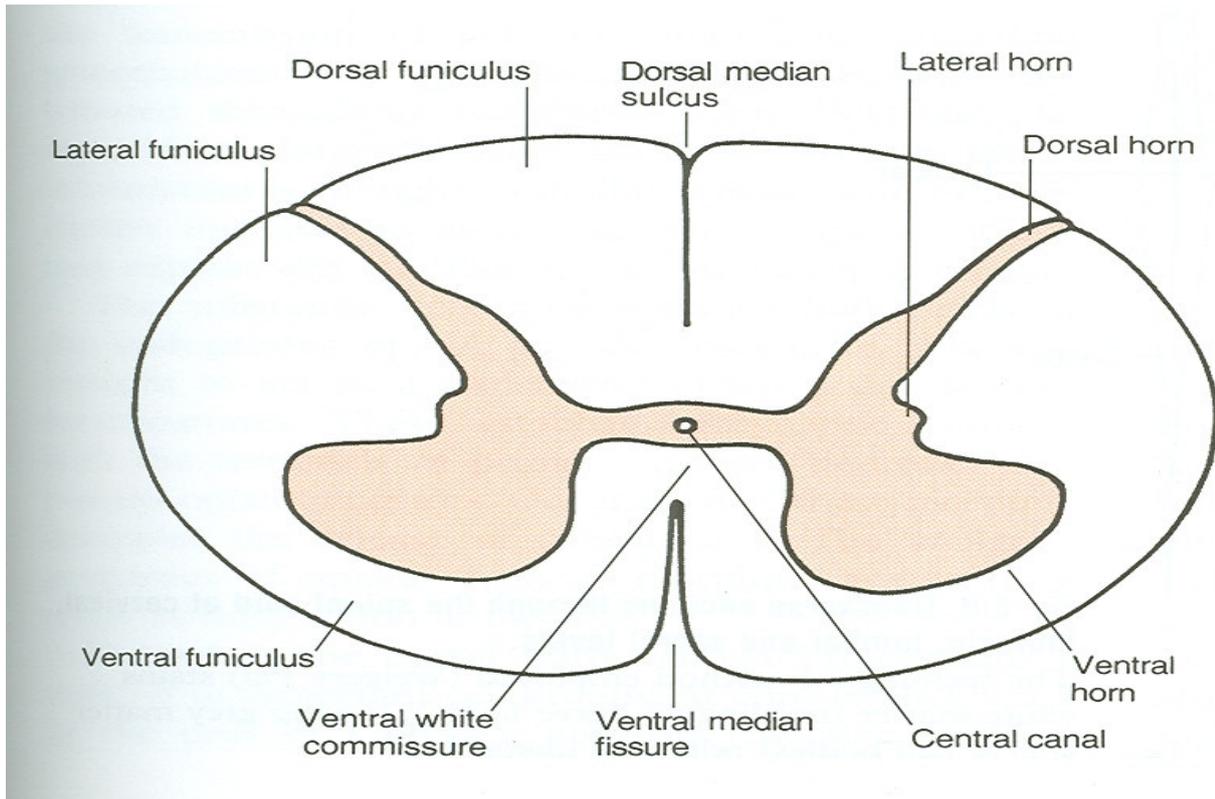


## INTERNAL FEATURES OF SPINAL CORD

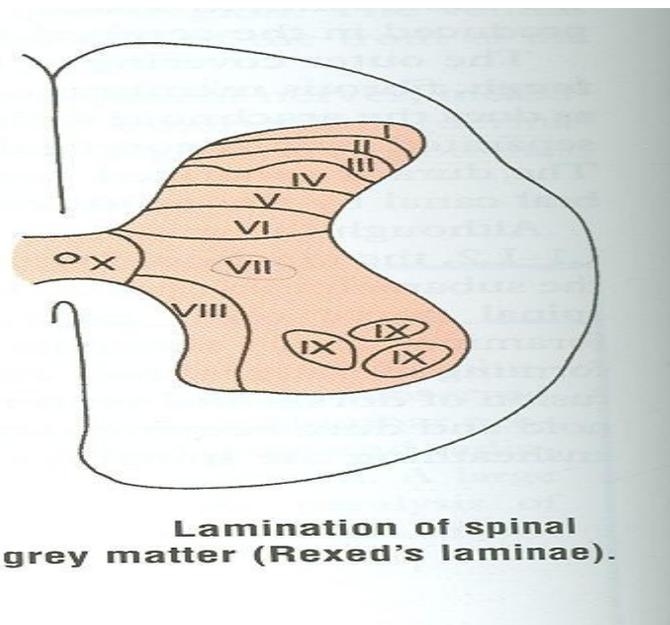


Transverse section

### 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.

