

# **HUMAN ANATOMY AND PHYSIOLOGY**

## **JOINTS**

Joints or articulation is a site where two or more bones meet.

Functions of joints:

- Serve as functional junctions between bones.
- Bind bones , strokes , and other related tissues together.
- Allow bone growth to occur .
- Permit certain structures to change shape during childbirth (i.e. pubic symphysis).
- Enable the body to have movements, lever actions, and body posture.

Classification of joints:

Structural classification:

Based on material binding bones together and whether a joint cavity or not a joint cavity is present. It is of three types

- Fibrous
- Cartilaginous
- Synovial

Functional classification:

Based on amount of movement allowed by the joint. It is of three types

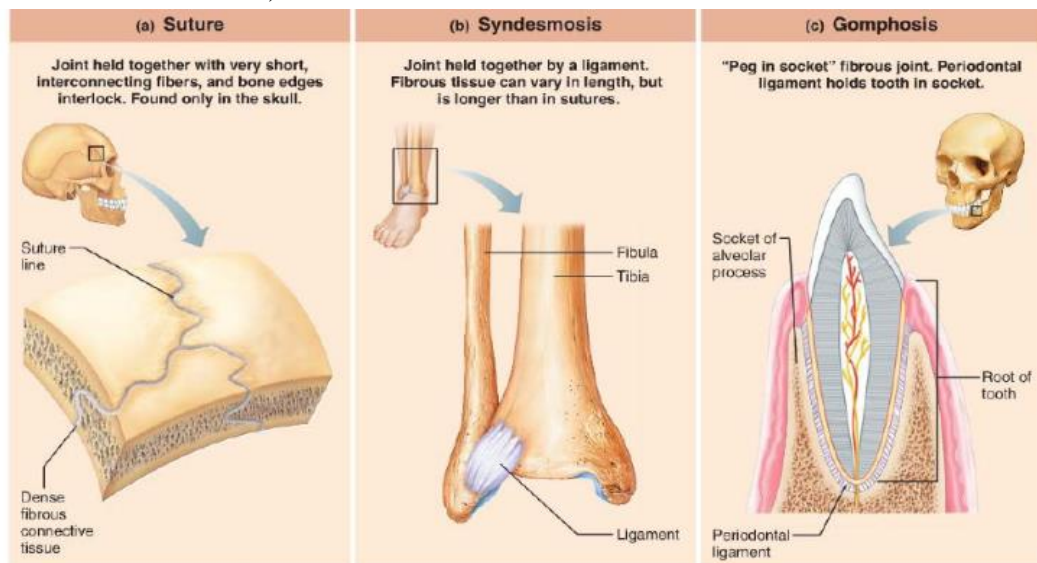
- Synarthrotic- immovable
- Amphiarthrotic – slightly movable
- Diarthrotic- freely movable

## **STRUCTURAL CLASSIFICATION**

Fibrous Joints

1. Occur between bones that have close case contact ( e.g. cranial bones, tibia and fibula, ulna and radius).
2. Fibrous connective tissue fastens the bones tightly.
3. Small amount of movement (amphiarthrosis) or no movements at all is possible (synarthrosis).
4. Subdivided into:
  - Syndesmosis = uses interosseous ligaments; amphiarthrotic (e.g. distal end of tibia and fibula).

- Suture = uses sutural ligaments; synarthrotic (e.g. cranial sutures in the skull).
- Gomphosis = uses periodontal ligaments; synarthrotic (e.g. joining teeth to maxilla and mandible).



