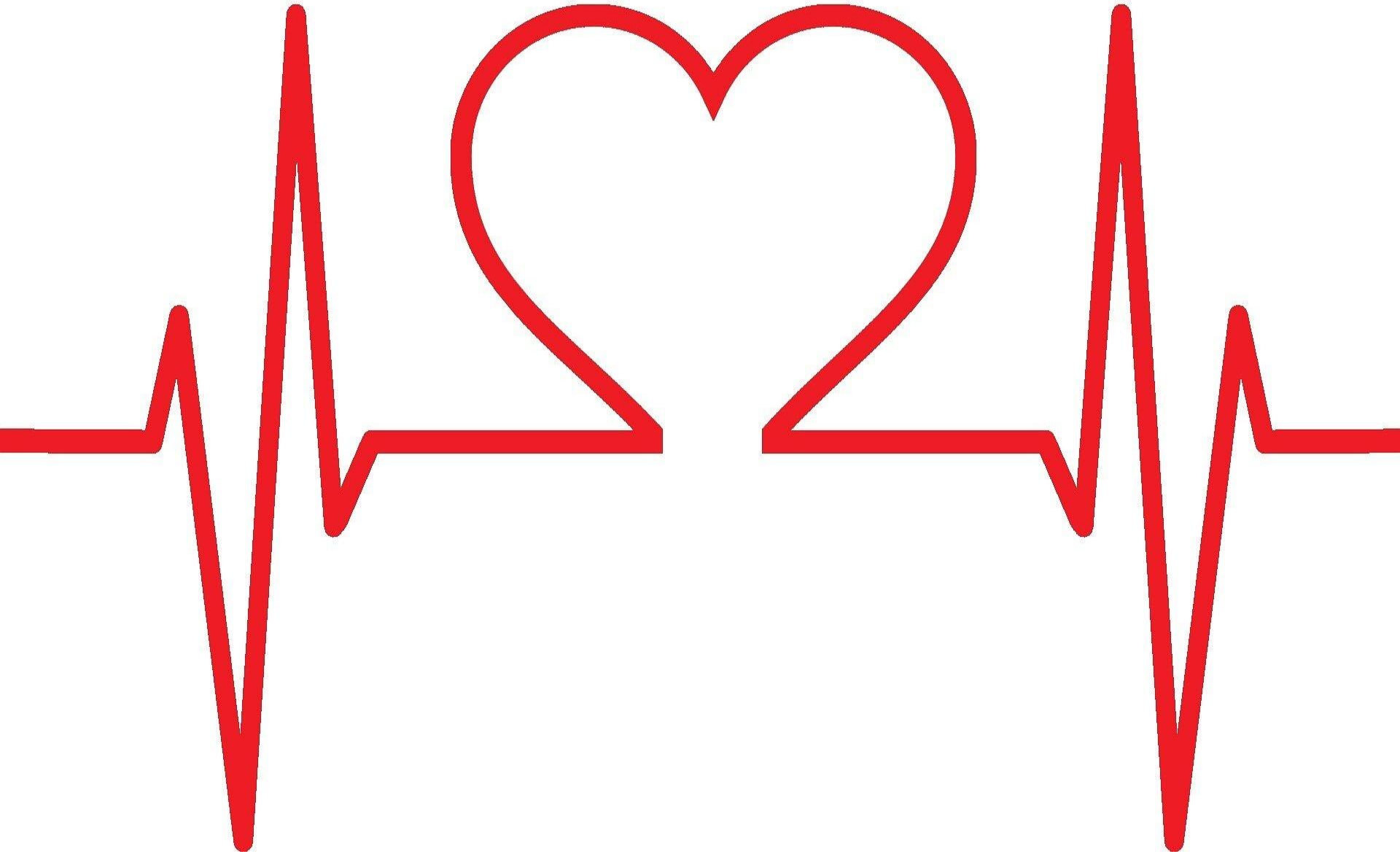
Histology of muscles

DR. SHABNAM GUL



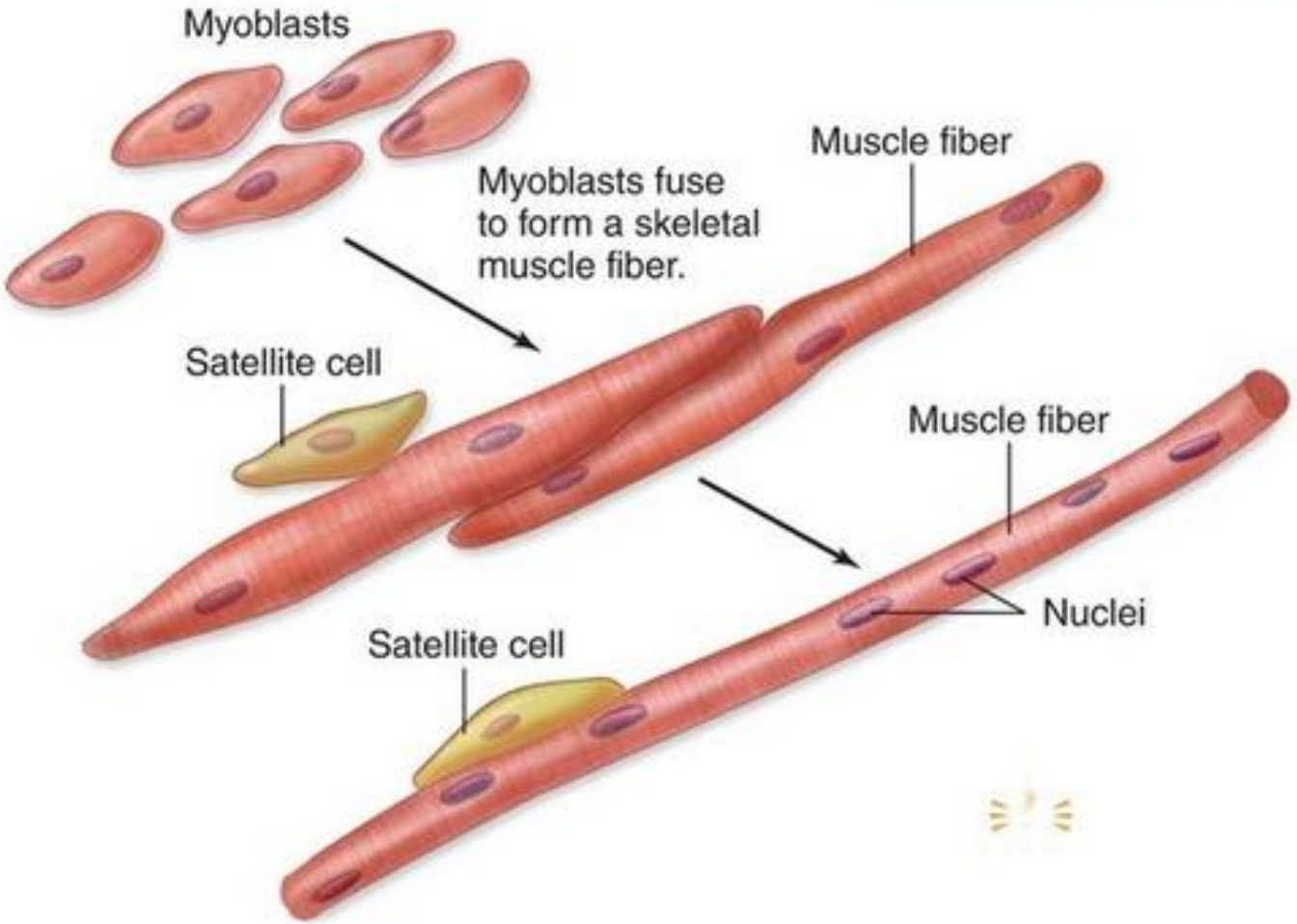
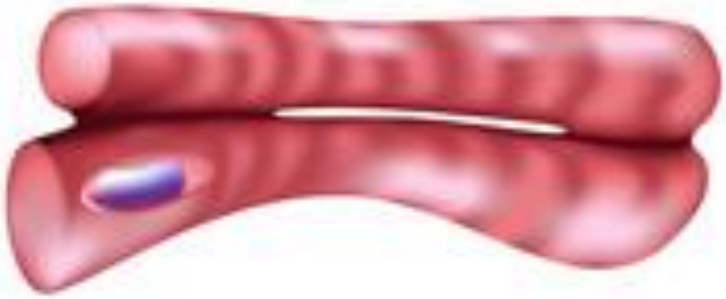


Figure 10.2

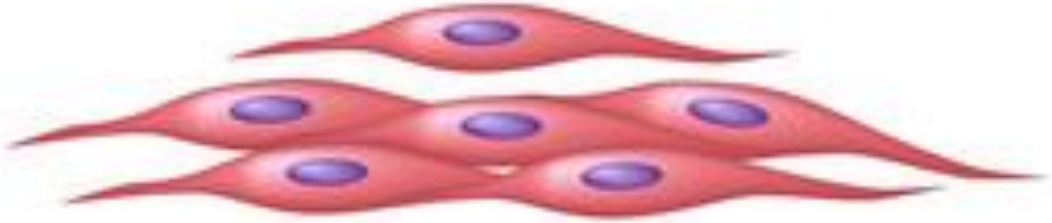
Development of Skeletal Muscle.

Embryonic muscle cells called myoblasts fuse to form a single skeletal muscle fiber. After development, both muscle fibers and satellite cells are present. Satellite cells are myoblasts that do not go on to form the skeletal muscle fiber. Instead, satellite cells remain with postnatal skeletal muscle tissue and assist in repair of muscles.



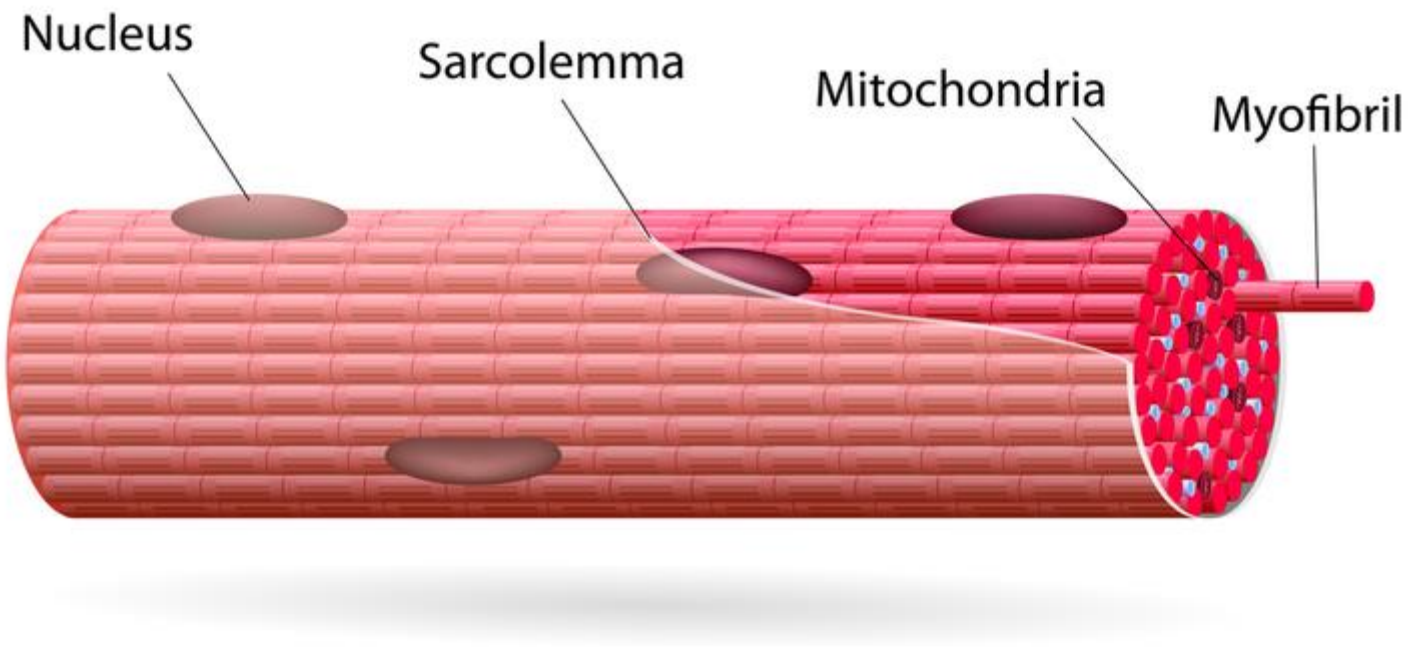
Cardiac muscle cell

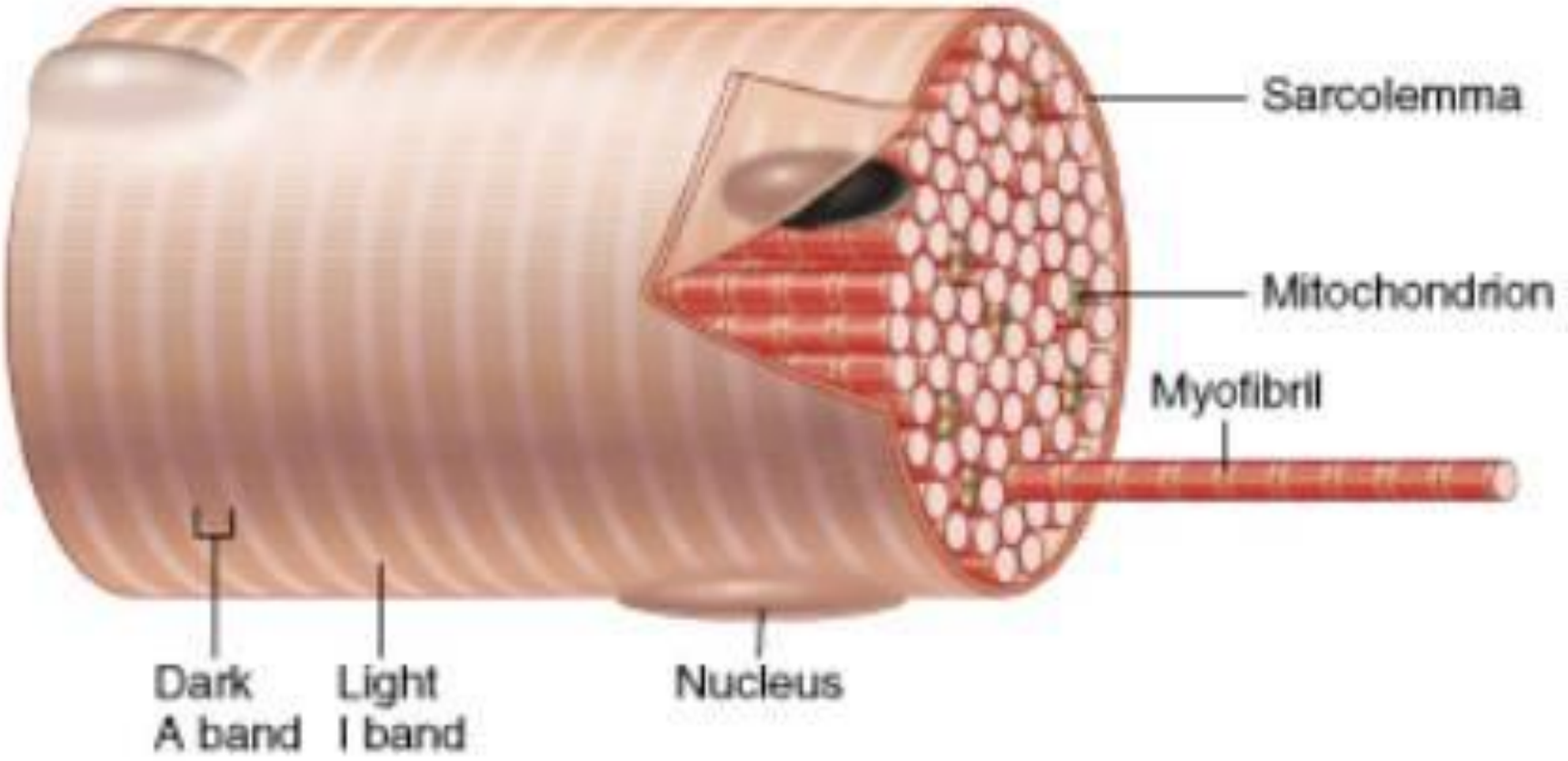
Skeletal muscle cells

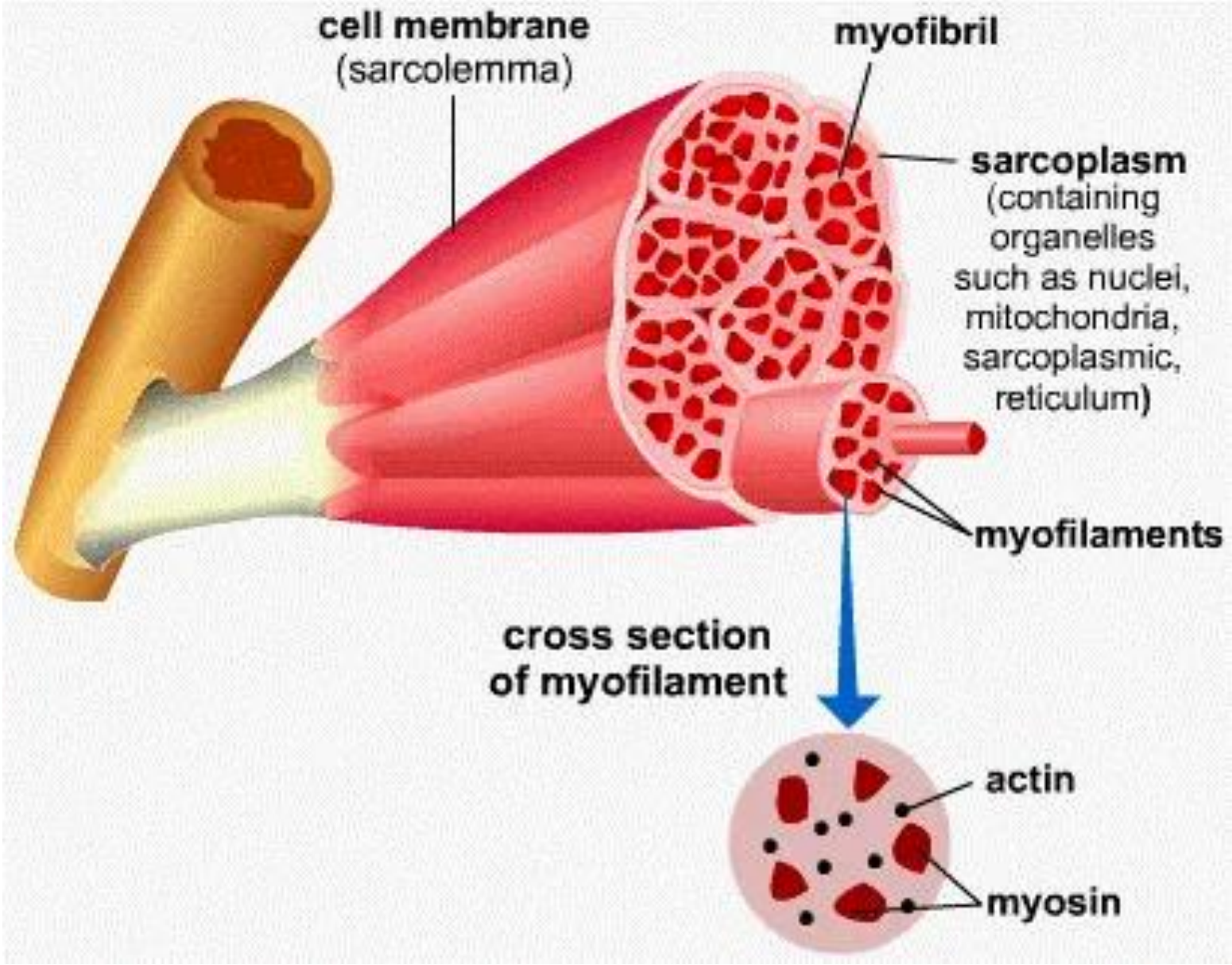


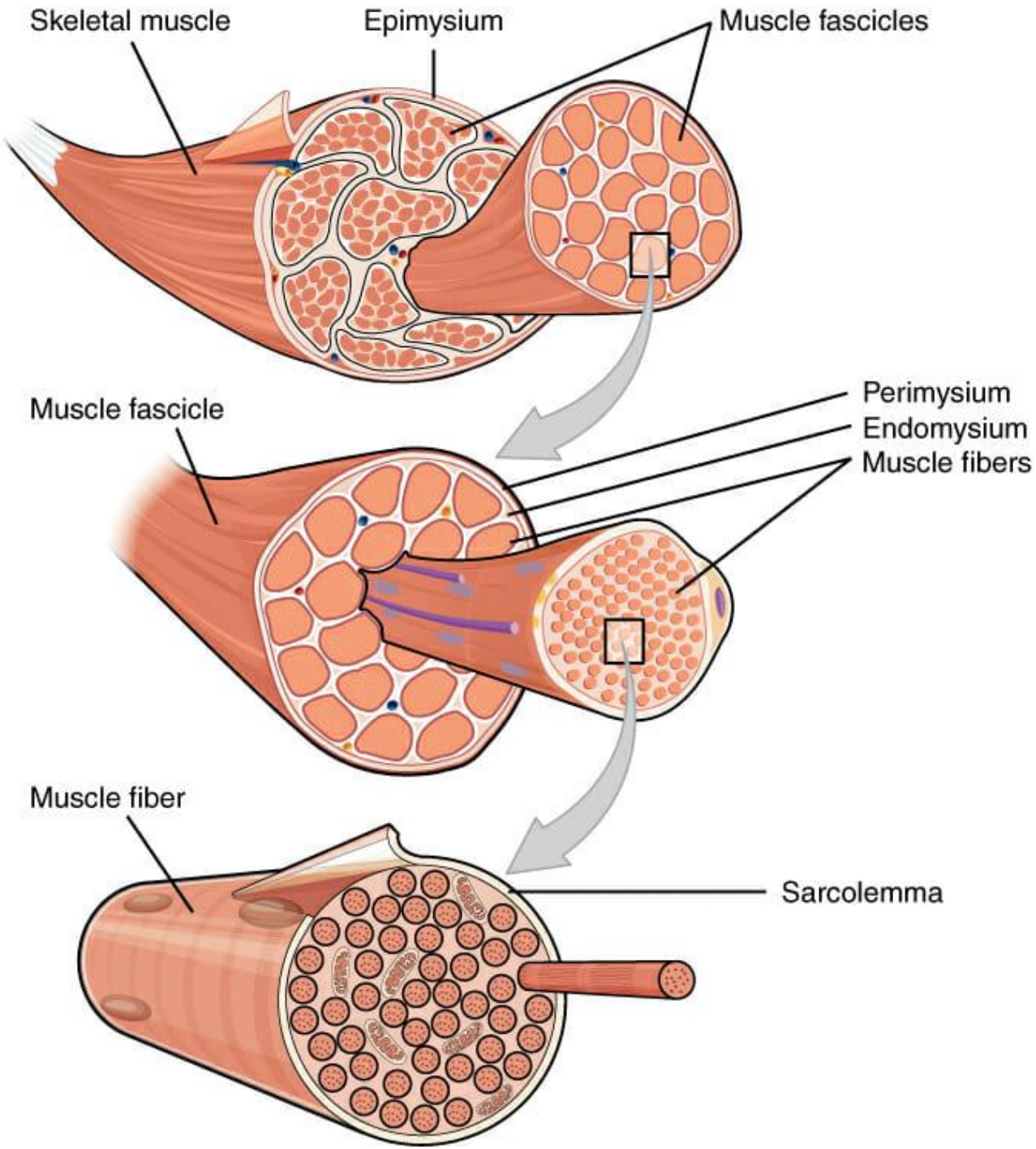
Smooth muscle cells

MUSCLE FIBER

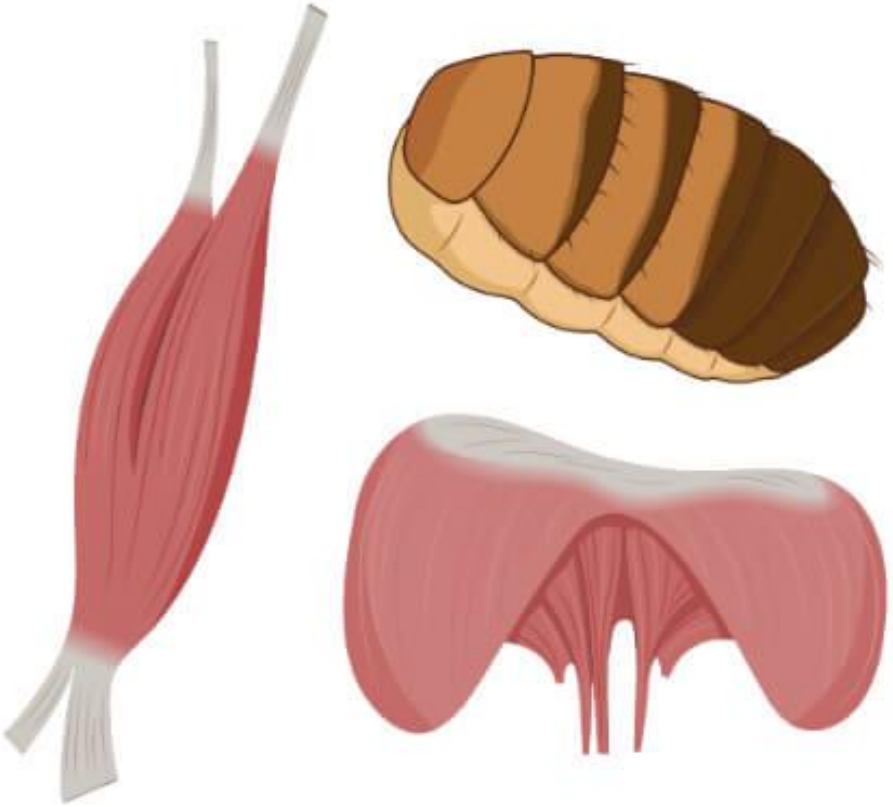


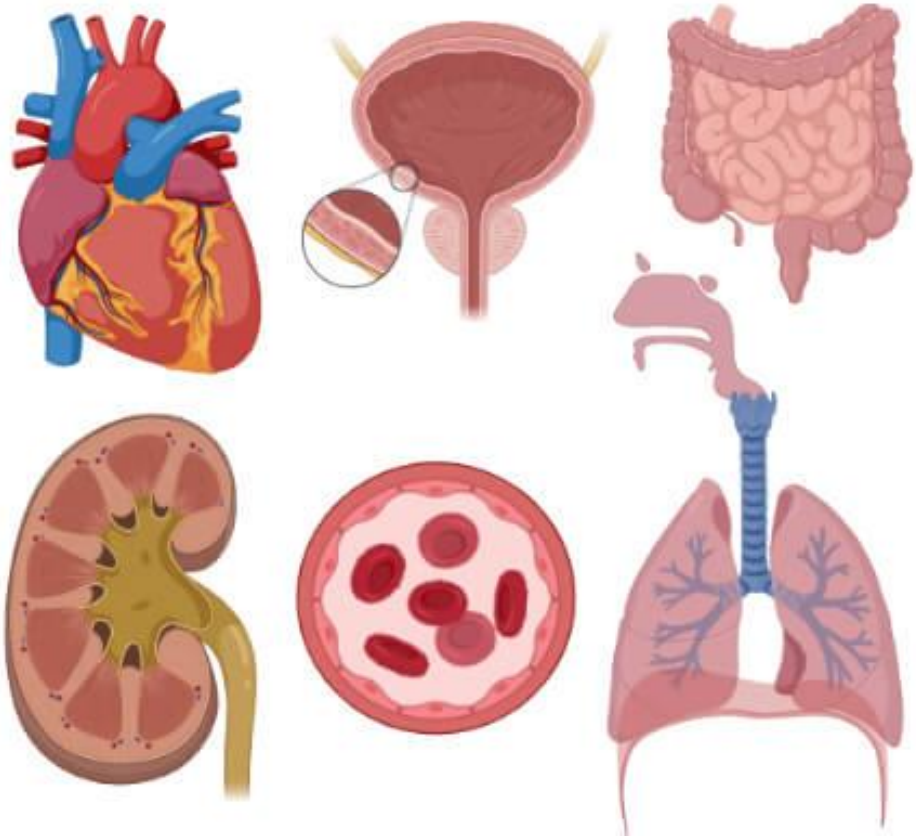

Sarcolemma
Mitochondrion
Myofibril
Dark
A band
Light
I band
Nucleus

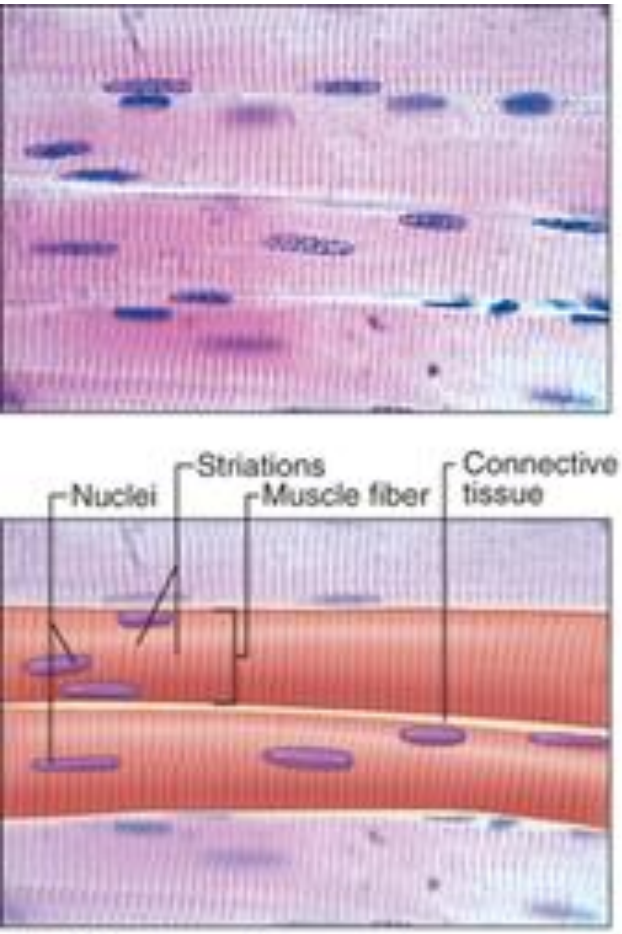

cell membrane
(sarcolemma)
myofibril
sarcoplasm
(containing
organelles
such as nuclei,
mitochondria,
sarcoplasmic,
reticulum)
myofilaments
cross section
of myofilament
actin
myosin


