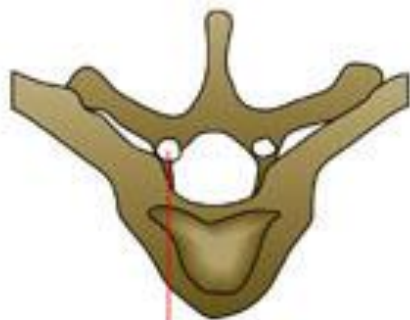


Syndesmology

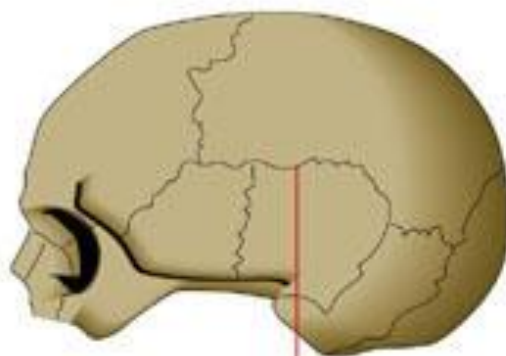
Types of connection

- *synarthrosis*, it has no cavity
 - between two bones is located connective tissue
- *diarthrosis*
 - two bones are covered with cartilage, between them is present gap, covered by capsule
- *symphysis*
 - between two bones is located cartilage with gap inside, no capsule

TYPES OF JOINTS FOUND IN THE HUMAN BODY



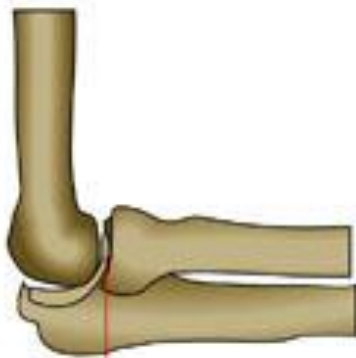
ribs and vertebrae =
semi-mobile joints



skull=
immovable joints



vertebrae =
cartilagenous joints



elbow=
hinged joint



hip=
ball and socket joint

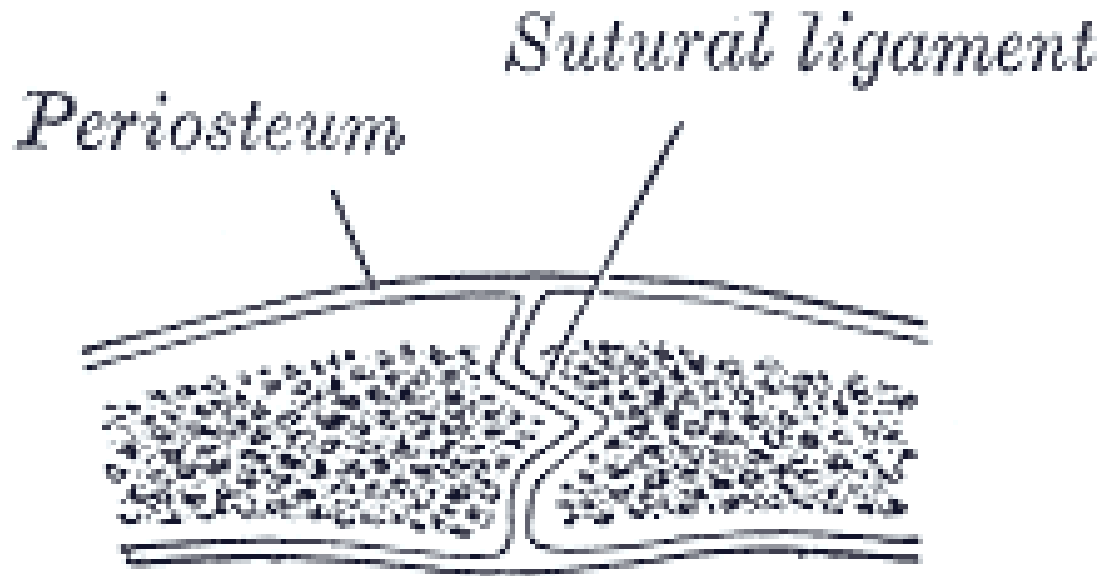
Synarthrosis =
bone - solid connective tissue - bone

- I Syndesmosis
- II Synchondrosis
- III Synostosis

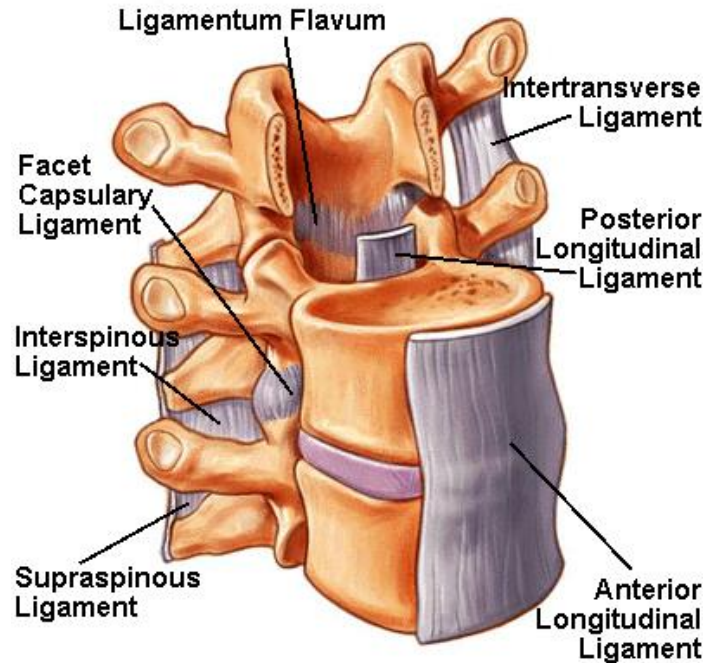
Syndesmosis

1. *sutures* =

bone - collagenous sutural ligament – bone



Syndesmosis

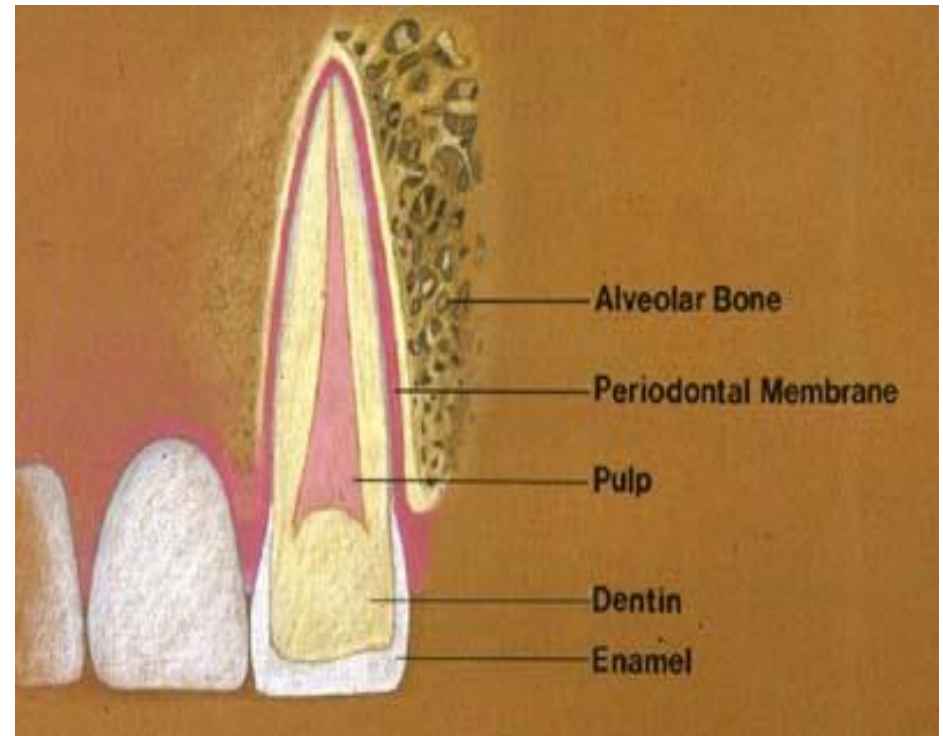


2. Ligaments =

bone - collagenous interosseous ligament - bone

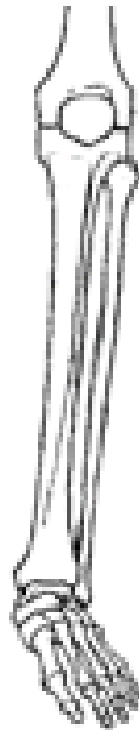
Syndesmosis

3. gomphosis =
bone - complex
periodontium - bone



Syndesmosis

**4. *Membrana interossea* =
bone – fibrous membrane- bone**

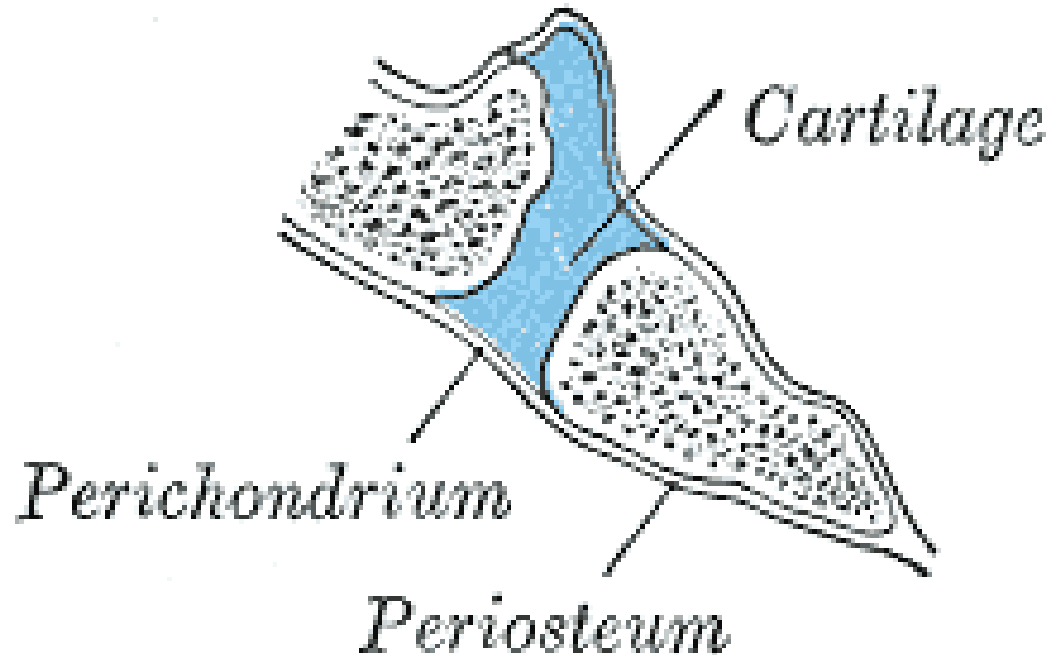


Syndesmosis

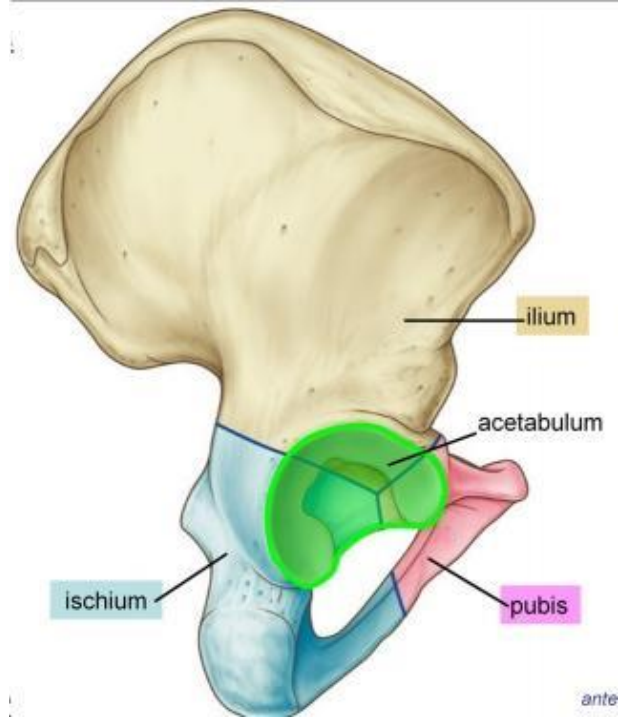
- ***5. Fonticuluses***
- These are connections between bones of neurocranium in newborn skull presented by connective tissue.
- There are: fonticulus anterior, posterior, sphenoidale and mastoideus.

Synchondrosis

- ***synchondrosis*** =
bone - hyaline cartilage - bone



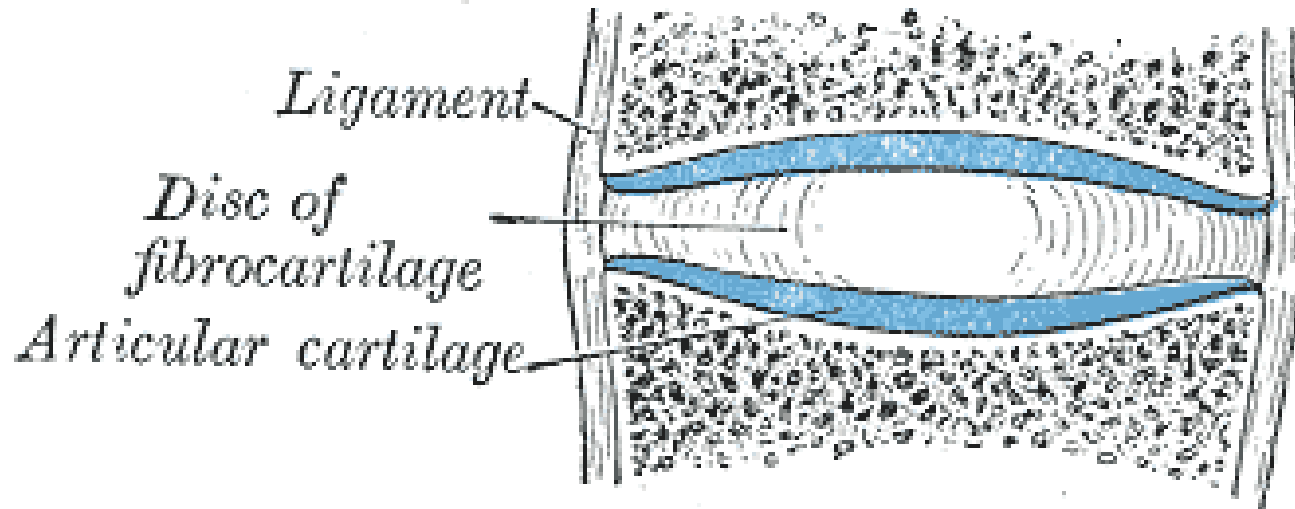
Synostosis



- ***Synostosis*** = rigid bony union

synarthrosis ↔ *symphysis*

bone - hyaline cartilage - fibrocartilage disc
(with a gap) - hyaline cartilage – bone



Diarthrosis consists of:

- *Obligatory elements:*

- articular surfaces
- articular capsule
- articular cavity

- *Nonobligatory elements:*

- ligaments
- tendons
- bursa
- meniscs
- discs
- labra
- plica synovialis

Diarthrosis =

bone - cavitated connective tissue - bone

- *Synovial joints* =

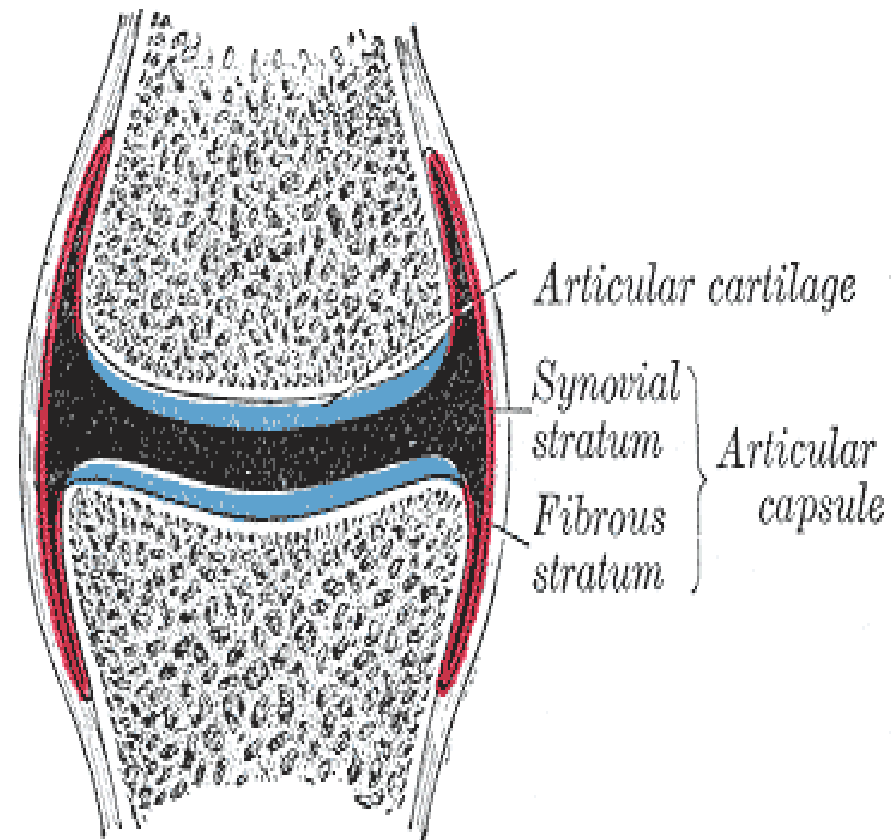
bone –

articular cartilage -

fluid in cavity -

articular cartilage -

bone

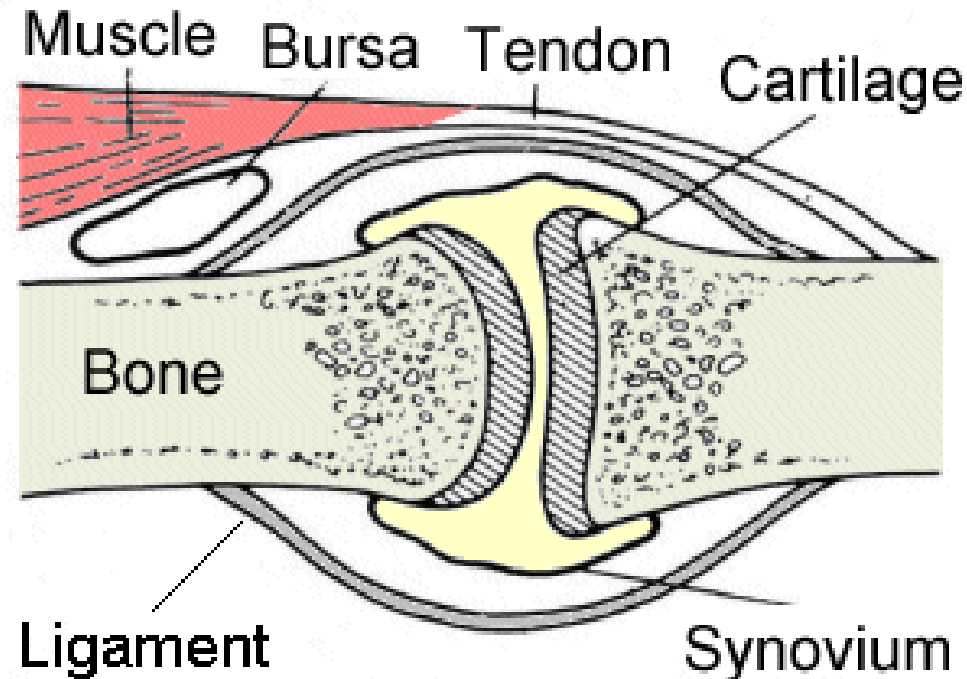


Diarthrosis consists of:

- ***cartilage***

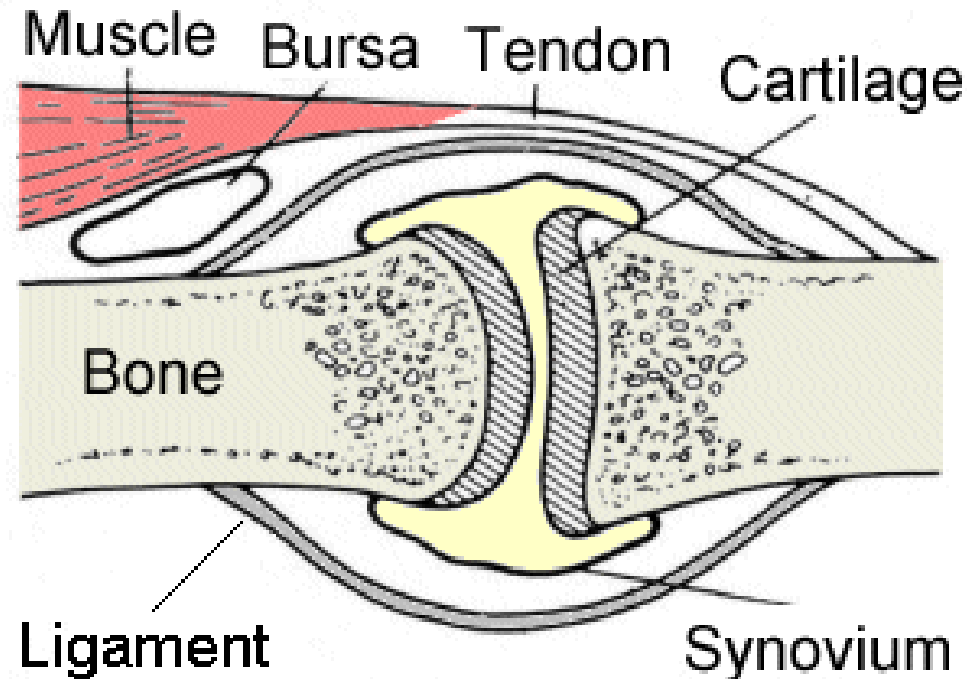
Articular surfaces of the bones are covered with cartilage. Cartilage helps reduce the friction of movement.

