



Muscular system

- Year : one
- Block: GBMS
- Problem: 9

Presented by:



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Learning objectives:



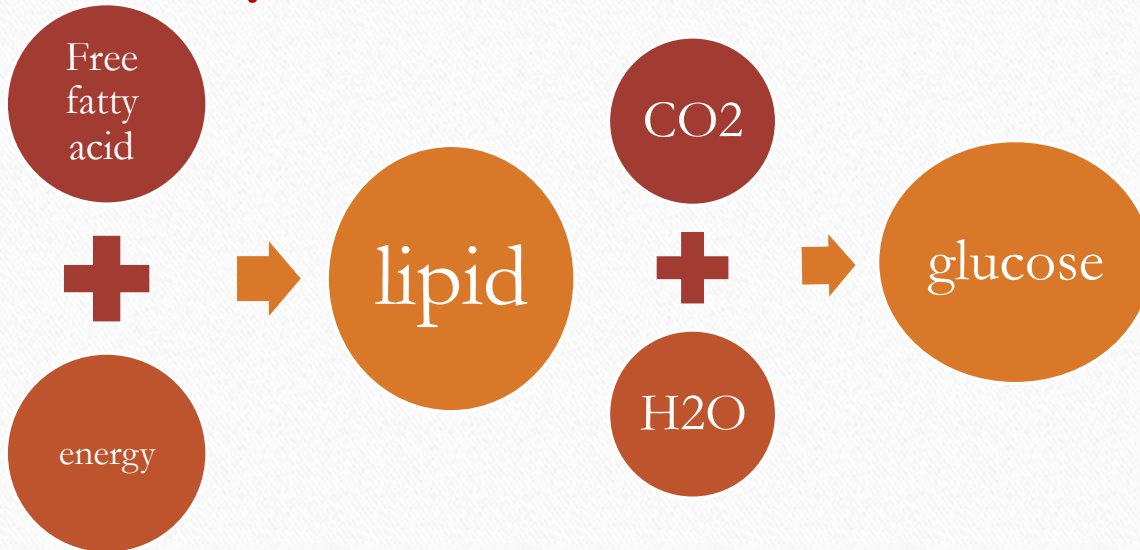
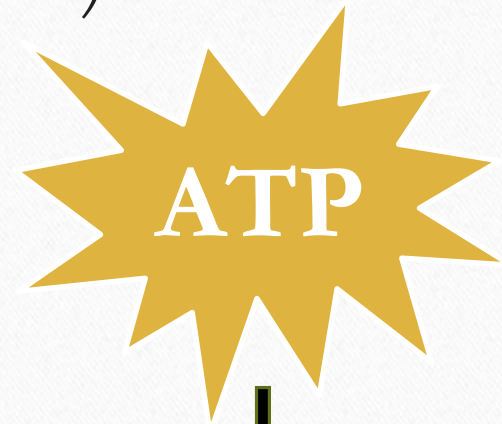
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1. Discuss the role of muscular system in homeostasis
 2. Differentiate the major classes of muscles in the body
 3. Describe the molecular and electrical contraction of muscle cell excitation, contraction coupling
 4. Define thick and thin filaments and how they slide to create contraction
 5. Differentiate Ca^{+2} role in skeleton, cardiac, & smooth muscle

(Skeletal muscle in homeostasis)

- **ATP is our molecular currency**



- **Lipid** \longrightarrow **during rest**
Carbohydrate \longrightarrow **Increase exercise**



Aerobic
Glycolysis

The diagram is a flowchart with two rows. The top row shows 'Aerobic Glycolysis' in a gold octagon pointing to a box 'Contains Oxygen'. The bottom row shows 'Anaerobic glycolysis' in a gold octagon pointing to a box 'Doesn't Contain Oxygen'. A horizontal line separates the two rows. The entire diagram is enclosed in a white box with a green border, and two thick black bars extend from the left and right sides.



