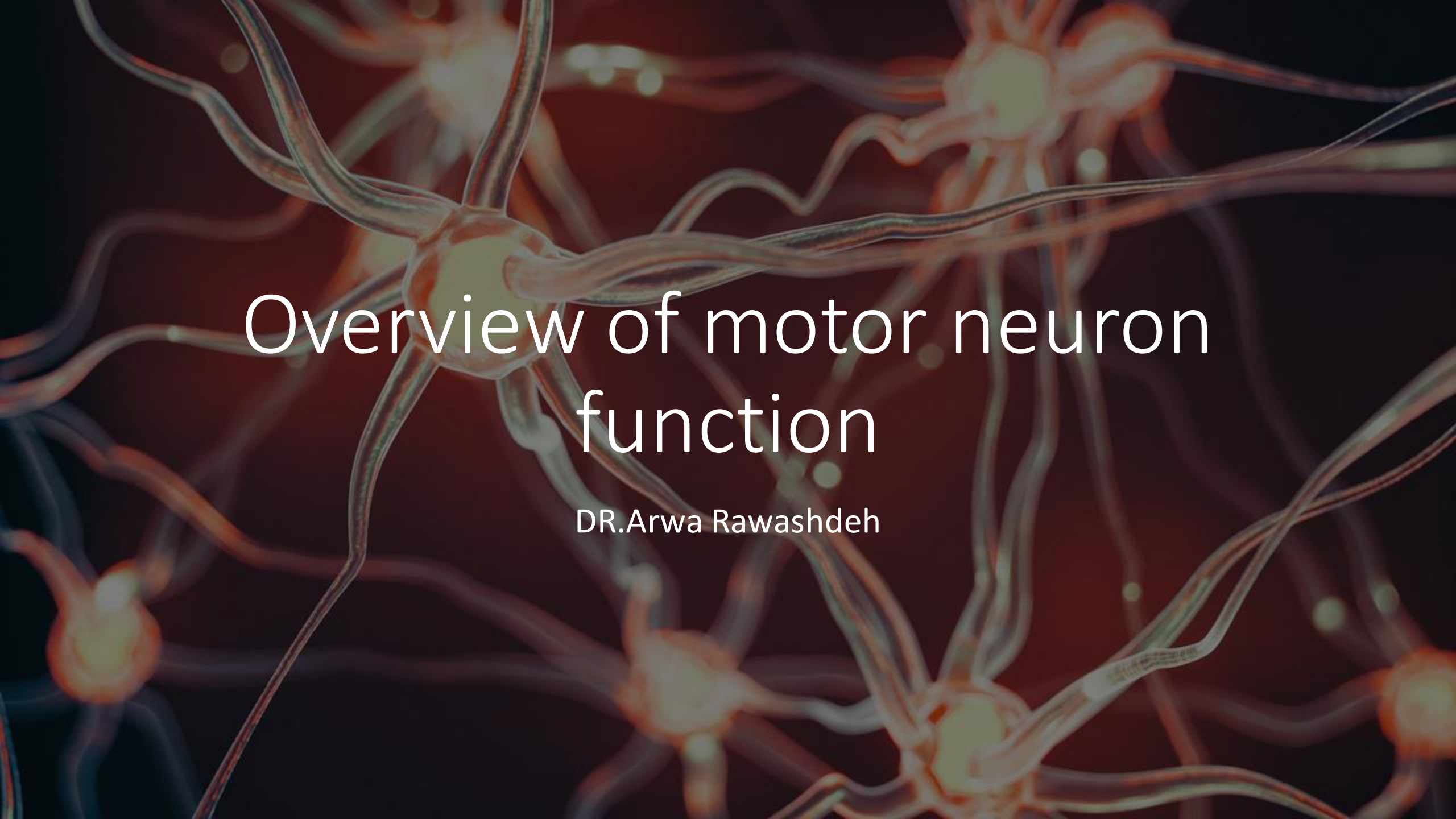


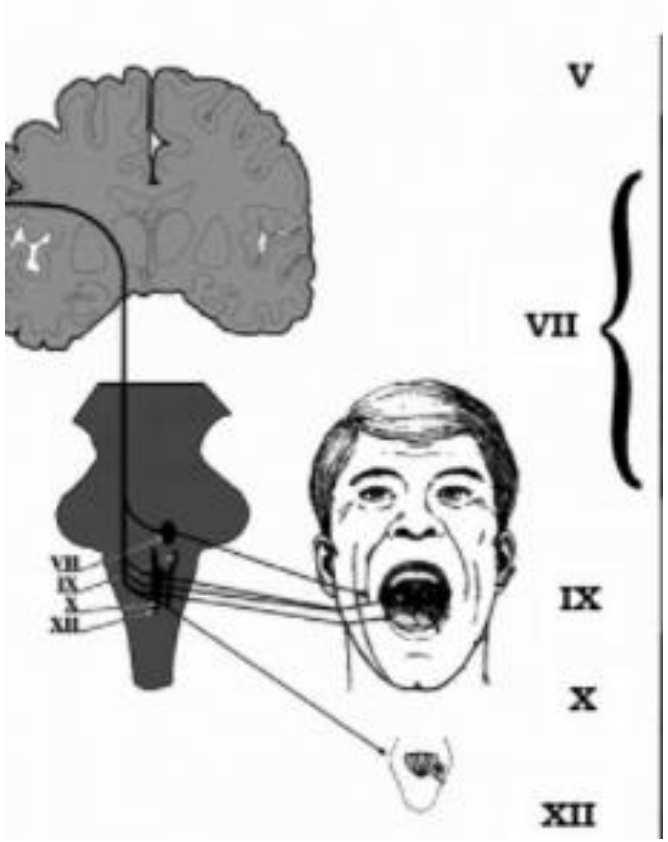
# Overview of motor neuron function

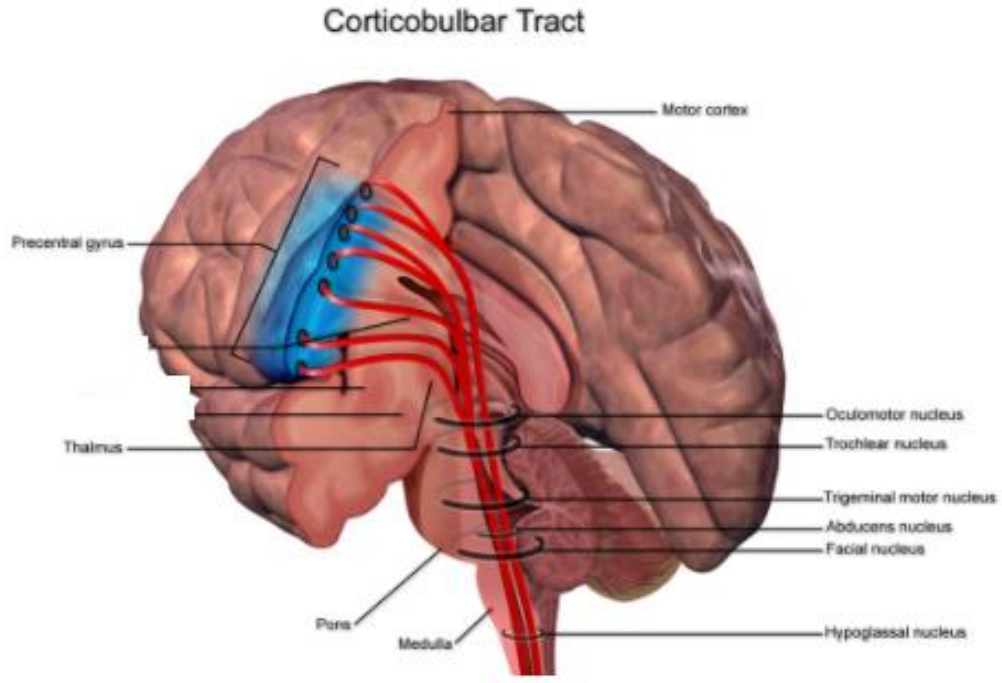
DR.Arwa Rawashdeh

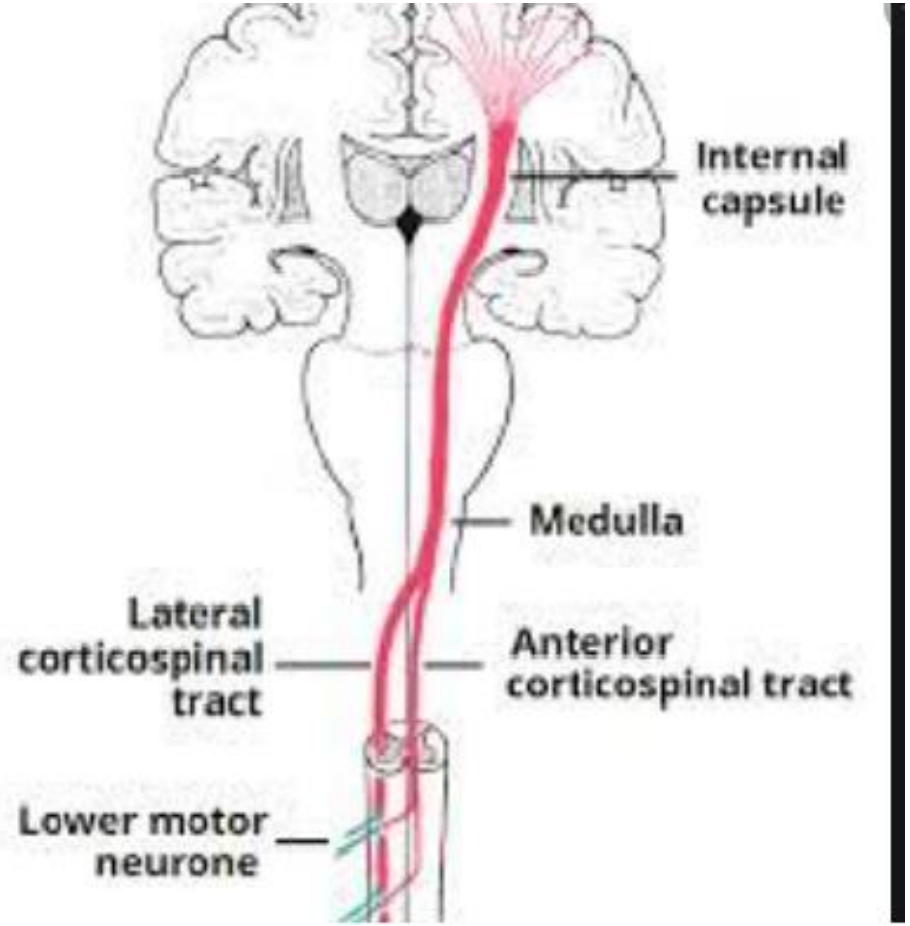
# Upper (UMN)and lower motor neuron tracts (LMN)

| | | |
|---|---|---|
| UMN | Corticospinal | Corticobulbar |
| LMN | Anterior gray horn in the spinal cord | Cranial nerve nuclei |

