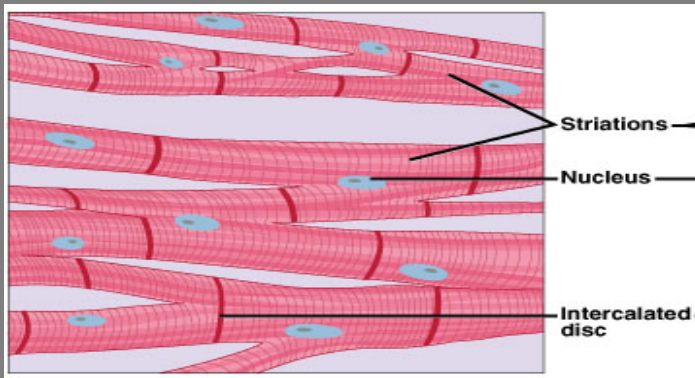
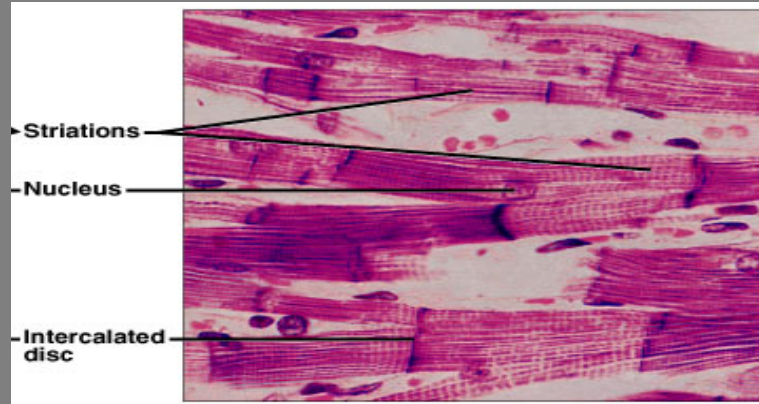


MUSCULAR TISSUE

Objectives:

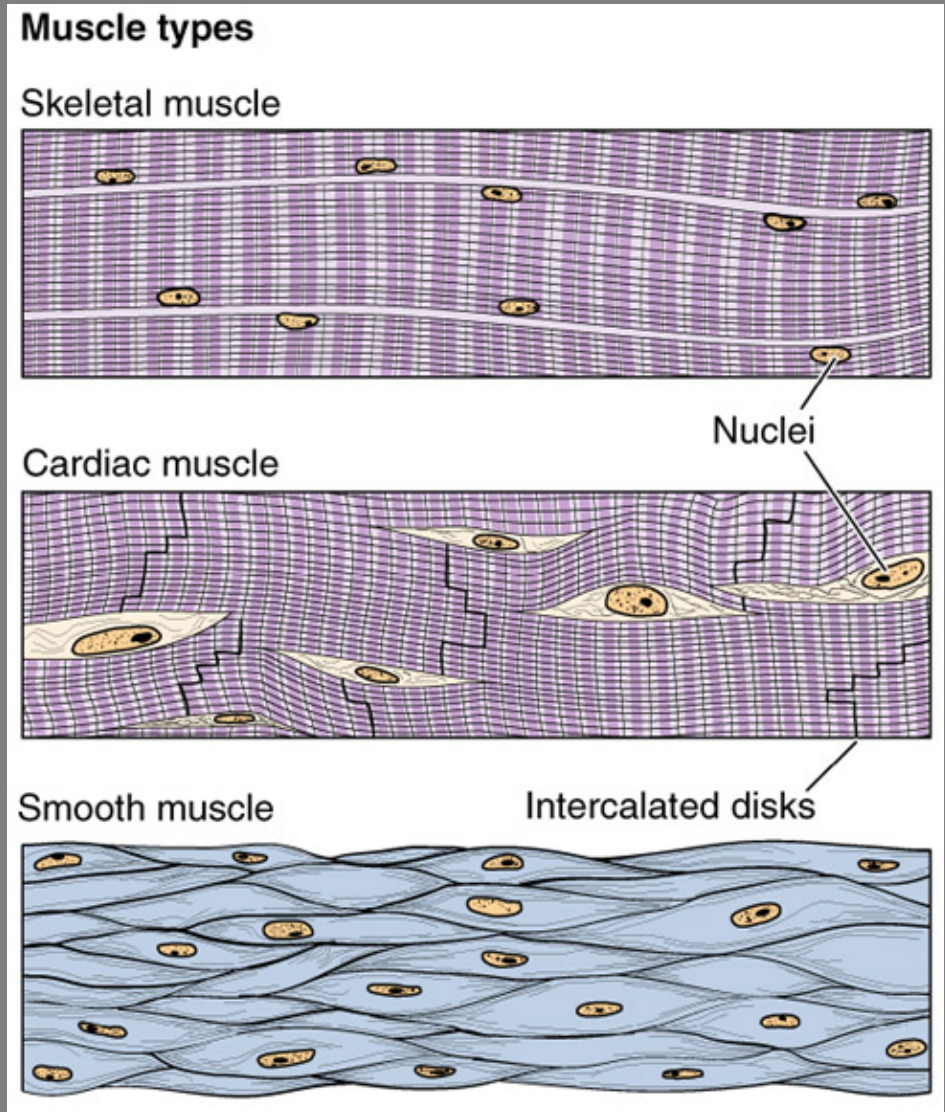
By the end of this lecture you should be able to:

- Identify and describe the histological structure of the three types of muscle cells and list the differences between them.



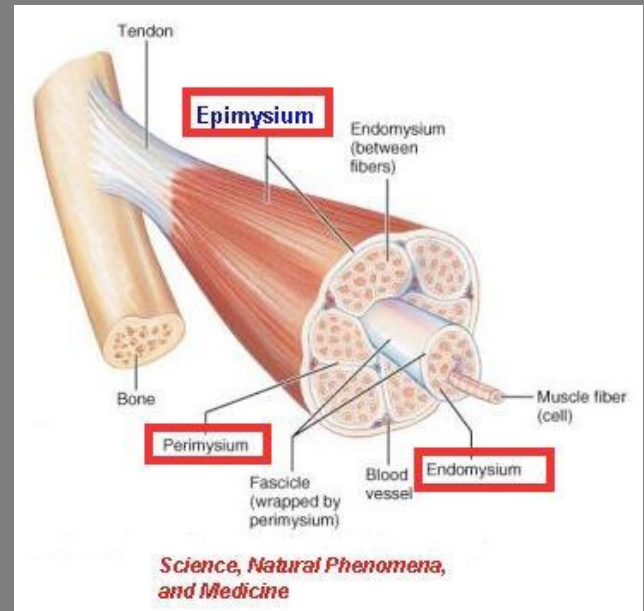
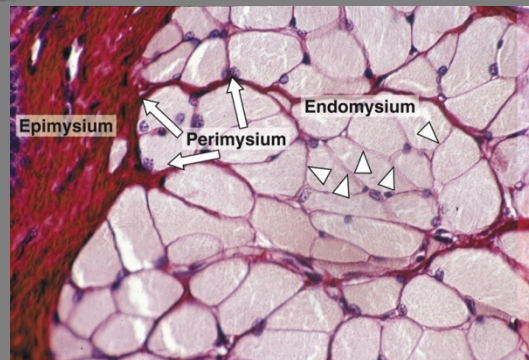
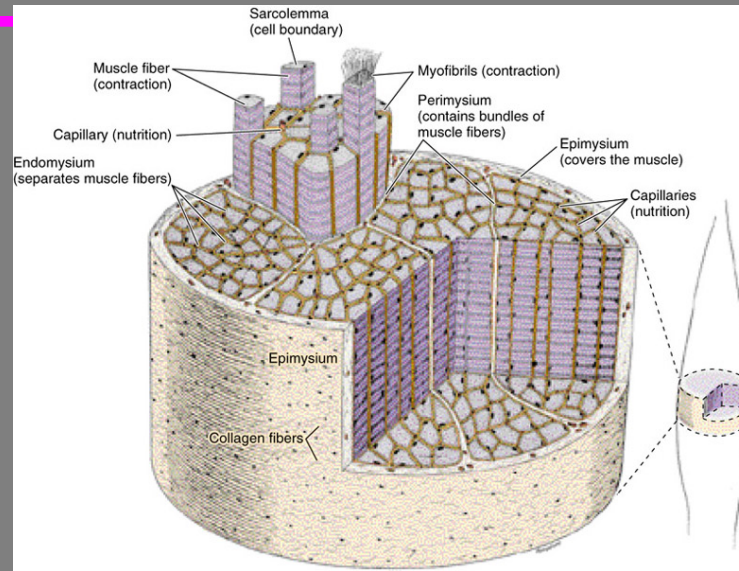
MUSCULAR TISSUE

- Made of elongated muscle cells (fibers).
- 3 types of muscles (muscle fibers):
 - 1- **Skeletal**: striated, voluntary.
 - 2- **Cardiac**: striated, involuntary.
 - 3- **Smooth**: non-striated, involuntary.



