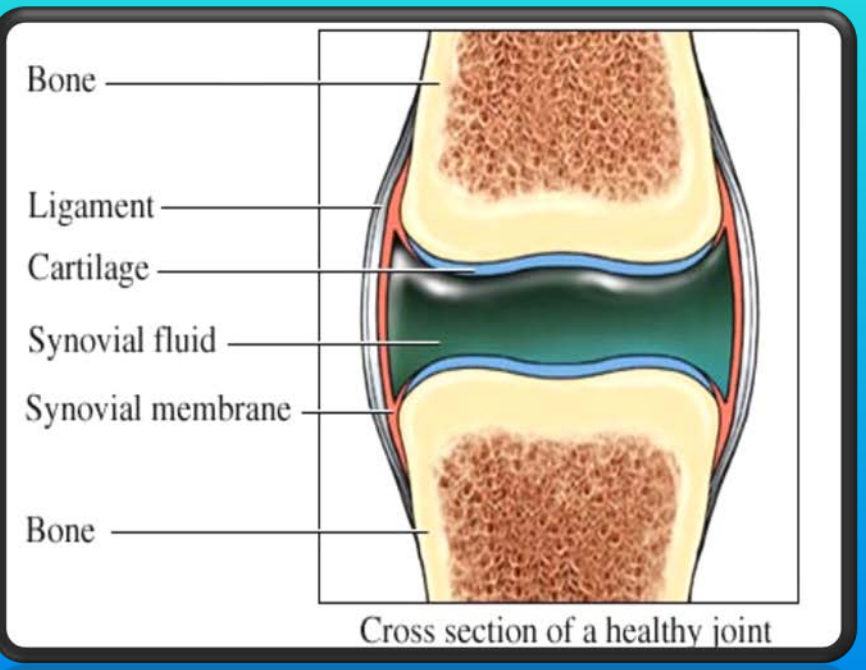
JOINT



Cross section of a healthy joint

DR.HETAL VAISHNANI
Professor & HOD
Department of Anatomy
S.B.K.S.M.I. & R.C.

Competency

- **AN 2.6 Synovial joint, blood supply & nerve supply**

Specific learning objectives

- Classification of the synovial joint
- Characteristics of the synovial joint
- Blood supply
- Nerve supply
- Clinical notes

Joints

- Definition
- Introduction
- Classification-
  - Synarthoses (Immovable)
  - Diarthroses (Movable)
- Blood supply
- Nerve supply
- Lymphatic drainage
- Clinical notes

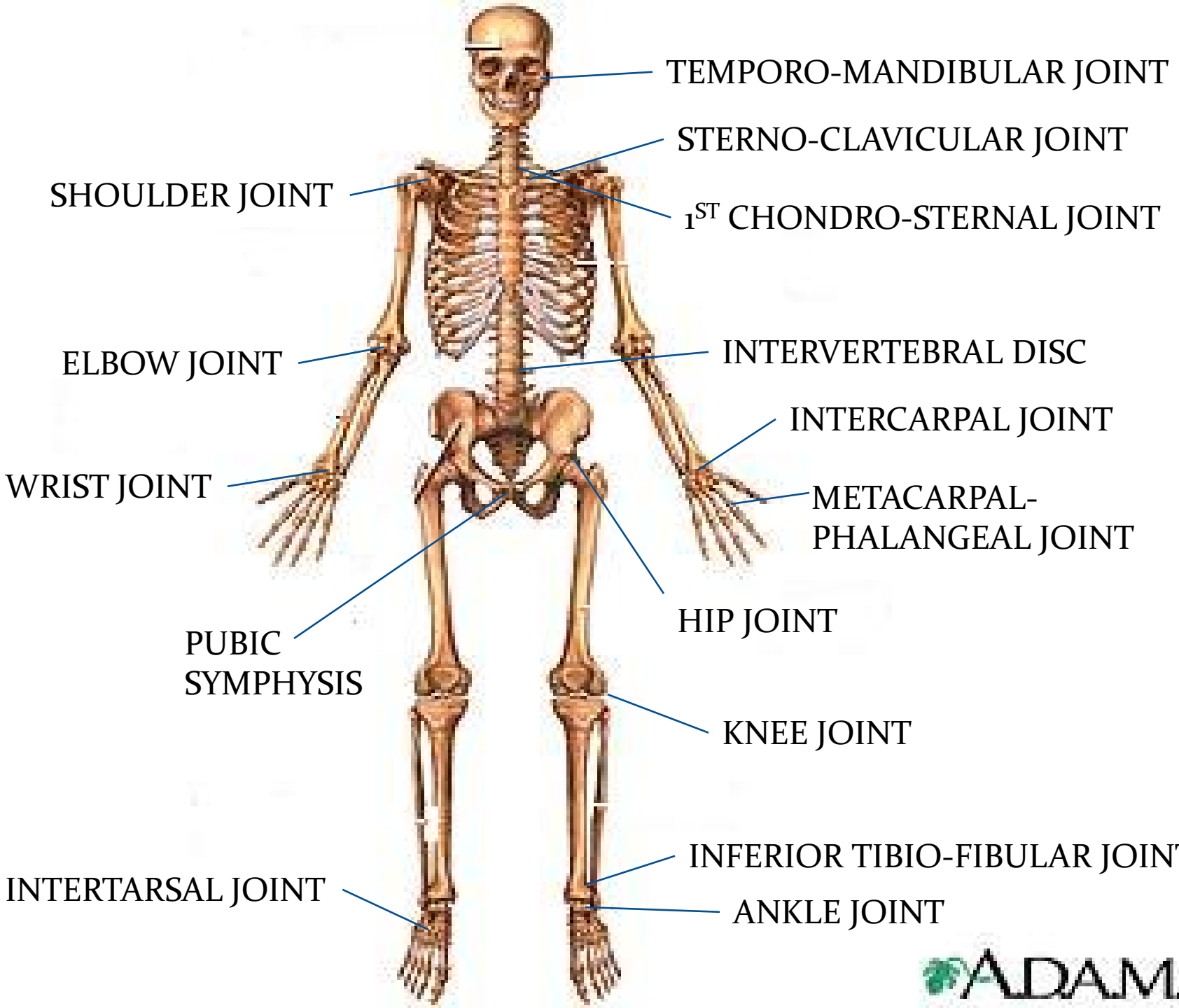
Definition

- **It is a junction between two or more bones or cartilages**

- **Related term:** Arthron
  Articulatio
  Junctura
  Syndesmology

Introduction

- Joints are the weakest part of the skeleton
- Joints are responsible for- movements
  - weight bearing
  - growth of bones
- There are more joints in a child than in adult . E.g.-hip bone
- **Note:** Long bones articulate by their ends
  Flat bones by their margins
  Short and irregular bones by surfaces


TEMPORO-MANDIBULAR JOINT
STERNO-CLAVICULAR JOINT
SHOULDER JOINT
1ST CHONDRO-STERNAL JOINT
ELBOW JOINT
INTERVERTEBRAL DISC
INTERCARPAL JOINT
WRIST JOINT
METACARPAL-
PHALANGEAL JOINT
HIP JOINT
PUBIC
SYMPHYSIS
KNEE JOINT
INFERIOR TIBIO-FIBULAR JOINT
INTERTARSAL JOINT
ANKLE JOINT
ADAM

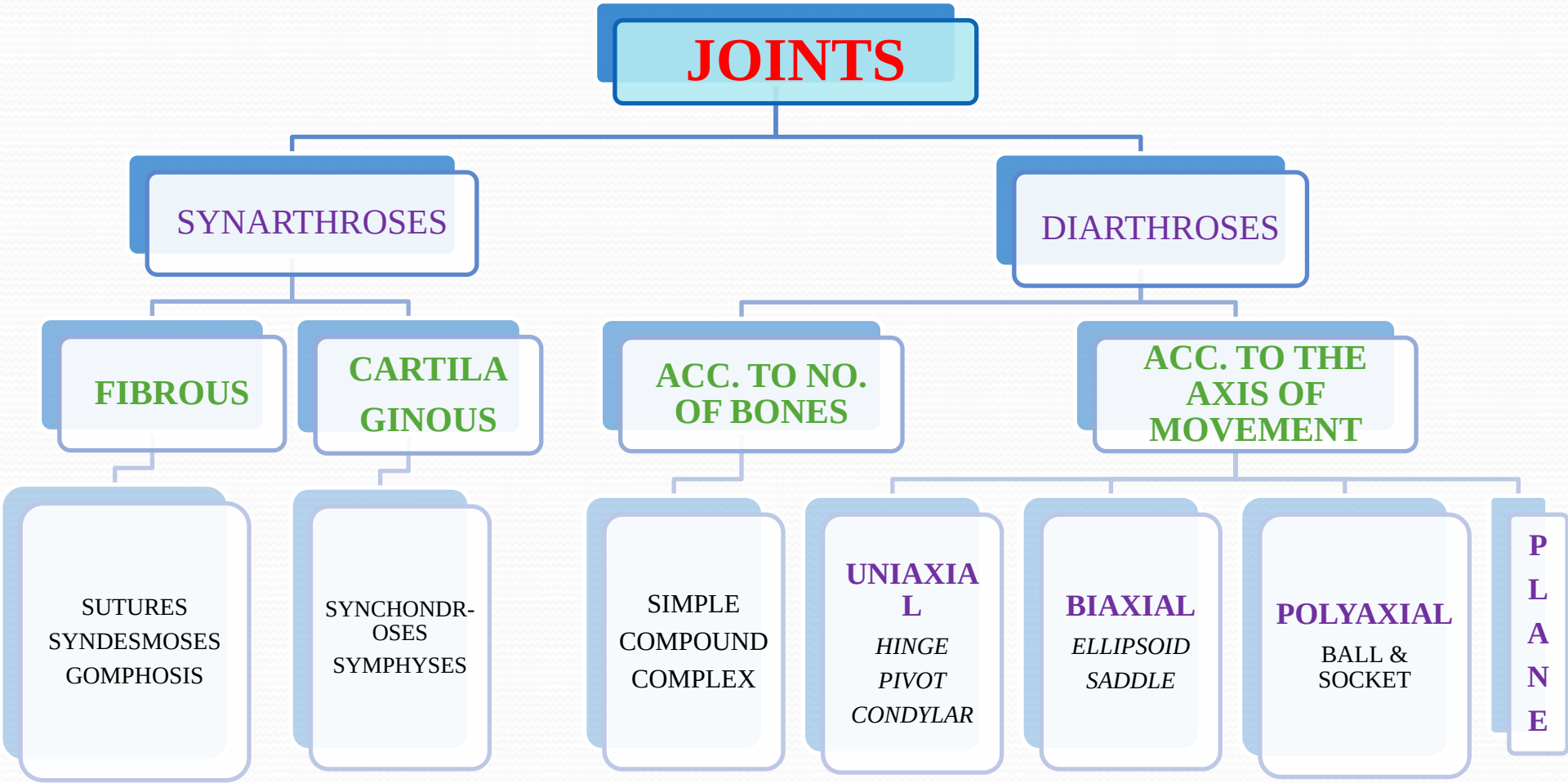
Classification

Functional: according to degree of mobility

- 1). Synarthroses: Immovable joints,like fibrous joints
- 2). Amphiarthroses: Slightly movable joint, like cartilaginous joint
- 3). Diarthroses: Fully movable joints, like synovial joint

Classification

Structural- based on material binding the bone.



Synarthroses (Immovable joints)

A. Fibrous joints

- In these joints bones are united by fibrous tissue.

- **3 Types:**

  a. Suture-

  1.serrate suture

  2.denticulate suture

  3.squamous suture

  4.plane suture

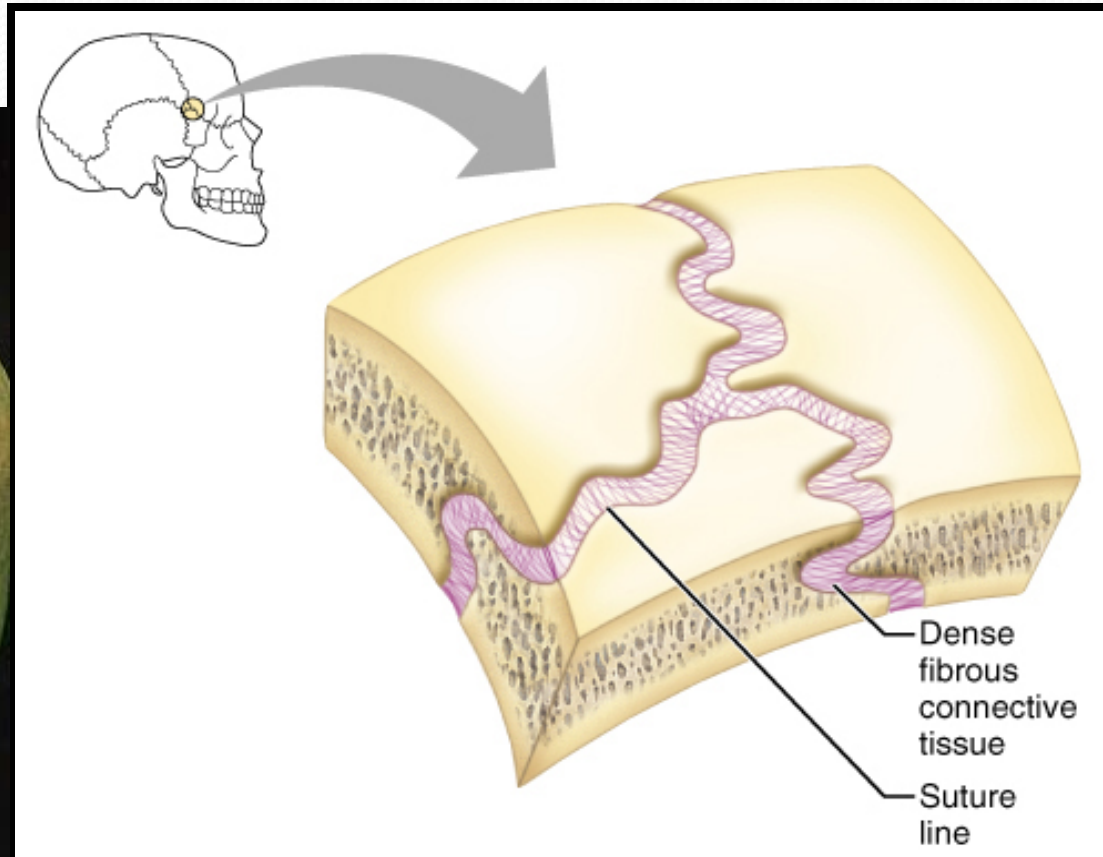
  5.wedge in groove suture

  b. Syndesmoses

  c. Gomphosis

1.Serrate suture-

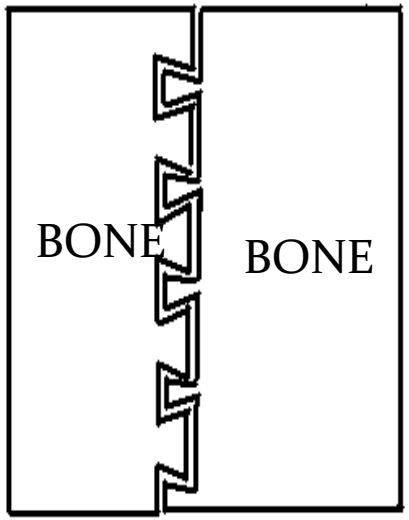
The edge of bones present saw tooth appearance. **Exp.**- sagittal suture of the skull



(a) Suture

2.Denticulate suture-

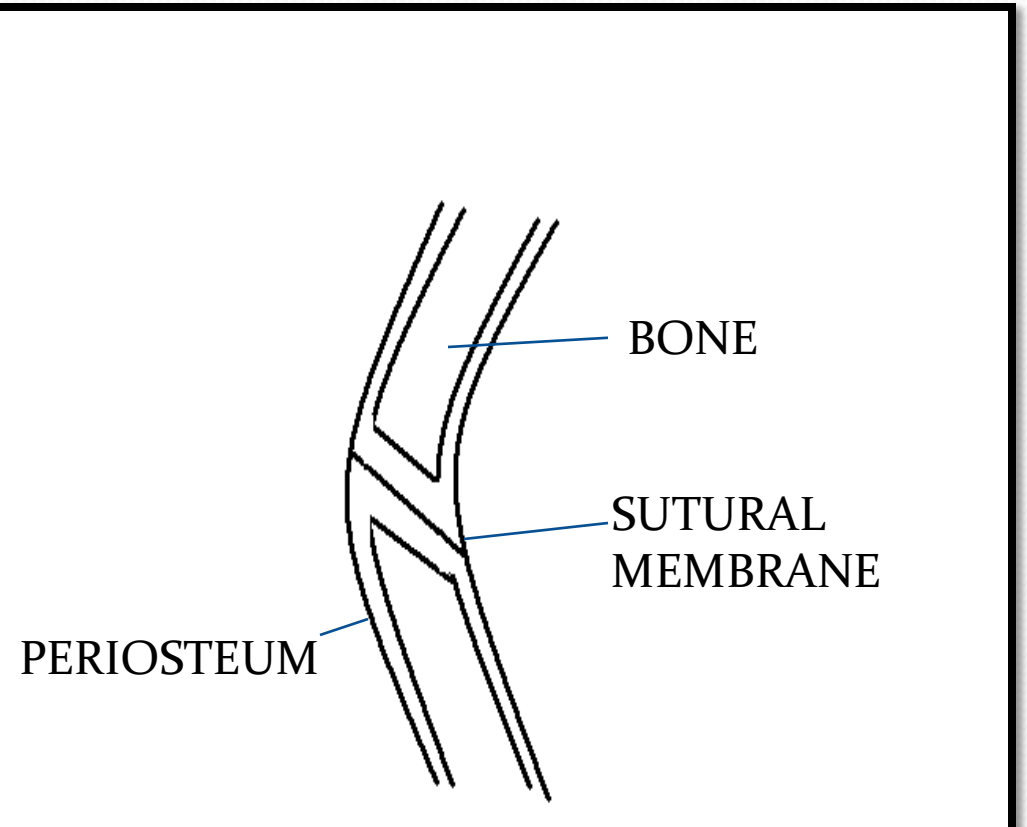
The margins present teeth the tips being broader than the roots. **Exp**.- lamdoid suture

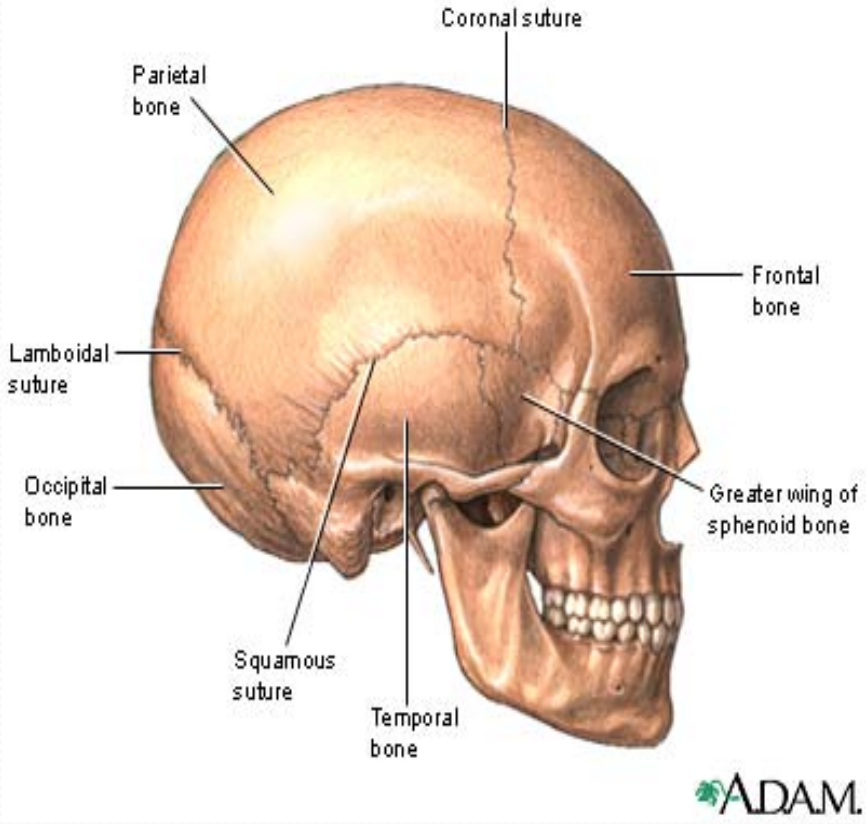


3. Squamous suture-

Here the edges of bone are united by overlapping.

