The Appendicular Skeleton

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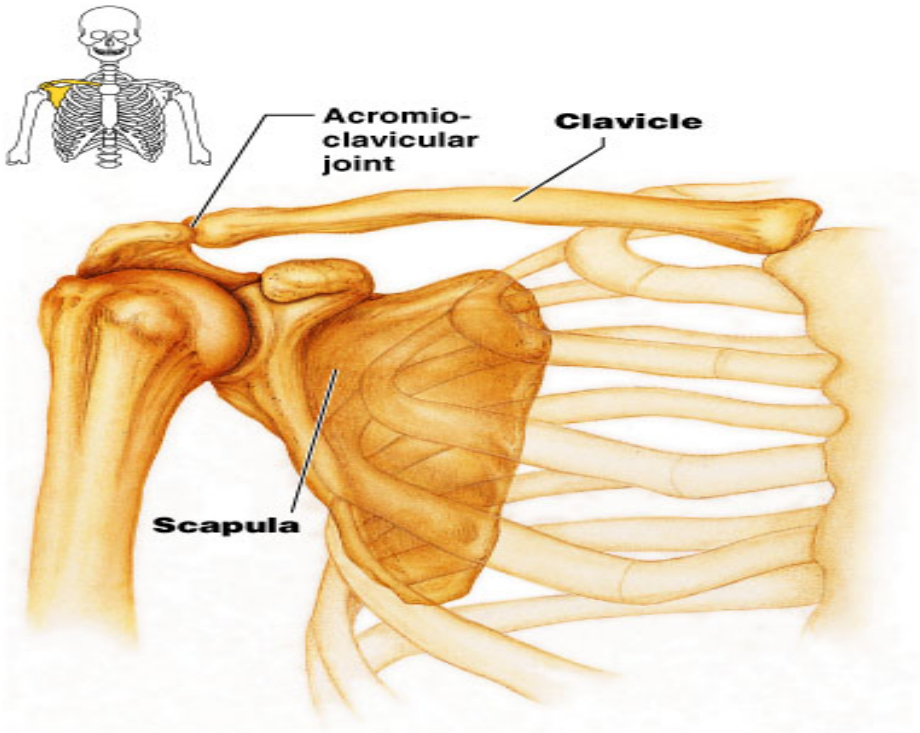
Appendicular Skeleton

- The appendicular skeleton is made up of the bones of the limbs and their girdles
- Pectoral girdles attach the upper limbs to the body trunk
- Pelvic girdle secures the lower limbs

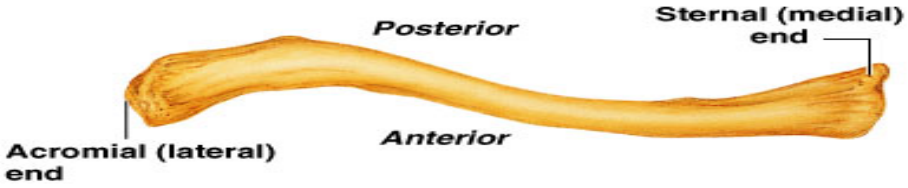
Pectoral Girdles (Shoulder Girdles)

- The pectoral girdles consist of the anterior clavicles and the posterior scapulae
- They attach the upper limbs to the axial skeleton in a manner that allows for maximum movement
- Pectoral girdles do not quite encircle the body completely
    - Medial end of each clavicle articulates with the manubrium and first rib
    - Laterally—the ends of the clavicles join the scapulae
- Girdle is very light and upper limbs are mobile
- Mobility of the pectoral girdle
    - Only clavicle articulates with the axial skeleton
    - Scapula can move freely
    - Socket of the shoulder joint (glenoid cavity) is shallow
        - Good for flexibility, bad for stability



Clavicles (Collarbones)

- The clavicles are slender, doubly curved long bones lying across the superior thorax
- The acromial (lateral) end articulates with the scapula, and the sternal (medial) end articulates with the sternum
- Hold the scapulae and arms laterally
- Transmit compression forces from the upper limbs to the axial skeleton
- They provide attachment points for numerous muscles, and act as braces to hold the scapulae and arms out laterally away from the body

