



PresenterMedia

MUSCLES

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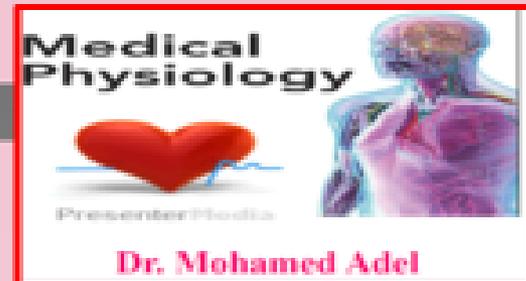
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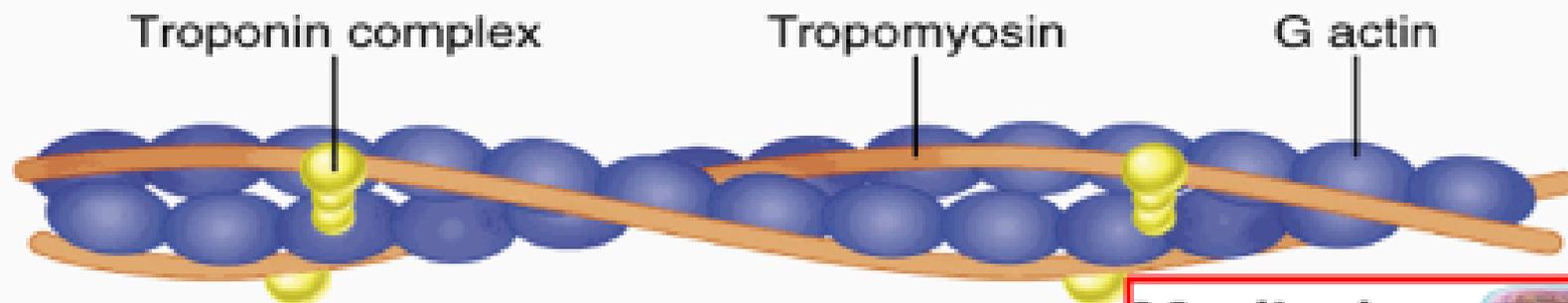
Thin filaments

1- Actin

2- Troponin

3-
Tropomyosin





(c) Portion of a thin filament

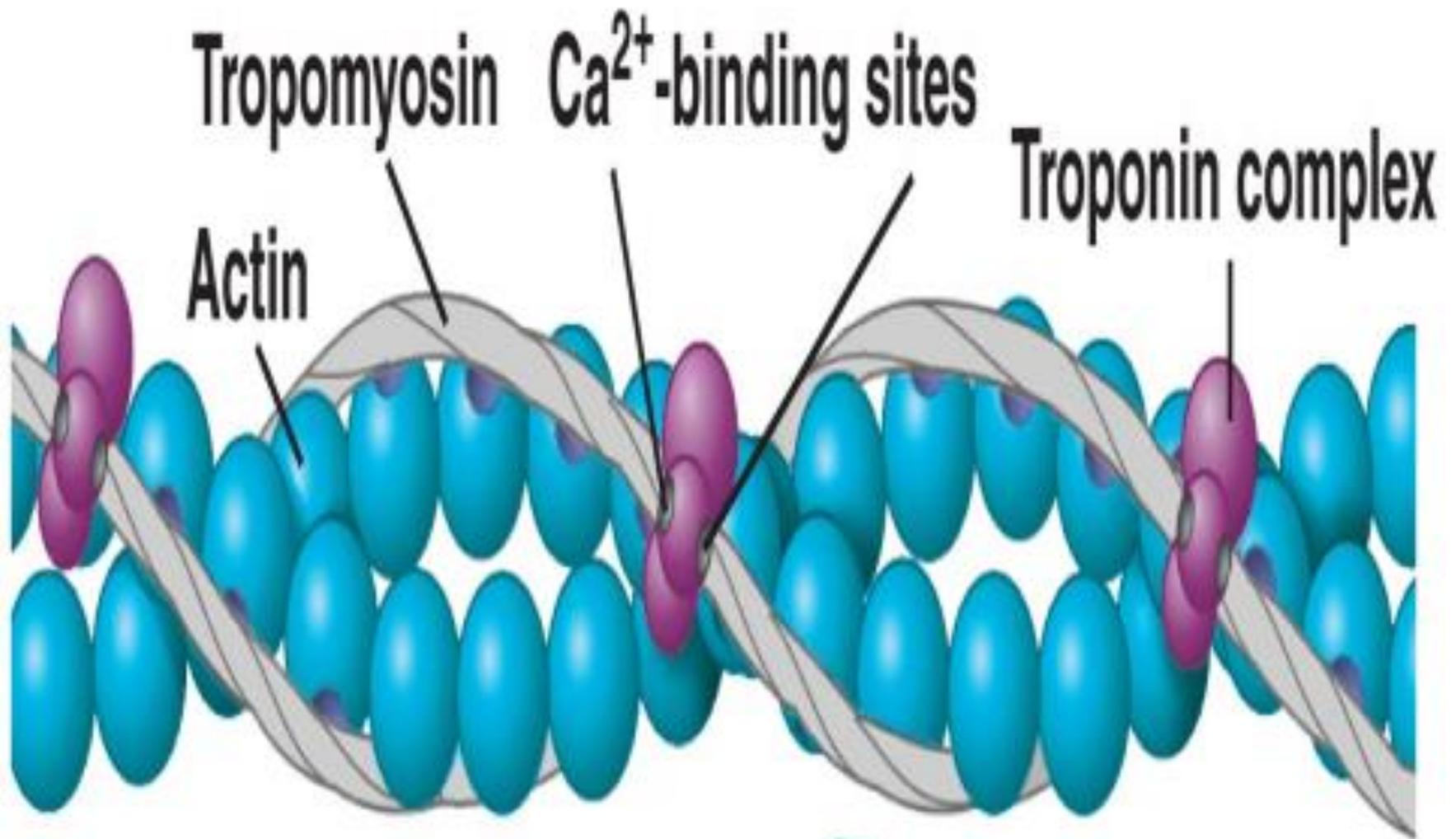
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a) Actin: forming 2 chains which are twisted with each other in spiral manner.