Exp.-between parietal bone and squamous part of temporal bone.

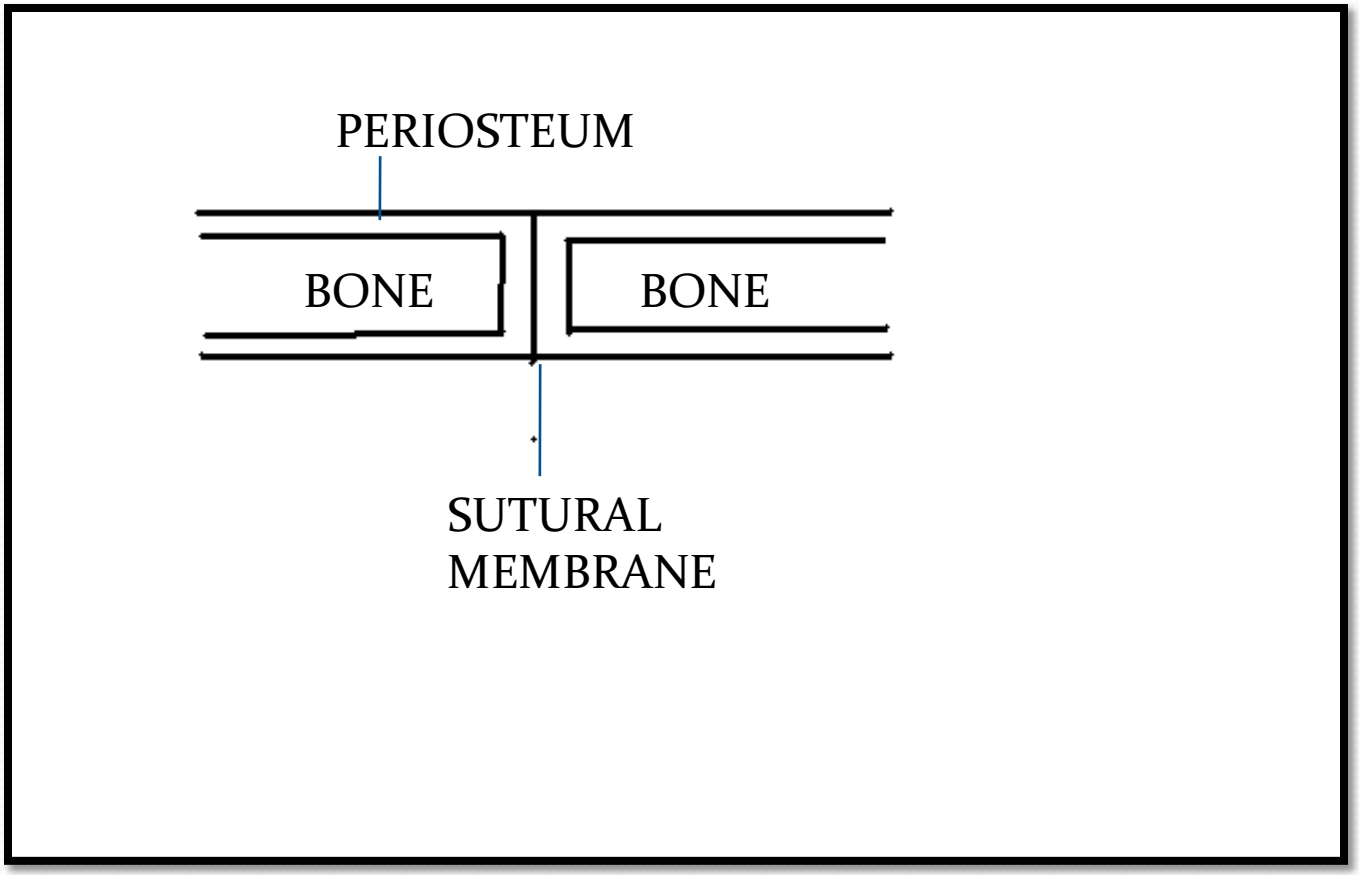




4. Plane suture-

The borders are plane and united by sutural ligament.

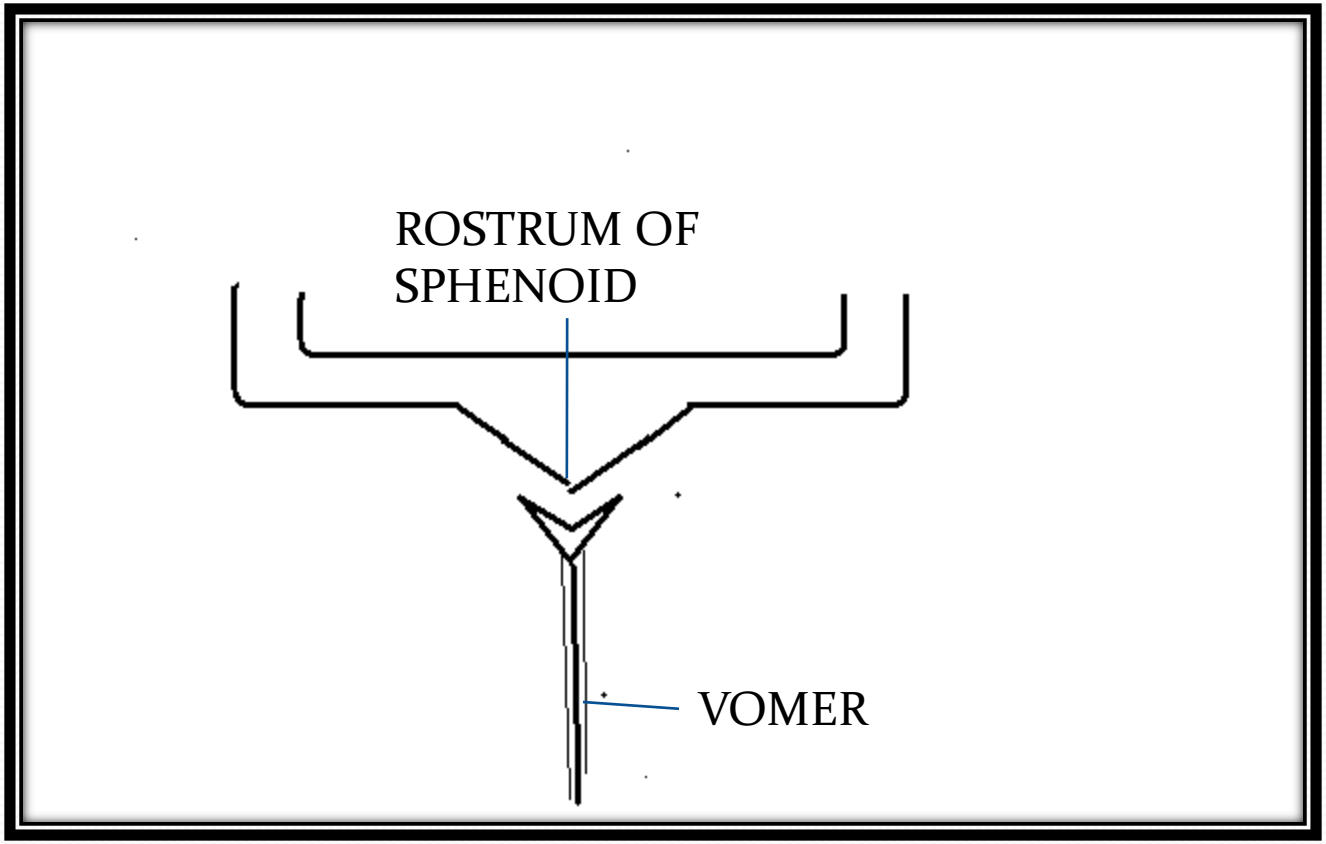
Exp.- articulation between palatine process of two maxillae.



5. Wedge and groove suture-

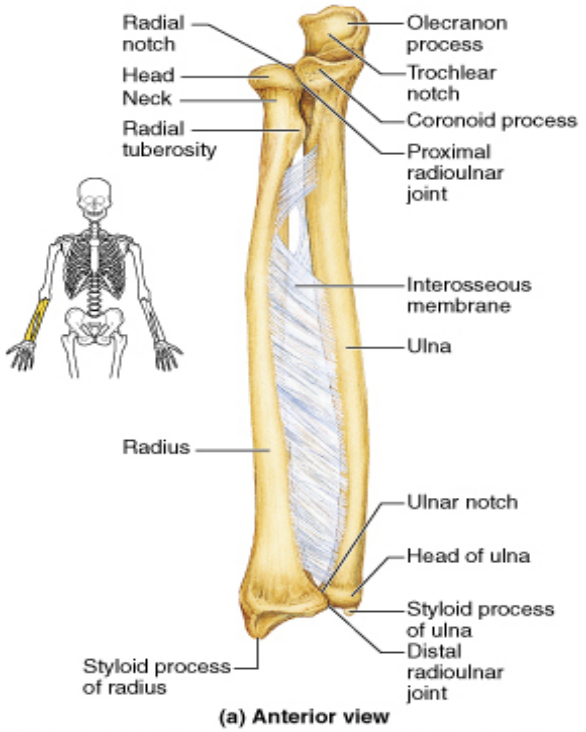
The edge of one bone fits in the groove of the other bone.

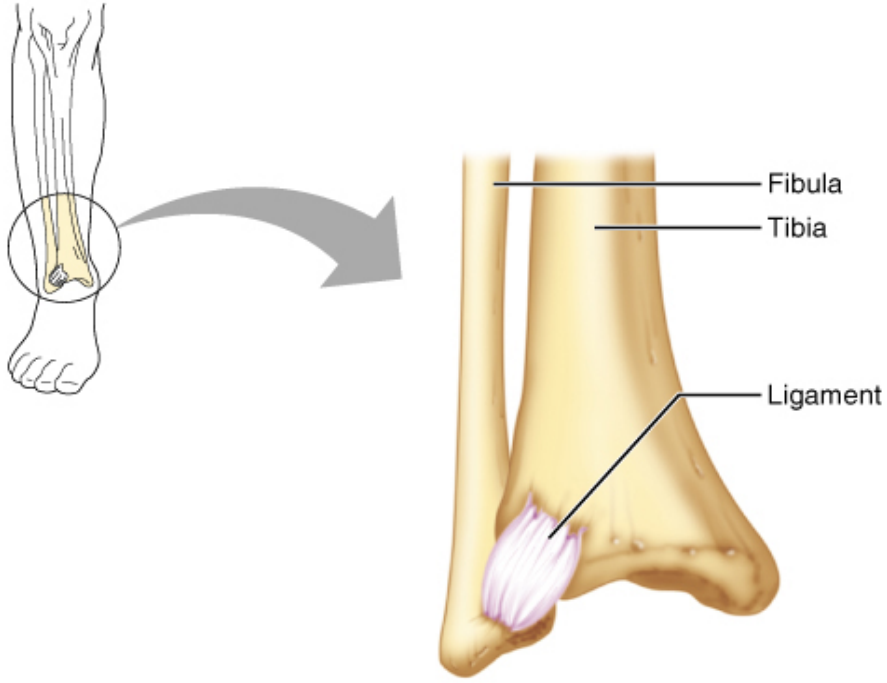
Exp.-between the rostrum of sphenoid and the upper margin of vomer.



b. Syndemoses

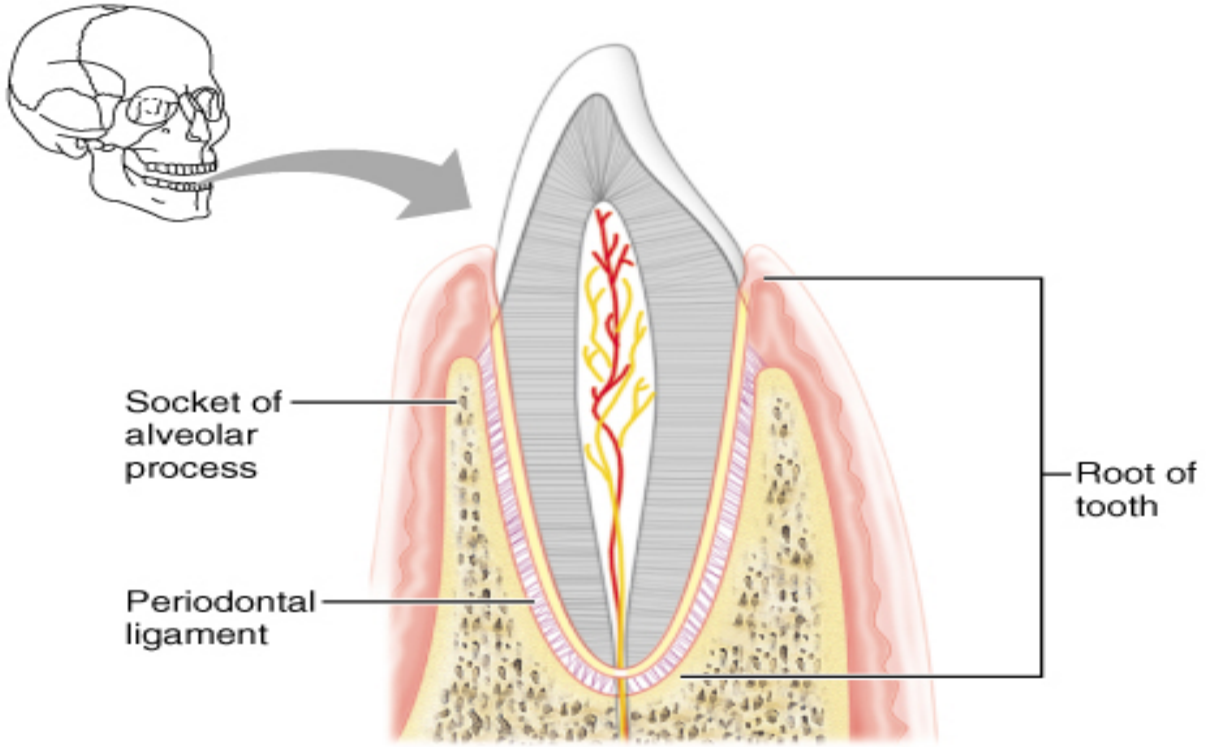
- Bones are connected by ligaments, slight amount of movement is possible
- Such ligament persist throughout life
- E.g. tibiofibular ligament, interosseous membrane of radius/ulna, ligamenta flava





c. Gomphosis

- Peg in socket joint
- The root of teeth fit in the socket of the jaw & are united by fibrous tissue
- Only found in teeth/alveoli

