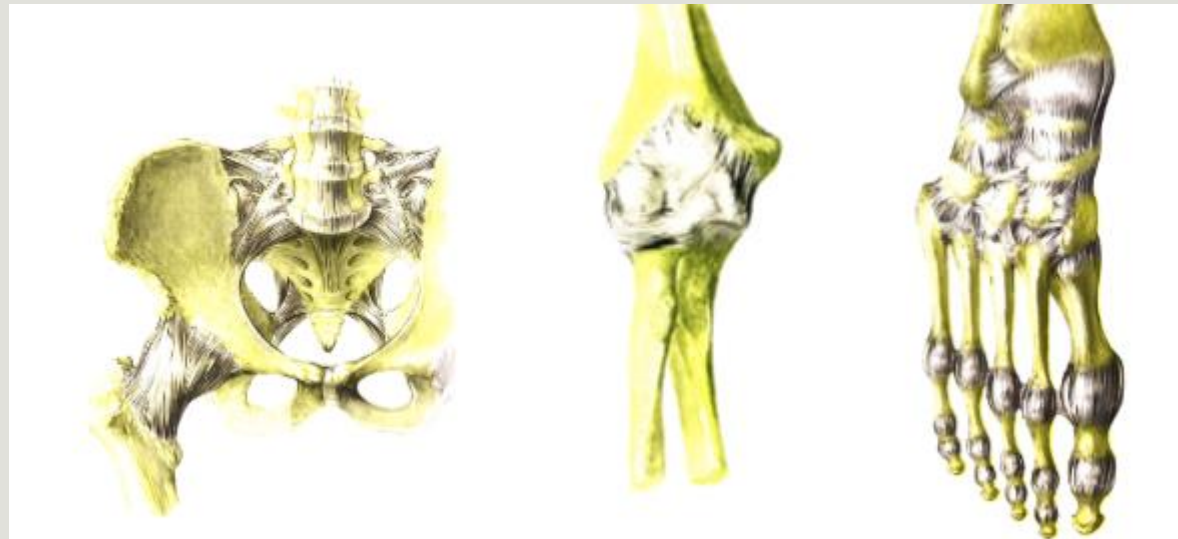


Joints

Introduction to Joints

A joint is a point of connection **between two bones**

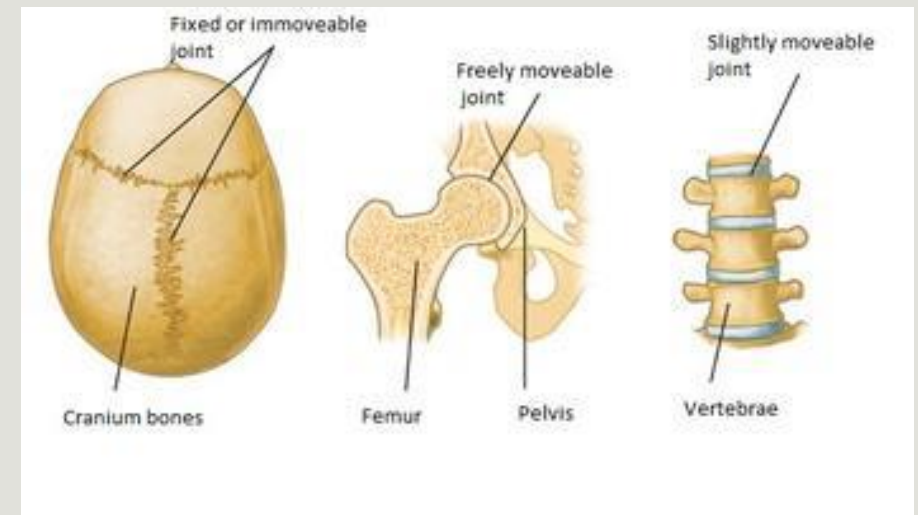
Strands of connective tissue, called **ligaments**, **hold the bones together and ensure the stability of joints**



Joint Classification

Joints are classified according to their motion capabilities:

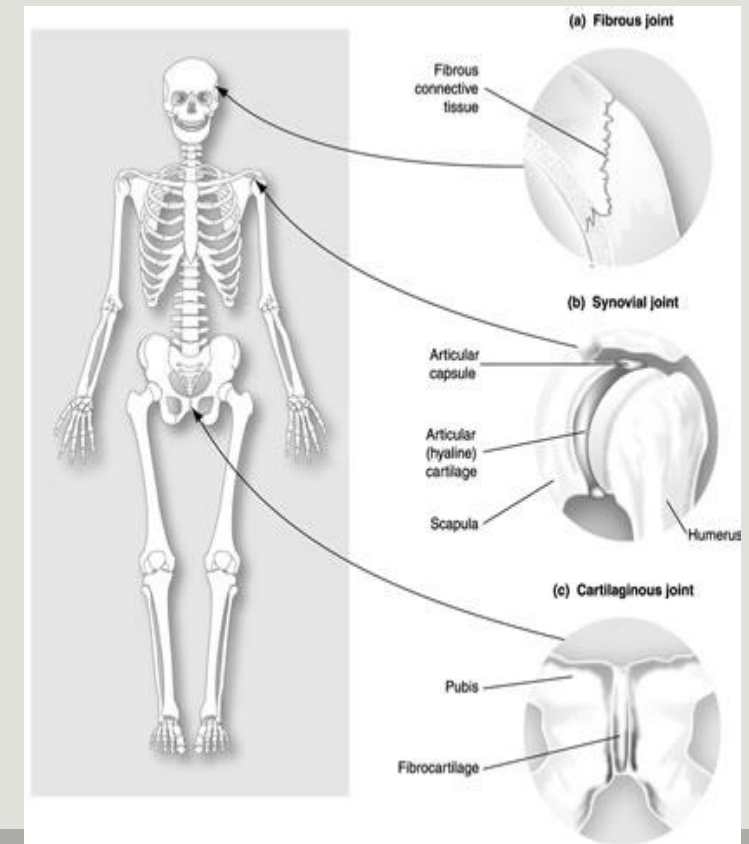
- Syntharoses
 - **immovable**
- Amphiarthroses
 - **Slightly movable**
- Diarthroses
 - **Allow the greatest amount of motion**



Joint Classification

Joints are further classified by the material that joints them:

- Fibrous joint
 - **Allow no movement**
 - E.g. sutures of the skull
- Cartilaginous joint
 - **Allow limited movement**
 - E.g. intervertebral disks
- Synovial joint
 - **Allow large range of movement**
 - Eg: Hip joint



Characteristics of Synovial Joints

Hyaline cartilage

- A protective layer of dense white connective tissue that **covers the ends of the articulating bones**

Joint cavity

Synovial membrane

- Covers joint cavity, except over the surfaces of articular cartilages
- **Secretes the lubrication fluid**

Synovial fluid

- **Lubricates the joints**

Capsule

- May or may not have thickenings called intrinsic ligaments

Extrinsic ligaments

- Support the joint and **connect the articulating bones of the joint**

Types of Synovial Joints

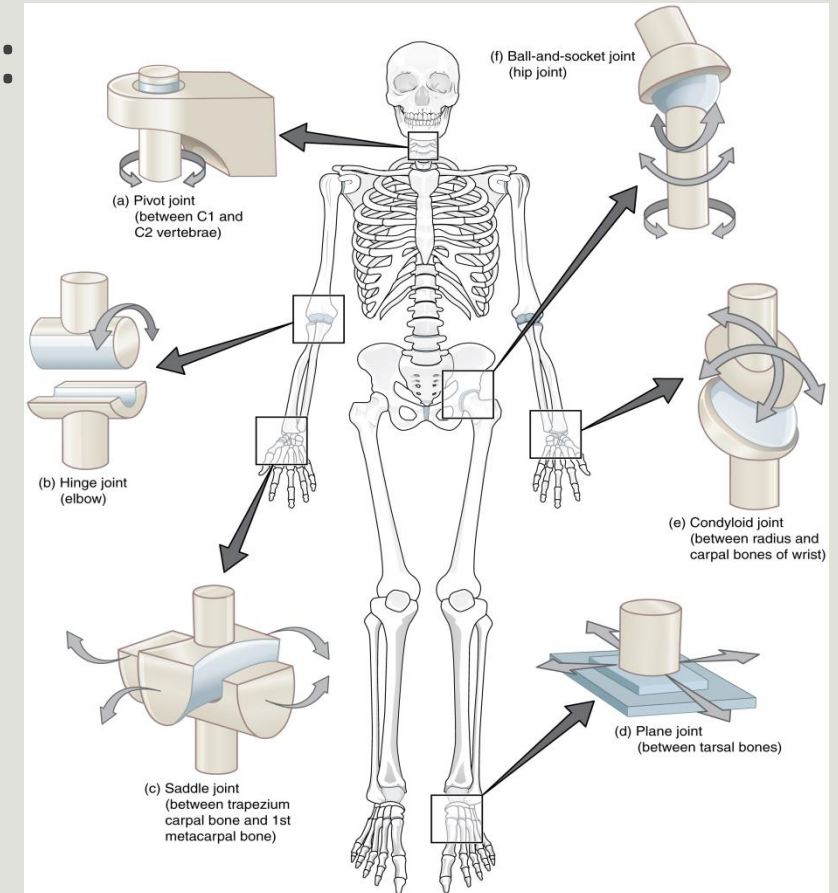
There are three basic types of synovial joints:

- Unilateral (**rotation about only one axis**)
- Biaxial joints (movement about **two perpendicular axes**)
- **Multiaxial joints** (movement about all **three** perpendicular axes)

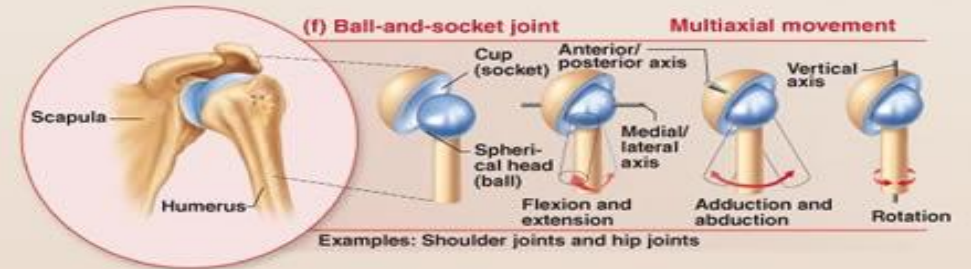
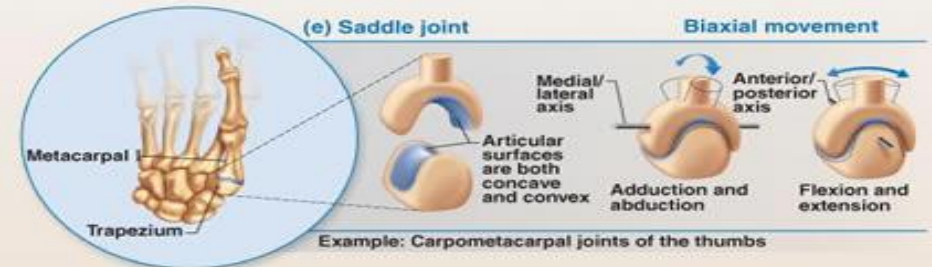
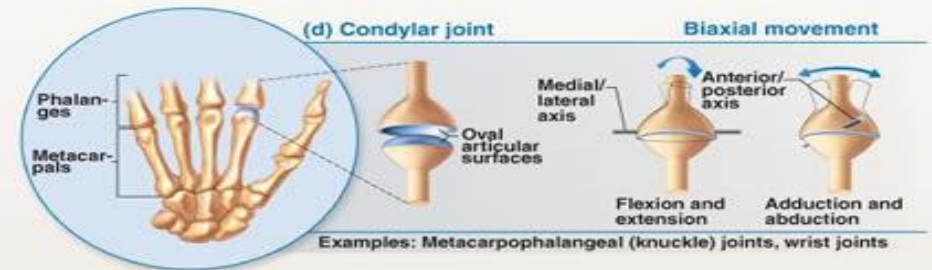
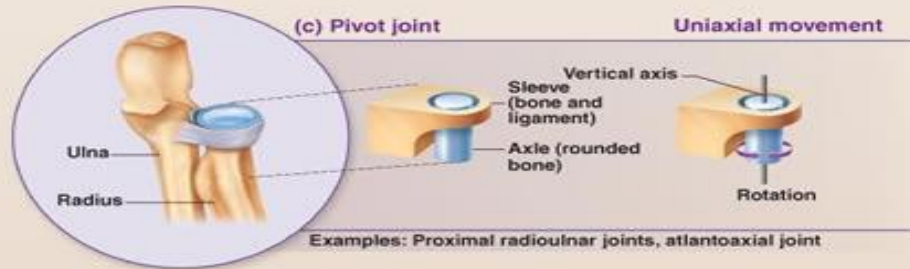
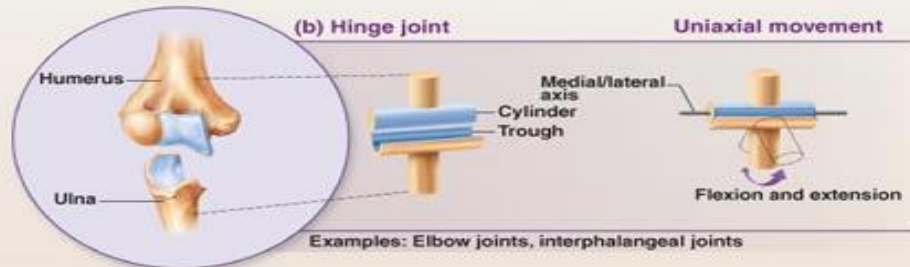
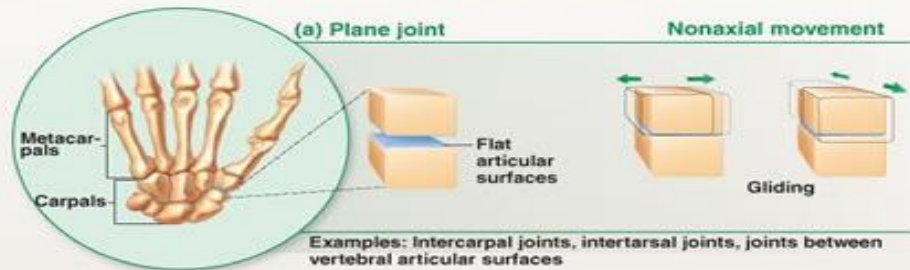
Types of Synovial Joints

Synovial joints are further classified into:

- **Hinge joint**
- Pivot joint
- **Condyloid joint**
- Saddle-shaped joint
- **Ball and socket joint**
- Plane joint



