

# MUSCLE CONTRACTION

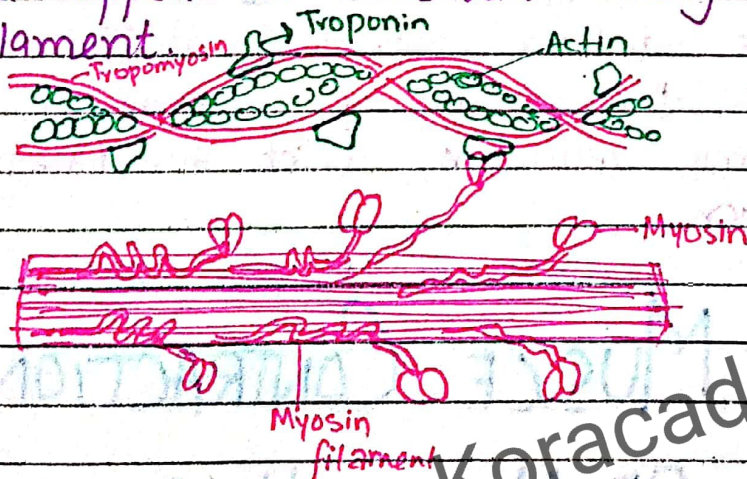
The mechanism of muscle contraction is explained by sliding filament model. The arrangement of actin and myosin myofilament within a sarcomere is crucial in the mechanism of muscle contraction.

## ACTIN

An actin myofilament is made up of actin molecule, tropomyosin and troponin complex. Tropomyosin form two helical strand which are wrapped around actin molecule longitudinally in thin twisted stranded form.

## MYOSIN

A myosin filament consists of long rod-shaped tail called myosin rod and two globular intertwined myosin head. The globular head appear at intervals along the myosin myofilament.



## CONTRACTION MECHANISM

### ★ NERVE IMPULSE

When the nerve impulse from brain and spinal cord are carried along motor neurons to muscle fibre

$Ca^{++}$  ions are released in the terminal axon.

## 2. RELEASE OF NEUROTRANSMITTER

Increased calcium ion concentration stimulates the release of neurotransmitter (Acetylcholine) in the synaptic cleft.

## 3. GENERATION OF ACTION POTENTIAL

The neurotransmitter binds to the receptor on the sarcolemma and depolarization and generation action potential across muscle fibre for muscle contraction.

## 4. PROPAGATION OF ACTION POTENTIAL

The action potential propagates over entire muscle fibre and move to the adjacent fibres along transverse tubules.

## 5. RELEASE OF CALCIUM IONS

The action potential in Transverse tubules causes the release of calcium ion from sarcoplasmic reticulum, which stimulate muscle contraction.

Koracademy.com

# STEPS OF MUSCLE CONTRACTION

## 1. BLOCKING OF MYOSIN HEAD

Actin and myosin overlaps each other forming cross bridge. The cross bridge is active only when myosin head is attached like hook to the actin filament. When muscle is at rest, the overlapping of actin filament to the

myosin head is blocked by tropomyosin.  
The actin myofilament is in off position.

## 2. RELEASE OF CALCIUM ION

Nerve impulse causing depolarization and action potential in the sarcolemma trigger the release of calcium ions.

## 3. BINDING OF CALCIUM ION

The calcium ion then binds with the troponin complex on the actin myofilament causing displacement of tropomyosin from its blocking site.

## 4. CROSS BRIDGE FORMATION

As soon as the actin binding site is exposed, myosin cross bridge with actin.

The cross bridge between actin and myosin acts as an enzyme (Myosin ATPase), which hydrolyses ATP stored in myosin head into ADP and inorganic phosphate and release energy.

## 5. SLIDING OF ACTIN AND MYOSIN FILAMENTS

The released energy is used for movement of myosin head toward actin filament. The myosin head tilts and pull actin filament along so that myosin and actin filament slide each other. The opposite end of actin myofilament with a sarcomere move towards each other, resulting in muscle contraction.

After sliding the cross bridge detaches and the actin and myosin filament come back to original position.