MUSCLE TISSUE

Muscle tissue-specialized tissue that capable to contraction

Histogenetic classification:

1. Somatic type - originates from myotomes of mesoderm (skeletal muscle)
2. Coelomic type- originates from ventral mesoderm (cardiac muscle)
3. Visceral type - originates from mesenchyme (smooth muscle of inner organs)
4. Neural type- originates from neural tube (smooth muscle of iris)
5. Epidermal type -originates from skin ectoderm (myoepithelial cells os sweat, mammary glands)

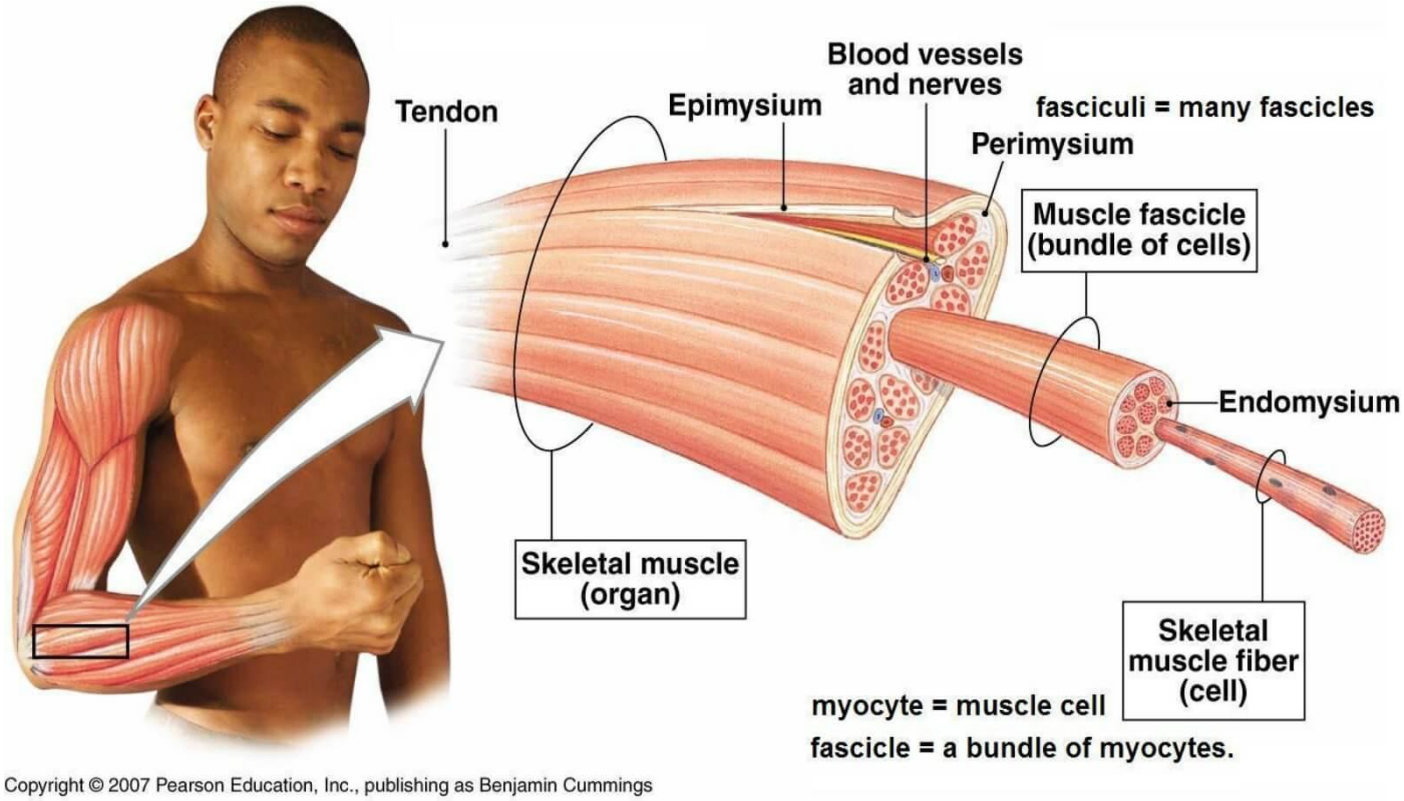
Morphofunctional classififcation

1. Smooth muscle tissue
2. Striated muscle tissue (skeletal, cardiac)

Skeletal muscle tissue

The structural and functional unit of the skeletal muscle tissue is **muscle fiber** that consists of:

