

Exam II is coming! I'll be ready!!...



BI 121 Exam II!



## BI 121 Lecture 14

**I. Announcements** Last Lab 6, Pulmonary Function Testing + Optional notebook ✓ this Thur. **Exam II Fri Dec 13, 8am Q?**  
**American Heart Association 2019 Philadelphia update.**

**II. Nervous System Connections** LS ch 3, 4 & 7; DC Module 9

**A. Fight-or-Flight Stories!**

**B. How does the signal cross the nerve-muscle gap?**

LS p 185-92 fig 7-5 p 190; DC pp 69-71 fig 9-4

1.  $\text{Ca}^{2+}$  bones!...but what else? LS p 190

2. What do black widow spider venom, botulism, curare & nerve gas have in common? Botox LS pp 189-92

**III. Muscle Structure & Function** LS ch 8 + DC Mod 12

**A. Muscle types: cardiac, smooth, skeletal** LS fig 8-1

**B. How is skeletal muscle organized?** LS fig 8-2, DC fig 12-2

**C. What do thick filaments look like?** LS fig 8-4, DC fig 12-4

**D. Thin filaments? Banding pattern** LS fig 8-5, 8-3, 8-7

**E. How do muscles contract?** LS fig 8-6, 8-10

**F. What's a cross-bridge cycle?** LS fig 8-11 +...

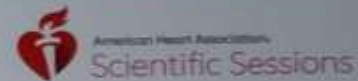


## Hot Topics Session: Vaping: The New Epidemic

Saturday, Nov. 16, 1:00 p.m. – 2:15 p.m. ET, Heart Theater

- **Rose Marie Robertson, M.D., FAHA**, Deputy Chief Science and Medical Officer
- **Pamela B. Morris, M.D.**, Director of Preventive Cardiology and the Seinsheimer Cardiovascular Health Program and Co-Director of Women's Heart Care, Medical University of South Carolina
- **Keith B. Churchwell, M.D.**, Senior Vice President and Executive Director of the Heart and Vascular Transplantation Services, Yale New Haven Hospital
- **Neal L. Benowitz, M.D.**, Professor Emeritus, University of California, San Francisco Center for Tobacco Control Research and Education
- **Michael J. Blaha, M.D., M.P.H.**, Director of Clinical Research, Ciccarone Center for the Prevention of Cardiovascular Disease, Professor of Medicine, Johns Hopkins Medicine
- **Suchitra Krishnan-Sarin, Ph.D.**, Professor of Psychiatry, Chair, Human Investigations Committee II & IV, Human Research Protections Program, Yale School of Medicine
- **Holly R. Middlekauff, M.D.**, Professor of Medicine and Physiology, University of California, Los Angeles
- **Aruni Bhatnagar, Ph.D., FAHA**, Professor of Medicine, Chief of Environmental Medicine, University of Louisville School of Medicine

## New Programs In 2019

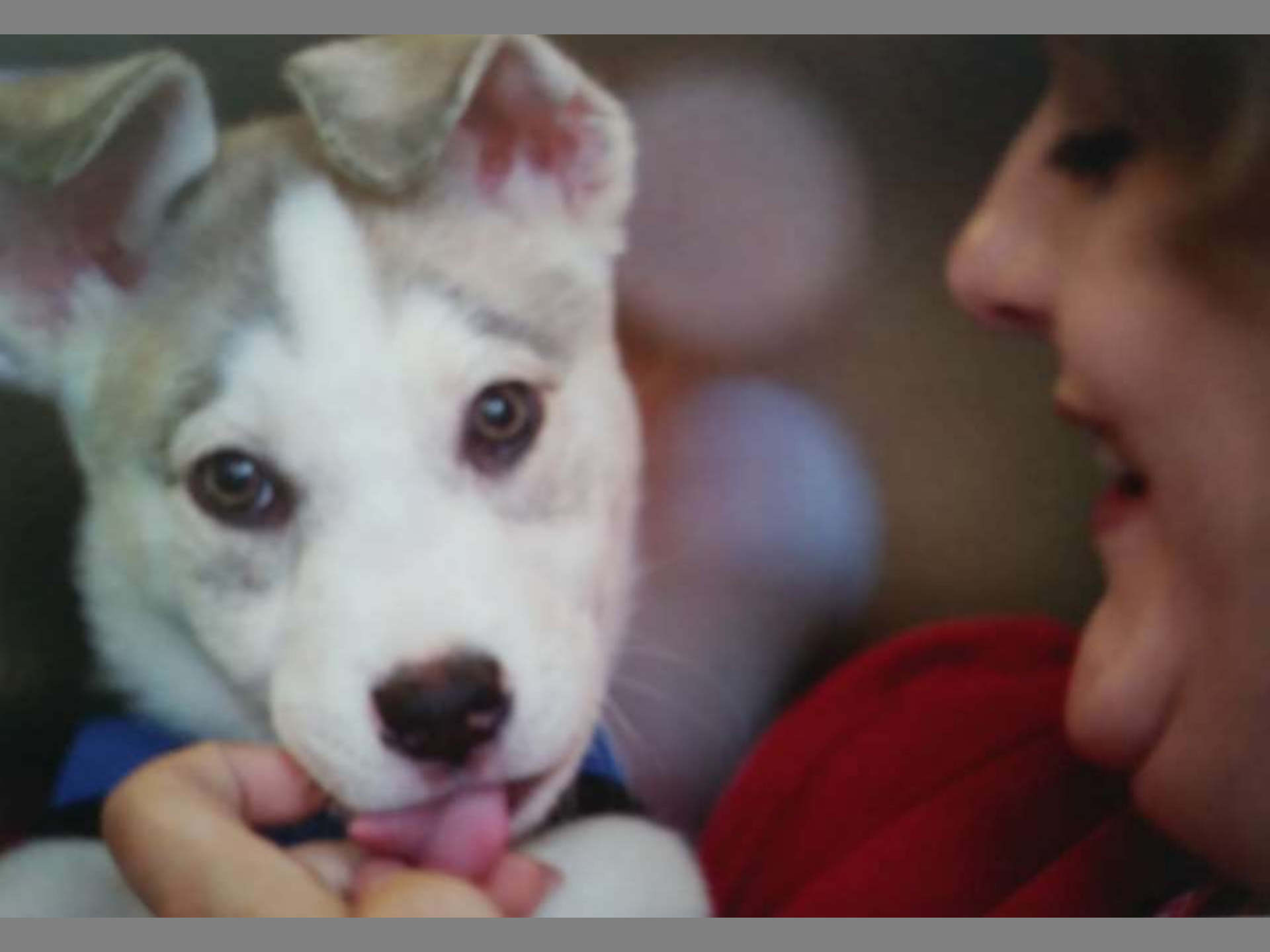


### Puppy Snuggle Zone

- People with pets tend to have lower baseline heart rates, lower blood pressures and significantly reduced increases in heart rate and blood pressure in response to stress.
- Puppies will be provided through a partnership with Philadelphia's Morris Animal Refuge, and puppies in the zone will be available for adoption.

**Saturday - Monday**

In the Bridge Area Outside the Science & Technology Hall





### Artificial Intelligence

- Machine learning: a technique used to give AI the ability to learn
- Deep learning: a subset of machine learning which mimics natural and human cognition

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A screenshot of a presentation slide, likely a continuation of the AI presentation, showing a diagram or chart.

### Artificial Intelligence

- Machine learning: a technique used to give AI the ability to learn
- Deep learning: a subset of machine learning which mimics natural and human cognition

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# Cytokinetics

## UNDERSTANDING CONTRACTILITY IN HEART FAILURE

### HEART FAILURE

Affects **6.2 MILLION** people in United States

In the U.S., approximately **~1,000,000** hospitalization discharges per year with a primary diagnosis of heart failure.