Skeletal muscle
Epimysium
Muscle fascicles
Muscle fascicle
Perimysium
Endomysium
Muscle fibers
Muscle fiber
Sarcolemma

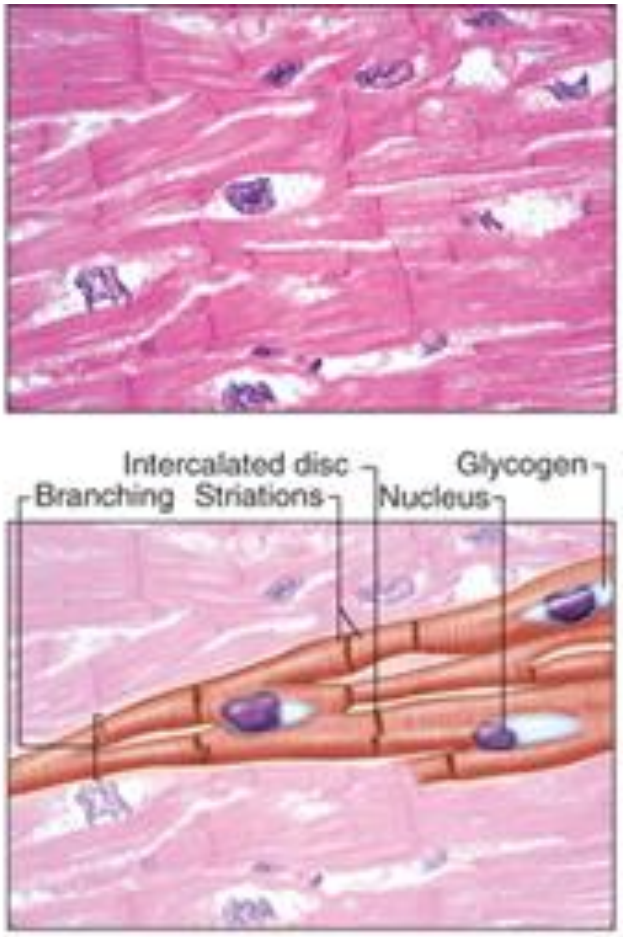
Differences Between Voluntary and Involuntary Muscles



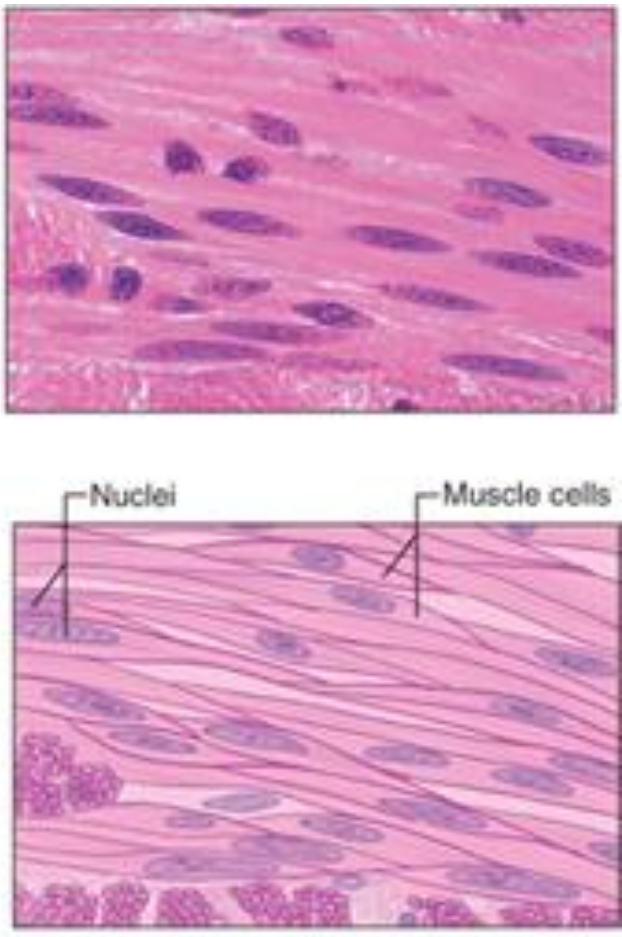




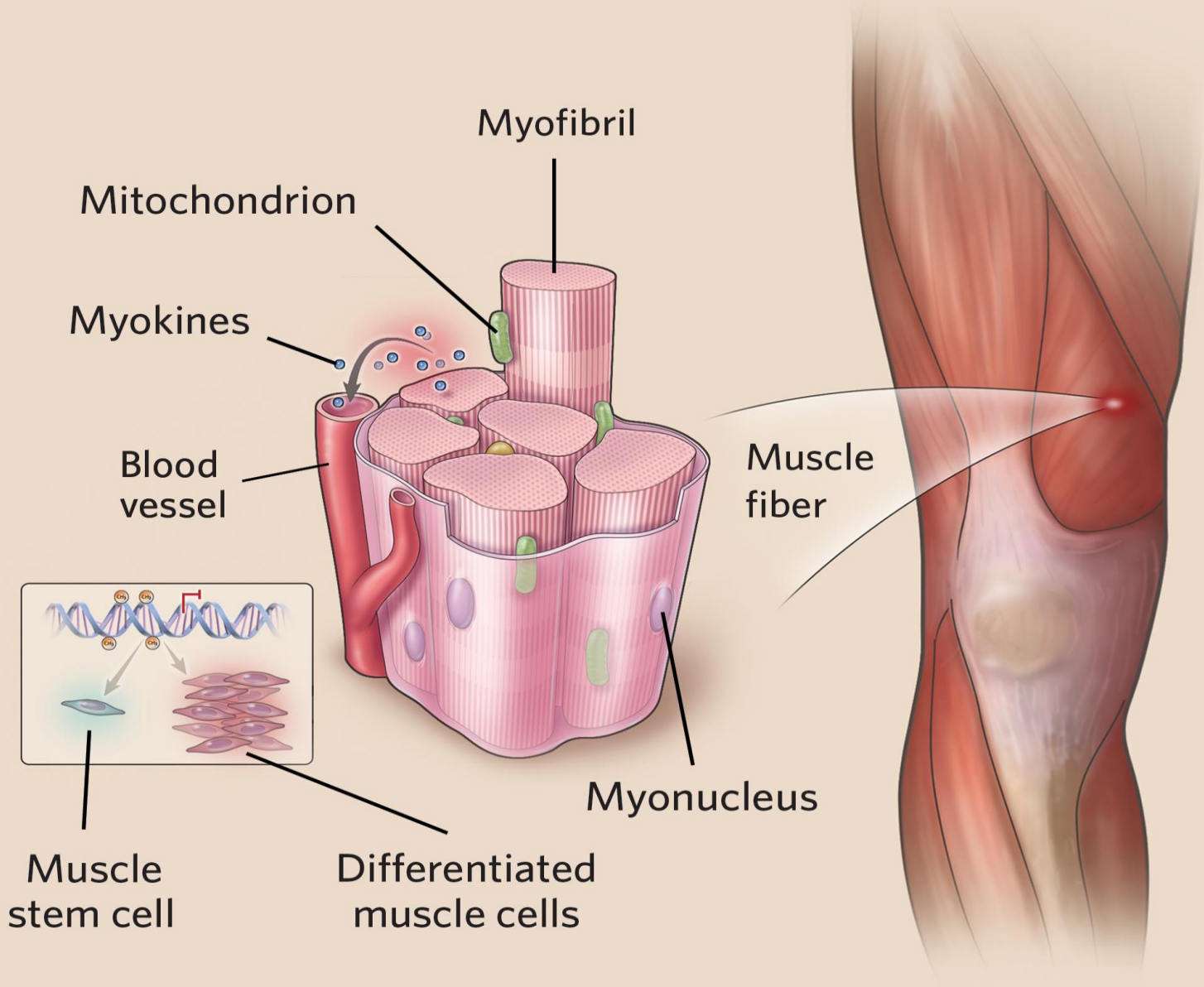
(a) Skeletal muscle



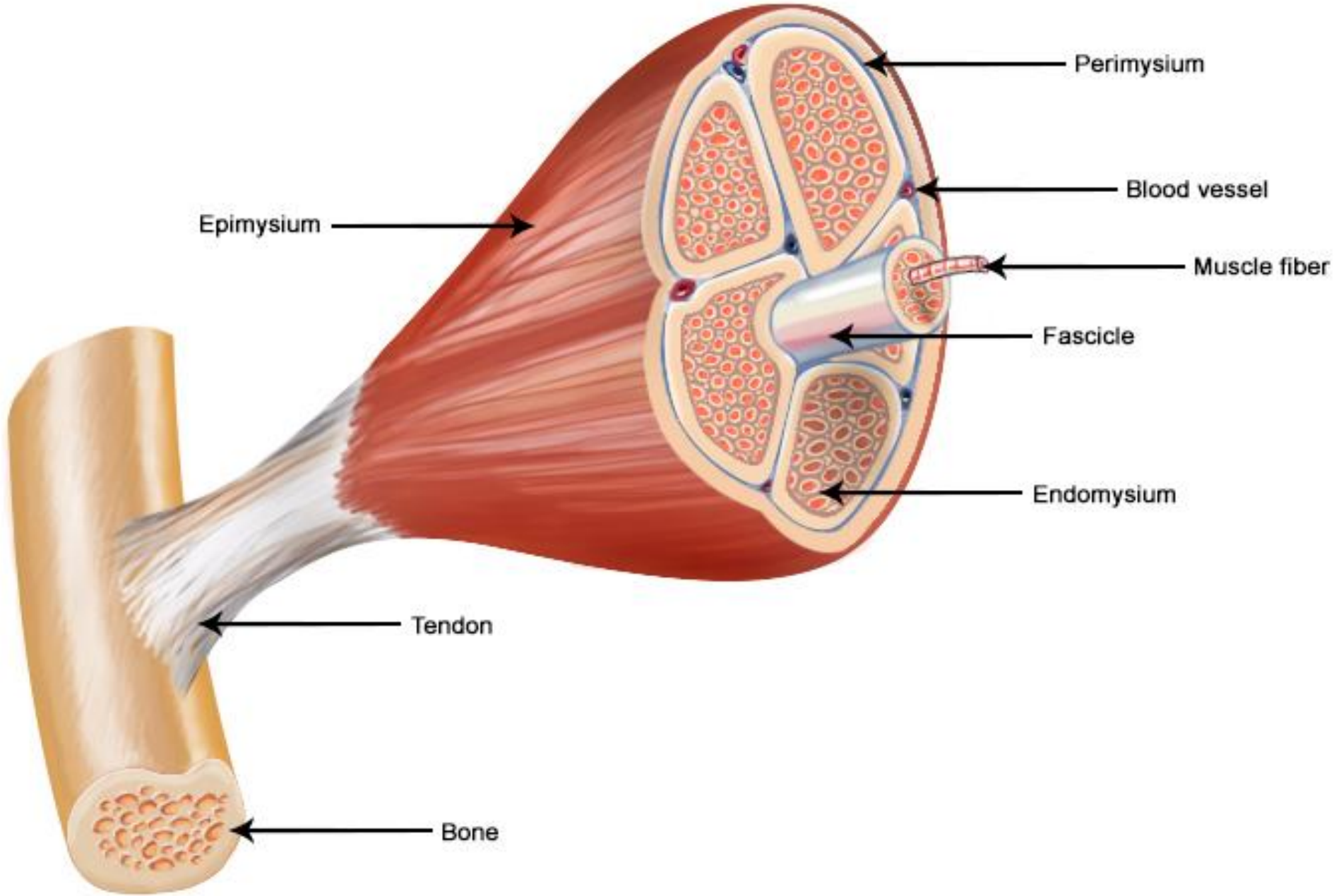
(b) Cardiac muscle

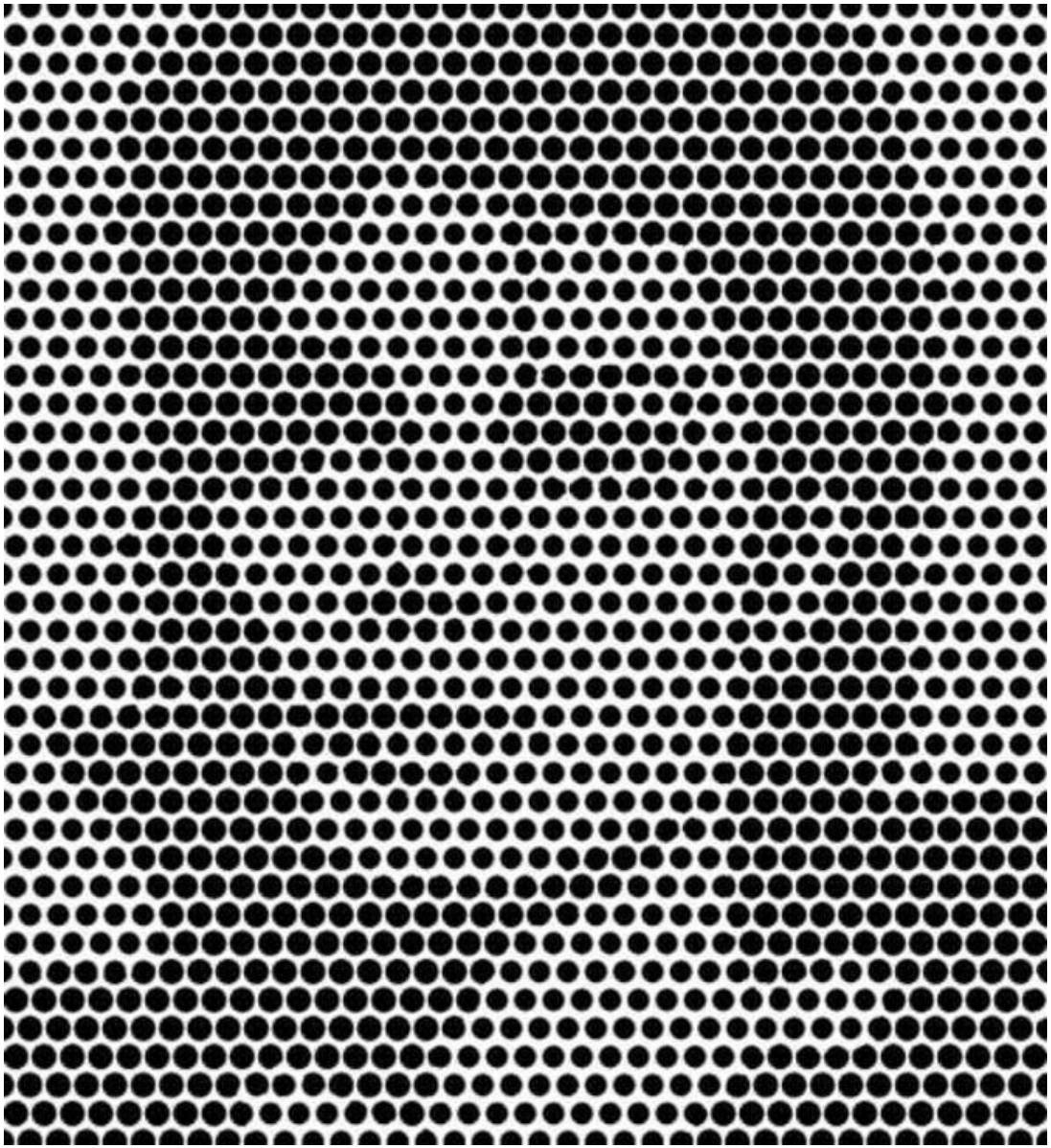


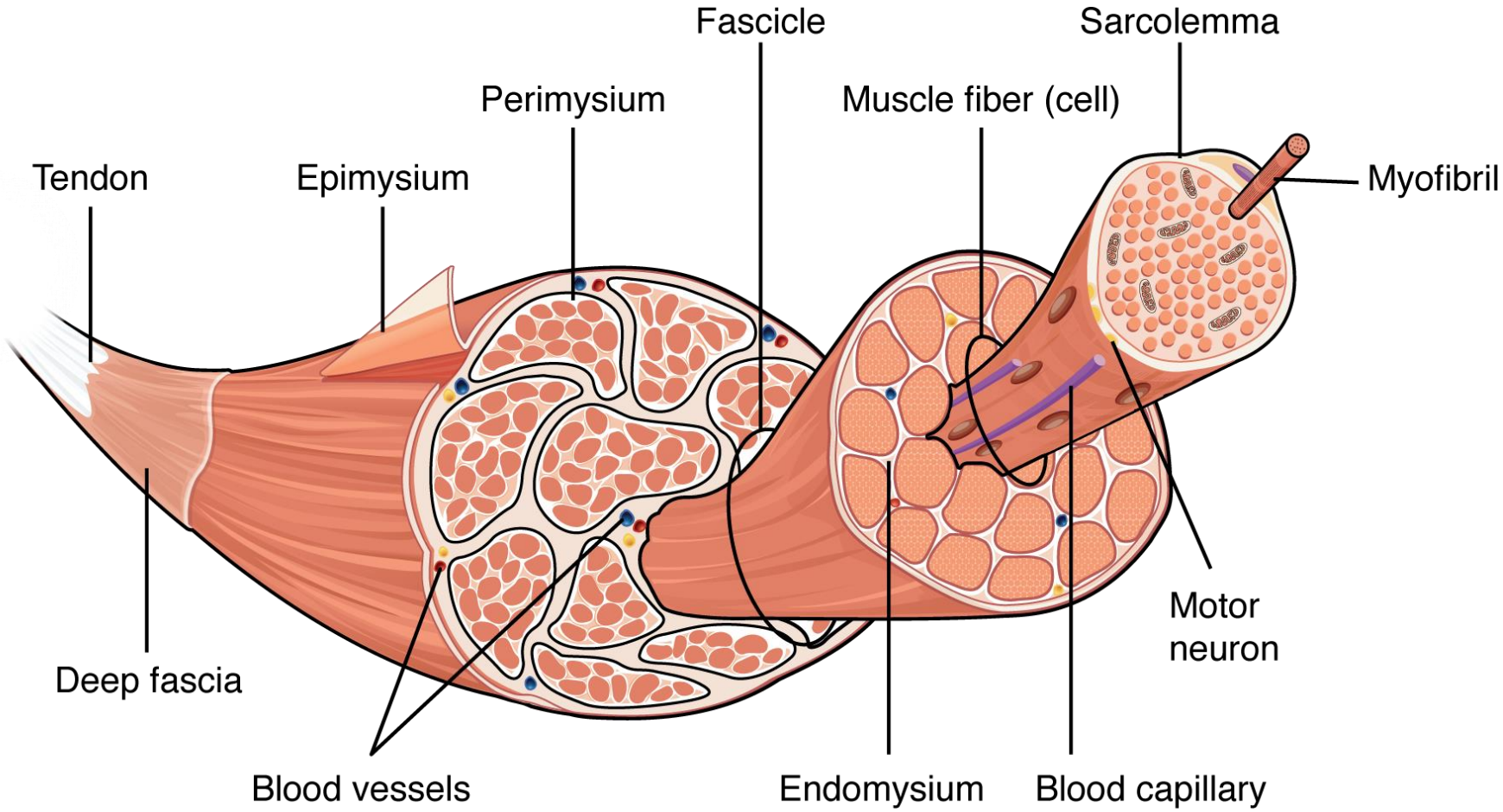
(c) Smooth muscle

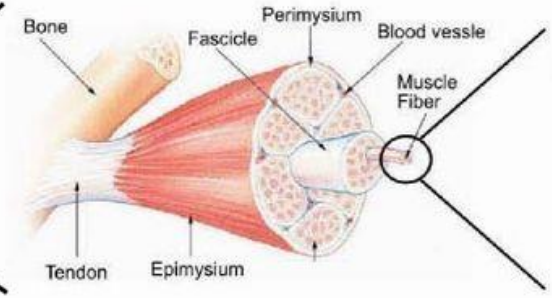

Myofibril
Mitochondrion
Myokines
Blood vessel
Muscle fiber
Myonucleus
Muscle stem cell
Differentiated muscle cells

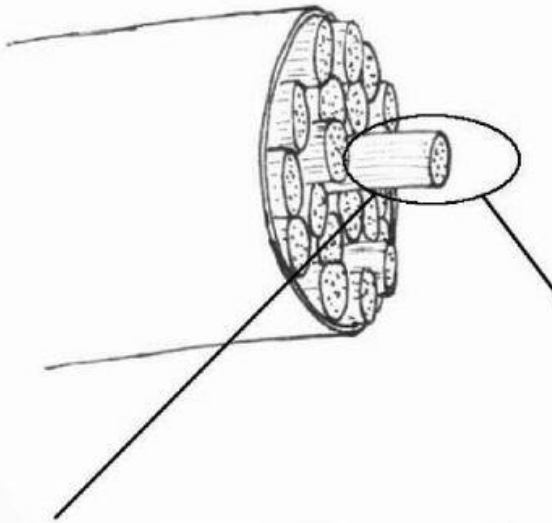
Structure of a Skeletal Muscle

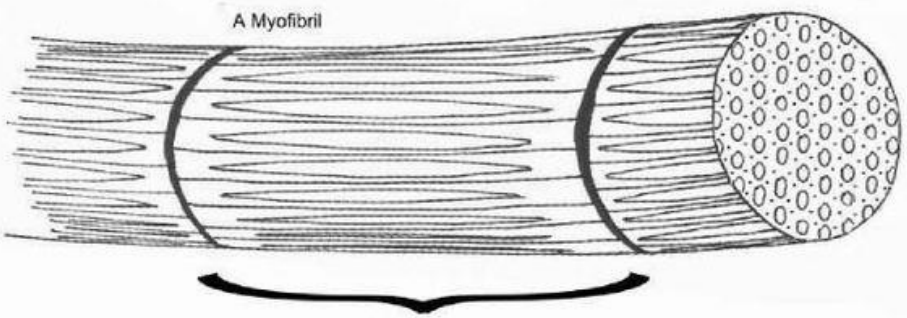


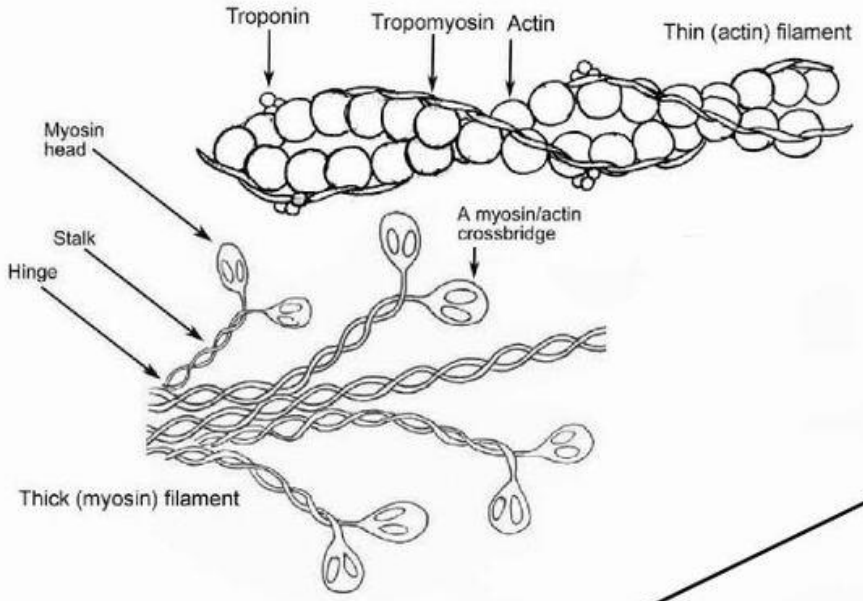


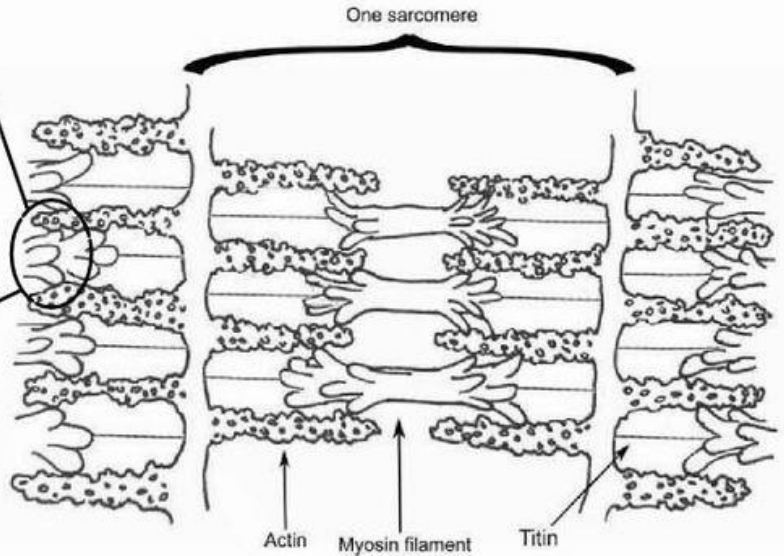

Fascicle
Sarcolemma
Perimysium
Muscle fiber (cell)
Tendon
Epimysium
Myofibril
Motor
neuron
Deep fascia
Blood vessels
Endomysium
Blood capillary

