THE SKELETAL SYSTEM

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Human Anatomy- 322

Semester 1

Week 3

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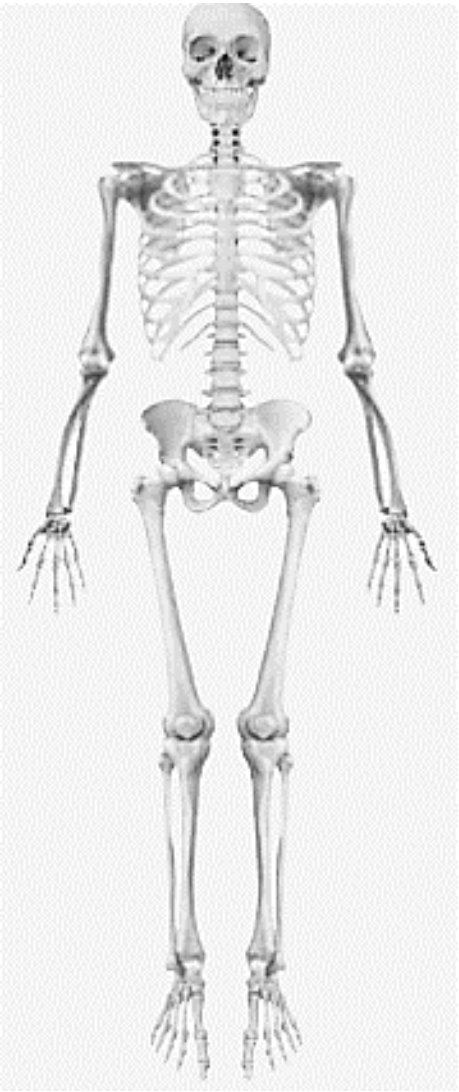


Outline

- ❖Functions of the skeletal system
- ❖Structure of **Bone**
- ❖Bone tissue components
- ❖Types of bones
- ❖ Skeletal system division
- ❖ Axial system components

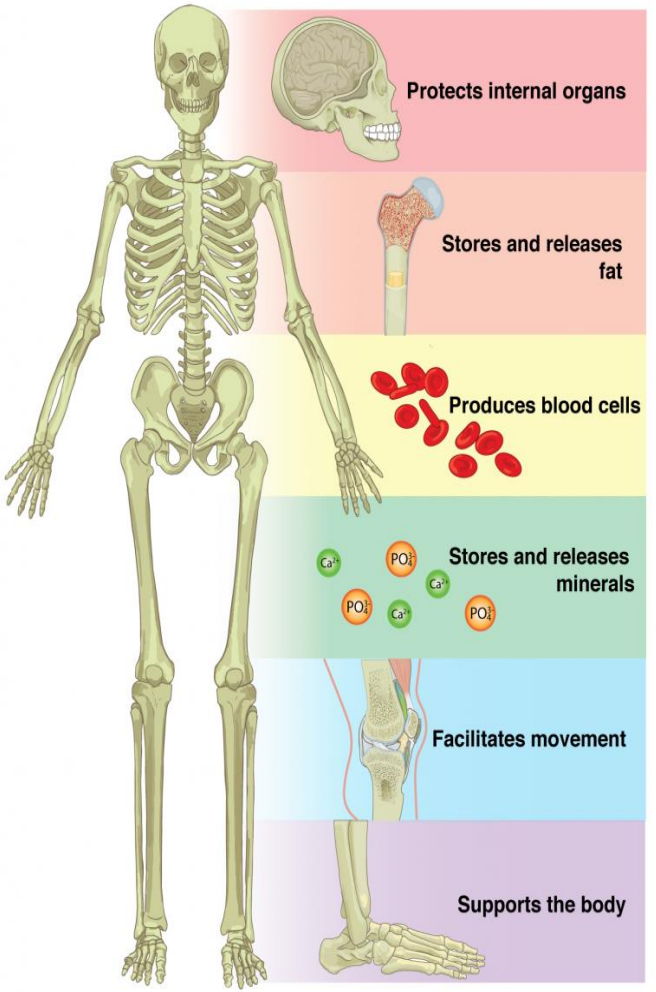
Objectives

You should be able to describe the following;

- ❖Understand the functions of the skeletal system
- ❖Understand the structure of **Bone**
- ❖Understand the bone tissue components
- ❖Understand the types of bones
- ❖ Understand the skeletal system division
- ❖ Understand the axial system components

Functions of skeletal system

- **Protect the internal organs** from injury; Ex, cranial bones protect the brain, and the rib cage protects the heart and lungs.
- **Support** tissues and provide attachment points for the tendons of skeletal muscles.
- **Aid in movement.** Most skeletal muscles attach to bones when they contract, they pull on bones to produce movement
- **Produce blood cells:** red bone marrow produces red blood cells, white blood cells, and platelets
- **Stores lipids (fats)** as the yellow bone marrow consists of adipose cells, which is a potential energy source.
- **Stores calcium and phosphorus**, which contribute to the strength of bone. Bone tissue stores 99% of the body's calcium, bone releases minerals into the blood when needed.

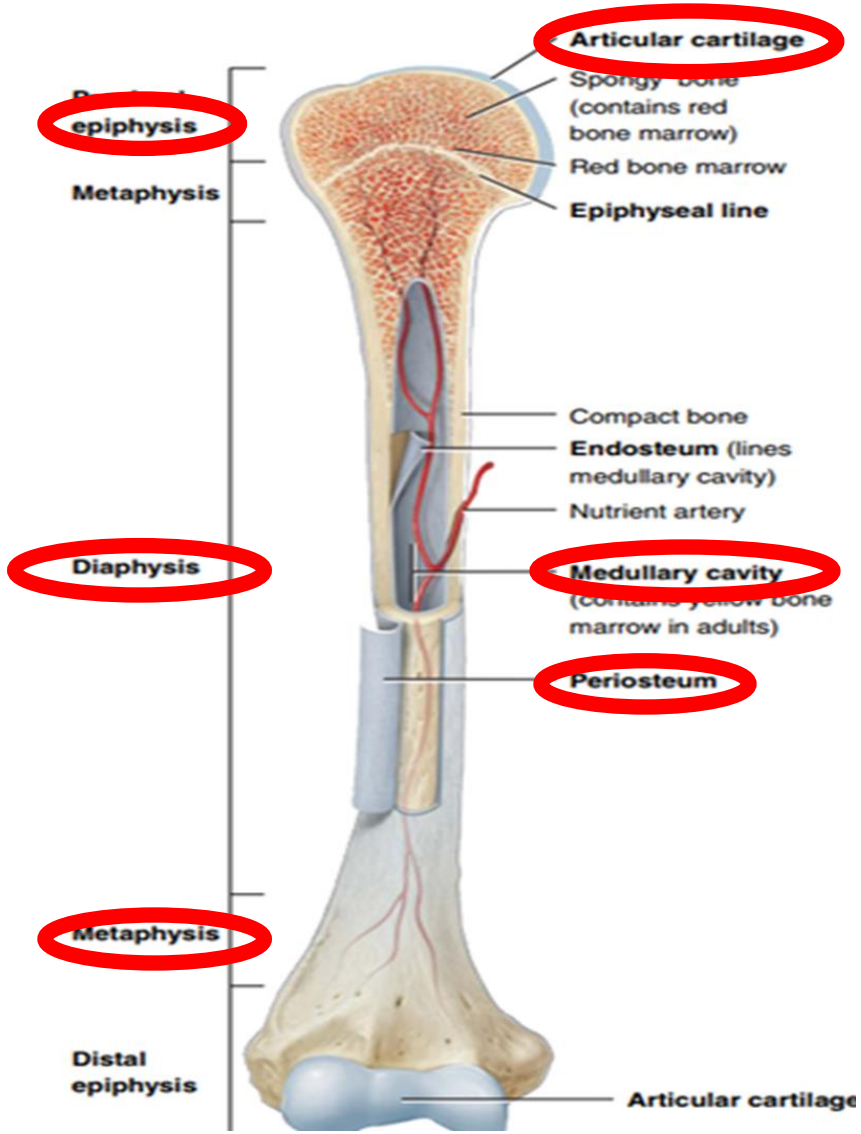


Introduction to skeletal system

- The skeletal system is the entire framework of bones, tendons and their cartilages
- Bone tissue makes up about 18% of the weight of the human body
- A bone is an organ made up of several different tissues working together:
  - Bone (osseous) tissue,
  - Cartilage,
  - Dense connective tissue,
  - Epithelium,
  - Adipose tissue, and nervous tissue.