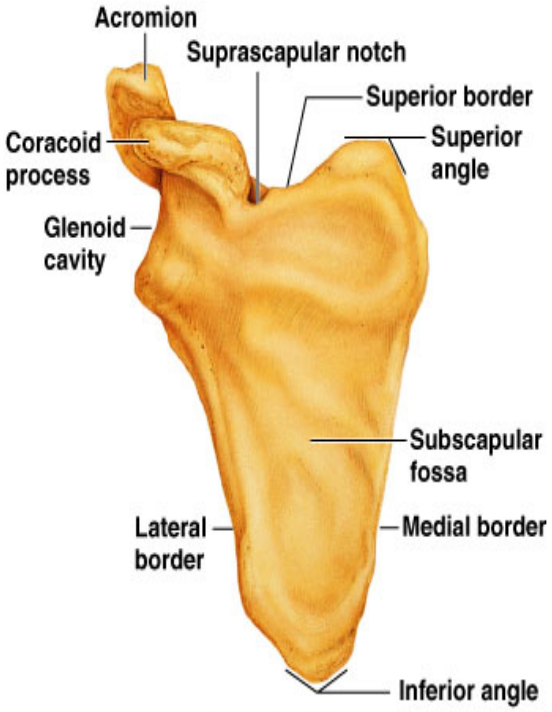


(b) Right clavicle, superior view

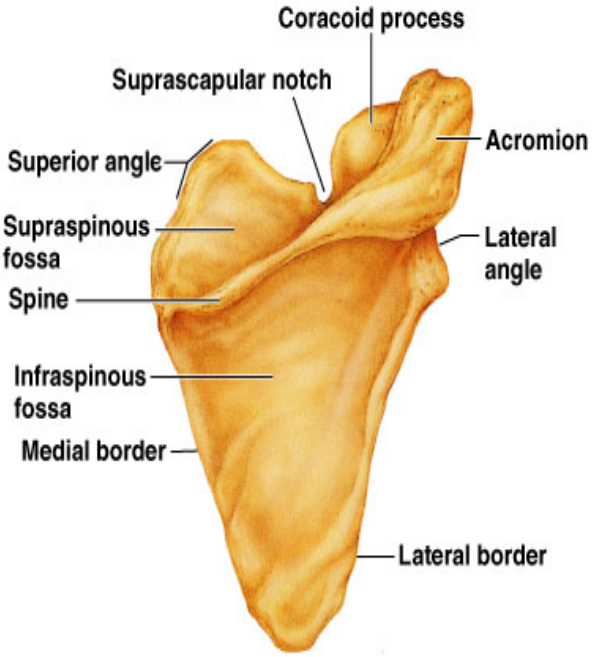
(c) Right clavicle, inferior view

Scapulae (Shoulder Blades)

- The scapulae are triangular, flat bones lying on the dorsal surface of the rib cage, between the second and seventh ribs
- Scapulae have three borders and three angles
- Major markings include the suprascapular notch, the supraspinous and infraspinous fossae, the spine, the acromion, and the coracoid process



