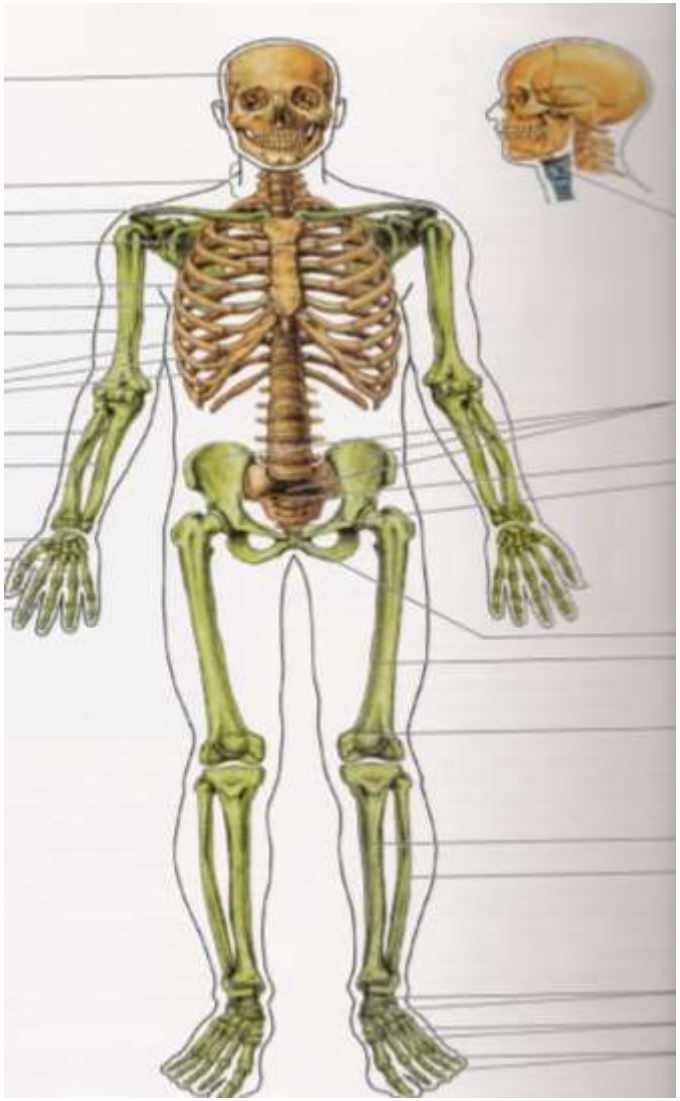
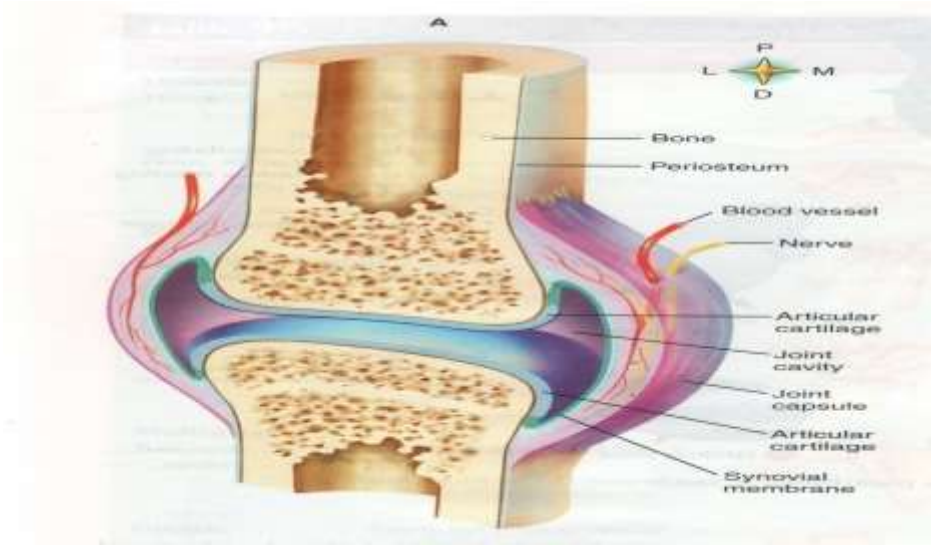
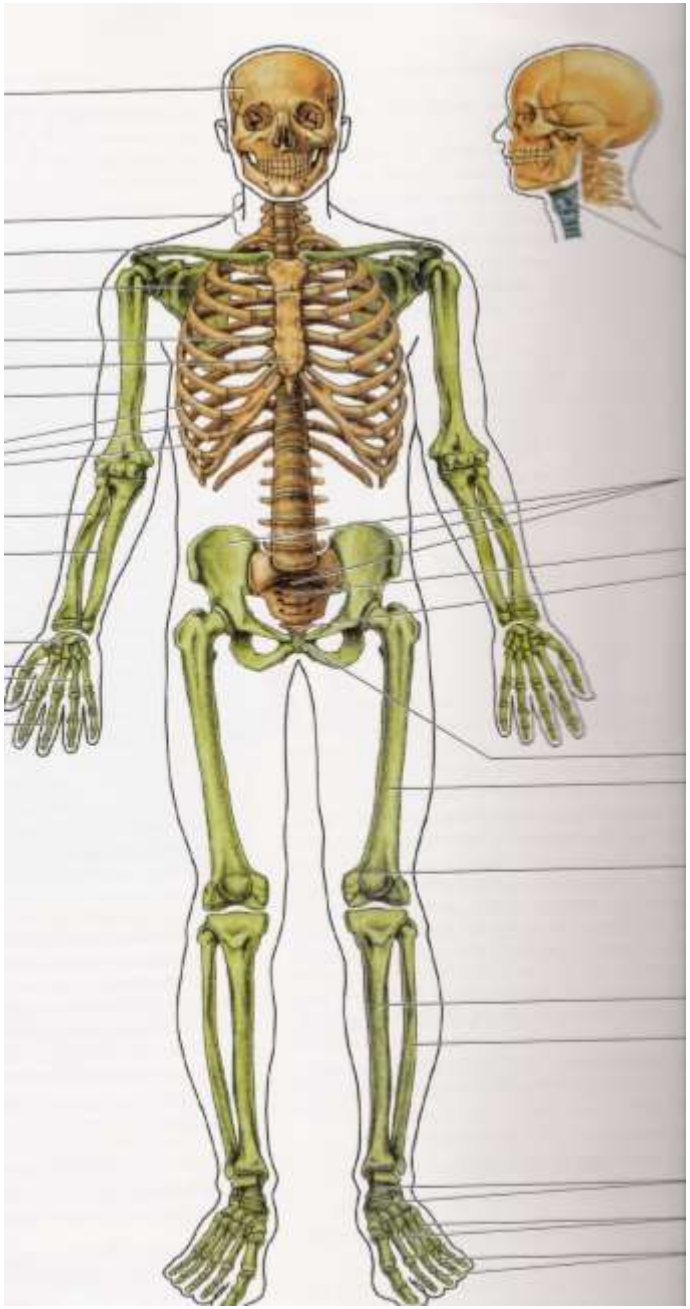
BONES





BY

Dr. Rajeev Kumar Mukhia



Skeleton

- Skeleton includes bones and cartilages & joints.
- It forms the main supporting framework.

