

# Bones

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Bone-Are specialized connective tissue composed of calcified extracellular materials, the bone matrix and three major cells types

1. Osteocytes
2. Osteoblasts
3. Osteoclasts

# Composition of Bones

Bones are composed of:

1. Bone cells:

- Osteoblast
- Osteocytes
- Osteoclasts

2. Extracellular matrix

- Collagen fibers
- Inorganic minerals( Calcium, Phosphate, Magesium, Potassium)

# **1.Osteoblast:**

- Immature cells
- are the cells required for bone synthesis and mineralization, both during the initial formation of bone and during bone remodeling
- play a vital role in bone development

## **2.Osteocytes:**

- Are the cells inside the bone.
- Derived from osteoblast.
- Osteocytes play a vital role in bone maintenance.
- Some of the osteoblasts turn into osteocytes while the new bone is being formed, and the osteocytes then get surrounded by new bone.

### **3.Osteoclast:**

- Help in resorption of bone.
- Is large cell with multiple nuclei, posses eosinophilic cytoplasm & devoid of process.

# Functions

1. Bones provide shape, support, and the framework of the body.
2. protect internal organs.
3. Bones serve as a storage place for minerals such as salts, calcium, and phosphorus
4. Bones play an important role in hematopoiesis and the formation of blood cells that takes place in bone marrow.
5. Bones provide a place to attach muscles.

# Types of Bones

A. Types of bone on the basis of shape:

1. Long bones
2. Short bones
3. Flat bones
4. Irregular bones
5. Pneumatic bones
6. Sesamoid bones.



B. Types on the basis of development:

1. Membranous bones
2. Cartilaginous bones
3. Membro-cartilaginous bones.

C. Types on the basis of region:

1. Bones of Axial skeleton
2. Bones of Appendicular skeleton

D. Types on the basis of structure:

1. According to Macroscopic approach:

a. Compact bone

b. Spongy bone

2. According to Microscopic approach:

a. Fibrous bone

b. Lamellar bone.

# On the basis of shape

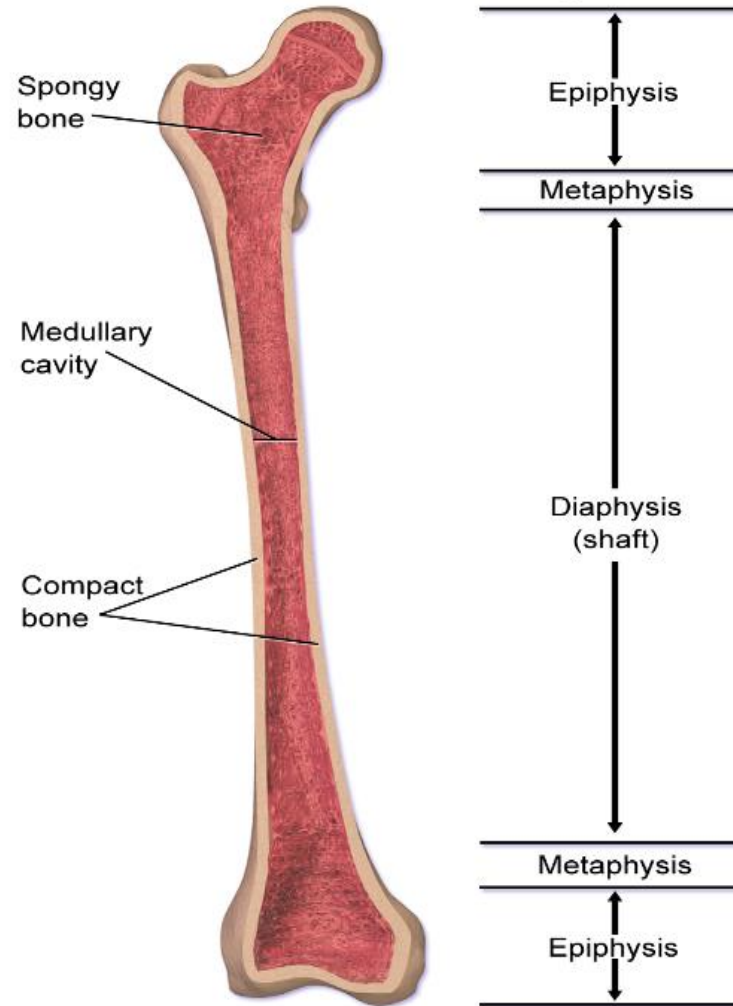
## 1. Long bones

These bones typically have an elongated shaft and two expanded ends one on either side of the shaft.