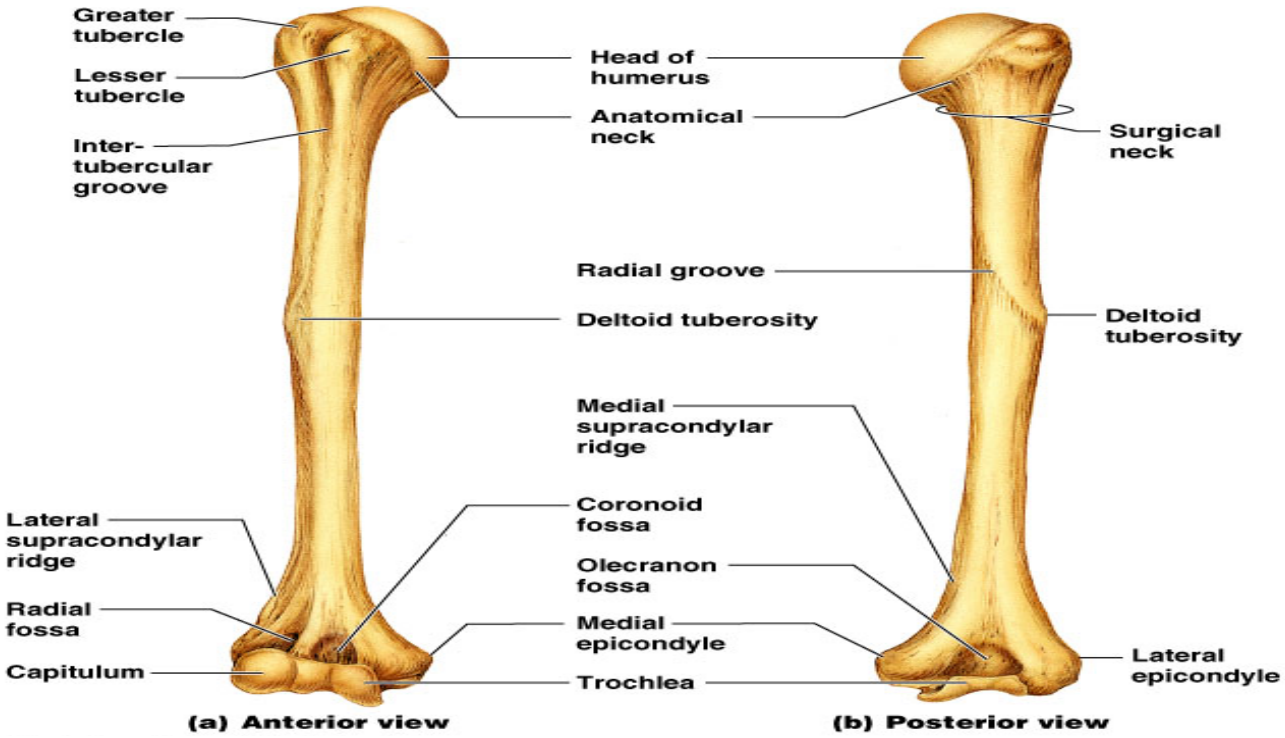
(d) Right scapula, anterior aspect



(e) Right scapula, posterior aspect

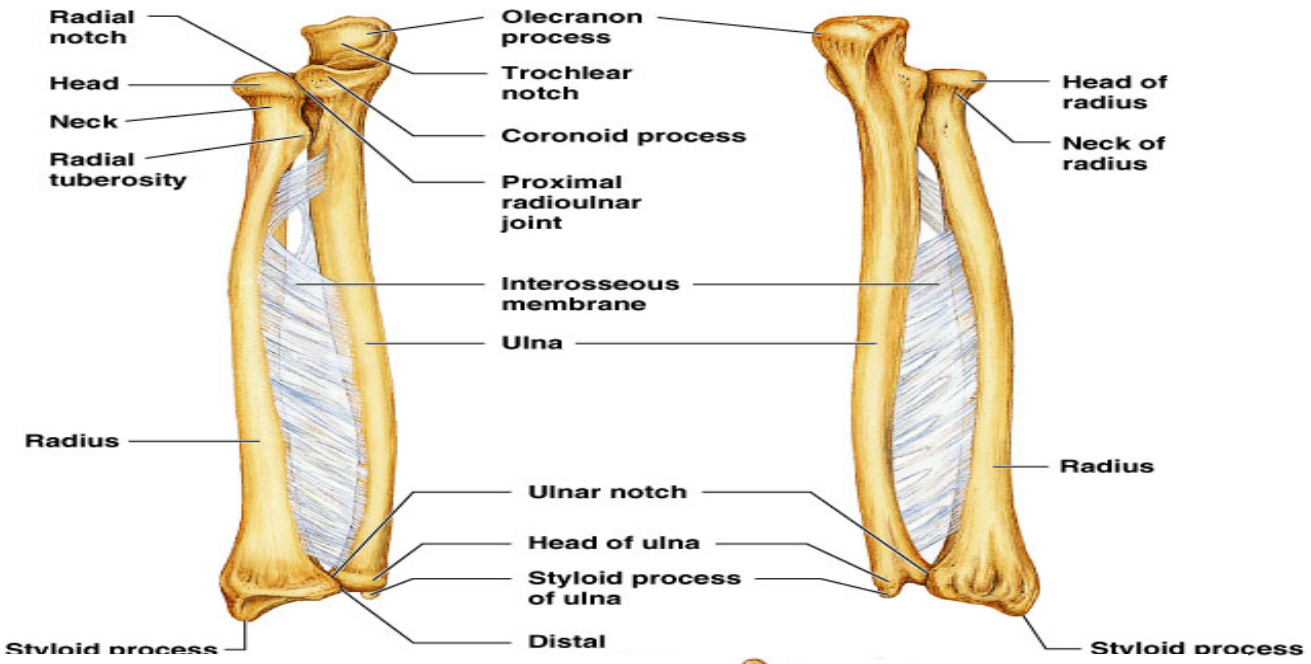
The Upper Limb

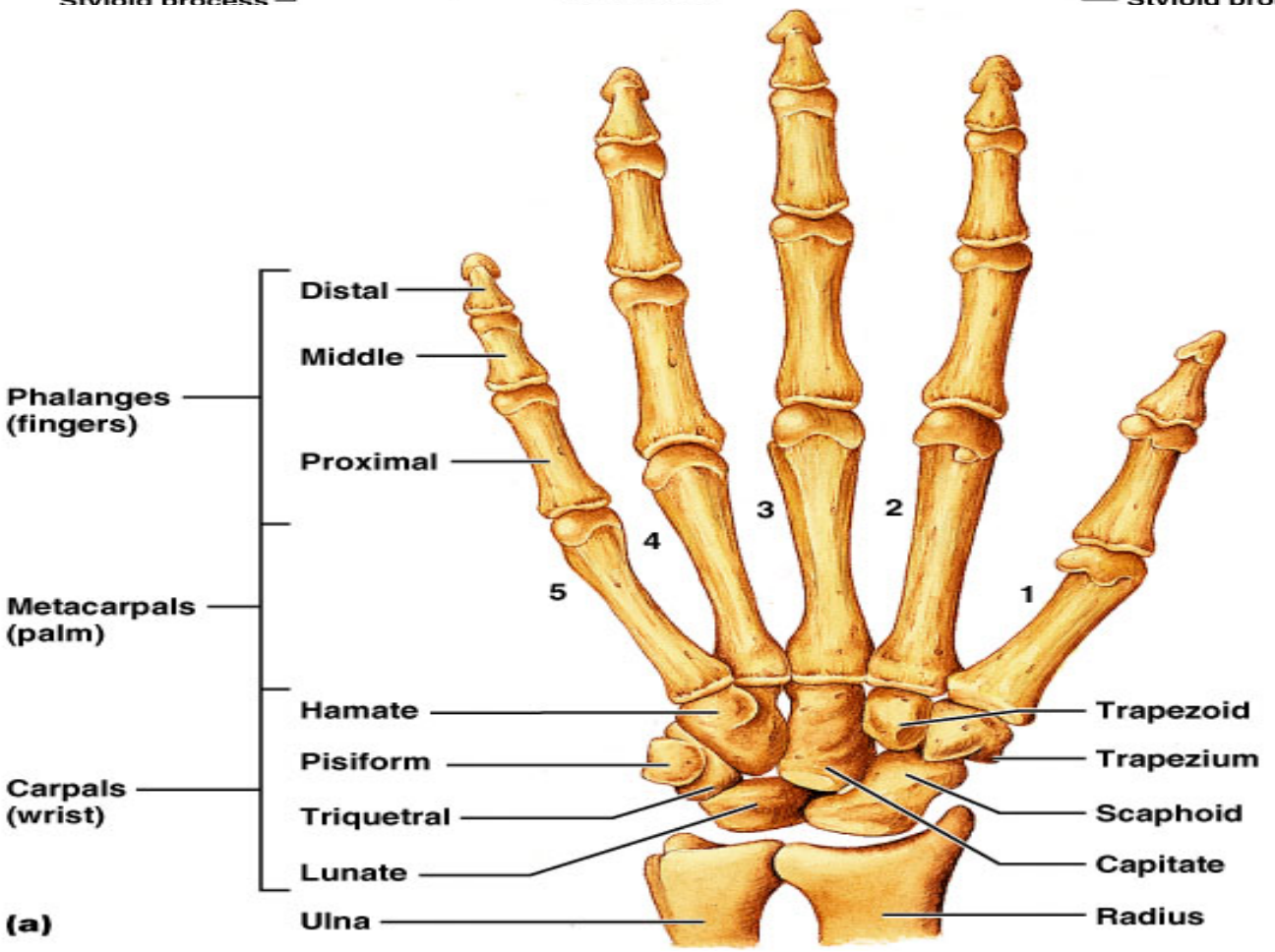
- The upper limb consists of the arm (brachium), forearm (antebrachium), and hand (manus)
- Thirty-seven bones form the skeletal framework of each upper limb
- Arm - Brachium
    - The humerus is the sole bone of the arm
    - Longest and strongest bone of the upper extermity
    - It articulates with the scapula at the shoulder, and the radius and ulna at the elbow
- Forearm - Antebrachium
    - The bones of the forearm are the radius and ulna
    - They articulate proximally with the humerus and distally with the wrist bones
    - They also articulate with each other proximally and distally at small radioulnar joints
    - Interosseous membrane connects the two bones along their entire length
    - Bones of the Forearm
        - Ulna
            - The ulna lies medially in the forearm and is slightly longer than the radius (non thumb side)
            - Forms the major portion of the elbow joint with the humerus



- Radius
  - The radius lies opposite the ulna and is thin at its proximal end, widened distally (thumb side)
  - The superior surface of the head articulates with the humerus

