

# Articulations

## Articulations

•Bones can only move at their ends. Where one bone meets another is known as a joint, or articulation.

•Each joint motion is dependent on its structure, and all joints are a compromise btn. strength & mobility.

### Joint Types:

#### 1. Synarthrosis (sin-are-THRŌ-sis) immovable joints

##### a. suture:

- Located in bones of skull (means sewing together)
- Bone edges are interlocked & bound by dense connective tissue.

##### b. gomphoses (gom-FŌ-sis):

- means bolting together
- synarthrotic joint between tooth root and socket; is the periodontal ligament.

#### c. synchondroses (sin-con-DRŌ-sis):

- a rigid cartilaginous bridge between to articulating bones  
*i.e.*- connections of ribs to sternum

#### d. synostoses (sin-os-TŌ-seas):

- totally rigid, immovable joint
- two separate bones fuse so well the boundary between them disappears.


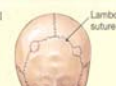


#### 2. Amphiarthrosis (am-fē-ar-THRŌ-sis):

##### a. syndesmosis (sin-dez-MŌ-sis):

- bones are connected by a ligament

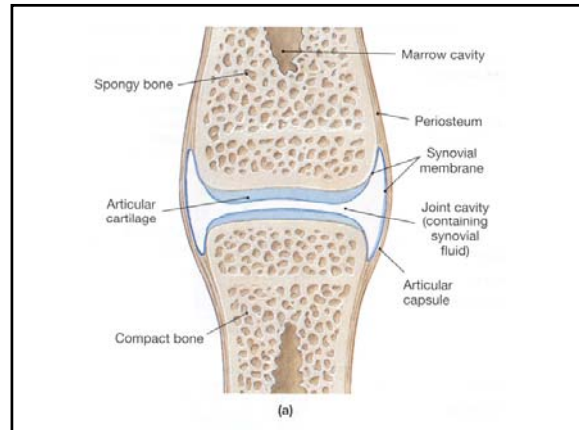
##### b. symphysis:

- bones separated by a pad of fibrocartilage  
*i.e.*- intervertebral cartilage, pubic symphysis)

Structure	Type	Functional Category	Example
Bony fusion	Synostosis (illustrated)	Synarthrosis	Frontal bone  Metopic suture (fusion)
Fibrous joint	Suture (illustrated) Gomphosis Syndesmosis	Synarthrosis Synarthrosis Amphiarthrosis	Skull  Lambdoidal suture
Cartilaginous joint	Synchondrosis Symphysis (illustrated)	Synarthrosis Amphiarthrosis	Pelvis  Pubic symphysis
Synovial joint	Monaxial Biaxial Triaxial (illustrated)	Diarthroses	Synovial joint 

**3. Diarthroses (di-ar-THRŌ-sis):**

- Freely movable joints  
*i.e.* - synovial joints
- Joint surrounded by an articular capsule
- A synovial membrane lines the articular cavity
- Typically found at the end of long bones
- Bones in synovial joints don't touch each other because they are covered with articular cartilage



**Articular Cartilage**

- Smooth, slick
- No perichondrium
- More H<sub>2</sub>O than normal hyaline cartilage
- Normally don't touch, because separated by a thin film of synovial fluid, this keeps friction in the joints to a minimum

**Synovial Fluid**

- Thick, viscous fluid (consistency of molasses)

With 3 main functions:

**1. Lubrication**

**2. Nutrient Distribution**

The circulating fluid carries wastes away from & brings nutrients to CT

**3. Shock Absorption**

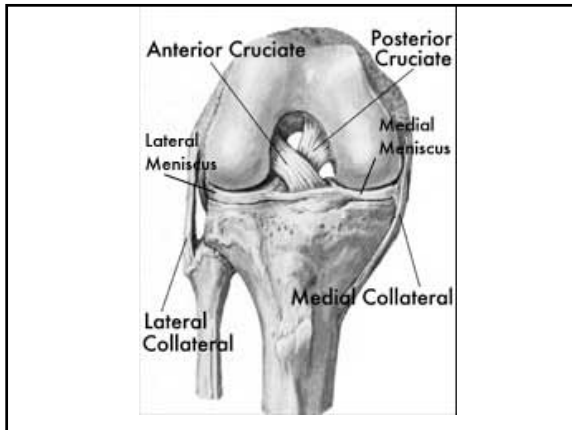
**TABLE 4.2** Coefficients of Friction <sup>a</sup>