- **Articular cartilage** has:
 - no pain receptors
 - no blood vessels
 - very low coefficient of friction



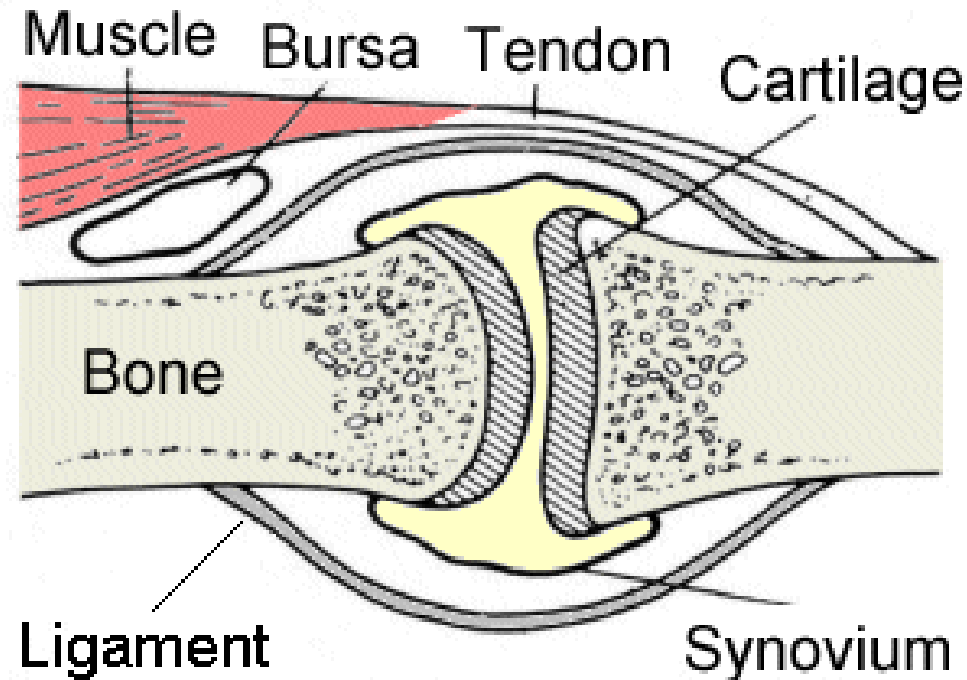
Diarthrosis consists of:

- ***synovial membrane*** - a tissue called the synovial membrane lines the joint and seals it into a joint capsule.
- The synovial membrane secretes synovial fluid (a clear, sticky fluid) around the joint to lubricate it.



Diarthrosis consists of:

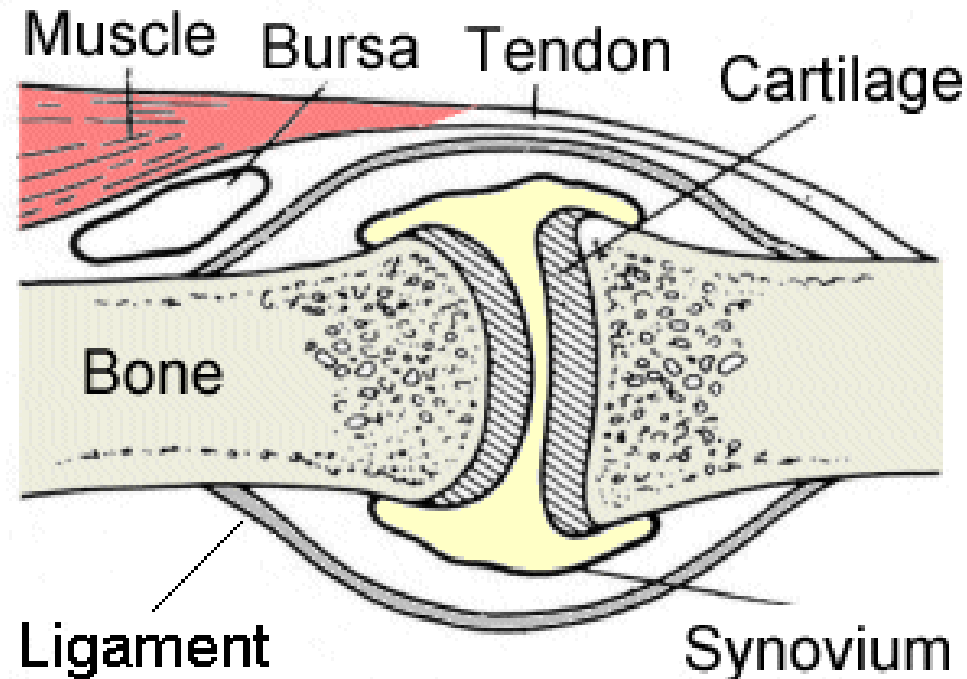
- ***synovial fluid*** - a clear, sticky fluid secreted by the synovial membrane.
- ***Articular capsule*** encloses synovial cavity from outside. It consists of collagen fibers.



Diarthrosis consists of:

- ***ligaments*** -

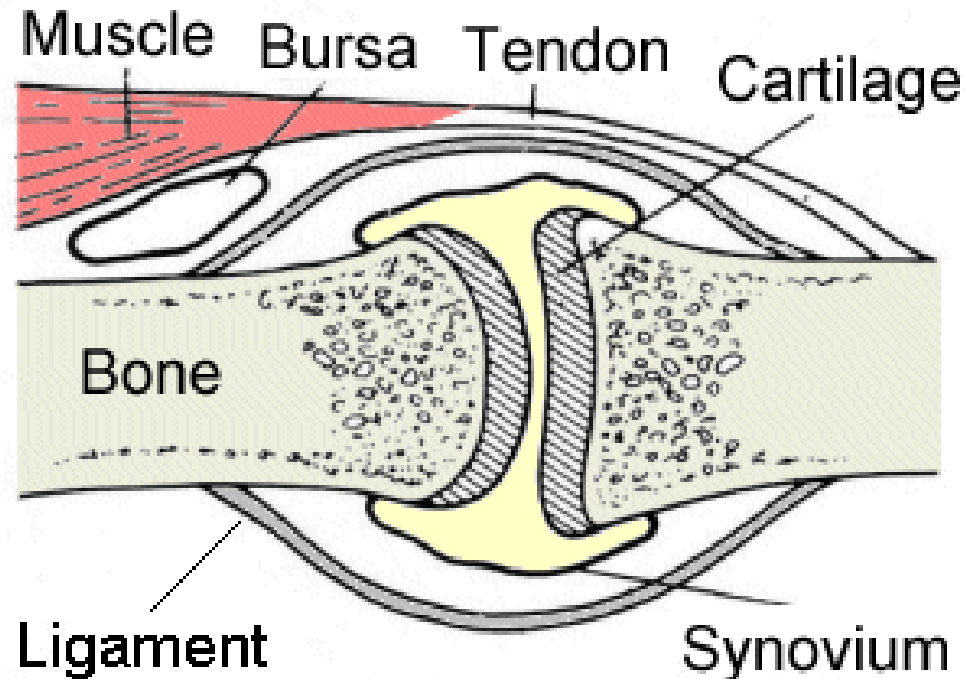
strong ligaments (tough, elastic bands of connective tissue) surround the joint to give support and limit the joint's movement.



Diarthrosis consists of:

- ***tendons*** -

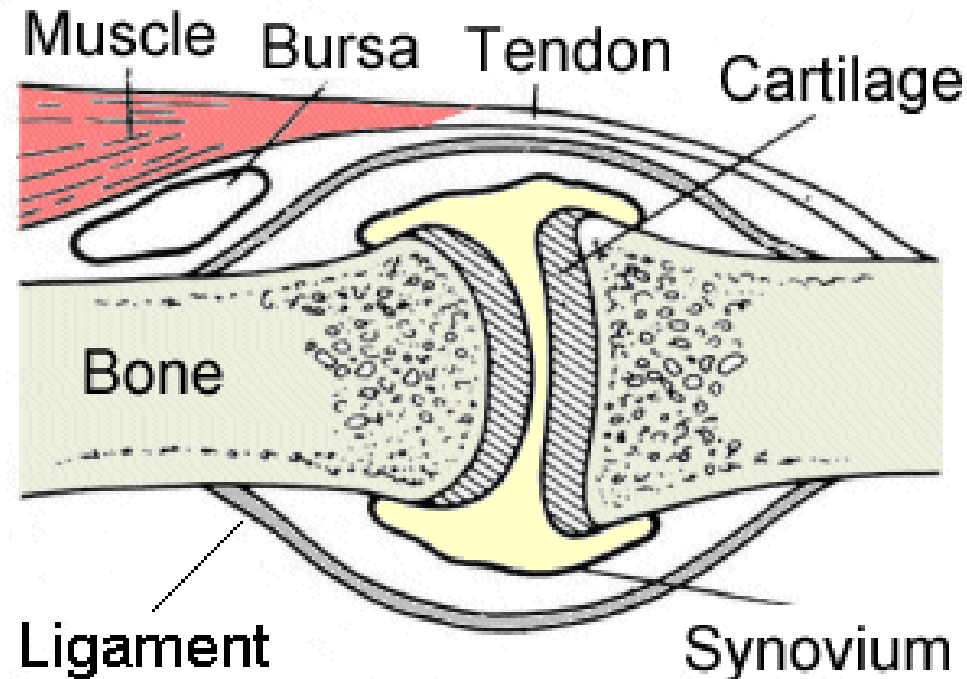
tendons (another type of tough connective tissue) on each side of a joint attach to muscles that control movement of the joint.



Diarthrosis consists of:

- ***bursas*** –

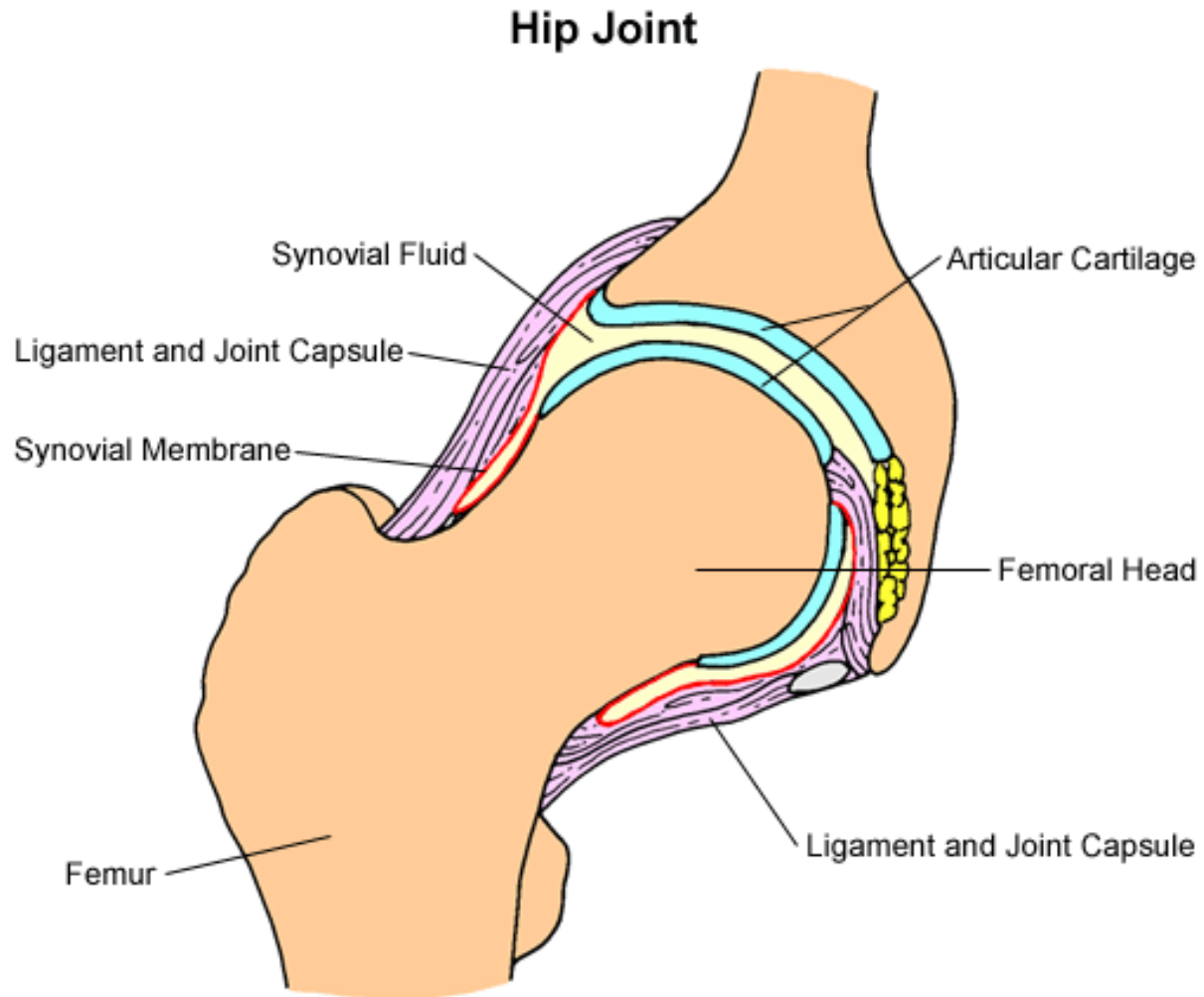
- fluid-filled sacs, called bursas, between bones, ligaments, or other adjacent structures help cushion the friction in a joint.



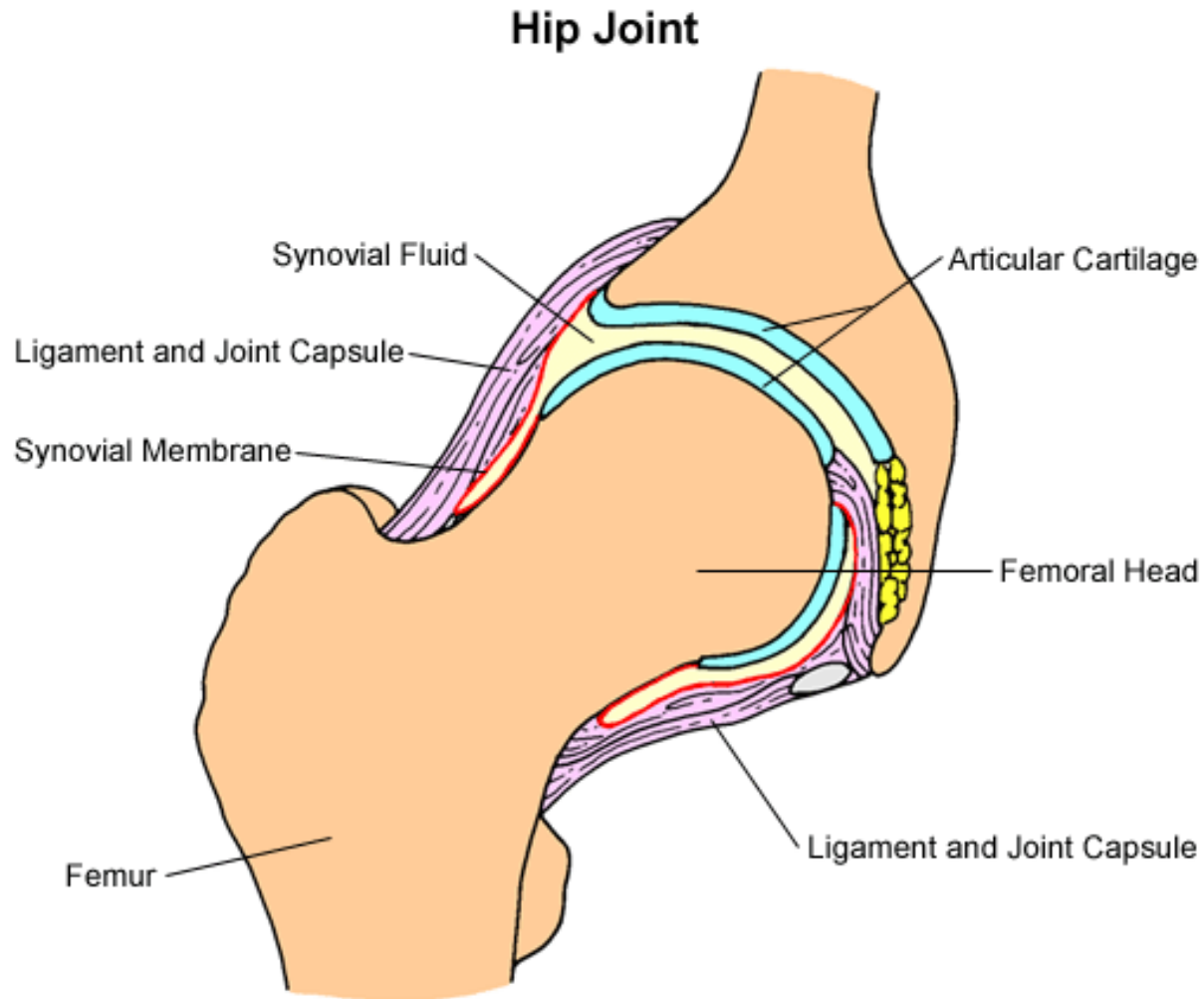
INCLUSIONS IN JOINTS

- ***Non-articular bony surface***
- ***tendons*** and ***ligaments*** passing through
- ***articular disc*** or ***meniscus***
 - may split the cavity completely into two joints -TMJ
 - or be partial and partly divide cavity - menisci of the knee
- ***labra*** or ***lips*** - cartilage around the edge of an articular margin which may deepen a concavity and add stability
- ***fat pads***

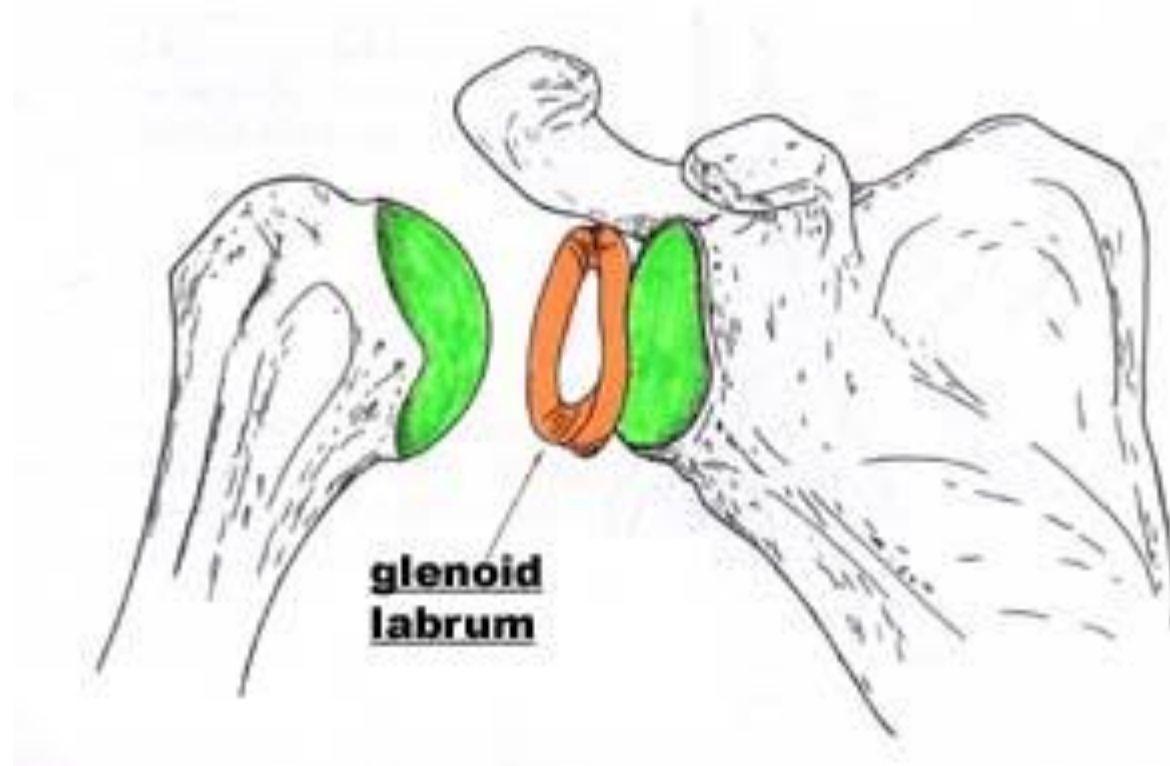
Non-articular bony surface



tendons and *ligaments* passing through

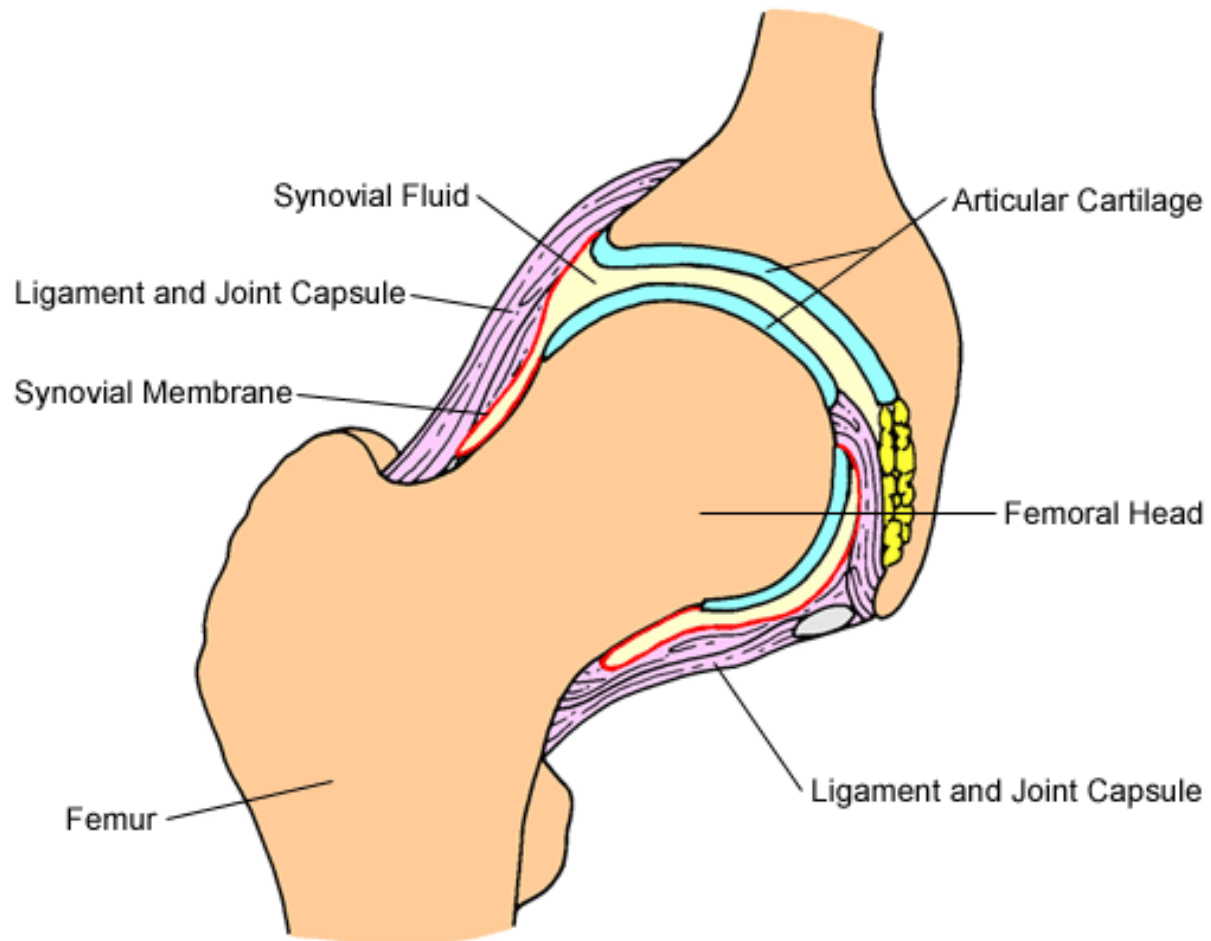


labra* or *lips - cartilage around the edge of an articular margin which may deepen a concavity and add stability