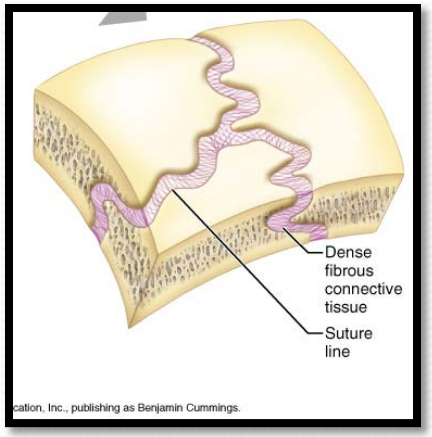


(c) Gomphosis

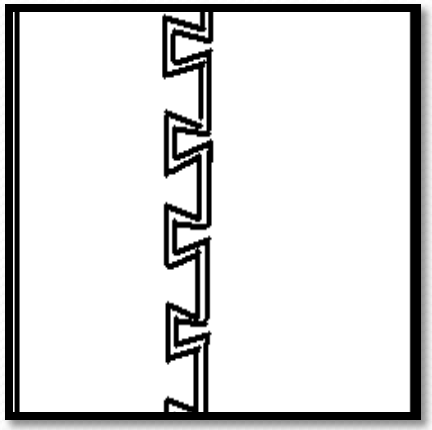
Fibrous joints

a. suture

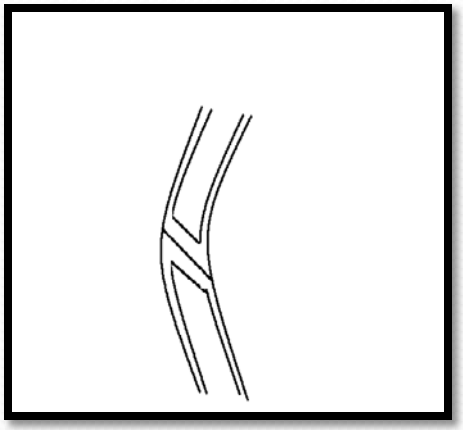
serrate



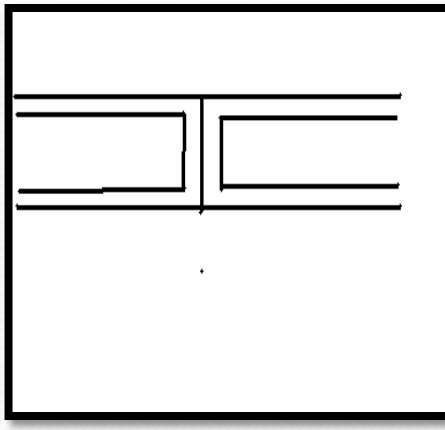
denticulate



squamous

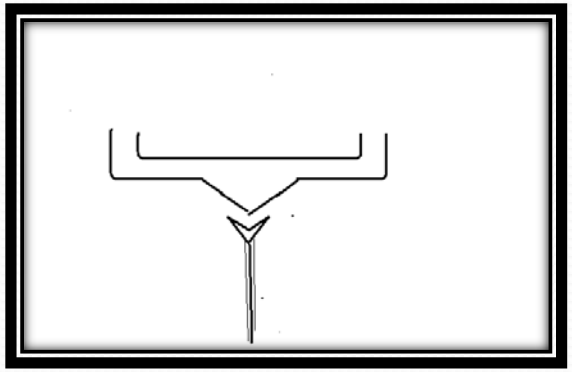


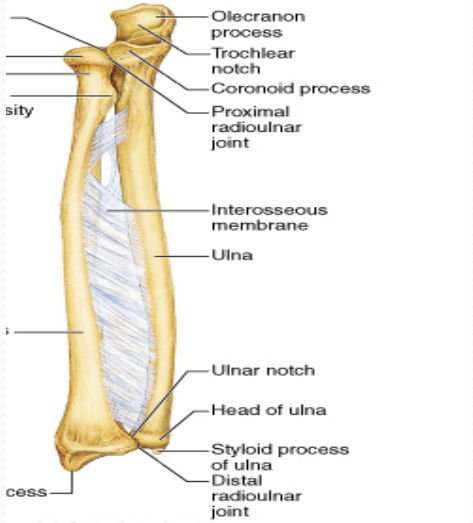
plane



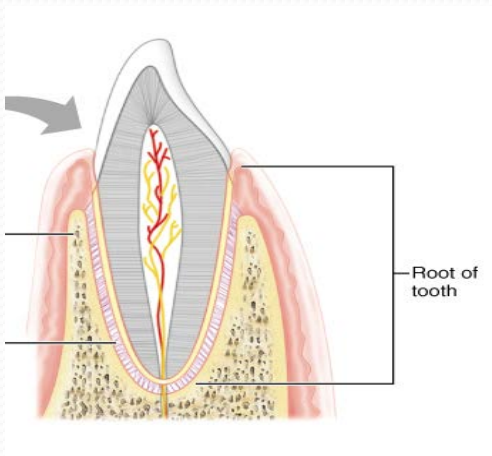
b.syndesmoses

Wedge in groove



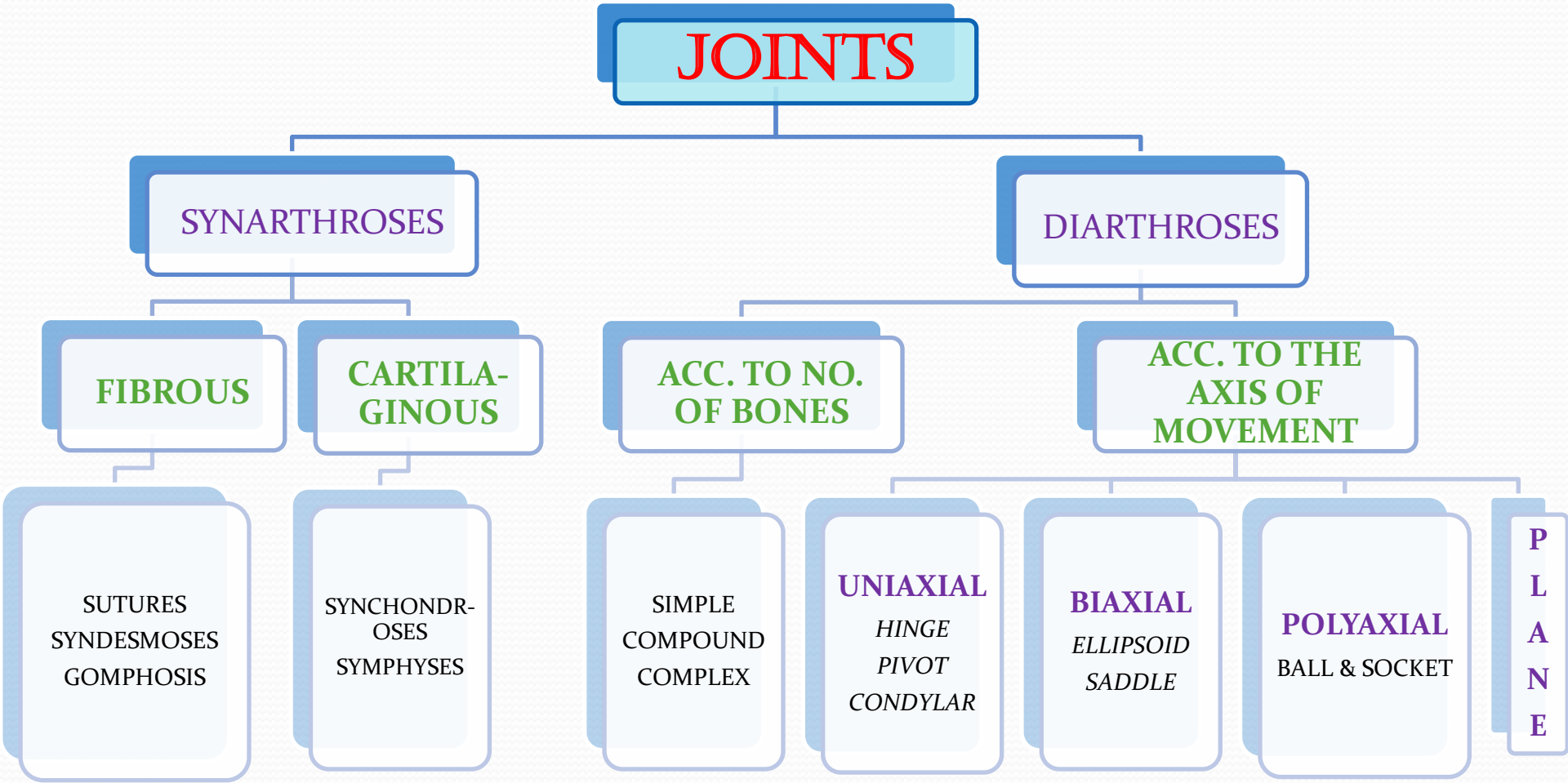


c. gomphosis



Classification

Structural- based on material binding the bone.

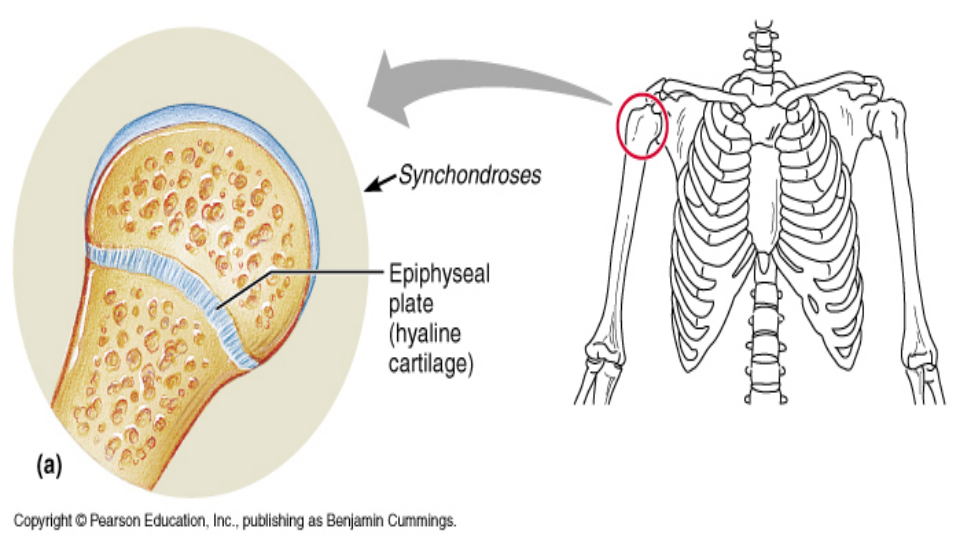


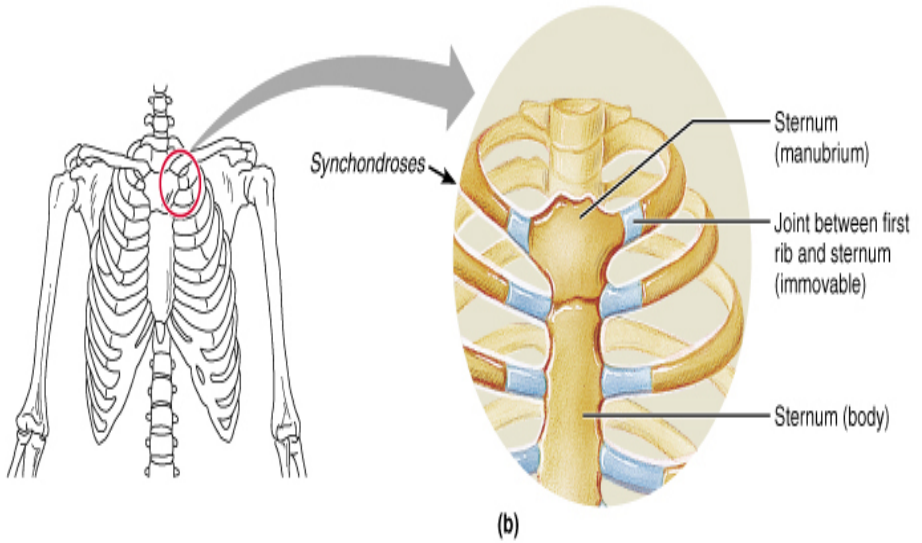
Cartilaginous Joints

a.Synchondroses (primary cartilaginous joint)

- Bones are united by a plate of hyaline cartilage
- Temporary in nature & replaced by bone
- No movement is possible

Exp.:Epiphyseal growth plates, 1st chondro-sternal joint, Basi-occiput & Basi-sphenoid

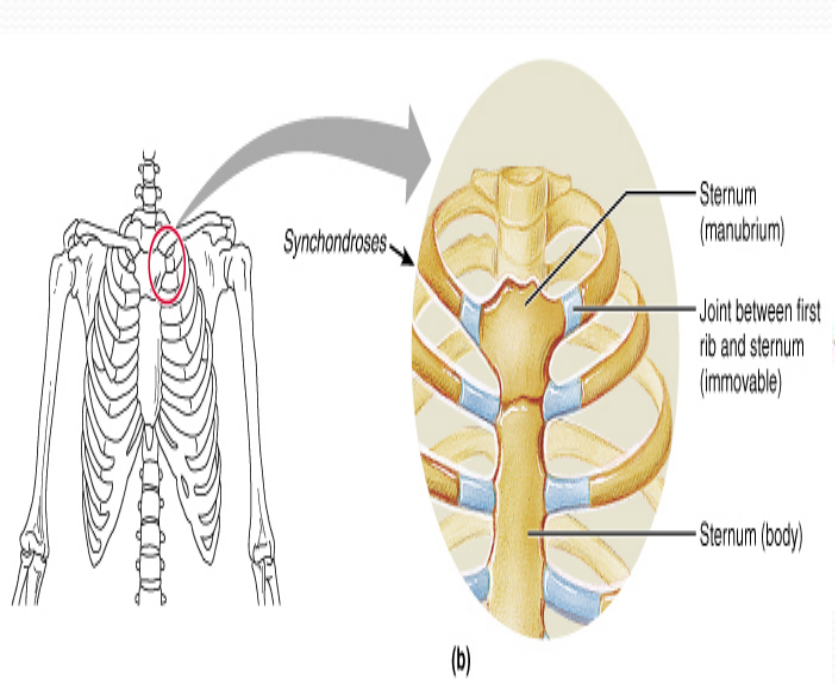


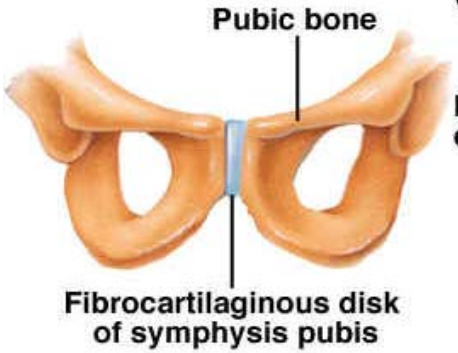


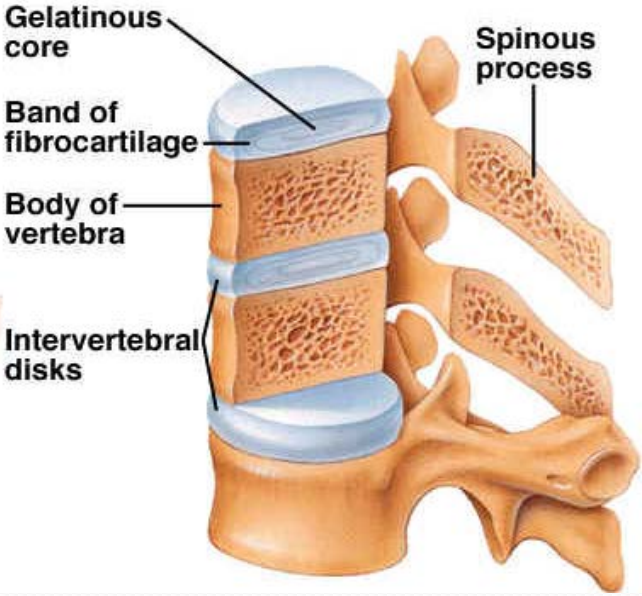
b.Symphyses (secondary cartilaginous joint)

- Bones are covered with hyaline cartilage & united by a plate of fibro-cartilage
- Persist throughout life and occupy median plane of the body

Exp.-Pubic symphysis, Intervertebral disc, Sterno-manubrial joint

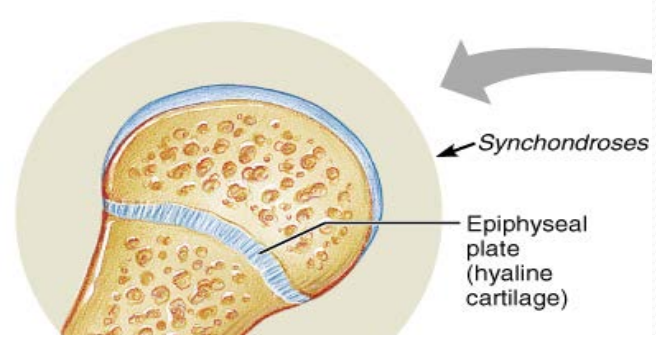


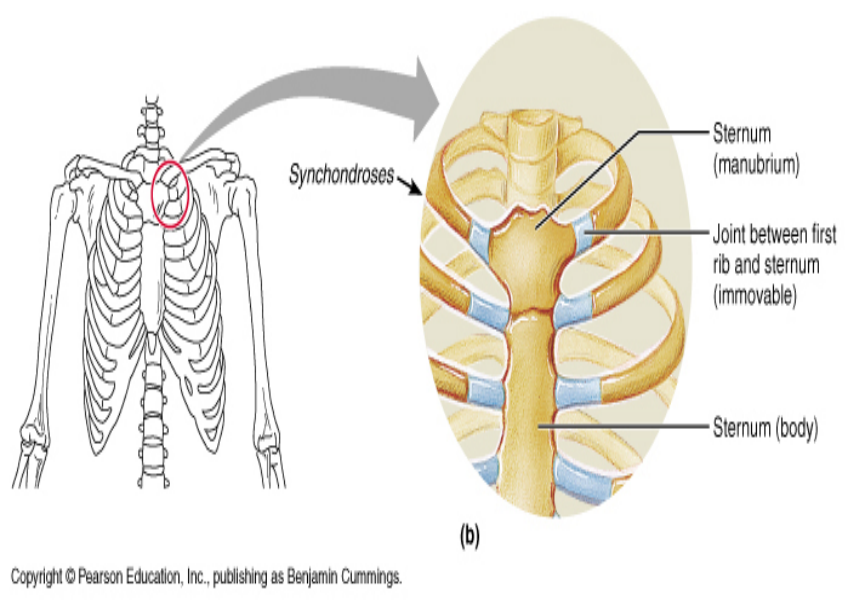




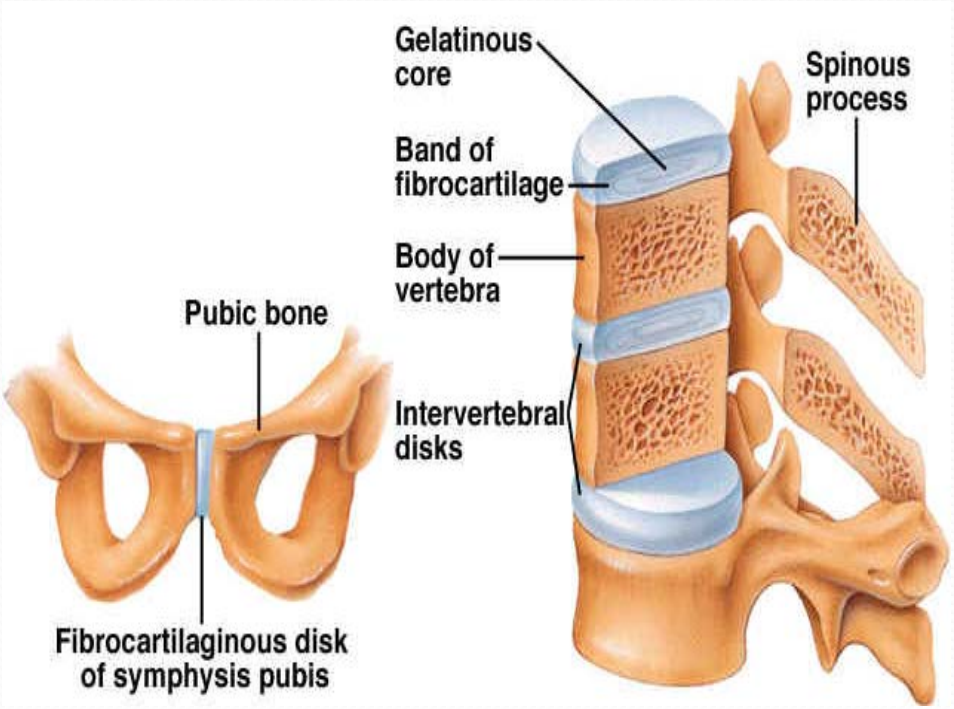
Cartilaginous joints

Synchondroses(Primary cartilaginous joint)





Symphyses(Secondary cartilaginous joint)



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Diarthroses(Synovial Joints)

