

CARTILAGE & BONE

Objectives:

- By the end of this lecture, the student should describe the microscopic structure, distribution and growth of the different types of:
 - (1) Cartilage.
 - (2) Bone.

CARTILAGE

- Cartilage is a specialized type of C.T. with a rigid matrix.
- Cartilage is **usually** nonvascular (avascular).
- **3 Types:**
 - Hyaline cartilage.
 - Elastic cartilage.
 - Fibrocartilage.

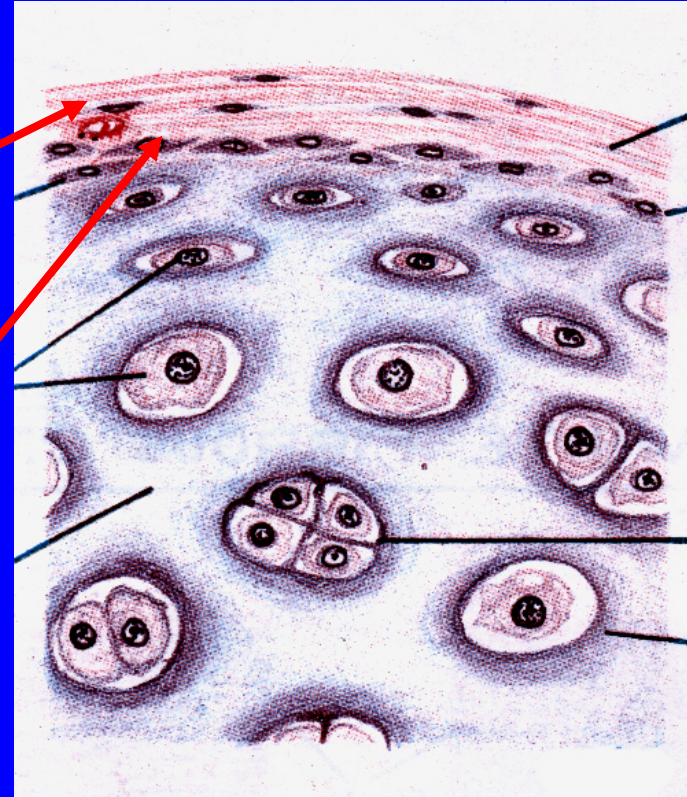
Hyaline Cartilage

1- Perichondrium:

– Vascular C.T. membrane formed of 2 layers:

» Outer fibrous layer: dense fibrous C.T.

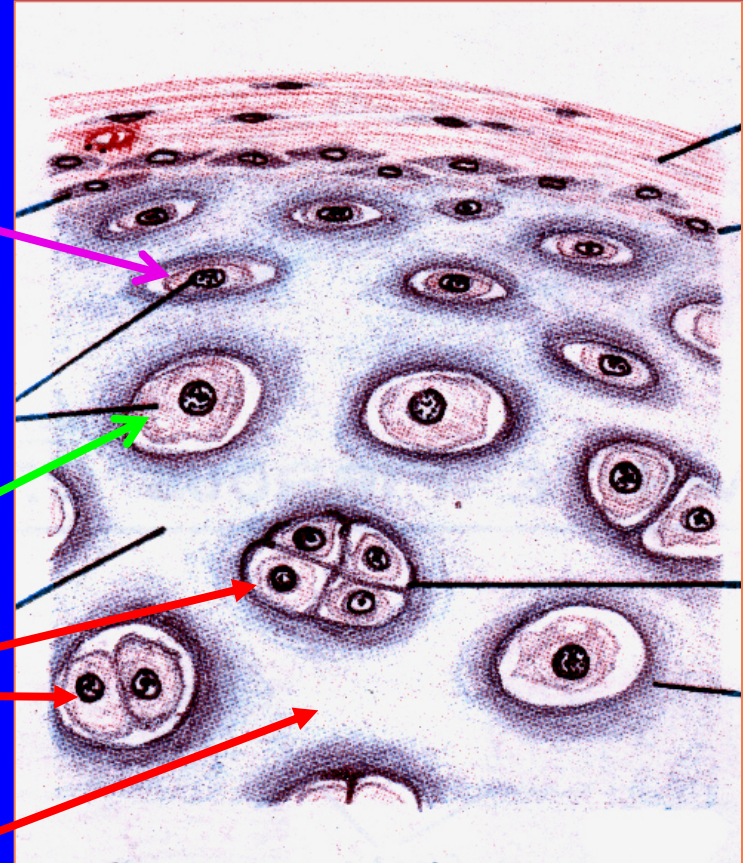
» Inner chondrogenic layer: contains chondroblasts (no lacunae). They secrete cartilage matrix and give rise to chondrocytes.



