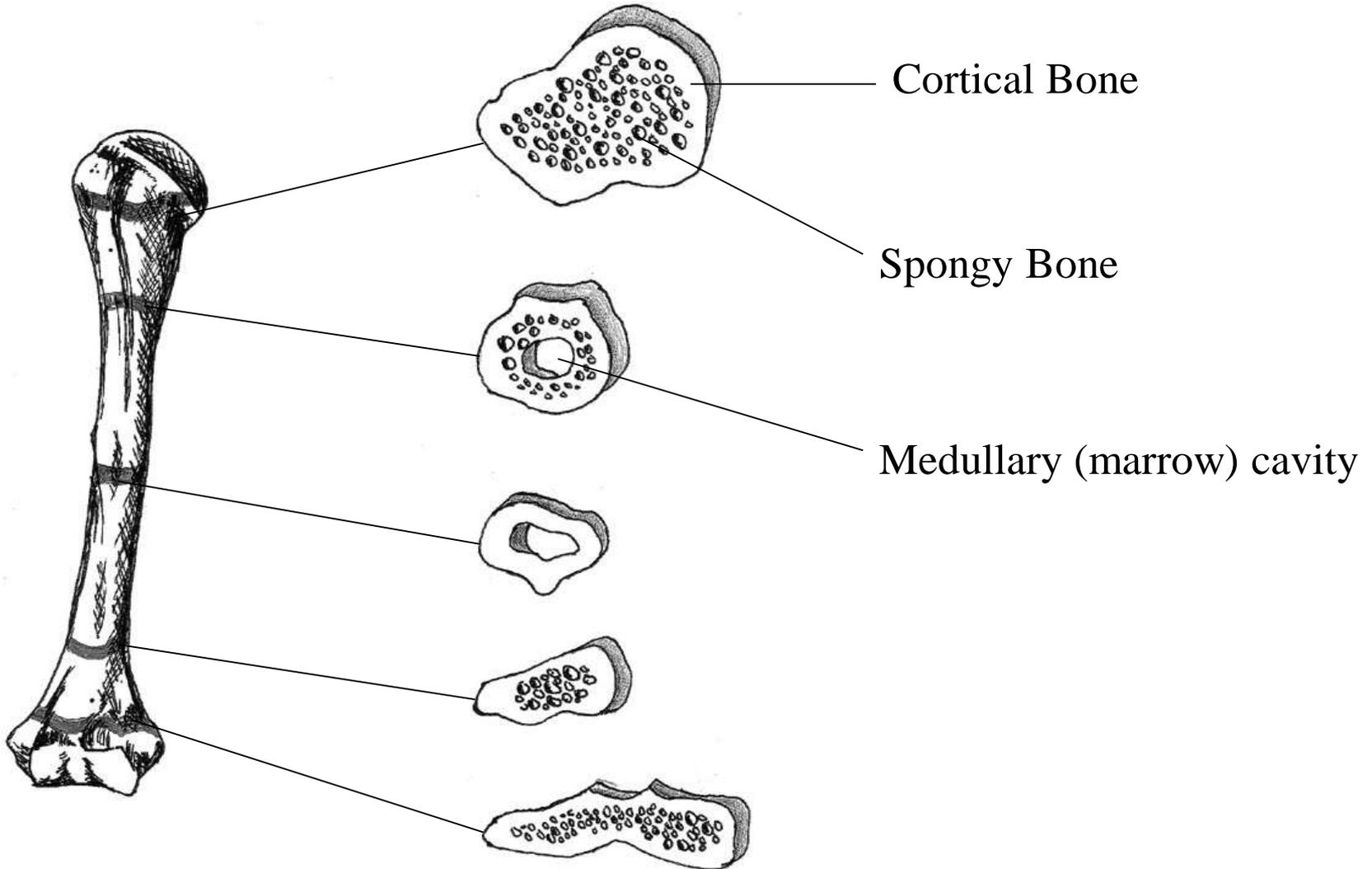


# Human Bones

# Bone Composition

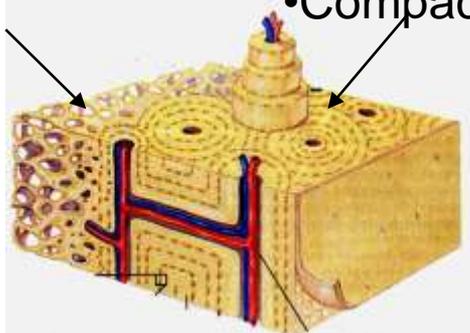


# Bone Composition Cont'd

- **Calcium carbonate and calcium phosphate:**
  - Make up 60-70% of bone weight
  - Provide much of the bone's stiffness and resistance to pressing or squeezing forces
- **Collagen (a protein):**
  - Gives bone its characteristic flexibility and contributes to its ability to resist pulling and stretching forces
  - With aging, collagen is lost progressively and bone becomes more brittle.
- **Water**
  - Bone consists of much smaller proportion of water than other body parts

