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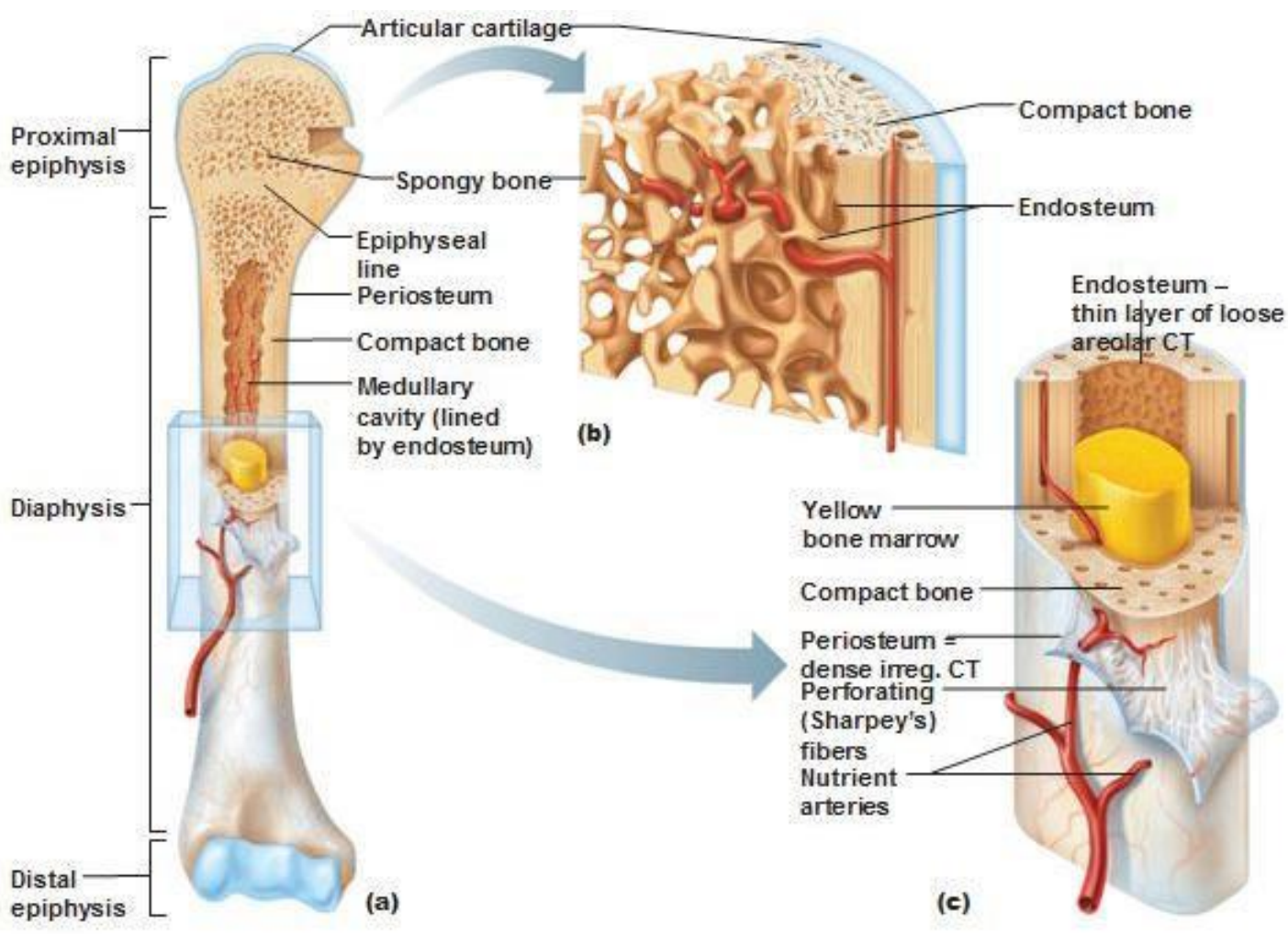
LEARNING OBJECTIVES

- Histological Organisation of Bone
- Bone Cells and Matrix
- Formation of Bone

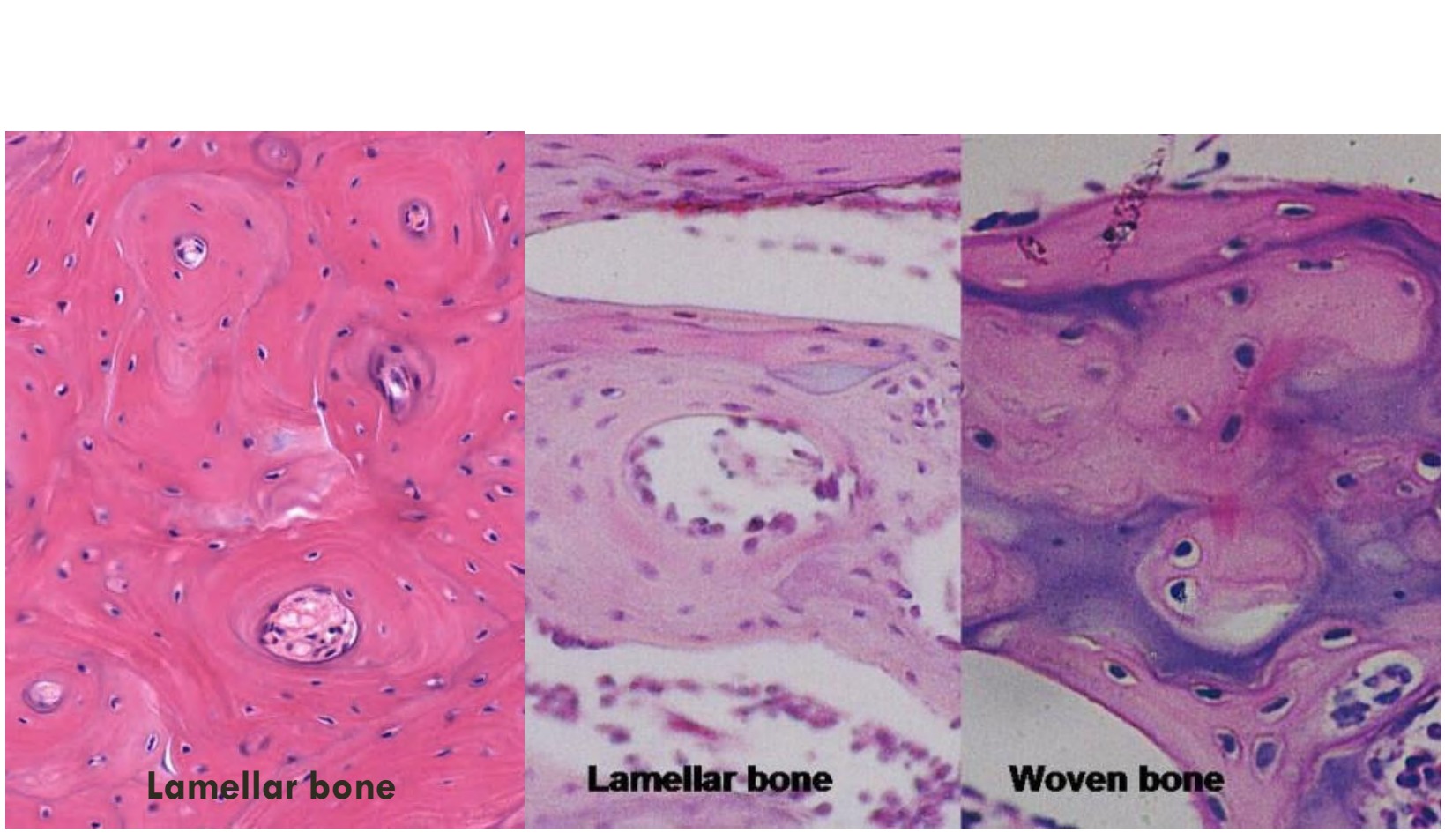
  Intramembranous Ossification

  Endochondral Ossification
- Reorganisation and Restoration of Bone

STRUCTURE OF LONG BONE

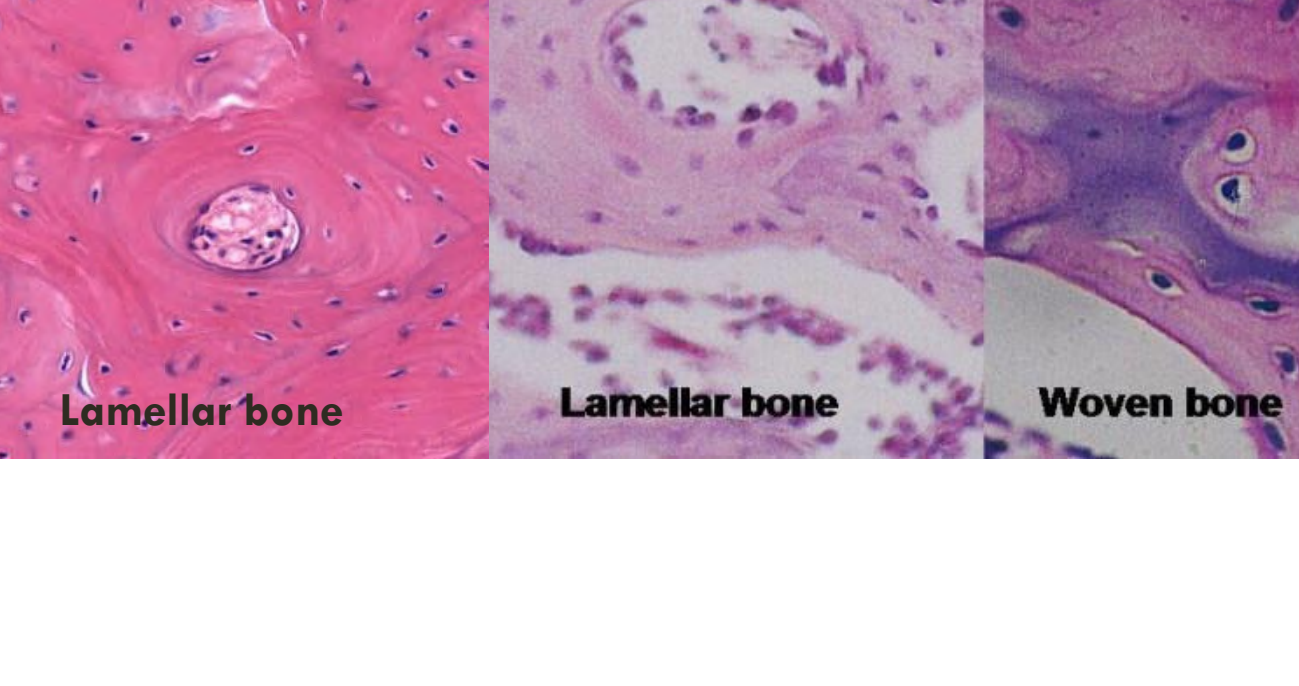


BASED ON BONE MATURITY



WOVEN BONE LAMELLAR BONE

- Lamellar appearance - arrangement of collagen fibres
- Woven bone is weak- repair of fracture



