CARTILAGE & BONE

Objectives:

By the end of this lecture, the student should be able to:

- Describe the microscopic structure of cartilage and bone.
- Classify cartilage; hyaline, elastic and fibrocartilage.
- Classify bone; compact and cancellous bone.
- Describe the distribution of different types of cartilage and bone.
- Describe the growth of cartilage and 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.

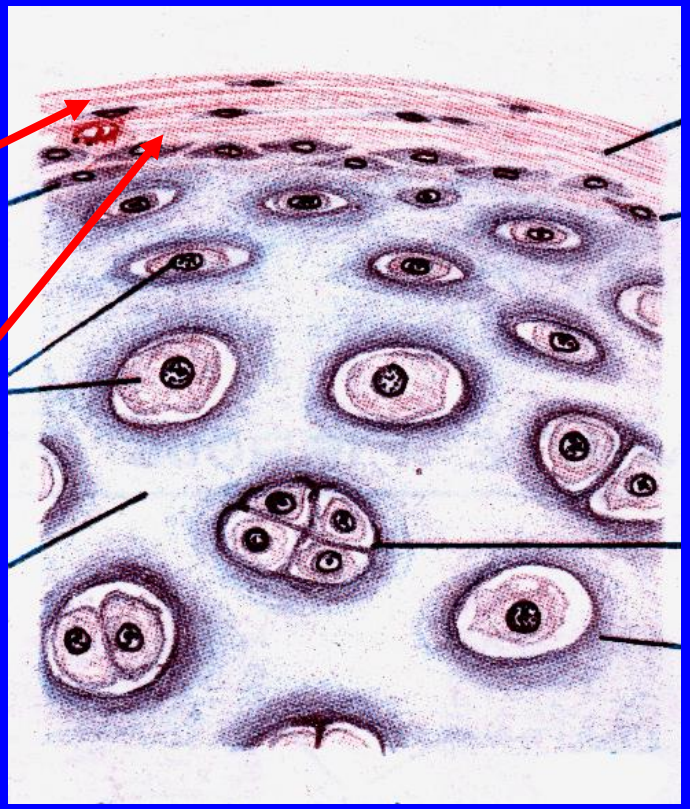
Hyaline Cartilage

1- Perichondrium:

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

» Outer fibrous layer: dense fibrous C.T.

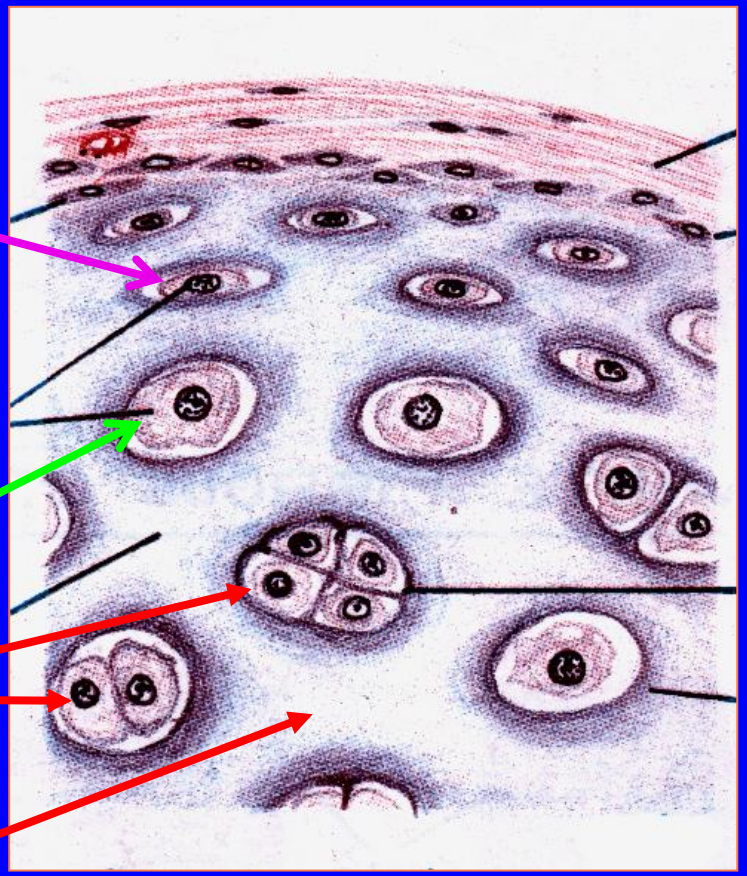
» Inner chondrogenic layer: contains chondroblasts (no lacunae). They secrete cartilage matrix and give rise to chondrocytes.



