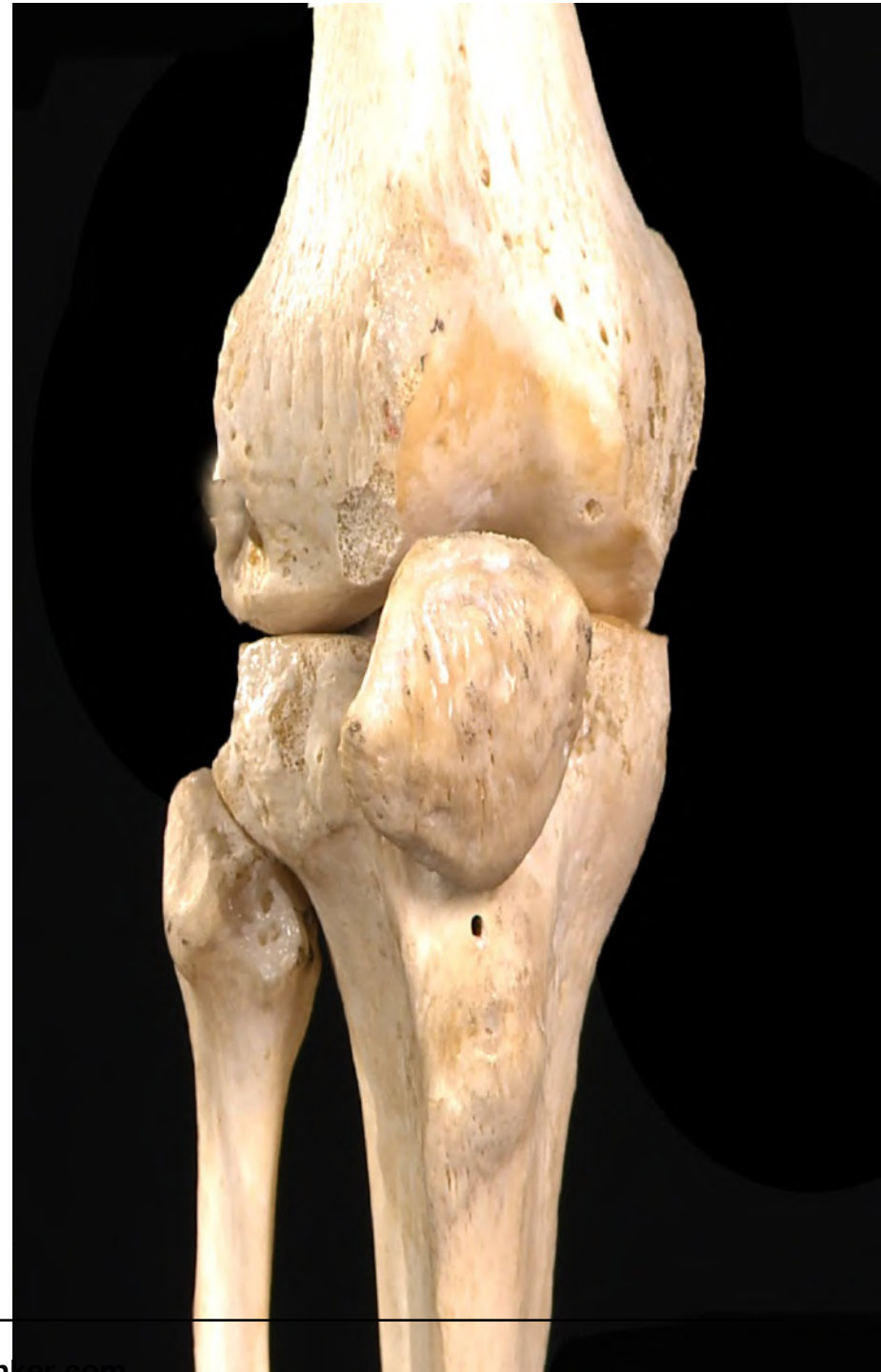


INTRODUCTION

- The knee joint is the largest and most complicated joint in the body.
- It is a modified hinge variety of synovial joint (because it allows some rotatory movements beside flexion and extension)



- It consists of 3 joints
 1. Medial condylar joint -
between the medial condyle of
the femur & medial condyle of
Tibia.
 2. Lateral condylar joint –
between the lateral
condyle of tibia & lateral
condyle of femur.
 3. Patellofemoral joint –
between the patella &
Patellar(trochlear) surface of
the femur



The Knee Joint

Consists of 3 distinct articulations
to form a complex hinge joint

- Medial Tibiofemoral joint





The Knee Joint

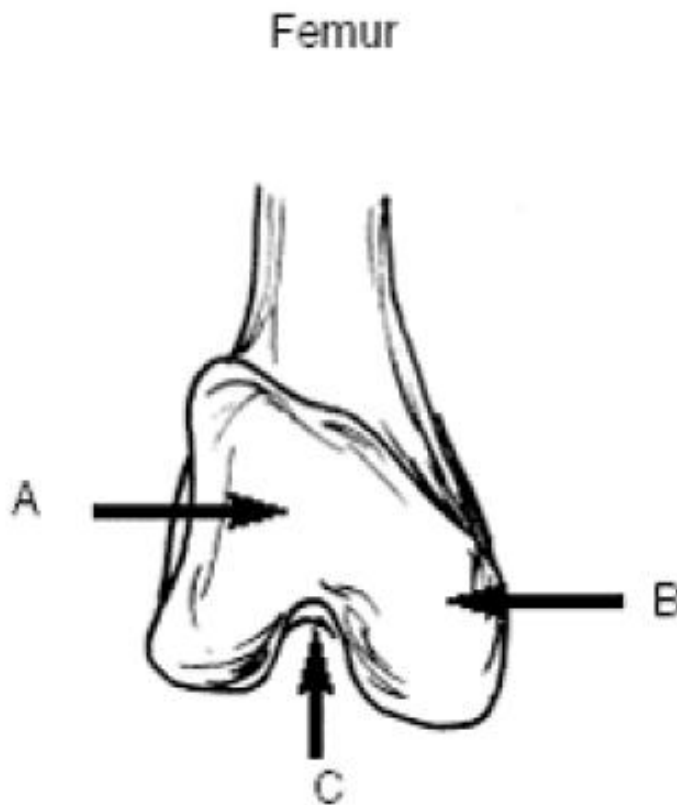
Consists of 3 distinct articulations to form a complex hinge joint

- Medial Tibiofemoral joint
- Patellofemoral joint
- Lateral Tibiofemoral joint



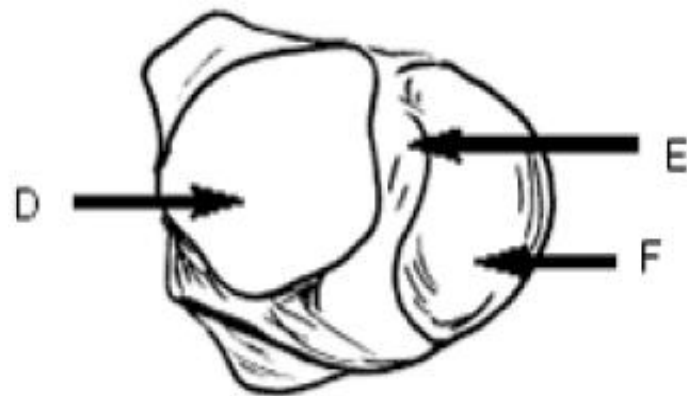
TIBIOFEMORAL JOINT

FEMORAL CONDYLES



- A – Lateral Condyle
 - Smaller radius of curvature
 - Smaller in all dimensions
 - Extends more anteriorly
- B – Medial Condyle
 - Larger radius of curvature
 - Extends more distally
- C – Intercondylar notch

TIBIAL PLATEAU



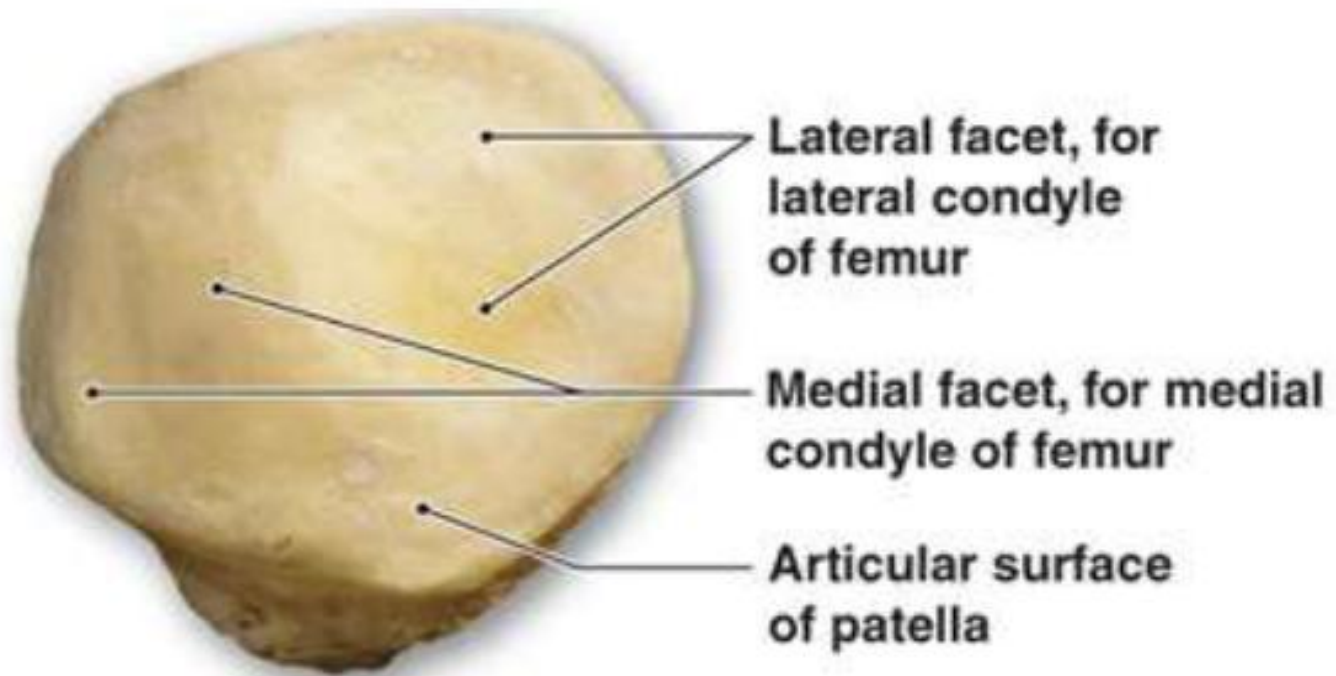
Tibia

- D – Medial Plateau
 - Greater surface area
 - Concave
 - Circular shape
- E – Intercondylar Eminence
- F – Lateral Plateau
 - Smaller surface area
 - Convex
 - Oval shape