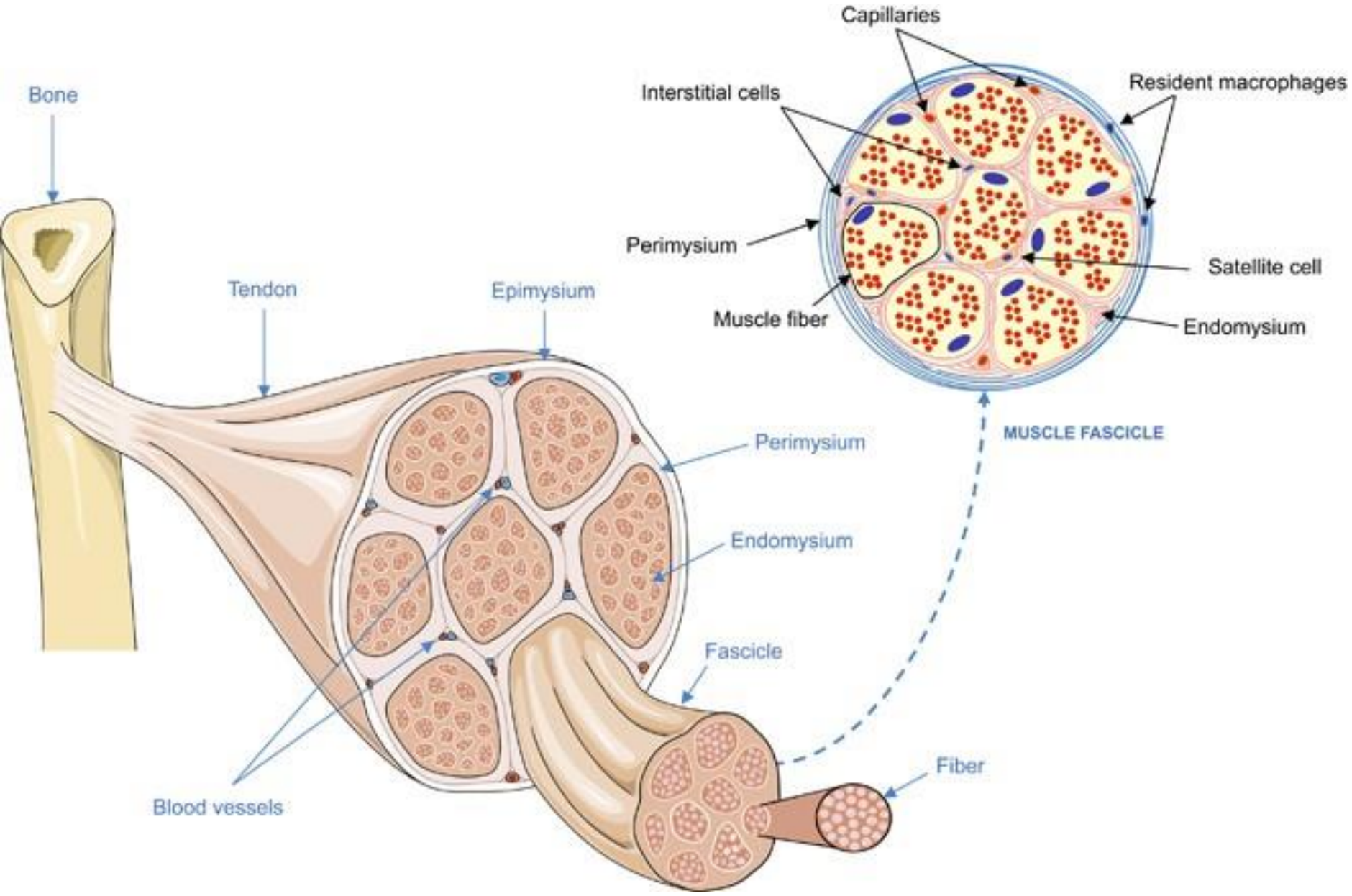

Bone
Perimysium
Fascicle
Blood vessle
Muscle Fiber
Tendon
Epimysium

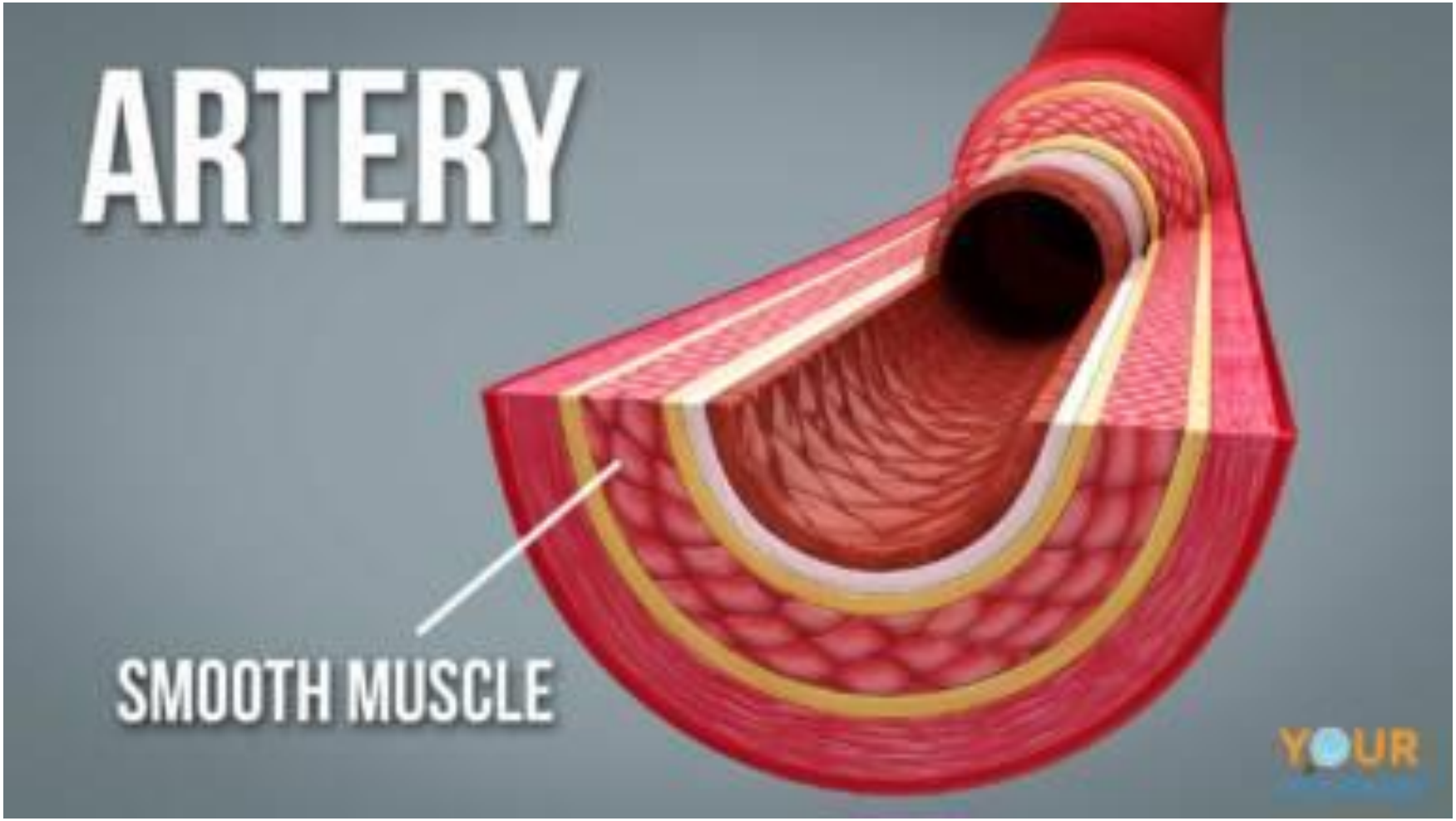


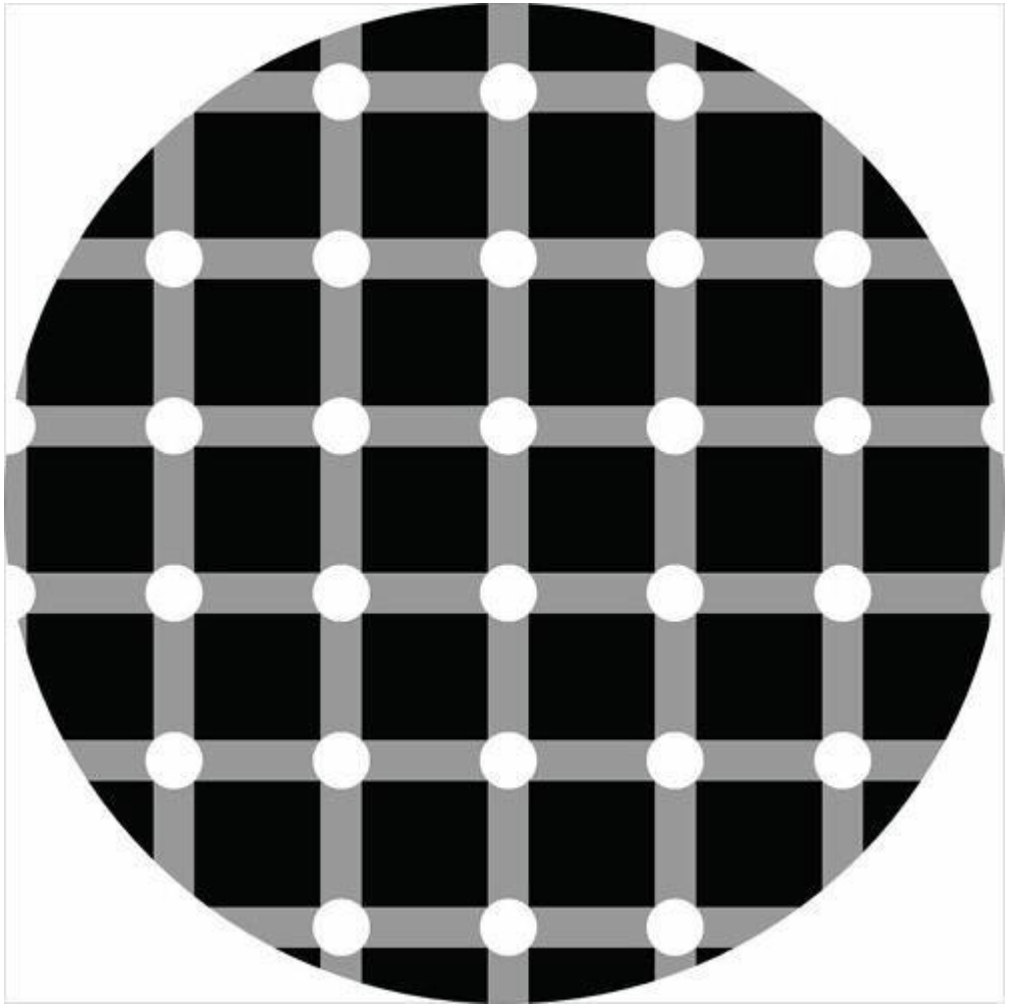

A Myofibril

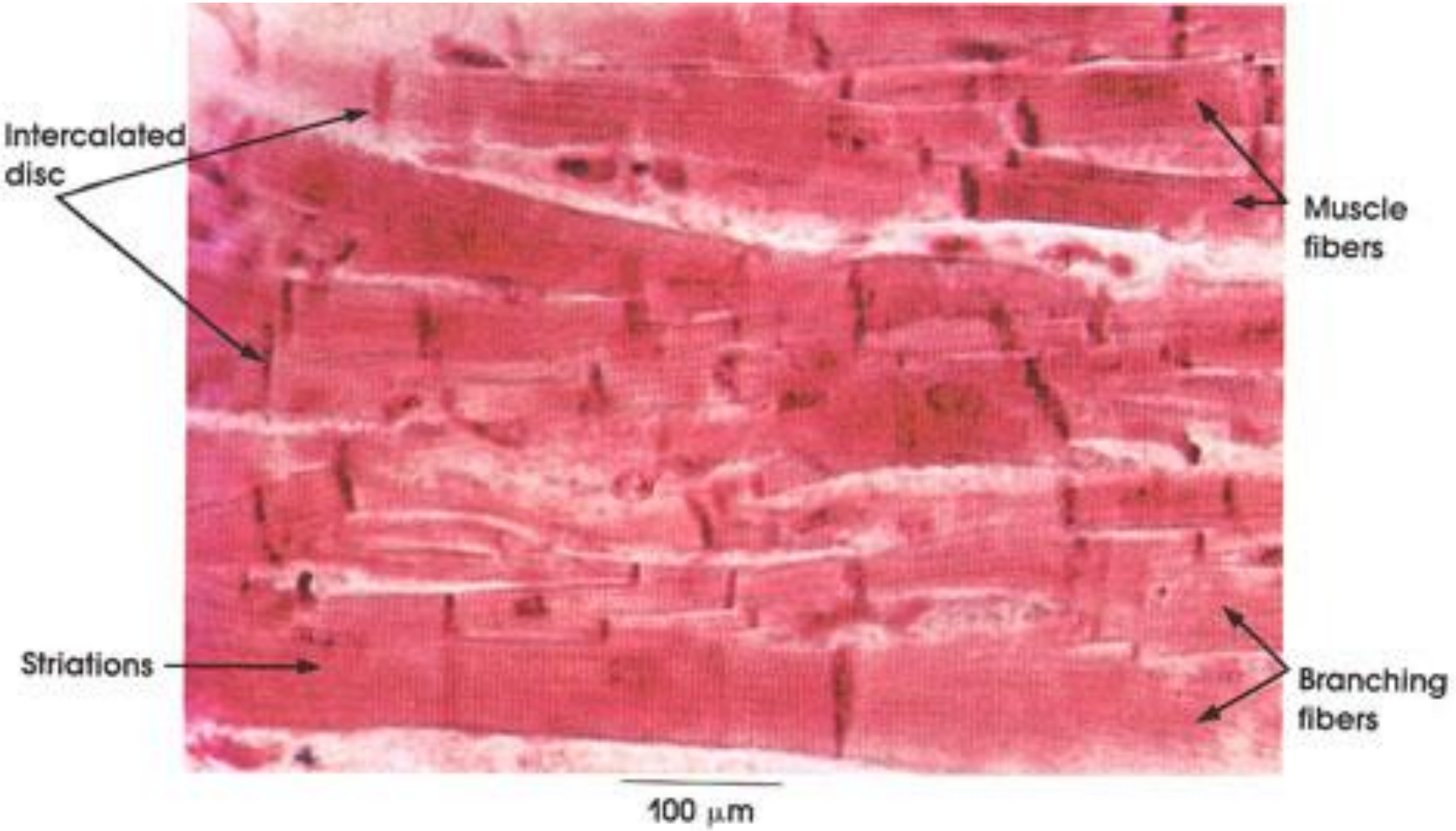

Troponin
Tropomyosin
Actin
Thin (actin) filament
Myosin head
A myosin/actin crossbridge
Stalk
Hinge
Thick (myosin) filament


One sarcomere
Actin
Myosin filament
Titin

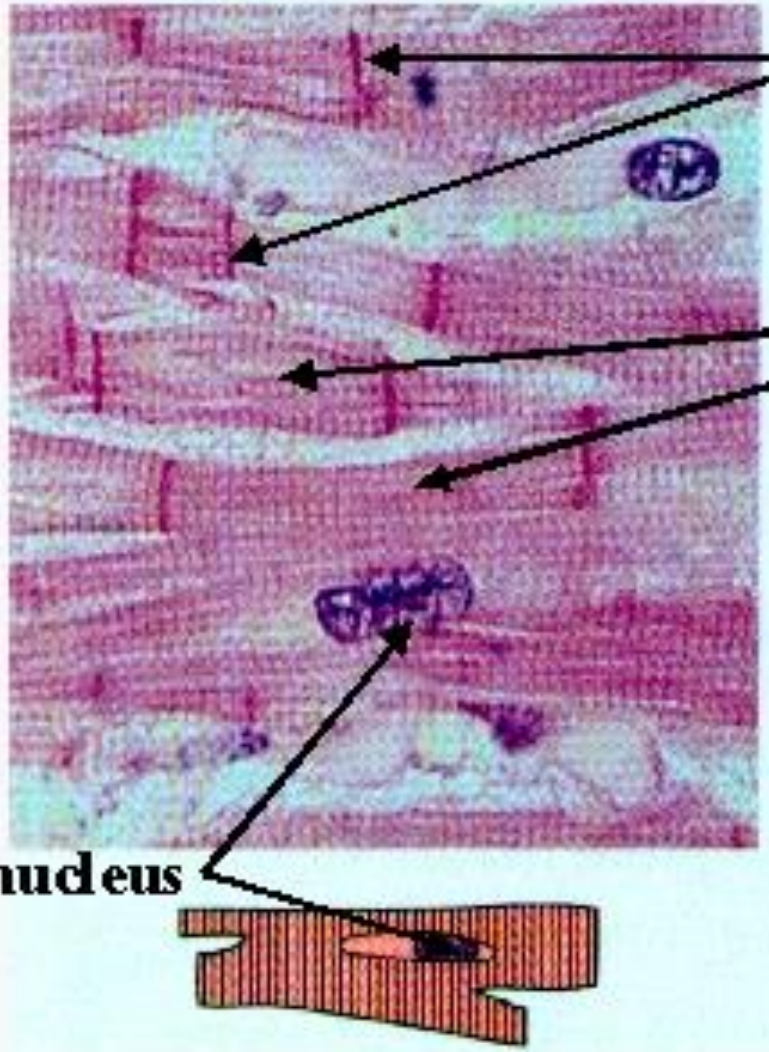

Capillaries
Interstitial cells
Resident macrophages
Perimysium
Satellite cell
Muscle fiber
Endomysium
MUSCLE FASCICLE
Bone
Tendon
Epimysium
Perimysium
Endomysium
Fascicle
Fiber
Blood vessels


ARTERY
SMOOTH MUSCLE
YOUR




Intercalated disc
Muscle fibers
Striations
Branching fibers
100 μm

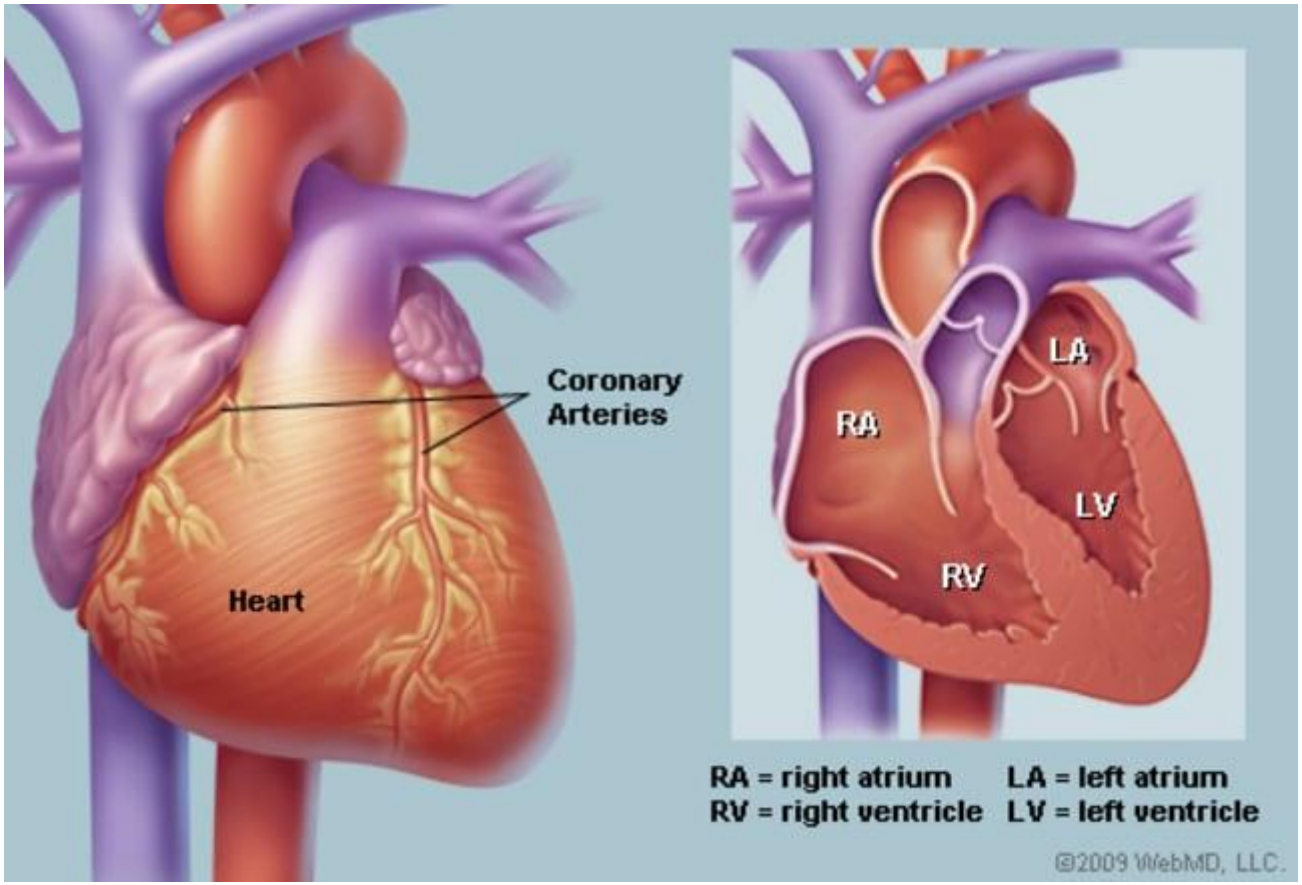
Cardiac Muscle Structure



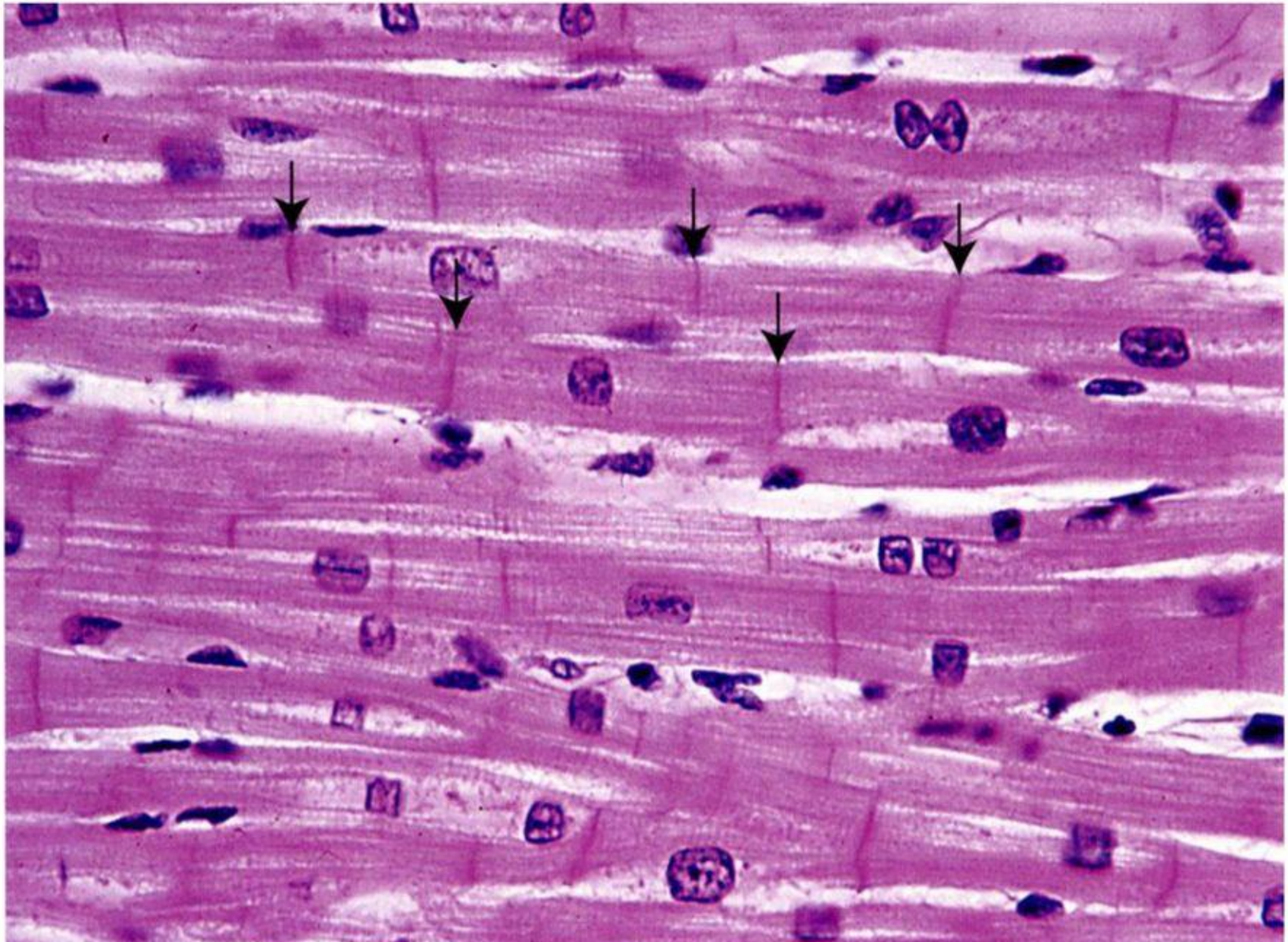
Intercalated disks are anchoring structures containing gap junctions

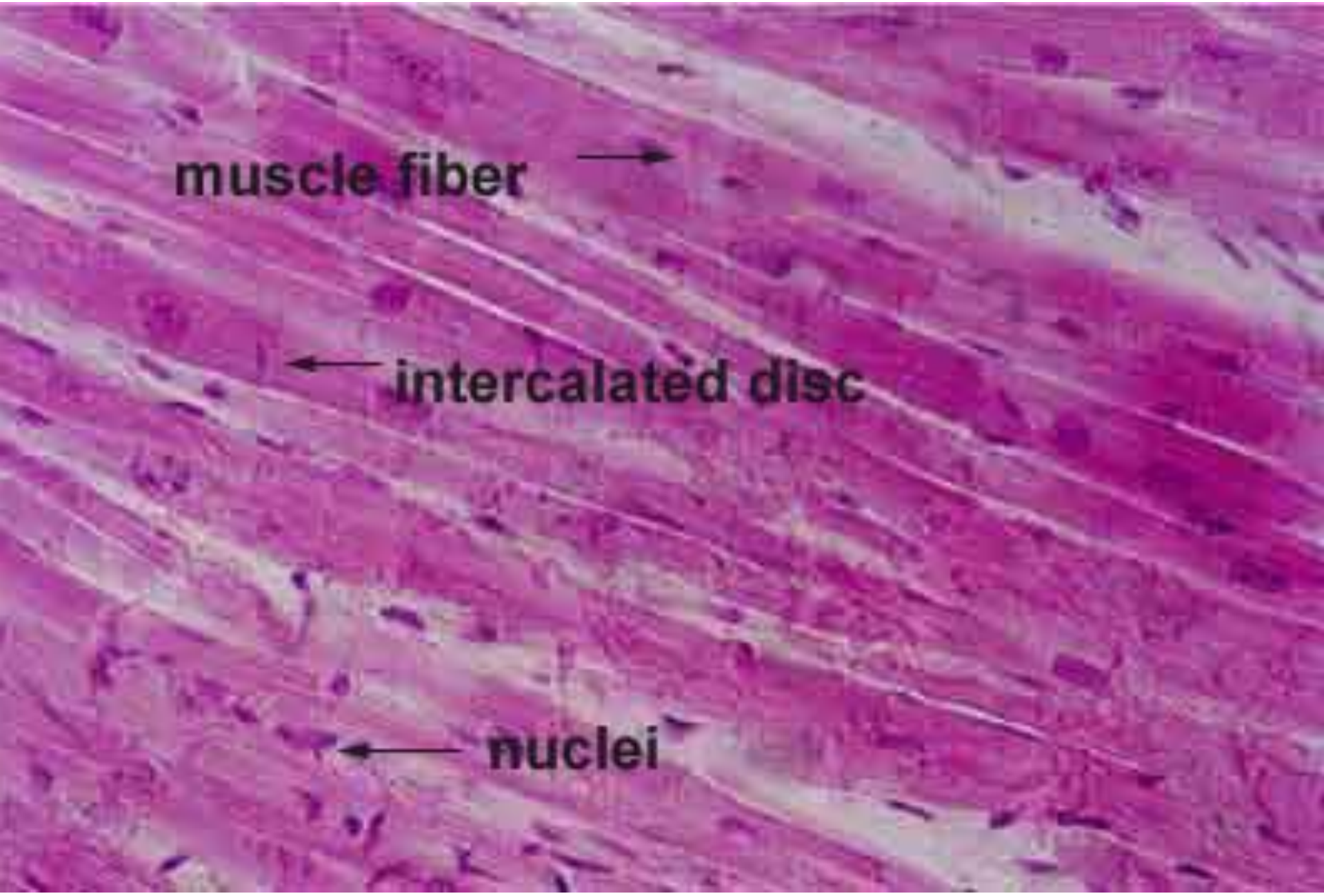
Cardiac muscle cells are faintly striated, branching, mononucleated cells, which connect by means of intercalated disks to form a functional network.

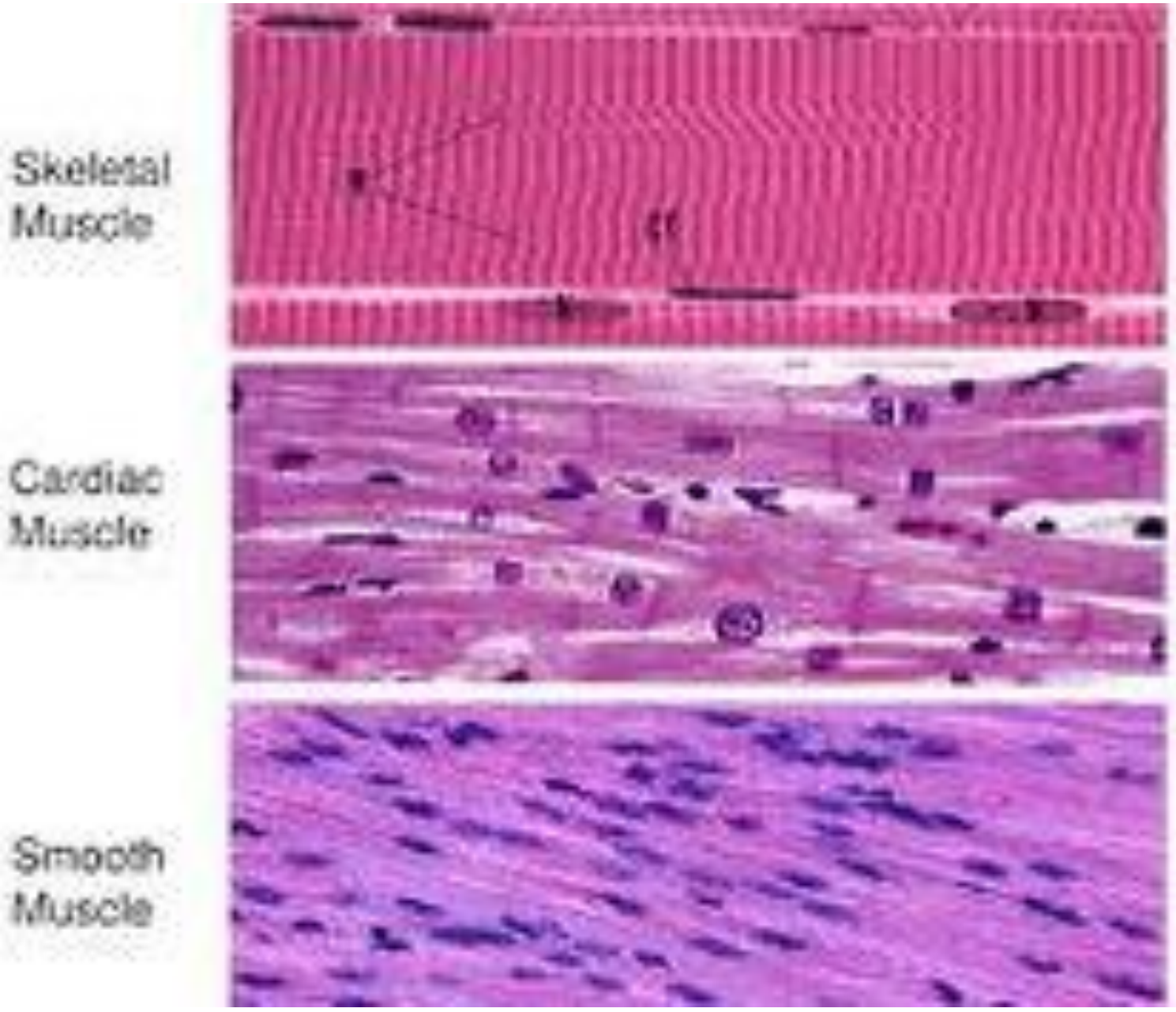
The action potential travels through all cells connected together forming a functional syncytium in which cells function as a unit.