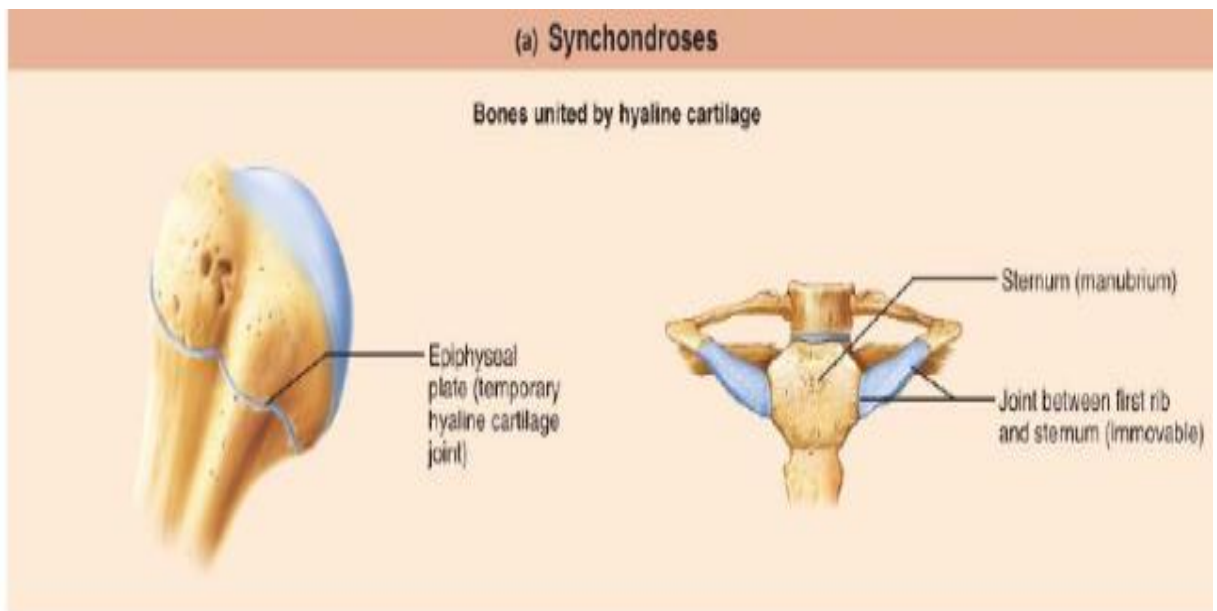
### Cartilaginous joints

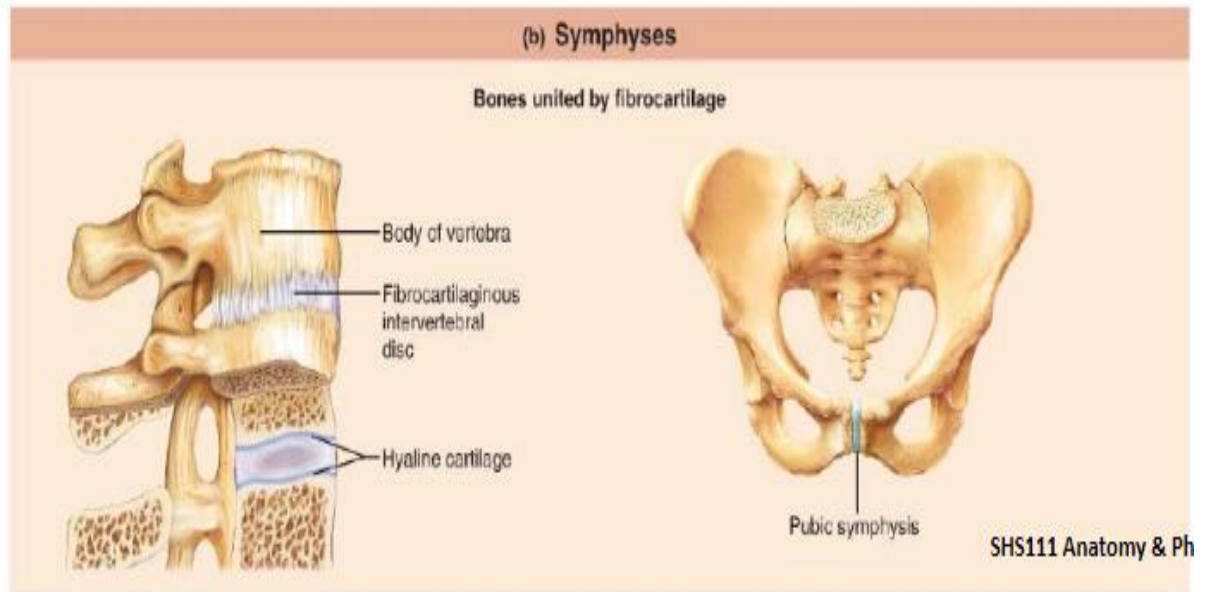
1. Hyaline cartilage and/or fibro cartilage form the joint.