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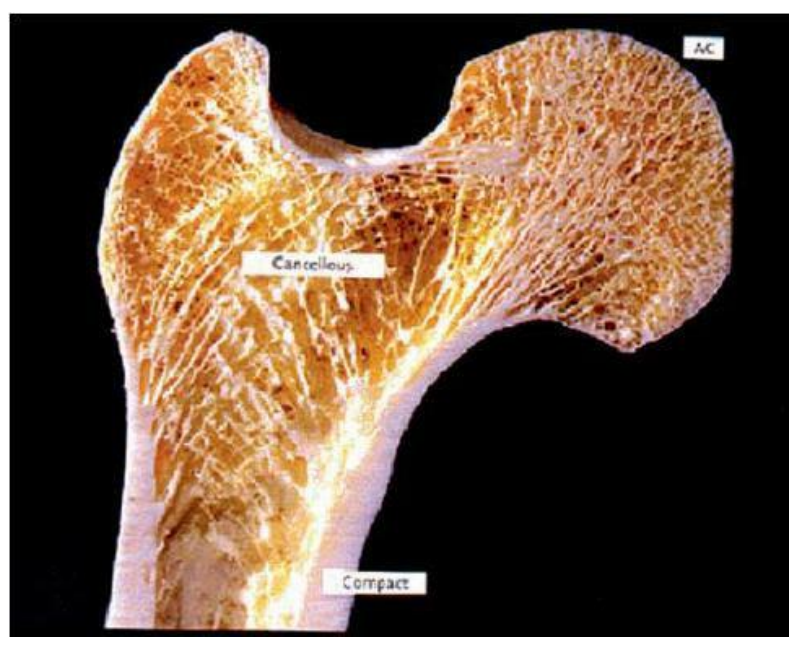
TYPES OF BONE : macroscopically



Trabecular bone :

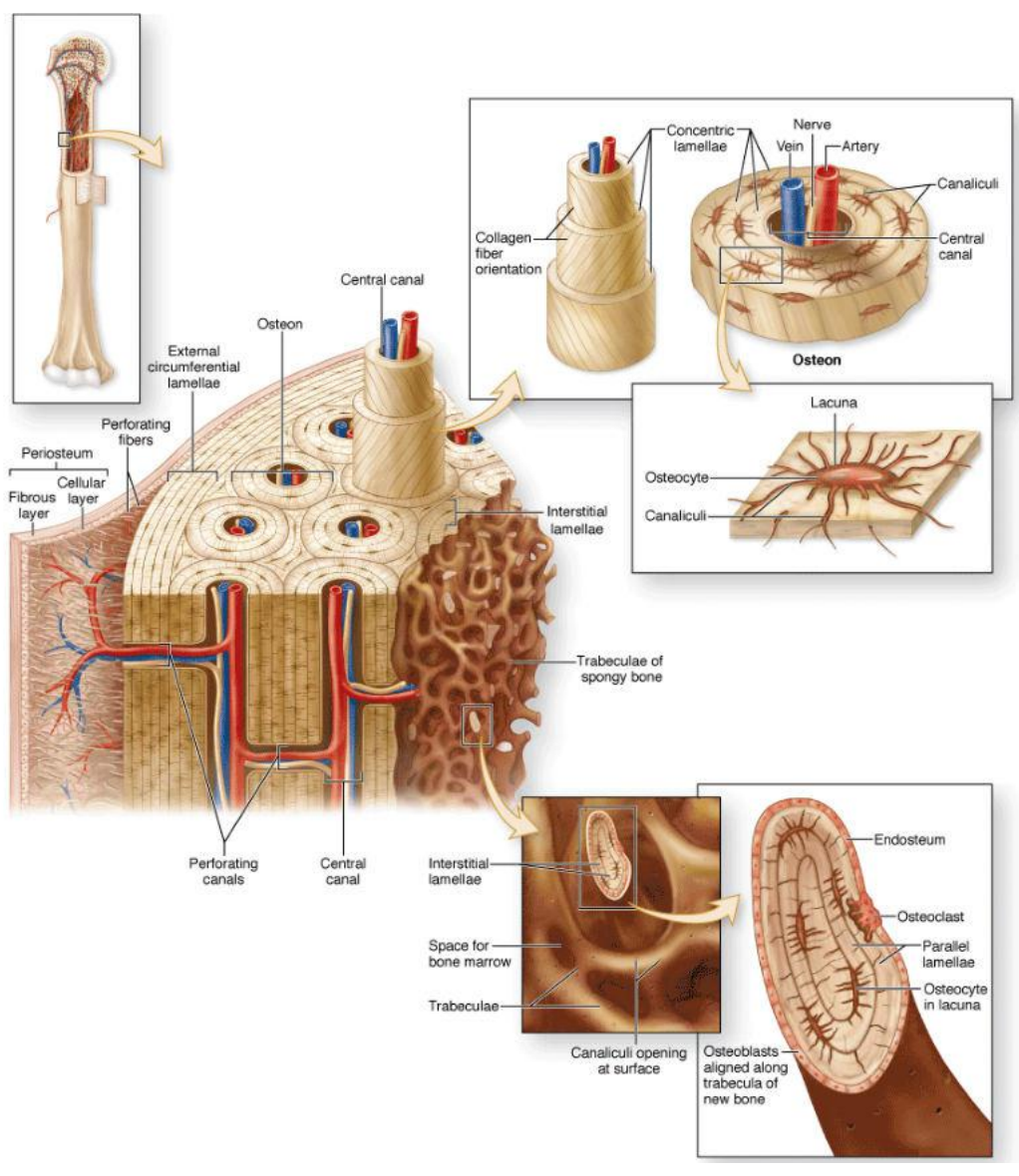
- Cancellous or spongy bone
- Ends of long bones

Compact bone:

- Forms thick-walled tube of the shaft (or *diaphysis*)
- A thin layer of compact bone also covers the epiphyses of long bones.

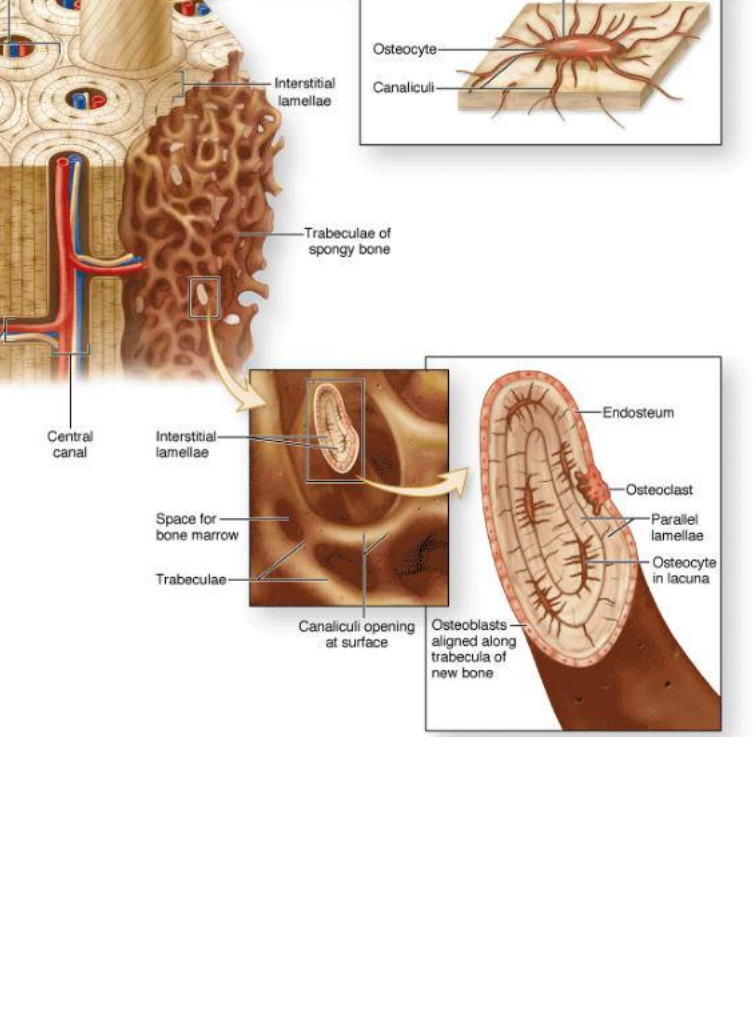
COMPACT BONE

- Matrix
- Lamellae*
- Lacunae
- Canaliculi
- Haversian Canals



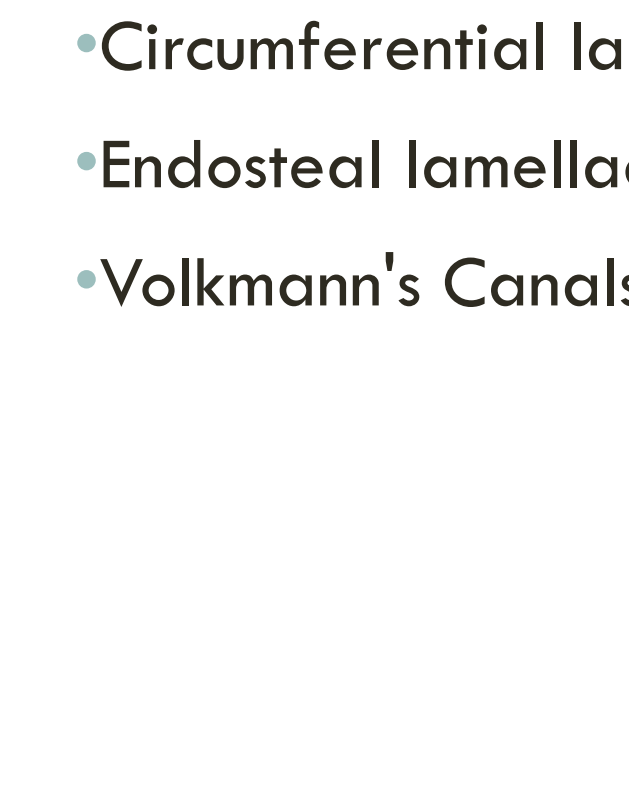
COMPACT BONE- UNSTAINED

- Haversian system - Osteon
- Interstitial lamellae
- Circumferential lamellae
- Endosteal lamellae
- Volkmann's Canals



