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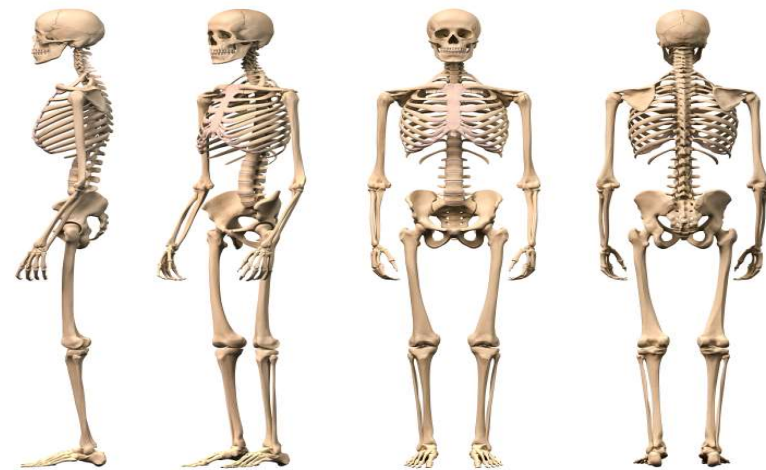
FACULTY OF NURSING



# RAMA UNIVERSITY

## Human Skeleton System

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# Human skeleton

- The **human skeleton** is the internal framework of the body. It is composed of 270 bones at birth
- This total decreases to 206 bones by adulthood after some bones have fused together.

## Cont...

- The bone mass in the skeleton reaches maximum density around age 30. The human skeleton can be divided into the axial skeleton and the appendicular skeleton.

# Functions

The human skeleton serves six major functions;

- Support
- Movement
- Protection
- Production of blood cells
- Storage of ions and endocrine regulation.



# Axial skeleton



- The axial skeleton (80 bones) is formed by the vertebral column (32–34 bones; the number of the vertebrae differs from human to human as the lower 2 parts, sacral and coccygeal bone may vary in length), the rib cage (12 pairs of ribs and the sternum), and the skull (22 bones and 7 associated bones).

## Cont...

The upright posture of humans is maintained by the axial skeleton, which transmits the weight from the head, the trunk, and the upper extremities down to the lower extremities at the Hip Joints

A human is able to survive with just the axial portion of their skeleton

# Appendicular skeleton

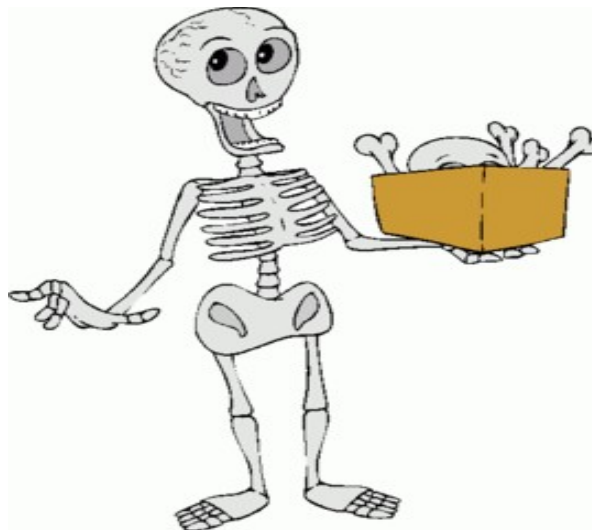
- The appendicular skeleton (126 bones) is formed by the pectoral girdles, the upper limbs, the pelvic girdle or pelvis, and the lower limbs. Their functions are to make locomotion possible and to protect the major organs of digestion, excretion and reproduction.





# Bone

A **bone** is a rigid organ that constitutes part of the vertebral skeleton. Bones support and protect the various organs of the body, produce red and white blood cells, store minerals and also enable mobility.



# Bone tissue

- Bone tissue is a type of dense connective tissue. Bones come in a variety of shapes and sizes and have a complex internal and external structure

## Cont...

- Mineralized osseous structure or bone tissue, is of two types – cortical and cancellous
- Other types of tissue found in bones include marrow, endosteum, periosteum, nerves, blood vessels and cartilage

# Structure of Bone

- Bone is not a uniformly solid material, but is mostly a matrix. The primary tissue of bone, Osseous tissue is relatively hard and lightweight.

## Cont...

Its matrix is mostly made up of a composite material incorporating the inorganic mineral calcium phosphate in the chemical arrangement termed calcium hydroxylapatite and organic collagen, an elastic protein which improves fracture resistance. Bone is formed by the hardening of this matrix around entrapped cells.