In 2016, contributed to **336,732 deaths**

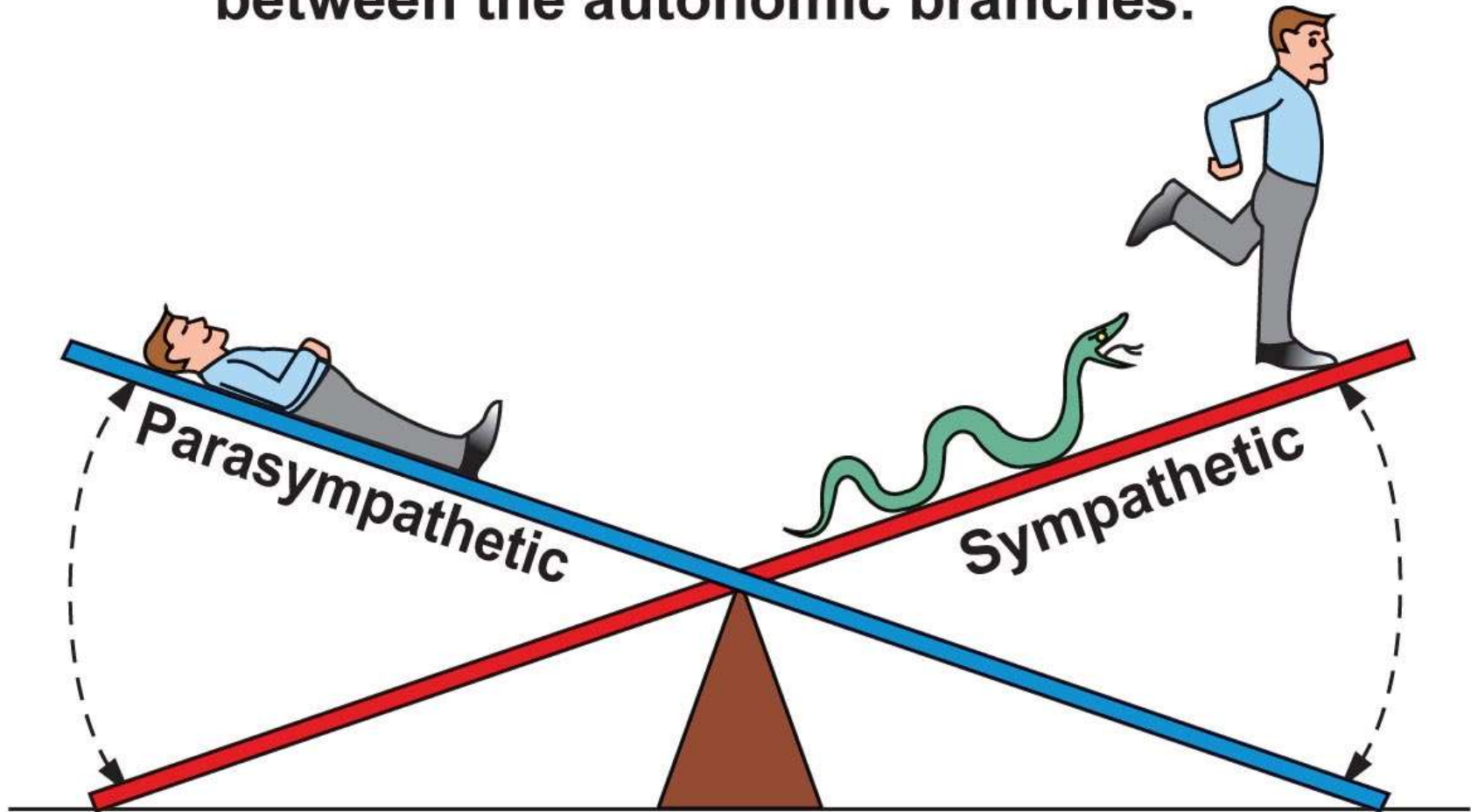
**~50% die** within 5 years of diagnosis

### HCM

Estimated prevalence of diagnosis in the U.S. **1 in 3,195**



Homeostasis is a dynamic balance between the autonomic branches.



**Rest-and-digest:  
Parasympathetic  
activity dominates.**

**Fight-or-flight:  
Sympathetic activity  
dominates.**



▲ **Table 7-1** Effects of Autonomic Nervous System on Various Organs

Organ	Effect of Sympathetic Stimulation	Effect of Parasympathetic Stimulation
<b>Heart</b>	Increases heart rate and increases force of contraction of the whole heart	Decreases heart rate and decreases force of contraction of the atria only
<b>Blood Vessels</b>	Constricts	Dilates vessels supplying the penis and the clitoris only
<b>Lungs</b>	Dilates the bronchioles (airways)	Constricts the bronchioles
<b>Digestive Tract</b>	Decreases motility (movement) Contracts sphincters (to prevent forward movement of tract contents) Inhibits digestive secretions	Increases motility Relaxes sphincters (to permit forward movement of tract contents) Stimulates digestive secretions
<b>Urinary Bladder</b>	Relaxes	Contracts (emptying)
<b>Eye</b>	Dilates the pupil Adjusts the eye for far vision	Constricts the pupil Adjusts the eye for near vision
<b>Liver (glycogen stores)</b>	Glycogenolysis (glucose is released)	None
<b>Adipose Cells (fat stores)</b>	Lipolysis (fatty acids are released)	None
<b>Exocrine Glands</b>		
<i>Exocrine pancreas</i>	Inhibits pancreatic exocrine secretion	Stimulates pancreatic exocrine secretion (important for digestion)
<i>Sweat glands</i>	Stimulates secretion by sweat glands important in cooling the body	Stimulates secretion by specialized sweat glands in the armpits and genital area
<i>Salivary glands</i>	Stimulates a small volume of thick saliva rich in mucus	Stimulates a large volume of watery saliva rich in enzymes
<b>Endocrine Glands</b>		
<i>Adrenal medulla</i>	Stimulates epinephrine and norepinephrine secretion	None
<i>Endocrine pancreas</i>	Inhibits insulin secretion	Stimulates insulin secretion
<b>Genitals</b>	Controls ejaculation (males) and orgasm contractions (both sexes)	Controls erection (penis in males and clitoris in females)
<b>Brain Activity</b>	Increases alertness	None

