1. Enumerate types of cartilage:

① Hyaline cartilage.

② Yellow elastic fibro-cartilage.

③ White fibro-cartilage

2. Regarding hyaline cartilage complete the following:

Appearance in fresh state	it appears translucent pale blue
Consistency	firm or rigid with some degree of flexibility

3. Mention type of collagen in the following:

Perichondrium	Collagen type I
Periosteum	Collagen type I
Matrix of Hyaline cartilage	Collagen type II

4. Enumerate functions of perichondrium:

① It acts as source of O2 + nutrients to the cartilage cells.

② The inner chondrogenic layer is responsible for new cartilage formation

5. Compare between young and old chondrocytes regarding the following:

	Young chondrocytes	Old chondrocytes
Site in the cartilage	At the periphery of the cartilage	Deep in the cartilage
Nucleus	Open-face nuclei	Rounded open face nuclei.
Cytoplasm	Pale basophilic cytoplasm	Granular, basophilic cytoplasm
Number in lacunae	Single	Single or in groups

6. Enumerate functions of mature chondrocytes?

① They synthesize and secrete the components of the cartilage matrix

② They are responsible for growth of the cartilage as they can divide.

7. Compare between bone matrix and cartilage matrix regarding the following?

	Bone matrix	Cartilage matrix
Consistency	Hard or solid	Rubbery or firm
Vascularity	Rich in blood supply	Non-vascular.
Collagen type	Type I	Type II

8. Enumerate components of hyaline cartilage matrix

① Collagen fibres type II

② Proteoglycans (chondroitin 4- sulphate, chondroitin 6- sulphate)

③ Chondronectin.

④ Chondrocalcin.

9. Enumerate sites of hyaline cartilage:

① It constitutes the majority of the fetal skeleton.

② Articular surface of bones.

③ Costal cartilage in the thoracic cage.

④ Nose, trachea, bronchi.

10. Mention the difference between yellow elastic fibro- cartilage and hyaline cartilage:

① The matrix of yellow elastic fibro- cartilage contains fine elastic fibers in addition to collagen type II fibrils which are responsible for elasticity and flexibility of this type.

② Fresh elastic cartilage has a yellow color due to presence of elastic fibers.

③ It can be stained by standard elastic stains e.g. verhoeff's stains.

11. Enumerate sites of yellow elastic fibro- cartilage:

① Auricle of the ear.

② External auditory meatus.

③ Eustachian tube.

④ Epiglottis

12. Compare between hyaline cartilage and white fibro cartilage regarding the following?

	Hyaline cartilage	White fibro cartilage
Appearance in fresh state	Translucent pale blue	White in color
Perichondrium	Present	Absent
Color of matrix by H&E	Homogenous basophilic	Acidophilic

13. Enumerate sites of white fibro cartilage?

① Intervertebral discs.
② Semilunar cartilage of knee joints.
③ Symphysis pubis.
④ Lips of glenoid cavity.
⑤ Terminal parts of tendons

14. Enumerate constituents of bone:

① Bone cells
② Bone Matrix
③ Periosteum
④ Endosteum

15. Enumerate bone cells:

① Osteogenic cells
② Osteoblasts
③ Osteocytes
④ Osteoclasts

16. Complete the following regarding LM of osteoclasts:

Size	large cell (20-30 um)
Nucleus	multinucleated cell (4-50 nuclei)
Shape	Irregular in shape
Cytoplasm	Foamy acidophilic
Border	Striated or brush border facing the bone surface.

17. Compare between osteoblasts and osteoclasts regarding the following:

	Osteoblasts	Osteoclasts
Origin	Activated osteogenic cells.	Monocytes
Sites	① Activated inner osteogenic layer of periosteum. ② Endosteum. ③ Walls of bone marrow spaces	① Bone marrow spaces. ② Medullary cavities. ③ Endosteum
Functions	They are responsible for bone formation and calcification	① They are concerned with bone resorption during ossification. ② They remove bone debris during ossification and after healing of bone fracture.

18. Enumerate the four zones of osteoclasts under EM:

① Ruffled or striated zone.

② Clear Zone.

③ Vesicular Zone.

④ Basal Zone

19. Mention the name of the following bone cells:

Osteocytes	Bone cells that are present inside lacunae and connected by processes and these processes intercommunicate with one another by gap junctions.
Osteogenic cells	Bone cells that are capable to divide and give osteoblasts during growth and healing of fracture bone.
Osteocytes	Bone cells that preserve the integrity of the bone matrix and maintain its inorganic components.

20. Compare between organic and inorganic components of bone matrix:

The Organic components	The Inorganic components
It constitutes about 50% of the dry weight of the bone matrix.	It constitutes about 50% of the dry weight of the bone matrix.
It includes: ① Bone collagen "Type I": ↳ It constitutes about 90% of the organic component. ② Sulphated glycosaminoglycans. ③ Glycoprotein = Osteonectin: ↳ Which anchor cells with bone matrix. ④ Protein = Osteocalcin: ↳ It helps bone calcification.	**It is formed mainly of:** ① Calcium and phosphorus salts ② Small amounts of sodium, carbonate, citrate, iron, Mg.

21. Compare between compact bone and cancellous bone regarding the following:

	Compact bone	Cancellous bone
Character	It is solid like ivory with no apparent holes	It looks like – sponge with many holes
Sites	① Shaft of long bones. ② Outer & inner tables of flat bones of the skull. ③ Outer covering of the vertebrae & ribs	① Epiphysis of long bones. ② Central part of flat bones of the skull. ③ Young embryonic bone. ④ Bodies of vertebrae and sternum.
Arrangement of Bone lamellae	① Outer circumferential lamellae ② Inner circumferential Lamellae ③ Haversian system ④ Interstitial Lamellae	Irregularly arranged bars or trabeculae which branch and anastomose and separated by bone marrow spaces of irregular shape and size.

22. Compare between periosteum and endosteum:

	Periosteum	Endosteum
Definition	It is a vascular C.T. membrane covering the bone from outside	It is a vascular C.T. membrane that lines the inner surface of the bone, bone marrow cavities and Haversian canals.
Functions	① Provide attachment for muscles, ligaments and tendons. ② Provide bone with blood supply and nourishment. ③ Inner osteogenic layer is important for formation of bone during its growth and after its fracture.	① It supplies bone with blood supply & nourishment. ② Its osteogenic cells & osteoblasts & osteoclasts are concerned with bone formation and resorption during growth & healing after fracture

23. Describe the structure of Haversian system:

Haversian Canal	Concentric bone lamellae	Osteocytes
It runs parallel to the longitudinal axis of bone. It contains loose C.T., rich in blood Vessels, osteogenic cells.	It is formed of 4-20 cylinders of concentric bone lamellae arranged around Haversian canal.	Found inside their lacunae in between the bone lamellae.

24. Mention the methods of bone ossification:

Intramembranous ossification	Intracartilagenous ossification
It occurs in mesenchymal membranes	It occurs in cartilage model

25. Enumerate stages of intracartilagenous ossification:

① Stage of resting cartilage.
② Stage of proliferation.
③ Stage of maturation and hypertrophy.
④ Stage of calcification.
⑤ Stage of invasion.
⑥ Stage of spongy bone formation.
⑦ Stage of remodeling and compact bone formation

26. Enumerate general characters of muscle tissue:

① The muscle tissue is formed of a group of muscle fibers.
② These fibers have a contractility power due to myofibrils in their cytoplasm.
③ The plasma membrane is called the sarcolemma.
④ The cytoplasm is called the sarcoplasm.
⑤ The muscle fibers may be striated or Non-striated, voluntary or Involuntary

27. Compare between the following:

	Skeletal muscles	Smooth muscles
Characters	① Striated ② Voluntary except: ☑ Upper third of esophagus. ☑ Cremastric muscle. ☑ Pharynx. ③ Do not branch except: tongue and face.	① Non-striated. ② Involuntary Except: ☑ Ciliary muscle ☑ Special Muscle in urinary bladder
Sites	① All skeletal muscle attached to skeleton. ② Eye. ③ Tongue. ④ Pharynx. ⑤ Larynx.	① Walls of the blood vessels. ② Viscera of various systems (G.I.T., G.U.T., and Respiratory system)

28. Mention the definition of the following:

Epimysium	It is a dense C.T. which surrounds the whole muscle
Perimysium	It is a dense C.T. which divides the muscle into bundles
Endomysium	It is a loose C.T. which separates the muscle fibers

29. Enumerate functions of CT in the muscles:

① It contains blood vessels, nerves and lymphatic and give attachment between muscle bundles.

② Help the attachment of muscle to tendon, ligament, perichondrium and periosteum.

30. Describe the LM of skeletal muscle fibres in L/S:

① Single elongated multinucleated cell (syncytium).

② Have multiple flattened oval peripherally situated nuclei.

③ Have regular transverse striation.

④ The sarcoplasm is acidophilic and contains B-Glycogen granules and myoglobin pigment.

31. Compare between light bands and dark bands of myofibrils:

Light bands	Dark bands
Isotropic or I- band	Anisotropic or A- band
Contain actin only	Contain actin and myosin
Each light band is divided at its center by a dark line called Z-line	Each dark band is divided at its center by a light disc called H-zone and contains only myosin.

32. Describe the sarcomere:

- It is the area between two Z-lines.
- It is the functional contractile unit of a myofibril.
- It includes a whole A (dark band) and ½ of I (light band) on either side.

33. Compare between skeletal muscle and smooth muscle fibers regarding the following:

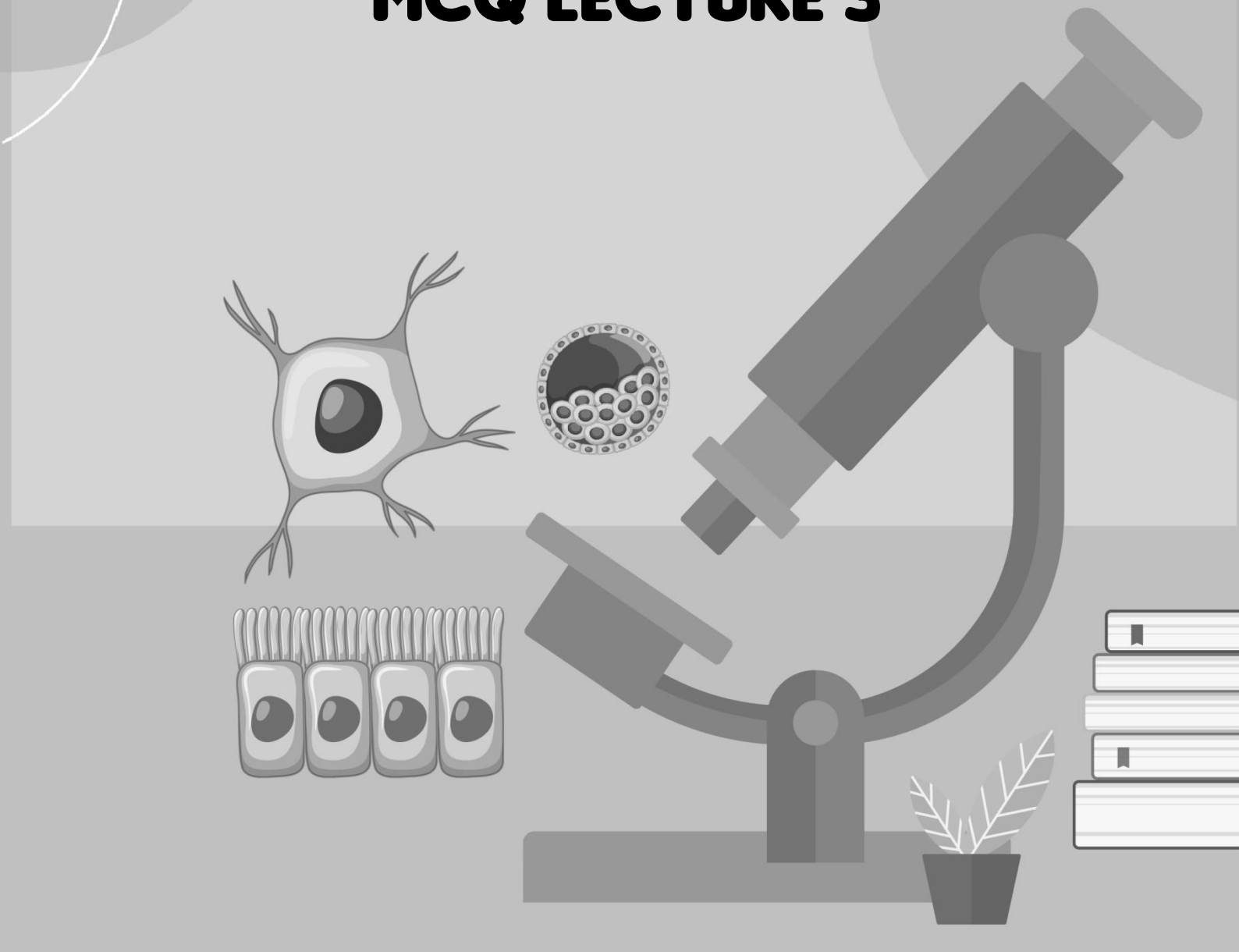
	Skeletal muscle fibers	Smooth muscle fibers
Shape	➲ Elongated	➲ Spindle (fusiform)
No. of cells per fiber	➲ Single cell	➲ Single cell
Nuclei	➲ Peripheral, ➲ Multiple, ➲ Oval, ➲ Flat	➲ Central, ➲ Single, ➲ Oval or rod-shaped ➲ In the widest part (middle part).
Myofilaments	➲ Thin filaments ➲ Thick filaments	➲ Thin filaments ➲ Thick filaments ➲ Intermediate filaments
T- Tubules	➲ Present	➲ Represented by vesicular Caveolae
Gap Junction	➲ Absent	➲ Present

LEVEL 1

Histology

DR/ M. SH.

MCQ LECTURE 3



MCQ

1) **bone matrix is characterized by** A. contain chondrocalcin B. rich in blood supply C. non vascular D. rich in elastic fibers	**B**
2) **Osteocytes are** A. present in lacuna in groups B. responsible for bone resorption C. mature osteoblast D. present in periostium	**C**
3) **about bone all true except** A. has hard matrix B. calcified CT C. poor in blood supply D. of two general types	**C**
4) **cells of bone building function include all except** A. osteoblast B. osteogenic C. osteoclast D. osteocyte	**C**
5) **Howships lacuna is site of** A. osteoblast B. osteoclast C. osteocyte D. osteogenic	**B**
6) **about osteoclast all true except** A. multinucleated cell B. well developed golgi apperatus C. lie in Hawships lacuna D. acidophillic cytoplasm	**B**

7) **osteoblast is charaterized by** A. multinucleated cell B. well developed golgi apperatus C. lie in Hawships lacuna D. acidophillic cytoplasm	**B**
8) **all bone cells have single nucleus except** A. osteoblast B. osteoclast C. osteocyte D. osteogenic	**B**
9) **all bone cells have basophillic cytoplasm except** A. osteoblast B. osteoclast C. osteocyte D. osteogenic	**B**
10) **osteoclast originate from** A. lymphocyte B. monocyte C. pericyte D. osteocyte	**B**
11) **osteocyte has** A. acidophilic cytoplasm B. multilobed nucleus C. branched inside lacunae D. simple columnar ciliated	**C**
12) **osteogenic cell is present in** A. endostium B. periostium C. Harvensian canal D. All of the above	**D**
13) **all is part of organic matrix except** A. collagen I B. collagen II C. osteocalcin D. osteonectin	**B**

14) bone maintaining cell is A. osteoblast B. osteoclast C. osteocyte D. osteogenic	**B**
15) bone eroding cell is A. osteoblast B. osteoclast C. osteocyte D. osteogenic	**C**
16) bone forming cell A. osteoblast B. osteoclast C. osteocyte D. osteogenic	**B**
17) all about bone except A. calcified hard tissue B. highly vascular C. made of system of canals & canaliculi D. lacuna contain groups of osteocytes	**A**
18) Bone matrix :2015 يناير A. Soft &flexible B. Collagen type 1 form 90% of organic component C. Osteoclastin prevent calcification D. Hardness due to osteonectin E. Contain large amount of Na , Mg ,iron	**B**
19) Osteoblast is rich in 2013 يناير A. Acid phosphatase enzymes B. Alkaline phosphatase enzymes C. Lysosomes D. SER E. microtubules	**B**
20) Bone matrix is characterized by :اسنان 2011 يناير A. Has chondrocalcin B. Rich in blood supply C. Rich in elastic fibers D. Non vascular	**B**

21) <u>Osteoblasts</u> are characterized by one of the following : يناير 2010 اسنان A. Surrounded by lacunae B. Nuclei are central C. Found between bone lamella D. Have basophillic cytoplasm	**D**
22) <u>Which of the following cells are present singly in lacunae</u> A. Osteocytes B. Osteoblast C. Fibrocyte **D.** chondroblast	**A**
23) <u>Osteocytes :يناير 2010 اسنان</u> A. Are bone resorping cells B. Have long cytoplasmic processes joined by gap junction C. Originate from monocyte **D.** Lie in Howships lacunae	**B**
24) <u>Osteoclast is : يناير 2011 اسنان</u> A. From osteogenic cells B. Multinucleated C. Responsible for bone formation **D.** Secret histamine	**B**

Level-1 Semester-2

Histology - MSS

BERLIN

BEST PRICE

12 L.E

SCAN ME

Lecture 4

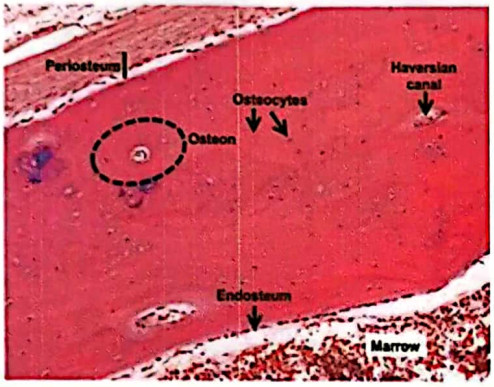
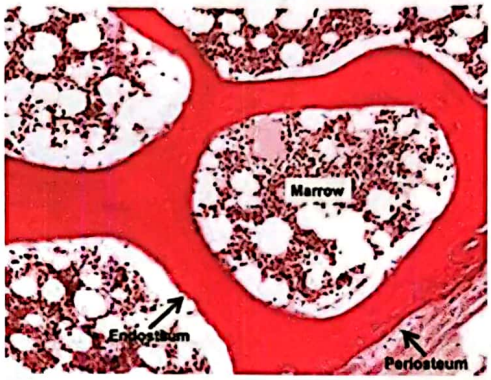
BONE-2

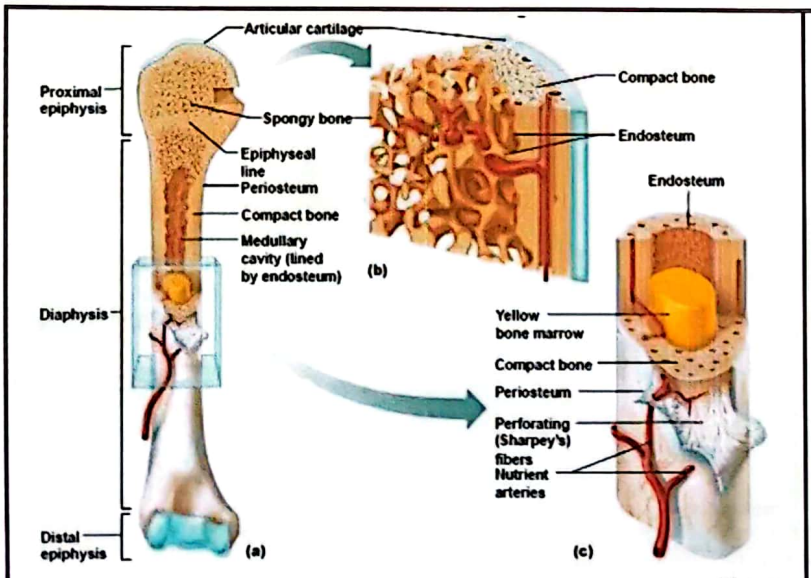
DR M. YUSUF

THE BONE (2)

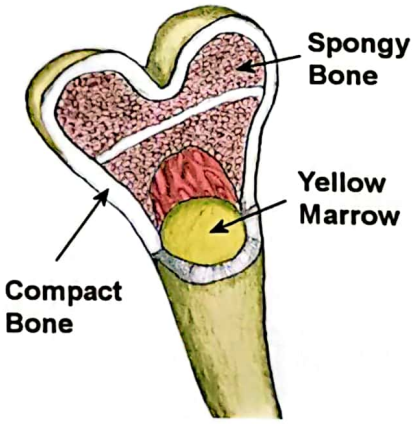
TYPES OF BONES

There are two types of bone:

	① Compact (Cortical) bone	② Cancellous (Spongy, Trabecular) bone
Site	Wall of the diaphysis	Epiphysis
Structure	Solid & Strong	▪ Covered with a thin layer of compact bone. ▪ Many branching bony plates
Fig.		



Structure of long bones



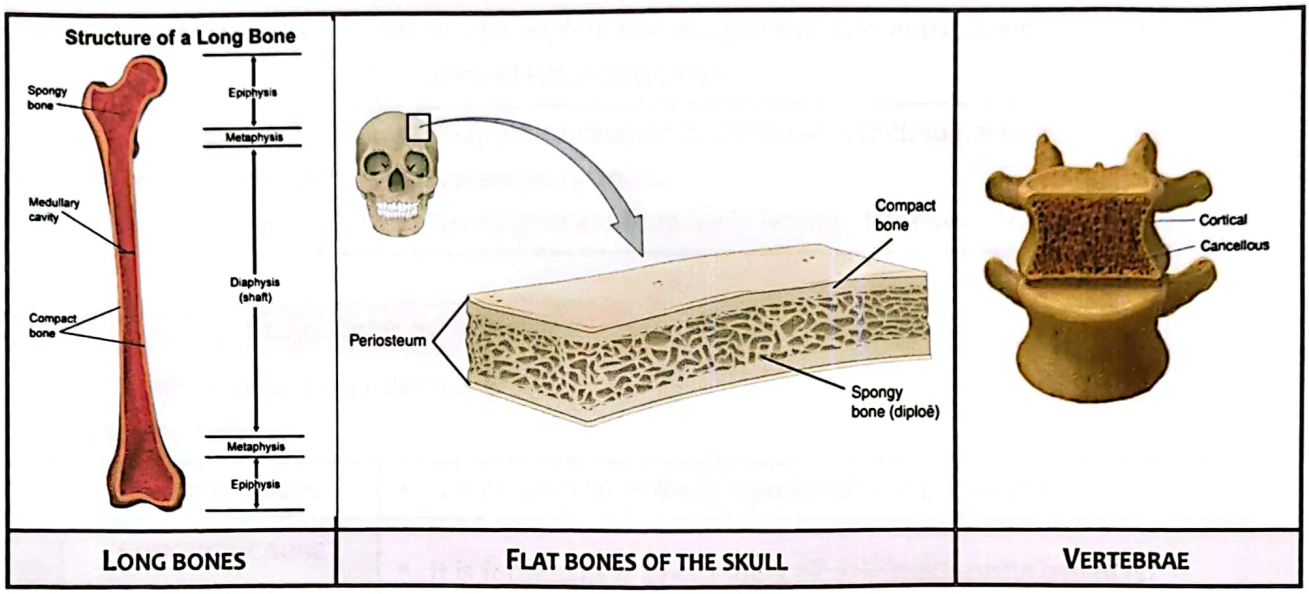
Types of Bone tissue

1 Compact Bone

Compact = Solid like ivory with no apparent holes

Sites

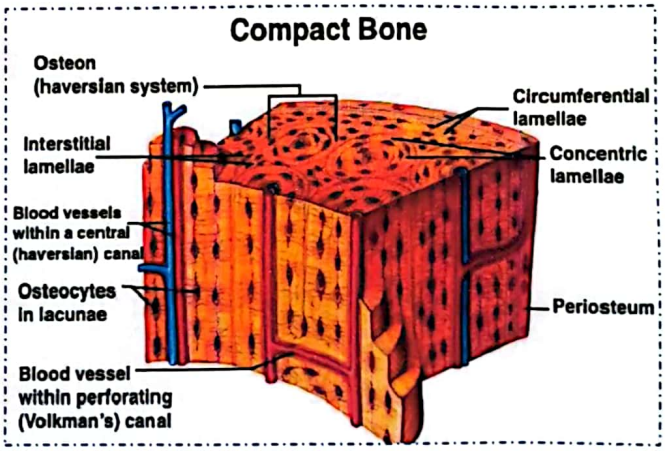
1. Shaft of **long bones.**
2. Outer & inner tables of **flat bones of the skull.**
3. Outer covering of the **vertebrae & ribs.**



LONG BONES	FLAT BONES OF THE SKULL	VERTEBRAE

Structure

1. Periosteum.
2. Endosteum.
3. **Bone matrix.**
4. Bone cells.



Bone matrix of compact bone

- The matrix is formed of **lamellae** of calcified osteoid tissue in which osteocytes are embedded.
- **Bone lamellae are deposited in regular pattern as follows:**

1	**Outer "External" Circumferential Lamellae**	▪ **These lamellae are present:** - **Under the periosteum & parallel to it.**
2	**Inner "Internal" Circumferential Lamellae**	▪ **These lamellae are present:** - **Under the Endosteum** - **Parallel to the medullary bone cavity,** which contains the bone marrow.
3	**Concentric Bone Lamellae**	▪ It is formed of **4-20 cylinders of concentric bone** lamellae arranged **around Haversian canal.**
4	**Interstitial "Inter-Haversian" Lamellae**	▪ They are formed of **calcified osteoid tissue** present between Haversian systems. ▪ Osteocytes are irregularly arranged between these lamellae.

Haversian system = Osteon

- **It is the structural unit of the bone.**
- **It is formed of:**

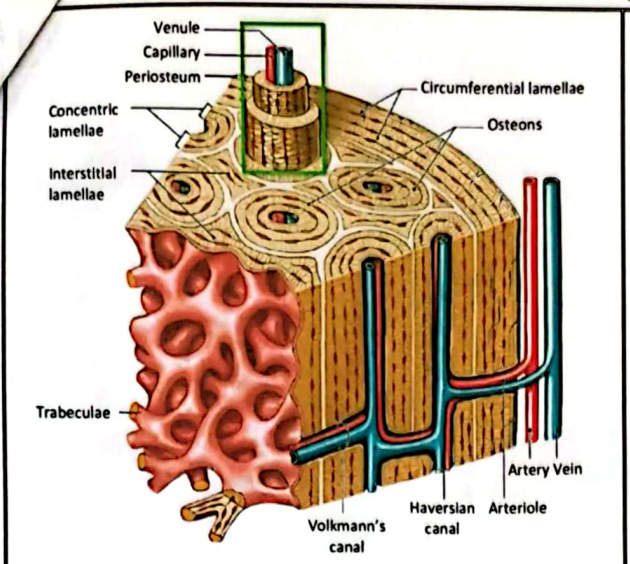
1	**Haversian Canal**	▪ It runs **parallel to the longitudinal axis of the bone.**
2	**Concentric bone lamellae**	▪ It is formed of **4-20 cylinders of concentric bone lamellae.**
3	**Osteocytes**	▪ They are found **inside their lacunae in between the bone lamellae.**

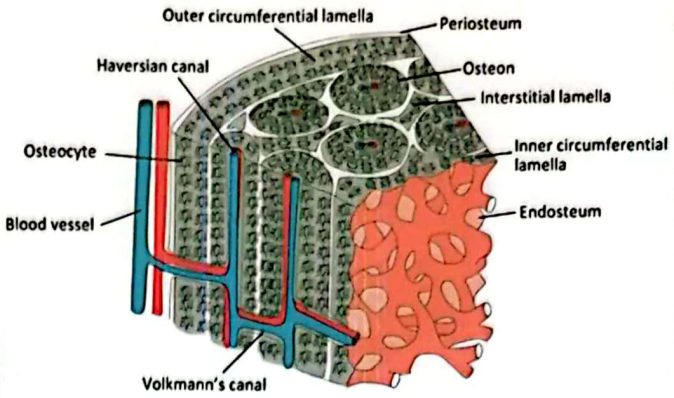
Volkman's canals

- **Structure:**
  - **These are transverse** or **oblique** canals.
  - **Lined with osteogenic cells**
  - **Contain** blood vessels.
- **Function:** They connect **Haversian canals together & with periosteal or endosteal blood vessels**

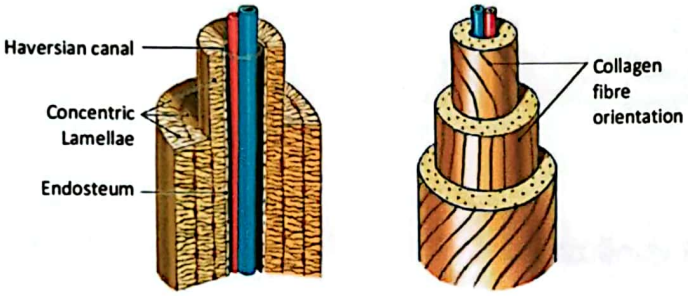
Perforating fibers of Sharpy

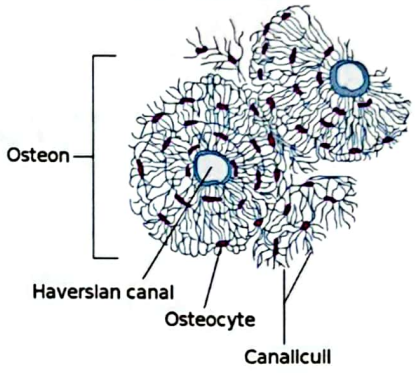
- **Structure: These are** calcified collagenous fibers.
- **Function:** Fixing the periosteum to the bone.



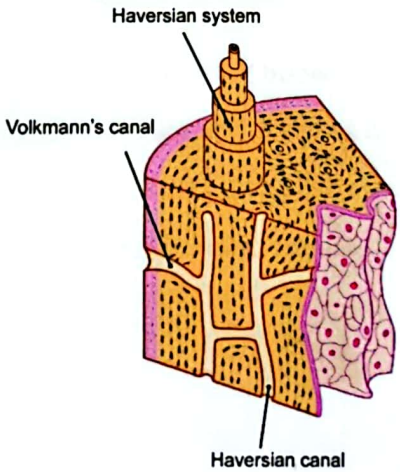


STRUCTURE OF COMPACT BONE

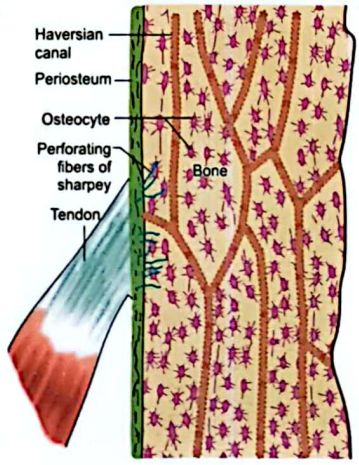


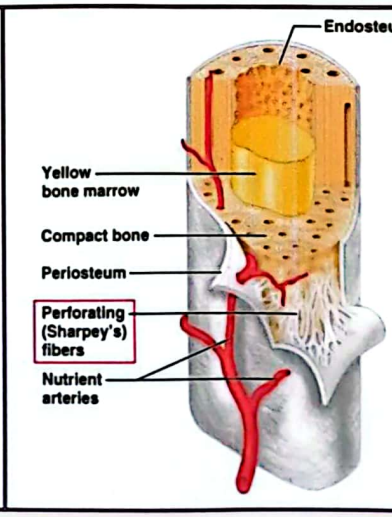


HAVERSIAN SYSTEM (OSTEON)

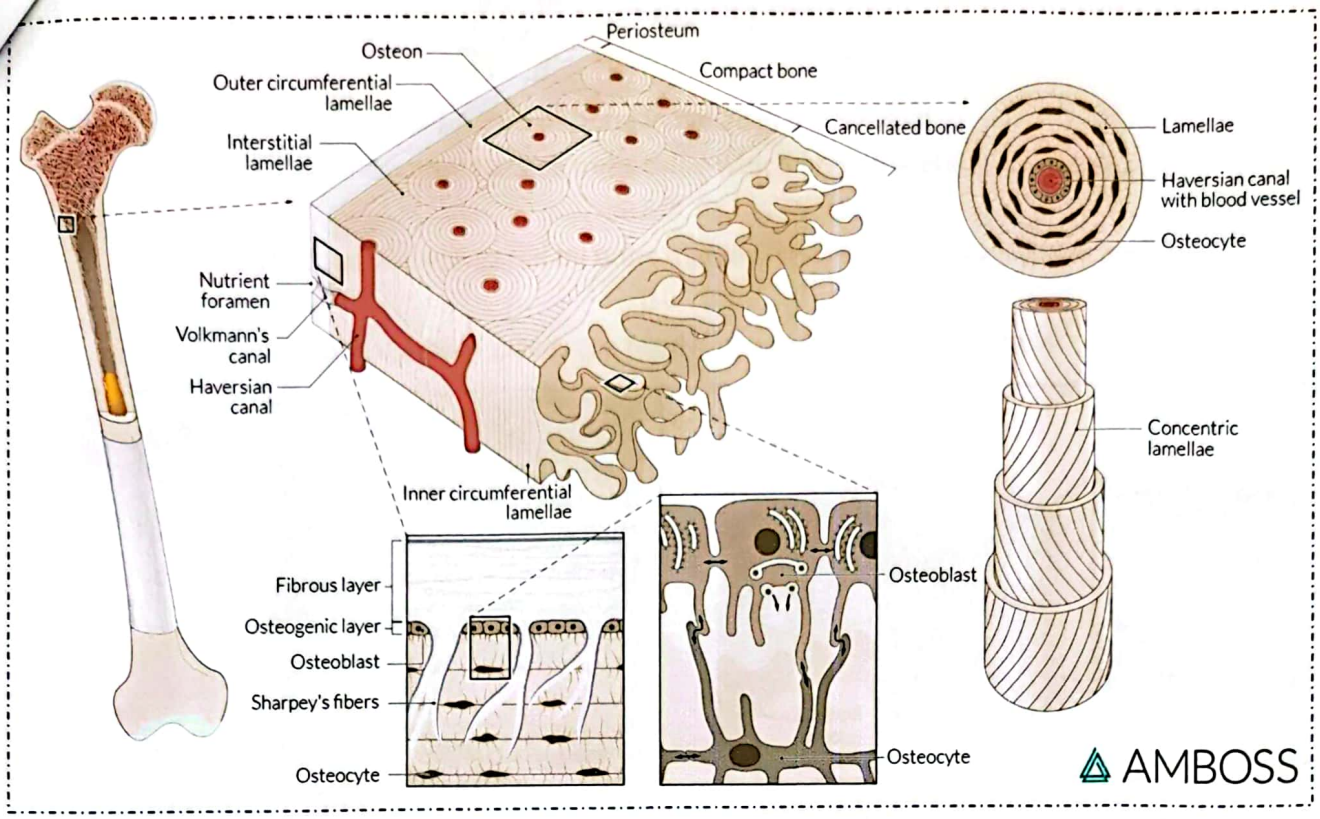


VOLKMAN'S VS HAVERSIAN CANALS





PERFORATING FIBERS OF SHARPY



II Cancellous Bone

It looks like sponge with Many holes → so called Spongy bone

SITE

1- **Epiphysis of long bones.**
2- **Central part of flat bones of the skull.**
3- **Bodies of vertebrae & sternum.**
4- **Young embryonic bone.**

STRUCTURE

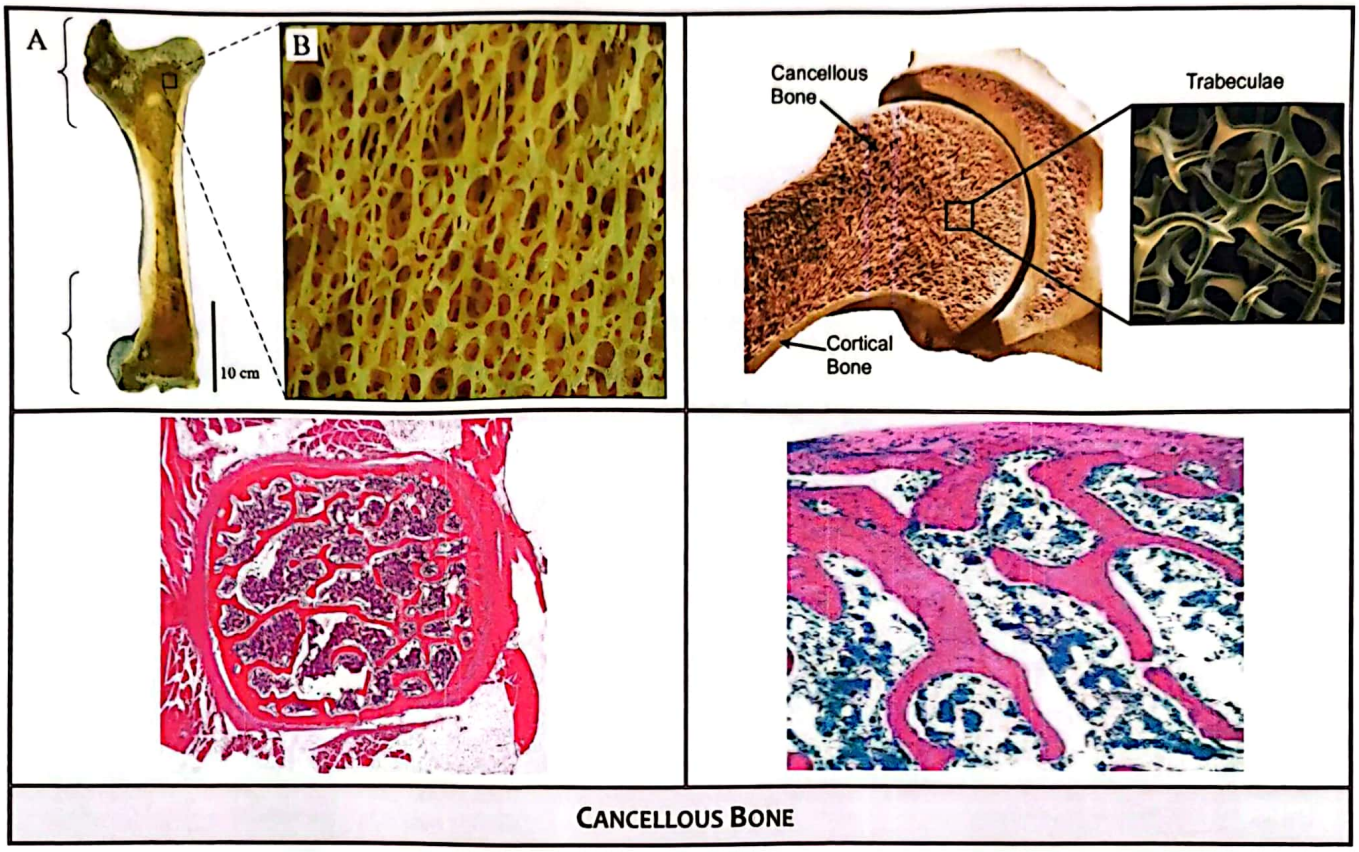
It is formed of bone lamellae in the form of
irregularly arranged bars or trabeculae which branch and anastomose.