COMPACT BONE

Schmorl Stained



Ground section - unstained

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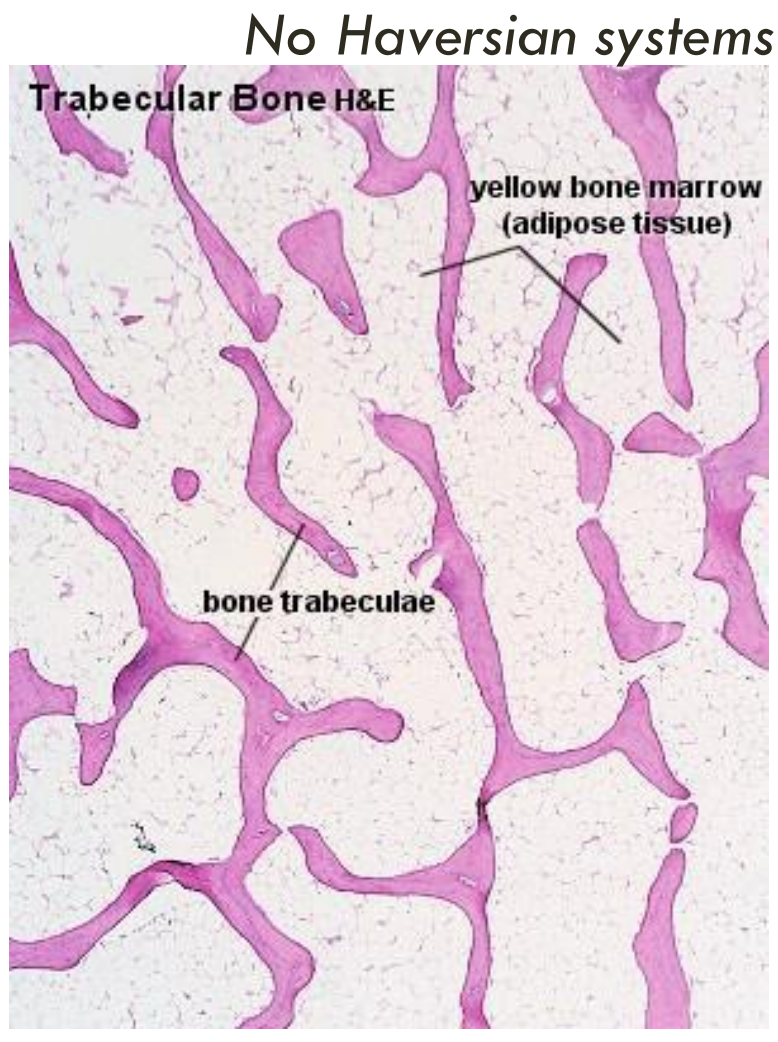
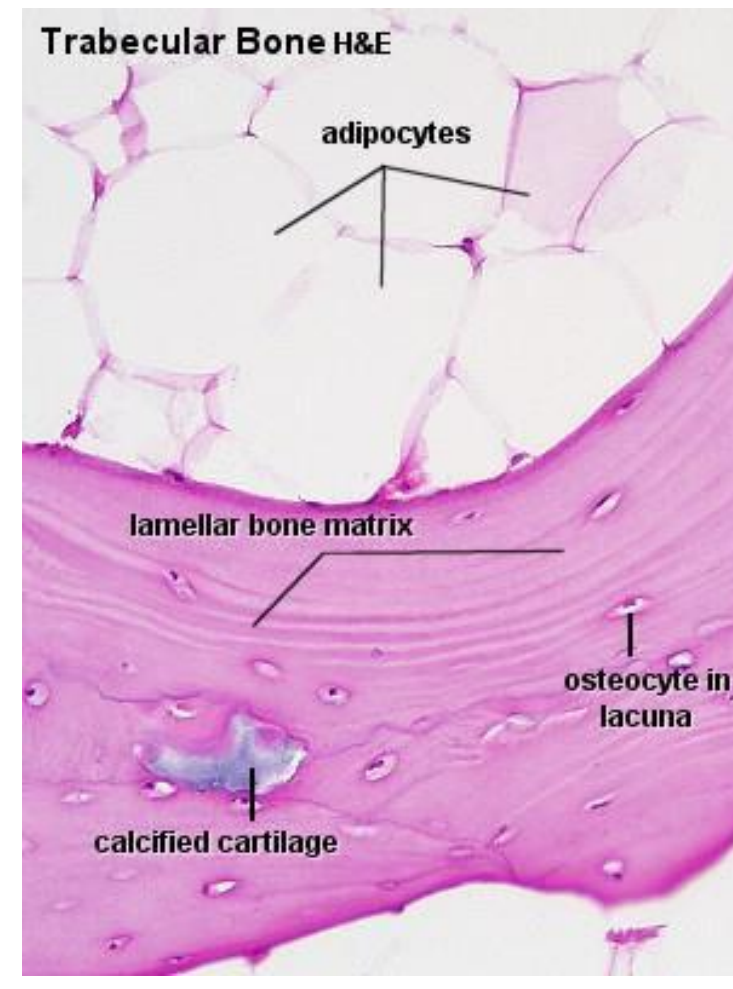
TRABECULAR BONE

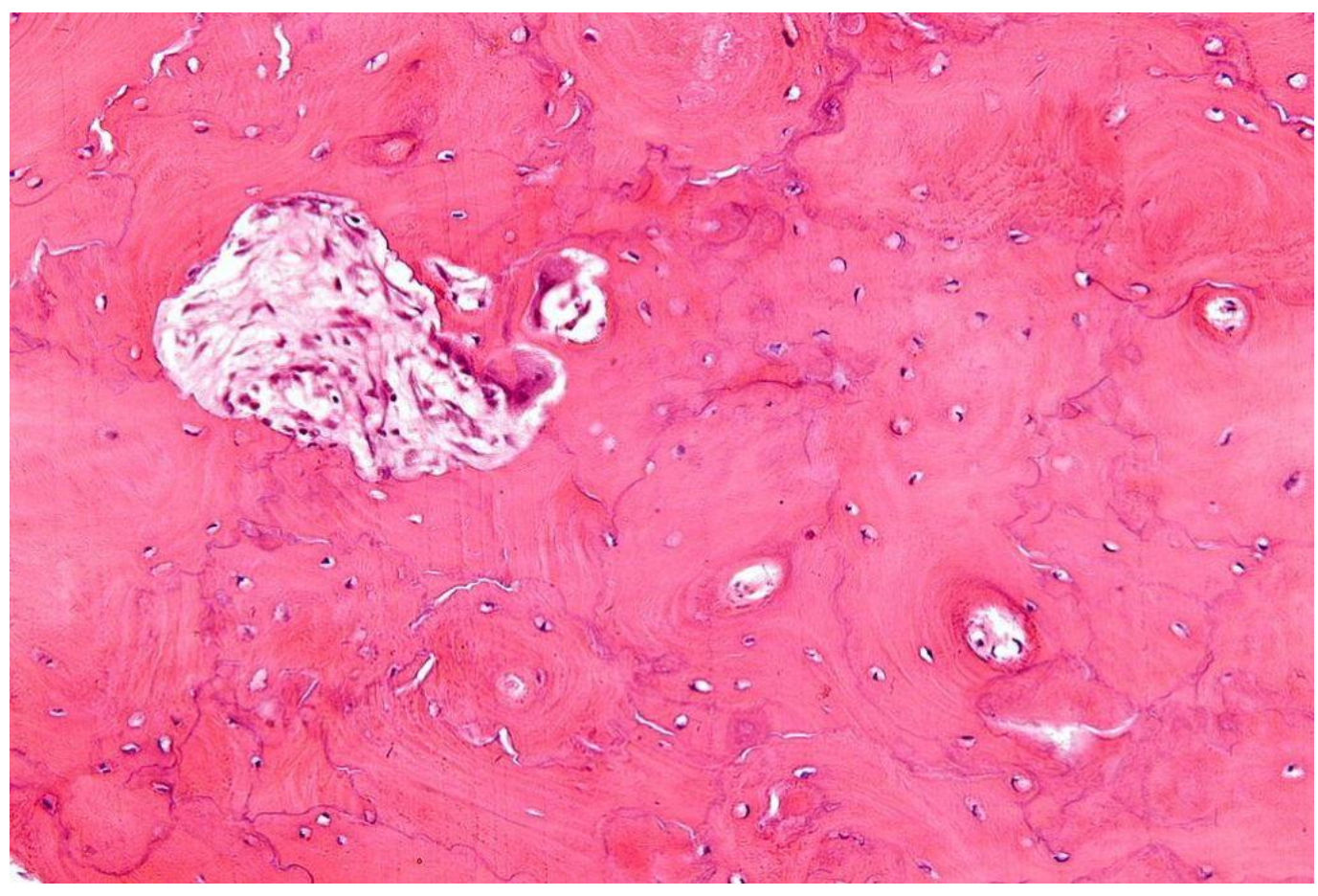
No Haversian systems





PAGET'S DISEASE

Woven bone and Lamellar bone in disorganised manner

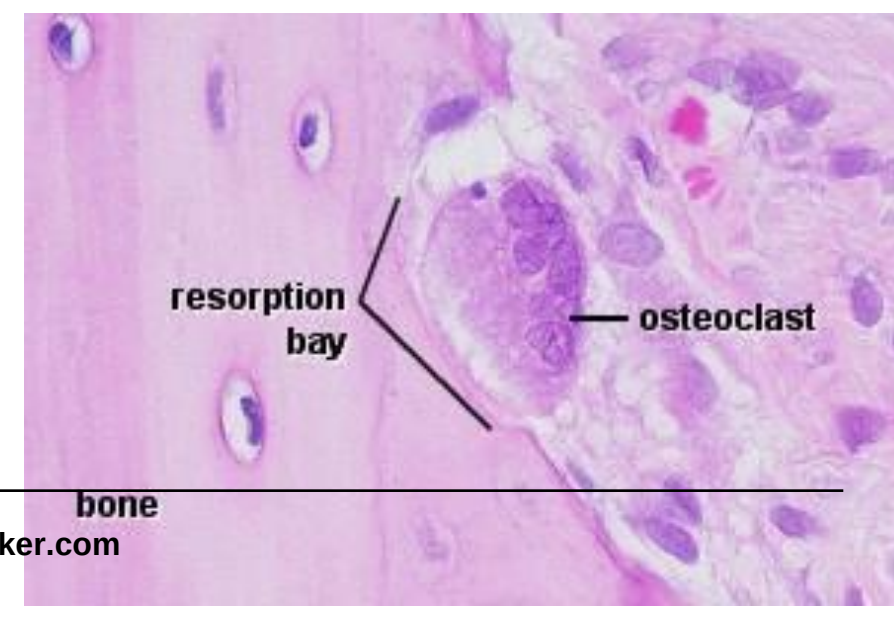


BONE MATRIX

- Collagen fibres (about 90% of the **organic** substance)
- Ground substance- osteonectin, osteocalcin
- Collagen type I
- Hardness of the matrix - inorganic salts
- Calcification - few days to several months.

BONE CELLS

- Osteoprogenitor cells (stem cells)
- Osteoblasts (or bone forming cells)
- Osteocytes
- Osteoclasts
  (Haematopoietic cells)



