

Physiology of Motor Tracts

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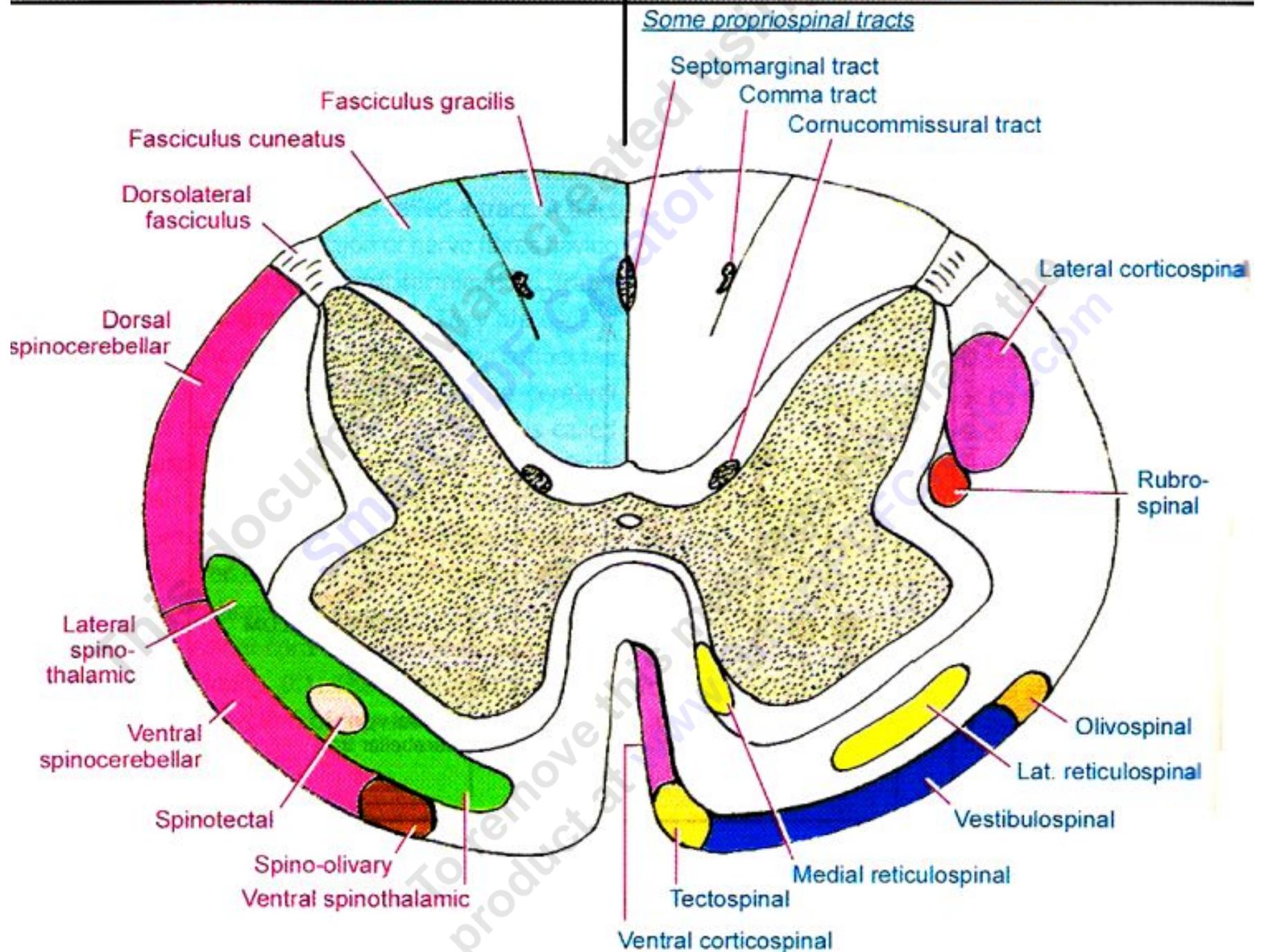
- The activity of the lower motor neurons (LMN, spinal motoneurons) is influenced by →
- (1) afferent inputs (sensory nerves) .
- (2) spinal neuronal pools (spinal centers) .
- (3) supraspinal areas where descending motor tracts originate . These constitute upper motor neurons .

