Structure, Types and Functions Of Bones and Cartilages

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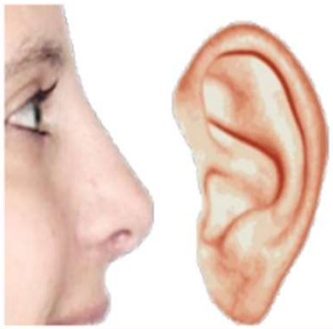
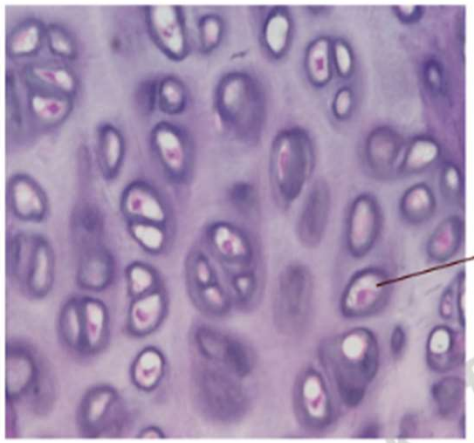
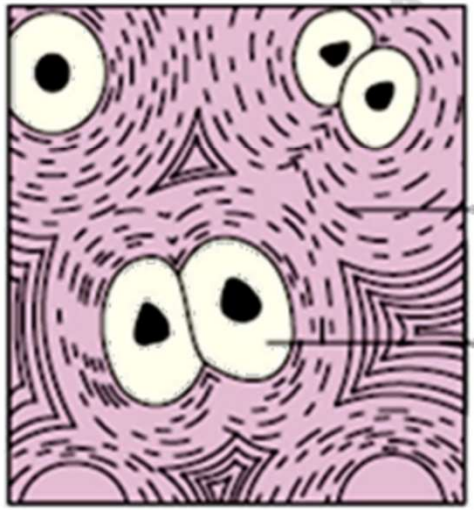
Specialized Connective Tissue

A. Cartilage







- In this, intercellular material (matrix) is solid and pliable (due to chondroitin salts) and resists compression.
- Cartilage cells (chondrocytes) are enclosed in small cavities within the matrix secreted by them.
- Most of the cartilages in vertebrate embryos are replaced by bones in adults.
- Cartilage is present in the tip of nose, outer ear, joints in the vertebral column, limbs and hands in adults.

Cartilage

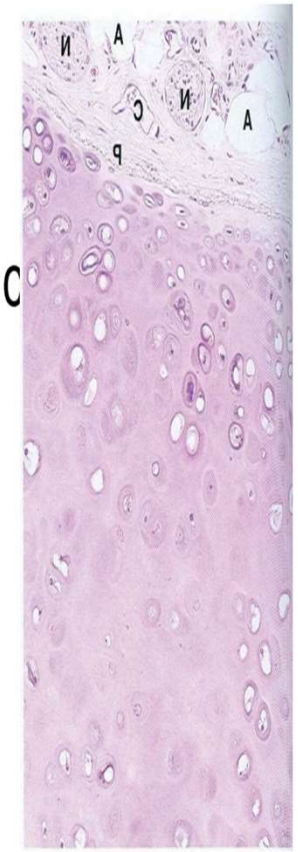
- Specialized dense connective tissue
- Semi rigid ,designed to give support, bear weight & withstand tension ,torsion & bending
- Devoid of blood vessels and not innervated by nerve
- Most of them are calcified in old age.
- Cartilage can grow by interstitial & appositional growth

Composition of cartilage

- Perichondrium
- Ground substance-

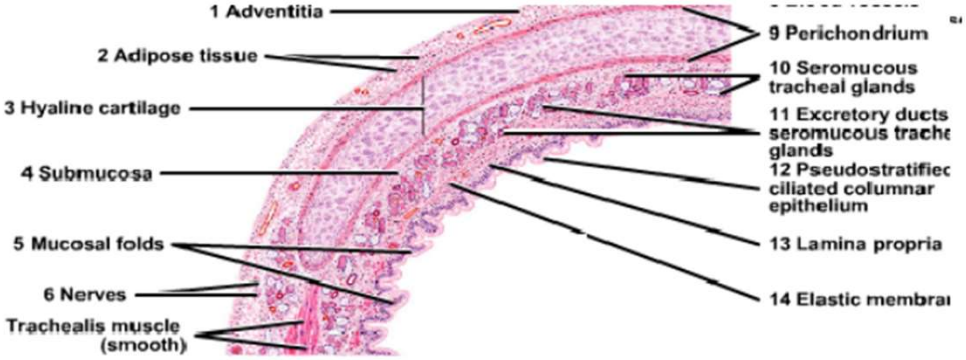
Highly hydrated Contains hyaluronic acid glucoseaminoglycans