b) Troponin.

c) Tropomyosin: thin filamentous protein forming 2 chains covering the binding sites of actin during relaxation



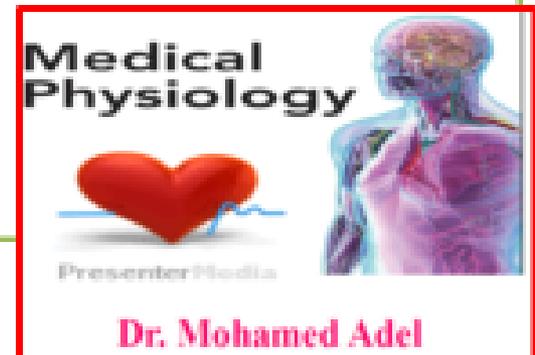
Myosin-binding sites blocked



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Mechanism of skeletal muscle contraction

- 1) Propagation of muscle action potential and release of Ca^{++} ions.
- 2) Activation of actin by Ca^{++} .
- 3) Cross bridge cycling.
- 4) Muscle relaxation.



1) Propagation of muscle action potential and release of Ca^{++} ions

- ❑ Muscle action potential spreads on both sides of motor end plate → **release of Ca^{++}** from the terminal cisterns of sarcoplasmic reticulum into the cytoplasm.



- ❑ **Ca^{++}** then **diffuses to the region of actin and myosin filaments.**

2) Activation of actin by Ca^{++}

- ❑ The released Ca^{++} ions combine with troponin of the thin filaments → **movement of tropomyosin laterally** away from its position → **exposure of the binding sites** present on actin molecules.
- ❑ Cross bridges (heads) from the thick (myosin) filaments combine with the binding sites on the actin.



3) Cross bridge cycling

a. Binding of Cross-bridges.

b. Bending: bending of cross bridges

c. Detachment: Detachment of the cross-bridges

d. Return to original position



3) Cross bridge cycling

- It results in sliding of thin filaments across the thick filaments by the following steps:
 - a) Binding of cross bridges of myosin with actin.
 - b) Bending of cross bridges: binding of cross bridges → pulling actin with it towards the center of the sarcomere.



3) Cross bridge cycling

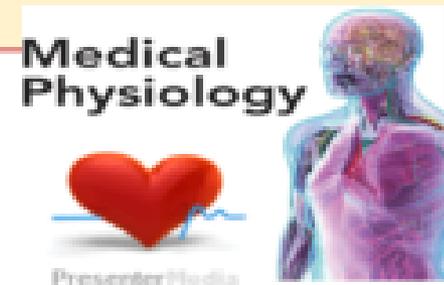
c) Detachment of the cross bridges from the actin which **needs energy** from ATP hydrolysis.



d) Return to original position of cross bridges and other cycle starts by binding with another actin molecule and so on.

- Cross bridges cycling continues, as long as, **Ca⁺⁺ binds with troponin** leading to sliding of actin over myosin.