# Corticobulbar Tract



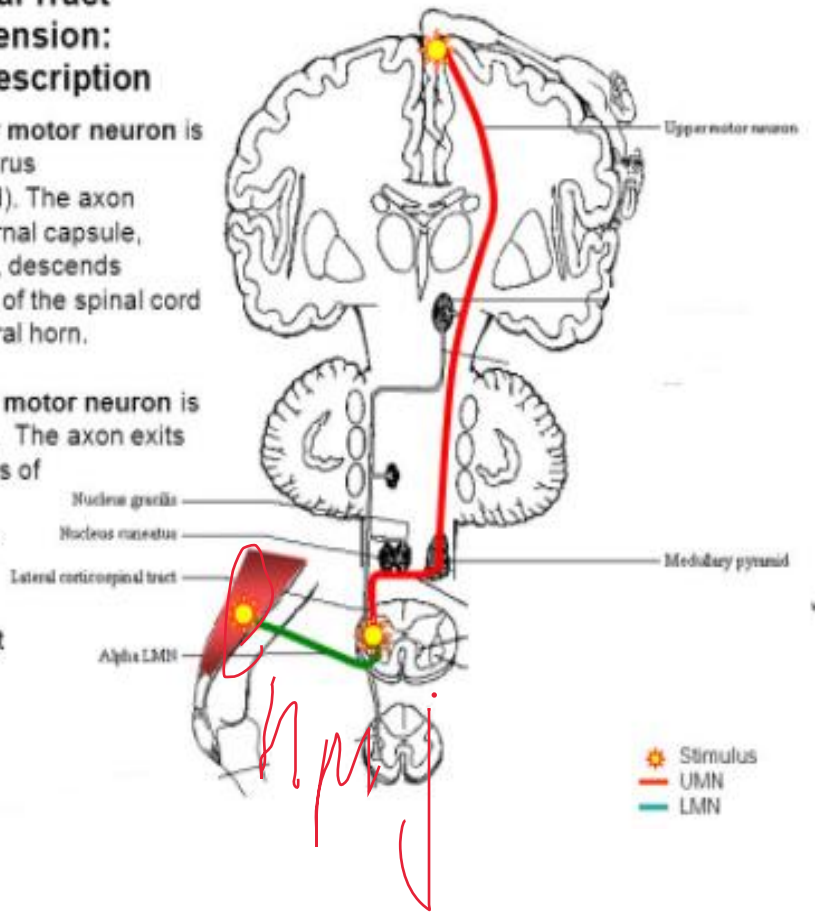



## Corticospinal Tract
## Voluntary Knee Extension: Neuroanatomical Description

The cell body of the **upper motor neuron** is located in he precentral gyrus (somatotopically organized). The axon descends through the internal capsule, decussates in the medulla, descends through the lateral column of the spinal cord and terminates in the ventral horn.

The cell body of the **lower motor neuron** is located in the ventral horn. The axon exits the CNS via ventral rootlets of spinal nerves and innervates skeletal muscle via a peripheral nerve.

