Integrated Muscle

Red: important.
Black: in male|female slides.
Gray: notes|extra.

Editing File

غيـــداء آل مصـــمع
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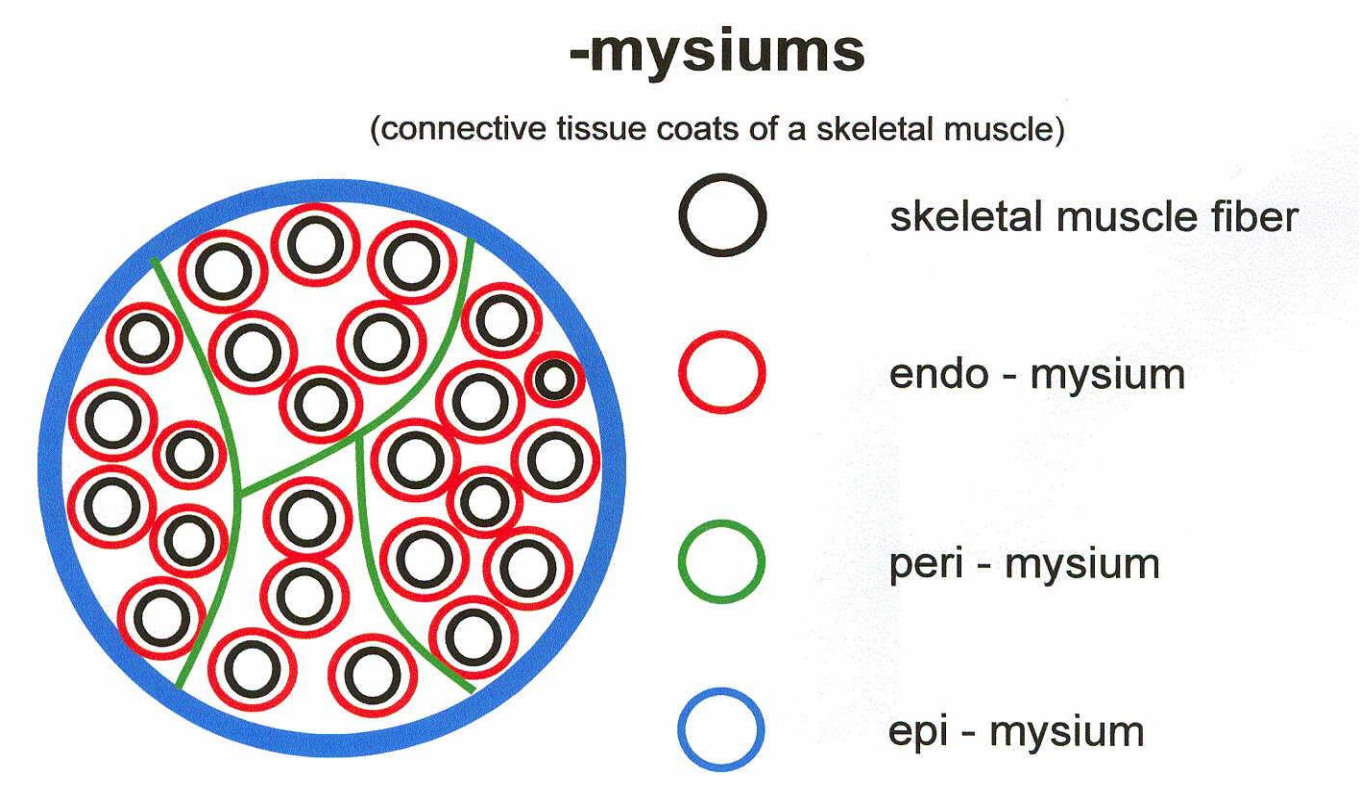
Revised by