- Myosymplast (syncytium)
- Satellite cells
- Basal lamina

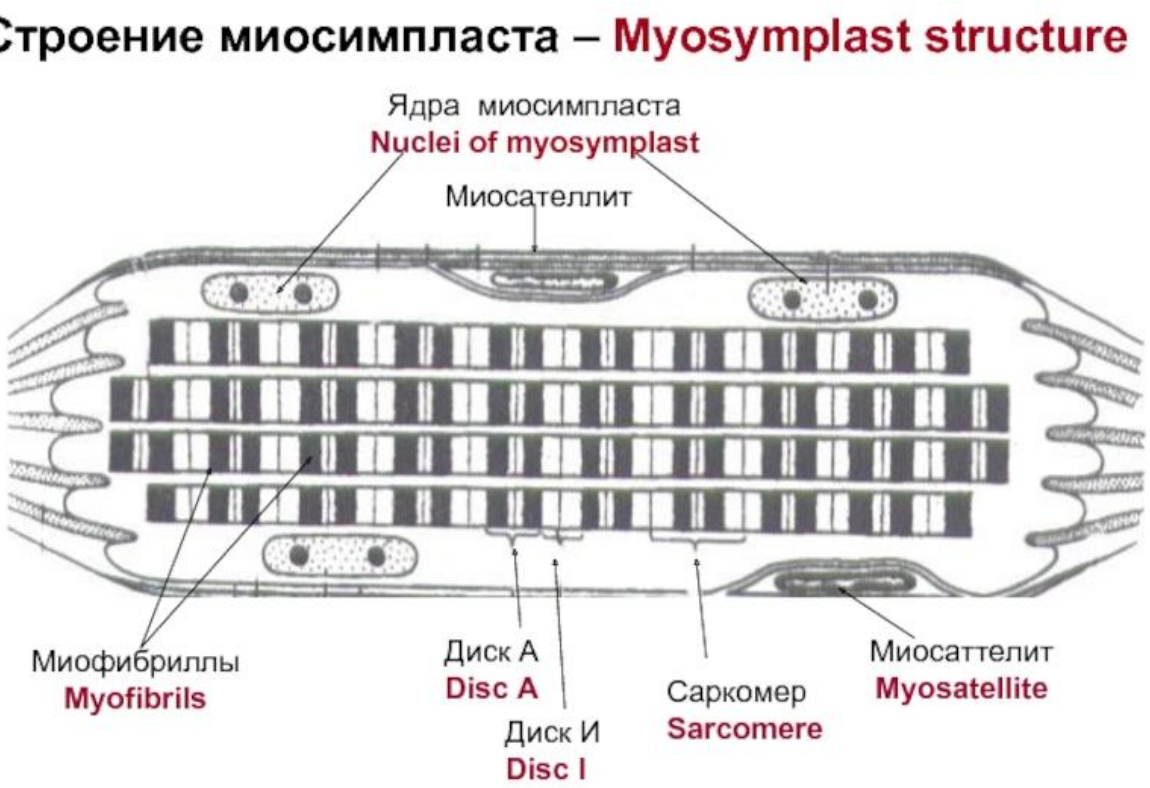


Myosymplast

- Is covered by **plasma membrane** which forms T-tubules

Sarcolemma consists of plasma membrane of myosymplast and basal lamina

- **Several thousand of nuclei**
- **General-function organelles**
- Specialized organelle- **myofibrils**
- **Inclusions**- lipids, carbohydrates, proteins

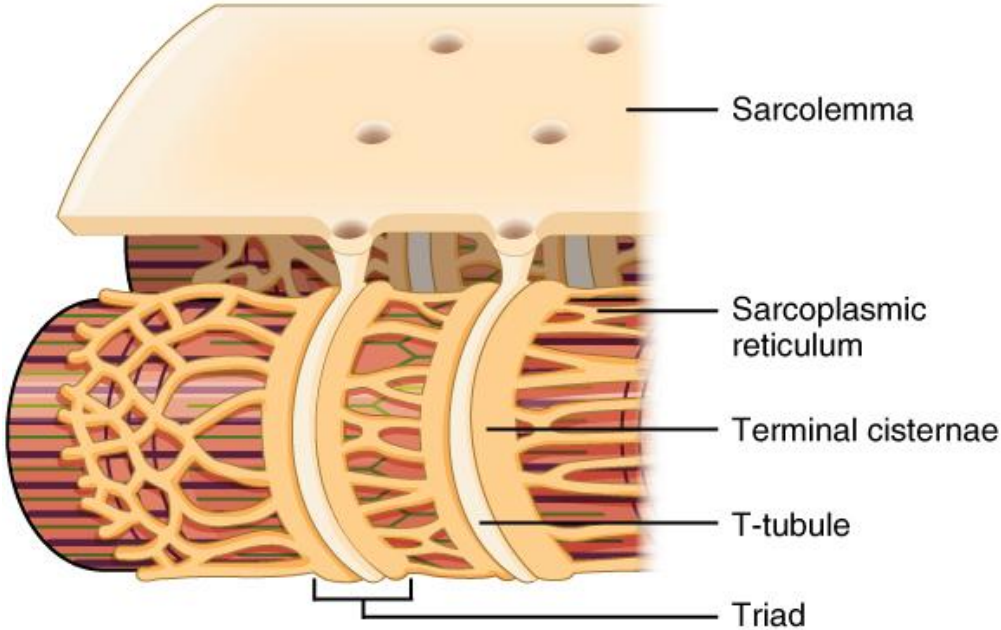


General - function organelles

- Mitochondria
- RER
- Golgi apparatus
- SER- sarcoplasmic reticulum- surrounds the myofibrils giving rise to L-tubules.