Bone structure

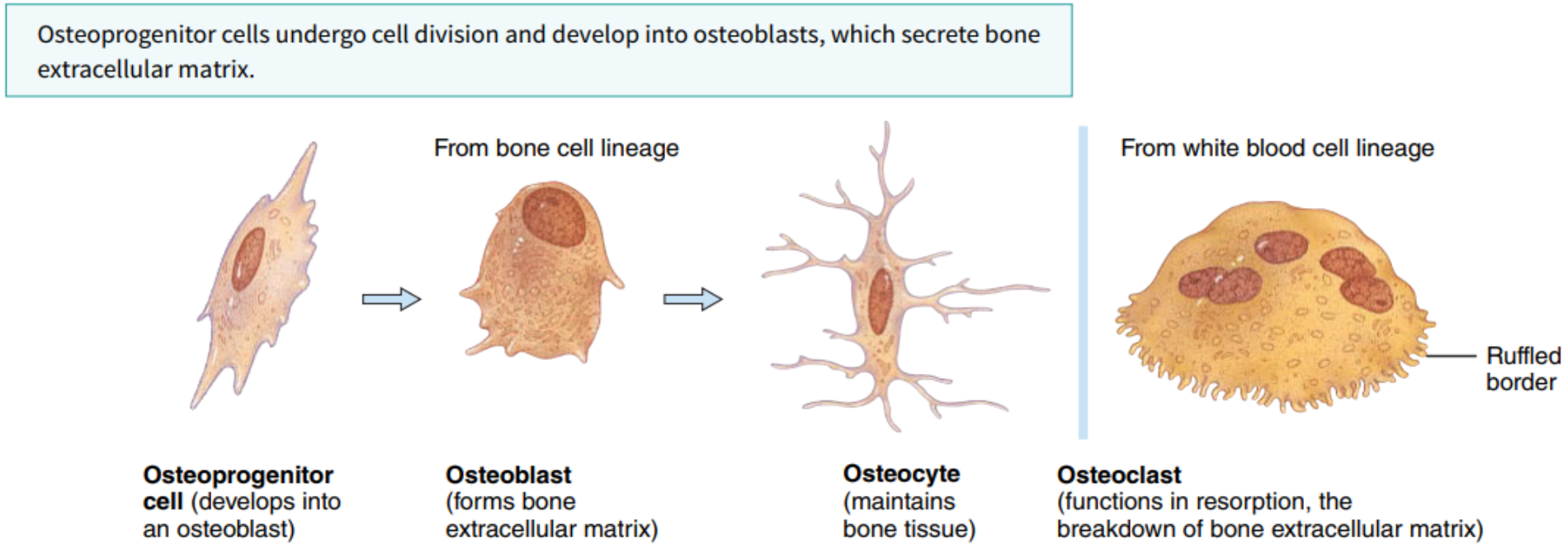
- Macroscopic bone structure such as the humerus (the long arm bone) consist of;
- **Diaphysis** (shaft); the bone's shaft or body the long, cylindrical, main portion of the bone.
- **Epiphyses** singular is epiphysis are the proximal and distal ends of the bone
- **Metaphysis**: are the regions between the diaphysis and the epiphyses.
- **Articular cartilage**: thin layer of hyaline cartilage covering the epiphysis where the bone joint with another bone
- **Periosteum**; connective tissue sheath and its associated blood supply that surrounds the bone surface
- **medullary cavity**; hollow, cylindrical space within the diaphysis contains fatty yellow bone marrow
- **Endosteum**. thin membrane that lines the medullary cavity.



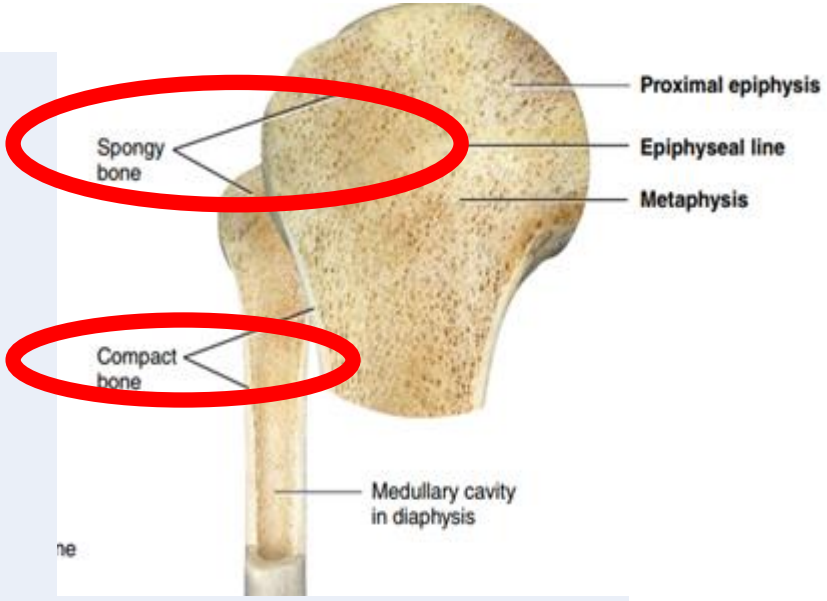
Bone tissue composition

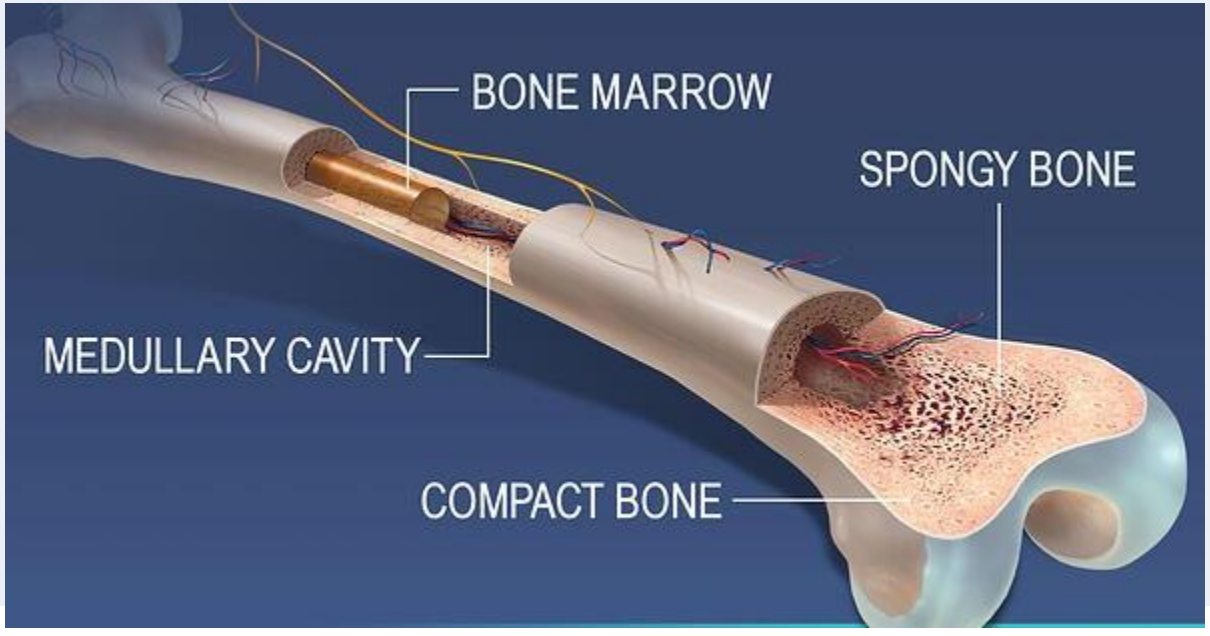
- Bone tissue consists of widely separated cells surrounded by large amounts of extracellular matrix.

- The four types of cells in bone tissue are **osteoprogenitor** cells, **osteoblasts** (bone-building cells), **osteocytes** (maintain daily activity of bone), and **osteoclasts** (bone-destroying cells).



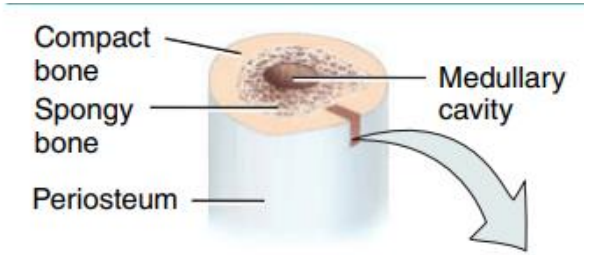
- Bone tissue is classified as either: compact or spongy, depending on how its extracellular matrix and cells are organized.

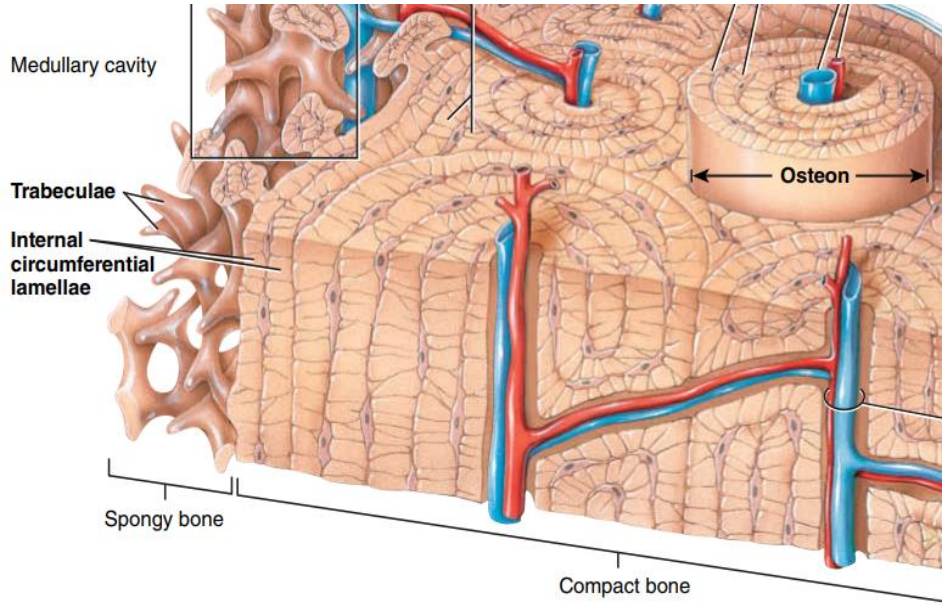




Bone tissue composition

- Compact bone tissue consists of osteons (haversian systems) with little space between them.
- Compact bone tissue makes up most of the bone tissue of the diaphysis.
- Spongy bone tissue does not contain osteons.
- It consists of trabeculae surrounding many red bone marrow filled spaces.



