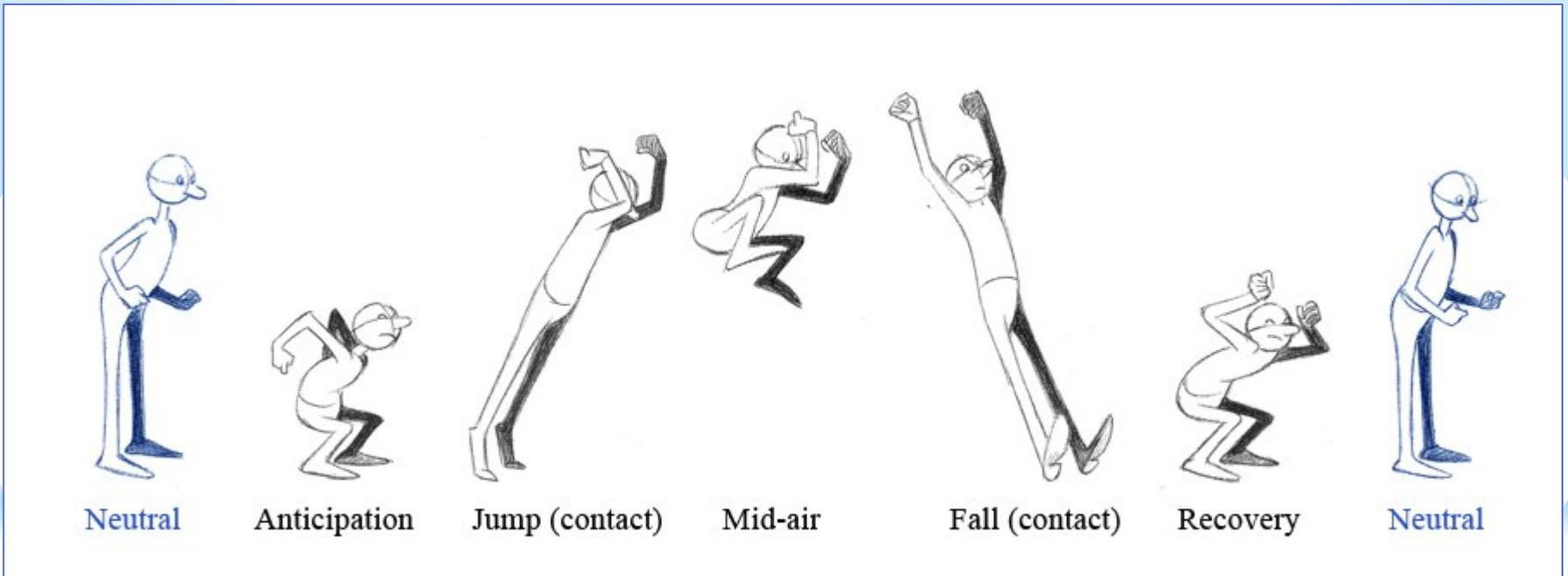


* Articular system II



Senior lecturer: Pevnev G.O.

* Cartilages

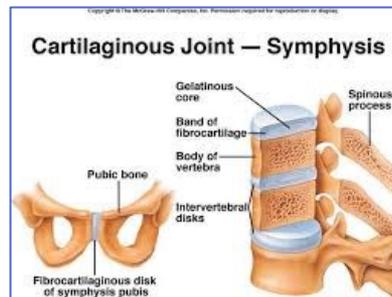
Hyaline

- Has an intercellular matrix rich in hyaluronic acid and mucopolysaccharides, which are natural lubricants
- Forms the articular cartilage in most joints
- Provides the anlage for long bone development



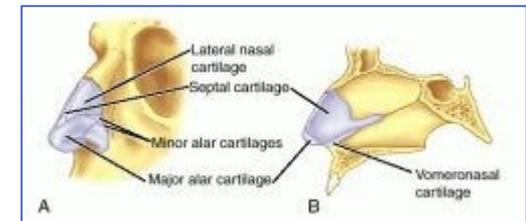
Fibrous

- Has an intercellular matrix rich in mucopolysaccharides and bundles of collagenous fibers
- Mucopolysaccharides provide high water content
- Especially resilient and durable form of cartilage
- Forms most symphyses and joint discs



Elastic

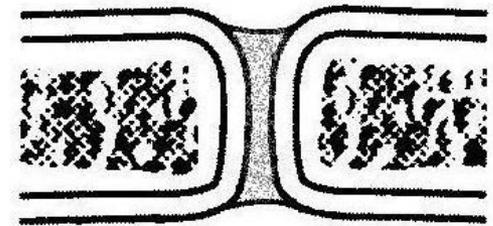
- Has an intercellular matrix rich in mucopolysaccharides and bundles of elastic fibers, which provide a strong, yet flexible, support
- Forms the skeletal structure of external ear and the tip of the nose



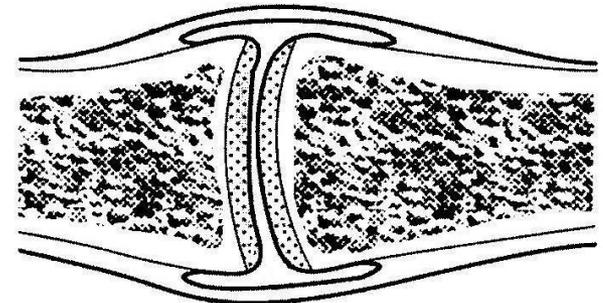
* Classification of the joints

1. **Synarthrosis** (immovable joint):

- 1) Syndesmosis
- 2) Synchondrosis
- 3) Synostosis



2. **Diarthrosis** (synovial joint, joint)



Complexity of the joints

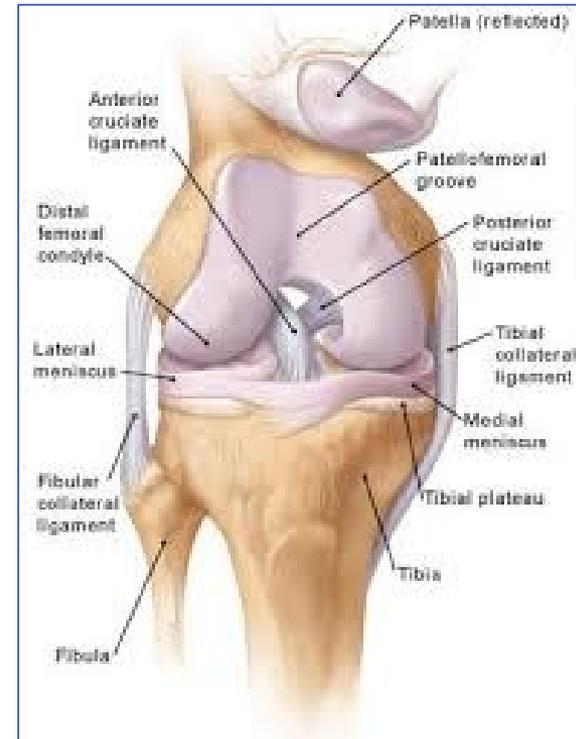
Simple joint

- two articular surfaces



Complex joint

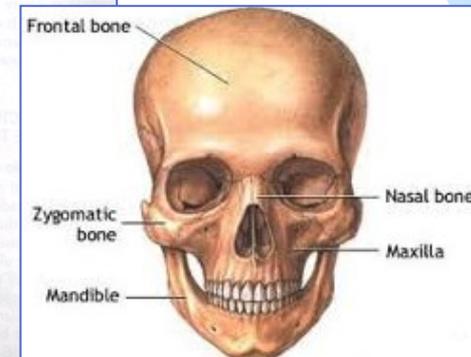
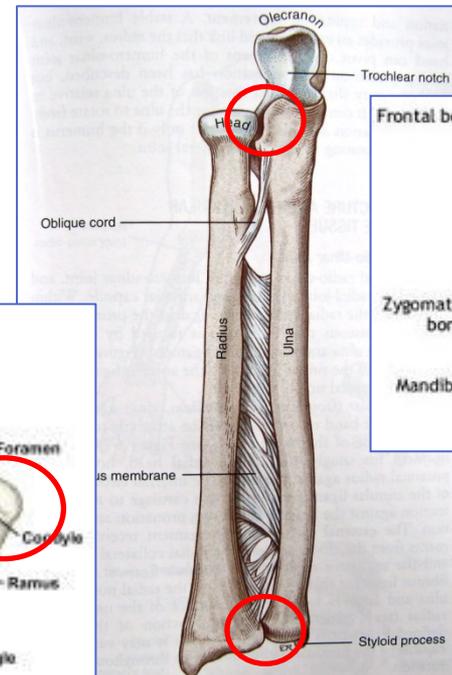
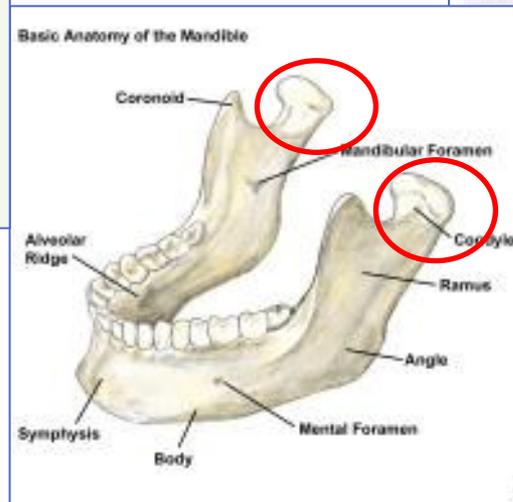
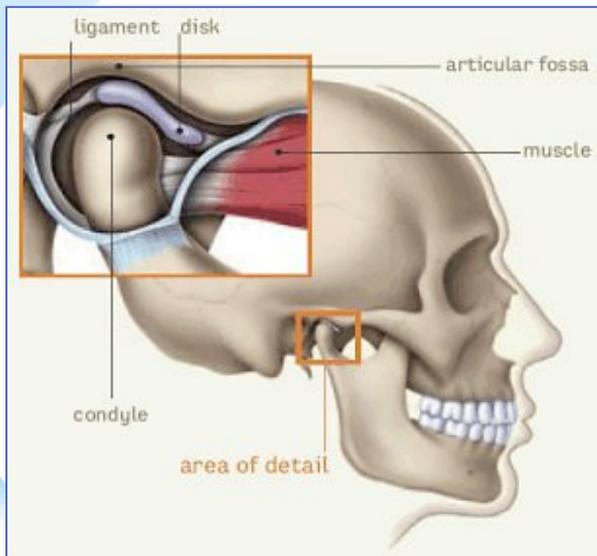
- more than two articular surfaces



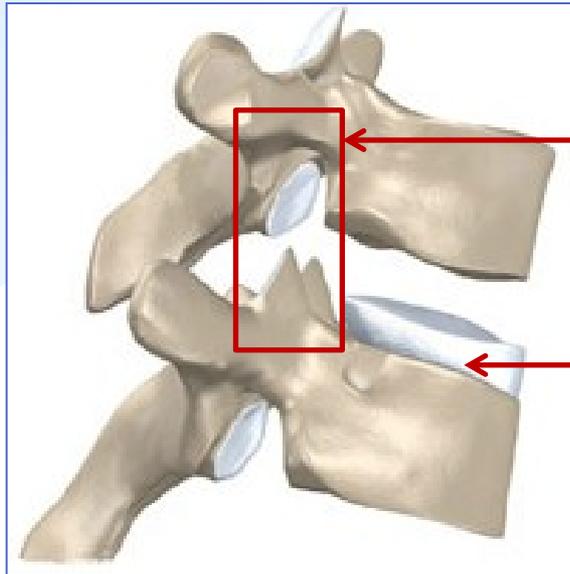
Synovial joints

Combined joint

- Two anatomically isolated joints move together at the same time

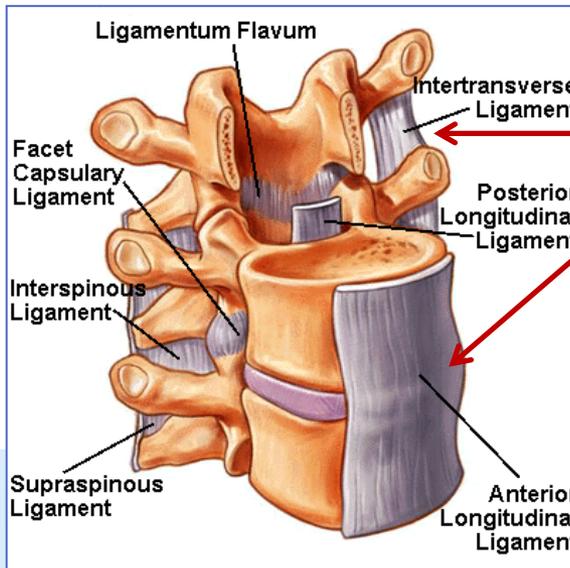


Joints of the vertebral column



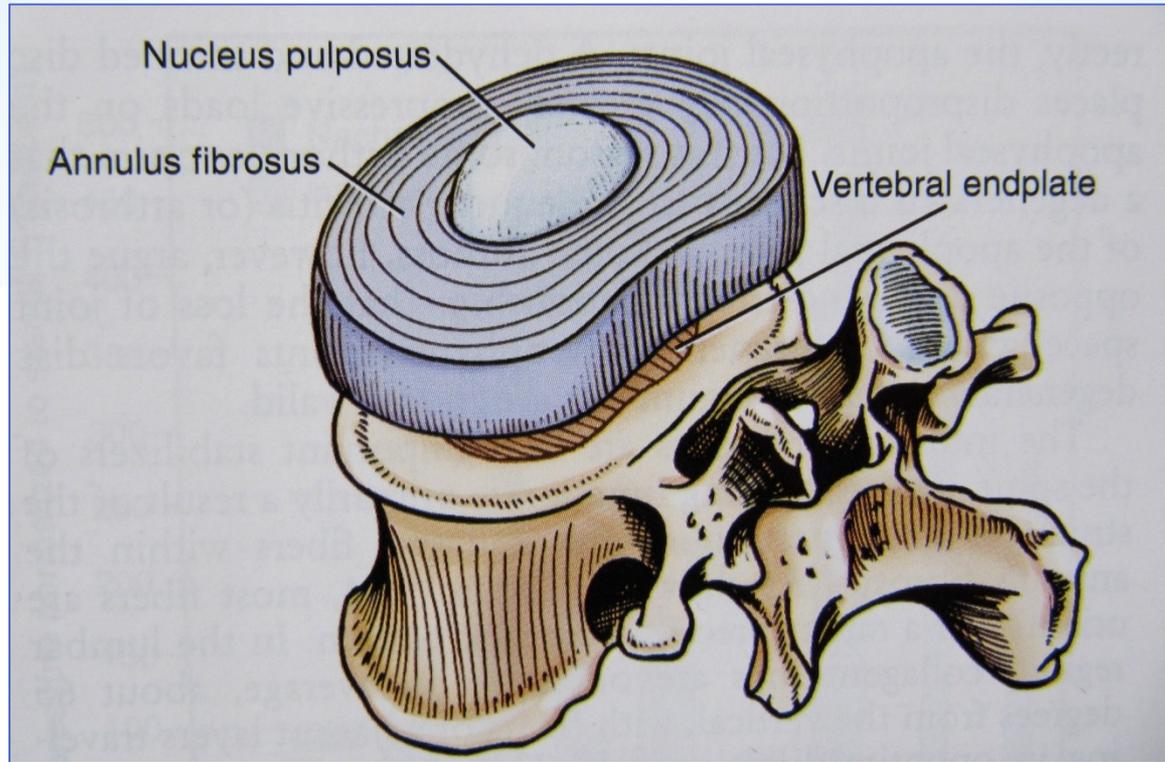
Zygapophysial joint
(simple plane combined synovial joint)

Symphysis / synchondrosis



Syndesmosis (Ligaments)

Intervertebral disc



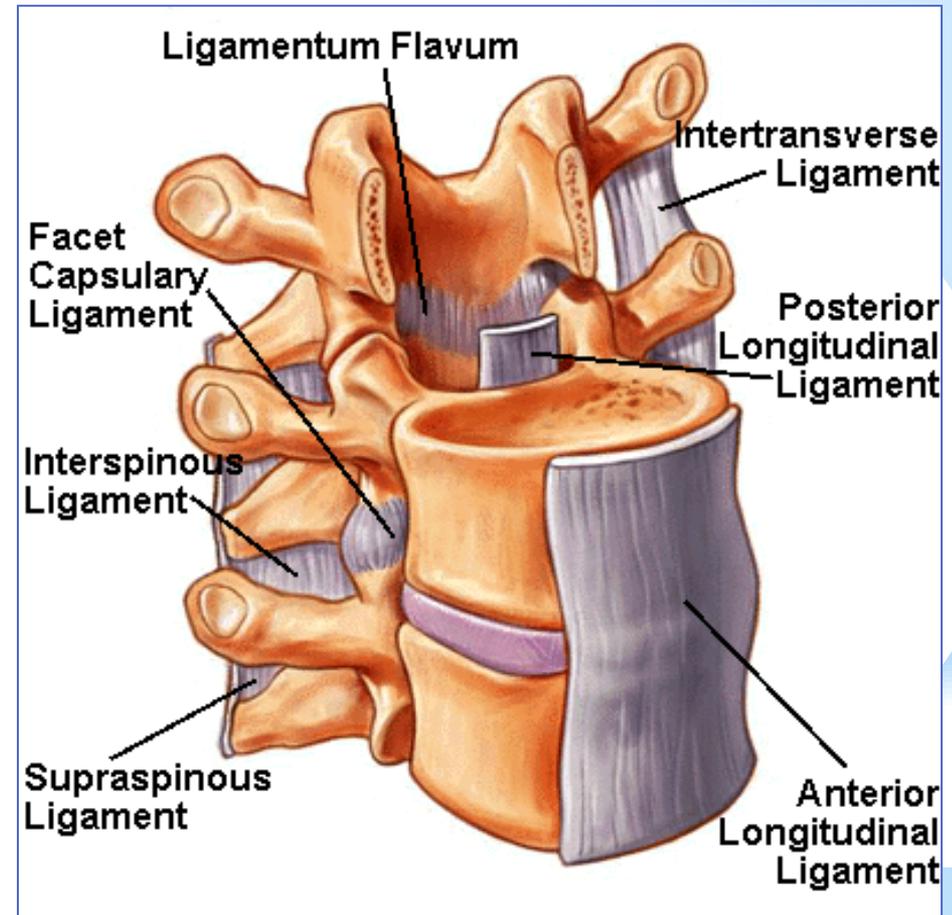
- Each disc composed of an outer fibrocartilaginous portion (*annulus fibrosus*) and an inner gelatinous central portion (*nucleus pulposus*)
- Nucleus pulposus – remnant of notochord

Functions of intervertebral disc:

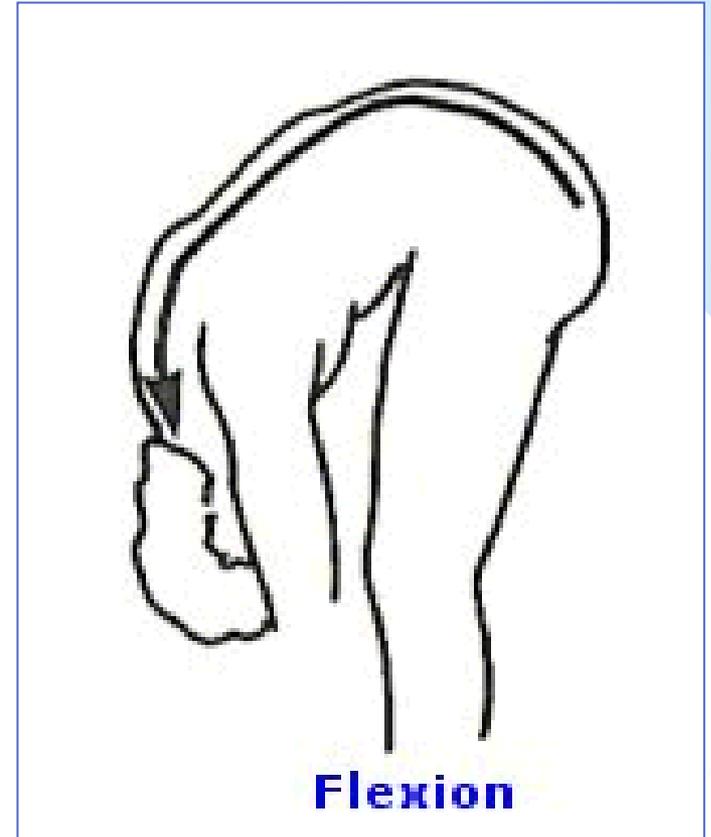
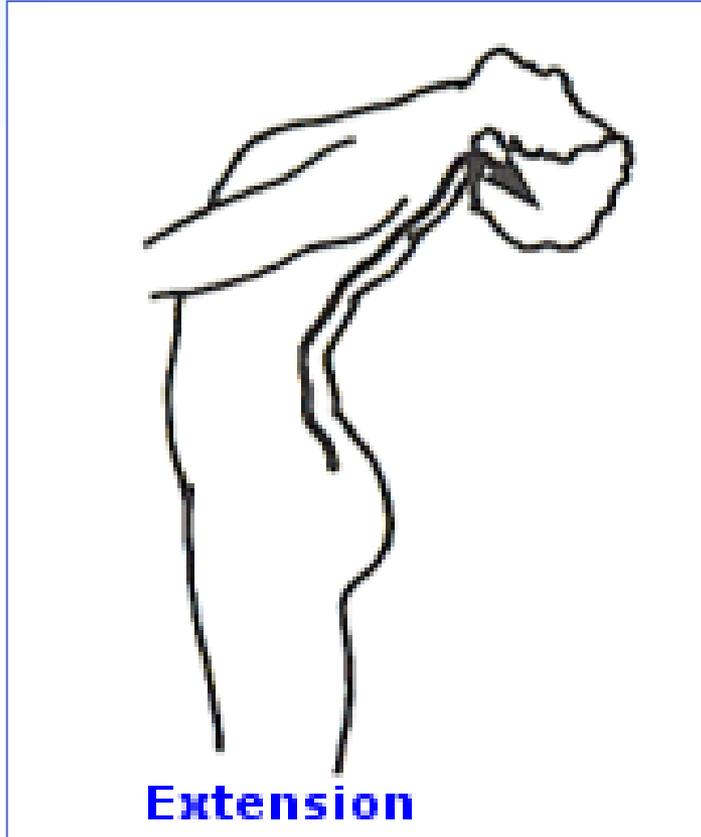
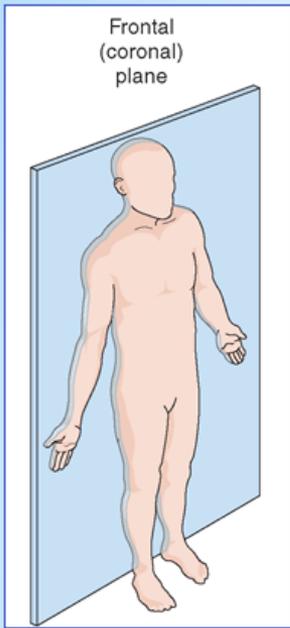
- Permit limited movement between adjacent vertebrae
- Nucleus pulposus – compressible but deformable pad, that distribute forces over the entire surface of the vertebra

* *Syndesmoses of vertebral column (ligaments):*

- * *The anterior longitudinal ligament (lig. longitudinale anterius)*
- * *The posterior longitudinal ligament (lig. longitudinale posterius)*
- * *The yellow ligaments (ligg. flava) - elastic fibers!*
- * *The interspinous ligaments (ligg. interspinalia)*
- * *The supraspinous ligament (lig. supraspinale)*
- * *The intertransverse ligaments (ligg. intertransversaria)*

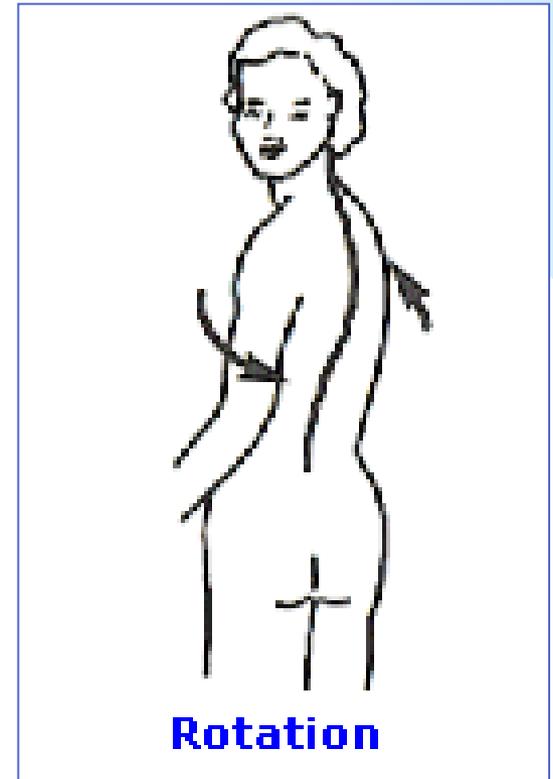
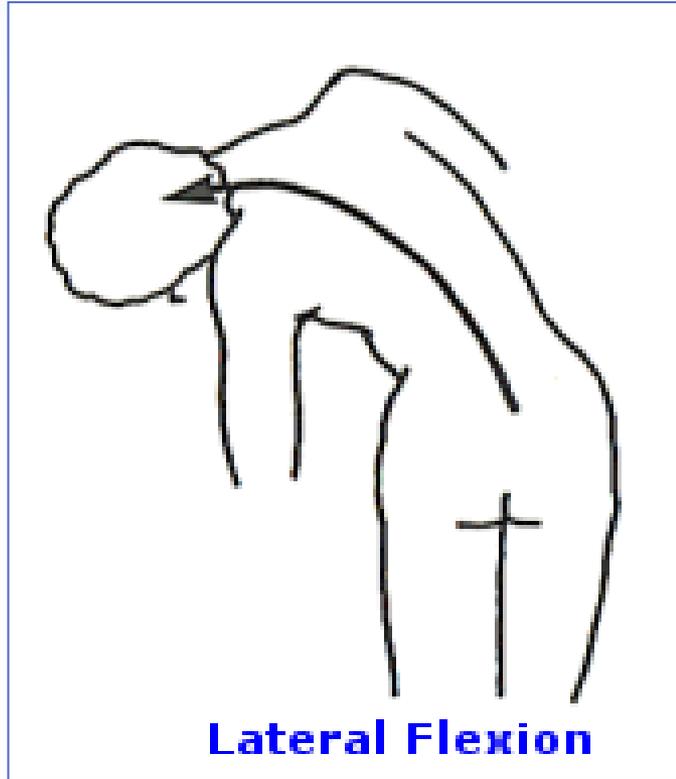
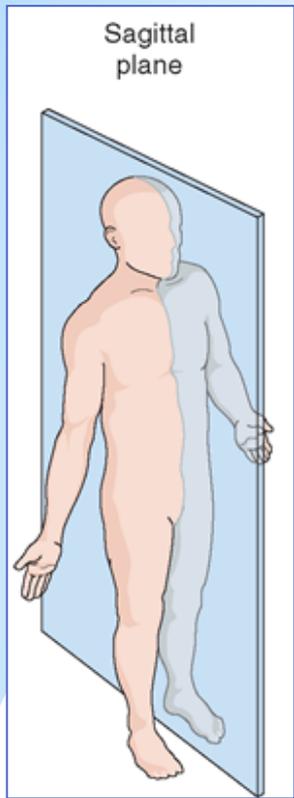