Coronary Arteries
Heart
LA
RA
LV
RV
RA = right atrium
RV = right ventricle
LA = left atrium
LV = left ventricle
©2009 WebMD, LLC.

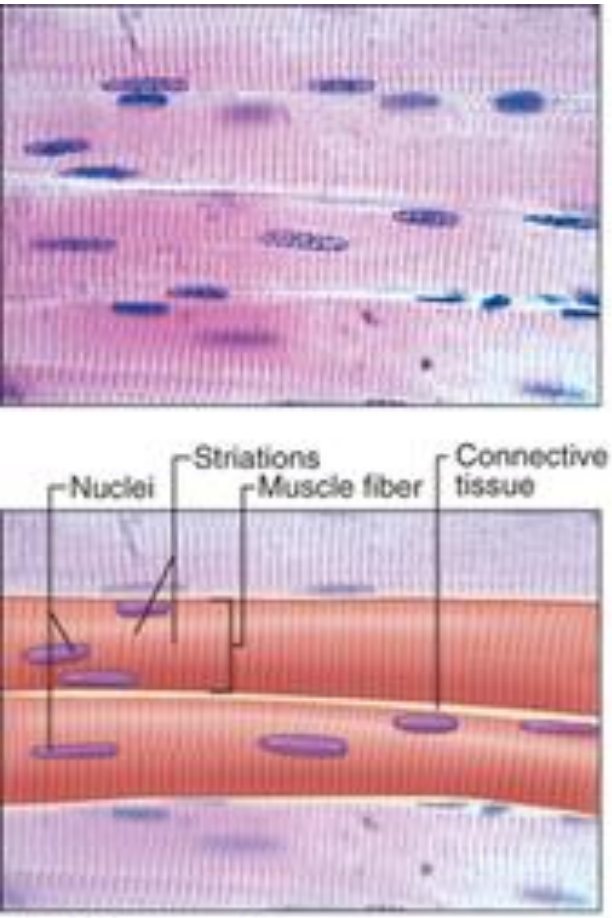
Cardiac Muscle (LS)



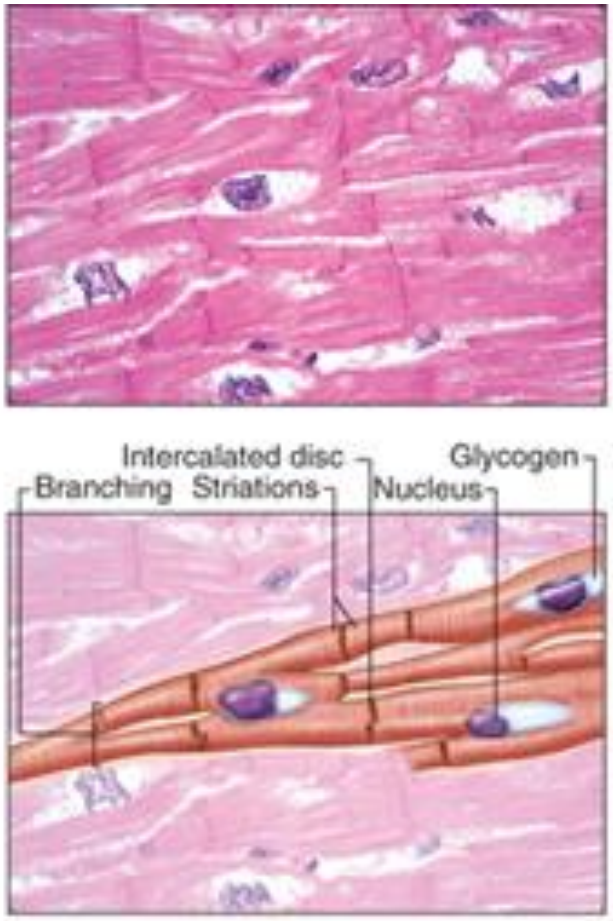

muscle fiber
intercalated disc
nuclei


Skeletal Muscle
Cardiac Muscle
Smooth Muscle


Coca-Cola

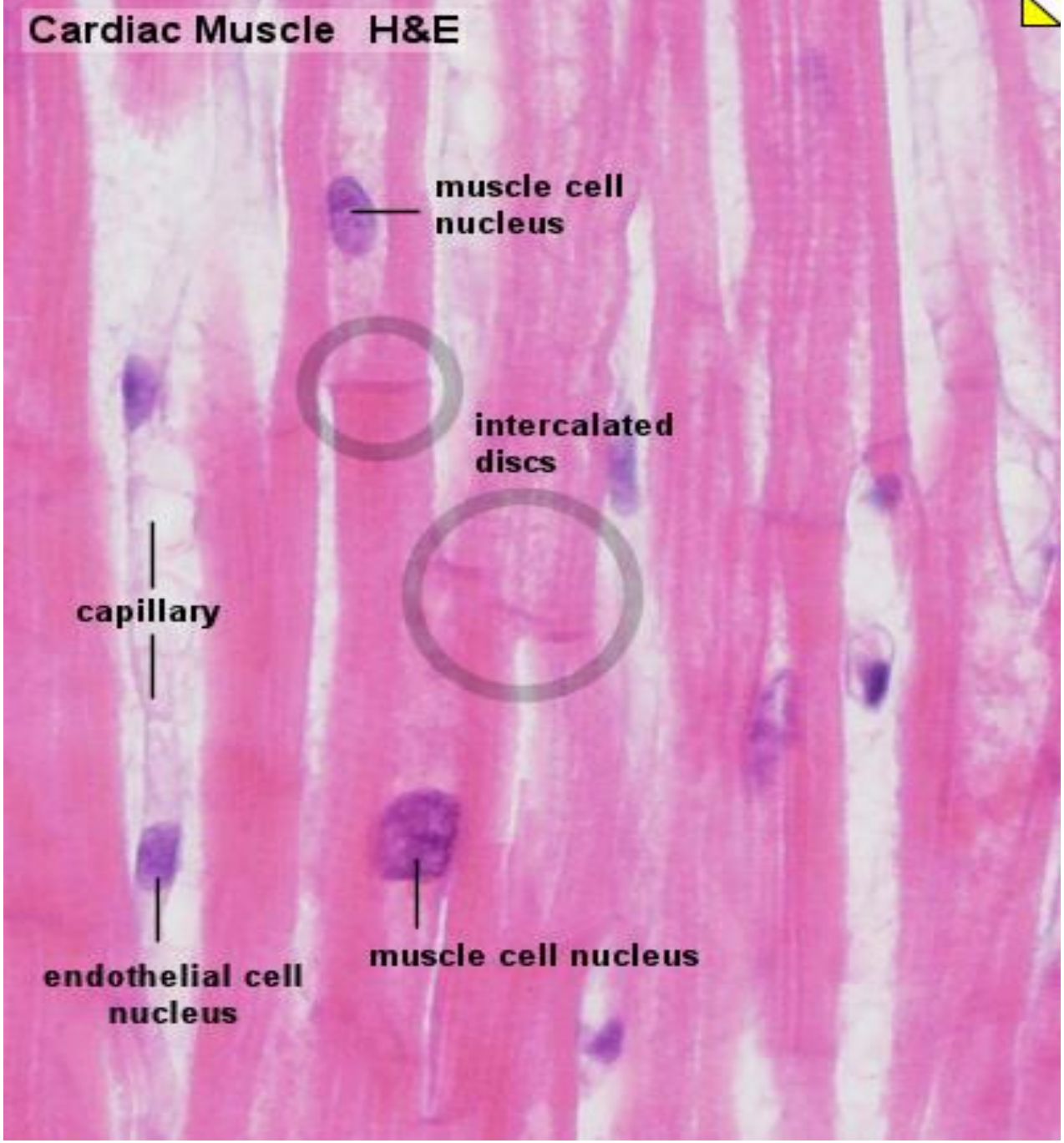


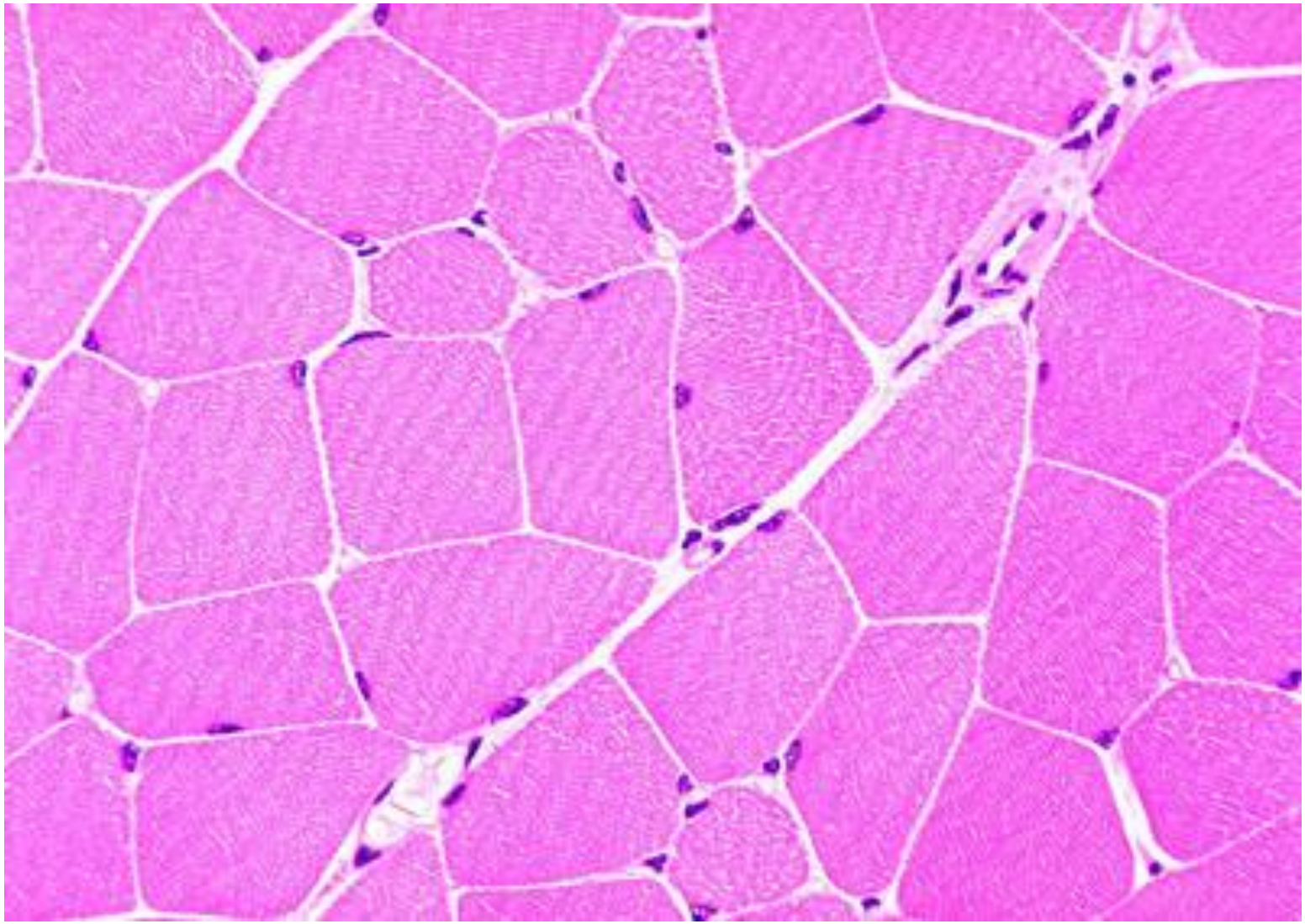
(a) Skeletal muscle

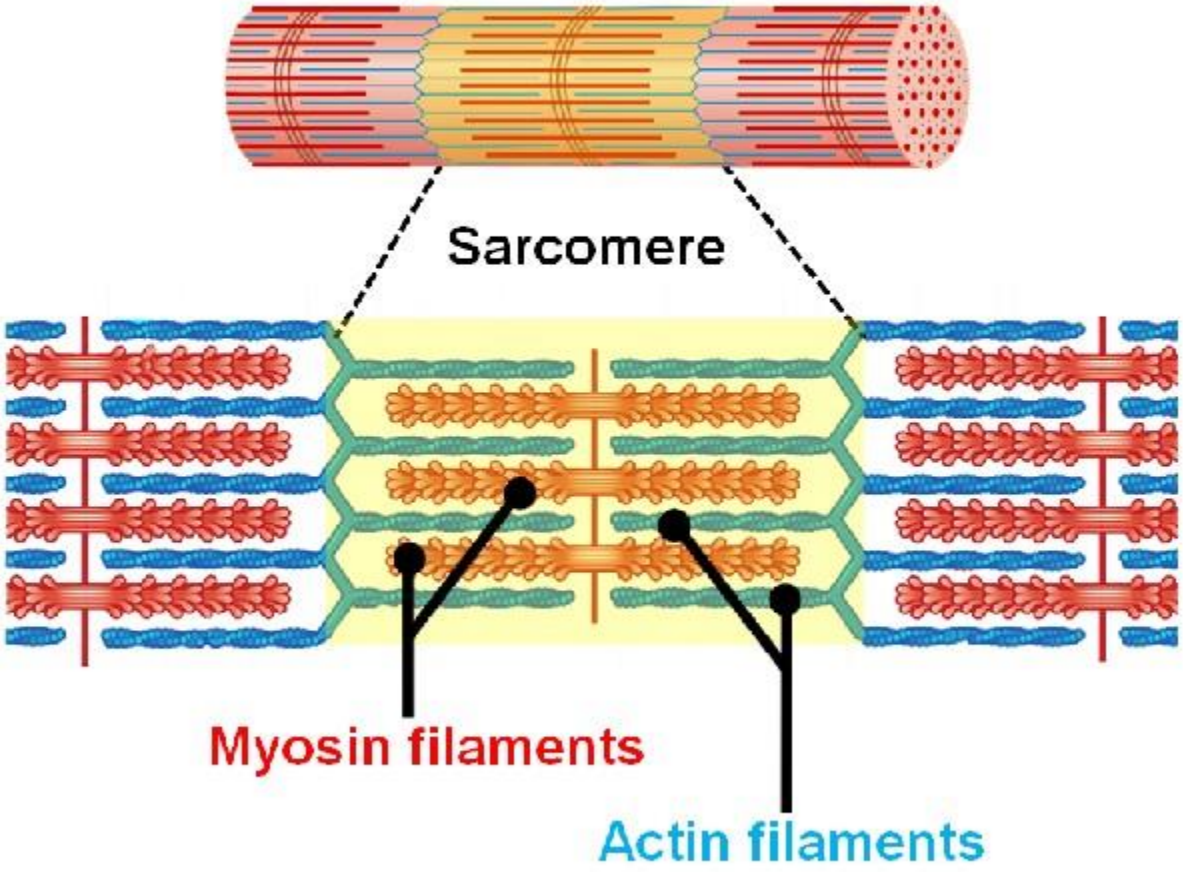


(b) Cardiac muscle

(c) Smooth muscle


Cardiac Muscle H&E
muscle cell nucleus
intercalated discs
capillary
endothelial cell nucleus
muscle cell nucleus



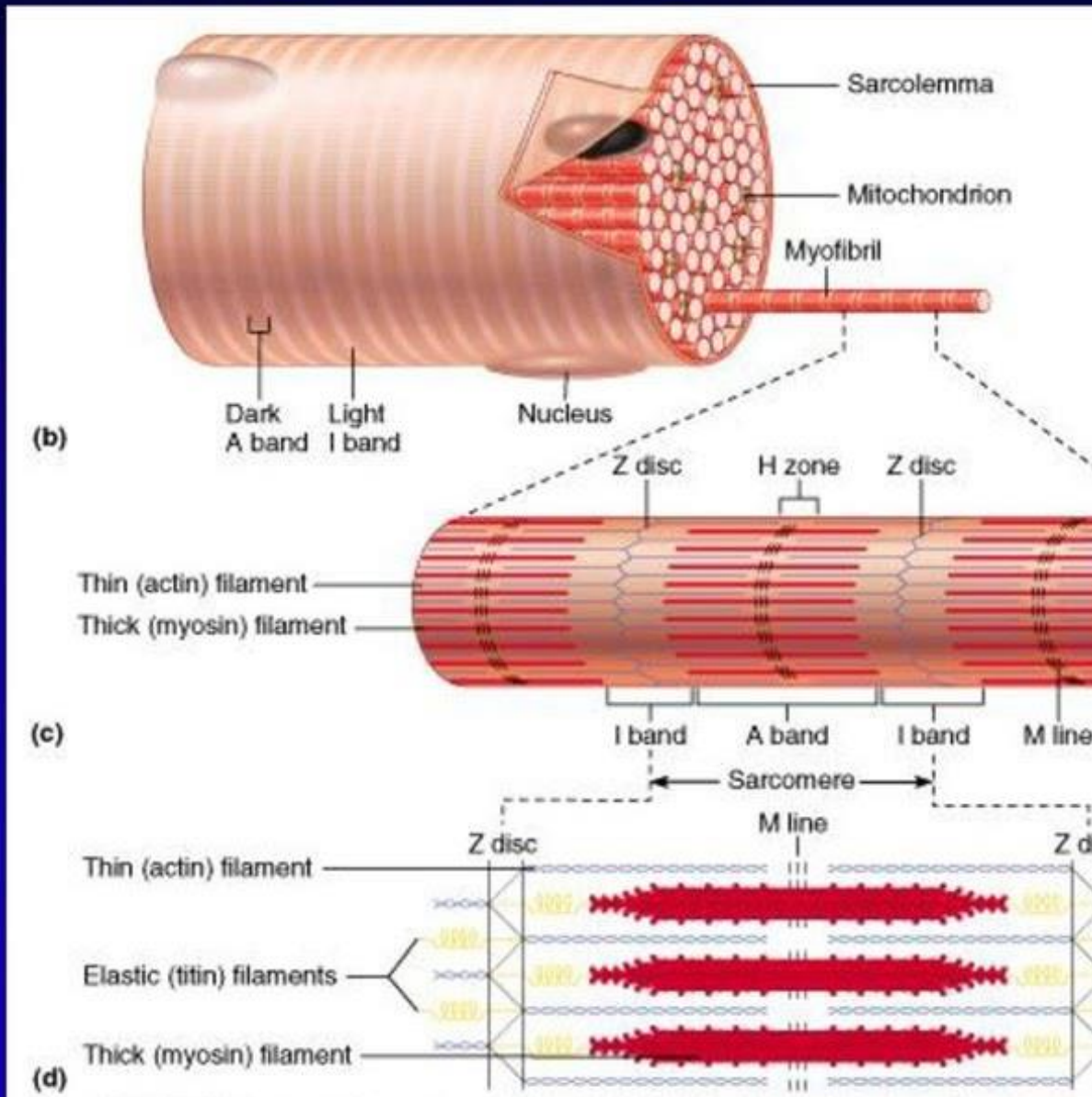

Sarcomere
Myosin filaments
Actin filaments

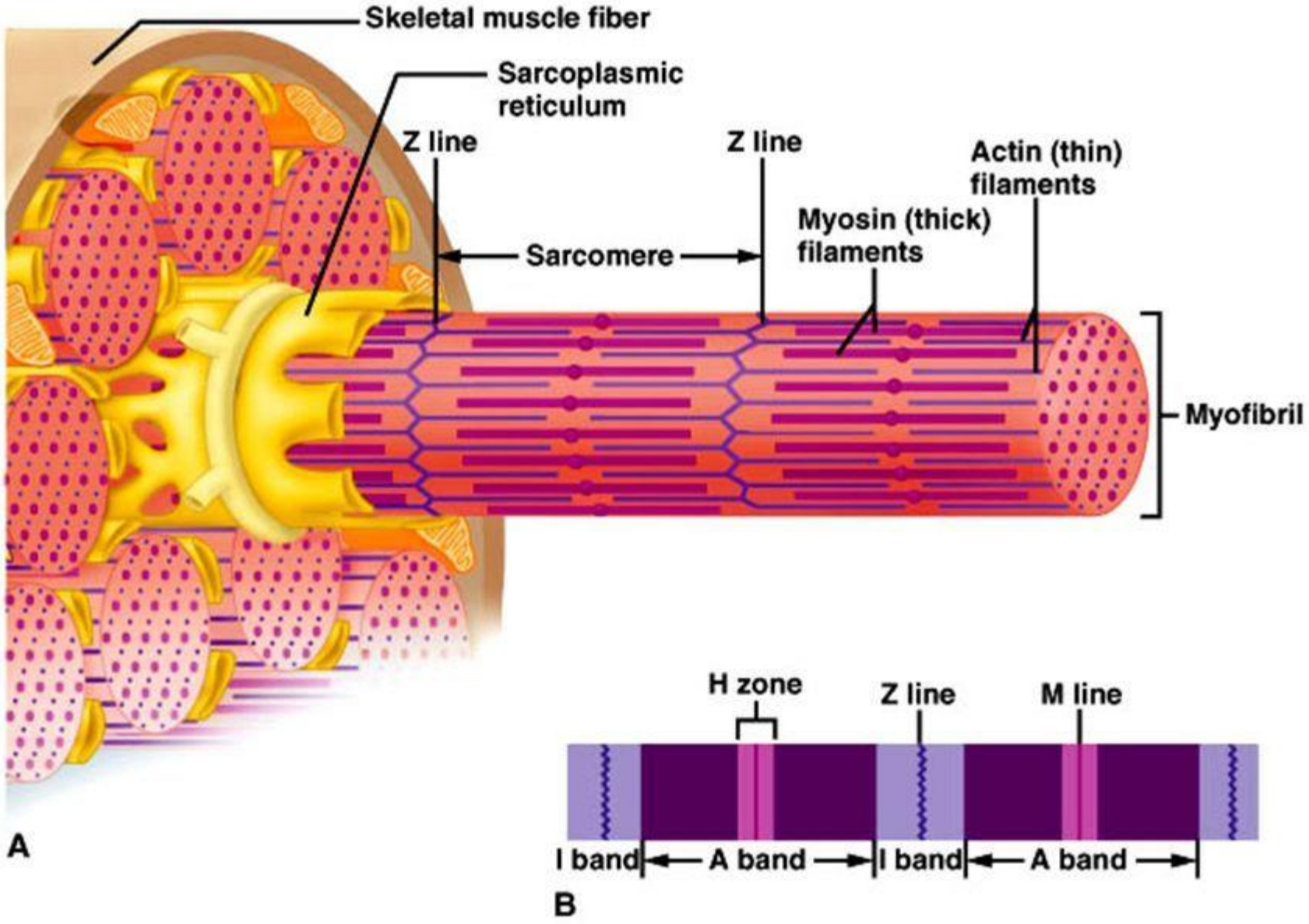
Use the picture to come up with a definition of the following:

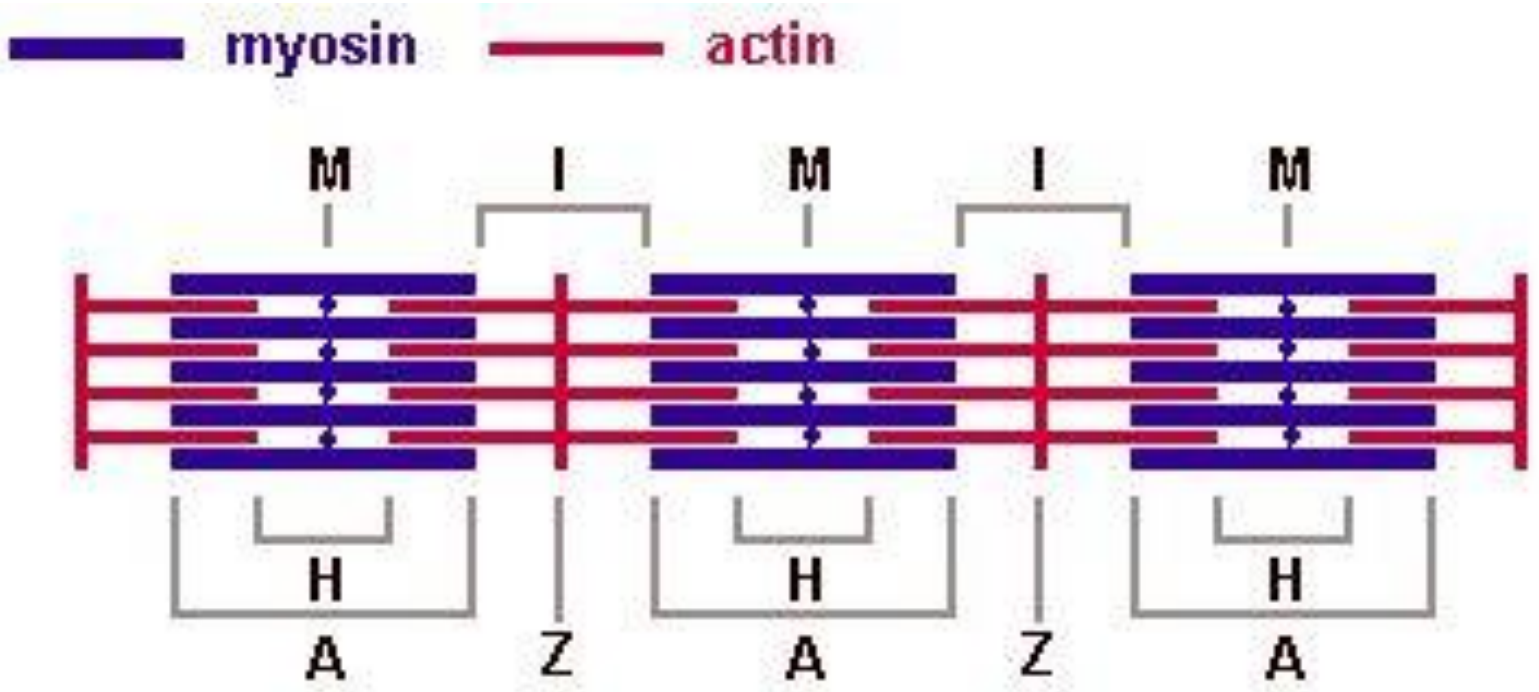
I band – area without myosin fibers; aka light band