	$\mu_s$	$\mu_k$
Steel on steel	0.74	0.57
Aluminum on steel	0.61	0.47
Copper on steel	0.53	0.36
Rubber on concrete	1.0	0.8
Wood on wood	0.25–0.5	0.2
Glass on glass	0.94	0.4
Waxed wood on wet snow	0.14	0.1
Waxed wood on dry snow	—	0.04
Metal on metal (lubricated)	0.15	0.06
Ice on ice	0.1	0.03
Teflon on Teflon	0.04	0.04
*Synovial joints in humans	0.01	0.003

**Synovial Accessory Structures**

**1. Cartilages & Fat Pads**

- **Meniscus**- pad of fibrocartilage btn. opposing bones in a synovial joint, provides shock absorption and channeling of synovial fluid
- **Fat Pads**- usually superficial to the joint, act as fillers/space keepers



## 2. Ligaments

### a. accessory ligaments

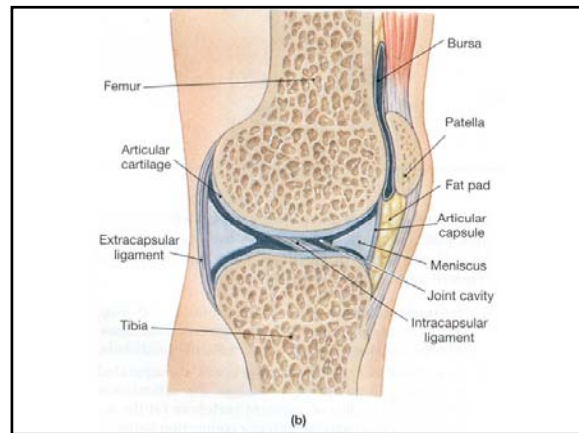
- localized thickening of articular capsule
- reinforce capsule
- strengthen capsule
- may limit range of motion of joint

### b. extracapsular ligament

- interconnect articulating bones
- comes outside capsule
- support wall of the joint

### c. intracapsular ligament

- found inside the capsule
- prevent extreme movements



## Sprain

- A ligament is stretched to the point at which some of the collagen fibers are torn, but the ligament as a whole survives, and the joint is not damaged.
- Ligaments are very strong, and one of the attached bones typically breaks before the ligament tears.
- In general, a broken bone heals much more quickly and effectively than does a torn ligament.

## Tendons

- While not part of the articulation itself, tendons passing across or around a joint may limit the range of motion and provide mechanical support.

*i.e.* - Tendons assoc. with the muscles of the arm provide much of the bracing for the shoulder joint.

### **Bursae**

- **Bursae** are small, fluid-filled pockets in CT. They contain synovial fluid and are lined by synovial membrane.
  - They form where a tendon or ligament rubs against other tissues.
  - Their function is to reduce friction and act as a shock absorber
- \*BURSITIS: inflammation of the bursae due to repetitive motion or pressure.  
*i.e.*- bunions, housemaids knee, students elbow



### **Stressed Joints**

•When a joint is stressed beyond its reinforcing structures ability to hold it, there can be a complete or partial dislocation (luxation / subluxation)

#### **1. Complete (luxation)**

- Articulating surfaces forced out of position.
  - a. may damage articular cartilage
  - b. may tear ligaments
  - c. may distort the joint capsule

\* No pain receptors in joint, but surrounding nerves are very sensitive

#### **2. Partial (subluxation)**

- The damage accompanying a partial dislocation

### **People who are Double Jointed**

- “double joints” are weakly stabilized
- Generally greater range of motion, but more likely to dislocate

