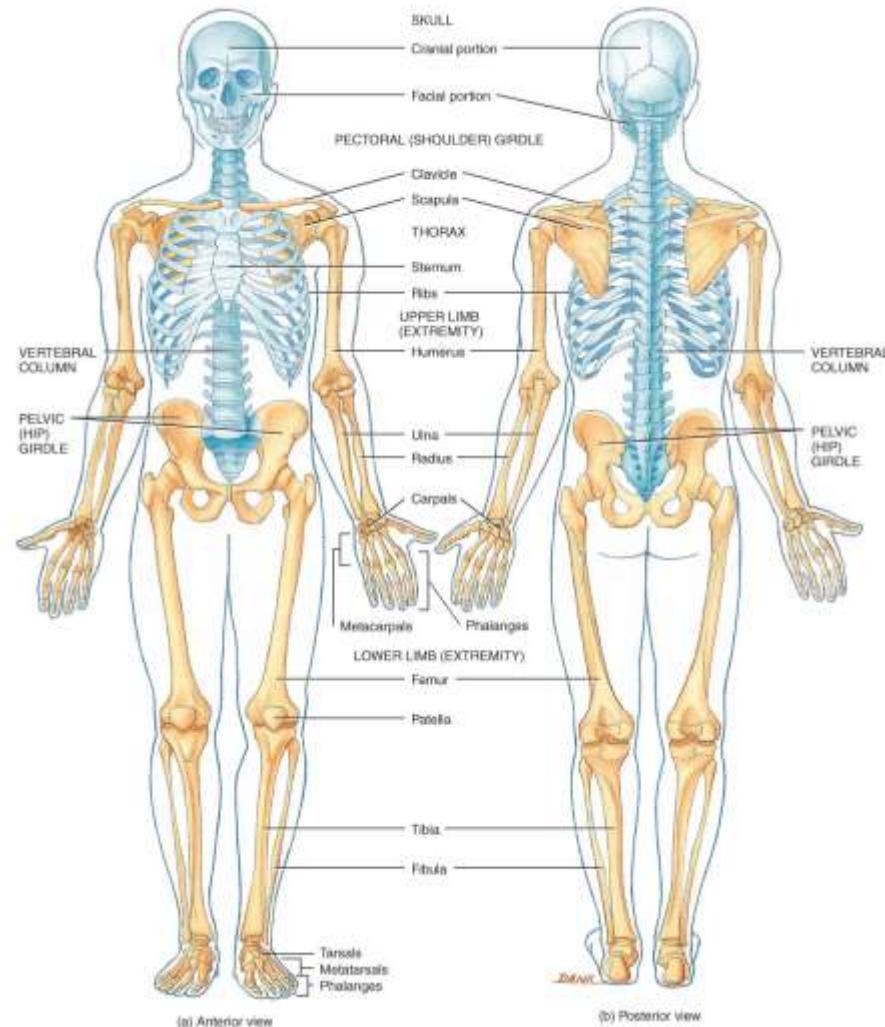


# Axial and Appendicular Skeleton

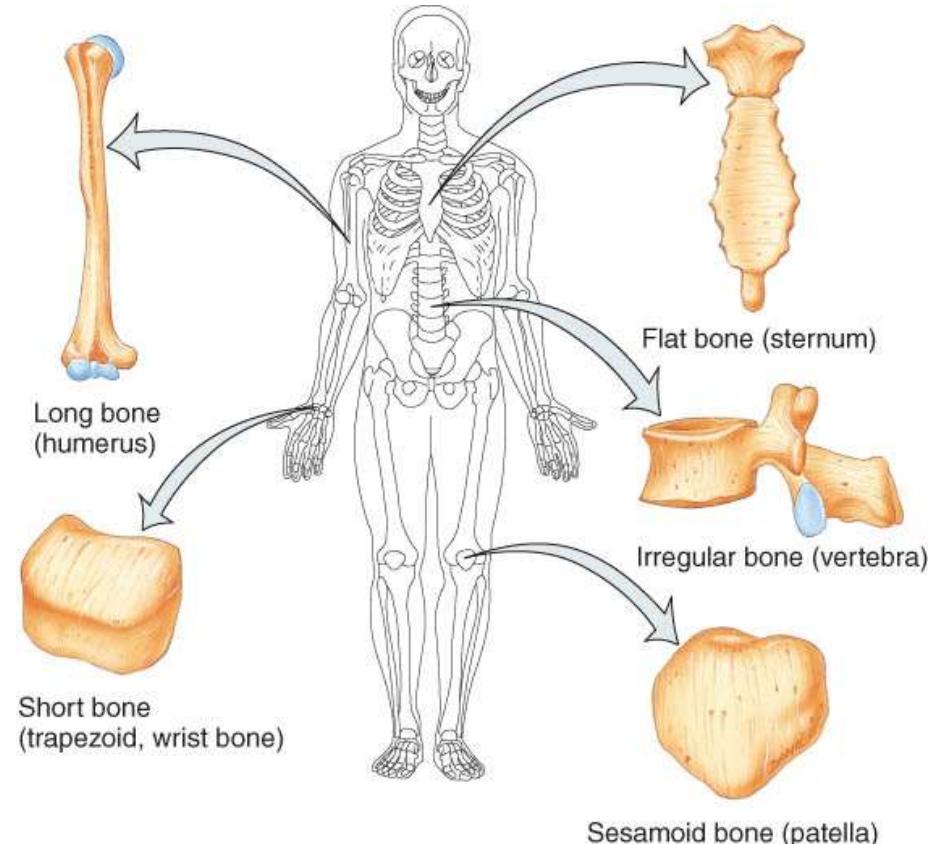
# The Skeletal System: The Axial Skeleton

- Axial Skeleton
  - 80 bones
  - skull, hyoid, vertebrae, ribs, sternum, ear ossicles
- Appendicular Skeleton
  - 126 bones
  - upper & lower limbs and pelvic & pectoral girdles



# Types of Bones

- 5 basic types of bones:
  - long
  - short
  - flat
  - irregular
  - sesamoid (patella)
- Sutural bones = in joint between skull bones



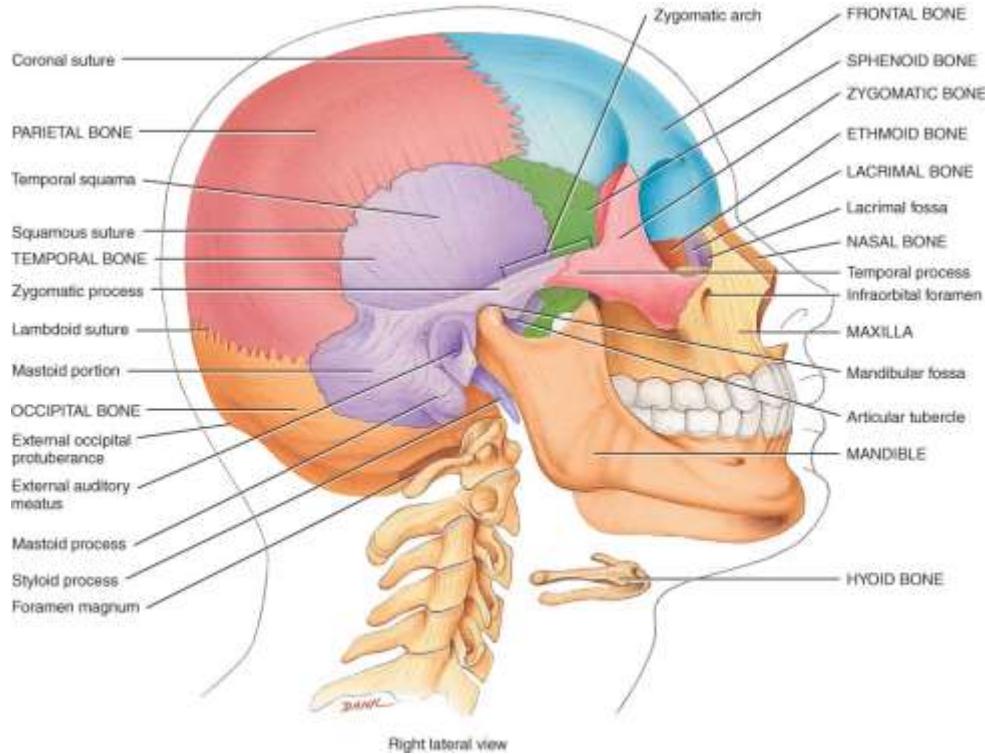
# BONE SURFACE MARKINGS

- There are two major types of surface markings.
  - **Depressions** and openings participate in joints or allow the passage of soft tissue.
  - **Processes** are projections or outgrowths that either help form joints or serve as attachment points for connective tissue.

# Bone Surface Markings

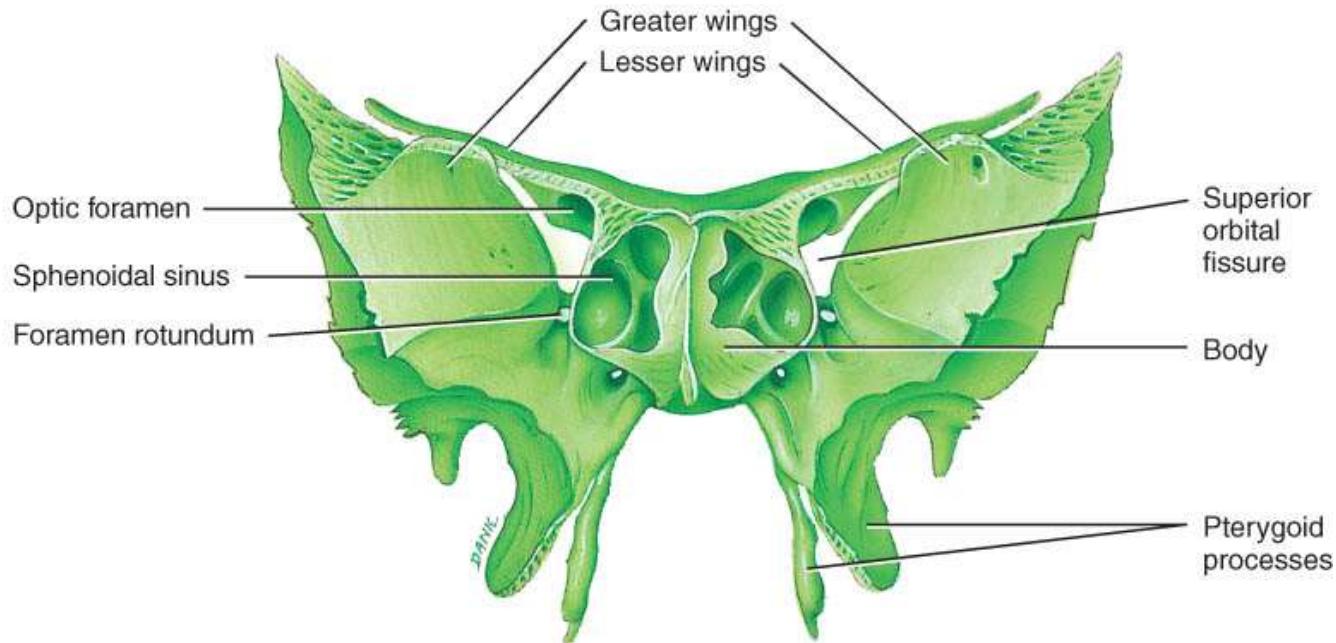
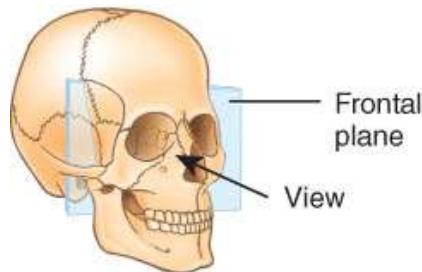
- Foramen = opening or hole
- Fossa = shallow depression
- Sulcus = groove
- Meatus = tubelike passageway or canal
- Condyle = large, round protuberance
- Facet = smooth flat articular surface
- Trochanter = very large projection
- Tuberosity = large, rounded, roughened projection

# The Skull



- 8 Cranial bones
  - protect brain & house ear ossicles
  - muscle attachment for jaw, neck & facial muscles
- 14 Facial bones
  - protect delicate sense organs -- smell, taste, vision
  - support entrances to digestive and respiratory systems