- Hand - Manus
  - Carpals - Wrist bones
    - Gliding movements occur between carpals
    - Composed of eight marble-sized bones
      - Are arranged in two irregular rows
      - Proximal row from lateral to medial
        - Scaphoid, lunate, triquetral, and pisiform
      - Distal row from lateral to medial
        - Trapezium, trapezoid, capitate, and hamate
  - Metacarpals – Palm
    - Five metacarpals radiate distally from the wrist
    - Metacarpals form the palm
    - Numbered I–V, beginning with the pollex (thumb)
    - Bases articulate proximally with the distal row of carpals
    - Heads articulate distally with the proximal phalanges
  - Phalanges – Fingers Phalanges
    - Numbered I–V, beginning with the pollex (thumb)
    - Except for the thumb, each finger has three phalanges
      - Proximal, middle, and distal


Radial notch
Head
Neck
Radial tuberosity
Olecranon process
Trochlear notch
Coronoid process
Proximal radioulnar joint
Interosseous membrane
Ulna
Radius
Ulnar notch
Head of ulna
Styloid process of ulna
Distal
Styloid process
Head of radius
Neck of radius
Radius
Styloid process


Phalanges (fingers)
Distal
Middle
Proximal
Metacarpals (palm)
5
4
3
2
1
Carpals (wrist)
Hamate
Pisiform
Triquetral
Lunate
Ulna
Trapezoid
Trapezium
Scaphoid
Capitate
Radius
(a)

Pelvic Girdle (Hip)