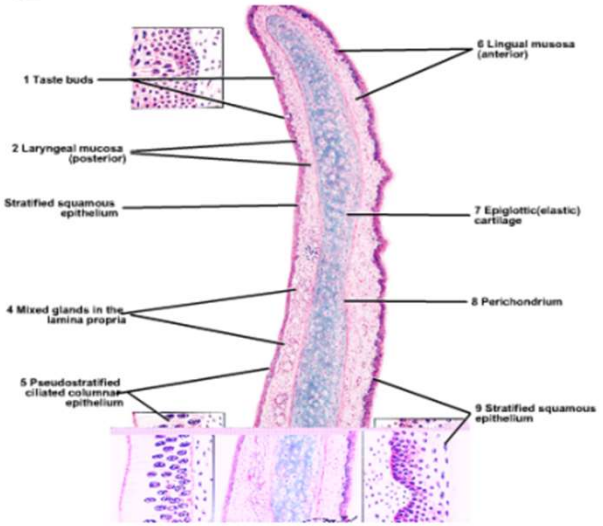
- Cells- chondroblasts, chondrocytes
- Fibers- collagen , elastic fibers

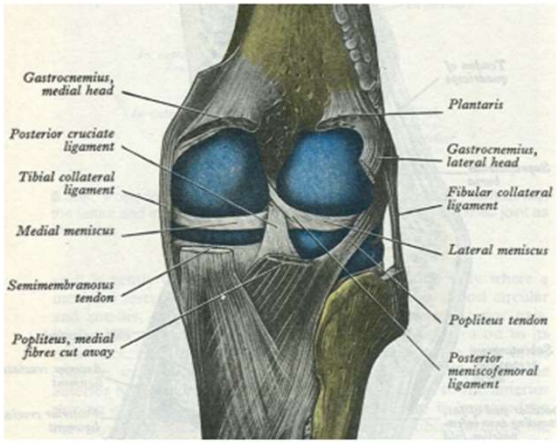


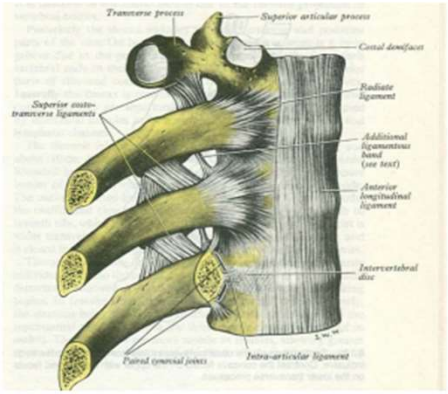
Types of cartilage

- Hyaline cartilage
- Elastic cartilage
- Fibrous cartilage









Hyaline cartilage

- Most common type
- Makes the skeletal model of most bones in embryo
- Gradually replaced by bone in grown ups except at the articular surface of bones, ends of the ribs, nose, larynx, trachea and bronchi

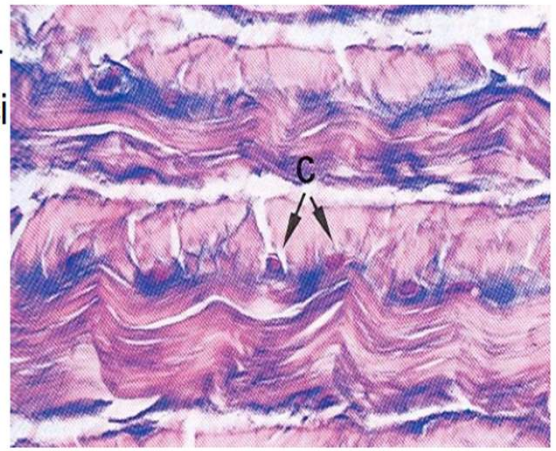
- In living conditions looks translucent & bluish white in colour
- Covered with perichondrium. Articular cartilage is not covered by perichondrium
- Matrix is homogenous which consists of chondroitin sulphate & collagen fibers
- Cells are chondrocytes arranged in groups in lacunae
- Collagen fibers are not visible in matrix because of the same refractive index as that of matrix

Elastic cartilage

- Present in external ear, epiglottis, auditory tube & few cartilage of larynx
- Covered with perichondrium
- Number of cells are more
- Matrix consist of bundles of branching & anastomosing elastic fibers which give elasticity to the tissue

