Anatomy of Skeleton System :

المحاضرة (٢) تشريح / طيف التوحــد

Its multiple groups of skeletal parts that joints together by cartilage . Skeleton system is divided into (2) main parts of bones :

1- **Axial skeletal bones (bones of the skull, spine and thoracic cavity) .**
2- **Appendicular skeleton (bones of the upper and lower limbs).**

- **Bones make up 20% of the body's mass.**
- **Number of bone in human body are (206) bones**
- **The longest bone is the femur & the smallest bone is stirrup found in ears .**

functions:

1. **Support soft tissues : Bones provide a frame to support the body. Muscles, tendons, and ligaments attach to bones .**
2. **Protection for internal organs as : the skull protects the brain, and the ribs protect the heart and lungs.**
3. **Attend the movement .**
4. **Produces blood cells : developing red blood cells, platelets, and white blood cells. Also, the body destroys defective and old red blood cells in bone marrow.**
5. **Storage of fats & regulates the calcium and phosphorus content in the body .**

Types of Bones : **According to the shape of the bone :**

1. **Long bones : Femur, tibia, fibula, humerus , radius & ulna , but are also some of the smallest including the Metacarpals, Metatarsals, and Phalanges.**
2. **Short bones : (cube - shaped) as : bones of the wrist, ankle and foot.**
3. **Flat bones : The classic example of a flat bone is the Scapula . The Sternum , cranium (skull) , ilium (hip bone) of pelvis and ribs are also classified as flat bones .**
4. **Irregular (odd) shapes : such as the vertebrae , the sacrum or the coccyx of the pelvis . Also the pneumatic bones . The bones forming the face , mandible (lower jaw) are also irregular.**
5. **Sesamoid bones : Patella . Other sesamoid bones are the Pisiform (smallest of the Carpals) and the two small bones at the base of the 1st Metatarsal .**

1- Axial skeletal bones : (Central Bone) :

❖ The skull :

The skull has(22) bones and formed of 2 sets of bones :

- **Cranium .**
- **Face .**

All these bones are connected at immobile joints called sutures except the mandible which is connected to the skull by freely movable joint.

Sutures are:

1. **Coronal suture.**
2. **Sagittal suture.**
3. **Lambdoid suture.**
4. **Squamous suture**

Bones of the cranium :

Single bones :

1. Frontal bone : In the front

2. Occipital bone : in the back

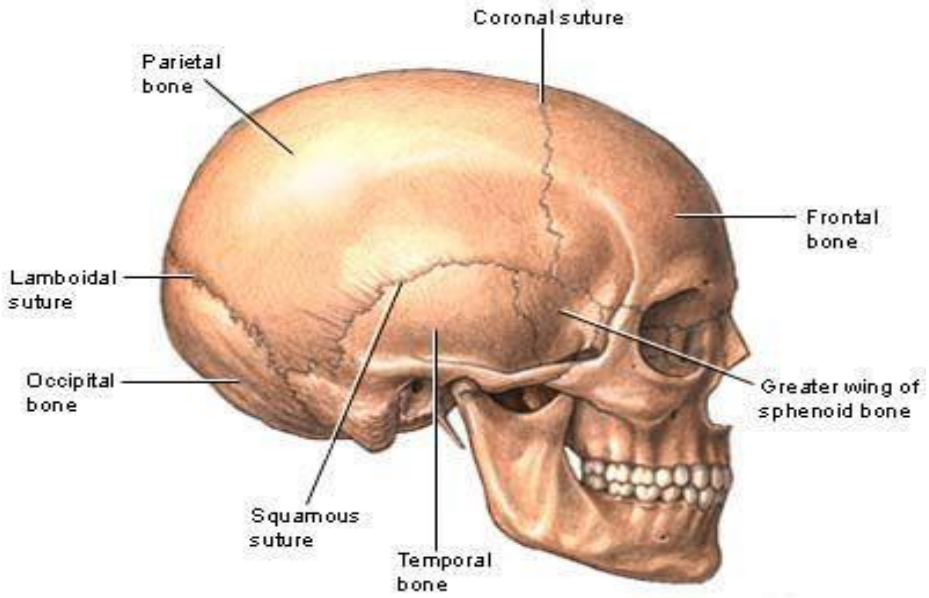
3. Ethmoid bone : in the base

4. Sphenoid bone : in the base

Paired bones : One on each side

1.parietal bones (2) bones above.

2.Temporal bones (2) bones below



Bones of the face :

They hold the eyes in the anterior position and allow the facial muscles to express our feelings . They consist of (14) bone :

- **(2) Single**
- **(12) Paired**

Single bones : In the middle .

1. **Vomer :** forms most of the nasal septum

2. **Mandible :** forms the lower jaw

Paired bones :

1. **Maxillae (2) :** They fuse together to form the upper jaw .

2. **Palatine bones (2) :** They are found behind the maxillary processes and form the posterior part of the hard palate .

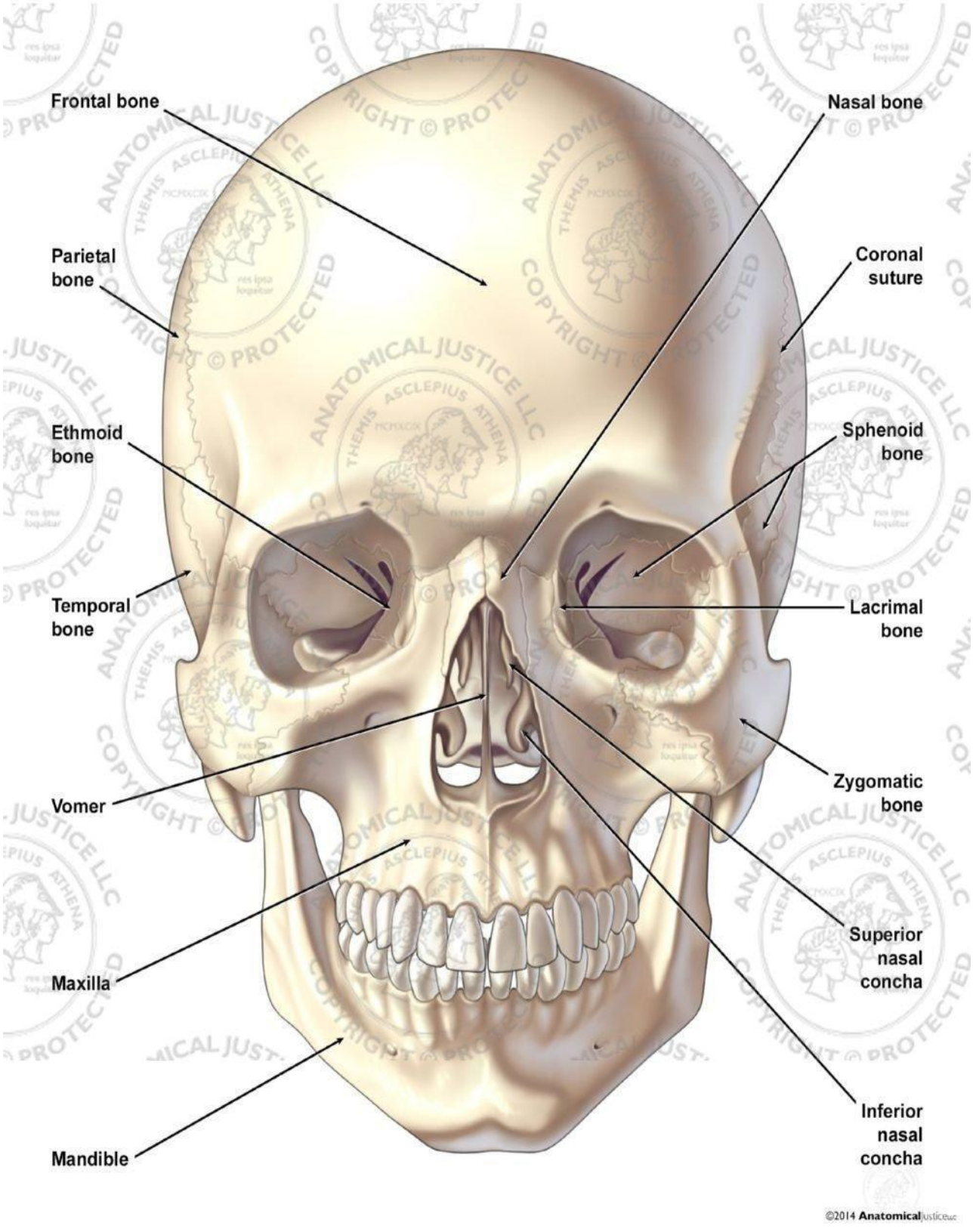
3. **Zygomatic bones (2) :** They form the bones of the cheek and also form a part of the lateral wall of the orbit (eye socket) .