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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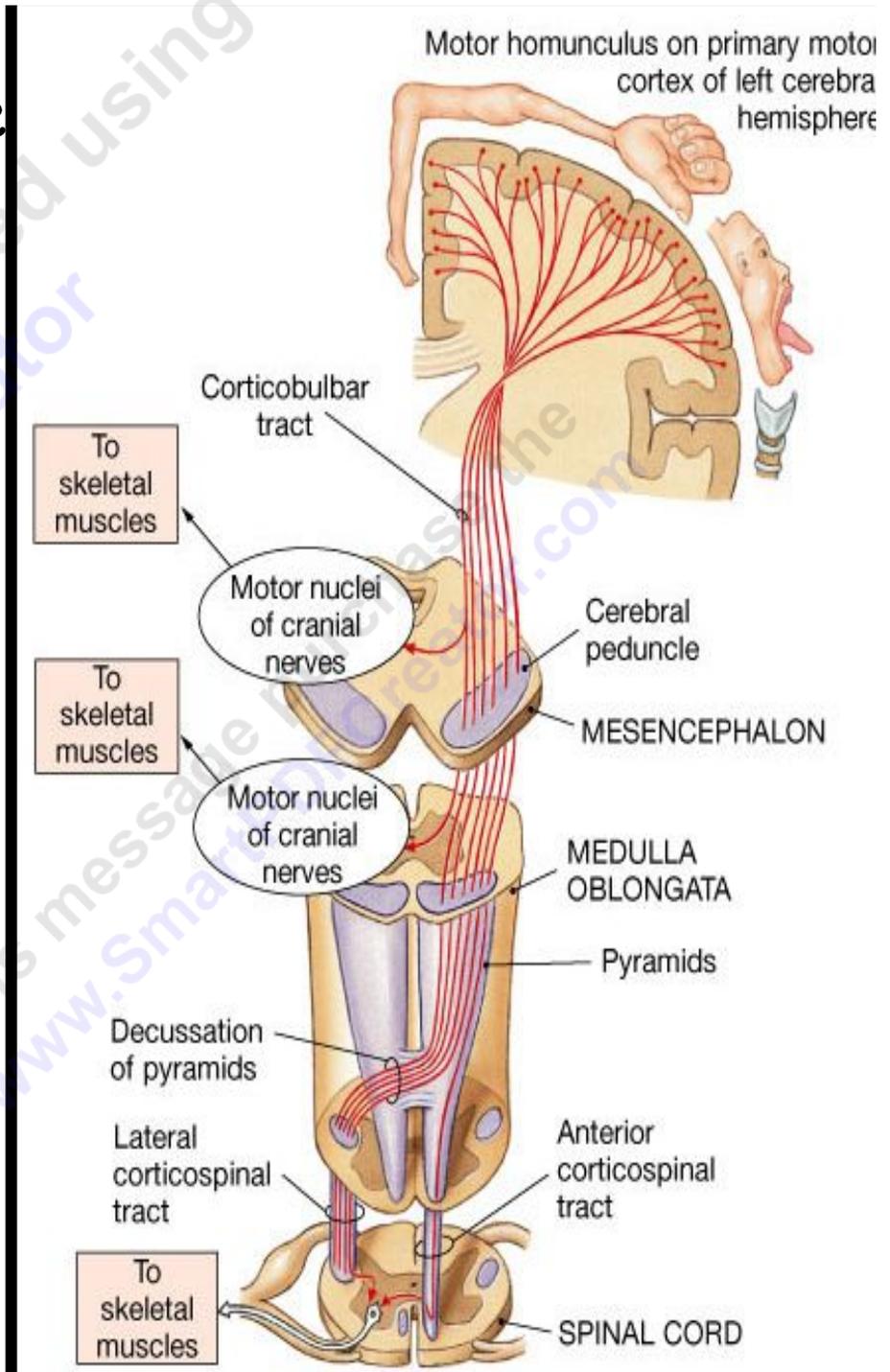
Areas Contributing Pyramidal (Corticospinal) Fibers