Bone

- **DEFINITION**

- Bone is a highly vascularised, mineralised, dynamic, constantly changing connective tissue.
- 1/3rd of CT.
- Total No.206

FUNCTIONS

- It forms the rigid frame-work of the body.
- Gives shape and support to the body & resist all form of stress.
- Provides surface for attachment of muscles, tendons, ligaments.
- Act as levers for muscular actions.
- Protection of organs and viscera.
- Erythropoiesis
- Phagocyte in nature
- Storage of minerals

Classification of bones

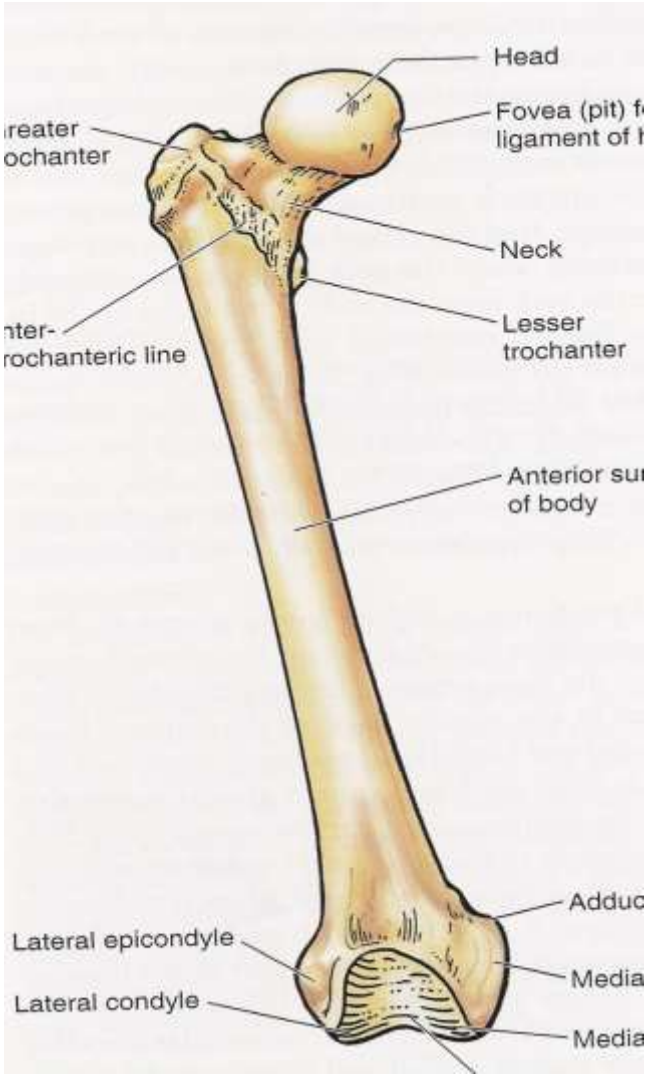
- According to shape
- According to development
- Regional
- Structural

A. According to shape

- Long bones
- Short bones
- Flat bones
- Irregular bones
- Pneumatic bones
- Sesamoid bones
- Accessory bones

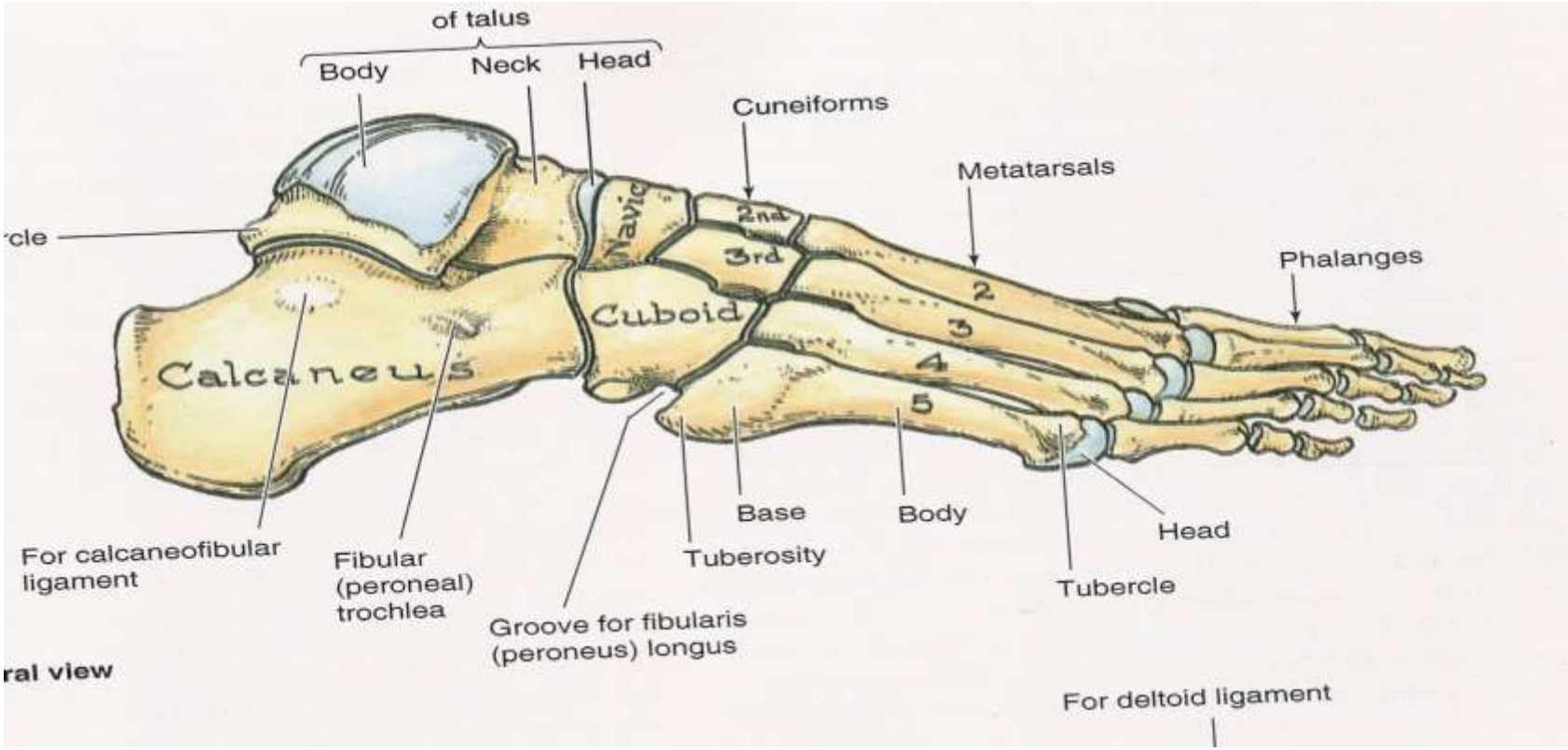
1. Long bones

- Typical long bones
- Shaft with two ends
- The epiphysis are smooth and articular.
- Normally it has 3 surface and 3 boders.
- Central medullary cavity
- Nutrient foramen
- E.g. humerus , ulna, femur etc.



