Office hours this week:

Tuesday 11:00 - 12:00

Wednesday 3:30 - 4:30

Muscle - How it works.

Chapter 10 in Eckert.
Skeletal muscle

Sliding-filament theory

A.F. Huxley and H.E. Huxley
1954
Actin filaments

Myosin filaments
Partial rotation of the actin-bound myosin head produces force.
Part covered by tropomyosin
Exposed binding site

G-actin

Low [Ca^{2+}]
High [Ca^{2+}]
Rigor

Exposed binding site
Part covered by tropomyosin

(a) Tension
ATP
ATP + Ca^{2+}
Ca^{2+} removed

(b) Relative force
Calcium concentration (M)

1.0
0.5
0.0
10^{-8} 10^{-7} 10^{-6} 10^{-5}

Ca^{2+} removed

T tubules and Sarcoplasmic reticulum
Function of Calcium Pump

ATP

Cytosol

Lumen of SER

2 Ca^{2+}

ADP

Uses 25-30% of the ATP used by muscles

Contraction

Isometric

Relaxed

Active

Isotonic

Tendon

Muscle

Tension transducer

Tension

Time

Isotonic contraction
Why is force inversely related to velocity?
Why is force inversely related to velocity?

Muscle function 1: Elastic storage
Muscle function 1: Elastic storage

Maximum force

Sonomychometry - changes in muscle length

Strain gage - changes in tendon length

Roberts et al., 1997
Muscle function 1: Elastic storage

Length of calf muscle.

Force of calf muscle.

Roberts et al., 1997

Muscle function 1: Elastic storage

Work per step (J kg\(^{-1}\))

<table>
<thead>
<tr>
<th>Speed (m s(^{-1}))</th>
<th>Shortening work (muscle + tendon)</th>
<th>Tendon energy recovered</th>
<th>Muscle shortening work</th>
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Roberts et al., 1997
Muscle function 1: Elastic storage

Mass Spring System
Muscle function 1: Elastic storage