The shaft is known as diaphysis and the ends are called epiphyses.

Examples: Humerus, femur etc.

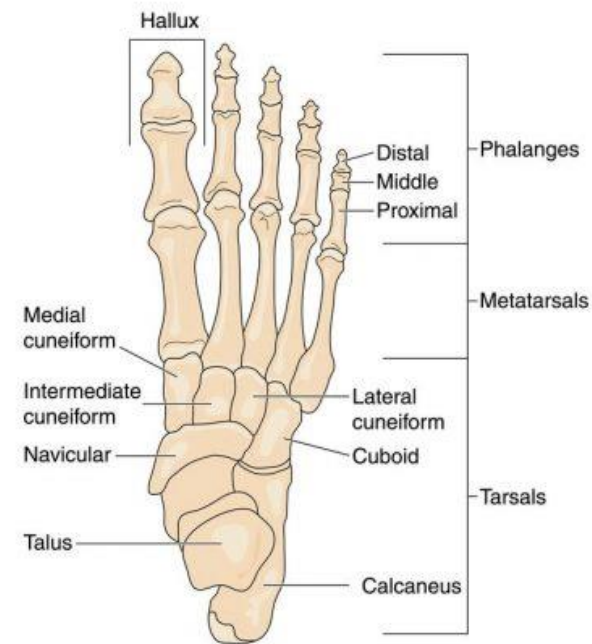
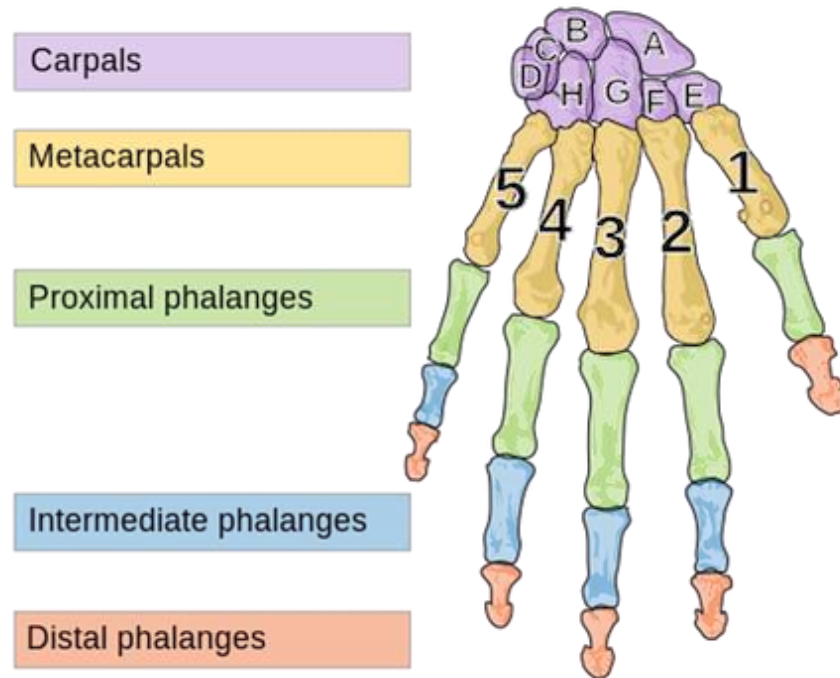
## Structure of a Long Bone



## 2.Short Bones:

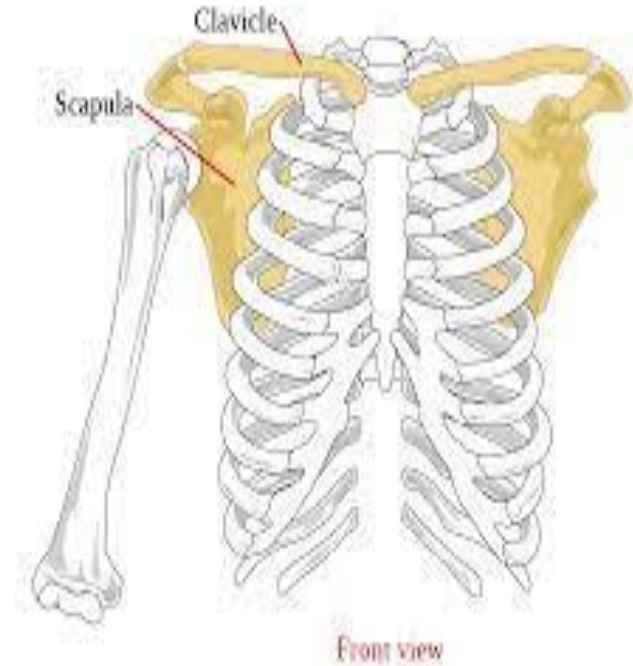
These bones are short in posture and can be of any shape.

