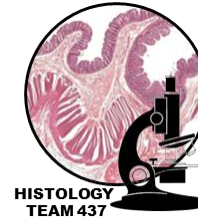




Cartilage & bone



Red: important.

Black: in male | female slides.

Gray: notes | extra.

Editing File

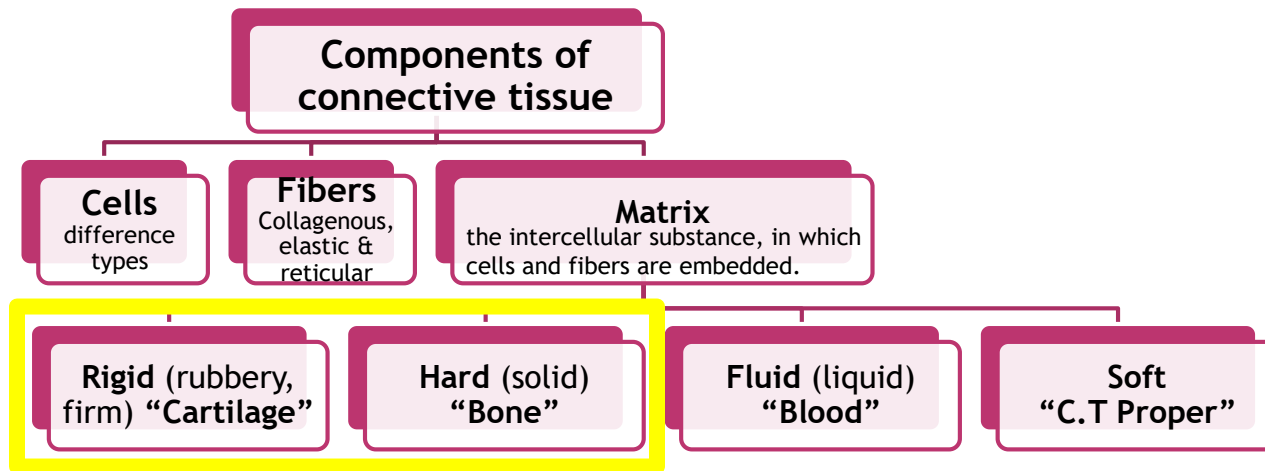
غيداء آل مصمغ
عبدالرحمن الحيسوني

Revised by

➤ **OBJECTIVES**

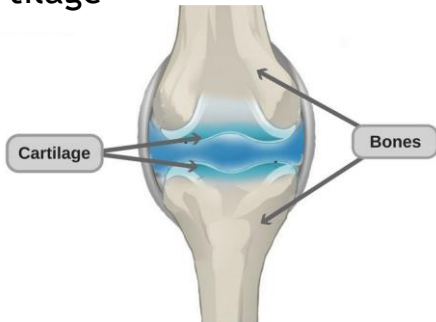
- describe the microscopic structure, distribution and growth of the different types of **Cartilage**
- describe the microscopic structure, distribution and growth of the different types of **Bone**

➤ REMEMBER from last block (connective tissue lecture)



CARTILAGE “Chondro- = relating to cartilage”

- Its specialized type of connective tissue with a **rigid** matrix (لا يكسر بسهولة)
- Its usually **nonvascular** (avascular = lack of blood vessels)
- Its poor nerve supply
- All cartilage contain **collagen fiber type II**
- **Types:**
 - 1) Hyaline cartilage (main type)
 - 2) Elastic cartilage
 - 3) Fibrocartilage



BONE “Osteo- = relating to bone”

- Its specialized type of connective tissue with a **hard** matrix
- **Types:**
 - 1) Compact bone
 - 2) Spongy bone
- **Components:**
 - 1) Bone cells:
 - Osteogenic cells
 - Osteoblasts
 - Osteocytes
 - Osteoclasts
 - 2) Bone Matrix (calcified osteoid tissue):
 - **hard** because it is **calcified (Calcium salts)**
 - It **contains collagen fibers type I**
 - It forms **bone lamellae and trabeculae**
 - 3) Periosteum
 - 4) Endosteum
- **Functions:**
 - 1) body support
 - 2) protection of vital organs as brain & bone marrow
 - 3) calcium store



