

بسم الله الرحمن الرحيم

كسابقتها ، هذه المذكرة لها نفس النهج ، ونفس المراجع

واطلع عليها الدكتور أشرف بنفسه ، ، فأعطانا الضوء الأخضر بنشرها

نتمنى لكم التوفيق دنيأً وأخراً



**PHYSIOLOGY TEAM - GROUP B**

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# EXTRAPYRAMIDAL SYSTEM

- **DEFINITION :**

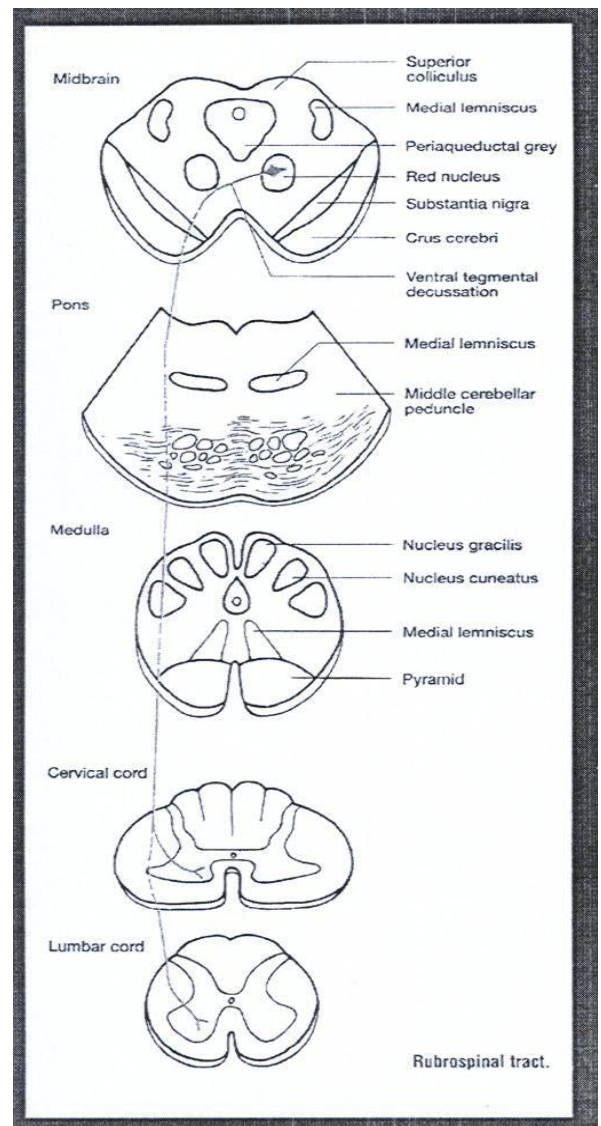
- ✓ Tracts other than corticospinal tracts are known as **EXTRAPYRAMIDAL TRACTS** .
- ✓ Mainly affect Gamma Motor Neuron .
- ✓ **Function :** Regulate body posture involving involuntary movement of large muscle groups of trunk and limbs .

- **COMPONENTS OF EXTRAPYRAMIDAL SYSTEME :**

- ✓ Basal Ganglia .
- ✓ Brainstem : giving rise to all of the following tracts :
  - Rubrospinal Tract .
  - Tectospinal Tract .
  - Vestibulospinal Tract .
  - Reticulospinal Tract .
  - Olivospinal Tract .

## RUBROSPINAL TRACT

- **Origin :** Red nucleus (midbrain) .
- **Input :** red nucleus gets input from both cerebellum and cerebral cortical areas.
- **Output :** Via Rubrospinal directed to contralateral spinal motor neurons (crosses to the opposite side at the level of the nucleus and axons are located in lateral spinal white matter anterior to lateral corticospinal tract .
- **Function :** involved in movement of distal limbs (hand & feet) , and also regulates tone and posture .
- It is excitatory to flexors and inhibitory to extensor muscles .