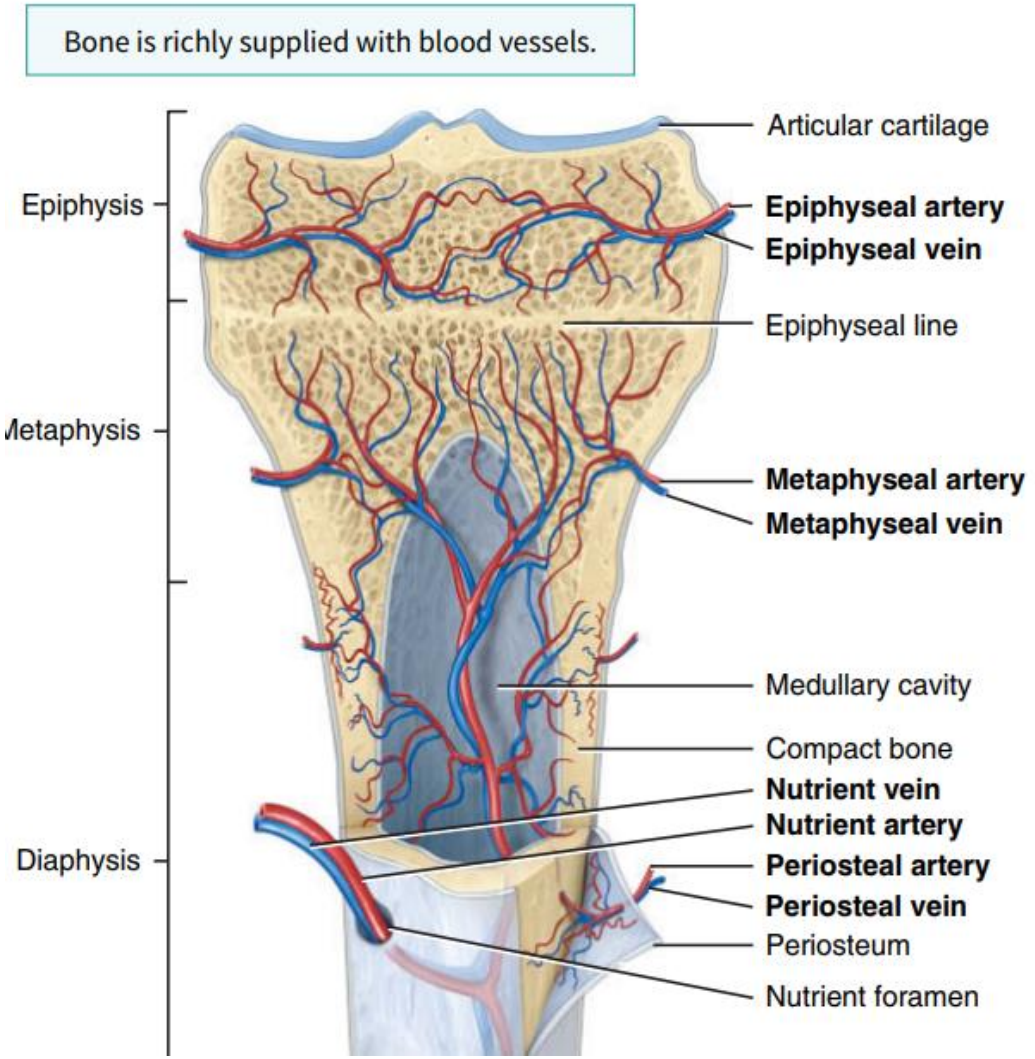


The extracellular matrix of bone contains abundant mineral salts and collagen fibers.

Blood and Nerve Supply of Bone

Long bones are supplied by periosteal, nutrient, metaphyseal, and epiphyseal arteries; veins accompany the arteries.

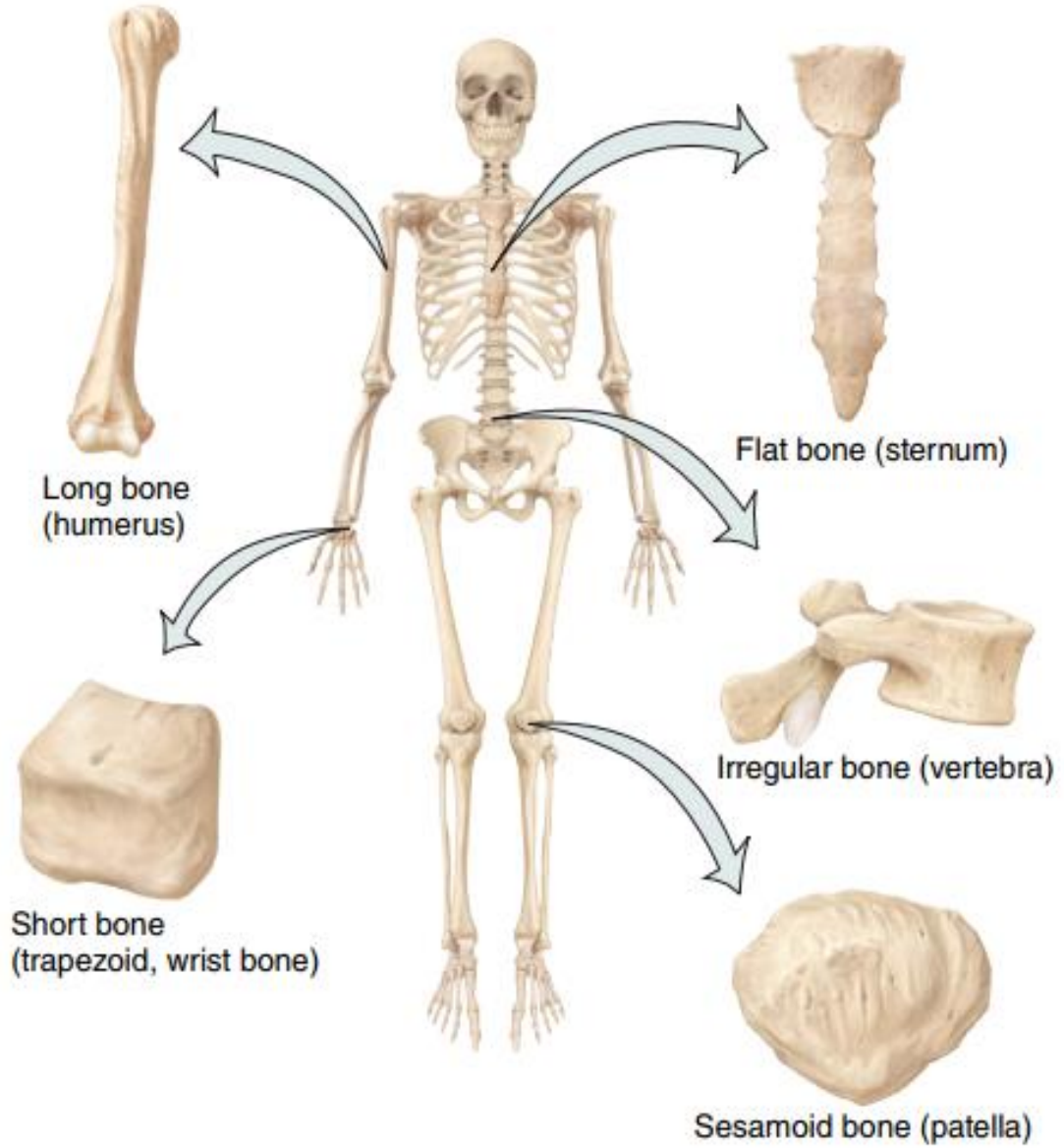
Nerves accompany blood vessels in bone; the periosteum is rich in sensory neurons



Types of Bones

- Long bone
- Short bone
- Flat bone
- Irregular bone
- Sesamoid bone

shaped like a sesame seed



Skeletal System divisions

The human skeleton are divided into two groups

The appendicular skeleton

- Consists of 126 bones includes :
- Upper limbs arms, hands,
- Lower limbs Legs and feet
- pelvic girdles
- shoulder

The axial skeleton

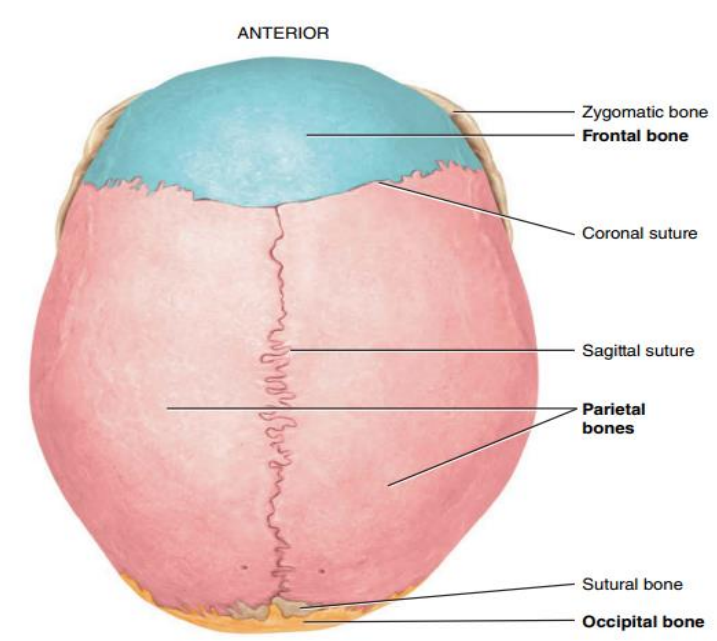
- consists of 80 bones.
- Includes all the bones along the body's long axis.
- Ex; skull, spine, ribs