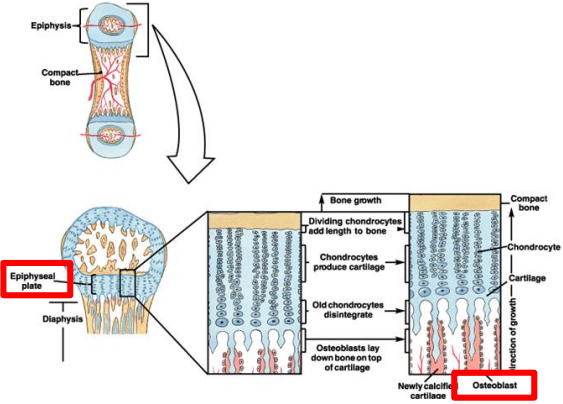


REMEMBER!

Cartilage contain collagen fiber type II ,Bone contain collagen fiber type I



➤ Growth of cartilage & bone

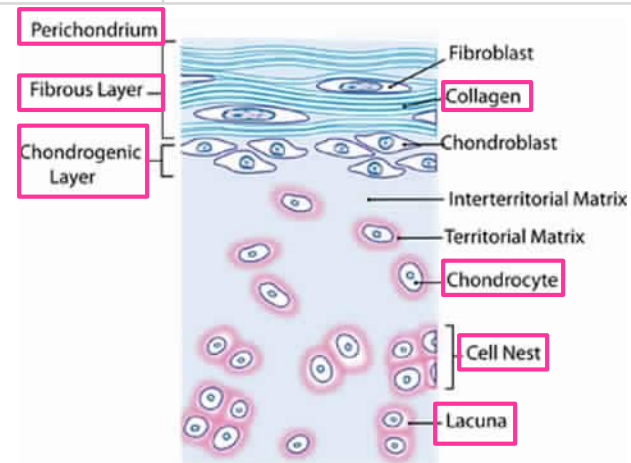
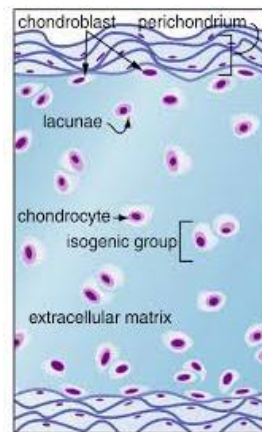
	CARTILAGE	BONE
Appositional growth (increase in WIDTH)	produced by the activity of <u>Chondroblasts</u> in the <u>inner chondrogenic layer</u>	produced by the activity of <u>osteoblasts</u>
Interstitial growth (increase in LENGTH)	produced by division and activity of <u>mature chondrocytes</u>	produced by the activity of <u>epiphyseal plate</u> of cartilage
pictures for explanation	<p><u>Chondroblasts</u> ← </p> <p><u>chondrocytes</u> ← </p>	

➤ Hyaline cartilage

PERICHONDRIUM	CELLS (CHONDROCYTES)	MATRIX
<ul style="list-style-type: none"> ○ Peri=outer ○ Vascular connective tissue membrane formed of 2 layers: <ol style="list-style-type: none"> 1) Outer fibrous layer: dense fibrous connective tissue 2) Inner chondrogenic layer: contains <u>chondroblasts</u> <u>no lacunae</u>, They secrete cartilage matrix and give rise to <u>chondrocytes</u> 	<ul style="list-style-type: none"> ○ Cytec=cells ○ Found in spaces called <u>lacunae</u> <ul style="list-style-type: none"> • Young chondrocytes: small & present singly in their lacunae • Mature chondrocytes: large & found singly or in groups of 2, 4 or 6 cells in their <u>lacunae</u> (cell nests) 	<ul style="list-style-type: none"> ○ Homogeneous and basophilic ○ Contains collagen fiber type II

○ Sites of hyaline cartilage :

- Foetal skeleton
- Costal cartilages
- Articular surfaces of bones
- Nose, trachea & bronchi

