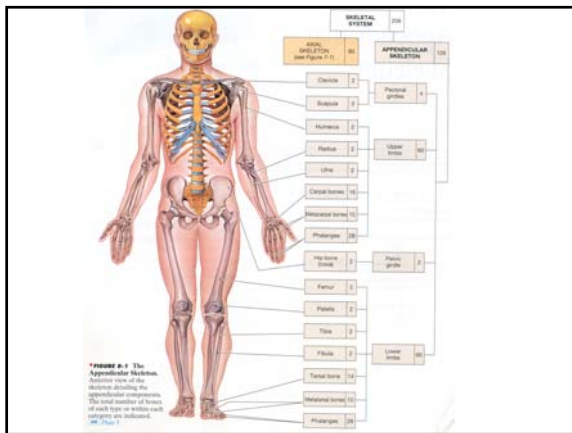


The Appendicular Skeleton

Appendicular Skeleton

•The appendicular skeleton includes the bones of the limbs and supporting elements that connect them to the trunk (a.k.a.-girdles).

Appendicular Skeleton: 126 bones



**Pectoral girdle: 4 bones -- 2 scapula (shoulder blade)
2 clavicle (collar bone)**

**Upper Limbs: 60 bones -- 2 humerus (upper arm)
2 radius (rotating forearm bone)
2 ulna (stationary forearm bone)
16 carpals (wrist)
10 metacarpals (hand)
28 phalanges (fingers)**

Pelvic Girdle: 2 bones -- 2 coxa (hip)

**Lower limbs: 60 bones -- 2 femur (upper leg)
2 patella (knee cap)
2 tibia (inner (strong) lower leg)
2 fibula (outer (less strong) lower leg)
14 tarsals (ankle)
10 metatarsals (foot)
28 phalanges (toes)**

•Each arm articulates with the shoulder girdle

•a.k.a. pectoral girdle

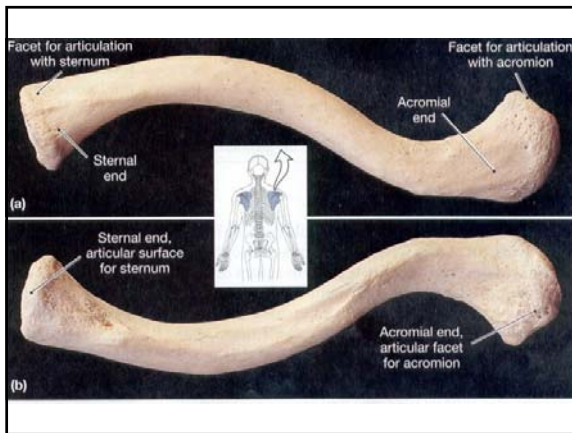
•The pectoral girdle consists of two S-shaped bones called clavicles and two broad flat scapulae

•Each clavicle articulates at one end with the scapula and the other with the manubrium of the sternum (this is the ONLY place that the pectoral girdle articulates with the axial skeleton).

- Because the scapulae do not articulate with the axial skeleton, the shoulder joints are highly flexible, but not very strong.
- The clavicles and scapulae are extremely important sites for arm muscle attachment, and as such provide a base for arm movement.

The Clavicles

- S-shaped bones
- The pyramid shaped end is called the Sternal end (articulates with the manubrium near the jugular notch)
- The other end is flattened somewhat and is called the Acromial end.

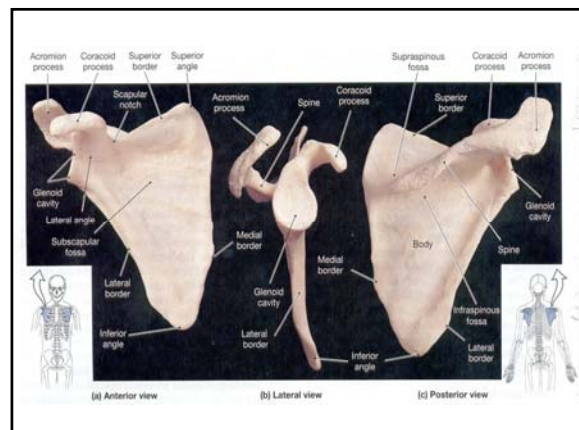


•Find your jugular notch and feel for the sternal end of your clavicles. Move your shoulder and get a feel for how the joint moves. Now feel your clavicle around to where it articulates with your scapula, and move your shoulder again.

