**The Axial Skeleton**

**Dr. Gary Mumaugh**

**The Axial Skeleton**

* Eighty bones segregated into three regions
  + Skull
  + Vertebral column
  + Bony thorax

**The Skull**

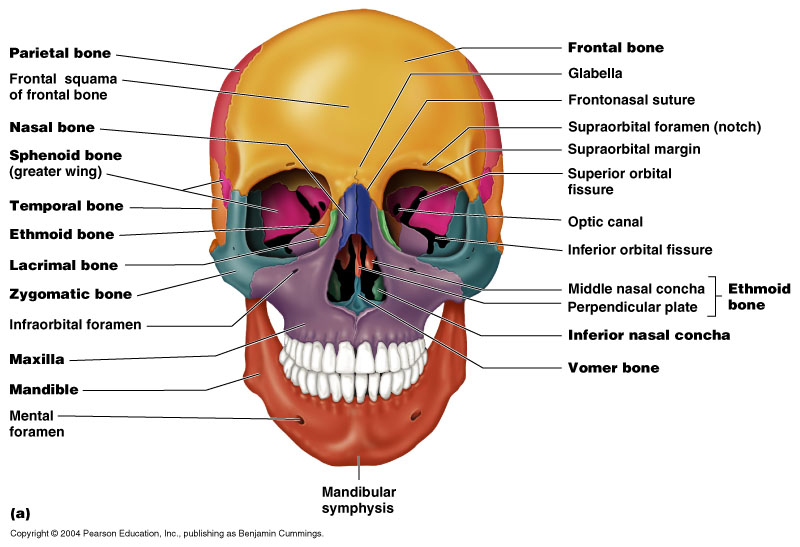
* The skull, the body’s most complex bony structure, is formed by the cranium and facial bones
* Cranium – protects the brain and is the site of attachment for head and neck muscle
* Facial bones
  + Supply the framework of the face, the sense organs, and the teeth
  + Provide openings for the passage of air and food
  + Anchor the facial muscles of expression

**Anatomy of the Cranium**

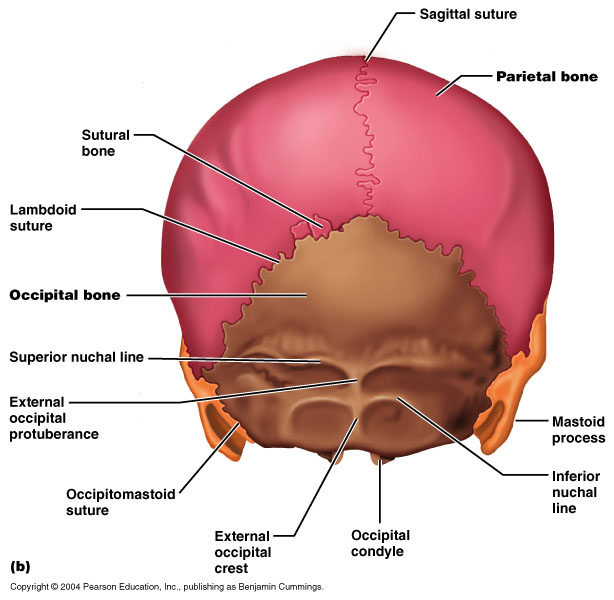
* Eight cranial bones
  + two parietal
  + two temporal,
  + one frontal, one occipital, one sphenoid, and one ethmoid
  + Cranial bones are thin and remarkably strong for their weight