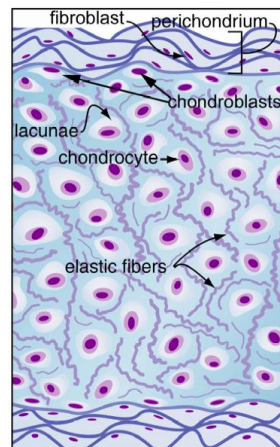
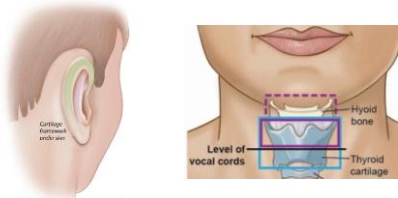


➤ Elastic cartilage

- Similar to hyaline cartilage + elastic fibres in the matrix

- **Sites:**

- External ear
- Epiglottis (لسان المزمار)

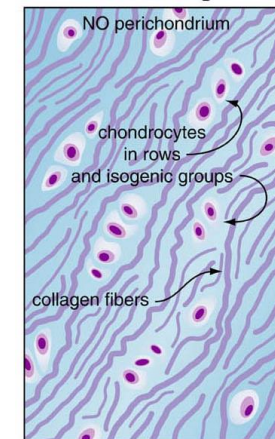
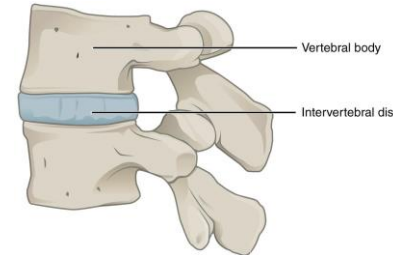


➤ Fibrocartilage

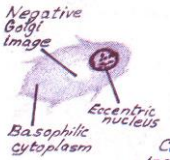
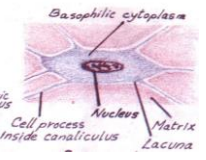
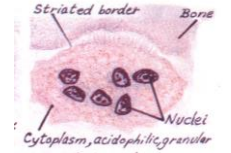
- No perichondrium
- Rows of chondrocytes in lacunae separated by parallel bundles of collagen fibres (type I) (only cartilage contain 2 types of collagen fiber I & II)