- Most common joints in body
- Most mobile joints

Characteristics of synovial joint:-

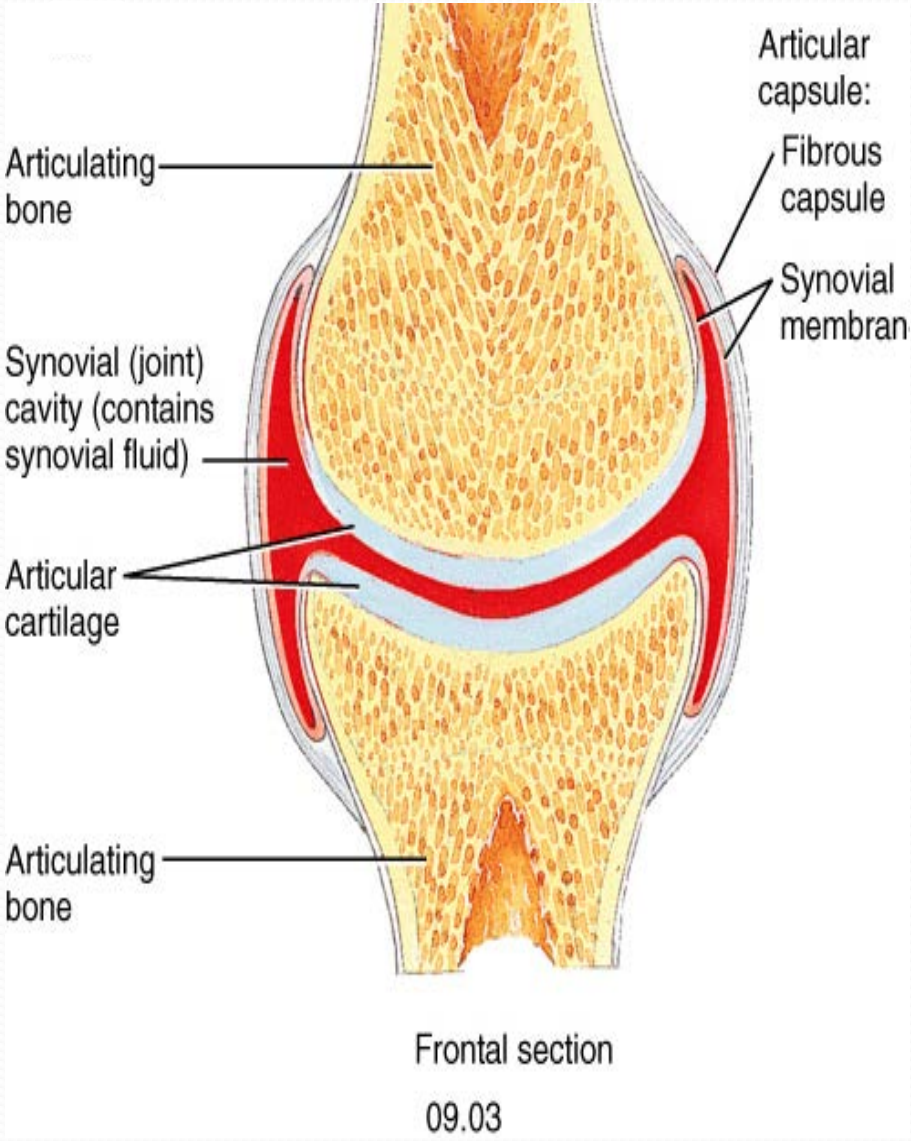
1. Articular surface of the bones are covered with **articular cartilage.**
2. Joint present a cavity which is filled with **synovial fluid.**
3. Joint cavity is covered by complete articular capsule
   Outer- fibrous capsule

   Inner- synovial membrane

4. The articular bones are connected by a number of **ligament** which are additional to the fibrous capsule.
5. The joint cavity is divided completely or incompletely by **articular disc or menisci.**

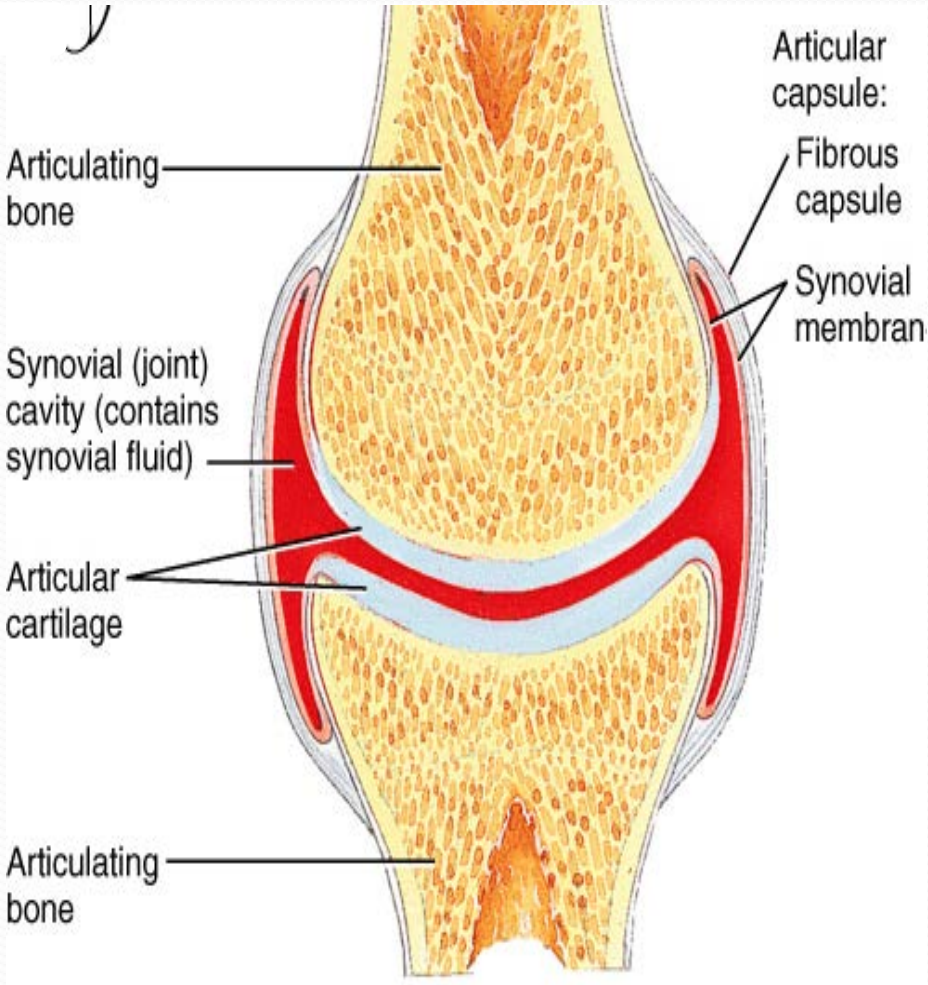
Articular cartilage

- Hyaline in structure except which ossified in membrane
- avascular, non-nervous and elastic
- It has no covering of perichondrium so cartilage once damaged, can not replaced by hyaline tissue, it's replaced by fibrous tissue.
- It's lubricated with synovial fluid, the cartilage provides slippery surfaces for free movements, like 'ice on ice'.



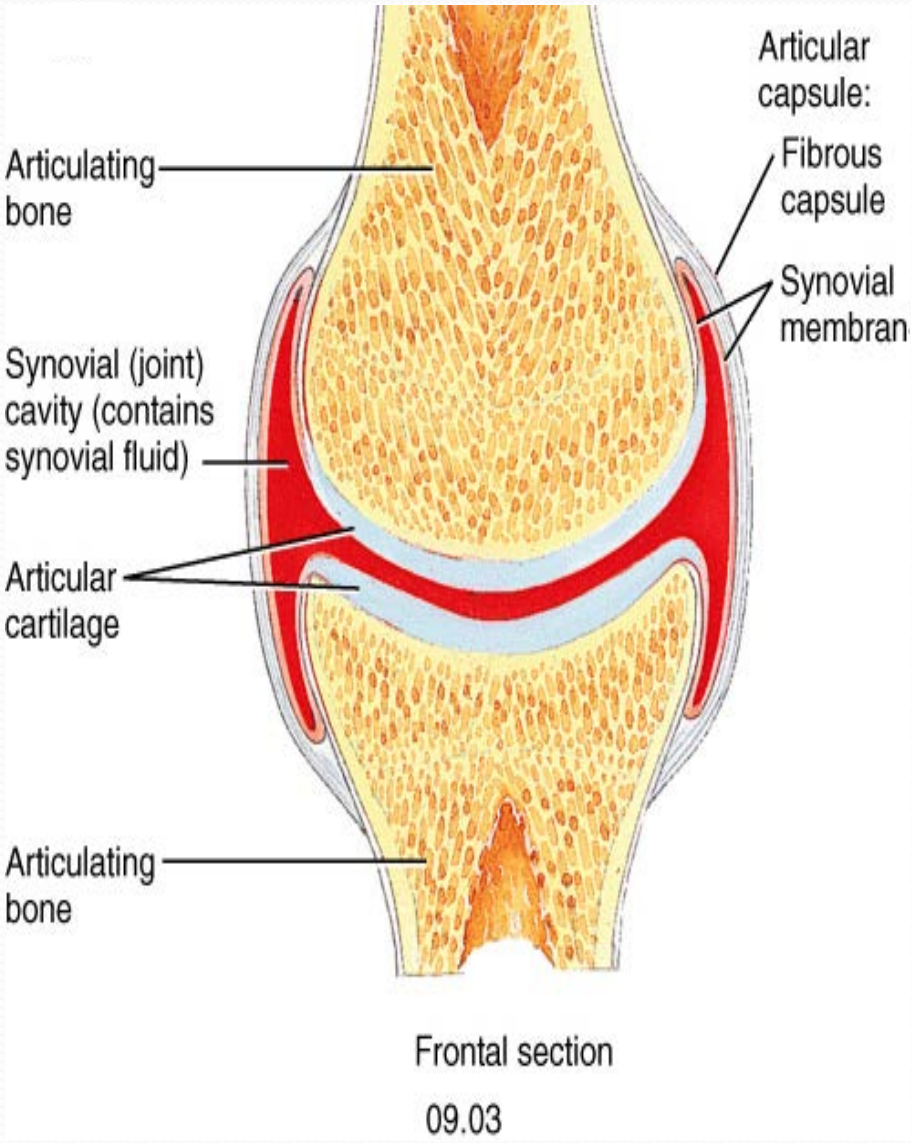
Articular capsule

- Outer -Fibrous capsule is sensitive to stretches imposed by movements.
- Pierced by blood vessel and nerves.
- Protect the joints from any sprain, this is called the “Watch –dog” action of capsule.
- Binds the articulating bones together.
- Supports the synovial membrane on the inner surface.



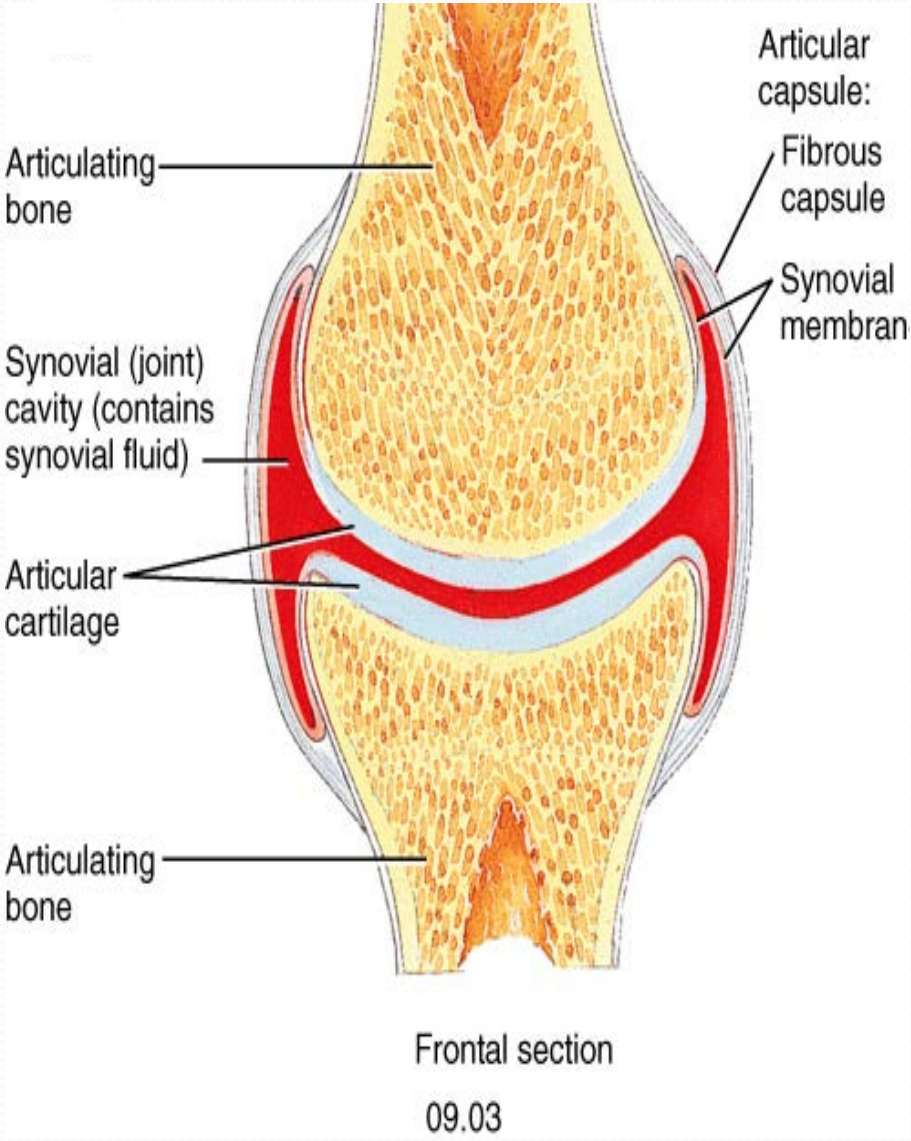
Articular capsule

- Inner – synovial membrane lines whole of the interior the joint except the articular surfaces covered by hyaline cartilage.
- Highly vascular and cellular
- The membrane secretes a synovial fluid.
- The viscosity of fluid is due to hyaluronic acid secreted by cells of the synovial membrane.



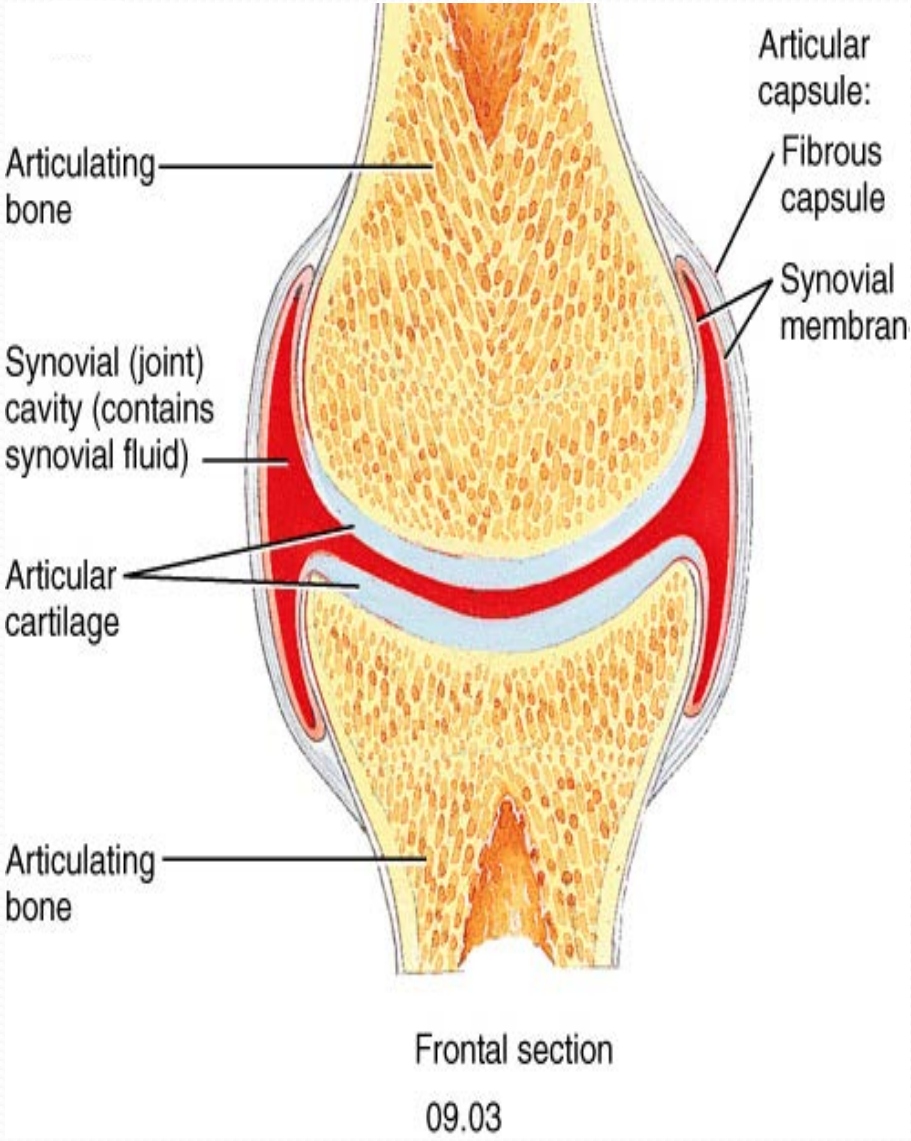
Synovial fluid

- It is a viscous fluid, which fills up the joint cavity.
- The synovial fluid is secreted by the synovial cells & by the mast cells of synovial membrane.
- Maintains nutrition of the articular cartilage
- Provides lubrication of the joint cavity to prevent wear and tear.



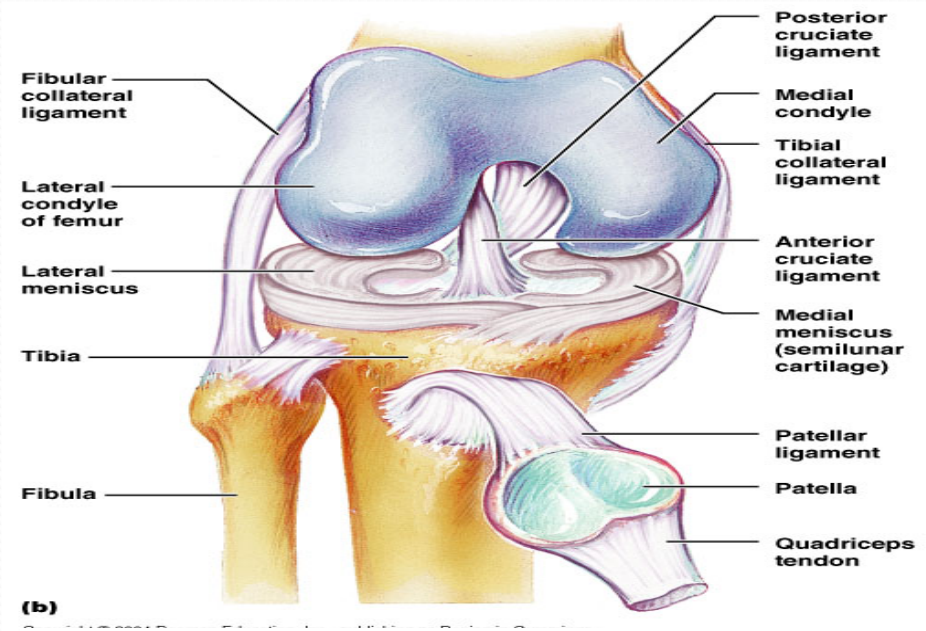
Ligament

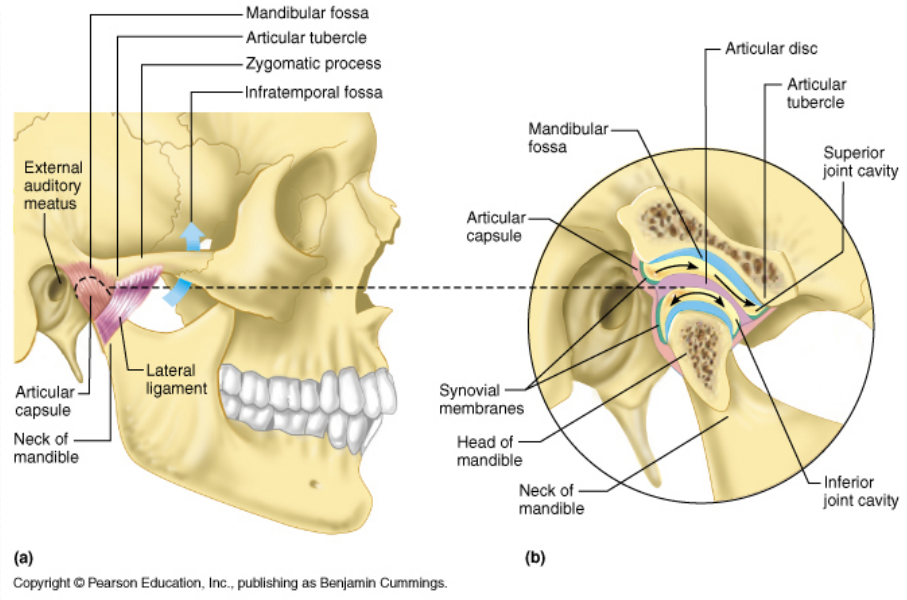
- Ligaments are fibrous band made up of collagen fibers which connect the adjacent bones
- Capsular or true ligaments representing thickening of the fibrous capsule
- Accessory ligaments which may be intra or extracapsular.
- Maintain the stability of the joint