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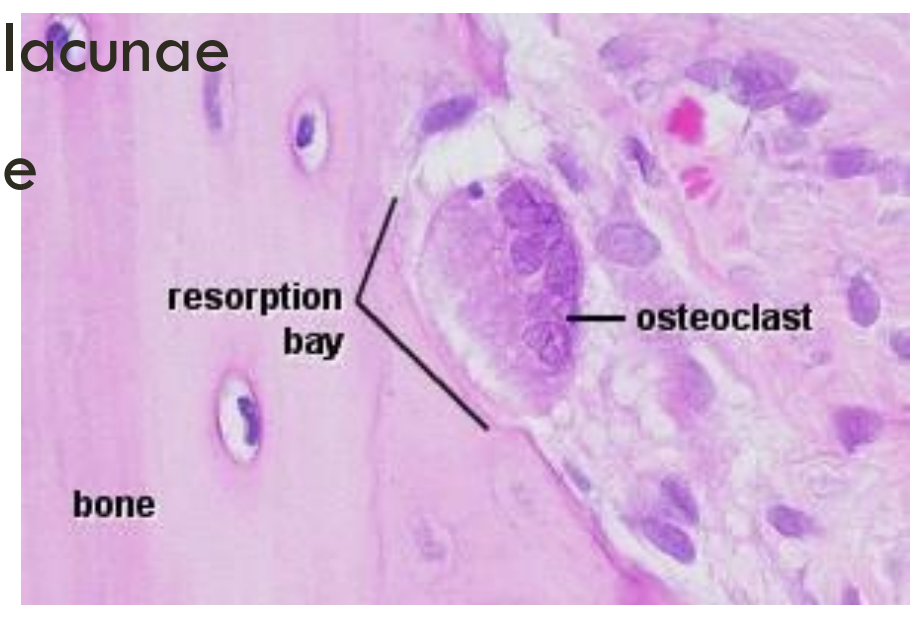
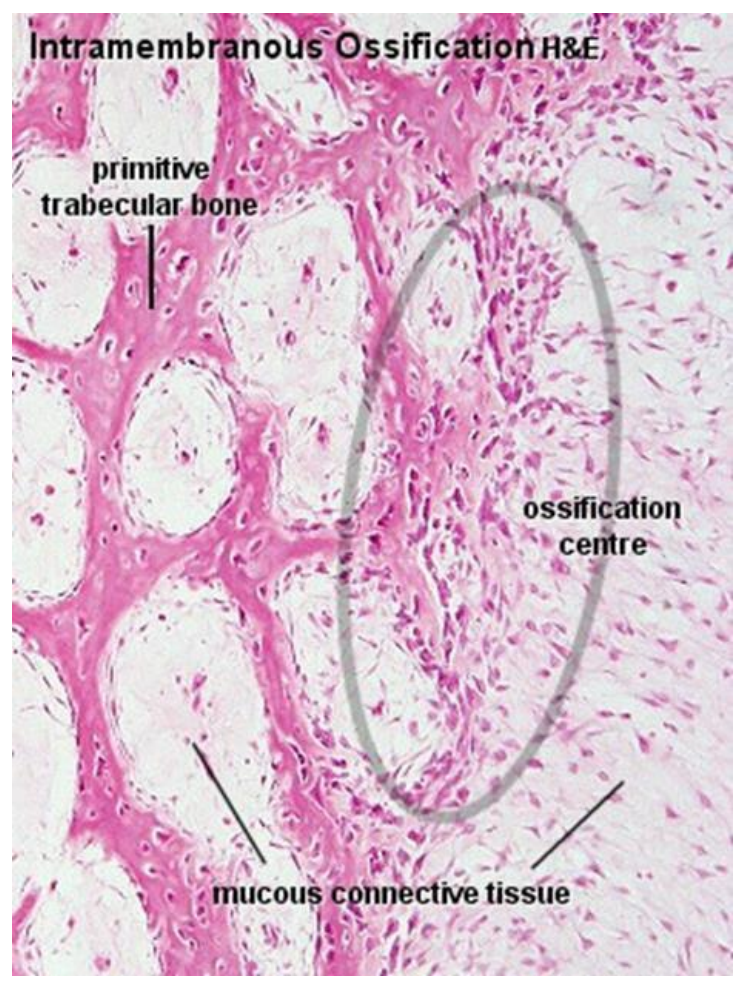
OSTEOCLASTS

- Large (up to 100 µm)
- Multi-nucleated (up to 50 nuclei in the actual cell)
- Arise by the fusion of monocytes
- Resorption bays/Howship's lacunae
- Stimulated by parathormone
- Inhibited by calcitonin

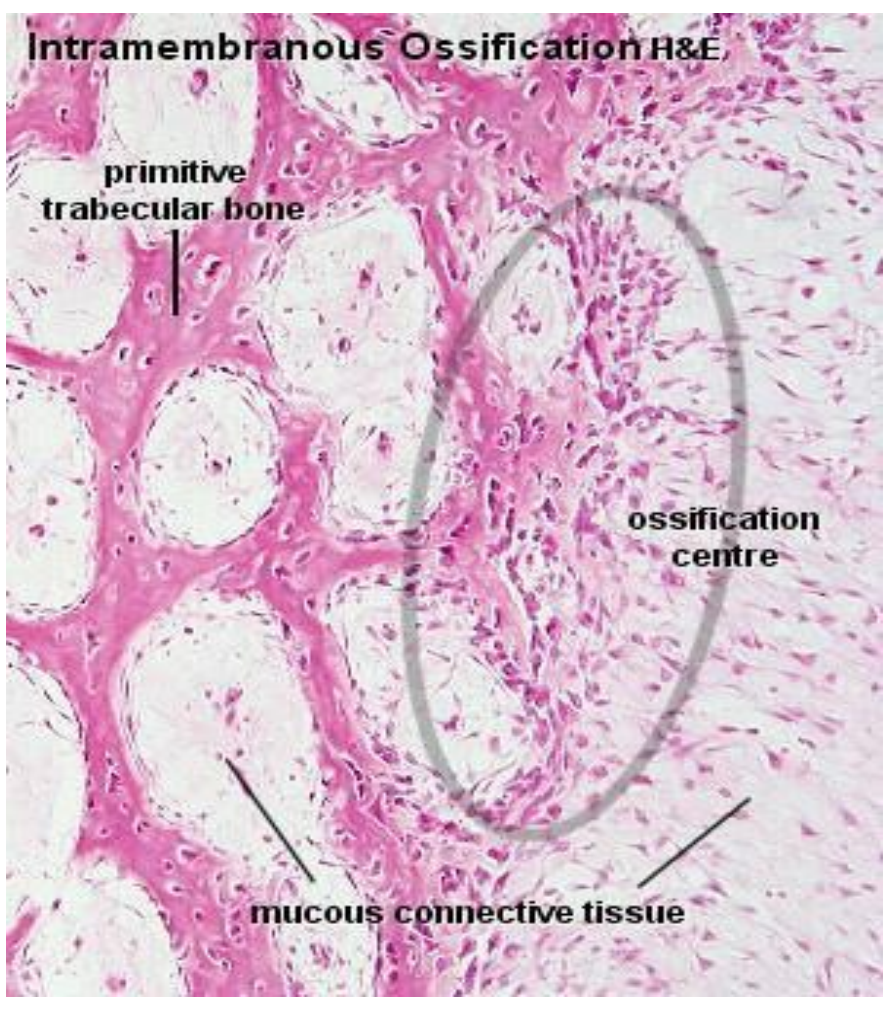


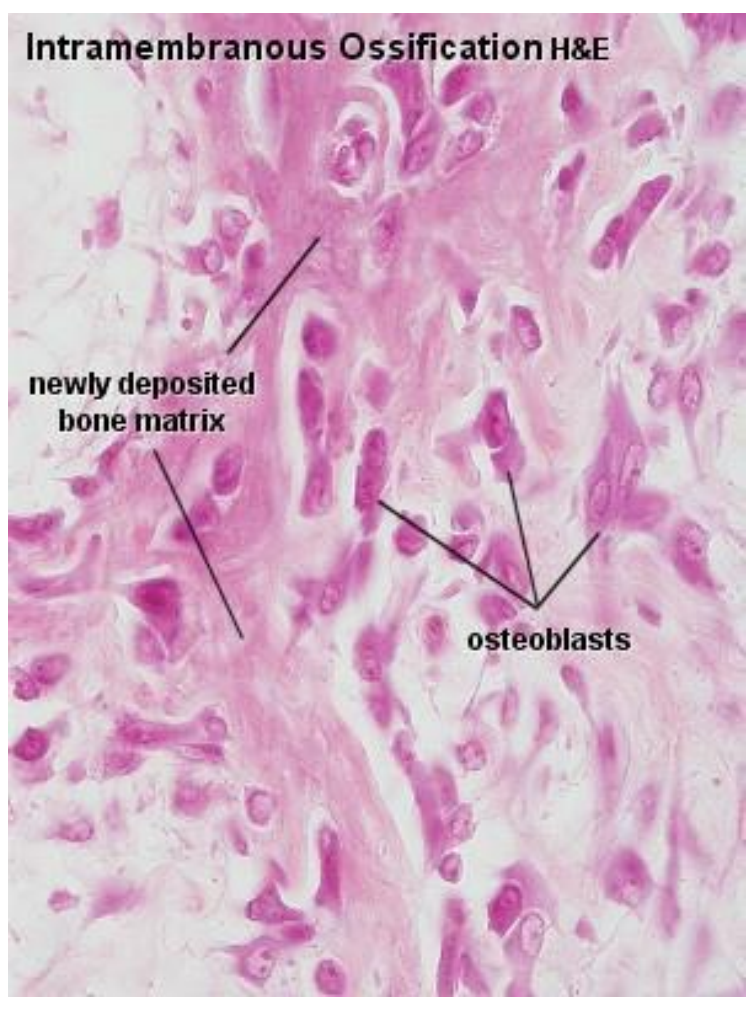
FORMATION OF BONE: INTRAMEMBRANOUS

- Osteoprogenitor cells
- Osteoblasts - deposit osteoid
- Woven network - no lamellae
- Osteoid calcifies
- Primitive trabecular bone
- Primitive compact bone
- Subsequent reorganisation