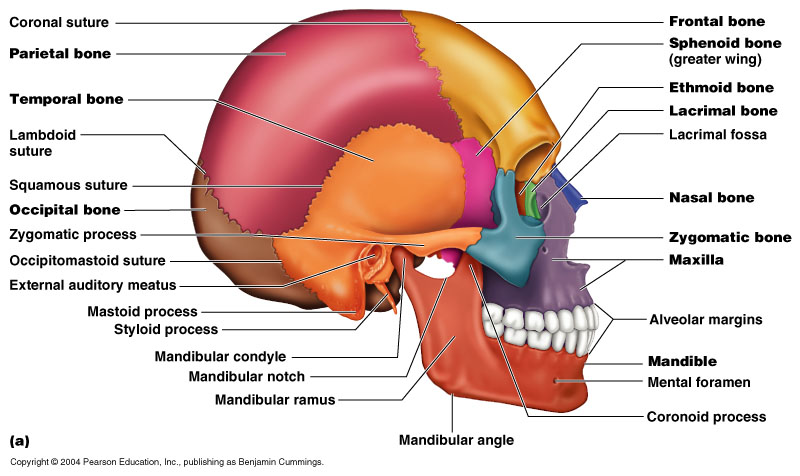
**Anterior Skull**



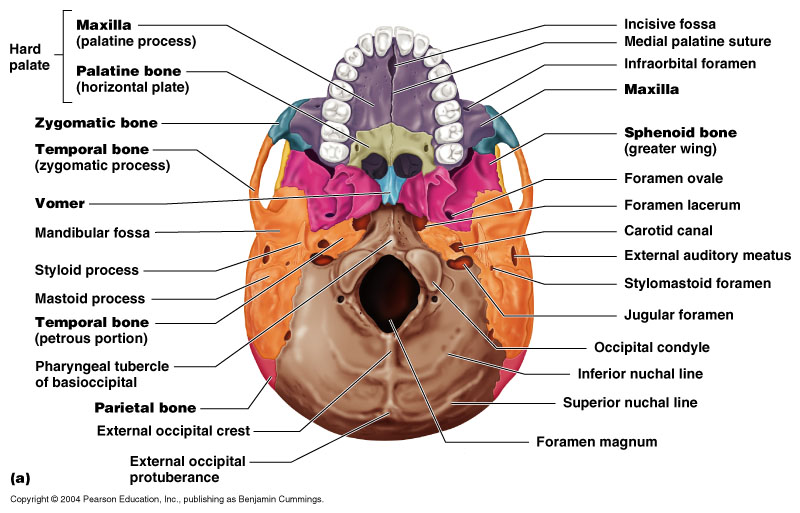
**Posterior Skull**



**Lateral Skull**

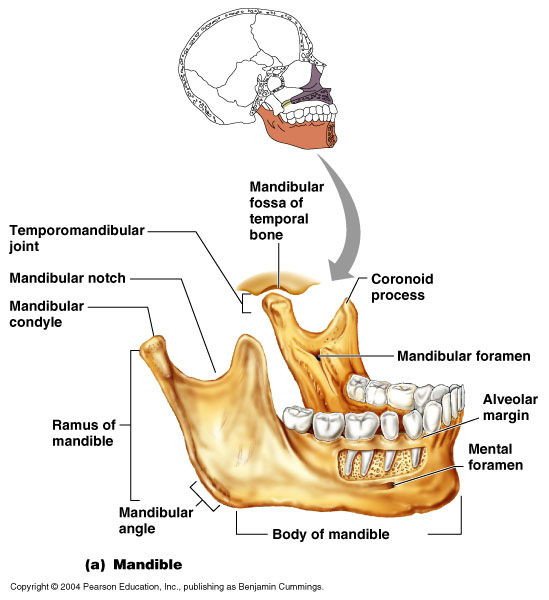


**Inferior Skull**



**Mandible**

* The mandible (lower jawbone) is the largest, strongest bone of the face

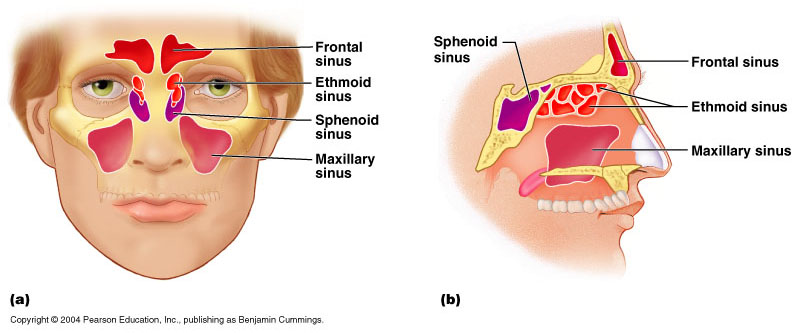


**Maxillary Bones**

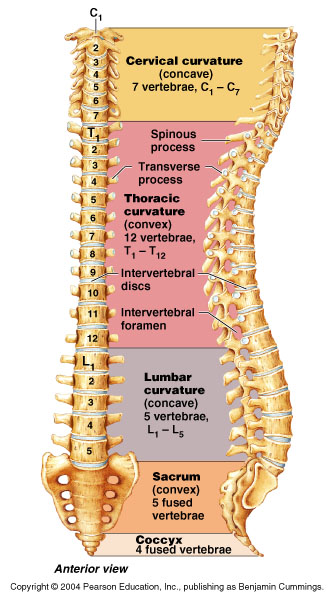
* Medially fused bones that make up the upper jaw and the central portion of the facial skeleton
* Facial keystone bones that articulate with all other facial bones except the mandible


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**Paranasal Sinuses**

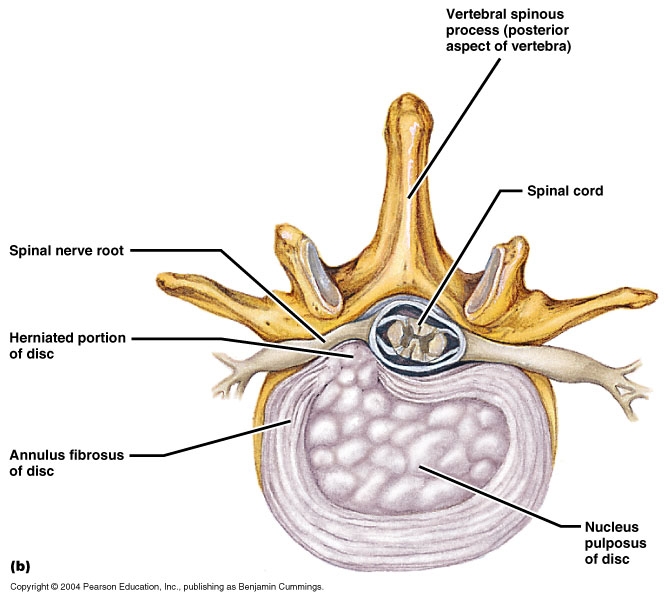
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**Vertebral Column**

* Formed from 26 irregular bones (vertebrae) connected in such a way that a flexible curved structure results
* Cervical vertebrae – 7 bones of the neck
* Thoracic vertebrae – 12 bones of the torso
* Lumbar vertebrae – 5 bones of the lower back
* Sacrum – bone inferior to the lumbar vertebrae that articulates with the hip bones

