Nervous System: Part V
Interactions With The Muscular System

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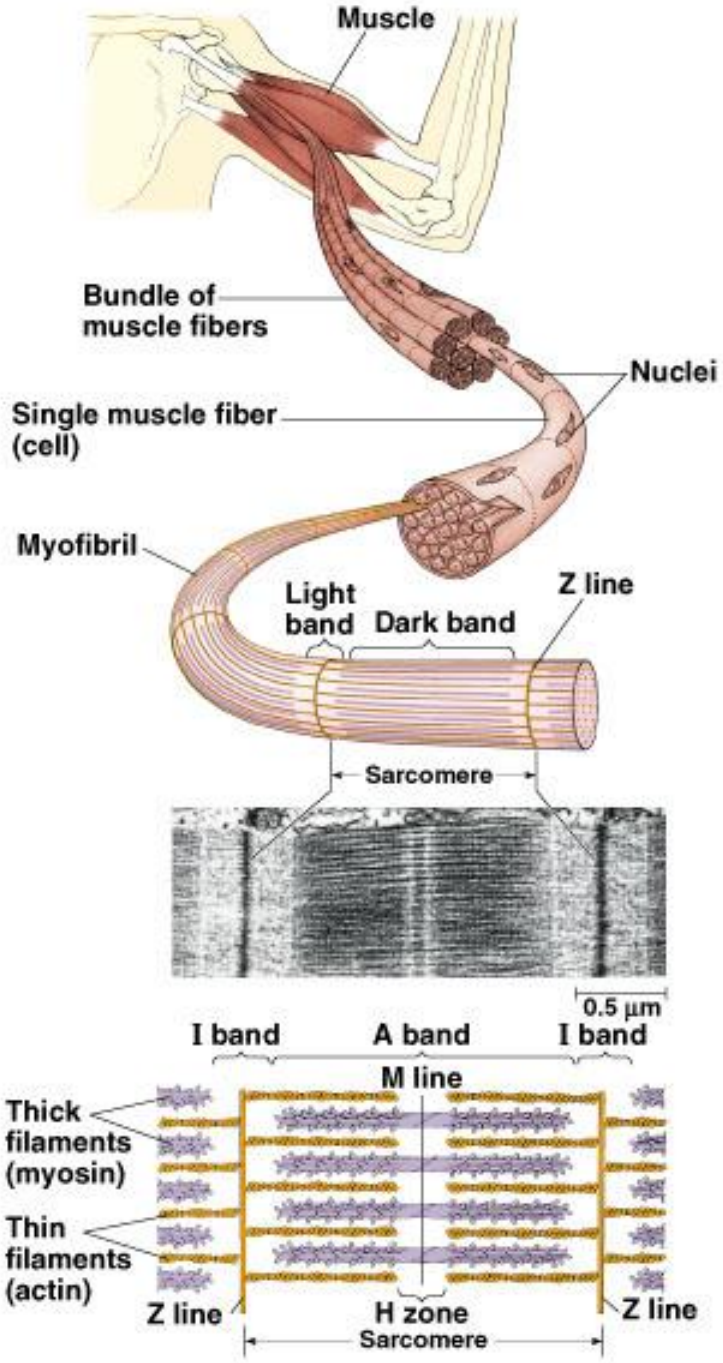
Enduring Understanding 4.A.4.b Interactions among systems

- Interactions and coordination between systems provide essential biological activities
  - Illustrative example:
    - Nervous and muscular



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- The contraction of a muscle is a typical response generated by the nervous system.
- Muscle contraction demonstrates the *interdependence* of the nervous and muscle systems.

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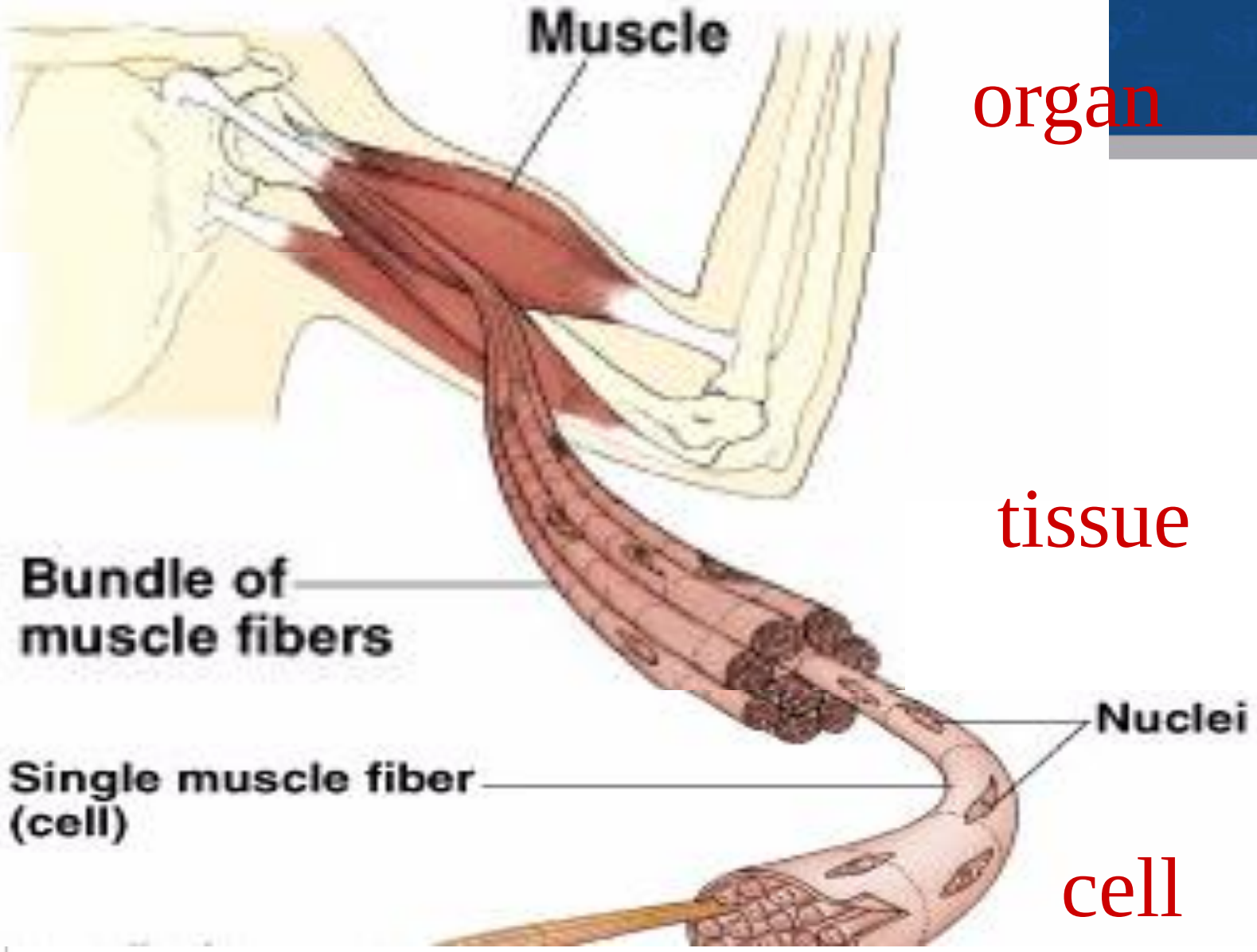
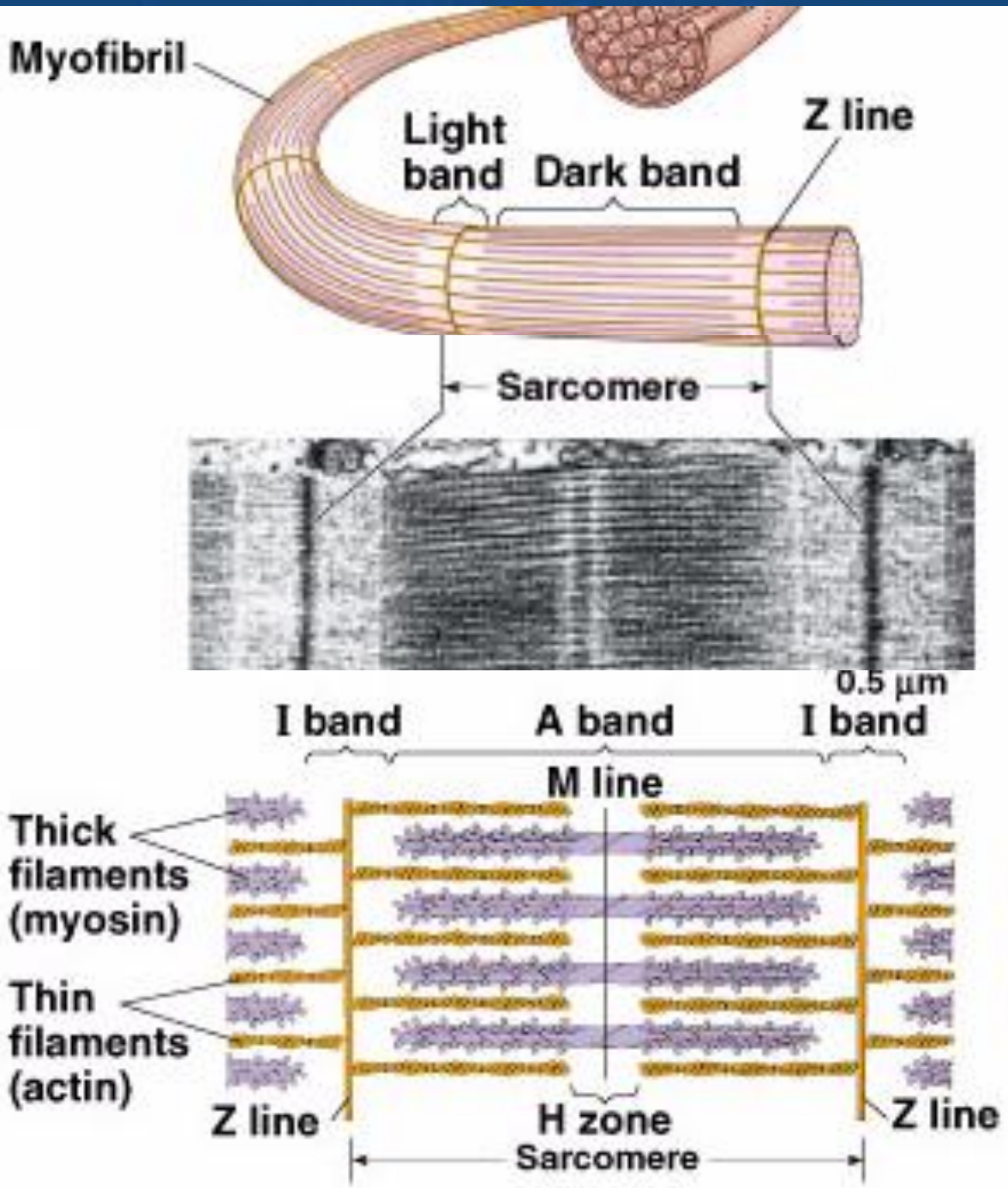


