

Physiology of Motor Tracts

Dr. Taha Sadig Ahmed

Physiology Department , College of
Medicine , King Saud University

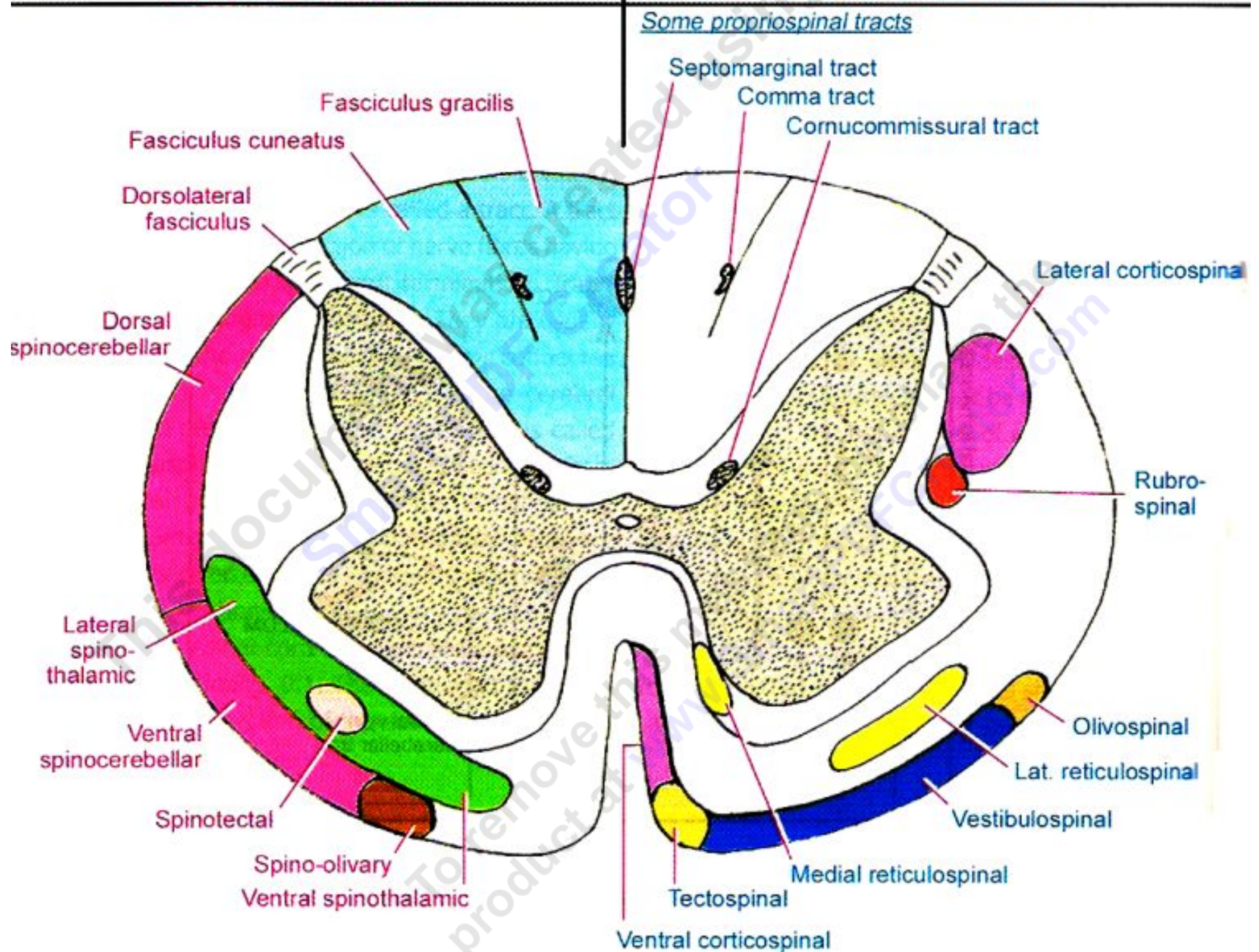
- The activity of the lower motor neurons (LMN, spinal motoneurons) is influenced by →
- (1) afferent inputs (sensory nerves) .
- (2) spinal neuronal pools (spinal centers) .
- (3) supraspinal areas where descending motor tracts originate . These constitute upper motor neurons .

