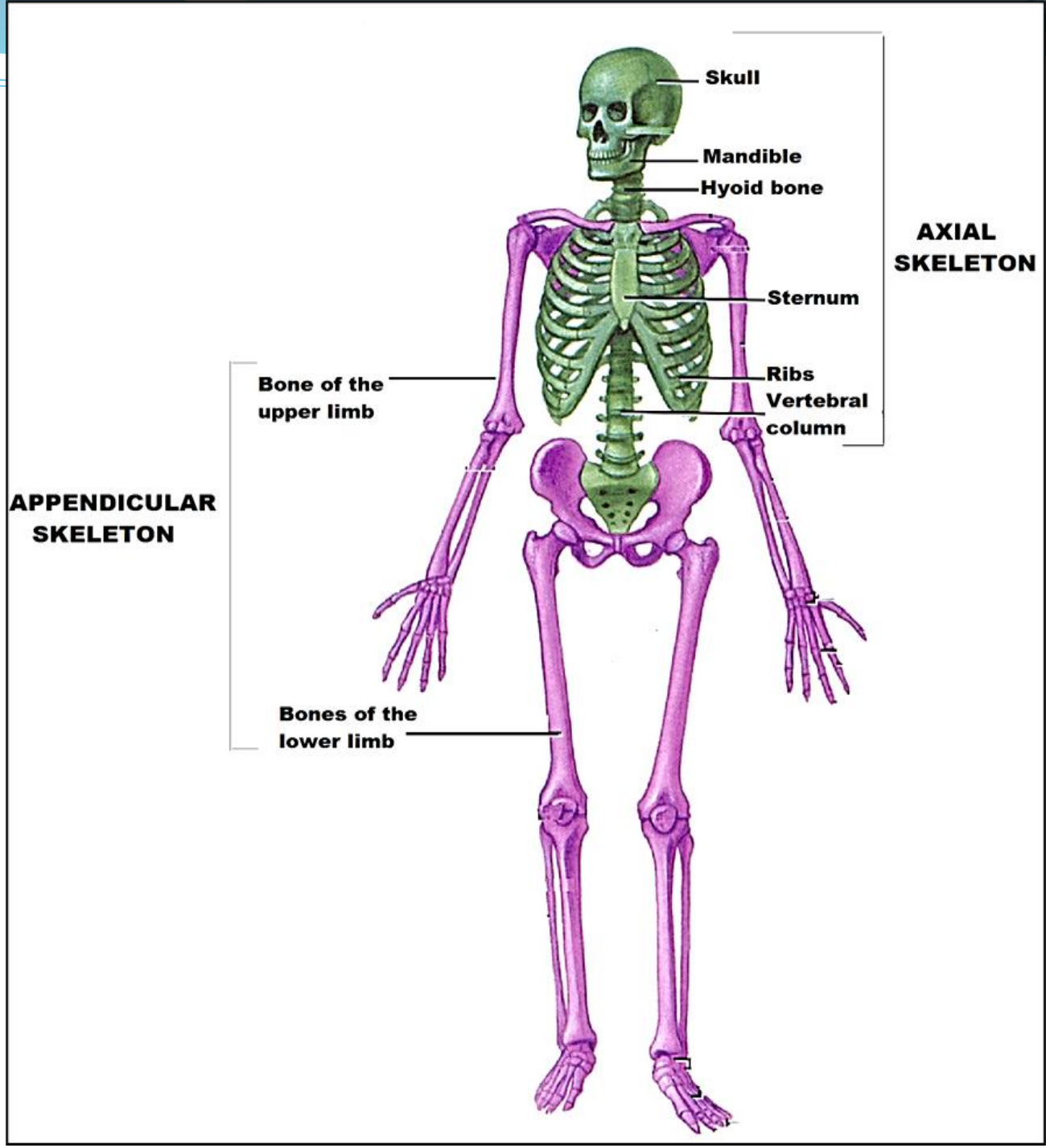
BONES

BY DR. DALIA M. BIRAM

The skeletal system consists Of:

Axial skeleton

-Appendicular skeleton



I. Axial Skeleton

The axial skeleton consists of the following:

A. Skull

B. Vertebral column, consists of:

a. Cervical vertebrae (7)

b. Thoracic vertebrae (12)

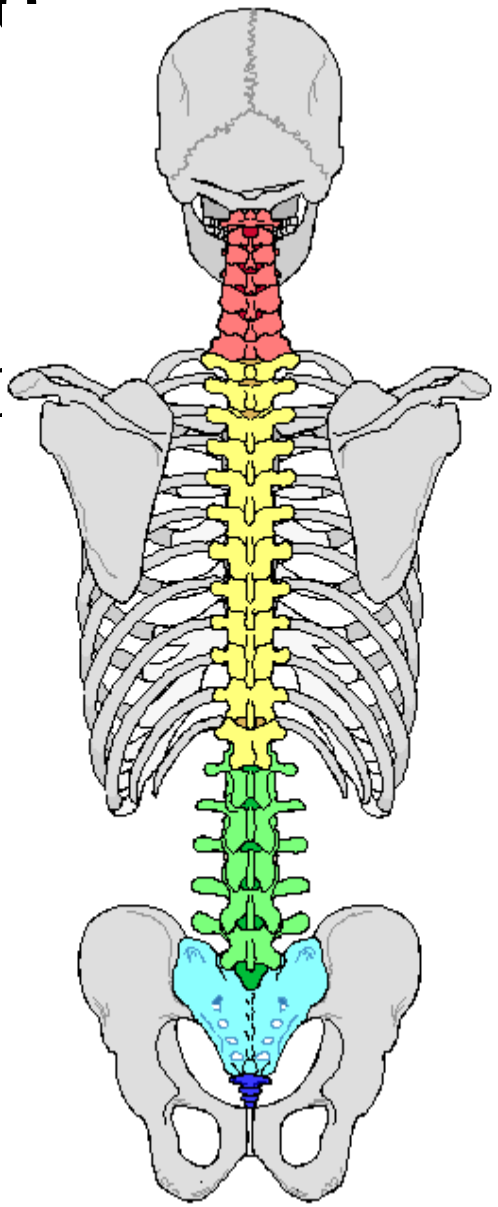
c. Lumbar vertebrae (5)

d. Sacral vertebrae (5 fused)

e. Coccygeal vertebrae (3-4fused)

C. Ribs (12 on each side)

D. Sternum (one in the midline)



Thoracic Cage

The thoracic cage consists of the sternum, the ribs, and the thoracic vertebrae.

- Sternum

- It is formed of manubrium sterni, body, and xiphoid process.

- The junction between the *manubrium* and the *body* is called the "sternal angle"

Applied anatomy:

- The sternal angle is an important landmark. It can be felt as a transverse ridge and lies at the level of the second costal cartilage and the second rib. All other ribs may be counted from this point.