# Fight-or-Flight Stories!



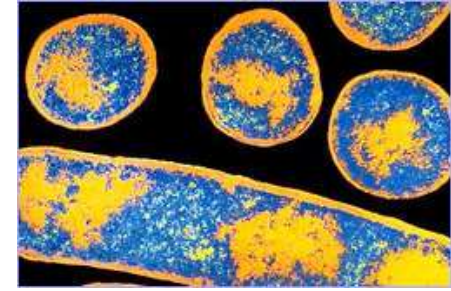
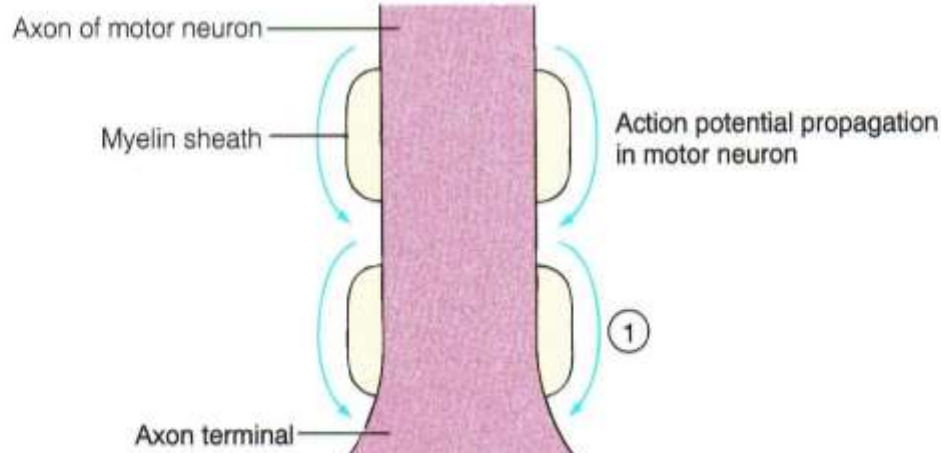
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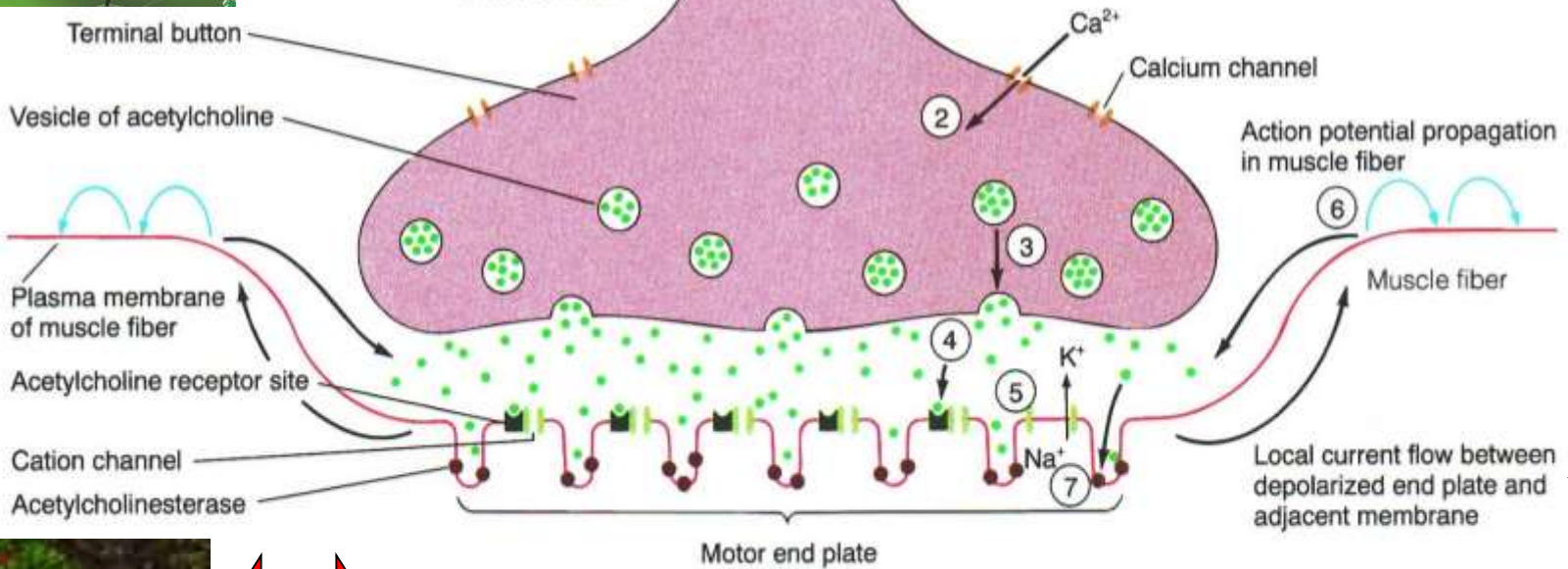
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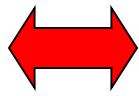
↑ 3



~~3~~



~~7~~



4



***Break for discussion/questions!***



Striated muscle

Unstriated muscle

Skeletal muscle

Cardiac muscle

Smooth muscle

Ed Reschke

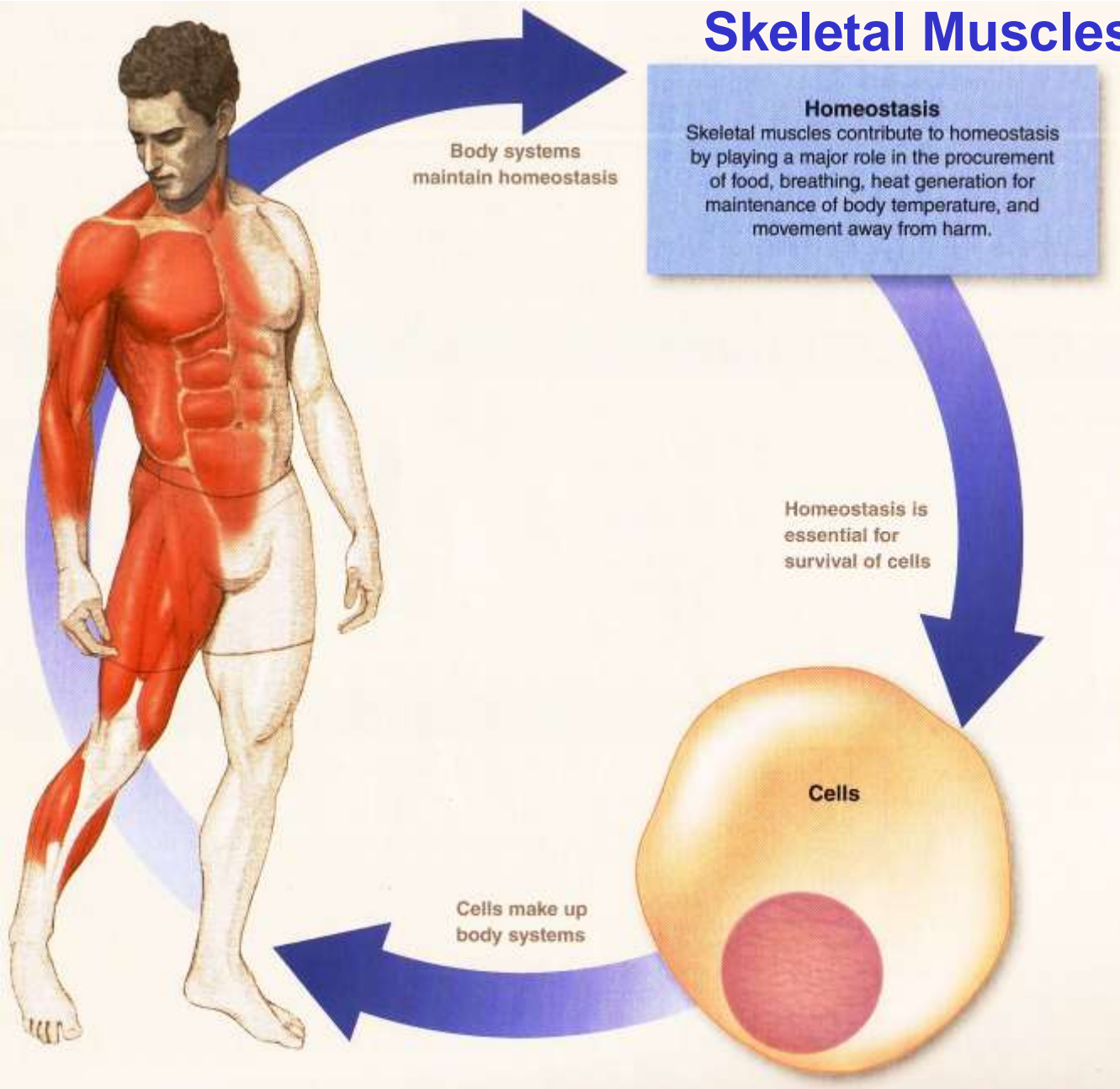
Ed Reschke

Biophoto/Photo Researchers, Inc.