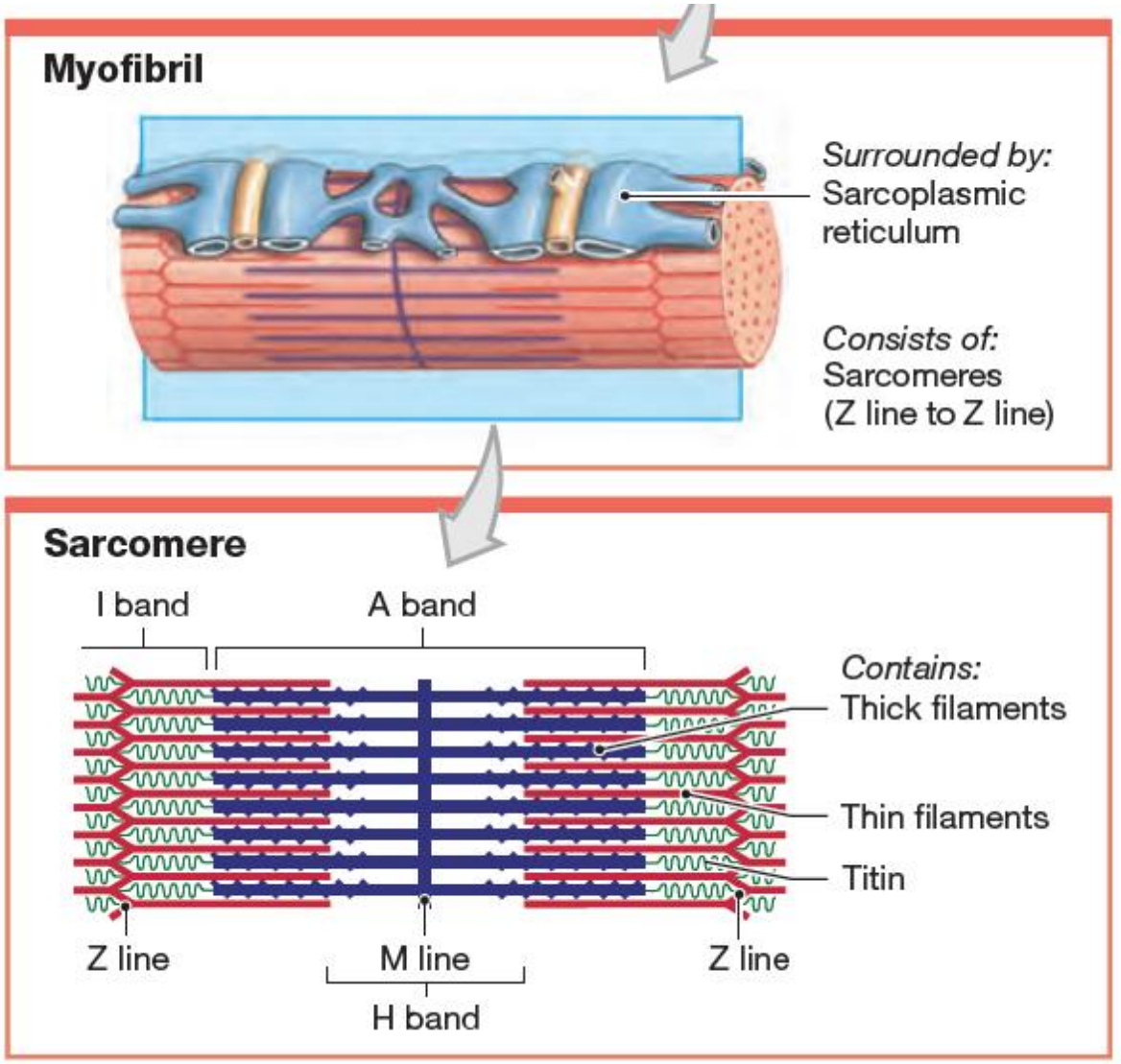
The terminal cisterna of the sarcoplasmic reticulum serves as reservoir for Ca