Hyaline Cartilage

2- Cells (Chondrocytes):

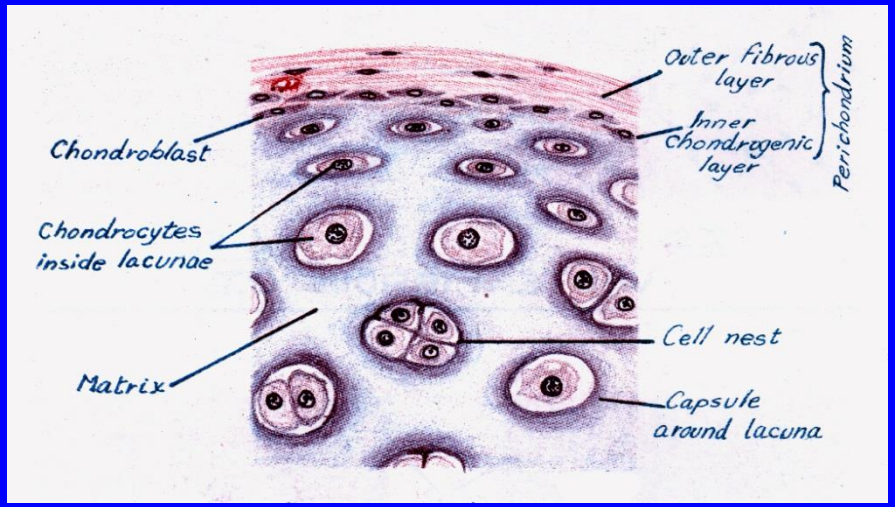
- Found in spaces called lacunae.
- **Young chondrocytes:** are small & present singly in their lacunae.
- **Mature chondrocytes:** are large, and are found singly or in groups of 2, 4 or 6 cells in their lacunae (cell nests).

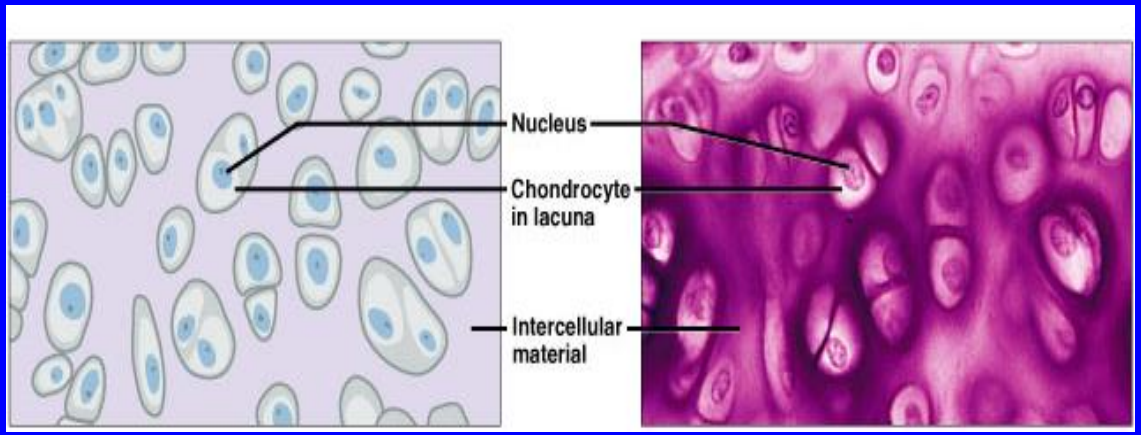


3- Matrix:

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

Hyaline Cartilage



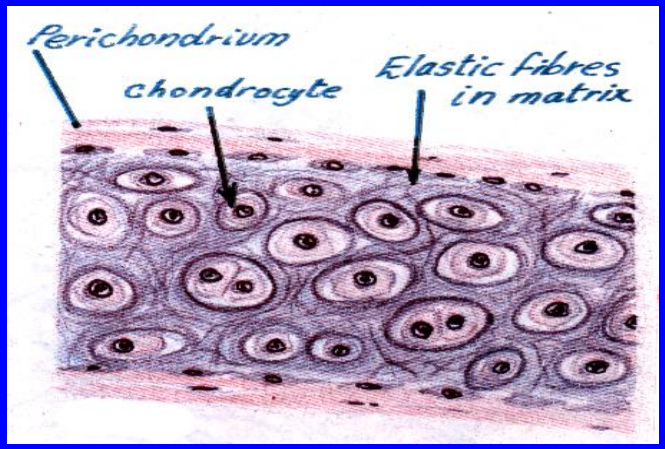


Hyaline Cartilage

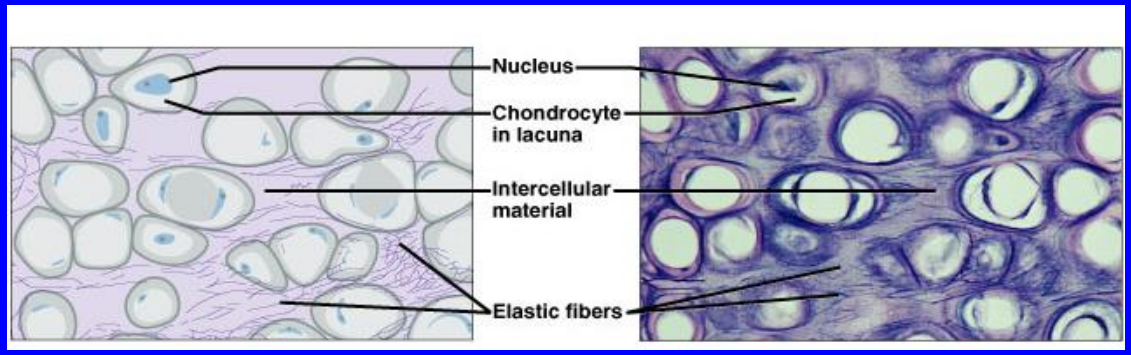
- **Sites of hyaline cartilage:**
  - Foetal skeleton.
  - Costal cartilages.
  - Articular surfaces of bones.
  - Nose, trachea & bronchi.

Elastic Cartilage

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



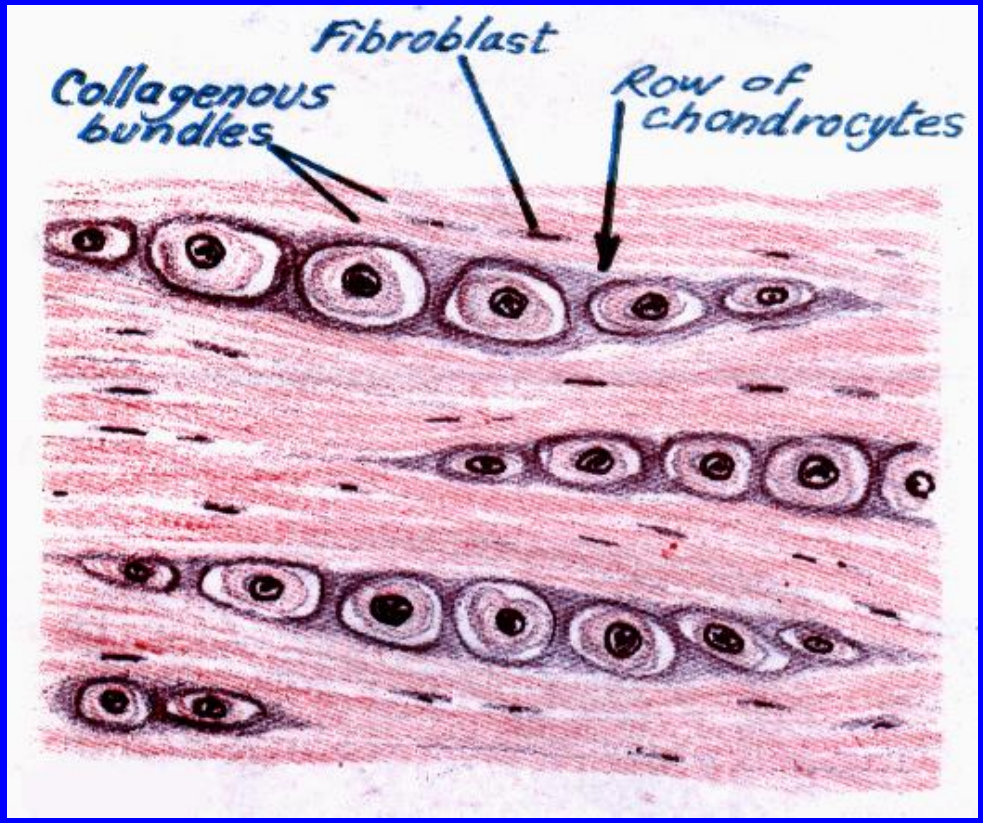
- **Sites:**
  - External ear.
  - Epiglottis.



