

Muscle Tissue

Objectives

- ▶ **By the end of this lecture you will be able to**
 - ▶ Understand the different type of muscles in human body
 - ▶ Learn the differences on function, shape and structures



Muscle Tissue

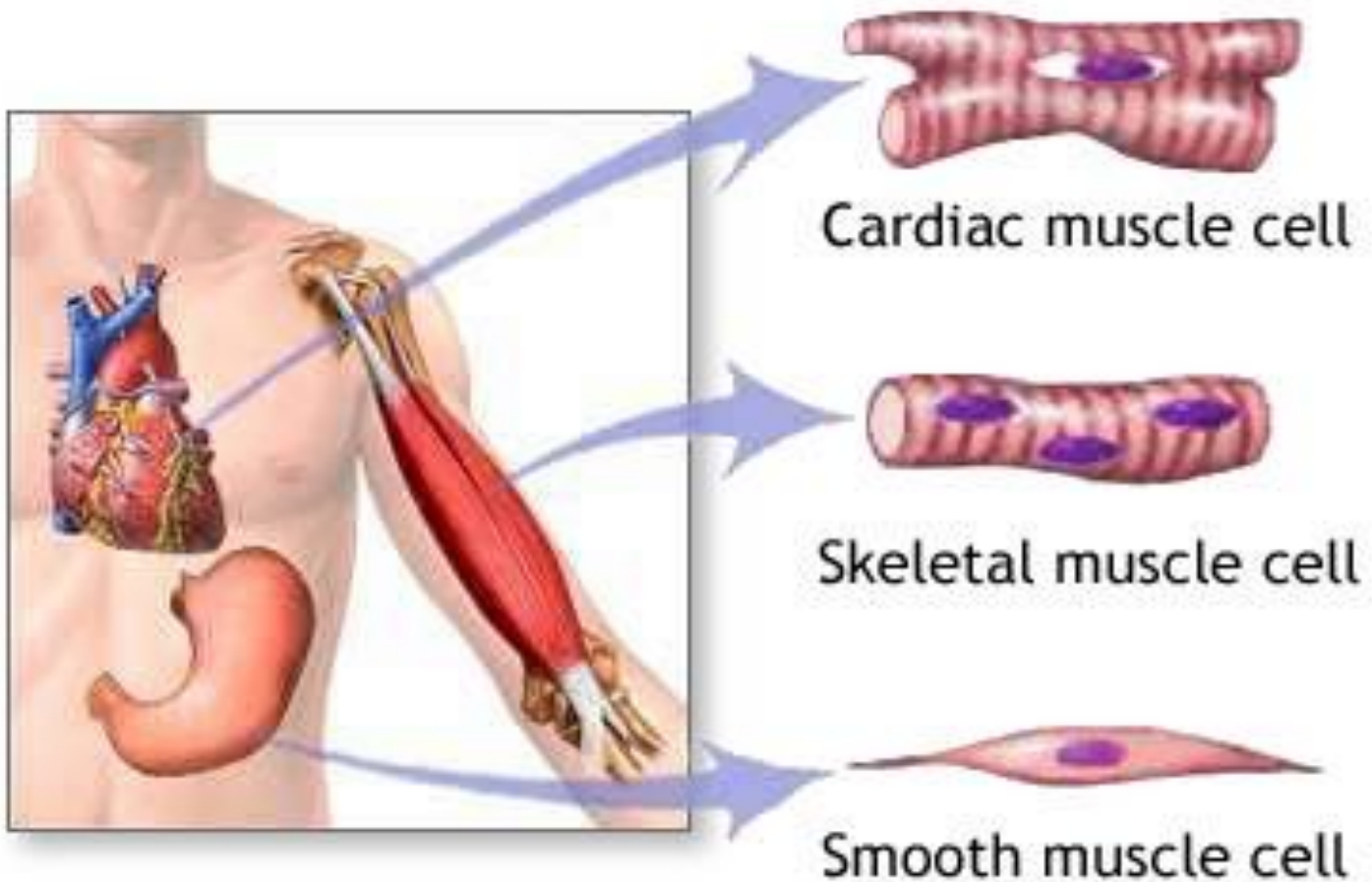
Muscle tissue is composed of differentiated cells containing contractile proteins.

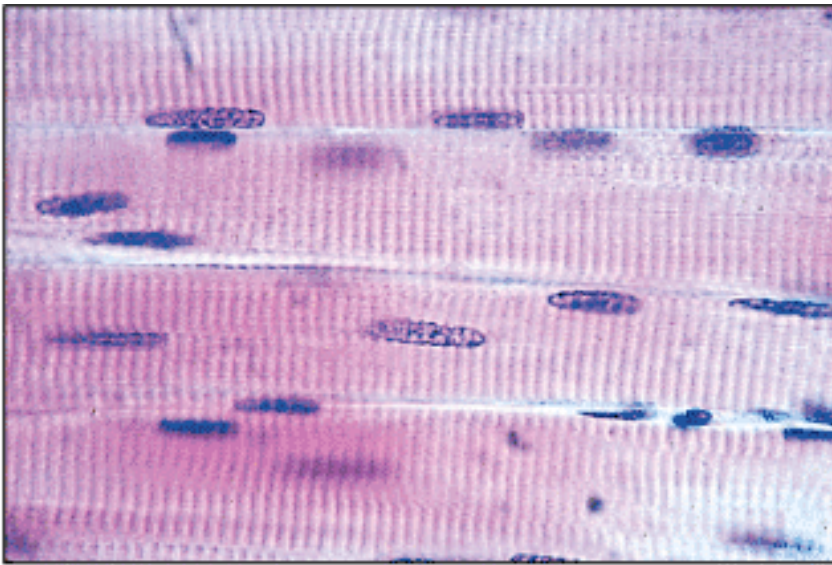
Microfilaments and associated proteins together generate the contraction.

- Originates from Mesenchyme.
- Provided with well developed vascular supply and nerve network.