Contains
Oxygen

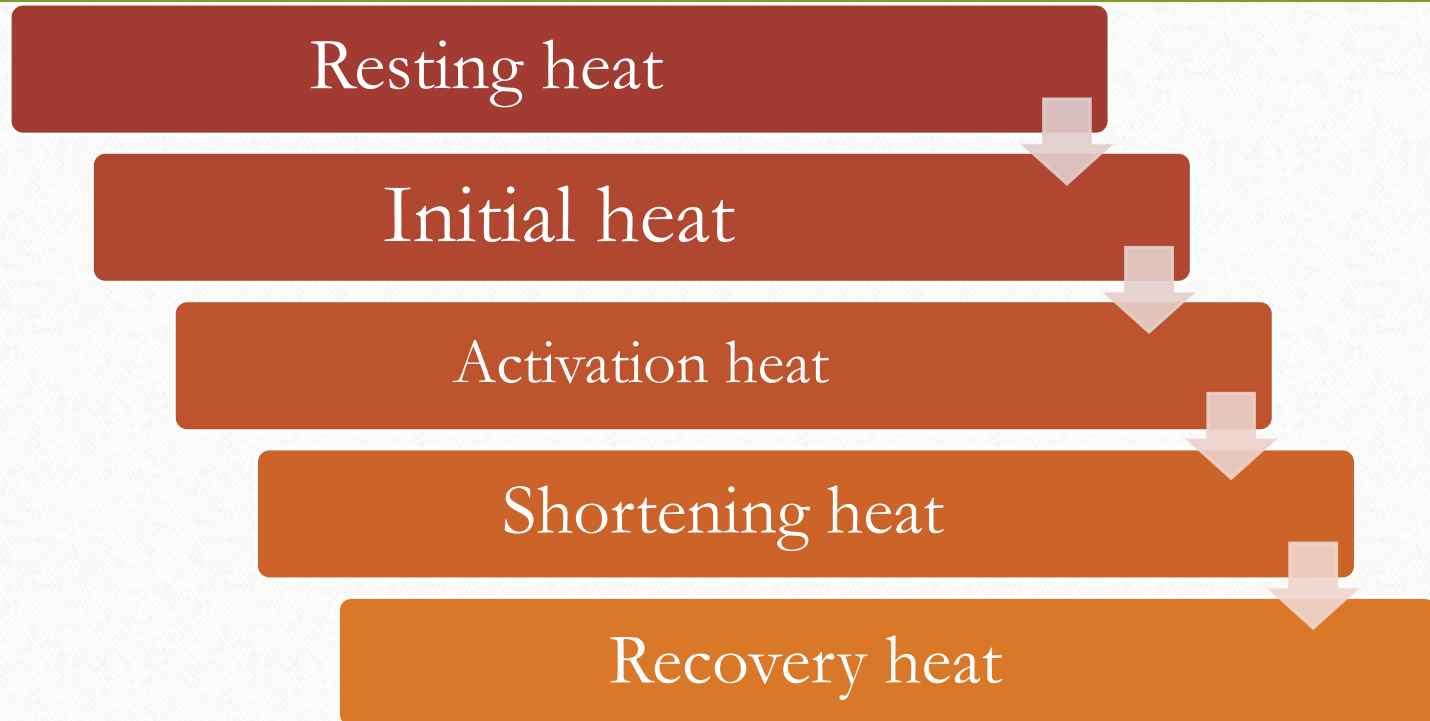
Anaerobic
glycolysis



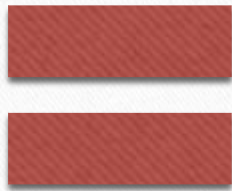
Doesn't
Contain
Oxygen

Heat production in the muscle:

The energy supplied to a muscle must equal its energy output



Recovery
heat



Initiate
heat

Muscle types

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graph TD; A[Muscle types] --> B[Striated]; A --> C[Non-striated]; B --> D[skeletal]; B --> E[cardiac]; C --> F[Smooth]
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Striated