- Clavicles are relatively small and fragile.
- Fractures of clavicles are fairly common.
- Fortunately most clavicular fractures heal quickly without a cast.

The Scapulae

- The anterior surface of the scapula form a broad triangle
- The three borders of the triangle are called the:
 - a. superior border (top edge)
 - b. medial border (vertebral edge)
 - c. lateral border (armpit edge)
- muscles attach to these borders



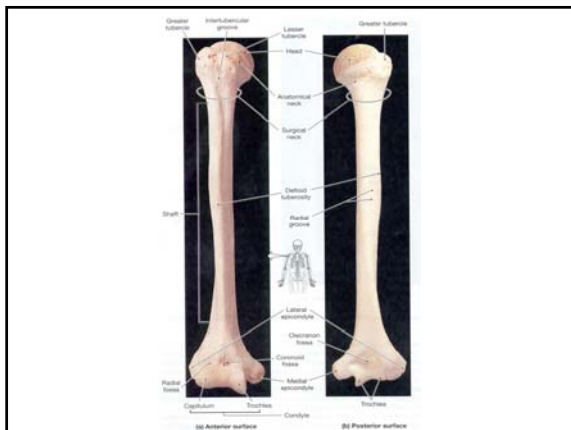
- the angles of the triangle are called the:
 - a. superior angle (top point / vertebral side)
 - b. inferior angle (bottom point / vertebral side)
 - c. lateral border (top out angle {contains Coracoid and Acromion processes , and Glenoid cavity})

- also at the lateral angle is a broad, cup-shaped structure called the glenoid cavity
- at the glenoid cavity, the scapula articulates with the humerus to make the shoulder joint (a.k.a.- glenohumeral or scapulohumeral joint).
- the curved depressions in the back of the scapula (that accommodate the ribs below) are known as the subscapular fossa.

- Two large processes extend over the margin of the glenoid cavity superior to the head of the humerus:
 - >the coracoid process is smaller and anterior
 - >the acromion is larger and posterior
- Both of these processes are important sites of attachment for shoulder muscles.
- The acromion process is continuous with the scapular spine.
- The area above the spine is called the supraspinous fossa and the area below the spine is called the infraspinous fossa.

The Humerus

- The proximal end of the humerus is called the “head” and articulates with the scapulae at the glenoid cavity.
- The distal end of the humerus articulates with the bones of the antibrachium, the ulna and the radius.
- A bump on the outside of the humerus head, the greater tubercle, forms the lateral contour of the shoulder (you can feel it just past the acromial process of the scapula).
- The proximal portion of the shaft of the humerus is round in cross section.



- The deltoid tuberosity runs along the lateral side of the shaft (called this because it is where the deltoid muscle attaches)
- On the posterior side of the bone the deltoid tuberosity ends at the radial groove
- The radial groove is a depression that marks the path of the radial nerve across the bone (the radial nerve is a large nerve that supplies sensory info from the back of the hand, and motor control over the muscles that straighten the elbow)
- The distal end of the humerus forms a broad triangle. The two lower points of the triangle form the **medial inner and lateral (outer) epicondyles**.

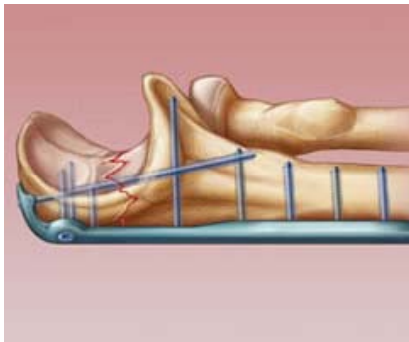
- The ulnar nerve crosses the humerus just posterior to the medial epicondyle. A blow to the humeral side of the elbow (hitting this nerve) can produce a temporary numbness and paralysis of muscles on the anterior surface of the forearm. For this reason, this area is often referred to as the funny bone.
- In the middle of the end of the humerus (btw. the lateral and medial epicondyles) there arises a process called the articular condyle which articulates with the bones of the forearm.