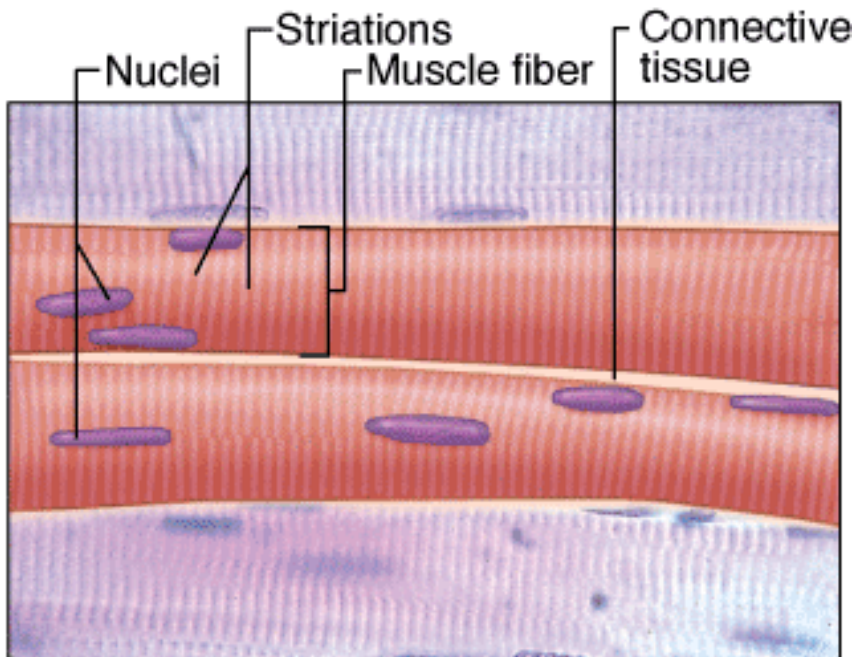


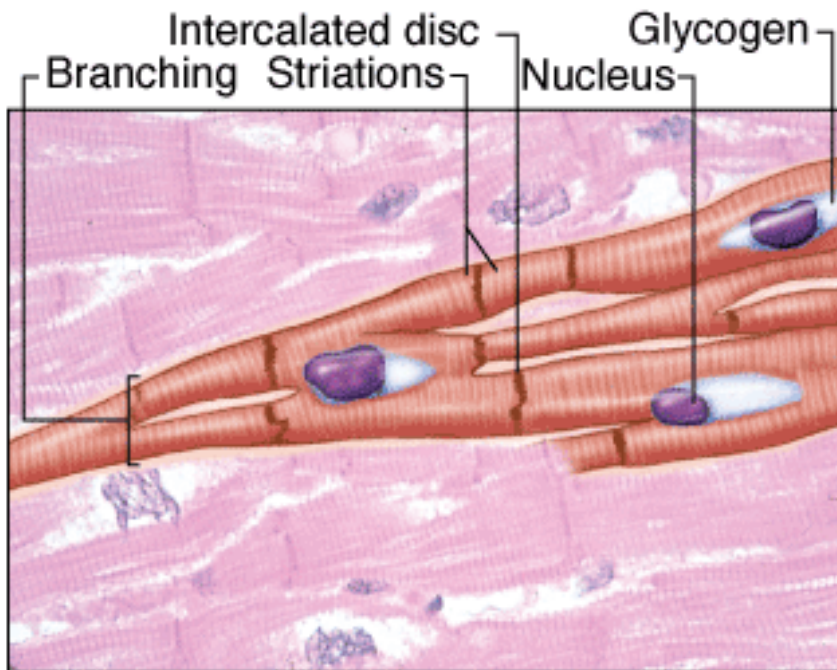
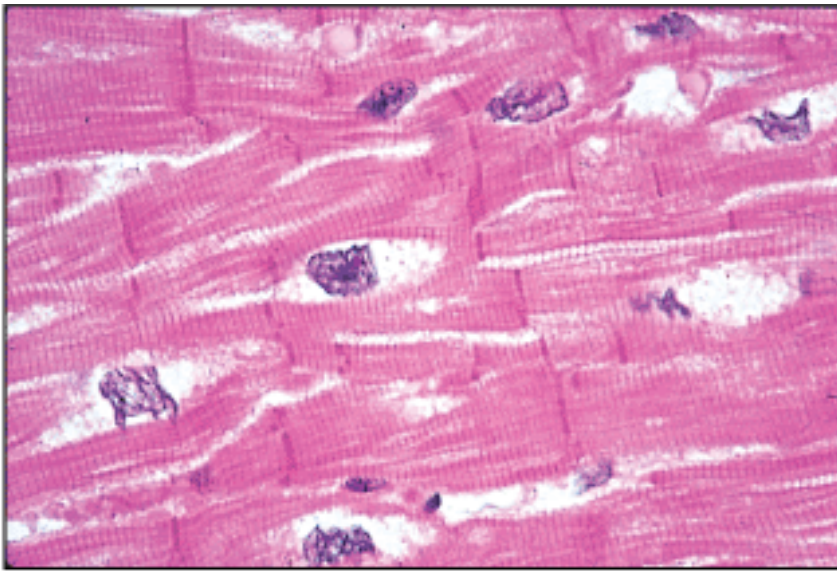
Muscle Types





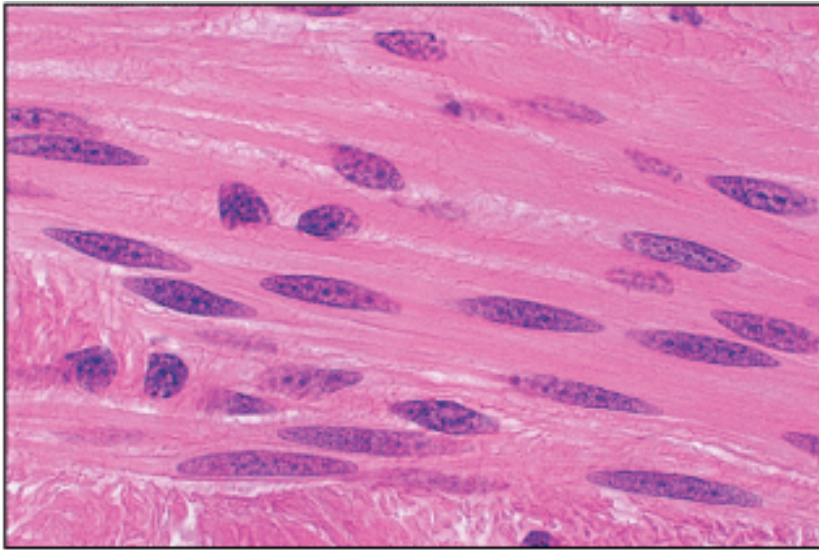
Skeletal Muscle
is composed of
large, elongated,
multinucleated fibers that
show strong, quick,
voluntary contractions





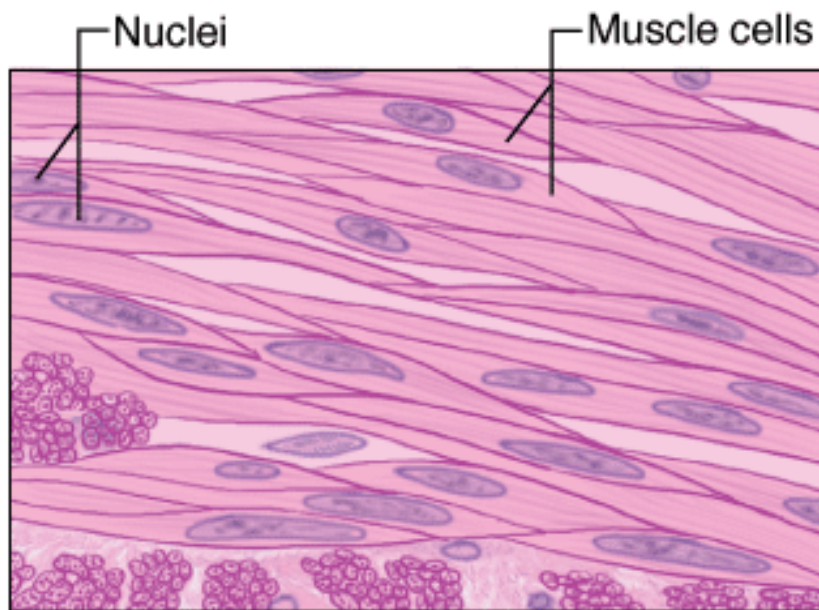
Cardiac Muscle

is composed of irregular branched cells bound together longitudinally by intercalated disks and shows strong, involuntary contractions



Smooth Muscle

is composed of grouped, fusiform cells with weak, involuntary contractions. The density of intercellular packing seen reflects the small amount of extracellular connective tissue present



Fusiform means having a spindle-like shape that is wide in the middle and tapers at both ends.

Definitions

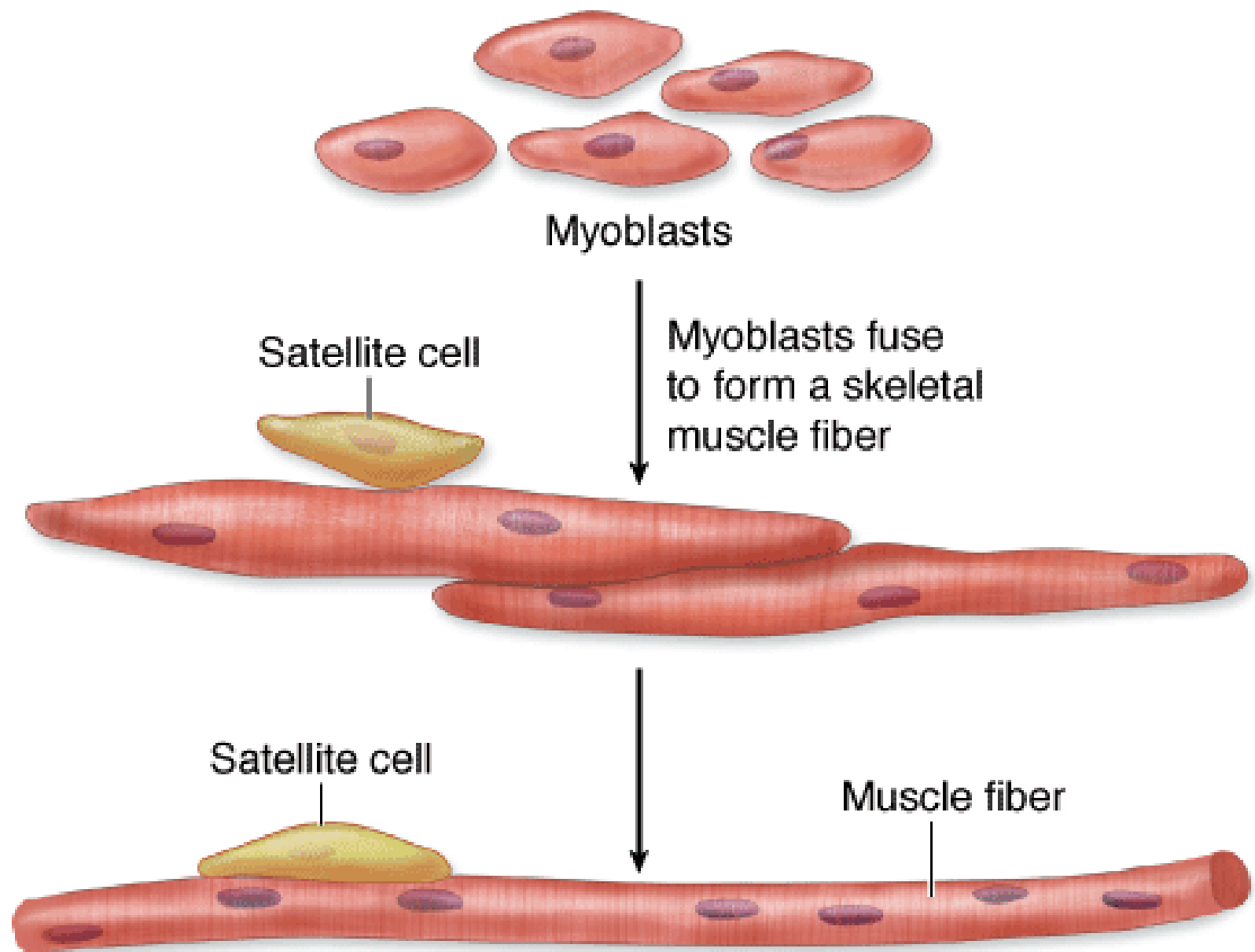
- ▶ The cytoplasm of muscle cells is called **sarcoplasm** (Gr. *sarkos*, flesh, + *plasma*, thing formed)
- ▶ The smooth ER is called **sarcoplasmic reticulum**.
- ▶ The **sarcolemma** (*sarkos* + Gr. *lemma*, husk) is the cell membrane, or plasmalemma.