* Movements of Spinal Column

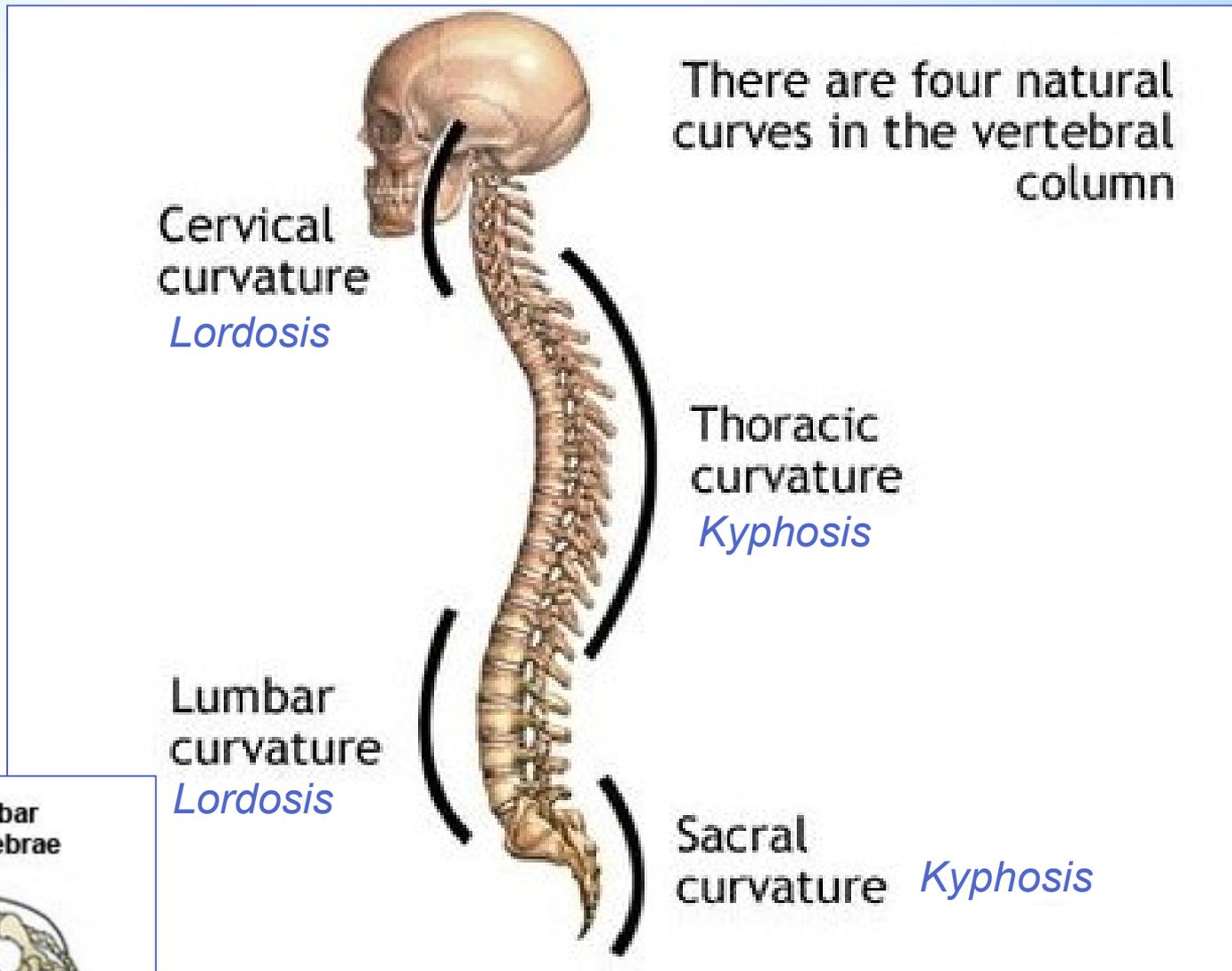
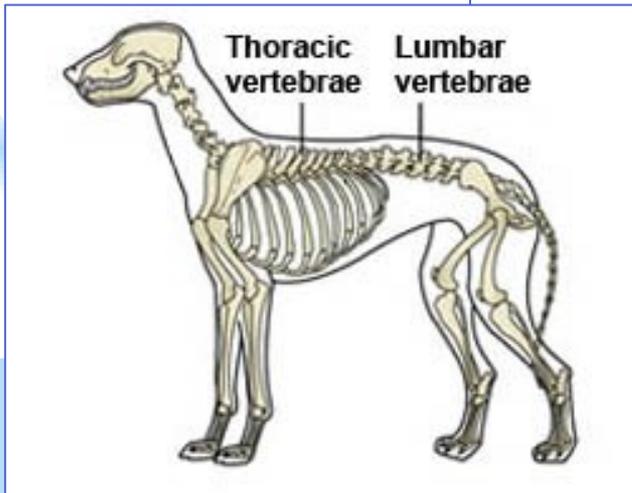
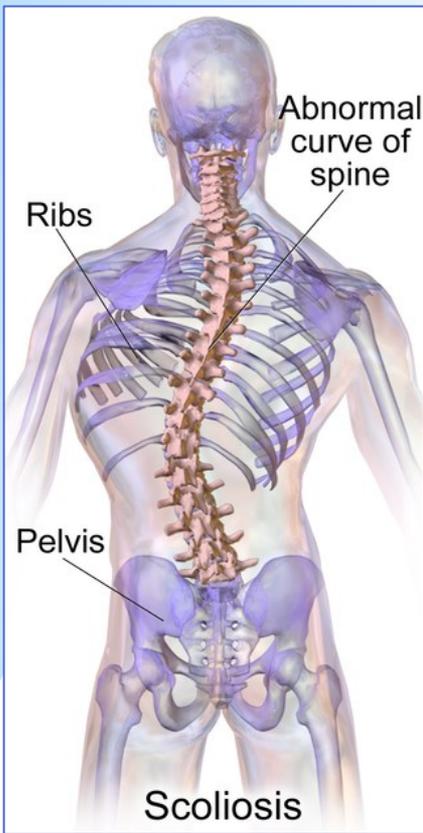


* Flexion and extension along frontal axis

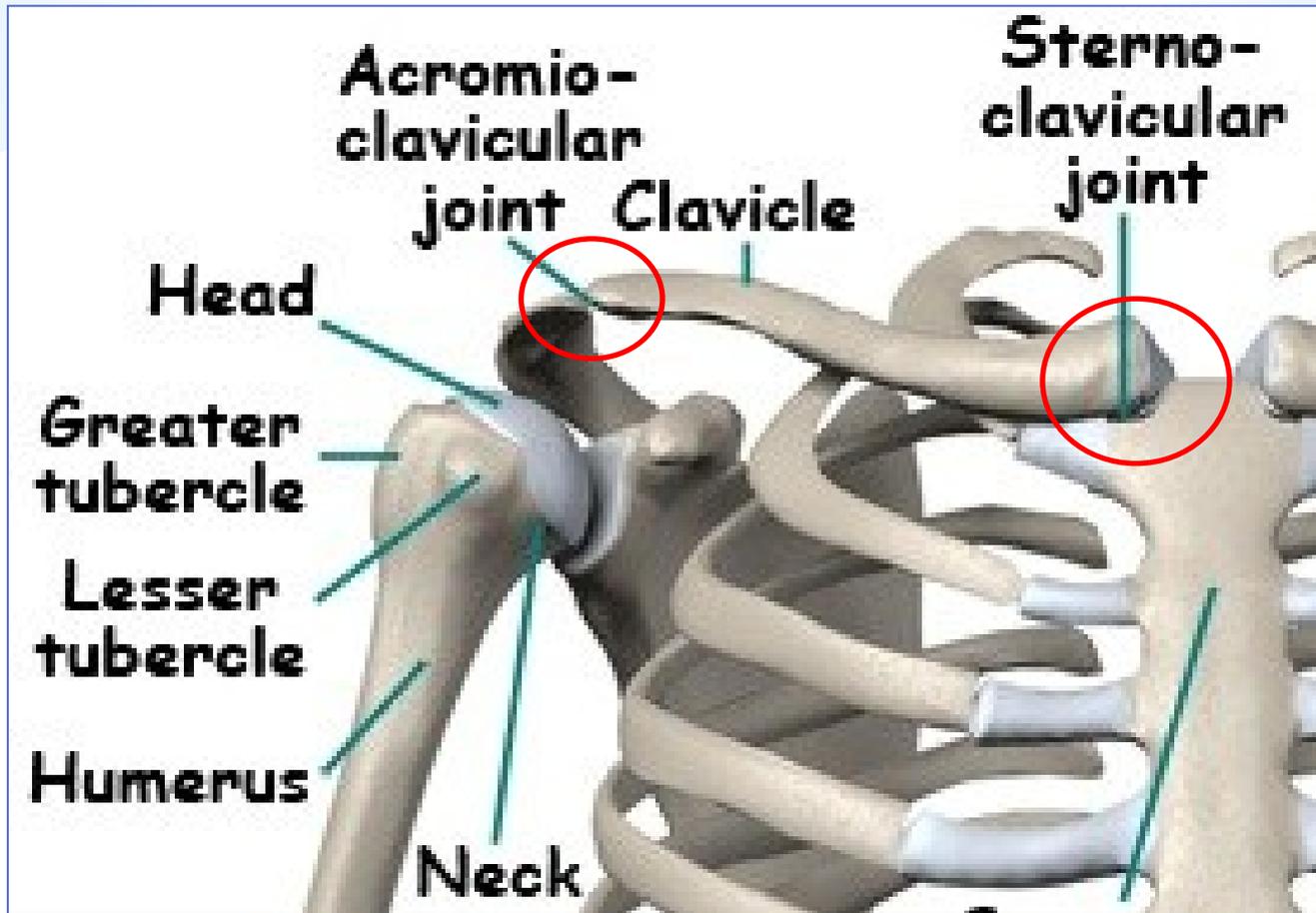
* Movements of Spinal Column



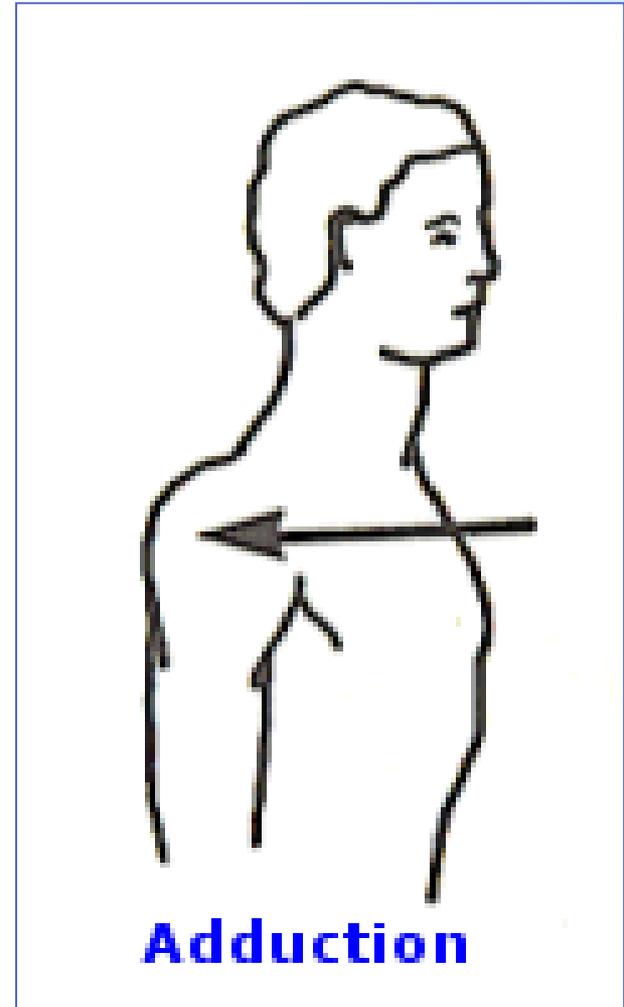
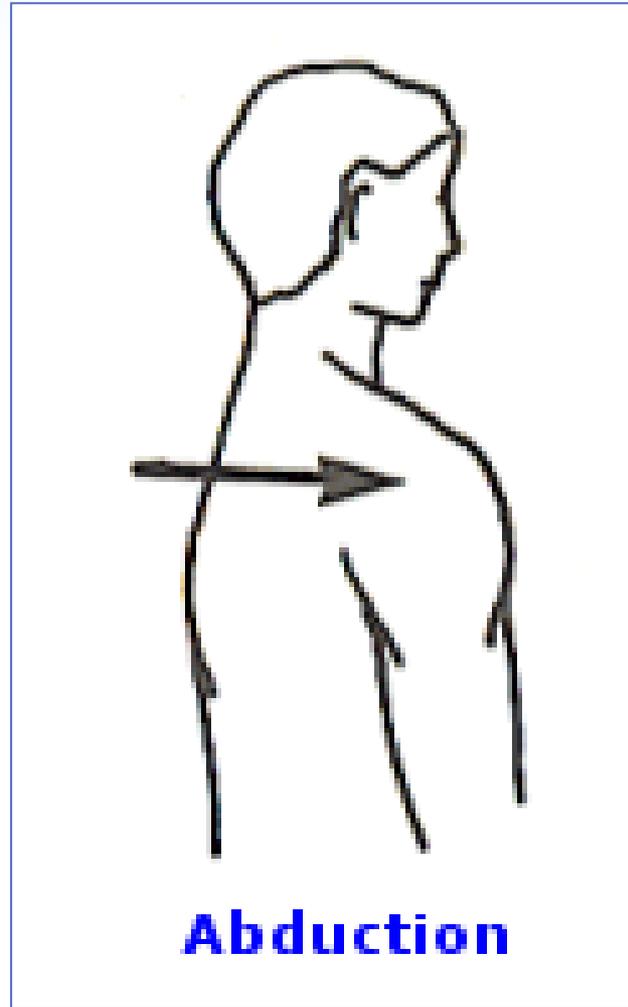
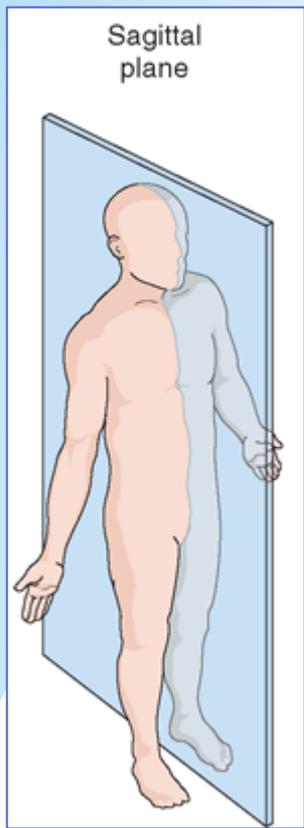
- * Lateral flexion along sagittal axis
- * Rotation along vertical axis



*Shoulder Girdle

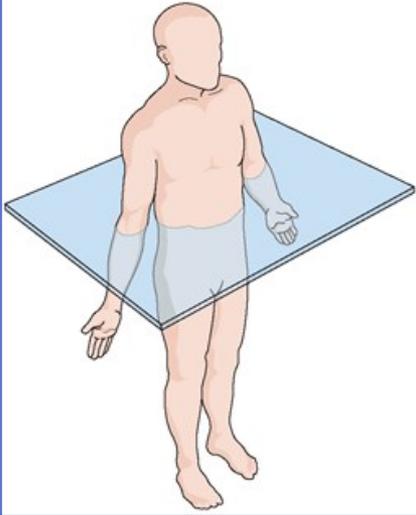


* Shoulder Girdle

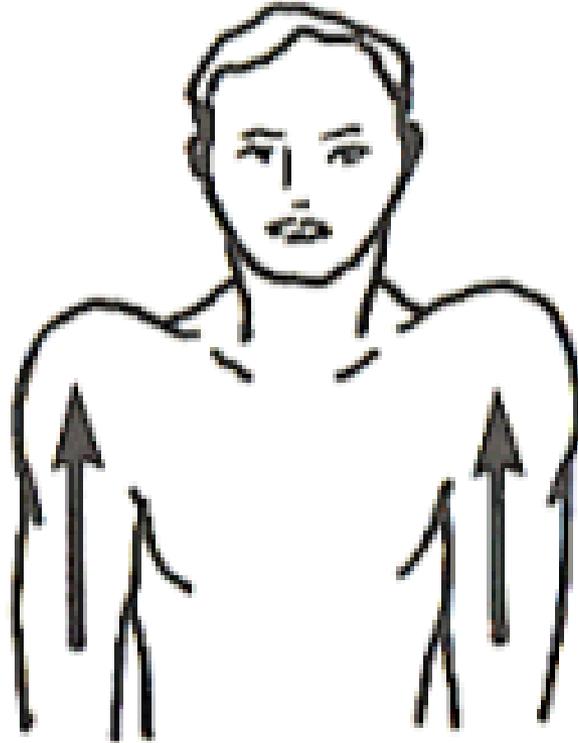


* Adduction and abduction along sagittal axis

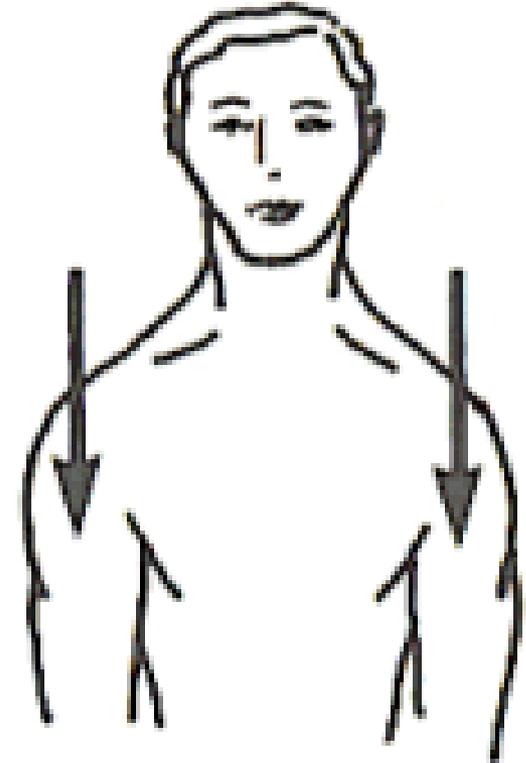
Transverse
(horizontal)
plane



*Shoulder Girdle



Elevation



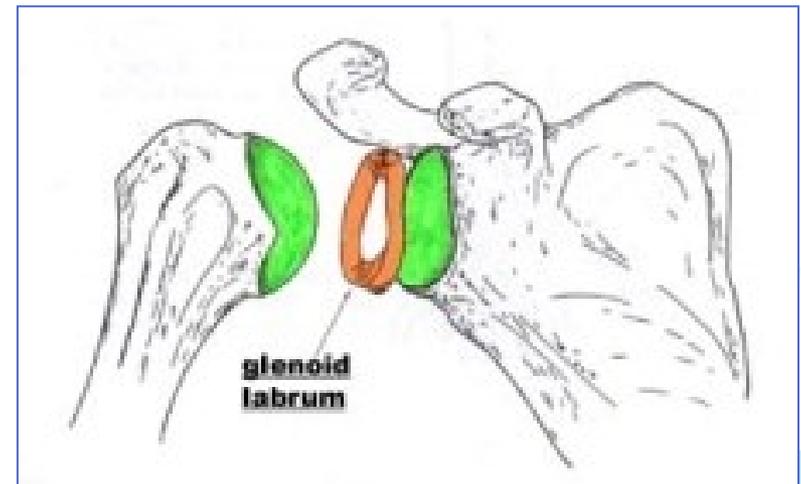
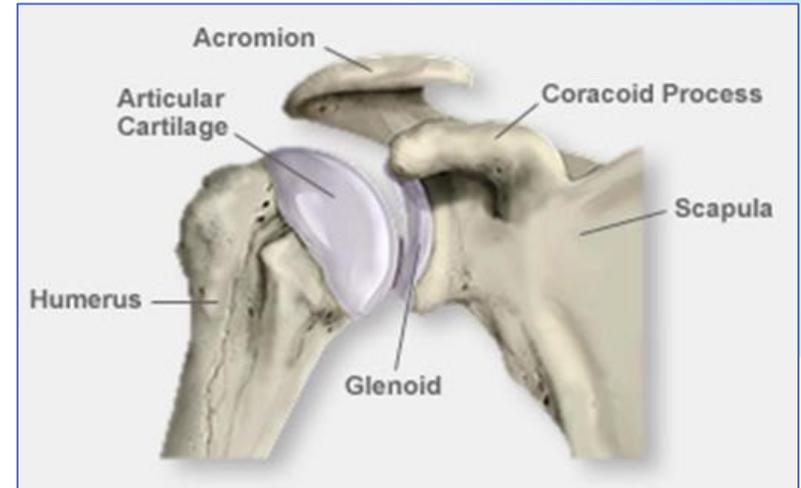
Depression

*Elevation and depression along transverse axis

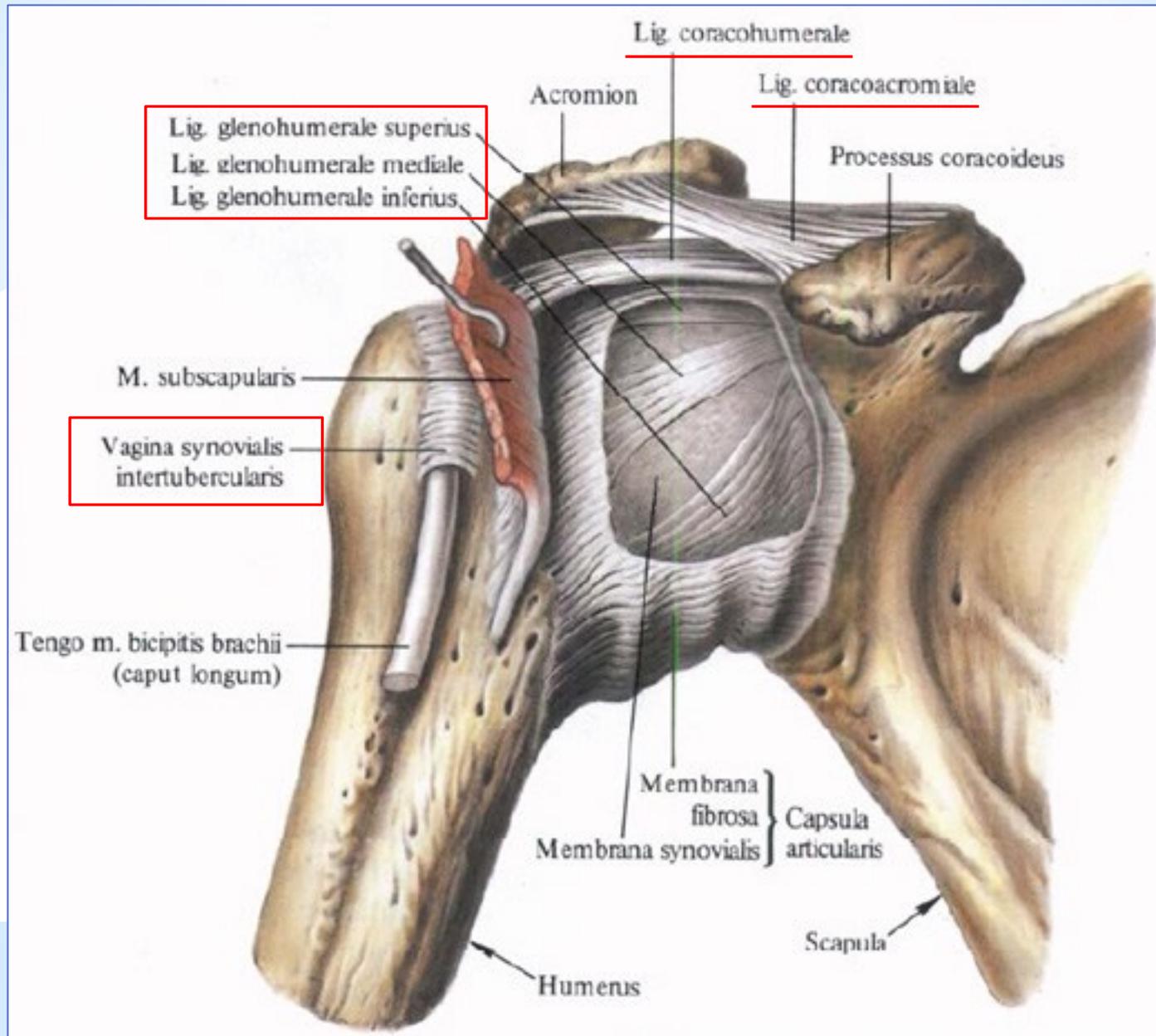
* Shoulder joint (*articulatio humeri*)

Articular surfaces:

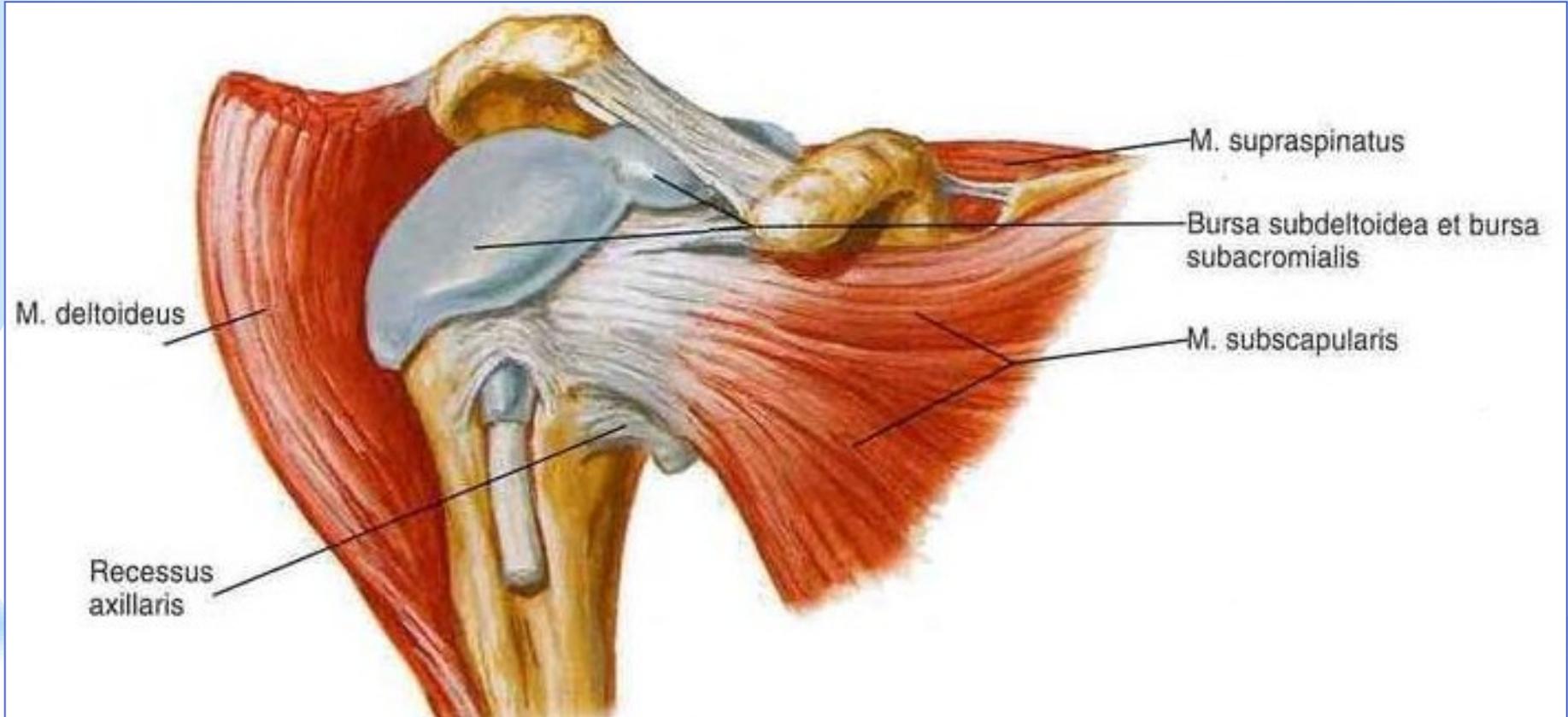
- * The head of the humerus - the glenoid cavity of the scapula.
- * The *glenoid labrum* (*labrum glenoidale*) is on the circumference of the glenoid cavity. It increases its depth.



* Shoulder joint (*articulatio humeri*)

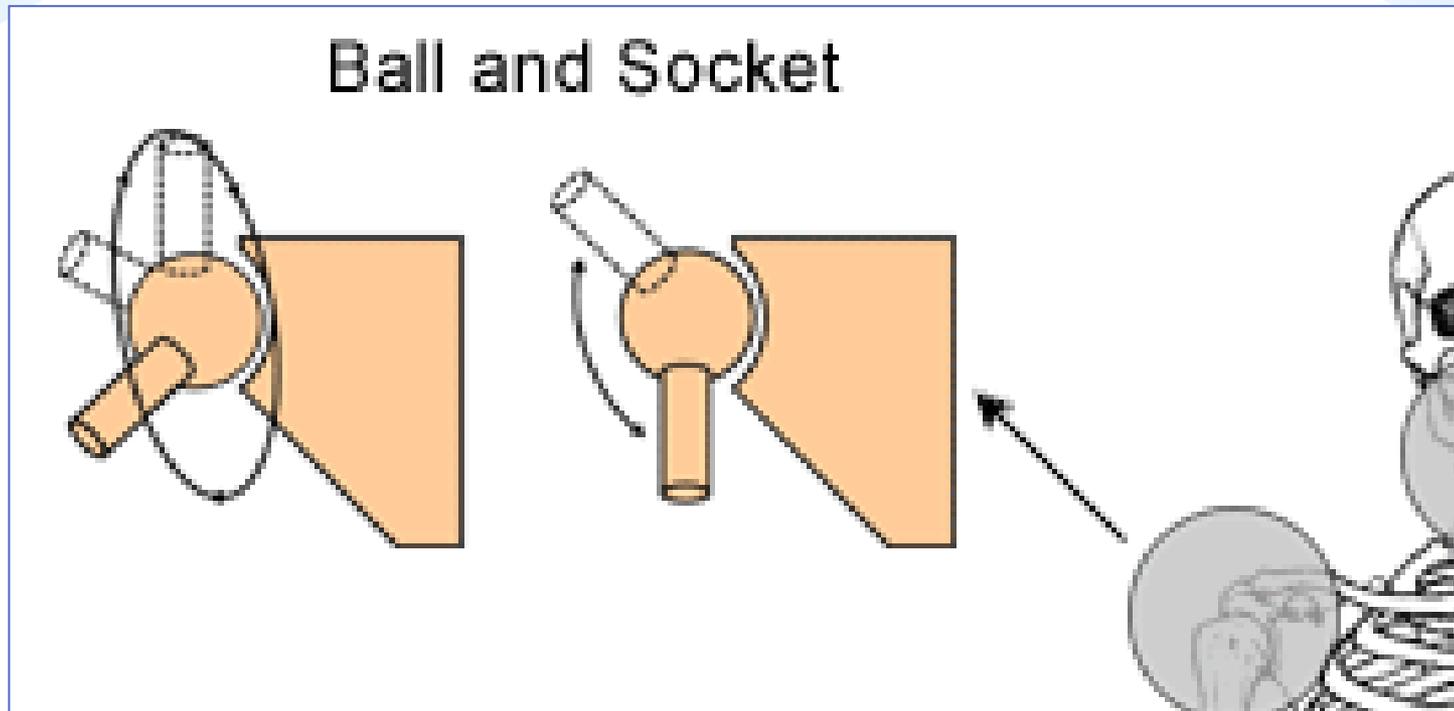


* Shoulder joint (*articulatio humeri*)

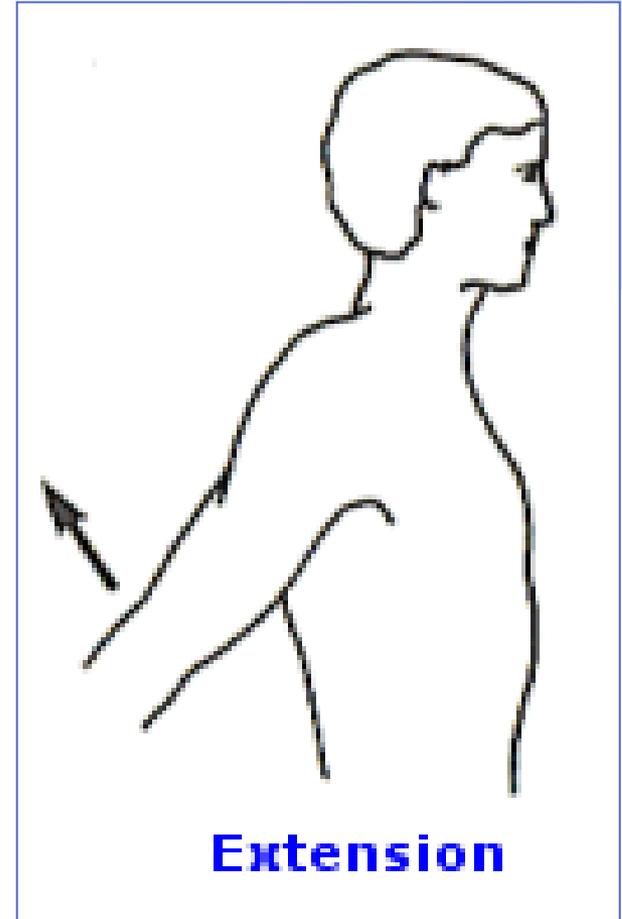
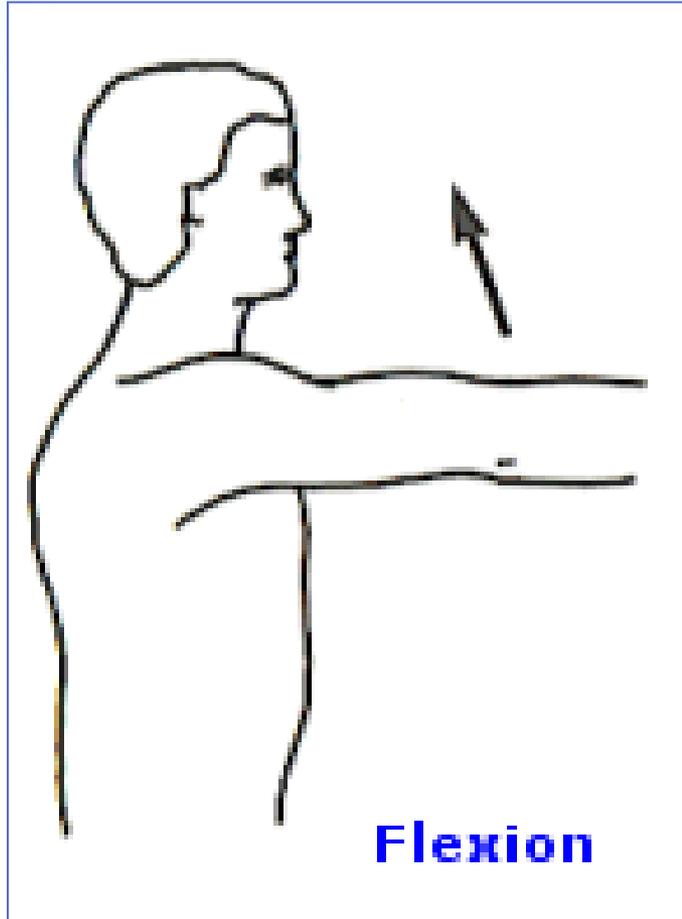
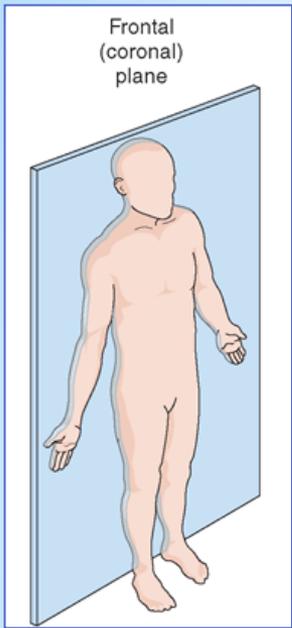


* Shoulder joint (*articulatio humeri*)

* Simple spheroidal joint.

