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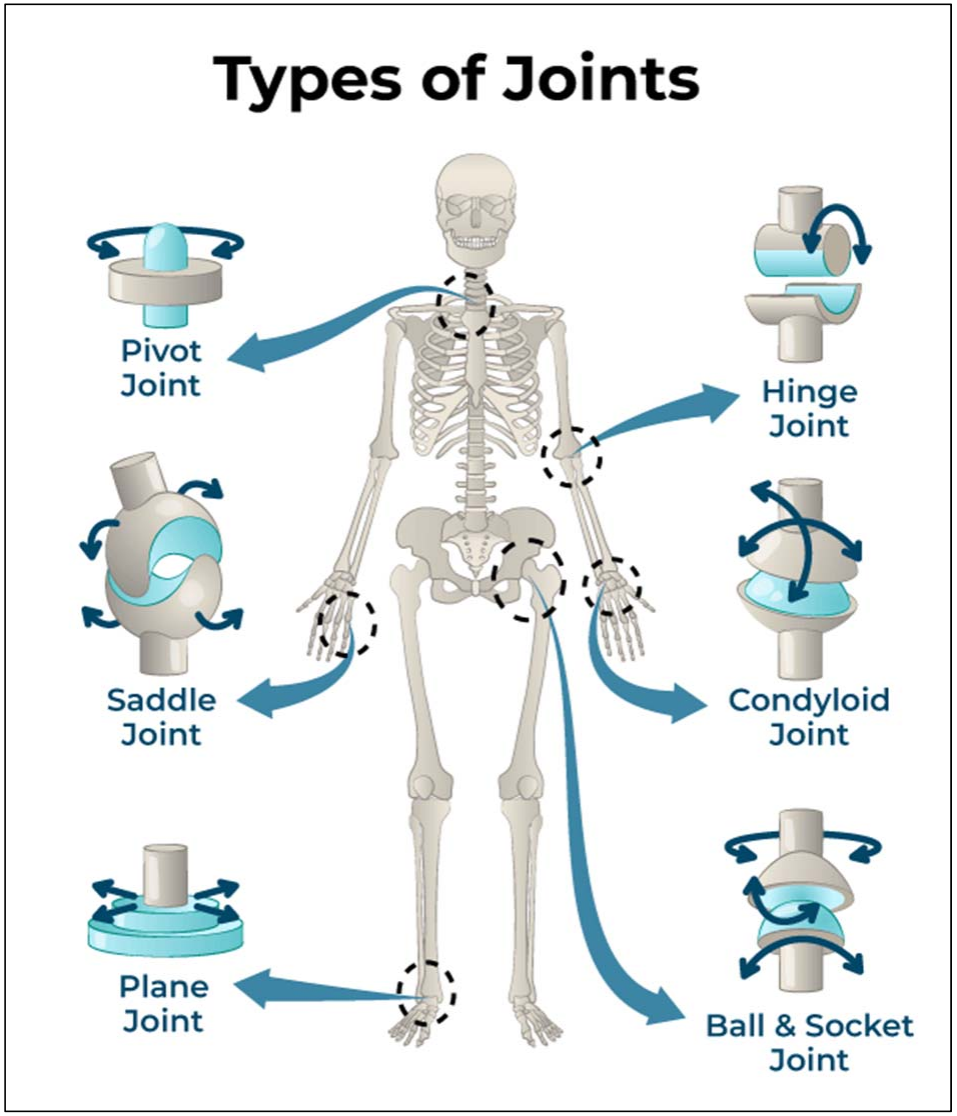
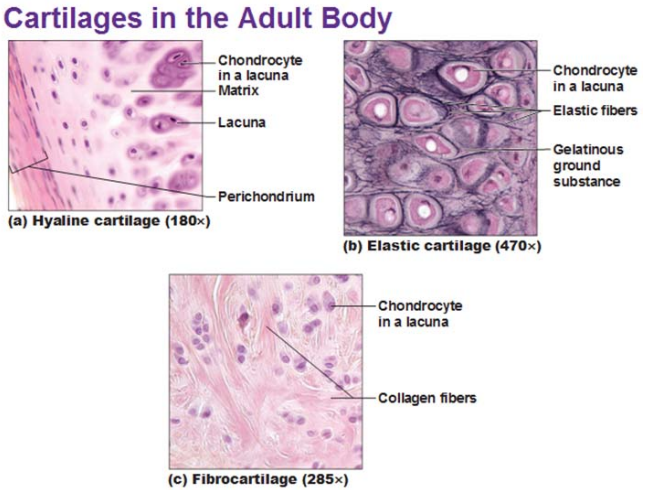
The Joints
Department of occupational Therapy
Techniques



Cartilage: is a strong, flexible connective tissue. Its a non-vascular and aneural that is found throughout the body.

Functions:

- Absorbing shock
- Reducing friction
- Supporting structures in the body



Types of cartilage:

There are three types of cartilage in the body:

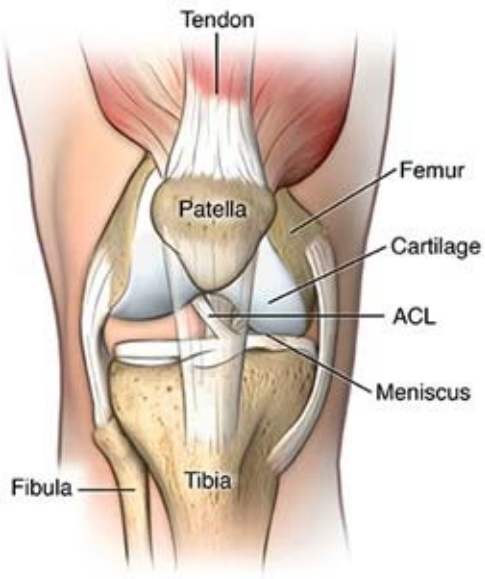
- **Hyaline cartilage:** has a smooth surface and is the most common of the three types of cartilage. Because of its smooth surfaces it allows tissues to slide/glide more easily, as well as providing flexibility and support. Example**:** cartilage between ribs and sternum, nasal cartilage and articular cartilage (which covers opposing bone surfaces in many joints).

- **Fibrocartilage:** is the toughest of the three types of cartilage. This makes it perfect to provide support and rigidity. Example**:** Intervertebral discs (between spinal vertebrae), Menisci (cartilage pads of the knee joint), pubic symphysis.

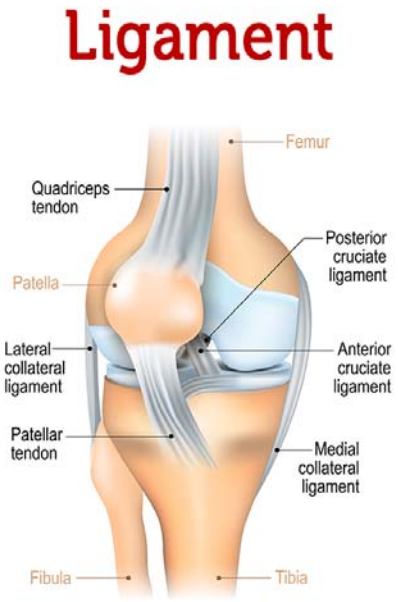
- **Elastic cartilage:** is most flexible cartilage. It supports parts of the body that need to bend and move to function. Located in external ears

A tendon: is a fibrous connective tissue that attaches muscle to bone. Tendons may also attach muscles to structures such as the eyeball. A tendon serves to move the bone or structure.

A ligament: is a fibrous connective tissue that attaches bone to bone, and usually serves to hold structures together and keep them stable.



Normal knee



Joint : Is a point of contact between two bones or more, bone and cartilage called an articulation.

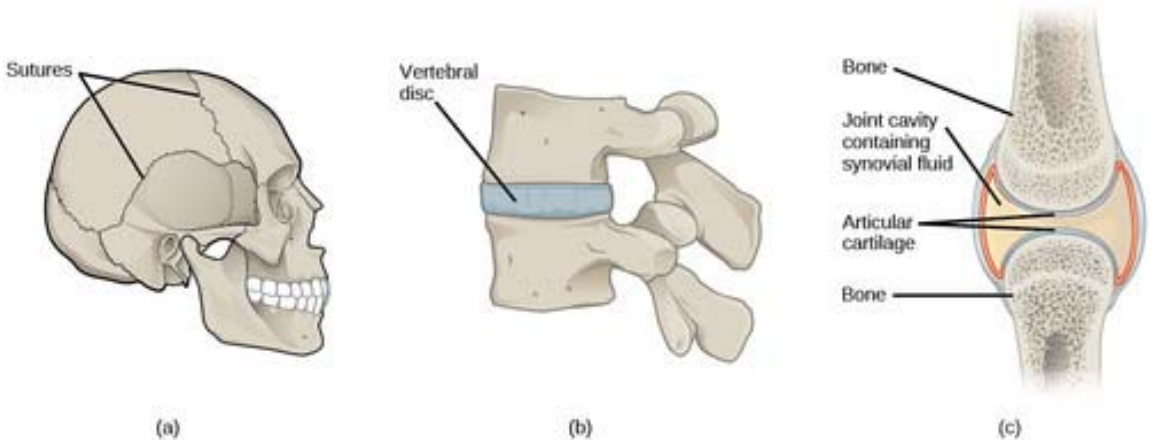
Joints are classified structurally, based on their anatomical characteristics, and functionally, based on the type of movement they permit.

1. **Structural classification of joints:** based on type of connective tissue that binds the bones together.

a. **Fibrous joints:** the bones are held together by dense irregular connective tissue that is rich in collagen fibers.

b. **Cartilaginous joints:** the bones are held together by cartilage.

c. **Synovial joints:** The bones forming the joint have a synovial cavity and are united by the dense irregular connective tissue of an articular capsule, and often by accessory ligaments.

