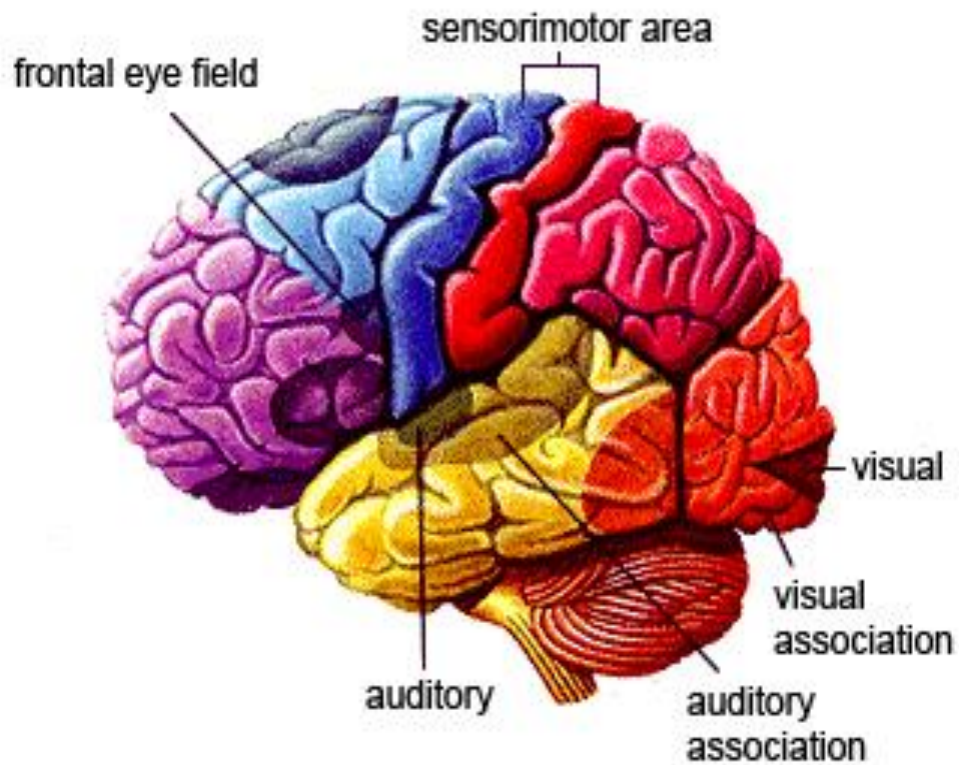


Physiology Team



Amna Baljoun

Ahlam Al –Maawi

Areej Al Kahtani

Bodoor Al Tayeb

Asmaa` Bedawi

(these notes are combination of female and male slides + our notes)

Physiology of Motor Tracts

❖ Upper & lower motor neurons

1- Lower motor neurons:-

spinal & cranial motor neurons that innervate muscles directly.

The activity of the LMN is influenced by :

- Afferent inputs (sensory nerves).
- Spinal neuronal pools (spinal centers).
- Supraspinal areas (where descending motor tracts originate) = these constitute UMN.

2- Upper motor neurons:-

-neurons of motor cortex & their axons that activates cranial & spinal motor neurons

❖ There are two UMN Systems :

• Pyramidal system :

- Initiates & controls voluntary , fine , skilled movements
- Output goes to → brainstem nuclei (corticobulbar tracts)
→ spinal cord (corticospinal tracts).
- Pyramidal fibers 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
- (2) controls subconscious gross movements

1-Pyramidal tracts=Corticospinal & Corticobulbar tracts:-

-origin

1- The primary motor area (M1) 30% :

- occupies the precentral gyrus & contains large, highly excitable Betz cell .
- M1 of one side controls skeletal muscles of the opposite side of the body .
- 30% from the premotor areas & supplementary cortex .