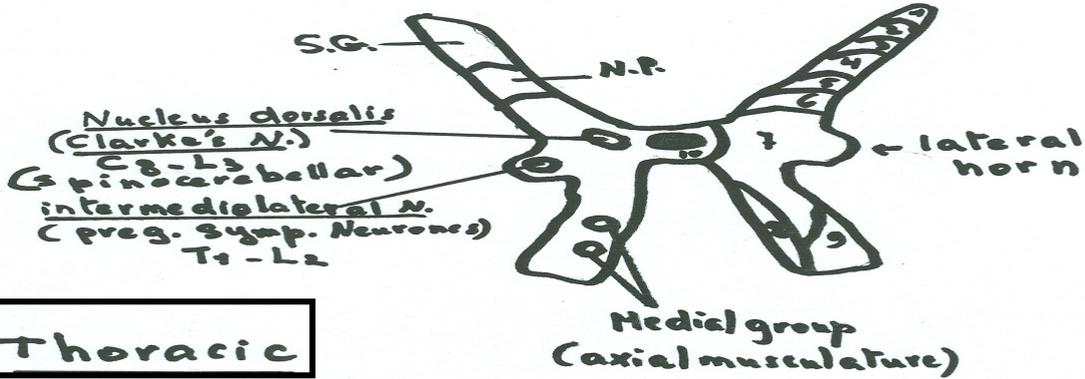
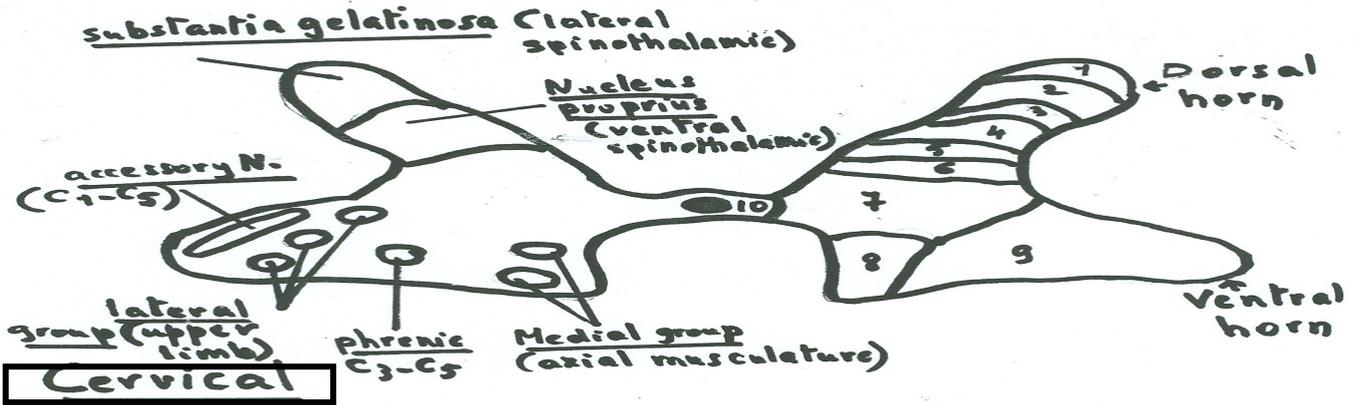
### LAMINATION OF GREY MATTER :



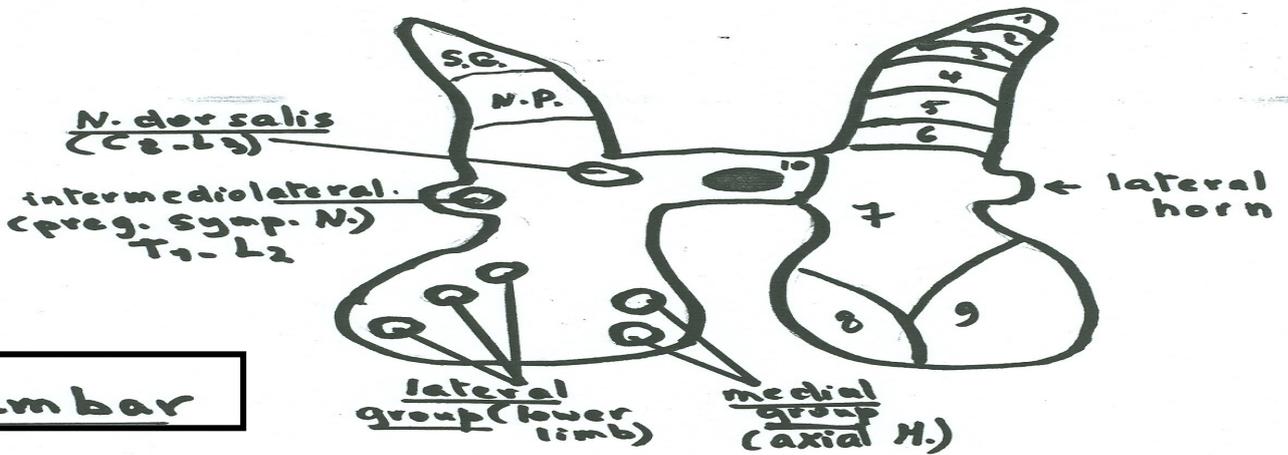
Lamination of spinal grey matter (Rexed's laminae).

