BONE

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Competency

- AN 71.1- Identify bone under the microscope; classify various types and describe the structure-function correlation of the same

SLO

- General features of bone and its function
- Components of bone
- Classification and structure of bone

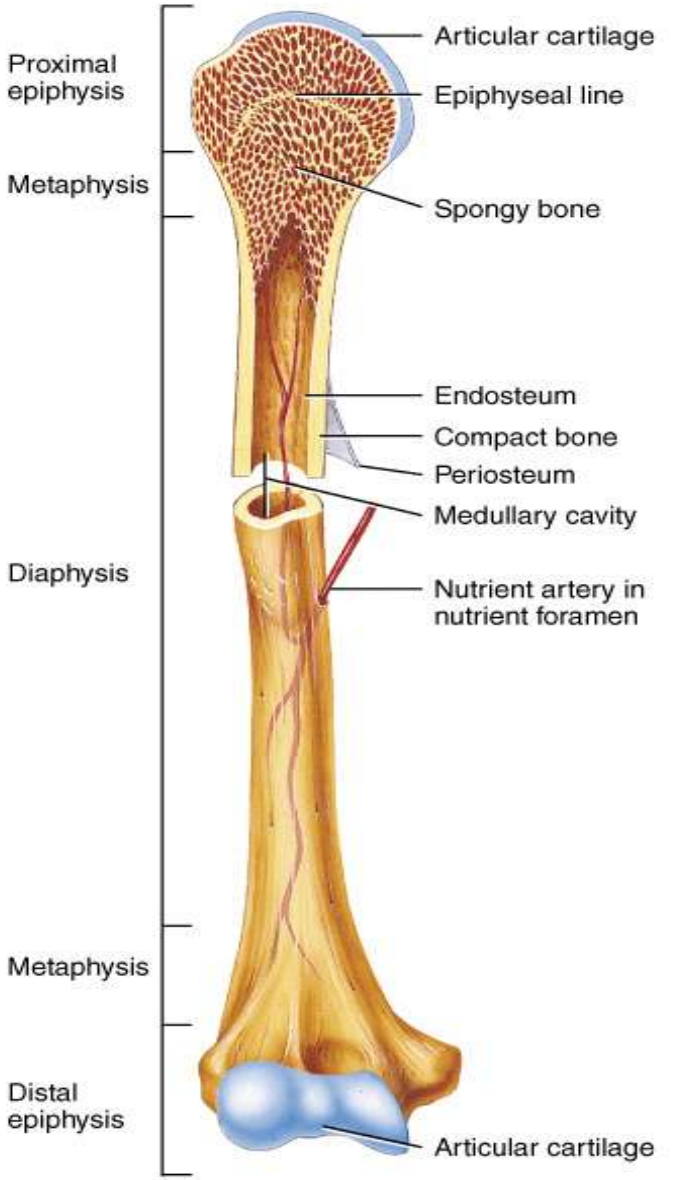
General features

- It is a specialized CT
- Bone is rigid and hard because the matrix is infiltrated with inorganic salt
- Gives attachment to the muscles and serves as a lever for muscular action
- Bears body weight

General features

- Protects vital organs like brain, heart and lungs
- Bone stores calcium, phosphate and other ions
- Contains bone marrow, which is a haemopoetic tissue

Diaphysis: long shaft of bone
Epiphysis: ends of bone
Epiphyseal plate: growth plate
Metaphysis: b/w epiphysis and diaphysis
Articular cartilage: covers epiphysis
Periosteum: bone covering (pain sensitive)
Medullary cavity: Hollow chamber in bone
- red marrow produces blood cells
- yellow marrow is adipose
Endosteum: thin layer lining the medullary cavity

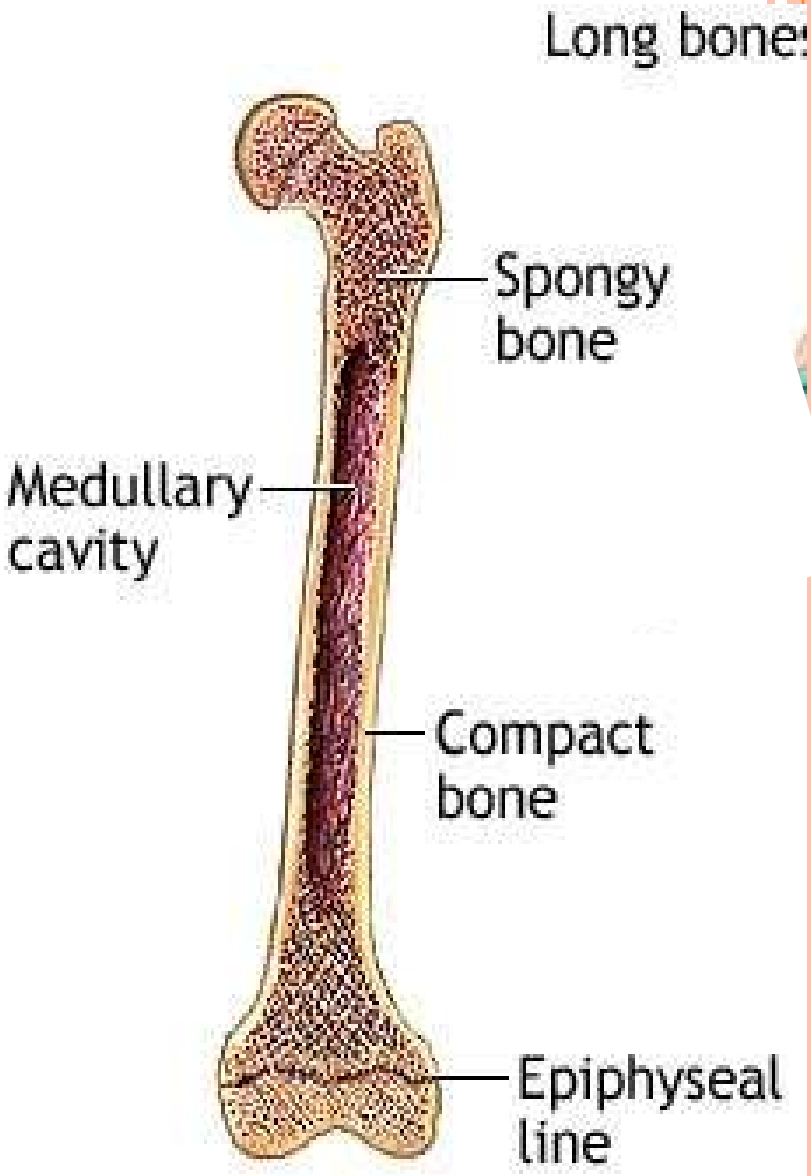


(a) Partially sectioned humerus (arm bone)