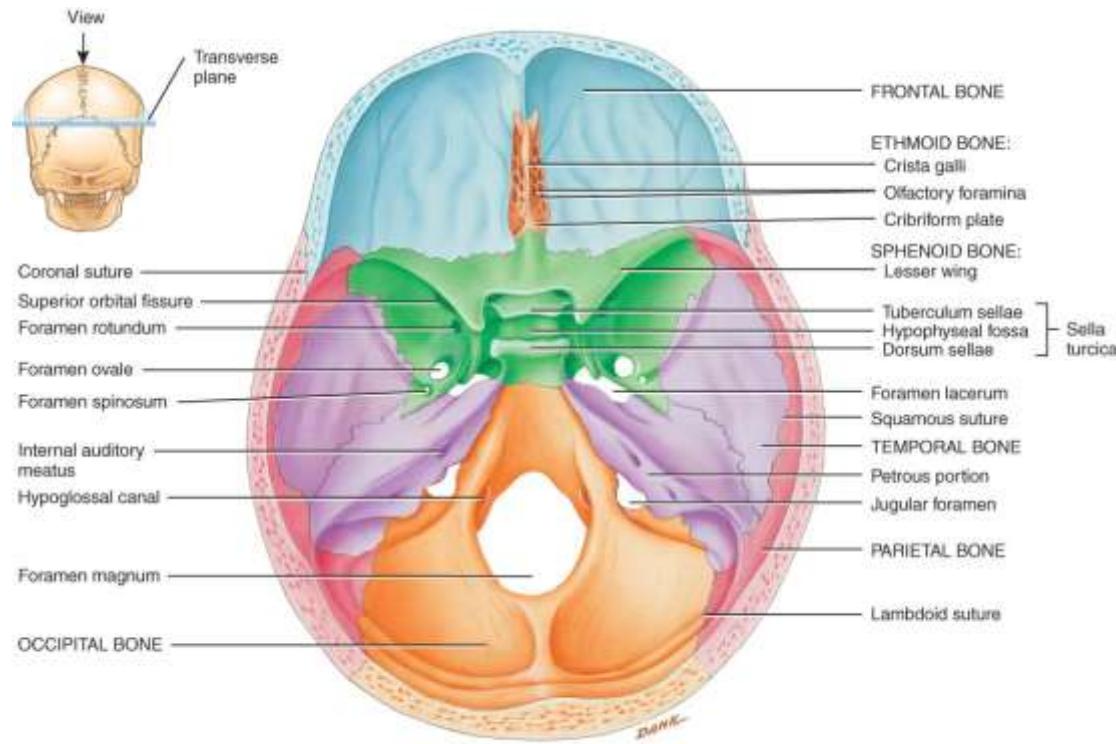
# Sphenoid in Anterior View



(b) Anterior view of sphenoid bone

- Body is a cubelike portion holding sphenoid sinuses
- Greater and lesser wings

# Sphenoid from Superior View

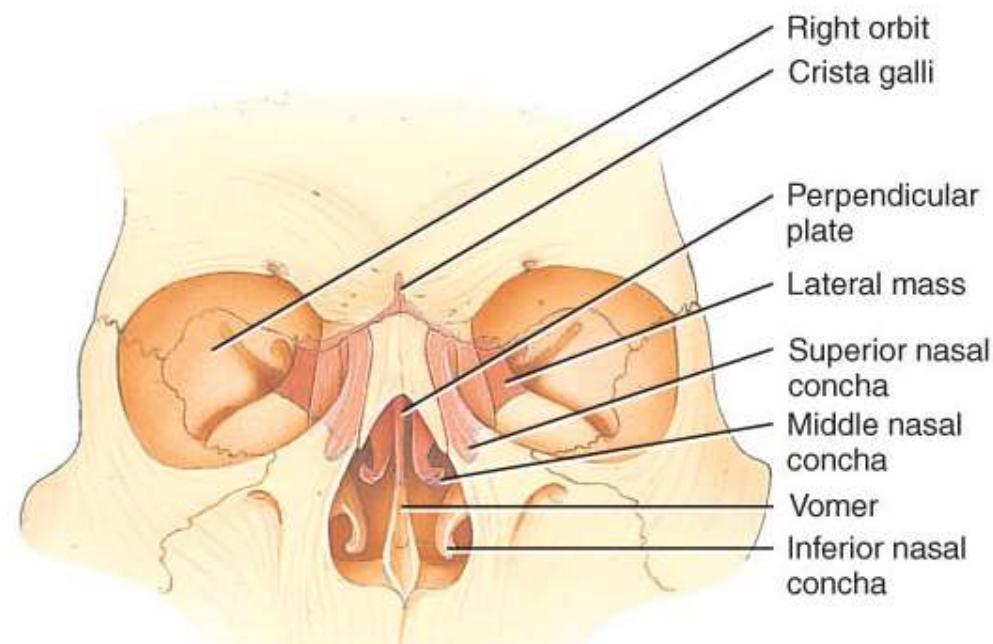
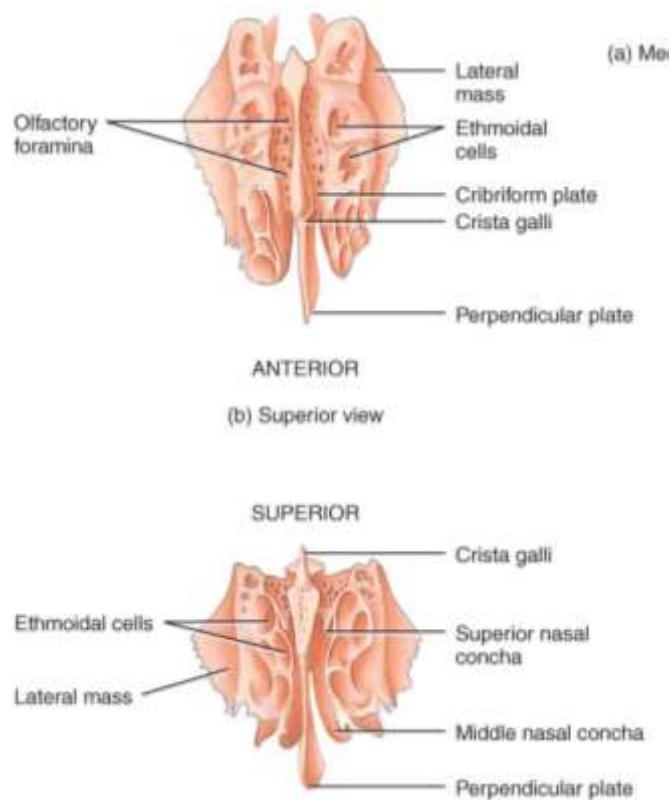


(a) Superior view of sphenoid bone in floor of cranium

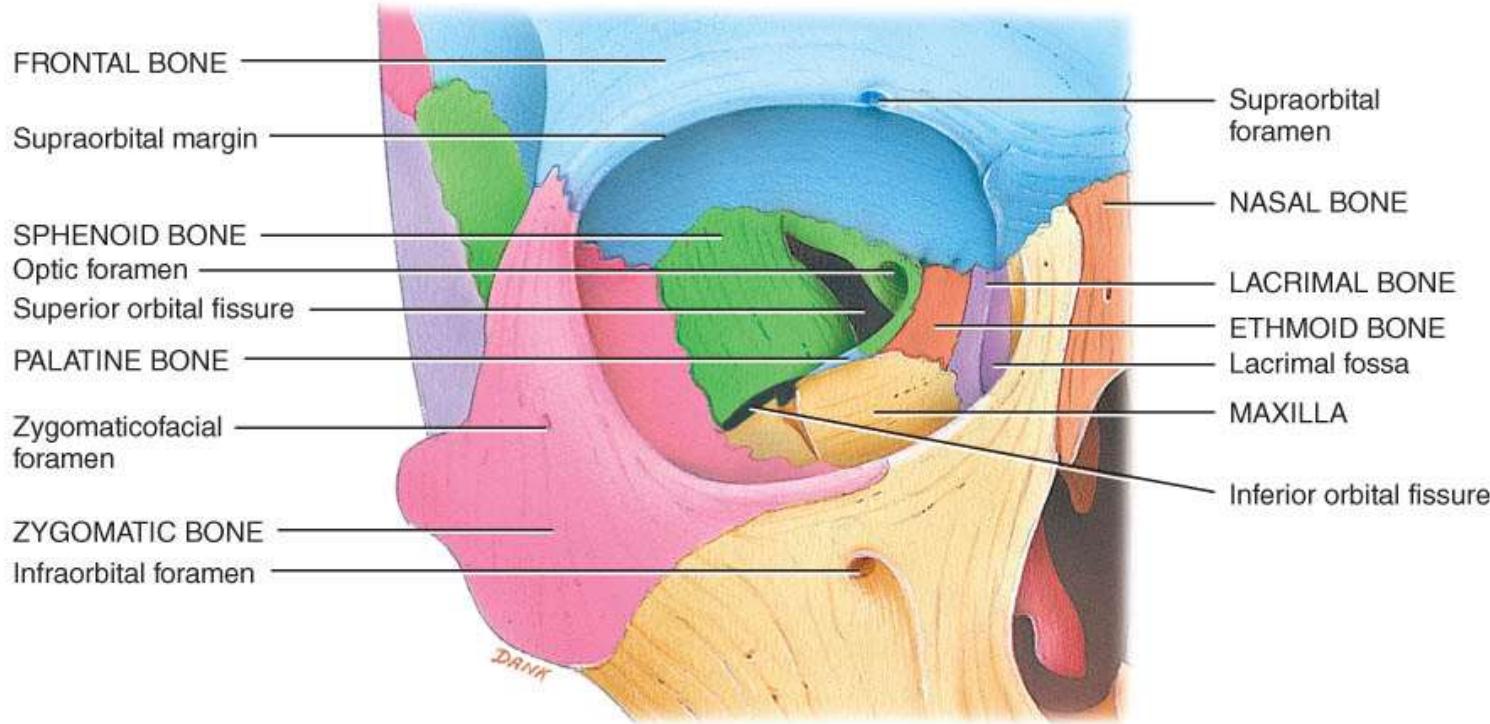
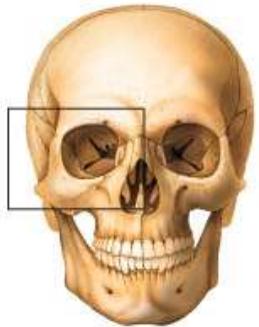
- Lesser wing & greater wing
- Sella turcica holds pituitary gland

# Ethmoid bone

- Lateral masses contain ethmoid sinuses
- Perpendicular plate is upper part of nasal septum
- Superior & middle nasal concha or turbinates
  - filters & warms air



# Bones of the Orbit



Anterior view showing the bones of the right orbit

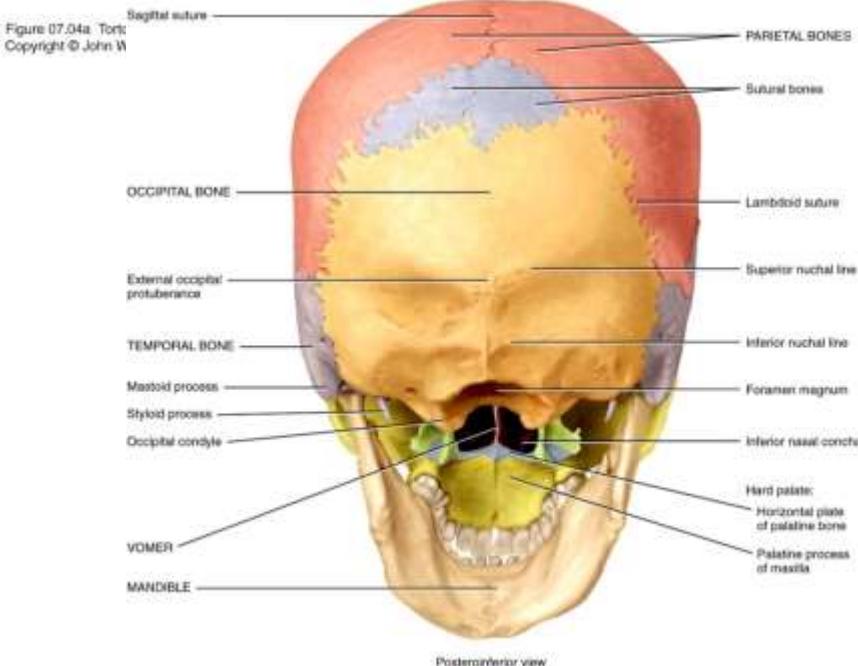
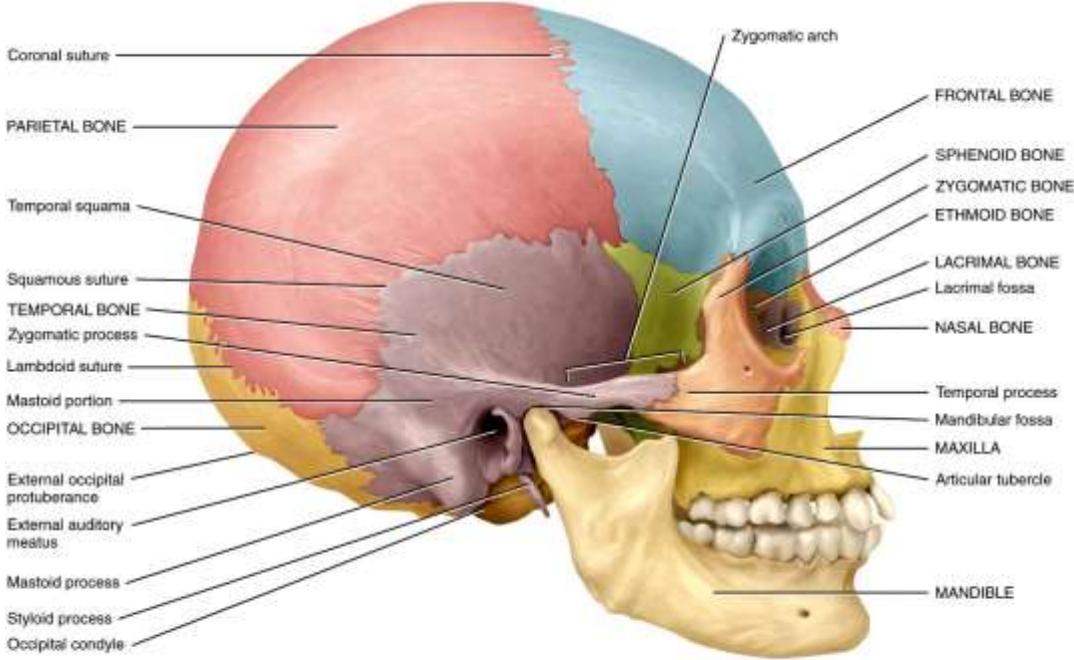
- Roof is frontal and sphenoid
- Lateral wall is zygomatic and sphenoid
- Floor is maxilla, zygomatic, palatine and sphenoid
- Medial wall is maxilla, lacrimal, ethmoid and sphenoid
- Orbital fissures and optic foramen

# Unique Features of the Skull

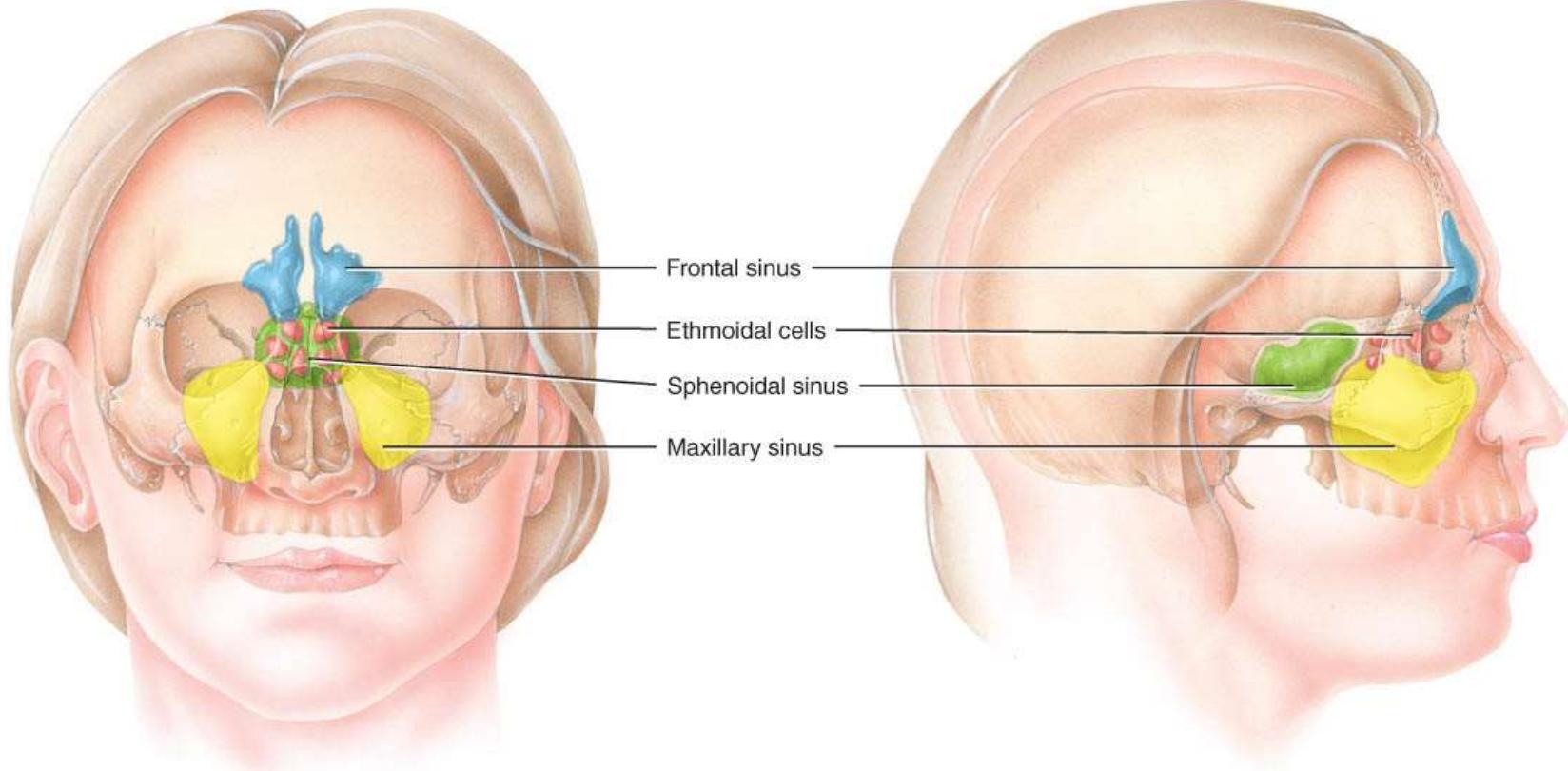
- Sutures
- Sinuses
- Fontanelles

# Sutures

- *Sutures* are immovable joints found only between skull bones and hold skull bones together.
- Sutures include the *coronal, sagittal, lamboidal, and squamous sutures*, among others