Examples: The carpal and tarsal bones



### 3.Flat Bones:

These bones are flat in appearance.  
Examples: Scapula, Ribs, Sternum



## 4. Irregular Bones:

- These bones are completely irregular in shape.
- Examples: vertebrae, hip bone and bones in the base of skull.

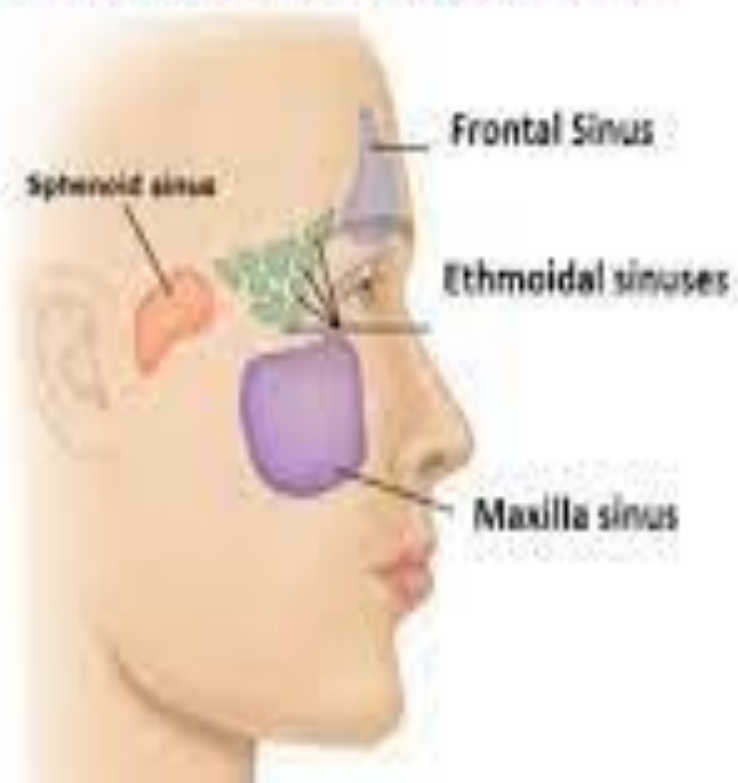


## 5. Pneumatic Bones:

- Pneumatic bones can also be categorized under the irregular bones.
- The characteristic difference is the presence of large air spaces in these bones which make them light in weight and thus they form the major portion of skull
- Examples: Sphenoid, Ethmoid, Maxila etc.



## Bones with paranasal air sinuses



## Pneumatic Bone



## 6.Sesamoid Bones:

- These are in the form of nodules embedded in tendons and joint capsules.
- Examples: Patella, Pisiform etc.



# On the basis of development

## 1. Membranous bones:

These bones ossify in membrane from mesenchyme condensations. Examples: Bones of the vault of skull and Facial bones.

## 2. Cartilaginous Bones:

They ossify in cartilage and thus derived from preformed cartilaginous models.

Examples: Thoracic cage etc

### 3. Membrano-cartilaginous Bones:

- They ossify partly in membrane and partly in cartilage.

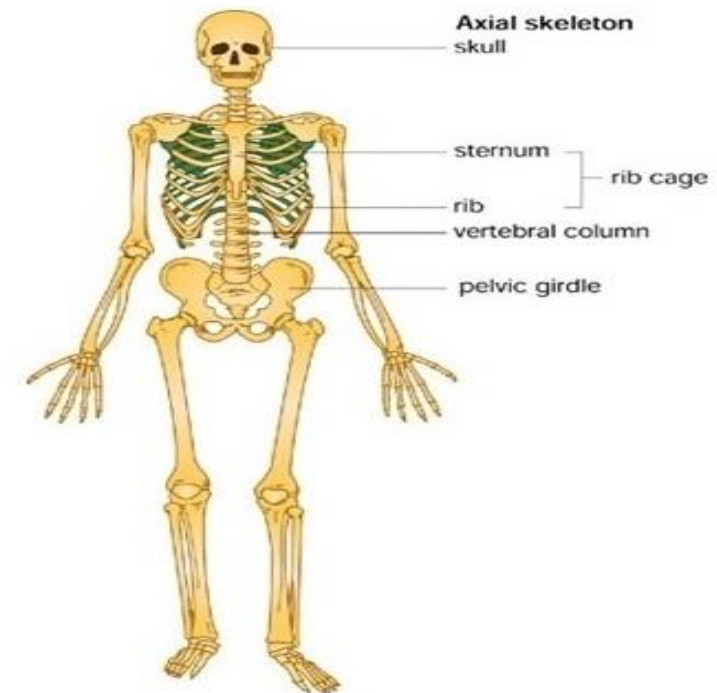
Examples: Clavicle, Mandible, Temporal etc