The condyle is divided into two projections:

1. the **trochlea** which articulates with the ulna
2. the **capitulum** that articulates with the radius

The Ulna

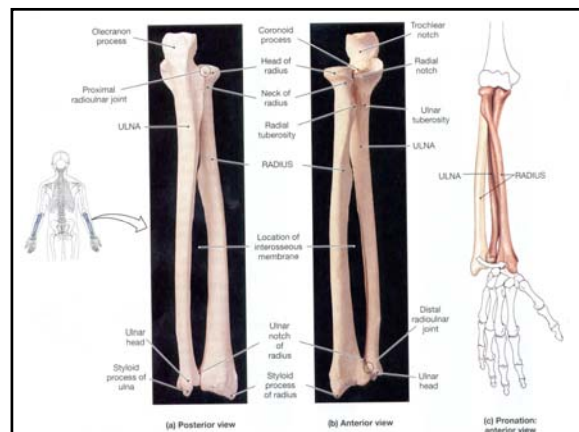
- The ulna and the radius are parallel bones that support the forearm.
- In the anatomical position, the ulna lies medial to the radius.
- The **olecranon process** lies on the ulna and is the point of the elbow.
- When viewed in cross section, the shaft of the ulna is roughly triangular.



The Radius

- The lateral bone of the forearm
- The disk shaped radial head articulates with the capitulum of the humerus
- Near the end of the radius is the radial tuberosity which is the site of attachment for the biceps brachii which are the muscles that flex the forearm
- The distal portion of the radius is MUCH larger than the distal portion of the ulna

- The radioulnar articulation allows for rotation of the radius. When the radius is **pronated**, it crosses the ulna, when **supinated**, its parallel to the ulna.



The Carpal Bones

- 8 carpal bones for the wrist
- They occur in two rows, 4 proximal carpal bones and 4 distal carpal bones
- The carpal bones articulate with one another at joints that permit limited sliding and twisting
- Carpal bones are held together with ligaments

•there are eight bones arranged roughly in two rows. I prefer the following names.

*proximal row (lateral to medial) *scaphoid, lunate, triquetral, pisiform.*

*distal row (lateral to medial) *trapezium, trapezoid, capitate, hamate.*

Note: the distal row articulates with the metacarpals.

mnemonic: Sally left the party to take Cathy home

- Tendons that flex the fingers pass across the anterior surface of the wrist and they are sandwiched between the intercarpal ligaments. Excessive finger flexing can cause an inflammation of this area which can compress the tendons and associated sensory nerves causing a painful condition called **carpal tunnel syndrome**.

The Hand

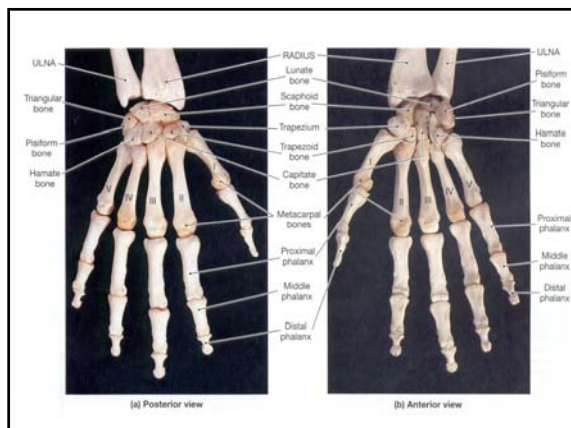
•5 metacarpal bones articulate with the distal carpal bones and support the hand.

•These metacarpal bones are given numerals **I – V** starting with the metacarpal bone that articulates with the thumb.

•The fingers contain 14 bones (phalanges, *sing.* Phalanx):

>Thumbs contain a proximal phalanx and distal phalanx

>All other fingers contain a proximal, middle, and distal phalanx



The Pelvic Girdle and Lower Limbs

•Because they have to support the weight of the lower body, the bones of the pelvic girdle tend to be more massive than bones of the pectoral girdle

•The pelvis is formed by the fusion of two coxae or innominate bones.