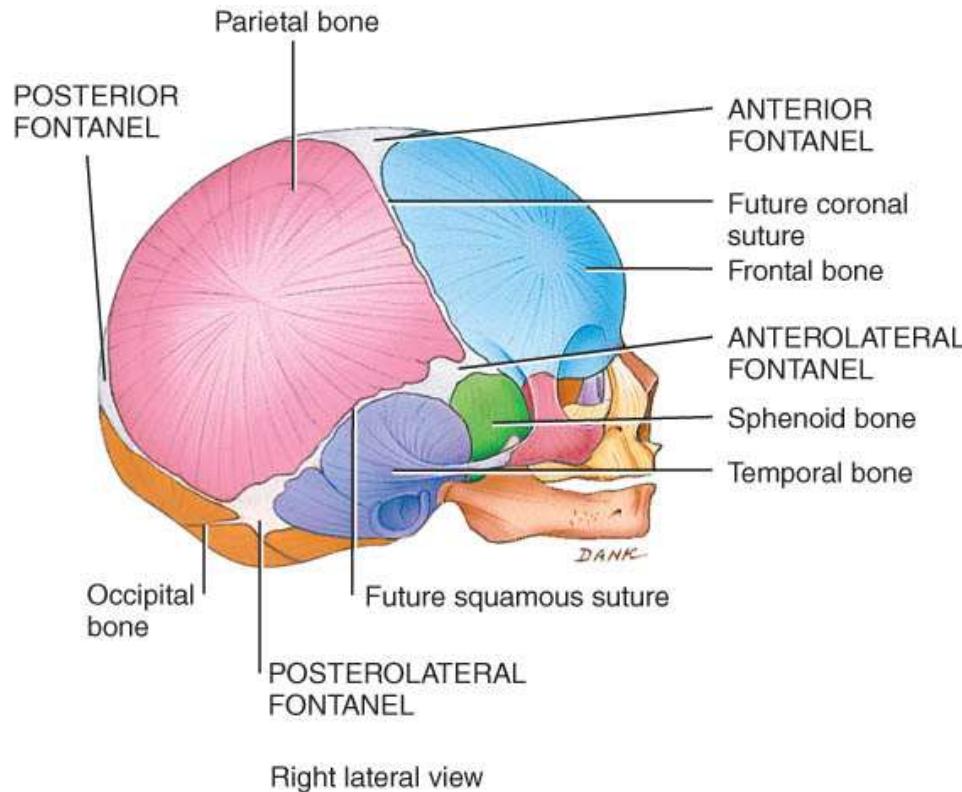
# Paranasal Sinuses

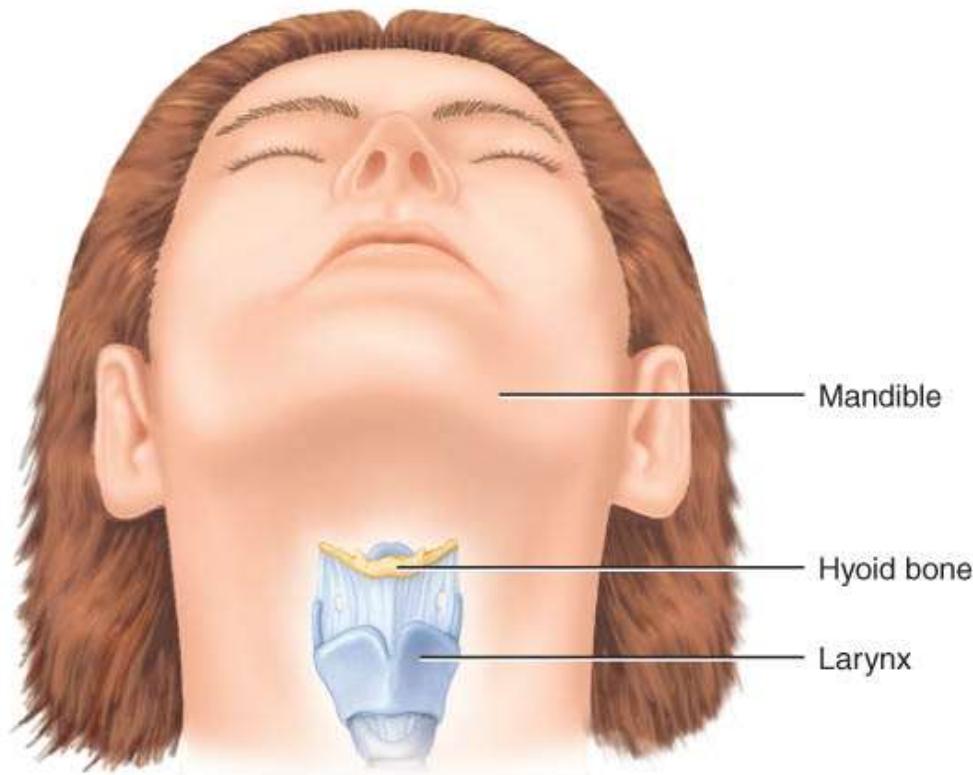


- Paired cavities in ethmoid, sphenoid, frontal and maxillary
- Lined with mucous membranes and open into nasal cavity
- Resonating chambers for voice, lighten the skull
- Sinusitis is inflammation of the membrane (allergy)

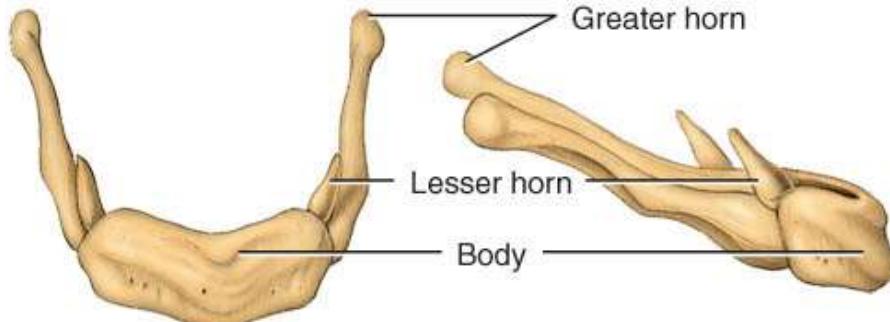
# Fontanels of the Skull at Birth.

- Dense connective tissue membrane-filled spaces (soft spots)
- Unossified at birth but close early in a child's life.





(a) Position of hyoid



(b) Anterior view

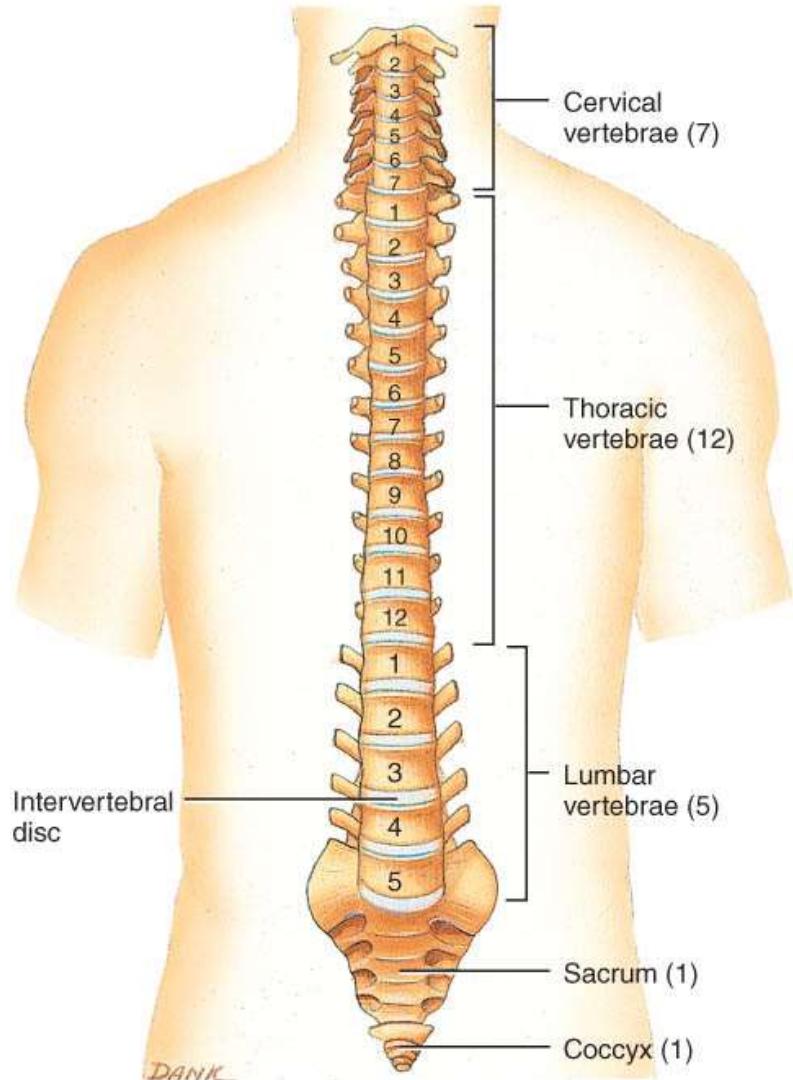
(c) Right lateral view

# Hyoid Bone

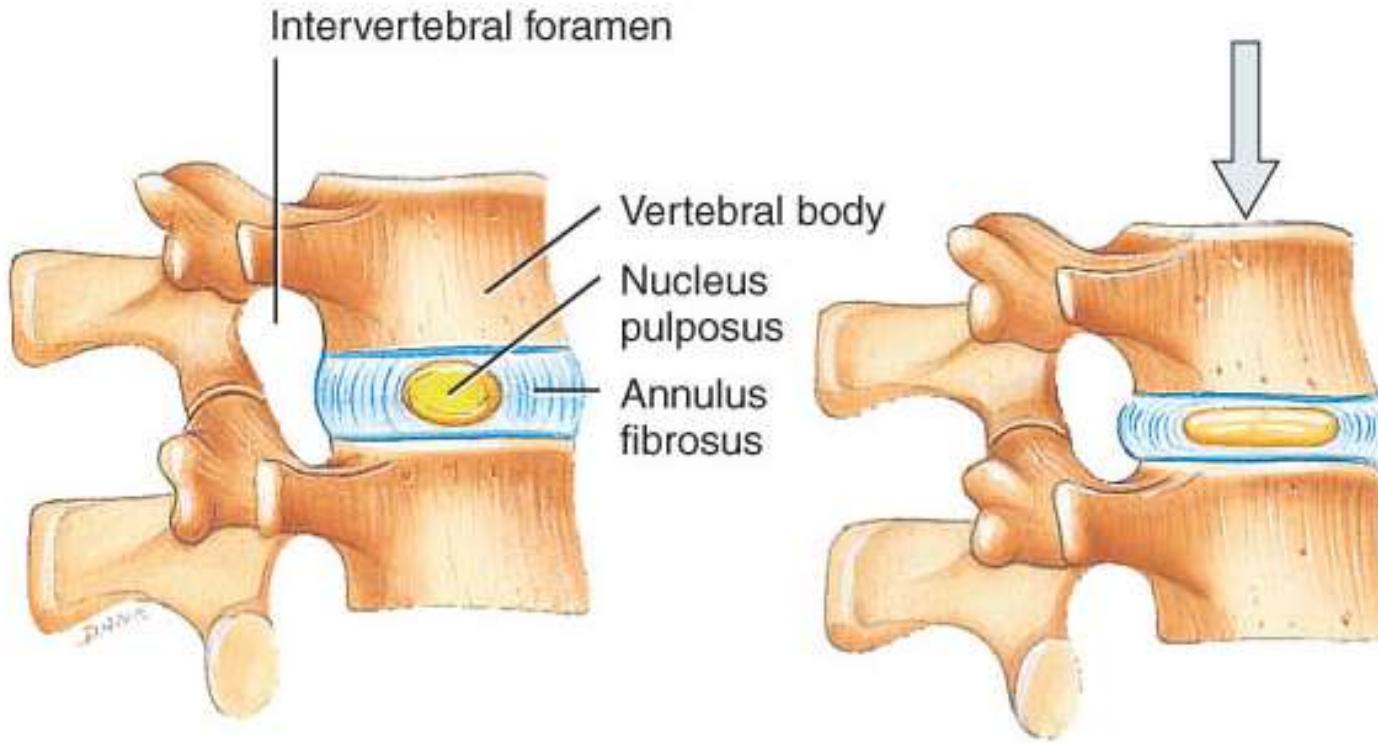
- U-shaped single bone
- Articulates with no other bone of the body
- Suspended by ligament and muscle from skull
- Supports the tongue & provides attachment for tongue, neck and pharyngeal muscles

# Vertebral Column

- Backbone or spine built of 26 vertebrae
- Five vertebral regions
  - cervical vertebrae (7) in the neck
  - thoracic vertebrae ( 12 ) in the thorax
  - lumbar vertebrae ( 5 ) in the low back region
  - sacrum (5, fused)
  - coccyx (3-5, fused)



# Intervertebral Discs

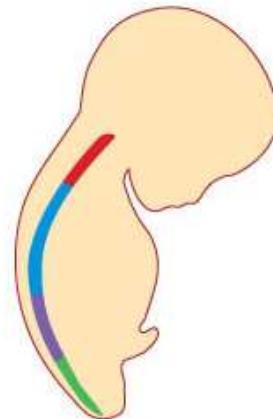


Normal intervertebral disc

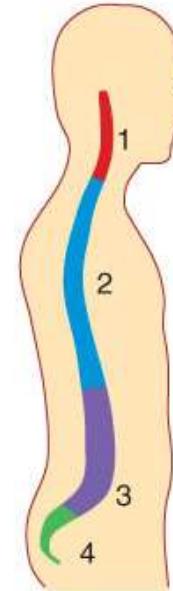
Compressed intervertebral disc  
in a weight-bearing situation

- Between adjacent vertebrae absorbs vertical shock
- Fibrocartilagenous ring with a pulpy center

# Normal Curves of the Vertebral Column



Single curve in fetus

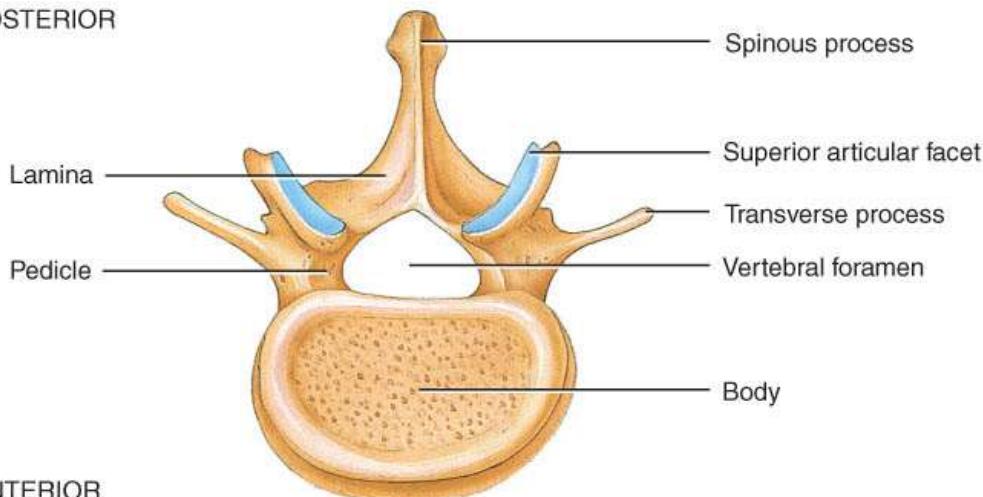


Four curves in adult

- Primary curves
  - thoracic and sacral are formed during fetal development
- Secondary curves
  - cervical is formed when infant raises head at 4 months
  - lumbar forms when infant sits up & begins to walk at 1 year