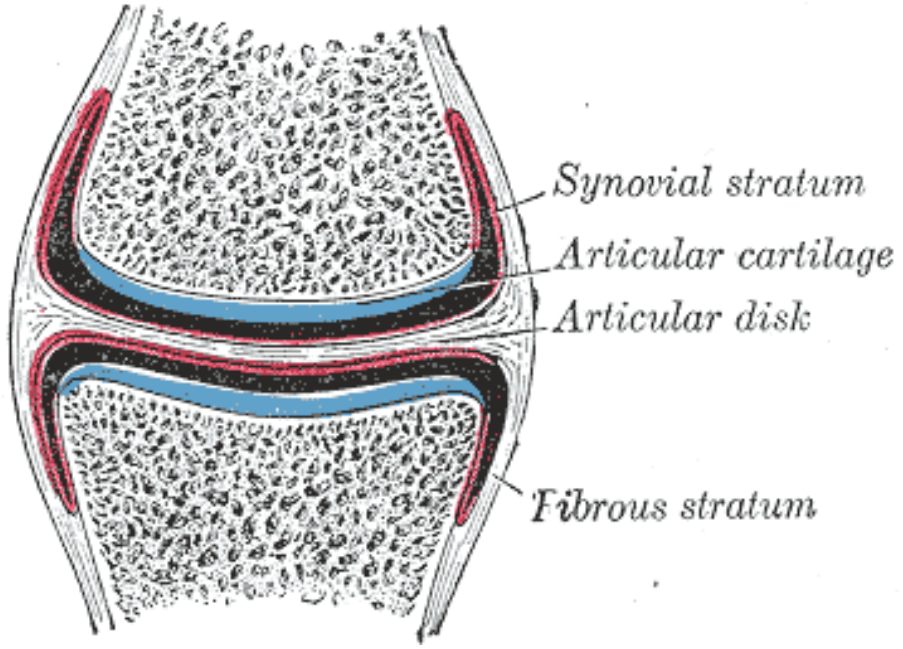
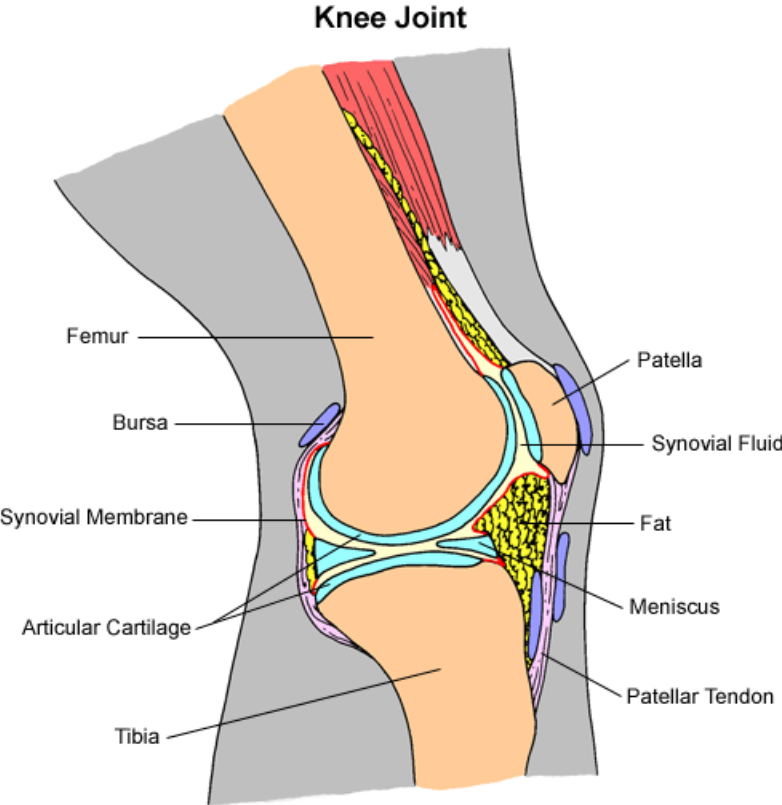


fat pads

Hip Joint

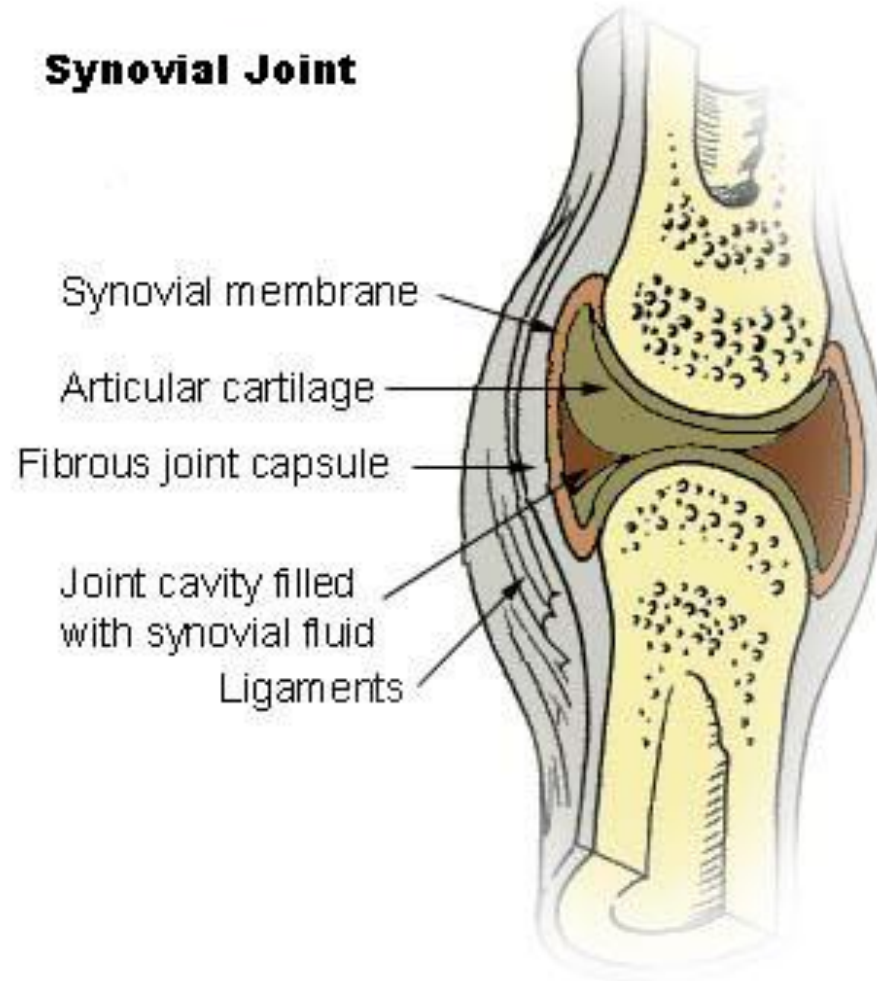


articular disc or meniscus



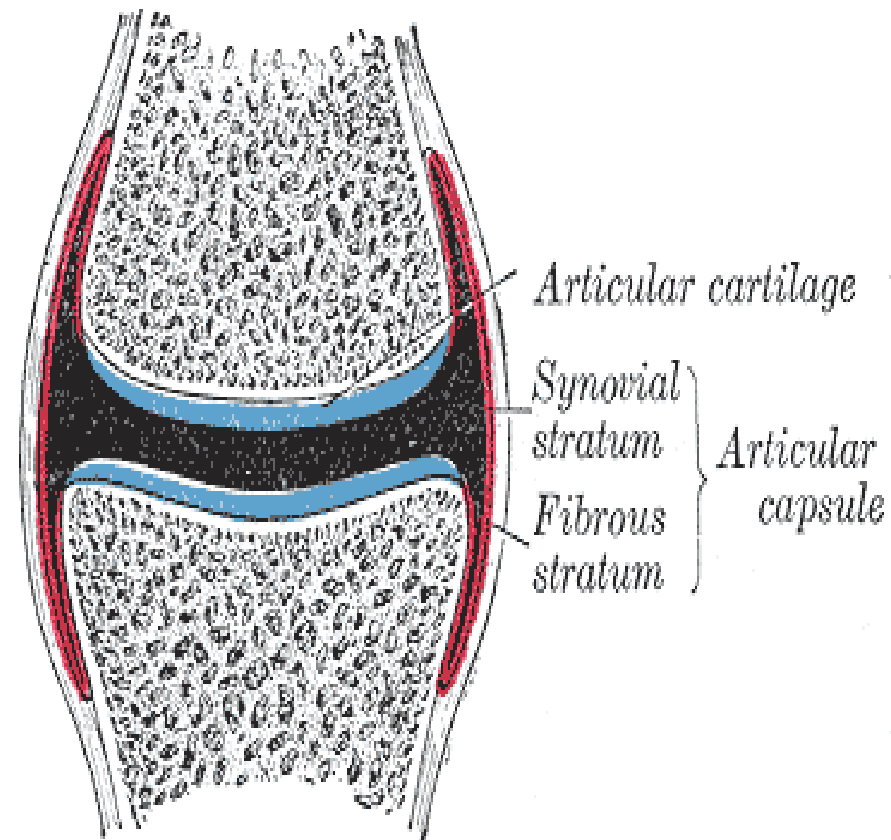
CLASSIFICATION OF DIARTHROSES

Synovial Joint



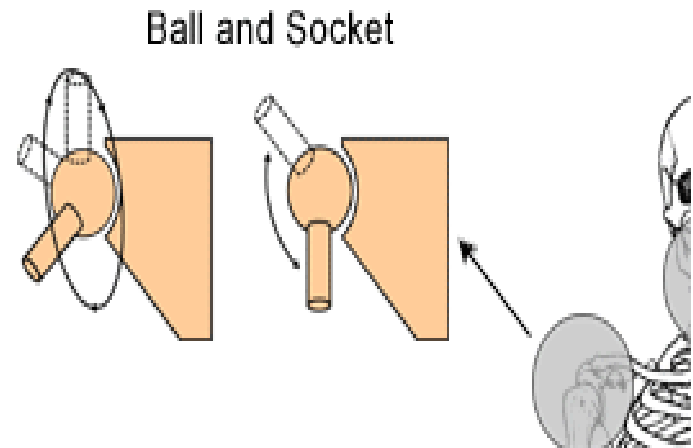
Diarthroses

- **bone –**
- **articular cartilage –**
- **fluid in cavity –**
- **articular cartilage –**
- **bone**

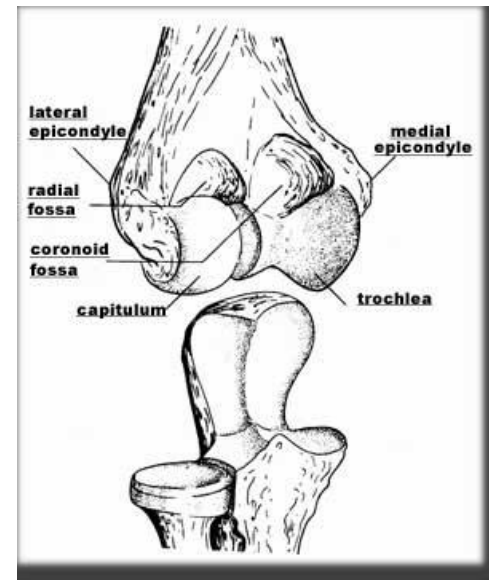


Complexity

- Two articular surfaces - ***simple***.



- More than 2 articular surfaces - ***compound***



Other characteristics

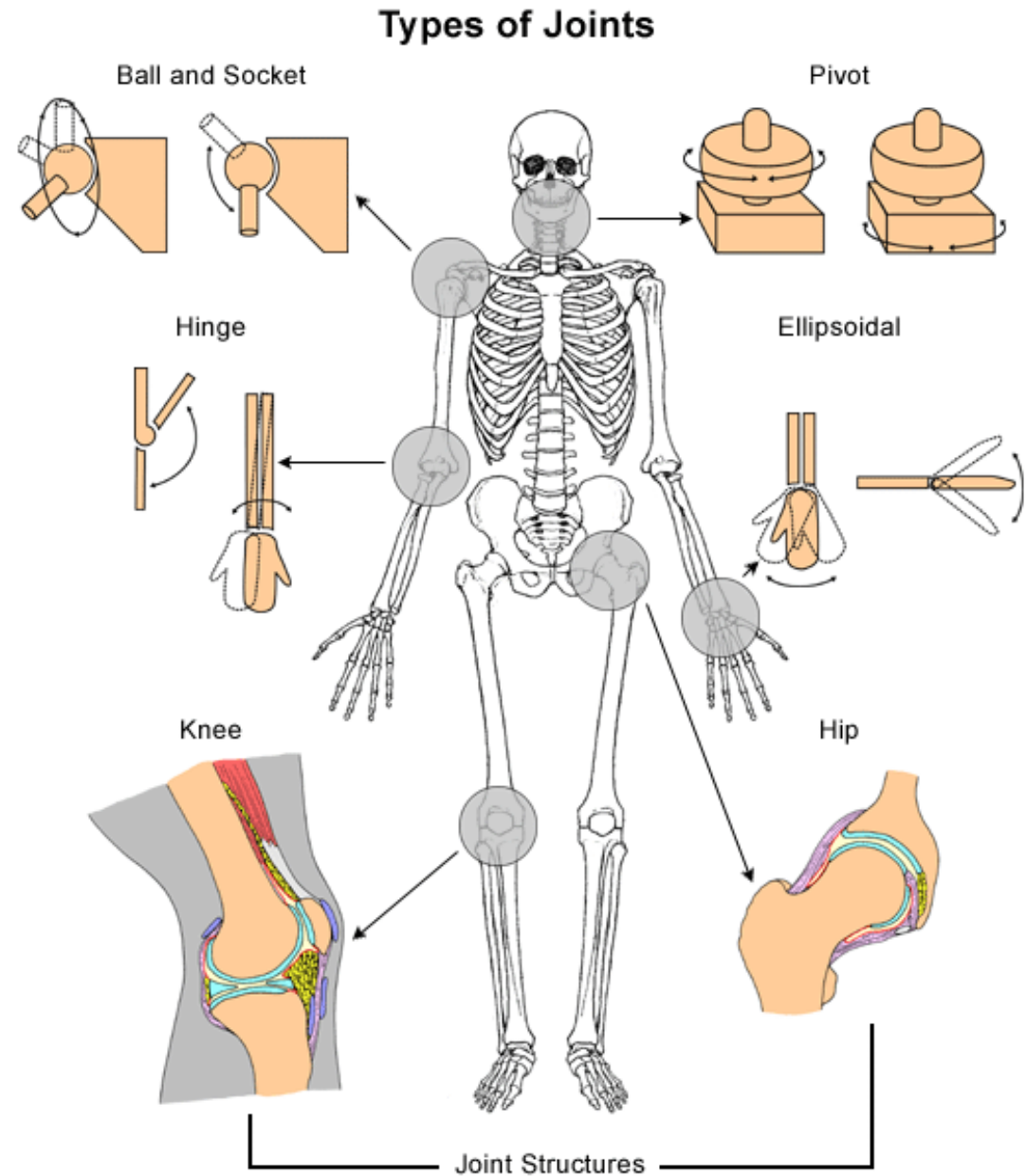
- Complicated by presence of discs or meniscs/ not complicated.
- Combined (requeres movement in other joint)/ not combined

Degrees of freedom

- Moves in one plane (elbow) ***uniaxial***
- Moves in two planes ***biaxial***
- Moves in three planes ***triaxial or multiaxial***

Shape

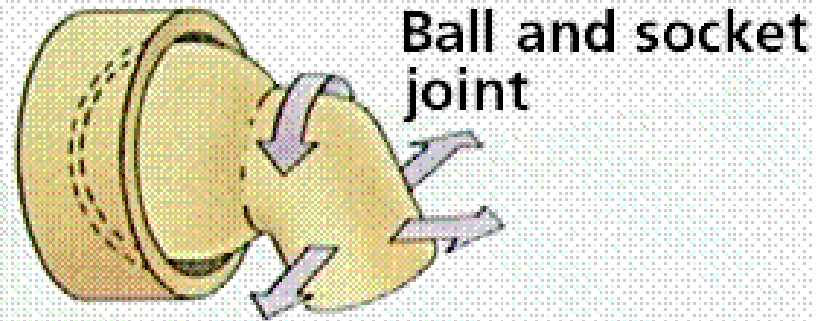
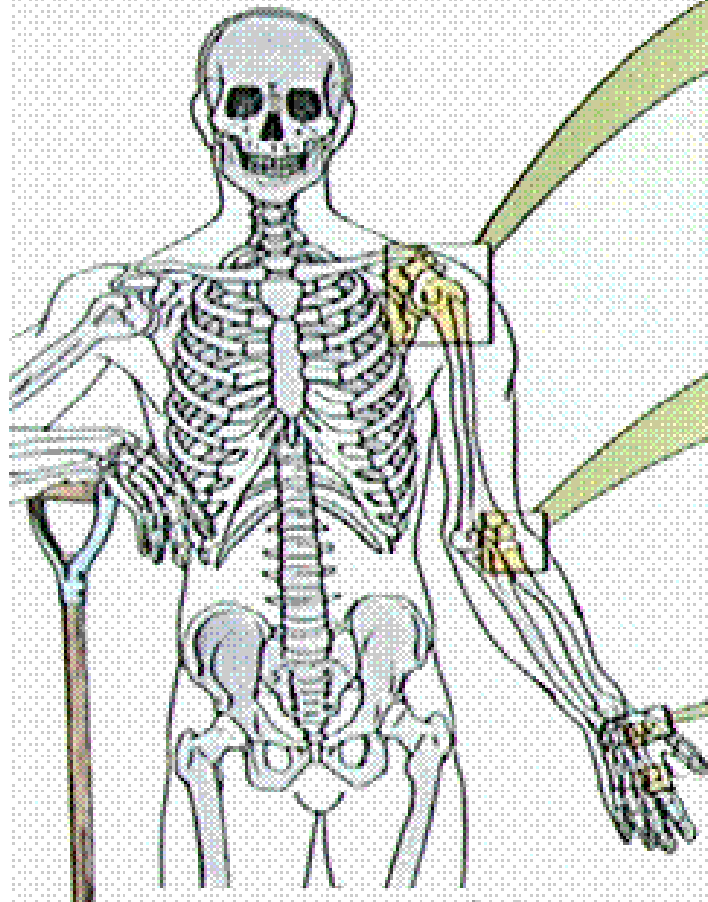
- *hinge* joints
- *pivot* joints
- *plane* joints
- *condylar* joints
- *saddle* joints
- *ball and socket*
- *ellipsoid*



