

JOINT CLASSIFICATION

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JOINT CLASSIFICATION

Traditionally, the joints of human body are classified into two broad categories depending upon the type of material and the methods used to unite the bony components:

- Synarthrosis or Non-synovial joints
- Diarthrosis or Synovial joints

Summary of Joint Classification

Structural Class	Characteristics	Types	Mobility
Fibrous	Bones united by collagen fibers	<ol style="list-style-type: none"> 1. Suture 2. Syndesmosis 3. gomphosis 	<ol style="list-style-type: none"> 1. Immobile (synarthrosis) 2. Slightly moveable (amphiarthrosis) 3. Immobile
Cartilaginous	Bone ends united by cartilage	<ol style="list-style-type: none"> 1. Synchondrosis (hyaline) 2. Symphysis (fibrocartilage) 	<ol style="list-style-type: none"> 1. Immobile 2. Slightly moveable
Synovial	Bone ends covered with articular cartilage and enclosed within a capsule lined with a synovial membrane	<ol style="list-style-type: none"> 1. Plane 2. Hinge 3. Pivot 4. Condylloid 5. Saddle 6. Ball and socket 	Freely moveable (diarthrosis) which depends on joint design

SYNARTHROSES

In this type of joint the material used to connect the bony components is interosseous connective tissue (fibrous and cartilaginous)

These are further divided classified into:

- Fibrous joint
- Cartilaginous joint

According to the type of connective tissue used to unite the bony components

FIBROUS JOINT

In this type of joint, the fibrous tissue directly unites the bone to bone.

It is further classified into:

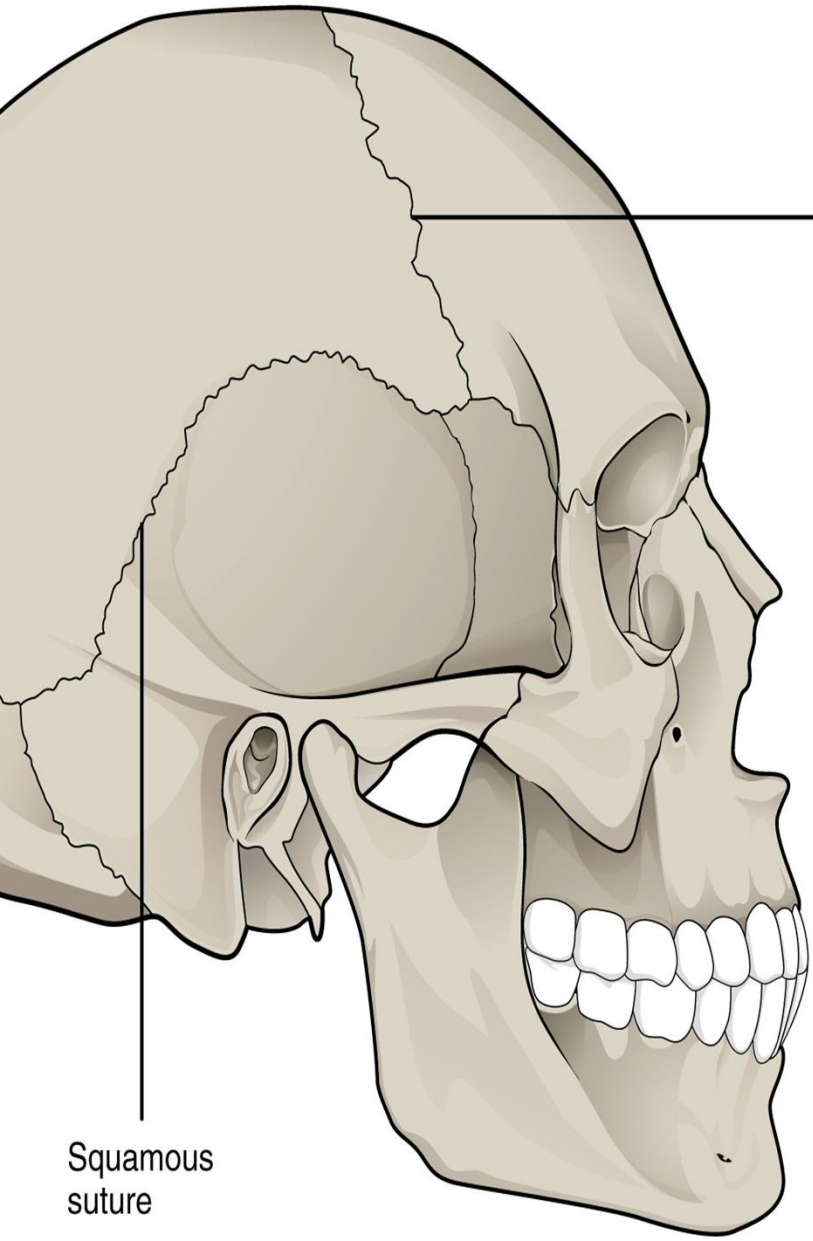
- Sutures
- Gomphosis
- Syndesmosis

SUTURES

A suture joint is one in which two bony components are limited by a sutural ligament or membrane

The ends of bony components are shaped in such a way that edges interlock or overlap one another

This type of joint is found only in skull and provides little movement in early stages of life, which gets fused later on leads to bony union called synostosis



Serrate suture

Bone



Wood



Dovetail joint



Lap suture



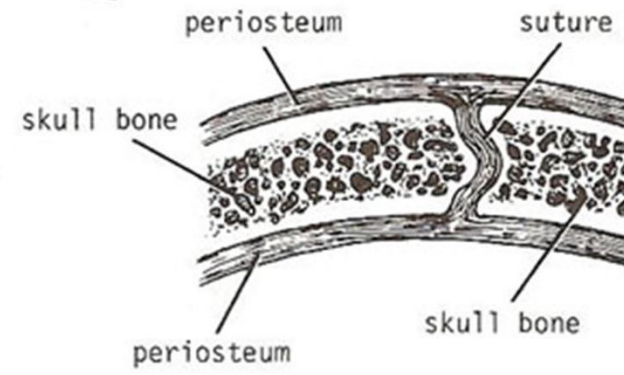
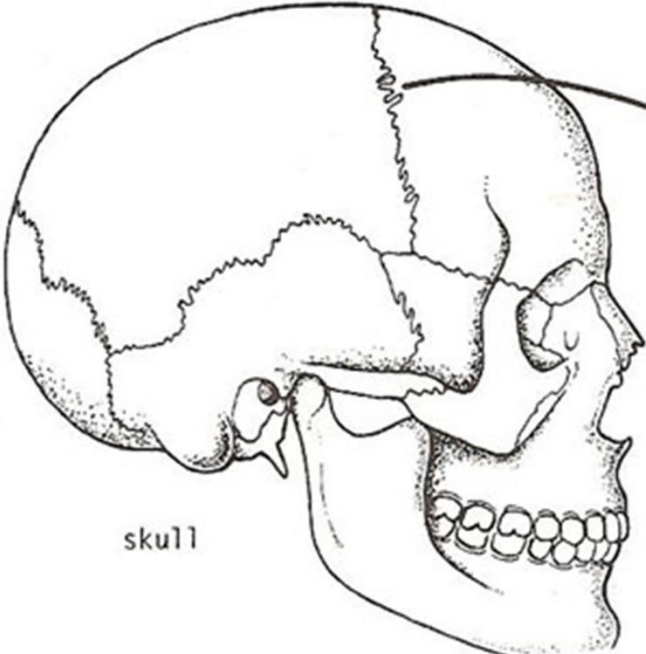
Miter joint



