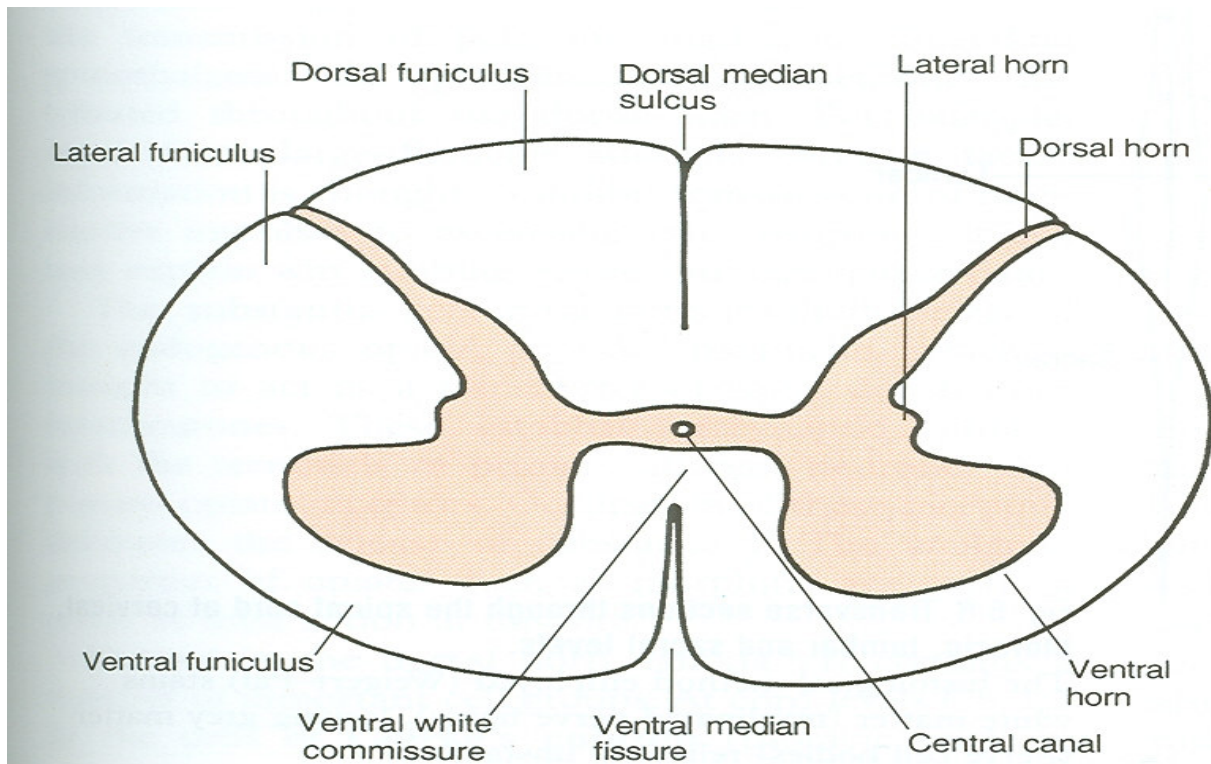


INTERNAL FEATURES OF SPINAL CORD

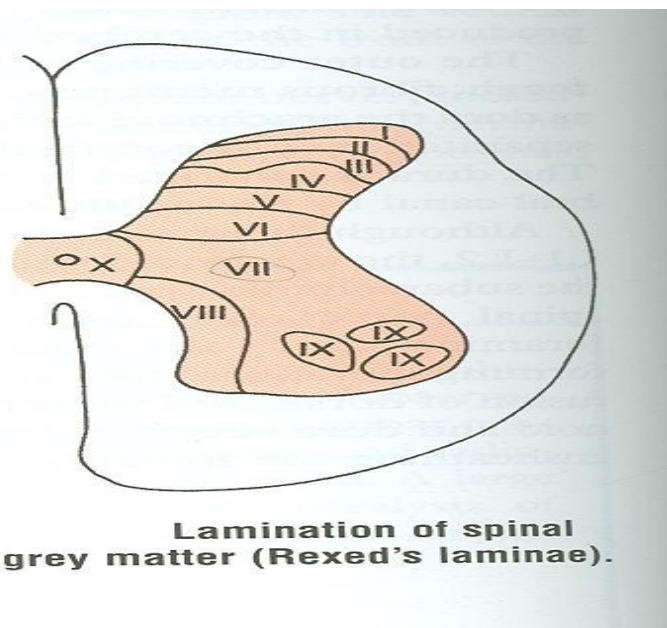


Transverse section

GREY MATTER OF SPINAL CORD :