⇩⇩

The bone trabecular are **separated by bone marrow spaces** of irregular shape and size.

⇩⇩

The bone marrow spaces are filled with active red bone marrow.



CANCELLOUS BONE

OSSIFICATION

Definition of OSSIFICATION

- It is the process of **bone formation**, which leads to its growth.

Methods of bone ossification:

① Intra-membranous ossification	② Intra-cartilagenous ossification
Occurs in **mesenchymal membranes**	Occurs in **cartilage model**

1 Intra-Membranous Ossification

Definition

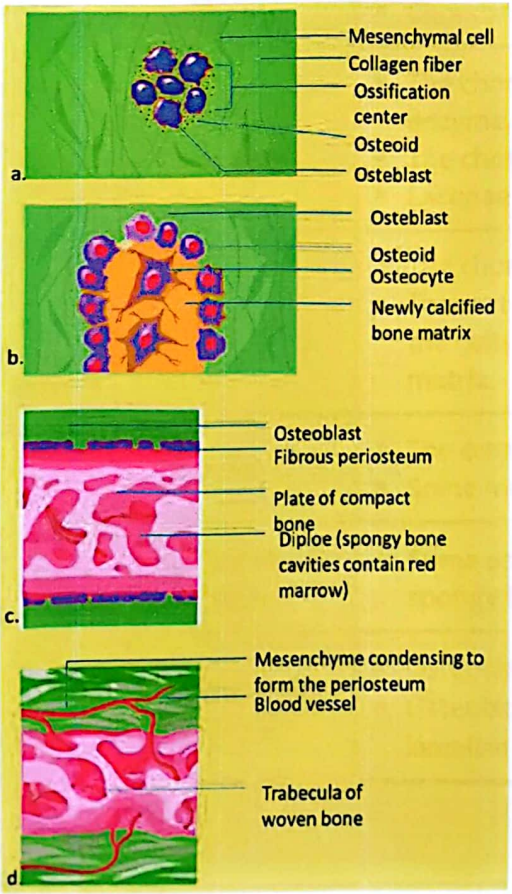
- It is the method by which a **membrane of mesenchymal connective** tissue is transformed into **spongy bone.**

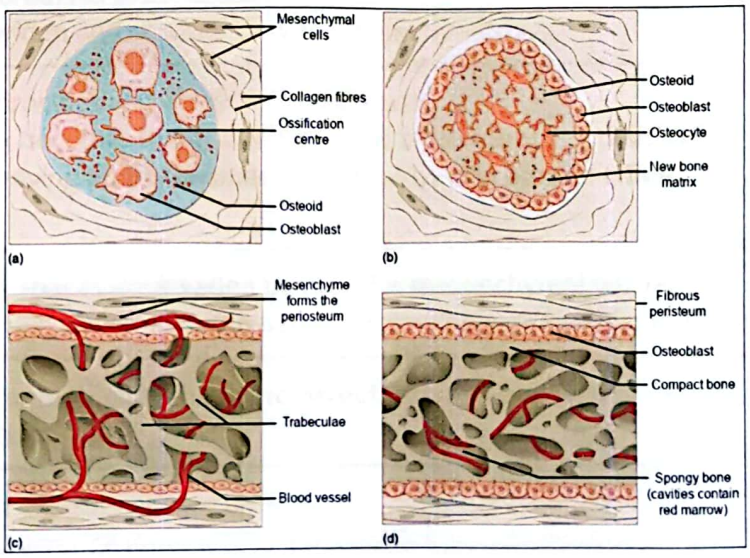
Site

- **Flat bones** of the skull, face and clavicle.

Stages

1- **UMCs** condense forming a **primary ossification center.**
2- **UMCs** change into **osteoblasts,** which start bone formation.
3- Osteoblasts synthesize **bone matrix.**
4- UMCs in the spaces between trabeculae give rise to **bone marrow.**
5- Mesenchymal tissue at the surface gives rise to the **periosteum.**





II Intra-Cartilagenous Ossification

"Growing End of Long Bone"

Definition

- It is a type of ossification by which **cartilaginous model** is replaced by **bone.**

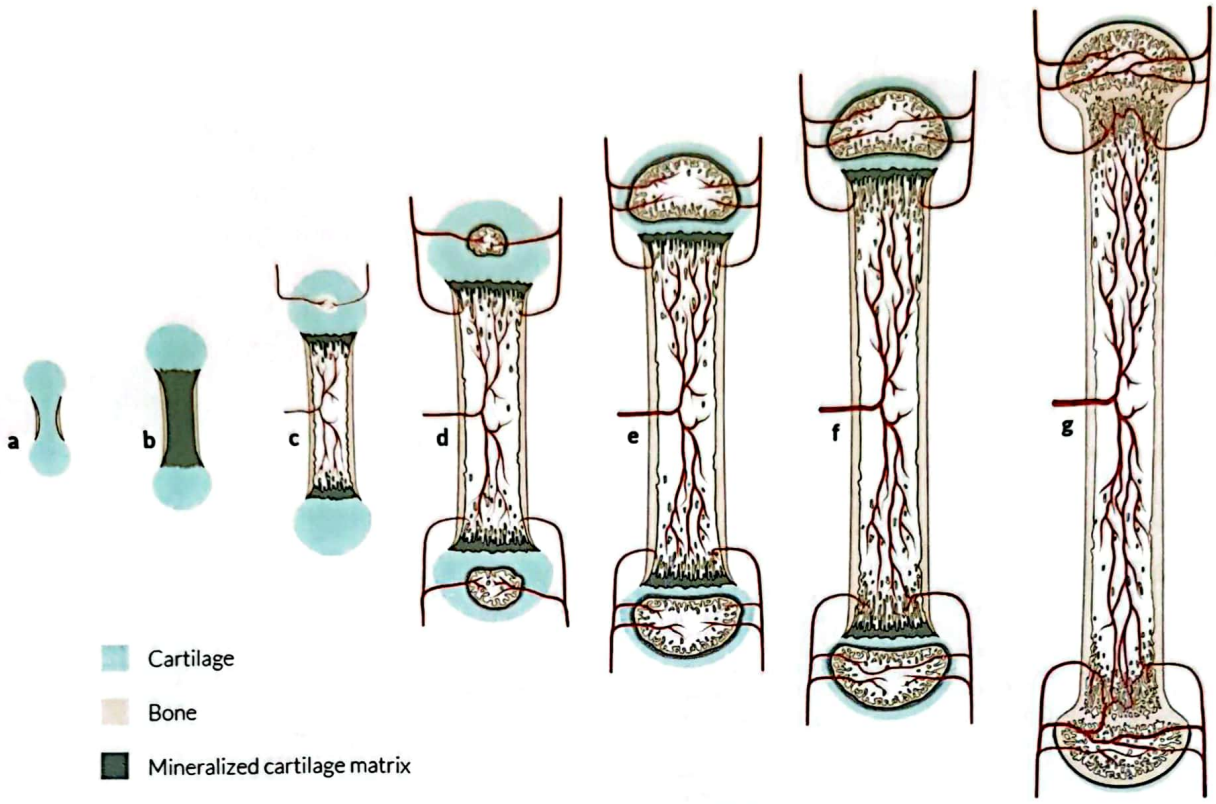
Site

Epiphyseal plates of the cartilage.

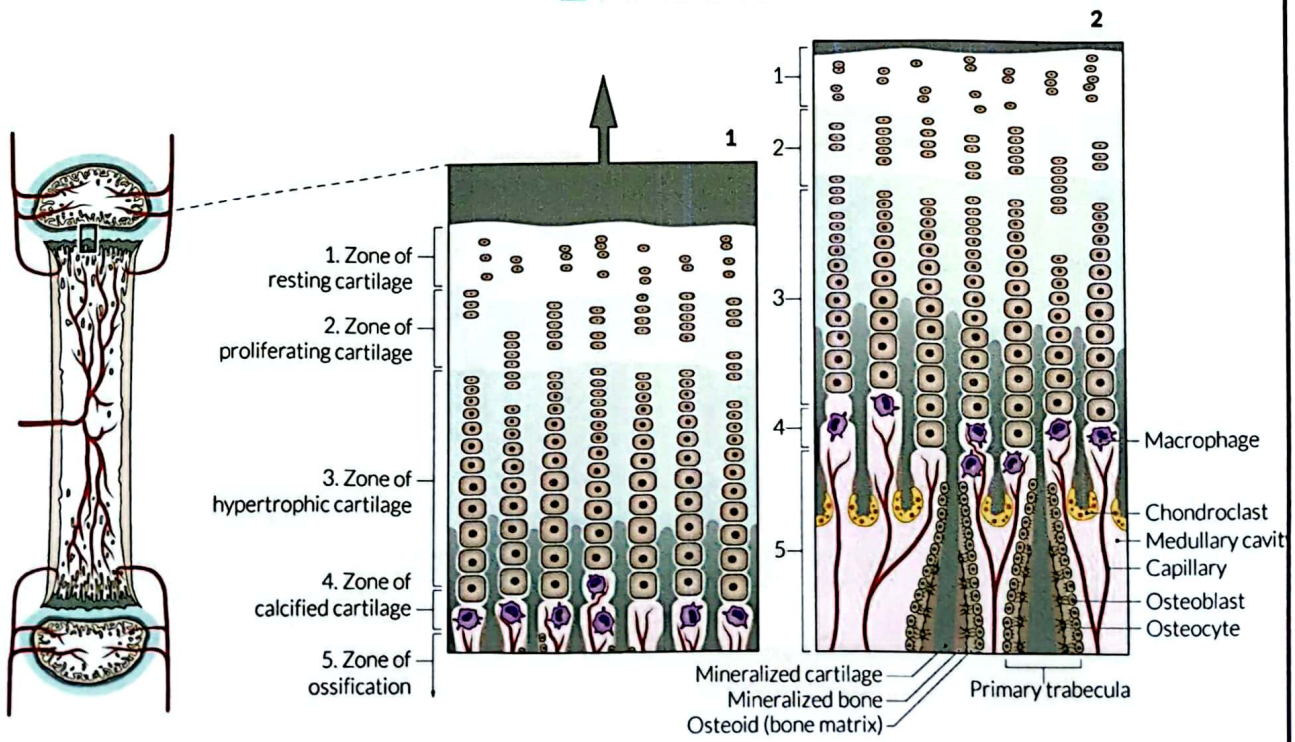
Stages

Examination of longitudinal section in the growing end of long bone demonstrates the following stages:

	Stage of..	Description
①	Resting cartilage	▪ **Chondrocytes** embedded in their matrix.
②	Proliferation	▪ **Chondrocytes divide** and give large number of flat chondrocytes.
③	Maturation & hypertrophy	▪ The chondrocytes accumulate **glycogen** and alk**aline phosphatase enzyme.** ▪ **The chondrocytes grow in size.** ▪ **Lacunae widen** and separated by thin bars of matrix.
④	Calcification	▪ The chondrocytes secrete **Alk. Phosphatase.** ▪ The matrix becomes **impermeable** → cut off nutrients → **death of the cells** leaving **empty lacunae** separated by **thin bars calcified matrix.**
⑤	Invasion	▪ The empty spaces are invaded by **vascular mesenchymal tissue.** ▪ **Some monocytes** change into **osteoclasts** → hole → vascular bud.
⑥	Spongy bone formation	▪ **Some osteogenic cells** change to **osteoblasts** → form trabeculae of **spongy bone.**
⑦	Remodeling & compact bone formation	▪ Osteoclast destruct bars of bone. ▪ Osteoblast arrange around blood vessels & form concentric lamellae → **Haversian system**



AMBOSS



OSSIFICATION OF LONG BONES & ZONES OF EPIPHYSEAL PLATE

2024

HISTOLOGY

level 1 - MSK

lecture 3

DR: A.G

The Bone

Importance of the bone :

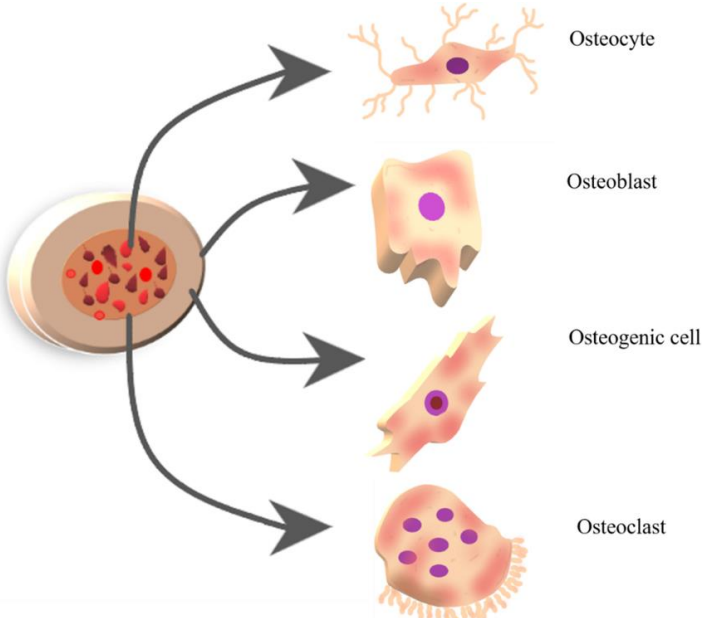
- Bone is a highly specialized variety of C.T
  1) It forms the skeleton.
  2) Muscles attachment.
  3) Protection of soft organs as brain.

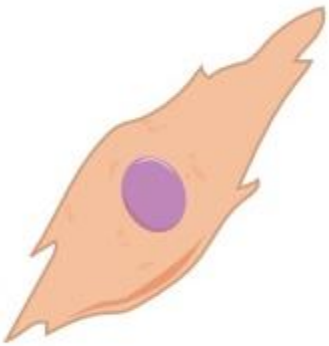
CONSTITUENTS OF BONE

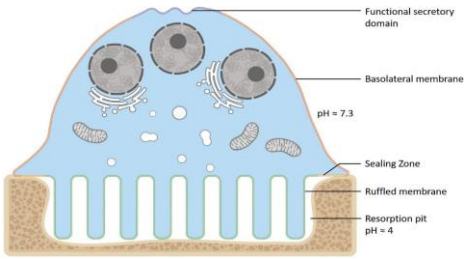
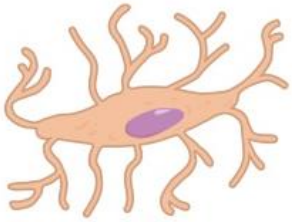
1) **Bone cells.**
2) **Bone matrix.**
3) **Periosteum.**
4) **Endosteum.**

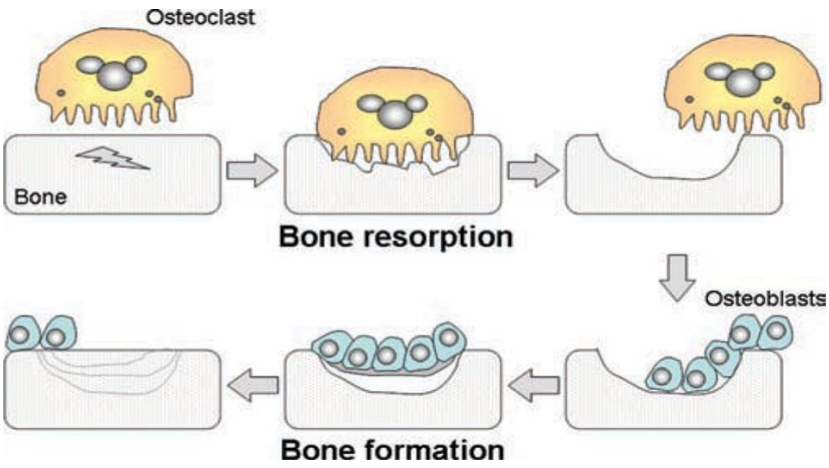
BONE CELLS

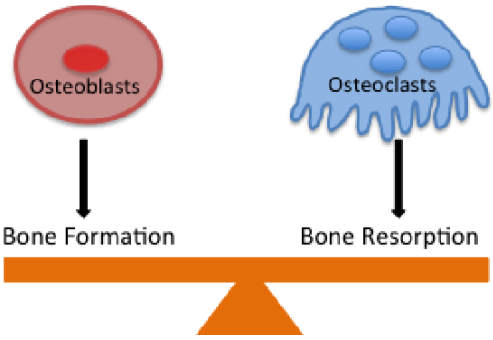
There are 4 Types of bone cells:

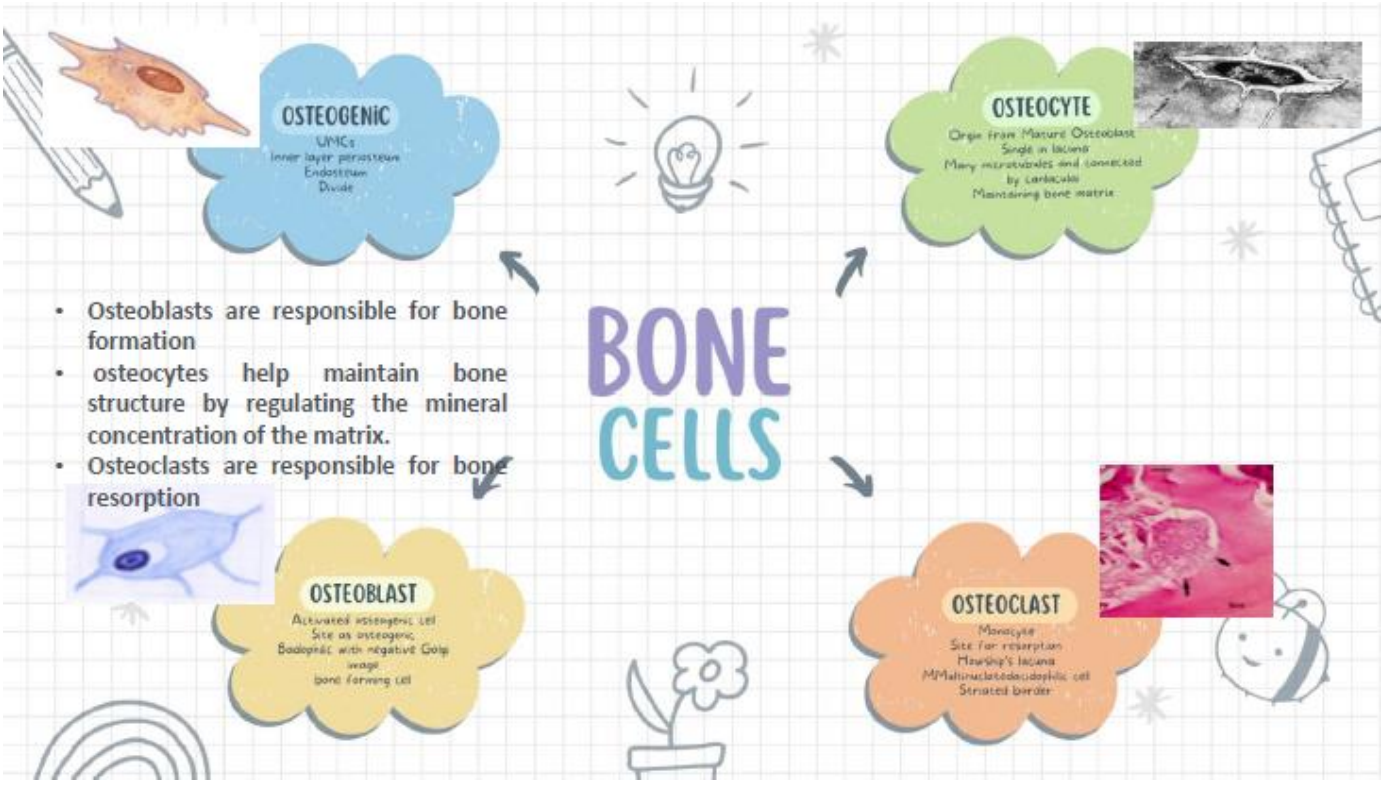


	OSTEOGENIC CELLS "osteoprogenitor cells"	OSTEOBLASTS
Origin	Undifferentiated mesenchymal cells (UMCs)	Activated osteogenic cells.
Sites	1) Inner osteogenic layer of periosteum. 2) Endosteum. 3) Bone marrow cavities	1) Activated inner osteogenic layer of periosteum. 2) Endosteum. 3) Walls of bone marrow spaces.
LM	▸ **Shape**: flat cells ▸ **Nuclei**: central flat ▸ **Cytoplasm**: pale basophilic.	▸ **Shape:** oval branched cells with few processes ▸ **Nuclei:** oval, eccentric, open face ▸ **Cytoplasm:** Deep basophilic
EM	Rich in ribosomes & rER.	Ribosomes, rER, well developed Golgi apparatus & mitochondria.
Function	▸ They are capable to divide & **give osteoblasts** during : 1- Growth of bone. 2- Healing of fracture bone.	1) **Bone formation** (matrix secretion). 2) **Bone calcification**: ↳ Alk phosphatase enz → facilitates deposition of calcium. ↳ Pyrophosphatase enz → inhibit pyrophosphate. 3) **Matrix vesicles**: buds from cell membrane, store Ca. 4) **Change into osteocytes**.
FIG.		

	OSTEOCYTES	OSTEOCLASTS
Origin	They are mature osteoblasts.	They arise from blood cells "monocytes"
Sites	----	▸ **Where resorption takes place:** 1- Bone marrow spaces. 2- Medullary cavities. 3- Endosteum. Each cell lies in a shallow cavity called "**Howships Lacuna**".
LM	▸ **Shape:** oval, branched cells. ▸ **Nuclei:** oval, central nuclei. ▸ **Cytoplasm:** slightly basophilic and rich in alkaline phosphatase. ▸ Osteocytes can't divide, so present singly in each lacuna.	▸ **Shape & Size:** ↳ large irregular "20-30 um". ▸ **Nuclei:** Multinucleated "4-50" ▸ **Cytoplasm:** foamy acidophilic. ▸ The cells have striated or brush border facing the bone surface
EM	▸ rER, ribosomes, Golgi apparatus, & many cytoplasmic microtubules. ▸ The cells are present inside lacunae between bone lamellae. ▸ They are connected with one another by processes passing through bone canaliculi connect adjacent lacunae together. ▸ These cell processes intercommunicate with one another by gap junctions. ↳ The gap junctions between the processes allow the electrolytes to pass freely from one cell to the other.	▸ The osteoclast shows the following 4-zones: 1) Ruffled or striated zone. 2) Clear Zone. 3) Vesicular Zone contains lysosomes. 4) Basal Zone. 
Function	1) **Formation of bone matrix & vesicles** rich in enzymes to preserve the integrity of the bone matrix & maintaining its inorganic components. 2) Related to **mobilization of Ca+** from the bone to the blood in times of need.	1) **Bone resorption** during ossification → remodeling of bone 2) **Remove bone debris** during ossification & after healing of bone fracture.
FIG.		

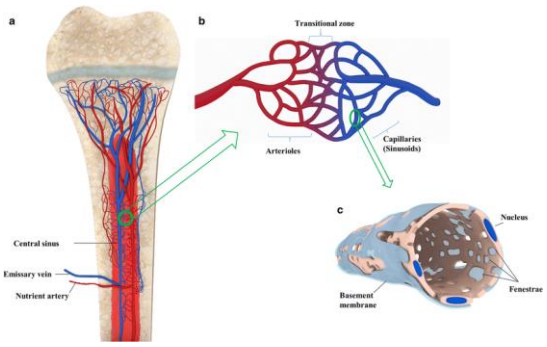

Osteoclast
Bone
Bone resorption
Osteoblasts
Bone formation


Osteoblasts
Osteoclasts
Bone Formation
Bone Resorption


OSTEOGENIC
OSTEOCYTE
BONE CELLS
OSTEOBLAST
OSTEOCLAST
• Osteoblasts are responsible for bone formation
• osteocytes help maintain bone structure by regulating the mineral concentration of the matrix.
• Osteoclasts are responsible for bone resorption

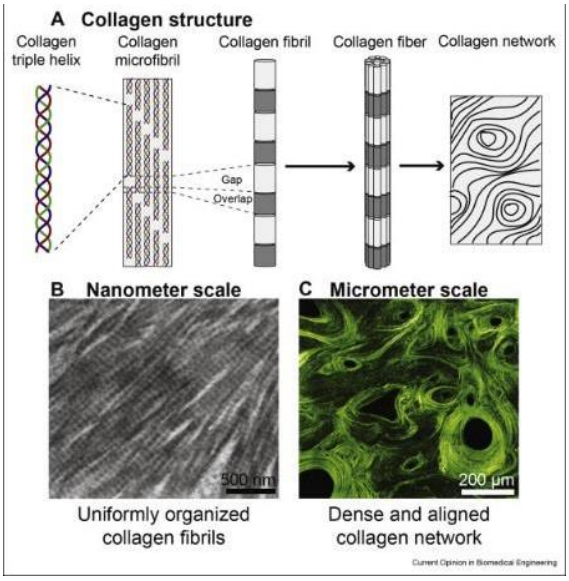
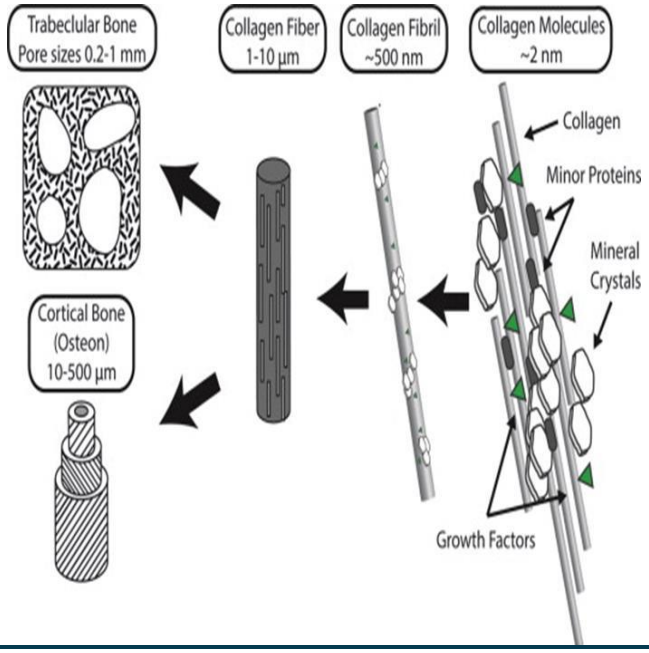
BONE MATRIX

General characters:



- It is hard or solid in consistency.
- It is rich in blood supply.

Structure:

Organic components	Inorganic components
50%	50%
Bone collagen Type I about 90%	Insoluble crystals called = " Hydroxy apitate crystals"
Sulphated glycosaminoglycans.	It is formed mainly of calcium & phosphorus salts
• Glycoprotein = Osteonectin • Protein = Osteocalcin	---
	

PERIOSTEUM

General characters:

- It is a vascular C.T. membrane covering the bone from outside.
- **It is formed of 2 layers:**

	Outer fibrous layer	Inner osteogenic layer
Formed of	Rich in collagenous fibers, blood vessels & fibroblasts	Formed of osteogenic spindle-shaped cells.
Function	1) Provides attachment for muscles, ligaments & tendons. 2) Provide bone with blood supply & Nourishment	These cells when stimulated during growth or healing of fracture can change → osteoblasts

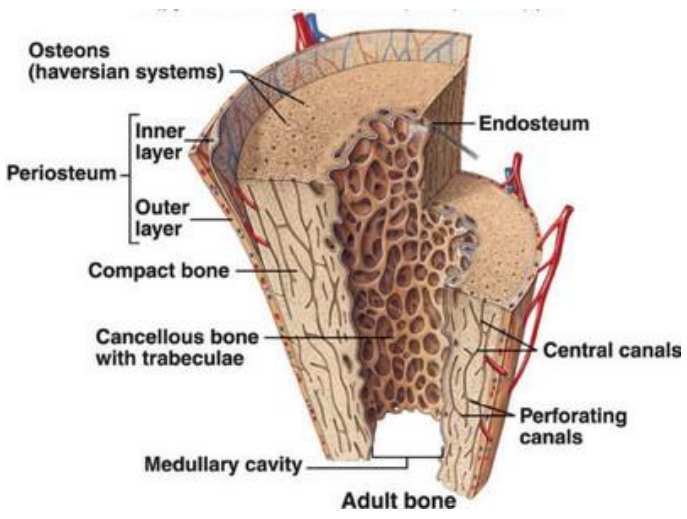
ENDOSTEUM

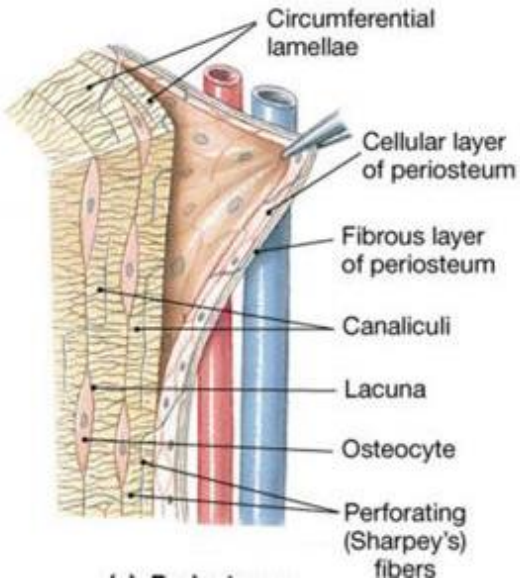
General characters:

- It is a vascular C.T. membrane
- Lines the inner surface of the bone, bone marrow cavities & Haversian canals.

Function of endosteum:

1) It supplies bone with blood supply & nourishment.
2) Its osteogenic cells & osteoblasts & osteoclasts are concerned with:
   - Bone formation and resorption during growth & healing after fracture.





