THE HIP JOINT INTRODUCTION

One of the most stable joints in the human body. Relatively one of the lest injured joints.

Synovial, ball and socket joint.

Motions:

- Flexion/extension - Sagittal plane.
- Abduction/Adduction - Frontal plane.
- Internal/External rotation in transverse plane

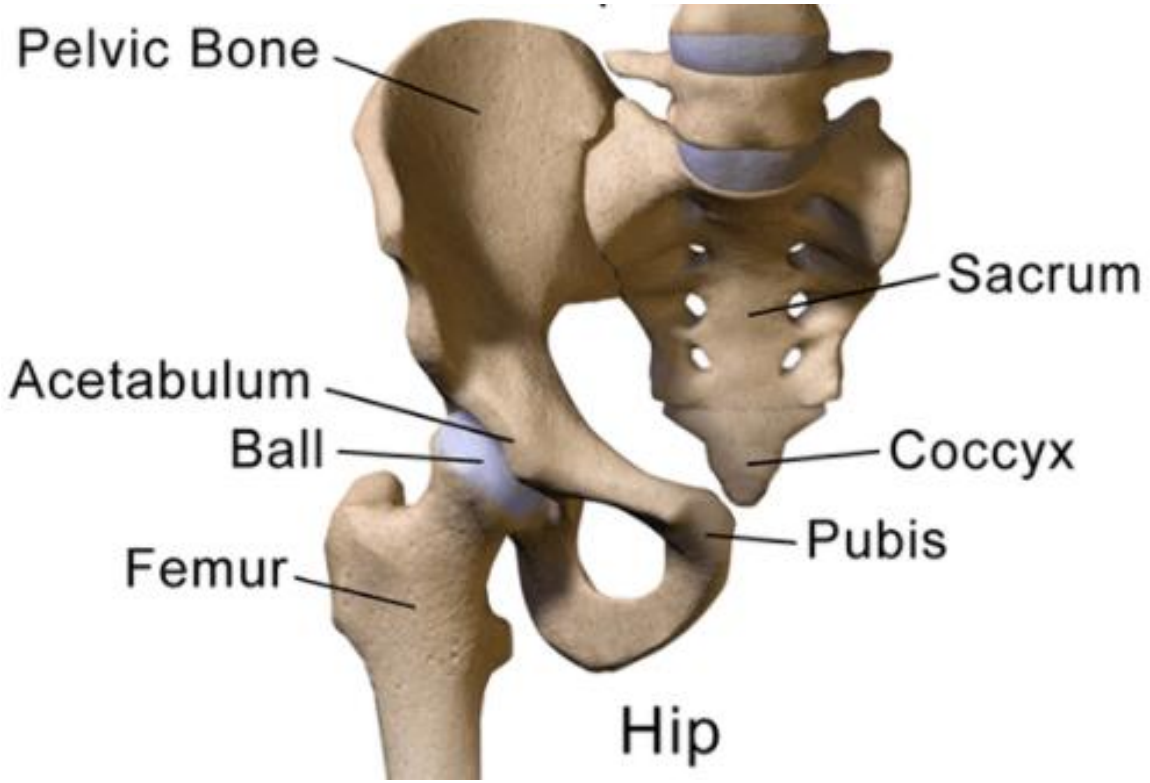
Articulation takes place between the head of the femur and the acetabular fossa.

ANATOMY - BONY

<u>2 Bones</u>:

-femur.

- pelvis

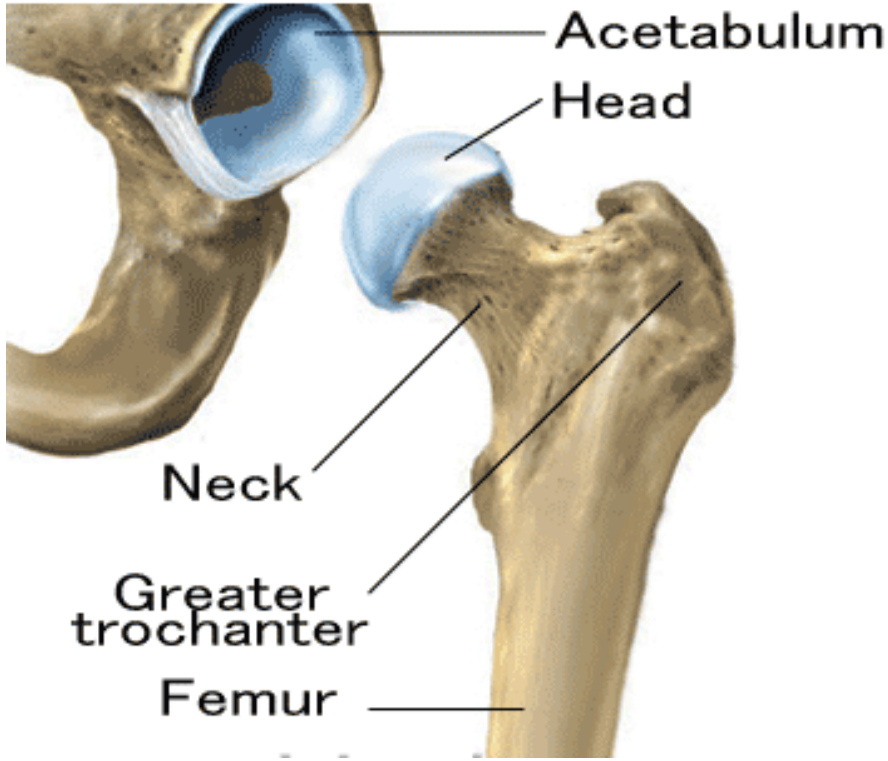


ANATOMY - BONY

Femur:

1. **Proximal head of femur**
   is covered in hyaline cartilage
   articulates with the articular
   portion of the acetubular fossa

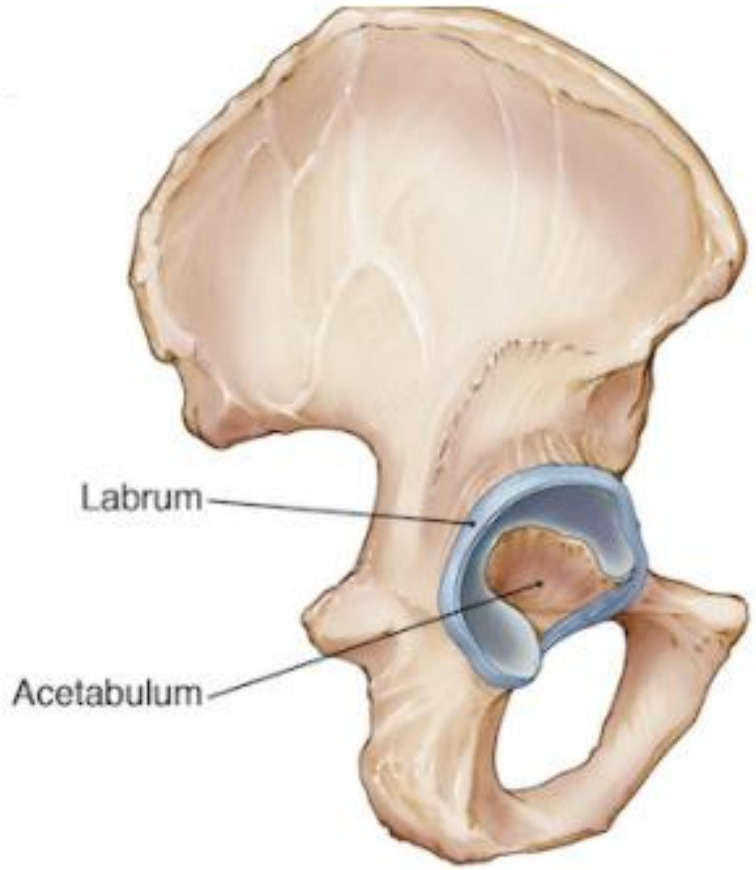
2. **Forms 2/3 of a sphere**



ANATOMY - BONY

Acetabulum:

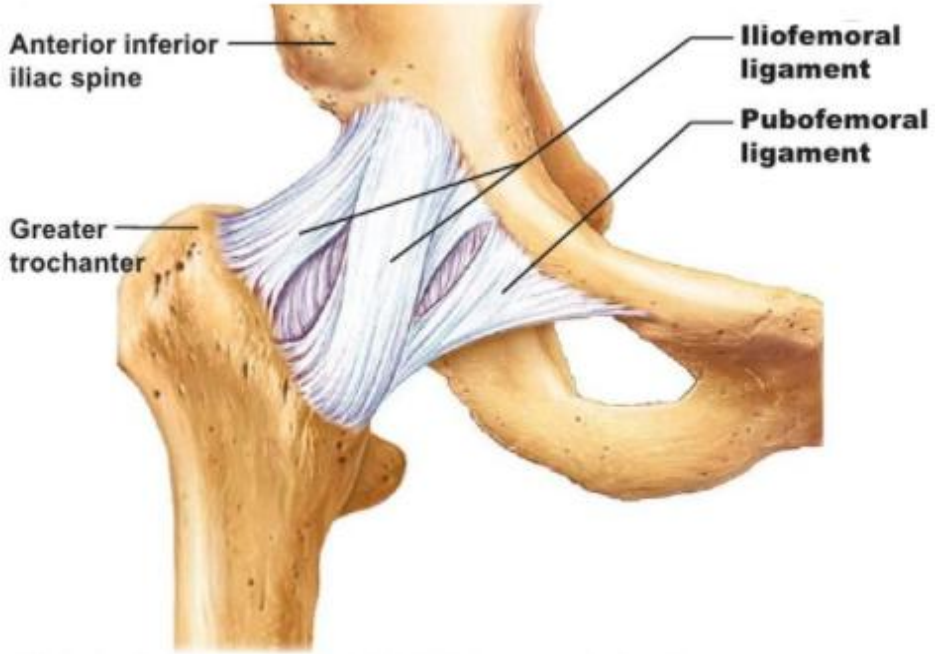
1. **divided into the articulating and non-articulating (acetubular fossa) portions.**
2. **Acetabular fossa contains fibro-elastic fat pad - covered with a synovial membrane.**



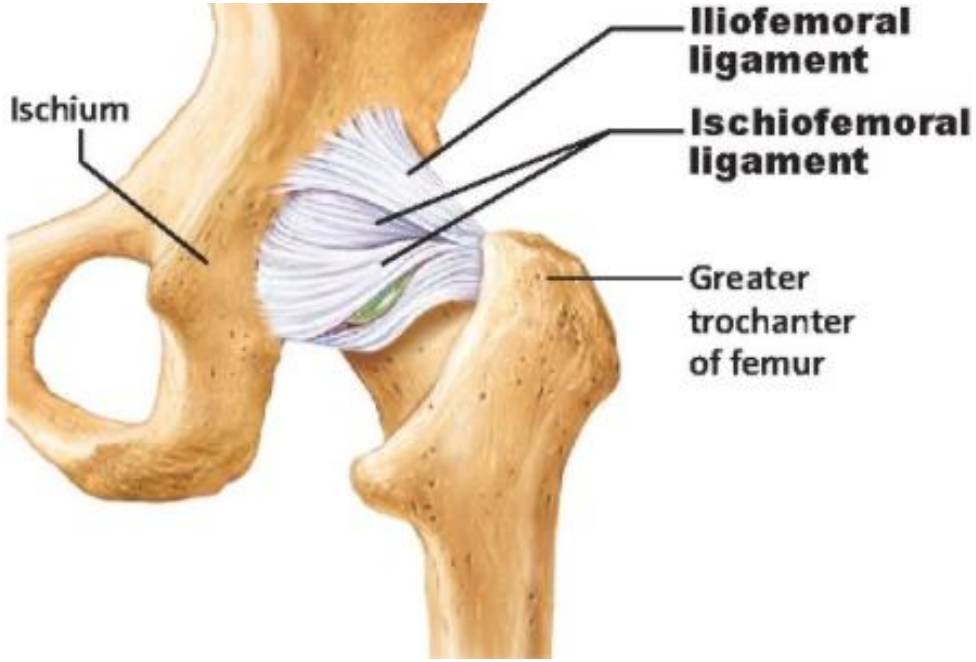
ANATOMY – LIGAMENTS

1. Iliofemoral Ligament
2. Pubofemoral Ligament
3. Ishiofemoral Ligament
4. Ligamentum Teres
5. Transverse Acetabular Ligament

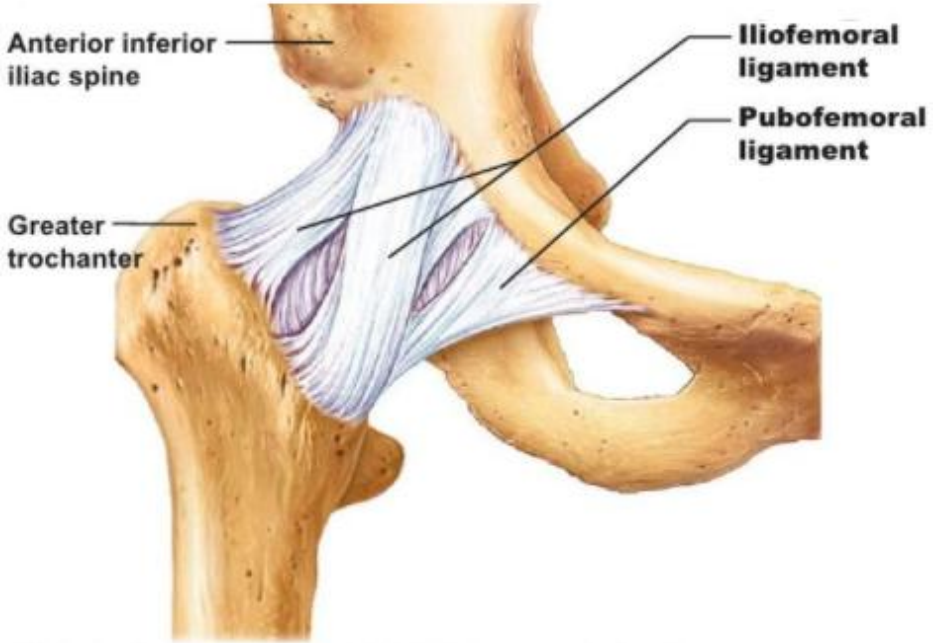
Anterior view

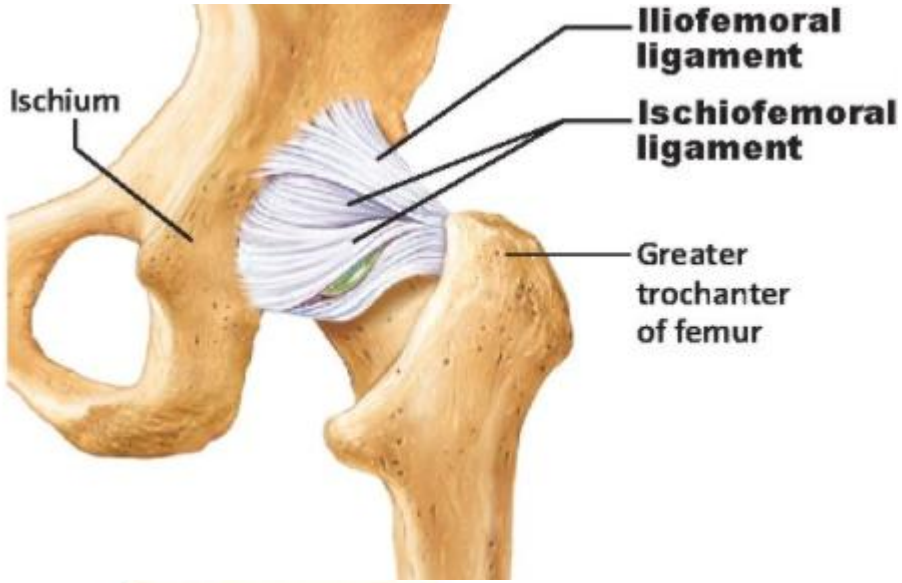


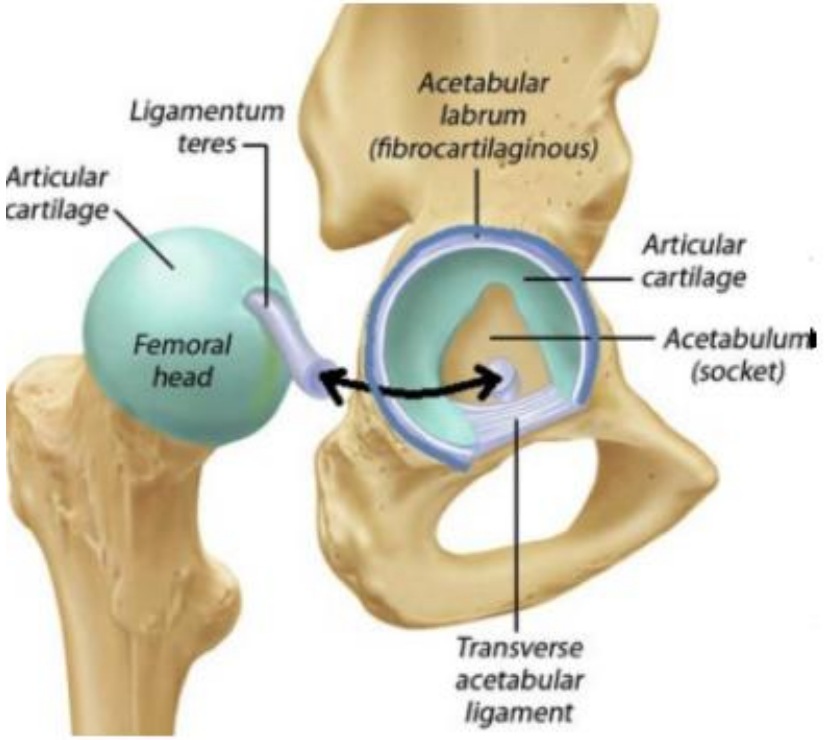
Posterior view



ANATOMY - SOFT TISSUE







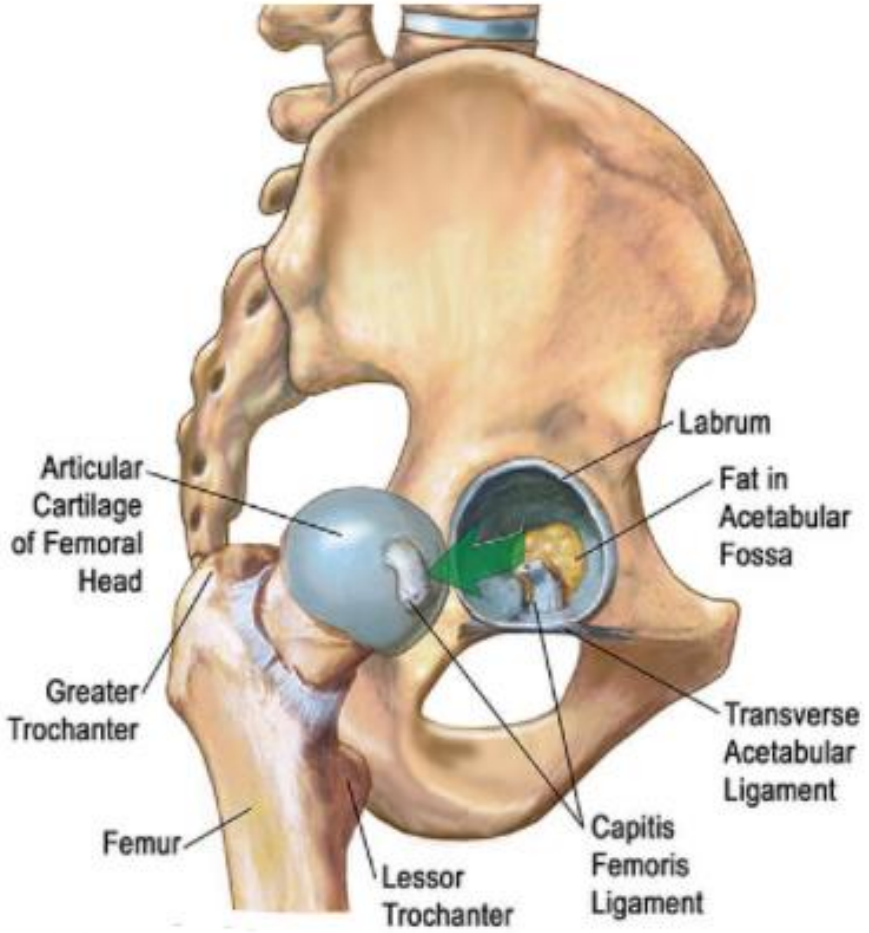
THE HIP JOINT

Head of femur articulates with acetabulum

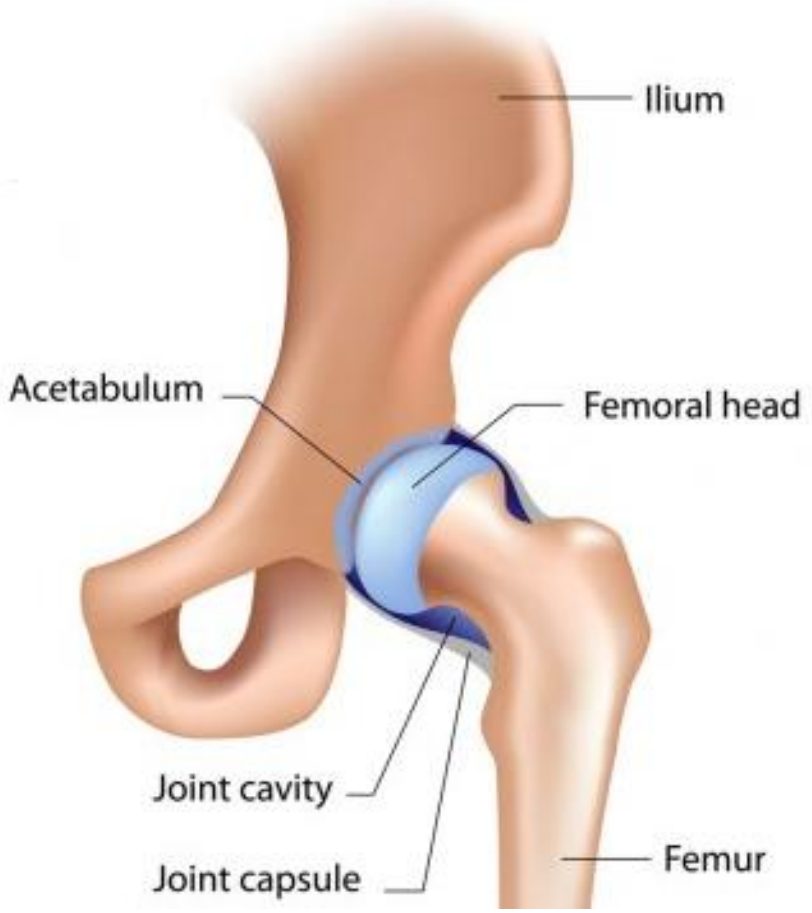
Socket deepened by acetabular labrum

Blood supply to head of femur found in ligament of the head of the femur (round ligament)

Joint capsule strengthened by ligaments

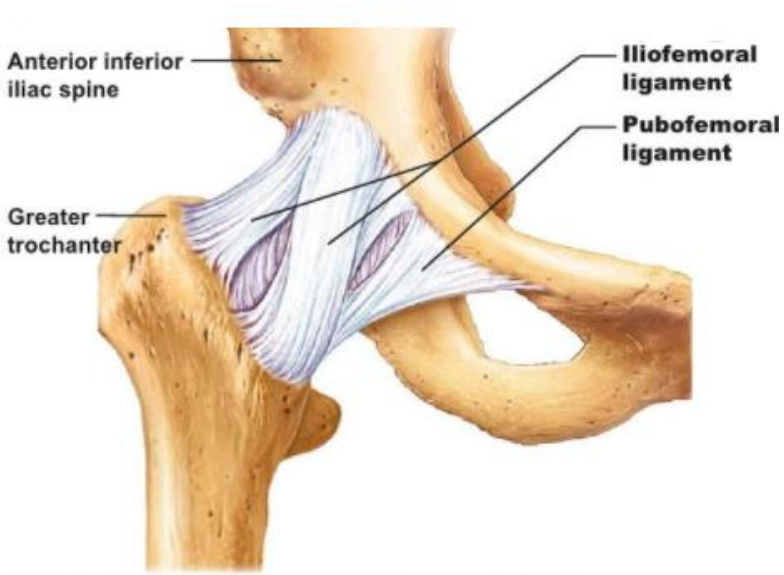


HIP JOINT

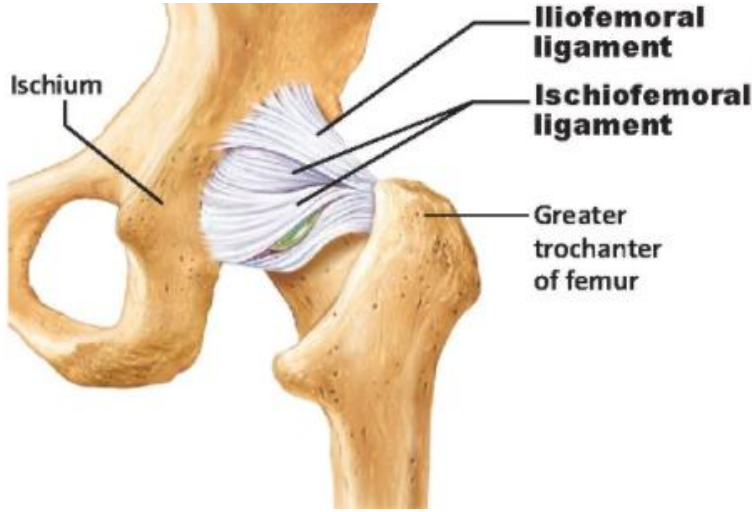


Joint capsule strengthened by ligaments:

- **pubofemoral**
- **ischiofemoral**
- **iliofemoral**

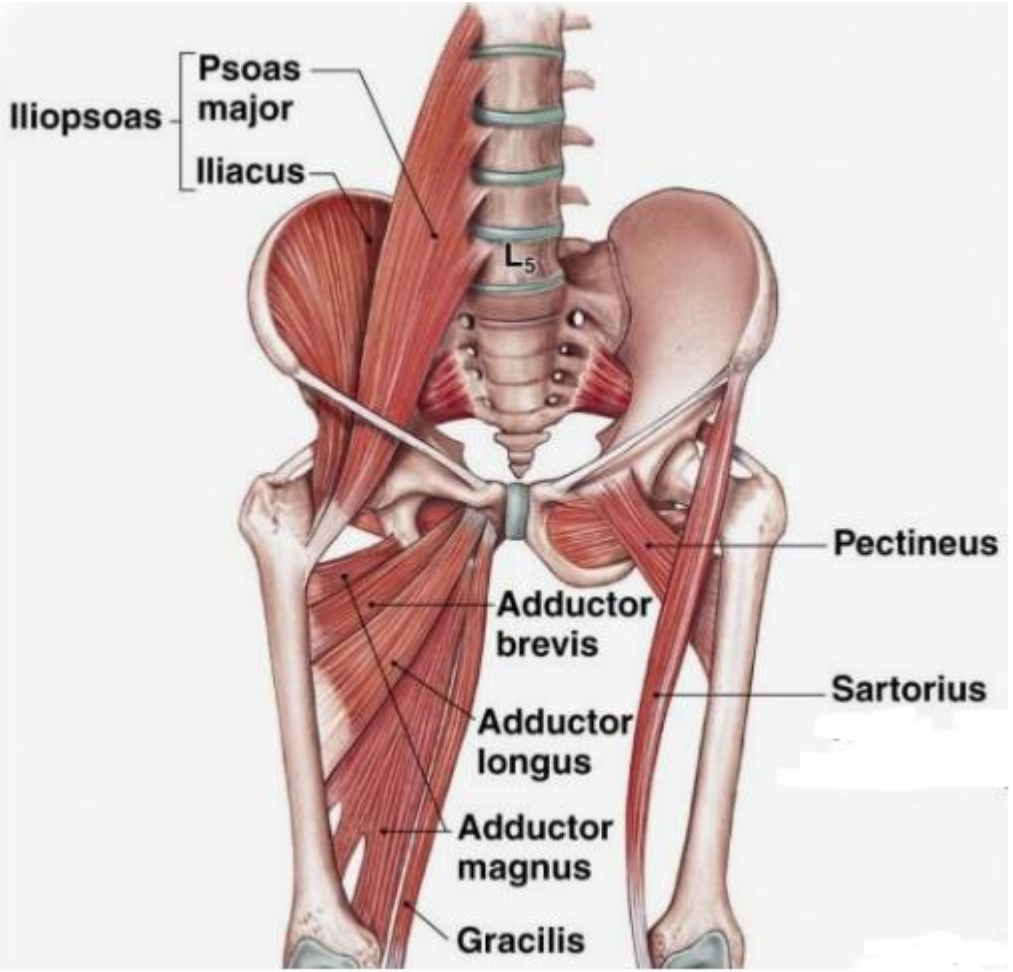


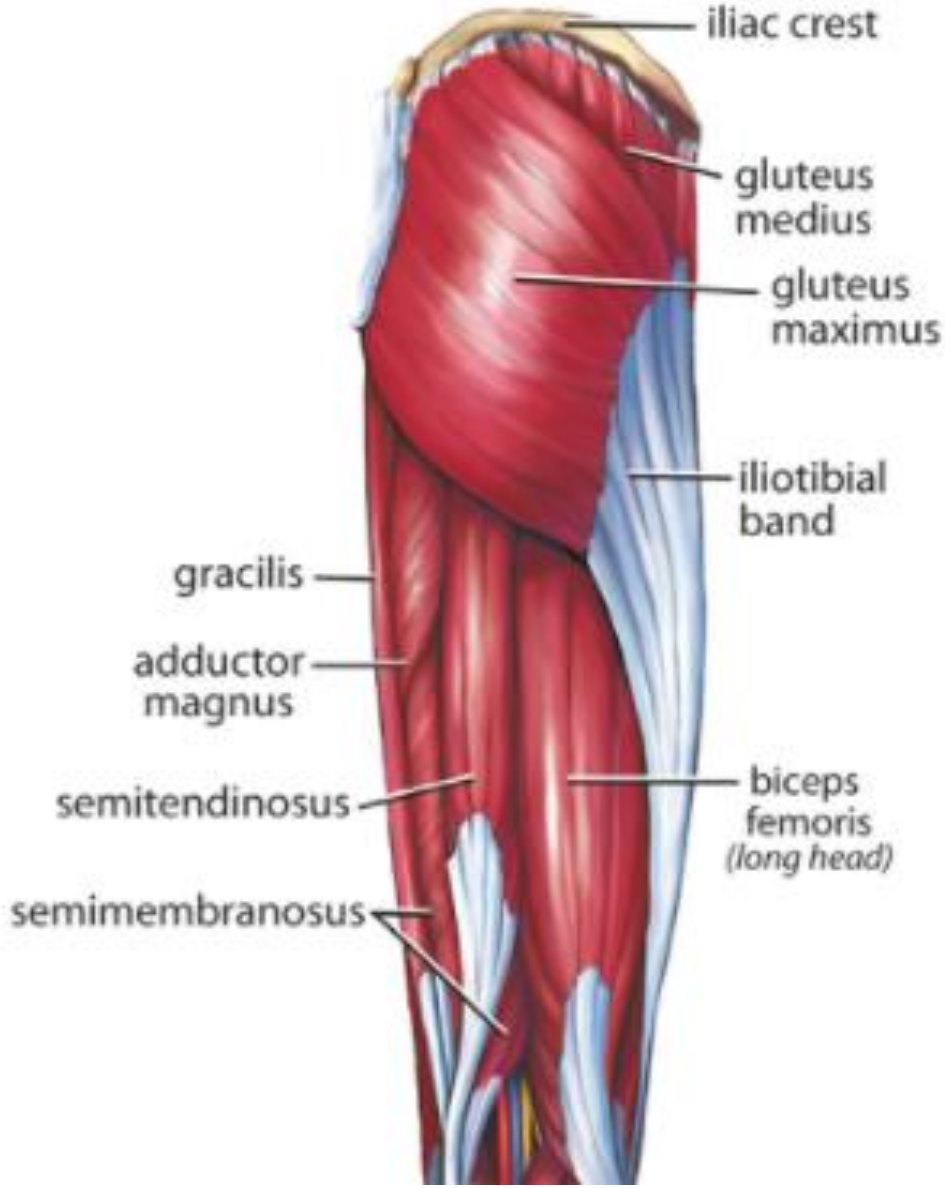
Anterior view



Posterior view

HIP JOINT – Soft Tissue
Muscles





HIP INNERVATION

Femoral nerve

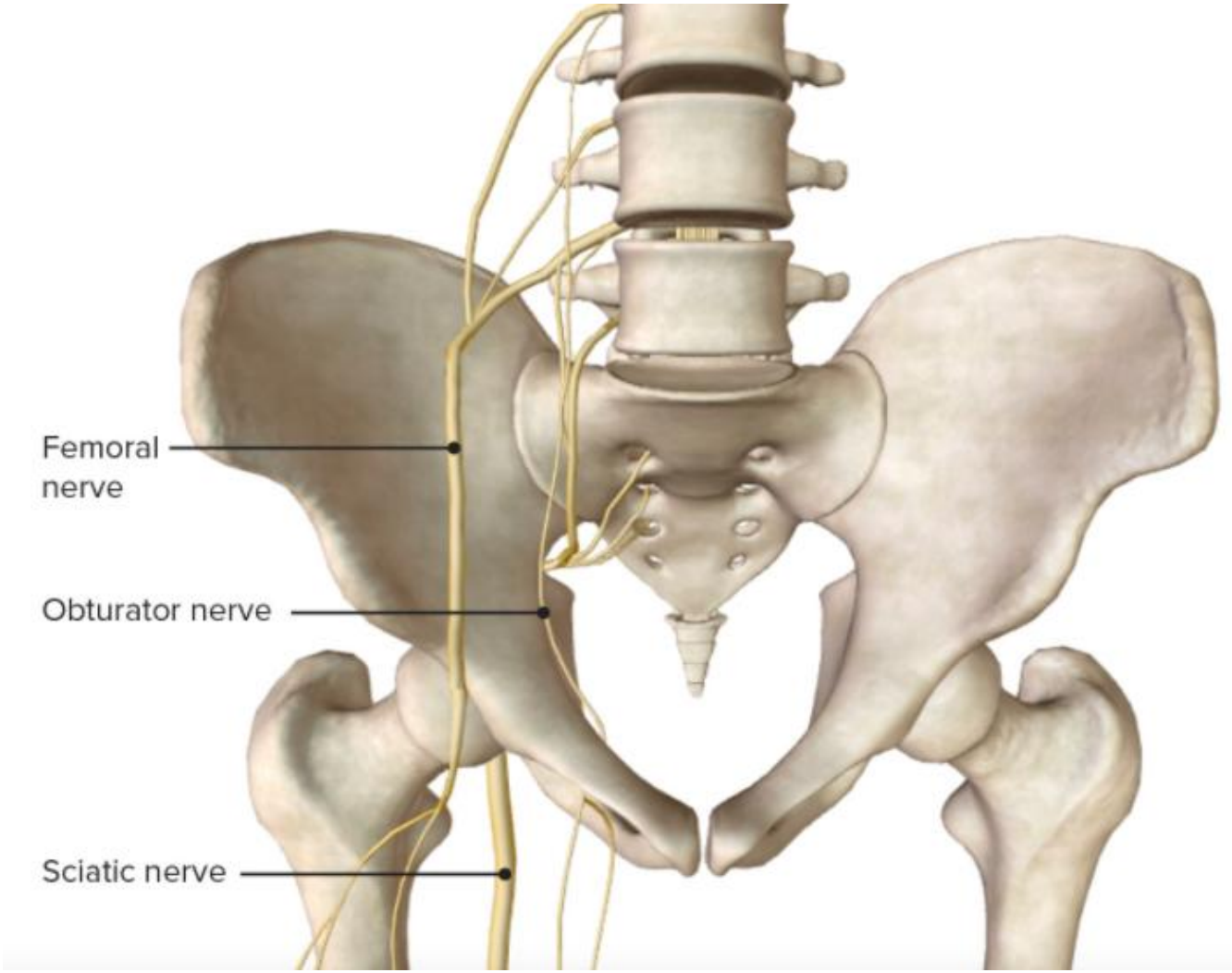
(L2–L4): innervates the anterior thigh muscles and anterior aspect of the hip joint

Obturator nerve

(L2–L4): primarily innervates the adductor muscles and inferior aspect of the joint

Sciatic nerve

(L4–S3): passes through the greater sciatic foramen to the gluteal region; the sciatic nerve is the longest and widest nerve in the body



THE KNEE

Largest joint in the human body.

One of the frequently disrupted joints in the body.

Synovial, bicondylar joint & is surrounded by a joint capsule.

Motions:

- **Flexion/extension - Sagittal plane.**
- **Rotation - transverse plane only w/ knee flexion.**

Articulation takes place between the tibia & femur via their respective condyles.

Articulation occurs between the patella & the femur is gliding without frictions.

ANATOMY - BONY

4 Bones:

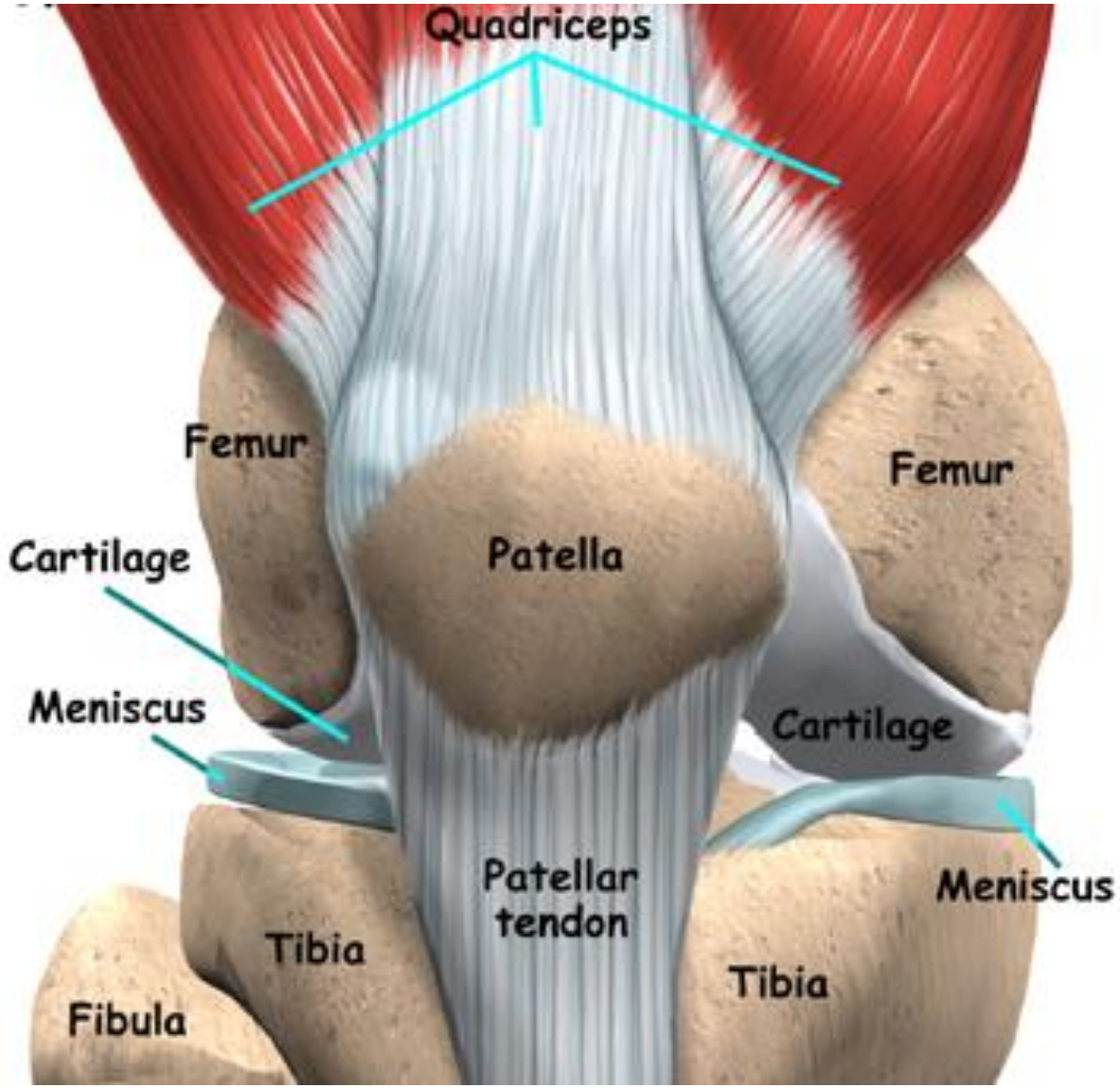
•- Tibia

•-Fibula

•-Femur

•- Patella - the largest sesamoid bone in the body

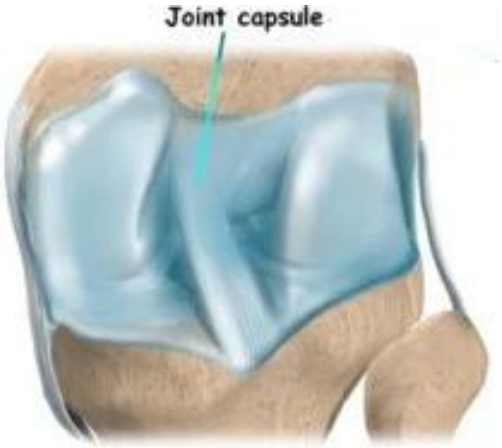
Fibula - function is muscle and ligament attachment



ANATOMY - SOFT TISSUE

Joint Capsule

- Single capsule passing from one articular margin to the next.
- Replaced anteriorly by the extensor mechanism.
- Capsule blends with the patella tendon & ligament



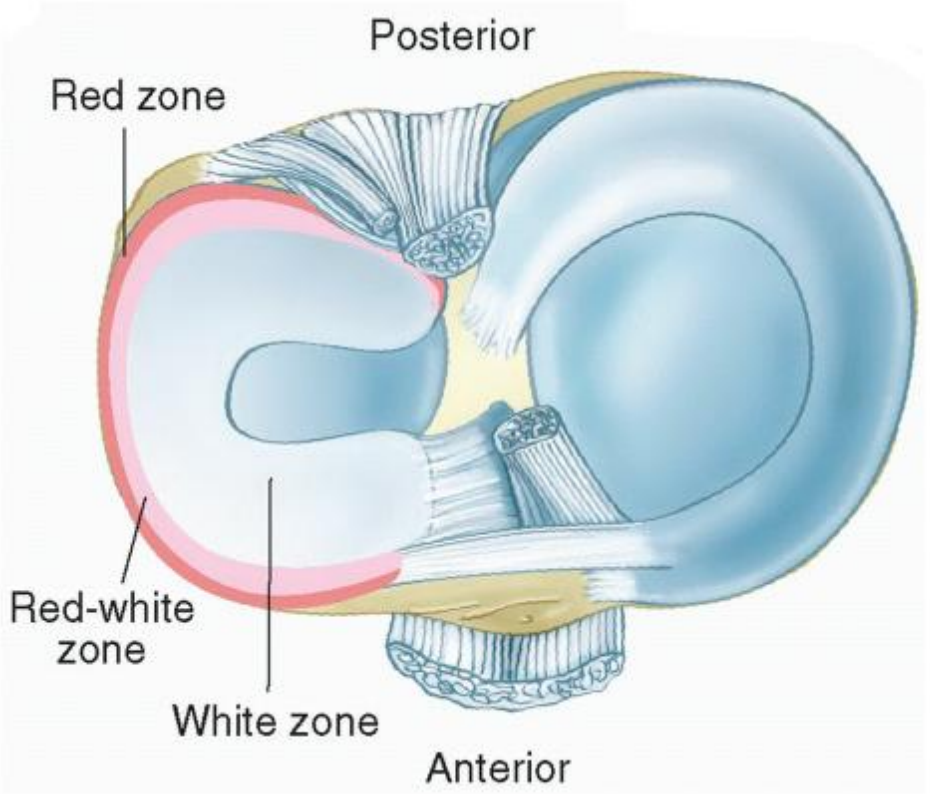
ANATOMY - SOFT TISSUE.

Menisci:

- 2 cartilages on superior portion of tibia. Medial (C) & lateral (0).

Functions:

1. Deepens the tibiofemoral joint improving congruency
2. Shock absorption & cushion stress.
3. Assists lubrication



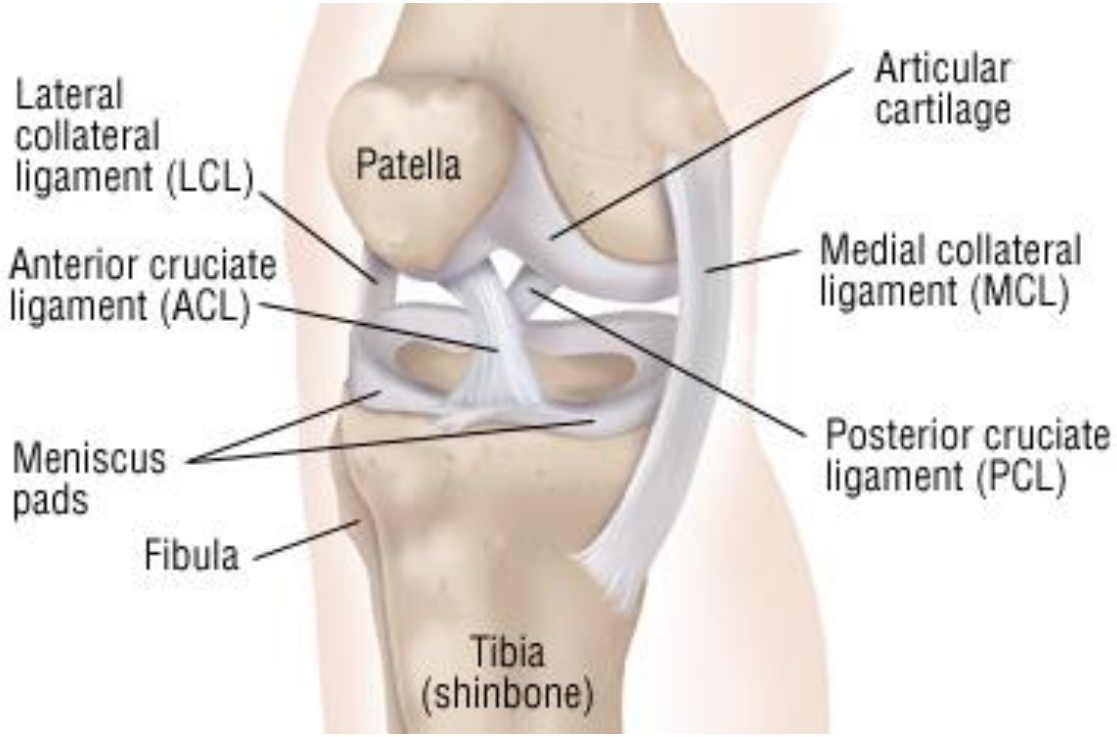
ANATOMY - SOFT TISSUE

Anterior Cruciate ligament (ACL):

- Attaches to the anterio-medial tibia to the posterior lateral femur.

Function:

- Prevents anterior translation of tibia on the femur by86%
- Medial displacement is restrained by 30%
- Stabilises against excessive tibial IR



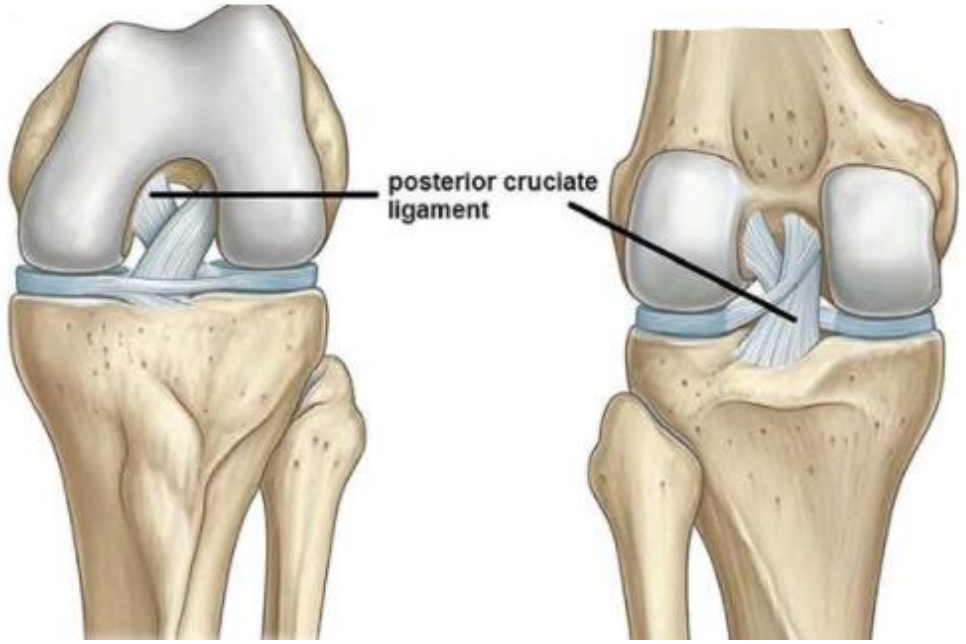
ANATOMY - SOFT TISSUE

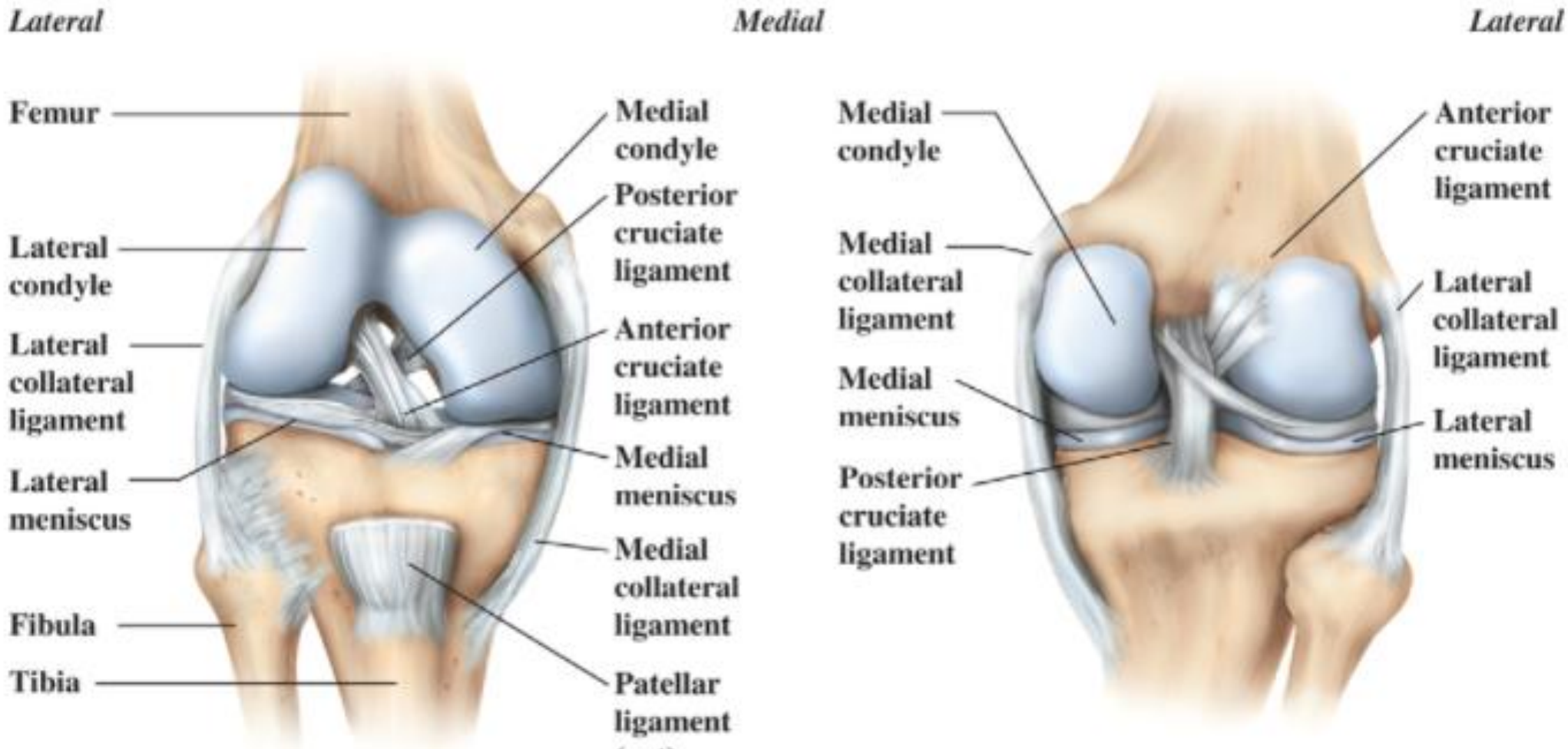
Posterior Cruciate ligament (PCL):

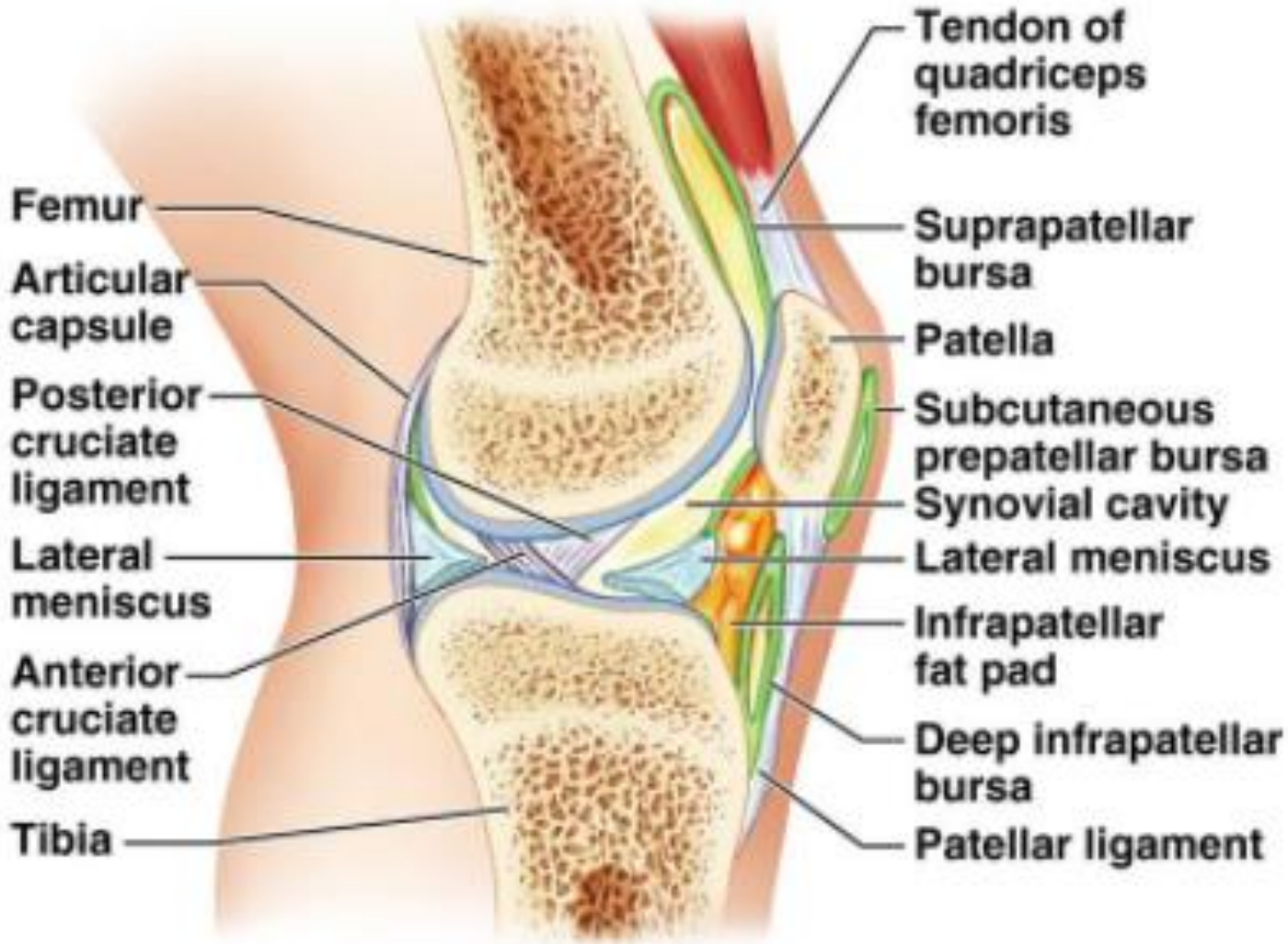
- Runs from the posterior intercondylar area of the tibia to the medial condyle of the femur
- Prime knee stabiliser and bigger & stronger than the ACL.