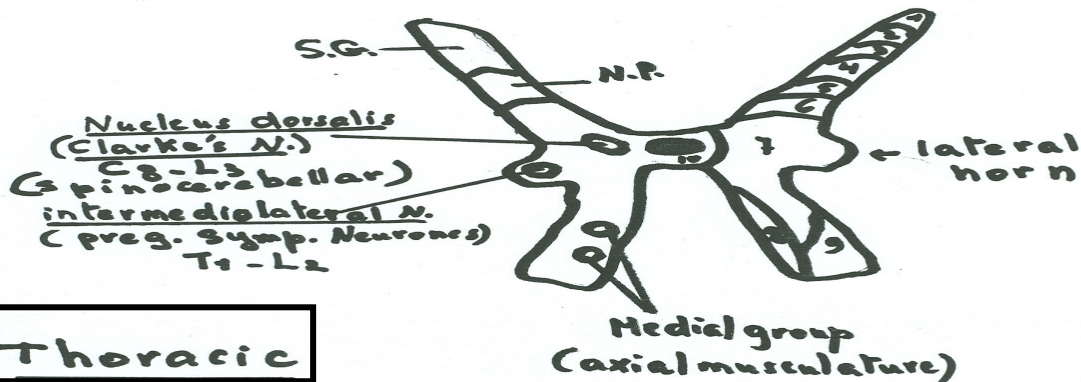
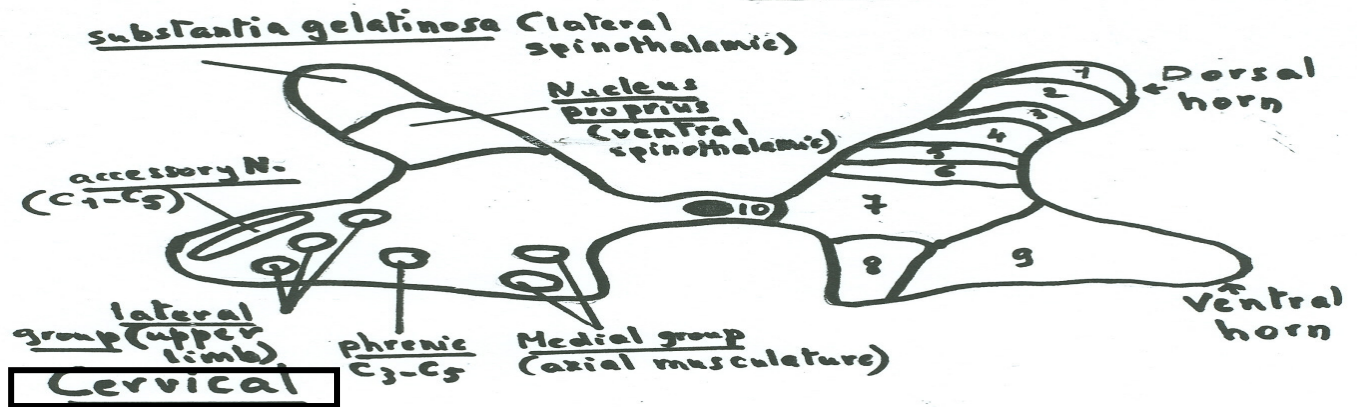
- **Dorsal horn** : contains sensory neurones.
- **Ventral horn** : contains motor neurones (lower motor neurones) :
 1. **Alpha motor neurones** : innervate extrafusal muscle fibers.
 2. **Gamma motor neurones** : innervate intrafusal muscle fibers.
- **Lateral horn (T1-L3)** : contains autonomic neurones.

LAMINATION OF GREY MATTER :