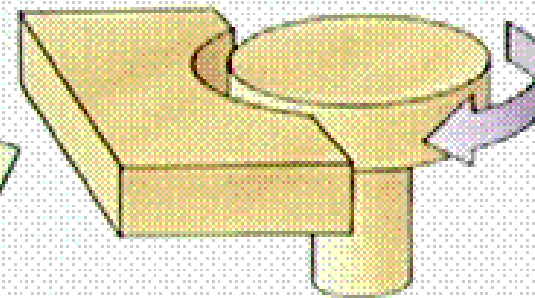
Classification

- ***Uniaxial:*** pivot, hinge
- ***Biaxial:*** condylar, saddle, ellipsoid
- ***Multiaxial:*** plane, spheroid, cotylica

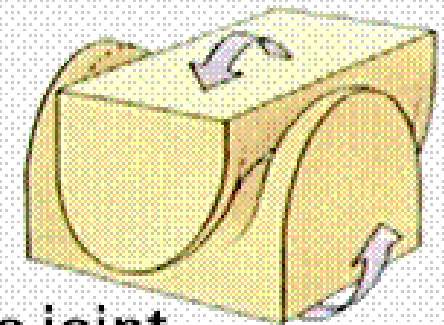
Types of Joints



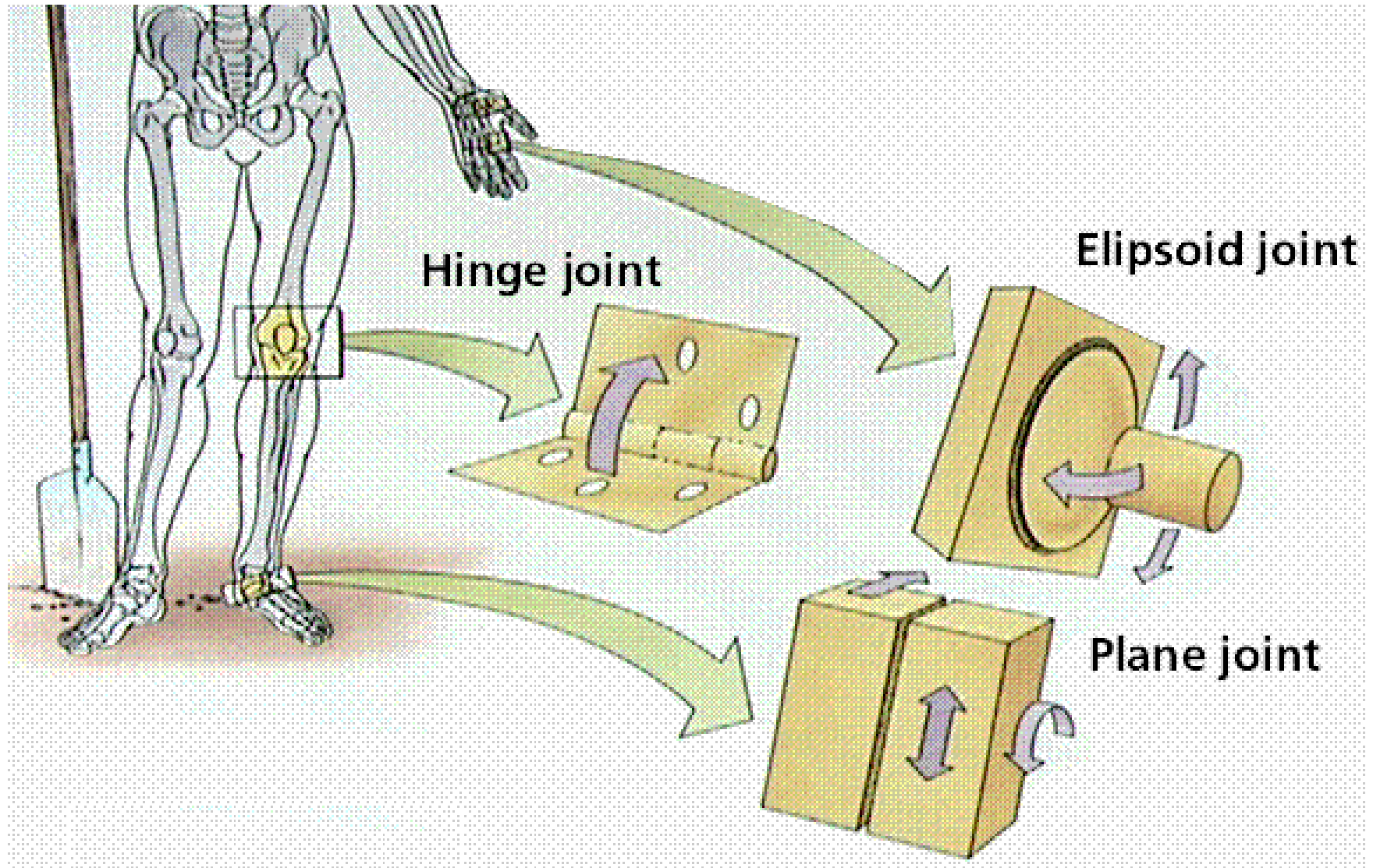
Ball and socket joint



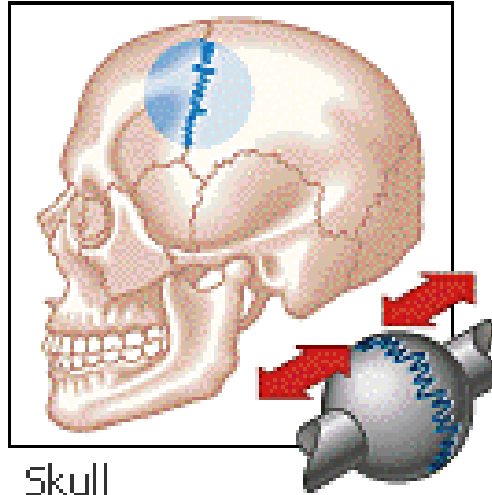
Pivot joint



Saddle joint

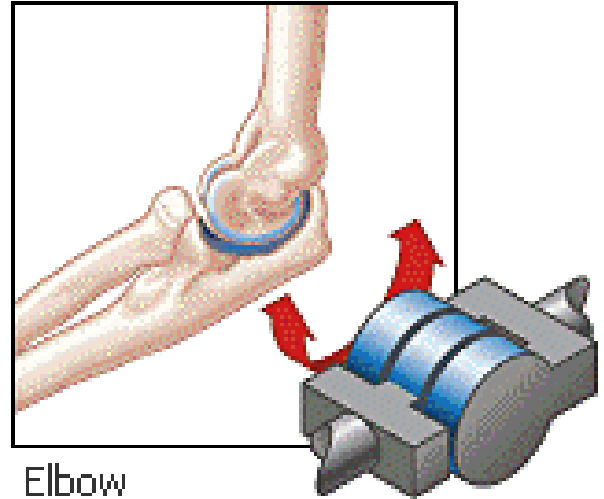


Suture



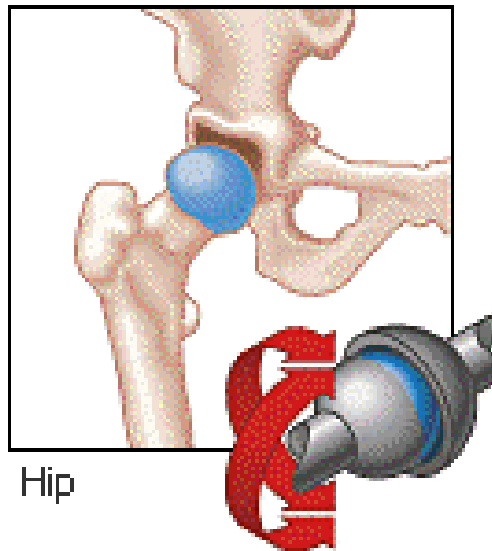
Skull

Hinge



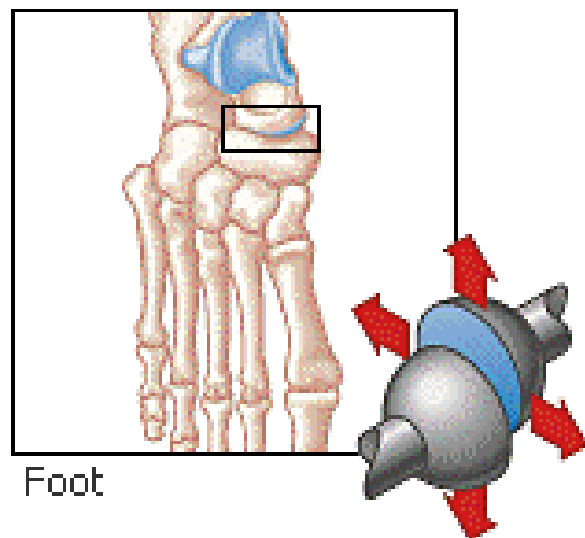
Elbow

Ball-and-socket



Hip

Gliding



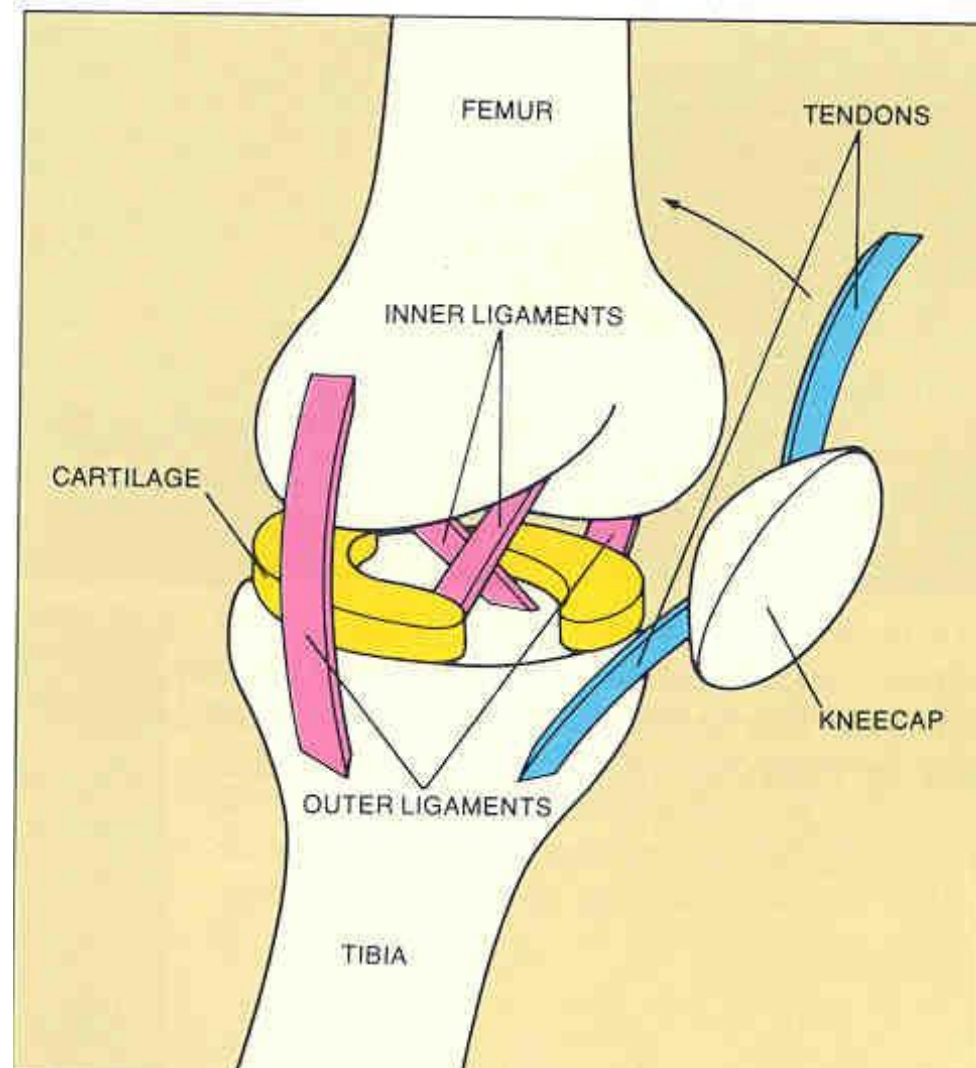
Foot

Ligaments are embedded in bone on either side of joint

- connect the bones
- reinforce the articulations
- contribute to joint stability

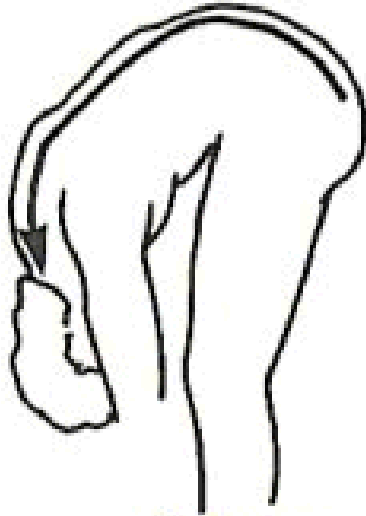
LIGAMENTS

- **Ligaments are bands of dense, regularly arranged connective tissue that cross joints and frequently form an articular capsule about the joint**



Range of Movement

Spinal Column



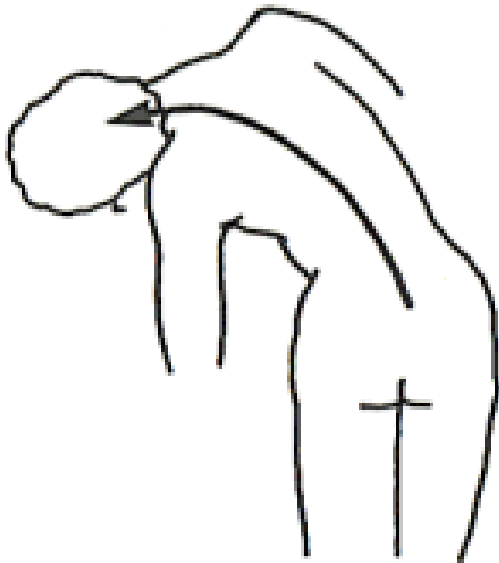
Flexion



Extension

- The vertebral column has the following normal ranges of movement: Flexion, Extension, Lateral Flexion and Rotation.

Spinal Column



Lateral Flexion

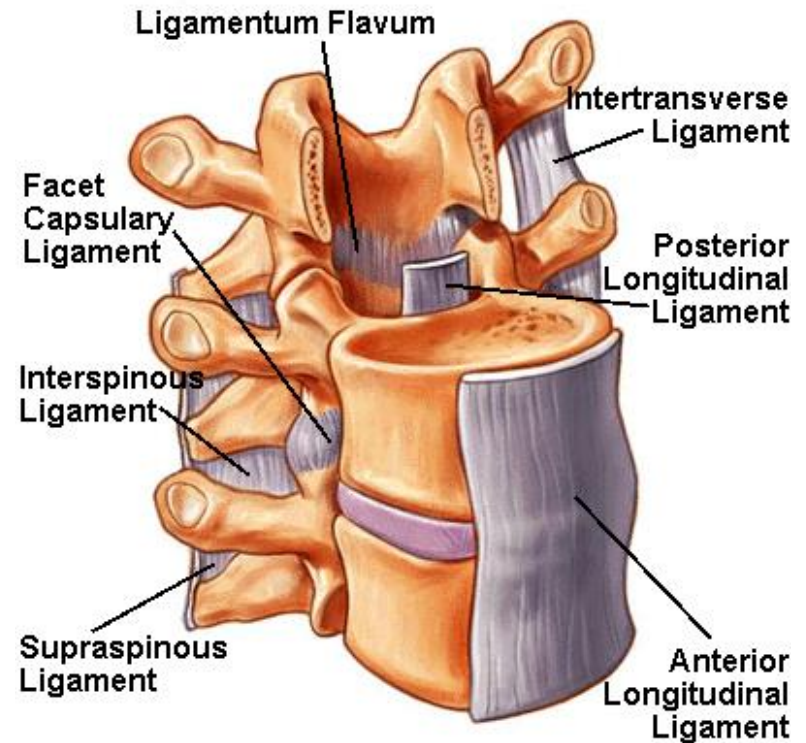


Rotation

- The vertebral column has the following normal ranges of movement: Flexion, Extension, Lateral Flexion and Rotation.

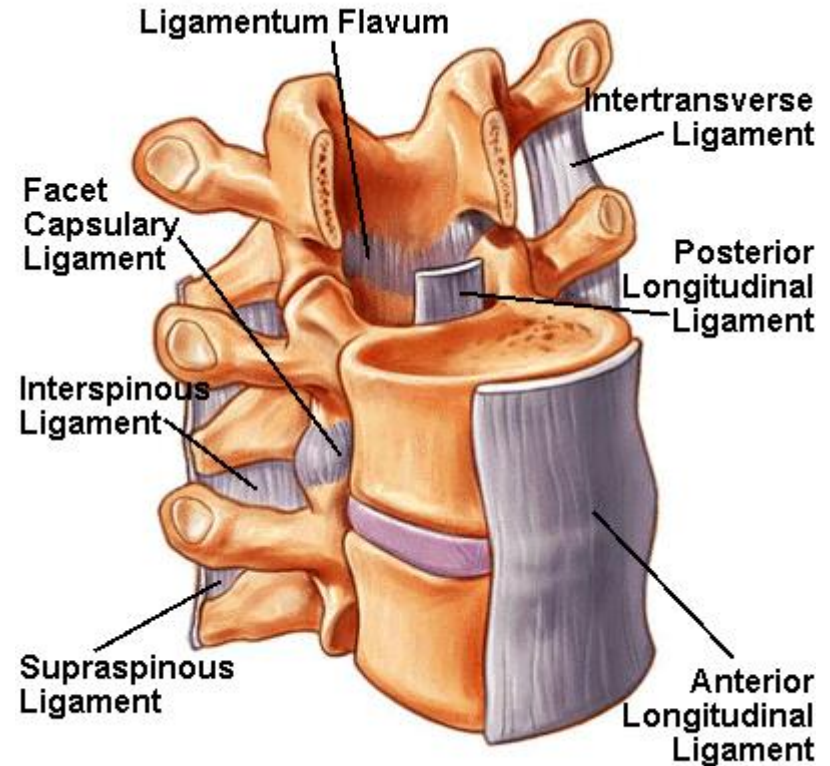
Articulations of vertebrae

- **Symphysis/Symphysis**
- The vertebral bodies articulate one with another (and also with the sacrum) by means of *the intervertebral discs (discus intervertebrale)*.
 - Each disc is a fibrocartilaginous plate whose periphery is formed of concentric layers of connective-tissue fibres. These fibres are called *the anulus fibrosus (annulus fibrosus)*.
 - The central part of the plate is *the nucleus pulposus (nucleus pulposus)* consisting of soft fibrous cartilage.



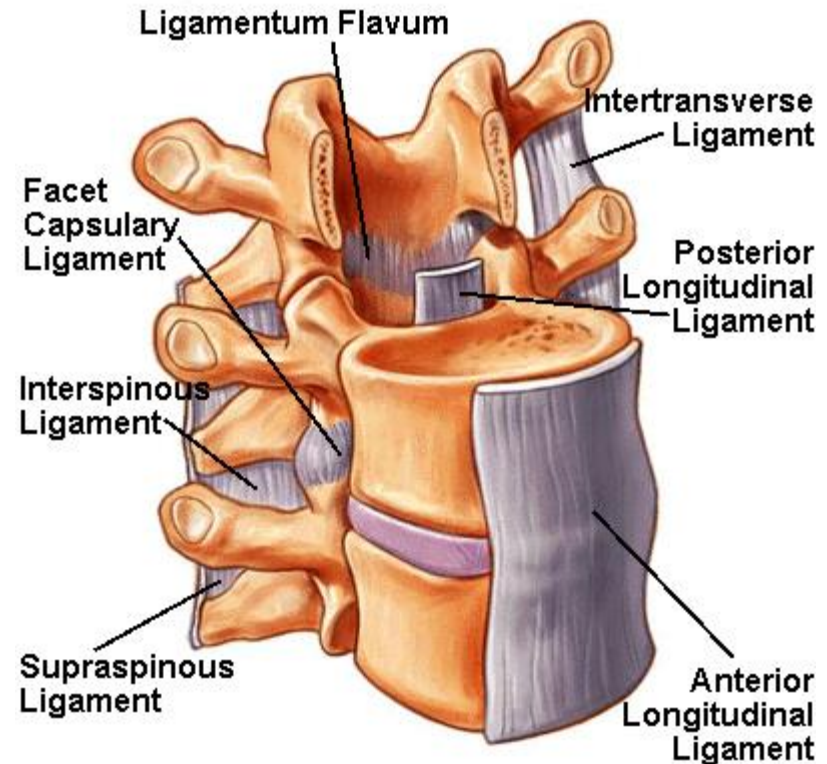
Articulations of vertebrae

- **Syndesmosis**
- *The anterior longitudinal ligament (lig. longitudinale anterius)* stretches on the anterior surface of the vertebral bodies and discs from the anterior tubercle of the atlas to the upper part of the pelvic surface of the sacrum.
- *The posterior longitudinal ligament (lig. longitudinale posterius)* extends on the posterior surface of the vertebral bodies in the vertebral canal from the second cervical vertebra to the upper end of the sacral canal.



