

JOINTS

Joint is a junction between two or more bones

Classification

- Functional

Based on the range and type of movement they permit

- Structural

On the basis of their anatomic structure

Functional Classification

- Synarthrosis
 - No movement
 - e.g. Fibrous joint
- Amphiarthrosis
 - Slight movement
 - e.g. Cartilagenous joint
- Diarthrosis
 - Movement present
 - Cavity present
 - Also called as Synovial joint
 - eg. shoulder joint

Structural Classification

Based on type of connective tissue binding the two adjacent articulating bones

Presence or absence of synovial cavity in between the articulating bone

- Fibrous
- Cartilagenous
- Synovial

Fibrous Joint

Bones are connected to each other by fibrous (connective) tissue

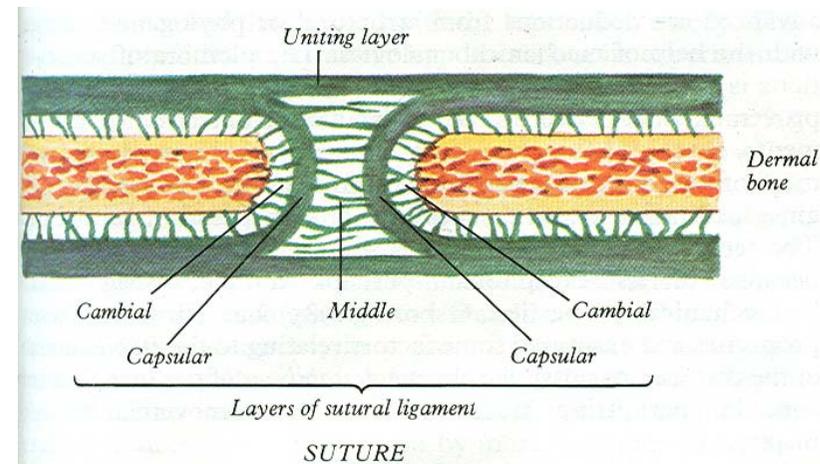
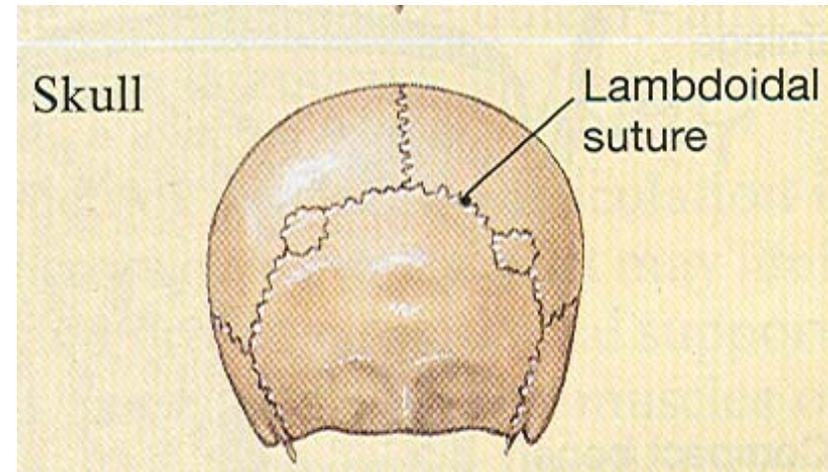
No movement