# Bone Classification

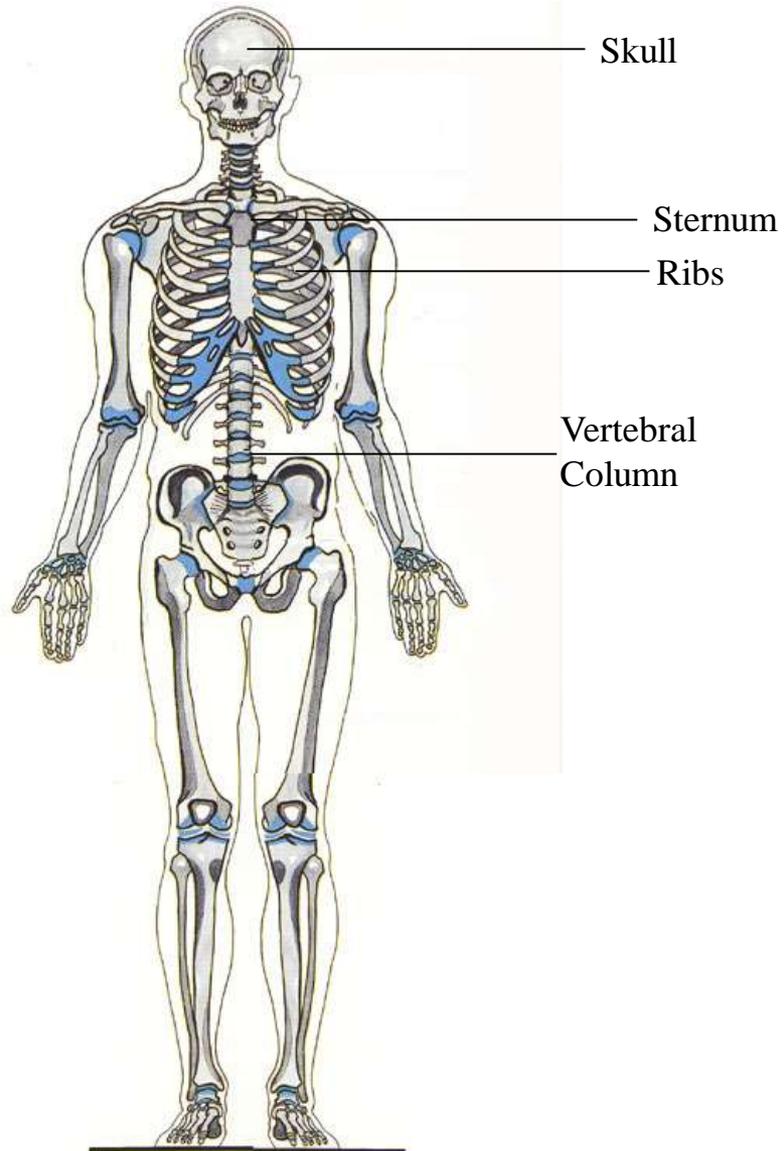
- According to the degree of porosity, bone can be classified into two general categories:
  - Cortical bone (low porosity)
  - Spongy or cancellous bone (high porosity)

	Cancellous bone	Compact Bone
•Porosity	• <b>High</b> (Low mineral content and high collagen)	• <b>Low</b> (High mineral content and low collagen)
•Structure	•Honey comb	•Compact
		
•Characteristic	•Provides more flexibility but is not as stress resistant	•Stiffer and can resist greater stress but less flexible
•Function	• <b>Shock absorption</b> due to its better ability to change shape are important	• <b>Withstanding stress</b> in body areas that are subject to higher impact loads
•Location	•e.g., vertebrae	•Long bones (e.g., bones of the arms and legs)

# Effect of Fitness on Bone

- When bones are subjected to regular physical activity and habitual loads, they tend to become denser and more mineralized
  - e.g. Right forearm of the right-handed tennis player is more dense than her left one from using it more frequently
- Inactivity works in the opposite direction, leading to a decrease in weight and strength.
  - e.g. Loss of bone mass has been noted in bed-ridden patients, inactive senior citizens, and astronauts