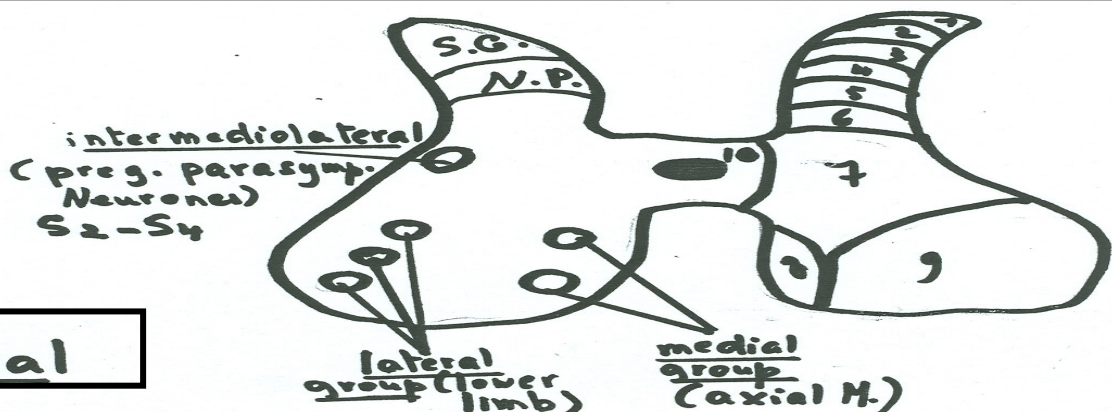
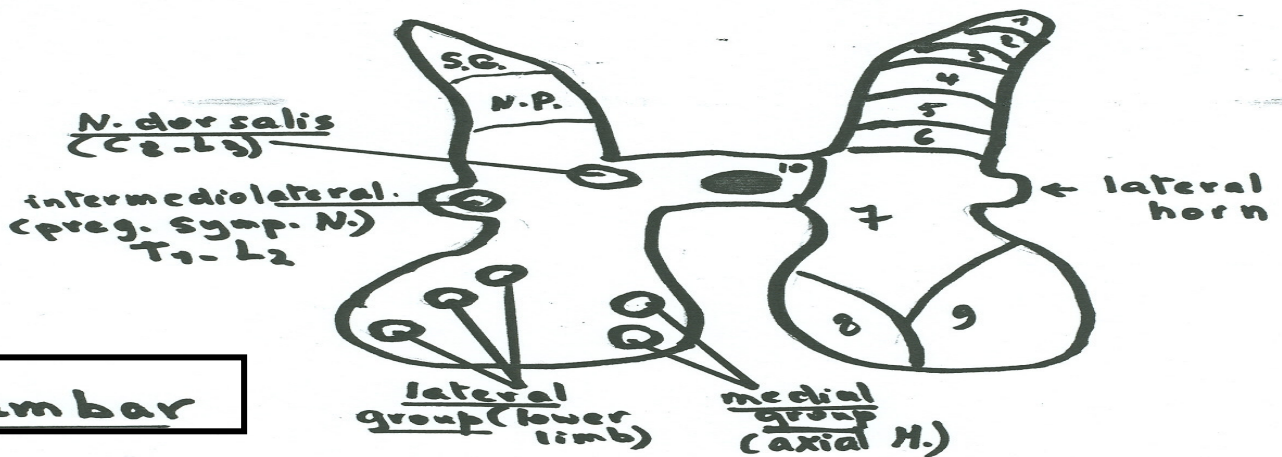


NUCLEI :

Nuclei



Nuclei



NUCLEI OF DORSAL HORN :

- **Substantia gelatinosa :**
 - **Site :** tip of dorsal horn, laminae I-III.
 - **Level :** all levels.
 - **Function :** contains **second order neurones** for pathway of **pain & temperature sensations** from the body to sensory cortex (**lateral spinothalamic tract**).
- **Nucleus proprius :**
 - **Site :** ventral to substantia gelatinosa, laminae IV-V.
 - **Level :** all levels.
 - **Function :** contains **second order neurones** for pathway of **crude touch sensation** from the body to sensory cortex (**ventral spinothalamic tract**).
- **Nucleus dorsalis (Clarke's column) :**
 - **Site :** base of dorsal horn, lamina VII.
 - **Level :** C8 – L3.
 - **Function :** contains **second order neurones** for pathway of **proprioceptive & exteroceptive sensations** to cerebellum (**dorsal spinocerebellar tract**).

NUCLEI OF VENTRAL HORN :

- **Medial group :**
 - **Site :** *medial* part of ventral horn, lamina VIII.
 - **Level :** all levels.
 - **Function :** contains cell bodies of neurones innervating **axial muscles**.
- **Lateral group:**
 - **Site :** *lateral* part of ventral horn, lamina IX.
 - **Level :** all levels :
 - More prominent in cervical & lumbosacral segments.
 - Represented by one nucleus in thoracic segments.
 - **Function :**
 1. In cervical & lumbosacral segments : contains cell bodies of neurones innervating **limb muscles**.
 2. In thoracic segments : contains cell bodies of neurones innervating **intercostal muscles**.
- **Phrenic nucleus :**
 - **Site :** central part of ventral horn, lamina IX.
 - **Level :** C3 – C5.
 - **Function :** contains cell bodies of neurones innervating the **diaphragm**.
- **Accessory nucleus :**
 - **Site :** base of ventral horn, lamina IX.
 - **Level :** C1 – C5.
 - **Function :** contains cell bodies of neurones innervating **sternomastoid & trapezius**.