organ

tissue

cell


Myofibril
Light band
Dark band
Z line
Sarcomere
0.5 µm
I band
A band
I band
M line
Thick filaments (myosin)
Thin filaments (actin)
Z line
H zone
Z line
Sarcomere

Arrange These In A Decreasing Hierarchy:

- Muscle
- Muscle fiber cell
- Actin
- Myofibril
- Muscle fibers in bundle
- Sarcomere
- Myosin

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CORRECTLY Arranged Into a Hierarchy:

- Muscle
- Muscle fibers in bundle
- Muscle fiber cell
- Myofibril
- Sarcomere
- Myosin
- Actin

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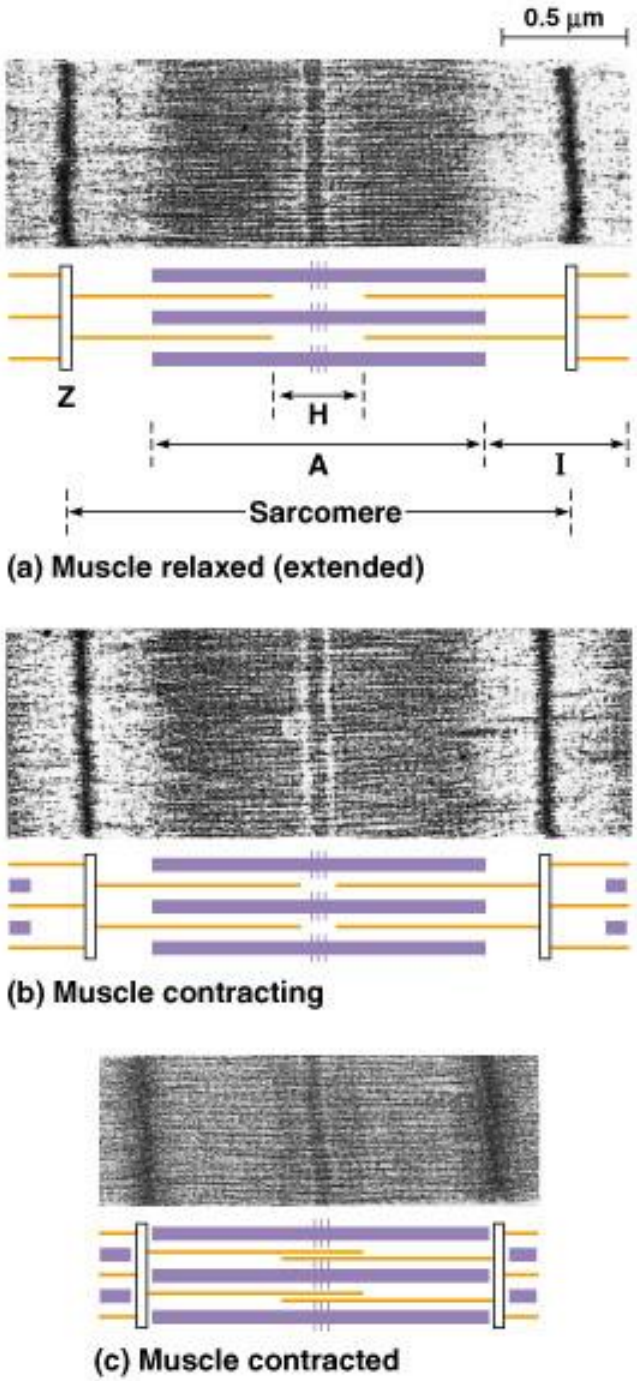

- What noticeable difference do you see in the relaxed and contracted sarcomere?

