

ANATOMY

The Knee Joint

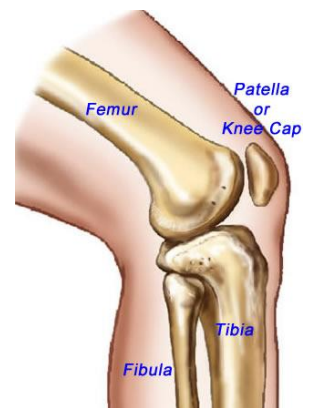


- The knee is a hinge synovial joint between the femur (thigh bone) and the tibia (shin bone).
- The joint is protected in front by the **patella (knee cap)** .
- Knee joint is a **complex compound synovial joint** (3 bone with meniscus) with a wide range of flexion & extension and limited medial & lateral rotation.
- It is the largest joint in the body .

Bones of knee joint

Three bones take part in forming the knee joint :

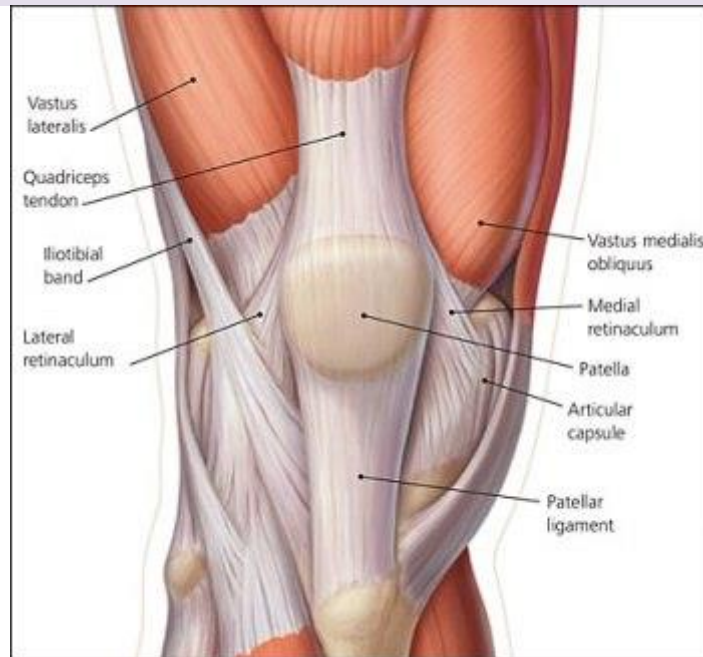
1. Lower end of the femur
2. Upper end of tibia
3. Patella (knee cup).



Patella

- Also known as the **knee cap or kneecap**
- is a thick , circular-triangular bone which **articulates with the femur (only !)** and **covers and protects the knee joint.**
- It is the largest sesamoid bone in the human body.
- It have apex (downward) and base (upward) .
- It is attached to the tendon of the **quadriceps femoris muscle**, which contracts to extend/straighten the knee.
 - ◇ The **vastus intermedius** muscle is attached to the base of patella.
 - ◇ The **vastus lateralis** and **vastus medialis** are attached to lateral and medial borders of patella respectively.

- The primary functional role of the patella is **knee extension** , The patella increases the leverage that the tendon can exert on the femur by increasing the angle at which it acts .



Articulations

The knee-joint is synovial hinge-joint, but is really of a much more complicated character

1. Femorotibial joint

- The lower end of femur has a curved articular surface, covered by **hyaline articular cartilages** ; **extends backward** and called medial and lateral condyles.
- The upper end of tibia has **oval** shaped articular surfaces, medial and lateral condyles.
- The femoral and tibial condyles articulate forming femorotibial joint.
 - This joint flexes and extends the knee.



2. Patellofemoral joint

- Patella articulates with femur to form patellofemoral joint
- is **plane gliding joint** , This joint allows the patella to glide over the surfaces of the femur as the knee flexes and extends.

