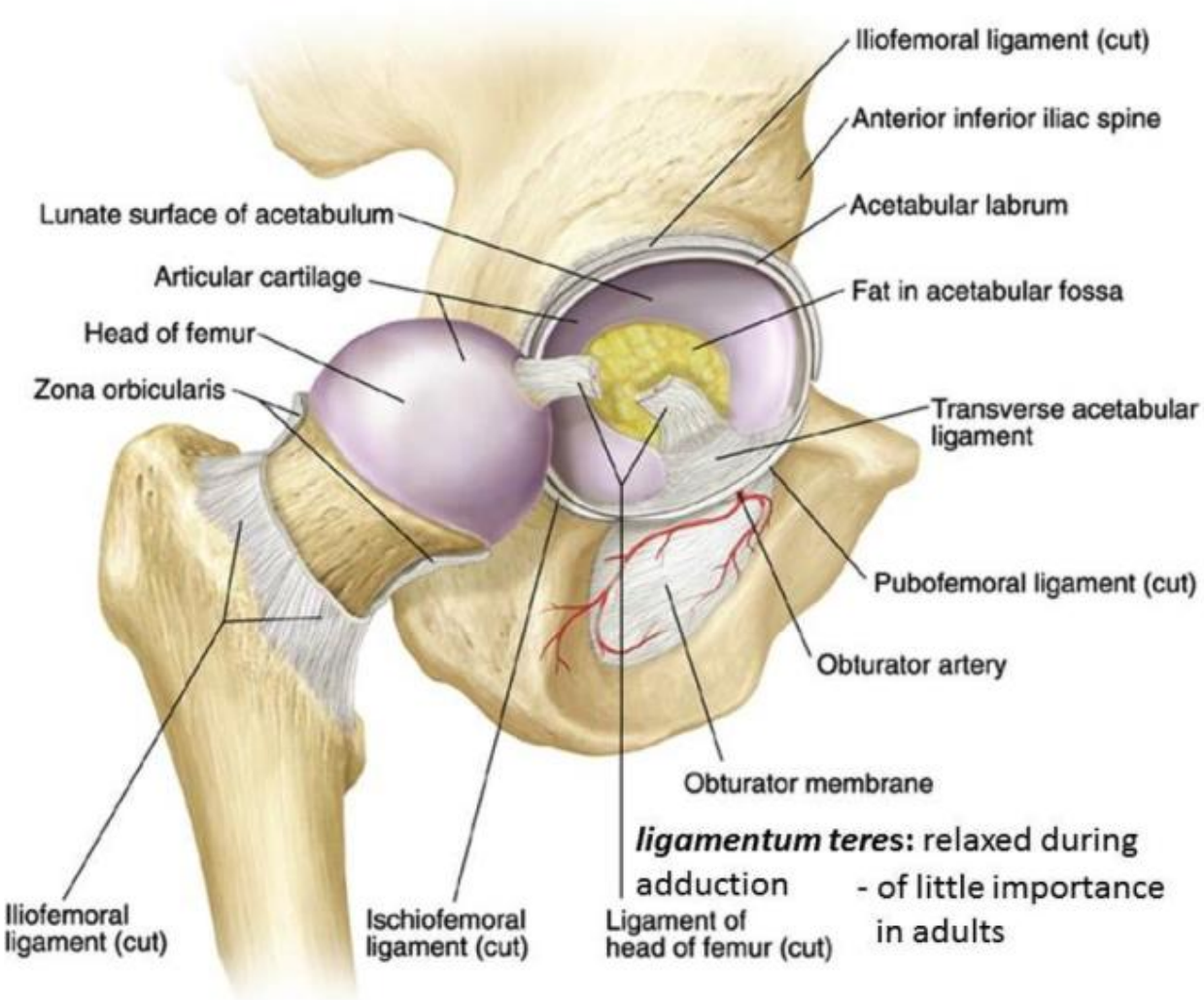
Joints of Lower Limb

Hip joint

- **Type**: synovial, polyaxial joint.
- **Variety**: **ball and socket**.
- **Articulating bones**:
  a- ***Head of femur*** : form 2/3 of a sphere (ball).
  b- Horse-shoe area ***lunate articular surface*** of the acetabulum of hip bone which becomes more deep by a fibrocartilagenous rim attached to the margin of the acetabulum called labrum acetabulare (socket).



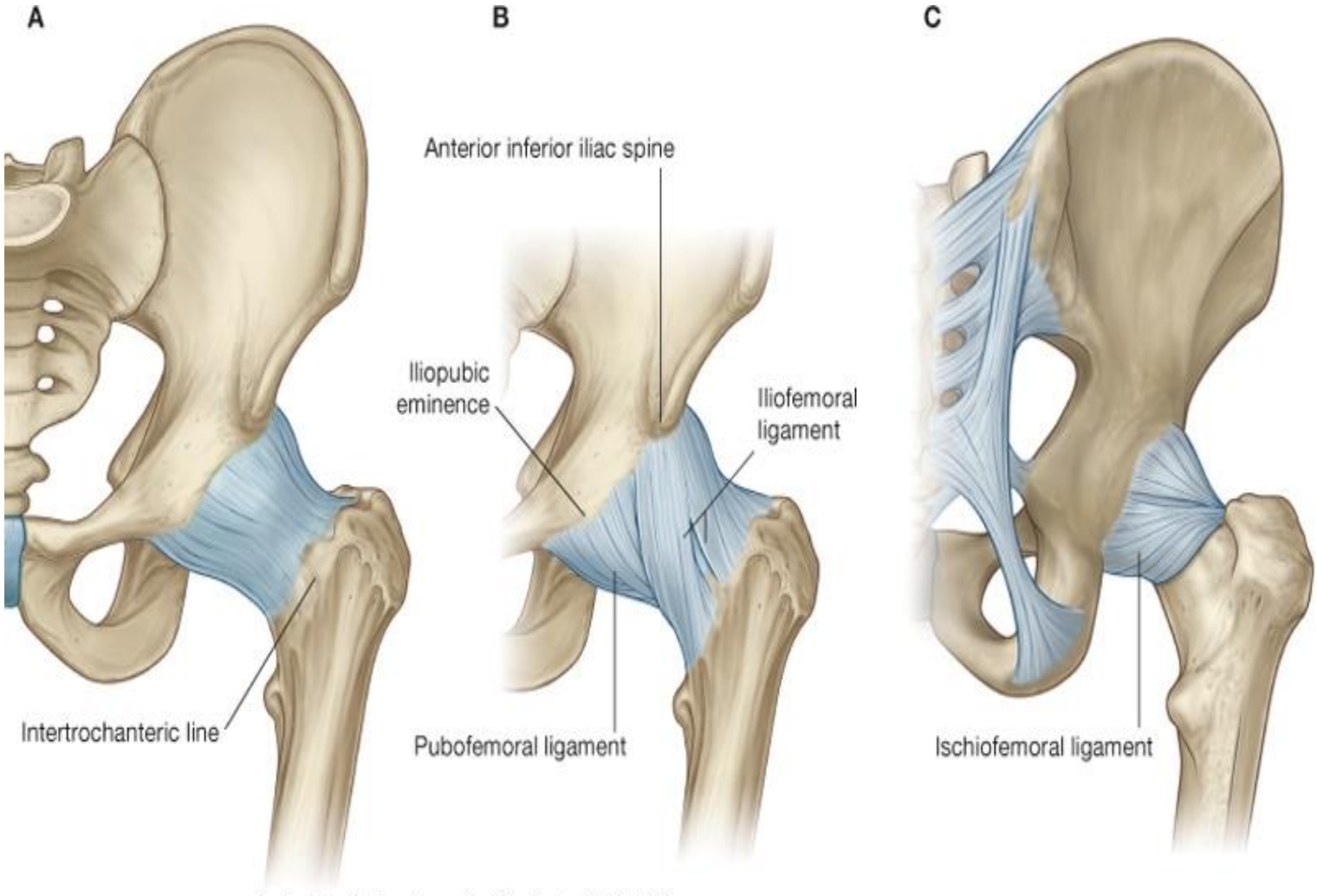
★ **Fibrous capsule**: a ***strong*** capsule surrounding the joint ***completely***. The capsule is thick except at its lower medial part which is frequently the site of dislocation of the head of femur.

- **Attachments**:
  - **To hip bone:**
    - To the margins of acetabulum (***beyond labrum acetabulare***).
    - To the ***transverse acetabular ligament***.
  - **To femur**:

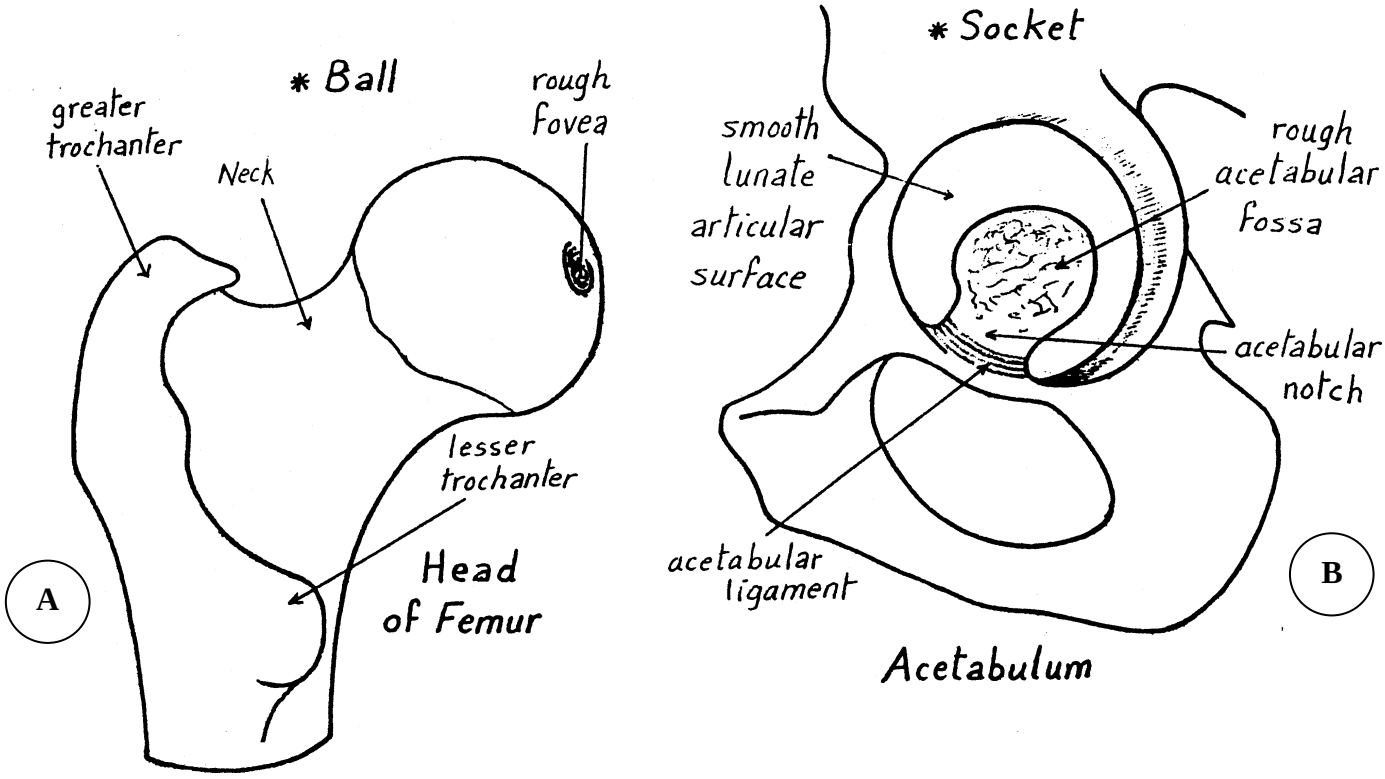
    - ***Anteriorly***: To the intertrochanteric line and upper borders of greater and lesser trochanters .

    - ***Posteriorly*** :To the middle of the back of neck of femur,.

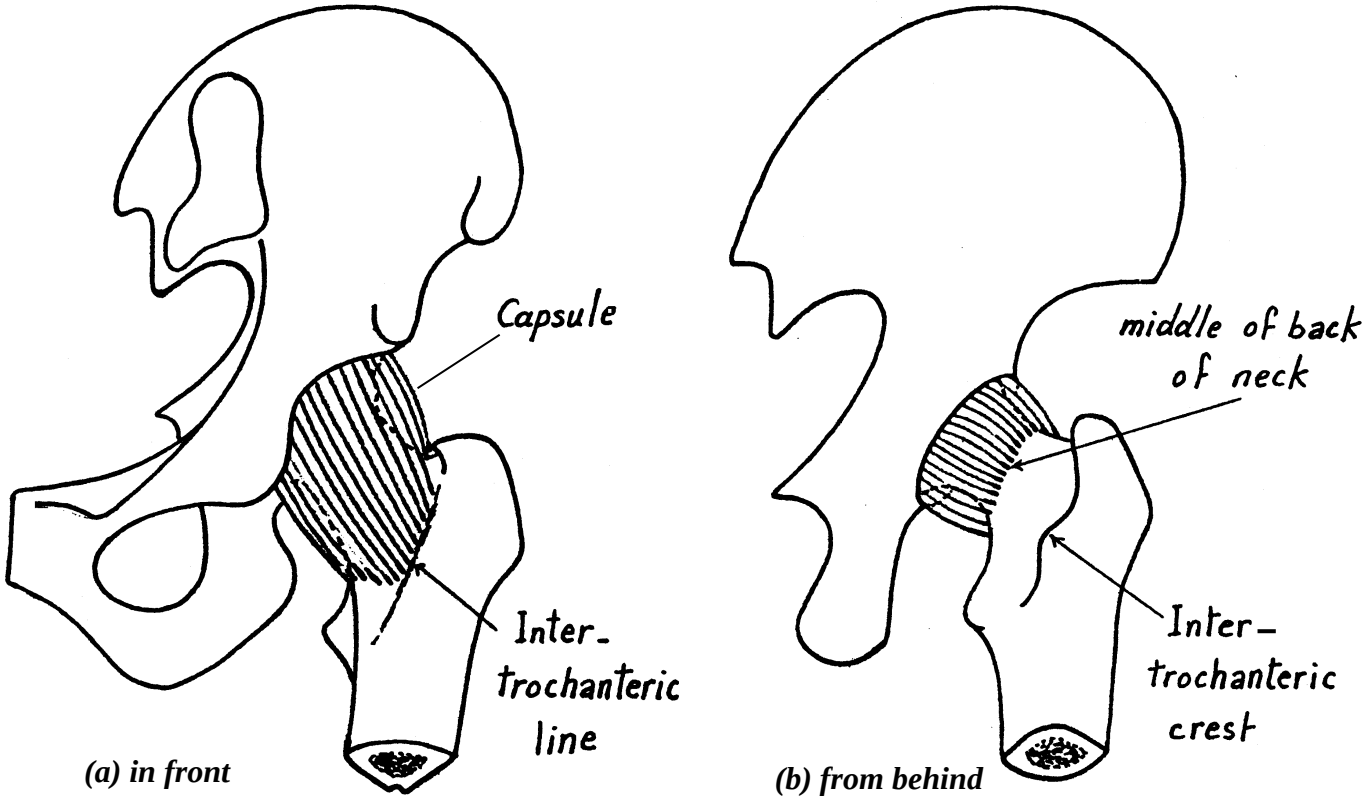
★ **N.B.:** Some fibres reflect from the capsule , called retinacula pass along the neck of femur towards its head. They carry blood supply to the head and neck of femur and also keep the segments of the fractured neck in position.



Drake: Gray's Anatomy for Students, 2nd Edition.



Articulating bones of the hip joint

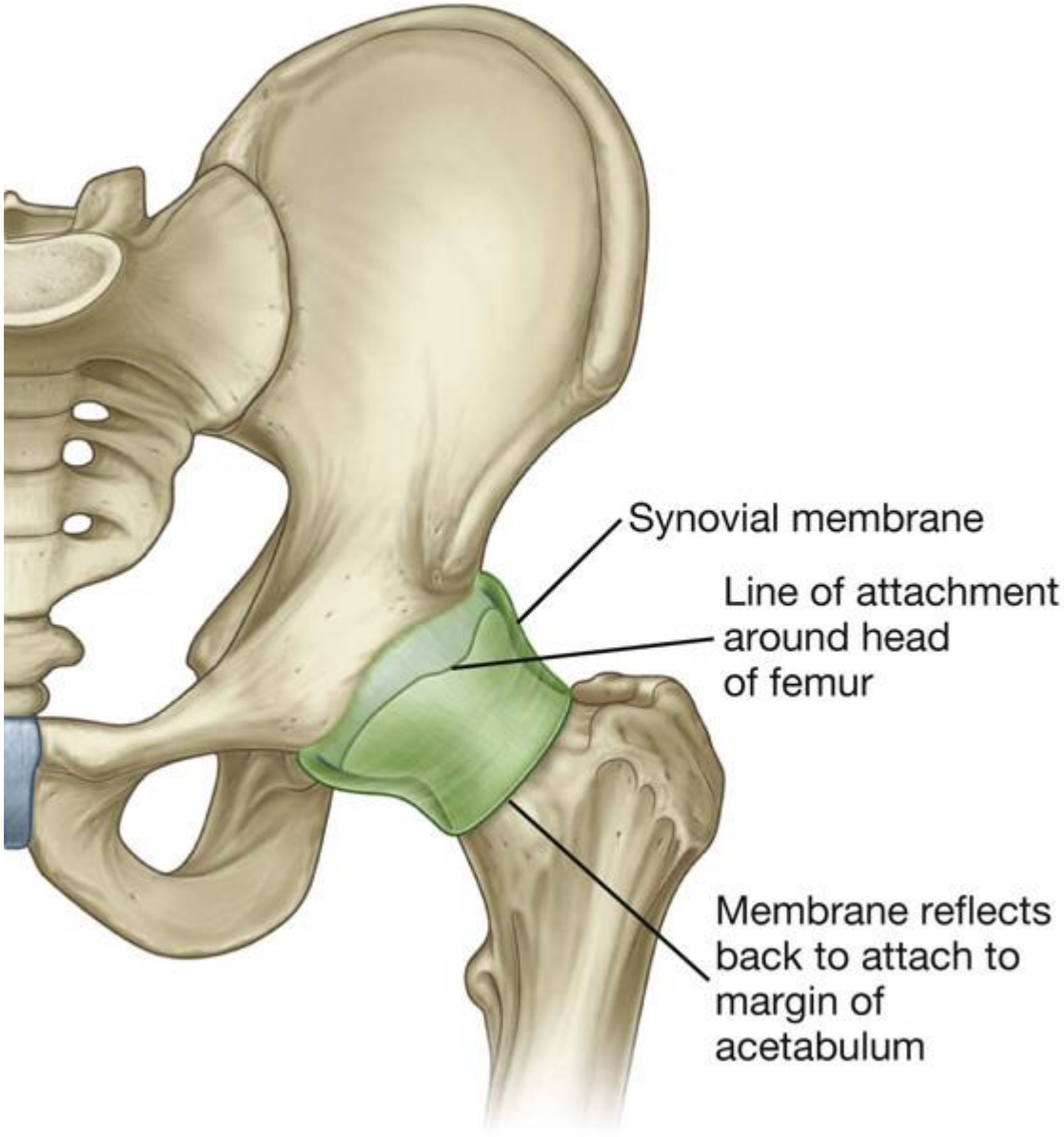


(a) in front

(b) from behind

Attachments of the capsule of the hip joint

- **Synovial membrane:**
  - It ***lines*** the inner surface of the fibrous capsule.
  - It forms a ***tubular sheath*** for the ligamentum teres of the head of femur .
  - It ***covers*** the intracapsular part of the ***neck*** of femur and ***labrum*** acetabulare (but not the articular bony surfaces which are covered with hyaline cartilage instead).



⁎ Ligaments of the hip joint:

- The capsule of the hip joint is strengthened by ***three extra-capsular ligaments.***

1) **Ilio-femoral ligament:**

a- **Attachments:** it is an inverted **Y**-shaped ligament; its stem is attached to the ***anterior inferior iliac spine*** while its 2 limbs are attached to the upper & lower ends of the ***intertrochanteric line*****.**

b- **Function:**

- It is the ***strongest*** ligament of the hip joint which inforces the ***anterior*** aspect of its capsule (it is one of the strongest ligaments in the body) .
- It ***limits over extension*** of the joint and ***prevents*** the body from falling backwards.
- It helps in ***transmission of body*** weight.

2) **Pubo-femoral ligament**:

a- **Attachments:** a ***triangular*** ligament, attached to the ***ilio-pubic eminence*** of the hip bone and blended to the ***medial part*** of the capsule.

b- **Function:** it supports the ***infero-medial*** part of the capsule, and limits over ***abduction*** of the joint.