# Cortical Bone

The hard outer layer of bones is composed of cortical bone also called compact bone. Cortical referring to the outer (cortex) layer. The hard outer layer gives bone its smooth, white, and solid appearance, and accounts for 80% of the total bone mass of an adult skeleton

# Cancellous Bone

- Filling the interior of the bone is the cancellous bone also known as trabecular or spongy bone tissue.
- It is an open cell porous network. Thin formations of osteoblasts covered in endosteum create an irregular network of spaces.

## Cont...

- Trabecular marrow is composed of a network of rod- and plate-like elements that make the overall organ lighter and allow room for blood vessels and marrow.



# Bone marrow

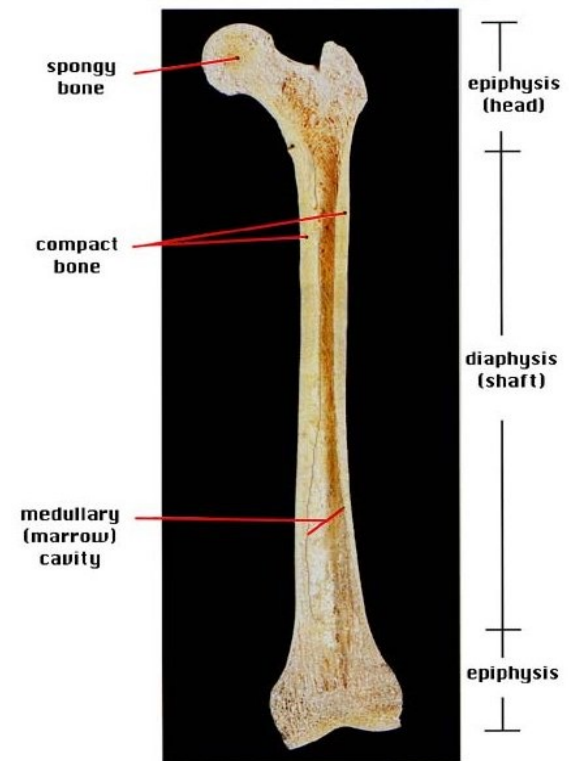
- Bone marrow, also known as myeloid tissue, can be found in almost any bone that holds cancellous tissue.
- In adults, red marrow is mostly found in the bone marrow of the femur, the ribs, the vertebrae and pelvic bones.

# Bone Cells

- Bone is an active tissue composed of different cells.
- Osteoblasts are involved in the creation and mineralisation of bone
- Osteocytes and Osteoclasts are involved in the reabsorption of bone tissue

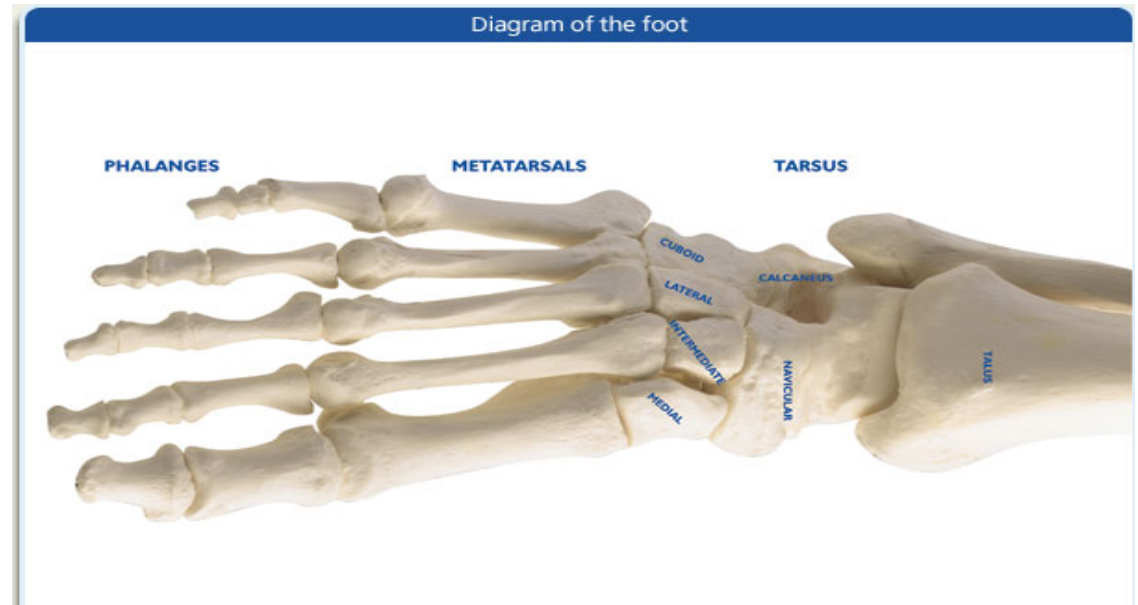
# Types

- **Long Bones** are characterized by a shaft, the Diaphysis, that is much longer than its width; and by an epiphysis a rounded head at each end of the shaft.
- Eg: Most bones of the limbs