PATELLOFEMORAL JOINT

- The patellofemoral joint is composed of the suprapatellar pouch, the patella bone, trochlear surface, the medial and lateral femoral condyles, and the medial and lateral patellofemoral ligaments

- The patella is one of the sesamoid bones of the body. It has a medial and a lateral facet that articulate with its respective condyles.
- Centrally, there is an apex of the bone that sits in the trochlea

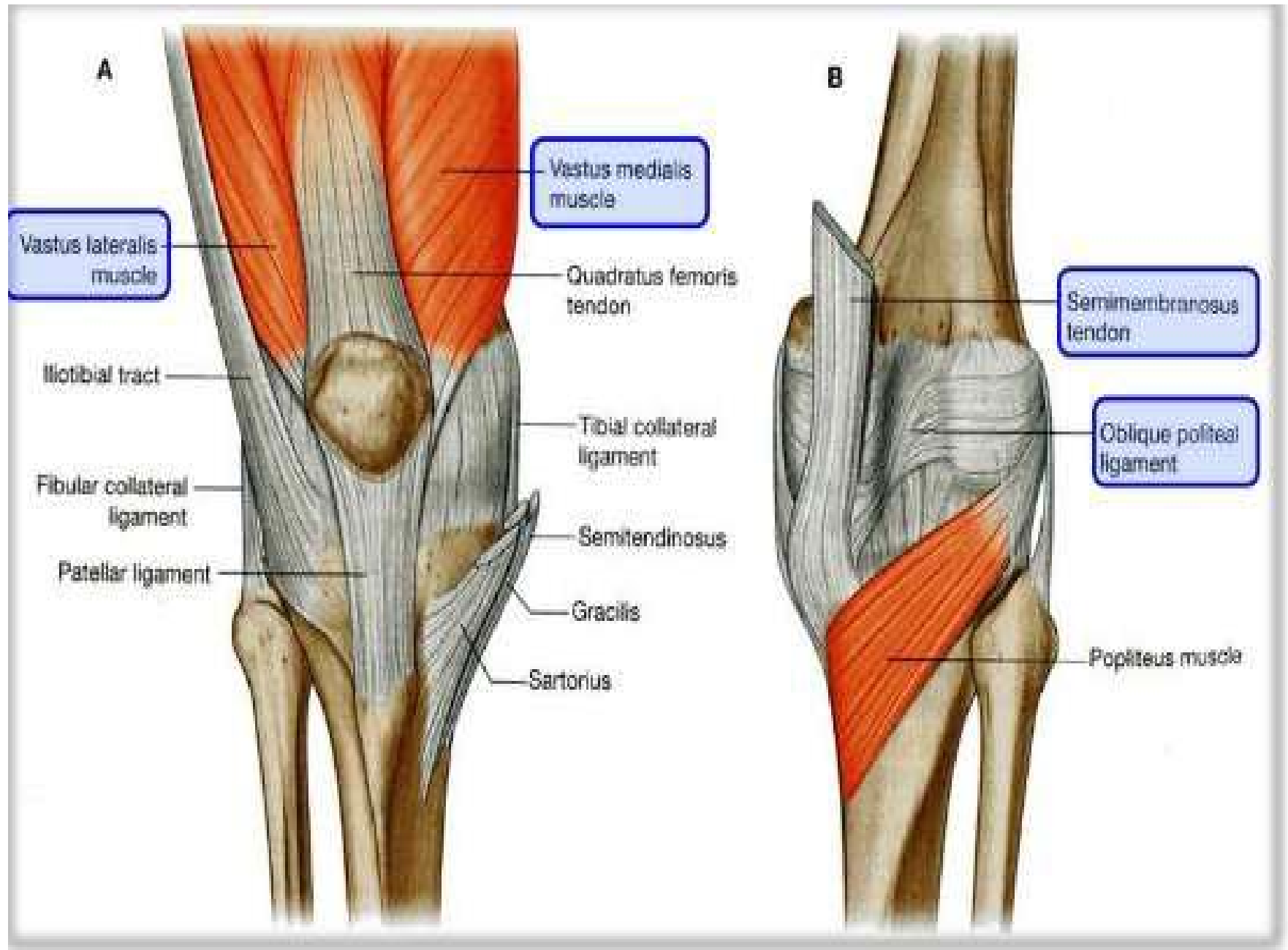


- In extension, the distal portion of lateral articular patella facet articulate with the lateral femoral condyle, but medial patellar facet barely articulates with the medial femoral condyle until complete flexion is approached
- The medial and lateral patellofemoral ligaments are thickenings of the medial and lateral retinaculum respectively. They originate centrally on the patella and insert onto the medial and lateral epicondyles of the femur

CAPSULE

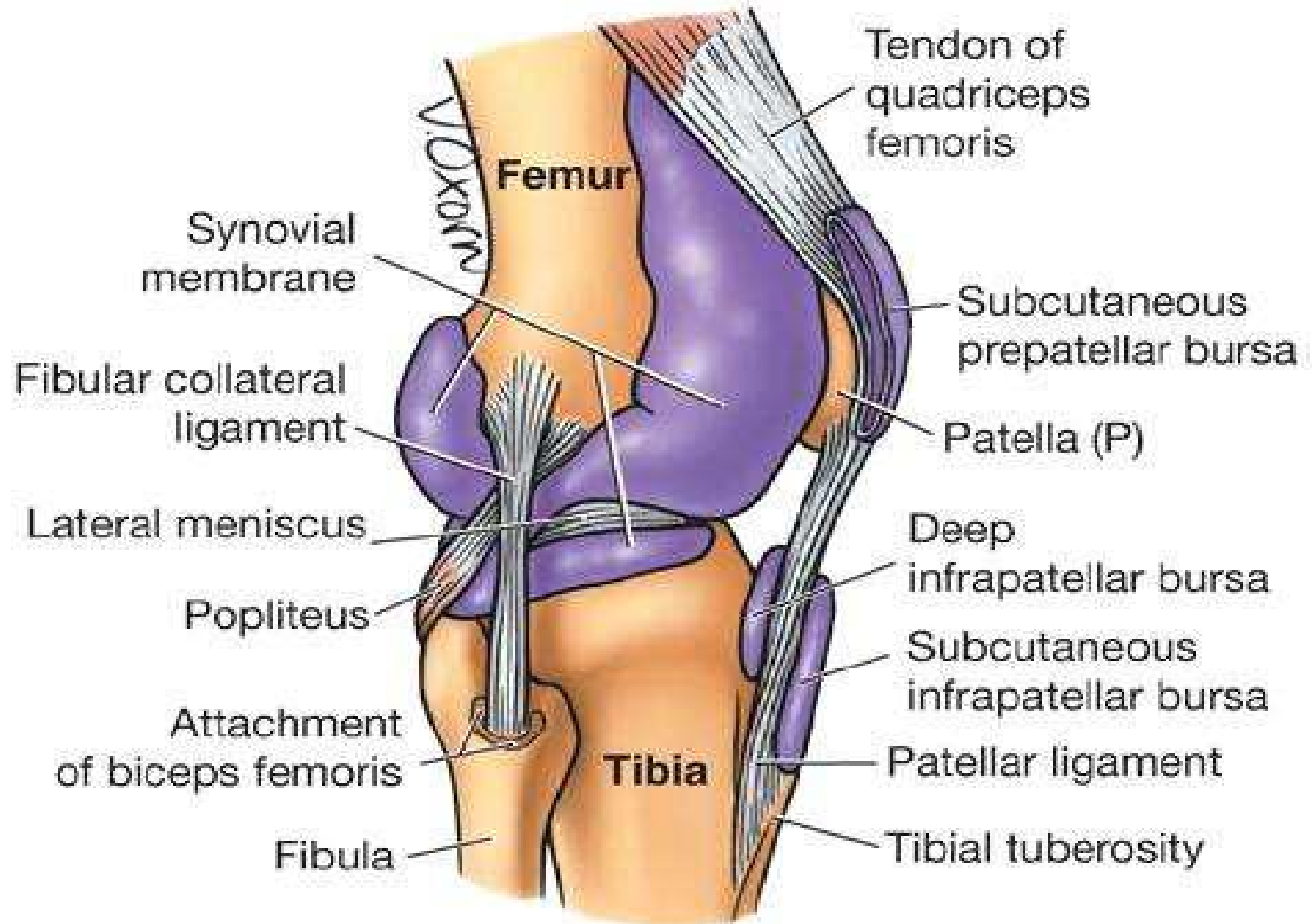
- Attached to the margins of articular surfaces & surrounds the sides and posterior aspect of the knee joint
- On the front of the joint the capsule is absent, permitting the synovial membrane to pouch upward beneath the quadriceps tendon forming the suprapatellar bursa
- On each side of the patella the capsule is strengthened by expansions from the tendons of vastus lateralis & medialis