Function:

- Prevents posterior translation of tibia on the femur by 94%
- Lateral displacement is restrained by 36%
- Stabilises against excessive tibial IR & ER




Lateral
Medial
Lateral
Femur
Lateral condyle
Lateral collateral ligament
Lateral meniscus
Fibula
Tibia
Medial condyle
Posterior cruciate ligament
Anterior cruciate ligament
Medial meniscus
Medial collateral ligament
Patellar ligament
Medial condyle
Medial collateral ligament
Medial meniscus
Posterior cruciate ligament
Anterior cruciate ligament
Lateral collateral ligament
Lateral meniscus


Tendon of quadriceps femoris
Femur
Suprapatellar bursa
Articular capsule
Patella
Posterior cruciate ligament
Subcutaneous prepatellar bursa
Synovial cavity
Lateral meniscus
Lateral meniscus
Infrapatellar fat pad
Anterior cruciate ligament
Deep infrapatellar bursa
Tibia
Patellar ligament

ANATOMY - SOFT TISSUE.

Collateral Ligaments

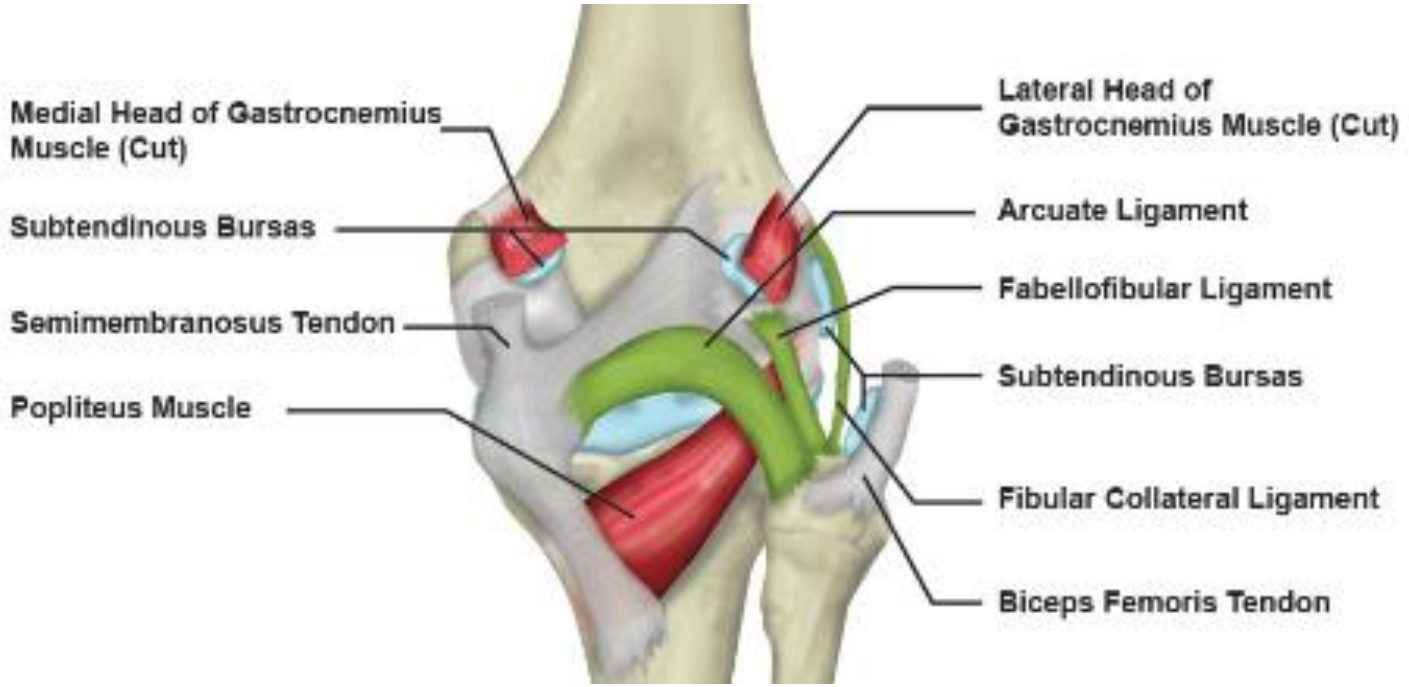
Functions:

•Connection of the bones in the joint
•Stability
•Directing movement - preventing too much sideway movement

Medial (Tibial) Collateral **(MCL)**
Lateral (Fibular) Collateral **(LCL)**

Capsular Ligaments:

- arcuate ligament= a thickening of the posterior capsule.
- attaches to popliteal muscle and lateral meniscus



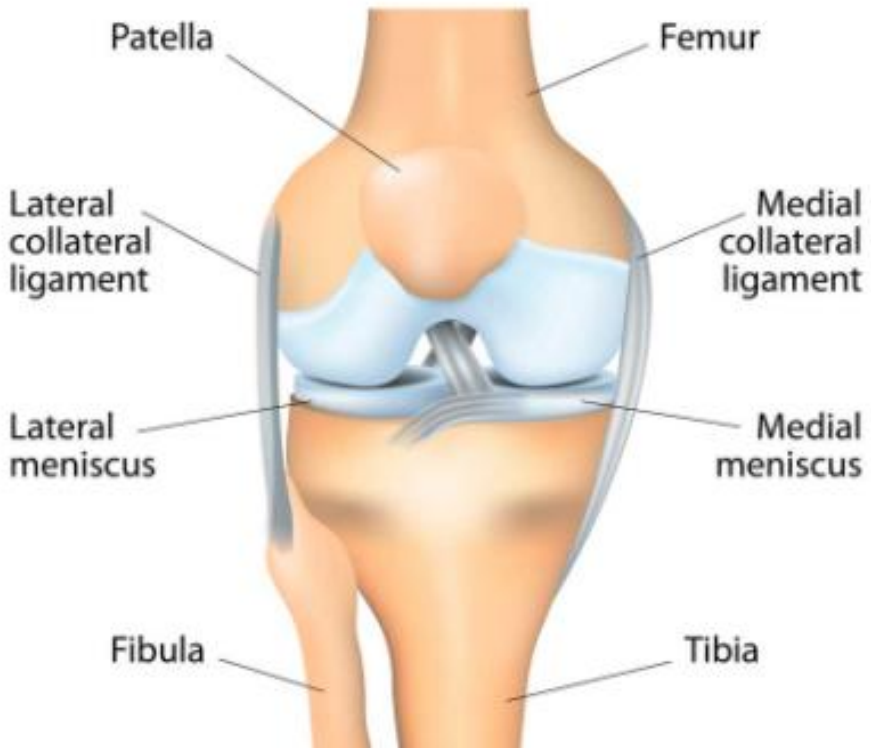
ANATOMY-SOFT TISSUE

Medial (Tibial) Collateral Ligament (MCL):

- Attaches to the medial femoral epicondyle & medial tibial condyle.
- Approx 10cm long.
- Very thick & meshes w/ medial meniscus.

Function:

- Stabilises the knee joint
- Prevents valgus
- Control sideways motion in the knee



ANATOMY - SOFT TISSUE.

Lateral (Fibular) Collateral Ligament (LCL)

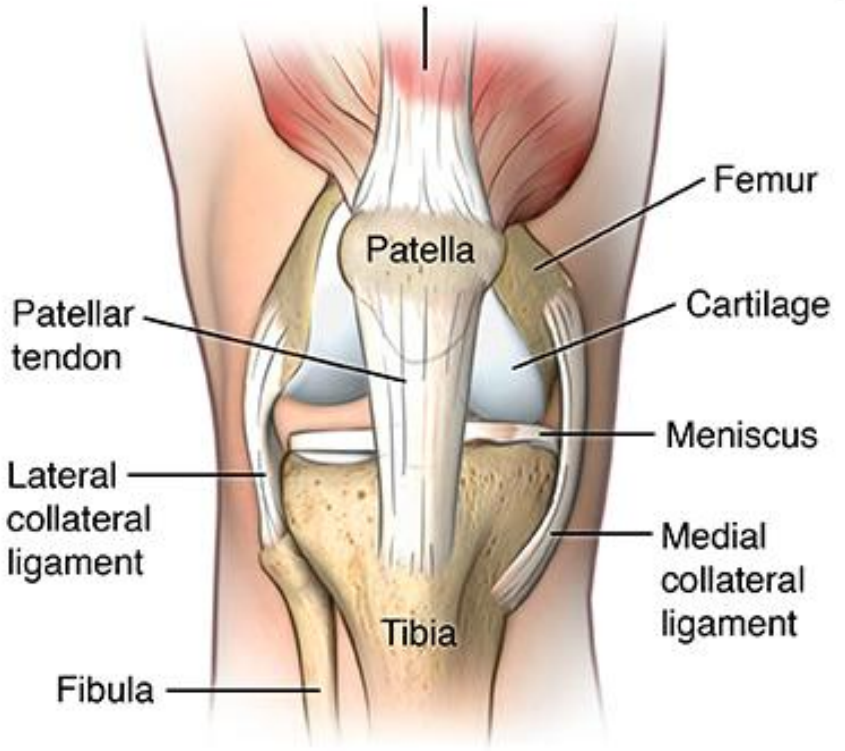
- Attaches to the lateral femoral epicondyle & to the fibular head.
- Approx 5cm long.
- stands clear of the capsule.

Function:

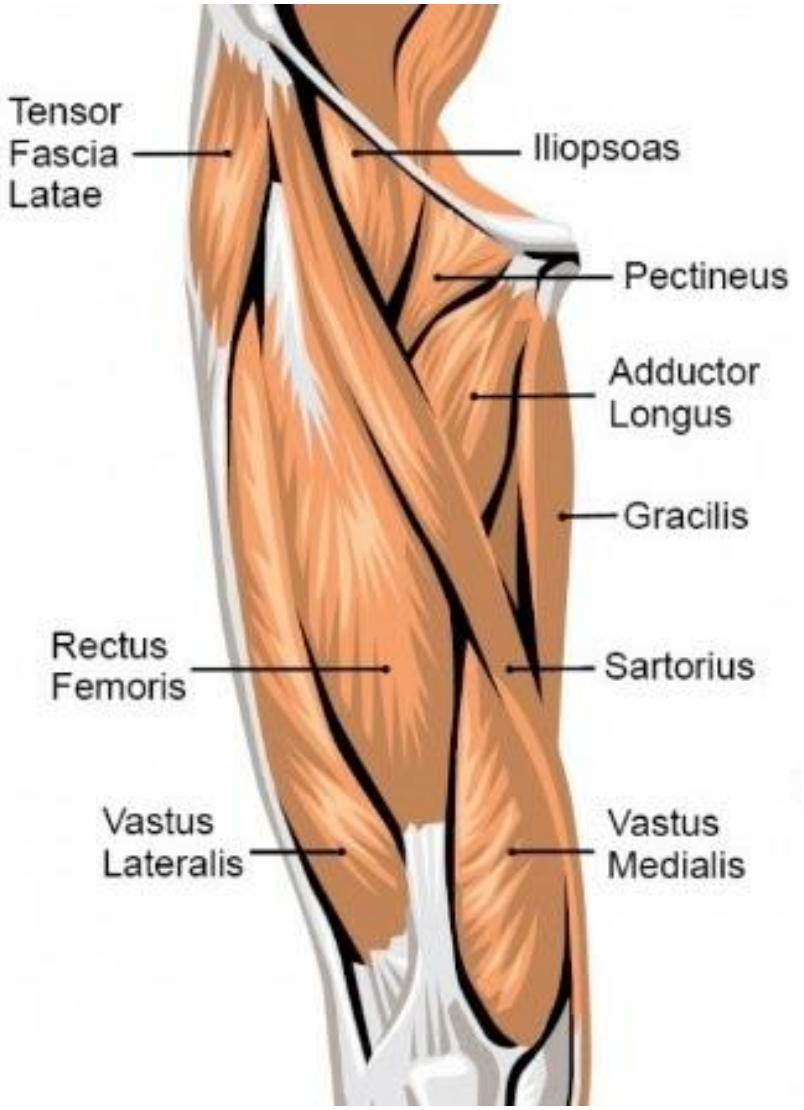
•Stabilises the knee joint

•Prevents varus

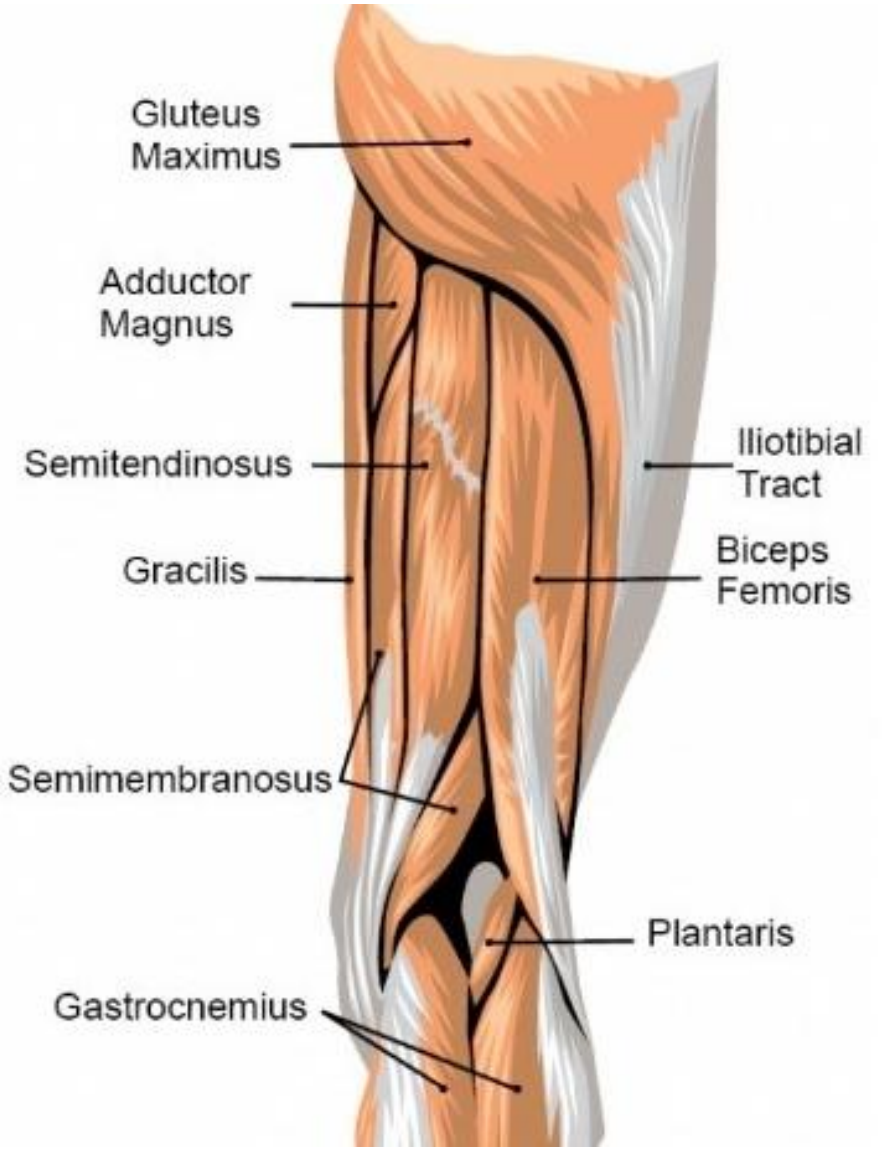
•Limits adduction.



KNEE JOINT - Soft Tissue - Muscles



Anterior view



Posterior view

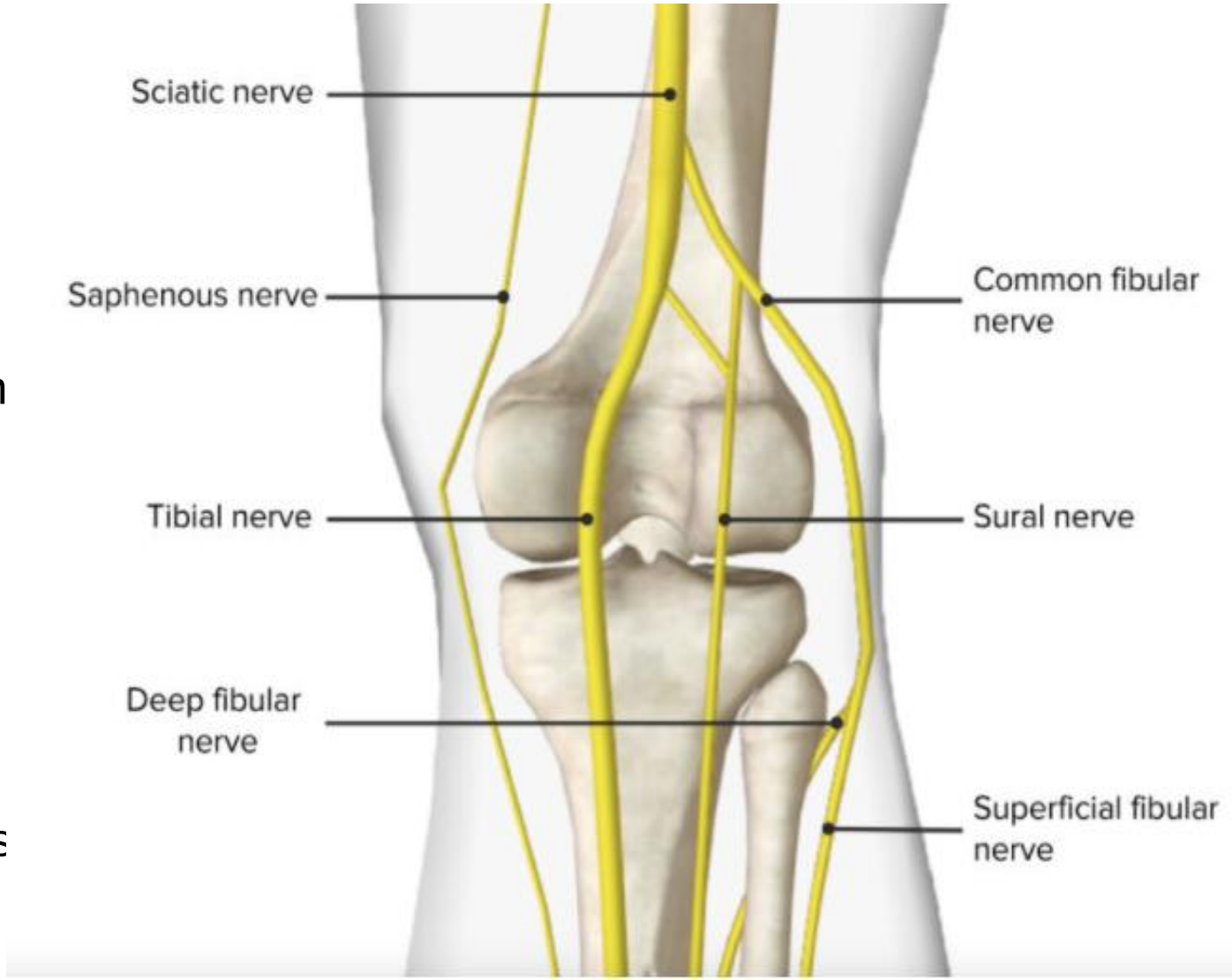
KNEE INNERVATION

Tibial nerve:

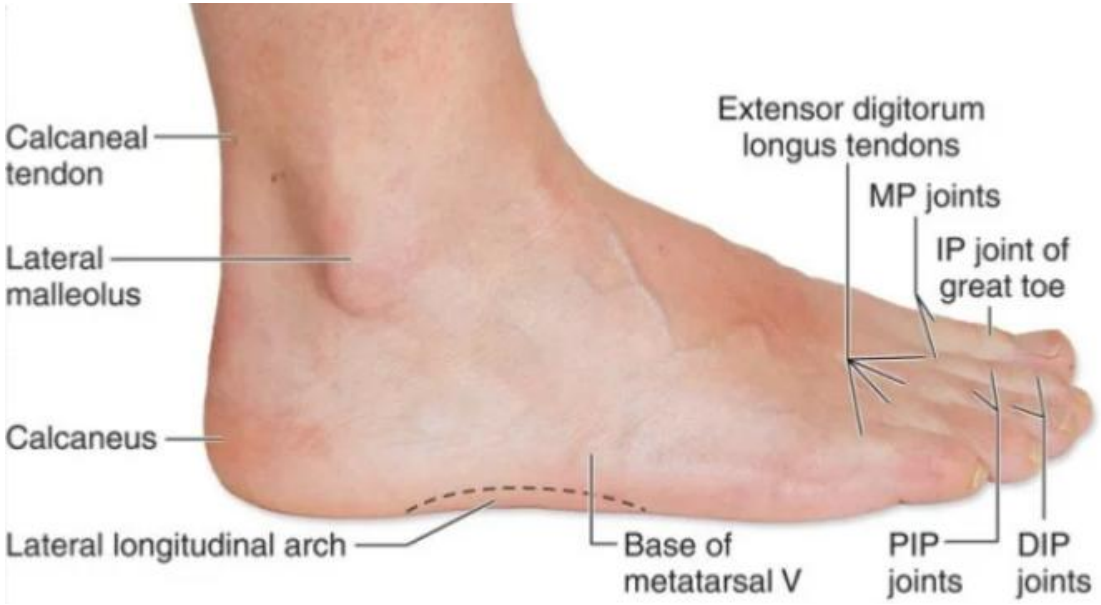
- More medial and larger of the two branches
- Runs deeply through the fossa and into th posterior compartment of the leg
- Gives off motor branches to the muscles of the popliteal region

Common fibular (peroneal) nerve:

- More lateral and smaller of the two branches
- Runs along the medial border of the biceps femoris muscle before exiting the fossa superficia



ANKLE JOINT INTRODUCTION



Bony landmarks

The ankle is a hinge

joint.

The joint has relationship with many other structures.

This unique design of the ankle makes it a very stable joint.

Withstands 1.5 times your body weight when you walk

Up to eight times your body weight when you run.

ANATOMY - BONY

Foot and Ankle:

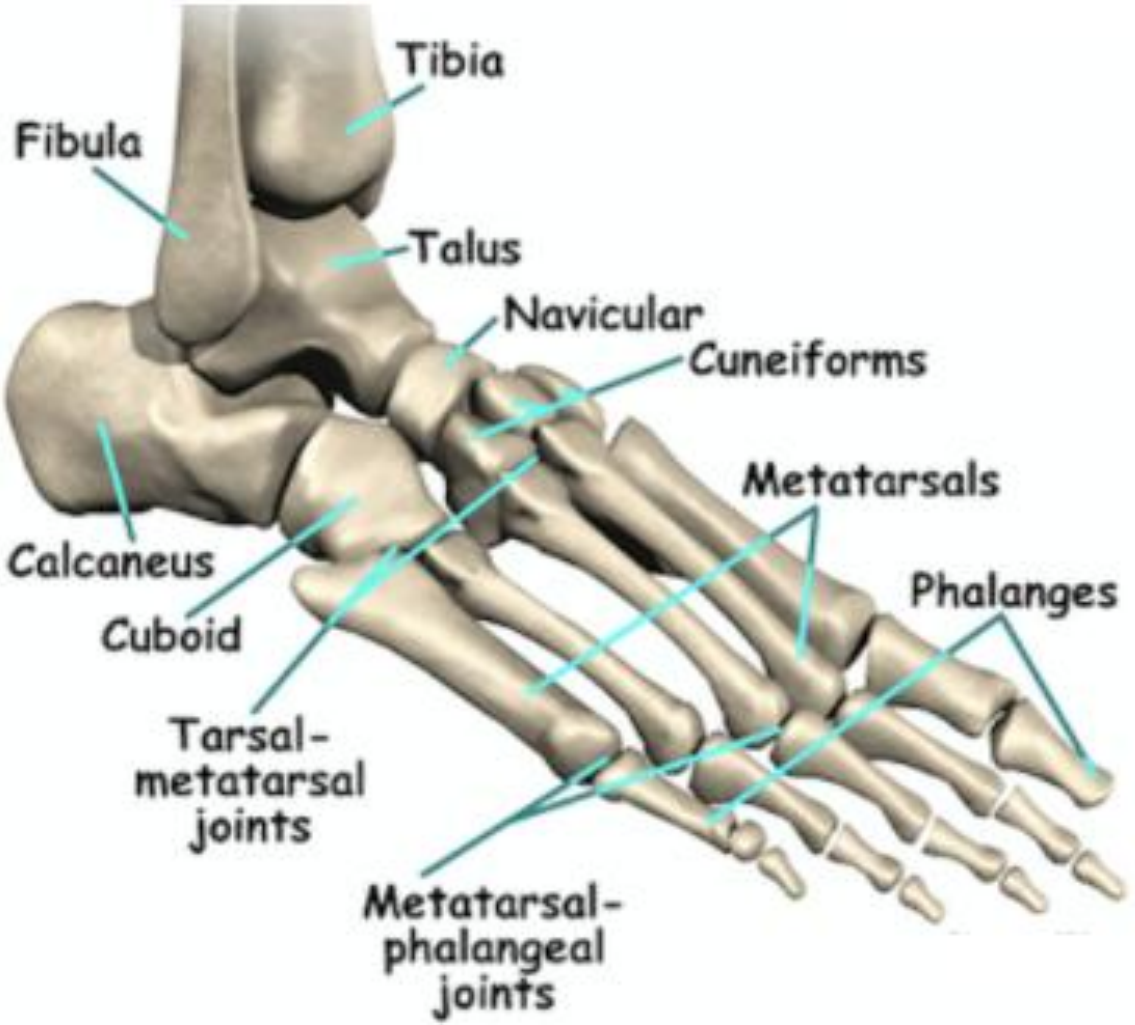
Comprise of 26 bones

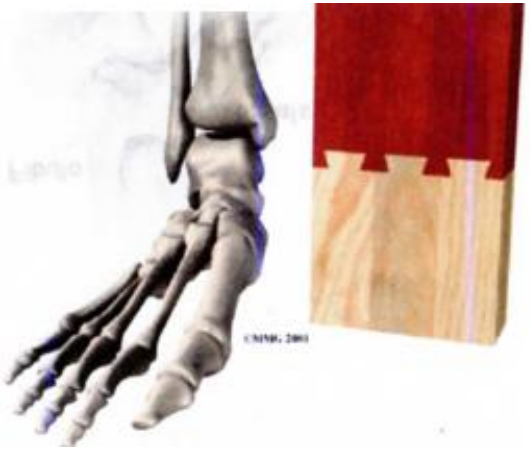
1. **7 tarsal bones**
2. **5 Metatarsals (1-5 great toe)**
3. **14 Phalanges**

Provides a strong but mobile base of support to meet its functions.

