Mechanism of muscle contraction (CC4 unit, unit1)

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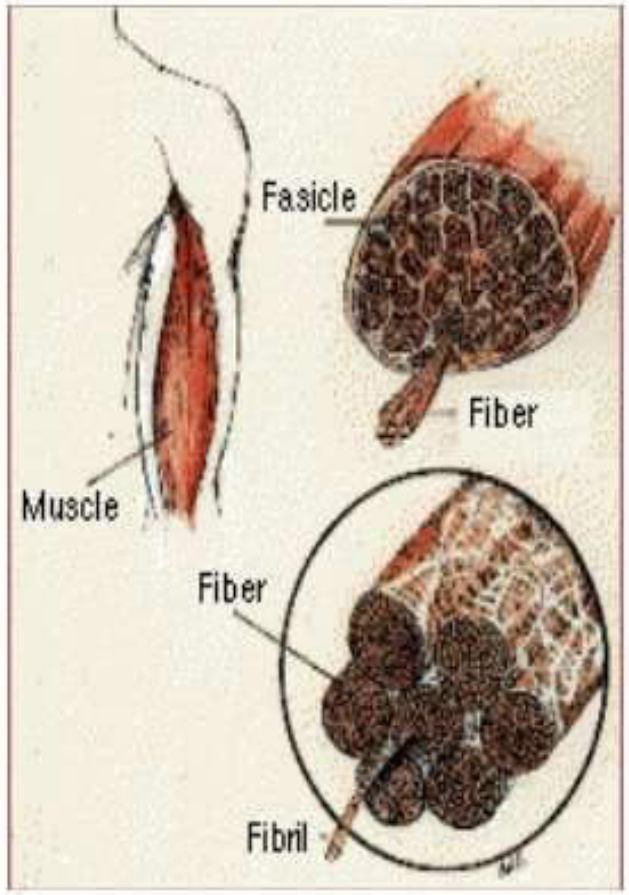
Structure Of Skeletal Muscle

- Muscle
- Muscle Fascicle
- Muscle Fiber
- Myofibrils



Skeletal Muscle

A. Muscle Fiber

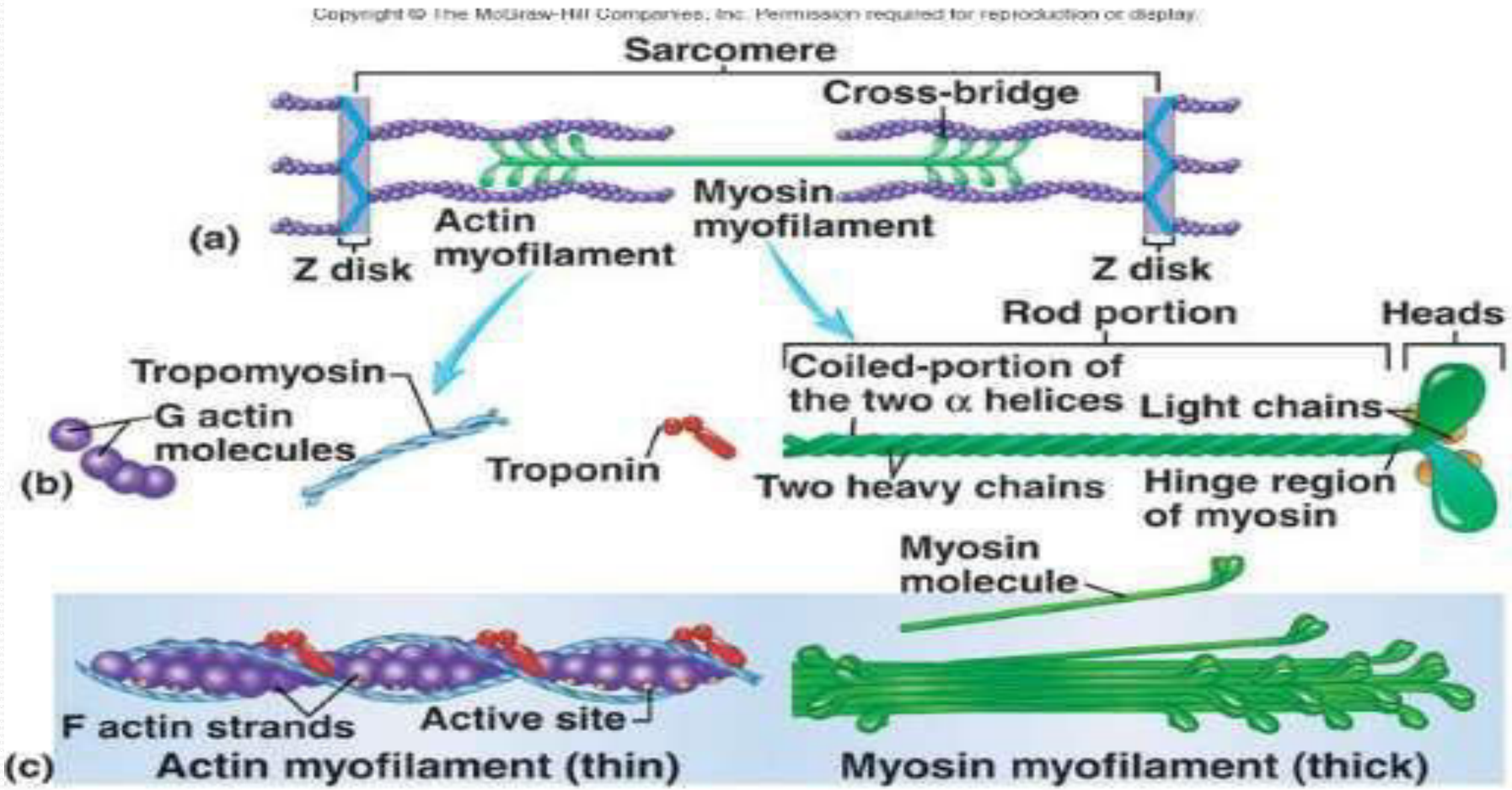
1. Sarcolemma
2. Sarcoplasm
3. Myofibrils – contractile elements
   - Actin
   - Myosin