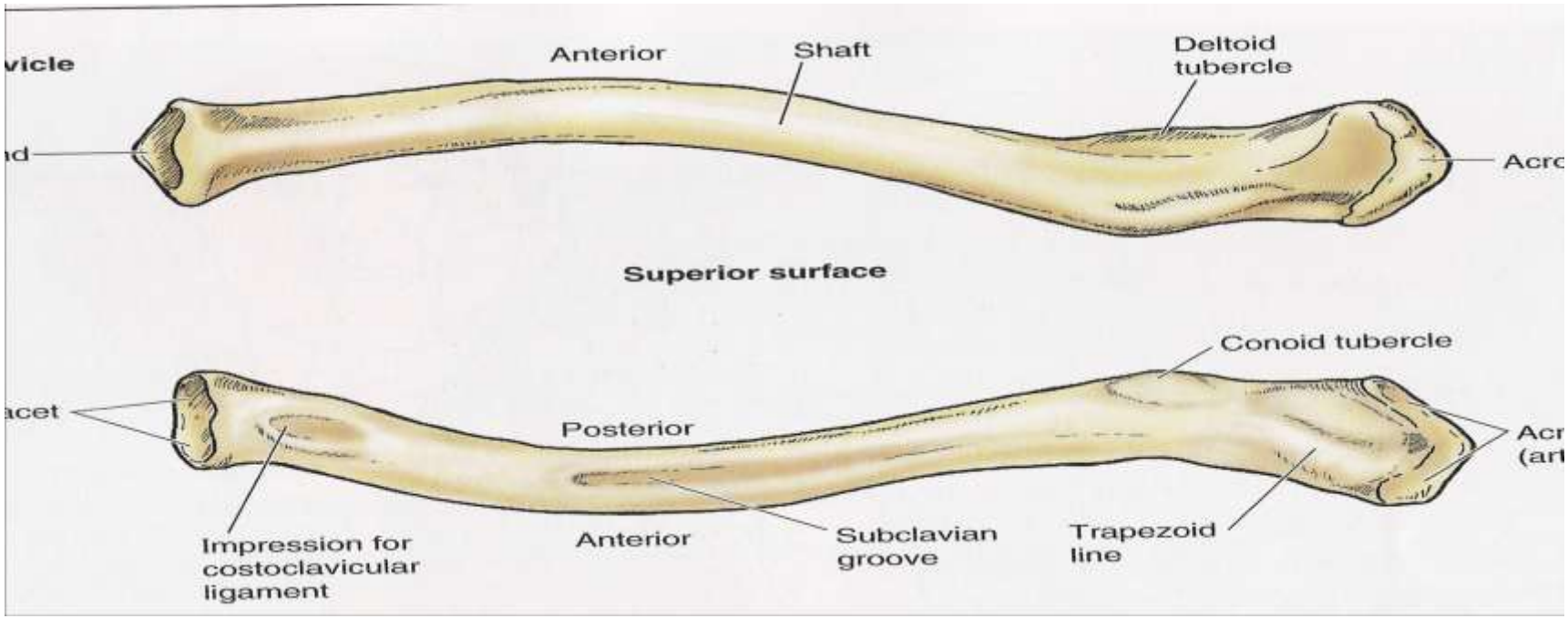
Short long/Miniature bones

Miniature long bones have a single epiphysis. Eg metacarpal, metatarsal & phalanges.

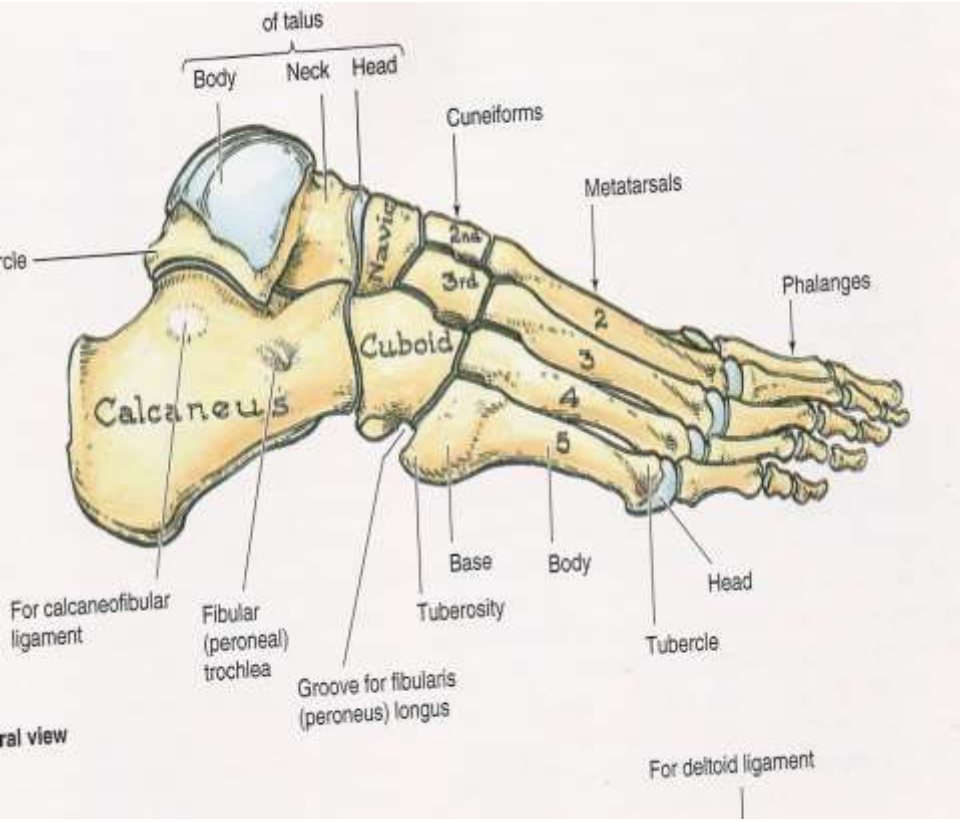


Modified long bones

Modified long bone is devoid of medullary cavity & ossifies in membrane. Eg clavicle.

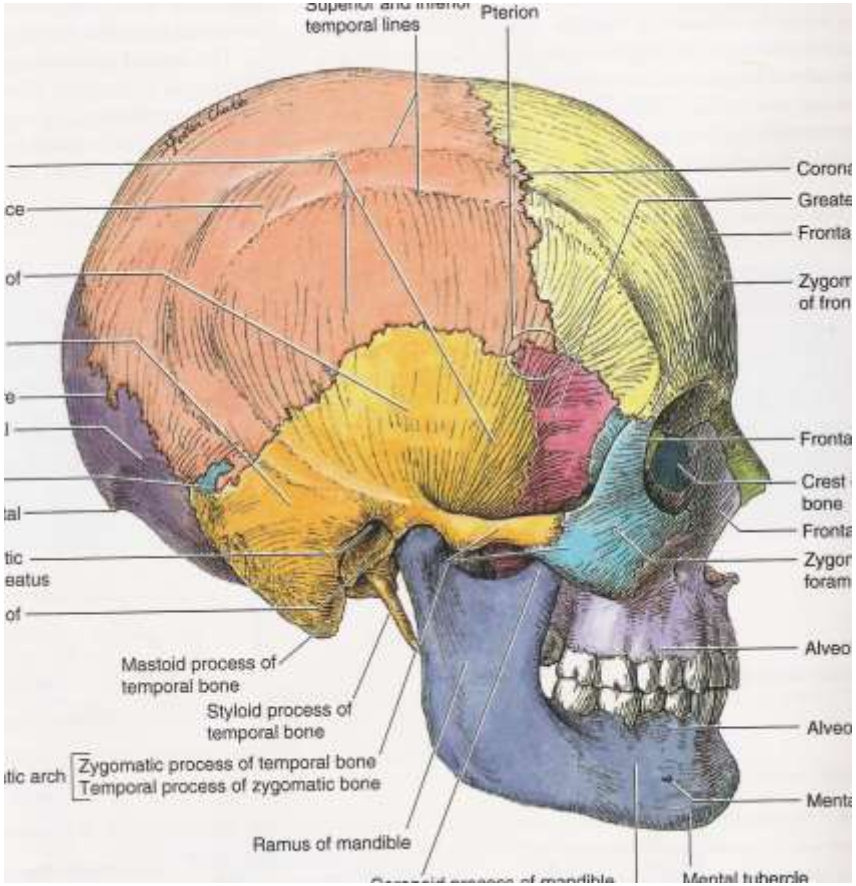


2. Short bones



- Shape is cuboid, trapezoid or cuneiform.
- Presents 6 sufraces.
- E.g: Carpal and tarsal bones

3. Flat bones



- Flat bones forms boundaries of some bony cavities & appear in those areas where protection is required.
- Eg skull, Ribs, Sternum, scapula

4. Irregular bones

- They are irregular in shape.
- Eg bones of the base of skull, vertebra, hip bone.

5. Pneumatic bones

Certain bones contain air-filled spaces which are lined by mucous membrane.

Eg – maxilla, sphenoid, ethmoid.

Functions

1. They make the skull bone lighter in weight.
2. Helps in resonance of voice.
3. Acts as air conditioning chambers for the inspired air.

6. Sesamoid bones

These are bony nodules embedded in the tendons or joints capsules.

They don't have periosteum & ossify after birth.

Eg - patella, pisiform etc.