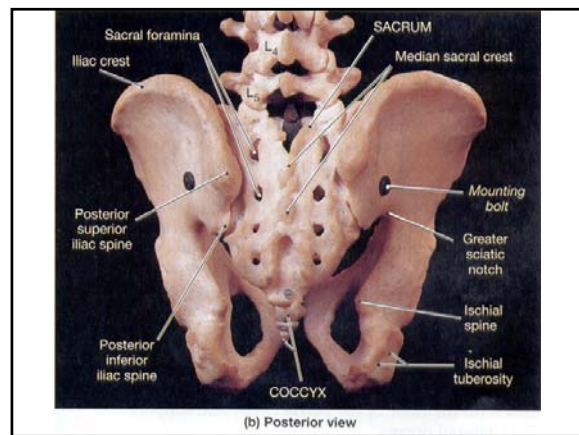
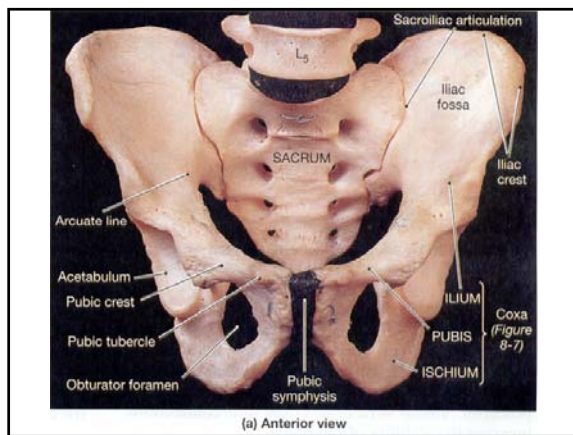
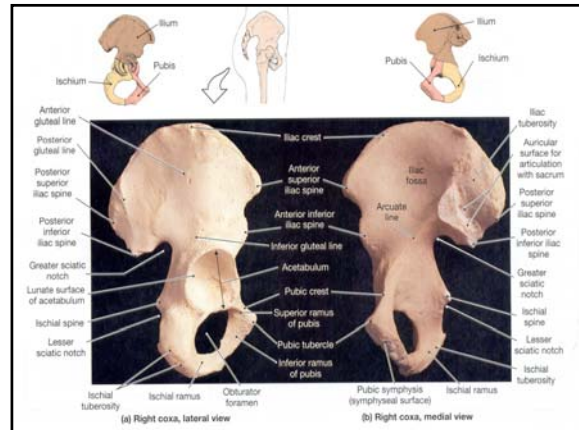
•Each coxa is really the fusion of three bones the **ilium**, the **ischium** and the **pubis**.

- In the posterior, the ilium of each side articulates with the sacrum, and in the anterior, the pubis of each side articulates with the **pubic symphysis**.

- The area where the ilium, ischium and pubis come fuse together is a cup shaped structure called the acetabulum.

- The **acetabulum** is where the head of the femur articulates with the pelvis.

- The most prominent feature of the coxa is the **iliac crest** which serves as the site of attachment for the muscles of the thigh, and is the "hip bone".



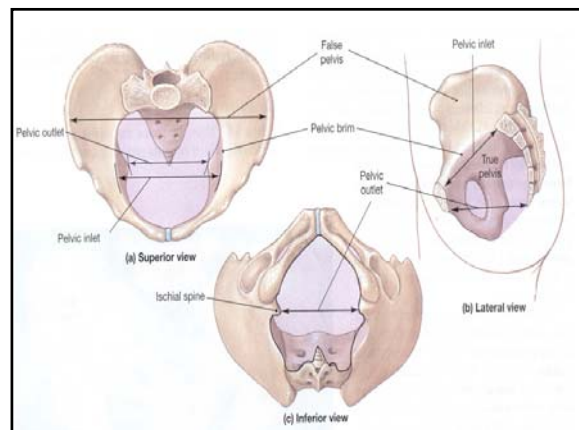
The Pelvis

- The connected coxae needs to be considered as a structure itself, called the pelvis.

- The pelvis can be divided into two sections the **true pelvis** (all the bones below the pelvic brim) and the **false pelvis** (all the bones above the pelvic brim).

- The pelvic brim surrounds the pelvic inlet.

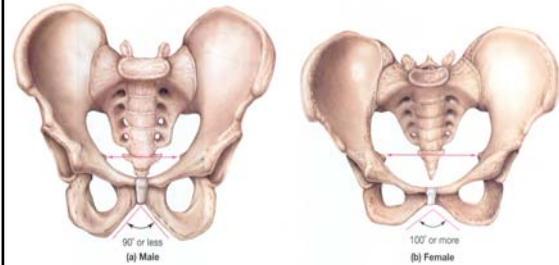
- The pelvic outlet is the opening bounded by the margin of the pubic bones, ischial spine, ischium, ilium, and sacrum/coccyx.



