

## **Objectives:**

Upon completion of this lecture, students should be able to:

Describe the upper and lower motor neurons

Understand the pathway of Pyramidal tracts  
(Corticospinal & corticobulbar tracts)

Understand the lateral and ventral corticospinal tracts.

Explain functional role of corticospinal & corticobulbar tracts

Describe the Extrapyramidal tracts as Rubrospinal , Vestibulospinal ,Reticulospinal and

**Tectospinal Tracts.**

# Upper & lower motorv neurons

## 1-Upper motor neurons (UMN):-

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

### -There are two UMN Systems :

1- Pyramidal system (corticospinal tracts ).

2- Extrapyramidal system

## 2- lower motorv neurons(LMN)

Spinal motor neurons in the spinal cord & cranial motor neurons in the brain stem that innervate muscles directly



# Descending Tracts

# 1-Pyramidal tracts = Corticospinal & corticobulbar tracts:-

## -origin/

1- 30% motor area 4 ( the primary motor area) ( M1)

Occupies the precentral gyrus.

2- 30% from the premotor areas& supplementary cortex

- Premotor area:- (motor association area) 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.

- Supplementary cortex is a small area located on the lateral side of the brain in front of area 4 and above the pre-motor area & extends on medial side of the cerebral hemisphere.

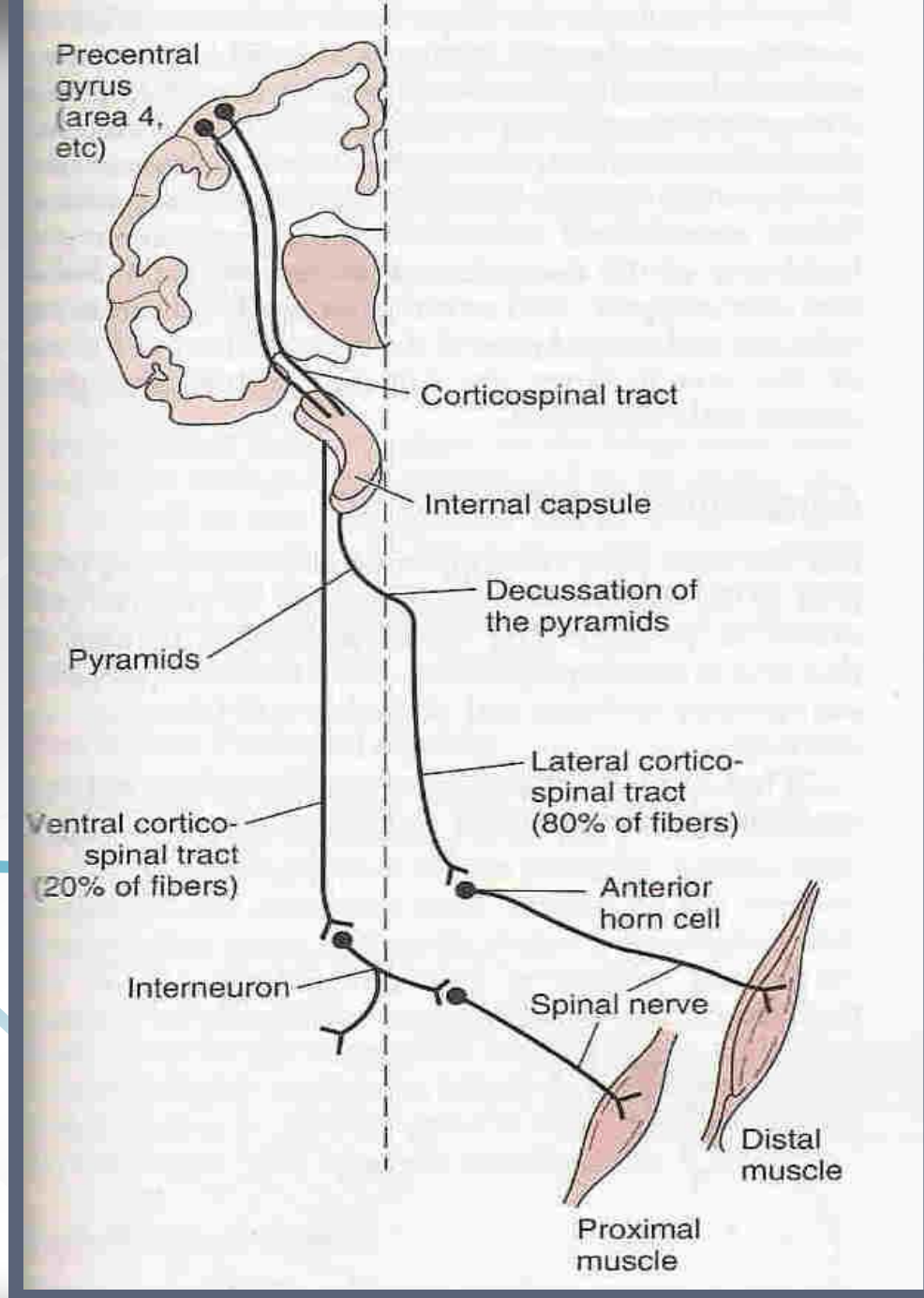
- This area projects mainly to M1 and is concerned with planning and programming motor sequences. •