TYPES OF THE BONE

- **Compact Bone** – dense outer layer

- **Spongy Bone** – (cancellous bone) honeycomb of trabeculae filled with bone marrow



•3 Components of BONE

1. CELLS
2. GROUND SUBSTANCES
3. FIBERS

HISTOLOGY OF BONE

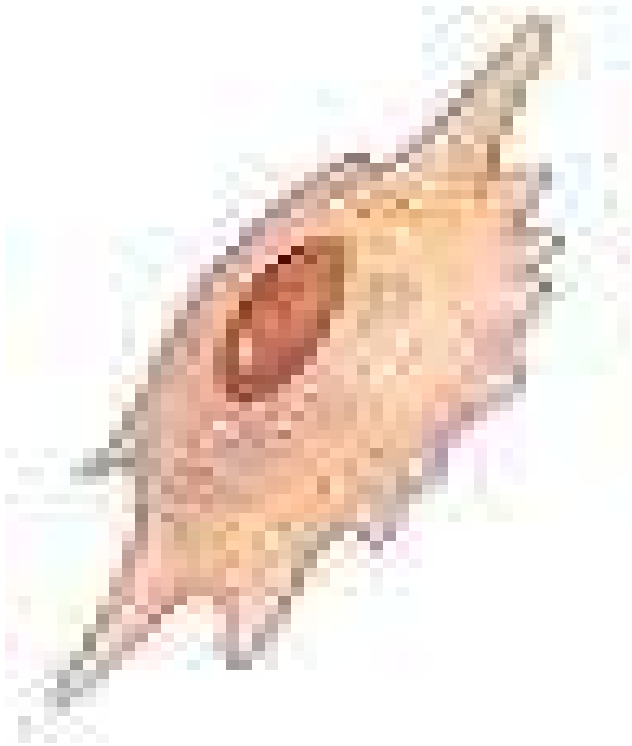
- **Cell -4 types**

- **Osteoprogenitor cells**
- **Osteoblasts**
- **Osteocytes**
- **Osteoclasts**

Cells of the bone

- **Osteoprogenitor cells**:

- derived from mesenchyme
- all connective tissue is derived
- unspecialized stem cells
- undergo mitosis and develop into osteoblasts
- found on inner surface of periosteum and endosteum.



Cells of the bone

- **Osteoblasts:**
  - bone forming cells
  - found on surface of bone
  - no ability to mitotically divide
  - collagen secretors

Cells of the bone

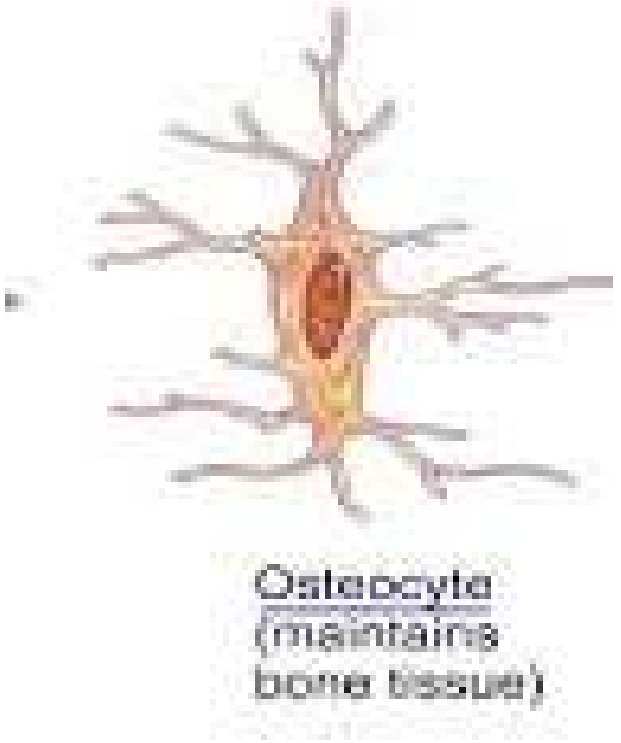
- **Osteocytes:**

  - mature bone cells

  - derived form osteoblasts

  - do not secrete matrix material

  - cellular duties include exchange of nutrients and waste with blood.



Cells of the bone

- **Osteoclasts**

  - bone resorbing cells

  - bone surface

  - growth, maintenance and bone repair

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

Fibers

- Consists of type I collagen fibers
- Synthesized by osteoblast
- Responsible for providing tensile strength to the bone

Ground substance

- Rich in proteoglycans
- 3 types of glycosaminoglycan (hyaluronic acid, keratan sulfate and chondroitin sulfate)

INTERCELLULAR SUBSTACE

ORGANIC= 90% COLLAGEN FIBER + 10% GROUND SUBSTANCES

INORGANIC = MINERAL SALTS
CALCIUM & PHOSPHORUS

Organization of bone

- **Lamella** - It is a thin plate of bone and is made up of collagen fibers and mineral salts embedded in ground substance

- Small spaces are seen between adjacent lamella that are called **lacuna**. Each lacuna is occupied by an osteocyte