# **On the basis of region**

1. Axial Skeleton.
2. Appendicular Skeleton.

# Axial Skeleton

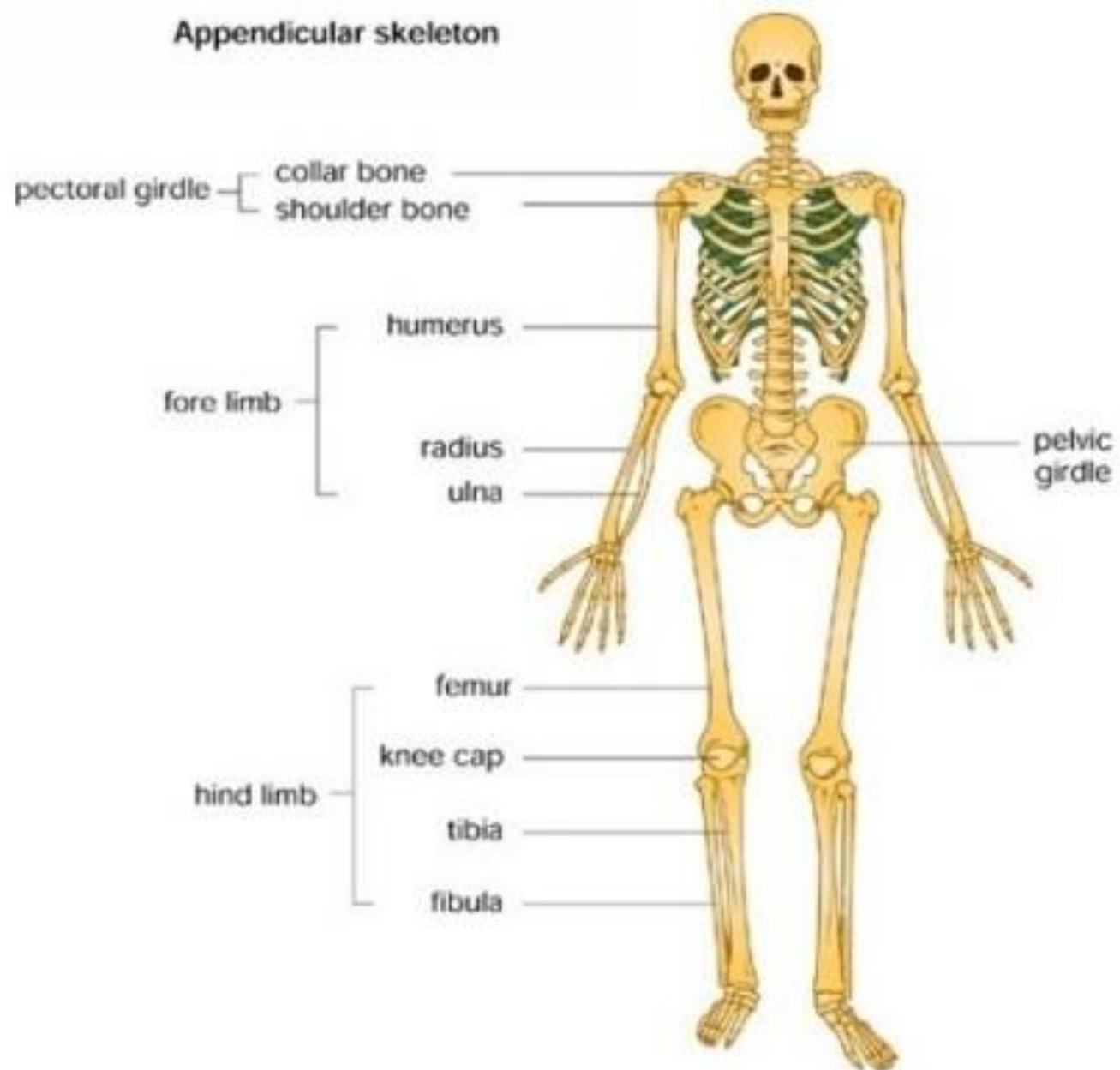
- The axial skeleton consists of 80 bones.
- The primary bones of the axial skeleton are the skull, spine, ribs and sternum (thorax).