Hyaline Cartilage

2- Cells (Chondrocytes):

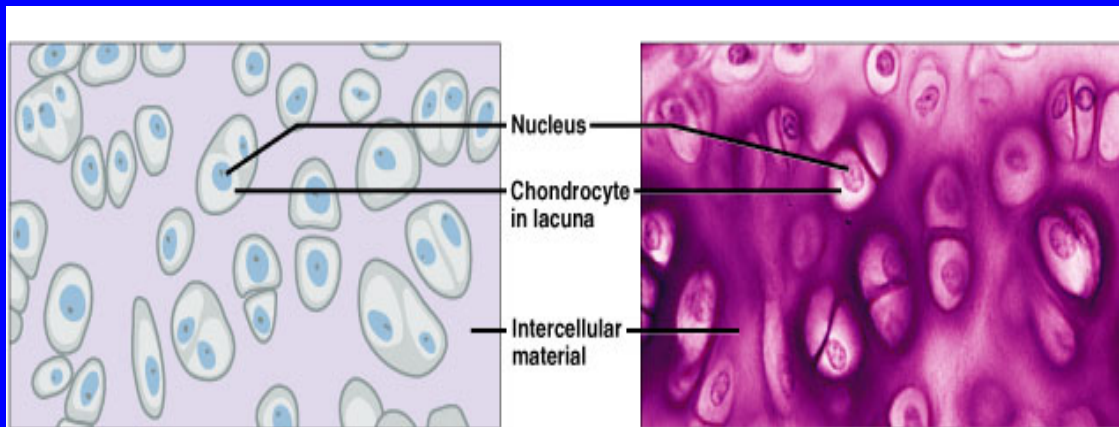
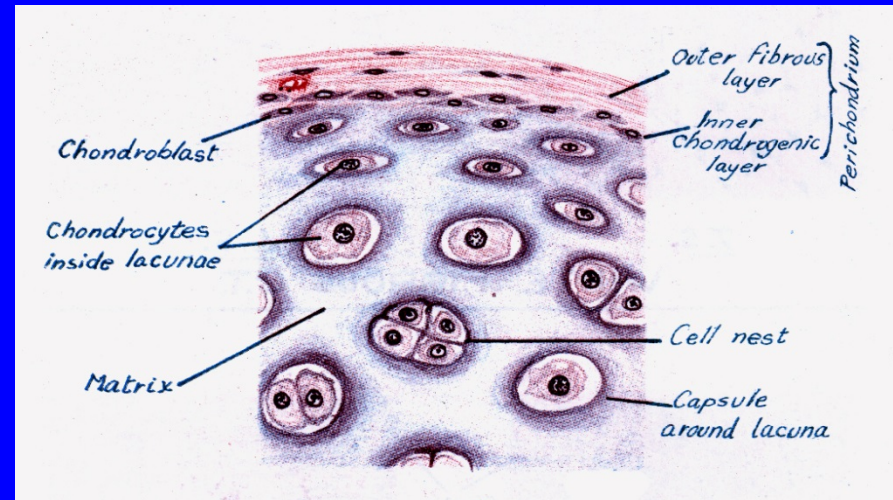
- Found in spaces called lacunae.
- **Young chondrocytes:** are small & present singly in their lacunae.
- **Mature chondrocytes:** are large, and are found **singly** or in groups of 2, 4 or 6 cells in their lacunae (cell nests).



3- Matrix:

- Homogeneous and **basophilic**.
- Contains **collagen type II**.