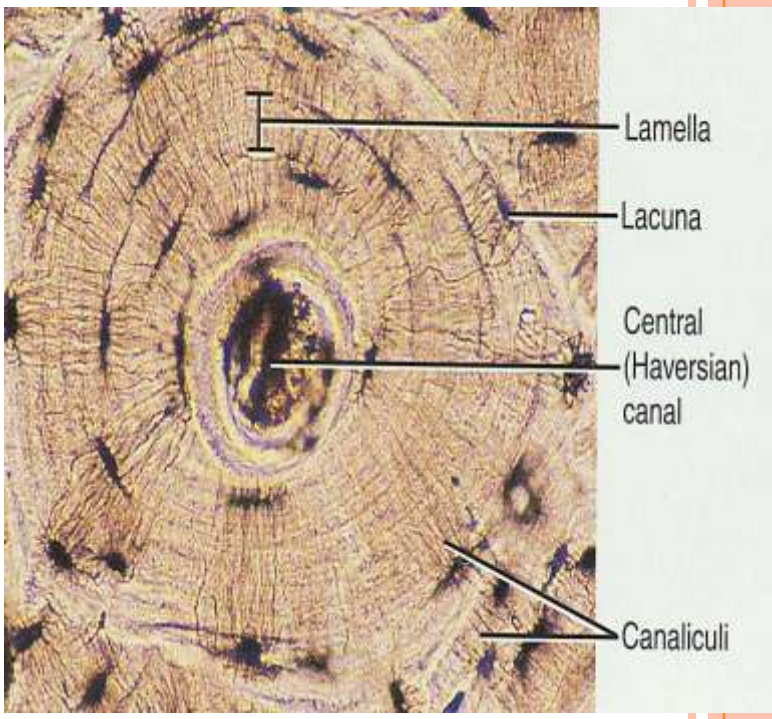
Compact bone

- No space is visible on naked eye examination
- Outer and inner surface it is covered by periosteum and endosteium respectively
- **3 patterns of lamellae:**

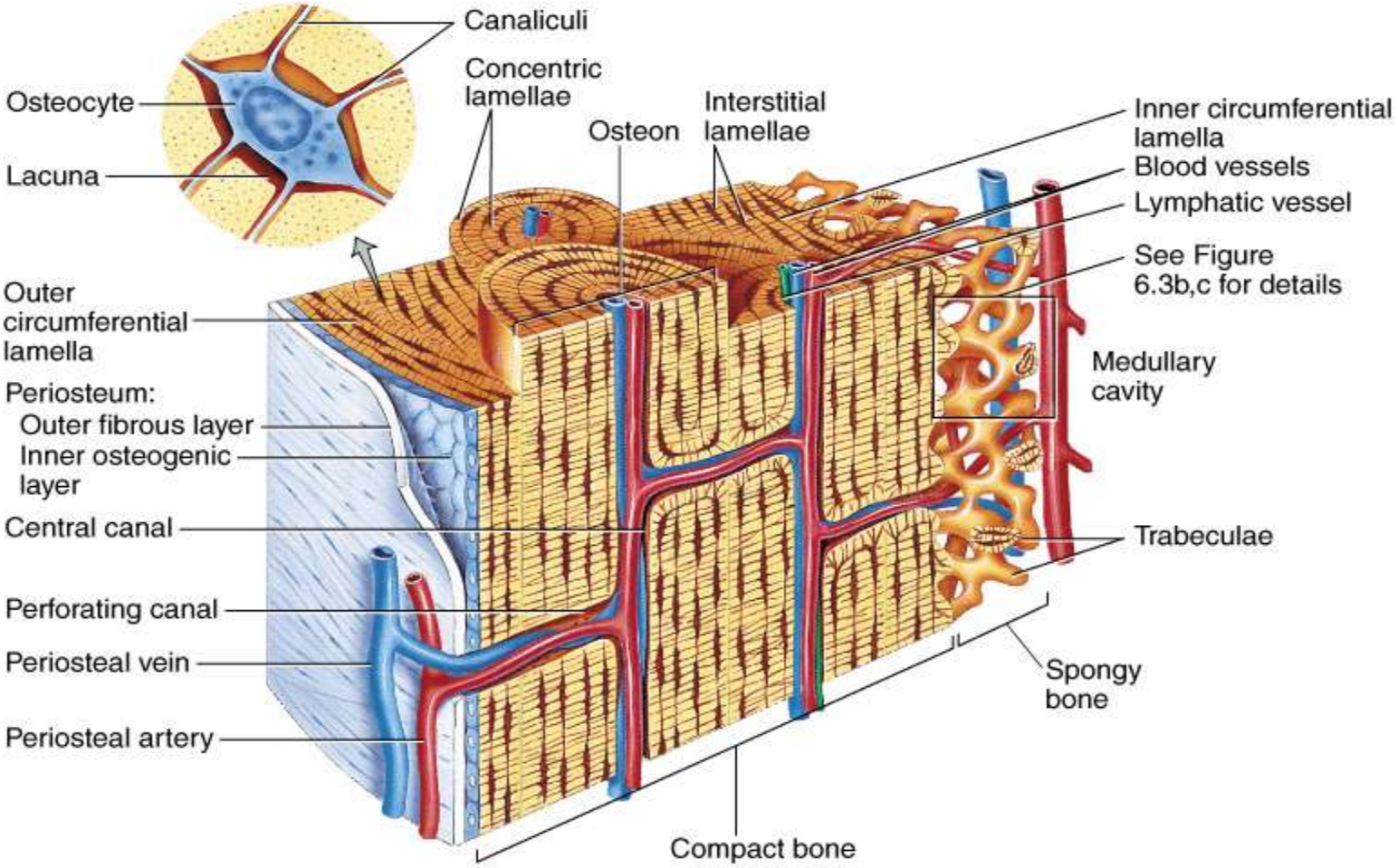
1. Haversian system
2. Interstitial lamellae
3. Circumferential lamellae

COMPACT BONE- HAVERSIAN SYSTEM

- Also know as osteon
- Central (Haversian) canals runs longitudinaly.
- Consist of cylinders of 4-15 lamellae arranged around central vascular canal
- Spaces between lamellae is called lacunae.