SKELETAL MUSCLE

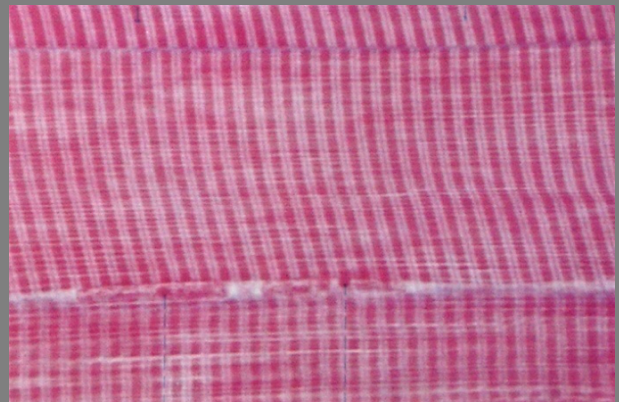
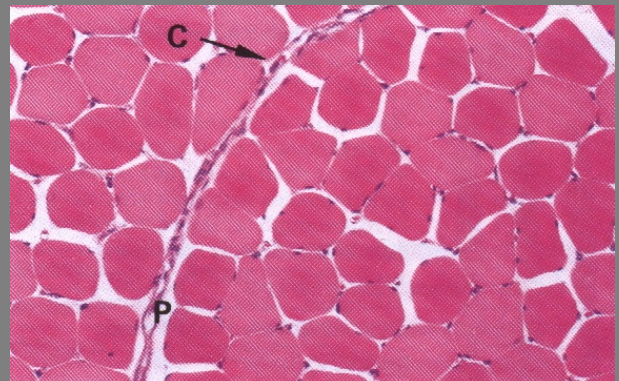
- The whole muscle is covered by a C.T. covering, the epimysium.
- Consists of parallel skeletal muscle fibers, arranged in bundles, separated by C.T. septa, the perimysium.
- The individual fibers are separated by C.T., endomysium.



Skeletal Muscle Fibers

■ L.M. Picture:

- Cylindrical in shape.
- Non-branched.
- Covered by a clear cell membrane, the **sarcolemma**.
- Multinucleated: nuclei are multiple and are peripherally located (close to the sarcolemma).
- Cytoplasm (**sarcoplasm**) is acidophilic and shows clear transverse striations.