Level-1 Semester-2

Histology - MSS

BERLIN

SCAN ME

Revision

Histo MSS Written Answers

DR M. YUSUF

Answers of Histo MSS Written Questions

Lecture 1 (Skeletal Muscle)

1. Definition:-

a) Epimysium (Dense C.T surrounds the Entire muscle)
b) Perimysium (Dense C.T divides the muscle into bundles "Fascicles")
c) Endomysium (Loose C.T surrounds the Individual muscle fiber)
d) Myofibrils (Contractile elements which are longitudinally arranged in the sarcoplasm of the skeletal muscle fiber)
e) Sarcomere (Functional contractile unit of skeletal myofibrils that lies between 2 Z-lines)
f) T-tubule (Narrow transverse tubular invagination that cell membrane sends into sarcoplasm fibers to encircle sarcomeres)
g) Terminal cisterna (Two wide tubules derived from sarcoplasmic reticulum present on both sides of t-tubule forming triad)

2. Enumerate:-

a) Involuntary skeletal muscles:-

1) Upper third of esophagus
2) Pharynx
3) Cremastric muscle

b) Sites of skeletal muscle:-

1) All skeletal muscles are attached to skeleton
2) Eye
3) Tongue
4) Pharynx
5) Larynx

c) Thin filaments in skeletal muscle:-

1) Actin
2) Troponin
3) Tropomyosin

d) Components of skeletal muscle triad:-

1) One T-tubule
2) Two terminal cisterna on both sides

3. **Compare:** Thin & Thick Filaments ذاكر الجدول كامل من النظري

4. **Discuss:-**

a) L/M of Skeletal Muscle fibers (L/S & T/S):-

L/S	★ Shape: Single elongated cell ★ Nuclei: Multiple, Peripheral, Flattened ★ Striations: Regular transverse ★ Sarcoplasm: Acidophilic with Myoglobin & Glycogen
T/S	★ Shape: Polyhedral ★ Nuclei: May be seen in some fibers ★ Sarcoplasm: May show dark Cohnheim's areas due to grouping of myofibrils

b) Structure of myofibril:-

★ Alternating light and dark bands
★ Dark band (A-band): Contain actin & myosin – Divided by H-zone
★ Light band (I-band): Contain actin only – Divided by Z-line

c) Role of skeletal muscle triad in contraction:-

★ When nerve impulses are transmitted to Sarcoplasm, It is transmitted to sarcoplasmic reticulum via T.T
★ SR will pump Ca ions into the myofibrils
★ Energy rich-ATP of muscle is converted into ADP with release of energy
★ This energy allows actin to interact with myosin & cause gliding of thin filaments over thick filaments
★ Thin filaments slide towards middle of sarcomere, pulling 2 Z-lines behind them
★ This allows shortening of sarcomere & lead to muscle contraction and loss of H-zone

Lecture 2 (Cardiac & Smooth Muscle)

1. Definitions:-

a) **Intercalated disc** (*A site where the cell membranes of two adjacent muscle cells interdigitate and join together So, it prevents cytoplasmic continuity between different segments*)

2. Enumerate:-

a) **Contents of cardiac muscle sarcoplasm:-**

1) Glycogen granules
2) Mitochondria
3) Golgi saccules
4) Lipid droplets
5) Lipochrome pigment

b) **Types of Junctions in Intercalated discs:-**

1) Fascia adherence (Intercellular adhesion)
2) Desmosome (Prevent separation during contraction)
3) Gap junction (Free & Rapid transmission of impulse)

c) **Functions of smooth muscle:-**

1) Maintain partial tonic contractions (Tonus) for long periods to regulate lumen size
2) Produce Rhythmic contractions or Peristaltic movements e.g GIT
3) In blood vessels can produce collagen type III & elastic fibers

3. Compare:-

a) **Skeletal muscle & Smooth muscle** ذاكر الجدول كامل من النظري

b) **Skeletal muscle & Cardiac muscle** ذاكر الجدول كامل من النظري

4. Discuss:-

a) **L/M of Cardiac muscle fiber:-**

★ Small caliber – variable length – Extensive branching & anastomosing
★ Nuclei: Large, Central, Oval, Mono or Binucleated
★ Sarcoplasm: Granular, Acidophilic, Contain Glycogen, Mitochondria, Lipochrome

b) E/M of Cardiac muscle T-tubules & Sarcoplasmic reticulum:-

★ Cardiac muscle fibers have only Dyads (No Triads)
★ One T-tubule: Present at Z-line
★ One Terminal cisterna: Small, Incomplete

c) L/M of Smooth muscle fibers:-

★ Shape: Spindle (Fusiform)
★ Nuclei: Single, Central, Oval or Rod-shaped
★ Cytoplasm: Acidophilic, Non-striated

d) E/M of Smooth muscle fibers:-

★ Organelles: Mitochondria, Glycogen, Ribosomes, RER, Golgi
★ No striations
★ Intermediate filaments (Desmosomes & Vimentin)
★ Vesicular caveolae (Fine invaginations from sarcolemma)
★ Less developed sarcoplasmic reticulum
★ Numerous gap junctions

Lecture 3 (Bone-1)

1. Definition:-

a) Periosteum (Vascular C.T membrane covering the bone from outside)
b) Endosteum (Vascular C.T membrane that lines the inner surface of BM cavities 7 Haversian canals)

2. Enumerate:-

a) Types of Bone cells:-

1) Osteogenic cells
2) Osteoblasts
3) Osteocytes
4) Osteoclasts

b) Functions of Osteoblasts:-

1) Bone formation (matrix secretion)
2) Bone calcification (Alk phosphatase enzyme & Pyrophosphatase enzyme)
3) Matrix vesicles: Buds from cell membrane, store Ca.
4) Change into Osteocytes

c) Zones found in Osteoclasts:-

1) Ruffled or striated zone
2) Clear Zone
3) Vesicular Zone contains lysosomes
4) Basal Zone

d) Organic components of Bone matrix:-

1) Collagen type 1
2) Sulfated GAGs
3) Osteonectin (Glycoprotein)
4) Osteocalcin (Protein)

e) Functions of Periosteum:-

1) Outer fibrous layer: Provide attachment for muscles – Provide bone with blood vessels and nutrition
2) Inner osteogenic layer: Contain Osteogenic cells when stimulated during growth or fracture healing they change to Osteoblasts

3. Compare: Osteoblast & Osteoclast (L/M – E/M – Functions)

	Osteoblast	Osteoclast
L/M	★ Oval branched with few processes ★ Oval eccentric open face nuclei ★ Deep basophilic cytoplasm ★ Negative Golgi image	★ Large irregular cell "20-30 um" ★ Multinucleated "4-50" nuclei ★ Cytoplasm is Foamy acidophilic ★ Have striated or brush border facing bone
E/M	Mitochondria – Ribosomes – RER – Well-developed Golgi	Osteoclast shows 4 zones (Ruffled or Striated zone – Clear Zone – Vesicular Zone – Basal Zone)
Function	★ Bone formation (matrix secretion) ★ Bone calcification (Alk phosphatase & Pyrophosphatase enzymes) ★ Matrix vesicles: Buds from cell membrane, Store Ca. ★ Change into Osteocytes	★ Bone resorption during ossification causing remodeling of bone ★ They remove bone debris during ossification and after healing of bone fracture

4. Discuss:-

a) Osteogenic cells (L/M – E/M):-

L/M	★ Flat cell ★ Flat central nuclei ★ Pale basophilic cytoplasm
E/M	Rich in Ribosomes & RER

b) Osteoblasts (L/M – E/M):-

L/M	★ Oval branched with few processes ★ Oval eccentric open face nuclei ★ Deep basophilic cytoplasm ★ Negative Golgi image
E/M	Mitochondria – Ribosomes – RER – Well-developed Golgi

c) Osteocytes (L/M – E/M):-

L/M	★ Oval branched cell singly in lacuna ★ Oval, central nuclei ★ Cytoplasm is slightly basophilic and rich in alkaline phosphatase
E/M	★ RER, Ribosomes, Golgi apparatus and many cytoplasmic microtubules ★ Cells are present inside lacunae between bone lamellae ★ They are connected by processes passing through bone canaliculi ★ These cell processes intercommunicate with one another by gap junctions ★ The gap junctions allow the electrolytes to pass from one cell to the other

d) Osteoclasts (L/M – E/M):-

L/M	★ Large irregular cell "20-30 um" ★ Multinucleated "4-50" nuclei ★ Cytoplasm is Foamy acidophilic ★ Have striated or brush border facing bone
E/M	Osteoclast shows 4 zones (Ruffled or Striated zone – Clear Zone – Vesicular Zone – Basal Zone)

e) Structure of periosteum:-

★ Outer fibrous layer: Blood vessels – Fibroblasts – Collagen type 1
★ Inner osteogenic layer: Osteogenic spindle-shaped cells

Lecture 4 (Bone-2)

1. Definition:-

a) **Osteon** (*Structural unit of compact bone formed of Haversian canal, 4-20 concentric bone lamellae & Osteocytes inside lacunae*)
b) **Volkmann canal** (*Transverse or oblique canals that connect Haversian canals together & with periosteal or endosteal blood vessels*)
c) **Perforating fibers of Sharpy** (*Calcified collagenous fibers fixing periosteum to Bone*)
d) **Intra-membranous ossification** (*The method by which a membrane of mesenchymal connective tissue is transformed into spongy bone*)

2. Enumerate:-

a) Sites of Compact bone:-

1) Shaft of long bones
2) Outer & inner tables of flat bones of the skull
3) Outer covering of vertebrae
4) Outer covering of ribs

b) Patterns of Compact bone lamellae:-

1) Outer "External" circumferential lamellae: Under periosteum
2) Inner "Internal" circumferential Lamellae: Under endosteum
3) Concentric bone lamellae: Formed of 4-20 cylinders around Haversian canals
4) Interstitial "Inter-Haversian" Lamellae

c) Components of Haversian system:-

1) Haversian canal: Run parallel to long axis of bone
2) Concentric bone lamellae: 4-20 cylinders
3) Osteocytes: Inside lacuna between bone lamellae

d) Sites of Cancellous bone:-

1) Epiphysis of long bones
2) Central part of flat bones of the skull
3) Bodies of vertebrae & sternum
4) Young embryonic bone

e) Stages of Intracartilagenous ossification:-

1) Stage of Resting cartilage
2) Stage of Proliferation
3) Stage of Hypertrophy & Maturation
4) Stage of Calcification
5) Stage of Invasion
6) Stage of Spongy bone formation
7) Stage of Remodeling & Compact bone formation

3. Discuss:-

a) Structure & Function of Volkmann canals:-

Structure	★ Transverse or oblique canals ★ Lined with Osteogenic cells ★ Contain Blood vessels
Function	They connect Haversian canals together & with periosteal or endosteal blood vessels

b) Structure of Cancellous bone:-

★ Formed of bone lamellae in the form of irregularly arranged bars or trabeculae which branch and anastomose
★ The bone trabecular are separated by bone marrow spaces of irregular shape and size
★ The bone marrow spaces are filled with active red bone marrow

c) Stages of Intramembranous ossification:-

★ UMCs condense forming a Primary ossification center
★ UMCs change into osteoblasts, which start bone formation (Matrix secretion)
★ UMCs in the spaces between trabeculae give rise to bone marrow
★ Mesenchymal tissue at the surface gives rise to the periosteum

Lecture 5 (Cartilage)

1. Definition:-

a) **Cell nest** (*Group of cells that are present inside single lacunae and separated by thin partitions of matrix*)
b) **Territorial matrix** (*The Darker staining cartilage matrix immediately surrounds the Lacuna of chondrocytes*)
c) **Interterritorial matrix** (*The cartilage matrix that occupies the majority of space between chondrocytes*)
d) **Achondroplasia** (*Short-limbed dwarfism due to a genetic mutation of gene responsible of converting cartilage to bone particularly in long bones of arms & legs*)

2. Enumerate:-

a) Functions of Cartilage:-

1) Firm matrix: Allows tissue to bear mechanical stresses without distortion
2) Supports soft tissues especially in respiratory system
3) In joints: Shock-absorbing because it is resilient
4) Smooth surface Prevent rubbing of bones against each other
5) Helps connect tendons and ligaments to bones
6) Essential for growth & development of bone in growing children

b) Sites of Hyaline cartilage:-

1) Forms majority of the Fetal skeleton
2) Articular Surface of bones
3) Costal Cartilage in Thoracic cage
4) Respiratory passages: Nose, Trachea, Bronchi
5) Laryngeal cartilages "Thyroid and Cricoid"

c) Functions of Perichondrium:-

1) Attachment of muscles
2) Blood supply & nourishment of cartilage cells
3) New cartilage formation during growth or repair "Chondroblasts"

d) Components of hyaline cartilage matrix:-

1) Tissue fluid (75%)
2) Collagen type 2
3) Proteoglycans (GAGs): Chondroitin sulphate
4) Chondronectin (Glycoprotein)
5) Chondrocalcin (Protein)

e) Sites of Yellow elastic cartilage:-

1) Ear Pinna
2) External auditory meatus
3) Eustachian tube
4) Epiglottis

f) Sites of White fibrocartilage:-

1) Intervertebral disc
2) Symphysis pubis
3) Semilunar cartilage of knee joint (Mensci)
4) Terminal parts of tendons

3. Compare:-

a) Old & Young chondrocytes (Site – Number – L/M):-

	Young Chondrocytes	Old "Mature" Chondrocytes
Site	Under the perichondrium	Deep in the cartilage
Number	Present singly in flat lacunae	Present in lacunae singly OR in groups (2, 4, 8) which are called "Cell nest"
L/M	Flat cells – Oval nuclei – Basophilic cytoplasm	★ Oval or rounded "When single" ★ Triangular or semicircular (When in groups) ★ Rounded and Open face nuclei ★ Granular Basophilic cytoplasm rich in Glycogen, Fat & Alkaline phosphatase enzyme

b) Appositional & Interstitial growth ذاكر الجدول كامل من النظري

c) Territorial & Interterritorial matrix

Territorial matrix	Dark staining cartilage matrix immediately surround Lacuna of chondrocytes
Interterritorial matrix	The matrix that occupies the majority of space between chondrocytes

4. Discuss:-

a) Structure of Perichondrium:-

Outer fibrous layer	Fibrous CT rich in Collagen type 1, Fibroblasts & Blood vessels
Inner chondrogenic layer	Cartilage forming cells (Chondroblast) which can divide and differentiate into Chondrocytes which secrete cartilage matrix

b) Old chondrocytes (L/M – E/M):-

L/M	★ Oval or rounded "When single" ★ Triangular or semicircular (When in groups) ★ Rounded and Open face nuclei ★ Granular Basophilic cytoplasm rich in Glycogen, Fat & Alkaline phosphatase enzyme
E/M	★ They contain: RER, ribosomes, well developed Golgi ★ The surface show short cytoplasm processes

c) Staining of Cartilage matrix:-

1) H & E: Basophilic Due to high content of Chondroitin sulphate
2) Metachromatic stain" Toluidine blue": Purple
3) PAS: Strong +ve

d) Explain why White fibrocartilage is the strongest type of cartilage:-

1) Presence of collagen fibers
2) Has alternating layers of hyaline cartilage matrix & thick layers of dense collagen fibers oriented in the direction of functional stresses

e) Structure of White fibrocartilage:-

★ Formed of parallel bundles of Collagen type I
★ Separated by rows of chondrocytes in lacunae (Single or Pairs)

f) Differences between White fibrocartilage & Hyaline cartilage:-

1) Not covered by Perichondrium: Transitional layer between hyaline cartilage and tendon, but it is surrounded by Dense CT
2) Matrix: Acidophilic because it contains type I collagen fibers arranged in bundles
3) Chondrocytes: Arranged in rows in lacunae (Single or Pairs) between collagen bundles

2024

HISTOLOGY

level 1 - MSK

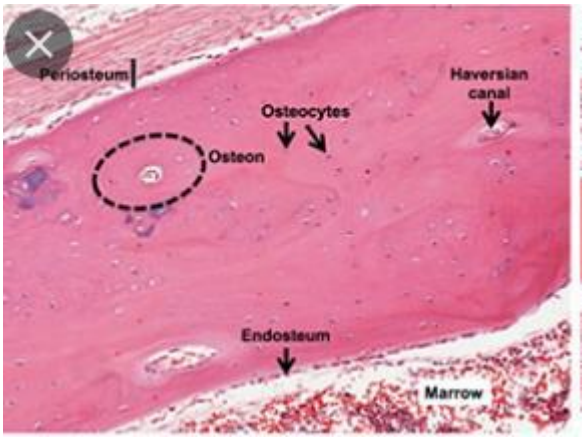
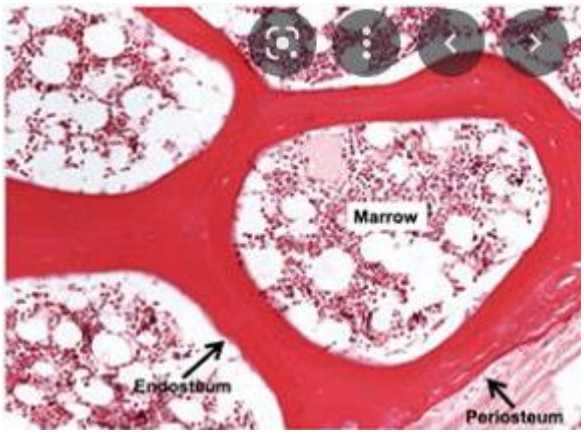
lecture 4

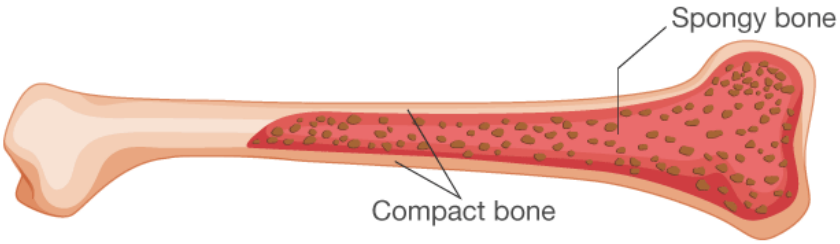
DR: A.G

The Bone II

TYPES OF BONES

There are 2 types of bone:

Compact bone	Cancellous " spongy" bone
	



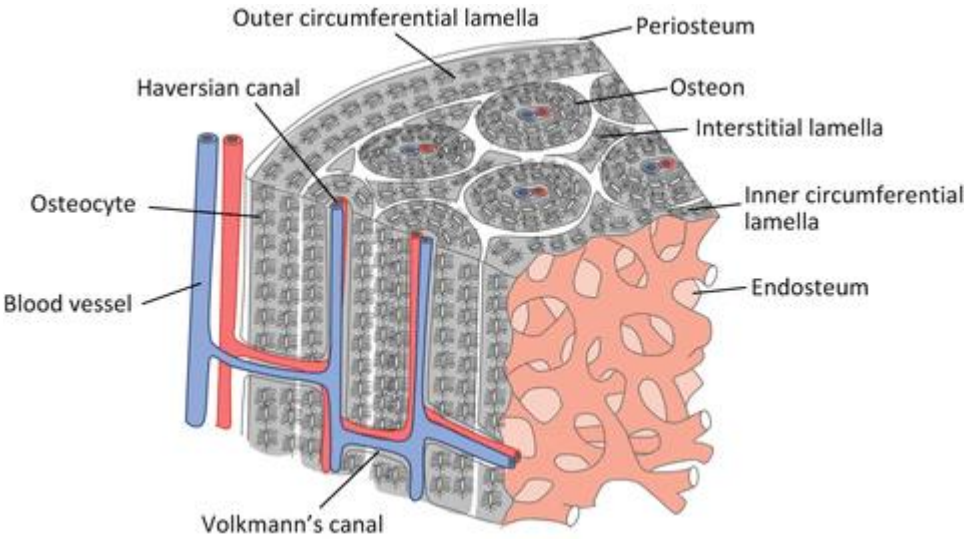
1 COMPACT BONE

Def	**Solid like ivory** with NO apparent holes i.e. compact.
Sites	1) Shaft of long bones. 2) Outer & inner tables of flat bones of the skull. 3) Outer covering of the vertebrae & ribs.
Structure	1. Periosteum. 2. Endosteum. 3. Bone matrix. 4. Bone cells.

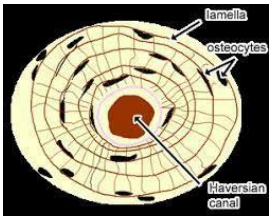
Bone matrix of compact bone

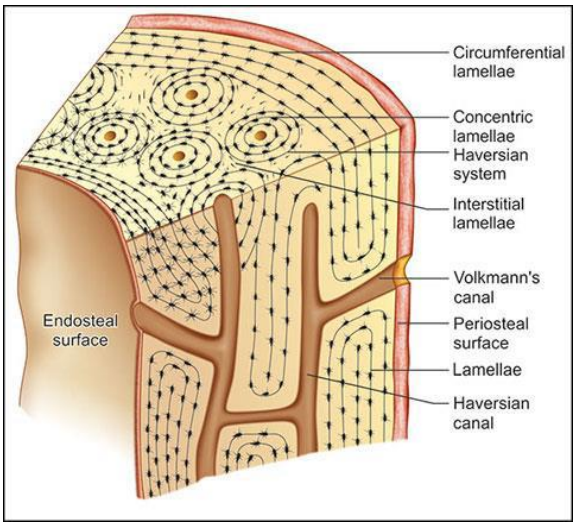
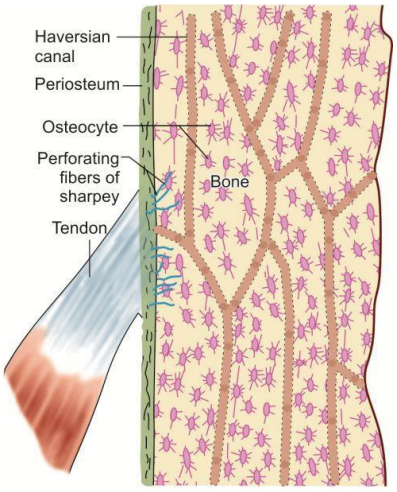
- Matrix is formed of lamellae of calcified osteoid tissue in which osteocytes are embedded.
- **Bone lamellae are deposited in regular pattern as follows:**

1	Outer "external" circumferential lamellae	▸ Present under the periosteum and parallel to it.
2	Inner "Internal" circumferential Lamellae	▸ Present under the endosteum & parallel to the medullary bone cavity, which contains the bone marrow.
3	Concentric bone lamellae	▸ Formed of 4–20 cylinders of concentric bone lamellae arranged around Haversian canal.
4	Interstitial Lamellae "Inter–Haversian"	▸ Formed of calcified osteoid tissue present between Haversian systems. ▸ Osteocytes are irregularly arranged between these lamellae.

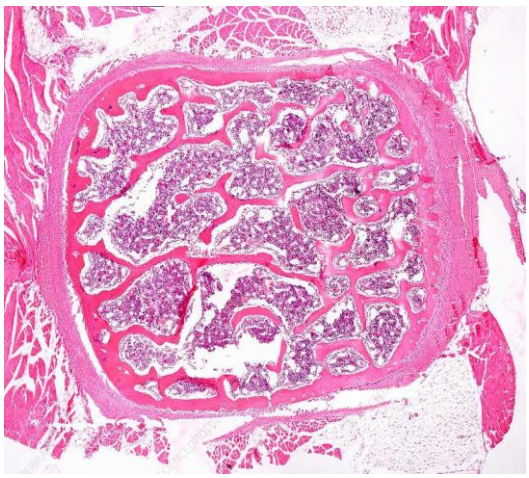


HAVERSIAN SYSTEM = OSTEON	
Def	▸ It is the structural unit of the bone.
formed of	1) **Haversian Canal**: ↳ It runs parallel to the longitudinal axis of the bone 2) **Concentric bone lamellae**: ↳ It is formed of 4–20 cylinders of concentric bone lamellae 3) **Osteocytes**: ↳ They are found inside their lacunae in between the bone lamellae.



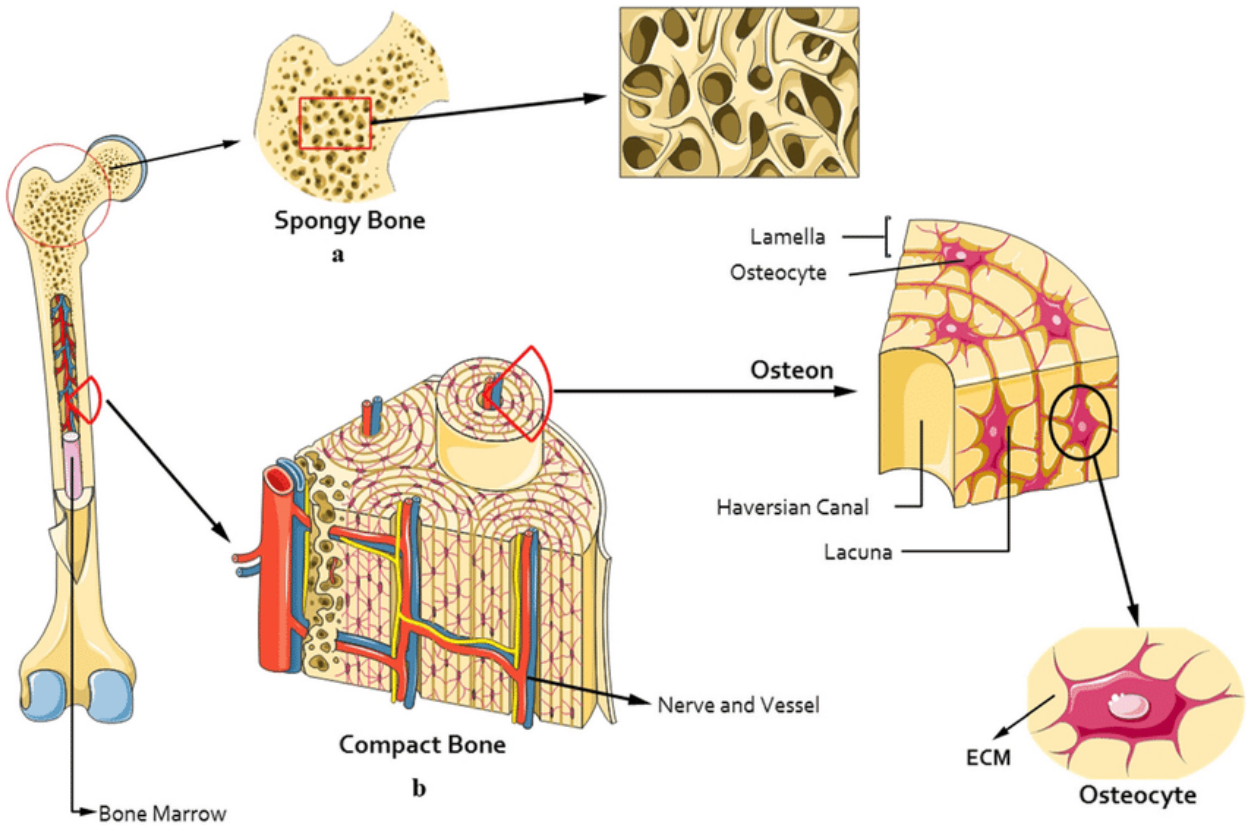
	VOLKMAN'S CANALS	PERFORATING FIBERS OF SHARPY
Def	These are transverse or oblique canals.	These are calcified collagenous fibers
Function	1) They connect Haversian canals together & with periosteal or endosteol blood vessels 2) They are lined with osteogenic cells and contain blood vessels.	Fixing the periosteum to the bone
Pic		

2 CANCELLOUS BONE

Def	It looks like – **sponge** with Many holes, so called spongy bone
Sites	1) Epiphysis of long bones. 2) Central part of flat bones of the skull. 3) Bodies of vertebrae & sternum. 4) Young embryonic bone.
Structure	▸ It is formed of bone lamellae in the form of **irregularly** arranged bars or trabeculae which branch & anastomose. ▸ The bone trabecular are separated by bone marrow spaces of irregular shape & size. ▸ The bone marrow spaces are filled with active red bone marrow. 

Compact Bone VS Spongy Bone

	Compact Bone	Spongy Bone
Def	**Solid like ivory** with no apparent holes i.e. compact.	It looks like – **sponge** with Many holes, so called spongy bone
Sites	1) Shaft of long bones. 2) Outer & inner tables of flat bones of the skull. 3) Outer covering of the vertebrae & ribs.	1) Epiphysis of long bones. 2) Central part of flat bones of the skull. 3) Bodies of vertebrae & sternum. 4) Young embryonic bone.
Structure	1. Periosteum. 2. Endosteum. 3. Bone matrix. 4. Bone cells.	▸ Formed of bone lamellae in the form of **irregularly** arranged bars or trabeculae which branch & anastomose. ▸ The bone trabecular are separated by bone marrow spaces of irregular shape & size. ▸ Bone marrow spaces filled with active red bone marrow.



OSSIFICATION

Definition:

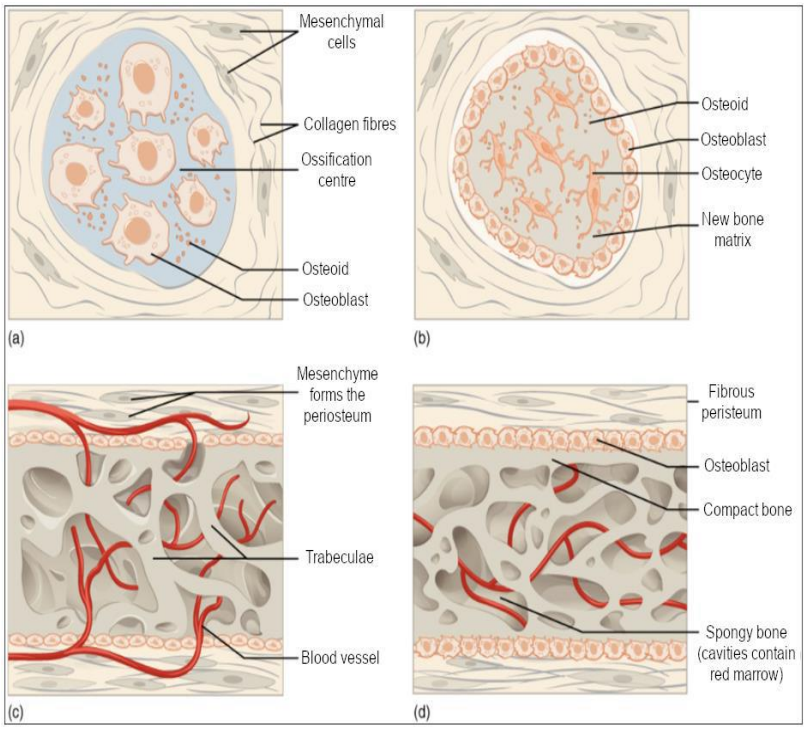
- It is the process of **bone formation**, which leads to its growth.

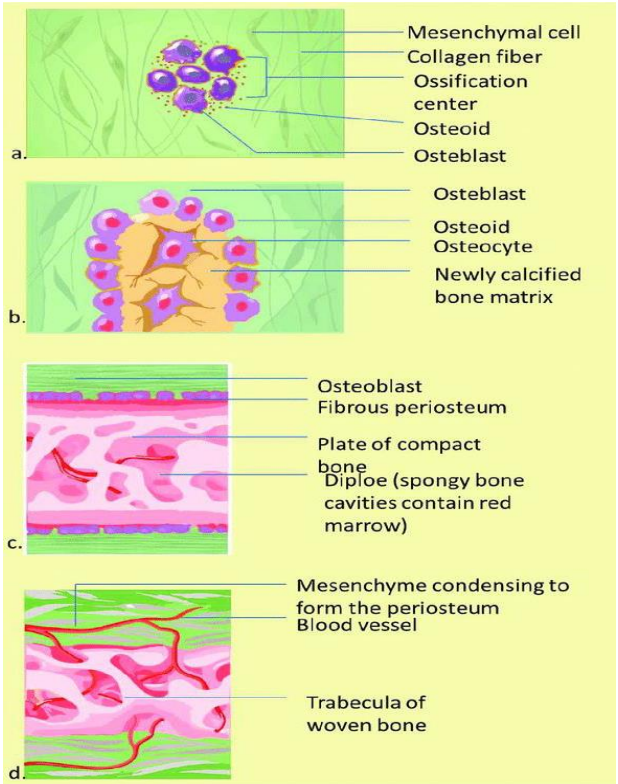
Methods of bone ossification:

1) **Intramembranous ossification**: It occurs in mesenchymal membranes.
2) **Intracartilagenous ossification**: It occurs in cartilage model.