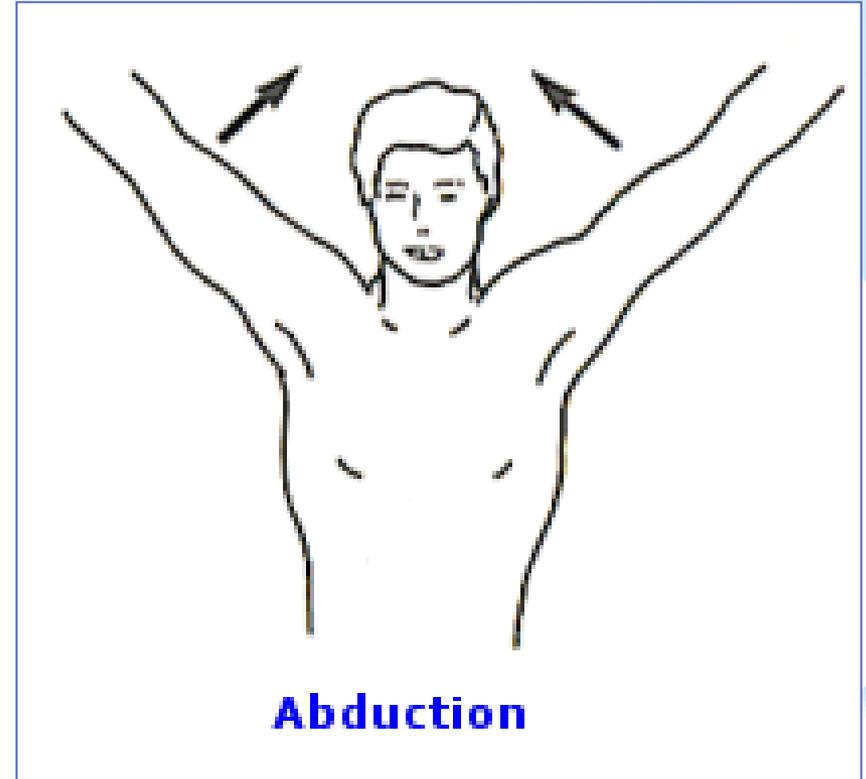
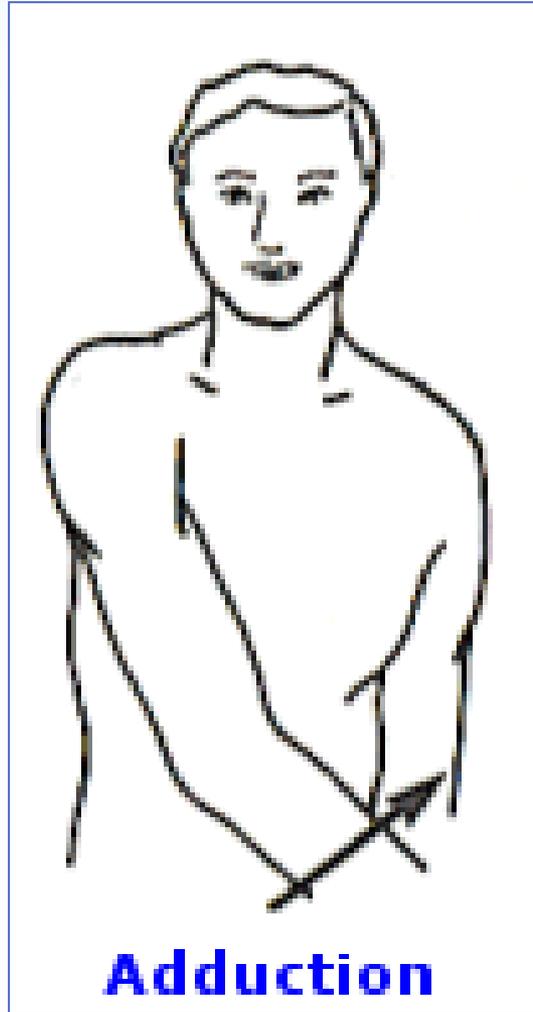
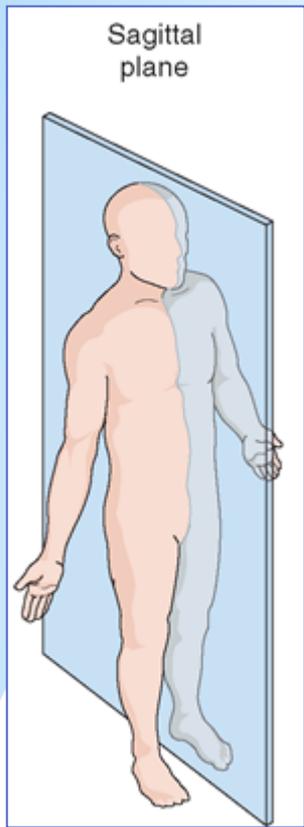


* Shoulder Joint



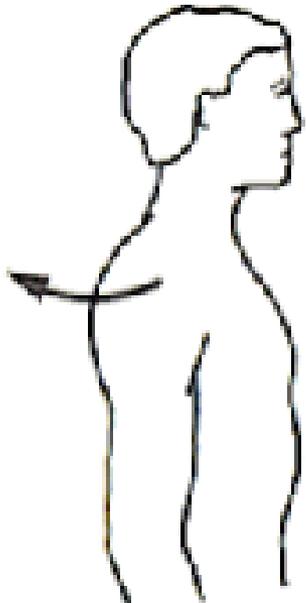
* Flexion and extension along frontal axis

* Shoulder Joint



* Adduction and abduction along sagittal axis

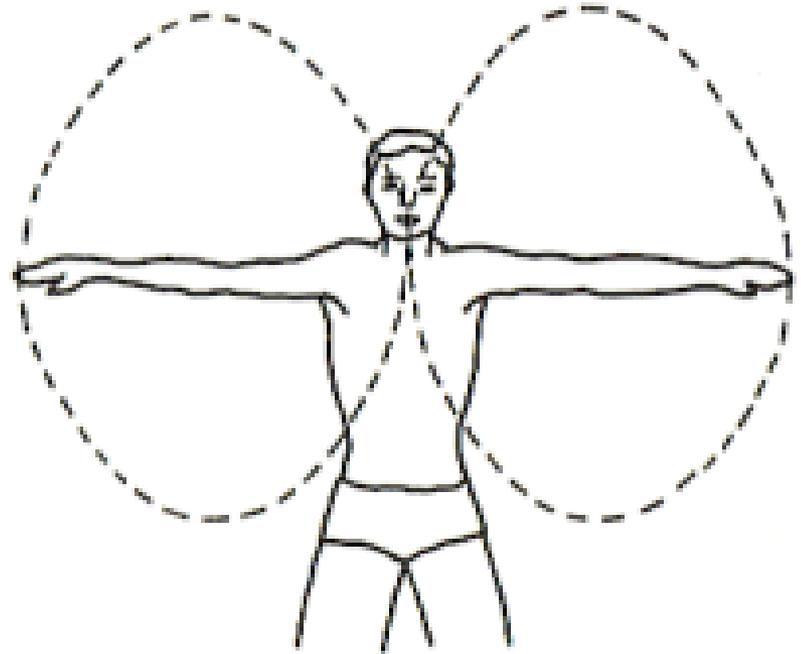
* Shoulder Joint



**Outward Medial
Rotation**



Inward Medial Rotat



Circumduction

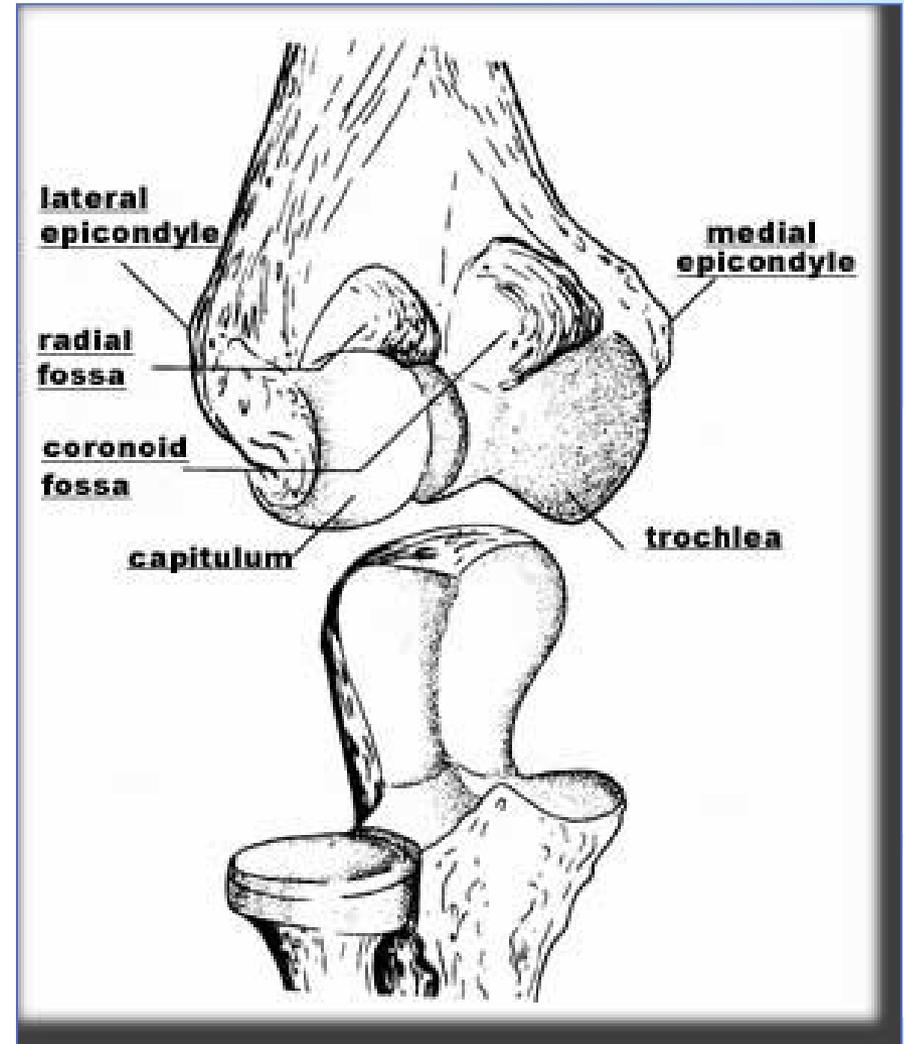
* Rotation and circumduction along vertical axis

*The elbow joint (*articulatio cubiti*)

Three articulating bones form three joints invested in a common capsule:

- 1) *humero-ulnar joint (hinge joint)*
- 2) *humeroradial joint (spheroidal joint)*
- 3) *proximal radio-ulnar joint (cylindrical=pivot joint)*

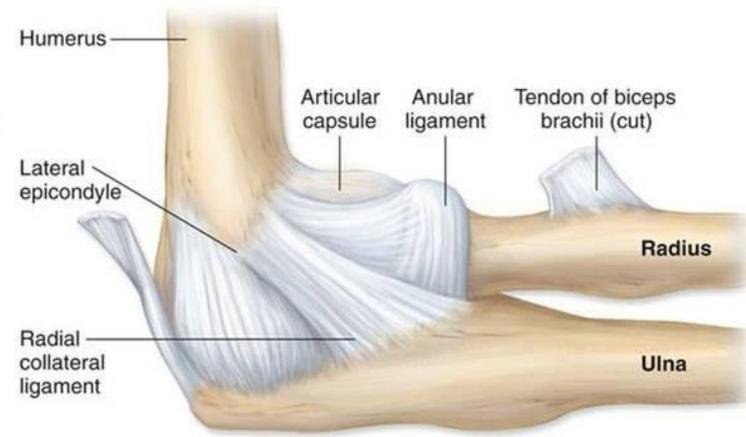
Articular capsule embraces the olecranon, radial and coronoid fossae but leaves the epicondyles free.



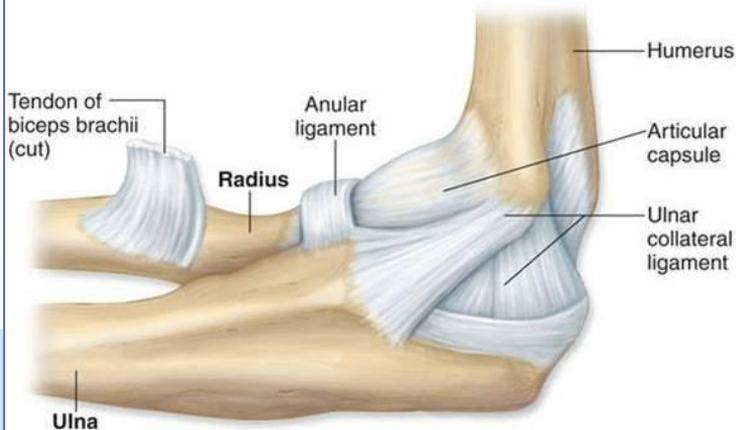
Elbow joint



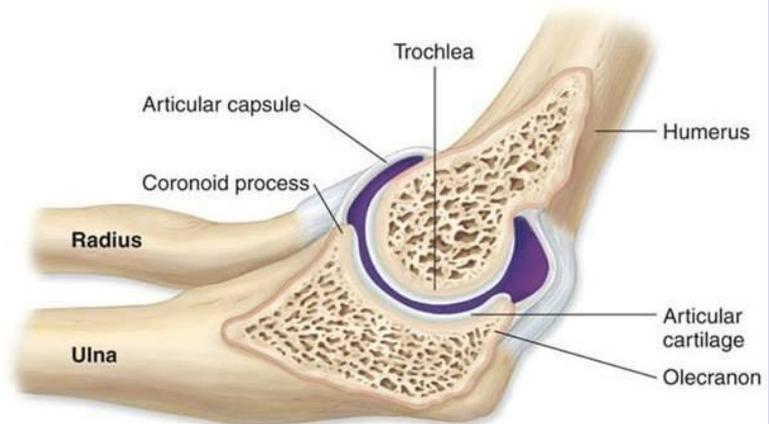
(a) Right elbow, anterior view



(b) Right elbow, lateral view

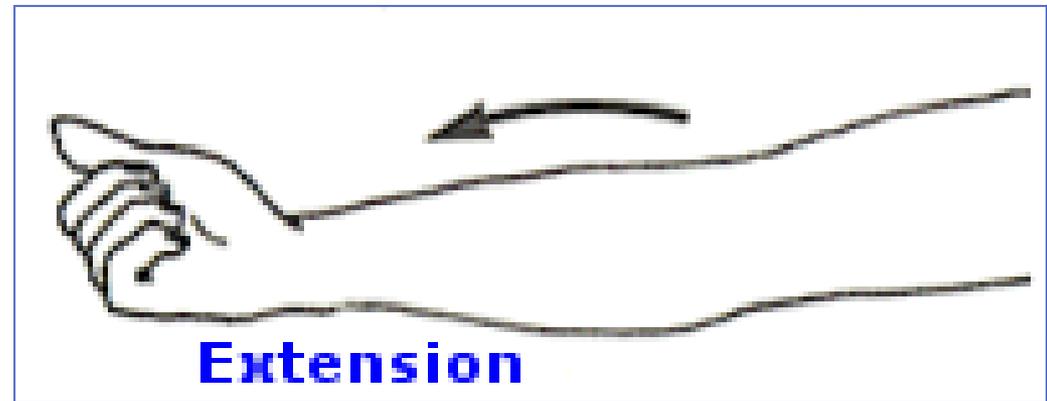
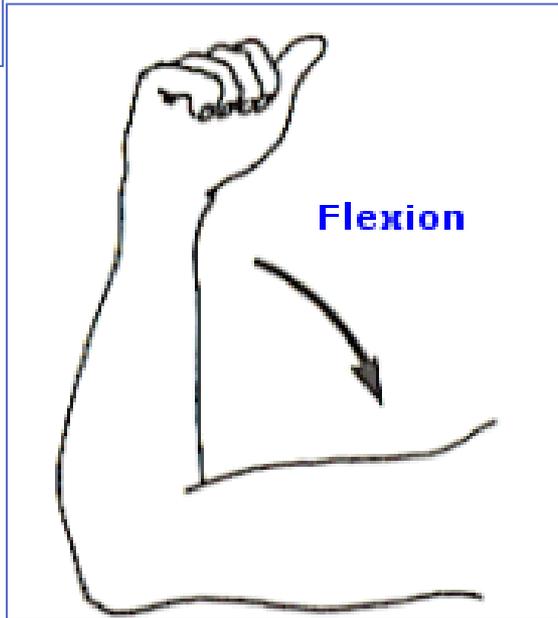
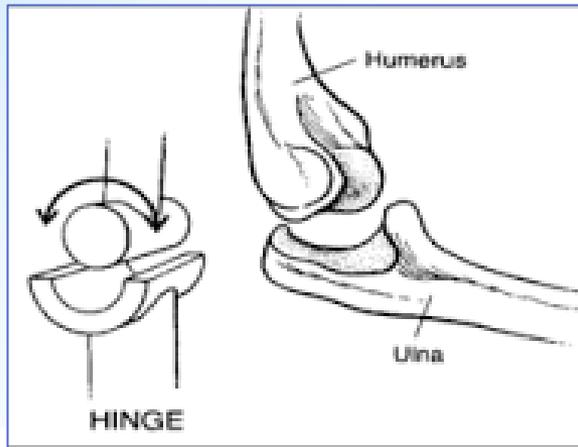


(c) Right elbow, medial view



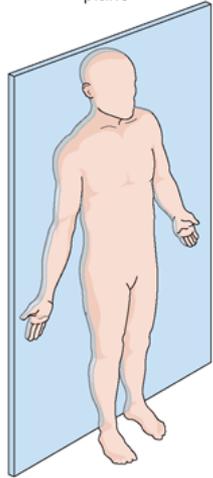
(d) Right elbow, sagittal section

* Elbow Joint

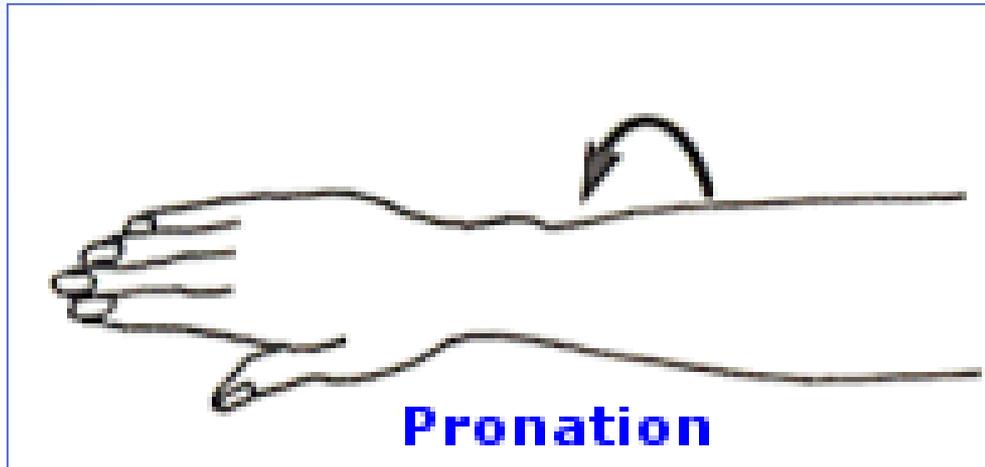


* Flexion and extension along frontal axis

Frontal
(coronal)
plane



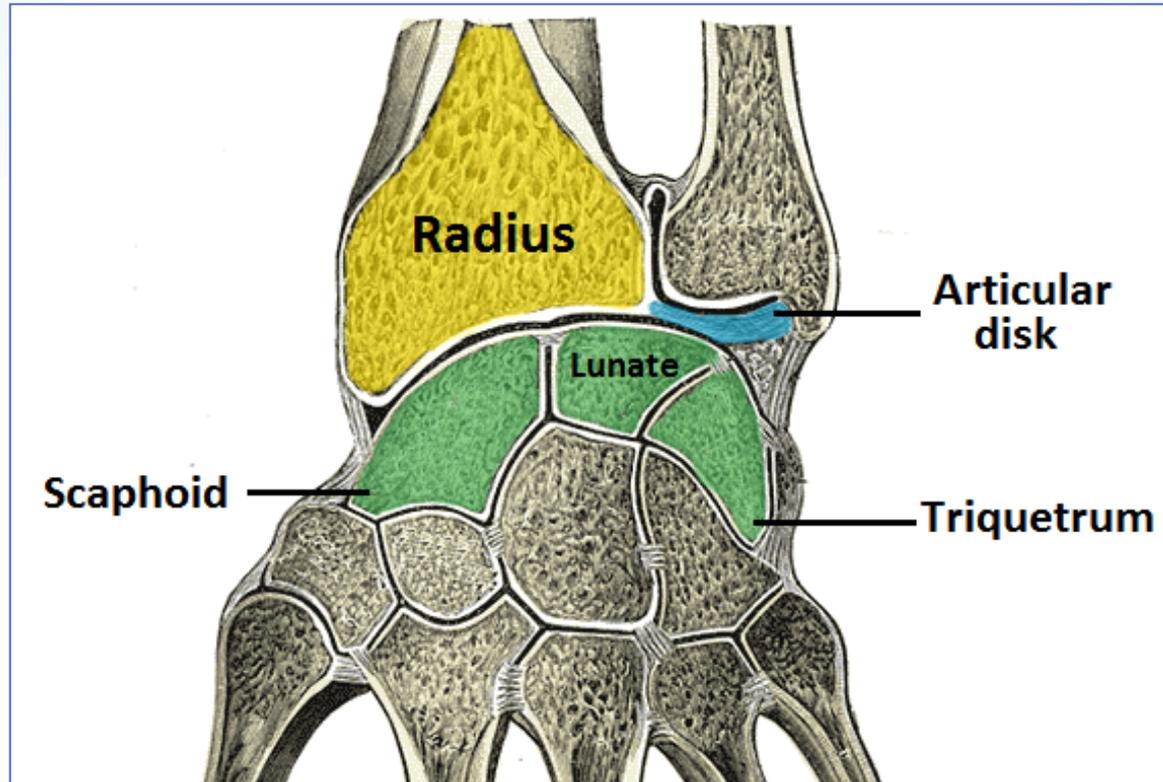
* Elbow Joint



* Pronation and supination along vertical axis

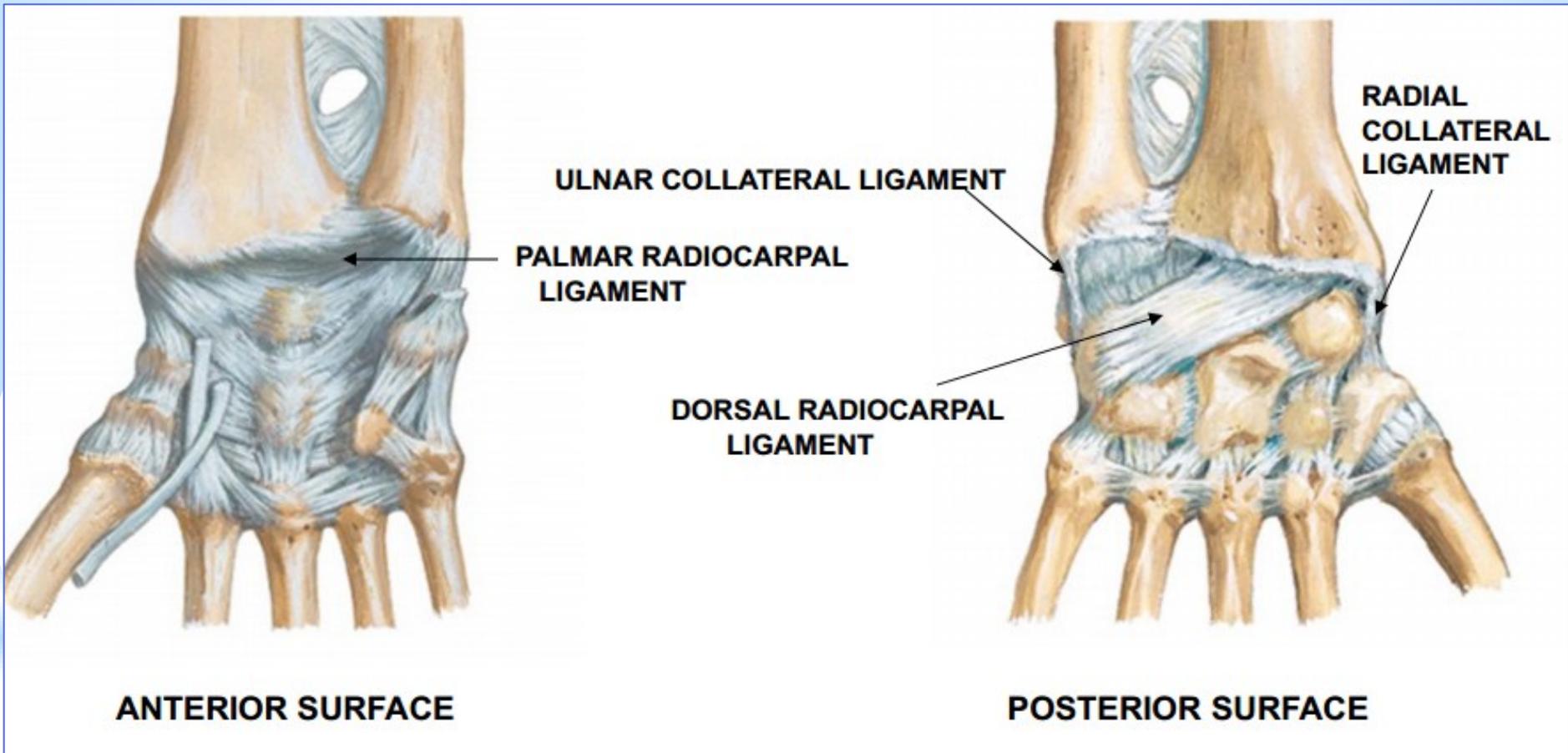
* Combined movement in proximal and distal radio-ulnar joint

* The wrist joint (*articulatio radiocarpalis*)

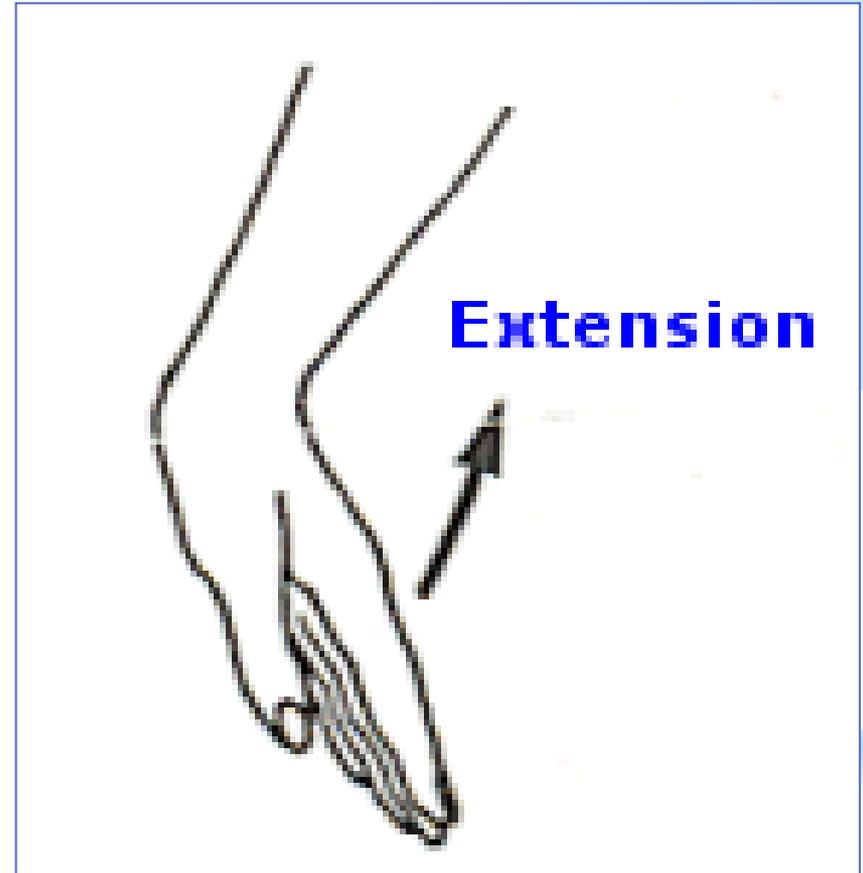
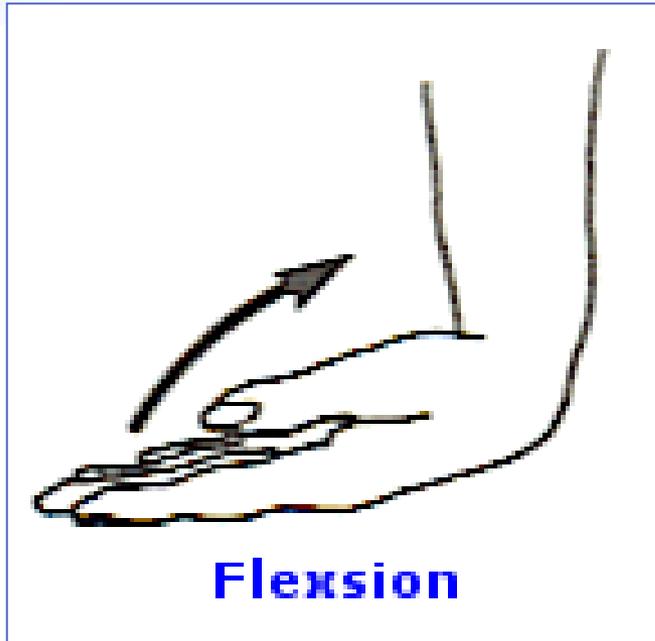
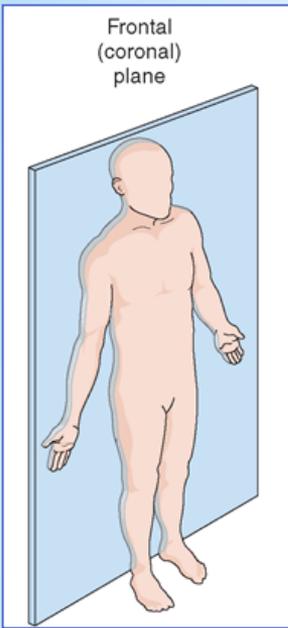


- Articular surfaces The carpal articular surface of the radius and the articular disc (the distal radio-ulnar joint) - scaphoid, lunate and triquetral bones.
- Complex ellipsoid joint.