Skeletal Muscle Development

- ▶ Skeletal Muscle - forms "flesh" or "meat" of body
- ▶ 40% of total body weight.
- ▶ Cells form long fibers up to 100 mm (0.4 inch)
- ▶ Cells are unique - formed from a syncytium (multinucleate), many cells fused together for more efficient function;
- ▶ Multinucleate, 3-5 nuclei/mm length; nuclei always at periphery of cell.
- ▶ very well organized; ensheathed by Proper CT (endomysium; perimysium; epimysium).





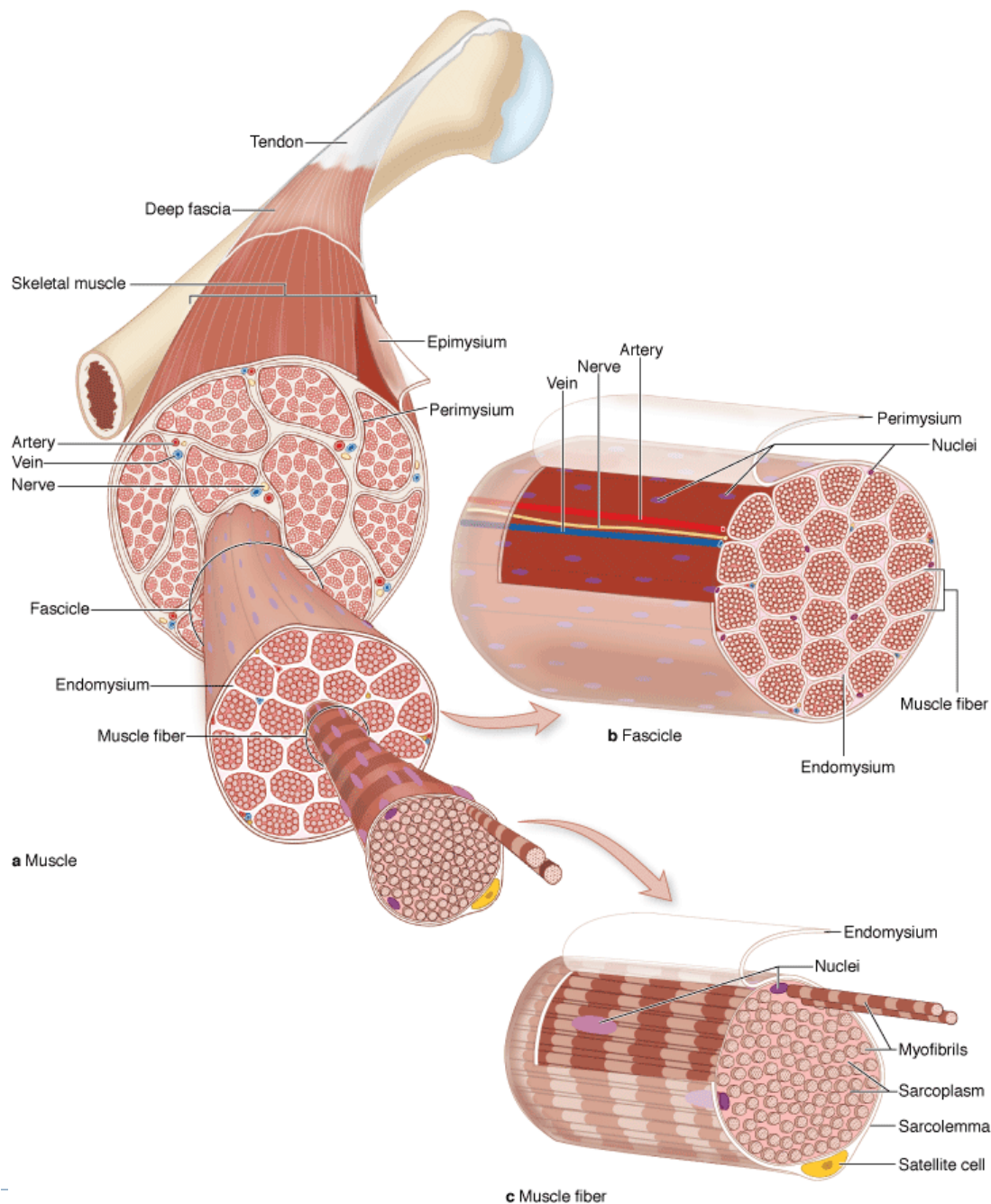
Source: Mescher AL: *Junqueira's Basic Histology: Text and Atlas*, 12th Edition: <http://www.accessmedicine.com>

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Skeletal Muscle Development con.

- ▶ Skeletal muscle begins to differentiate when mesenchymal cells called myoblasts align and fuse together to make longer, multinucleated tubes called myotubes.
 - ▶ Myotubes synthesize the proteins to make up myofilaments and gradually begin to show cross striations by light microscopy.
 - ▶ Myotubes continue differentiating to form functional myofilaments and the nuclei are displaced against the sarcolemma.
 - ▶ Part of the myoblast population does not fuse and differentiate, but remains as a group of mesenchymal cells called muscle satellite cells located on the external surface of muscle fibers inside the developing external lamina.
 - ▶ Satellite cells proliferate and produce new muscle fibers following muscle injury.
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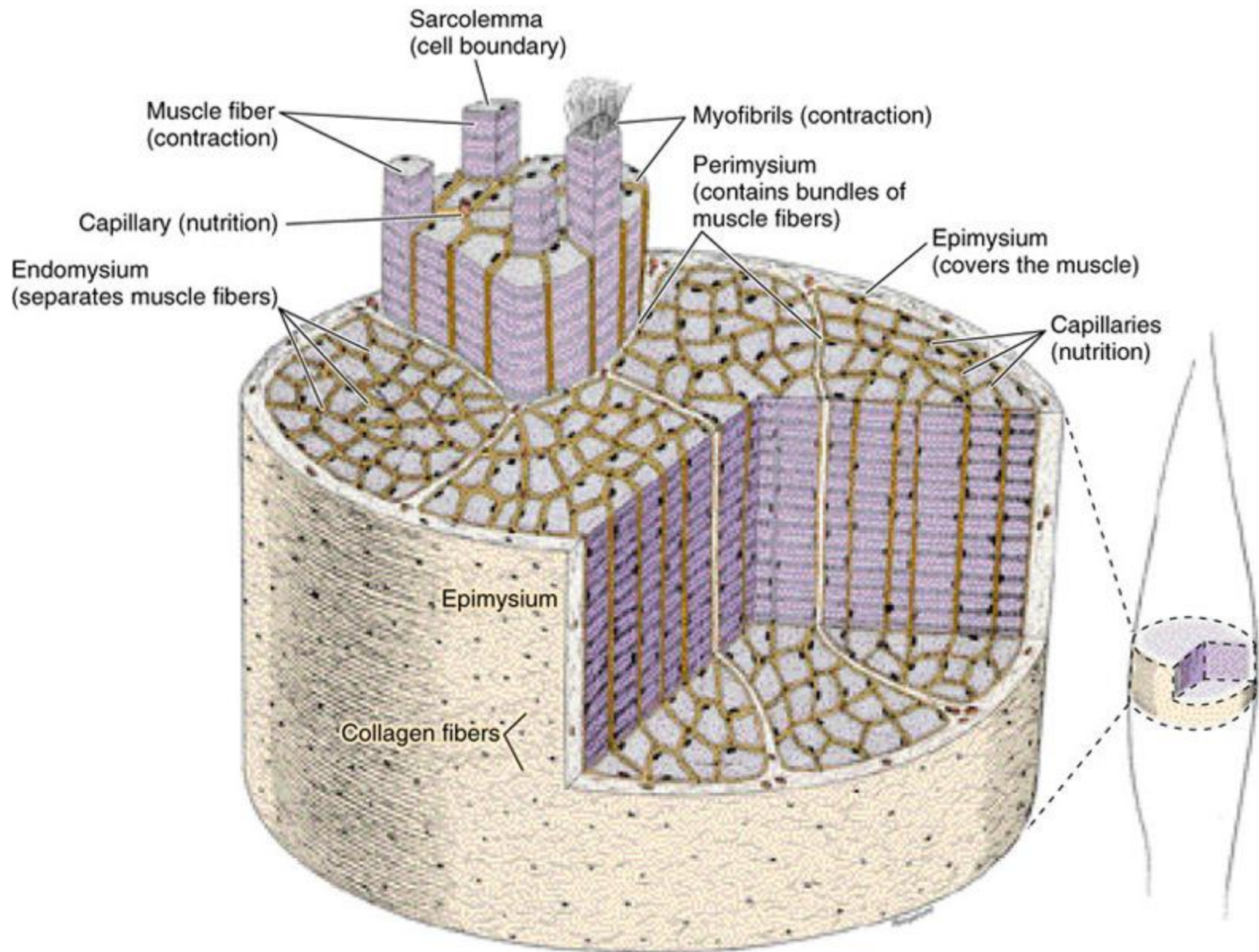