Hyaline Cartilage

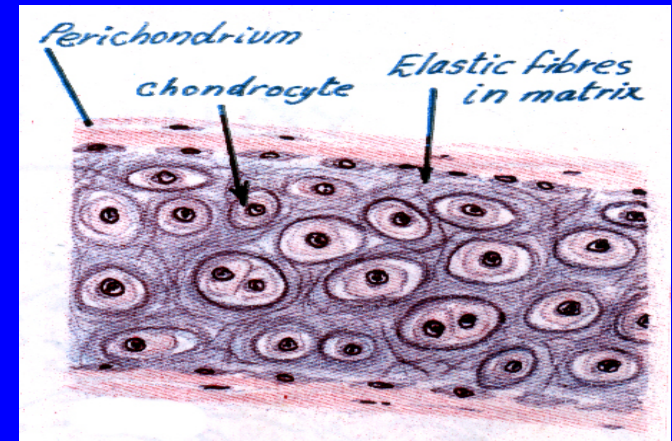


Hyaline Cartilage

- Sites of hyaline cartilage:
 - Foetal skeleton.
 - Costal cartilages.
 - Articular surfaces of bones.
 - Nose, trachea & bronchi.

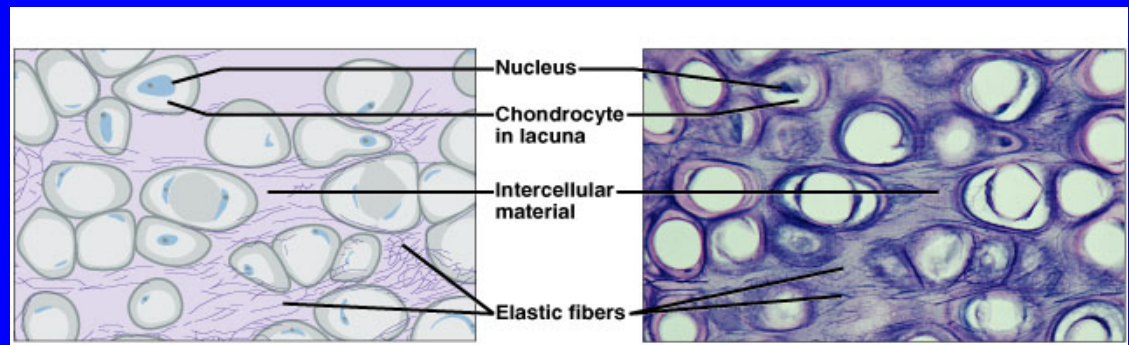
Elastic Cartilage

- Similar to hyaline cartilage + elastic fibres in the matrix.



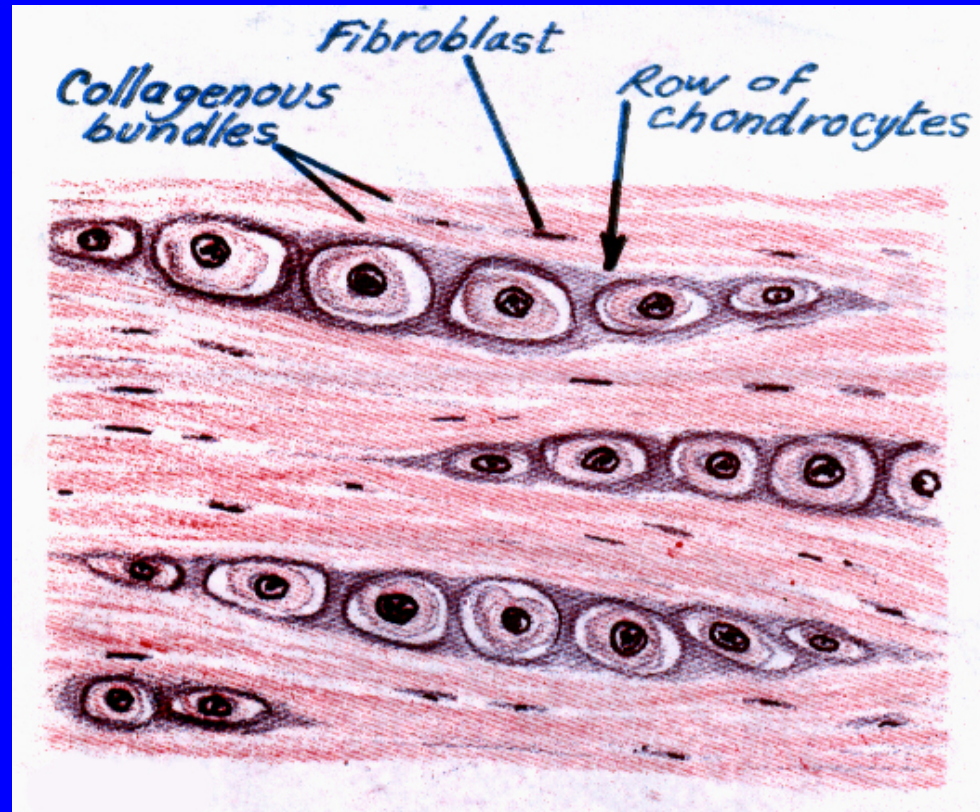
- Sites:

- External ear.
- Epiglottis.



Fibrocartilage

- No perichondrium.
- Rows of chondrocytes in lacunae separated by parallel bundles of collagen fibers (type I).
- Sites:
e.g. Intervertebral disks.



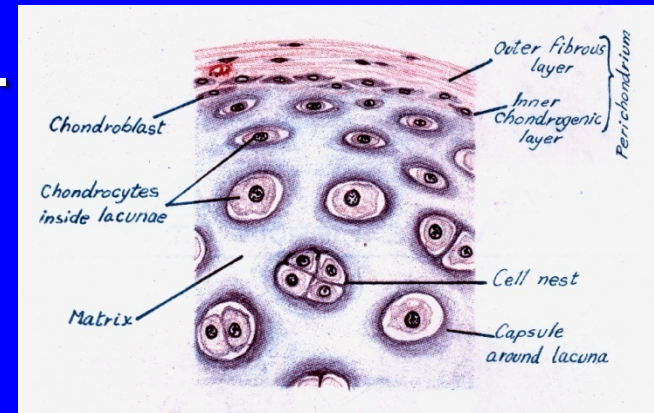
Growth of cartilage

1. Appositional growth:

- Is produced by the activity of Chondroblasts in the inner chondrogenic layer.
- It leads to **increase in width**.

2. Interstitial growth:

- Is produced by division and activity of mature chondrocytes.
- It leads to **increase in length**.



BONE

- Bone is a specialized type of C.T. with a hard matrix.
- **Types:** 2 types
 - Compact and spongy (cancellous) bone.
- **Components:**
 - Bone Cells: 4 types.
 - Bone Matrix (calcified osteoid tissue):
 - hard because it is calcified (**Calcium salts**).
 - It contains type I collagen fibers.
 - It forms **bone lamellae and trabeculae**.
 - Periosteum.
 - Endosteum.
- **Functions:**
 - body support.
 - protection of vital organs as brain & bone marrow.
 - calcium store.

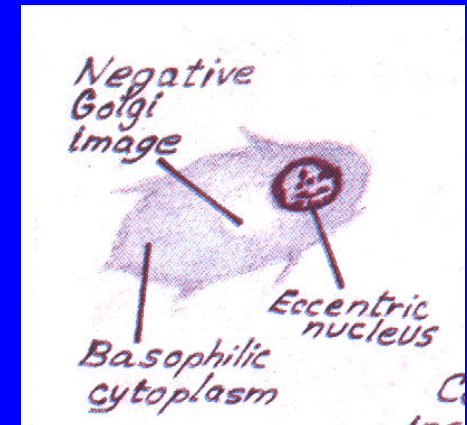
Bone Cells

1- Osteogenic Cells:

- in periosteum & endosteum.
- Fate: give rise to osteoblasts.