### **Types of Joint Movement**

**1. Gliding-** movement can occur in any direction, but is slight

*i.e.* – wrist(carpals), ankle(tarsals) & clavicle/sternum

#### **2. Angular Motion**

##### **a. extension & flexion**

- occur in one plane
- reduce the angle btn. articulating elements
- these are opposite movements

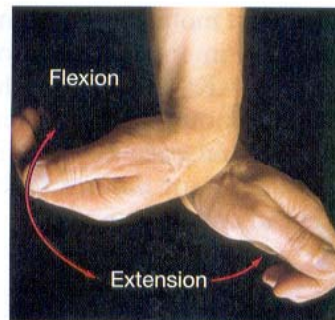
**flexion:** movement in the anterior/posterior plane that reduces the angle btn. the articulating elements

*i.e.*- head to chest

**extension:** movement in the anterior/posterior plane that increases the angle btn. the articulating elements

*i.e.*-head back up (return to anatomical position)

\*if extension occurs beyond the anatomical position it's called **hyperextension**

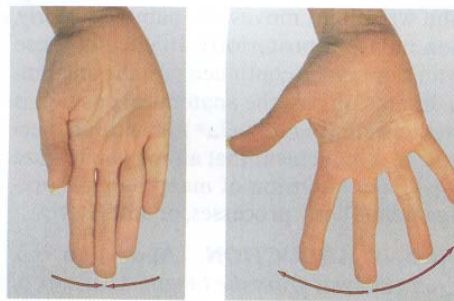


**b. abduction & adduction**

- **abduction** moves the joint away from the body in a longitudinal plane
- **adduction** moves the joint toward the body in a longitudinal plane

**c. circumduction**

- circular motion of the joint



(c)



Circumduction

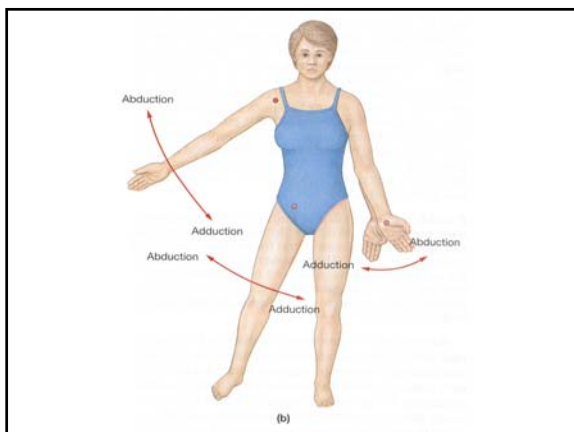
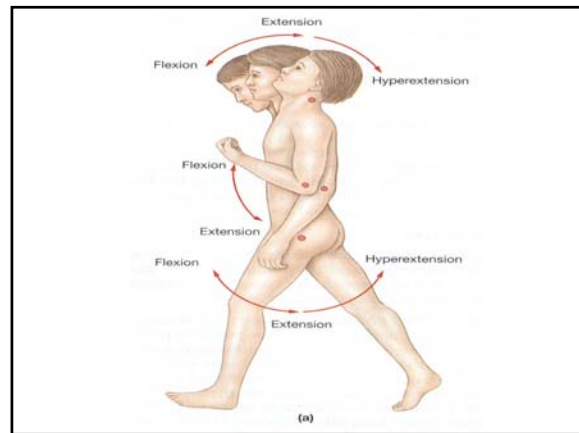
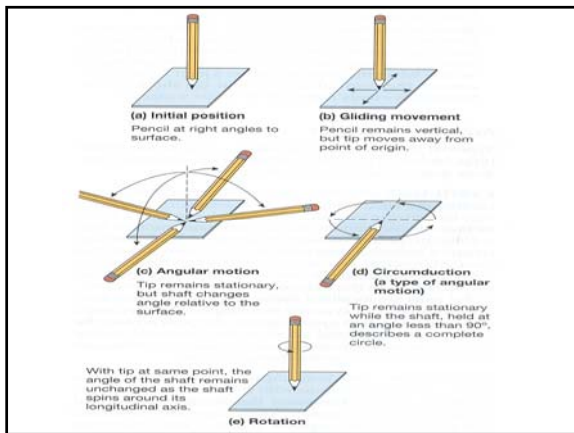
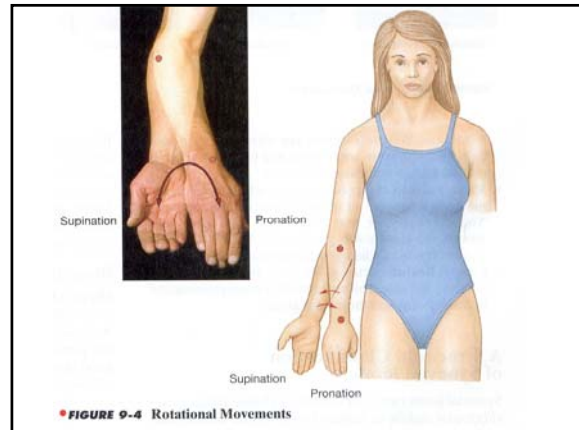
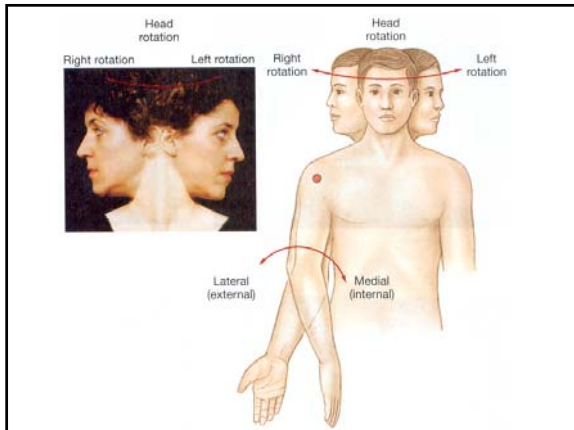
(d)

