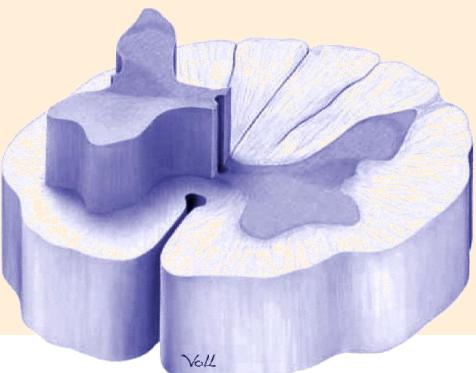
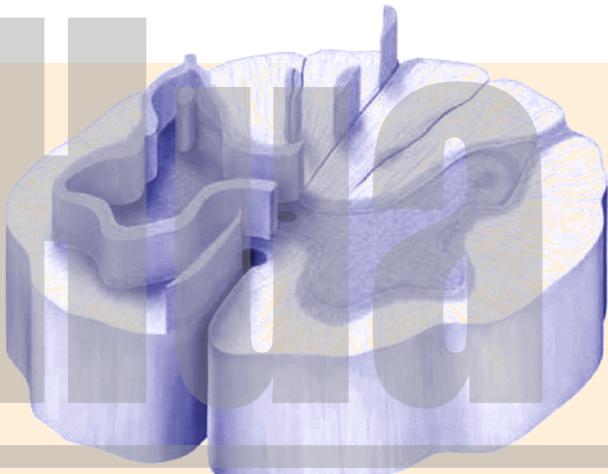
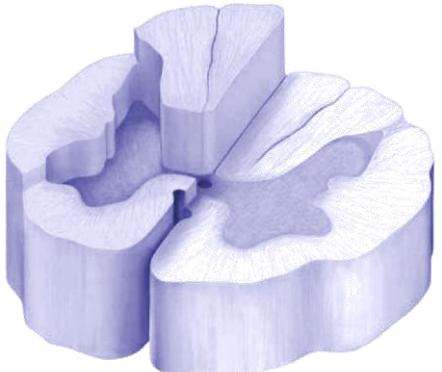




Human Anatomy: Neuroanatomy



The Internal Structure of Spinal Cord

Feng Shi

Dept. of Human Anatomy

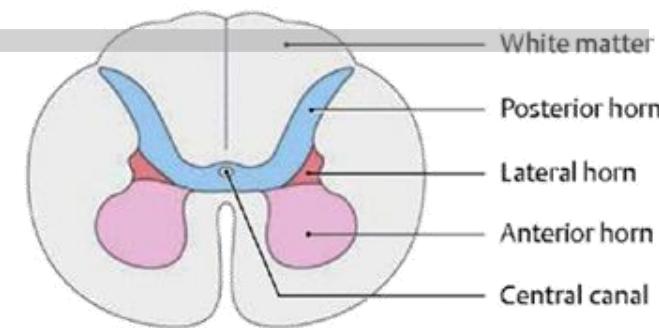
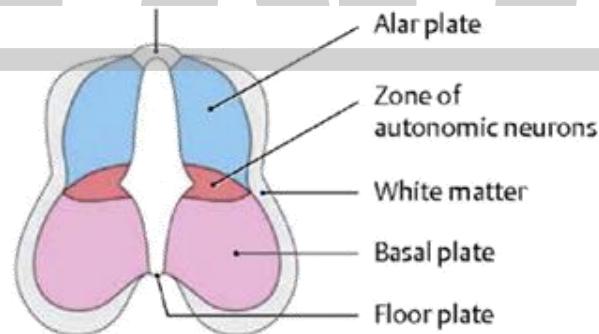
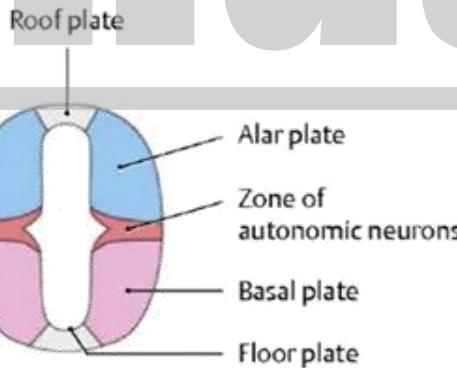
Sichuan University

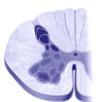


Human Anatomy: Neuroanatomy

OUTLINE

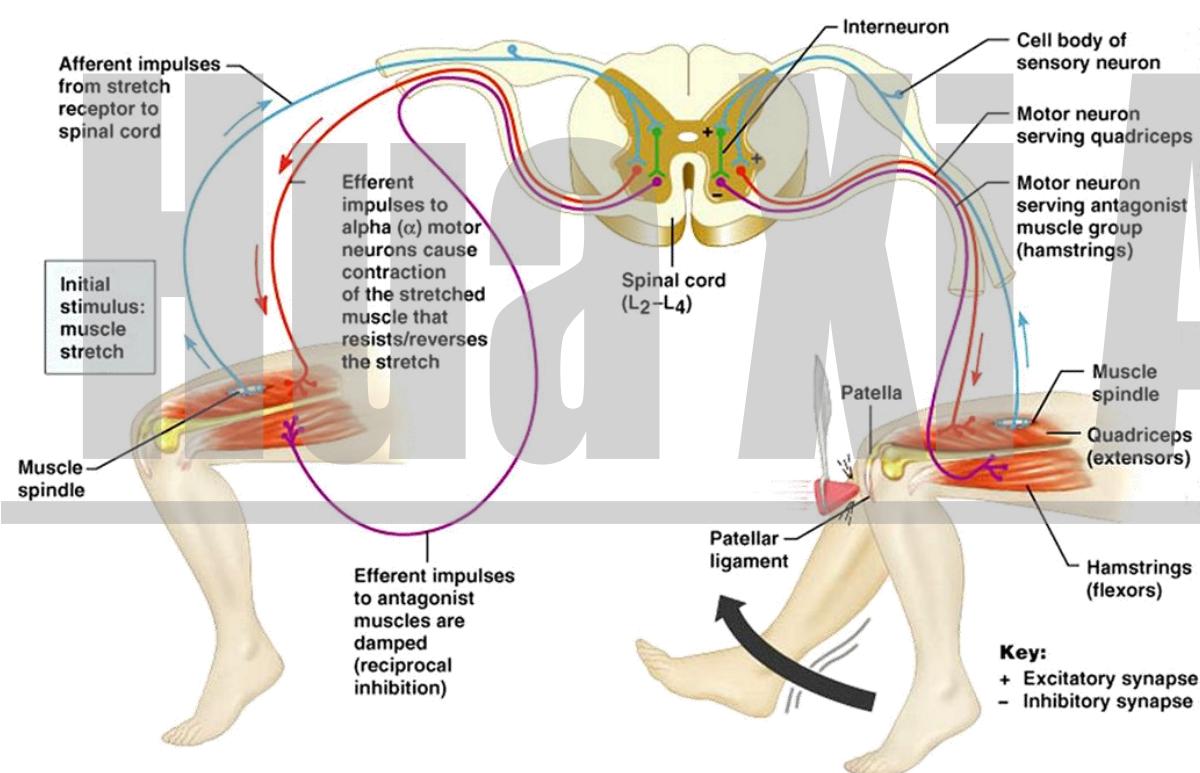
- Gray Matter
- White Matter
- Conscious Sensory & Motor Tracts





Functions of Spinal Cord

- transmitting
- spinal



The nervous system sorts and interprets incoming information before directing a response.

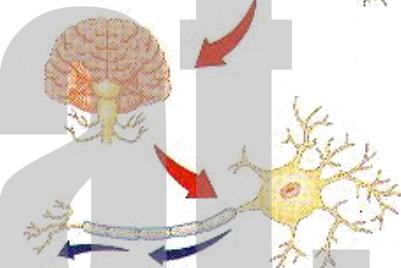
A Receptors in the skin sense a tap or other stimulus.



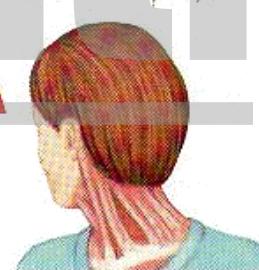
B Sensory neurons transmit the touch message.



C The message is interpreted. A response is sent to the motor neurons.

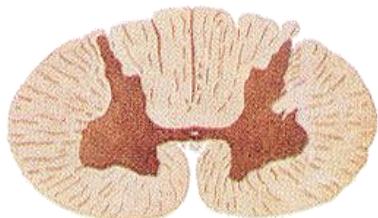


D Motor neurons transmit a response message to the shoulder muscles.

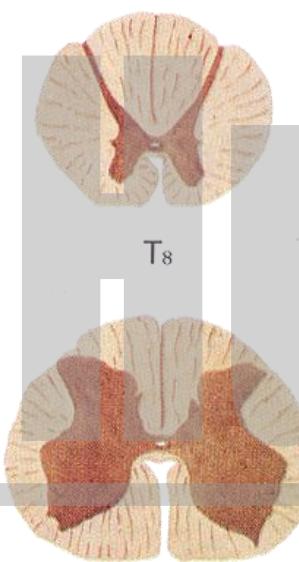


E The neck muscles are activated, causing the head to turn.

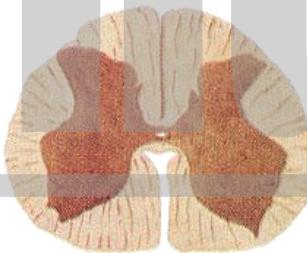




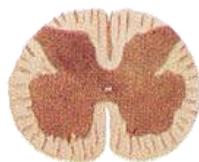
C₅



T₈

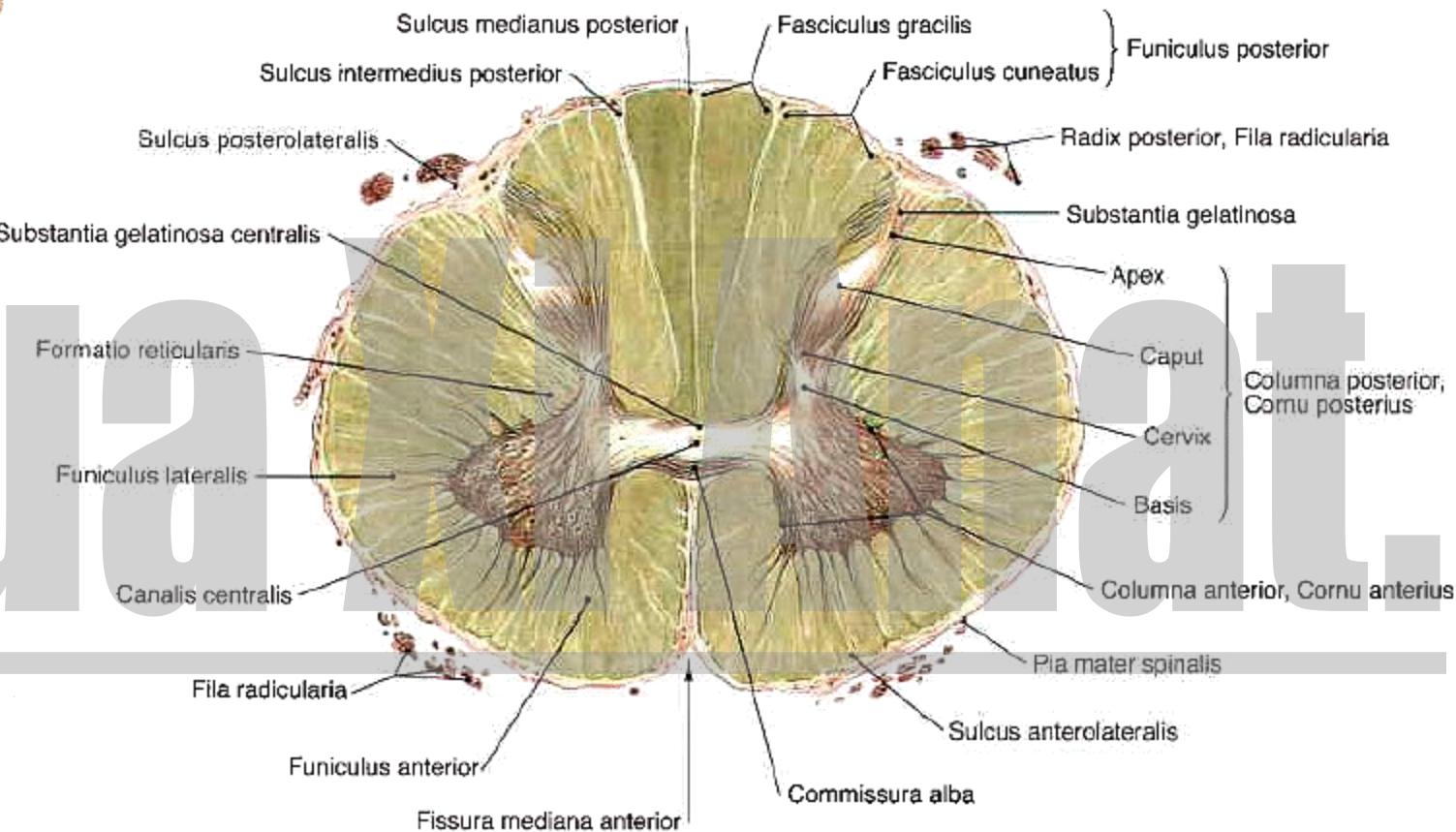


L₃



S₃

Internal Structure of Spinal Cord

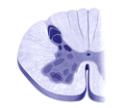


▪ white matter

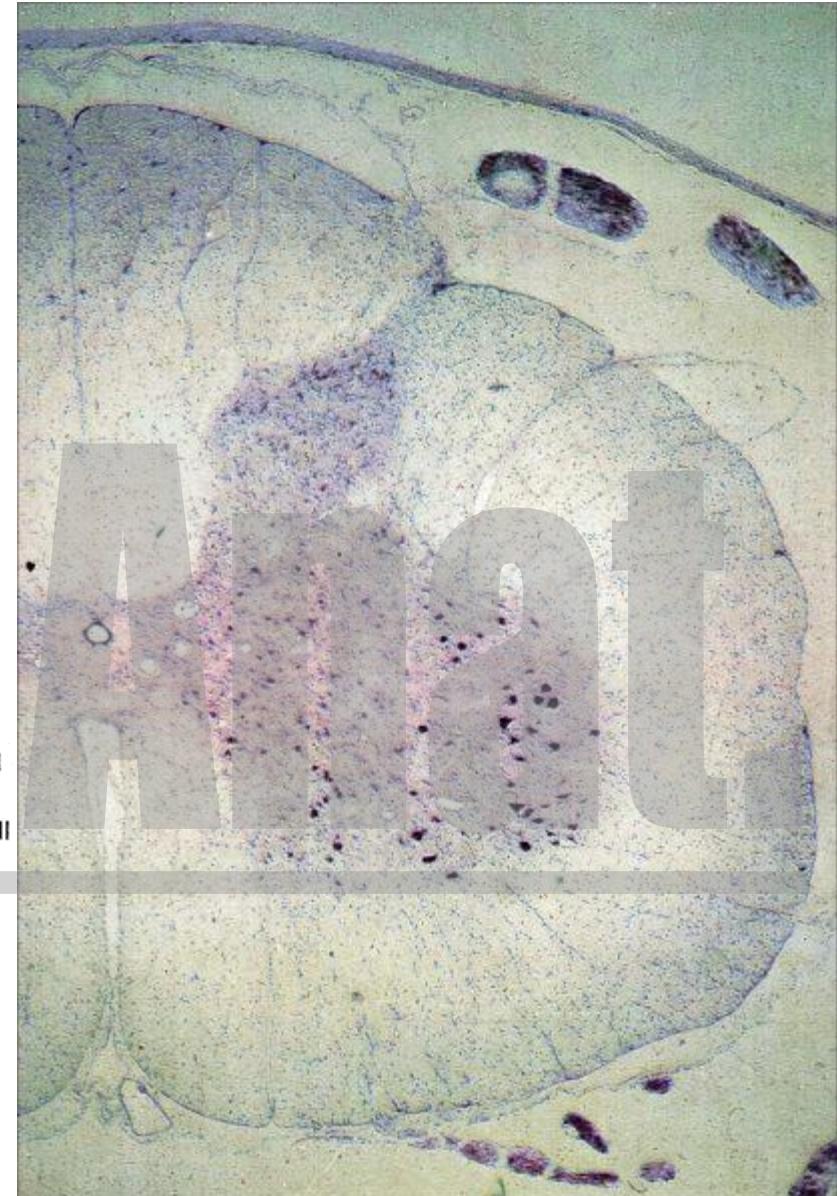
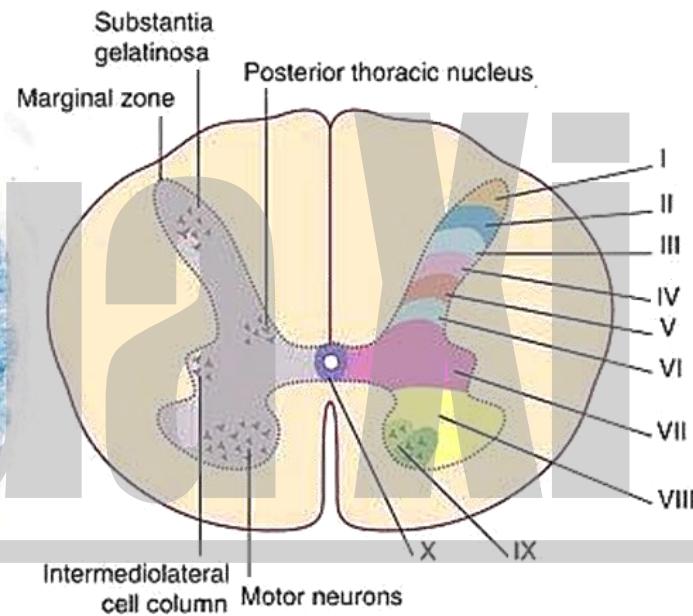
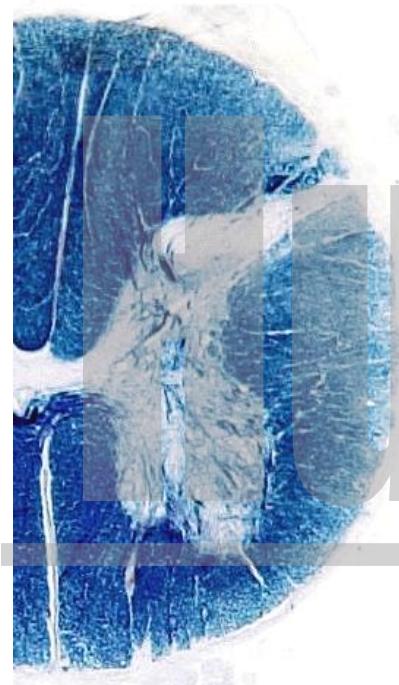
▪ grey matter

