Support connective tissues

- ***Cartilage:*** A versatile connective tissue that supports body structures. It is avascular and possesses no lymph vessels or nerves.
- ***Bone:*** Bone is a type of connective tissue that has a supportive and protective function; and also serves as a reservoir for calcium and phosphate.

- **Functions of Cartilage:**

1. Supporting soft tissues.
2. Providing a gliding surface at articulations (joints), where two bones meet.
3. Providing a model for the formation of most of the bones in the body.

- **Functions of bone:**

1. Provides structural support, giving shape and form to the body.
2. Provides movement through the insertion of muscles.
3. Serves as a stored source for calcium and phosphate.
4. Contains bone marrow (myeloid tissue).

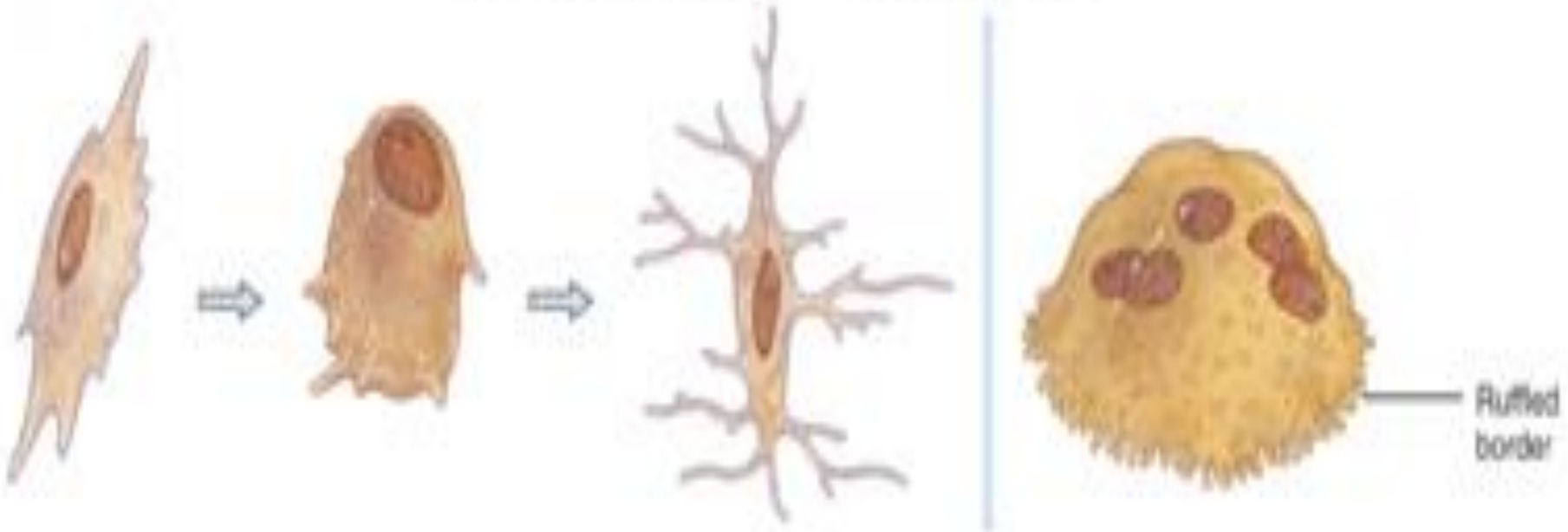
- Comparison between cartilage and bone:

Characteristic	Cartilage	Bone
Cells	Chondroblast and chondrocytes	Osteoblasts, osteocytes, Osteoprogenitor and osteoclasts
Matrix	Chondroitin sulfates with protein, forming hydrated proteogylcans	Calcium phosphate and calcium carbonate
Fibers	Collagen, elastic, reticular fibers (proportions vary)	Collagen fibers predominate
Vascularity	None	Extensive
Covering	Perichondrium, two layers	Periosteum, two layers
Strength	Limited: bends easily but hard to break.	Strong: resists distortion until breaking point is reached.
Growth	Interstitial and appositional	Appositional only
Repair capabilities	Limited ability	Extensive ability
Oxygen demands	Low	High
Nutrient delivery	By diffusion through matrix	By diffusion through cytoplasm and fluid in canaliculi