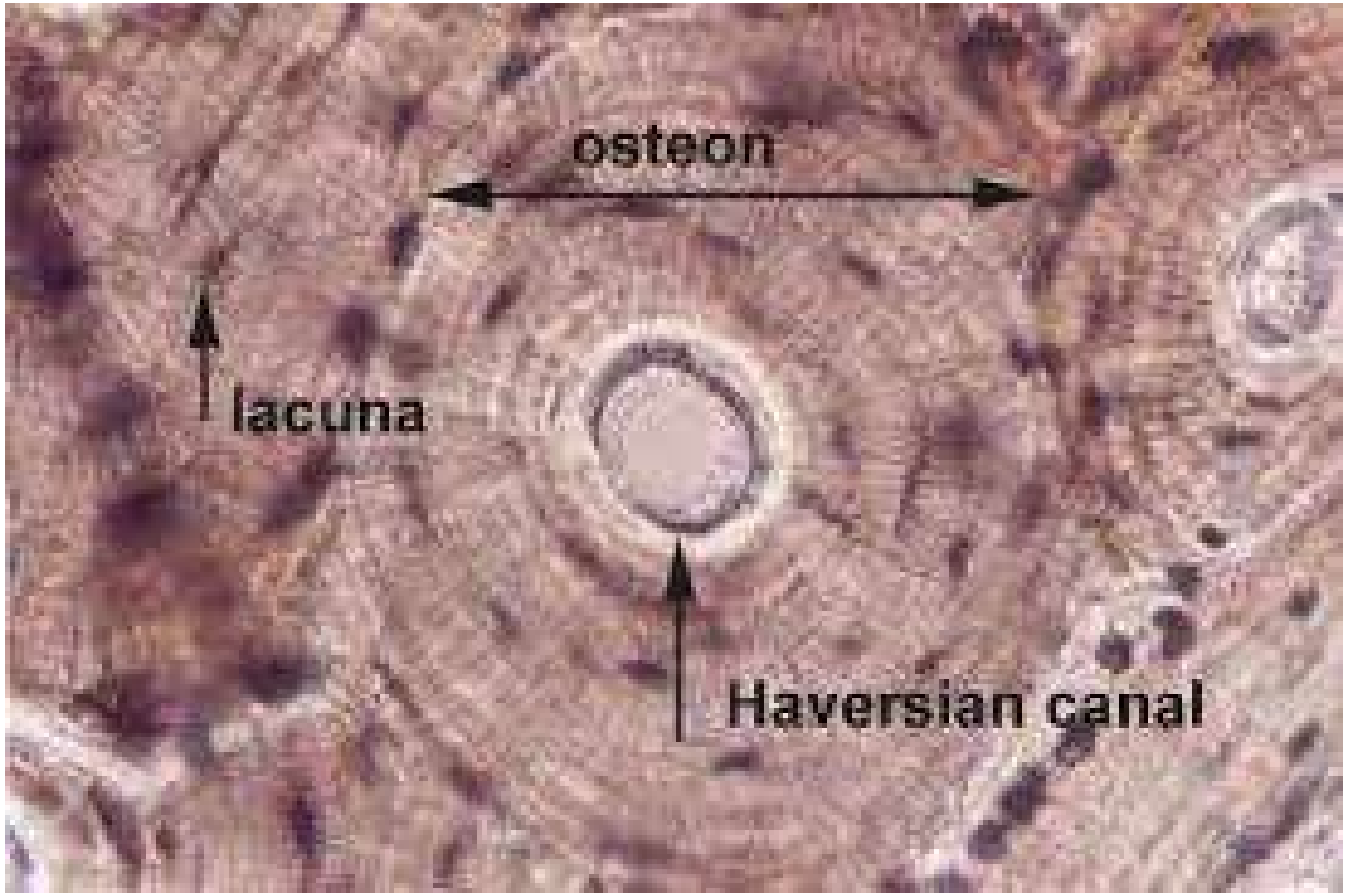


COMPACT BONE- HAVERSIAN SYSTEM

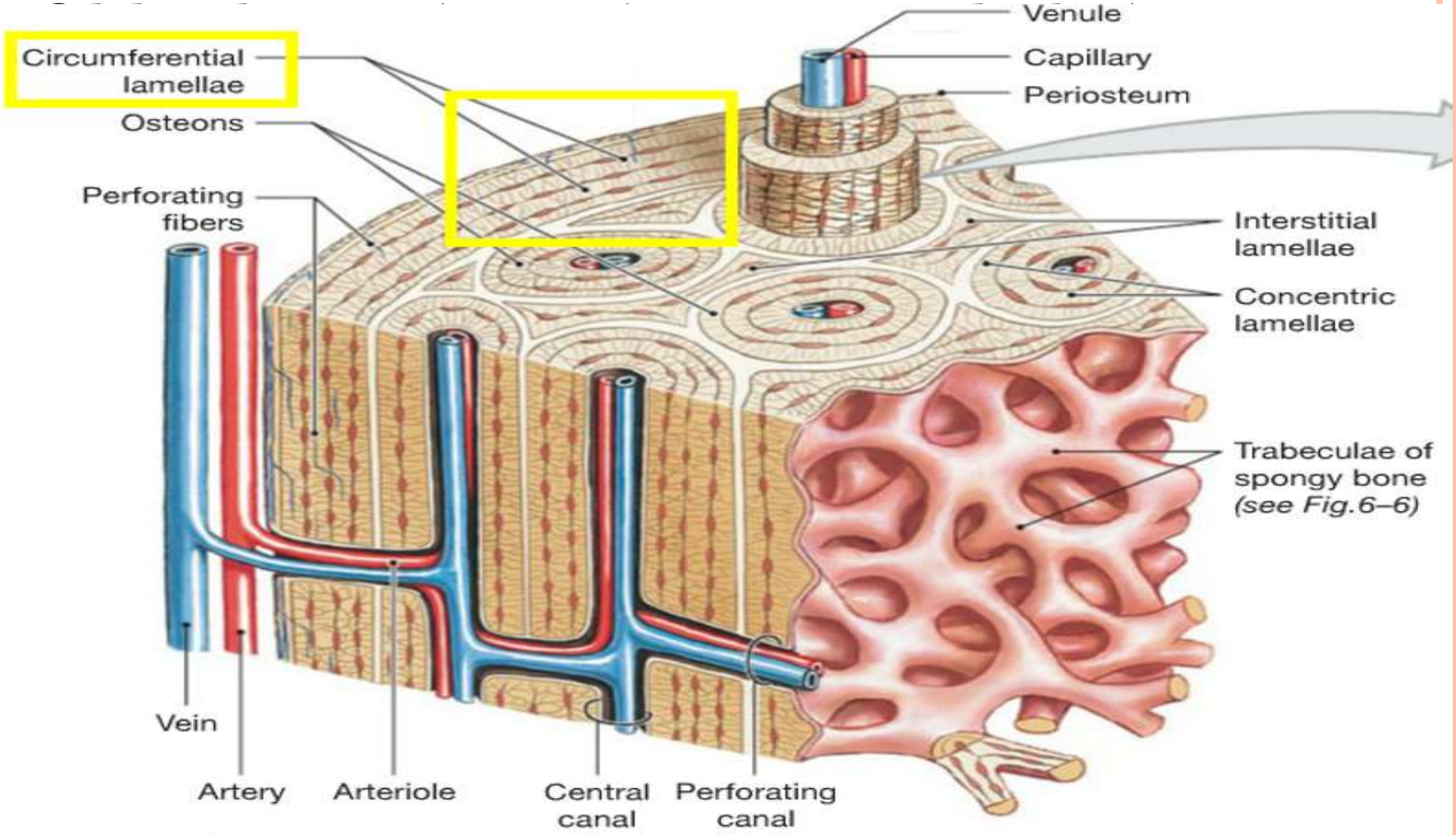


(a) Osteons (Haversian systems) in compact bone and trabeculae in spongy bone

Osteon contains: - central canal
- surrounding lamellae
- lacunae
- osteocytes
- canaliculi