Plane suture



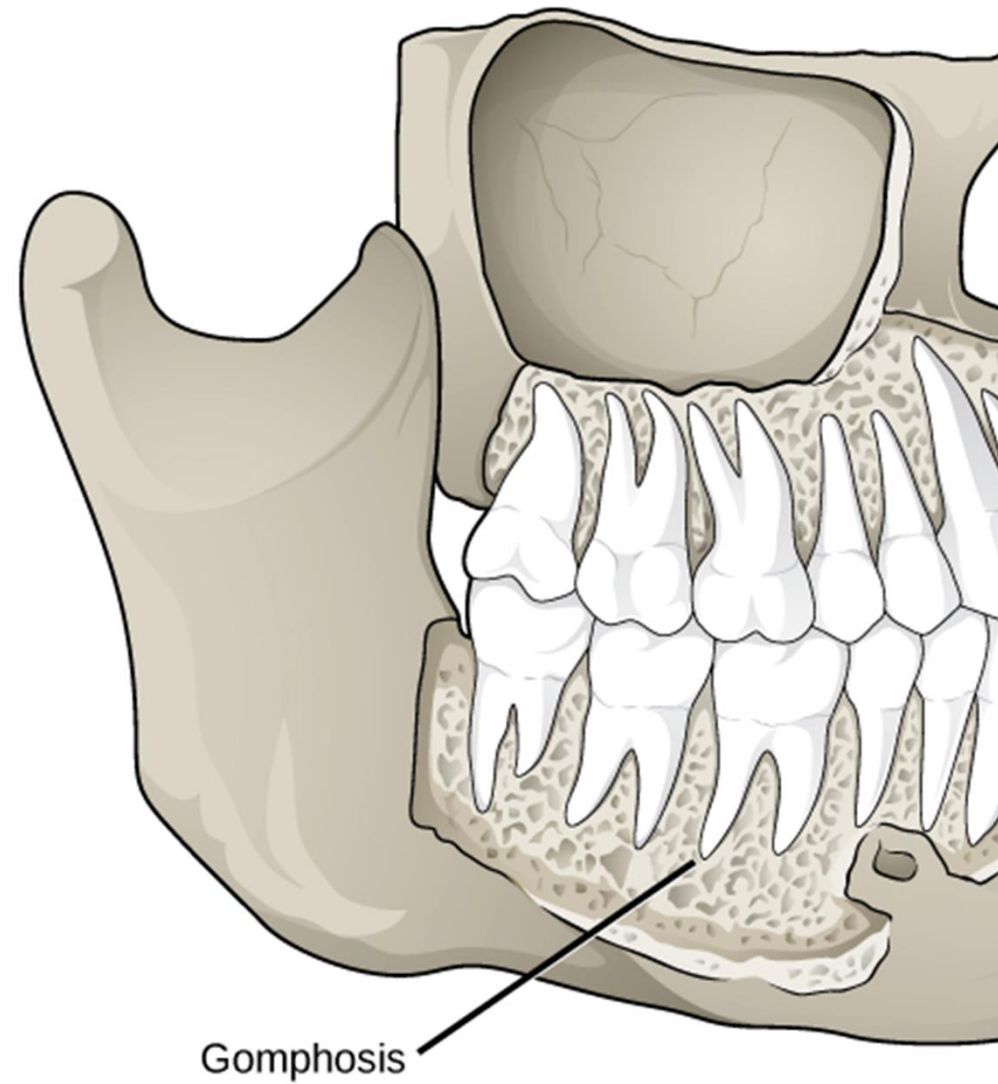
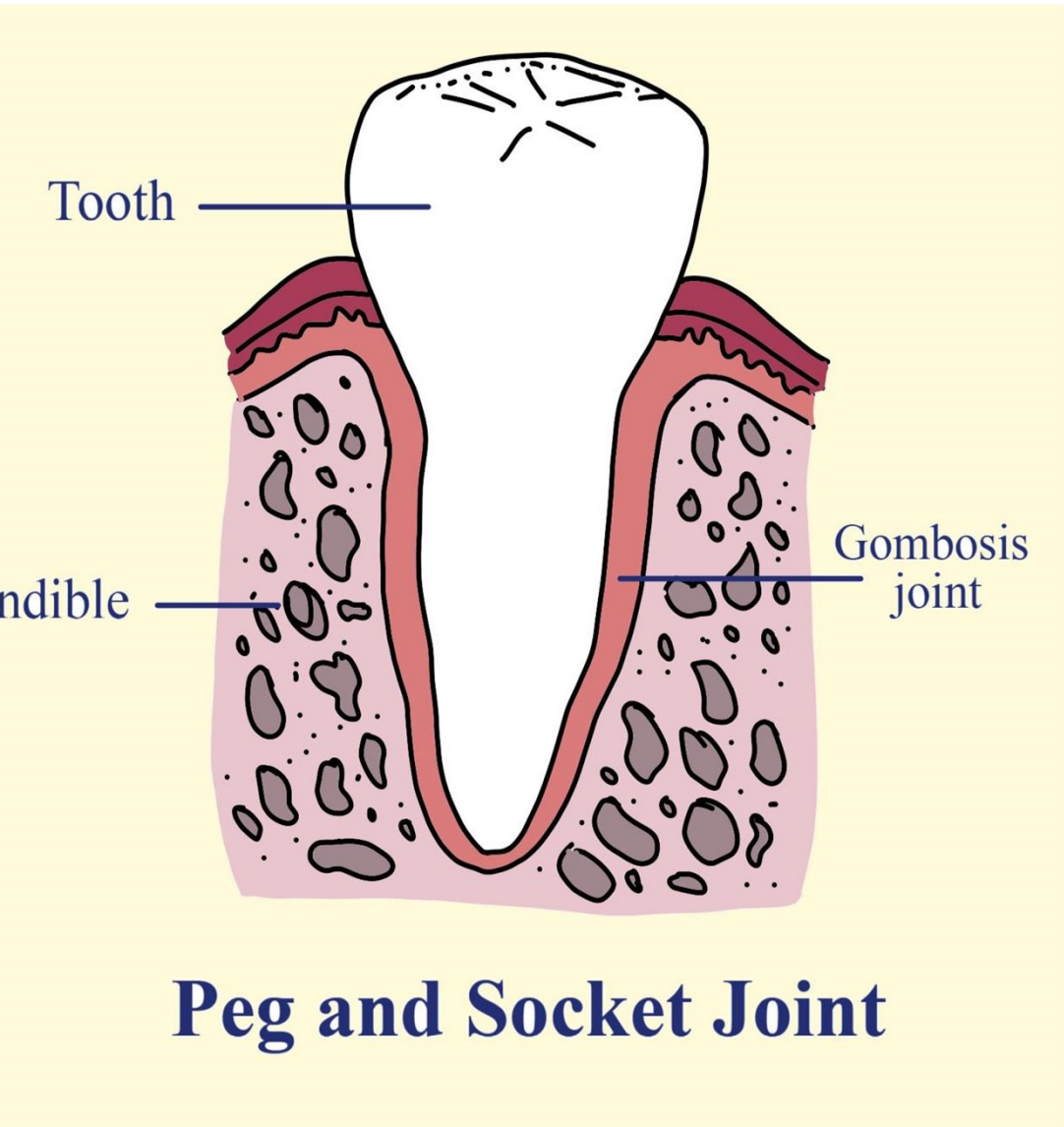
Butt joint



GOMPHOSIS

It is a joint into which surfaces of bony components are adapted to each other like peg in a hole