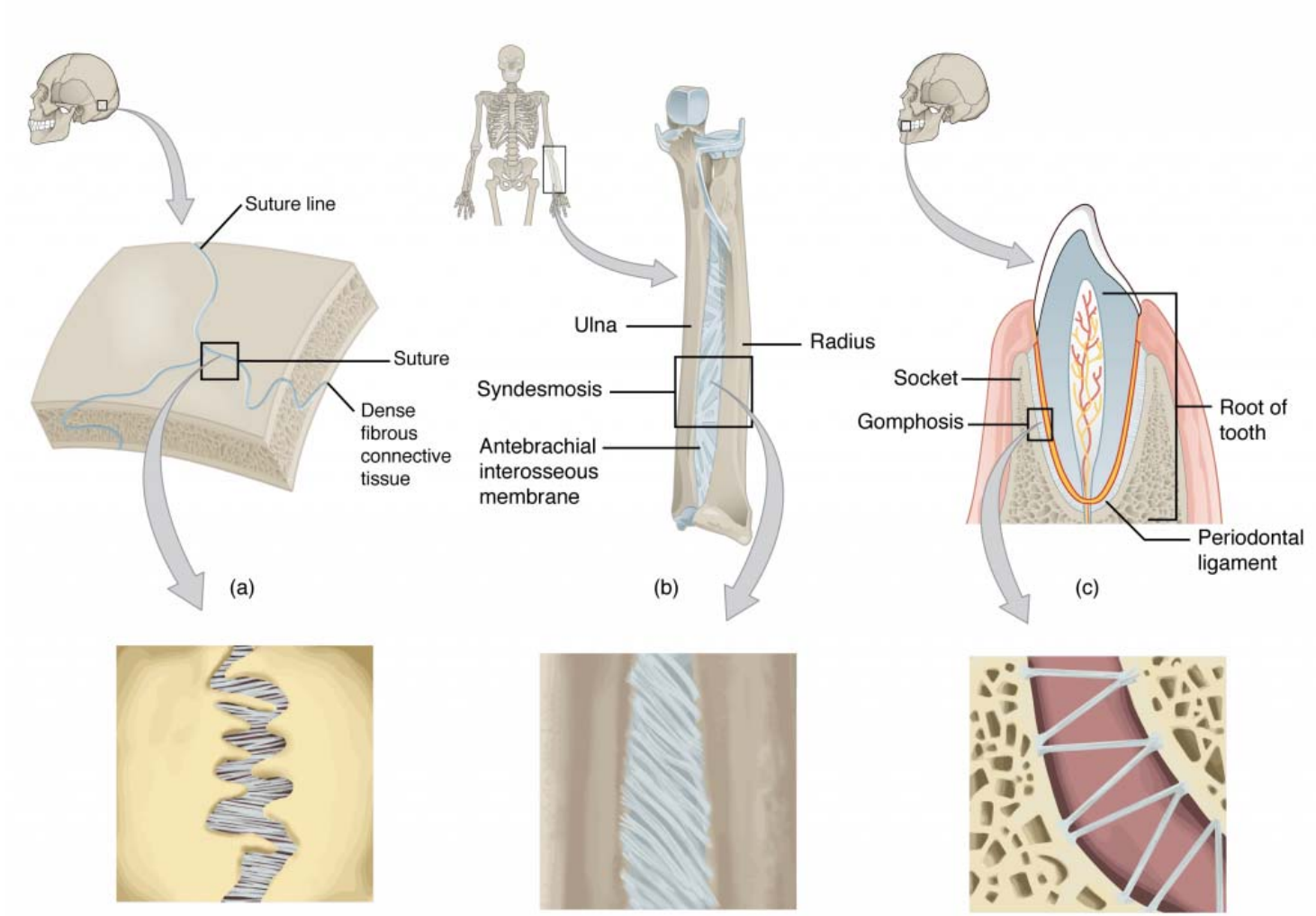


a. Fibrous Joints: the articulating bones are held very closely together by tough, fibrous tissue, permit little or no movement. **can be further sub-classified into sutures, gomphoses and syndesmoses.**

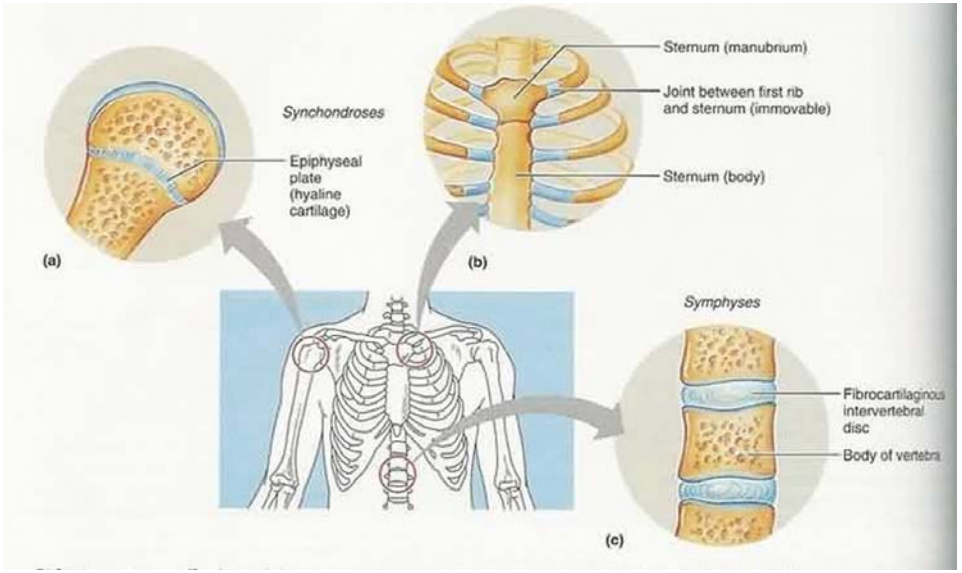
- **Sutures:** occur only between bones of the skull. An example is the coronal suture between the parietal and frontal bones, sutures are immovable joints. In older individuals, sutures are immovable, but in infants and children they are slightly movable.

- **Gomphoses or (dentoalveolar joint) :** They are found where the teeth articulate with their sockets in the maxilla (upper teeth) or the mandible (lower teeth), are also immovable joints.

- **Syndesmoses:** They are comprised of bones held together by an interosseous membrane, occur in the middle radioulnar joint between the radius and ulna in the forearm and middle tibiofibular joint between the tibia and fibula in the leg. are slightly movable joints.


Suture line
Suture
Dense fibrous connective tissue
(a)
Ulna
Radius
Syndesmosis
Antebrachial interosseous membrane
(b)
Socket
Gomphosis
Root of tooth
Periodontal ligament
(c)

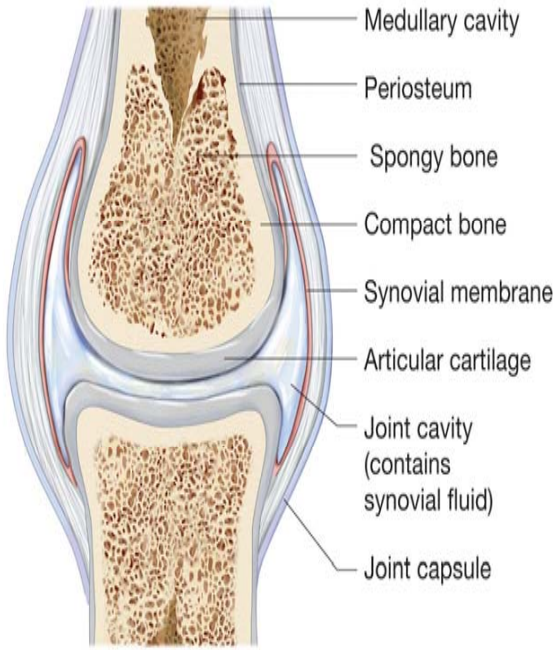
b. Cartilaginous Joints: the articulating bones are tightly connected by either **hyaline cartilage or fibrocartilage**, and allows little or no movement. There are two main types:



- **Synchondroses (Primary Cartilaginous Joint):** the bones are connected by **hyaline cartilage**. These joints are immovable. An example: the joint between the **diaphysis and epiphysis** of a growing long bone and the joint between the first rib and the manubrium of the sternum .

- **Symphyses (Secondary Cartilaginous Joint) :** All symphyses occur in the midline of the body, the bones are united by a layer of **fibrocartilage**. They are slightly movable. An examples include the **pubic symphysis**, **the intervertebral joints** between the bodies of vertebrae and also found at the junction of the manubrium and body of the sternum (Manubriosternal joint).

C. Synovial Joints: have certain characteristics that distinguish them from other joints.



1. **Synovial cavity** or **joint cavity:** between the articulating bones.

2. **Freely movable** (diarthroses).

3. **Articular cartilage**: the bones of a synovial joint are covered by a layer of hyaline cartilage.

4. **Articular Capsule:** A sleeve like articular capsule or joint capsule surrounds a synovial joint, encloses the synovial cavity, and unites the articulating bones. The articular capsule is composed of two layers, an outer fibrous membrane and an inner synovial membrane.

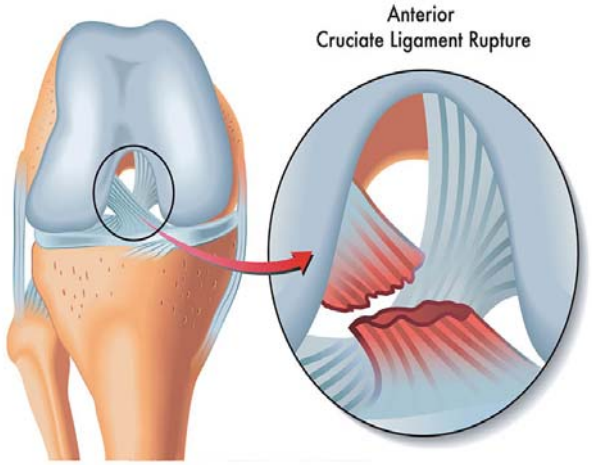
5. **Synovial Fluid:** The synovial membrane secretes synovial fluid, a viscous, clear or pale yellow fluid named for its similarity in appearance and consistency to uncooked egg white.