# Cont...

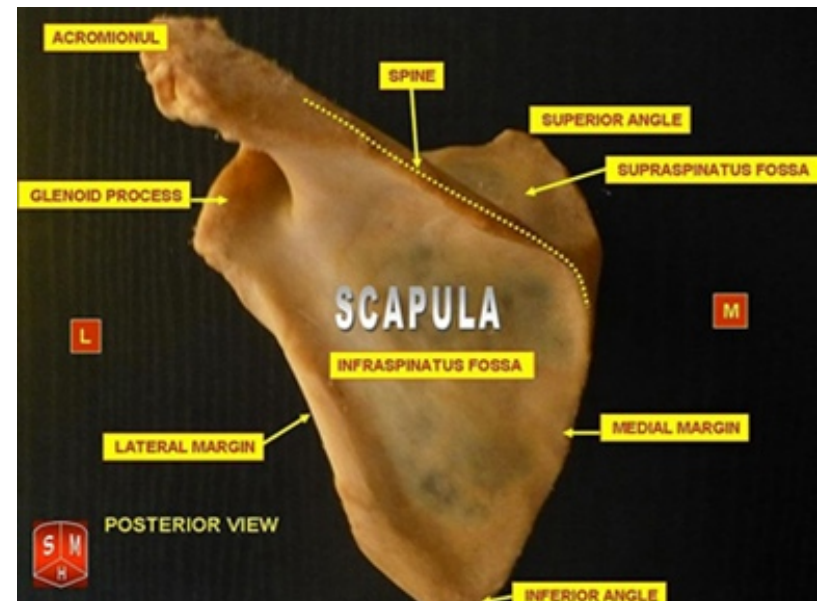
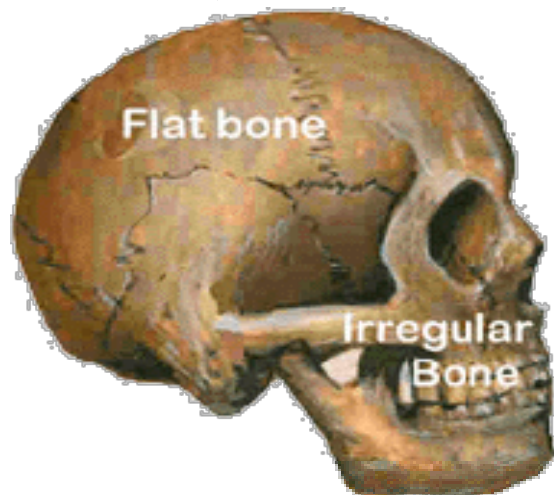
- **Short bones** have only a thin layer of compact bone surrounding a spongy interior. The bones of the wrist and ankle are short bones, as are the sesamoid bones



# Cont...

- **Flat Bones** are thin and generally curved, with two parallel layers of compact bones sandwiching a layer of spongy bone.

Eg: Most of the bones of the skull are flat bones, as is the sternum



# Sesamoid Bones

- Sesamoid bones are bones embedded in tendons. Since they act to hold the tendon further away from the joint, the angle of the tendon is increased and thus the leverage of the muscle is increased. Examples of sesamoid bones are the patella and the pisiform



# Irregular bones

- They consist of thin layers of compact bone surrounding a spongy interior. As implied by the name, their shapes are irregular and complicated.
- The bones of the spine, pelvis, and some bones of the skull are irregular bones



# JOINT

- A joint is a place where the ends of two bones are in proximity and move in relation to each other