- **Cells of cartilage and bone:**

	Cells			
Cartilage	***Chondroblast***: lie on the surface of cartilage, secretes extracellular matrix around themselves to become chondrocytes	***Chondrocytes:*** lie within cartilage in lacunae, secrete and maintain of extracellular matrix		
Bone	***Osteoblast:*** immature bone cell that secretes organic components of matrix	***Osteocyte:*** mature bone cell that maintains the bone matrix	***Osteoprogenitor:*** stem cell whose divisions produce Osteoblast.	***Osteoclast:*** multinucleated cell that secretes acids and enzyme to resorption and remodeling of bone

Bone cells



Osteogenic cell (develops into an osteoblast)

Osteoblast (forms bone matrix)

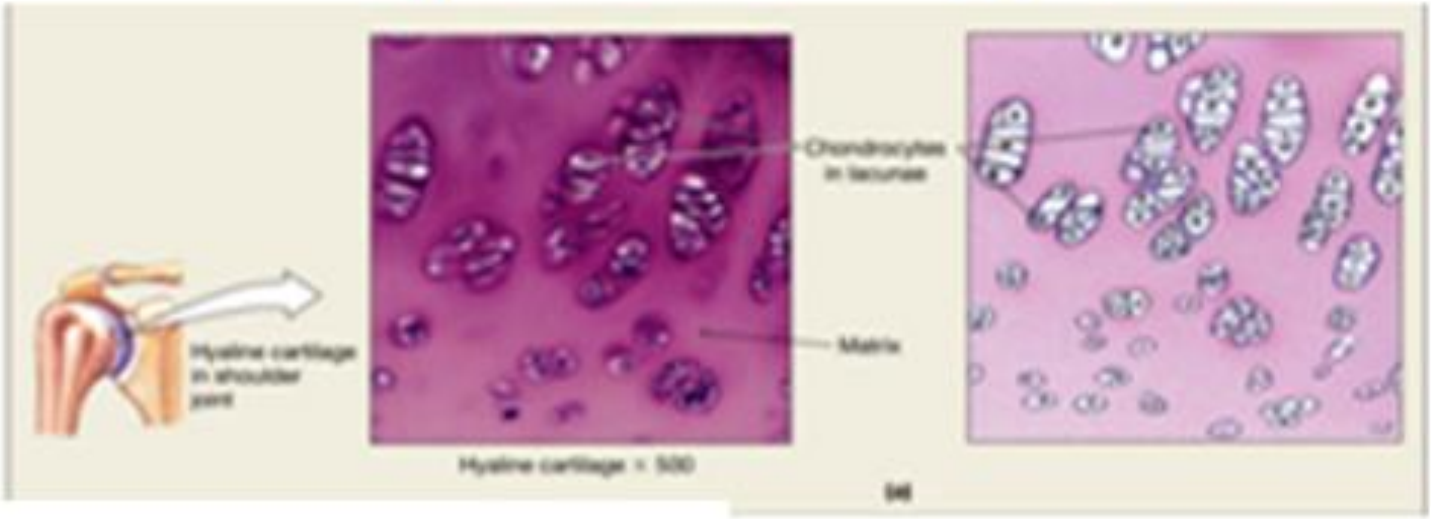
Osteocyte (maintains bone tissue)

Osteoclast (functions in resorption, the breakdown of bone matrix)