a. Actin Filament

- F- actin strands
- Tropomyosin
- Troponin (T,I,C)

b. Myosin Filament

Structure Of Myofibril



Mechanism Of Muscle Contraction

- Step 1. Nerve impulse, travels towards the synaptic knob.

- Step 2. Ca++ ion from ECF enter into the synaptic knob through **calcium channels**.

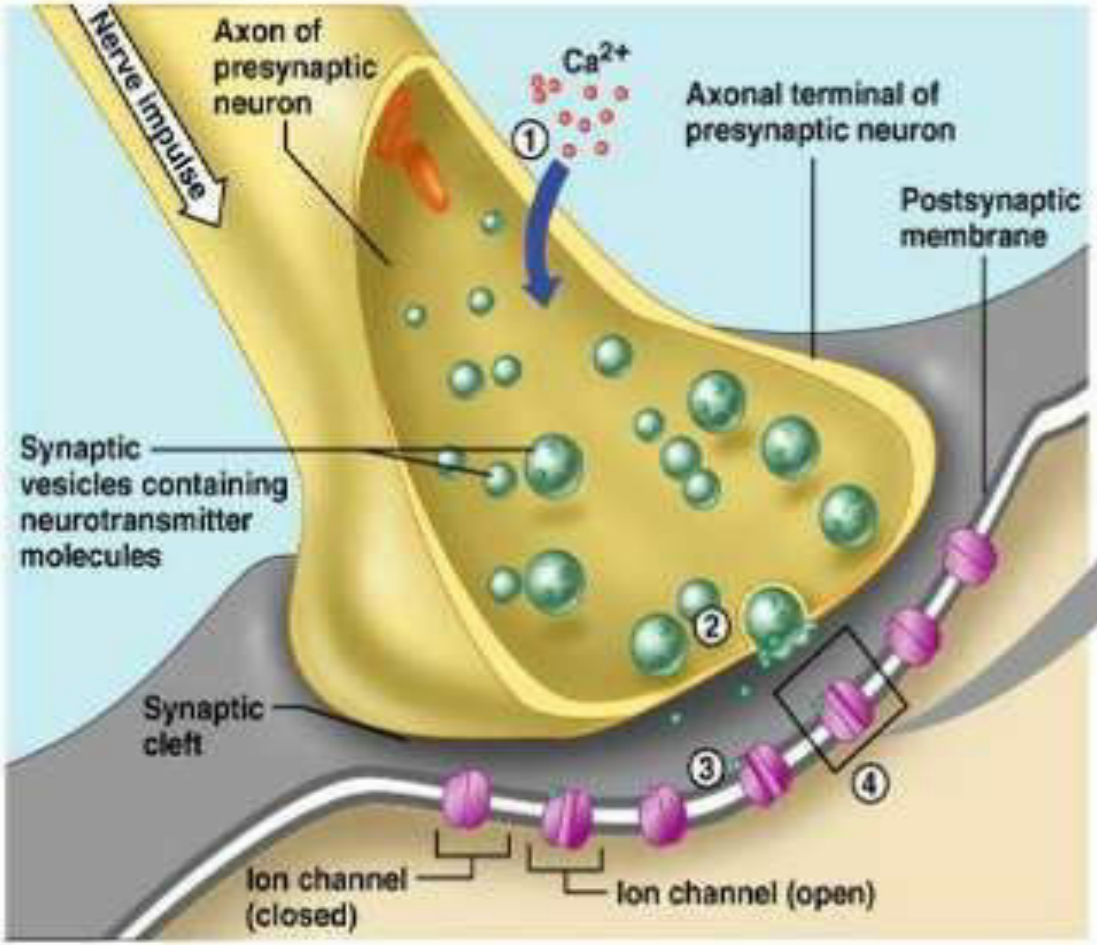
Mechanism Of Muscle Contraction

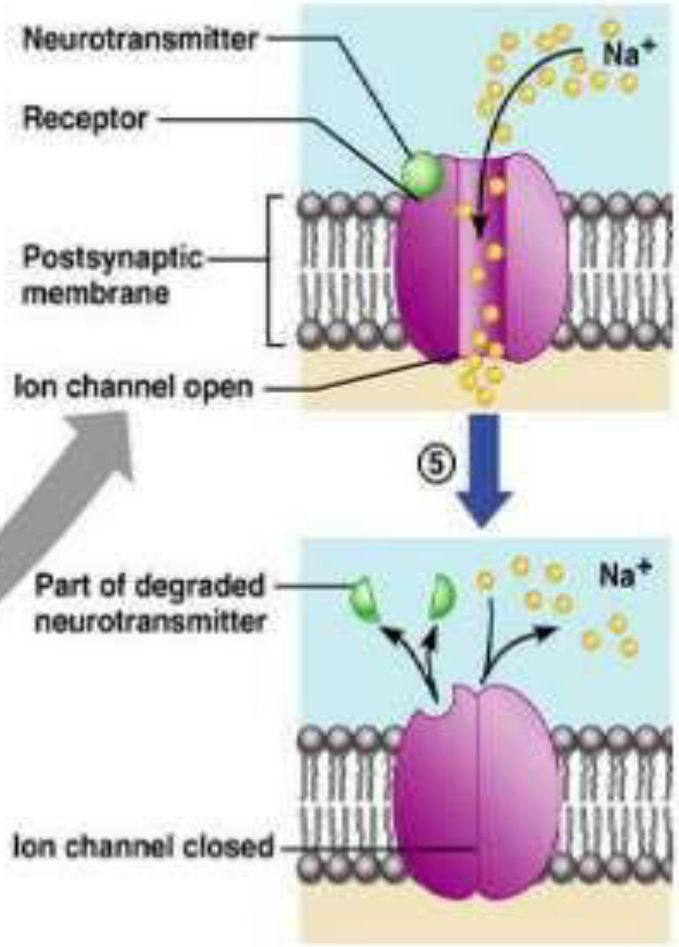
- Step 3. As Ca++ enter into synaptic knob, Ach. Vesicles ruptures and Ach. release out into synaptic cleft by exocytosis.

Mechanism Of Muscle Contraction

- Step 4. Ach diffuses across the neuromuscular junction and binds to the receptor sites on postsynaptic membrane.