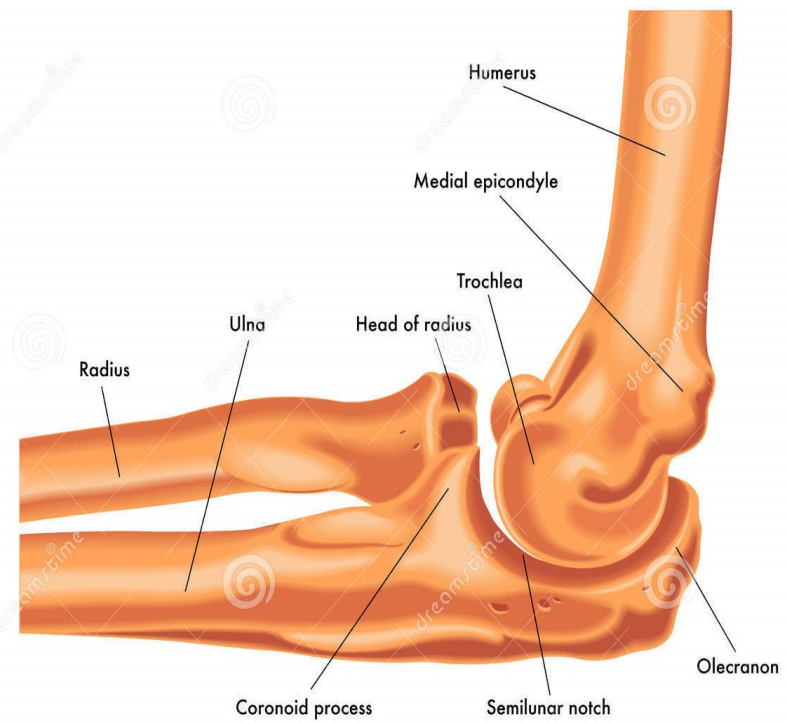




# TYPES

- Hinge Joint

Anatomy of the Knee



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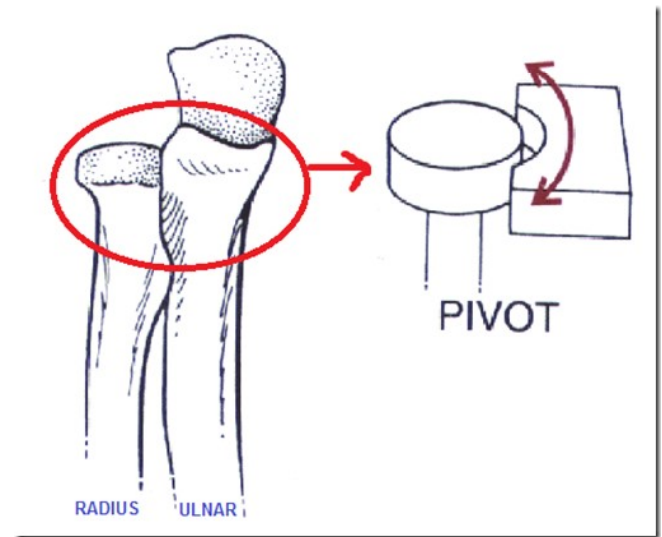
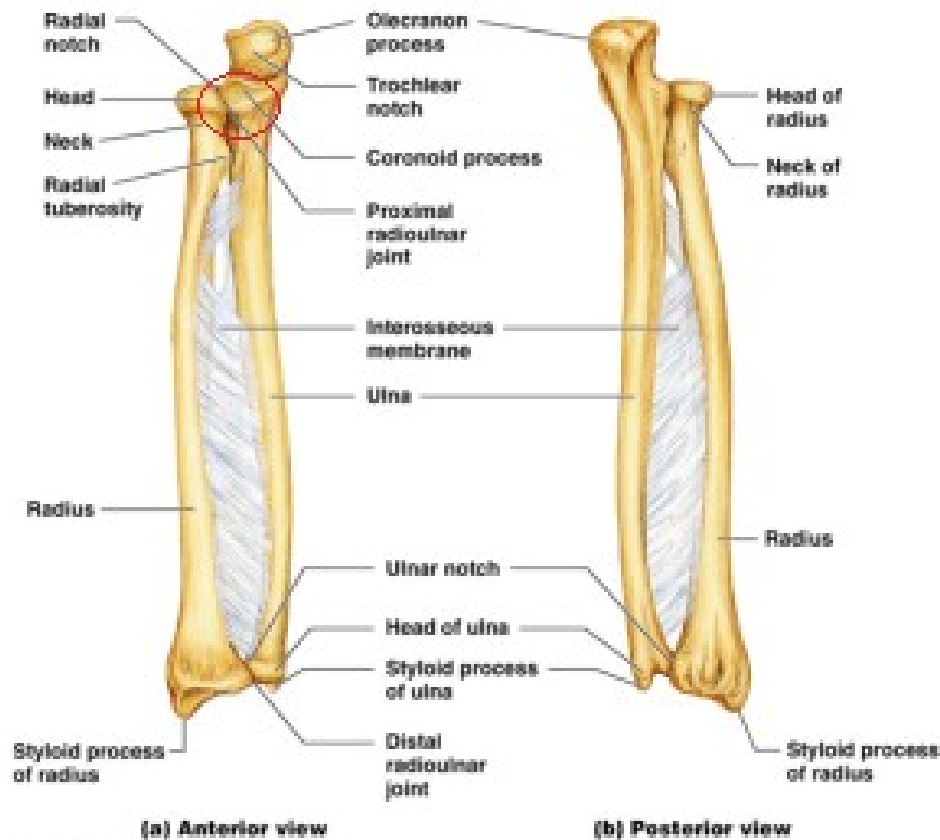
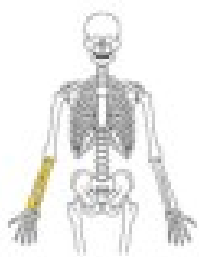
# Cont...