2- Osteoblasts:

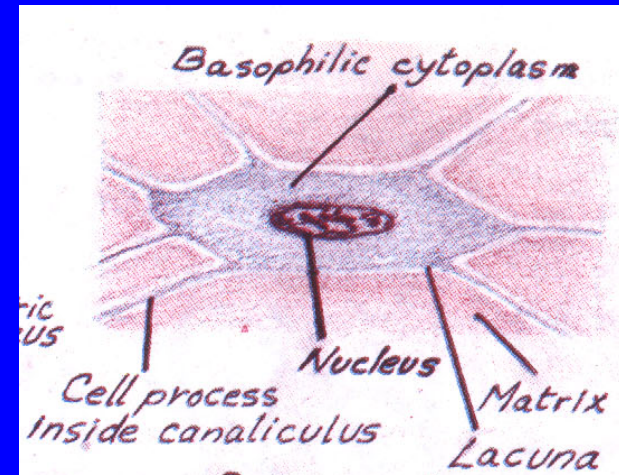
- in periosteum & endosteum.
- Origin: osteogenic cells.
- Function: They secrete the bone matrix & deposit Ca salts in it.
- Fate: change to osteocytes.



Bone Cells

3- Osteocytes :

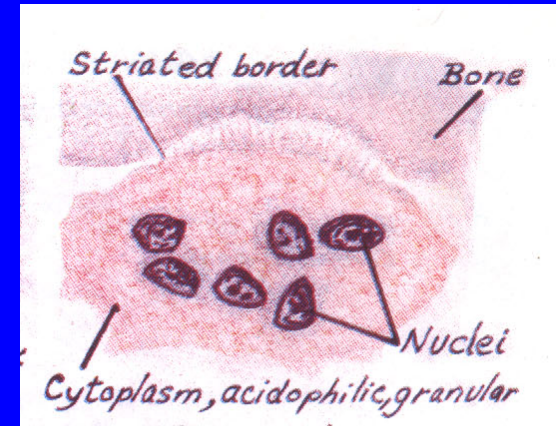
- Branched cells.
- Present singly in lacunae.
Their branches run in the canaliculi.
- Origin: osteoblasts.
- Function: They maintain the bone matrix.



Bone Cells

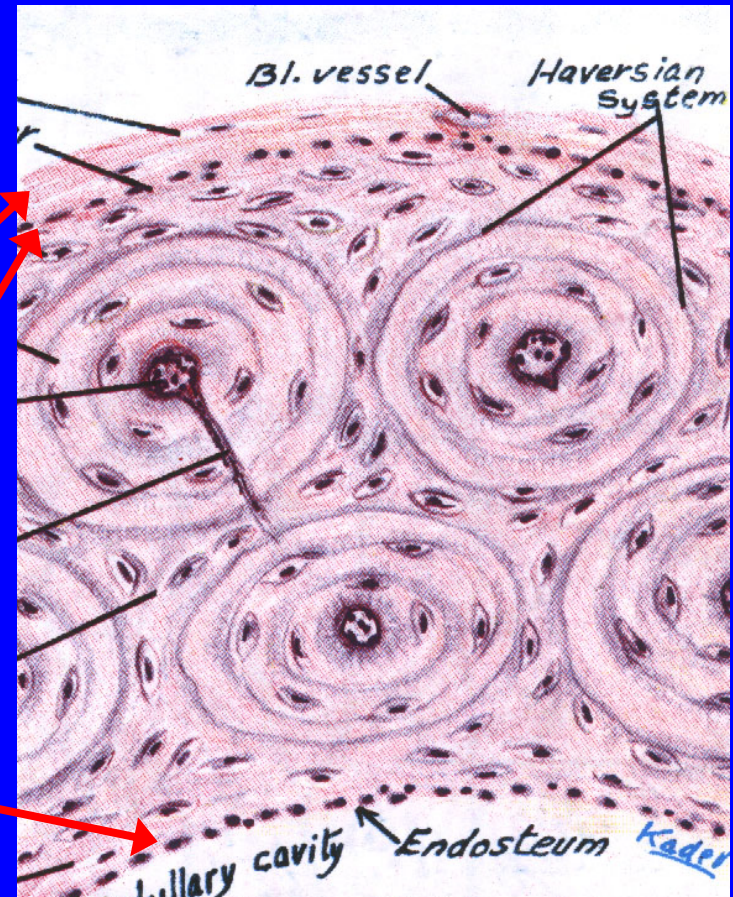
4- Osteoclasts:

- Large multinucleated cells on bony surfaces, in Howship's lacunae.
- They have striated or ruffled border.
- Cytoplasm is rich in lysosomes.
- Origin: blood monocytes.
- Function: bone resorption.