A band – area with myosin fibers; aka dark band

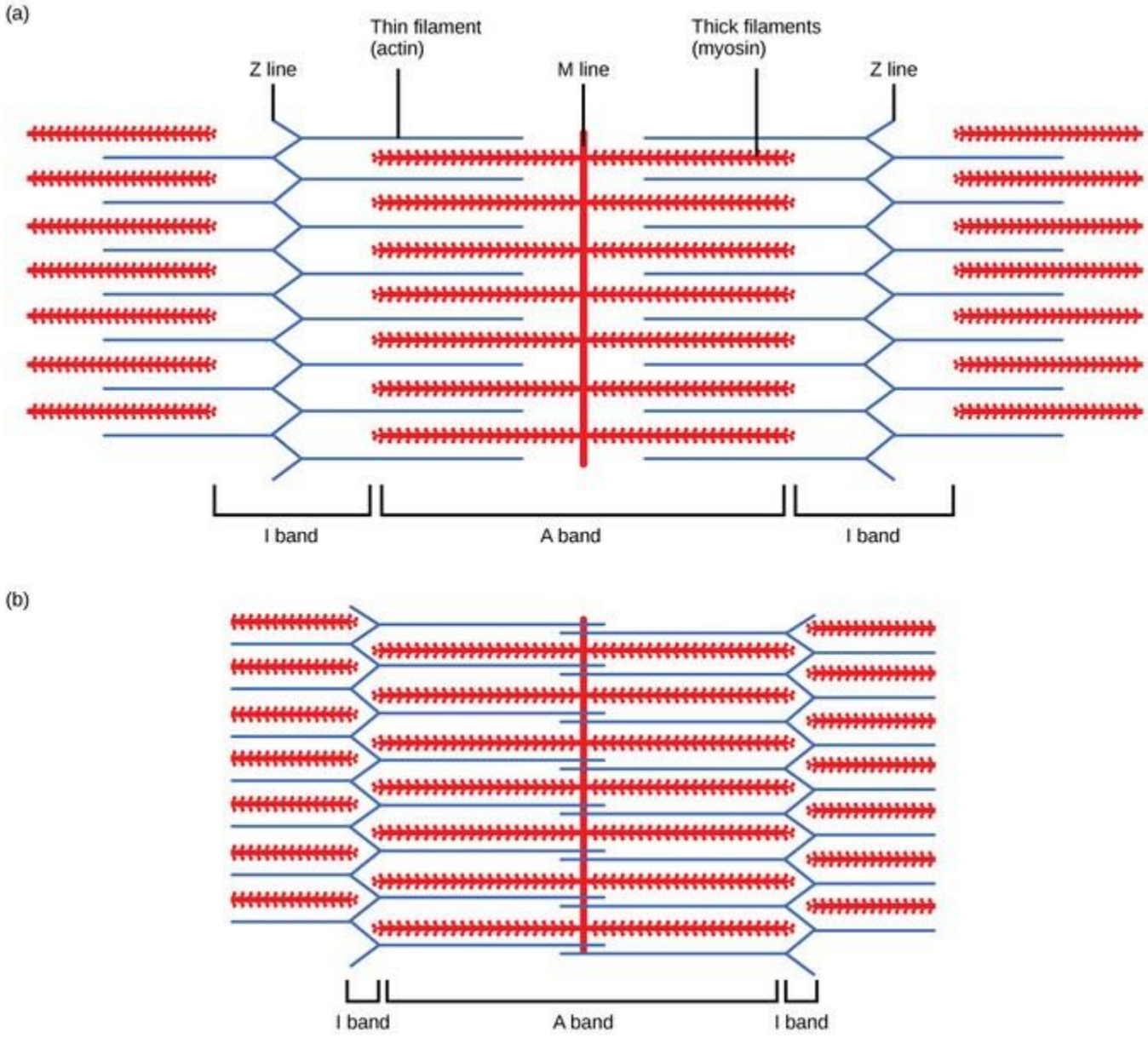
H zone – area without actin fibers

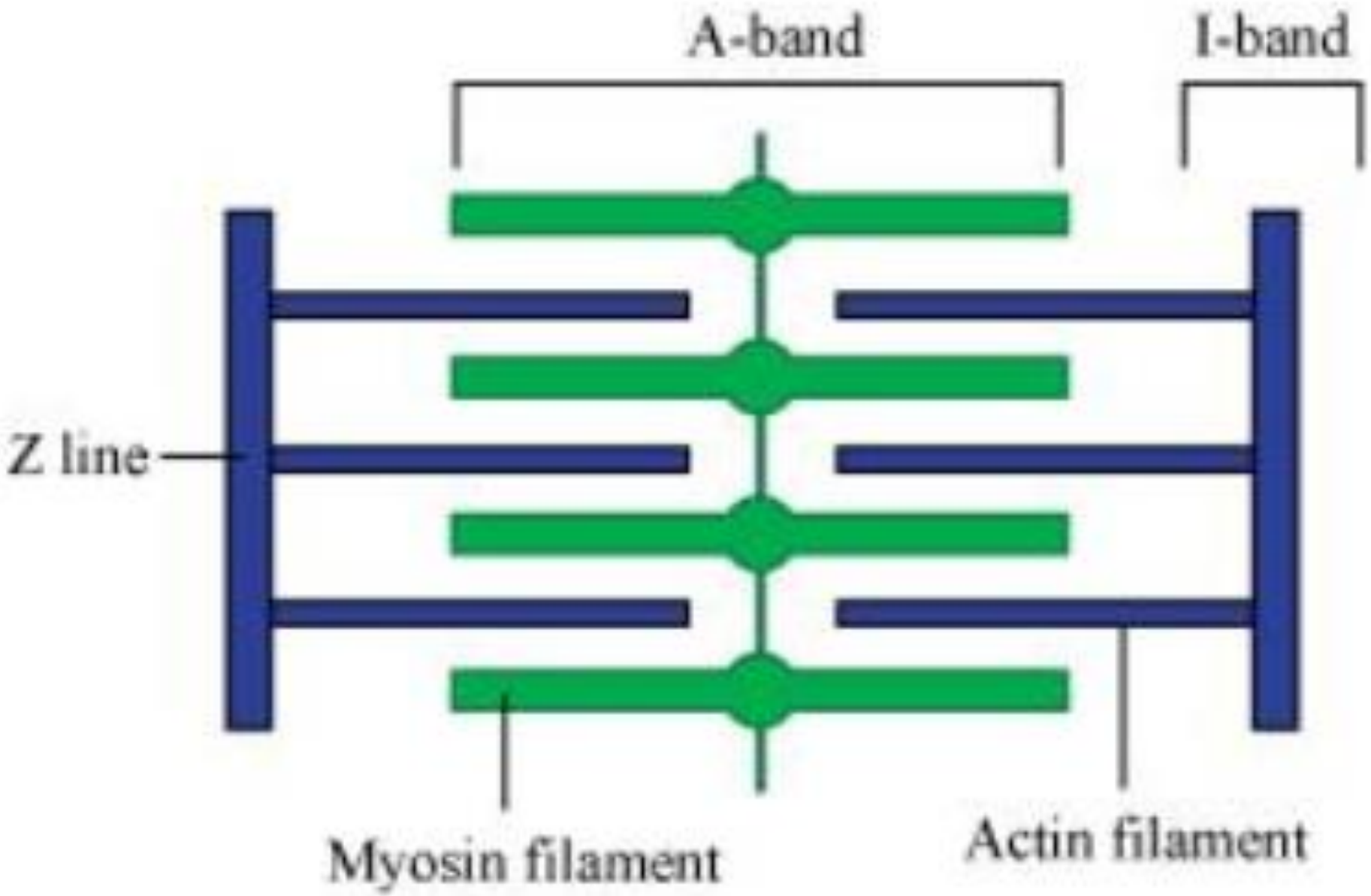




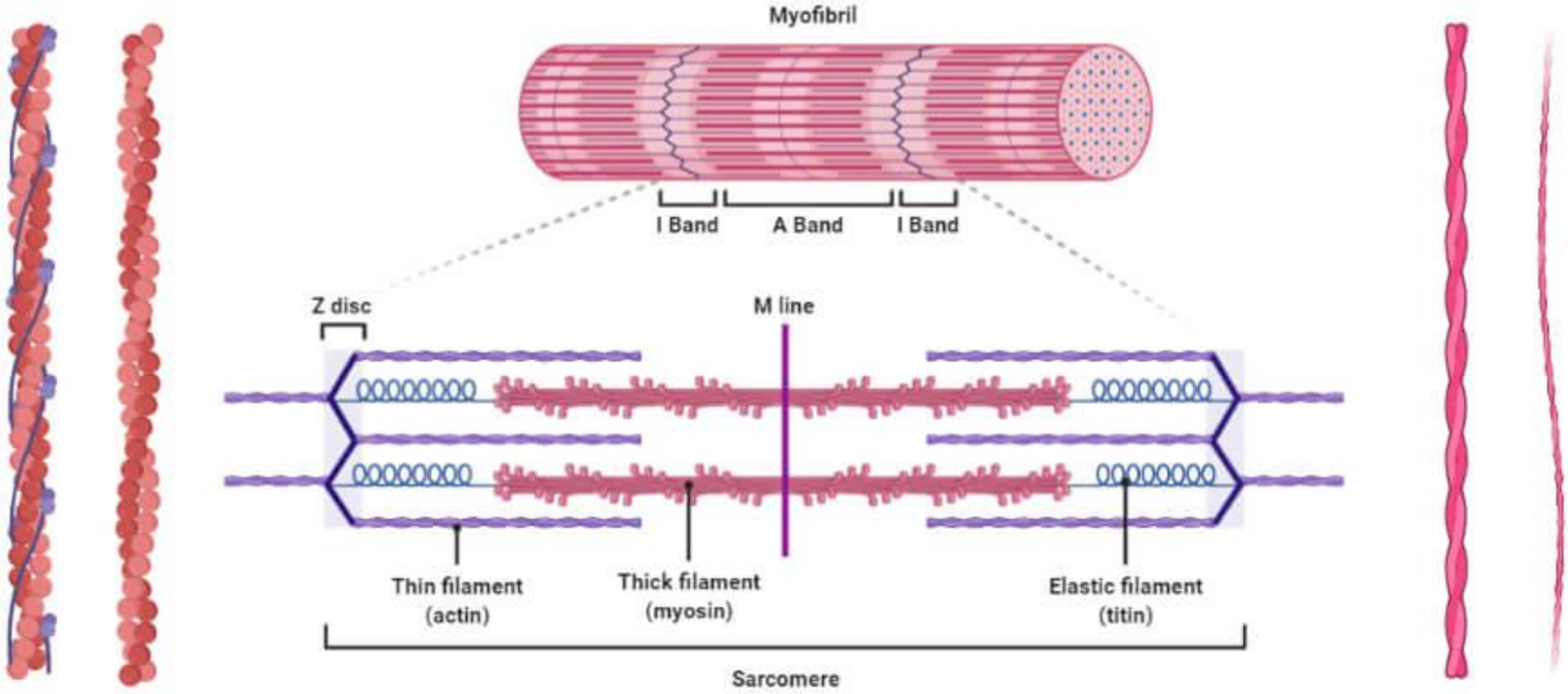


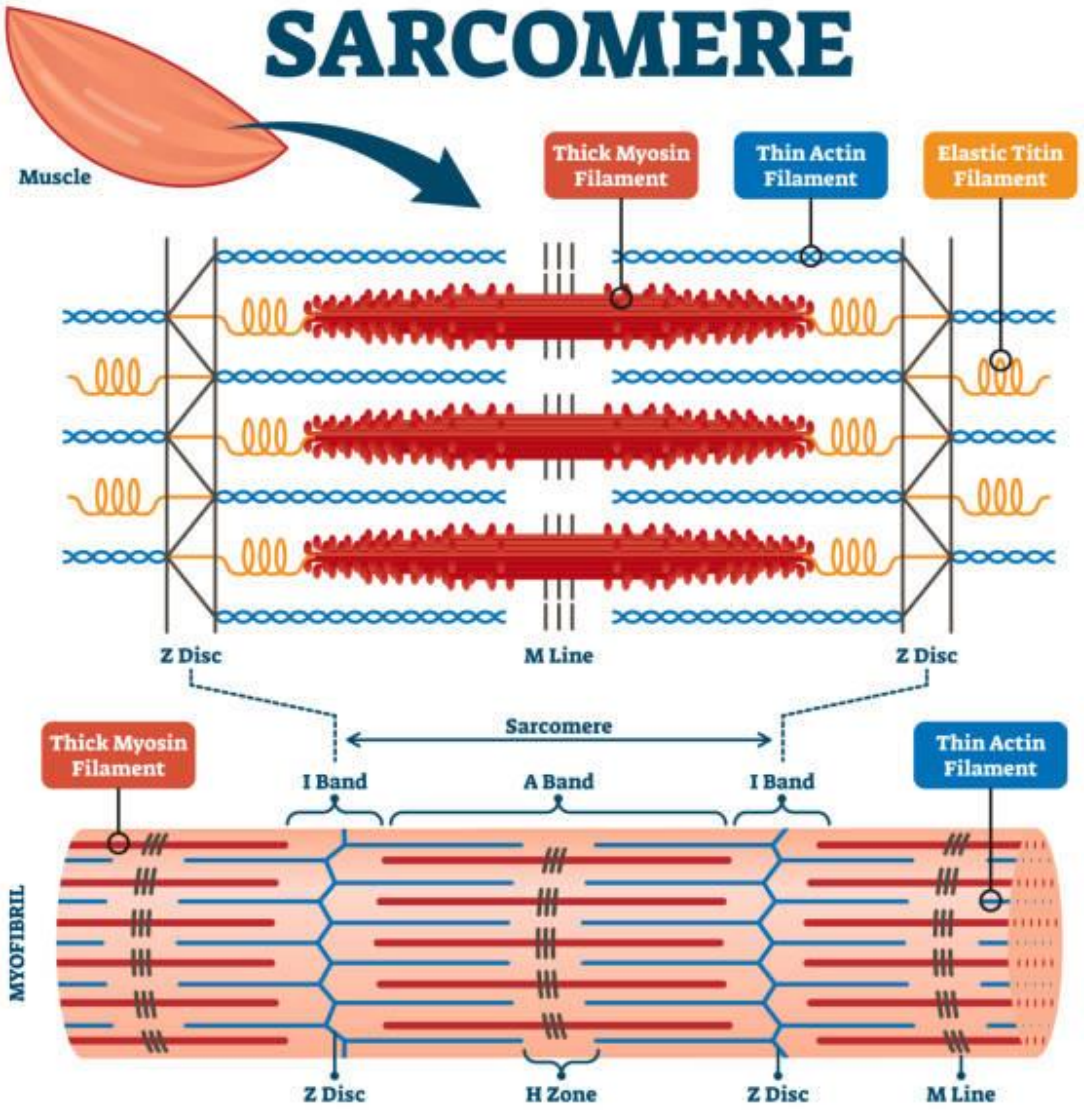
Bands and lines in the contractile apparatus of skeletal muscle

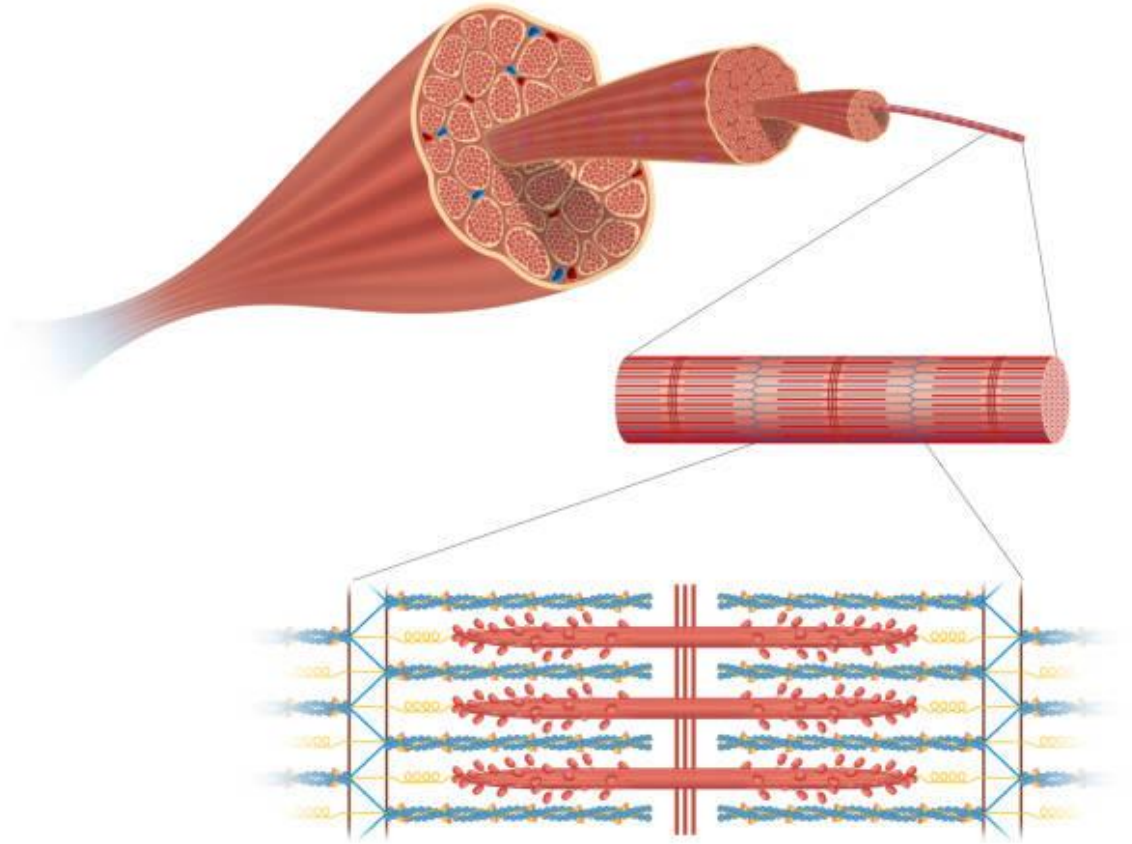

(a)
Thin filament
(actin)
Thick filaments
(myosin)
Z line
M line
Z line
I band
A band
I band
(b)
I band
A band
I band


A-band
I-band
Z line
Myosin filament
Actin filament

Differences between Actin and Myosin




SARCOMERE
Muscle
Thick Myosin Filament
Thin Actin Filament
Elastic Titin Filament
Z Disc
M Line
Z Disc
Sarcomere
Thick Myosin Filament
I Band
A Band
I Band
Thin Actin Filament
MYOFIBRIL
Z Disc
H Zone
Z Disc
M Line

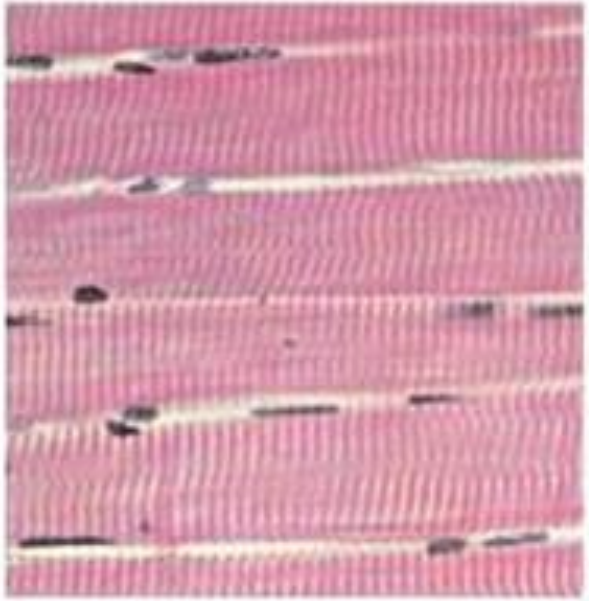


Three Types of Muscle Tissue

Skeletal muscle photo copyright Phototake / Eric Graves

Smooth and cardiac muscle photos copyright Phototake / North Carolina Biological Society

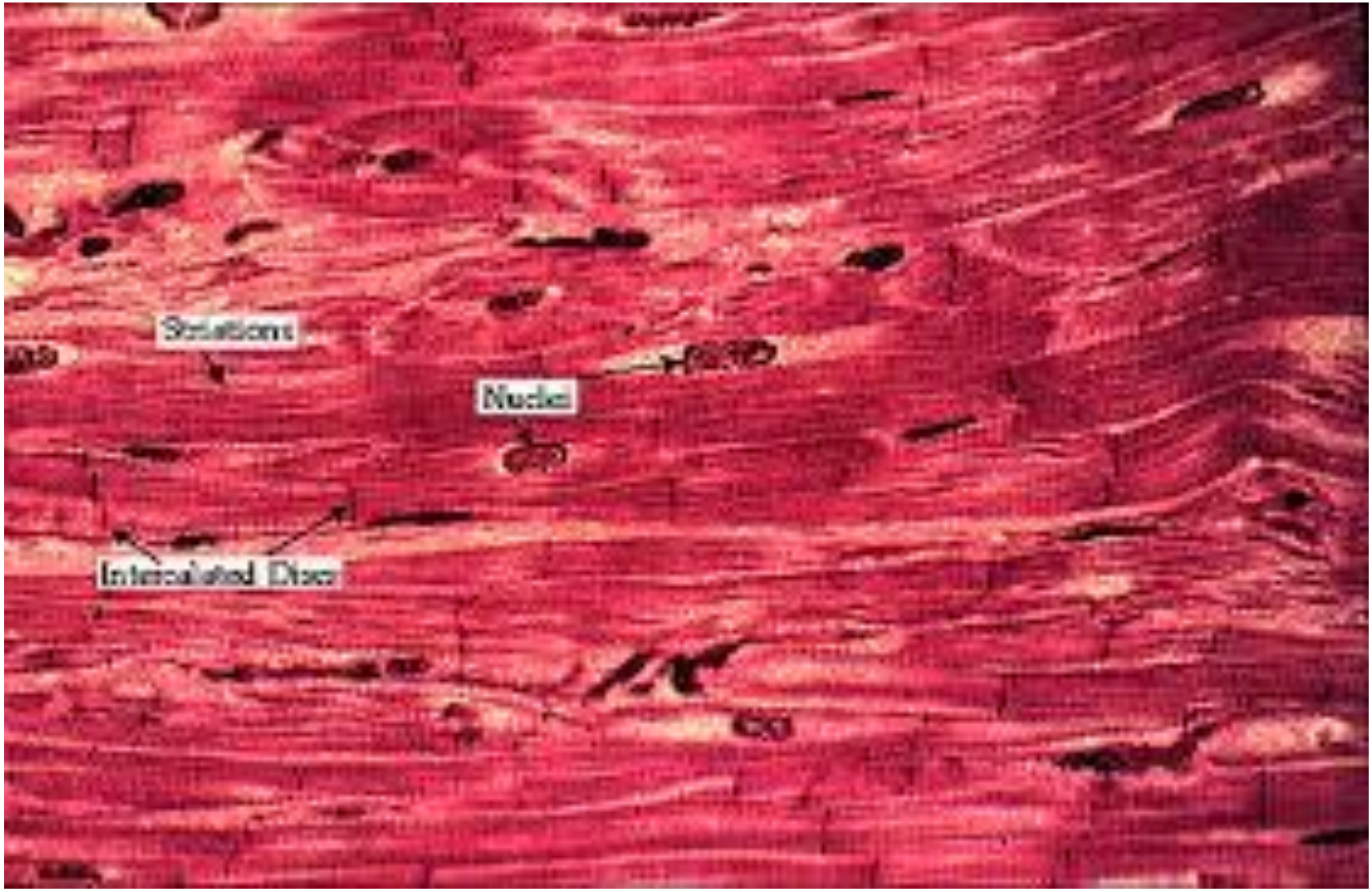
FIGURE 5.1
The Three Types of Muscle Tissue