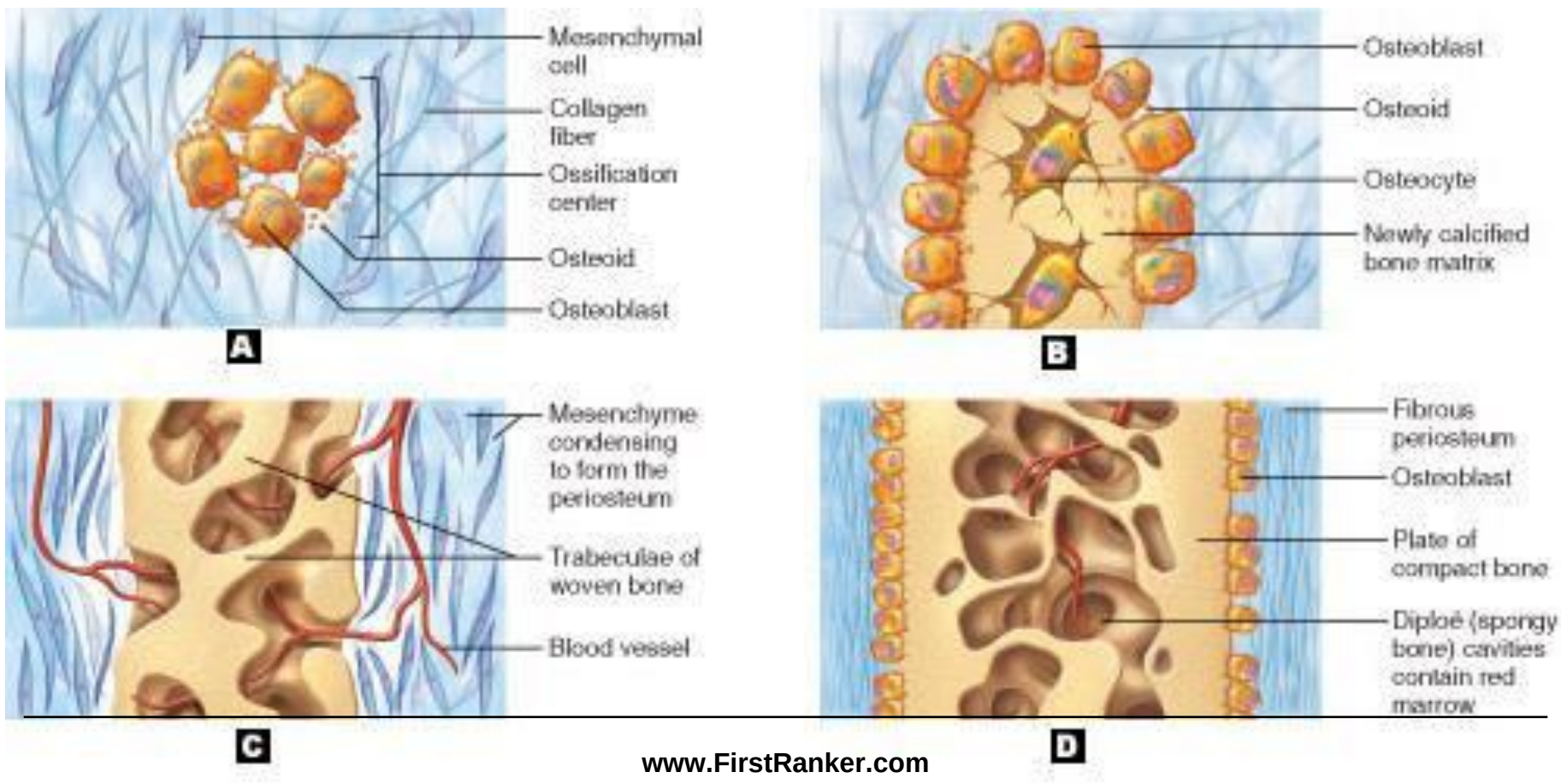


INTRAMEMBRANOUS OSSIFICATION





INTRAMEMBRANOUS OSSIFICATION



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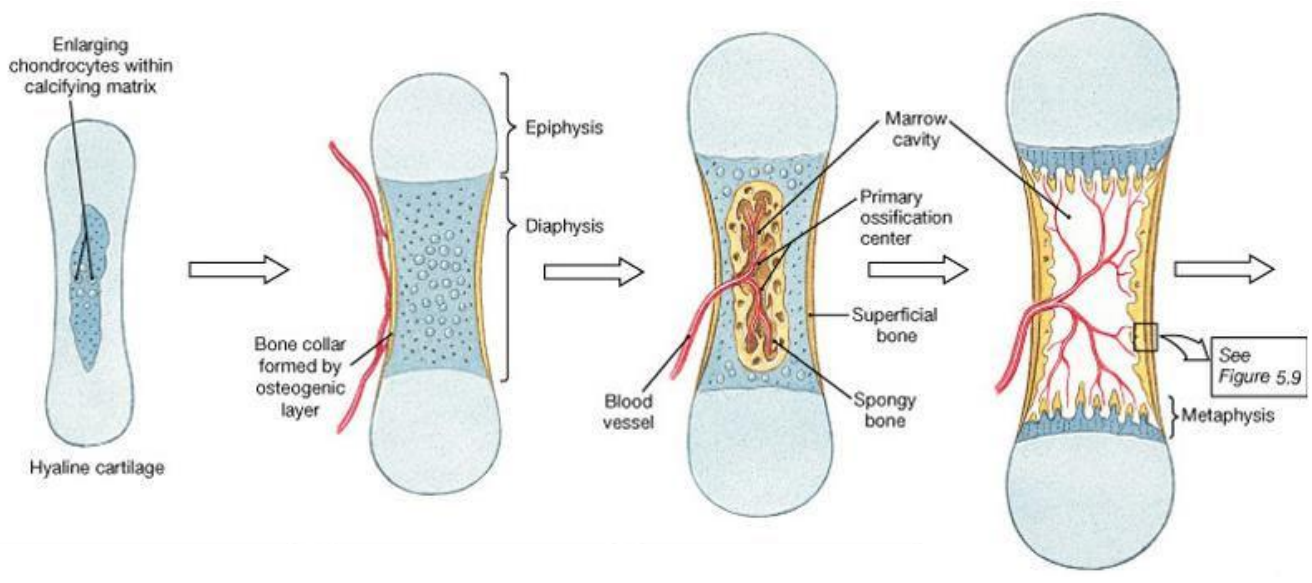
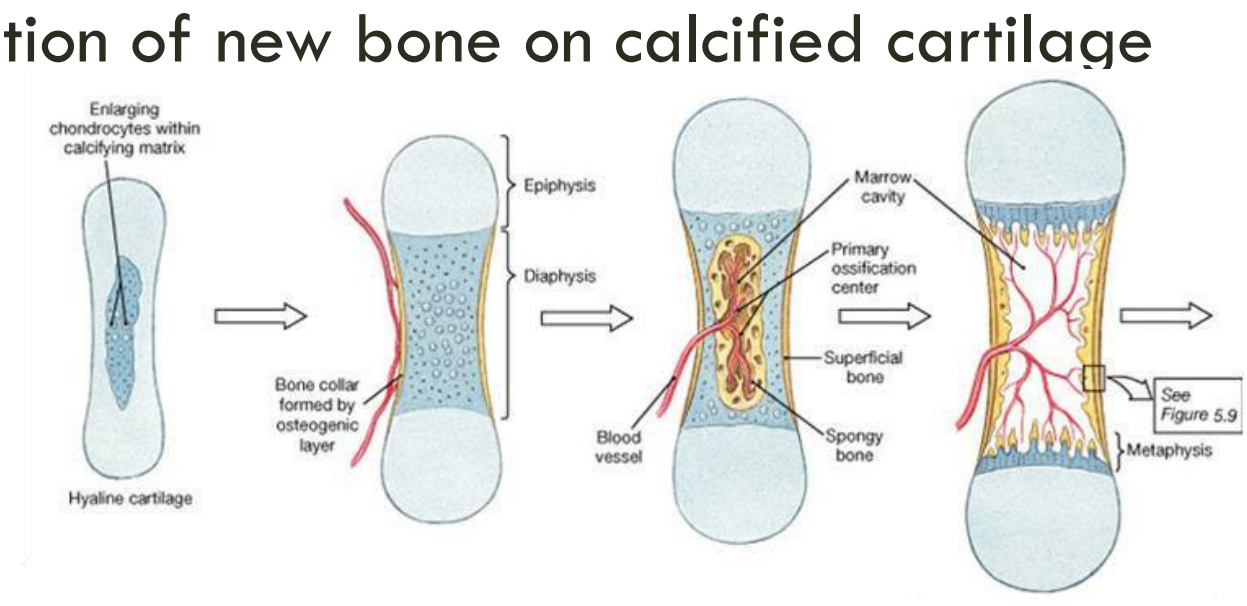
ENDOCHONDRAL OSSIFICATION

- Cartilage bone model
- Calcification of intercellular substance (ALP)
- Periosteal bud invasion