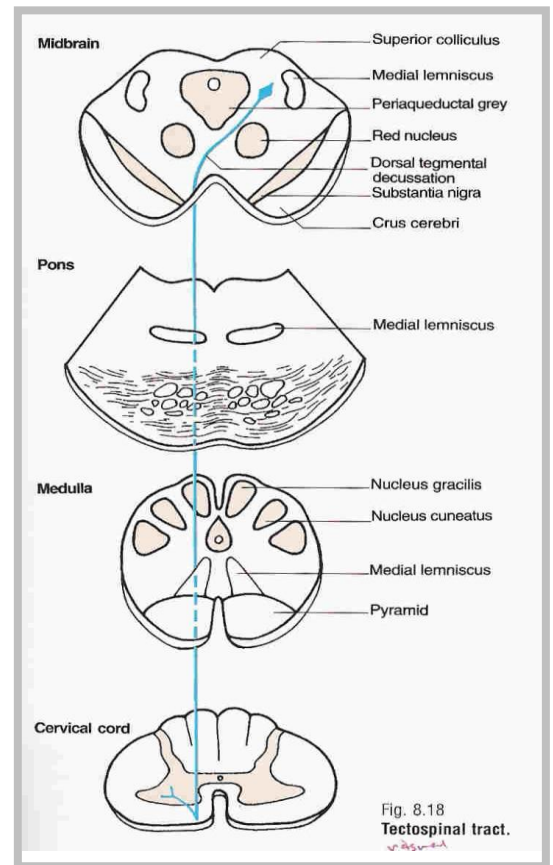
# TECTOSPINAL TRACT

- **Location** : originates in superior & inferior colliculus in midbrain.
  1. Sup. Colliculus : responsible for visual reflexes .
  2. Inf. Colliculus : responsible for hearing reflexes .

- **Input** : from visual stimuli.

- **Output** : Conveys nerve impulses from superior colliculus (midbrain) to contralateral skeletal muscles that move the head and eyes in response to visual stimuli.

- **Function** : Involved in control of neck muscle in response to visual & auditory stimuli.



# VESTIBULOSPINAL TRACT

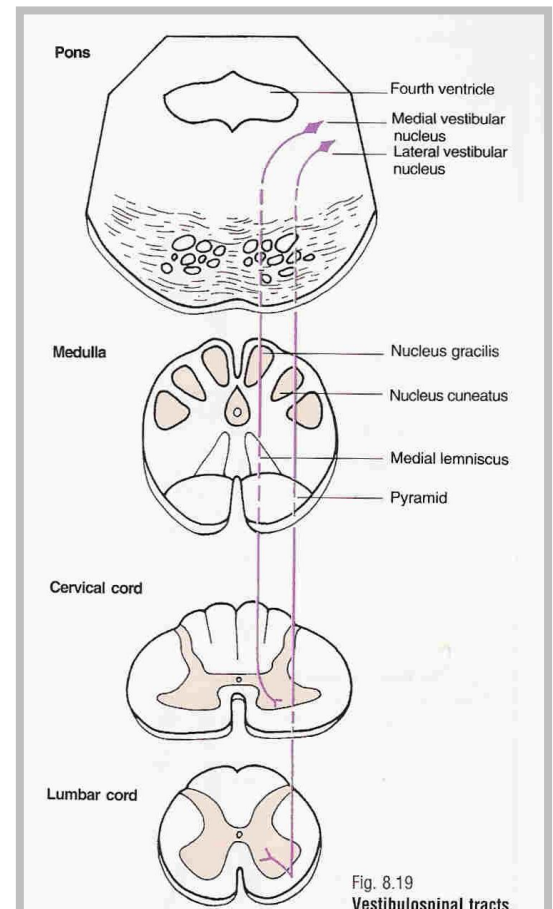
- **Location** : Vestibular nuclei are located in Pons and Medulla .

- **Input** : They receive input from Vestibular apparatus in the inner ear and Cerebellum .

- **Output** : Mainly From Lateral vestibular nuclei to spinal cord in Vestibulospinal tract. It remains **ipsilaterally** .

- **Function** : Excitatory to ipsilateral extensor , Inhibitory to flexors muscles .

- Regulates muscle tone for maintaining balance in response to head movement .



# RETICULOSPINAL TRACT

• **Location** : Reticular formation in the center of the brain stem , having a **network** appearance .

• **Input** : Afferent input to reticular formation comes from spinal cord, vestibular nuclei, cerebellum, Sensory & motor cortex, globus pallidus & Lat. Hypothalamus.

• **Output** : Descending tract arise from nuclei in pons and medulla.

1] Pons – Pontine Reticulospinal tract runs ipsilaterally .

✓ **Function** : Excitatory to Axial extensor muscles (antigravity muscles) .

2] Medulla – Medullary reticulospinal tract runs ipsilaterally (some cross also).

✓ **Function** : Inhibitory to axial extensor Muscle.