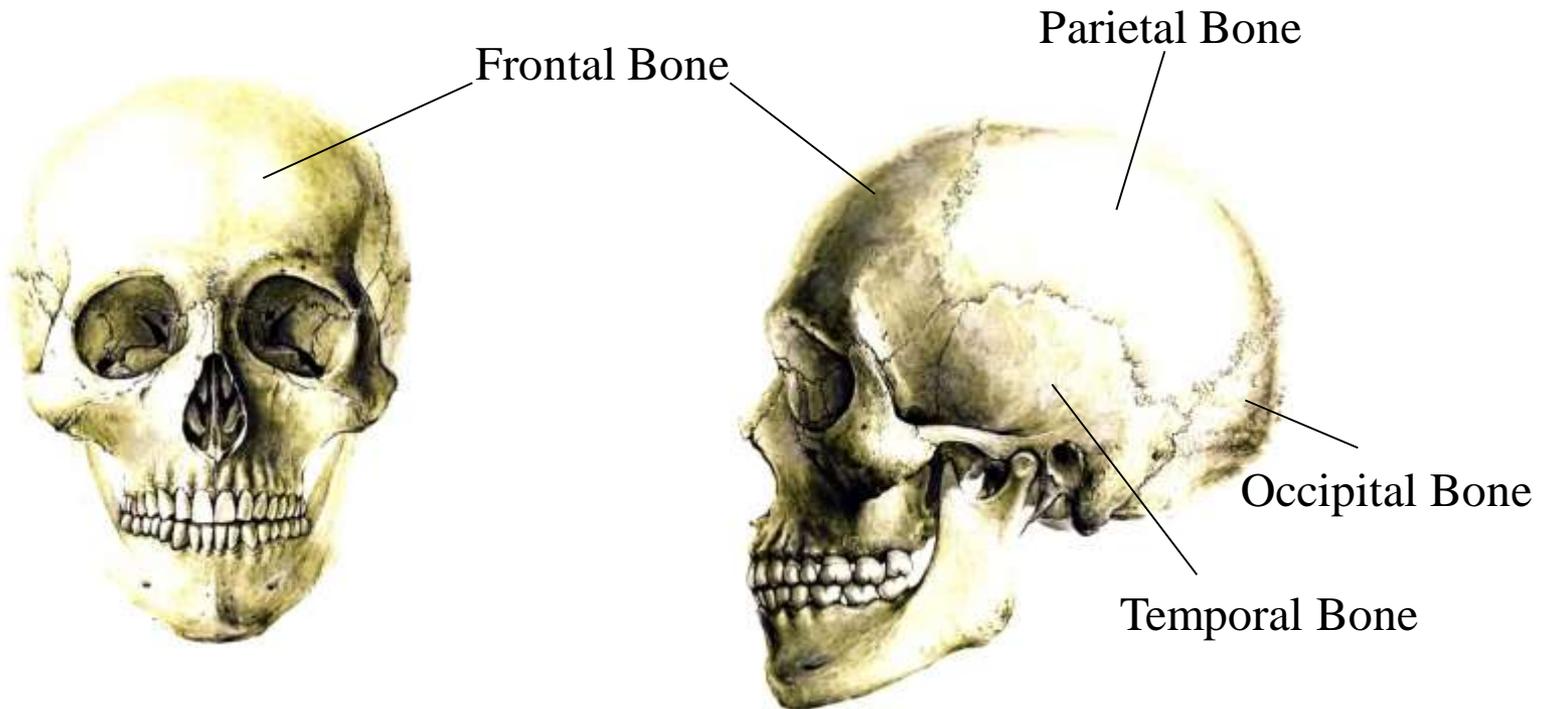
# Axial Skeleton



# Skull

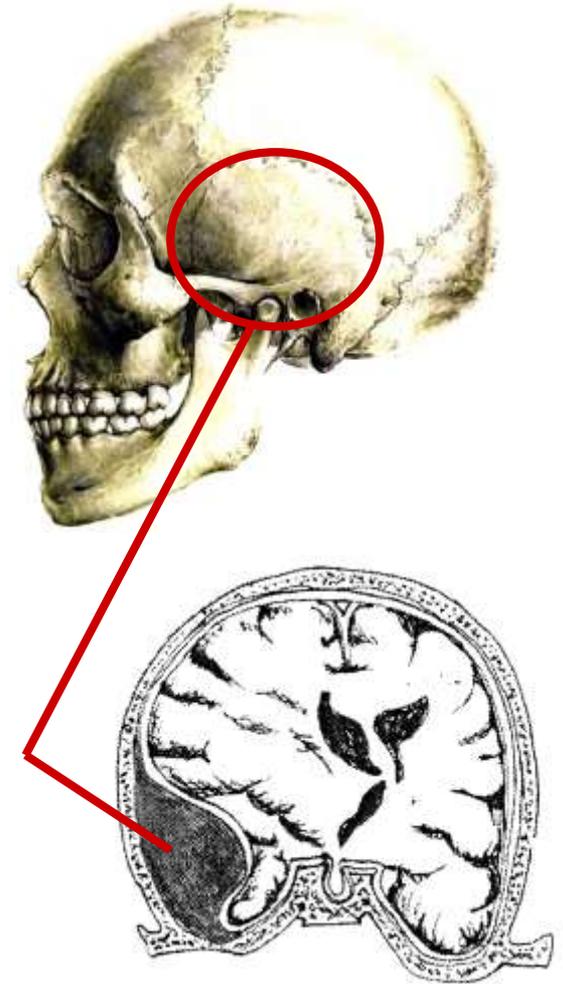
- Divided into two parts:
  - a) Calvaria
  - b) Face