▪ central canal



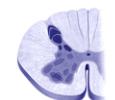


The Gray Matter of Spinal Cord

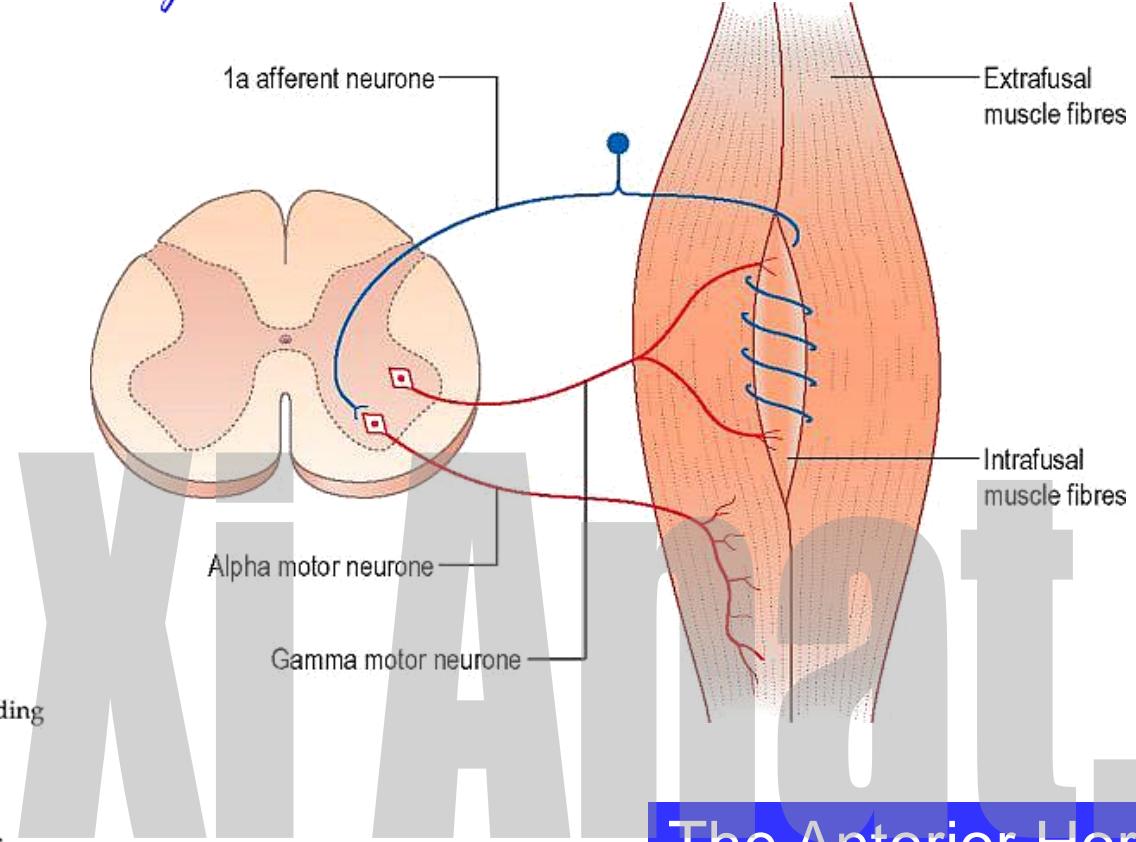
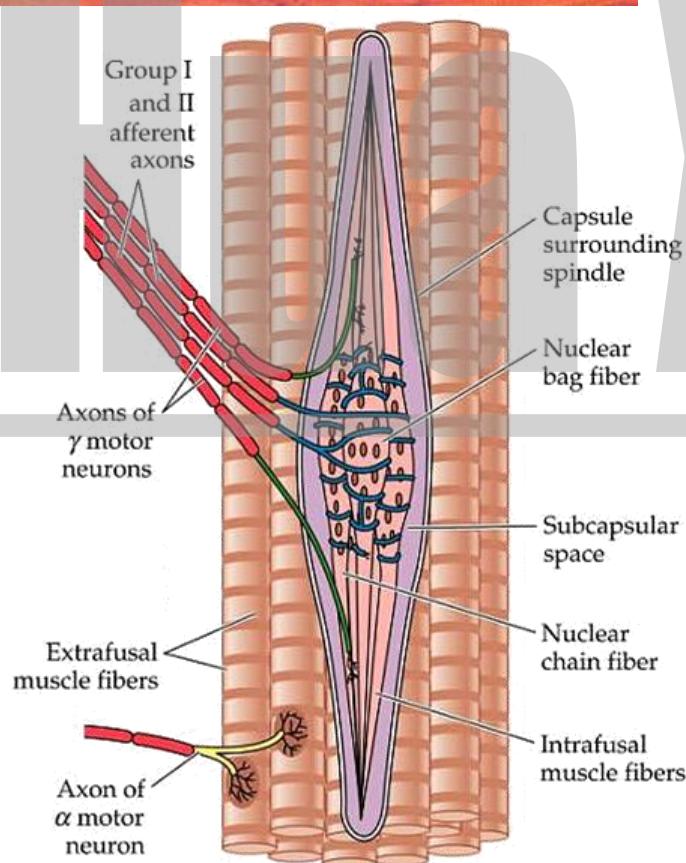
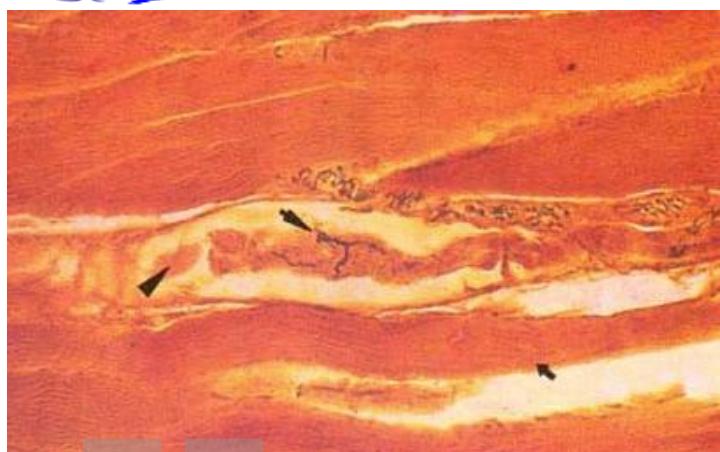


The Cytoarchitectural Lamination
(Rexed's Laminae)





Human Anatomy : Neuroanatomy



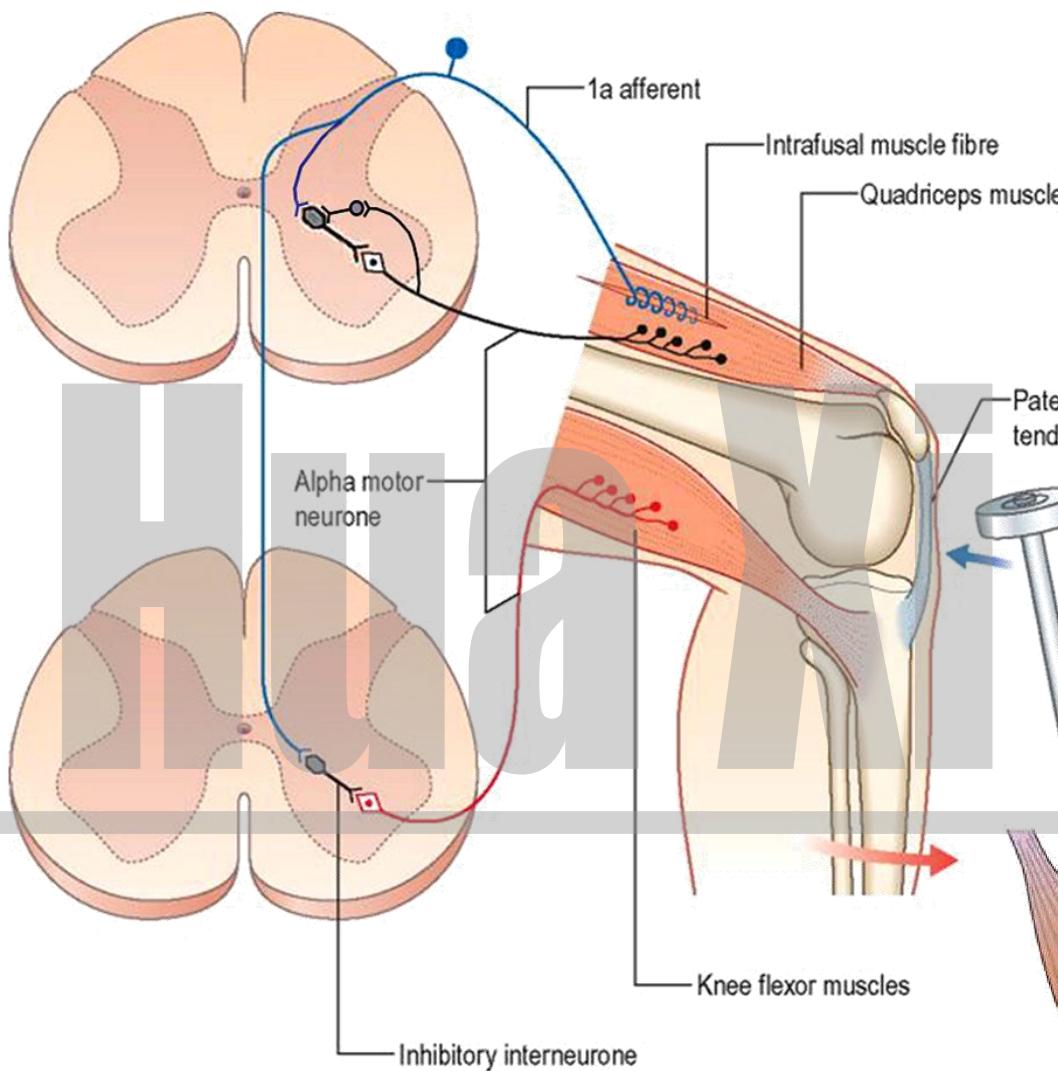
The Anterior Horn

- α motor neuron – extrafusal muscle fibres (voluntary movement)
- γ motor neuron – intrafusal muscle fibers (muscle tonus)

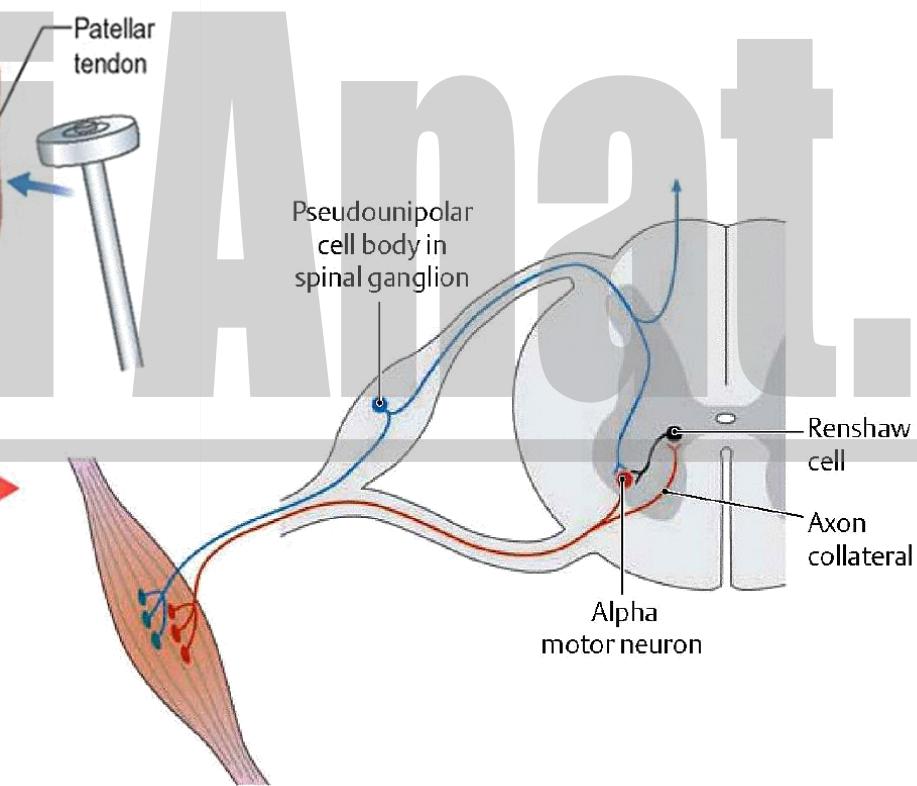




Human Anatomy · Neuroanatomy

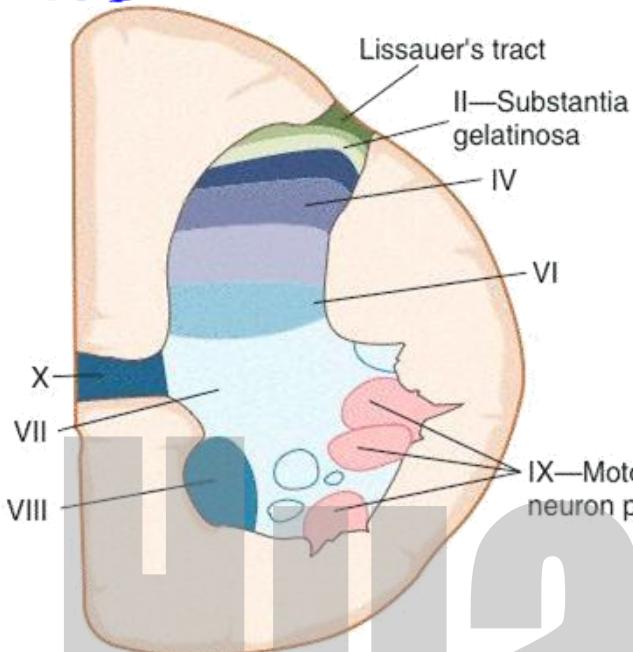


- Renshaw cell:
a motor neuron (axon collaterals)
↓
Renshaw cell
↓
αmotor neuron
(negative feedback mechanism)

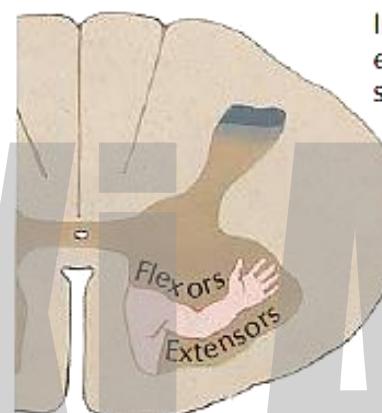




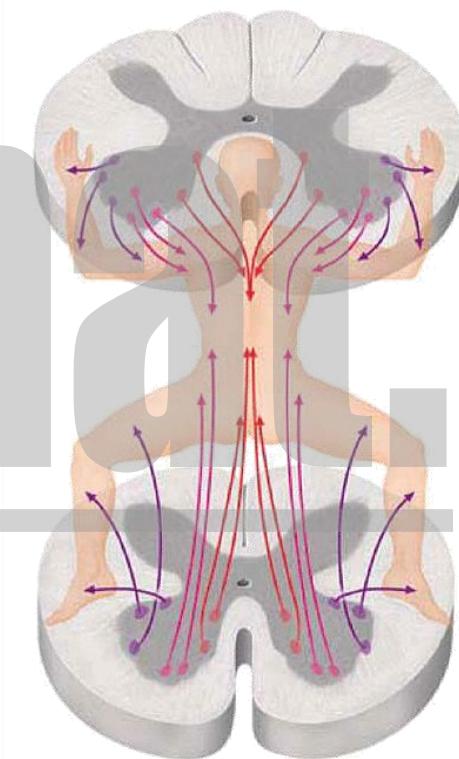
Human Anatomy · Neuroanatomy



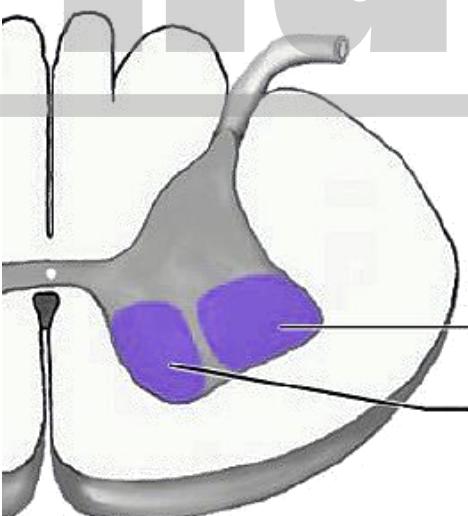
- medial nuclear group (lamina VIII) - axial muscles



