

# Muscular Tissue

Color Index:

-Main Text -Important -Notes

-Male Slides -Female Slides -Extra

Editing File

# Objectives:

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

1

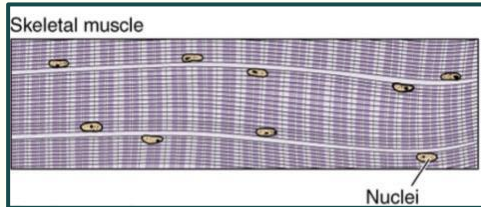
Identify and describe the histological structure of the three types of muscle cells and list the differences between them.

# 3 Types of Muscle (Muscle fibers)

- Made of elongated muscle cells

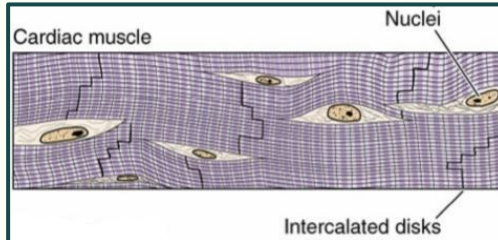
## Skeletal

- Striated
- Voluntary
- Attached to bones or for some facial muscles to skin



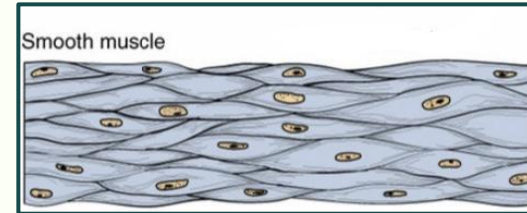
## Cardiac

- Striated
- Involuntary
- walls of the heart



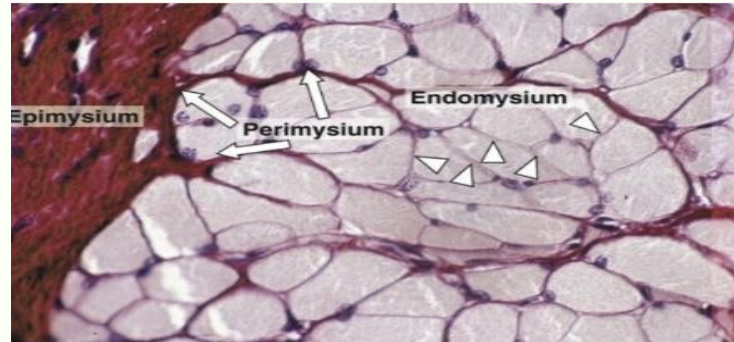
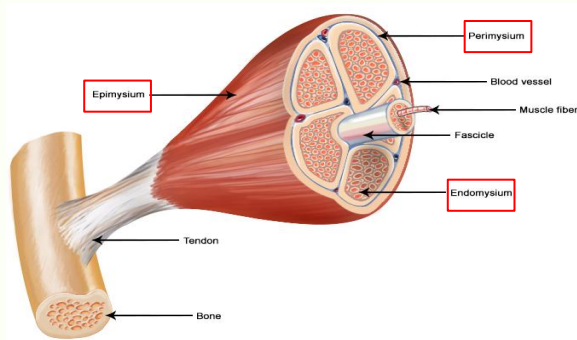
## Smooth

- non-Striated
- Involuntary
- Mostly in walls of visceral organs



# Skeletal Muscle Structure:

- **Epimysium:** The whole muscle is covered by a C.T covering, the epimysium (Thick, Irregular Collagenous C.T.)
- **Perimysium:** Consists of parallel skeletal muscle fibers arranged in Bundles, separated by C.T. septa, the perimysium (Thin, Irregular Collagenous C.T.)
- **Endomysium :** The individual fibers are separated by C.T, the endomysium (loose, Thin Vascular C.T.)