2. Usually slightly movable (amphiarthrotic) and very strong.

3. Subdivided into:

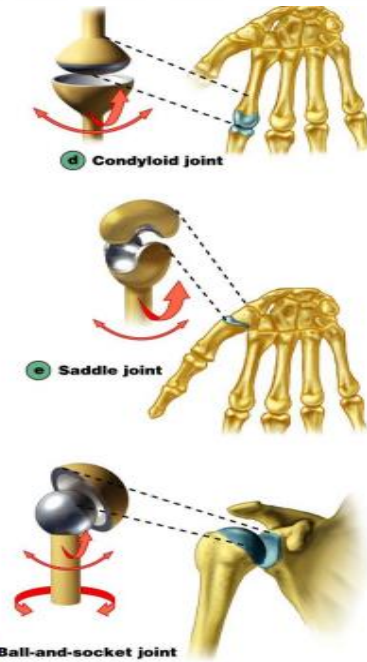
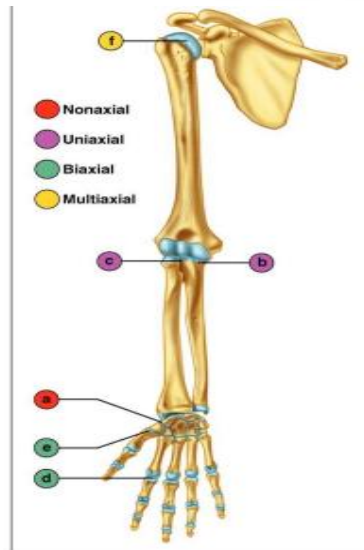
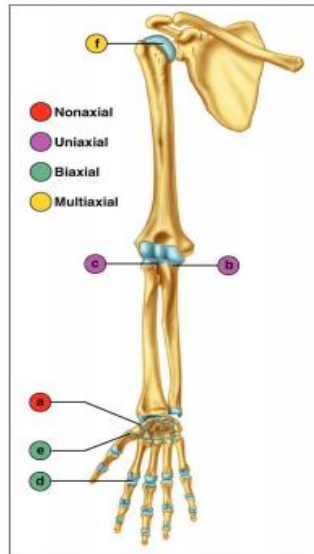
- Synchondrosis = uses hyaline cartilage, synarthrotic (e.g. between the first rib and manubrium).
- Symphysis = uses hyaline cartilage at the ends of bones, and a layer of fibrocartilage at the center; amphiarthrotic (e.g. intervertebral disk, pubic symphysis).





## Synovial Joints

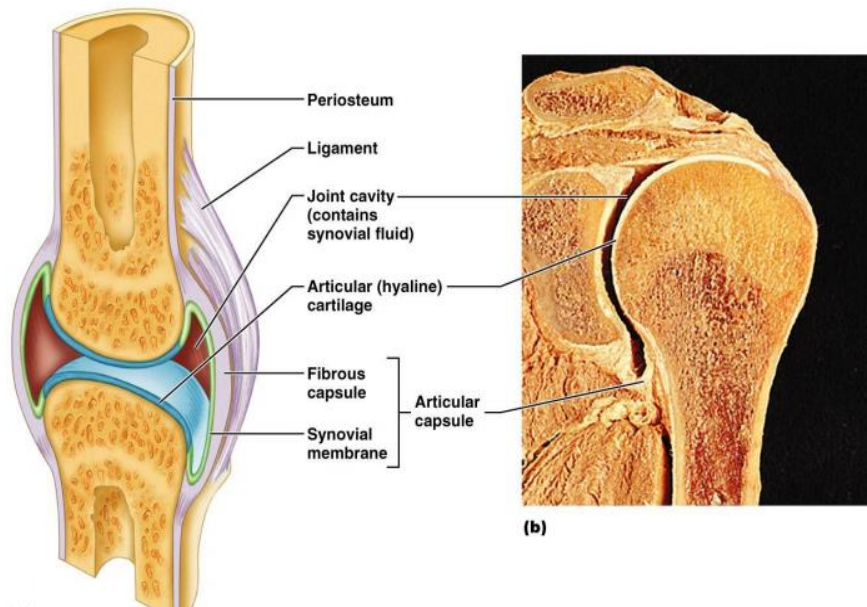
1. Most joints are synovial joints.
2. Usually freely movable (diarthrotic).
3. Contain articular cartilage (at the ends of bones), joint capsule (fibrous connective tissue surrounding the joint), and synovial membrane (inner lining of the joint capsule).
4. Subdivided into:
  - i) Gliding = allows back and forth movement (e.g. carpals sliding onto one another during wrist movements).
  - ii) Hinge = allows folding movement (e.g. elbow joint).
  - iii) Pivot = allows rotation around an axis (e.g. between atlas and axis at the odontoid process).
  - iv) Condyloid = allows all movements except rotation (e.g. between metacarpals amid proximal phalanges).
  - v) Saddle = allows all movements except rotation (e.g. between carpals and metacarpals).
  - vi) Ball - and - socket = allows all movements (e.g. shoulder joint and hip joint).