**Skeletal muscles** contract to produce the force to extend the knee.



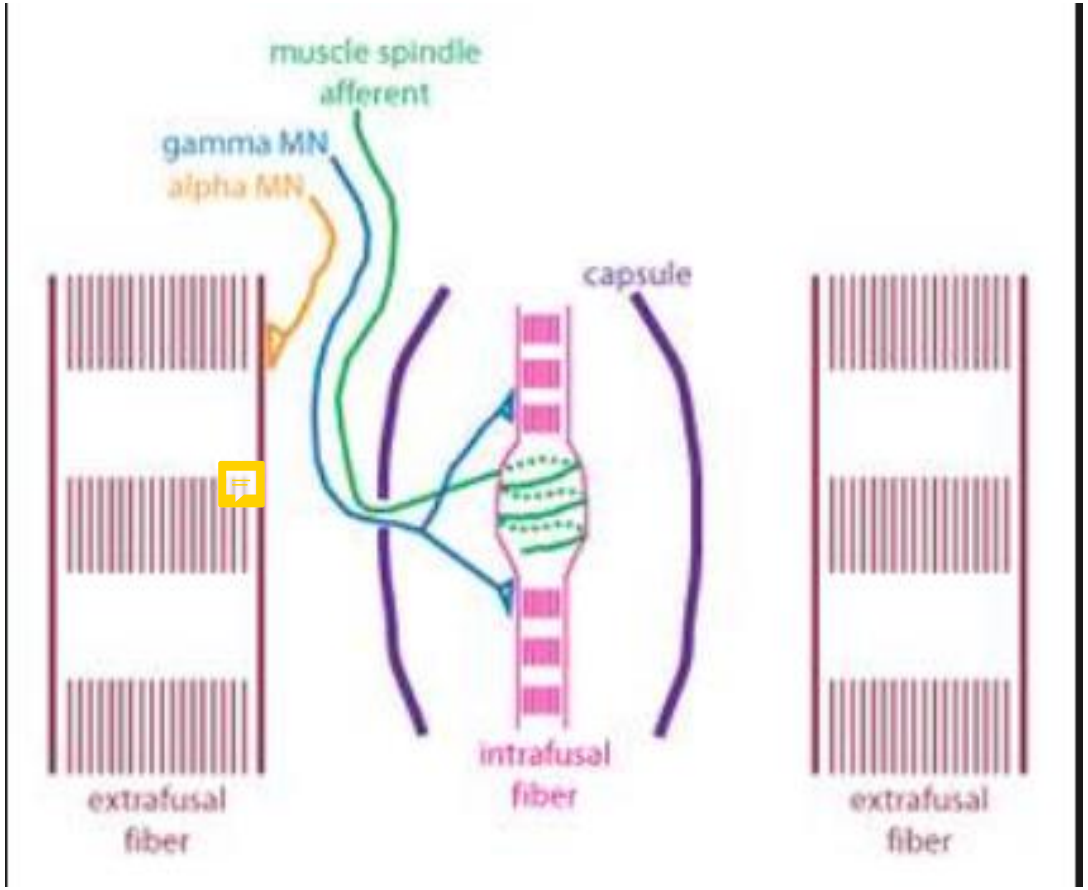

# Corticospinal tract