* The wrist joint

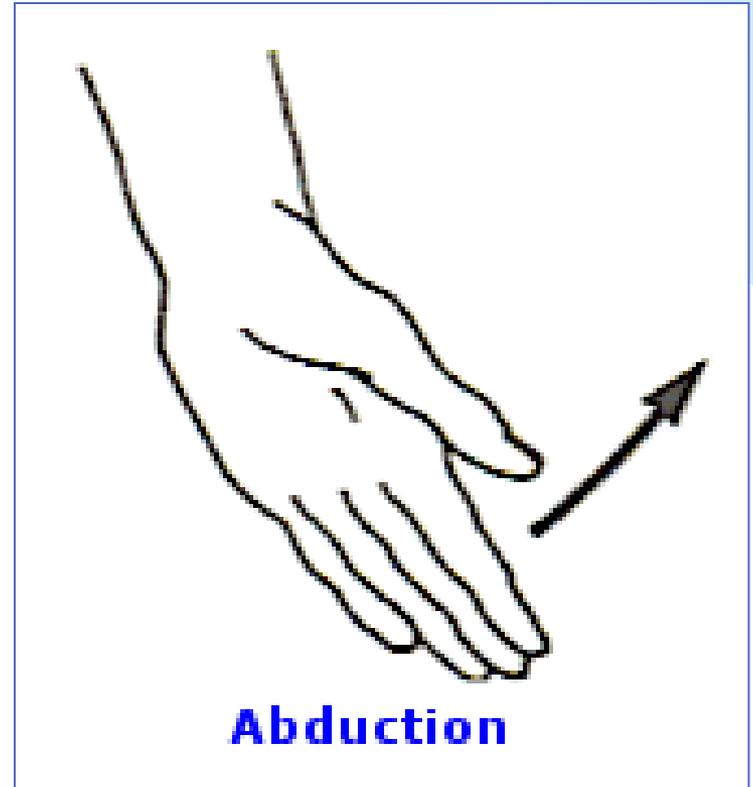
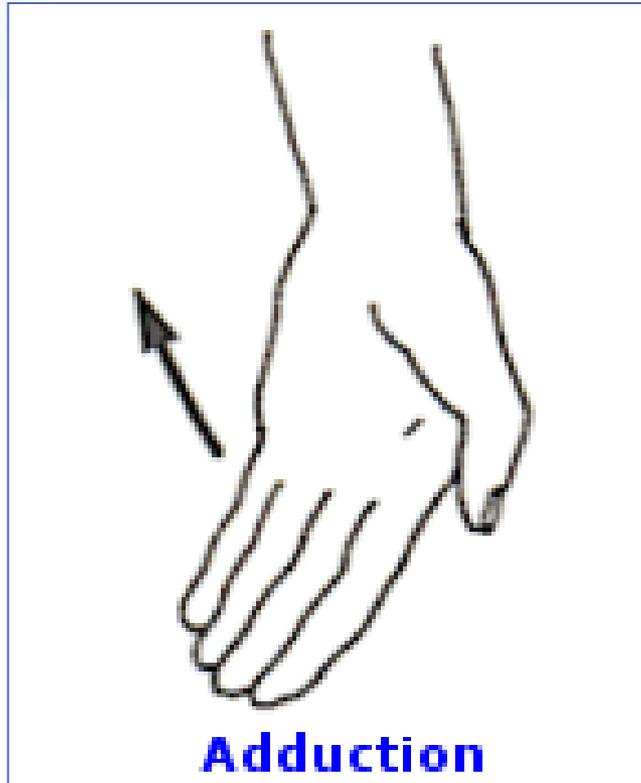
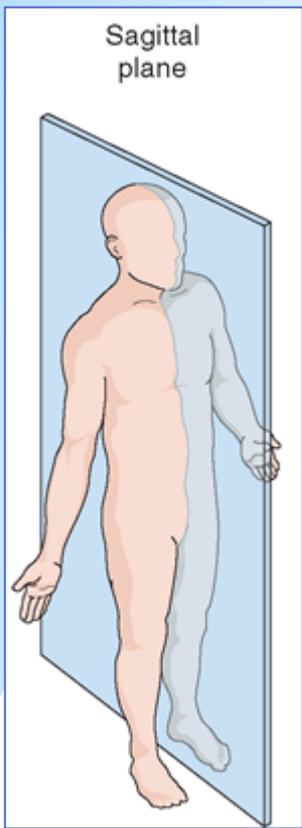


*Wrist Joint



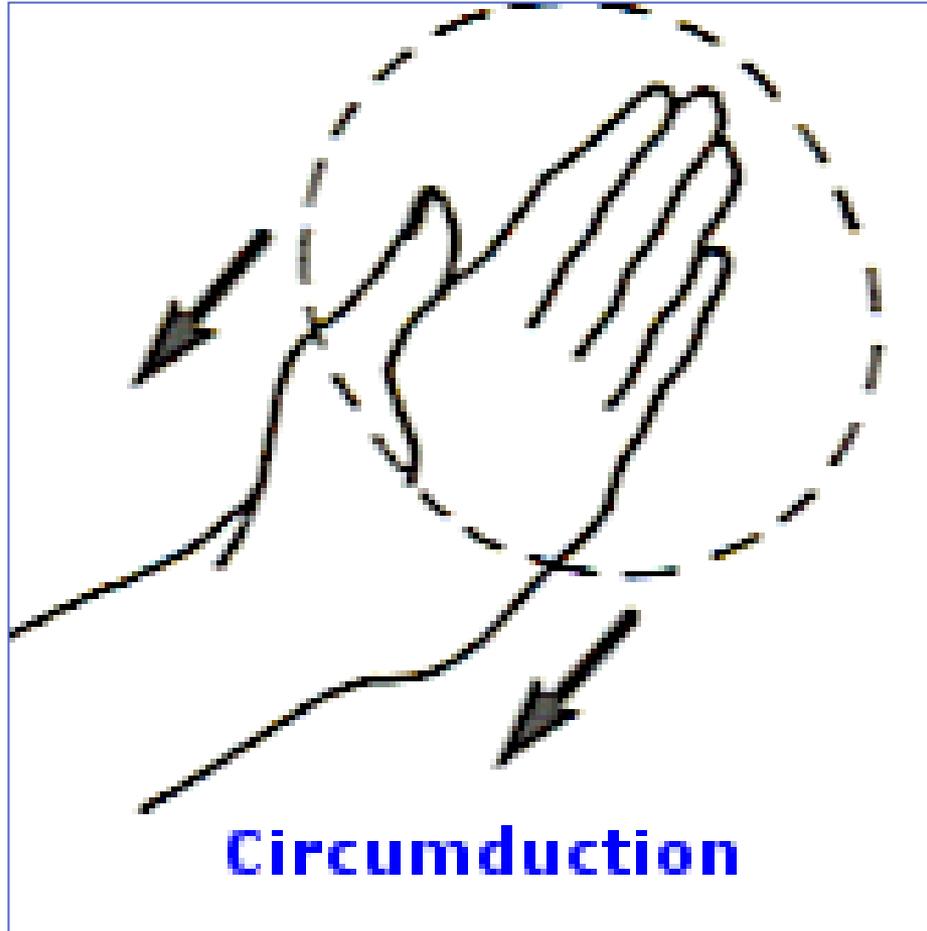
*Flexion and extension along frontal axis

*Wrist Joint

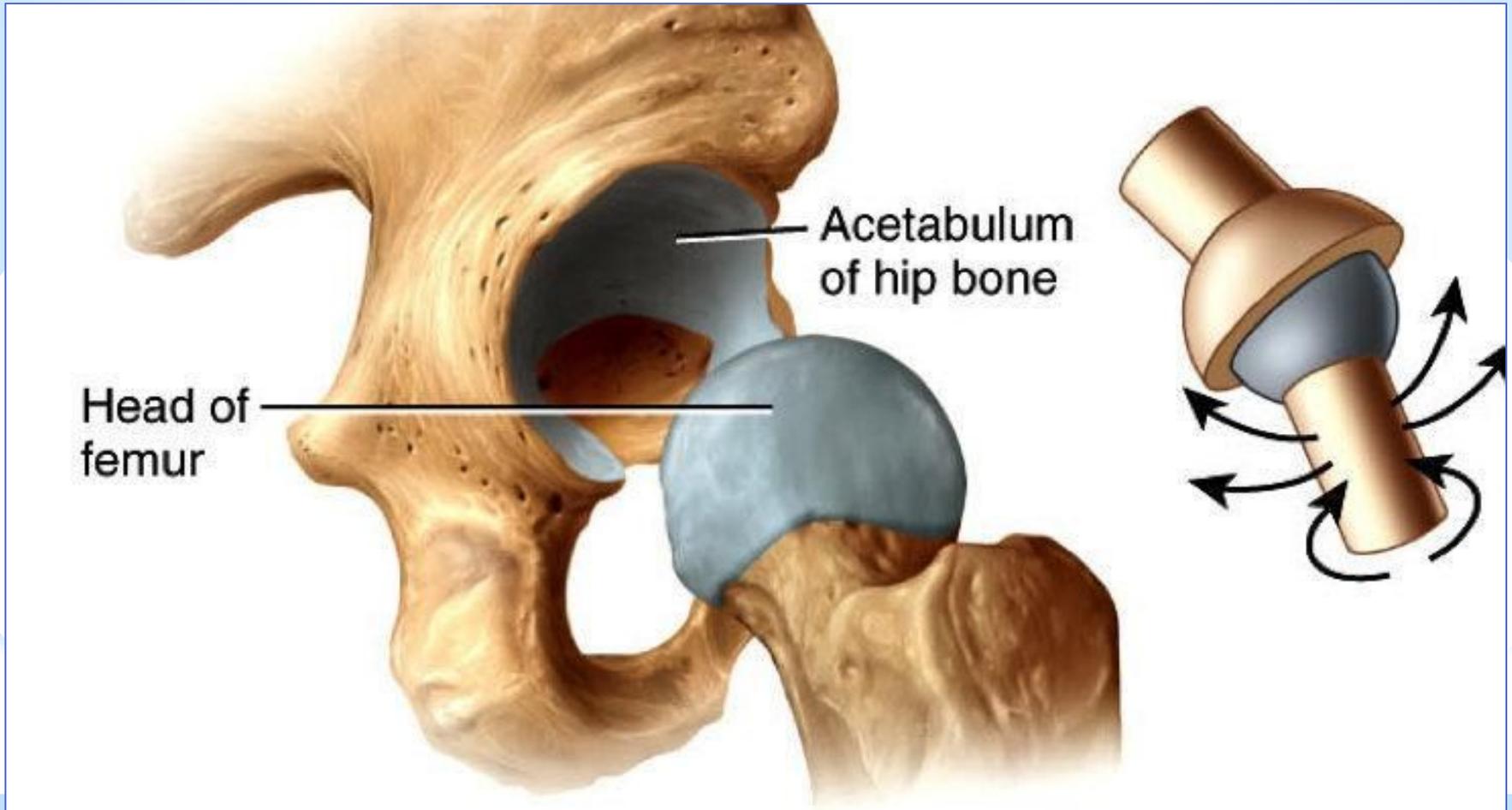


*Adduction and abduction along sagittal axis

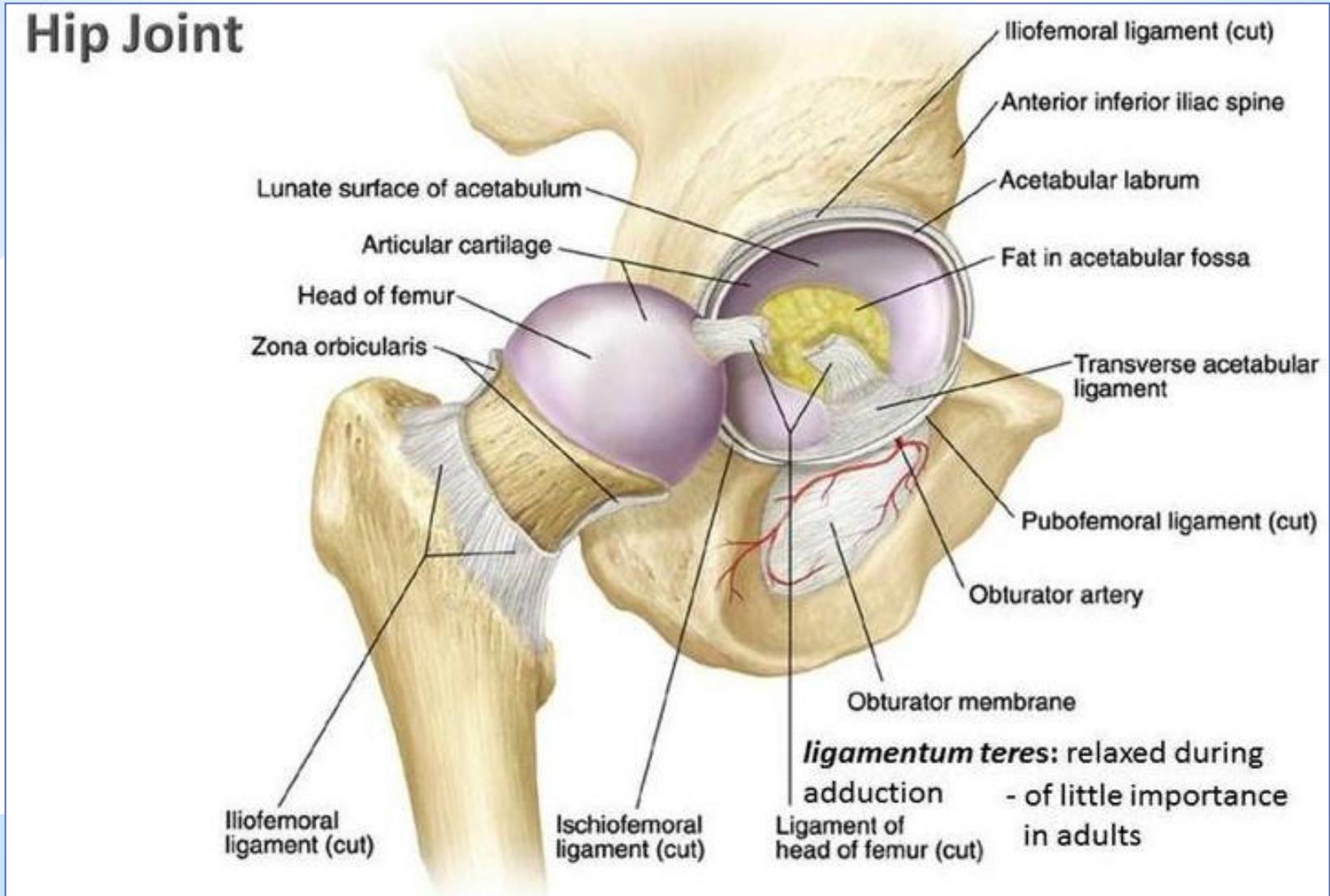
*Wrist Joint



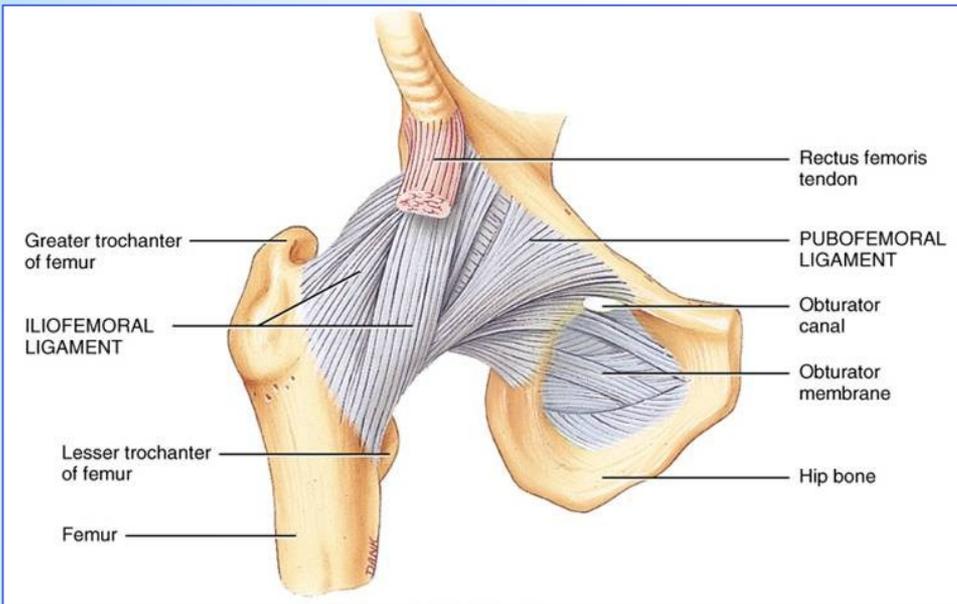
*The hip joint (*articulatio coxae*)



*The hip joint (*articulatio coxae*)

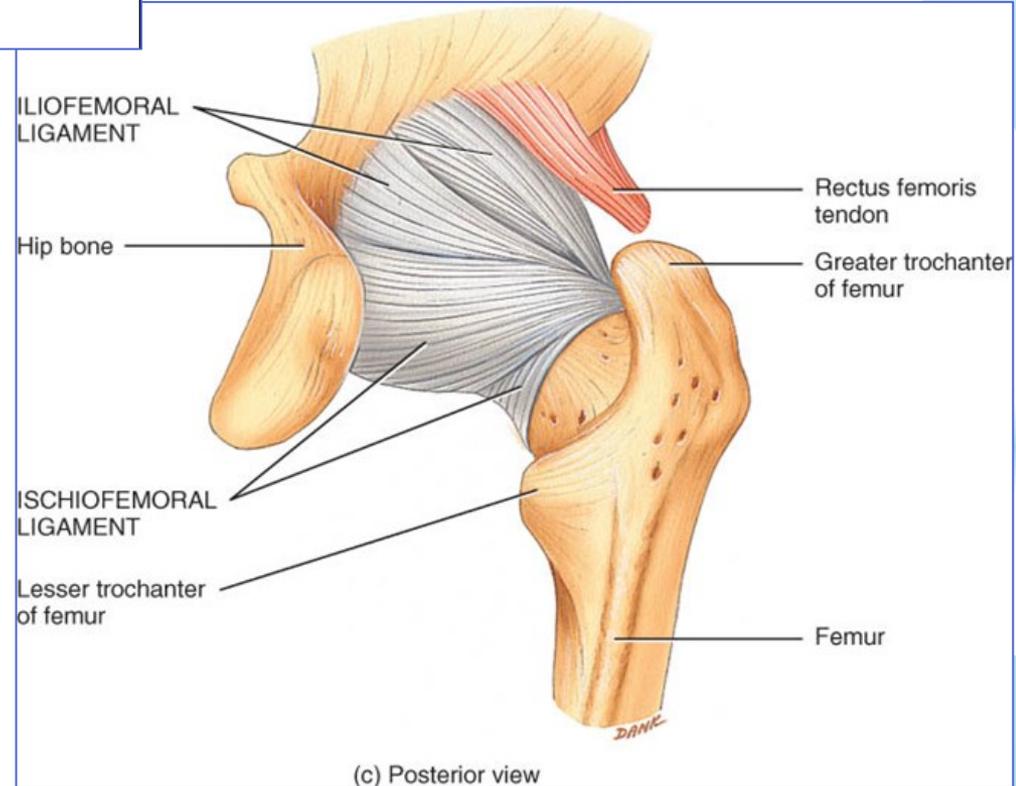


*The hip joint

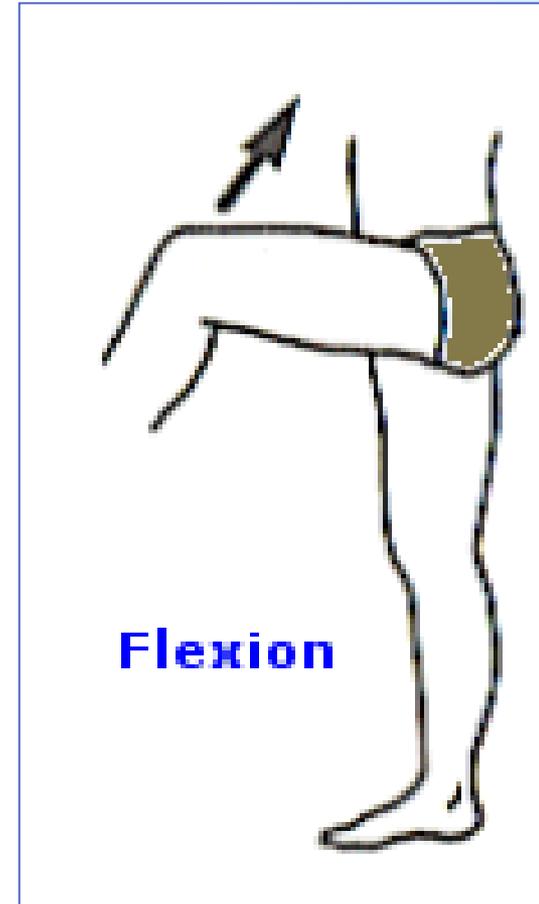
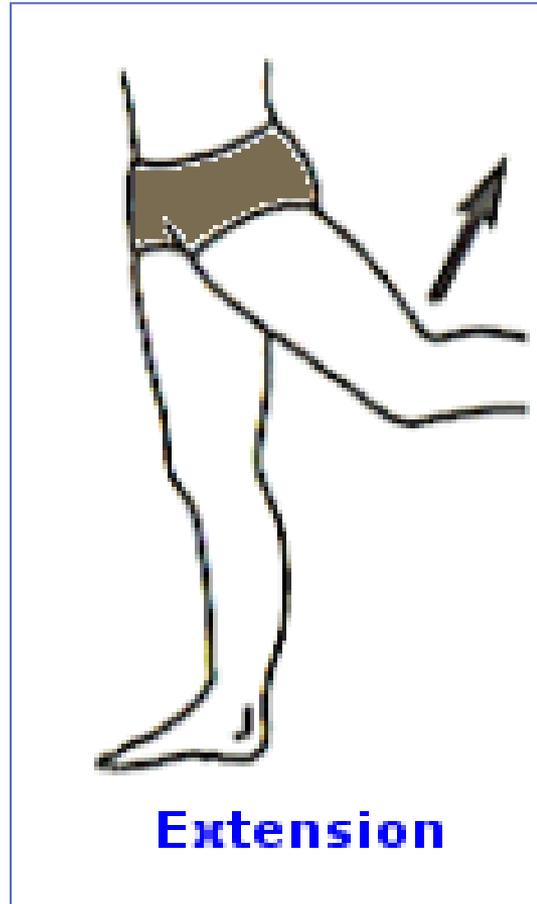
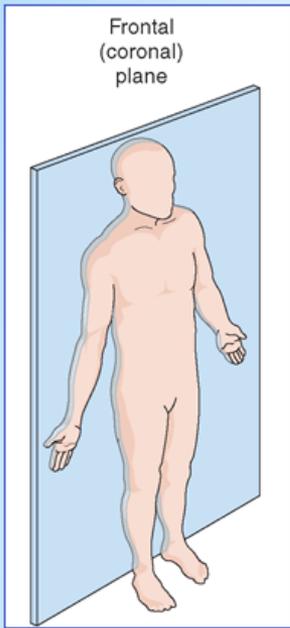


Ligaments:

- 1) Lig. iliofemorale
- 2) Lig. ischiofemorale
- 3) Lig. pubofemorale
- 4) Zona orbicularis
- 5) Lig. capitis femoris