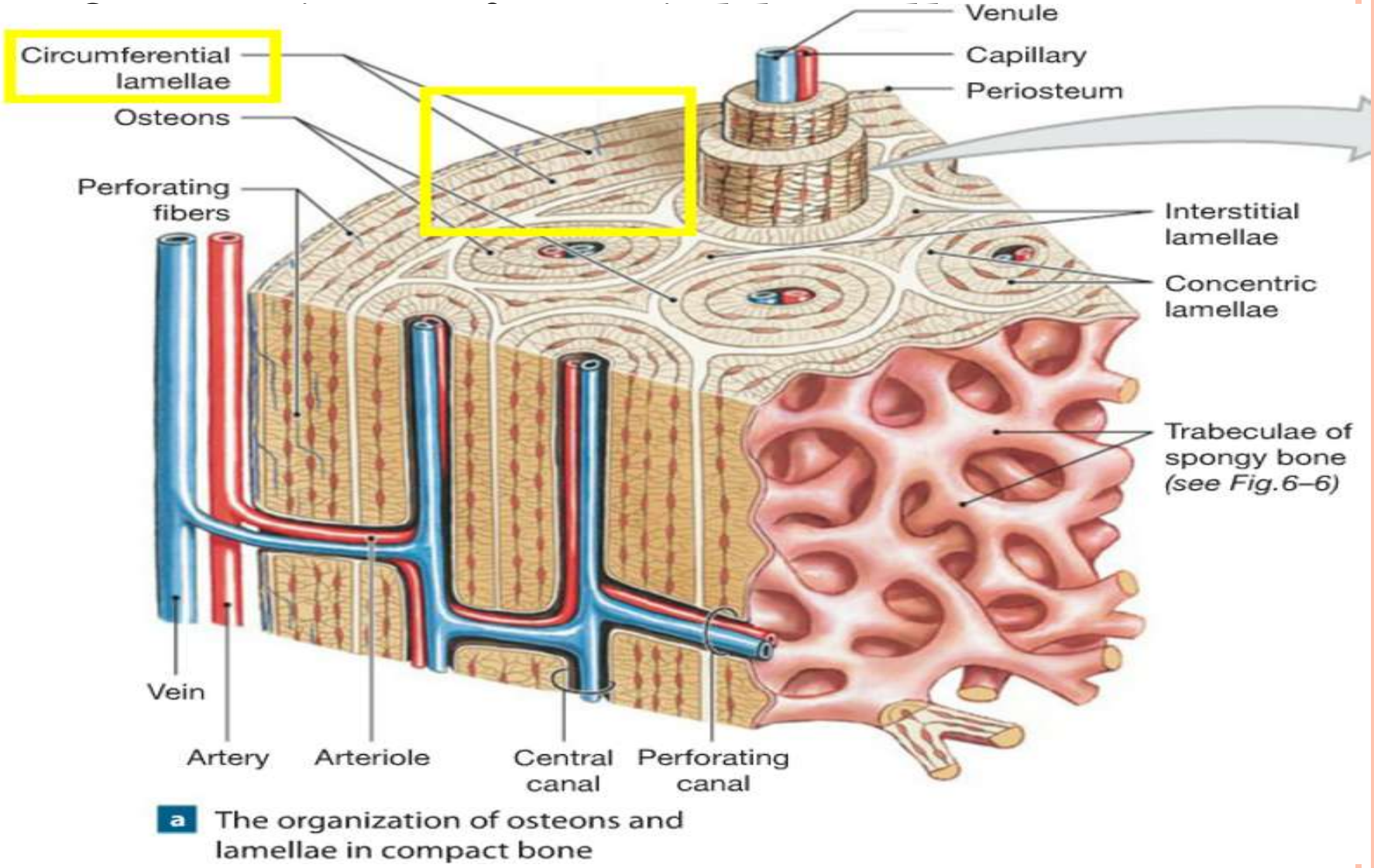


2. INTERSTITIAL LAMELLAE



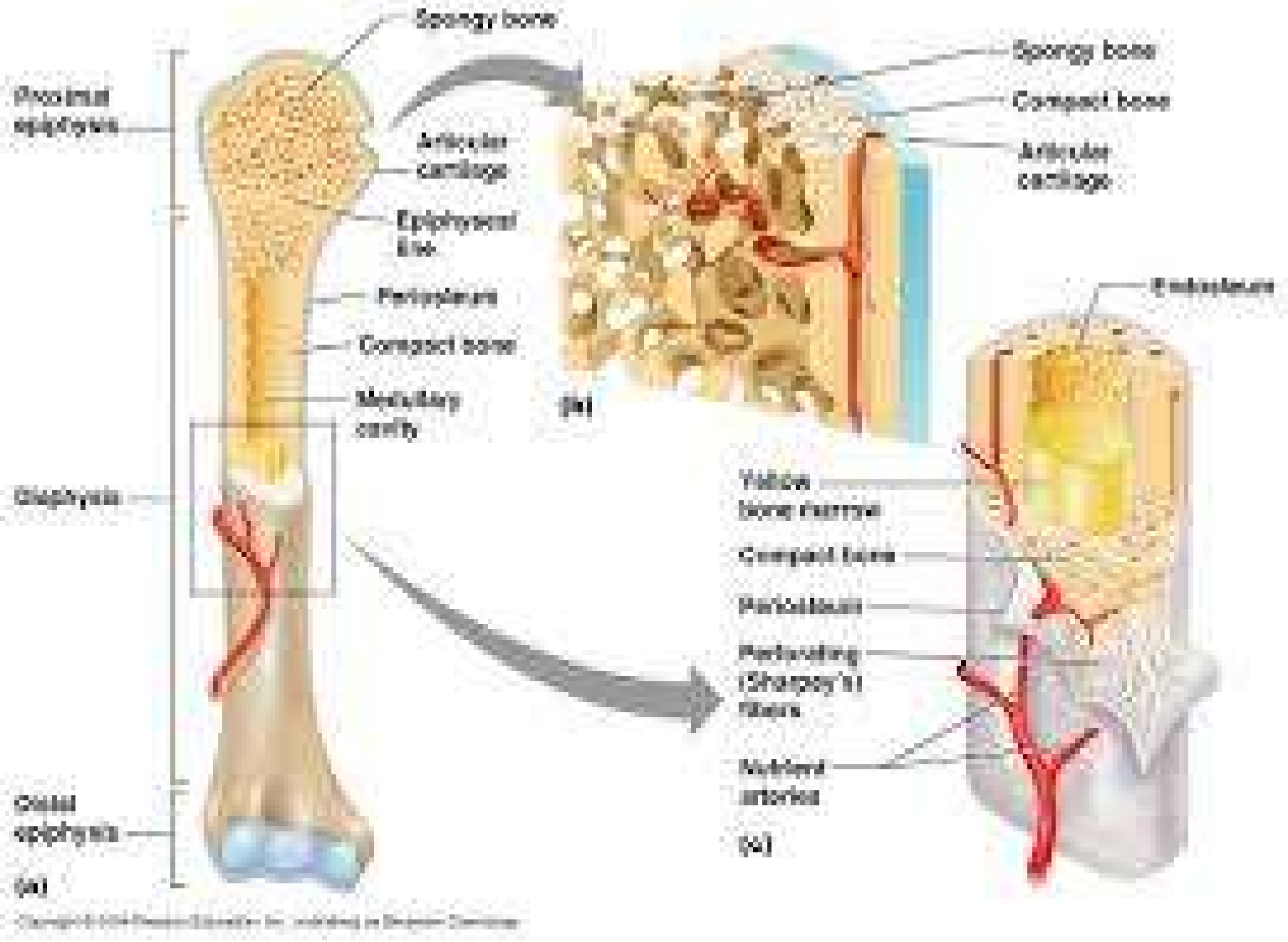
a The organization of osteons and lamellae in compact bone