➢ OBJECTIVES

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

Extra picture for explanation only



➢ MUSCULAR TISSUE =carco=myo=mysium

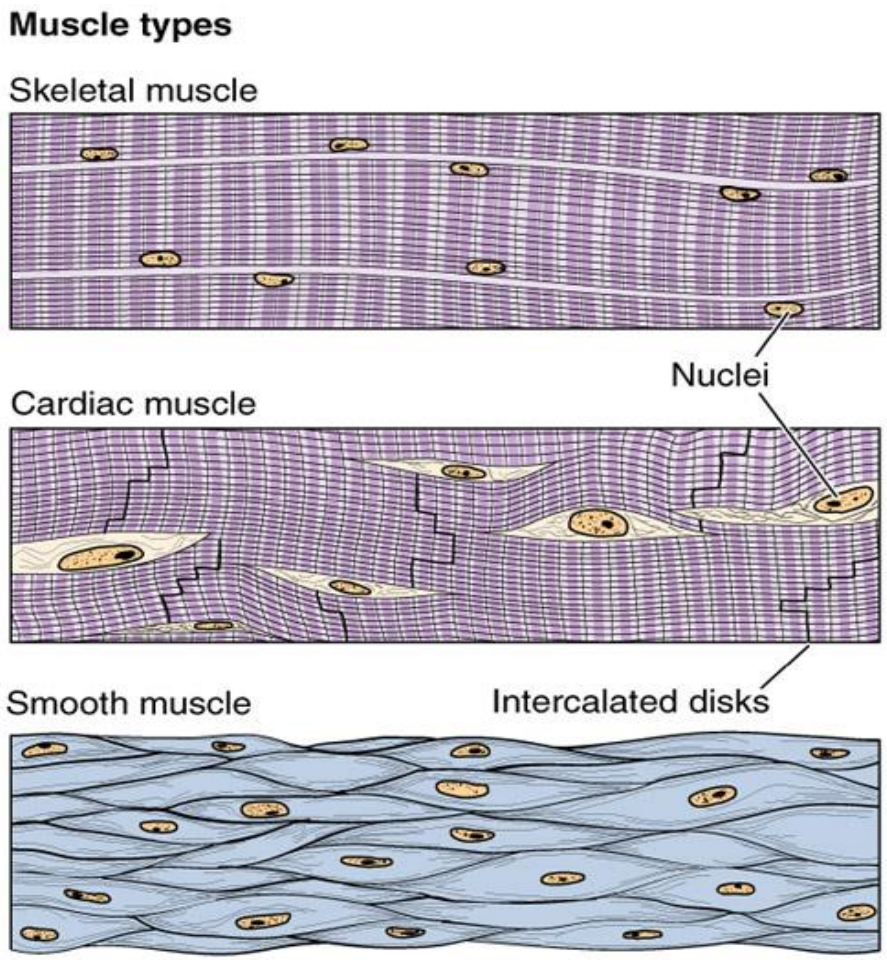
- **Made of elongated muscle cells (fibers)**

types of muscles (muscle fibers)

Skeletal
striated, voluntary
The Cells are the fibers

Cardiac
striated, involuntary
The fibers are segmented to cells

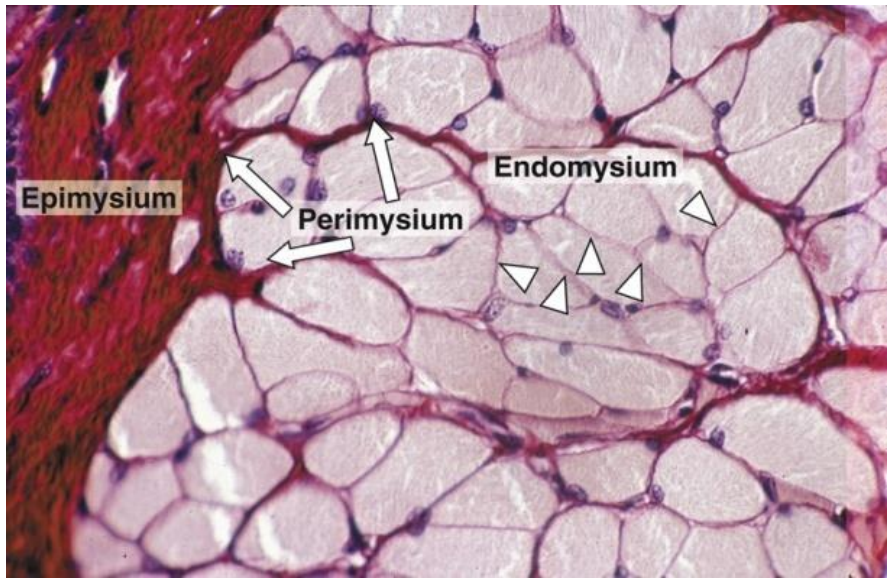
Smooth
non-striated, involuntary
The Cells are the fibers