Functions:

To resist pressure

To minimise friction

To maintain the local circulation

To alter the direction of pull of the muscle

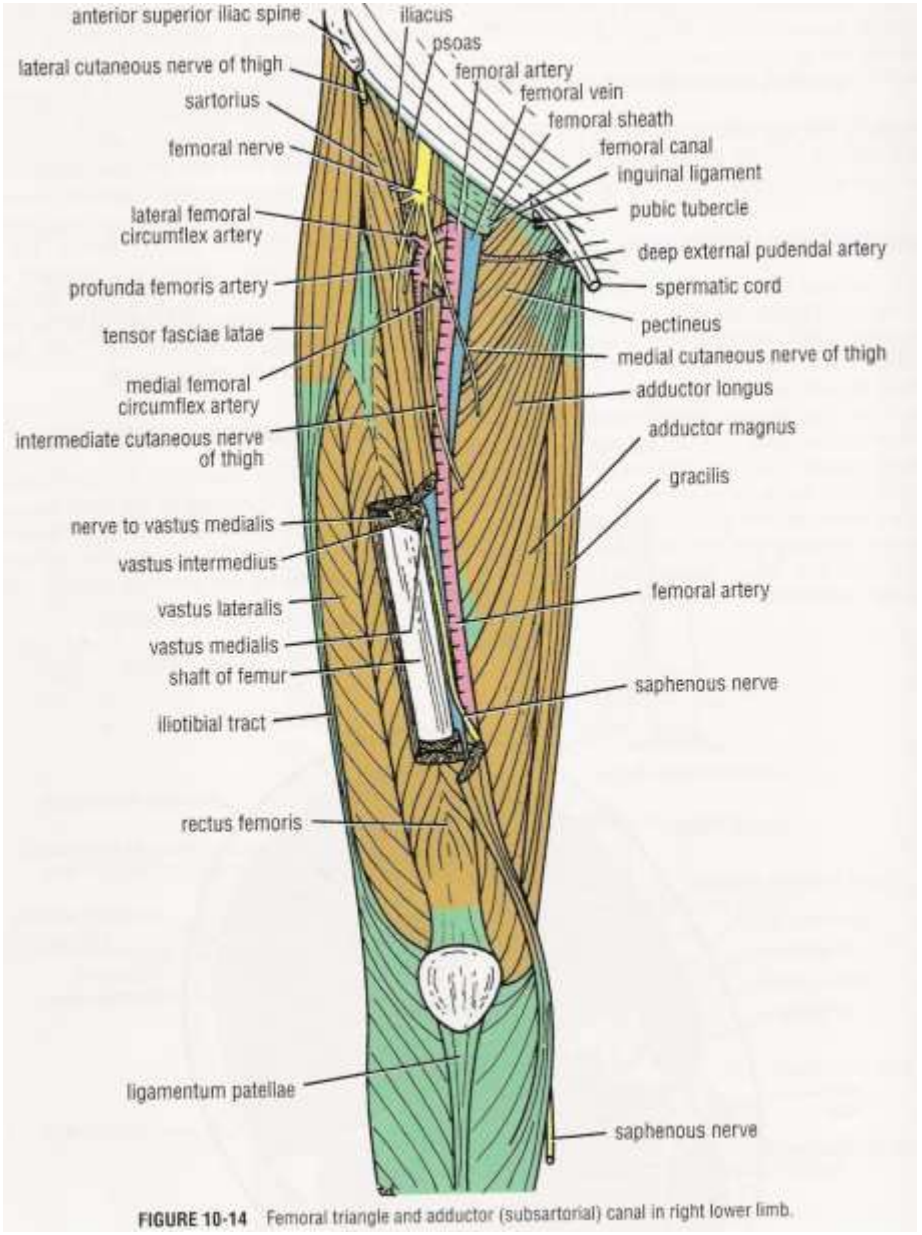


FIGURE 10-14 Femoral triangle and adductor (subsartorial) canal in right lower limb.

7. Accessory bones

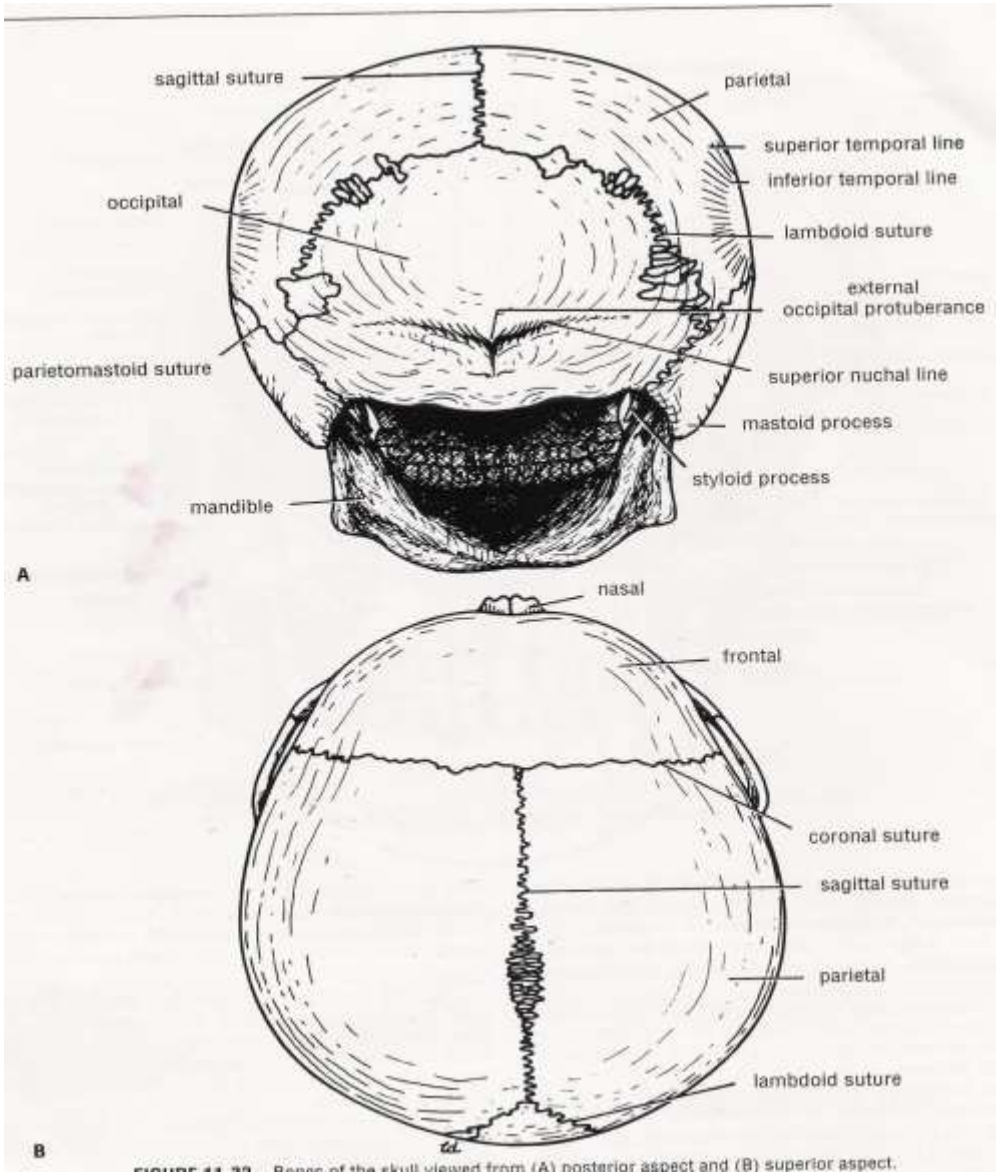
Also known as supernumerary bones.

They are not always present.

Occurs due to ununited epiphysis.

Eg – sutural/wormian bones, interparietal bones.

In medicolegal practice accessory bones may be misteken for fractures.