Stability - base of support and rigid lever for propulsion

Mobility – adaptor to terrain shock absorption





ANATOMY - JOINT
TALOCRURAL JOINT

Talocrural Joint

Synovial hinge joint

Mortise and tenon joint

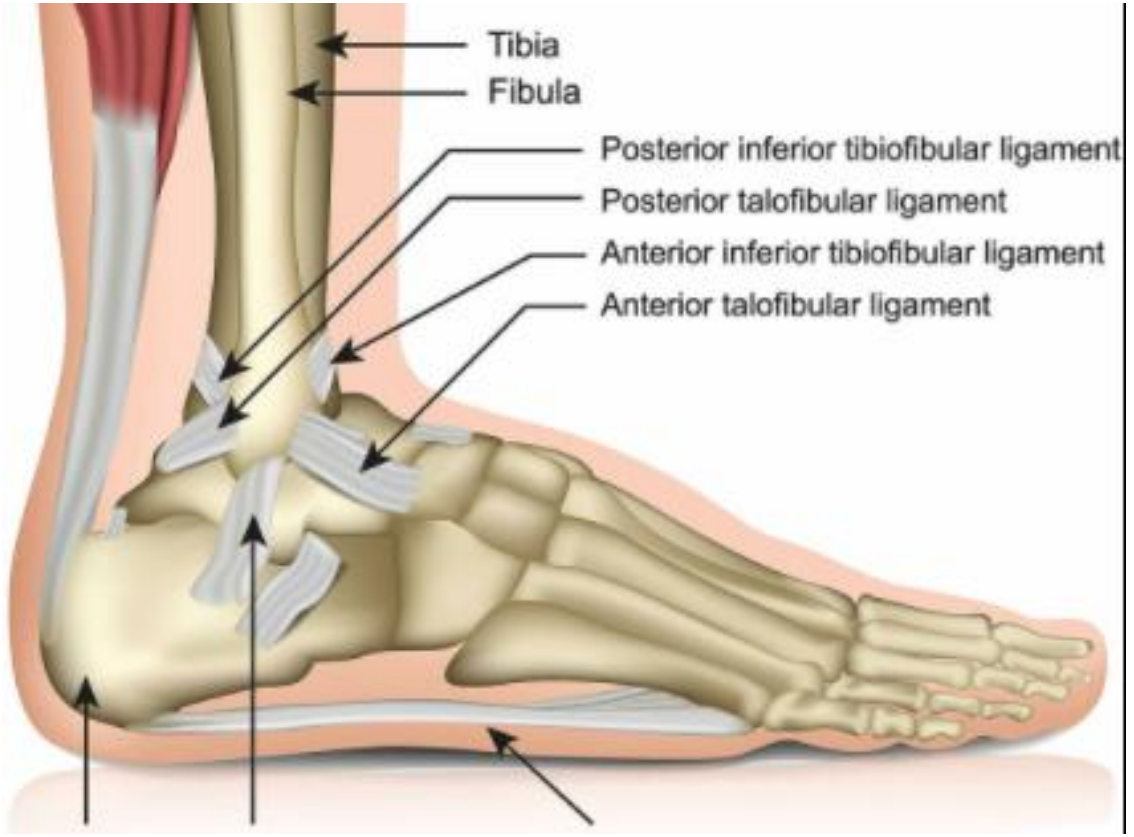
Uniaxial with a strong set of collateral ligaments

Allows planter and dorsiflexion.

Some times classified as a biaxial saddle joint.

Due to the fact in planter flexion there is a few degrees of lateral motion

Inherently stable



Calcaneus **calcaneofibular ligament** **plantar fascia**

ANATOMY -LIGAMENTS
TALOCRURAL JOINT

Laterial Ligaments

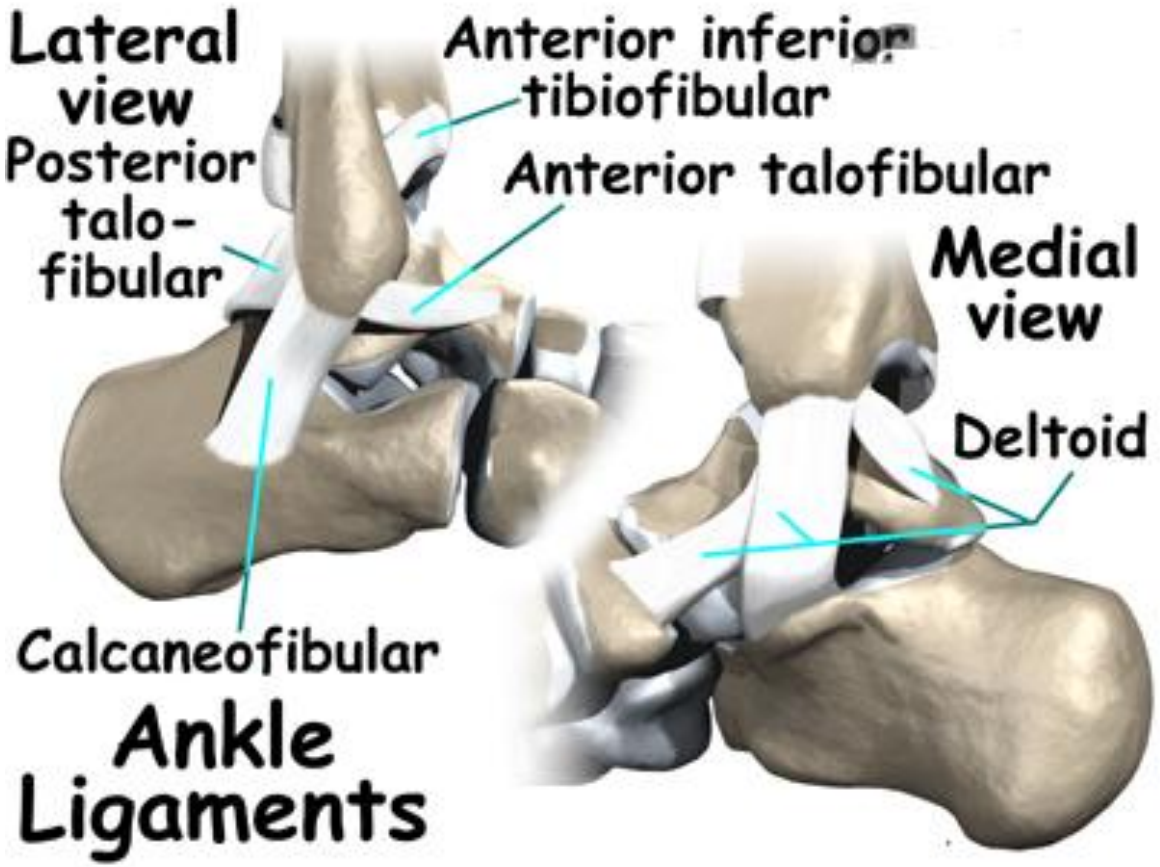
Weaker than medial arise from lateral malleolus

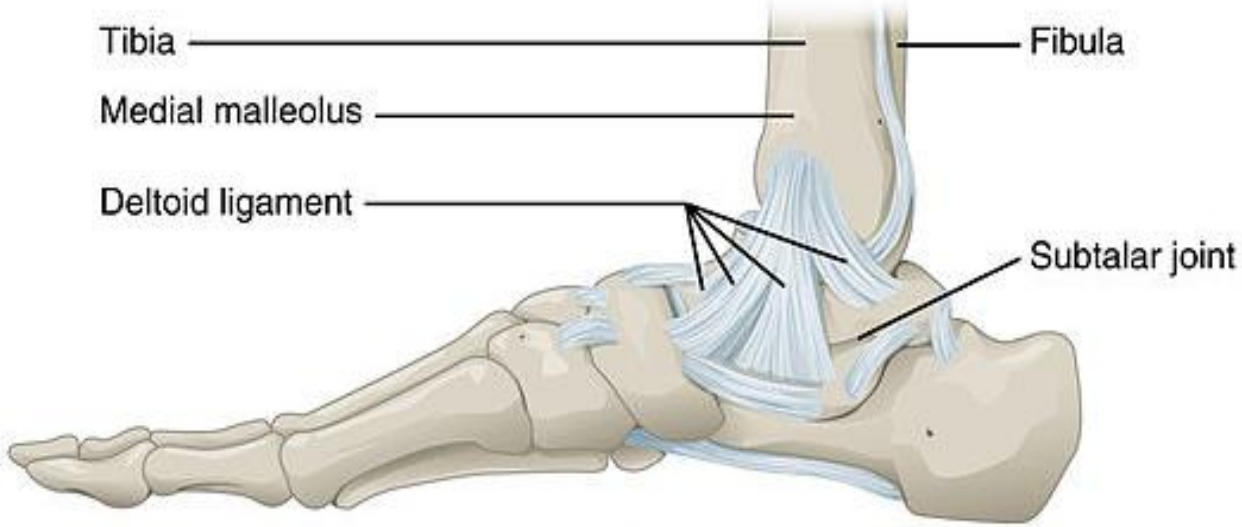
1. Anterior talofibular (ankle sprain)
2. Calcaneofibular
3. Posterior talofibular

Medial ligaments

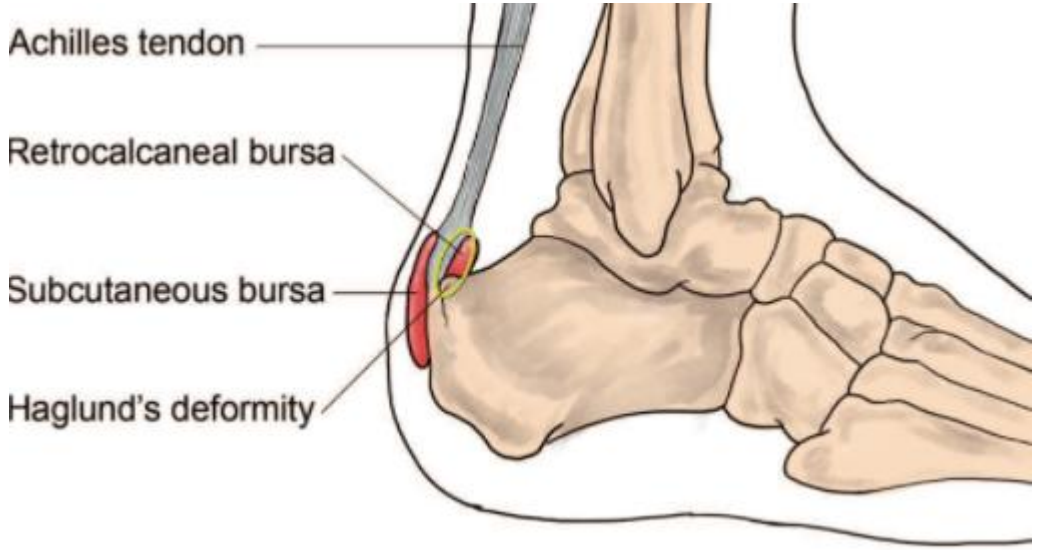
Known as the deltoid ligament

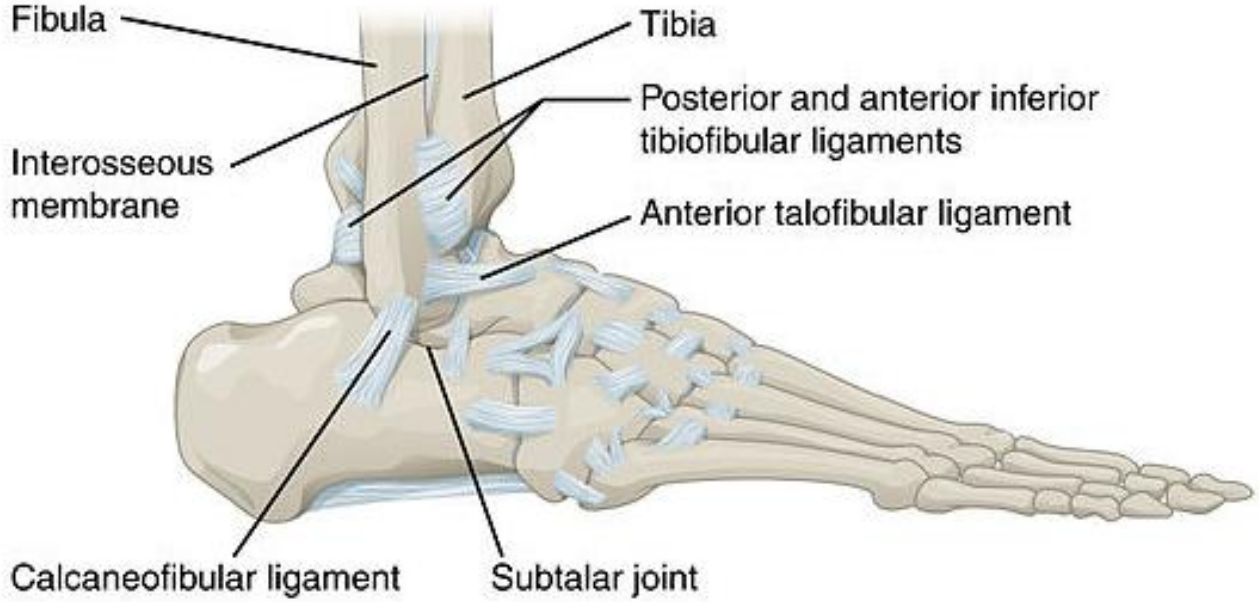
1. Anterior tibiotalar
2. Tibionavicular
3. Tibiocalcaneal
4. Posterior Tibiotalar





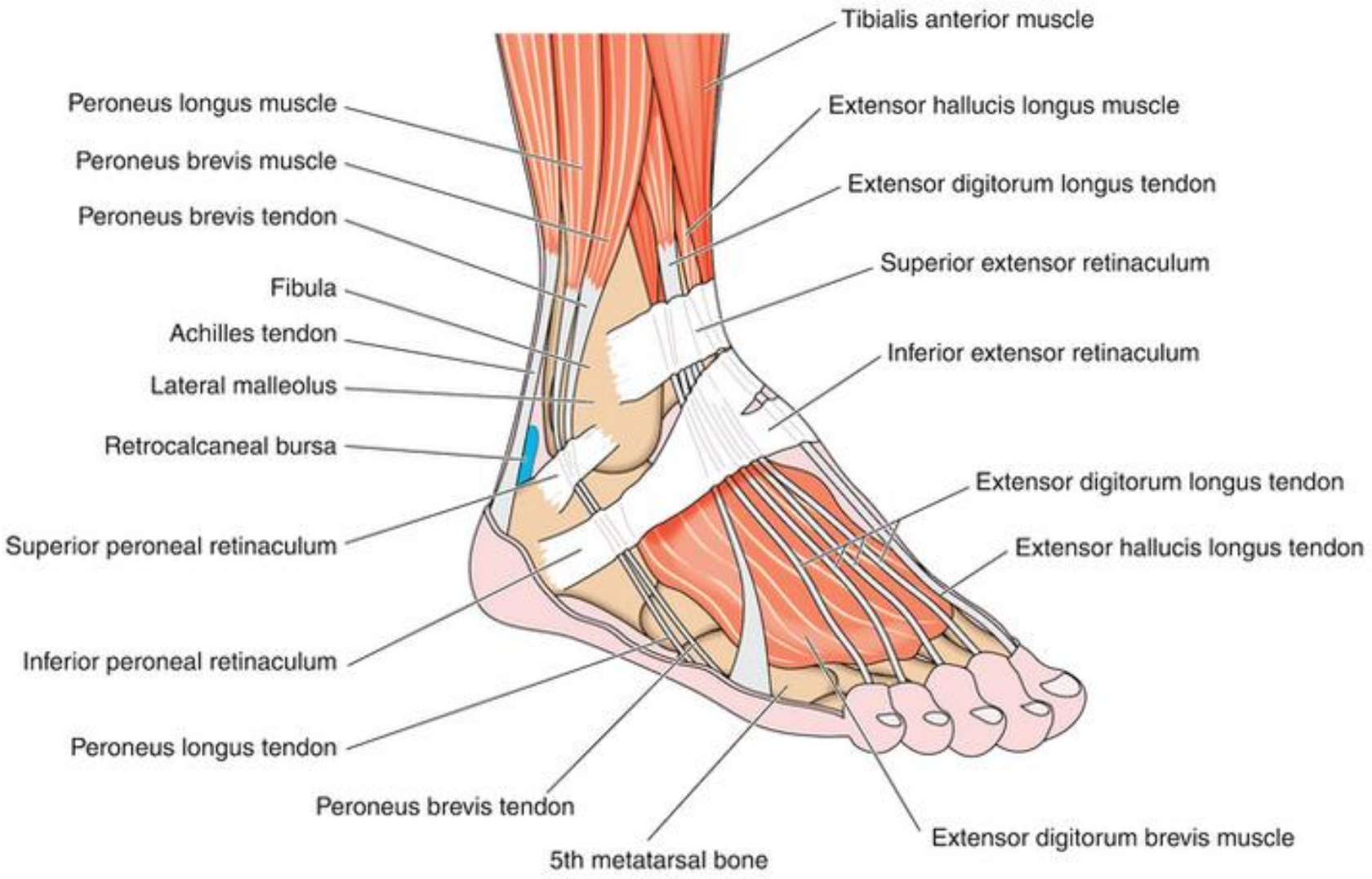
Medial view





Lateral view

SOFT TISSUE - Retinaculum



A **retinaculum** is a band of thick deep fascia that holds the long tendons of the ankle muscles in place.

It is a major source of neurological receptors involved in balance and proprioception.

It's a key structure in spatial control for foot and ankle movements.

Retinaculum also acts as a pulley system increasing mechanical advantage of the ankle joint

Plantar Fascia - Plantar aponeurosis

Plantar fascia is a thick connective tissue, which supports and protects the underlying vital structures of the foot.

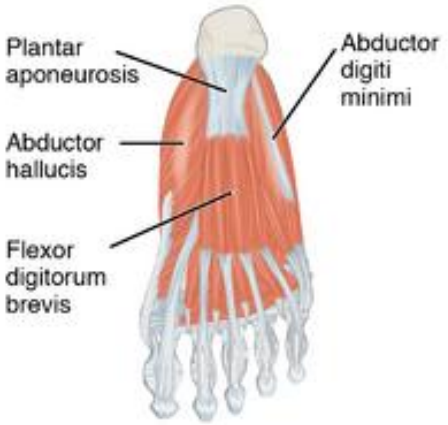
The fascia consists of three parts: medial, lateral and the central

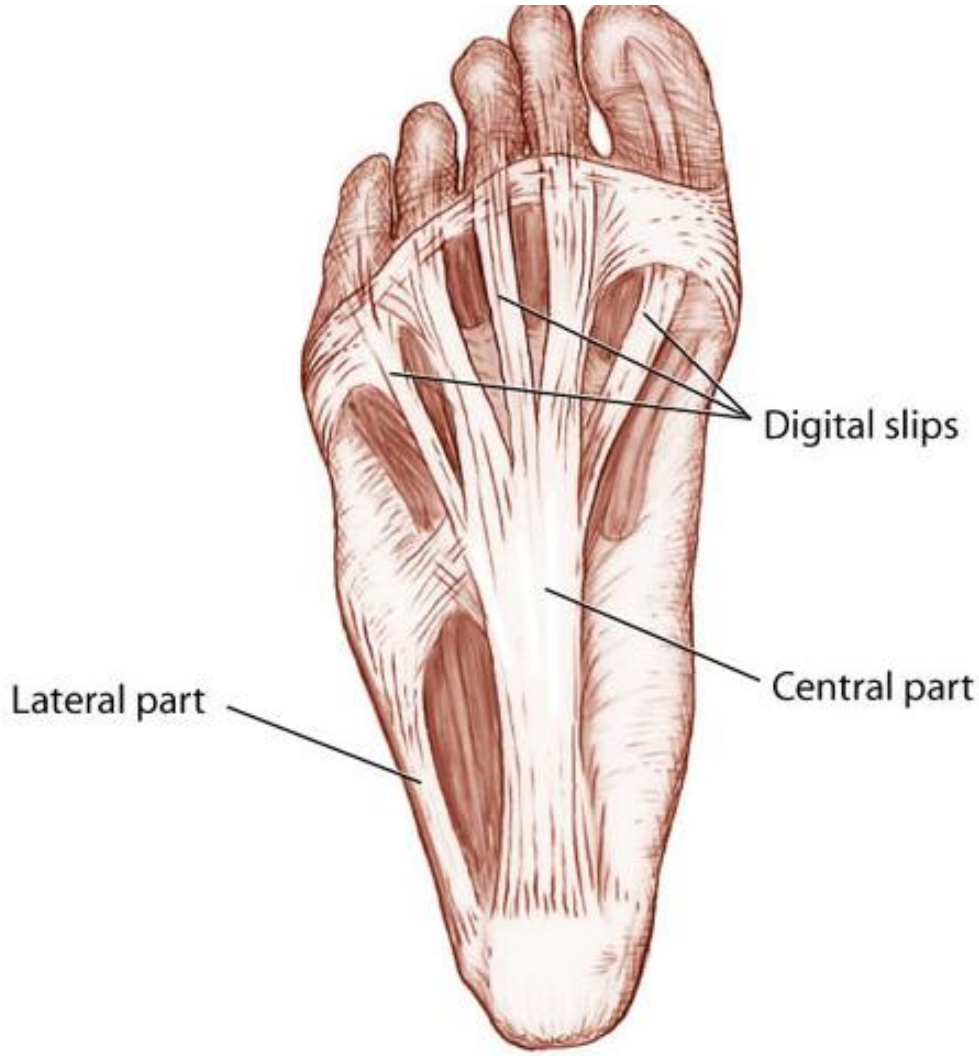
The central part – **aponeurosisis** – is thiker

The side parts are thiner

Functions:

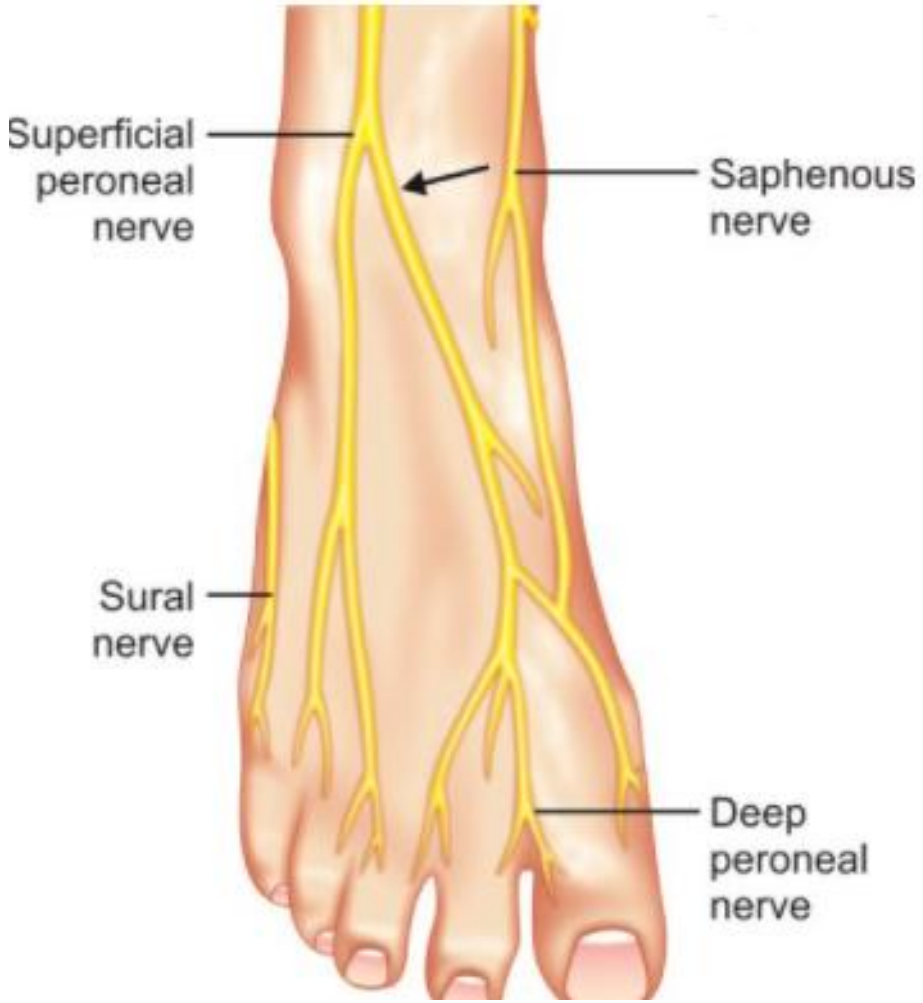
- Protects deeper structures of the foot : nerves, vessels.
- Maintains the longitudinal arches of the foot.
- Provides muscular attachment.
- Prevents excessive dorsiflexion
- Distributes plantar pressure during static and dynamic loading

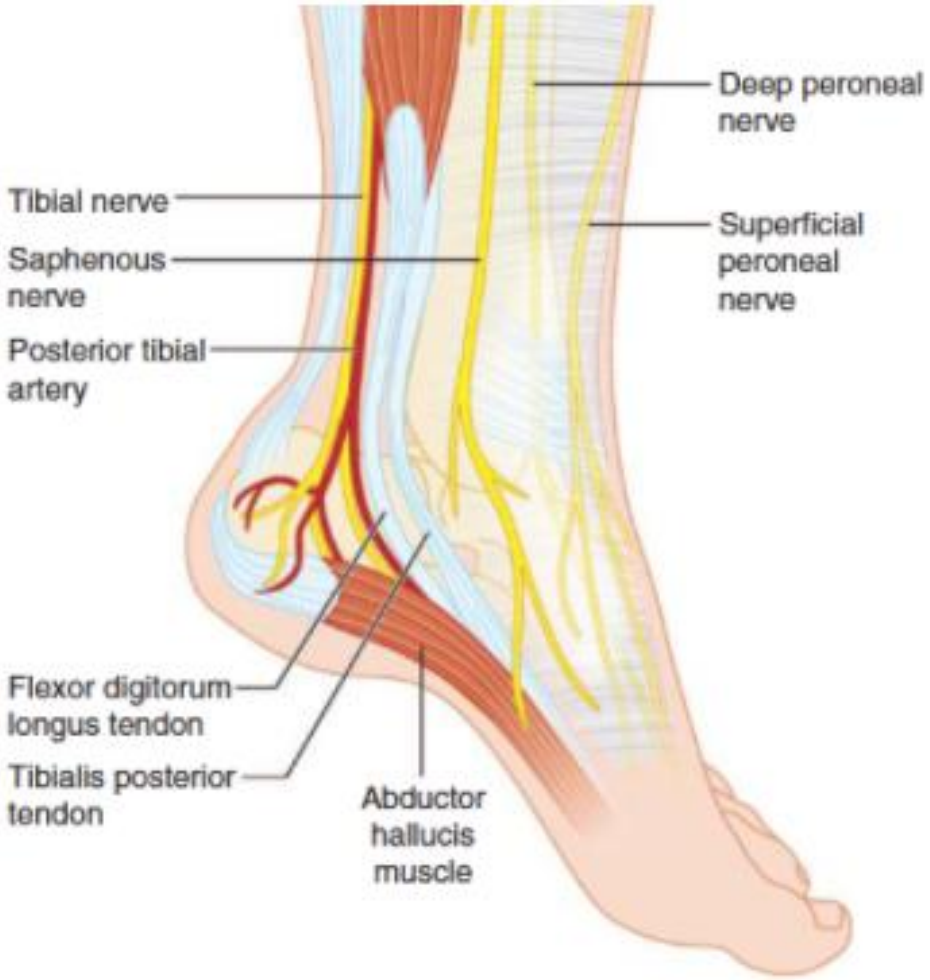




Plantar Aponeurosis

FOOT and ANKLE INNERVATION





SOULDER JOINT INTRODUCTION

Large degree of stability but functional quite unstable. Synovial, ball and socket oint.