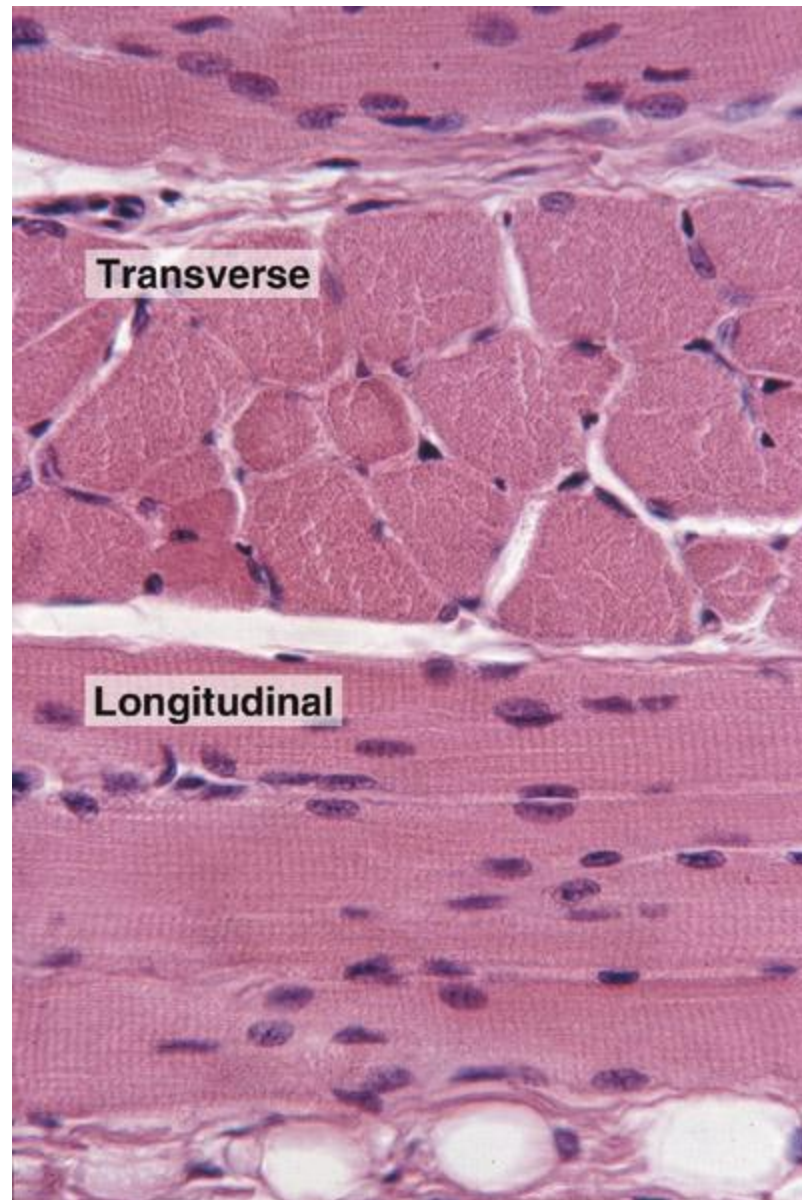


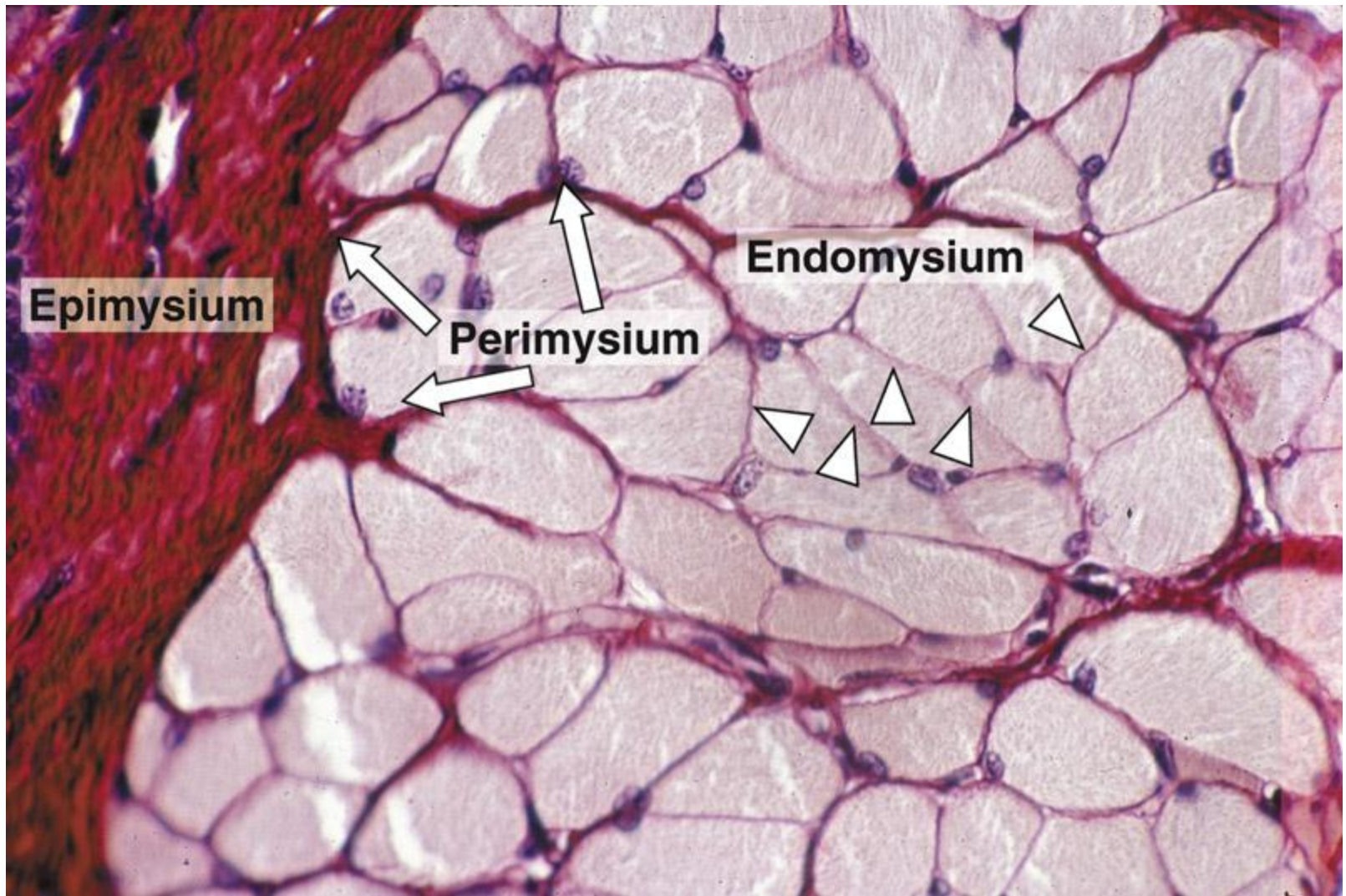
Organization of skeletal muscle.

- ▶ An entire skeletal muscle is enclosed within a dense connective tissue layer called the epimysium continuous with the tendon binding it to bone (a).
- ▶ Each fascicle (bundle) of muscle fibers is wrapped in another connective tissue layer called the perimysium (b).
- ▶ Individual muscle fibers (elongated multinuclear cells) is surrounded by a very delicate layer called the endomysium, which includes an external lamina produced by the muscle fiber (and enclosing the satellite cells) and ECM produced by fibroblasts (c).