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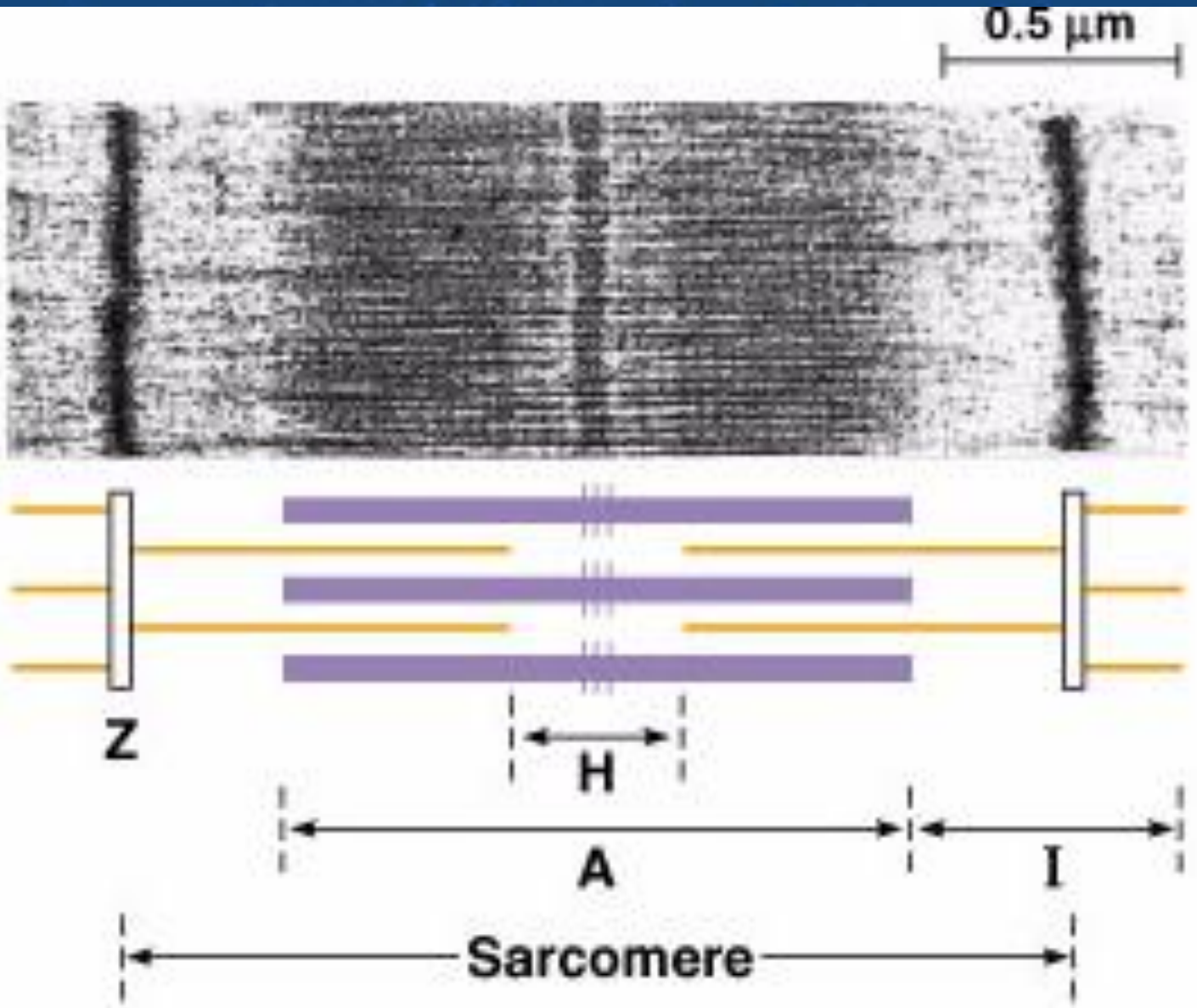
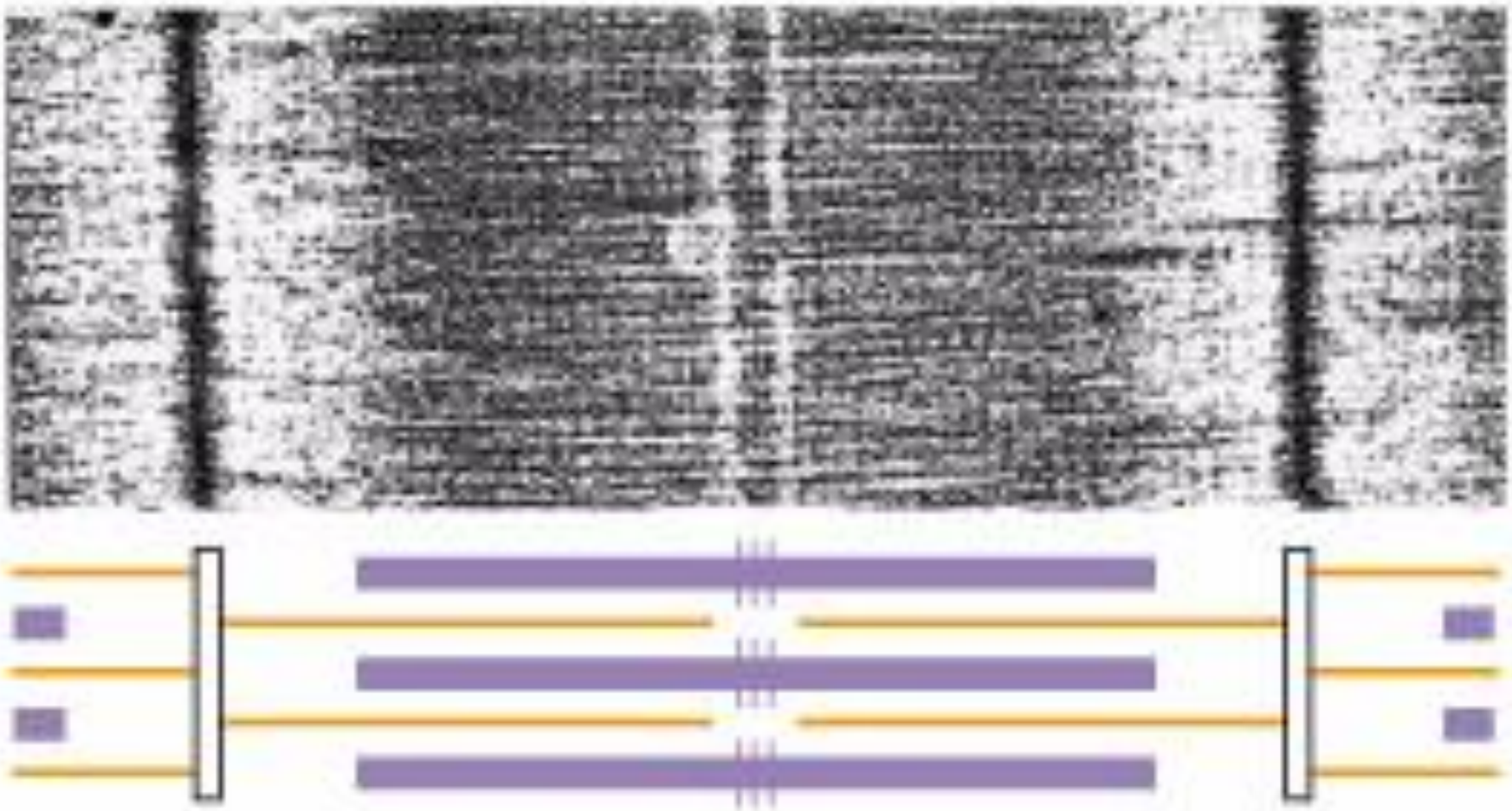


(a) Muscle relaxed (extended)



(b) Muscle contracting

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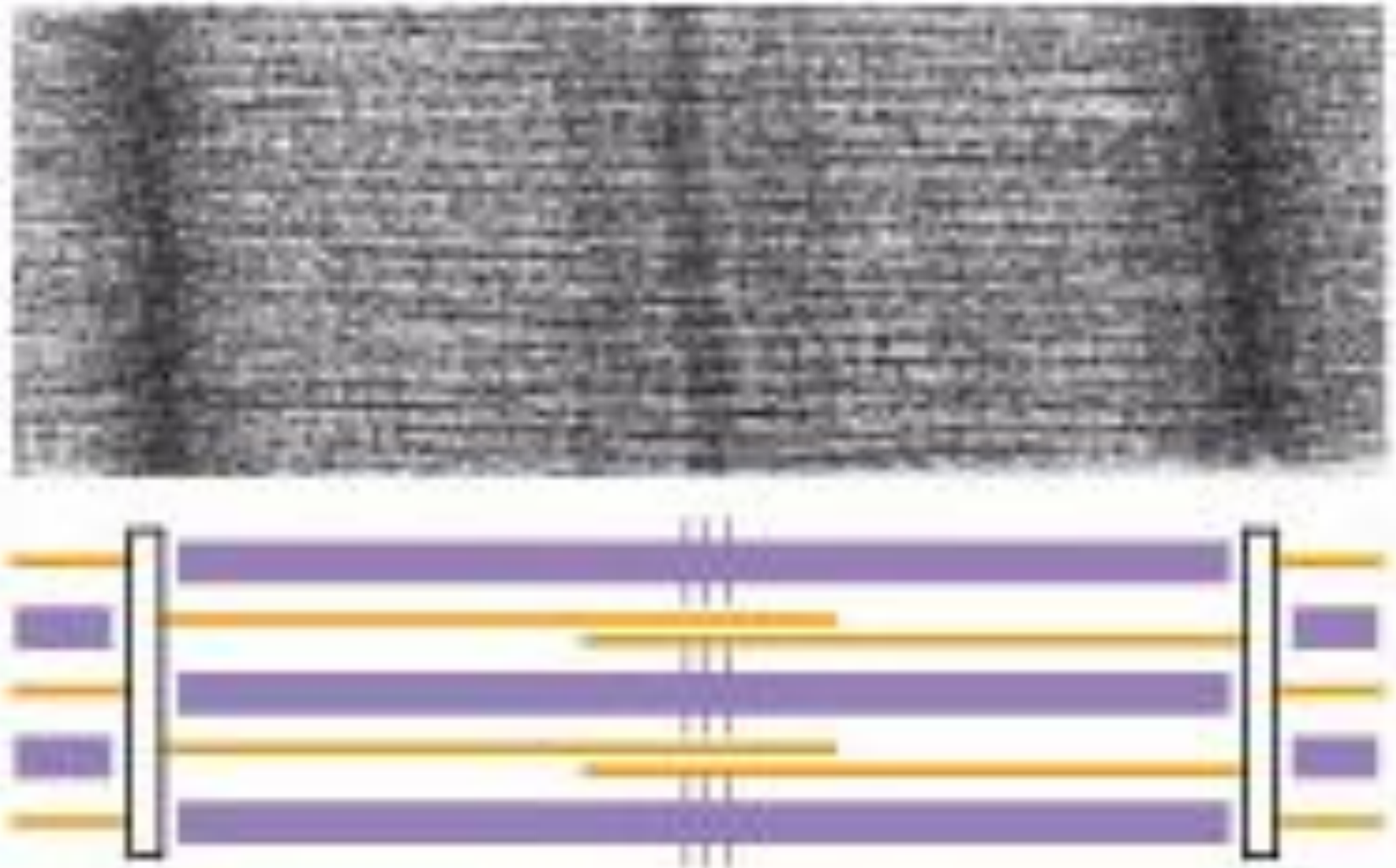