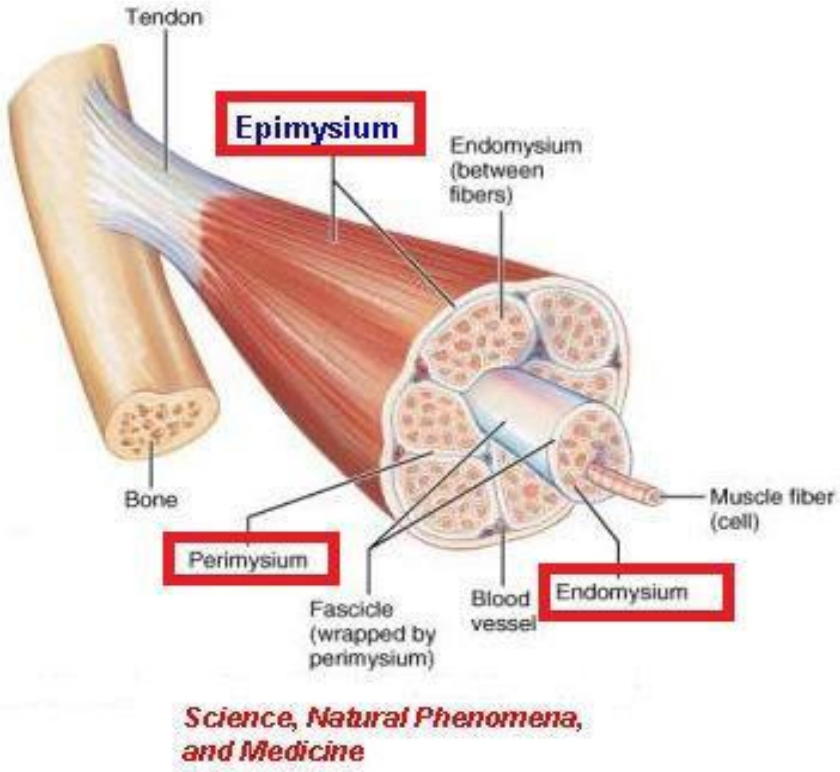
- Muscle cell is only cell that we can see by naked eye
  Muscle supply by somatic nerve

SKELETAL MUSCLE

- The whole muscle is covered by a connective tissue covering called the **epimysium** "consist of dense collagen irregular connective tissue"
- Consists of parallel skeletal muscle fibers, arranged in bundles, separated by connective tissue septa called the **perimysium** "consist of loose connective tissue"
- The individual fibers are separated by connective tissue called **endomysium**.



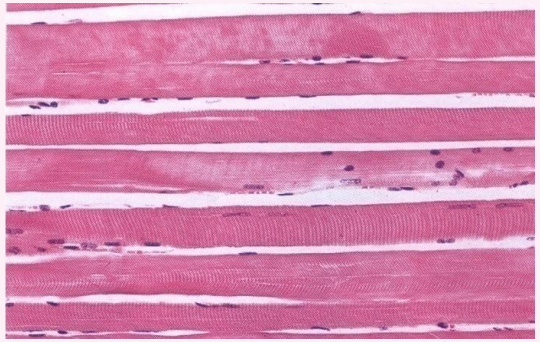
Mysium = Flesh
Epi = Over
Peri = Surrounding

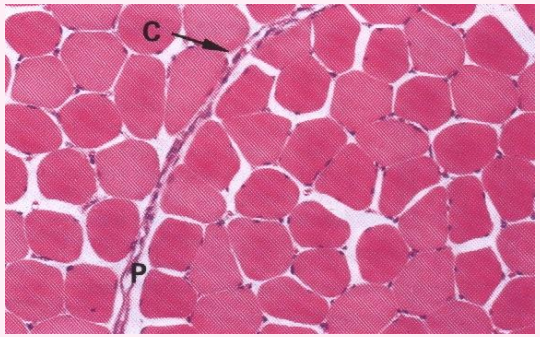


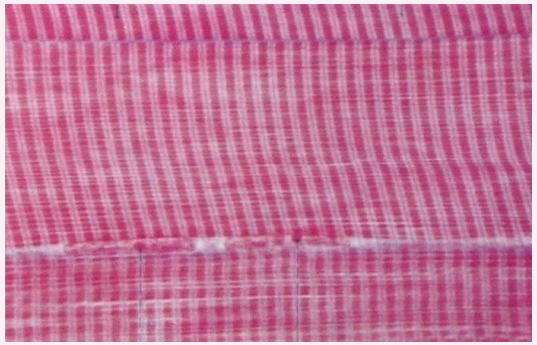
Skeletal Muscle Fibers under Microscope

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.