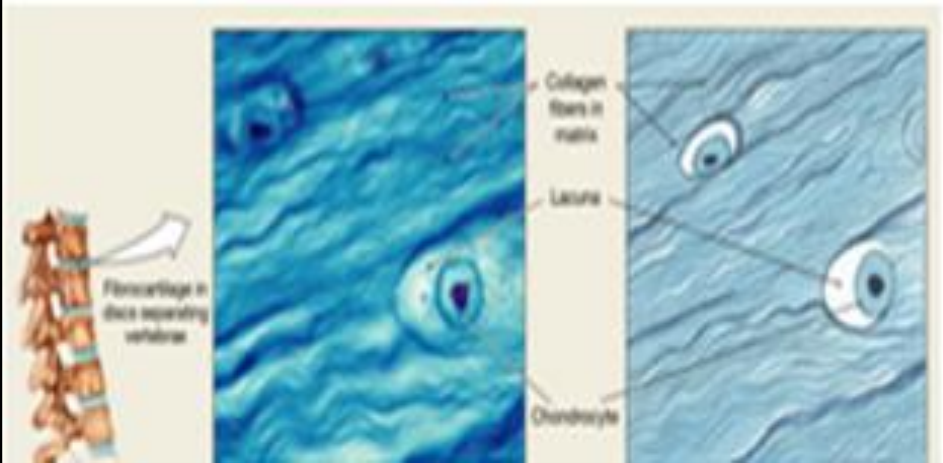
- **Types of cartilage:**

Type of cartilage	Description	Location	Function
Hyaline (glassy)	Amorphous but firm matrix, collagen fibers II, Chondroblast, and chondrocytes when mature lie in lacunae	Forms most embryonic skeleton, covers the ends of long bones in joint cavities, forms costal cartilage of the ribs, cartilage of the nose, tracheae and larynx	Support and reinforces, has resilient cushioning properties, resist compressive stress.
Elastic	Similar to hyaline cartilage but more elastic fibers in matrix	External ear (pinna), epiglottis	Maintains the shape of a structure while allowing great flexibility
Fibro	Matrix similar to but less firm than that in hyaline cartilage, thick collagen fibers predominate	Intervertebral discs, pubic symphysis, discs of knee joint	Tensile strength with the ability to absorb compressive shock.