2- Supplementary cortex (M11) :

- is a small area located on the lateral side of the brain in front of (M1) and above the pre-motor area .
- This area projects mainly to M1 and is concerned with planning and programming motor sequences.

3- Premotor area (M111) :-

- 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- 40% parietal cortex (somatic sensory area 3,1,2).

- 3% of the fibres are large myelinated fibres, derived from the large , highly excitable pyramidal Betz cells.
- 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-third of the posterior limb)

Fibers >> CORONA RADIATA >> INTERNAL CAPSULE >>
BRAIN STEM

- Then descend through the midbrain and pons.
- In the lower medulla oblongata -the fibers form pyramids so called pyramidal tract which divide into:-

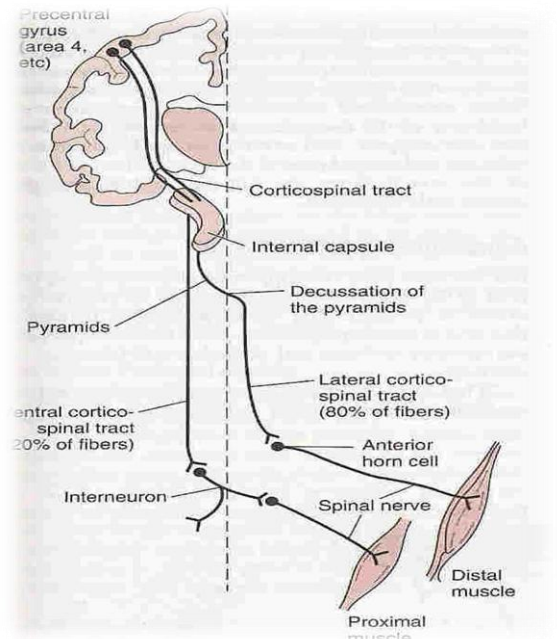
A- CORTICOSPINAL TRACTS:

1- lateral corticospinal tracts :-

- 80% of fibers cross midline in pyramids
- ends directly (not via interneurons) on motor neurons (AHCs)
- lateral so control distal limb muscles

2- ventral (anterior) corticospinal tracts :-

- remaining 20% fibers does not cross midline
- cross at level at which it ends to synapse with interneurons that synapse with motor neurons (AHCs)
- pass medially in ventral horn so control axial & proximal limb muscles & control posture.

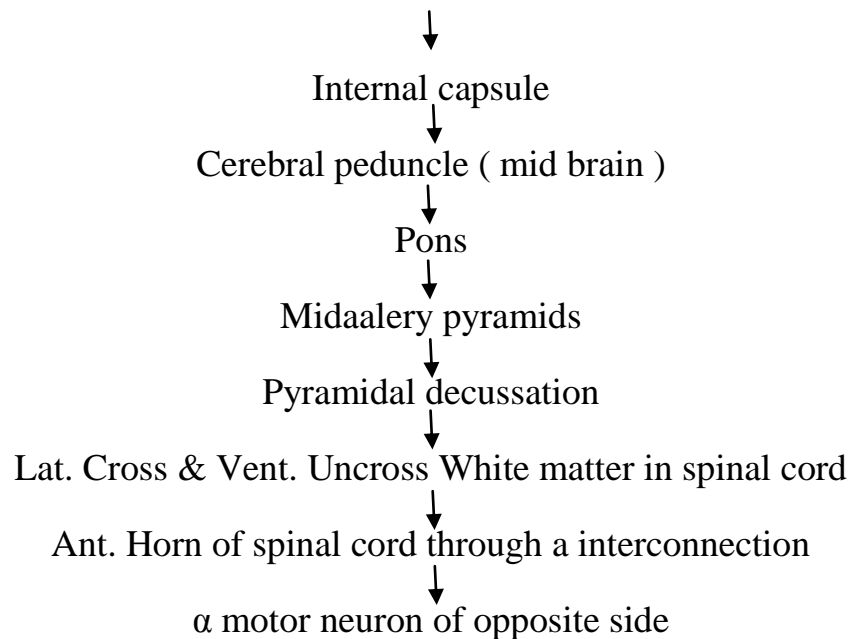


B - Corticobulbar tracts :

fibers that ends on cranial nerve nuclei of opposite side.