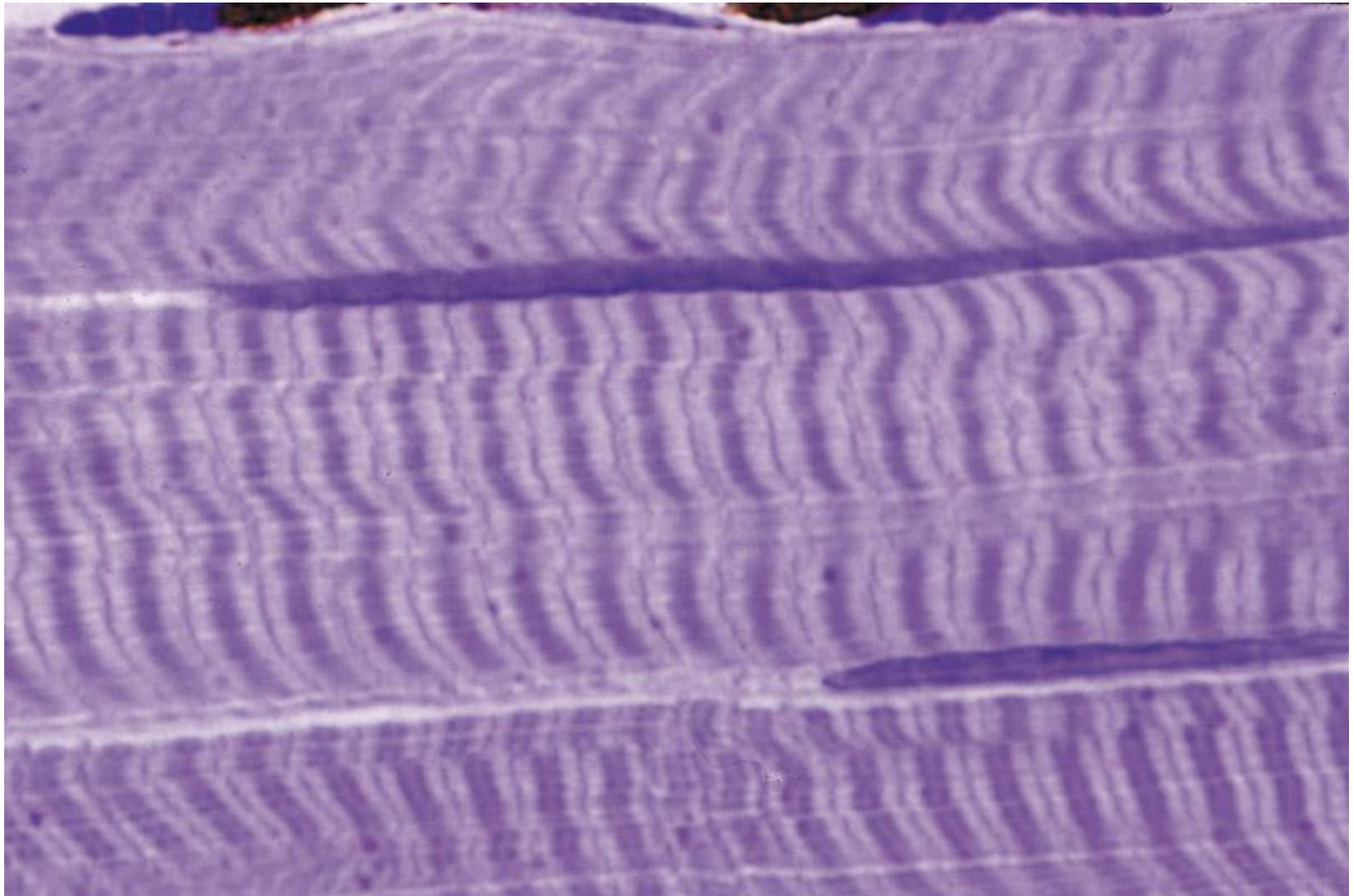


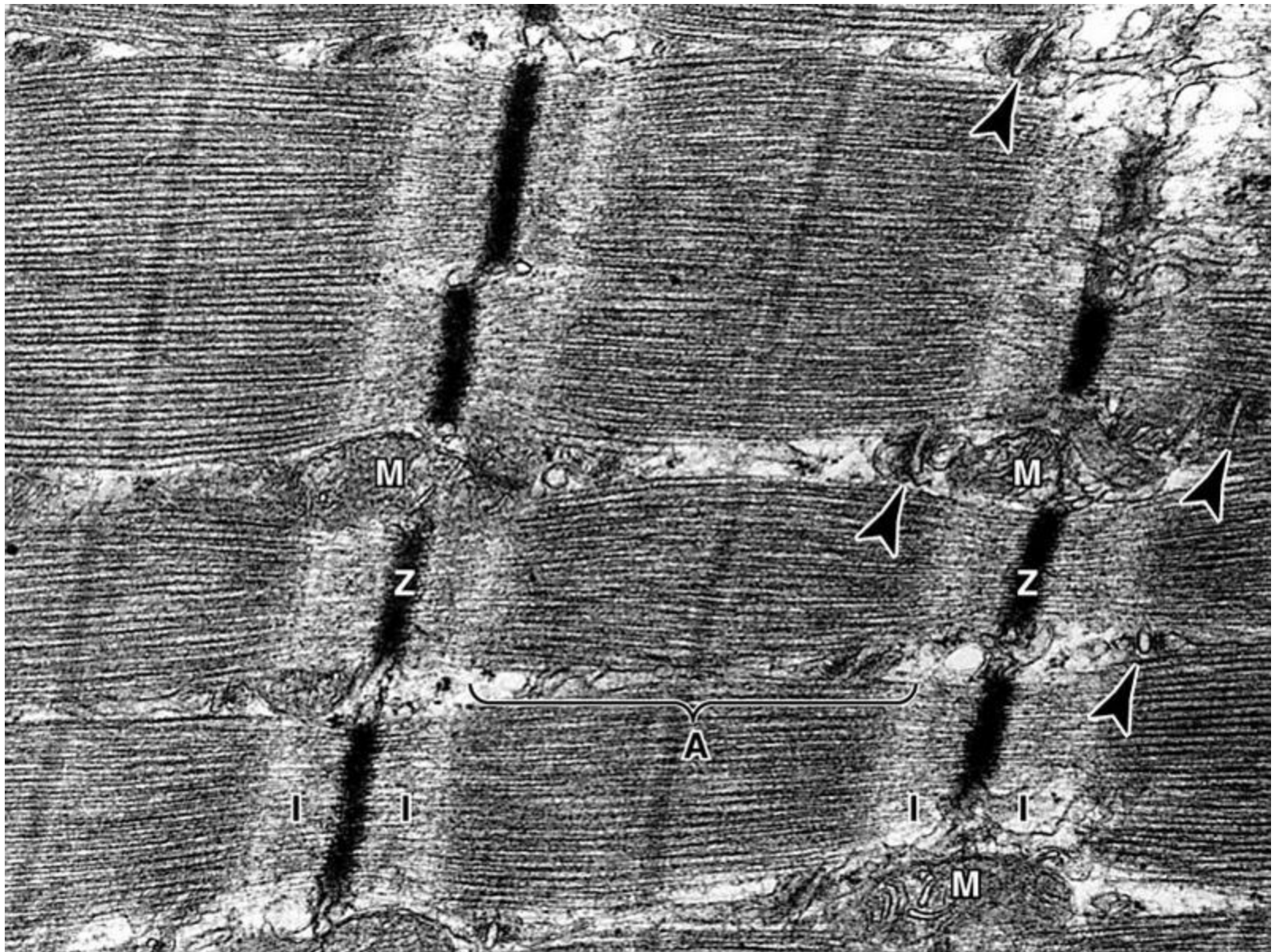


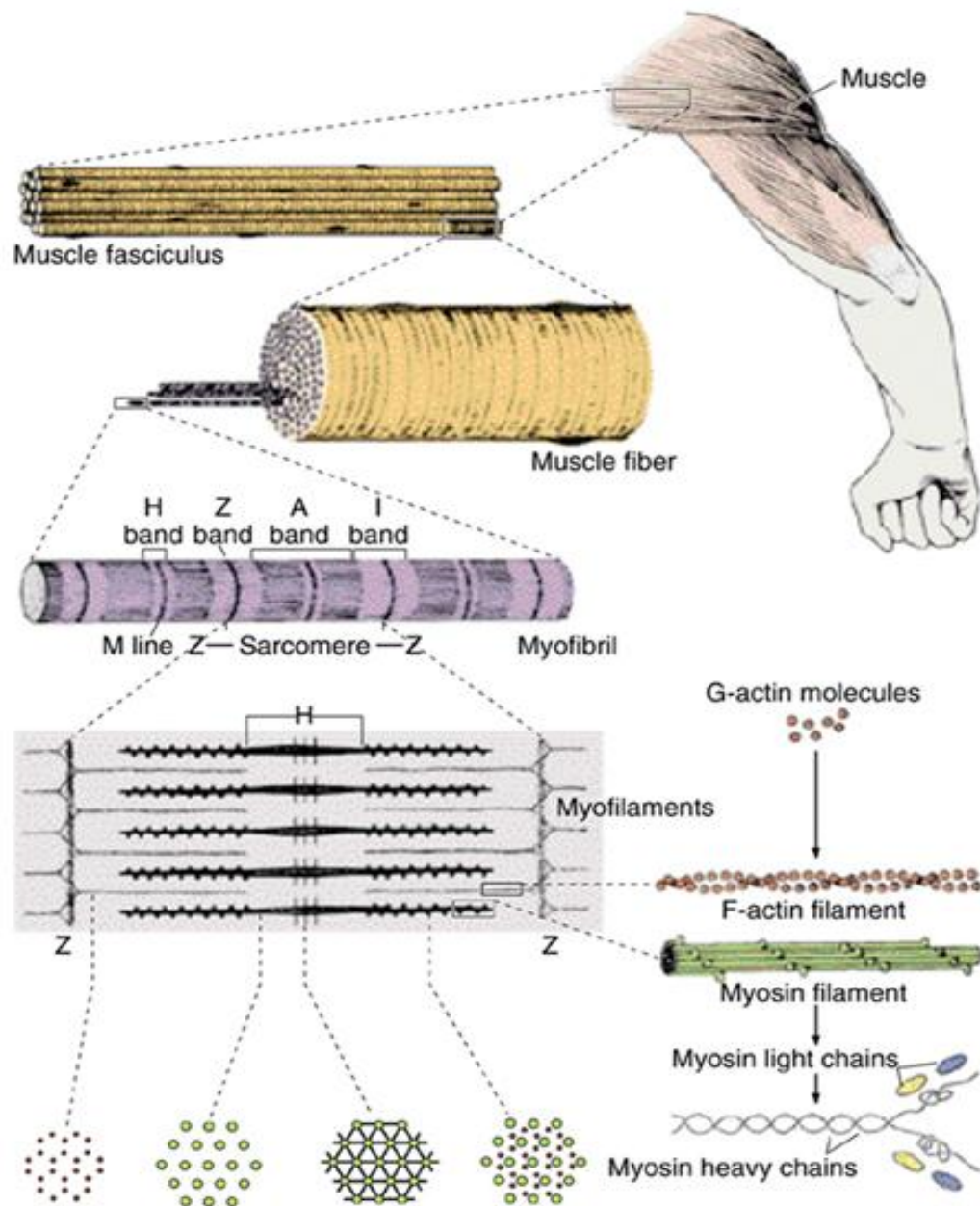
Skeletal Muscle

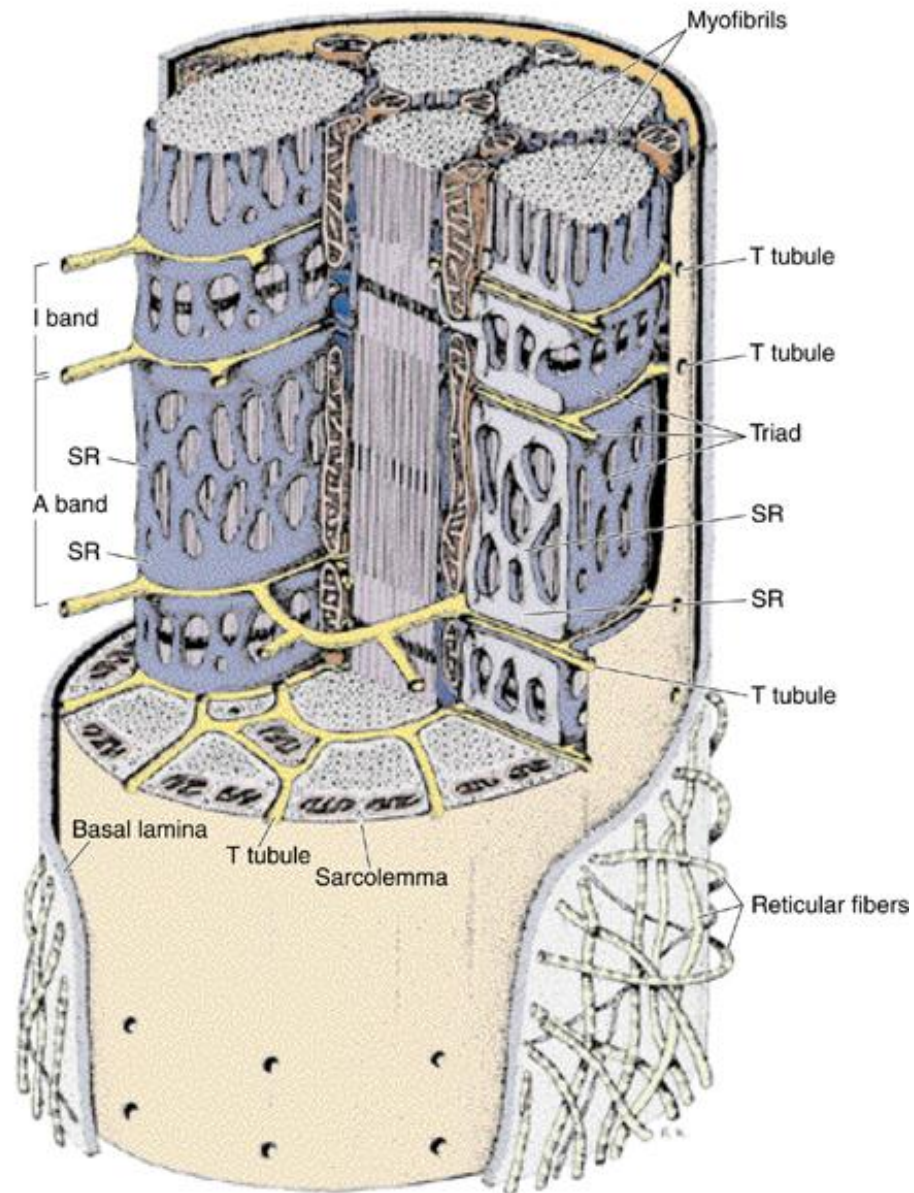
- ▶ Cells organized into contractile units = Sarcomeres.
- ▶ Sarcomeres are connected end to end = Myofibril. Many myofibrils then make up a cell.
- ▶ Sarcomere - the basic functional contractile unit;