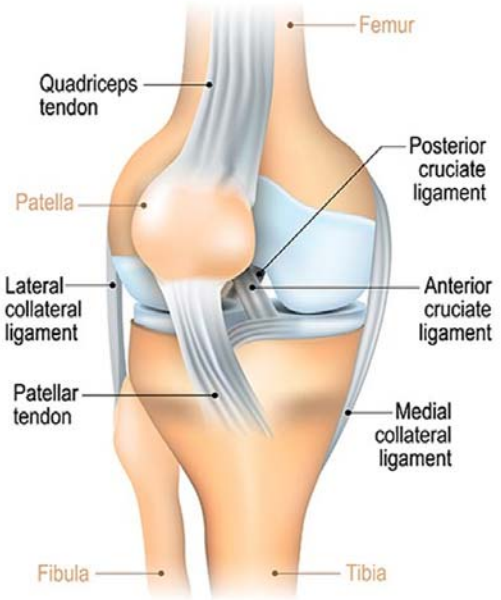
Functions:

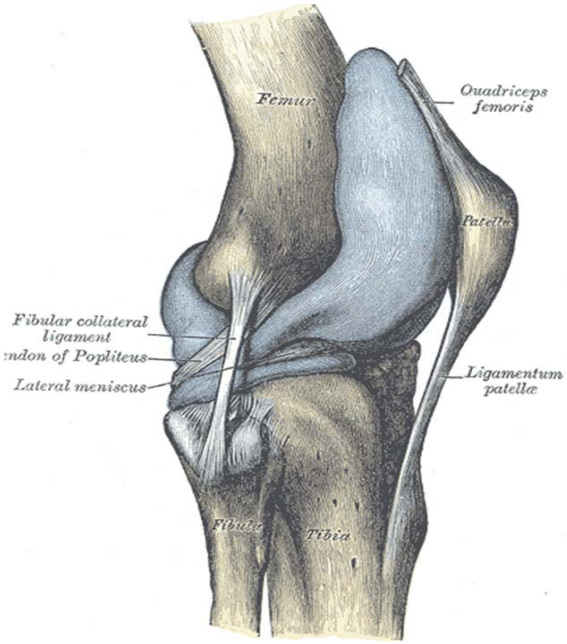
- Reducing friction by lubricating the joint
- absorbing shocks.
- supplying oxygen and nutrients to and removing carbon dioxide and metabolic wastes.
- contains phagocytic cells that remove microbes and the debris that results from normal wear and tear in the joint**.**

Many, but not all, synovial joints also contain additional structures:

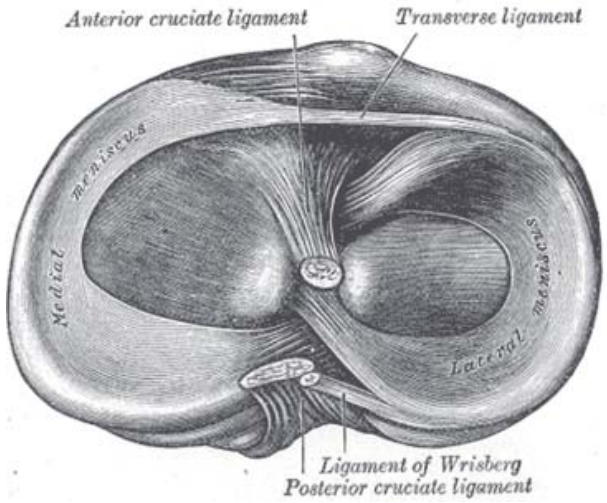
- **Accessory ligaments**:
- **Extracapsular ligaments:** lie outside the articular capsule. Examples are the fibular and tibial collateral ligaments of the knee joint.
- **Intracapsular ligaments:** occur within the articular capsule but are excluded from the synovial cavity by folds of the synovial membrane. Examples are the anterior and posterior cruciate ligaments of the knee joint providing support for knee rotational movements.



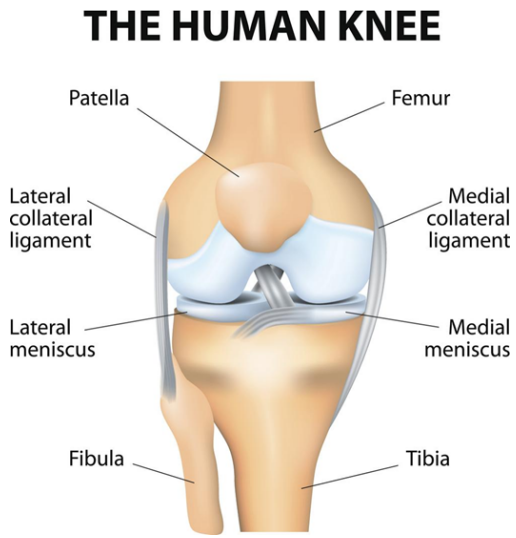


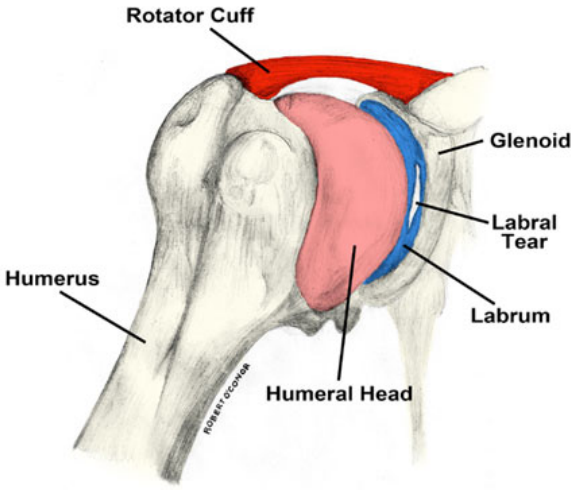


- Inside some synovial joints, such as the knee, crescent-shaped pads of fibrocartilage lie between the articular surfaces of the bones and are attached to the fibrous capsule. These pads are called **articular discs or menisci** bind strongly to the inside of the fibrous membrane and usually subdivide the synovial cavity into two spaces, allowing separate movements to occur in each space.



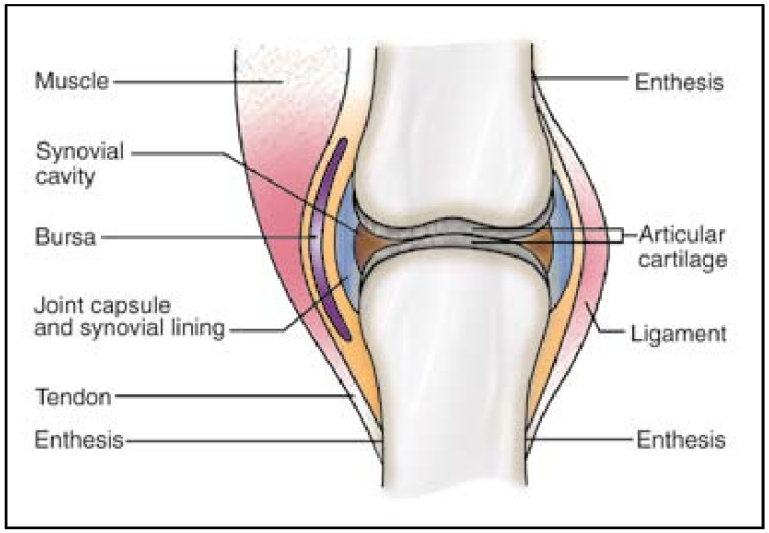
- **A labrum**: prominent in the ball-and socket joints of the shoulder and hip, is the fibrocartilaginous lip that extends from the edge of the joint socket. The labrum helps deepen the joint socket and increases the area of contact between the socket and the ball-like surface of the head of the humerus or femur.

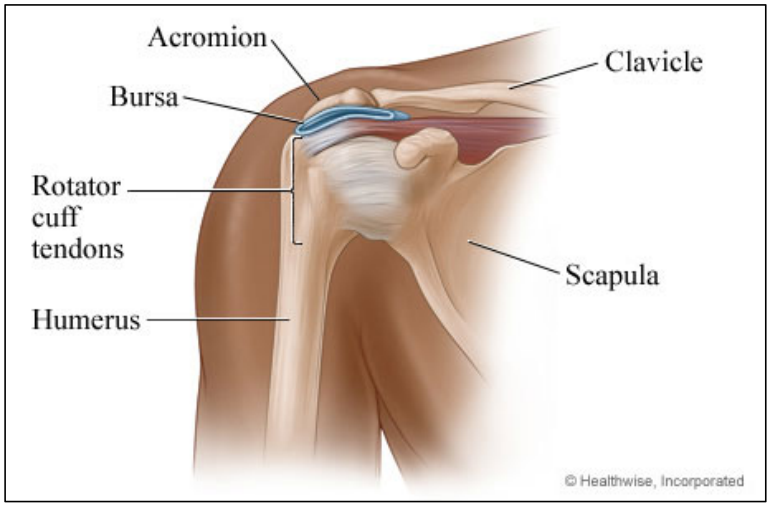




- In some joints little sacs are present called **Bursae**
- They do resemble joint capsules because their walls consist of an outer fibrous membrane of thin, dense connective tissue lined by a synovial membrane.
- They are filled with a small amount of fluid that is similar to synovial fluid.
- Bursae can be located between the skin and bones, tendons and bones, muscles and bones, or ligaments and bones.