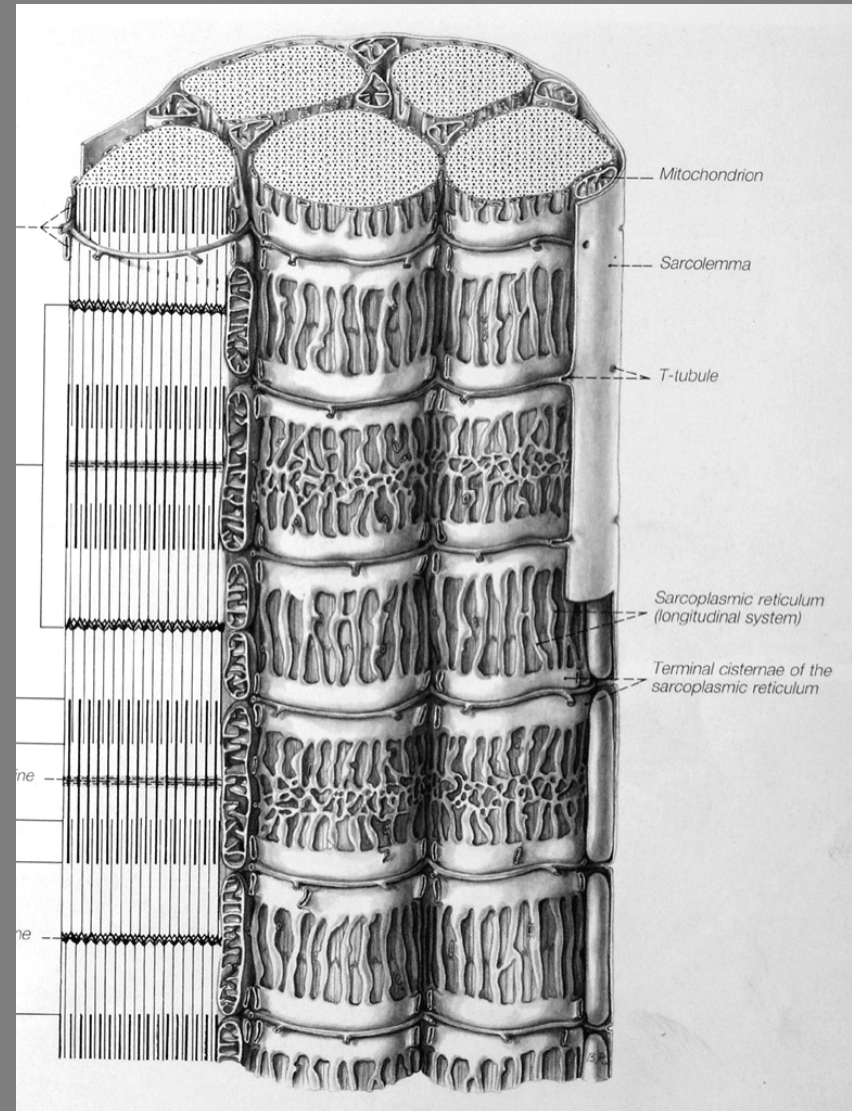


Skeletal Muscle Fibers

■ E.M. Picture:

Sarcoplasm contains:

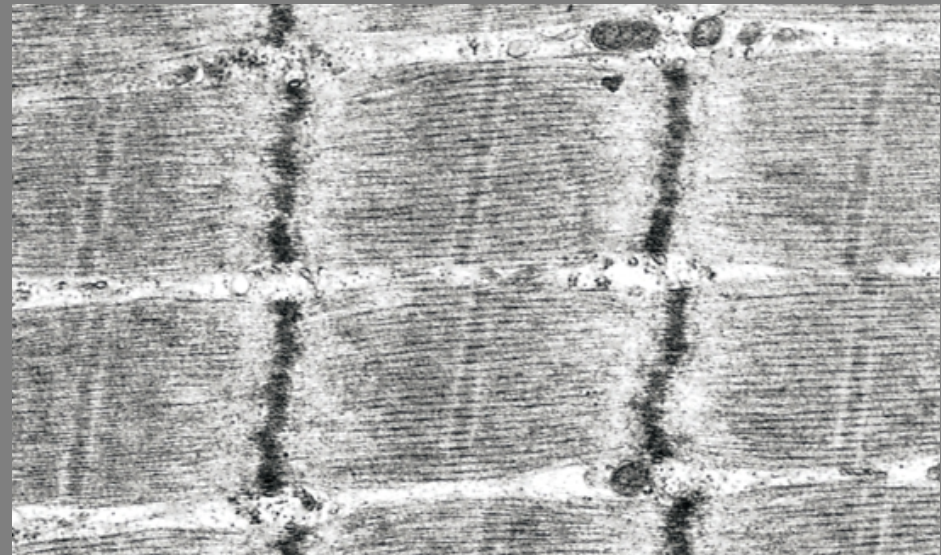
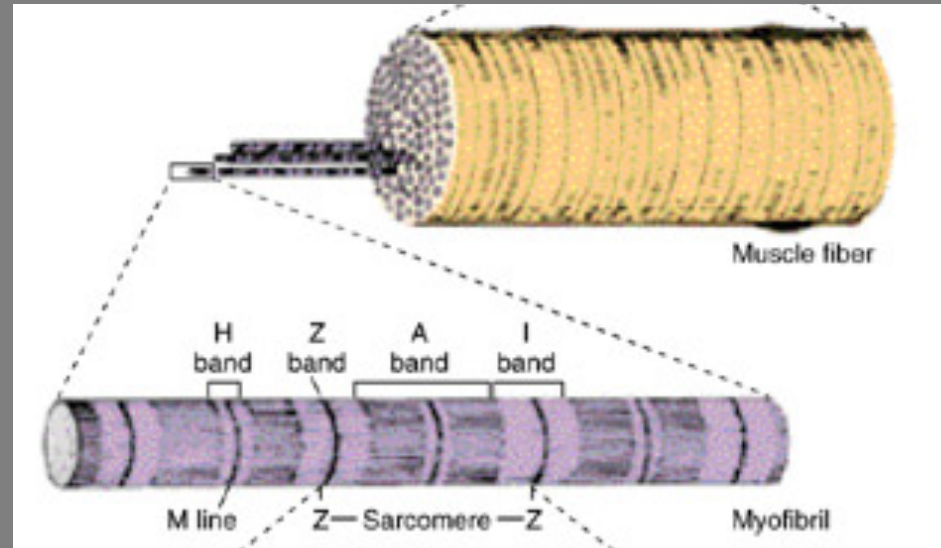
- Parallel myofibrils.
- Numerous mitochondria, arranged in rows between the myofibrils.
- Well developed smooth endoplasmic reticulum (sarcoplasmic reticulum-SR).
- Myoglobin pigment.
- Glycogen.



