

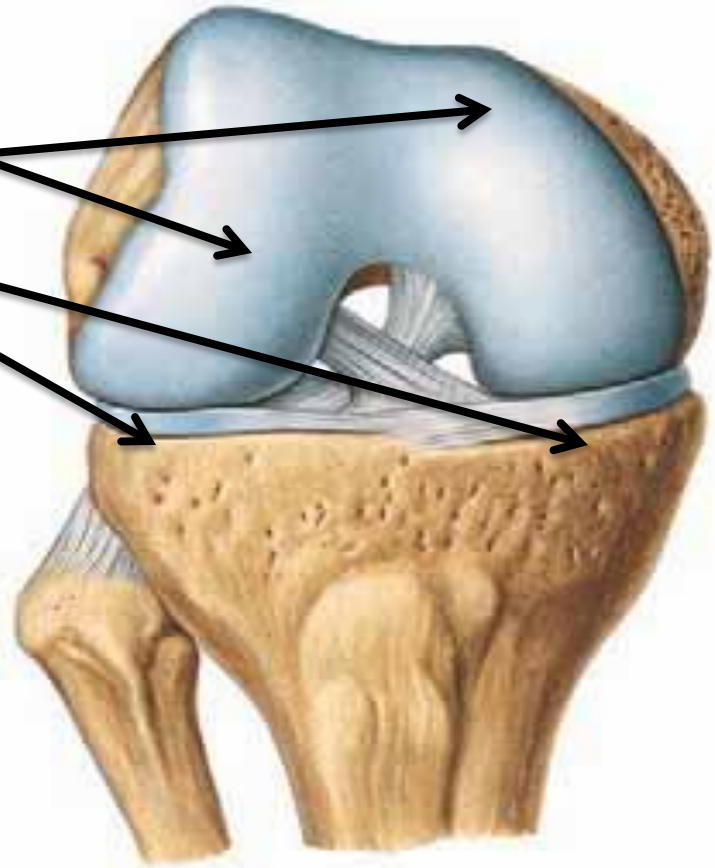
# ***KNEE JOINT***

# ***Knee Joint***

➤ Is the most **complicated** joint in the body!!!!

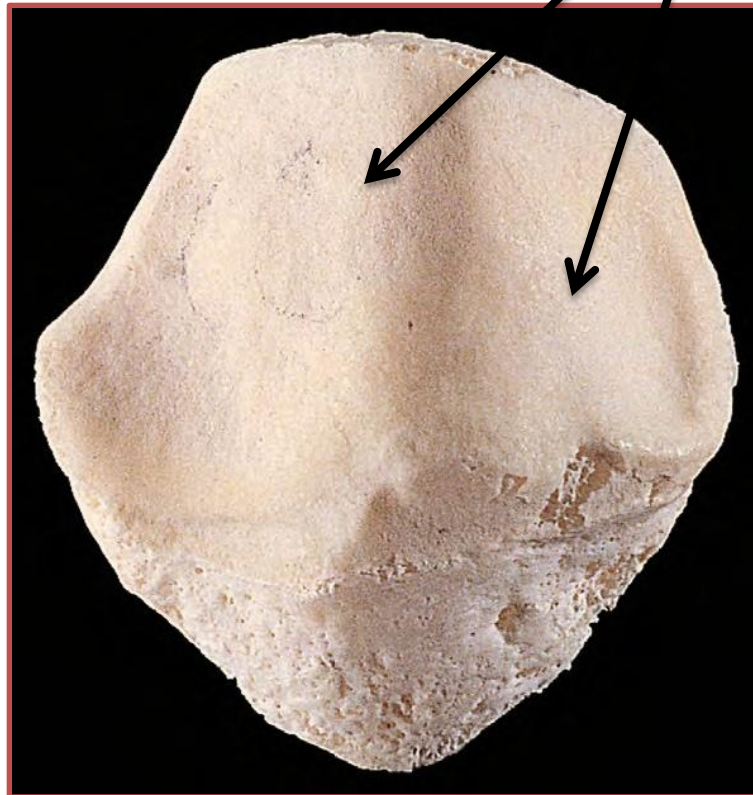
1-Consists of two condylar joints between:  
A-The **medial and lateral condyles** of the **femur**  
and **The condyles of the tibia**