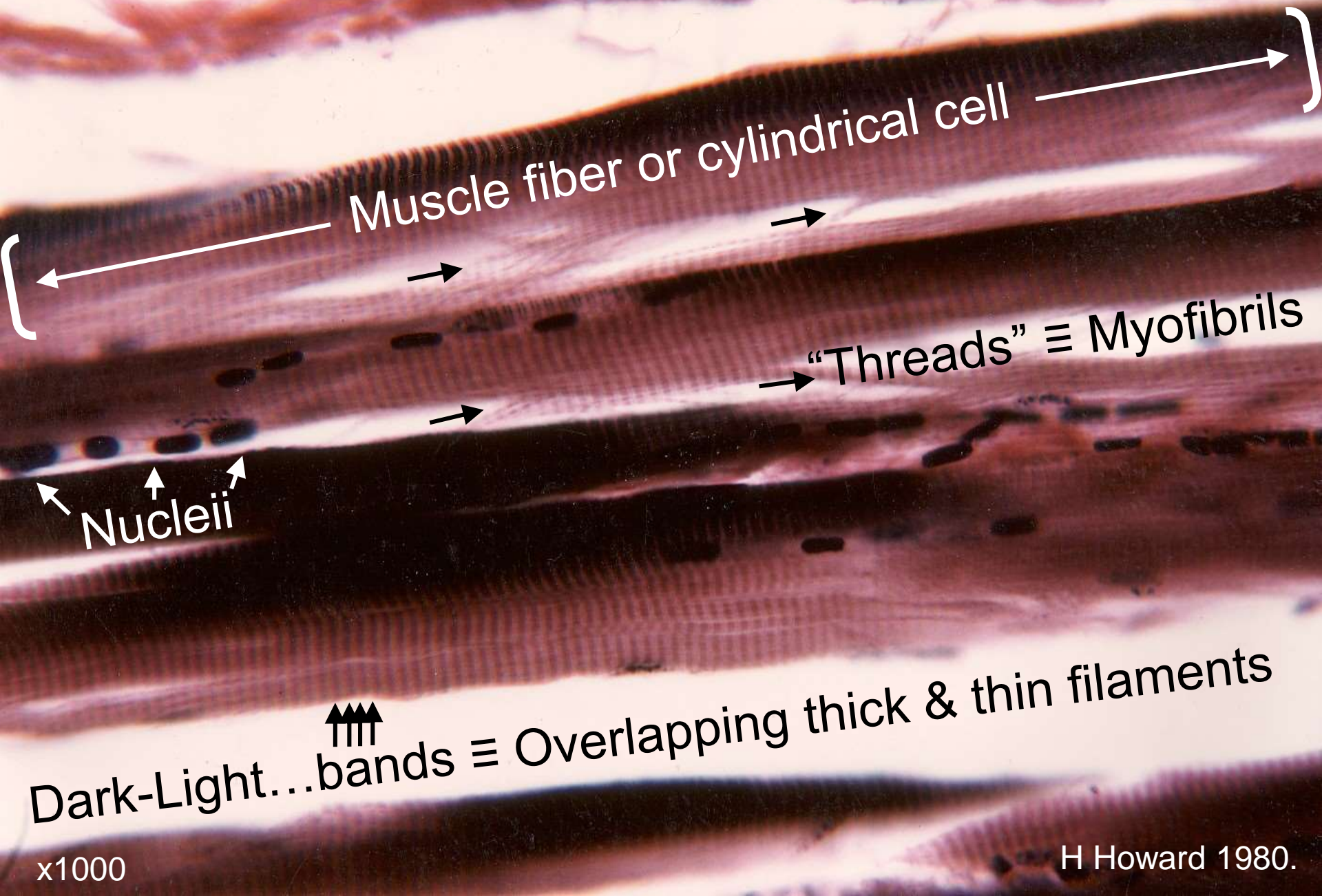
Voluntary muscle

Involuntary muscle

# Skeletal Muscles



# Skeletal Muscle Histology: Microscopic Anatomy



Muscle fiber or cylindrical cell

Nucleii

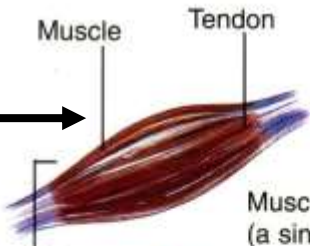
"Threads" ≡ Myofibrils

Dark-Light...bands ≡ Overlapping thick & thin filaments

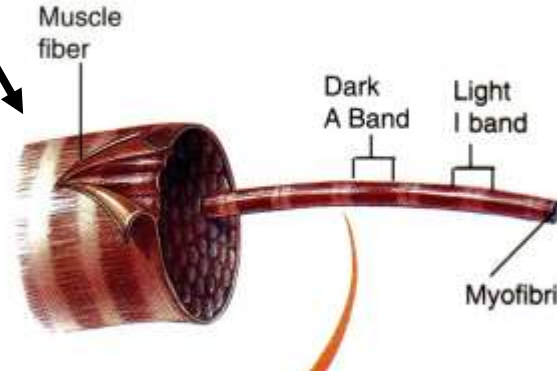
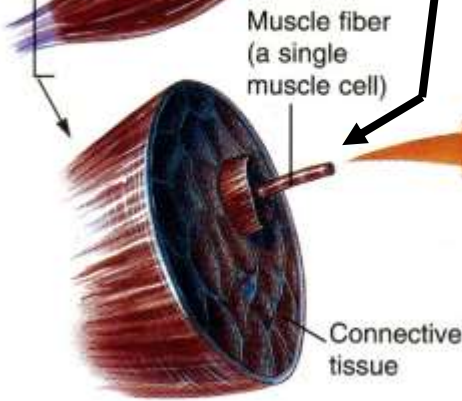
x1000

H Howard 1980.