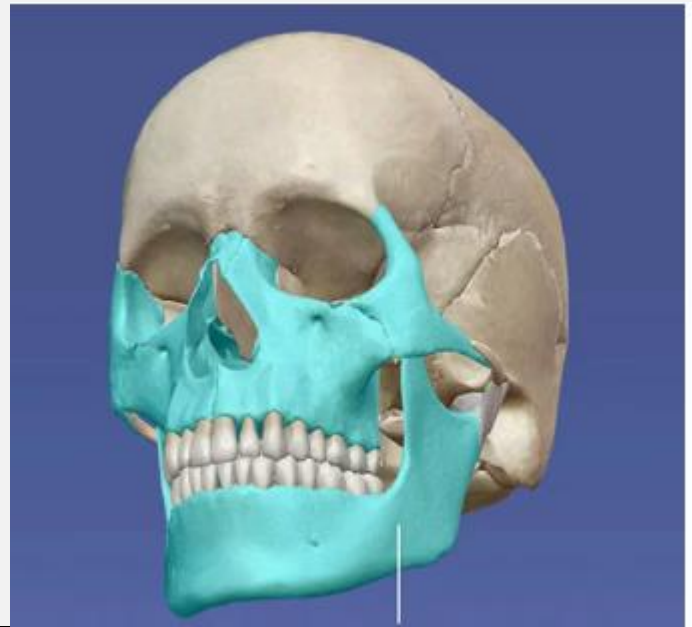
and sternum (thorax).

Components of the Skull

- The skull is the bony framework of the head. It contains 22 bones.
- The bones of the skull are grouped into two categories:

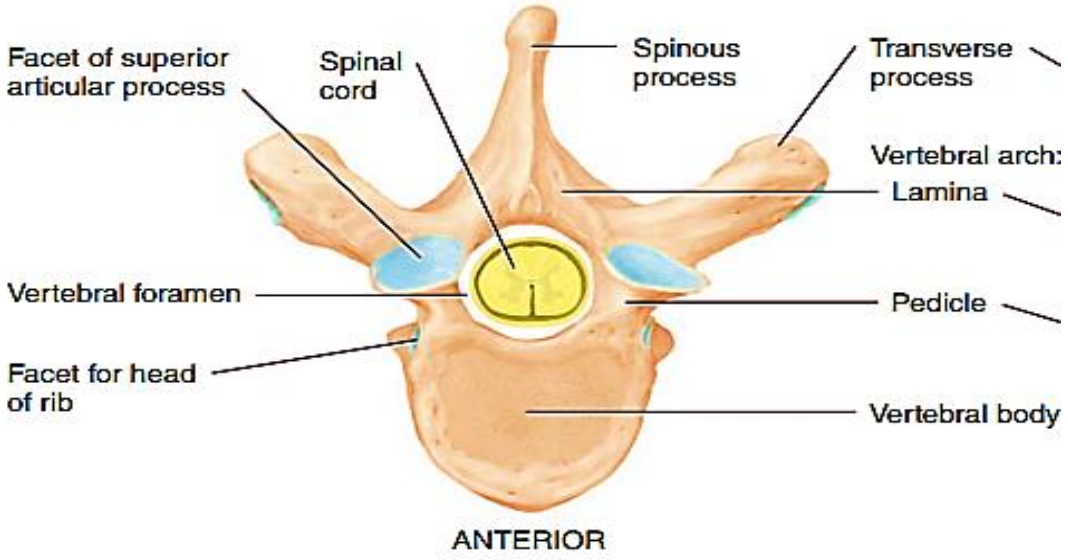
cranial bones	Facial bone
• Encloses and protects the brain. • Includes; Frontal, parietal, temporal, occipital, sphenoid, and ethmoid.	• Form the face • Includes; nasal, lacrimal, palatine, inferior nasal conchae, vomer, maxillae, zygomatic, and mandible.



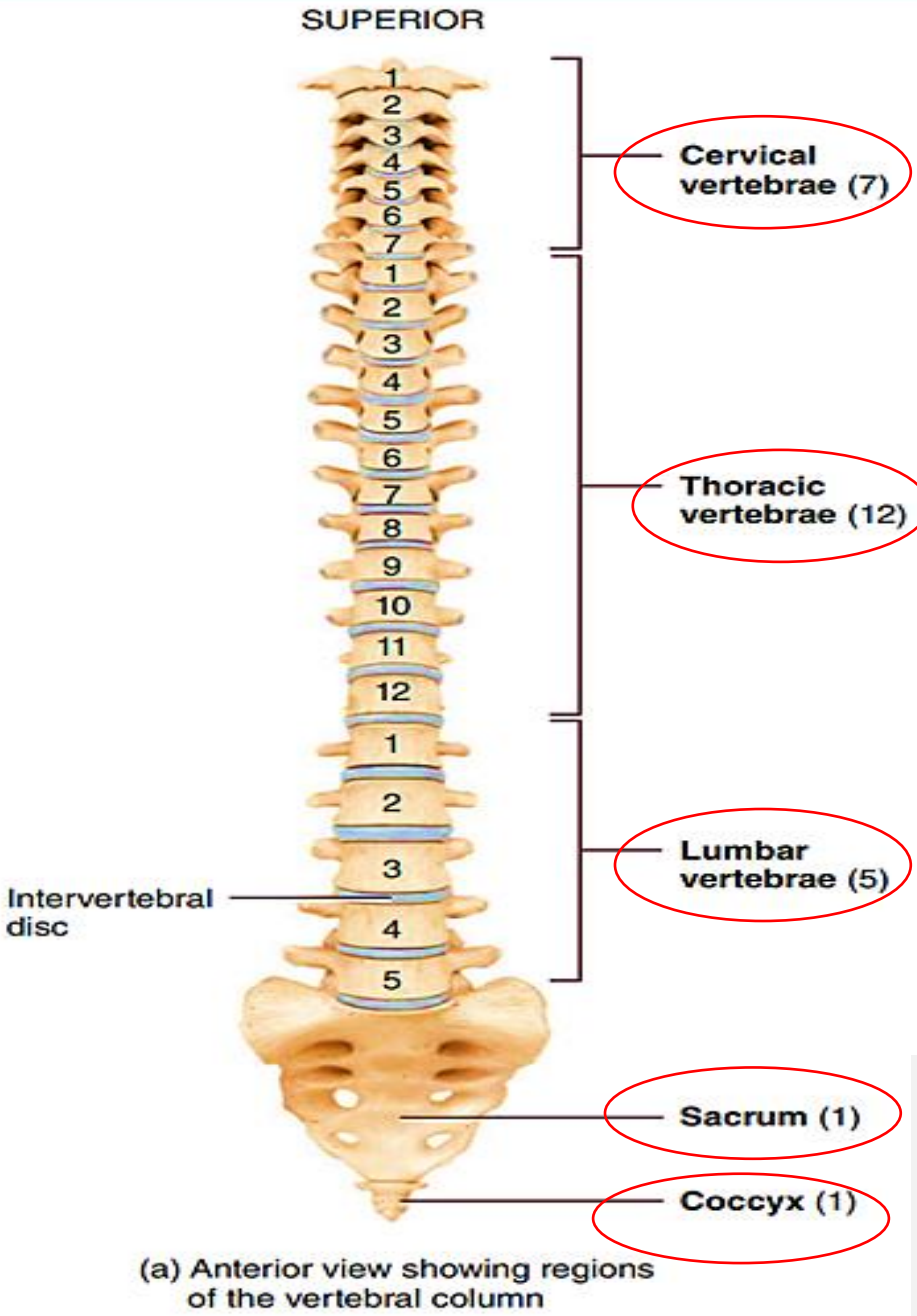


Vertebral Column

- Also called the spine, backbone, or spinal column
- Composed of a series of bones called vertebrae
- The vertebral column consists of bone and connective tissue
- It surrounds and protect he spinal cord which consist of nervous and connective tissue
- The vertebral column, the sternum, and the ribs form the skeleton of the trunk of the body.
- Vertebrae in different regions of the spinal column vary in size, shape, and detail but also similar
- A typical vertebra consists of
  - a vertebral body
  - a vertebral arch
  - several processes.



The adult vertebral column typically contains 26 vertebrae.



(a) Anterior view showing regions of the vertebral column

The cervical vertebrae are found in the neck region.