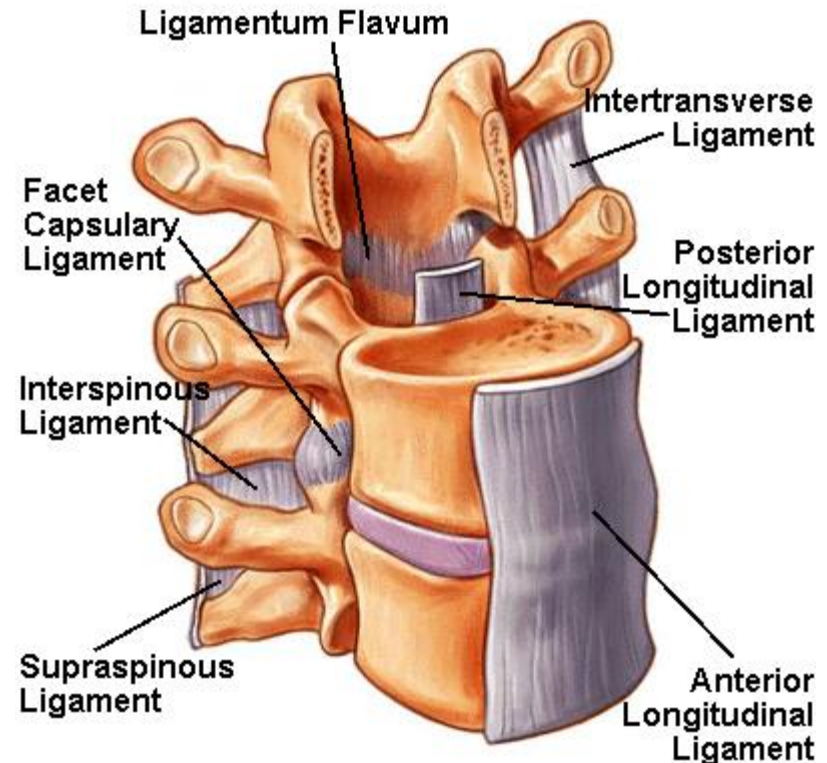
Articulations of vertebrae

- **Syndesmosis**
- The spaces between the arches are filled by elastic fibres of yellow colour which are called *yellow ligaments (ligg. flava)*.
- The ligaments between the spinous processes are *the interspinous ligaments (ligg. interspinalia)*. The part of these ligaments stretched over the apices of the spinous processes is *the supraspinous ligament (lig. supraspinale)*.
- *The intertransverse ligaments (ligg. intertransversaria)* are between the transverse processes.

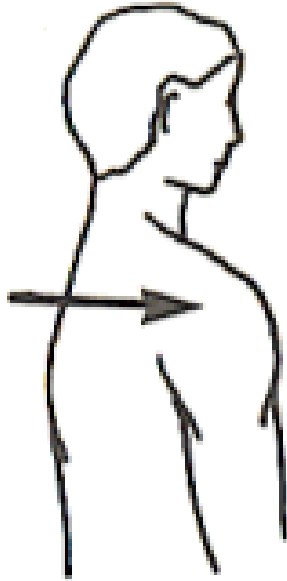


Articulations of vertebrae

- **Zygapophysial joints**
- Articular surfaces. Facies articularis superior of articular process of one vertebra – facies articularis inferior of articular process of the vertebra above it.
- Articular capsule is attached along the borders of articular surfaces.
- Description. Simple plane combined joint.



Shoulder Girdle



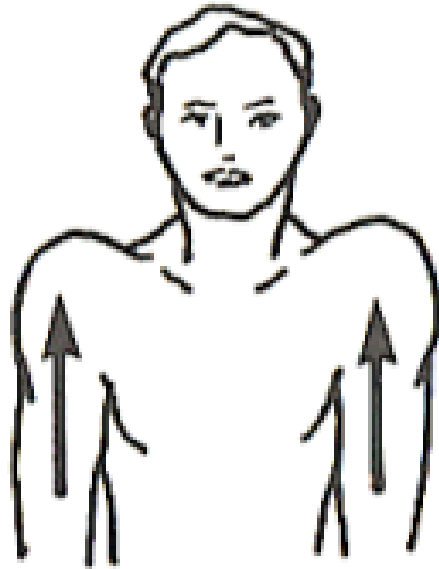
Abduction



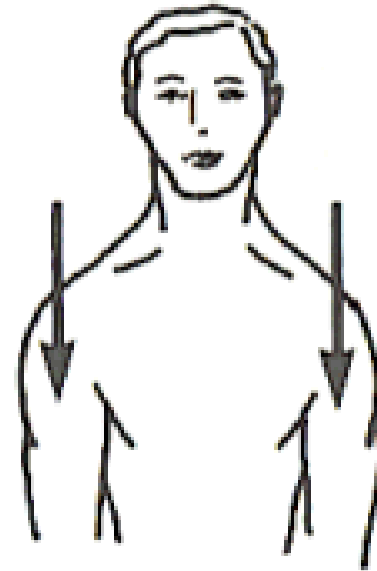
Adduction

- The shoulder girdle has the following normal ranges of movement: Elevation, Depression, Adduction and Abduction.

Shoulder Girdle



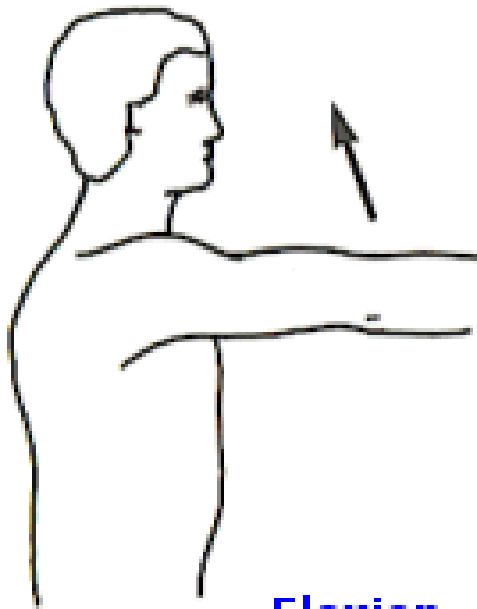
Elevation



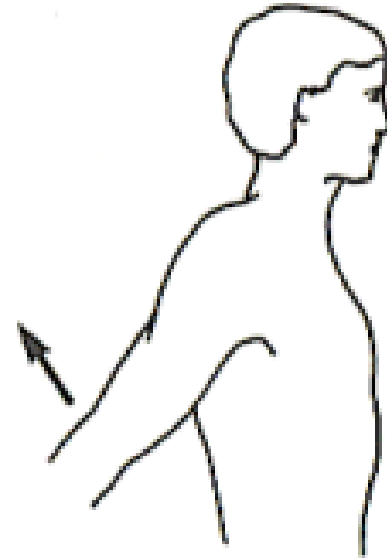
Depression

- The shoulder girdle has the following normal ranges of movement: Elevation, Depression, Adduction and Abduction.

Shoulder Joint



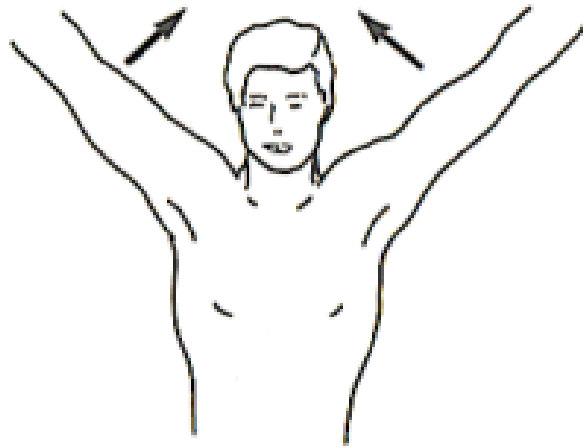
Flexion



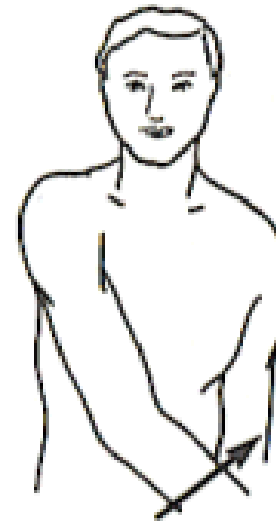
Extension

- The shoulder joint has the following normal ranges of movement: Flexion, Extension, Adduction, Abduction and Medial Rotation.

Shoulder Joint



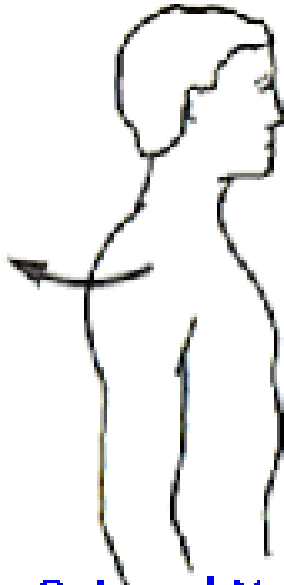
Abduction



Adduction

- The shoulder joint has the following normal ranges of movement: Flexion, Extension, Adduction, Abduction and Medial Rotation.

Shoulder Joint



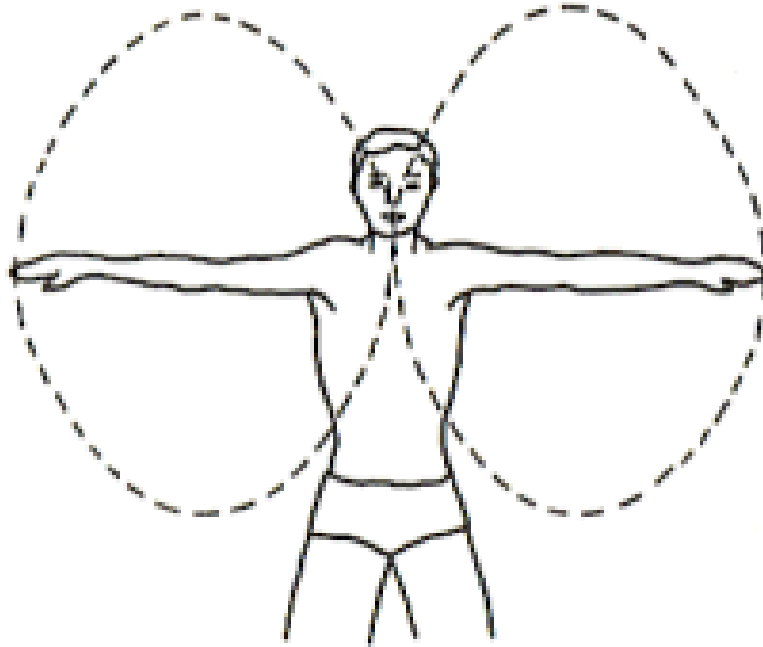
**Outward Medial
Rotation**



Inward Medial Rotation

- The shoulder joint has the following normal ranges of movement: Flexion, Extension, Adduction, Abduction and Medial Rotation.

Shoulder Joint

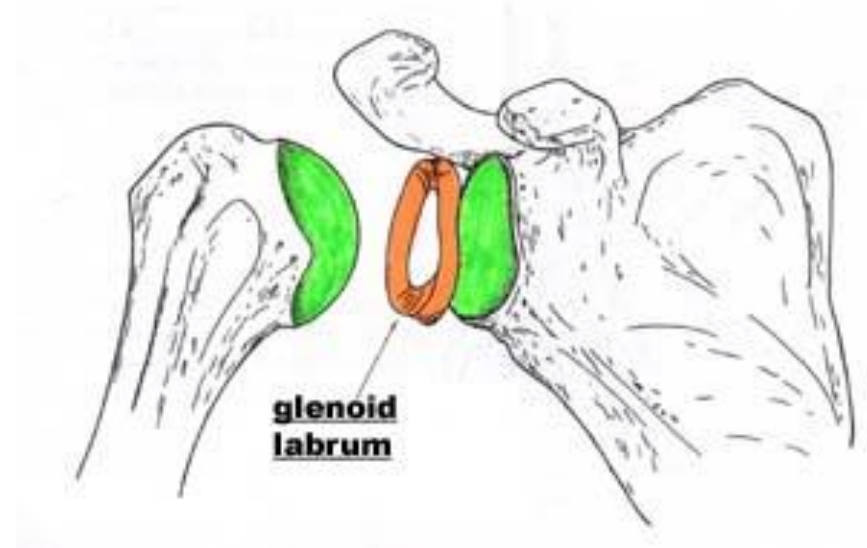


Circumduction

- The shoulder joint has the following normal ranges of movement: Flexion, Extension, Adduction, Abduction and Medial Rotation.

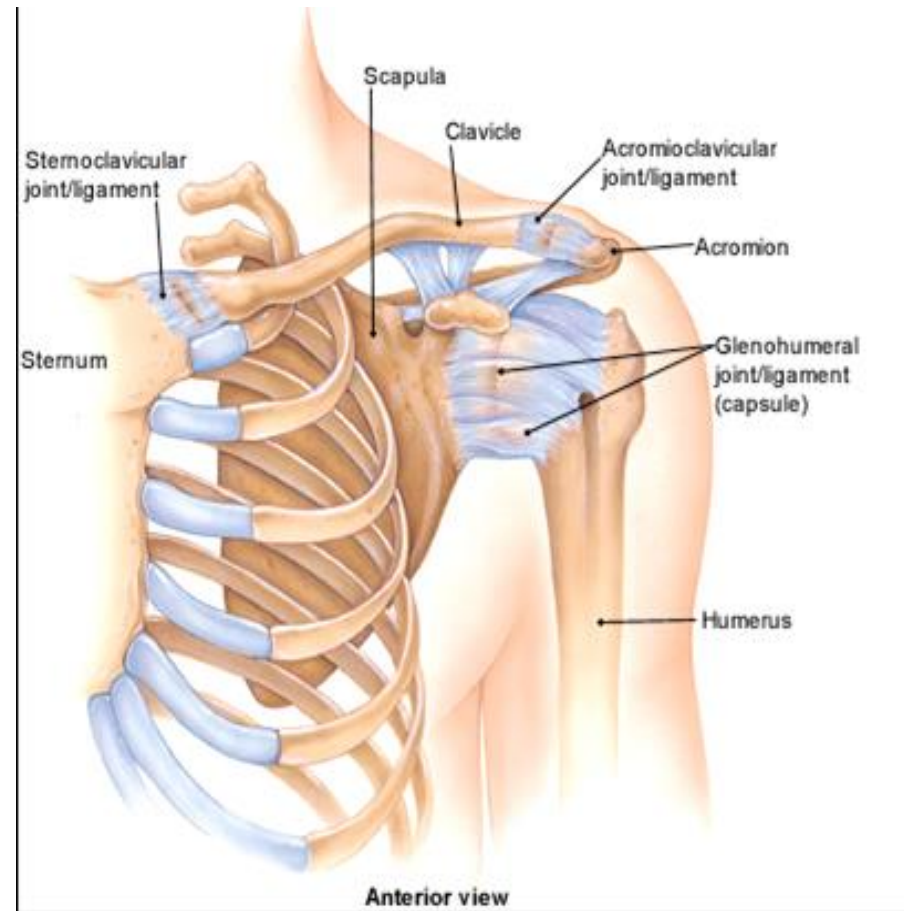
Shoulder joint (articulatio humeri)

- Articular surfaces:
- Caput humeri and cavitas glenoidale.
- **Labrum glenoidale** is on the circumference of the cavitas glenoidale. It increases its depth (increase congruence).



Articular capsule

- It is attached to the bony border of the glenoid cavity, embraces the head of humerus and terminates on the anatomical neck.
- It bridges the intertubercular groove with the long head of the biceps muscle. The synovial membrane has extraarticular protrusion called the intertubercular synovial sheath (vagina synovialis intertubercularis/) encompasses the long head of the biceps muscle.



Ligaments

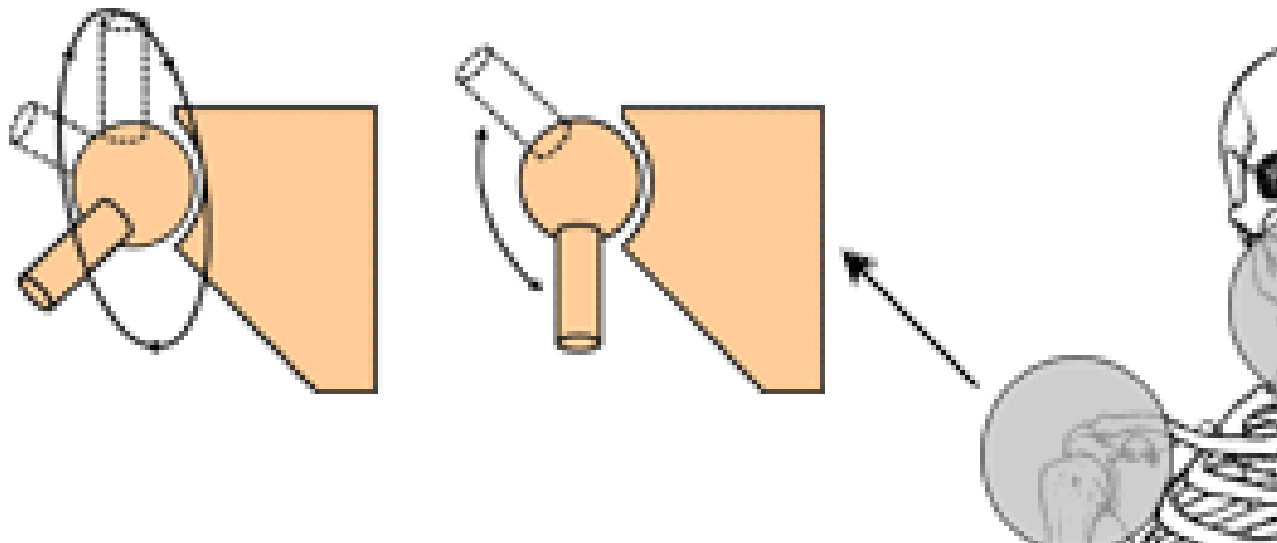
- **lig. coracohumerale**
from the root of the coracoid process to the greater tubercle of the humerus.



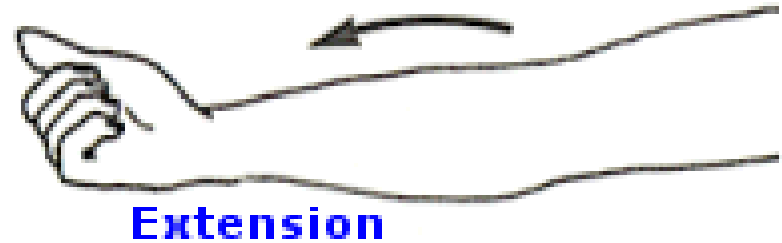
Description.

- Simple spheroidal joint.

Ball and Socket



Elbow Joint



- The elbow joint has the following normal ranges of movement: Flexion, Extension, Pronation and Supination.

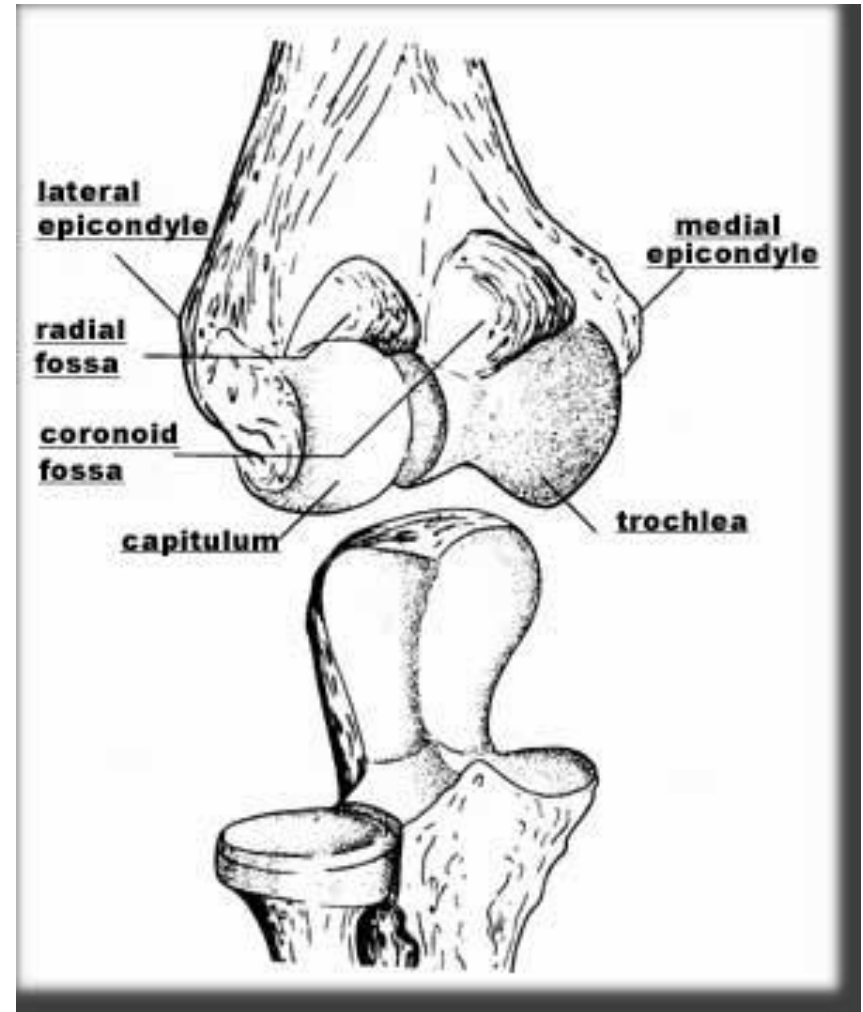
Elbow Joint



- The elbow joint has the following normal ranges of movement: Flexion, Extension, Pronation and Supination.