# a) Calvaria

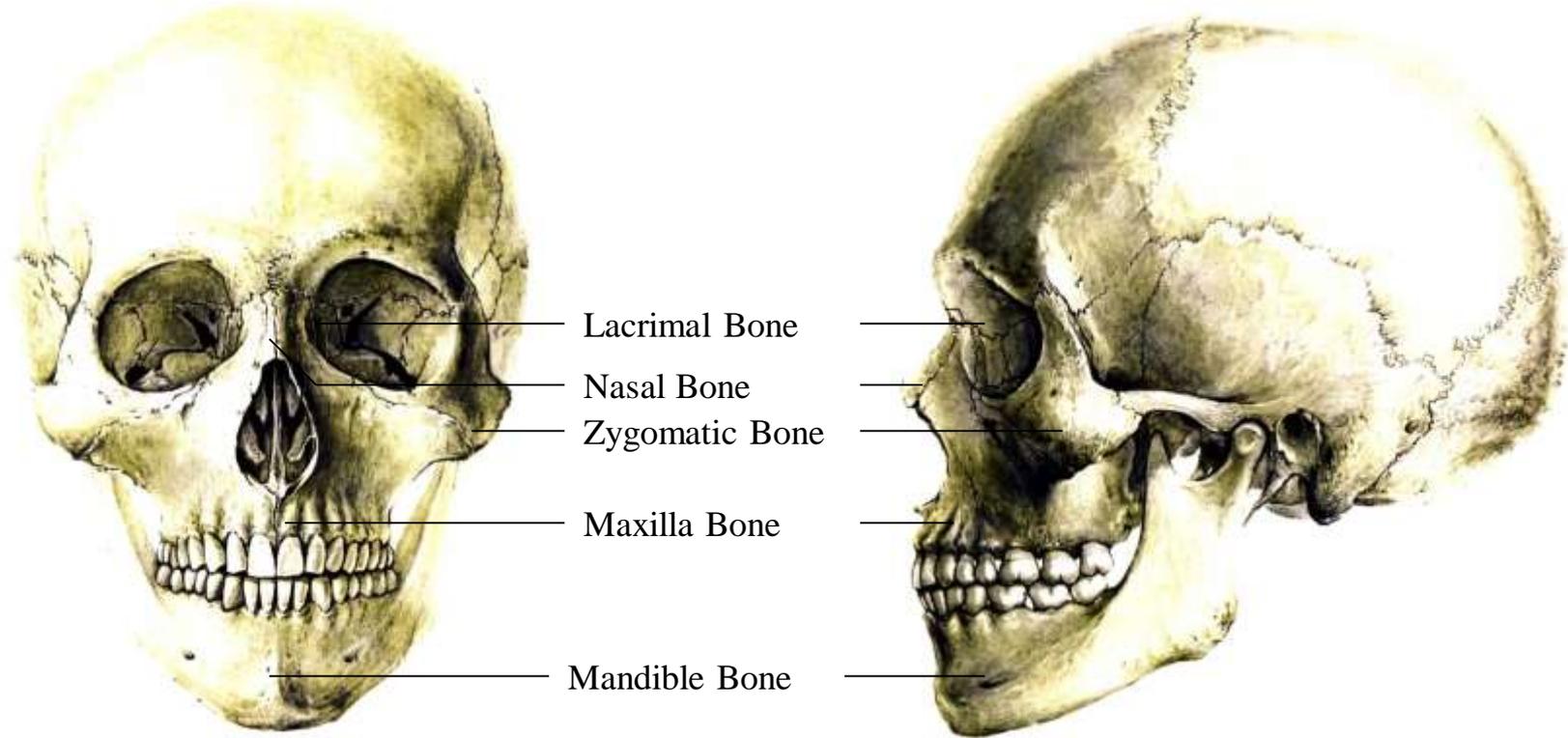


# Calvaria Cont.

- May be fractured in blows to the skull (e.g., in hockey, being checked and hitting the skull on the ice)
- Temporal bone:
  - more fragile of the calvaria bones
  - overlies one of the major blood vessels
  - if fractured and displaced internally = medical emergency (picture)



# b) Facial Bones



# Vertebral Column



7 Cervical Vertebrae (of the neck)

12 Thoracic Vertebrae (of the chest)

5 Lumbar Vertebrae (of the lower back)

Sacrum (mid-line region of buttocks)

Coccyx (4 or 5 fused vertebrae of the tail bone)

*Lumbar vertebra,  
lateral view*



*Lumbar vertebra,  
superior view*



# Vertebral Column

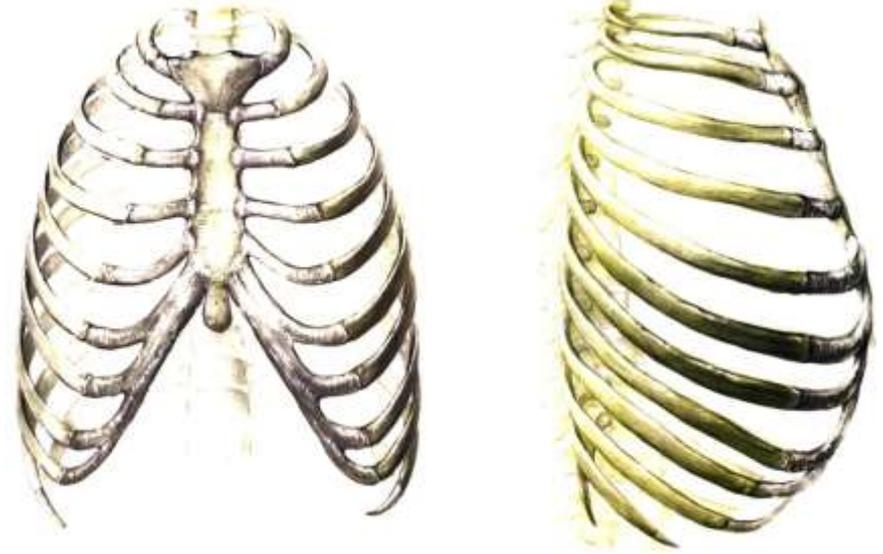
- Vertebrae are arranged in a cylindrical column interspersed with fibrocartilaginous (intervertebral) discs
- Function:
  - provides a strong and flexible support for the body and the ability to keep the body erect
  - the point of attachment for the muscles of the back.
  - protect the spinal cord and nerves
  - absorbs shock through the intervertebral discs without causing damage to other vertebrae