- ▶ Organization of myofilaments, thin (actin) and thick (myosin) ,
- ▶ ER = Sarcoplasmic Reticulum
- ▶ Triads (t-tubule + 2 cisternae) at A-I Junction











Cardiac Muscle

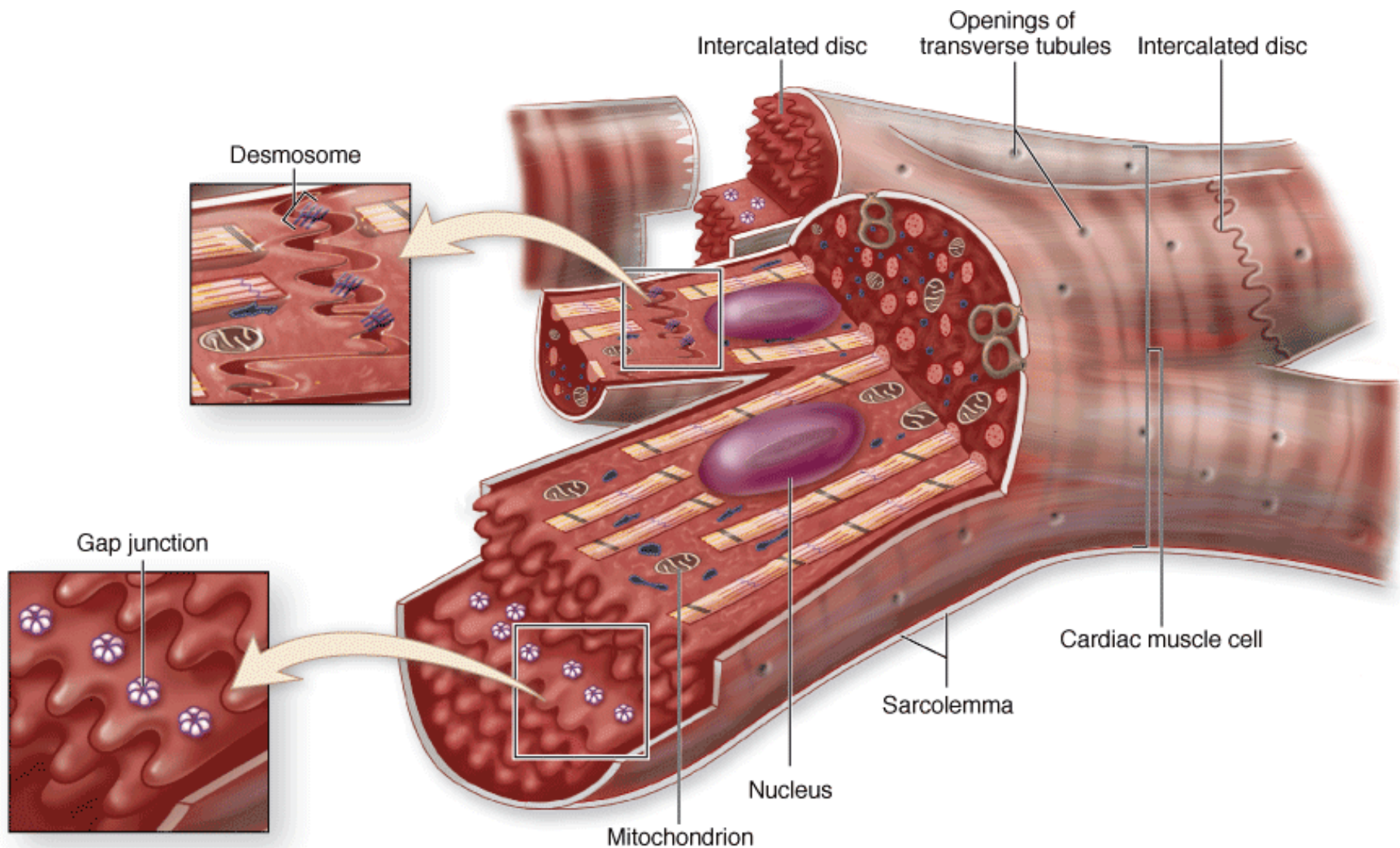
Cells branch, anastomose; 85-100 μm long; sarcomeres with striations;

1 or 2 nuclei per cell; diads (t-tubule and one cisterna) at Z lines; nuclei in center of cell;