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

- 3% of the fibres are large myelinated fibres, derived from the large, highly excitable pyramidal Betz cells in motor area 4.
- These fibers form monosynaptic connections with motor neurons of the spinal cord
- Fibers from the cerebral cortex descend in >>>>CORONA RADIATA to >>>>INTERNAL CAPSULE genu and the anterior two-third of the posterior limb >>>>>BRAIN STEM (midbrain, pons, medulla oblongata)

- In the brain stem Corticobulbar tract terminates on LMNs in the brain stem (fibers ends on cranial nerve nuclei of opposite side )
- Corticospinal tracts (pyramidal) descends through the midbrain and pons.
- In the lower medulla oblongata -the fibers form pyramids so called pyramidal tract which divide into:-





## A-CORTICOSPINAL TRACTS divides into:

### 1- lateral corticospinal tracts :-

- 80% of fibers cross midline in pyramids
- ends directly ( not via interneurons = monosynaptic connections) on motor neurons (AHCs)
- Pass laterally in spinal cord so **control distal limb muscles**, so control fine skilled movements

### 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**



## Functions of corticospinal tracts:-

- 1- **initiation** of fine skilled voluntary movements
- 2- **lateral corticospinal control** of distal muscles of limb as fingers & thumb which concerned with fine skilled movement) e.g Painting writing, picking up of a small object etc.
- 3- **Ventral corticospinal tracts** control **posture** of axial & proximal muscle for **balance, climbing, walking**