Example: Between tooth and either the mandible or the maxilla

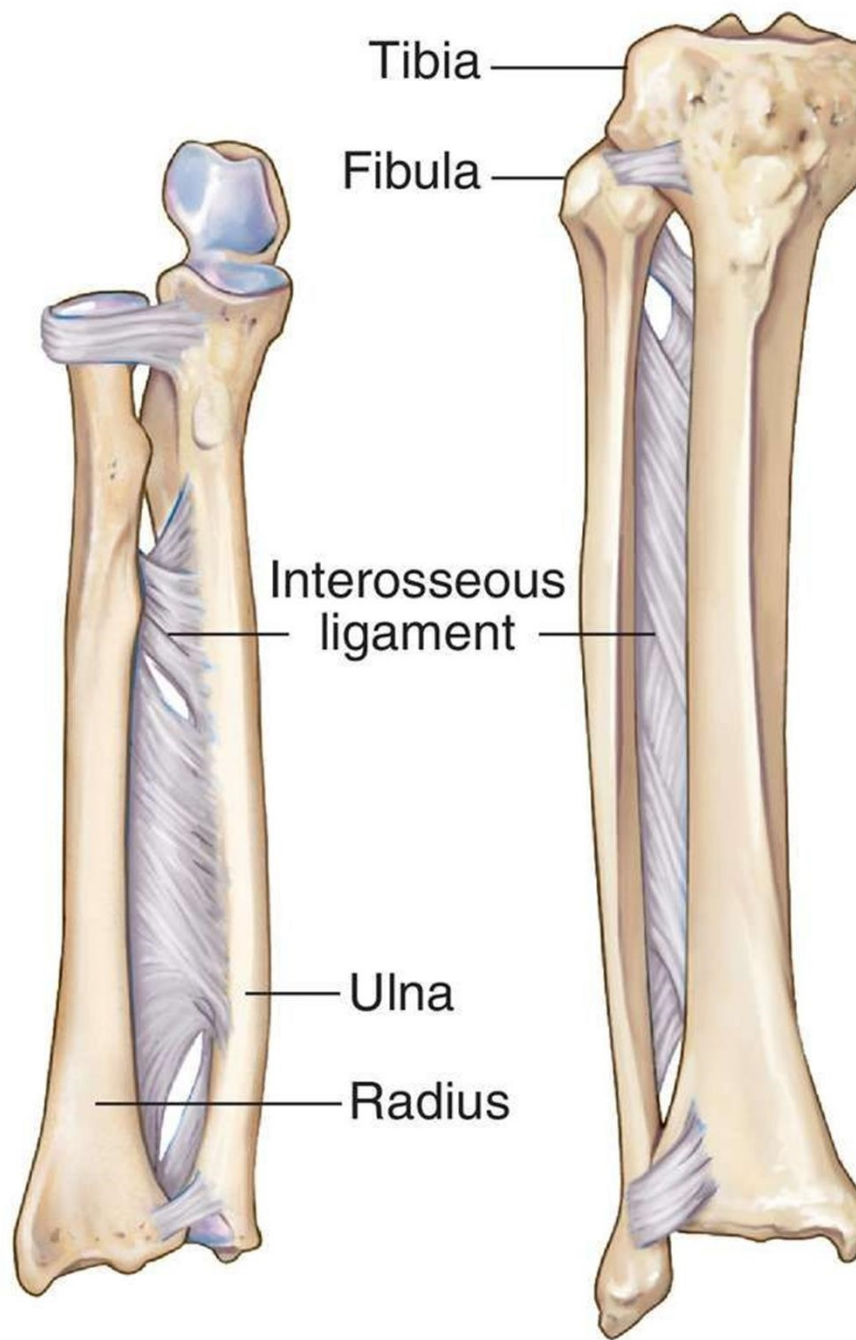
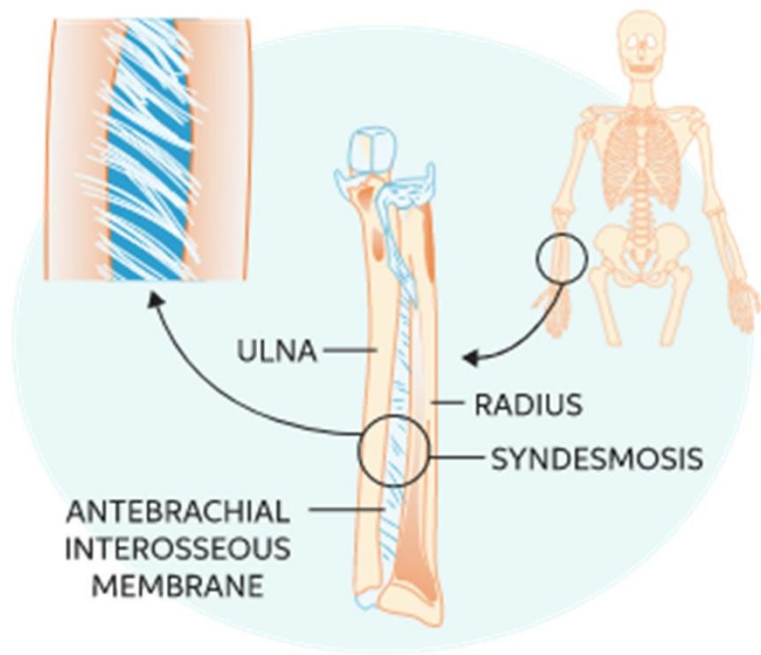


SYNDESMOSIS

In this type of joint two bony components are joined by interosseous membrane or aponeurotic membrane

This type of joint permits small amount of motion

Example: Between shaft of Radius and Ulna, Between shaft of Tibia and Fibula



CARTILAGINOUS JOINT

Here the material used to connect the bony components are either fibro-cartilage or hyaline cartilage

This is also classified into:

- Symphysis
- synchondrosis

SYMPHYSIS

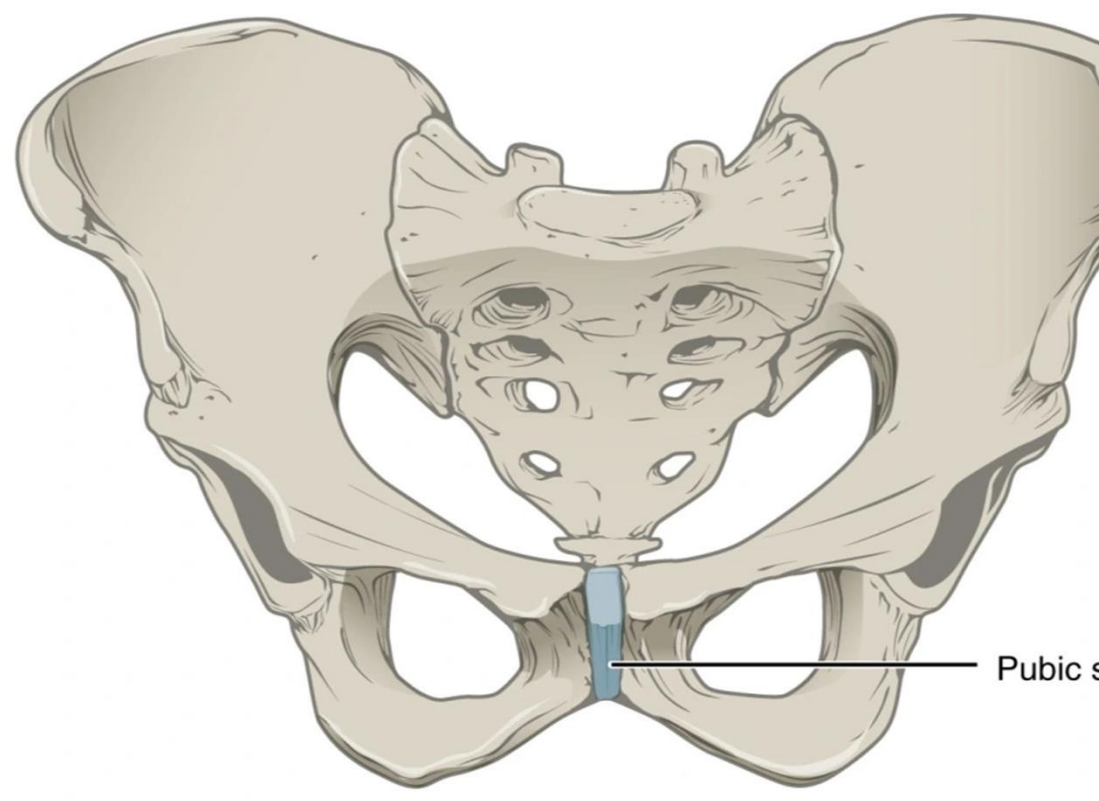
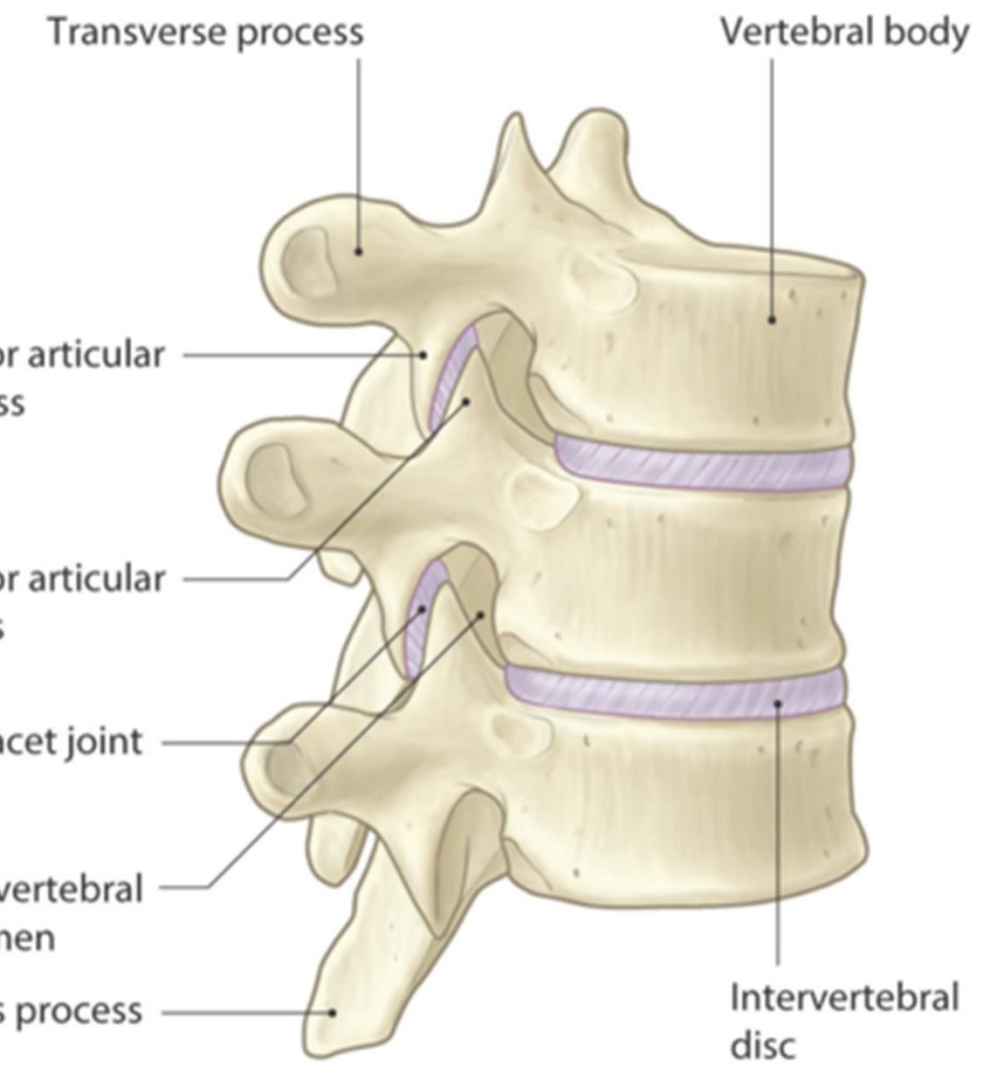
Symphysis is also referred as the secondary cartilaginous joint