No synovial cavity

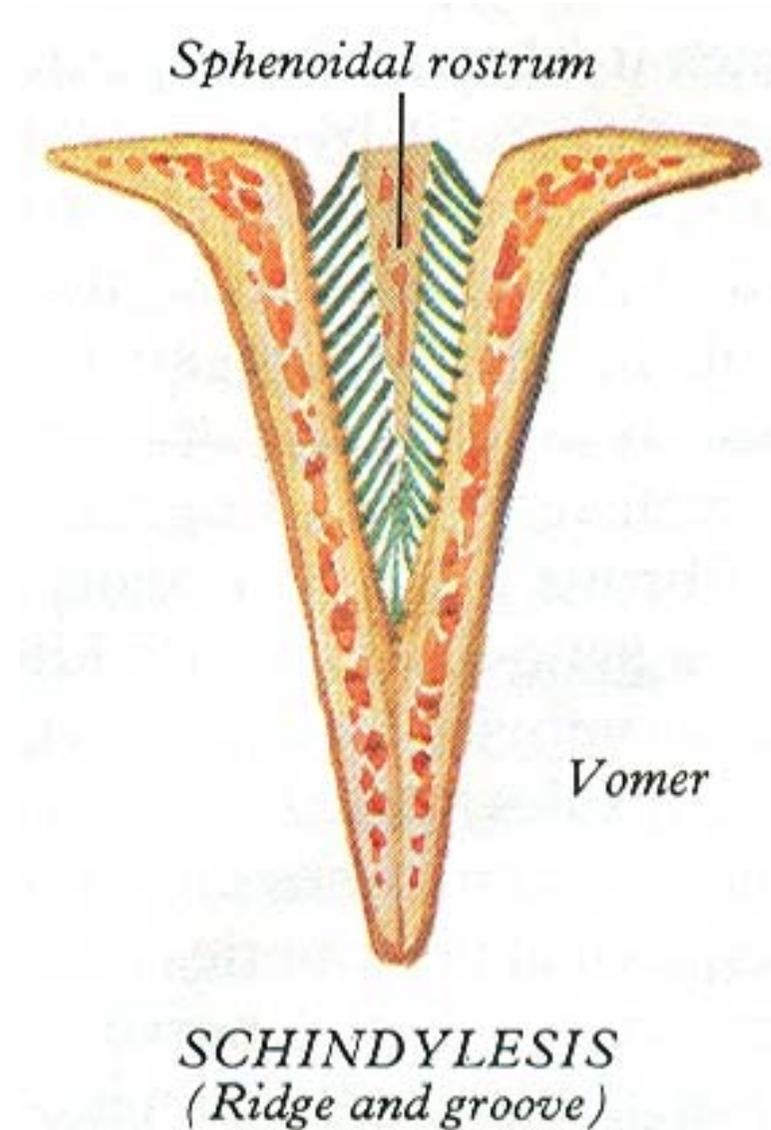
- Suture
- Syndesmosis
- Gomphosis

Sutural Joints

- A thin layer of dense fibrous tissue binds the adjacent bones
- These appear between the bones which ossify in membrane
- Present between the bones of skull e.g. coronal suture, sagittal suture

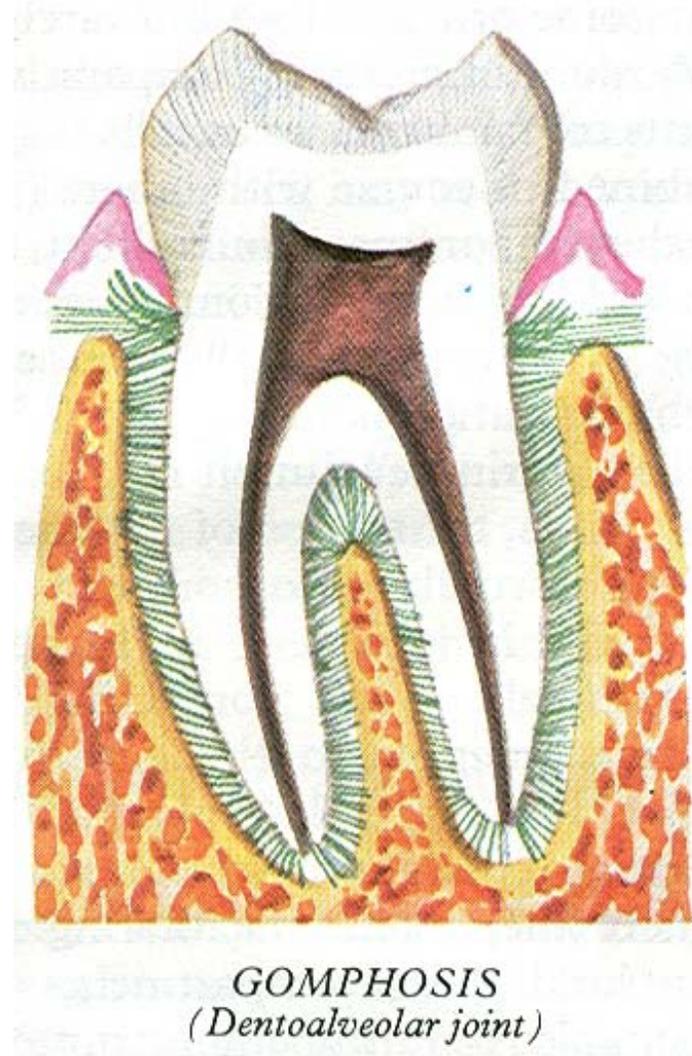


- **Schindylesis:**
 - rigid bone fits in to a groove on a neighbouring bone
e.g. Vomer and sphenoid