- Behind the joint, the capsule is strengthened by an expansion of semimembranosus muscle called the oblique popliteal ligament
- An opening in the capsule behind the lateral tibial condyle permits the tendon of the popliteus to emerge



SYNOVIAL MEMBRANE

- The synovial membrane of the knee joint attaches to the margins of the articular surfaces and to the superior and inferior outer margins of the menisci.
- It lines the joint capsule except posteriorly where cruciate ligaments found.
- In front, it is absent from patella
-



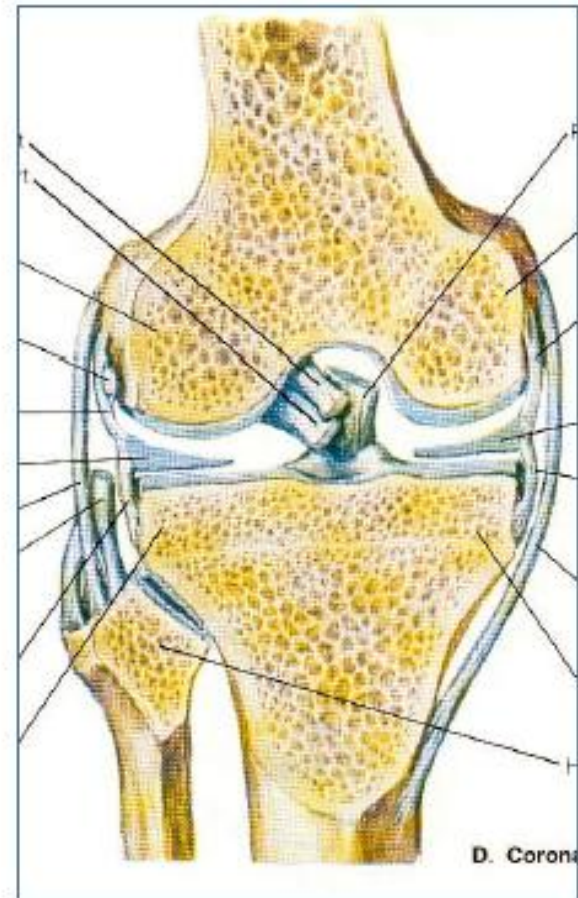
A Lateral view

LIGAMENTS

- CORONARY LIGAMENT.
- LIGAMENTUM PATELLAE.
- ANTERIOR CRUCIATE LIGAMENT.
- POSTERIOR CRUCIATE LIGAMENT.
- TIBIAL/MEDIAL COLLATERAL LIGAMENT.
- FIBULAR/LATERAL COLLATERAL LIGAMENT.
- OBLIQUE POPLITEAL LIGAMENT.
- ARCUATE POPLITEAL LIGAMENT.
- MEDIAL MENISCUS.
- LATERAL MENISCUS.
- TRANSVERSE LIGAMENT.

CORONARY LIGAMENT

- Fibrous Capsule is attached to periphery of Menisci.
- Connects the periphery of the menisci to the tibia
- They are the portion of the capsule that is stressed in rotary movements of the knee



LIGAMENTUM PATELLAE

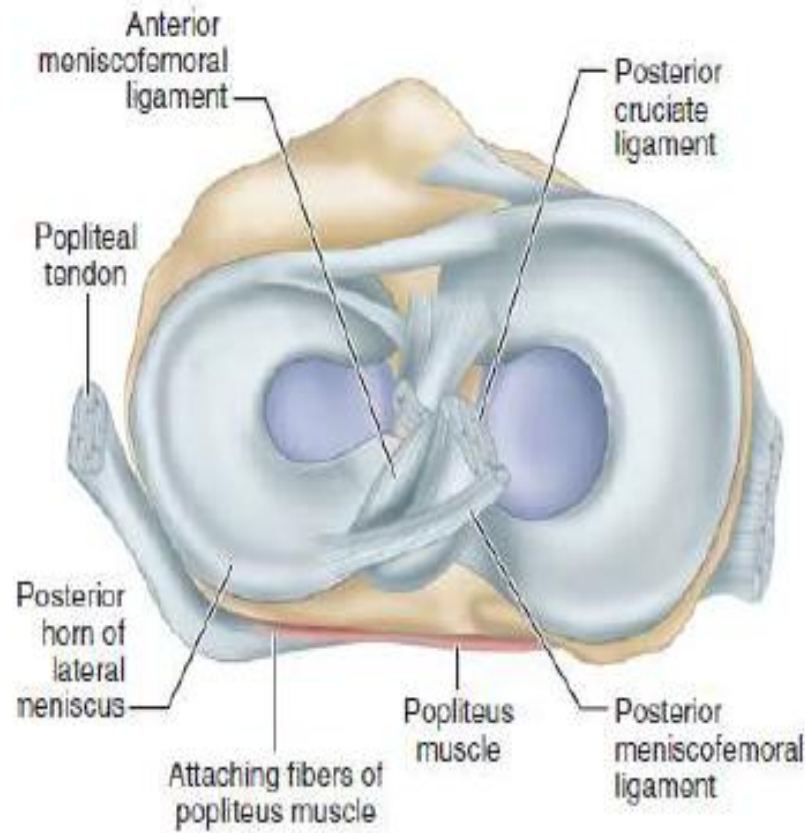
Attaches the
Patella to the Tibia.

It is the continuation
of the tendon of
Quadriceps Femoris



CRUCIATE LIGAMENT

- VERY THICK, STRONG FIBROUS BANDS
- DIRECT BONDS OF UNION BETWEEN FEMUR & TIBIA
- REPRESENT COLLATERAL LIGAMENTS OF ORIGINAL FEMORO TIBIAL JOINTS
- MAINTAIN ANTERO-POSTERIOR STABILITY
- NAMED ACCORDING TO ATTACHMENT ON TIBIA
- SUPPLIED BY VESSELS AND NERVES WHICH PIERCE OBLIQUE POPLITEAL LIGAMENT



ANTERIOR CRUCIATE LIGAMENT

- the **anterior cruciate ligament attaches to a facet** on the anterior part of the intercondylar area of the tibia and ascends posteriorly to attach to a facet at the back of the lateral wall of the intercondylar fossa of the femur.
- The anterior cruciate ligament crosses lateral to the posterior cruciate ligament as they pass through the intercondylar region.
- The anterior cruciate ligament prevents anterior displacement of the tibia relative to the femur.
- it is taut during knee extension



POSTERIOR CRUCIATE LIGAMENT

- the **posterior cruciate ligament attaches to** the posterior aspect of the intercondylar area of the tibia and ascends anteriorly to attach to the medial wall of the intercondylar fossa of the femur.
- posterior cruciate ligament restricts posterior displacement.
- it tauts during knee flexion

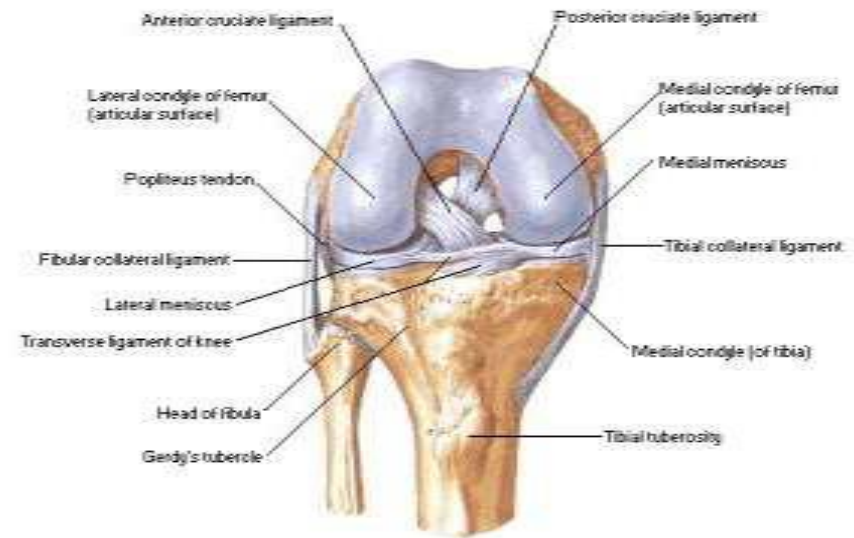


MEDIAL COLLATERAL LIGAMENT (MCL) OR TIBIAL COLLATERAL LIGAMENT

- Is attached superiorly to the medial condyle of the femur just below adductor tubercle.
- Inferiorly it divides into superficial and deep
- Superficial part attached to the upper third of the tibia, as far down as the tibial tuberosity
- The deep portion, which is short, fuses with the capsule and with the medial meniscus
- A bursa usually separates the two parts
- MCL, tightens in extension