1 Intramembranous ossification

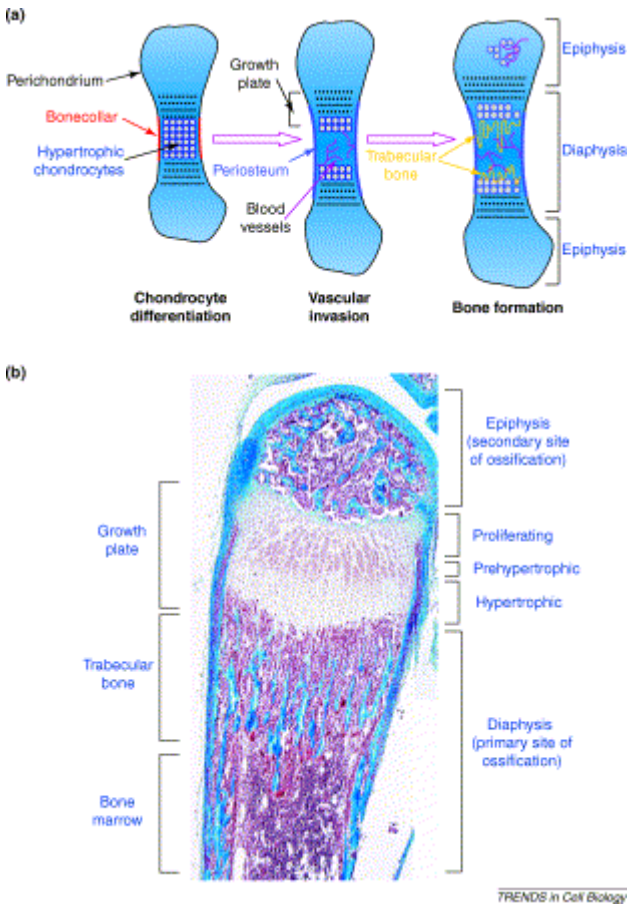
Def	It is the method by which a membrane of mesenchymal connective tissue is transformed into spongy bone " **CT → Bone**"
Sites	Flat bones of the skull, face & clavicle.
Stages	1) UMCs condense forming a primary ossification center. 2) UMCs change into osteoblasts, which start bone formation. 3) Osteoblasts synthesize bone matrix. 4) UMCs in the spaces between trabeculae give rise to bone marrow. 5) Mesenchymal tissue at the surface gives rise to the periosteum

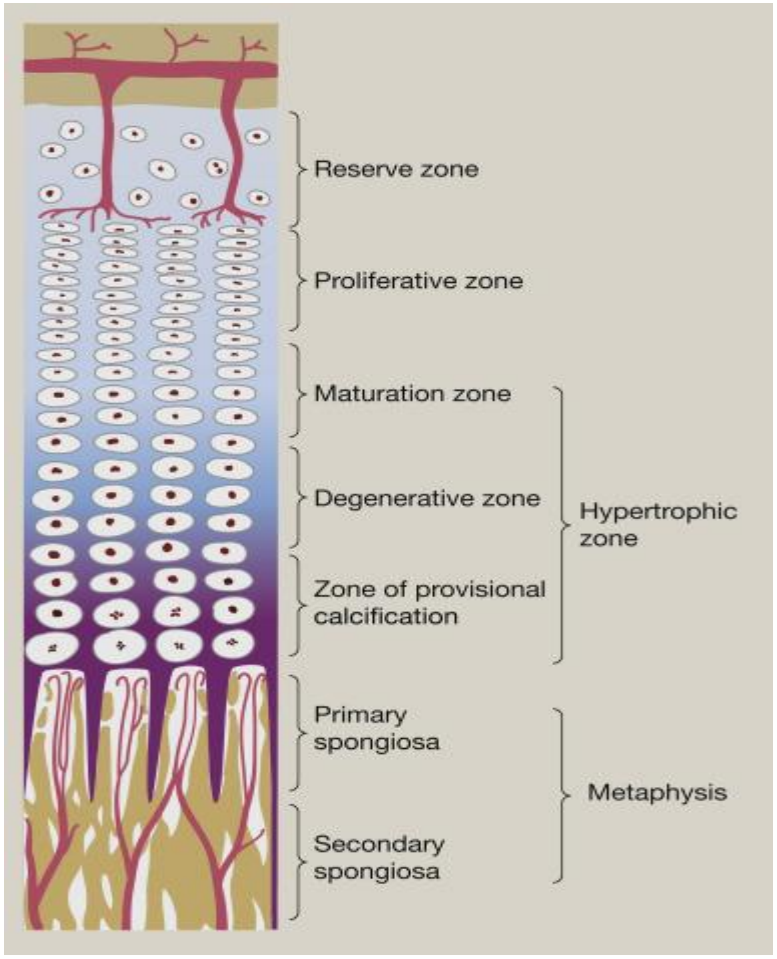


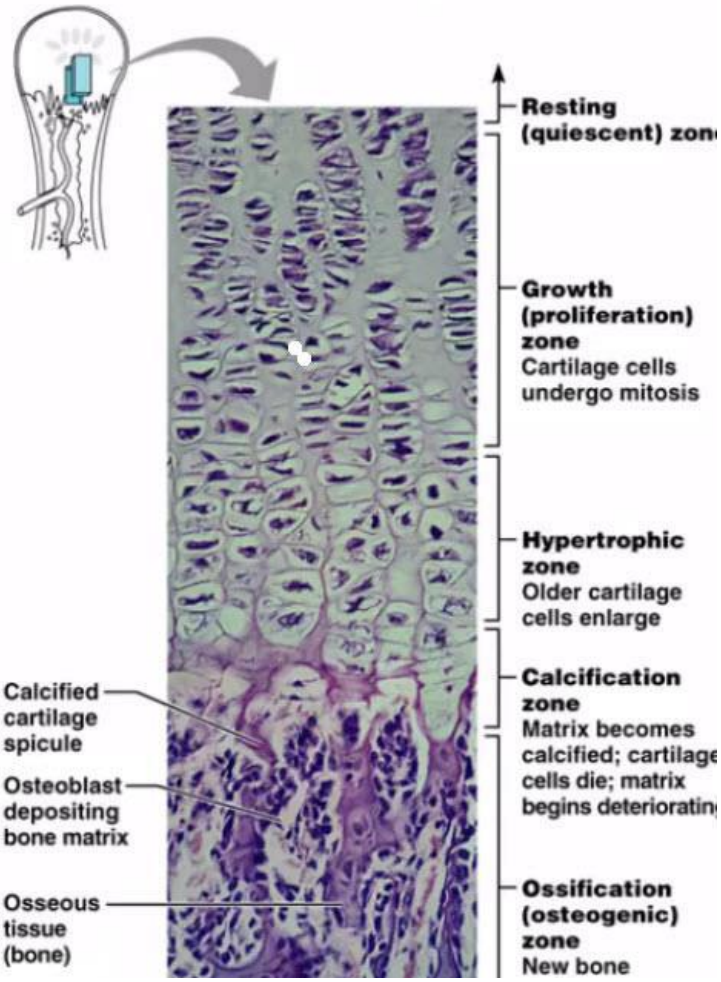


2 Intracartilagenous ossification "Growing end of long bone"

Def	It is a type of ossification by which cartilaginous model is replaced by bone.
Sites	**Epiphyseal plates** of the cartilage
Stages	Examination of longitudinal section in the growing end of long bone demonstrates the following stages: "7" 1) **Stage of resting cartilage**: ↳ Chondrocytes embedded in their matrix. 2) **Stage of proliferation**: ↳ Chondrocytes divide → large number of flat chondrocytes. 3) **Stage of maturation & hypertrophy**: ↳ The chondrocytes grow in size. ↳ Lacunae widen & separated by thin bars of matrix. 4) **Stage of calcification**: ↳ The chondrocytes secrete Alk. Phosphatase. ↳ The matrix becomes impermeable → cut off nutrients → **DEATH** of the cells leaving empty lacunae separated by thin bars calcified matrix. 5) **Stage of Invasion**: ↳ The empty spaces are invaded by vascular mesenchymal tissue. ↳ Some monocytes change into osteoclasts → hole → vascular bud. 6) **Spongy bone formation:** ↳ Some osteogenic cells change to osteoblasts → form trabeculae of spongy bone. 7) **Stage of remodeling and compact bone formation**: ↳ Osteoclast destruct bars of bone. ↳ Osteoblast arrange around blood vessels → form concentric lamellae → haversian system


(a)
Perichondrium
Bonecollar
Hypertrophic chondrocytes
Growth plate
Periosteum
Blood vessels
Trabecular bone
Epiphysis
Diaphysis
Epiphysis
Chondrocyte differentiation
Vascular invasion
Bone formation
(b)
Epiphysis (secondary site of ossification)
Growth plate
Proliferating
Prehypertrophic
Hypertrophic
Trabecular bone
Diaphysis (primary site of ossification)
Bone marrow
TRENDS in Cell Biology

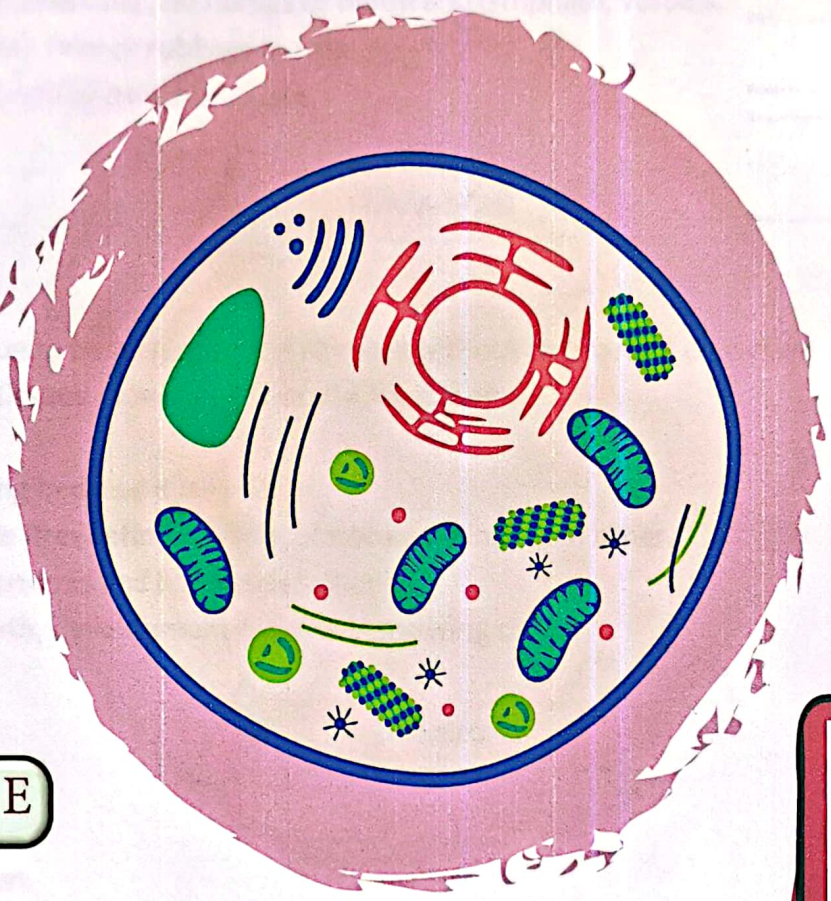

Reserve zone
Proliferative zone
Maturation zone
Degenerative zone
Zone of provisional calcification
Hypertrophic zone
Primary spongiosa
Secondary spongiosa
Metaphysis


Resting (quiescent) zon
Growth (proliferation) zone
Cartilage cells undergo mitosis
Hypertrophic zone
Older cartilage cells enlarge
Calcification zone
Matrix becomes calcified; cartilage
cells die; matrix
begins deteriorating
Ossification (osteogenic) zone
New bone
Calcified cartilage spicule
Osteoblast depositing bone matrix
Osseous tissue (bone)

Level-1 Semester-2

Histology - MSS

BERLIN



BEST PRICE

11 L.E

SCAN ME

Lecture 5

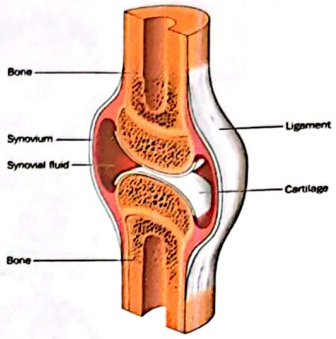
CARTILAGE

DR M. YUSUF

CARTILAGE

INTRODUCTION

- **It is a Specialized type of C. T.:**
  - THE CARTILAGE IS **avascular, no** nerves or blood and lymphatic vessels.
  - THE CARTILAGE HAS **firm** or **rubbery** matrix
  - ITS USUALLY COVERED BY **perichondrium.**

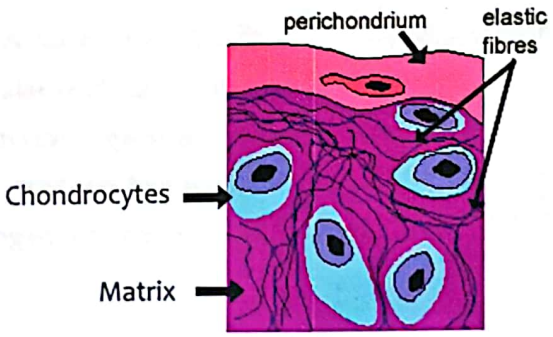


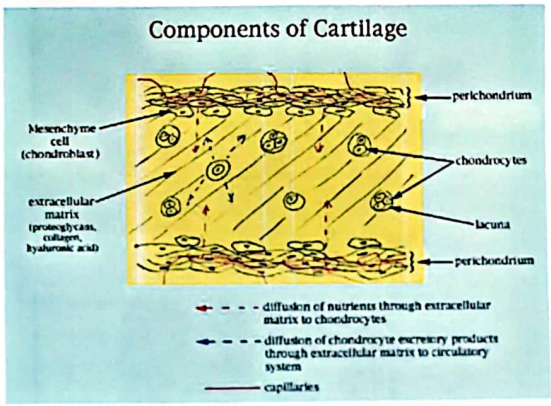
FUNCTIONS

1. **Firm matrix**
   A. Allows the tissue to **bear mechanical stresses** without permanent distortion
   B. **Supports soft tissues** especially in respiratory system.
2. **In joints:**
   A. **Shock-absorbing** because it is **resilient.**
   B. **Smooth surface Preventing rubbing of bones** against each other.
3. **It helps connect tendons** and **ligaments** to bones.
4. **Essential for growth, development** of bone in growing children.

STRUCTURE

- **It is formed of:**
  1. **Perichondrium.**
  2. **Cartilage cells = chondrocytes.**
  3. **Cartilage matrix.**

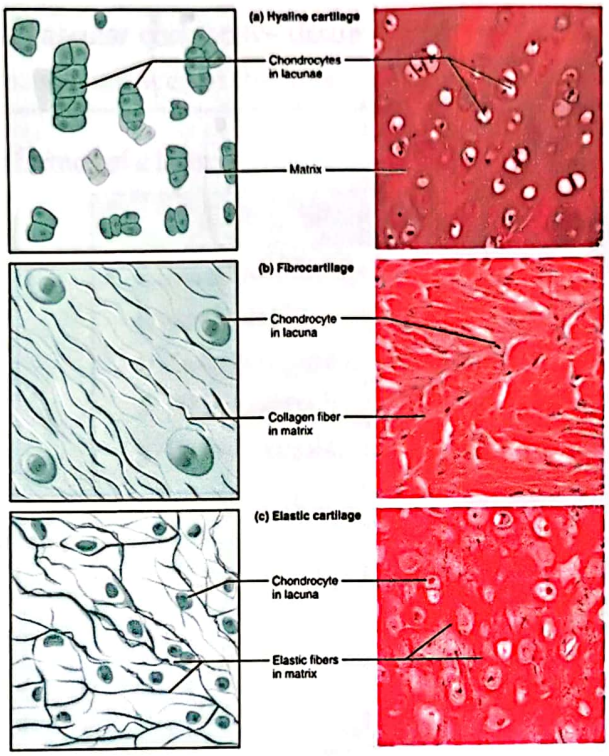


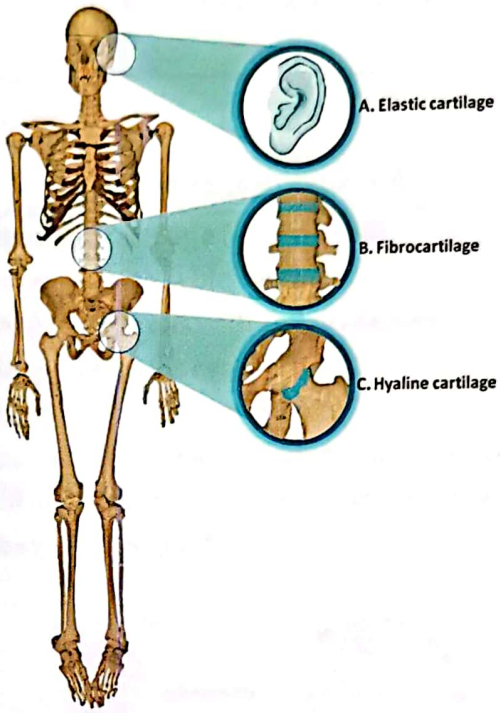


TYPES OF THE CARTILAGE

There are 3 types of cartilage:

1. **Hyaline cartilage:** it appears translucent pale blue i.e. hyaline = glassy in fresh state.
2. **Yellow Elastic cartilage:** It is yellow colour in fresh state.
3. **White Fibro-cartilage:** It is white colour in fresh state.



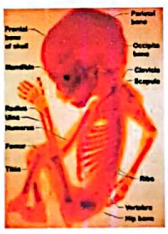


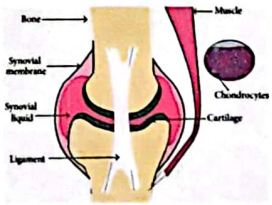
1 Hyaline Cartilage

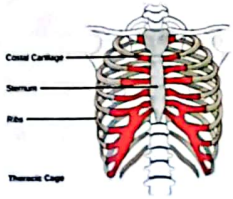
It is the most common type of cartilage

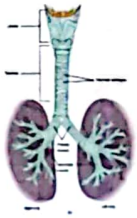
SITES

1. It constitutes the majority of the **foetal skeleton.**
2. **Articular surface of bones.**
3. **Costal cartilage** in the thoracic cage.
4. **Nose, trachea, bronchi.**
5. **Laryngeal cartilage** "thyroid and cricoid".









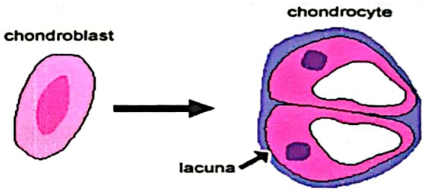
STRUCTURE

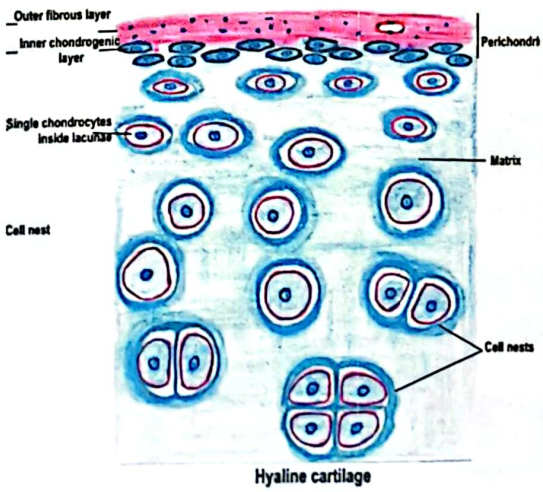
1 Perichondrium

Definition of Perichondrium

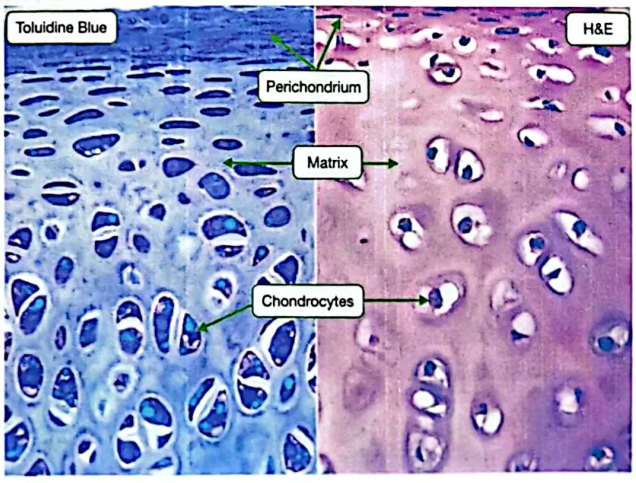
- It is **vascular connective tissue membrane** which surrounds the cartilage except at the articular surfaces of the joints.

It is formed of 2 layers:

	① Outer fibrous layer	② Inner chondrogenic layer
Structure	▪ Formed of **fibrous connective tissue rich in:** 1. Collagen type I. 2. Fibroblasts. 3. Blood vessels.	▪ Formed of **cartilage forming cells (chondroblast), which are:** - **Oval young cells** with **cell processes** - **Deep basophilic cytoplasm.** - Present in **perichondrium.** - Precursors of **chondrocytes** (can divide & differentiate into chondrocytes which secrete the **cartilage matrix**) 
Function	1. **Attachment of muscles.** 2. **Blood supply & nourishment** of cartilage cells.	▪ **New cartilage formation** during growth or repair (as chondroblasts secrete matrix, then change into chondrocytes).



Hyaline cartilage



2 Cartilage cells

Types:

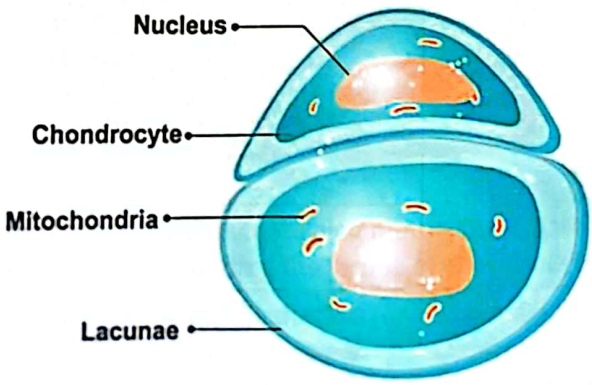
			① Young chondrocytes	② Old (Mature) chondrocytes
Site			Under the perichondrium	Deep in the cartilage
Number inside their lacunae			They present **singly** in flat lacunae	Present in lacunae **singly** OR **in groups** (2, 4, 8) which are called "Cell nest" as they can divide.
Structure	LM	Cells	**Flat** cell	▪ **When single → Oval** or **Rounded** ▪ **When in groups → Triangular** or **Semicircular**
		Nuclei	**Oval** nuclei	**Rounded** and **open face** nuclei
		Cytoplasm	**Basophilic** cytoplasm	▪ **Granular.** ▪ **Basophilic.** ▪ **Rich in** glycogen, fat & alkaline phosphatase enzyme.
	EM			▪ **They contain:** - rER, ribosomes, well developed Golgi. ▪ The surface show **short cytoplasm processes.**

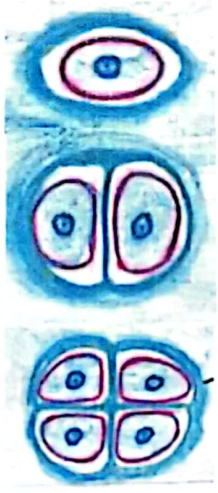
Function:

1- **They also synthesize & secrete:** the components the cartilage matrix (collagen type II, proteoglycans hyaluronic acid and chondronectin).
2- **They can divide →** so, they are responsible for **interstitial growth of the cartilage.**

N.B.: Cell nests: A group of cells that are:

- Present inside single lacunae, and
- Separated by thin partitions of matrix.





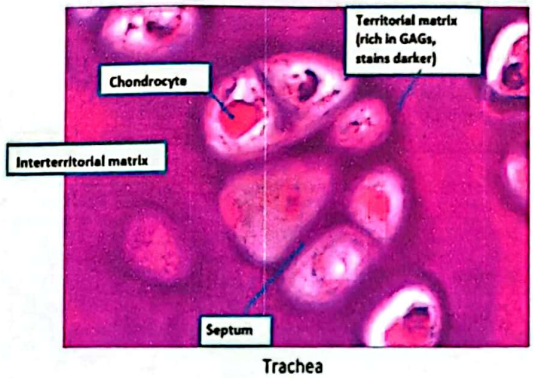
3 Cartilage matrix

Structure: It is formed of:

1	COLLAGENOUS FIBERS TYPE II	▪ Which form 40% of the dry weight of the hyaline cartilage.
2	AMORPHOUS SUBSTANCE	▪ **Which includes:** 1. **Proteoglycan** (GAGs as chondroitin sulphate linked with a core of protein). 2. **Chondronectin** (Glycoprotein) 3. **Chondrocalcin** (Protein).
3	TISSUE FLUID	▪ 75% of matrix.

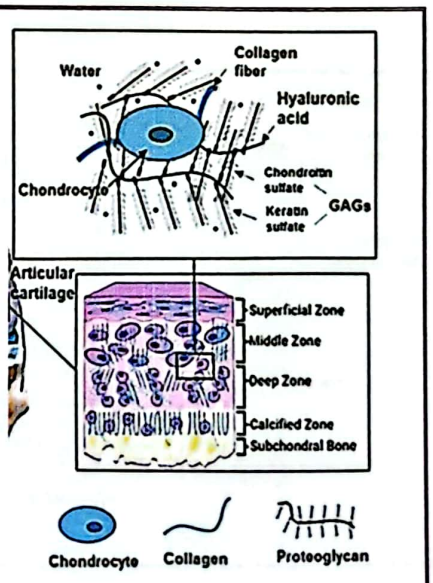
General characters:

Consistency		Firm or rubbery
Vascularity		▪ The Cartilage matrix is **non-vascular.** ▪ But it allows **diffusion of nourishment and oxygen** from blood vessels of perichondrium to chondrocytes.
Appearance		▪ It is **homogenous** as collagenous fibers have the same refractive index of the amorphous substance.
Staining	H&E	▪ It is **basophilic** due to **high content of chondrotin sulphate.** o The basophilia is markedly **increased around lacunae & cell nests.**
	Toluidine blue	▪ It is stained metatchromatically by **Toluidine blue** → appear **purple.**
	PAS	▪ It shows strong **PAS** positivity.
Territorial matrix		▪ There is concentrated of the cartilage matrix around each lacuna which is **rich in glycosaminoglcans** and **poor in collagen** → this zone called the **territorial or capsular matrix.**



Trachea

Territorial matrix	The darker staining matrix immediately surrounding the lacuna of chondrocytes
Interterritorial matrix	Is the matrix that occupies the majority of space between chondrocytes.



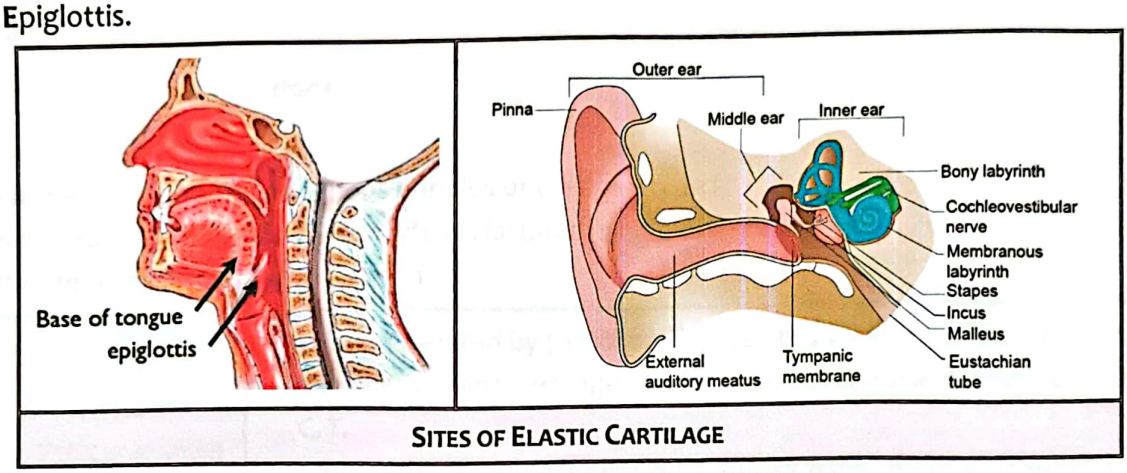
II Elastic Cartilage

General characters:

1. **Fresh elastic cartilage** has **a yellow colour** due to presence of elastin in the elastic fibers.
2. **The most flexible and stretchable type of cartilage.**
3. **It can be stained by standard elastic stains** e.g. Orcein (Brown) and Verhoeff's stain (Black).

Sites:

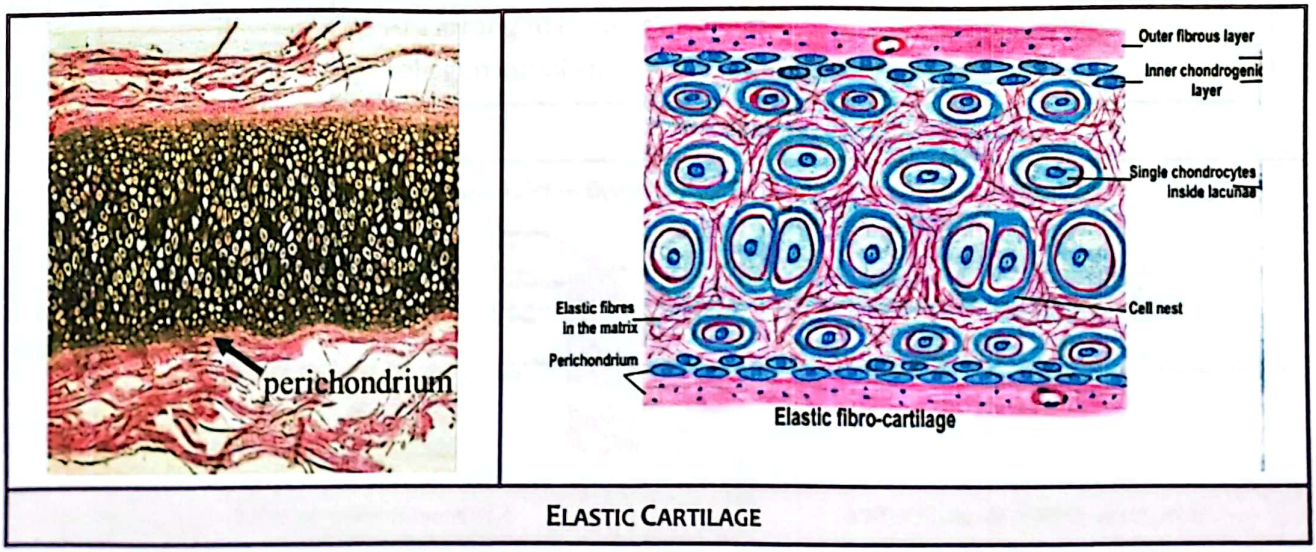
1. Ear pinna.
2. External auditory meatus.
3. Eustachian tube.
4. Epiglottis.



SITES OF ELASTIC CARTILAGE

Structure: It is essentially identical to hyaline cartilage except that:

- The matrix contains an **abundant network of fine elastic fibers** in addition to **collagen type II fibrils** which responsible for elasticity & flexibility of this type.



ELASTIC CARTILAGE

III Fibrocartilage

General characters:

- It is **white in colour** in fresh state.
- **It is the strongest type of cartilage that resists stretch** due to:
  A. Presence of **collagen fibers.**
  B. Has **alternating layers of hyaline cartilage matrix & thick layers of dense collagen fibers** oriented in the direction of functional stresses.

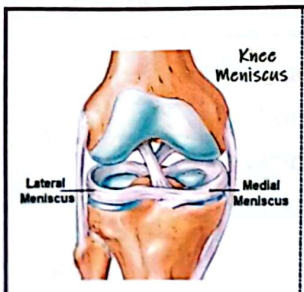
Sites:

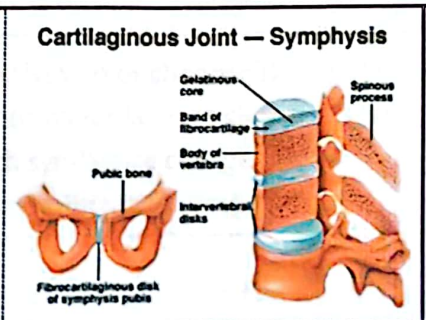
1. **Interverterbal discs.**
2. **Semilunar cartilage** of knee joints (mensci).
3. **Symphysis pubis.**
4. Terminal parts of **tendons.**

Structure:

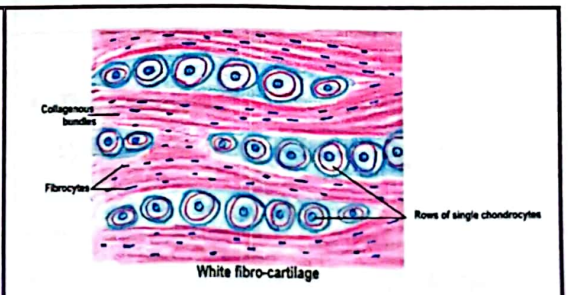
- Formed of **parallel** collagenous bundles of collagen type I
- Separated by **rows of chondrocytes** in lacunae (single or in pairs).
- **It differs from hyaline cartilage in:**

1	NO PERICHONDRIUM	▪ **It is not covered by perichondrium** as it is usually a transitional layer between hyaline cartilage and tendon, But it is **surrounded by dense C. T.** ▪ It receives the nourishment & O2 supply **from the blood vessels of the surrounding C.T.**
2	MATRIX	▪ It is **acidophilic** because it contains a great number of **coarse type I collagen fibers** arranged in bundles.
3	CHONDROCYTES	▪ Are **arranged in rows in lacunae** (single or in pairs) between collagen bundles.

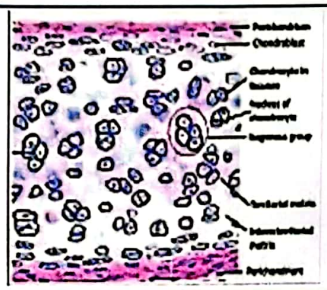
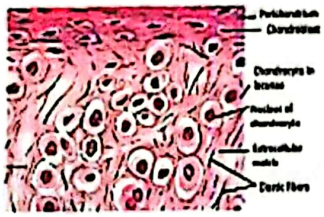
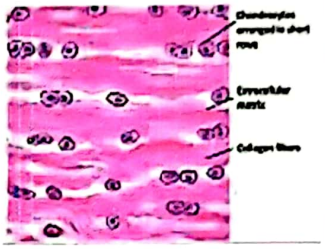




SITES OF FIBROCARTILAGE



STRUCTURE OF FIBROCARTILAGE

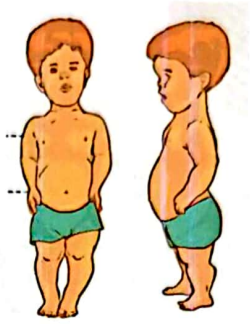
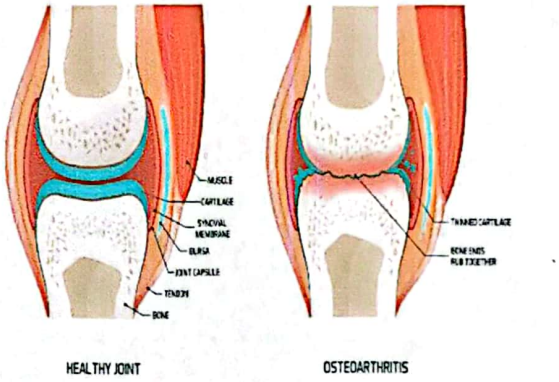
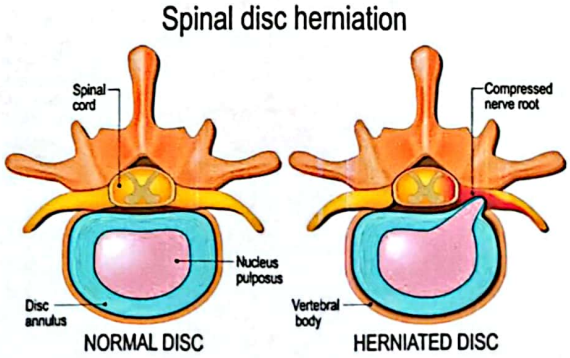
	① Hyaline Cartilage	② Elastic Cartilage	③ Fibrocartilage
Appearance	Glassy	Yellow	White
Site	1. Long bone of fetal skeleton. 2. Costal cartilage. 3. Cartilage of respiratory passages	1. Ear pinna. 2. External auditory meatus. 3. Eustachian tube. 4. Epiglottis.	1. Intervertebral discs. 2. Symphysis pubis. 3. Semilunar cartilage of knee joint.
Perichondrium	Present	Present	Absent
Matrix	Basophilic & homogenous	Abundant network of fine elastic fibers	Acidophilic & abundant collagen fibers
Collagen fibers	Type II	Type II	Type I
Fig.			