2L+1T=triad

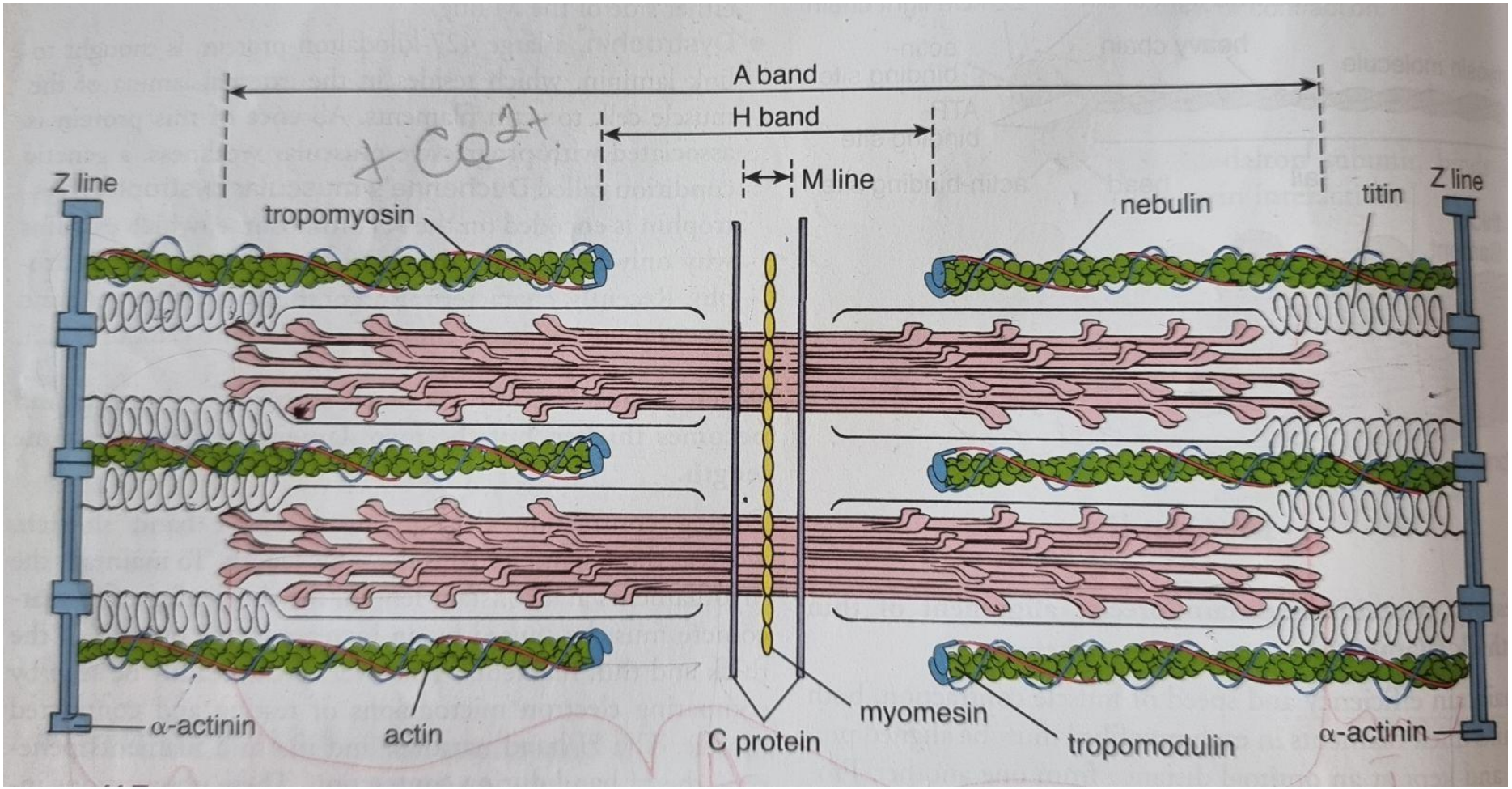


Special-function organelle- myofibril

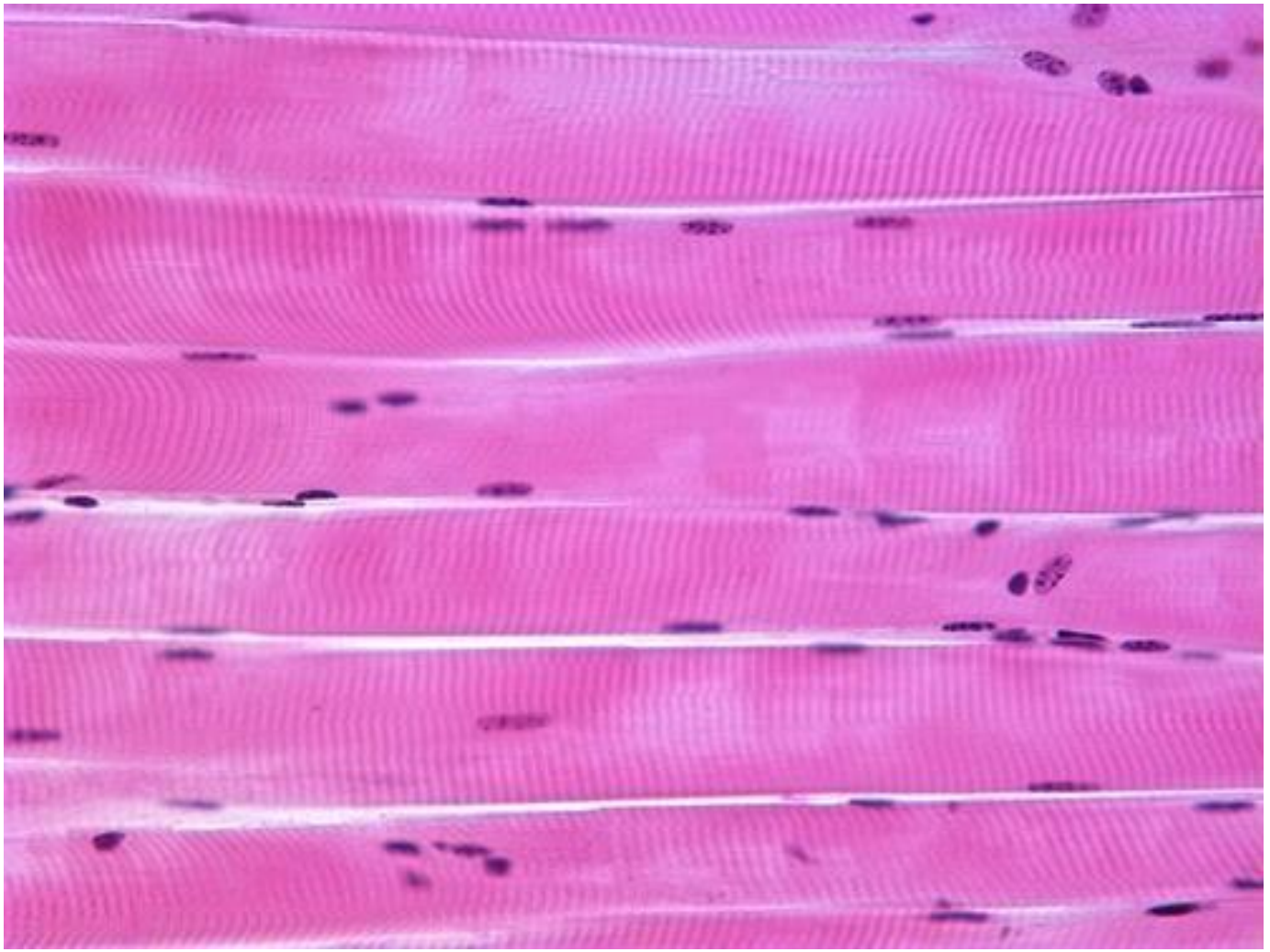
- The functional and structural unit of myofibril is **sarcomere.**
- Sarcomere consists of **actin and myosin filaments.**
- The arrangement of thick and thin filaments produce cross-striations of the myofibril



Sarcomere


A band
H band
M line
Z line
Z line
tropomyosin
nebulin
titin
α-actinin
actin
C protein
myomesin
tropomodulin
α-actinin