Articular disc or menisci

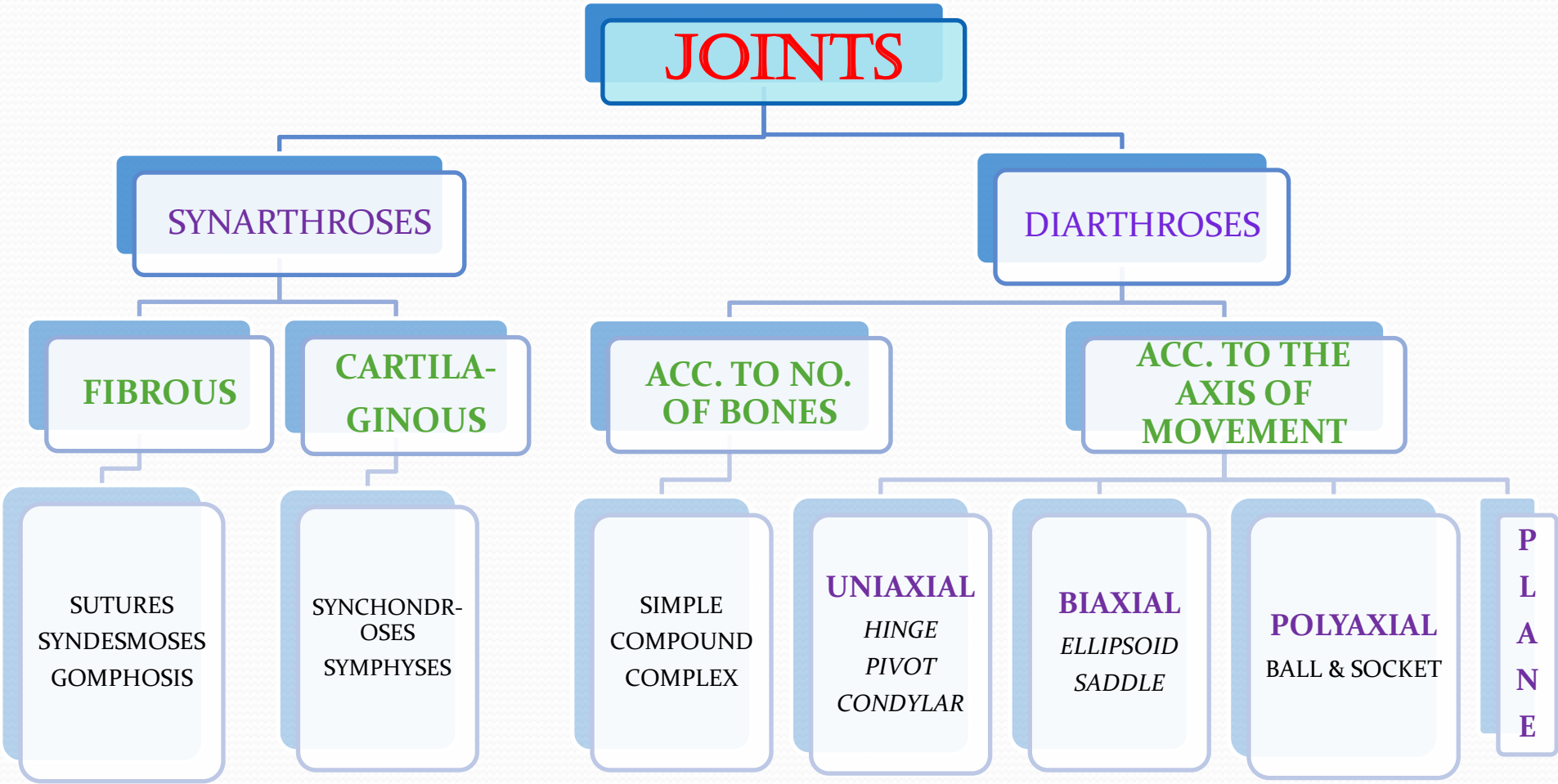
- Joint cavity is divided completely into two compartments, is attached at the periphery to the fibrous capsule
- Made up of fibro-cartilage
- Provides different movement into upper and lower compartments.
- Prevents wear & tear of the articular cartilage.





Classification

Structural- based on material binding the bone.



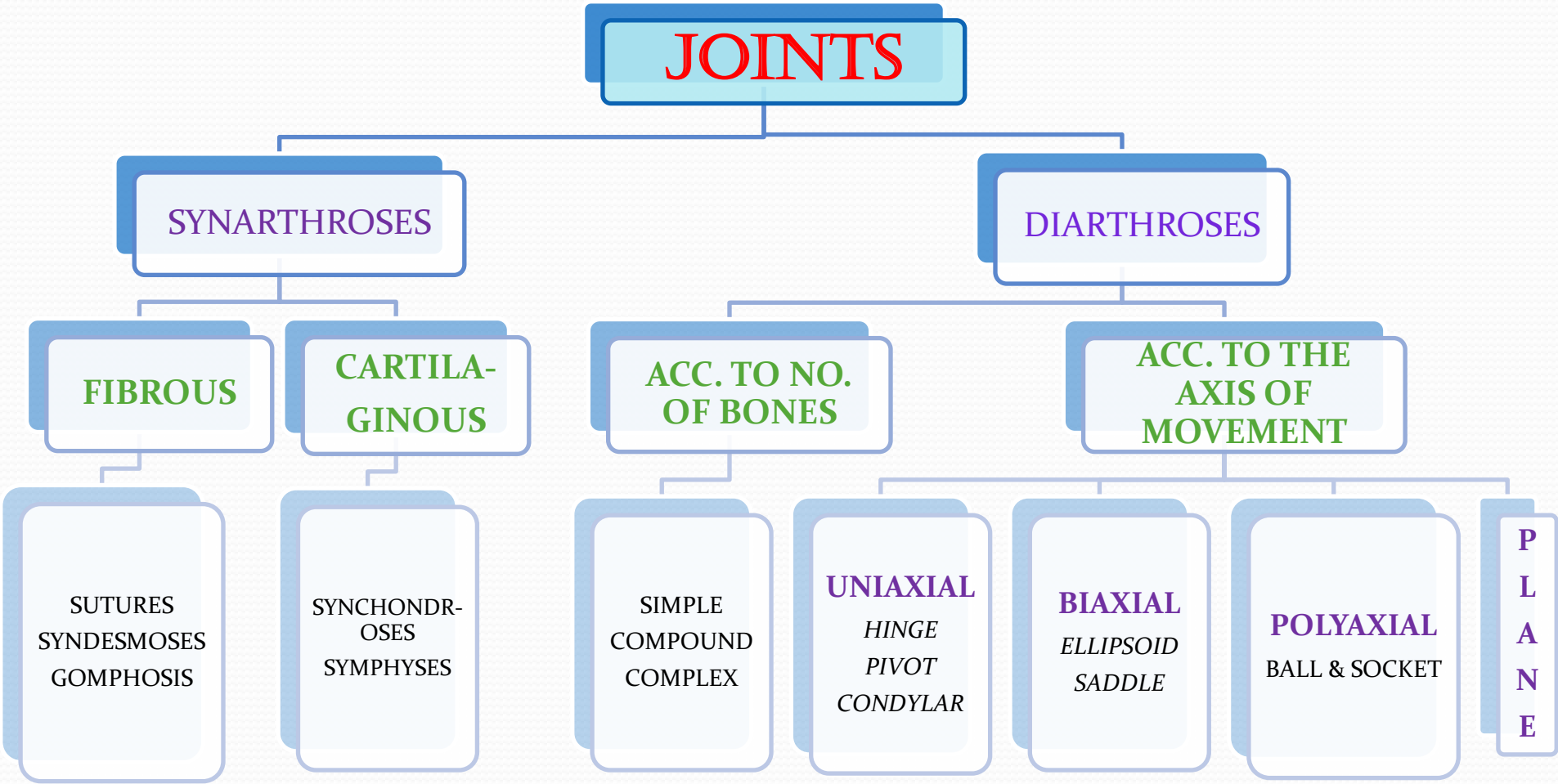
Classification of synovial joint

- **Accordoing to the number of bones**

1. **Simple joint-** when only two bones enter in the articulation. Exp.- inter-phalangeal joint of the fingers and toes.
2. **Compound joint-** more than two bones are involved in the joint. Exp.- ankle and radiocarpal joint.
3. **Complex joint-** joint is divided into two comparment by a articular disc or menisci. Exp.- knee joint, sterno-clavicular joint.

Classification

Structural- based on material binding the bone.



Classification of synovial joint

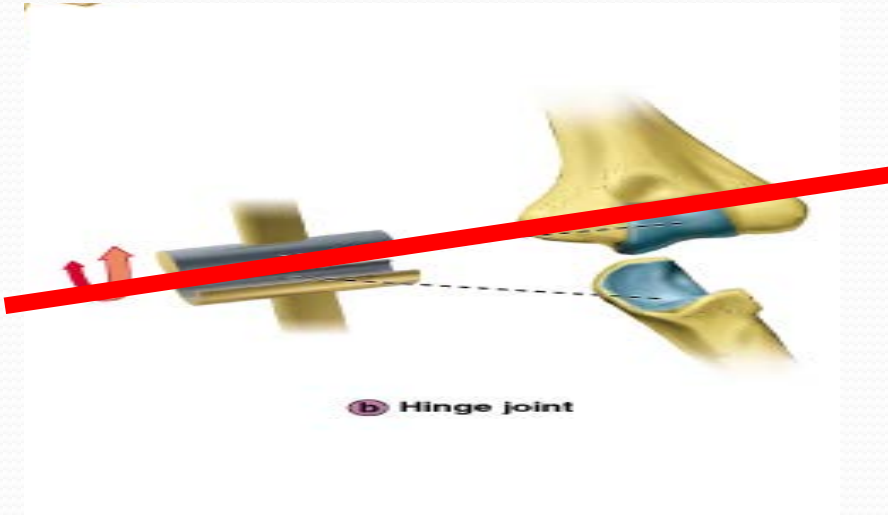
- **According to the axis of movement and the shape of articular surface**:

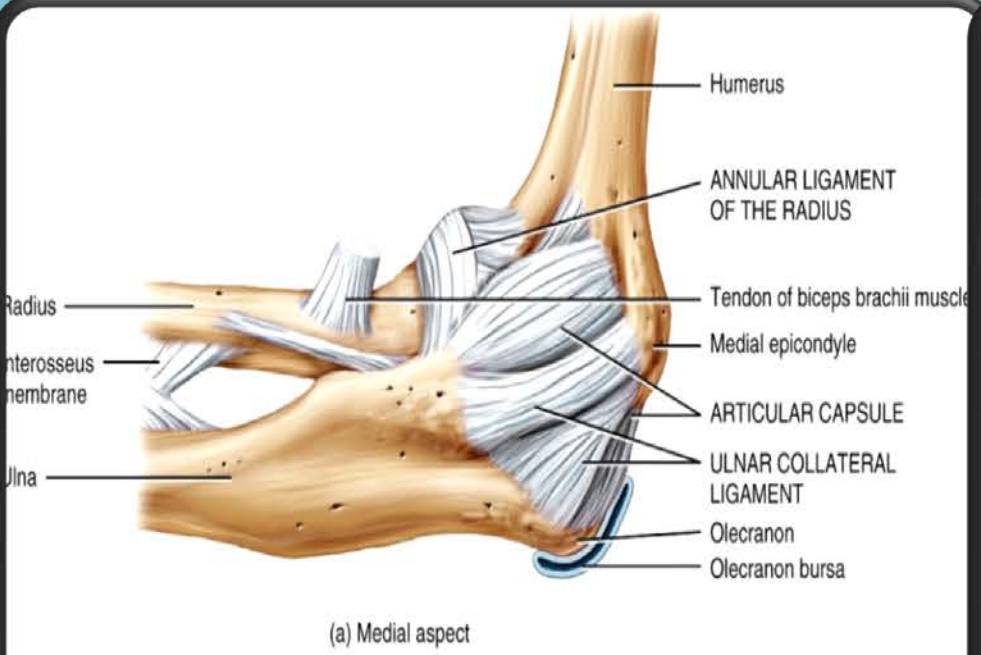
1. **Uniaxial joint**-has one degree freedom of movement

a) **Hinge or ginglymus joint-**

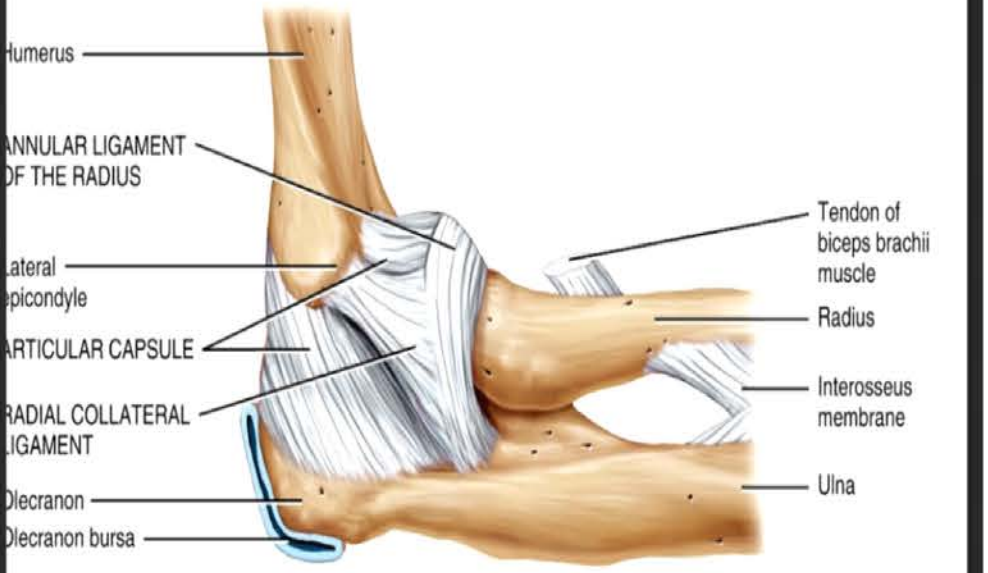
- it moves around a transverse axis
- One articular surface is convex and other is curved

Exp.- interphalangeal joint of finger & toes, ankle joint, elbow joint

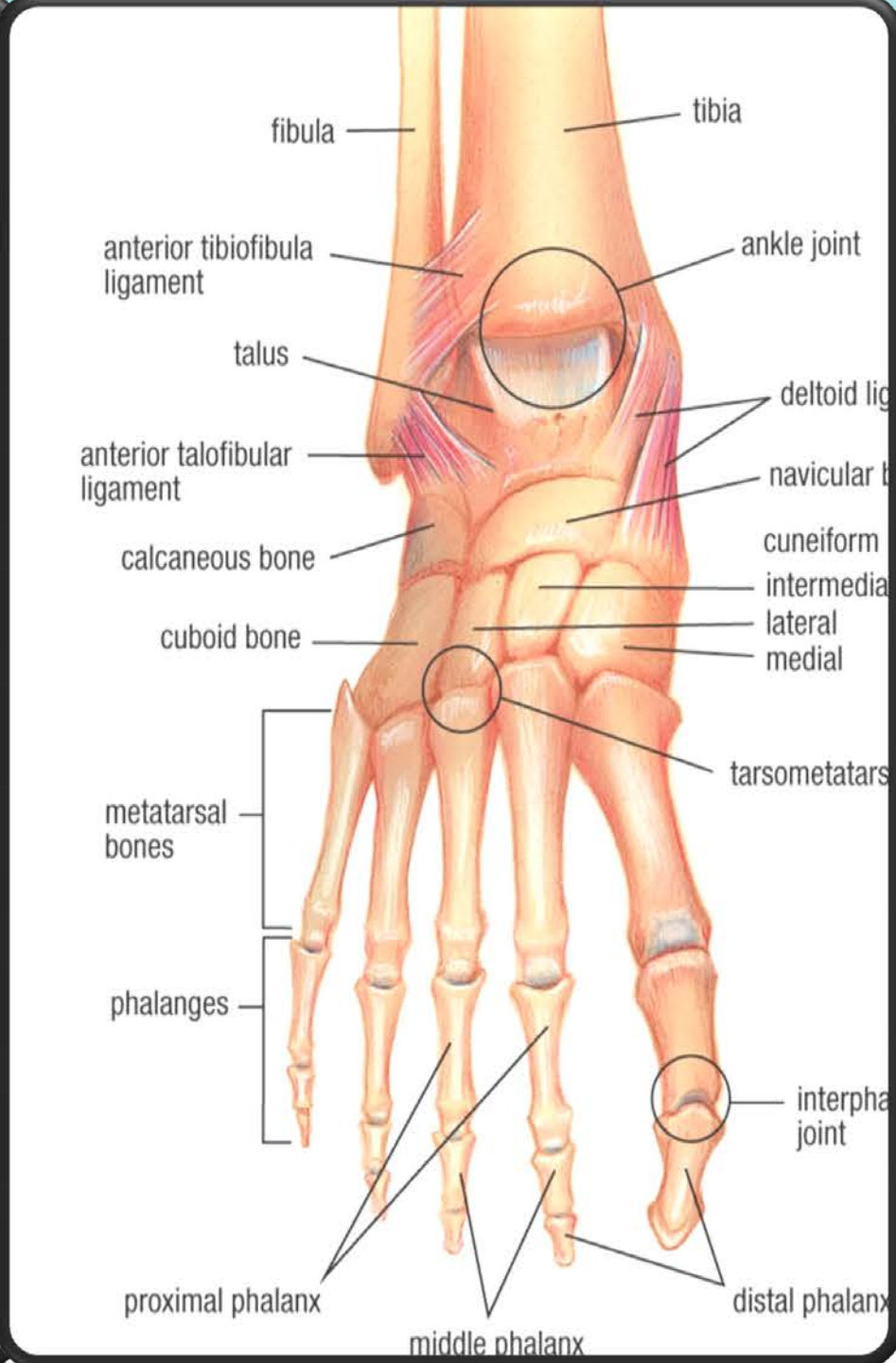




(a) Medial aspect

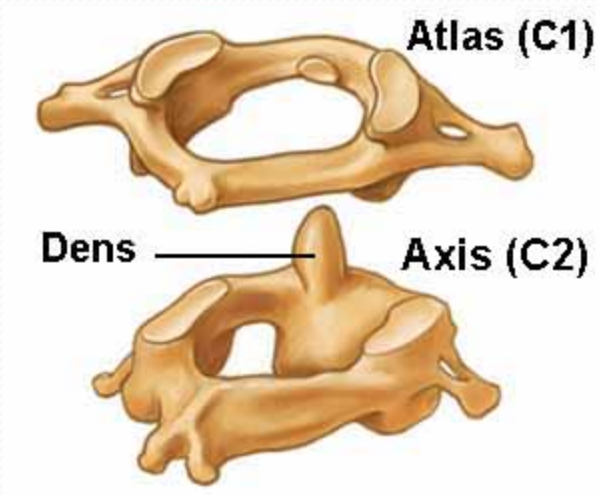


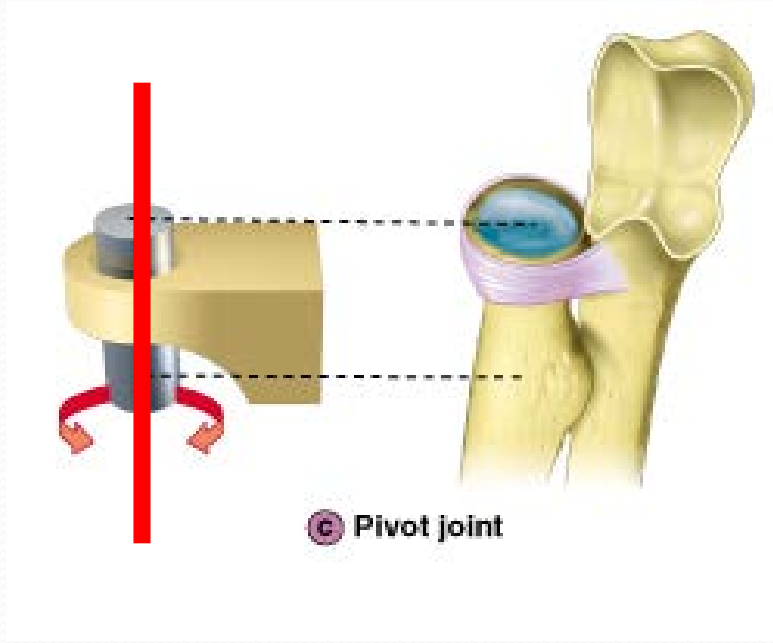
(b) Lateral aspect



b) **Pivot or trochoid joint-** movement takes place on a vertical axis.