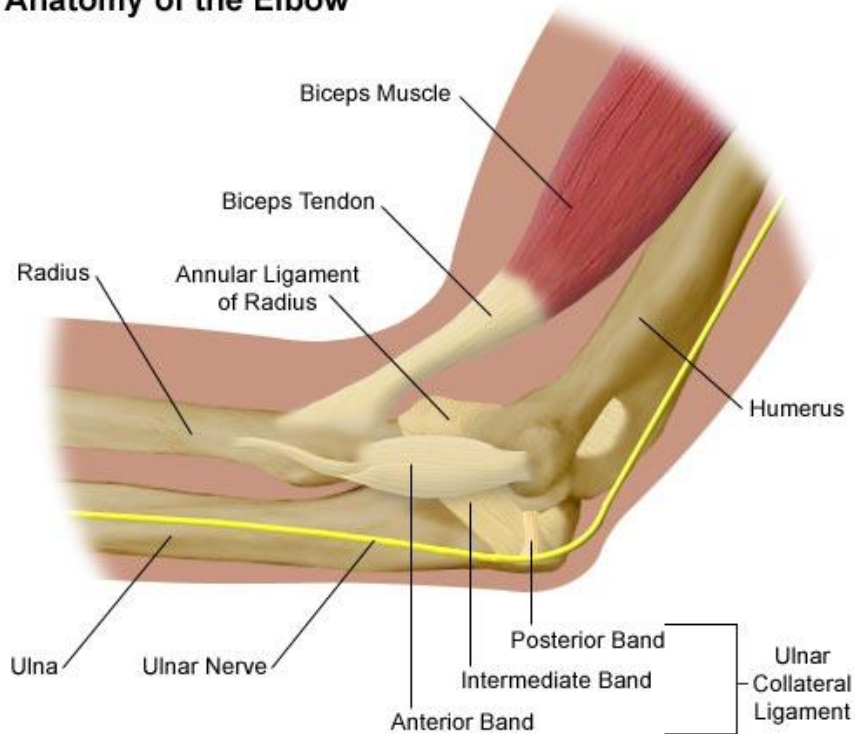
Articulatio cubiti

- Three articulating bones form three joints invested in a common capsule
- Articular capsule embraces the olecranon, radial and coronoid fossae but leaves the epicondyles free.



Articulatio humeroulnaris

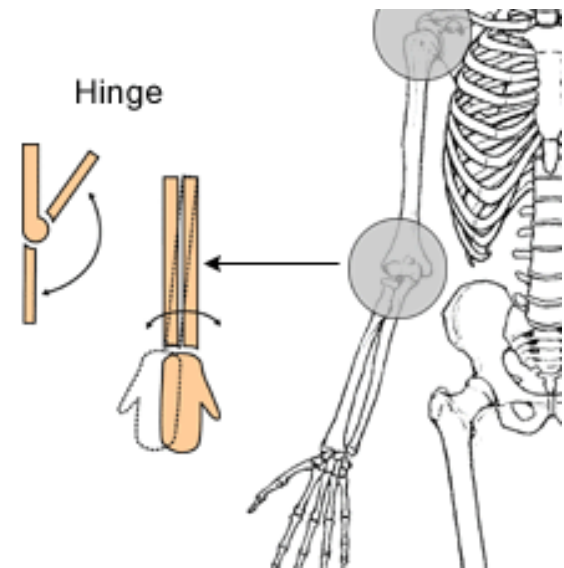
Anatomy of the Elbow



Articular surfaces:

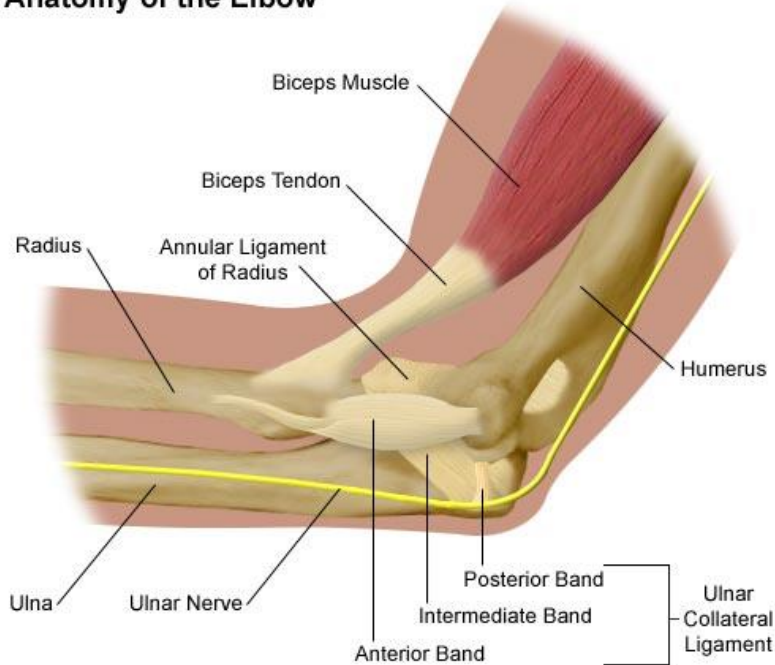
Trochlea humeri and
incisura trochlearis

Description. Hinge joint.

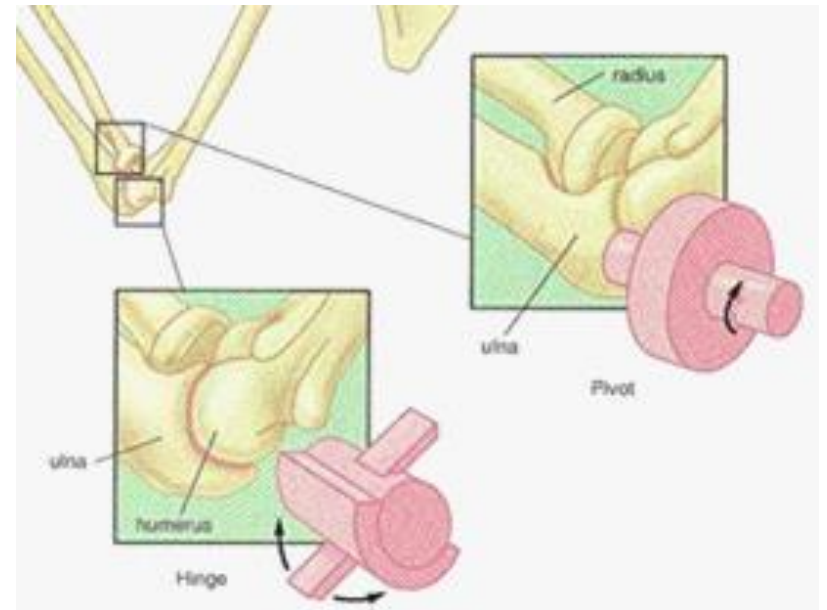


Articulatio humeroradialis

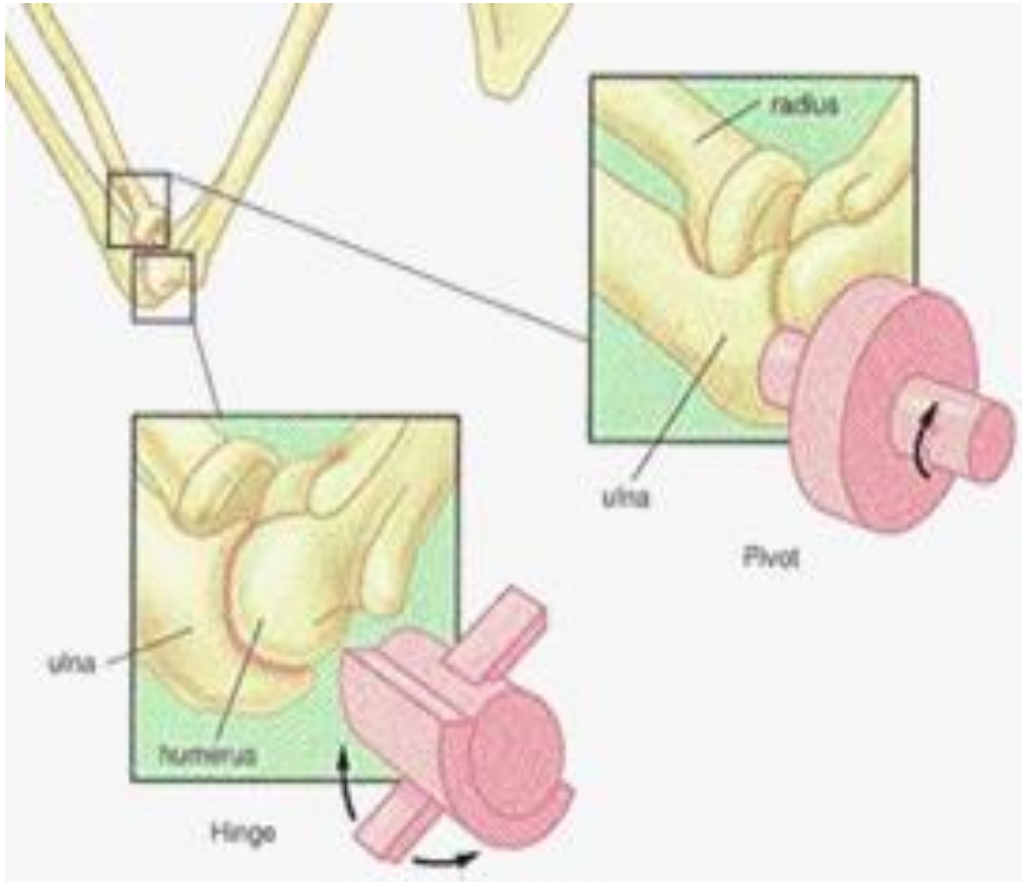
Anatomy of the Elbow



- Articular surfaces: capitulum humeri and fovea articularis capitis radii.
- Description. Spheroidal joint.



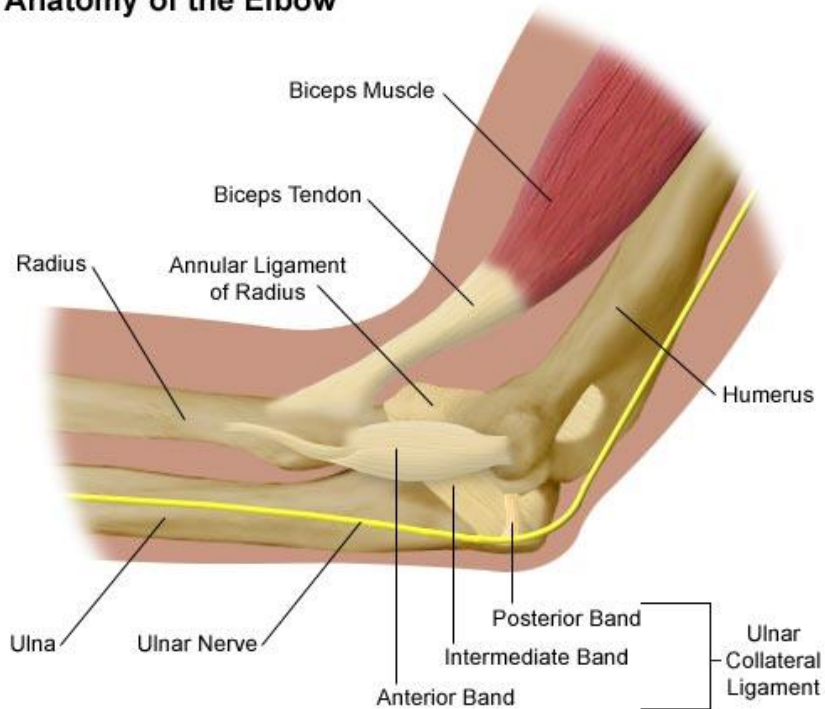
Articulatio radioulnaris proximalis



- Articular surfaces:
circumferentia radii
and incisura radialis
ulnae.
- Description.
Cylindrical, combined
(with the distal radio-
ulnar joint) joint.

Ligaments

Anatomy of the Elbow



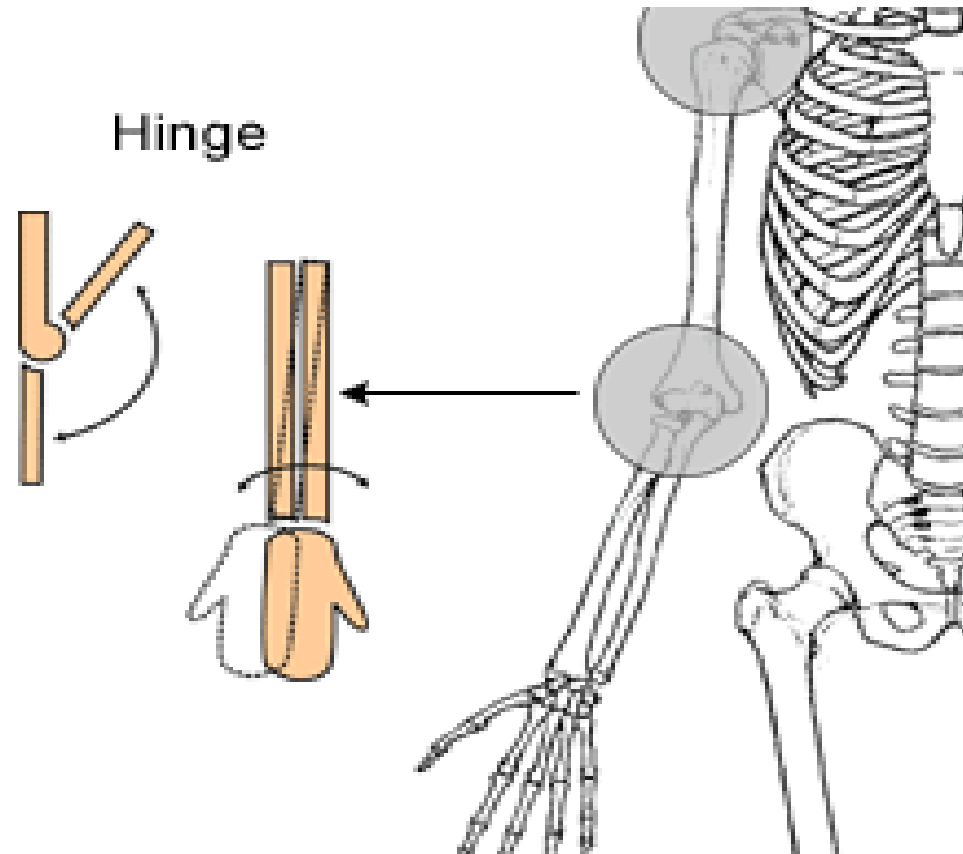
lig. collaterale ulnare from the medial epicondyle of the humerus to the medial margin of the trochlear notch of the ulna.

lig. collaterale radiale from the lateral epicondyle of the humerus to the anterior and posterior margins of the radial notch of the ulna.

lig. anulare radii encircles the neck and head of the radius. It is attached to the anterior and posterior margins of the radial notch of the ulna.

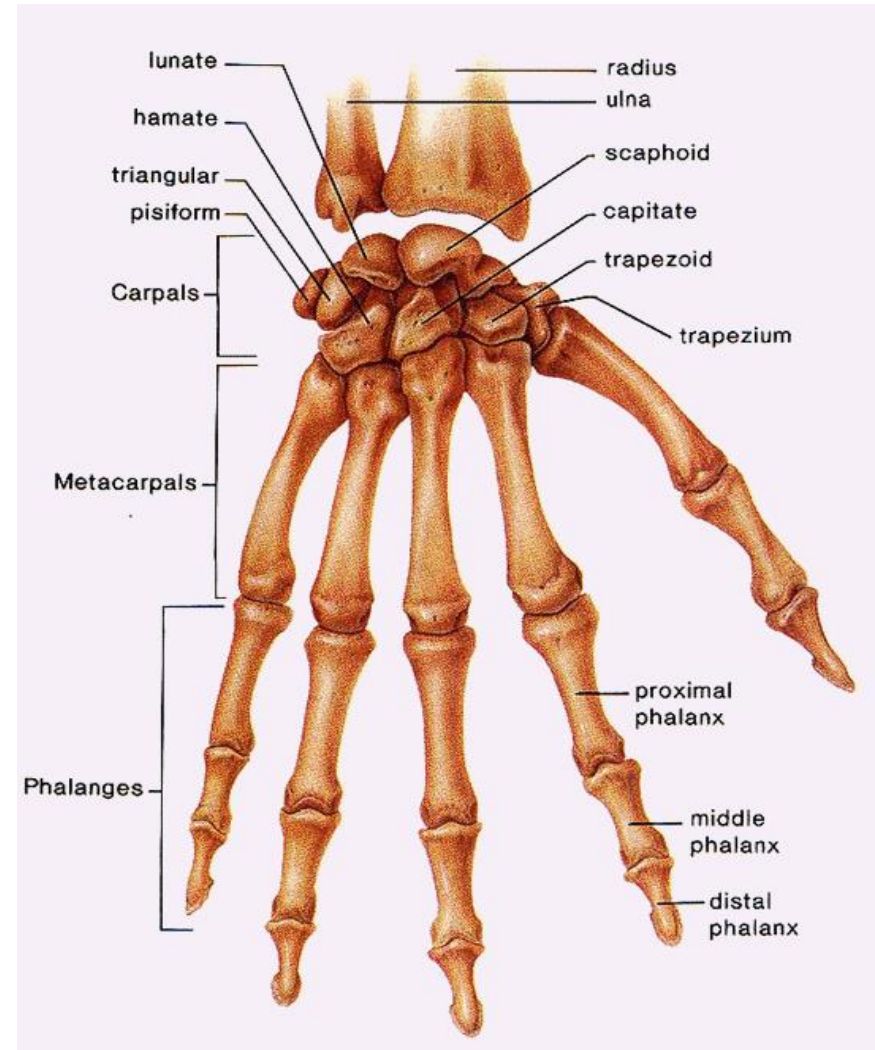
Description.

- Complex hinge joint with screwing motion.



Articulatio radiocarpalis

- Articular surfaces
Facies articularis carpalis radii and the discus articularis – scaphoid, lunate and triquetral bones.
- Articular capsule is attached to the borders of articular surfaces.



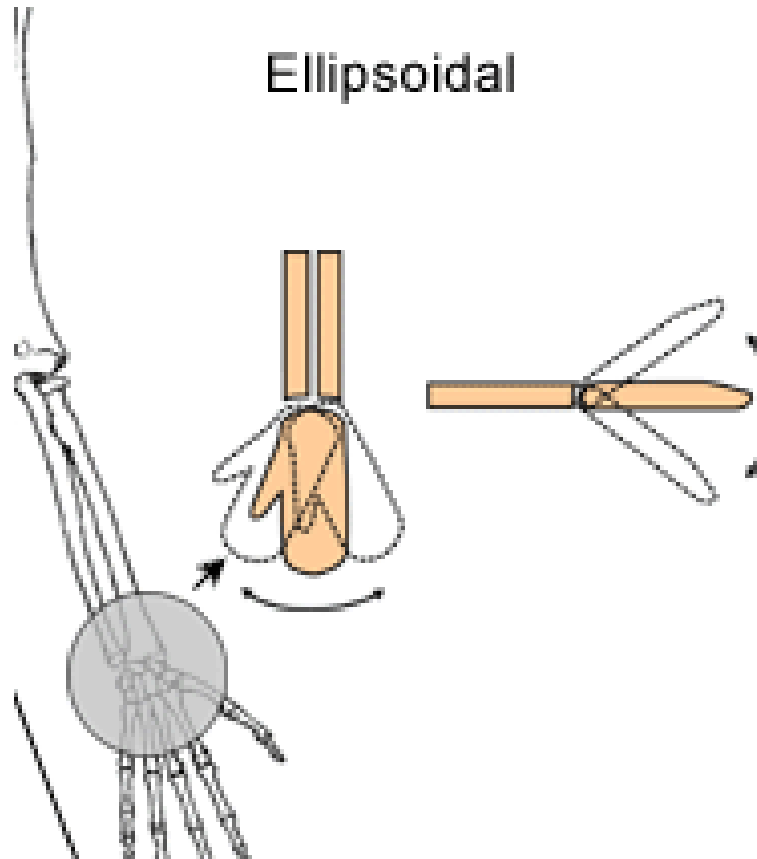
Ligaments

- **lig. radiocarpale dorsale** from the posterior surface of the articular surface of the radius to the bones of the first carpal row.
- **lig. radiocarpale palmare** from the anterior surface of the articular surface of the radius to the bones of the first carpal row and capitate bone.
- **lig. collaterale carpi ulnare** from the styloid process of the ulna to the triquetral and pisiform bones.
- **lig. collaterale carpi radiale** from the styloid process of the radius to the scaphoid bone.