- **(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

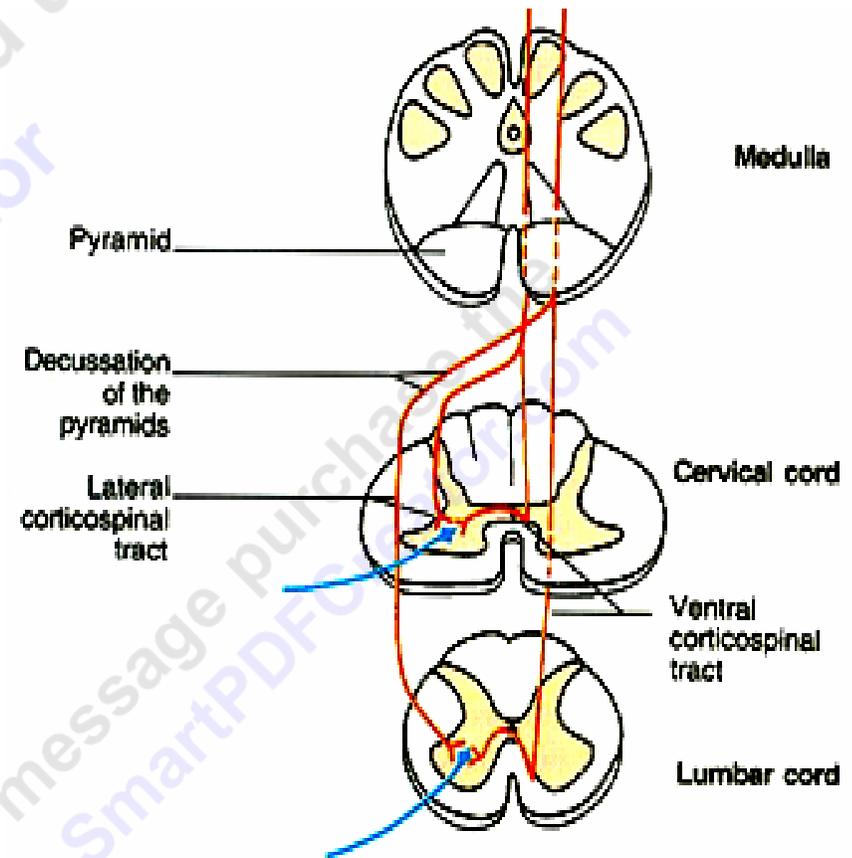
Corticospinal (Pyramidal) Tracts

- 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

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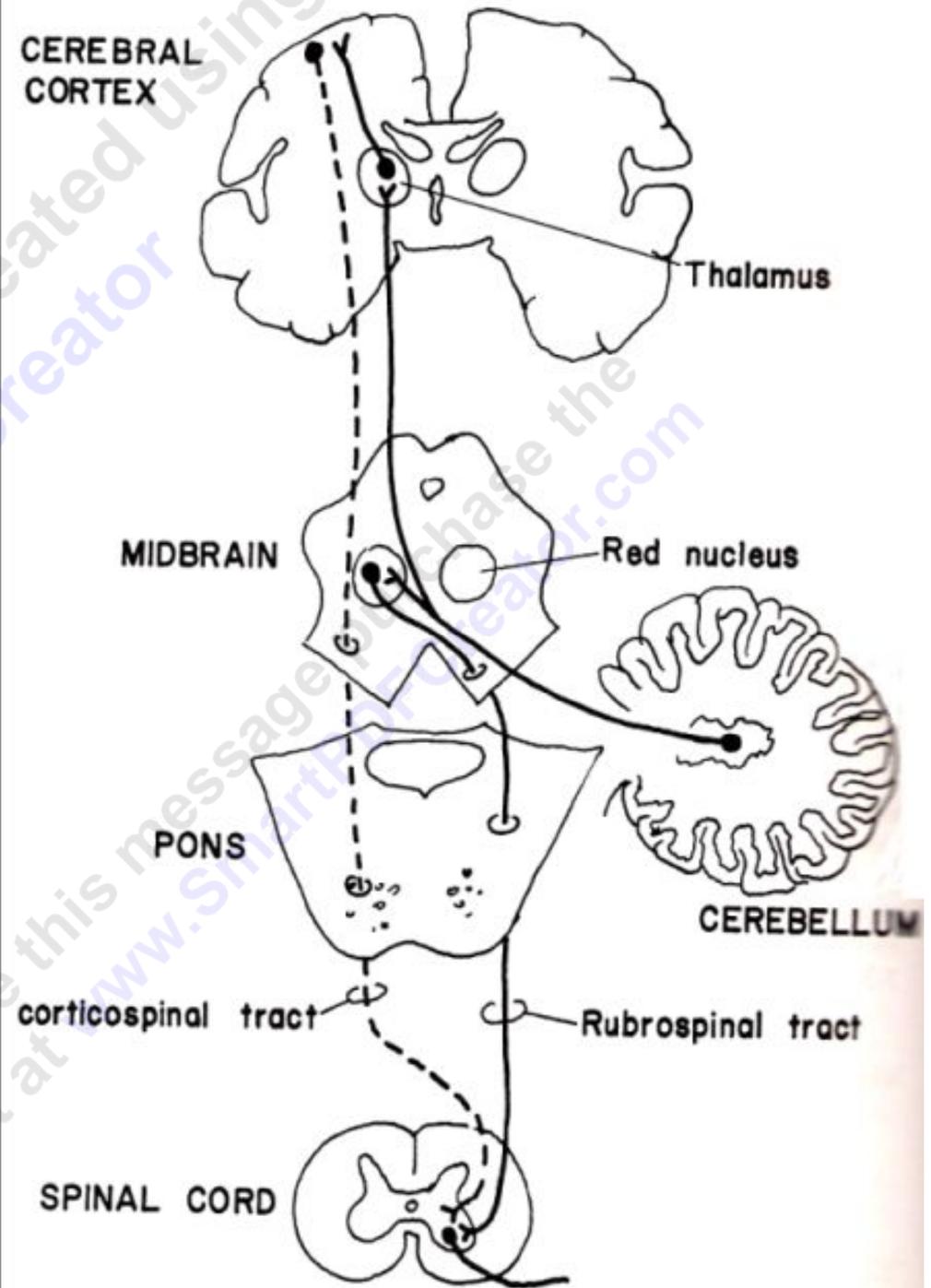
Rubrospinal Tracts