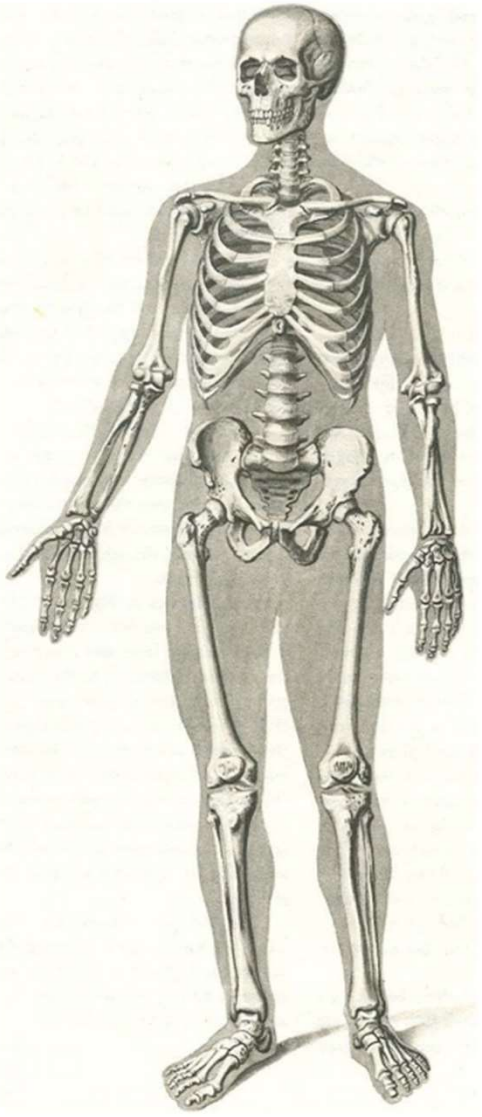
Fibrous cartilage

- Found in intervertebral disc, pubic symphysis, intrarticular disc of certain joints, menisci of knee joint & articular cartilage of temporomandibular cartilage
- Consists of bundles of collagen fibers embedded in minimal amount of matrix
- Cells are usually placed single in between the bundles of collagen fibers
- Not covered with perichondrium



BONE

- Specializes form of dense connective tissue
- Makes supportive frame work
- Support & transmit weight of the body
- Provide the levers for locomotion by forming articulations
- Give attachment to muscles & ligaments
- Provide mechanical protection to the vital organ
- Store calcium
- Form blood in their marrow



HUMAN SKELETAL SYSTEM

- Consists of a framework of bones (206) and few cartilages.
- Bone has a very hard matrix due to Ca salts.
- Cartilage has slightly pliable matrix due to chondroitin salts.