The pathway :

Origin – Sensory cortex (40%) , primary Motor Cortex (30%) , premotor & supplementary cortex (30%) :



Functions of corticospinal tracts:-

- 1-initiation of fine skilled voluntary movements
- 2- lateral corticospinal control of distal muscles of fine skilled movements
- 3- Ventral corticospinal tracts control posture of axial &proximal muscle
- 4- Effect on stretch reflex (Faccilitate muscle tone).
- 5- those fibers originate from parietal lobe are for sensory-motor coordination

* corticobulbar tracts /control what?

Cranial nerve neuclei (control head & neck only)

-Extrapyramidal tracts :-

Definition: Tracts other than corticospinal tract & are outside pyramids

Origin/ motor area 4, premotor area 6, 4S

CORONA RADIATA → INTERNAL CAPSULE → BASAL GANGLA
→ BRAIN STEM → BULBOSPINAL TRACTS:-

A- Rubrospinal tract.

B- Vestibulospinal Tract.

C- Reticulospinal Tract

D- Tectospinal Tract.

E- Olivospinal Tract

Function of extrapyramidal system :

- (1) sets the postural background needed for performance of skilled movements and,
- (2) controls subconscious gross movements.

1-Rubrospinal tracts (INHIBITORY):-

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



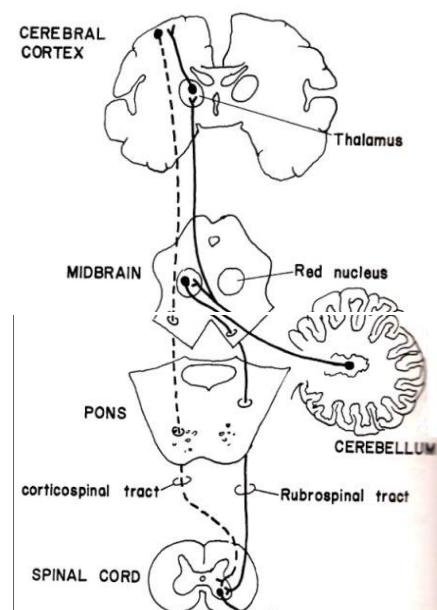
Descend with the lateral corticospinal tract



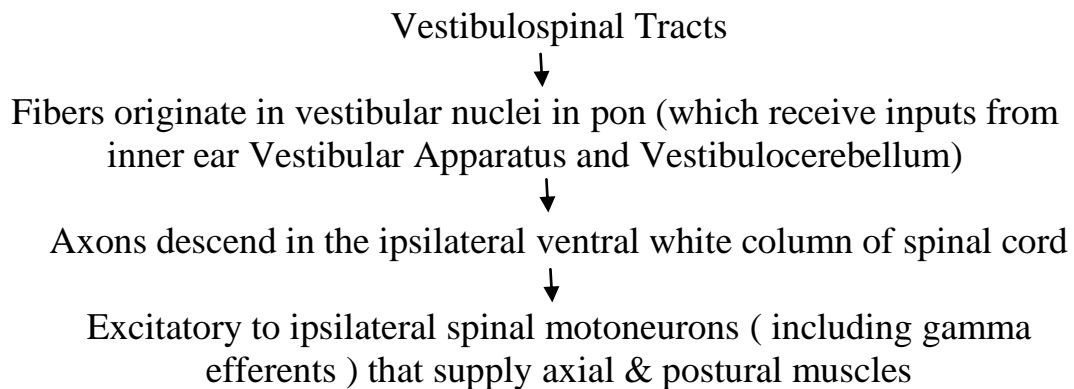
In spinal cord tract occupies the lat. White column , & fibers synapse on the contralateral AHCs