Gomphosis

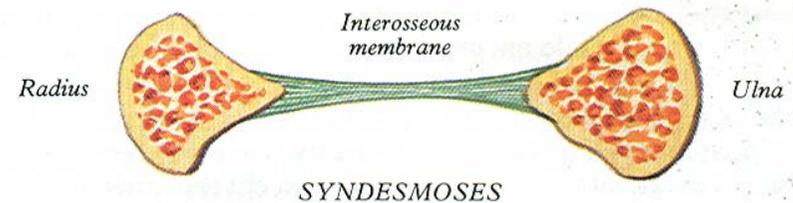
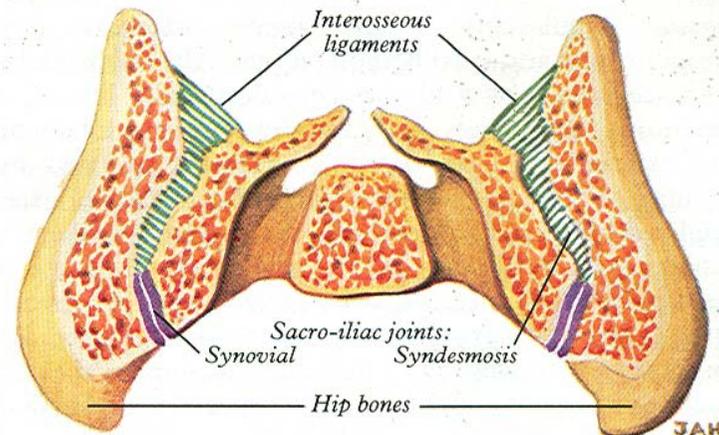
- Peg and socket variety
- Cone shaped root of tooth fits in to a socket of jaw
- Immovable
- Root is attached to the socket by fibrous tissue (periodontal ligament).



Syndesmosis

- Bony surfaces are bound together by interosseous ligament or membrane
- Membrane permits slight movement
- Functionally classified as amphiarthrosis e.g. inferior tibiofibular joint

FIBROUS JOINTS

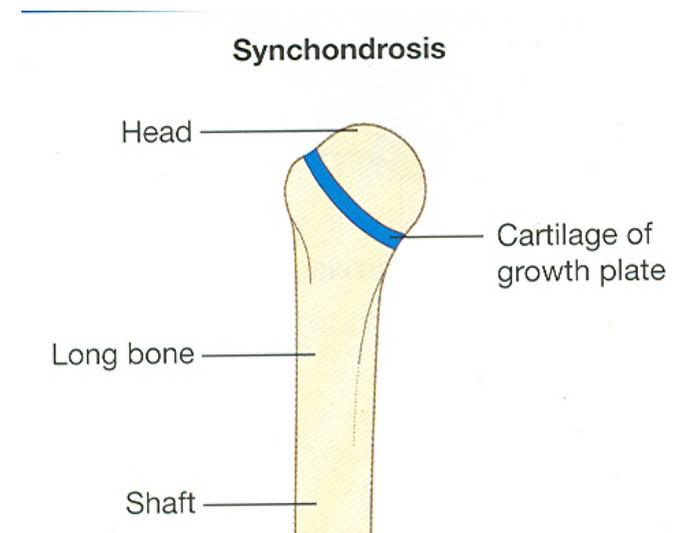


Cartilaginous joint

- Bones are held together by cartilage
- Absence of synovial cavity
 - Synchondrosis
 - Symphysis

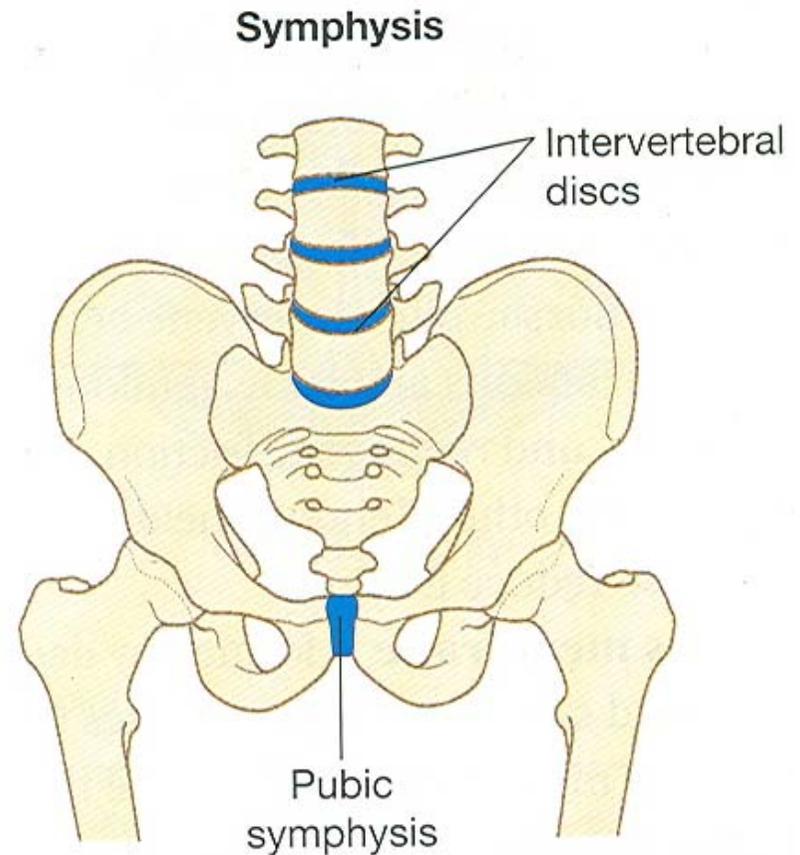
Synchondrosis

- Primary cartilaginous joint
- Connecting material between two bones is hyaline cartilage
- Temporary joint
- Immovable joint
- After a certain age cartilage is replaced by bone (synostosis)
- e.g. Epiphyseal plate connecting epiphysis and diaphysis of a long bone, joint between basi-occiput and basi-sphenoid