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 decussate in the dorsal tegmentum



Near Medial longitudinal fasciculus

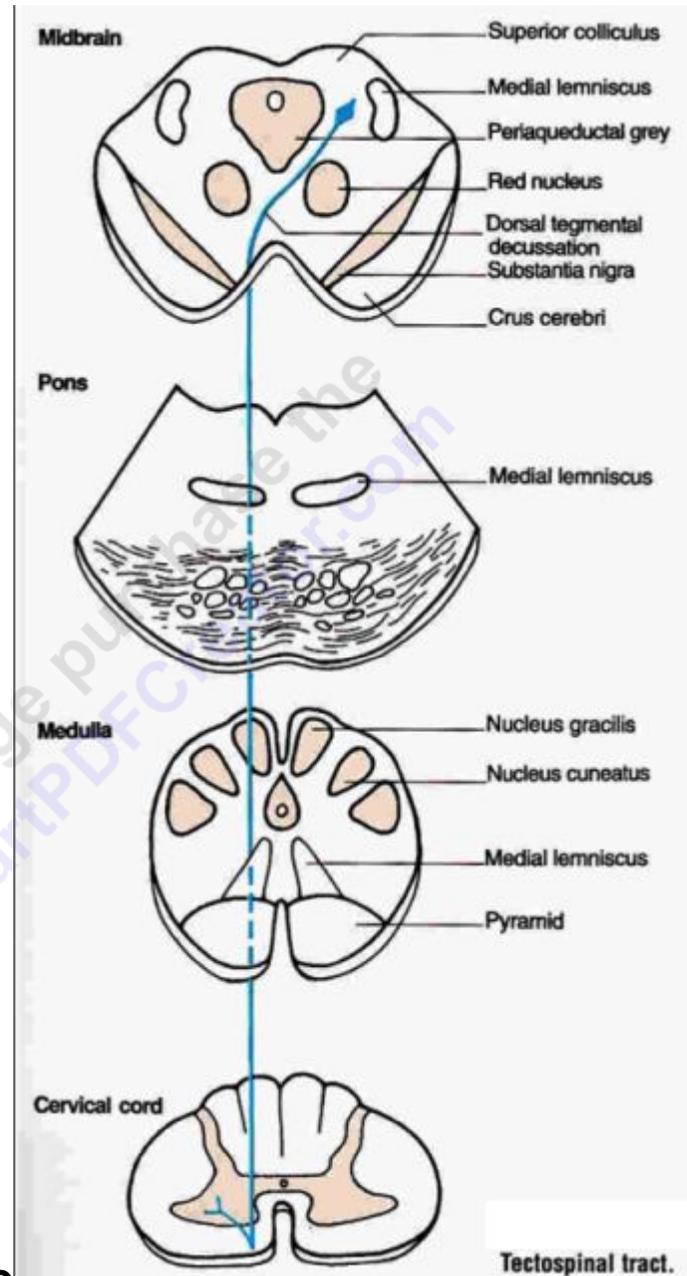


Axons descend in ventral white column of spinal cord