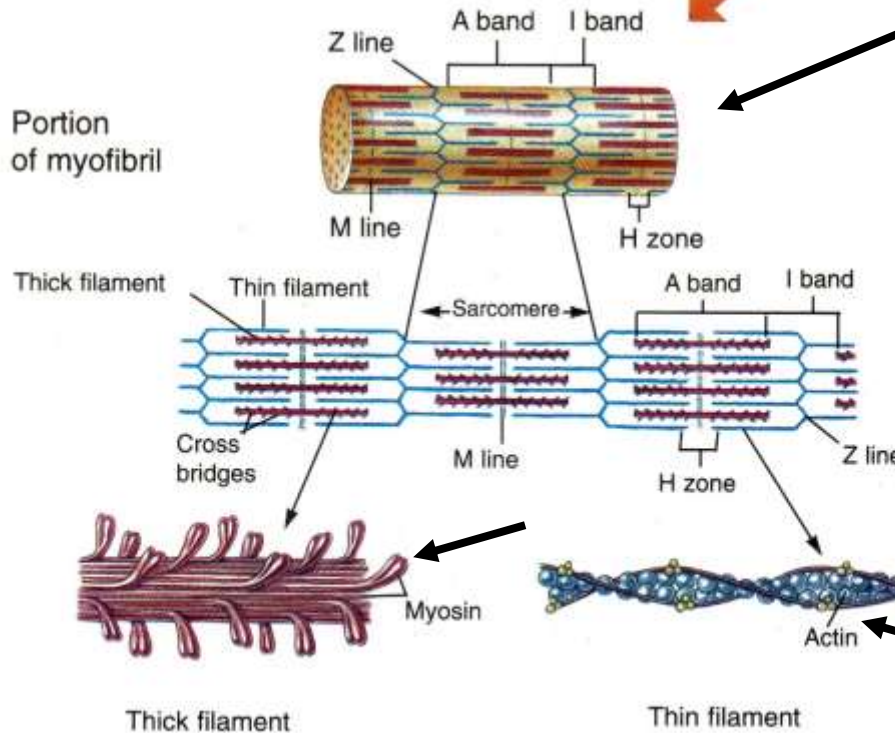
**Organ =  
Muscle**



**Cell = Myocyte = Fiber**

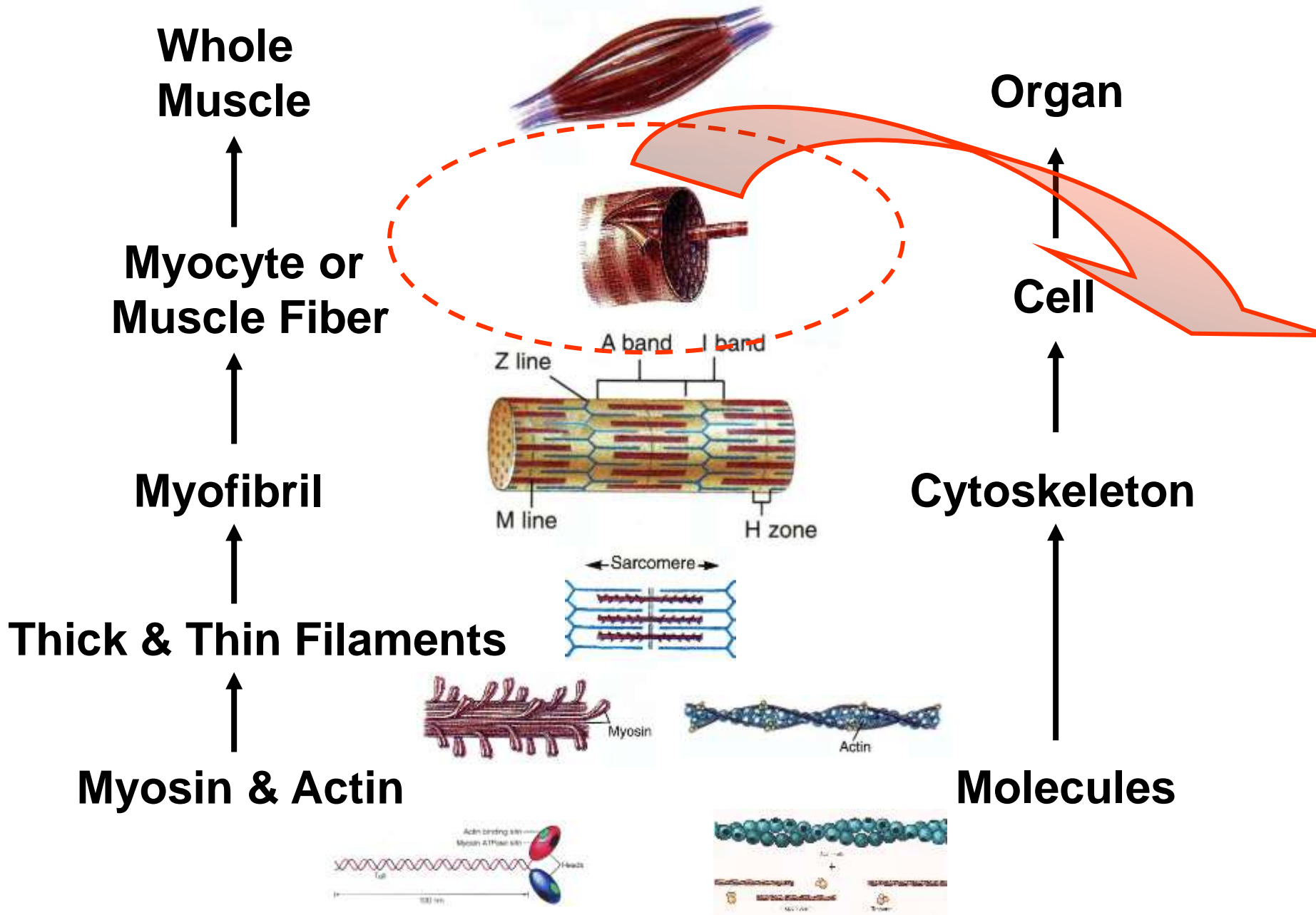


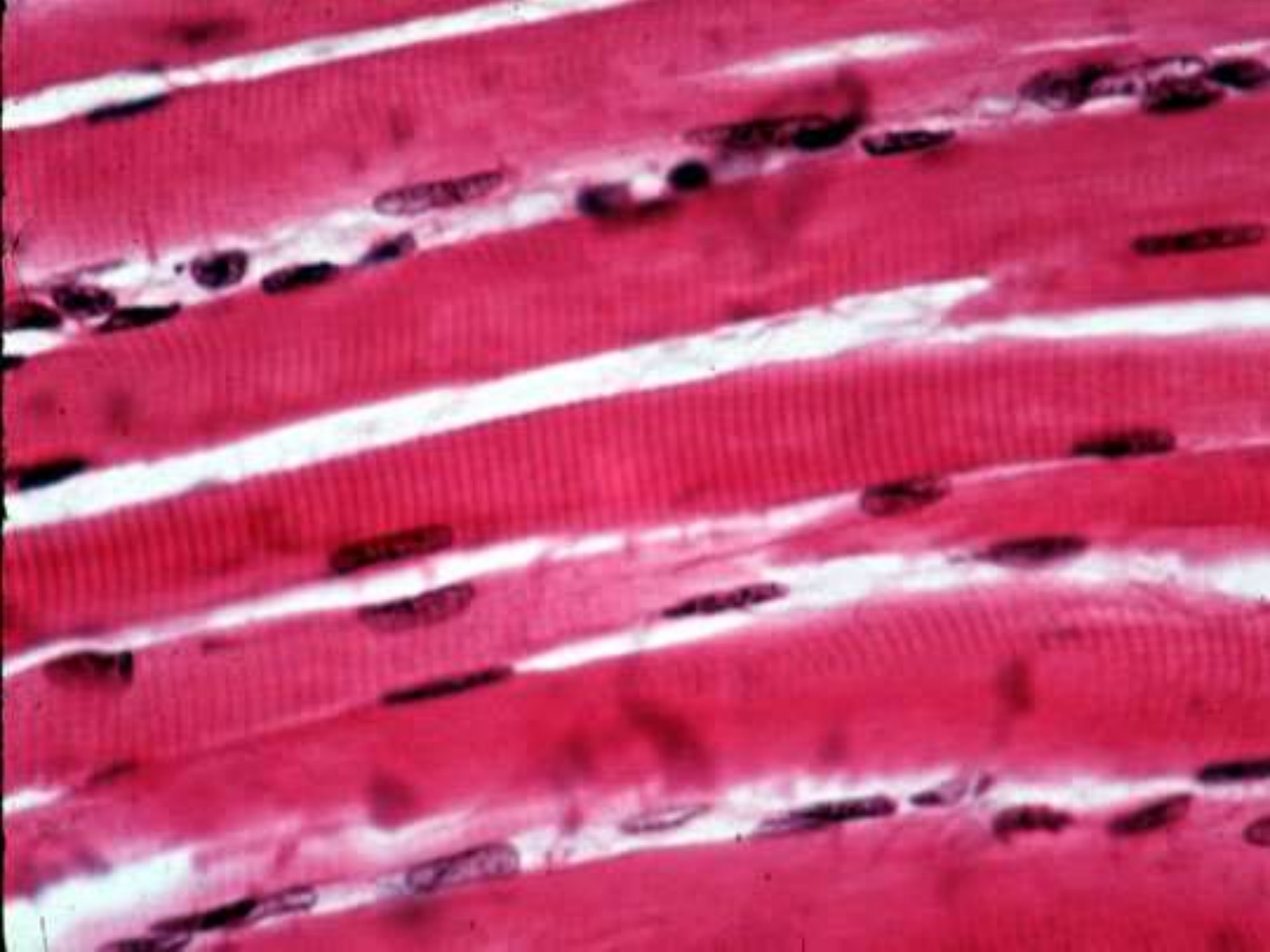
**Subcellular =  
Cytoskeleton**