# Typical Vertebrae

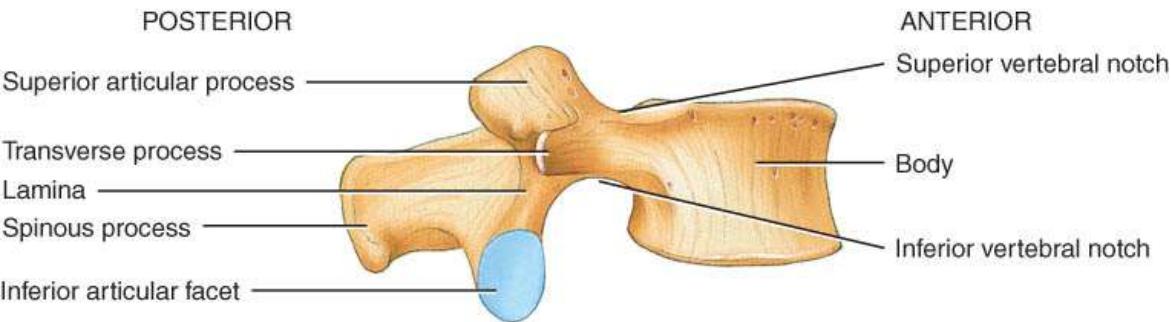
POSTERIOR



(b) Superior view

ANTERIOR

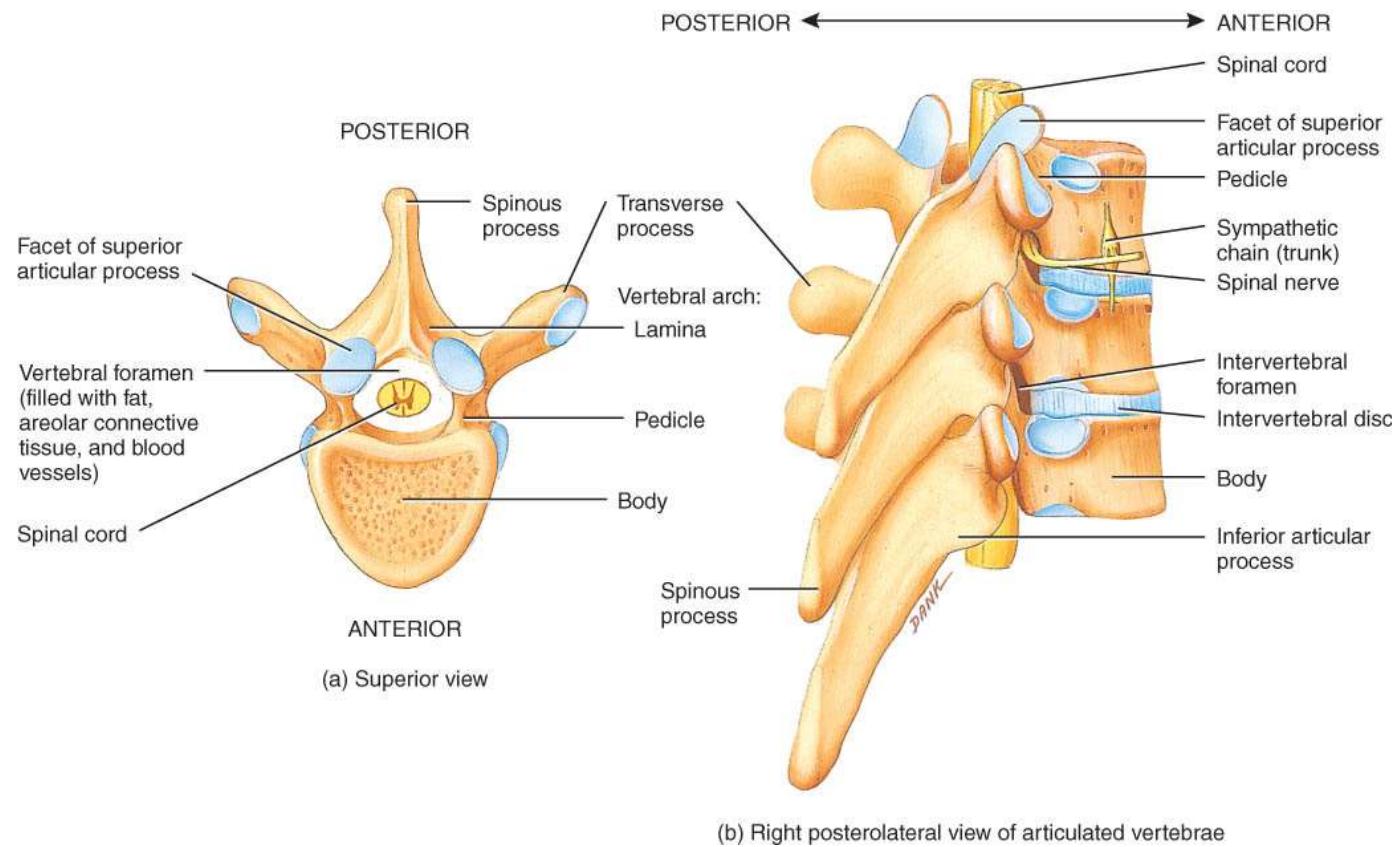
POSTERIOR



(c) Right lateral view

- Body
  - weight bearing
- Pedicle
- Lamina
- Vertebral foramen
- Seven processes
  - 2 transverse
  - 1 spinous
  - 4 articular
    - 2 superior
    - 2 inferior
- Vertebral notches

# Intervertebral Foramen & Spinal Canal



- Spinal canal is all vertebral foramen together
- Intervertebral foramen are 2 vertebral notches together

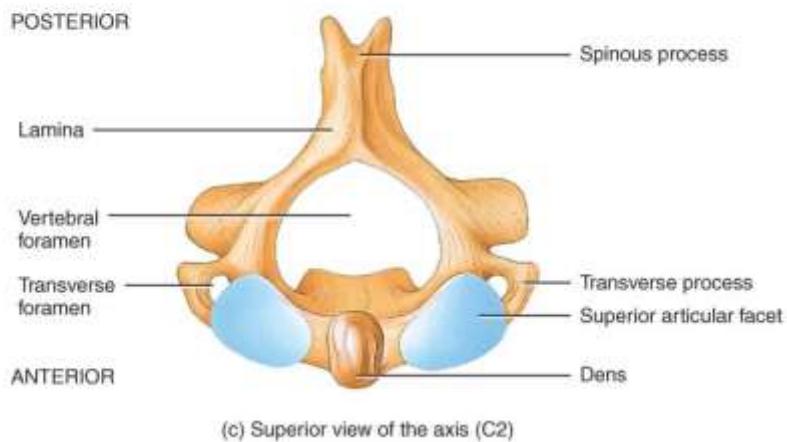
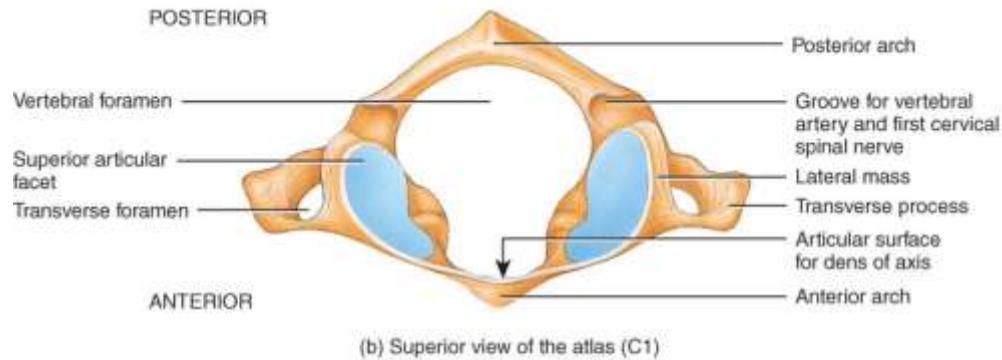
# Regions of the Vertebral Column

- Cervical
- Thoracic
- Lumbar
- Sacral
- Coccygeal

# Cervical Vertebra

- There are 7 cervical vertebrae.
  - The first cervical vertebra is the *atlas* and supports the skull.
  - The second cervical vertebra is the *axis*, which permits side-to-side rotation of the head.
  - The third to sixth correspond to the structural patterns of the typical cervical vertebrae.
  - The seventh called the *vertebra prominens* is somewhat different

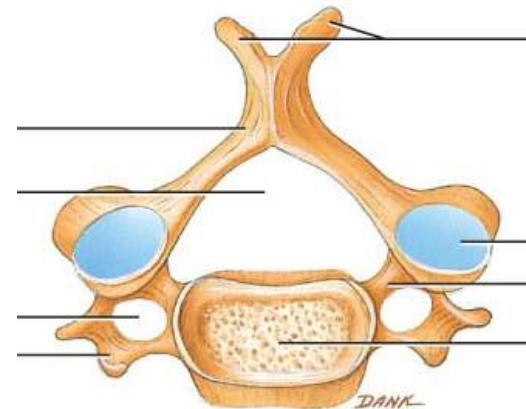
# Atlas & Axis (C1-C2)



- **Atlas -- ring of bone, superior facets for occipital condyles**
  - nodding movement at atlanto-occipital joint signifies “yes”
- **Axis -- dens or odontoid process is body of atlas**
  - pivotal movement at atlanto-axial joint signifies “no”

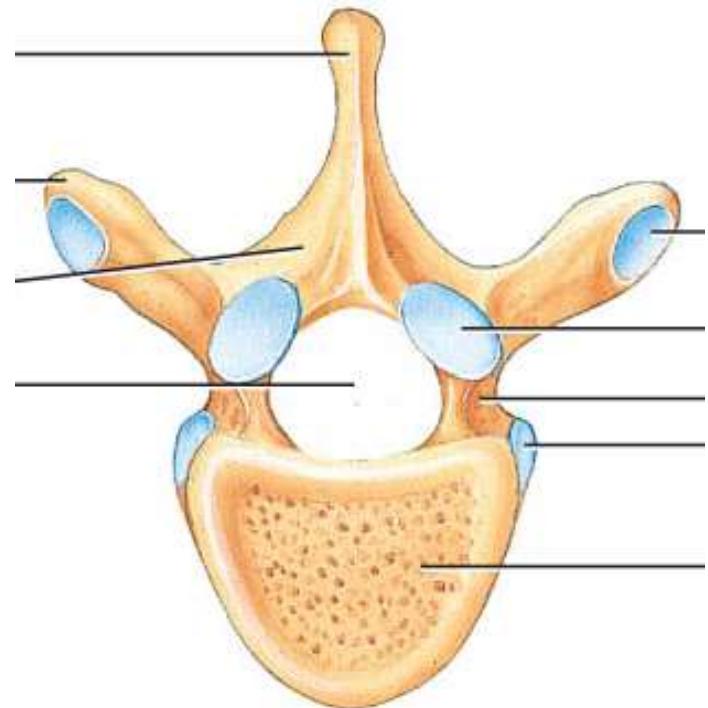
# Typical Cervical Vertebrae (C3-C7)

- Smaller bodies but larger spinal canal
- Transverse processes
  - shorter, with transverse foramen for vertebral artery
- Spinous processes of C2 to C6 often bifid



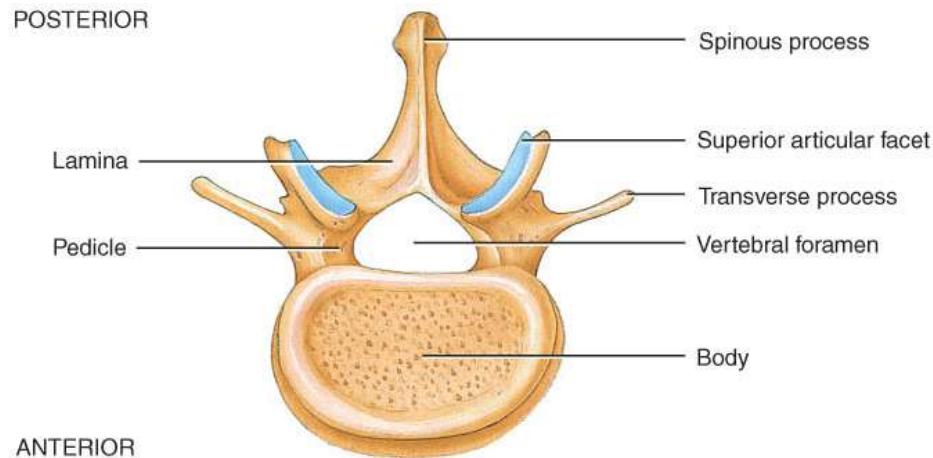
# Thoracic Vertebrae (T1-T12)

- Larger and stronger bodies
- Longer transverse & spinous processes
- Facets or demifacets on body for head of rib
- Facets on transverse processes (T1-T10) for tubercle of rib

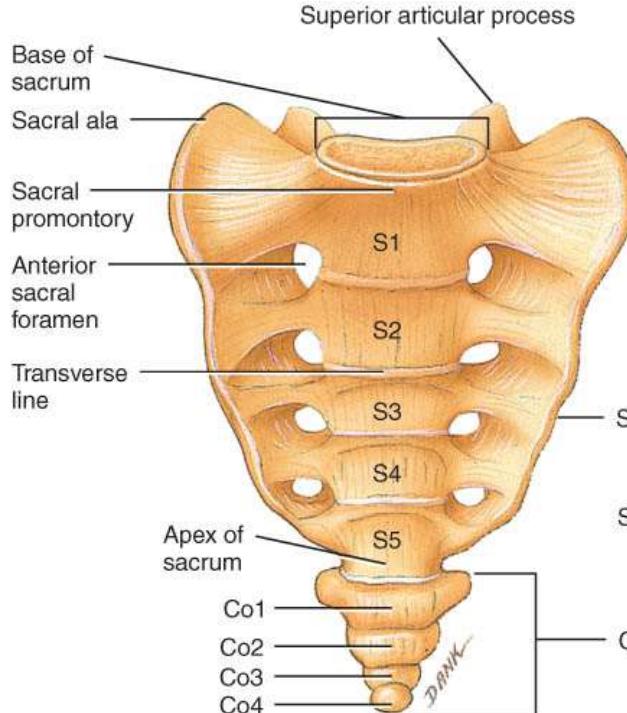


# Lumbar Vertebrae

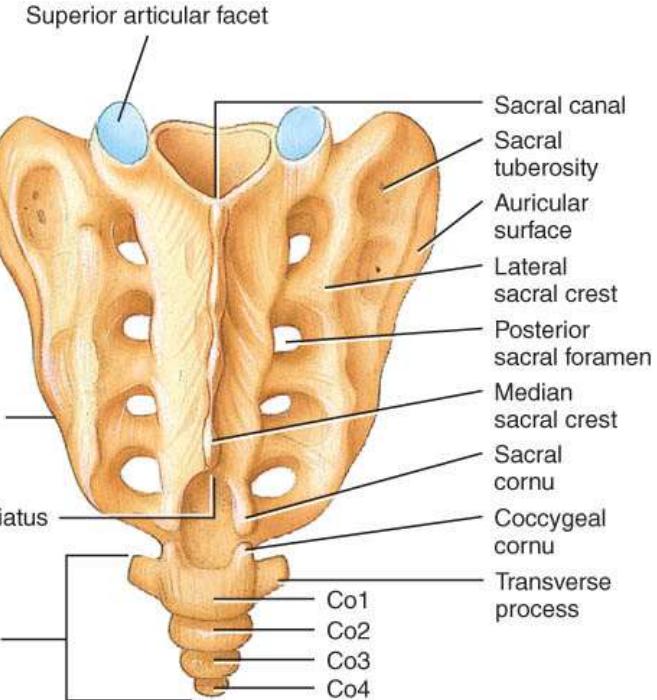
- Strongest & largest
- Short thick spinous & transverse processes
  - back musculature