Fibrocartilage

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

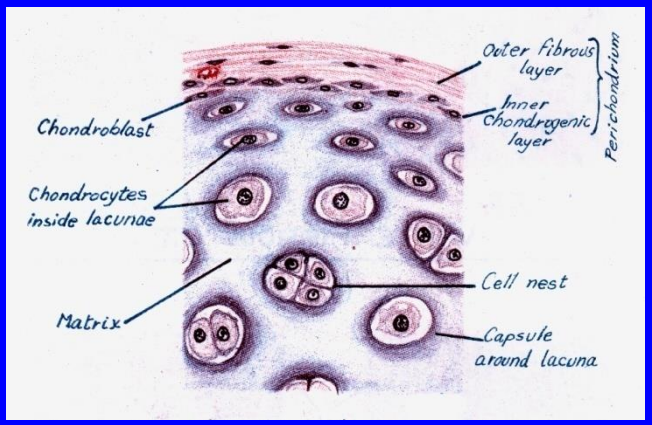
  e.g. Intervertebral disks.



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.

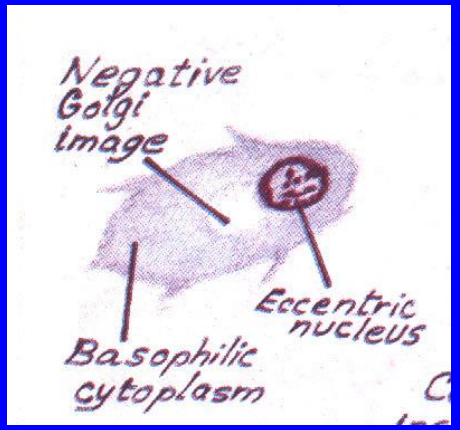
BONE

- 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.

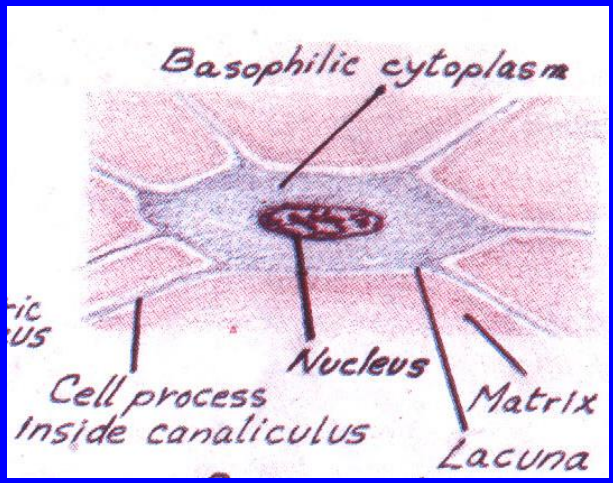
2- **Osteoblasts:**
   - in periosteum & endosteum.
   - **Origin:** osteogenic cells.
   - **Function:** They secrete the bone matrix & deposit Ca salts in it.
   - **Fate:** change to osteocytes.



Bone Cells

3- Osteocytes :

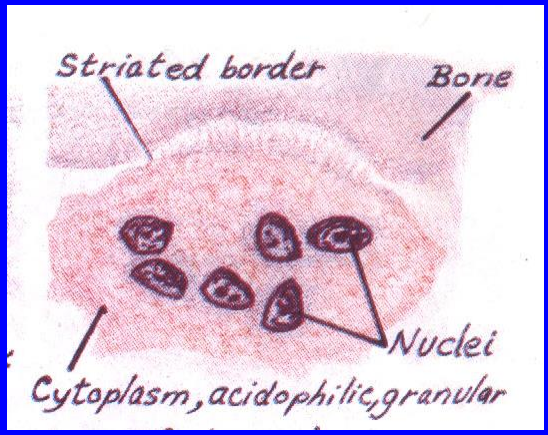
- Branched cells.
- Present singly in lacunae. Their branches run in the canaliculi.
- **Origin:** osteoblasts.
- **Function:** They maintain the bone matrix.