In the chest, they articulate with the ribs except for T11 and T12 are free

the largest and strongest vertebrae and are found in the lower back,

Intervertebral disc found between the vertebrae from the second cervical vertebra to the sacrum

the sacrum is formed by the union of 5 sacral vertebrae

Coccyx is formed by the union of usually 4 coccygeal vertebrae

Comparison of Major Structural Features of Cervical, Thoracic, and Lumbar Vertebrae

CHARACTERISTIC	CERVICAL	THORACIC	LUMBAR
Overall structure			
Size	Small.	Larger.	Largest.
Foramina	One vertebral and two transverse.	One vertebral.	One vertebral.
Spinous processes	Slender, often bifid (C2–C6).	Long, fairly thick (most project inferiorly).	Short, blunt (project posteriorly rather than inferiorly).
Transverse processes	Small.	Fairly large.	Large and blunt.
Articular facets for ribs	Absent.	Present.	Absent.
Direction of articular facets			
Superior	Posterosuperior.	Posterolateral.	Medial.
Inferior	Anteroinferior.	Anteromedial.	Lateral.
Size of intervertebral discs	Thick relative to size of vertebral bodies.	Thin relative to size of vertebral bodies.	Thickest.

Thorax

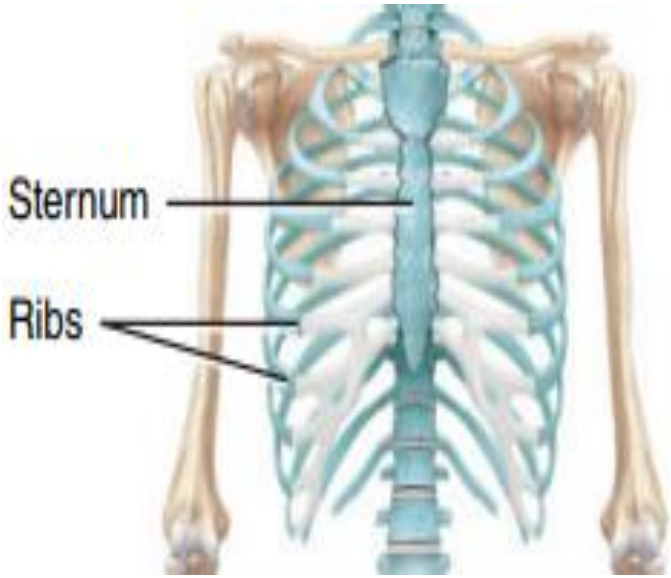
- Refers to the entire chest region.
- The costal cartilages attach the ribs to the sternum.
- It encloses and protects the organs in the thoracic and superior abdominal cavities.
- Thoracic cage, is a bony enclosure formed by

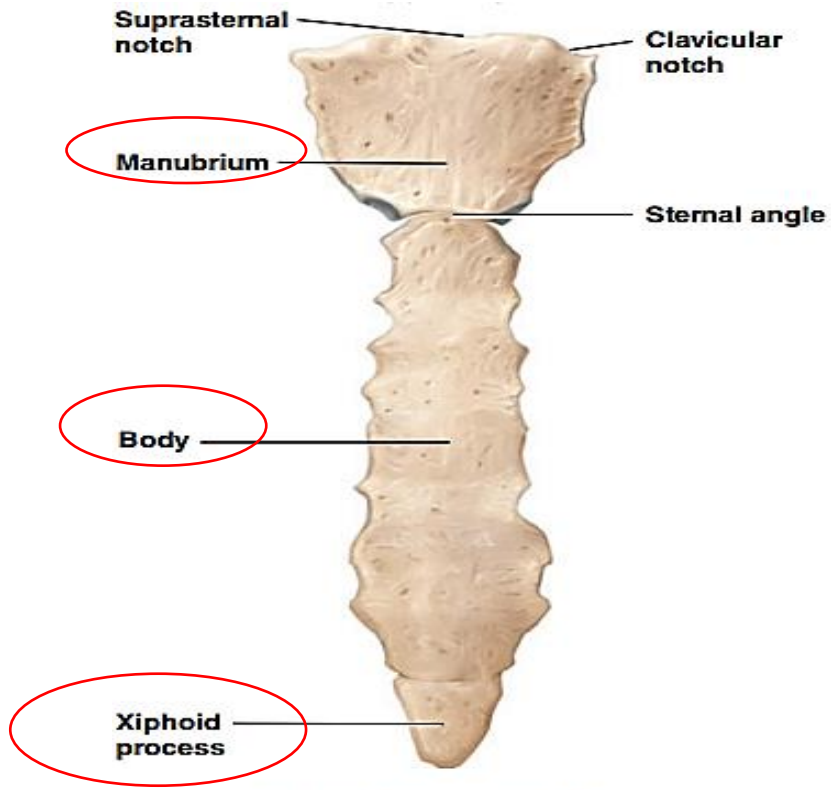
sternum, **ribs**, their costal cartilages, and

the bodies of the thoracic vertebrae.

The **sternum**, or breastbone, is a flat, narrow bone in the centre of the anterior thoracic wall that measures about 15 cm

Sternum consist of 3 parts
- superior manubrium,
- Middle body
- nferior xiphoid process





(a) Anterior view of sternum

Ribs

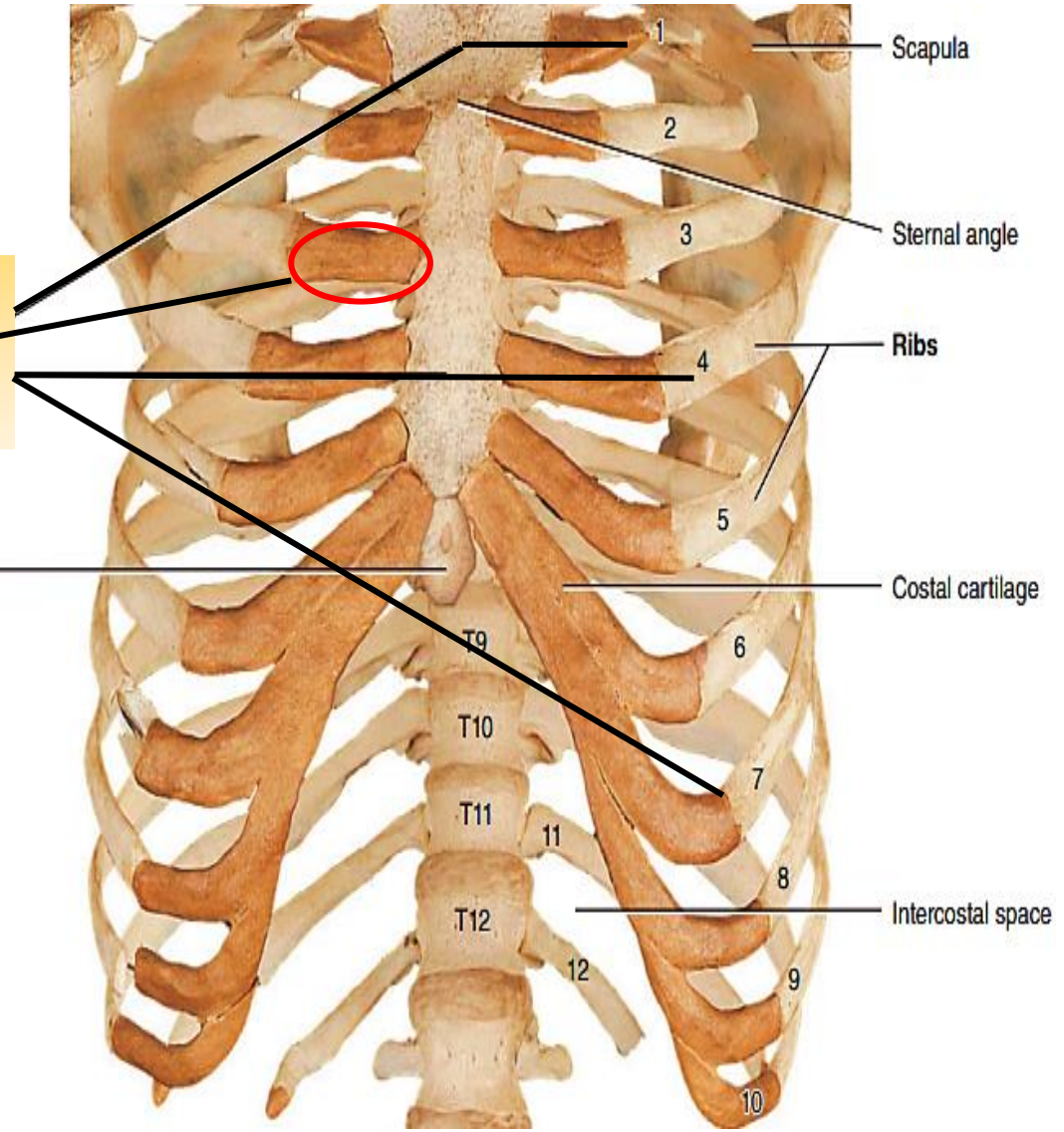
Twelve pairs of ribs, numbered 1-12 from superior to inferior,

The first seventh pairs of ribs have a direct anterior attachment to the sternum by the costal cartilage

The remaining five pairs of ribs are termed false ribs because their cartilages either attach indirectly to the sternum or do not attach at all

8, 9, and 10 pairs of ribs attach to one another and then to the cartilages of the seventh pair of ribs.