(c) Muscle contracted

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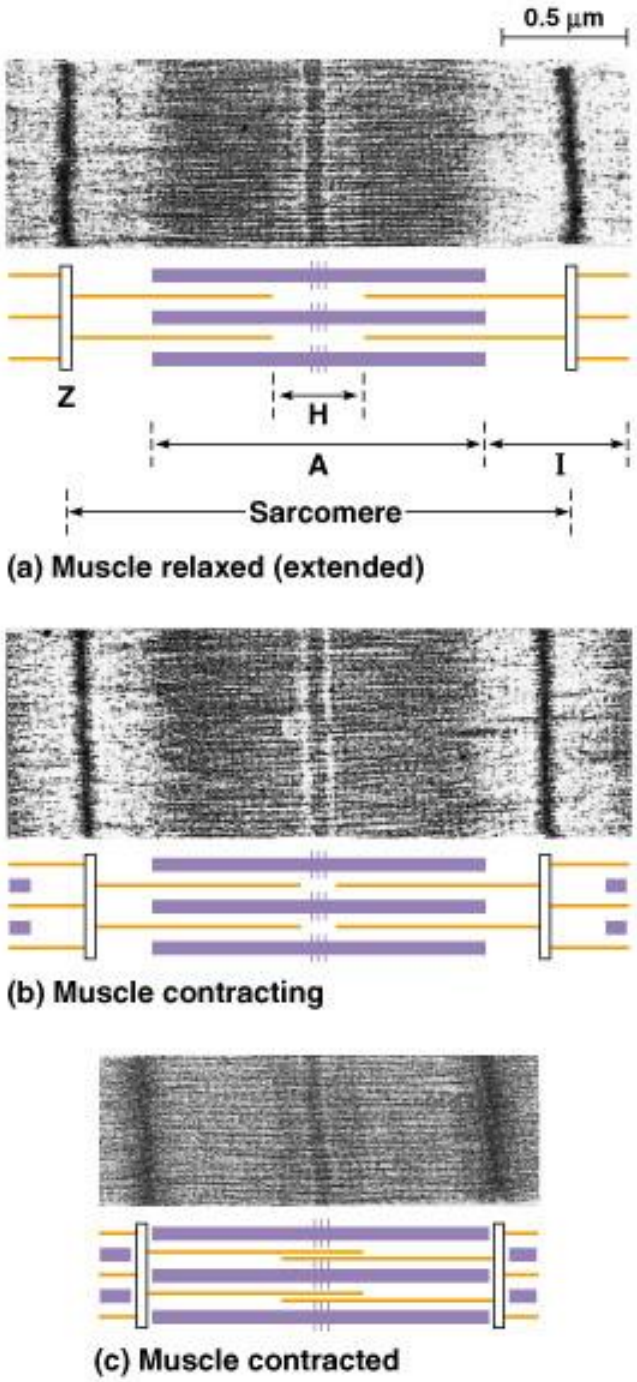

Now lets examine contraction on a molecular level.

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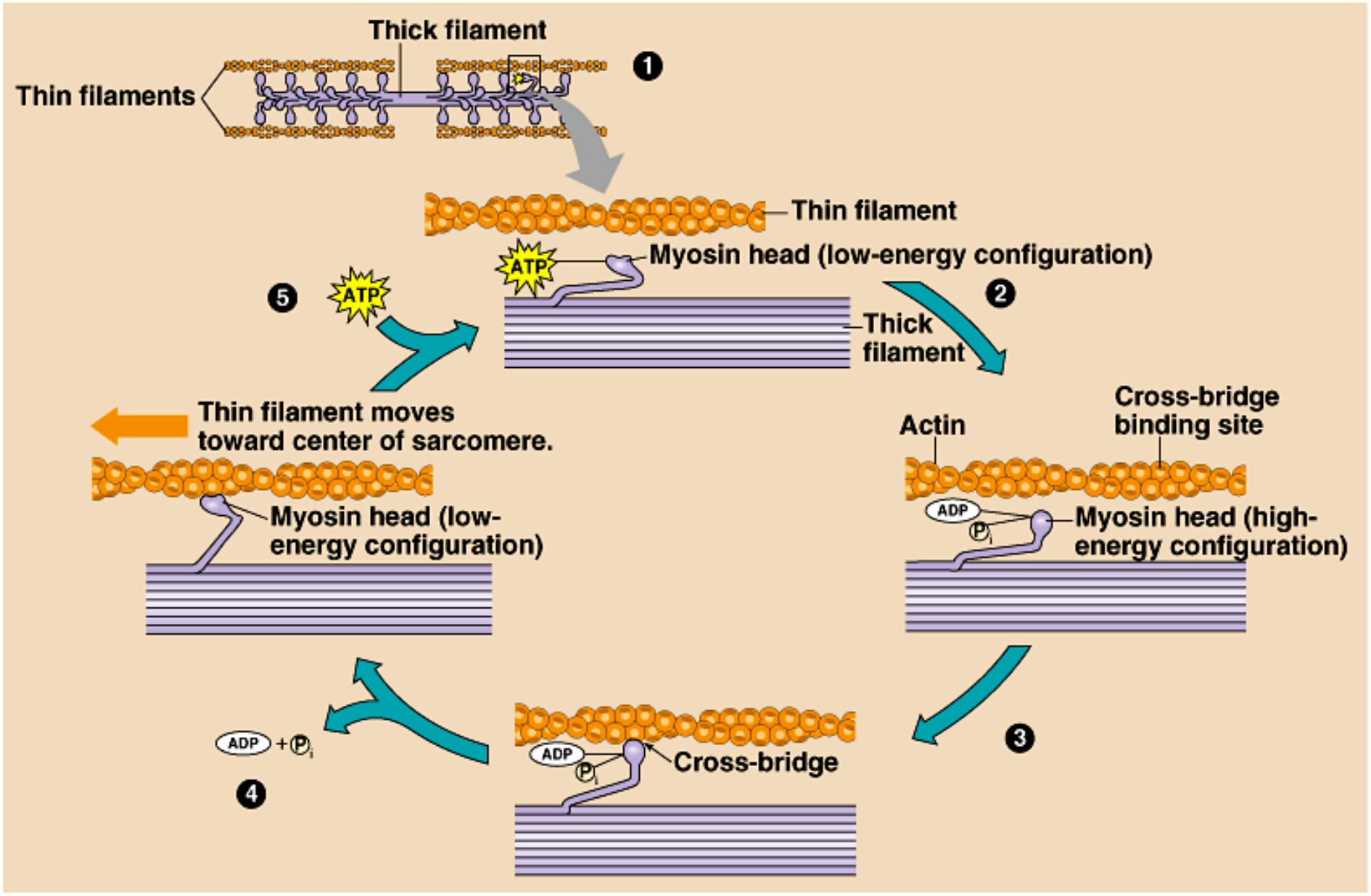

