present throughout the spinal cord.
- Function: Carries sensory information from the lower body (below T6), including the legs and lower trunk.
  - Sensory Modalities:
    - Discriminative touch
    - Vibratory sense
    - Conscious muscle joint sense
    - Proprioception

### 2) Fasciculus Cuneatus

- Location: Lateral part of the dorsal columns, present only above T6 spinal level.
- Function: Carries sensory information from the upper body (above T6), including the arms and upper trunk.

- Sensory Modalities:
  - Discriminative touch
  - Vibratory sense
  - Conscious muscle joint sense
  - Proprioception

## » Functions of Anterior Gray Column structures:

[Written within the table given above]

## » Functions of Posterior Gray Column structures

### 1) Substantia Gelatinosa

- Has golgi type-II neurons
- Receives afferent fibers concerned with pain + temperature + touch from posterior root.
- It receives input from descending fibers from supraspinal levels.

### 2) Nucleus Proprius

- It receives fibers from the posterior white column that are associated with the senses of position + movement + proprioception + two point discrimination + vibration.

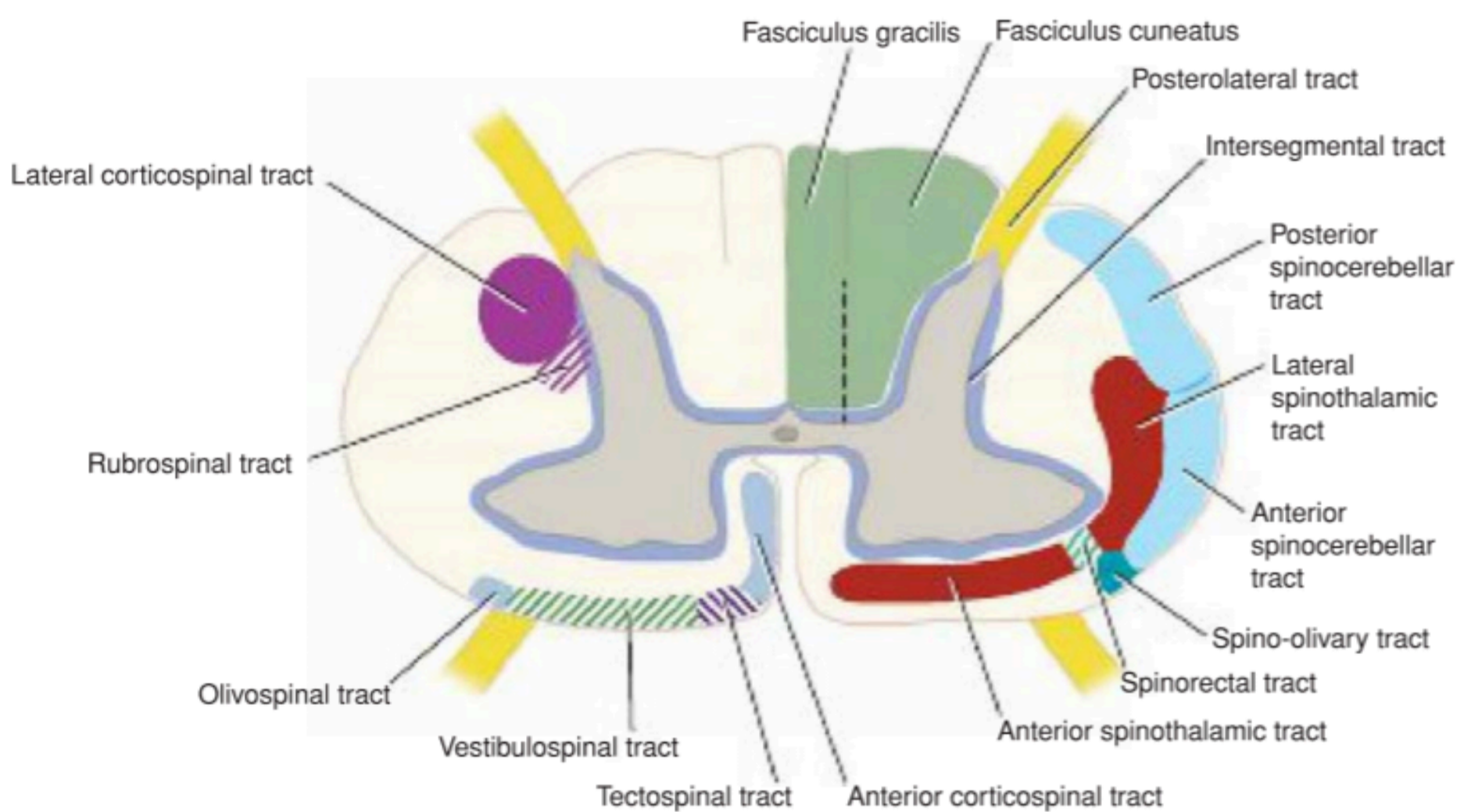


### 3) Nucleus Dorsalis (Clarke column)

- Associated with proprioceptive endings (NMJ and golgi tendon organs)
- Associated with anterior and posterior spinocerebellar tract

### 4) Visceral Afferent Nucleus

- Receives visceral afferent information



**Figure 4-11** Transverse section of the spinal cord at the midcervical level showing the general arrangement of the ascending tracts on the right and the descending tracts on the left.

(Reference: Snell's Clinical Anatomy Textbook)