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.

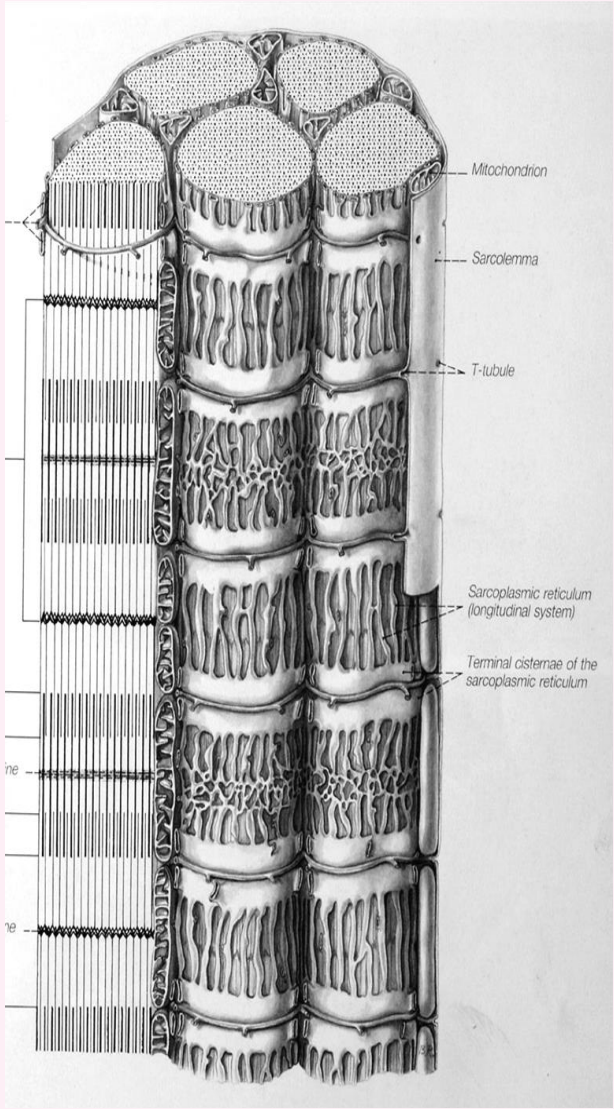
"myoglobin is protein high affinity for oxygen"

- Glycogen

Glycogen is food for muscles"

Glycogen + Ca+ = contraction

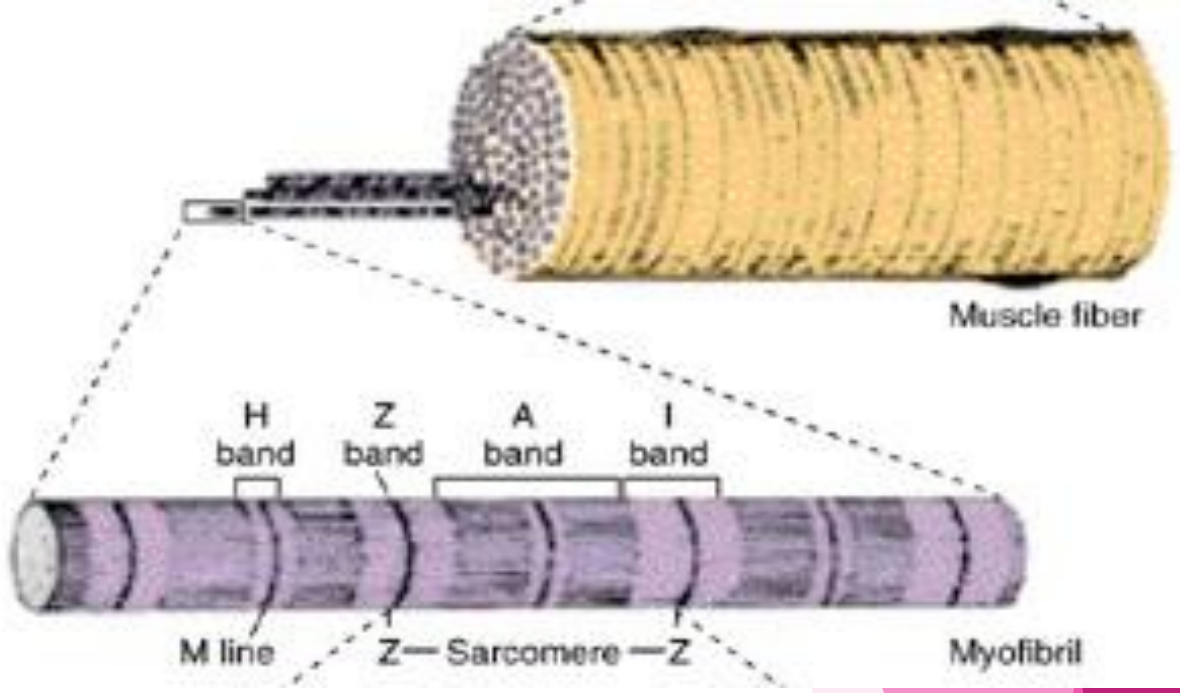
- High concentration of Ca+ that release from smooth ER increase cause muscle contraction