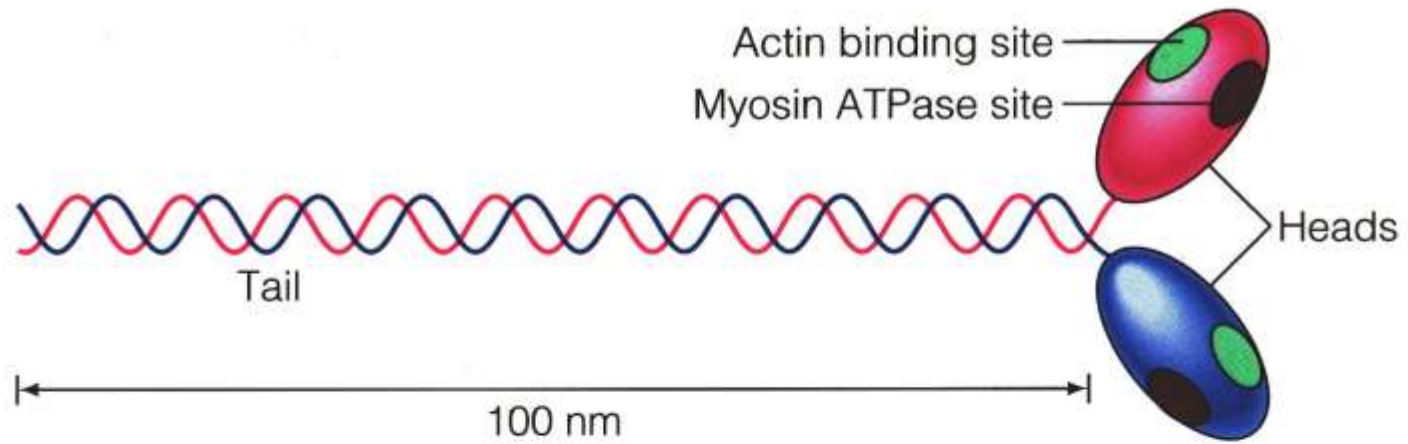


**Molecules =  
Actin & Myosin**



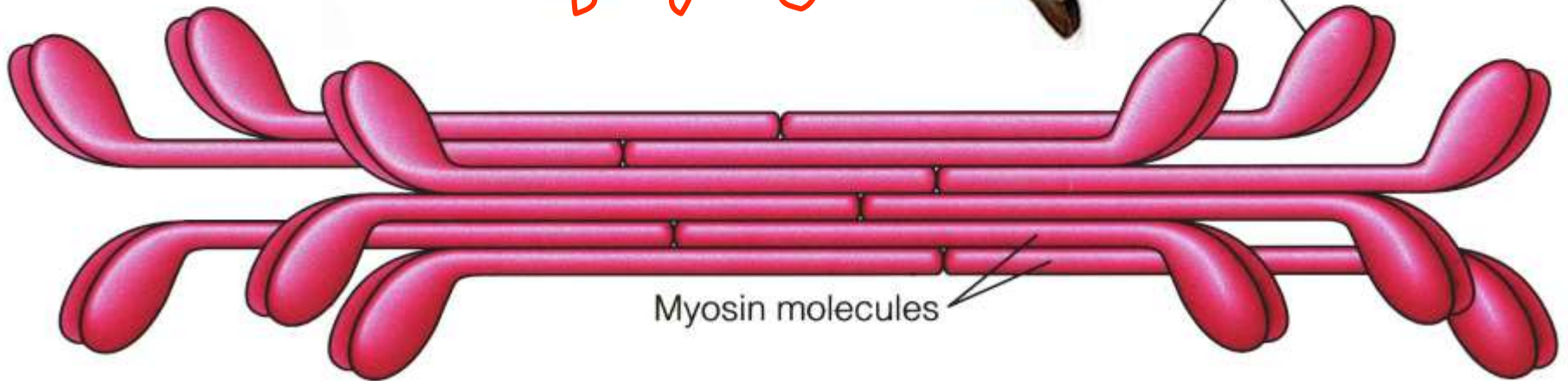
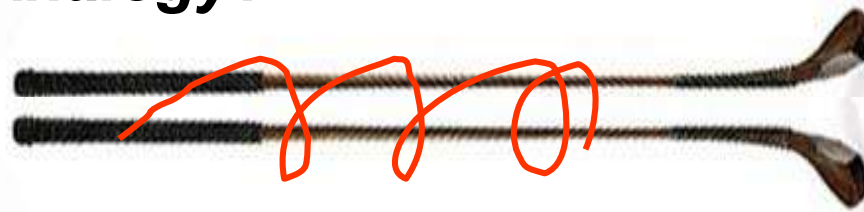






(a)

## ***Golf Club Analogy?***



(b)