Ribs

Classification of the ribs according to their attachments to the sternum:

- There are twelve (12) ribs on each side classified as:

I. True ribs: Upper seven ribs (their anterior ends are *attached to* the sternum).

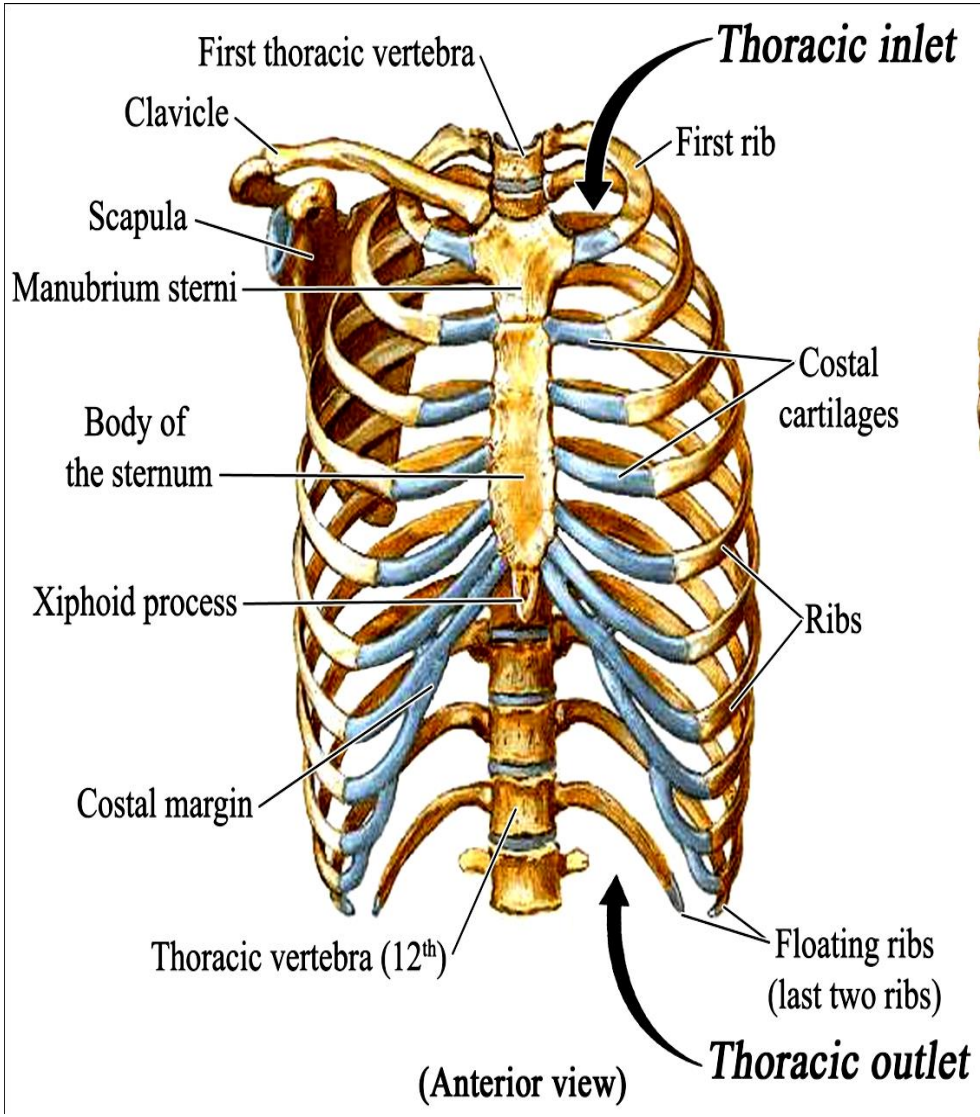
II. False ribs: Lower five ribs (they are *not attached* anteriorly to the sternum).

- **The lower two ribs are called the *floating ribs* because they are *free* anteriorly. It has narrow *"inlet"* and wide *"outlet"*.**

Thoracic Vertebrae

- They form the posterior part of the thoracic cage.

- There are twelve (12) vertebrae and articulate with each other by intervertebral discs.



II. Appendicular Skeleton

Bones of the upper limb

The skeleton of the upper limb consists of the following bones:

I. Shoulder girdle is formed of:

- Clavicle (anterior).
- Scapula (posterior).

II. Skeleton of the arm is formed of:

- Humerus.

III. Skeleton of the forearm is formed of:

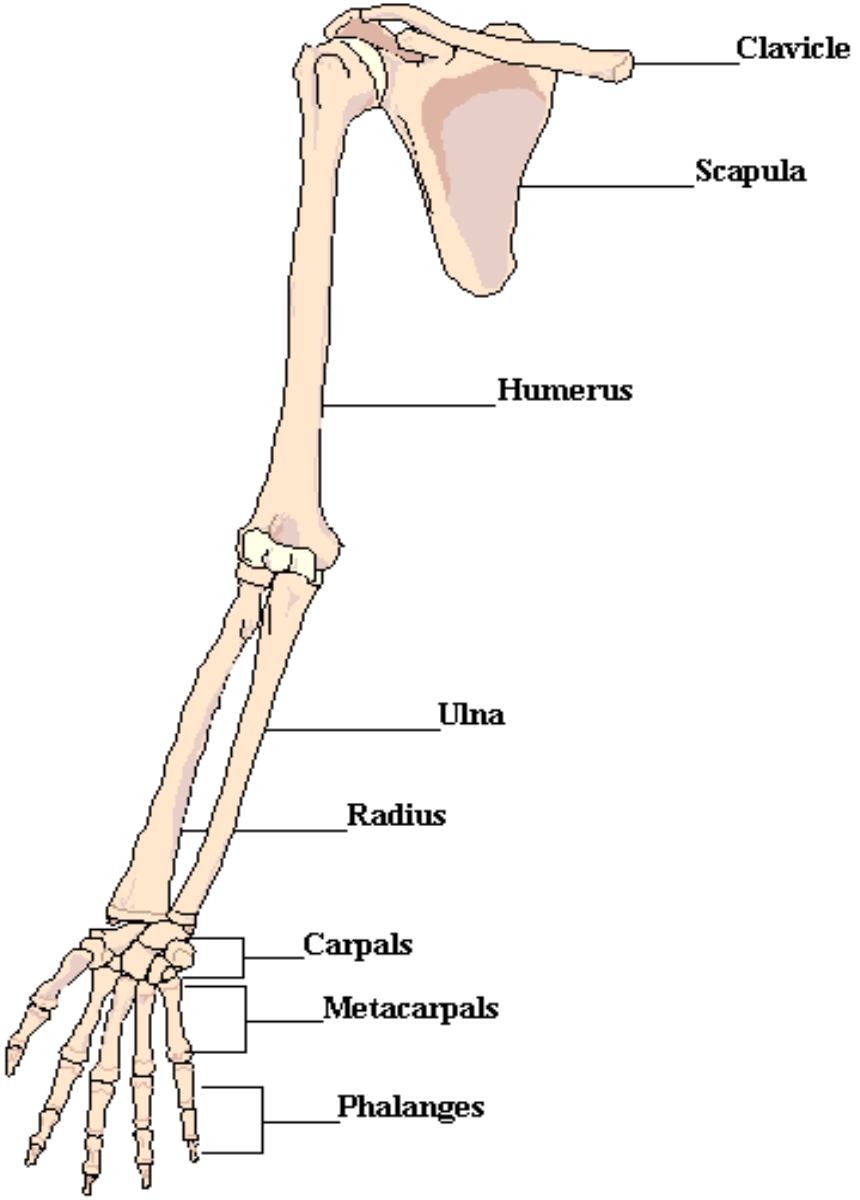
- Radius (lateral).
- Ulna (medial).

IV. Skeleton of the hand is formed of three regions:

A. Carpal bones (proximal, **8** carpal bones).

B. Metacarpals (intermediate, **5** metacarpal bones).

C. Phalanges (distal, **14** Phalanx **3** for each finger and **2** for the thumb).



Bones of the lower limb

The skeleton of the lower limb consists of the following regions:

I. Pelvic girdle is formed of:

- Hip bone.

