

# MUSCULAR TISSUE

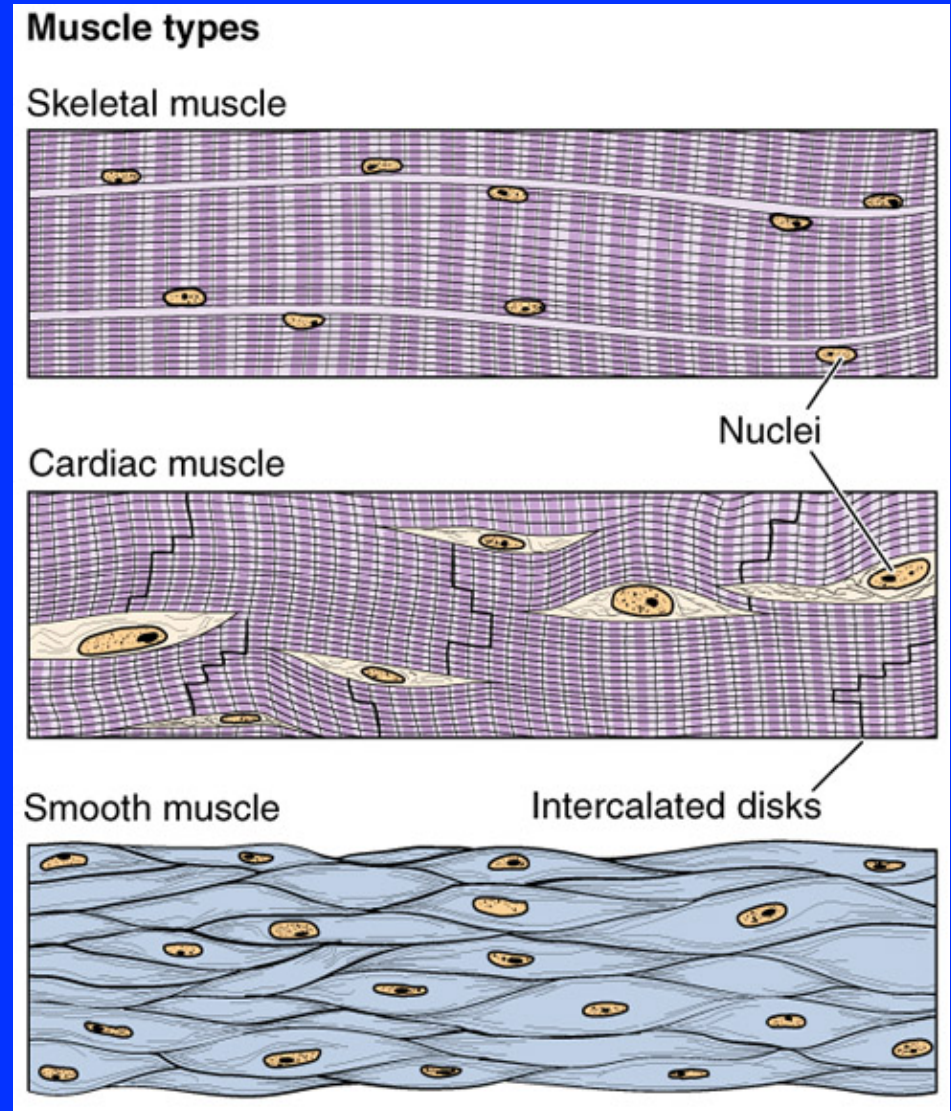
## Objectives:

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.