- Twelve pairs
- Made up of :

- bone

- cartilage which strengthen the chest cage and permit it to expand.

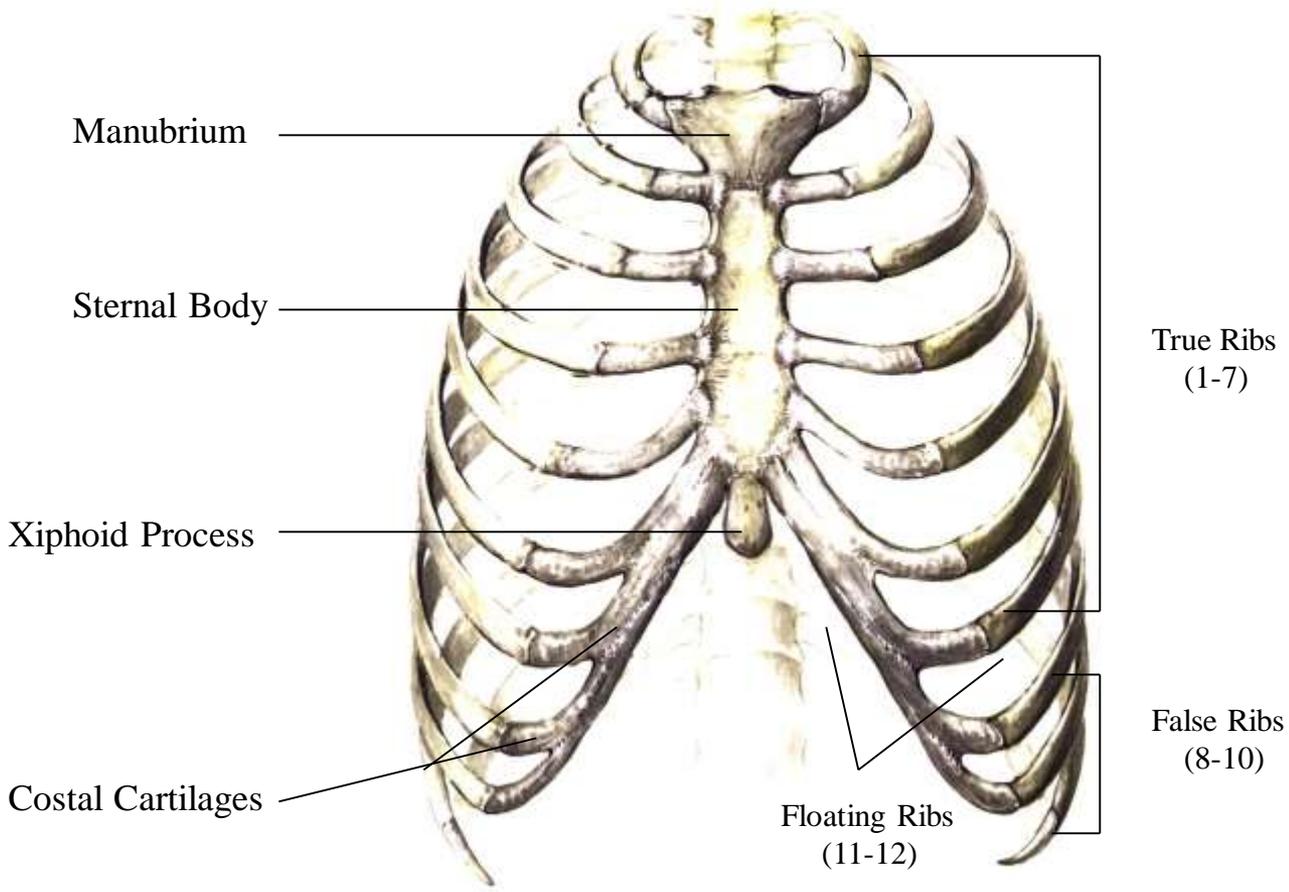
- Curved and slightly twisted making it ideal to protect the chest area



# Ribs Cont'd

- All 12 pairs of ribs articulate with the twelve thoracic vertebrae posteriorly
- Classified into three groups based on anterior attachment: (picture)
  - true ribs
    - 1-7
    - attach to both the vertebrae and the sternum
  - false ribs
    - 8-10
    - attach only to the sternum indirectly, through 7<sup>th</sup> rib
  - floating ribs
    - 11 and 12
    - only attach to the vertebral column

# The Ribs



Manubrium

Sternal Body

Xiphoid Process

Costal Cartilages

True Ribs  
(1-7)

