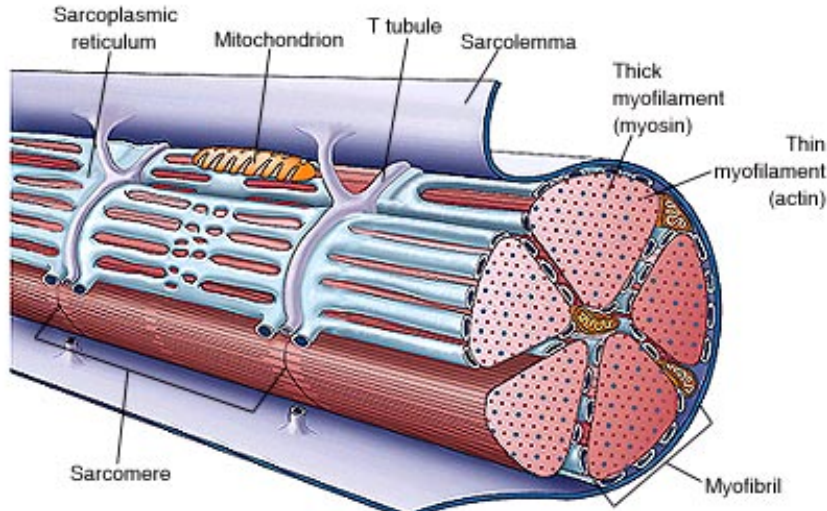


# MUSCLE PHYSIOLOGY

revised 18 October 2016  
 S&M: p. 188, Martini 6<sup>th</sup>: 301-307, 7<sup>th</sup>: 294-299, 8<sup>th</sup>: 299-315, 9<sup>th</sup>: 284-317  
 Martini 10<sup>th</sup>: pp 295, 300-330  
 Electron microscopic anatomy: 295



Fiber: formed from **fused cells**. Around each fiber:  
**sarcolemma** ["lemma: husk"] muscle cell membrane  
**T-tubules** extend from sarcolemma into interior, transverse tubules around myofibril  
**sarcoplasmic reticulum** ["flesh form network little"] membranous network within cell, hold  $Ca^{++}$

## PHYSIOLOGY:

**Acetylcholine** (P 300, 301) released at neuromuscular junction triggers change in permeability, passes over sarcolemma, into cell via T tubules

p304, 305: See videos

- a) **nerve stimulation** of contraction: <http://www.youtube.com/watch?v=70DyJwwFnkU> P 300
- b) **interaction of actin and myosin**: <http://www.youtube.com/watch?v=gJ309LfhQ3M> P 304
- c) **Nerve stimulation** (long): <http://www.youtube.com/watch?v=hZXVe4RS8-A> p 300

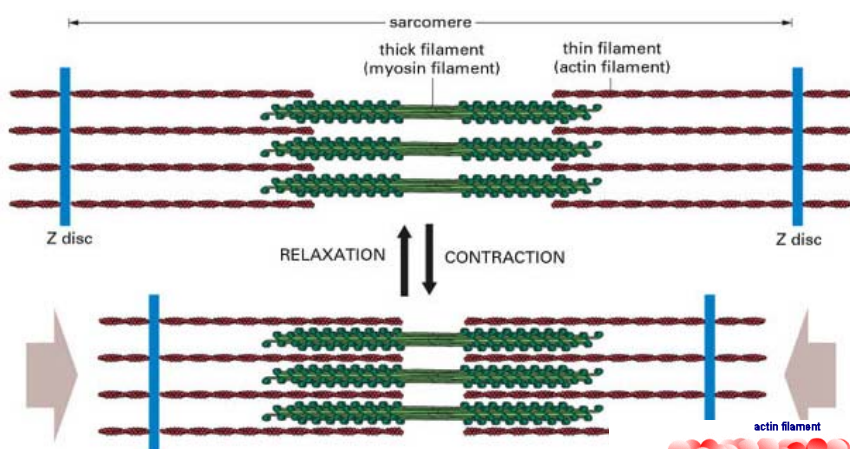
## Sarcoplasmic reticulum

(reticular **enlargements** along T-tubules) release  $Ca^{++}$   
 $Ca^{++}$  stimulates series of events leading to contraction

## REVIEW:

Components of **sarcomere**:

- G-actin globular actin subunits
- F-actin complex of G-actin tropomyosin
- troponin regulator, blocks myosin heads from linking with G actin,  $Ca$  inactivates
- myosin thick fiber



## CONTRACTION CYCLE: P 304-305

- 1) ATP charges clubs on myosin heads, but is prevented from attaching to actin due to tropomyosin blocking
- 2) When troponin binds  $Ca^{++}$ , it draws into fiber, allows binding of G actin to myosin head.
- 3) Bound ATP is split upon linkage of myosin with actin via a covalent bond (rigor complex)  
 The myosin flexes, pulling actin causing fibers to slide past each other = contraction ["pull process"]
- 4) When another ATP is bonded to the myosin club, the rigor complex dissolved.
- 5) The cycle repeats resulting in the thin filament (actin) being pulled along the thick filament (myosin).
- 6) When  $Ca^{++}$  is pumped back into sarcoplasmic membrane, muscle relaxes.

ATP come mostly from aerobic respiration, but also from anaerobic glycolysis, producing lactic acid.

Fast fibers: "white meat": powerful, quick, fatigued easily, fermentation becomes source of energy

Muscle can store energy as creatine  $PO_4$  also source of energy for super exertion

Slow fibers: "dark or red meat" because of myoglobin which stores oxygen in muscle

**Muscle cells:** fibers respond all or nothing, latent period, contract, relax

single neuron causes **group of fibers**, called a **motor unit**, to contract at same time,

p 322

muscles controlling fine movements individual neurons control few individual motor units  
 coarse movement one neuron controls many motor units simultaneously

asynchronous discharge allows for smooth response

rate of volley of discharge controls strength of pull by wave summation