**Rotation**

- Left/right rotation of the head
- **Lateral** (external) / **medial** (internal) rotation of elbows

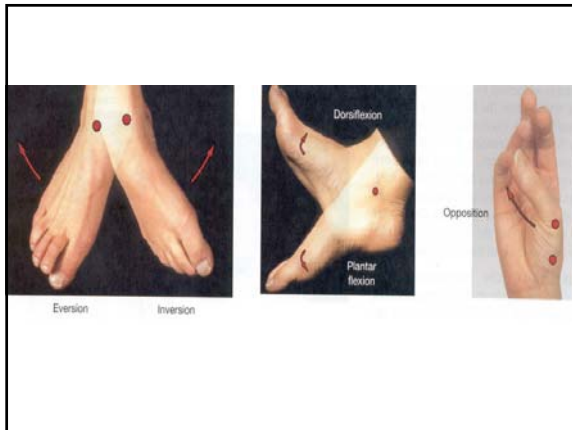
**Supination**- ulna and radius parallel

**Pronation**- ulna and radius cross

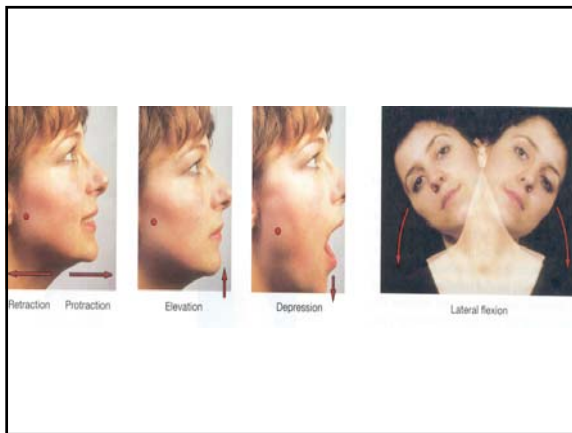


**Special Movement**

- a. inversion**
  - twisting motion of the foot to turn the sole inward
- b. eversion**
  - twisting motion of the foot to turn the sole outward
- c. dorsiflexion**
  - flexion of the ankle (lift up toes)
- d. plantar flexion**
  - extends ankle and elevates heel, as when you stand on tiptoe
- e. opposition**
  - special movement of thumb allowing it to touch the other finger tips on the same hand (allows grasping)