4. **Lacrimal bones (2) :** They form the bridge of the medial wall of the orbit each bone carries a groove for passage of tear(lacrima) These bones are small in size .

5. **Nasal bones (2) :** They form the bridge of the nose.

6. **Inferior conches (2) :** They are thin curved bones . Each bone appear projecting from the lateral wall of the nose

Anterior Anatomy of the Skull



❖ Vertebral column :

It's the back which extent from the skull to the tip of coccyx , and can be define as the posterior surface of the trunk. It the central-bony pillar of the body .

The main functions of vertebral column are :

A- its support :

1. The skull :
2. Shoulder girdle .
3. Upper limbs .
4. Thoracic cage.

B- By way of the pelvic girdle transmit the body weight to the lower limb .

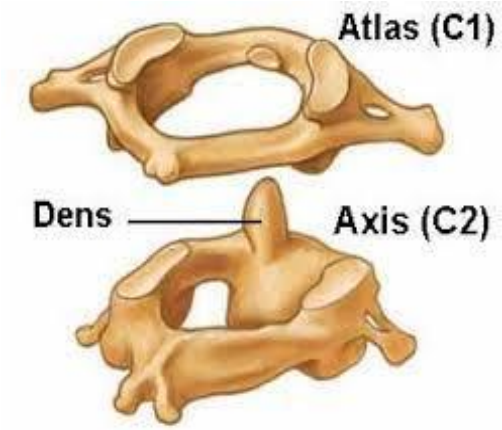
C- Protection of : spinal cord , roots of the spinal nerves and the covering meanings that are lying within vertebral column .

The vertebral column is composed of (33) vertebrae :

- **7 Cervical V .**
- **12 Thoracic V .**
- **5 Lumber V .**
- **5 Sacral V. (fused to form the sacrum)**
- **4 Coccygeal V. (the lower 3 are fused)**

1-Cervical Vertebra : Are (7) vertebrae

- **The 1st one called Atlas which articulate with the occipital bone of the skull by Atlanto – occipital joint .**
- **The 2nd vertebrae called Axis which support the movement of the atlas vertebra and skull .**



2-Thoracic vertebrae:

Are (12) vertebrae each one has (big body + long spine) , its articulate with the ribs of the chest

3-Lumbar vertebrae:

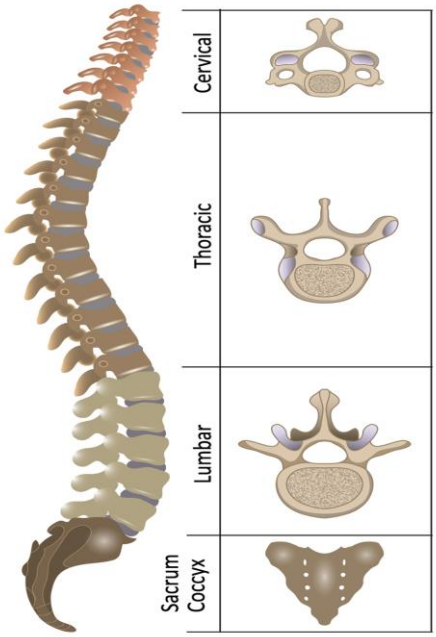
They are (5) in number , it's the biggest one in the vertebral column, it has restriction in movement, and has kidney shape , the vertebral canal is triangular in shape .

4-Sacral vertebrae :

They are (5) vertebrae , they are joint together to form sacrum bone , which is triangular in shape ,the base is in the upper and the apex in the lower part , articulated with coccyx .

5- Coccygeal vertebrae :

Its triangular small bone consist of (4) vertebrae

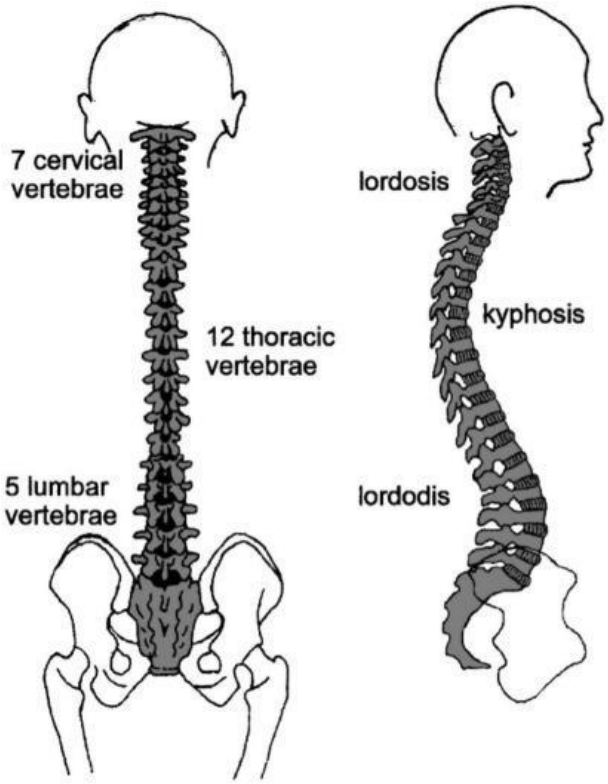


The curvatures of the vertebral column :

1-Kyphosis (Thoracic curvature) .

