

Topic - Mechanism of muscle contraction

- 7 Muscle contraction occurs by the sliding filament mechanism, first explained by Hugh Huxley and Andrew Huxley in 1954
- 7 It mainly occurs in skeletal muscle but the basic mechanism is similar in cardiac muscle

* Structure involved in contraction

1. Muscle fiber

- 7 covered by sarcolemma
- 7 cytoplasm called sarcoplasm
- 7 contain many myofibrils

2. myofibrils

- 7 made of repeating units called sarcomere

3. Sarcomere

- 7 A sarcomere extends from Z-line to Z-line

Bands -

A band - Dark band

I band - Light band

H zone - only myosin in center

M line - middle line

During contraction:-

- 7 I band decreases
- 7 H zone disappears
- 7 A band remains constant

Step of muscle contraction -

1. Excitation:-

- 7 Motor neuron release acetylcholine at neuromuscular junction.

- 7 ACh binds to receptor on sarcolemma.

- 7 Depolarisation occurs

- 7 Action potential spreads along Sarcolemma and through T-tubers

2. Calcium release:-

- 7 Action potential reaches SR.

- 7 SR release Ca^{2+} into sarcoplasm

3. Role of troponin and tropomyosin
when Ca^{2+} binds to troponin:-

- 7 tropomyosin shift position

- 7 myosin binding sites on actin are exposed

- 7 myosin heads binds to actin

- 7 they form cross-bridge

power stroke

- 7 myosin heads bend
- 7 Actin filaments slide towards M line
- 7 ADP + P_i are released
- 7 this is called power stroke
- 7 ATP binds to myosin head
- 7 myosin detaches from actin

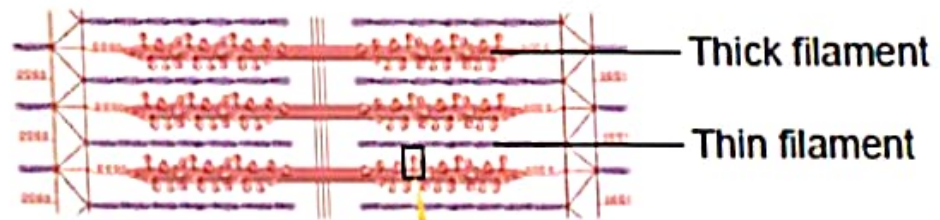
Re-cocking of myosin head

- 7 ATP breaks into ADP + P_i
- 7 Energy released repositions myosin head
- 7 cycle repeats as long as
 - Ca²⁺ is present
 - ATP is available

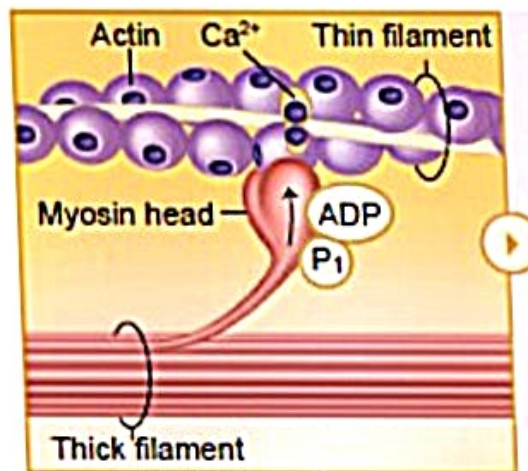
Relaxation of muscle —

- 7 nerve impulse stops
- 7 Ca²⁺ pumped back into sarcoplasmic reticulum
- 7 troponin again blocks actin binding site
- 7 muscle relaxes

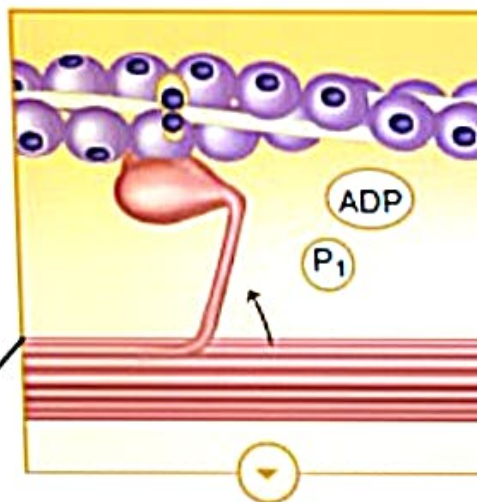
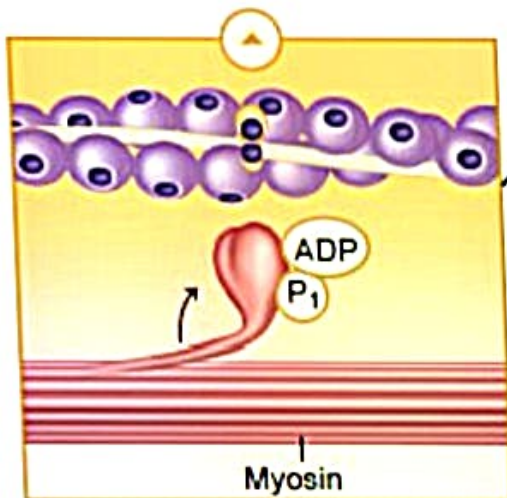
Sarcomere



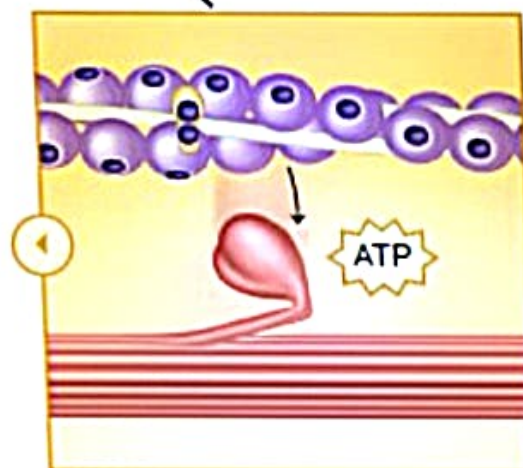
4. Cocking of myosin head. As ATP is hydrolyzed to ADP and P_i , the myosin head returns to its prestrike high-energy or "cocked," position.



1. Cross bridge formation. Energized myosin head attaches to actin myofilament, forming a cross bridge.



3. Cross bridge detachment. After ATP attaches to myosin, the link between myosin and actin weakens, and the myosin head detaches (the cross bridge breaks)



2. The power (working) stroke. ADP and P_i are released and the myosin head pivots and bends, changing to its bent low-energy shape. As a result it pulls on the actin filament, sliding it toward the M-line.

