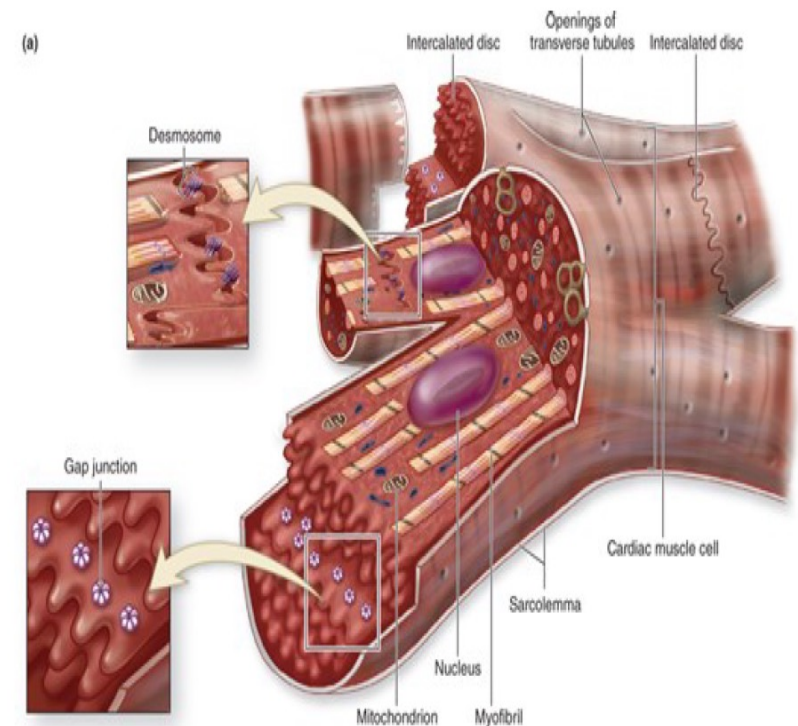


# Muscle histology

# Cardiac muscles

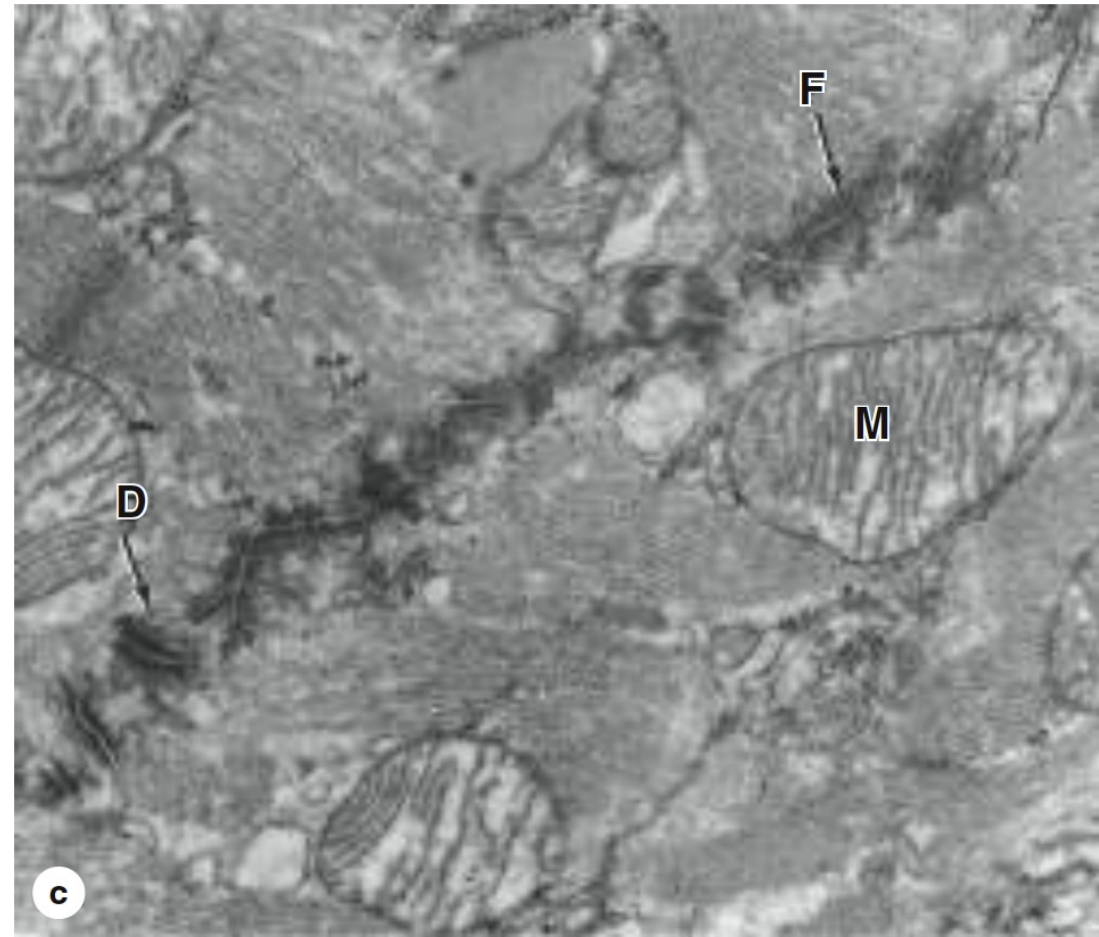
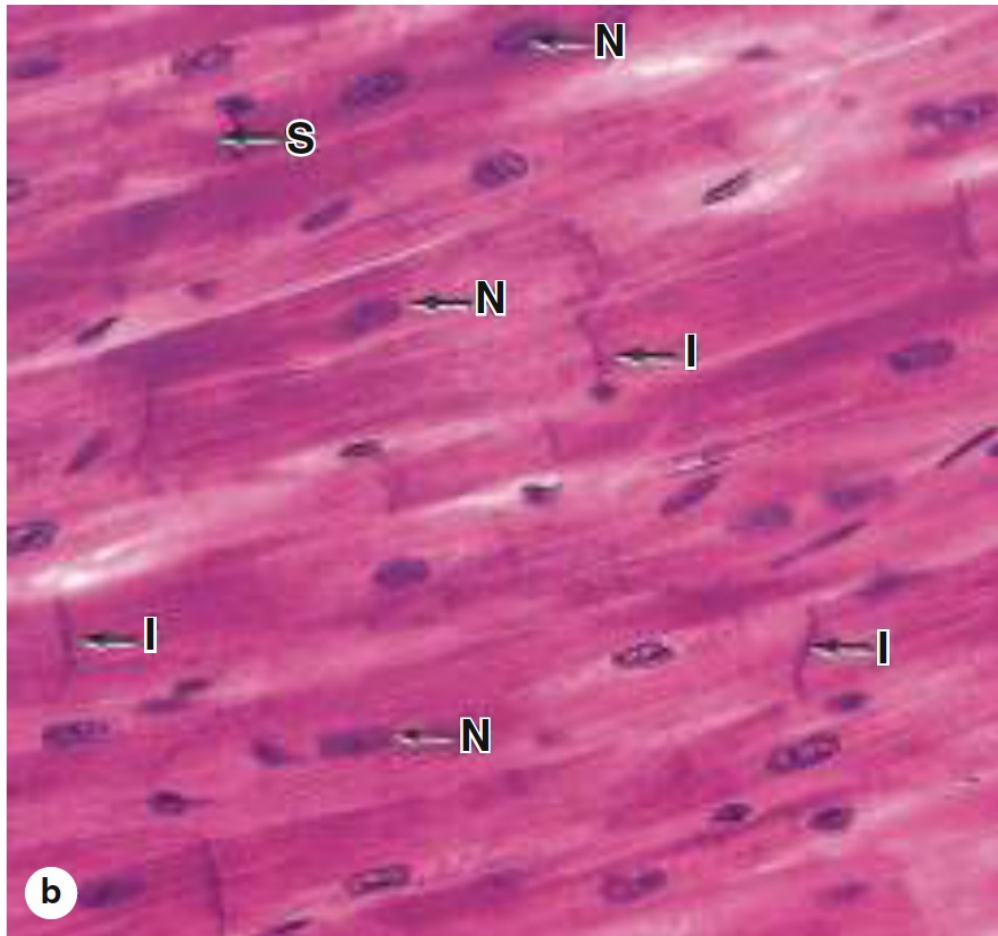
- Cells align into chain-like arrays.
- Form complex junctions between interdigitating processes
- Cells within one fiber often branch..
- Mature cardiac muscle cells are 15-30  $\mu\text{m}$  in diameter and 85-120  $\mu\text{m}$  long,
- Striated
- One centrally nucleus located.
- Each muscle cells is a surrounded by endomysium with a rich capillary network.