- f. protraction**
  - moves part of body anteriorly in a horizontal plane
- g. retraction**
  - opposite of protraction (move part of body dorsally in horizontal plane)
- h. elevation**
  - move a joint superiorly
- i. depression**
  - move a joint inferiorly
- j. lateral flexion**
  - spine moves to the side



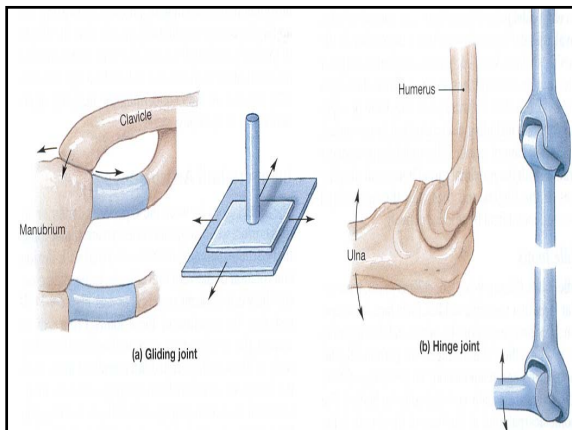
**A Structural Classification of Synovial Joints**

**Gliding joints-** permit limited movement, generally in a single plane.

i.e.- joints btn. vertebrae

**Hinge Joint-** are monaxial joints that permit only angular movement in one plane.

i.e.- elbow

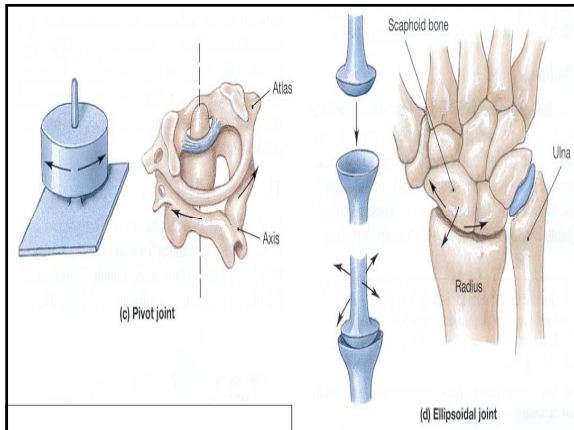


**Pivot joints-** a monaxial joints that permit only rotation.

i.e.- atlas & axis

**Ellipsoidal joints-** are biaxial joints with an oval articular face that nestles within a depression in the opposing surface.

i.e.- radiocarpals & phalanges w/metacarpals or metatarsals

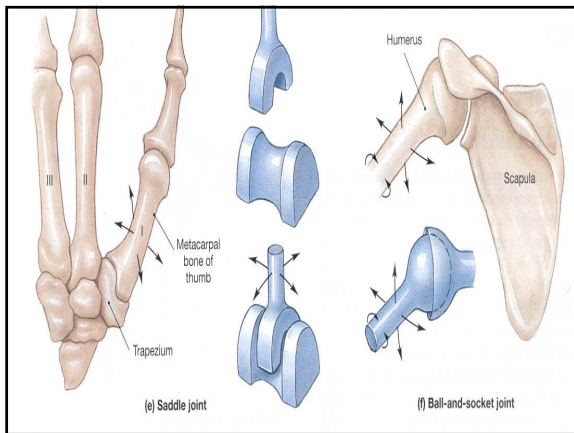


**Saddle joints**- are biaxial joints with articular faces that are concave one axis and convex on the other.

i.e.- base of thumb

**Ball-and-socket joints**- are triaxial joints that permit rotation as well as other movements.

i.e.- glenohumeral



### Intervertebral Articulation

- The articular processes of vertebrae form gliding joints with those of adjacent vertebrae. The bodies form symphyseal joints.

