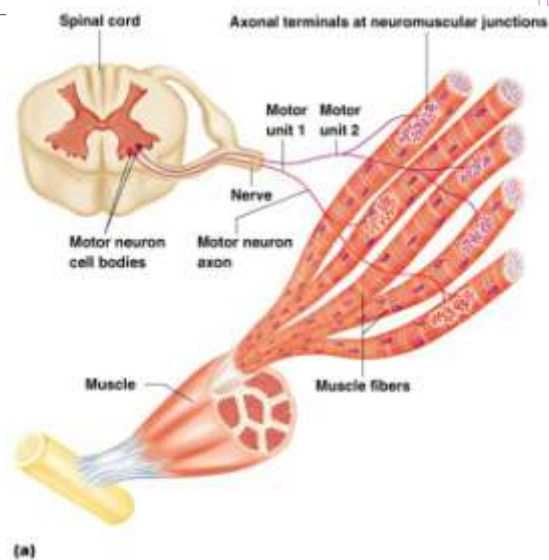


Muscle Physiology

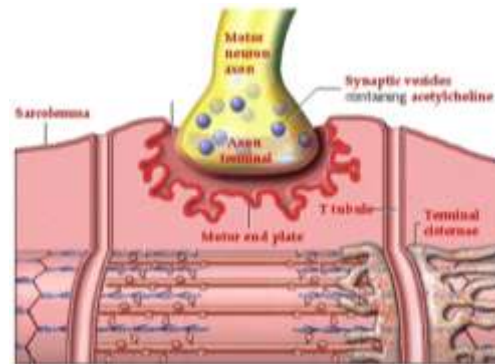
Motor Unit

- One neuron and the muscle fibers it stimulates



Neuromuscular Junction

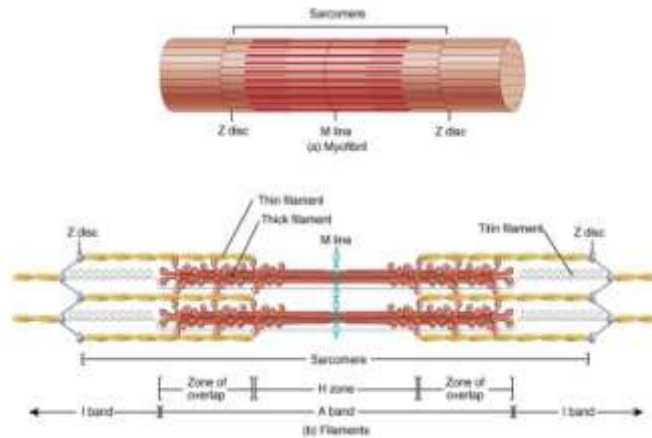
- Axon terminal of nerve forms junction with sarcolemma
 - Never actually touch
 - Space = synaptic cleft



Neuromuscular Junction

1. Synaptic vesicle releases neurotransmitter into synaptic cleft
 - Acetylcholine (ACh) [quickly broken down]
2. ACh diffuses across cleft and attached to receptors on sarcolemma
3. Sarcolemma temporarily permeable to Na^+
 - cell interior has excess $+$ ions
4. Change in electrical conditions generates action potential
 - Once begun = unstoppable
 - Contraction

Mechanism of Contraction

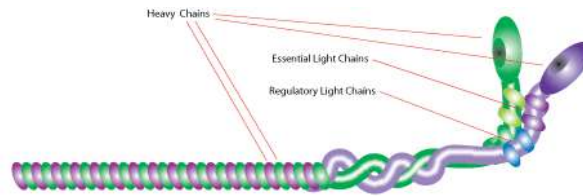


Sliding Filament Theory

- The chemical players in muscle contraction
 1. myosin
 2. actin
 3. tropomyosin
 4. troponin
 5. ATP
 6. calcium ions

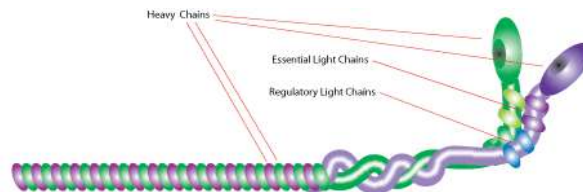
Myosin

- Thick filament
- A tail and two heads (cross bridge)
- Heads move back and forth, providing the power stroke for muscle contraction



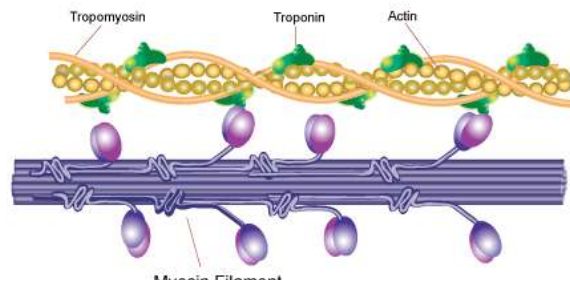
Myosin

- The cross bridge has binding site for actin and ATP.



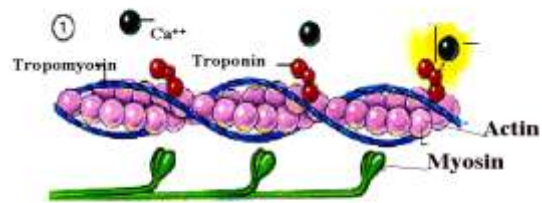
Thin Filaments

- Actin (double strand) contains myosin binding sites
- Tropomyosin twists around the actin, blocking binding sites
- Troponin moves tropomyosin to expose binding sites



Role of Calcium

- Action potential occurs
- Ca^{2+} released from sarcoplasmic reticulum
- Ca^{2+} bind to troponin
 - Conformation change
- Tropomyosin moves exposing myosin binding sites on actin



Six Steps of Cross Bridge Cycling

1. Exposure of Binding Sites on Actin
 - Ca²⁺ required
2. Binding of Myosin to Actin
3. Power Stroke of the Cross Bridge
4. Disconnecting the Cross Bridge
5. Re-energizing the Cross Bridge
6. Removal of Calcium Ions

Exposure of Binding Sites on Actin

- Presence of an action potential in the muscle cell membrane.
- Release of calcium ions
- Calcium ions rush into the cytosol and bind to the troponin.
- There is a change in the conformation of the troponin-tropomyosin complex.
- This tropomyosin slides over, exposing the binding sites on actin.

Power Stroke of the Cross Bridge

- The ADP and P⁻ are released from the actin.
- The myosin head (cross bridge) tilts backward.
- The power stroke occurs as the thin filament is pulled inward toward the center of the sarcomere.

Removal of Calcium Ions

- Calcium ions fall off the troponin.
- Calcium is taken back up into the sarcoplasmic reticulum.
- Tropomyosin covers the binding sites on actin