Compact Bone

- It is found in the diaphysis of long bones.
- Consists of:
 - 1- Periosteum:
 - » Outer fibrous layer.
 - » Inner osteogenic layer.
 - 2- Endosteum.
 - 3- Bone Lamellae.
 - 4- Bone Cells.



Compact Bone

Bone Lamellae:

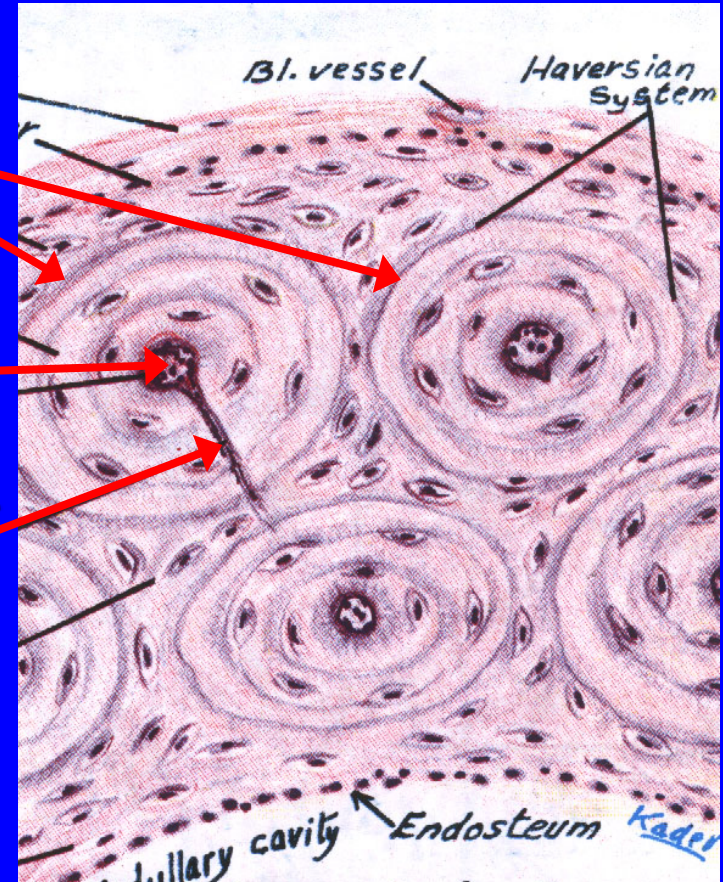
1- Haversian Systems (Osteons):

- Longitudinal cylinders.
- Each is formed of:
 - » a Haversian canal in the center,
 - » surrounded by concentrically arranged bone lamellae separated by osteocytes in lacunae.
- Volkman's canals: connect the Haversian canals together. They run obliquely or transversely.