II. Skeleton of the thigh is formed of:

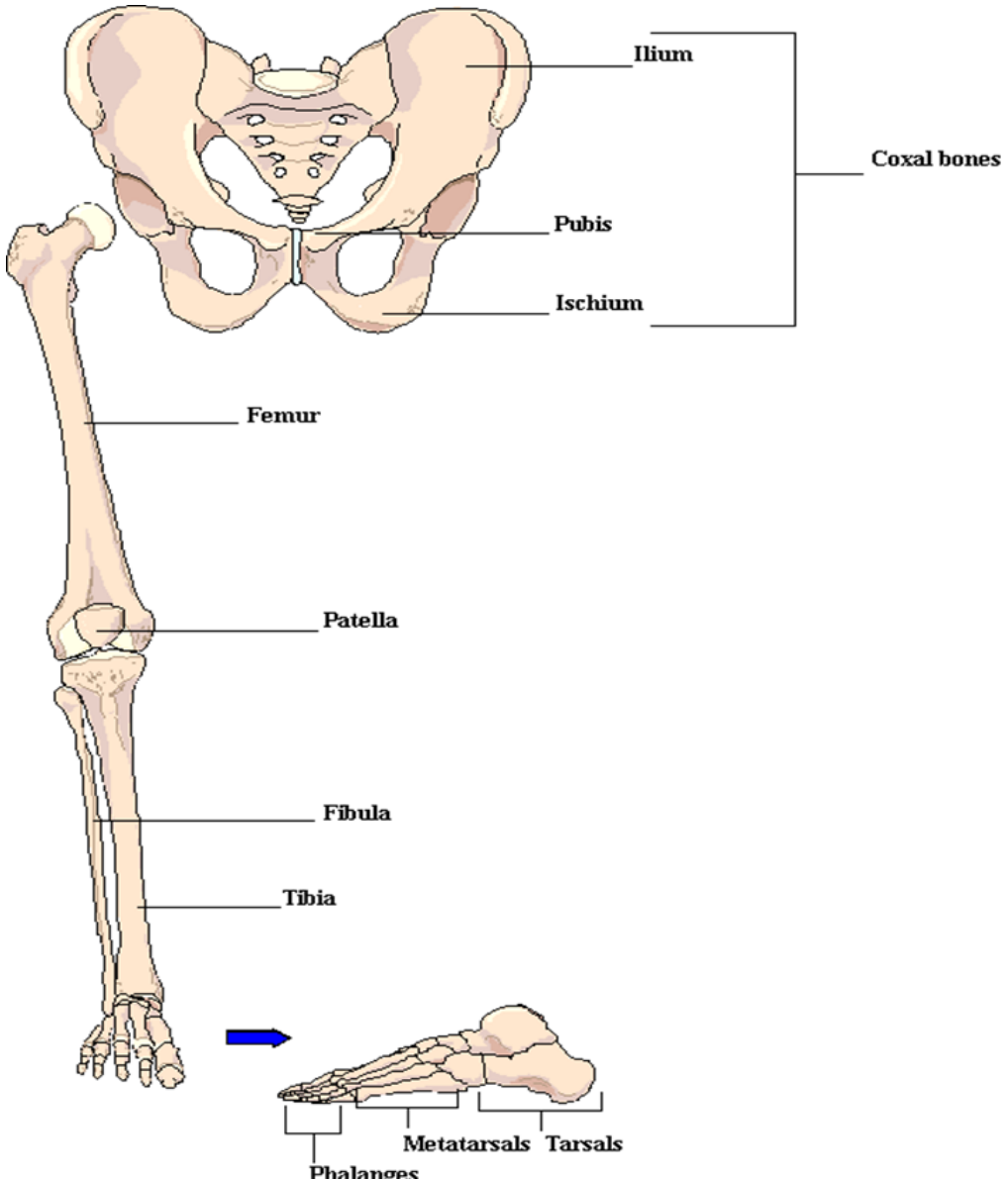
- Femur.

III. Skeleton of the leg is formed of:

- Tibia (medial).
- Fibula (lateral).

IV. Skeleton of the foot is formed of three regions:

A. Tarsus (proximal, 7 tarsal bones).
B. Metatarsus (intermediate, 5 metatarsal bones).
C. Phalanges (distal, 14 phalanx).



I-Types of bones according to its shape

I. Long bones : two ends (epiphyses) and **a shaft** (diaphysis) in between

Example: Humerus

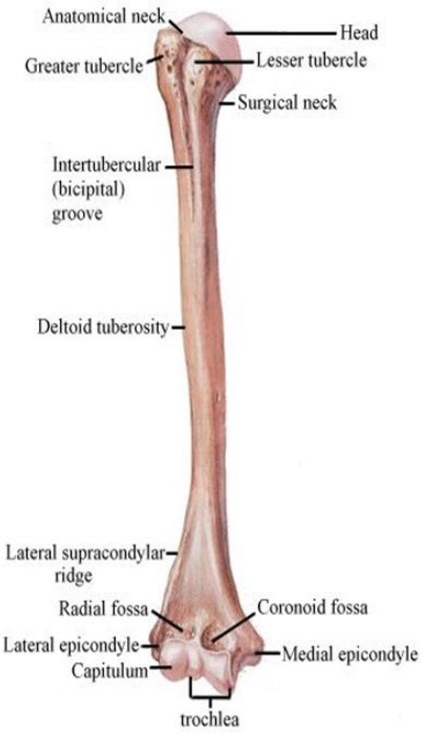
II. Short bones

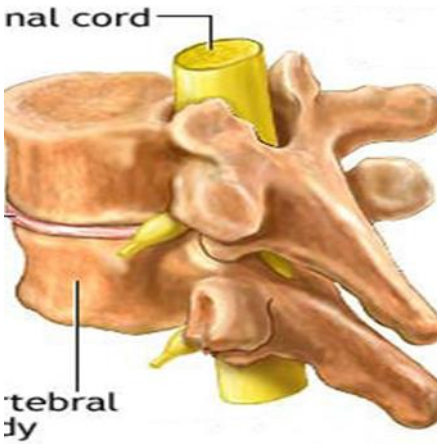
Example: carpal and tarsal bones

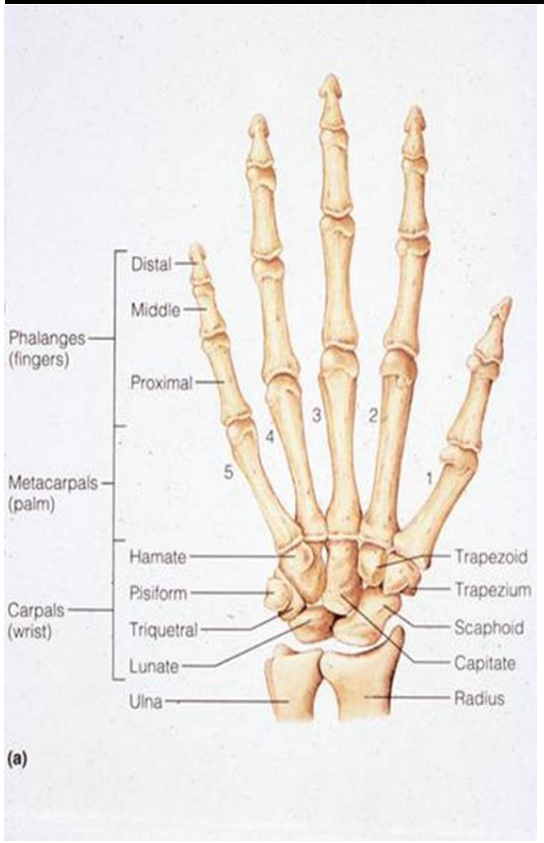
III. Irregular bones

Bones of **irregular** shape with projecting **processes** e.g. vertebrae.