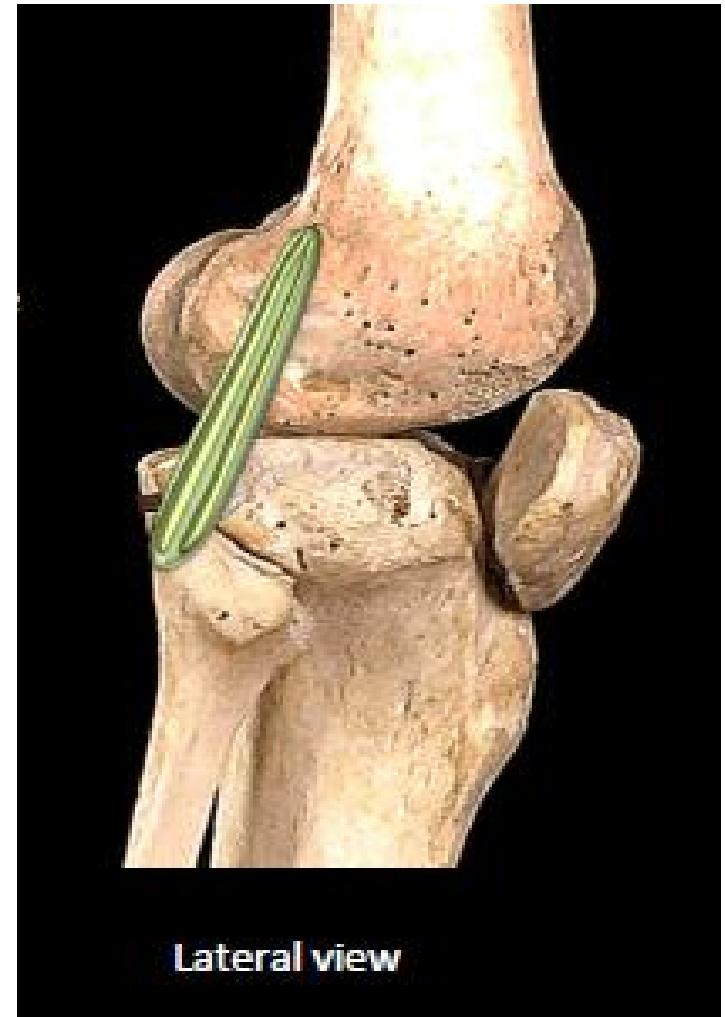
Knee - Cruciate and Collateral Ligaments
Right Knee in Flexion



Anterior View

LATERAL/FIBULAR COLLATERAL LIGAMENT (LCL)

- Superiorly attached to lateral condyle of femur just above popliteal groove.
- Inferiorly embraced with tendon of biceps femoris and attached to head of fibula in front of its apex.
- Separated from lateral meniscus by popliteal tendon and fibrous capsule



Oblique Popliteal Ligament

- It is an expansion from the semimembranosus tendon close to its insertion to the tibia.
- Oblique popliteal ligament passes upwards and laterally.
- Fuses with the Fabella if present



Fabella

MOB TCD



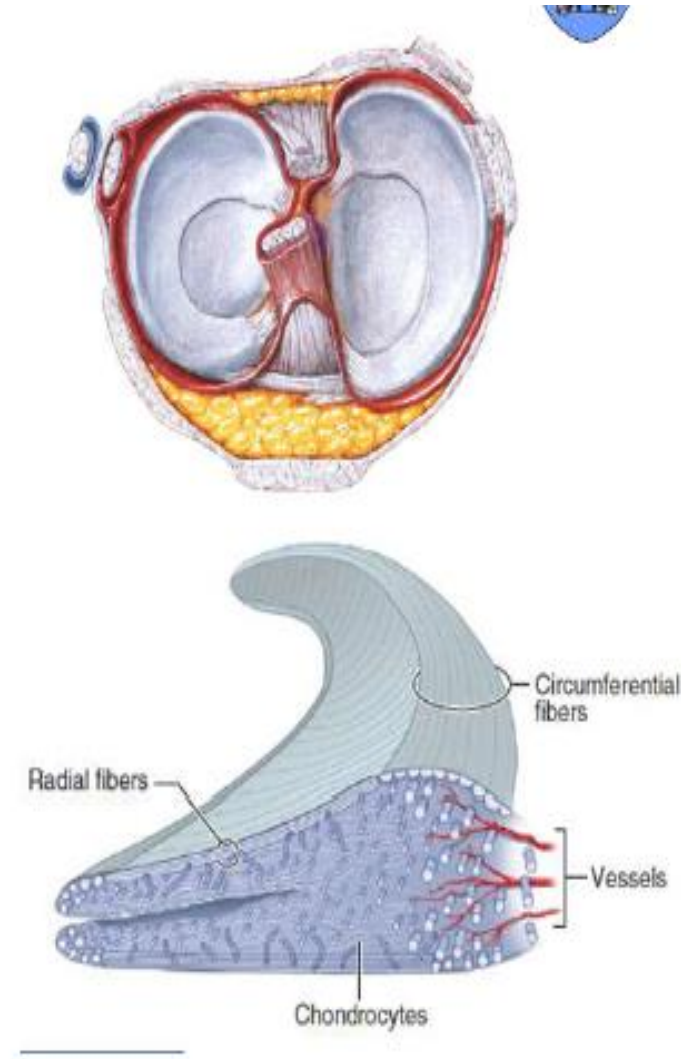
- Fabella lies at point on the poster lateral side of knee
- Where multidirectional collagenous tensile stress meet
- 8% - 10% osseous
- 90% - 92% cartilagenous

Fabbricani & Oransky, 1992

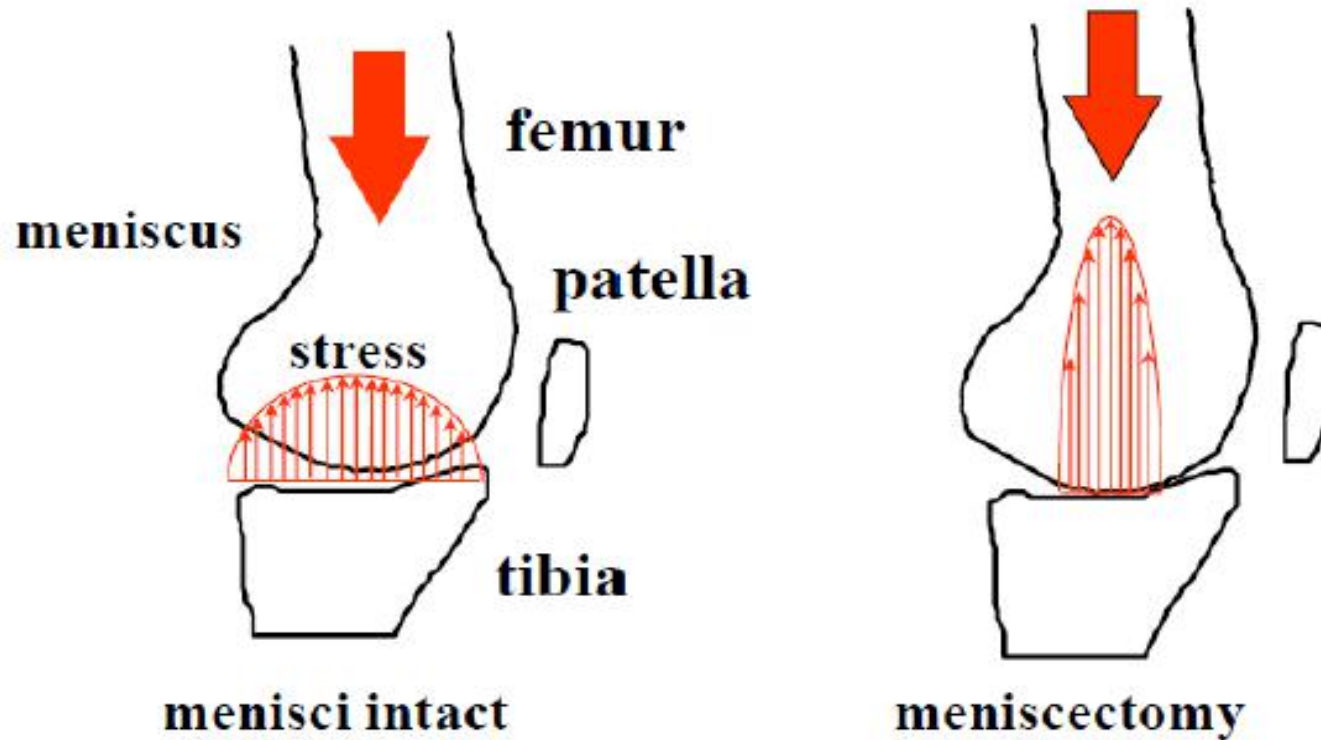


MENISCI

- Menisci are fibro cartilagenous.
- Crescent shaped attached ends to tibia. Deepen the articular surface of tibia.
- Wedge shaped on cross section
- Outer border thick, convex, fixed and vascular
- Inner border thin, concave, free, avascular and nourished by synovial fluid
- They are intracapsular and intra synovial