- **Sites:**

- Intervertebral disc



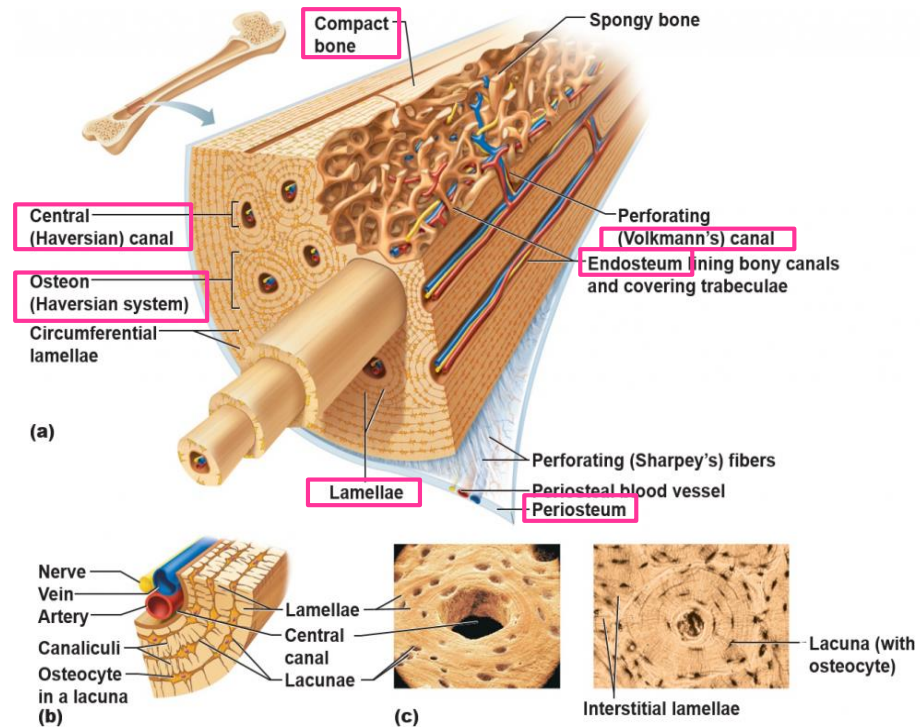
➤ Bone cells

Bone cells	OSTEOGENIC	OSTEOBLASTS	OSTEOCYTES	OSTEOCLASTS
Characters	In periosteum & endosteum	In periosteum & endosteum 	Branched cells, Present singly in <u>lacunae</u>, their branches run in the <u>canaliculi</u> 	Large multinucleated cells on bony surfaces, in <u>howship's lacunae</u>, they have striated or ruffled bordered, Cytoplasm is rich in lysosomes 
Origin	-	Osteogenic cells	Osteoblasts	Blood monocytes
Fate	Give rise to osteoblasts	Change to osteocytes	-	-
Function	-	They secrete the bone matrix & deposit calcium salts in it	They maintain the bone matrix	<ul style="list-style-type: none"> - Bone resorption - calcium resorption by secret acid - remodeling bones and make canaliculi



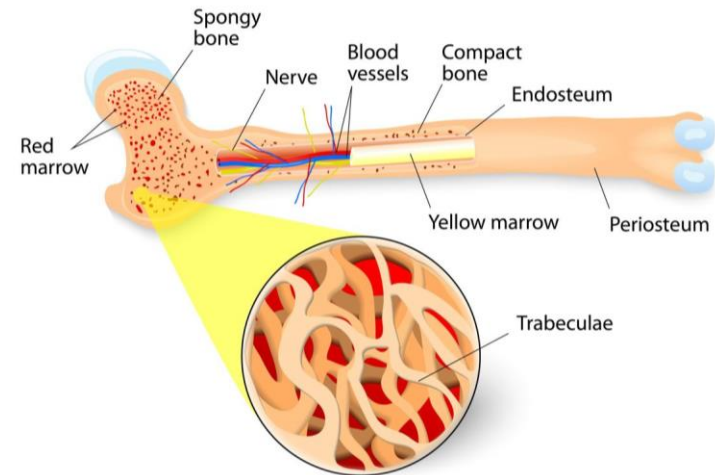
➤ Compact bone = (Cortical bone)

- It is found in the diaphysis of long bones
- Consists of:
 - Periosteum (casing):
 - 1) Outer fibrous layer
 - 2) Inner osteogenic layer
 - Endosteum (cavity)
 - Bone cells
 - Bone lamellae:
 - 1) Haversian Systems (Osteons):
 - Longitudinal cylinders
 - Each is formed of **concentric bone lamellae** & **Haversian canal**, running in the centre (have blood vessels and nerve supply)
 - **Volkmann's canals**: connect the Haversian canals together, they run **obliquely** or **transversely**
 - 2) **External Circumferential Lamellae**
 - 3) **Internal Circumferential Lamellae**
 - 4) **Interstitial Lamellae**: between osteons



➤ **Spongy bone = (Cancellous bone) = (Trabecular bone)**

- It is found in flat bones & epiphysis of long bones
- **Consists of:**
 - Periosteum
 - Endosteum
 - Bone cells
 - Irregular bone trabeculae (are formed of irregular bone lamellae separated by osteocytes inside lacunae)
 - Many irregular red bone marrow spaces
- No Haversian Systems (No Osteons)



➤ **QUESTIONS:**

Q1: All types of cartilage contain?

- A) Collagen fiber type I B) Collagen fiber type II C) Collagen fiber type III D) Elastic fiber

Q2: Hyaline cartilage contain?

- A) Collagen fiber type I B) Collagen fiber type II C) Collagen fiber type III D) Elastic fiber

Q3: Elastic cartilage contain?

- A) Collagen fiber type I + collagen fiber type II B) Collagen fiber type I + Elastic fiber
C) Collagen fiber type II + Elastic fiber D) Elastic fiber

Q4: Fibrocartilage contain?

- A) Collagen fiber type I + collagen fiber type II B) Collagen fiber type I + Elastic fiber
C) Collagen fiber type II + Elastic fiber D) Elastic fiber

Q5: Interstitial growth mean?

- A) Increase in width B) Decrease in width C) Increase in length D) Decrease in length

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



Q6: Most of cartilage?