In cervical
enlargement of
spinal cord

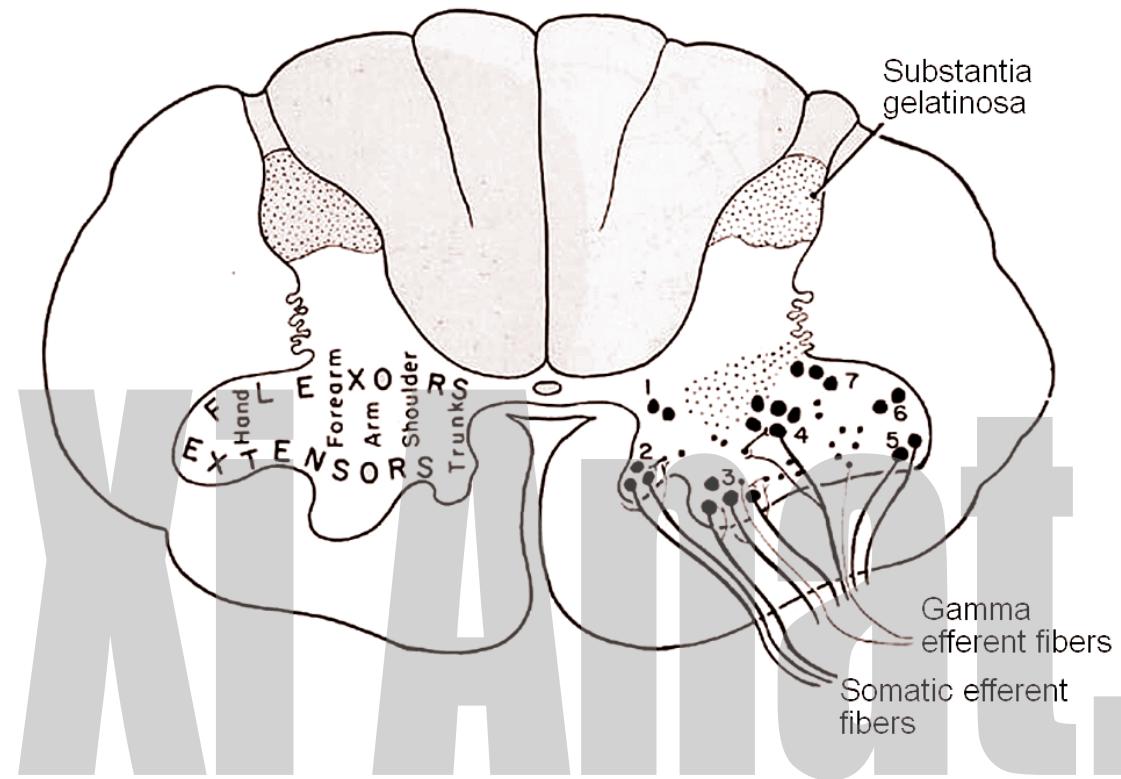
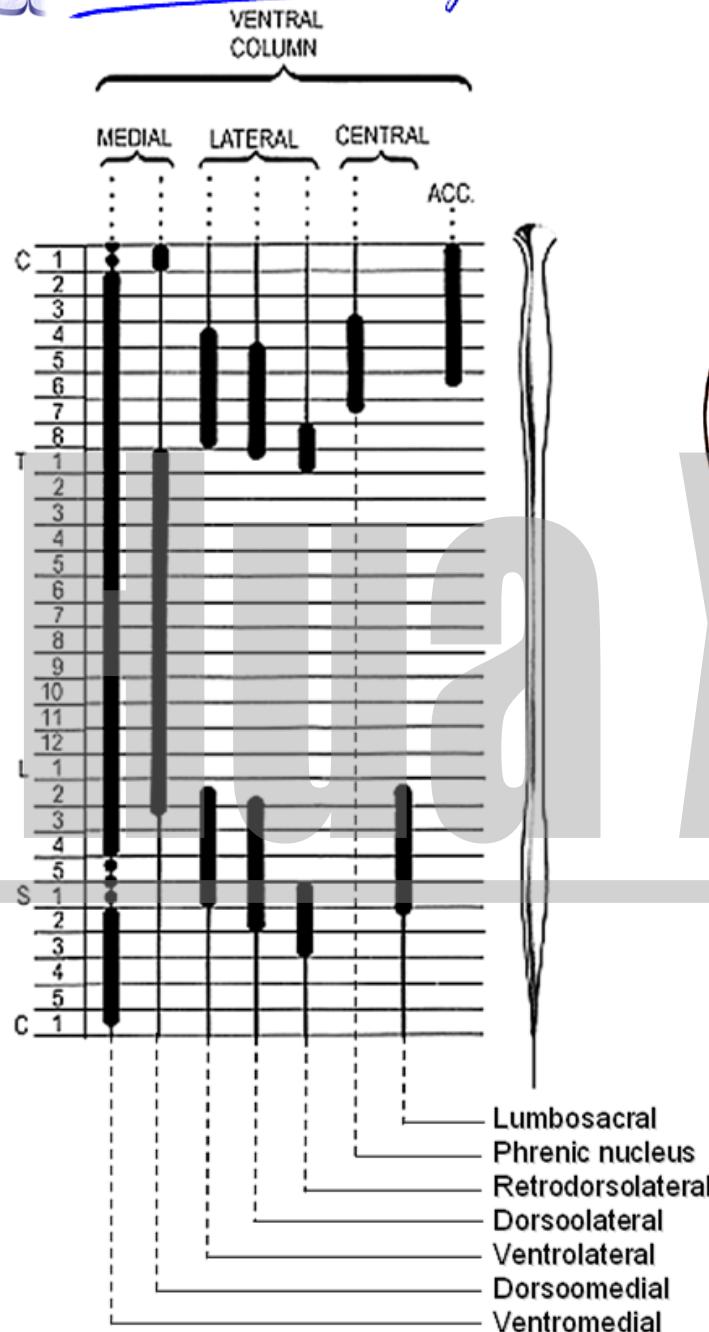


In lumbar
enlargement
of spinal cord





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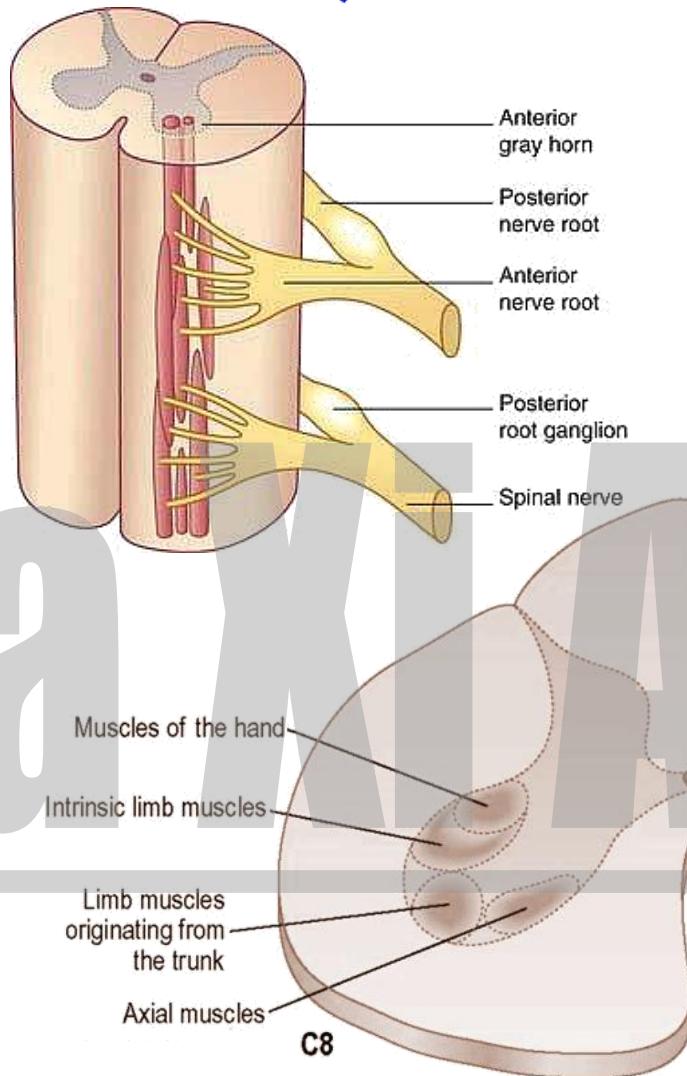
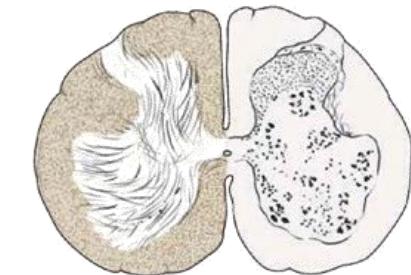
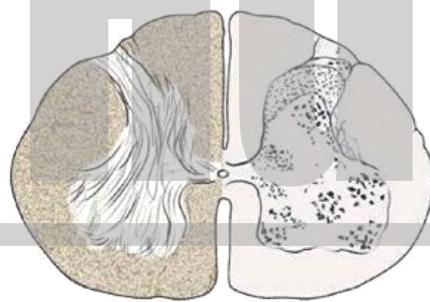
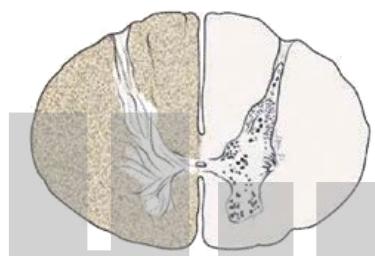
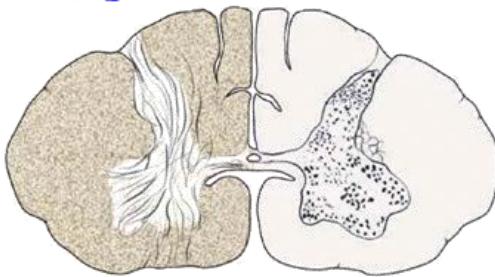


- **Medial Group:** extends throughout the whole length of spinal cord, supplies axial muscles
- **Lateral Group:** exists in the 2 enlargements, supplies distal muscles

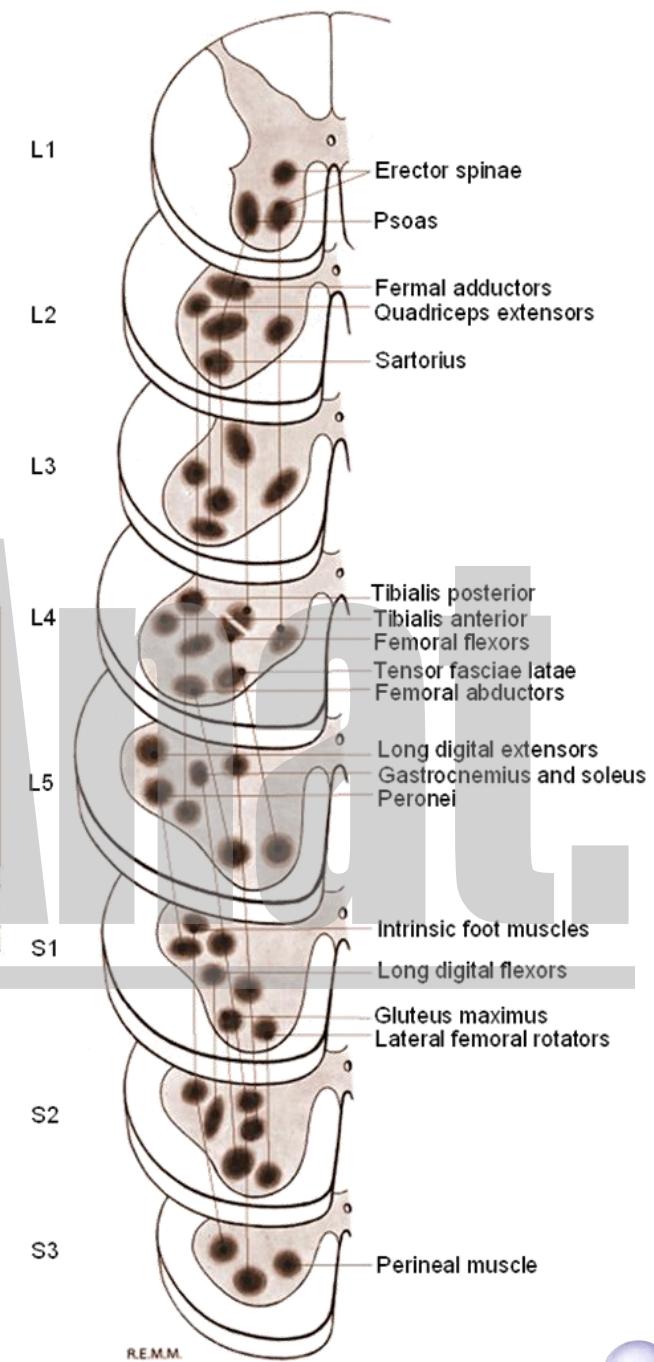




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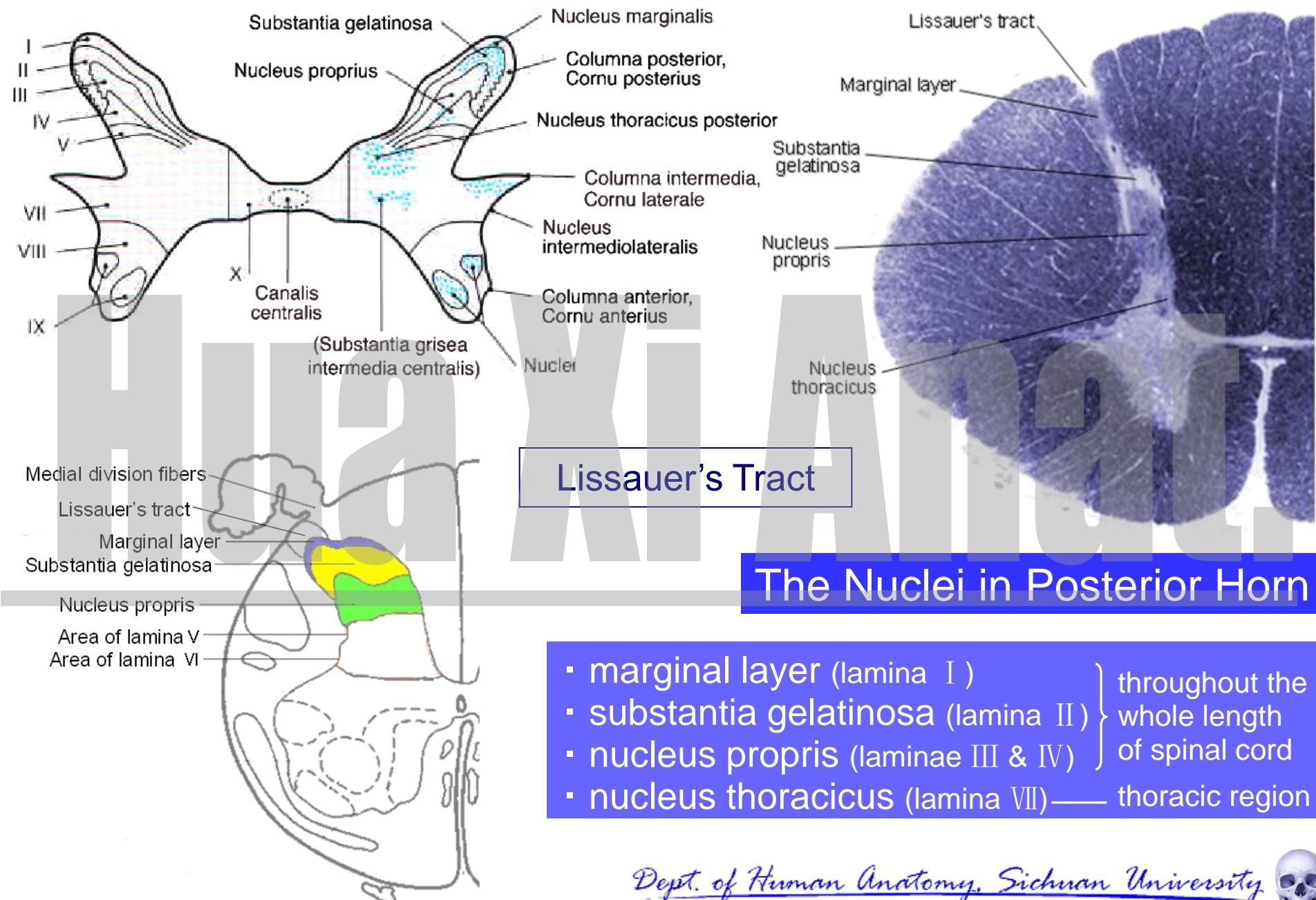


Nuclei in Cervical, Lumbar Enlargements



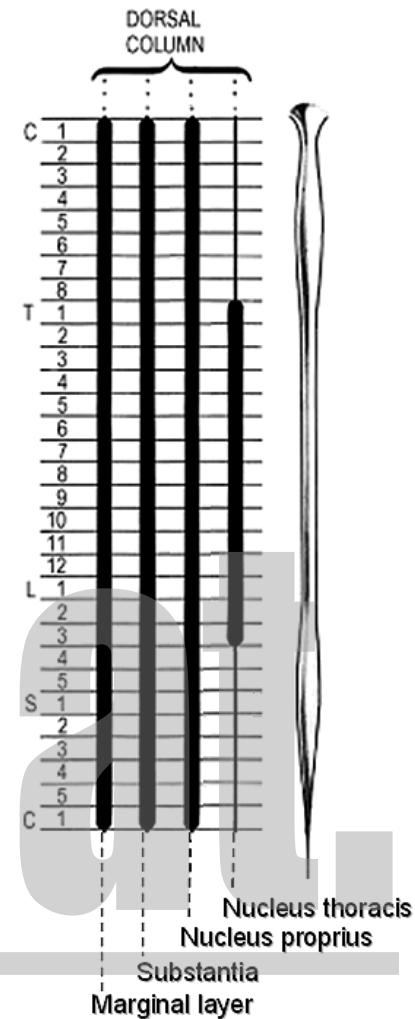
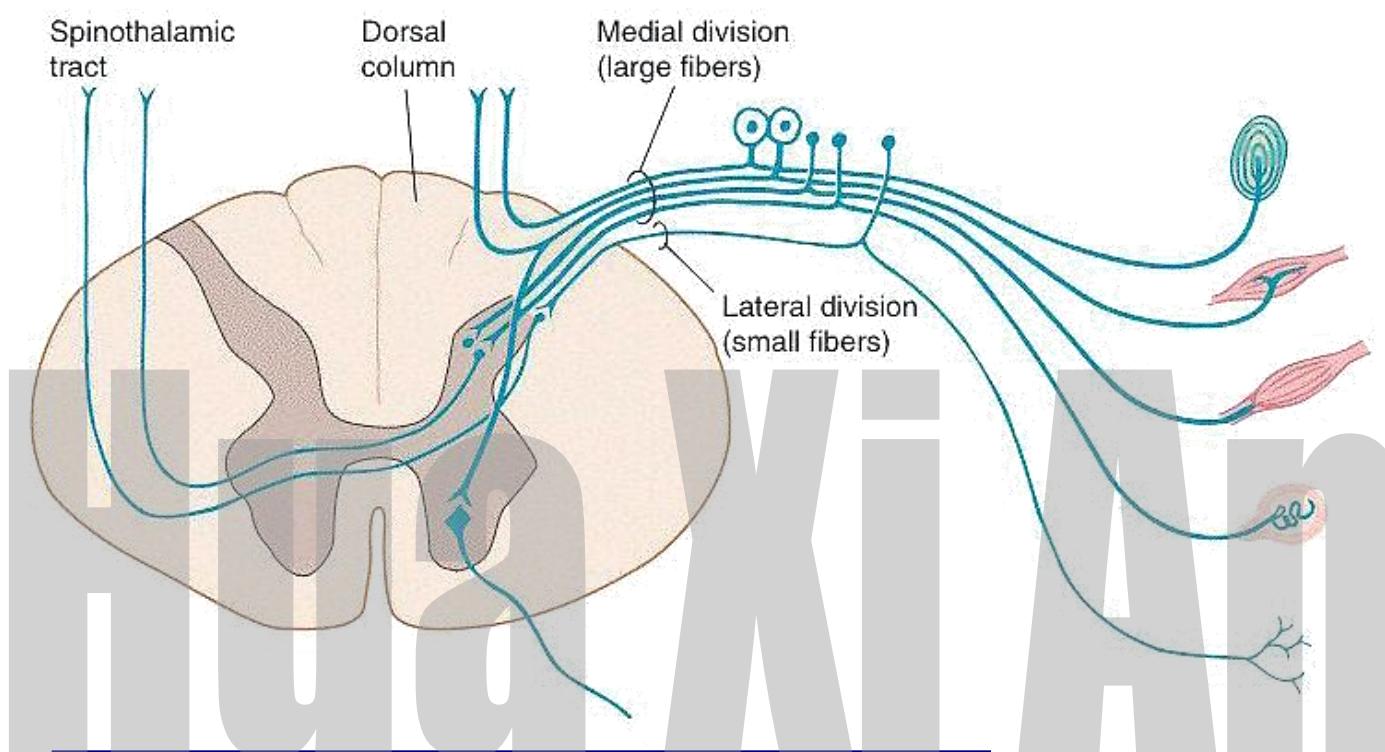