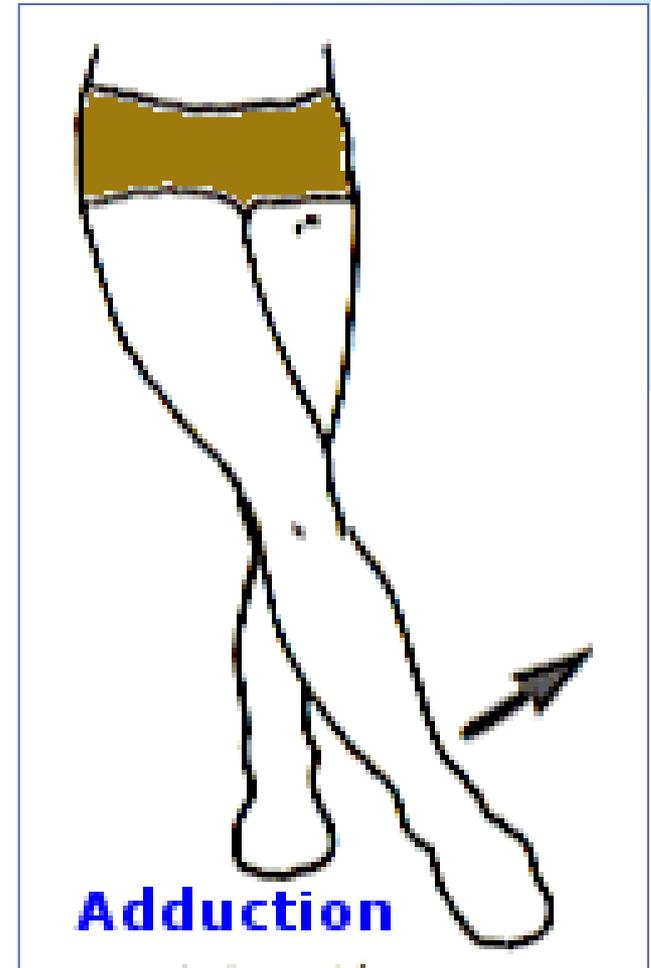
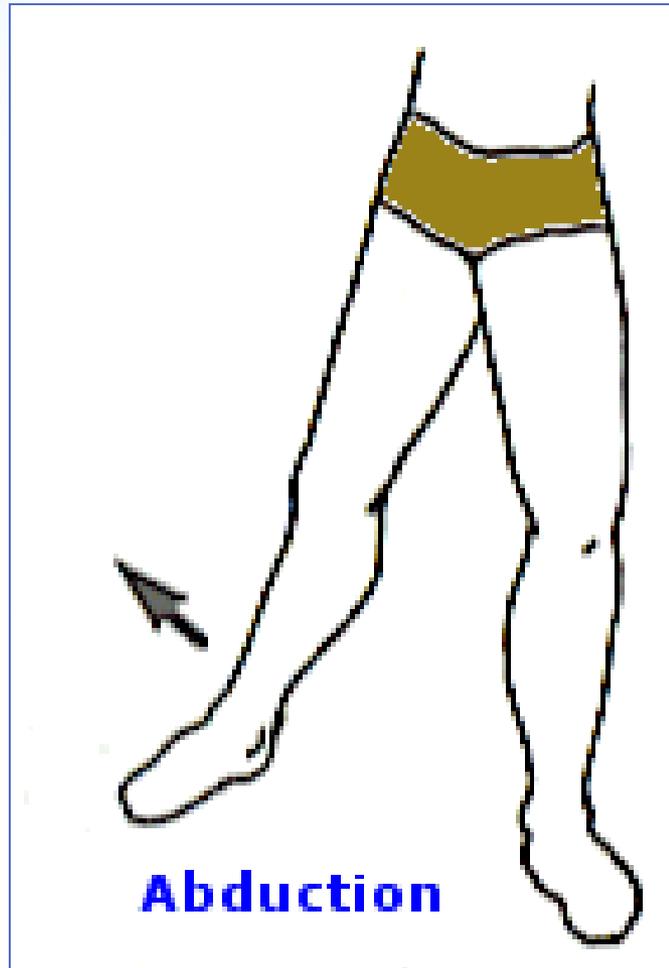
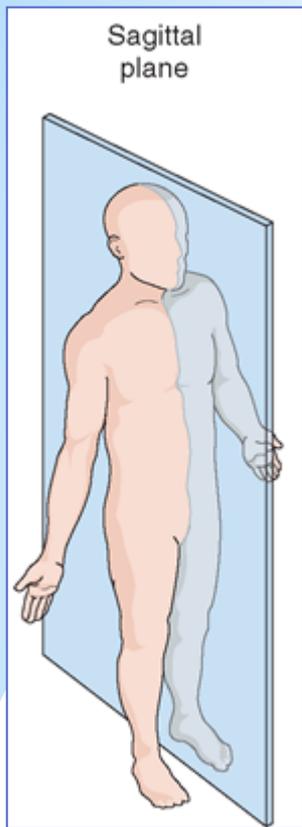


*The hip joint



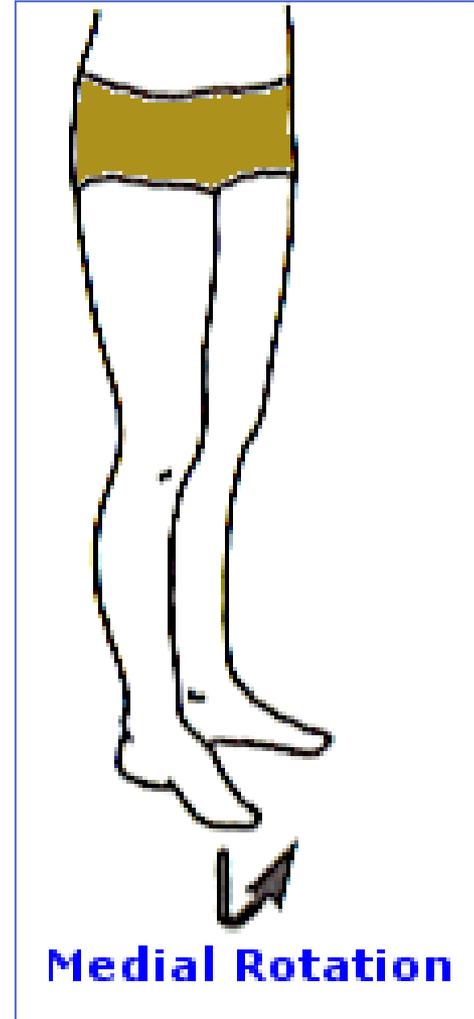
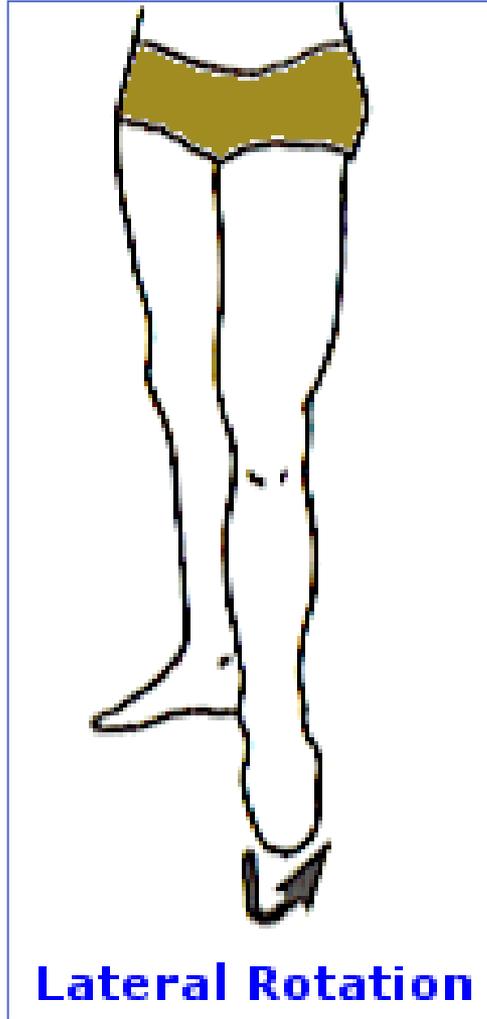
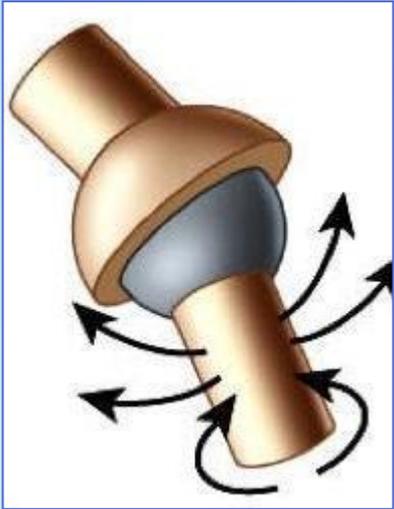
*Flexion and extension along frontal axis

* Hip Joint



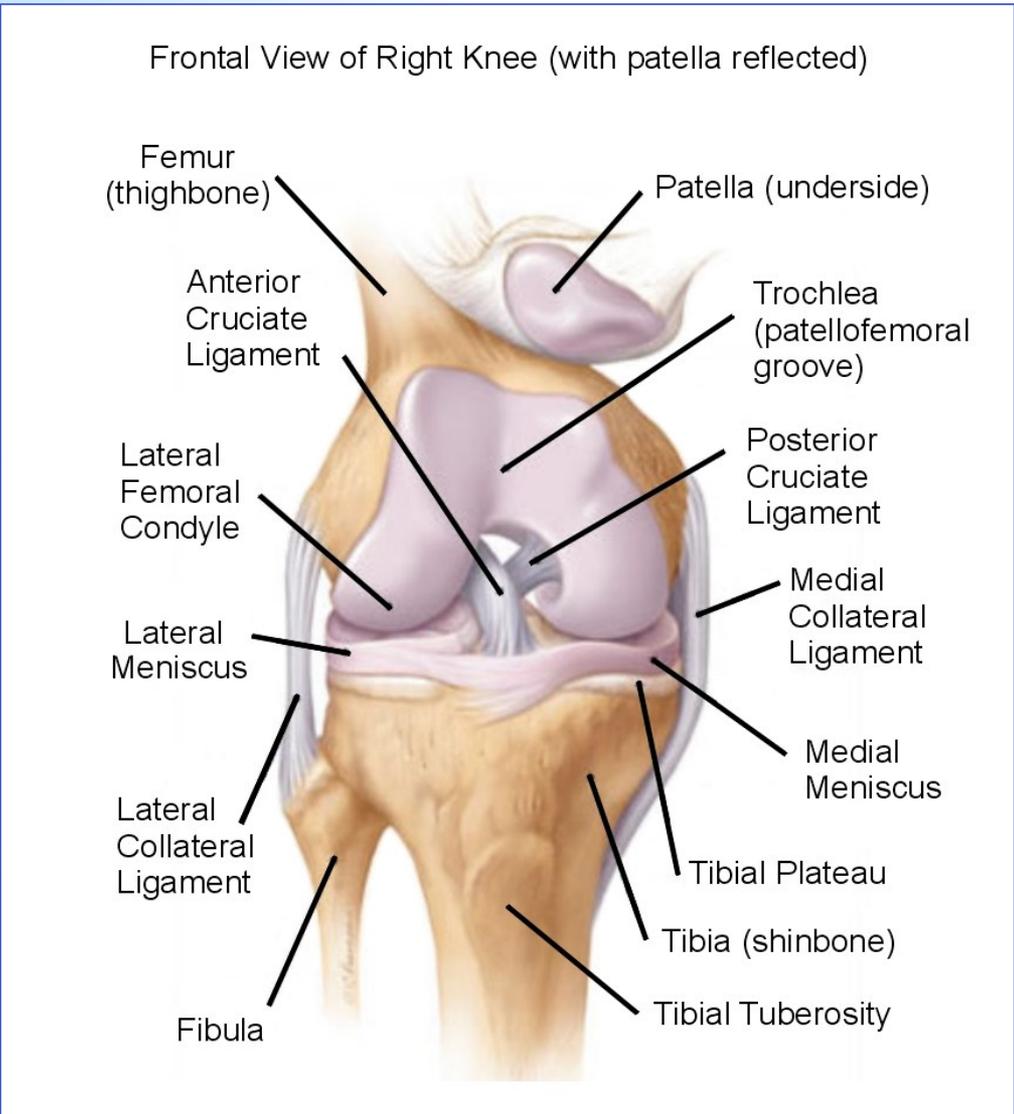
* Adduction and abduction along sagittal axis

* Hip Joint

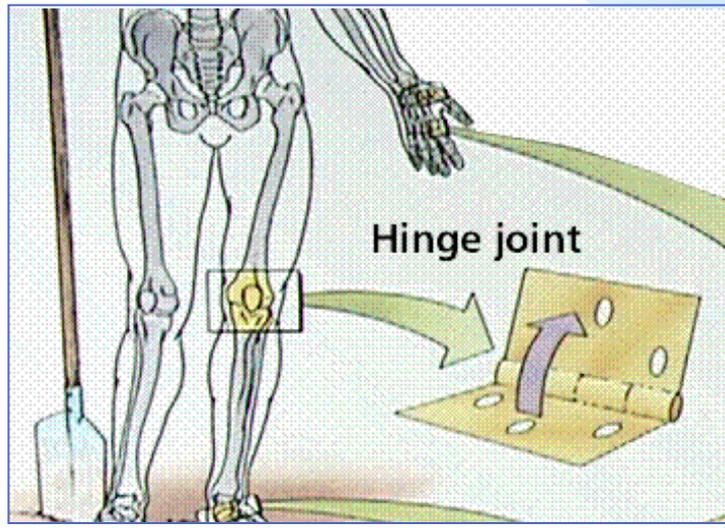


* Rotation along vertical axis

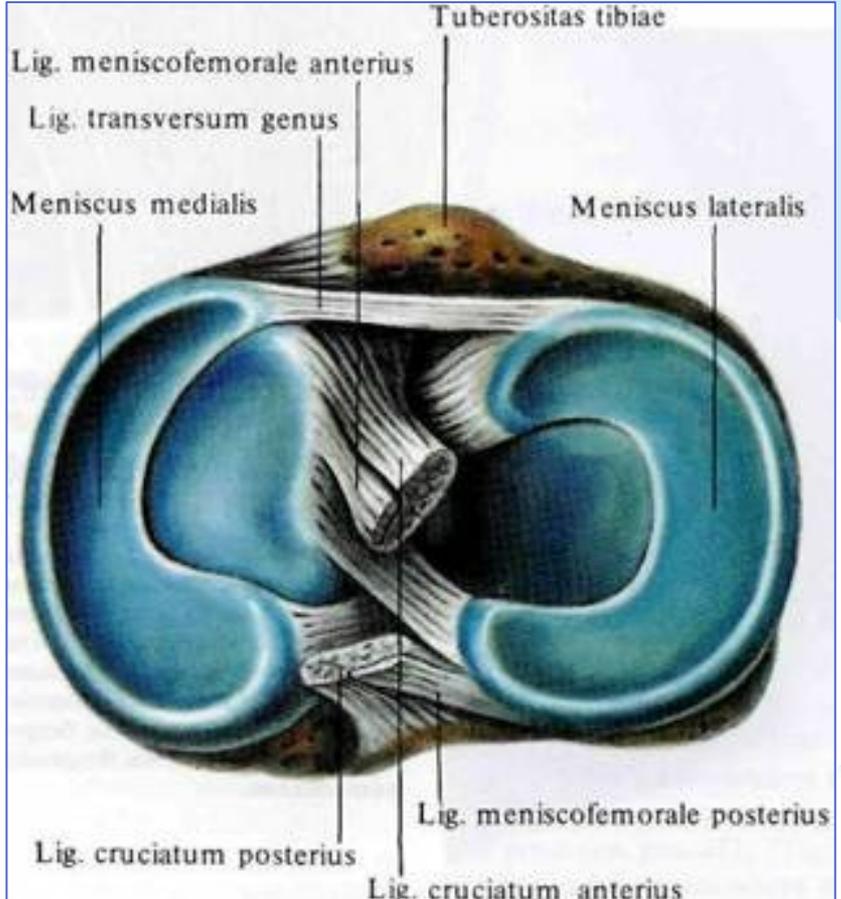
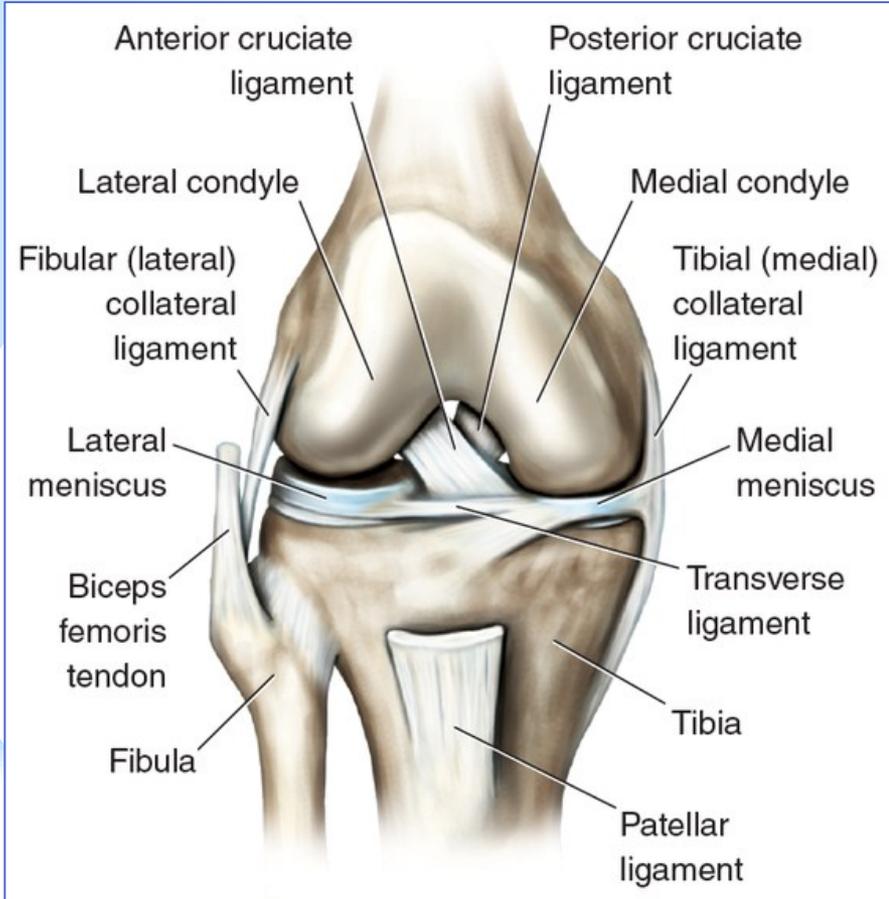
*The knee joint (*articulatio genus*)



Complex bicondylar joint

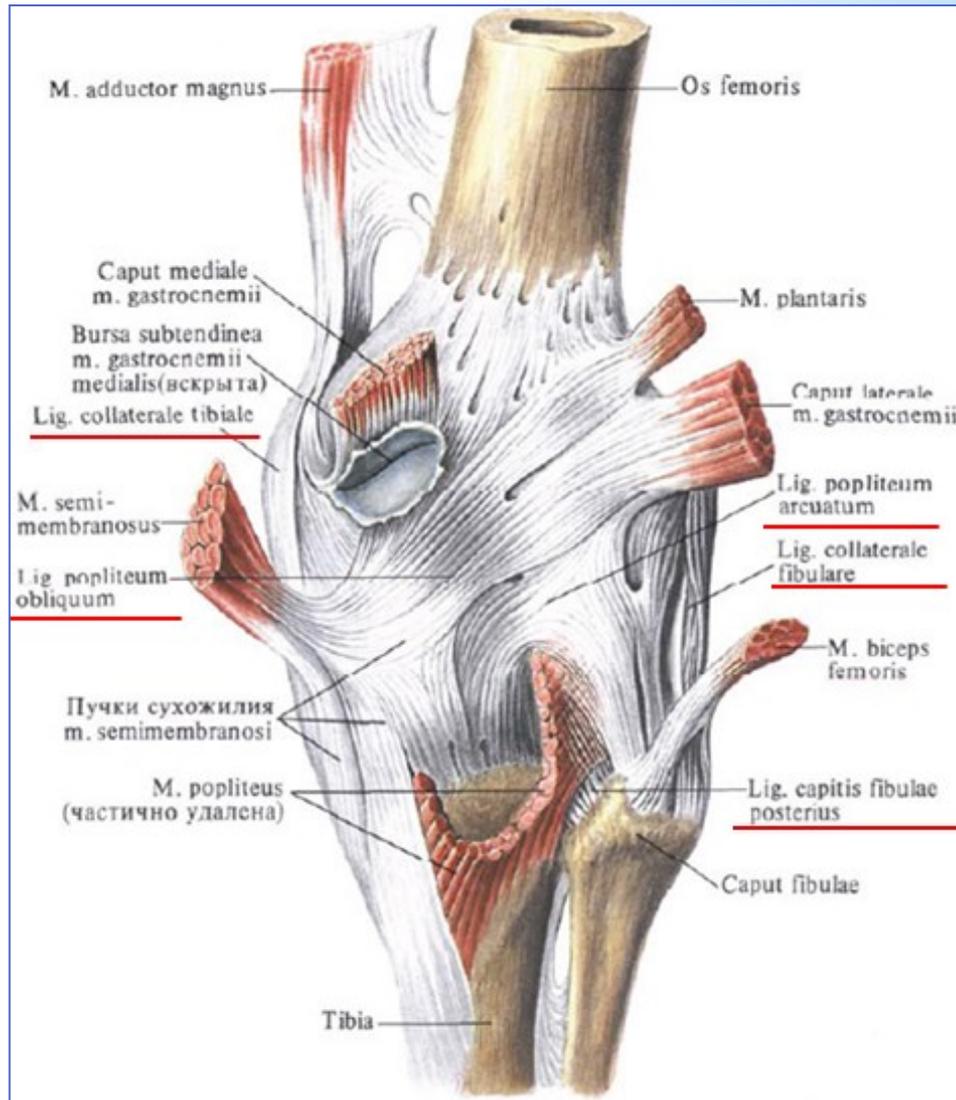
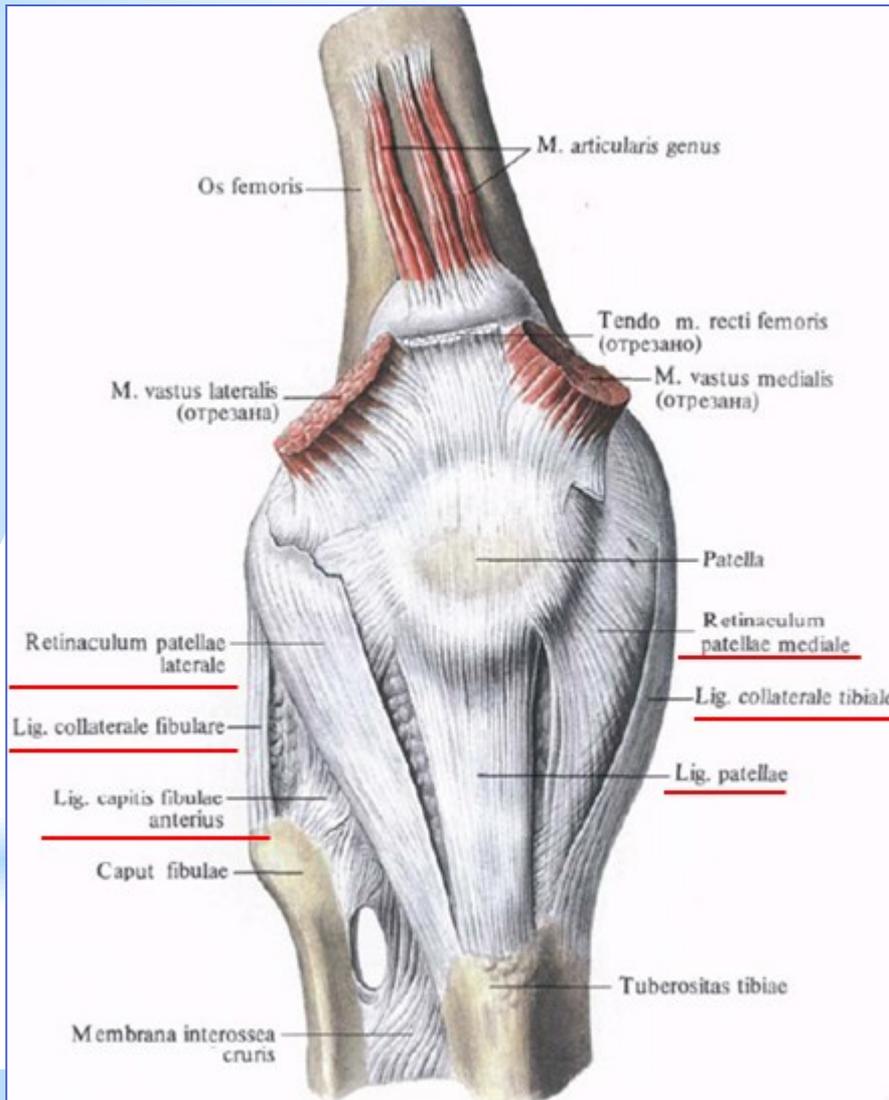


*The knee joint (*articulatio genus*)



Intra-articular ligaments

*The knee joint (*articulatio genus*)



Extra-articular ligaments

Anterolateral ligament of the knee joint

Journal of **Anatomy**

J. Anat. (2013) 223, pp321-328

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Anatomy of the anterolateral ligament of the knee

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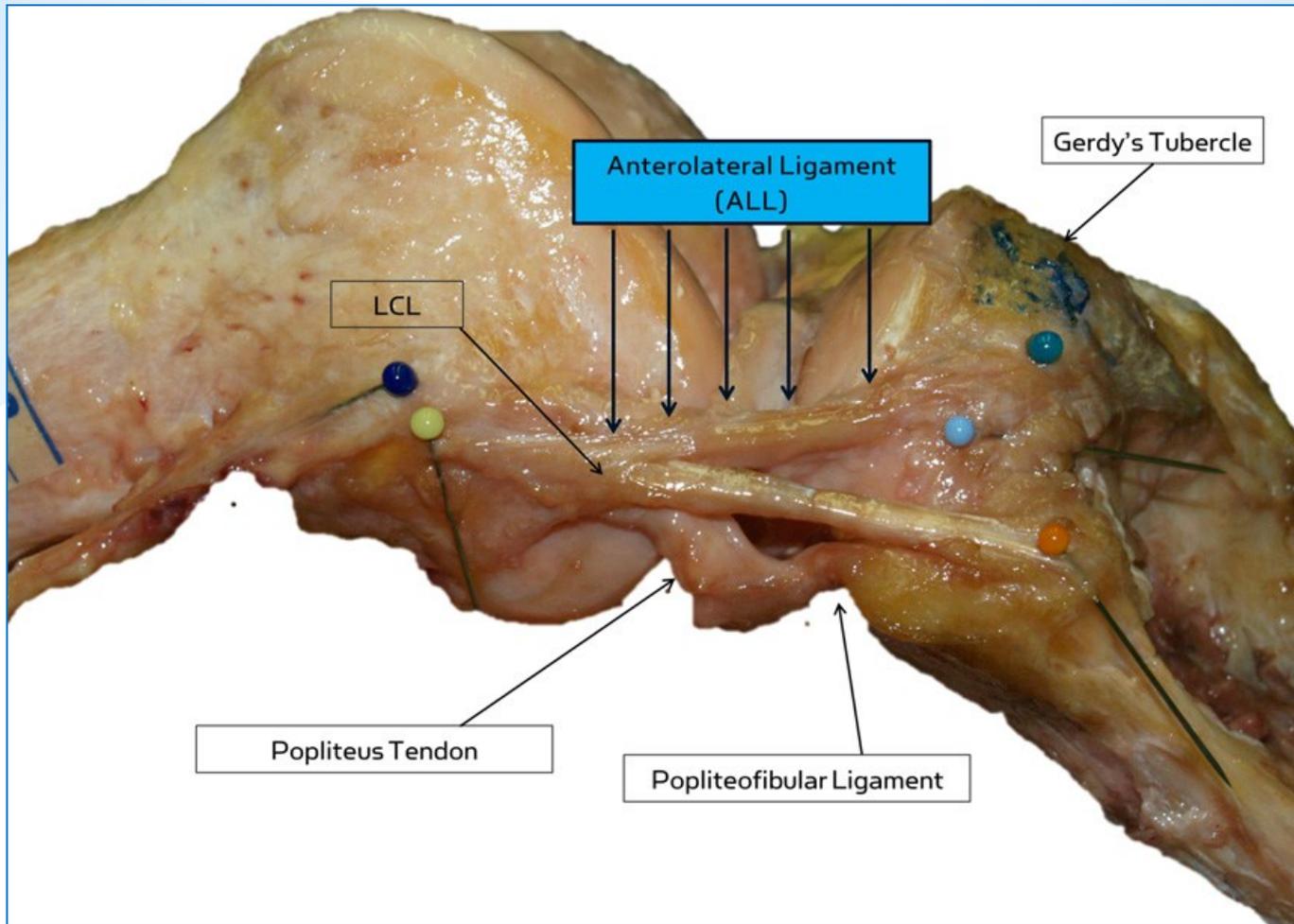
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Hypothesized function -
control internal tibial rotation,
stabilize internal rotation





Origin – on the prominence of the lateral femoral epicondyle

Insertion - the body of the ALL ran an oblique course to the anterolateral side of the proximal tibia.

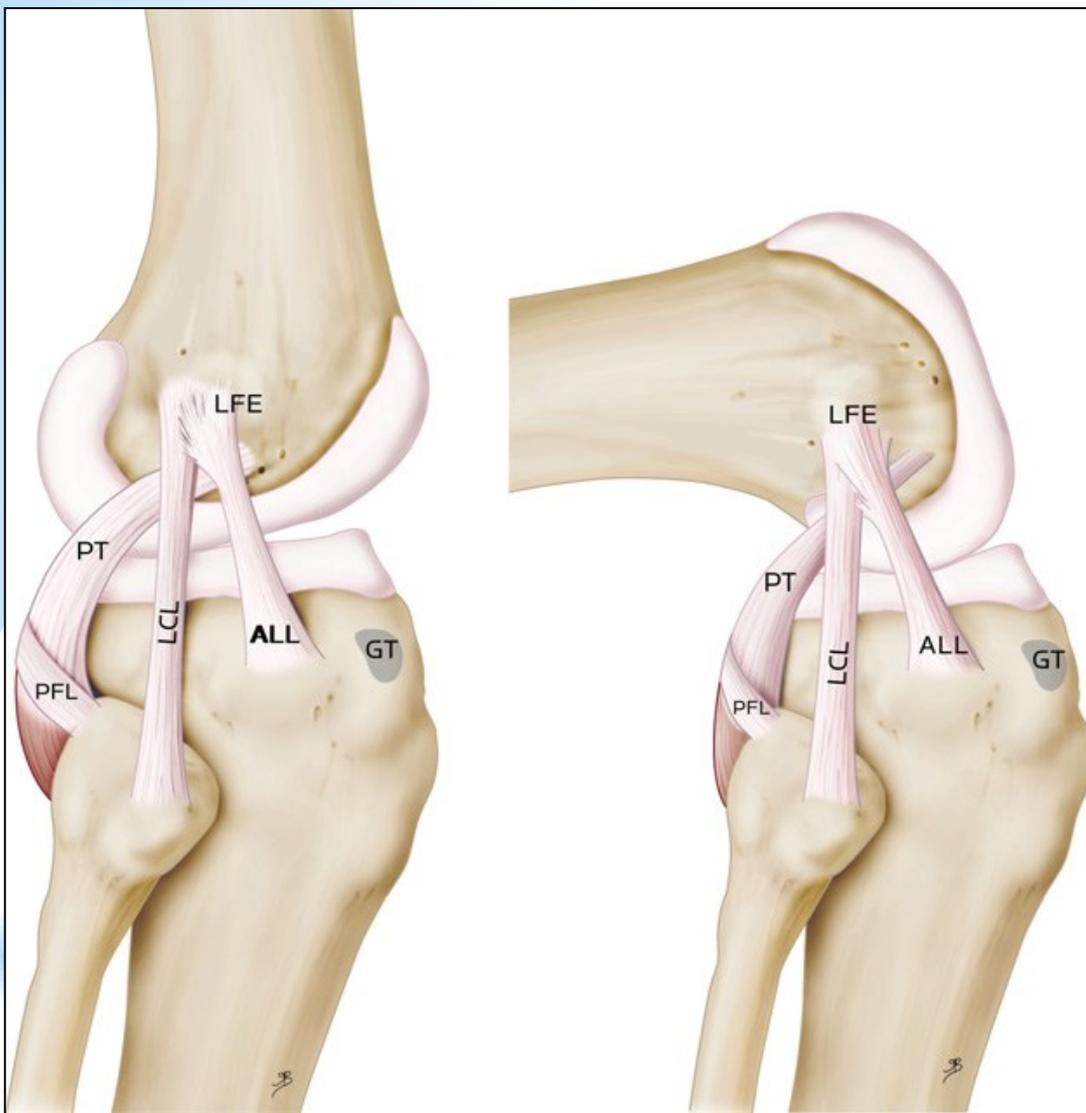


Fig. 4 Anatomic drawing considering the ALL and its relationship with well-known anatomical landmarks on the lateral aspect of the human knee.
 (A) Knee in full extension.
 (B) Knee in 90° of flexion.