- Ball and Socket type



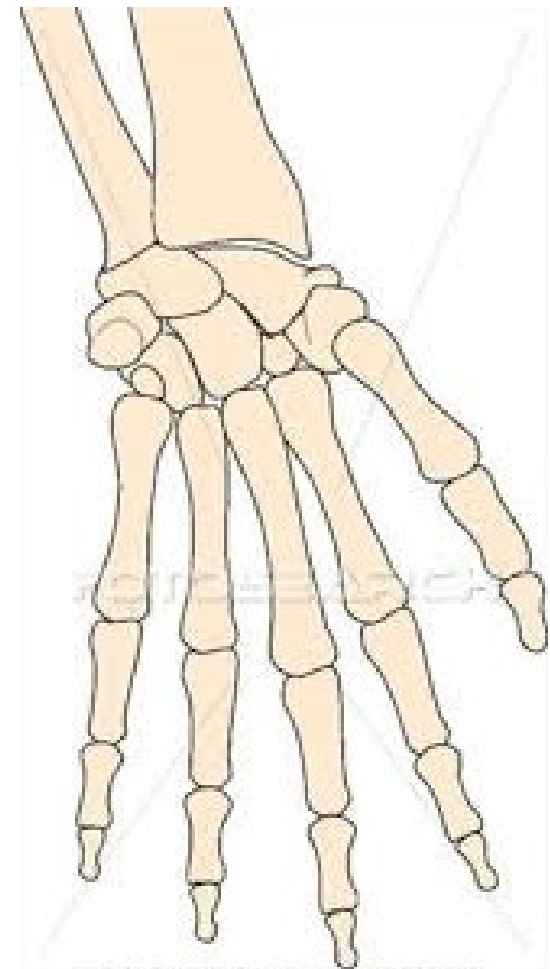
# Cont....