The 11 and 12 pairs of ribs are false ribs called floating (vertebral) ribs because they do not attach to the sternum at all

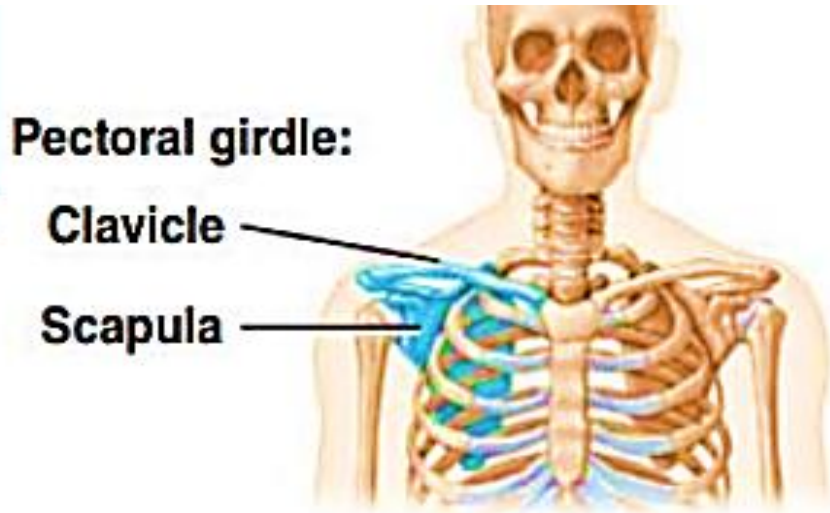


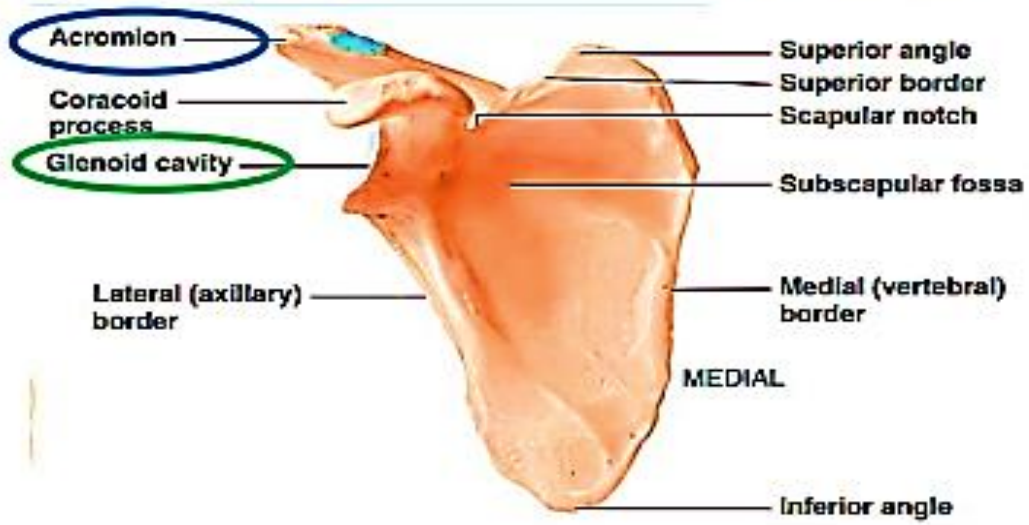
The Appendicular Skeleton

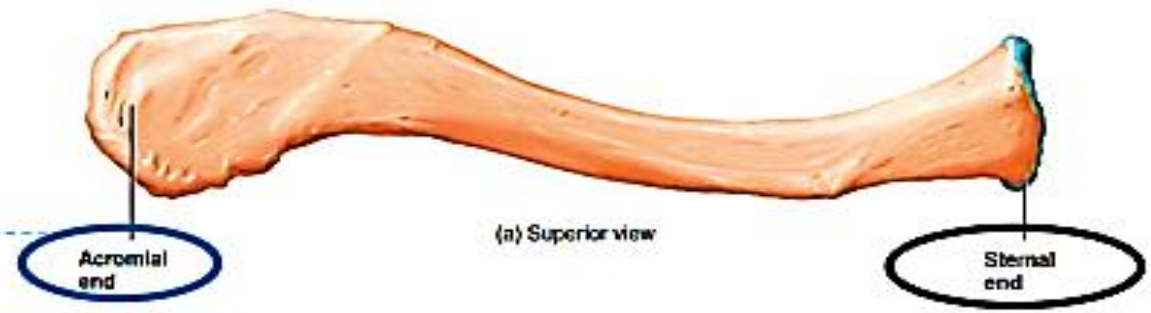
Pectoral (Shoulder) Girdle

- There are 2 pectoral (shoulder) girdles that attach the upper limbs to the axial skeleton
- Each pectoral Girdle consist of;

1. **Scapula** is the posterior bone.
   - The glenoid cavity of the scapula attach with the head of the humerus to form the glenohumeral (shoulder) joint.
2. **Clavicle** is the anterior bone
   - It **sternal end** articulates with the sternum
   - Acromial end attached with the acromion of scapula to form the acromioclavicular joint



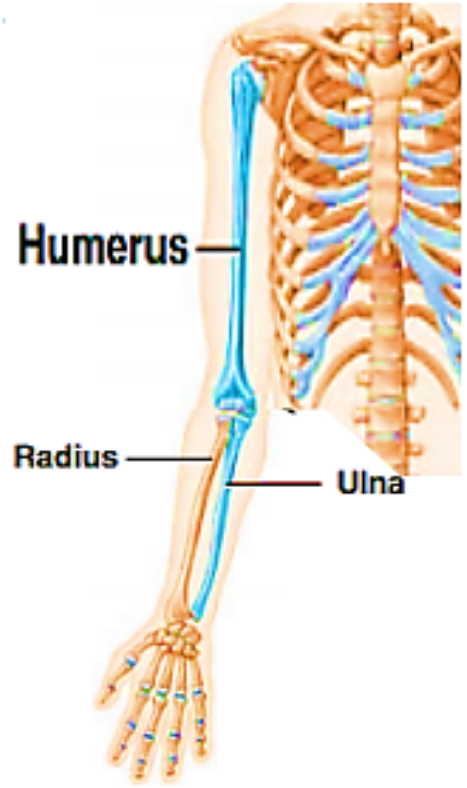




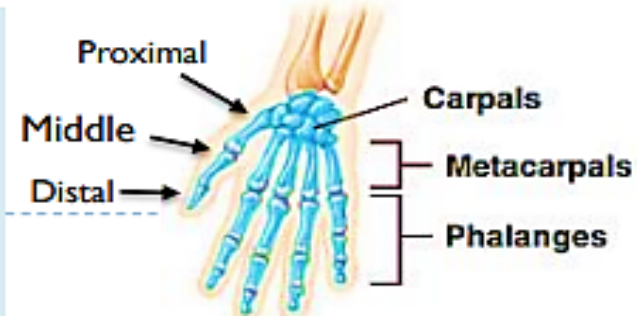
The Appendicular Skeleton- Upper Limb

- Consist of 3 bones:
- **Humerus**, longest and largest bone of the upper limb, articulates with scapula proximally and distally with (ulna & radius) at the elbow joint
- **Ulna**; at the forearm and is longer than the radius
- **Radius**; the smaller bone of the forearm at the thumb side.

In contrast to the ulna, the radius is narrow at its proximal end and widens at its distal end (wrist)

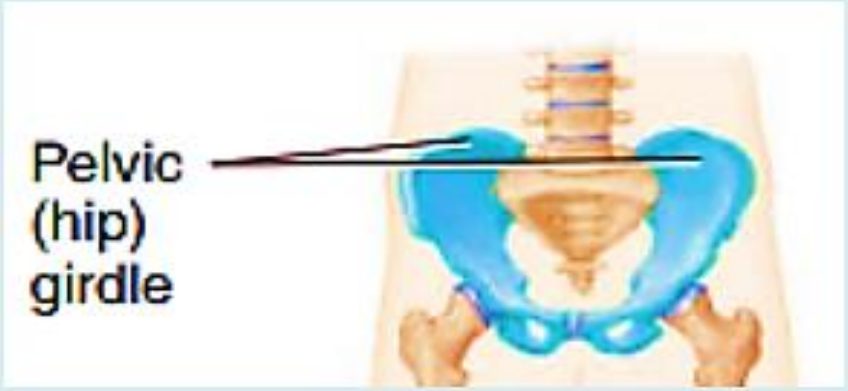


Hand includes 8 bones in the wrist, 5 bones the palm, and 14 bones form the fingers. The wrist bones are called **carpals**. The bones that form the palm of the hand are called **metacarpals**. The **phalanges** are the bones of the fingers.