There are two UMN Systems :

- Pyramidal system :
- Initiates & controls voluntary , fine , skilled
- Output goes to the brainstem nuclei (corticobulbar tracts) & spinal cord (corticospinal tracts).
- Pyramidal fibres are comparatively slow conducting , because at least half of the pyramidal tract fibers are unmyelinated .
- Extrapyramidal system :
 - (1) sets the postural background needed for performance of skilled movements and,
 - (2) controls subconscious gross movements.

ASCENDING TRACTS

DESCENDING TRACTS



Pyramidal Tracts

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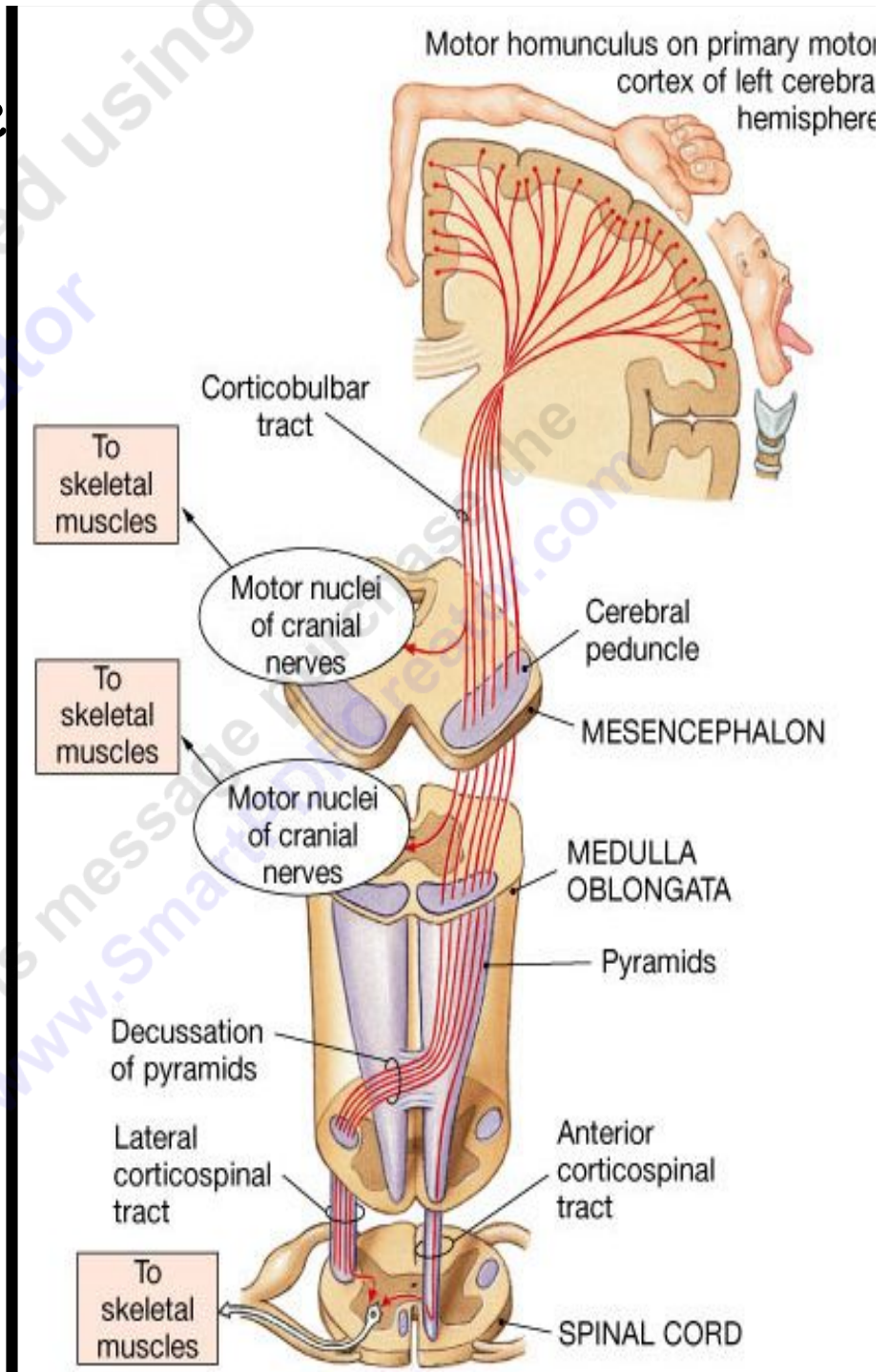
Areas Contributing Pyramidal (Corticospinal) Fibers