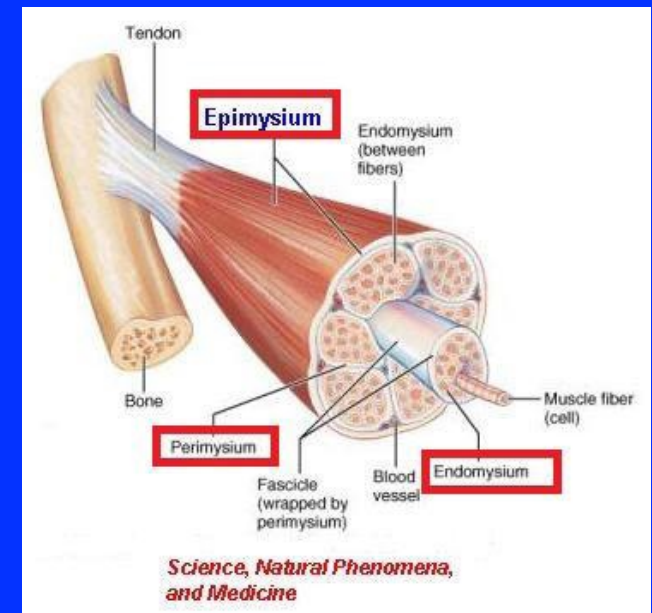
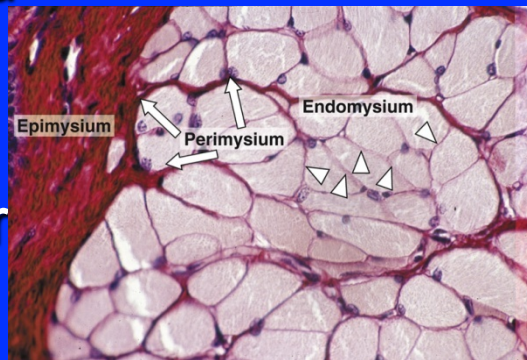
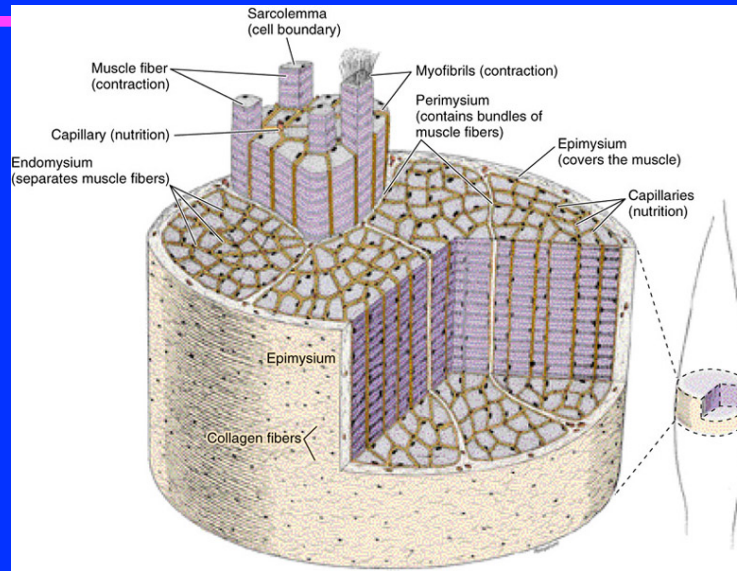
# MUSCULAR TISSUE

- 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

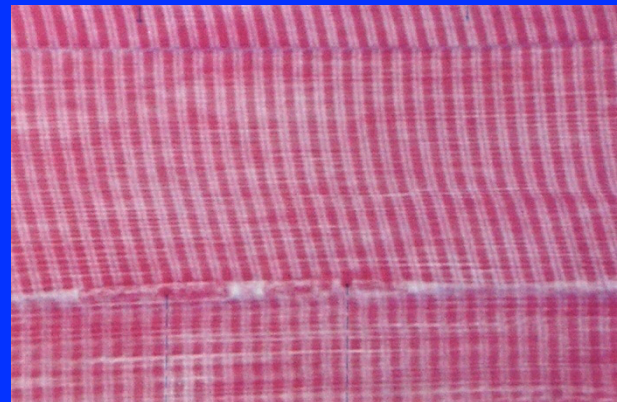
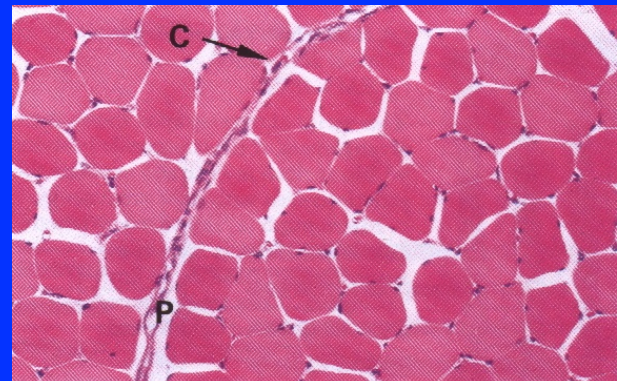
- The whole muscle is covered by a C.T. covering, the epimysium.
- Consists of parallel skeletal muscle fibers, arranged in bundles, separated by C.T. septa, the perimysium.
- The individual fibers are separated by C.T., endomysium.