Skeletal muscle tissue

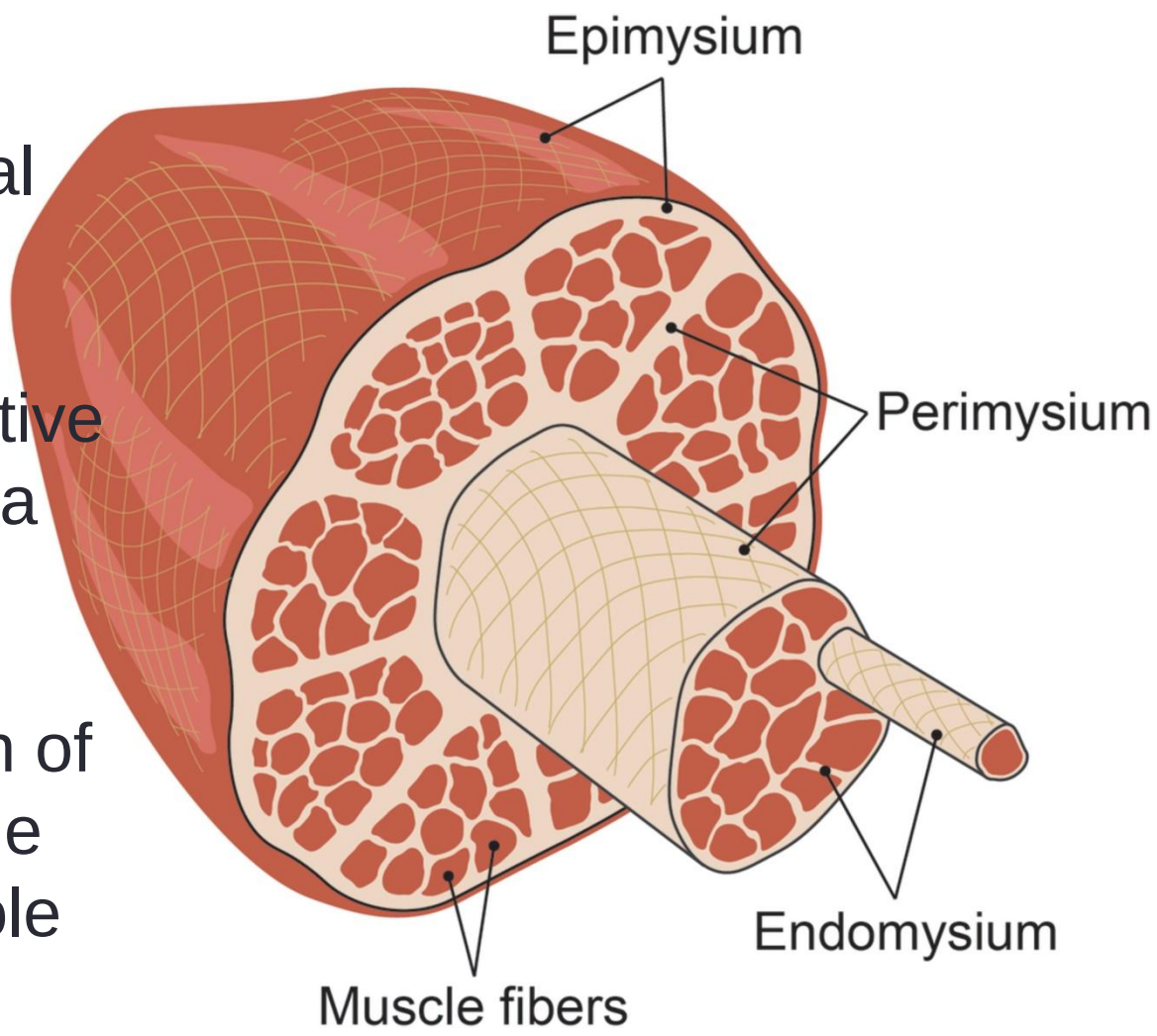


Skeletal muscle as an organ

Endomysium - connective tissue surrounds the individual muscle fiber.

Perimysium – connective tissue layer surrounds a group of fibers

Epimysium – a sheath of dense connective tissue that surrounds the whole muscle



Types of skeletal muscle fiber

- **Red muscle fiber** has large amount of myoglobin and cytochrome complexes. So, they are slow-switched and fatigue-resistance.

- **Intermediate muscle fiber** has large amount of glycogen. They are both quite fast-twitched and fatigue-resistance.

- **White muscle fiber** has less myoglobin and few mitochondria. They are fast-twitched and fatigue-prone

Cardiac muscle tissue

- The structural and functional unit is **cardiomyocyte**

Types of cardiac muscle cells:

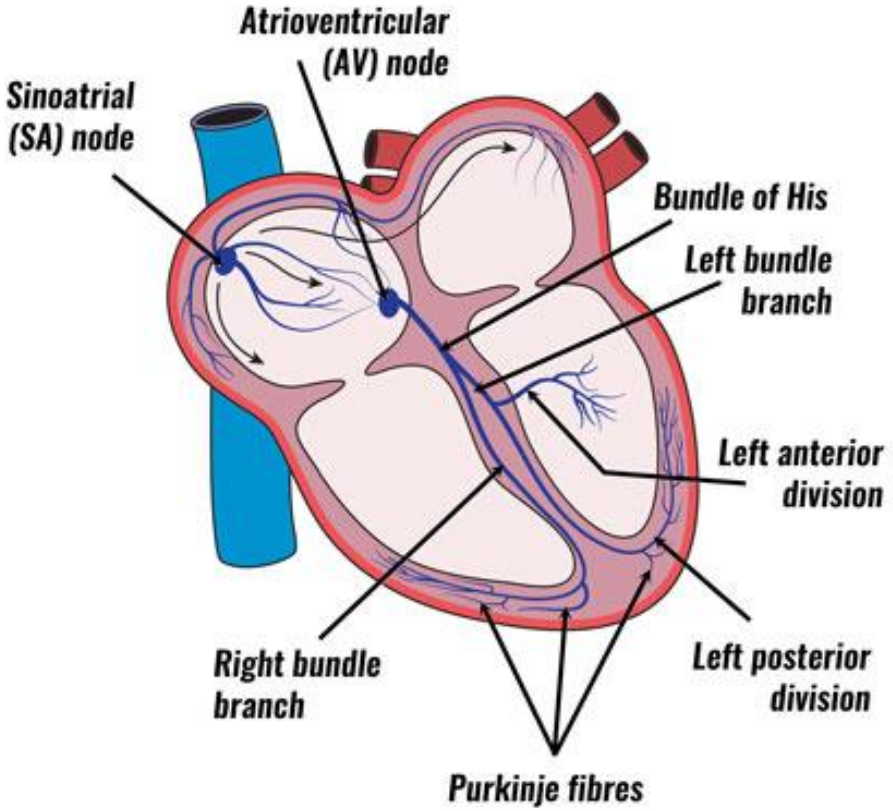
- **Contractile**

- **Conducting**
- Pecemaker cells (SA node)- generate nerve impulse

- Transitional cells (AV node)