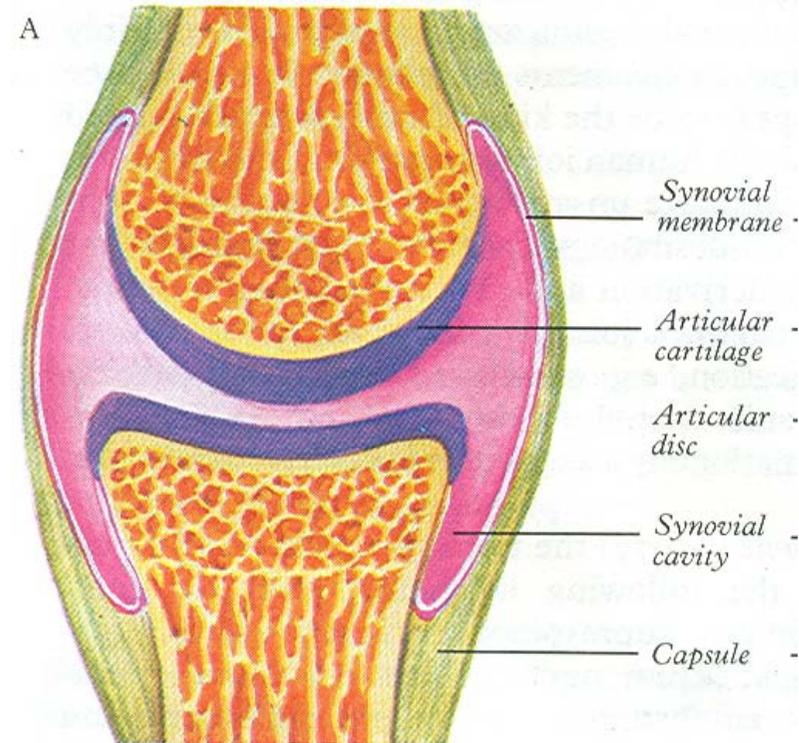
Symphysis

- Secondary cartilaginous joint (fibrocartilaginous joint)
- Permanent joint
- Occur in median plane of the body
- Slightly movable
- e.g. Joint between two vertebral bodies, pubic symphysis and manubriosternal joint



Synovial joint (Diarthrosis)

- Permit free movement
- Presence of synovial cavity
- Ends of articulating bones are covered by articular cartilage
- Joint is surrounded by fibrous capsule
- Fibrous capsule is lined by the synovial membrane
- eg. Most of the joints of body



SIMPLE

Structure of synovial joint

- Articular surface of the bones covered by ***articular cartilage*** (hyaline)
Articular cartilage works as shock absorber and provides smooth slippery surface for the movement

Fibrous capsule

- Joins the articulating bones close to their articular cartilage
 - **Capsule is made up of collagen fibers**
 - **Richly supplied by nerves so sensitive to pain**
 - **Blood vessels and nerves pierce the capsule to supply the deeper structure**

Synovial Membrane

Secrets a viscous fluid needed for lubrication of joint cavity and also provide nutrition to the cartilage

- Double layered membrane
- Highly vascular
- Lines the inner aspect of fibrous capsule and nonarticular part of the bone lying within the capsule.
- Synovial fluid also contain phagocytic cells

Ligaments

- Thickening in the fibrous capsule at certain places are called true ligament
 - Join the ends of two articulating bones thus provide stability to the joint
 - Permit movement in one plane

Accessory ligaments may be present.