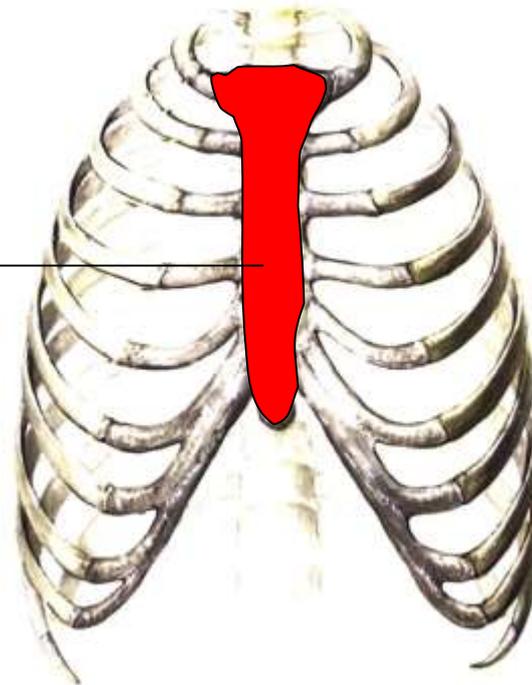
False Ribs  
(8-10)

Floating Ribs  
(11-12)

# Sternum

- Mid-line breast bone
- The clavicles and ribs one to seven articulate with the sternum

**Sternum** – comprised of the manubrium, sternal body and xiphoid process



# Appendicular skeleton

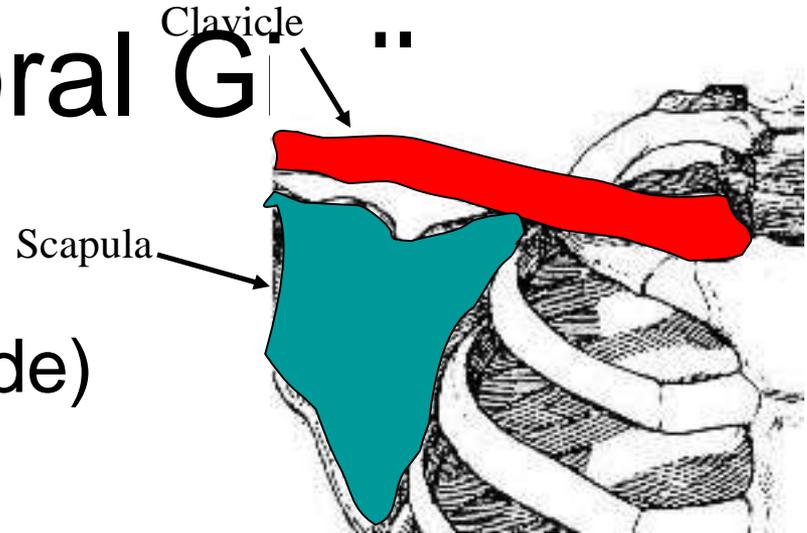
Consists of:

- 1. The pectoral girdle (chest)
- 2. Pelvic girdle (hip)
- 3. The upper limbs
- 4. The lower limbs

# 1. Pectoral Girdle

Consists of:

- Scapula (shoulder blade)
- Clavicle (collar bone)



- Allows the upper limb great mobility
- The sternoclavicular joint is the only point of attachment between the axial skeleton and the pectoral girdle

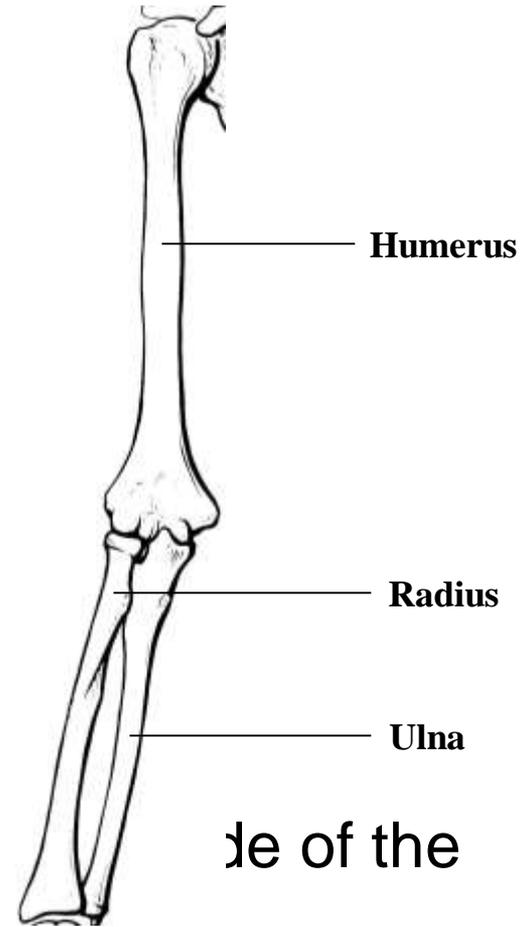
## 2. Pelvic Girdle

- Formed by pair of os coxae (hip bones)
- supports the bladder and abdominal contents
- Attachment:
  - Posteriorly – join with the sacrum
  - Anteriorly - join to each other anteriorly
  - Laterally – join to the head of thigh bone through a cup-shaped acetabulum