2-Lordosis (Lumber curvature) .

3-Scoliosis (side curvature) .



2-Appendicular skeleton bone :

❖ **bones of the upper limb : It is consist of :**

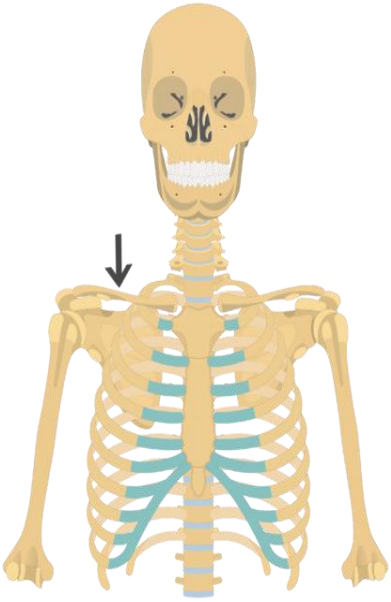
- **Bones of the shoulder girdle: Clavicle (Anteriorly), and Scapula (Posteriorly).**
- **The bone of the arm: Humerus**
- **Bones of the forearm: Radius (situated laterally), and Ulna (situated medially).**
- **Bones of the hand: 8 carpal bones, 5 metacarpal bones are bones of the palm, and Phalanges: bones of the fingers (each finger has 3 except thumb has 2 phalanges).**

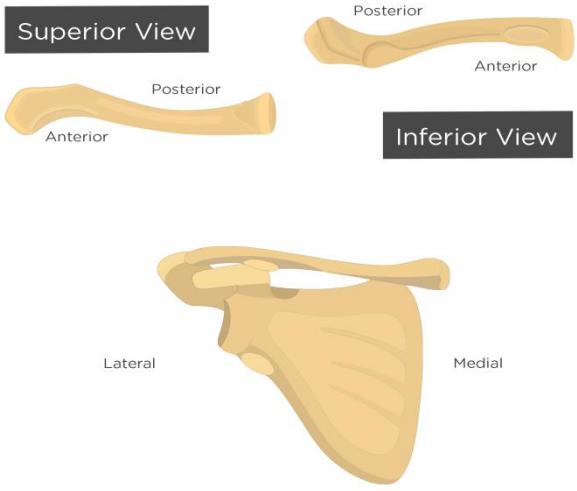
1-Skeleton of the shoulder :

A- Clavicle bone: is along slender bone lies horizontal across the neck . It has a shaft with double curvature; its medial 2/3 is convex anteriorly and its lateral 1/3 is concave anteriorly. The clavicle has 2 ends :

- **Medial (Sternal) end is rounded in shape and articulates with the manubrium sterni.**
- **The lateral (Acromial) end is flattened, articulates with the acromion process of the scapula.**

B- scapula :The scapula is a flat triangular bone that lies on the posterior . There are three angle of the scapula : Superior , Inferior & Lateral



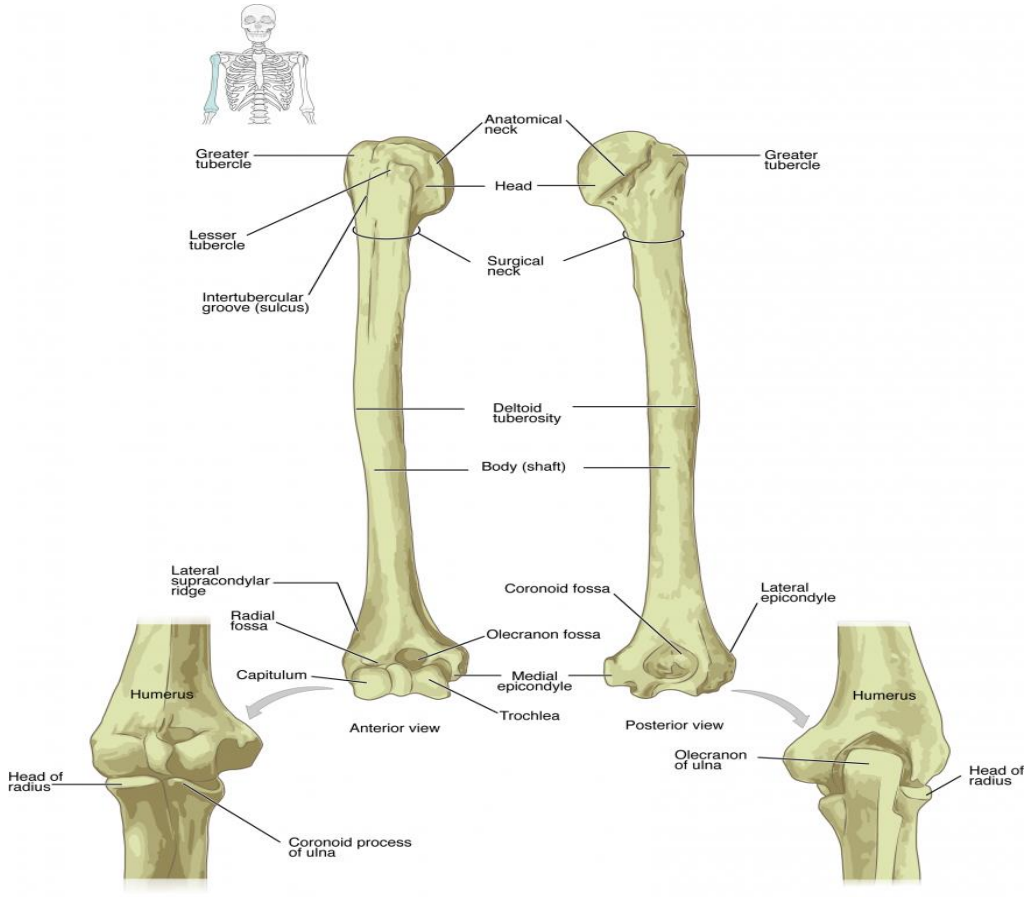


2-Skeleton of the upper arm (Hummerus bone):

The humerus : is the single long & strong bone of the arm region . Consist of :

- **Head : located at its proximal end of the humerus. This is the large, round, smooth region that faces medially. The head articulates with the glenoid cavity of the scapula to form the glenohumeral (shoulder) joint .**
- **anatomical neck (surgical neck) : is located where the proximal end of the humerus joins the narrow shaft of the humerus, and is a common site of arm fractures**
- **greater tuberosity : Located on the lateral side of the proximal .**
- **lesser tuberosity : Located on the anterior aspect of the humerus .**

  Both the greater and lesser tubercles serve as attachment sites for muscles that act across the shoulder joint
- **inter-tubercular groove .**
- **Shaft**
- **Distal end : The distal end of the humerus has two articulation areas, which join the ulna and radius bones of the forearm to form the (elbow) joint**