Synovial Joints Have 5 distinguishing features

1. Articular cartilage – glassy – smooth articular cartilage covers the opposing bone surface . it resists wear and minimizes friction.
2. Joint cavity – space that is filled with Synovial fluid. Synovial membrane – covers all the surface within the joint capsule and secretes synovial fluid.
3. Articular capsule – the joint cavity is enclosed by a double – layered articuller capsule.
4. Synovial fluid – a slippery fluid that occupies all free spaces within the joint capsule.

5. Reinforcing ligaments – are reinforced by a number of ligaments.



- Some synovial joints such as hip and knee have fatty pads between the fibrous capsule and the bone
- Some have discs or wedges of fibrocartilage separating the articular surface of bones (e.g. menisci of knee)
- Some synovial joints have bursa which is a fluid filled sac containing the synovial fluid.
- Ligament: a sheet of strong fibrous connective tissue connecting the articular ends of bones, binding them together and facilitating or limiting motion.
- Tendon: Fibrous connective tissue that attaches muscle to bone

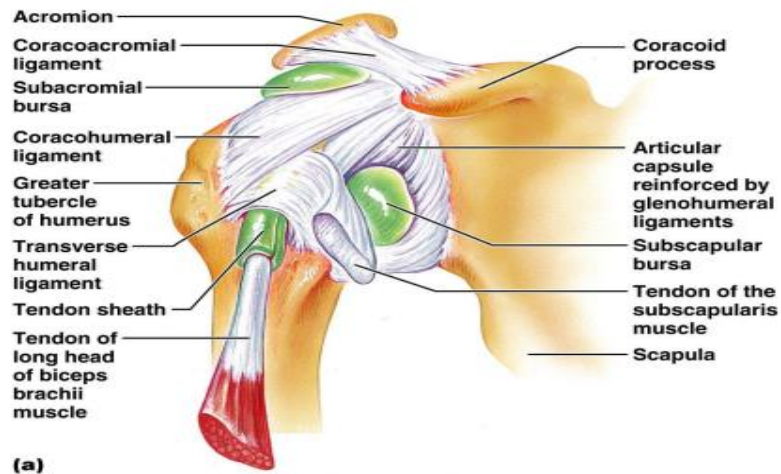
### **Shoulder joints**

#### **Ball and Socket joint**

##### **• Ligaments: •**

- a) Coracohumeral ligament – connects the coracoid process of scapula to the greater tubercle of the humerus.
- b) Glenohumeral ligament – extend from the edge of glenoid cavity to lesser tubercle of humerus
- c) Transverse humeral ligament – runs between the lesser and the greater tubercles.
- d) Coracoacromial ligament.
- e) Glenoid labrum – attaches along the margin of glenoid cavity

# Shoulder Joint

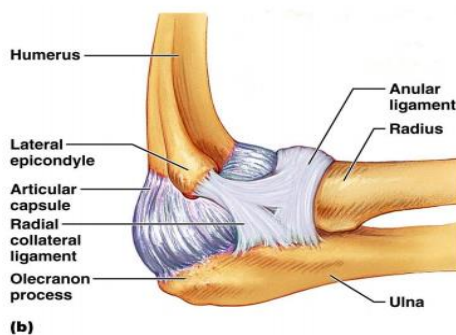


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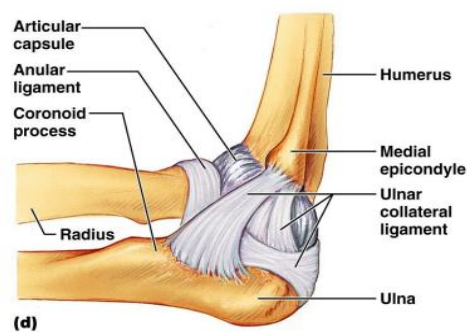
## Elbow joint

- Hinge joint
- ligaments: Annular ligament: surrounds the head of radius, and attaches to the trochlear notch of ulna
- Ulnar collateral ligament:
  - \* Ant. end of ligament connects the medial epicondyle of humerus to the medial margin of the coronoid process of the ulna
  - \*Post. end – attaches the medial epicondyle of humerus to the olecranon process of the ulna.
- Radial collateral ligament: extends between lat. Epicondyle of humerus and the annular ligament of the radius.