Cardiac muscle.





# Intercalated discs



# Cardiac muscles

- Intercalated discs: transverse lines that cross the fibers at irregular intervals where the myocardial cells join (junctional complexes ).
- Transverse regions: many desmosomes and fascia adherens junctions--- strong intercellular adhesion.
- Longitudinally: run parallel to the myofibrils and are filled with gap junctions (ionic continuity between the cells).

# Cardiac muscles

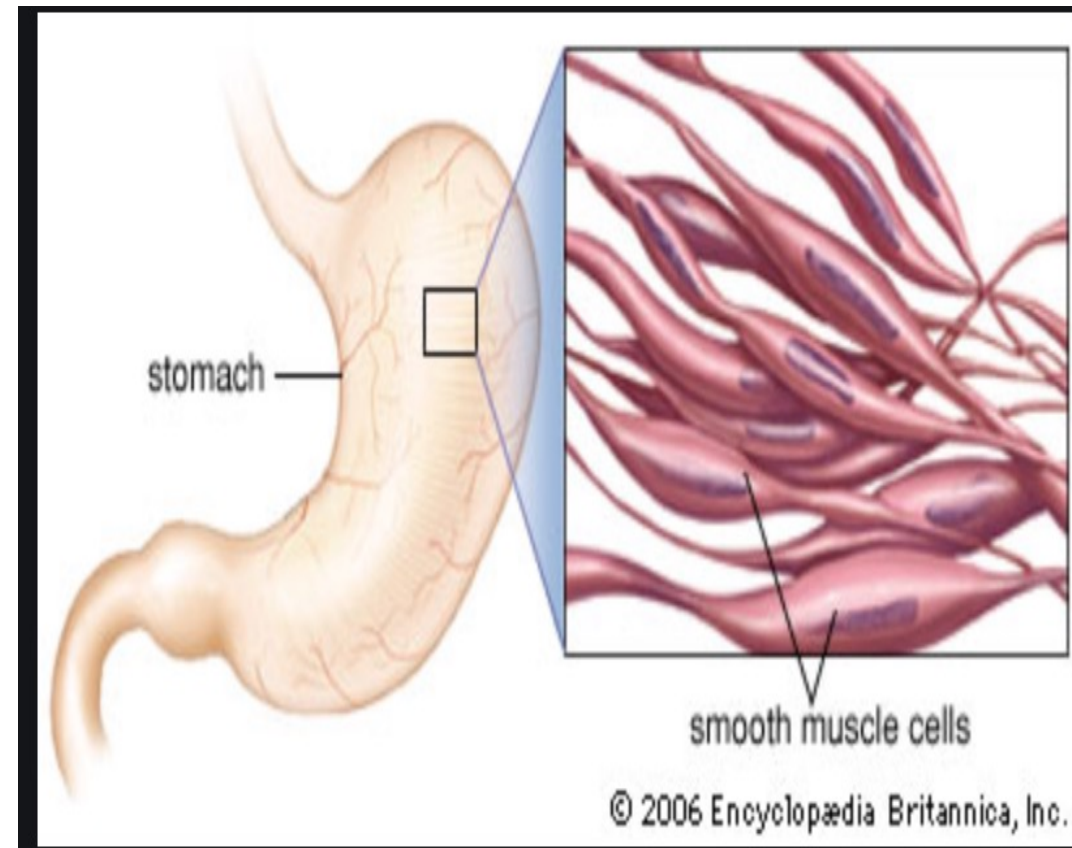
- Mitochondria occupy up to 40% of the cell volume.
- Fatty acids, the major fuel of the heart, are stored as triglycerides.
- Glycogen granules are present.
- T-tubules in ventricular muscle fibers are well-developed, but much smaller atrial regions.
- Sarcoplasmic reticulum is less well-organized.
- **Dyads**: the junctions between terminal cisterns and T-tubules involve only one structure of each.