skeletal

cardiac

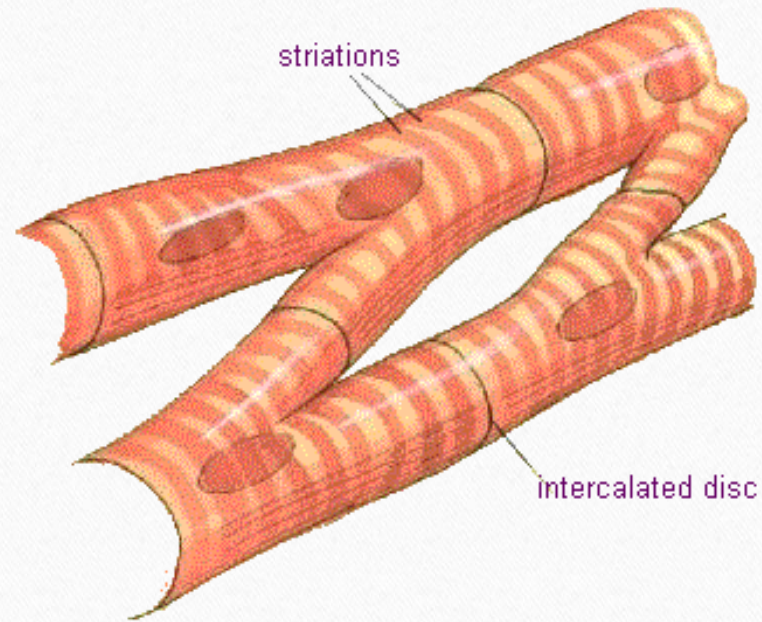
Non-
striated

Smooth

Cardiac muscle:

Found in heart

- Striated
- Uninucleate



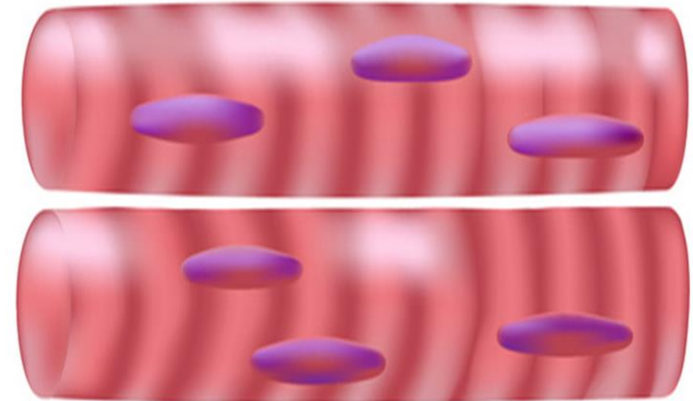
- Can be modulated via the autonomic nervous control or can contract rhythmically by the pacemaker cells in the myocardium

Involuntary Control

Skeletal muscle:

- ❑ Makes up the Greater mass of the body 40-50%
- ❑ Striated
- ❑ Need nervous stimulation
- ❑ Multi-nucleated

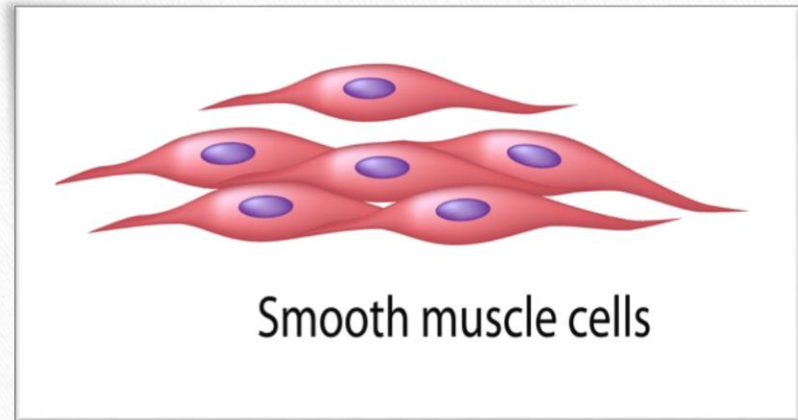
Voluntary control



Skeletal muscle cells

Smooth muscle:

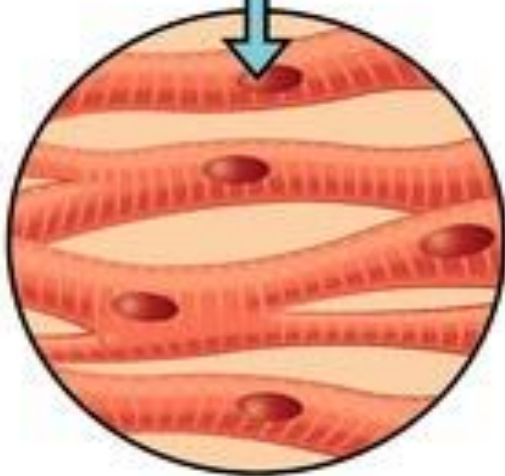
- ❑ Lack-cross striation
- ❑ Uninucleate
- ❑ Occurs In the walls of internal organs