Exp.- atlanto- axial joint, radio-ulnar joint

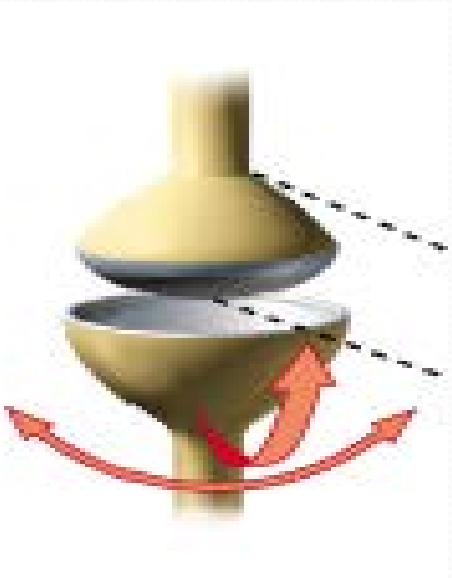


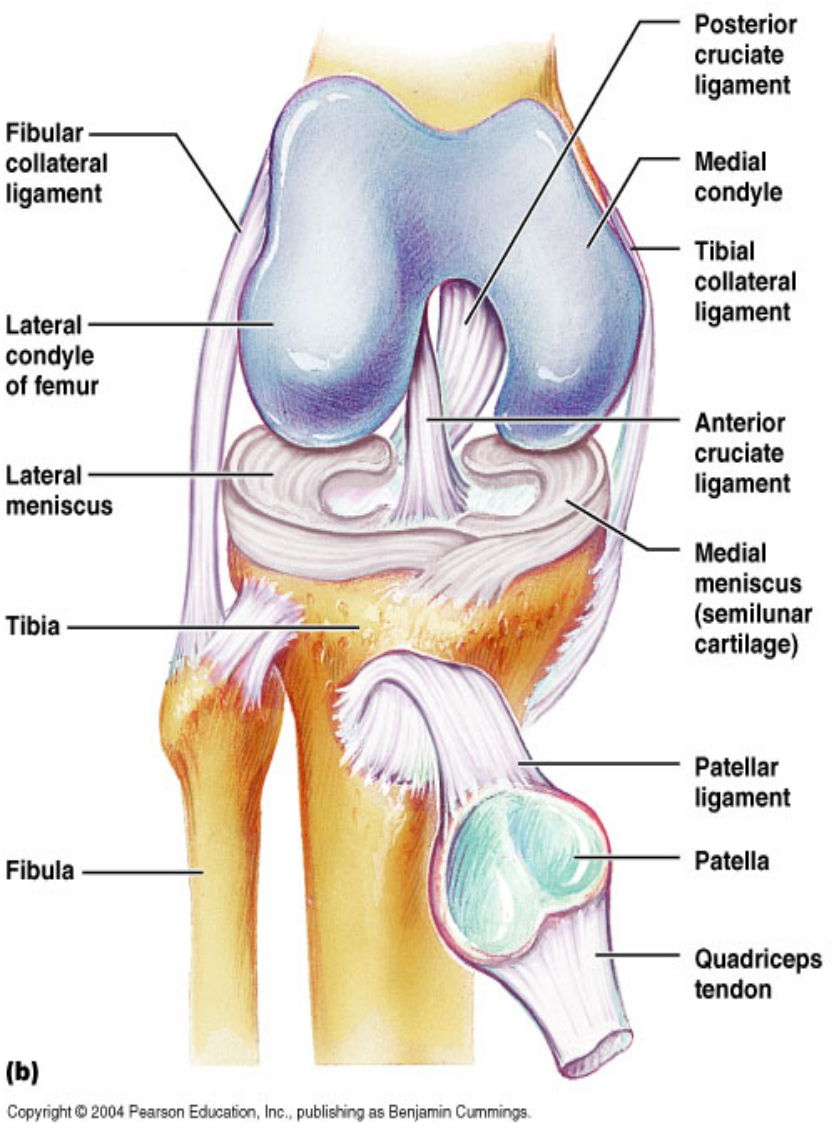


c) **Condylar joint-** moves mainly on the transverse axis and partly on a vertical axis.

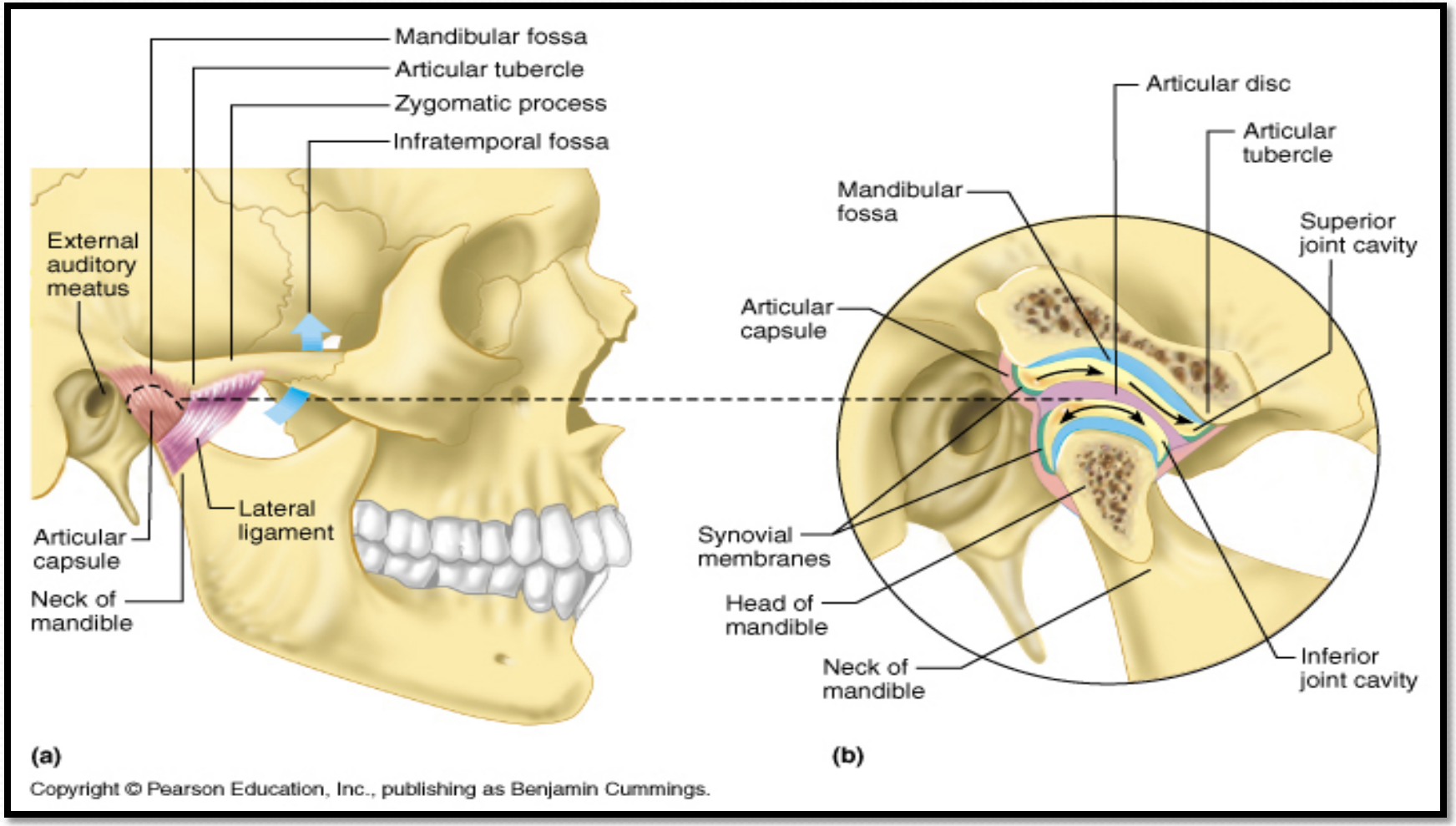
- It is a modified hinge joint.
- Each bone consist of two distinct articular surfaces known as condyles

Exp.- knee joint,temporo-madibular joint





Temporo-mandibular joint- condylar joint

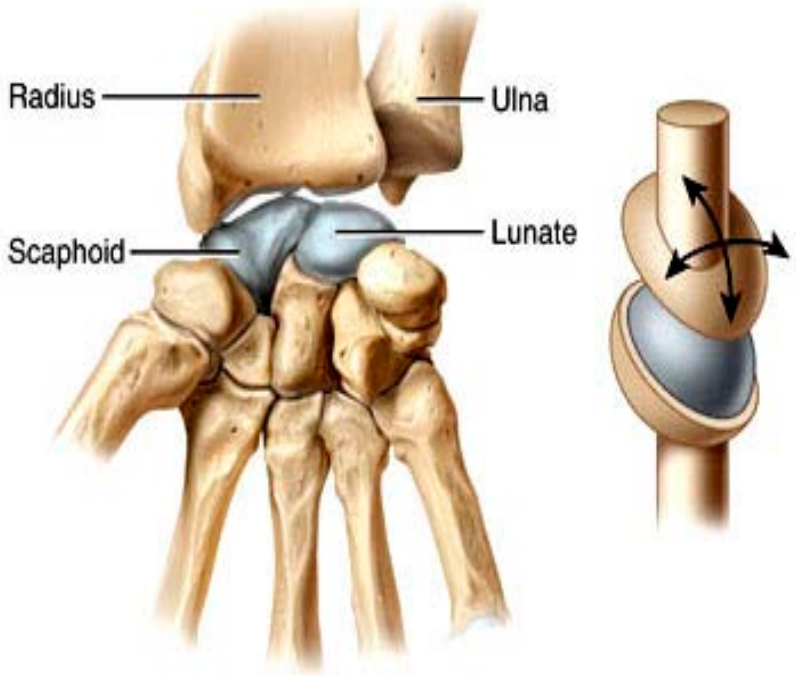


2. Biaxial joint-have two degree freedom of movement and present two varieties.

a) Ellipsiod joint

- movement takes place around transverse & antero-posterior axis.
- one articular surface is convex and elliptical (oval) in outline. The other articular surface is concave and reciprocally curved.

Exp.- radio-carpal, metacarpo-phalangeal, atlanto-occipital joint

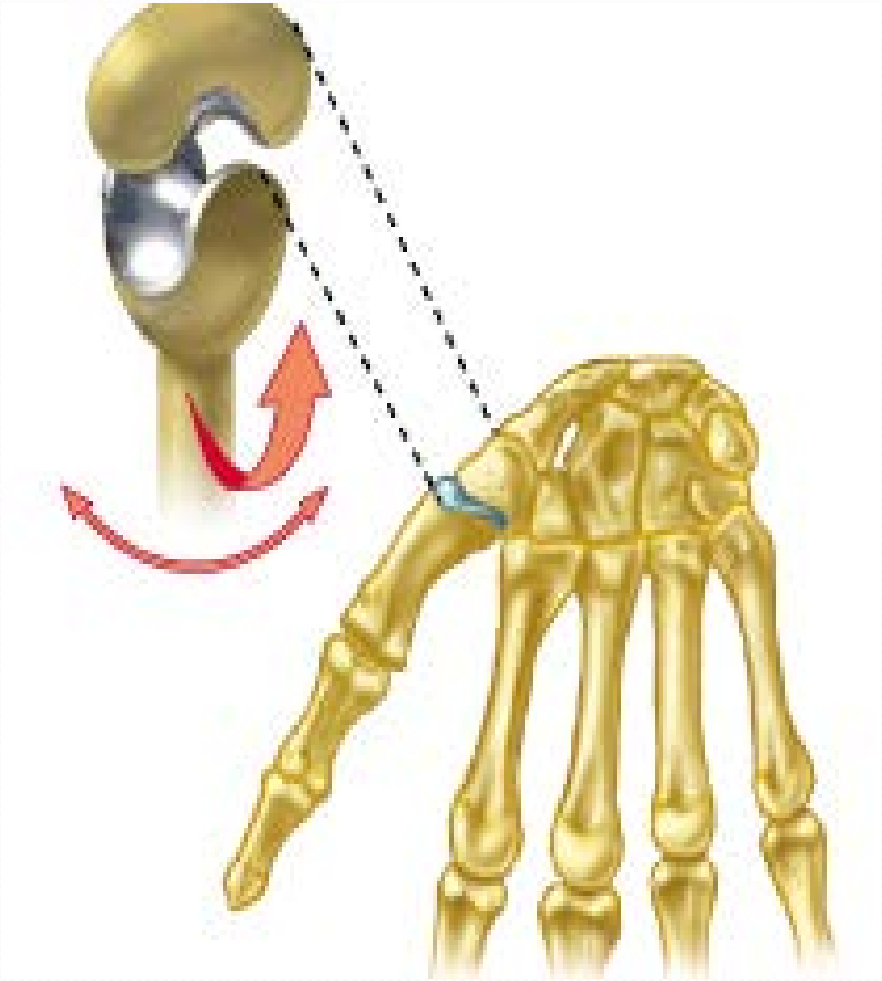


(d) Condyloid joint between radius and scaphoid and lunate bones of carpus (wrist)

b) Saddle joint-movement takes place around transverse & antero-posterior axis. Movement same as ellispsoid joint.

- Articular surfaces are saddle shaped and the other bone has the reciprocally concavo-convex surface.

Exp.-carpo-metacarpal joint of thumb, sterno-clavicular joint.

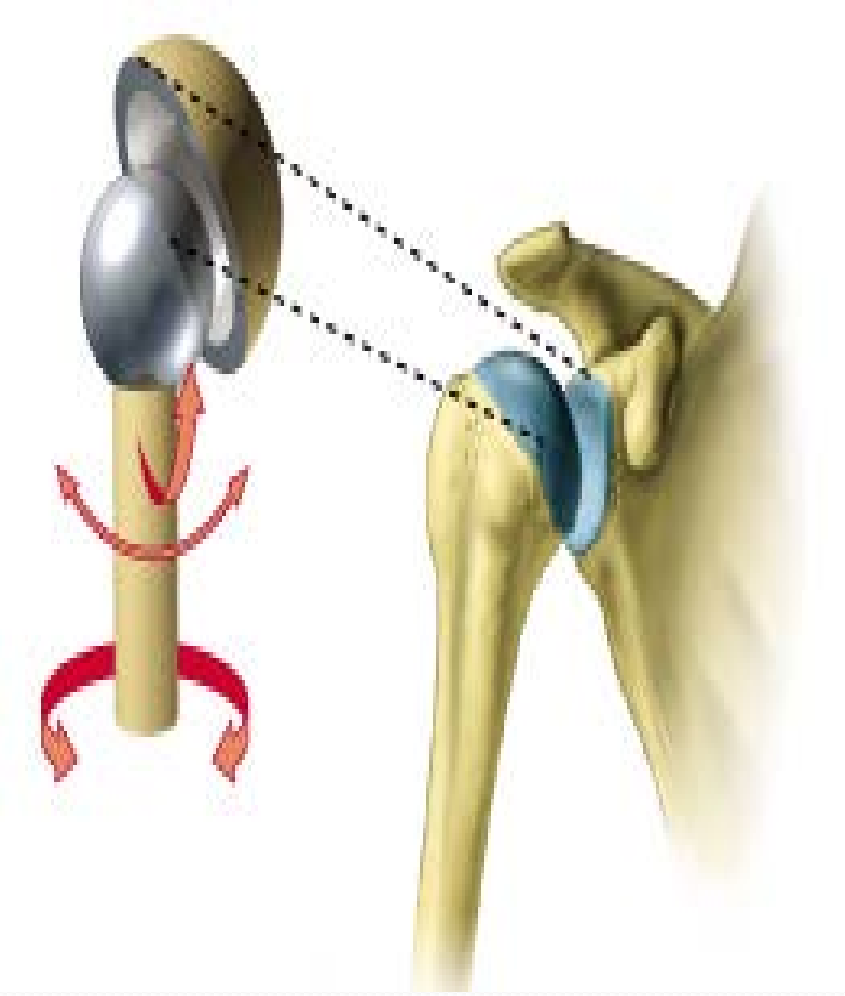


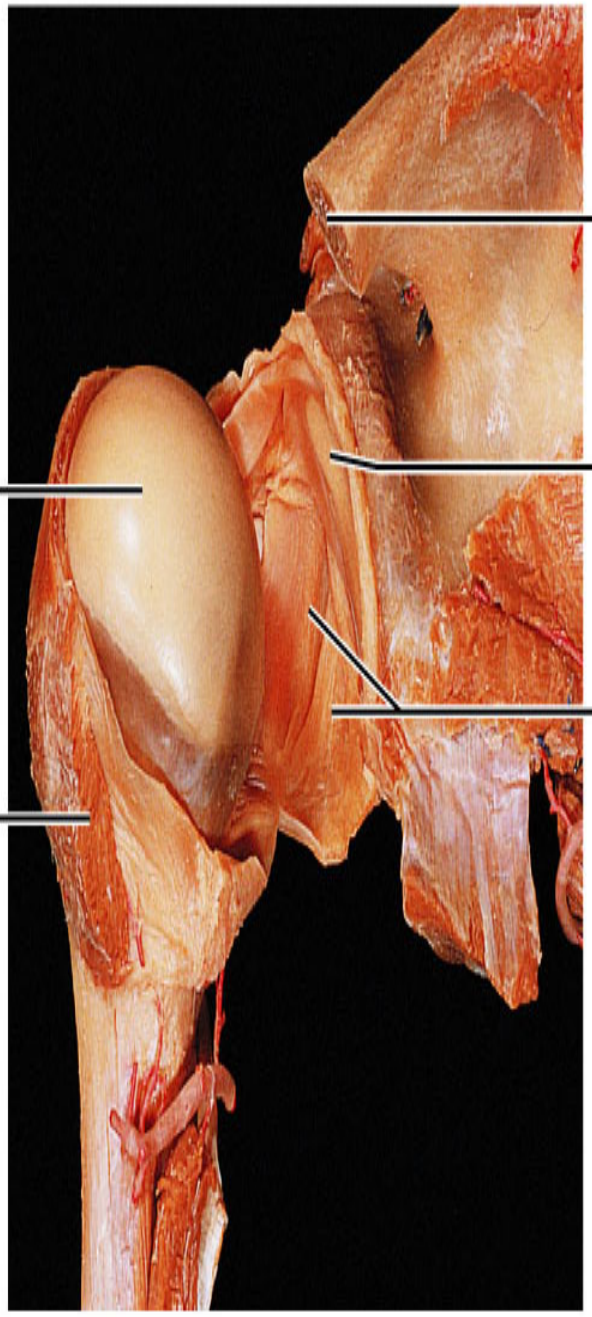
3. Polyaxial joint- have three degree freedom of movement

a) **Ball & socket joint or spheroidal joint-** movement take place around transverse, antero-posterior, vertical axis.