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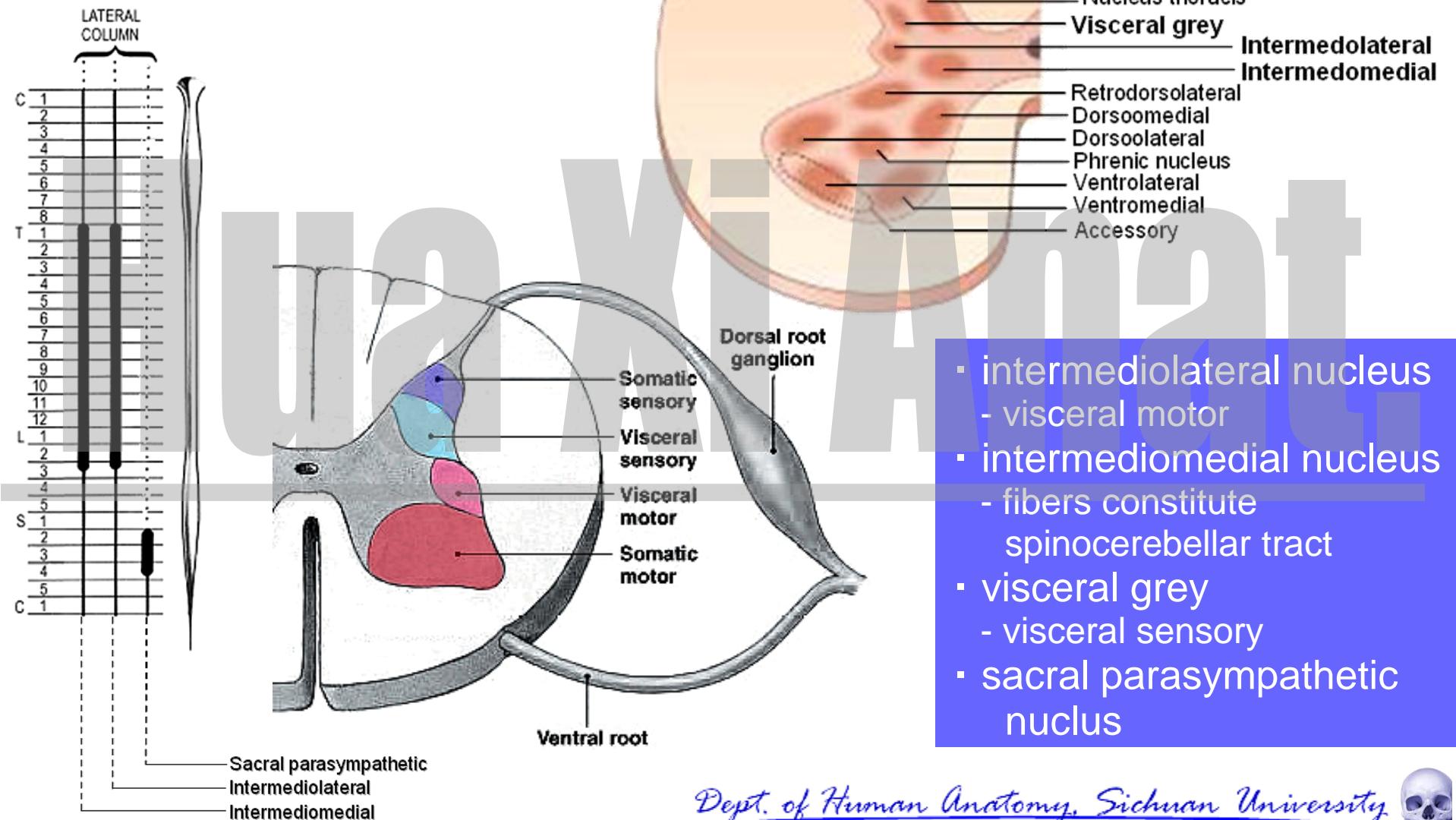
Functions of Nuclei in Posterior Horn

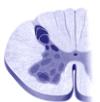
- **marginal layer & substantia gelatinosa:** pain, temperature, crude touch & pressure
- spinothalamic tract
- **nucleus proprius:** discriminative touch, vibratory sense & conscious muscle joint sense
- fasciculi gracilis & cuneatus
- **nucleus thoracicus:** proprioceptive information to cerebellum
- spinocerebellar tract



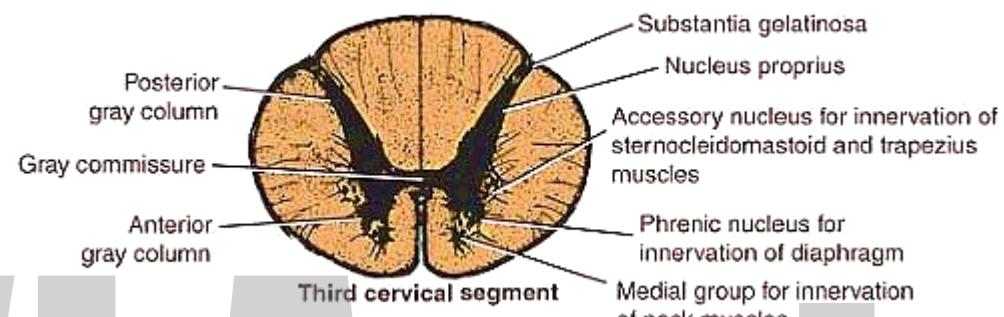
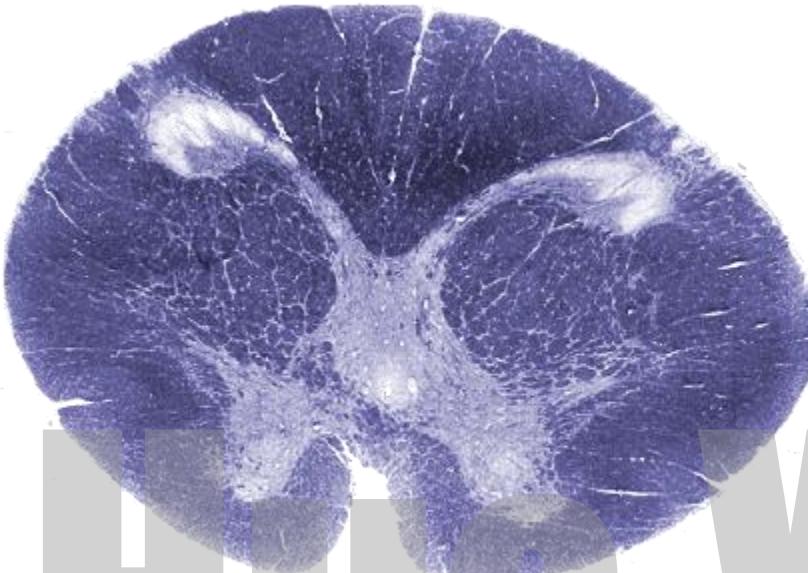


The Nuclei in Lateral (Intermediolateral) Horn

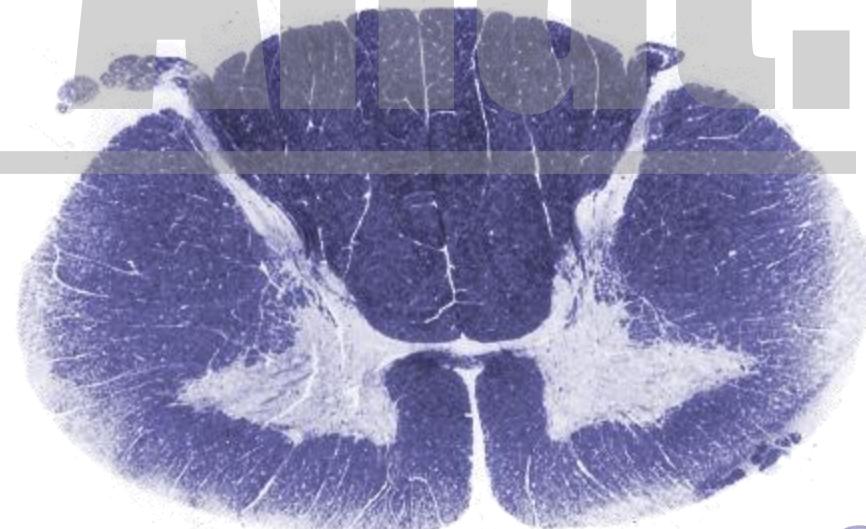
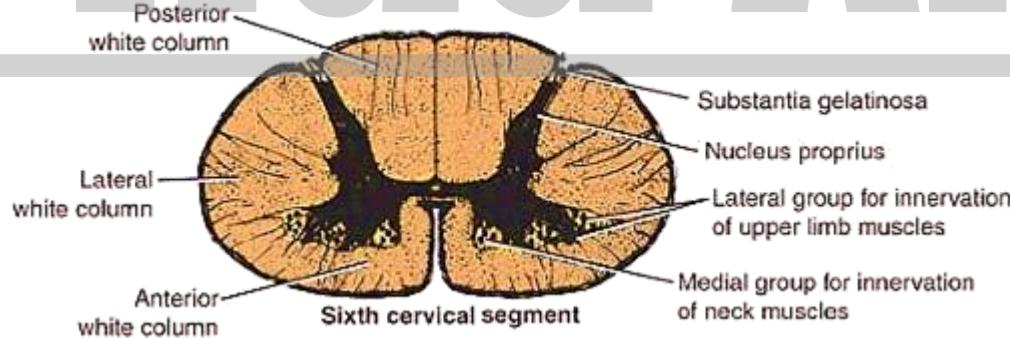


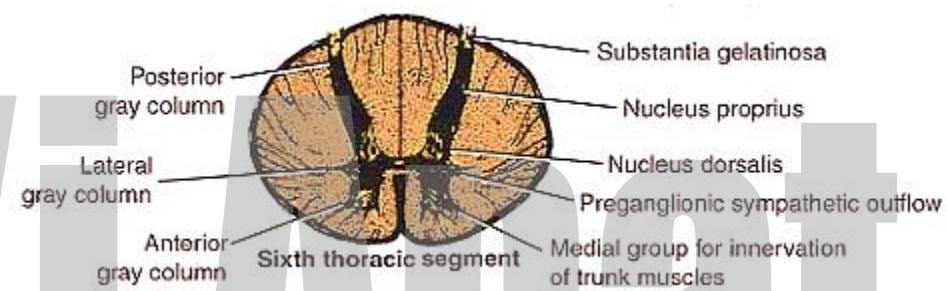
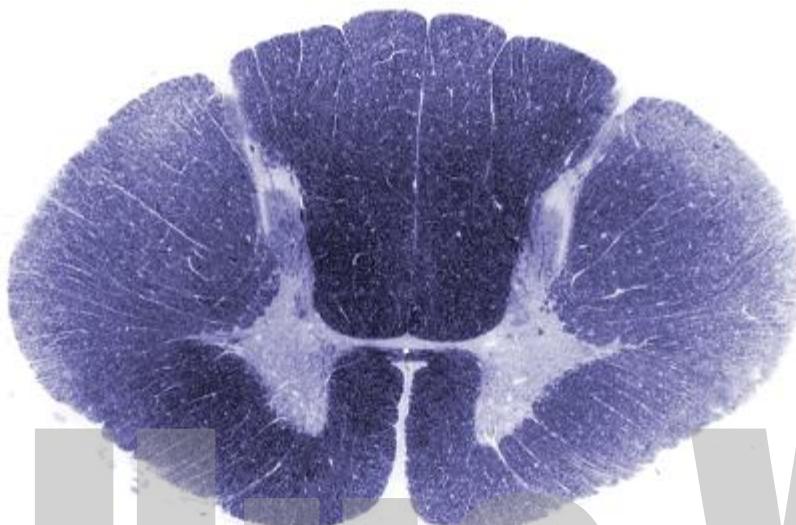


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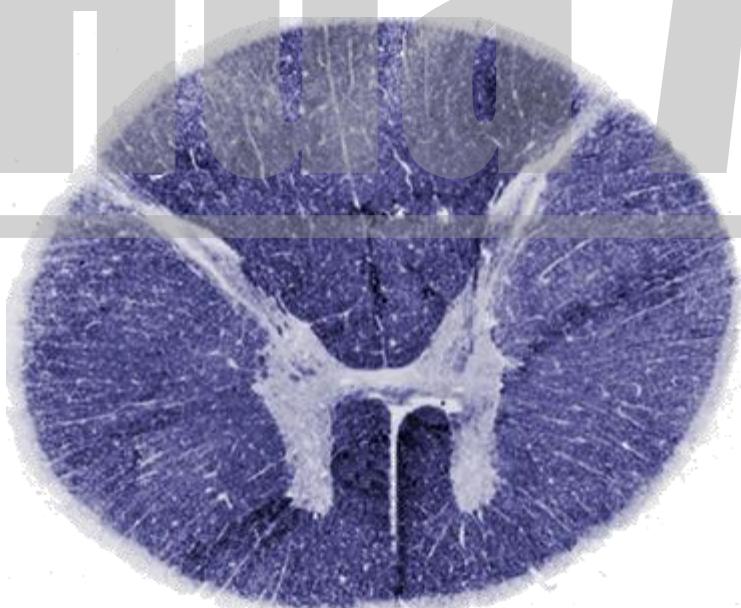


Coronal Section of the Spinal Cord at the Upper & Lower Cervical Levels



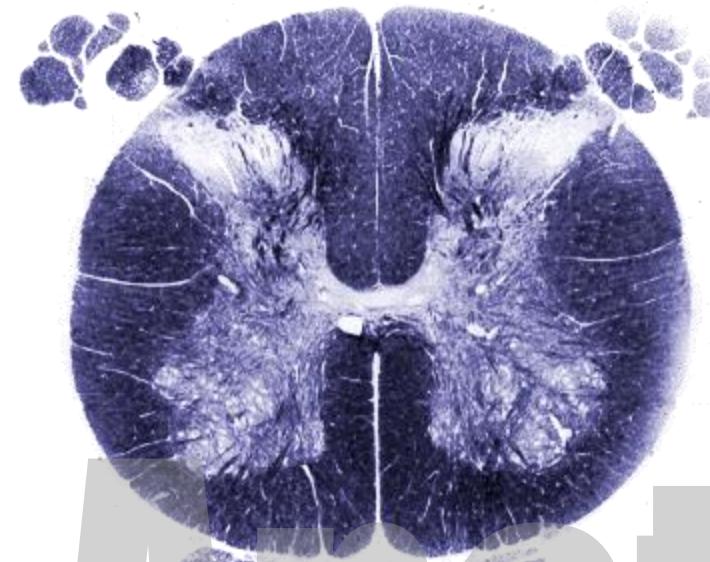
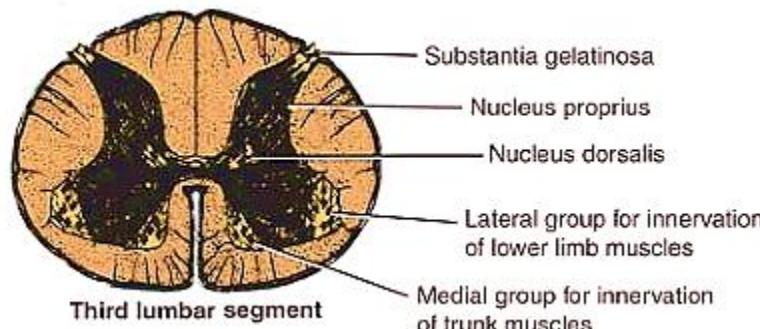


Coronal Section of the Spinal Cord at the Thoracic Levels

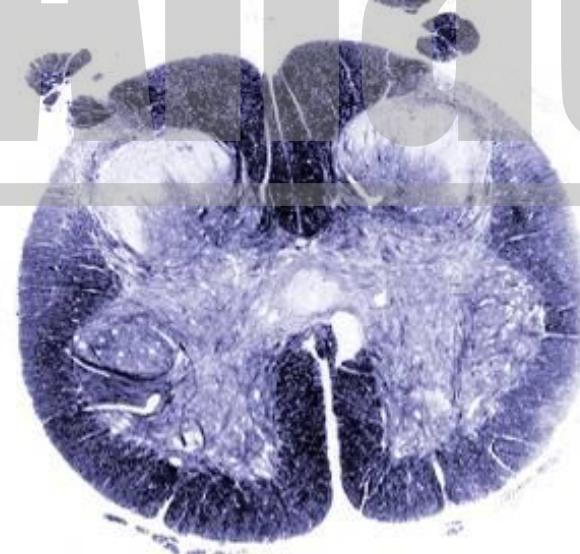
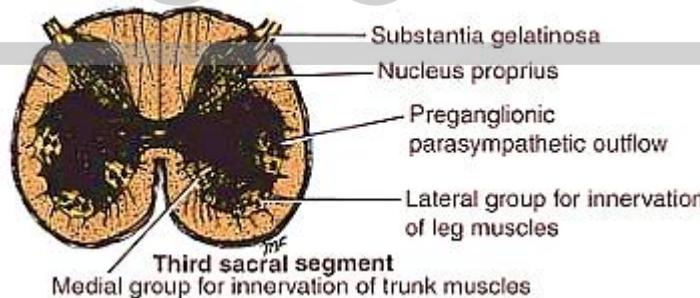




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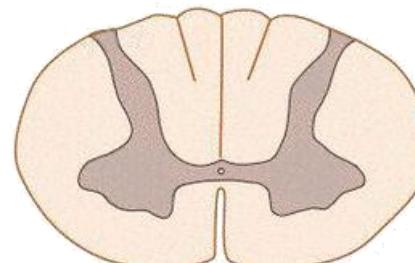
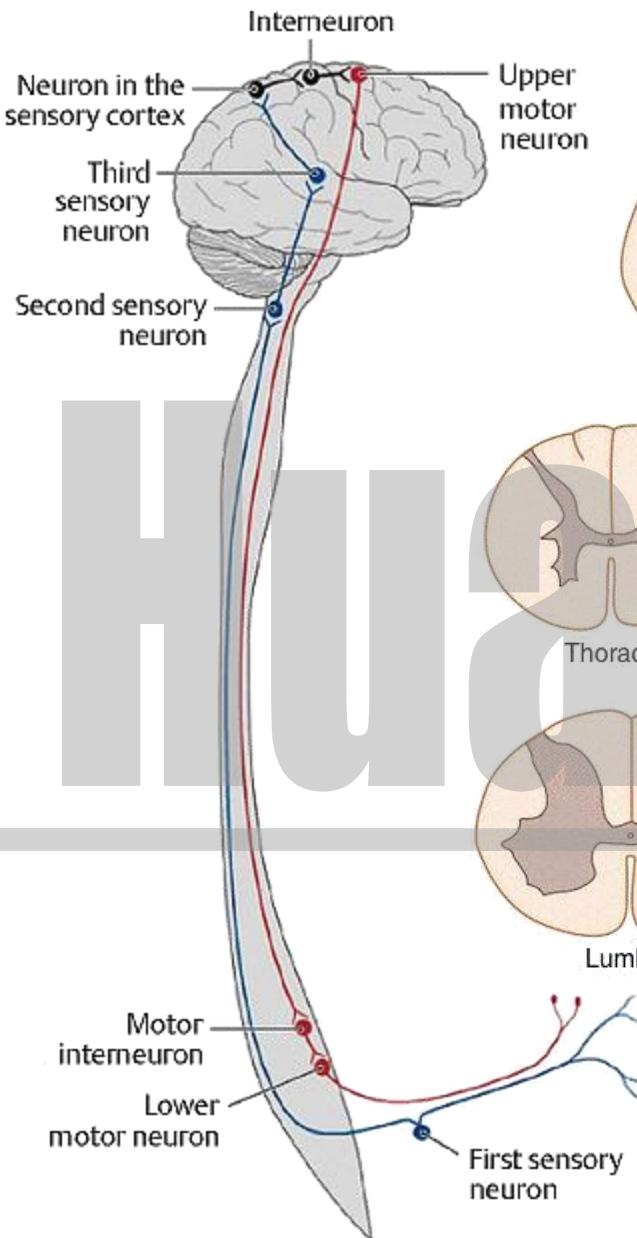


