جامعة الملك سعود
King Saud University

MED439
KING SAUD UNIVERSITY

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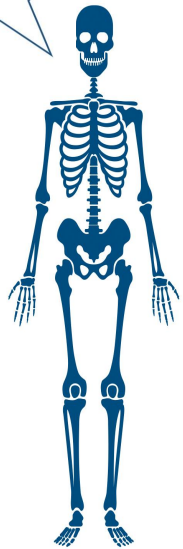
Lecture 2:
Muscular tissue



musculoskeletal block

Color index:
important
Doctor's note
Extra info

Histology team
MED 439

Objectives:

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

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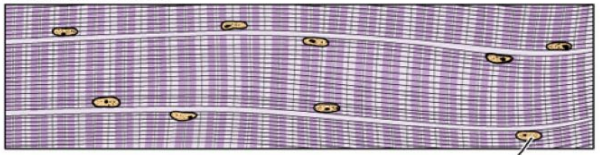
MUSCULAR TISSUE

- Made of elongated muscle cells (fibers).

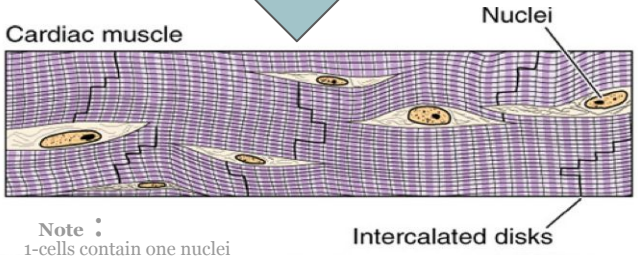
3 types of muscles (muscle fibers)

Skeletal
Striated, voluntary



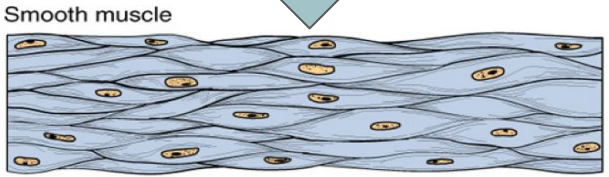
Note :
1-nuclei are located on the periphery of the cell
2-They have multiple nuclei
3- skeletal muscle cells have a single centrally located nucleus
4-shape of cell : elongated or tubular

Cardiac
Strairated, involuntary



Note :
1-cells contain one nuclei
2-position of nuclei : central
3-Shape of nuclei : oval
4-Position of cell : Intermediate cells (مو على طرف الخلية)

Smooth
Non-striated, involuntary



Note :
1-cell has single elongated nuclei
2-position of nuclei : central
3-shape of nuclei : flat
4-shape of cell : Fusiform

Skeletal Muscle

Site

muscle attached to the skeleton.

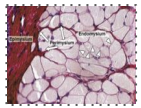
Structure

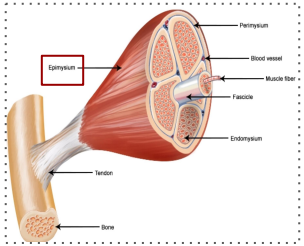
epimysium

المعنى : covering
from outside

The whole muscle is covered by irregular C.T . covering, the **(epimysium) .**

عبارة عن طبقة من C.T تغطي skeletal muscle من الخارج



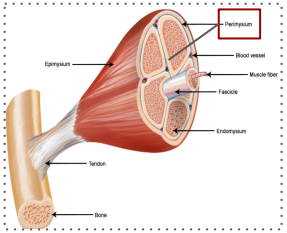


perimysium

المعنى : around , حول

Consists of parallel skeletal muscle fibers, arranged in bundles, separated by C.T. septa, the **(perimysium).**

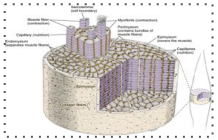
عبارة عن C.T يقوم ب divide muscle fibers into group تسمي bundles

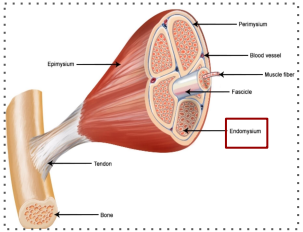


endomysium

The individual fibers are separated by C.T **(endomysium) .** المكان الي يتواجد فيه blood vessels

عبارة عن C.T يقوم ب separate muscle fibers inside the bundle





Note : epimysium and perimysium exist only in skeletal muscle , endomysium exist in all type of muscle

Skeletal Muscle under the microscope

L.M Picture: Of Muscle Fibers

- Cylindrical in shape.
- Non-branched.
- Cover 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 (dark , light lines) .

E.M Picture: Of muscle fibers

Sarcoplasm contains = cytoplasm:

- Parallel myofibrils.
- Myoglobin pigment. (type of hemoglobin have high affinity to oxygen)
- Glycogen.
- Numerous mitochondria, arranged in rows between the myofibrils.
- Well developed smooth endoplasmic reticulum = (sarcoplasmic reticulum-SR).