GROWTH OF THE CARTILAGE

The cartilage grows by 2 mechanisms:

	① Appositional growth	② Interstitial growth
Definition	▪ It is the **addition of new cartilage** under the perichondrium.	▪ It occurs in **epiphyseal plates** and **within articular cartilage.**
Direction of growth	▪ Growth **from outside**	▪ Growth **from within**
Mechanism	▪ By **activation of chondroblast** in the chondrogenic layer **to chondrocytes** which synthesize collagen fibrils & ground substance.	▪ The **chondrocytes** divide and synthesize the **cartilage matrix.**
Result of growth	▪ It causes growth of **cartilage in width**	▪ It causes growth of cartilage **in length**

CARTILAGE ABNORMALITIES & THEIR CLINICAL CORRELATIONS

❶	**ACHONDROPLASIA**	▪ It is a form of **short-limbed dwarfism** due to a **genetic mutation** of a gene responsible of converting cartilage to bone (a process called ossification), particularly in the long bones of the arms and legs. 
❷	**OSTEOARTHRITIS**	▪ **Degenerative change** in the articular cartilages of both opposing bone ends of a joint leading to their **rubbing with pain sensation.**  HEALTHY JOINT OSTEOARTHRITIS
❸	**DISC DEGENERATION & PROLAPSE**	▪ **Degenerative change in intervertebral disc between 2 vertebrae.** ▪ A slipped disc occurs when the outer covering of the disc (annulus) tears & the internal gel (nucleus) herniates → causing the **gel to press on the nerve root.** 

MSS
Module

level 1
semester 2

Histology

LECTURE 5

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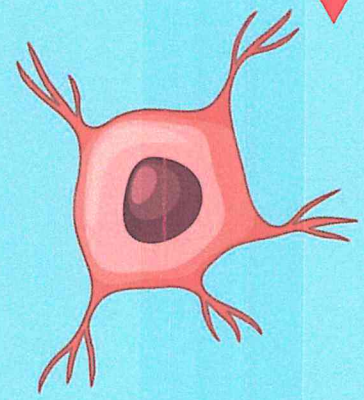

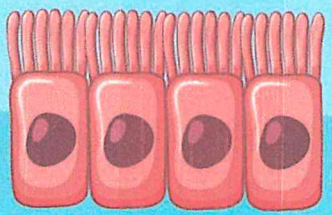

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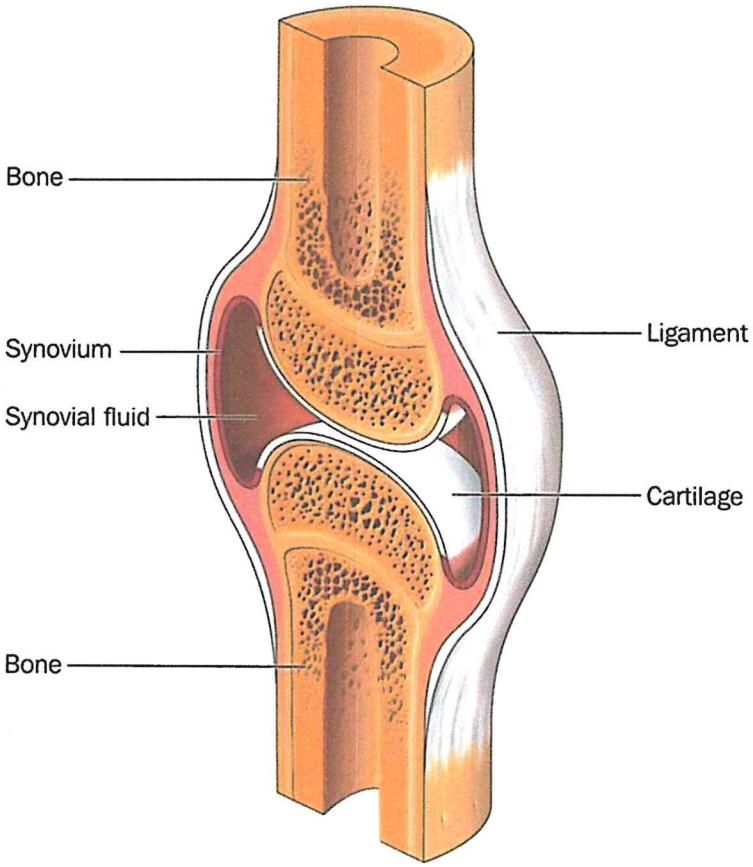
CARTILAGE

CHARACTERISTIC FEATURES

- It is a Specialized type of connective tissue (CT)
- The cartilage is avascular, no nerves or blood and lymphatic vessels.
- Has firm or rubbery matrix
- Usually covered by perichondrium.

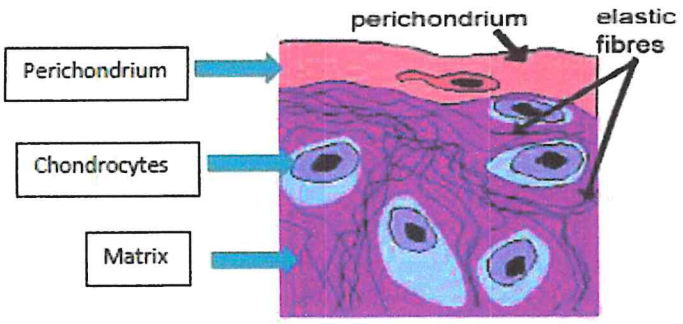
FUNCTIONS

1. **Firm matrix:**
   - Allows the tissue to bear mechanical stresses without permanent distortion
   - Supports soft tissues especially in respiratory system.
2. **In joints:**
   - Shock-absorbing because it is resilient.
   - Smooth surface Preventing rubbing of bones against each other.
3. **Connect tendons and ligaments to bones.**
4. **Essential for** growth, development of bone in growing children.



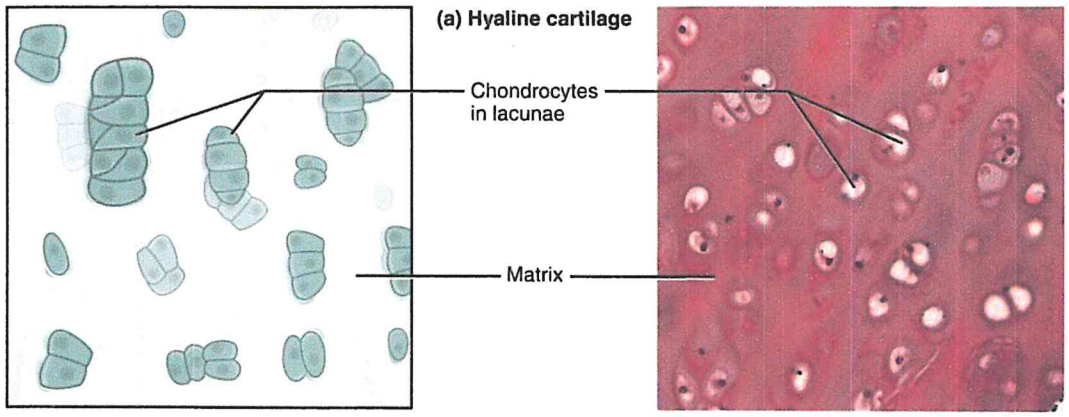
STRUCTURE

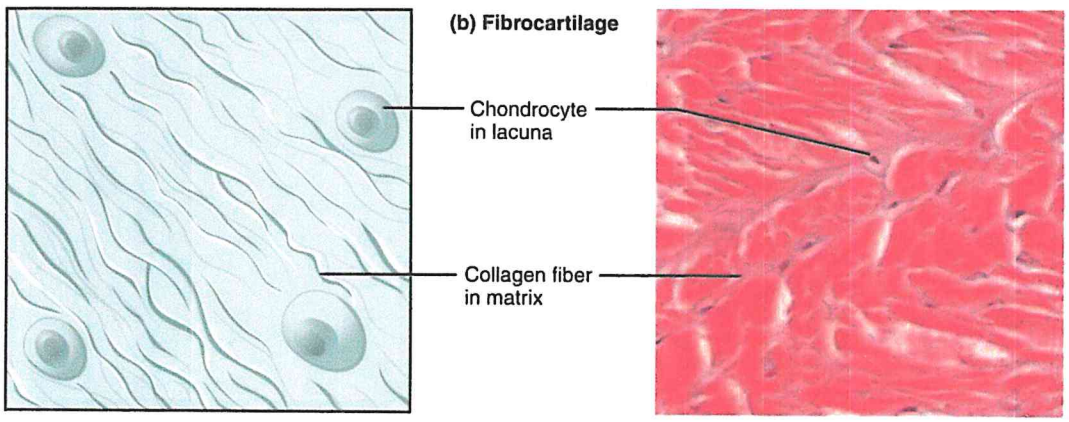
1. Perichondrium.
2. Cartilage cells = chondrocytes.
3. Cartilage matrix.

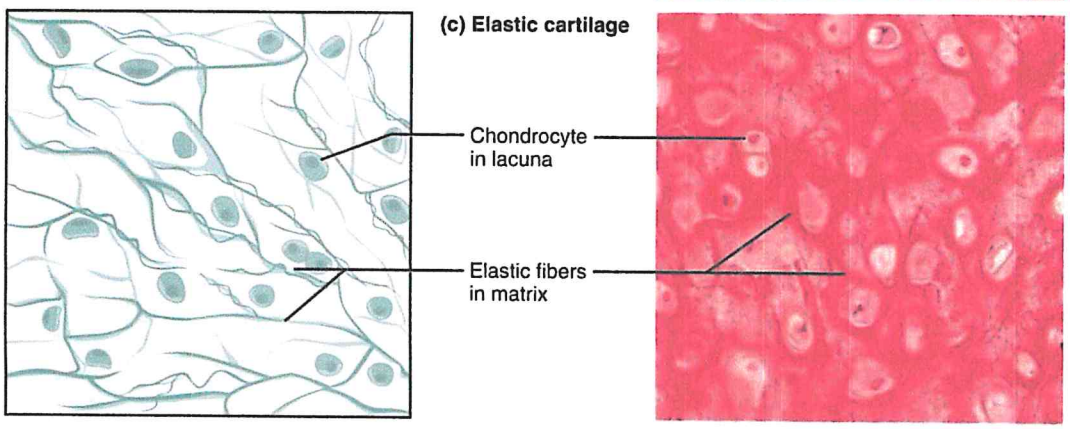


TYPES

HYALINE CARTILAGE	YELLOW ELASTIC FIBRO-CARTILAGE	WHITE FIBRO-CARTILAGE
✦ Translucent **pale blue** ✦ i.e. **Hyaline = glassy** in fresh state	✦ **Yellow** colour in fresh state	✦ **White** colour in fresh state



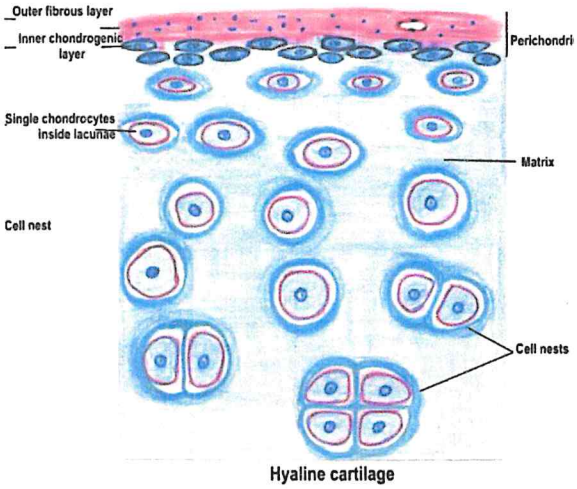




A HYALINE CARTILAGE

INCIDENCE

- It is the **most common type** of cartilage.



Hyaline cartilage

SITES

1. Costal cartilage in the **thoracic cage.**
2. Articular surface of **bones.**
3. Nose, trachea, bronchi.
4. Majority of the **foetal skeleton.**
5. **Laryngeal cartilage** "thyroid and cricoid".

STRUCTURE

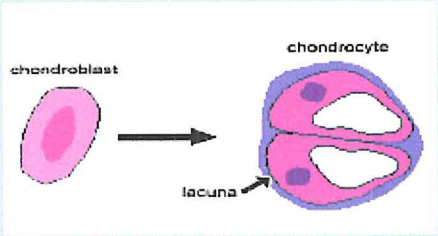
Perichondrium → Cartilage cells → Cartilage matrix.

1. PERICHONDRIUM :

DEF	✦ It is a vascular connective tissue membrane. ✦ Surrounds the cartilage **except** at the articular surfaces of the joints.	
TYPES		
	OUTER FIBROUS LAYER	**INNER CHONDROGENIC LAYER**
FORMED OF	✦ Fibrous CT. ✦ **Rich in :** 1. Collagen type II. 2. Fibroblasts. 3. Blood vessels.	✦ Cartilage forming cells (**chondroblast**) which can divide and differentiate into chondrocytes which secrete cartilage matrix.
FUNCTION	✦ Attachment of muscles. ✦ Blood supply & nourishment of cartilage cells.	✦ **New cartilage formation** during growth or repair, (as chondroblasts secrete matrix, then change into chondrocytes).

CHONDROBLASTS

- Oval young cells with cell processes.
- Deep basophilic cytoplasm.
- Present in perichondrium.
- Precursors of chondrocytes.



2. CARTILAGE CELLS :

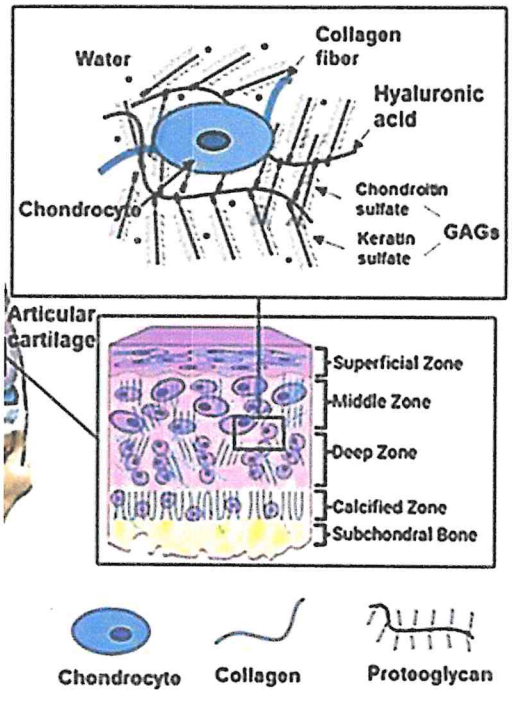
	YOUNG CHONDROCYTES	OLD CHONDROCYTE
SITE	Under the perichondrium	Deep in the cartilage
STRUCTURE	✦ Flat cell with oval nuclei and basophilic cytoplasm	✦ **LM:** ➢ Single → Oval or rounded ➢ Groups → Triangular or semicircular. ➢ Rounded and open face nuclei. ➢ Granular, basophilic cytoplasm rich in glycogen, fat and alkaline phosphatase enzyme. ✦ **EM:** ➢ Contain rER, ribosomes, well developed Golgi. ➢ Surface → short cytoplasm processes.
NUMBER INSIDE LACUNAE	✦ Present **singly** in flat lacunae	✦ Present in lacunae **singly** or **in groups (2, 4, 8)** which are called **"Cell nest"** as they can divide.
FUNCTION	1. **They synthesize and secrete:** the components the cartilage matrix (collagen type II, proteoglycans hyaluronic acid and chondronectin). 2. **They can divide** so, they are responsible for interstitial growth of the cartilage.	

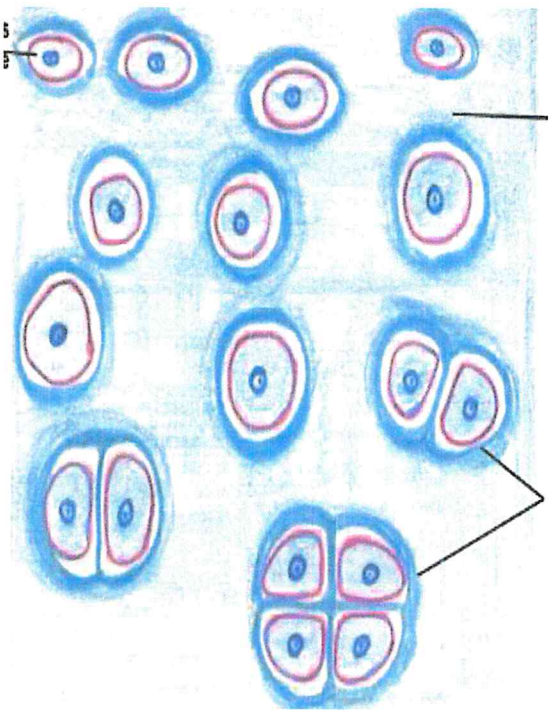
NB

➢ a group of cells that are present inside single lacunae and separated by thin partitions of matrix are named **(cell nests).**

3. CARTILAGE MATRIX :

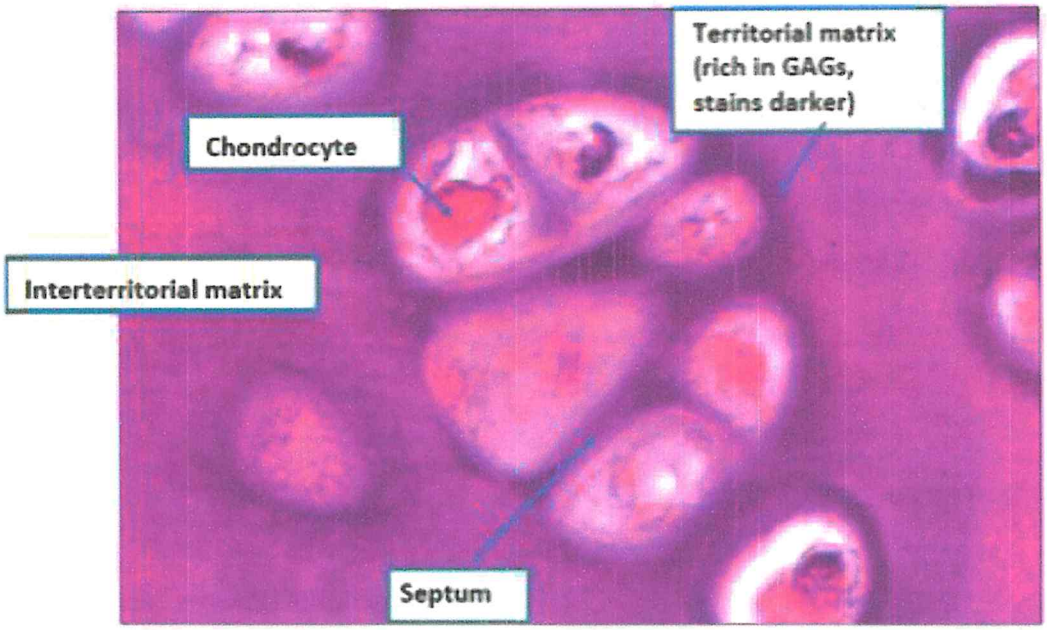
GENERAL CHARACTERS	1. **Consistency:** firm or rubbery. 2. **Non-vascular:** but it allows diffusion of nourishment and oxygen from blood vessels of perichondrium to chondrocytes. 3. It is **homogenous** as collagenous fibers have the same refractive index of the amorphous substance. 4. It is **basophilic** due to high content of chondrotin sulphate. ✦ The basophilia is markedly increased around lacunae and cell nests. 5. It is stained **metatchromatically** by Toluidine blue → appear purple. 6. It shows strong **PAS positivity.** 7. There is concentrated of the cartilage matrix around each lacuna which is ✦ **Rich** in glycosaminoglcans ✦ **Poor** in collagen. This zone called the **territorial or capsular matrix.**
STRUCTURE	**a- Collagenous fibers type II:** ➢ form 40% of the dry weight of the hyaline cartilage **b- Amorphous substance:** ➢ Proteoglycan (GAGs as chondroitin sulphate linked with a core of protein). ➢ Chondronectin (glycoprotein) ➢ Chondrocalcin (protein). **c- Tissue fluid** (75% of matrix).





WHAT IS THE DIFFERENCE BETWEEN TERRITORIAL AND INTERTERRITORIAL MATRIX?

TERRITORIAL MATRIX	INTERTERRITORIAL MATRIX
✦ The darker staining matrix immediately surrounding the lacuna of chondrocytes	✦ Is the matrix that occupies the majority of space between chondrocytes.



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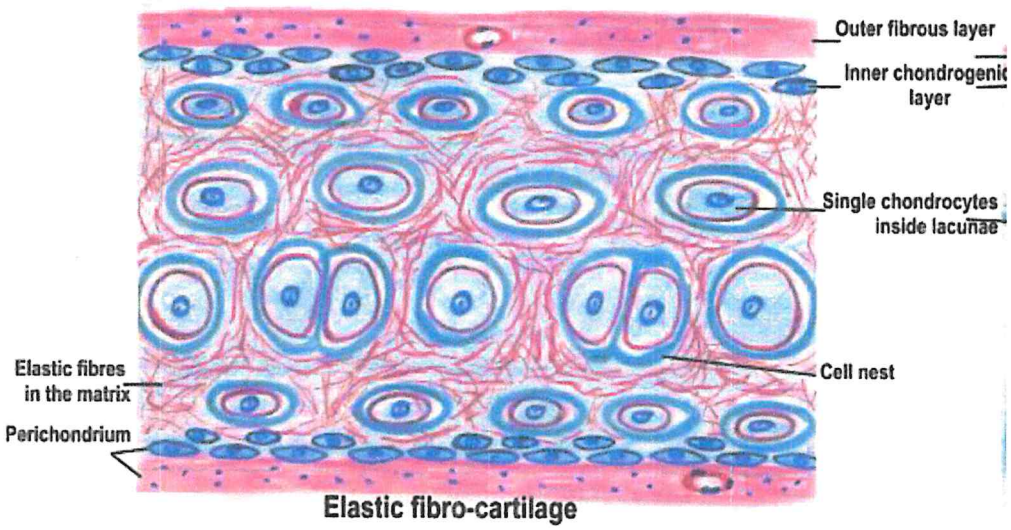
B YELLOW ELASTIC FIBRO- CARTILAGE

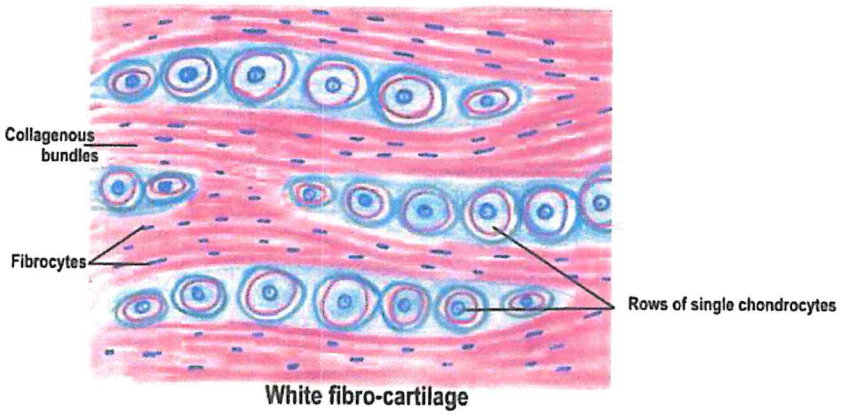
GENERAL CHARACTERS	✦ Fresh elastic cartilage has a yellow colour due to presence of elastin in the elastic fibers. ✦ The most flexible and stretchable type of cartilage. ✦ Stained by standard elastic stains e.g. orcein and verhoeff's stains.
SITES	✦ Ear pinna. ✦ External auditory meatus. ✦ Eustachian tube. ✦ Epiglottis.
STRUCTURE	✦ **It is essentially identical to hyaline cartilage except that:** ➢ The matrix contains an abundant network of fine elastic fibers in addition to collagen type II fibrils which responsible for elasticity and flexibility of this type.



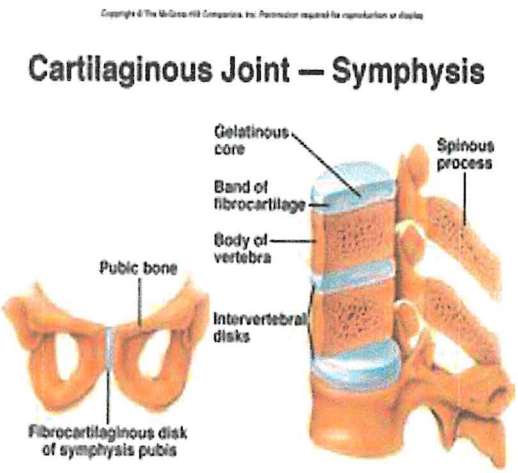
Elastic fibro-cartilage

C WHITE FIBRO-CARTILAGE

GENERAL CHARACTERS	✦ It is white in colour in fresh state. ✦ It is the **strongest type** of cartilage that resists stretch due to presence of collagen fibers and has alternating layers of hyaline cartilage matrix and thick layers of dense collagen fibers oriented in the direction of functional stresses.
SITES	✦ Interverterbal discs. ✦ Semilunar cartilage of knee joints (mensci). ✦ Symphysis pubis. ✦ Terminal parts of tendons.
STRUCTURE	✦ **It differs from hyaline cartilage in:** 1. **It is not covered by perichondrium** ➢ Usually a transitional layer ( ) hyaline cartilage & tendon, but surrounded by dense C. T. ➢ It receives the nourishment and O2 supply from the blood vessels of the surrounding C.T. 2. **Matrix:** ➢ It is acidophilic because it contains a great number of coarse type I collagen fibers arranged in bundles. 3. **Chondrocytes:** ➢ Arranged in rows in lacunae (single or in pairs) ( ) collagen bundles.



White fibro-cartilage



	HYALINE	YELLOW ELASTIC	WHITE FIBROCARTILAGE
APPEARANCE	Glassy	Yellow	White
SITE	✦ Long bone of foetal skeleton. ✦ Costal cartilage. ✦ Cartilage of respiratory passages	✦ Ear pinna. ✦ External auditory meatus. ✦ Eustachian tube. ✦ Epiglottis.	✦ Intervertebral discs. ✦ Symphysis pubis. ✦ Semilunar cartilage of knee joint.
PERICHONDRIUM	Present	Present	Absent
MATRIX	Basophilic & homogenous	abundant network of fine elastic fibers	Acidophilic & abundant collagen fibers
COLLAGEN FIBERS	Type II	Type II	Type I

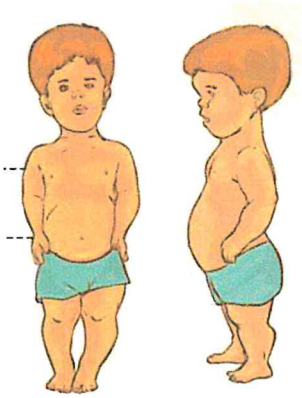
GROWTH OF THE CARTILAGE

	APPOSITIONAL GROWTH	INTERSTITIAL GROWTH
DEFINITION	✦ It is the addition of new cartilage under perichondrium	✦ It occurs in **epiphyseal plates** and within articular cartilage.
DIRECTION OF GROWTH	✦ Growth from **outside.**	✦ Growth from **within.**
MECHANISM	✦ By activation of **chondroblast** in the chondrogenic layer to chondrocytes which synthesize collagen fibrils and ground substance.	✦ The chondrocytes divide and synthesize the **cartilage matrix.**
RESULT OF GROWTH	✦ Growth of cartilage in **width.**	✦ Growth of cartilage in **length.**

CARTILAGE ABNORMALITIES

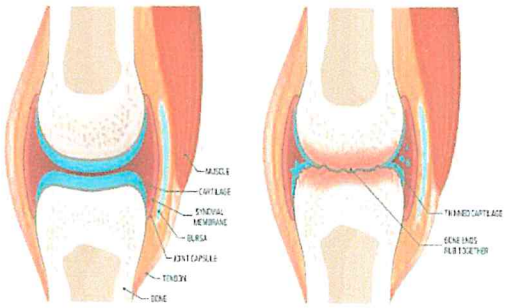
ACHONDROPLASIA

- Form of short-limbed dwarfism due to a **genetic mutation**.
- Responsible of converting cartilage to bone (a process called ossification), particularly in the long bones of the arms and legs.



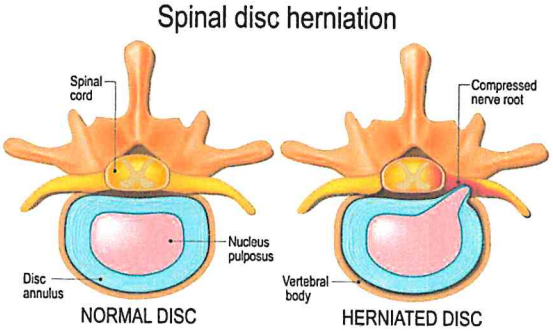
OSTEOARTHRITIS

- Degenerative change in the **articular cartilages of both opposing bone ends** of a joint leading to their rubbing with pain sensation.



DISC DEGENERATION AND PROLAPSE

- Degenerative change in **intervertebral disc** between 2 vertebrae.
- A slipped disc occurs when the outer covering of the disc (annulus) tears and the internal gel (nucleus) herniates, causing the gel to press on the nerve root.



MSS
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Histology

LECTURE 3

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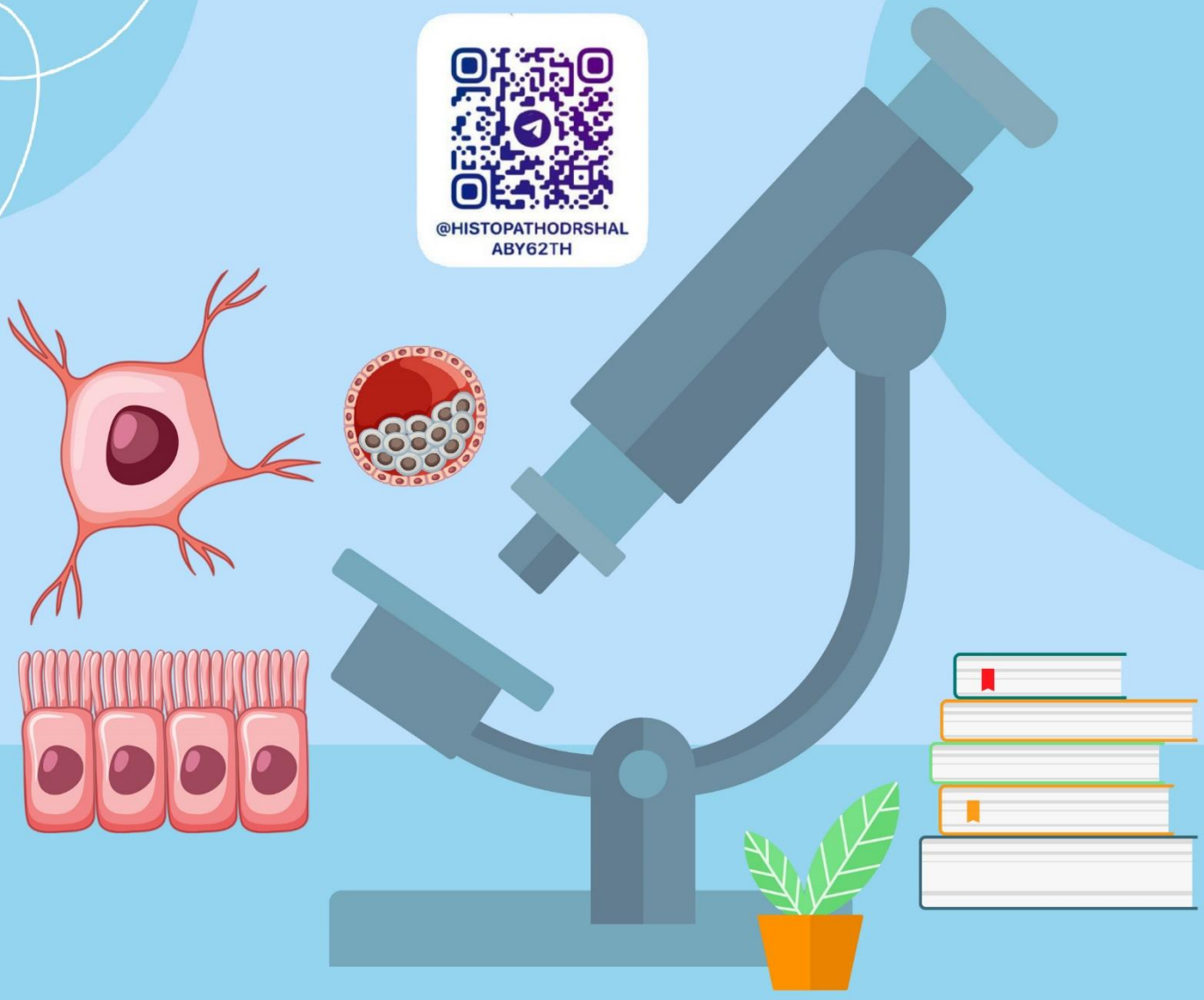

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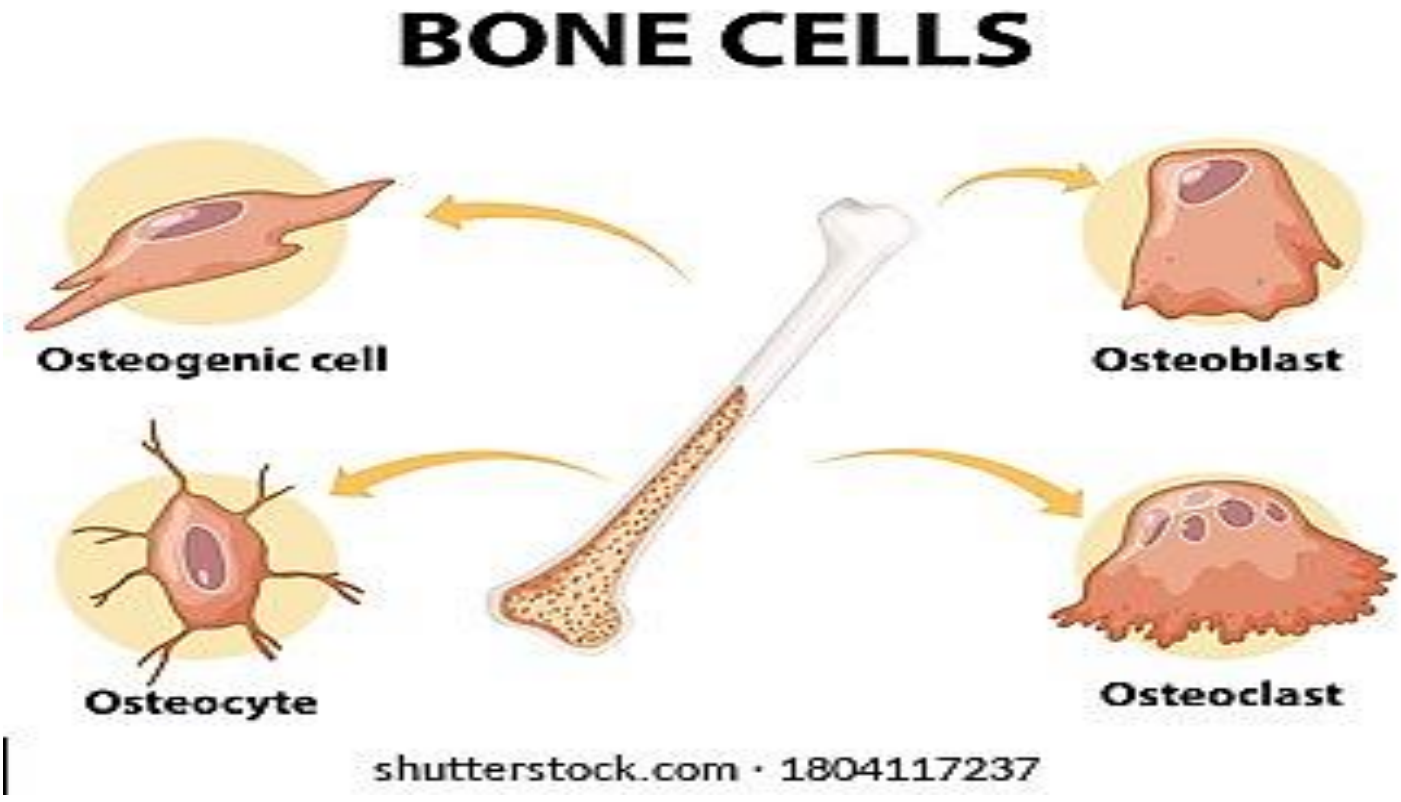
BONE

FUNCTIONS

- Highly Specialized type of connective tissue (CT)
  1. It forms the skeleton.
  2. Muscles attachment.
  3. Protection of soft organs as brain.