3-Skeleton of the fore arm :

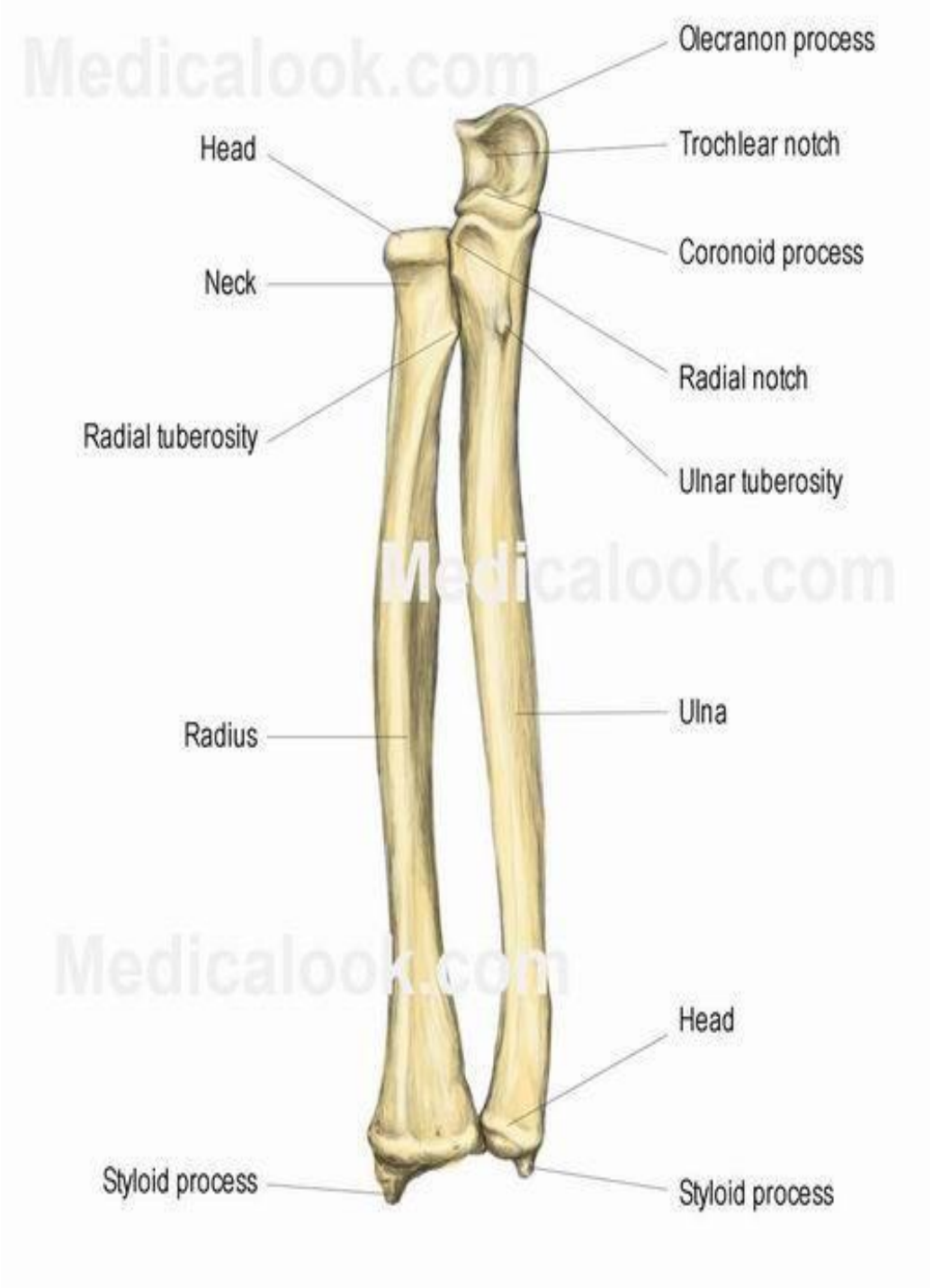
A- Radius : Which is lateral bone .The radius runs parallel to the ulna, on the lateral (thumb) side of the forearm . Consist of :

- **Head : is a disc-shaped structure that forms the proximal end. The small depression on the surface of the head articulates with the capitulum of the humerus as part of the elbow joint**
- **Neck :**
- **Radial tuberosity : serves as a muscle attachment point.**
- **Shaft : is slightly curved and has a small ridge along its medial side. This ridge forms the inter osseous border of the radius , which, like the similar border of the ulna, is the line of attachment for the inter osseous membrane that unites the two forearm bones (radius & ulna) .**
- **Lower (distal) end has a smooth surface for articulation with two carpal bones to form the radiocarpal joint or wrist joint . The distal end of radius has two sides :**
  - **medial side of the distal radius is (the ulnar notch of the radius). This shallow depression articulates with the head of the ulna, which together form the distal radioulnar joint.**
  - **lateral end of the radius has a pointed projection called the styloid process of the radius. This provides attachment for ligaments that support the lateral side of the wrist joint**

B-Ulna : The ulna is the long medial bone of the forearm consist of :

- **Upper end (proximal end) resembles a crescent wrench with its large, C-shaped, trochlear notch. This region articulates with the trochlea of the humerus as part of the elbow joint.**
- **Shaft and**
- **Lower end (distal end).There is medial styloid process . This process serves as an attachment point for connective tissues that unite the distal end of the ulna with the carpal bones of the wrist joint .**

Between the two bones (radius & ulna) there is inter-osseous space .


Olecranon process
Head
Trochlear notch
Coronoid process
Neck
Radial notch
Radial tuberosity
Ulnar tuberosity
Ulna
Radius
Head
Styloid process
Styloid process

4-Skeleton of the wirst & hand :

❖ Skeleton of wrist : Carpal bones (8 bones)

Bones made of two row of four bones in each one .

- **The proximal consist of (from lateral to medial):**
  - **Scaphoid (“boat-shaped”) .**
  - **Lunate (“moon-shaped”).**
  - **Triquetral (“three-cornered”) .**
  - **Pisiform (“pea-shaped”) .**

- **The distal row consist of (from lateral to medial):**
  - **Trapezium (“table”) .**
  - **Trapezoid (“resembles a table”) .**
  - **Capitates (“head-shaped”).**
  - **Hamate (“hooked bone”).**

❖ Metacarpal bones :

The palm of the hand contains (5) elongated metacarpal bones. These bones lie between the carpal bones of the wrist and the bones of the fingers and thumb (phalanx) . The proximal end of each metacarpal bone articulates with one of the distal carpal bones to form carpometacarpal joint .The expanded distal end of each metacarpal bone articulates with proximal phalanx bone of the thumb or one of the fingers at the metacarpophalangeal joint .