- **(1) The primary motor area (M1)**
- occupies the precentral gyrus & contains large , highly excitable Betz cells.
- M1 of one side controls skeletal muscles of the opposite side of the body
- **(2) The Supplementary Motor Area (MII)**
- is a small area located on the lateral side of the brain in front of area 4 and above the pre-motor area .
- This area projects mainly to M1 and is concerned with planning and programming motor sequences.
- **(3) Premotor Area (MIII)**
- lies in front of the primary motor area & below supplementary motor area.
- Stimulation of the premotor area produces complex coordinated movements, such as setting the body in a certain posture to perform a specific task.
- **(4) Parietal lobe :**
The Parietal lobe contributes about 40% of the fibers that run in the pyramidal tracts

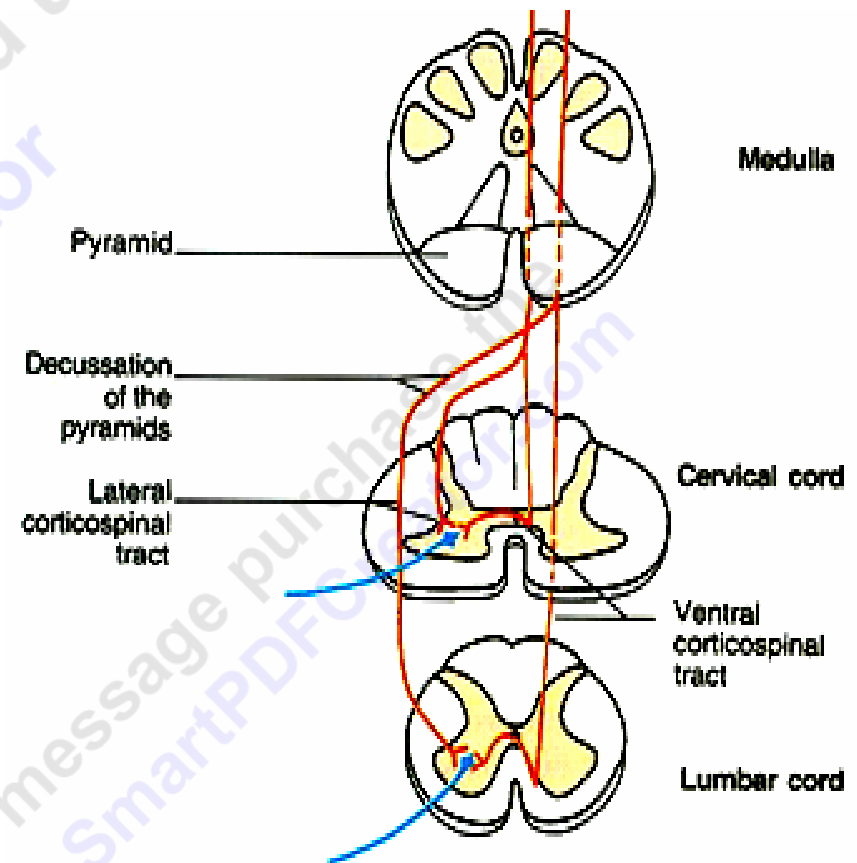
Corticospinal (Pyramidal) Tracts

- Cells of origin →
30% originate from the primary motor area,
30% from the premotor areas , and
40% from the somatosensory areas in parietal lobe.
- 3% of the fibres are large myelinated fibres, derived from the large , highly excitable pyramidal Betz cells of MI .
- These fibers form monosynaptic connections with motor neurons of the spinal cord.
- Fibers from the cerebral cortex descend in corona radiata to reach the internal capsule (occupying the genu and the anterior two-thirds of the posterior limb)

- Then descend through the midbrain and pons.
- In the lower medulla around 80% of the fibres cross to the opposite side, and descend in the lateral column of spinal cord white matter as the Lateral Corticospinal Tract.
- They synapse on the contralateral spinal motoneurons, or on interneurons in the intermediate region of the cord grey matter.