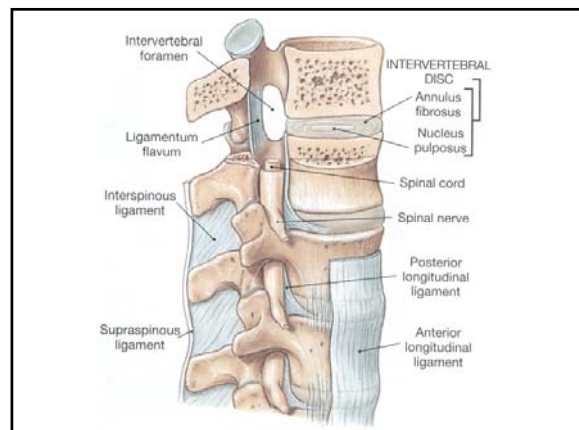
- They are separated and cushioned by **intervertebral discs**, which contain an inner **nucleus pulposus** and an outer **annulus fibrosus**.

**Intervertebral disc**- fibrocartilage that separates and cushions vertebrae.

**Nucleus pulposus**- a soft, elastic gelatinous core that gives the disc resiliency and enables it to act as a shock absorber. (75% water; the rest is scattered reticular & elastic fibers)

**Annulus fibrosus**- tough outer layer of fibrocartilage; the collagen fibers attach the disc to the bodies of adjacent vertebrae.

- Several ligaments stabilize the vertebral column.



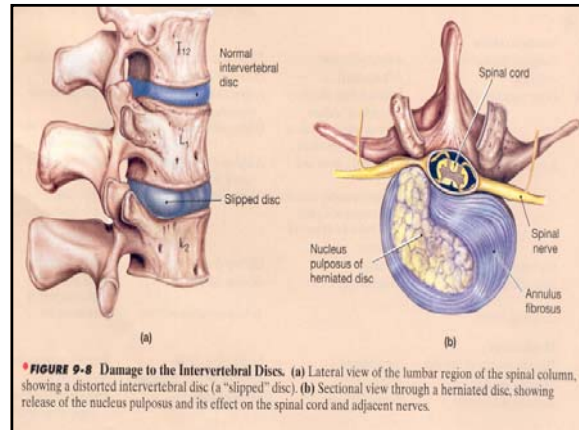


### Problems with Intervertebral Discs

**Slipped disc-** a common name for a condition caused by distortion of an intervertebral disc. The distortion applies pressure to the spinal nerves, causing pain and limited range of motion.

**Herniated disc-** a condition caused by an intervertebral compression severe enough to rupture an annulus fibrosus and release the nucleus pulposus which may protrude beyond the intervertebral space.

**Laminectomy-** removal of the vertebral laminae; may be performed to access the vertebral canal and relieve symptom of a herniated disc.



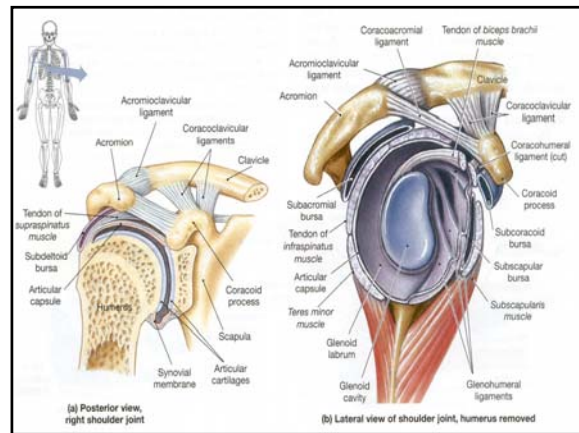
### The Shoulder Joint

•The shoulder joint, or **glenohumeral** (scapulohumeral) joint, is formed by the glenoid cavity and head of the humerus.