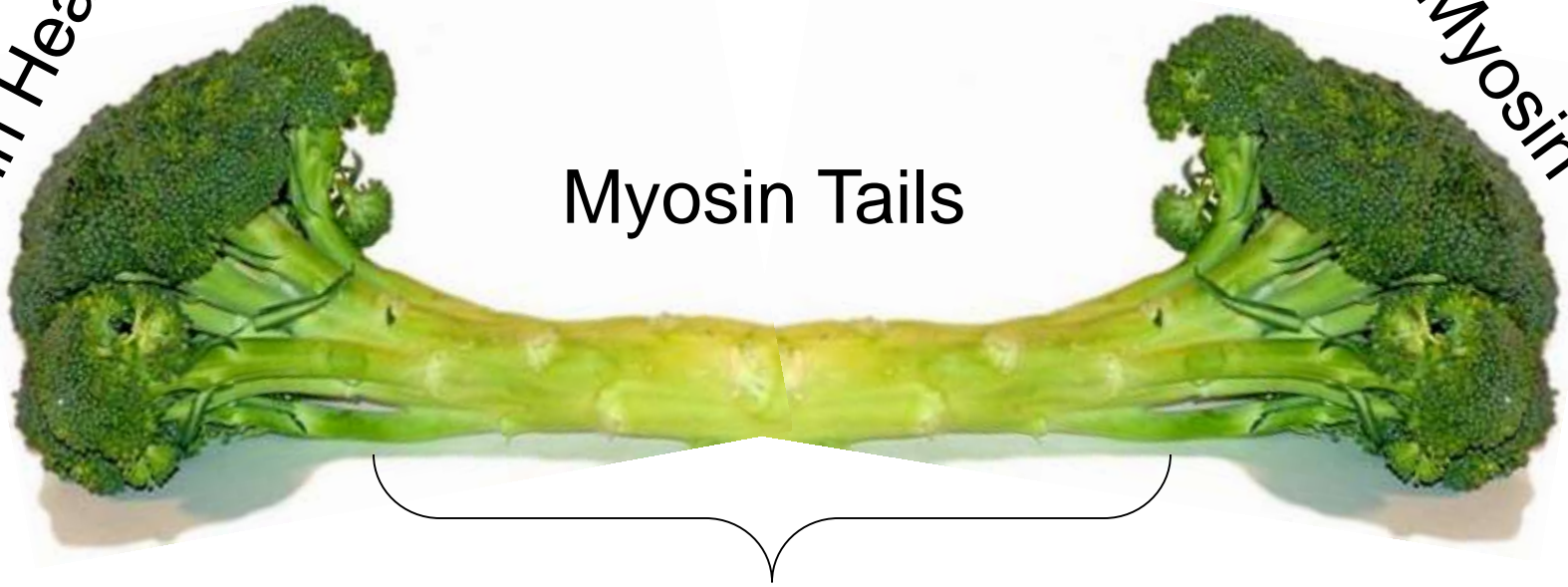
# *Broccoli Analogy?*

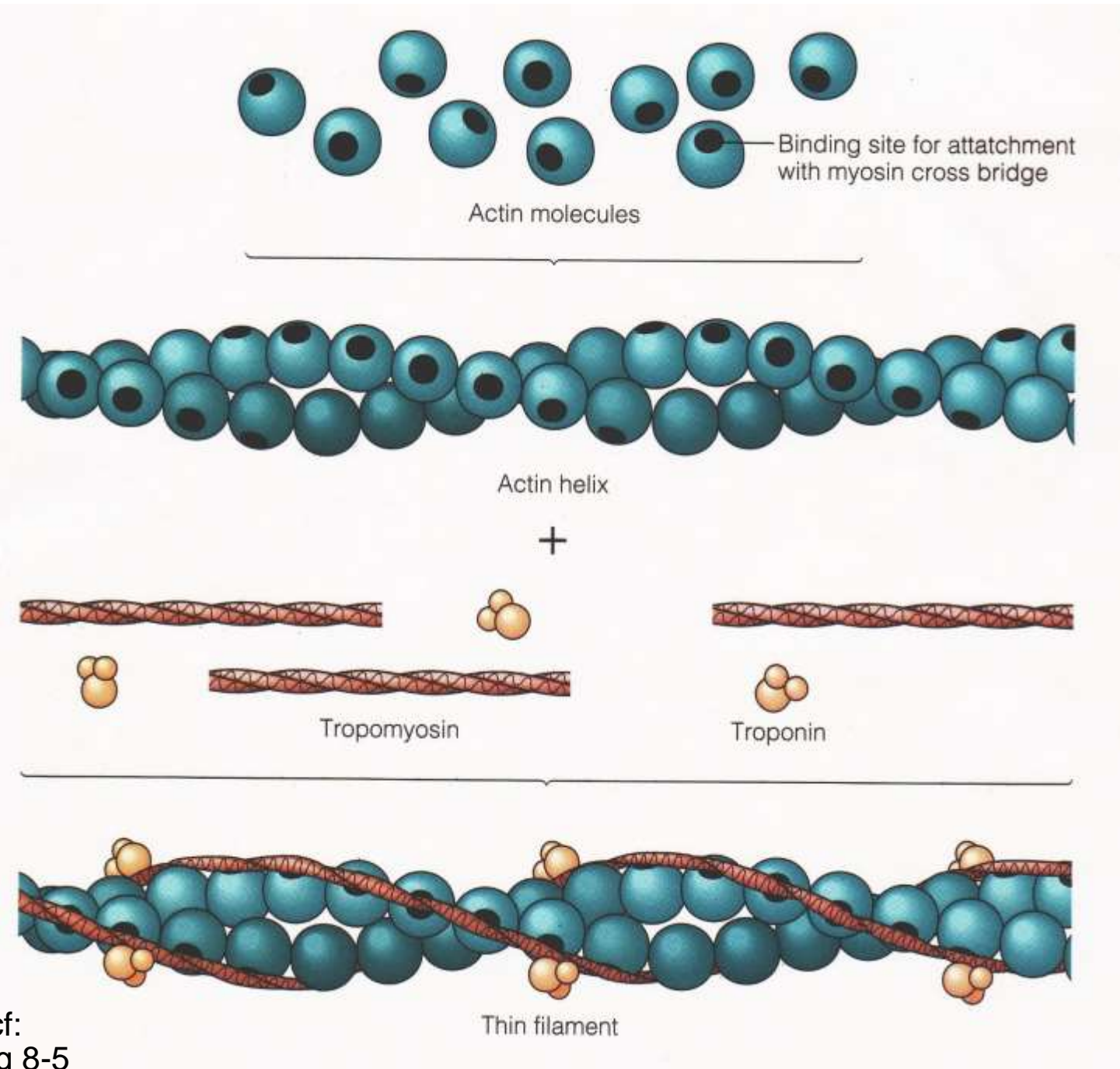
*Myosin Heads*

*Myosin Heads*

Myosin Tails

Bare Zone

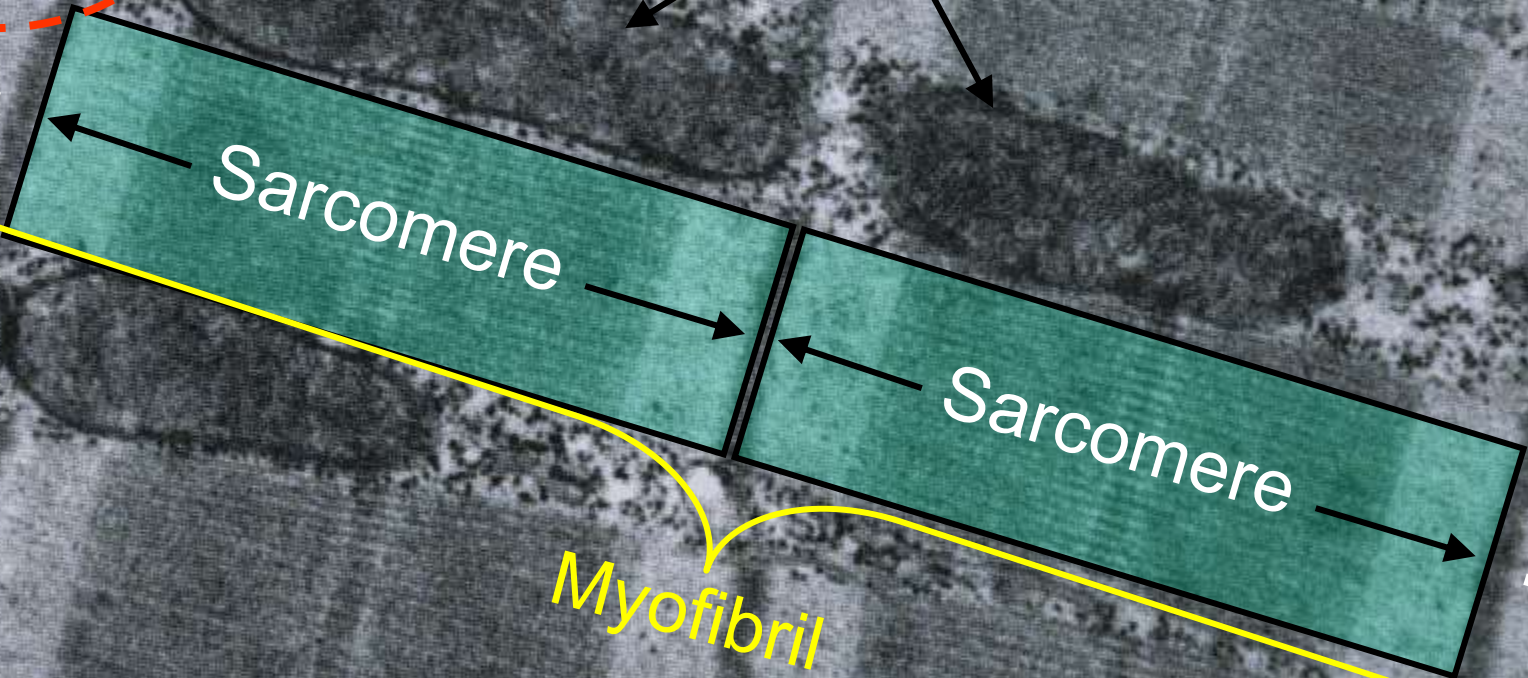




LS 2006, cf:  
LS 2012 fig 8-5

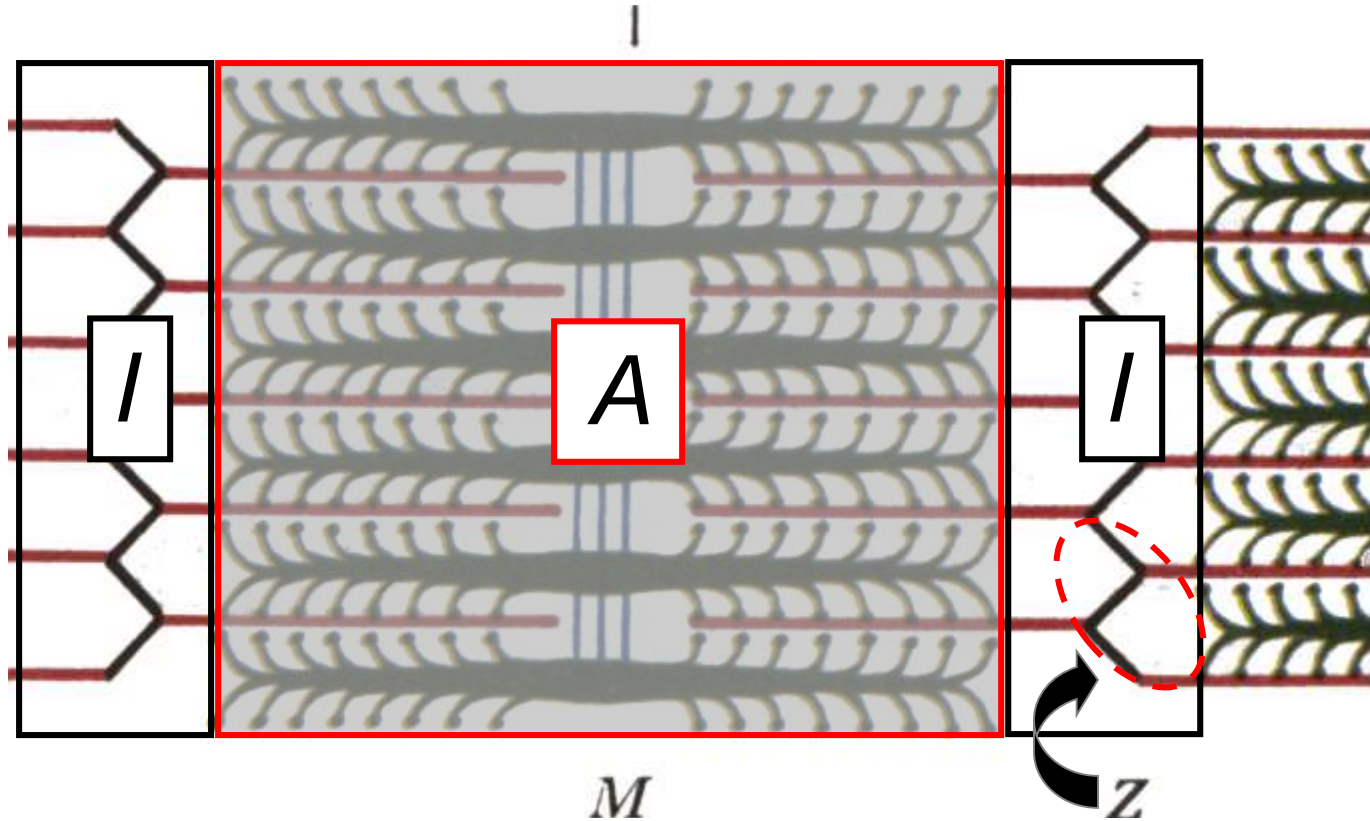
Triad  $\equiv$  T tubule abutting cisternae