IV. Flat bones consist of two thin **plates of compact** bone with middle layer of **spongy** bone







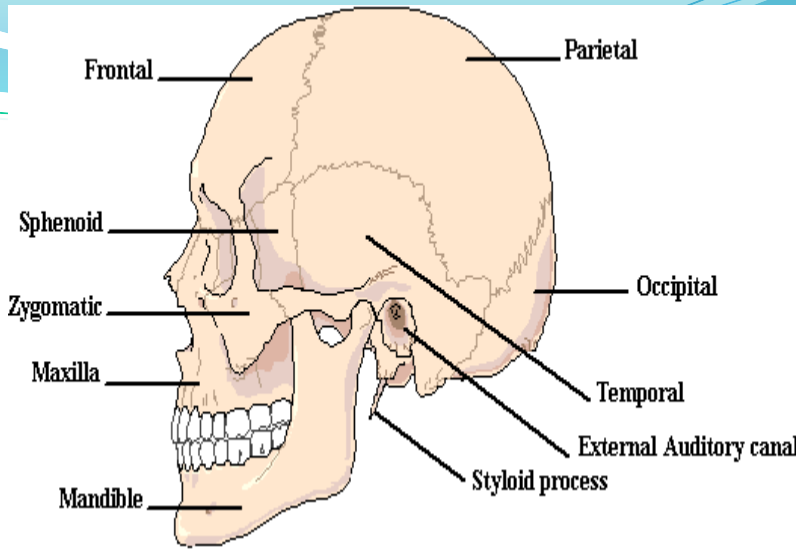
V. Pneumatic bones (bones containing air cavities)

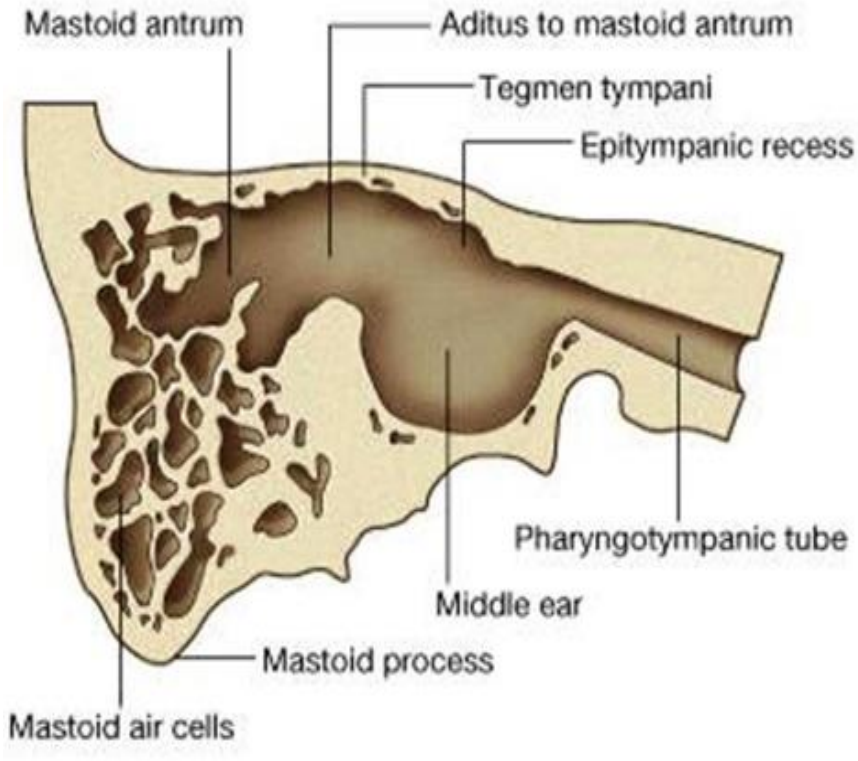
Example: Skull

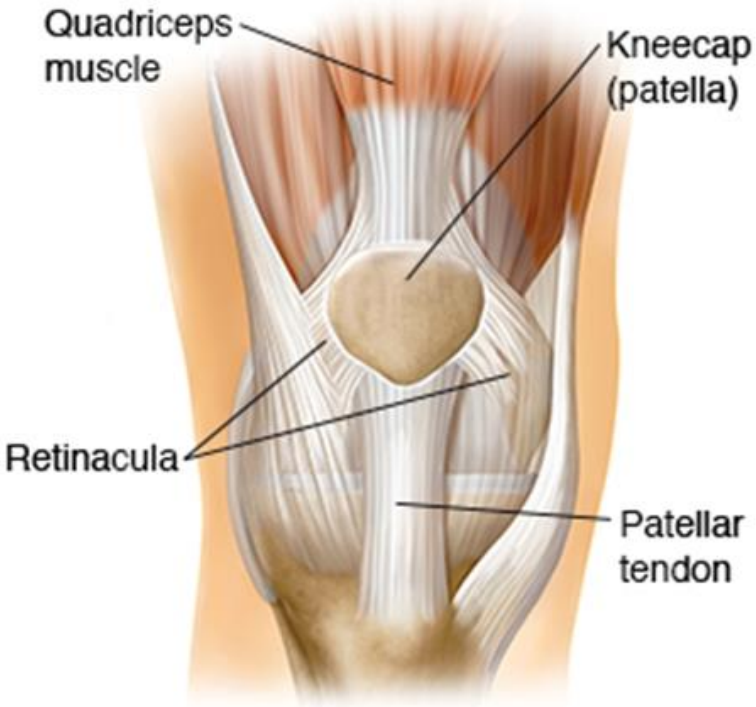
VI. Sesamoid bones : small **nodules** of bones **embedded** in some muscle tendons

Example: Patella

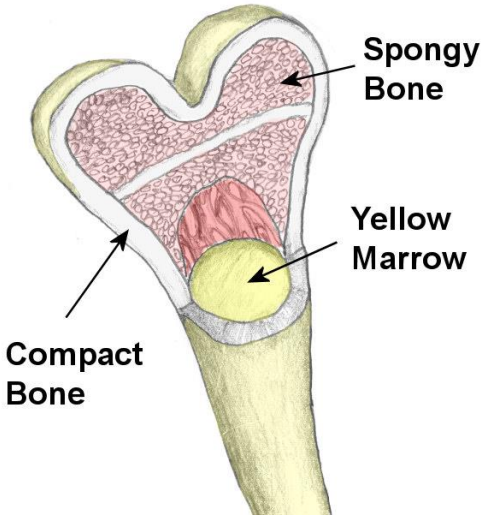
Function: They **diminish friction** between tendons and underlying bones.







II-Types of bones according to its structure

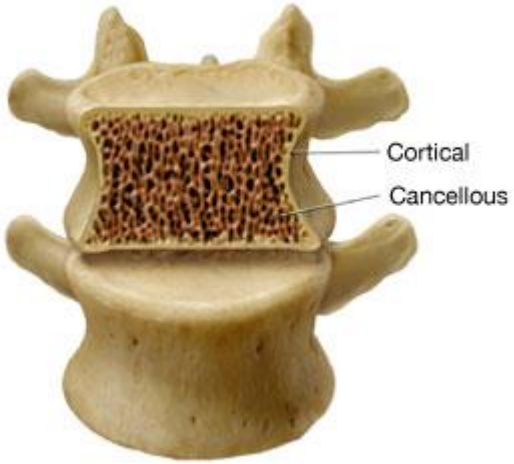


I. Compact bone

- It is firm and forms the outer layer of the shaft of bone.