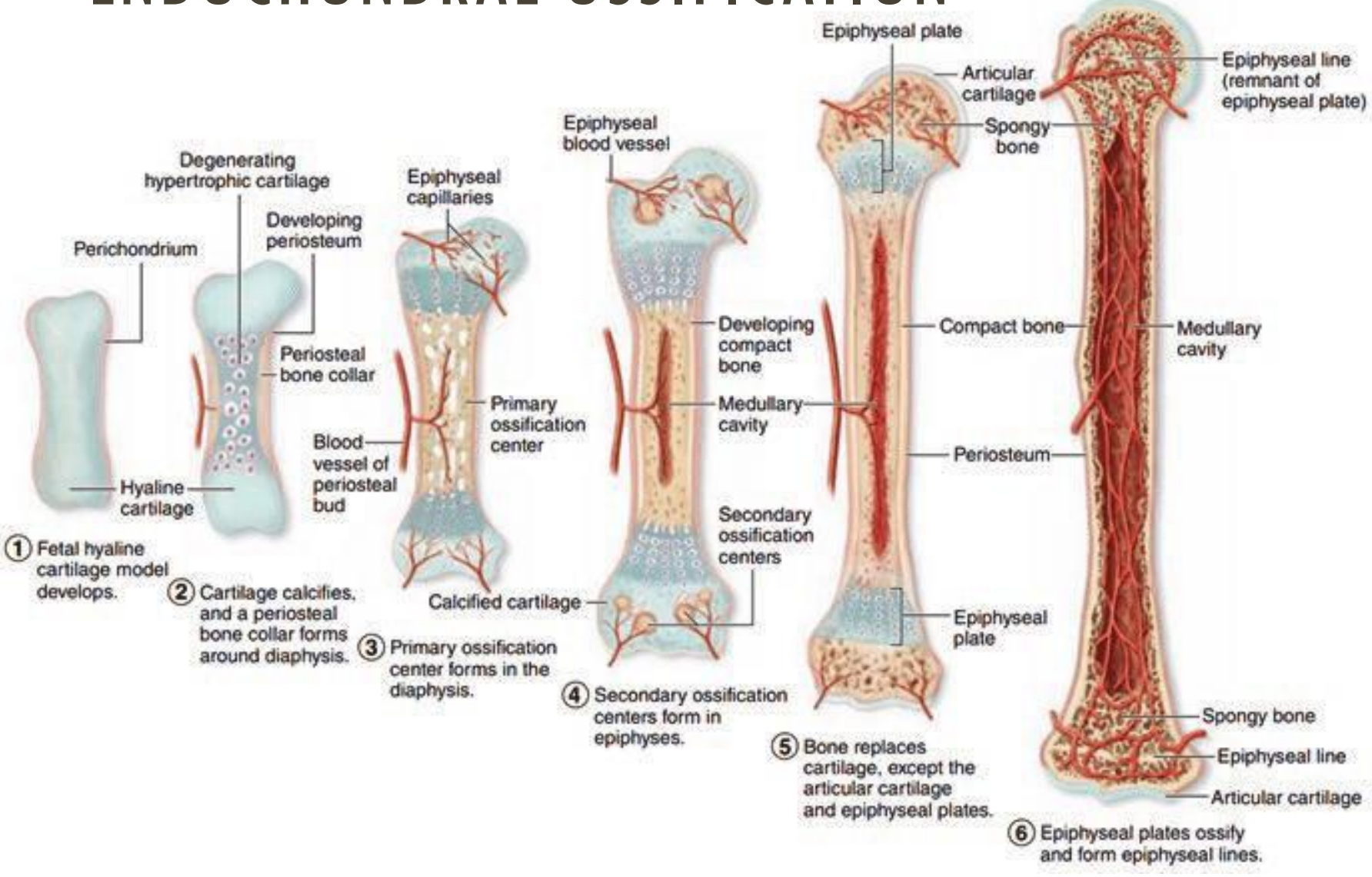


ENDOCHONDRAL OSSIFICATION

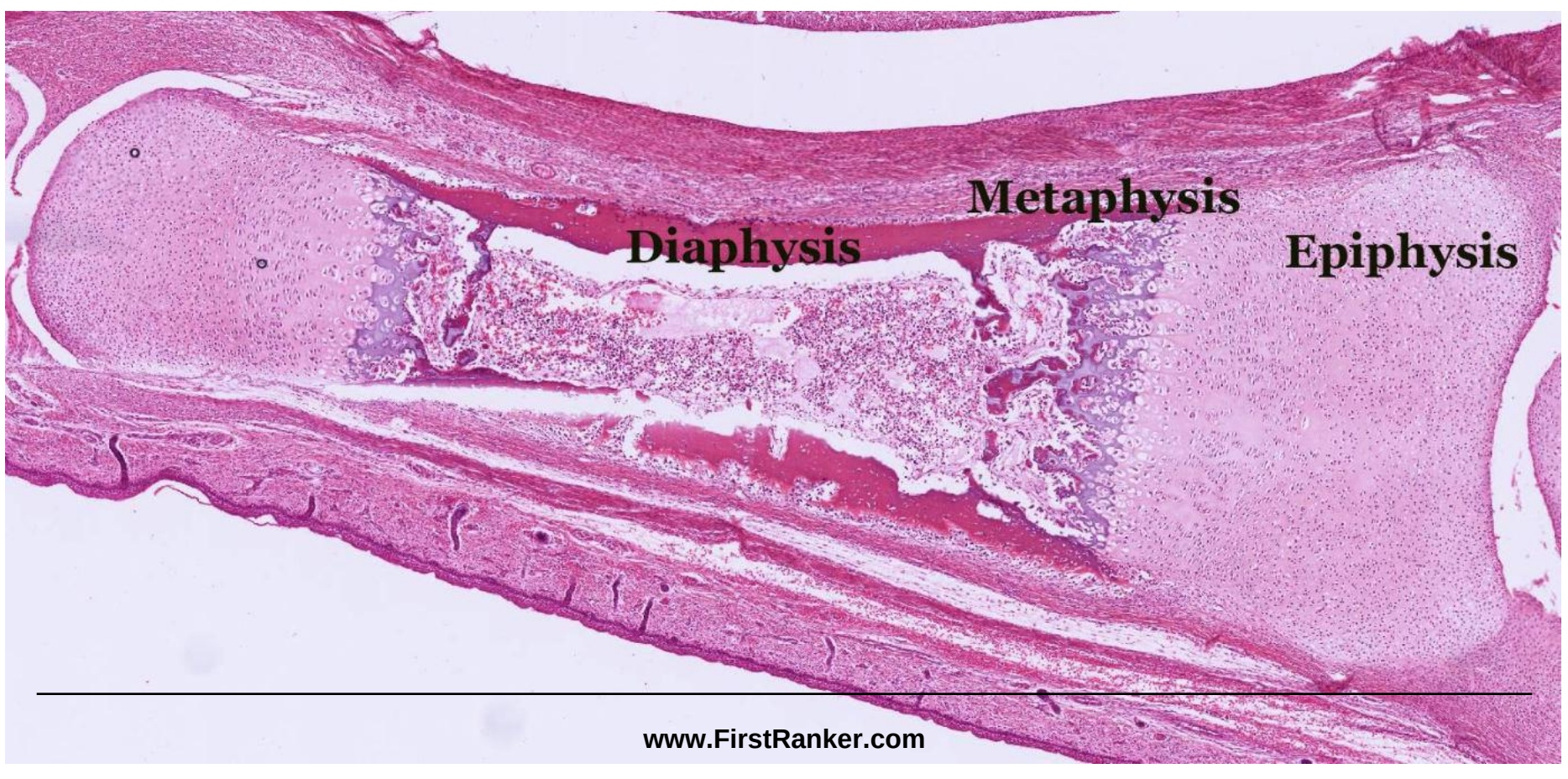
- Osteoprogenitor cells - enter hypertrophied and partial calcified cartilage
- Mature into osteoblasts
- Deposition of new bone on calcified cartilage



ENDOCHONDRAL OSSIFICATION



ENDOCHONDRAL OSSIFICATION



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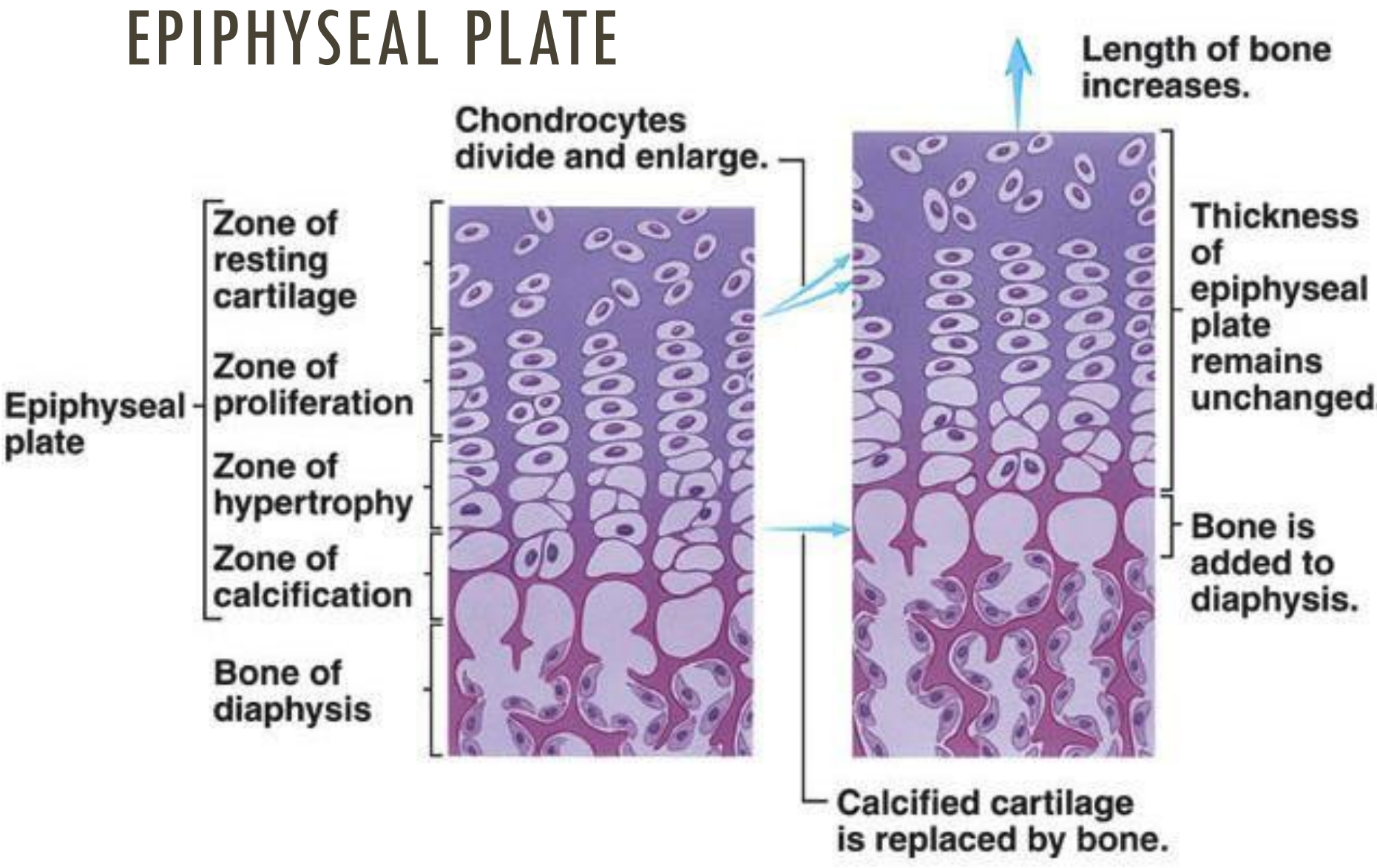
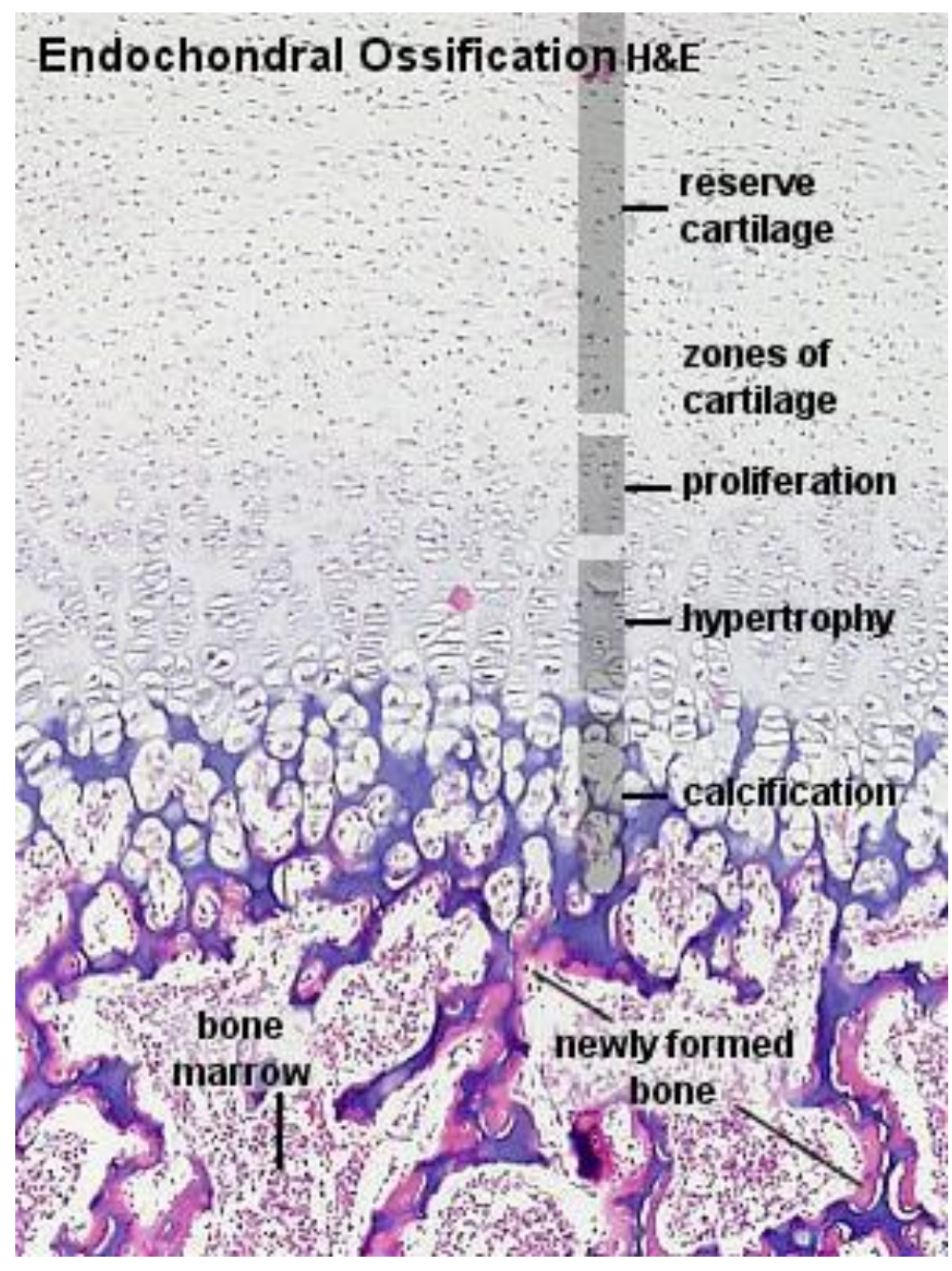
EPIPHYSEAL PLATE