Male and Female pelvises are shaped somewhat differently: female pelvises have adaptations for child birth, like:

- An enlarged pelvic outlet
- Less curvature on the sacrum & coccyx
- A wider more circular pelvic inlet
- A relatively broad, low pelvis
- Iliac that project farther laterally
- A broader pubic angle (>100°)

Male vs. Female

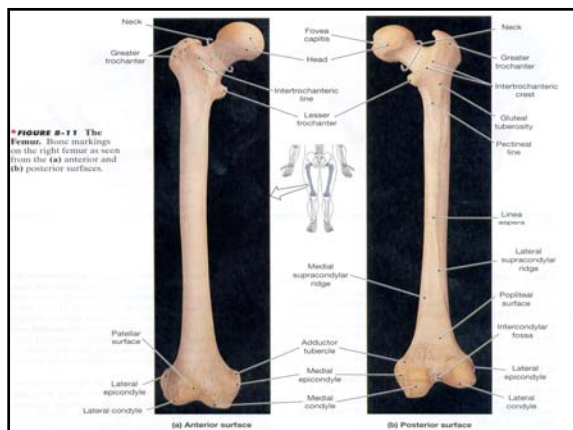


The Lower Limbs

- Each lower limb consists of a femur, patella, tibia and fibula, and the bones of the ankle and foot.
- The upper part of the leg is referred to generally as the femur (we can also use thigh), the “foreleg” is more accurately referred to as Crural, or just the leg.
- Unlike the upper limbs, the lower limbs are designed to transfer weight of the body to the surface below the body and as a result have a slightly different geometry.

The Femur

- The longest and heaviest bone in the body.
- Articulates with the coxa at the hip joint (specifically the epiphysis “head” of the femur articulates with the pelvis at the acetabulum), and the tibia at the knee joint.
- A ligament attaches to the acetabulum to the head of the femur at the fovea capitis (a small dent at the center of the head).
- The “neck” of the femur joins the shaft at an angle of about 125°.



- The Greater and Lesser trochanters project laterally from the junction of the neck and shaft (the greater, outward, and the lesser inward).

- The **linea aspera** (rough line) is a prominent elevation that runs along the center of the posterior surface (attachment site for the muscles that move the femur).

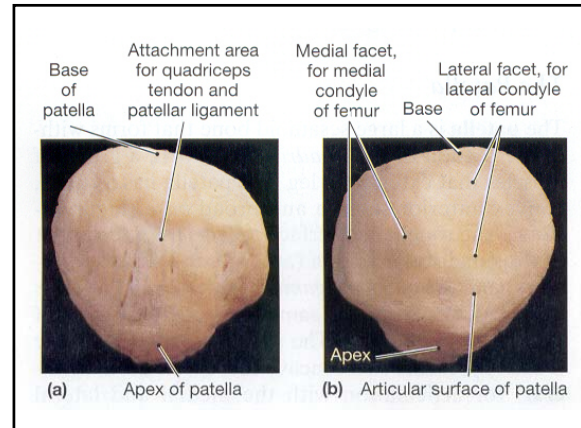
- As it approaches the knee joint, it divides to a pair of ridges that continue to the medial and lateral epicondyles.

- Both epicondyles participate in the knee joint, and posteriorly are separated by a deep intercondylar fossa.

The Patella

- A large sesamoid bone that forms within the tendon of the quadriceps femoris (a group of muscles that extends the leg).

- The patellar ligament connects the apex of the patella to the tibia.



The Knee Joint

- Held together by 4 ligaments (2 on the outer margins, and 2 running through the knee joint itself).

- The Lateral Collateral Ligament (**LCL** (a.k.a.: the fibular collateral ligament)) is on the outside of the knee and connects the head of the fibula to the lateral epicondyle of the femur.

- The Medial Collateral Ligament (**MCL** (a.k.a.: the tibular collateral ligament)) is on the inside of the knee and connects the head of the tibia to the medial epicondyle of the femur.

- The Posterior Cruciate Ligament (**PCL**) connects the posterior of the tibia through the knee joint to the medial femoral epicondyle (prevents excessive anterior movement of the knee joint).