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:

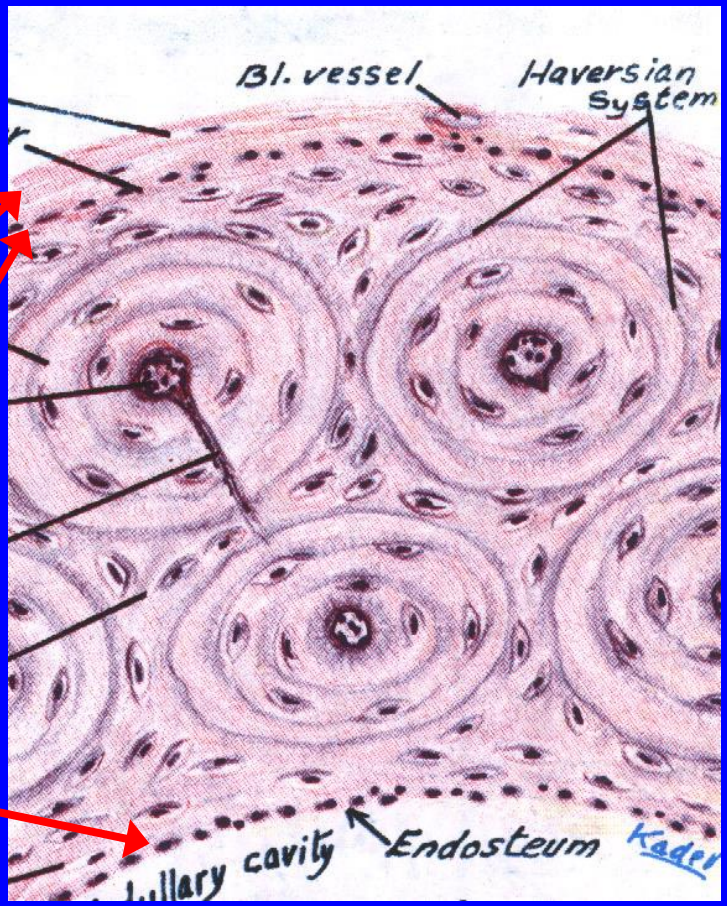
» Outer fibrous layer.

» Inner osteogenic layer.

2- Endosteum.

3- Bone Lamellae.

4- Bone Cells.



Compact Bone

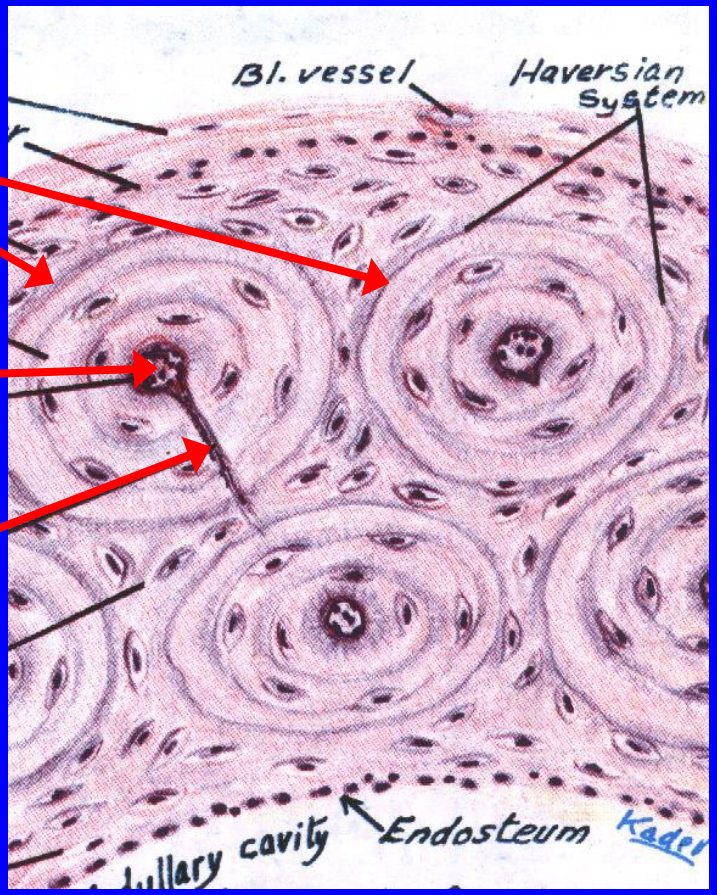
Bone Lamellae:

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.
   - Volkmann's canals: connect the Haversian canals together. They run obliquely or transversely.