# 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.

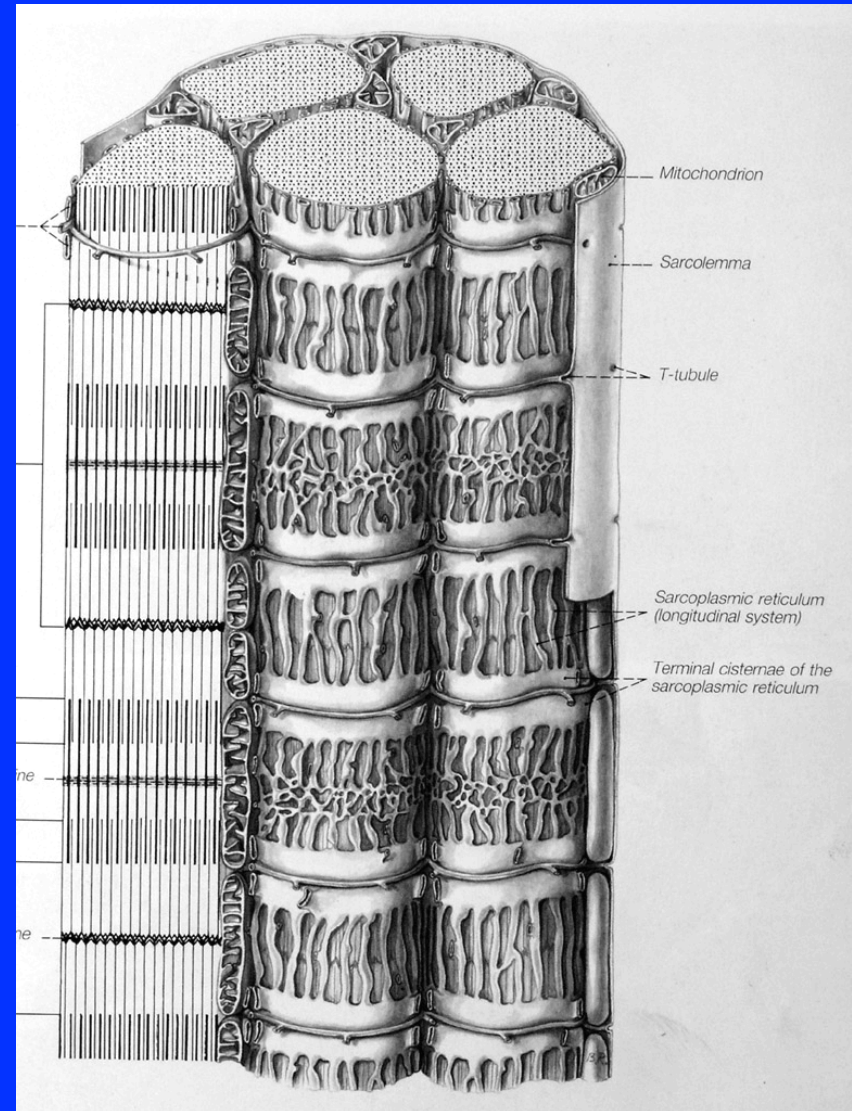


# Skeletal Muscle Fibers

## ■ E.M. Picture:

Sarcoplasm contains:

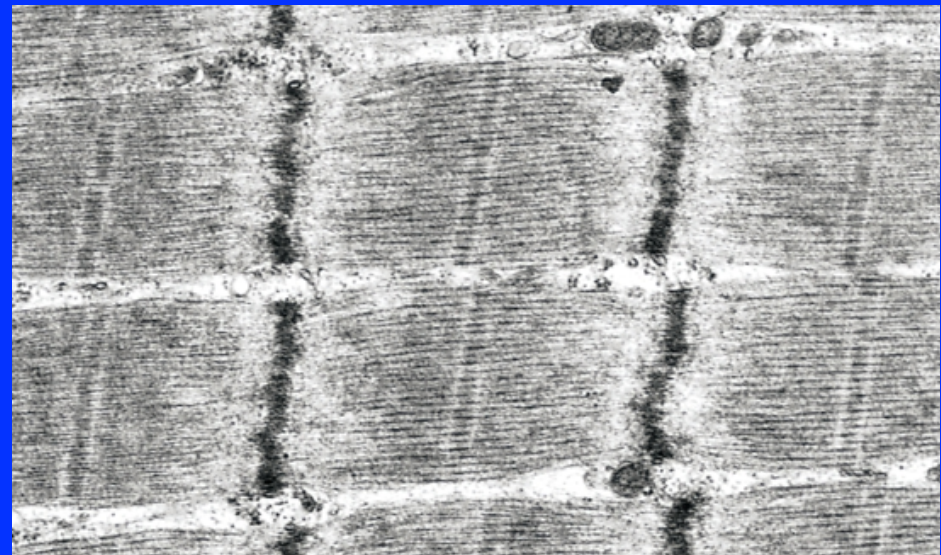
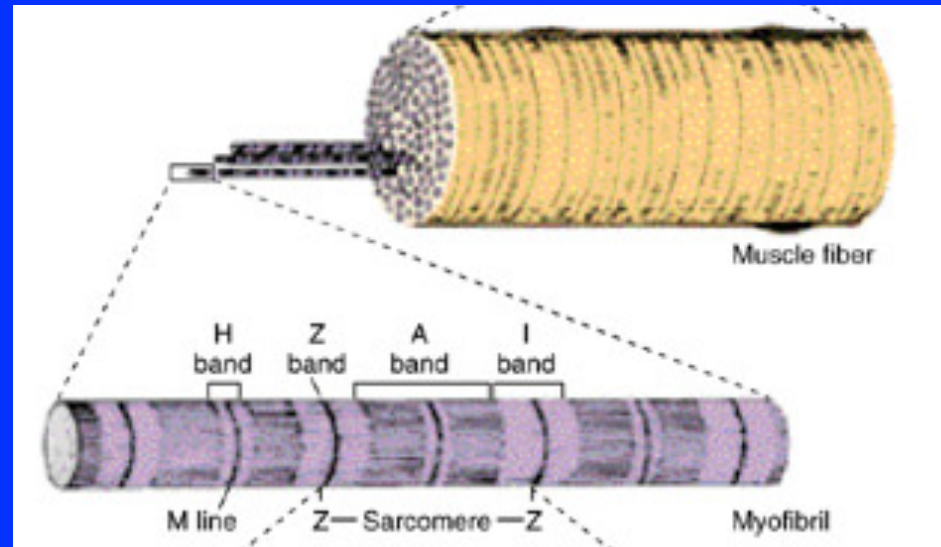
- Parallel myofibrils.
- Numerous mitochondria, arranged in rows between the myofibrils.
- Well developed smooth endoplasmic reticulum (sarcoplasmic reticulum-SR).
- Myoglobin pigment.
- Glycogen.