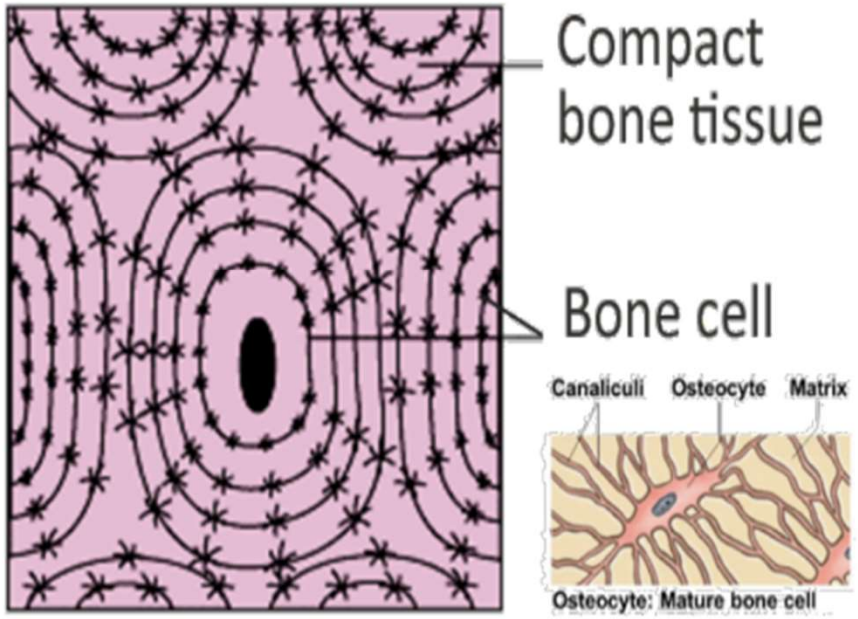
HUMAN SKELETAL SYSTEM

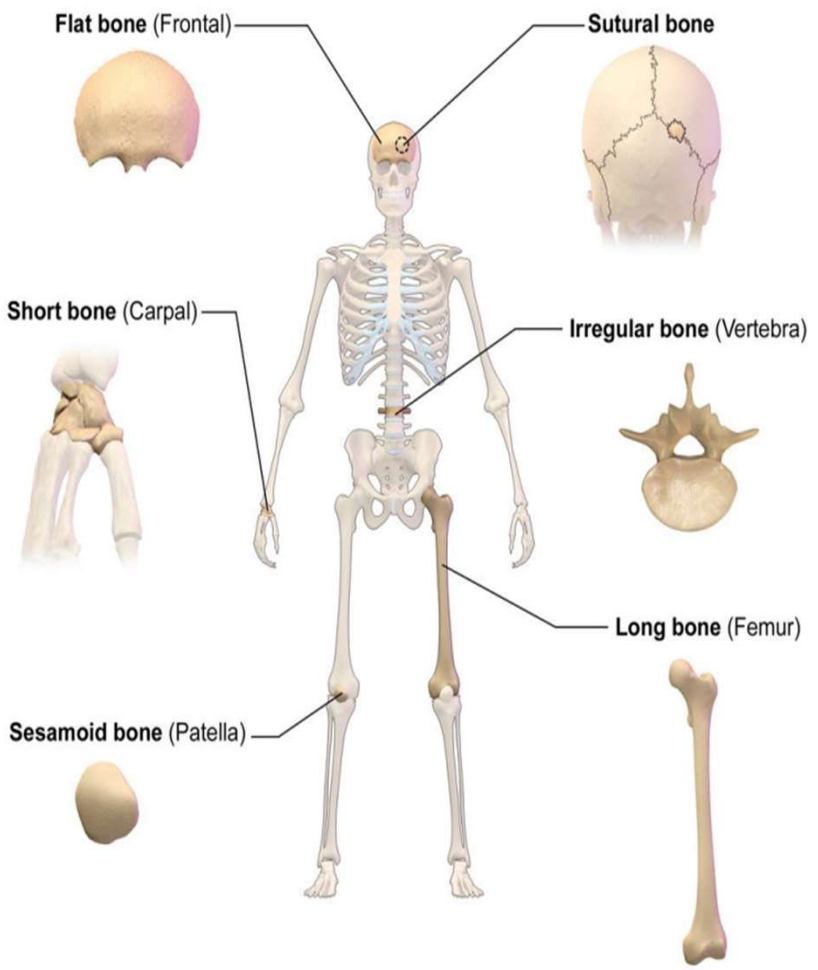
- **Axial Skeleton (80 bones)**
  - Bones of head
  - Vertebral column
  - Sternum
  - Ribs
- **Appendicular skeleton (126 bones)**
  - Bones of fore-limbs
  - Bones of hind limbs
  - Pectoral girdle
  - Pelvic girdle

Specialized Connective Tissue

B. Bone

- It has hard and non-pliable matrix rich in calcium salts and collagen fibres which give bone its strength.
- Bone cells (osteocytes) are seen in spaces called lacunae.