Steps 1-4


Nerve impulse
Axon of presynaptic neuron
Ca^{2+}
Axonal terminal of presynaptic neuron
Postsynaptic membrane
Synaptic vesicles containing neurotransmitter molecules
Synaptic cleft
Ion channel (closed)
Ion channel (open)
1
2
3
4


Neurotransmitter
Receptor
Postsynaptic membrane
Ion channel open
Na^+
5
Part of degraded neurotransmitter
Ion channel closed
Na^+

Mechanism Of Muscle Contraction

- Step 5. Stimulating of the receptor causes conformational change in post synaptic membrane and generate an action potential.

Ach. destroyed by an enzyme (**acetylcholinestrase**)

Mechanism Of Muscle Contraction

- Step 6. This action potential travels along the length of muscle fiber, and then penetrates deep into the muscle through the T-tubular system.

Mechanism Of Muscle Contraction

- Step 7. The electrical impulse stimulates the sarcoplasmic reticulum to release calcium into the (a contractile unit of a mofibril) area.

Mechanism Of Muscle Contraction

- Step 8. Calcium bind with tropnin-C and activates myosin ATPase.
  As myosin ATPase become active. Tropomyosin slipped off, G-action exposed.
  ATPase react with ATP.

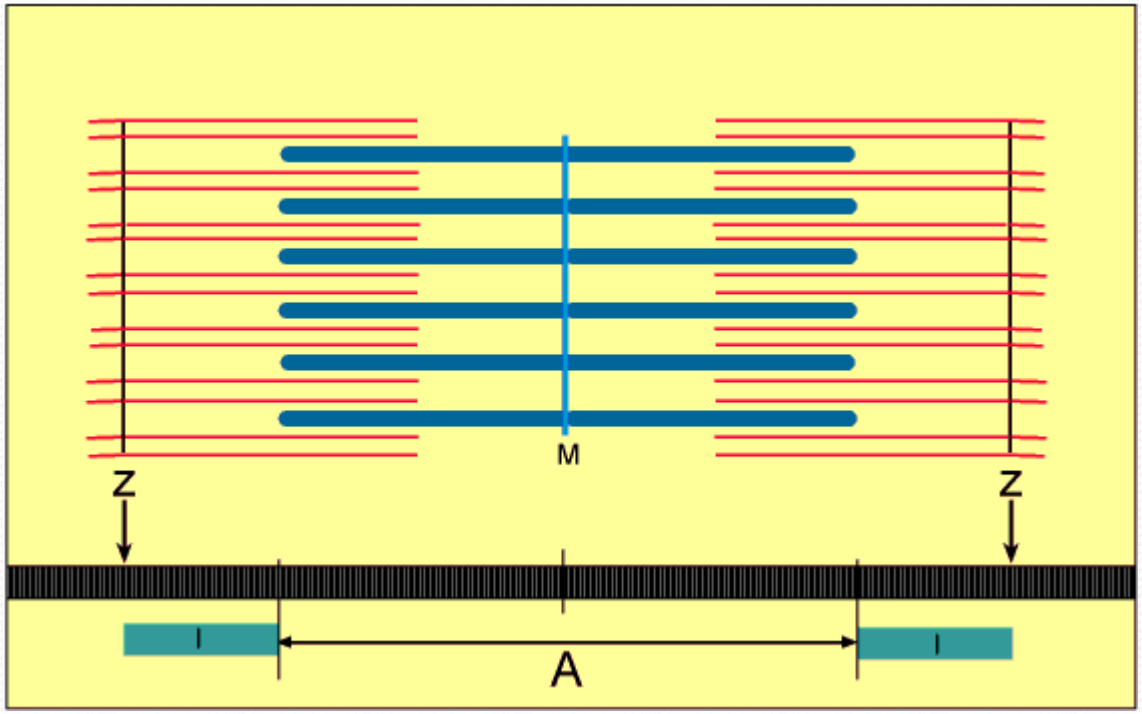
$$ATP + ATPase \xrightarrow{Ca^{++}} ADP + {\sim}P$$

Muscle contraction takes place.

Mechanism Of Muscle Contraction

- Muscle contraction occurs when calcium is pumped back into the sarcoplasmic reticulum, away from the actin and myosin.
- When Calcium moves in this way, the actin and myosin cannot interact, and the muscle relaxes.