#### **4- Effect on stretch reflex:-**

- Facilitate muscle tone**

**5- those fibers originate from parietal lobe are for sensory-motor coordination**

**6- corticobulbar tracts / control face & neck muscles & facilitate their tone**

## -Extrapyramidal tracts :-

Tracts other than corticospinal tract & are outside pyramids

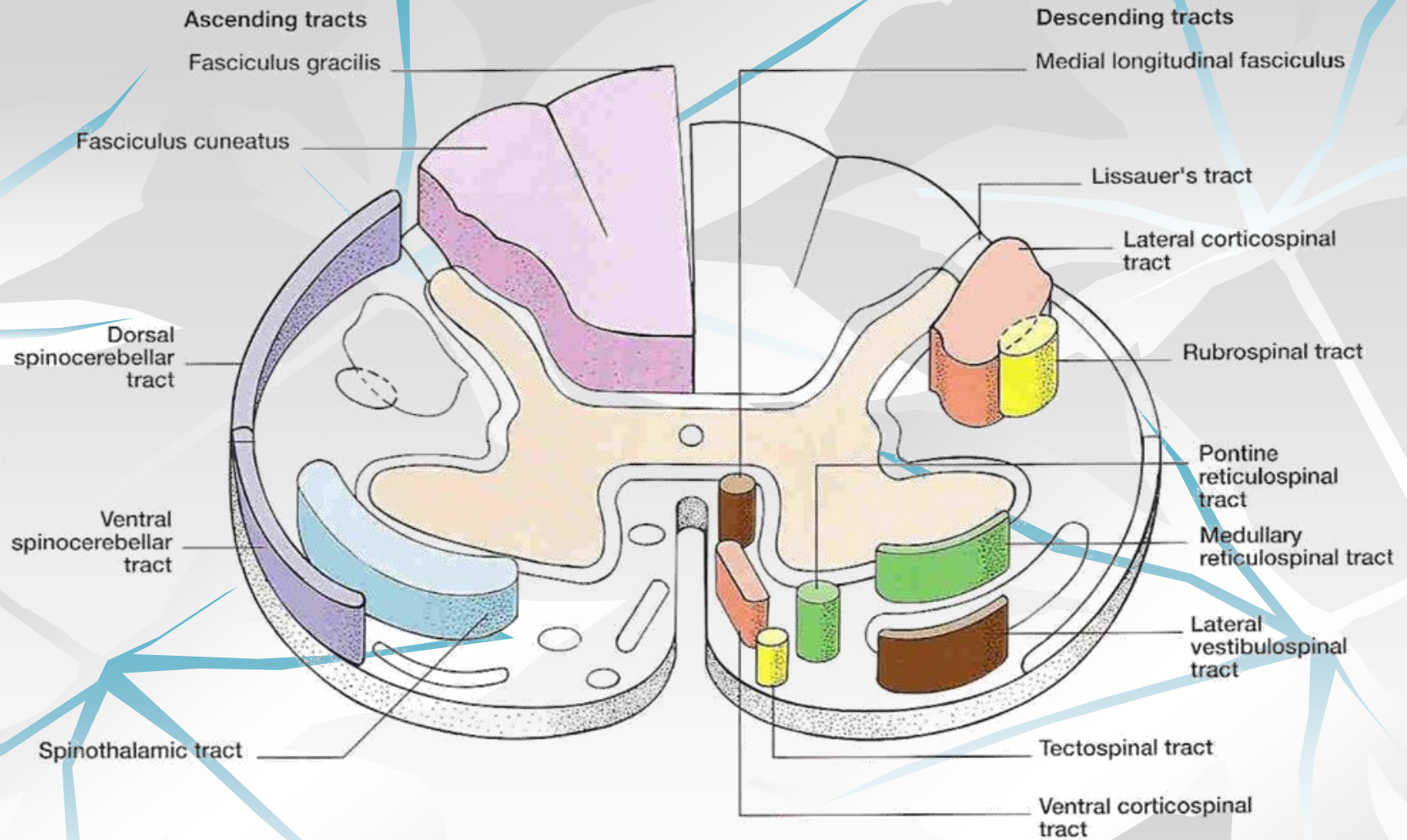
Origin/ motor area 4, premotor area 6, 4 S >>>>CORONA  
RADIATA>>>>INTERNAL CAPSULE>>>>BASAL  
GANGLA>>BRAIN STEM >>>BULBOSPINAL TRACTS

descend to spinal cord :-

- A- Rubrospinal tract.
- B- Vestibulospinal Tract.
- C- Reticulospinal Tract
- D- Tectospinal Tract.
- E- Olivospinal Tract

Extrapyramidal system :

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



## **1-Rubrospinal tracts (INHIBITORY):-**

-From Red nucleus which is connected by fibers with cerebral cortex. Its motor function **is inhibitory** to Distal limb motoneurons & control skilled movements

## **2- Vestibulospinal tracts:-**

-from vestibular nucleus. Fibers originate in vestibular nuclei in pons(which receive inputs from inner ear Vestibular Apparatus and cerebellum)

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

### **-Functions:-**

1- Controls Postural & righting reflexes.

2-Excitatory to ipsilateral spinal motor neurons-that supply axial & postural muscles

3- Control eye movements.



## Functions of Vestibulospinal Tracts

- **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**



### 3- Tectospinal tracts:-

-from superior(VISUAL)& inferior colliculi (AUDITORY)of midbrain

- Ends on **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.
- Pontine and medullary nuclei projects to the anterior horn of the spinal cord via **Reticulospinal Tract**

#### **Functions:**

- 1-influence motor functions as voluntary & reflex movement
- 2-**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 ,( excitatory = 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**
- **Axons terminate in ipsilateral & contralateral ventral horn cells of spinal cord**
- **Medullary Reticulospinal Tract, inhibits Gamma efferent activity ( inhibitory= 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