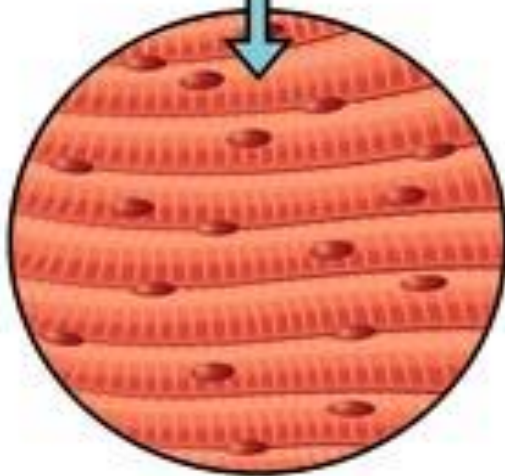
Involuntary control

Unitary

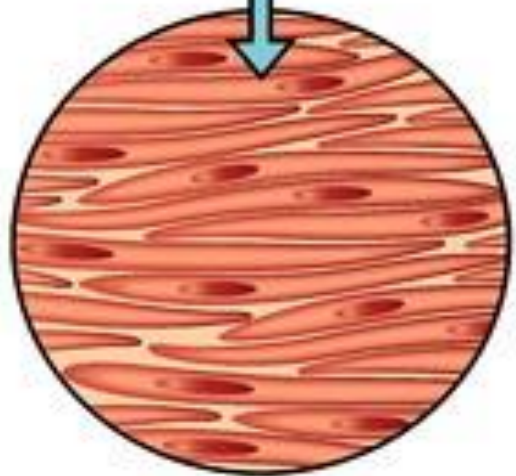
Multiunit



Cardiac muscle tissue
(Involuntary control)




Skeletal muscle tissue
(Voluntary control)