Cell membranes interdigitate with each other = intercalated discs

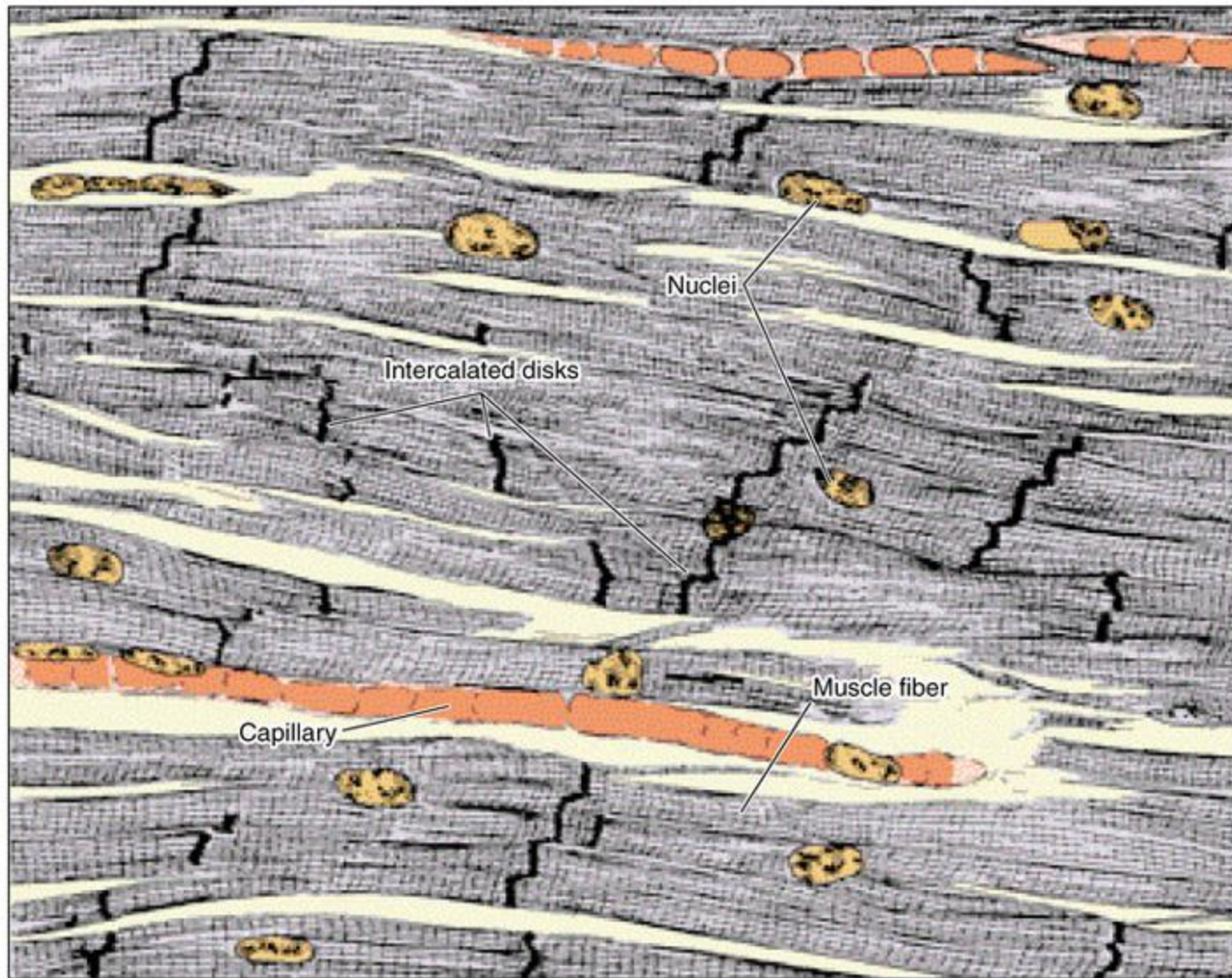
Rich with mitochondria (up to 40% of volume)

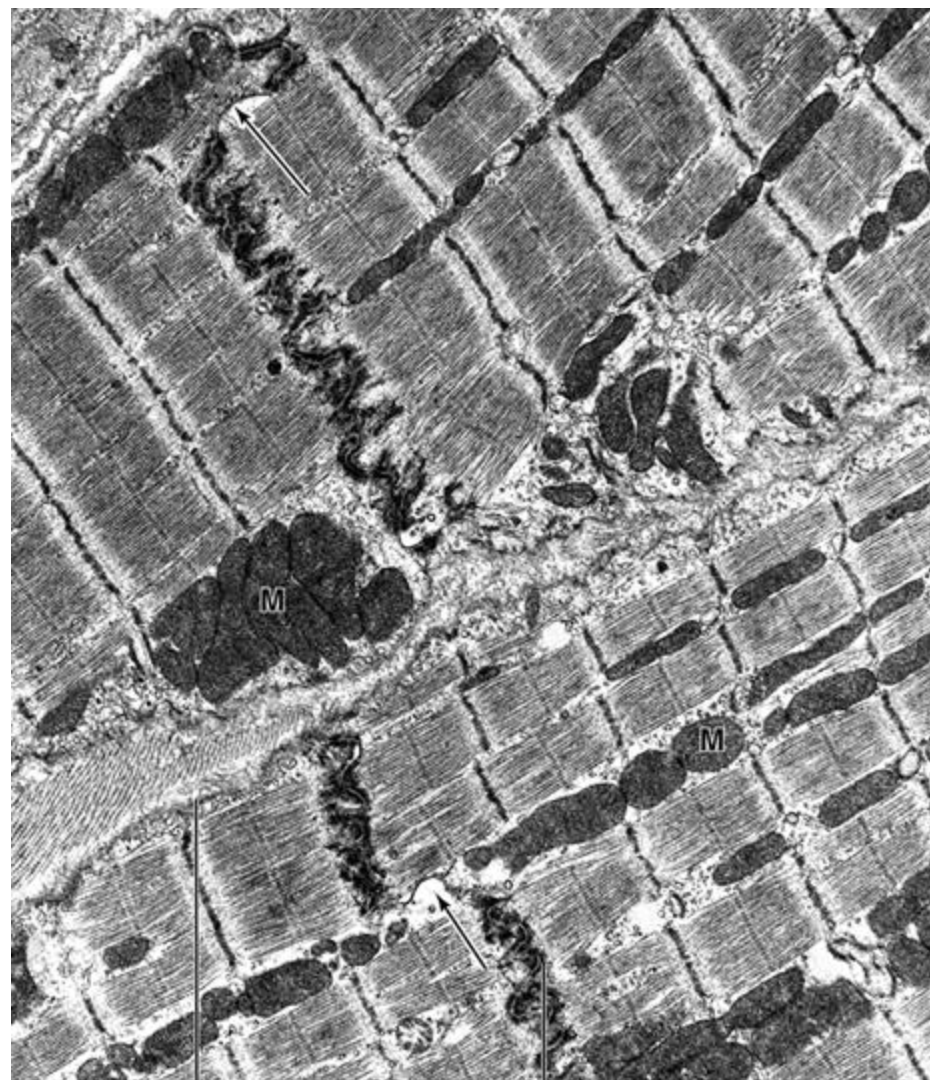
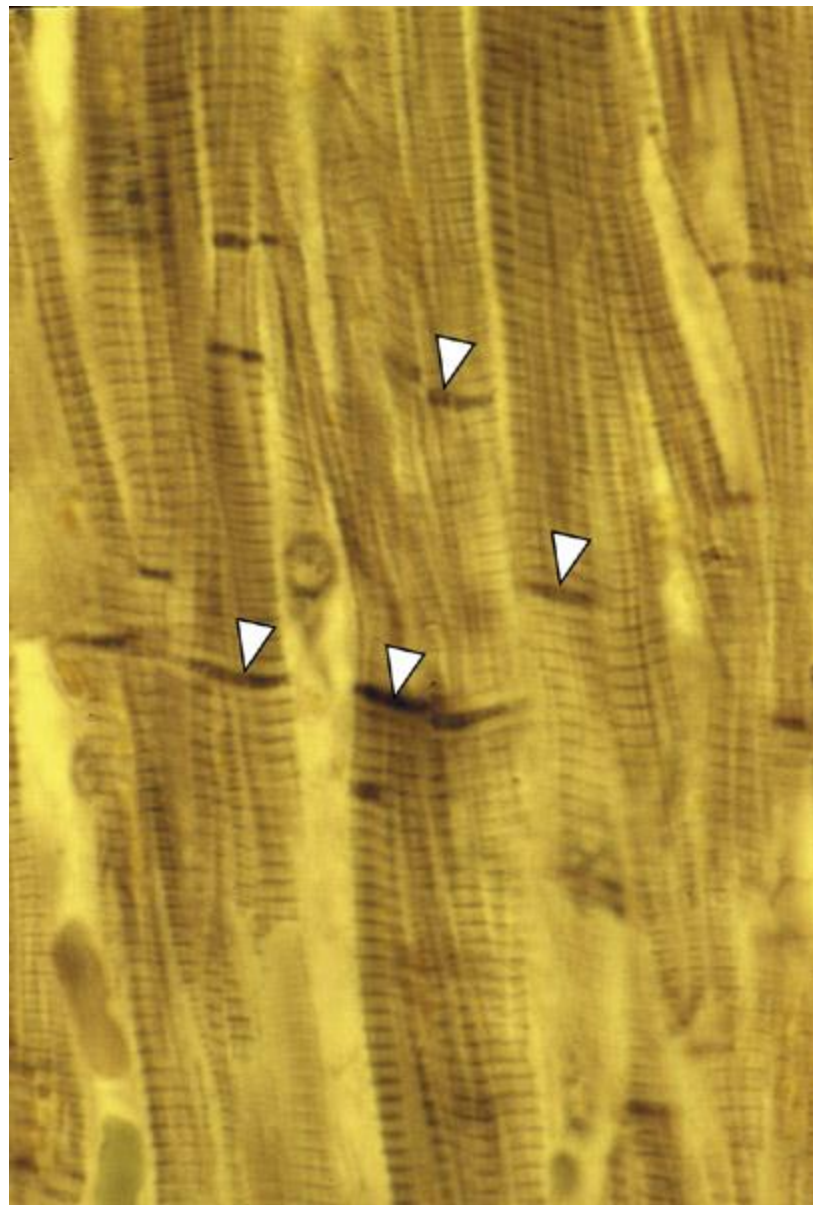