3) **Ischio-femoral ligament**: (weakest ligament)

a- **Attachments:**

- It is attached to the ***ischium below the acetabulum*** and is blended to the ***back of the capsule***.

b- **Function**:

- It supports the ***posterior part*** of the capsule and limits excessive ***medial rotation*** & adduction of the hip joint (predisposing to posterior dislocation of hip joint)

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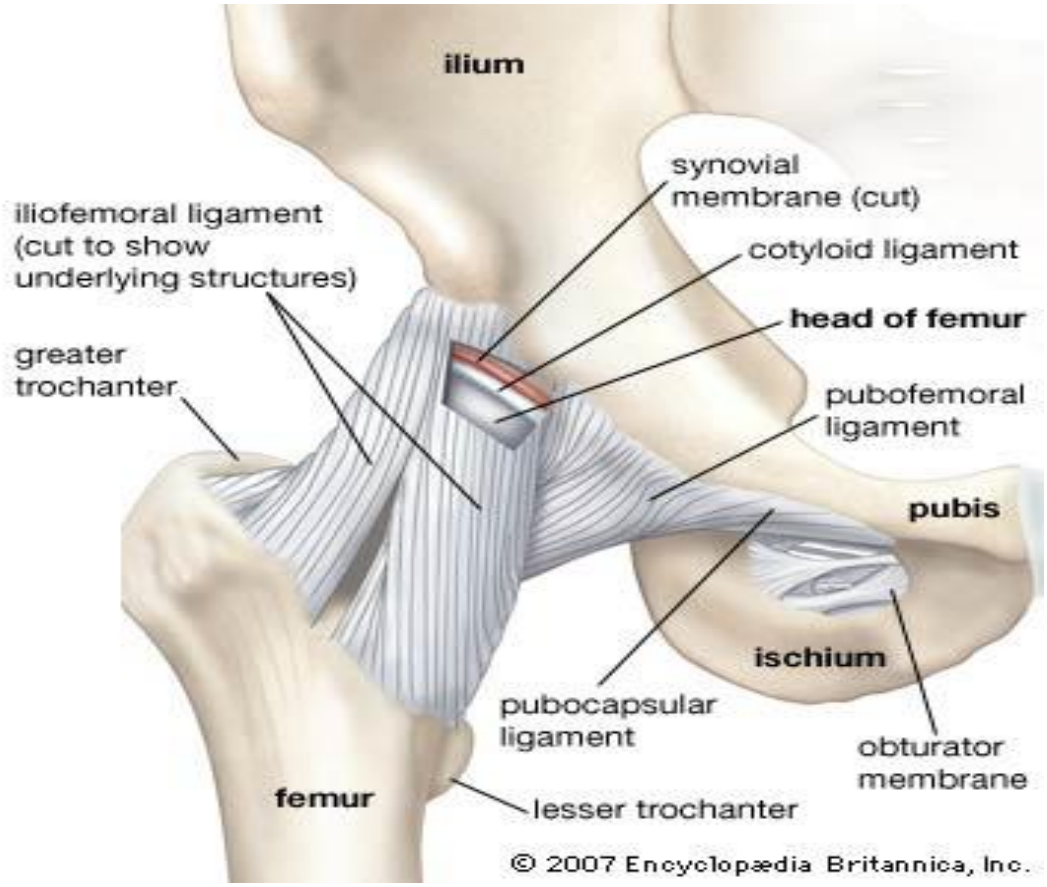
ilium
synovial membrane (cut)
iliofemoral ligament (cut to show underlying structures)
cotyloid ligament
head of femur
greater trochanter
pubofemoral ligament
pubis
ischium
pubocapsular ligament
obturator membrane
femur
lesser trochanter
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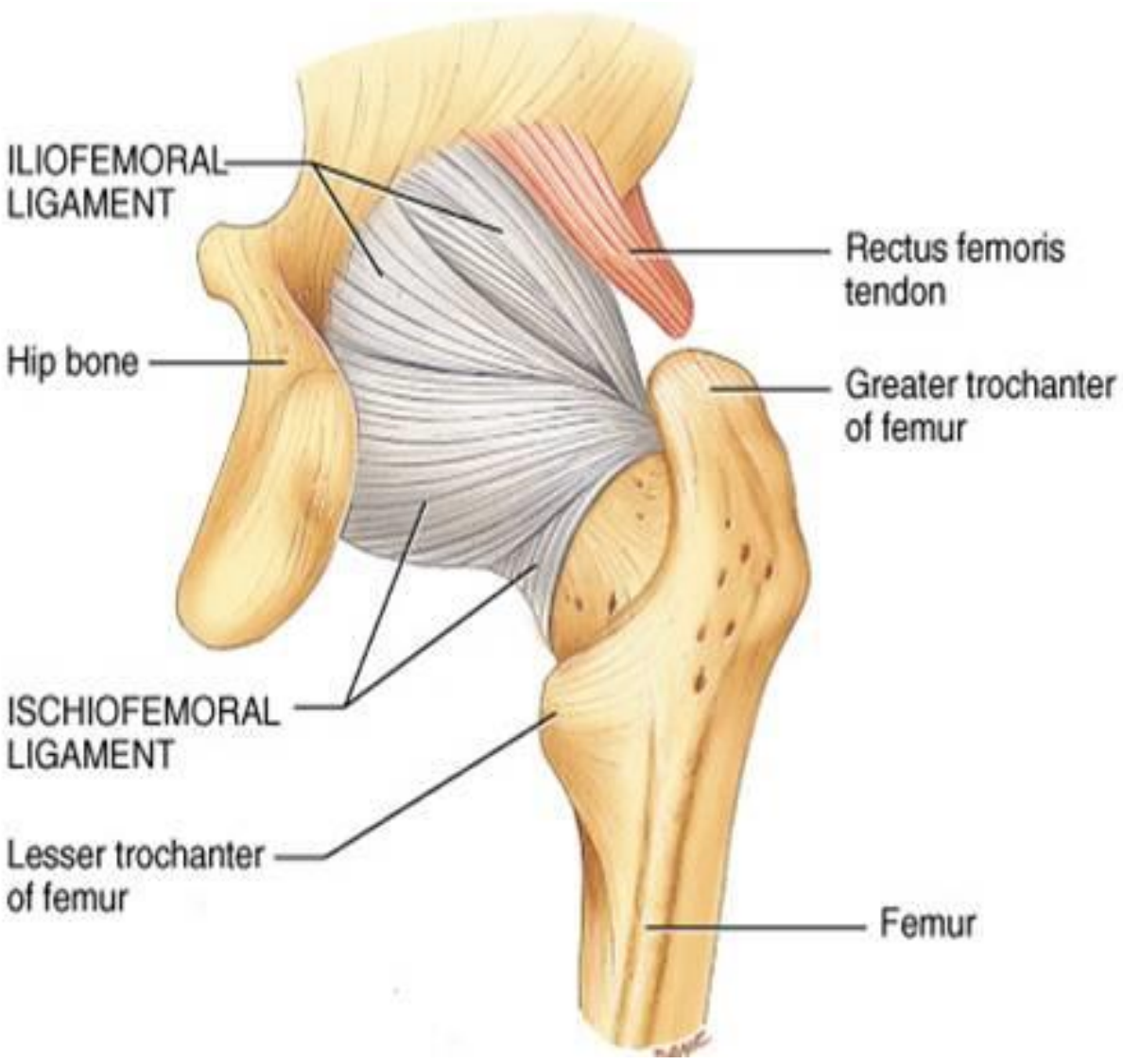
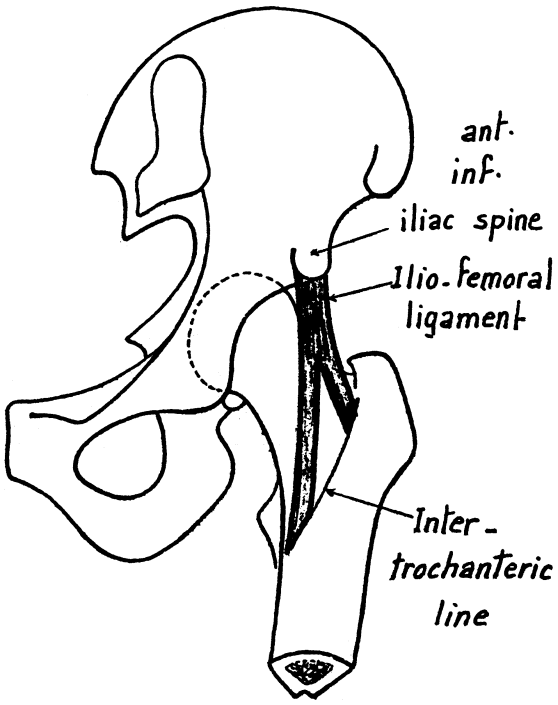
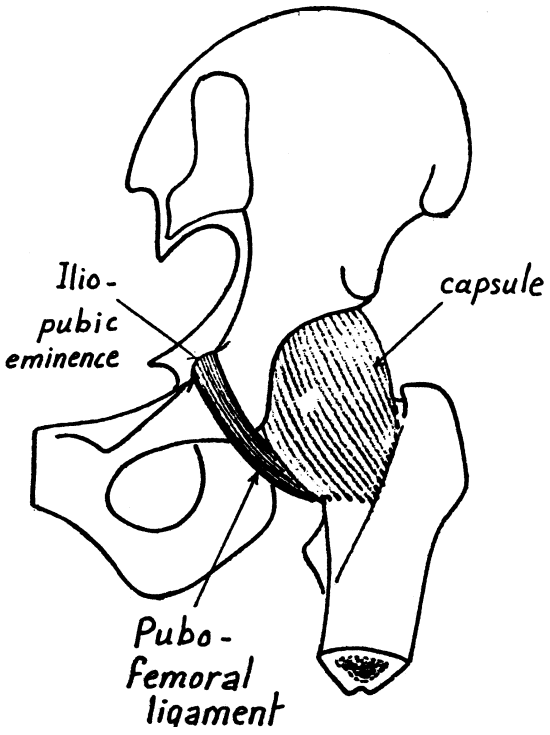
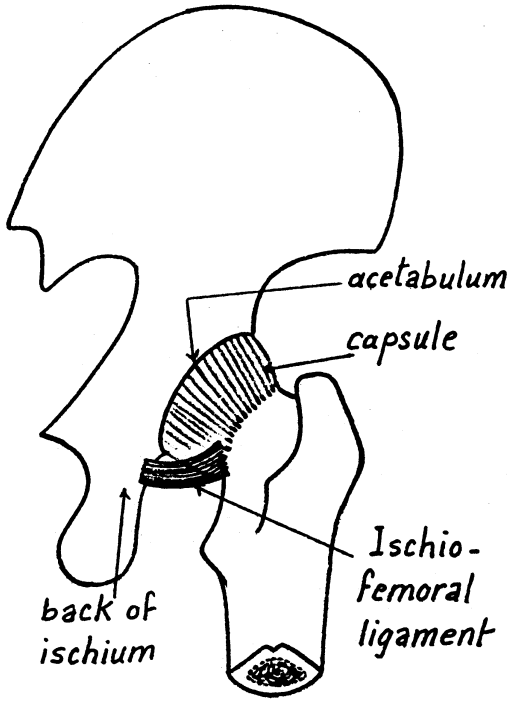

ILIOFEMORAL LIGAMENT
Rectus femoris tendon
Hip bone
Greater trochanter of femur
ISCHIOFEMORAL LIGAMENT
Lesser trochanter of femur
Femur



(a) Ilio-femoral ligament



(b) Pubo-femoral ligament



(c) Ischio-femoral ligament

Ligaments of the hip joint

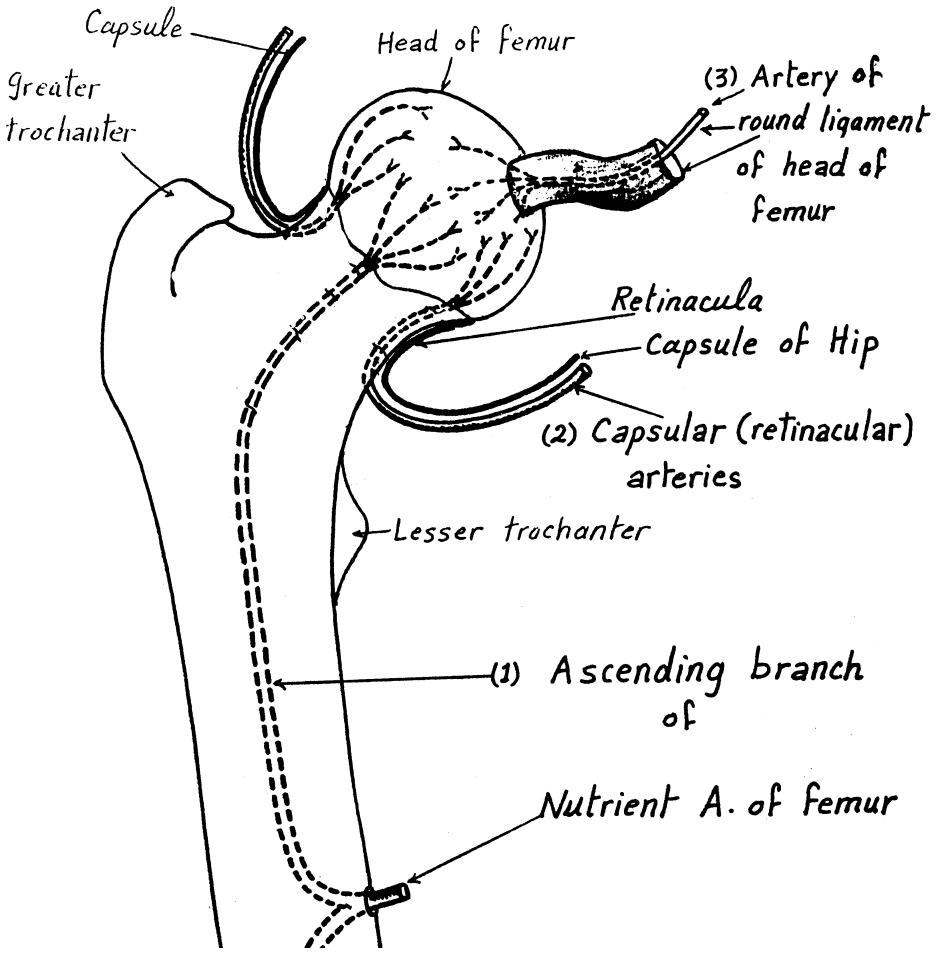
4) Round **Ligament of the head of femur**:(Ligamentum teres)

a- **Attachments:**

- A ***weak triangular*** band lying inside the cavity of the hip joint ***surrounded by*** a synovial sheath (so it is ***intracapsular but extrasynovial).***
- Its ***apex*** is attached to a ***fovea*** on the head of femur.
- Its ***base*** is attached to both sides of ***acetabular notch*** and to the ***transverse acetabular*** ligament (which bridges the acetabular notch).

b- **Function**:

- It allows the passage of ***minor arterial*** branches to the head of femur.



Ligament and arterial supply of head of femur

- **Stability of the hip joint:** a very stable joint due to:
  - **Bony factor**: (shape of articular surfaces): the femoral head ***fits well*** in the deep socket of the acetabulum.
  - **Ligamentous factor**: strong capsule and ligaments surround the joint (especially the ilio-femoral ligament).
  - **Muscular factor:** many strong muscles surround the joint.

- **Movements of the hip joint and muscles acting on it**:
  - **Flexion**: done ***mainly by iliopsoas***, assisted by sartorius , rectus femoris , gracilis , pectineus , adductor longus & brevis and pubic part of adductor magnus .
  - **Extension**: done ***mainly by gluteus maximus***, assisted by hamstrings and ischial part of adductor magnus.
  - **Adduction**: done ***mainly by the adductors***, assisted by gracilis and pectineus.
  - **Abduction**: done ***mainly by gluteus medius and minimus***, assisted by tensor fasciae latae.
  - **Medial rotation**: done by **anterior fibres *gluteus medius and minimus*** assisted by tensor fasciae latae.
  - **Lateral rotation**: done by the 6 lateral rotators of the thigh , assisted by gluteus maximus and sartorius.
  - **Circumduction**: a combination of flexion, abduction, extension and finally adduction movements.

- **Nerve supply of hip joint**: by branches from femoral, obturator , sciatic and nerve to quadratus femoris muscle.

- **Arterial supply of hip joint**: From gluteal, medial & lateral circumflex femoral (gives retinacular supply) and obturator (gives artery to head) arteries.

- **Clinical points related to the hip joint**:

(A) Fractures of the neck of femur:

- Very common in old age, especially in females due to osteoporosis (weak and brittle bones).
- **Sites of fracture**:

a) Sub-capital fracture. b) Cervical fracture.

Both (a) and (b) are intracapsular fractures which interrupt the nutrient artery ascending along the shaft & neck of femur as well as the retinacular vessels which are the main blood supply to the head. So avascular necrosis of head of femur occurs. It should be surgically replaced by synthetic prosthesis.

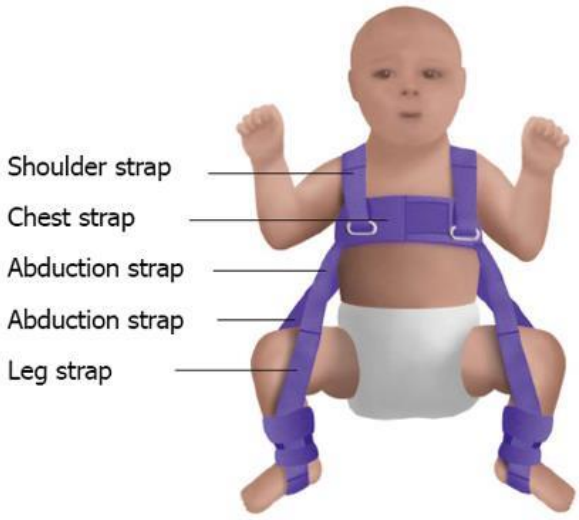
c) Basal fracture. d)Inter-trochanteric fracture.

Both (c) and (d) are extracapsular fractures which interrupt only the nutrient artery but not the retinacular vessels. So there is no avascular necrosis of the head of femur.

(B) Dislocation of the hip joint: May be congenital or traumatic.

- Congenital dislocation is more common in female children.
- Traumatic is usually posterior dislocation occurs in car accidents, in which the posterior lip of the acetabulum is fractured with rupture of the ligament of the head of femur.
  - In this condition, the affected thigh becomes shorter with flexion , adduction and medial rotation and the head of femur is not felt at the femoral triangle which feels empty. The sciatic nerve is also liable to be injured.

- Posterior: - flexed, internally rotated, and adducted.

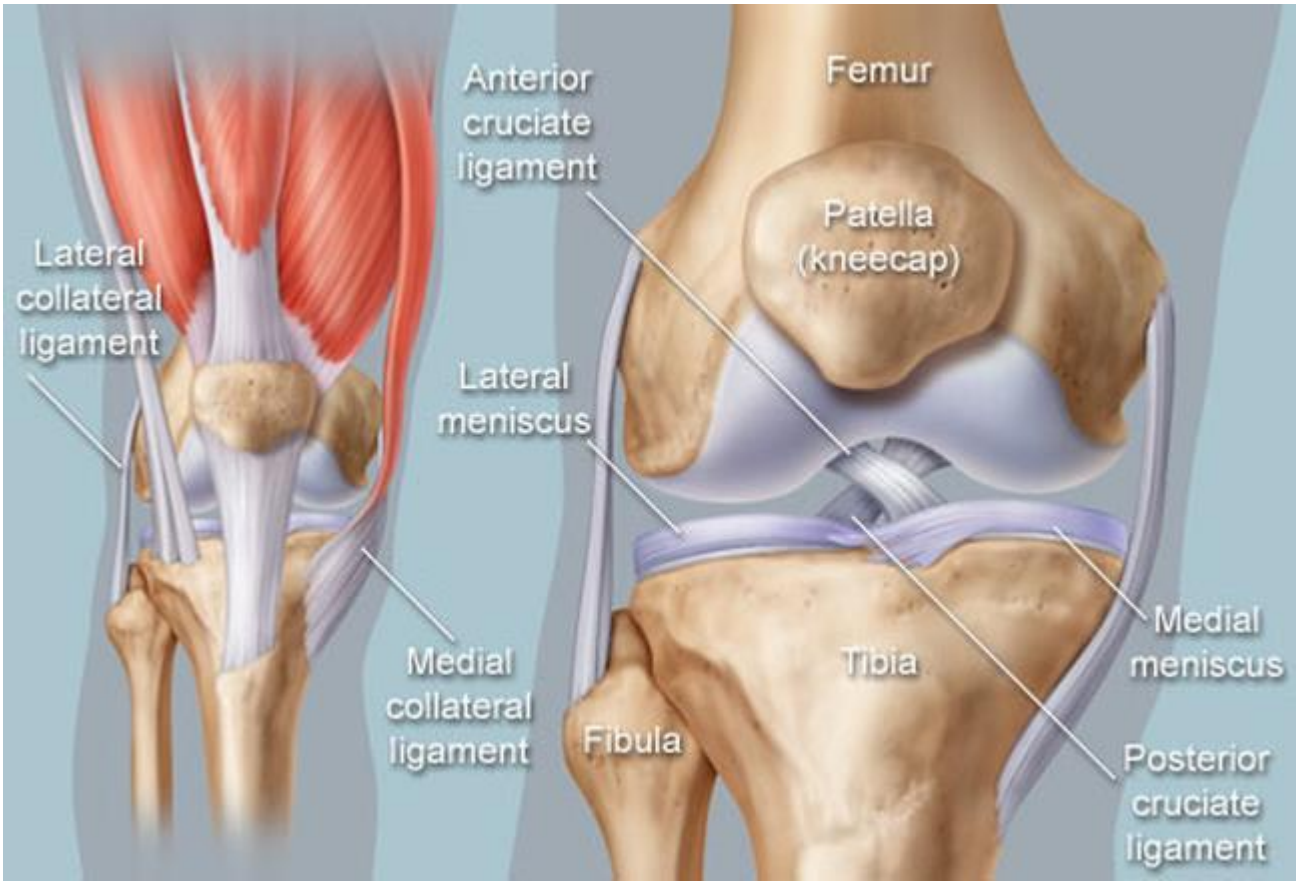


(C) Pain from the hip joint may be felt at the knee region:

- This is due to the rich nerve supply of the hip joint from the femoral , obturator and sciatic nerves which also supply the knee joint.
- So, referred pain at the knee may be of hip origin.

Knee Joint

- **Type**: synovial joint.
- **Variety**: ***modified hinge***: as it allows some medial and lateral rotation added to flexion and extension (actions done by any hinge joint).
- **Articulating surfaces**: articular surfaces of ***2 condyles of femur*** , upper articular surface of ***tibial condyles*** and articular surface on the ***back of patella***. The ***fibula has no role*** in formation of knee joint .



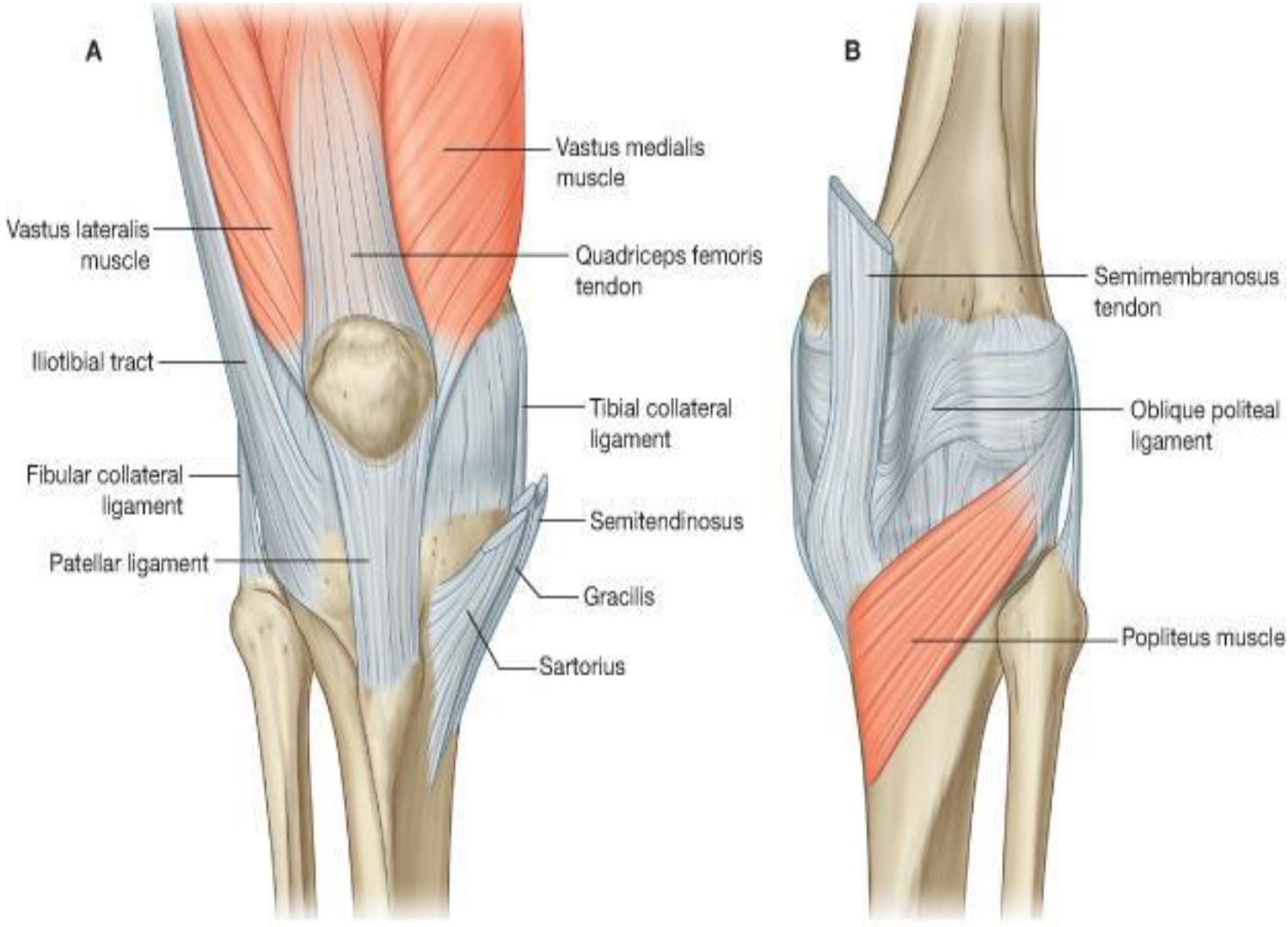
- **Fibrous capsule**:
  - **Attachments**:
    - **Anteriorly**: in general the capsule is attached to the margins of the articular surfaces and to the margin of patellar surface of femur (except superiorly), to both tibial condyles on either sides of the tibial tuberosity.