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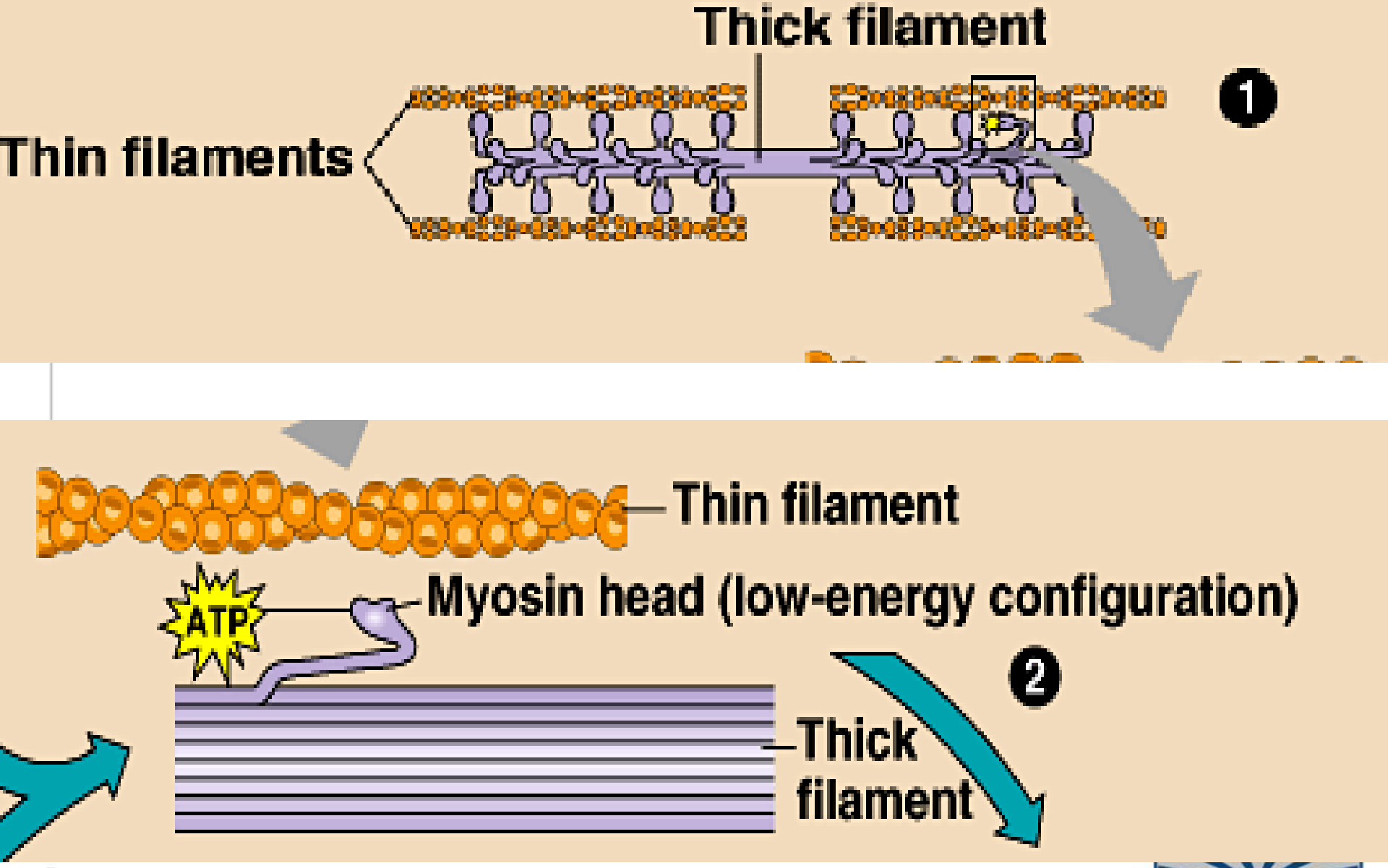
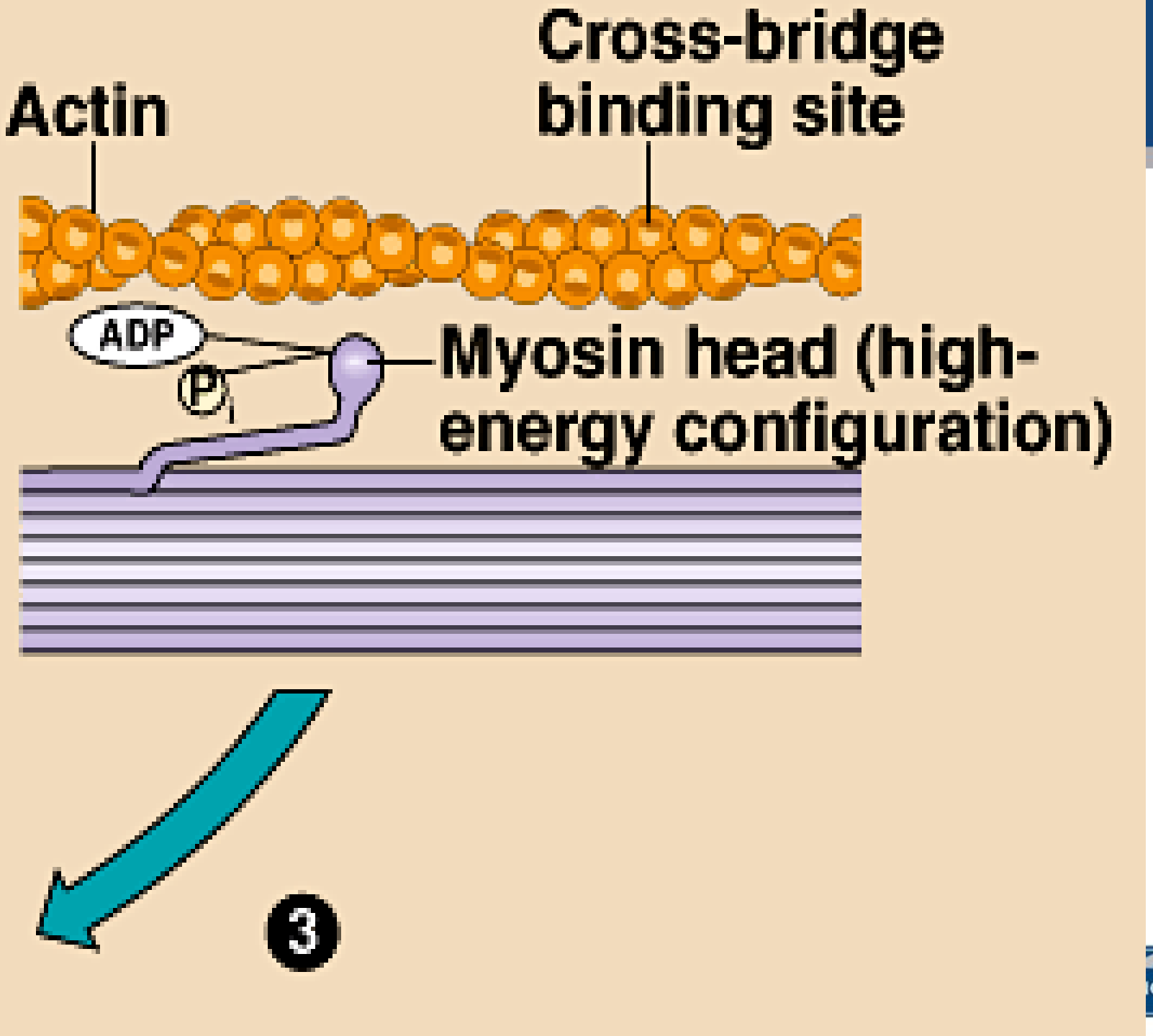