In this type of joint the two bony components are covered with a thin lamina of hyaline cartilage and are joined by fibro-cartilage in the form of disks or pads

Example: Intervertebral joint- between the bodies of vertebrae

- : The joint between the manubrium and sternal body

- : Symphysis pubis in pelvis



SYNCHONDROSIS

It is also referred to as the primary cartilaginous joint

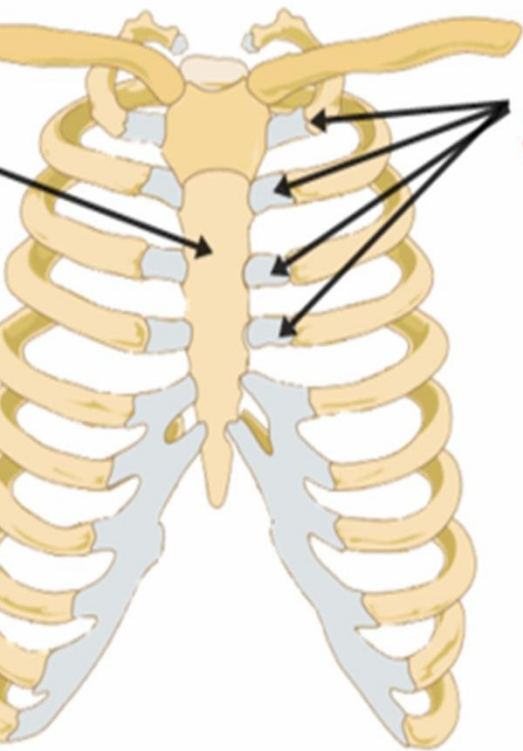
In this type of joint the material used to connect two bony components are hyaline cartilage

The cartilage forms a band between two ossifying centres of the bones

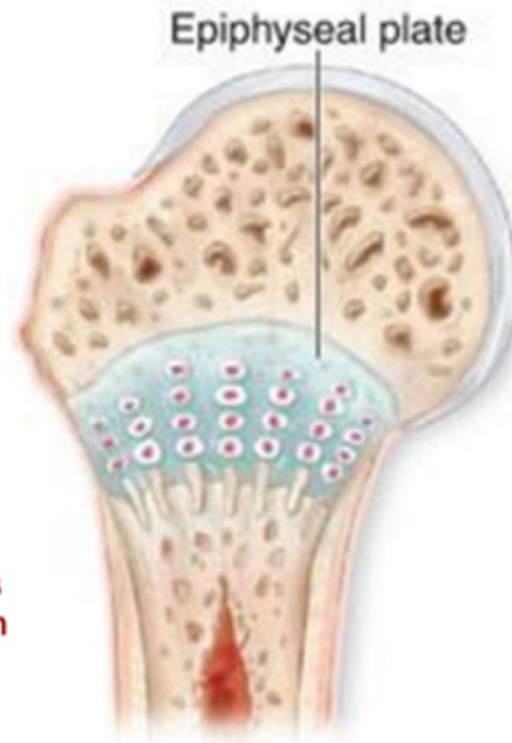
The function of this type of joint is to permit bone growth while providing stability and some amount of mobility also

Example : First Chondro-sternal joint

: Some of the joints are also found in skull



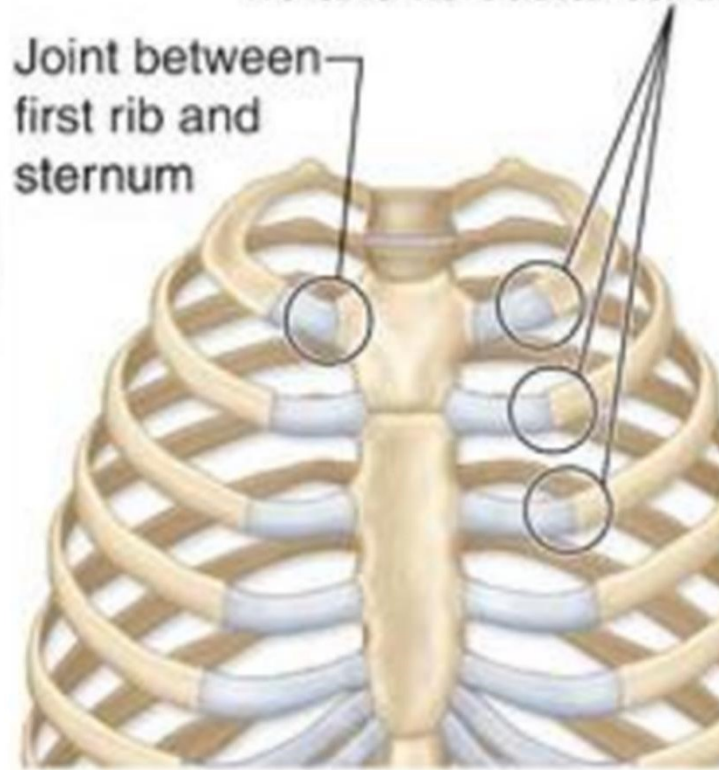
Amphiarthrodial Joints
where ribs join sternum
by costal cartilages



Epiphyseal plate

Costochondral joint
(immovable joints between
rib and its costal cartilage)

Joint between
first rib and
sternum



DIARTHROSES

Here the bony components are indirectly connected to one another by means of a joint capsule that encloses the joint.

All synovial joints are constructed in a similar fashion and all have the following features:

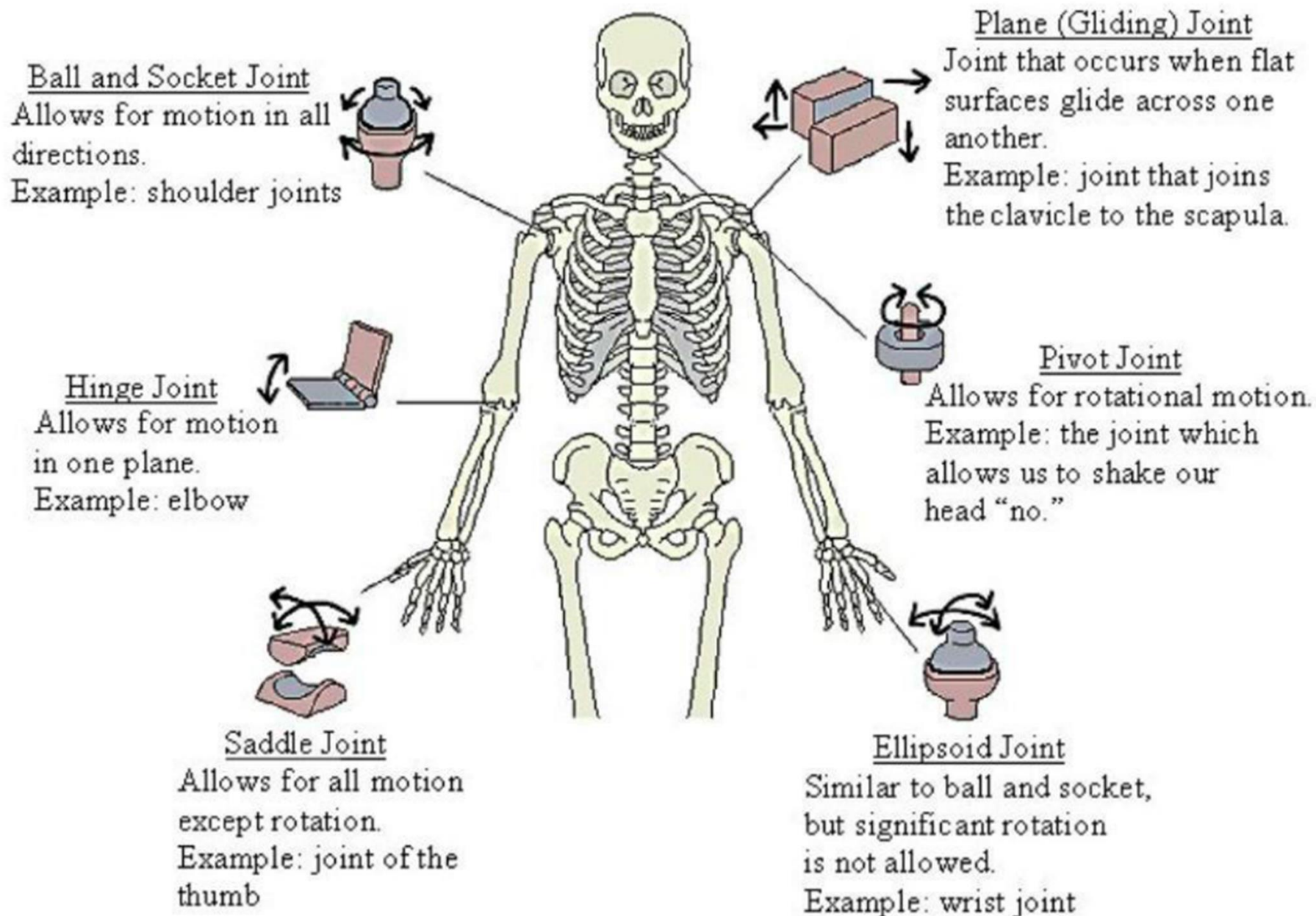
- A joint capsule
- A joint cavity enclosed by the joint capsule
- Synovial tissue that lines inner surface of the capsule
- Synovial fluid
- Hyaline cartilage that covers the articular surfaces