Skeletal Muscle Fibers

■ E.M. Picture of Myofibrils:

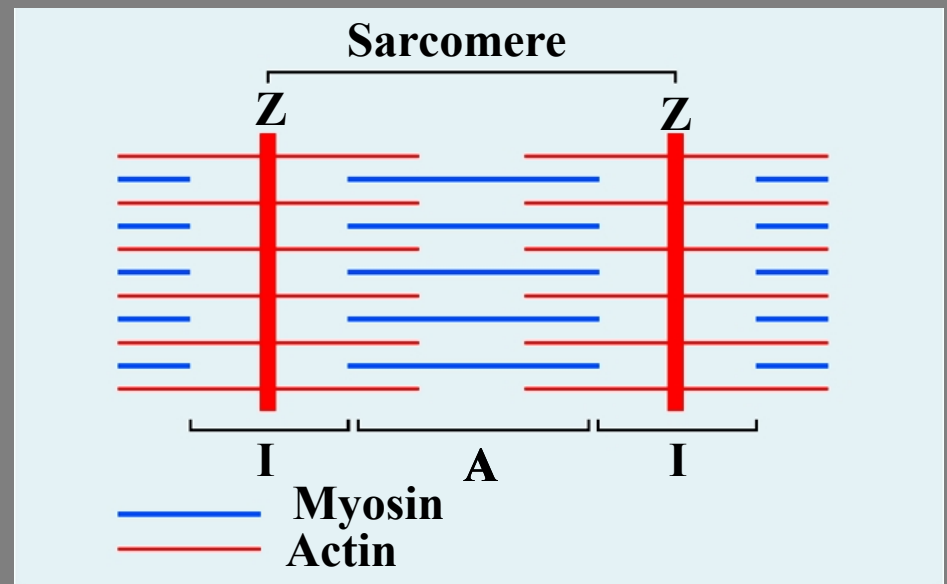
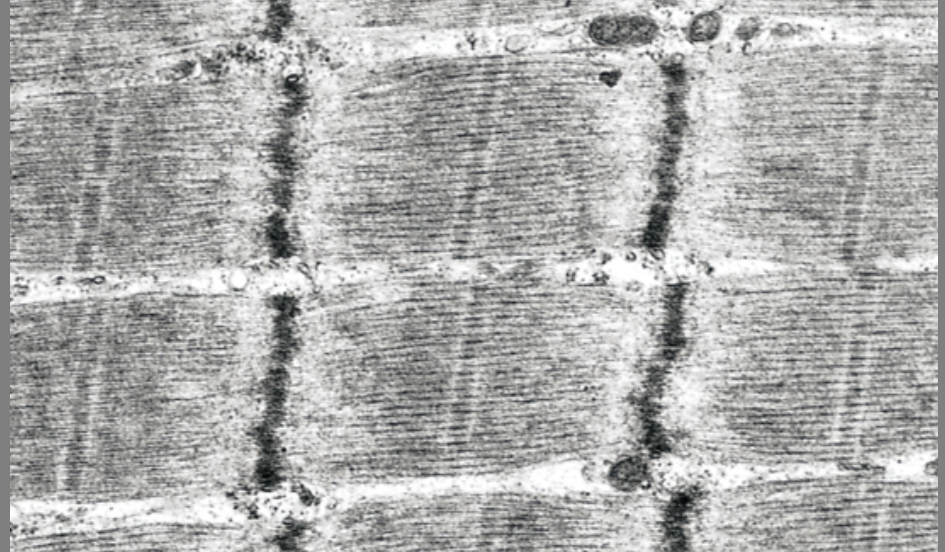
- Contractile threads (organelles), arranged longitudinally in the sarcoplasm.
- Each myofibril shows alternating dark (A) and light bands (I).
- The A band shows a pale area in the middle (H band) which is divided by a dark line (M line).
- The (I) band shows a dark line in the middle (Z line).