Mitochondria



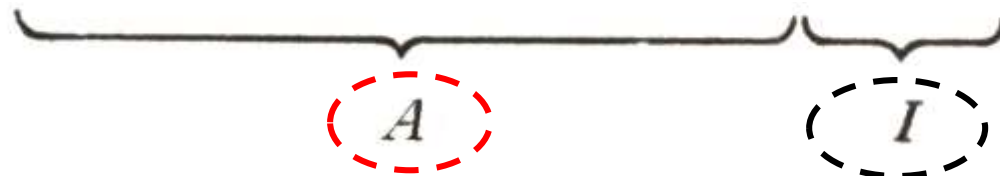
A Band = Dark Band

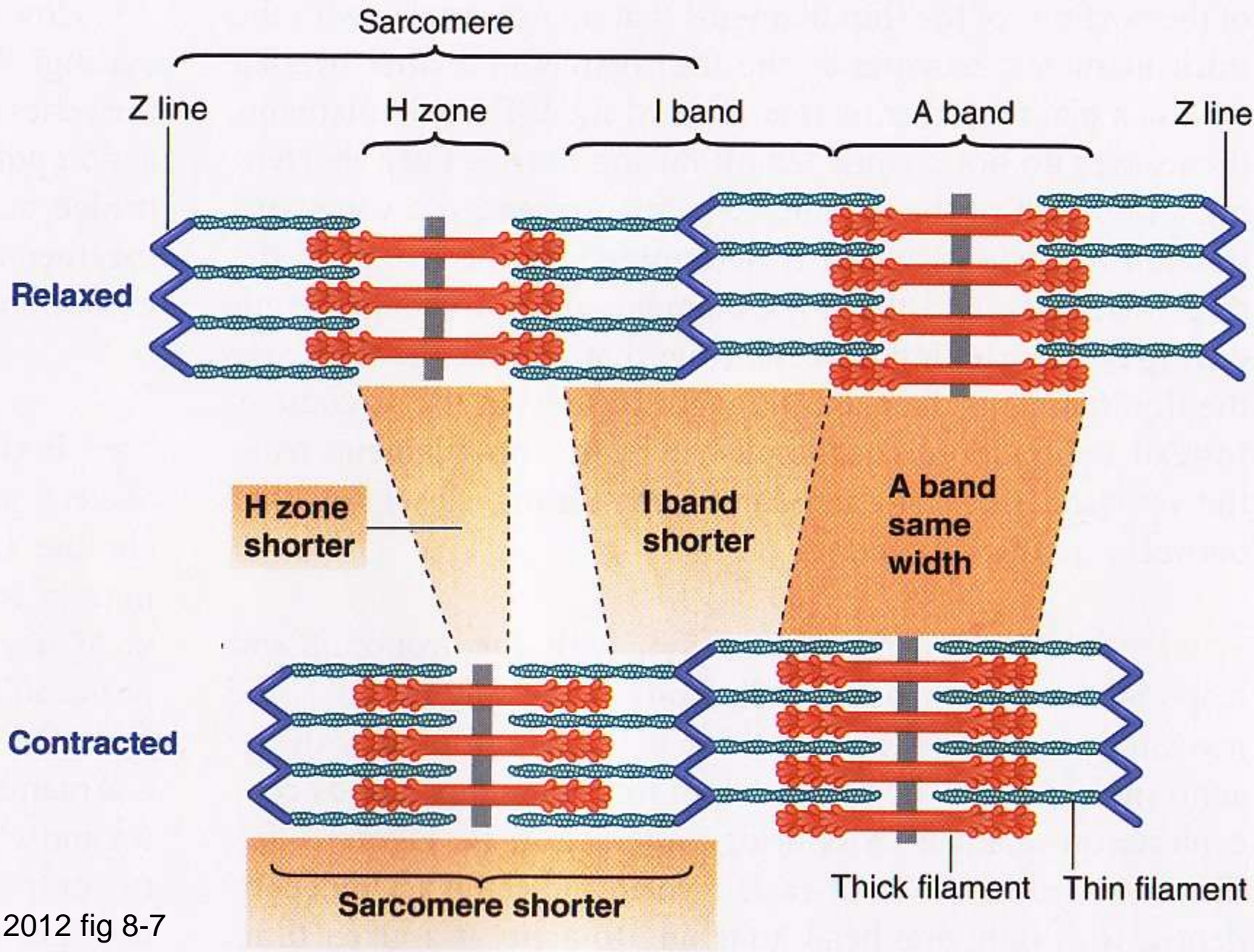
Anisotropic = Light Can't Shine Through



I Band = Light Band

I/sotropic = Light Can Shine Through





LS 2012 fig 8-7



# *Discussion + Time for Questions!*