CONSTITUENTS OF BONE

1- Periosteum.
2- Endosteum.
3- Bone matrix.
4- Bone cells:
   a) Osteogenic cells
   b) Osteoblasts
   c) Osteocytes
   d) Osteoclasts



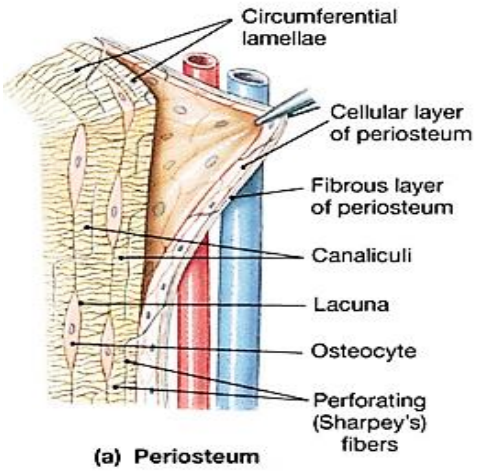
A PERIOSTEUM

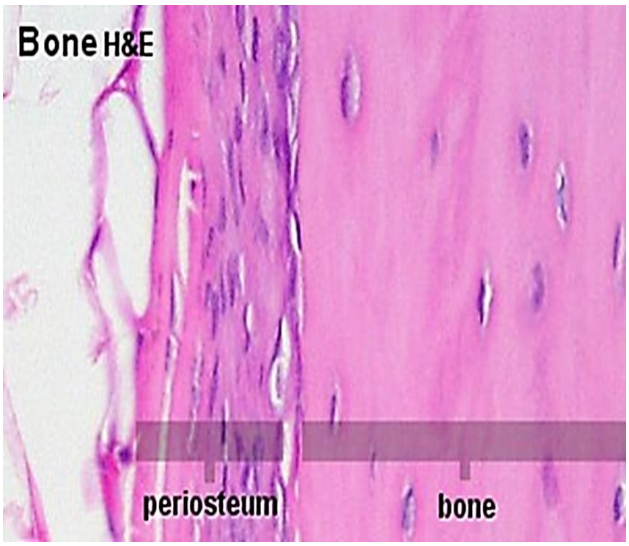
DEFINITION

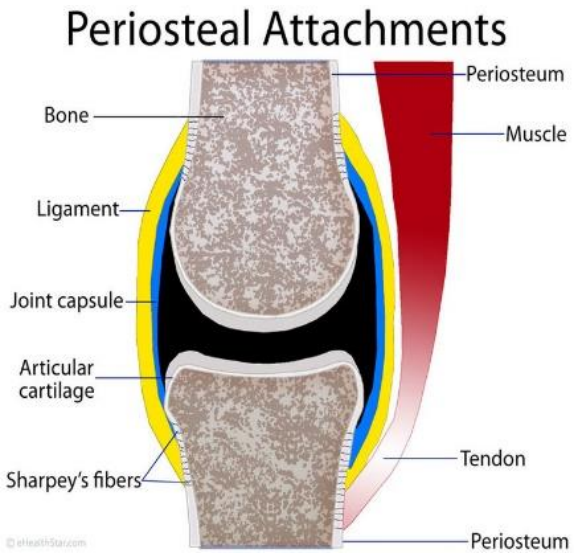
- It is a vascular C.T. membrane **covering the bone from outside.**

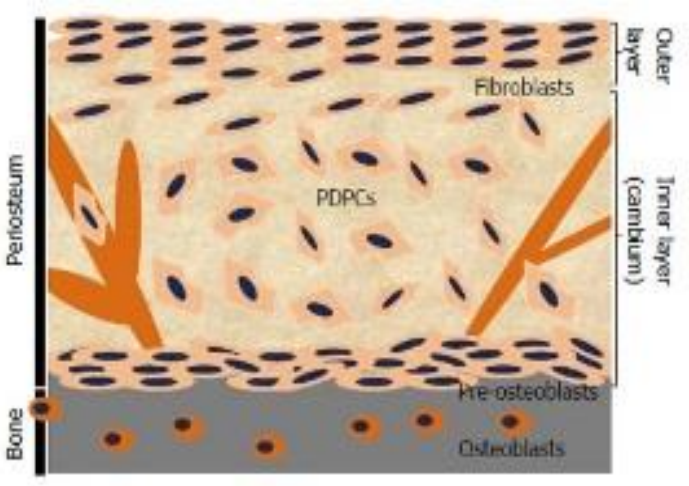
LAYERS

	OUTER FIBROUS LAYER	INNER OSTEOGENIC LAYER
STRUCTURE	- Collagenous fibers - Blood vessels - Fibroblasts.	- Osteogenic spindle-shaped cells.
FUNCTION	- Provide **attachment** for muscles, ligaments and tendons. - Provide bone with **blood supply** and nourishment.	- These cells when stimulated during growth or healing of fracture can change into **osteoblasts**



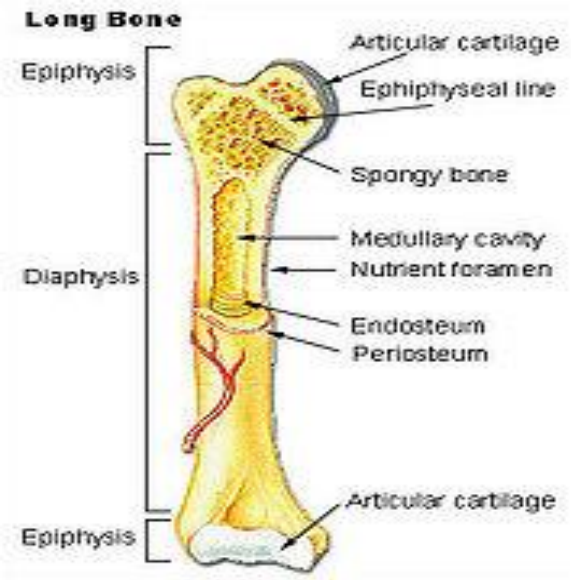


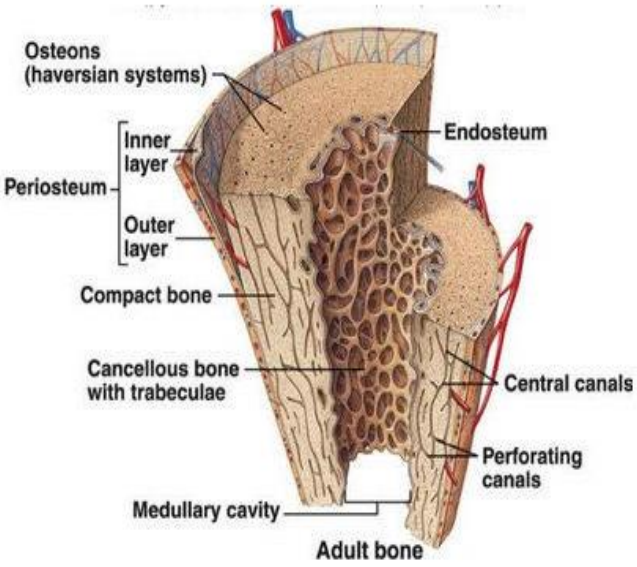




B ENDOSTEUM

DEFINITION	It is a vascular C.T. membrane that lines the **inner surface of the bone**, bone marrow cavities and Haversian canals.
FUNCTION	It supplies bone with **blood supply & nourishment**. Its osteogenic cells & osteoblasts & osteoclasts are concerned with **bone formation** and **resorption** during growth & healing after fracture.



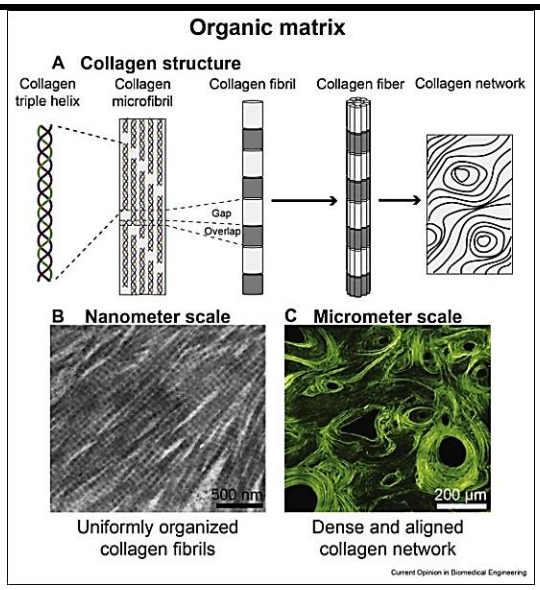
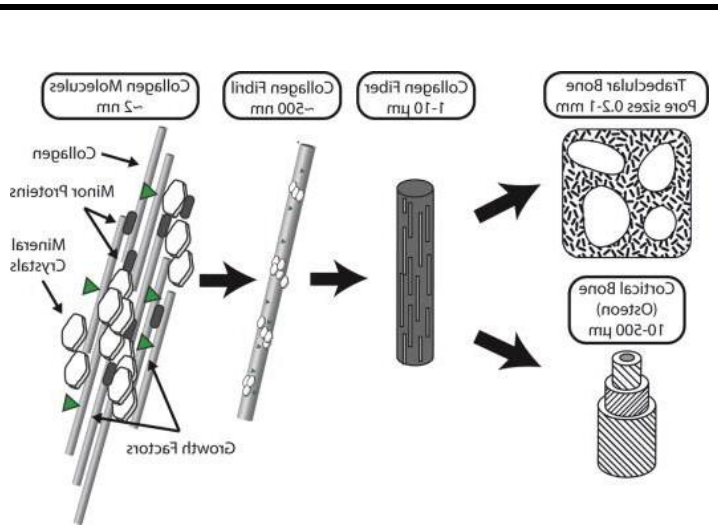


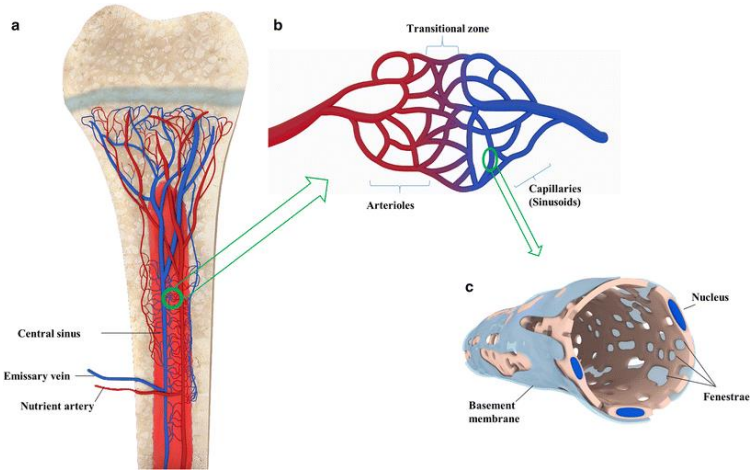
C BONE MATRIX

GENERAL CHARACTERS

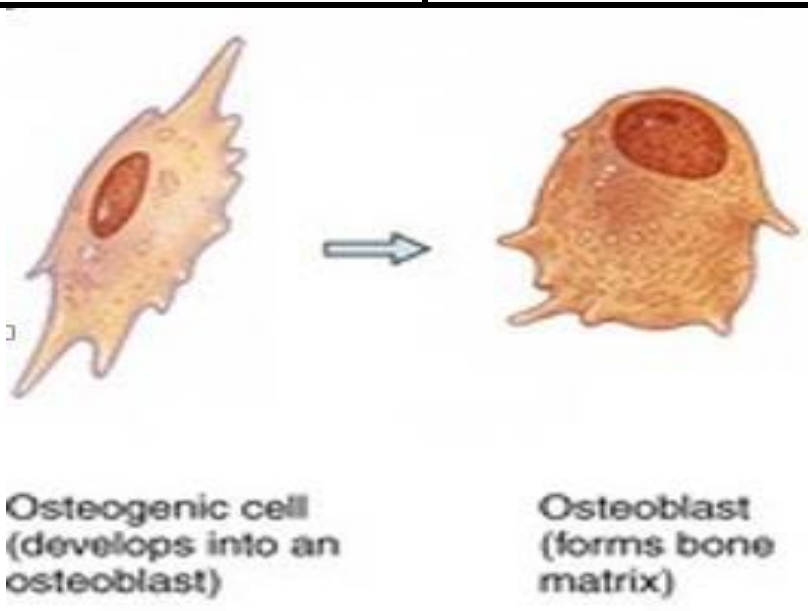
- It is hard or solid in consistency.
- It is rich in **blood supply.**

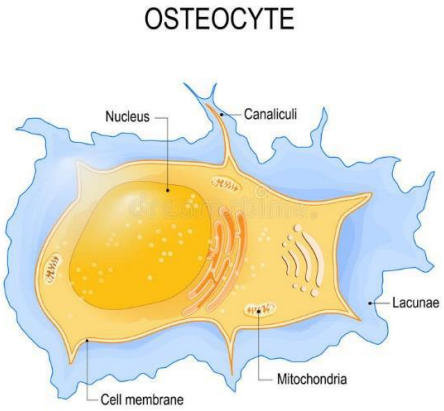
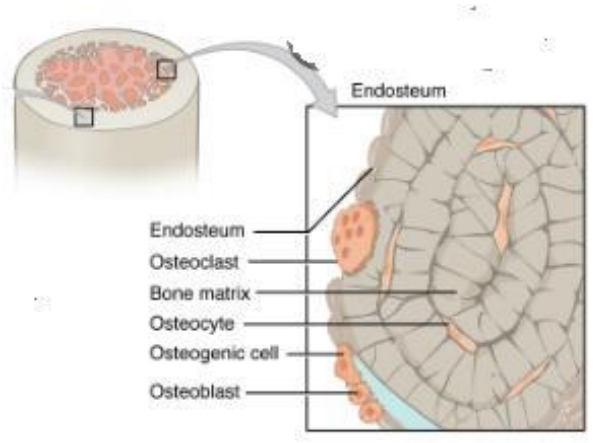
STRUCTURE

ORGANIC COMPONENTS	INORGANIC COMPONENTS
It constitutes about **50%**	It constitutes about **50%**
Bone **collagen** "Type I" about 90% of the organic component.	These salts form insoluble crystals called = "**Hydroxy apitate crystals**"
Sulphated **glycosaminoglycans**.	It is formed mainly of **calcium and phosphorus salts**.
Glycoprotein = Osteonectin. **Protein** = Osteocalcin.	
	



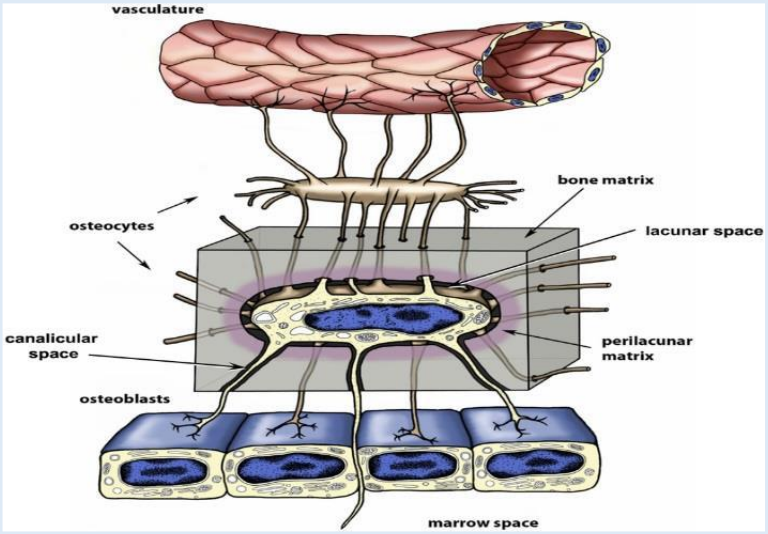
D BONE CELLS

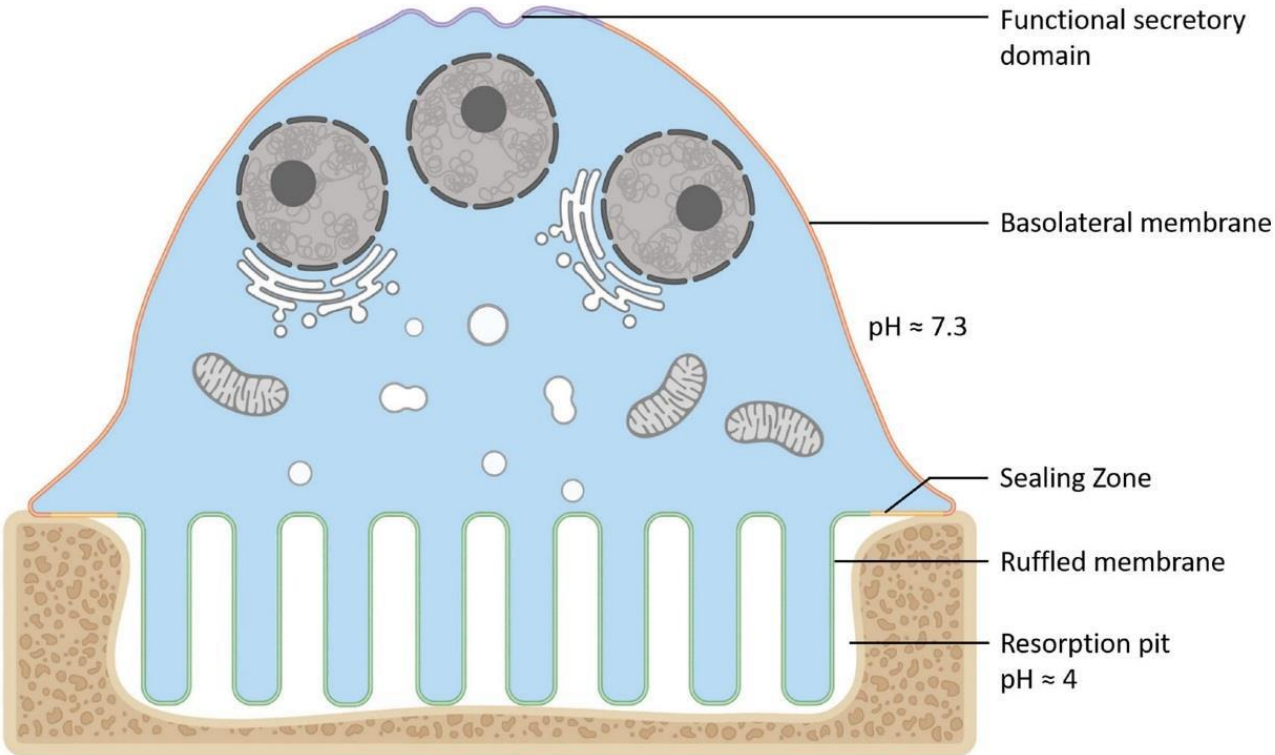
	1. OSTEOGENIC CELLS (OSTEOPROGENITOR CELLS)	2. OSTEOBLASTS
ORIGIN	✦ **Sites:** 1. Inner osteogenic layer of periosteum. 2. Endosteum. 3. Bone marrow cavities	**Activated osteogenic** cells
LM	✦ Flat cells ✦ Central flat nuclei ✦ Pale basophilic cytoplasm.	✦ Oval branched cells ✦ with few processes ✦ Oval, eccentric, open face nuclei. ✦ Deep basophilic cytoplasm
EM	✦ Rich in ribosomes and rER.	✦ Ribosomes, rER, well developed Golgi apparatus and mitochondria.
FUNCTION	✦ They are capable to divide and give osteoblasts "**bone forming cells**" during: 1. **Growth** of bone. 2. **Healing** of fracture bone.	1. **Bone formation** (matrix secretion). 2. **Bone calcification:** a. **Alk phosphatase enz**→ facilitates deposition of calcium. b. **Pyrophosphatase enz**→ inhibit pyrophosphate. c. **Matrix vesicles:** buds from cell membrane, store Ca. 3. **Change into osteocytes.**
PHOTO		

	3. OSTEOCYTES	4. OSTEOCLASTS
ORIGIN	They are mature **osteoblasts**.	✦ Arise from blood cells called monocytes. ✦ **Sites: Where resorption takes place** ✓ Bone marrow spaces. ✓ Medullary cavities. ✓ Endosteum. Each cell lies in a shallow cavity called "Howships Lacuna".
LM	✦ Oval, branched cells. ✦ Oval, central nuclei. ✦ The cytoplasm is Slightly basophilic. ✦ Rich in alkaline phosphatase. ✦ Osteocytes can't divide, so present singly in each lacuna.	✦ Large irregular cell"20-30um". ✦ Multinuclated"4-50"nuclei ✦ Cytoplasm is foamy acidophilic. ✦ The cells have striated or brush border facing the bone surface.
EM	✦ rER, ribosomes, Golgi apparatus, and many cytoplasmic microtubules. ✦ The cells are present inside lacunae between bone lamellae.	✦ **The osteoclast shows the following 4-zones:-** 1. Ruffled or striated zone. 2. Clear Zone. 3. Vesicular Zone. 4. Basal Zone.
FUNCTION	1. Formation of bone matrix & vesicles rich in enzymes to preserve integrity of bone matrix and maintain its inorganic components. 2. Mobilization of Ca+ from bone to blood in times of need.	1. **Bone resorption** during ossification causing remodeling of bone 2. They remove bone debris during ossification and after healing of bone fracture.
PHOTO		

OSTEOCYTES

- Connected with one another by processes passing through bone canaliculi which connect adjacent lacunae together.
- These cell processes intercommunicate with one another by gap junctions.
- The gap junctions between the processes allow the electrolytes to pass freely from one cell to the other.





ZONES OF OSTEOCLASTS

Level-1 Semester-2

Histology - MSS

BERLIN

SCAN ME

MCQ Lecture 3

BONE-1

DR M. YUSUF

MCQ on Bone-1

1. Which of the following is found in Howship's lacuna:- a) Osteoblast b) Osteoclast c) Osteocytes d) Osteoprogenitor cells e) Pericytes	**B**
2. The cell responsible for synthesis of bone matrix is:- a) Osteoclast b) Chondrocyte c) Chondrogenic cell d) Osteogenic cell e) Osteoblast	**E**
3. Osteogenic cells:- a) Cannot divide b) Exist on inner layer of periosteum c) Are absent in cancellous bone d) Differentiate into osteoclasts e) Present inside lacuna	**B**
4. What is the main type of collagen present in osteoid matrix of bone:- a) Type I b) Type II c) Type III d) Type IV e) Type V	**A**
5. Bone eating cells are:- a) Osteoblasts b) Osteoclasts c) Osteocytes d) Osteogenic cells e) Osteoprogenitor cells	**B**

6. Regarding osteocytes:- a) Oval cell with oval nucleus and deep basophilic cytoplasm b) Capable of dividing c) Present in groups in their lacunae d) Maintain bone integrity e) Can be found in the periosteum	**D**
7. Ruffled border of osteoclast is also known as:- a) Striated zone b) Clear zone c) Vesicular zone d) Basal zone e) Apical zone	**A**
8. The most common constituent in the organic component of bone is:- a) Type II collagen b) Sulfated GAGs c) Protein d) Glycoproteins e) Type I collagen	**E**
9. Osteoclasts:- a) Have acidophilic cytoplasm b) Usually have a single nucleus c) Synthesize bone matrix d) Exist mainly in periosteum e) Have regular shape	**A**
10. The bone is characterized by the following except:- a) It has hard matrix b) It is calcified epithelial tissue c) It is rich in Ca salts d) It is rich in blood supply e) It is rich in collagen type 1	**B**

11. The bone forming cells include the following except:- a) Osteocytes b) Osteoblasts c) Osteoclasts d) Osteogenic cells e) None of the above	**C**
12. Osteoclasts are derived from:- a) Osteogenic cells b) Monocytes c) Osteoblasts d) Pericytes e) Lymphocytes	**B**
13. Osteogenic cells are present in:- a) Endosteum b) Periosteum c) Bone marrow cavities d) All of the above e) None of the above	**D**
14. Osteoblast is characterized by:- a) Acidophilic cytoplasm b) Multi- nucleated c) Well-developed Golgi apparatus d) Ruffled zone e) None of the above	**C**
15. Osteocyte is characterized by:- a) Acidophilic cytoplasm b) Multilobed nucleus c) Branched cells inside lacunae d) Simple columnar ciliated e) Capable of dividing	**C**

16. Organic component of the bone matrix contains the following Except:- a) Collagen type II b) Collagen type I c) Osteonectin d) Osteocalcin e) Sulfated GAGs	**A**
17. Each of the following statements concerning osteocytes is true except:- a) They are present singly inside bony lacunae b) Their cytoplasm contains alkaline phosphatase c) They originate from blood monocytes d) They maintain hardness of bone matrix by deposition of calcium salt e) They are bone forming cells	**C**
18. All the following statements regarding osteoclasts are correct except:- a) They are large multinucleated cells b) They are found in Howship's lacunae c) They have foamy acidophilic cytoplasm d) They communicate through canaliculi connecting their lacunae together e) They contain many lysosomes	**D**
19. Which of the following is not a feature of bone:- a) It is calcified hard tissue b) It is highly vascular c) Its lacunae contain groups of chondrocytes d) It contains a system of canals and canaliculi e) It contains cells found singly inside lacunae	**C**
20. Which of the following is feature of osteoclasts:- a) Are found in Howship's lacunae b) Are derived from fibroblasts c) Are mature bone forming cells d) Have basophilic cytoplasm containing alkaline phosphatase e) Present in the inner layer of the periosteum	**A**

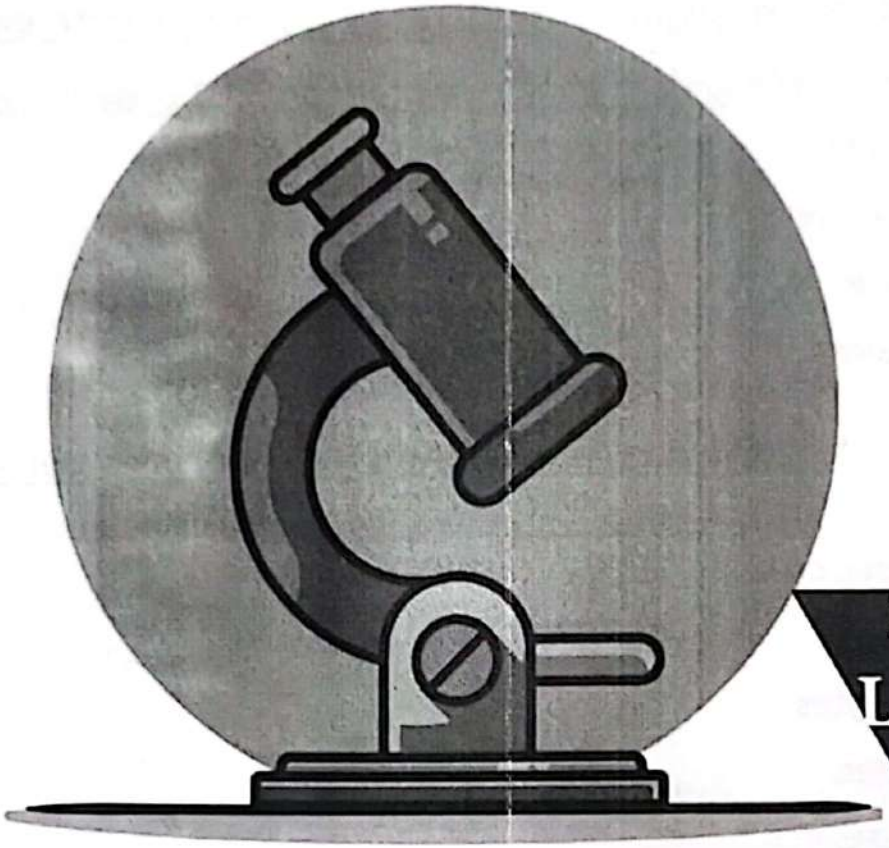
21. Regarding osteoclasts which of the following statements is true:- a) Their cytoplasm contains alkaline phosphatase b) They are branched basophilic cells c) They originate from osteogenic cells d) They are present singly inside Howship's lacunae e) They maintain hardness of bone matrix by deposition of calcium salt	**D**
22. Which of the following is true about osteoblasts:- a) Are large rounded cells with eccentric nuclei b) Are derived from blood monocytes c) Are bone eating cells d) Have dark acidophilic cytoplasm e) Contain acid phosphatase enzyme	**A**
23. Bone matrix:- a) Forms irregular lamellae in compact bone b) Is non-vascular c) Contains canaliculi connecting lacunae d) Contains no lacunae e) Is hard due to periosteum	**C**
24. Bone maintaining cell is:- a) Osteogenic cell b) Osteoblast c) Osteocyte d) Osteoclast e) Fibroblast	**C**
25. Which of the following bone cells needs an acidic medium to act well:- a) Osteoclast b) Osteoprogenitor cell c) Osteoblast d) Osteocyte e) Fibroblasts	**A**

26. Which of the following bone cells have the ability to divide:- a) Osteoblast b) Osteocyte c) Osteoclast d) Osteoprogenitor cell e) Bone macrophage	**D**
27. Bone marrow cavity is lined by:- a) Periosteum b) Internal lamellae c) External lamellae d) Endosteum e) Fibers of Sharpy	**D**
28. Which cells are responsible for bone calcification:- a) Fibroblasts b) Osteogenic cells c) Osteocytes d) Osteoblasts e) Osteoclasts	**D**
29. Which of the following is an inorganic component of bone matrix:- a) Sulfated GAGs b) Type 1 collagen c) Osteonectin d) Hydroxyapatite e) Osteocalcin	**D**

2024

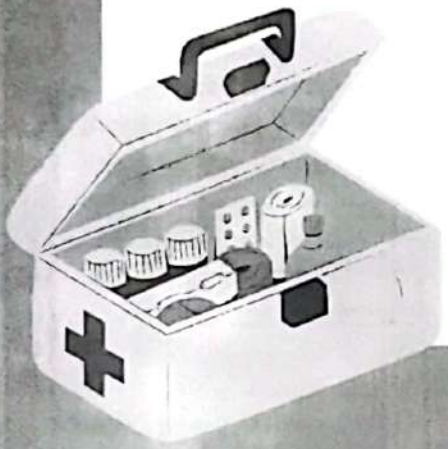
HISTOLOGY

level 1 - MSK



2
L.E

lecture 3 - MCQ



DR: A.G

1) Monocytes is the origin of which cell of the following :

A) Osteogenic cells.

B) Osteoblasts.

C) Chondrocytes

D) Osteocytes.

E) Osteoclasts

2) which of the following cells secrete Pyrophosphatase enzyme?

A) Osteogenic cells.

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3) which of the following cells present inside lacunae between bone lamellae?

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4) which of the following cells responsible for bone resorption

A) Osteogenic cells.

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1	2	3	4
E	B	D	E

5) what is the main character of Osteocalsts :

A) have acidophilic cytoplasm

B) usually have a single nucleus

C) synthesize bone matrix

D) exist mainly in periosteum

E) has regular shape

6) What is type of collagen located mainly in bone matrix?

A) Collagen type I.

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7) All the following are of Organic components of bone matrix except :

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E) Phosphorus salts

5	6	7	8
A	A	D	C

9) which of the following is deep basophilic cytoplasm?

A) Osteogenic cells.
B) Chondrocytes
C) Osteocytes.
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E) Osteoclasts

10) which of the following cells secrete Pyrophosphatase enz that inhibit pyrophosphate.

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A) Osteogenic cells.
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12) which of the following cells are capable to divide & give osteoblasts during Growth of bone?

A) Osteoblasts.
B) Chondrocytes
C) Osteocytes.
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E) Osteoclasts.

9	10	11	12
D	C	C	D

(3) which of the following cells have slightly basophilic cytoplasm and rich alkaline phosphatase?

A) Osteogenic cells.

B) Osteoblasts.

C) Osteocytes.

D) Chondrocytes

E) Osteoclasts

14) which of the following cells connected with one another by processes passing through bone canaliculi connect adjacent lacunae together?

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16) What is the main function of osteocytes?

A) Bone resorption during ossification → remodeling of bone

B) Remove bone debris during ossification & after healing of bone fracture.

C) mobilization of Ca+ from the bone to the blood in times of need

D) They are capable to divide & give osteoblasts during Growth of bone

13	14	15	16
C	B	A	C

17) which of the following cells have Multinucleated "4-50" and foamy acidophilic cytoplasm?

A) Osteogenic cells.
B) Osteoclasts.
C) Osteoblasts.
D) Chondrocytes
E) Osteocytes.