3. Circumferential lamellae



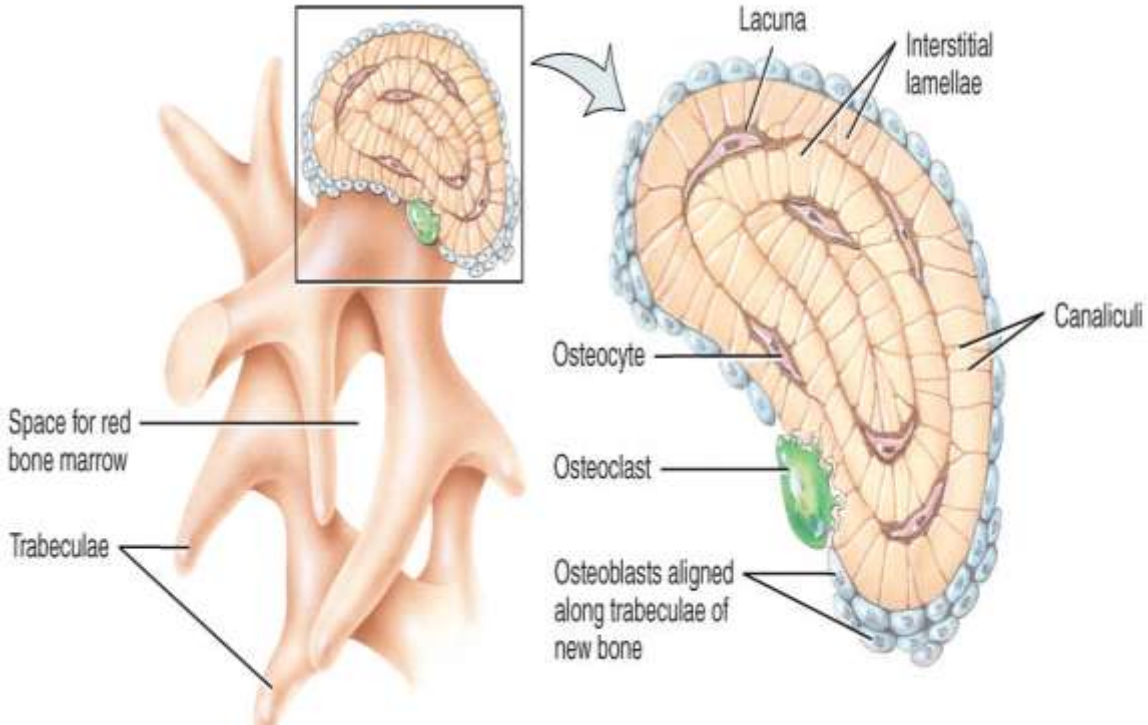
a The organization of osteons and lamellae in compact bone