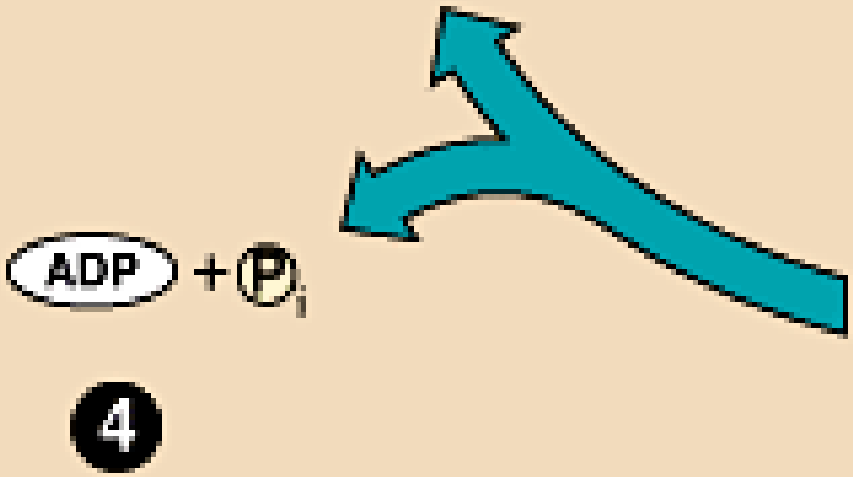
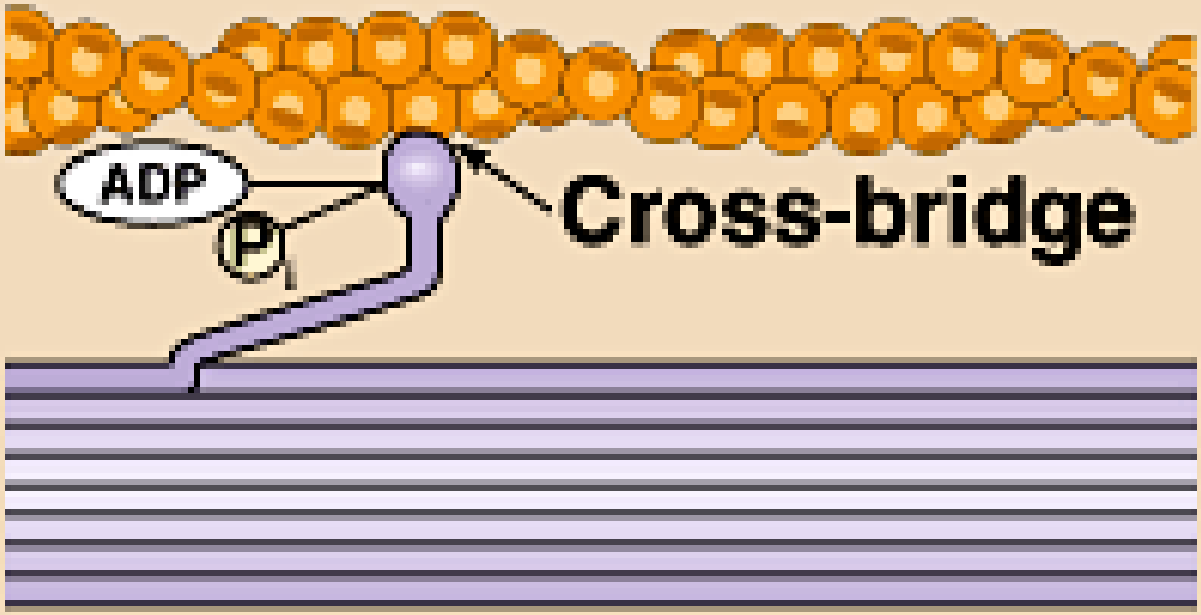
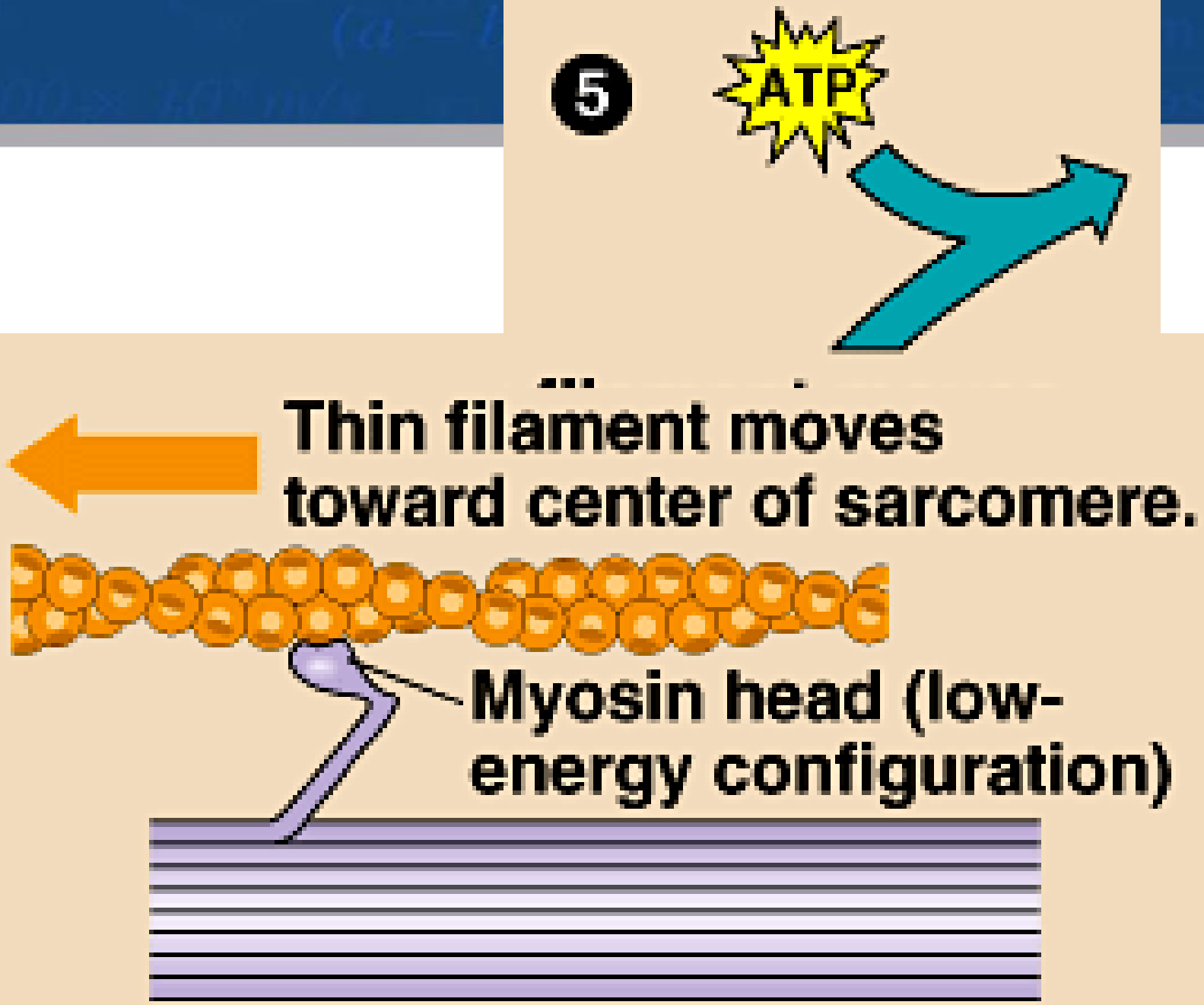
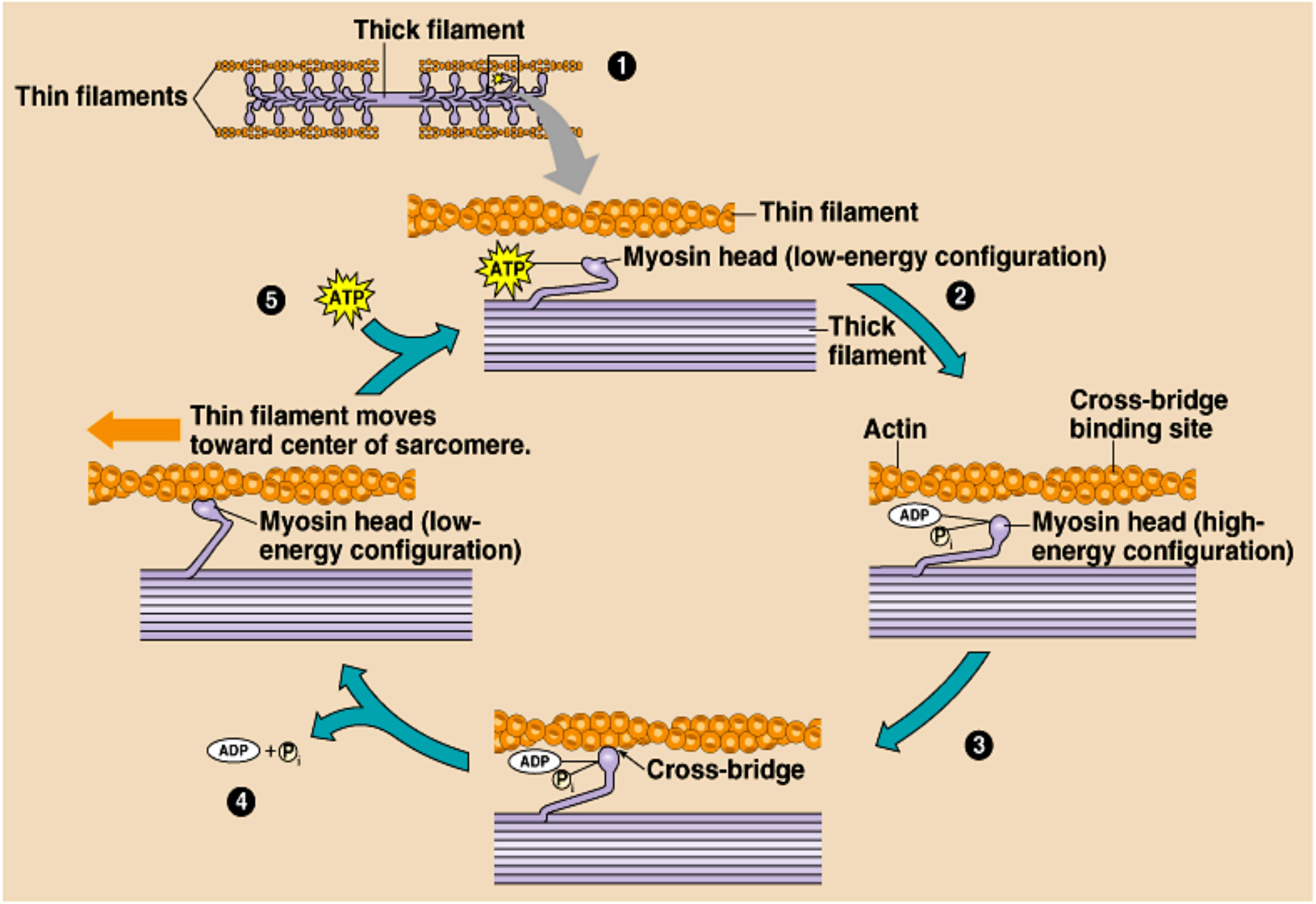