# Skeletal Muscle under the microscope

## L.M. Picture

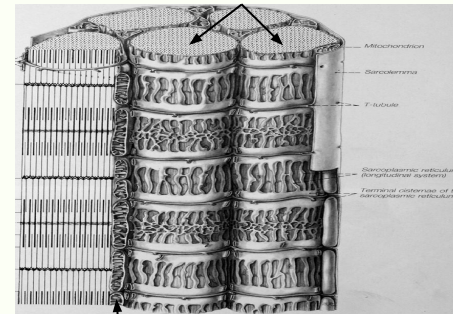
- Cylindrical in shape.
- Non-branched
- Covered by a clear cell membrane, the **Sarcolemma** (cell membrane of muscle fiber).
- **Multinucleated** : nuclei are multiple and are **peripherally** located (close to the sarcolemma).
- Cytoplasm (**sarcoplasm**)= (cytoplasm of muscle fiber) is **acidophilic**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

## E.M. Picture

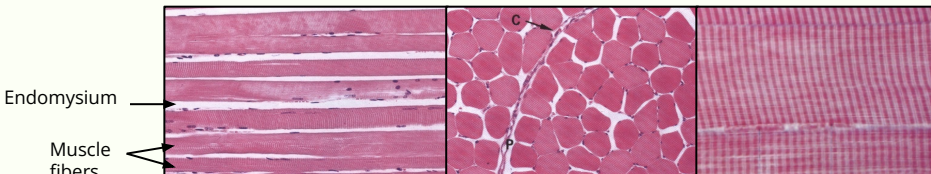
**Sarcoplasm** contains:

- **Parallel myofibrils.**
- Numerous **mitochondria**, arranged in rows between the myofibrils.
- Well-developed smooth endoplasmic reticulum (sarcoplasmic reticulum-SR) (Its functions: store and regulate calcium)
- Myoglobin pigment ( type of hemoglobin have high affinity to oxygen )
- Glycogen.

Myofibrils (composed of thick and thin filaments)



Mitochondria in rows (between myofibrils)

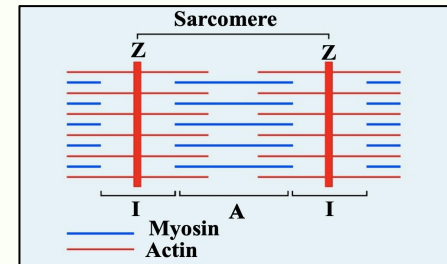
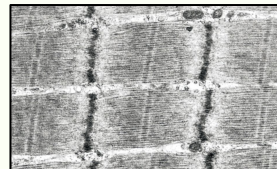
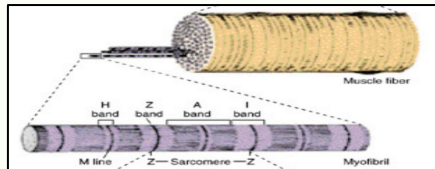


# Skeletal Muscle under the microscope

## E.M. Picture of Myofibrils:

- Contractile threads (organelles), arranged longitudinally in the sarcoplasm.
- Each myofibril shows alternating dark (A) and light (I) bands .
- 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 (only) myofilaments.

During contraction: the two Z lines will come together



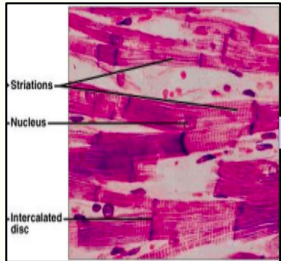
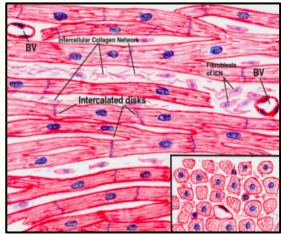
Characteristics:  
1-**Striated** 2-**Involuntary**

## Cardiac muscle:

### Cardiac Muscle fibers under the microscope

Site

Found in the myocardium.

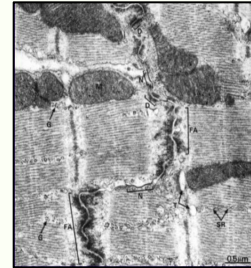


L.M. Picture

- **Cylindrical** in shape.
- **Intermediate** in diameter between skeletal and smooth muscle fibers.
- **Branch** and anastomose (**connected together**).
- Covered by a thin sarcolemma.
- Cardiac muscle cells are mononucleated, Nuclei are oval and central.
- Sarcoplasm is **acidophilic** and shows **non-clear striations** (fewer myofibrils).
- Cardiac muscle fibers are divided into short segments (cells) by the **intercalated discs** (junctions between the cells).