## Elbow



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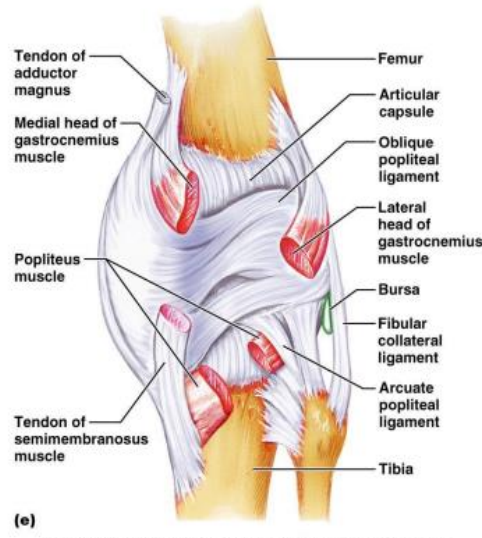
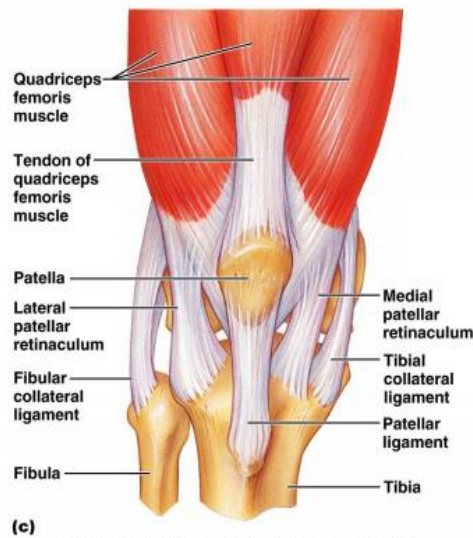
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## Knee Joint

- i) largest synovial joint
- ii) Hinge joint

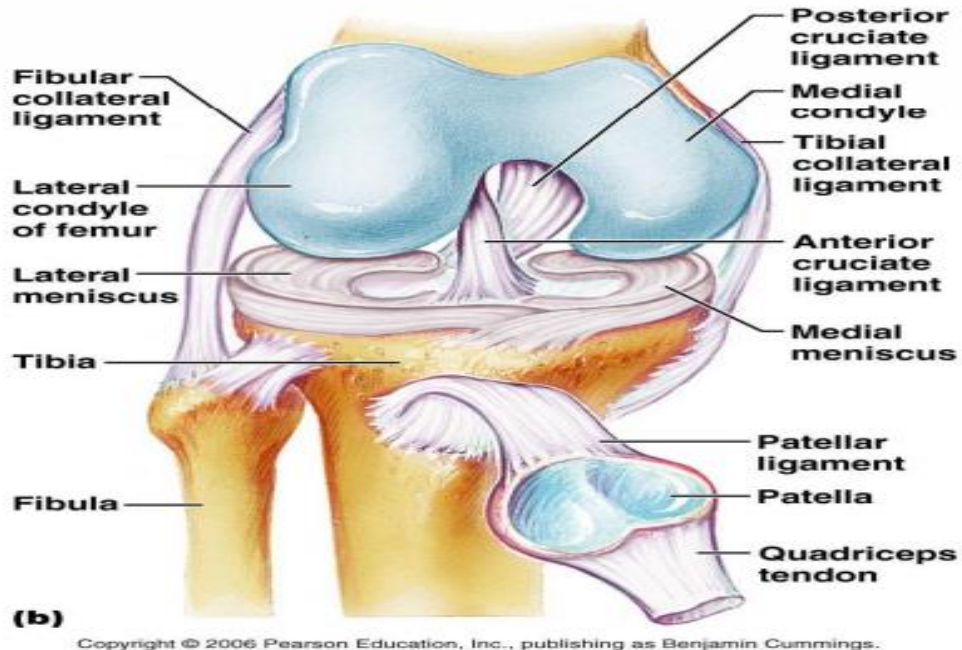
Ligaments – associated with joint capsule:

1. Patellar ligament – is continuation of the tendon of quadriceps femoris muscle; extends from patella to tibial tuberosity.
2. Oblique popliteal ligament – is continuation of the tendon of semimembranosus muscle crossing the posterior knee joint. This ligament connects the lat. condyle of the femur to head of tibia.
3. Arcuate popliteal ligament – extends from lat .condyle of femur to head of fibula.
4. Tibial collateral ligament (medial collateral ligament) - connects medial condyle of femur to the medial condyle of tibia.
5. Fibular collateral ligament (lateral collateral ligament) – connects lateral condyle of femur to head of fibula.