Types of Synovial Joints

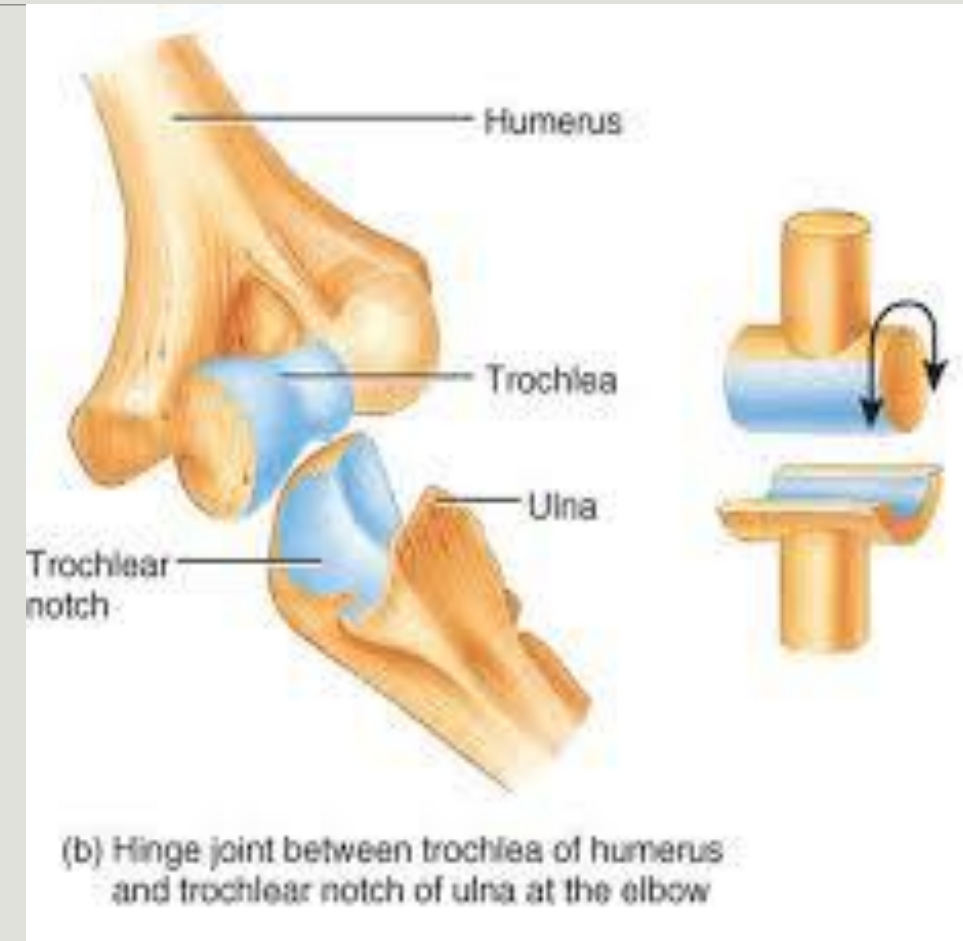


Hinge Joint

Uniaxial

Has one articulating surface that is **convex**, and another that is **concave**

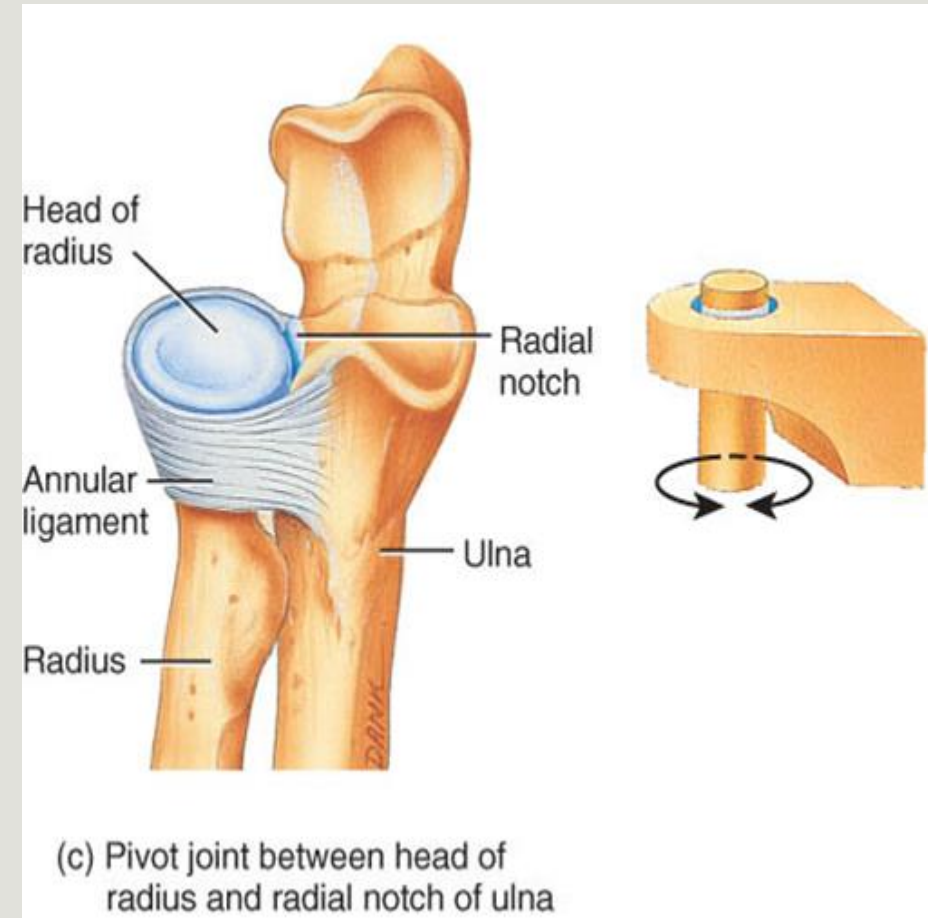
E.g. humero-ulnar elbow joint, interphalangeal joint



Pivot Joint

Uniaxial

E.g. head of radius rotating against ulna

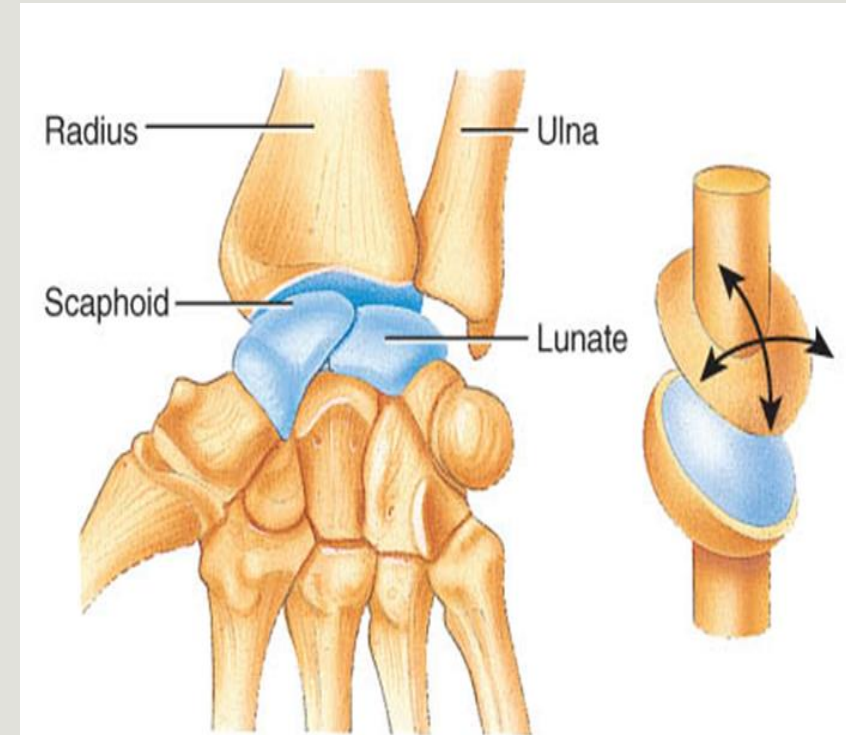


Condyloid (Knuckle) Joint

Biaxial (**flexion-extension, abduction--adduction**)

The joint surfaces are usually oval

One joint surface is an ovular convex shape, and the other is a **reciprocally shaped concave surface**



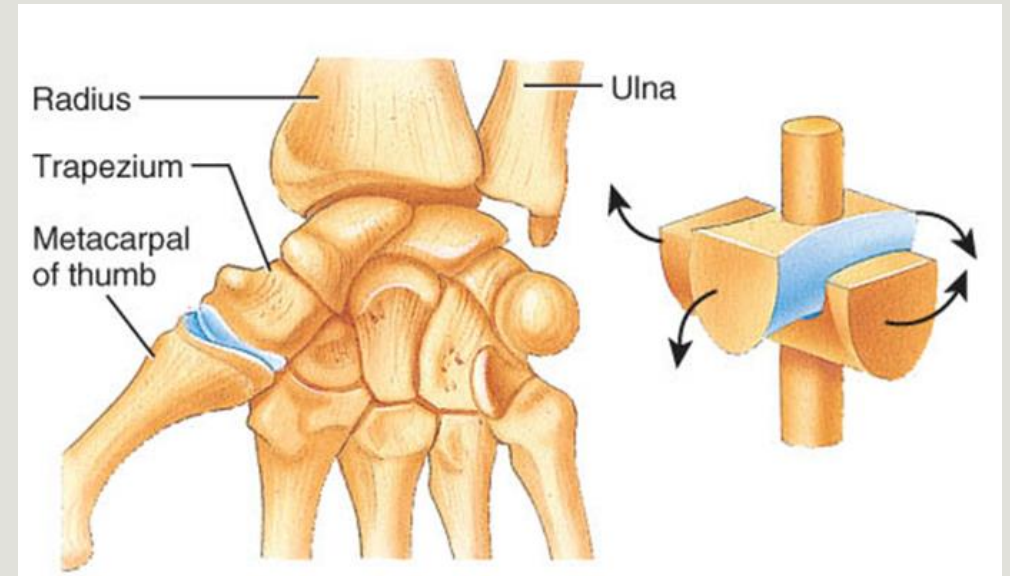
(d) Condyloid joint between radius and scaphoid and lunate bones of the carpus (wrist)