In addition to these structures synovial joints are also associated with accessory structures such as ligaments, tendons, labrums, menisci or plates, fibrocartilaginous disks

The disks, menisci and synovial fluid helps to prevent excessive compression of opposing joint surface and also helps for providing lubrication increases congruity

Ligaments and tendons help to keep the joint together and may assist in guiding motions

FIGURE 4.8
The Six Major Types of Synovial Joints



CLASSIFICATION OF DIARTHROSES

These synovial joints have been further classified into three main categories on the basis of the number of axes about which “gross visible” motions occur.

The three main categories are:

- Uni-axial
- Bi-axial
- Tri-axial

UNI-AXIAL DIARTHROSES

These are constructed so that visible motions of the bony components are allowed in only one of the planes of the body around a single axis

These are of further two types:

- Hinge joint
- Pivot joint

HINGE JOINT

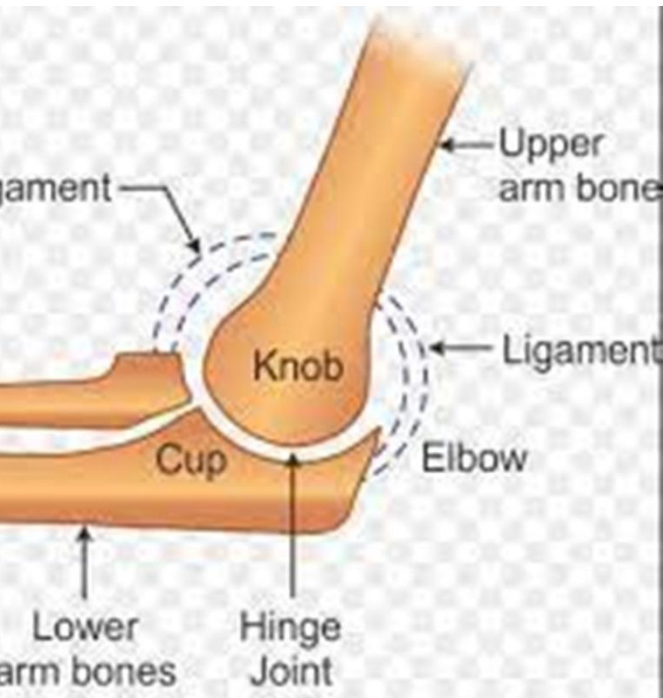
It is a type of joint that resembles a door hinge

It permits motion around one axis only

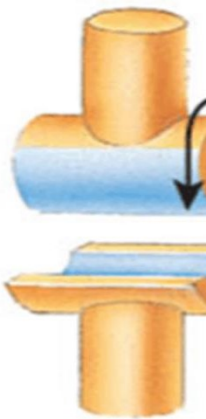
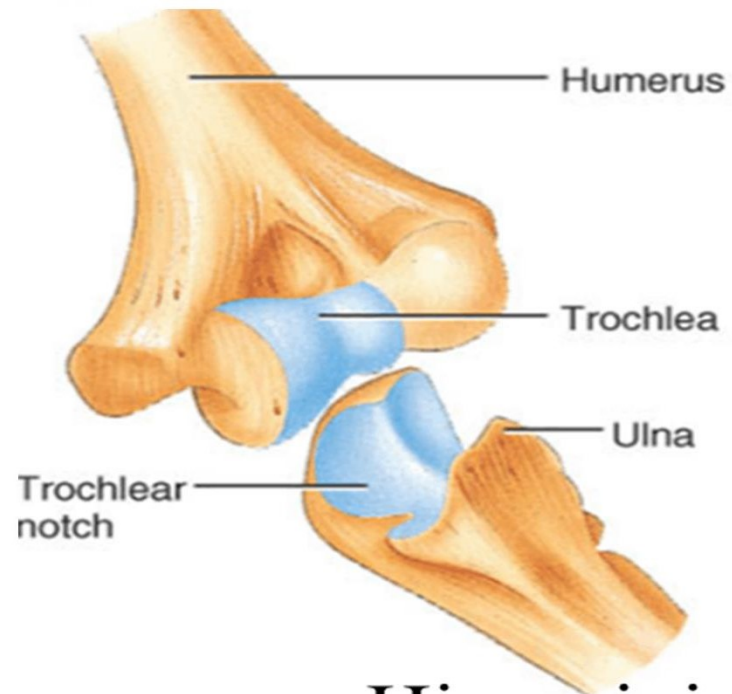
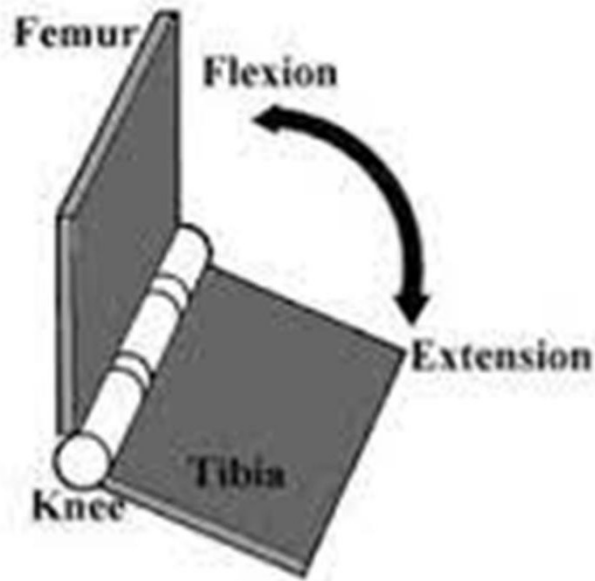
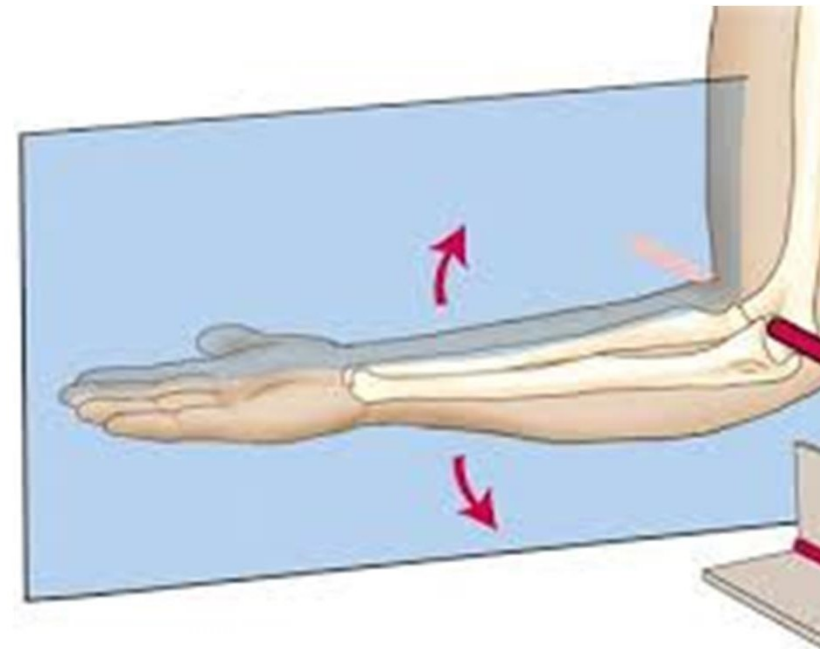
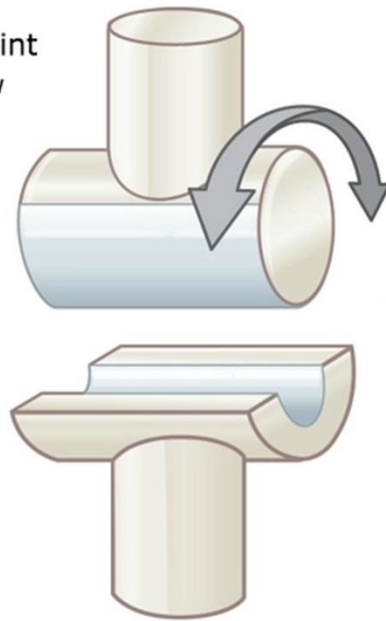
Example: Interphalangeal joints, Elbow joint, etc.