Coronal Section of the Spinal Cord at the Lumbar & Sacral Levels



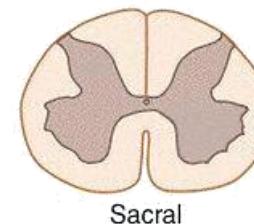
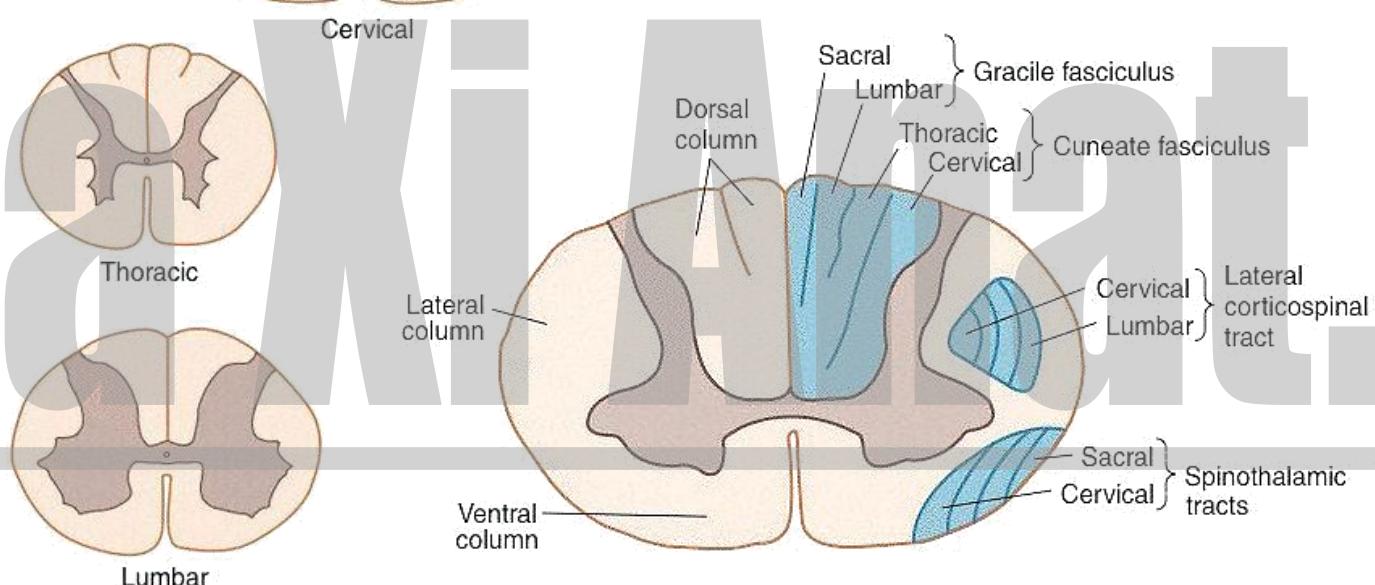


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The White Matter of Spinal Cord

- 3 funiculi (columns): anterior (ventral), lateral & posterior (dorsal)

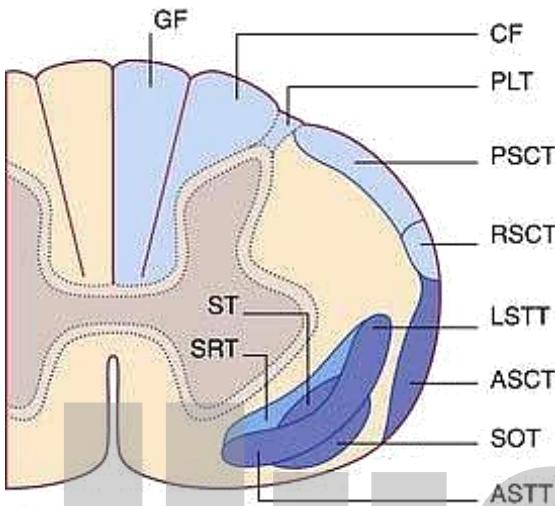


- 2 commissures: anterior &

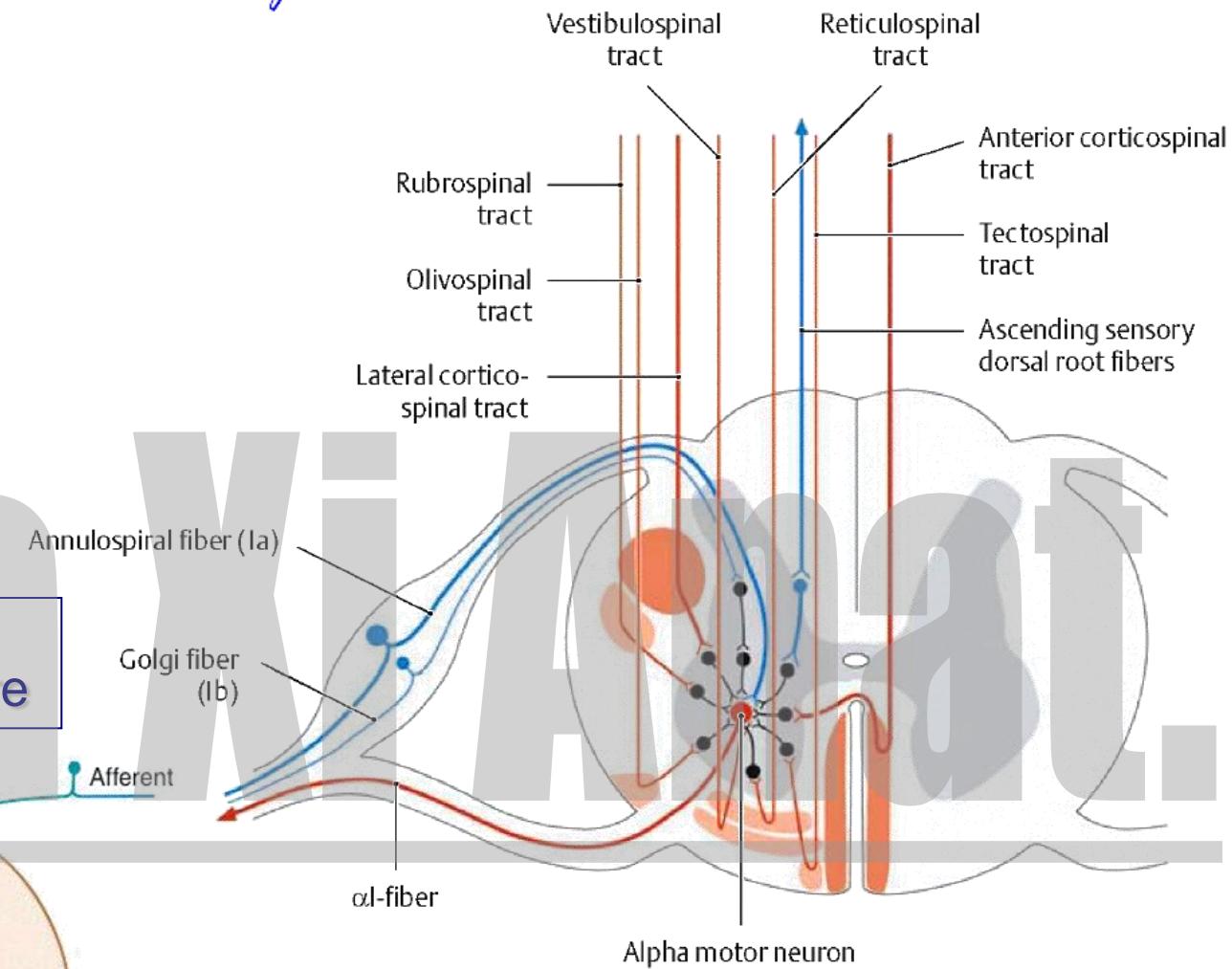
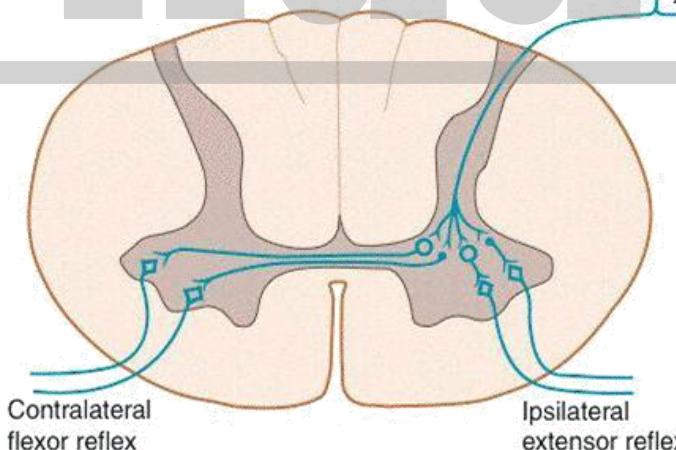




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Fasciculus Proprius & Anterior Commissure



- long tracts: ascending & descending tracts
- short tracts: fasciculus proprius



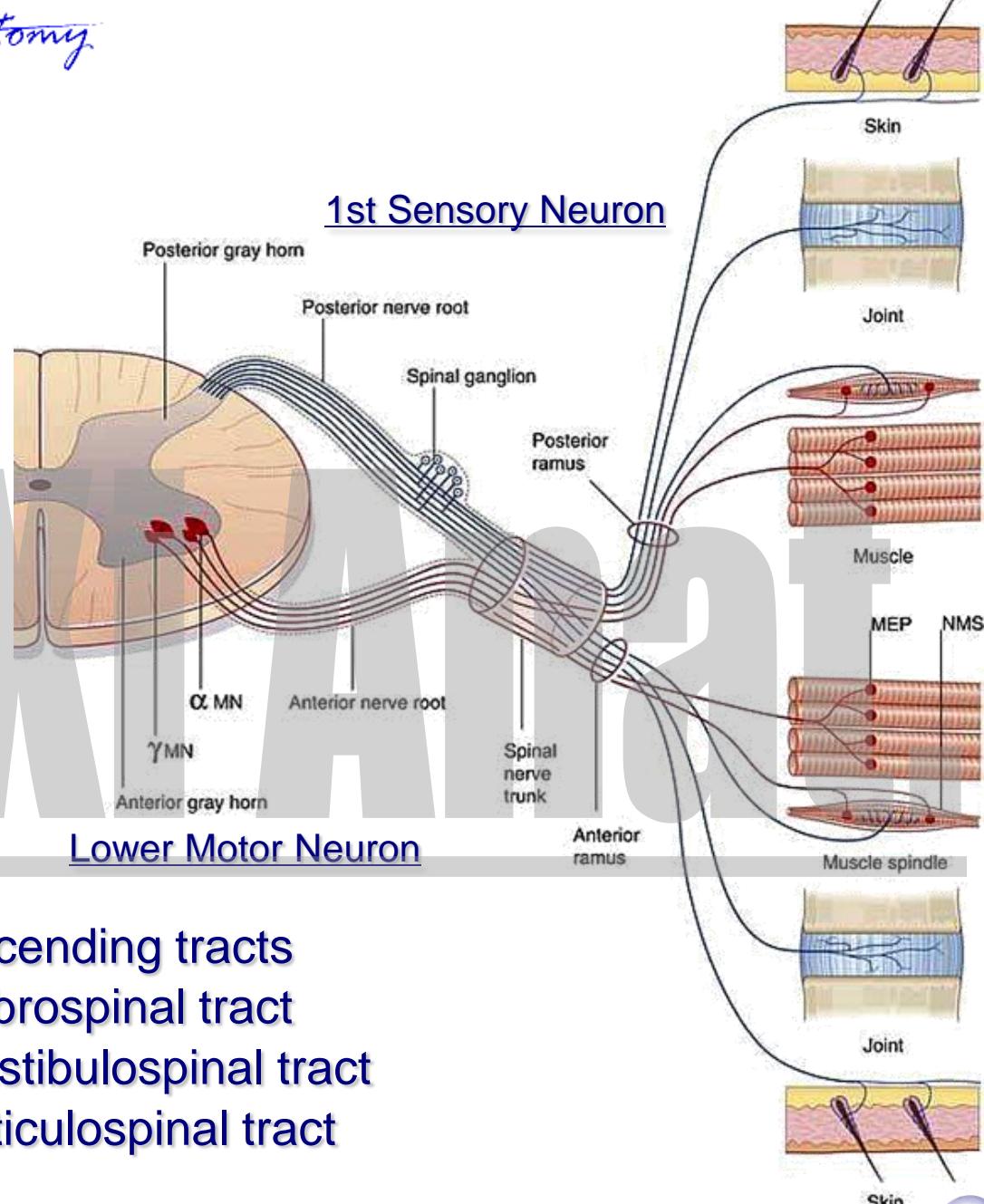


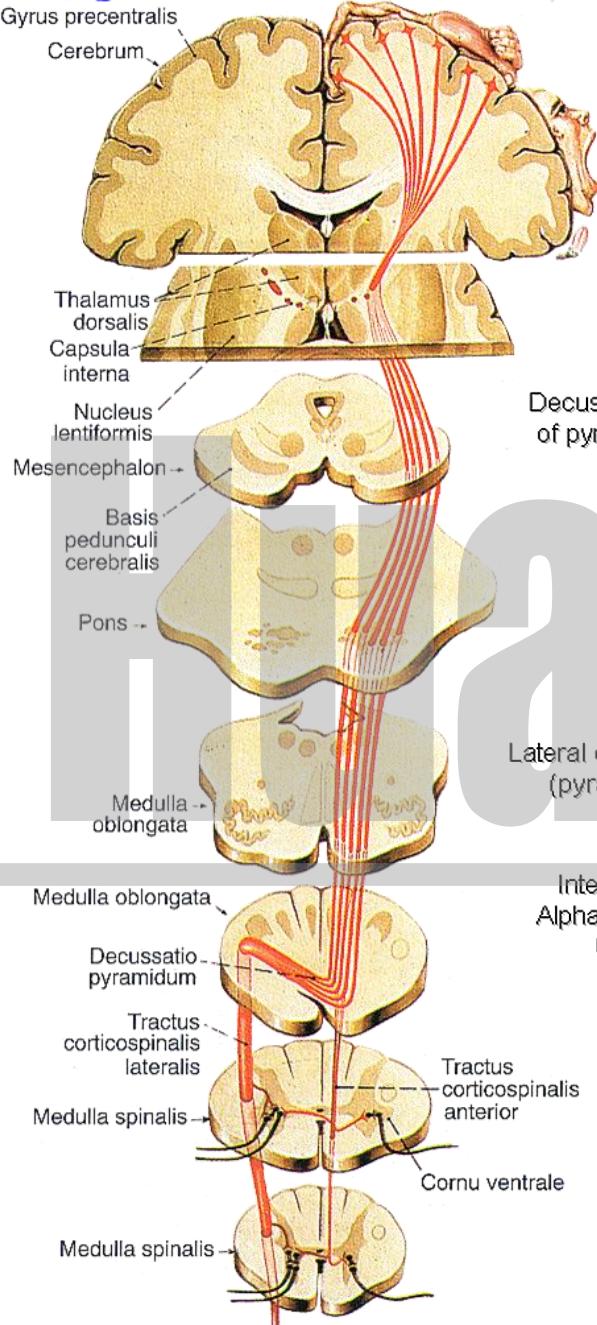
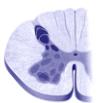
Conscious Long Tracts

- descending tract
 - corticospinal tract
- ascending tracts
 - fasciculi gracilis & cuneatus
 - spinothalamic tract

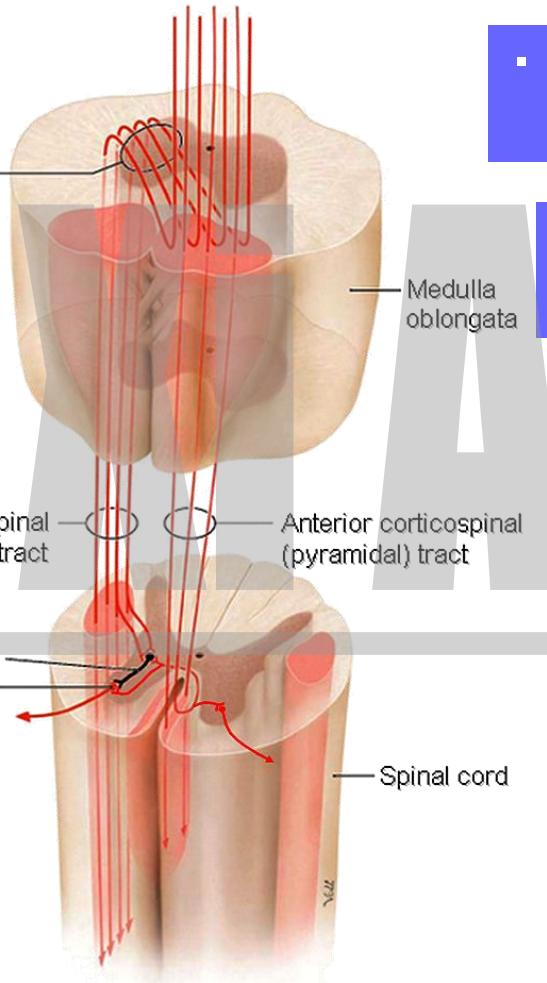
Subconscious Long Tracts

- ascending tracts
 - spinocerebellar tract
 - spinoreticular tract
- descending tracts
 - rubrospinal tract
 - vestibulospinal tract
 - reticulospinal tract





Conscious Descending Tract: Corticospinal Tract (System)



- anterior corticospinal tract
 - axial muscles

- lateral corticospinal tract
 - distal muscles

- Upper Motor Neuron
 - cerebral cortex
- Lower motor neuron
 - ant. horn of spinal cord