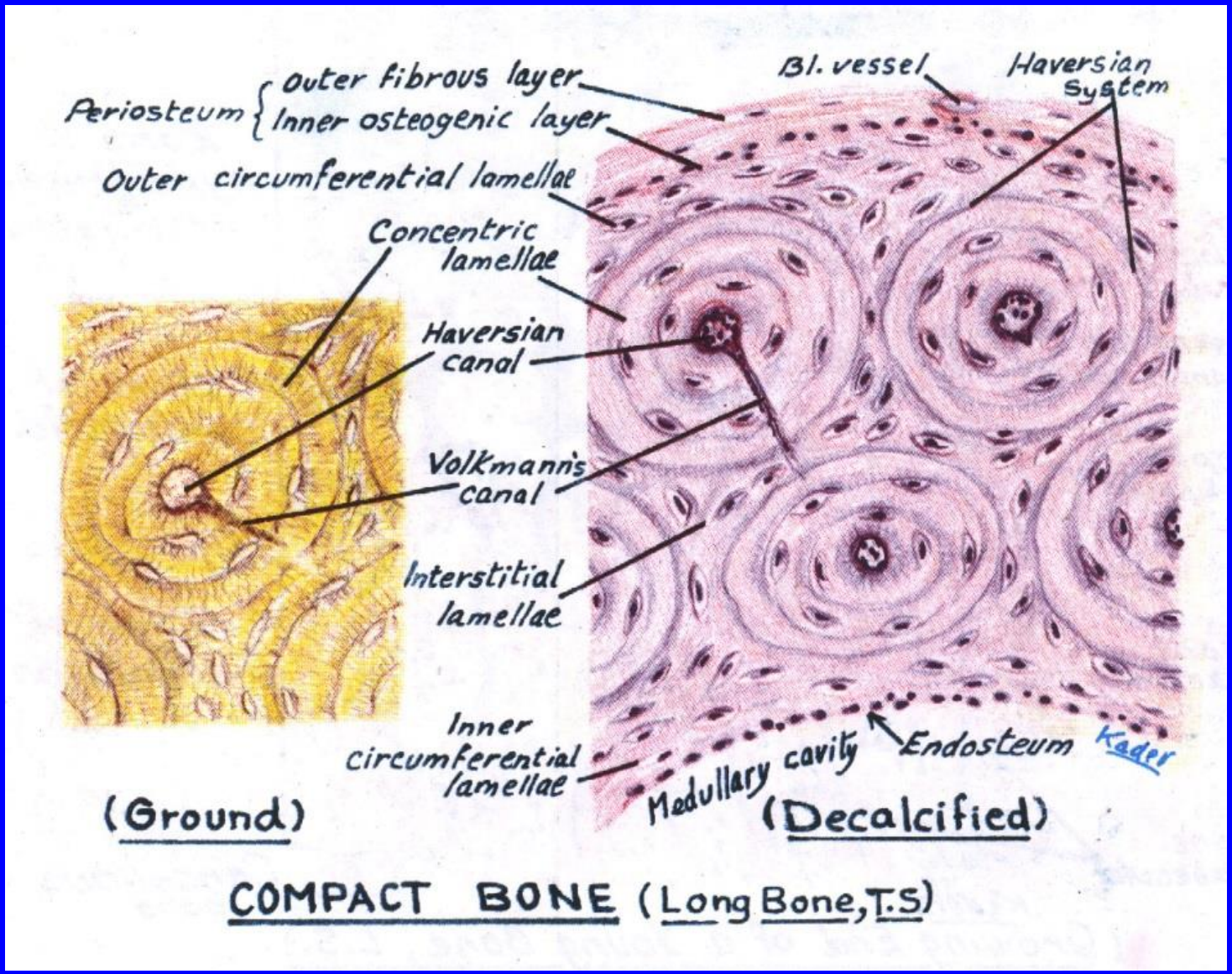
2. **External Circumferential Lamellae.**