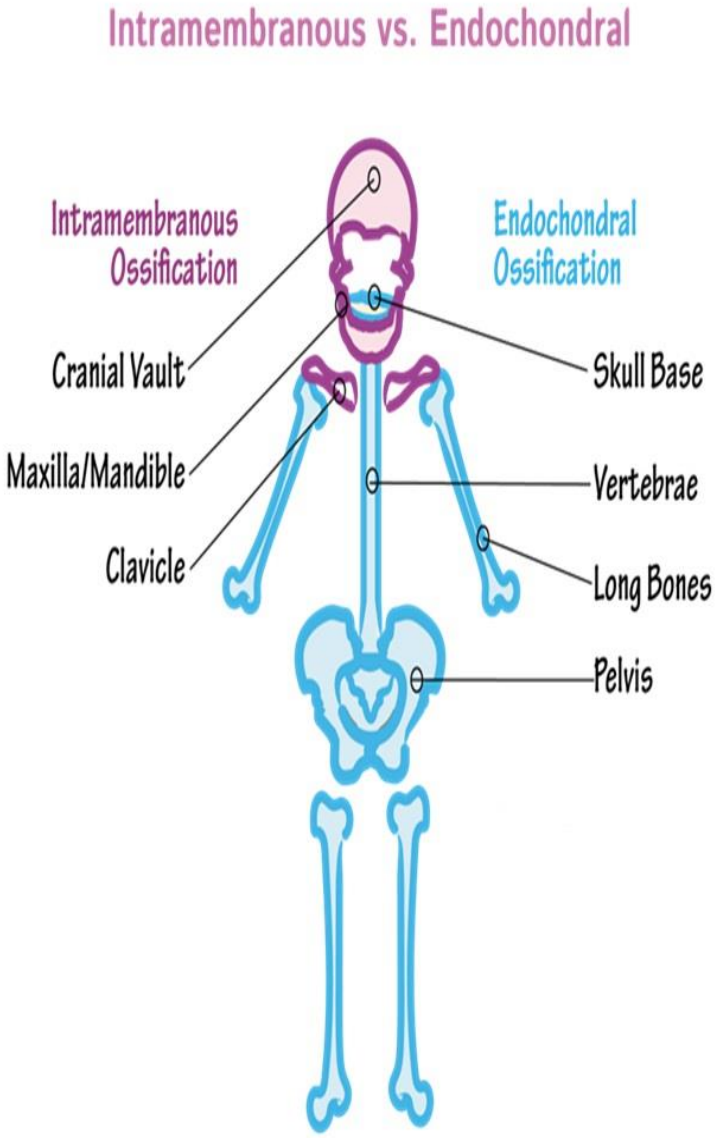
II. Cancellous bone

- It is formed of interlacing trabeculae .
- it is present at the ends of long bones.



III) Type of bone According to the process of ossification

a-Intra-membranous ossification	**b-Intra-cartilaginous** ossification
▪ e.g. clavicle , mandible and skull cap.	**1.**e.g. in long bones, vertebrae, ribs and base of skull.
1. The bones develop directly from mesodermal **connective tissue membrane** . **2.** It begins at one or more centers of ossification.	**2.** The mesoderm is changed at first into a **cartilage model**, and then the cartilage is dissolved and disappears, and displaced by bone.



- Bone formation starts during the **5th. week** of intra-uterine fetal life by appearance of **primary centers of ossification** and continues by appearance of **secondary centers of ossification** .

Stages of Cartilaginous Ossification

1)In the embryo, each bone is represented by a small mould of cartilage.

2) Primary center of ossification appears in the shaft during intra-uterine life.

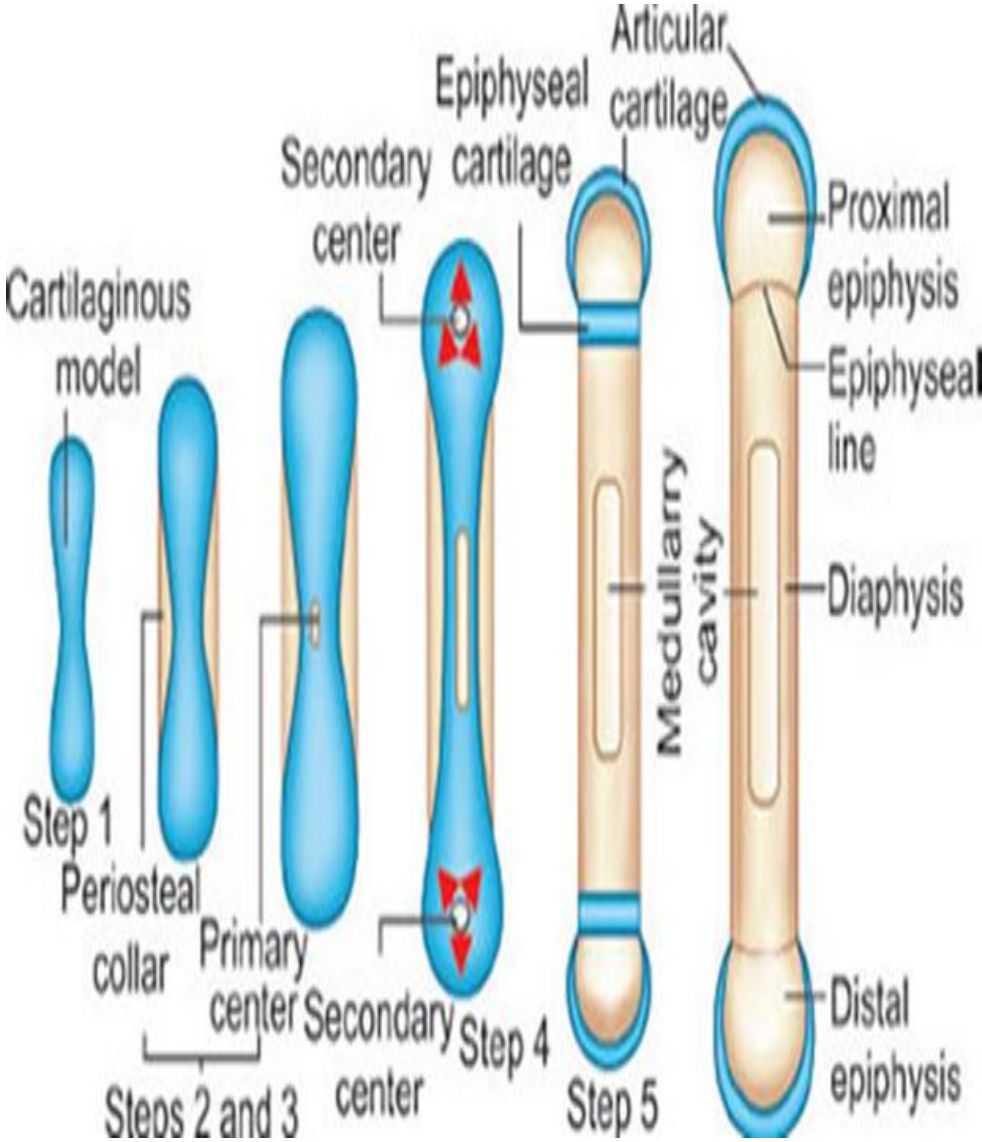
3) Secondary centers appear at the ends of long bones just before or after birth.