- ***The anterior part*** of the capsule is thus ***completely absent*** where it is ***replaced*** by the tendon of quadriceps femoris muscle, patella and patellar ligament.

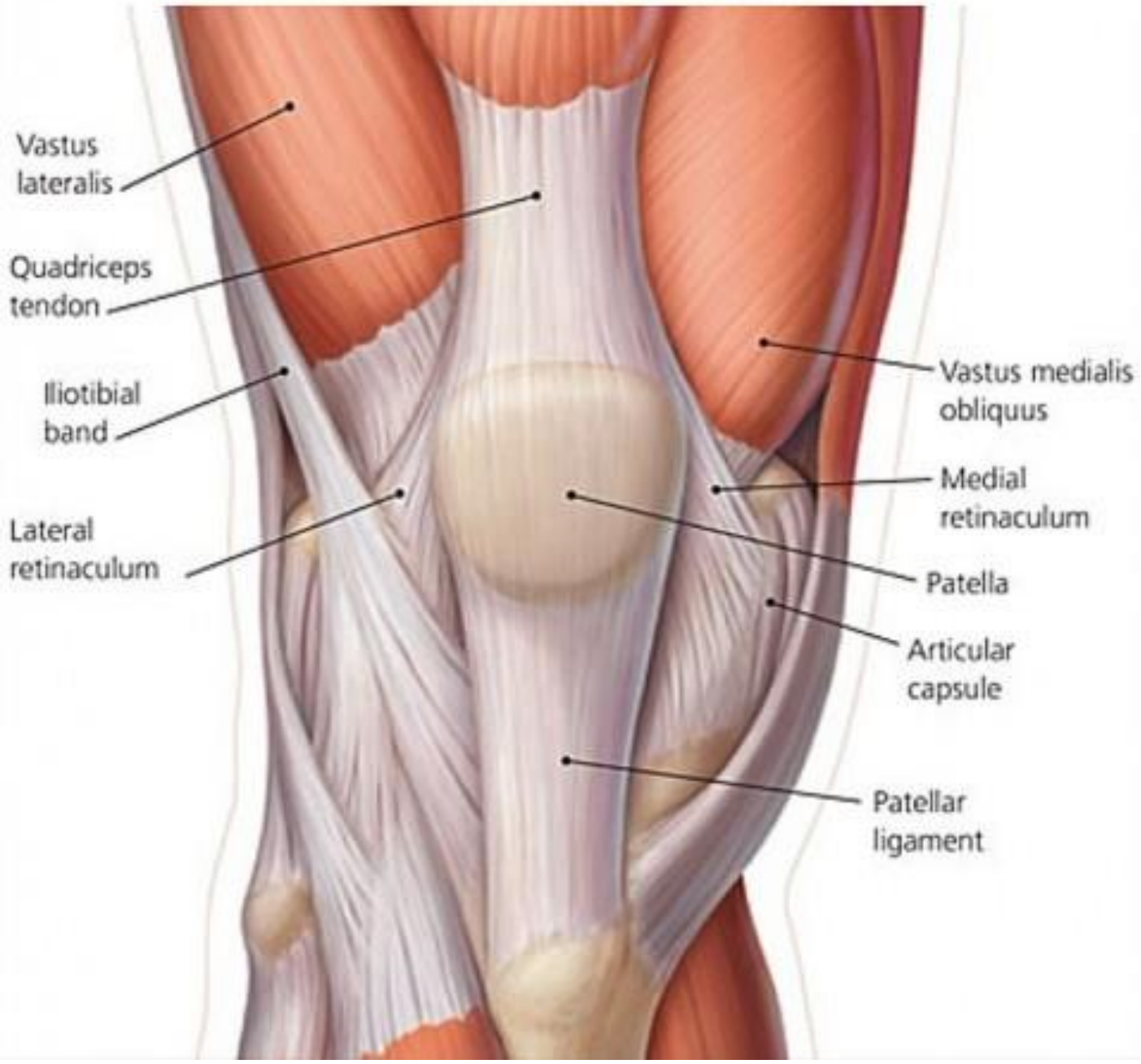
* **Posteriorly:** the capsule is attached to the ***margins of both femoral and tibial condyles.***

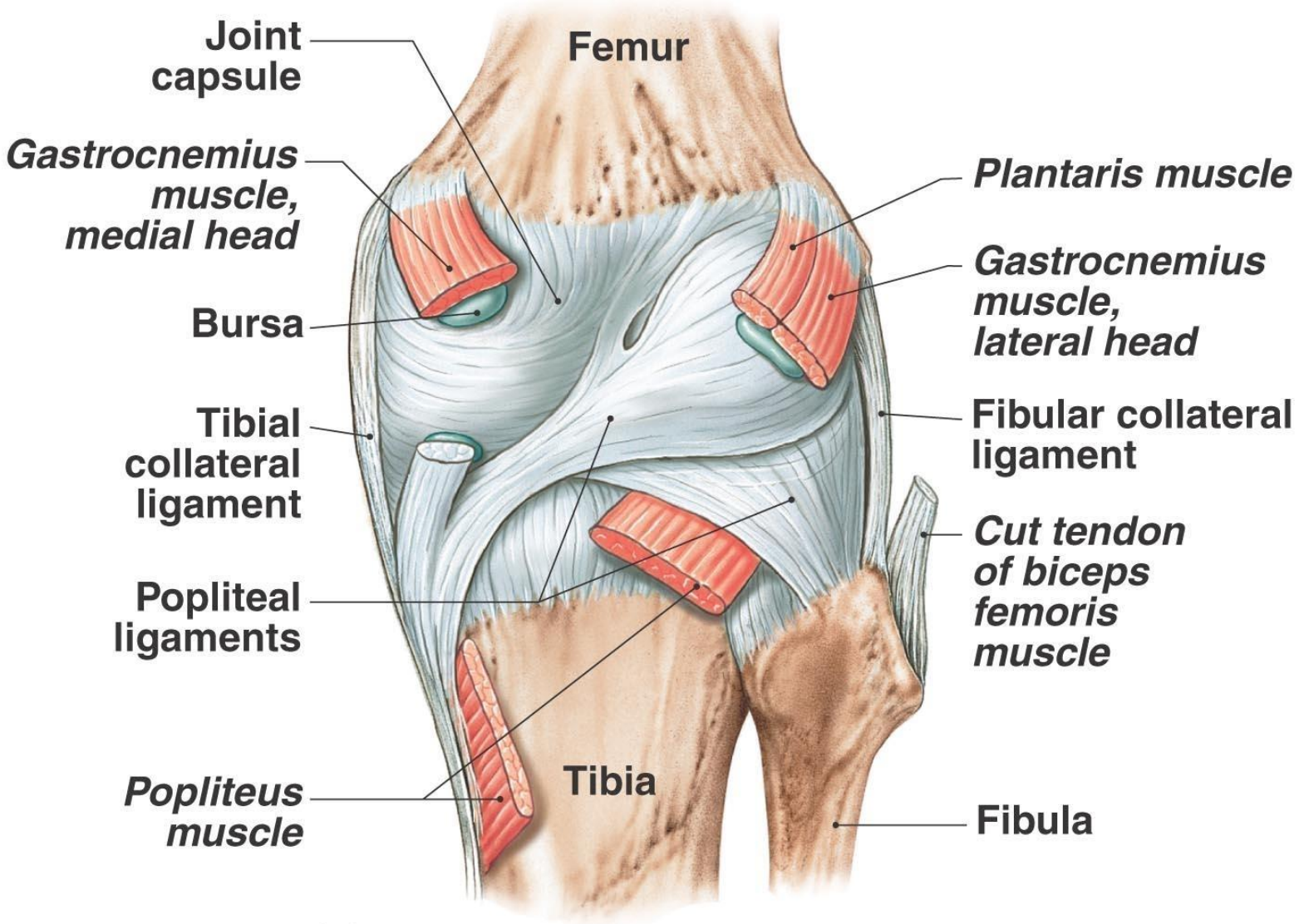
  - The posterior wall of the capsule is ***perforated*** by the ***tendon*** of popliteus muscle which is thus ***intracapsular.***

Lateraly:** the capsule is attached to the ***margin of the articular surfaces , ***just above the groove for popliteus*** muscles; the ***2 epicondyles are extracapsular.***



Tendons of the Knee

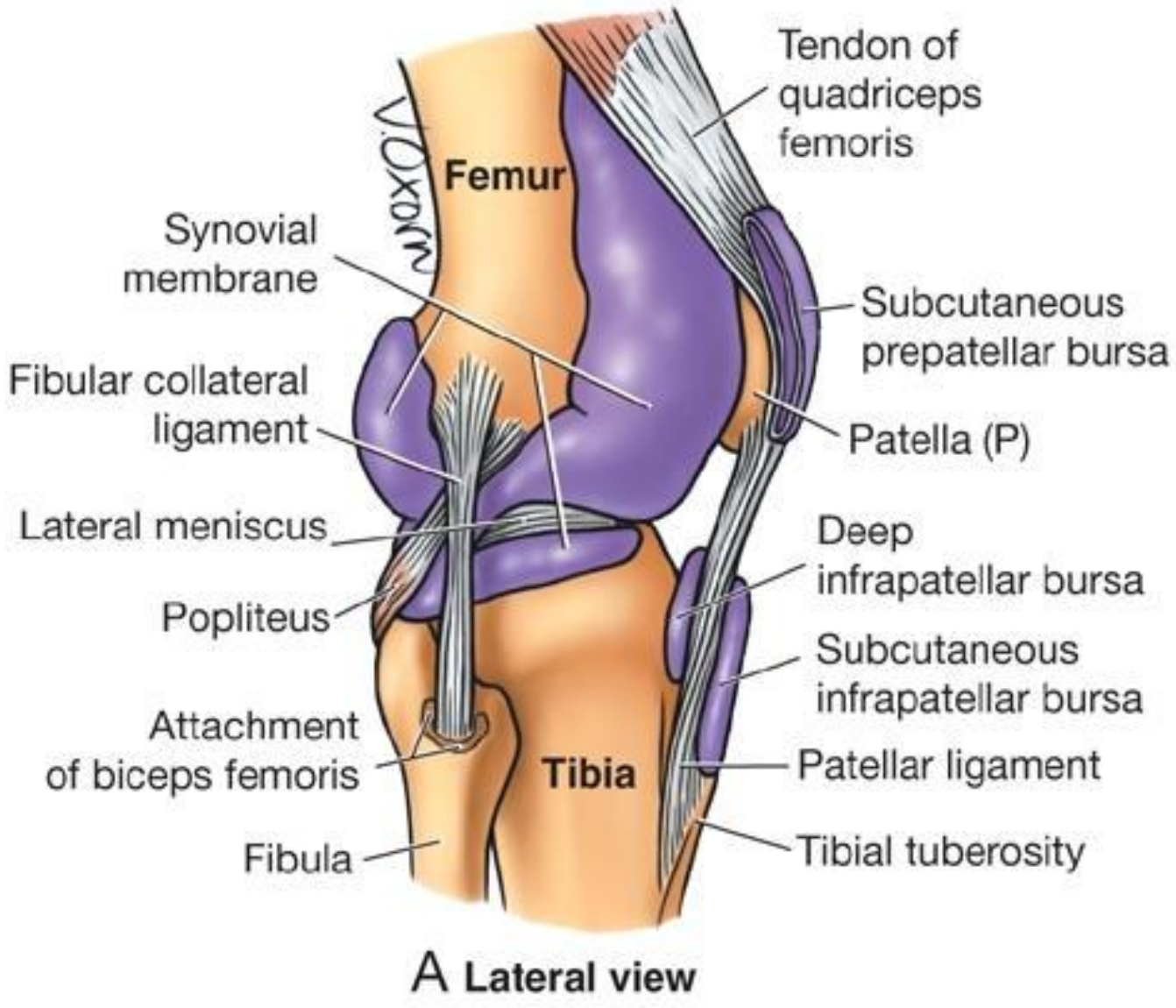




(a) Posterior view, superficial layer

⁕ Synovial membrane:

- ***Lines*** the fibrous capsule and ***cover*** all the intra-articular structures (like the 2 cruciate ligaments)) ***except*** the bony articular surfaces.
- There is a pouch of synovial membrane lying deep to the tendon of quadriceps femoris (called ***suprapatellar bursa***)
- The ***tendon of popliteus*** muscle lies inside the fibrous capsule but outside the synovial membrane (so it is called ***intracapsular but extrasynovial).***

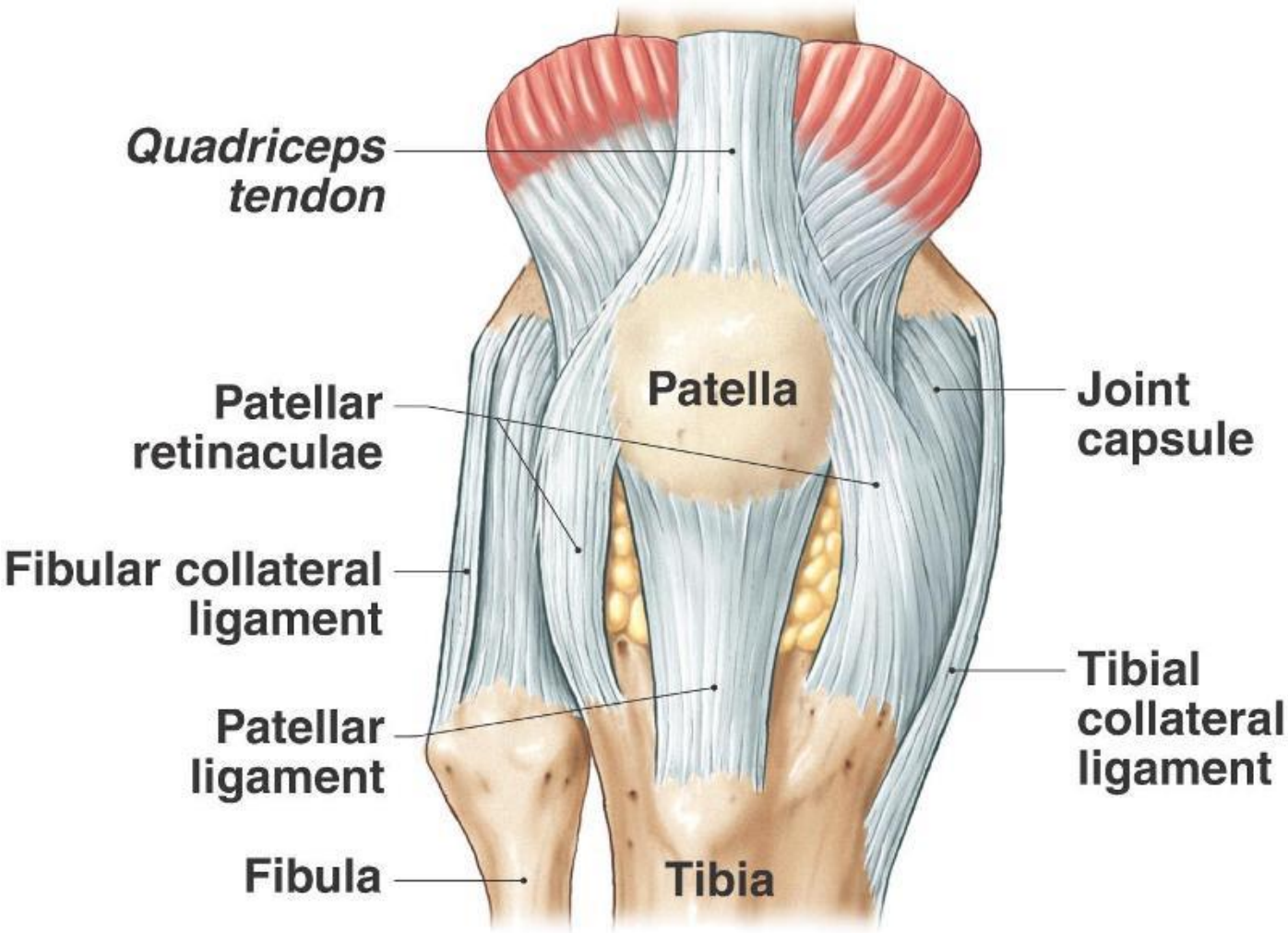


⁕ Ligaments of the knee joint:

- **Four extra-capsular ligaments (lying outside the capsule of the joint):**

a- **Patellar ligament**: (Ligamentum patellae): (anteriorly).

- It is the downward ***continuation*** of the quadriceps femoris tendon.
- It extends from the apex of ***patella*** to the ***tibial tuberosity***.
- It ***forms*** part of the ***anterior wall*** of the knee joint.



(a) Anterior view, superficial layer

b- **Fibular (lateral) collateral ligament**: (cord-like)

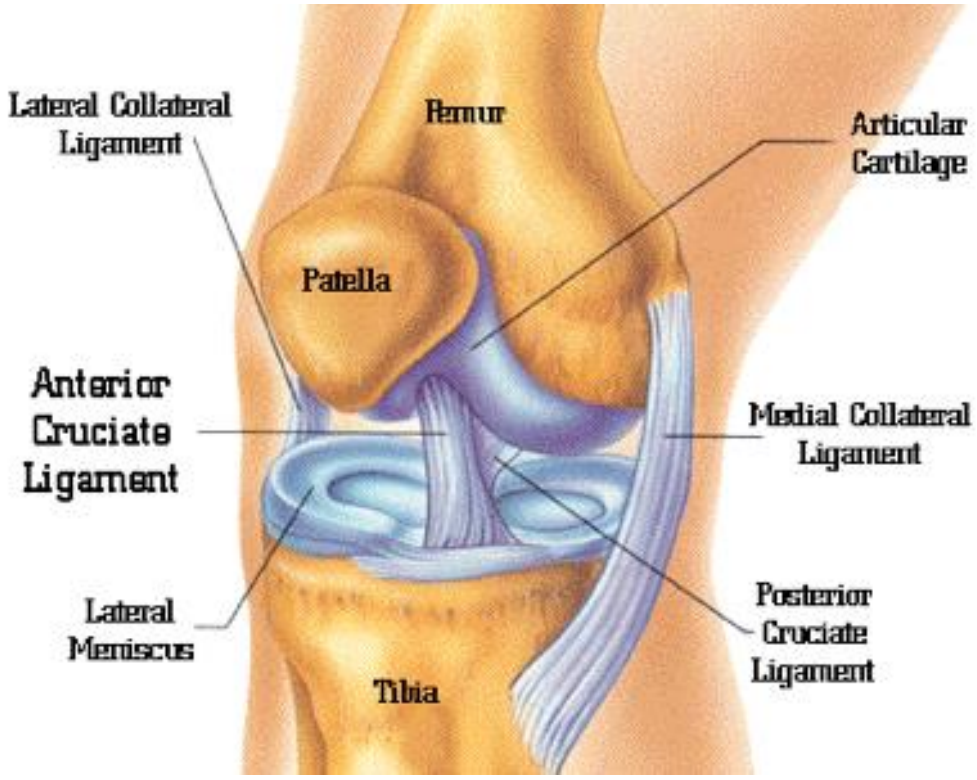
- It ***extends from*** the ***lateral epicondyle*** of the femur (above) to the ***head*** of fibula (below).
- It ***inforces*** the lateral aspect of the capsule & prevent adduction.
- The tendon of ***popliteus*** muscle (inside the capsule) ***separates*** this ligament from the lateral meniscus, which is therefore free and mobile.