and

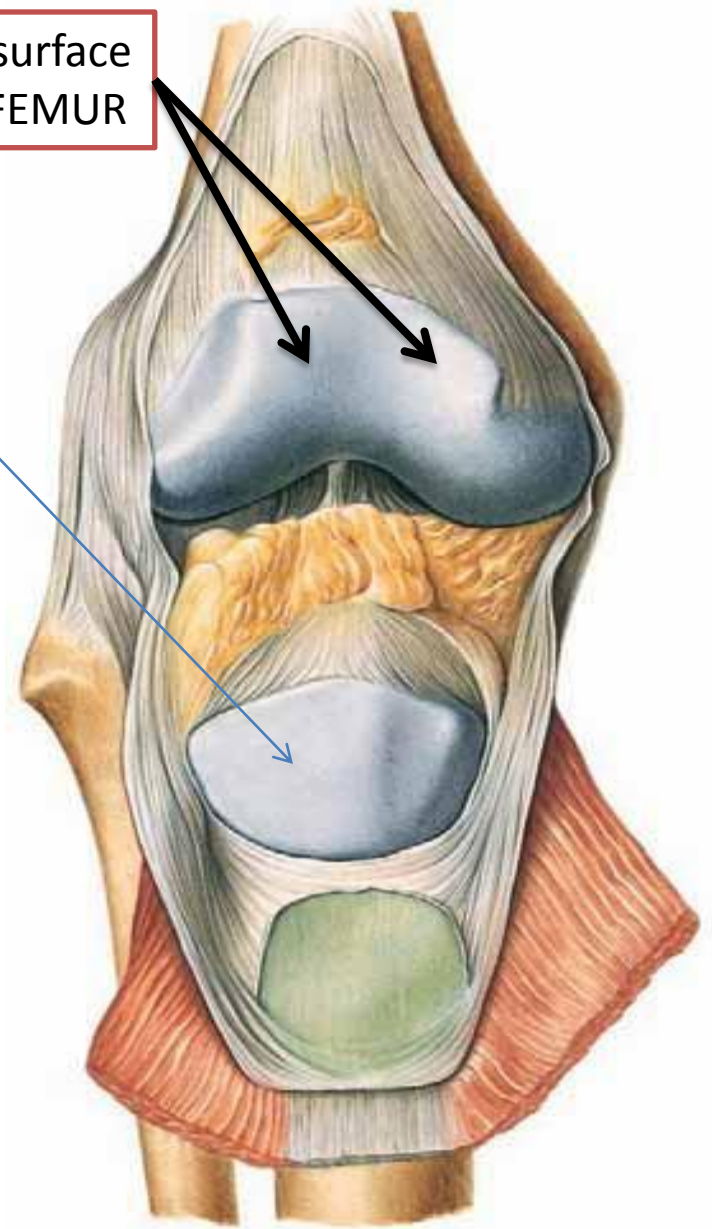


B- a **gliding joint**  
between the **patella** and the **patellar surface**  
**of the femur**

Note that the fibula is not directly involved in  
the joint.