- The fluid-filled bursal sacs cushion the movement of these body parts against one another.
- they act as cushions to prevent friction between a bone and a ligament or tendon, or skin where a bone in a joint is near the surface



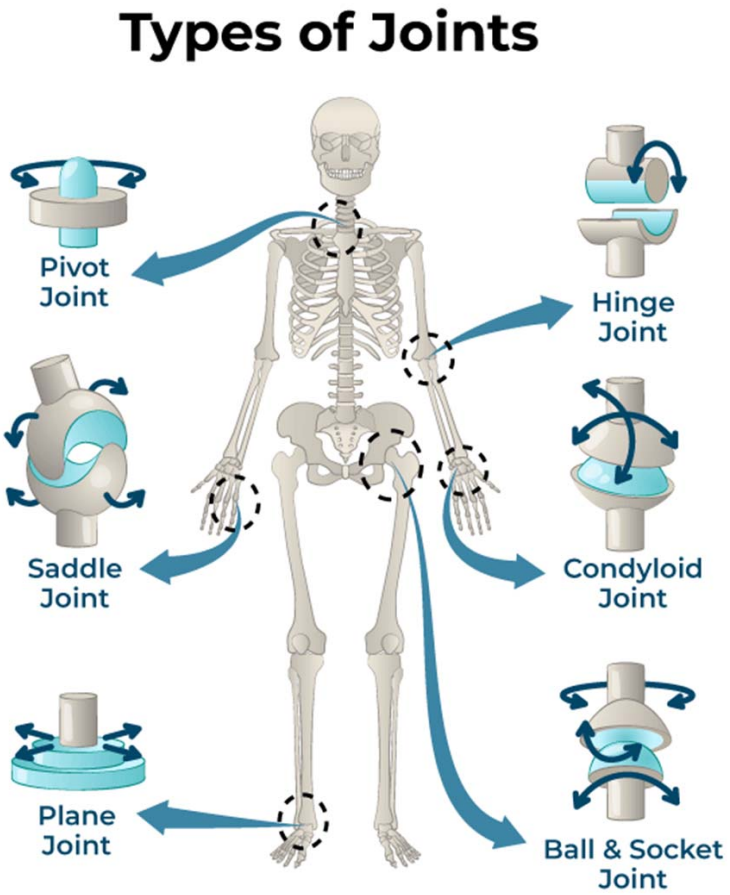


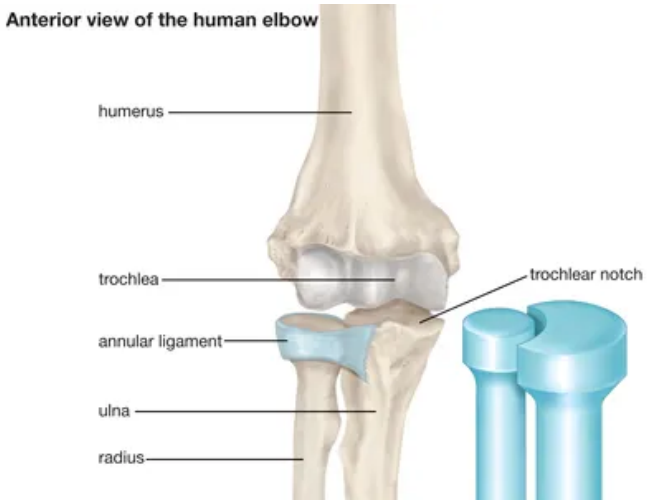
Types of Synovial Joints: Although all synovial joints have many characteristics in common, the shapes of the articulating surfaces vary; thus, many types of movements are possible. Synovial joints are divided into six categories based on type of movement: plane, hinge, pivot, condyloid, saddle, and ball-and-socket.

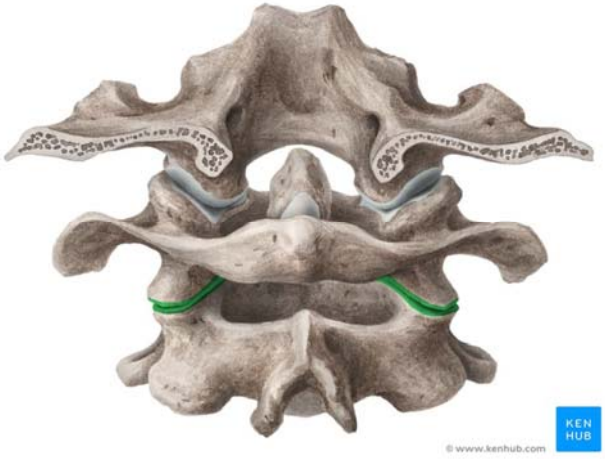
- **plane joint:** the articulating surfaces are flat, and the bones primarily glide back and forth and side to side, they may also permit rotation. Examples the intercarpal joints, intertarsal joints, sternoclavicular and acromioclavicular joints

- **hinge joint**: the convex surface of one bone fits into the concave surface of another, and the motion is angular around one axis (uniaxial); examples are the elbow, knee (a modified hinge joint), interphalangeal and ankle joints.

- **pivot joint:** a round or pointed surface of one bone fits into a ring formed by another bone and a ligament, and movement is rotational (uniaxial). Examples are the atlanto-axial and radioulnar joints.







Plane Joint

Saddle Joint

Hinge Joint

Pivot Joint

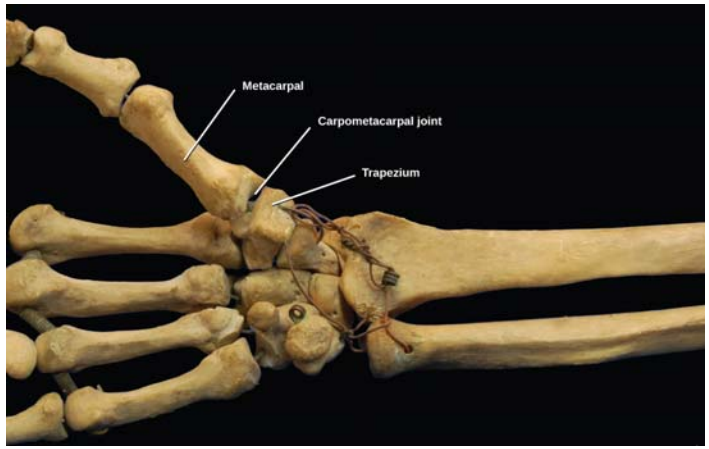
Ball-and-Socket Joint

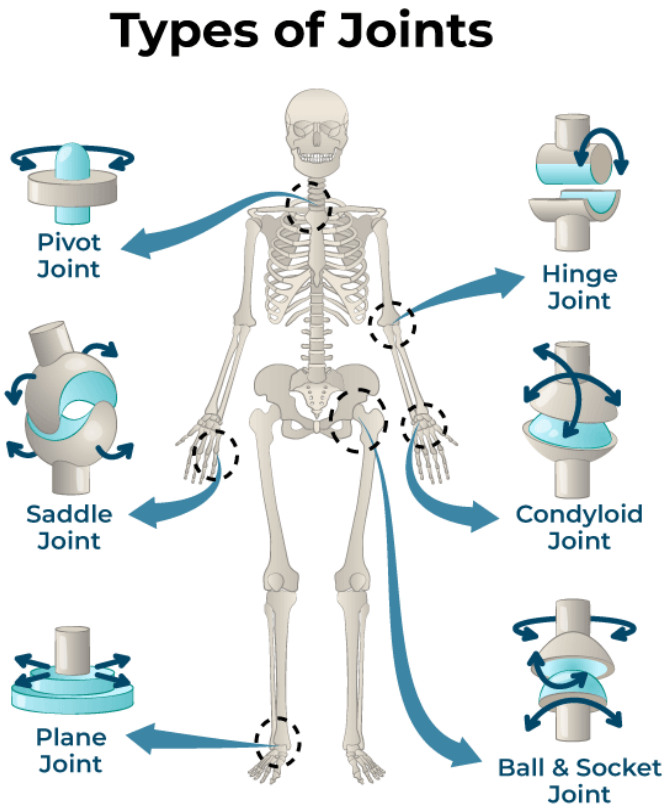
Ellipsoid Joint

- **Condyloid joint or (ellipsoidal):** an oval projection of one bone fits into an oval cavity of another, and motion is angular around biaxial (flexion–extension and abduction–adduction) plus limited circumduction. Examples include the wrist joint and metacarpophalangeal joints of the second through fifth digits.

- **saddle joint**: the articular surface of one bone is shaped like a saddle and the other bone fits into the saddle like a sitting rider; movement is biaxial plus limited circumduction. An example is the carpometacarpal joint between the trapezium and the metacarpal of the thumb.

- **ball-and-socket joint**: the ball-shaped surface of one bone fits into the cuplike depression of another; motion is around three axes (triaxial). Examples include the shoulder and hip joints

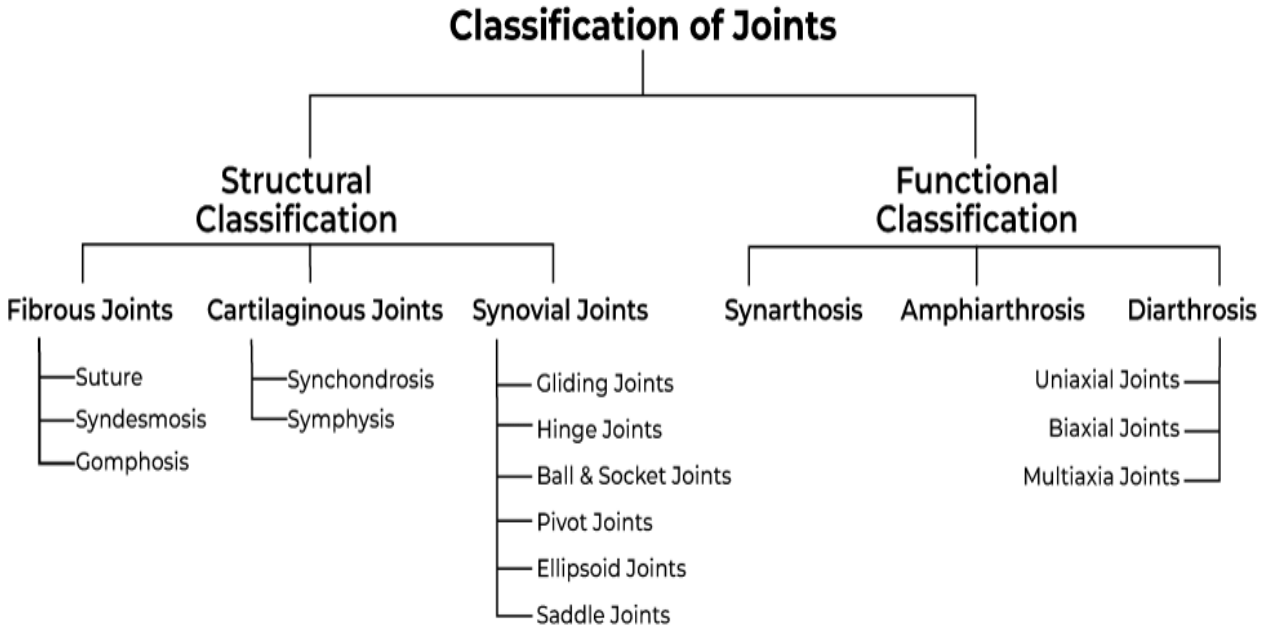




2. Functional classification of joints: relates to the degree of movement they permit.

Functionally, joints are classified as one of the following types:

a. **Synarthrosis:** An immovable joint.
b. **Amphiarthrosis:** A slightly movable joint.
c. **Diarthrosis:** A freely movable joint. All diarthroses are synovial joints. They have a variety of shapes and permit several different types of movements.