**Vertebral Column: Curvatures**

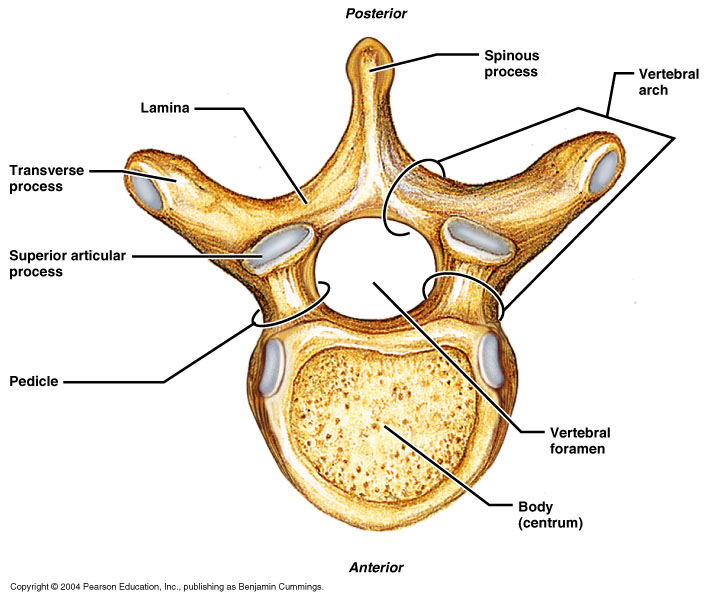
* Posteriorly concave curvature
  + cervical and lumbar
* Posteriorly convex curvatures
  + thoracic and sacral
* Abnormal spine curvatures
  + scoliosis (abnormal lateral curve)
  + kyphosis (hunchback),
  + lordosis (swayback)

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**Vertebral Column: Intervertebral Discs**

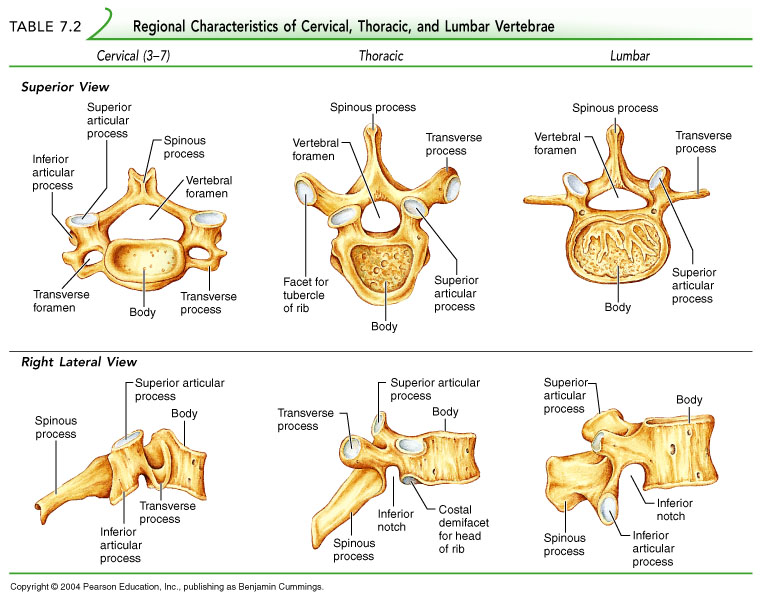
* Cushionlike pad composed of two parts
* Nucleus pulposus – inner gelatinous nucleus that gives the disc its elasticity and compressibility
* Annulus fibrosus – surrounds the nucleus pulposus with a collar composed of collagen and fibrocartilage