NUCLEI OF LATERAL HORN :

- **Intermediolateral nucleus :**
 - **Level :** T1 – L3.
 - **Function :** contains preganglionic sympathetic neurones.
 - *N.B. : the nucleus is present in S2-S4 segments (with no lateral horn) & contains preganglionic parasympathetic neurones.*

WHITE MATTER OF SPINAL CORD :

- Dorsal column (Funiculus).
- Lateral column (Funiculus).
- Ventral column (Funiculus).
- The white matter is formed of tracts :
 1. Ascending.
 2. Descending.
 3. Both ascending & descending.

MAIN ASCENDING TRACTS :

- Dorsal column tract :
 - Site : occupies the whole dorsal column, gracile tract is *medial* to cuneate tract.
 - Level :
 1. Gracile tract : all levels.
 2. Cuneate tract : from T6 to C1.
 - Second order neurones : Gracile & cuneate nuclei in medulla oblongata.
 - Types of fibers : proprioceptive & discriminative (fine) touch fibers.
 1. Gracile tract : from lower half of body.
 2. Cuneate tract : from upper half of body.
 - Termination : sensory cortex.
- Spinothalamic tracts :
 - Site :
 1. Lateral spinothalamic : *lateral* column.
 2. Ventral spinothalamic : *ventral* column.
 - Level : all levels.
 - Second order neurones : Substantia gelatinosa.
 - Types of fibers : exteroceptive fibers from body.
 1. Lateral spinothalamic : pain & temperature.
 2. Ventral spinothalamic : non discriminative (crude) touch.
 - Termination : sensory cortex.
- Spinocerebellar (dorsal & ventral) tracts :
 - Site : both tracts are located in lateral column.
 - Level : all levels.
 - Second order neurones :
 1. Dorsal spinocerebellar : Clarke's column.
 2. Ventral spinocerebellar : laminae V-VII.
 - Types of fibers : proprioceptive & exteroceptive fibers from body.
 - Termination : cerebellum.

DESCENDING TRACTS :