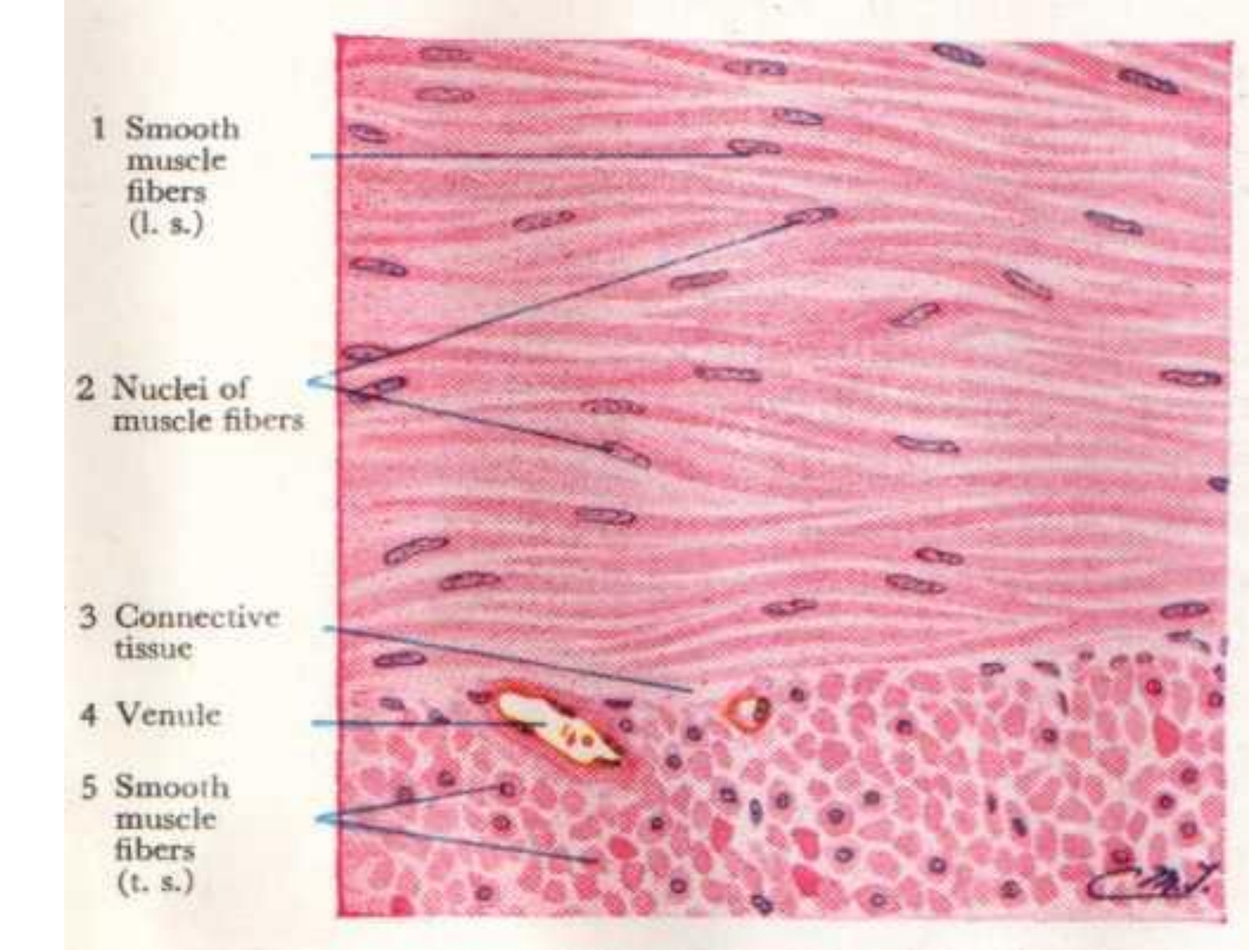


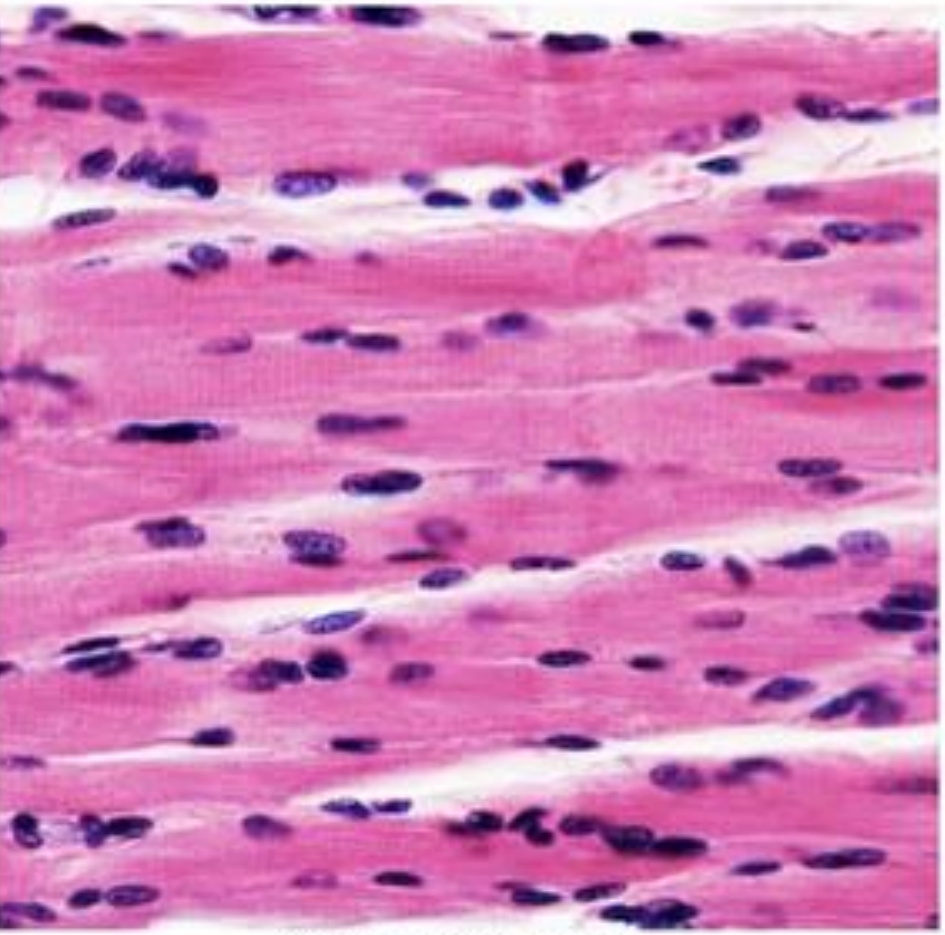
Skeletal Muscle

Smooth Muscle

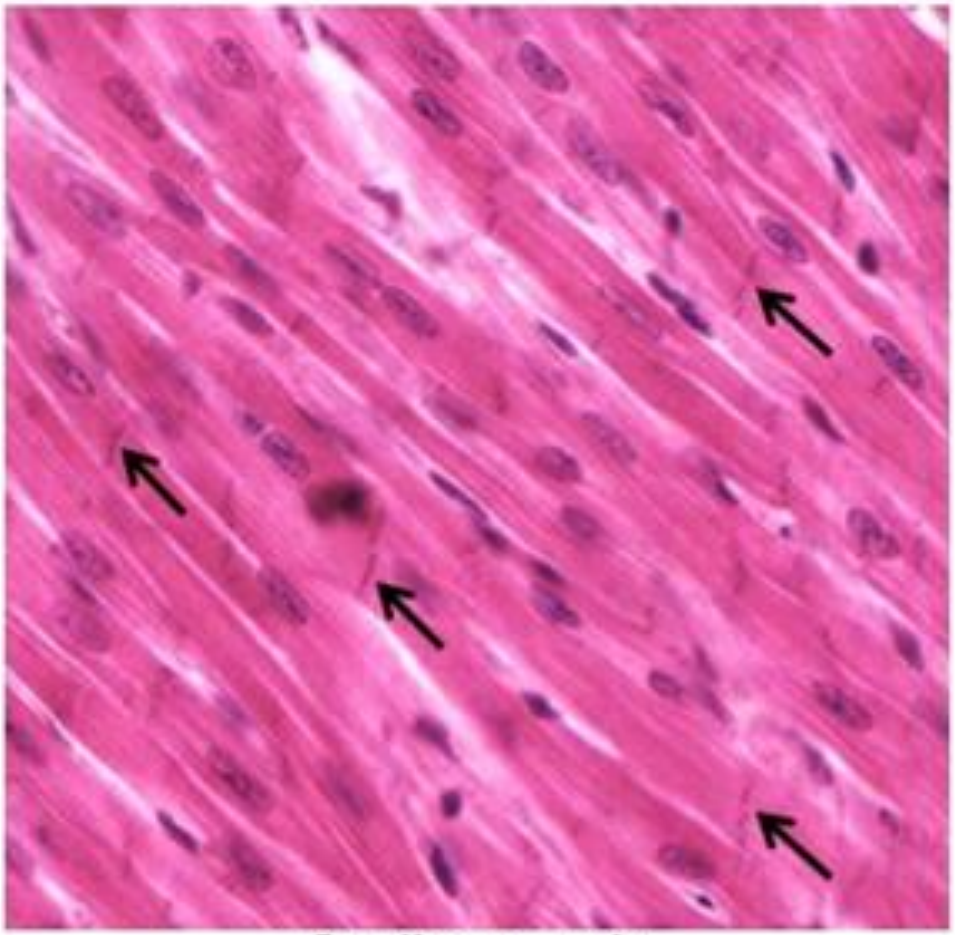
Cardiac Muscle


Striations
Nuclei
Intercalated Discs


1 Smooth muscle fibers (l. s.)
2 Nuclei of muscle fibers
3 Connective tissue
4 Venule
5 Smooth muscle fibers (t. s.)



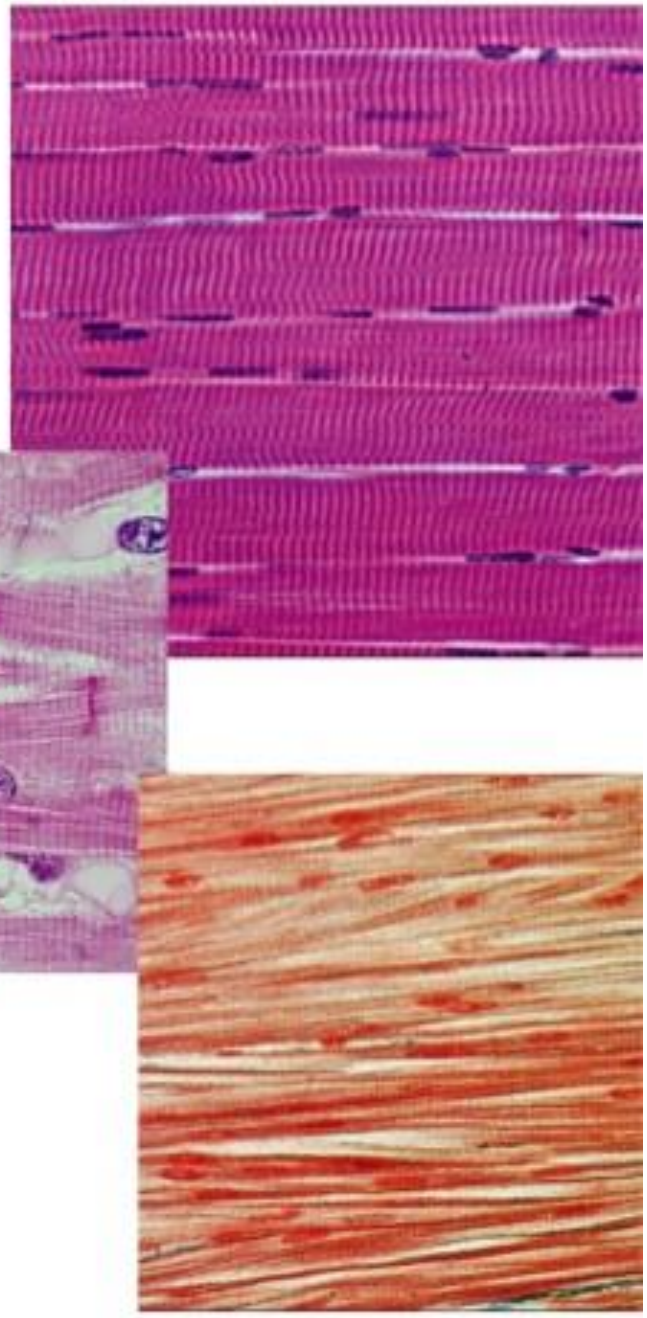
Skeletal muscle

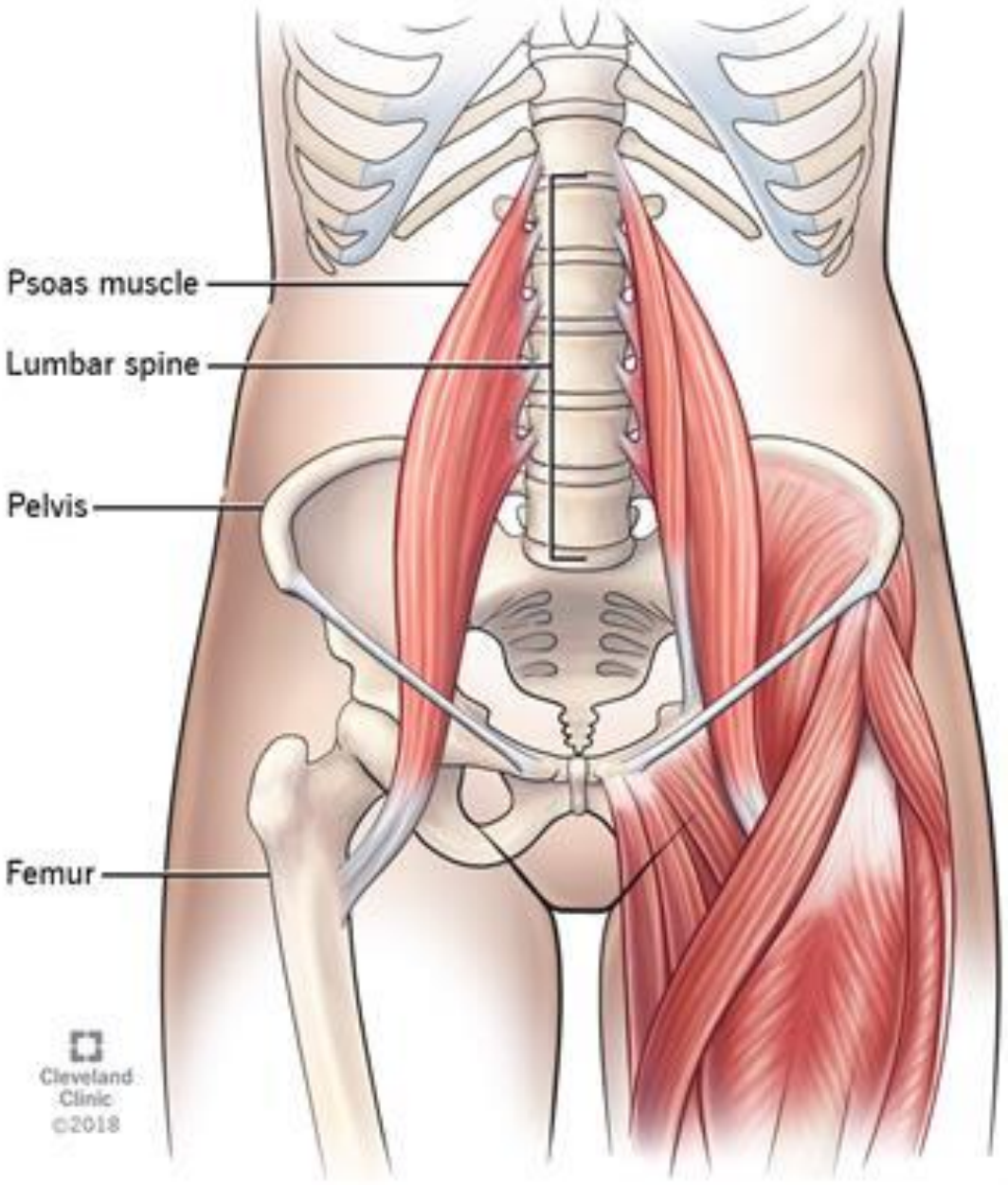


Cardiac muscle

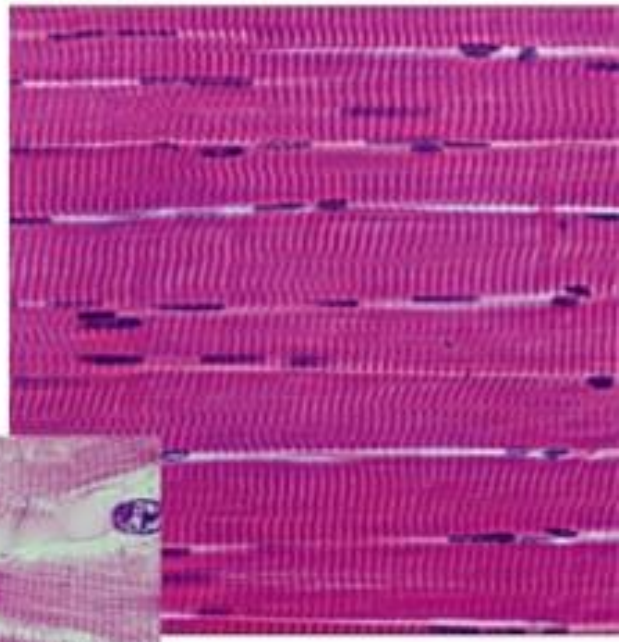
Types of Muscle Tissue

- Skeletal muscle
- Cardiac muscle
- Smooth muscle



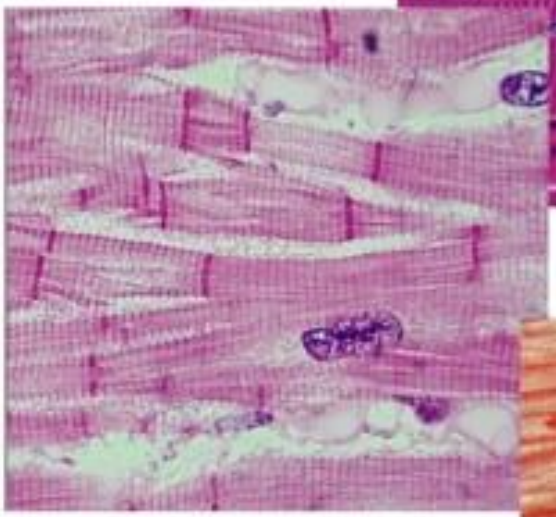

Psoas muscle
Lumbar spine
Pelvis
Femur
Cleveland Clinic
©2018

Types of Muscle Tissue



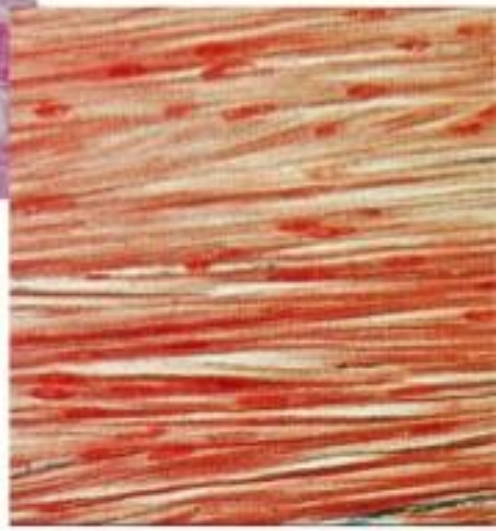
Skeletal

- Attach to and move skeleton
- 40% of body weight
- Fibers = multinucleate cells (embryonic cells fuse)
- Cells with obvious striations
- Contractions are voluntary



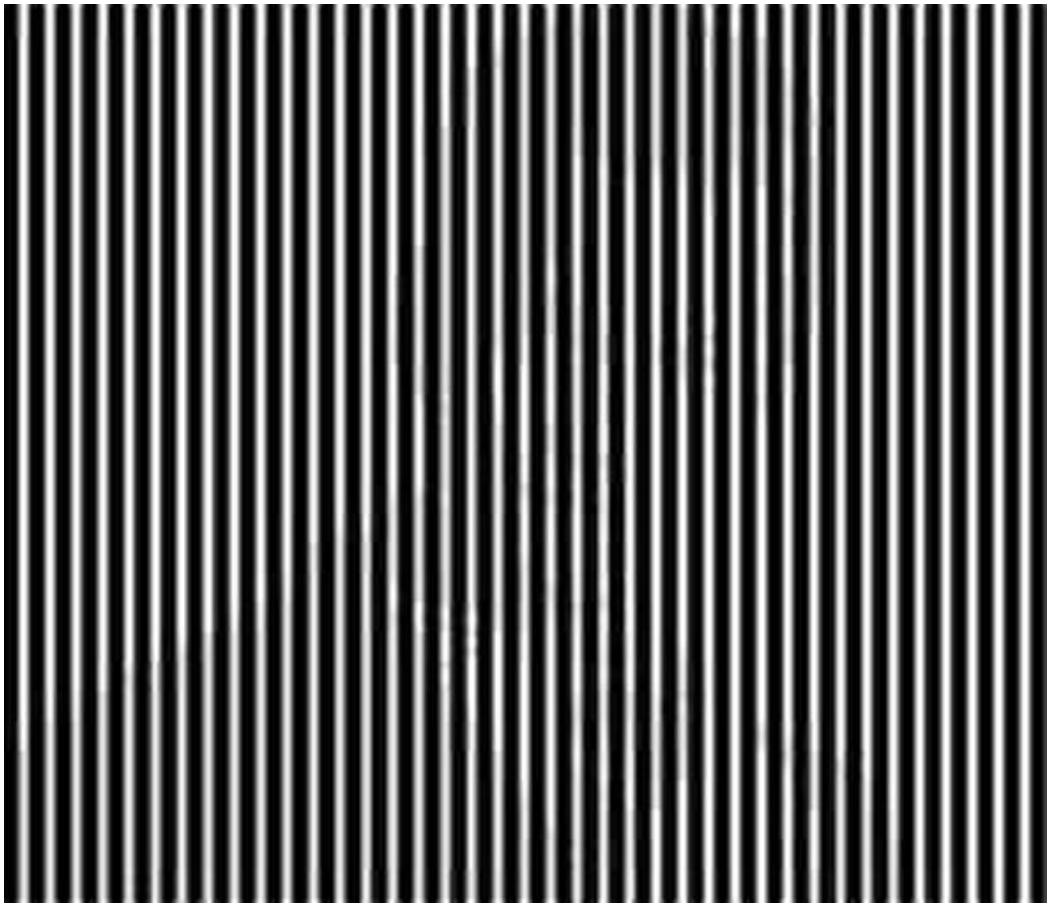
Cardiac: *only in the wall of the heart*

- Cells are striated
- Contractions are involuntary (*not* voluntary)

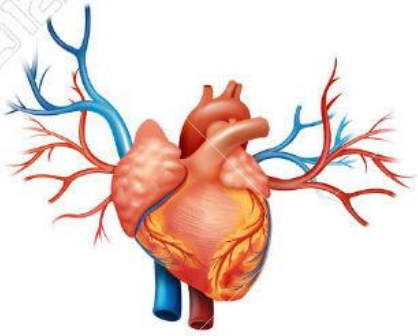


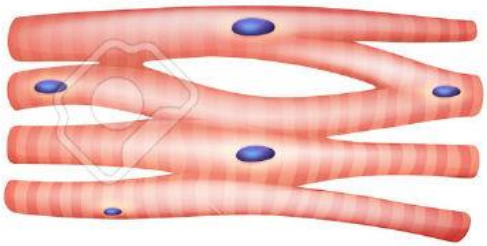
Smooth: *walls of hollow organs*

- Lack striations
- Contractions are involuntary (*not* voluntary)

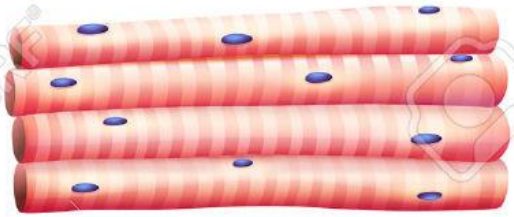


Types of Muscle

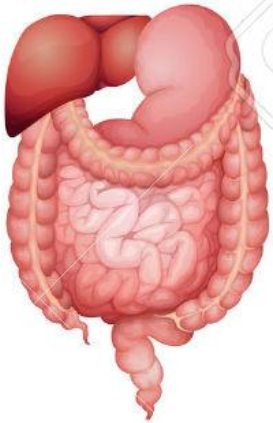


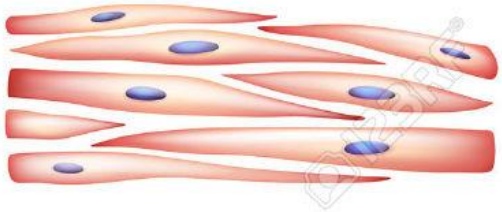


Cardiac muscle



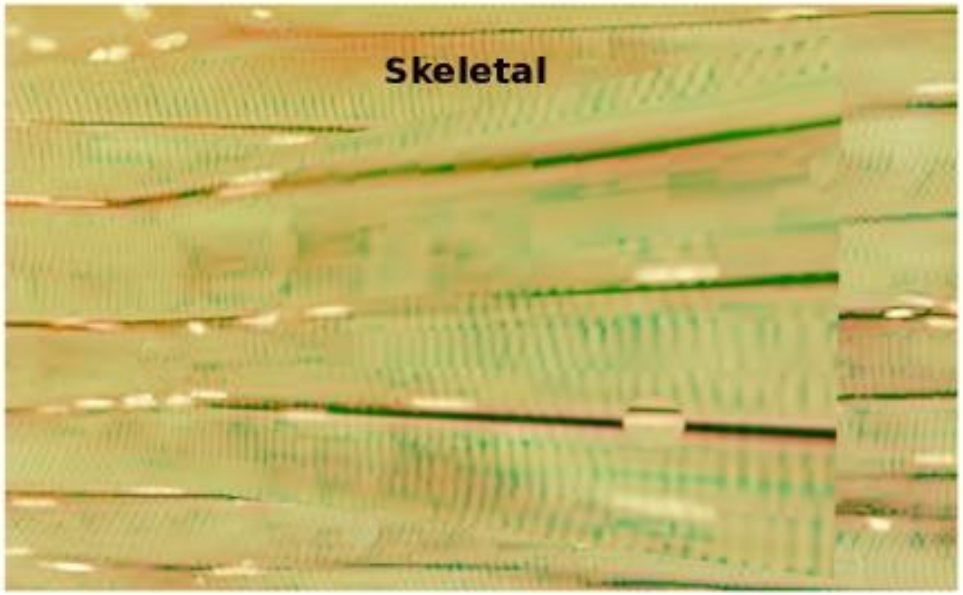
Skeletal muscle

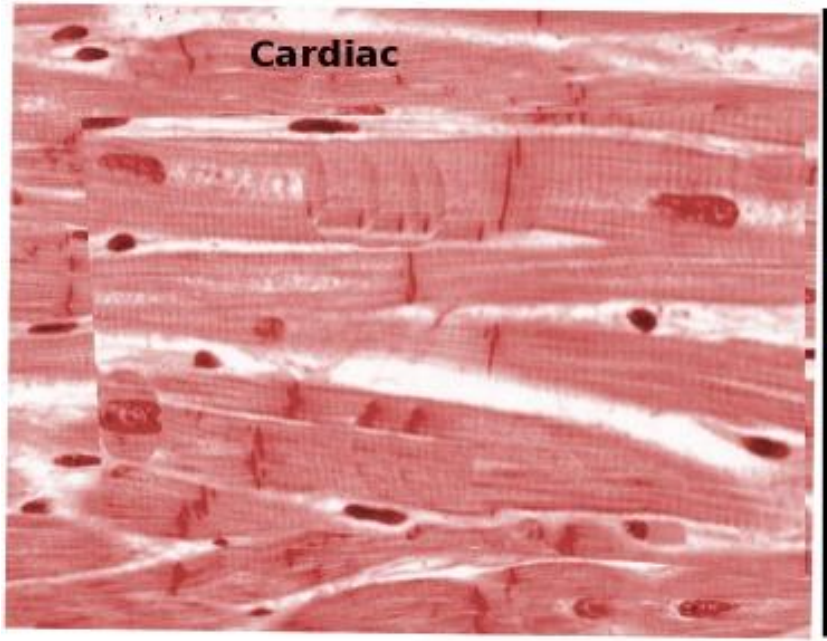


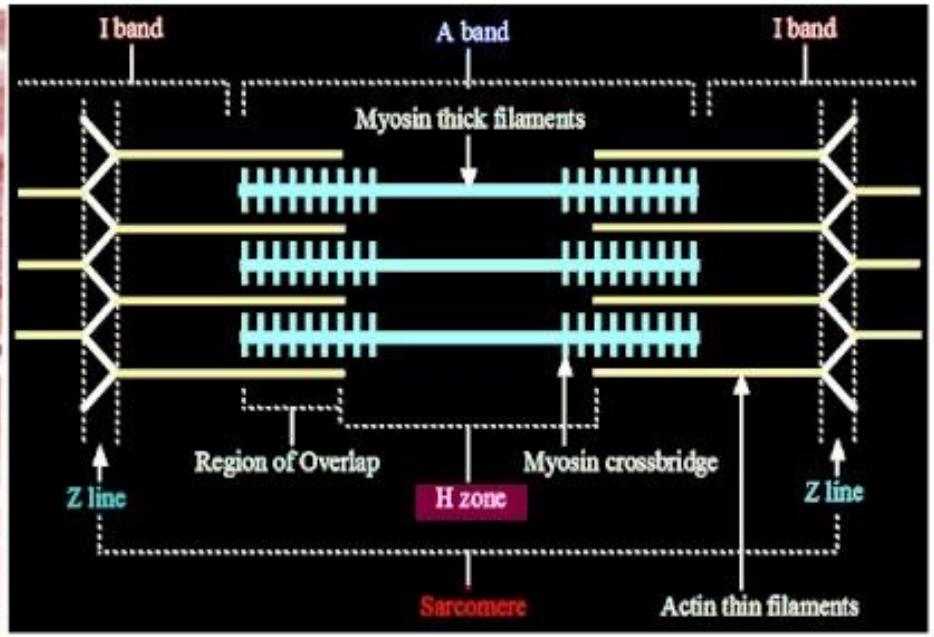


Smooth muscle

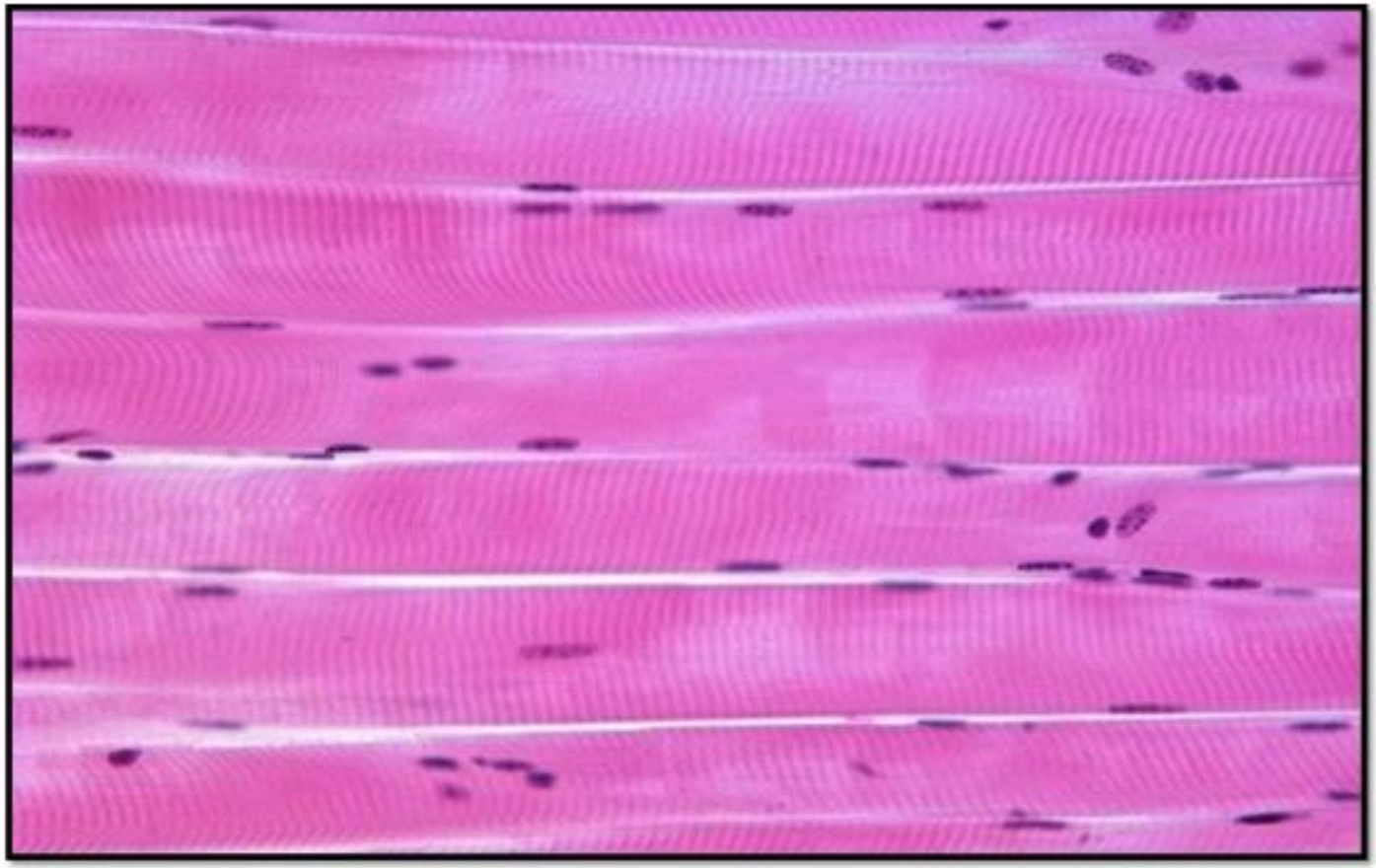

Smooth


Skeletal


Cardiac


I band
A band
I band
Myosin thick filaments
Region of Overlap
Myosin crossbridge
Z line
H zone
Z line
Sarcomere
Actin thin filaments

L.M. Skeletal Muscle (L.S.)