The first metacarpal bone, at the base of the thumb, is separated from the other metacarpal bones. This allows it a freedom of motion that is independent of the other metacarpal bones, which is very important for thumb mobility. The remaining metacarpal bones are united together to form the palm of the hand.

❖ Phalangese Bones :

The fingers and thumb contain 14 bones , each of which is called a phalanx bone . The thumb (pollex) is digit number (1) and has two phalanges only : a proximal and distal phalanx bones . Other digits have 3 sets of phalanx bones are : proximal , middle & distal


DISTAL PHALANX
MIDDLE PHALANX
PROXIMAL PHALANX
DISTAL PHALANX
PROXIMAL PHALANX
METACARPAL
TRAPEZOID
TRAPZIUM
CAPITATE
SCAPHOID
LUNATE
RADIUS
PHALANXES
METACARPUS
HAMATE
TRIQUETRUL
CARPUS
PISIFORM
ULNA
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The Pelvis :

The bony pelvis is a complex basin-shaped structure that comprises the skeletal framework of the pelvic region and houses the pelvic organs. It is usually divided into two separate anatomic regions:

1- **The pelvic girdle**

2- **Pelvic spine.**

The pelvic girdle, also known as the hip bone , is composed of three fused bones :

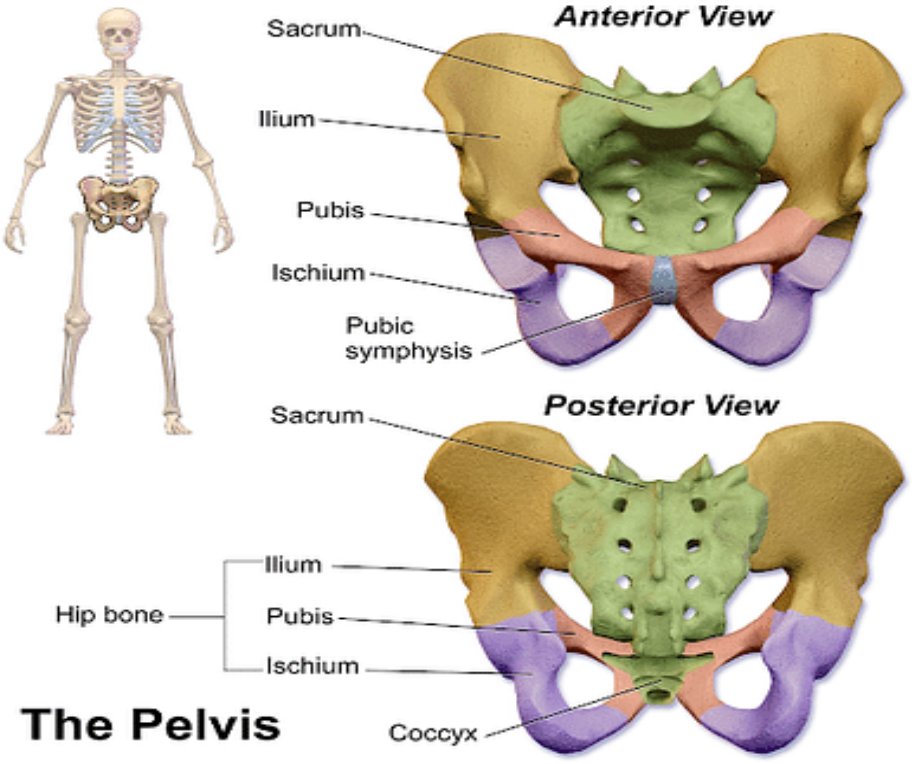
1-The ilium bone .

2-The ischium bone .

3-The pubic bone.

These three bones are also known as the innominate bones, pelvic bones or coxal bones. In children they are connected only by cartilage then completely fuse during puberty to comprise the complex and compact hip bone .

The pelvic spine is the posterior portion of the pelvis below the lumbar spine, composed of the sacrum and coccyx. The two pelvic bones are connected anteriorly by the pubic symphysis, while posteriorly they articulate with the pelvic spine to form the sacroiliac joints.



The pelvis plays several important functions in the human body as :

1- **The pelvis carries the entire weight of the upper body, stabilizes it and transmits it to the lower limbs, allowing various actions to occur (e.g. sitting, standing, bipedal gait).**

2- **It houses and protects the abdominopelvic viscera and provides the attachment point for muscles and reproductive organs.**

3- **The bony pelvis provides a comfortable environment for the fetus during pregnancy.**

The integrity, biomechanical properties and anatomical features of the female pelvis are important for carrying out the labor.

The hip bone has two surfaces : **Lateral and Medial**

Bounded by four margins : **Anterior , Posterior , Superior and Inferior .**

The lateral surface houses the most prominent landmark of the bone, the acetabulum . It is a socket shaped articular surface via which the hip bone articulates with femur and makes the hip joint .

Types of Pelvic Bone:

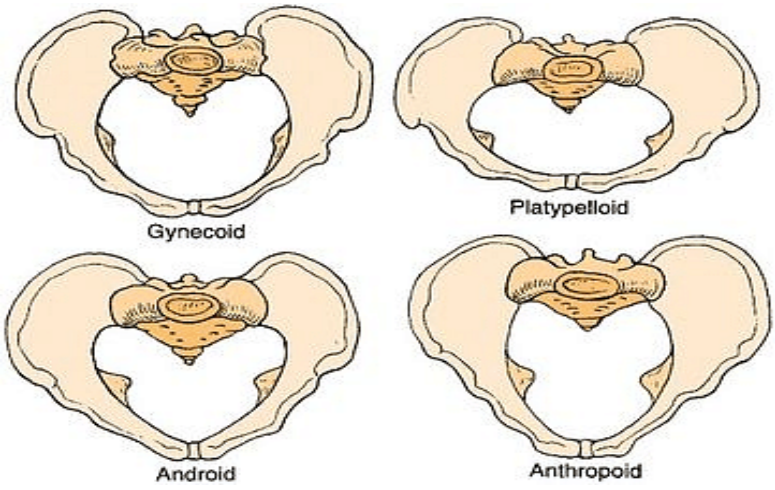
There are four general types of pelvis:

- ***Android:*** **The android pelvis has a heart-shaped brim with a narrow shape in the front. This type of pelvic bones are mainly found in tall women with narrow hips and also in African women.**

- ***Anthropoid:*** **This is an oval-shaped anthropoid pelvis brim with a slightly narrow pelvic cavity. In this pelvis, the outlet is large but most of the diameters are reduced.**

- ***Gynecoid:*** **This is one of the most common pelvis shapes found in the female body and it favours vaginal birth. Different shapes like android and platypelloid face more trouble in vaginal birth. Gynecoid is also known as the genuine female pelvis.**

- ***Platypelloid:*** **It has a kidney-shaped brim and it very well might be tightened in diameter across from front to back. In this, there's just an issue for the baby while entering the pelvis.**