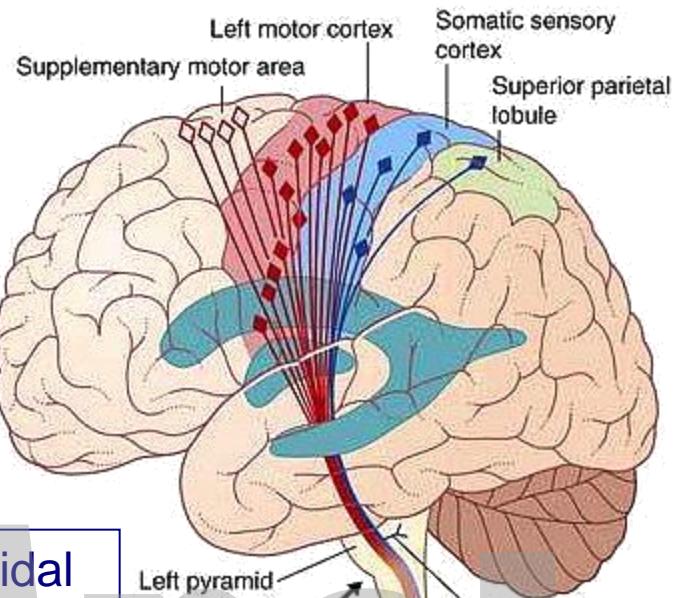
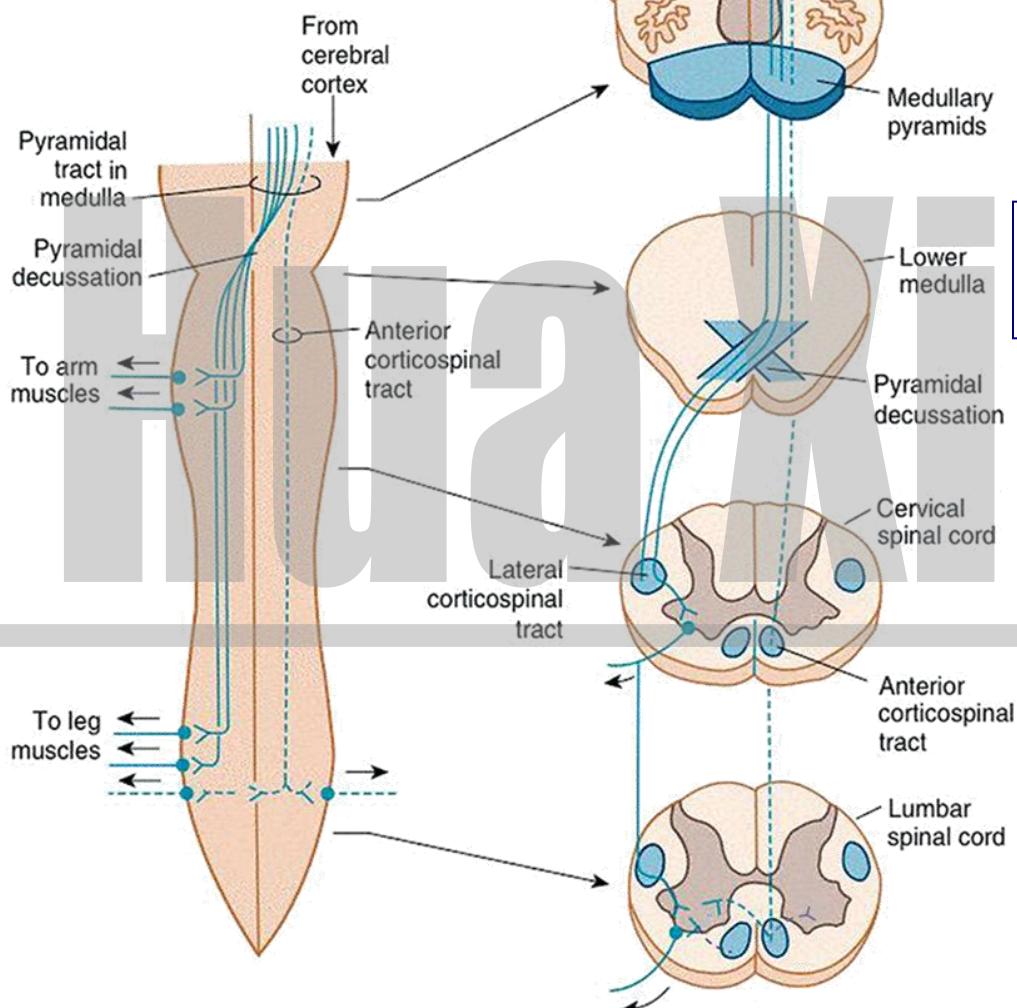
- Decussation
 - lateral corticospinal tract decussates at the medulla oblongata



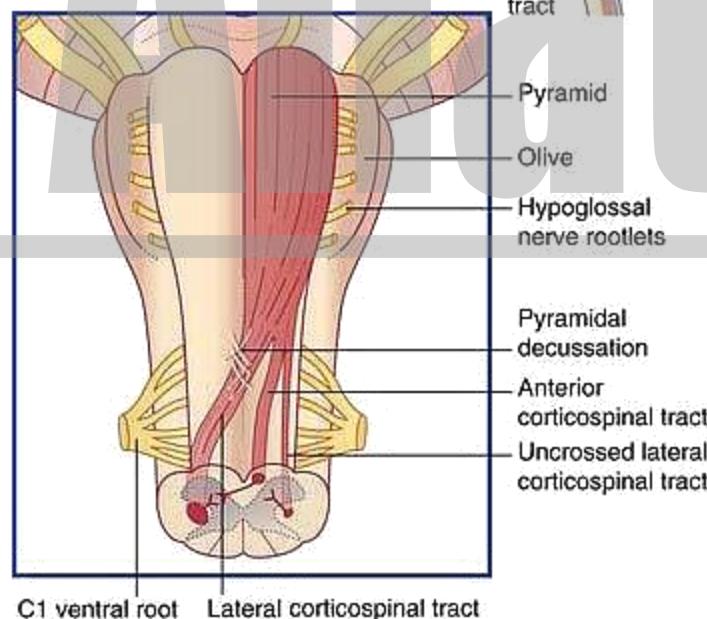


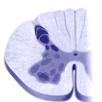
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Corticospinal System



Pyramidal Decussation





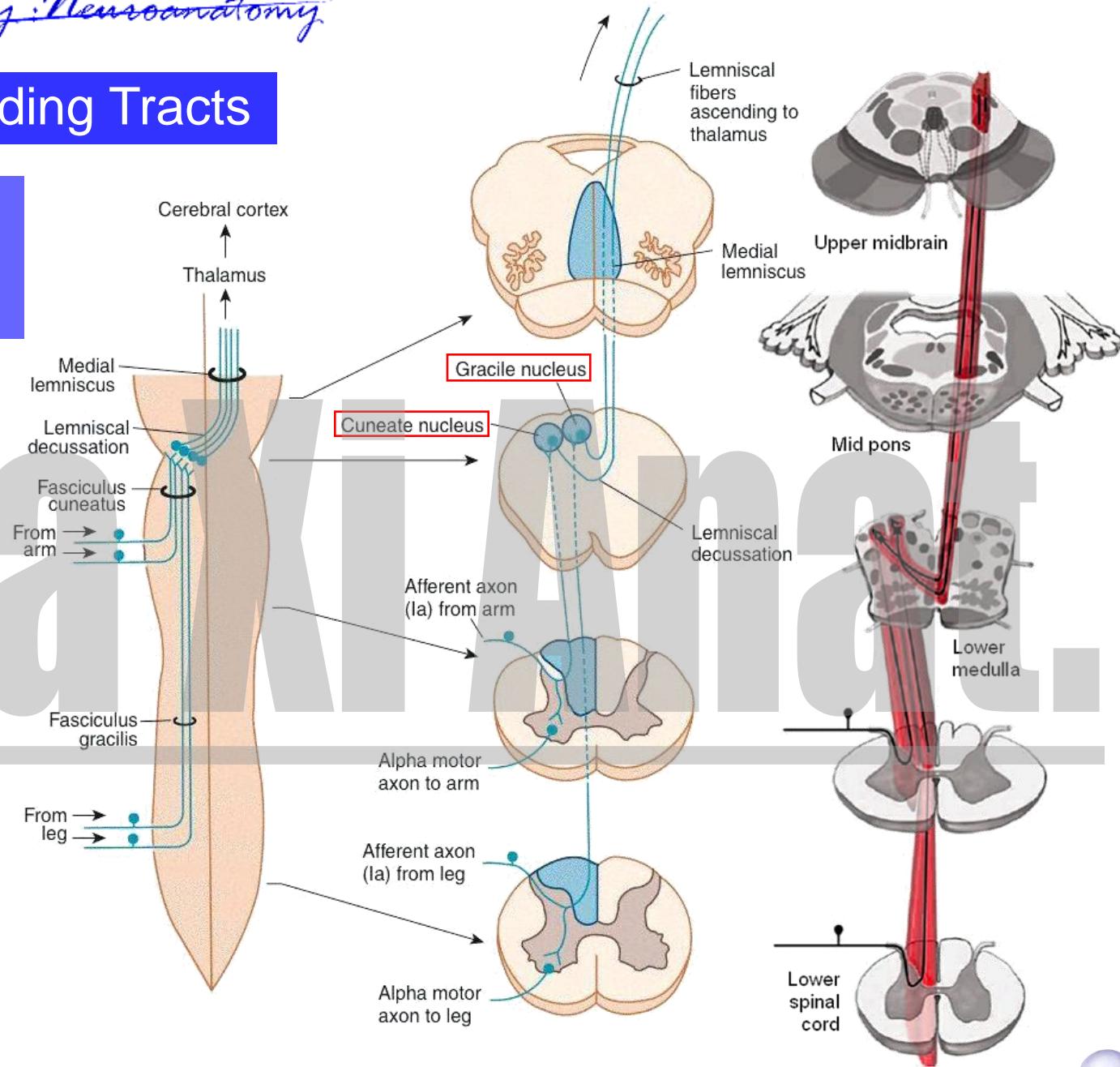
Conscious Ascending Tracts

- fasciculus gracilis
- fasciculus cuneatus

- proprioception & discriminative (fine) touch

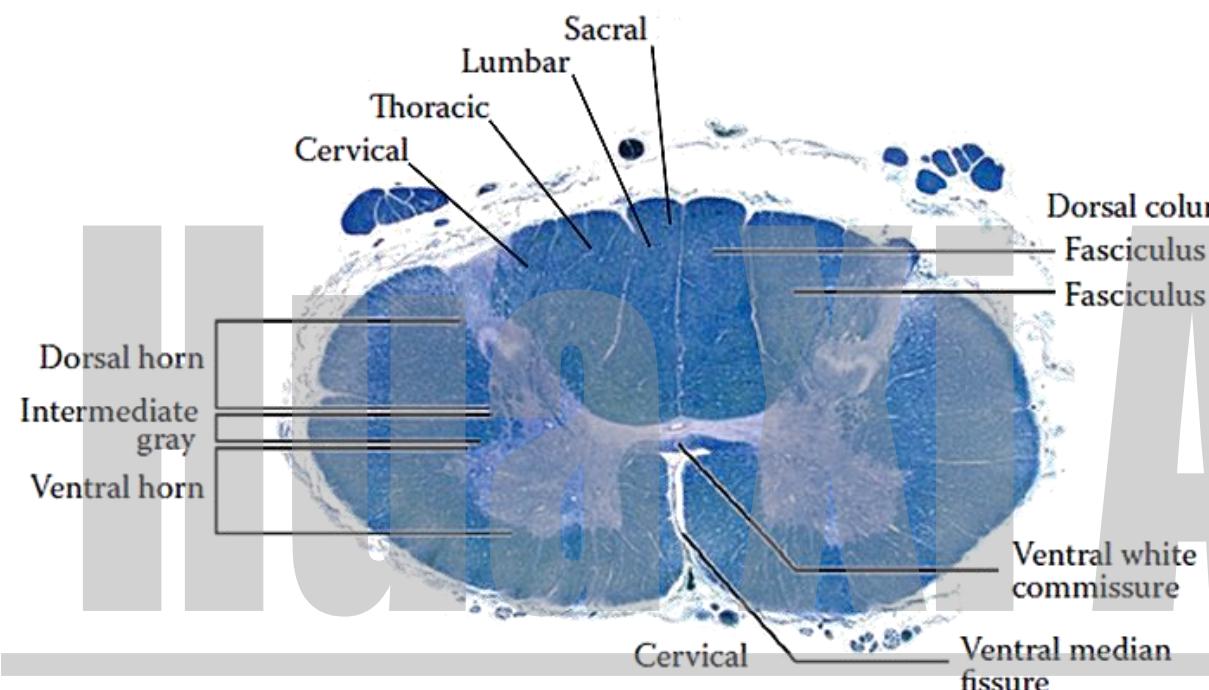
- 1st sensory neuron
 - spinal ganglion
- 2nd sensory neuron
 - medulla oblongata

- Decussation
 - no decussation in spinal cord

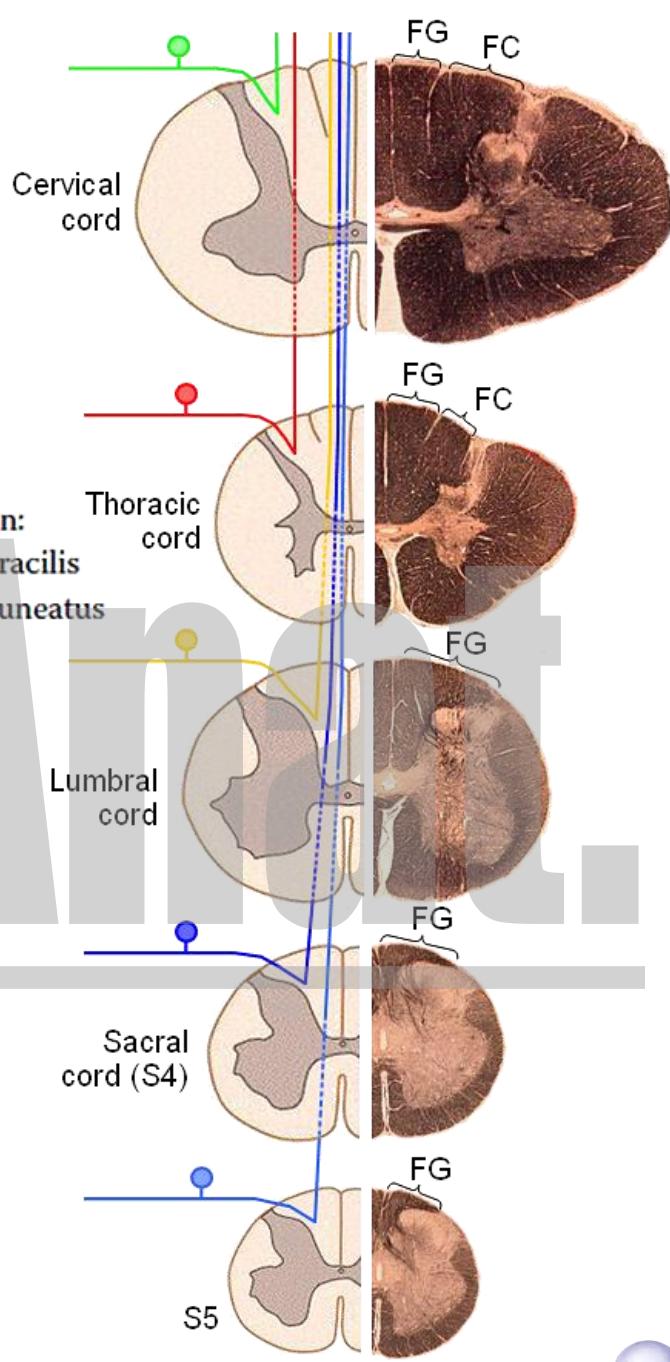


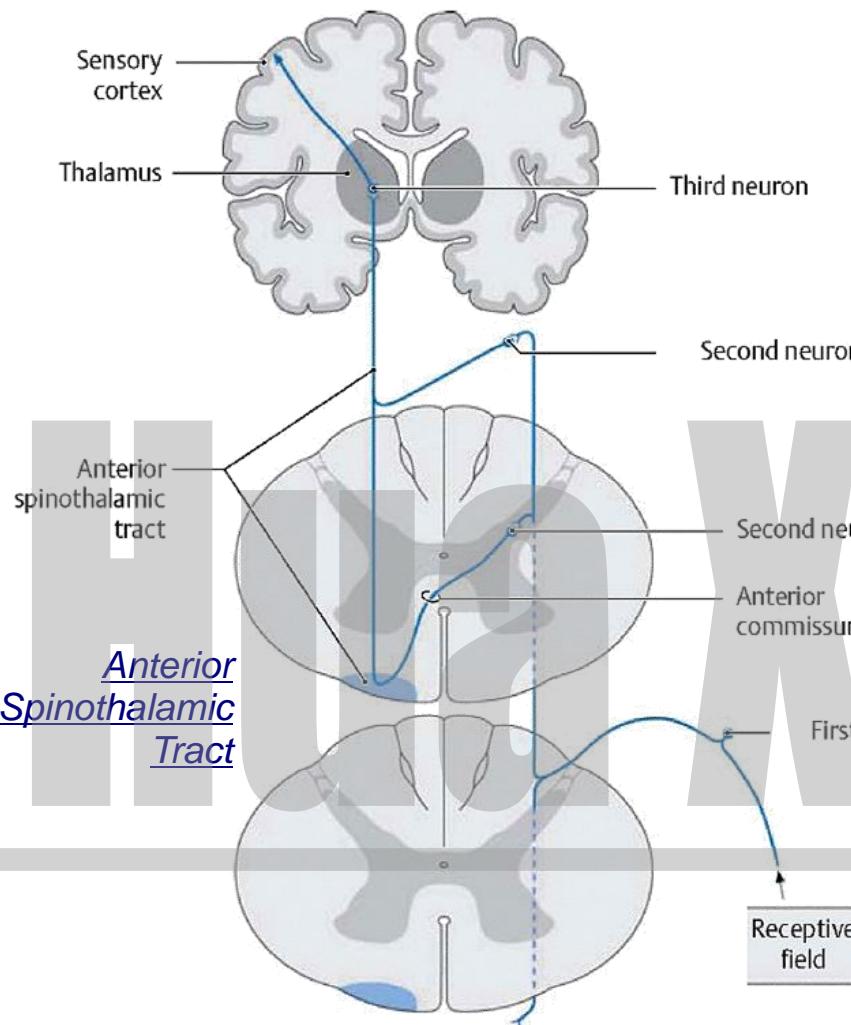


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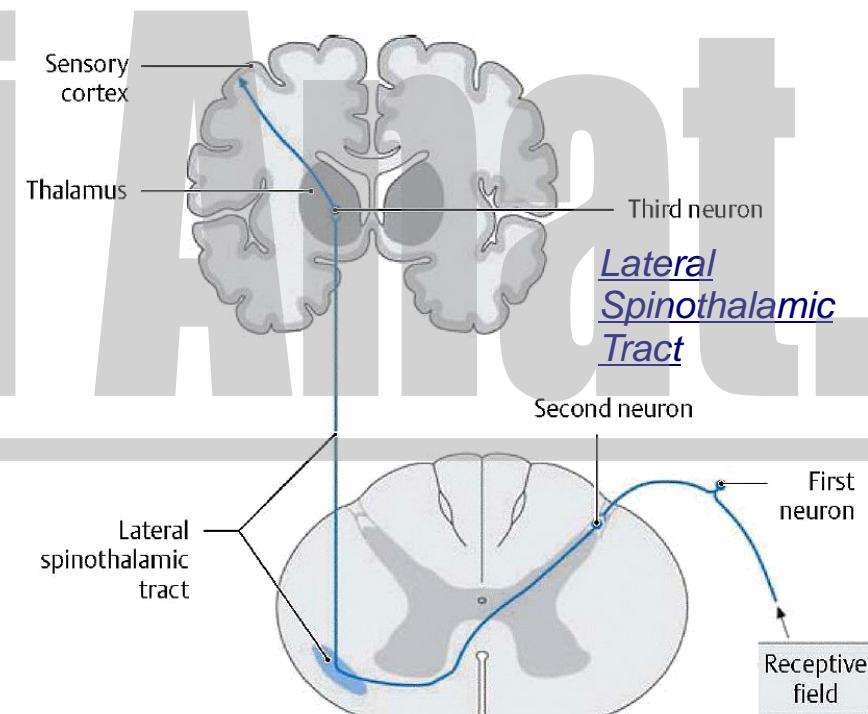
Fasciculi Gracilis & Cuneatus