# CLASSIFICATION OF LMN

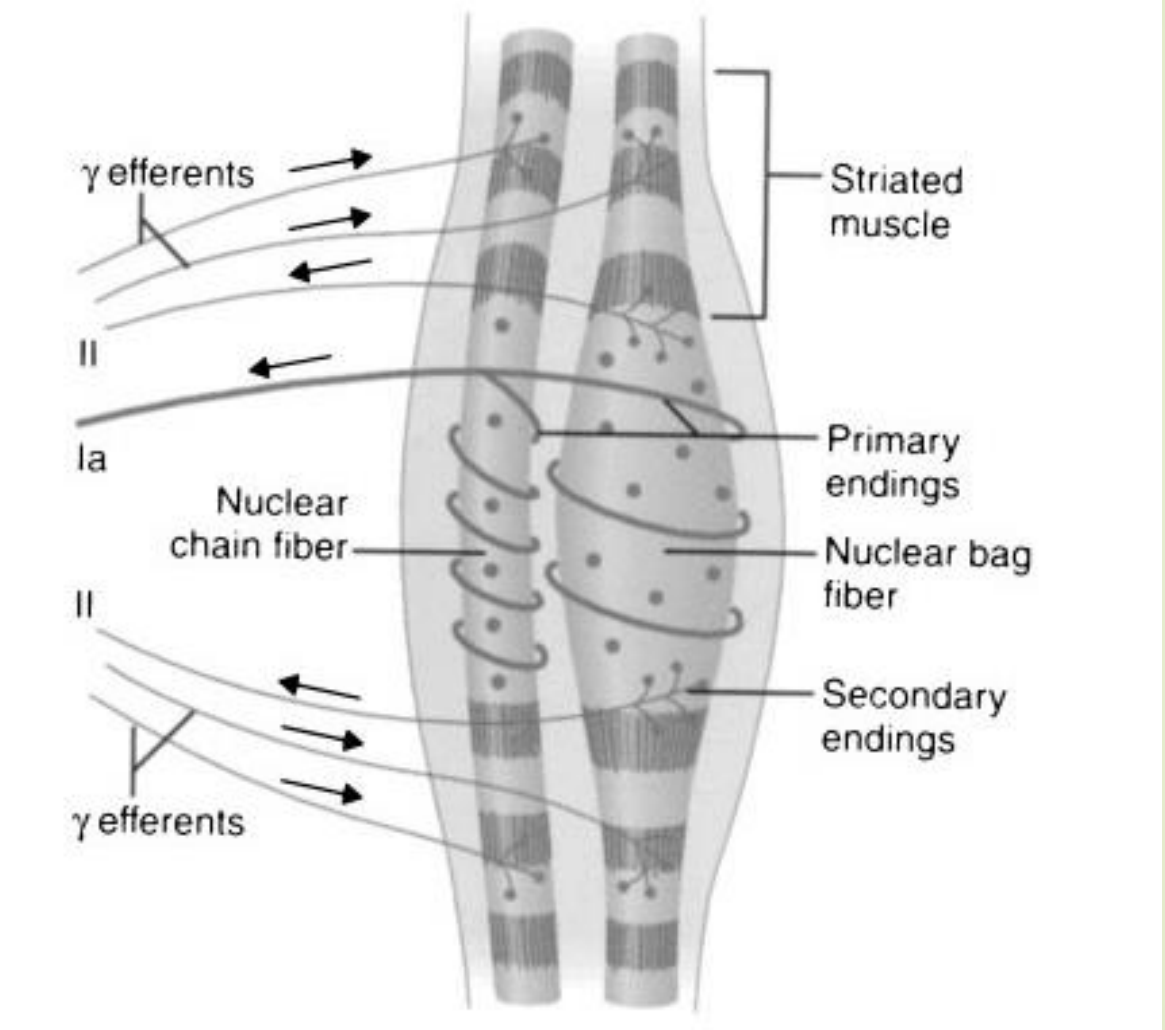
Lower motor neurons are classified based on the type of muscle fiber they innervate:

•Alpha motor neurons (α-MNs) innervate extrafusal muscle fibers, the most numerous type of muscle fiber and the one involved in muscle contraction.

•Gamma motor neurons (γ-MNs) innervate intrafusal muscle fibers, which together with sensory afferents compose muscle spindles. These are part of the system for sensing body position (proprioception)



# The stretch reflex (myotatic reflex)



# WHAT ARE LOWER MOTOR NEURON

All voluntary movement depend upon excitation of lower motor neuron by upper motor neuron

These are the only neurons that innervate the skeletal muscle fibers, they function as the final common pathway, the final link between the CNS and skeletal muscles

# WHERE THEY COME FROM

- Motor Neuron in spinal cord **in the anterior gray horn**

- Motor component of cranial nerve nuclei in brain stem (Those in cranial nerves innervate the skeletal muscles associated with the movements of the eyes, tongue, chewing, swallowing, vocalizing.)

# Upper motor lesion

1. Stroke (occurs when the blood supply to part of your brain is interrupted or reduced)
2. Demyelination the axons of nerve fibers ( multiple sclerosis and B12 deficiency)
3. Amyotrophic lateral sclerosis (ALS) is a neurodegenerative neuromuscular disease that results in the progressive loss of motor neurons that control voluntary muscles

# Lower motor neuron lesion

1. Polio virus damage the anterior gray horn
2. Spinal muscular atrophy ( genetic disease that damage the anterior gray horn)
3. Neuropathy ( damage to the nerve because of herniated disc or diabetes
4. Botulinum toxin ( inhibit the Ach release)
5. Amyotrophic lateral sclerosis (ALS)

# Corticobulbar tract lesion

**BULBAR PALSY**

is a similar disorder as psedobulbar palsy but is caused by lower motor neuron lesions

It consists of **LMN signs** in regions innervated by the **facial (VII), glossopharyngeal (IX), Vagus (X) and hypoglossal (XII**

**PSEUDOBULBAR PALSY**

results from an upper motor neuron lesion to the corticobulbar pathways

It results from **bilateral lesion of UMN's** of the muscles of the tongue (XII), face (VII), speech and swallowing (IX,X)

# Corticospinal tract lesions

# MASS

UMN

- Disuse atrophy
- Decrease the mass of skeletal muscle ( 15-20%) Damage to UPPER motor neuron

LMN

- Decrease Ach release ( nicotinic and muscarinic receptors)

Nicotinic for muscle contraction

Muscarinic for cell signaling pathway and stimulate transcription factors and lead to the synthesis of muscle proteins and decrease in protein synthesis leads to proteolysis

- Denervation atrophy
- Decrease in muscle mass ( 70-80%)