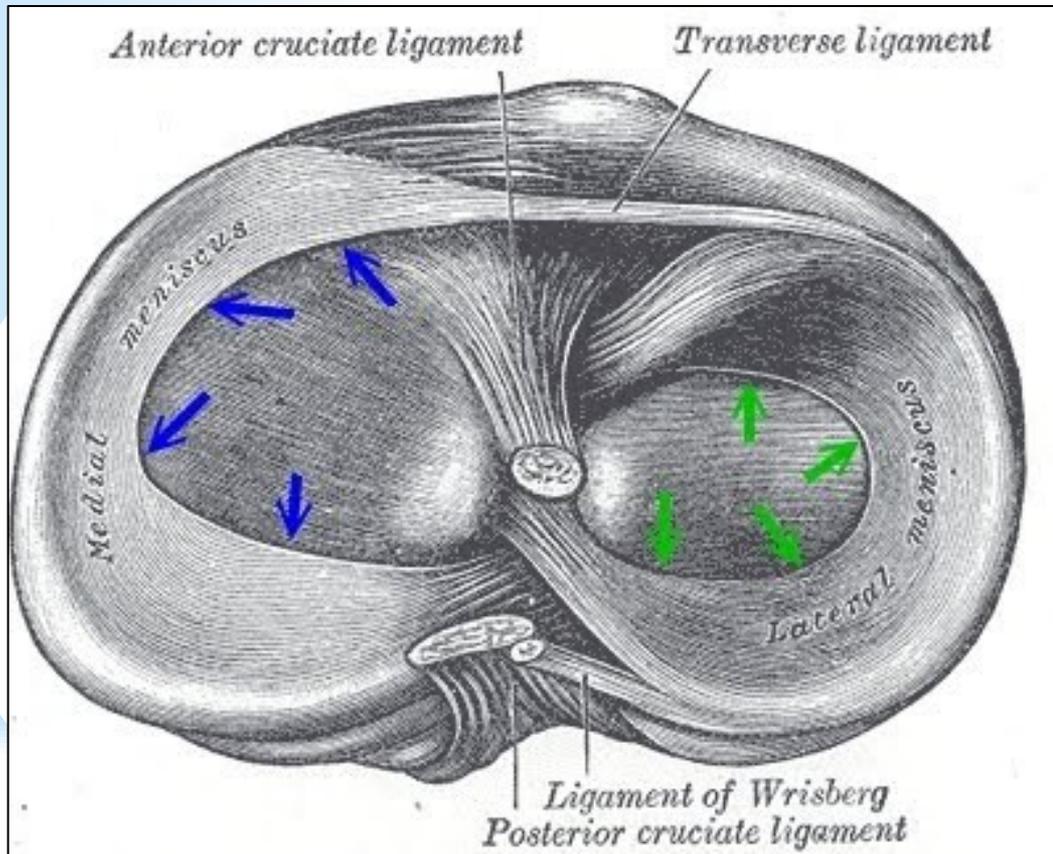
ALL, anterolateral ligament;
 LCL, lateral collateral ligament;
 GT, Gerdy's tubercle;
 LFE, lateral femoral epicondyle;
 PT, popliteus tendon;
 PFL, popliteo-fibular ligament.



1879, years before the discovery of X-rays, **Dr. Paul Segond** described a remarkably constant avulsion fracture pattern at the anterolateral proximal tibia as a result of forced internal rotation at the knee (**Segond fracture**)

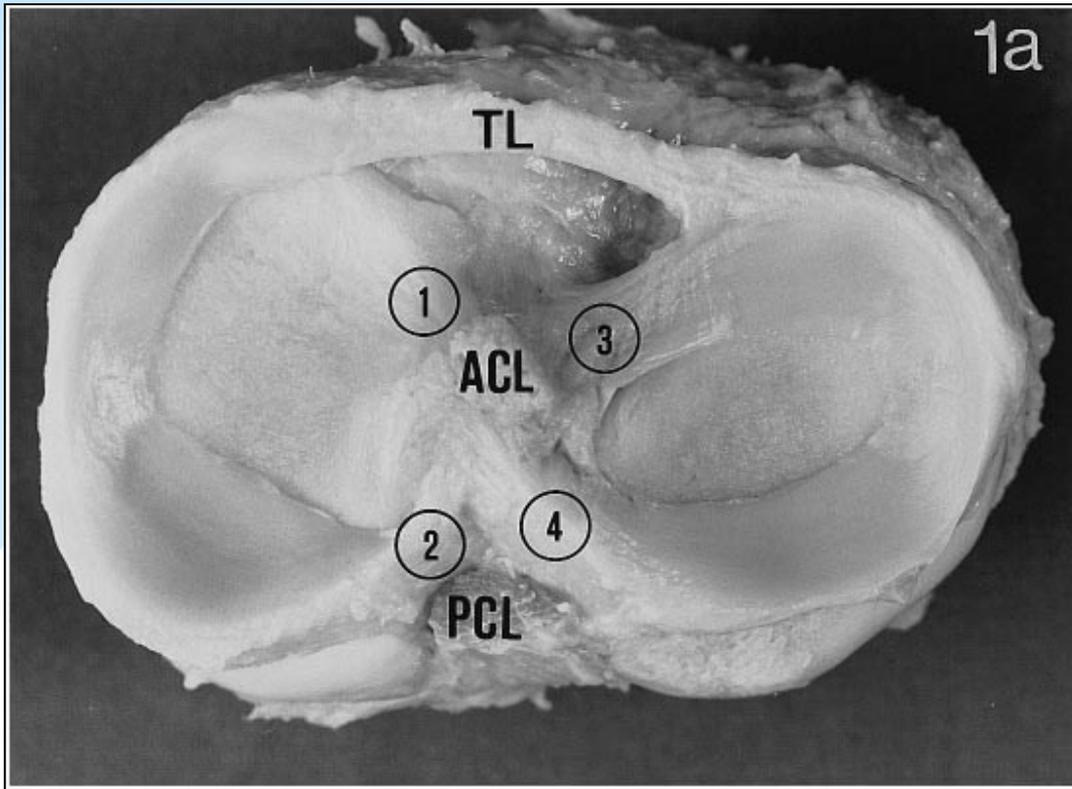
Lateral and medial menisci of the knee joint

(viscoelastic soft tissue)



Functions of the menisci:

- adapt articular surfaces of femur and tibia, increase their congruence, hence the stresses on tibial cartilage are reduced
- to distribute loads and therefore reduce the stresses on the tibia,
- joint stabilisation;
- shock absorption;
- joint lubrication;
- cartilage protection and prevention of osteoarthritis

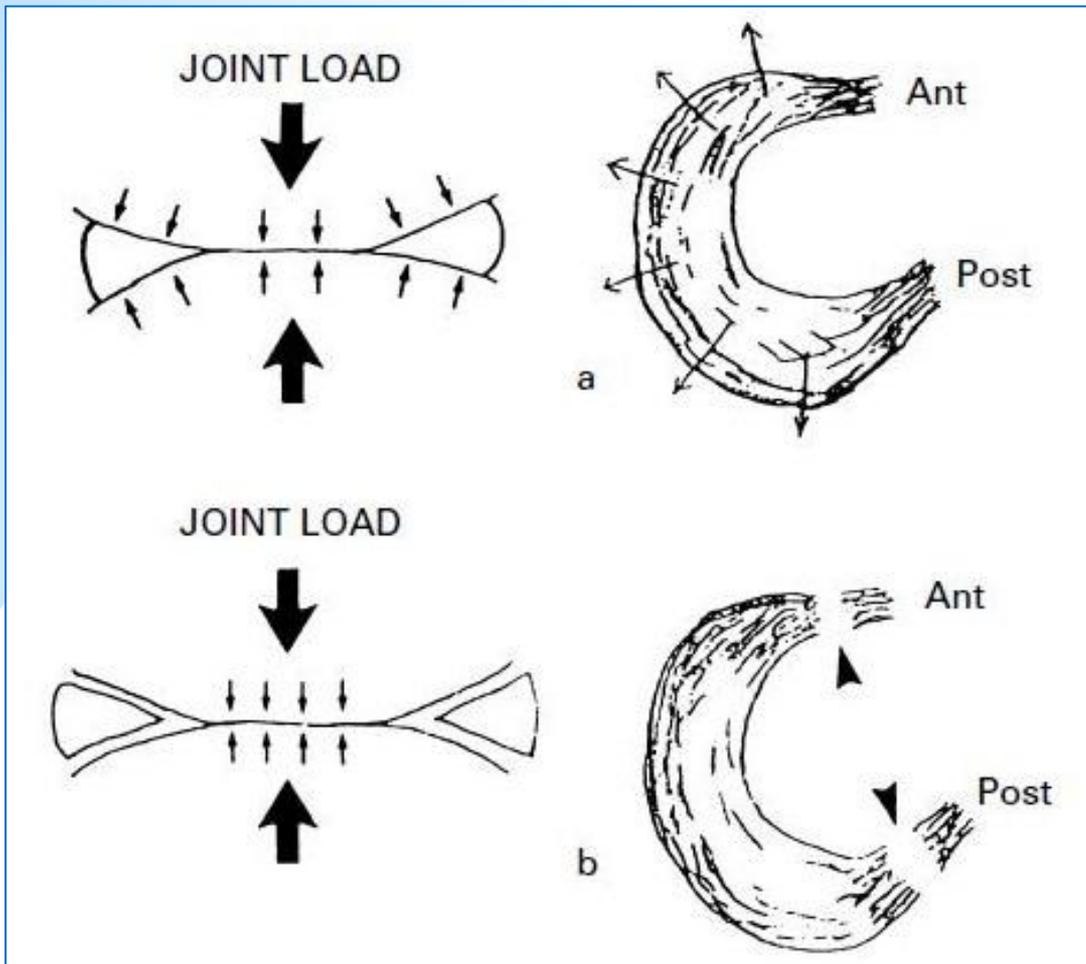


Human meniscus

Fig. 1. Human meniscus. (a) Right human knee joint viewed from above (the femur has been removed); the tibial tuberosity is on top. The medial and lateral menisci are connected by a transverse ligament (TL).

1 - anterior insertional ligament of the medial meniscus;
2 - posterior insertional ligament of the medial meniscus;
3 - anterior insertional ligament of the lateral meniscus;
4 - posterior insertional ligament of the lateral meniscus;
ACL - cross section of the anterior cruciate ligament;
PCL - cross section of the posterior cruciate ligament.

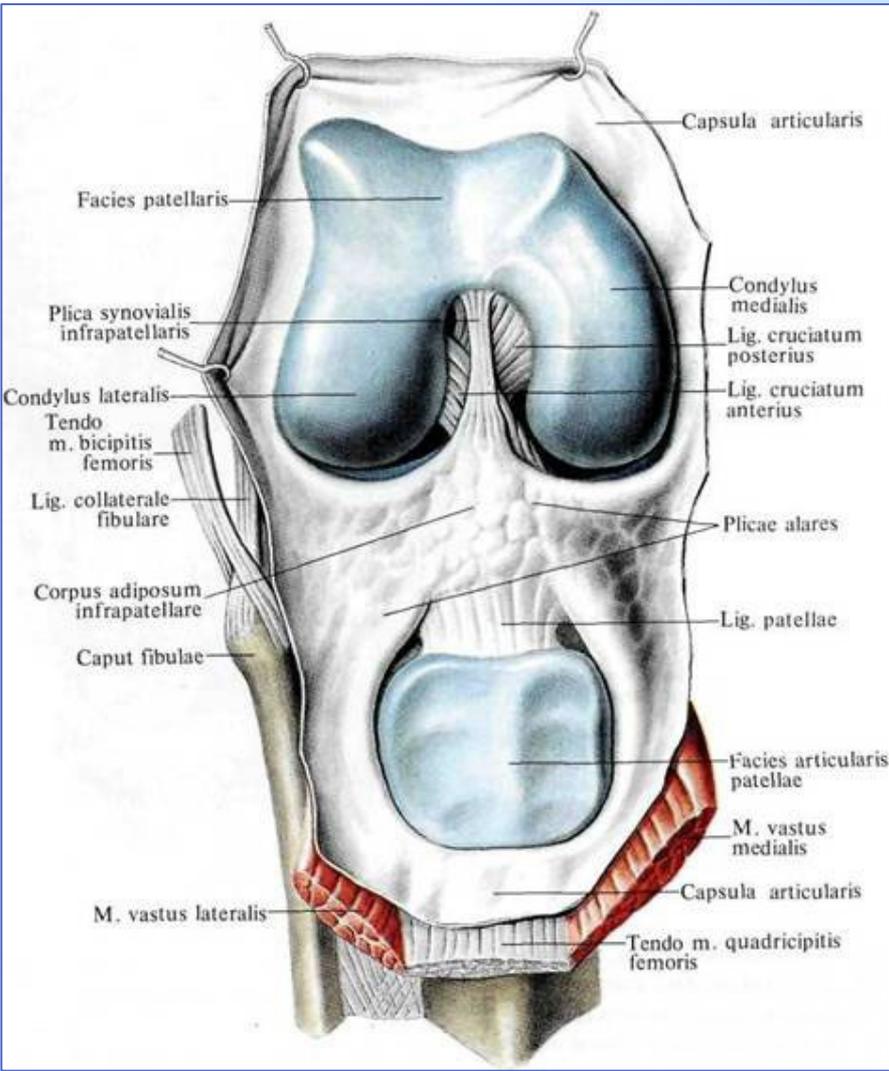
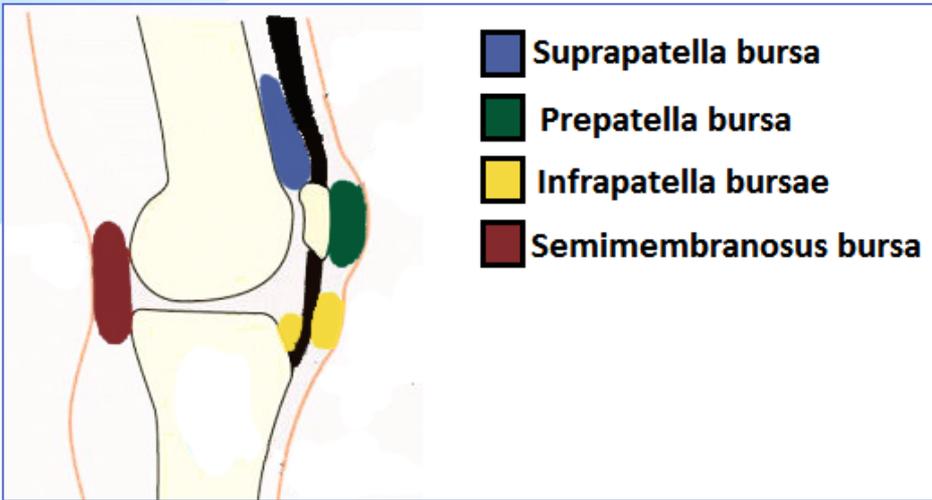
*Karola Messner and Jizong Gao.
The menisci of the knee joint.
Anatomical and functional
characteristics, and a rationale for
clinical treatment. Review. J. Anat.
(1998) 193, pp. 161±178*



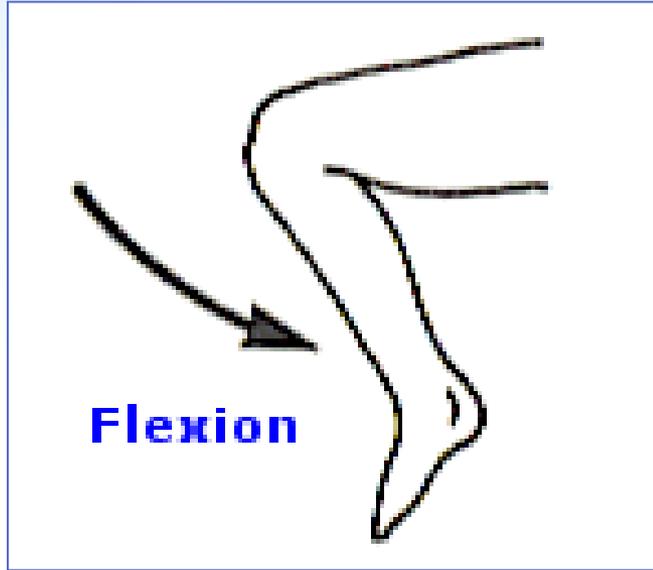
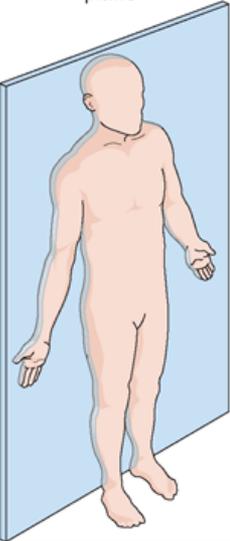
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Fig. 2. Diagram demonstrating the importance of intact meniscal entheses for the load distribution function of the meniscus. (a) With intact entheses the load (thick arrows) is transmitted via the menisci and articular cartilage through a large contact area (left hand side of figure; small arrows). Part of the load is transformed to hoop stresses (right hand side of figure; long arrows). (b) When the insertional ligaments are transected (right hand side of figure; arrowheads), the meniscus will extrude from the knee joint during loading, and the load (left hand side of figure; thick arrows) is mainly transmitted via articular cartilage through a reduced contact area (small arrows).

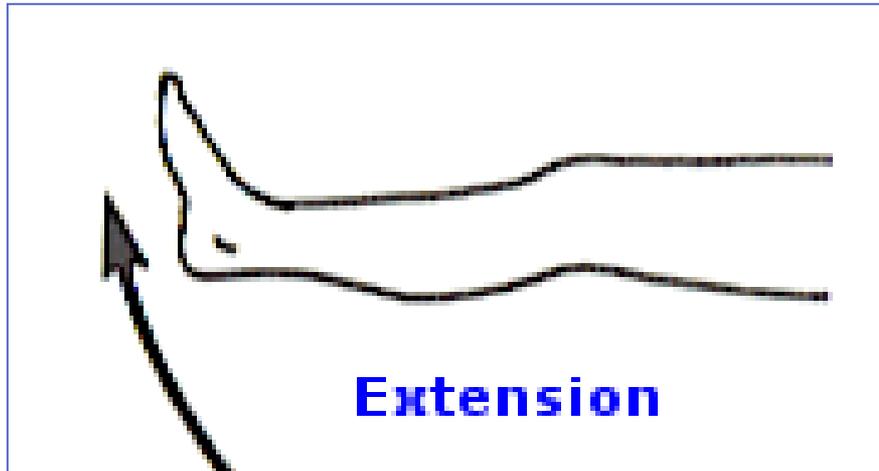
*The knee joint (*articulatio genus*)



Frontal
(coronal)
plane

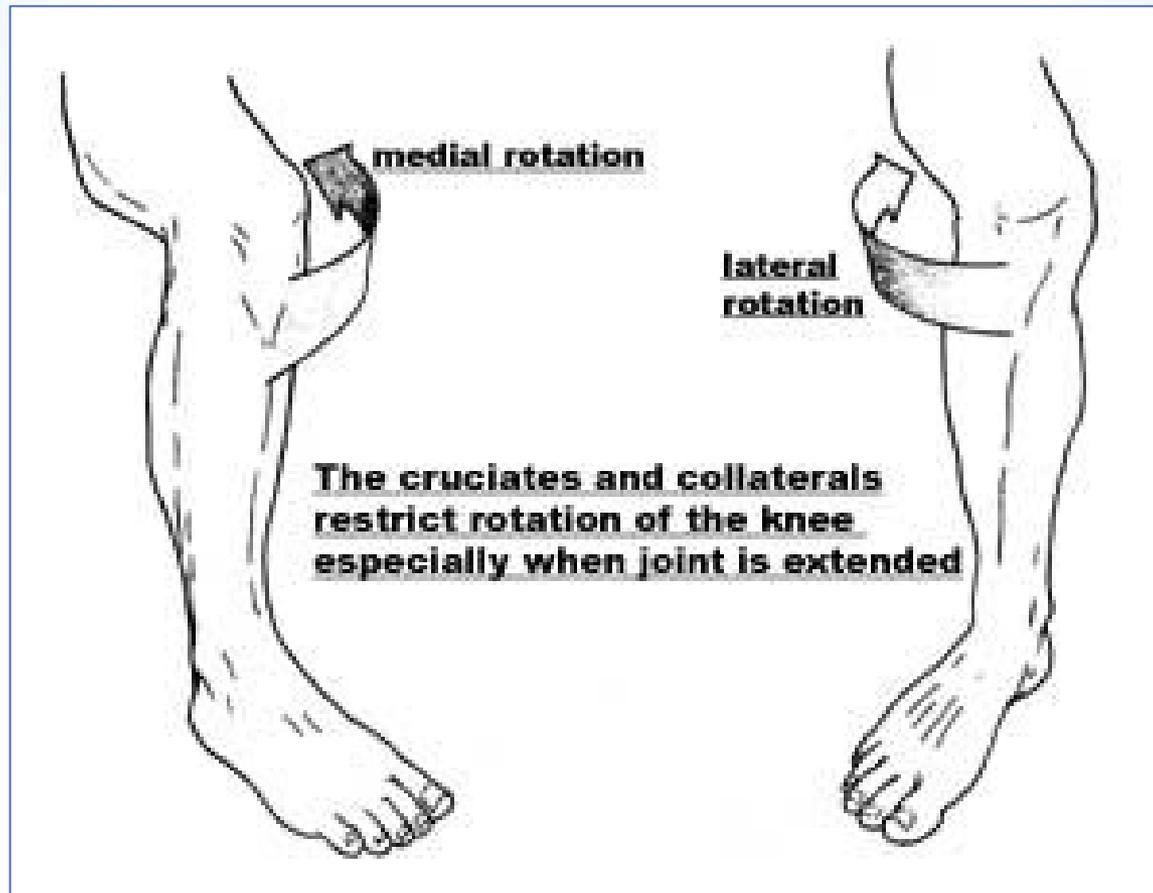


*The knee joint



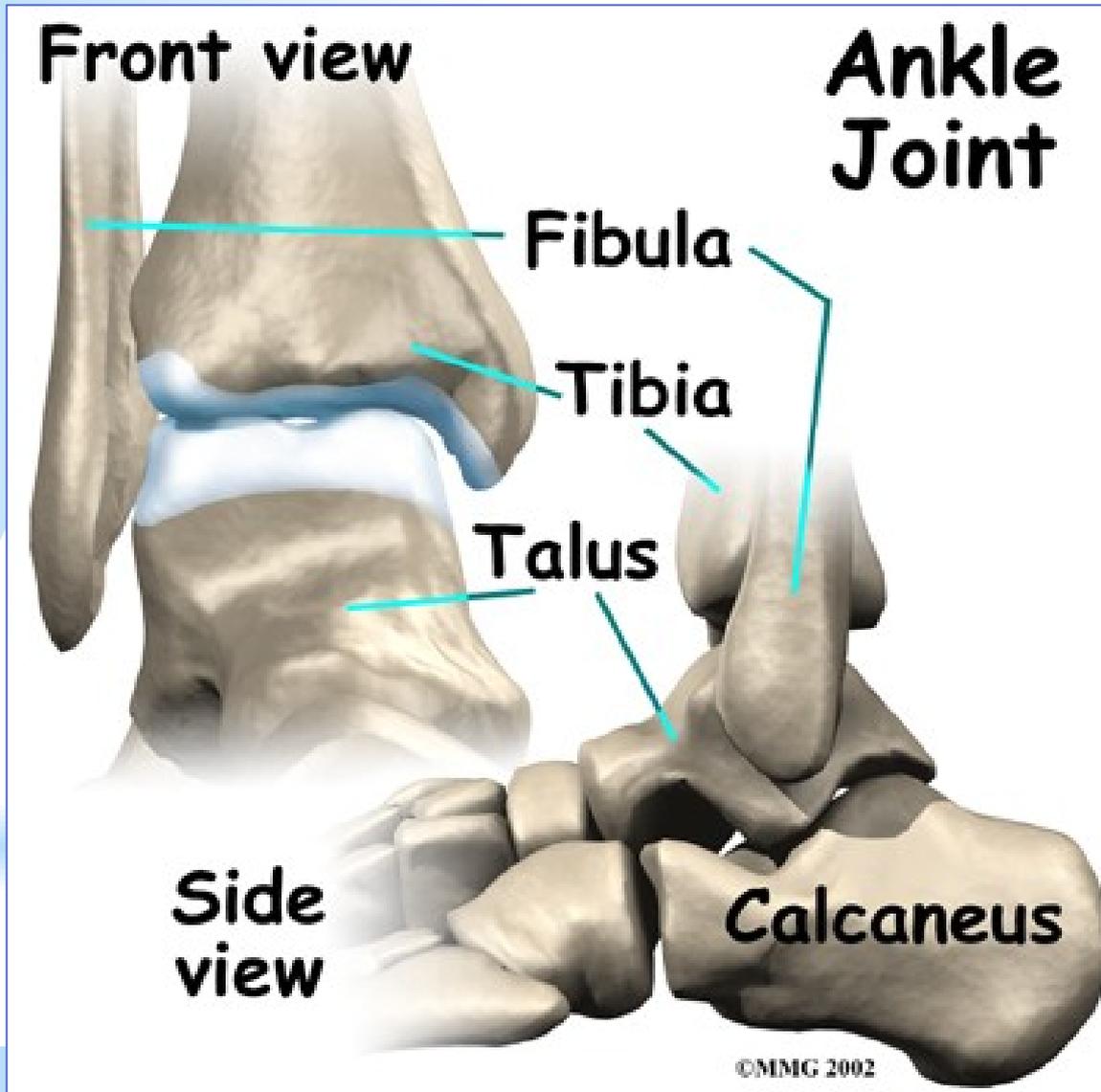
*Flexion and extension along frontal axis

*The knee joint

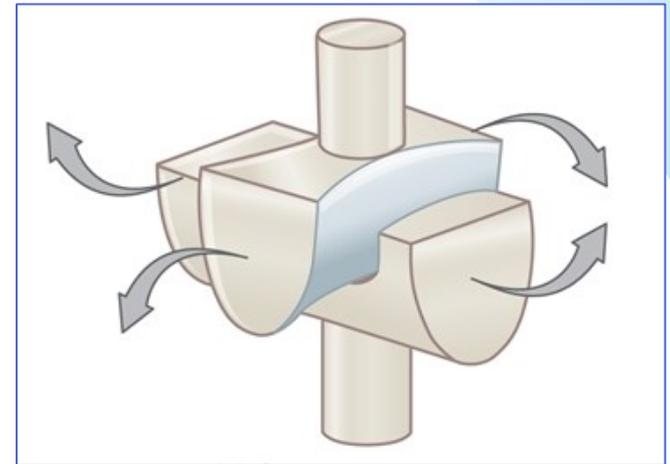


Rotation becomes possible when the knee is flexed!