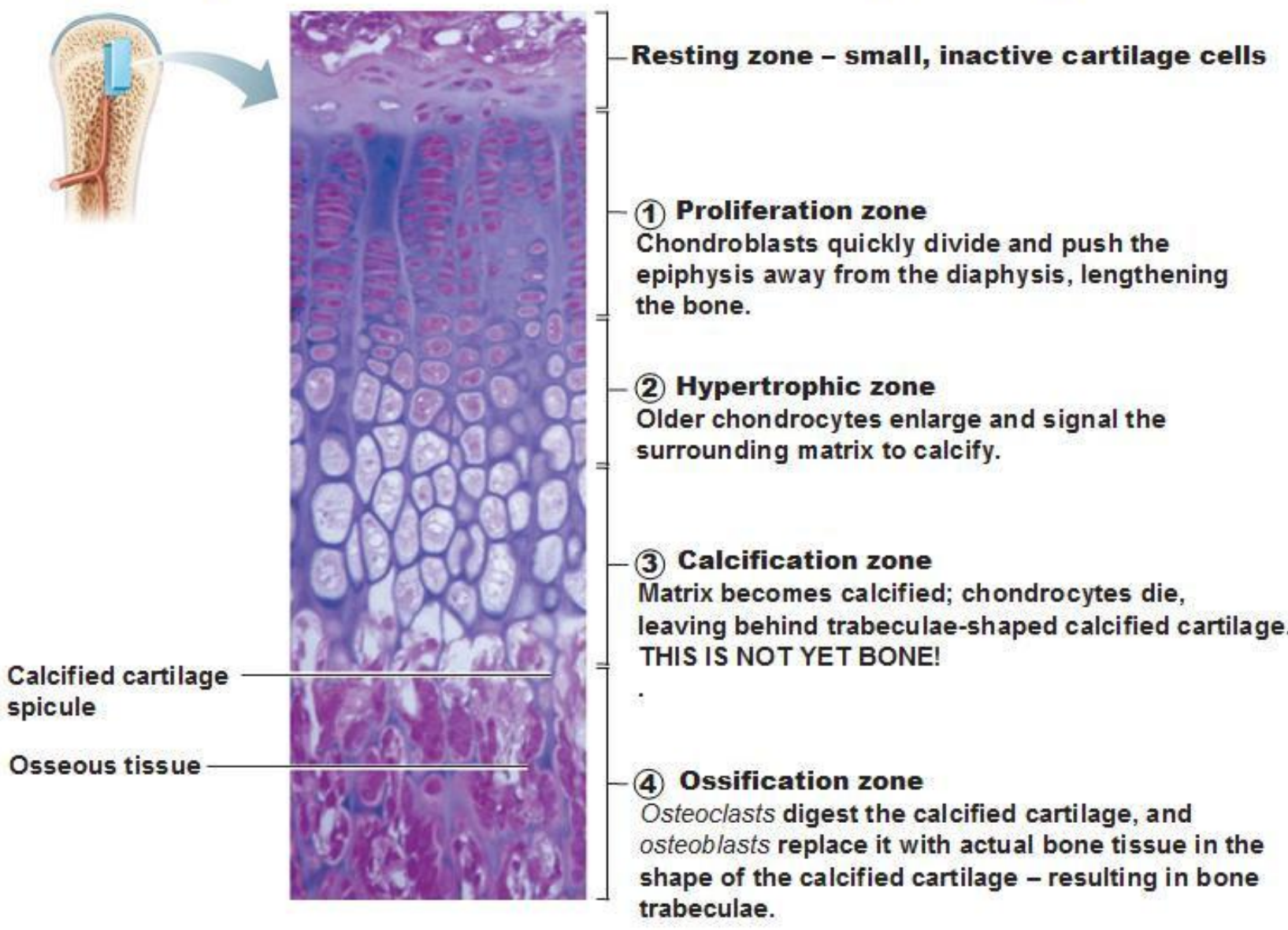


EPIPHYSEAL PLATE

1. Resting zone
2. Proliferation zone
3. Hypertrophic zone
4. Calcification zone
5. Ossification zone

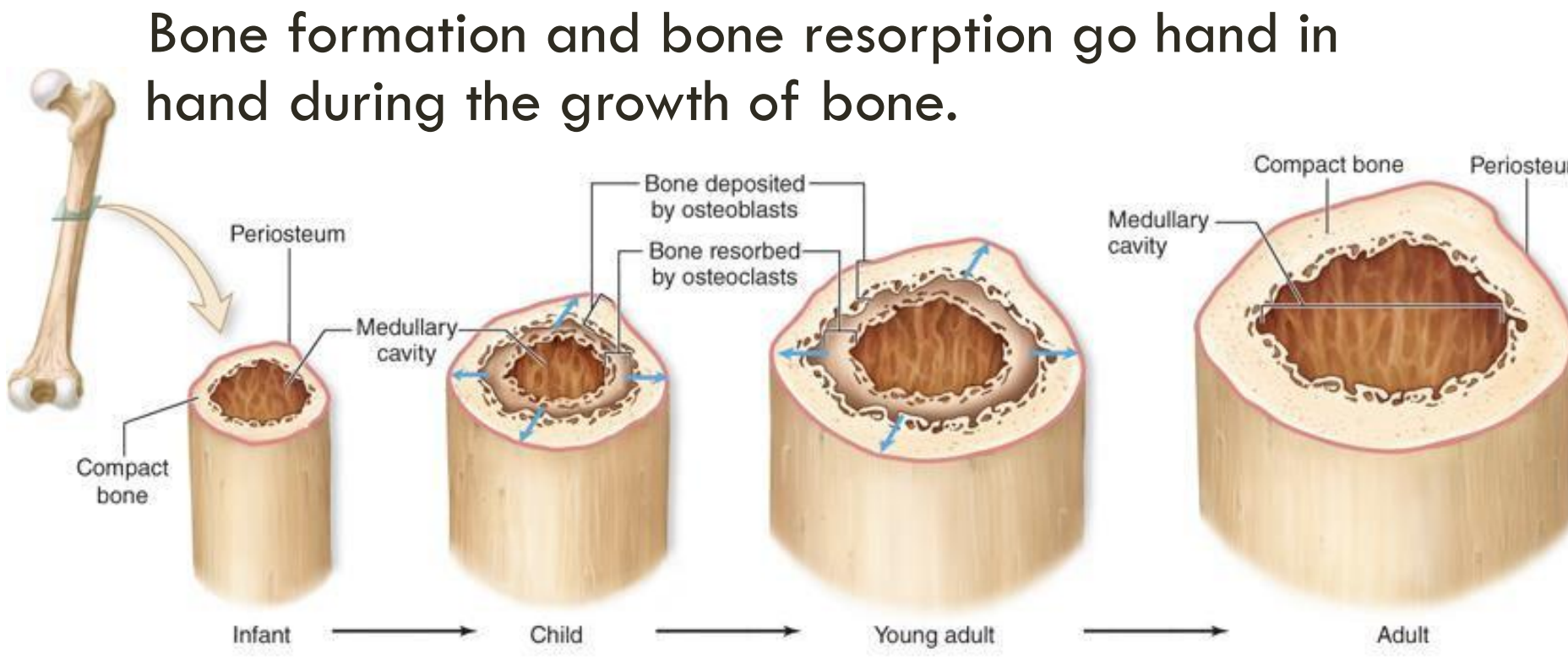


Organization of Cartilage within Epiphyseal Plate of Growing Long Bone



GROWTH OF BONE

Bone formation and bone resorption go hand in hand during the growth of bone.



Source: Anthony L. Mescher: Junqueira's Basic Histology, 14th Edition.
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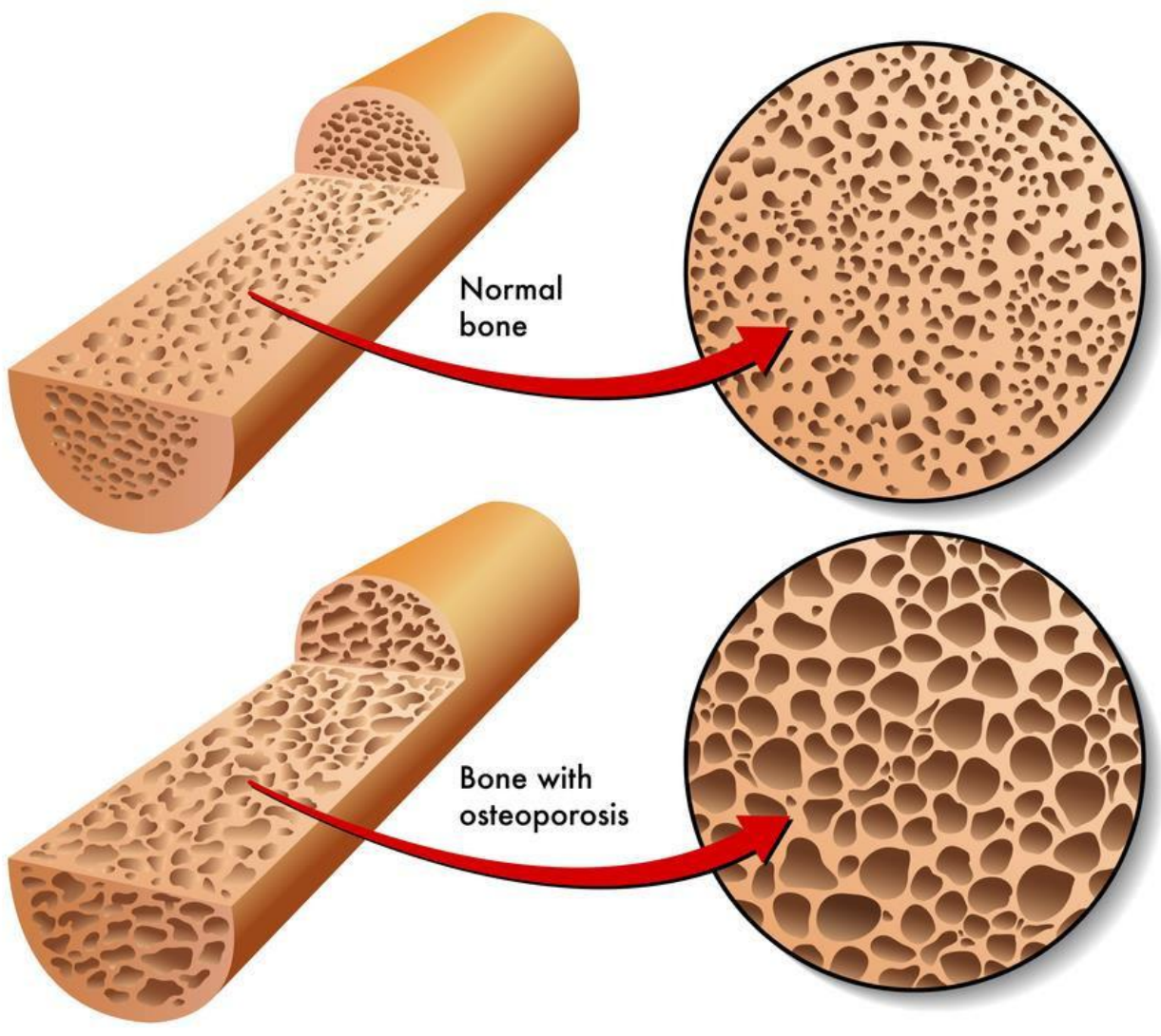
REORGANISATION AND RESTORATION

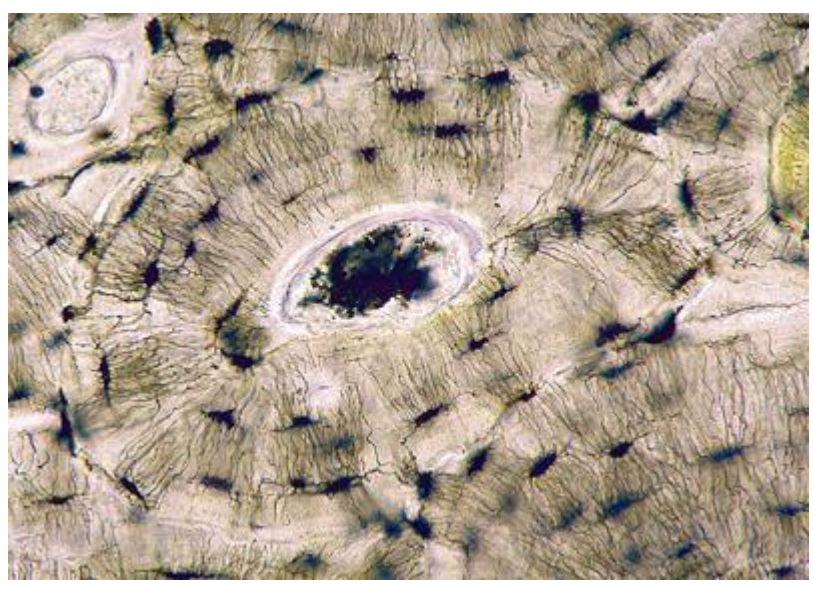
- During growth period and continues
- Changes of tensile and compressive forces.
- Wear and tear occurring in bone
- Osteoclasts and osteoblasts
- Forms new Haversian system within the matrix of compact bone.
- Older Haversian systems - interstitial lamellae
- Capillaries and nerves sprout in