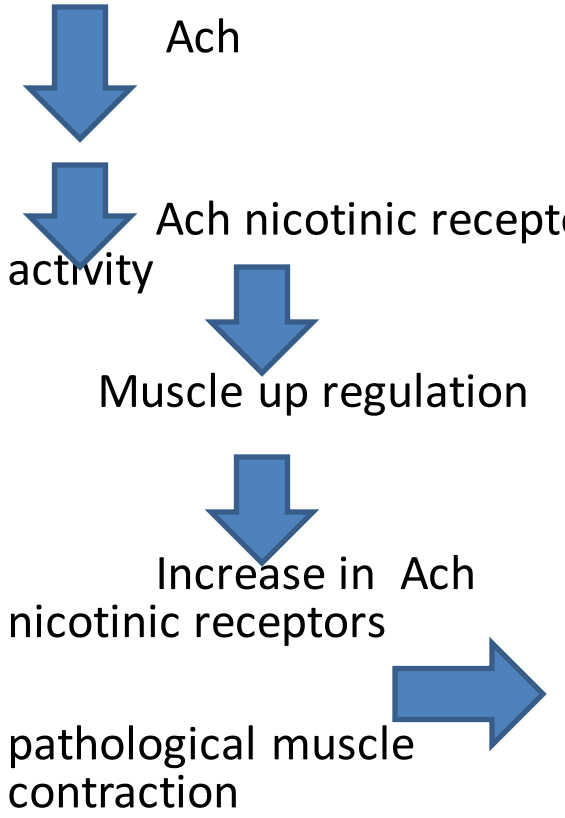
# Fasciculations

Only in lower motor neuron lesions

Involuntary pathological muscle contraction

Increase the sensitivity of ligand channels ( even the tapping could stimulate the channels)

Fibrillation ( Expressed on EMG )



# Tone , deep tendon reflex and reflex

**LMN**
**Flaccid paralysis**

action potential the LMN
(Extrafusal and intrafusal)

Hypotonia ( alpha)
Hypo- reflexia ( Gamma)
Decrease the activity of muscle spindle

**UMN**
**Spastic paralysis**

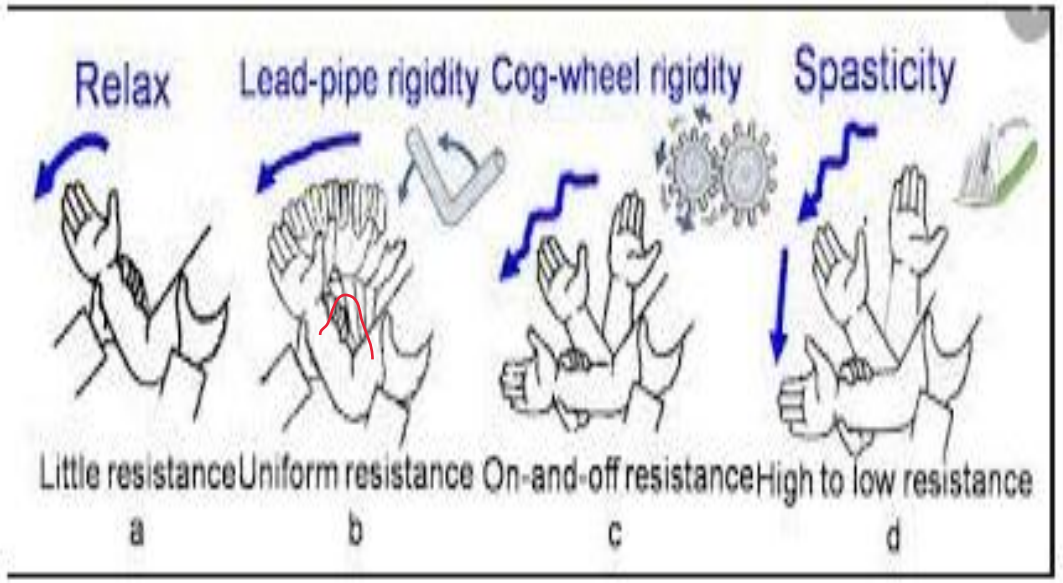
action potential at the level of medullary nucleus

action potential the LMN ( Extrafusal and intrafusal)

hypertonia ( alpha)
hyper- reflexia( Gamma)


Hyporeflexia/A
)
Normal reflex
Hyperreflexia (
)

# Difference between spasticity and rigidity

Spasticity and rigidity are 2 types of hypertonic states elicited when examining the tone of limbs. It is important to differentiate between them to arrive at a correct diagnosis.

**Spasticity:**

Seen in pyramidal tract lesions

Classically termed 'Clasp knife spasticity' – more tone during the initial part of movement – as in opening a pocket knife

**Rigidity:**

like parkinsonism

Cog wheel rigidity – Tremor superimposed on hypertonia – resulting in intermittent increase in tone during the movement – felt as jerks

Lead pipe rigidity – Uniform increase in tone