•This articulation permits the greatest range of motion of any joint in the body.

•It is a **ball-and socket diarthrosis** with various stabilizing ligaments.

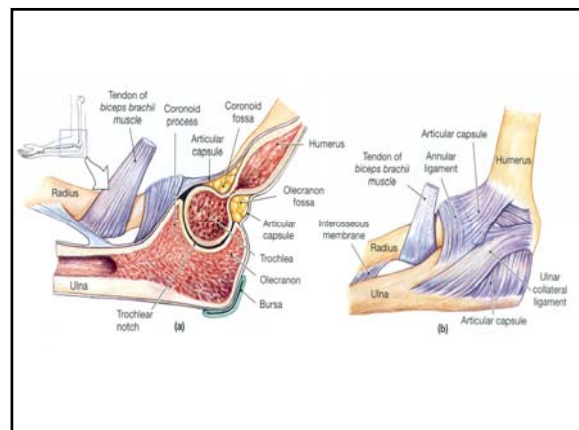
•Strength and stability are sacrificed to obtain mobility.



### The Elbow Joint

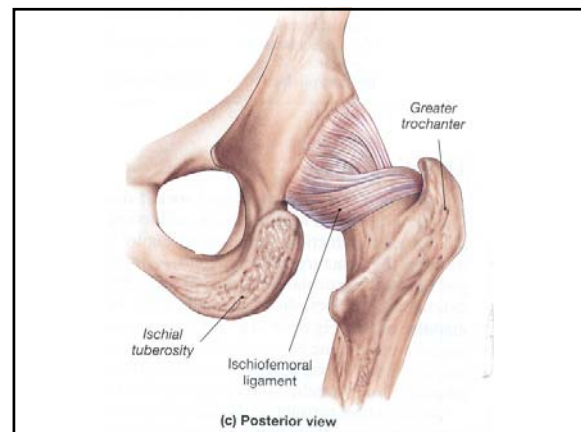
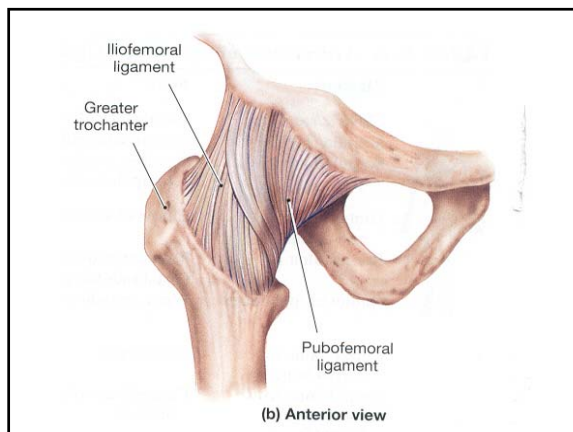
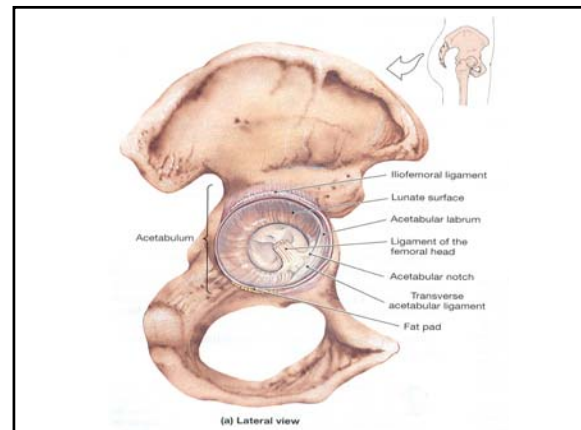
•The elbow joint or **olecranal joint**, permits only flexion/extension.

•It is a hinge diarthrosis whose capsule is reinforced by strong ligaments.