6. Intercapsular ligaments: are within the joint and include the Anterior & Posterior Cruciate ligaments.

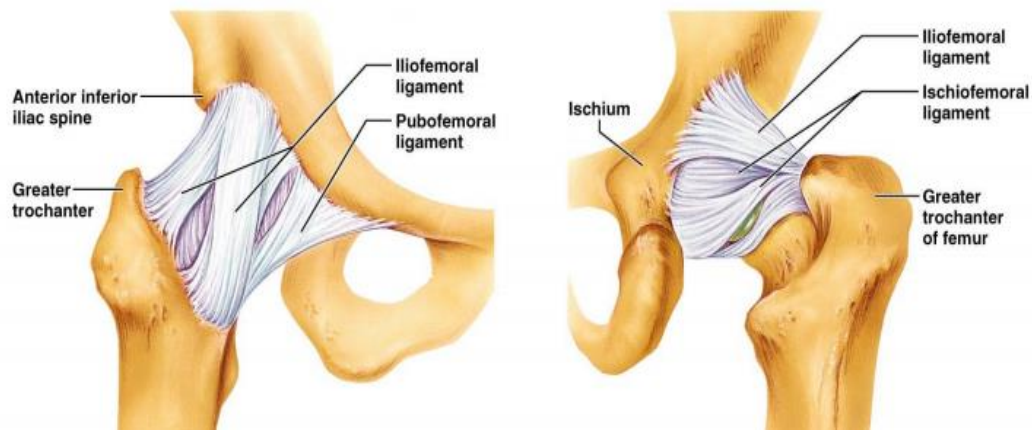
- \* Ant. cruciate: extends from the ant. intercondylar area of tibia to lat. condyle of femur
- \* post. cruciate: extends from the post. Intercondylar area of tibia to the medial condyle of femur.
- Menisci – Interarticular fibrocartilage separating the articular surfaces of tibia and fibula.



## Hip Joint

- Ball and socket joint
- Ligaments:
  1. Iliofemoral ligament – connects the Anterior inferior iliac spine to intertrochanteric line between lesser and greater trochanter).
  2. Pubofemoral ligament – extends between the superior portion of pubis and the iliofemoral ligament.
  3. Ischiofemoral ligament – extends from ischium to the joint capsule itself.

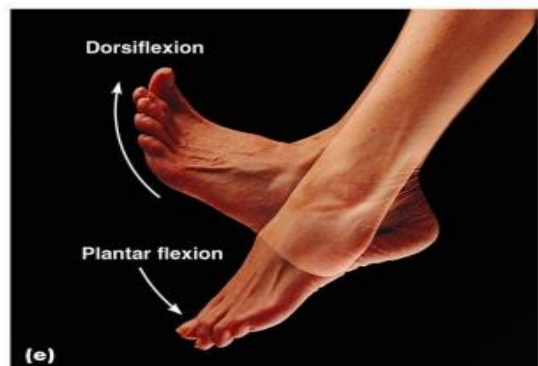
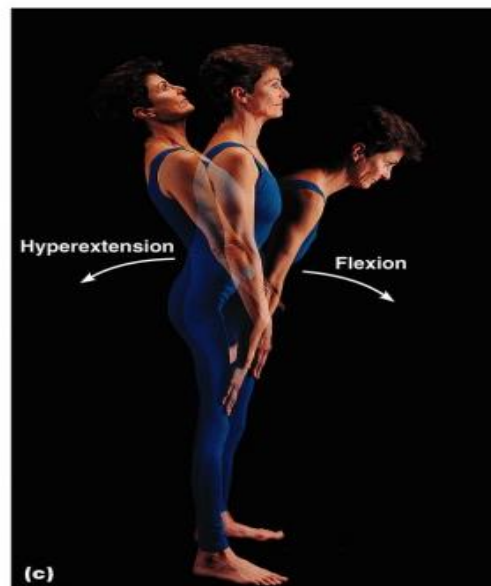
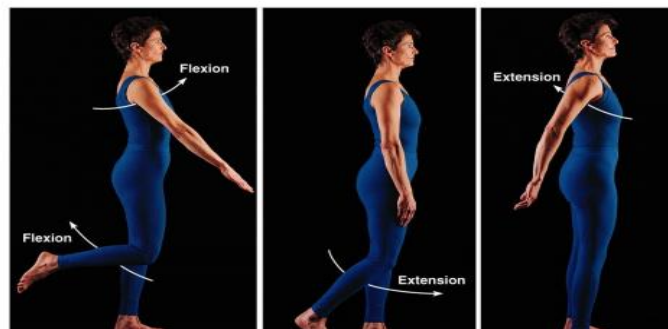
## Hip Joint