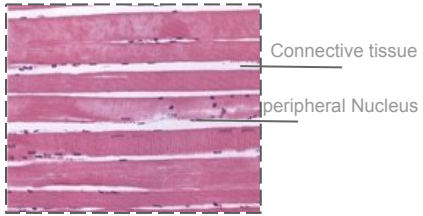
E.M Picture : of Myofibrils

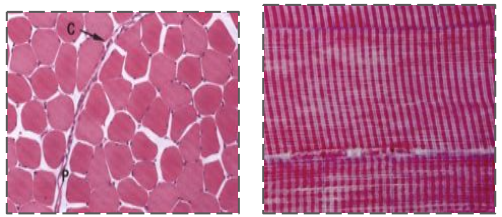
Myofibrils (formed of myofilament) :

- Contractile threads (organelles), arranged longitudinally in the sarcoplasm.
- Each myofibril shows alternating dark (A) and light (I) bands .
- The (I) band shows a dark line in the middle (Z line).
- The (A) band shows a pale area in the middle (H band) which is divided by a dark line (M line).
- The **sarcomere** is the segment between 2 successive Z line , It is the contractile unit of a myofibril.
- The **myofibrils** are formed of myofilaments(specific arrangement of myosin and actin (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.

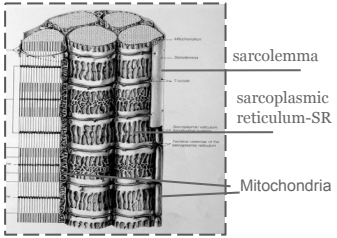
Skeletal Muscle under the microscope

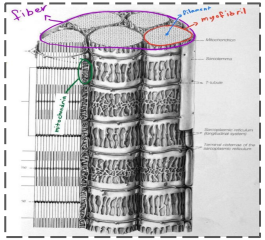
L.M Picture:
Of Muscle Fibers

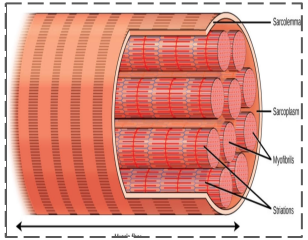




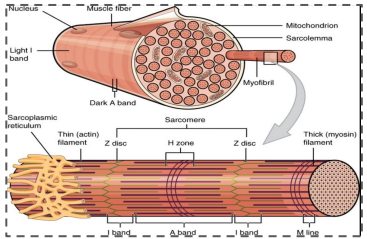
E.M Picture:
Of muscle fibers

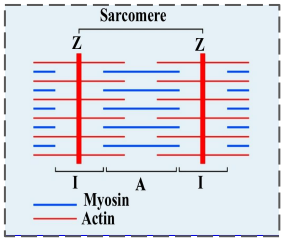


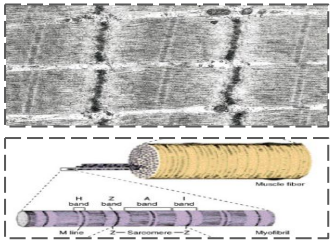




E.M Picture :
of Myofibrils

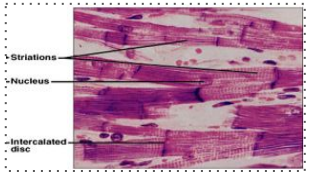


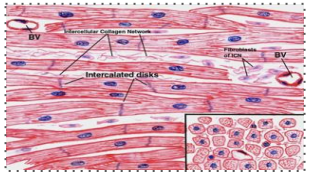




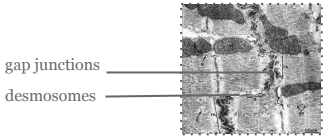
Cardiac Muscle Fibers

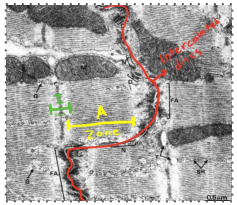
Site	Found in the **myocardium** (of the heart) .
Characteristic	1-Striated 2-Involuntary .
L.M. Picture : **of Cardiac Muscle Fibers**	-cylindrical in shape . -Intermediate in diameter between skeletal and smooth muscle fibers. -Branch and anastomose (has multiple fibers) . -Covered by a thin sarcolemma . -Mononucleated . Nuclei are oval and central . -Sarcoplasm is acidophilic and shows non-clear striations (fewer myofibrils). -Divided into short segments (cells) by the intercalated disc .
E.M. Picture: **of Cardiac Muscle Fibers**	-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).