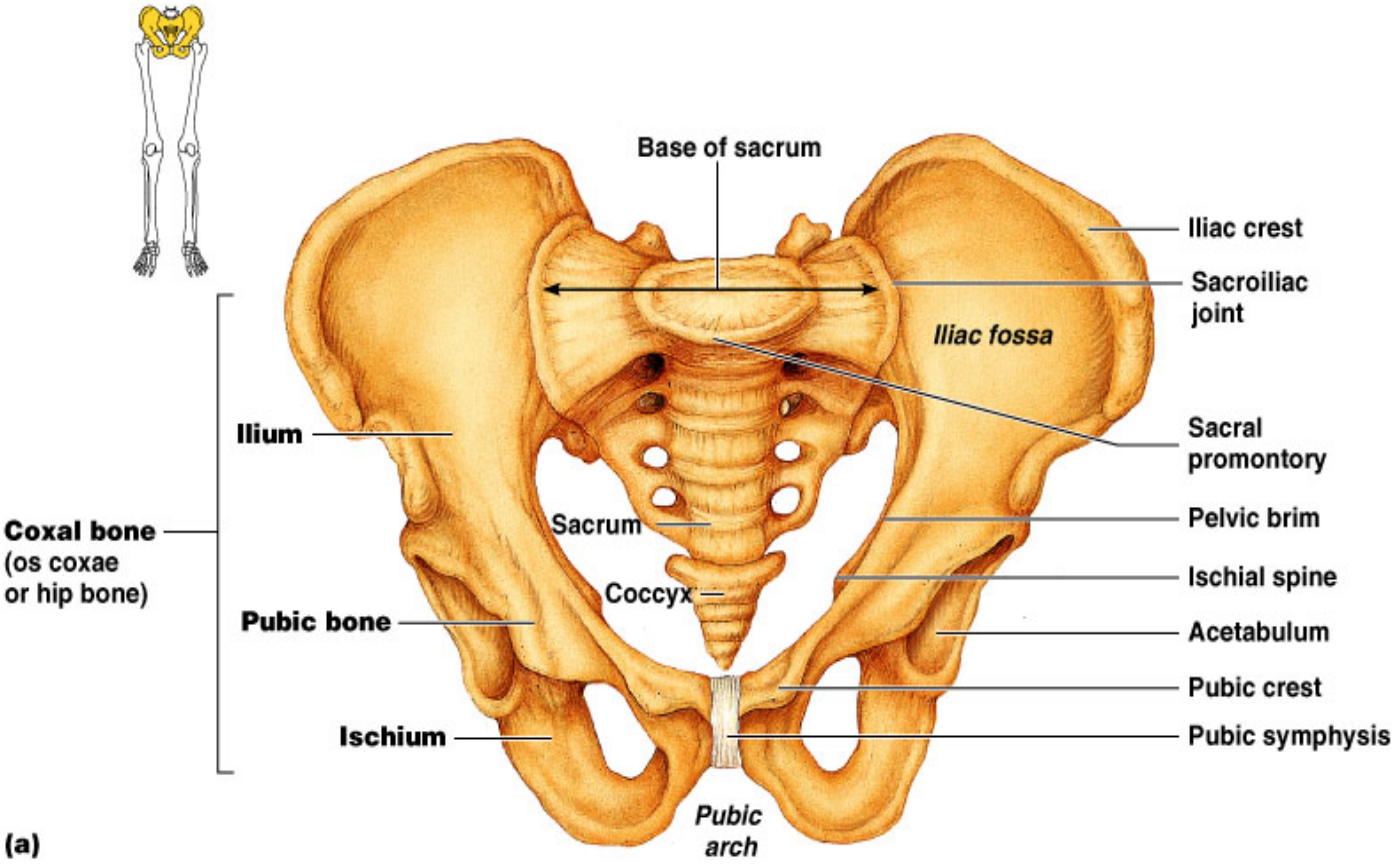
- The hip is formed by a pair of hip bones
- Together with the sacrum and the coccyx, these bones form the bony pelvis
- The pelvis
    - Attaches the lower limbs to the axial skeleton with the strongest ligaments of the body
    - Attaches lower limbs to the spine
    - Transmits weight of the upper body to the lower limbs
    - Supports the visceral organs of the pelvis
    - Lower limbs have less freedom of movement
    - Are more stable than the arm
    - Acetabulum is a deep cup that holds the head of the femur
    - Consists of paired hip bones (coxal bones or pelvic bone) and the sacrum
    - Coxal bones unite anteriorly with each other and articulate posteriorly with the sacrum
    - Consists of three separate bones in childhood
        - Ilium, ischium, and pubis
        - Bones fuse, retain separate names to regions of the coxal bones
    - Forms the superior region of the coxal bone
    - Site of attachment for many muscles
    - Articulation with the sacrum forms sacroiliac joint Forms posteroinferior region of the coxal bone
    - Anteriorly—joins the pubis
    - Ischial tuberosities - Are the strongest part of the hip bone

Pubis

- Forms the anterior region of the coxal bone
- Lies horizontally in anatomical position
- Pubic symphysis
- The two pubic bones are joined by fibrocartilage at the midline
    - Pubic arch—inferior to the pubic symphysis
- Angle helps distinguish male from female pelvis