Movements at Synovial Joints:

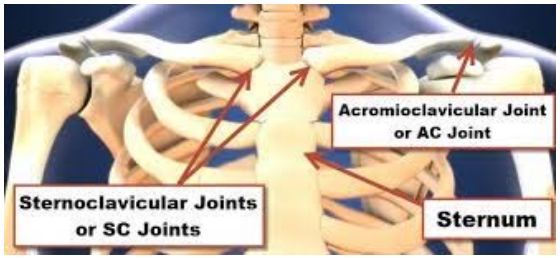
MOVEMENT	DESCRIPTION
Gliding	Movement of relatively flat bone surfaces back-and-forth and side-to-side over one another; little change in angle between bones.
Flexion	Decrease in angle between articulating bones,
Lateral flexion	Movement of trunk in frontal plane.
Extension	Increase in angle between articulating bones.
Hyperextension	Extension beyond anatomical position.
Abduction	Movement of bone away from midline.
Adduction	Movement of bone toward midline.
Circumduction	Flexion, abduction, extension, adduction, and rotation in succession (or in the opposite order); distal end of body part moves in circle
Rotation	Movement of bone around longitudinal axis; in limbs, may be medial (toward midline) or lateral (away from midline).

Special movements occurs at specific joints.

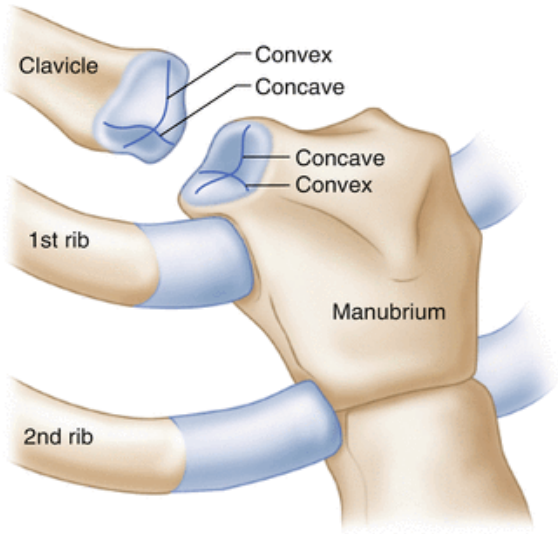
Elevation: Superior movement of body part.
Depression: Inferior movement of body part.
Protraction: Anterior movement of body part in transverse plane.
Retraction: Posterior movement of body part in transverse plane.
Inversion: Medial movement of sole.
Eversion: Lateral movement of sole.
Dorsiflexion: Bending foot in direction of dorsum (superior surface).
Plantar flexion: Bending foot in direction of plantar surface (sole).
Supination: Movement of forearm that turns palm anteriorly.
Pronation: Movement of forearm that turns palm posteriorly.
Opposition: Movement of thumb across palm to touch fingertips on same hand

Joints of the upper limb:

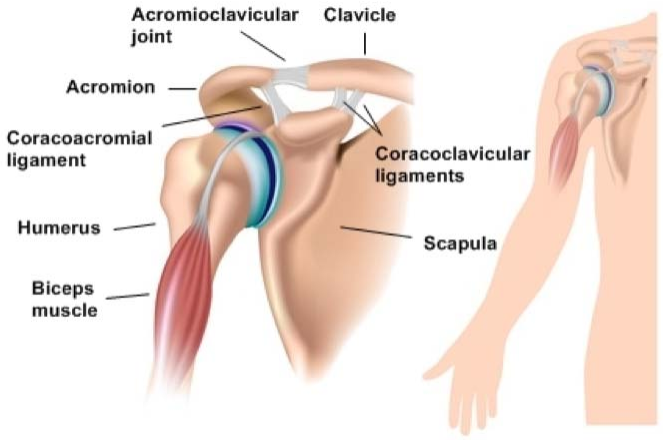
Shoulder Girdle Joints:



- **The sternoclavicular joint:** is formed by an articulation between three structures Sternal end of the clavicle, manubrium of the sternum and first costal cartilage (cartilage associated with the first rib).



- **The Acromioclavicular joint:** is formed by of an articulation between the lateral end of the clavicle and the acromion process of the scapula.



- **Type of joint** : It is a **plane** type synovial joint.
- **Movements :**Gliding and rotation of scapula on clavicle

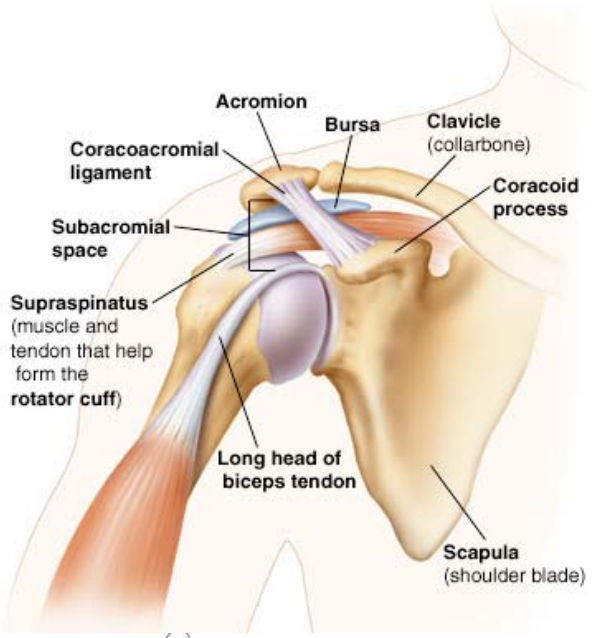
❑ **Shoulder Joint:** The shoulder joint is a ball-and-socket joint formed by the head of the humerus and the glenoid cavity of the scapula. It is also referred to as the glenohumeral joint.

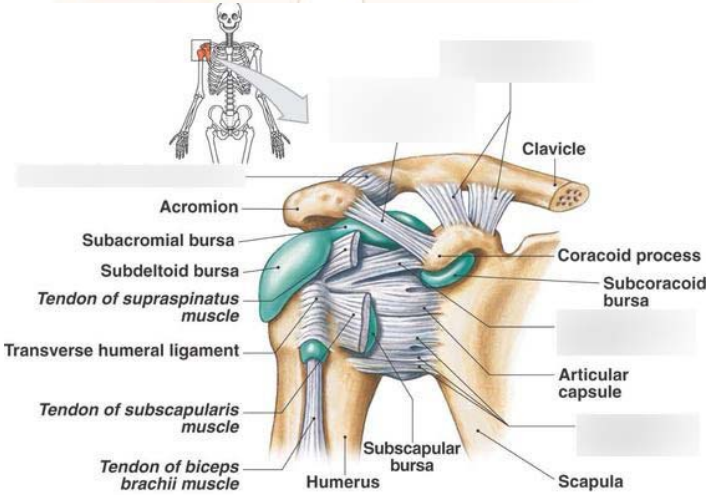
❑ **Anatomical Components:**

1. **Articular capsule:** Thin, loose sac that completely envelops the joint and extends from the glenoid cavity to the anatomical neck of the humerus.

2. **Glenoid labrum**

3. **Bursae:** Four bursae are associated with the shoulder joint. They are the subscapular bursa, subdeltoid bursa, subacromial bursa and subcoracoid bursa.

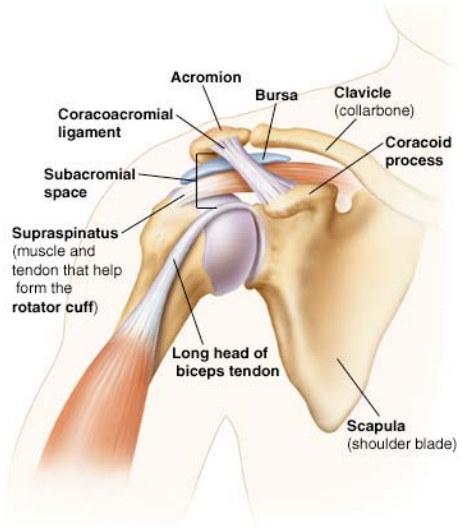


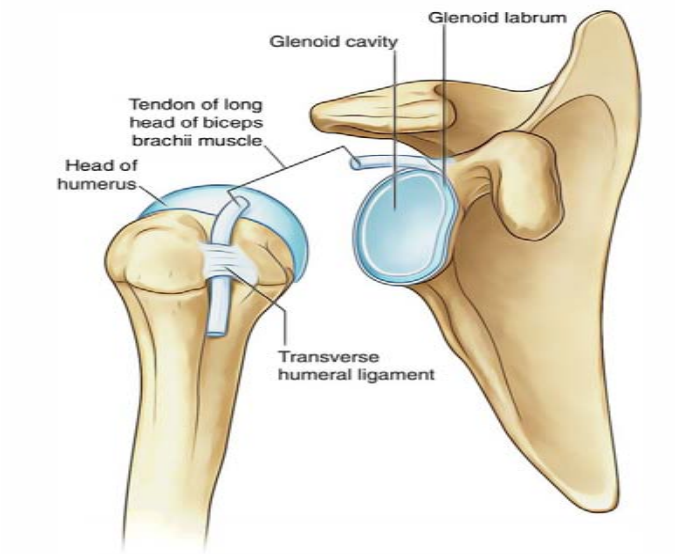


4. **Coracohumeral ligament:** extends from the coracoid process of the scapula to the greater tubercle of the humerus.

5. **Glenohumeral ligaments:** extend from the glenoid cavity to the lesser tubercle and anatomical neck of the humerus.