- The remaining 20 % of corticospinal fibers do not decussate in the medulla .
- They descend ipsilaterally in the ventral column of the spinal cord white matter , Constituting the Ventral (Anterior) Corticospinal Tract .
- Finally they decussate (cross to the opposite side) & synapse on the contralateral spinal motoneurons



Extrapyramidal Tracts

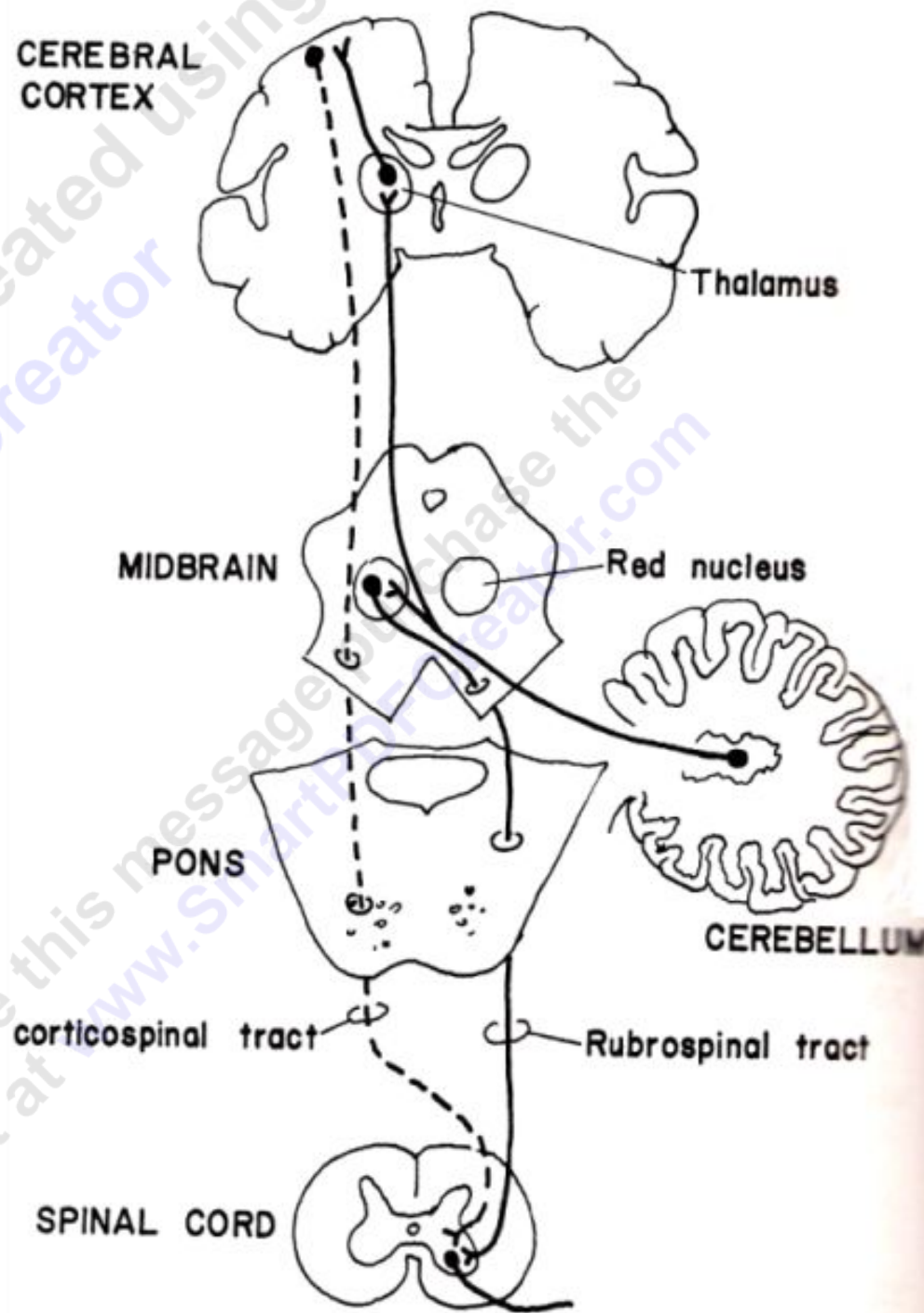
Rubrospinal Tracts

After emerging from Red Nucleus in midbrain ,
fibers decussate at same level of red nucleus

Descend with the lateral corticospinal tract

In spinal cord tract occupies the lat. white
column , & fibers synapse on the contralateral
AHCs

- ✓Red nucleus is connected by fibers with the cerebral cortex & cerebellum ..
- ✓Fibers are inhibitory & distributed, similar to corticospinal fibers (which are largely excitatory) , to distal limb motoneurons that control skilled movement