- Articular surfaces include a globular head fitting into cup shaped socket

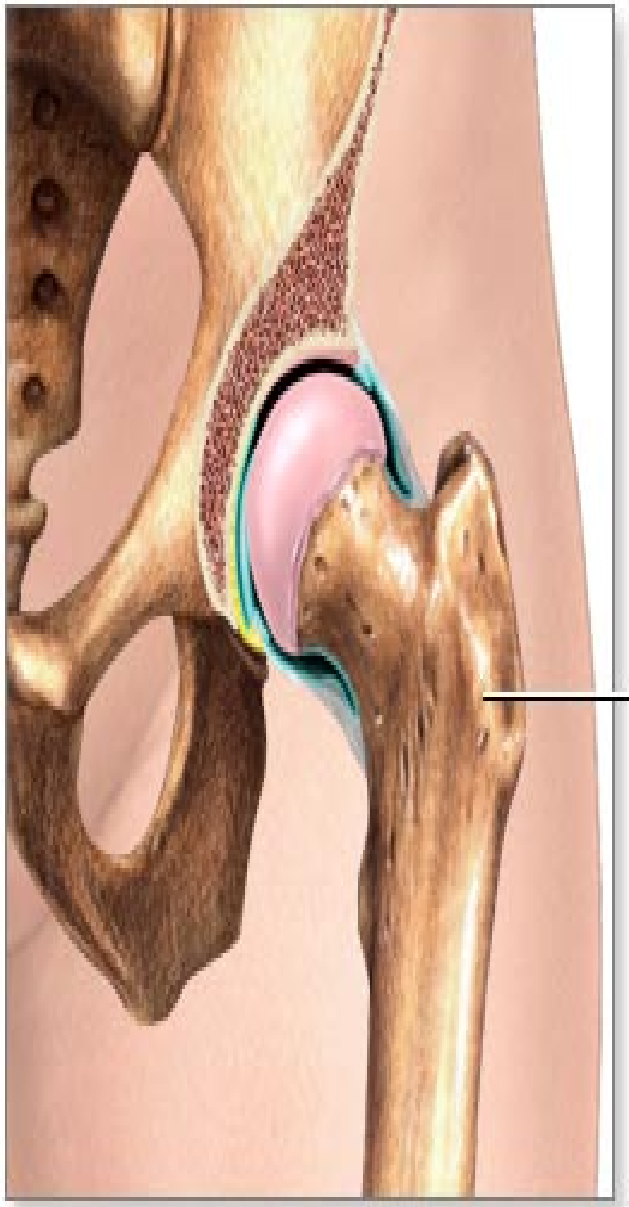
Exp.- shoulder & hip joint,talo-calcaneo-navicular joint.

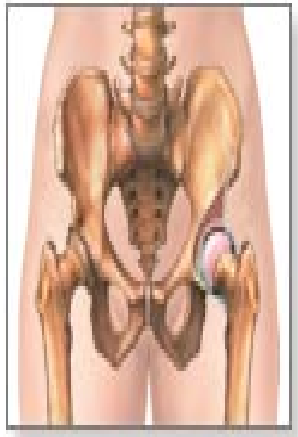




(c)

Normal hip joint



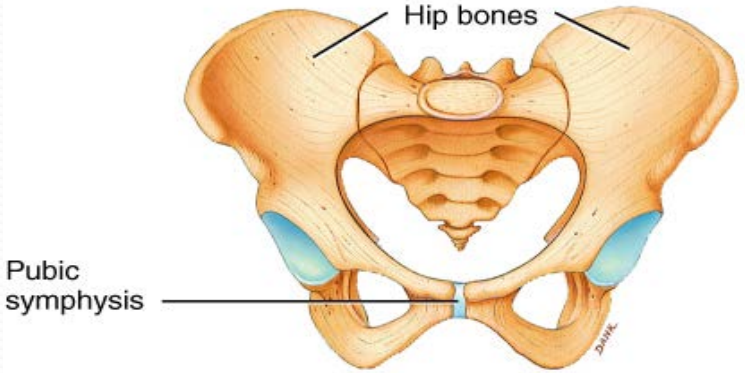


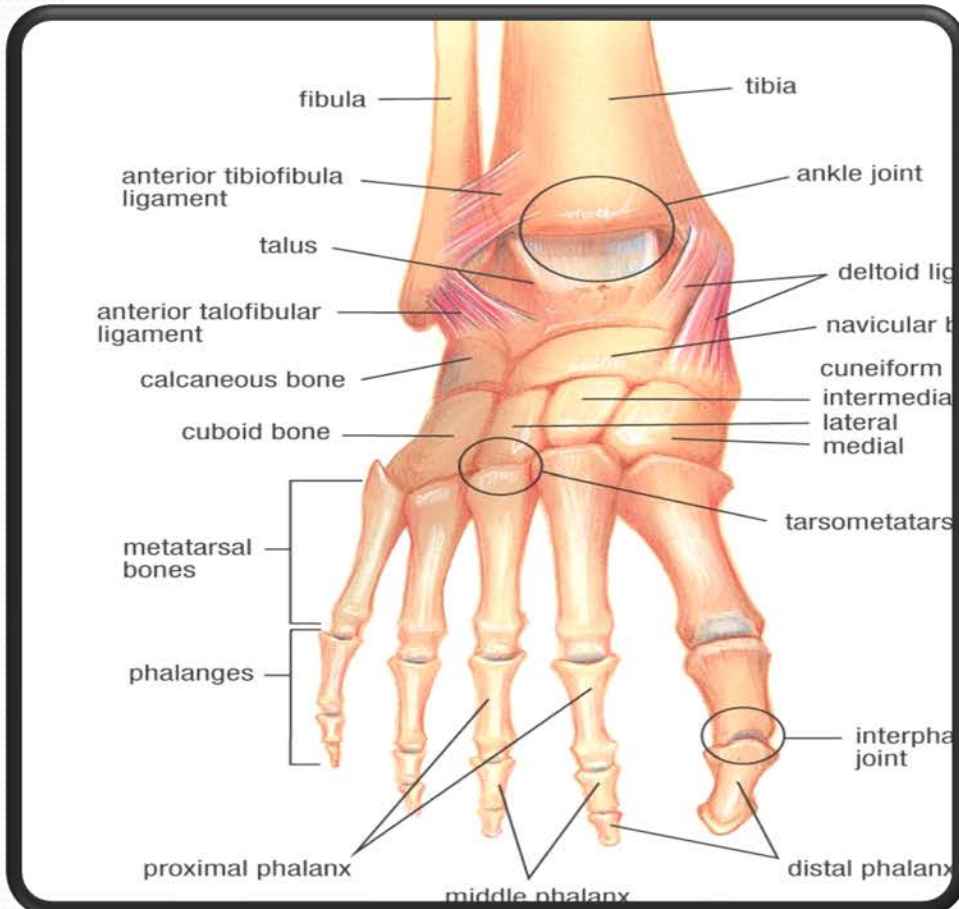
4.Plane joint-

- Articular surface are flat & produce gliding movement in various direction is possible.

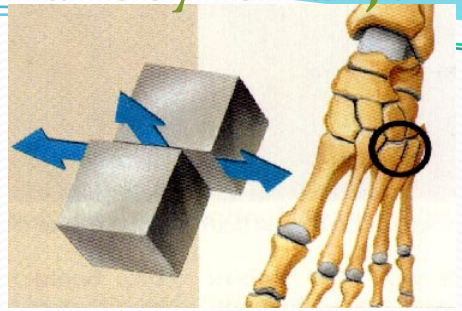
Exp.- intercarpal, intermetatarsal

- Intercarpometacarpal
- Chondrosrernal except 1st
- Interchondral
- Costoverterbral, costotransverse
- acromioclavicular





Plane synovial joint

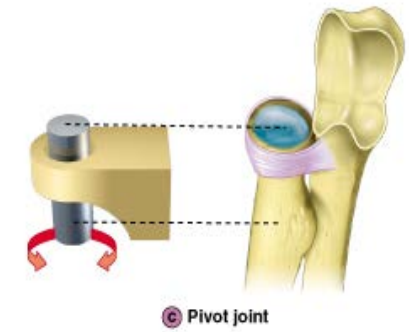


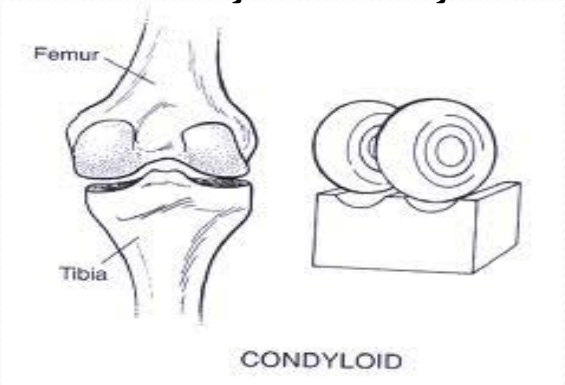
Uniaxial joint

a.hinge variety

b.Pivot variety

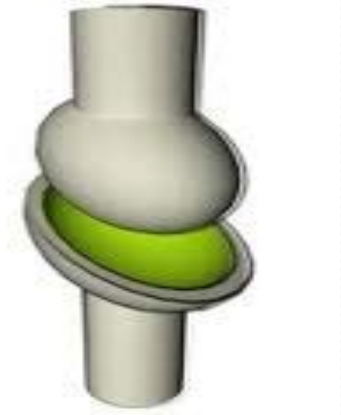
c.Condyler variety



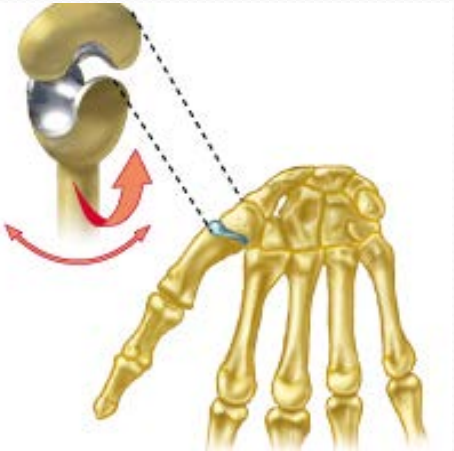


Biaxial joint

a.Ellipsoid variety

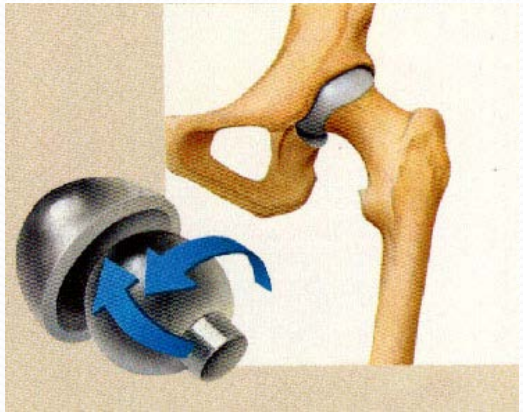


b.Saddle variety



Polyaxial joint

Ball & socket variety



Peculiarities of synovial joint:-

1. Radiological joint space is larger than the actual one, because articular cartilage are not opaque to x-ray.
2. The pad of fat are intracapsular but extra-synovial and are known as harversian gland which is act as a vaccum filter.

Factors limiting the range of movement

1. **shape of articulating bones:**

   disproportionate shape of glenoid cavity and head of humerus provides wider range of moment.

2. **Tension of ligament:**

   e.g. over-extension of hip joint is prevented by tension of iliofemoral ligament

3. **Tension of antagonist muscle**

4. **The approximation of soft part:**

   flexion at elbow joint

Factors maintaining stability of joint

1. Muscles:

tone of different muscle groups maintain the joint stability, important factor e.g. shoulder joint

2. Shape of articulating surfaces of bones:

e.g. hip joint, head of femur is completely received by acetabular socket

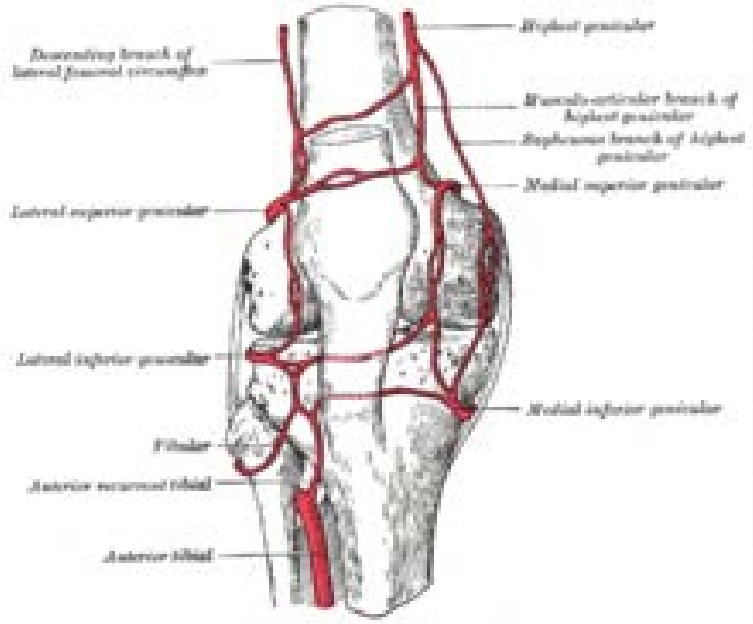
3. Ligaments:

permits desirable movements and prevents undesirable movements.

Blood supply

- Arterial branches from several different arteries merge around a joint, & form a rich plexus before penetrating the articular capsule

- Articular cartilage is avascular & gets nutrition by diffusion.



Nerve supply

- Capsule and ligaments possess a rich nerve supply.

- **3 different types-**

1. sensory nerves- convey pain sensation
2. sensory nerve conveying proprioceptive sensations.
3. autonomic nerves- vasomotor, vasosensory

* therefore, the joint pain is associated with, nausea, vomiting, slowing of pulse and blood pressure

Hilton's law

- The law states that the nerves supplying a joint, also suppy muscles regulating the movements of the joint & the skin over the joint
- This mechanism of innervation helps to protect the joint.
- The irritation of the nerves in joint disease causes reflex spasm of the muscles, the pain may be referred to the overlying skin.

Lymphatic drainage:

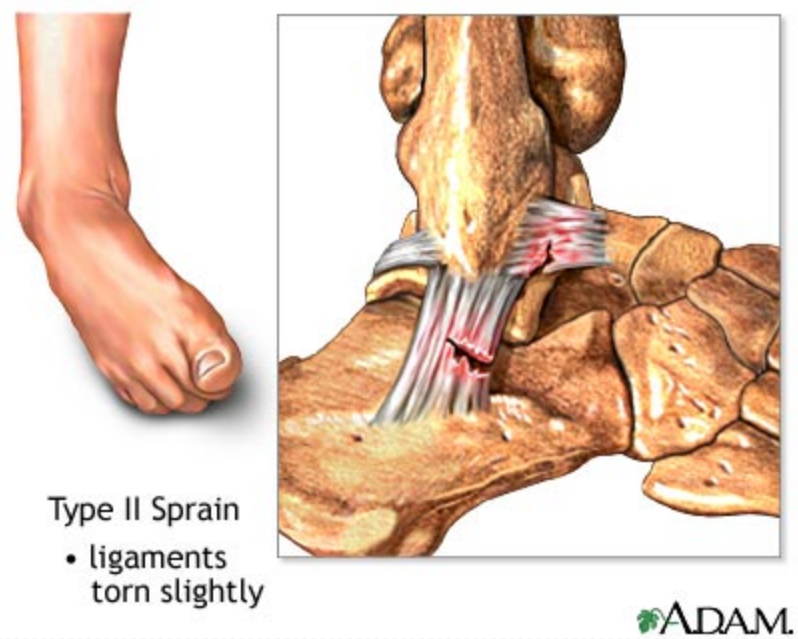
- Form a plexus in the synovial membrane

Factors preventing friction during movement

- 1. synovial fluid
- 2. articular cartilage
- 3. bursae
- 4. sesamoid bone

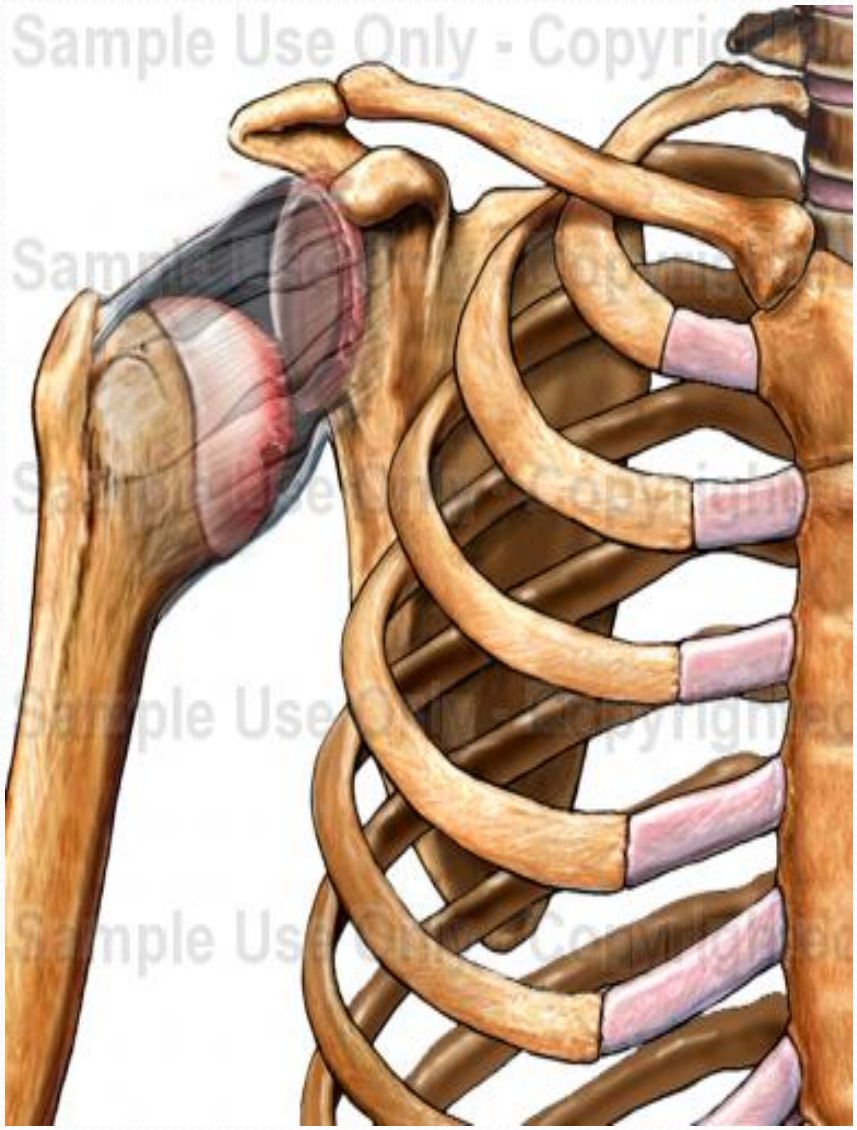
Clinical anatomy:

- **Sprains** occur when ligaments are torn.