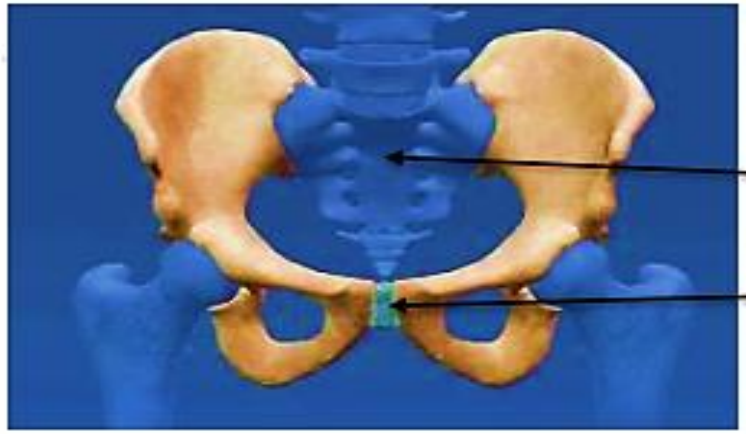


Appendicular system- Pelvic (Hip) Girdle-

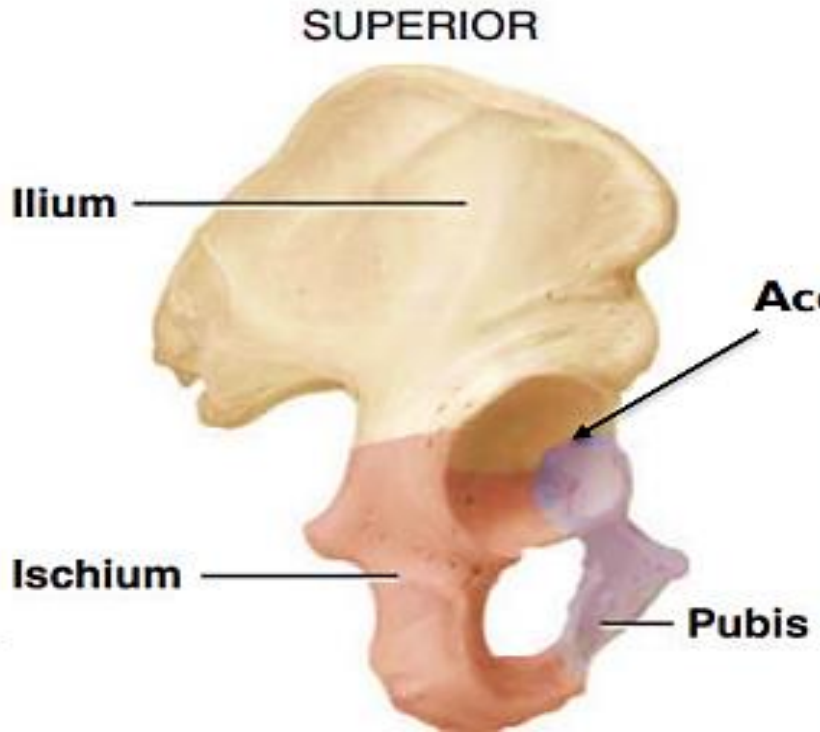
- Also called coxal or pelvic bones or coxa
- The pelvic girdle consists of the right and left hip bones.



- Each hip bone is a large, flattened, function as single bones, and irregularly shaped fusion of three bones: the ilium, ischium, and pubis.

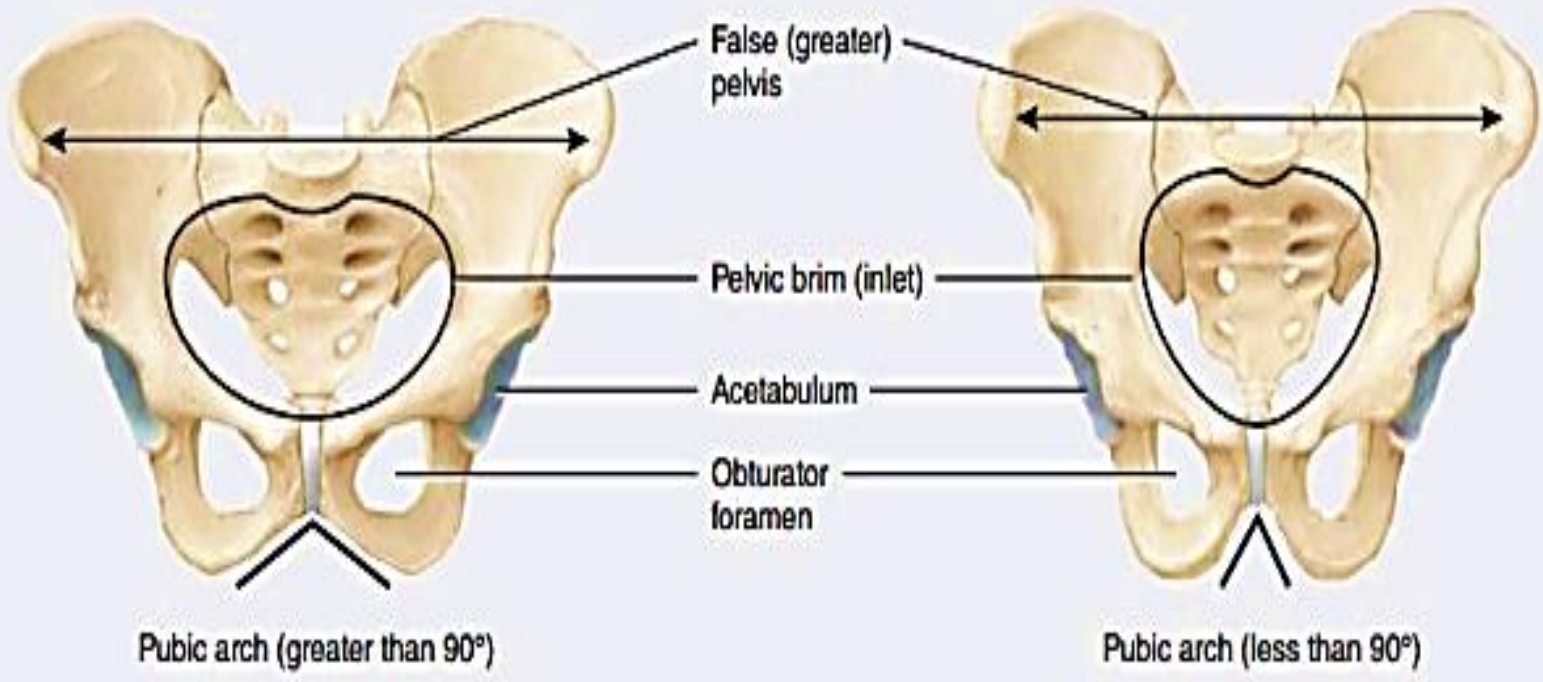


The hip bones unite posteriorly at the sacrum and anteriorly at the pubic symphysis to form the bony pelvis.



The acetabulum is the socket for the head of the femur, where the 3 hip bones converge and ossify.

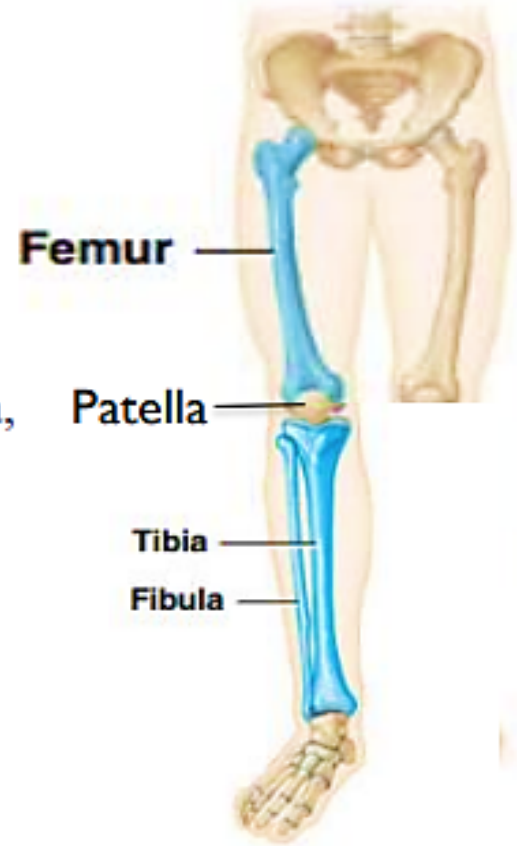
POINT OF COMPARISON	FEMALE	MALE
General structure	Light and thin.	Heavy and thick.
False (greater) pelvis	Shallow.	Deep.
Pelvic brim (inlet)	Wide and more oval.	Narrow and heart-shaped.
Acetabulum	Small and faces anteriorly.	Large and faces laterally.
Obturator foramen	Oval.	Round.
Pubic arch	Greater than 90° angle.	Less than 90° angle.



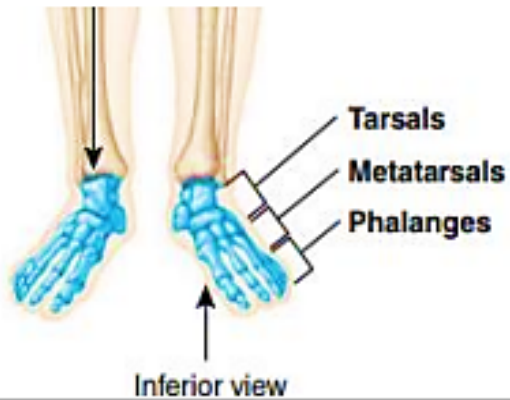
Appendicular system- Lower Limbs

Each lower limb consists of four:

- Femur or thigh bone, the longest, heaviest and strongest bone. Articulates with the tibia and pelvic girdle
- Tibia and fibula in the leg;
  - Tibia larger than fibula articulate with the femur and tarsus
  - Smaller fibula does not articulate with the fumur but with the tibia, and distally with the tarsus.