- A) Vascular with rigid matrix
- B) Vascular with hard matrix
- C) Avascular with rigid matrix
- D) Avascular with hard matrix

Q7: Most cartilage in our body is?

- A) Hyaline cartilage
- B) Elastic cartilage
- C) Fibro cartilage
- D) Spongy cartilage

Q8: Which type of chondrocyte is found singly or in groups of 2,4 or 6 cells in their lacunae (cell nests)?

- A) Inner chondrocyte
- B) Outer chondrocyte
- C) Young chondrocyte
- D) Mature chondrocyte

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

Q9: What is function of bone?

- A) Body support
- B) protection of vital organs
- C) Calcium store
- D) All of them

Q10: Which responsible for Appositional growth in cartilage & bone?

- A) Cartilage (chondroblasts), bone (osteoblast)
- B) Cartilage (chondrocytes), bone (epiphysial plate)
- C) Cartilage (chondrocytes), bone (osteocytes)
- D) Cartilage (epiphysial plate), bone (osteoblasts)



Q11: Perichondrium of hyaline cartilage is?

- A) Avascular connective tissue formed 2 layers
- C) Vascular connective tissue formed 2 layers

- B) Avascular connective tissue formed one layer
- D) Vascular connective tissue formed one layer

Q12: Which is responsible for secrete cartilage matrix & give rise to chondrocytes?

- A) Outer fibrous layer (perichondrium)
- C) Inner chondrogenic layer (perichondrium)

- B) Outer fibrous layer (endosteum)
- D) Inner chondrogenic layer (matrix)

Q13: Bronchi is example of?

- A) Hyaline cartilage
- B) Elastic cartilage
- C) Fibro cartilage
- D) Compact cartilage

Q14: Epiglottis is example of?

- A) Hyaline cartilage
- B) Elastic cartilage
- C) Fibro cartilage
- D) Spongy cartilage

Q15: Which of these is example of Fibrocartilage?

- A) Trachea
- B) Nose
- C) External ear
- D) Intervertebral dis

15-D
14-B
13-A
12-C
11-C



Q16: Why bone matrix is hard?

- A) Because it is calcified (calcium salts)
- C) Because it is contain elastic fiber

- B) Because it is contain type III collagen fiber
- D) Because it is contain type II collagen fiber

Q17: Matrix of chondrocyte is?

- A) Homogenous & basophilic
- C) Homogenous & acidophilic

- B) Heterogenous & basophilic
- D) Heterogenous & acidophilic

Q18: All types of bone contain?

- A) Collagen fiber type I
- B) Collagen fiber type II
- C) Collagen fiber type III
- D) Elastic fiber

Q19: Osteogenic of bone cells give rise to?

- A) Osteoclast cells
- B) Osteoblast cells
- C) Osteocyte cells
- D) periosteum

Q20: Origin of osteocytes is?

- A) Osteoclast cells
- B) Osteoblast cells
- C) Osteocyte cells
- D) periosteum

B-20
B-19
A-18
A-17
A-16



Q21: Which bone cells responsible for maintain the bone matrix?

- A) Osteoblast cells B) Osteoclast cells C) Osteocyte cells D) periosteum

Q22: Which bone cells cytoplasm is rich in lysosomes?

- A) Osteoblast cells B) Osteoclast cells C) Osteocyte cells D) periosteum

Q23: Cancellous is another name of?

- A) Compact bone B) Spongy bone C) Cartilage D) blood

Q24: Which connect the Haversian canals together?

- A) Bone lamellae B) Haversian canal C) Volkmann's canal D) circumferential lamellae

Q25: Spongy bone consist of ?

- A) Haversian systems B) Irregular bone trabecular & irregular red bone marrow spaces
C) Regular bone trabecular D) Regular bone trabecular & irregular red bone marrow spaces

Q26: Which responsible for increase length in cartilage & bone?

- A) Cartilage (chondroblasts), bone (osteoblast) B) Cartilage (chondrocytes), bone (epiphysial plate)
C) Cartilage (chondrocytes), bone (osteocytes) D) Cartilage (epiphysial plate), bone (osteoblasts)

B -9Z
C -5Z
24-C
B -3Z
B -2Z
C -1Z



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