Source: Mescher AL: *Junqueira's Basic Histology: Text and Atlas*, 12th Edition: <http://www.accessmedicine.com>

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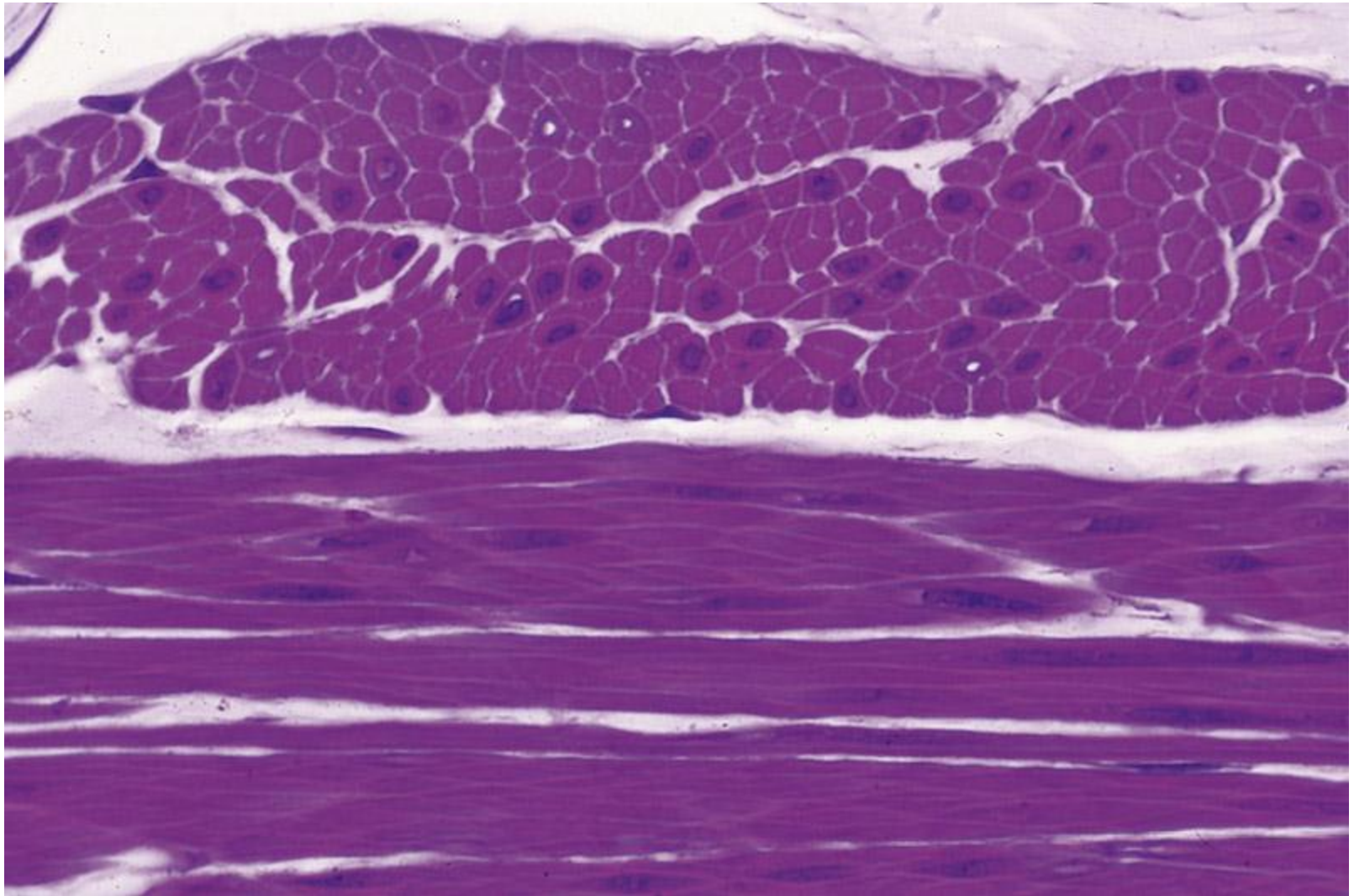
Fibrils of
reticular
fibers

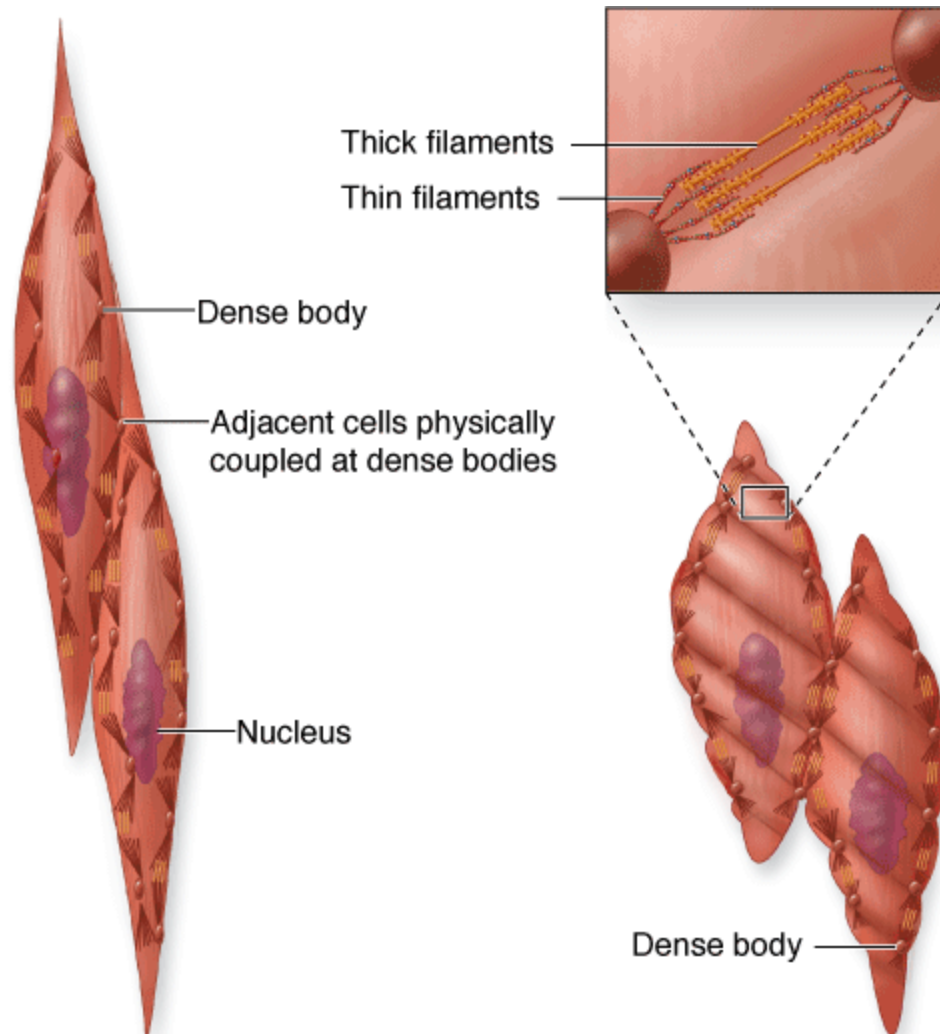
Intercalated
disk

Smooth Muscle

- Forms broad, thin sheets of muscle in layers around organs; e.g. GI tract.
 - Individual spindle (fusiform) shaped cells are small (20 - 500 μm) loosely packed, have one cigar shaped nucleus in the center of the cell;
 - Actin and myosin myofilaments are unorganized; there are no striations or sarcomeres.
 - Capable of hyperplasia (e.g. uterus in pregnancy)
 - The tissue is poorly innervated
-







a

Source: Mescher AL: *Junqueira's Basic Histology: Text and Atlas*, 12th Edition: <http://www.accessmedicine.com>

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http://www.youtube.com/watch?v=0_ihc26yxN4