3- **Internal Circumferential Lamellae.**

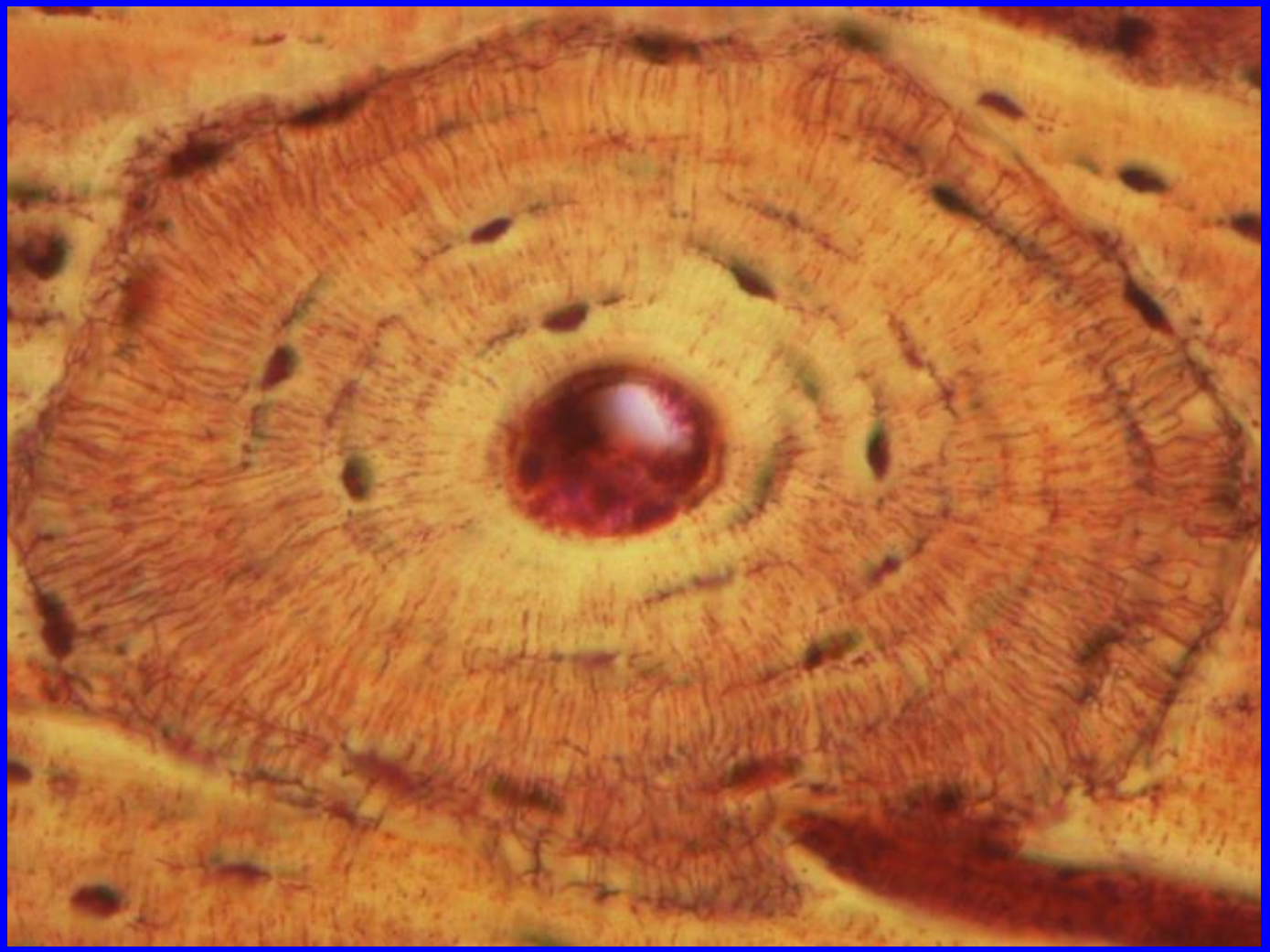
4- **Interstitial Lamellae:** between osteons.