Injuries are normally chronic.

Motions:

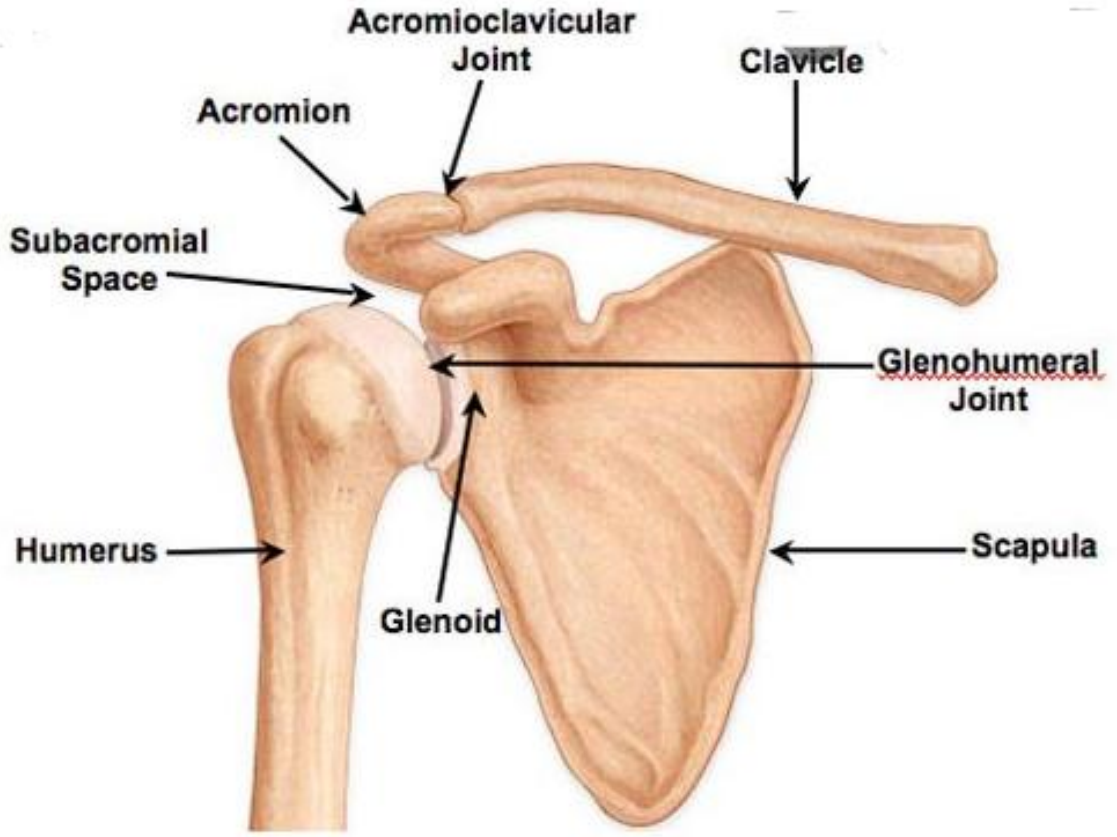
- **Flexion/ extension - Sagittal plane and transverse.**
- **Rotation - transverse plane**
- **Adduction/Abduction - Frontal plane**
- **Circumduction - combination of all movement**

Articulation takes place between the head of the humerus and the glenoid fossa of the scapula.

ANATOMY - BONY

3 Bones:

- clavicle
- scapula
- humerus



Bony anatomy of the shoulder

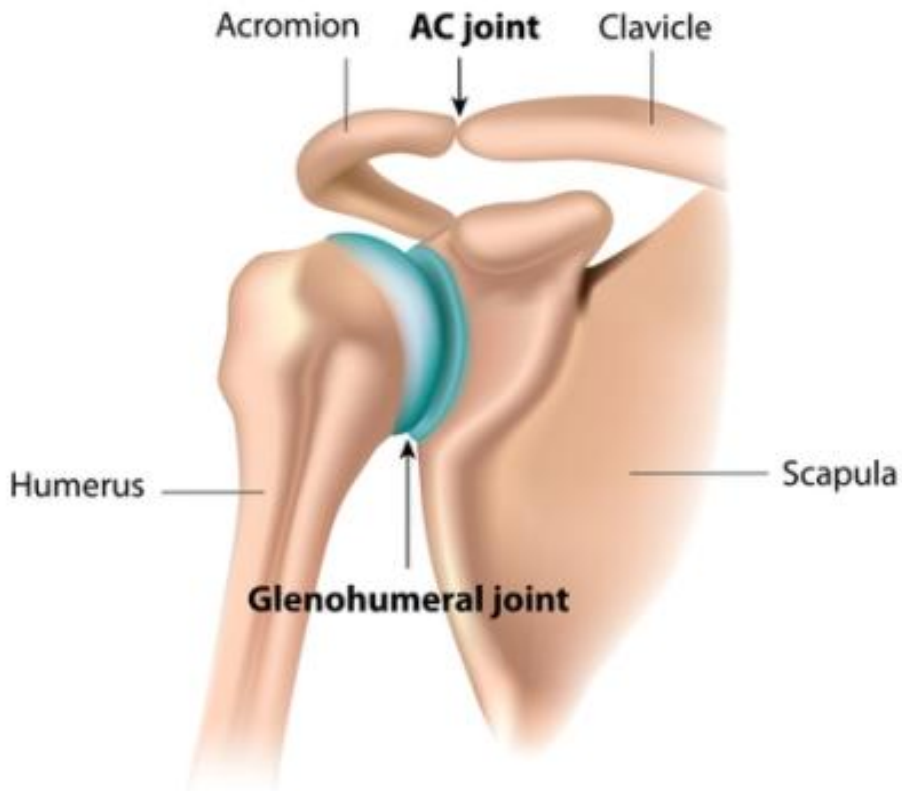
ANATOMY - JOINT

Gleno-humeral joint:

ball and socket

articulation of glenoid fossa of humeral head.
very shallow joint

- **1:4 size difference**
- **sacrifices stability for mobility**
- **golf ball on a tee**
- **Muscle and ligament help stabilise joint.**
- **Glenoid labrum – deepens joint.**



ANATOMY - SOFT

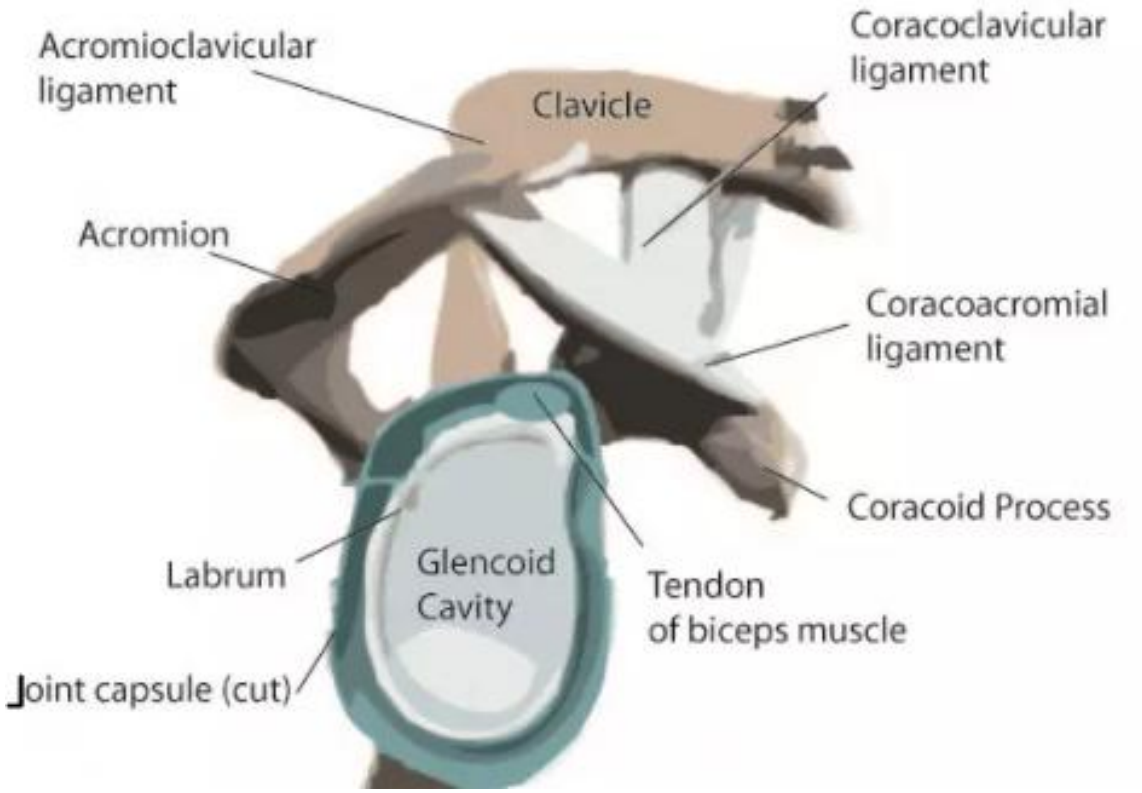
<u>Glenoid Labrum:</u>

Is a deepening by fibro-cartilage

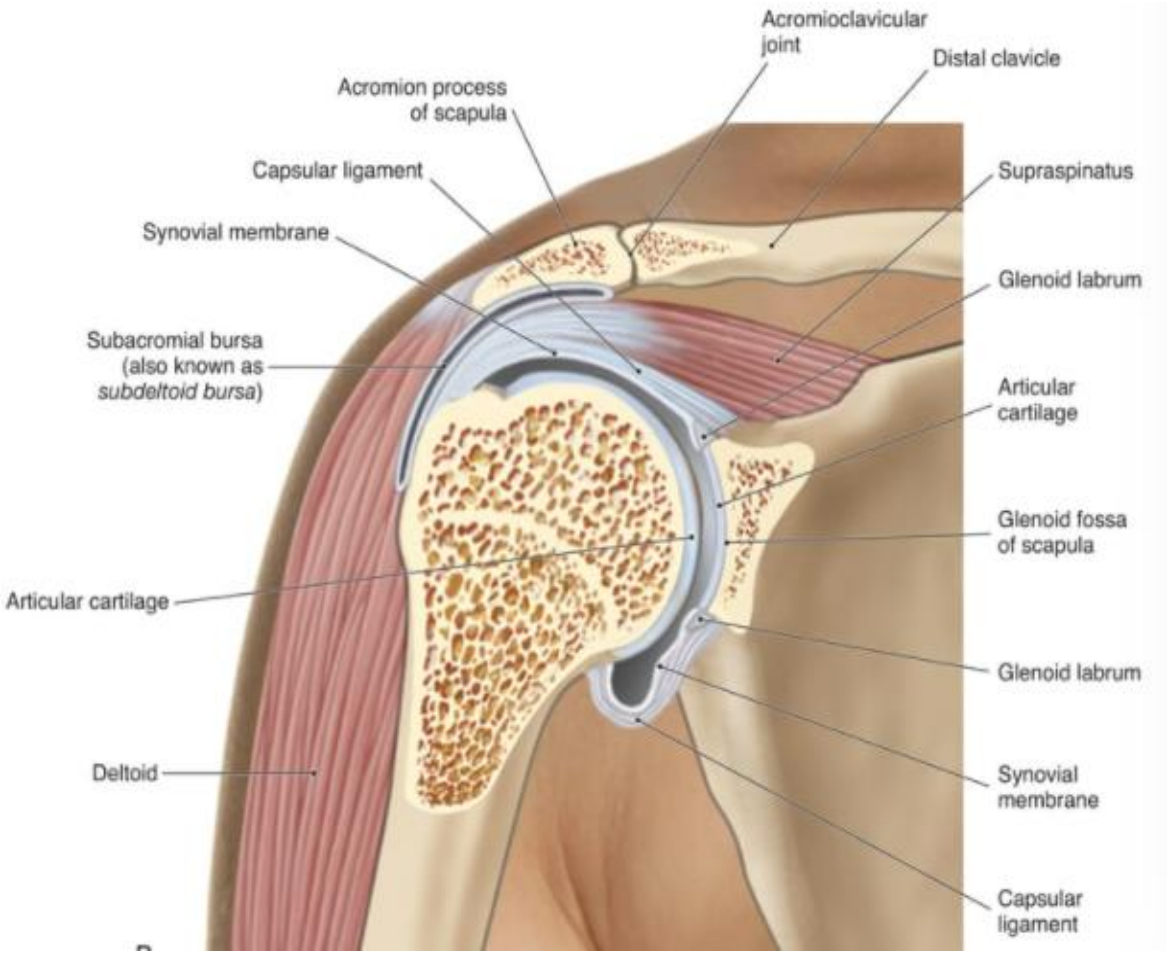
glenoid labrum –

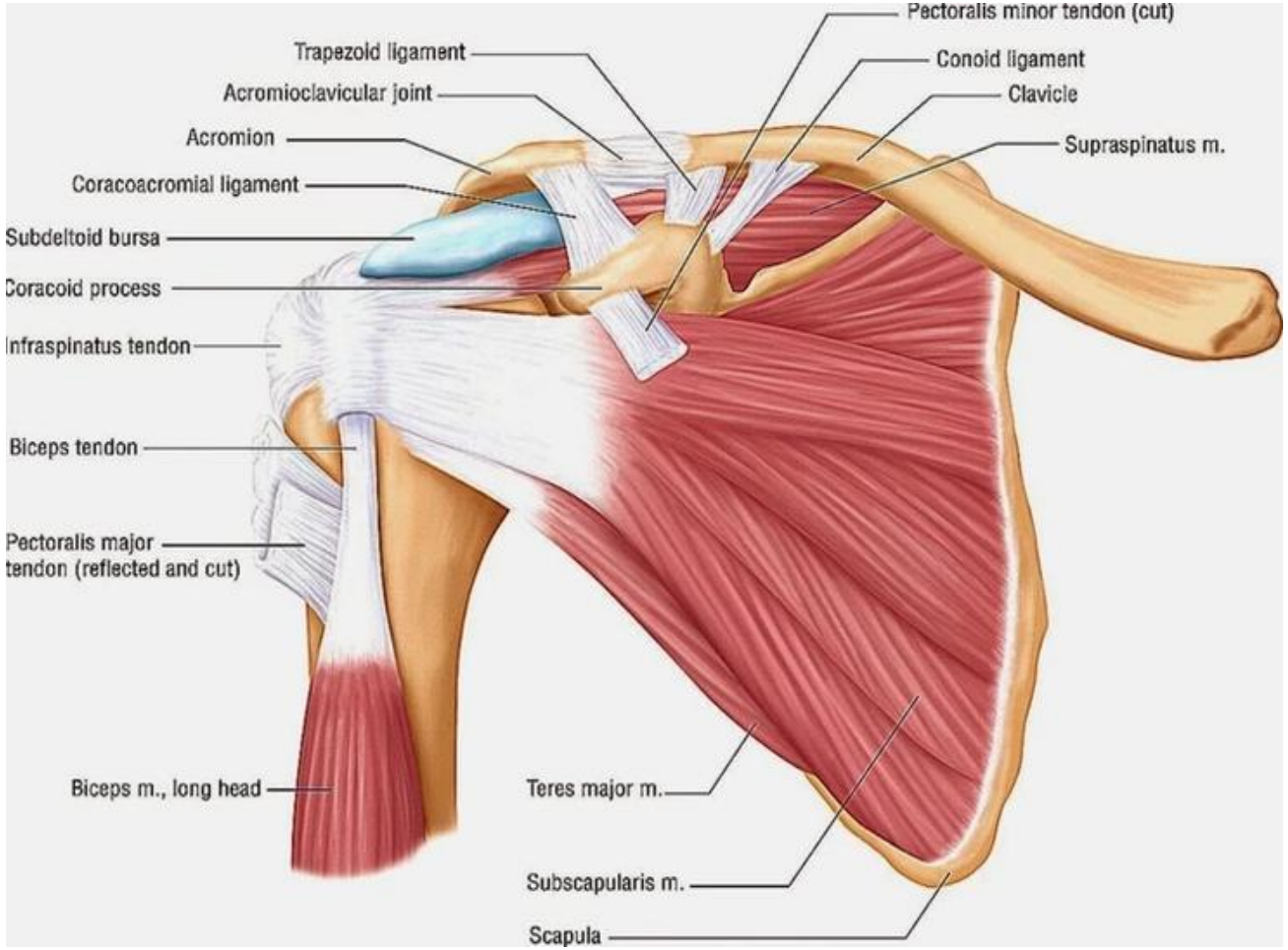
improves size ration.

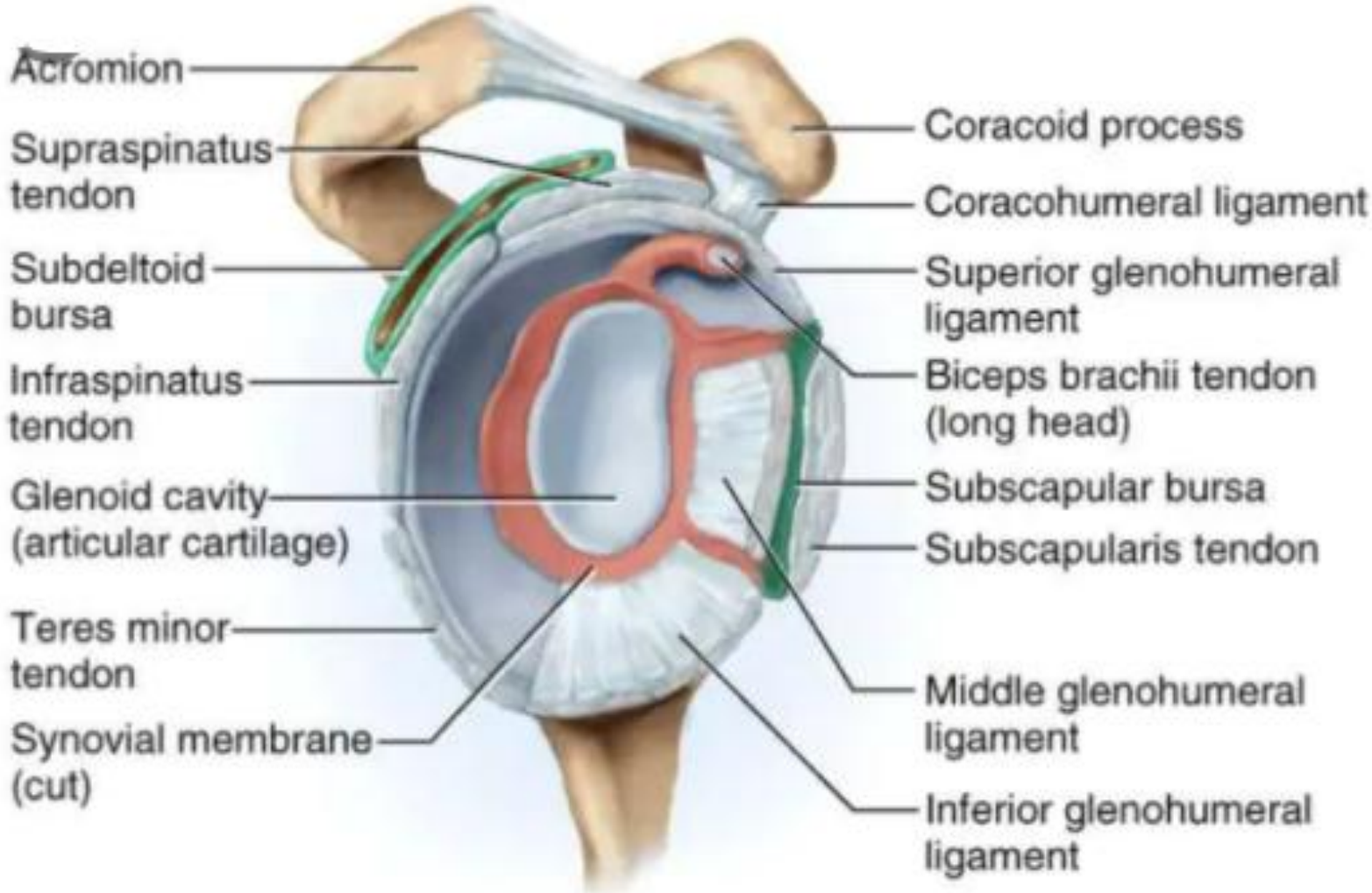
Superior portion offers attachment to the biceps tendon