These centers act as foci around which bone is deposited.

4) Bone occupies the whole mould except at the epiphyseal plates.
At this stage, the bone is formed of two ends (epiphysis) and a shaft (diaphysis) which are separated by epiphyseal plates (epiphyseal cartilage).

•5- The bone grows rapidly in length by ossification at the metaphysis

(the metaphysis is the part of the diaphysis immediately adjacent to the epiphyseal cartilage).



PARTS OF LONG BONES

a) Epiphysis:

It is the expanded upper and lower ends of the long bone.

It is used for articulation and its articular surface is covered with a layer of articular hyaline cartilage.

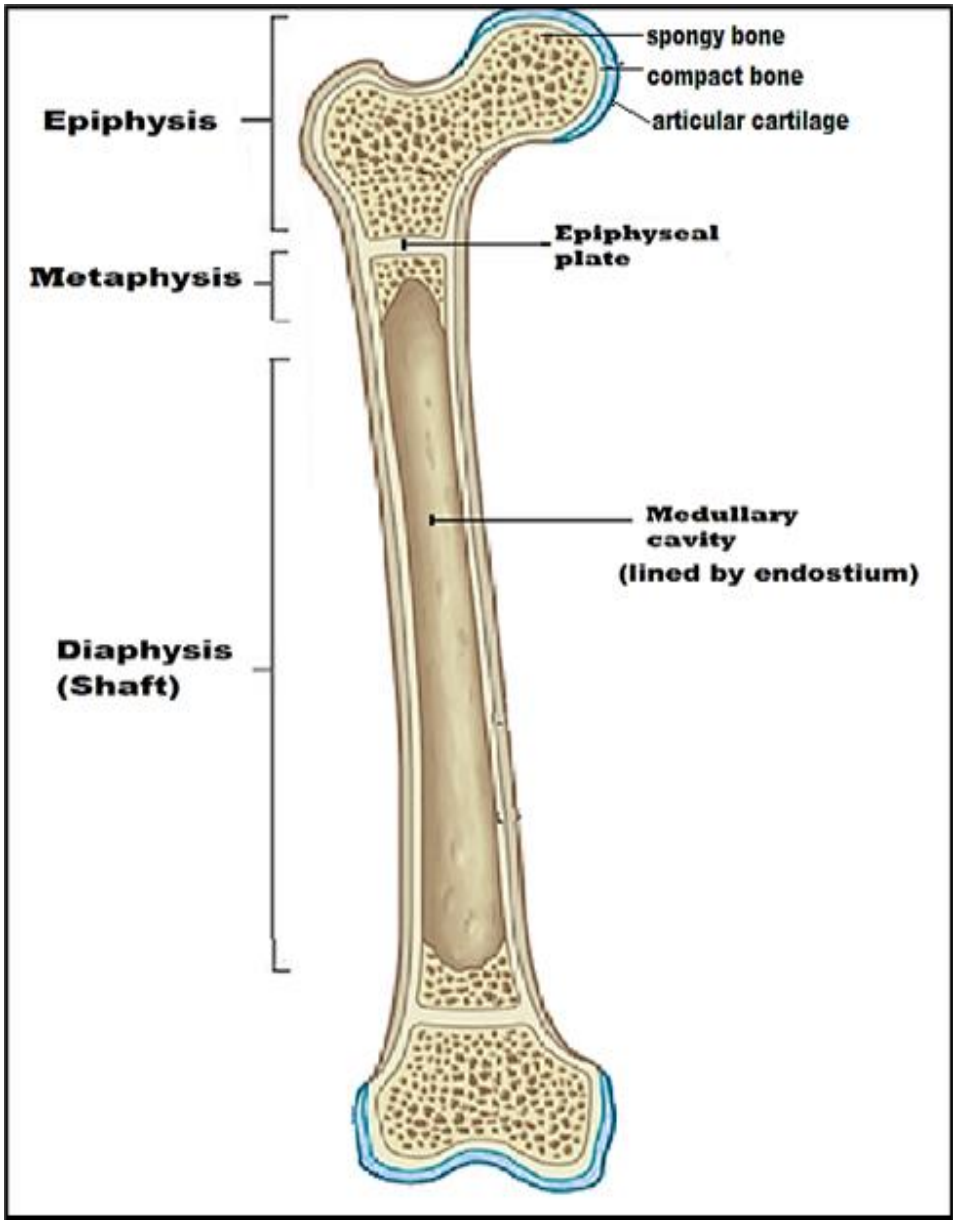
b)Diaphysis (Shaft):

A tube of compact bone (cortex) with a central medullary cavity lined with endosteum and is filled with bone marrow (soft vascular tissue).This medullary cavity doesn't extend to the epiphysis or the metaphysis.

The shaft is covered with fibro-cellular sheath called The long boperiosteum

Bones increase in diameter from periosteum.

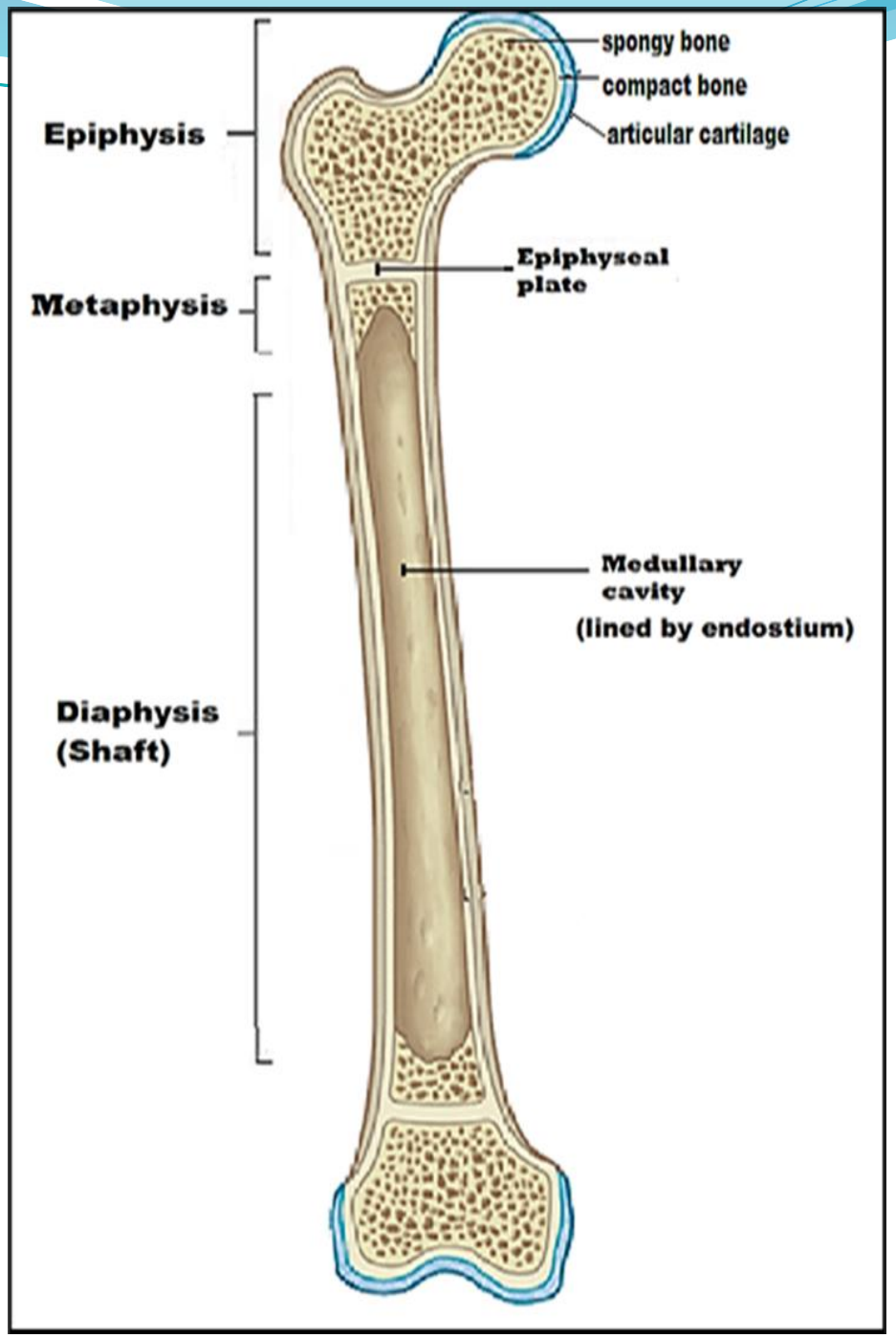
In the growing long bones, the epiphysis and the diaphysis are separated by a disc of hyaline cartilage called epiphyseal cartilage which is responsible for the growth in length