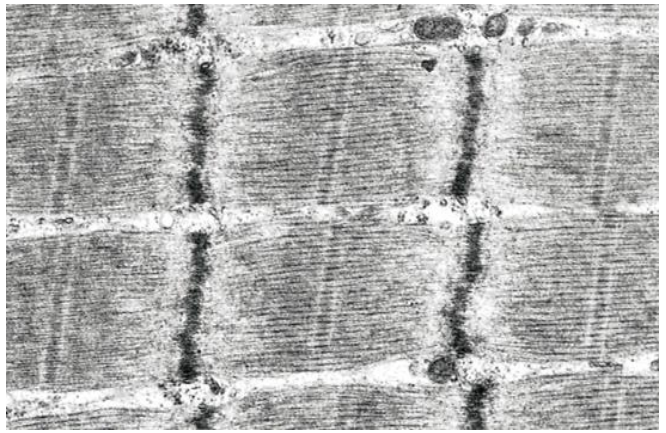


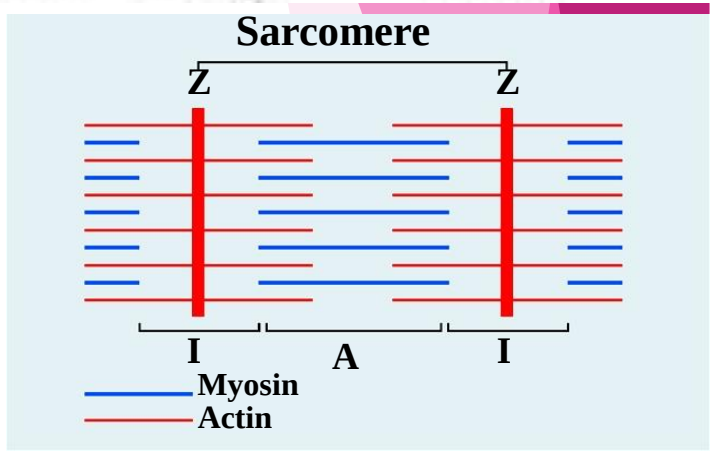
➢ Myofibrils of Skeletal Muscles

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).
- 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.







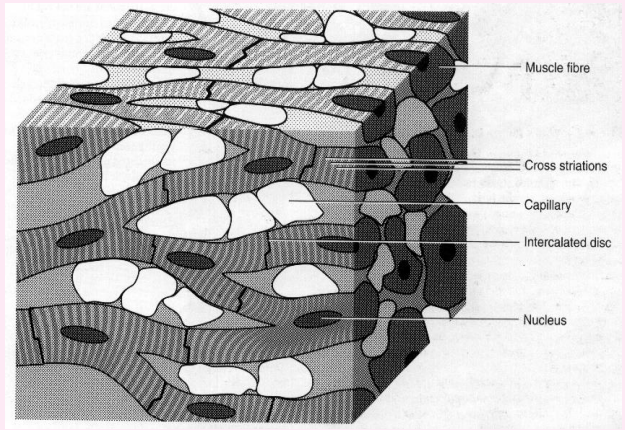
The (A) band is dark because it contains both myosin and actin. The (I) band and the (H) zone are light because they have only one type of myofilaments (actin in I and myosin in H).