# Sacrum



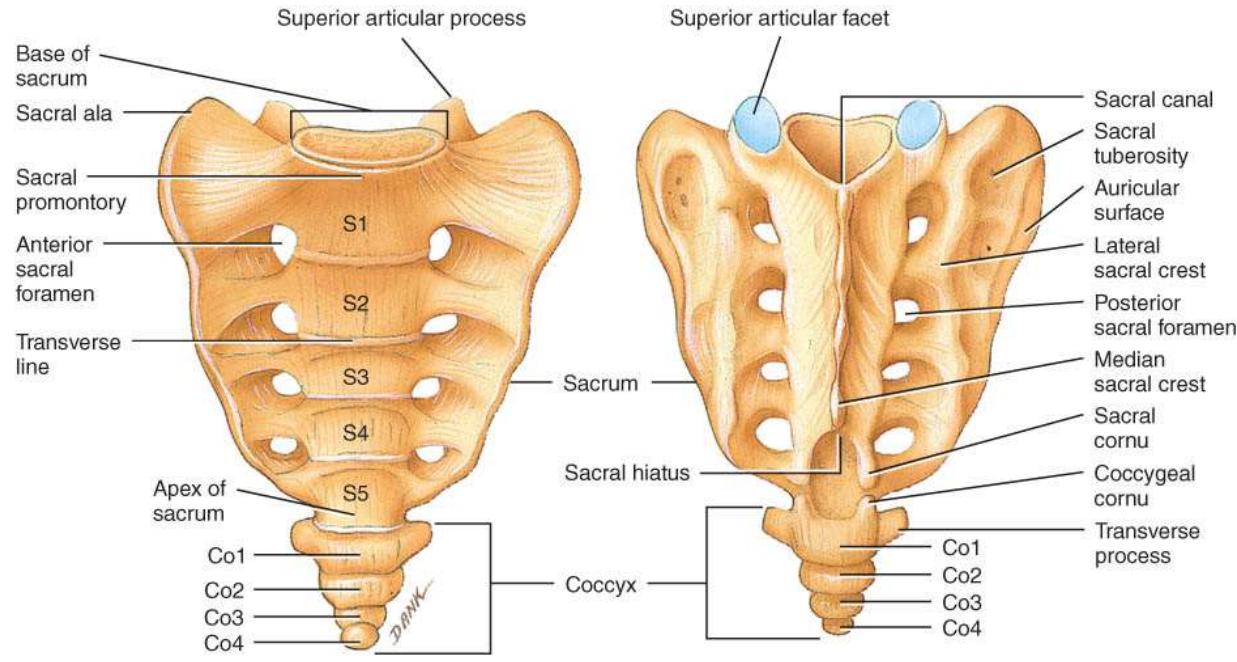
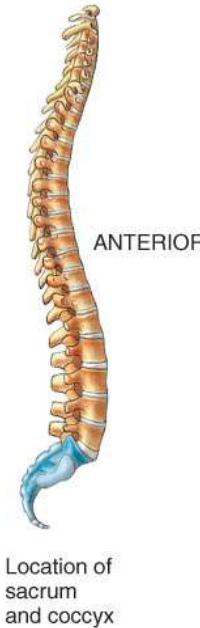
(a) Anterior view



(b) Posterior view

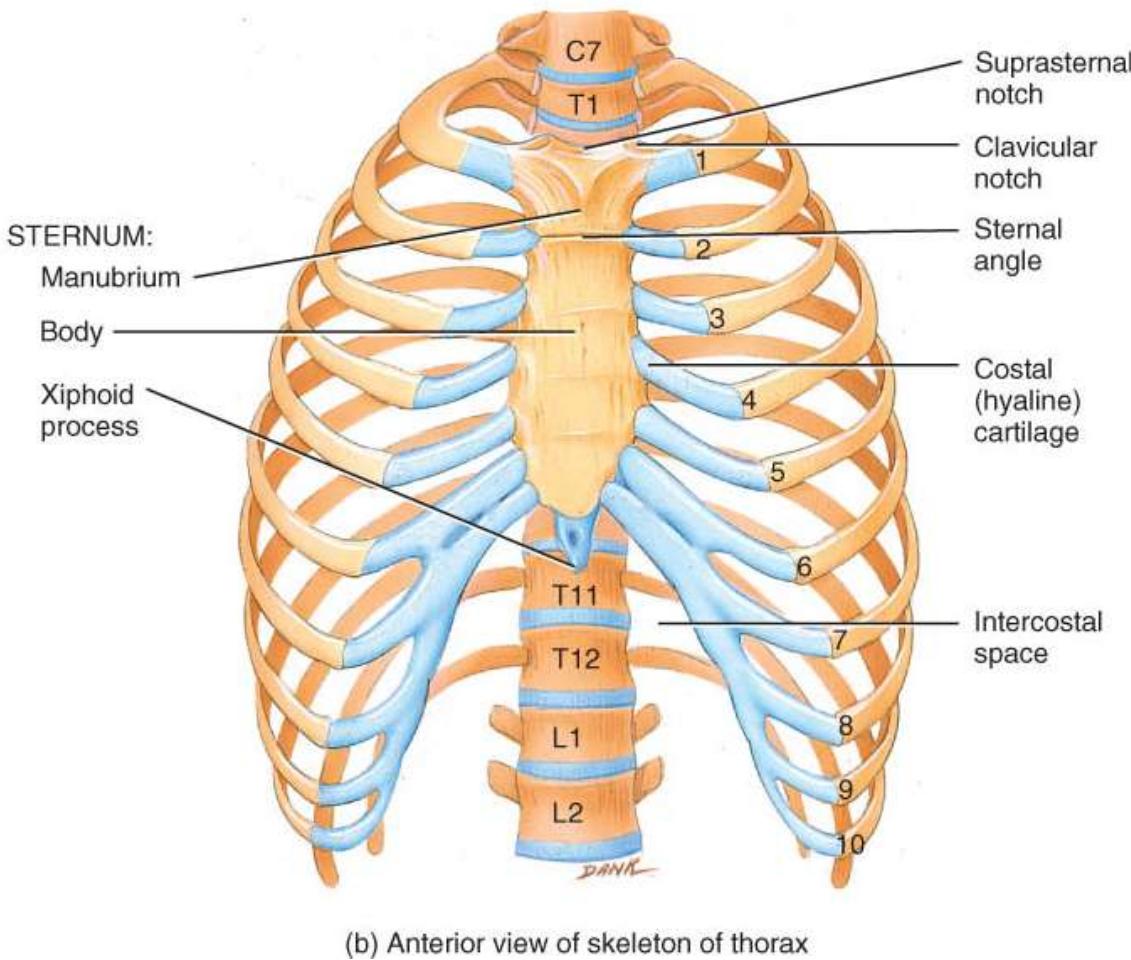
- Union of 5 vertebrae (S1 - S5) by age 30
  - median sacral crest was spinous processes
  - sacral ala (aye-la) is fused transverse processes
- Sacral canal ends at sacral hiatus

# Coccyx



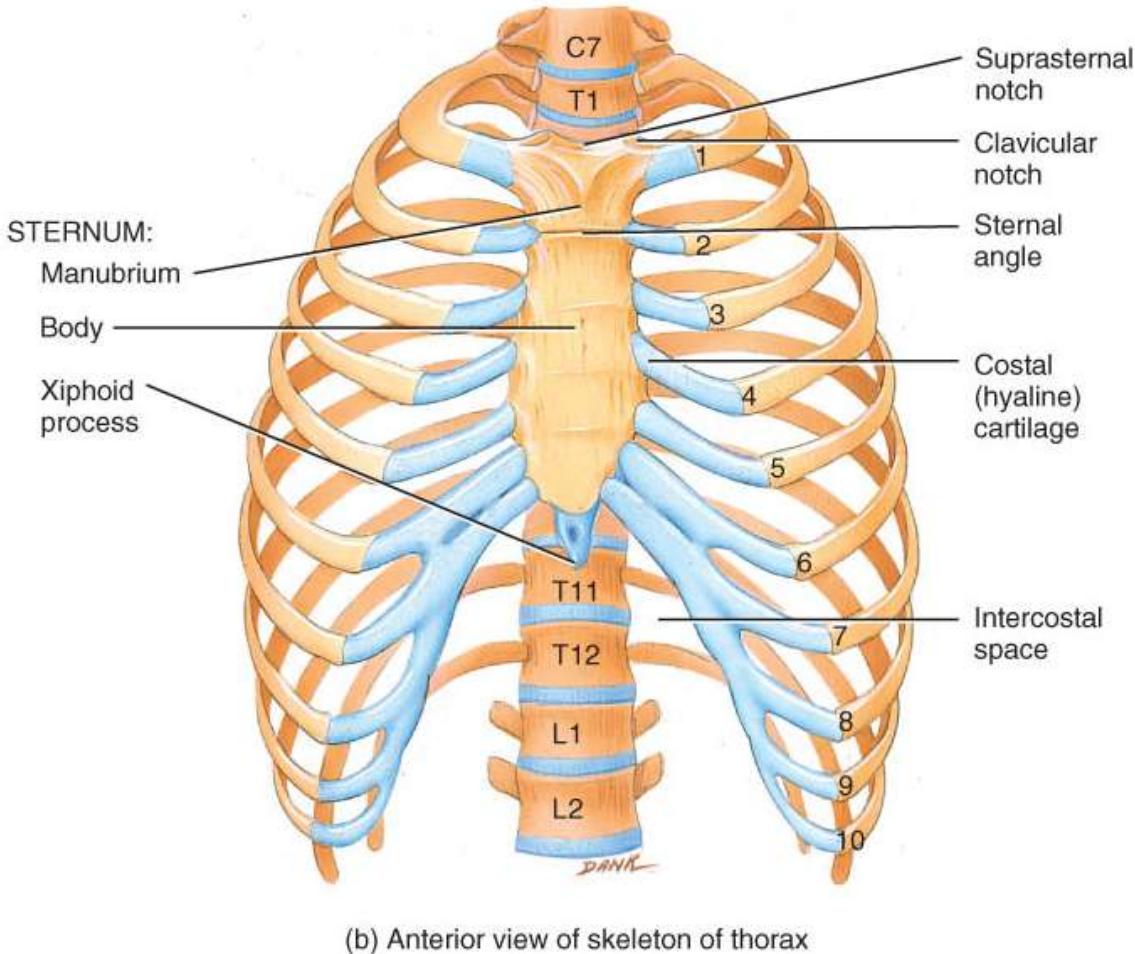
- Union of 3-5 vertebrae (Co1 - Co4) by age 30

# Thorax



- Bony cage flattened from front to back
- Sternum (breastbone)
- Ribs
  - 1-7 are true ribs (vertebrosternal)
  - 8-10 are false ribs (vertebrochondral)
  - 11-12 are floating (vertebral)
- Costal cartilages
- Bodies of the thoracic vertebrae.

# Sternum



- Manubrium
  - 1st & 2nd ribs
  - clavicular notch
- Body
  - costal cartilages of 2-10 ribs
- Xiphoid
  - ossifies by 40
  - CPR position
  - abdominal muscles
- Sternal puncture
  - biopsy

# Appendicular Skeleton

# INTRODUCTION

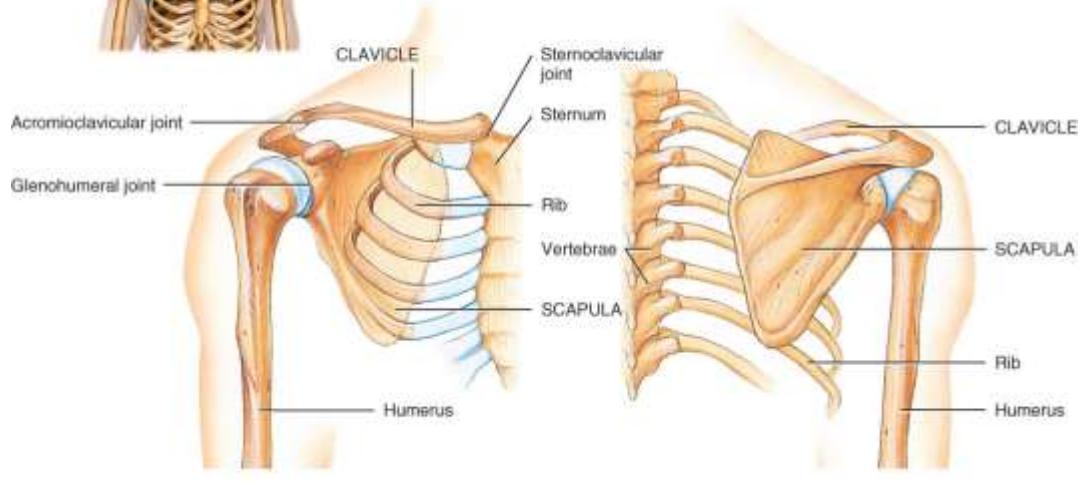
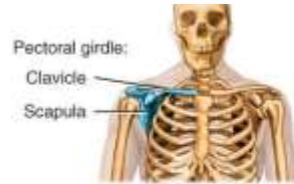
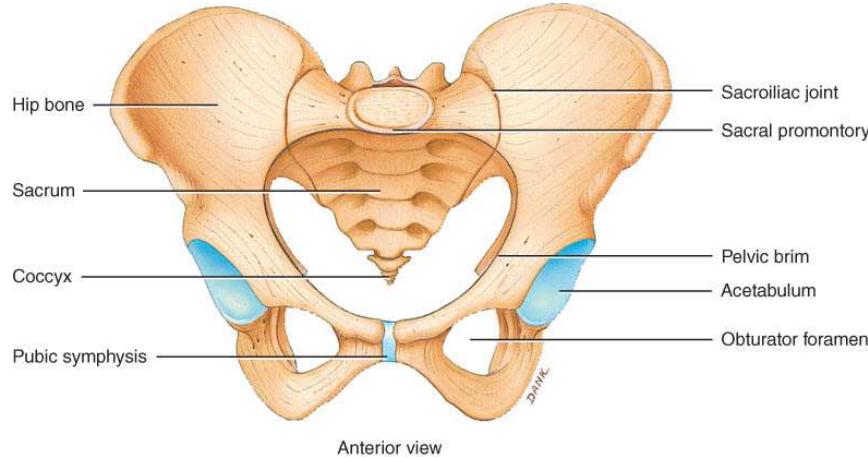
- The *appendicular skeleton* includes the bones of the upper and lower extremities and the shoulder and hip girdles.
- The appendicular skeleton functions primarily to facilitate movement.