- Pivot Joint



# Cont...

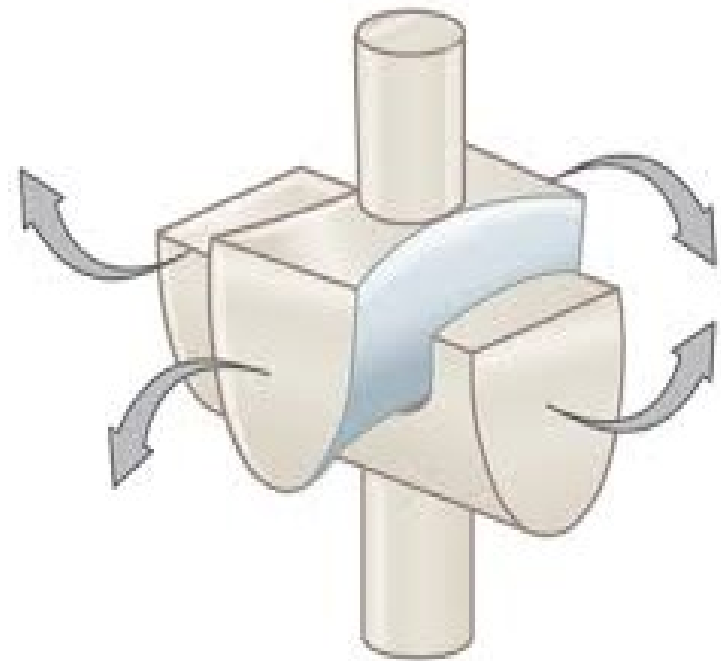
- **Condyloid Joint**



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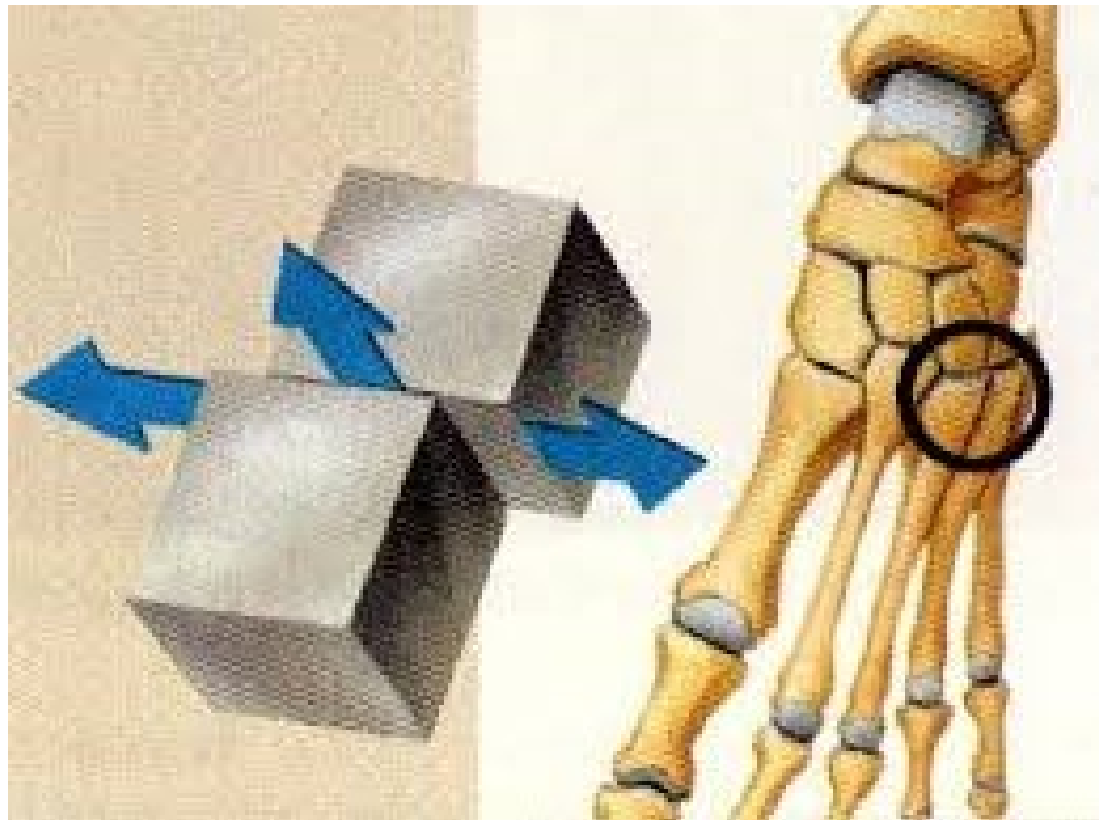
# Cont...