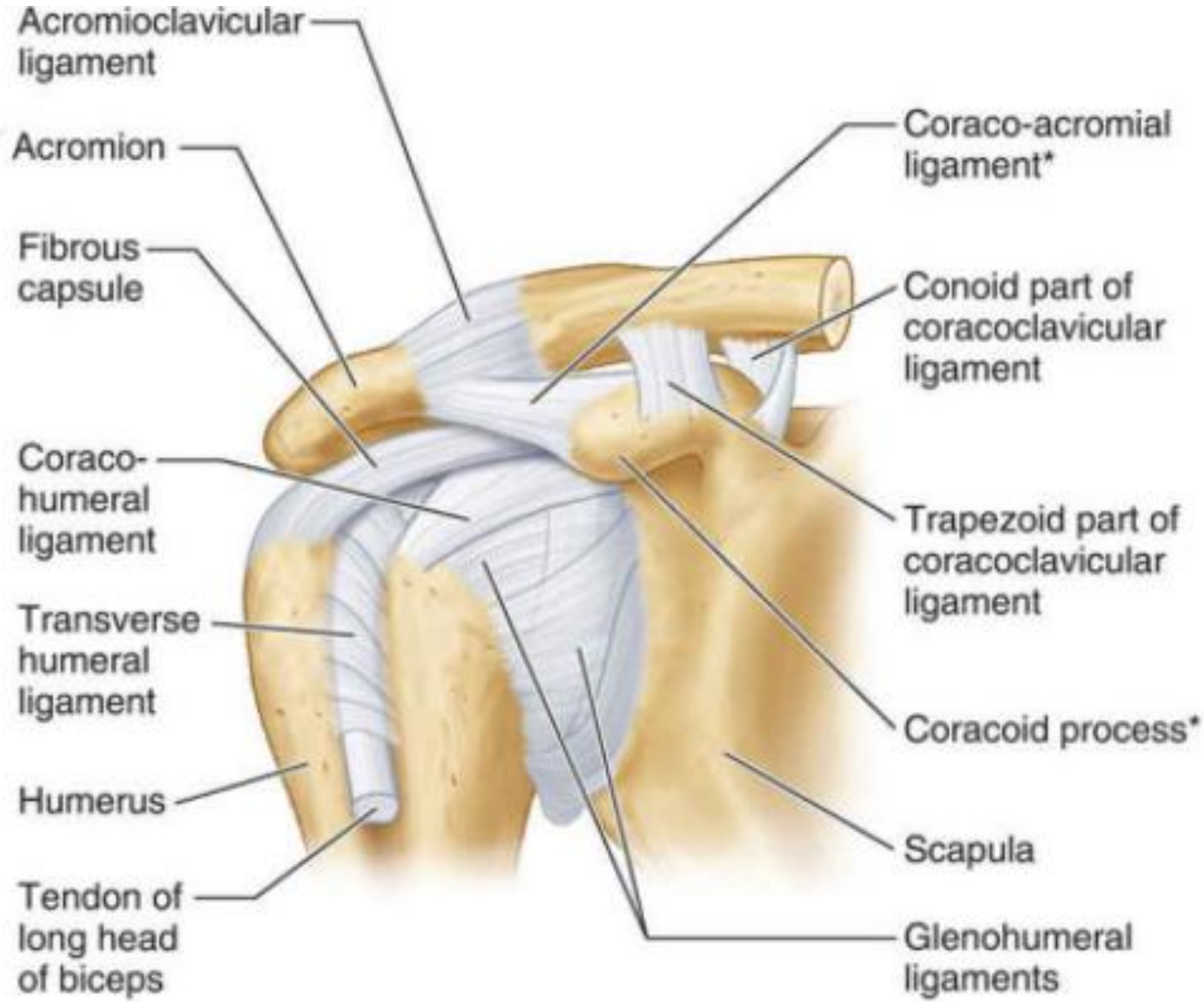


ANATOMY – SOFT TISSUE

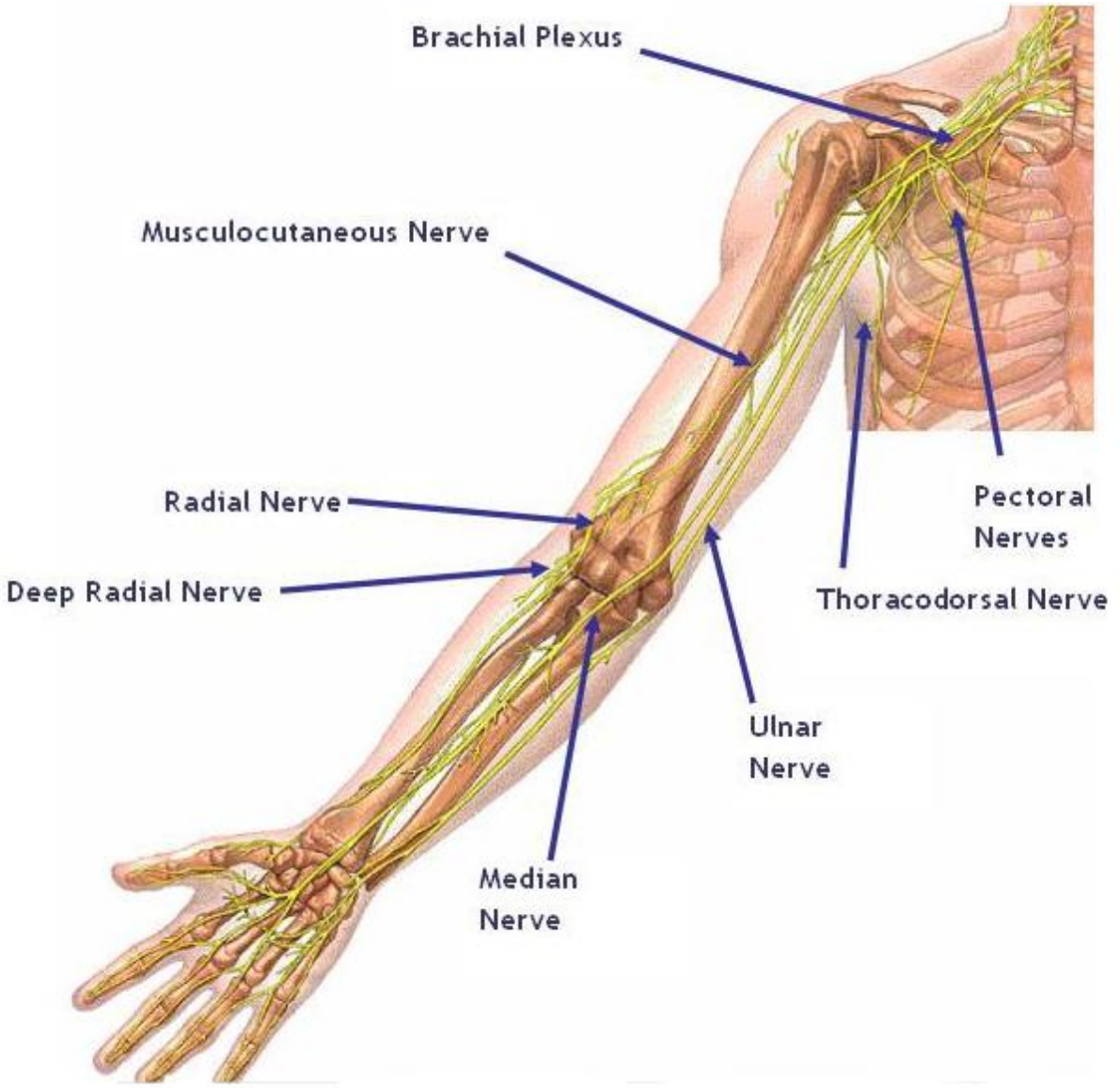


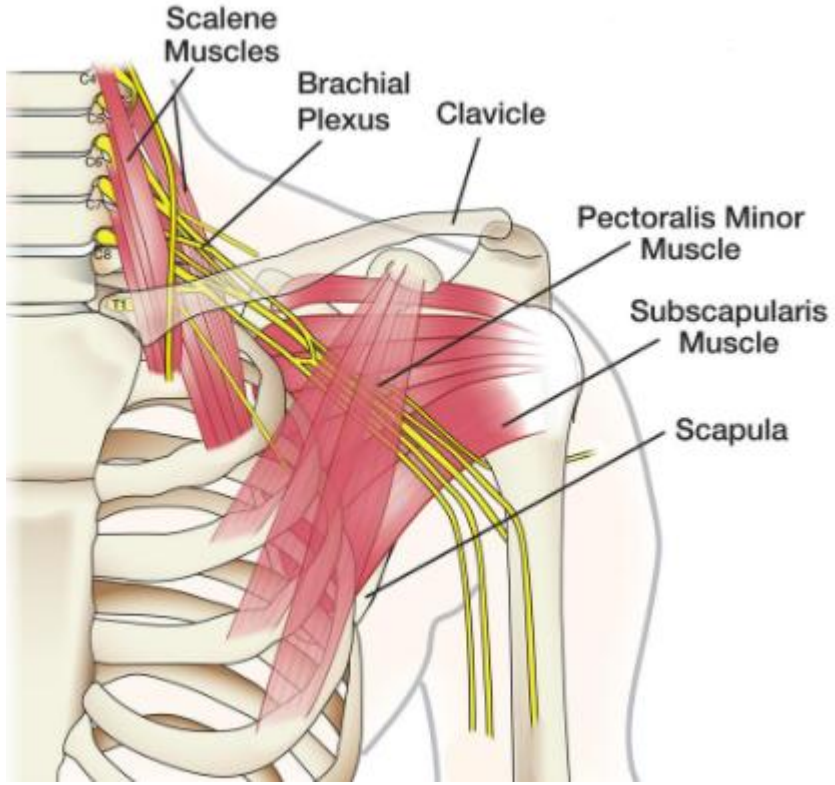


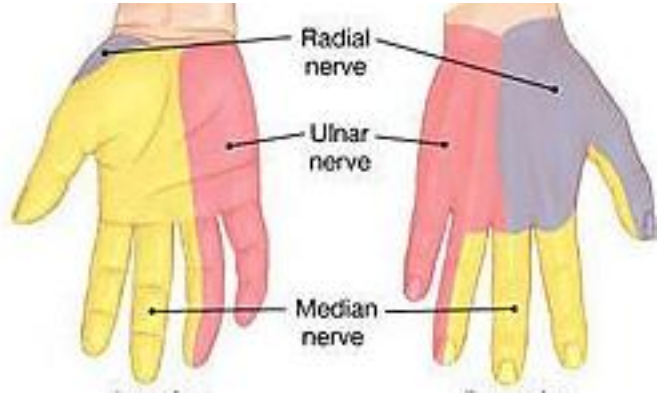

Acromion
Supraspinatus tendon
Subdeltoid bursa
Infraspinatus tendon
Glenoid cavity (articular cartilage)
Teres minor tendon
Synovial membrane (cut)
Coracoid process
Coracohumeral ligament
Superior glenohumeral ligament
Biceps brachii tendon (long head)
Subscapular bursa
Subscapularis tendon
Middle glenohumeral ligament
Inferior glenohumeral ligament


Acromioclavicular ligament
Acromion
Fibrous capsule
Coraco-humeral ligament
Transverse humeral ligament
Humerus
Tendon of long head of biceps
Coraco-acromial ligament*
Conoid part of coracoclavicular ligament
Trapezoid part of coracoclavicular ligament
Coracoid process*
Scapula
Glenohumeral ligaments

Shoulder/arm/hand innervations







ELBOW JOINT INTRODUCTION
a synovial hinge joint

The elbow is a relatively stable joint.
Its main function is as a link between the wrist and the shoulder. Very strong collateral ligaments

Motions:

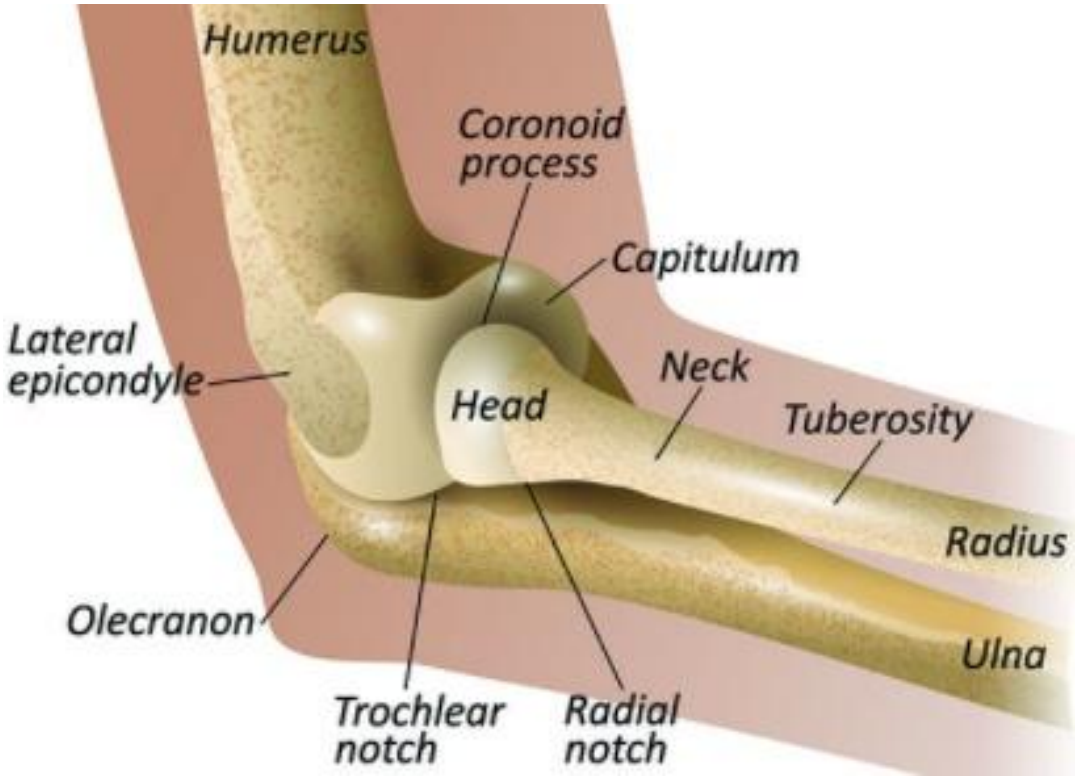
- Flexion - Sagittal plane/transverse/frontal.
- Extension - Sagittal plane/transverse/frontal.

145° of flexion and 90 ° of supination and pronation

Articulation takes place between the distal head of the humerus, proximal head of ulna and radius.

Elbow demonstrates a carrying angle due to distal projection of humerus

•Normal in females is 10-15°, males 5°



Bones:

Humerus - Lateral and medial epicondyle
Ulna –Olecranon prosess
Radius – head of radius

ANATOMY - LIGAMENTS

Ulnar (Medial) Collateral Ligament

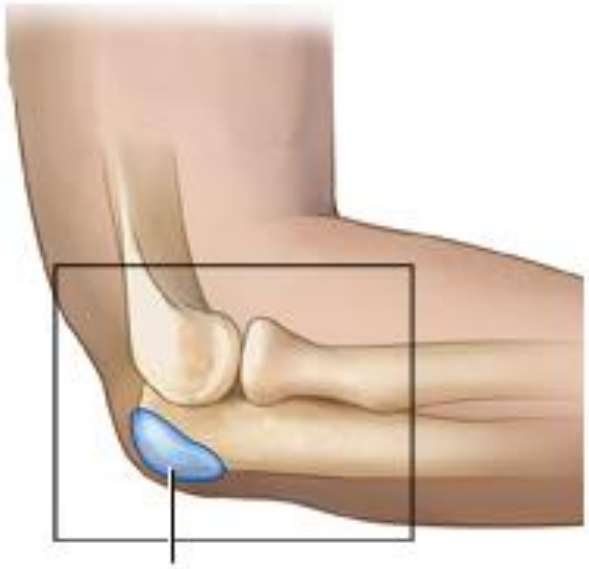
- Anterior Oblique Band
- Transverse Oblique Band
- Posterior Oblique Band

Radial (Lateral) Collateral Ligament

Annular Ligament

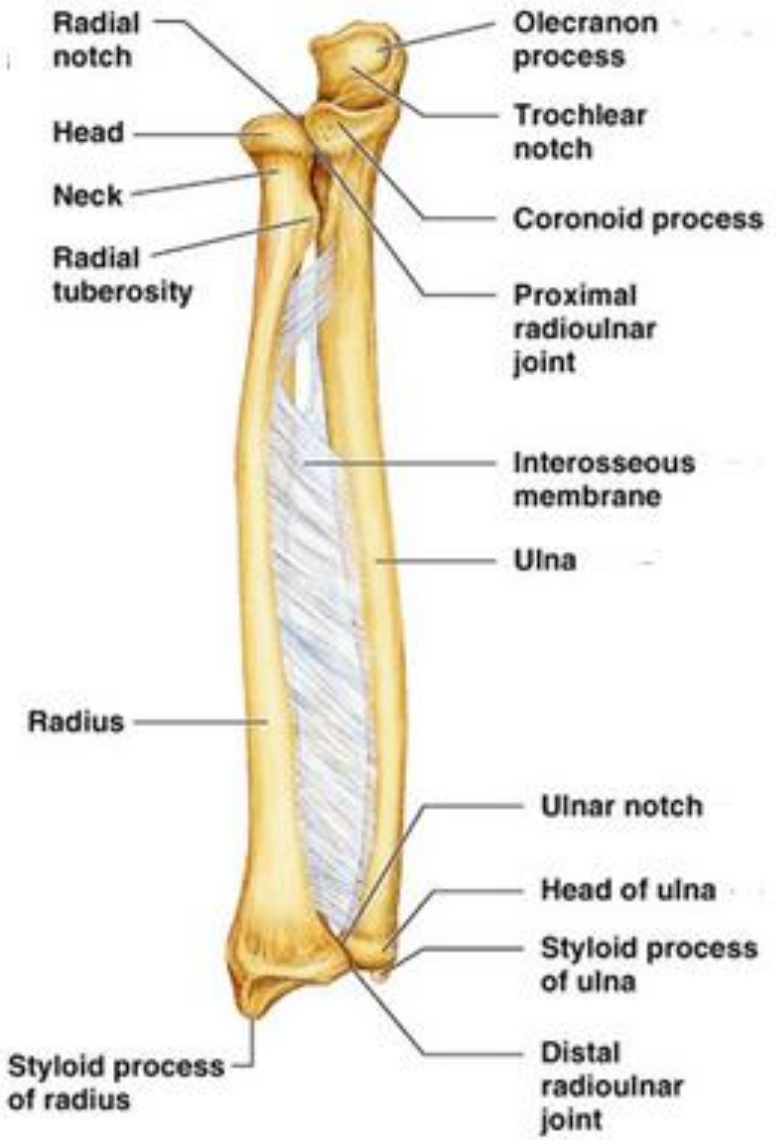
Interosseous Membrane

ANATOMY- SOFT TISSUE



Olecranon Bursa - overlying the olecranon process at the proximal aspect of the ulna.

The bursa supports the olecranon and reduces friction between it and the skin, especially during movement.



The **distal interosseous membrane** (DIOM) - a fibrous tissue with an oblique orientation from the radius to the ulna.

ANATOMY- LIGAMENTS

Ulnar Collateral (Medial)

Supports against valgus force

1. Anterior Band:

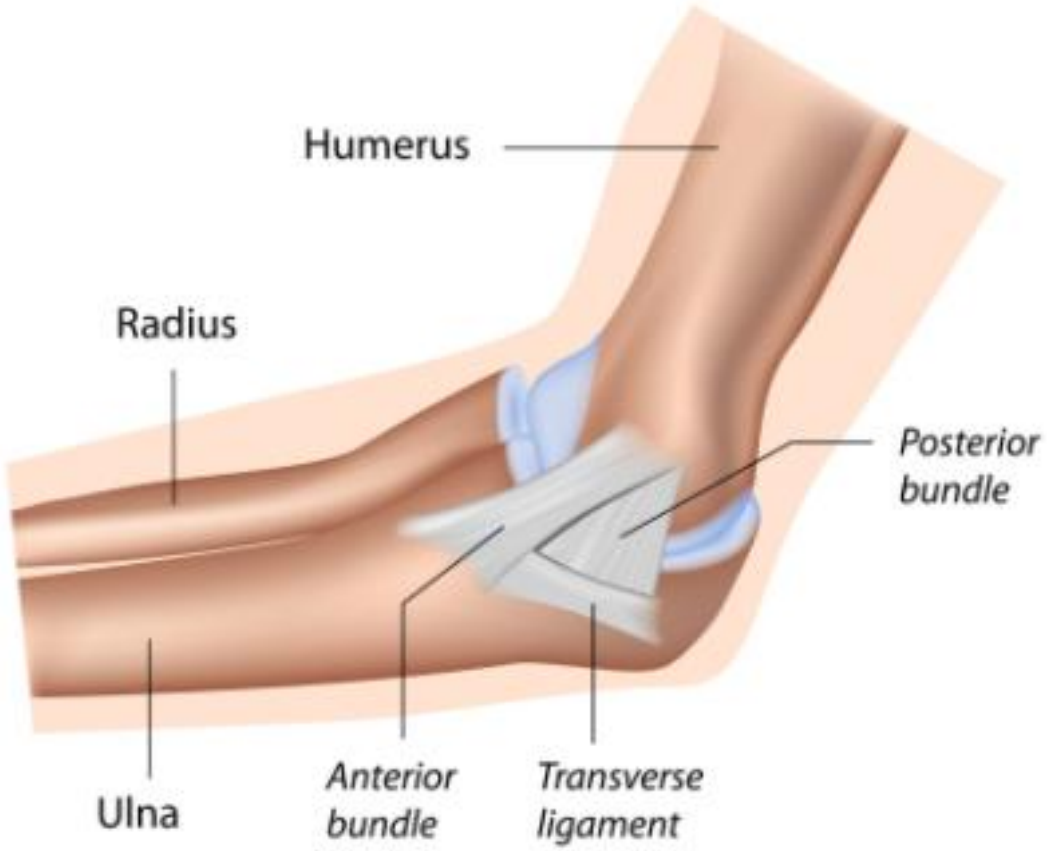
Taut in extension

2. Transverse Band:

Deepens the socket

3. Posterior Band:

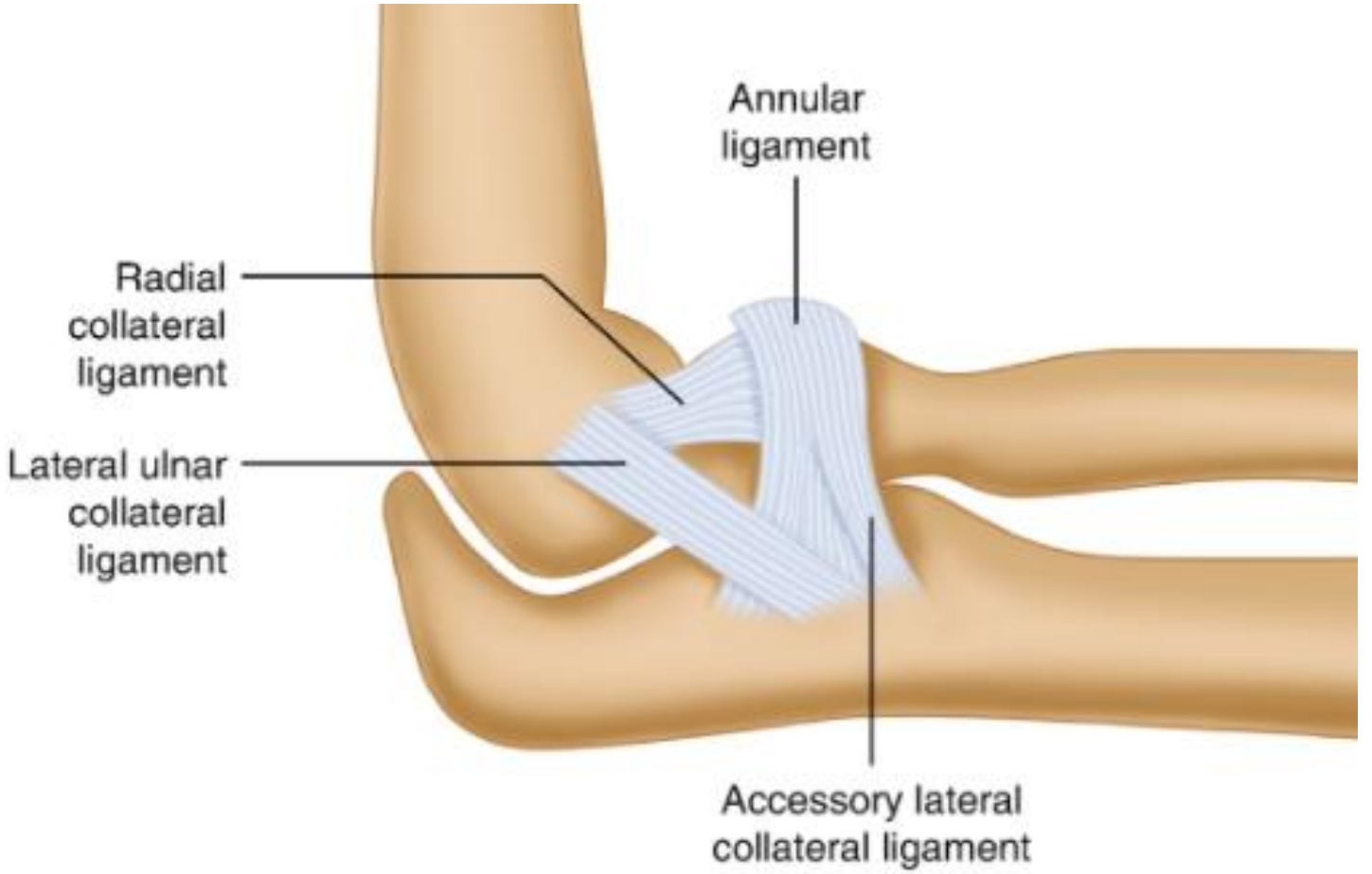
Weak, fan shaped becomes taut in flexation



ANATOMY - LIGAMENTS

Radial Collateral (Lateral) :

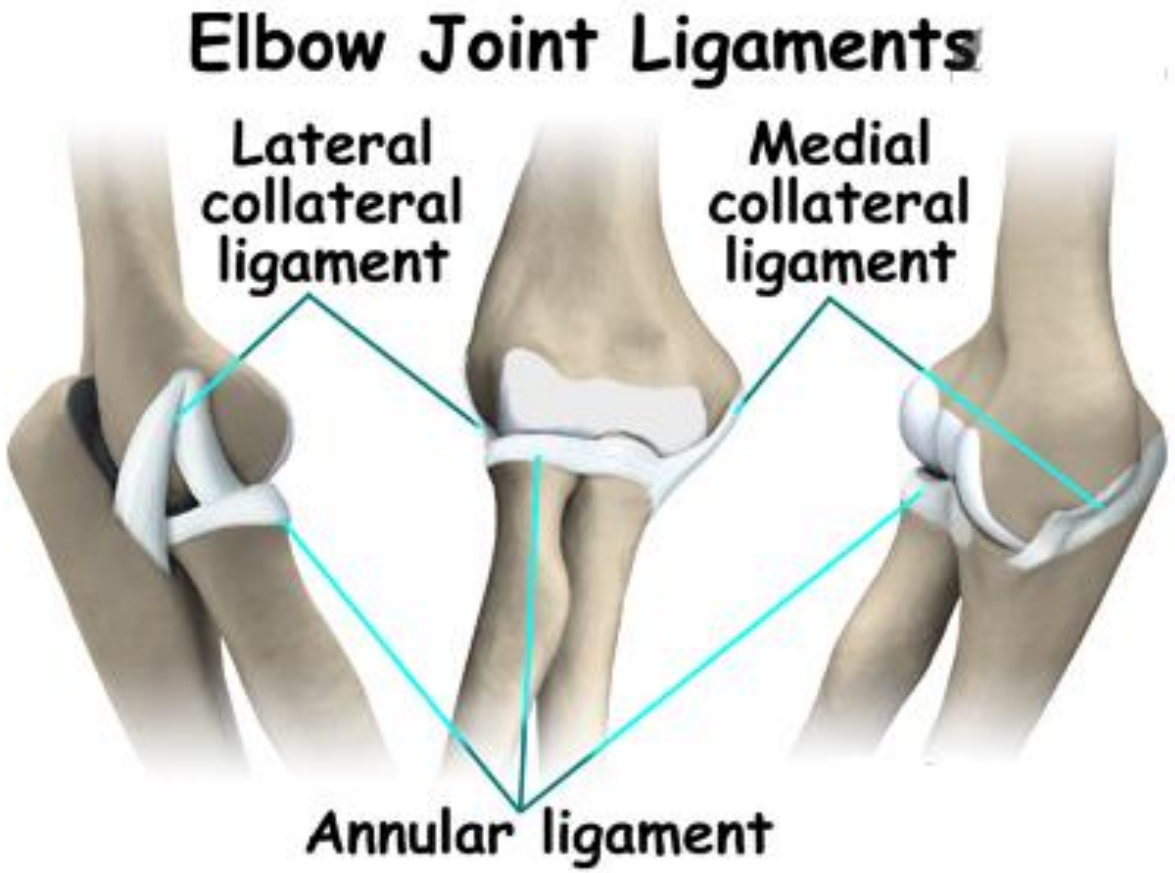
1. Thickened area in lateral joint capsule between the lateral epicondyle and annular ligament
2. Strong and fan shaped
3. Resists varus stress
4. Maintains relationship between humeral and radial head