Skeletal Muscle Fibers

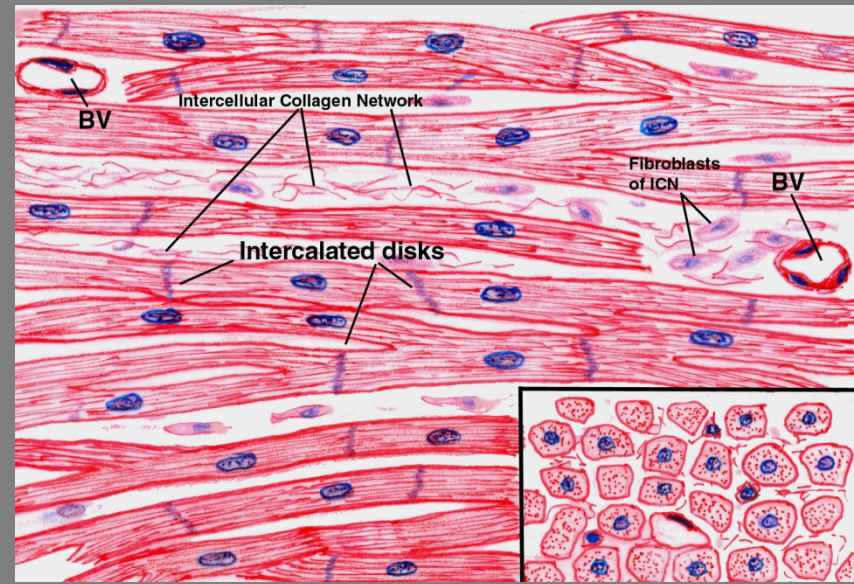
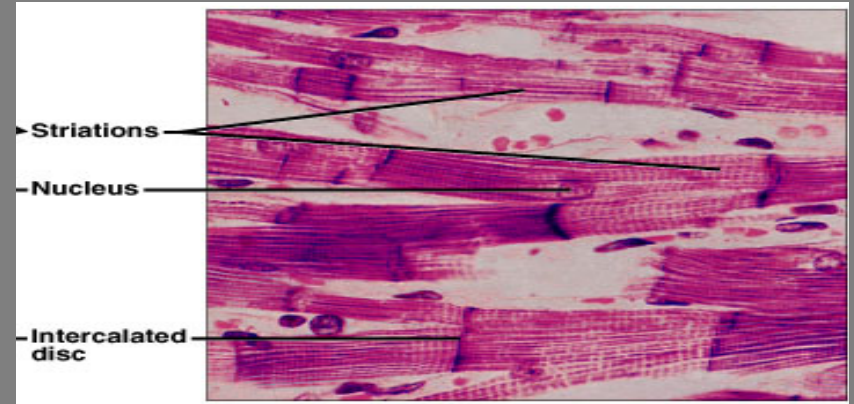
■ E.M. Picture of Myofibrils:

- The sarcomere is the segment between 2 successive Z lines. It is the contractile unit of a myofibril.
- The myofibrils are formed of myofilaments (thick myosin and thin actin).
- The (A) band is formed of myosin myofilaments mainly and the terminal ends of actin myofilaments.
- The (I) band is formed of actin myofilaments.