# Appendicular Skeleton



## Four parts

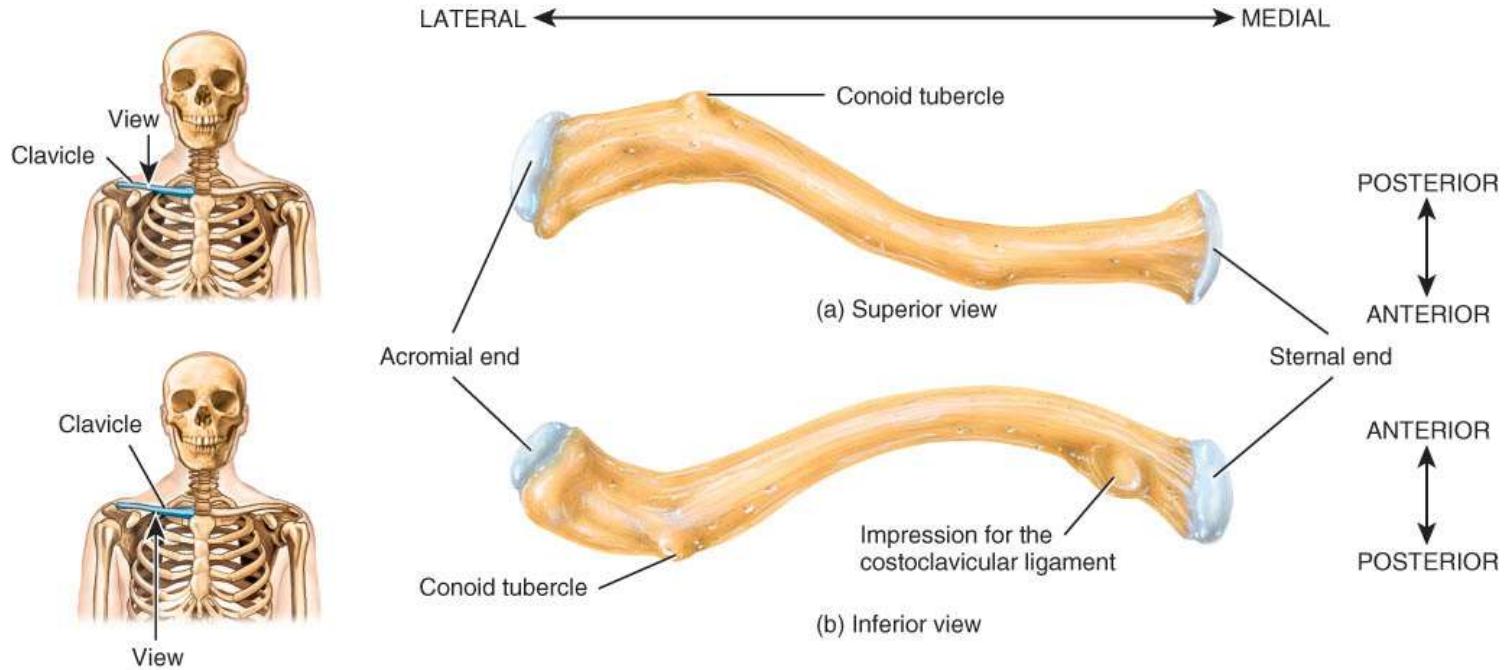
1. Pectoral girdle
2. Pelvic girdle
3. Upper limbs
4. Lower limbs



# Pectoral (Shoulder) Girdle

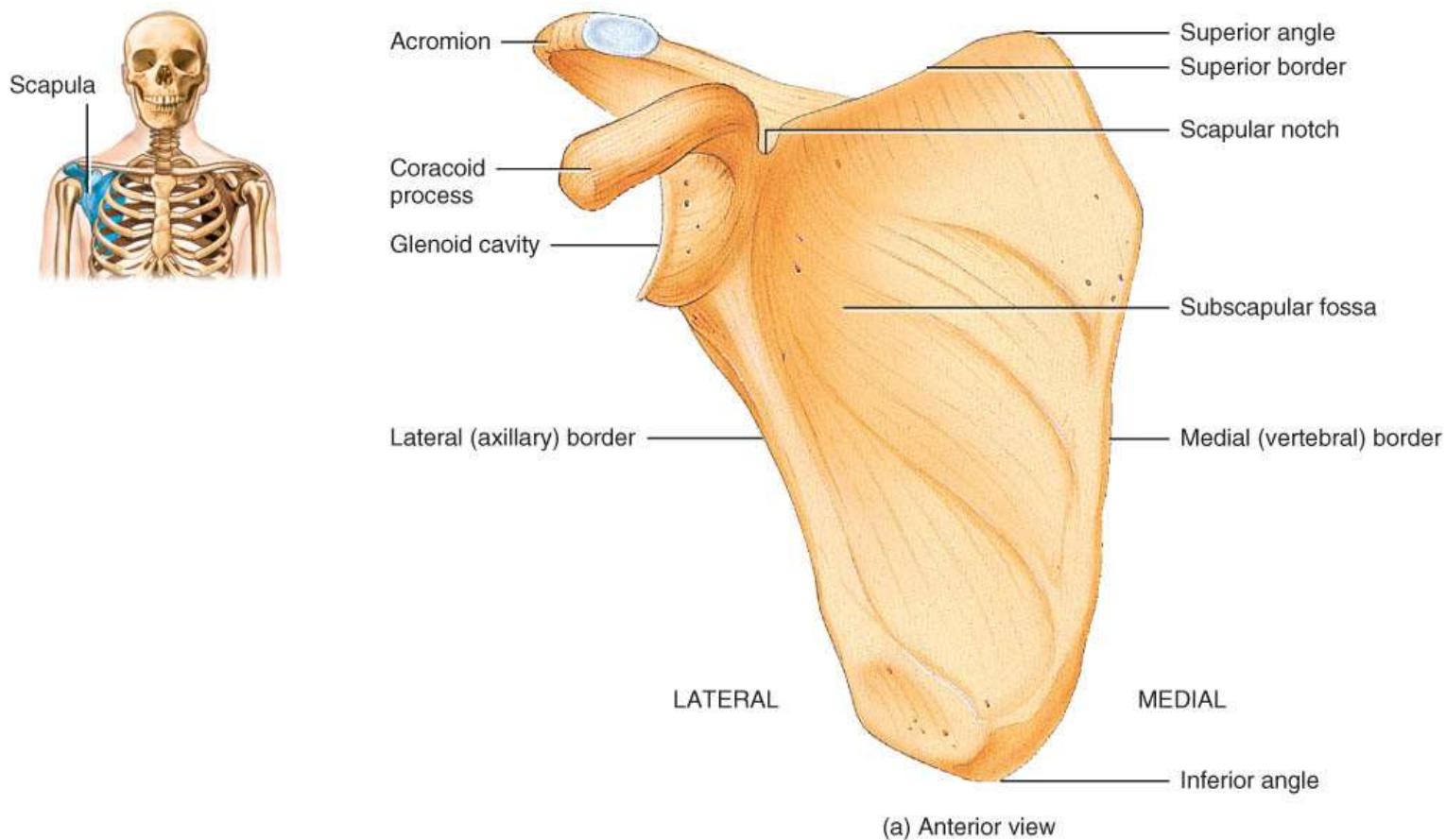
The *pectoral or shoulder girdle* attaches the bones of the upper limbs to the axial skeleton.

- Consists of scapula and clavicle
- Scapula held in place by muscle only
- Upper limb attached to pectoral girdle at shoulder (glenohumeral joint)



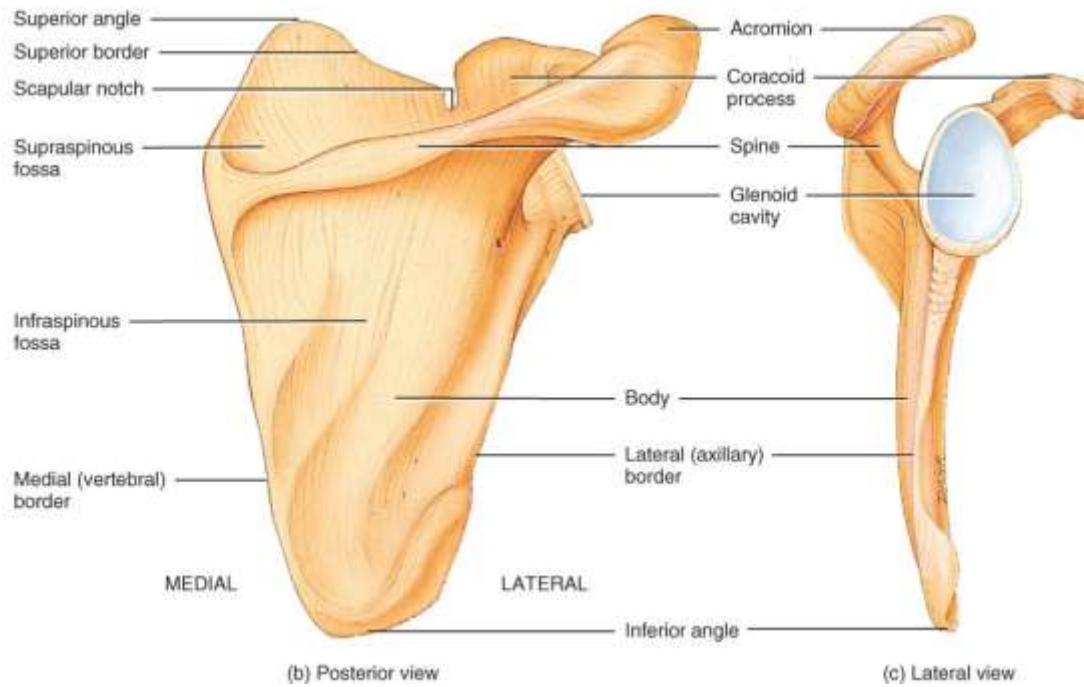
- S-shaped bone with two curves
- Extends from sternum to scapula above 1st rib
- Fracture site is junction of curves

# Anterior Surface of Scapula

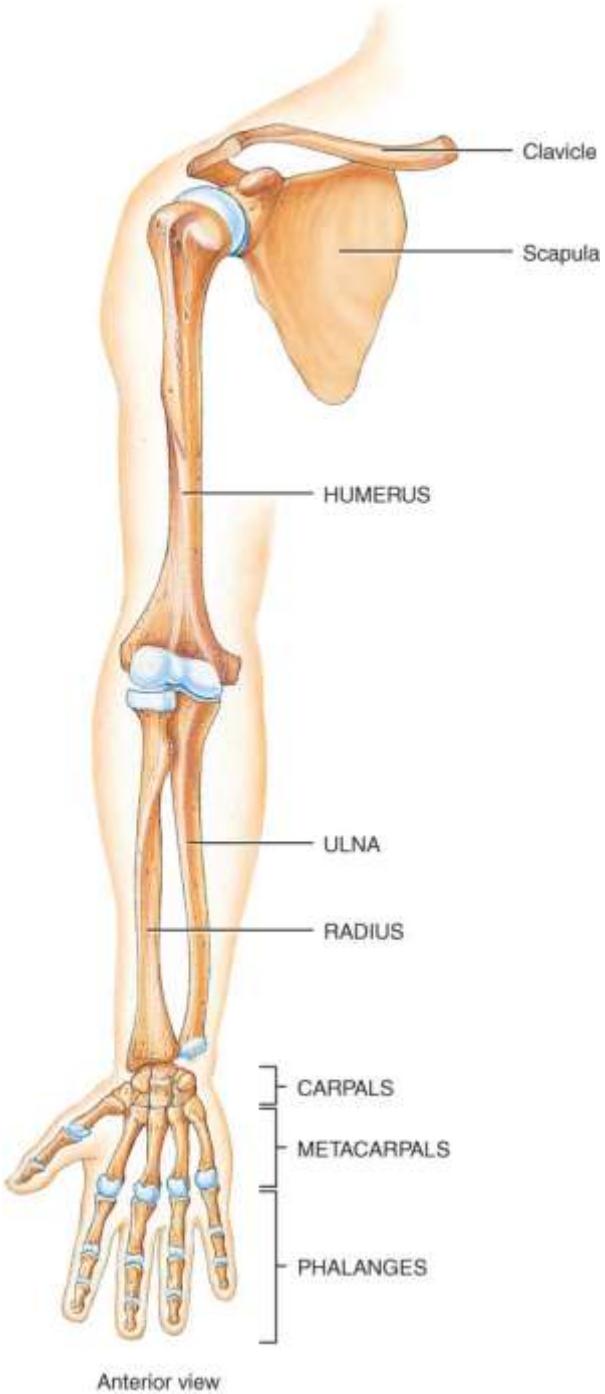


- Subscapular fossa filled with muscle
- Coracoid process for muscle attachment

# Posterior Surface of Scapula



- Triangular flat bone found in upper back region
- Glenoid cavity forms shoulder joint with head of humerus
- Supraspinous & infraspinous fossa for muscular attachments

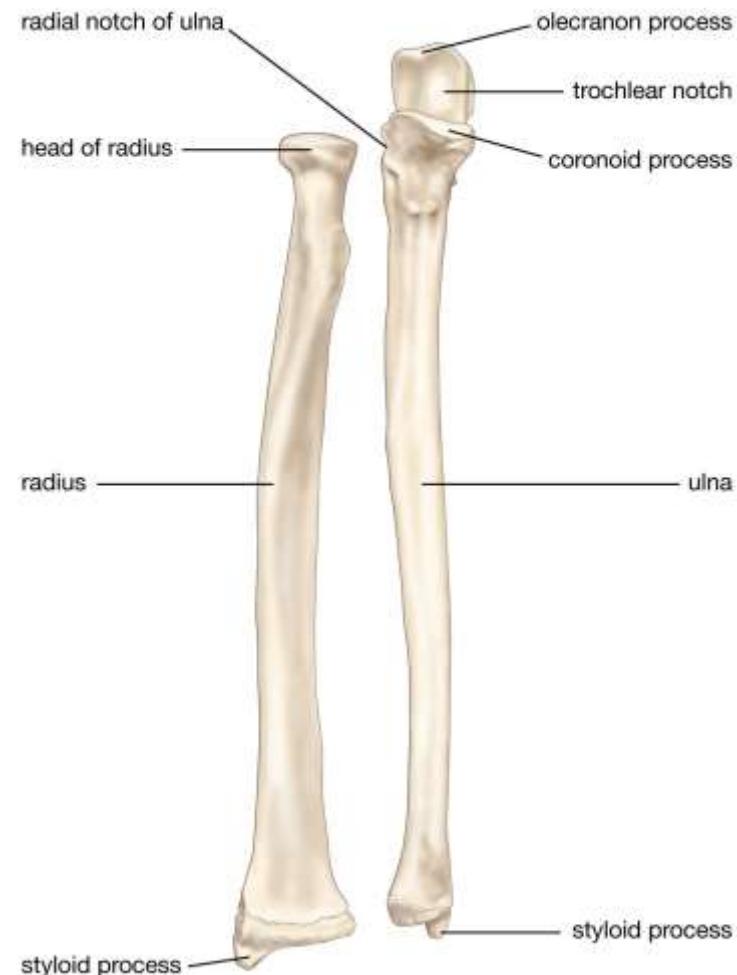


# Upper Extremity

- Each upper limb = 30 bones
  - humerus within the arm
  - ulna & radius within the forearm
  - carpal bones within the wrist (8)
  - metacarpal bones within the palm
  - phalanges in the fingers (14)
- Joints
  - shoulder (glenohumeral), elbow, wrist, metacarpophalangeal, interphalangeal