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 Vestibular 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

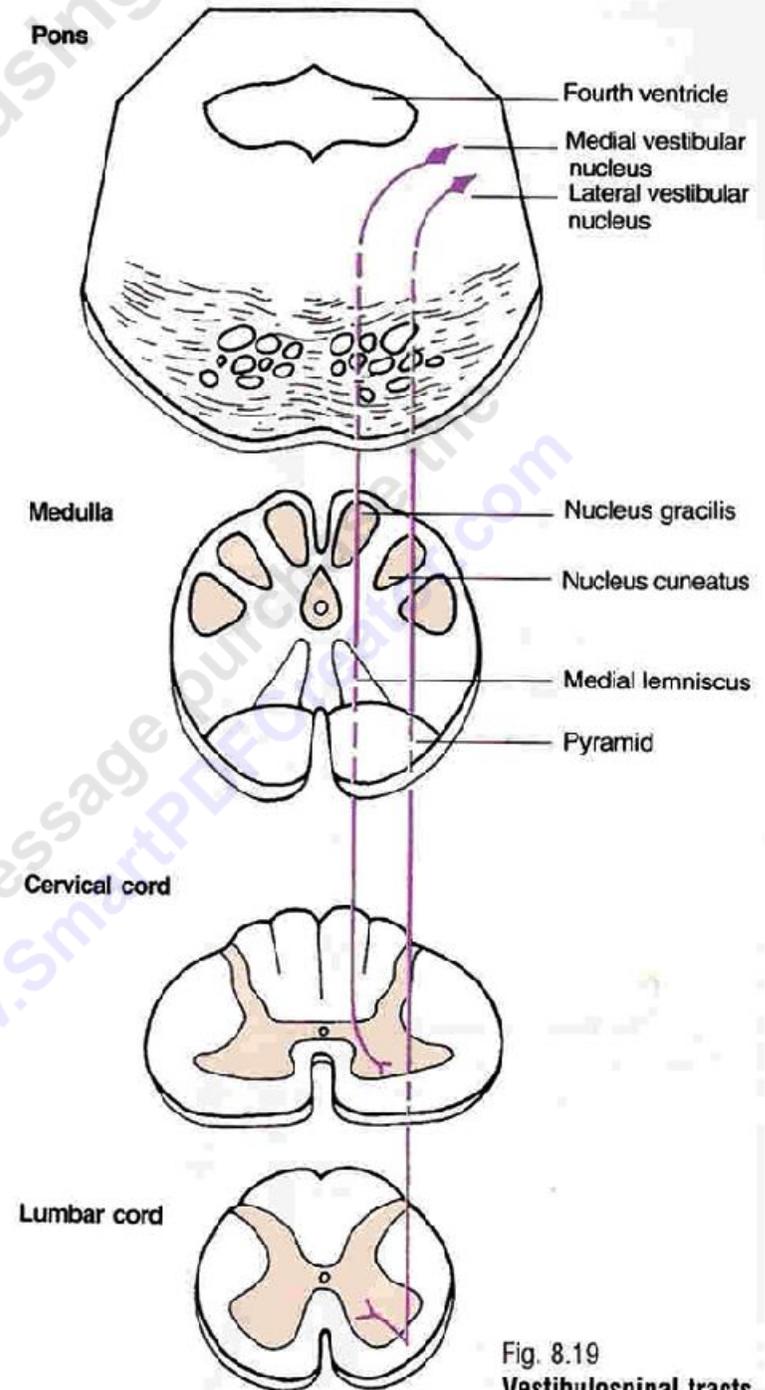


Fig. 8.19
Vestibulospinal tracts.

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

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