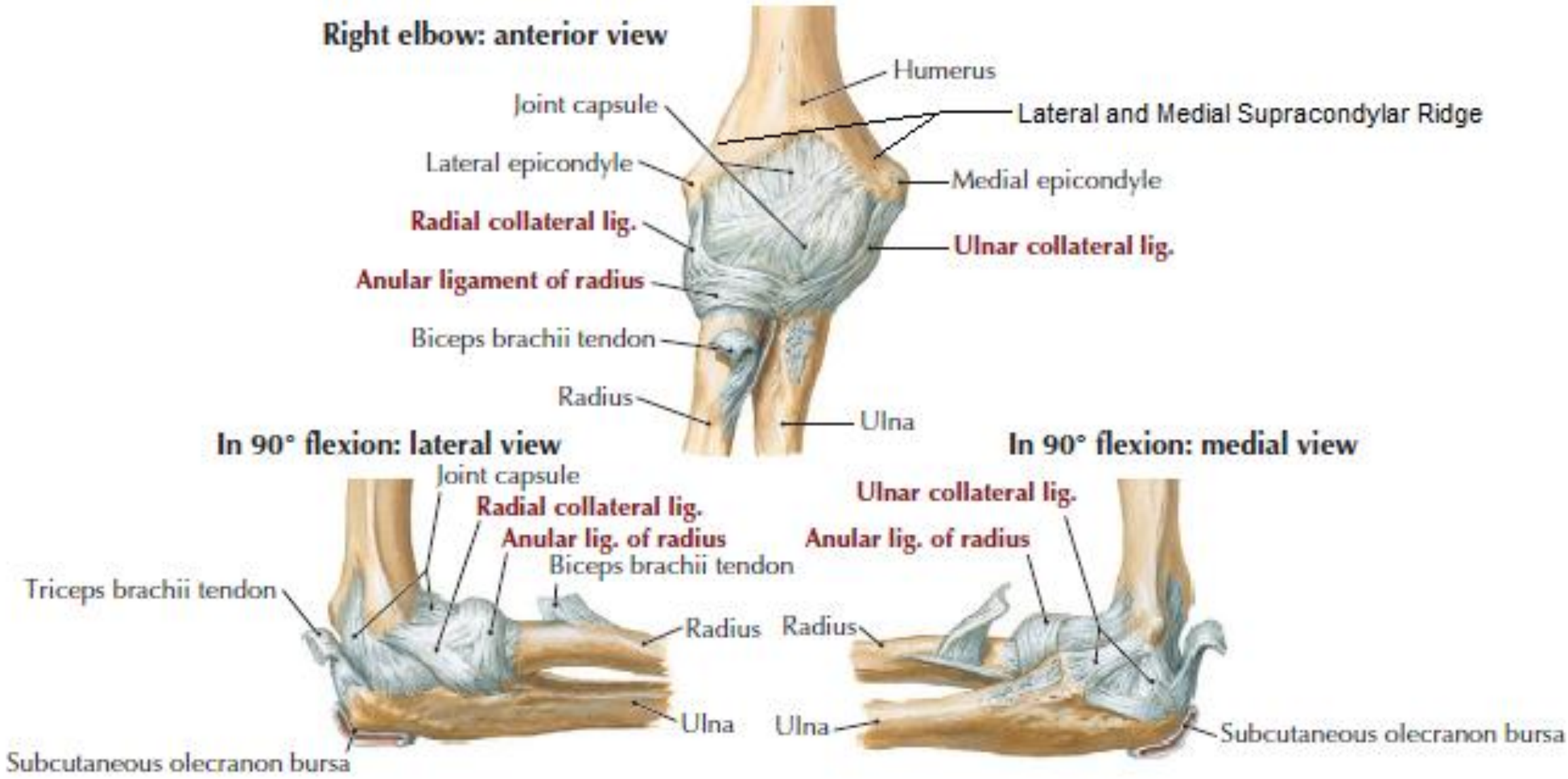


ANATOMY- LIGAMENTS

Annular Ligament:

1. Permits IR/ER of radius/ulna
2. Attach to coronoid process
3. Anterior fibers are taut with supination
4. Posterior fibers are taut during hyperpronation
5. Inner surface is smooth and lined with synovial fluid




Right elbow: anterior view
Humerus
Joint capsule
Lateral and Medial Supracondylar Ridge
Lateral epicondyle
Medial epicondyle
Radial collateral lig.
Ulnar collateral lig.
Anular ligament of radius
Biceps brachii tendon
Radius
Ulna
In 90° flexion: lateral view
Joint capsule
Radial collateral lig.
Anular lig. of radius
Biceps brachii tendon
Triceps brachii tendon
Radius
Ulna
Subcutaneous olecranon bursa
In 90° flexion: medial view
Ulnar collateral lig.
Anular lig. of radius
Radius
Ulna
Subcutaneous olecranon bursa

WRIST and HAND JOINT
ANATOMY - BONY

Wrist abd Hand consists of :

Radius bone- distal

Ulna bone - distal

8 **Carpal** bones:
Scaphoid,Lunate,Triquetrum,Trapezoid,Trapezium

Capitate, Hamate, Pisiform

5 **Mtacarpa**l bones

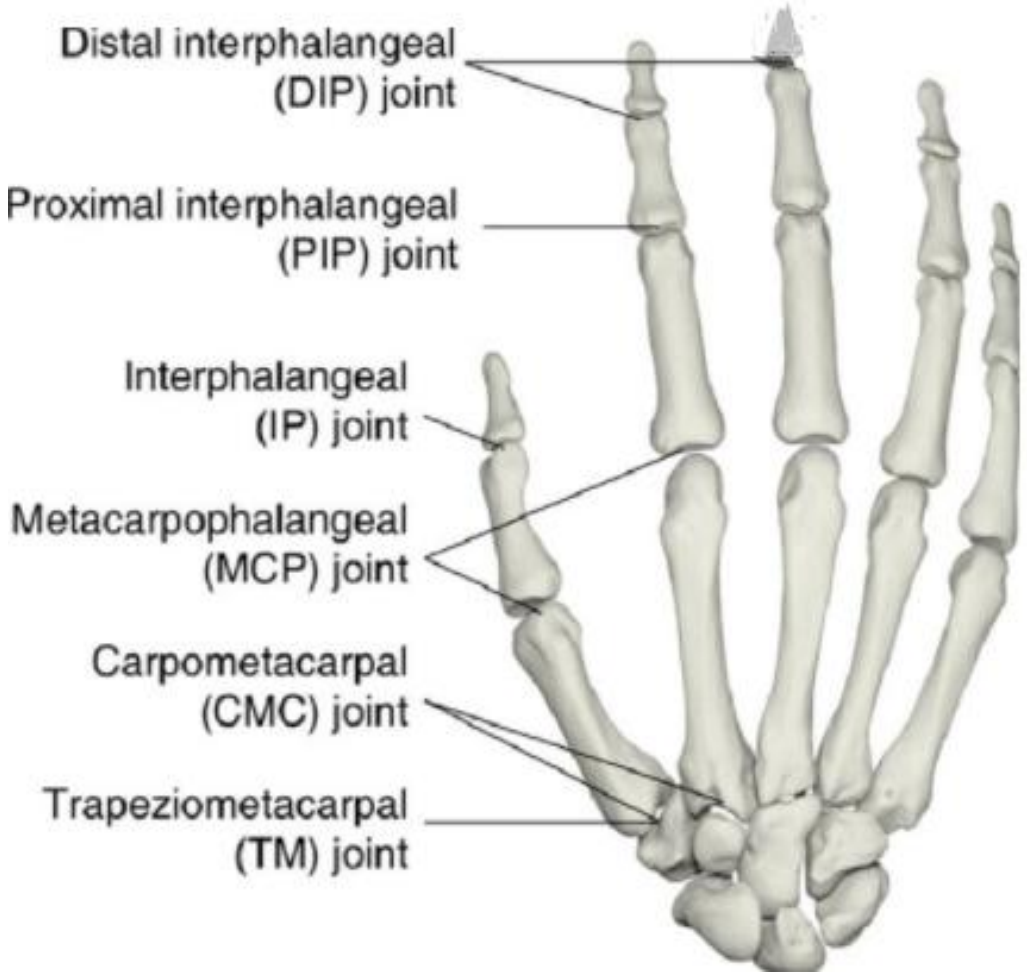
14 **Phalanges** bones -14 bones of the fingers

Each finger consists of 3 phalanges:

distal, middle, and proximal

The thumb has 2 phalangies

WRIST and HAND JOINT ANATOMY -JOINTS



Radiocarpal joint -synovial joint **condyloid (ellipsoid)** formed between the distal ends of the Radius and Ulna and the carpal bones (Scaphoid, Lunate, Triquetrum)

Midcarpal joint - a functional **compound** synovial joint **(glide)** in the wrist between the carpals bones :scaphoid, lunate and triquetrum,trapezium, trapezoid, capitate and hamate

Movement : flexion, extension, abduction and adduction of the wrist **- movements that occur at both the wrist and midcarpal joint take place at the same time**

Carpometacarpal joint (thumb) -a **saddle** joint (between the first metacarpal and trapezium) located at the very base of the thumb. It is a subject to large physical stresses

Movement: extension, flexion, adduction and abduction. Together, these movements allow the complex movements of the thumb:opposition, retro-pulsion, palmar and radial abduction, and adduction

Carpometacarpal joint (fingers)- **ellipsoida**l synovial plane joints provide articulation between the carpals and the metacarpals. The primary function - to optimize the grip function of the hand

Interphalangeal joints of the hand -synovial **hinge** joints between the phalanges of the fingers

Movement: flexion (towards the palm of the hand) and extension

SOFT TISSUE - LIGAMENTS

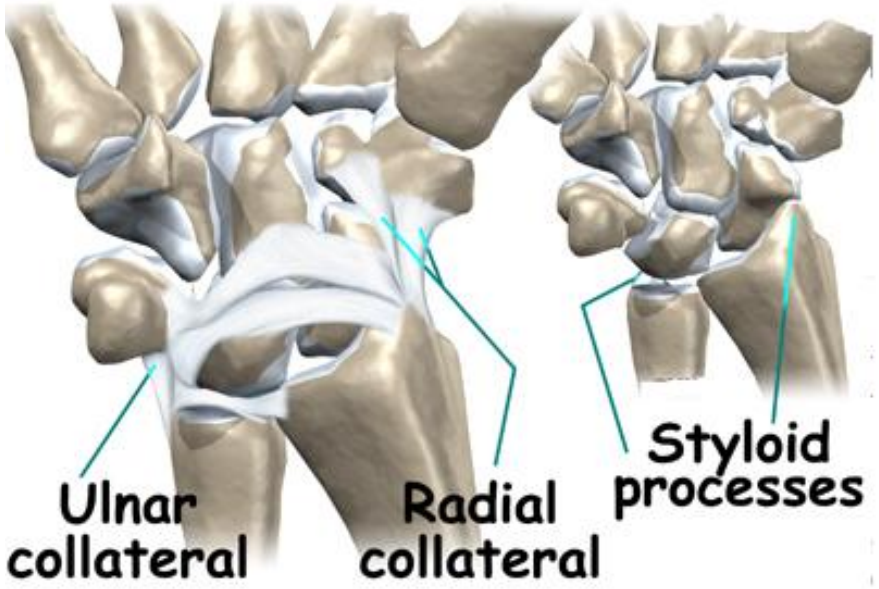
Wrist

The **radial carpal collateral** ligament connects the scaphoid bone and the radial styloid process.

Function: prevents the wrist from lateral over extension away from the thumb.

The **ulnar carpal collateral ligament** (a rounded cord) connects the styloid process of the ulna and the medial side of the triquetral, the pisiform and flexor retinaculum.

Function:stubilising the wrist against valgus and varus, against internal and external rotational stress.



The **thumb** metacarpophalangeal joint :

2 mail ligaments: the **ulnar collateral ligament**
the **radial collateral ligament**

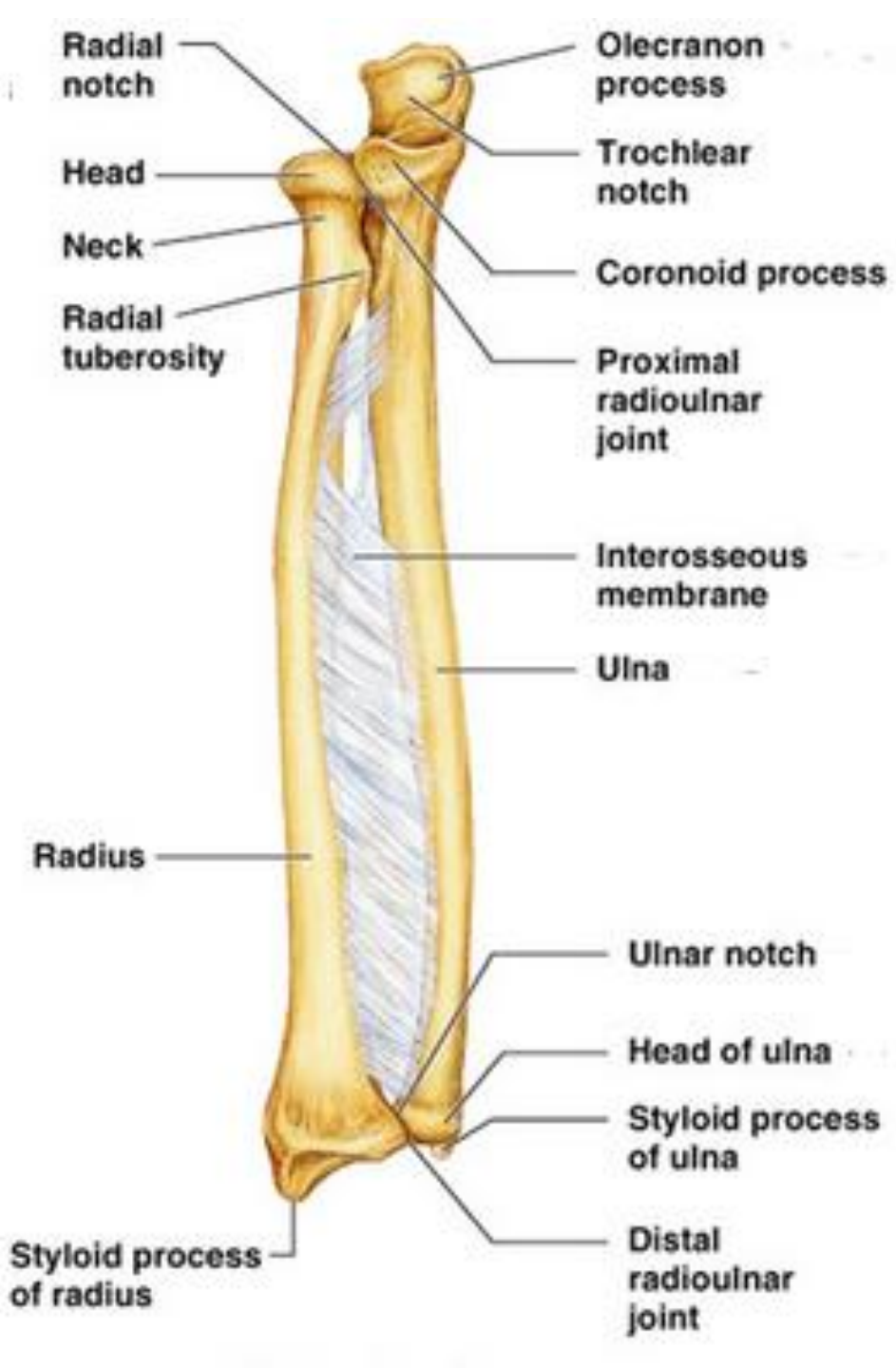
Functions: stability of the thumb for pinch and grip activities

SOFT TISSUE - LIGAMENTS

The **distal interosseous membrane** (DIOM) - a fibrous tissue with an oblique orientation from the radius to the ulna.

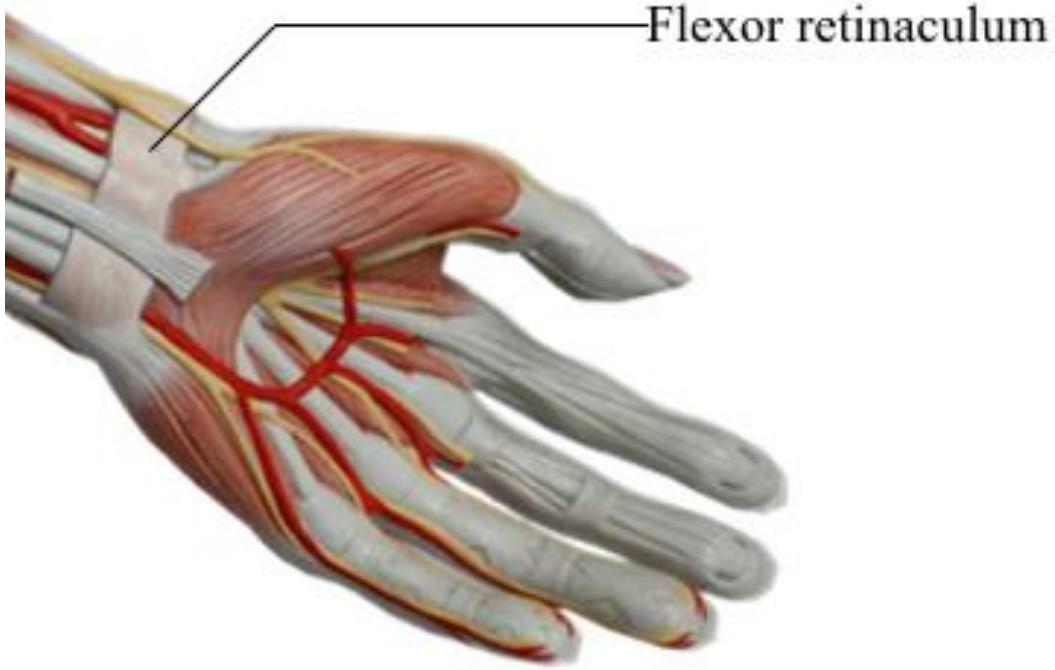
Functions:

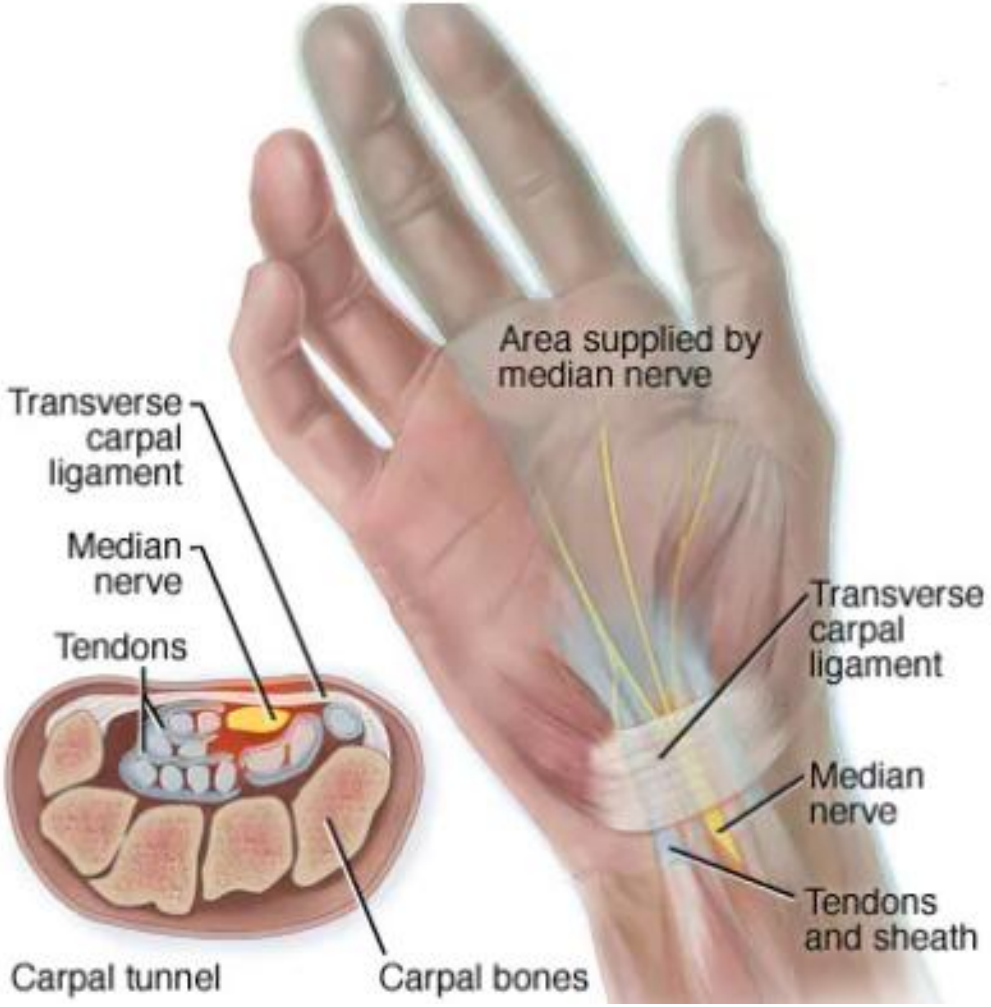
- Secondary stabiliser of the distal radioulnar joint (on the wrist side)
- Maintains the interosseous space between the radius and ulna through forearm rotation and actively transfers forces from the radius to the ulna



SOFT TISSUE -INNERVATION

The carpal tunnel - an osteofibrous canal situated between the carpal bones and consists of tendons and the and flexor retinaculum (transverse carpal ligament). It provides a passway to the median nerve which innervates the thumb, index finger, middle finger and the thumb side of the ring finger.





The **flexor retinaculum** -transverse carpal ligament (or anterior annular ligament) is **a fibrous band which** is covering and forming the carpal tunnel.

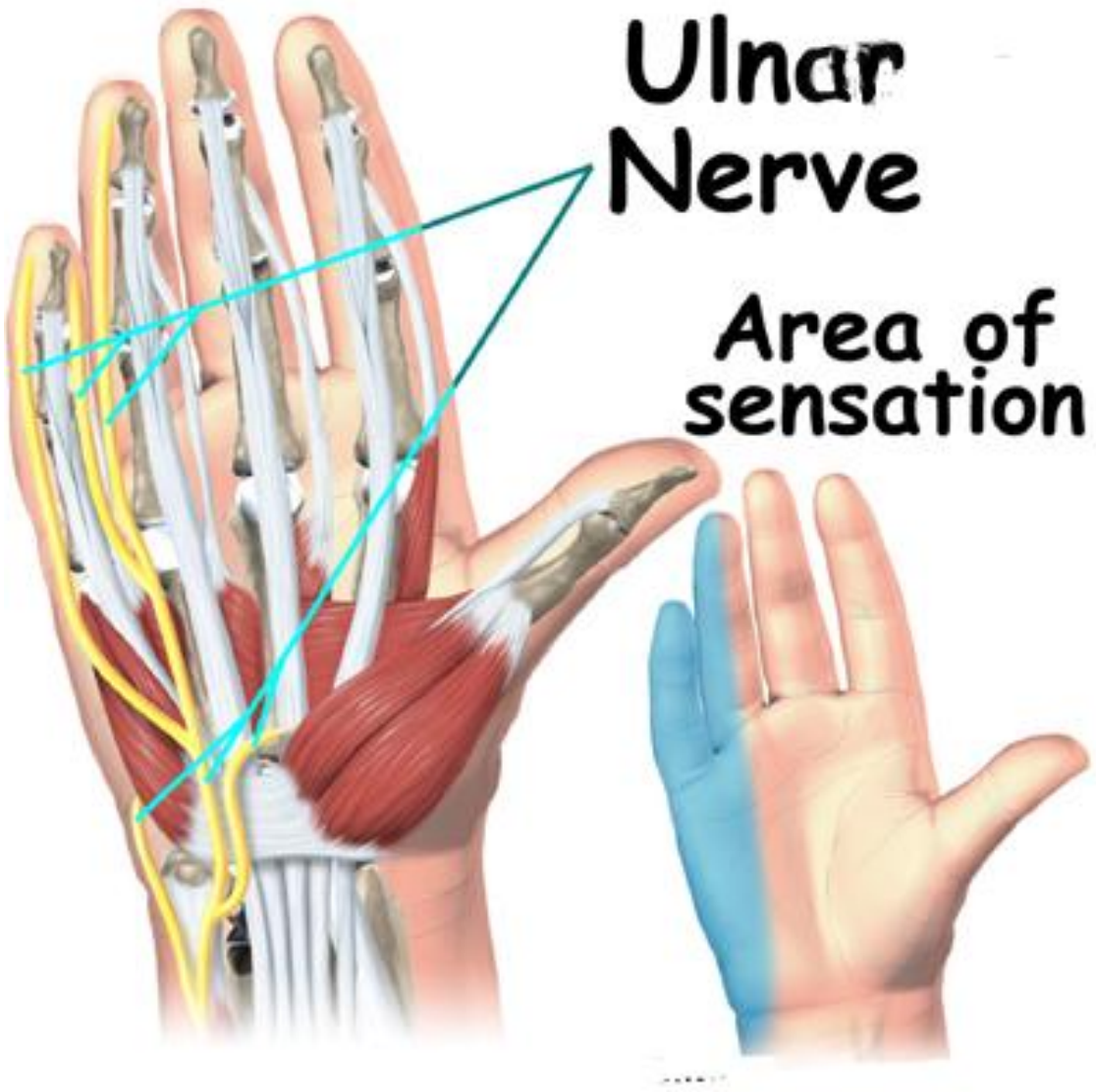
SOFT TISSUE - INNERVATION

Guyon's canal - **ulnar tunnel** or ulnar canal -an anatomical fibro-osseous canal situated on the medial side of the hand.

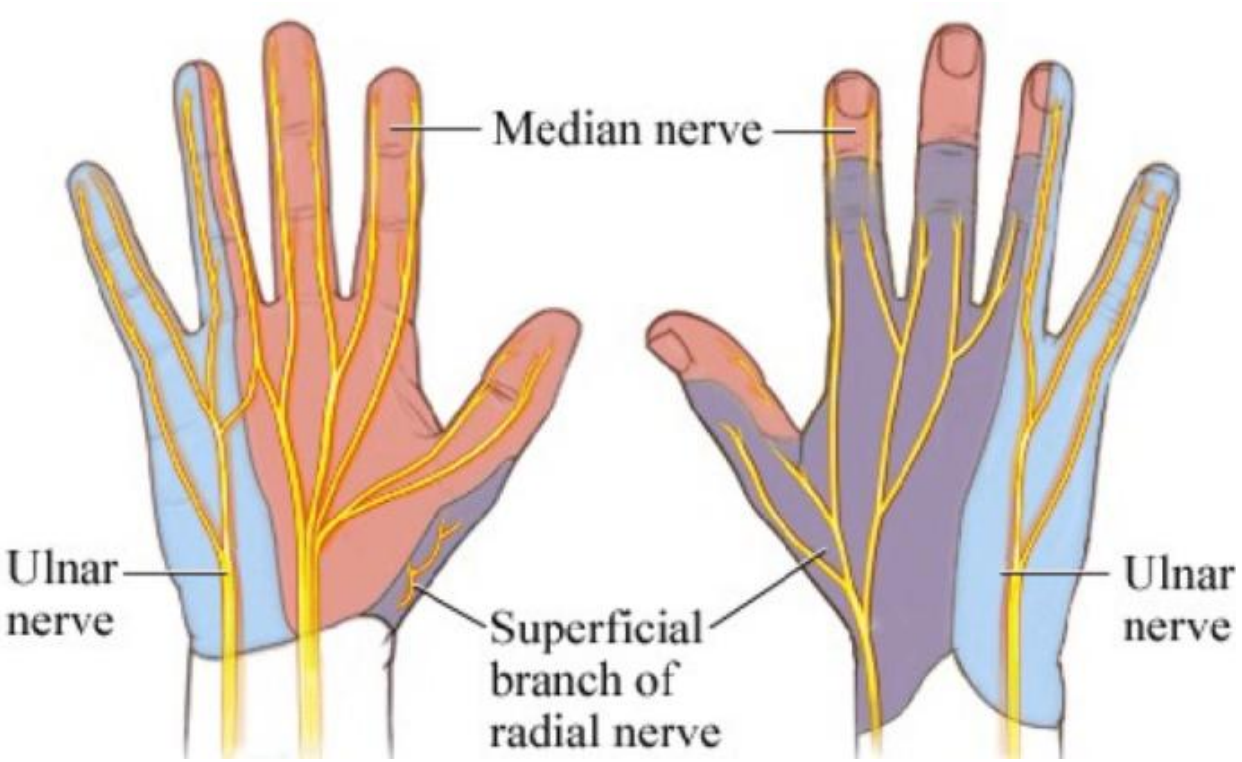
Guyon canal provides the pass way to the **ulna nerve** from distal forearm to the hand.