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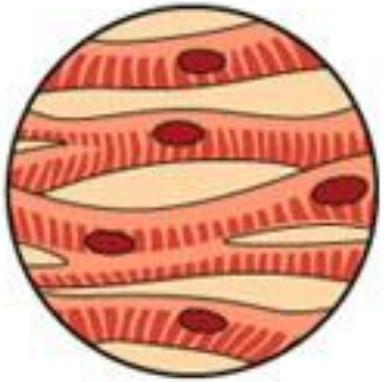
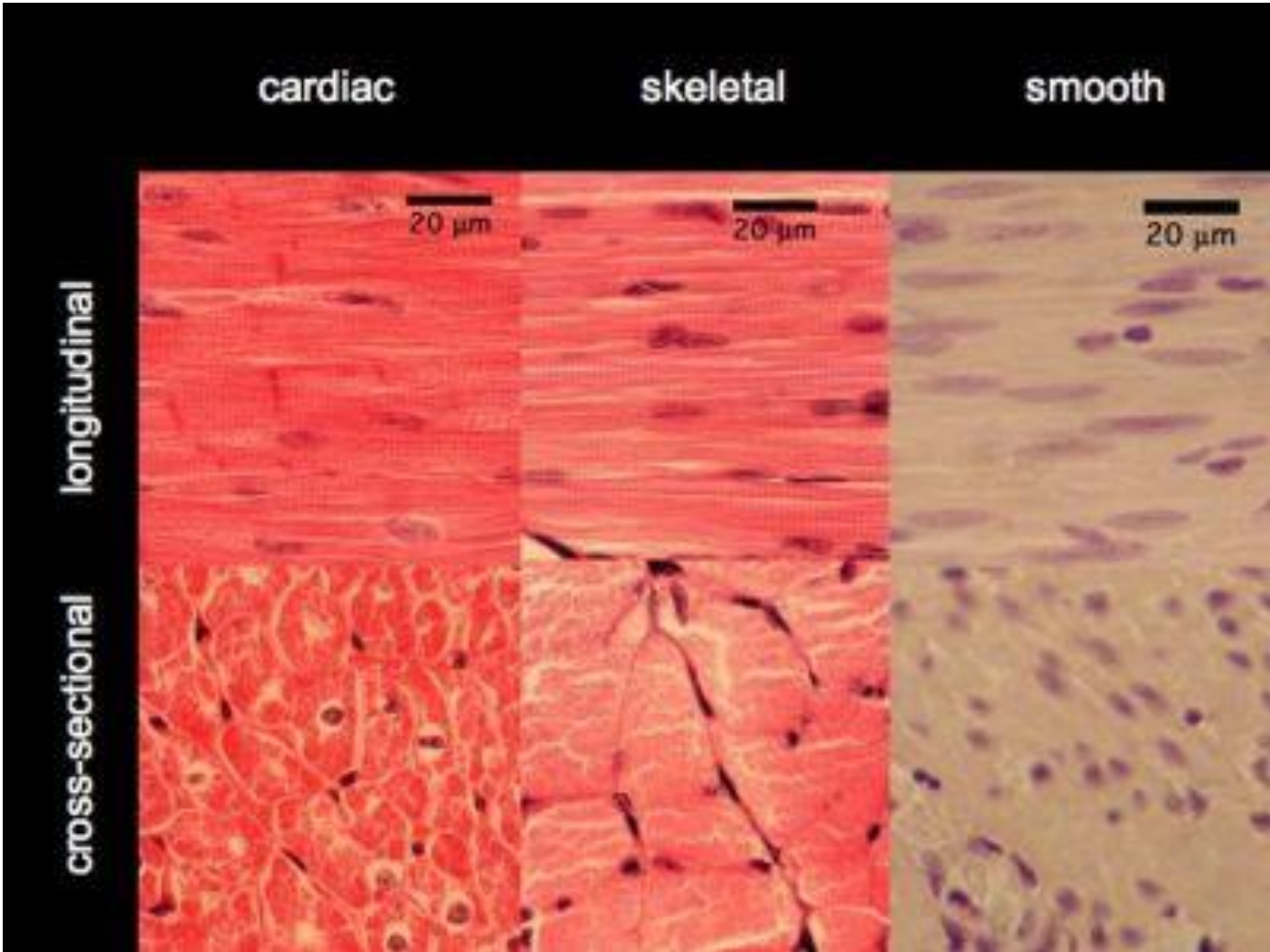
Cardiac muscle

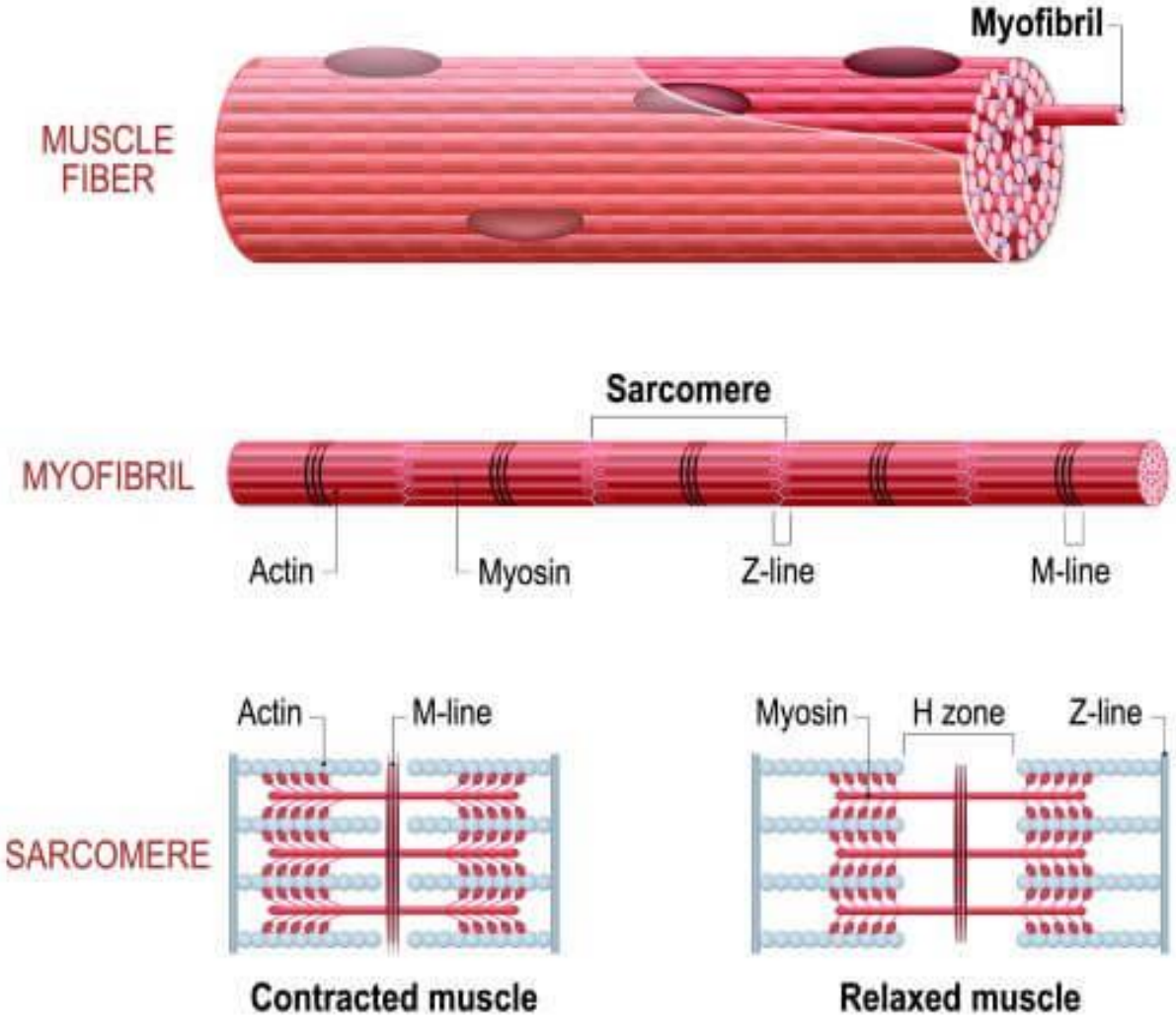


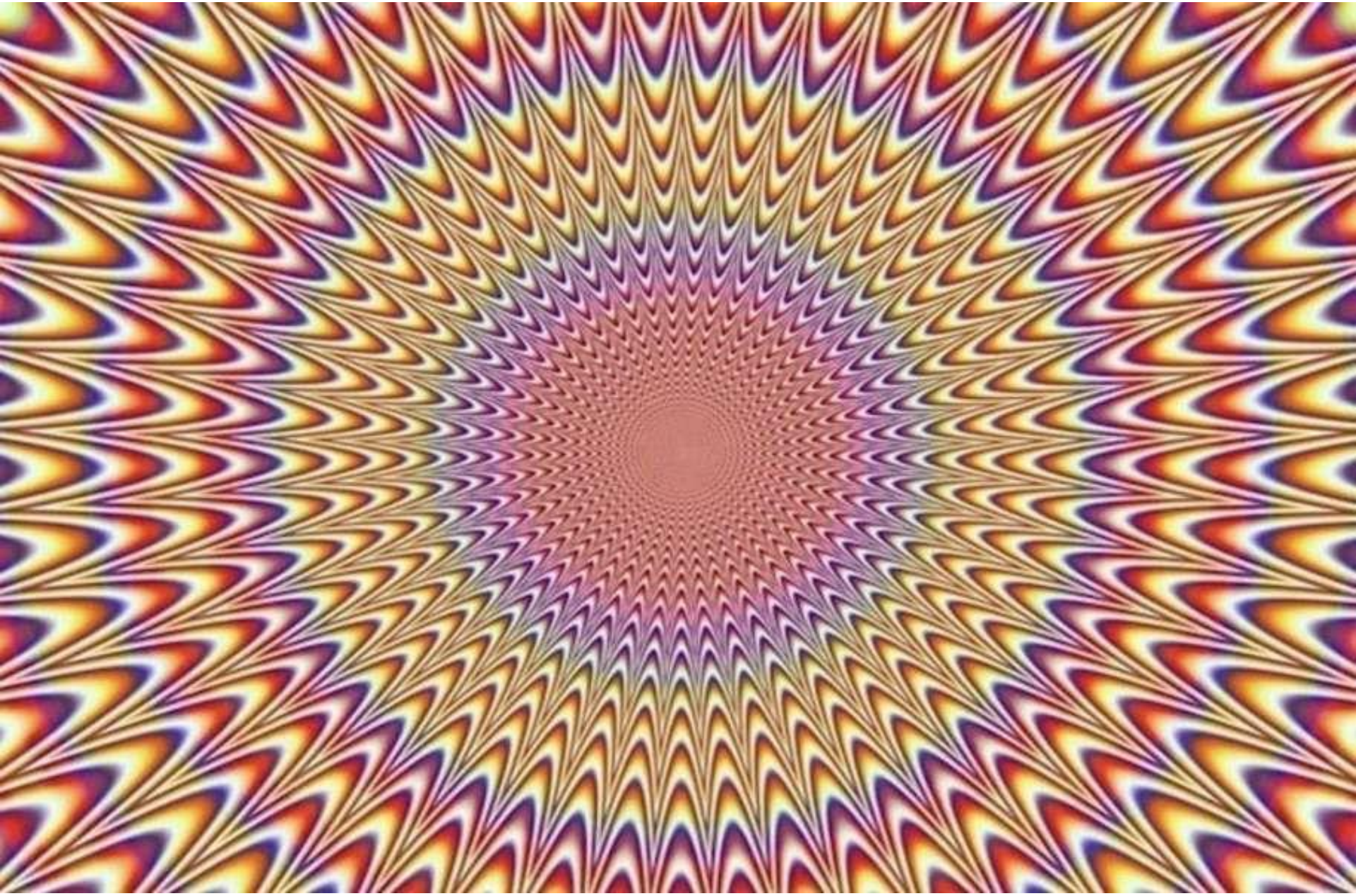
Skeletal muscle

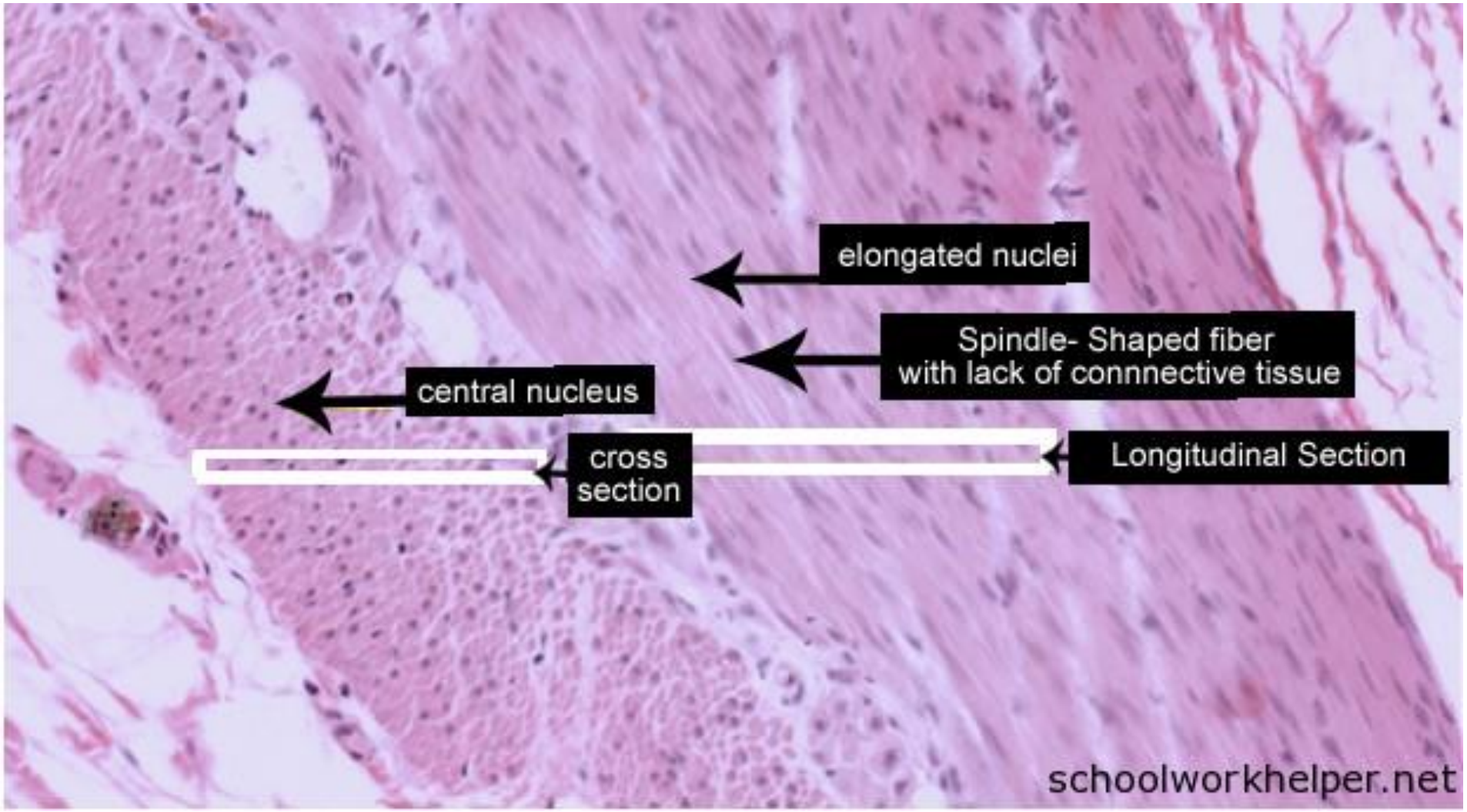
Smooth muscle


cardiac
skeletal
smooth
longitudinal
cross-sectional
20 µm
20 µm
20 µm

Structures of the muscle



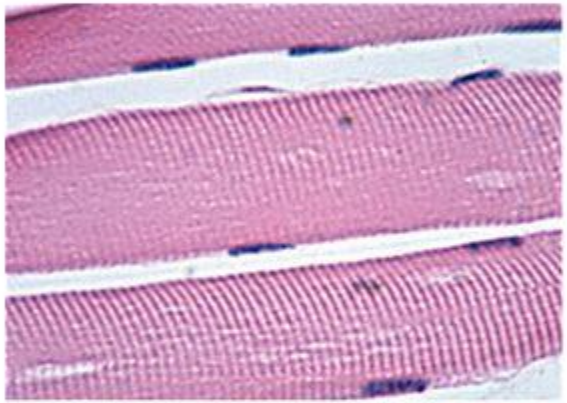



elongated nuclei
Spindle- Shaped fiber
with lack of connnective tissue
central nucleus
cross
section
Longitudinal Section
schoolworkhelper.net

Muscle Types

Which is Which?

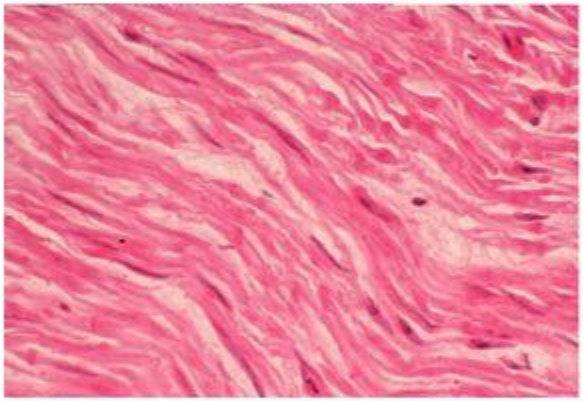
Cardiac?



Skeletal

- Striated
- Voluntary

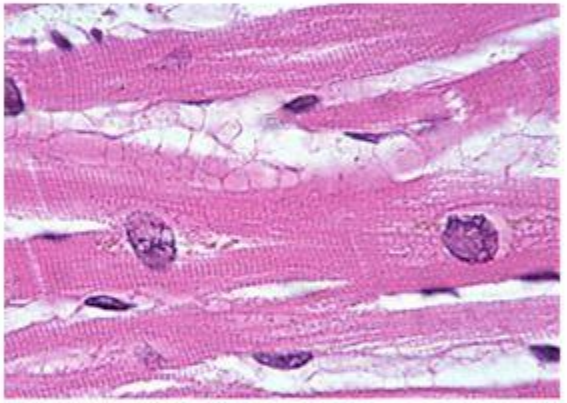
Skeletal?



Smooth

- Smooth
- Involuntary

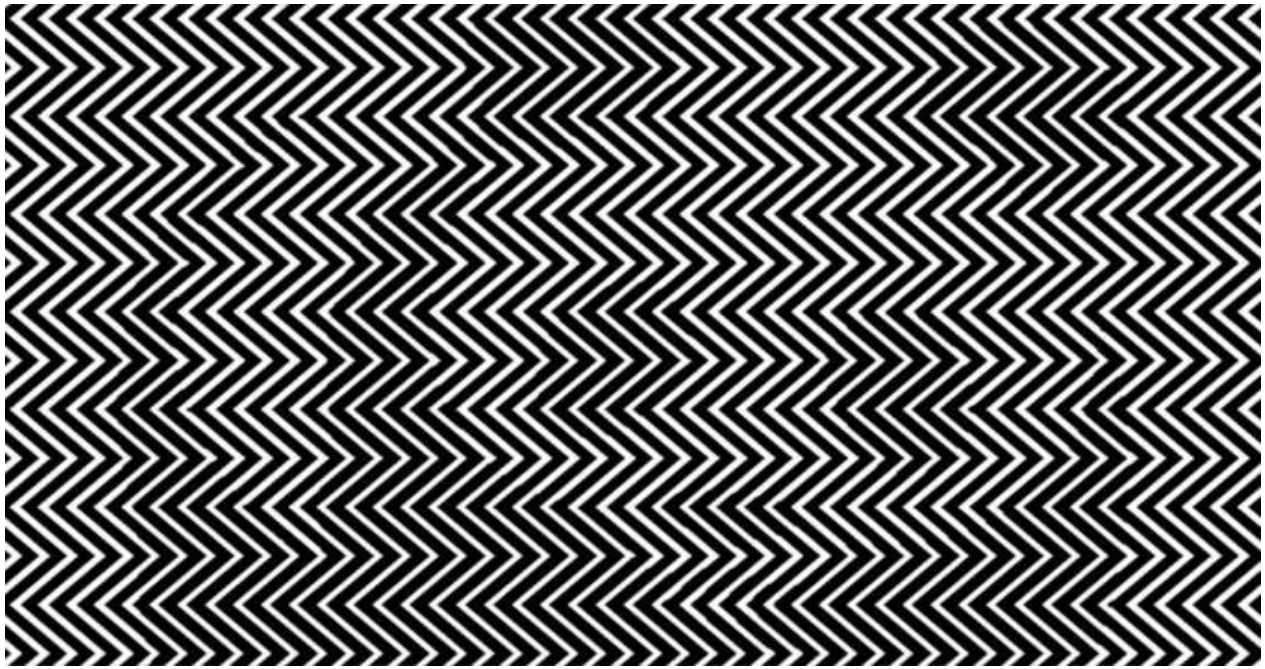
Smooth?

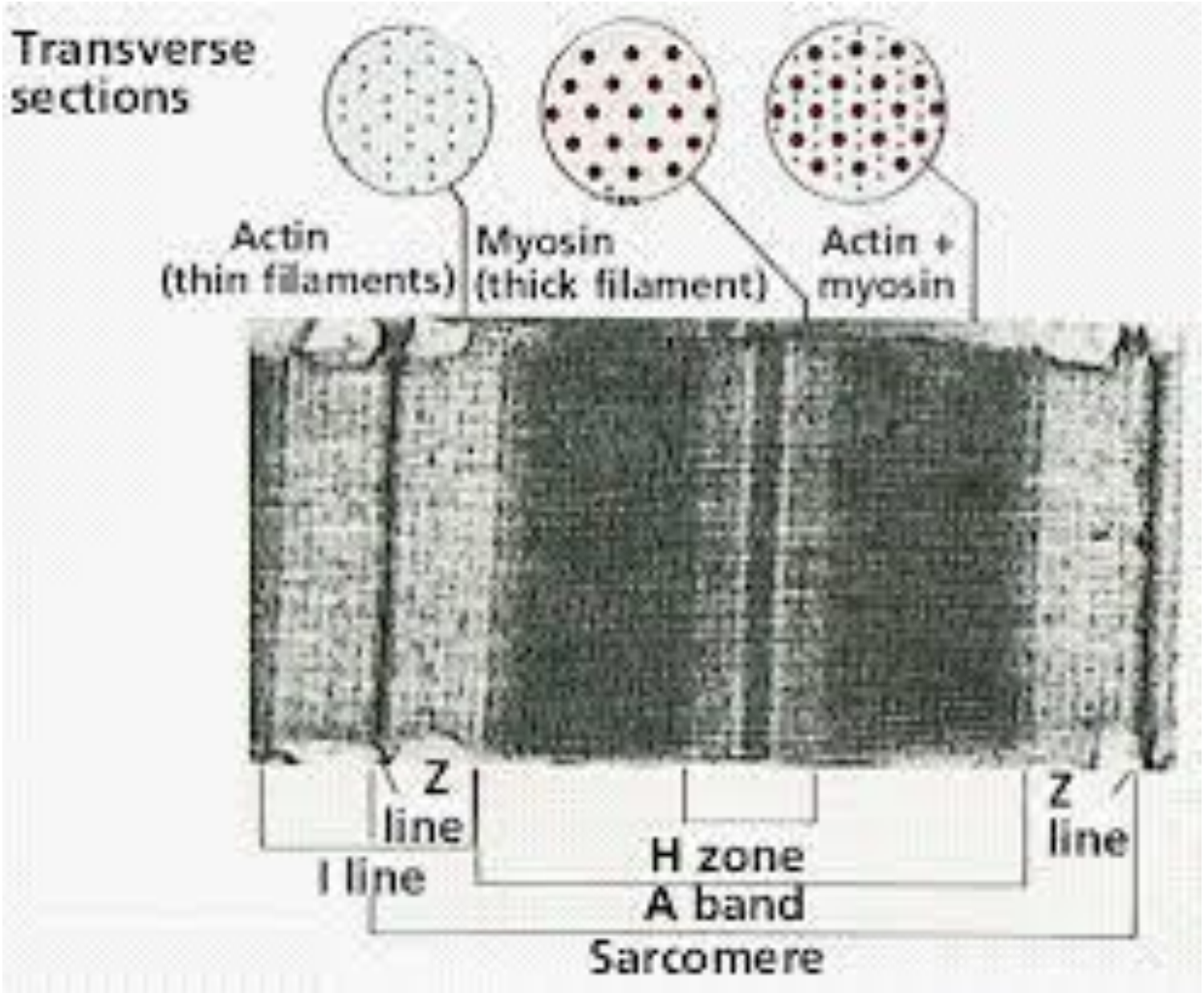


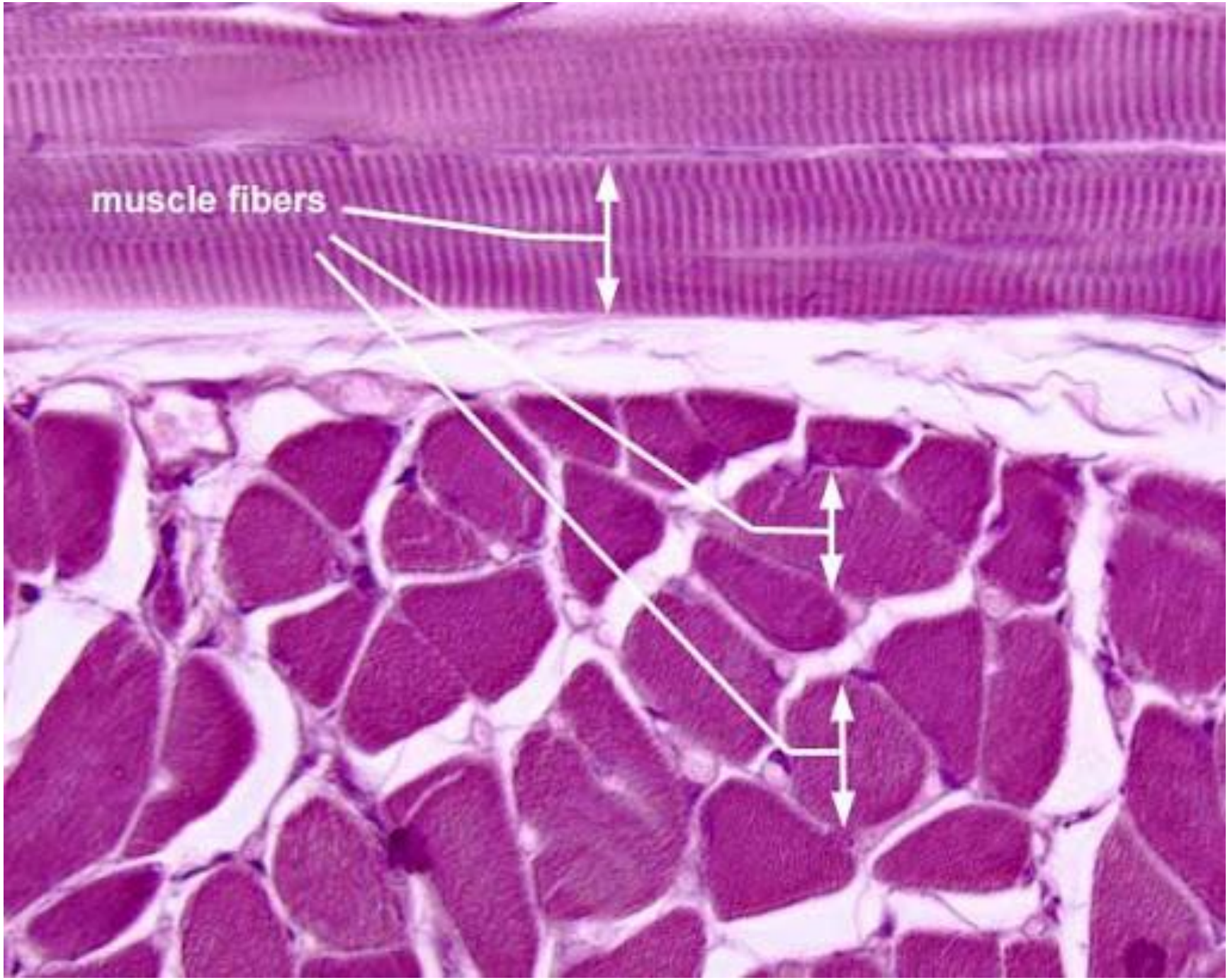
Cardiac

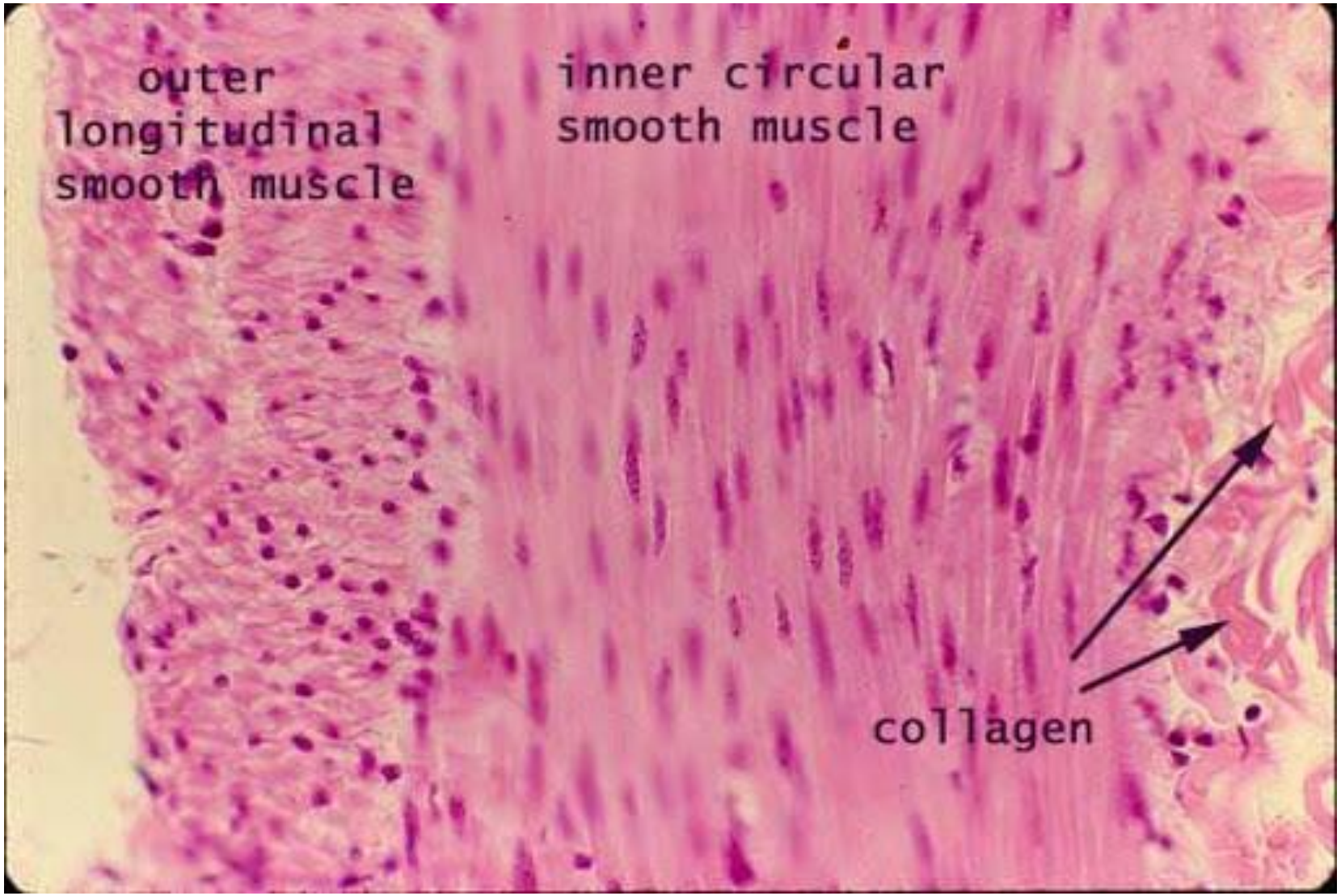
- Striated
- Involuntary

What other places can "skeletal" muscle be found?