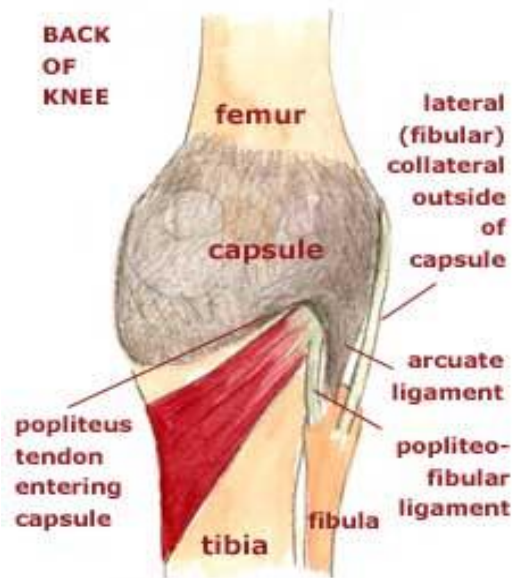
- The articular surfaces of femur, tibia, and patella are **covered with hyaline cartilage**.
- upper end of fibula (head) **does not adjoin** the femur .it articulates with lateral side of tibia, just below the lateral tibial condyles .this joint **allow slight movement**.

Capsule of knee joint

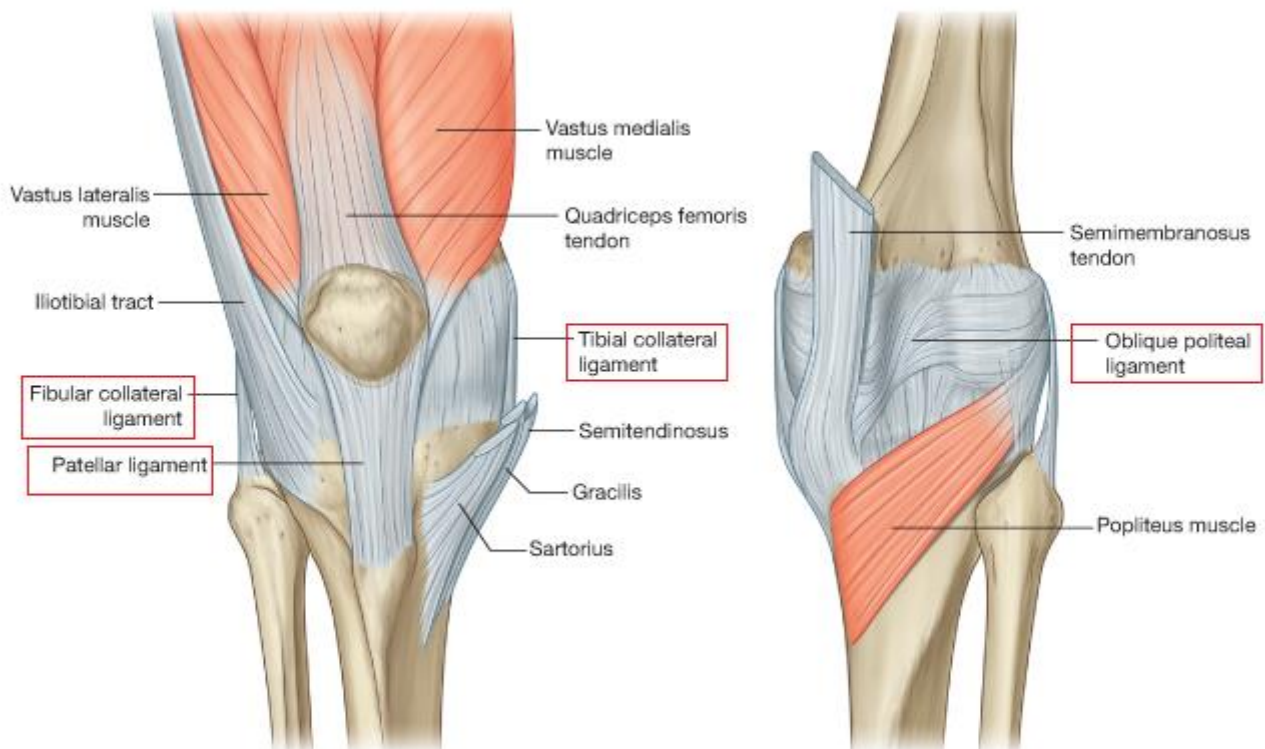
- The knee joint is enclosed by a **fibrous capsule**
- it is **thin** anteriorly and posteriorly but is reinforced on sides by a strong collateral ligaments.
- The articular capsule has a **synovial and a fibrous membrane** separated by **fatty deposits**.

Anteriorly: the synovial membrane is attached **on the margin of the cartilage** both on the femur and the tibia.

Behind: the synovial membrane is attached to **the margins of the two femoral condyles**.