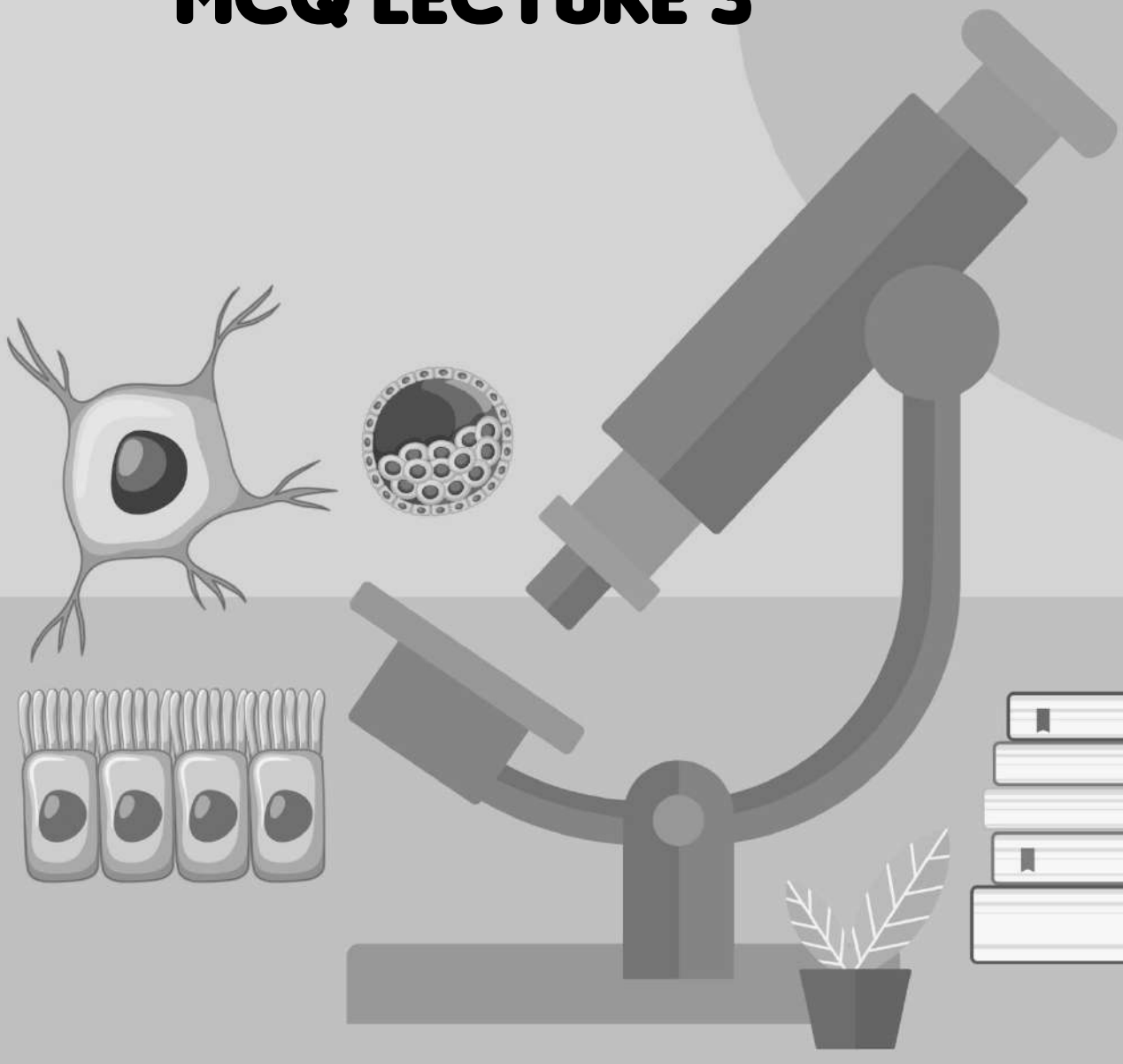
17
B

LEVEL 1

Histology

DR/ M. SH.

MCQ LECTURE 3



MCQ

1) **bone matrix is characterized by** A. contain chondrocalcin B. rich in blood supply C. non vascular D. rich in elastic fibers	**B**
2) **Osteocytes are** A. present in lacuna in groups B. responsible for bone resorption C. mature osteoblast D. present in periostium	**C**
3) **about bone all true except** A. has hard matrix B. calcified CT C. poor in blood supply D. of two general types	**C**
4) **cells of bone building function include all except** A. osteoblast B. osteogenic C. osteoclast D. osteocyte	**C**
5) **Howships lacuna is site of** A. osteoblast B. osteoclast C. osteocyte D. osteogenic	**B**
6) **about osteoclast all true except** A. multinucleated cell B. well developed golgi apperatus C. lie in Hawships lacuna D. acidophillic cytoplasm	**B**

7) **osteoblast is charaterized by** A. multinucleated cell B. well developed golgi apperatus C. lie in Hawships lacuna D. acidophillic cytoplasm	**B**
8) **all bone cells have single nucleus except** A. osteoblast B. osteoclast C. osteocyte D. osteogenic	**B**
9) **all bone cells have basophillic cytoplasm except** A. osteoblast B. osteoclast C. osteocyte D. osteogenic	**B**
10) **osteoclast originate from** A. lymphocyte B. monocyte C. pericyte D. osteocyte	**B**
11) **osteocyte has** A. acidophilic cytoplasm B. multilobed nucleus C. branched inside lacunae D. simple columnar ciliated	**C**
12) **osteogenic cell is present in** A. endostium B. periostium C. Harvensian canal D. All of the above	**D**
13) **all is part of organic matrix except** A. collagen I B. collagen II C. osteocalcin D. osteonectin	**B**

14) <u>bone maintaining cell is</u> A. osteoblast B. osteoclast C. osteocyte D. osteogenic	**B**
15) <u>bone eroding cell is</u> A. osteoblast B. osteoclast C. osteocyte D. osteogenic	**C**
16) <u>bone forming cell</u> A. osteoblast B. osteoclast C. osteocyte D. osteogenic	**B**
17) <u>all about bone except</u> A. calcified hard tissue B. highly vascular C. made of system of canals & canaliculi D. lacuna contain groups of osteocytes	**A**
18) <u>Bone matrix :2015 يناير</u> A. Soft &flexible B. Collagen type 1 form 90% of organic component C. Osteoclastin prevent calcification D. Hardness due to osteonectin E. Contain large amount of Na , Mg ,iron	**B**
19) <u>Osteoblast is rich in 2013 يناير</u> A. Acid phosphatase enzymes B. Alkaline phosphatase enzymes C. Lysosomes D. SER E. microtubules	**B**
20) <u>Bone matrix is characterized by :اسنان 2011 يناير</u> A. Has chondrocalcin B. Rich in blood supply C. Rich in elastic fibers D. Non vascular	**B**

21) <u>Osteoblasts</u> are characterized by one of the following : يناير 2010 اسنان A. Surrounded by lacunae B. Nuclei are central C. Found between bone lamella D. Have basophillic cytoplasm	**D**
22) <u>Which of the following cells are present singly in lacunae</u> A. Osteocytes B. Osteoblast C. Fibrocyte **D.** chondroblast	**A**
23) <u>Osteocytes :يناير 2010 اسنان</u> A. Are bone resorping cells B. Have long cytoplasmic processes joined by gap junction C. Originate from monocyte **D.** Lie in Howships lacunae	**B**
24) <u>Osteoclast is : يناير 2011 اسنان</u> A. From osteogenic cells B. Multinucleated C. Responsible for bone formation **D.** Secret histamine	**B**

Level-1 Semester-2

Histology - MSS

BERLIN

4L.E

SCAN ME

MCQ Lecture 3

BONE-1

DR M. YUSUF

MCQ on Bone-1

1. **Which of the following is found in Howship's lacuna:-** a) Osteoblast b) Osteoclast c) Osteocytes d) Osteoprogenitor cells e) Pericytes	B
2. **The cell responsible for synthesis of bone matrix is:-** a) Osteoclast b) Chondrocyte c) Chondrogenic cell d) Osteogenic cell e) Osteoblast	E
3. **Osteogenic cells:-** a) Cannot divide b) Exist on inner layer of periosteum c) Are absent in cancellous bone d) Differentiate into osteoclasts e) Present inside lacuna	B
4. **What is the main type of collagen present in osteoid matrix of bone:-** a) Type I b) Type II c) Type III d) Type IV e) Type V	A
5. **Bone eating cells are:-** a) Osteoblasts b) Osteoclasts c) Osteocytes d) Osteogenic cells e) Osteoprogenitor cells	B

6. Regarding osteocytes:- a) Oval cell with oval nucleus and deep basophilic cytoplasm b) Capable of dividing c) Present in groups in their lacunae d) Maintain bone integrity e) Can be found in the periosteum	D
7. Ruffled border of osteoclast is also known as:- a) Striated zone b) Clear zone c) Vesicular zone d) Basal zone e) Apical zone	A
8. The most common constituent in the organic component of bone is:- a) Type II collagen b) Sulfated GAGs c) Protein d) Glycoproteins e) Type I collagen	E
9. Osteoclasts:- a) Have acidophilic cytoplasm b) Usually have a single nucleus c) Synthesize bone matrix d) Exist mainly in periosteum e) Have regular shape	A
10. The bone is characterized by the following except:- a) It has hard matrix b) It is calcified epithelial tissue c) It is rich in Ca salts d) It is rich in blood supply e) It is rich in collagen type 1	B

11. The bone forming cells include the following except:- a) Osteocytes b) Osteoblasts c) Osteoclasts d) Osteogenic cells e) None of the above	C
12. Osteoclasts are derived from:- a) Osteogenic cells b) Monocytes c) Osteoblasts d) Pericytes e) Lymphocytes	B
13. Osteogenic cells are present in:- a) Endosteum b) Periosteum c) Bone marrow cavities d) All of the above e) None of the above	D
14. Osteoblast is characterized by:- a) Acidophilic cytoplasm b) Multi- nucleated c) Well-developed Golgi apparatus d) Ruffled zone e) None of the above	C
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16. Organic component of the bone matrix contains the following Except:- a) Collagen type II b) Collagen type I c) Osteonectin d) Osteocalcin e) Sulfated GAGs	A
17. Each of the following statements concerning osteocytes is true except:- a) They are present singly inside bony lacunae b) Their cytoplasm contains alkaline phosphatase c) They originate from blood monocytes d) They maintain hardness of bone matrix by deposition of calcium salt e) They are bone forming cells	C
18. All the following statements regarding osteoclasts are correct except:- a) They are large multinucleated cells b) They are found in Howship's lacunae c) They have foamy acidophilic cytoplasm d) They communicate through canaliculi connecting their lacunae together e) They contain many lysosomes	D
19. Which of the following is not a feature of bone:- a) It is calcified hard tissue b) It is highly vascular c) Its lacunae contain groups of chondrocytes d) It contains a system of canals and canaliculi e) It contains cells found singly inside lacunae	C
20. Which of the following is feature of osteoclasts:- a) Are found in Howship's lacunae b) Are derived from fibroblasts c) Are mature bone forming cells d) Have basophilic cytoplasm containing alkaline phosphatase e) Present in the inner layer of the periosteum	A

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25. Which of the following bone cells needs an acidic medium to act well:- a) Osteoclast b) Osteoprogenitor cell c) Osteoblast d) Osteocyte e) Fibroblasts	A

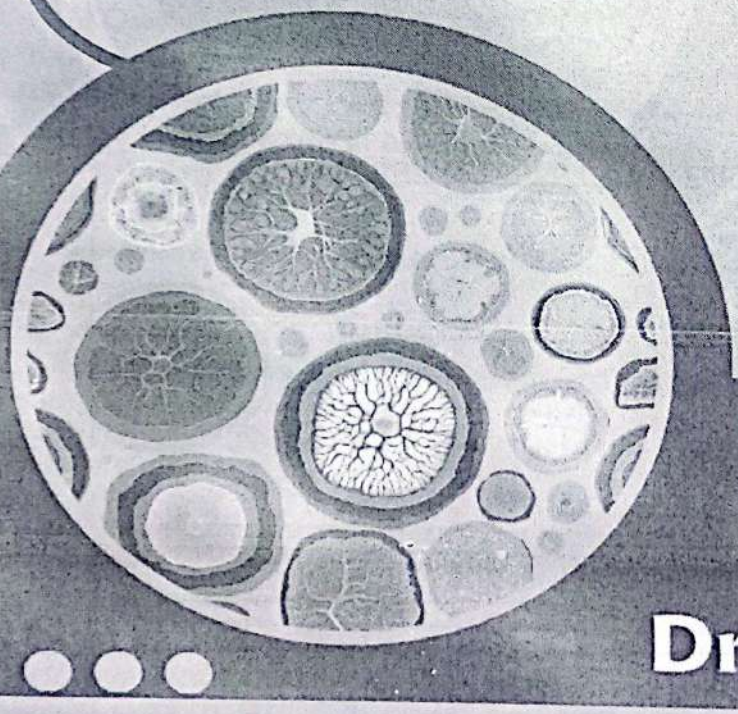
26. **Which of the following bone cells have the ability to divide:-** a) Osteoblast b) Osteocyte c) Osteoclast d) Osteoprogenitor cell e) Bone macrophage	D
27. **Bone marrow cavity is lined by:-** a) Periosteum b) Internal lamellae c) External lamellae d) Endosteum e) Fibers of Sharpy	D
28. **Which cells are responsible for bone calcification:-** a) Fibroblasts b) Osteogenic cells c) Osteocytes d) Osteoblasts e) Osteoclasts	D
29. **Which of the following is an inorganic component of bone matrix:-** a) Sulfated GAGs b) Type 1 collagen c) Osteonectin d) Hydroxyapatite e) Osteocalcin	D

Semester 2

2025

HISTOLOGY

MSS



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Lecture 3 - MCQs

Dr.A.G

1) **Monocytes is the origin of which cell of the following :**

a) Osteogenic cells.

b) Osteoblasts.

c) Chondrocytes

d) Osteocytes.

e) Osteoclasts

2) **which of the following cells secrete Pyrophosphatase enzyme?**

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3) **which of the following cells present inside lacunae between bone lamellae?**

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4) **which of the following cells responsible for bone resorption**

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1	2	3	4
E	B	D	E

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5	6	7	8
A	A	D	C

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d) Osteogenic cells.

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9	10	11	12
D	C	C	D

Which of the following cells have slightly basophilic cytoplasm and rich in alkaline phosphatase?

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b) Remove bone debris during ossification & after healing of bone fracture.
c) mobilization of Ca+ from the bone to the blood in times of need
d) They are capable to divide & give osteoblasts during Growth of bone

13	14	15	16
C	B	A	C

171 **Which of the following cells have Multinucleated "4-50" and foamy acidophilic cytoplasm?**

a) Osteogenic cells.

b) Osteoclasts.

c) Osteoblasts.

d) Chondrocytes

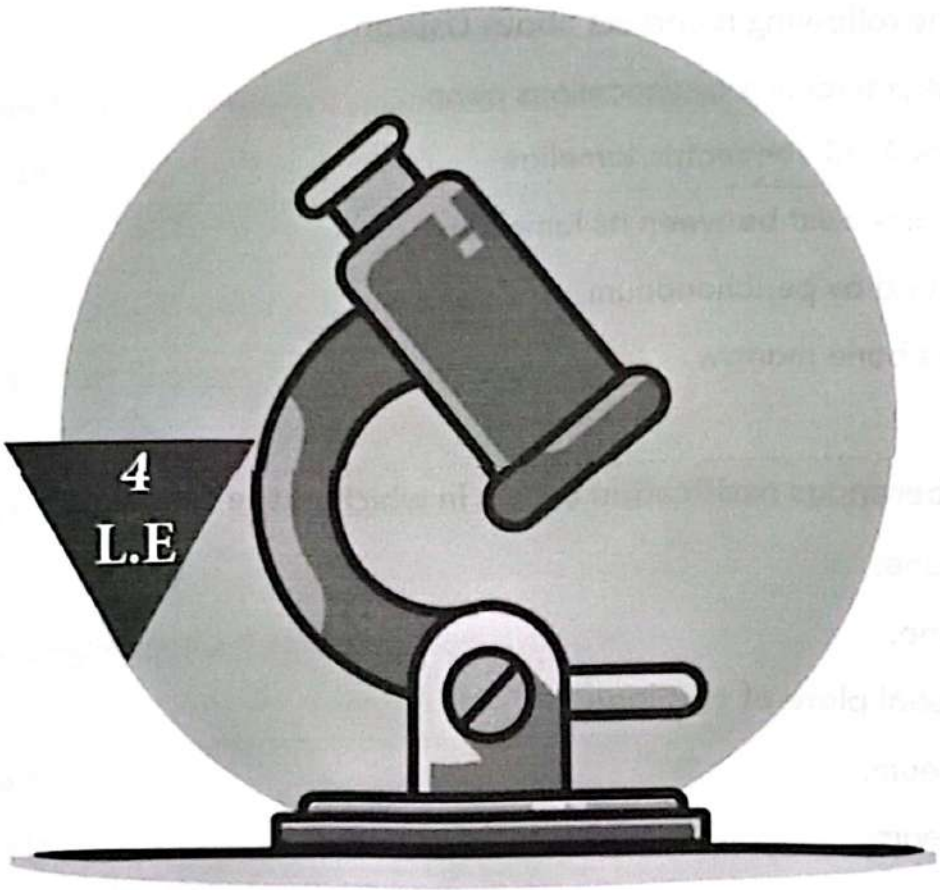
e) Osteocytes.

17
B

2024

HISTOLOGY

level 1 - MSK



lecture 4 - MCQ

DR: A.G

1) **Stage of proliferation in Intra-Cartilagenous ossification include the following :**

a) Chondrocytes divide and give large number of flat chondrocytes.

b) The chondrocytes grow in size.

c) The chondrocytes secrete Alk. Phosphatase.

d) Some osteogenic cells change to osteoblas

e) Chondrocytes embedded in their matrix

2) **which of the following is correct about Osteon :**

a) is the structural unit of cancellous bone

b) contains 4-20 concentric lamellae

c) osteoclasts exist between its lamellae

d) surrounded by perichondrium

e) contains bone marrow

3) **Intra memberanous ossification occurs in which of the following :-**

a. Long bone.

b. Flat bone.

c. Epiphyseal plate of cartilage.

d. Periosteum.

e. Endosteum

4) **Lamellae present under the periosteum and parallel to it, is :**

a) Outer "external" circumferential lamellae

b) Inner "Internal" circumferential Lamellae

c) Concentric bone lamellae

d) Interstitial Lamellae

e) Intermediate lamellae

1	2	3	4
A	B	B	A

5) **Calcified osteoid tissue present between Haversian systems is considered which of the following?**

a) Outer "external" circumferential lamellae
b) Inner "Internal" circumferential Lamellae
c) Concentric bone lamellae
d) Interstitial Lamellae
e) Intermediate lamellae

6) **Transverse or oblique canals connect Haversian canals together and with periosteal or endosteal blood vessels is?**

a) Osteon
b) Volkman's canals
c) Perforating fibers of Sharpy
d) Interstitial Lamellae
e) Intermediate lamellae

7) **What is type of collagen located mainly in bone matrix?**

a. Collagen type I.
b. Collagen type II.
c. Collagen type III.
d. Collagen type IV.
e. Collagen type V

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a. Long bone.
b. Flat bone.
c. Epiphyseal plate of cartilage.
d. Periosteum.
e. Endosteum.

5	6	7	8
D	B	A	C

9) **Which of the following describes interhaversian lamellae?**

a) 4-20 cylinders of concentric bone lamellae

b) calcified osteoid tissue between haversian systems

c) parallel and under periosteum

d) parallel to medullary cavity, contain bone marrow

10) **Which of the following is characterized by solid like ivory with no apparent holes?**

a) spongy bone

b) hyaline cartilage

c) white fibro cartilage

d) compact bone

e) cancellous bone

11) **how many cylinders of concentric bone lamellae arranged around haversian canal?**

a) 2-10

b) 4-20

c) 5-50

d) 100-200

e) 50-60

12) **Which of the following structures present in central part of flat bones of skull?**

a) hyaline cartilage

b) white fibro cartilage

c) compact bone

d) cancellous bone

9	10	11	12
B	D	B	D

13) **which of the following structures characterized by irregular arranged bars or trabeculae of bone lamellae?**

a) spongy bone
b) hyaline cartilage
c) white fibro cartilage
d) compact bone

14) **which of the following fix periosteum to bone?**

a) volkman's canals
b) bone lamellae
c) osteon
d) perforating fibers of sharpy
e) osteocytes

15) **Which OF THE following form primary ossification center in intramembranous ossification?**

a) osteoblast
b) osteocytes
c) UMCs
d) bone marrow
e) osteoclast

16) **Which of the following synthetize bone matrix?**

a) osteocytes
b) osteoblasts
c) osteoprogenitor
d) osteogenic cells
e) osteoclast

13	14	15	16
A	D	C	B

17) **In which stage in intracartilagnous ossification chondrocytes grow in size and lacunae widens**

a) stage of profileration
b) stage of invasion
c) spongy bone formation
d) maturation and hypertrophy
e) remodeling

18) **In which stage in intracartilagnous ossification chondrocytes secrete alkaline phosphatase?**

a. stage of profileration
b. stage of invasion
c. calcification
d. maturation and hypertrophy
e. remodeling

19) **In which stage in intracartilagnous ossification chondrocytes divide?**

a) stage of proliferation
b) stage of invasion
c) spongy bone formation
d) maturation and hypertrophy
e) remodeling

17	18	19
D	C	A

20) **In which stage in intracartilagnous ossification vascular mesenchymal tissue fill the empty spaces**

a. stage of profileration
b. stage of invasion
c. spongy bone formation
d. maturation and hypertrophy
e. remodeling

21) **In which stage in intracartilagnous ossification osteoclast destruct bars of bones and osteoblast form the lamellae**

a. stage of profileration
b. stage of invasion
c. spongy bone formation
d. maturation and hypertrophy
e. remodeling and compact bone formation

20	21
B	

Level-1 Semester-2

Histology - MSS

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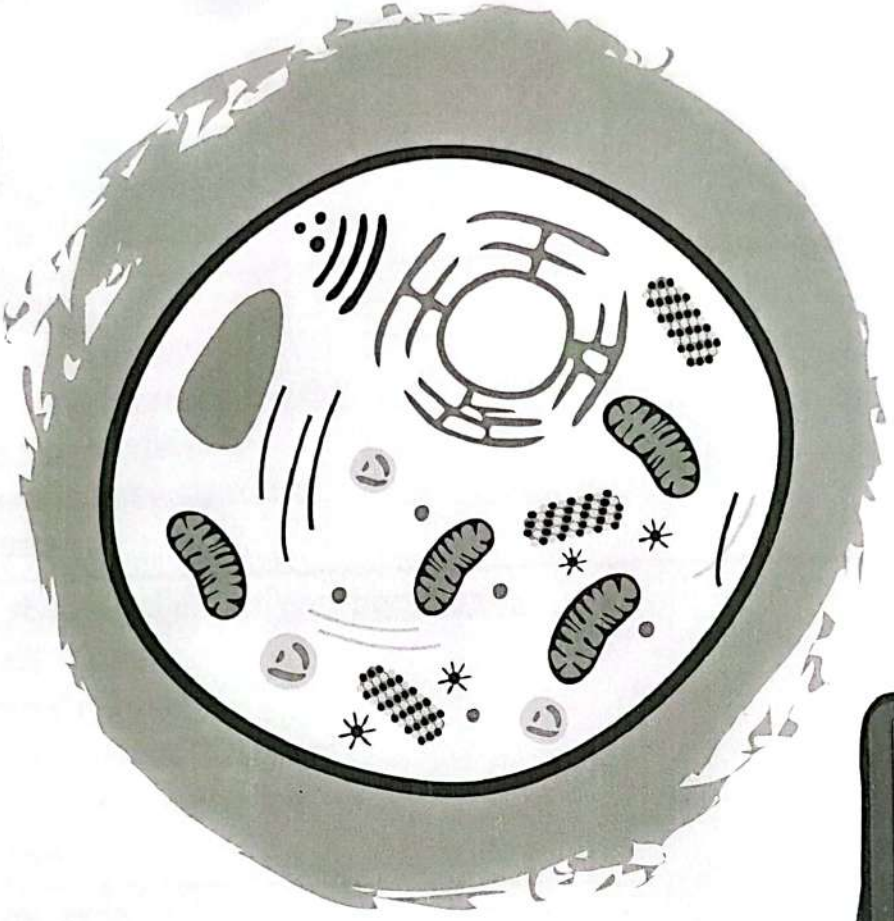


SCAN ME

MCQ Lecture 4

BONE-2

DR M. YUSUF

MCQ on Bone-2

1. Which is the structural unit of bones:- a) Osteoblast b) Periosteum c) Osteon d) Endosteum e) Osteocytes	**C**
2. Regarding Haversian canals:- a) Oblique canals b) Act as ossification center c) Contains Vascular CT d) Lined by chondrogenic cells e) Connecting Volkmann canals	**C**
3. Osteon shows:- a) Volkmann canals b) Perforating fibers of Sharpy c) Osteoblasts in lacuna d) Concentric bone lamellae e) Cell nests	**D**
4. What is the structural unit of compact bone:- a) Haversian Canal b) Volkmann's Canal c) Haversian system "Osteon" d) Concentric bone lamellae e) Osteocytes	**C**
5. Volkmann's canal is:- a) Oblique canal between Haversian system b) Oblique canal between periosteum and endosteum c) Transverse canals between osteocytes d) Longitudinal canal in the bone e) Lined with osteoclast cell	**A**

6. Osteon:- a) Is the structural unit of cancellous bone b) Contains 4-20 concentric lamellae c) Osteoclasts exist between its lamellae d) Surrounded by perichondrium e) Contains bone marrow	**B**
7. Intra membranous ossification occurs in:- a) Long bone b) Flat bone c) Epiphyseal plate of cartilage d) Periosteum e) Endosteum	**B**
8. Perforating fibers of Sharpy anchor the matrix with:- a) Haversian canal b) Periosteum c) Endosteum d) Volkmann's canal e) Bone canaliculi	**B**
9. Haversian system shows:- a) Concentric bone lamellae b) Layers of osteocytes c) Haversian canal d) All of the above e) None of the above	**D**
10. Intra-cartilaginous ossification occurs in:- a) Periosteum b) Endosteum c) Epiphyseal plate d) Flat bone e) None of the above	**C**

11. **Cancellous bone is present in:-** a) Outer layer of periosteum b) Central part of the skull bones c) Outer cover of ribs d) Shaft of Long bone e) All of the above	B
12. **All the following statements regarding compact bone are true except:-** a) It is found in the shaft of long bones b) A perichondrium covers its outer surface c) It is composed of Haversian systems d) It contains Haversian systems running longitudinally with the long axis of bone e) It has perforating fibers of Sharpy	B
13. **Which of the following is not a feature of spongy bone:-** a) It consists of irregular bone trabeculae b) It is found in the epiphysis of long bones c) It has Haversian systems d) Its bone trabeculae are branching and anastomosing e) It contains bone marrow spaces	C
14. **Haversian systems in compact bone are interconnected together by:-** a) Interstitial lamellae b) Circumferential lamellae c) Concentric lamellae d) The periosteum e) Volkmann's canals	E
15. **All the following are true about Haversian systems except:-** a) Are the structural units of spongy bone b) Contain central Haversian canals c) Are surrounded by concentric lamellae of calcified collagen d) Contain osteocytes inside their lacunae e) Are connected to the periosteum by Volkmann's canals	A

16. Which zone of endochondral ossification contain the largest cell:- a) Zone of hypertrophic cartilage b) Zone of invasion c) Zone of ossification d) Zone of proliferation e) Zone of resting cartilage	**A**
17. Which type of collagen is mainly found in compact bone:- a) Collagen Type I b) Collagen Type II c) Collagen Type III d) Collagen Type IV e) Collagen Type V	**A**
18. The periosteum is fixed to the underlying structure by:- a) Howship's lacunae b) Sharpy fibers c) Volkmann canal d) Haversian canal e) Bone canaliculi	**B**
19. The process by which most of the Flat bones are formed:- a) Membranous ossification b) Endochondral ossification c) Synochondrosis d) Synostosis e) Exostosis	**A**
20. What is the formation of bone in presence of cartilagenous model called:- a) Intracartilagenous b) Intramembranous c) Lamellar d) Non-lamellar e) Osteon	**A**

21. Spongy bone is present in:- a) Shaft of long bone b) Outer cover of vertebrae c) Young embryonic bone d) Outer cover of ribs e) Inner table of skull	C
22. Number of concentric bone lamellae in one osteon:- a) 1-2 b) 3-6 c) 4-20 d) 15-40 e) 30-50	C
23. In which stage of cartilaginous ossification chondrocytes accumulate glycogen and alkaline phosphatase:- a) Stage of resting cartilage b) Stage of proliferation c) Stage of hypertrophy and maturation d) Stage of calcification e) Stage of invasion	C
24. Death of cells leaving empty lacunae occurs in which stage of ossification:- a) Stage of resting cartilage b) Stage of proliferation c) Stage of hypertrophy and maturation d) Stage of calcification e) Stage of invasion	D

Level-1 Semester-2

Histology - MSS

BERLIN

4L.E

SCAN ME

MCQ Lecture 4

BONE-2

DR M. YUSUF

MCQ on Bone-2

1. **Which is the structural unit of bones:-** a) Osteoblast b) Periosteum c) Osteon d) Endosteum e) Osteocytes	C
2. **Regarding Haversian canals:-** a) Oblique canals b) Act as ossification center c) Contains Vascular CT d) Lined by chondrogenic cells e) Connecting Volkmann canals	C
3. **Osteon shows:-** a) Volkmann canals b) Perforating fibers of Sharpy c) Osteoblasts in lacuna d) Concentric bone lamellae e) Cell nests	D
4. **What is the structural unit of compact bone:-** a) Haversian Canal b) Volkmann's Canal c) Haversian system "Osteon" d) Concentric bone lamellae e) Osteocytes	C
5. **Volkmann's canal is:-** a) Oblique canal between Haversian system b) Oblique canal between periosteum and endosteum c) Transverse canals between osteocytes d) Longitudinal canal in the bone e) Lined with osteoclast cell	A

6. **Osteon:-** a) Is the structural unit of cancellous bone b) Contains 4-20 concentric lamellae c) Osteoclasts exist between its lamellae d) Surrounded by perichondrium e) Contains bone marrow	B
7. **Intra membranous ossification occurs in:-** a) Long bone b) Flat bone c) Epiphyseal plate of cartilage d) Periosteum e) Endosteum	B
8. **Perforating fibers of Sharpy anchor the matrix with:-** a) Haversian canal b) Periosteum c) Endosteum d) Volkmann's canal e) Bone canaliculi	B
9. **Haversian system shows:-** a) Concentric bone lamellae b) Layers of osteocytes c) Haversian canal d) All of the above e) None of the above	D
10. **Intra-cartilaginous ossification occurs in:-** a) Periosteum b) Endosteum c) Epiphyseal plate d) Flat bone e) None of the above	C

11. **Cancellous bone is present in:-** a) Outer layer of periosteum b) Central part of the skull bones c) Outer cover of ribs d) Shaft of Long bone e) All of the above	B
12. **All the following statements regarding compact bone are true except:-** a) It is found in the shaft of long bones b) A perichondrium covers its outer surface c) It is composed of Haversian systems d) It contains Haversian systems running longitudinally with the long axis of bone e) It has perforating fibers of Sharpy	B
13. **Which of the following is not a feature of spongy bone:-** a) It consists of irregular bone trabeculae b) It is found in the epiphysis of long bones c) It has Haversian systems d) Its bone trabeculae are branching and anastomosing e) It contains bone marrow spaces	C
14. **Haversian systems in compact bone are interconnected together by:-** a) Interstitial lamellae b) Circumferential lamellae c) Concentric lamellae d) The periosteum e) Volkmann's canals	E
15. **All the following are true about Haversian systems except:-** a) Are the structural units of spongy bone b) Contain central Haversian canals c) Are surrounded by concentric lamellae of calcified collagen d) Contain osteocytes inside their lacunae e) Are connected to the periosteum by Volkmann's canals	A

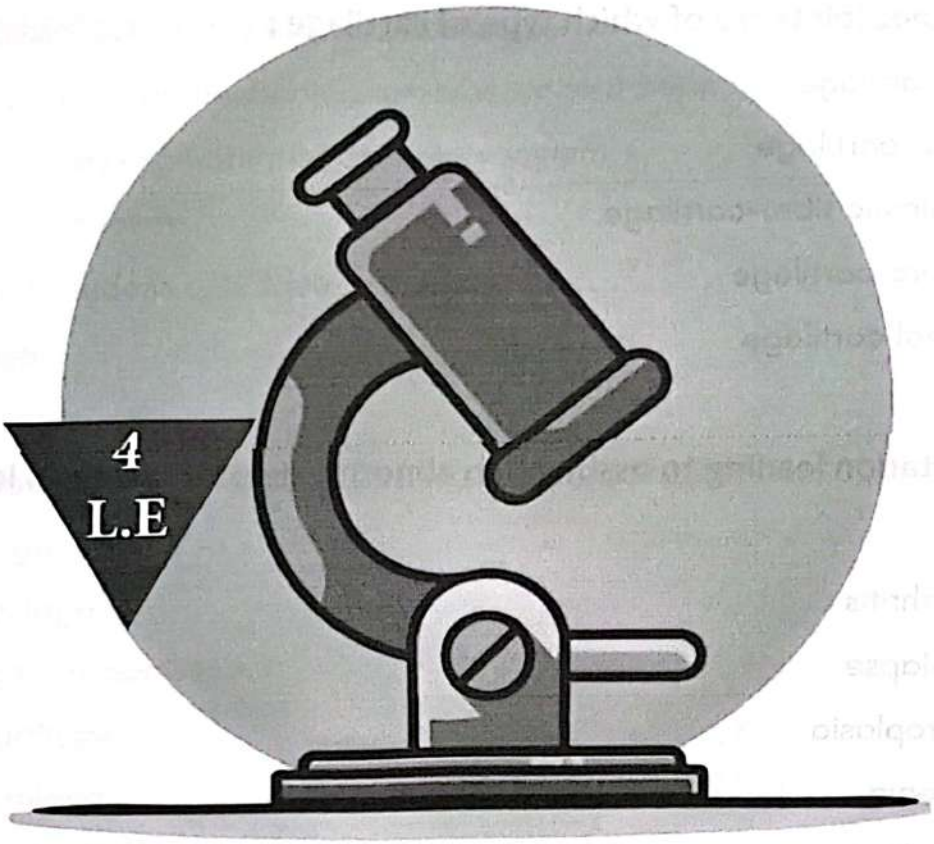
16. **Which zone of endochondral ossification contain the largest cell:-** a) Zone of hypertrophic cartilage b) Zone of invasion c) Zone of ossification d) Zone of proliferation e) Zone of resting cartilage	A
17. **Which type of collagen is mainly found in compact bone:-** a) Collagen Type I b) Collagen Type II c) Collagen Type III d) Collagen Type IV e) Collagen Type V	A
18. **The periosteum is fixed to the underlying structure by:-** a) Howship's lacunae b) Sharpy fibers c) Volkmann canal d) Haversian canal e) Bone canaliculi	B
19. **The process by which most of the Flat bones are formed:-** a) Membranous ossification b) Endochondral ossification c) Synochondrosis d) Synostosis e) Exostosis	A
20. **What is the formation of bone in presence of cartilagenous model called:-** a) Intracartilagenous b) Intramembranous c) Lamellar d) Non-lamellar e) Osteon	A

21. **Spongy bone is present in:-** a) Shaft of long bone b) Outer cover of vertebrae c) Young embryonic bone d) Outer cover of ribs e) Inner table of skull	C
22. **Number of concentric bone lamellae in one osteon:-** a) 1-2 b) 3-6 c) 4-20 d) 15-40 e) 30-50	C
23. **In which stage of cartilaginous ossification chondrocytes accumulate glycogen and alkaline phosphatase:-** a) Stage of resting cartilage b) Stage of proliferation c) Stage of hypertrophy and maturation d) Stage of calcification e) Stage of invasion	C
24. **Death of cells leaving empty lacunae occurs in which stage of ossification:-** a) Stage of resting cartilage b) Stage of proliferation c) Stage of hypertrophy and maturation d) Stage of calcification e) Stage of invasion	D

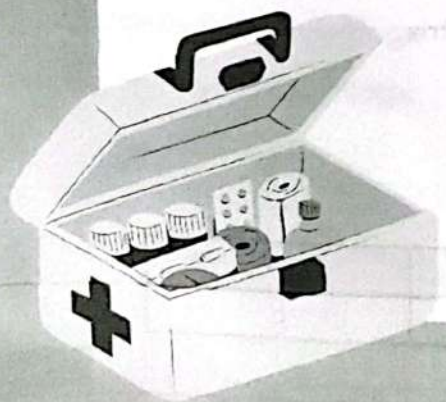
2024

HISTOLOGY

level 1 - MSK



lecture 5 - MCQ



DR: A.G

1) **White fibro cartilage is characterized by :**

a) Not covered by perichondrium

b) Receives nourishment & O2 supply from blood vessels of surrounding C.T.

c) Matrix contains great number of coarse type I collagen fibers arranged in bundles.

d) Present in Symphysis pubis.

e) All of the above

2) **Mensci of knee joints are of which type of cartilage :**

a) Hyaline cartilage

b) Blue fibro-cartilage

c) Yellow elastic fibro-cartilage.

d) White fibro-cartilage

e) Epiphyseal cartilage

3) **Genetic mutation leading to ossification abnormality particularly in long bones of arms & legs is :**

a) Osteoarthritis

b) Disc prolapse

c) Achondroplasia

d) Osteopenia

e) Paraplegia

4) **Appositional growth is :**

a) Occurs in epiphyseal plates & within articular cartilage.

b) Growth from inside.

c) Growth by Chondrocytes divide & synthesize cartilage matrix.

d) Growth of cartilage in length

e) activation of chondroblasts in the chondrogenic layer

1	2	3	4
E	D	C	E

5) **Degenerative change in articular cartilages of knee joint leading to rubbing with pain is :**

a) Osteoarthritis

b) Disc prolapse

c) Achondroplasia

d) Osteopenia

e) Paraplegia

6) **Cartilage is important for which of the following?**

a) Allows the tissue to bear mechanical stresses without permanent distortion

b) Supports soft tissues especially in respiratory system.

c) Shock-absorbing In joints

d) It helps connect tendons and ligaments to bones.

e) All of the above

7) **which of the following is the most common type of cartilage?**

a) Hyaline cartilage

b) Blue fibro-cartilage

c) Yellow elastic fibro-cartilage.

d) White fibro-cartilage

e) Epiphyseal cartilage

8) **What is The most flexible & stretchable type of cartilage?**

a) Hyaline cartilage

b) Blue fibro-cartilage

c) Yellow elastic fibro-cartilage.

d) White fibro-cartilage

e) Epiphyseal cartilage

5	6	7	8
A	E	A	C

9) **What Is The strongest type of cartilage:?**

a) Hyaline cartilage

b) Blue fibro-cartilage

c) Yellow elastic fibro-cartilage.

d) White fibro-cartilage

e) Epiphyseal cartilage

10) **Ear Auricle & External auditory meatus are of which type of cartilage ?**

a) Hyaline cartilage

b) Blue fibro-cartilage

c) Yellow elastic fibro-cartilage.

d) White fibro-cartilage

e) Epiphyseal cartilage

11) **Which of the following statements regarding the chondroblasts is true?**

a) Arise from blood monocytes.

c) Have granulated pale basophilic cytoplasm.

d) Responsible of interstitial growth.

e) Are located in the inner perichondrium layer.