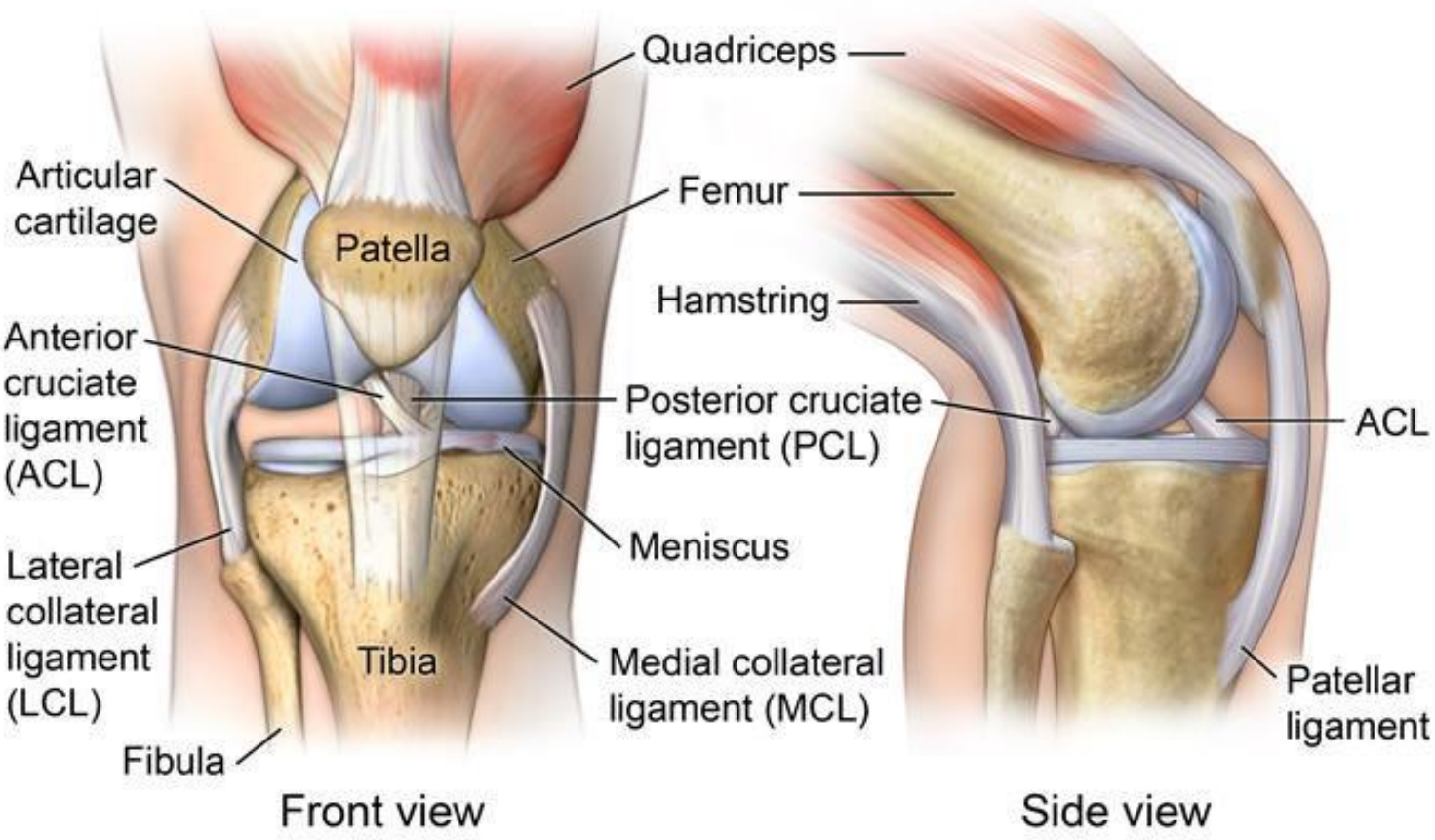
c- **Tibial (medial) collateral ligament**: (flattened band)

- It is attached to the ***medial epicondyle of femur*** (above) and to the ***medial condyle of tibia*** (below) ***deep to*** the tendons of sartorius, gracilis and semitendinosus muscles (S.G.S.).
- It ***inforces*** the medial aspect of the capsule& prevent abduction.
- It is firmly ***attached to the medial meniscus***, that is why the medial meniscus is **more fixed** than the lateral one.
- It is ***frequently torn*** with the medial meniscus in football players.

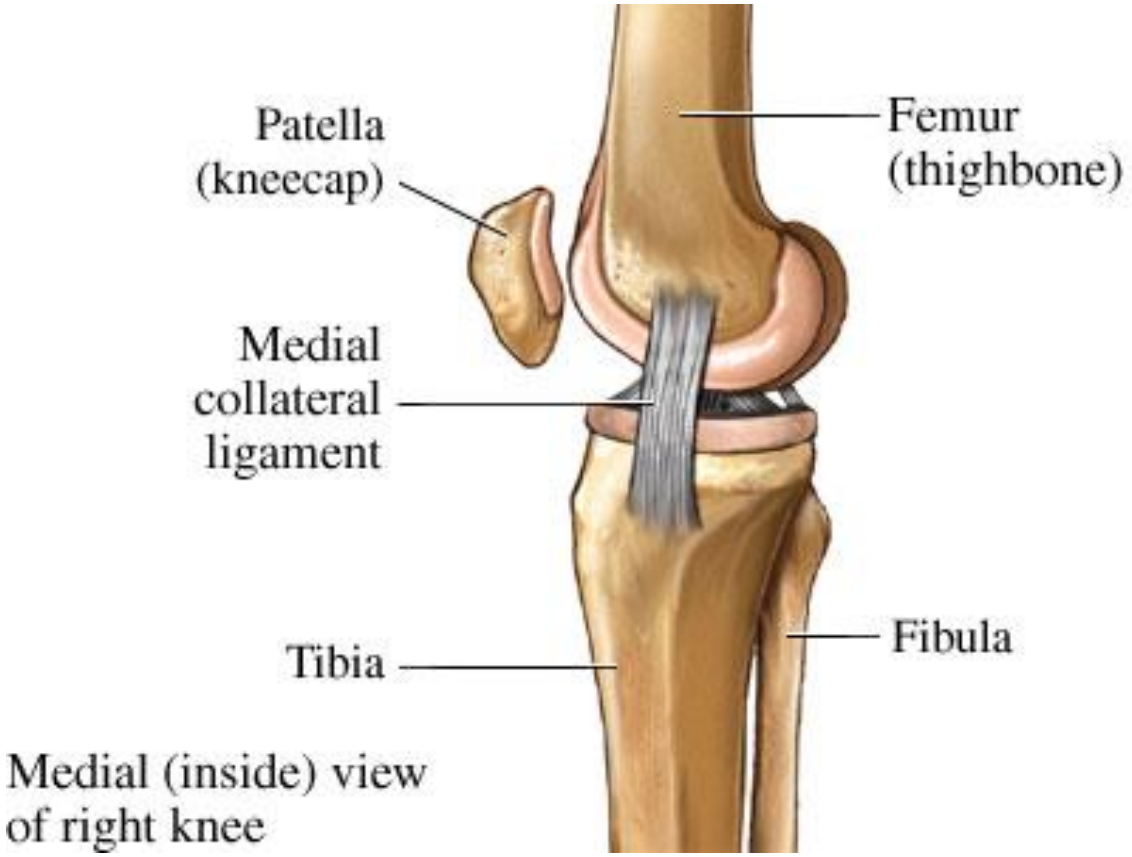
d- **Oblique popliteal ligament**: (posteriorly)

- It is an ***extension*** from the tendon of insertion of ***semimembranosus*** muscle.
- It passes ***upwards and laterally*** towards the lateral condyle of the femur ***inforcing*** the posterior aspect of the capsule& prevent hyperextension .





Knee anatomy



- **Three intracapsular ligaments : (lying inside the capsule of the joint)**
  1- ***Anterior cruciate*** ligament.
  2- ***Posterior cruciate*** ligament.
  3- ***Transverse ligament of the knee***: which connects the anterior horns of the 2 menisci (has no bony attachment).

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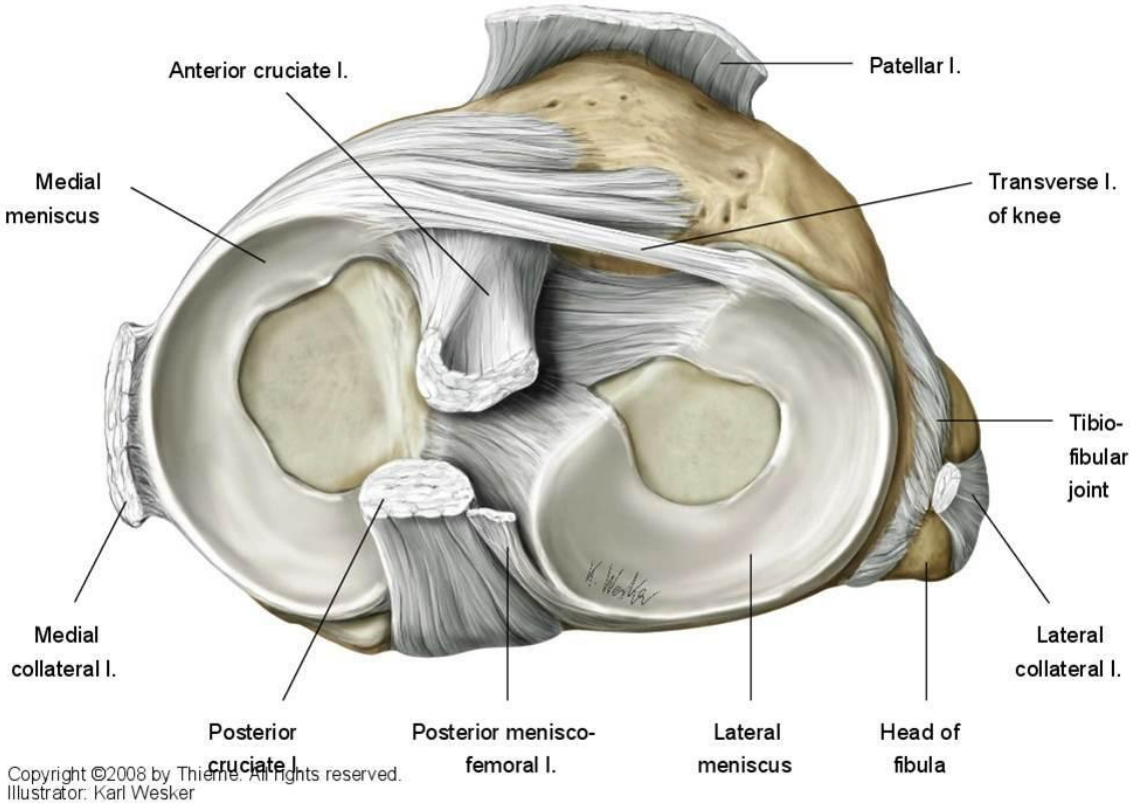


❋ Cruciate Ligaments:

- ***Two strong ligaments*** (anterior and posterior) present ***inside*** the knee joint.
- They ***cross each other*** in the form of the letter ***X.***

1) Anterior cruciate ligament:

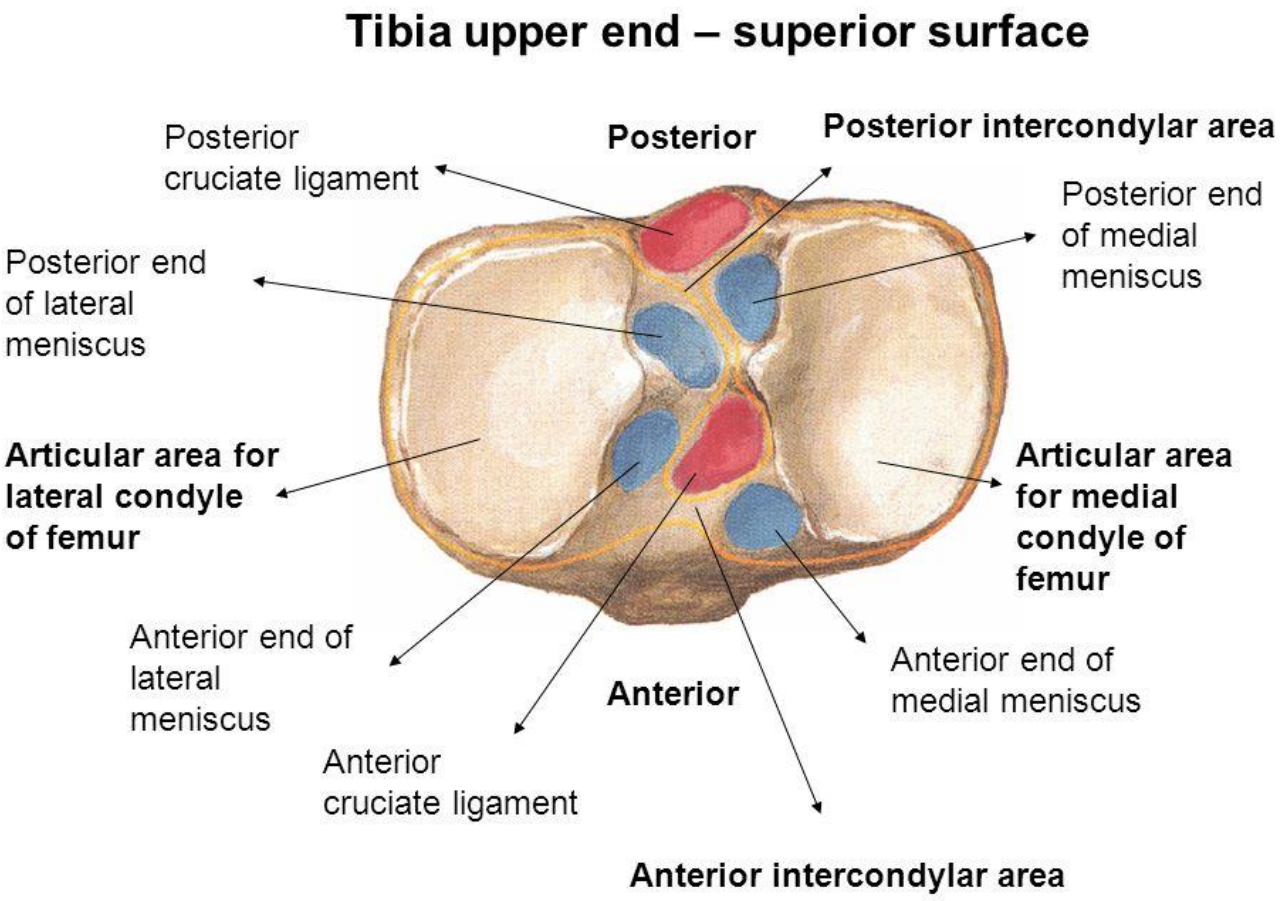
- **Attachments**:
  - To the ***anterior intercondylar area*** of the tibia ***between*** the anterior horns of the 2 menisci.

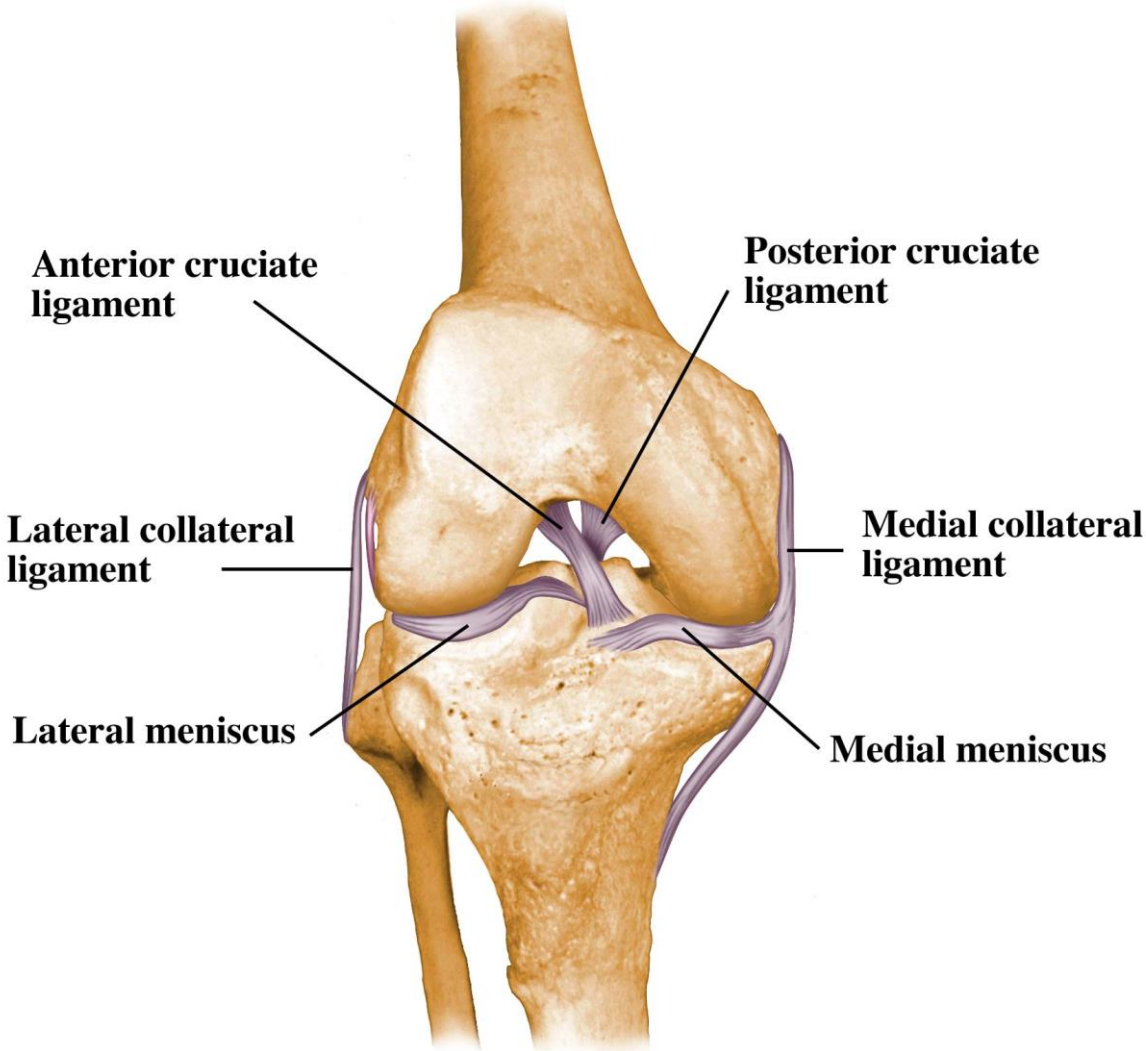
- It then passes ***upwards, backwards and laterally*** to become attached to the medial surface of the ***lateral condyle*** of femur.

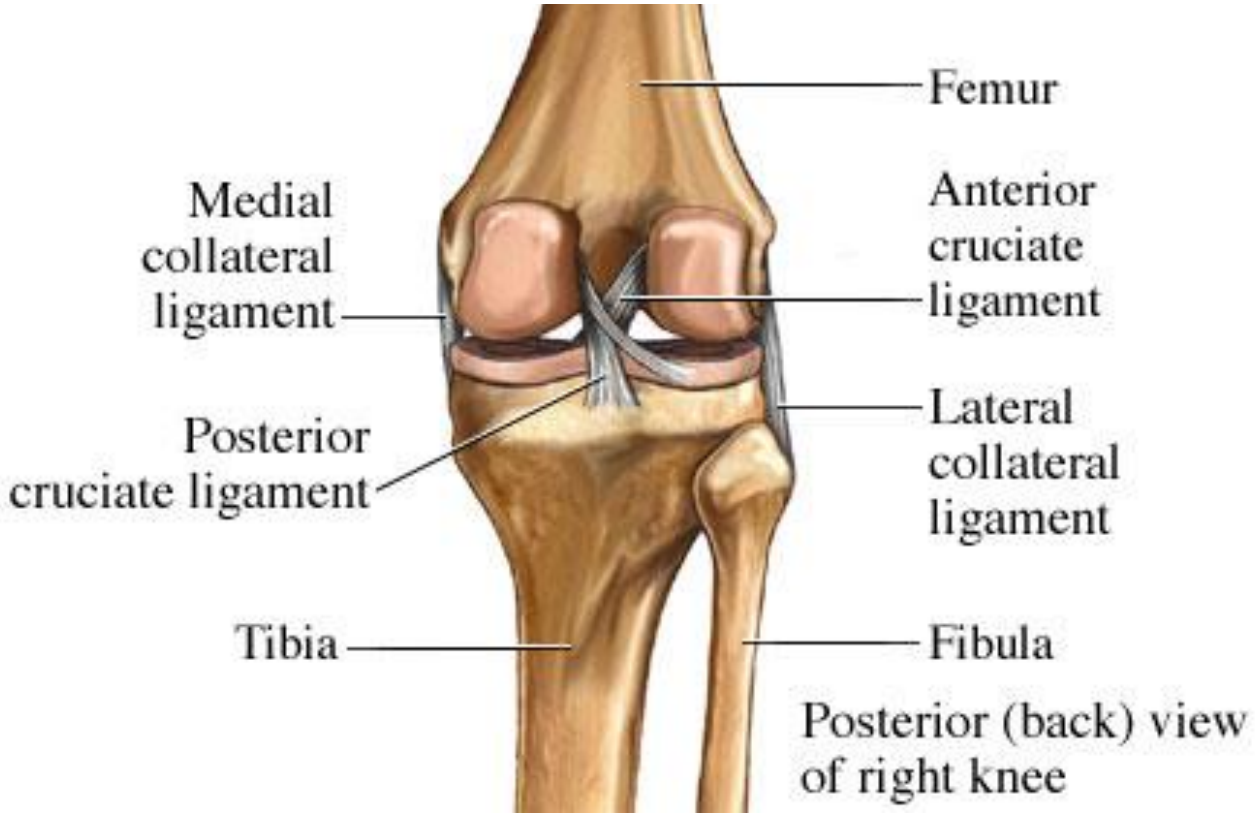
- **Function:** being stretched on ***extension*** of the knee, so:
  - It ***prevents*** its hyperextension.
  - It prevents ***anterior dislocation*** of the tibia during extension.

2) Posterior cruciate ligament:

- **Attachments:**
  - To the ***posterior intercondylar*** area of the tibia ***posterior*** to the posterior horns of the 2 menisci .
  - It then passes ***upwards, forwards and medially*** to become attached to the lateral surface of the ***medial condyle*** of femur.
- **Function:** being stretched on ***flexion*** of the knee, so it prevents ***posterior dislocation*** of the tibia during flexion.