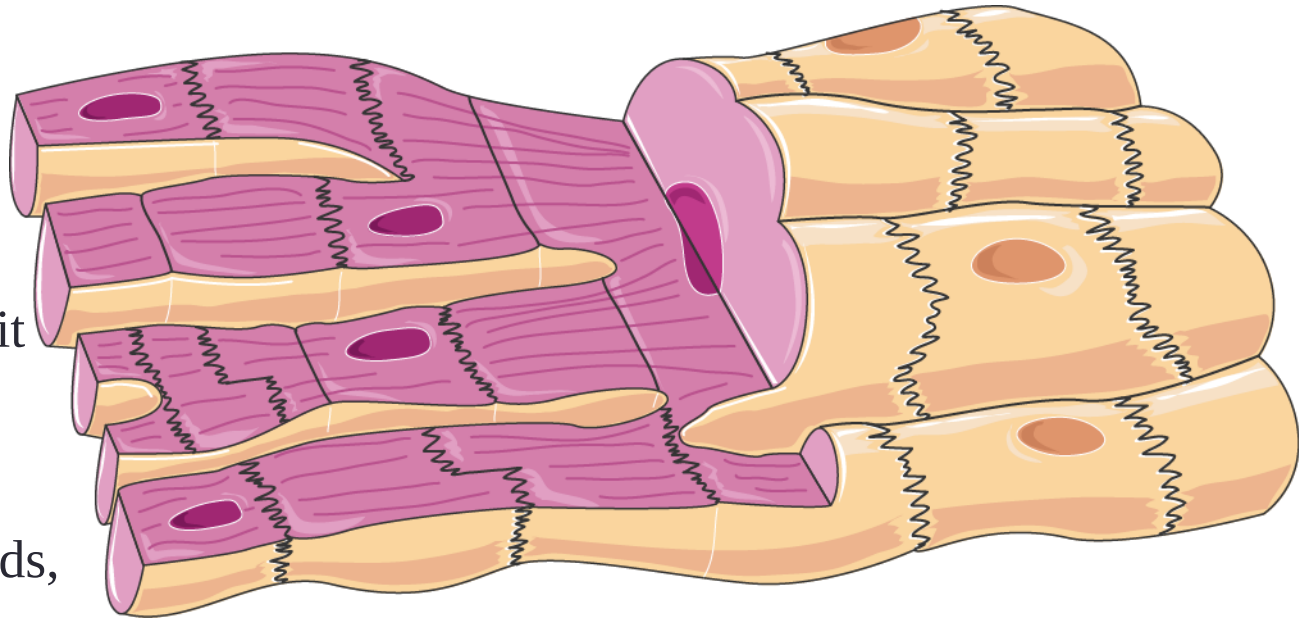
- Cells of the bundle of His and Purkinje fibers