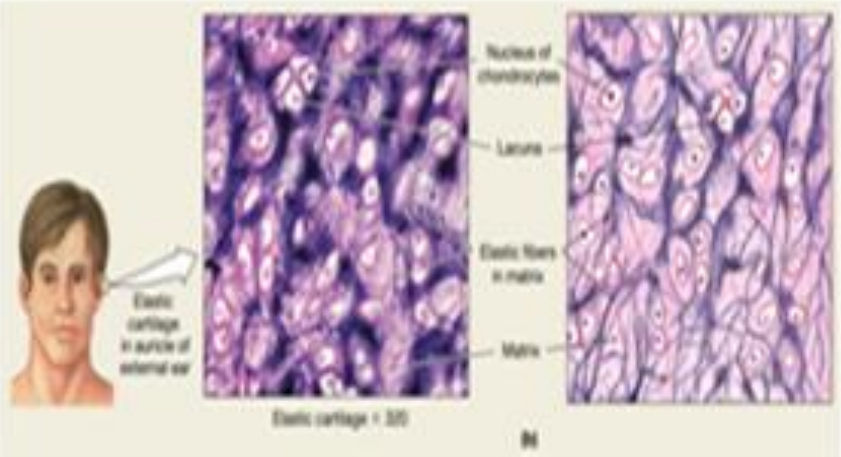
Hyaline cartilage



Fibro cartilage

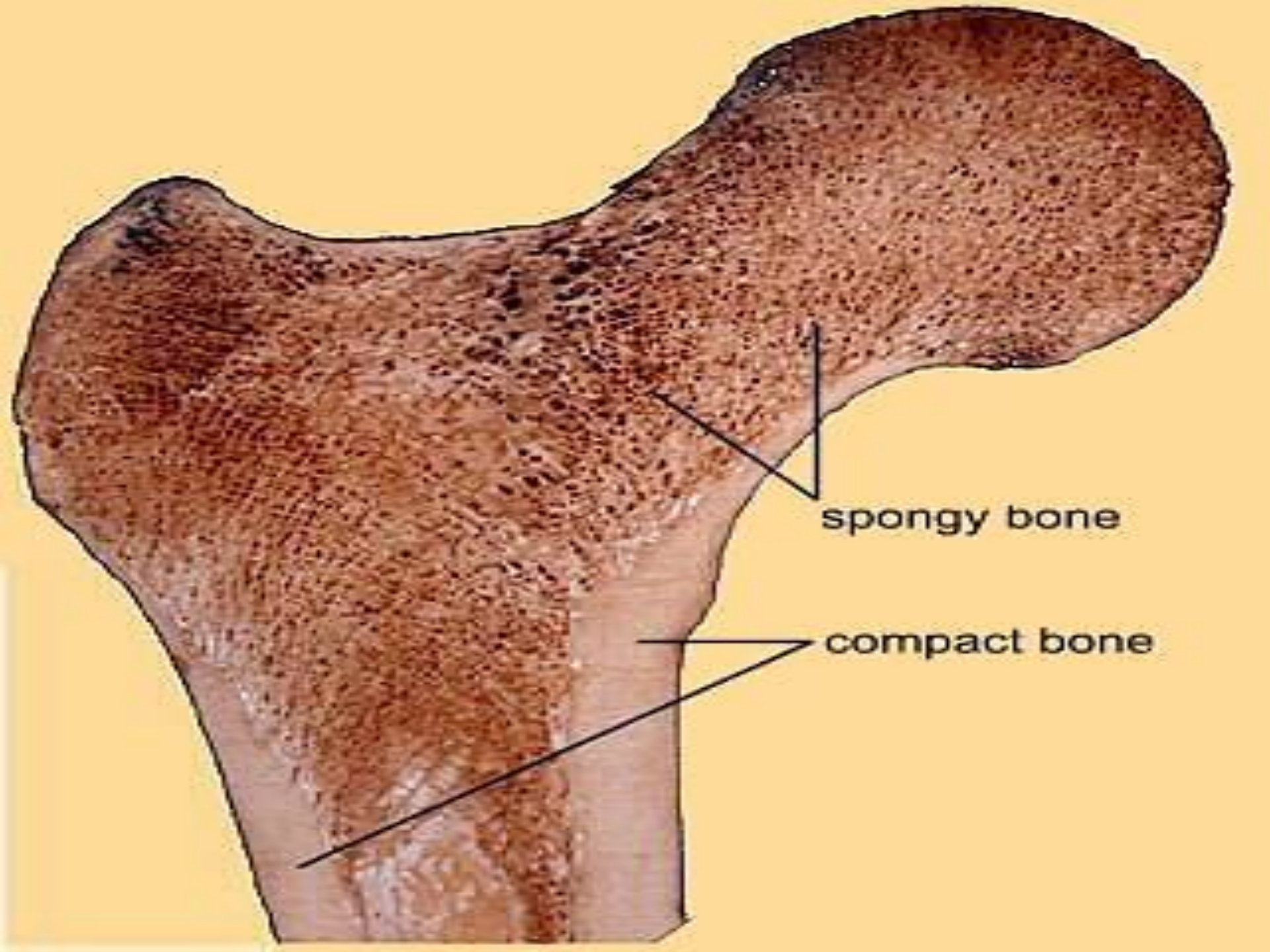


Elastic cartilage

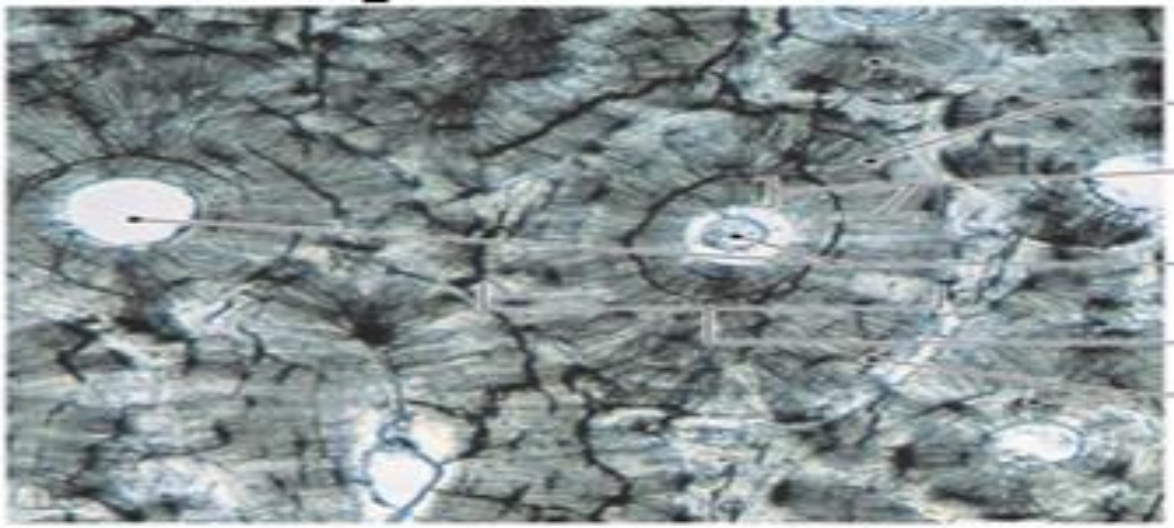


- **Types of bone:**

Compact bone	*Spongy bone*
Appears as a solid mass to the naked eye	Gross appearance is like a sponge
Arrange in osteons	Arranged in trabeculae
Lamellae are found around periphery and between osteons	small quantities of lamellae, which lie close to blood vessels
yellow marrow found in the medullary cavity surrounded by compact bone	Contain red bone marrow fill the spaces between trabeculae
Has Harvesian system provides neutral materials	Has no Harvesian system
Covering the exterior of bones and forming the shaft of long bones	Makes up the majority of the irregular, flat, and short bones such as hip, ribs, sternum, and ends of long bones (femur)