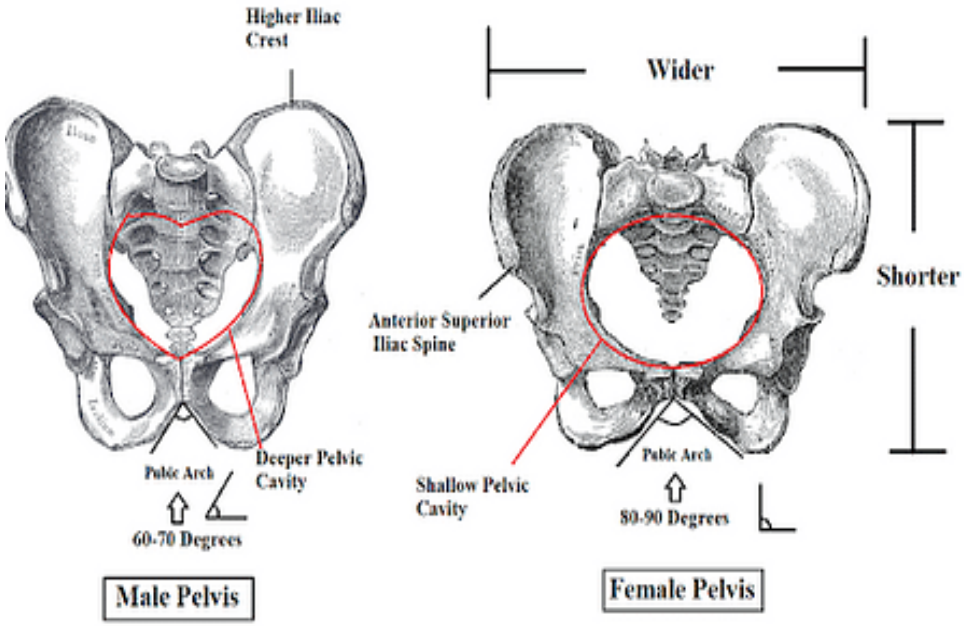


Types of pelvic bone

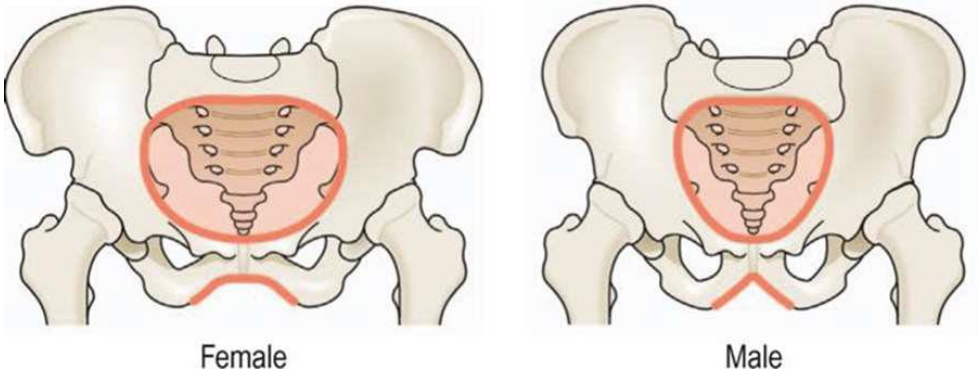
Structure of Pelvic Bone:

There are some structural differences between male and female pelvic bone anatomy. The design of the female pelvis is in such a way that it provides adequate space for the baby to develop and go

through the birth canal of the female pelvis. Because of this reason, the female pelvis is usually wide and broader than the male pelvis.



Pelvic Bone: Structure



Most of the women have gynaecoid pelvis whereas male have an android pelvis. Rather than the differences of bone, the sacrotuberous and sacrospinous ligaments can stretch the size under the effect of progesterone.

Bone of Lower extremity (Limb) :

The lower limb is divided into three regions :

1- **The thigh is that portion of the lower limb located between the hip joint and knee joint .**
2- **The leg is specifically the region between the knee joint and the ankle joint .**
3- **The foot is located distal to the ankle .**

The lower limb contains 30 bones . These are : the femur, patella, tibia, fibula, tarsal bones, metatarsal bones, and phalanges .

Femur :

The femur OR thigh bone : is the single bone of the thigh region . It is the longest and strongest bone of the body, and accounts for approximately one-quarter of a person's total height. The rounded, proximal end is the head of the femur, which articulates superiorly with the acetabulum of the hip bone to form the hip joint , and inferiorly with the tibia at the knee joint. The patella only articulates with the distal end of the femur.

The narrowed region below the head is the *neck of the femur*. This is a common area for fractures of the femur.

- **The *greater trochanter* is the large, upward, bony projection located above the base of the neck..**
- **The *lesser trochanter* is a small, bony prominence that lies on the medial aspect of the femur, just below the neck.**

The distal end of the femur has medial and lateral bony expansions :

- **On the lateral side, the smooth portion that covers the distal and posterior aspects of the lateral expansion is the *lateral condyle of the femur*.**
- **The roughened area on the outer, lateral side of the condyle is the *lateral epicondyle of the femur*.**

Bones of The leg :

1-Patella.

2-Tibia

3-Fibula

Patella :

The patella (kneecap) is largest sesamoid bone of the body .

***A sesamoid bone* : is a bone that is incorporated into the tendon of a muscle where that tendon crosses a joint & articulates with the underlying bones to prevent damage to the muscle tendon due to rubbing against the bones during movements of the joint.**

The patella is found in the tendon of the *quadriceps femoris muscle*, the large muscle of the anterior thigh that passes across the anterior knee to attach to the tibia. The patella articulates with the patellar surface of the femur & does not articulate with the tibia , thus prevents rubbing of the muscle tendon against the distal femur.

Tibia :

The tibia (shin bone) is the medial bone of the leg and is larger than the fibula . The tibia is the main weight - bearing bone of the leg and the second longest bone of the body, after the femur. The medial side of the tibia is located immediately under the skin, allowing it to be easily palpated down the entire length of the medial leg .

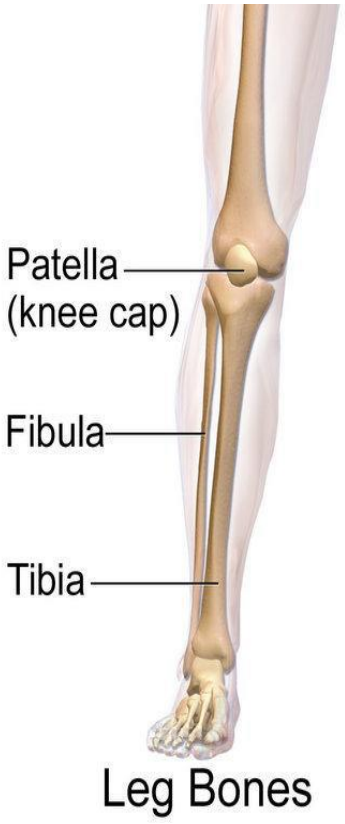
The proximal end of the tibia is greatly expanded. The two sides of this expansion form the *medial condyle of the tibia* and the *lateral condyle of the tibia* . These areas articulate with the medial and lateral condyles of the femur to form the *knee joint* .