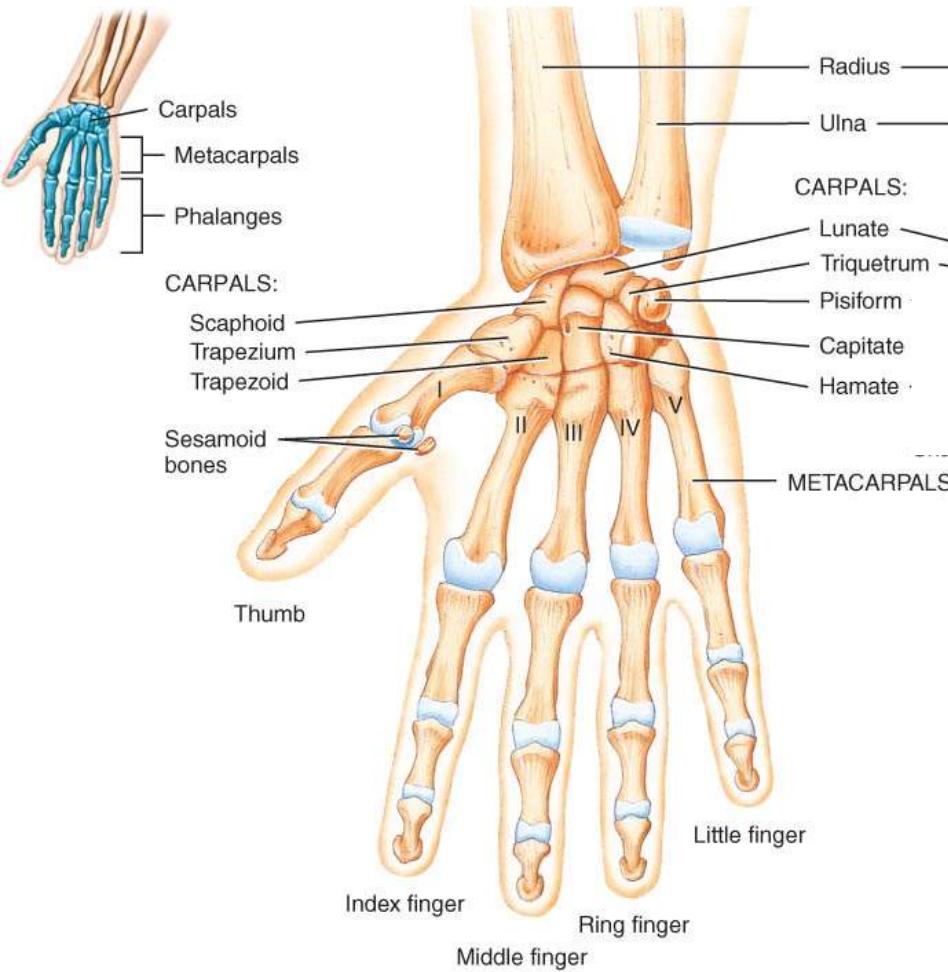
# Ulna & Radius

- Ulna (on little finger side)
  - trochlear notch articulates with humerus & radial notch with radius
  - olecranon process forms point of elbow
- Radius (on thumb side)
  - head articulates with capitulum of humerus & radial notch of ulna
  - tuberosity for muscle attachment

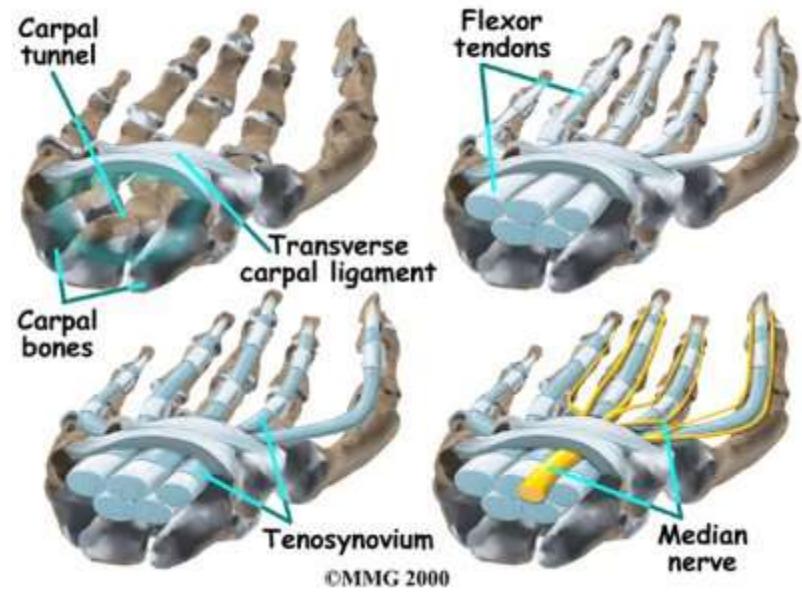


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# 8 Carpal Bones (wrist)



- Proximal row - lat to med

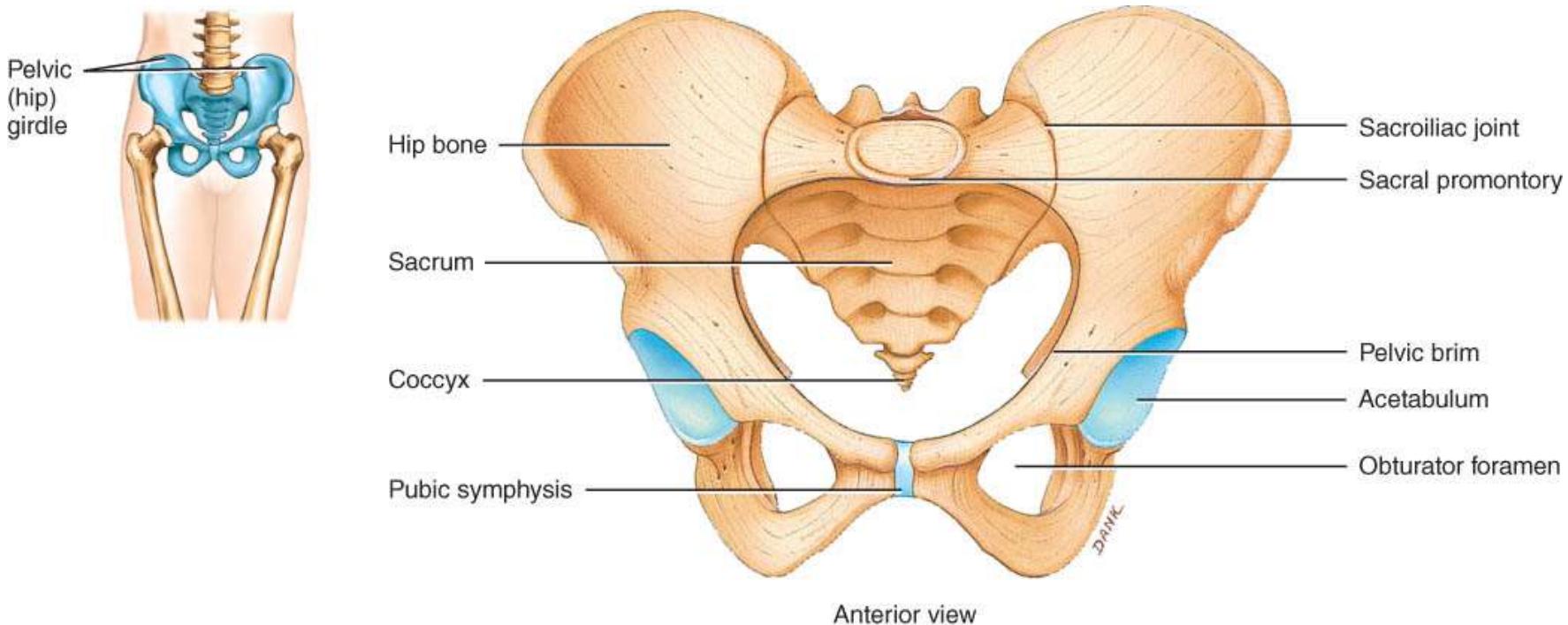


- hamate - hooked process
- Carpal tunnel--tunnel of bone & flexor retinaculum

**Stop Letting Those People Touch The Cadaver's Hand.**

Scaphoid, Lunate, Triquetrum, Pisiform, Trapezium, Trapezoid, Capitate, Hamate<sup>40</sup>

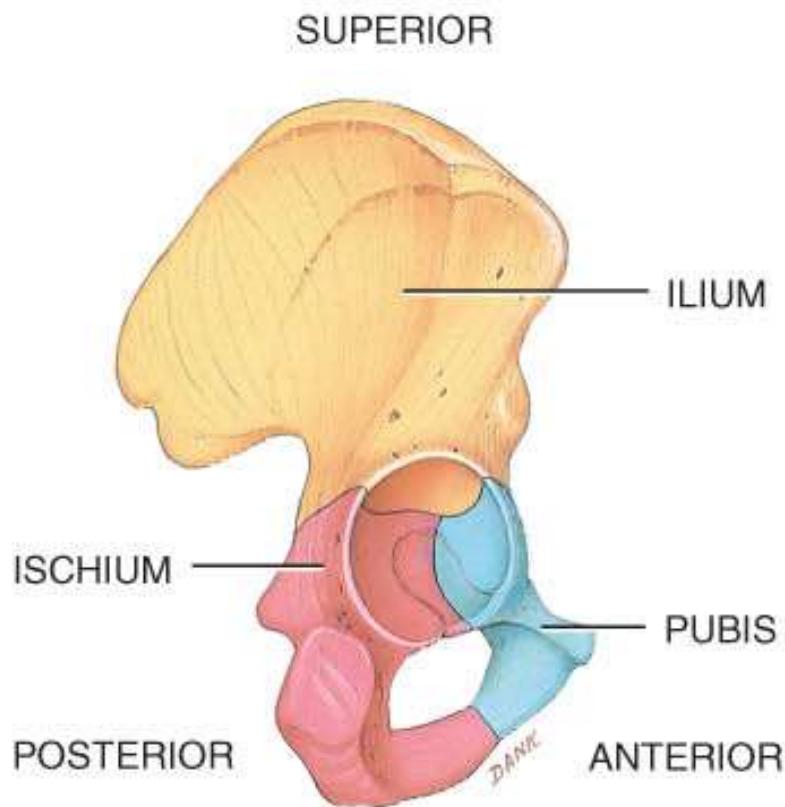
# Pelvic Girdle and Hip Bones



- Pelvic girdle = two hipbones united at pubic symphysis
  - articulate posteriorly with sacrum at sacroiliac joints
- Each hip bone = ilium, pubis, and ischium
  - fuse after birth at acetabulum
- Bony pelvis = 2 hip bones, sacrum and coccyx

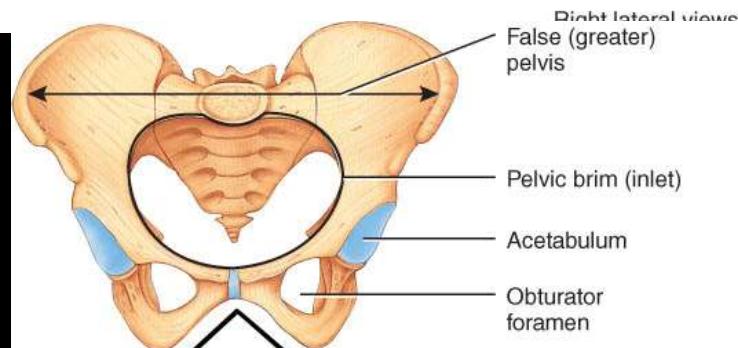
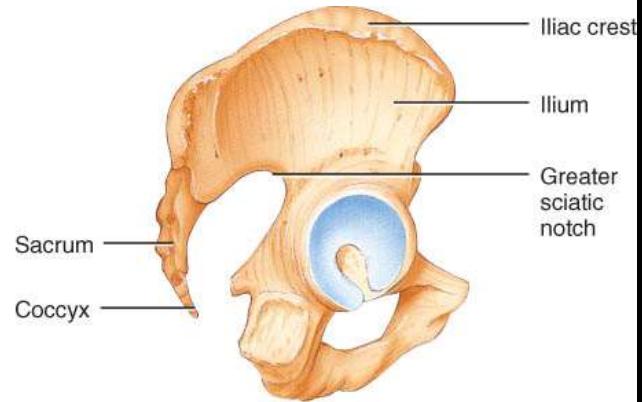
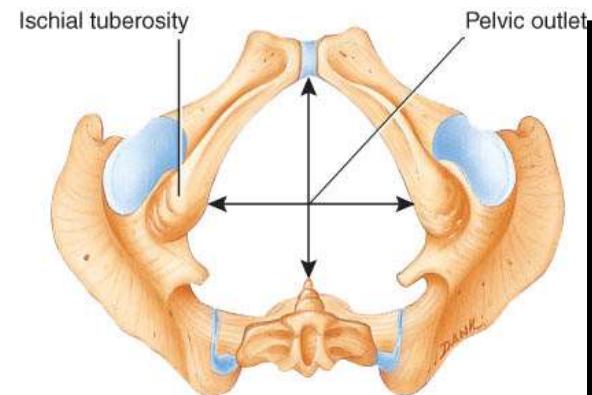
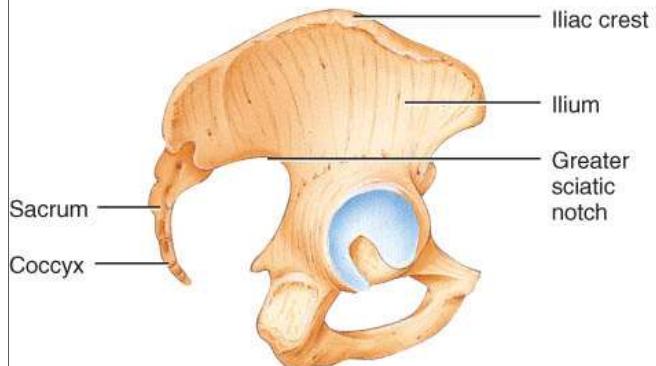
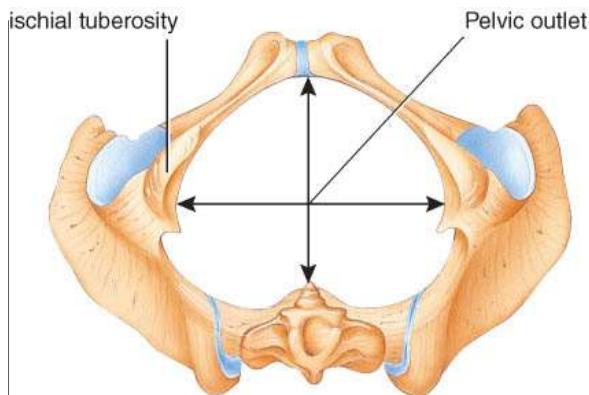