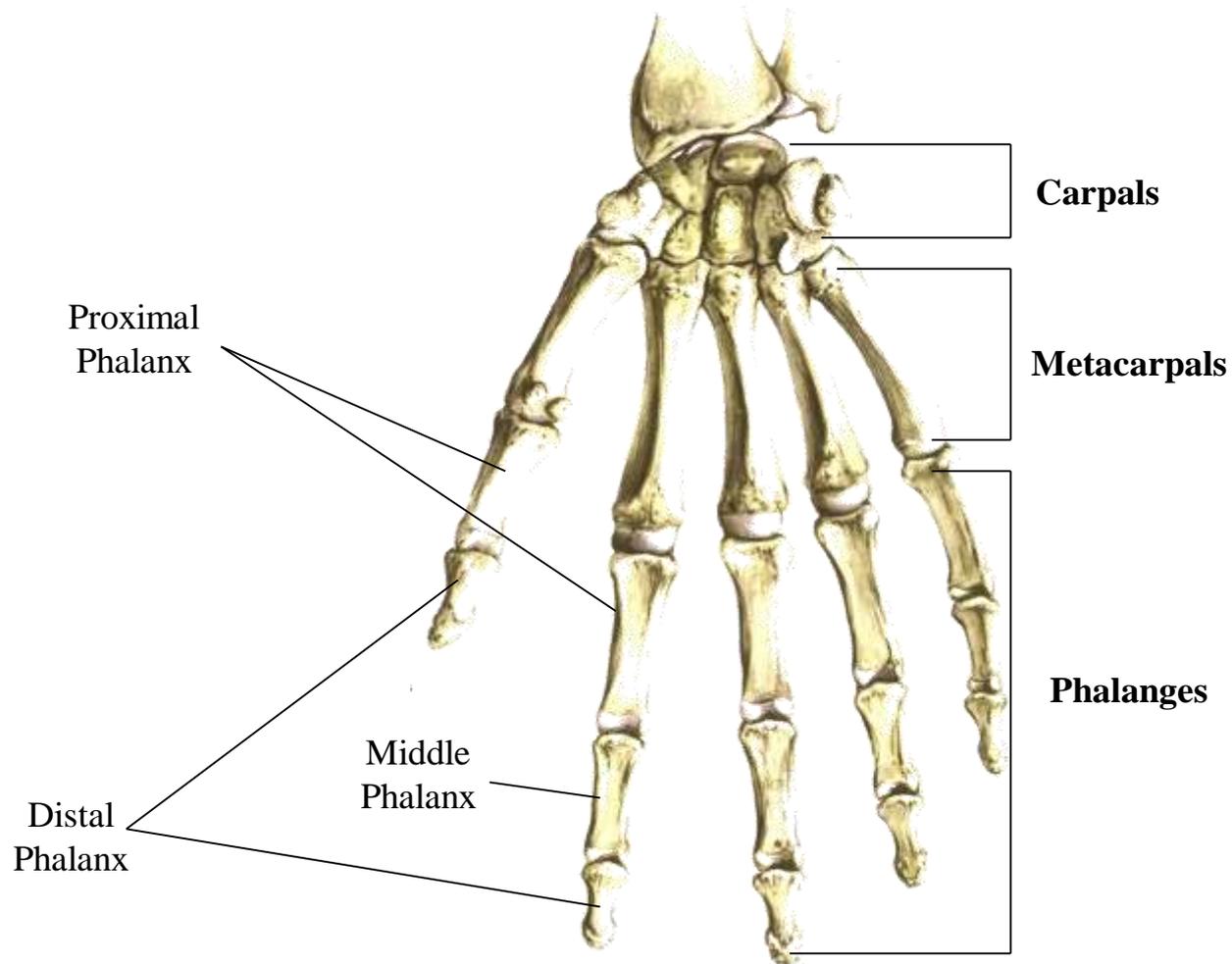


# 3. Upper

- Humerus
  - The arm bone
  - shoulder to elbow
- Radius and Ulna
  - The forearm bones
  - elbow to wrist
  - the radius being located on the thumb side of the hand
  - when you pronate the forearm, the radius is actually crossing over the ulna - try it yourself