**NUCLEI :**

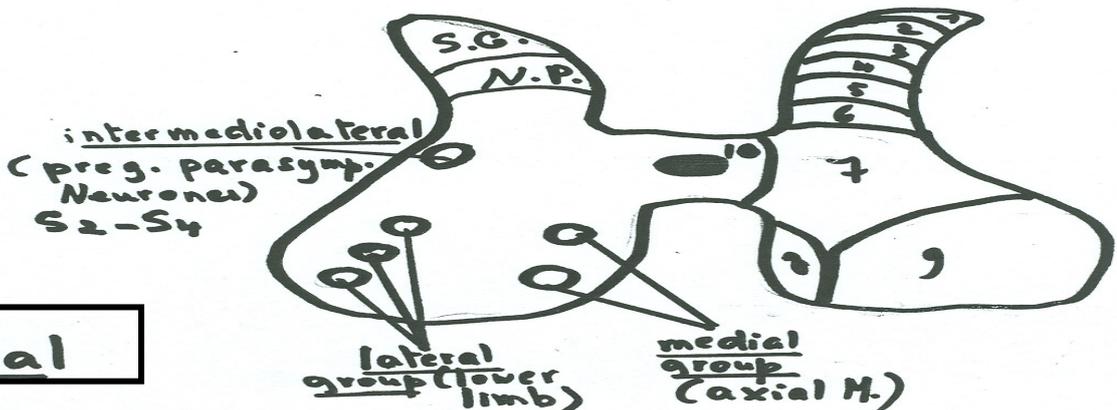
Nuclei



Nuclei



**Lumbar**



**Sacral**

## 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 :**

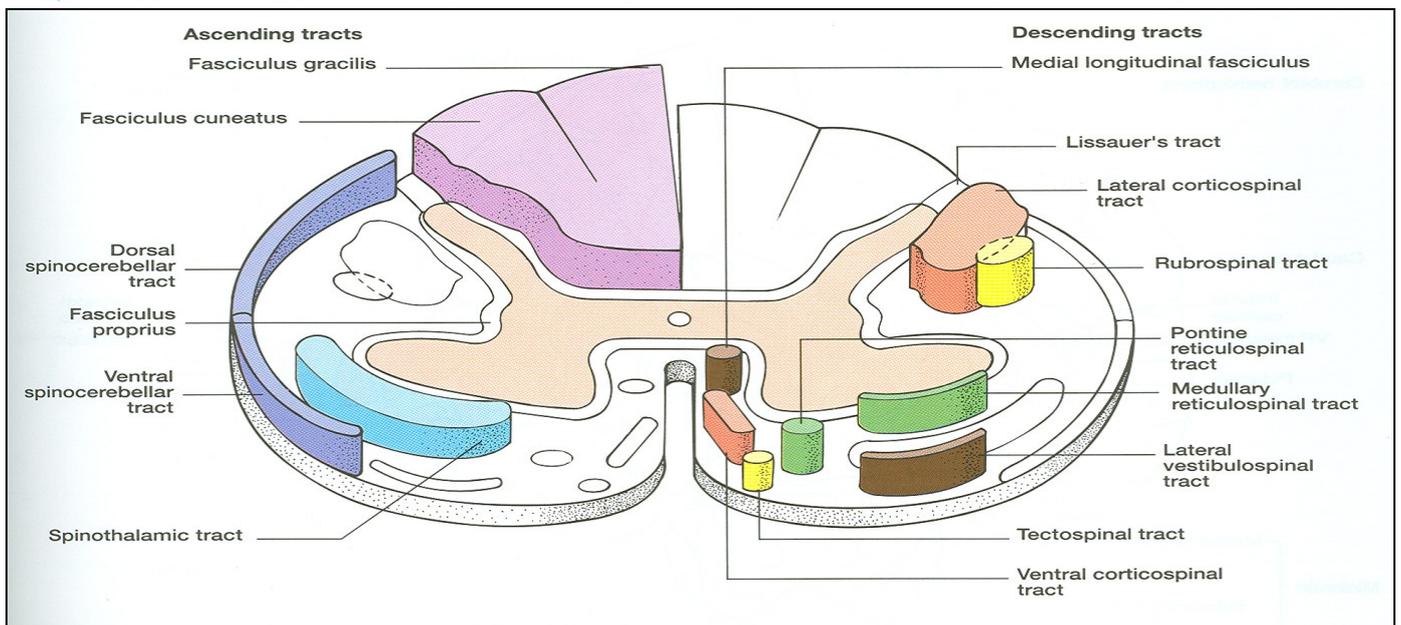
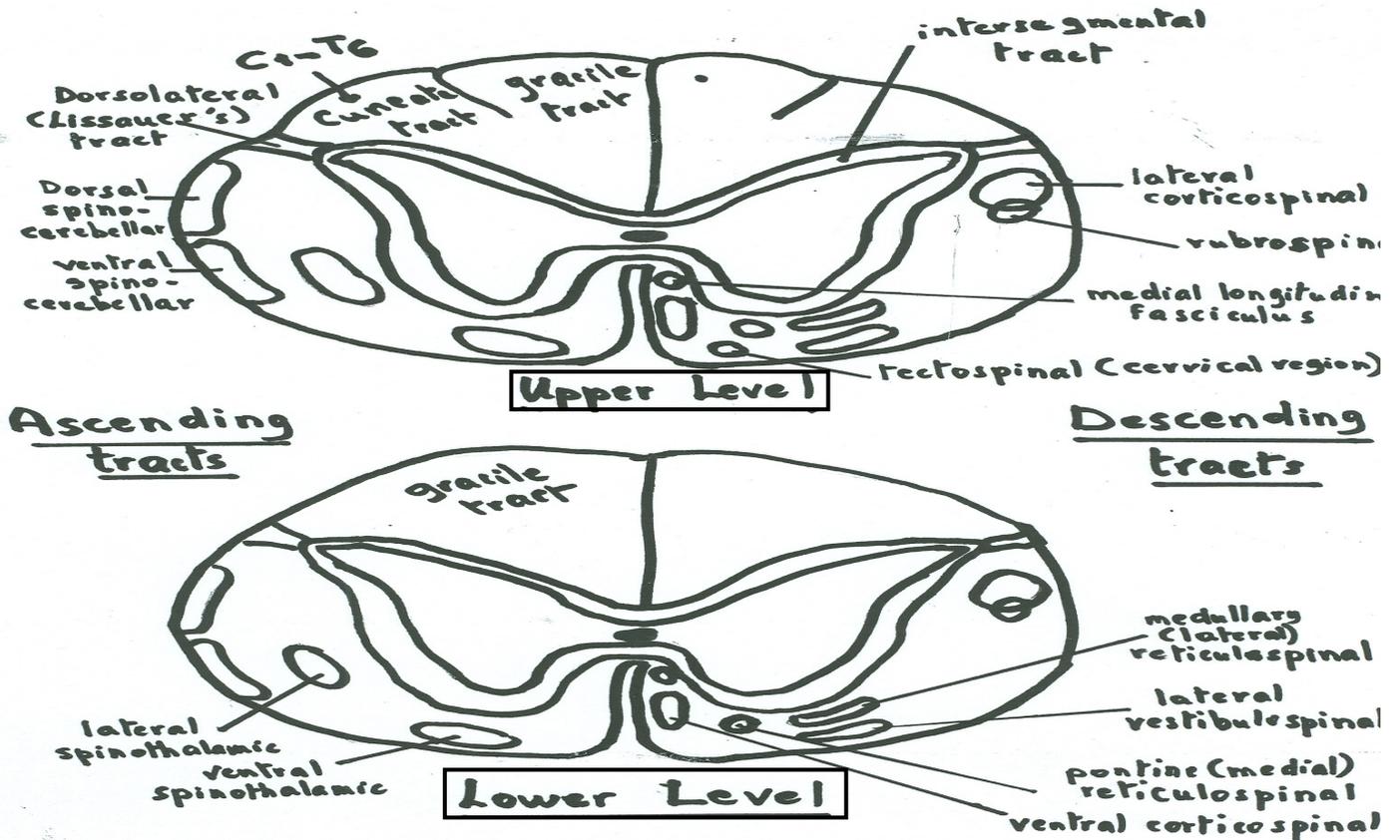
- **Corticospinal tracts :**
  - **Site :**
    1. Lateral corticospinal : *lateral* column.
    2. Ventral corticospinal : *ventral* column.
  - **Level :** all levels.
  - **Origin :** **motor cortex.**
  - **Function :** control of **voluntary, discrete & fine movements**, especially those of distal 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 nigra.
- 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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Abo Slo7