Saddle Joint

Biaxial (flexion-extension, abduction adduction)

The bones **set together as in sitting on a horse**

E.g. **carpometacarpal joint of the thumb**



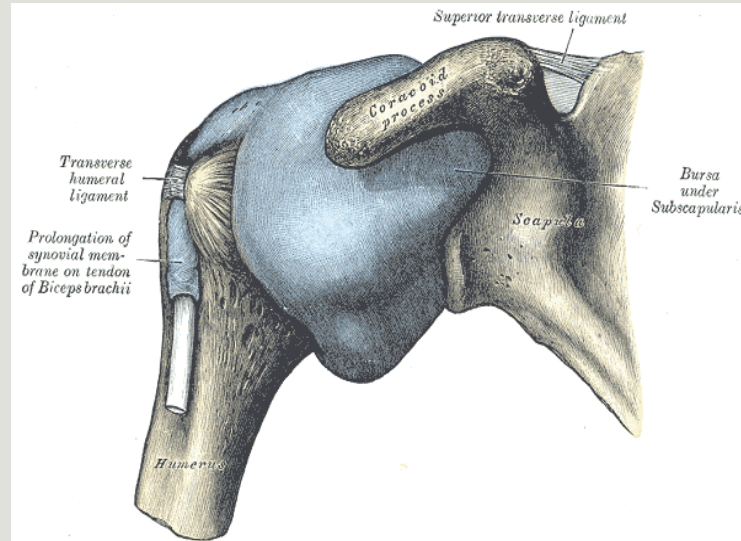
Ball and Socket Joint

Multiaxial rotation (rotation in all planes)

A rounded bone is fitted into a cup

- like a receptacle

E.g. shoulder & hip joints

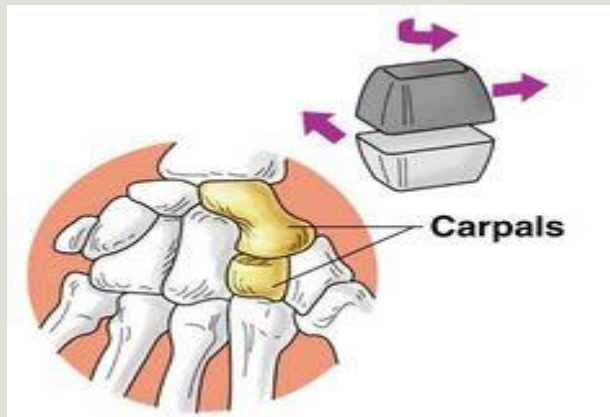


Plane (Gliding) Joint

Uniaxial (permits gliding movements)

The bone surfaces involved **are nearly flat**

E.g. **intercarpal joints** and **acromioclavicular joint** of the vertebrae

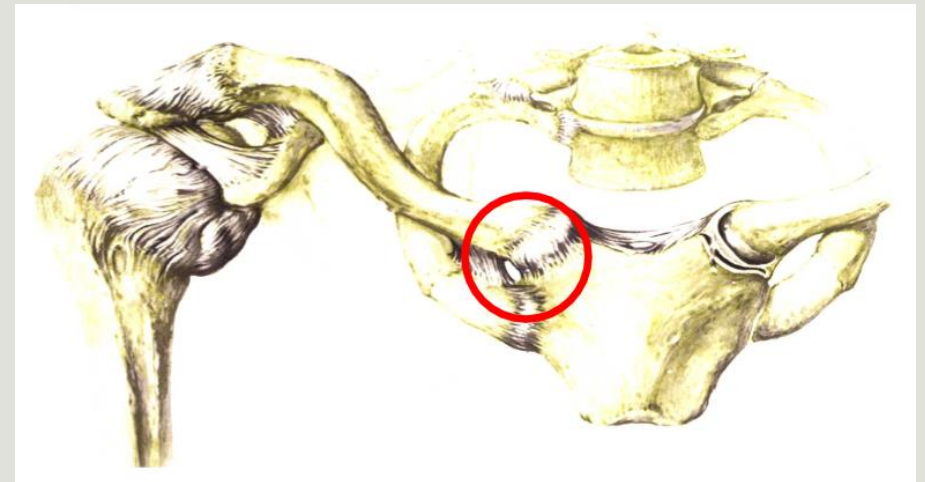


Sternoclavicular Joint

Connects the **sternum to the clavicle**

The only joint connecting **the pectoral girdle to the axial skeleton**

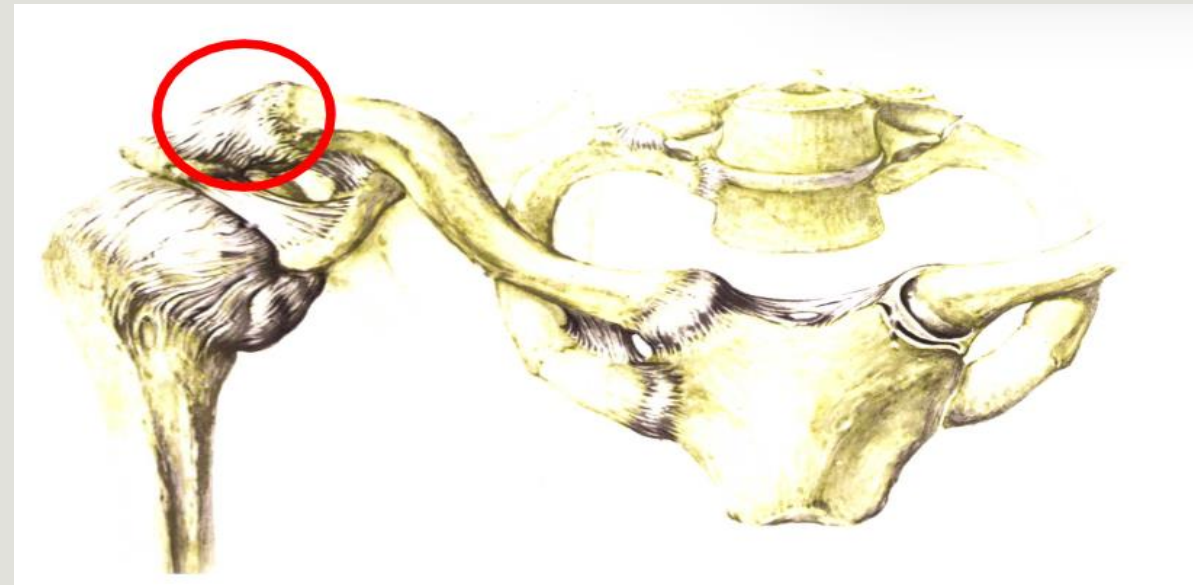
True synovial joint strengthened by an intracapsular disc and extrinsic ligaments



Acromioclavicular Joint

Unites the **lateral end of the clavicle** with the acromion process of the scapula

Where the shoulder separations often occur in sports such as hockey, baseball, and football