Joint Motion :

- Flexion vs. Extension
- Abduction vs. Adduction
- Supination vs. Pronation
- Dorsiflexion vs. Plantar flexion
- Eversion vs. Inversion
- Protraction vs. Retraction
- Elevation vs. Depression





(a) Supination (S) and pronation (P)



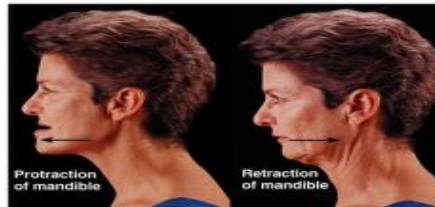
(d) Elevation and depression



(b) Inversion and eversion



(e) Opposition



(c) Protraction and retraction

## COMMON JOINT INJURIES

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- Sprains
  - Ligaments are stretched or torn
  - Partial tears slowly repair themselves
  - Complete ruptures need surgery
  - Common sprain sites – lumbar region, the ankle, the knee
- Cartilage tears
  - Due to compression and sheer stress
  - Fragments may cause joint to lock or bind
  - Cartilage rarely repairs itself because it is avascular and can't obtain enough nourishment
  - Repaired by arthroscopic surgery
  - most cartilage injuries involve tearing of the knee menisci
- Dislocations
  - Occurs when bones forced out of alignment
  - Accompanied by sprains, inflammation and joint immobilization
  - Caused by serious falls or playing sports
  - **Subluxation:** partial dislocation of a joint

## INFLAMMATORY AND DEGENERATIVE CONDITIONS

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- Bursitis
  - Inflammation of a bursa, usually caused by a blow or friction (overuse)
  - Treated with rest and ice and, if severe, anti-inflammatory drugs
- Tendonitis
  - Inflammation of tendon sheaths
  - Caused by overuse
  - Symptoms – pain and swelling
  - Treatment – rest, ice, anti-inflammatory drugs
- Arthritis
  - Describes over 100 different types of inflammatory or degenerative diseases that damage the joints
  - Most widespread crippling disease in the US
  - Symptoms: pain, stiffness, swelling of the joint
  - Acute forms: result from bacterial invasion, treated with antibiotics
  - Chronic forms: include osteoarthritis, rheumatoid arthritis, gouty arthritis

**Osteoarthritis (OA):**

- Common, irreversible, degenerative (wear-and-tear) arthritis
- **More cartilage is destroyed than replaced**
- 85% of all Americans get it, more women than men
- Probably related to the normal aging process
- Articular cartilages are eroded: exposed bone ends thicken, enlarge, form bone spurs, and restrict movement
- Treatment: moderate activity, mild pain relievers, capsaicin creams, glucosamine, chondroitin sulfate

**Rheumatoid arthritis (RA):**

- Chronic, inflammatory, autoimmune disease of unknown cause
  - Usually arises between age 40 and 50, but may occur at any stage; affects 3 times as many women as men
  - Signs and symptoms: joint pain, swelling (usually bilateral – so if right elbow is affected, left elbow will also be affected), anaemia, osteoporosis, muscle weakness, and cardiovascular problems
  - Autoimmune disease – a disorder where the body's immune system attacks its own tissues
  - Begins with synovitis (inflammation of the synovial membrane – part of articular capsule) of the affected joint
  - Inflammatory blood cells migrate to the joint, release inflammatory chemicals
  - Inflamed synovial membrane thickens into a pannus (an abnormal tissue that clings to the articular cartilages)
  - Pannus erodes cartilage, scar tissue forms, articulating bone ends connect (ankylosis)
- 