# Cardiac muscles

- Cardiac muscle fiber contraction is intrinsic and spontaneous.
- Impulses for the rhythmic contraction initiated, regulated, and coordinated locally by nodes of unique myocardial fibers.
- Contraction of individual myocardial fibers is all-or-none.
- The rate of contraction is modified by autonomic innervation at the nodes of conducting cells.
- Sympathetic nerve supply accelerating and the parasympathetic supply decreasing it

# SMOOTH MUSCLE

- Slow and steady contraction
- Under the control of autonomic nerves and various hormones.
- Present in blood vessels, digestive, respiratory, urinary, and reproductive tracts.
- Fibers of smooth muscle are elongated, tapering, and unstriated cells.
- Enclosed by an endomysium (a network of type I and type III).
- Length is 20  $\mu\text{m}$  - 500  $\mu\text{m}$ .

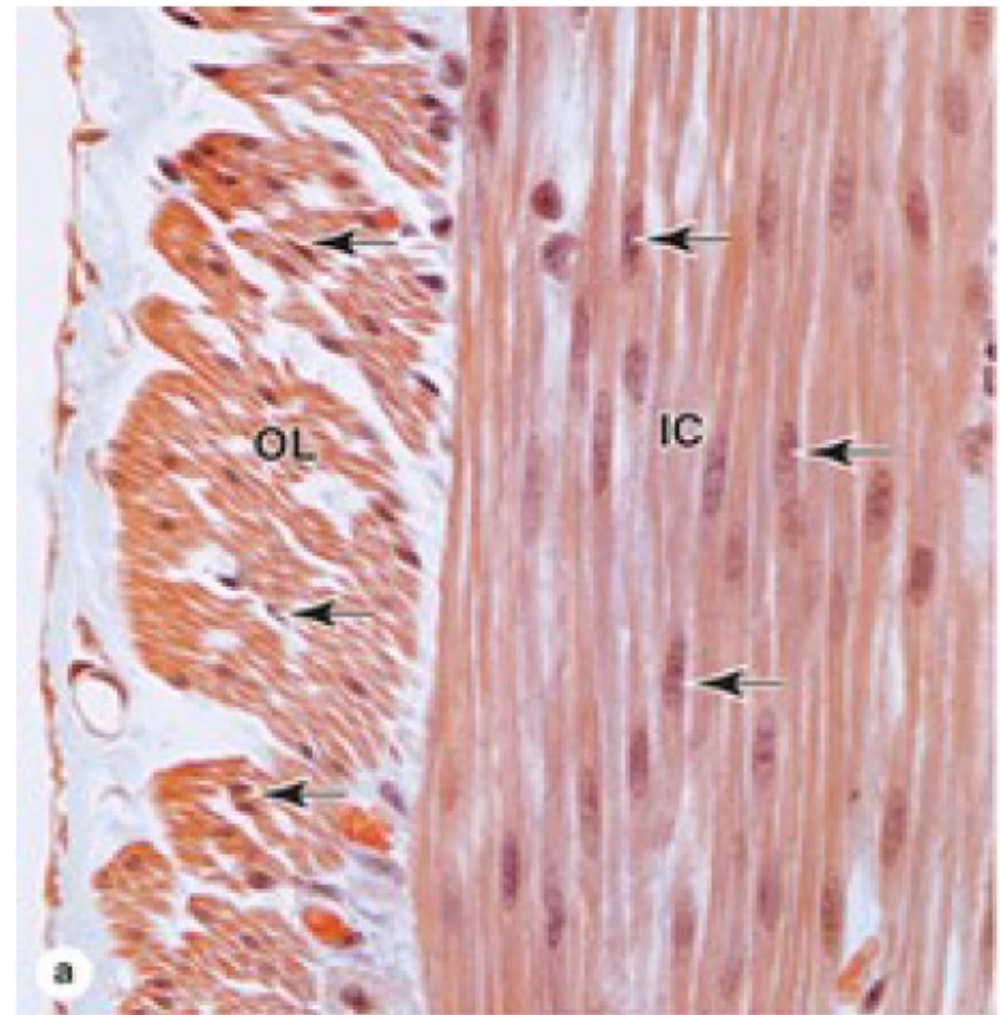
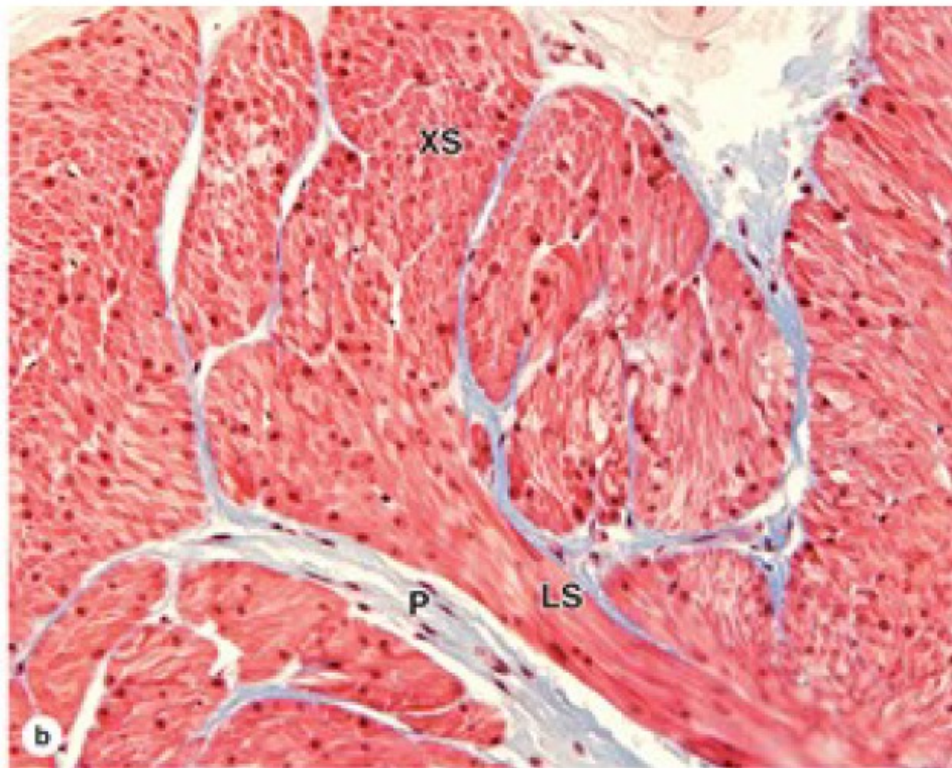


# SMOOTH MUSCLE

- Lack well-defined neuromuscular junctions
- Axons of autonomic nerves have periodic swellings close to muscle fibers----synaptic vesicles-----acetylcholine o norepinephrine--- binds receptors in many muscle cells.
- Stimulation is propagated via gap junctions-----contract synchronously
- Fibroblast activity!!!