- Saddle Joint



# Cont....

- Gliding Joint



# Cartilage

# Cartilage

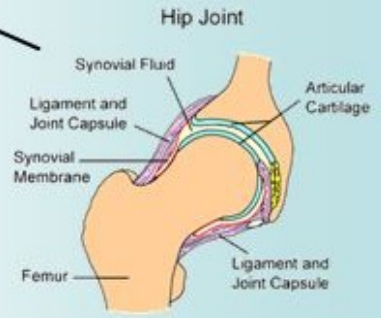
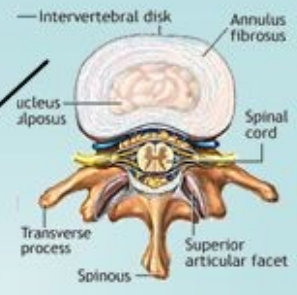
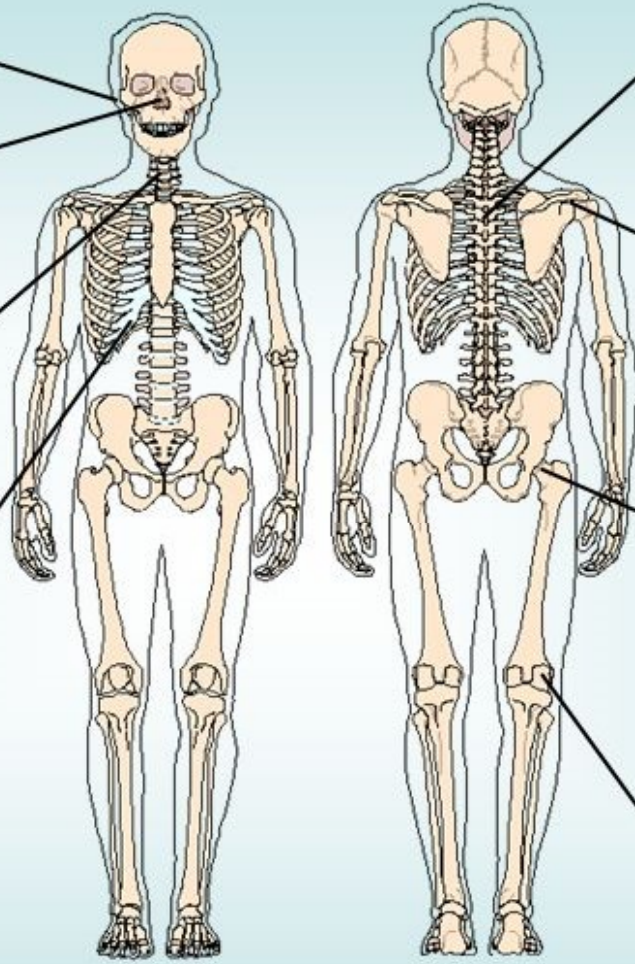
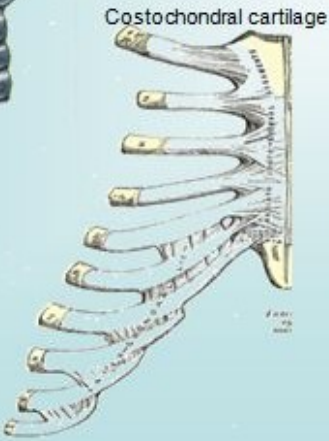
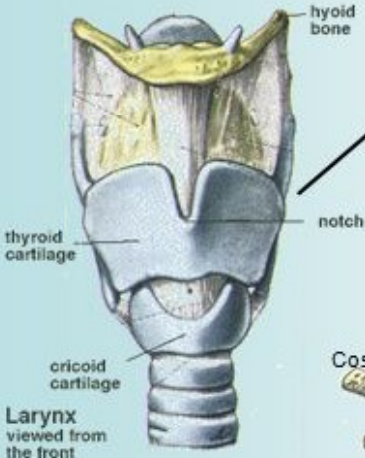
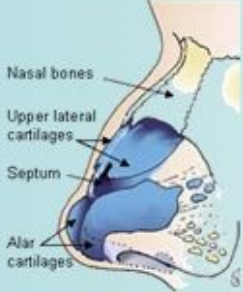
- Cartilage is an important structural component of the body. It is a firm tissue but is softer and much more flexible than bone.



## Cont...

- Cartilage is a connective tissue found in many areas of the body including:
  - Joints between bones e.g. the elbows, knees and ankles
  - Ends of the ribs
  - Between the vertebrae in the spine
  - Ears and nose
  - Bronchial tubes or airways

# CARTILAGE IN THE HUMAN BODY



## Cont...

- Cartilage is made up of specialized cells called chondrocytes.
- These chondrocytes produce large amounts of extracellular matrix composed of collagen fibres, proteoglycan, and elastin fibers.
- There are no blood vessels in cartilage to supply the chondrocytes with nutrients.

## Cont...

- Instead, nutrients diffuse through a dense connective tissue surrounding the cartilage (called the perichondrium) and into the core of the cartilage.
- Due to the lack of blood vessels, cartilage grows and repairs more slowly than other tissues

# Types

- Cartilage is categorized into three types which include:

## **Hyaline cartilage**

This is a low-friction, wear-resistant tissue present within joints that is designed to bear and distribute weight. It is a strong, rubbery, flexible tissue but has a poor regenerative capacity.

Cont...