- The Anterior Cruciate Ligament (**ACL**) connects the anterior of the tibia through the knee joint to the lateral femoral epicondyle (prevent excessive posterior movement of the knee joint).

The Tibia

- The large medial bone of the leg.

- The medial and lateral epicondyles of the femur articulate with the medial and lateral tibial condyles at the proximal end of the tibia.

- The intercondylar eminence is a ridge that separates the condyles on the superior surface.

- On the anterior surface of the tibia there is a rough tibial tuberosity that marks the attachment site of the patellar ligament.

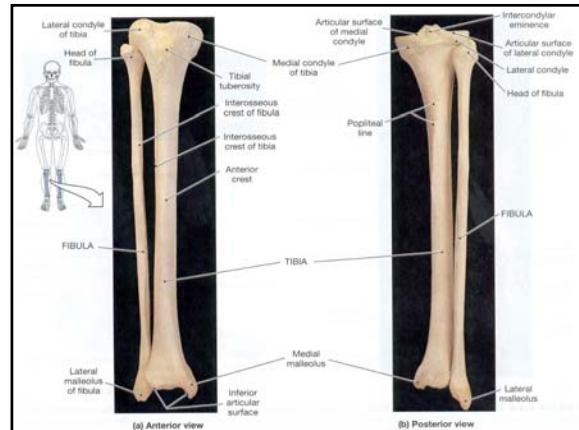
- A prominent ridge extends distally from the tibial tuberosity (that can be easily felt through the skin), called the anterior crest.

- At the inferior end of the tibia, the bone broadens and the medial border ends in a large process called the medial malleolus which helps provide lateral stability for the ankle joint.

- The inferior end of the tibia articulates with the talus (most proximal ankle bone).

The Fibula

- The proximal end articulates with the tibia at a special articular facet located near the lateral tibial condyle.
- The fibula never articulates with the femur, and does not participate in the transfer of weight, but it is important for muscle attachment.
- The inferior end of the fibula ends in a large process called the lateral malleolus that helps provide lateral stability for the ankle.



The Ankle

- a.k.a. the tarsus
- Consists of 7 tarsal bones:
 - talus
 - calcaneus
 - cuboid
 - navicular
 - 3 cuneiform bones
- The talus transmits the weight of the body from the tibia to the toes.
- The trochlea is an anvil shaped process of the talus that articulates with the tibia.

- The **calcaneus** (or heel bone) is the largest of the tarsal bones.

•When you stand normally, most of your weight is transferred from the tibia through the talus to the calcaneus bone and then to the ground.

- The other bones of the ankle articulate with each other.

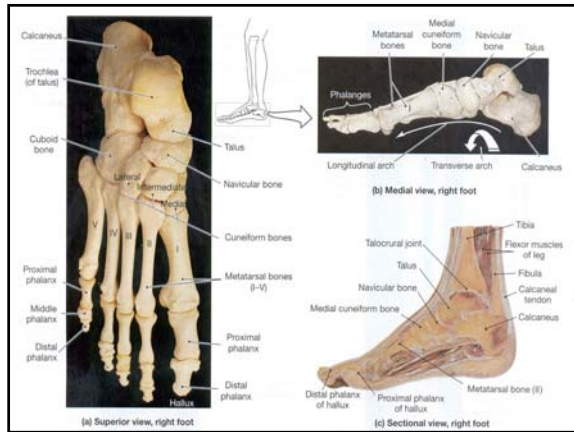
•The three cuneiform bones are named for their position: **medial cuneiform** is the closest to the inside of the foot, then progressing outward is the **intermediate cuneiform** and finally the **lateral cuneiform**.

The Ankle Joint

- The stability of the joint is somewhat limited.
- Forceful movement of the foot outward and backward can dislocate the ankle, breaking both the lateral malleolus of the fibula and the medial malleolus of the tibia.
- This injury is called a Pott's Fracture.

The Foot

- 5 long bones (metatarsals) form the sole of the foot.
- The metatarsals are identified with Roman numerals proceeding from medial to lateral across the sole of the foot.
- Metatarsals I-III articulate with 3 cuneiform bones, and metatarsals IV and V articulate with the cuboid.



•Toes are laid out similarly to fingers and the bones are also called phalanges (*sing.* Phalanx).

•The big toe (or great toe) is anatomically known as the **hallux** and contains only two phalanges, all others contain 3.