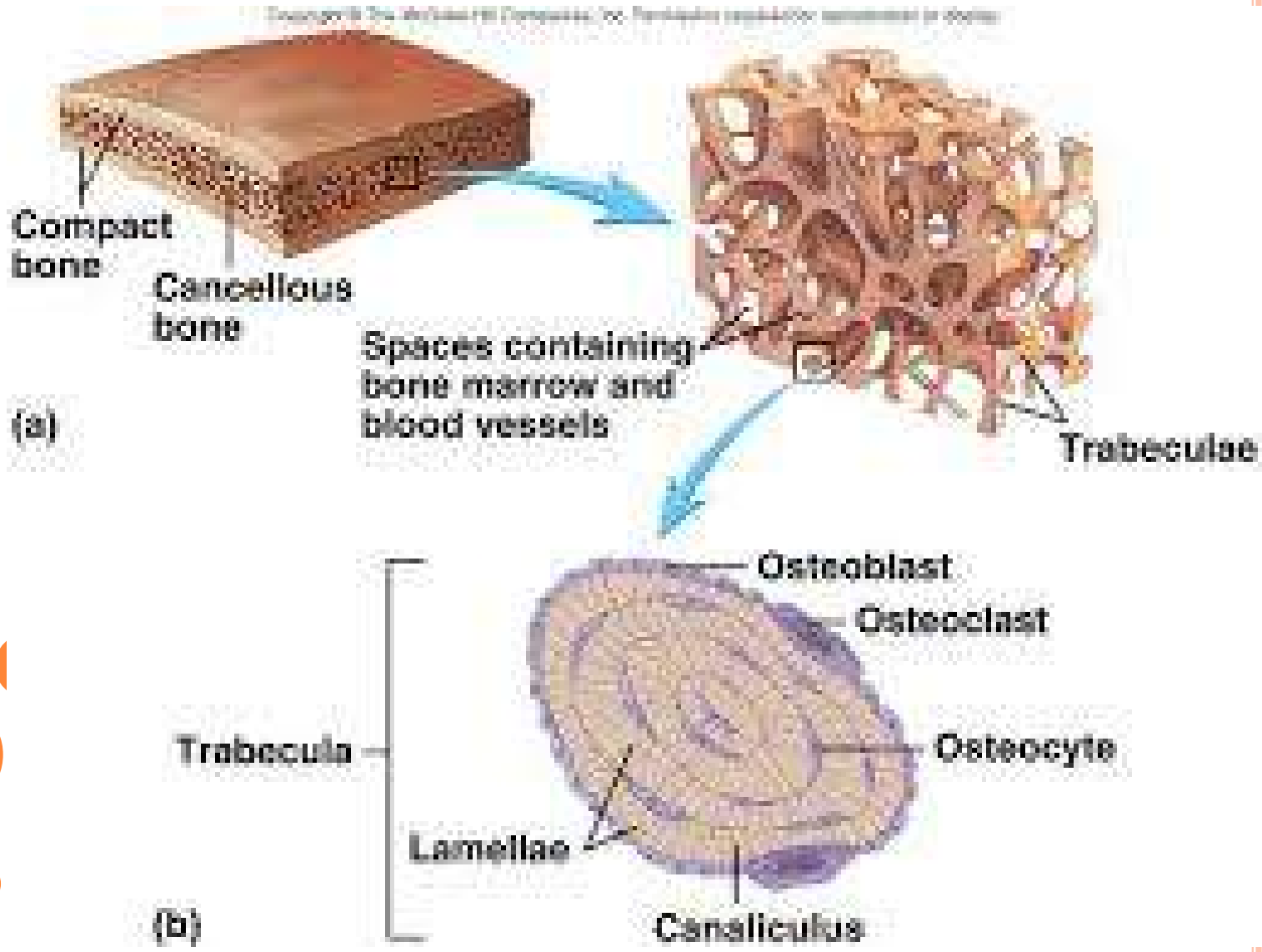
SPONGY BONE (CANCELLOUS BONE)



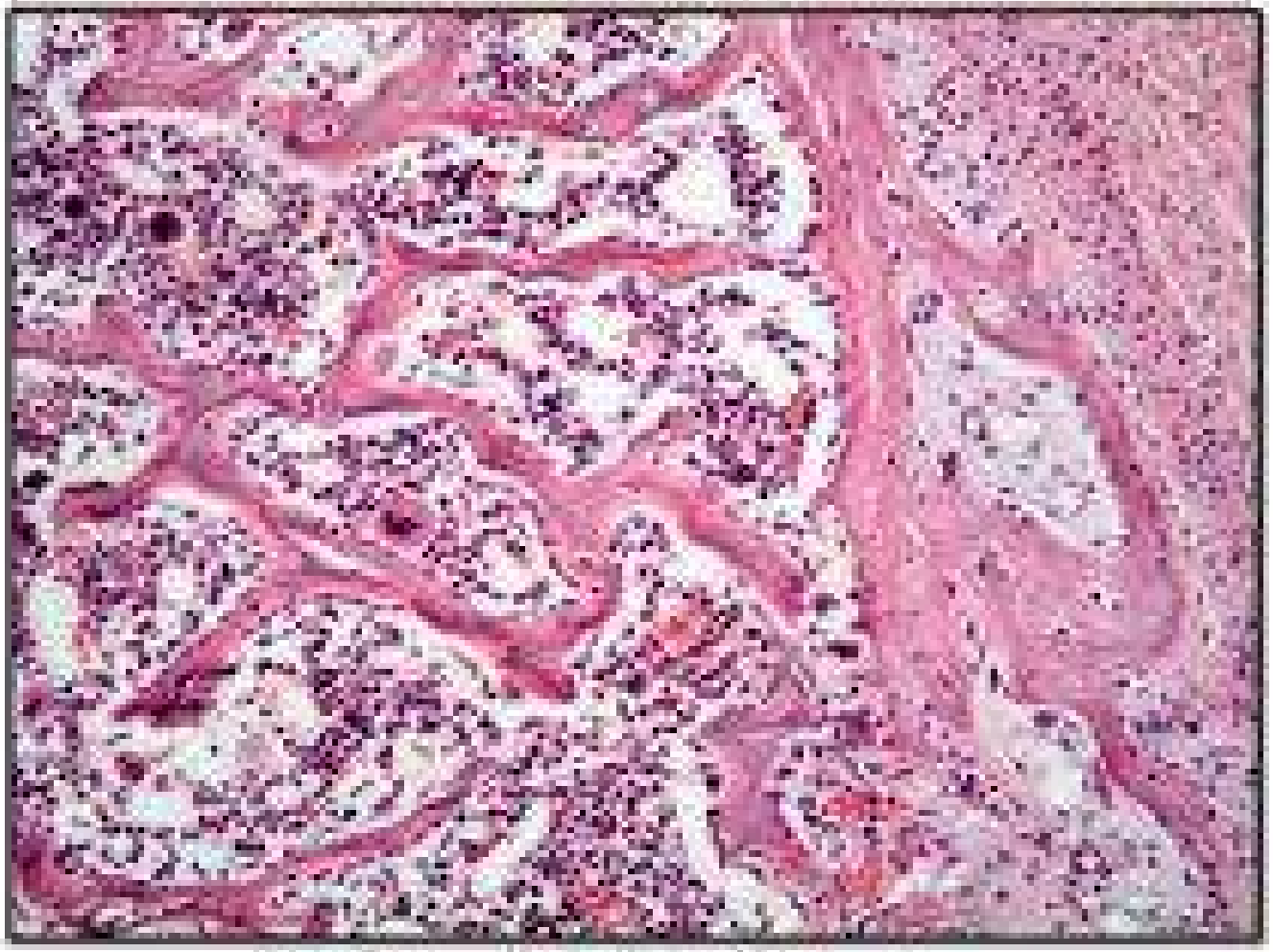
SPONGY BONE (CANCELLOUS BONE)