Pelvic Structure and Childbearing

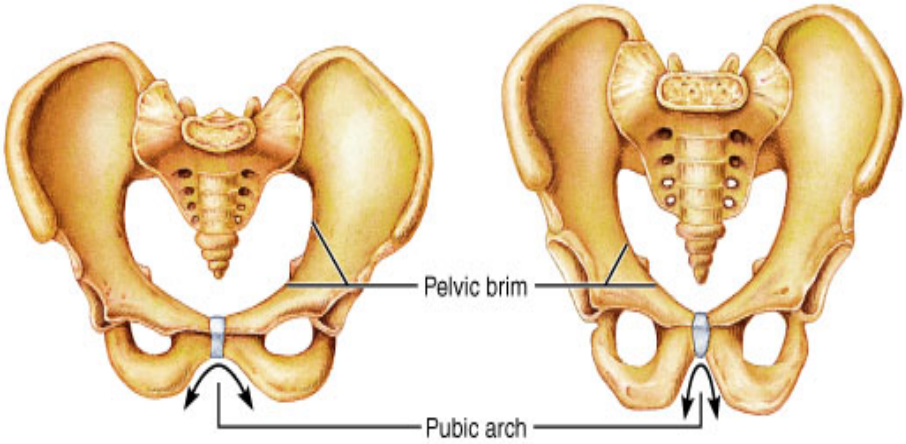
- Bony pelvis is divided into two regions
- False (greater) pelvis—bounded by alae of the iliac bones
- True (lesser) pelvis—inferior to pelvic brim
    - Forms a bowl containing the pelvic organs
- Male and female pelvis exhibit differences
    - Female pelvis is wider, shallower, and lighter
    - Female pelvis is adapted for childbearing
    - Pelvis is lighter, wider, and shallower than in the male
    - Provides more room in the true pelvis



Pelvic Girdle (Hip)

- Ilium
  - The ilium is a large flaring bone that forms the superior region of the hip bone
    - It consists of a body and a superior winglike portion called the ala
    - The broad posterolateral surface is called the gluteal surface
  - The auricular surface articulates with the sacrum (sacroiliac joint)
- Ischium
  - The ischium forms the posteroinferior part of the hip bone

Female **Male**



The Lower Limb

- The three segments of the lower limb are the thigh, leg, and foot
- Bones of lower limb are thicker and stronger than those of upper limb
- They carry the weight of the erect body, and are subjected to exceptional forces when one jumps or runs

Thigh

- The region of the lower limb between the hip and the knee
- Femur—the single bone of the thigh
- Longest and strongest bone of the body
    - Ball-shaped head of the femur articulates with the acetabulum

Patella

- Triangular sesamoid bone
- Embedded in the tendon that secures the quadriceps muscles
- Protects the knee anteriorly
    - Improves leverage of the thigh muscles across the knee

Leg

- Refers to the region of the lower limb between the knee and the ankle
- Composed of the tibia and fibula
    - Tibia—more massive medial bone of the leg
        - Receives weight of the body from the femur
        - Tibia articulates with femur at superior end - Forms the knee joint
        - Tibia articulates with talus at the inferior end - Forms the ankle joint
    - Fibula—sticklike lateral bone of the leg
        - Fibula does not contribute to the knee joint
        - Stabilizes the ankle joint
    - Interosseous membrane
        - Connects the tibia and fibula

The Foot

- Foot is composed of
  - Tarsus, metatarsus, and the phalanges
- Important functions
  - Supports body weight
  - Acts as a lever to propel body forward when walking
    - Segmentation makes foot pliable and adapted to uneven ground

Tarsus

- Makes up the posterior half of the foot
- Contains seven bones called tarsals
- Body weight is borne primarily by the talus and calcaneus
  - Other tarsals:
    - Cuboid and navicular
    - Medial, intermediate, and lateral cuneiforms

Metatarsus

- Consists of five small long bones called metatarsals
- Numbered I–V beginning with the hallux (great toe)
  - First metatarsal supports body weight

Phalanges of the Toes

- 14 phalanges of the toes
- Smaller and less nimble than those of the fingers
- Structure and arrangement are similar to phalanges of fingers
- Each toe has proximal, middle, and distal phalanges
  - Exception: great toe has only two phalanges, proximal and distal