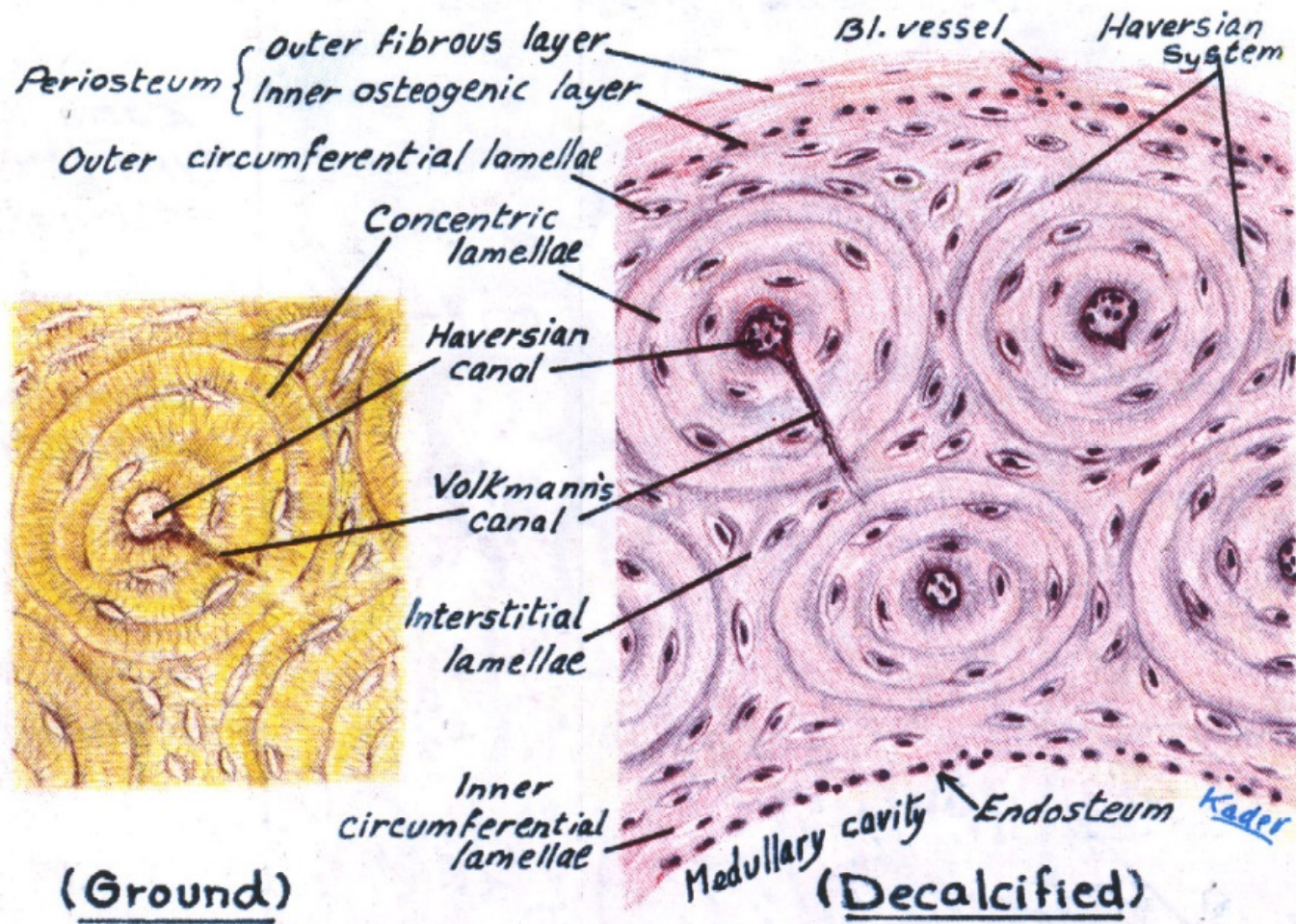
2. External Circumferential Lamellae.

3- Internal Circumferential Lamellae.

4- Interstitial Lamellae: between osteons.



Compact Bone



(Ground)

(Decalcified)

