

**Topic: Muscle Contraction**  
**Class: B.Sc Part –III (Hons.)**  
**Paper- V**  
**Group – B**


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# The Mechanism of Muscle Contraction;

- The two different but similar descriptions of muscle contraction that explain the processes involved in notification, contraction, and relaxation.
- **The following steps are involved in muscle contraction:**
  - (1) The sequence of events leading to contraction is initiated somewhere in the central nervous system, either as voluntary activity from the brain or as reflex activity from the spinal cord.
  - (2) A motor neuron in the ventral horn of the spinal cord is activated, and an action potential passes outward in a ventral root of the spinal cord.

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- (3) The axon branches to supply a number of muscle fibers called a motor unit, and the action potential is conveyed to a motor end plate on each muscle fiber.
- (4) At the motor end plate, the action potential causes the release of packets or quanta of **acetylcholine** into the **synaptic clefts** on the surface of the muscle fiber.
- (5) Acetylcholine causes the electrical **resting potential** under the motor end plate to change, and this then initiates an action potential which passes in both directions along the surface of the muscle fiber.


(6) At the opening of each transverse tubule onto the muscle fiber surface, the action potential spreads inside the muscle fiber.

(7) At each point where a transverse tubule touches part of the sarcoplasmic reticulum, it causes the sarcoplasmic reticulum to release  $\text{Ca}^{++}$  ions.

(8) The calcium ions result in movement of troponin and tropomyosin on their thin filaments, and this enables the myosin molecule heads to “grab and swivel” their way along the thin filament. This is the driving force of muscle contraction.

## Contraction is turned off by the following sequence of events:

- (9) Acetylcholine at the neuromuscular junction is broken down by acetylcholinesterase, and this terminates the stream of action potentials along the muscle fiber surface.
- (10) The sarcoplasmic reticulum ceases to release calcium ions, and immediately starts to resequence all the calcium ions that have been released.

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- (11) In the absence of calcium ions, a change in the configuration of troponin and tropomyosin then blocks the action of the myosin molecule heads, and contraction ceases.
- (12) In the living animal, an external stretching force, such as gravity or an antagonistic muscle, pulls the muscle back to its original length.