Thick filament
Thin filaments
1
Thin filament
ATP
Myosin head (low-energy configuration)
2
Thick filament


Cross-bridge binding site
Actin
ADP
P_i
Myosin head (high-energy configuration)
3


ADP
+ Pi
4


ADP
Pi
Cross-bridge


5
ATP
Thin filament moves toward center of sarcomere.
Myosin head (low-energy configuration)



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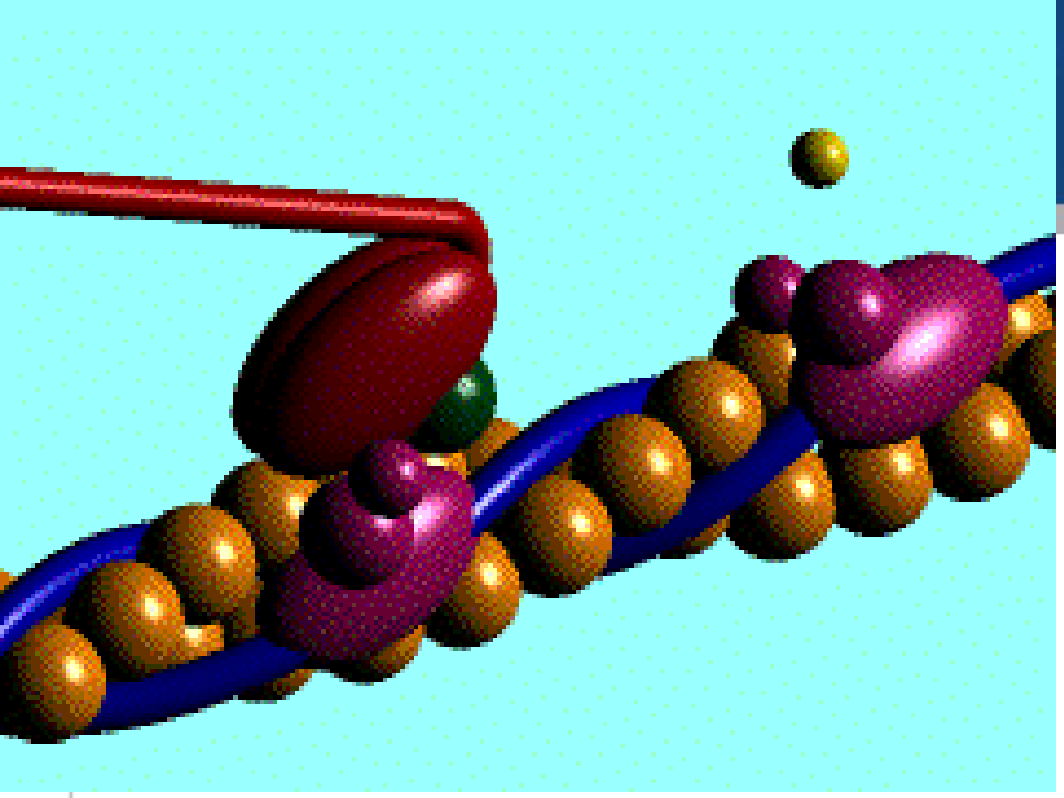
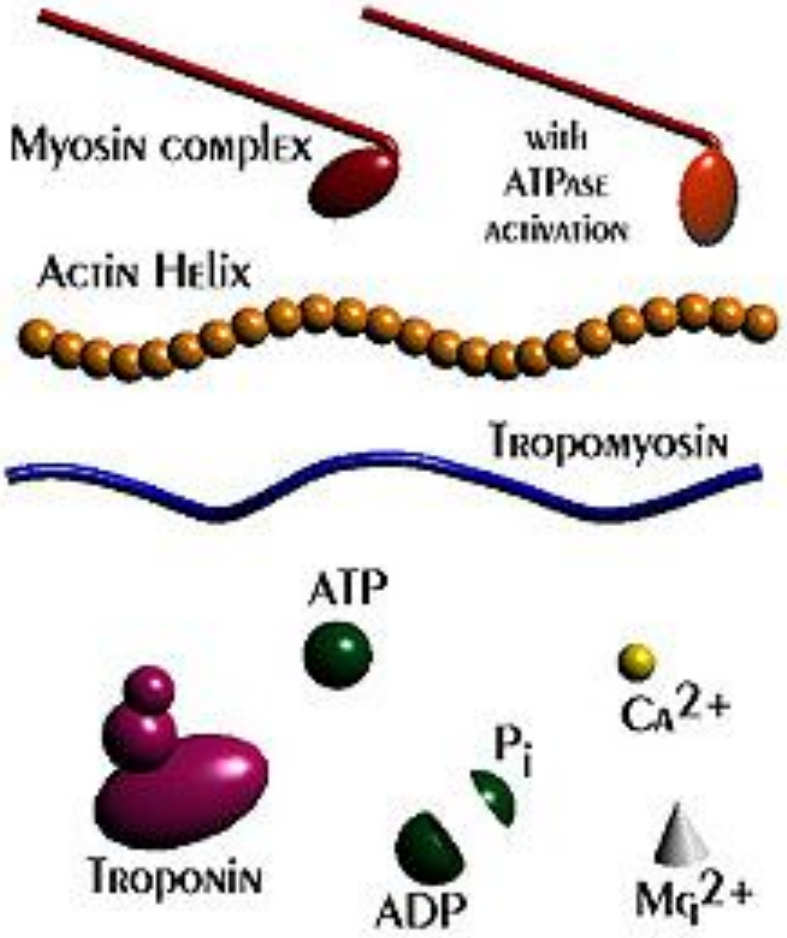
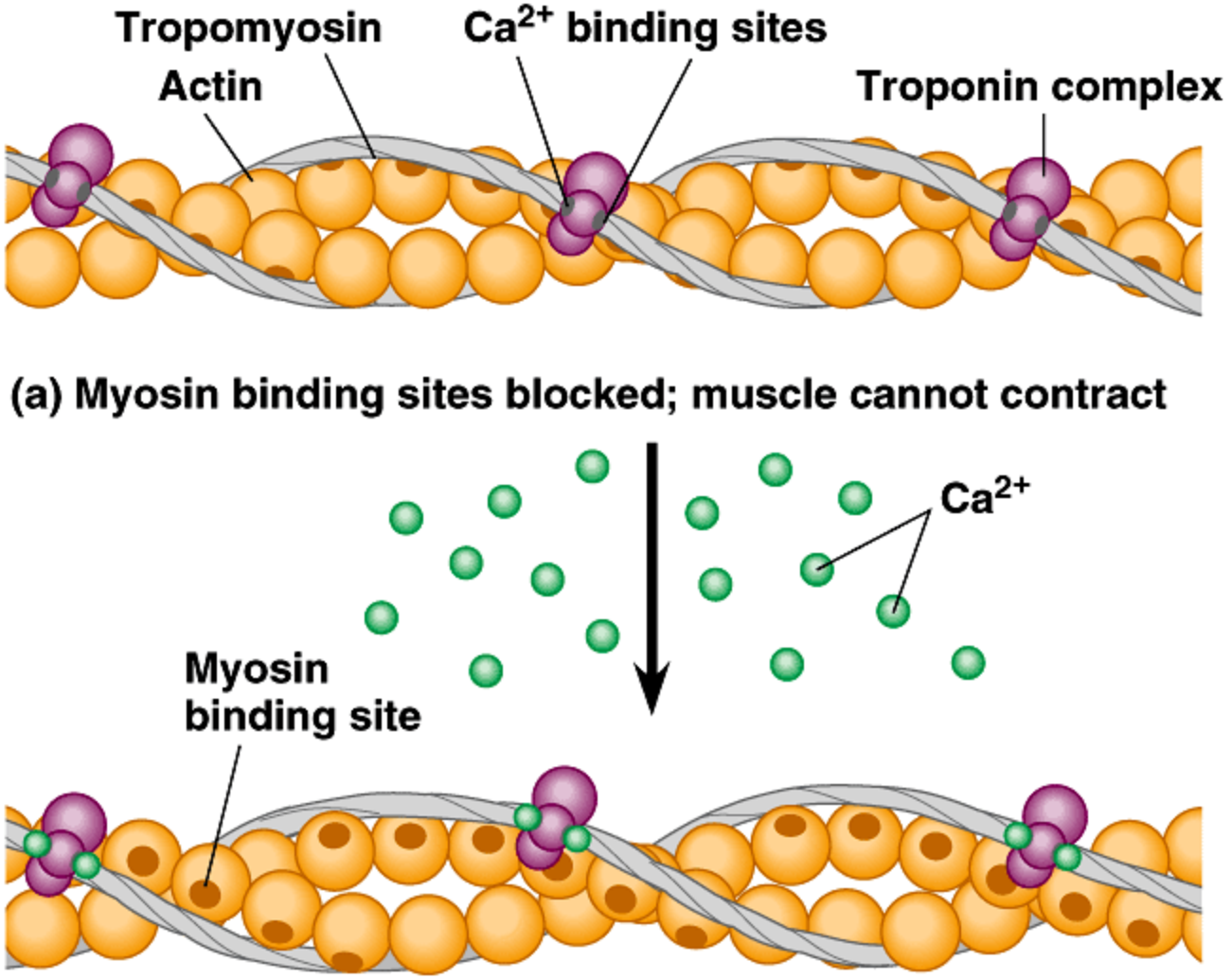