B. Developmental classification

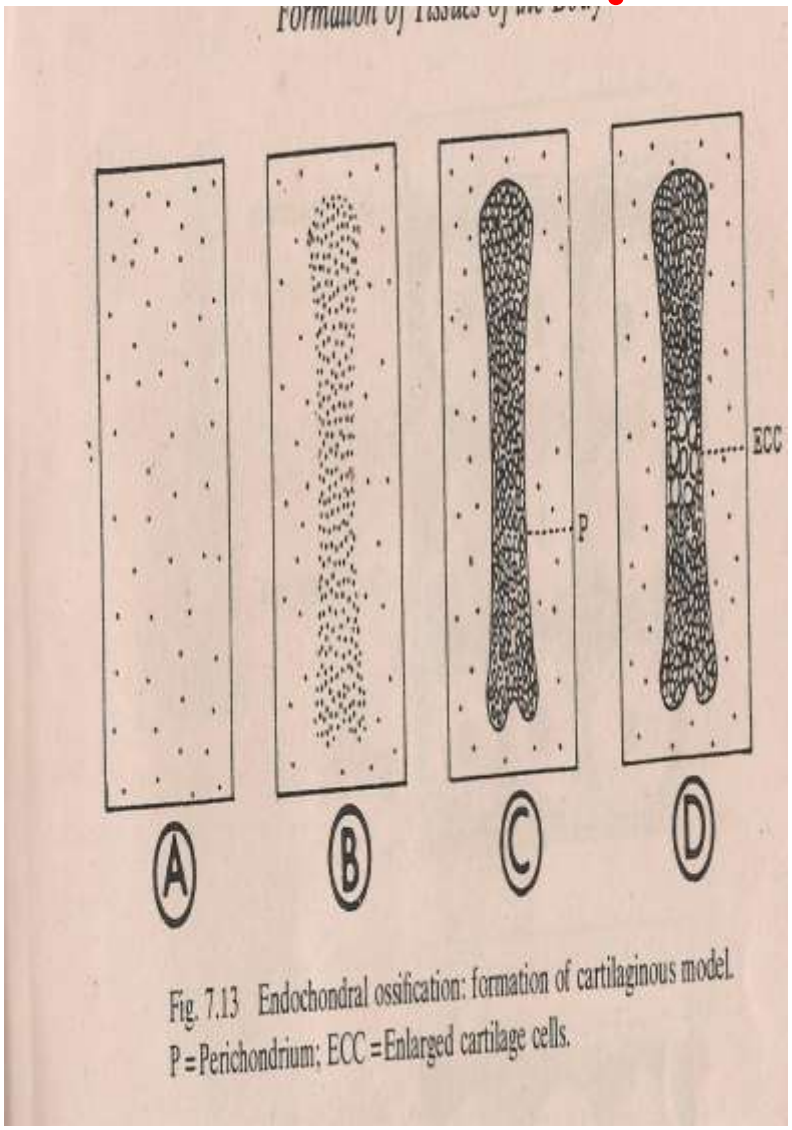


Fig. 7.13 Endochondral ossification: formation of cartilaginous model.
P = Perichondrium; ECC = Enlarged cartilage cells.

- **Membrane bones**

- Ossify in membrane and are derived from mesenchymal condensation. Eg bones of the vault of skull & facial bones.

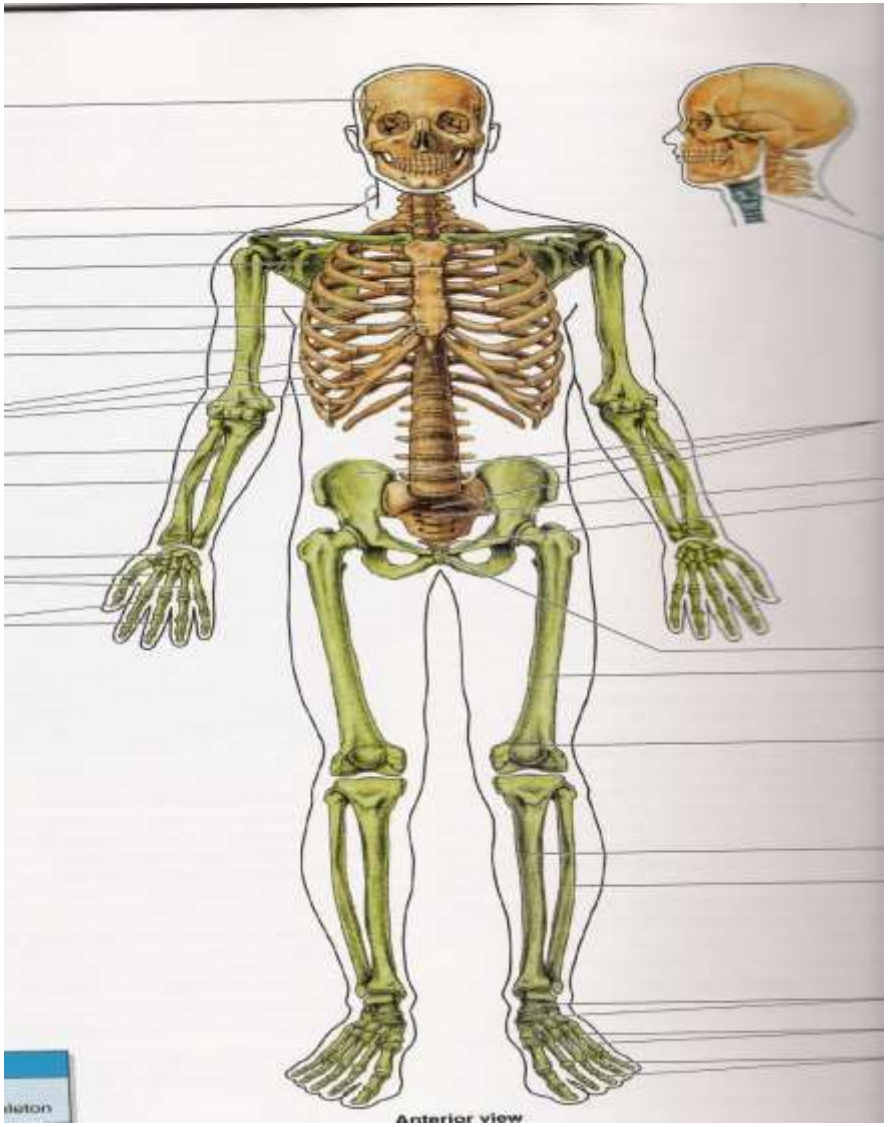
- **Cartilaginous bones**

- Ossify in cartilage and are derived from cartilagenious models. Eg bones of limb, vertebral column & thoracic cage.

- **Membrano-cartilaginous bones**

- Ossify partly in membrane & partly in cartilage. Eg clavicle, mandible, occipital, temporal.

C. Regional classification



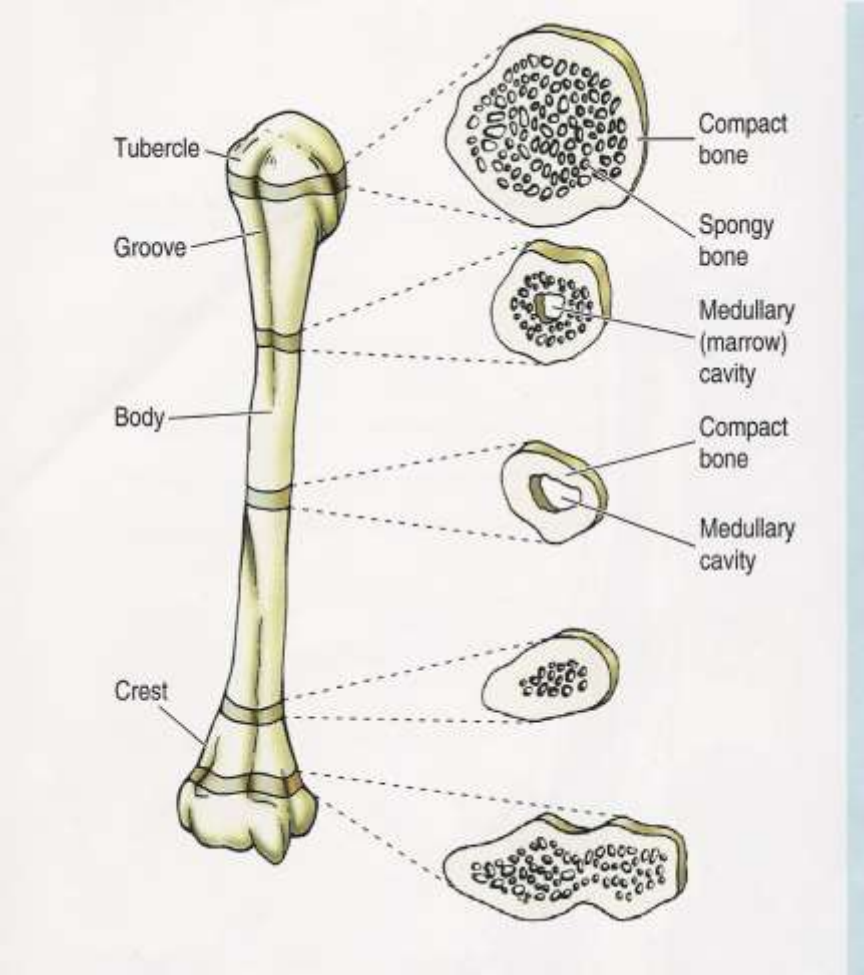
- Axial skeleton

- Includes skull, vertebral column & thoracic cage.