E.M. Picture

- Few myofibrils.
- Numerous mitochondria.
- Less abundant SR.(because it contains less Calcium inside)
- Glycogen & myoglobin.
- **Intercalated discs**: are formed of the two cell membranes of 2 successive cardiac muscle cells, connected together by fascia adherens, desmosomes, and **gap junctions**.(med441: In all involuntary muscle )



Characteristic :  
**Non-striated** and  
**Involuntary.**

# Smooth Muscle

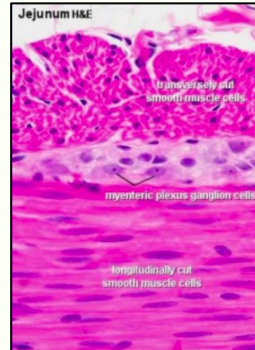
## Smooth muscle fibers under microscope

### Site

Present in walls of Blood vessels and Viscera (Digestive, Urinary, Genital)

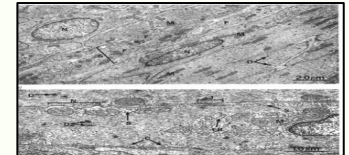
### L.M. Picture

- 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, sarcoplasmic reticulum, and glycogen.
- **Myosin & Actin** myofilaments do not form myofibrils; instead, they are **irregularly** arranged (that's why no striations could be observed).
- Cells are connected together by **gap junctions** for cell communication.





# REGENERATION OF MUSCLE

## Cardiac muscle cells

- **No** regenerative capacity ( no stem cell and no mitosis)  
(When cardiac muscles are injured it replaced by C.T.)

It increases in size with Hypertension.

## Smooth muscle cells

- Can divide (Mitosis)  
- Regenerate from pericytes ( stem cells that generate smooth muscle, found in blood vessels ) 442  
→ active regenerative response.

It increases in size according to its function, like in uterus, it increases in size with pregnancy.

## Skeletal muscle cells

- Can not divide (no Mitosis)  
- **Limited** regeneration by satellite cells  
(stem cells on the muscle cell's surface )

It increases in size with exercises.

# Comparison between different types of muscle fibers

	Skeletal	Cardiac	Smooth
site	Muscle attached to skeleton	Myocardium of the heart	Viscera, eg.stomach
Shape	Cylindrical	Cylindrical	Fusiform
Diameter	Largest	Medium-sized	Smallest
Branching	Non-branched	Branched	Non-branched
Striation	Clear	Not clear	Absent
Intercalated discs	Absent	Present	Absent
Sarcomeres & myofibrils	Present	Present	Absent
Nuclei	Numerous and peripheral	One central nucleus	One central nucleus
Action	Voluntary	Involuntary	Involuntary
Regeneration	Limited	No	Active

# MCQs

Q1: Which of the following is fusiform in shape?

A- Skeletal muscle

B-Cardiac muscle

C-Smooth muscle

D-Both B&C

Q2: The (I) band is formed of ?

A- Myofibrils

B-Myosin

C-Actin

D-Both A&B

Q3:Which of the following has peripheral and multiple nuclei?

A- Skeletal muscle

B-Cardiac muscle

C-Smooth muscle

D-Fibrocartilage



# MCQs

Q4: Which of the following muscle fibers is divided to cells? From Dr

A- Smooth muscle

B-Cardiac muscles

C-Skeletal muscle

D-Myofibrils

Q5: Which of the following has non-striated

A- Smooth muscle

B-Skeletal muscle

C-Cardiac muscles

D-D) Both B&C

Q6: The whole muscle is covered by C.T covering called?

A- Epimysium

B-Perimysium

C-Endomysium

D-Myoglobin





## *Team Leaders*

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## *Team Members*

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- Raneem Faleh

- Ibrahim Albabtain
- Abdulaziz Alobathani 
- Abdullah Balbaid