### The Hip joint

- The hip joint is a ball-and-socket diarthrosis formed by the union of acetabulum with the head of the femur.
- The joint permits flexion/extension, adduction/abduction, circumduction, and rotation.
- It is stabilized by numerous ligaments.



### The Knee Joint

- The knee joint is a hinge joint formed by the union of the condyles of the femur with superior condylar surfaces of the tibia.
- The joint permits flexion/extension and limited rotation, and it is stabilized by several ligaments.

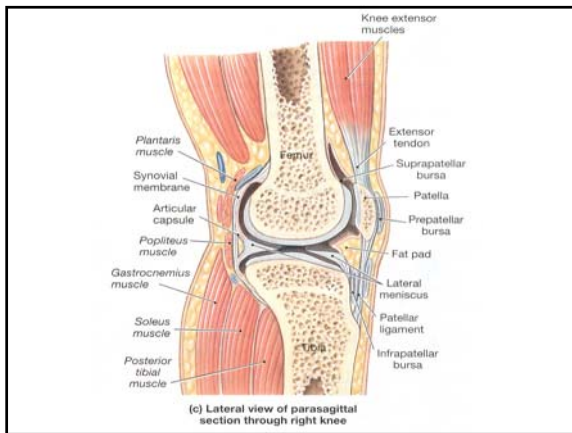
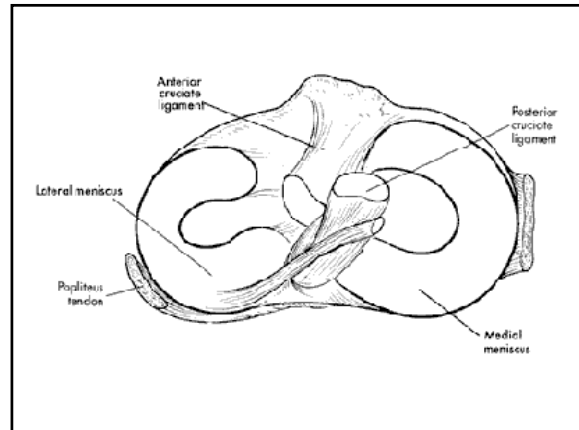
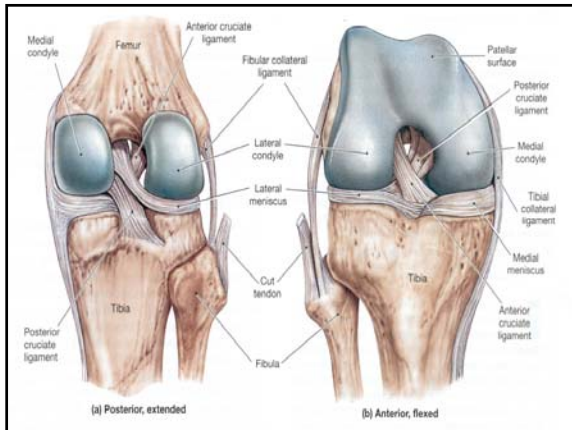
i.e. - MCL, LCL, PCL, ACL

- A pair of fibrocartilage pads, the medial and lateral **menisci**, lie btm. the tibial and femoral surfaces.

#### The Menisci:

- (1) Act as cushions
- (2) Conform to the shape of the articulating surfaces as the femur changes position
- (3) Provide lateral stability to the joint

- Prominent **fat pads** cushion the margins of the joint and assist many bursae reducing friction btm the patella and other tissue.



**Osteoarthritis**

- Also known as *degenerative arthritis* or *degenerative joint disease* (DJD), generally affects individuals 60 or over.
- DJD may result from cumulative wear and tear at joint surfaces or from genetic factors affecting collagen formation.
- In the U.S. population, 25% of women and 15% of men over age 60 show signs of this disease.

**Rheumatoid Arthritis**

- An inflammatory arthritis that affects roughly 2.5% of the adult U.S. population.
- The cause is uncertain, although allergies, bacteria, viruses, and genetic factors have all been proposed.
- The primary symptom is *synovitis*, swelling and inflammation of the synovial membrane.