SLIDING FILAMENT

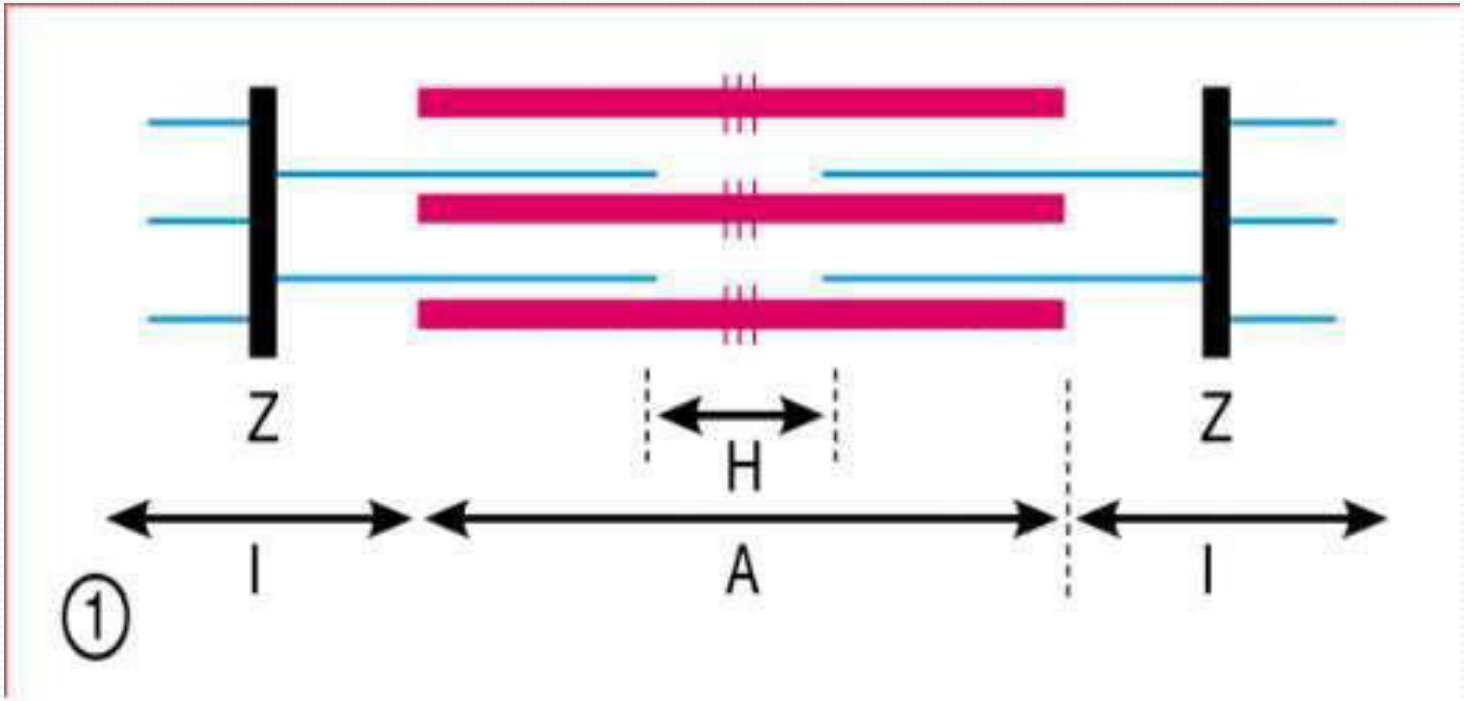


CONTRACTION

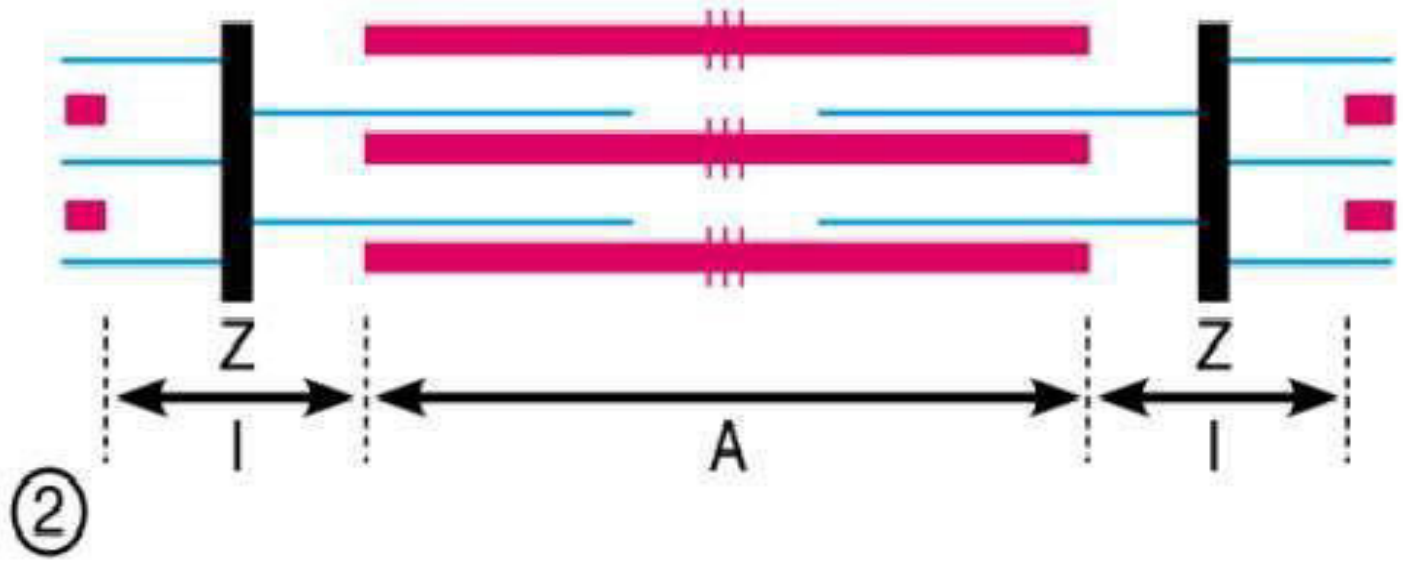
In Contraction

- I- band disappear
- H- band disappear
- M- band disappear
- Length of sarcomere decreases.