- The fibrous capsule is supplemented and strengthened by **extracapsular ligaments**: patellar ligament, fibular collateral ligament, tibial collateral ligament, oblique popliteal ligament, and arcuate popliteal ligament.



Ligaments of knee joint

A-Extra capsular ligament

1. Tibial or medial collateral ligament

- is a broad flat, membranous band
- situated medially **near to the back** than to front of the joint
- Its attachments :
 - ◊ **above** to medial condyles of femur below adductor tubercle
 - ◊ **below** to the medial condyles and surface of tibial shaft.
- Forced abduction of tibia on femur, result in partial tearing of this ligament .

2. Fibular or lateral collateral ligament

- is cord-like fibular collateral ligament
- descends from **lateral epicondyles of femur** to **styloid process and head of fibula**
- separated from lateral meniscus by **popliteus muscle tendon**.
- Forced adduction of tibia on femur results in partial tearing of this ligament .

3. Oblique popliteal ligament

- is a tendinous expansion of **semimembranosus** muscles.
- It strengthens the **posterior** aspect of the capsule.
- This ligament is a broad, flat, fibrous band.
- The oblique popliteal ligament forms part of the floor of the popliteal fossa, and the popliteal artery rests upon it.

4. Ligamentum patellae

- The patellar ligament connects the **patella** to the **tuberosity of the tibia**.
- It is also occasionally **called the patellar tendon** because there is no definite separation between the quadriceps tendon (which surrounds the patella) and the area connecting the patella to the tibia.

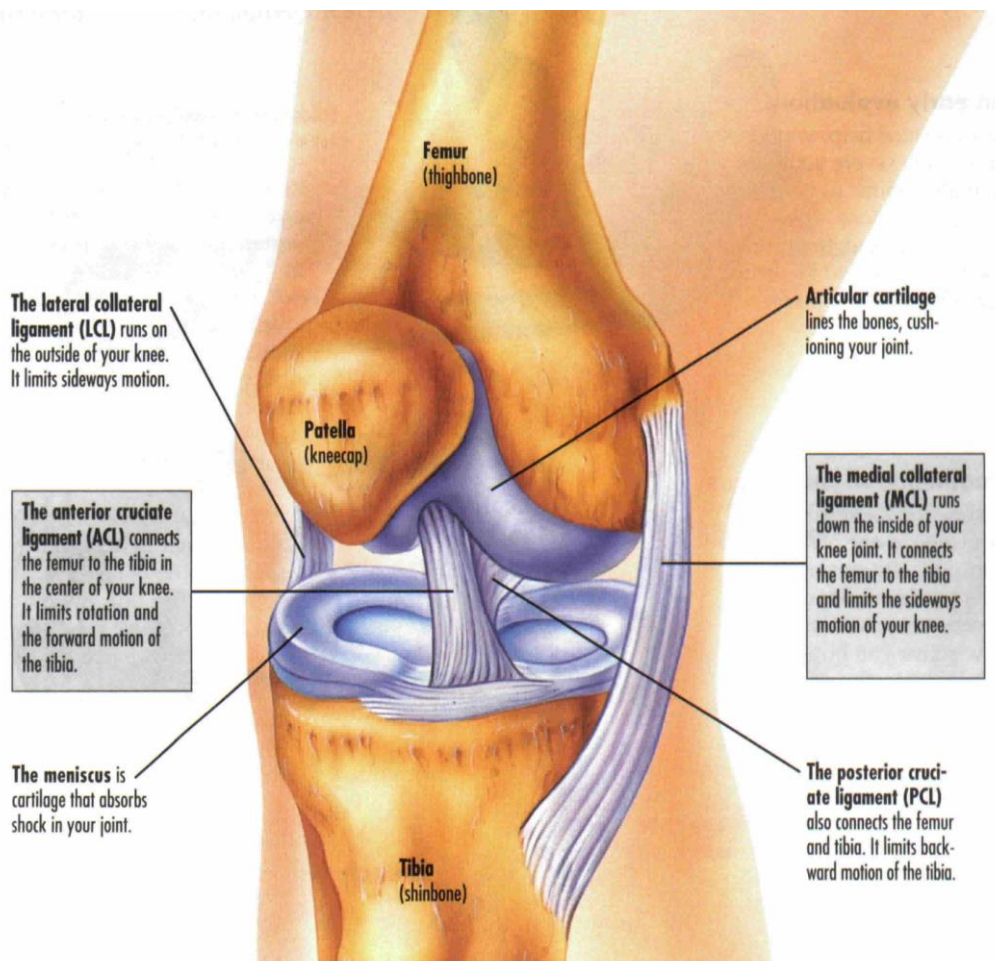
- This very strong ligament gives the patella its mechanical leverage and also functions as a cap for the condyles of the femur.