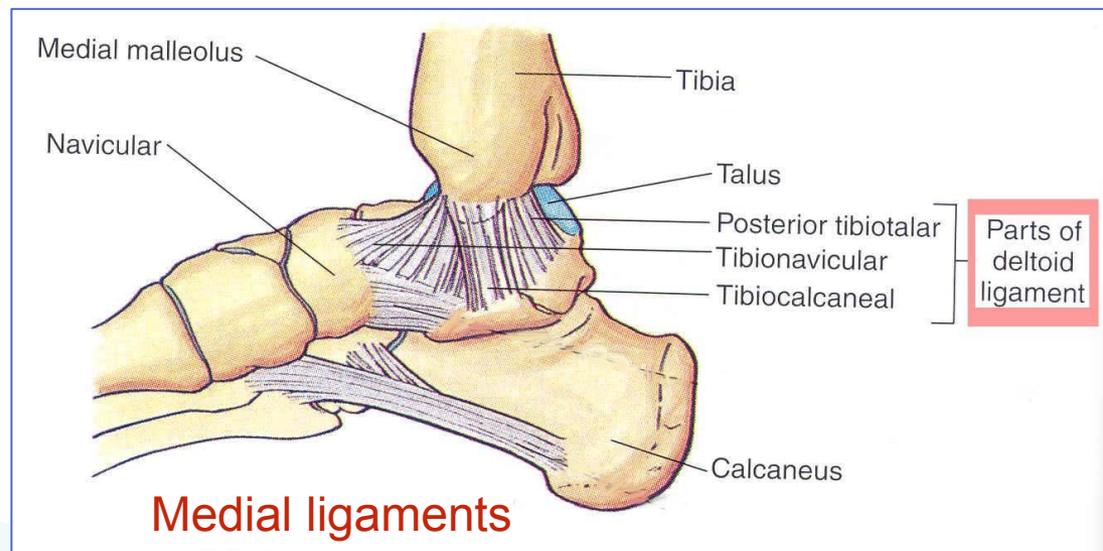
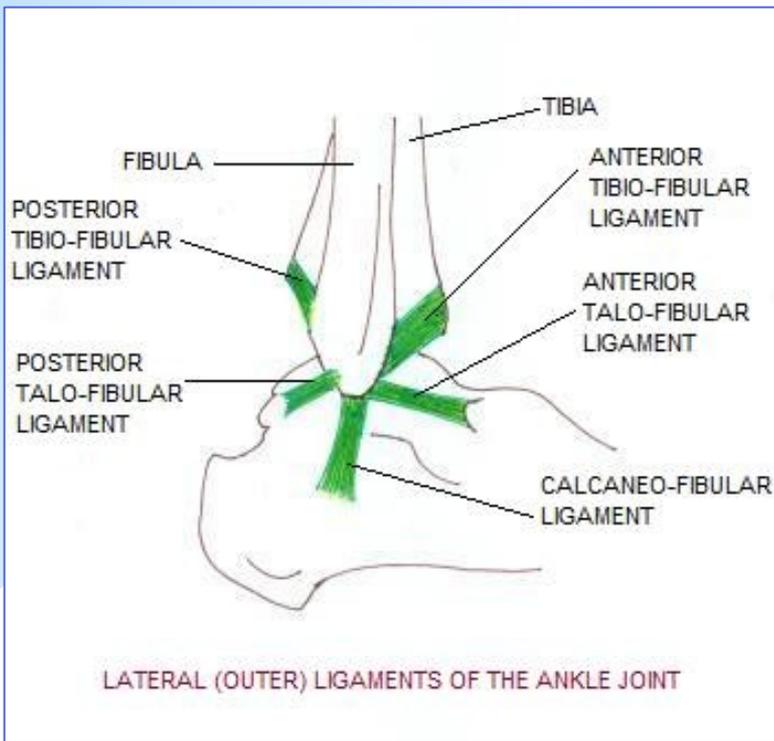
Articulatio talocruralis



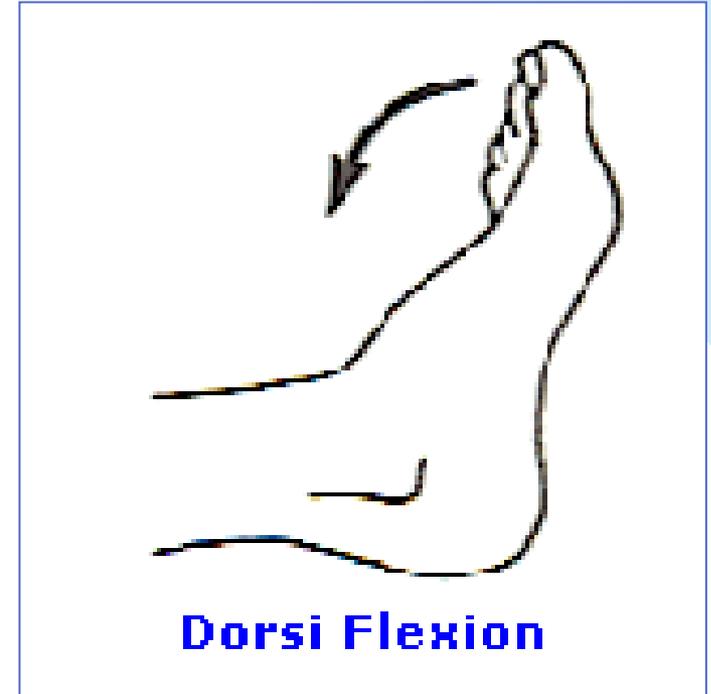
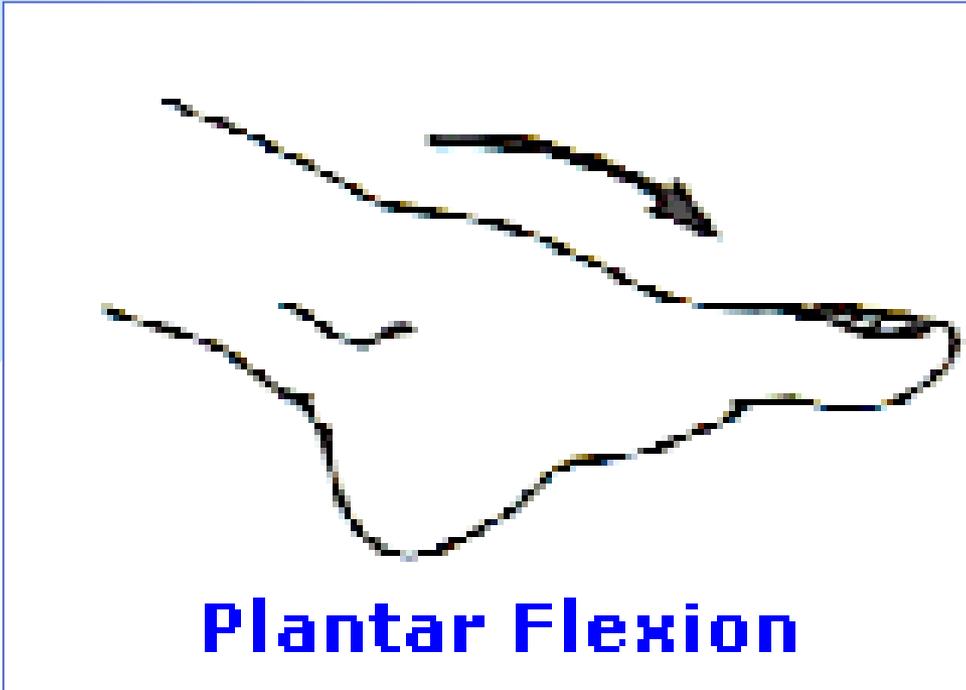
Complex saddle joint



Ankle joint ligaments

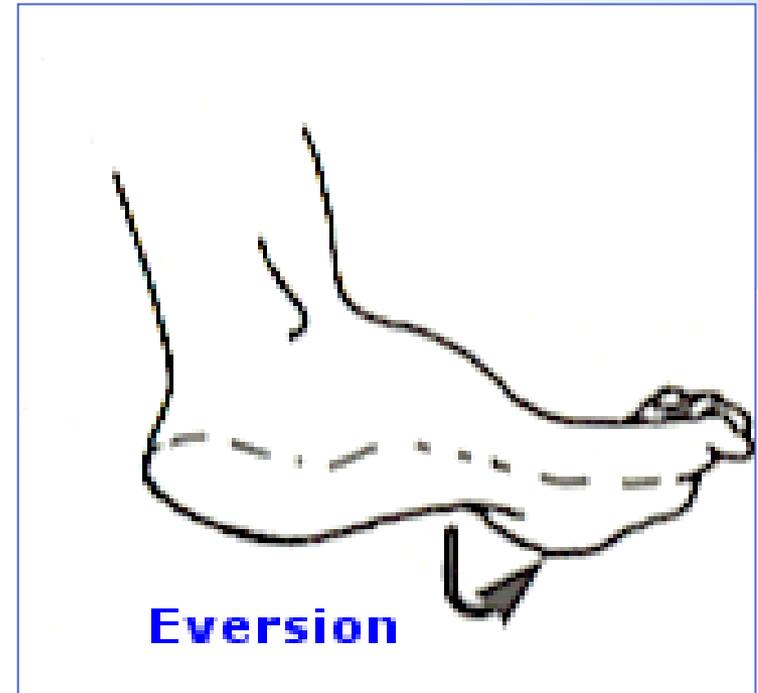
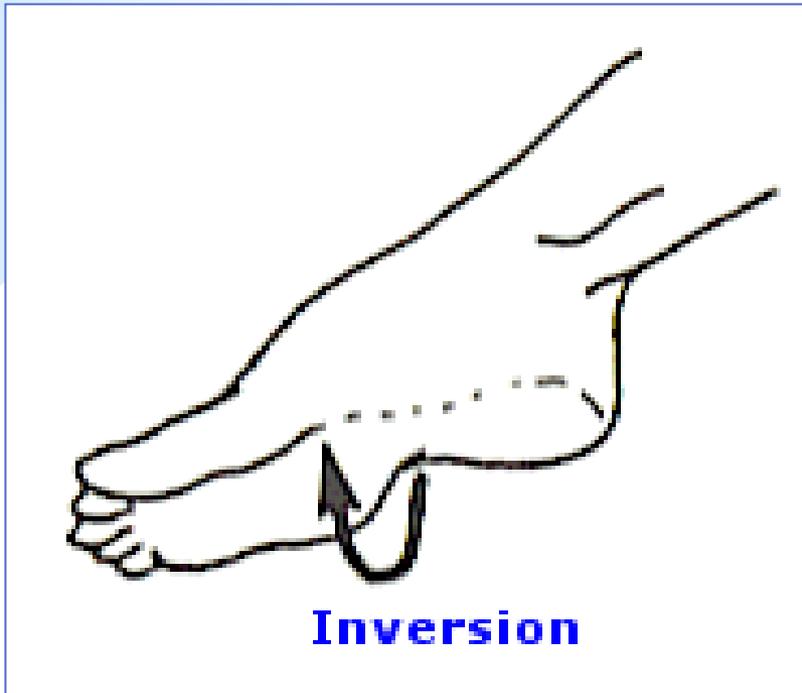


* Ankle Joint



* Plantar flexion and dorsi flexion along frontal axis

* Ankle Joint (subtalar joint)



* Inversion and eversion along vertical axis



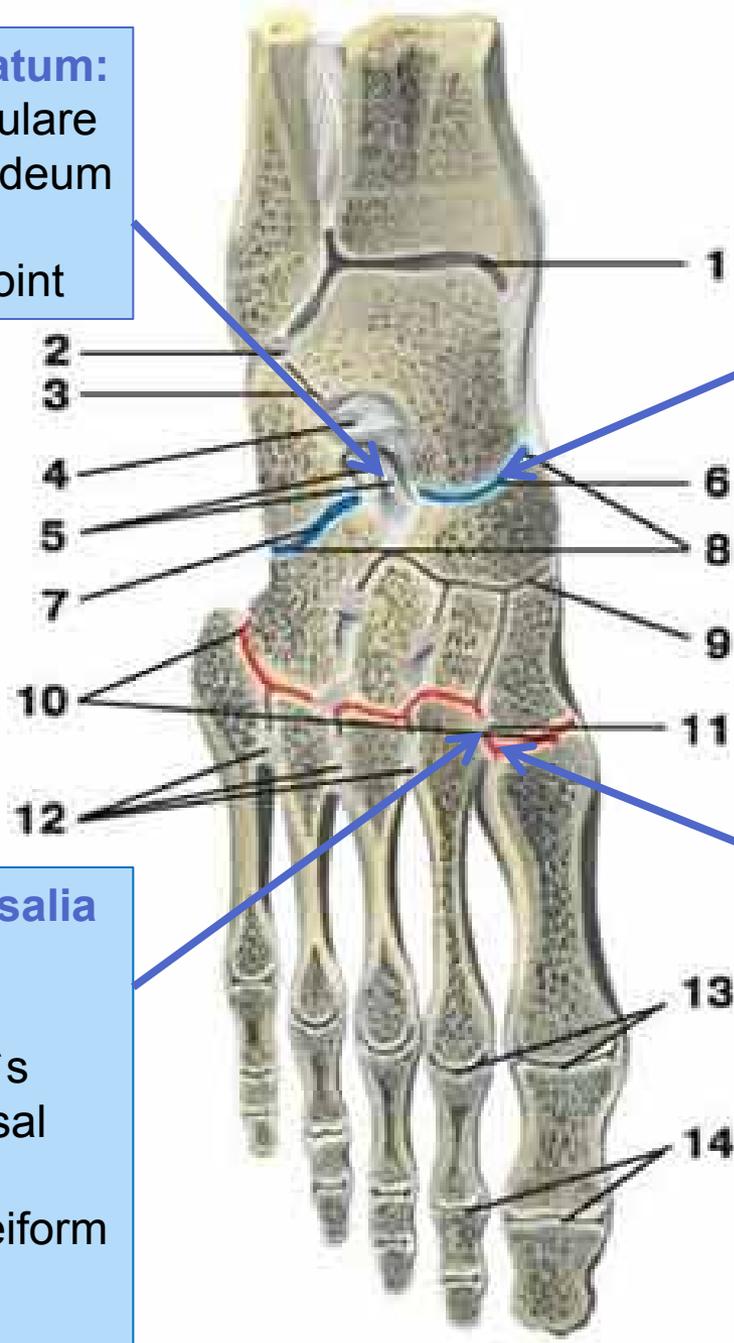
Ligamentum bifurcatum:

- lig. calcaneonaviculare
- lig. calcaneocuboideum

- “key” of Chopart`s joint

Ligg. cuneometatarsalia interossea:

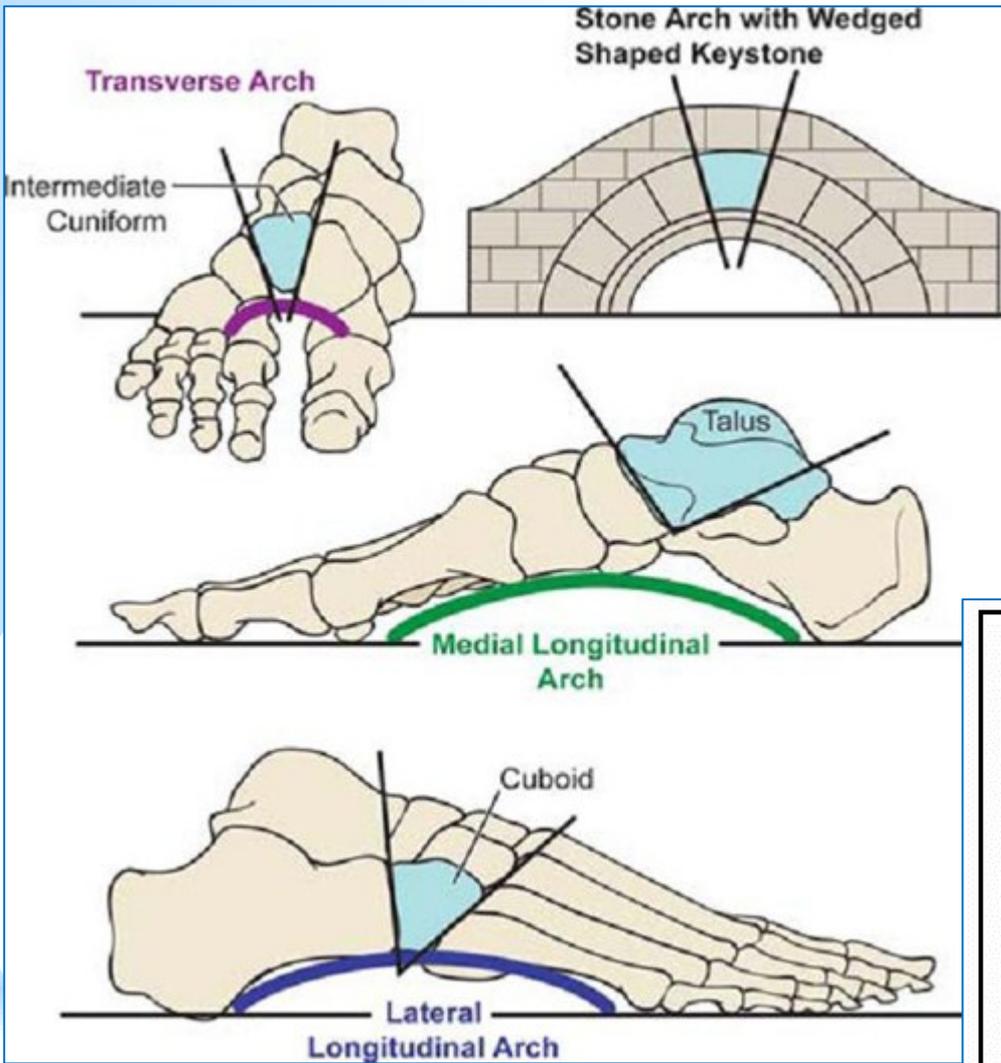
The “key” of Lisfrank`s joint – cuneometatarsal interosseus ligament between medial cuneiform bone and second metatarsal bone



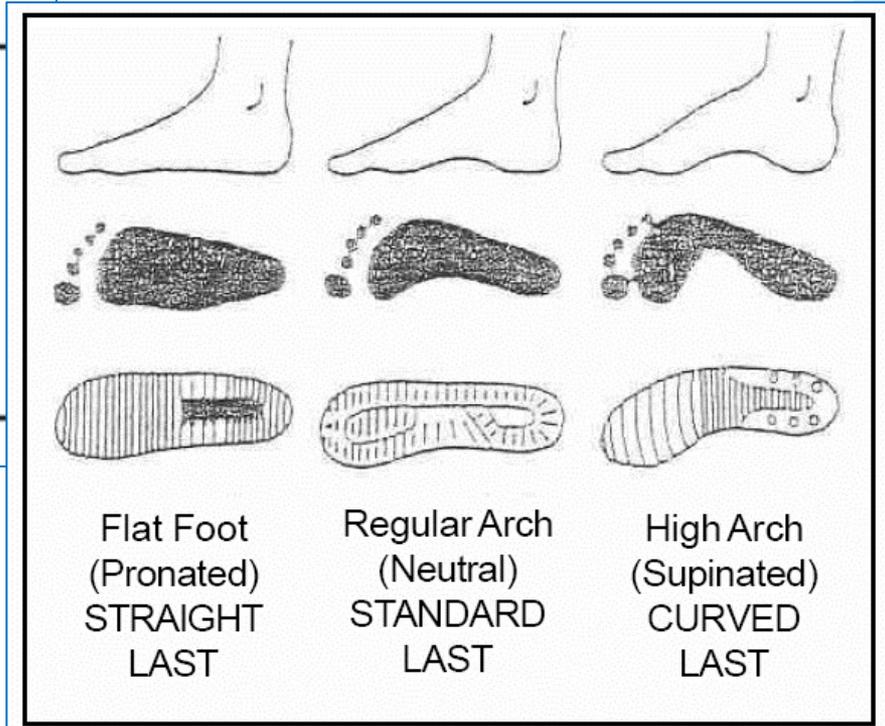
Articulatio tarsi transversa (Chopart`s joint) combines two joints:

- Calcaneocuboid joint
- Talonavicular joint

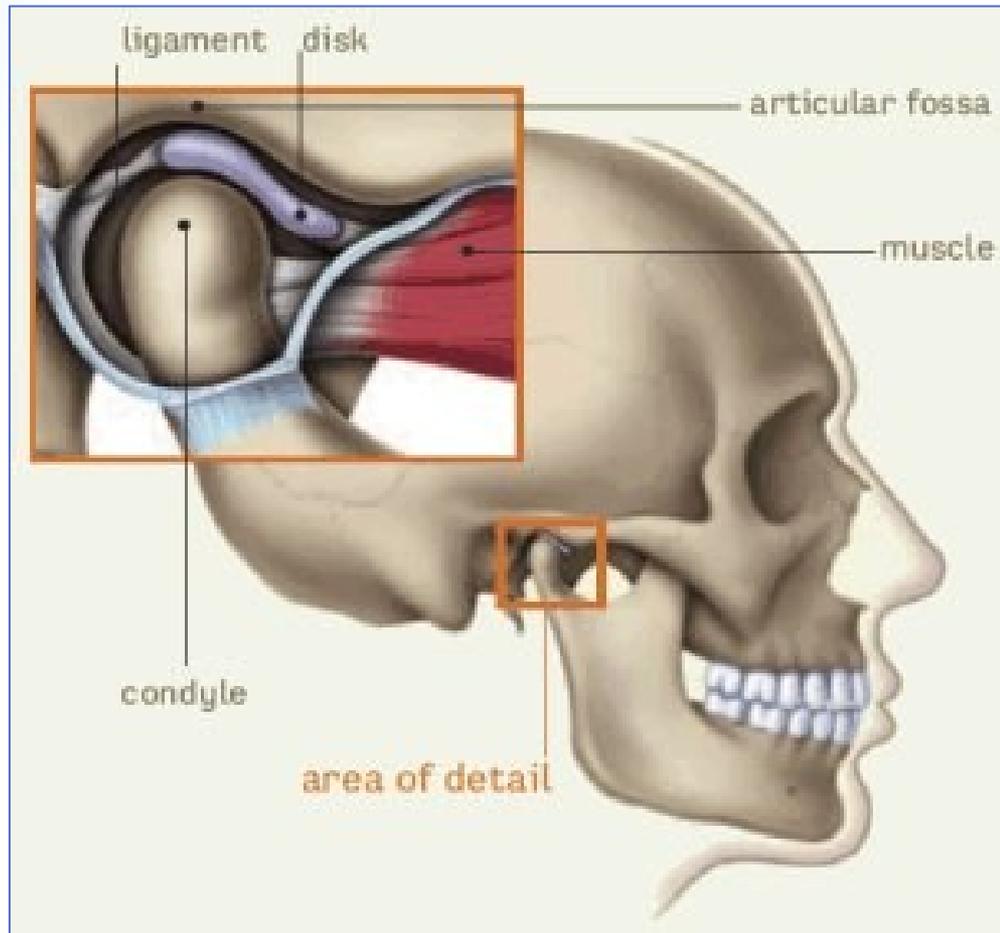
Articulatio tarsimetatarsales (Lisfrank`s joint)



- Weight distribution, amortization
- Adequate blood supply of foot

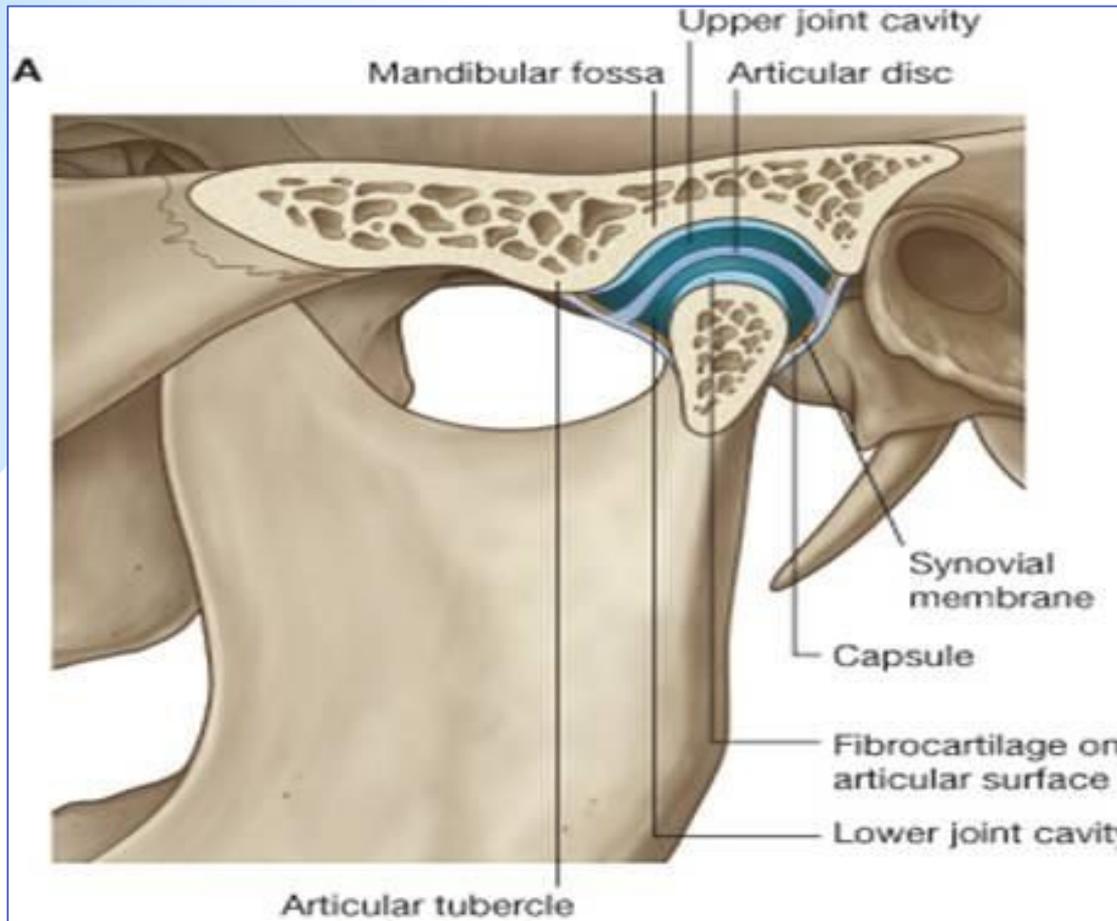


* The temporomandibular joint
(*articulatio temporomandibularis*, TMJ)



* Complex bicondylar combined joint

* The temporomandibular joint

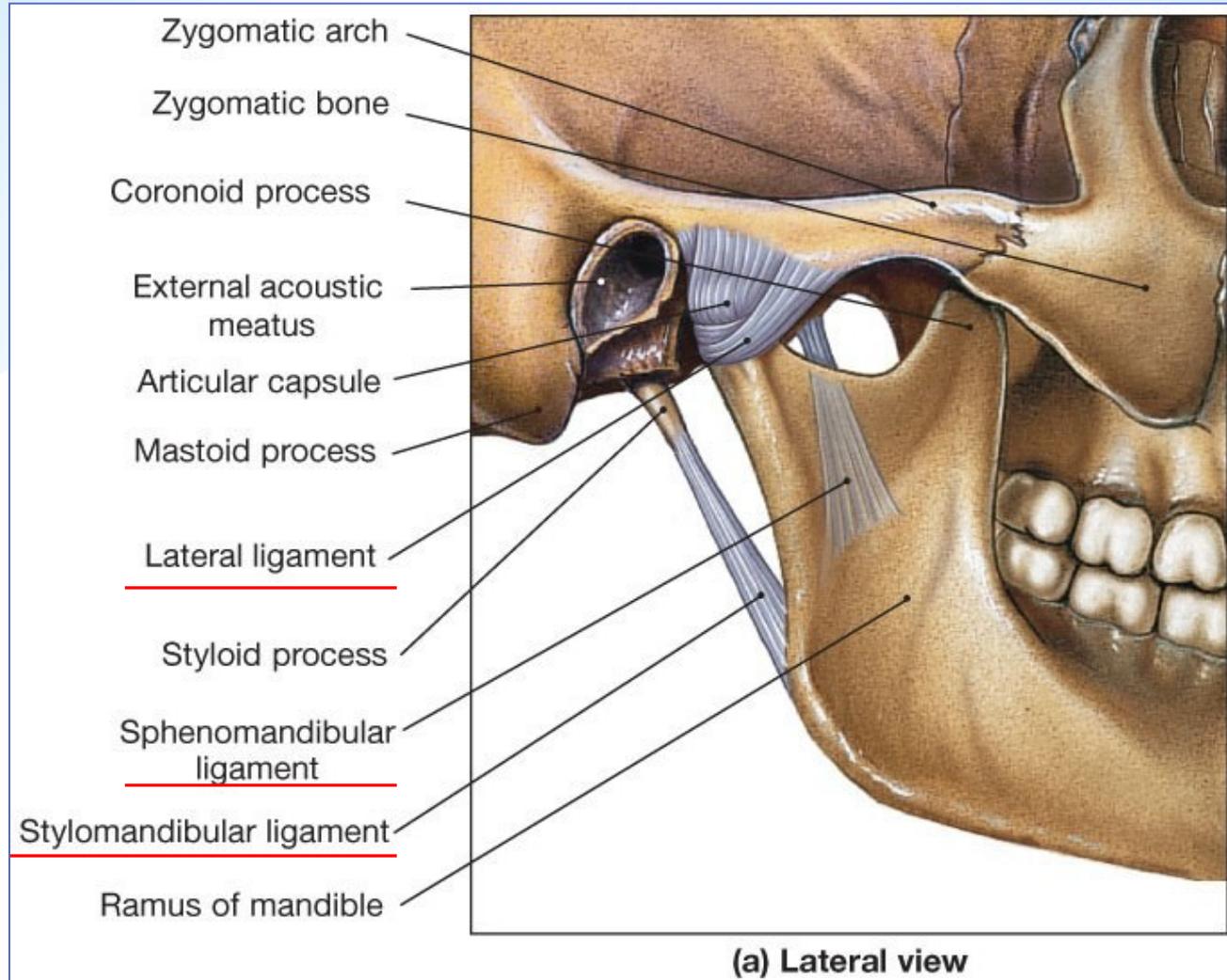


Disc is made out of fibrocartilage with markedly anteroposterior alignment.