CARDIAC MUSCLE

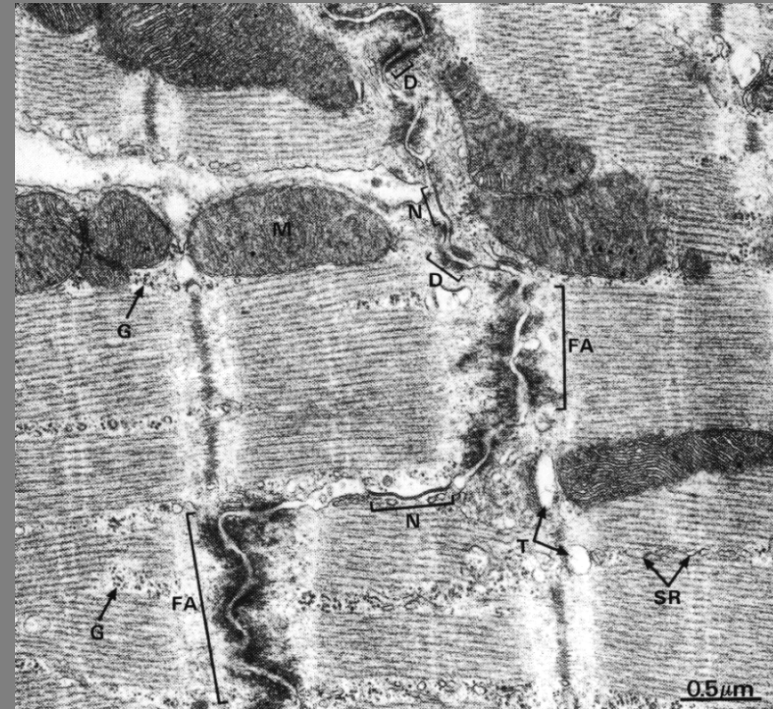
- Found in the myocardium.
- Striated and involuntary.
- **L.M. Picture of Cardiac Muscle Fibers:**
 - Cylindrical in shape.
 - Intermediate in diameter between skeletal and smooth muscle fibers.
 - Branch and anastomose.
 - Covered by a thin **sarcolemma**.
 - Mononucleated. Nuclei are oval and central.
 - **Sarcoplasm** is acidophilic and shows non-clear striations (fewer myofibrils).
 - Divided into short segments (cells) by the intercalated discs.



Cardiac Muscle Fibers

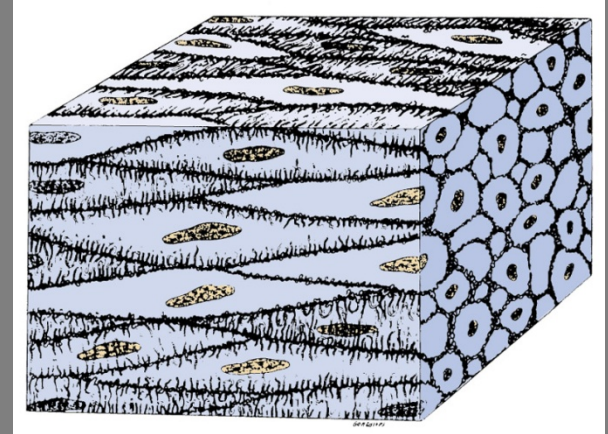
■ E.M. Picture:

- Few myofibrils.
- Numerous mitochondria.
- Less abundant SR.
- Glycogen & myoglobin.
- Intercalated discs: are formed of the two cell membranes of 2 successive cardiac muscle cells, connected together by junctional complexes (desmosomes and gap junctions).