Tectospinal Tract

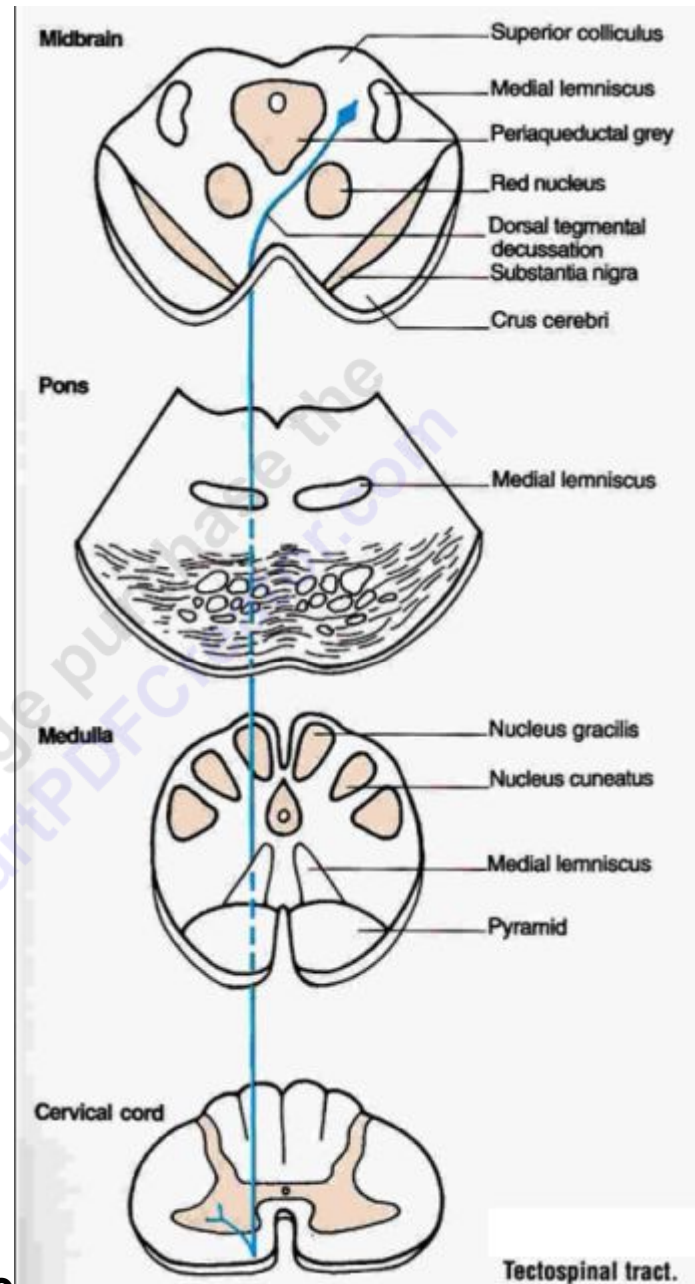
Originates in Superior & Inferior colliculi in midbrain, then decussates in the dorsal tegmentum

Near Medial longitudinal fasciculus

Axons descend in ventral white column of spinal cord

Contralateral cervical motoneurons

Function: Mediate/facilitate turning of the head in response to visual or Auditory stimuli.



Vestibulospinal Tracts

**Fibers originate in vestibular nuclei in pons
(which receive inputs from inner ear Vestibula
Apparatus and Vestibulocerebellum)**