# Pelvic bones

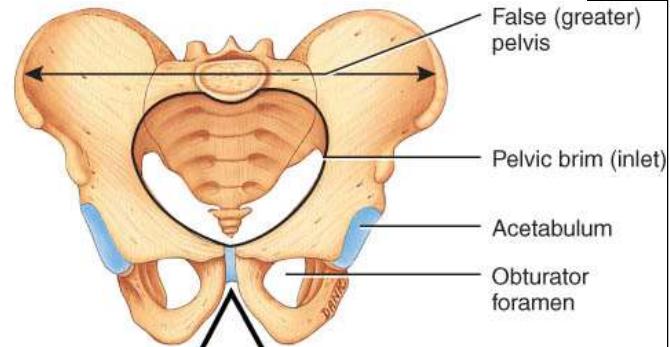


# Female and Male Skeletons

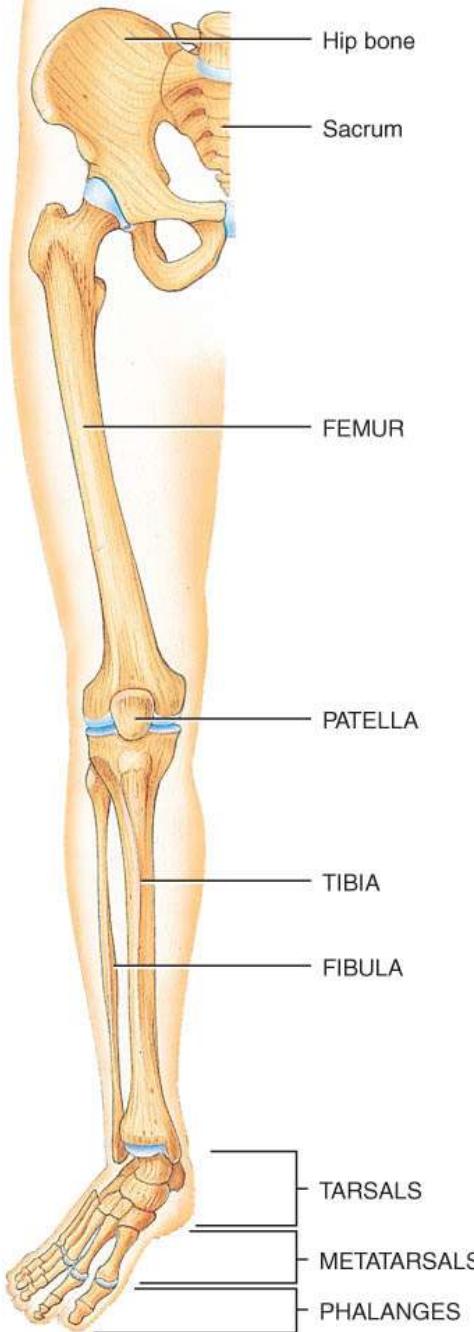
- Male skeleton
  - larger and heavier
  - larger articular surfaces
  - larger muscle attachments
- Female pelvis
  - wider & shallower
  - larger pelvic inlet & outlet
  - pubic arch >90 degrees



Pubic arch (greater than 90°)



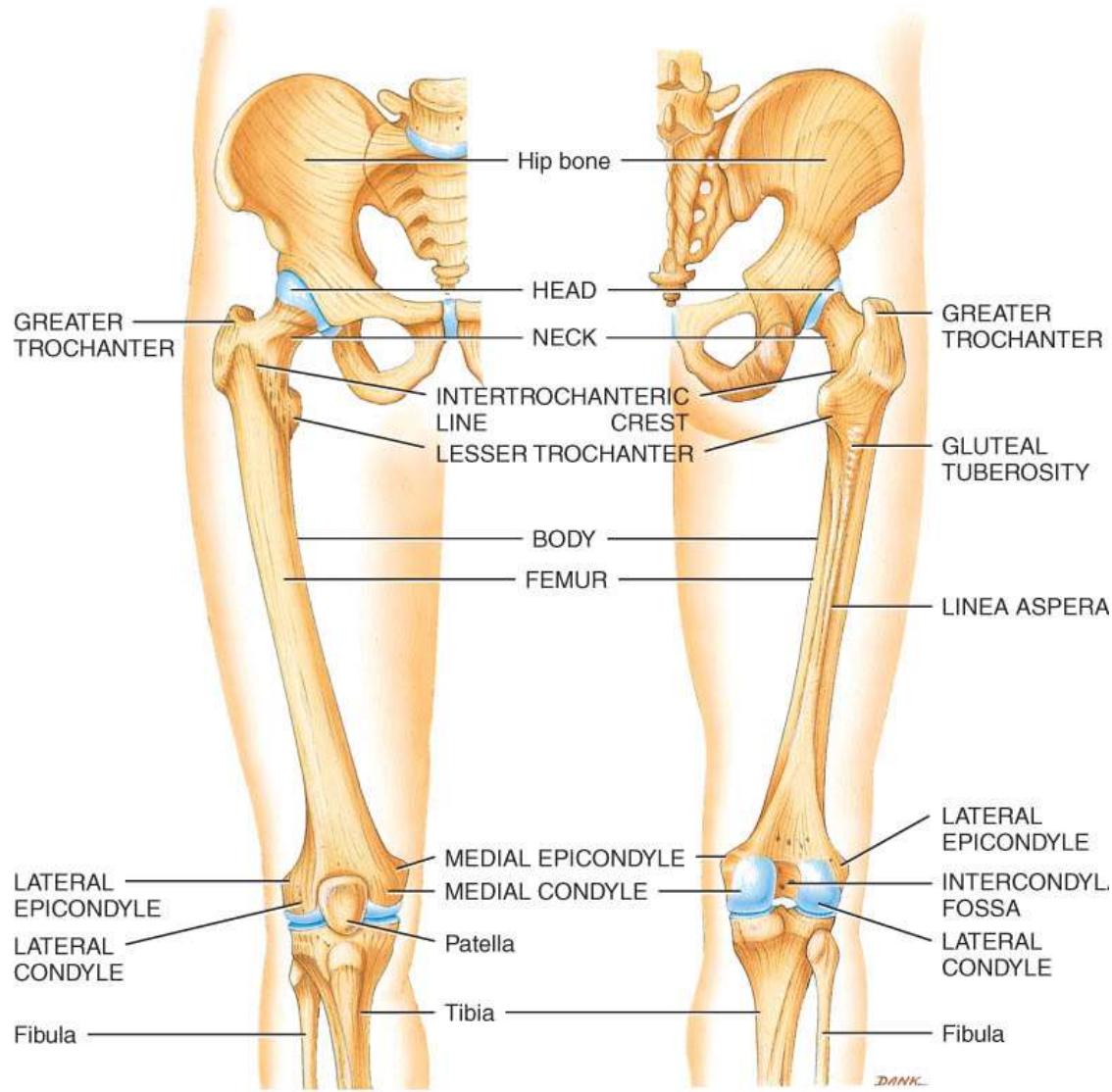
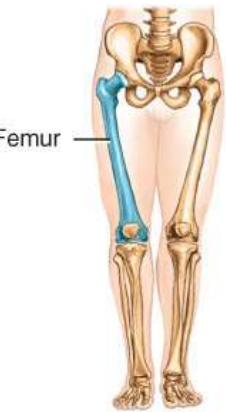
Pubic arch (less than 90°)



# Lower Extremity

- Each lower limb = 30 bones
  - femur and patella within the thigh
  - tibia & fibula within the leg
  - tarsal bones in the foot
  - metatarsals within the forefoot
  - phalanges in the toes
- Joints
  - hip, knee, ankle
  - proximal & distal tibiofibular
  - metatarsophalangeal

# Femur



(a) Anterior view

(b) Posterior view



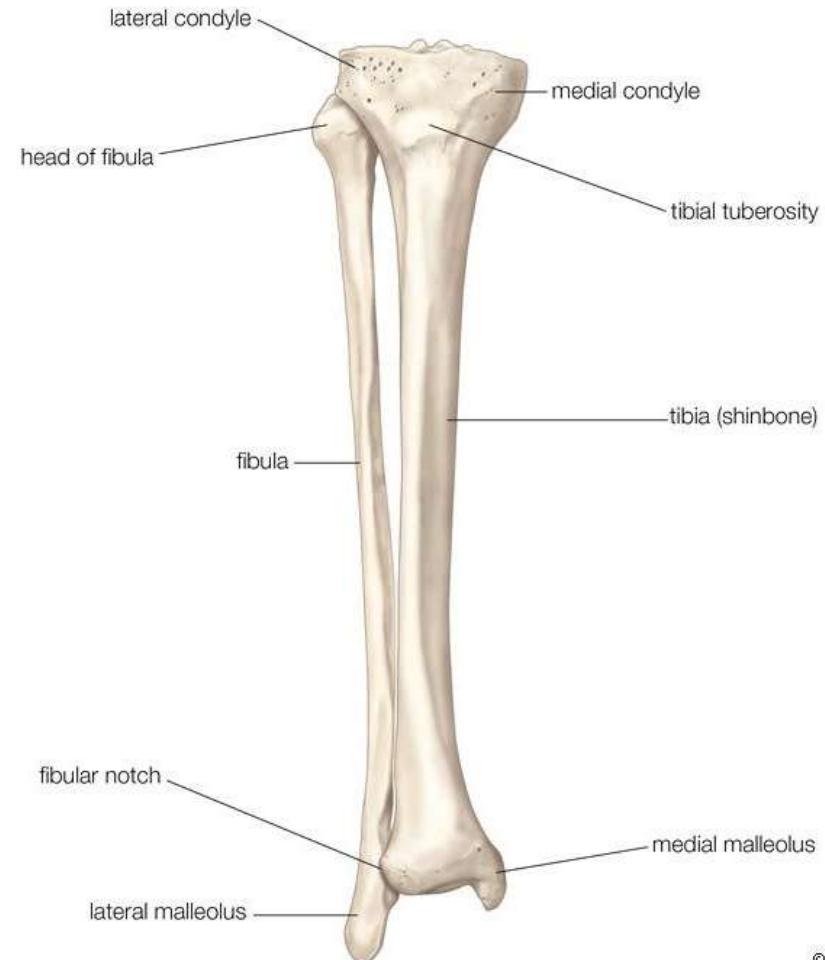
# Patella

- The *patella* or kneecap is a sesamoid bone located anterior to the knee joint .
- It functions to increase the leverage of the tendon of the quadriceps femoris muscle, to maintain the position of the tendon when the knee is bent, and to protect the knee joint.

# Tibia and Fibula

## Tibia

- Weight bearing bone



## Fibula

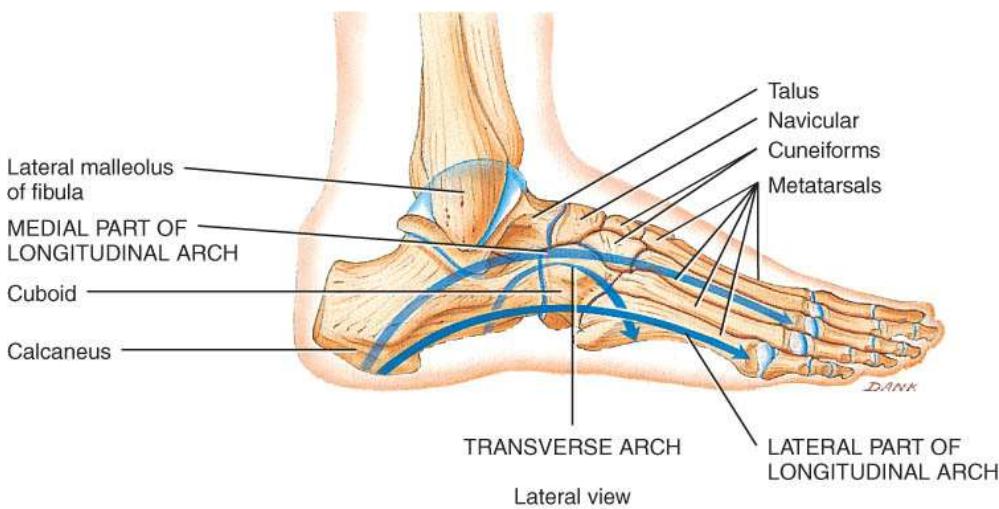
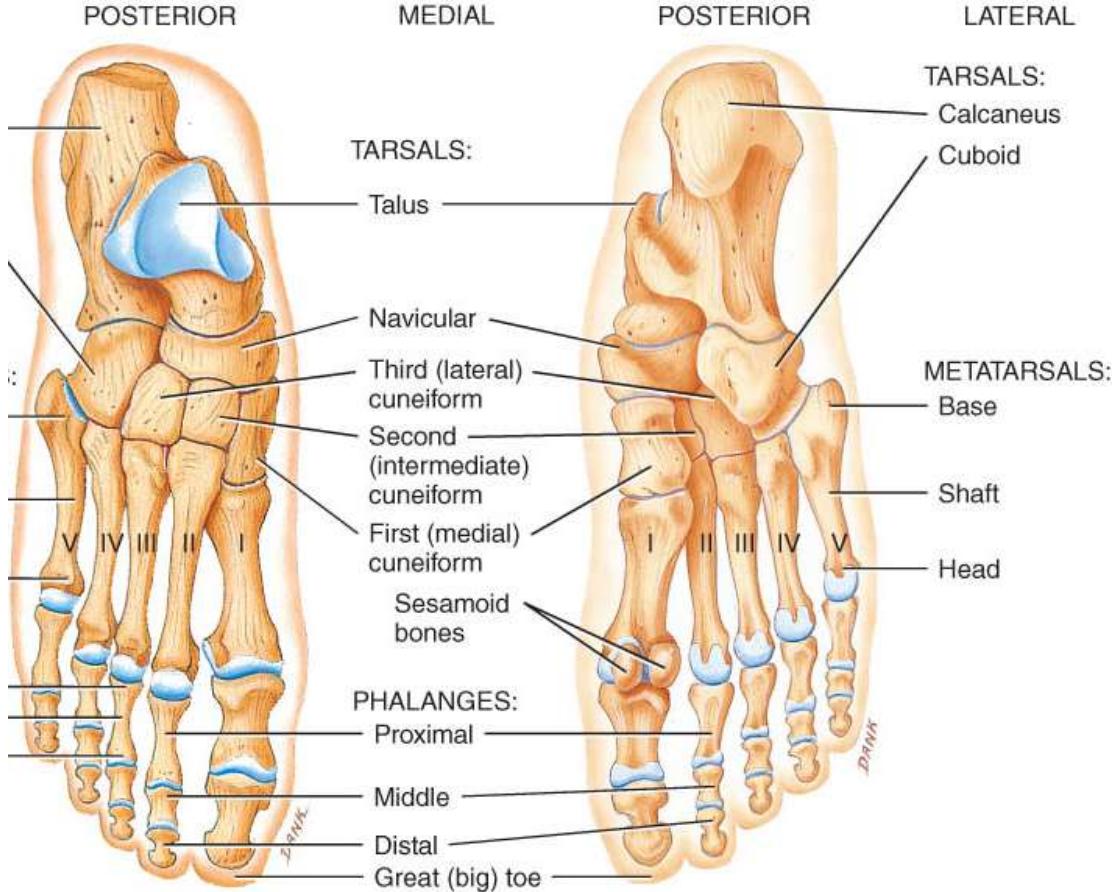
- not part of knee joint
- muscle attachment only

# Tarsals, Metatarsals, and Phalanges

- Seven *tarsal* bones constitute the *ankle* and share the weight associated with walking
- Five *metatarsal* bones are contained in the *foot*
  - Fractures of the metatarsals are common among dancers, especially ballet dancers.
- The arrangement of *phalanges* in the *toes* is the same as that described for the fingers and thumb above - fourteen bones in each foot

# Tarsus

- Proximal region of foot (contains 7 tarsal bones)
- Talus = ankle bone (articulates with tibia & fibula)
- Calcaneus - heel bone



# Arches of the Foot

- Function
  - distribute body weight over foot
  - yield & spring back when weight is lifted
- Longitudinal arches along each side of foot
- Transverse arch across midfoot region
  - navicular, cuneiforms & bases of metatarsals