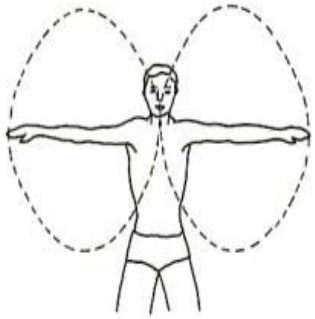
6. **Transverse humeral ligament:** Narrow sheet extending from the greater tubercle to the lesser tubercle of the humerus.

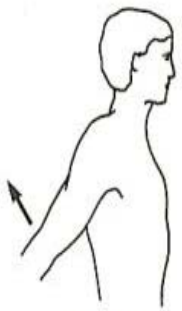


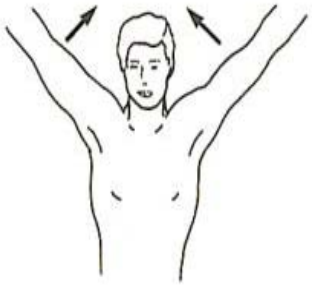


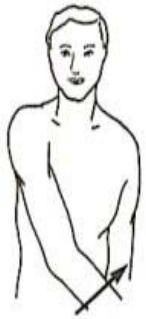
- The shoulder joint can do most ROM:

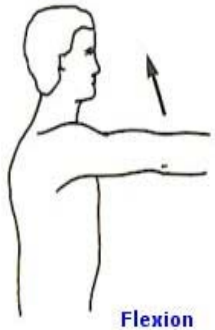
- Flexion
- Extension
- Abduction
- Adduction
- Rotation
- Circumduction


Circumduction


Extension


Abduction


Adduction


Flexion

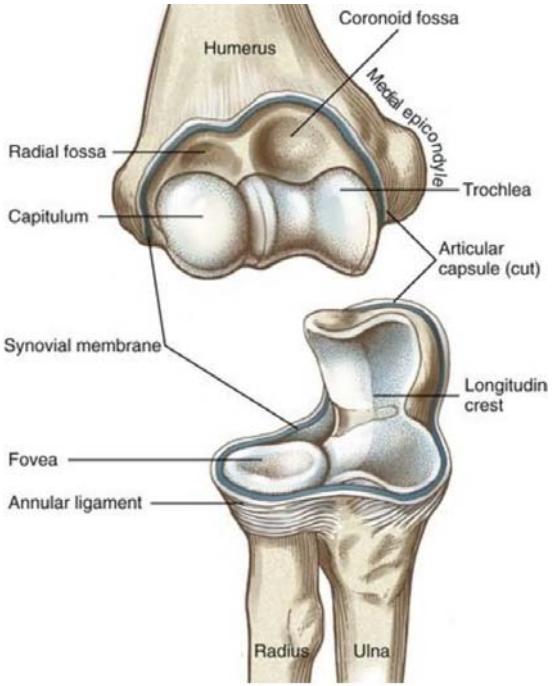
Elbow Joint: Is hinge joint made up of three distinct articulations, which are:

- The humeroulnar, between the trochlea of the humerus and the trochlear notch of the ulna (a hinge-joint).

- The humeroradial, between the capitulum and the upper concave surface of the radial head.
- The superior radio-ulnar, between the head of the radius and the radial notch of the ulna, the head being held in place by the tough annular ligament (a pivot joint).

Anatomical Components:

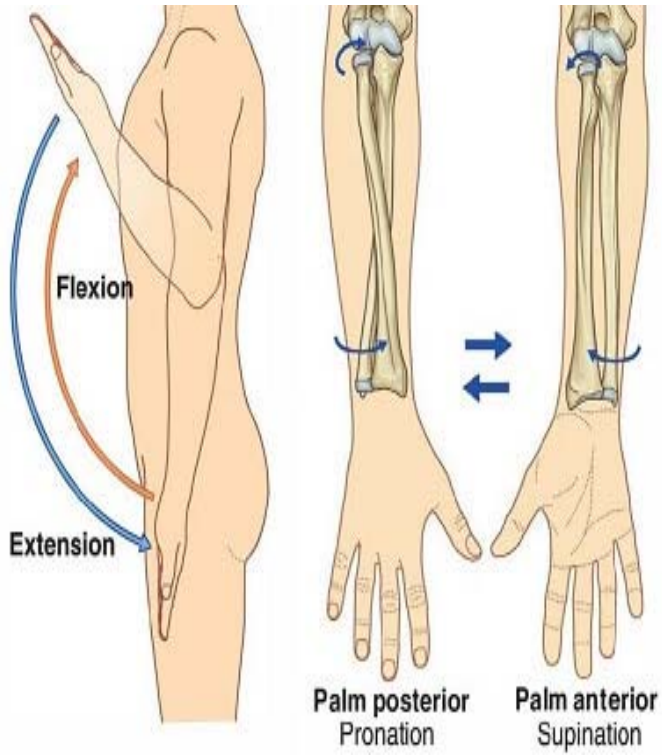
1. **Articular capsule:** the capsule is thin and loose anteriorly and posteriorly to allow flexion and extension, whereas it is strongly thickened on either side to form the medial and lateral collateral ligaments.
2. **Ulnar collateral ligament**. Thick, triangular ligament that extends from the medial epicondyle of the humerus to the coronoid process and olecranon of the ulna.
3. **Radial collateral ligament**. Strong, triangular ligament that extends from the lateral epicondyle of the humerus to the annular ligament of the radius and the radial notch of the ulna.
4. **Annular ligament of the radius**. Strong band that encircles the head of the radius. It holds the head of the radius in the radial notch of the ulna



Movements:

- The elbow joint allows flexion and extension of the forearm at the humeroulnar and humeroradial joints

- Pronation and supination at the proximal radio-ulnar (in conjunction with associated movements of the distal radio-ulnar joint)



Proximal and distal radioulnar joints:

- **Proximal radioulnar joint:** between head of radius and radial notch of ulna.
- **Distal radioulnar joint:** between ulnar notch of radius and head of ulna.

- **Type of joints:** synovial (pivot).

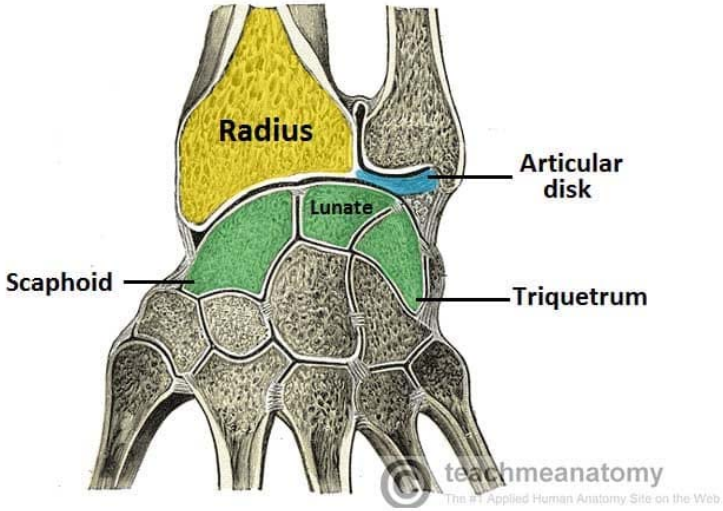
- **Movements:** Rotation of forearm.

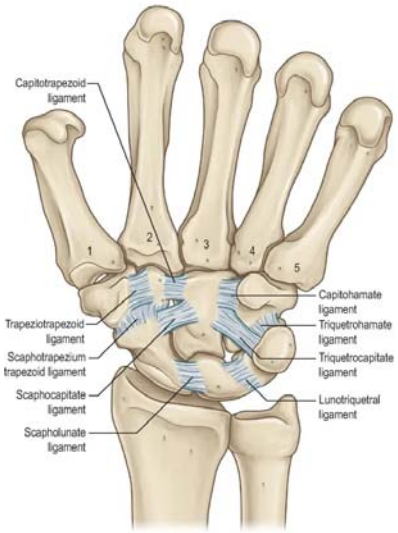
Wrist joint (radiocarpal joint):

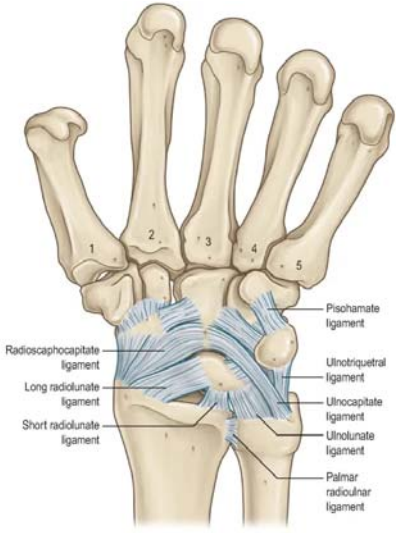
- the wrist joint is a condyloid joint, formed by an articulation between distal end of the radius, the articular disk (a fibrocartilaginous disc separates the ulna from the carpal bones) and proximal row of the carpal bones (scaphoid, lunate and triquetrum).

- Extracapsular structures consist of medial and lateral ligaments and anterior and posterior radiocarpal ligaments.

- **Movements:** flexion, extension, abduction, adduction and circumduction, the last being a combination of the previous four.