- Trabecular bone tissue (haphazard arrangement).
- Filled with red and yellow bone marrow
- Osteocytes get nutrients directly from circulating blood.
- Sho ade up (




Compact bone
Cancellous bone
(a)
Spaces containing bone marrow and blood vessels
Trabeculae
Osteoblast
Osteoclast
Trabecula
Osteocyte
Lamellae
Canaliculus
(b)

L.M. Spongy Bone



For practical in next week

- Draw a compact bone with simple pencil in front of page no. 23

- Draw a spongy bone with H & E pencil in front of page no. 24

THANK YOU

1. All of the following are the cells of the bone except

A) Osteocyte
B) Osteoblast
C) Monocyte
D) Osteoclast

2. Which cell is responsible for growth, maintenance and bone repair

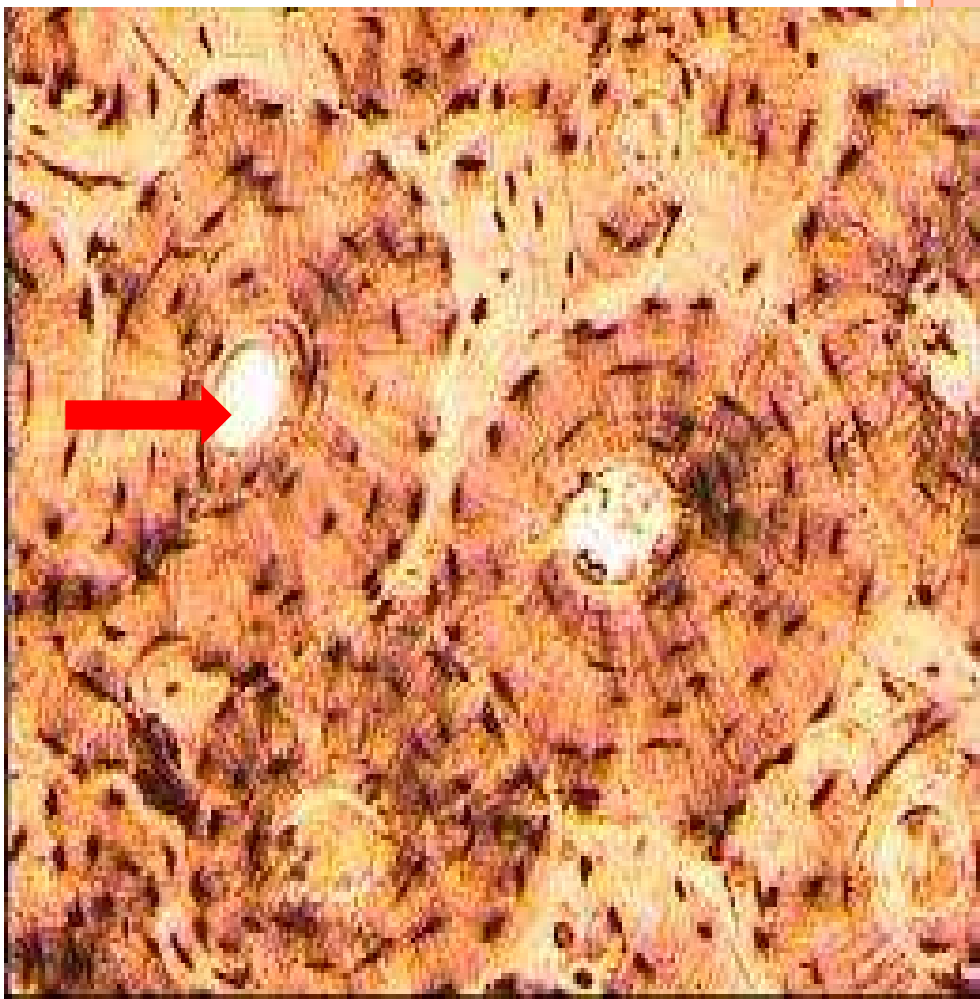
A) Osteocytes
B) Osteoclast
C) Osteoblast
D) Osteoprogenitor cell

3. Identify the structure

A) Compact bone
B) Spongy bone
C) Both
D) None

4. Identify the structure with arrow

A) Haversian canal
B) Volkman's canal
C) Osteon
D) Osteocyte



5. Identify the structure with arrow

A) Haversian canal
B) Volkman's canal
C) Osteon
D) Osteocyte