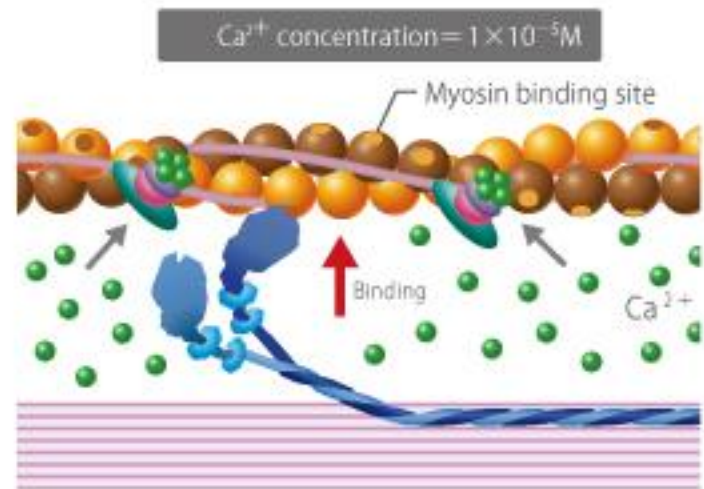
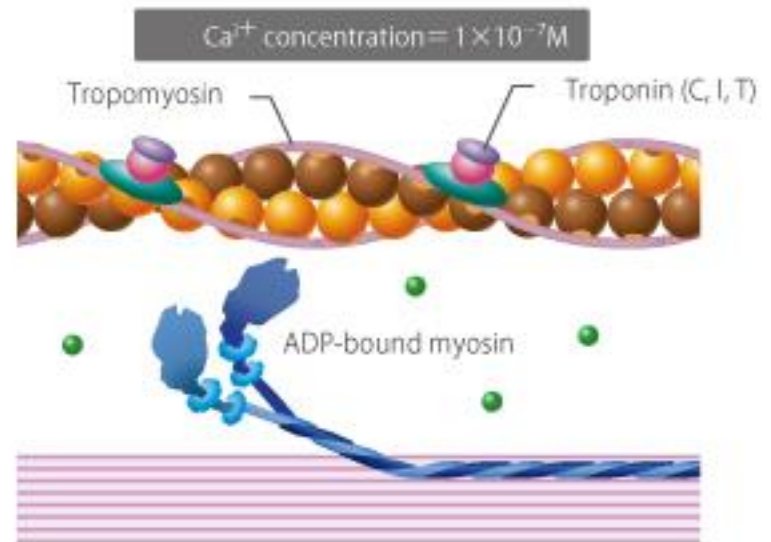
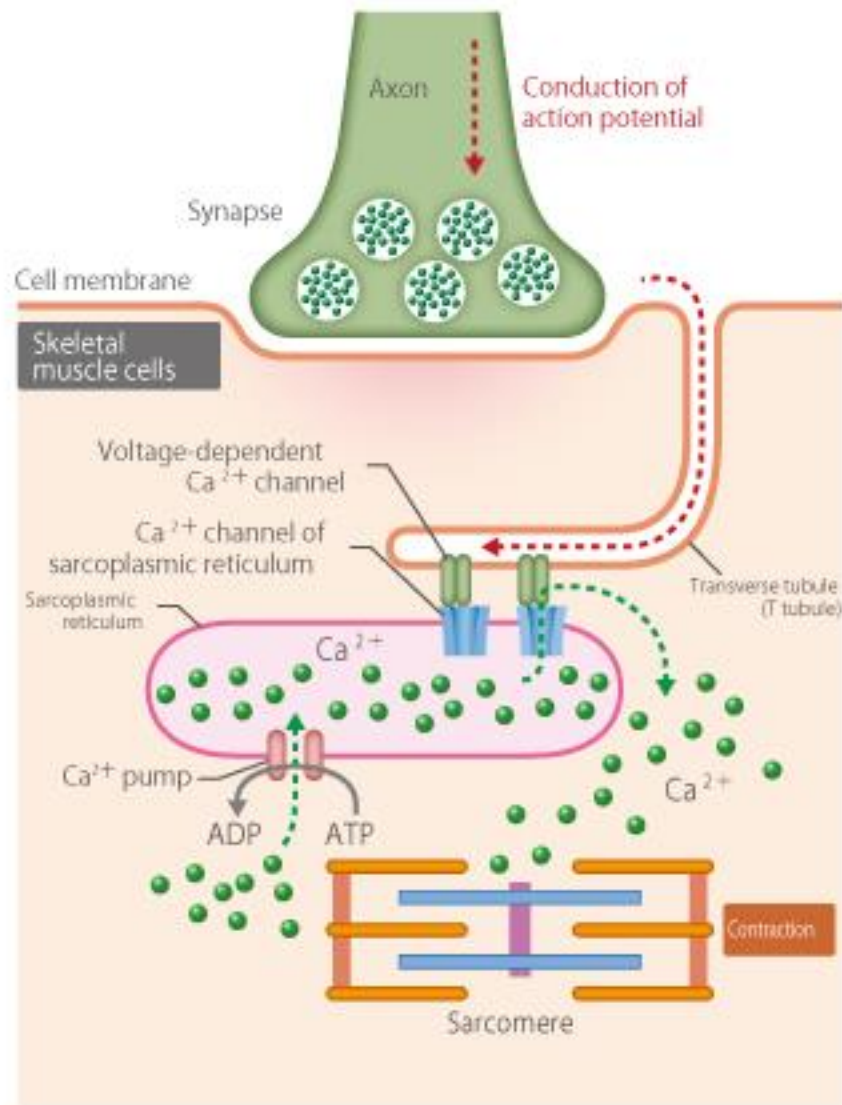
Smooth muscle tissue
(Involuntary control)

Electrical and molecular
Make up of muscle cell
excitation, contraction
coupling



Skeletal muscle

actions. Skeletal muscle works under voluntary control. Skeletal muscles are composed of bundles of muscle fibers.