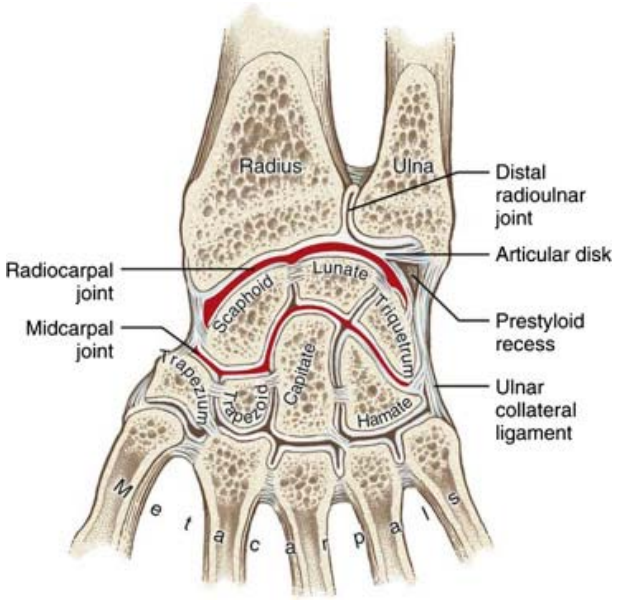






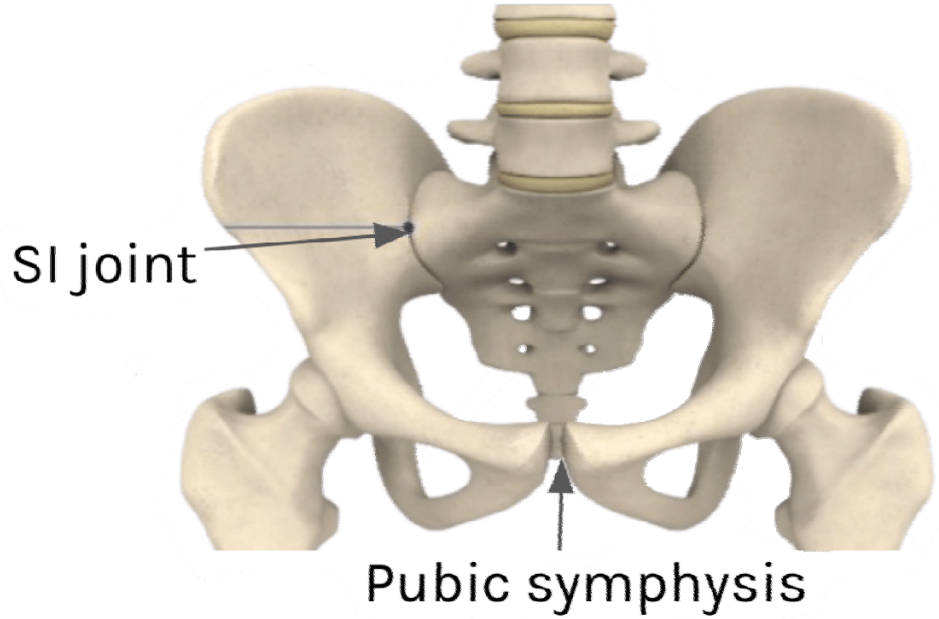
The joints of the hand

JOINT	ARTICULAR COMPONENTS	Type of joints	MOVEMENTS
Intercarpal	Between proximal row of carpal bones, distal row of carpal bones, and between both rows of carpal bones (midcarpal joints).	synovial (plane), except for hamate, scaphoid, and lunate (midcarpal) joint, which is synovial (saddle).	Gliding plus flexion, extension, abduction, adduction, and slight rotation at midcarpal joints.
Carpometacarpal	Carpometacarpal joint of thumb between trapezium of carpus and first metacarpal; carpometacarpal joints of remaining digits formed between carpus and second through fifth metacarpals.	synovial (saddle) at thumb; synovial (plane) at remaining digits..	Flexion, extension, abduction, adduction, and circumduction at thumb; gliding at remaining digits.
Metacarpophalangeal	between the metacarpal bones and proximal phalanges	synovial (condyloid)	Flexion, extension, abduction, adduction, and circumduction of phalanges.
Interphalangeal	Between heads of phalanges and bases of more distal phalanges.	synovial (hinge).	Flexion and extension of phalanges.



Joints of lower limb:

- **Sacroiliac joint:** between auricular surfaces of sacrum and ilia of hip bones
  - Type of joint: synovial (plane).
  - Movements: Slight gliding.
- **Pubic symphysis:** between anterior surfaces of hip bones.
  - Type of joint: cartilaginous (symphysis).
  - Movements: slight movements.



❑ **Hip Joint:** The hip joint (coxal joint) is a ball-and-socket joint formed by the head of the femur and the acetabulum of the hip bone.

❑ **Anatomical Components:**

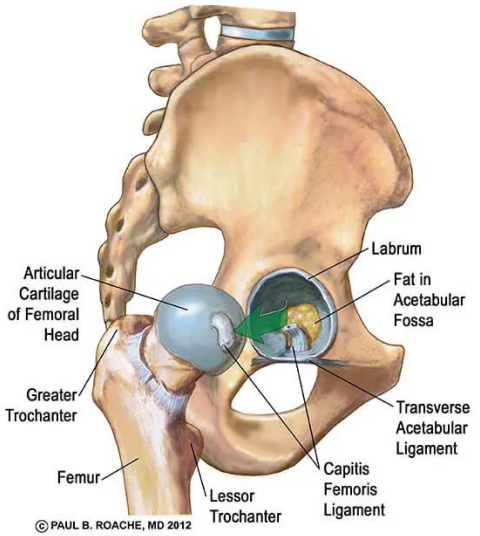
➢ **Articular capsule:** Very dense and strong capsule that extends from the rim of the acetabulum to the neck of the femur. The articular capsule consists of circular and longitudinal fibers.

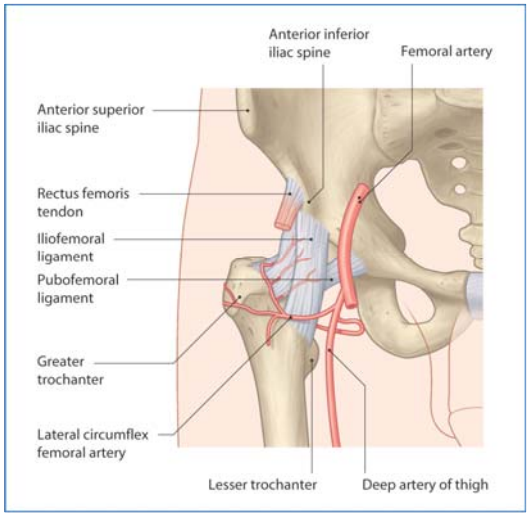
Three ligaments reinforce the capsule:

➢ **Iliofemoral ligament:** which arises from the anterior inferior iliac spine, bifurcates, and is inserted at each end of the trochanteric line. prevents hyperextension of the femur at the hip joint during standing.

➢ **Pubofemoral ligament:** arising from the iliopubic junction to blend with the medial aspect of the capsule. this ligament prevents over abduction of the femur at the hip joint and strengthens the articular capsule.

➢ **Ischiofemoral ligament:** arising from the ischium to be inserted into the base of the greater trochanter. this ligament slackens during adduction, tenses during abduction, and strengthens the articular capsule.`



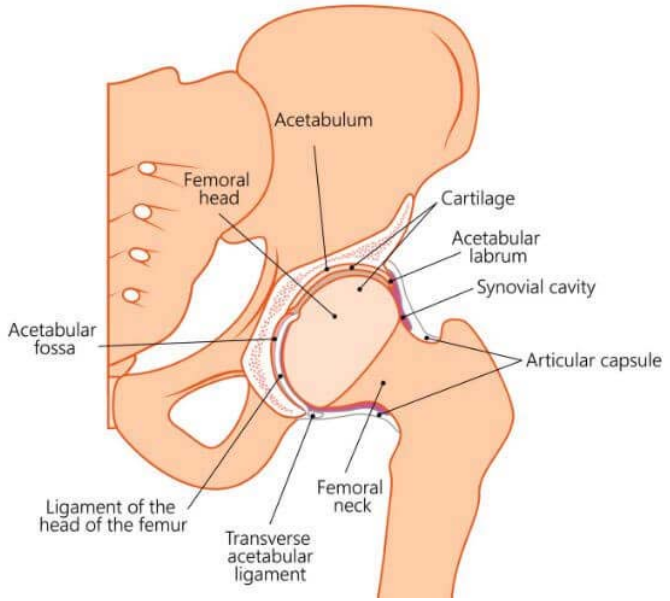


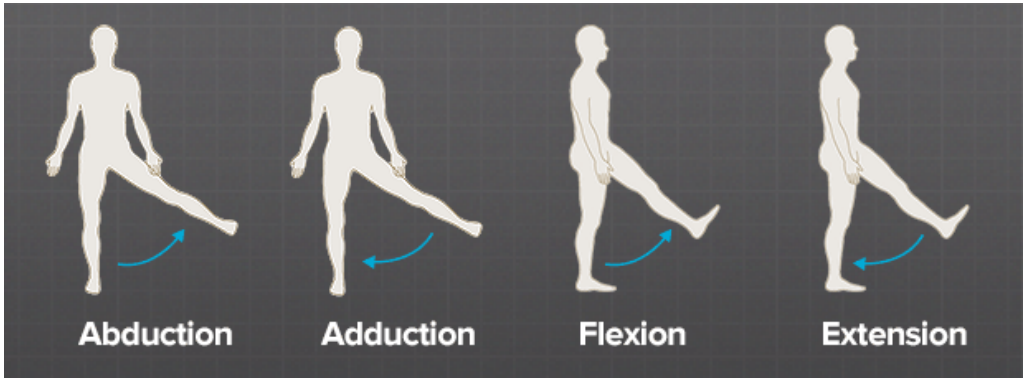
- **Ligament of the head of the femur:** Flat, triangular band (primarily a synovial fold) that extends from the fossa of the acetabulum to the fovea capitis of the head of the femur. The ligament usually contains a small artery that supplies the head of the femur.

- **Acetabular labrum:** As a result, dislocation of the femur is rare.

- **Transverse ligament:** Strong ligament that crosses over the acetabular notch. It supports part of the acetabular labrum and is connected with the ligament of the head of the femur and the articular capsule.