5. Arcuate Popliteal Ligament

- A triangular band in the posterior part of the knee
- passes medially downward from the lateral condyle of the femur to the area between the condyles of the tibia and to the head of the fibula

B-Intracapsular ligaments

- it comprised the menisofemoral ligament and anterior and posterior cruciate ligaments
- covered by synovial membrane , both are crossed each other and serve to protect the ends of bone from rubbing on each other:



1. Anterior cruciate ligament

- its distal attachment to **anterior intercondylar area**, passed upwards backwards and laterally, and attached to **posterior part of medial surface of the lateral femoral condyle**.
- It's **slack** when the knee is flexed and **taut** when it is fully extended
- ◇ It's prevents posterior displacement of the femur on the tibia hyperextension of the knee joint.
- ◇ Also prevents tibia from pulled anteriorly When the joint is flexed at a right angle

2. Posterior cruciate ligament

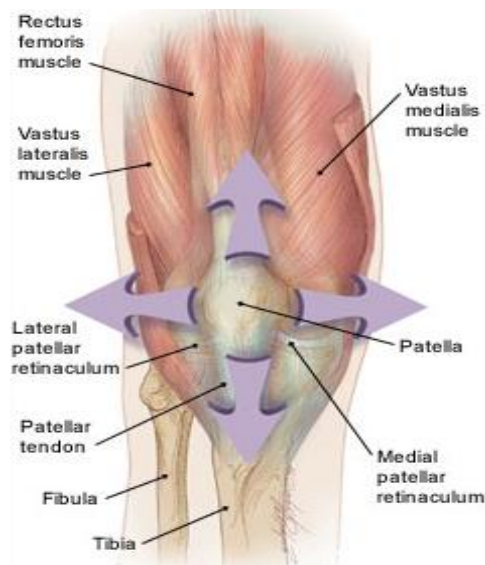
- its distal attachment to **posterior intercondylar area**, passed upwards, forwards and medially, to attached to the **anterior part of the lateral surface of medial femoral condyle**.
- It tightens during flexion of the knee joint
- ◇ It's prevents anterior displacement of the femur on the tibia or posterior displacement of the tibia.
- ◇ It also helps to prevent hyperflexion of the knee joint.
- ◇ In the weight bearing flexed knee, it is the main stabilising factor for the femur, e.g., when walking downhill or downstairs.
- Both ligaments may be cracked or torn when knee is forcefully rotated

3. Menisofemoral ligament

- attaches the posterior border of lateral meniscus close to femoral attachment of posterior cruciate ligaments.
- ◇ It stabilizes the meniscus during rotation of femur on tibia.
- ◇ It is also covered with synovial membrane.

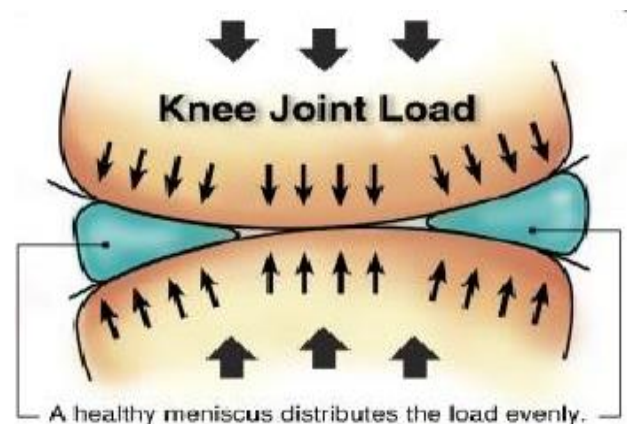
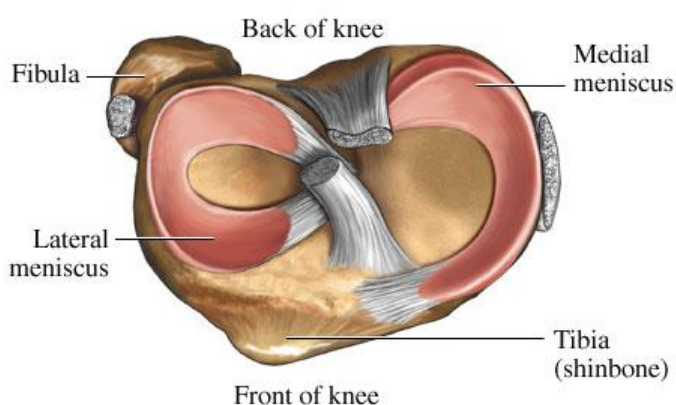
4. Transverse Ligament

- Connects the Anterior margin of the lateral meniscus to the anterior end of the medial meniscus .