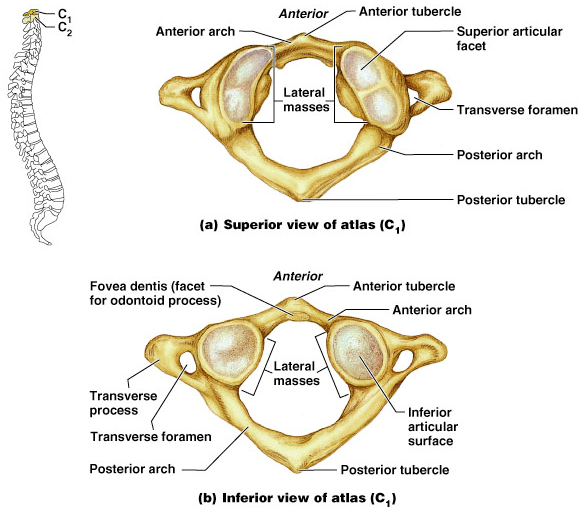
**General Structure of Vertebrae**

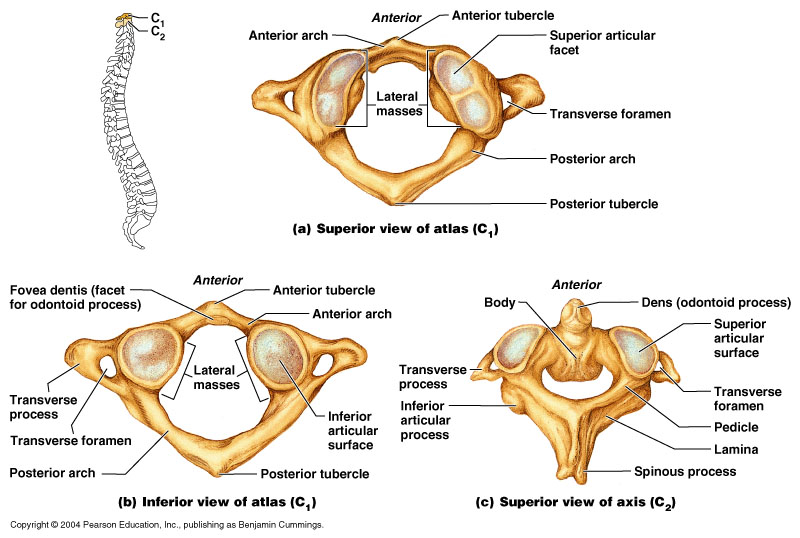
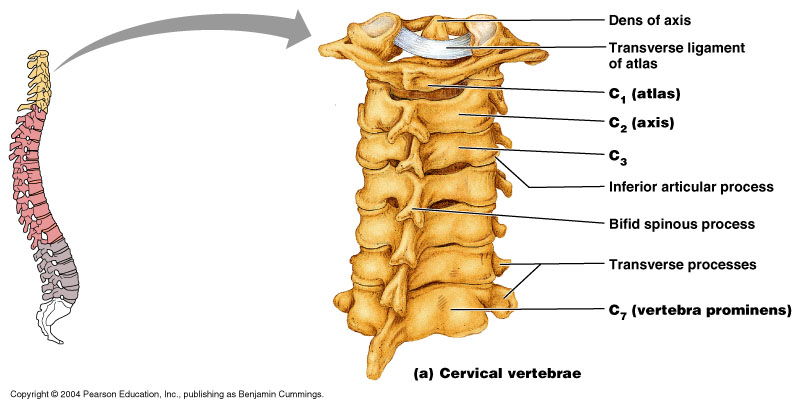
  
**Vertebral Column**

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**Cervical Vertebrae**

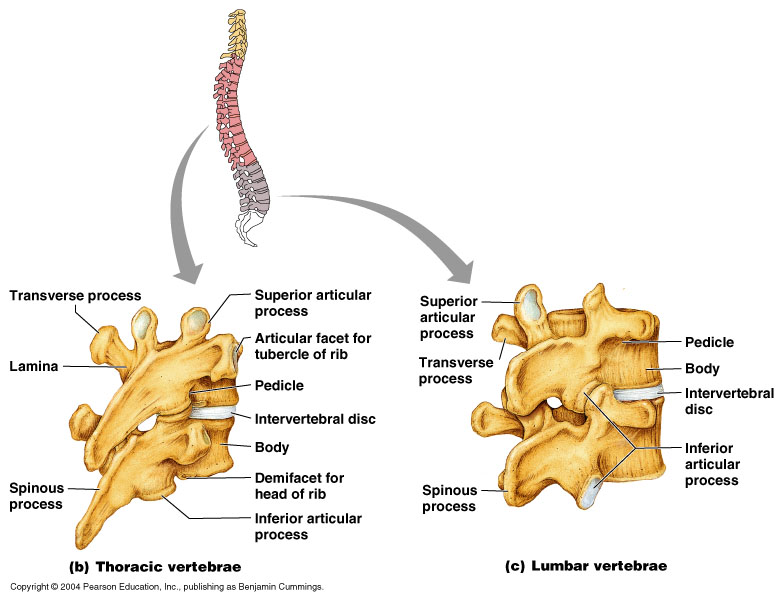
* Seven vertebrae (C1-C7) are the smallest, lightest vertebrae
* C3-C7 are distinguished with an oval body, short spinous processes, and large, triangular vertebral foramina
* Each transverse process contains a transverse foramen
* Cervical Vertebrae: The Atlas (C1)
  + The atlas has no body and no spinous process
  + It consists of anterior and posterior arches, and two lateral masses
  + The superior surfaces of lateral masses articulate with the occipital condyles
* Cervical Vertebrae: The Axis (C2)
  + The axis has a body, spine, and vertebral arches as do other cervical vertebrae
  + Unique to the axis is the dens, or odontoid process, which projects superiorly from the body and is cradled in the anterior arch of the atlas
  + The dens is a pivot for the rotation of the atlas