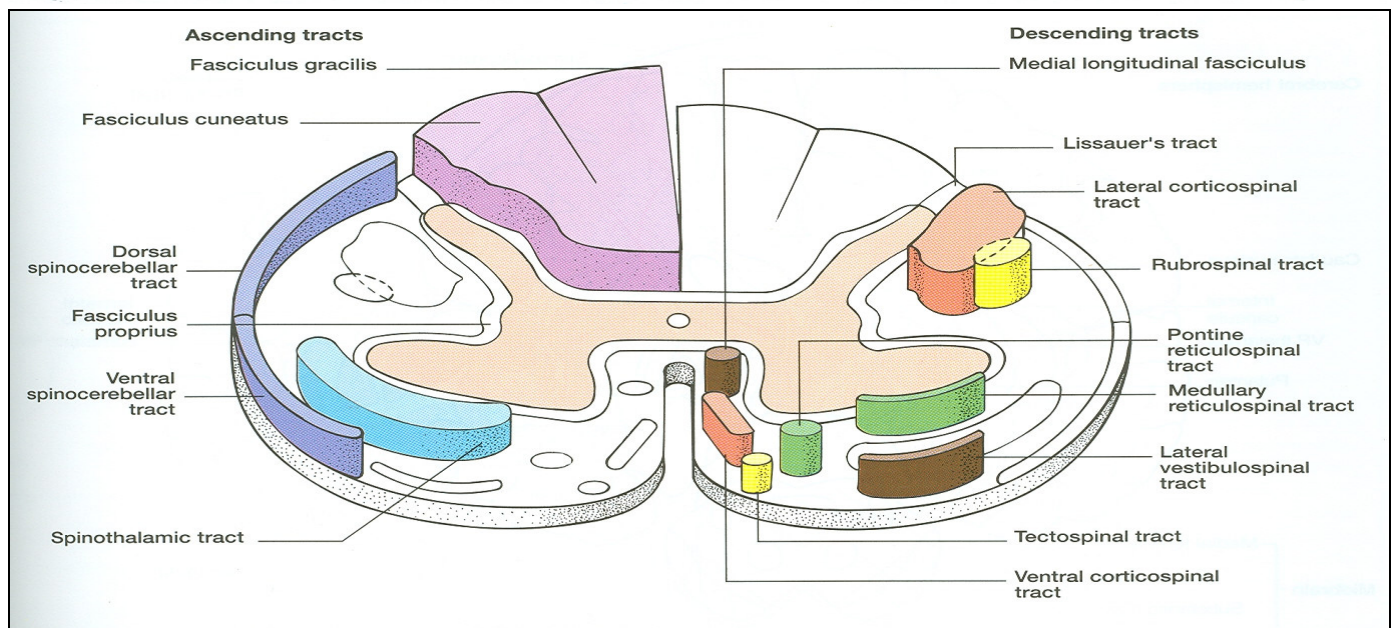
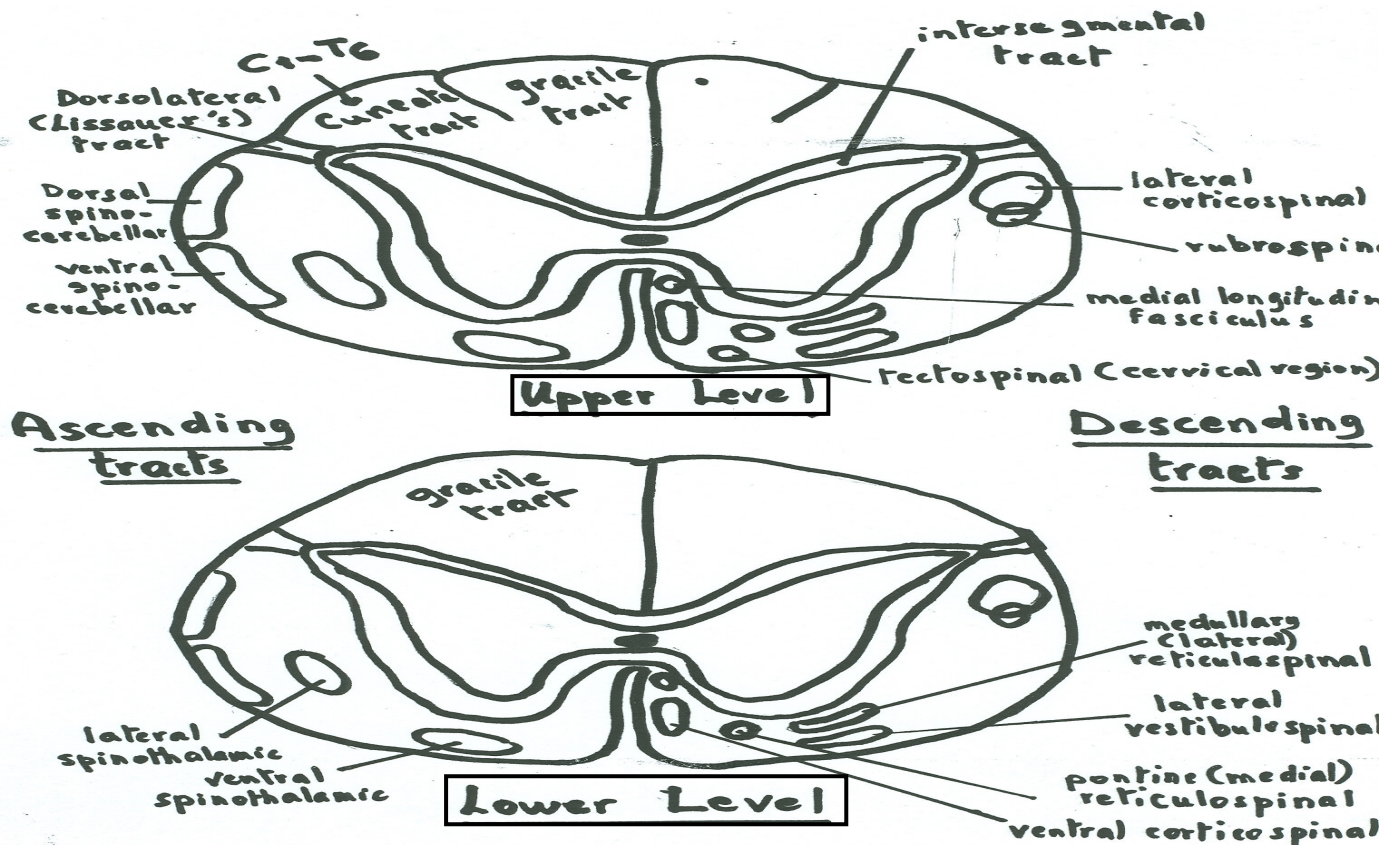
- **Corticospinal tracts :**
 - **Site :**
 1. Lateral corticospinal : *lateral* column.
 2. Ventral corticospinal : *ventral* column.
 - **Level :** all levels.
 - **Origin :** motor cortex.
 - **Function :** control of **voluntary, discrete & fine movements**, especially those of distal parts of limbs.
- **Rubrospinal tract :**
 - **Site :** lateral column, intermingled with lateral corticospinal tract.
 - **Level :** all levels.
 - **Origin :** red nucleus of midbrain.
 - **Function :** excitatory effect over tone of limb flexor muscles.
- **Tectospinal tract :**
 - **Site :** ventral column.
 - **Level :** in cervical region.
 - **Origin :** superior colliculus of midbrain.
 - **Function :** mediates reflex movements in response to visual stimuli.
- **Vestibulospinal tracts :**
 - **Site :** both tracts are located in ventral column.
 - **Level :** all levels.
 - **Origin :**
 1. Lateral vestibulospinal : *lateral* vestibular nucleus in **pons & medulla**.
 2. Medial vestibulospinal : forms the descending fibers of the *medial* longitudinal fasciculus.
 - **Function :** control body posture & balance.
- **Reticulospinal tracts :**
 - **Site:** both tracts are located in ventral column.
 - **Level :** all levels.
 - **Origin :**
 1. Medial reticulospinal : **Pontine** reticular formation.
 2. Lateral reticulospinal : **Medullary** reticular formation.
 - **Function :** inhibitory or excitatory effect on muscle tone.