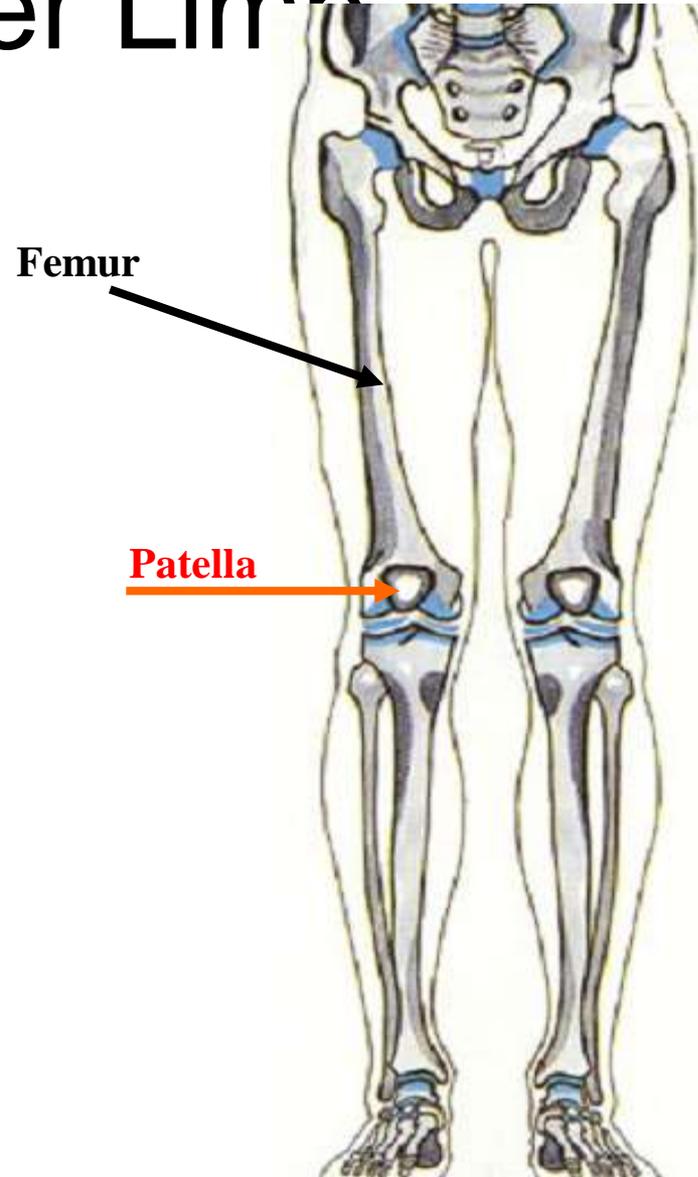


# Upper Limb Cont.



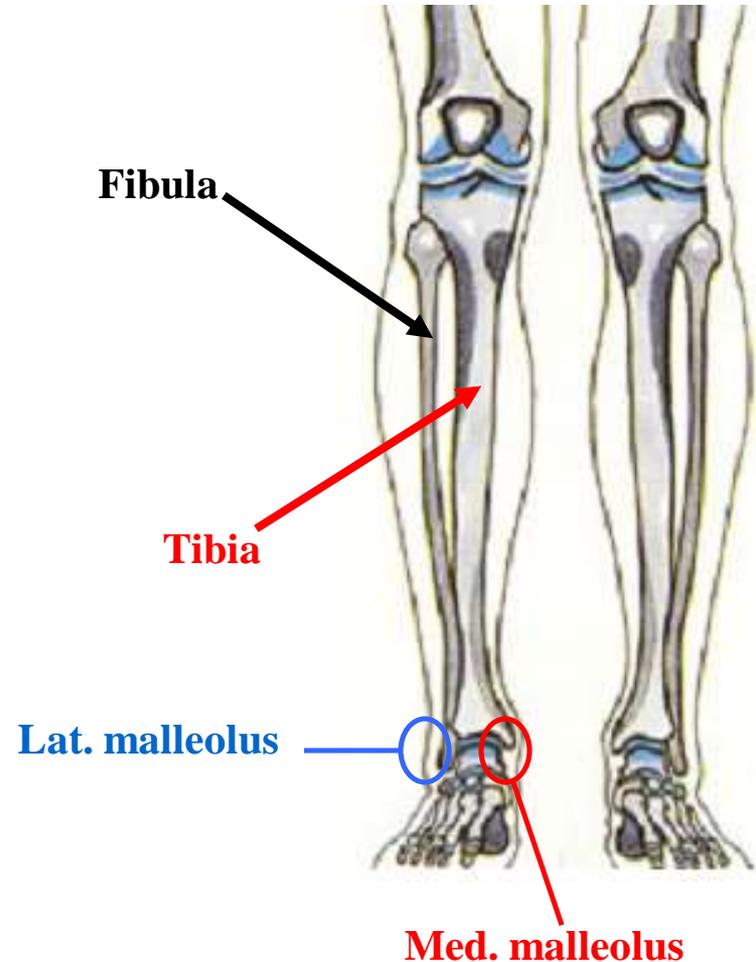
# 4. Lower Limb

- Femur
  - thigh bone
  - from hip to knee
- Patella
  - knee cap
  - sesamoid bone in the tendon of the quadriceps muscles (thigh)



# Lower Limb Cont'd

- **Tibia and Fibula**
  - leg bones
  - From knee to ankle
  - Tibia is medial and fibula is lateral
- **Medial malleolus and Lateral malleolus**
  - The distal ends of the tibia and fibula, respectively
  - commonly referred to as the "ankle bones"
  - can be easily palpated



# Lower Limb Cont'd

- **Tarsals**
  - ankle bones
  - calcaneus or the heel bone
  - talus
- **Metatarsals**
  - 5 bones of the foot
  - unite with the toes
- **Phalanges**
  - toe bones
  - three per toe except the big toe - proximal, middle and distal