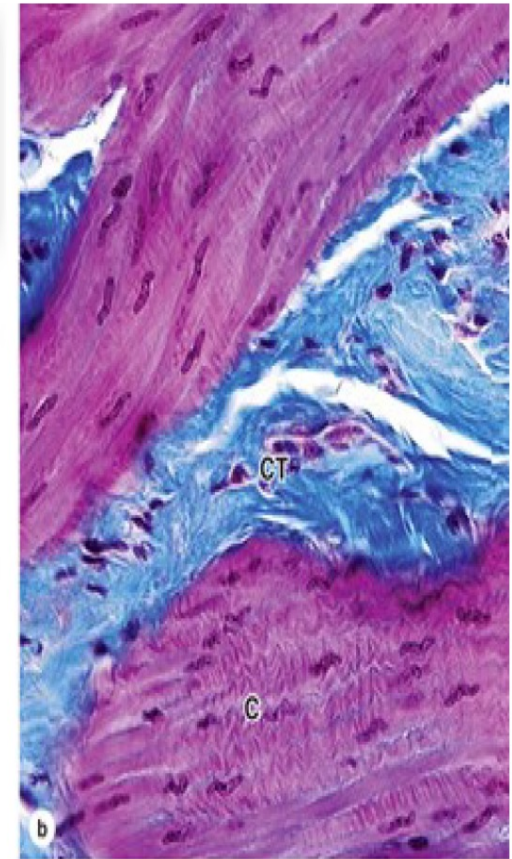
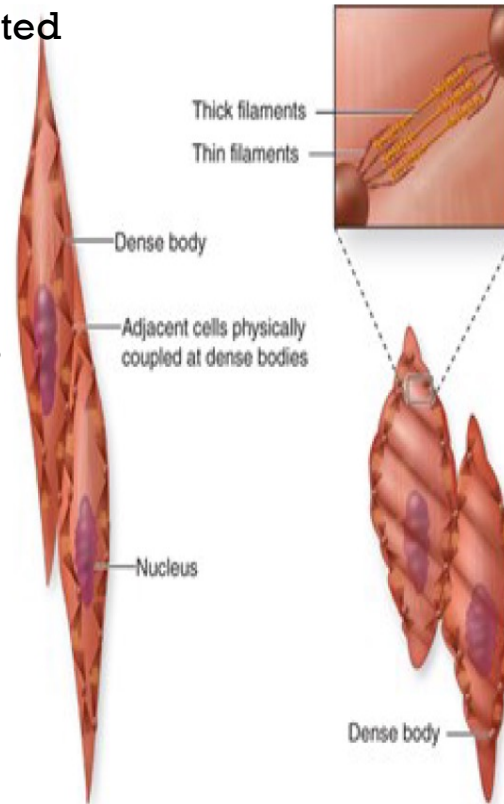


# SMOOTH MUSCLE



# Contraction

- Dense bodies (similar to Z discs) plasmalemma-associated attach to thin filaments.
- Thin and thick myofilaments crisscross the sarcoplasm obliquely
- Mitochondria, glycogen granules, and Golgi complexes located centrally near nucleus.
- Rudimentary sarcoplasmic reticulum
- Rich in gap junction
- Caveolae are small plasmalemma invaginations which contain signaling components.
- $\text{Ca}^{2+}$ : Calmodulin and  $\text{Ca}^{2+}$ -sensitive myosin light-chain<sup>a</sup> kinase (MLCK)



# REGENERATION OF MUSCLE TISSUE

- In **skeletal muscle**, although the multinucleated cells cannot undergo mitosis
- Mesenchymal satellite cells lying inside the external lamina can participate in limited regeneration.
- **Cardiac muscle** lacks satellite cells
- very little regenerative capacity beyond early childhood.
- Defects or damage replaced by proliferating fibroblasts and CT formation leading to myocardial scars.
- **Smooth muscle** is capable of a more active regenerative response.
- Can undergo mitosis and replace the damaged tissue.