Movement is possible only in one direction, i.e., flexion and extension in sagittal plane around coronal axis

It has 1 degree of freedom



Hinge Joint
eg. Elbow



Hinge joint

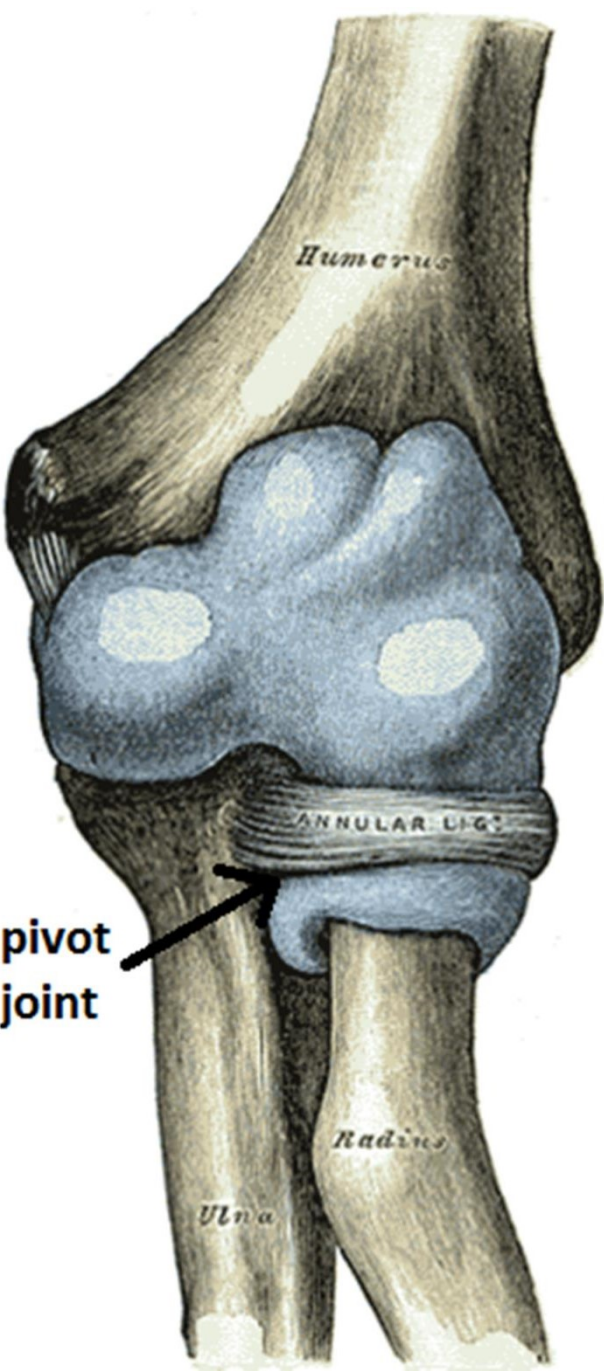
PIVOT JOINT

It is a type of joint constructed so that one component is shaped like a ring and the other component is shaped so that it can rotate within the ring

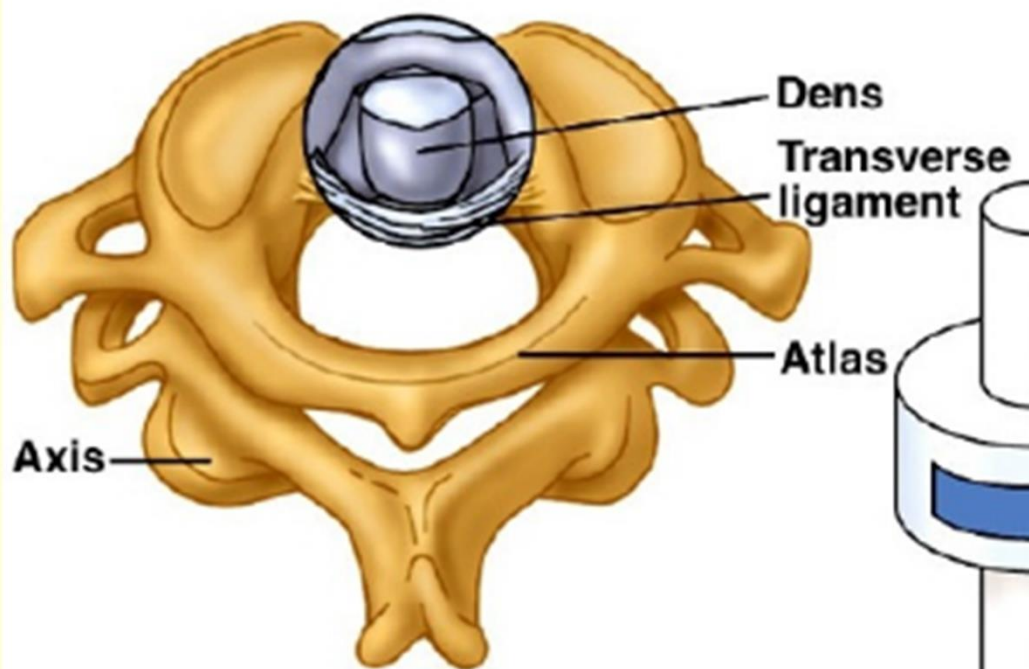
Example: Median atlanto-axial joint

The ring portion is formed by atlas and transverse ligament.

The odontoid process of the axis which is enclosed in the ring rotates, motion seems in transverse plane and longitudinal axis