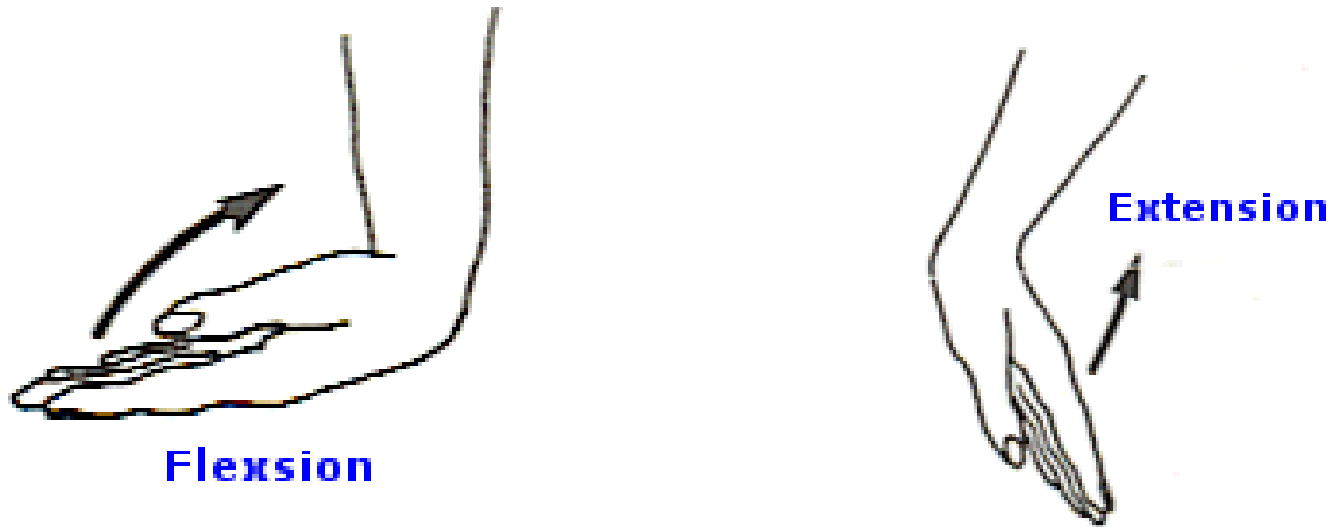


Description.

- Complex ellipsoid joint

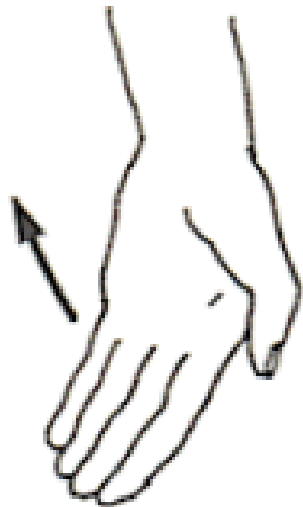


Wrist Joint

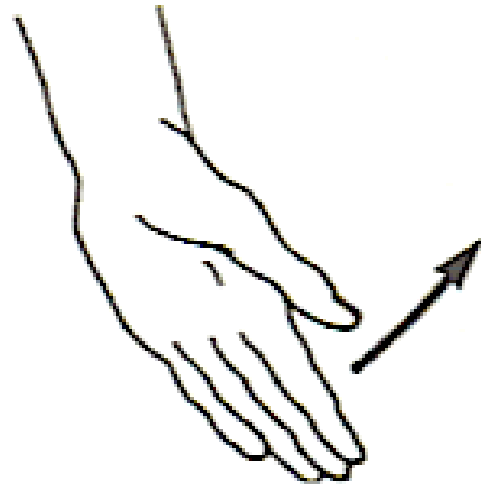


- The wrist joint has the following normal ranges of movement: Flexion, Extension, Adduction, Abduction and Circumduction.

Wrist Joint



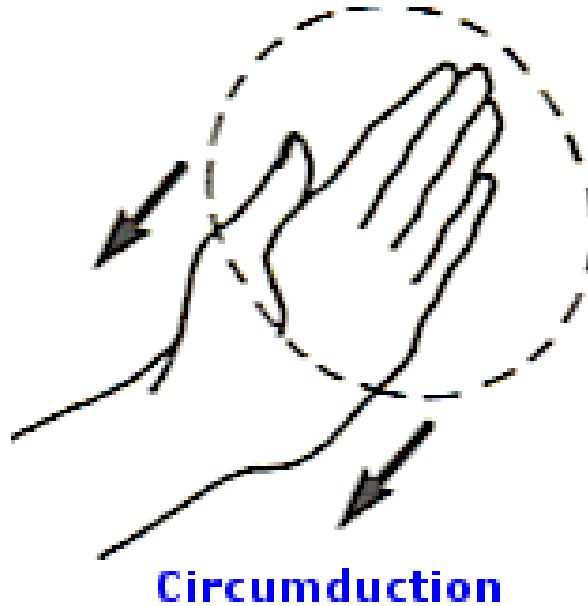
Adduction



Abduction

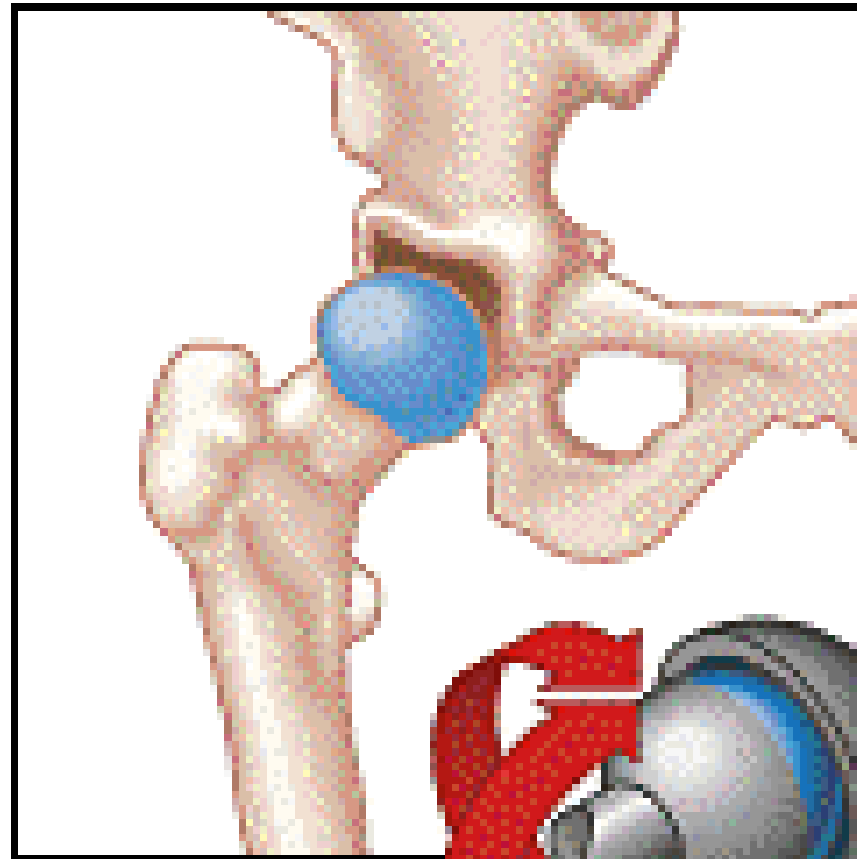
- The wrist joint has the following normal ranges of movement: Flexion, Extension, Adduction, Abduction and Circumduction.

Wrist Joint

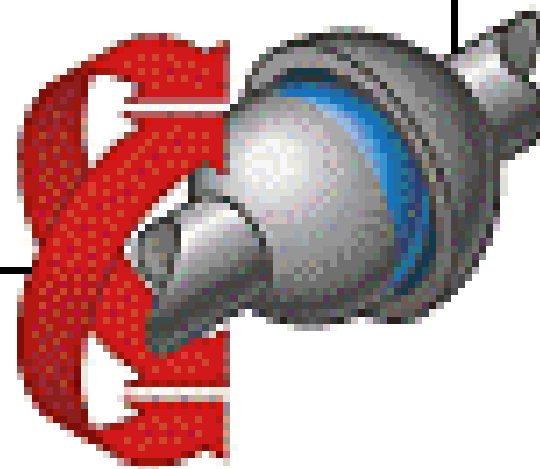


- The wrist joint has the following normal ranges of movement: Flexion, Extension, Adduction, Abduction and Circumduction.

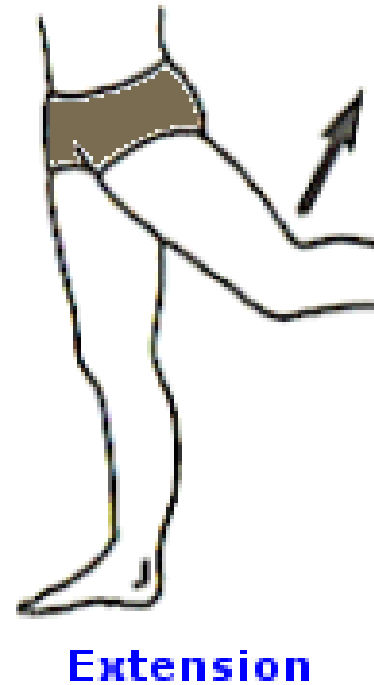
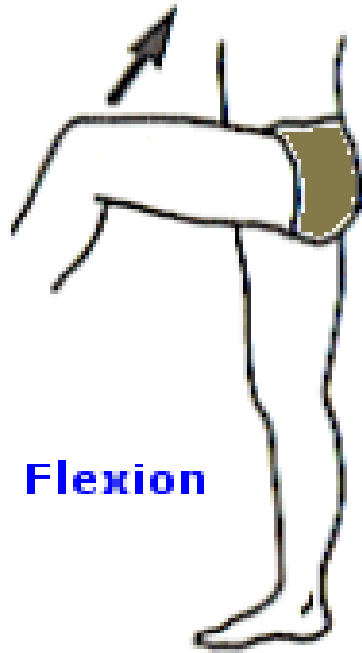
Ball-and-socket



Hip

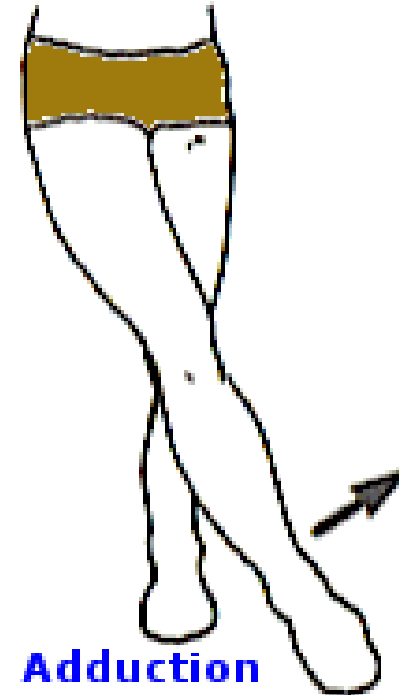
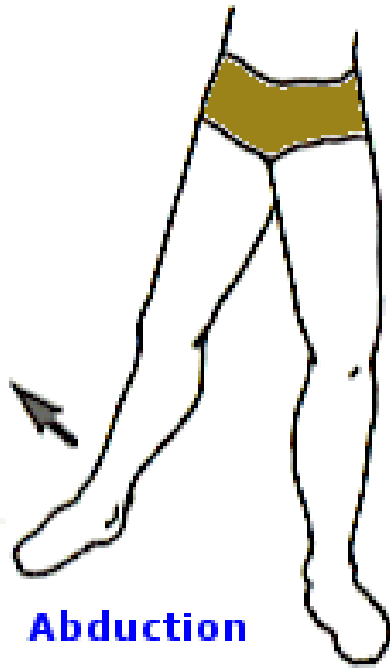


Hip Joint



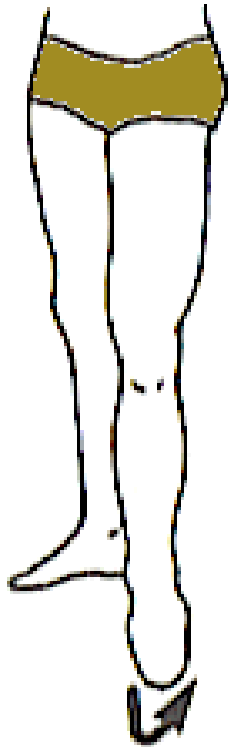
- The hip joint has the following normal ranges of movement: Flexion, Extension, Adduction, Abduction, Medial Rotation and Lateral Rotation.

Hip Joint

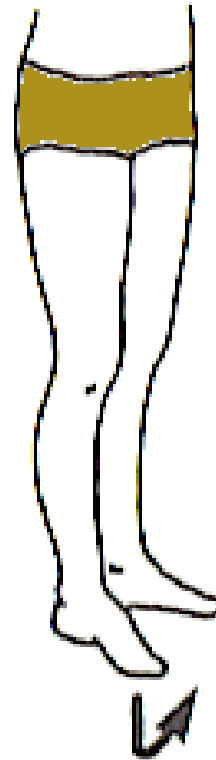


- The hip joint has the following normal ranges of movement: Flexion, Extension, Adduction, Abduction, Medial Rotation and Lateral Rotation.

Hip Joint



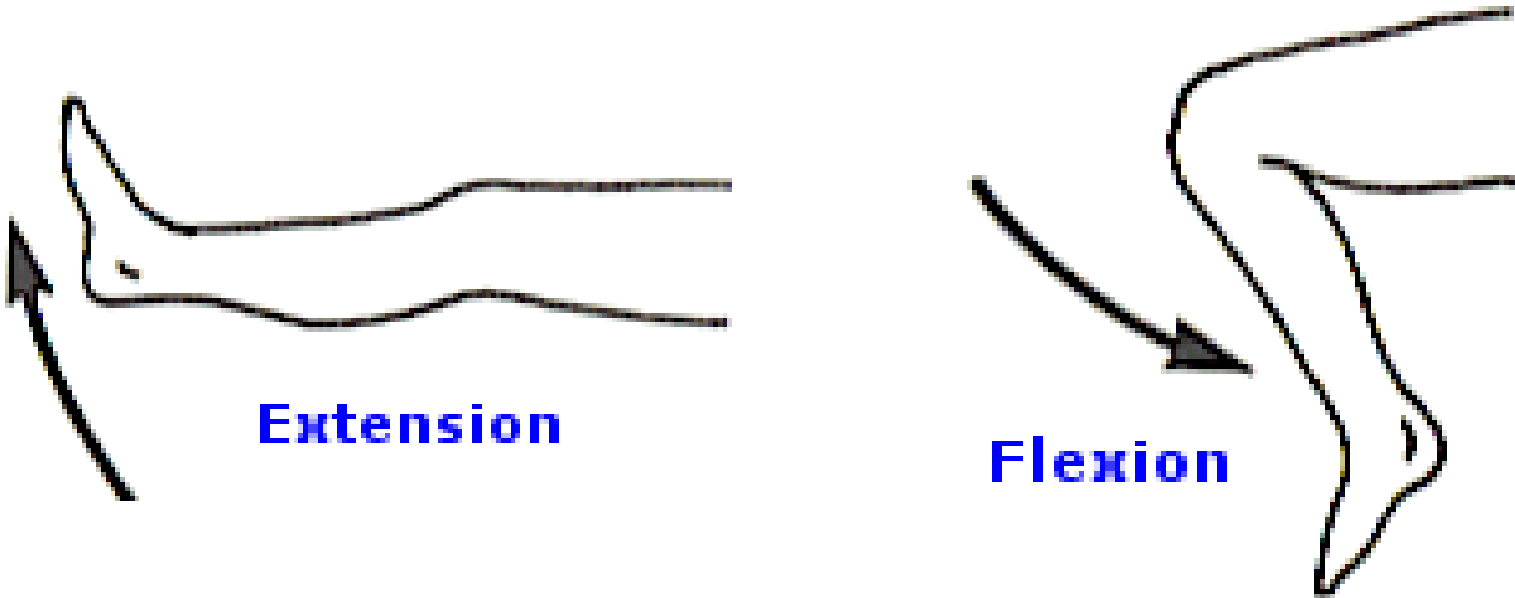
Lateral Rotation



Medial Rotation

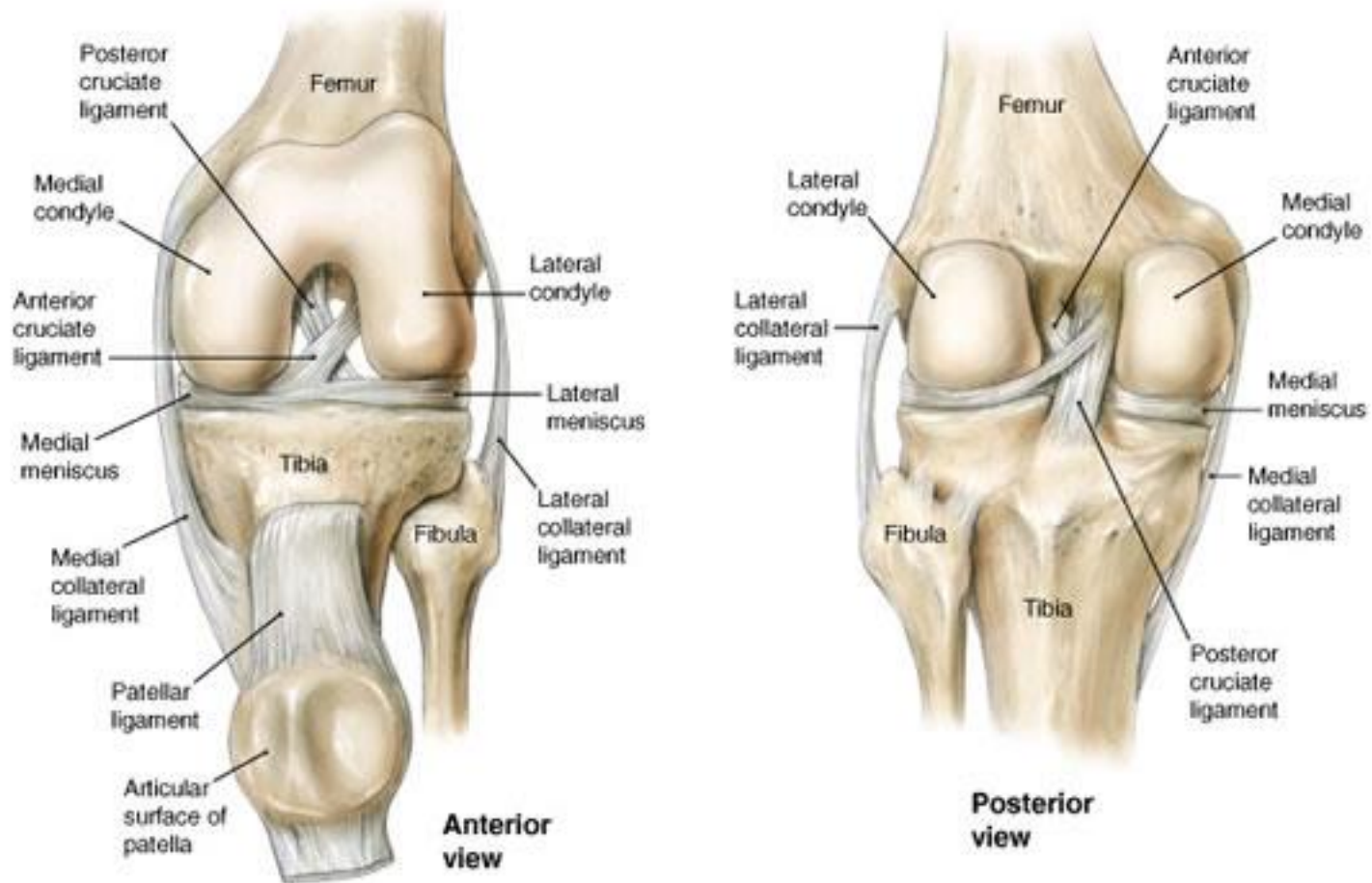
- The hip joint has the following normal ranges of movement: Flexion, Extension, Adduction, Abduction, Medial Rotation and Lateral Rotation.

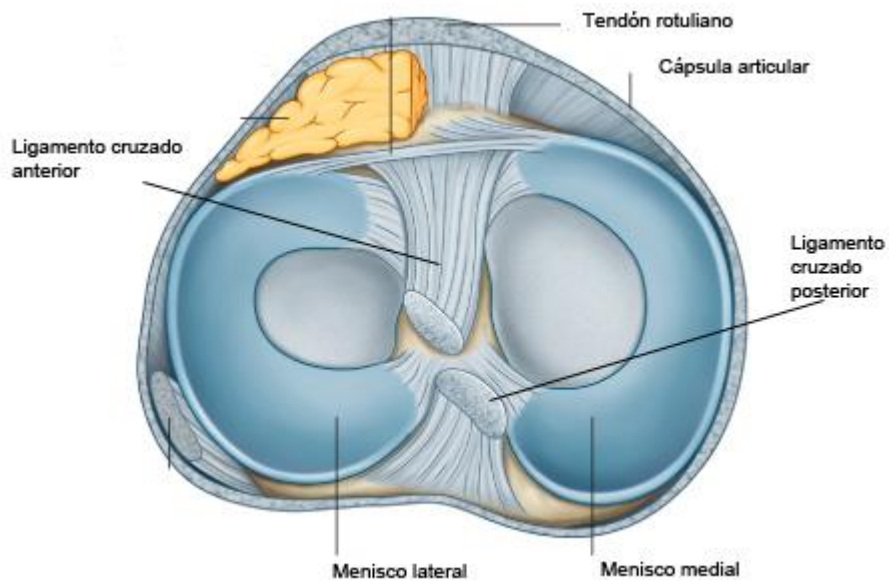
Knee Joint



- The knee joint has the following normal ranges of movement: Flexion and Extension

Normal Anatomy of the Left Knee



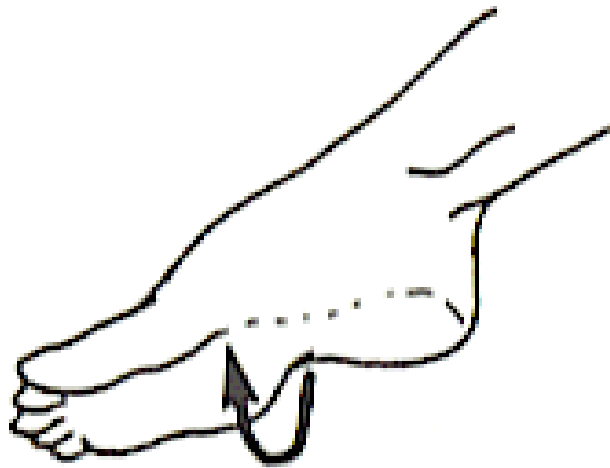


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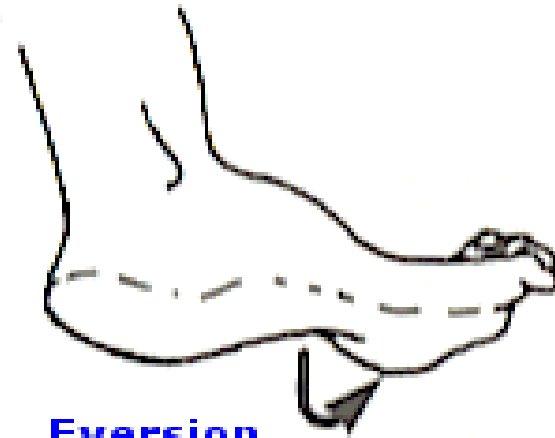


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Ankle Joint



Inversion



Eversion

- The ankle joint has the following normal ranges of movement: Plantar Flexion, Dorsi Flexion, Inversion and Eversion.