Posterior (back) view of right knee

⁕ Intracapsular structures of the knee joint:

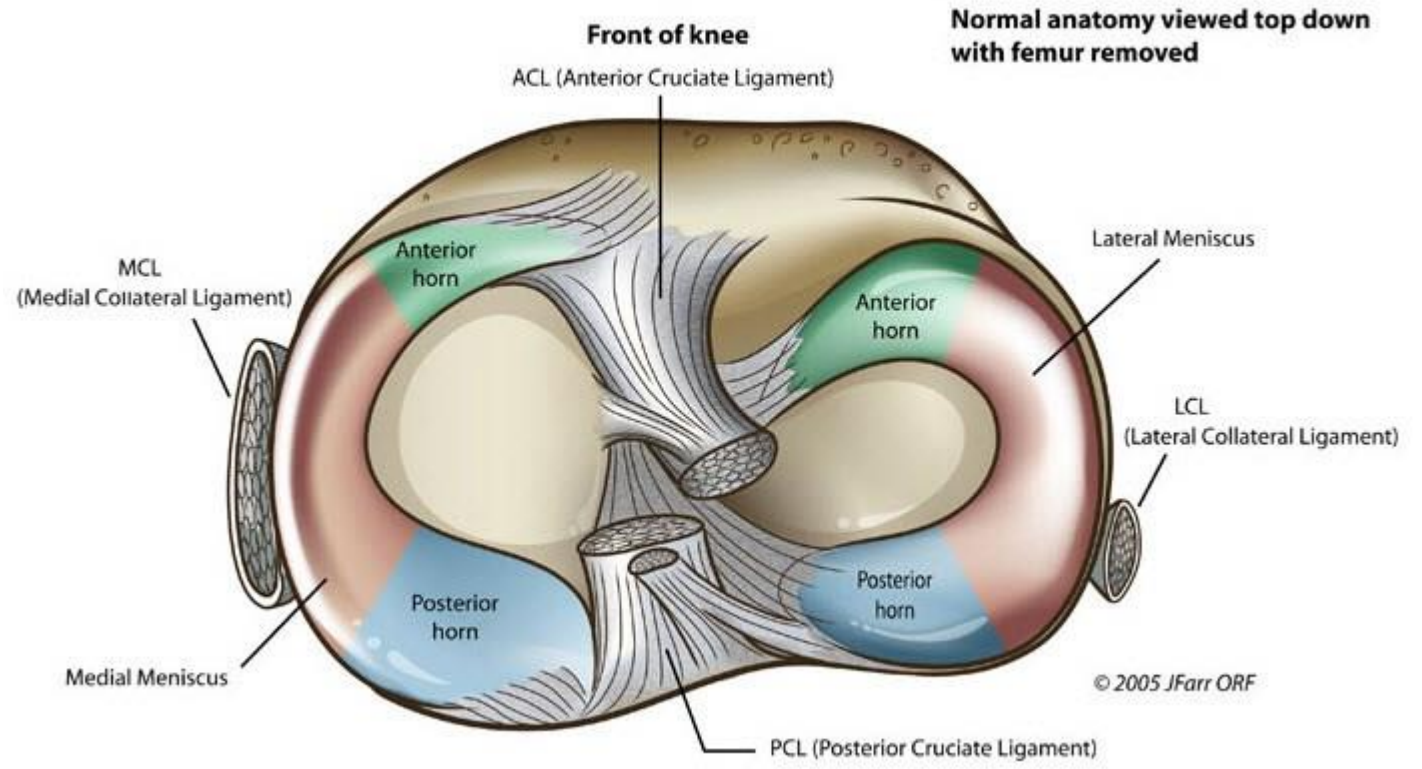
1. ***Two menisci*** (semilunar cartilages).
2. ***Two cruciate*** ligaments.
3. ***Transverse ligament*** of the knee
4. Tendon of origin of ***popliteus*** which perforates the back of the capsule to leave the knee joint, accompanied by its synovial sheath.
5. Infra-patellar ***pad of fat.***
6. ***Supra-patellar bursa***.

⁕ Semilunar Cartilages : (Menisci)

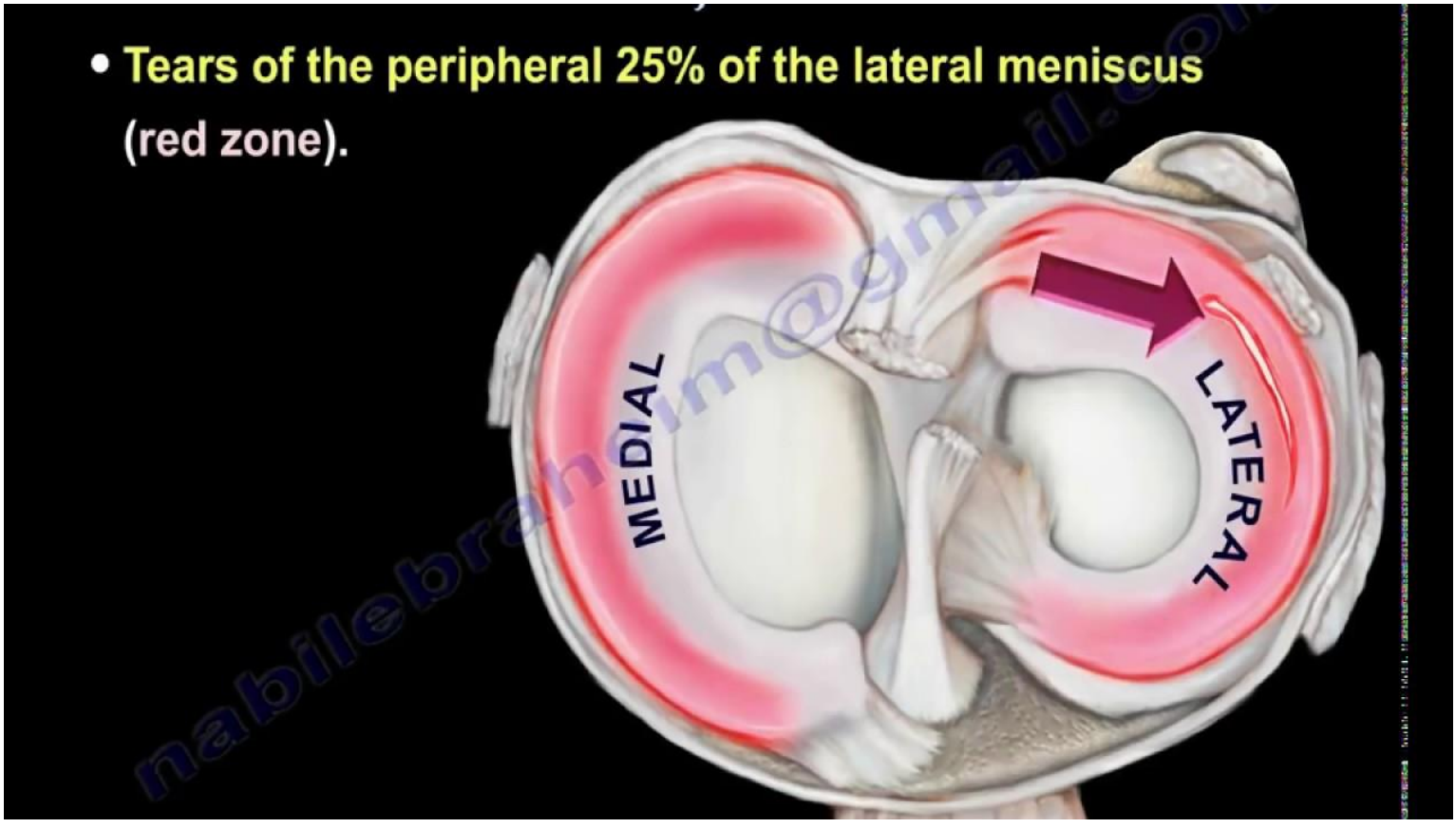
- The meniscus is a ***curved plate of fibrocartilage*** which lies on the ***upper surface*** of the 2 condyles of tibia. Each meniscus has an outer ***thick*** and an inner very thin border and is ***attached*** by 2 horns to the ***intercondylar area*** of the tibia.
- **Functions :**
  - The menisci act as ***shock absorbers***.
  - ***They increases the concavity*** of the articular surface of condyles of tibia .

1) Medial Meniscus:

- **Shape**: ***C-shaped , larger*** than the lateral meniscus.
- **Attachments**:
  - **The anterior horn** : is attached to the ***most anterior*** part of the anterior intercondylar area of tibia(in front of the anterior cruciate ligament).
  - **The posterior horn :** is attached to the posterior part of the intercondylar area (behind the posterior horn of the lateral meniscus and in front of the posterior cruciate ligament).
- **Mobility:** it is less mobile as it is ***fixed to the tibial collateral*** ligament and the ***capsule*** of the knee joint. So, it is ***more liable to be injured*** by becoming trapped between the moving femoral and tibial condyles.



Menisci of the knee joint. (superior view)



2) Lateral Meniscus:

- **Shape**: ***circular*** in shape***, smaller.***
- **Attachments**: its ***2 horns lie very close*** to each other:
  - The ***anterior*** horn: it is attached to the anterior intercondylar area of tibia just ***in front of the lateral intercondylar tubercle***.
  - The ***posterior*** horn: it is attached to the posterior intercondylar area of tibia just ***behind the lateral intercondylar tubercle.***
- **Mobility:** it is ***more mobile***, being ***separated from*** the capsule and the fibular collateral ligament ***by the tendon of origin of popliteus*** muscle to which it is attached; this arrangement makes it ***less liable to be injured.***

⁕ **Nerve supply of the knee joint:**

- Three genicular nerves from ***tibial*** nerve.
- Three genicular nerves from ***common fibular*** nerve.
- From ***femoral , obturator and sciatic*** nerves (as the hip joint); that is why diseases of the hip joint may lead to pain which may be referred to the knee joint.

⁕ **Arterial supply of the knee joint:** from the anastomosis around the knee joint.

⁕ **Movements of the Knee Joint:**

a- **Flexion**: done ***mainly by the 3 hamstrings***, assisted by popliteus, sartorius , gracilis and gastocnemius .

b- **Extension**: done by ***quadriceps femoris only.***

c- **Lateral rotation:** done by ***biceps*** femoris ***only***.

d- **Medial rotation:** done ***mainly by popliteus***, assisted by sartorius, gracilis, semitendinosus (S.G.S) and semimembranosus. (i.e muscles inserted in upper part of tibia)

⁎ Locking and unlocking of the knee joint:

	Locking	Unlocking
Mechanism:	On full extension , taut anterior cruciate , leading to medial rotation of femur on the axis of anterior cruciate (medial femoral condyle moves back and lateral femoral condyle moves forwards) with tightening of 2 collateral ligaments & oblique popliteal ligament and tensor fascia latae & gluteus maximus tighten iliotfebial tract .	Popliteus lateraly rotates femur on tibia leading to loosening of ligaments of the knee and hamstring can flex the knee .
	Occurs at full extension to make the knee & lower limb mechanically rigid structure to support body weight transmission .	**Occurs** at the beginning of flexion.
Ligaments tense during movement	-Anterior cruciate ligament . -2 collateral ligaments. - oblique popliteal ligament.	
Muscles involved	- Mostly passive .	- Popliteus

⁎ Bursae around the knee joint: (10 in number)

I) Bursae on the anterior aspect of the joint:

1- **Supra-patellar bursa**: between tendon of quadriceps femoris and front of lower end of femur.

2- **Infra-patellar bursa**:

- **Subcutaneous** infra-patellar bursa: between skin and tuberosity of tibia.
- **Deep** infra-patellar bursa: between patellar ligament and front of upper end of tibia.

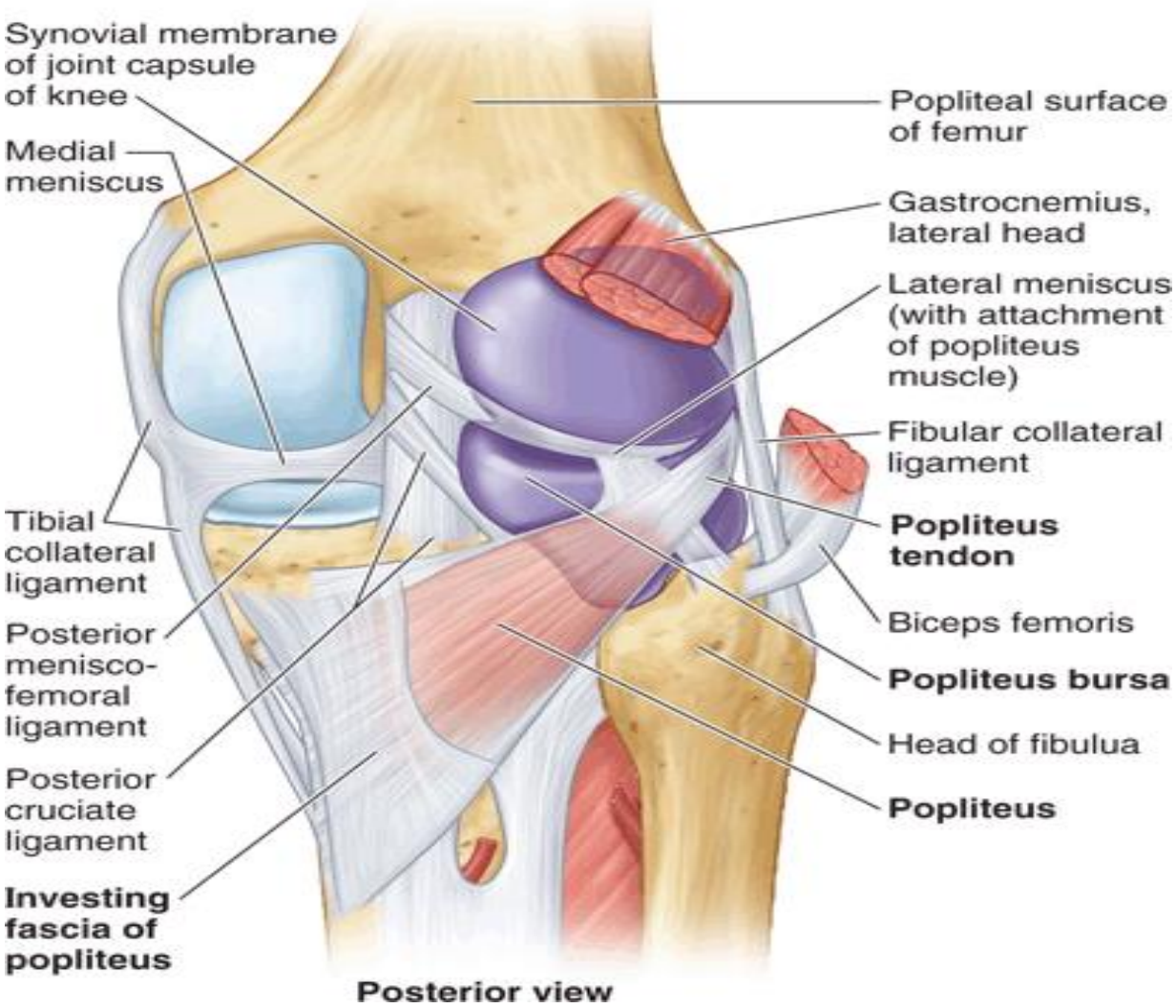
3- **Subcutaneous pre-patellar** bursa: between skin and patella. (This bursa may swollen from frequent kneeling, a condition called **housemaid's knee**).

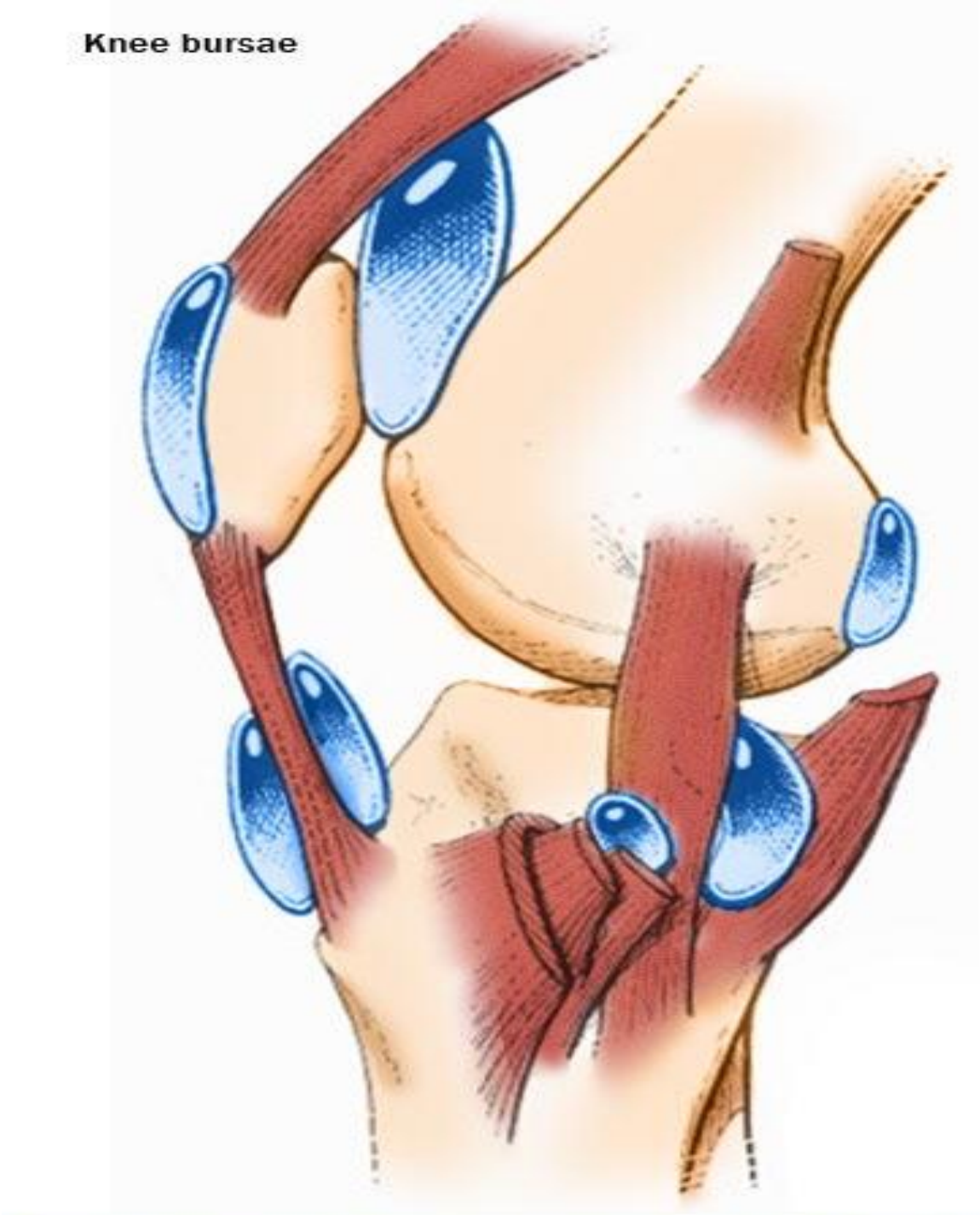
II) Bursae on the medial aspect of the joint:

1. Between **medial head of gastrocnemius** and capsule of the knee joint.
2. Between **semimembranosus** and medial condyle of tibia. **Semimembranosus bursitis is the commonest swelling in the popliteal fossa .**
3. Between tendons of **(S.G.S)** and capsule of the joint.

III) Bursae on the lateral aspect of the joint:

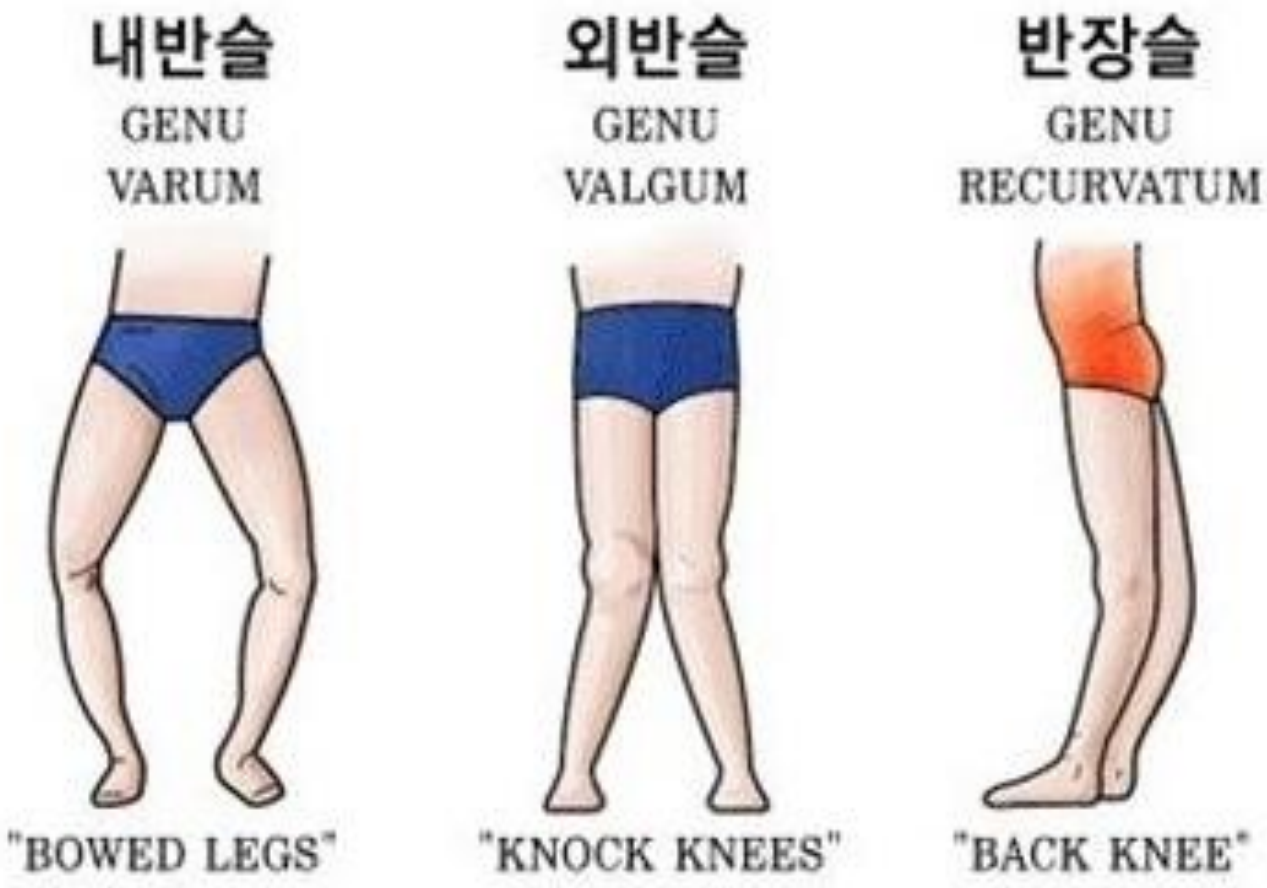
1. Between the **lateral head of gastrocnemius** and the capsule of the joint.
2. Between the **tendon of biceps** and the fibular collateral ligament.
3. Between the **tendon of popliteus** and the lateral condyle of femur.





★ **Clinical points related to the knee joint:**

- **Genu valgus**: (Knock knee)
  - Usually congenital or rarely traumatic .
  - There is abduction deformity of the leg .
- **Genu varus** : (Bow leg)
  - Usually congenital or rarely traumatic .
  - There is adduction deformity of the leg .
- **Genu recurvatum** is hyperextension deformity of the knee joint .
- **Hemarthrosis of knee joint :** is collection of blood inside the joint cavity.
- **Effusion of knee joint :** is collection of clear serous fluid inside the joint cavity.
- Suppurateve arthritis of knee joint is collection of pus inside the joint cavity.
- **Osteoarthritis** is a common degenerative disease in old obese patient characterized by degeneration and roughness in the articular surface of the joint .



