

## **Sliding filament theory**

The sliding filament theory is the basic summary of the process of skeletal muscle contraction. Myosin moves along the filament by repeating a binding and releasing sequence that causes the thick filament to move over the thinner filament. This progresses in sequential stages. By progressing through this sequence the filaments slide and the skeletal muscles contract and release.

### First Stage:

The first stage is when the impulse gets to the unit. The impulse travels along the axon and enters the muscle through the neuromuscular junction. This causes voltage-gated calcium channels in the axon membrane to then open. Calcium ions come from extra cellular fluid and move into the axon terminal causing synaptic vesicles to fuse with pre synaptic membranes. This causes the release of acetylcholine (a substance that works as a transmitter) within the synaptic cleft. As acetylcholine is released it diffuses across the gap and attaches itself to the receptors along the sarcolemma and spreads along the muscle fiber.

### Second Stage:

The second stage is for the impulse spreads along the sarcolemma. The action potential spreads quickly along the sarcolemma once it has been generated. This action continues to move deep inside the muscle fiber down to the T tubules and the action potential triggers the release of calcium ions from the sarcoplasmic reticulum.

### Third Stage:

During the third stage calcium is released from the sarcoplasmic reticulum and actin sites are activated. Calcium ions once released begin binding to Troponin. Tropomyosin blocking the binding of actin is what causes the chain of events that lead to muscle contraction. As calcium ions bind to the Troponin it changes shape which removes the blocking action of Tropomyosin (thin strands of protein that are wrapped around the actin filaments). Actin active sites are then exposed and allow myosin heads to attach to the site.

### Fourth Stage:

The fourth stage then begins in which myosin heads attach to actin and form cross bridges, ATP is also broken down during this stage. Myosin binds at this point to the exposed binding sites and through the sliding filament mechanism the muscles contract.

### Fifth Stage:

During the fifth stage the myosin head pulls the Actin filament and ADP and inorganic Phosphate are released. ATP binding allows the myosin to detach and ATP hydrolysis occurs during this time. This recharges the myosin head and then the series starts over again.

#### Stage Six:

Cross bridges detach while new ATP molecules are attaching to the myosin head while the myosin head is in the low-energy configuration. Cross bridge detachment occurs while new ATP attaches itself to the myosin head. New ATP attaches itself to the myosin head during this process.

#### Stage Seven:

During stage seven the ATP is broken down and used as energy for the other areas including new cross bridge formation. Then the final stage (stage 8) begins and a drop in stimulus causes the calcium concentrate and this decreases the muscle relaxation.