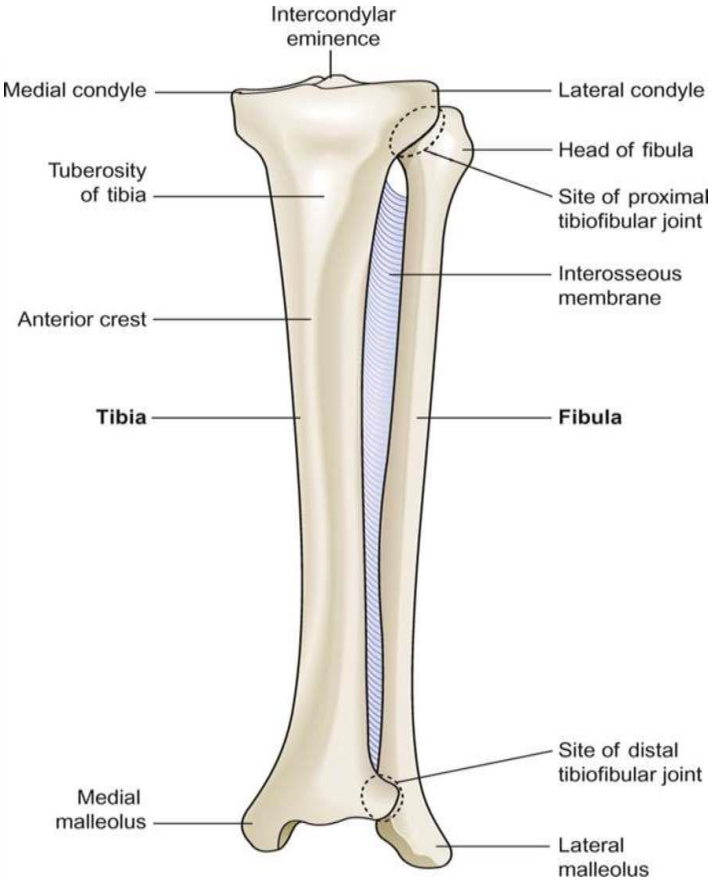
Fibula :

The fibula is the slender bone located on the lateral side of the leg . The fibula does not bear weight. It serves primarily for muscle attachments and thus is largely surrounded by muscles .
Only the proximal and distal ends of the fibula can be palpated .

The *head of the fibula* is the small, knob-like, proximal end of the fibula. It articulates with the inferior aspect of the lateral tibial condyle, forming the *proximal tibiofibular joint*. The distal end of the fibula forms the *lateral malleolus*, which forms the easily palpated bony bump on the lateral side of the ankle. The deep (medial) side of the lateral malleolus articulates with the talus bone of the foot as part of the ankle joint. The distal fibula also articulates with the fibular notch of the tibia.

Between the two bones (Tibia & Fibula) there is interosseous membrane.





The Bones of Foot :

The foot is consist of three groups of bones :

- **7 tarsal bones : that compose the heel and root of the foot .**
- **5 metatarsal bones : that comprise the sole and dorsum of the foot & the roots of the toes .**
- **3 sets of phalanges (14 phalanx bones)**

The tarsal bones :

Tarsal bones are consist of 7 bones articulate with each other & arranged in two rows as :

The posterior row has two bones :

- **Talus (the most superior bone) .**
- **Calcaneous (heel bone) which is largest bone of the foot .**

The anterior row has :

- **3 Cuneiform bones which are medial , intermediate & lateral .**
- **Cuboids bone .**
- **Navicular bone .**

The *talus* bone is a relatively square-shaped, superior surface articulates with the tibia and fibula to form the *ankle joint* . Inferiorly, the *talus* articulates with the *calcaneus* (heel bone) to forms the heel .

Body weight is transferred from the tibia to the talus to the calcaneus, which rests on the ground .The medial calcaneus has a prominent bony extension called the *sustentaculum tali* ("support for the talus") that supports the medial side of the talus bone .

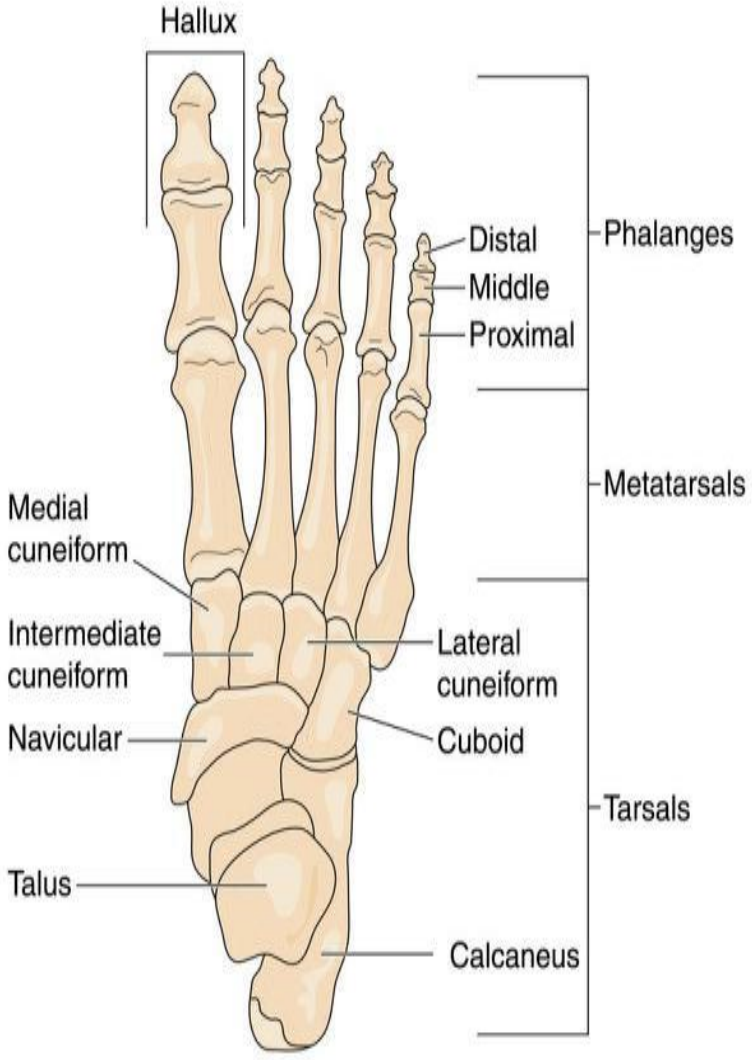
Metatarsal Bones :