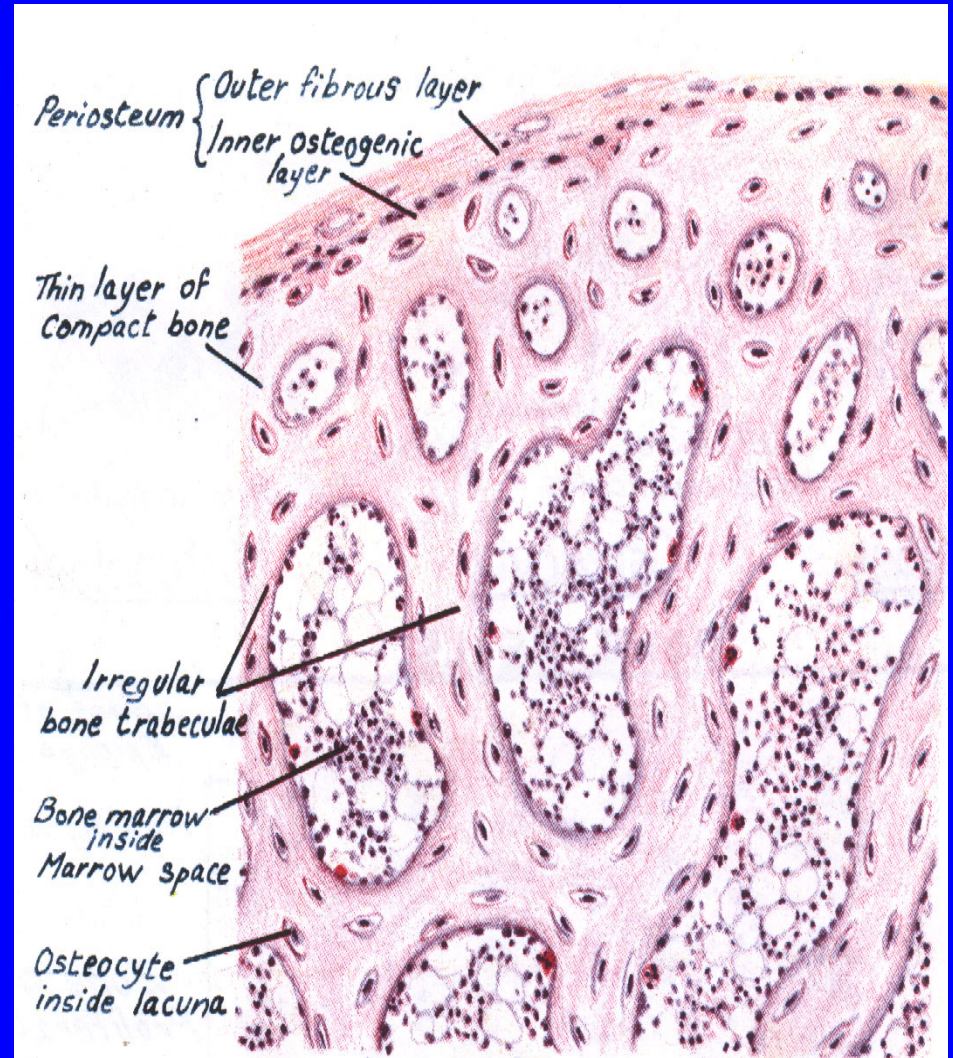
COMPACT BONE (Long Bone, T.S)

Osteon of Compact Bone



Spongy (Cancellous) Bone

- In flat bones & epiphysis of long bones.
- Consists of :
 1. Periosteum.
 2. Endosteum.
 3. Irregular bone trabeculae. (are formed of irregular bone lamellae separated by osteocytes inside lacunae).
 4. Many irregular red bone marrow spaces.
 5. Bone Cells.
- **No Haversian systems**
(no osteons).



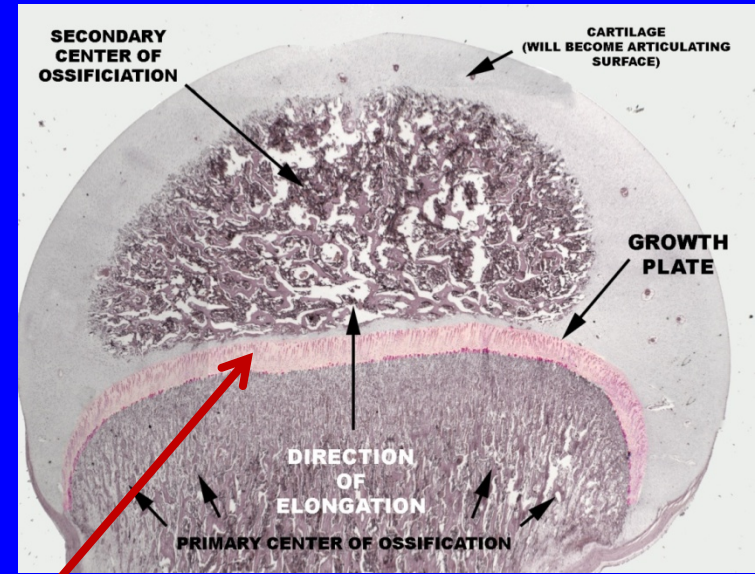
Growth of Bone

■ Appositional growth:

- Is produced by the activity of osteoblasts.
- It leads to **increase in width.**

■ Growth in length:

- Is produced by the activity of epiphyseal plate of cartilage.



Thank you