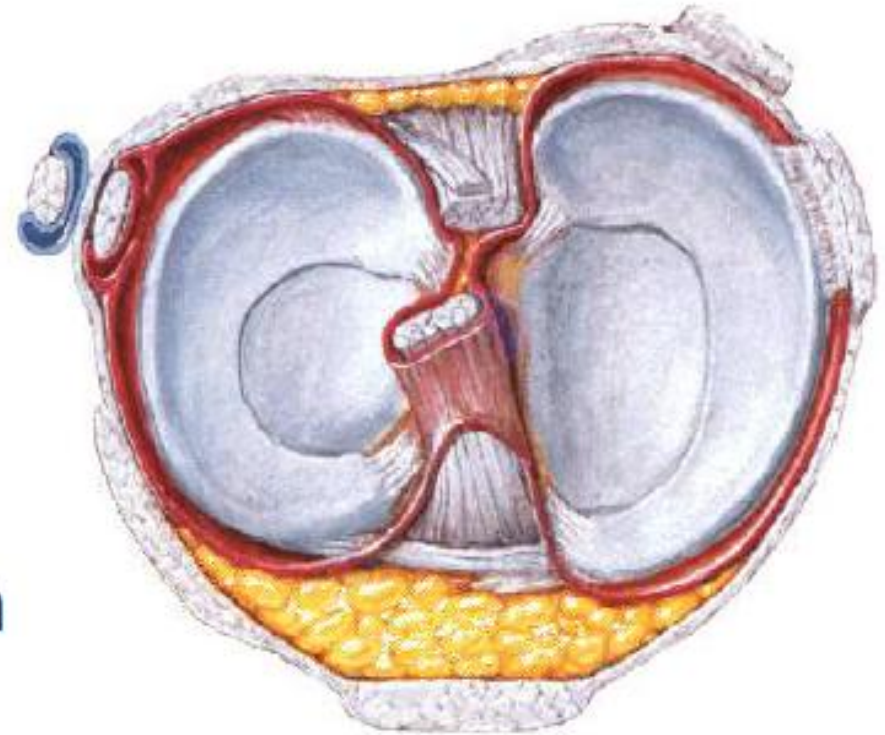
Menisci & Stress Distribution





Anatomy of menisci

- IT HAS TWO ENDS, TWO BORDERS AND TWO SURFACES
- Flexion and extension takes place at the upper surface of the menisci
- Rotation occurs between the lower surface of the menisci and the tibia



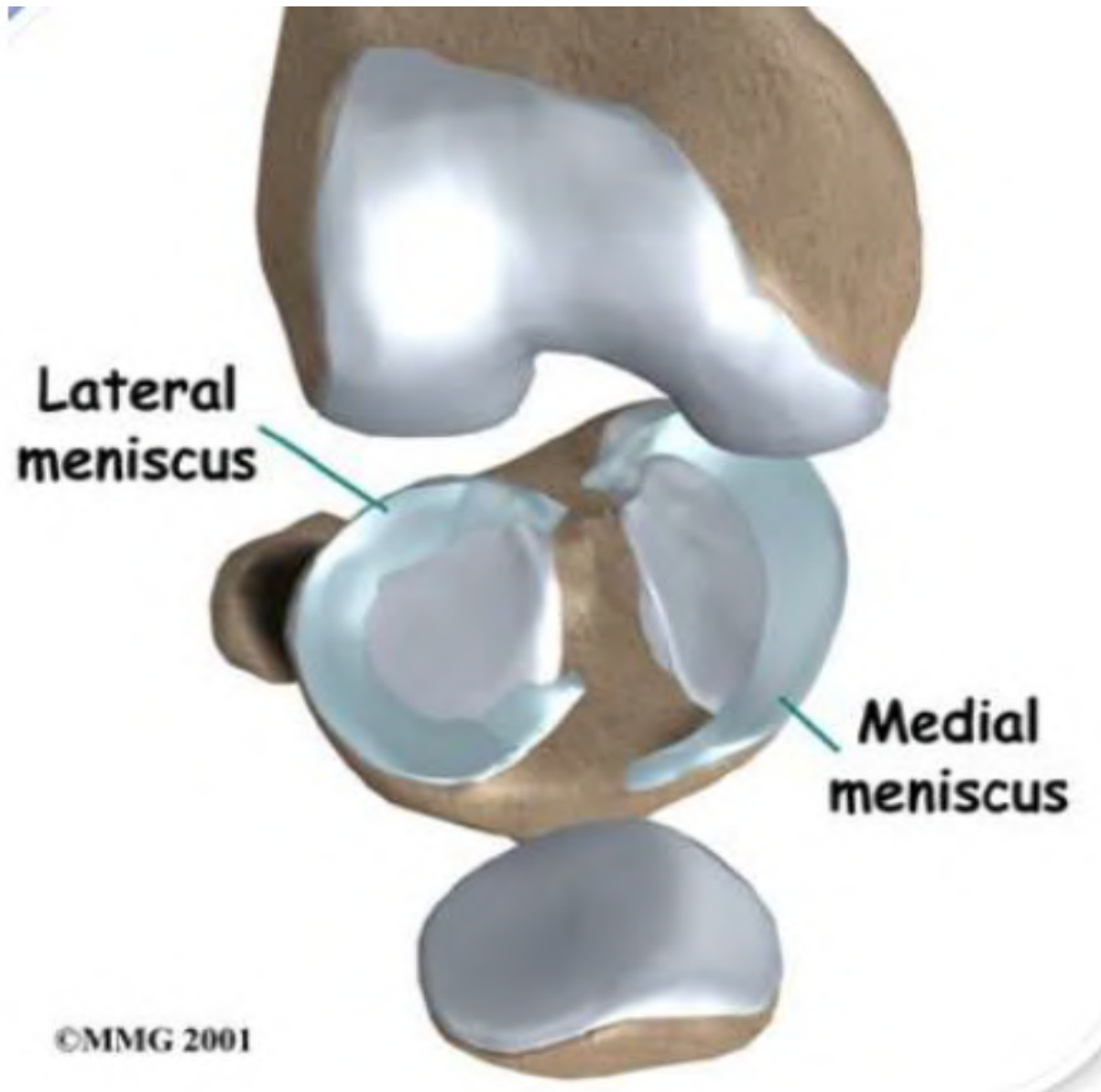
anterior

MEDIAL MENISCUS

- IT IS RELATIVELY IMMOBILE.
- IT IS C-SHAPED/SEMICIRCULAR FIBROCARILAGENOUS DISC.
- PERIPHERAL MARGIN ADHERENT TO TIBIAL COLLATERAL LIGAMENT.
- MORE LIABLE TO INJURY.

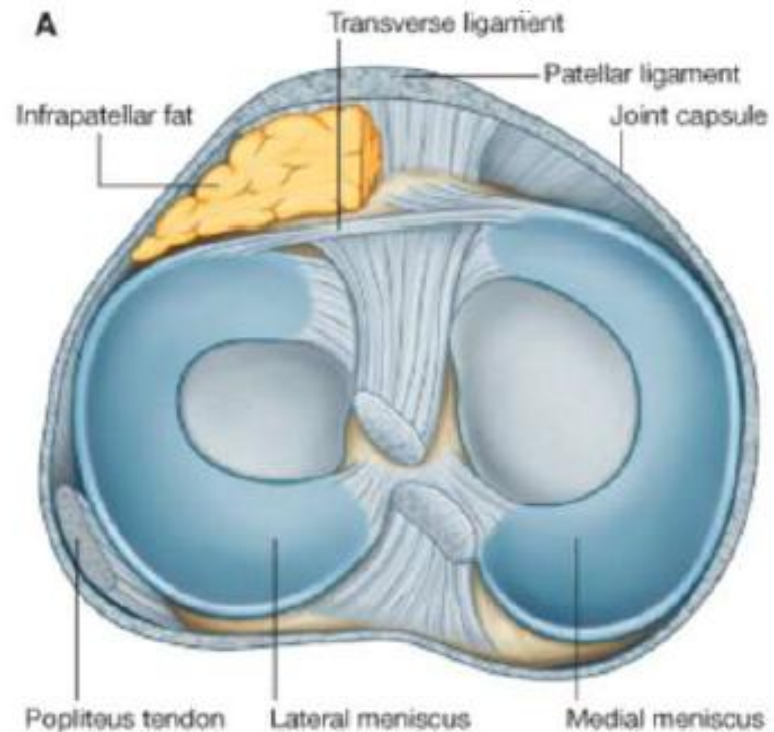
LATERAL MENISCUS

- IT IS MORE ROUND/CIRCULAR IN SHAPE.
- THE POSTERIOR END OF THE MENISCUS IS ATTACHED TO FEMUR THROUGH 2 MENISCOFEMORAL LIGAMENTS.
- THE TENDON OF POPLITEUS AND FIBROUS CAPSULE SEPARATE IT FROM LCL.
- MOBILITY OF POSTERIOR END IS CONTROLLED BY POPLITEUS AND 2 MENISCOFEMORAL LIGAMENTS.



TRANSVERSE LIGAMENT

- IT CONNECTS THE ANTERIOR ENDS OF MEDIAL AND LATERAL MENISCI.