- Appendicular skeleton

- Includes bones of the limb.

D. Structural classification



- Compact bone (Hard and Ivory like)
- Cancellous bone (Spongy bone)

Gross structure

SHAFT: Consist of periosteum, outer compact part and inner spongy part.

The outer covering of bone is the periosteum.

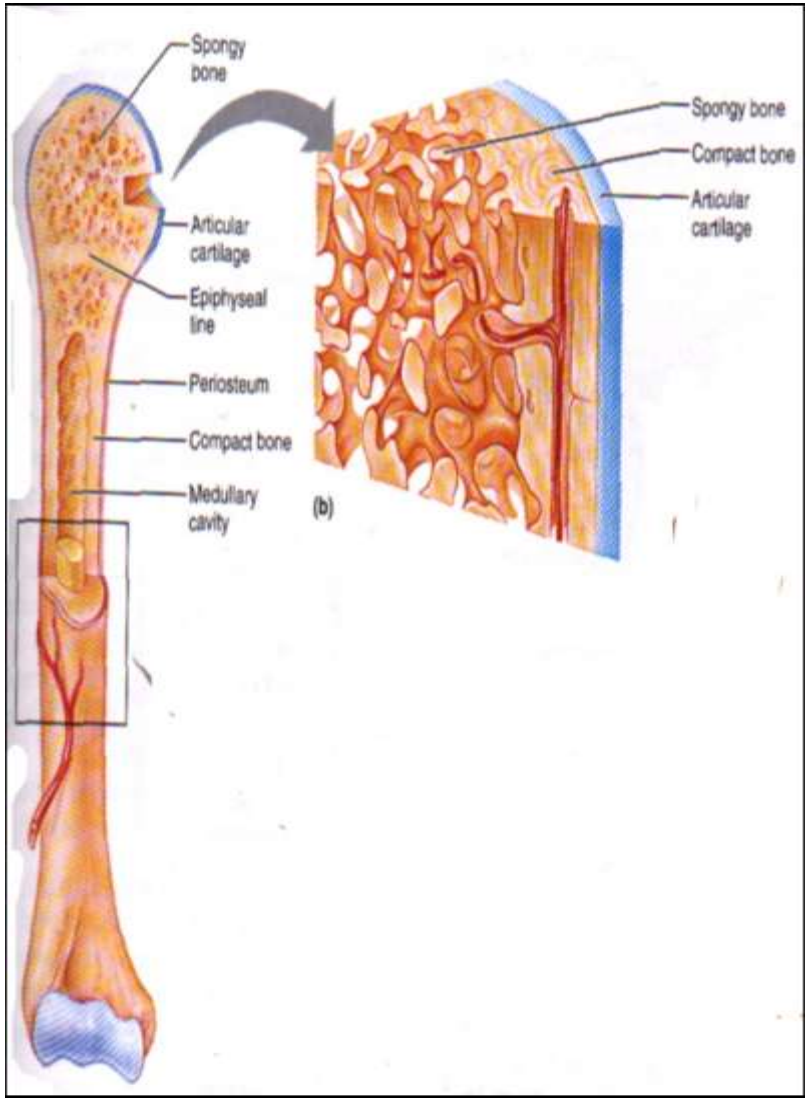
- It consist of 2 layers

Outer fibrous layer & inner cellular layer

Fibrous layer consist of collagen fibres &

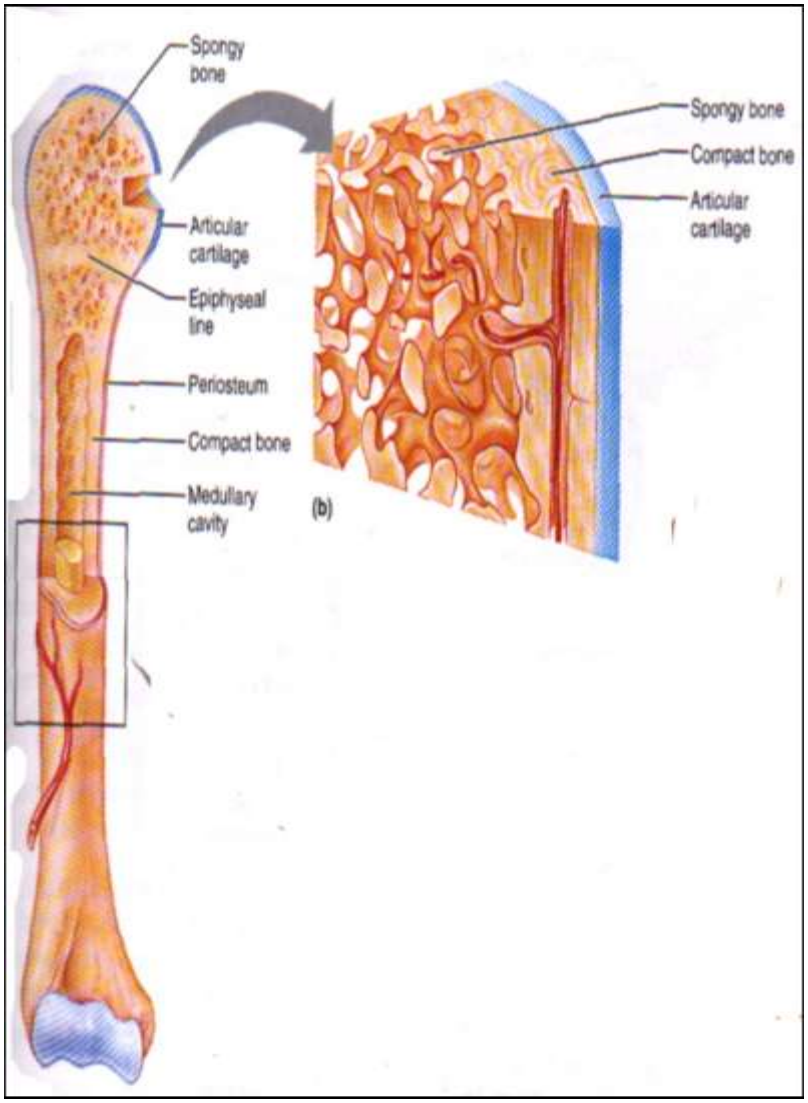
Cellular layer consist of osteoblast.

- The compact part is ivory-like and extremely porous.
- The spongy part also known as cancellous bone & is composed of network of trabeculae.