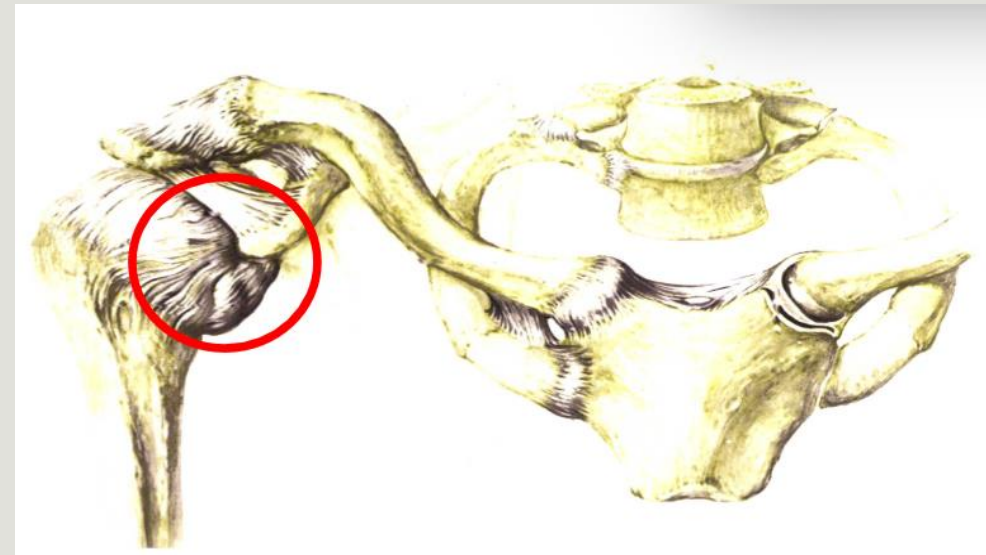
Glenohumeral Joint

Connects the **upper limb and the scapula**

Typical **multiaxial joint**

Wide range of movement at this joint

Compromised = relative lack of stability



Upper Limb Joints

Elbow Joint

There are three joints at the elbow:

Humero-ulnar joint

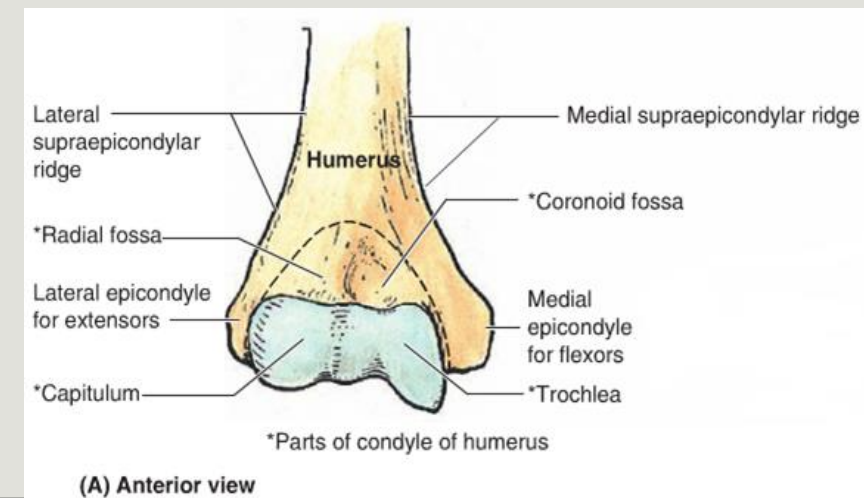
- **Medial (with respect to anatomical position)**
- Between the trochlea of the humerus and the olecranon process of the ulna

Humero-radial joint

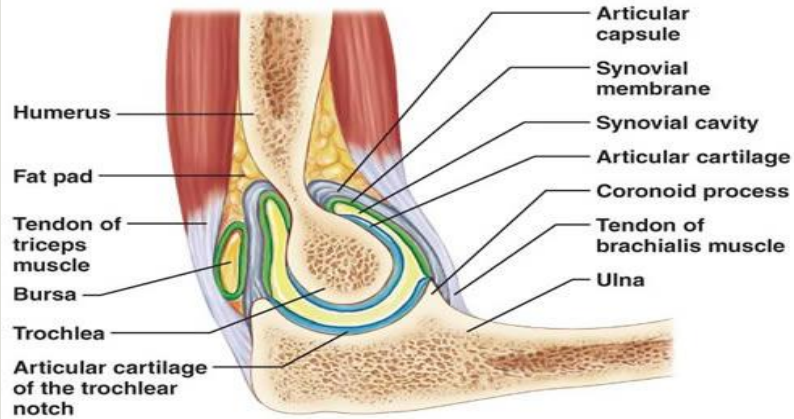
- **Lateral**
- Between the capitulum of the humerus and the head of the radius

Radio-ulnar joint

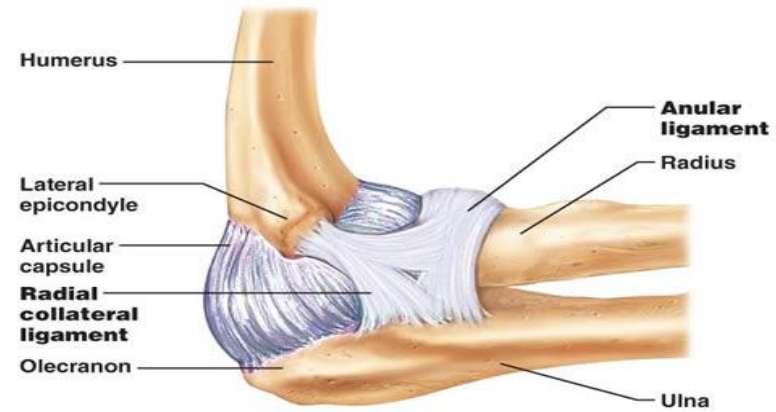
- Between the radius and the ulna



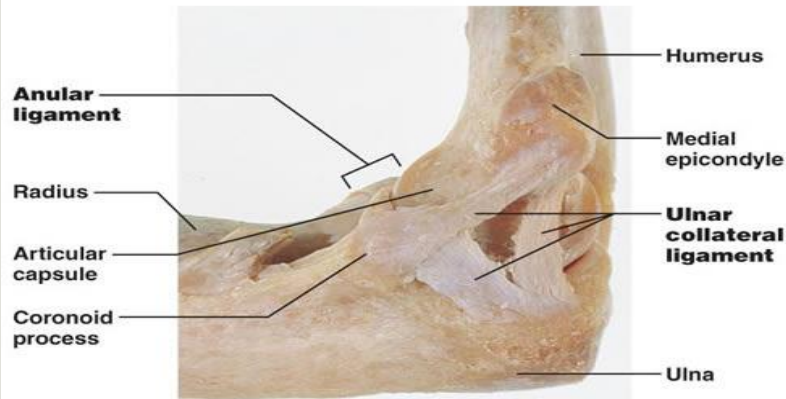
Elbow Joint



(a) Median sagittal section through right elbow (lateral view)