These may be external (stylomandibular and sphenomandibular) or internal (cruciate ligament in knee). Intracapsular ligaments are covered with synovial membrane but extrasynovial

Articular Disc and Menisci

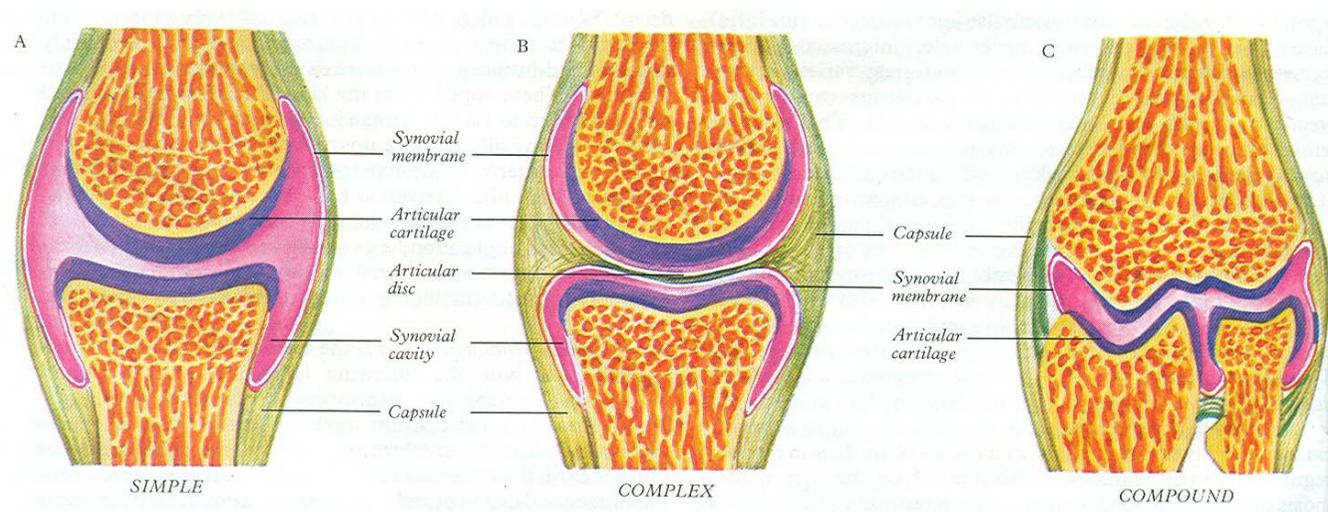
- Some times fibrocartilaginous articular disc is present
- Disc is attached to the capsule at its periphery
- Subdivides the joint cavity in to two compartment
- Menisci are articular Disc which is not complete but deficiant in the middle
- Not covered by synovial membrane
- eg. Temporomandibular joint, sternoclavicular and inf. Radio ulnar joint

- They modify the shape of articulating surface
- The movements are different in upper and lower compartment
 - eg. In temporomandibular joint gliding in upper and rotation in lower compartment

Classification of synovial joint

- According to the number of bones forming joint
 - Simple
 - Compound
 - Complex
- According to the axis of movement and the shape of articular surface
 - Uni-axial
 - Bi-axial
 - Multi-axial
 - Non-axial

- **Simple joint** : only two bones form the joint e.g. joints of fingers and toes
- **Compound joint** : more than two bones form the joint e.g. tibia fibula talus in ankle
- **Complex joint**: joint cavity is divided into two compartment e.g. Knee joint



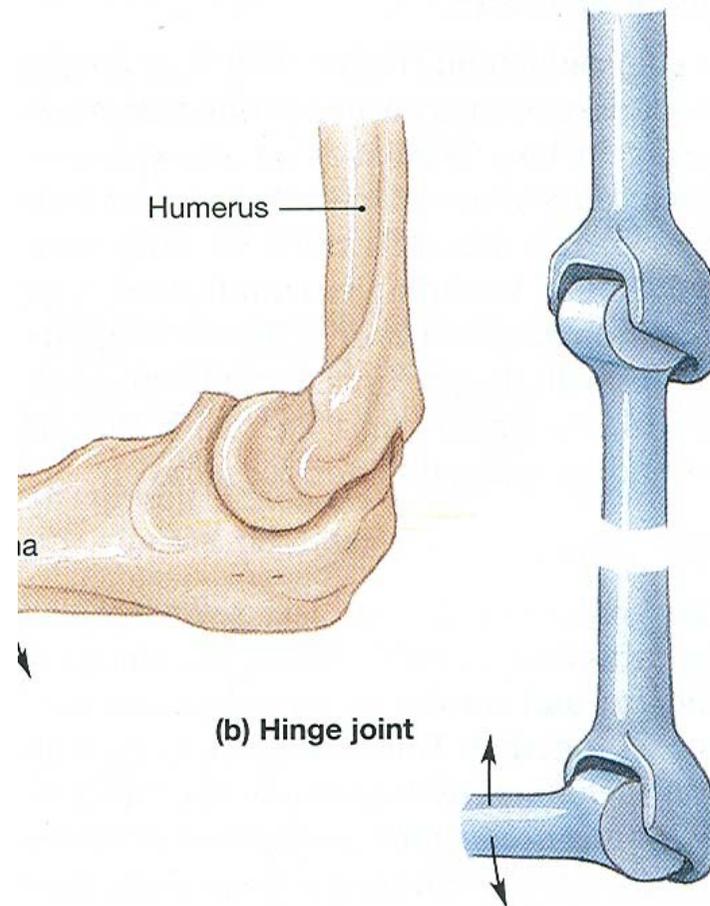
Classification according to axis of movement