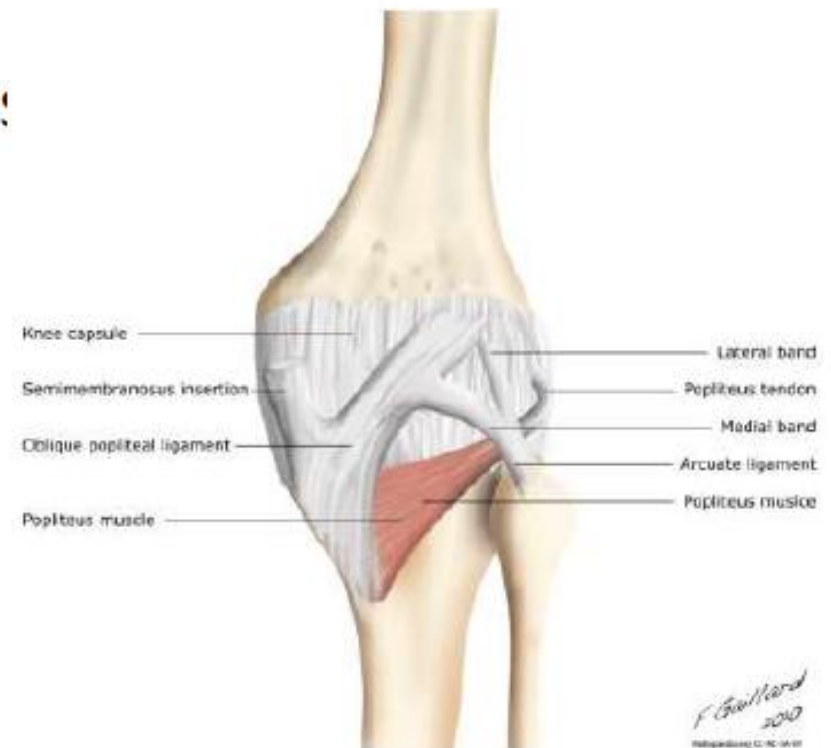
MENISCOFEMORAL LIGAMENTS

- The ANTERIOR MENISCOFEMORAL LIGAMENTS (Humphrey) is attached to lateral aspect of the medial femoral condyle in front of the PCL
- The POSTERIOR MENISCOFEMORAL LIGAMENTS (Wrisberg) is attached posterior to the PCL



ARCUATE LIGAMENT

- Fibers oriented in various directions
- Y-shaped configuration over popliteus
- Medial limb terminates into oblique popliteal ligament
- Lateral limb invariable present, and is less distinct

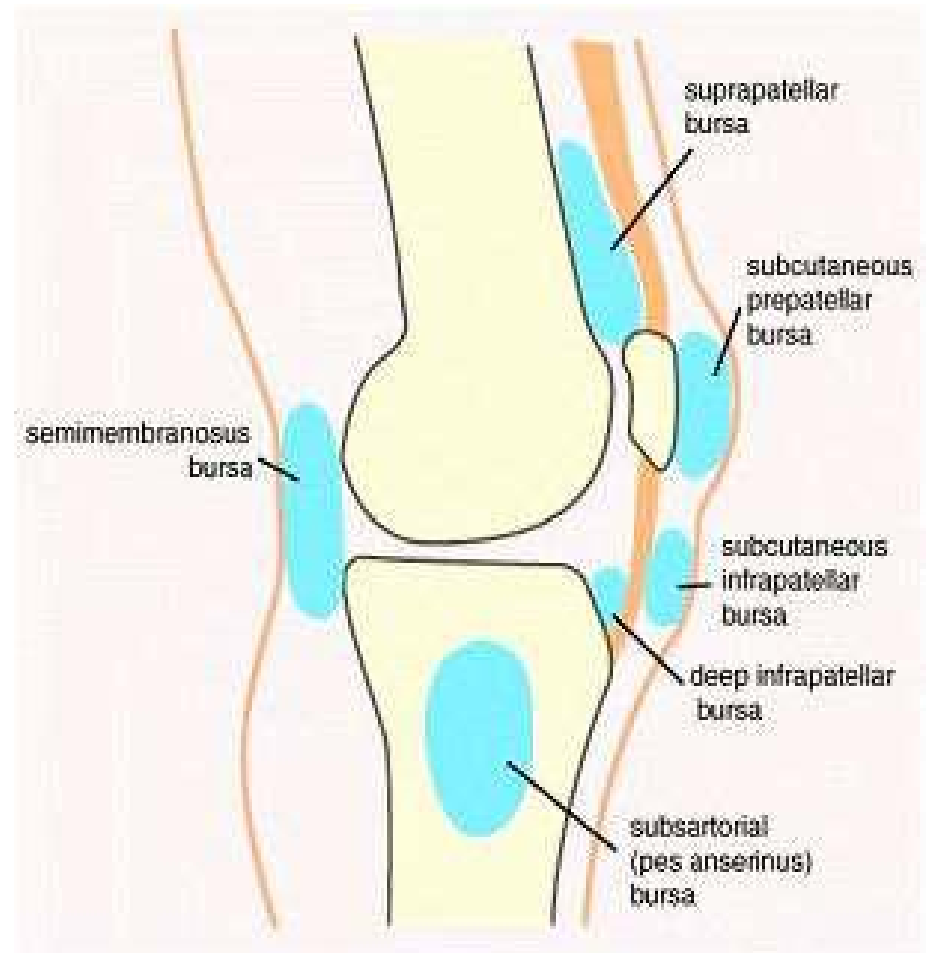


BURSAE AROUND KNEE JOINT

There are about 12 bursae around the knee, four anterior, three lateral, three medial, and two posterior.

ANTERIOR BURSAE

- Suprapatellar bursa
- Subcutaneous Prepatellar bursa
- Subcutaneous infrapatellar bursa
- Deep infrapatellar bursa

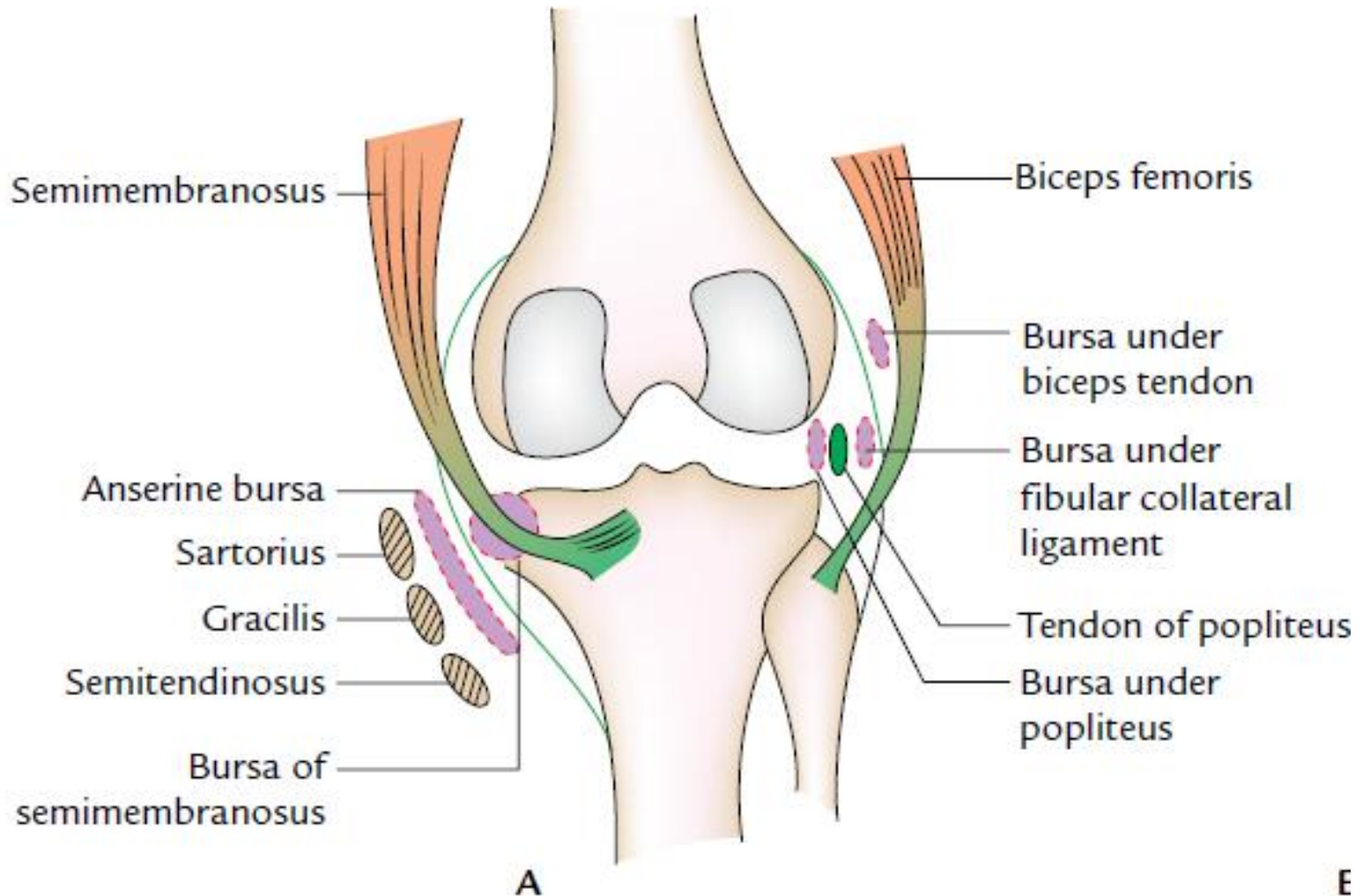


Interactive Knee 1.1 © 2000 Primal Pictures Ltd.

Clinical correlation

- **Housemaid's knee:** It is the inflammation of the prepatellar bursa (*prepatellar bursitis*). It occurs due to friction of bursa against the patella when it comes in contact with the ground during scrubbing of the floor by the housemaid. Such a bursa may get very large and drop by its weight to much below to its original position.
- **Clergyman's knee:** It is the inflammation of subcutaneous infrapatellar bursa (*subcutaneous infrapatellar bursitis*). It occurs due to the friction of bursa against the tibial tuberosity due to kneeling (e.g., kneeling during prayer by Christian priests/clergymen, roofers, and floor tilers).
- **Baker's cyst:** The chronic inflammation of bursa deep to semimembranosus may present as cystic swelling in the medial part of the popliteal fossa called *Baker's cyst*.