Menisci (medial and lateral)

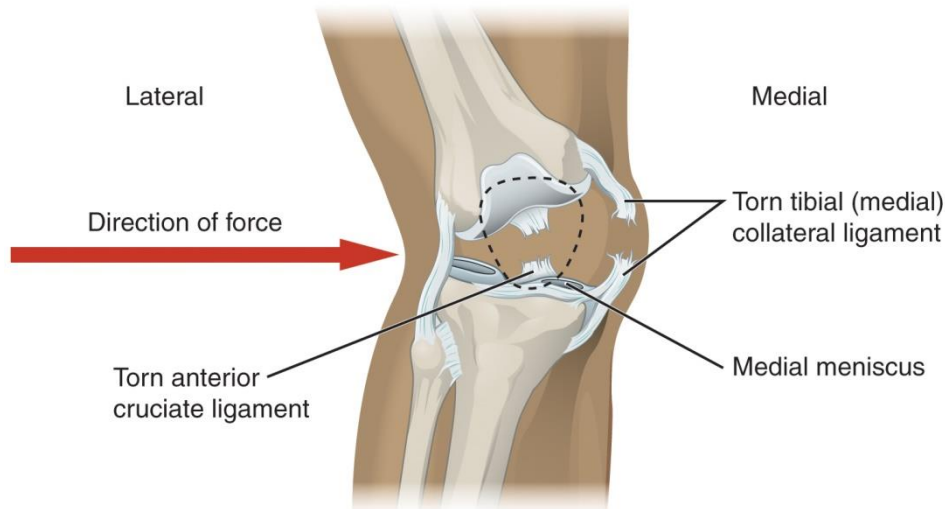
- are two c-shape semi lunar pads of fibrocartilage (???)
- interposed between the femoral and tibial condyles.
- Menisci **deepen the articular surfaces of tibial condyle** by forming a concave surface to receive femoral condyle , also it act **as a cushions between the tibia and femur** .
- This arrangement **distributes the weight over joint surface** , and also **helps in stabilization of the joint by block abnormal movement between tibia and fibula**.



Clinical notes

- Injuries menisci are common.

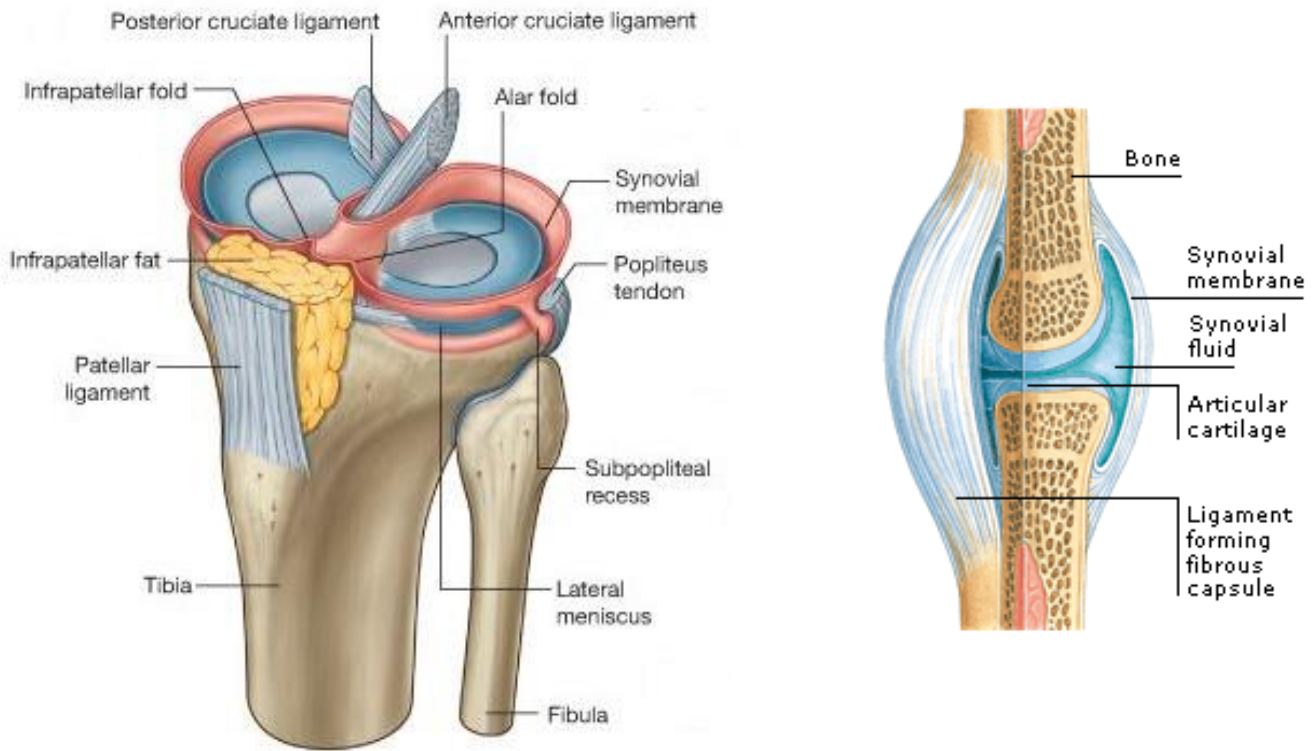
- **Medial menisci** is damaged more frequent than lateral because of its strong attachment to medial collateral ligament of the knee which restricts its mobility. (Usually the foot stays fixed on the ground and the rest of body rotates)