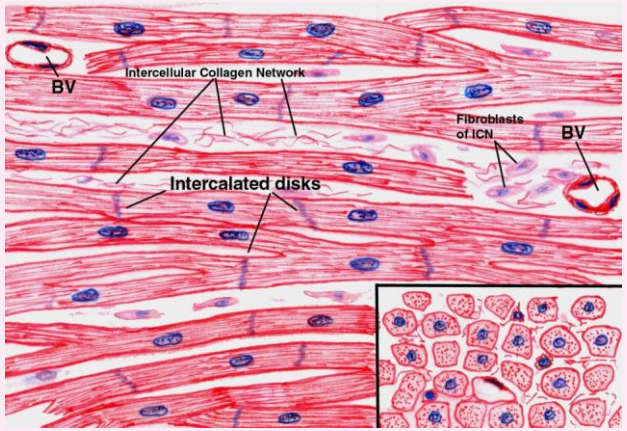
CARDIAC MUSCLE

- Found in the myocardium.
- Striated and involuntary.
- Have only Endomysium.

L.M. Picture

- 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.

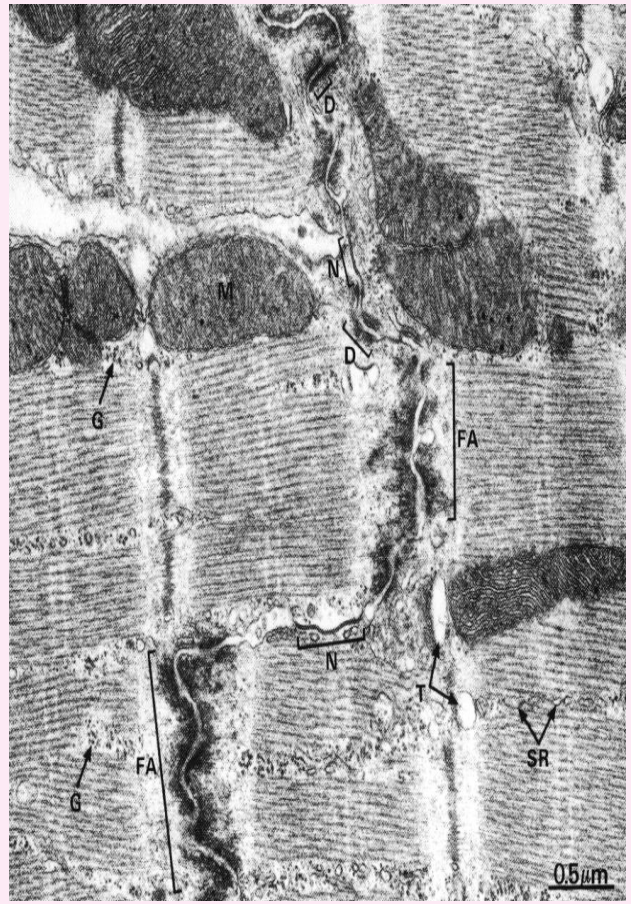




E.M. Picture

- 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*).

*Gap junctions allow communication and passage of impulses between cardiac muscle cells

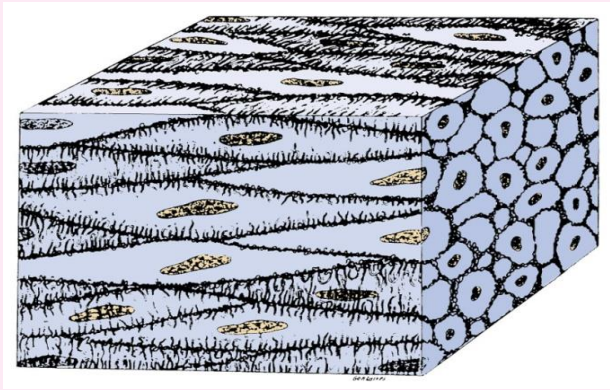


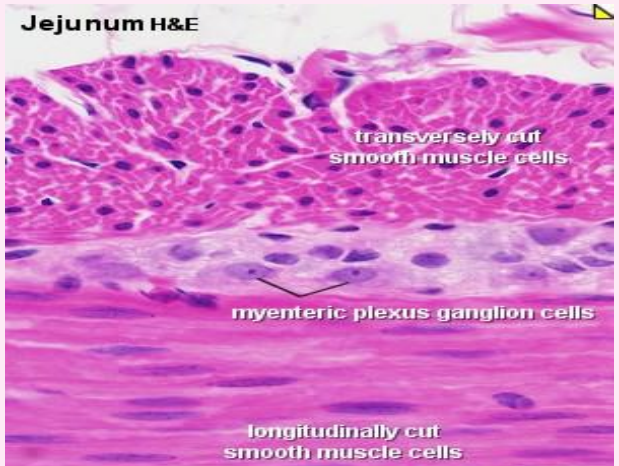
SMOOTH MUSCLE

- Present in walls of blood vessels and viscera (digestive, urinary, genital .... etc).
- Non-striated and involuntary.
- Smooth muscle have dense body that help in contraction
- Gap junction found cardiac & smooth muscle