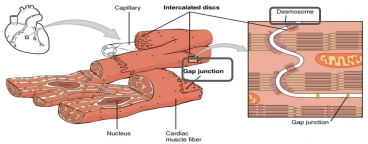




Unique feature (specific structure)of cardiac muscle is intercalated disc



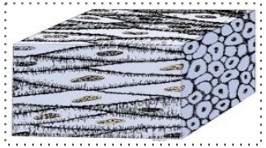
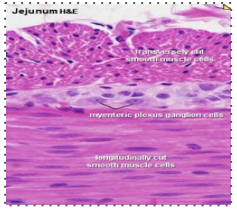
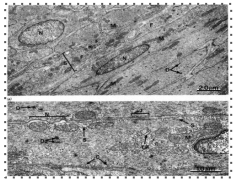




*Gap junctions: - allow communication and passage between cardiac muscle .
-can be seen only in involuntary muscles (cardiac & smooth).

There is two type of junction in cardiac muscle :
1/gap junctions
2/desmosomes
-desmosomes: a structure by which two adjacent cells are attached or adhere

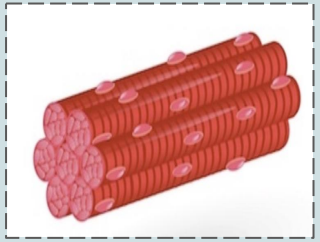
SMOOTH MUSCLE

Site	Present in **walls of blood vessels** and viscera (digestive, urinary, genital .... etc).
Characteristic	1-Non-striated 2-involuntary. 
L.M. Picture : **of Cardiac Muscle Fibers**	1-Fusiform in shape (spindle-shaped). 2-Small diameter. 3-Non-branched. 4-Thin sarcolemma. 5-Mononucleated. Nuclei are oval & central in position. 6-Sarcoplasm is non-striated and acidophilic. 
E.M. Picture: **of Cardiac Muscle Fibers**	-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.  All type of muscle consist of actin and myosin

REGENERATION OF MUSCLE

Skeletal muscle cells:

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

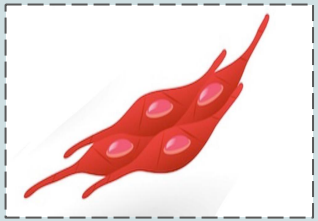


Cardiac muscle cells:

- No regenerative capacity.

Smooth muscle cells:

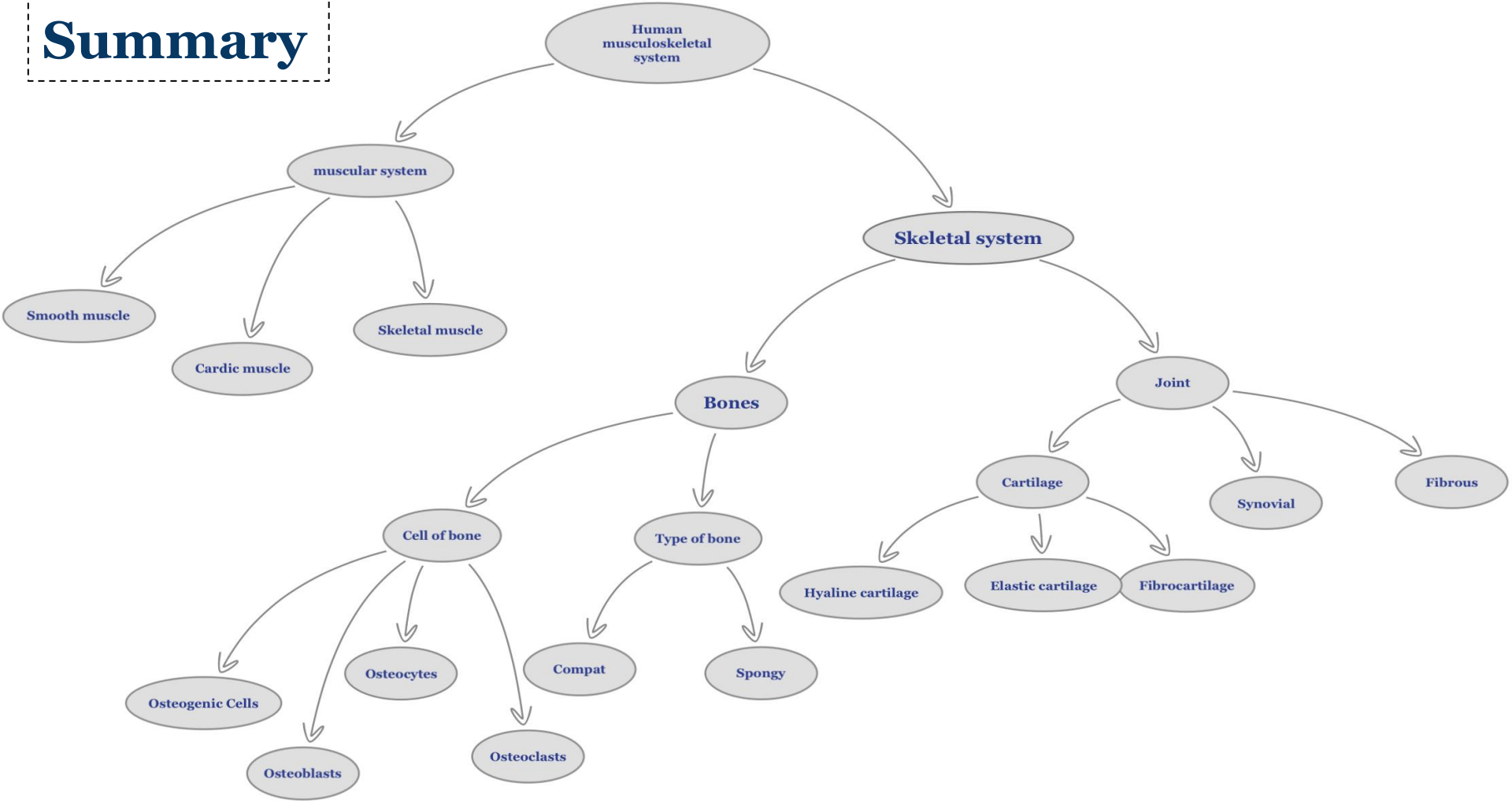
- Can divide.
- Regenerate from pericytes (Stem cells that generate smooth muscles found of the blood vessels).
- → active regenerative response.