Arches of the Foot

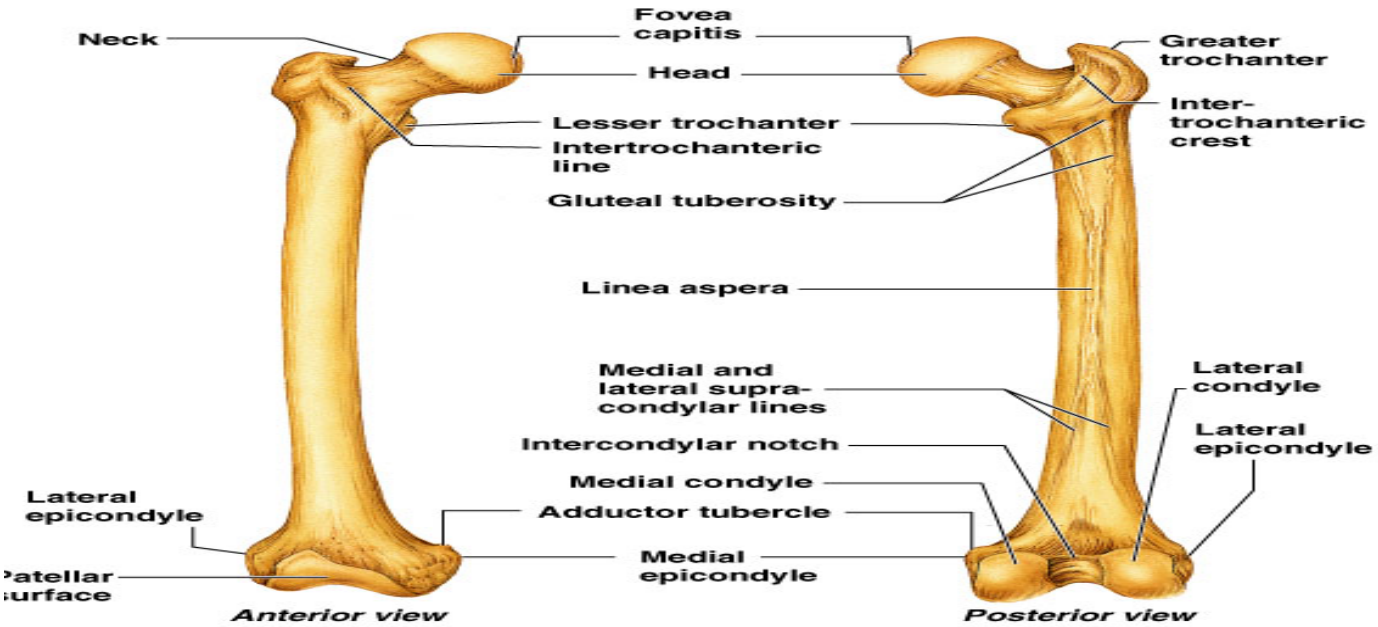
- Foot has three important arches
  - Medial longitudinal arch, lateral longitudinal arch, transverse arch
- Arches are maintained by
  - Interlocking shapes of tarsals
  - Ligaments and tendons
- “Keystone” bones of arches
  - Talus—medial longitudinal arch
  - Cuboid—lateral longitudinal arch