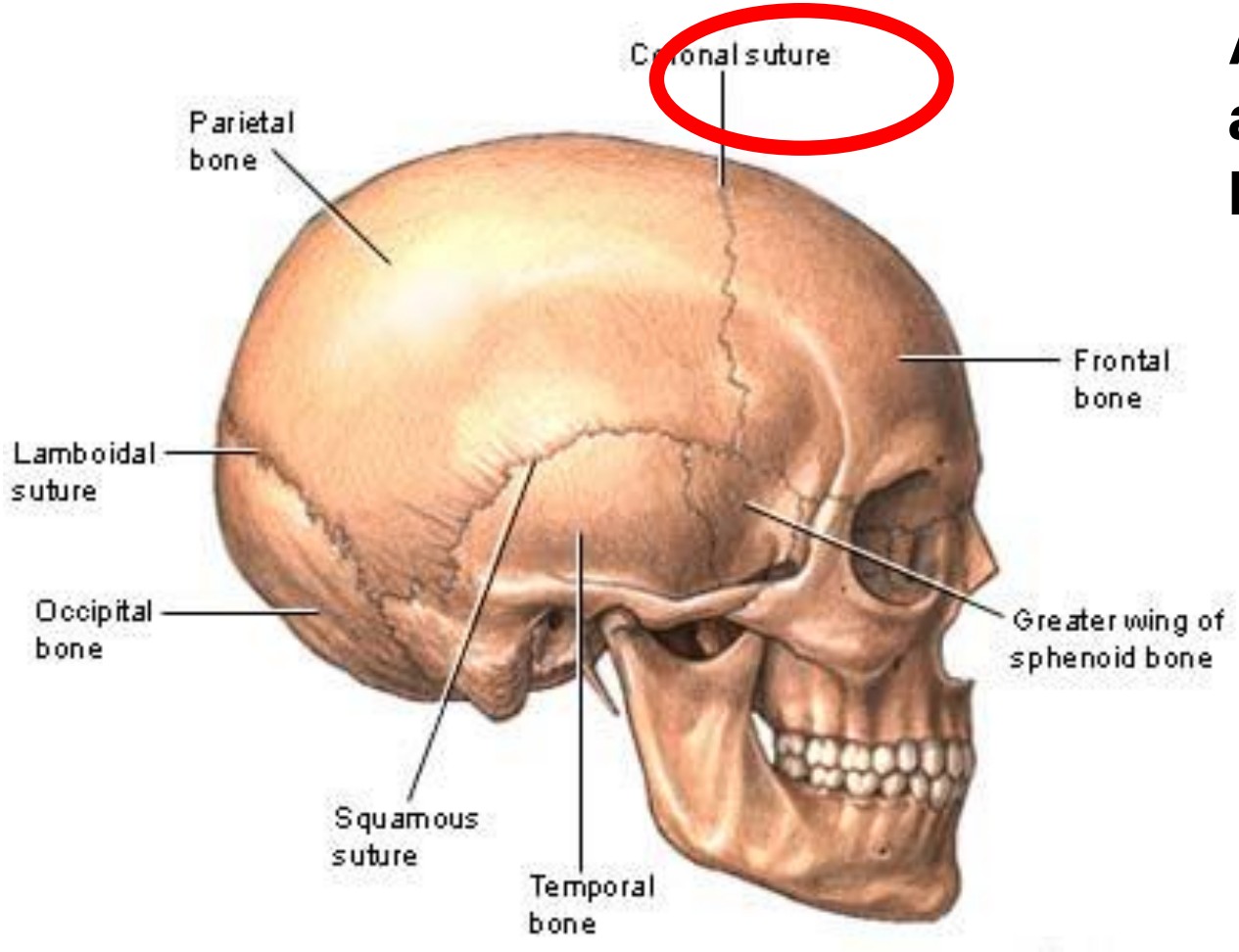
- Patella (kneecap); protect the knee joint where the thigh and leg bones articulate
- Tarsals in the tarsus (ankle), metatarsus, and phalanges in the



- Tarsus (ankle) is the proximal region of the foot and consists of seven tarsal bones

Joints

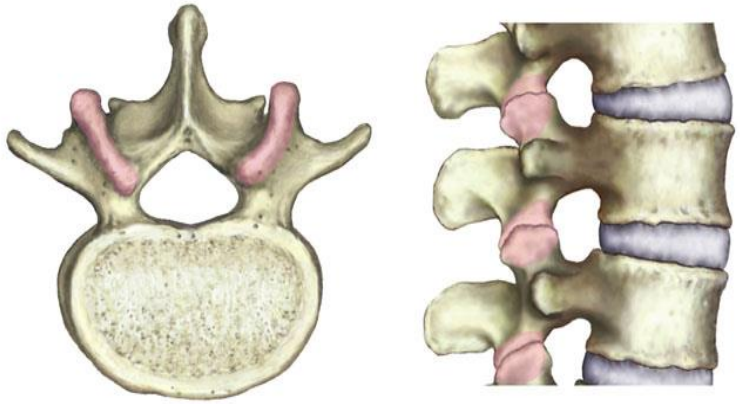
A joint is a place where two or more bones connect. The manner in which they connect determines the type of movement allowed at that joint.



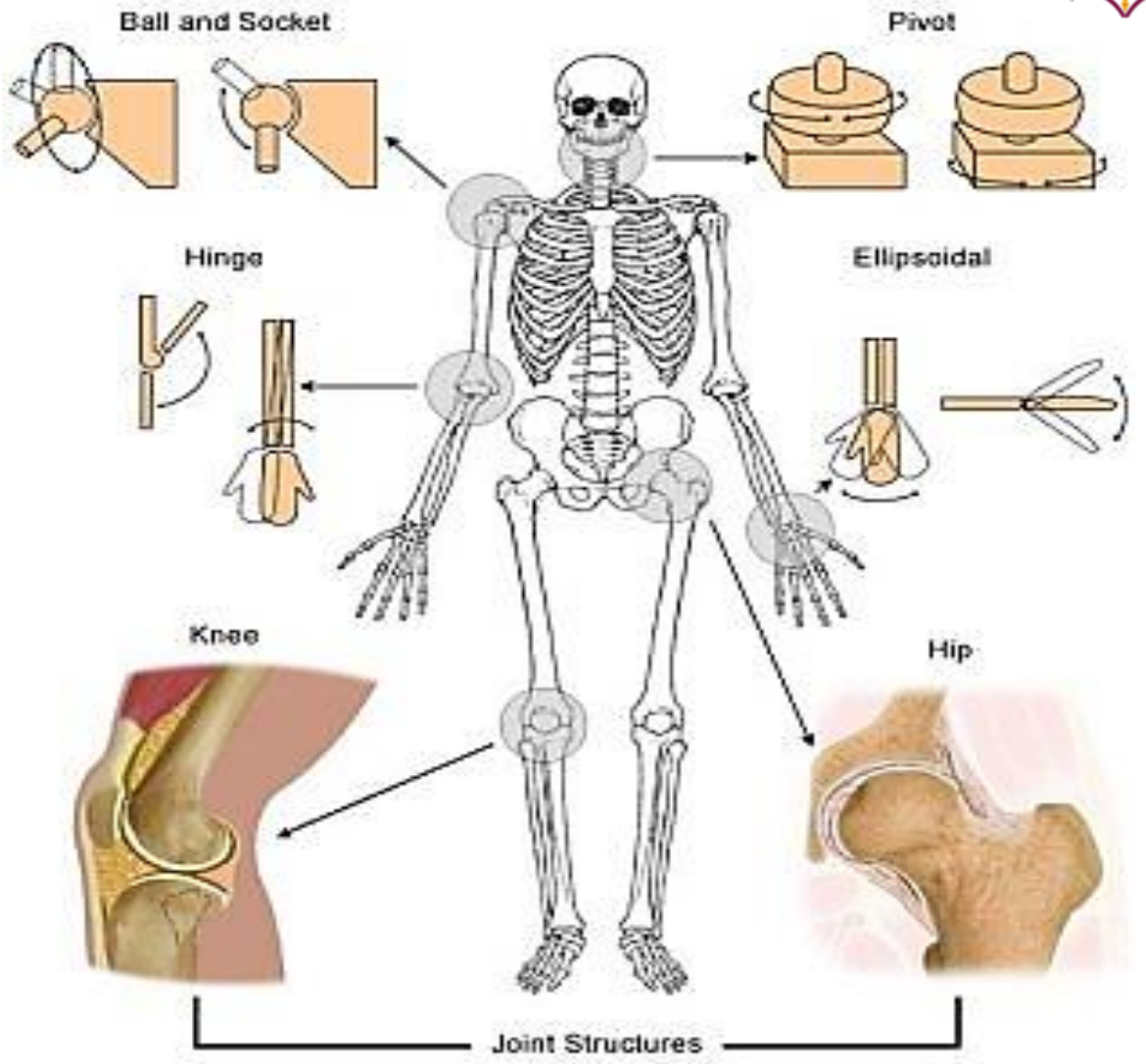
A synarthrosis is a joint that allows no movement. Example a cranial suture.

Joints

A amphiarthrosis is a joint that allows slight movement such as a vertebra.



Facet Joints



A diarthrosis (is a joint that allows free movement in a variety of directions, such as knee, hip, elbow, wrist, and foot.

Q & A

- Describe the six main functions of the skeletal system
- Describe the structure of each part of a long bone.
- Which type of bone primarily provides protection and a large surface area for muscle attachment?
- Give examples of long, short, flat, and irregular bones.
- What bones form the skeleton of the thorax?
- What are the functions of the bones of the thorax?

References

- **For further reading please see:**

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