Uni-axial

- Movement is possible only in one axis

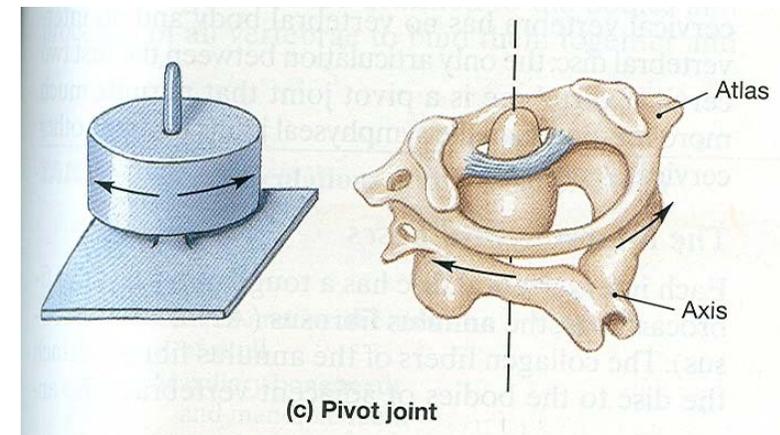
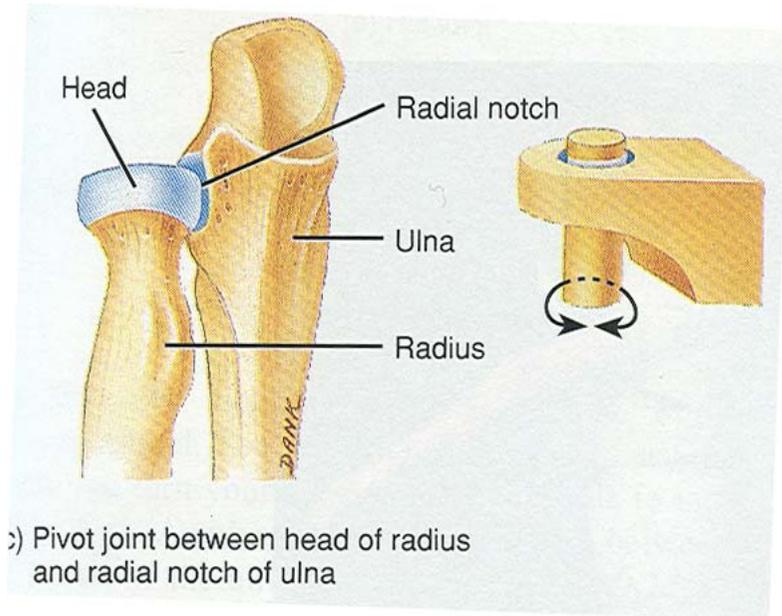
Hinge joint

- One surface is convex that fits in to concave surface of other bone
- Movement takes place around a transverse axis only flexion and extension is possible
- e.g. Elbow, ankle, interphalangeal joints of fingers and toes.



Pivot joint

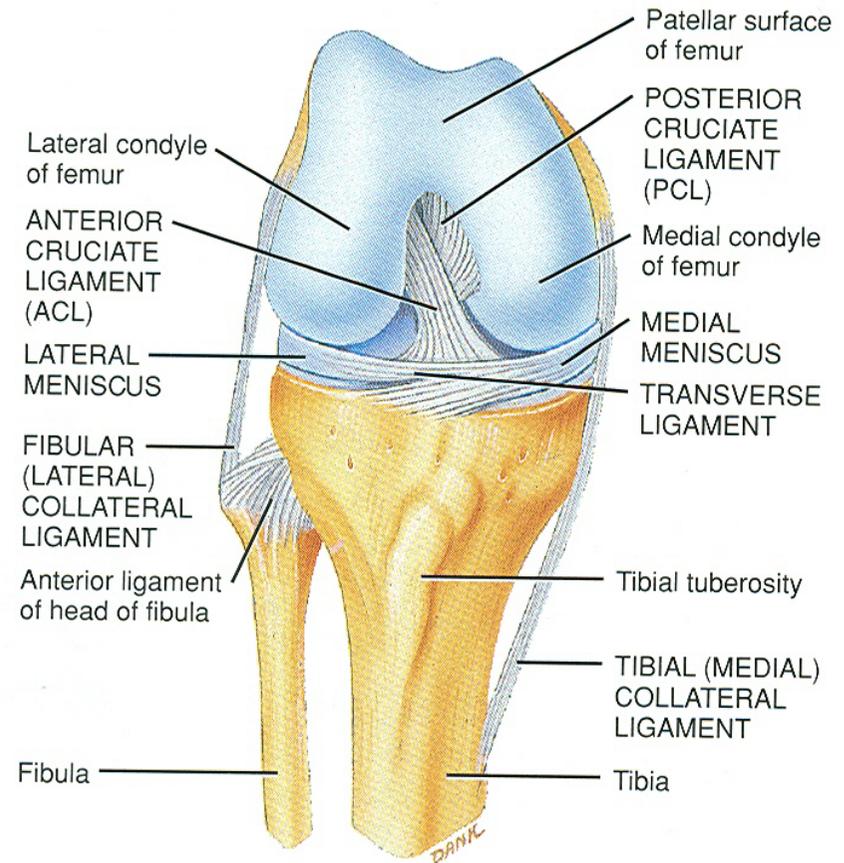
- Rounded or pointed surface fits into a ring formed partly by bone and partly by ligament
- Movement take place around a vertical axis hence only rotation movement is possible
- Eg. Superior radioulnar and atlantoaxial joint