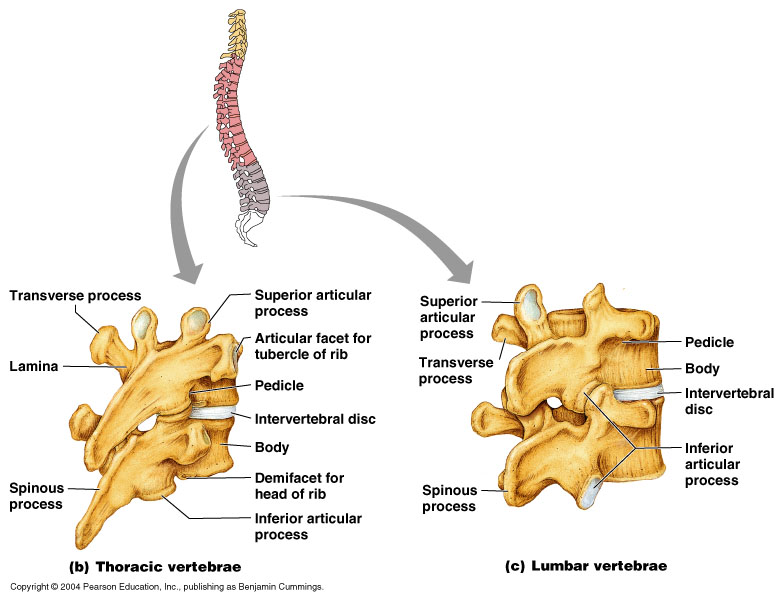
**Thoracic Vertebrae**

* There are twelve vertebrae (T1-T12) all of which articulate with ribs



**Lumbar Vertebrae**

* The five lumbar vertebrae (L1-L5) are located in the small of the back and have an enhanced weight-bearing function
* They have short, thick pedicles and laminae, flat hatchet-shaped spinous processes, and a triangular-shaped vertebral foramen
* Orientation of articular facets locks the lumbar vertebrae together to provide stability



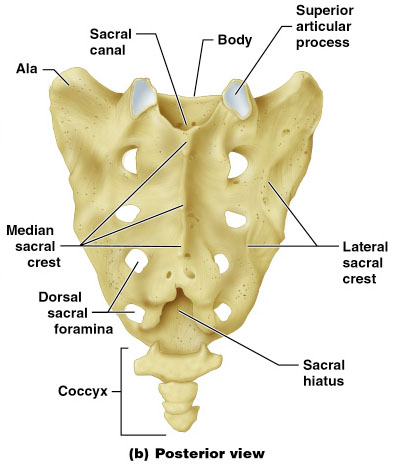
**Sacrum**

* Consists of five fused vertebrae (S1-S5), which shape the posterior wall of the pelvis
* It articulates with L5 superiorly, and with the auricular surfaces of the hip bones

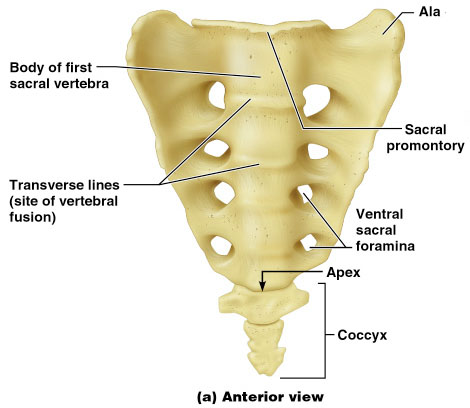
**Coccyx (Tailbone)**

* The coccyx is made up of four (in some cases three to five) fused vertebrae that articulate superiorly with the sacrum

**Posterior Sacrum**



**Anterior Sacrum**

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**Bony Thorax (Thoracic Cage)**

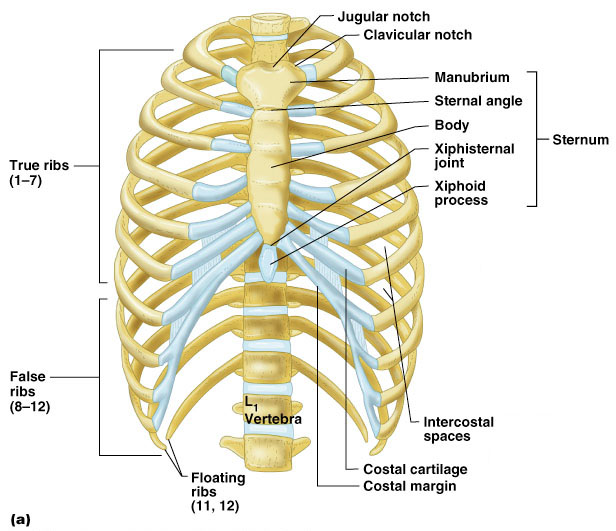
* The thoracic cage is composed of the thoracic vertebrae dorsally, the ribs laterally, and the sternum and costal cartilages anteriorly
* Functions
  + Forms a protective cage around the heart, lungs, and great blood vessels
  + Supports the shoulder girdles and upper limbs
  + Provides attachment for many neck, back, chest, and shoulder muscles
  + Uses intercostal muscles to lift and depress the thorax during breathing

**Sternum (Breastbone)**

* A dagger-shaped, flat bone that lies in the anterior midline of the thorax
* Anatomical landmarks include the jugular (suprasternal) notch, the sternal angle, and the xiphisternal joint

**Ribs**

* There are twelve pair of ribs forming the flaring sides of the thoracic cage
* All ribs attach posteriorly to the thoracic vertebrae
* The superior 7 pair (true, or vertebrosternal ribs) attach directly to the sternum via costal cartilages
* Ribs 8-10 (false, or vertebrocondral ribs) attach indirectly to the sternum via costal cartilage
* Ribs 11-12 (floating, or vertebral ribs) have no anterior attachment