Spinothalamic Tract

- anterior spinothalamic tract
 - non-discriminative touch & pressure
- lateral spinothalamic tract
 - pain & thermal sense (temperature)

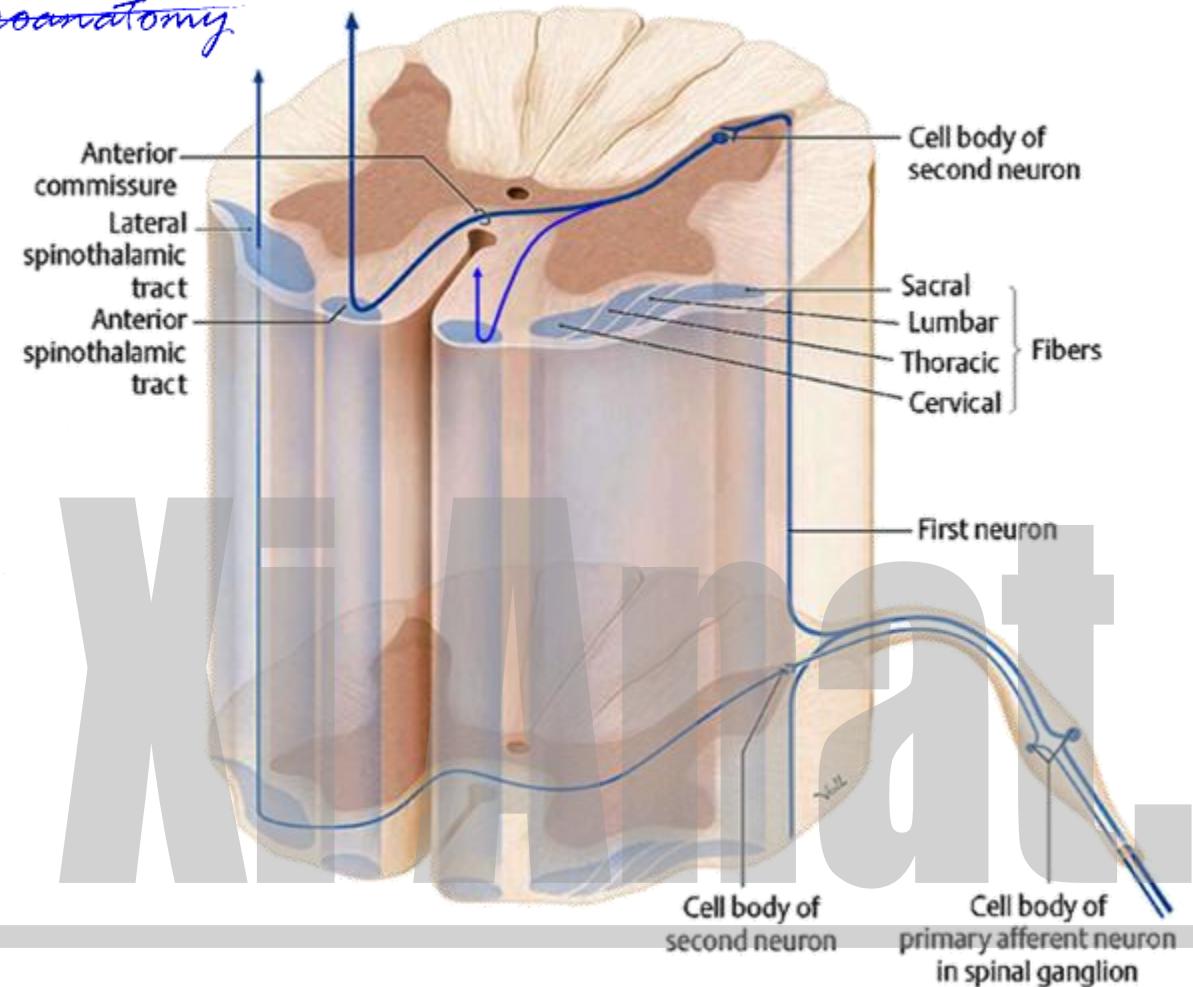
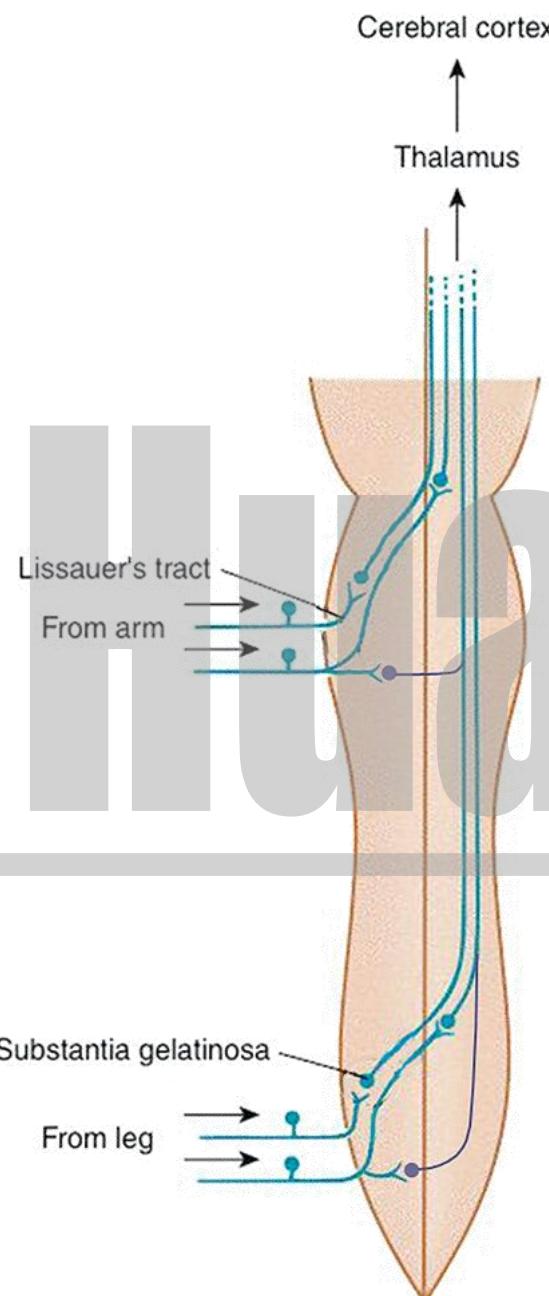


- 1st sensory neuron
 - spinal ganglion, fiber doesn't decussate
- 2nd sensory neuron
 - posterior horn, fiber decussates to opposite side by passing through anterior commissure





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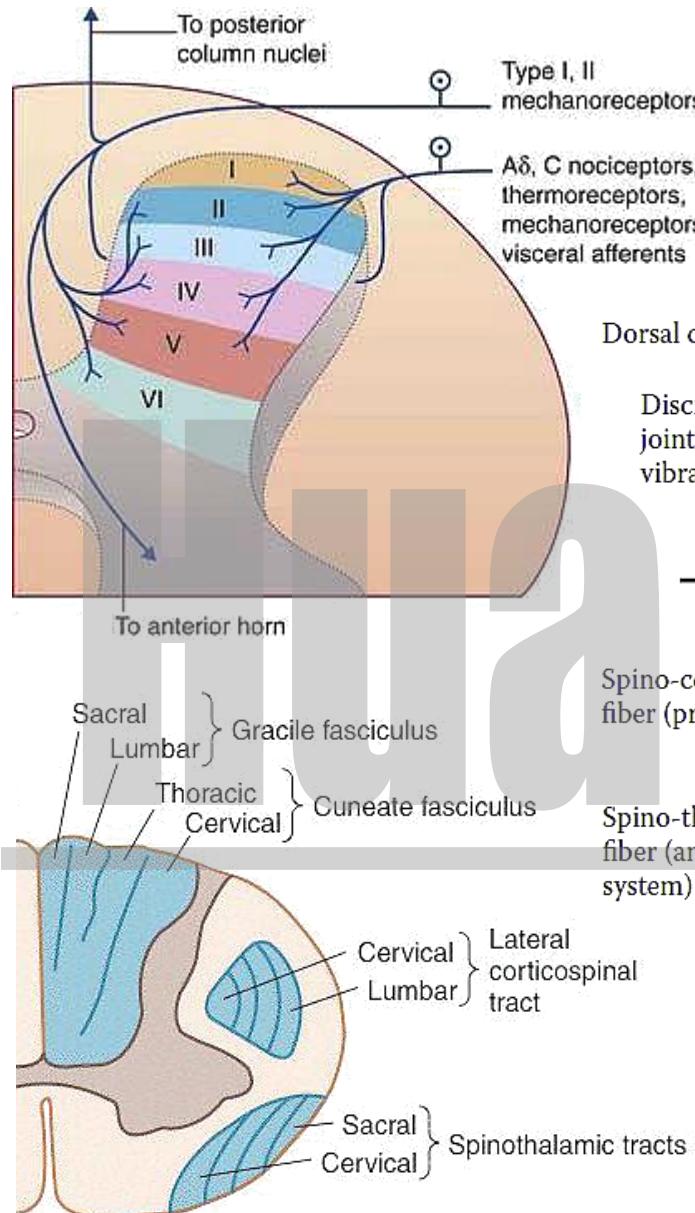


- **Anterior Spinothalamic Tract**
 - contains ascending fibers of both side
- **Lissauer's Tract**
 - ascend one to two segments before crossing somatotopically arranged

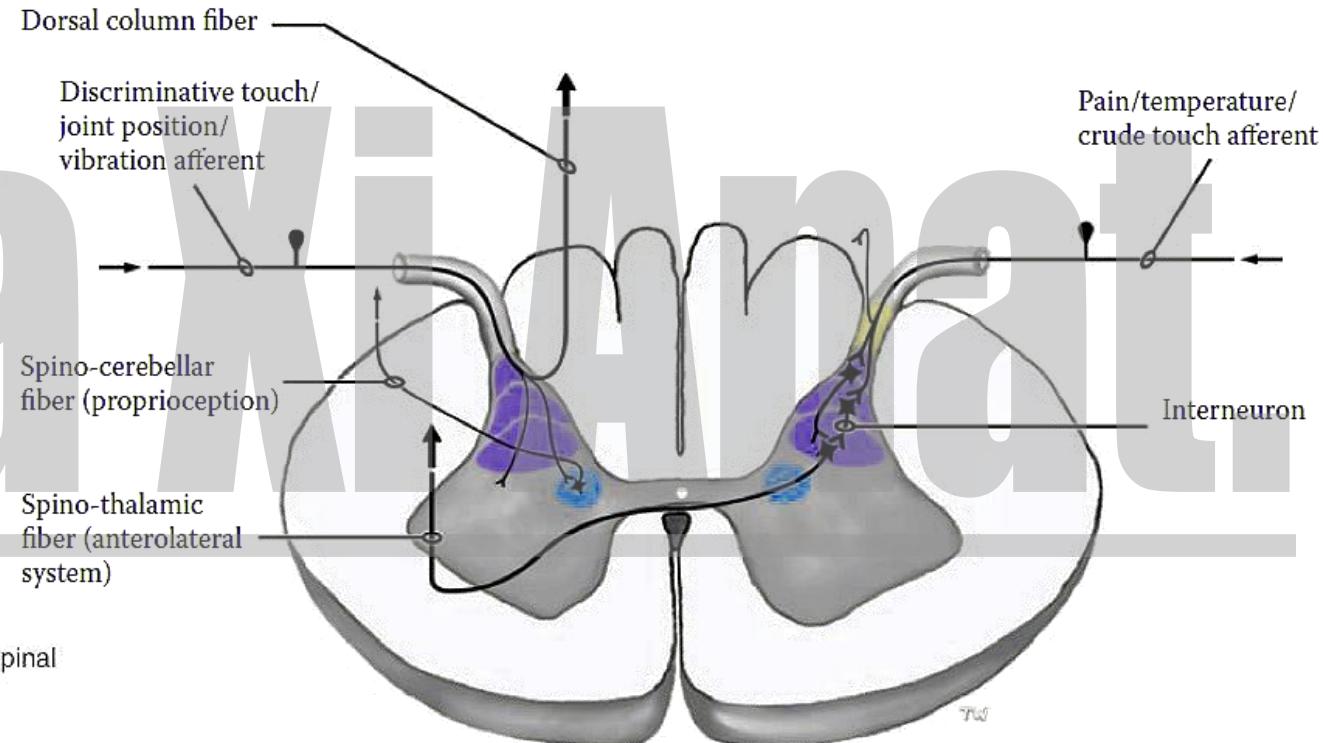




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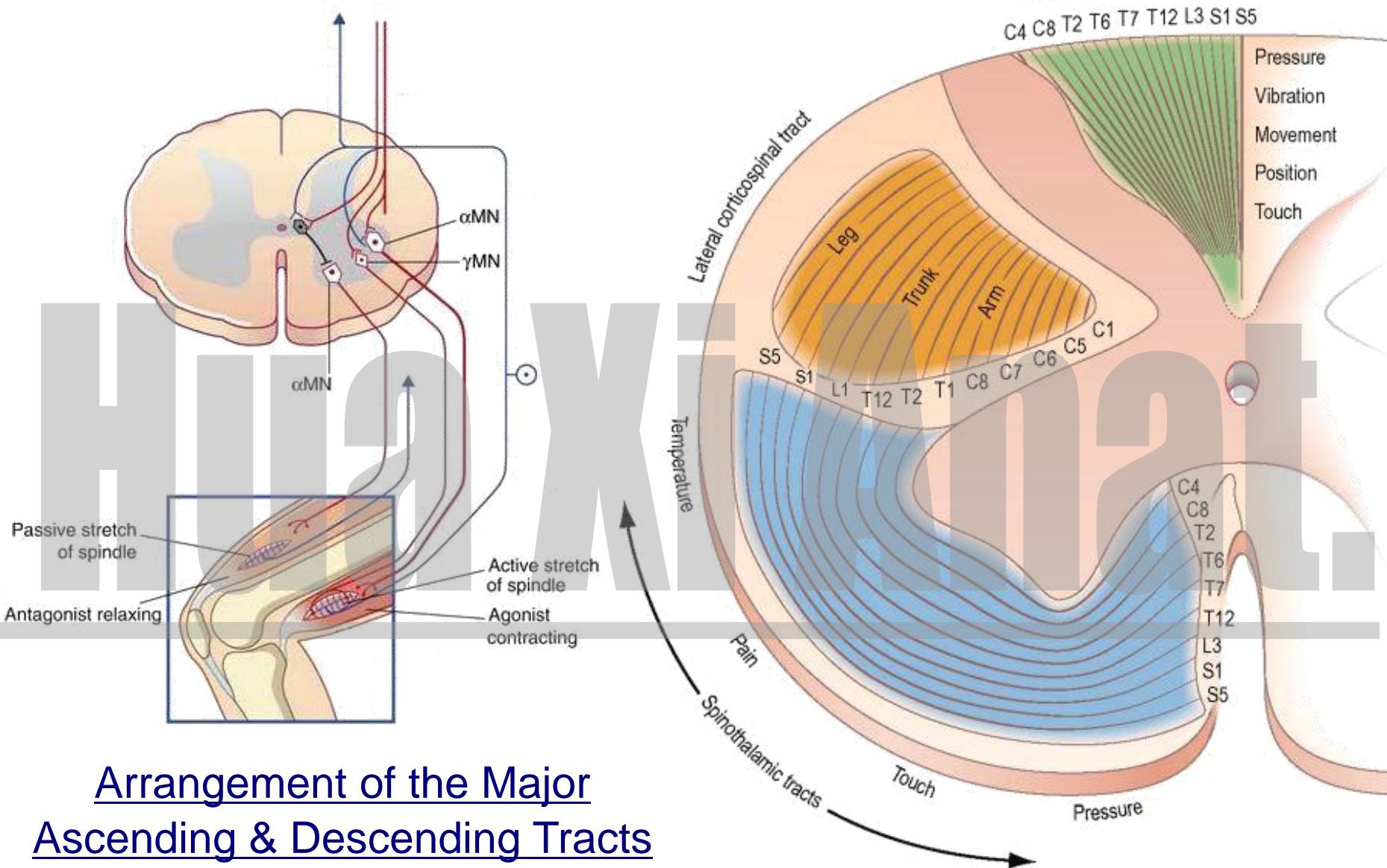