- ❑ **Rigors mortis is due to failure of detachment between actin and myosin.**



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Changes in the sarcomere as a result of muscle contraction:

I- Approximation of 2 Z lines.

II- Shortening of I band.

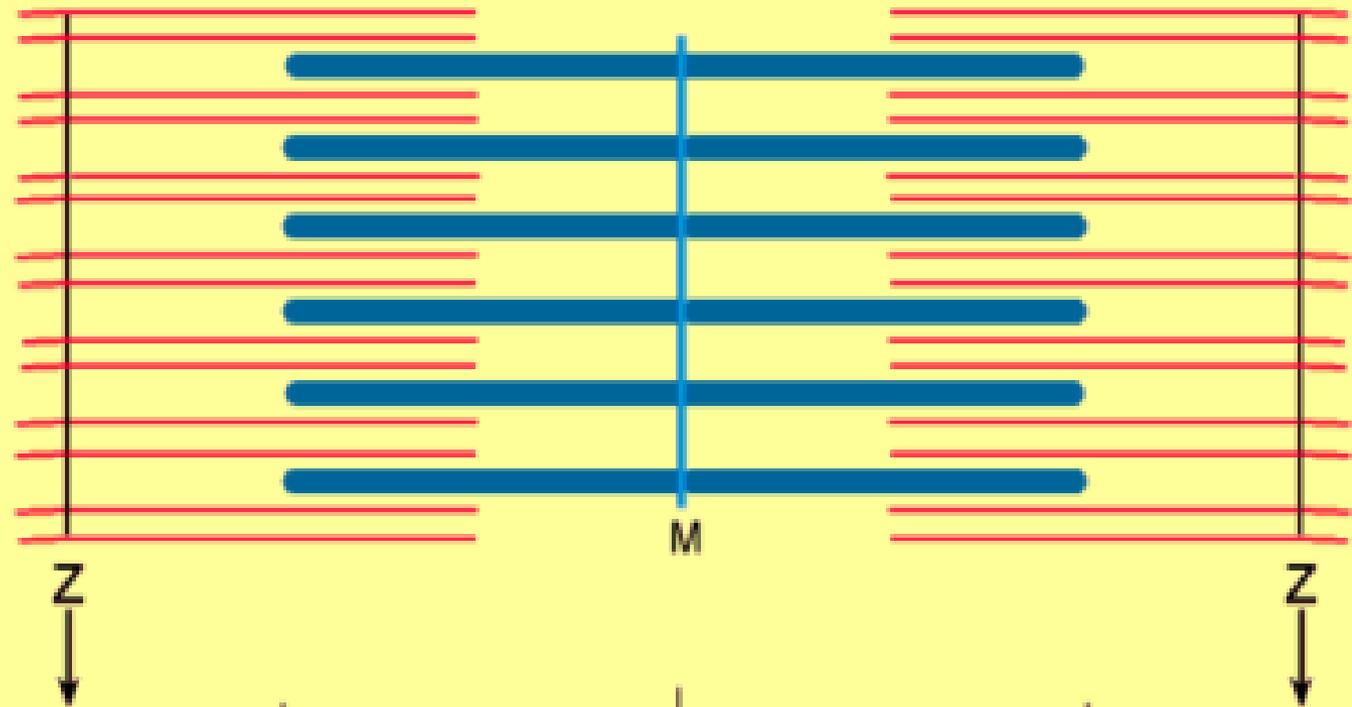
III- Narrowing of H zone.

IV- Constant A band.





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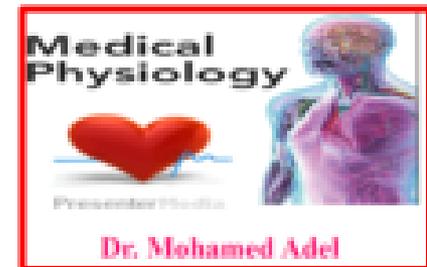


4) Muscle relaxation

□ Active Ca^{++} uptake by the terminal cisternae of sarcoplasmic reticulum by Ca^{++} pump (Ca^{++} ATPase) leading to:

a) Release of Ca^{++} from troponin.

b) Tropomyosin will cover the binding sites of actin again and the cross bridge cycling stops.





□ What is the functions of tropomyosin in skeletal muscle?

- A) Sliding on actin to produce shortening.
- B) Releasing Ca^{2+} after initiation of contraction.
- C) Binding to myosin during contraction.
- D) Acting as a “relaxing protein” at rest by covering up the sites where myosin binds to actin.
- e) Inhibition of Na-K pump.

Thanks!