Important

	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
Strations	Clear	Not clear	Absent
Intercalated disc	Absent	Present	Absent
Nuclei	Numerous and peripheral	One central nucleus	One central nucleus
Action	Voluntary	Involuntary	Involuntary
Regeneration	Limited	No	Active

Summary


Human musculoskeletal system
muscular system
Skeletal system
Smooth muscle
Cardic muscle
Skeletal muscle
Bones
Joint
Cell of bone
Type of bone
Cartilage
Synovial
Fibrous
Osteogenic Cells
Osteoblasts
Osteocytes
Osteoclasts
Compat
Spongy
Hyaline cartilage
Elastic cartilage
Fibrocartilage

MCQs:

Q1: Which of the following is not striated?

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

Q2: What is muscular tissue composed of?

A) Chondrocyte
B) Filaments
C) Fibers
D) Pericyte

Q3: The whole muscle is covered by a C.T covering, the ?

A) epimysium
B) perimysium
C) endomysium
D) non of above

Q4: The meaning of sarcolemma is?

A) Mitochondria
B) Cytoplasm
C) Cell membrane
D) Lysosome

Q5: Intercalated disc is present in which of the following?

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

Q6: Which one of the following is a common feature in involuntary muscles?

A) multinucleated
B) can divide
C) gap junction
D) intercalated disc

Q7: Which of the following is mononucleated?

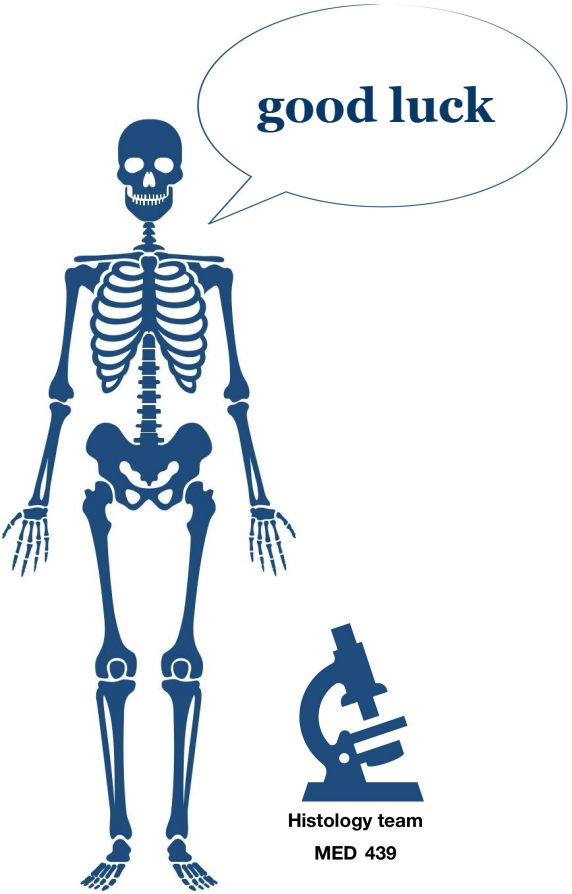
A) skeletal muscle
B) Cardiac muscle
C) Smooth muscle
D) Both B & C

Q8: Which of the following has the thinnest sarcolemma?

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

8: C
7: D
6: C
5: B
4: C
3: A
2: C
1: B

Made by



Histology team

MED 439

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