Bi-axial joint

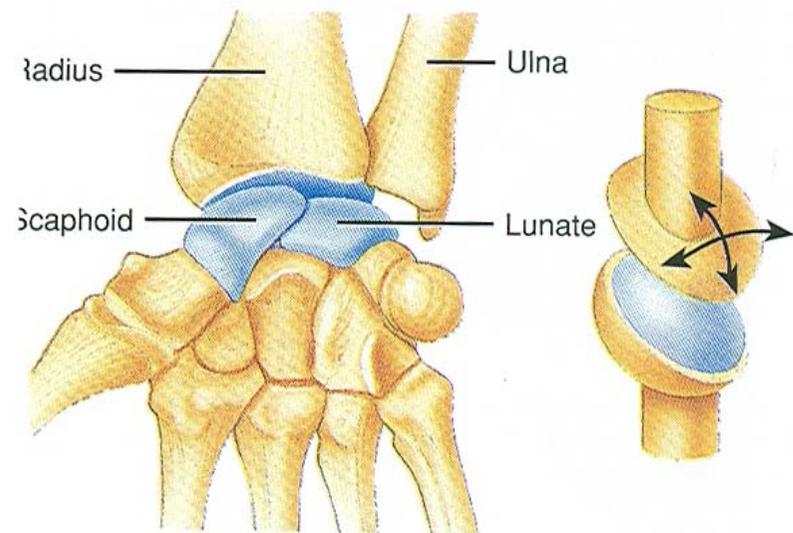
Condylar joint

- One articulating bone has two condyles which are convex and fits in to concave surface of the other bone
- It is a modified hinge where besides flexion extension slight rotation is also possible around vertical axis
- e.g. Temporomandibular and knee joint



Ellipsoid joint

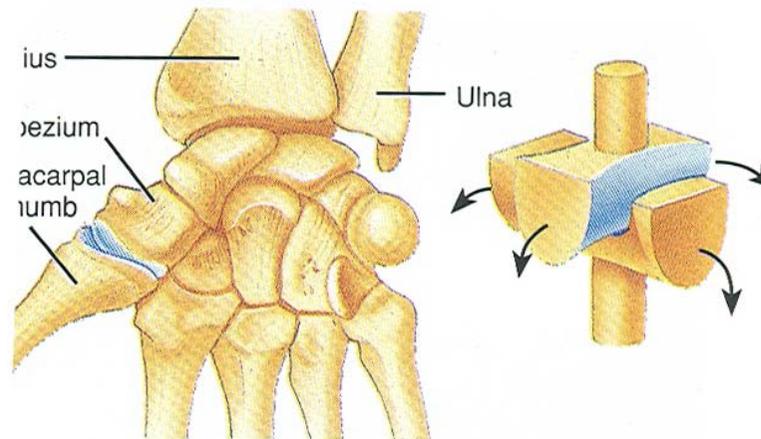
- Articular surface is oval in shape. The radius of curvature of one surface is long in one direction and short in the direction that is right angle to it
- Flexion and extension takes place around a transvers axis. abduction and adduction around a anteroposterior axis. Circumduction is also possible
- e.g. wrist, metacarpophalangeal and metatarso-phalangeal joint