Tibio-fibular Joints

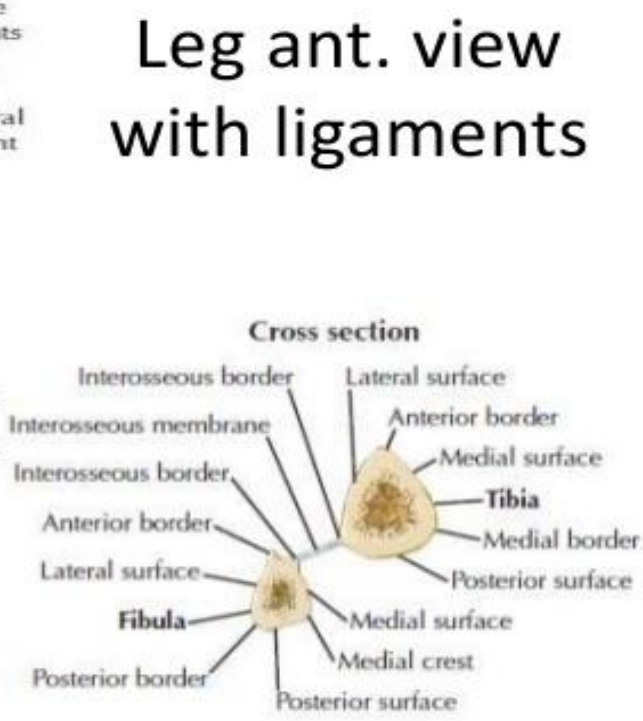
1- Superior tibio-fibular joint:

- A ***synovial*** joint of ***plane*** variety, between head of fibula and a rounded facet on the inferior surface of the lateral condyle of tibia.

2- **Middle tibio- fibular joint:** (***interosseus membrane***)

- A fibrous membrane extending between ***interosseus borders*** of tibia and fibula.
- It is ***tense***, so ***not allowing movements*** between tibia and fibula.
- Its fibres run obliquely ***downwards and laterally*** from tibia to fibula.
- It is ***perforated***: -
  a) In its ***upper part***: by the ***anterior tibial*** vessels.
  b) In its ***lower part***: by the ***perforating branch of the fibular*** artery.

3- **Inferior tibio-fibular joint:** a ***fibrous*** joint **(syndesmosis)** between the medial surface of the lower end of fibula and the fibular notch of tibia.

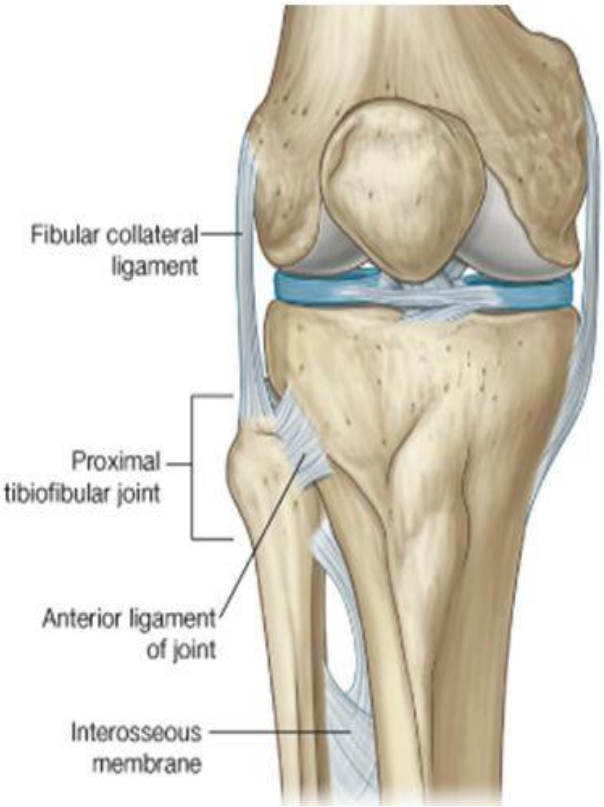


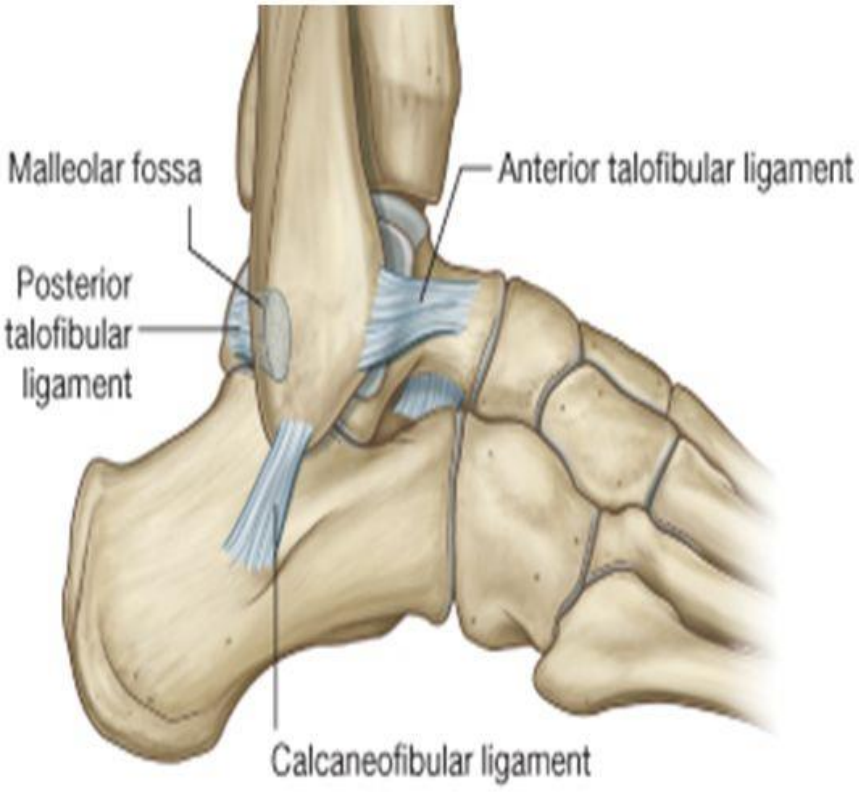
TIBIOFIBULAR JOINTS

(Superior) Tibiofibular joint

Syndesmosis (inferior tibiofibular) joint

In addition, an interosseous membrane joins the shafts of the two bones.





The Ankle Joint

- **Type and variety:** synovial, uniaxial joint of ***the hinge*** variety.
- **Articulating surfaces**:
  - Above: Inferior articular surface of lower end of tibia
  - Medially : medial malleolus.
  - Laterally : lateral malleolus of fibula.
  - Below : trochlea of talus.
- **Fibrous capsule:**
  - It is attached to the **margins** of the articulating surfaces.
  - It is **weak** both anteriorly and posteriorly **but thickened** on both sides due to the presence of **2 strong collateral ligaments** (medial and lateral ligaments of ankle).
- **Synovial membrane: l**ines the fibrous capsule and covers the intra-articular structures (as the neck of talus).
- **Ligaments of ankle joint:**

a) **Medial ligament of ankle**: **(deltoid ligament**):

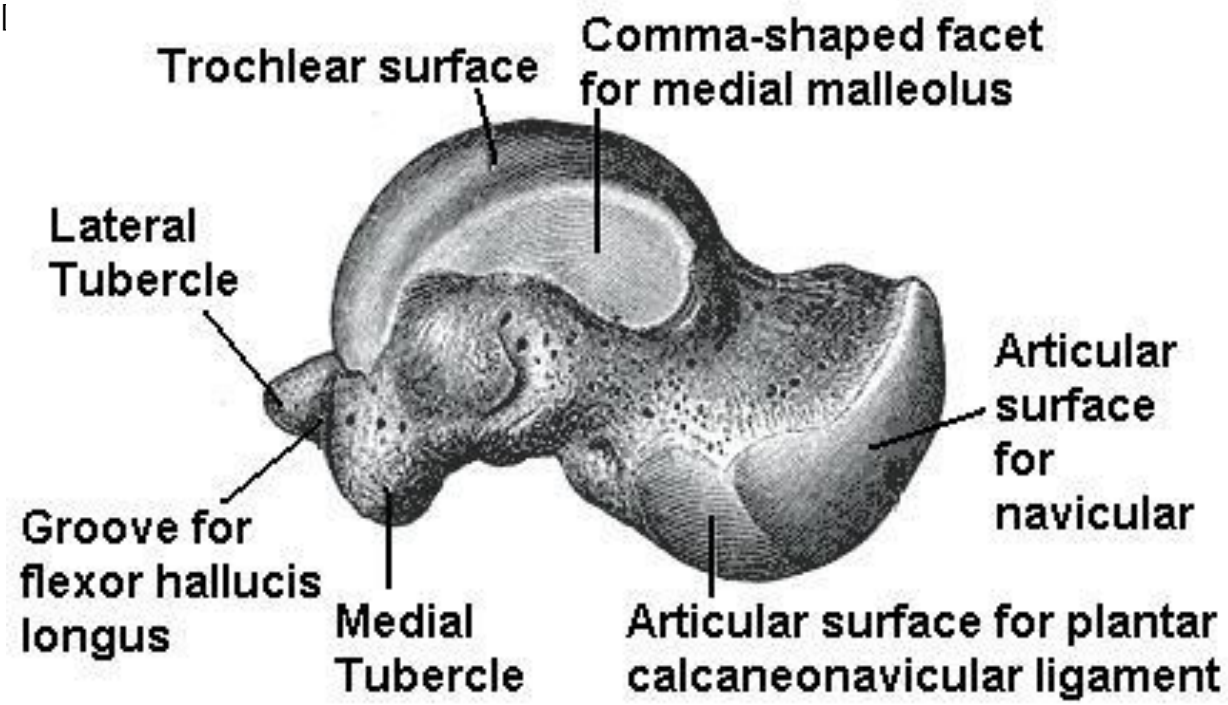
It is ***triangular*** in shape (hence the name deltoid). It is attached by its ***apex*** (above) to the tip of the medial malleolus, and by its ***base*** (below) to the neck of talus, tuberosity of navicular bone, spring ligament, sustentaculum tali and medial tubercle of talus.

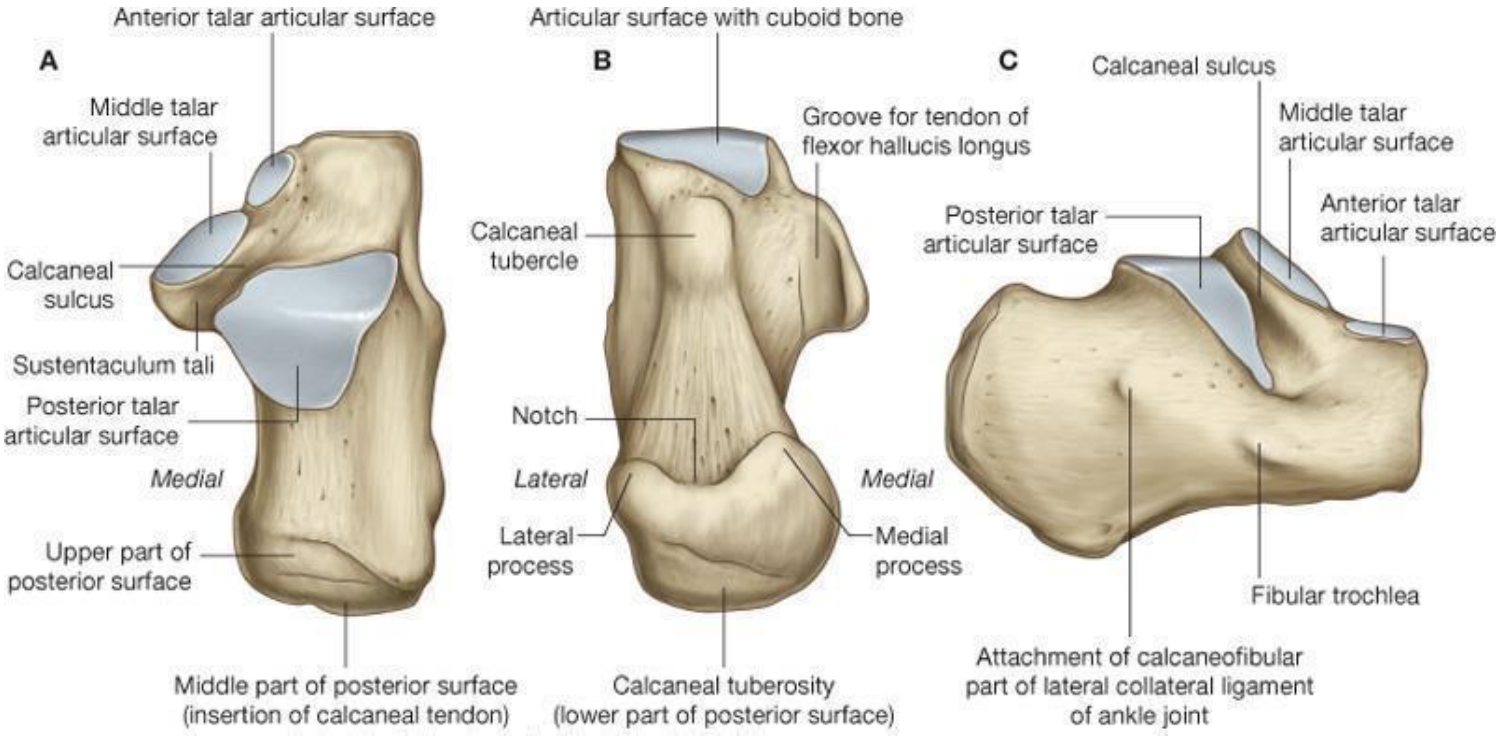
b) Lateral ligament of ankle: formed of ***3 separate bands radiating*** from lateral malleolus of fibula.

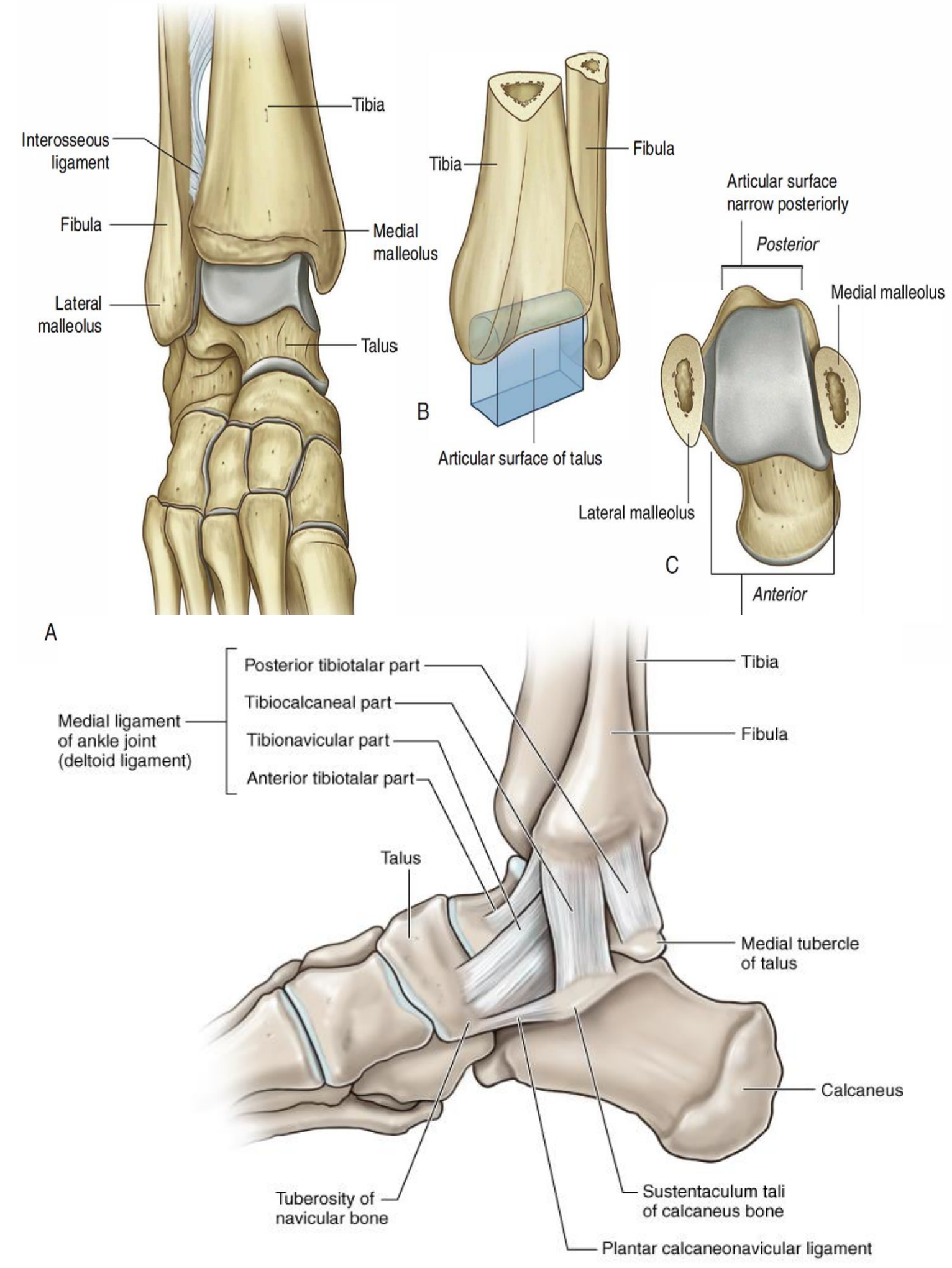
1- ***Anterior talo-fibular ligament***: it extends **horizontally** forwards from lateral malleolus to talus.

2- ***Posterior talo-fibular ligament***: (the strongest of them): it extends **horizontall**y backwards from malleolar fossa of fibula to talus.

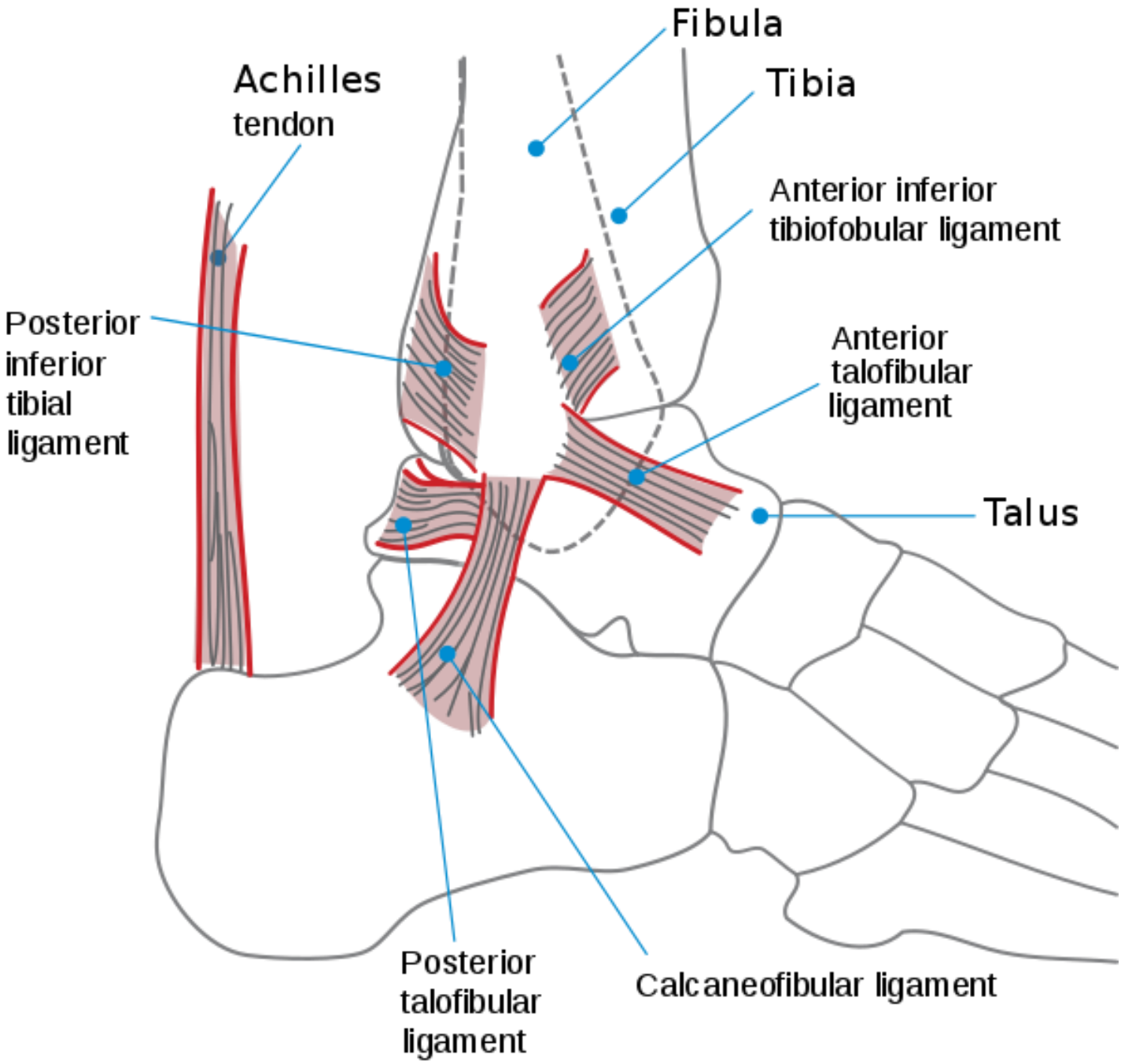
3- ***Calcaneo-fibular ligament***: it is a **vertical** middle band which extends from the lateral malleolus to the lateral surface of calcaneus.


Trochlear surface
Comma-shaped facet for medial malleolus
Lateral Tubercle
Articular surface for navicular
Groove for flexor hallucis longus
Medial Tubercle
Articular surface for plantar calcaneonavicular ligament


A
Anterior talar articular surface
Middle talar articular surface
Calcaneal sulcus
Sustentaculum tali
Posterior talar articular surface
Medial
Upper part of posterior surface
Middle part of posterior surface (insertion of calcaneal tendon)
B
Articular surface with cuboid bone
Groove for tendon of flexor hallucis longus
Calcaneal tubercle
Notch
Lateral
Medial
Lateral process
Medial process
Calcaneal tuberosity (lower part of posterior surface)
C
Calcaneal sulcus
Middle talar articular surface
Anterior talar articular surface
Posterior talar articular surface
Fibular trochlea
Attachment of calcaneofibular part of lateral collateral ligament of ankle joint



Source: Dutton M: *Dutton's Orthopaedic Examination, Evaluation, and Intervention*, 3rd Edition: www.accessphysiotherapy.com


Fibula
Tibia
Achilles
tendon
Anterior inferior
tibiofobular ligament
Posterior
inferior
tibial
ligament
Anterior
talofibular
ligament
Talus
Posterior
talofibular
ligament
Calcaneofibular ligament

- **Movements of the ankle joint: (Only two)**

a) **Plantar flexion**: (moving the foot downwards):

Produced ***mainly by: gastrocnemius and soleus*** and helped by the deep calf muscles (tibialis posterior, flexor hallucis longus and flexor digitorum longus).

b) **Dorsiflexion (Extension**): (moving the foot upwards with the heel on the ground)

Produced by: muscles of ***anterior compartment*** of leg (tibialis anterior, extensor digitorum longus, extensor hallucis longus and peroneus tertius).