The **ulnar nerve** innervates:

- The flexor muscles of the forearm including the flexor carpi ulnaris and flexor digitorum profundus.
- The intrinsic muscles of the hand: **palmaris brevis, lumbricals, hypothenar and interossei muscles**.
- provide sensation to little finger and lateral side of the ring finger



SOFT TISSUE - INNERVATION



3 nerves innervate muscles of the hand:

Radial nerve(superficial) - the finger extensors and the thumb abductor:

Movement: controls extension of the wrist and metacarpophalangeal joints ; abduction and extension of the thumb

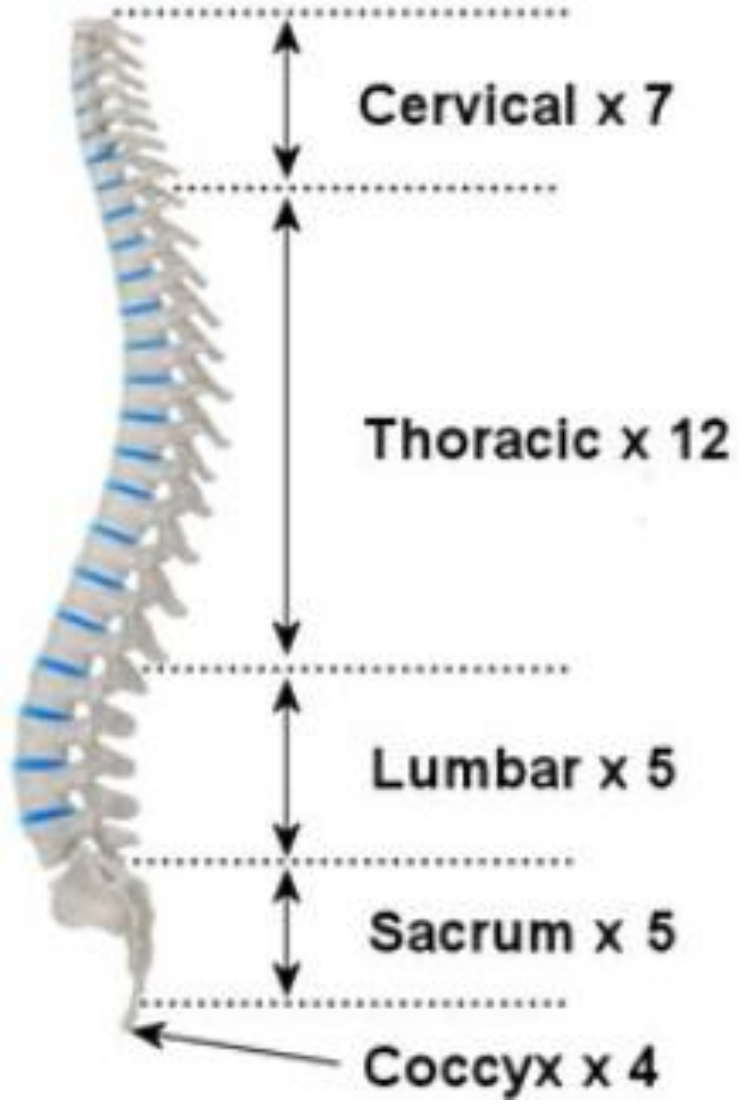
Median nerve - the skin of the palmar (volar) side of the index finger, thumb, middle finger, and half the ring finger, and the nail bed flexor carpi radialis, palmaris longus,digital flexors and pronator quadratus

Movement: controls thumb flexion, opposition, flexion of digits 2 &3, flexion of the wrist and abduction, forearm pronation

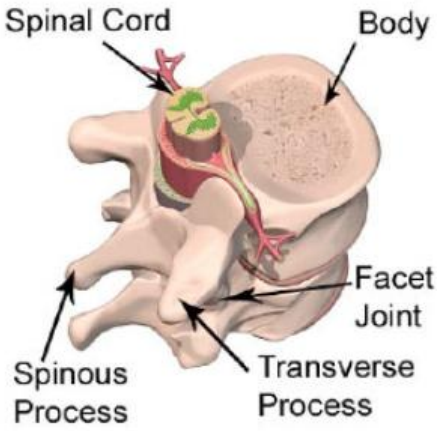
Ulnar nerve - flexor muscles of the forearm including the flexor carpi ulnaris and flexor digitorum profundus

Movement:controls finger adduction and abduction, thumb addiction, flexion of the digits 4&5, wrist flexion and adduction

SPINE COLUMN and VERTEBRAE
Cartilaginous joints

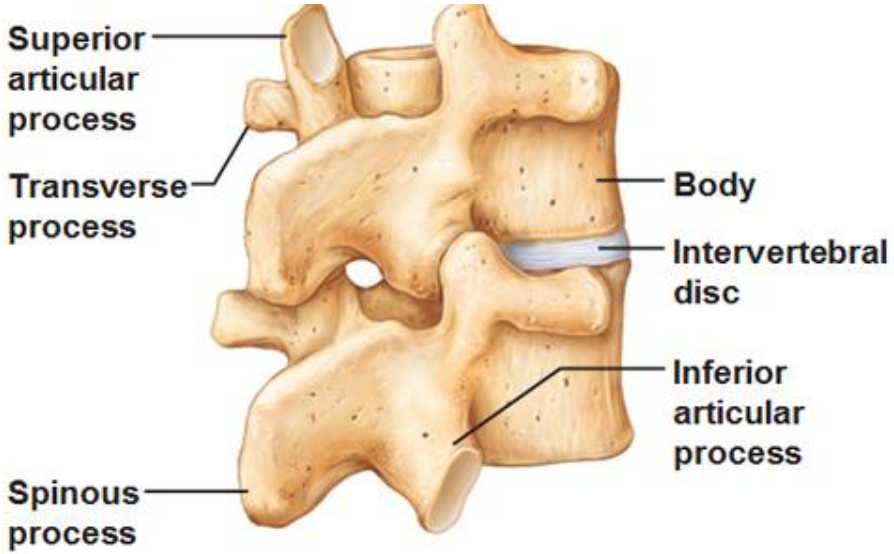


Vertebrae



Symphysis:

- No joint cavity
- Connected by **fibrocartilage** –interverabral discs between the vertebral bones
- Allow slight movement



ANATOMY – BONY

Facet joints

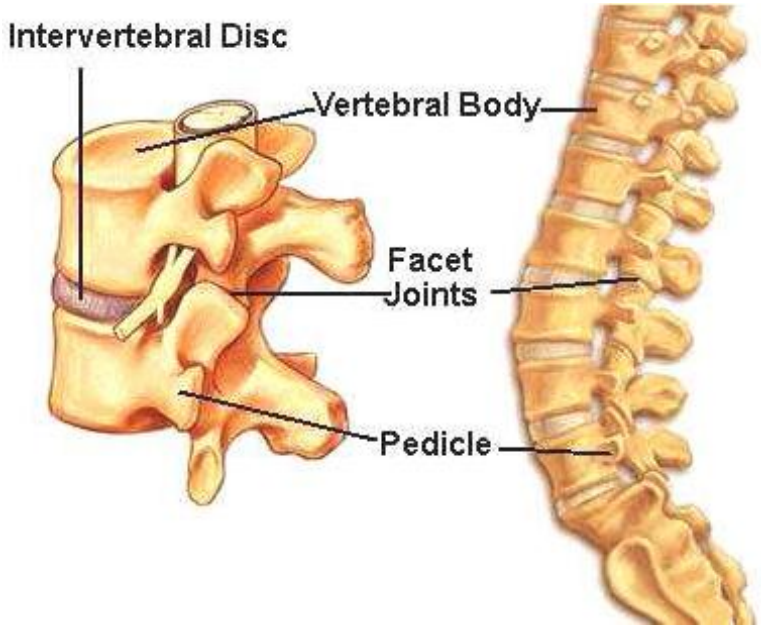
Located **posterior to the vertebral body**

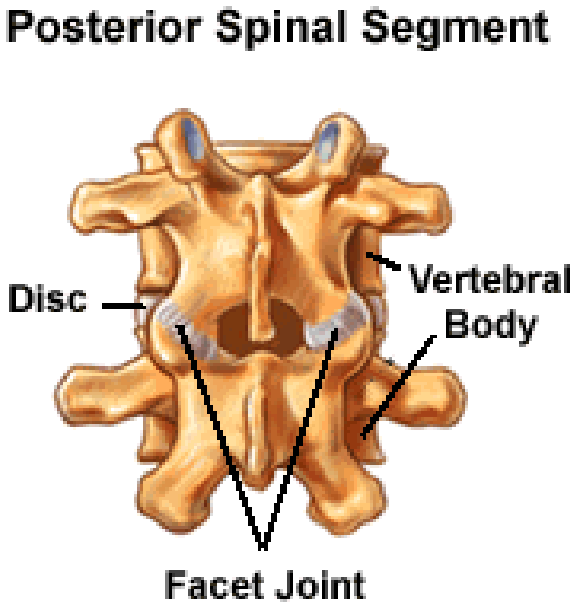
Allow certain mobility of the spine :flexion, extention, twisting in different directions

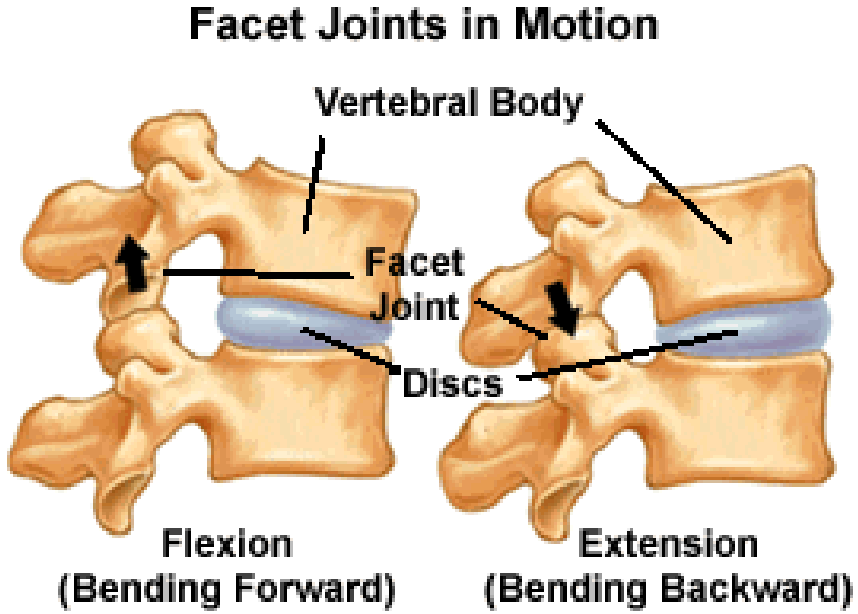
Restrict excessive movement such as hyperextension and hyperflexion

Each vertebra has two sets of facet joints.

The superior articular facet faces upward and works like a hinge with the inferior articular facet below



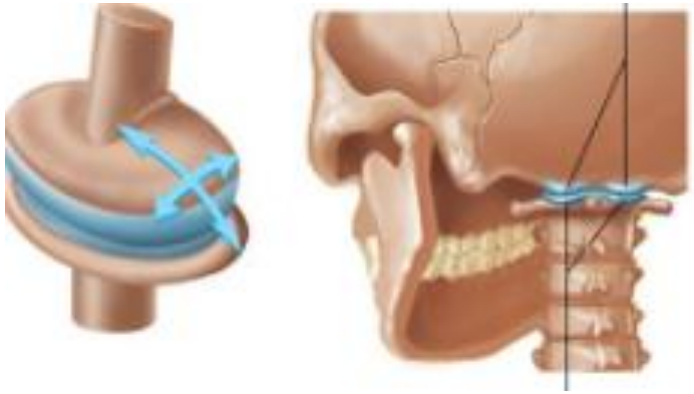




ANATOMY – BONY

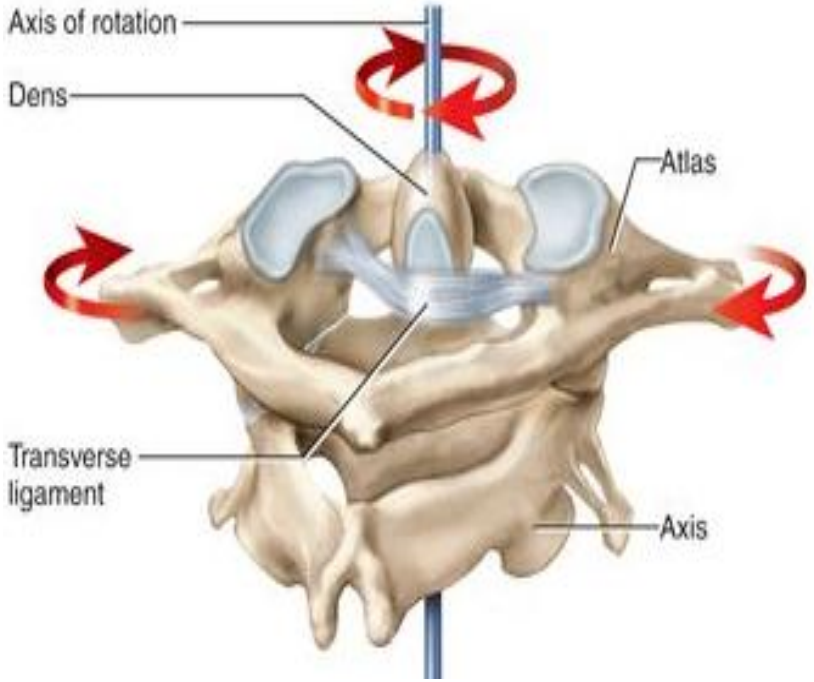
Atlas and Axis cervical vertebrae C1 C2

Synovial joints

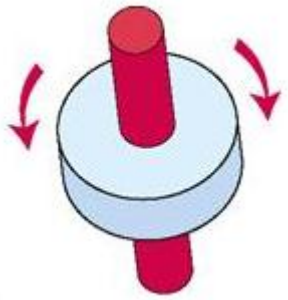


Atlanto-occipital (craniovertebral**)** joints –a pair of bilaterally symmetrical **ellipsoid (condyloid)** joints.

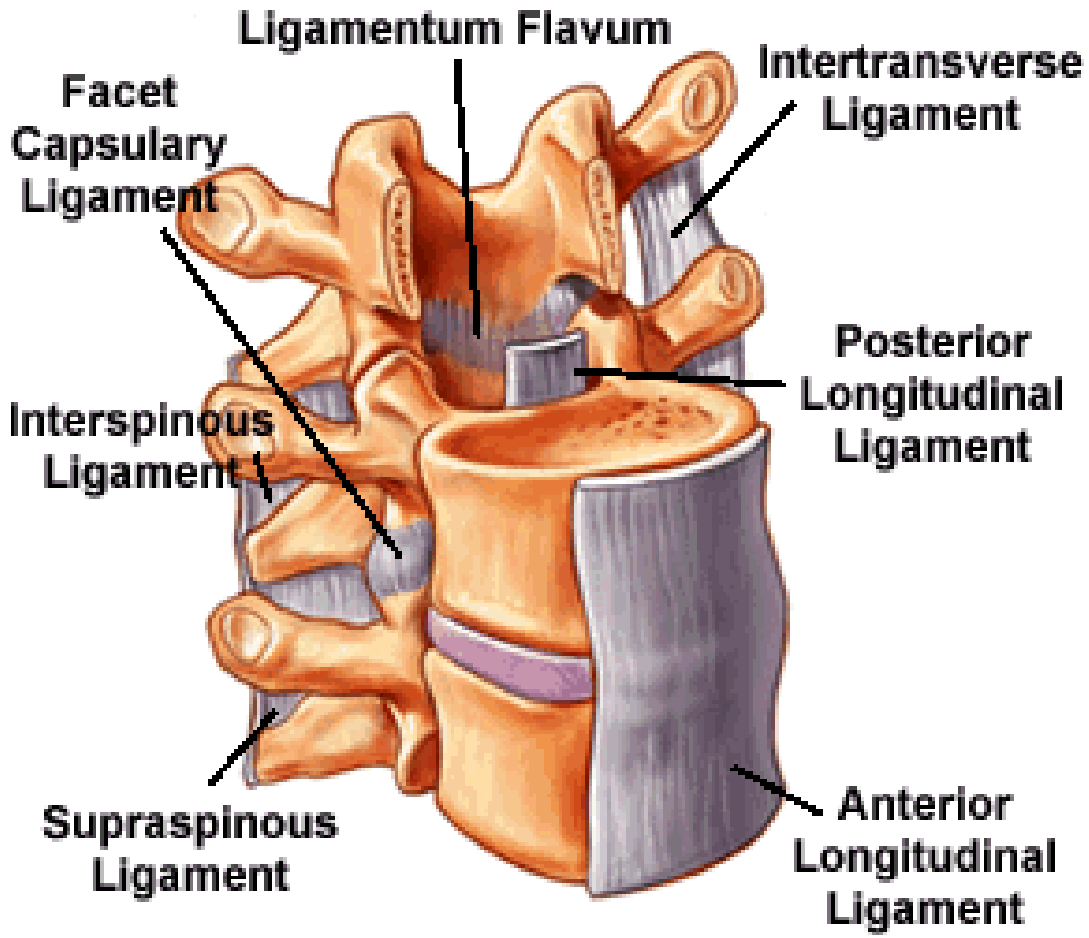
Allows flexion-extension and lateral flexion.



Atlanto-axial joint – a **pivot** joint
Rotation is the primary movement
Allows wider range of motion than the rest of the joints of the vertebral column- - 60% of cervical rotation (50°)



ANATOMY – SOFT TISSUE
The vertebral column – Ligaments



The system of ligaments combined with the tendons and muscles, provides a natural brace to help protect the spine from injury.

Functions:

- Provides joint stability during rest and movement:
- Prevent injuries from excessive movements hyperextension and hyperflexion

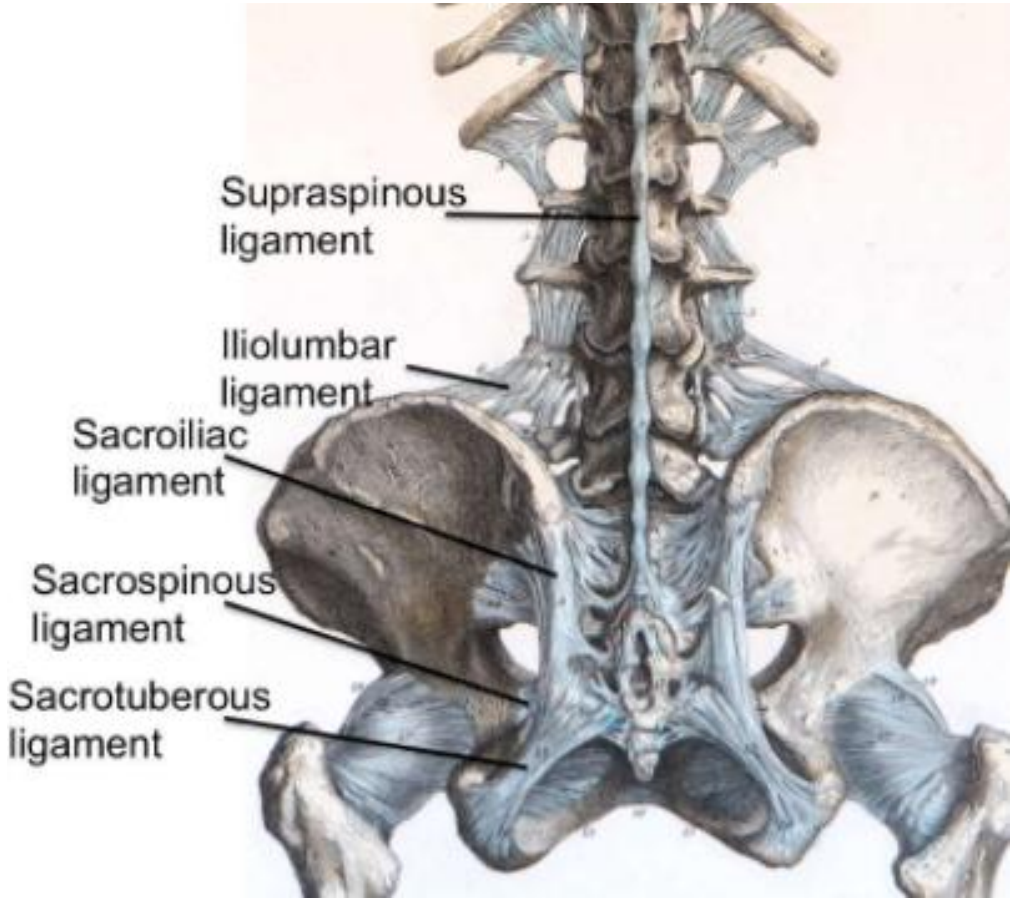
The Vertebral Column
Ligaments of the pelvis and lower back

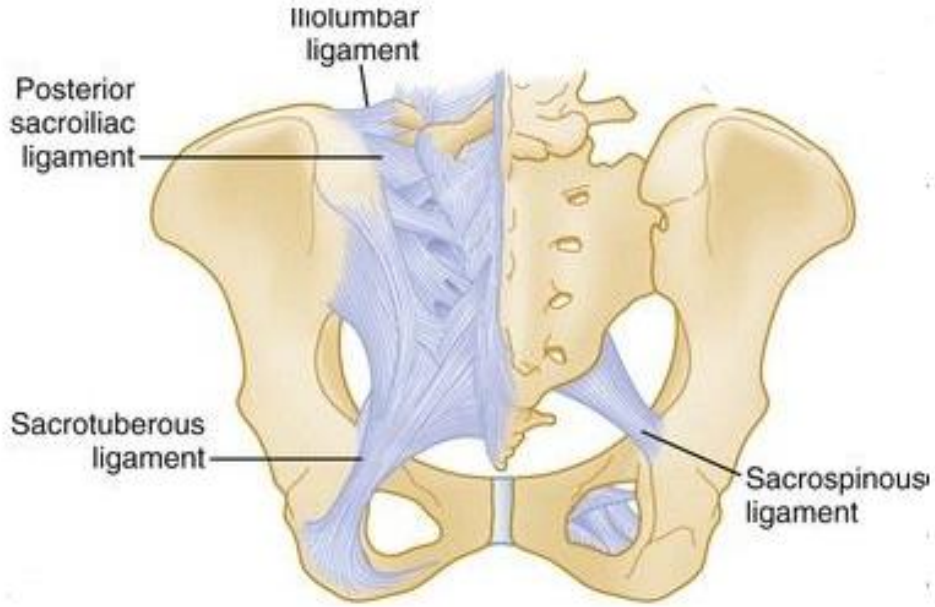
Sacrospinous ligament

Sacrotuberous ligamen

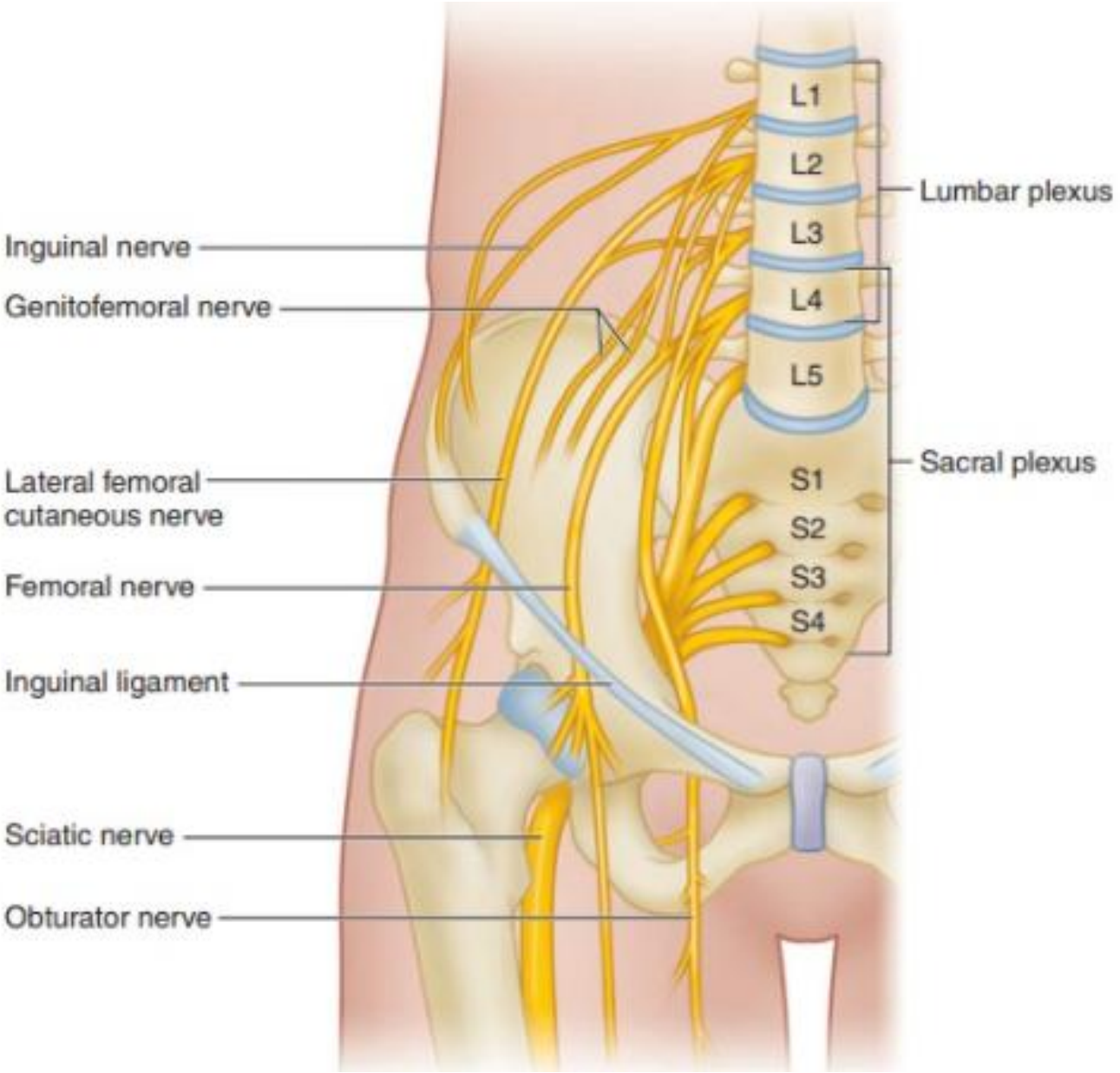
Iliolumbar ligamen

Sacroiliac ligamen





INNERVATION



The lumbar plexus - a network of nerve fibres formed by the lower thoracic and lumbar ventral nerve roots (T12 to L5).

The sacral plexus formed by the anterior divisions of the sacral spinal nerves S1, S2, S3 and S4. It also receives contributions from the lumbar spinal nerves L4 and L5.

They supply the motor and sensory innervation for the posterior thigh, most of the lower leg, the entire foot, and the pelvis.

Location: posterior surface of the pelvic wall, anterior to the piriformis muscle.

They form the **Sciatic** nerve which enters the gluteal region of the lower limb, innervating the structures there.