C)Metaphysis:

It lies in the upper and lower parts of the long bone just close to the epiphyseal cartilage.

It is the most active part of long bone and contains the newly formed bone , formed by the epiphyseal cartilage , which gradually migrate towards the diaphysis .



GROWTH OF LONG BONES

The long bones increase in length from the epiphyseal cartilages by proliferation of its cells.

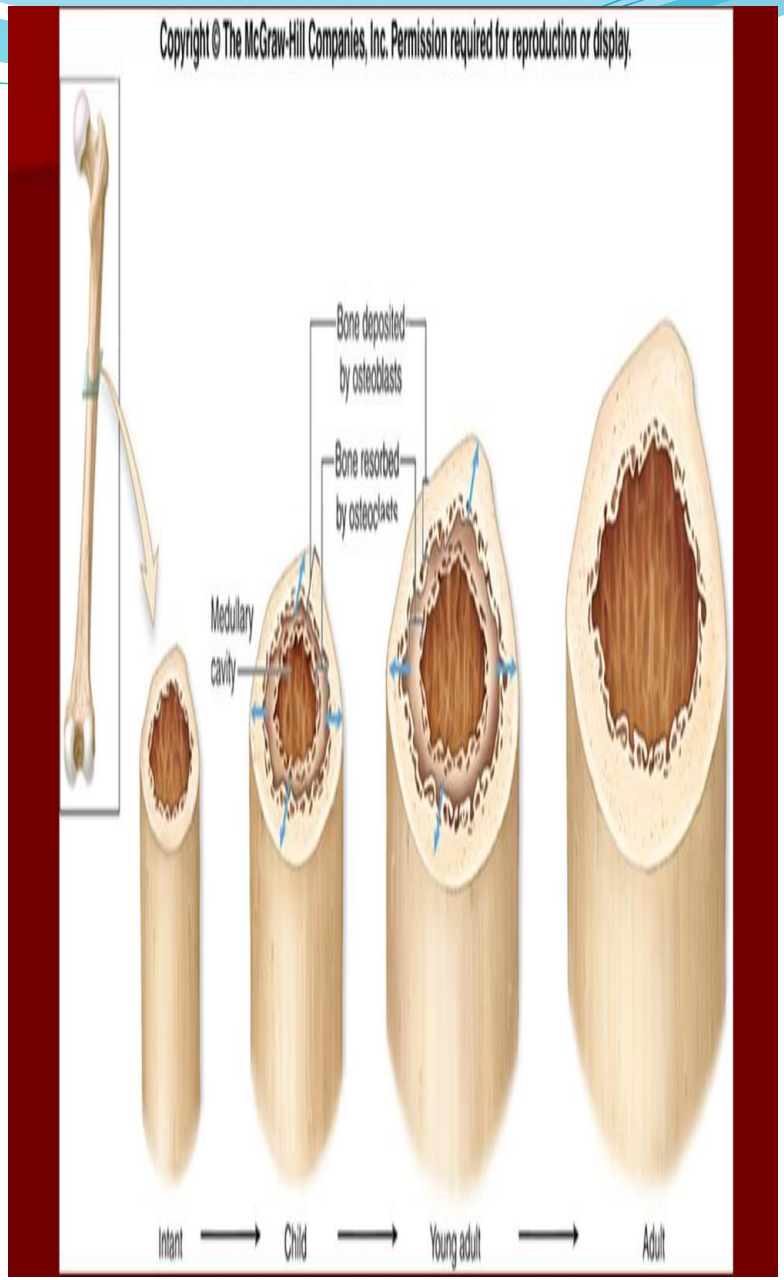
When the bone becomes mature, the cells of the epiphysial plate stops division and ossifies resulting in fusion between epiphysis and diaphysis.

The epiphyseal plate at one end of the shaft of long bone ossifies earlier than that at the other end, which continues adding bone to the shaft for another 2 to 3 years before it undergoes ossification as well. This end is called the growing end.

Fusion of the epiphysis and diaphysis is under hormonal control.

It occurs in females earlier than males by about 2 years.

The long bones increase in width from osteoblasts in the periosteum around the external bone surface. At the same time, osteoclasts in the endosteum break down bone on the internal bone surface, around the medullary cavity.