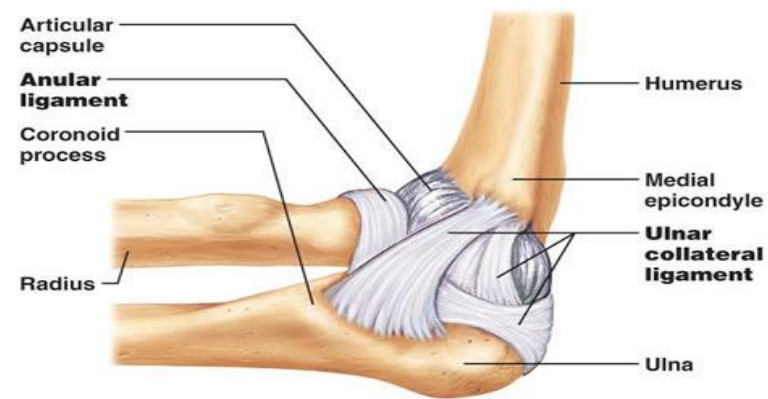


(b) Lateral view of right elbow joint



(c) Cadaver photo of medial view of right elbow

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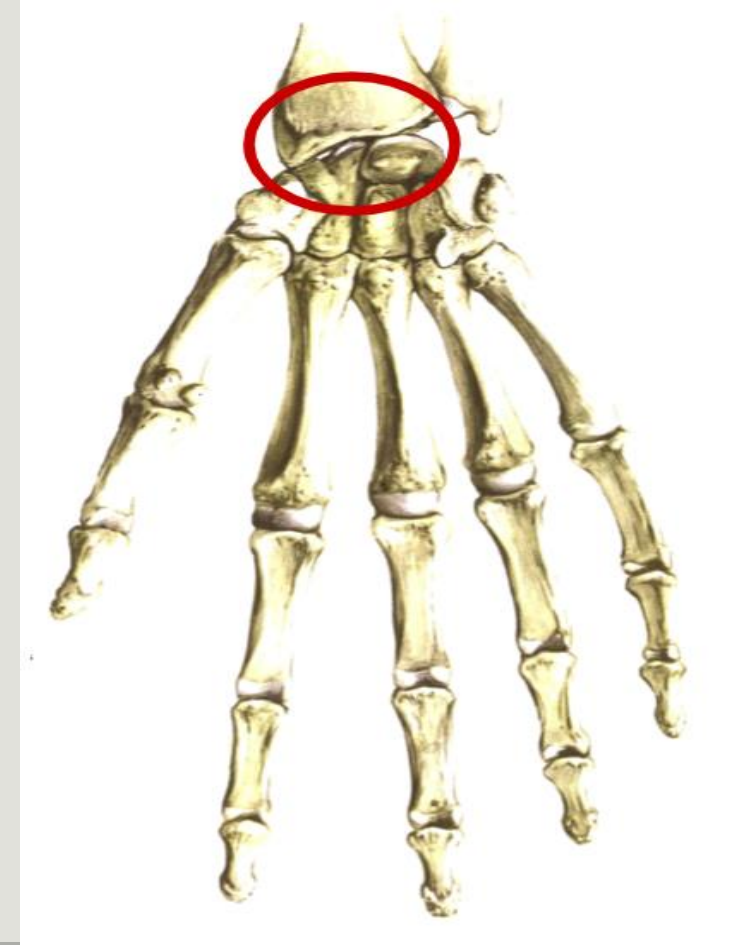


(d) Medial view of right elbow

Joints of the Wrist

Radio-carpal joint

- Between the distal end of **the radius and the carpals**
- Movements: **flexion-extension** and **abduction-adduction**



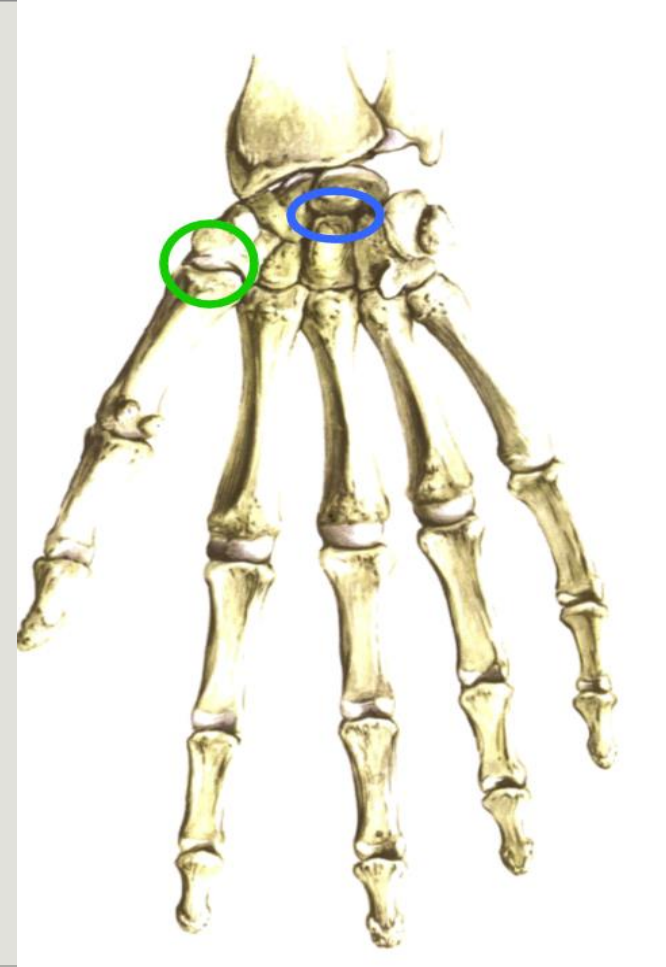
Joints of the Hand

Intercarpal joints

- Between the bones of the Carpus
- Gliding joints

Carpometacarpal joint

- **Between carpals and metacarpals**
- The characteristics of the carpometacarpal joint of the thumb allows the range of movement **necessary for grasping**



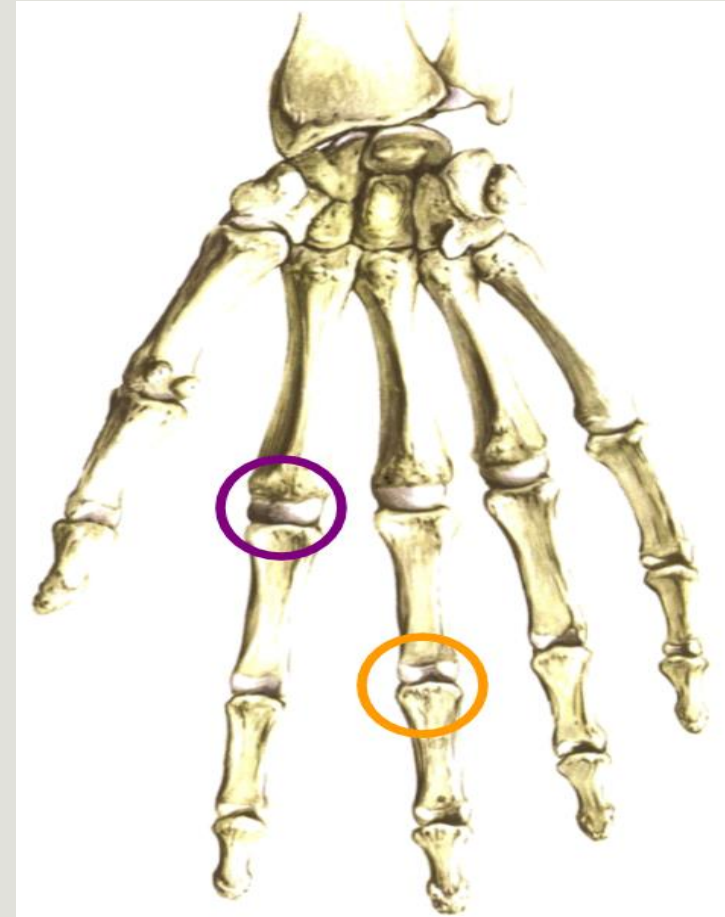
Joints of the Hand

Metacarpophalangeal joints

- Joints between metacarpals and phalanges
- **The knuckles**
- Movement → flexion-extension, abduction-adduction

Interphalangeal joints

- **Joints between the phalanges**
- Permit flexion-extension



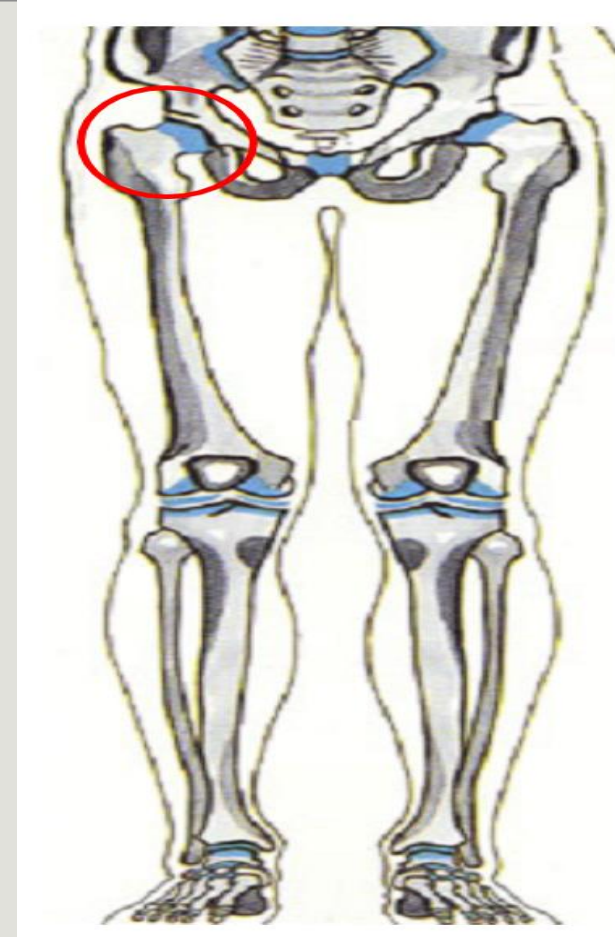
Joints of the Pelvic Girdle

Hip Joint

Between the head of the femur and the cup (**acetabulum**) of the hip bone (**os coxae**)