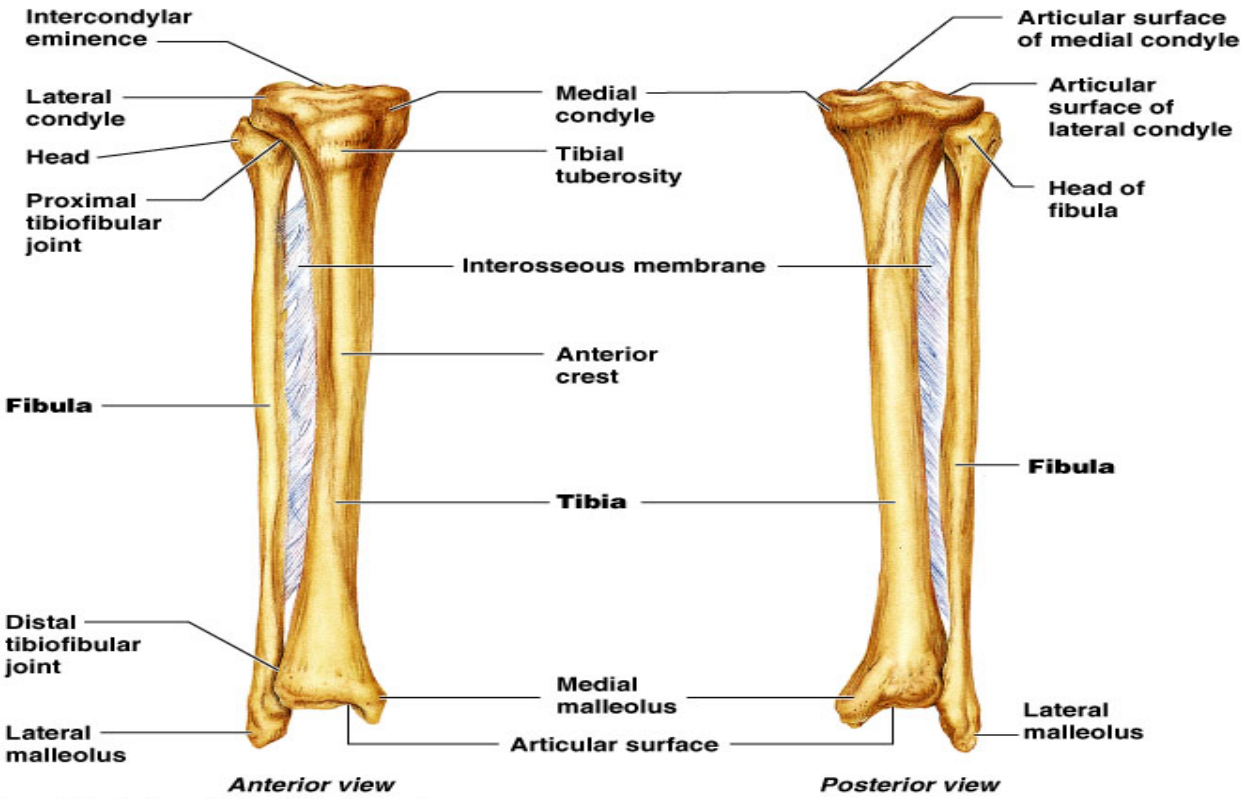
Disorders of the Appendicular Skeleton

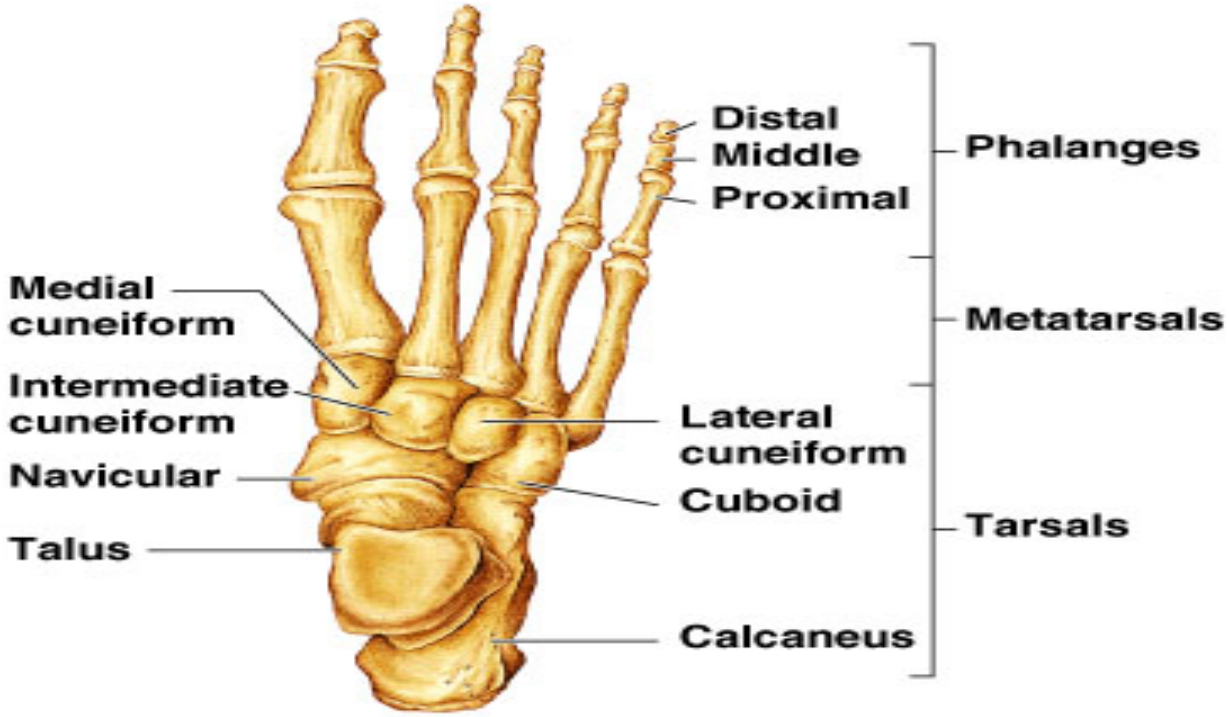
- Bone fractures
- Hip dysplasia
  - Head of the femur slips out of acetabulum
- Clubfoot
  - Soles of the feet turn medially

The Appendicular Skeleton Throughout Life

- Growth of the appendicular skeleton
  - Increases height
  - Changes body proportions
  - Upper/lower body ratio changes with age
- At birth, head and trunk are 1.5 times as long as lower limbs
- Lower limbs grow faster than the trunk
- Upper/lower body ratio of 1 to 1 by age 10
- Few changes occur in adult skeleton until middle age, when:
  - Skeleton loses mass
  - Osteoporosis and limb fractures become more common




Intercondylar eminence
Lateral condyle
Head
Proximal tibiofibular joint
Fibula
Distal tibiofibular joint
Lateral malleolus
Medial condyle
Tibial tuberosity
Interosseous membrane
Anterior crest
Tibia
Medial malleolus
Articular surface
Anterior view
Articular surface of medial condyle
Articular surface of lateral condyle
Head of fibula
Fibula
Lateral malleolus
Posterior view



(a) Superior view

Skeletal Anatomy Mnemonics

Facial Bones

- Virgil Can Not Make My Pet Zebra Laugh!
    - Vomer, Conchae, Nasal, Maxilla, Mandible, Palatine, Zygomatic, Lacrimal

Carpal Bones

- Some Lovers Try Positions That They Cannot Handle or
- Stop Letting Those People Touch The Cadaver's Hand or
- She Looks Too Pretty, Try To Catch Her or
- She Like To Play, Try To Catch Her or
    - Proximal row, lateral-to-medial: Scaphoid Lunate Triquetrum Pisiform
    - Distal row, lateral-to-medial: Trapezium Trapezoid Capitate Hamate

Tarsal Bones

- Tall Californian Navy Medcial Interns Lay Cuties or
- Tiger Cubs Need MILC
    - In order (right foot, superior to inferior, medial to lateral):
        - Talus, Calcaneus, Navicular, Medial cuneiform, Intermediate cuneiform, Lateral cuneifrom, Cuboid

Tibia vs. Fibula – which is lateral?

- Fibu**LA** is **LA**teral.

Recognizing and Thoracic vs. Lumbar Vertebra

- Examine vertebral body shape:
    - **Thoracic** is **heart**-shaped body since your **heart** is in your **thorax**.
    - **Lumbar** is **kidney-bean** shaped since **kidneys** are in **lumbar** area.