Transverse sections
Actin (thin filaments)
Myosin (thick filament)
Actin + myosin
Z line
I line
H zone
A band
Z line
Sarcomere


muscle fibers

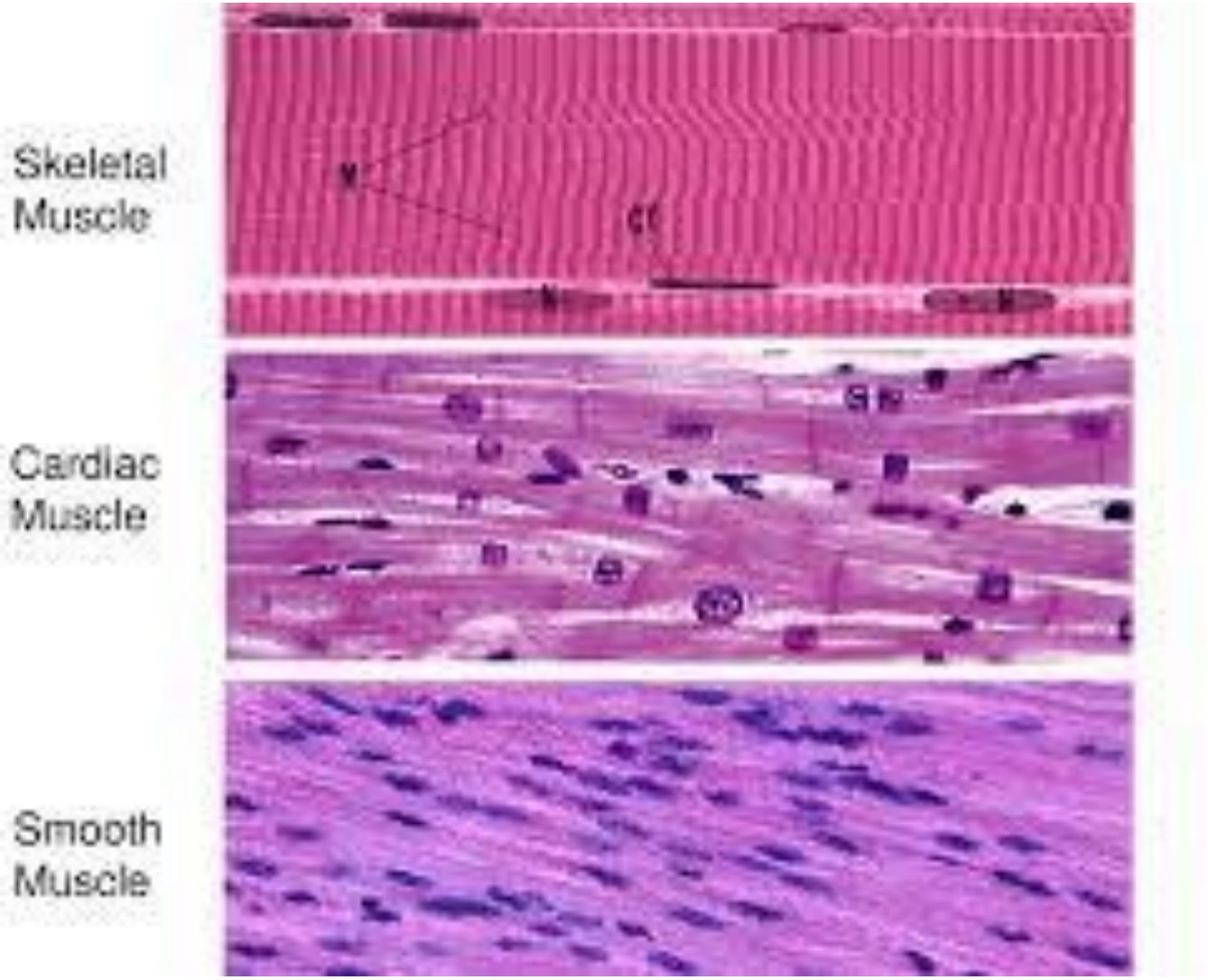

outer
longitudinal
smooth muscle
inner circular
smooth muscle
collagen

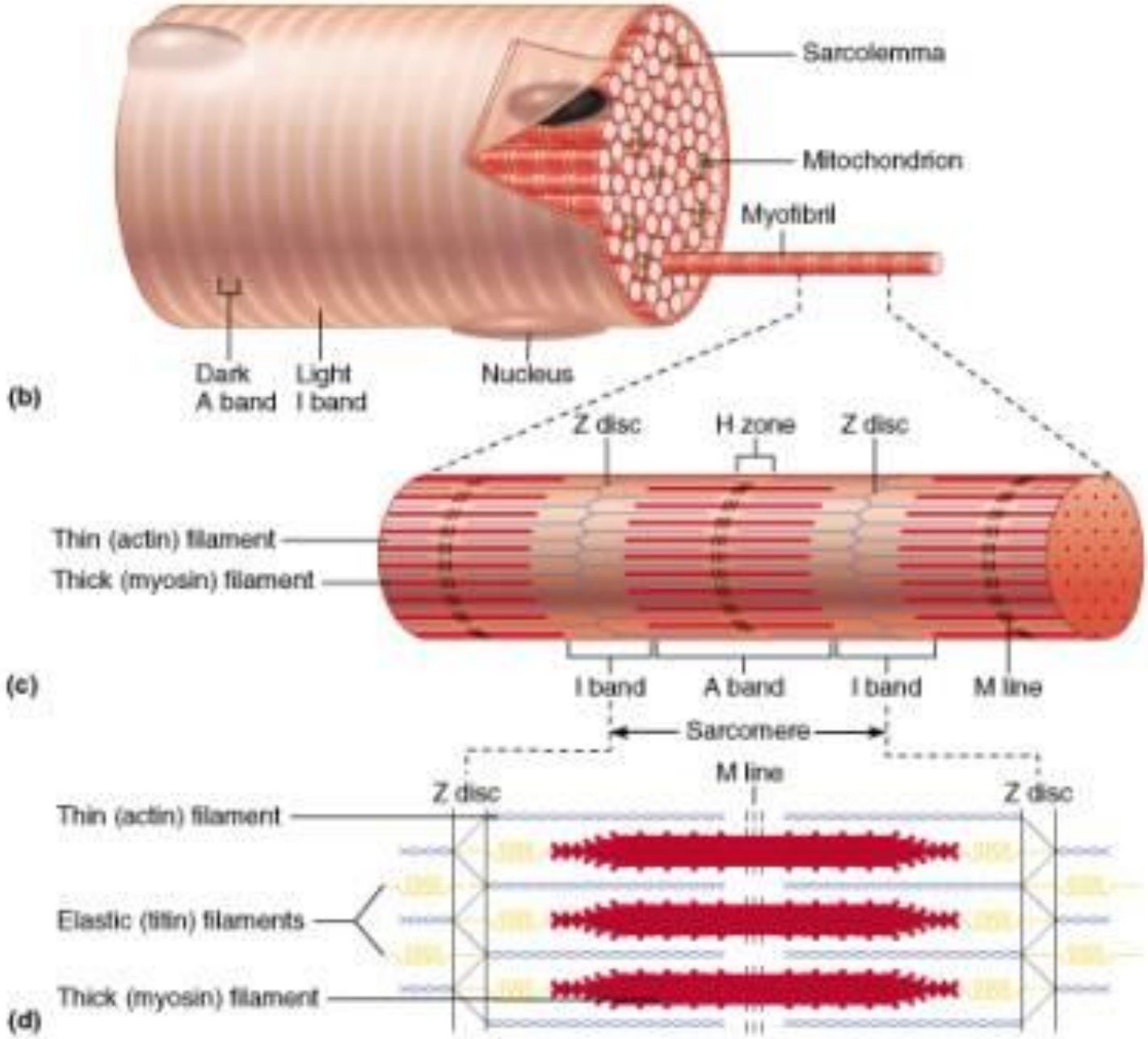
FACT

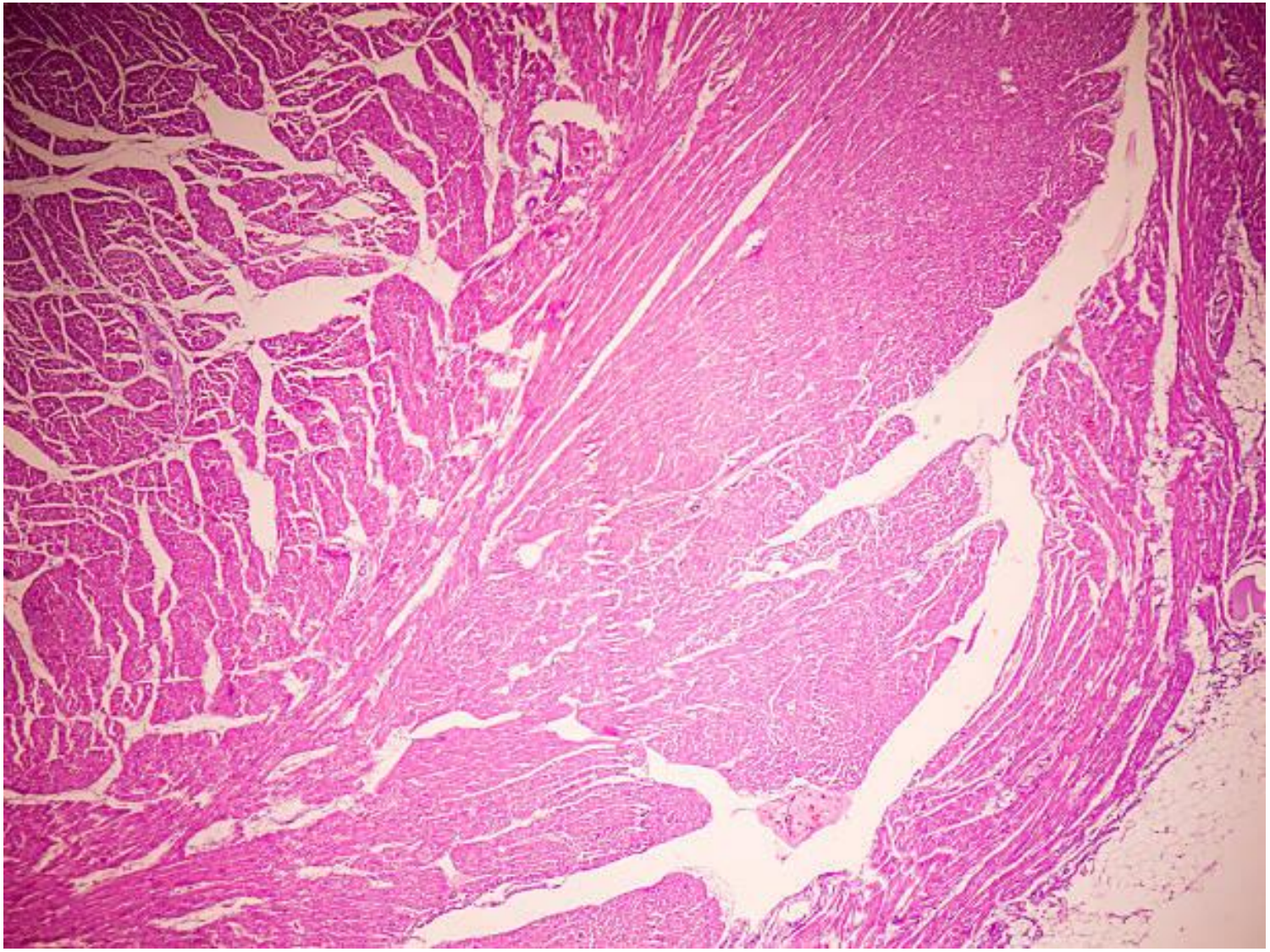
More than half of your bones are located in the hands, wrists, feet, and ankles.

BEFORE 6 BEERS

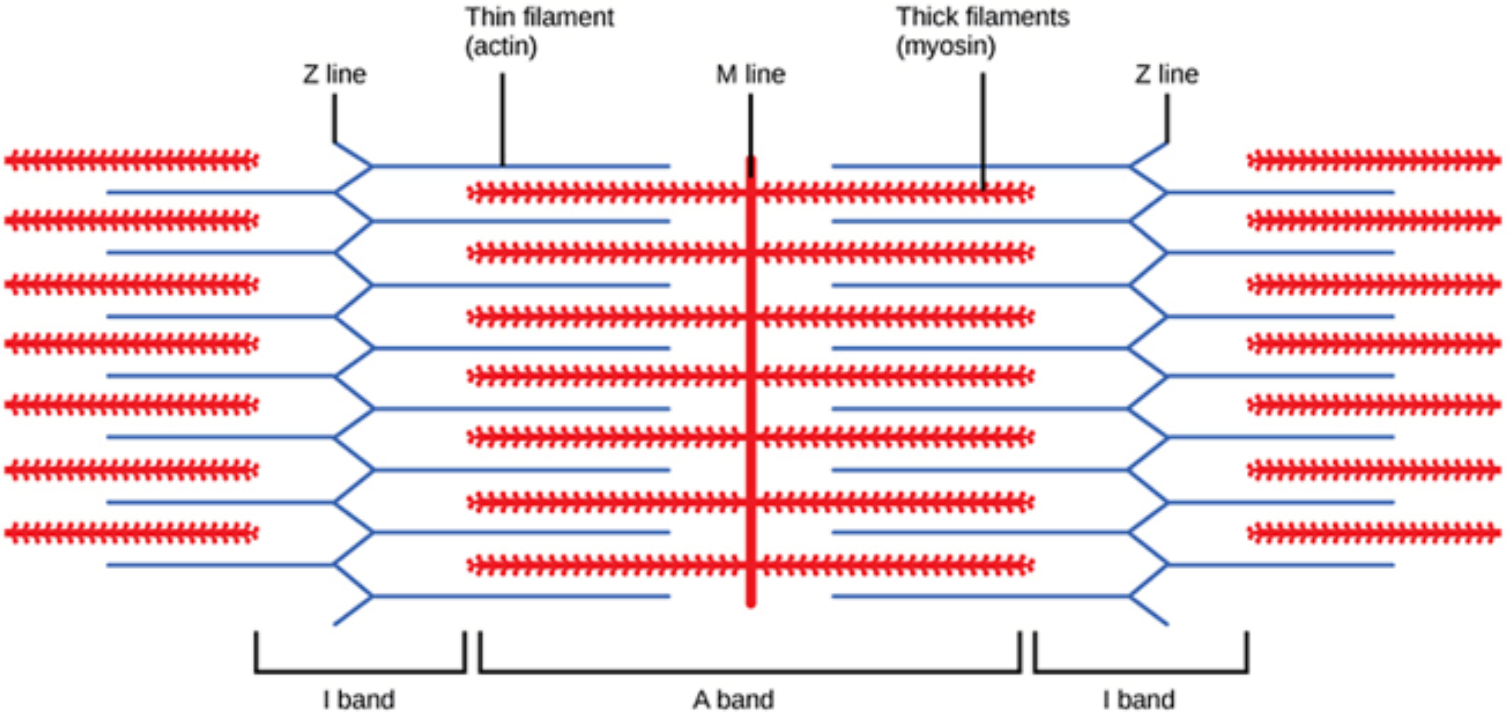
AFTER 6 BEERS


Skeletal Muscle
Cardiac Muscle
Smooth Muscle



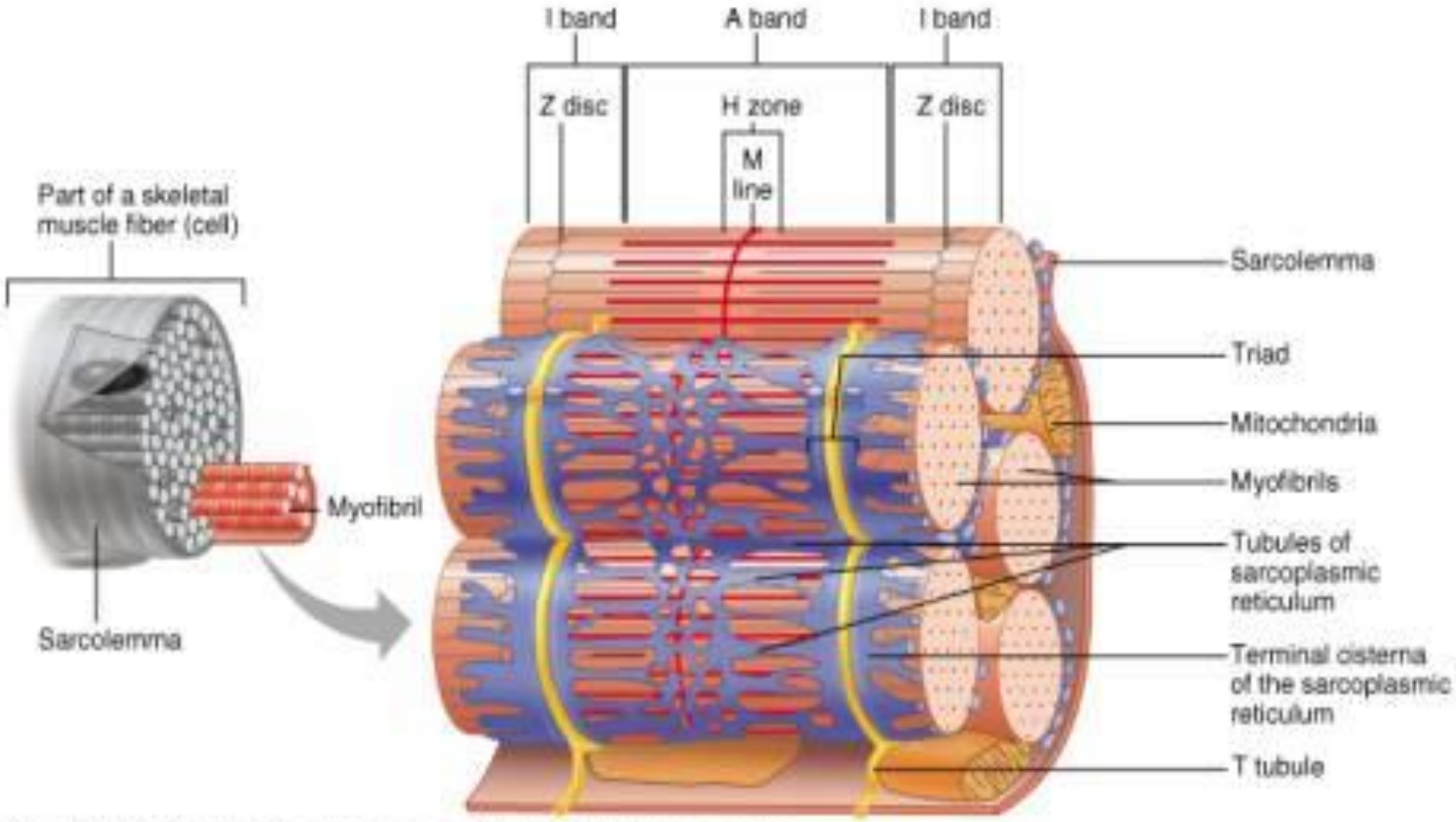


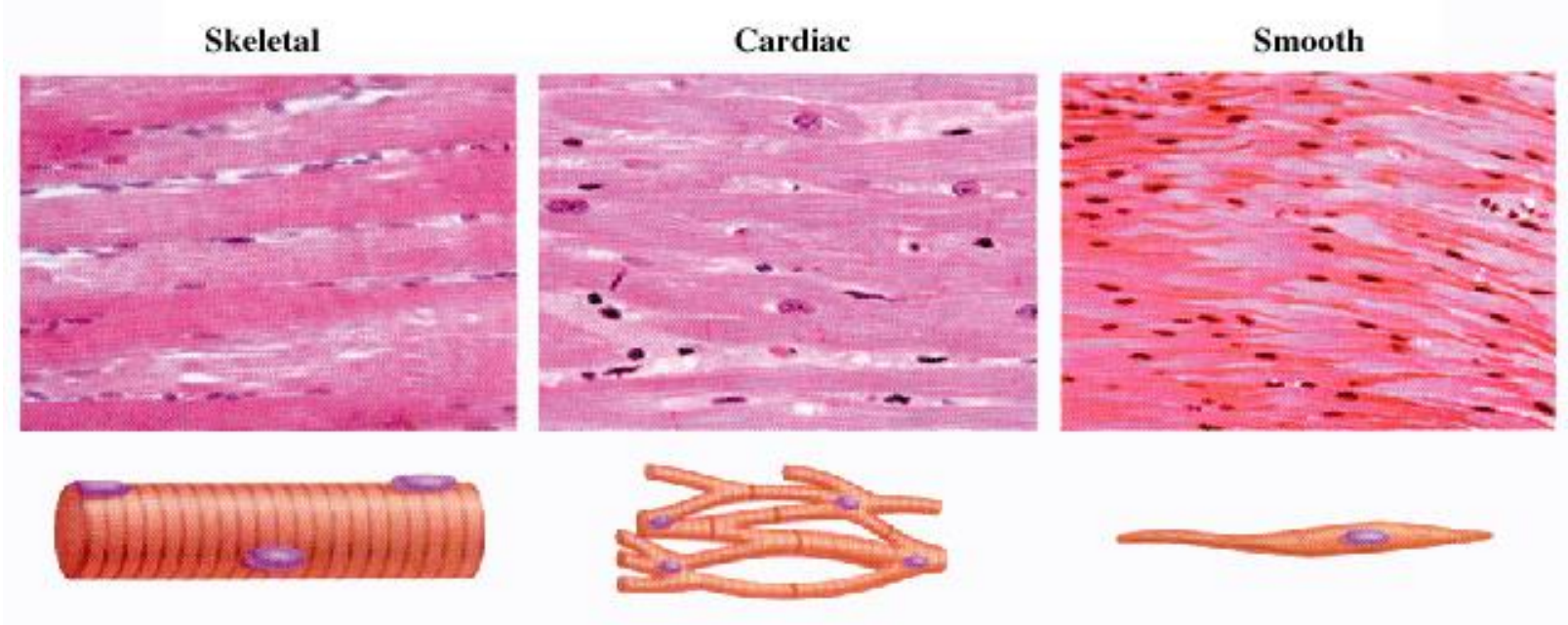
Sarcomere structure



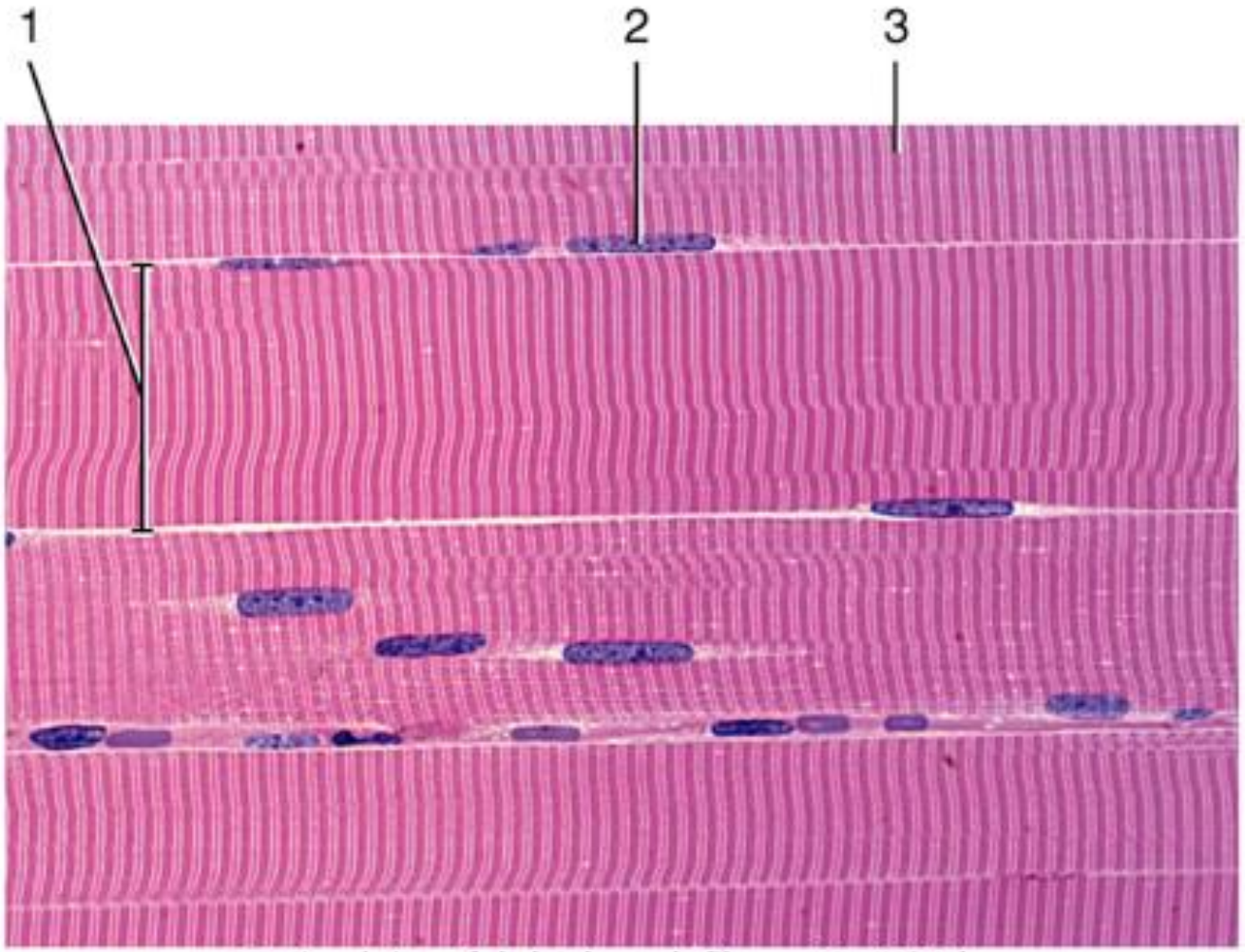
Task 2:

- what is the function of the Z and M line?
- What is the difference between the A band and I band?



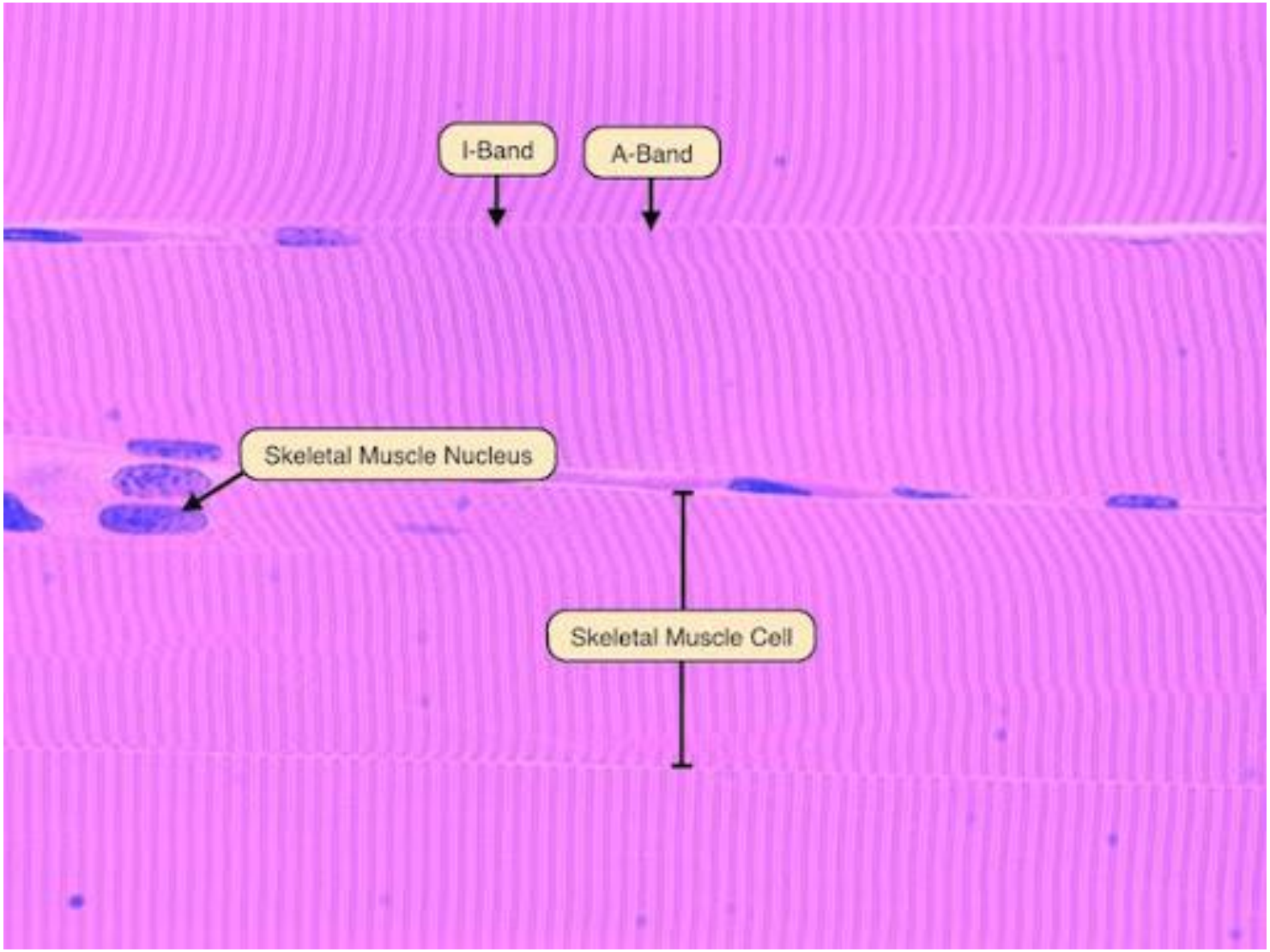

Skeletal
Cardiac
Smooth

Muscle Tissue: Drawing Exercise



Sectional view of skeletal muscle fibers. 400×, H&E, human


gettyimages
Ed Reschke
1035609016


I-Band
A-Band
Skeletal Muscle Nucleus
Skeletal Muscle Cell