Synovial membrane

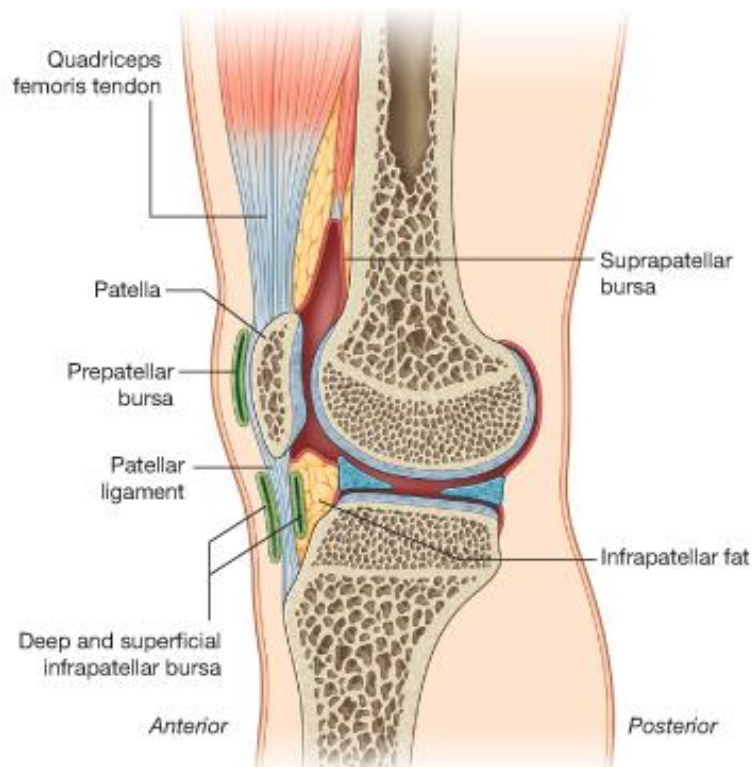
- The interior of knee joint capsule is lined by a synovial membrane, which secretes **synovial fluid** to lubricate the joint.
- **On femur:** it is attached to the **margins of intercondylar notch** and covers the front and sides of :
 - cruciate ligaments
 - infrapatellar pad of fat
 - tendon of popliteus
- The synovial membrane **does not** cover the menisci.

Joint cavity: space inside synovial membrane, both femorotibial and patellofemoral joints are incorporated within same joint cavity.



Bursa

numerous synovial sac , act as cushions between tendon and bone, ligament and bone, or skin and bone.



Anterior bursae

are present in front of knee

1. Suprapatellar bursa

beneath the quadriceps.

2. Prepatellar bursa

lies in the subcutaneous tissue between skin & the front of the lower half of the patella & the upper part of ligamentum patellae.