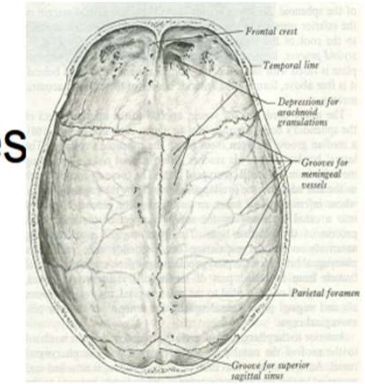


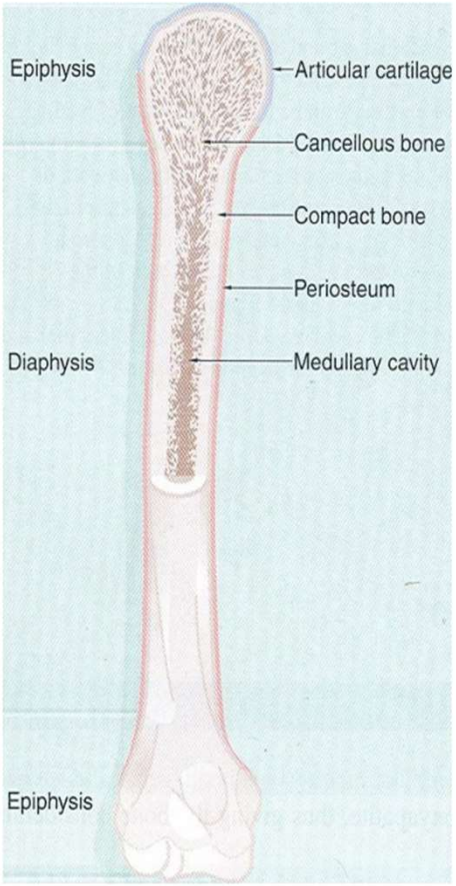


Classification of Bones by Shape

According to gross structure

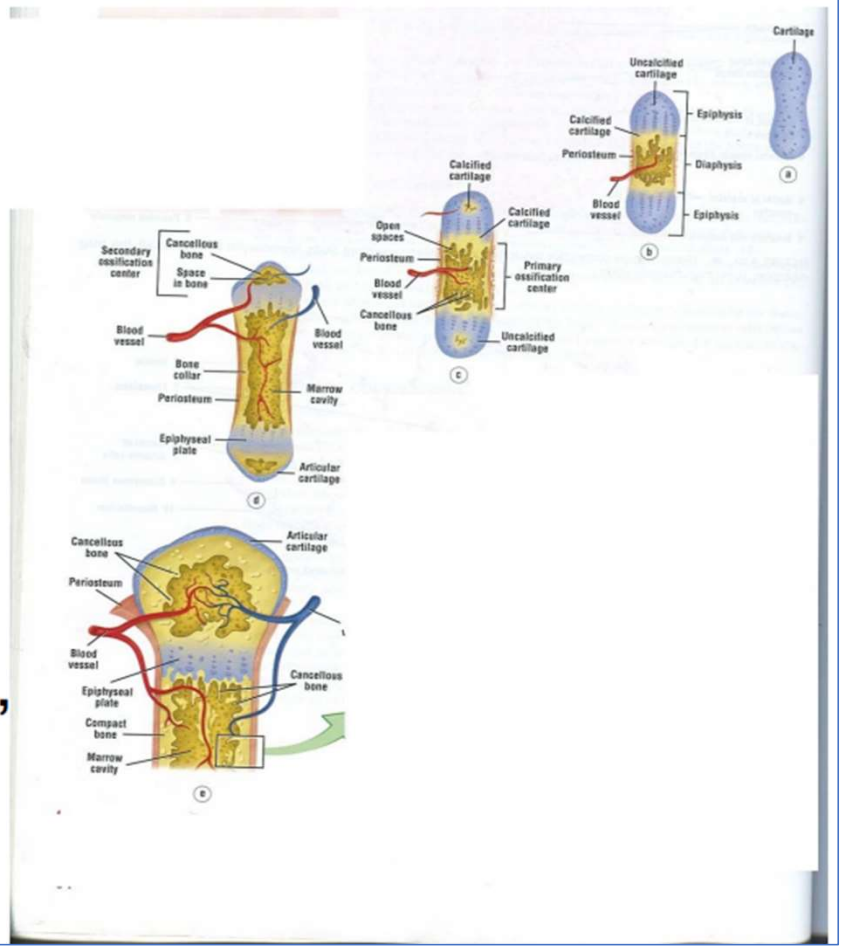
- Compact (Lamellar) bone
- Spongy (cancellous) bone
- Diploic bones





According to development

- Membranous bones- Bone is laid down directly in the fibrous membrane e.g. bones of vault of skull, mandible
- Cartilaginous bones- Formation of bone is proceeded by the formation of a cartilage, which is later replaced by a bone e.g. femur, tibia



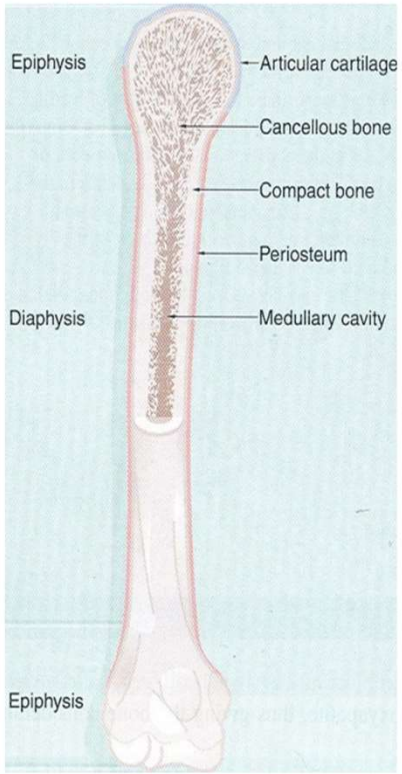
Composition of bone -

- organic matter- forms 1/3 weight of bone. Consists of fibrous material & cells. Responsible for toughness & resilience
- Inorganic matter- forms 2/3 weight of bone. Consists of mineral salts like **calcium** carbonate, cal. Fluoride, and magnesium phosphate