- 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 tha control skilled movement



2- Vestibulospinal tracts:-



Functions:

- 1- Controls Postural & righting reflexes.
- 2- Excitatory to ipsilateral spinal motor neurons-that supply axial & postural muscles
- 3- 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 fibers that link vestibular nuclei to nuclei supplying the extraocular muscles for coordination of head and eye movements

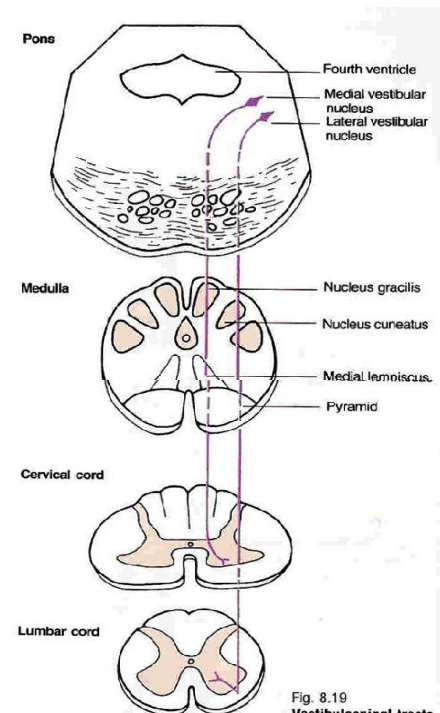


Fig. 8.19
Vestibulospinal tracts.

3- Tectospinal tracts:-

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



Near Medial longitudinal fasciculus



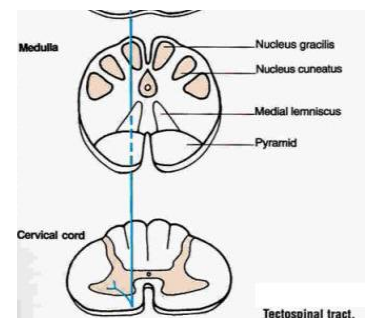
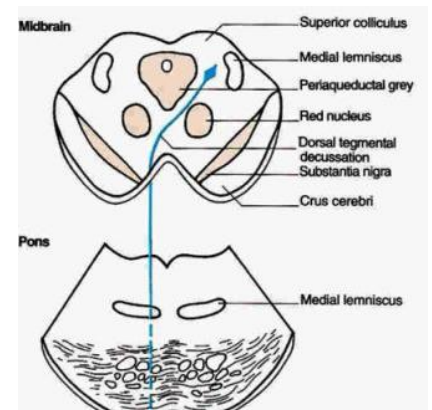
Axons descend in ventral white column of spinal cord



Contralateral cervical motoneurons

Function :

Mediate/facilitate turning of the head in response to visual or auditory stimuli.



4- Reticulospinal Tract :-

-The reticular formation makes up a central core of the brainstem. It contains many different neuronal groups.

-These tracts influence both alpha & gamma motoneuron activities (they regulate muscle tone & inhibit unwanted reflex contractions) .

-Pontine and medullary nuclei project to the anterior horn of the spinal cord via reticulospinal tract

Functions:

influence motor functions as voluntary & reflex movement & excitatory or inhibitory to muscle tone).

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 Gamma efferent activity ,(increases muscle tone)

2- Medullary (Lateral) Reticulospinal Tract:

Cells of origin: Medullary Reticular Formation

- Axons descend in ventral white column of spinal cord on both sides
- Axons terminate in ipsilateral & contralateral ventral horn cells of spinal cord
- Medullary Reticulospinal Tract, inhibits Gamma efferent activity (decreases muscle tone)

5-Olivospinal Tract :-

It arises from inferior olivary N of the medulla & is found only in the cervical region of the spinal cord (supply neck muscles) of unknown function