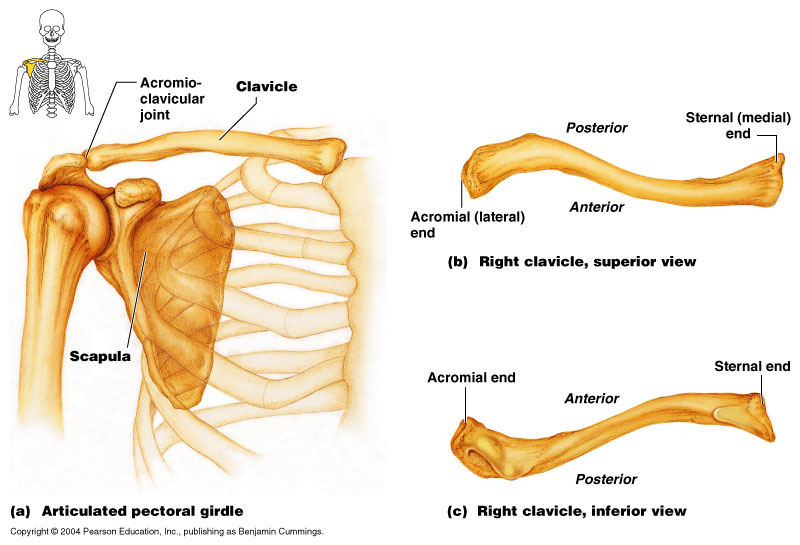
**The Appendicular Skeleton**

**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

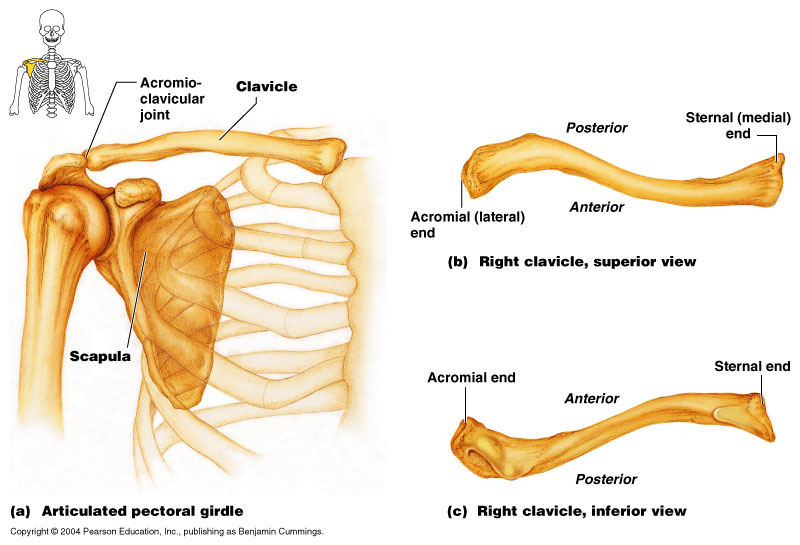
**Pectoral Girdles (Shoulder Girdles)**

* 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
* They provide attachment points for muscles that move the upper limbs



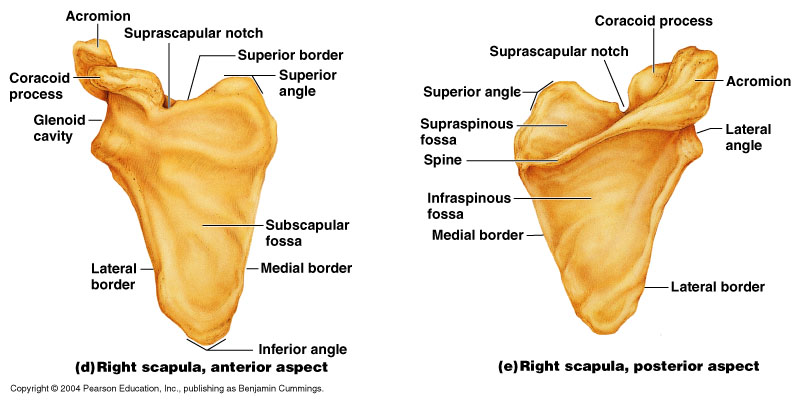
**Clavicles (Collarbones)**

* 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
* They provide attachment points for numerous muscles, and act as braces to hold the scapulae and arms out laterally away from the body