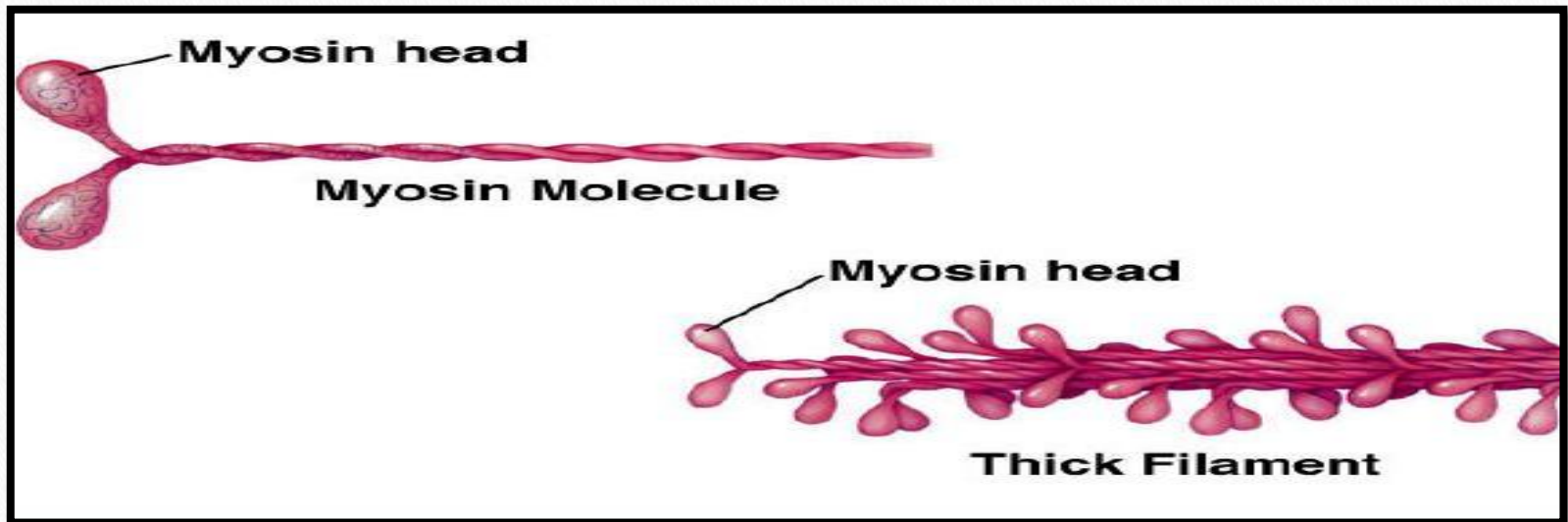
Muscle cell

sarcomere

myofibril

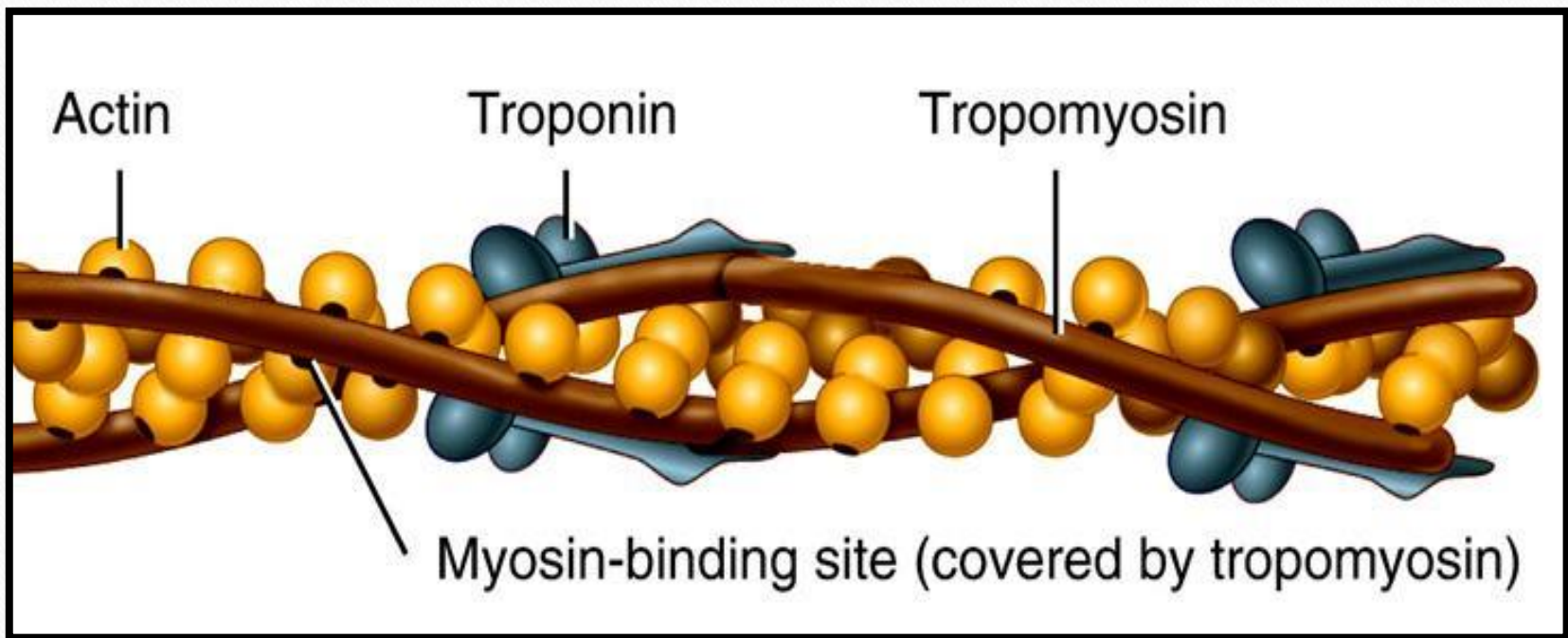
Thick filament:

One of the contractive elements in skeletal, cardiac, and smooth muscle fiber, found in the sarcomere attached to the M line and made primarily of **Myosin**



Thin filament:

One of the contractile elements in muscular fibers, it's in the sarcomere attached to the transverse Z filaments, they are formed from three proteins called **actin**, **troponin**, **tropomyosin**.



The sliding mechanism for Thick & thin filaments



Role of calcium in skeletal muscle

Signals causing action potential

Na influx & K efflux (depolarization)

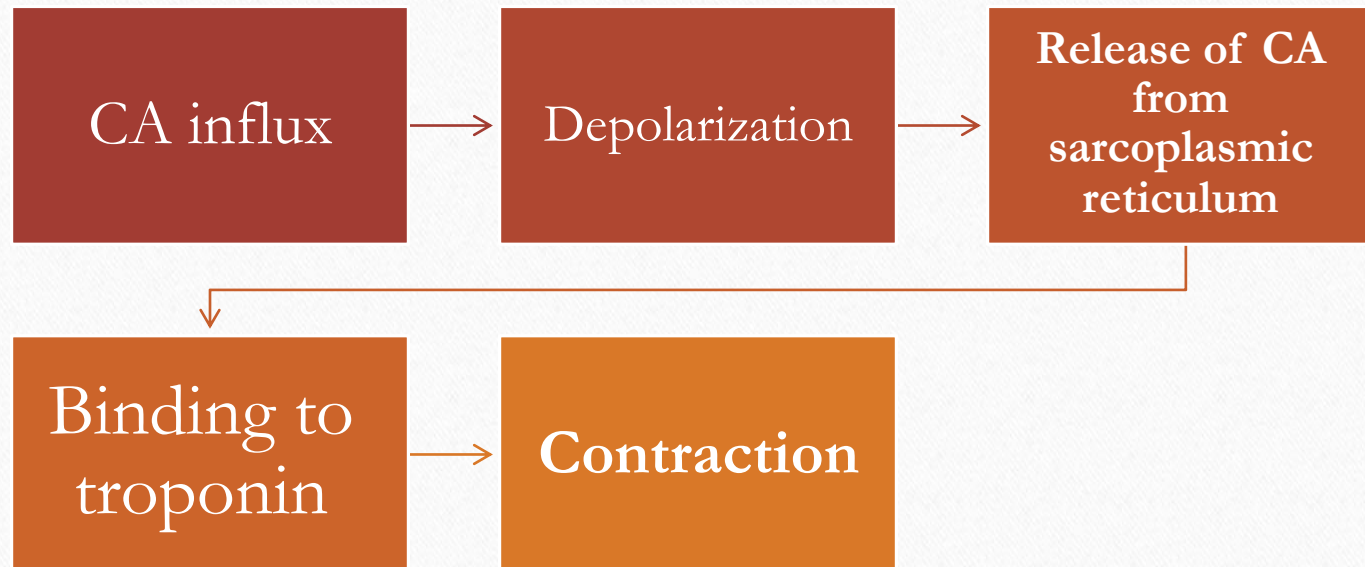
Transfer through T system