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

Saddle joint

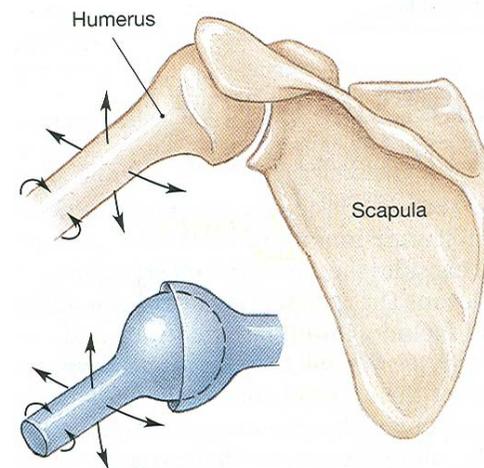
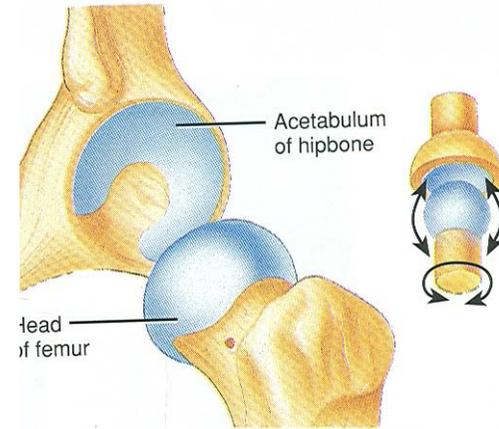
- Articular surface of one bone is saddle shaped i.e. convexity in one direction, at the same time concavity at right angle to it. The other bone has reciprocal concavoconvexity
- Flexion extension around a transvers axis. Abduction adduction around a anteropostero axis
- Carpometacarpal joint of thumb, sternoclavicular joint



Saddle joint between trapezium of carpus (wrist) and metacarpal of thumb

Multi-axial joint

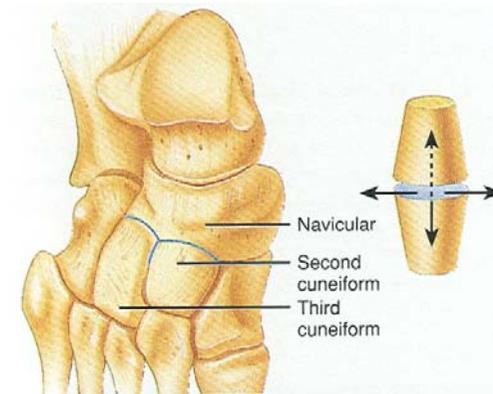
- ***Ball and socket joint***
- One of the articular surface is spheroidal (ball like) and fits in the socket (cup shaped surface) of the other bone.
- All kind of movement are possible i.e. flexion extension ,abduction adduction, rotation and circumduction. These movement take place around multiple axes
- e.g. Shoulder and hip joint



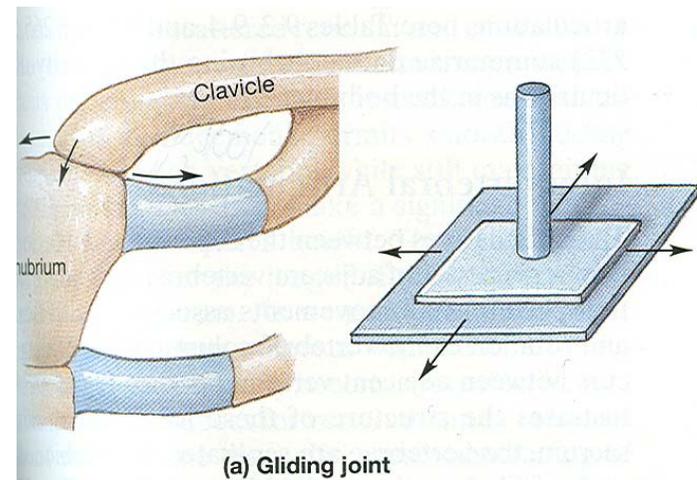
(f) Ball-and-socket joint

Non-axial joint

- Plane joint
- Usually small joint where articulating surfaces of articulating bones are flat or almost flat
- Only gliding movement in one of the many direction is possible
- e.g. intercarpal, intertarsal and facet joints of vertebrae



(a) Gliding joint between the navicular and second and third cuneiforms of the tarsus in the foot



(a) Gliding joint

Nerve supply of synovial joint

- Sensory nerve convey pain and proprioceptive sensation and autonomic nerve for blood vessels.
- Capsule ,ligaments and synovial membrane are richly innervated by nerves (pain)
- Articular cartilage is not supplied by nerves hence insensitive to pain

- Proprioceptive nerves supplying capsule and ligament are responsible for conveying degree of movement and stretch at a joint.
- These nerves by reflex action control posture and body movements
- Autonomic nerve supply blood vessel.
- Each joint capsule is supplied by many nerves The area of each nerve overlaps on joint capsule.

Hilton's law

Nerve supplying the sensory fibers to the capsule of a joint also supply the motor fiber to the muscles acting on the same joint and the sensory fibers to skin of the same joint

Blood supply of the synovial joint

- Arteries lying close to the joint form a rich plexus around the joint
- Articular blood vessel supply epiphysis, synovial membrane and articular capsule
- Articular cartilage is an avascular structure and gets its nourishment by diffusion from neighbouring vessels