# Skeletal Muscle Fibers

## ■ E.M. Picture of Myofibrils:

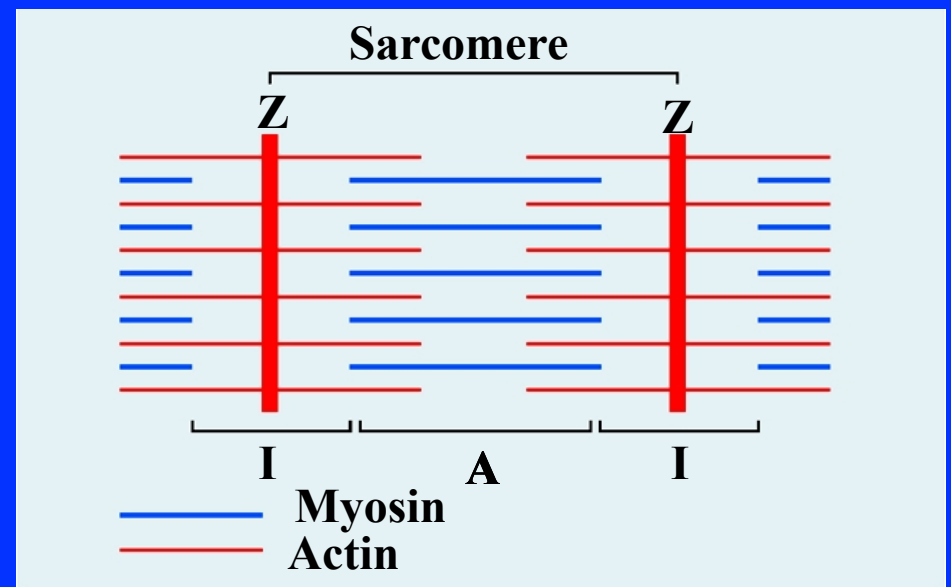
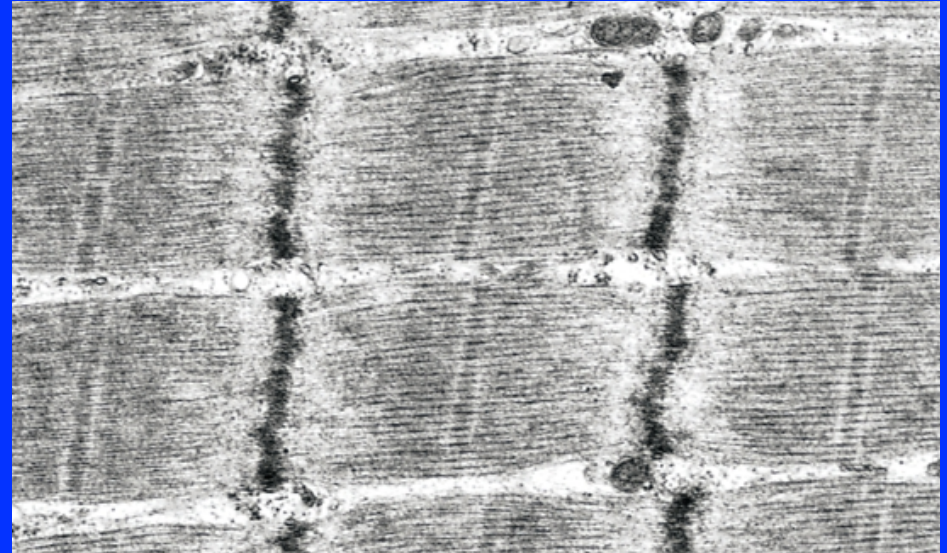
- Contractile threads (organelles), arranged longitudinally in the sarcoplasm.
- Each myofibril shows alternating dark (A) and light bands (I).
- The A band shows a pale area in the middle (H band) which is divided by a dark line (M line).
- The (I) band shows a dark line in the middle (Z line).