BOTH ASCENDING & DESCENDING TRACTS :

- **Fasciculus Proprius (intersegmental tract) :**
 - Occupies a narrow band immediately peripheral to grey matter.
 - Serves for coordination between upper & lower limb muscles.
- **Lissauer's tract :**
 - Lies *superficial* to the tip of dorsal horn.
 - By the help of this tract, exteroceptive fibers can establish synaptic contacts over several segments of spinal cord.

N.B. TRACTS :

- **Ascending :**
 1. **Dorsal column :** contains only *dorsal* column tracts.
 2. **Ventral column :** contains *ventral* spinothalamic tract.
 3. **Lateral column :** contains the rest of tracts.
- **Descending :**
 - All descending tracts are present in ventral column *EXCEPT* : lateral corticospinal & rubrospinal tracts (present in lateral column).
 - No descending tract present in dorsal column.
- All ascending tracts have same first order neurones : cells of dorsal root ganglion.
- All descending tracts have same termination : cells of ventral horn (lower motor neurones).



SELF QUIZ

- 1- Regarding the internal structure of the spinal cord choose the correct statement :
 - a. C2 has more white matter than L3.
 - b. White matter contains cell bodies.
 - c. The ascending and descending tracts are found in the grey matter.
 - d. Later horn is a cervical and sacral characteristic.
 - e. All of above.

- 2- Which of the following statements regarding grey matter is incorrect :
 - a. The ventral horn is well developed in the cervical and lumbar region.
 - b. Lamina I-III = substantia gelatinosa.
 - c. Interneurons are found in the grey matter.
 - d. Nucleus proprius is found in all spinal levels.
 - e. Phrenic nucleus is found at the level of C1 to T3.

- 3- All of the following nuclei are found in the entire level of the spinal cord except :
 - a. Substantia gelatinosa.
 - b. Substantia propria.
 - c. Nucleus dorsalis.
 - d. Lamina VIII.
 - e. Lamina III.

- 4- Given the following features, choose the correct spinal segment :
 grey matter bears accessory nucleus & phrenic nucleus , white matter bears cuneate tract.
 - a. C1.
 - b. C4.
 - c. L1.
 - d. L4.
 - e. S2.

- 5- Choose the correct pair :

a. Rubrospinal tract	:	origin is red nucleus.
b. Tectospinal tract	:	in the lumbar region.
c. Reticulospinal tract	:	ascending tract.
d. Corticospinal tract	:	origin is sensory cortex.
e. Ventral spinothalamic tract	:	carries pain and thermal sensation.

1. a	2. e	3. c	4. b	5. a
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Special thanks to PSL TEAM



THE END

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