LATERAL & MEDIAL BURSAE



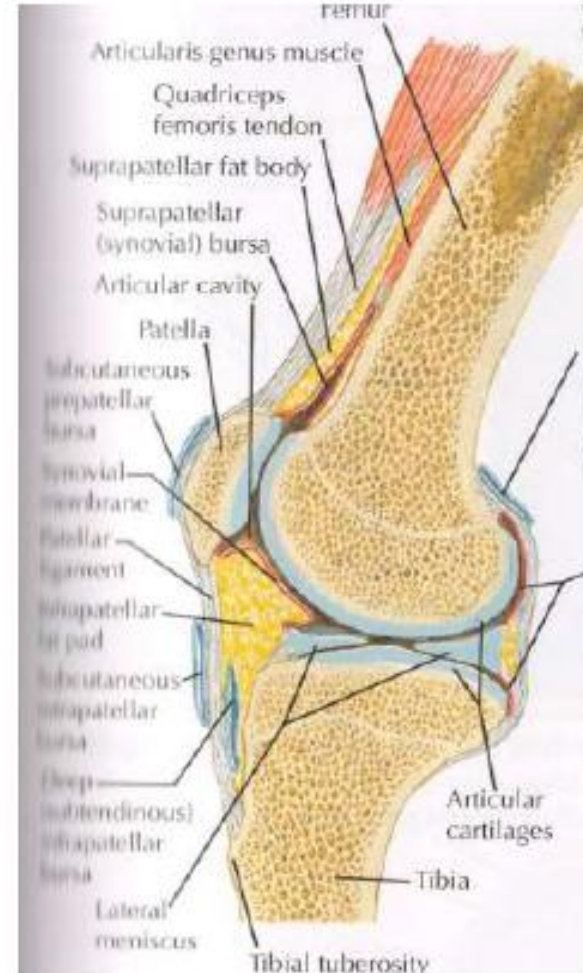
POSTERIOR BURSAE

1. The bursa between the lateral head of gastrocnemius and capsule of the joint.
2. The bursa between the medial head of gastrocnemius and capsule of the joint (**Brodie's bursa**).

RELATIONS OF KNEE

ANTERIORLY:-

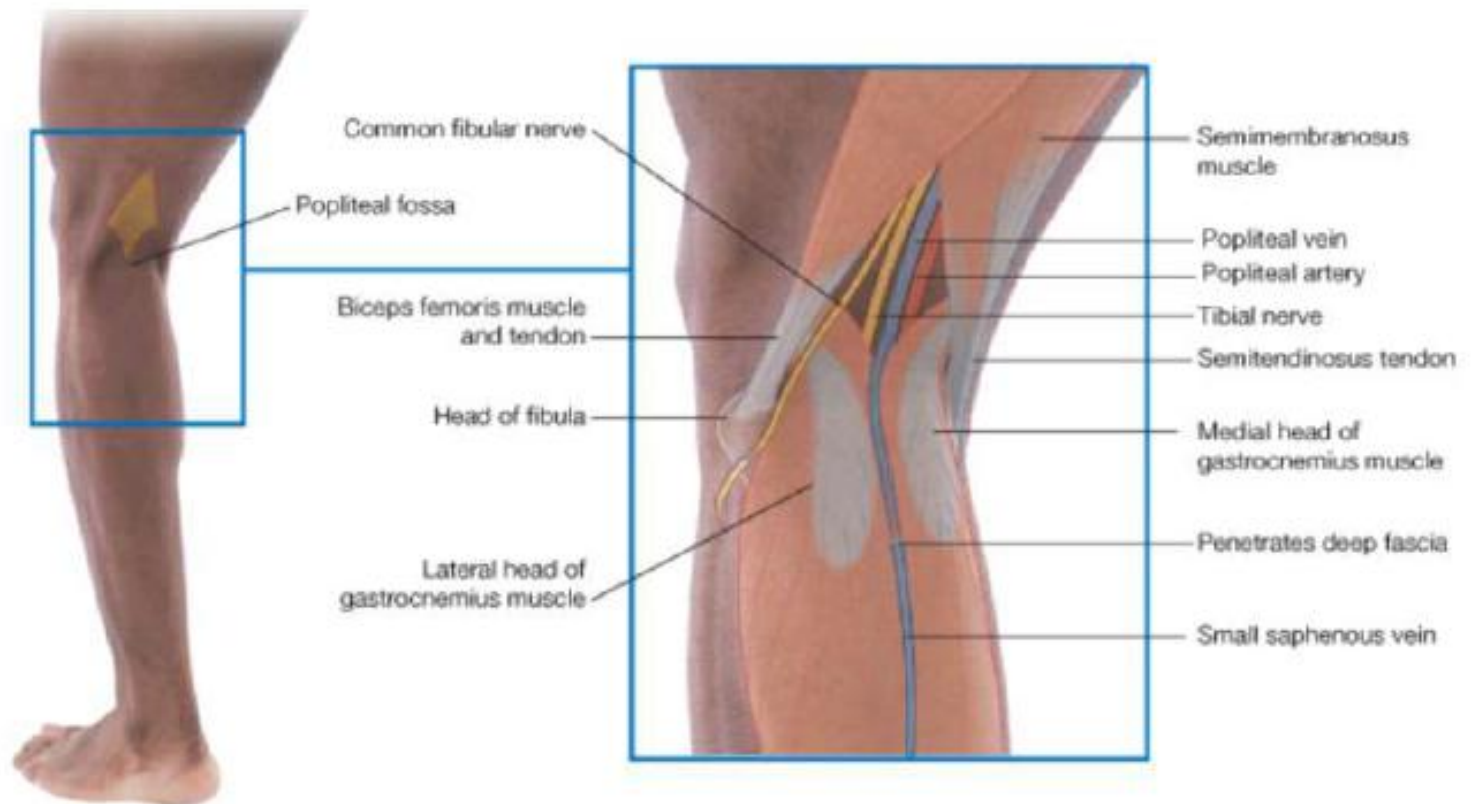
- ANTERIOR BURSA,
LIGAMENTUM
PATELLAE, PATELLAR
PLEXUS



RELATIONS OF KNEE

POSTERIORLY:-

- POPLITEAL VESSEL, TIBIAL NERVE, PERONEAL NERVE, GASTROCNEMIUS, PLANTARIS, SEMITENDINOSUS, SEMIMEMBRANOSUS, GRACILIS, POPLITEUS



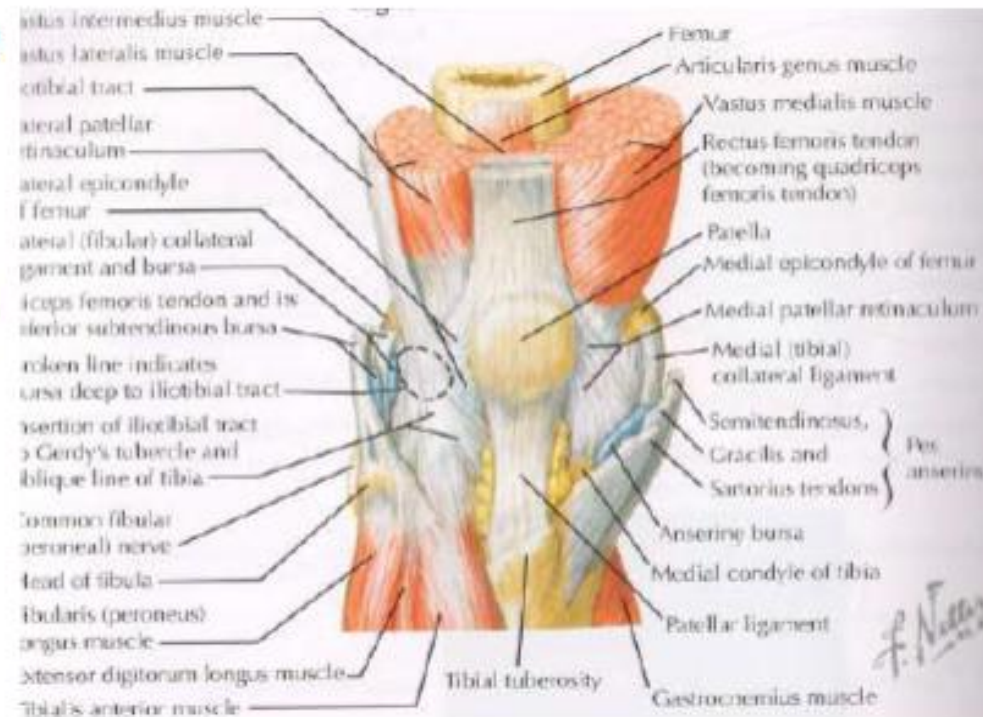
RELATIONS OF KNEE

MEDIALY:-

- SARTORIUS, GRACILIS, SEMITENDINOSUS, SAPHENOUS VEIN, SAPHENOUS NERVE, SEMIMEMBRANOSUS

LATERALLY:-

- BICEPS FEMORIS, TENDON OF POPLITEUS



Arterial supply

- Femoral artery – descending genicular
descending branch of the
lateral circumflex femoral
- Popliteal artery – sup & inf. medial genicular
middle genicular
sup & inf. Lateral genicular
- Anterior tibial artery – ant & post tibial recurrent
- Posterior tibial artery- circumflex fibular



Nerve supply

- Femoral nerve – gives twigs from the nerves to the three vasti
- Tibial nerve - sup & inf. Medial genicular N.
middle genicular N.
- Common peroneal N. - sup & inf lateral genicular N.
recurrent genicular N.
- Obturator nerve – genicular branch from its posterior division

MOVEMENTS

The following movements occur at the knee joints:

1. Flexion
2. Extension } Main/active movements.
3. Medial rotation
4. Lateral rotation } Conjunct movements.

FLEXION & EXTENSION

These movements occur in the upper meniscomfemoral compartment of the joint, i.e., above the menisci.