- **Pivot joint:** rotation around a central axis
- **Ex:** atlas/axis joint



(e) Pivot joint

BI-AXIAL DIARTHROSES

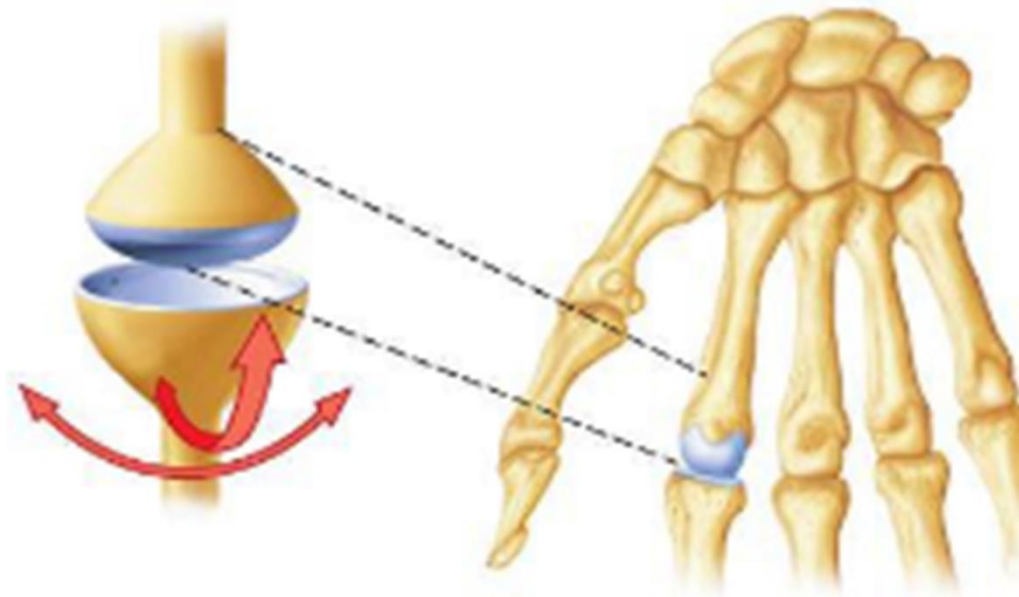
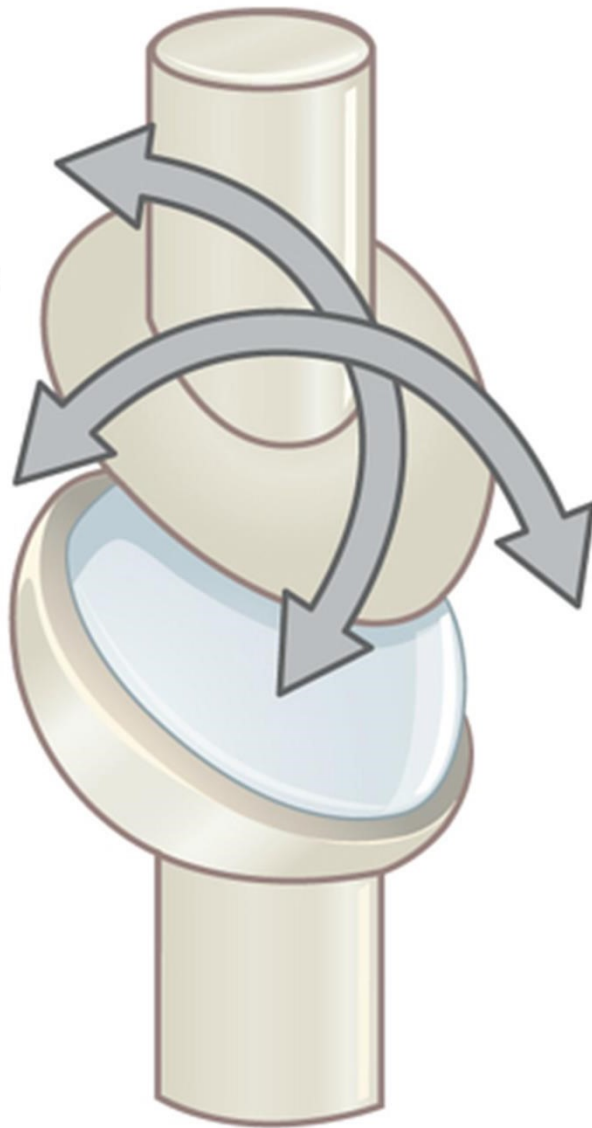
In this type of joint the bony components are free to move in two planes and two axes

It allows 2 degrees of freedom

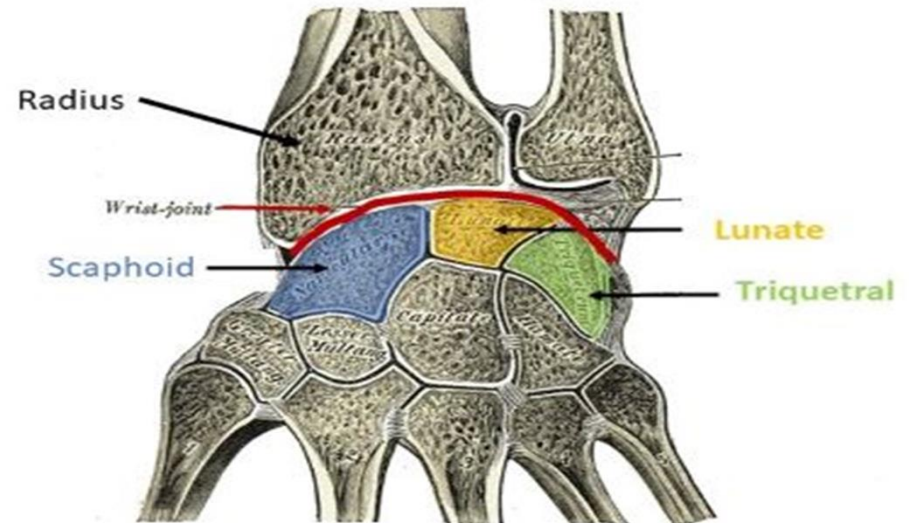
There are two further classifications of Bi-axial joints:

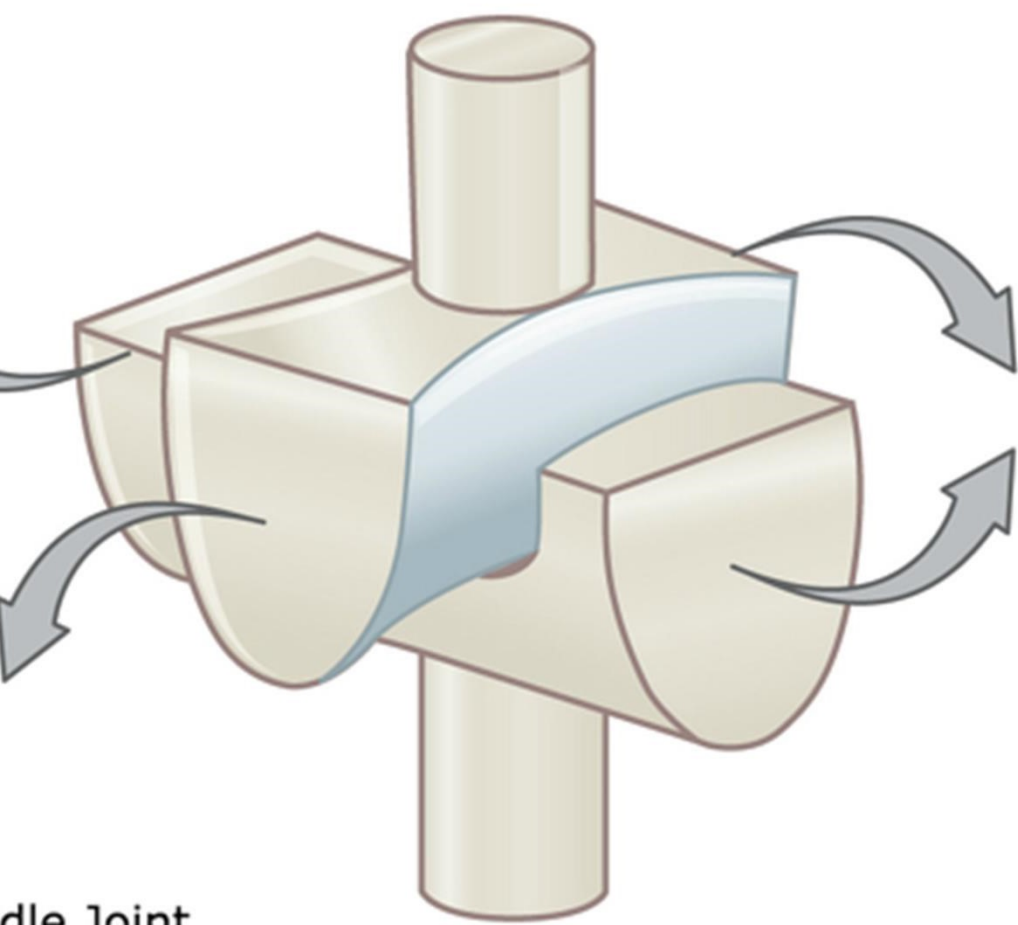
- **Condyloid**- a type of joint that is shaped so that the concave surface of one bony component is allowed to slide over the convex surface of another bony component in two directions. Example: Metacarpophalangeal joint
- **Saddle**- in this type of joint each joint surface is both convex in one plane and concave in another plane and these surfaces are fitted together like a rider on a saddle. Example: CMC joint of the thumb