Like the shoulder, hip joint is:

- **Ball and socket joint**
- Multiaxial joint that allows **flexionextension, abduction-adduction and circumduction**



Hip Joint

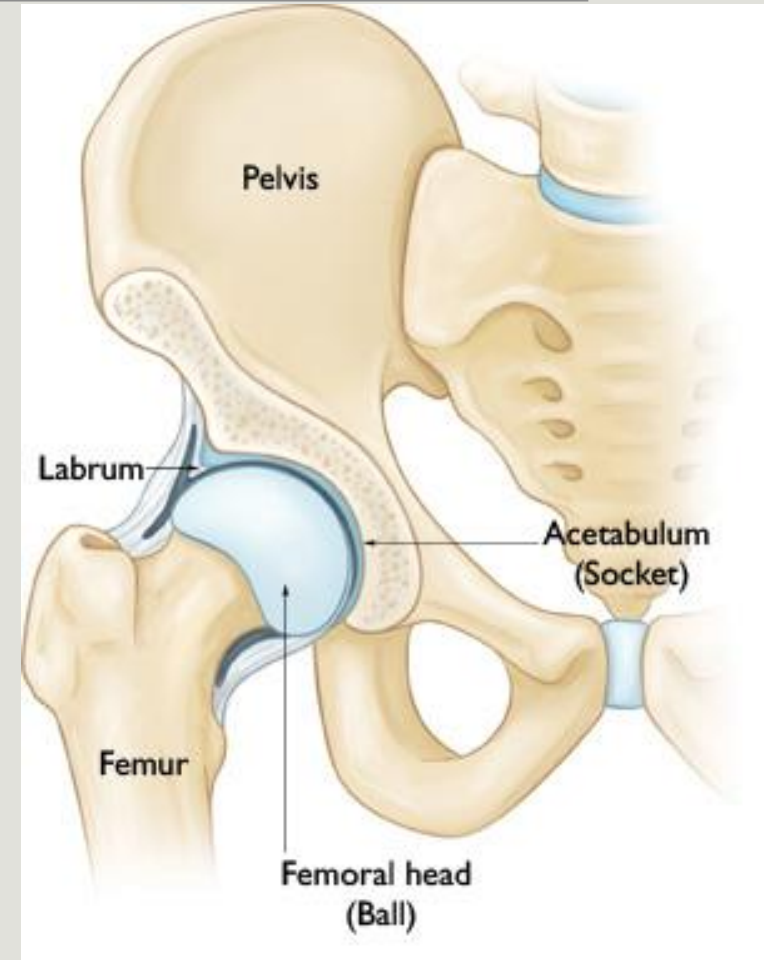
Unlike shoulder joint, **hip joint is very stable**

Dislocation in sports is not common, but can occur via car collisions

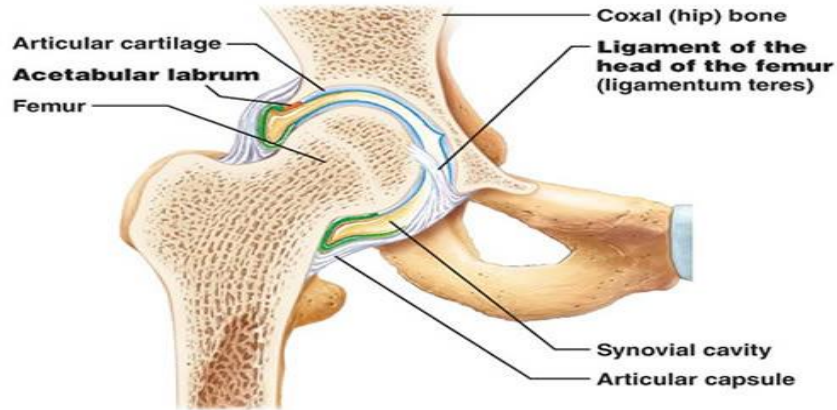
Dislocate the head posteriorly or drive it through the posterior lip of the acetabulum

In fact, it is the body's most stable synovial joint due to:

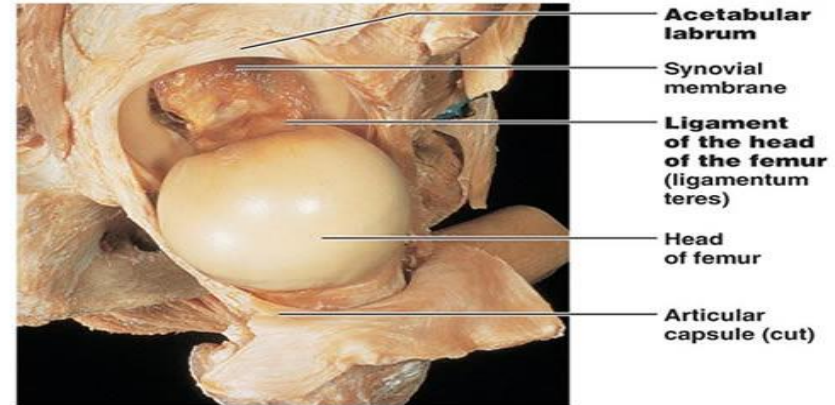
- **Deepened socket**
- **An intrinsic and very strong extrinsic ligaments**



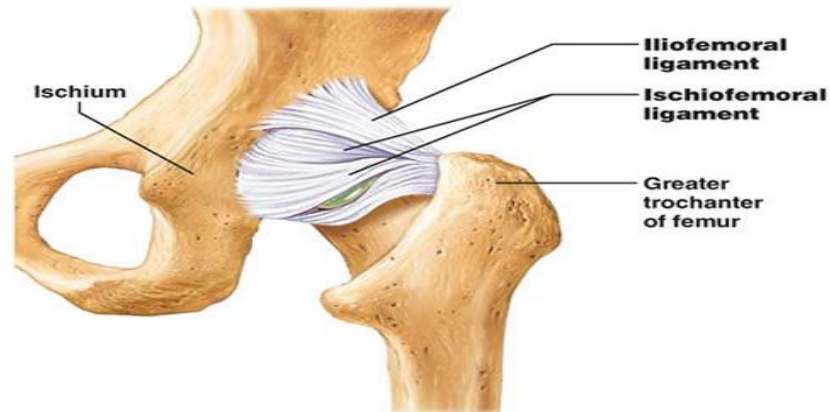
Hip Joint



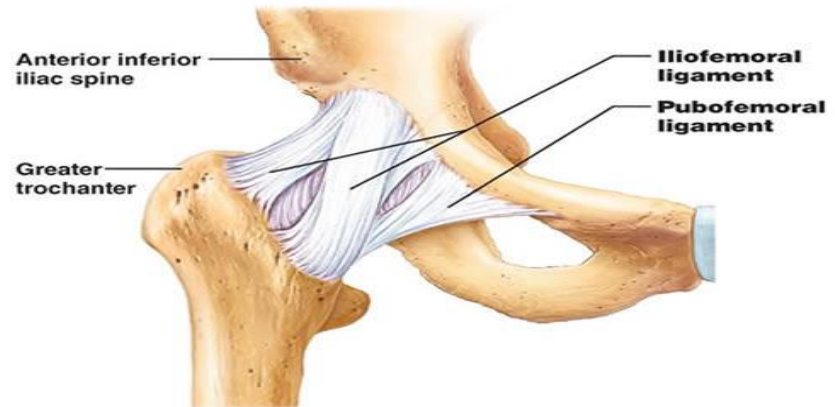
(a) Frontal section through the right hip joint