# Skeletal Muscle Fibers

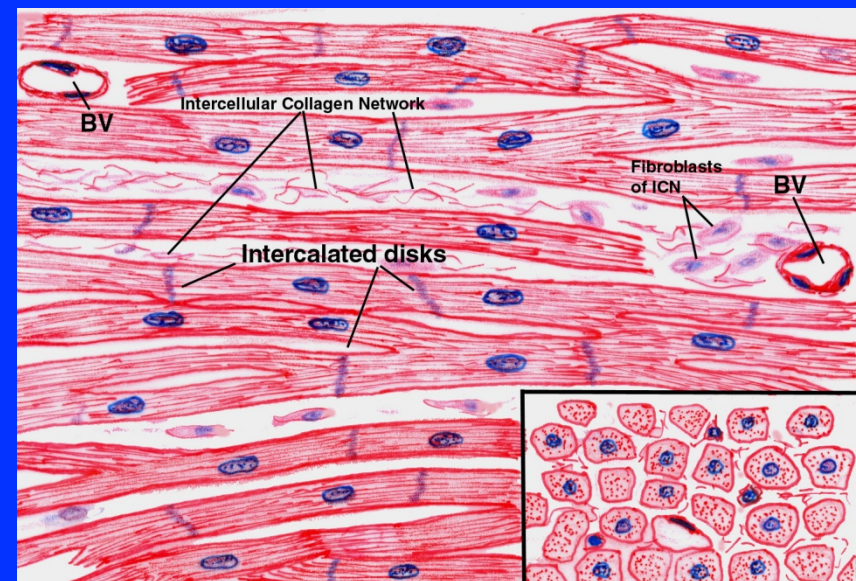
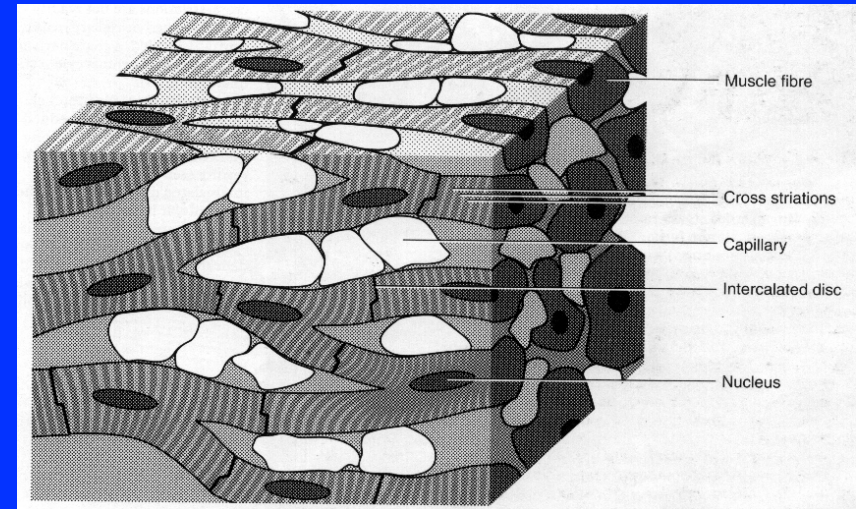
## ■ E.M. Picture of Myofibrils:

- 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.

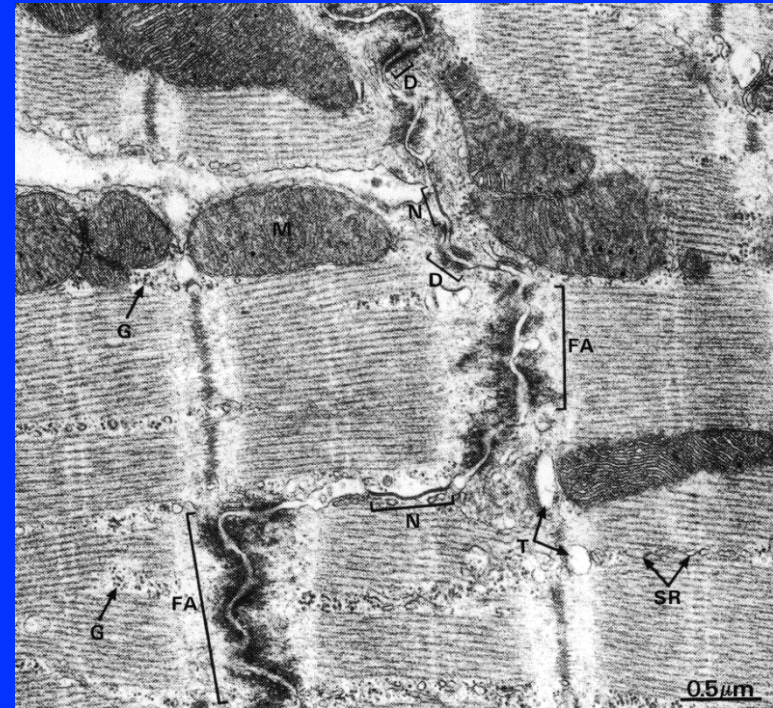




# Cardiac Muscle Fibers

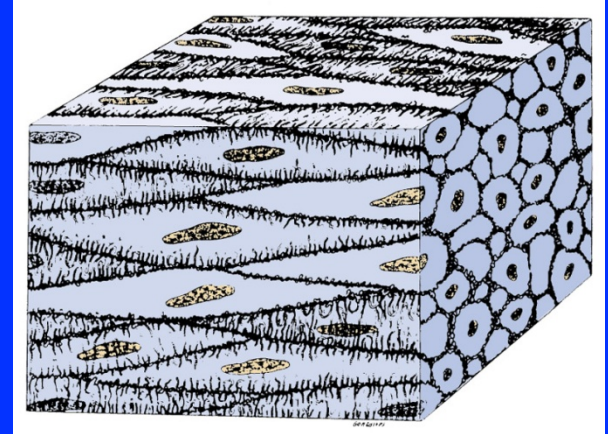
## ■ E.M. Picture:

- 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

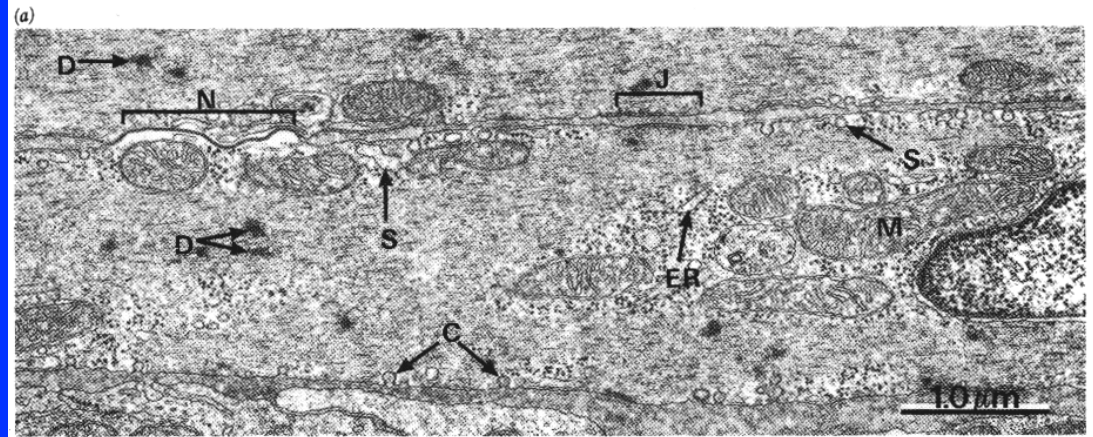
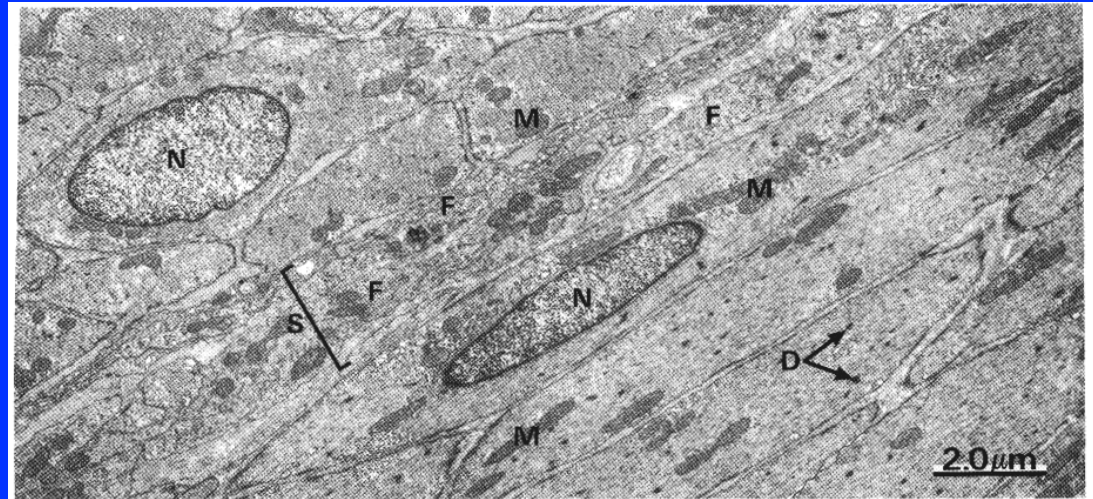
- Present in walls of blood vessels and viscera (digestive, urinary, genital .... etc).
- Non-striated and involuntary.
- **L.M. Picture of Smooth Muscle Fibers:**
  - Fusiform in shape (spindle-shaped).
  - Small diameter.
  - Non-branched.
  - Thin **sarcolemma**.
  - Mononucleated. Nuclei are oval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

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

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**Thank you**