- **Secretory**



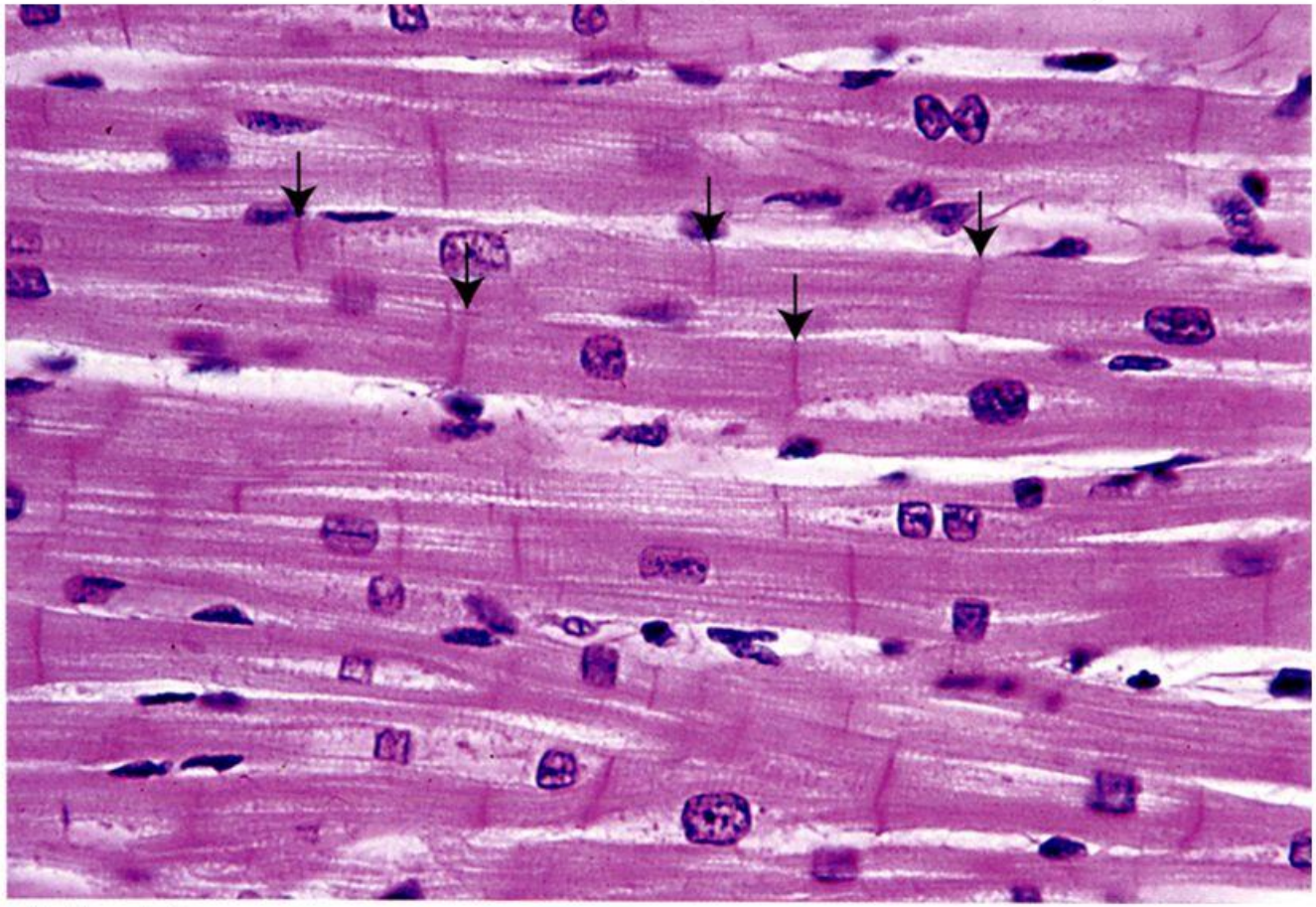
Contractile cardiac muscle cells

- Nucleus is oval in the center of the cell
- General-function organelles: lysosomes, Golgi apparatus, centrosome, RER, **highly-developed SER**
- **1L+1T=diad**
- Specialized organelles- **myofibrils.** Structural unit of the myofibril is **sarcomere**
- Inclusions: glycogen, lipids, **myoglobin**
- **Intercalated disks: desmosome, nexus,**



Cardiac muscle tissue

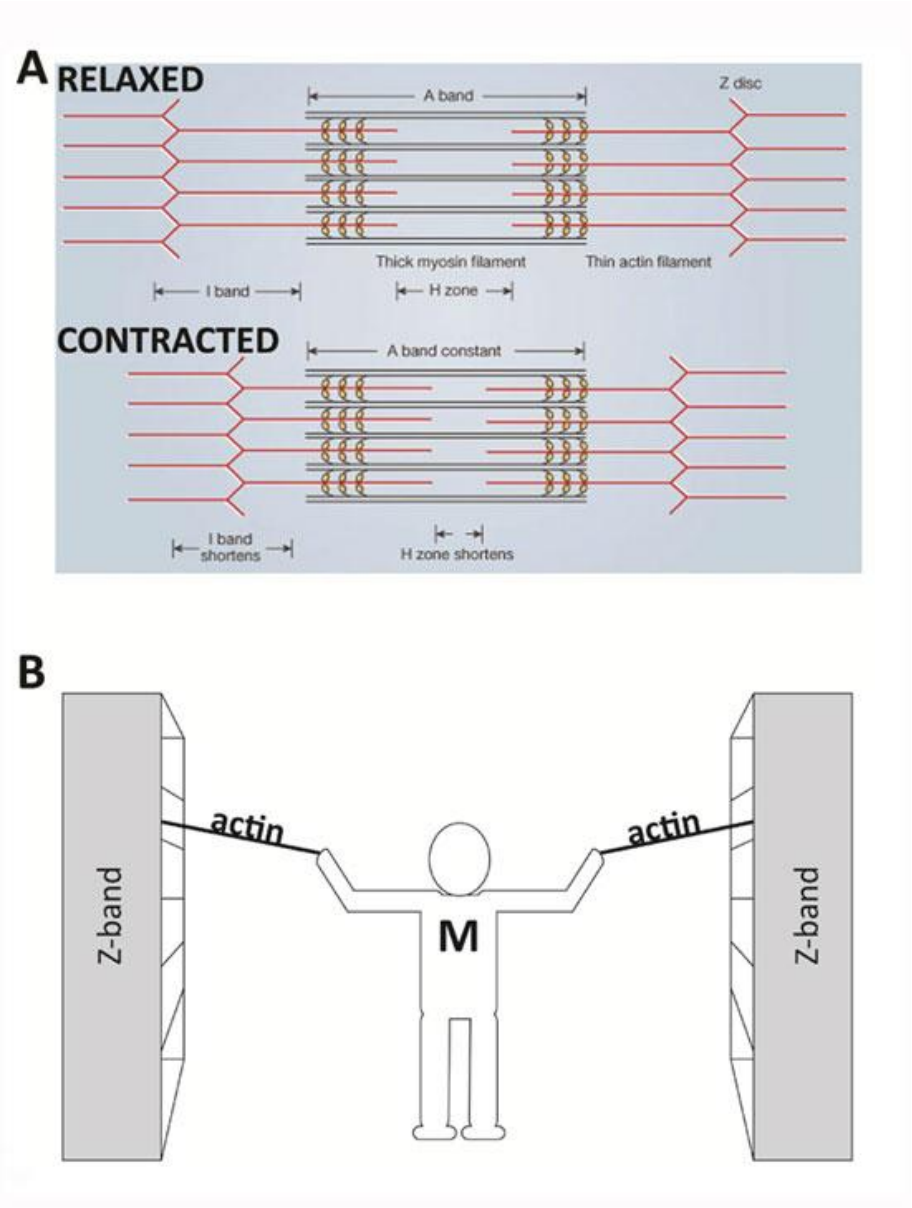
Cardiac Muscle (longitudinal section)



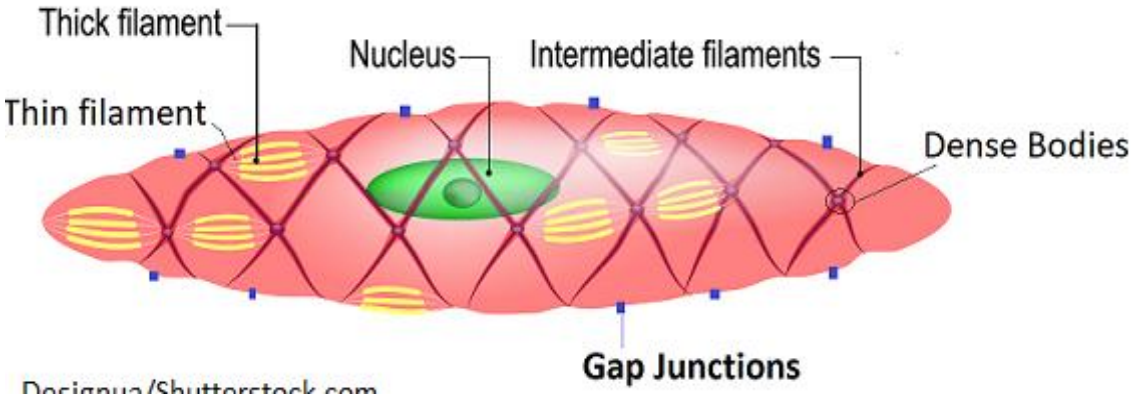
- Central nuclei
- Striated, branched fibers joined by intercalated disks (arrows) forms interwoven meshwork