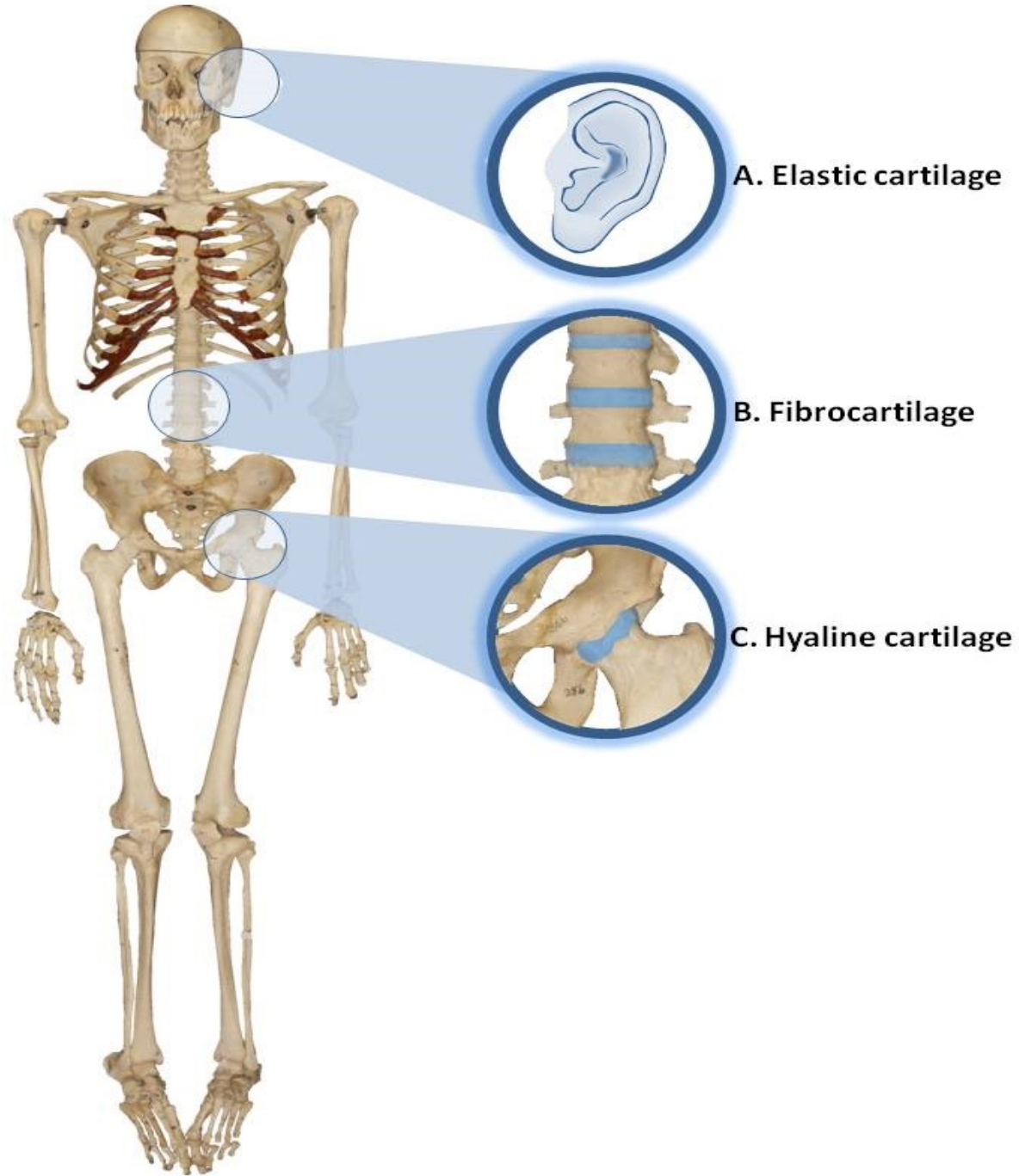
## **Elastic cartilage**

Elastic cartilage is more flexible than hyaline cartilage and is present in the ear, larynx and epiglottis.

Cont...

## **Fibrocartilage**

Fibrocartilage is a tough and inflexible form of cartilage found in the knee and between vertebrae.





# Functions

- **Mechanical Properties**

The mechanical properties of articular cartilage in load bearing joints such as Knee and Hip

- **Frictional properties**

Lubricin, a glycoprotein abundant in cartilage and synovial fluid, plays a major role in bio-lubrication and wear protection of cartilage

- **Repair**

Cartilage has limited repair capabilities

# MUSCLE

**Muscle** is a soft tissue found in most animals.

Muscle cells contain protein filaments of actin and myosin that slide past one another, producing a contraction that changes both the length and the shape of the cell.

# Cont...

Muscle tissues are derived from the mesodermal layer of embryonic germ cells in a process known as myogenesis.

There are three types of muscle, Skeletal or striated, Cardiac, and Smooth.

Muscle action can be classified as being either voluntary or involuntary.

## Cont...

- Skeletal Muscle or "voluntary muscle" is anchored by tendons to bone and is used to effect skeletal movement such as locomotion and in maintaining posture.
- Smooth muscle or "involuntary muscle" is found within the walls of organs and structures such as the esophagus, stomach, intestines, Bronchi, blood vessels etc

# Cont...

- Cardiac muscle (myocardium), is also an "involuntary muscle" but is more akin in structure to skeletal muscle, and is found only in the heart.