- **Nerve supply of the ankle joint:** branches from deep fibular and tibial nerves.
- **Arterial supply of the ankle joint:** from the anastomosis around the ankle (around medial and lateral malleoli).
- **Clinical points related to the ankle joint**:

1- ***Sprain*** (microscopic tear in the ligaments) of ankle joint: occurs in

- Excessive inversion of foot leading to damage of the lateral ligaments .
- Excessive eversion of foot leading to damage of the deltoid ligament .
- In both conditions, local pain and swelling occur.

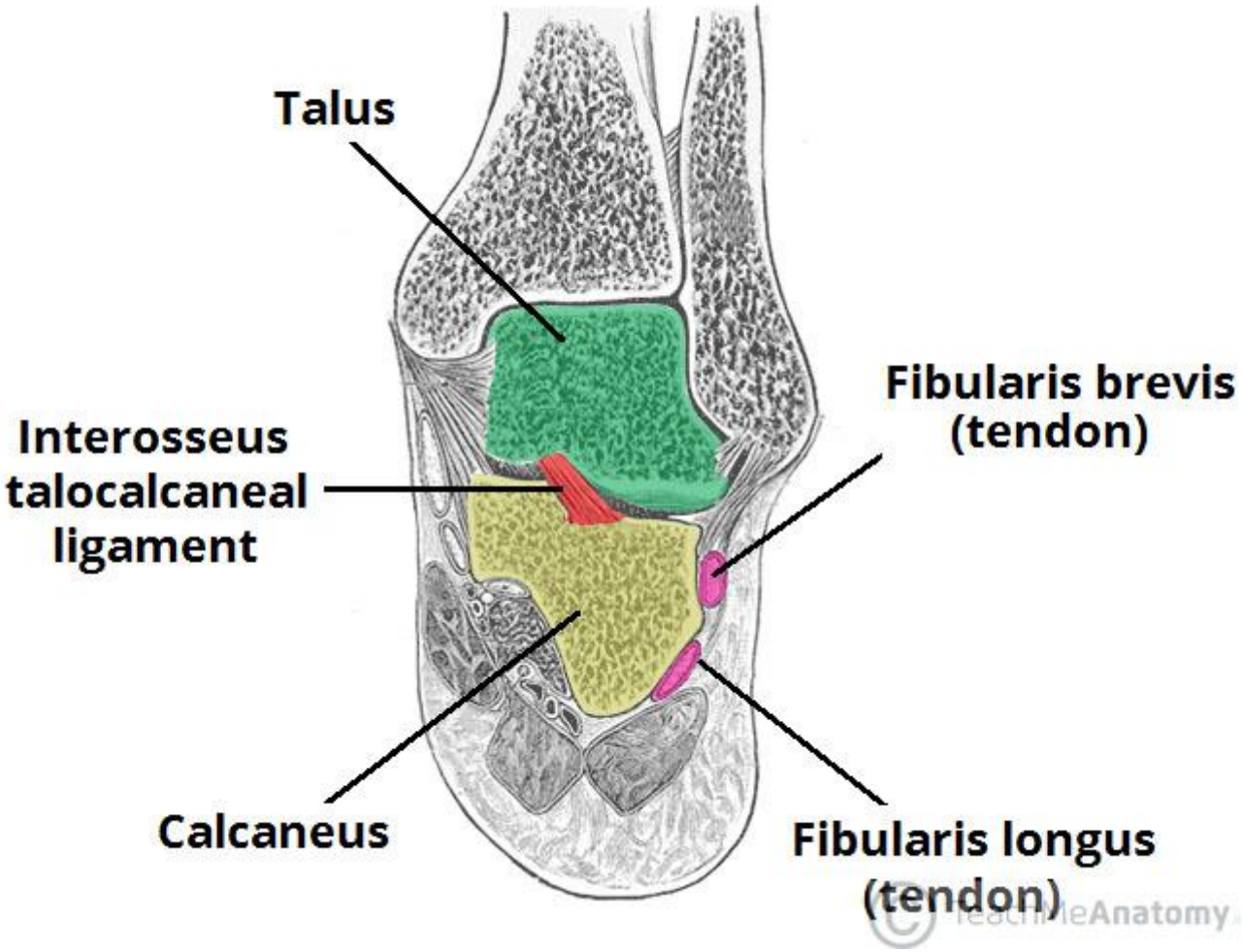
2- ***Ankle fractures*** :

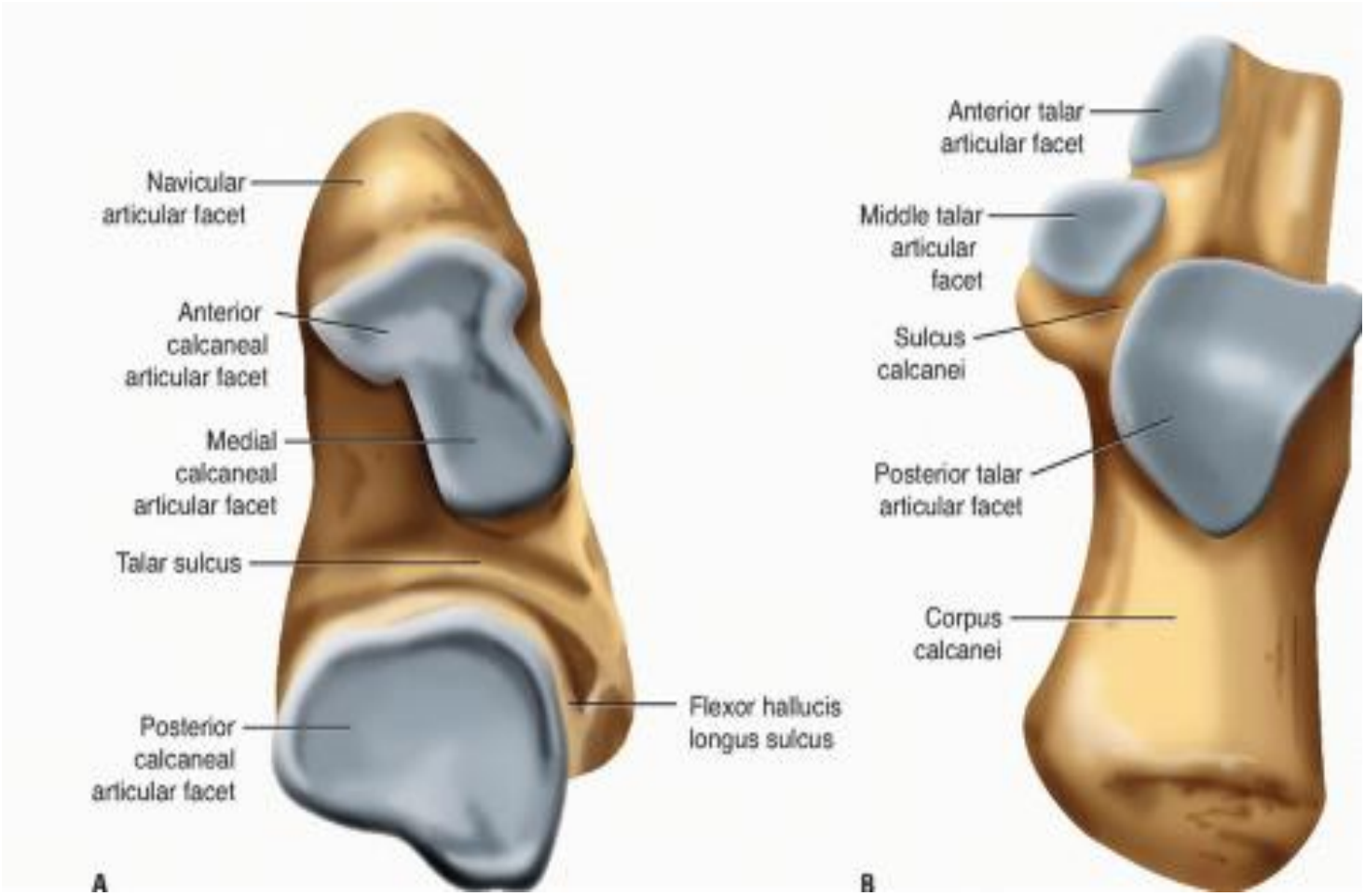
- Affect one or more of the three malleoli with affection of deltoid or lateral ligaments of the ankle .

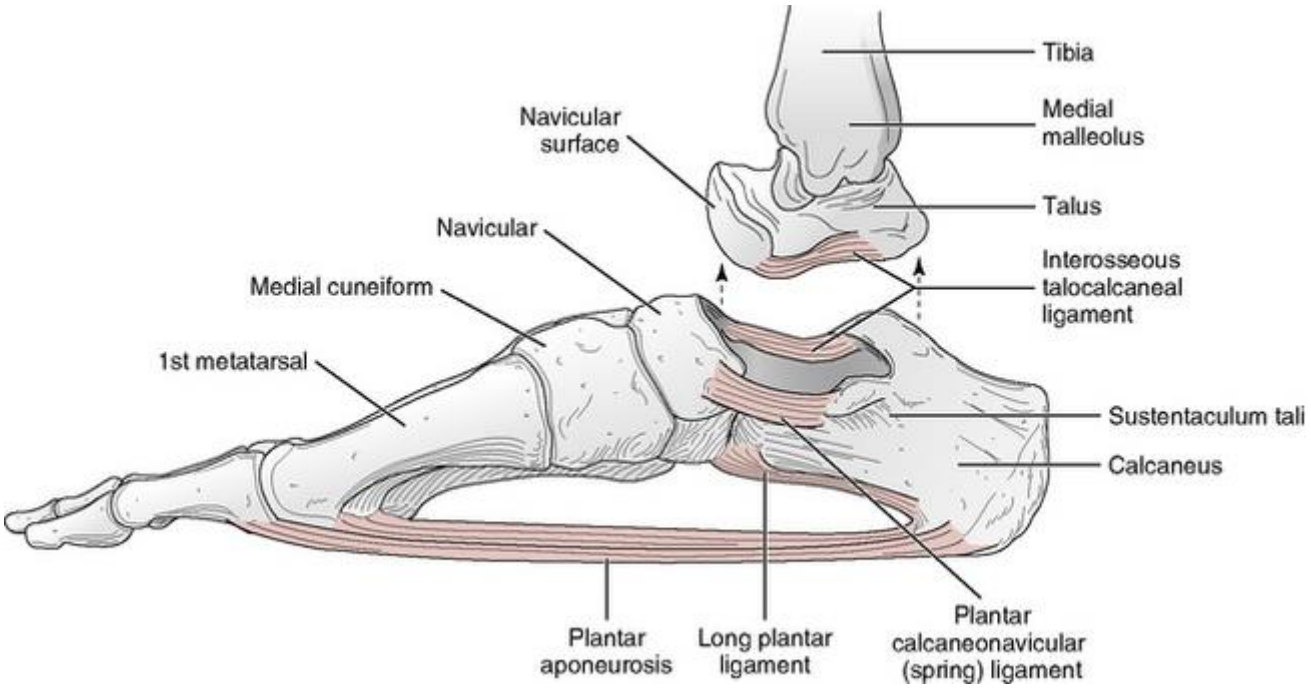
Intertarsal Joints

1- **Subtalar (talo-calcanean) joint**:

- **Type**: synovial joint.
- **Variety**: ***plane*** (or gliding).
- **Articular surfaces**: between inferior surface of body of talus and upper surface of calcaneus.
- **Capsule**: attached to the margins of the articular surfaces.
- **Ligaments**: 3 ***talo-calcanean ligaments*** (lateral, medial and interosseus).
- **Function**: the subtalar joint allows ***inversion and eversion*** of foot.




Navicular articular facet
Anterior calcaneal articular facet
Medial calcaneal articular facet
Talar sulcus
Posterior calcaneal articular facet
Flexor hallucis longus sulcus
A
Anterior talar articular facet
Middle talar articular facet
Sulcus calcanei
Posterior talar articular facet
Corpus calcanei
B


Tibia
Medial malleolus
Navicular surface
Talus
Navicular
Interosseous talocalcaneal ligament
Medial cuneiform
1st metatarsal
Sustentaculum tali
Calcaneus
Plantar aponeurosis
Long plantar ligament
Plantar calcaneonavicular (spring) ligament

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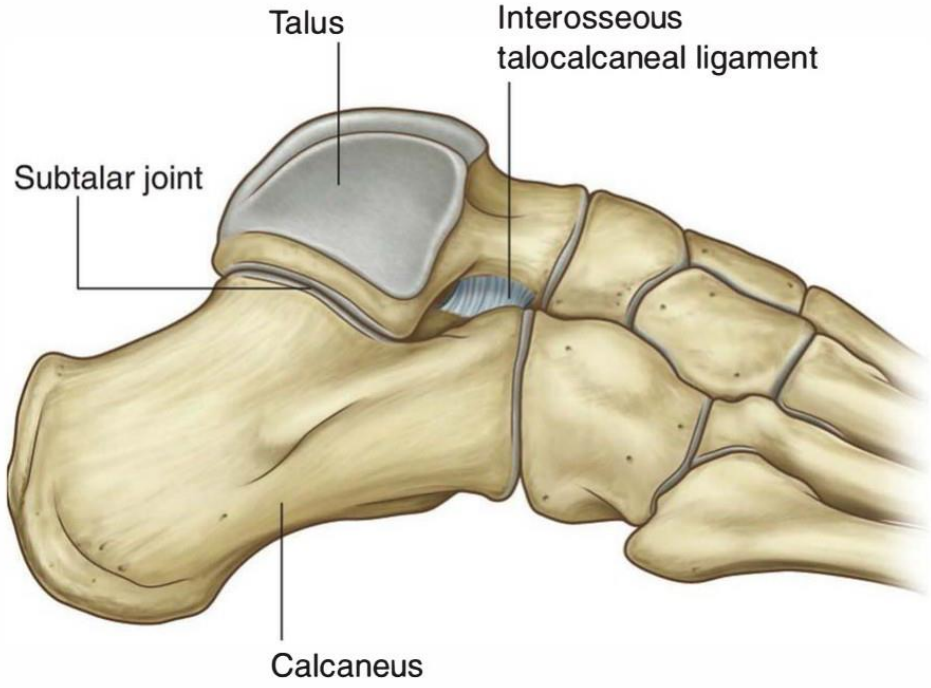
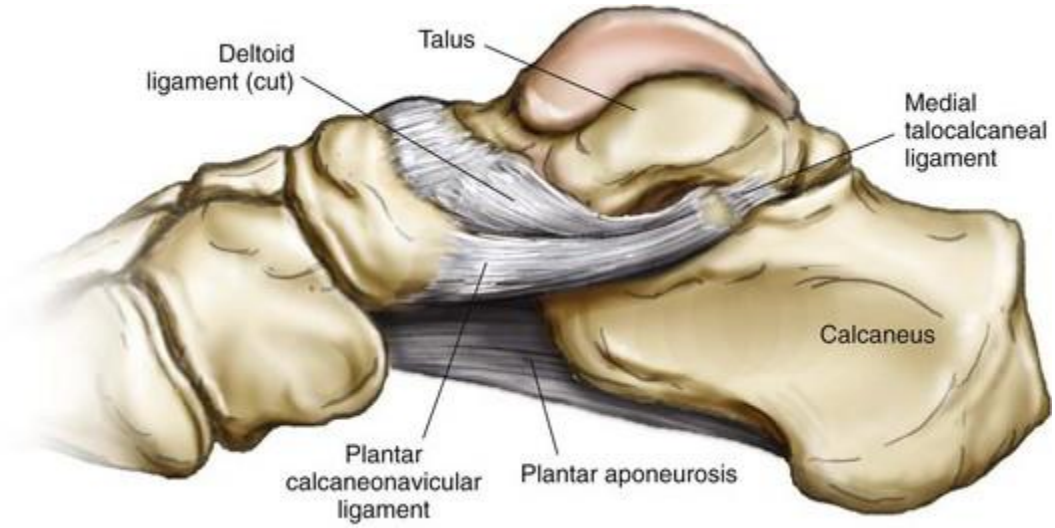
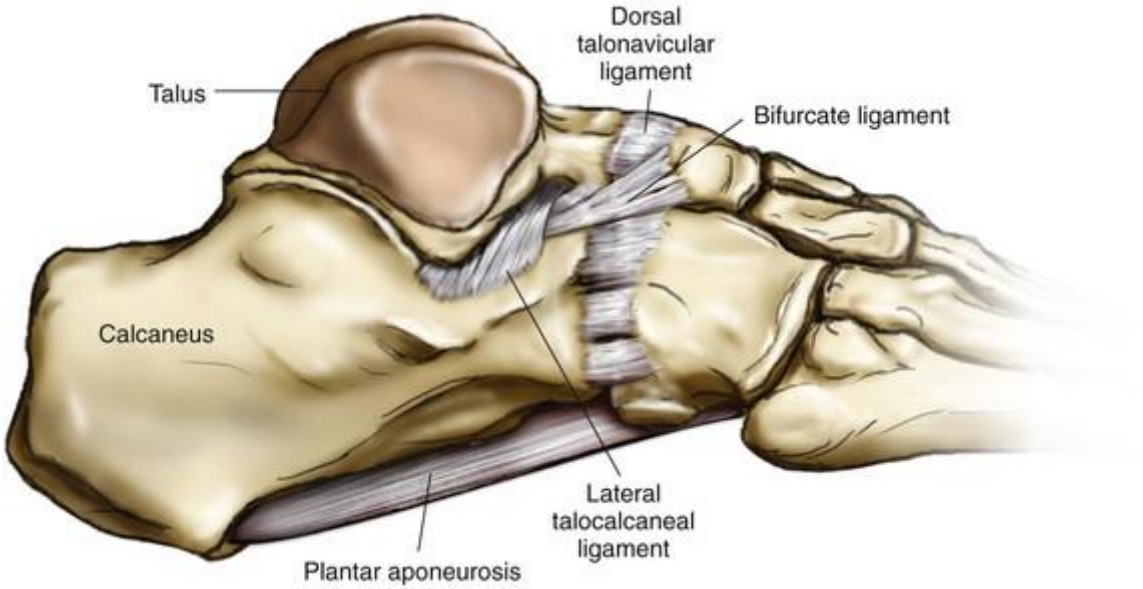
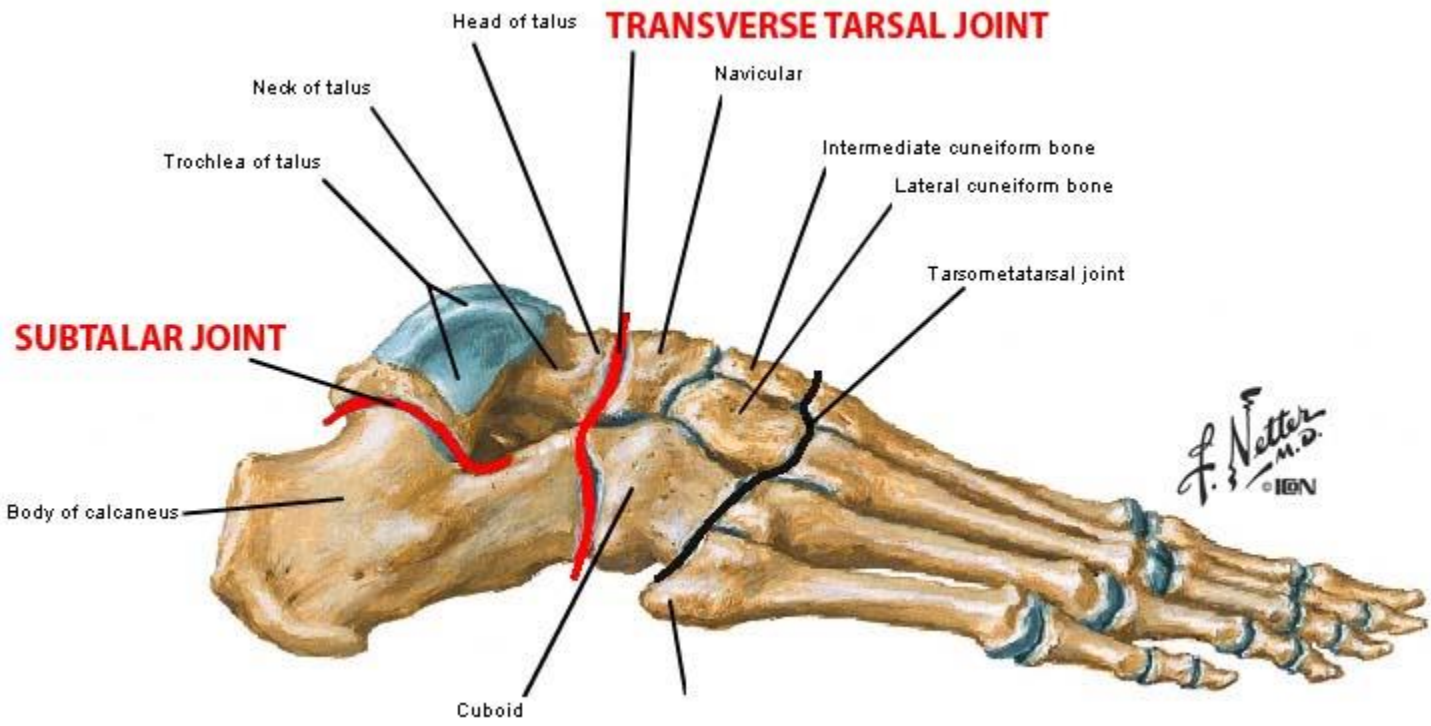

Talus
Interosseous talocalcaneal ligament
Subtalar joint
Calcaneus


Deltoid ligament (cut)
Talus
Medial talocalcaneal ligament
Calcaneus
Plantar calcaneonavicular ligament
Plantar aponeurosis


Dorsal talonavicular ligament
Talus
Bifurcate ligament
Calcaneus
Lateral talocalcaneal ligament
Plantar aponeurosis

2- Transverse tarsal (or midtarsal) joint : It is formed of 2 joints that lie transversely side-by-side:

a) **Talo-navicular joint (medially).**
b) **Calcaneo-cuboid joint (laterally) .**



A)Talo-calcaneo-navicular joint:

- **Type:** synovial joint.
- **Variety**: ***complex ball and socket***.
- **Articular surfaces**: between ***head of talus*** (a ball) which articulates with (a socket) formed by ***sustentaculum tali*** of ***calcaneus*** and ***navicular*** bones with the ***spring ligament*** between them.
- **Ligaments:**