SMOOTH MUSCLE

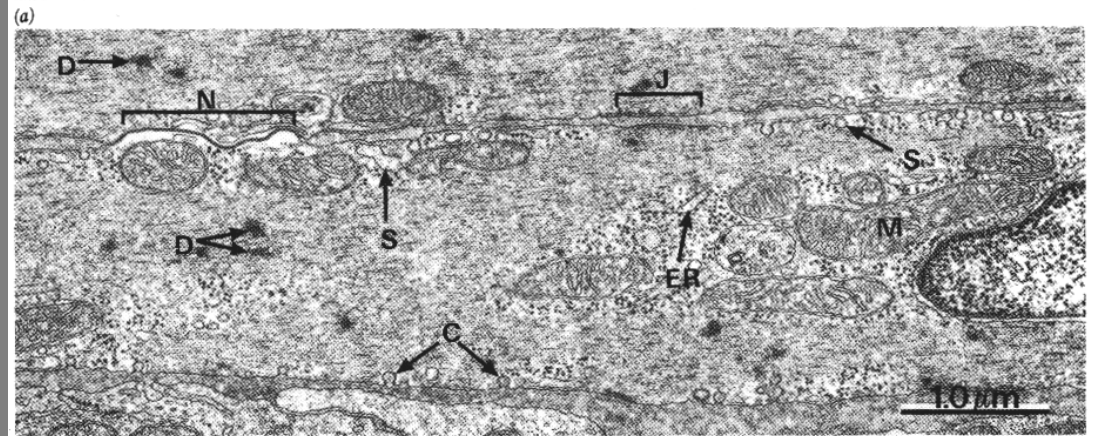
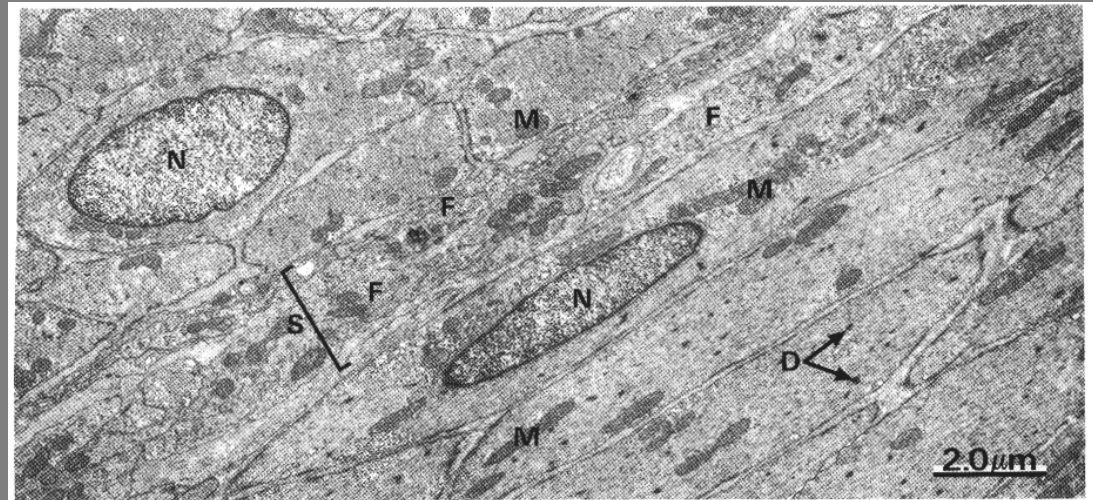
- Present in walls of blood vessels and viscera (digestive, urinary, genital etc).
- Non-striated and involuntary.
- L.M. Picture of Smooth Muscle Fibers:
 - Fusiform in shape (spindle-shaped).
 - Small diameter.
 - Non-branched.
 - Thin **sarcolemma**.
 - Mononucleated. Nuclei are oval & central in position.
 - **Sarcoplasm** is non-striated and acidophilic.



Smooth Muscle Fibers

■ E.M. Picture:

- Sarcoplasm contains mitochondria and sarcoplasmic reticulum.
- Myosin & actin filaments are irregularly arranged (that's why no striations could be observed).
- Cells are connected together by gap junctions for cell communication.



REGENERATION OF MUSCLE

(1) Skeletal muscle cells:

- Can not divide.
- Limited regeneration by satellite cells (stem cells on the muscle cell's surface).

(2) Cardiac muscle cells:

- No regenerative capacity.

(3) Smooth muscle cells:

- Can divide.
- Regenerate from pericytes.
→ active regenerative response.

Comparison between different types of muscle fibers

	SKELETAL	CARDIAC	SMOOTH
Site	Muscle attached to skeleton	Myocardium of the heart	Viscera, e.g. stomach
Shape	Cylindrical	Cylindrical	Fusiform
Diameter	Largest	Medium-sized	Smallest
Branching	Non-branched	Branched	Non-branched
Striations	Clear	Not clear	Absent
Intercalated discs	Absent	Present	Absent
Nuclei	Numerous and peripheral	One central nucleus	One central nucleus
Action	Voluntary	Involuntary	Involuntary
Regeneration	Limited	No	Active

Thank you