  Responsible for rigidity & hardness. Cal. In bone makes it opaque to x-ray

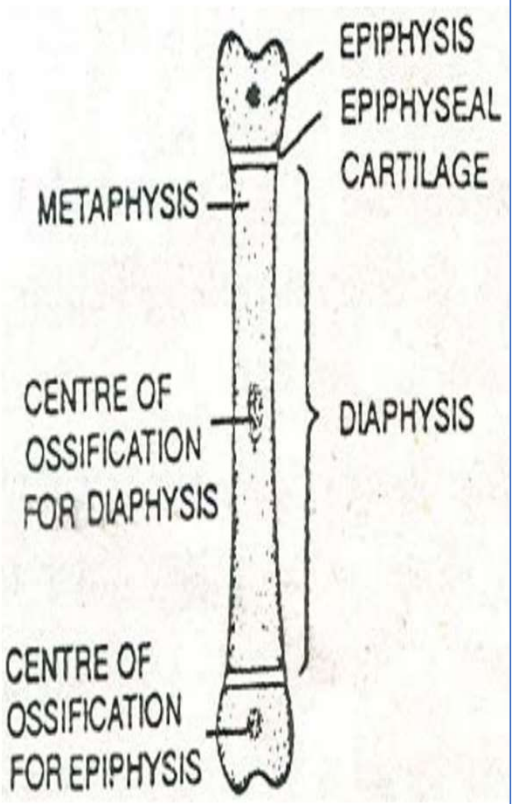
Macroscopic structure of living adult bone

- Compact bone
- Cancellous bone

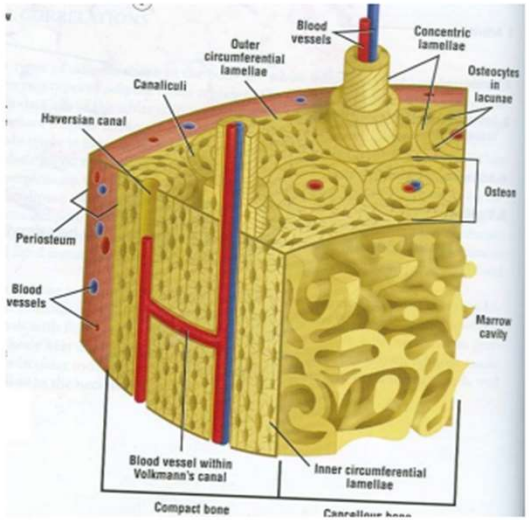


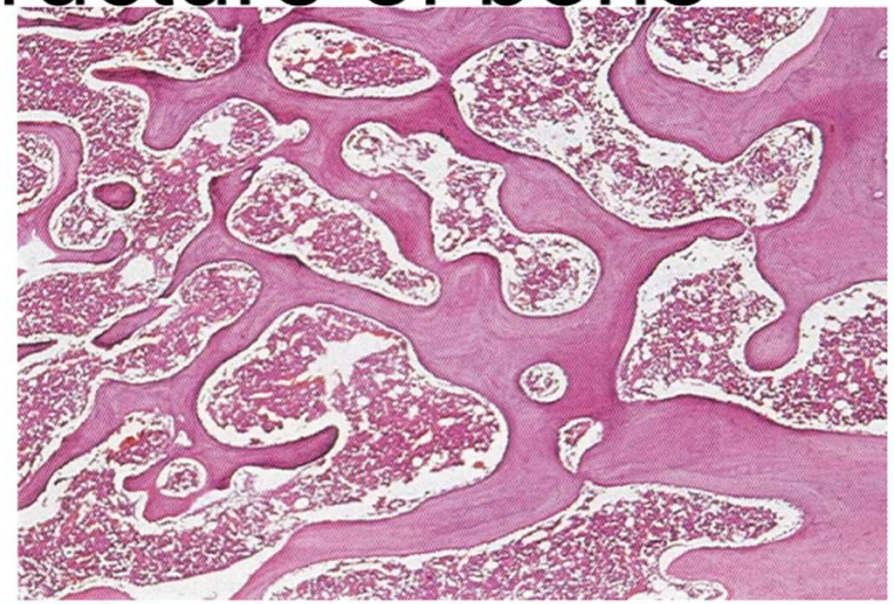
Parts of a developing long bone

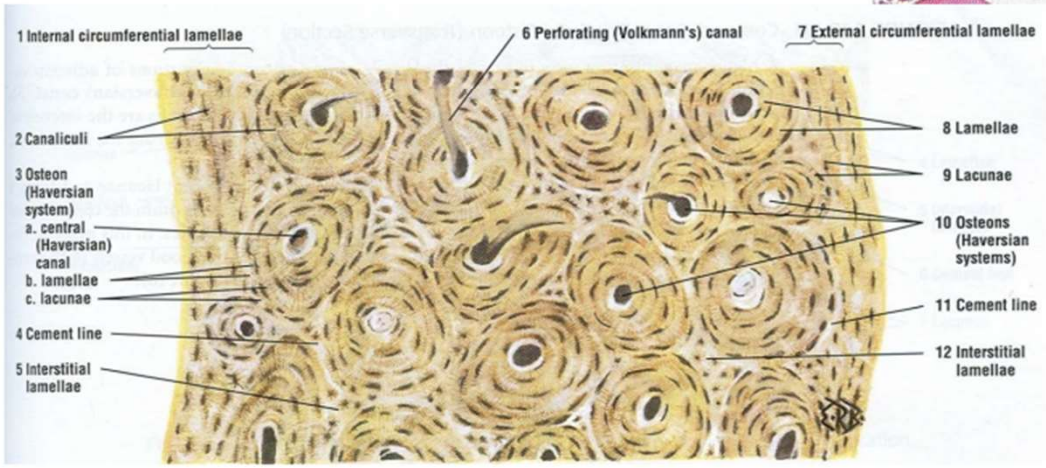
- **Diaphysis-** intermediate region or shaft
- **Metaphysis-** developing extraepiphyseal regions of shaft
- **Epiphysis-** ends of bone which ossify with a separate centre of ossifi. (secondary)