Movements: flexion, extension, abduction, adduction, lateral rotation medial rotation, and circumduction of the thigh

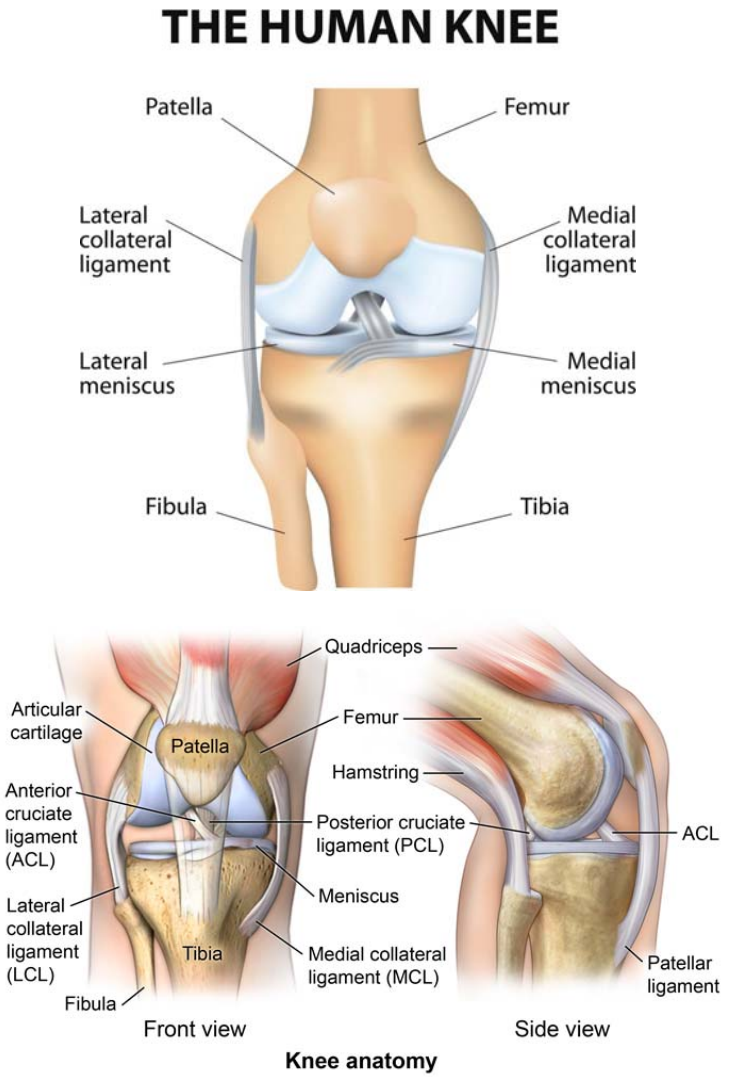




Knee Joint:

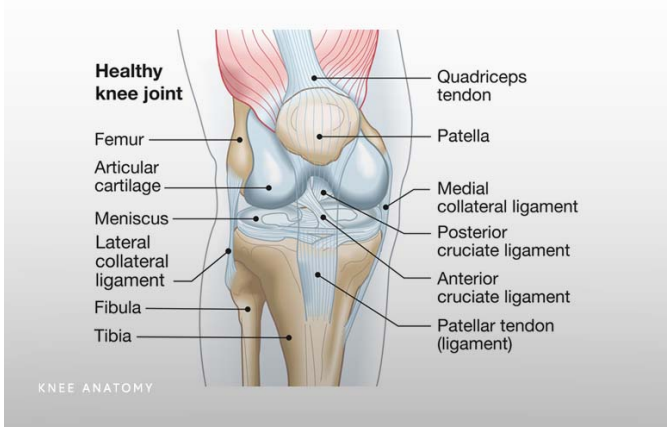
The knee joint (tibiofemoral joint) is the largest and most complex joint of the body . It is a modified hinge joint (because its primary movement is a uniaxial hinge movement) that consists of three joints within a single synovial cavity.

- Laterally is a tibiofemoral joint, between the lateral condyle of the femur, lateral meniscus, and lateral condyle of the tibia, which is the weight-bearing bone of the leg.
- Medially is another tibiofemoral joint, between the medial condyle of the femur, medial meniscus, and medial condyle of the tibia.
- An intermediate patellofemoral joint is between the patella and the patellar surface of the femur.



Anatomical Components:

- ❑ The anterior part of the capsule consists of the tendon of the quadriceps femoris muscle which also supports the patella.



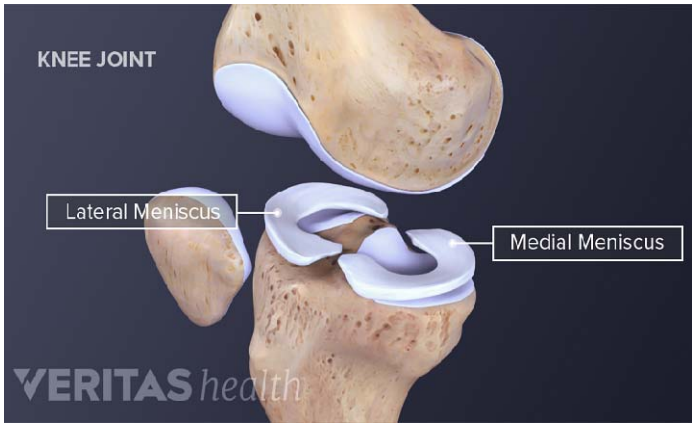
- ❑ Intracapsular structures include two **cruciate ligaments** that cross each other. They help to stabilize the joint during back and forth motion .

- ❑ **Menisci:** They help to stabilize the joint by preventing lateral displacement of the bones.

- ❑ **Bursae:** They prevent friction between a bone and a ligament or tendon and between the skin and the patella.

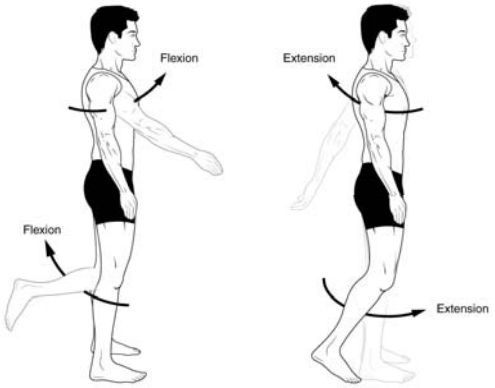
- ❑ **ligaments:**

- The medial collateral ligament (MCL) connects the femur to the tibia
- The lateral collateral ligament (LCL) connects the femur to the fibula. The collateral ligaments control the sideways motion of knee and brace it against unusual movement.



Movements:

The knee joint allows flexion, extension, slight medial rotation, and lateral rotation of the leg in the flexed position.



Ankle joint:

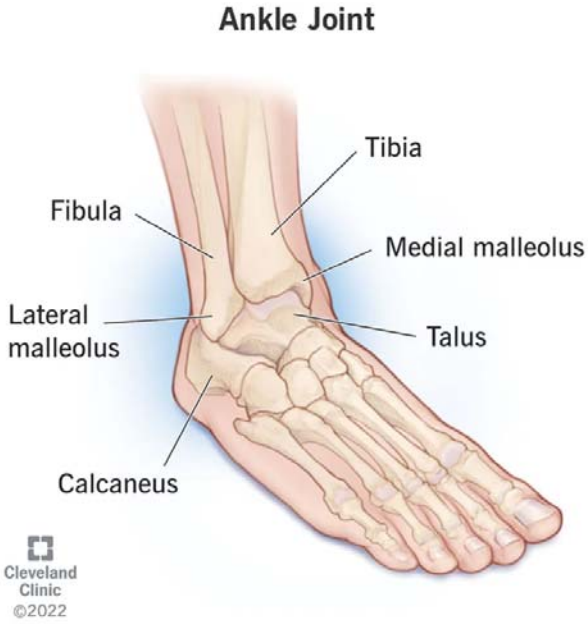
This hinge joint is formed by the distal end of the tibia and its malleolus (medial malleolus), the distal end of the fibula (lateral malleolus) and the talus.

The capsule of the joint: it is weak anteriorly and posteriorly but reinforced laterally and medially by collateral ligaments.

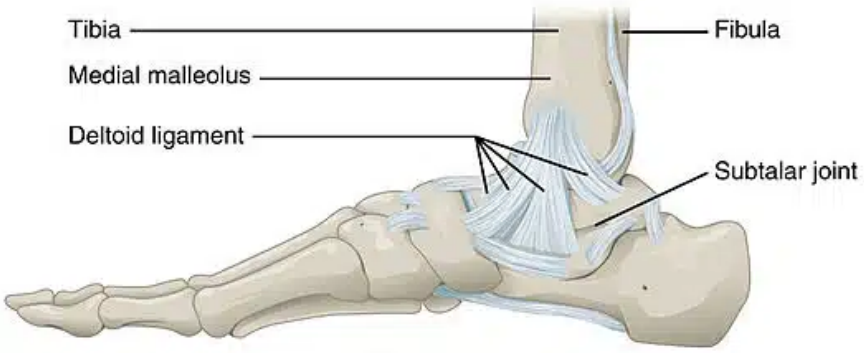
Ligaments:

- The **medial ligament** (or deltoid ligament) is attached to the medial malleolus. It consists of four ligaments, which fan out from the malleolus, attaching to the talus, calcaneus and navicular bones. **The primary action of the medial ligament is to resist over-eversion of the foot**.

- **Lateral Ligament:** originates from the lateral malleolus. It resists over-inversion of the foot, and is comprised of three distinct and separate ligaments:

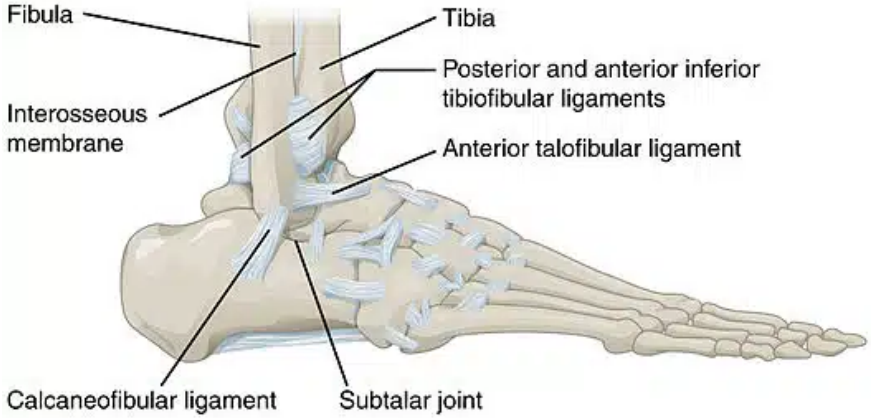


•**Anterior talofibular**: extended between the lateral malleolus and lateral aspect of the talus.
•**Posterior talofibular**: extended between the lateral malleolus and the posterior aspect of the talus.
•**Calcaneofibular**: extended between the lateral malleolus and the calcaneus.



Medial view

❑ **Movements:**
- Flexion (dorsiflexion) and extension (plantarflexion).



Lateral view