3. Superficial infrapatellar bursa

lies in the subcutaneous tissue between the skin and the front of the lower part of the ligamentum patellae.

4. Deep infrapatellar bursa

lies between the ligamentum patellae and the tibia

Lateral bursa

1. Between LCL & biceps femoris tendon
2. Between the LCL & the capsule , where it overlies popliteus tendon

Medial bursa

1. between MCL & the tendons of sartorius, gracilis & semitendinosus
2. Between the MCL & the tibia & joint capsule

Posterior bursae

are 6 bursae in the back of knee.

- 1-Popliteal bursa : Under popliteus tendon
- 2-Semimembranosus bursa
- 3-Between joint capsule & medial head of gastrocnemius
- 4-Between joint capsule & lateral head of gastrocnemius

Semitendnosis bursa (???????)

Inflammations of bursa is **bursitis**, may be due to trauma or disease

Movement

The principle movements of the knee joint are flexion & extension

1. Flexion

Produced by biceps femorus , semimembranosus & semitendinosus

Assisted by Gracillus , Sartorius & popliteus

2. Extension

Produced by quadriceps femoris & gluteus maximums

3. Medial rotation

Produced by Sartorius , Gracillus & Semitendinosus

4. Lateral rotation

Produced by biceps femorus

Stability of knee joint

Factors responsible for knee joint stability are :

1. **Muscle tone** : especially in quadriceps

2. **Cruciate ligaments** :

- stabilize femur on tibia
- preventing anteroposterior movement

3. **Collateral ligaments** : assist in medial and lateral stability

4. **Iliotibial tract** : stabilizes knee joint during extension

5. **Oblique posterior ligament** : prevent hyperextension

Innervation

- Sensory fibers from femoral nerve
- Genicular branches from tibial nerve and common peroneal nerve
- Fiber from posterior division of obturator nerve

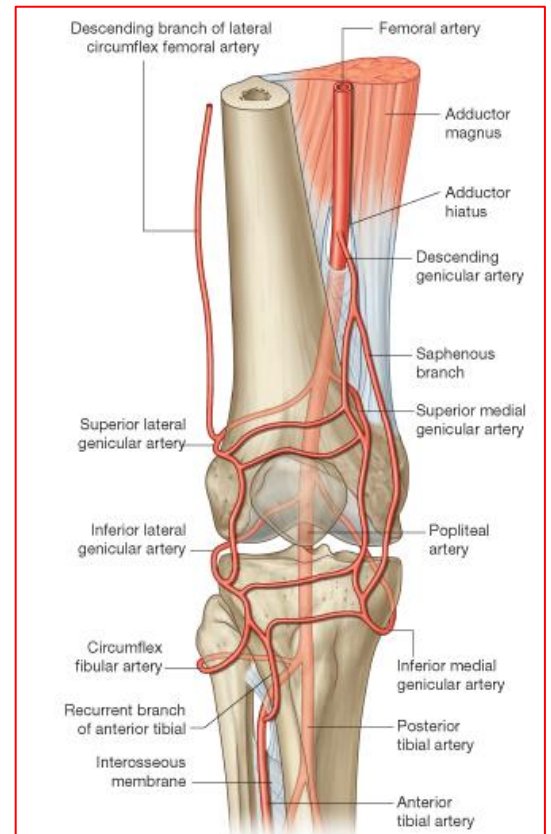
Blood supply (anastomosis around knee joint)

- The knee joint receives blood supply from extensive **genicular anastomosis** mainly from popliteal, anterior and posterior tibial artery.

➤ Popliteal artery in its course through the fossa, it gives off medial and lateral superior genicular arteries to form collateral circulation around the knee joint

➤ Also medial and lateral inferior genicular arteries encircle the leg and form anastomosis around the knee joint.

1. Superior medial & lateral genicular arteries
2. Inferior medial & lateral genicular arteries
3. Descending genicular artery from (femoral artery)
4. Recurrent branch of anterior tibial artery



Important Relation

Anteriorly	<ul style="list-style-type: none"> ● The prepatellar bursa
Posteriorly	<ul style="list-style-type: none"> ● Popliteal vessels ● tibial & common peroneal nerves ● lymph nodes ● the semimembranosus ● semitendinosus ● biceps femoris ● the heads of gastrocnemius ● plantaris
Medially	<ul style="list-style-type: none"> ● Sartorius ● Gracilis ● Semitendinosus

Laterally

- Biceps femoris
- common peroneal nerve