In flexion the angle between the posterior thigh and leg is decreased whereas in extension the angle between the posterior thigh and leg is increased (i.e., return from the flexion back to the anatomical position).

Movements	Chief muscles	Accessory muscles
Flexion	• Semimembranosus • Semitendinosus • Biceps femoris	• Popliteus (initiates flexion) • Sartorius • Gracilis • Gastrocnemius • Plantaris
Extension	Quadriceps femoris	Tensor fasciae latae

MEDIAL& LATERAL ROTATION

These movements take place in the lower meniscotibial compartment of the joint, i.e., below the menisci. These movements occur around the vertical axis.

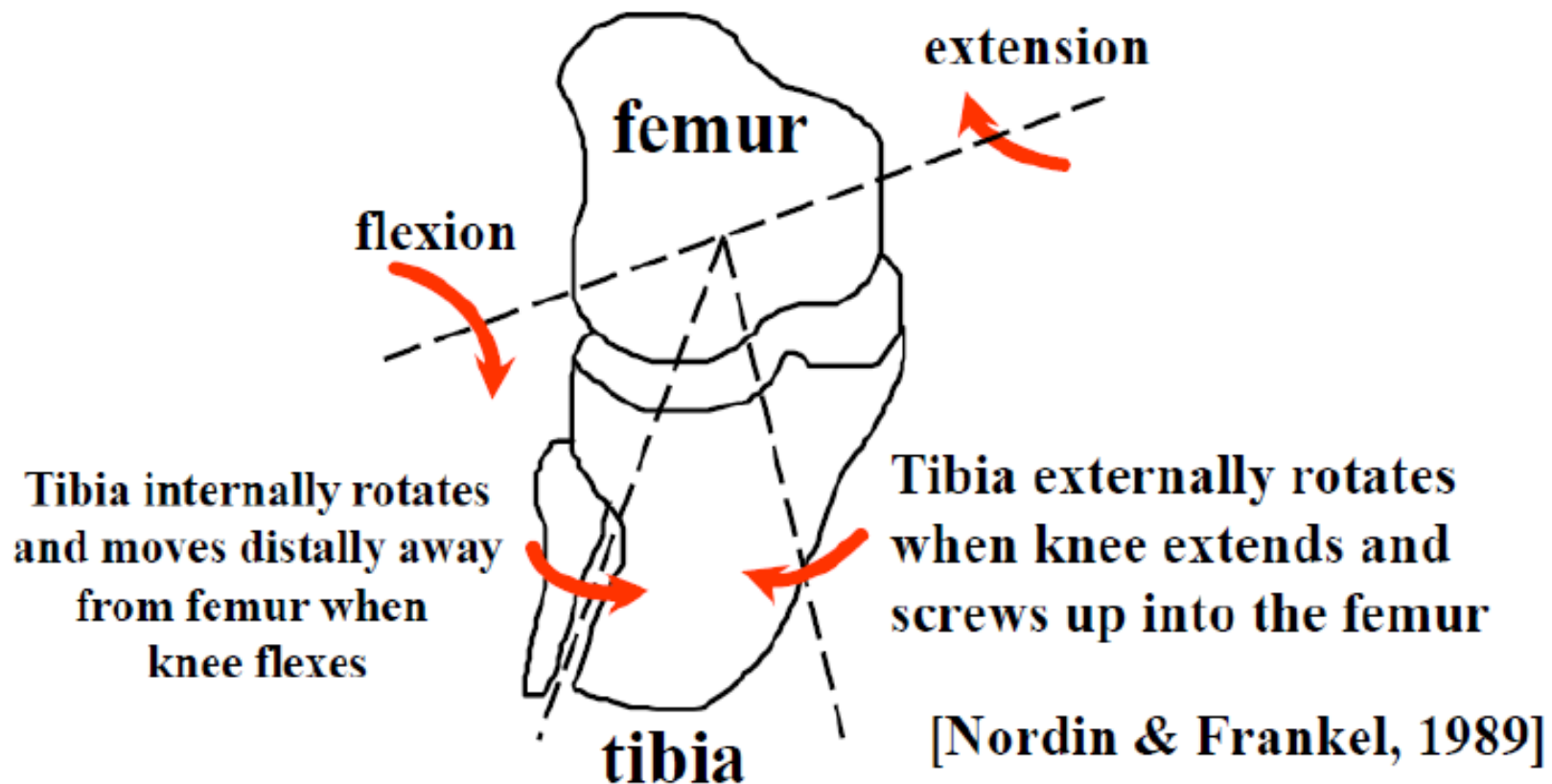
The medial and lateral rotations usually occur with flexion and extension (**conjunct rotations**) but may occur independently if the knee is flexed (**adjunct rotations**).

Medial rotation	• Semitendinosus • Semimembranosus • Popliteus	• Sartorius • Gracilis
Lateral rotation	Biceps femoris	• Gluteus maximus • Tensor fasciae latae

Locking of knee

- Is the terminal stage of full extension of knee joint
- The tibia is laterally rotated & femur is medially rotated
- This rotatory movement locks the joint (which means that the joint cannot be flexed unless It is unlocked by reverse rotation)
- In full extension with the locked knee, all the ligaments are stretched and the joint is stable
- Produced by biceps femoris muscle (the only lateral rotator)

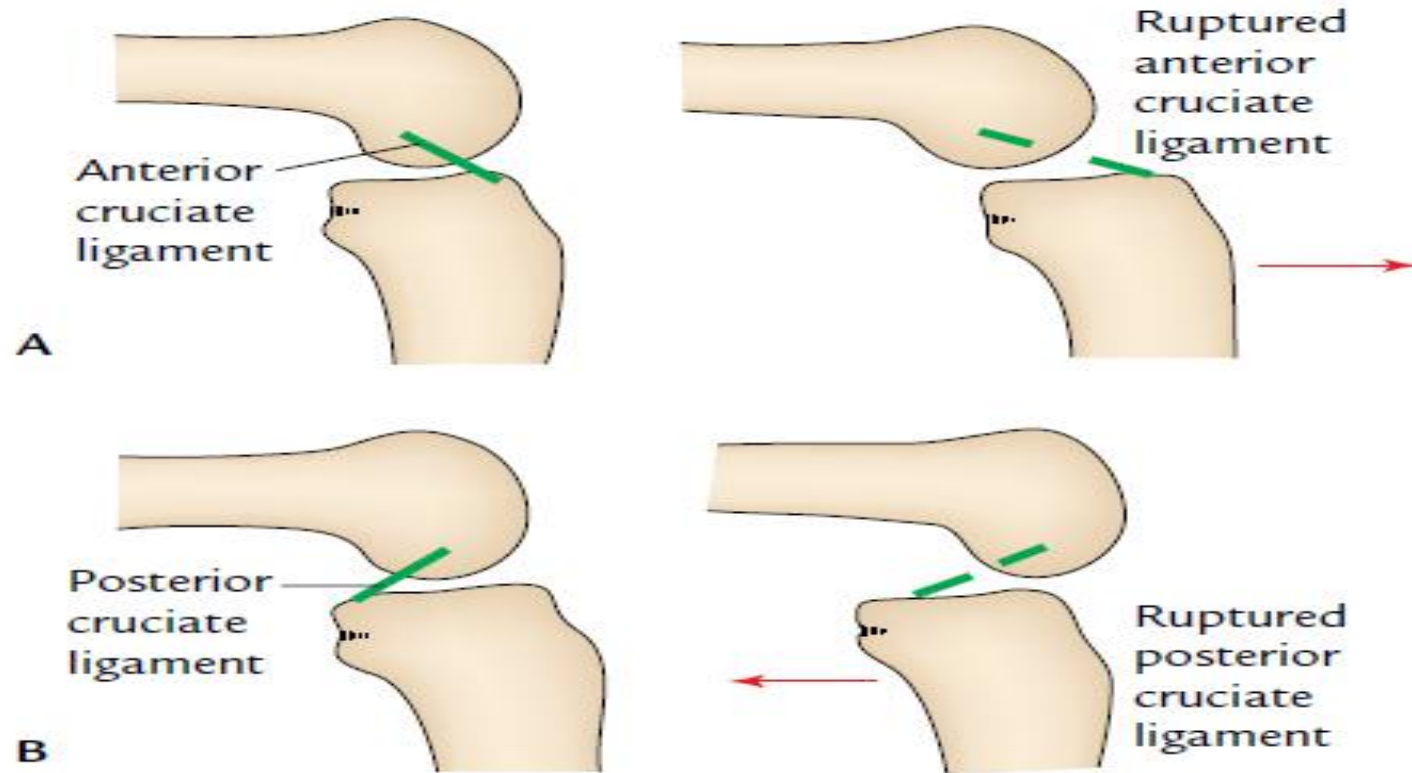
Screw-Home Mechanism



Unlocking of knee

- "Unlocking" of the knee. During knee flexion, it is first necessary to "untwist" and reduce tension within the major ligaments of the knee, in order to prevent their repeated excessive stretching.
- Contraction of the popliteus muscle, laterally rotates the femur on the tibia, and pulls the lateral meniscus posteriorly, out of the way of the rotating lateral femoral condyle. Once the femur has laterally rotated, the knee is said to be "unlocked" and flexion can proceed.

CLINICAL CORRELATION



Injury of cruciate ligaments of the knee joint:
 A, rupture of anterior cruciate ligament (positive anterior Drawer's sign); B, rupture of the posterior cruciate ligament (positive posterior Drawer's sign).