Sensory Nuclei & Sensory Tracts



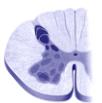


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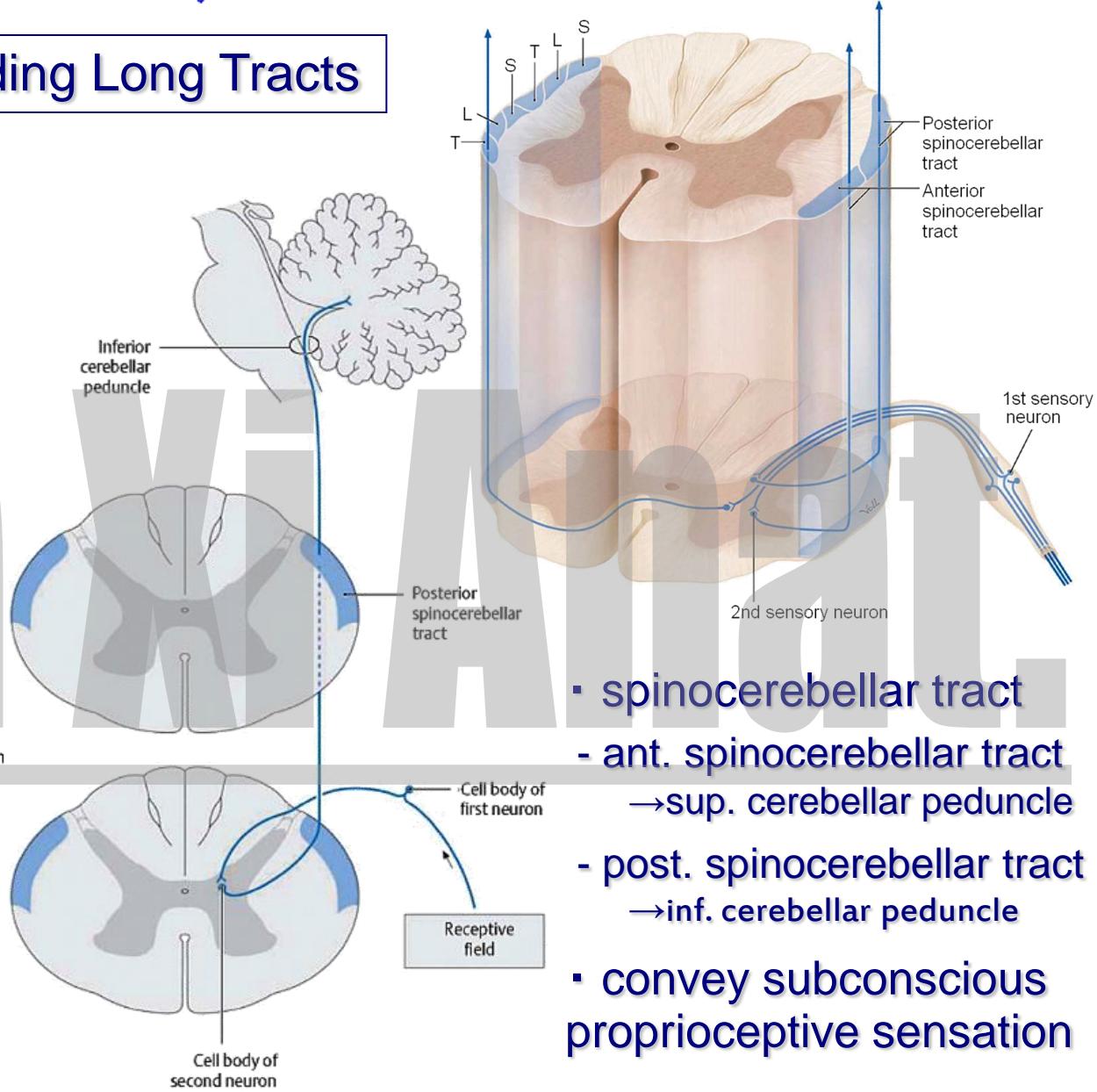
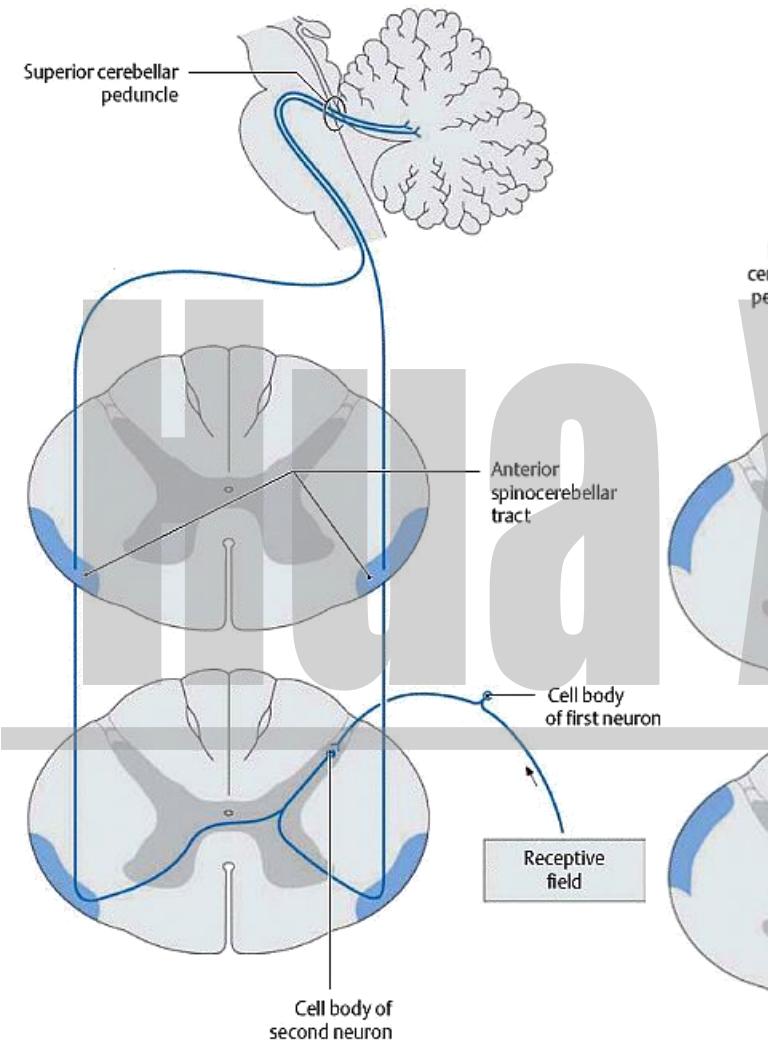


Arrangement of the Major Ascending & Descending Tracts



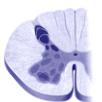


Subconscious Ascending Long Tracts



- spinocerebellar tract
- ant. spinocerebellar tract
→ sup. cerebellar peduncle
- post. spinocerebellar tract
→ inf. cerebellar peduncle
- convey subconscious proprioceptive sensation





- **spinoreticular tract**

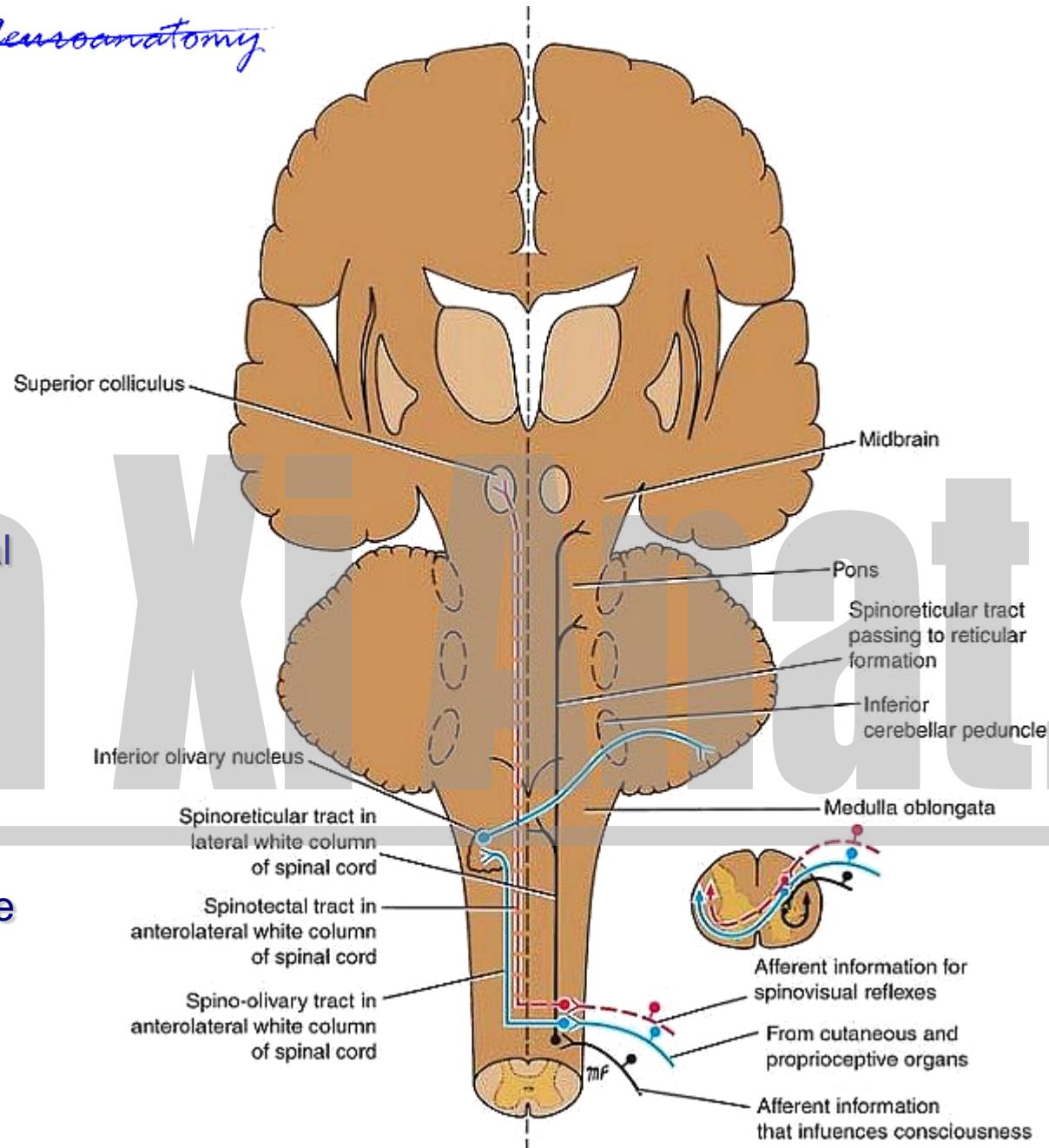
provides an afferent pathway for the reticular formation

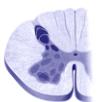
- **spinothalamic tract**

provides afferent information for spinovisual reflexes and brings about movements of the eyes and head toward the source of the stimulation.

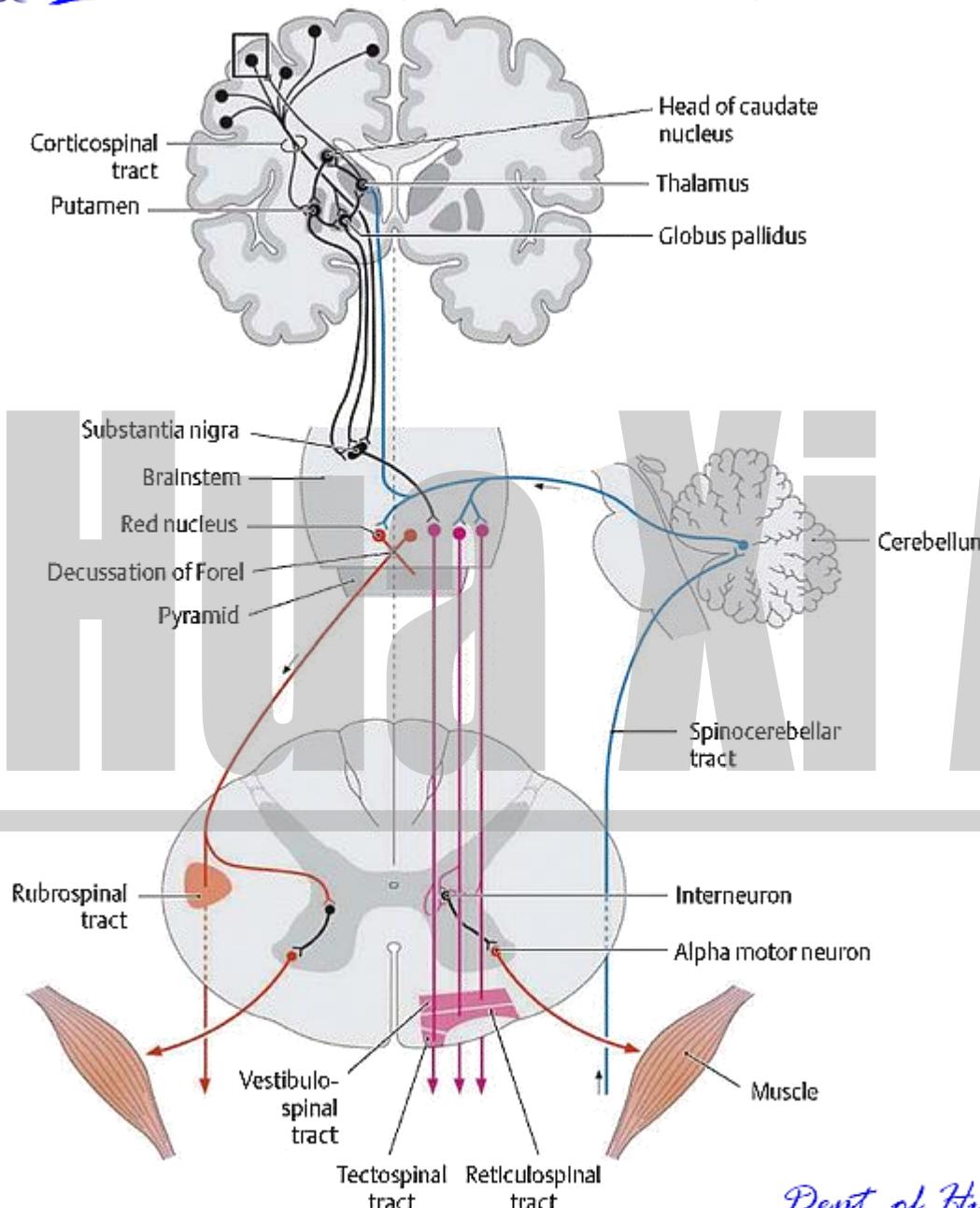
- **spino-olivary tract**

conveys information to the cerebellum from cutaneous and proprioceptive organs





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Subconscious Descending Long Tracts

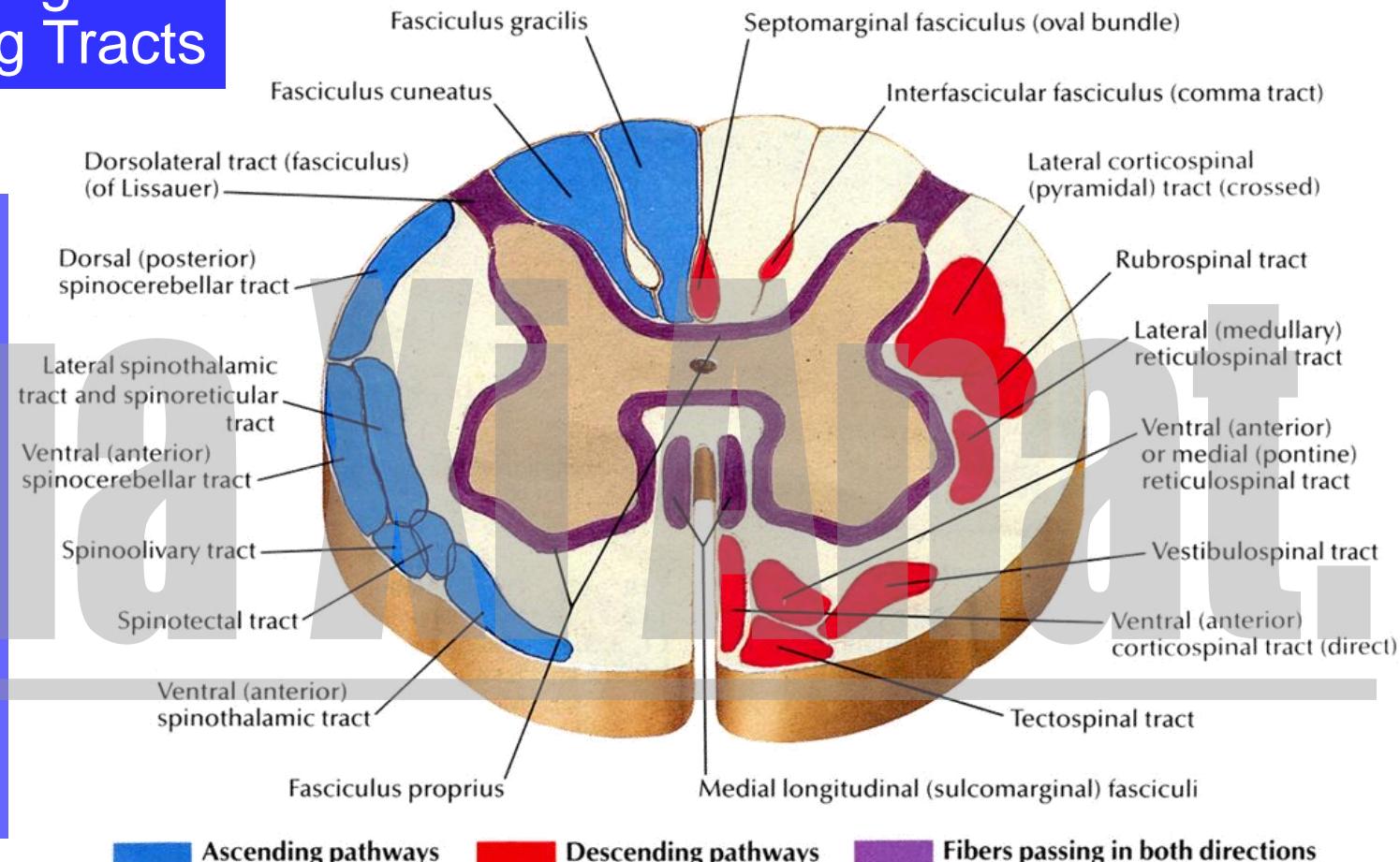
- **tectospinal tract**
concerned with reflex postural movements in response to visual stimuli.
- **rubrospinal tract**
facilitates the activity of the flexor muscles
- **vestibulospinal tract**
facilitates the activity of the extensor muscles
- **reticulospinal tract**
provides a pathway by which the hypothalamus can control the sympathetic outflow and the sacral parasympathetic outflow





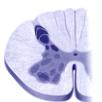
Short Ascending & Descending Tracts

- surrounding the grey matter of the spinal cord
- connecting two sides within one segment or connecting adjacent segments



The Principal Tracts of the Spinal Cord





CASE

23岁男性在开车回家的路上发生车祸。急诊检查发现TV9胸椎发生骨折，患者主诉左侧下肢无法运动并感觉不到自己左腿。皮肤敏感试验发现其脐水平左侧腹壁一带状皮肤区感觉过度敏感，在此敏感带之下有一狭窄带状麻木和痛觉缺失区。右侧脐平面以下痛觉温度觉缺失，触觉减弱或部分消失。

试分析脊髓损伤的水平。

脊髓是完全离断么？如果不是，是哪侧离断？

解释此患者表现出的各种症状原因。