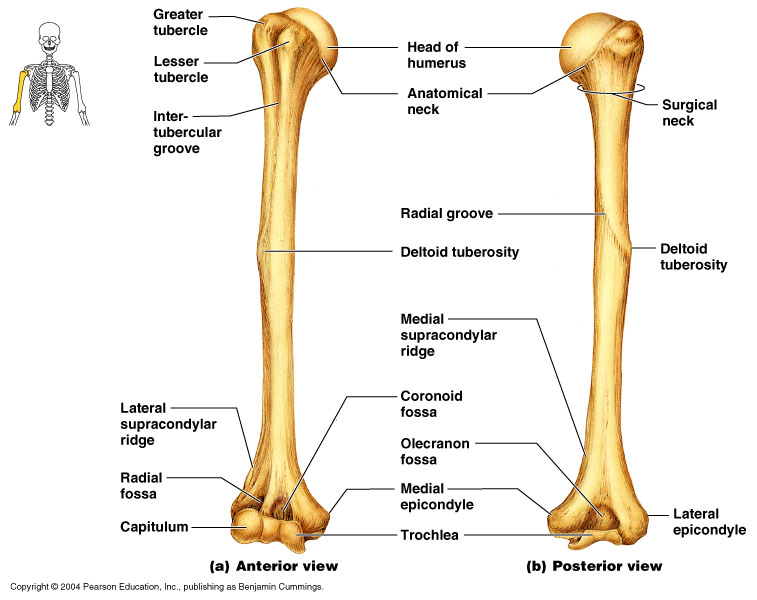


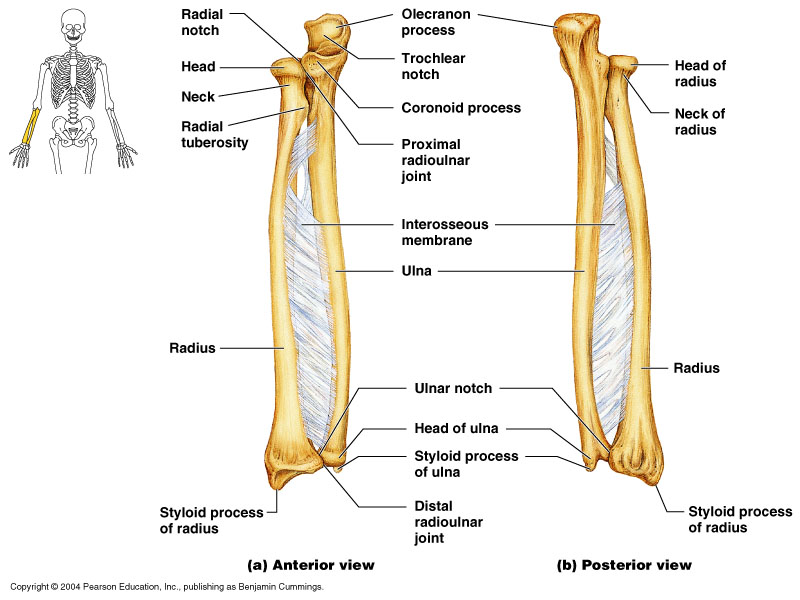
**Scapulae (Shoulder Blades)**

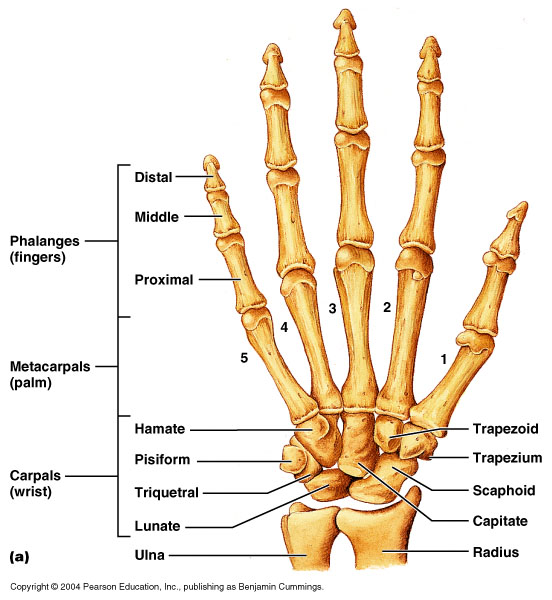
* The scapulae are triangular, flat bones lying on the dorsal surface of the rib cage, between the second and seventh ribs
* Scapulae have three borders and three angles
* Major markings include the suprascapular notch, the supraspinous and infraspinous fossae, the spine, the acromion, and the coracoid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



**The Upper Limb**

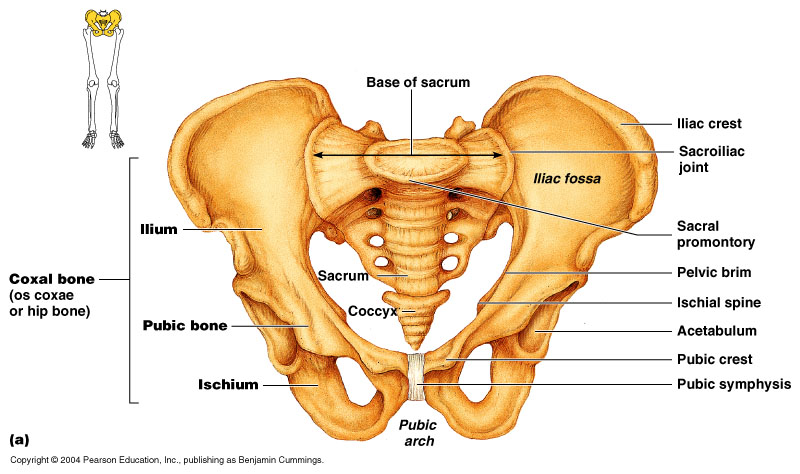
* The upper limb consists of the arm (brachium), forearm (antebrachium), and hand (manus)
* Thirty-seven bones form the skeletal framework of each upper limb
* Arm - Brachium
  + The humerus is the sole bone of the arm
  + It articulates with the scapula at the shoulder, and the radius and ulna at the 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
  + Metacarpals - Palm
  + Phalanges - Fingers





**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
  + Transmits weight of the upper body to the lower limbs
  + Supports the visceral organs of the pelvis



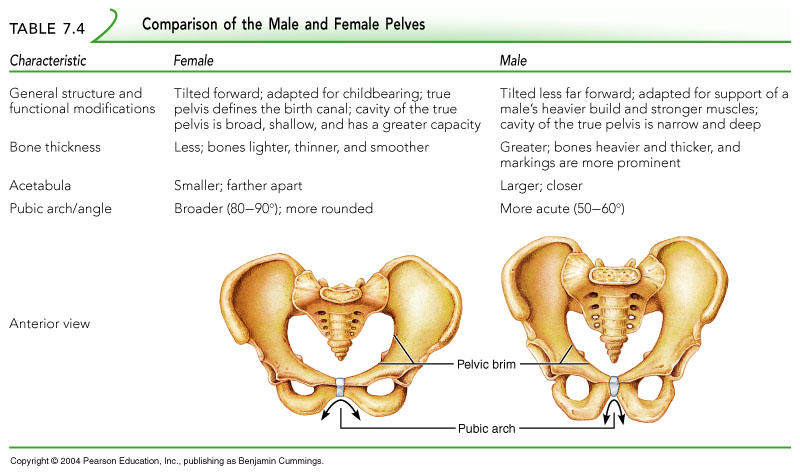
**Pelvic Girdle (Hip)**

* 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

**Comparison of Male and Female Pelvic Structure**

* Female
  + For childbearing
* Male
  + For support of heavier male build and stronger muscles