Myosin complex
with
ATPase
activation
Actin Helix
Tropomyosin
ATP
Troponin
ADP
P_i
Ca^{2+}
Mg^{2+}



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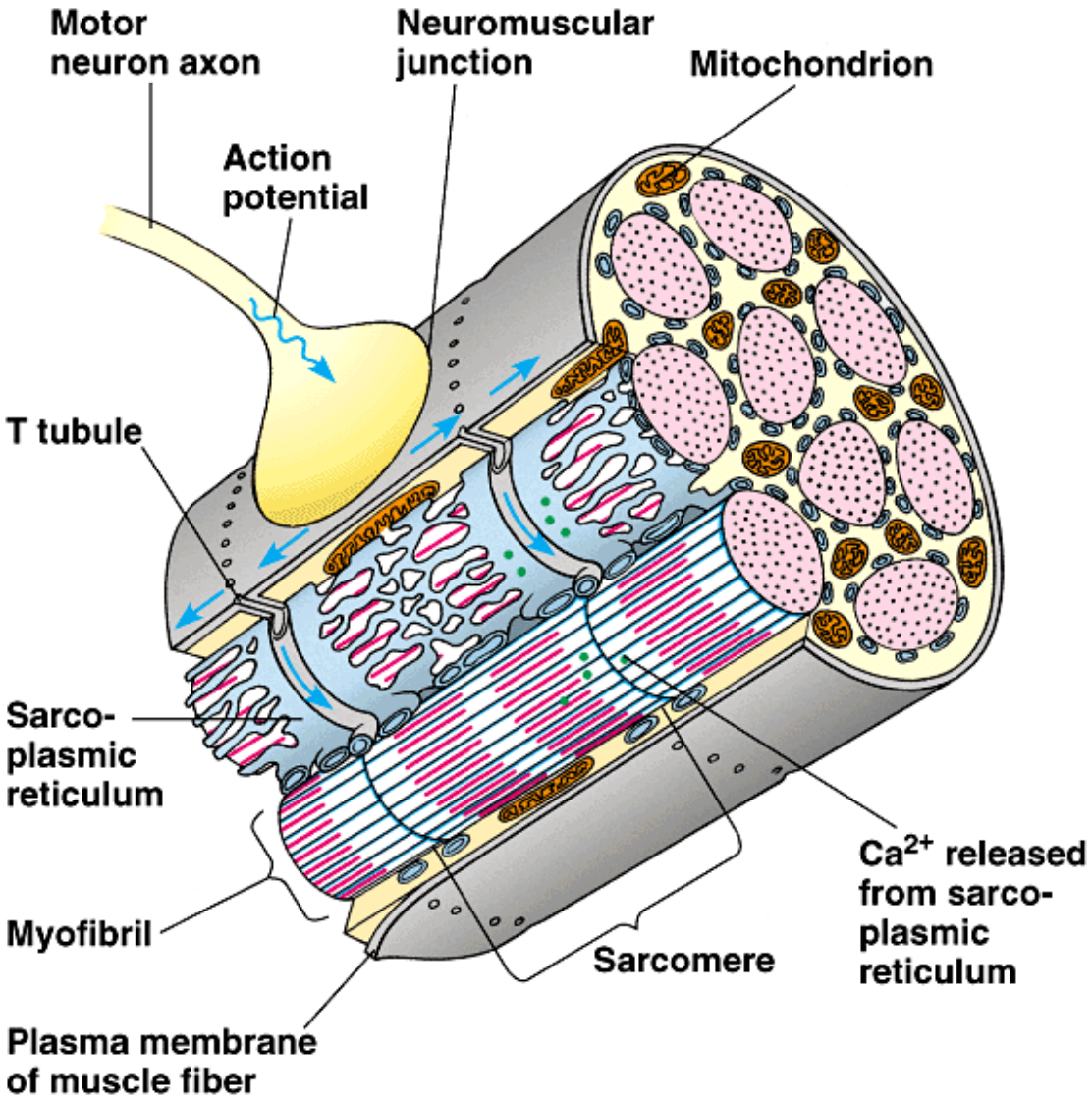
- The arrival of the action potential causes the sarcoplasmic reticulum to release calcium



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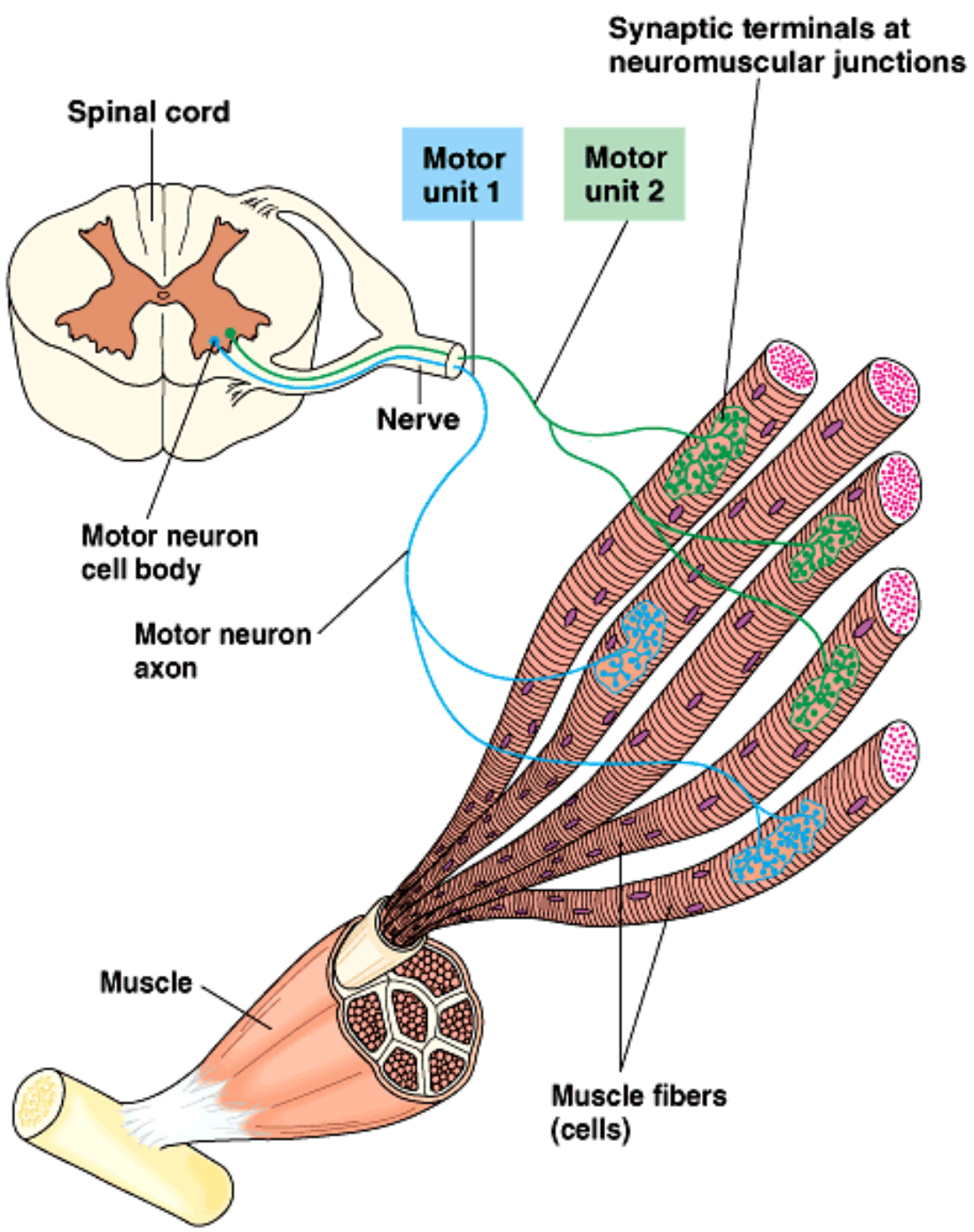

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