Microscopic structure of bone





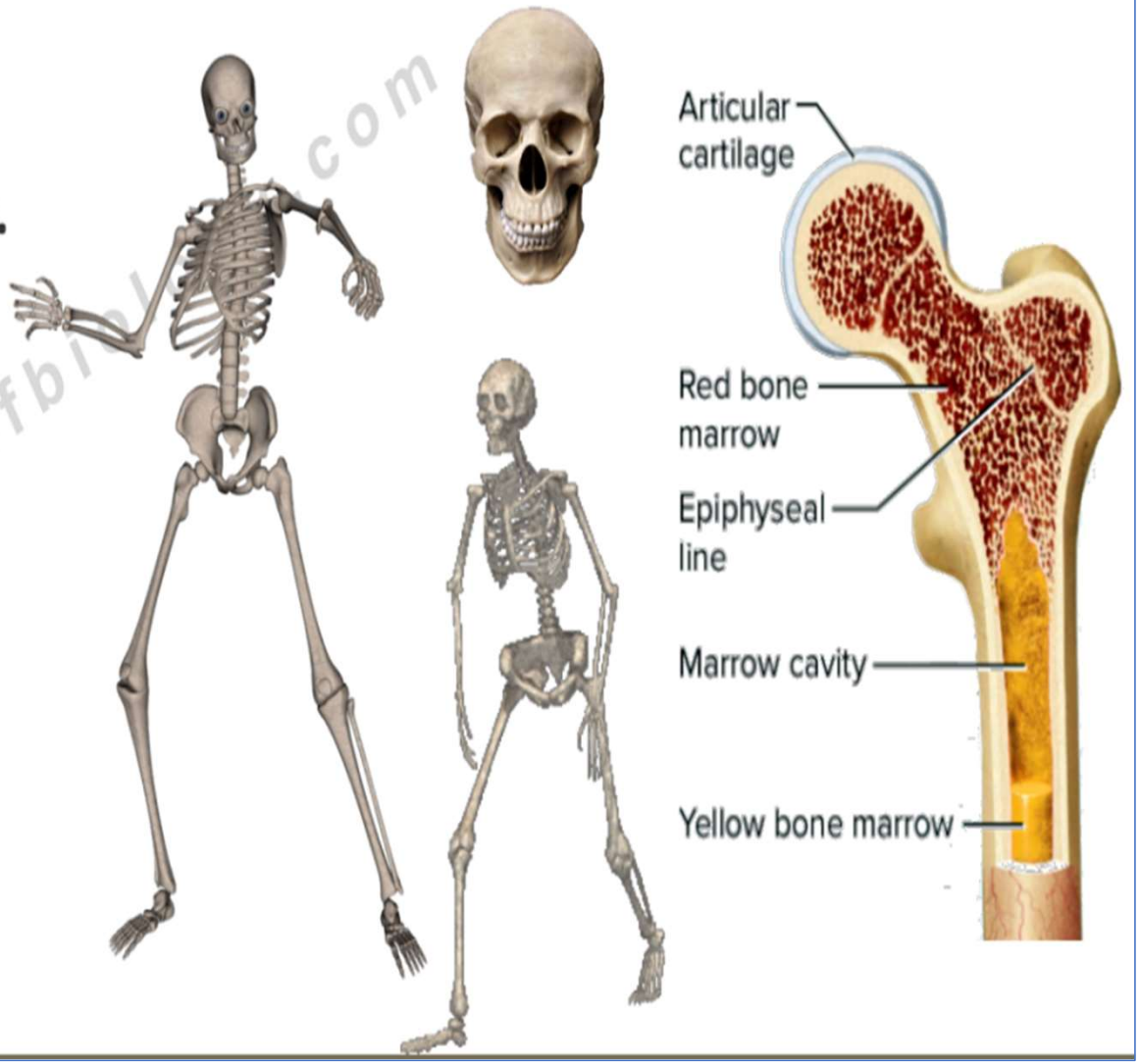


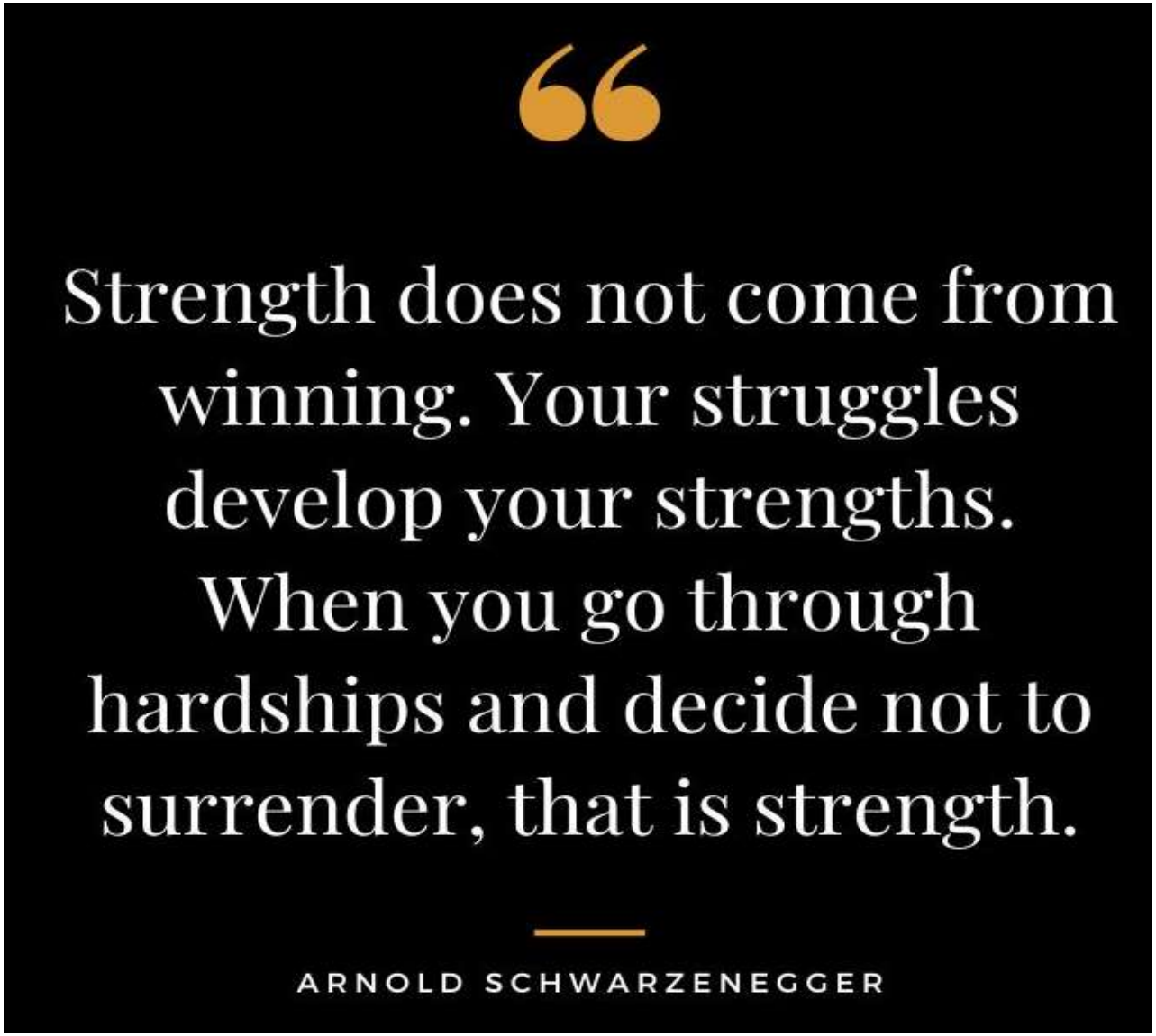
Cell type	Function	Location
Osteogenic cells	Develop in osteoblast	Deep layers of the periosteum and the marrow
Osteoblast	Bone formation	Growing portions of bone, including periosteum and endosteum
Osteocytes	Maintain mineral concentration of matrix	Entrapped in matrix
Osteoclasts	Bone resoprtion	Bone surfaces and at sites of old, injured, or unneeded bone

Table 1.
Bone cells, their function, and location

Functions

- ✓ It provides **structural frame** to body.
- ✓ **Support and protect** softer tissues and organs.
- ✓ Limb bones serve **weight-bearing** functions.
- ✓ Take part in **locomotion** and **movements.**
- ✓ **Blood cells** are produced in **bone marrow.**




Strength does not come from winning. Your struggles develop your strengths. When you go through hardships and decide not to surrender, that is strength.
ARNOLD SCHWARZENEGGER