**Female Male**

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**The Lower Limb**

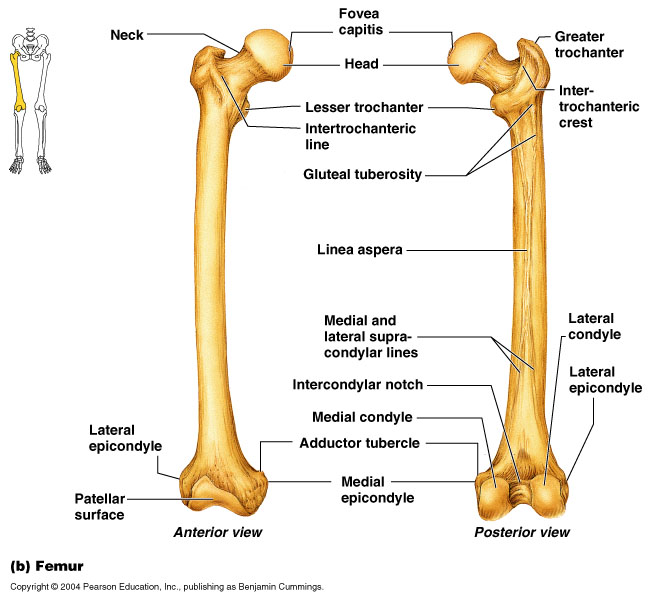
* The three segments of the lower limb are the thigh, leg, and foot
* They carry the weight of the erect body, and are subjected to exceptional forces when one jumps or runs

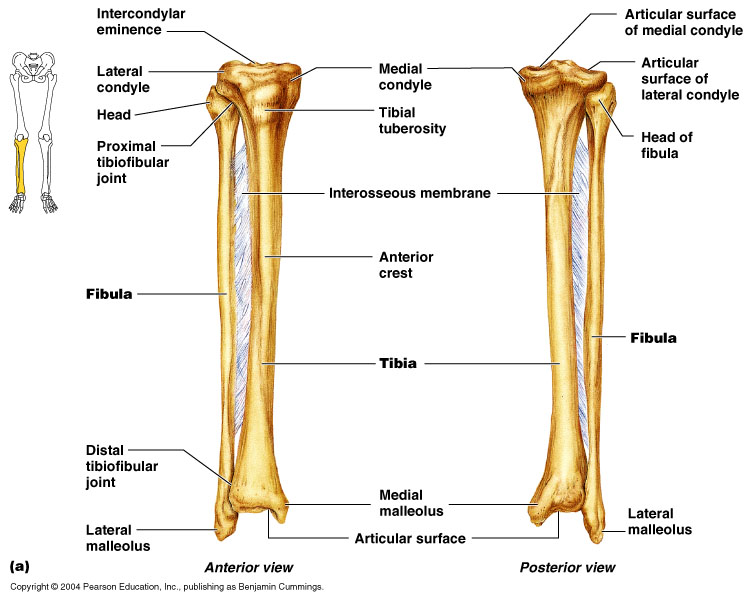
**Femur**

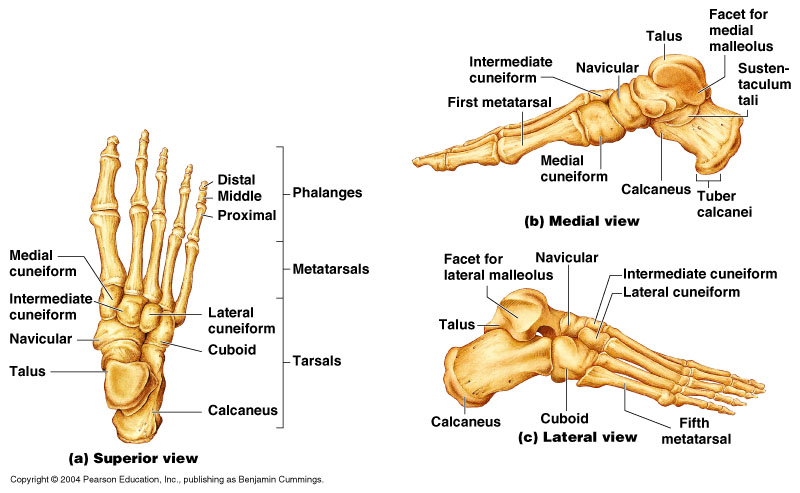
* The sole bone of the thigh is the femur
* The largest and strongest bone in the body
* It articulates proximally with the hip and distally with the tibia and fibula

**Leg**

* The tibia and fibula form the skeleton of the leg
* They are connected to each other by the interosseous membrane
* They articulate with the femur proximally and with the ankle bones distally







**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.