Functions:

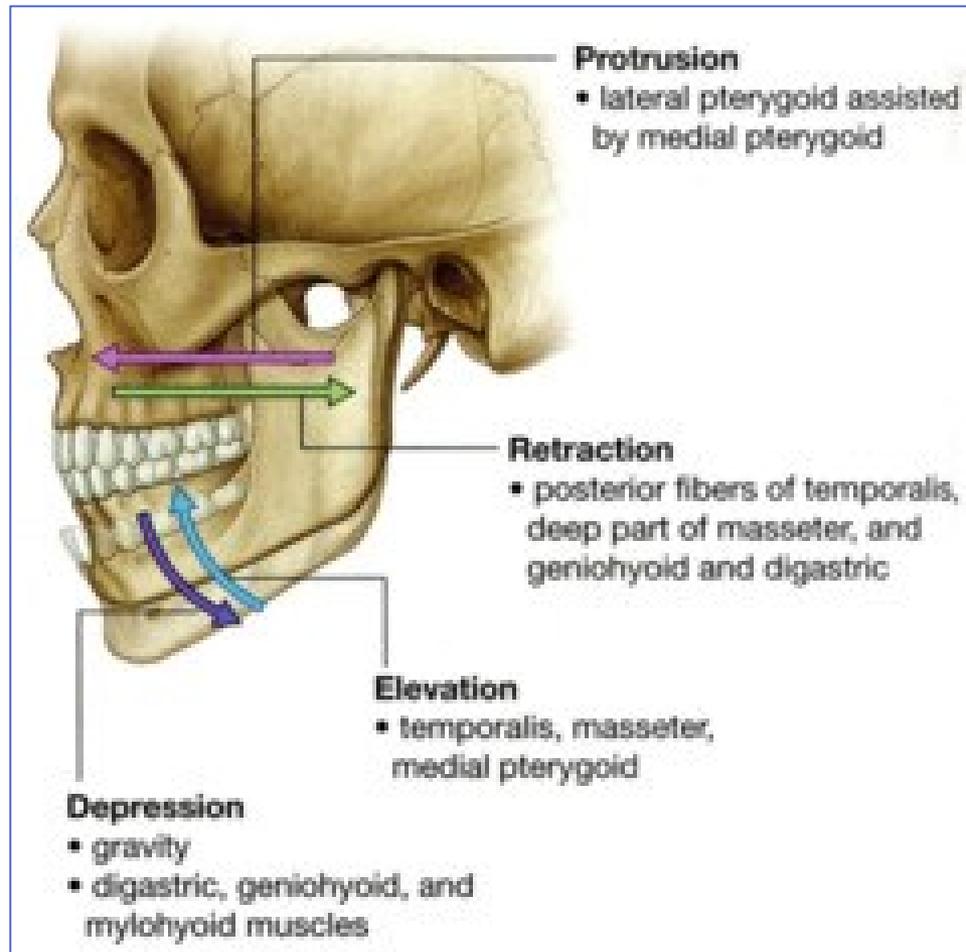
- 1) to diminish the effects of incongruence between the articular surfaces.
- 2) the disc acts as a shock absorber when the joint is subjected to impact loading.

* The surfaces are complemented by a *fibrous articular disc (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.

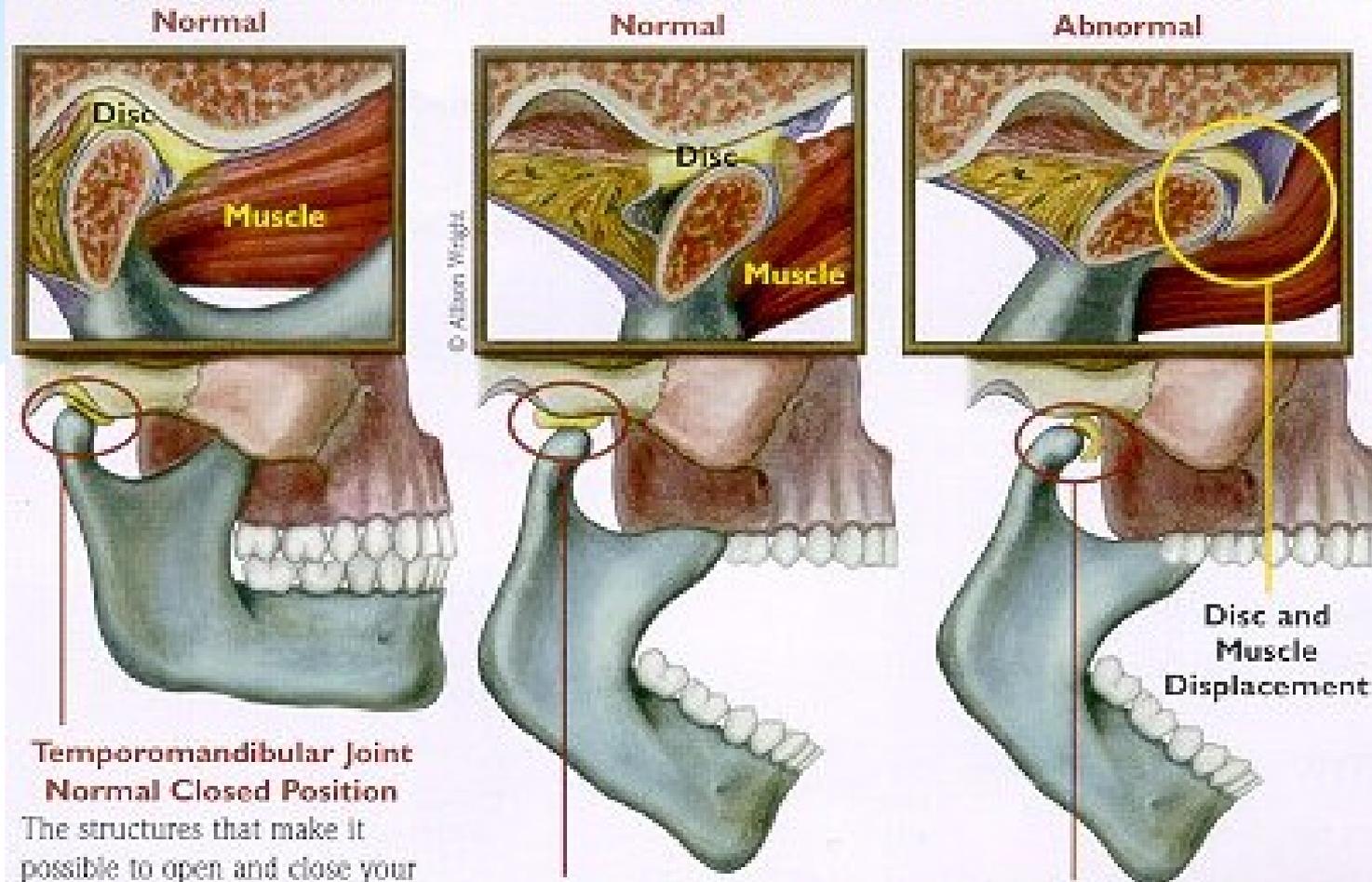


* Articular capsule is attached along the borders of articular surfaces. The mandibular neck is within the articular cavity.

* Movements of the temporomandibular joint



Function of the Temporomandibular Joint



Temporomandibular Joint Normal Closed Position

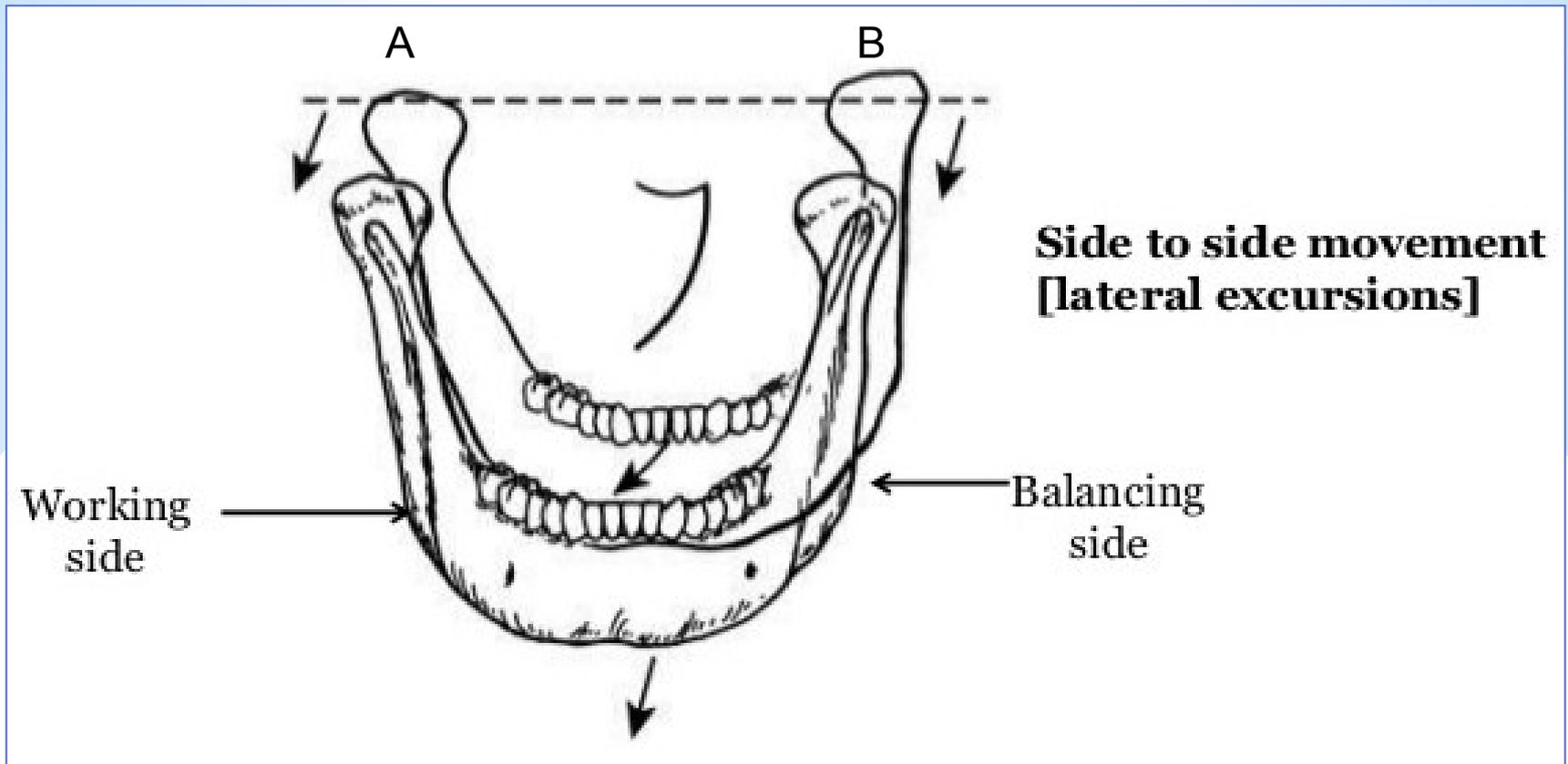
The structures that make it possible to open and close your mouth include the bones, joints, and muscles. When functioning correctly, your jawbone is separated from your skull by a soft disc that acts as a cushion when you chew, speak or swallow.

Temporomandibular Joint Normal Open Position

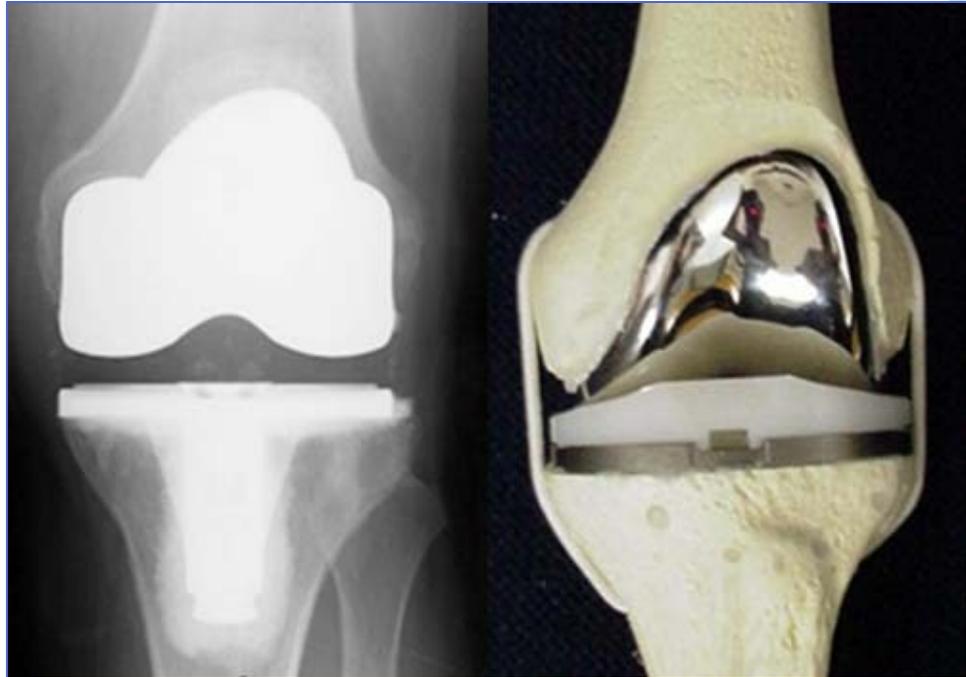
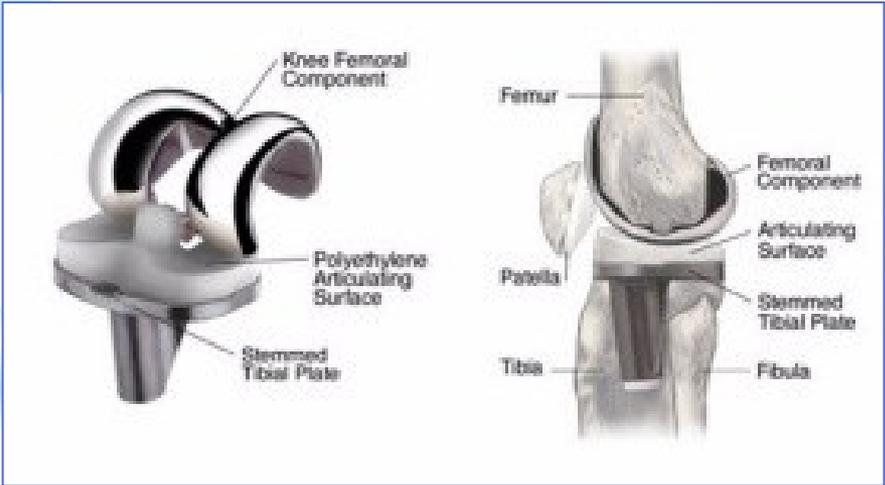
When the joint is functioning properly, the disc stays in place when the jaw is in use, preventing the bony structures from coming in contact.

Temporomandibular Joint Dysfunctioning Open Position

When the joint is not functioning properly, the disc is commonly pulled forward when the jaw is in use, causing the bones of the skull and jaw to grind together.



- * When the mandible moves laterally, one condyle (B) moves forward and inward, while the other condyle (A) will shift slightly in a lateroposterior (or rotate in vertical axis) direction



Consequence of the answer:

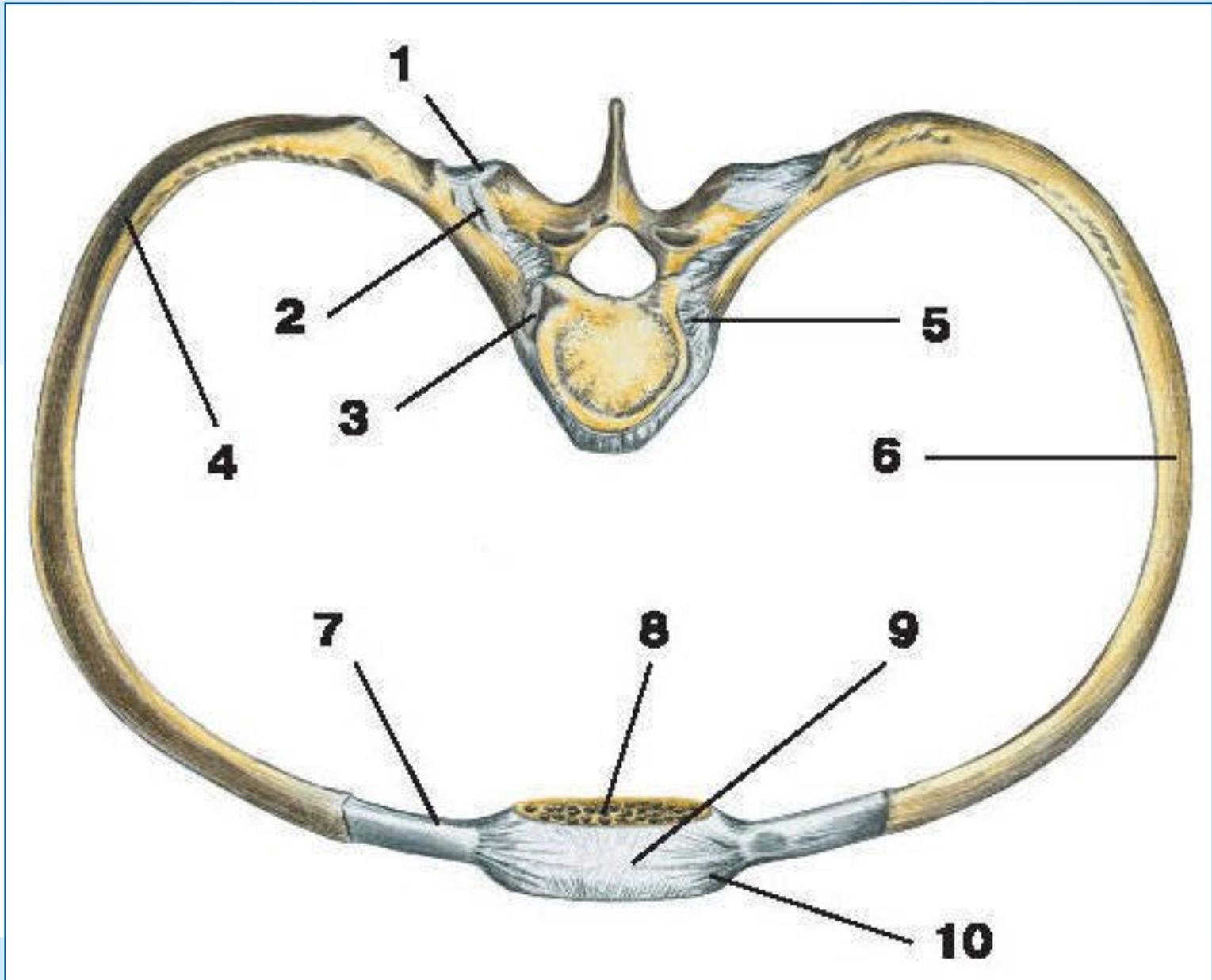
1. Name of the joint (English and Latin)
2. Classification of the joint (simple, combined, complex)
3. Description of the essential elements of the joint (articular surface, type of cartilage, cavity and capsule)
4. Description of the ligaments.
5. Special features (bursa)
6. Movements

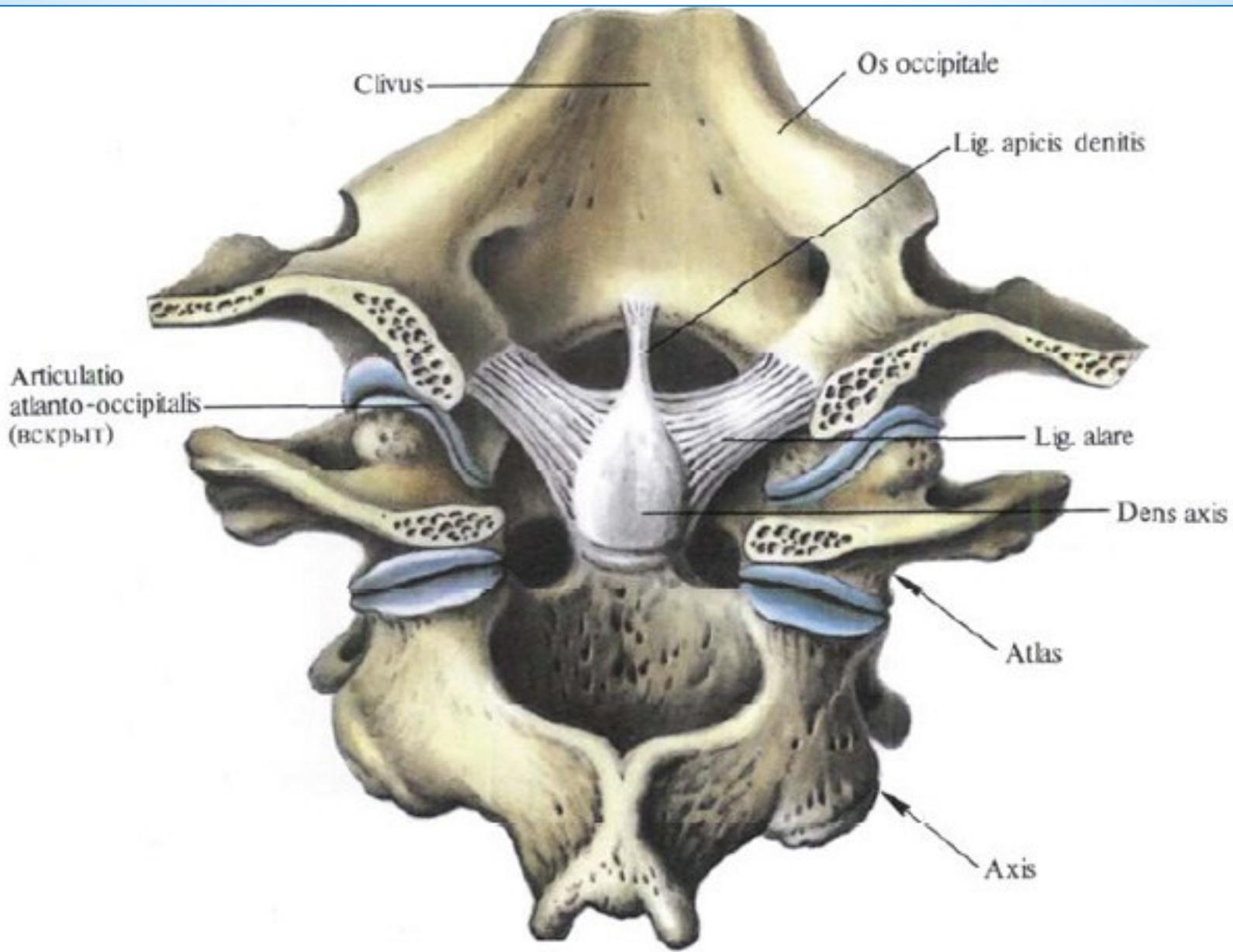
Which of the joint has intraarticular ligaments:

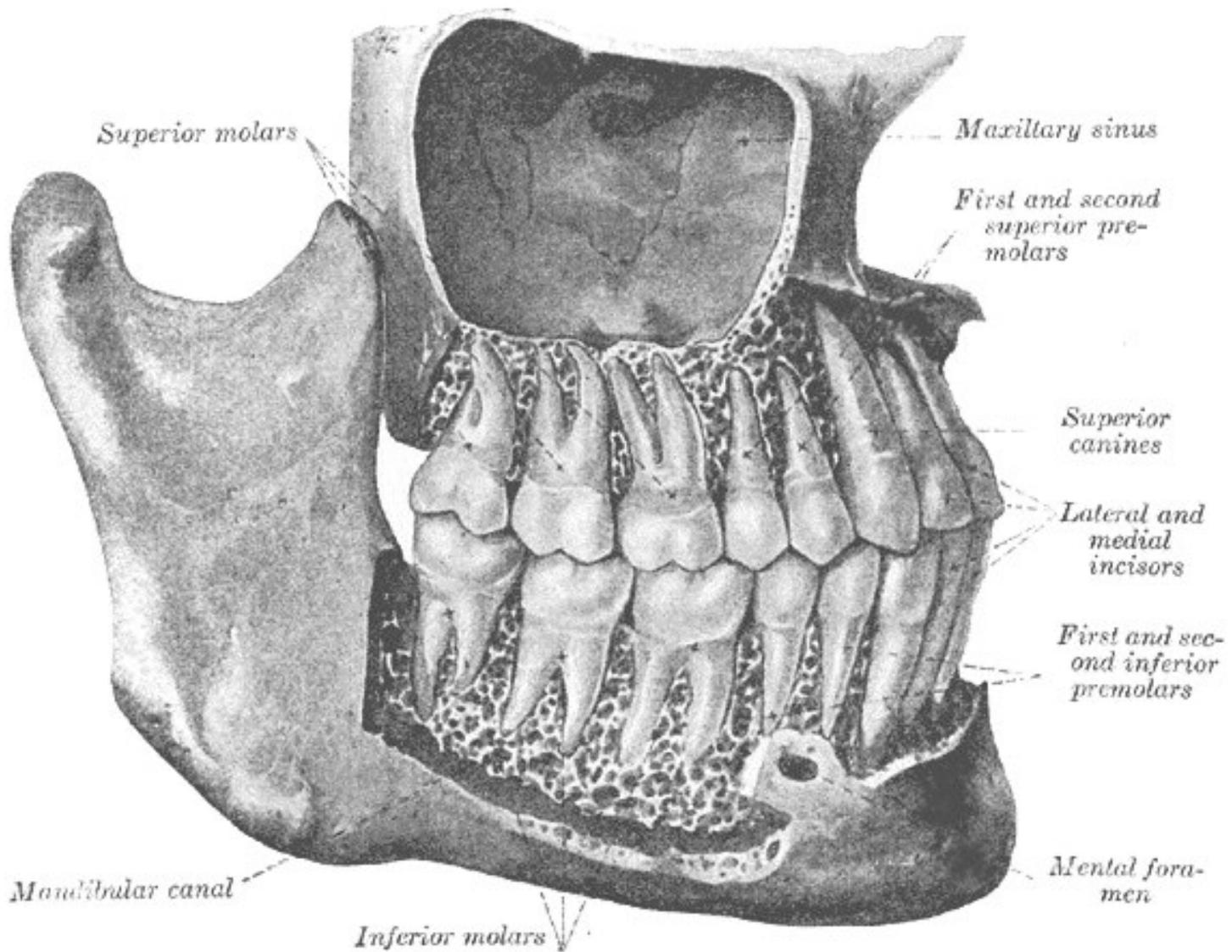
- 1) Shoulder joint
- 2) Hip joint
- 3) Elbow joint
- 4) Knee joint
- 5) TMJ
- 6) Wrist joint

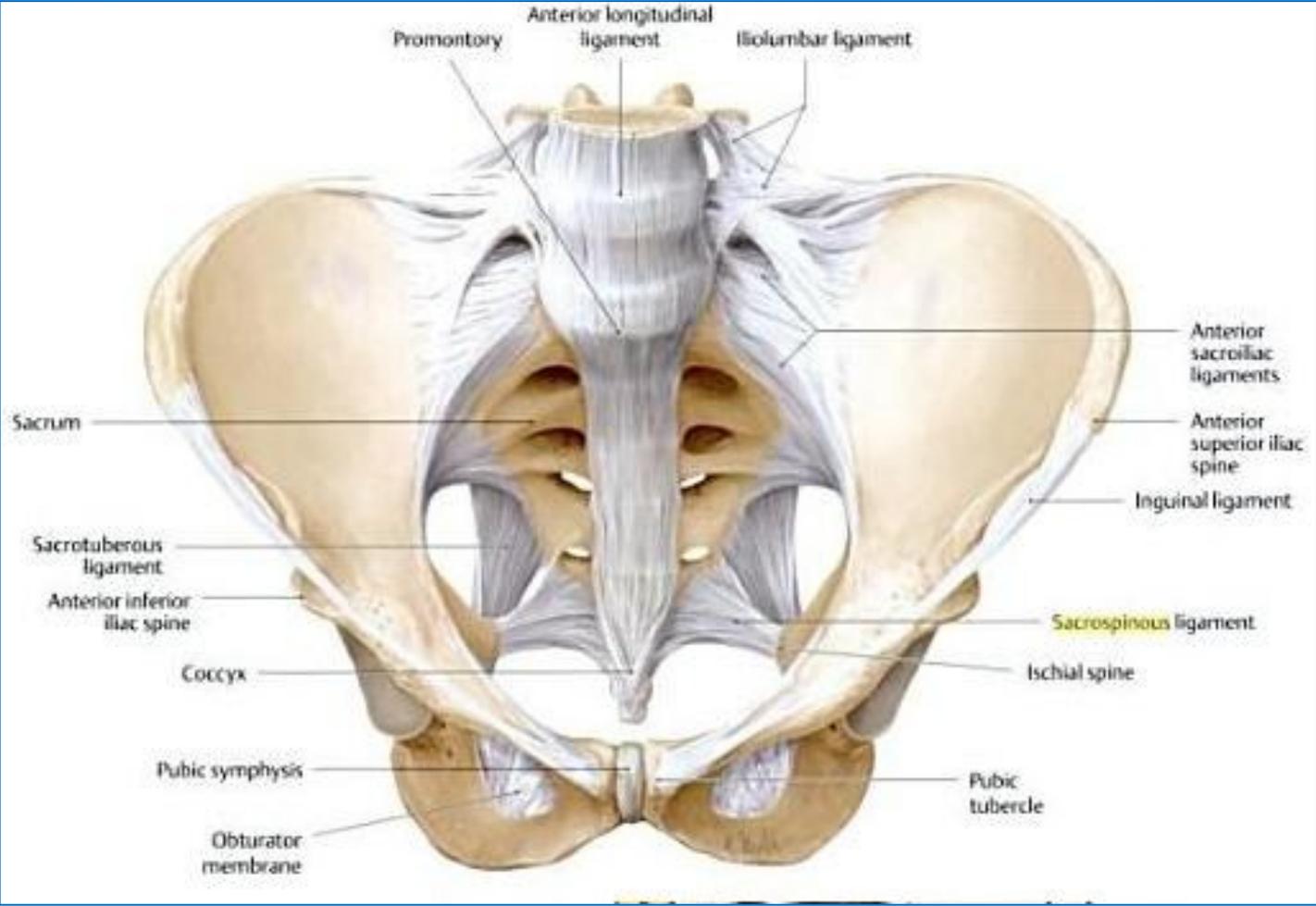
Hyaline cartilage covers the surfaces of the joints:

- 1) Shoulder joint
- 2) Hip joint
- 3) Sternoclavicular joint
- 4) Knee joint
- 5) TMJ
- 6) Wrist joint









Comparison of Male and Female Pelves

TABLE 7.4 Comparison of the Male and Female Pelves

CHARACTERISTIC	FEMALE	MALE
General structure and functional modifications	Tilted forward; adapted for childbearing; true pelvis defines the birth canal; cavity of the true pelvis is broad, shallow, and has a greater capacity	Tilted less far forward; adapted for support of a male's heavier build and stronger muscles; cavity of the true pelvis is narrow and deep
Bone thickness	Less; bones lighter, thinner, and smoother	Greater; bones heavier and thicker, and markings are more prominent
Acetabula	Smaller; farther apart	Larger; closer
Pubic arch/angle	Broader (80–90°); more rounded	More acute (50–60°)

Anterior view