spongy bone
compact bone

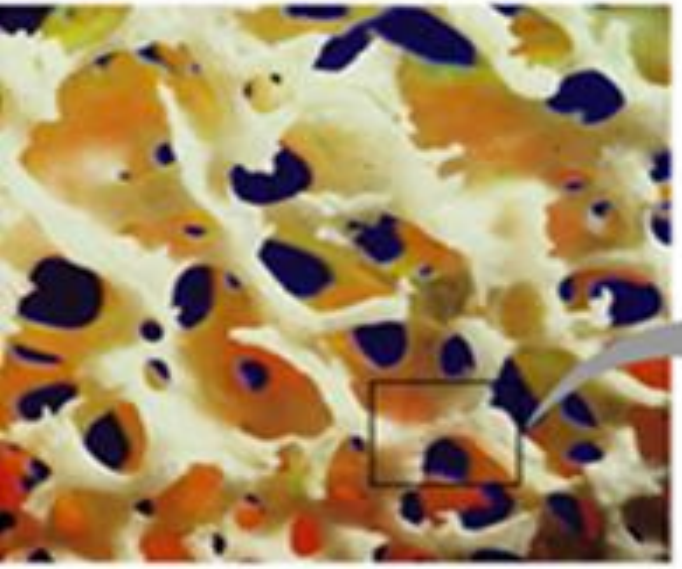
Compact bone

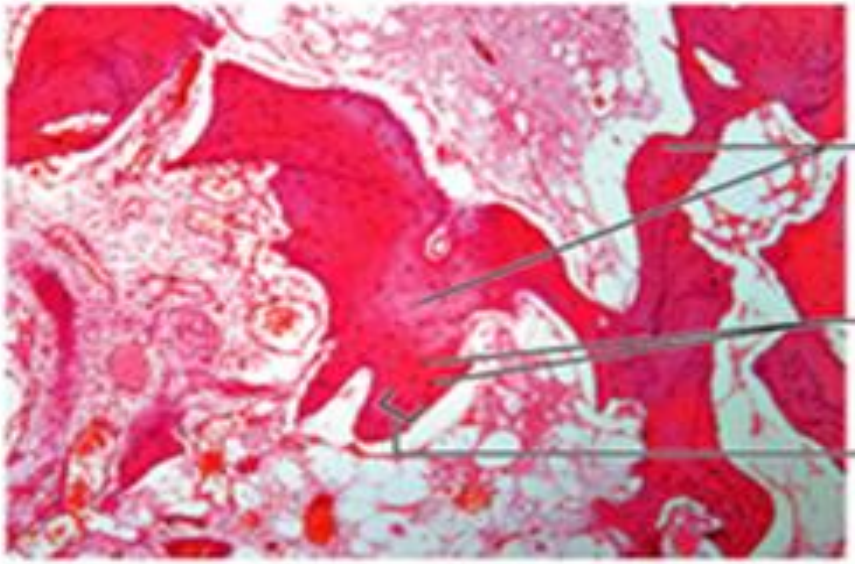


(c) Light micrograph of osteons

LM × 220

SPONGY BONE





- **Some important terms:**
  1. ***Lamellae***: rings of hard, calcified matrix that are arranged concentrically around central canal.
  2. ***Lacunae***: small spaces between lamellae that contain osteocytes.
  3. ***Canaliculi:*** outward extensions of osteocytes from lacunae connect with each other and finally with central canal. Form a branching network throughout bone to provide numerous routes for nutrients and oxygen delivery
  4. ***Central canal (Harvesian canal)***: canal run lengthwise through bone; contain blood vessels and nerves.
  5. ***Osteons (Harvesian system):*** each central canal with its surrounding lamellae, lacunae, osteocytes, and canaliculi makeup an osteon.


THANK YOU