OSTEOPOROSIS



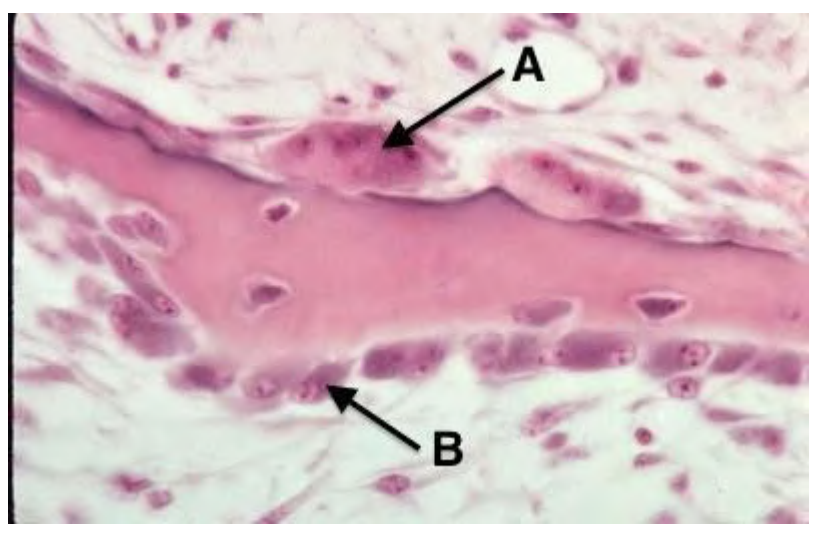
WHAT IS COMPACT BONE?

a. Dense bone
b. Woven bone
c. Immature bone
d. Spongy bone



WHAT CELL IS INVOLVED IN BONE RESORPTION?

a. Osteoclast
b. Osteon
c. Osteocyte
d. Osteoid



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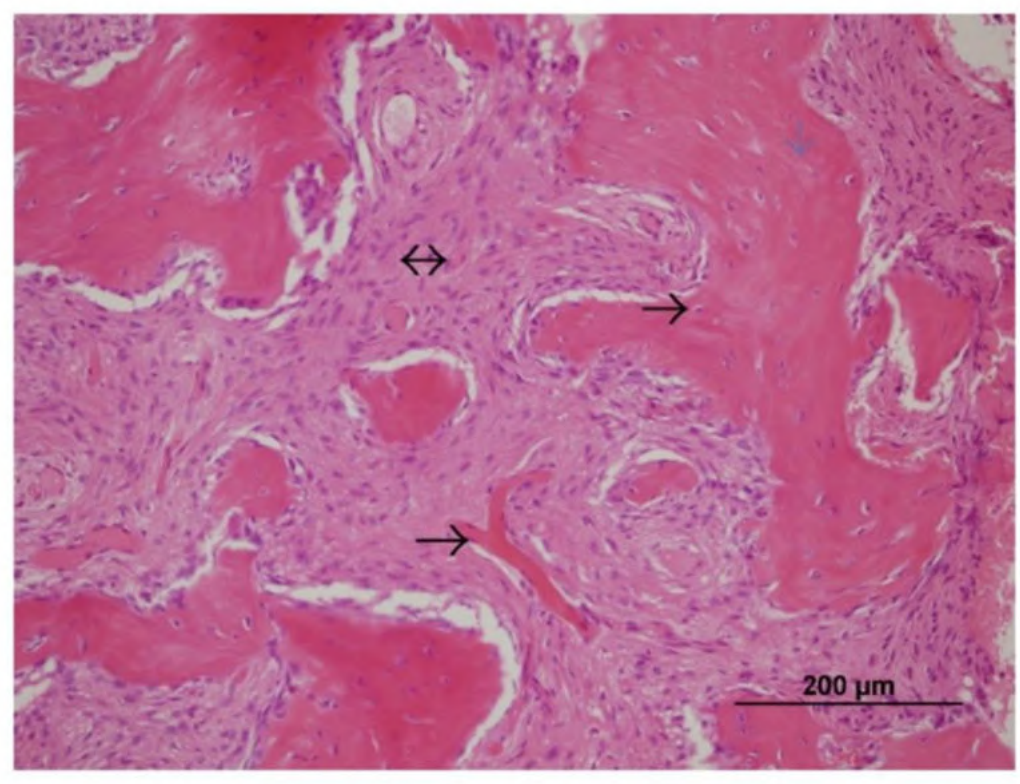
WHAT TYPE OF BASIC TISSUE TYPE IS BONE?

a. Epithelium
b. Connective tissue
c. Muscle
d. Bone

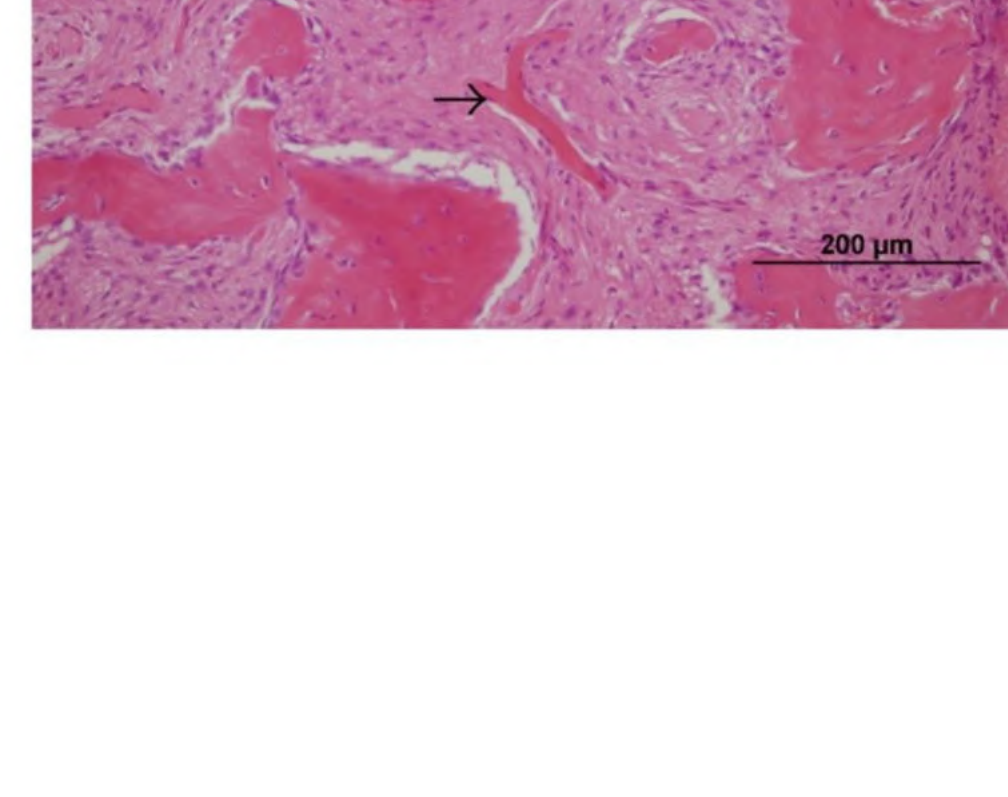
WHAT IS WOVEN BONE?

a. Cancellous bone
b. Dense bone
c. Immature bone
d. Spongy bone



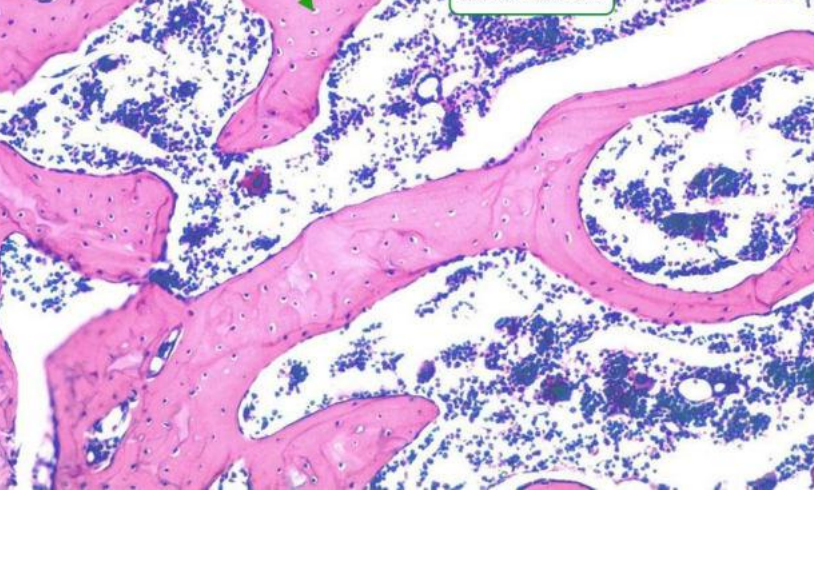
WHAT ARE THE SPICULES ON SPONGY BONE CALLED?

a. Canaliculi
b. Sharpey's fibers
c. Trabeculae
d. Lacuna



WHAT IS BONE FORMATION CALLED WHEN THE BONE IS FORMED DIRECTLY, WITHOUT USING A CARTILAGE TEMPLATE?

a. Intraosseous
b. Intramembranous
c. Endochondral
d. Endosteum



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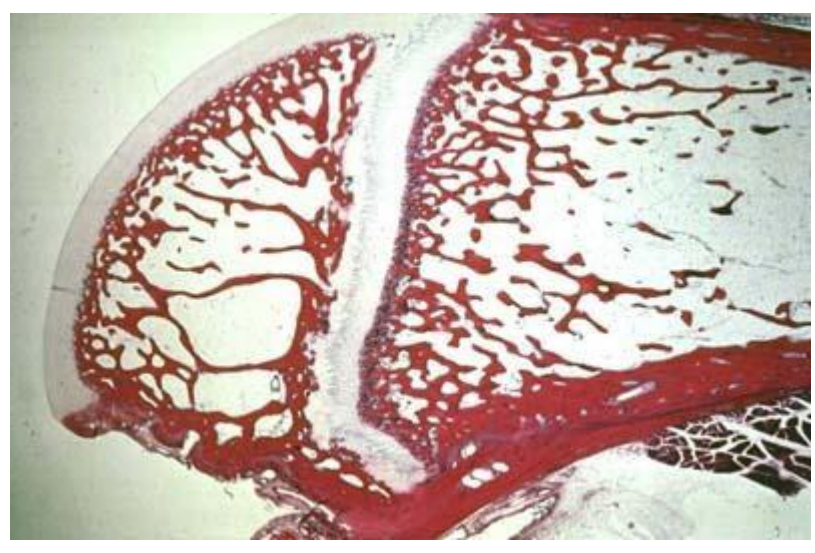
WHAT FORMS THE EPIPHYSEAL GROWTH PLATE?

a. Fibrocartilage
b. Hyaline cartilage
c. Compact bone
d. Spongy bone



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