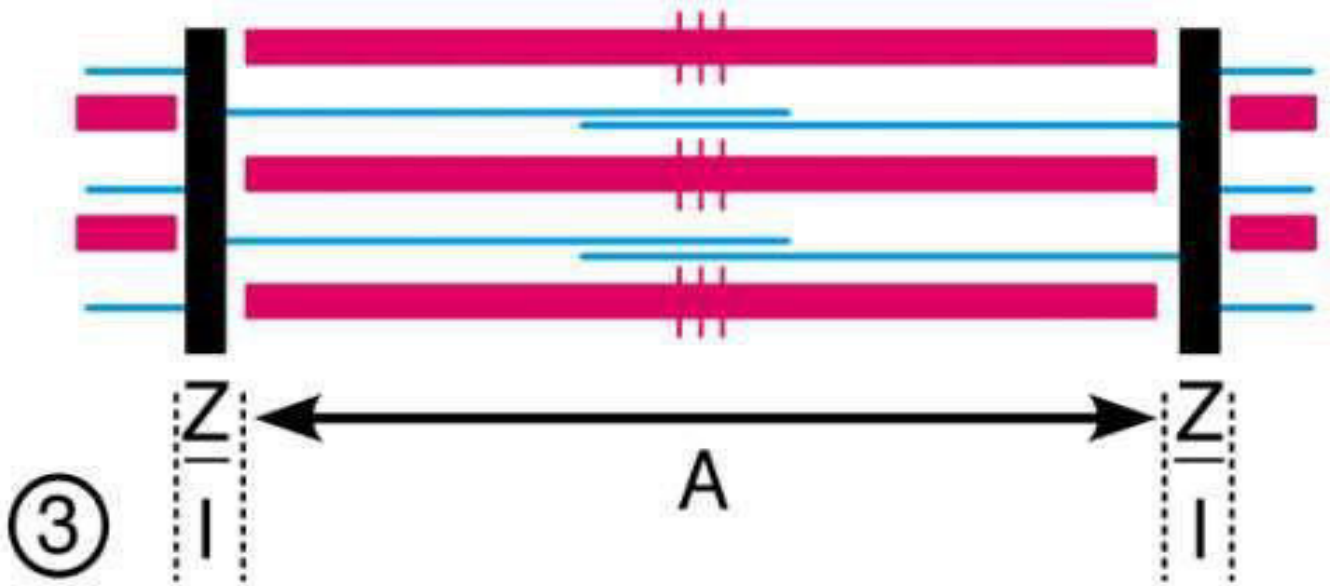
Sarcomere Relaxed



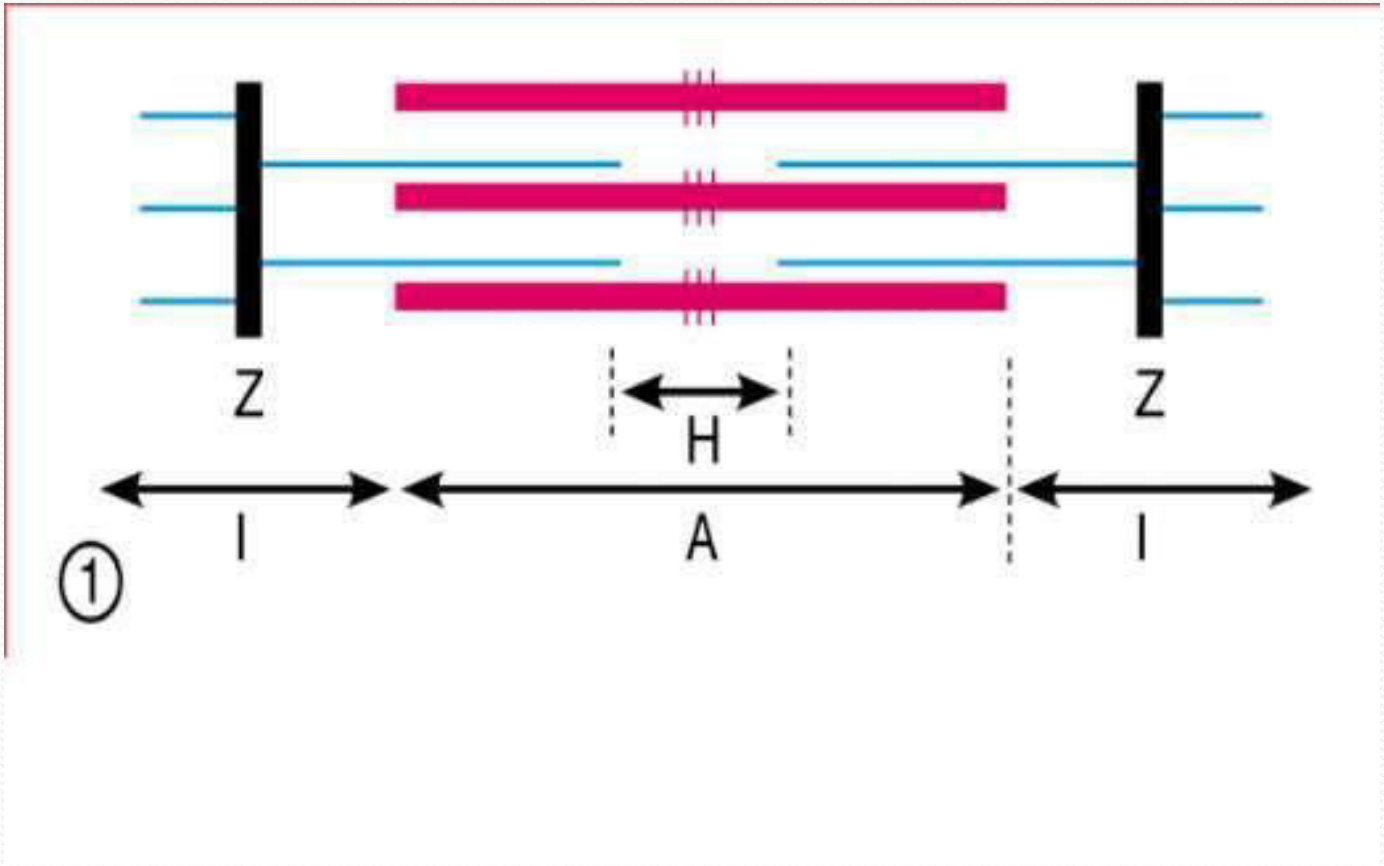
Sarcomere Partially contracted



Sarcomere completely contracted



Sarcomere relaxed



Stages Of Muscle Contraction