## OlivoSpinal Tract

- It arises in the cells of inferior olive of the medulla and is found only in the cervical region of the spinal cord .
- Function is unknown .

# Differences between pyramidal and extra pyramidal Tracts

## PYRAMIDAL TRACTS



1. - Lateral corticospinal
  - Ant. or ventral corticospinal
  - Corticobulbar
2. Cell bodies that contribute to pyramidal tracts are located in precentral gyrus ( Primary, Premotor and supplementary motor cortex) and somatosensory area.
3. Pyramidal tract descend directly without synaptic interruption from cerebral motor cortex to spinal cord ( on interneuron and anterior Horn cells).
4. 80 % of Corticospinal tracts (lateral) cross in medulla.
  - 20 % of corticospinal tract (ventral) cross in spinal cord.
  - \_ Because of crossing cerebral cortex controls opposite side of the body.
5. Function:
  - Lat. Corticospinal tract : fine movement of fingers eg. Writing, needle work.
  - Ventral corticospinal tract : Axial or Postural Movement

## EXTRA PYRAMIDAL TRACTS

1. -Rubrospinal
  - Vestibulospinal
  - Reticulospinal
  - Tectospinal
2. They originate in Midbrain and brainstem nuclei and have influence of cerebral cortex, basal ganglia and cerebellum which can stimulate or inhibit these nuclei.
3. No direct control of motor cortex or basal ganglia on spinal cord but via nuclei in midbrain and brainstem .
4. Major extra pyramidal tracts are uncrossed , except **rubrospinal** and **tectospinal tracts** which are crossed .
5. Function:
  - Control of body posture involving involuntary movements of axial and Proximal limb muscle.

# Clinical Neurology

## • NEUROPATHY AND MYOPATHY :

<u>Neuropathy</u>	<u>Myopathy</u>
usually affects distal muscles	usually affects proximal muscles
Weakness	Weakness
Loss of sensation	Sensation is intact
 <p>↑Duration , ↑amplitude</p>	 <p>↓Duration , ↓amplitude</p>
<u>Incomplete</u> interference pattern	Complete interference pattern

## • UPPER MOTER NEURON LESIONS :

- **UMN** : Motor tracts coming from Motor Cortex to Anterior Horn cells.

- **UMN lesion causes :**

- ✓ Extensive power loss .
- ✓ Increased tone : [ in **flexor muscles of the upper limb** , and **extensor muscles of the lower limb** ]
  - Spasticity : in corticospinal lesions .
  - Rigidity : in extrapyramidal lesions , and of two forms :
    - a) Lead-pipe (no tremor , continuous ) .
    - b) Cogwheel (with tremors) .
- ✓ Presence of **BABINSKI'S SIGN** :
  - Normally , this stimulation causes plantar reflex that is downward flexion of big and small toes
  - In patients with present Babinski's sign , stimulation of the sole of the foot along outer border causes extension of big toe upward and fanning of other toes .
  - Babinski's sign is hard sign for upper motor neuron lesion, signifies damage to lateral corticospinal tract .
  - **N.B.** Babinski's sign can be seen in non pathological conditions:
    - Infants below one year of age, because myelin sheath is not well developed .
    - Deep sleeping person .



- **LOWER MOTER NEURON LESIONS :**

- **LMN :** Motor tracts coming from Anterior Horn cells to periphery .
- **LMN lesion causes :**

- ✓ Power loss is limited .
  - ✓ Decreased Tone (Hypotonia / Flaccidity) .
  - ✓ Absent or Decreased reflexes (deep reflexes) .
  - ✓ Marked wasting of the muscles .

## General notes

- ✓ Pure pyramidal tract lesions cause **Hypotonia** (not spasticity) .
- ✓ Extrapyramidal tract lesions cause **Hypertonia** (rigidity) .
- ✓ **HEMIPLÉGIA :** Paralysis (loss of power) off half side off the body..
- ✓ **HEMIPARESIS :** Partial loss of power off half side off the body..
- ✓ **PARAPLEGIA :** Paralysis in both legs..
- ✓ **PARAPARESIS :** Partial loss of power in both legs..
- ✓ **QUADRIPLEGIA :** Paralysis in all four limbs..
- ✓ **MONOPLÉGIA :** Paralysis in one limb..

- **REFERANCE :**

Review of Medical Physiology by Gannon (22<sup>nd</sup> edition) , pages (203-210) .