**Axons descend in the ipsilateral
ventral white column of spinal cord**

**Excitatory to ipsilateral spinal motoneurons
(including gamma efferents) that supply
axial & postural muscles**

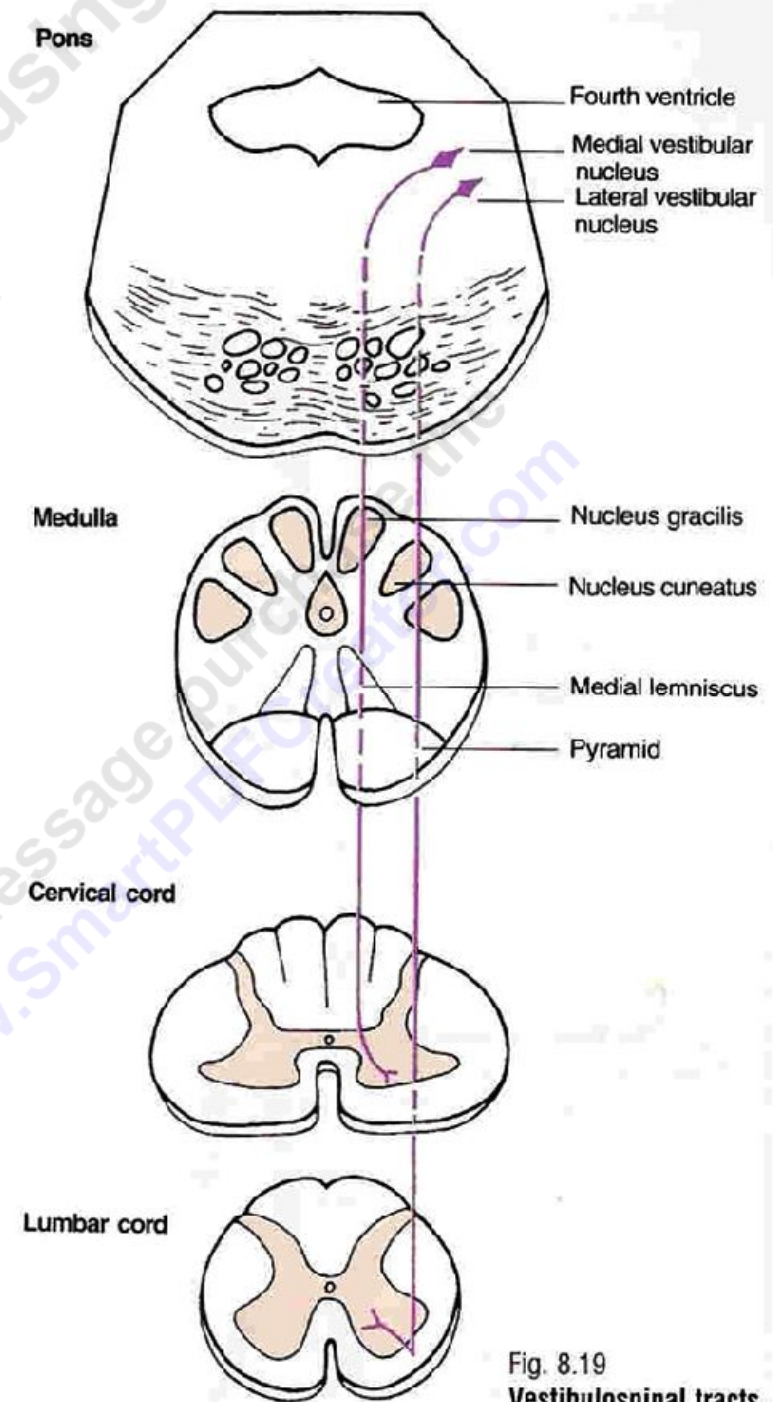


Fig. 8.19
Vestibulospinal tracts.

Functions of Vestibulospinal Tracts

- Vestibulospinal tracts control reflexes e.g. Postural & righting + control eye movements.
- The lateral vestibulospinal
- Cells of origin : Lateral Vestibular Nucleus
- Axons descend in the ipsilateral ventral white column of spinal cord .
- This tract mediates excitatory influences upon extensor motor neurones to maintain posture
- The medial vestibulospinal tract :
- Cells of origin : Medial Vestibular Nucleus
- As its axons descend ipsilaterally in the ventral white column of spinal cord , they form part of the Medial Longitudinal Fasciculus
- The medial longitudinal fasciculus consists of both ascending & descending fibers that link vestibular nuclei to nuclei supplying the extraocular muscles for coordination of head and eye movements

Reticulospinal Tracts

- Functions : These tracts influence both Alpha & Gamma motoneuron activities .They regulate muscle tone and inhibit unwanted reflex contractions .

(1) Pontine (Medial) Reticulospinal Tract:

- Cells of origin: Pontine Reticular Formation
- Axons descend in ventral white column of spinal cord
- Axons terminate in ipsilateral spinal motoneurons
- Pontine Reticulospinal Tract increases activity ,
(consequently , increases muscle tone) ,

(1) Medullary (Lateral) Reticulospinal Tract:

- Cells of origin: Medullary Reticular Formation
- Axons descend in ventral white column of spinal cord on both sides (both crossed & uncrossed)
- Axons terminate in ipsilateral & contralateral ventral horn cells of spinal cord
- Medullary Reticulospinal Tract, on the other hand , inhibits Gamma Efferent activity (consequently, decreases muscle tone) .

Olivospinal Tract

- Originates in Inferior Olivary Nucleus of the medulla is found only in the cervical region of the spinal cord.
- Function is uncertain

- Thank you

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