Condylloid Joint
Radiocarpal Joint



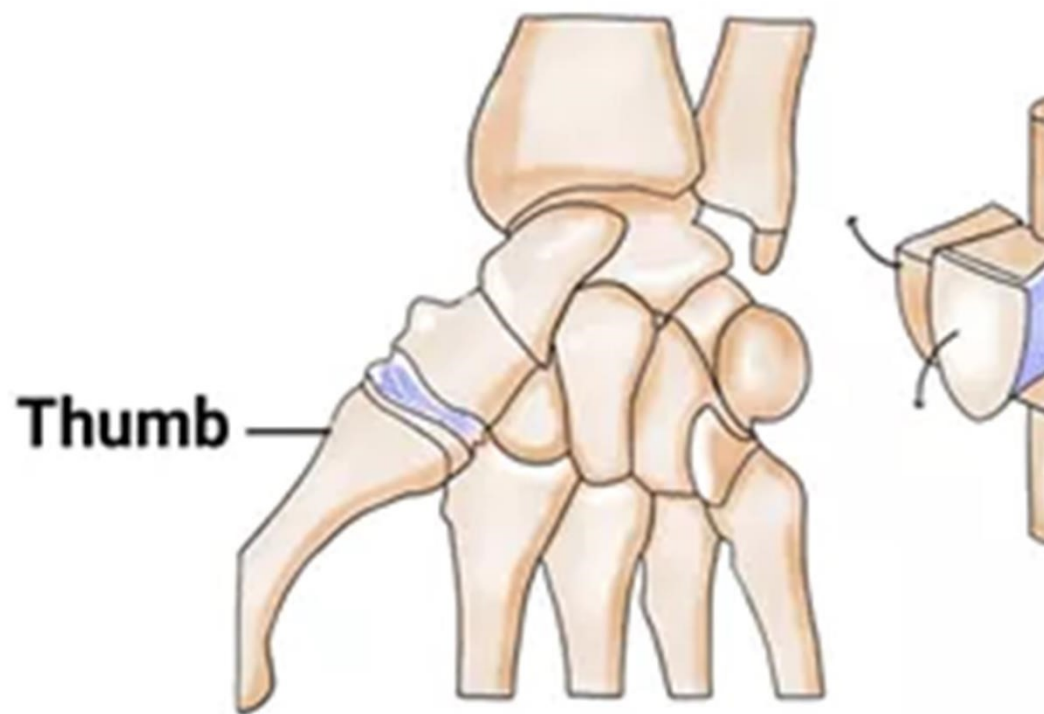
Radiocarpal joint
(Condyloid)





Saddle Joint
CMC Joint of Thumb

Saddle joint



Thumb

TRI-AXIAL DIARTHROSES

These are the joints that are free to move in three planes around three axes

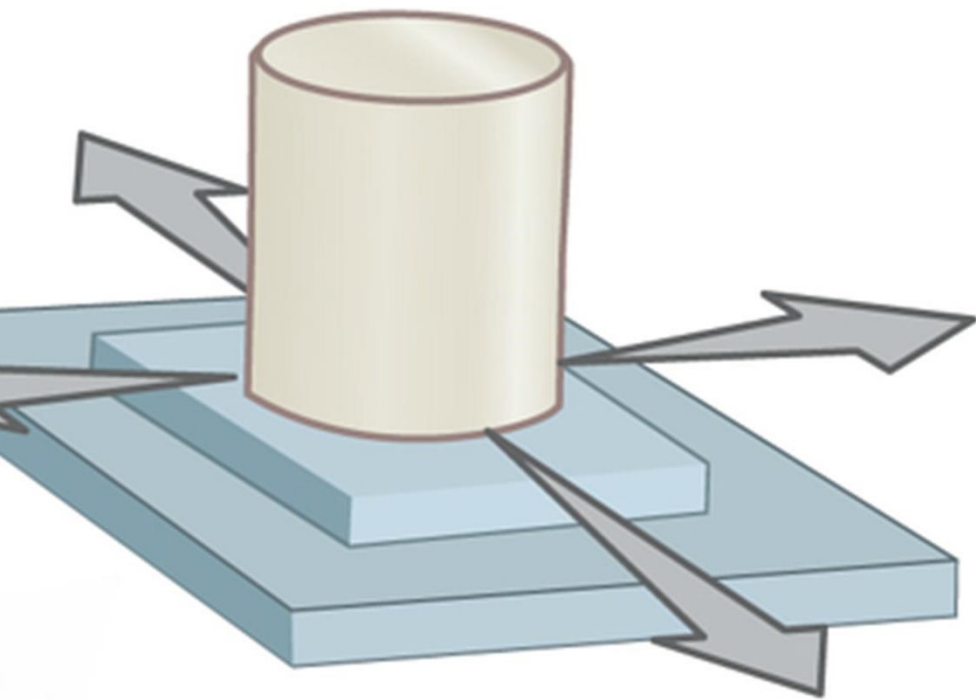
These offer 3 degree of freedom

These are further classified into two types:

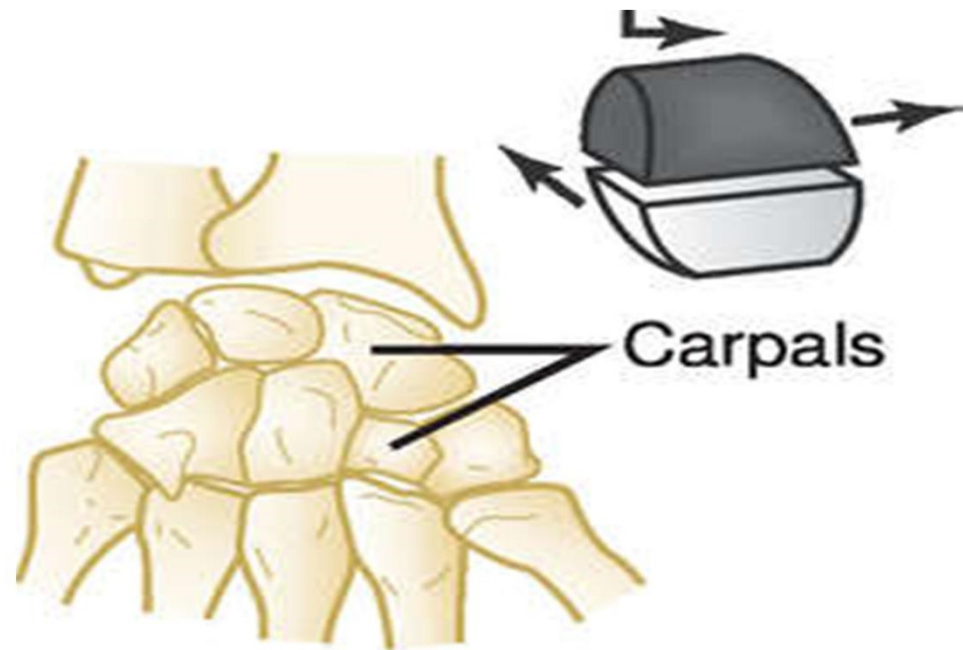
- Plane joints
- Ball and Socket joints

PLANE JOINTS

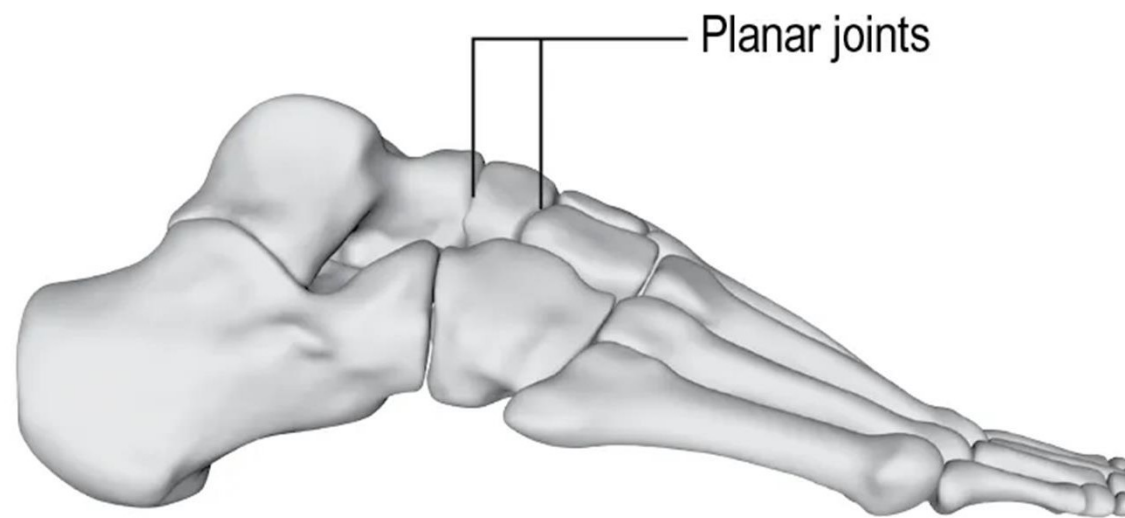
- Plane joints have a variety of surfaces configuration and permit gliding between two or more bones
- These joints are found between adjacent surfaces of carpal bones
- It may glide on one another or rotate with respect to one another in any plane



Plane Joint
Intercarpal Joints



Plane joint



BALL AND SOCKET JOINT

These joints are formed by a ball like convex surface being fitted into a concave socket.

Movement permitted are flexion/ extension, abduction/ adduction, rotations

Example: Hip joint- joint formed by the head of femur and the socket called acetabulum

& Socket Joint
Hip Joint