Compact Bone



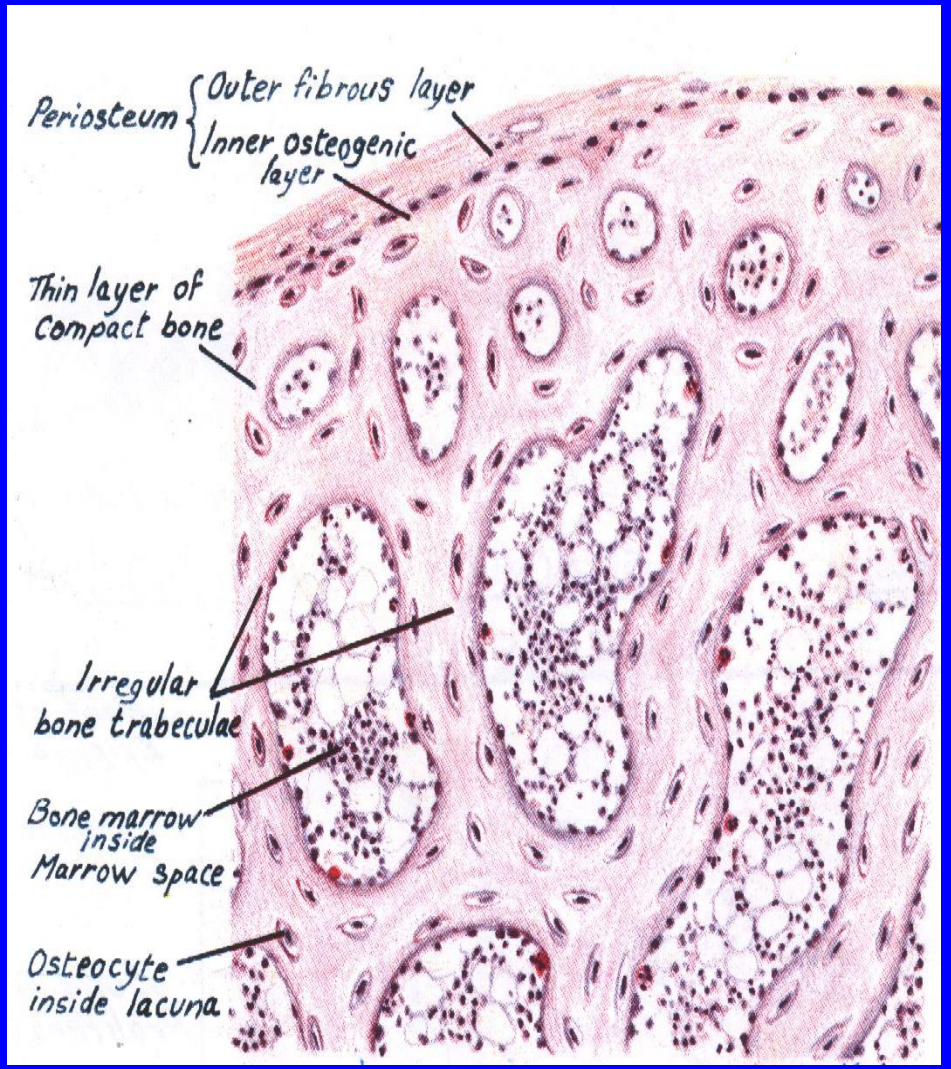
Osteon of Compact Bone



Spongy (Cancellous) Bone

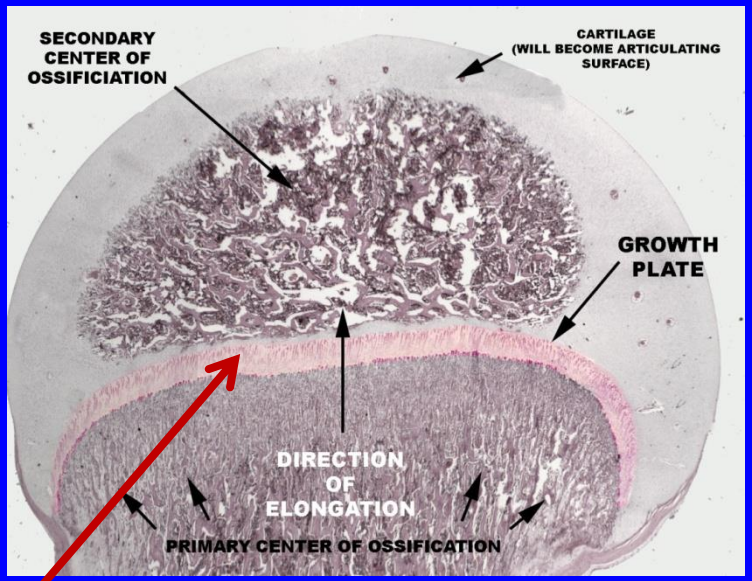
- In flat bones & epiphysis of long bones.
- Consists of :
  1. Periosteum.
  2. Endosteum.
  3. Irregular bone trabeculae.

     (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