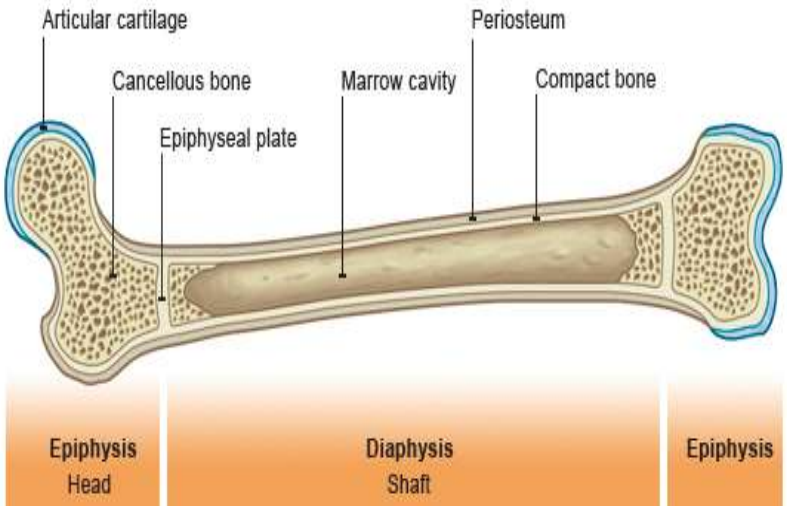
- Medullary Cavity
- It is lined by endosteum.
- The osteoblast in endosteum help in bone repair and remodelling of bone.
- It is filled with yellow or red bone marrow.

- 2 Ends
- The upper and lower ends of bones are made of cancellous bone covered by hyaline cartilage.



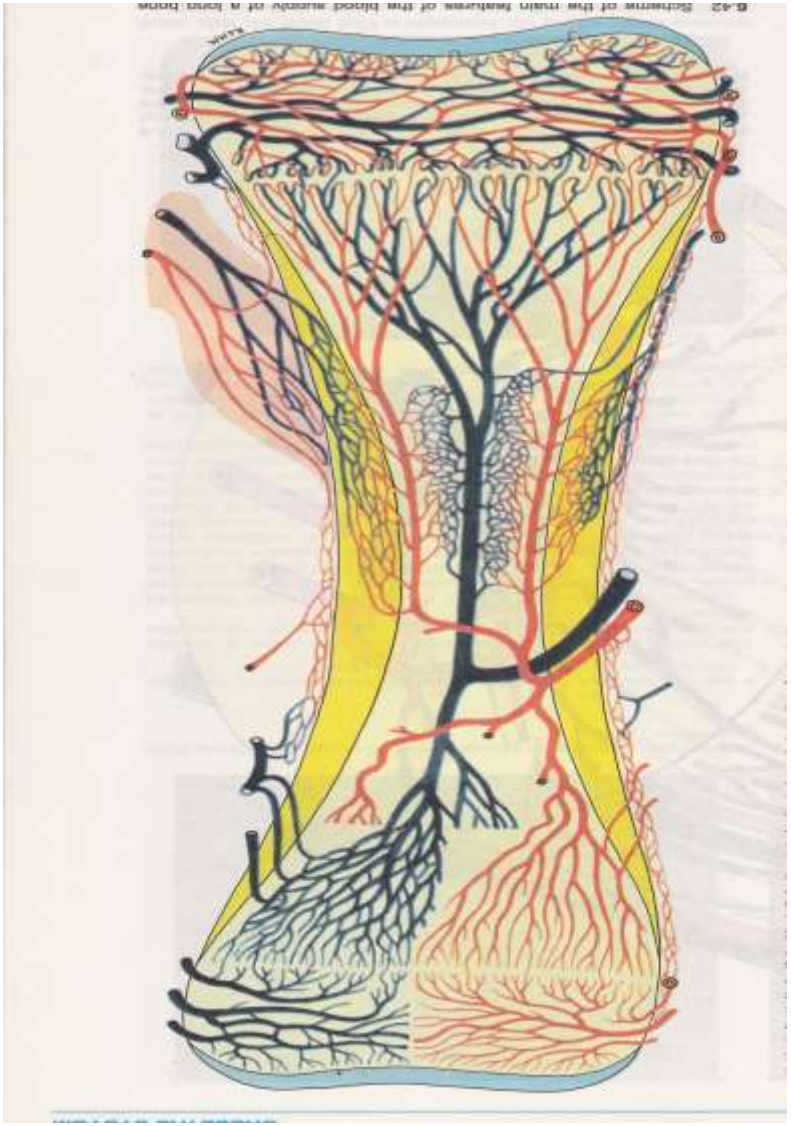
Parts of young long bone

- A young long bone presents
  - ❖Epiphysis
  - ❖Diaphysis
  - ❖Metaphysis
  - ❖Epiphyseal cartilage



Epiphysis- Part of bone ossified from the secondary centre to form ends of long bone.
Diaphysis- Part of the bone ossified from the primary centre, and forms the shaft of the bone.
Metaphysis- End of diaphysis facing towards the epiphyseal cartilage
Epiphyseal cartilage- Plate of hyaline cartilage that intervenes between the epiphysis and diaphysis of a growing bone.

Blood supply of long bone



- Nutrient artery
- Periosteal arteries
- Epiphyseal arteries
- Metaphyseal arteries

Osteon/HAVERSIAN SYSTEM

- It is a functional & structural unit of compact bone.
- Haversian system contains—
- 1. central canal called Haversian canal. It contains blood vessel, nerves & lymphatics.
- 2. it is surrounded by concentric bony lamellae.
- In between lamellae are osteocytes in lacunae.
- Lacunae are connected to each other by canaliculi.

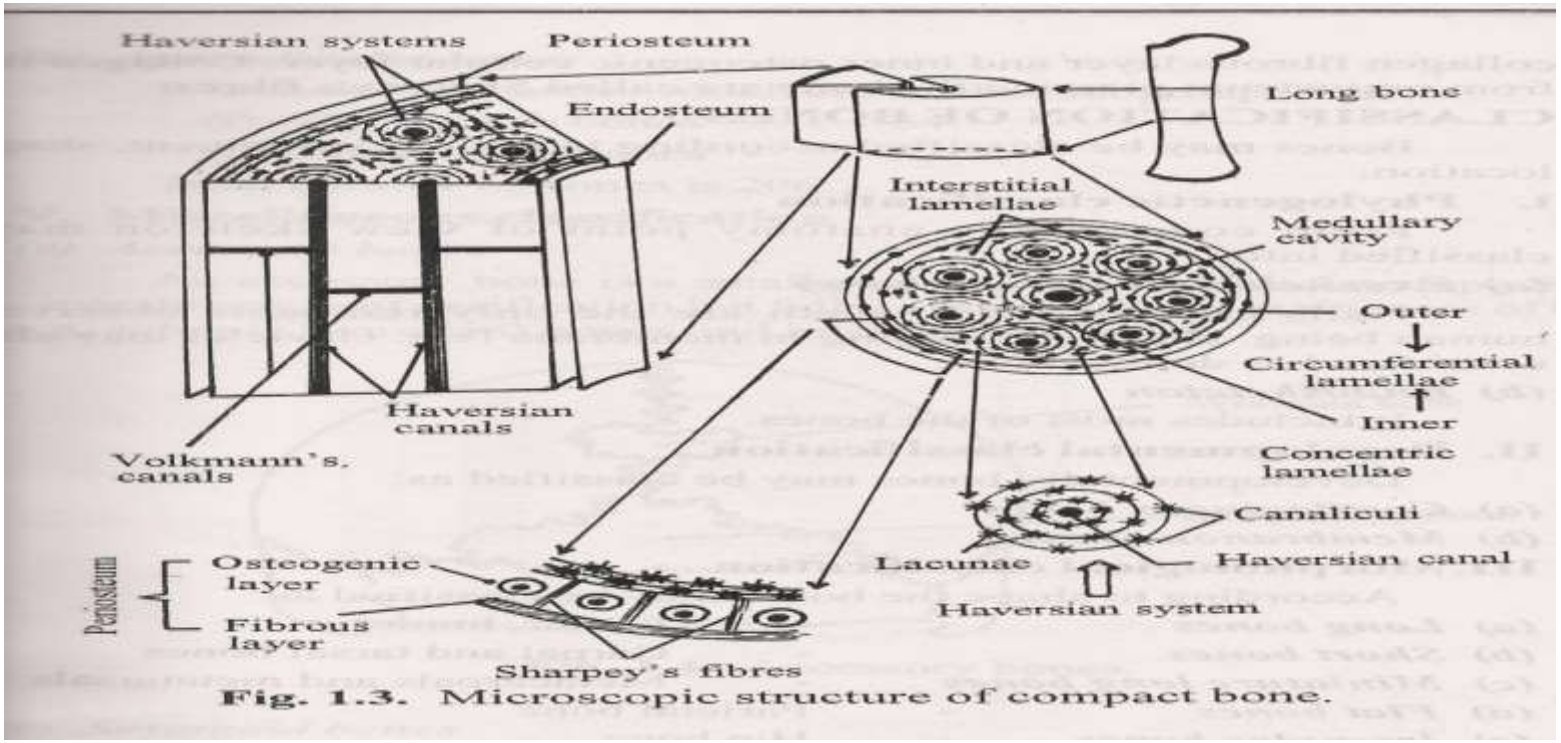
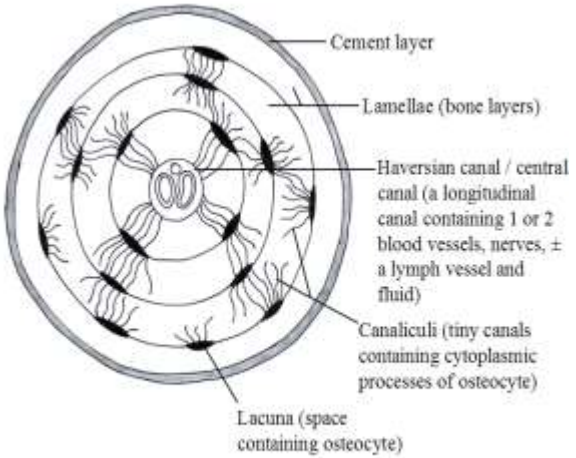
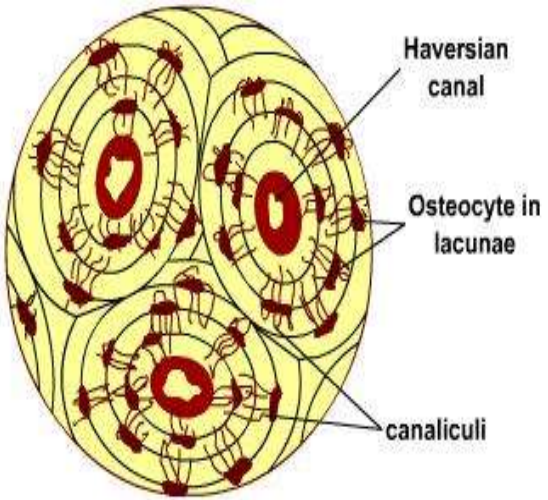