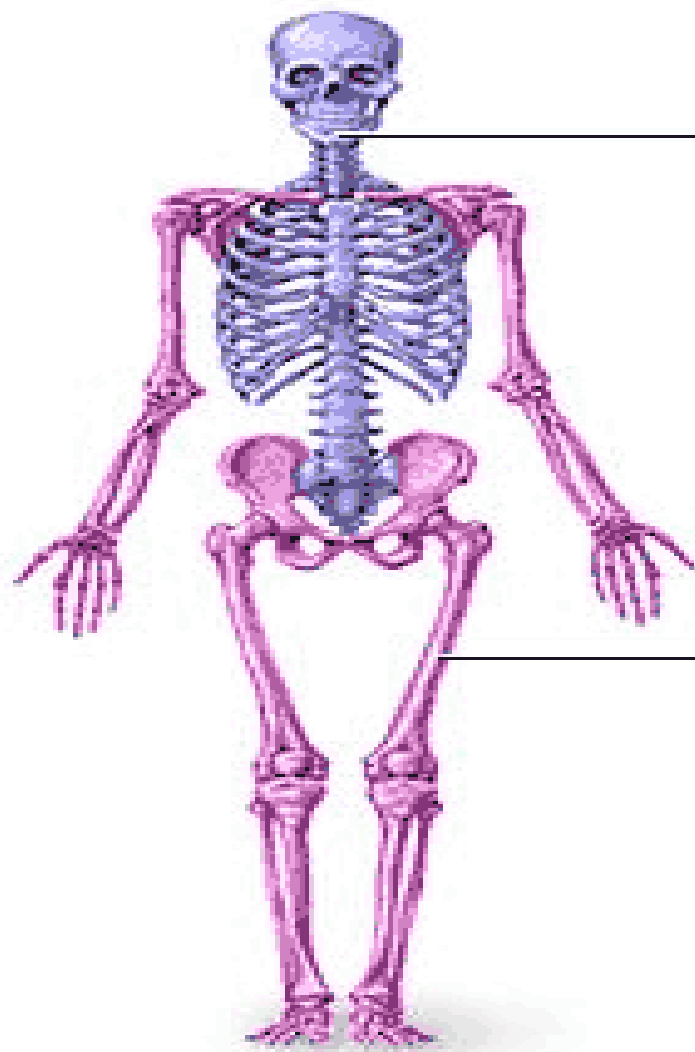
# Appendicular Skeleton

- The appendicular skeleton consists of 126 bones.
- The primary bones of this skeleton are the shoulder or pectoral girdle, arms, hands, pelvic girdle and feet

## Appendicular skeleton







Axial skeleton (blue)

Appendicular  
skeleton (pink)

# On the basis of structure:

## 1. Macroscopic Approach:

a. Compact Bone: Compact bone is dense in texture but is extremely porous.

Example: In the cortex of long bones.

b. Spongy Bone: The part of bone where there is more empty space and less bone tissue.

Example: The inner part of Long Bones

## 2. Microscopic Approach:

a. Fibrous Bone: It is found in young fetal bone

Example: Found only in fetus, and sutures of the skull.

b. Lamellar Bone: Most of the mature human bones, are composed of thin bony plates called lamellae.

Example: Formed on the periosteal surface of diaphysis

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c. Woven Bone: Occurs initially in fetal bones. In adults woven bone is created after fractures.

Example: Seen in fetal bone, fracture repair bone

d. Cementum and Dentine: Example: Occur in teeth, Dentine of a tooth.

# Do you know?

- By age 25 the skeleton is completely hardened.
- 206 bones make up the adult skeleton (20% of body mass)
- 80 bones of the axial skeleton
- 126 bones of the appendicular skeleton
- The largest bone in the human skeleton is Femur.
- The smallest bone in the human skeleton is stapes of ear
- Babies are born with about 270- 300 bones of babies eventually fuse together to form the 206-bone skeleton of an adult

**Thank You**