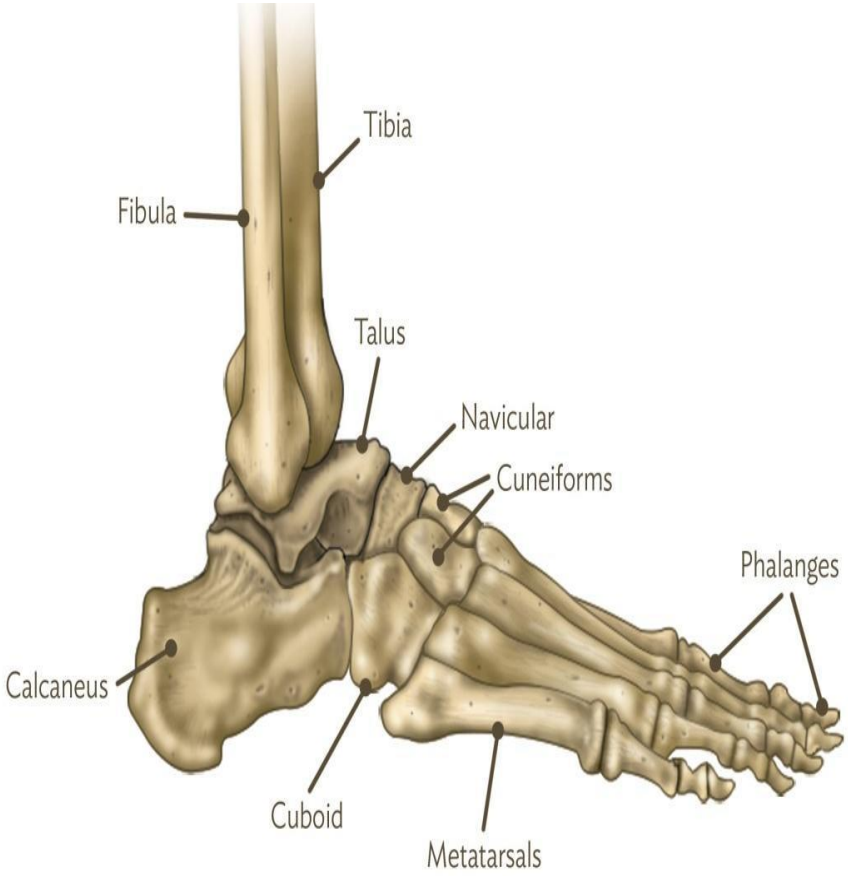
The metatarsal bones are located between the tarsal bones of the posterior foot and the phalanges of the toes . These elongated bones are numbered 1–5 , starting with the medial side of the foot. The first metatarsal bone is shorter and thicker than the others. The second metatarsal is the longest .

The base of the metatarsal bone is the proximal end of each metatarsal bone. These articulate with the cuboid or cuneiform bones .

Phalanges :

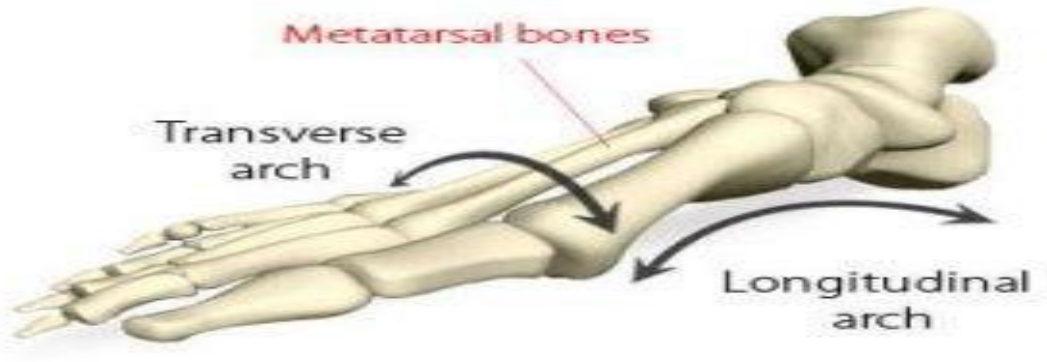
The phalanges have 3 sets of phalanx bones are : proximal , middle & distal , which is build the skeleton of the toes . The toes are numbered 1–5, starting with the big toe (hallux). The big toe is devoid of middle phalanx & consisting just of the proximal and distal phalanges .The remaining toes all have proximal, middle, and distal phalanges. A joint between adjacent phalanx bones is called an interphalangeal joint.

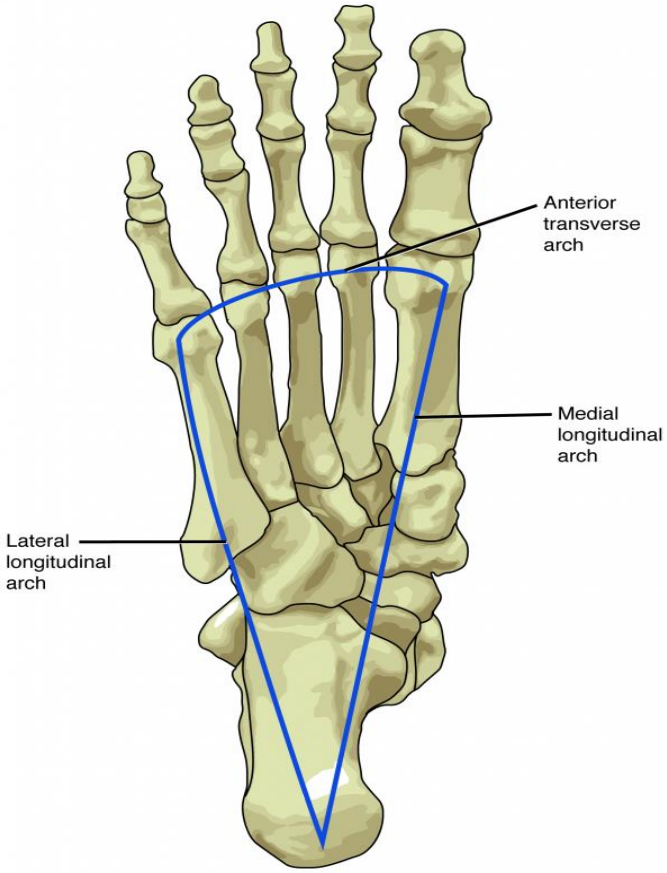




Arches of the Foot :

The foot has a transverse arch, a medial longitudinal arch, and a lateral longitudinal arch . The transverse arch forms the medial-lateral curvature of the mid-foot. It is formed by the wedge shapes of the cuneiform bones and bases (proximal ends) of the first to fourth metatarsal bones. This arch helps to distribute body weight from side to side within the foot, thus allowing the foot to accommodate uneven terrain. The lateral longitudinal arch is relatively flat, whereas the medial longitudinal arch is larger (taller).


Metatarsal bones
Transverse arch
Longitudinal arch


Anterior transverse arch
Medial longitudinal arch
Lateral longitudinal arch