Mechanism of contraction of striated muscle tissue

- The action potential spreads through the plasmolemma and T-tubules and initiates releasing of the Ca.
- The Ca interact with special regulatory proteins of the myofibrils (troponin and tropomyosin)
- The activated regulatory proteins of the myofibrils makes to be activated myosin filaments which initiates the movement.

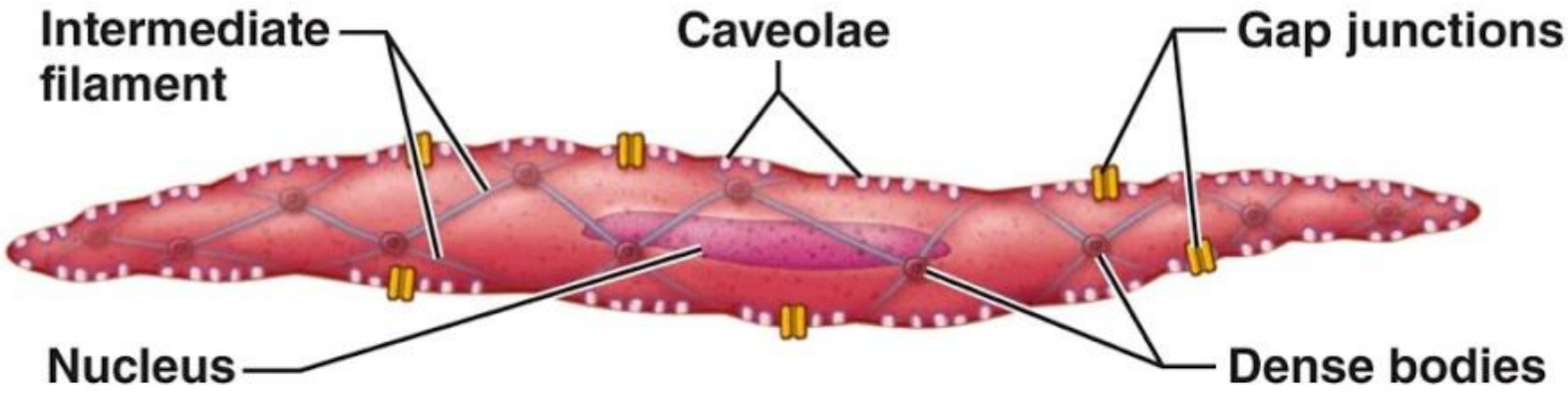


Smooth muscle tissue

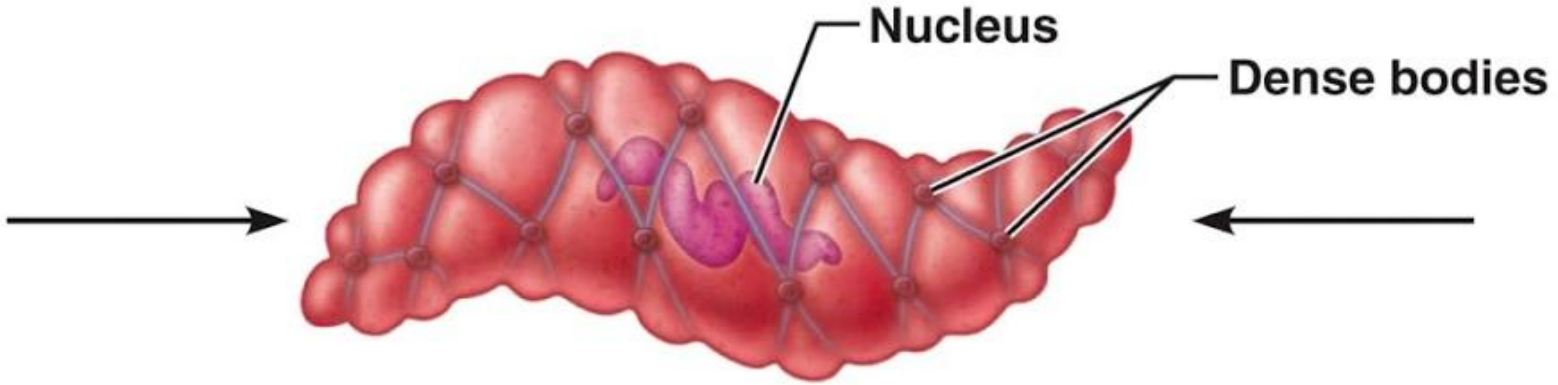


- **The structural and functional unit** of the smooth muscle tissue is **smooth muscle cell**
- **The shape** of the cell is **fusiform**
- **Nucleus** is oval in the center of the cell
- The plasmalemma forms numerous invaginations-pinocytotic vesicles **(caveolae)**
- **General-function organelles:** lysosomes, Golgi apparatus, centrosome, RER, SER
- **Specialized organelles-** actin and myosin filaments which form three-demensional network. The sites of attachment of the actin filaments to the cytoplasm are called **dense bodies. The myosin filaments** are longitudinally arranged
- **Inclusions:** glycogen, lipids, myoglobin
- Cells are interacted with **nexus**

Smooth Muscle Contraction



(a) Relaxed smooth muscle fiber (note that gap junctions connect adjacent fibers)



Comparison of different types of muscles