Arterial supply of bones

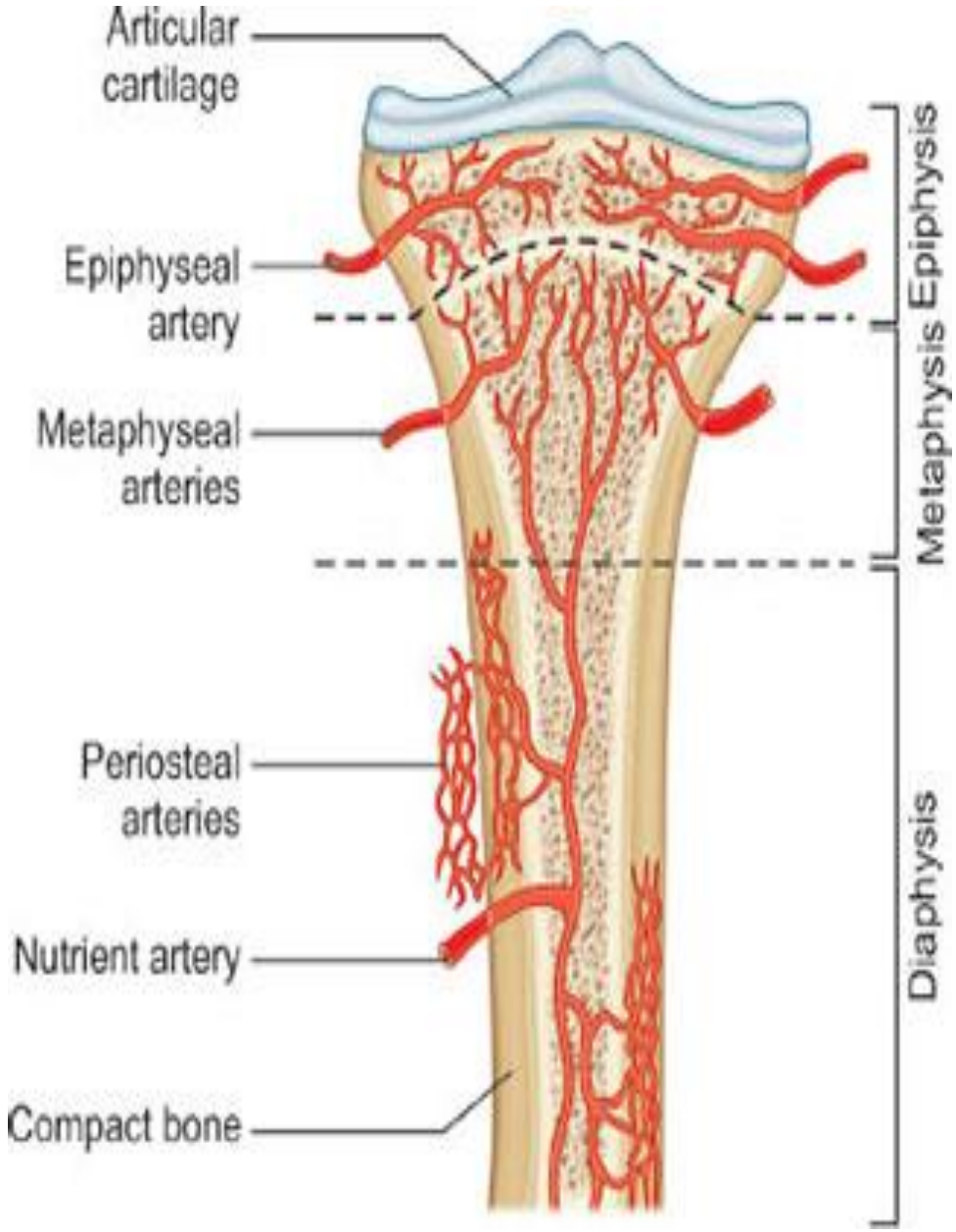
1)Nutrient artery:

It enters the middle 1/3 of the shaft through an oblique nutrient foramen and runs away from the growing end of bone.

- **TOWARDS THE ELBOW I GO, AWAY FROM THE KNEE I FLEE.**

2)Epiphyseal arteries:

They supply the epiphysis, and they anastomose with the metaphyseal arteries after the ossification of the epiphyseal plate of cartilage

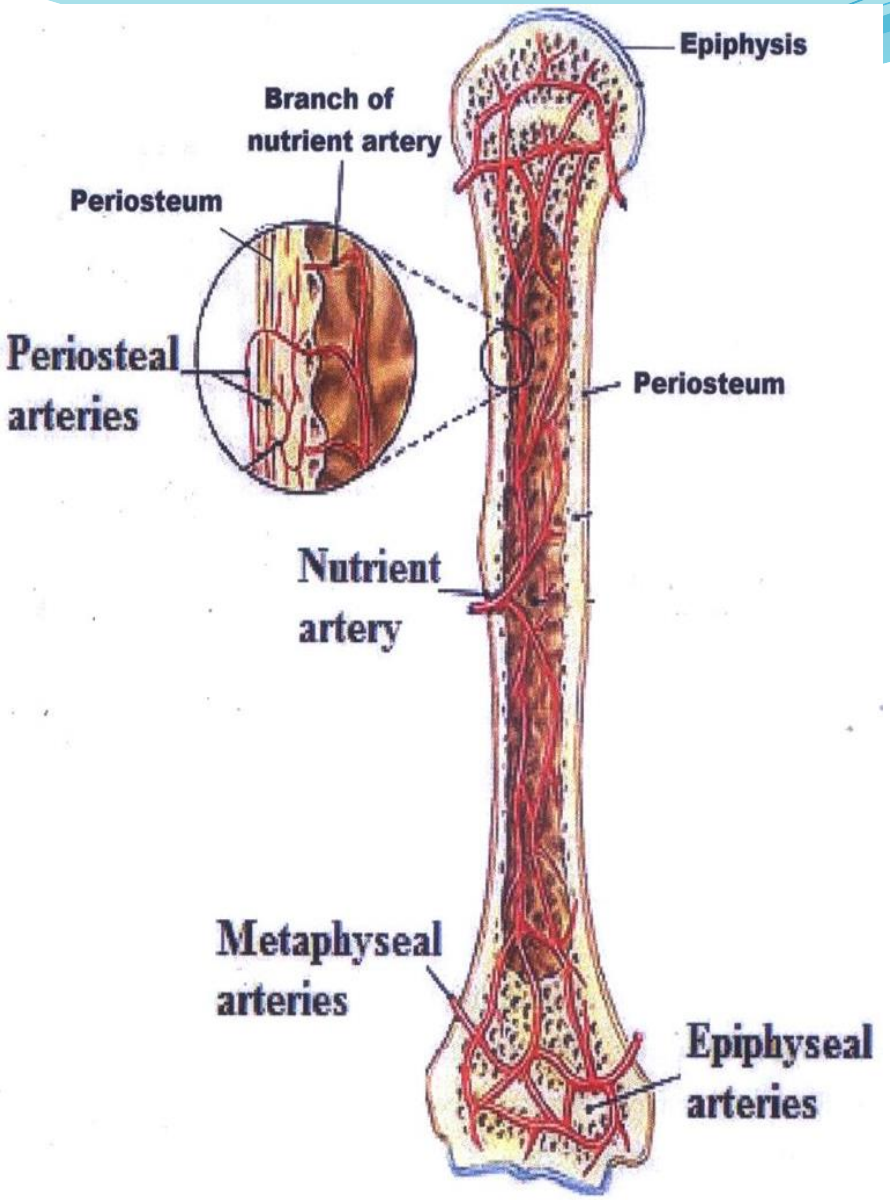


3)Metaphyseal arteries:

They enter the bone through minute foramina to supply metaphysis.

4)Periosteal arteries: they supply the outer ⅓ of the cortex of the shaft and they communicate with other arteries.

5)**Arteries of the attached muscles .**



Arterial Supply of Long Bone

Functions of the skeletal system

1-Gives the specific shape to the body.

2-Provides the central axis of the body and the skeleton of both upper and lower limbs.

3-Protects the vital organs: the skull protects the brain, and thoracic cage protects the heart and lungs.

4-Provides surface for muscular attachment.

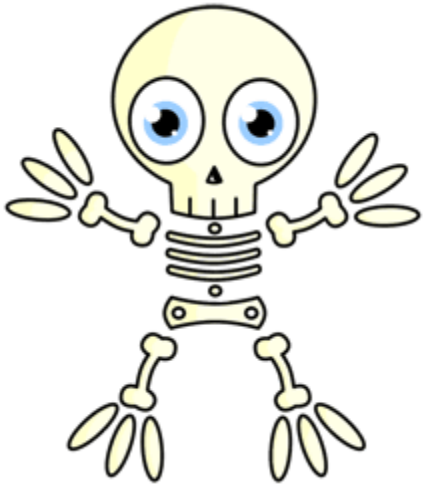
5-Transmits and supports the body weight e.g. vertebral column transmits the weight of the head and trunk to the bony pelvis then through the bones of lower limbs to the feet and lastly to the ground.

6-Forms the joints to make an important part of the locomotor system.

7- Forms the blood elements in the red bone marrow.

8-**Stores phosphorus salts. &calcium**

Thank You



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