12) **One of the following is considered cartilage disorder:**

a) Disc prolapse

b) Paget disease

c) Pemphigoid

d) Osteomalcia

e) Rickets

9	10	11	12
D	C	E	A

13) **Which is true about hyaline cartilage?**

a) Is the strongest type of cartilage

b) Abundant in elastic fibrils

c) Present in trachea

d) Contains type I collagen fibrils

e) Covered by perichondrium in articular surfaces of bones

14) **Hyaline cartilage contain which type of collagen :**

a) Type I

b) Type II

c) Type III

d) Type IV

e) Type V

15) **White fibro-cartilage contain which type of collagen :**

a) Type I

b) Type II

c) Type III

d) Type IV

e) Type V

16) **Cartilage matrix is considered which of the following?**

a) Vascular with capillaries

b) Fibers not have same refractive index of amorphous substance

c) Acidophilic

d) Basophilia is concentrated around lacuna & cell nests

e) Metatchromatic stain with Trypan blue

13	14	15	16
C	B	A	D

17) **Interterritorial matrix is characterized by the following?**

a) Surround lacuna of chondrocytes

b) Occupies the majority of space between chondrocytes.

c) Part of outer fibrous layer

d) Part of inner chondrogenic layer

e) Responsible for new cartilage formation during Growth

18) **Concentrated areas of matrix around lacuna & cell nests is called :**

a) Capsular matrix.

b) Perichondrium

c) Outer fibrous layer

d) Inner chondrogenic layer

e) Epiphyseal plates

19) **Tears of annulus in intervertebral disc & herniation of Nucleus causing compression on nerve root.**

a) Osteoarthritis

b) Disc prolapse

c) Achondroplasia

d) Osteopenia

e) Paraplegia

20) **Appositional growth is characterized by which of the following**

a) Occurs in epiphyseal plates & within articular cartilage.

b) Growth from within.

c) Growth by Chondrocytes divide & synthesize cartilage matrix.

d) Growth of cartilage in width.

e) None of the above

17	18	19	20
B	A	B	D

21) **What is the type of cartilage present in Thyroid Cartilage?**

a) Hyaline cartilage
b) Blue fibro-cartilage
c) Yellow elastic fibro-cartilage.
d) White fibro-cartilage
e) Epiphyseal cartilage

22) **Hyaline cartilage is present in which of the following?**

a) Eustachian tube.
b) Epiglottis.
c) Interverterbal discs.
d) Symphysis pubis.
e) Costal cartilage

23) **Yellow elastic fibro-cartilage is present in which of the following?**

a) Eustachian tube.
b) Interverterbal discs.
c) Foetal skeleton.
d) Costal cartilage
e) Thyroid Cartilage.

24) **White fibrocartilage is present in which of the following?**

a) Eustachian tube.
b) Interverterbal discs.
c) Foetal skeleton.
d) Costal cartilage
e) Thyroid Cartilage

21	22	23	24
A	E	A	B

Level-1 Semester-2

Histology - MSS

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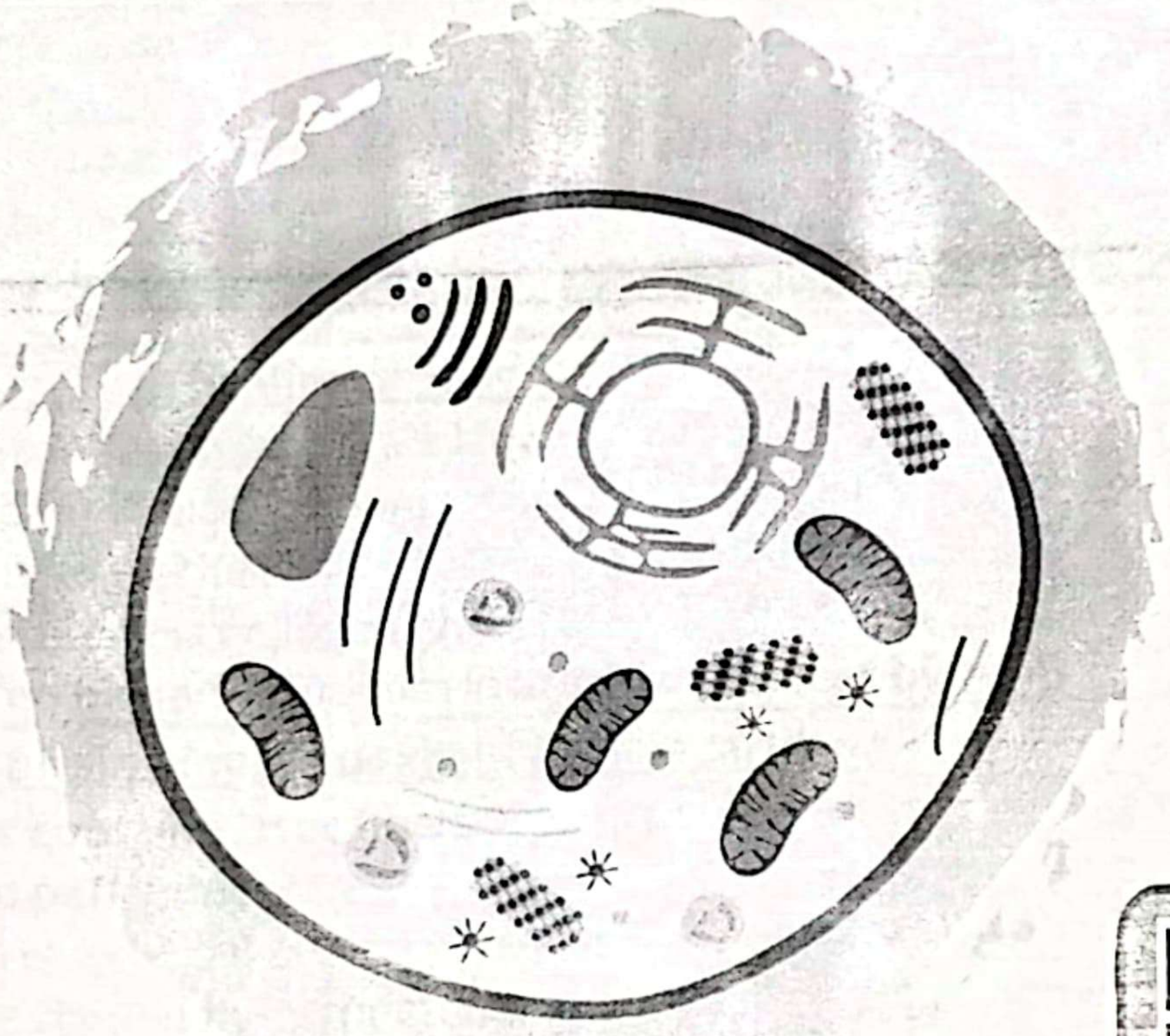

MCQ Lecture 5

SCAN ME

CARTILAGE

DR M. YUSUF

MCQ on Cartilage

1. **Which of the following statements regarding chondroblasts is true:-** a) Arise from blood monocytes b) Can form isogenic groups c) Have granular pale basophilic cytoplasm d) Responsible for interstitial growth e) Are located in the inner perichondrium layer	**E**
2. **One of the followings is considered a cartilage disorder:-** a) Disc prolapse b) Paget disease c) Pemphigoid d) Osteomalacia e) Rickets	**A**
3. **Which is true about hyaline cartilage:-** a) The strongest type of cartilage b) Abundant in elastic fibers c) Present in trachea d) Contains type 1 collagen fibrils e) Covered by perichondrium in articular surfaces of bone	**C**
4. **Which of the following is true about hyaline cartilage:-** a) Matrix contain elastic fibers b) Has no perichondrium c) Found in external auditory meatus d) Can be stained by Verhoeff stain e) Matrix contains collagen type 2	**E**
5. **Which of the followings is true about perichondrium:-** a) Formed of 3 layer b) The outer layer is chondrogenic c) The inner layer is vascular d) Non-vascular e) Not found in white fibrocartilage	E

6. **Regarding young chondrocytes:-**
   a) They have granular, basophilic cytoplasm
   b) They are present in lacunae in groups
   c) Form cell nests
   d) Contain alkaline phosphatase enzyme
   e) Found at the periphery of the cartilage

7. **Elastic fibrocartilage is characterized by:-** **C**
   a) Resist Stretch
   b) Has no perichondrium
   c) Yellow in fresh state
   d) Contains collagen type I
   e) Stain yellow with Verhoeff stain

8. **What is type of collagen located mainly in white fibro-cartilage matrix:-** **A**
   a) Collagen type I
   b) Collagen type II
   c) Collagen type III
   d) Collagen type IV
   e) Collagen type V

9. **Regarding hyaline cartilage which of the following is true:-** **E**
   a) Matrix contains elastic fiber
   b) There is no perichondrium
   c) Found in external auditory meatus
   d) Can be stained with Verhoeff
   e) Matrix contains collagen fibers type II

10. **Which is not true regarding elastic fibrocartilage:-** **D**
   a) Found in external auditory meatus
   b) Can be stained with Verhoeff
   c) Matrix contains elastic fibers
   d) There is no perichondrium
   e) Chondrocytes are present singly or in groups at lacunae

11. What type of cartilage present at intervertebral disc:- a) Hyaline cartilage b) Elastic fibrocartilage c) White fibrocartilage d) Glassy cartilage e) None of the above	C
12. What type of cartilage present at fetal skeleton:- a) Hyaline cartilage b) Elastic fibrocartilage c) White fibrocartilage d) Membranous cartilage e) None of the above	A
13. Cartilage matrix is stained .... with Toluidine blue:- a) Magenta b) Red c) Black d) Yellow e) Purple	E
14. What type of cartilage provide smooth surface for articulation:- a) Hyaline cartilage b) Elastic fibrocartilage c) White fibrocartilage d) Membranous cartilage e) None of the above	A
15. What type of cartilage is considered the strongest type:- a) Hyaline cartilage b) Elastic fibrocartilage c) White fibrocartilage d) Glassy cartilage e) None of the above	C

16. Regarding cartilage matrix which of the following is not true:- a) Gives strong PAS positivity b) Gives purple color when stained with toluidine blue c) Gives Heterogenous basophilic color when stained with Hx & E d) May appear acidophilic in cases of white fibrocartilage e) Yellow elastic fibrocartilage may appear black with Verhoeff stain	
17. Regarding Appositional growth of cartilages which of the following is true:- a) It is growth of cartilage in length b) Mediated primarily by chondroblasts c) Mediated primarily by chondrocytes d) It is growth of the cartilage from within e) Seen in epiphyseal plate of long bones	***B***
18. Chondrocytes show the following except:- a) May present single in lacuna b) May present in cell nests c) Show mitotic figures d) They can't divide e) Rich in alkaline phosphatase	***D***
19. Matrix of hyaline cartilage shows the following except:- a) It is stained vitally by trypan blue b) It is rich in collagen type II c) Tissue fluid constitute 75% of its weight d) It is non-vascular e) Rich in proteoglycans	**A**
20. The following are true regarding hyaline cartilage except:- a) It is weight bearing tissue b) Has perichondrium c) Rich in blood supply d) Appears translucent in fresh state e) Contains mainly collagen fibers type 2	C

21.<u>The perichondrium shows the following except:-</u> a) It is responsible for interstitial growth of cartilage b) Its outer fibrous layer is rich in collagen type 1 c) Provides attachment for muscles d) It is vascular C.T membrane e) Inner layer contains chondroblasts	A
22. <u>Regarding white fibro-cartilage, one is not true:-</u> a) It is covered by perichondrium b) Transitional layer between hyaline cartilage and tendon c) It is rich in collagen type I d) Chondrocytes are arranged in rows e) Acidophilic matrix	A
23. <u>The following are sites of yellow elastic fibro-cartilage except:-</u> a) Epiglottis b) Eustachian tube c) Epiglottis d) Costal cartilage e) Ear pinna	D
24. <u>The following are sites of white –fibro cartilage except:-</u> a) Symphysis pubis b) Articular surface of bone c) Intervertebral discs d) Semilunar cartilage of knee e) None of the above	B
25. <u>The following are sites of hyaline cartilage except:-</u> a) Nose, Trachea b) Laryngeal cartilage "Thyroid and Cricoid" c) Costal cartilage d) Intervertebral disc e) Fetal skeleton	D

26. <u>Young chondrocyte shows the following except:-</u> a) It is flat cells with oval nuclei b) Present in groups in their lacunae c) Originate from inner chondrogenic layer d) Present under perichondrium e) It has basophilic cytoplasm	**B**
27. <u>Mature chondrocyte shows the following except:-</u> a) They are present in cell nests b) They can't divide c) Their surface shows short cytoplasmic processes d) Responsible for interstitial growth of the cartilage e) Granular basophilic cytoplasm	**B**
28. <u>One of the following is true for matrix of hyaline cartilage:-</u> a) It is acidophilic b) It is rich in collagen type I c) It is non-vascular d) It is stained negative by PAS e) It is stained black with Verhoeff stain	**C**
29. <u>Yellow elastic fibrocartilage shows the following except:-</u> a) Its matrix is rich in fine elastic fibers b) It can be stained with sudan black c) It is present in the ear pinna, epiglottis d) It is yellow in fresh state e) It is the most flexible cartilage	**B**
30. <u>White fibrocartilage shows the following except:-</u> a) It is white in fresh state b) It is covered by perichondrium rich in type I collage c) It is present in terminal parts of tendons d) Its matrix is acidophi e) The strongest type of cartilage	B

31. Regarding interstitial growth of the cartilage one is false:- a) It causes growth of the cartilage in width b) It occurs in epiphyseal plate c) The chondrocytes divide and synthesize the matrix d) The growth occurs from within e) None of the above	**A**
32. All the following statements about hyaline cartilage is true except:- a) It has homogenous basophilic matrix b) Its matrix contains elastic fibers c) It is found in the costal cartilage d) A layer of perichondrium is found on its surface e) It contains chondrocytes	**B**
33. Which of the following statements best describes chondrocytes:- a) They are present in the inner layer of perichondrium b) They are found in spaces called lacunae c) They are non-dividing cells d) They secrete bone extra cellular matrix e) They are found in Howship's lacunae	**B**
34. Concerning perichondrium ,all the following are true except one:- a) Has a chondrogenic layer b) It contains blood vessels c) Its deep layer contains chondrocytes d) It's a C.T membrane covering the cartilage e) It gives attachments to muscles	**C**
35. About matrix of hyaline cartilage which of the following is true:- a) Appears homogenous and basophilic b) Contains chondroitin sulfate c) Has type II collagen d) All of the above e) None of the above	**D**

36. About matrix of hyaline cartilage the followings are true except:- a) Is covered by perichondrium b) Contains cells nests c) Found in epiglottis d) Contains homogenous matrix e) PAS positive	C
37. About the perichondrium all the following are true except:- a) C.T membrane b) Contains fibrocytes and chondrocytes c) Supplies cartilage with nutrition d) Gives attachment to muscles e) Has inner chondrogenic layer	B
38. Regarding yellow elastic cartilage the following are true except:- a) Formed of cartilage cells and matrix b) Found in fetal skeleton c) Found in ear pinna d) Covered by perichondrium e) Found in epiglottis	B
39. About white fibrocartilage which of the following is wrong:- a) Covered by perichondrium b) Contains acidophilic matrix c) Contains abundant collagen fibers type 1 in the matrix d) Found in the Symphysis pubis e) Found in intervertebral disc	A
40. What is the source of cells that repair cartilage:- a) Adjacent bones b) Adjacent loose connective tissue c) Cell nests d) Perichondrium e) Stem cells circulating the blood	D

41. Which of the following sites contains hyaline cartilage:- a) Epiglottis b) External auditory meatus c) Semilunar cartilage of knee d) Symphysis pubis e) Trachea	**E**
42. Which stain would be best to demonstrate elastic fibers in elastic fibrocartilage:- a) Hematoxylin and eosin (H & E) b) Sudan III c) Silver d) Orcein e) Periodic acid Schiff (PAS)	**D**
43. The outer fibrous layer of the perichondrium:- a) Covers the articular cartilage b) Covers the white fibrocartilage c) Supplies cartilage with nutrition d) Gives attachment to the cardiac muscle e) Contains osteogenic cells for repair of fracture	**C**
44. What is the cause of basophilic appearance of hyaline cartilage matrix:- a) It contains chondroitin sulphate b) It contains type I collagen c) It contains hydroxyapatite crystals d) Due to presence of the elastic fibers e) Due to presence of the collagen fibers	A
45. Which feature is typical of elastic cartilage:- a) The most flexible type of cartilage b) Forming most of the fetal skeleton c) Formed mainly of collagen fibrils type II d) The commonest type of cartilage e) Absence of perichondrium	A

46. The type of cartilage present in the growing epiphysis:- a) Articular cartilage b) Fibro-cartilage c) Elastic cartilage d) Hyaline cartilage e) Osteo-cartilage	D
47. The following are classified as elastic cartilage except:- a) Eustachian tube b) Ear pinna c) Epiglottis d) Symphysis pubis e) External auditory meatus	D
48. The type of fibers present in the intervertebral disc cartilage:- a) Collagen type I b) Reticular fiber c) Elastic fiber d) Collagen type II e) Collagen type IV	A
49. The elastic cartilage stained brown by:- a) Osmic acid b) Verhoeff's stain c) Orcein stain d) Silver stain e) PAS stain	C
50. Articular cartilage differs from other hyaline cartilage in:- a) Absence of collagen in matrix b) Lack of blood vessels c) Lack of perichondrium d) It contains rows of chondrocyte e) Lack of chondrocytes	C

Level-1 Semester-2

Histology - MSS

BERLIN

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MCQ Lecture 5

CARTILAGE

DR M. YUSUF

MCQ on Cartilage

1. Which of the following statements regarding chondroblasts is true:- a) Arise from blood monocytes b) Can form isogenic groups c) Have granular pale basophilic cytoplasm d) Responsible for interstitial growth e) Are located in the inner perichondrium layer	E
2. One of the followings is considered a cartilage disorder:- a) Disc prolapse b) Paget disease c) Pemphigoid d) Osteomalacia e) Rickets	A
3. Which is true about hyaline cartilage:- a) The strongest type of cartilage b) Abundant in elastic fibers c) Present in trachea d) Contains type 1 collagen fibrils e) Covered by perichondrium in articular surfaces of bone	C
4. Which of the following is true about hyaline cartilage:- a) Matrix contain elastic fibers b) Has no perichondrium c) Found in external auditory meatus d) Can be stained by Verhoeff stain e) Matrix contains collagen type 2	E
5. Which of the followings is true about perichondrium:- a) Formed of 3 layer b) The outer layer is chondrogenic c) The inner layer is vascular d) Non-vascular e) Not found in white fibrocartilage	E

6. Regarding young chondrocytes:- a) They have granular, basophilic cytoplasm b) They are present in lacunae in groups c) Form cell nests d) Contain alkaline phosphatase enzyme e) Found at the periphery of the cartilage	**E**
7. Elastic fibrocartilage is characterized by:- a) Resist Stretch b) Has no perichondrium c) Yellow in fresh state d) Contains collagen type I e) Stain yellow with Verhoeff stain	**C**
8. What is type of collagen located mainly in white fibro-cartilage matrix:- a) Collagen type I b) Collagen type II c) Collagen type III d) Collagen type IV e) Collagen type V	**A**
9. Regarding hyaline cartilage which of the following is true:- a) Matrix contains elastic fiber b) There is no perichondrium c) Found in external auditory meatus d) Can be stained with Verhoeff e) Matrix contains collagen fibers type II	**E**
10. Which is not true regarding elastic fibrocartilage:- a) Found in external auditory meatus b) Can be stained with Verhoeff c) Matrix contains elastic fibers d) There is no perichondrium e) Chondrocytes are present singly or in groups at lacunae	**D**

11. What type of cartilage present at intervertebral disc:- a) Hyaline cartilage b) Elastic fibrocartilage c) White fibrocartilage d) Glassy cartilage e) None of the above	C
12. What type of cartilage present at fetal skeleton:- a) Hyaline cartilage b) Elastic fibrocartilage c) White fibrocartilage d) Membranous cartilage e) None of the above	A
13. Cartilage matrix is stained …. with Toluidine blue:- a) Magenta b) Red c) Black d) Yellow e) Purple	E
14. What type of cartilage provide smooth surface for articulation:- a) Hyaline cartilage b) Elastic fibrocartilage c) White fibrocartilage d) Membranous cartilage e) None of the above	A
15. What type of cartilage is considered the strongest type:- a) Hyaline cartilage b) Elastic fibrocartilage c) White fibrocartilage d) Glassy cartilage e) None of the above	C

16. Regarding cartilage matrix which of the following is not true:- a) Gives strong PAS positivity b) Gives purple color when stained with toluidine blue c) Gives Heterogenous basophilic color when stained with Hx & E d) May appear acidophilic in cases of white fibrocartilage e) Yellow elastic fibrocartilage may appear black with Verhoeff stain	C
17. Regarding Appositional growth of cartilages which of the following is true:- a) It is growth of cartilage in length b) Mediated primarily by chondroblasts c) Mediated primarily by chondrocytes d) It is growth of the cartilage from within e) Seen in epiphyseal plate of long bones	B
18. Chondrocytes show the following except:- a) May present single in lacuna b) May present in cell nests c) Show mitotic figures d) They can't divide e) Rich in alkaline phosphatase	D
19. Matrix of hyaline cartilage shows the following except:- a) It is stained vitally by trypan blue b) It is rich in collagen type II c) Tissue fluid constitute 75% of its weight d) It is non-vascular e) Rich in proteoglycans	A
20. The following are true regarding hyaline cartilage except:- a) It is weight bearing tissue b) Has perichondrium c) Rich in blood supply d) Appears translucent in fresh state e) Contains mainly collagen fibers type 2	C

21. The perichondrium shows the following except:- a) It is responsible for interstitial growth of cartilage b) Its outer fibrous layer is rich in collagen type 1 c) Provides attachment for muscles d) It is vascular C.T membrane e) Inner layer contains chondroblasts	**A**
22. Regarding white fibro-cartilage, one is not true:- a) It is covered by perichondrium b) Transitional layer between hyaline cartilage and tendon c) It is rich in collagen type I d) Chondrocytes are arranged in rows e) Acidophilic matrix	**A**
23. The following are sites of yellow elastic fibro-cartilage except:- a) Epiglottis b) Eustachian tube c) Epiglottis d) Costal cartilage e) Ear pinna	**D**
24. The following are sites of white –fibro cartilage except:- a) Symphysis pubis b) Articular surface of bone c) Intervertebral discs d) Semilunar cartilage of knee e) None of the above	**B**
25. The following are sites of hyaline cartilage except:- a) Nose, Trachea b) Laryngeal cartilage "Thyroid and Cricoid" c) Costal cartilage d) Intervertebral disc e) Fetal skeleton	**D**

26. Young chondrocyte shows the following except:- a) It is flat cells with oval nuclei b) Present in groups in their lacunae c) Originate from inner chondrogenic layer d) Present under perichondrium e) It has basophilic cytoplasm	**B**
27. Mature chondrocyte shows the following except:- a) They are present in cell nests b) They can't divide c) Their surface shows short cytoplasmic processes d) Responsible for interstitial growth of the cartilage e) Granular basophilic cytoplasm	**B**
28. One of the following is true for matrix of hyaline cartilage:- a) It is acidophilic b) It is rich in collagen type I c) It is non-vascular d) It is stained negative by PAS e) It is stained black with Verhoeff stain	**C**
29. Yellow elastic fibrocartilage shows the following except:- a) Its matrix is rich in fine elastic fibers b) It can be stained with sudan black c) It is present in the ear pinna, epiglottis d) It is yellow in fresh state e) It is the most flexible cartilage	**B**
30. White fibrocartilage shows the following except:- a) It is white in fresh state b) It is covered by perichondrium rich in type I collage c) It is present in terminal parts of tendons d) Its matrix is acidophilic e) The strongest type of cartilage	**B**

31. Regarding interstitial growth of the cartilage one is false:- a) It causes growth of the cartilage in width b) It occurs in epiphyseal plate c) The chondrocytes divide and synthesize the matrix d) The growth occurs from within e) None of the above	**A**
32. All the following statements about hyaline cartilage is true except:- a) It has homogenous basophilic matrix b) Its matrix contains elastic fibers c) It is found in the costal cartilage d) A layer of perichondrium is found on its surface e) It contains chondrocytes	**B**
33. Which of the following statements best describes chondrocytes:- a) They are present in the inner layer of perichondrium b) They are found in spaces called lacunae c) They are non-dividing cells d) They secrete bone extra cellular matrix e) They are found in Howship's lacunae	**B**
34. Concerning perichondrium ,all the following are true except one:- a) Has a chondrogenic layer b) It contains blood vessels c) Its deep layer contains chondrocytes d) It's a C.T membrane covering the cartilage e) It gives attachments to muscles	**C**
35. About matrix of hyaline cartilage which of the following is true:- a) Appears homogenous and basophilic b) Contains chondroitin sulfate c) Has type II collagen d) All of the above e) None of the above	**D**

36. About matrix of hyaline cartilage the followings are true except:- a) Is covered by perichondrium b) Contains cells nests c) Found in epiglottis d) Contains homogenous matrix e) PAS positive	C
37. About the perichondrium all the following are true except:- a) C.T membrane b) Contains fibrocytes and chondrocytes c) Supplies cartilage with nutrition d) Gives attachment to muscles e) Has inner chondrogenic layer	B
38. Regarding yellow elastic cartilage the following are true except:- a) Formed of cartilage cells and matrix b) Found in fetal skeleton c) Found in ear pinna d) Covered by perichondrium e) Found in epiglottis	B
39. About white fibrocartilage which of the following is wrong:- a) Covered by perichondrium b) Contains acidophilic matrix c) Contains abundant collagen fibers type 1 in the matrix d) Found in the Symphysis pubis e) Found in intervertebral disc	A
40. What is the source of cells that repair cartilage:- a) Adjacent bones b) Adjacent loose connective tissue c) Cell nests d) Perichondrium e) Stem cells circulating the blood	D

41. Which of the following sites contains hyaline cartilage:- a) Epiglottis b) External auditory meatus c) Semilunar cartilage of knee d) Symphysis pubis e) Trachea	**E**
42. Which stain would be best to demonstrate elastic fibers in elastic fibrocartilage:- a) Hematoxylin and eosin (H & E) b) Sudan III c) Silver d) Orcein e) Periodic acid Schiff (PAS)	**D**
43. The outer fibrous layer of the perichondrium:- a) Covers the articular cartilage b) Covers the white fibrocartilage c) Supplies cartilage with nutrition d) Gives attachment to the cardiac muscle e) Contains osteogenic cells for repair of fracture	**C**
44. What is the cause of basophilic appearance of hyaline cartilage matrix:- a) It contains chondroitin sulphate b) It contains type I collagen c) It contains hydroxyapatite crystals d) Due to presence of the elastic fibers e) Due to presence of the collagen fibers	**A**
45. Which feature is typical of elastic cartilage:- a) The most flexible type of cartilage b) Forming most of the fetal skeleton c) Formed mainly of collagen fibrils type II d) The commonest type of cartilage e) Absence of perichondrium	**A**

46. The type of cartilage present in the growing epiphysis:- a) Articular cartilage b) Fibro-cartilage c) Elastic cartilage d) Hyaline cartilage e) Osteo-cartilage	**D**
47. The following are classified as elastic cartilage except:- a) Eustachian tube b) Ear pinna c) Epiglottis d) Symphysis pubis e) External auditory meatus	**D**
48. The type of fibers present in the intervertebral disc cartilage:- a) Collagen type I b) Reticular fiber c) Elastic fiber d) Collagen type II e) Collagen type IV	**A**
49. The elastic cartilage stained brown by:- a) Osmic acid b) Verhoeff's stain c) Orcein stain d) Silver stain e) PAS stain	**C**
50. Articular cartilage differs from other hyaline cartilage in:- a) Absence of collagen in matrix b) Lack of blood vessels c) Lack of perichondrium d) It contains rows of chondrocyte e) Lack of chondrocytes	**C**

Level-1 Semester-2

Histology - MSS

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BEST PRICE 5 L.E

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Revision

MSS Written Qs

DR M. YUSUF

Histo MSS Written Questions

Lecture 1 (Skeletal Muscle)

1. Definition:-

a) *Epimysium*	e) Myofilaments
b) *Perimysium*	f) Sarcomere
c) *Endomysium*	g) Transverse tubules
d) Myofibril (Sarcostyle)	h) Terminal cisterns

2. Enumerate:-

a) *Involuntary skeletal muscles*
b) *Sites of skeletal muscle*
c) *Thin filaments in skeletal muscle*
d) *Components of skeletal muscle triad*

3. Compare: *Thin & Thick filaments*

4. Discuss:-

a) ***L/M of** skeletal muscle fibers **(L/S & T/S)***
b) ***E/M of** skeletal muscle fibers*
c) ***Structure of** myofibril*
d) ***Structure of** skeletal muscle triad*
e) ***Role of** skeletal muscle triad in contraction*

Lecture 2 (Cardiac muscle & Smooth muscle)

1. **Definition:-**
   a) Intercalated disc

2. **Enumerate:-**
   a) Contents of cardiac muscle sarcoplasm
   b) Types of Junctions in Intercalated discs
   c) Functions of smooth muscle

3. **Compare:-**
   a) Skeletal muscle & Smooth muscle
   b) Skeletal muscle & Cardiac muscle

4. **Discuss:-**
   a) **L/M of** Cardiac Muscle Fibers
   b) **E/M of** Cardiac muscle Myofibril
   c) **E/M of** Cardiac muscle T-tubules and Sarcoplasmic reticulum
   d) **L/M of** Intercalated discs
   e) **L/M of** Smooth muscle fibers
   f) **E/M of** Smooth muscle fibers

Lecture 3 (Bone-1)

1. **Definition:-**
   a) Periosteum
   b) Endosteum

2. **Enumerate:-**
   a) Types of Bone cells
   b) Sites of Osteogenic cells
   c) Functions of Osteoblasts
   d) Functions of Osteocytes
   e) Sites of Osteoclasts
   f) Zones found in Osteoclasts
   g) Organic components of Bone matrix
   h) Functions of Periosteum
   i) Cells present in Endosteum

3. **Compare:** Osteoblast & Osteoclast **(L/M – E/M – Functions)**

4. **Discuss:-**
   a) **L/M & E/M of** Osteogenic cells
   b) **L/M & E/M of** Osteoblasts
   c) **L/M & E/M of** Osteocytes
   d) **L/M & E/M of** Osteoclasts
   e) **Structure of** Periosteum

Lecture 4 (Bone-2)

1. Definition:-

a) Osteon
b) Volkmann's canal
c) Perforating fibers of Sharpy
d) Intramembranous ossification

2. Enumerate:-

a) Sites of Compact bone
b) Patterns of Compact bone lamellae
c) Components of Haversian system
d) Sites of Cancellous bone
e) Stages of Intracartilagenous ossification

3. Discuss:-

a) **Structure of** Osteon (Haversian system)
b) **Structure & Function of** Volkmann canals
c) **Structure of** Cancellous bone
d) **Stages of** Intramembranous ossification

Lecture 5 (Cartilage)

Definition:-

a) Perichondrium b) Cell nest c) Territorial matrix d) Interterritorial matrix	e) Achondroplasia f) Osteoarthritis g) Disc prolapse

2. Enumerate:-

a) Functions of Cartilage
b) Types of Cartilage
c) Sites of Hyaline cartilage
d) Functions of Perichondrium
e) Components of Cartilage matrix
f) Sites of Yellow elastic cartilage
g) Sites of White fibrocartilage

3. Compare:-

a) Old & Young chondrocytes **(Site – Number – L/M – E/M)**
b) Different types of Cartilage
c) Appositional & Interstitial growth

4. Discuss:-

a) ***Structure & Function of*** Perichondrium
b) ***Structure & Functions of*** Old chondrocytes
c) ***Staining of*** Cartilage matrix
d) ***Structure & Staining of*** Yellow elastic cartilage
e) ***Explain why:*** White fibrocartilage is the strongest type of cartilage
f) ***Structure of*** White fibrocartilage
g) ***Differences between*** White fibrocartilage & Hyaline cartilage