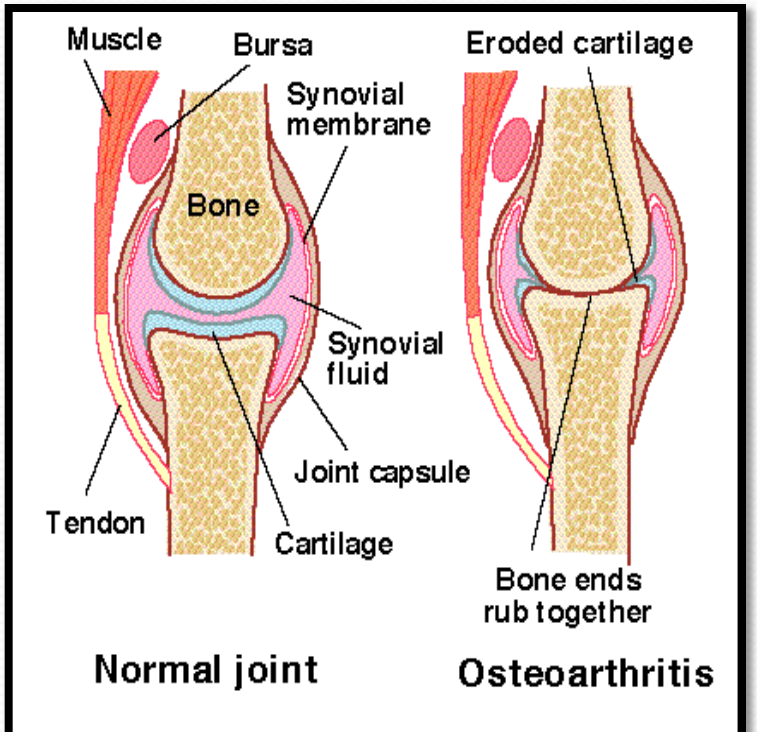
Dislocation of the joint

- This is a condition in which the articular surfaces of the joint are abnormally displaced, so one surface loses its contact completely from the other.
- If partial contact is still retained, it is better called subluxation.



Osteoarthritis

- Degenerative joint disease
  - aging, wear & tear
  - Affects large weight bearing joints
  - Patient feels lots of pain due to rubbing of bones during movements.



visual.merriam-webster.com/human.../types-synovial-joints

injury

1. Tearing of – menisci
   - E.g. football players

2. Intraarticular fractures- can lead to collection of blood and broken particles in the joint cavity

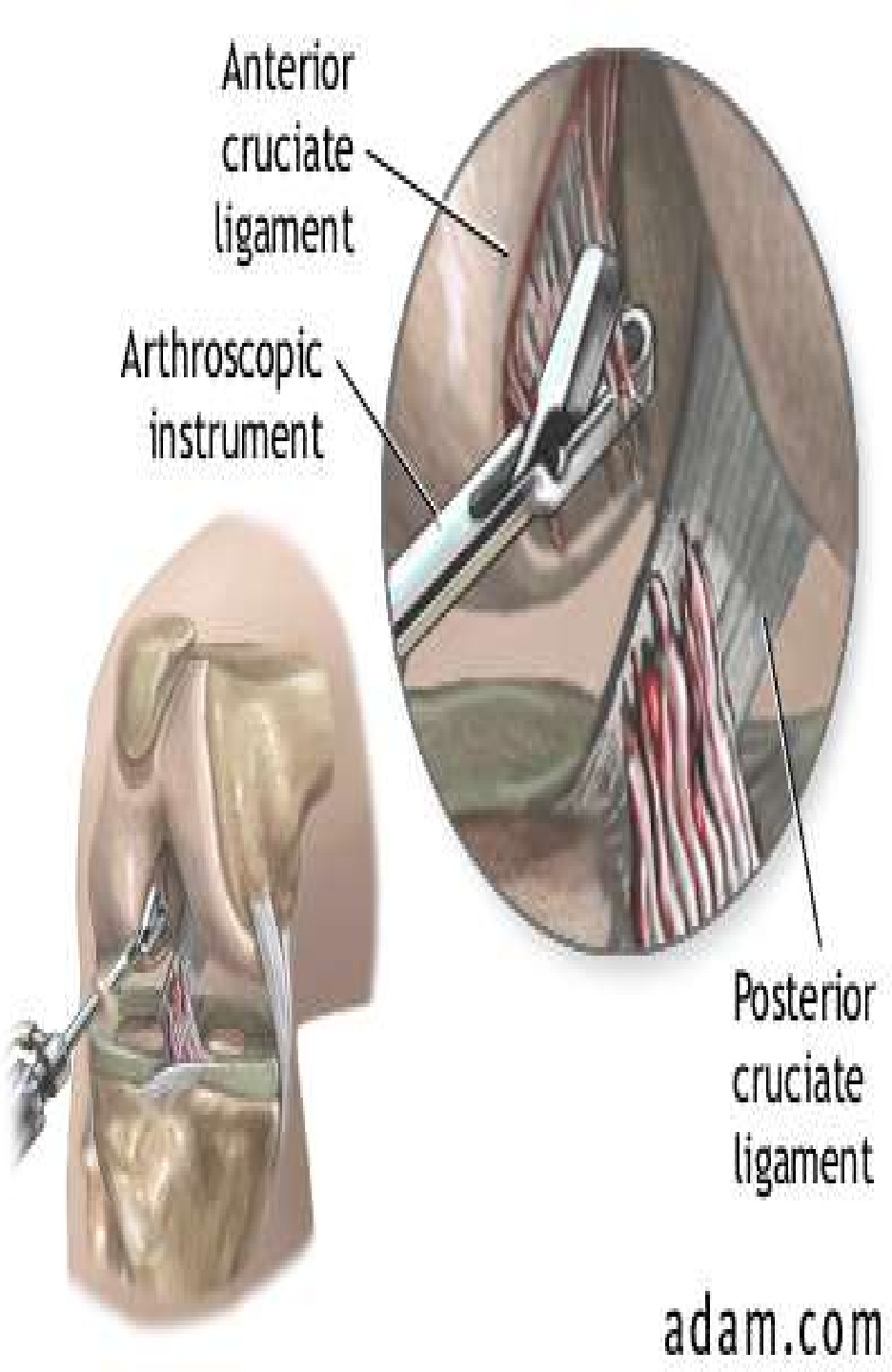
Stiffness of joint

- Related to weather with reduction in the temperature (cold weather), viscosity of synovial fluid increses – leads to joint stiffness.

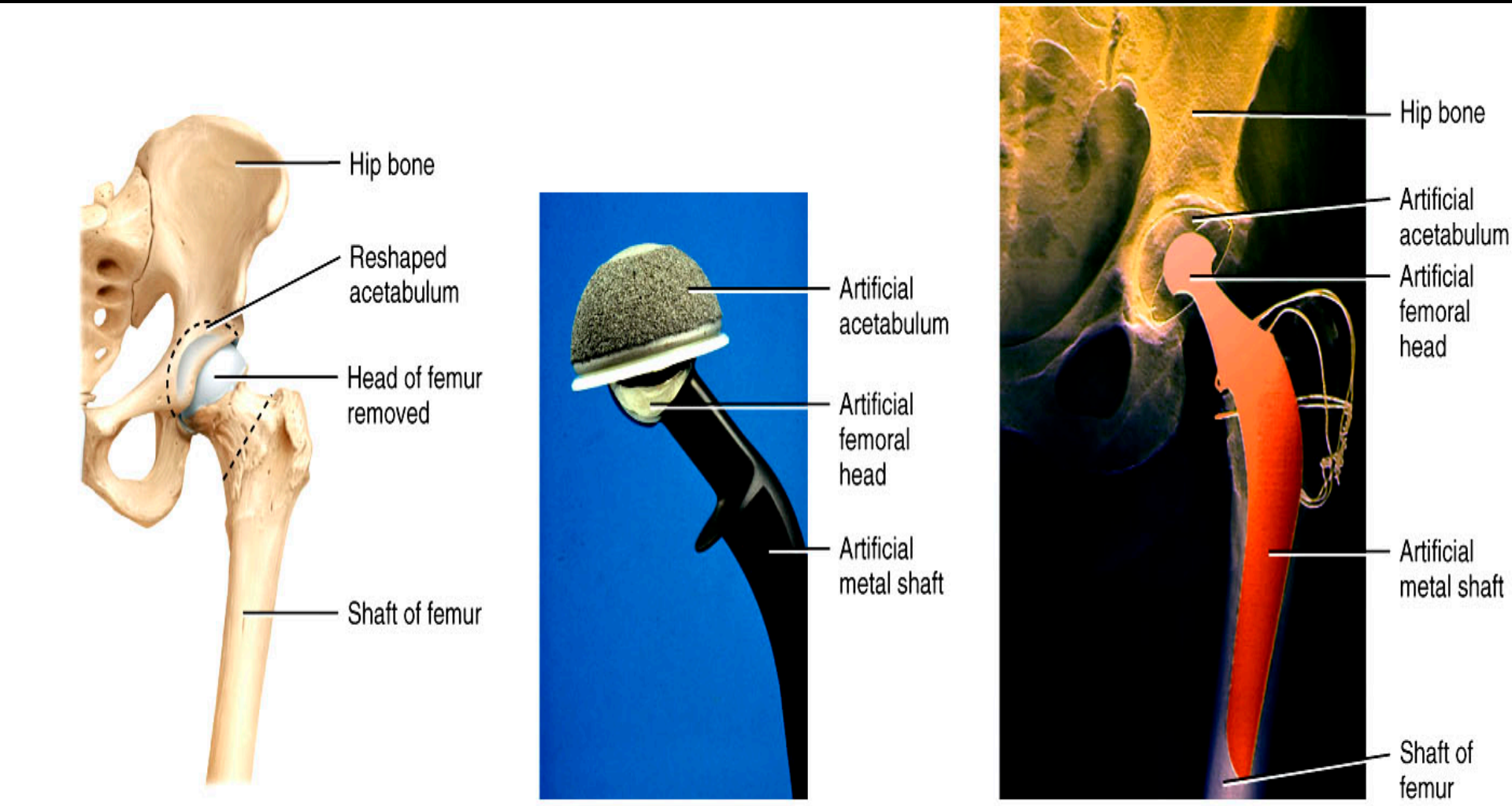
Arthroscopy- examination of joint

- By an instrument size of a pencil
- Requires small incisions only

- Diagnostic and therapeutic purpose
- remove torn knee cartilage



Arthroplasty- Replacement of joints

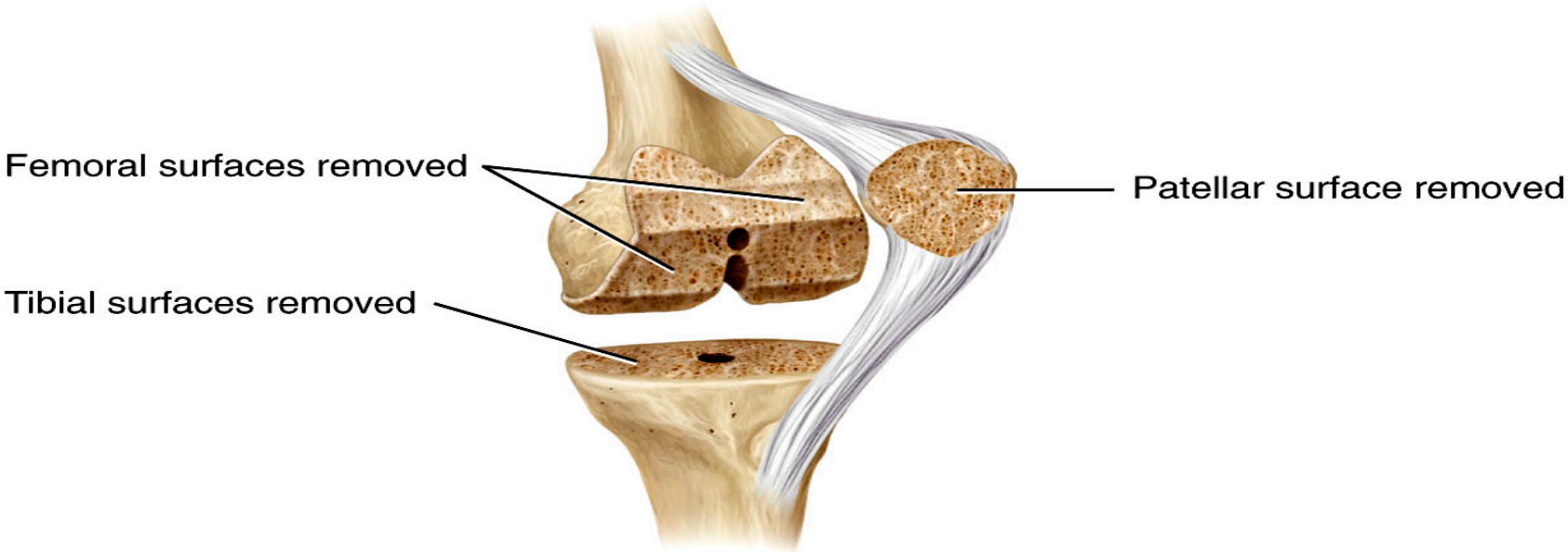


(a) Preparation for total hip replacement

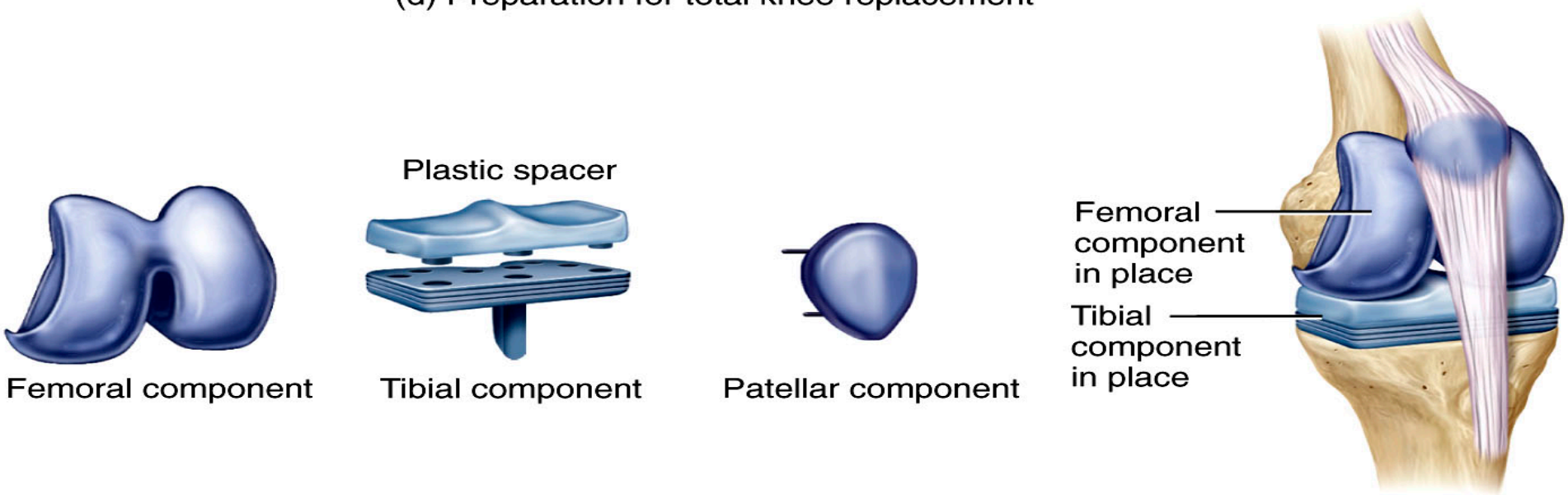
(b) Components of an artificial hip joint

(c) Radiograph of an artificial hip joint

Figure 09.16abc Tortora - PAP 12/e



(d) Preparation for total knee replacement



(e) Components of artificial knee joint (isolated and in place)

Figure 09.16de Tortora - PAP 12/e

Questions

1. Write the type of joint:

a. Hip joint
b. Elbow joint
c. Sacroiliac joint
d. Knee joint

2. When the end of one bone gets out of its socket is known as-

- A. arthritis
- B. joint dislocation
- C. paralysis
- D. stiffness of a joint

3. The movable joint is-

- A. serrate suture
- B. denticulate suture
- C. synovial joint
- D. cartilaginous joint

4.Which of the following is not a fibrous joint-

- A. serrate suture
- B. denticulate suture
- C. plane suture
- D. primary cartilaginous joint

5. Which of the following is not a characteristic of a synovial joint-

- A. immobile
- B. possess a joint cavity
- C. covered by an articular capsule
- D. synovial fluid fills the joint cavity

Answers

1. Write the type of joint:

a. Hip joint - ball and socket variety of synovial joint
b. Elbow joint – hinge variety of synovial joint
c. Sacroiliac joint- plane variety of synovial joint
d. Knee joint- condyler variety of synovial joint

2. When the end of one bone gets out of its socket is known as-

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- B. joint dislocation
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Evidence on the topic of joint

Prepared by : Dr.Hetal Vaishnani

Frances Vaughn Wilder · Lissa Fahlman · Robert Donnelly
Received: 21 July 2009 / Accepted: 7 October 2009 / Published online: 29 October ,2009

•Frances Vaughn Wilder Lissa Fahlman •Robert Donnelly	Radiographic cervical spine osteoarthritis progression rates: a longitudinal assessment	we provide age-speciWc progression rates of radiographic cervical spine OA, by gender. Data from cohort subjects (ages 40+) from the Clearwater Osteoarthritis Study were analyzed (*N* = 707). All study subjects' demonstrated radiographic cervical spine OA at baseline (2+). Lateral cervical spine	The study outcome was radiographic disease progression. A grade increase of 1, or more, by the Lawrence and Kellgren ordinal scale was considered progression	We show that the progression rates for cervical spine OA increase with age. For all ages combined, men demonstrated higher rates of progression compared with women.

Referances

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- *www.fotosearch.com/**photos-images**/**joints**.htm*


THANK YOU