L.M. Picture

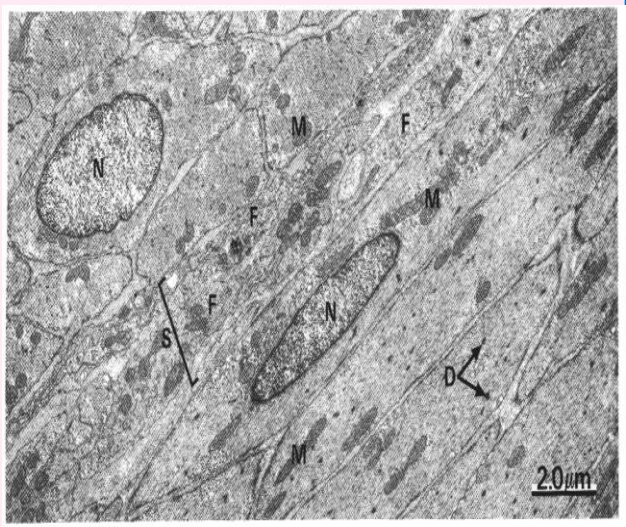
- Fusiform in shape (spindle-shaped).
- Small diameter.
- Non-branched.
- Thin sarcolemma.
- Mononucleated. Nuclei are oval & central in position.
- Sarcoplasm is non-striated and acidophilic.

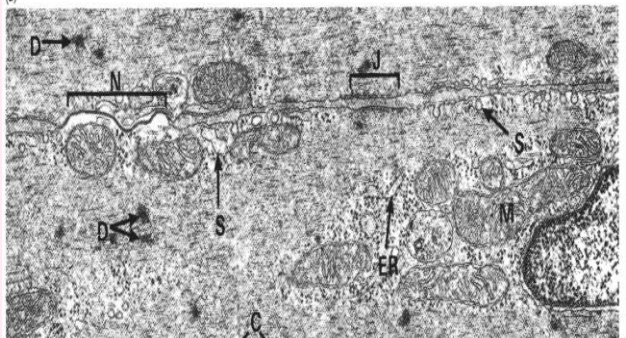




E.M. Picture

- 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.

- mitosis for other healthy cell | stem cell

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

QUESTIONS:

Q1:What is the name of the dark line in the middle of The (I) band?
A) M line B) Z line C) H line D) E line

Q2:Which one of the following not striated?
A) Cardiac muscle B) Skeletal muscle C) Smooth muscle D) All of them

Q3: Intercalated discs is present in which of the following type of muscle fibers?
A) Cardiac muscle B) Skeletal muscle C) Smooth muscle D) All of them

Q4: one of the following is a common feature in both smooth and cardiac muscles?
A) Multinucleated B) Steriation C) Fusiform cells D) Gap junctions

Q5: Which one is never regenerate?
A) Cardiac muscle B) Skeletal muscle C) Smooth muscle D)all of them

1-B
2-C
3-A
4-D
5-A

Q6: Whose have largest dimeter?

A) Cardiac muscle B) Skeletal muscle C) Smooth muscle D) A&B

Q7: Which of the following C.T. separates each individual skeletal muscle fibers?

A) Sarcoplasm B) Perimysium C) Endomysium D) Epimysium

Q8: the contractile unit of a myofibril?

A) Sarcomere B) Sarcoplasm C) Sarcoplasmic reticulum D) Sarcolemma

Q9: The shape of smooth muscle is?

A) Cylindrical B) Circular C) Triangular D) Fusiform

Q10: Sarcomere is the distance between two?

A) M lines B) Z lines C) H lines D) E lines

Q11:Which one of the following muscle fibers can divide?

A) Cardiac muscle B) Skeletal muscle C) Smooth muscle D) All of them

6-B
7-C
8-A
9-D
10-B
11-C

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