(b) Photo of the interior of the hip joint, lateral view



(c) Posterior view of right hip joint, capsule in place



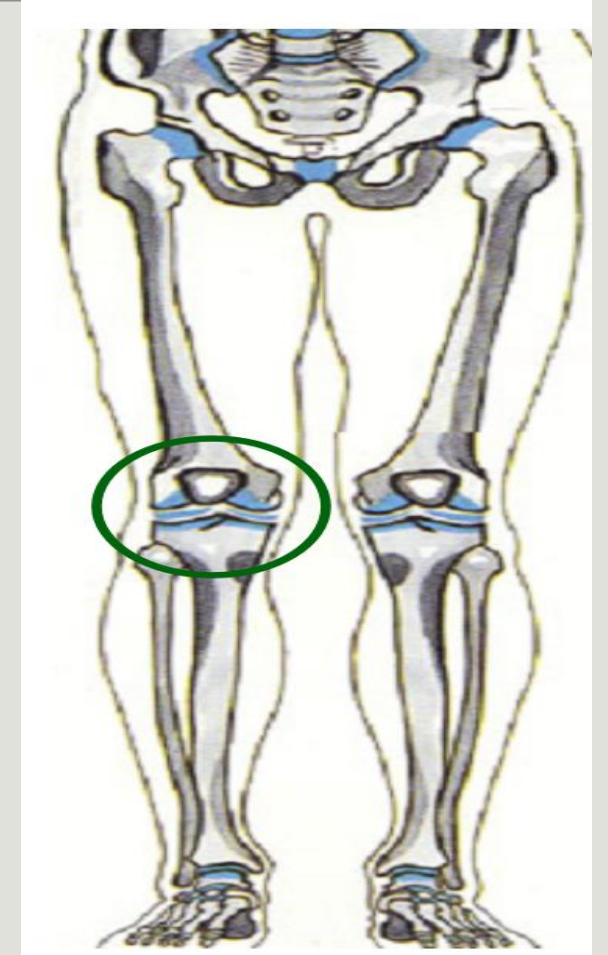
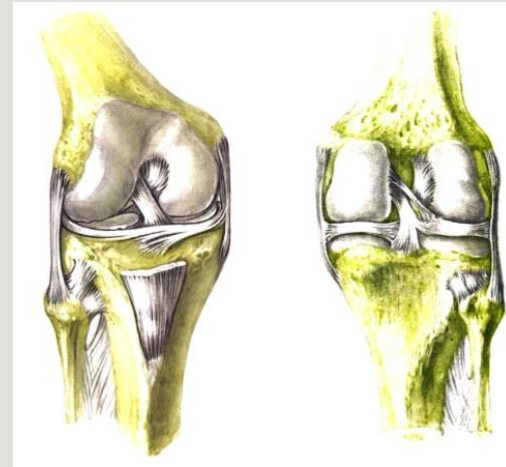
(d) Anterior view of right hip joint, capsule in place

Lower Limb Joints

Knee Joint

Tibiofemoral or knee joint

Incredible range of movement
(flexion extension)



Knee

However, knee joint is relatively stable due to additional structural supports from:

- Menisci
 - Shock-absorbing fibrocartilaginous discs
- Anterior and posterior cruciate ligaments
 - In the center of the joint
- Lateral and medial collateral ligaments
 - Extending from the sides of the femur to the tibia and fibula
- The musculature that surrounds it

Knee Joint

Movements:

Primary action is **flexion-extension** (i.e. squat or jump)

When flexed, medial and lateral rotation can also occur

Knee
(tibiofemoral joint)



Lateral rotation of flexed knee
(right knee)



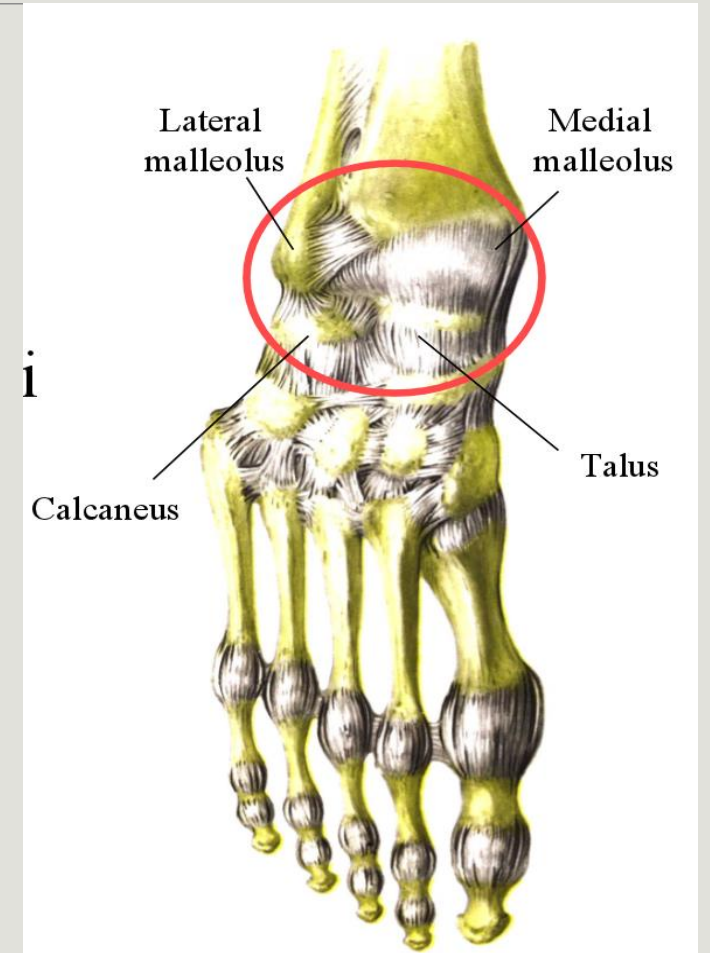
Medial rotation of flexed knee
(right knee)

Ankle Joint

Talocrural or ankle joint

Involves several bones

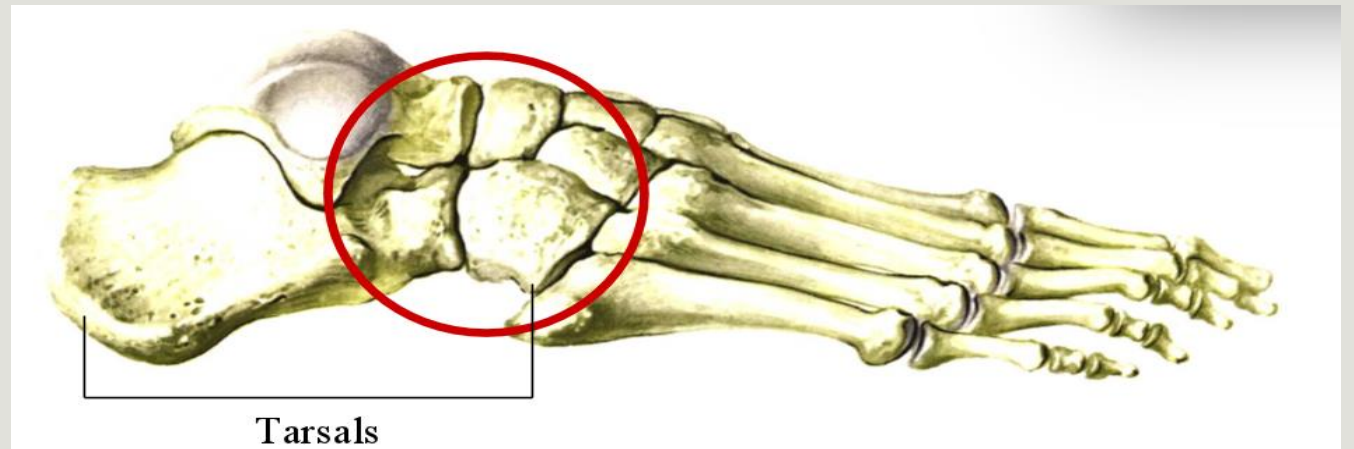
- Medial and lateral malleoli of the tibia and fibula
- Head of the talus
- Calcaneus (heel bone)



Foot and Toe Joints

Intertarsal joints

- **Between tarsals**
- Transverse tarsal joint
 - Between the proximal and distal row of the tarsal bones
 - Movement: **inversion-eversion** of the sole of the foot
 - This action enables you to **adjust to uneven ground when walking or running**



Foot and Toe Joints

As in the hand, there are joints between the **tarsal bones, metatarsals and phalanges**:

- **Tarsometatarsal**
- **Metatarsophalangeal**
- **Interphalangeal**
 - They are strengthened by plantar ligaments which **aid in maintaining the arc of the foot**