Ankle Joint



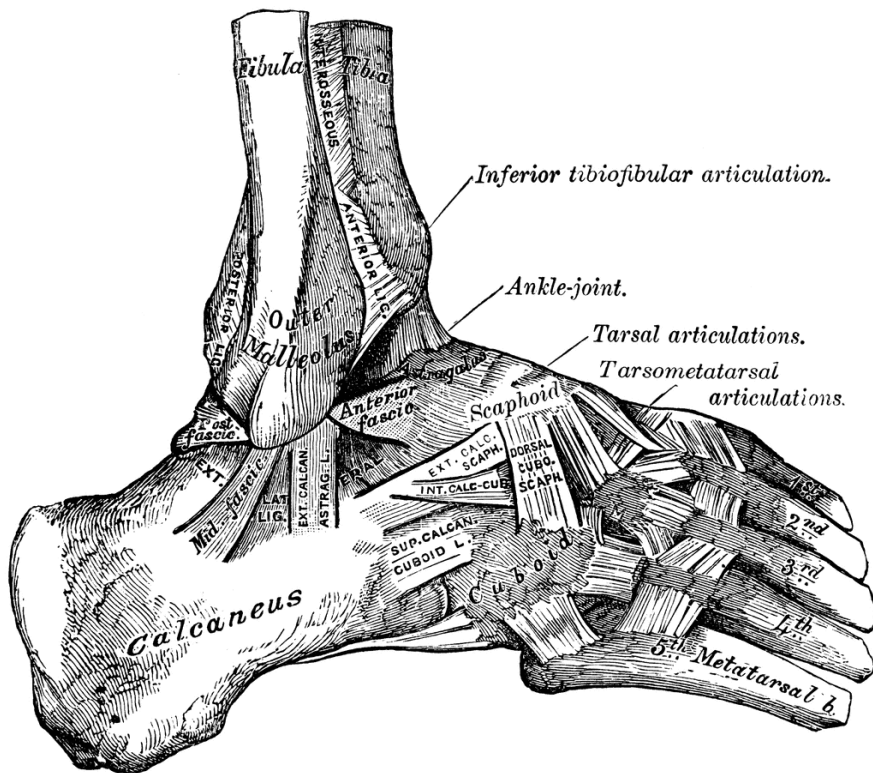
Plantar Flexion



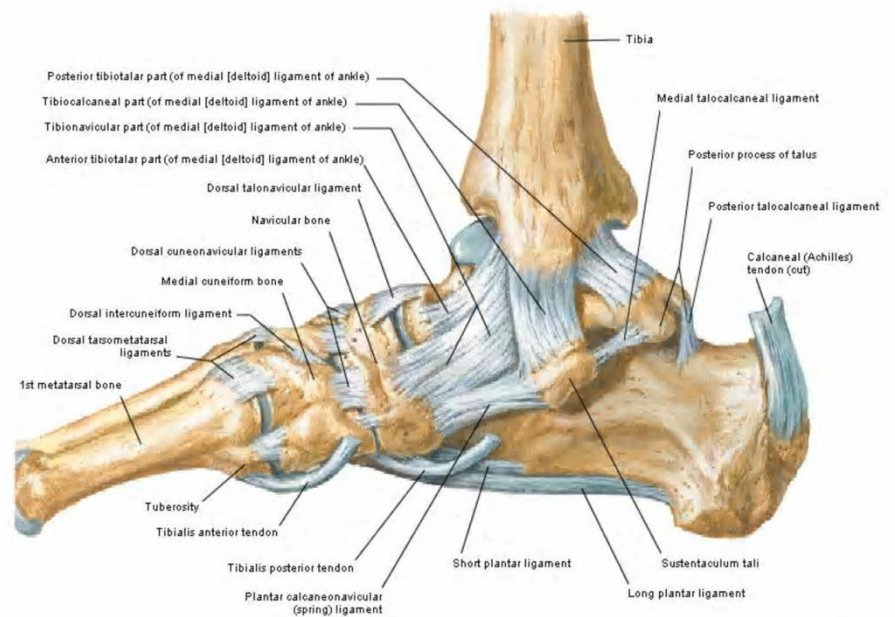
Dorsi Flexion

- The ankle joint has the following normal ranges of movement: Plantar Flexion, Dorsi Flexion, Inversion and Eversion.

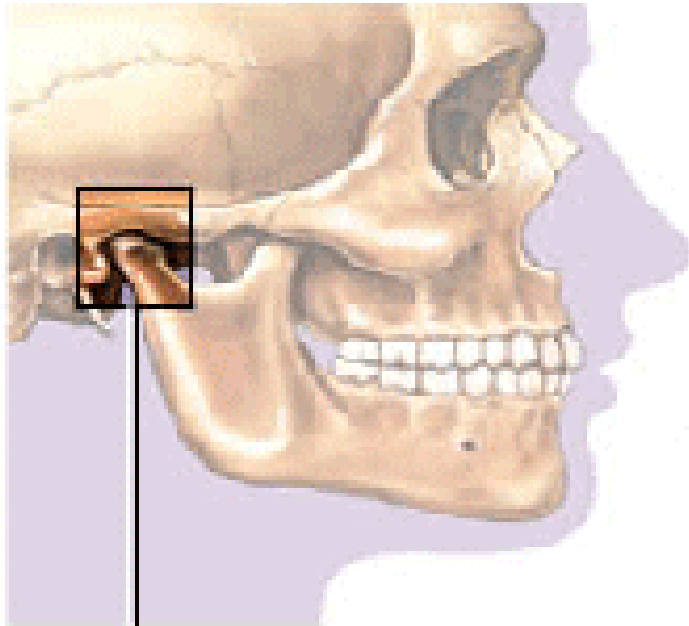
Ankle Joint



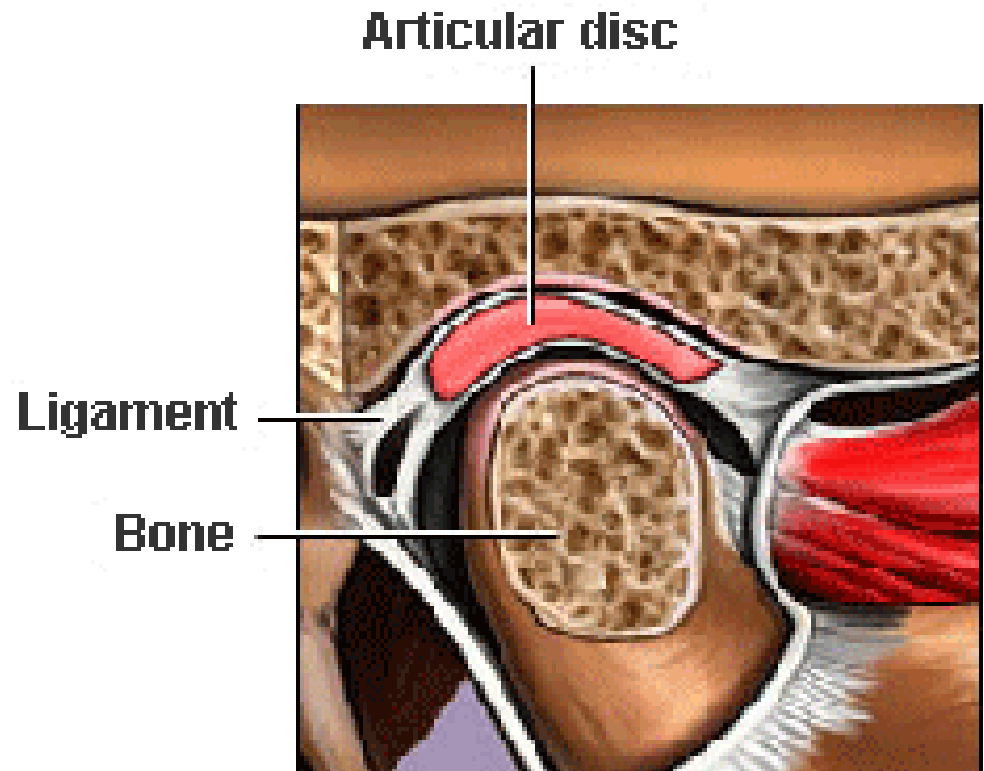
Ligaments and Tendons of Right Ankle
Medial View



The temporomandibular joint (articulatio temporomandibularis)

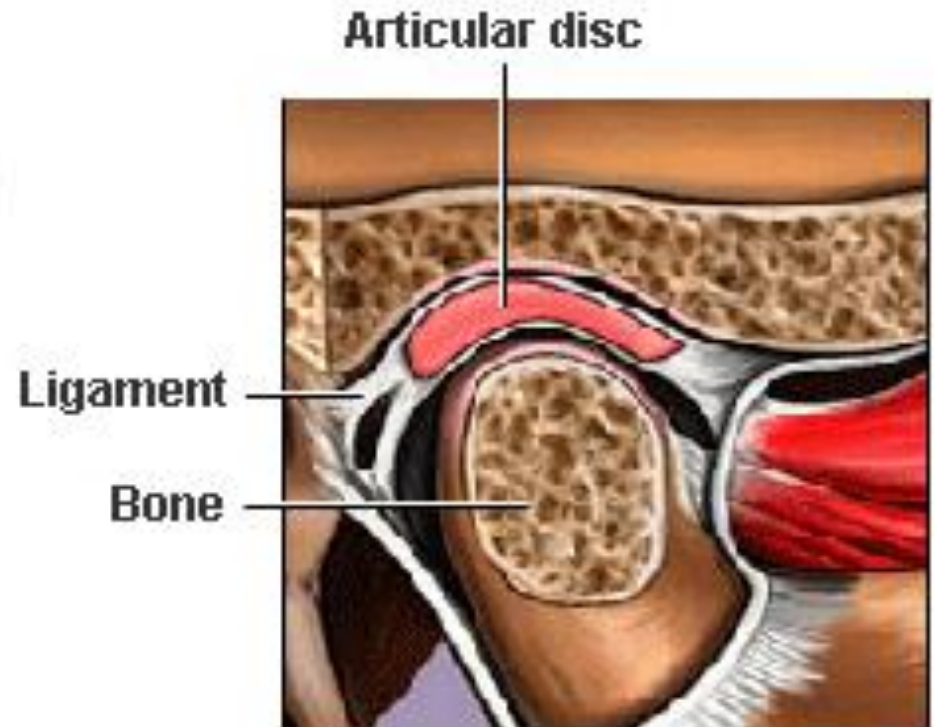


Temporomandibular joint
(TMJ)

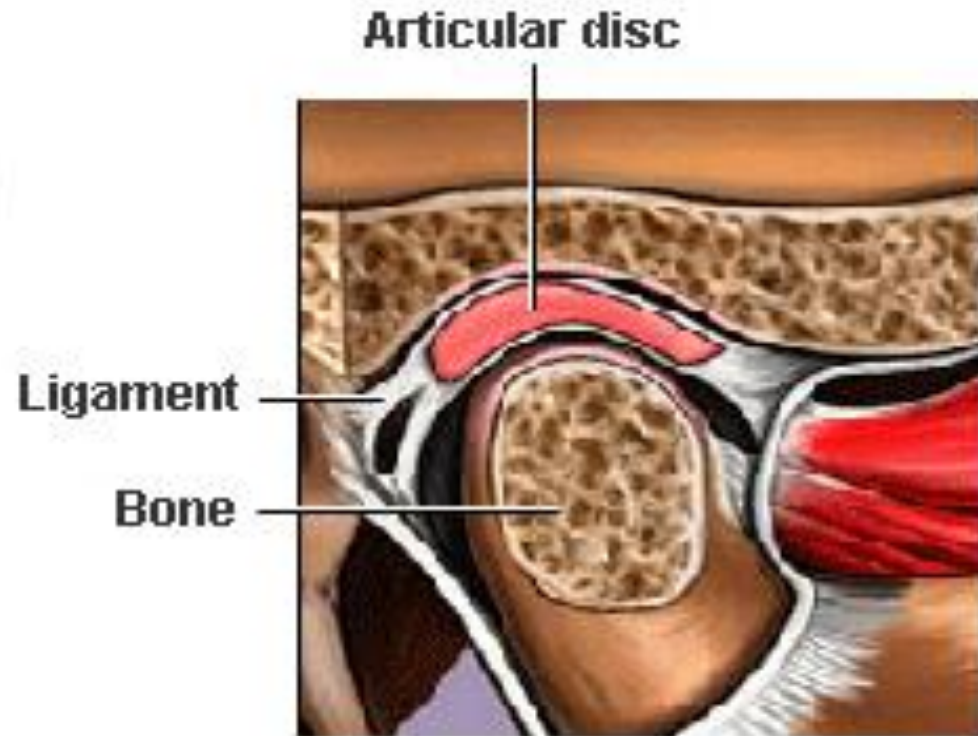


Articular surfaces

- Caput mandibulae and fossa mandibularis.
- The surfaces are complemented by **discus articularis** located between them. The edges of the disc are joined to the articular capsule as a result of which the articular cavity is separated into two isolated compartments.

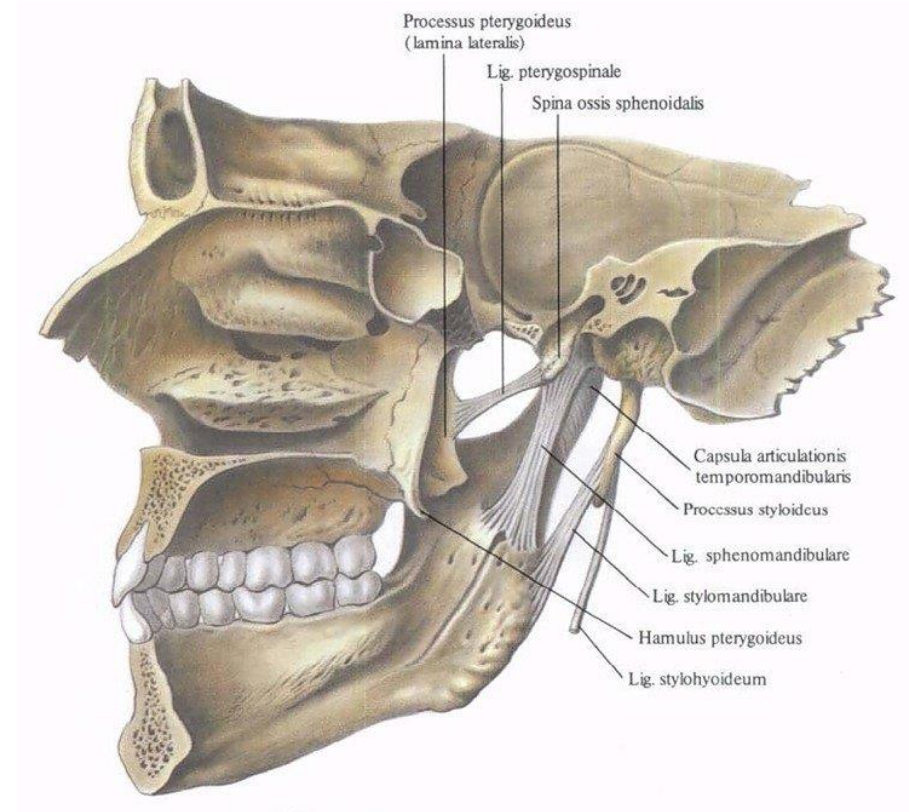


- **Articular capsule** is attached along the borders of articular surfaces. The mandibular neck is within the articular cavity.



Ligaments

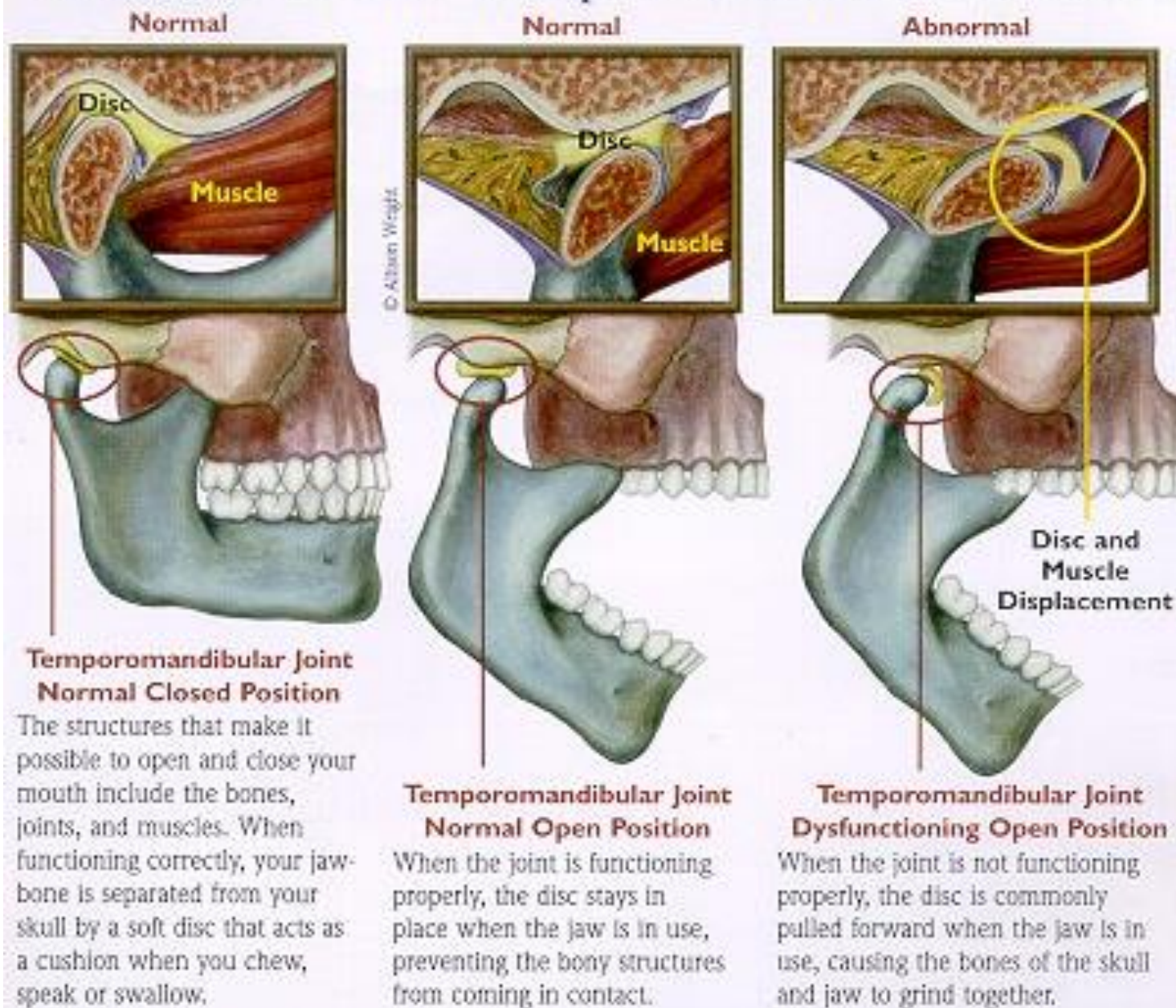
- **lig. laterale** passes on the lateral side of the joint from the zygomatic process of the temporal bone to the neck of the condylar process of the mandible.
- **lig. sphenomandibulare** from the sphenoidal spine to the mandibular lingula.
- **lig. stylomandibulare** from the styloid process to the inner surface of the angle of mandible.



Description.

- Simple bicondylar combined joint
 - Combine – left working with right

Function of the Temporomandibular Joint



- Opening of the lower jaw:
- 1. movement in inferior compartment, caput mandibulae slides anteriorly along discus articulare.
- 2. movement in superior compartment, discus articulare slides anteriorly long tuberculum articulare.
- 3. maximal opening of the lower jaw, movement in inferior compartment, caput mandibulae slides anteriorly along discus articulare.

- Lateral movements of the lower jaw:
- Example – to the right.
- 1. on the left side movement in inferior compartment, caput mandibulae slides anteriorly along discus articulare.
- 2. on the right caput mandibulae rotates laterally.