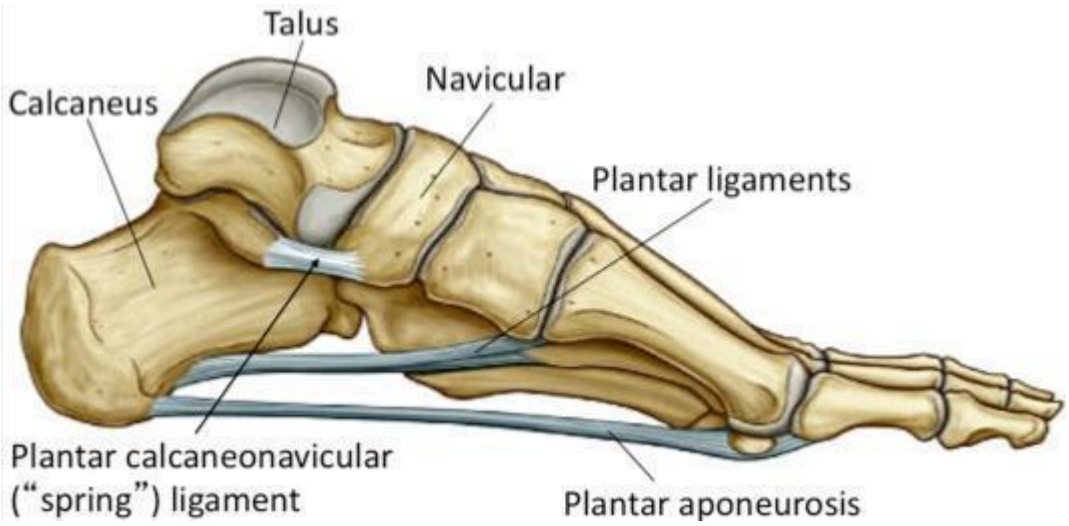
a. Spring (plantar calcaneo-navicular) ligament: it extends between ***the sustentaculum tali*** of calcaneus to the ***tuberosity of navicular*** bone ***on the plantar surface of foot.***

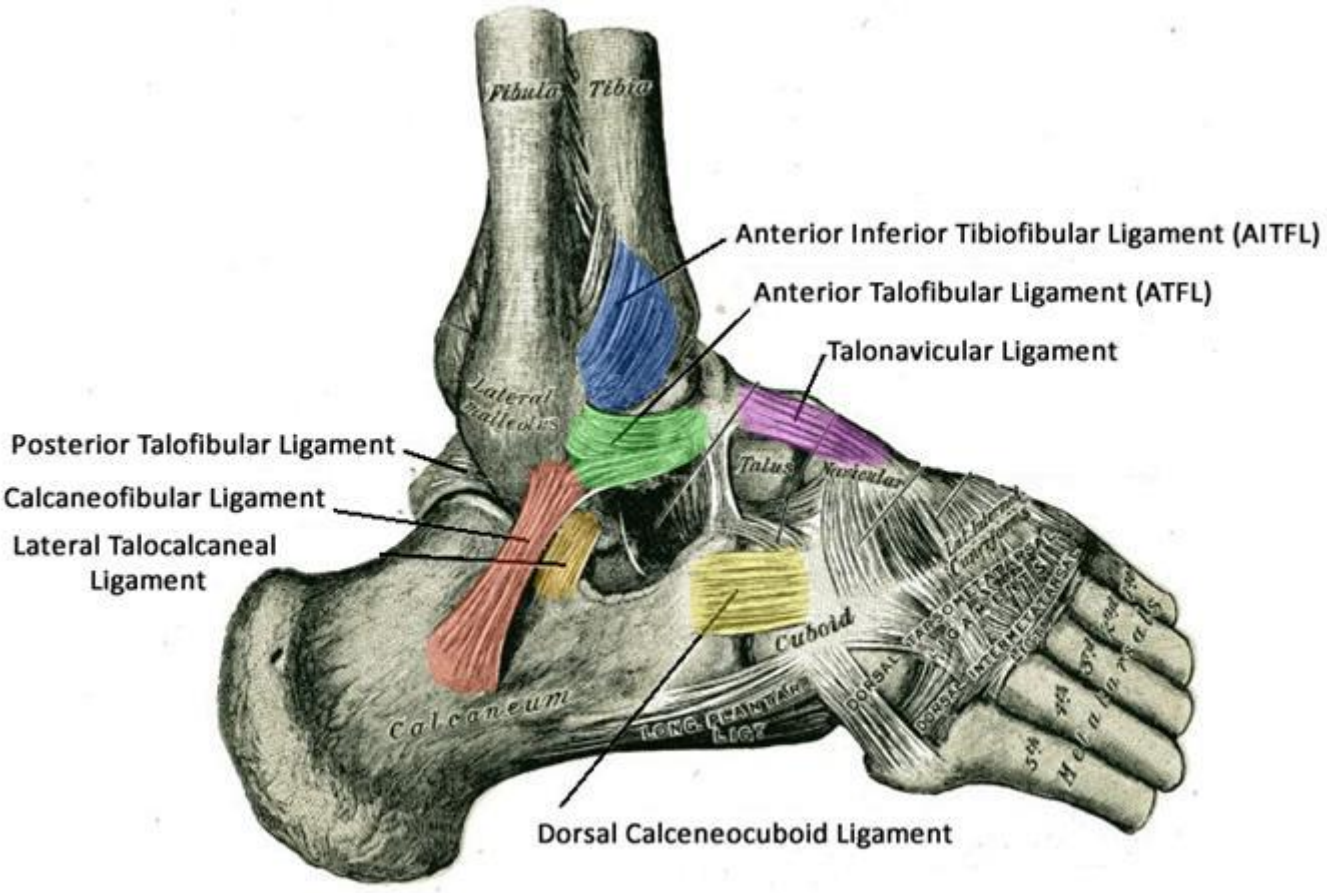
- It support head of talus from below , play an important role in transmission of body weight & maintain the medial longitudinal arch .

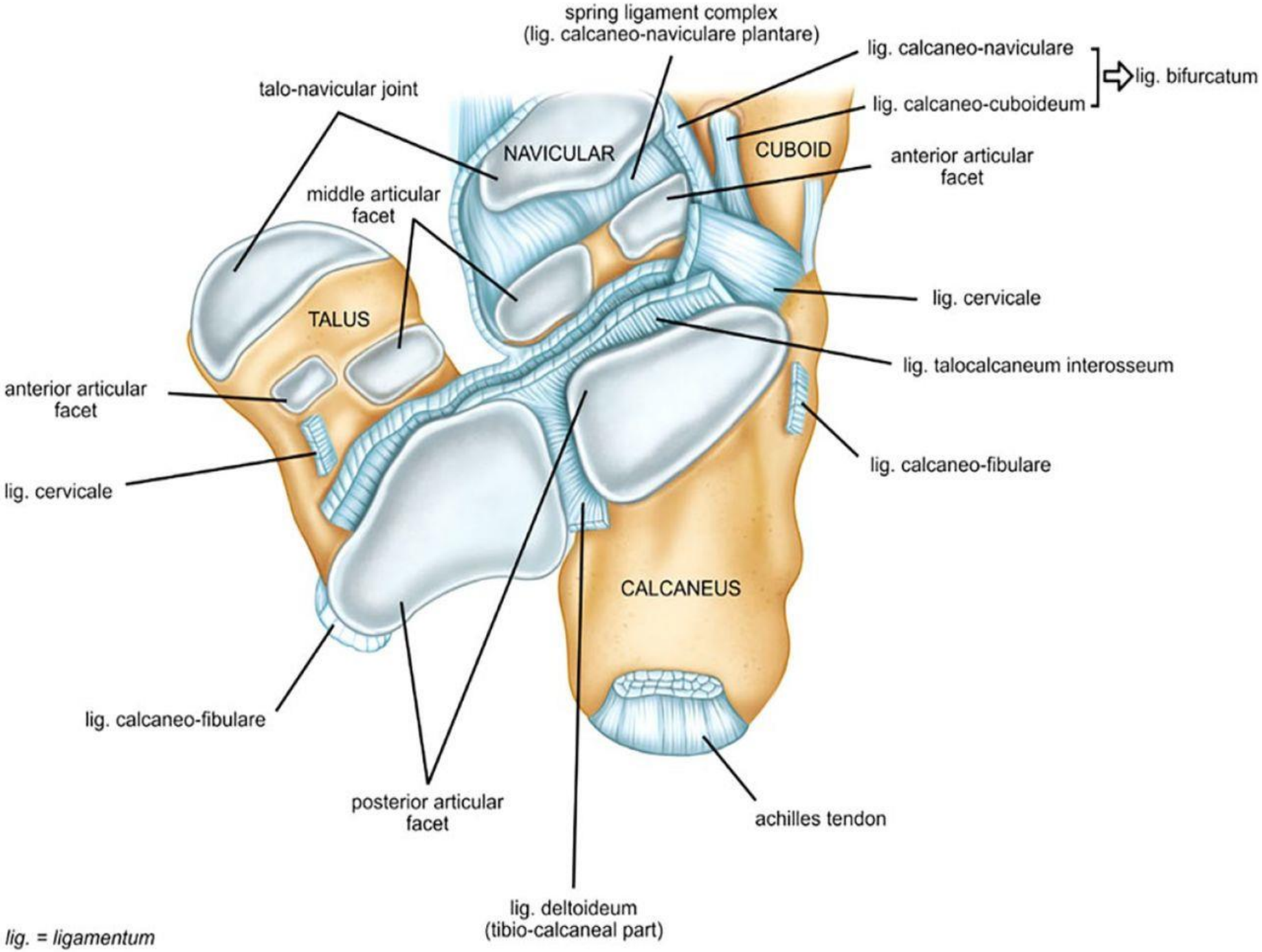
b. Dorsal Calcaneo-navicular ligament: it forms the ***medial limb*** of the ***bifurcate l***igament of the calcaneo-cuboid joint.

c.Talo-navicular ligament: connects the ***neck of talus to the navicular*** bone .

- **Function:** this joint allows ***inversion and eversion*** of foot.







lig. = ligamentum

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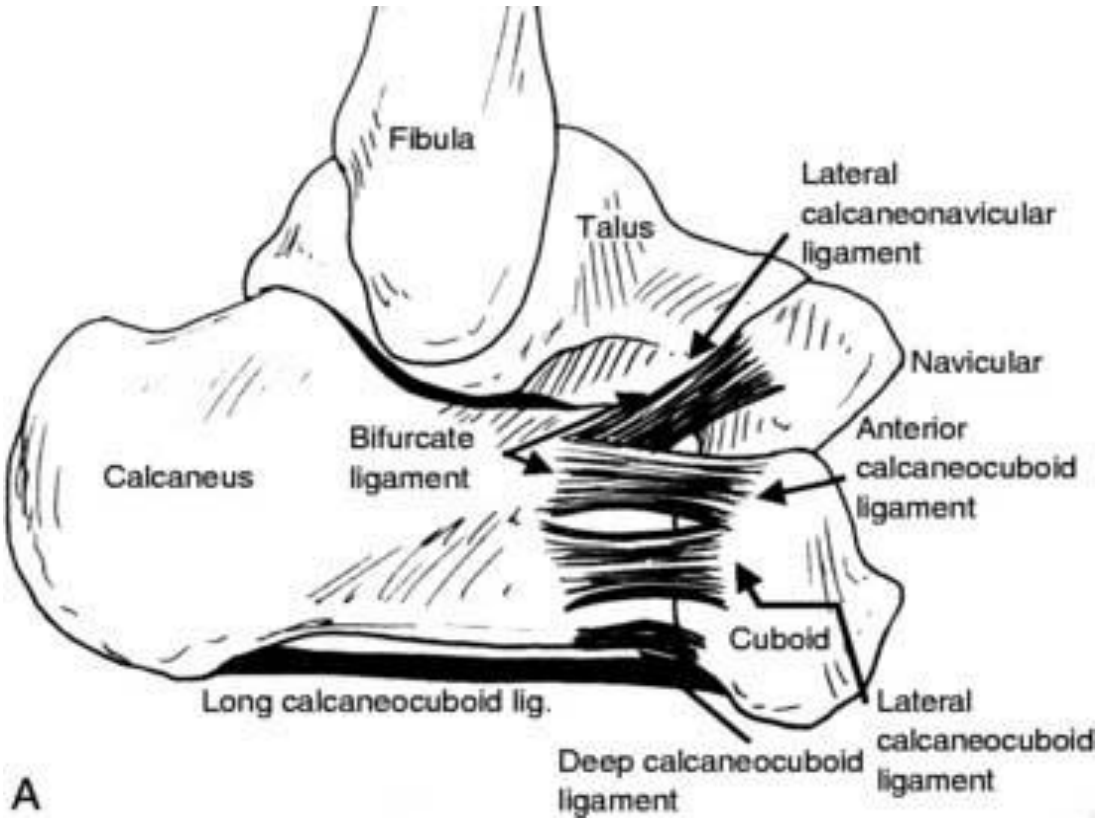
B) Calcaneo-cuboid joint:

- **Type**: synovial joint.
- **Variety:** ***saddle*** or biaxial joint.
- **Articular surfaces**: **anterior end of calcaneus** articulates with **posterior surface of cuboid** bone.
- **Ligaments:**
  - **Bifurcate ligament**: it is a ***Y-shaped*** ligament which lies on the ***dorsal surface of foot***. It is formed of a stem and 2 limbs:
    - The ***stem*** is attached to the **upper surface of calcaneus**.
    - The ***2 limbs*** are made of 2 ligaments:

      -Dorsal calcaneo-cuboid ligament: attached to the ***medial side of cuboid bone.***

      -Dorsal calcaneo-navicular ligament: attached to the ***lateral side of navicular bone.***
  - **Long and short plantar ligaments**: (see later)



Ligaments of the Foot

1) **Spring ligament**: **(plantar calcaneo-navicularligament)**

- It ***extends between*** the sustentaculum tali of calcaneus to the tuberosity of navicular bone on the plantar surface of foot.
- It is attached to the ***deltoid ligament*** (medial ligament of ankle).
- It is so called as it acts as a ***spring below the head of talus***.
- It is also called plantar calcaneo-navicular ligament as it lies on the medial side of the plantar surface of foot.
- It is **supported** from below by the tendon of ***tibialis posterior muscle.***
- It supports the ***medial longitudinal arch***; so weakness of this ligament results in a condition called ***flat foot***.

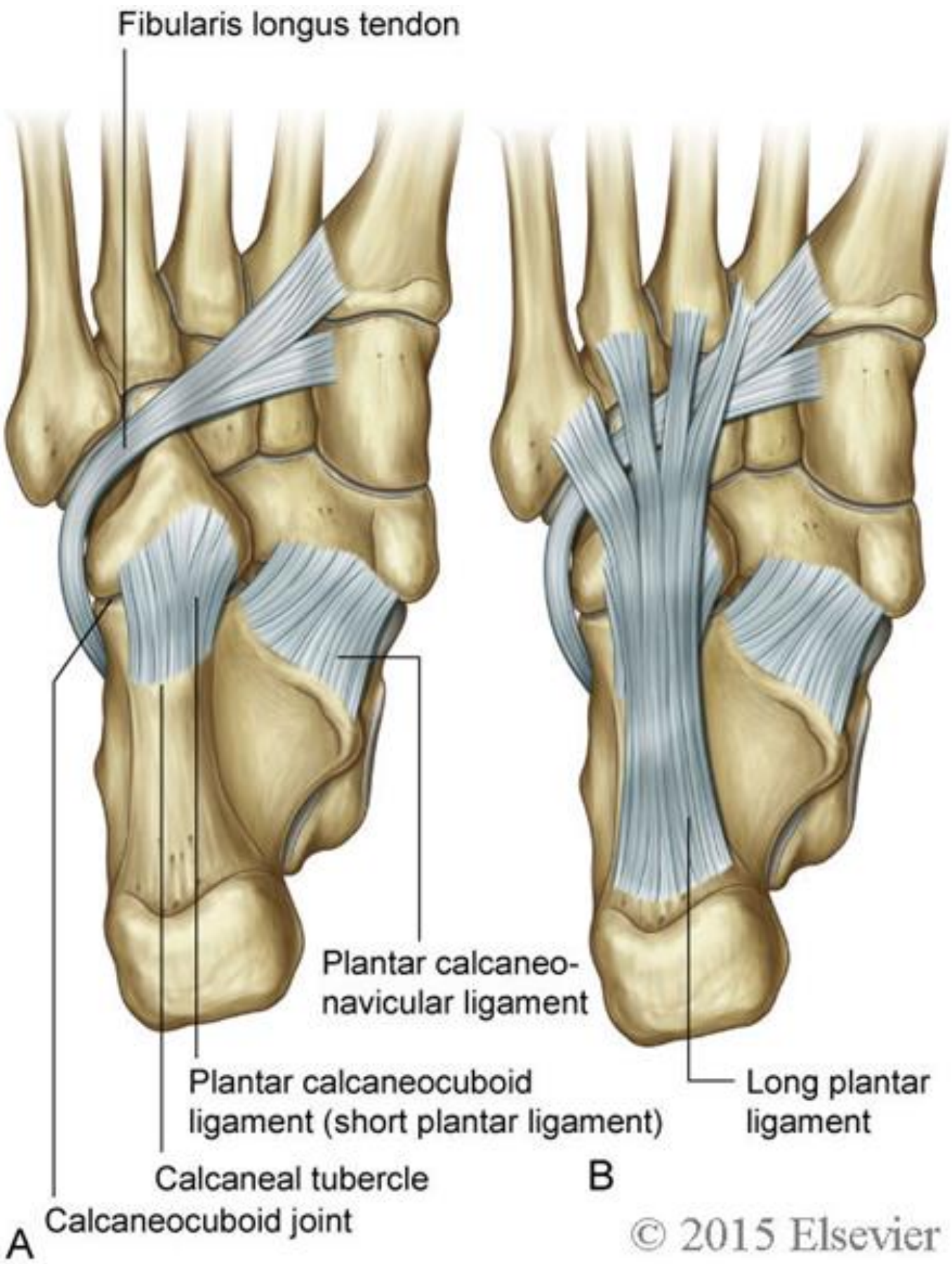
2) **Bifurcate ligament**: (see before).

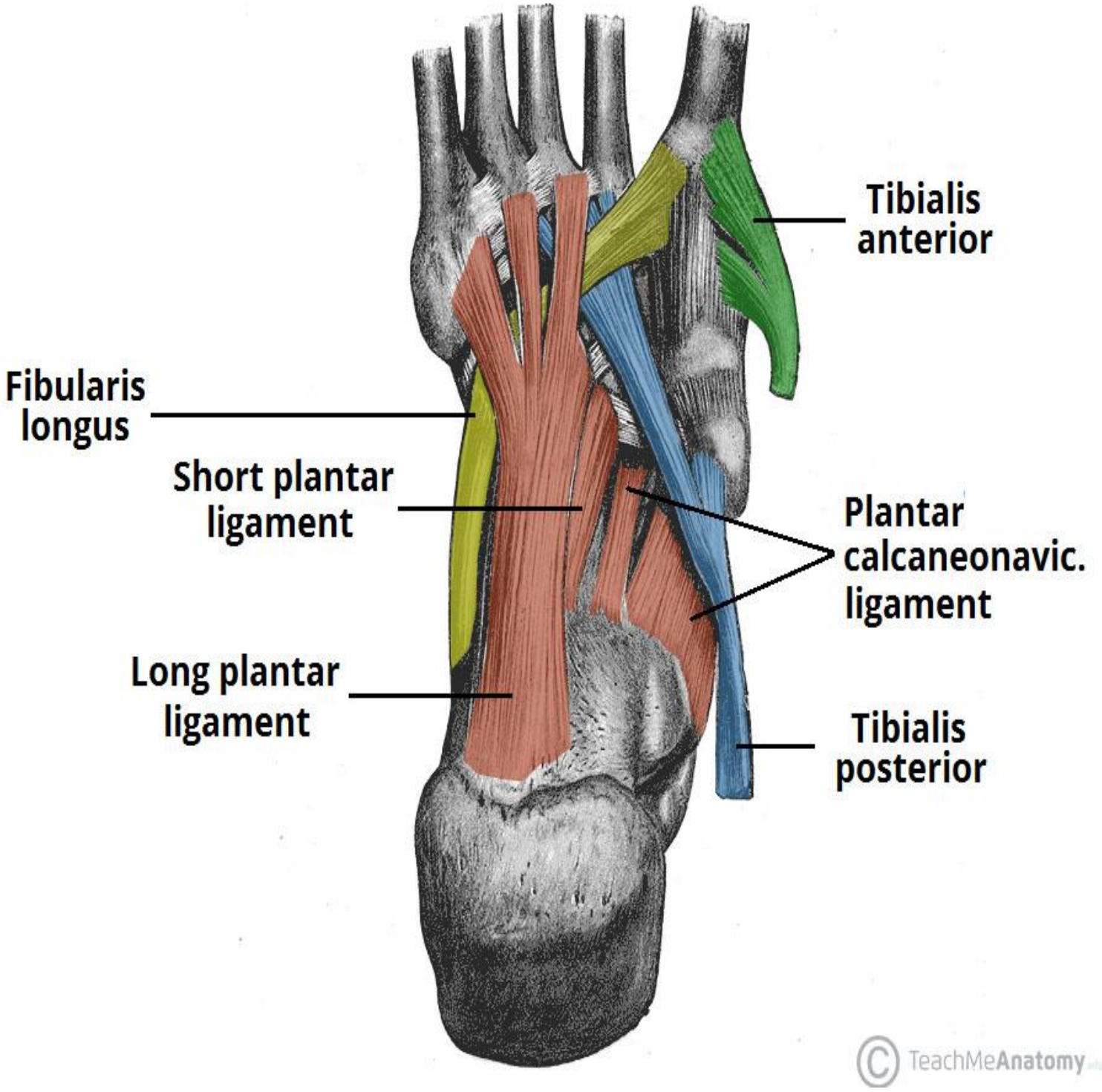
3) **Long plantar ligament**: lies on the ***lateral side of sole*** of foot.

- It ***extends*** from the plantar surface of ***calcaneus*** to the bases of lateral 3 ***metatarsal*** bones.
- It supports the ***lateral longitudinal arch*** of foot.
- With the cuboid bone, it forms a ***tunnel for*** the tendon of ***fibularis longus*** muscle.

4) **Short plantar ligament (or plantar calcaneo-cuboid**):

- It lies on plantar surface of ***lateral side of sole of foot*** (immediately **deep to** long plantar ligament).
- It stretches ***between*** the anterior calcaneal tubercle and the plantar surface of the cuboid bone.
- It supports the ***lateral longitudinal arch*** of foot.




Tibialis anterior
Fibularis longus
Short plantar ligament
Plantar calcaneonavic. ligament
Long plantar ligament
Tibialis posterior
TeachMeAnatomy

Inversion and Eversion of Foot

- **In inversion**: the sole turns medially (to inside).
- **In eversion**: the sole turns laterally (to outside).

These movements take place at the intertarsal joints:

1- Subtalar joint.

2- Talo-calcaneo-navicular joint.

The range of these movements is increased by the gliding action that occur at the transverse tarsal (mid-tarsal) joint.

Mechanism: the talus is fixed (by the 2 malleoli) while the calcaneus , navicular bones and spring ligament swing around it carrying the other bones of the foot with them.

Muscles acting in:

Inversion	**Eversion**
Tibialis anterior	**Fibularis** longus
Tibialis posterior	**Fibularis** brevis
	Fibularis tertius

N.B.: These movements are <u>not done</u> by the ankle joint.