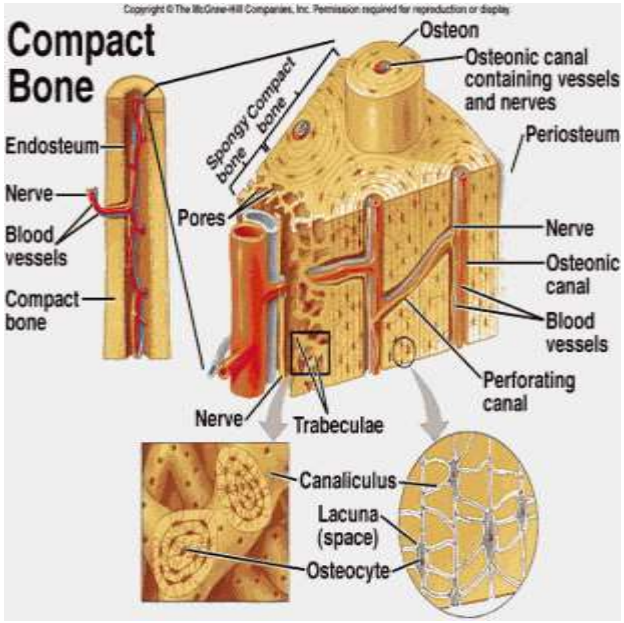
Fig. 1.3. Microscopic structure of compact bone.

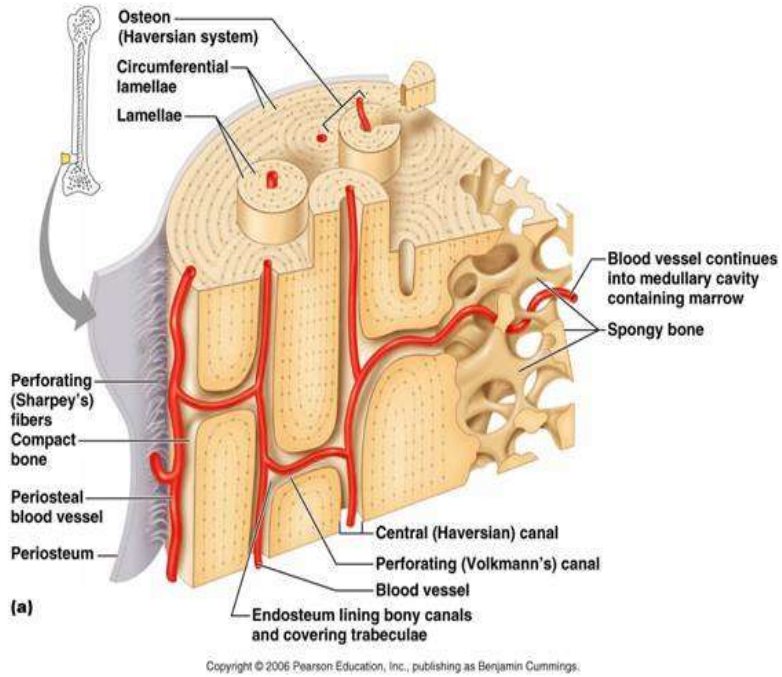
ARRANGEMENT OF BONY LAMELLAE



A single osteon in cross-section







Spongy bone- functions

- Spongy bone is **much lighter than compact bone.**
- Spongy bone **reduces the weight of the skeleton** and makes it easier for muscles to move the bones.
- Presence of bony trabeculae separated by marrow space containing bone marrow.
- Absence of Haversian systems and lamellar arrangement.

FIGURE 4.15 ■ Cancellous bone with trabeculae and marrow cavities: sternum (decalcified bone, transverse section). Stain: hematoxylin and eosin. Low magnification.

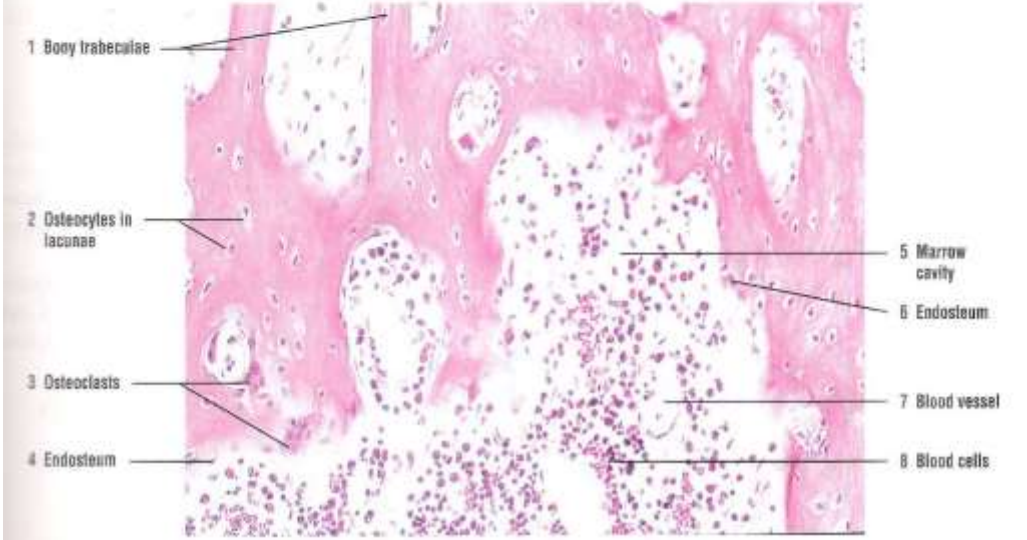


FIGURE 4.16 ■ Cancellous bone: sternum (decalcified bone, transverse section). Stain: hematoxylin and eosin. 64×

THANK YOU