Activating DHPR receptor

Contraction occurs

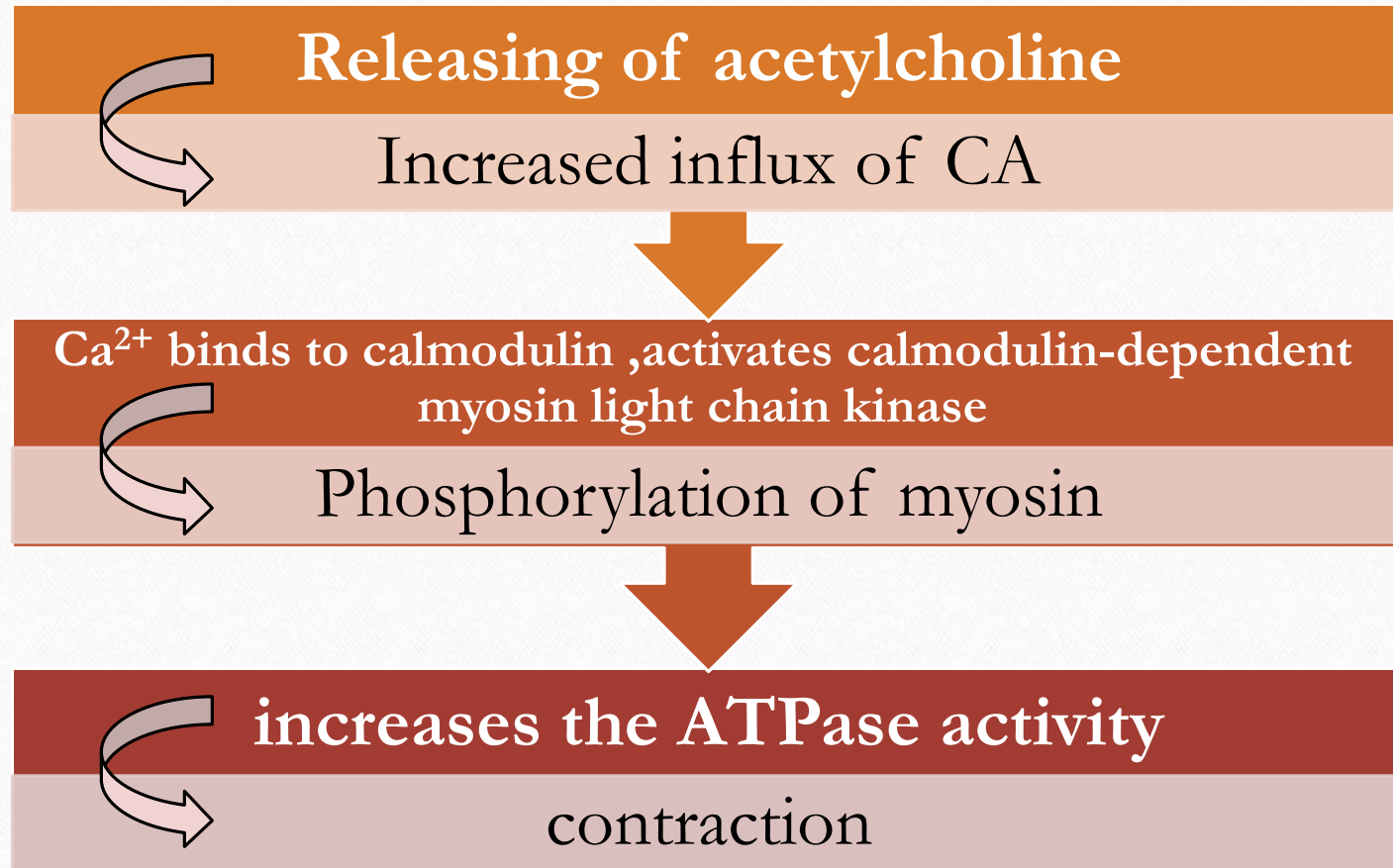
Role of calcium in cardiac muscle

- ❖ *has a double supply of Ca^{+2} which play the main role in contraction.*
- ❖ *The first supply similar to skeleton muscle*
- ❖ *the second plays the main role of cardiac contraction.*



Role of calcium in smooth muscle

Smooth muscle Doesn't contain troponin so the contraction is activated by another way



❖ Reference:

Kim E. barrett, Susan M. barman, Scott boitano,
Heddwen L. Brooks , **Ganong's review of
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THANK

YOU