Patellar surface  
OF THE FEMUR



## 2-Type OF JOINT

```
graph TD; A[2-Type OF JOINT] --> B["The joint between the femur and tibia is a synovial joint of the hinge variety, but some degree of rotatory movement is possible."]; A --> C["❖ The joint between the patella and femur is a synovial joint of the plane gliding variety."]; B --> D[MEDIAL AND LATERAL ROTATION];
```

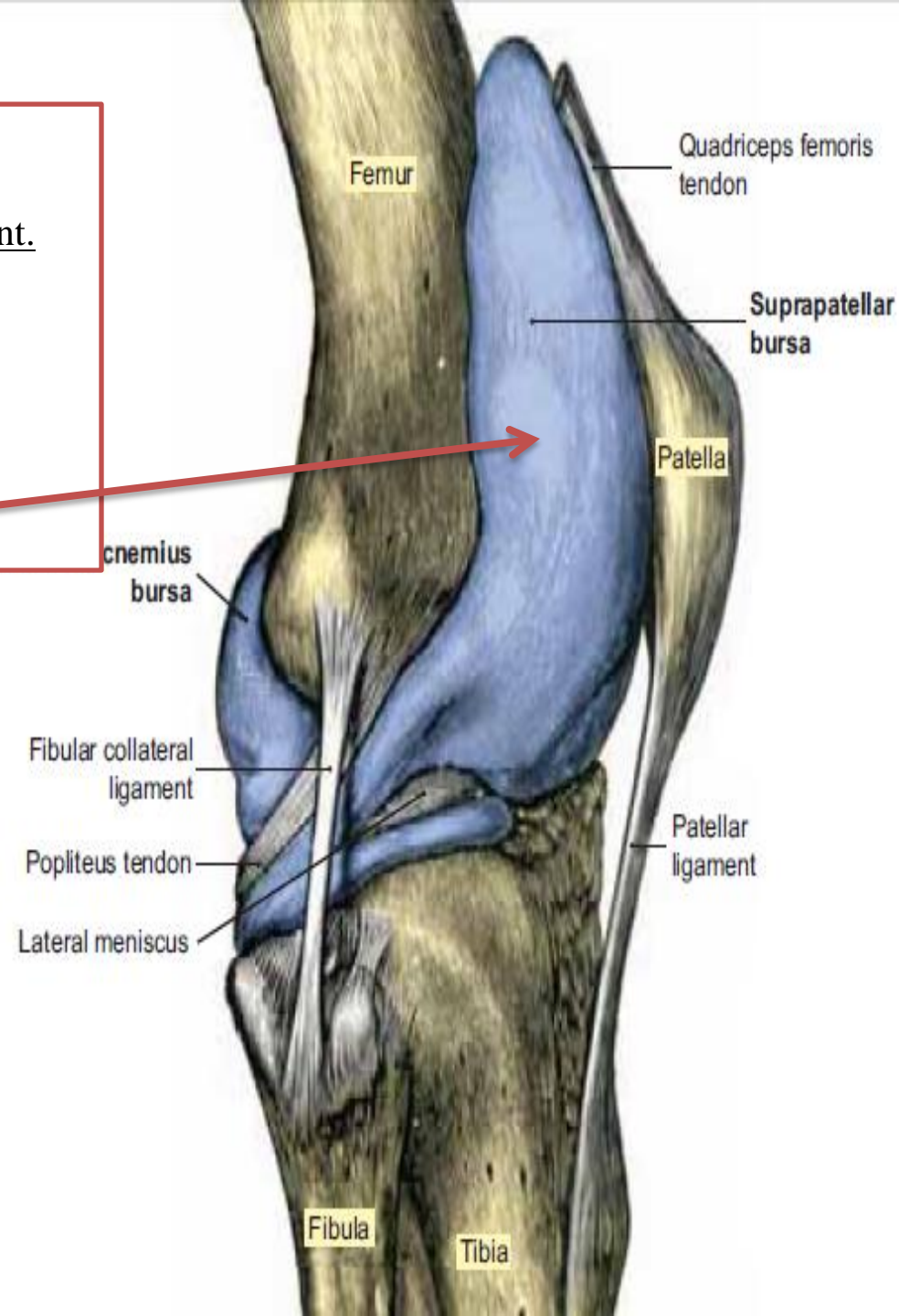
The joint between the *femur and tibia* is a *synovial* joint of the *hinge variety*, but some degree **of rotatory movement** is possible.

❖ The joint between the *patella and femur* is a synovial joint of the *plane gliding* variety.

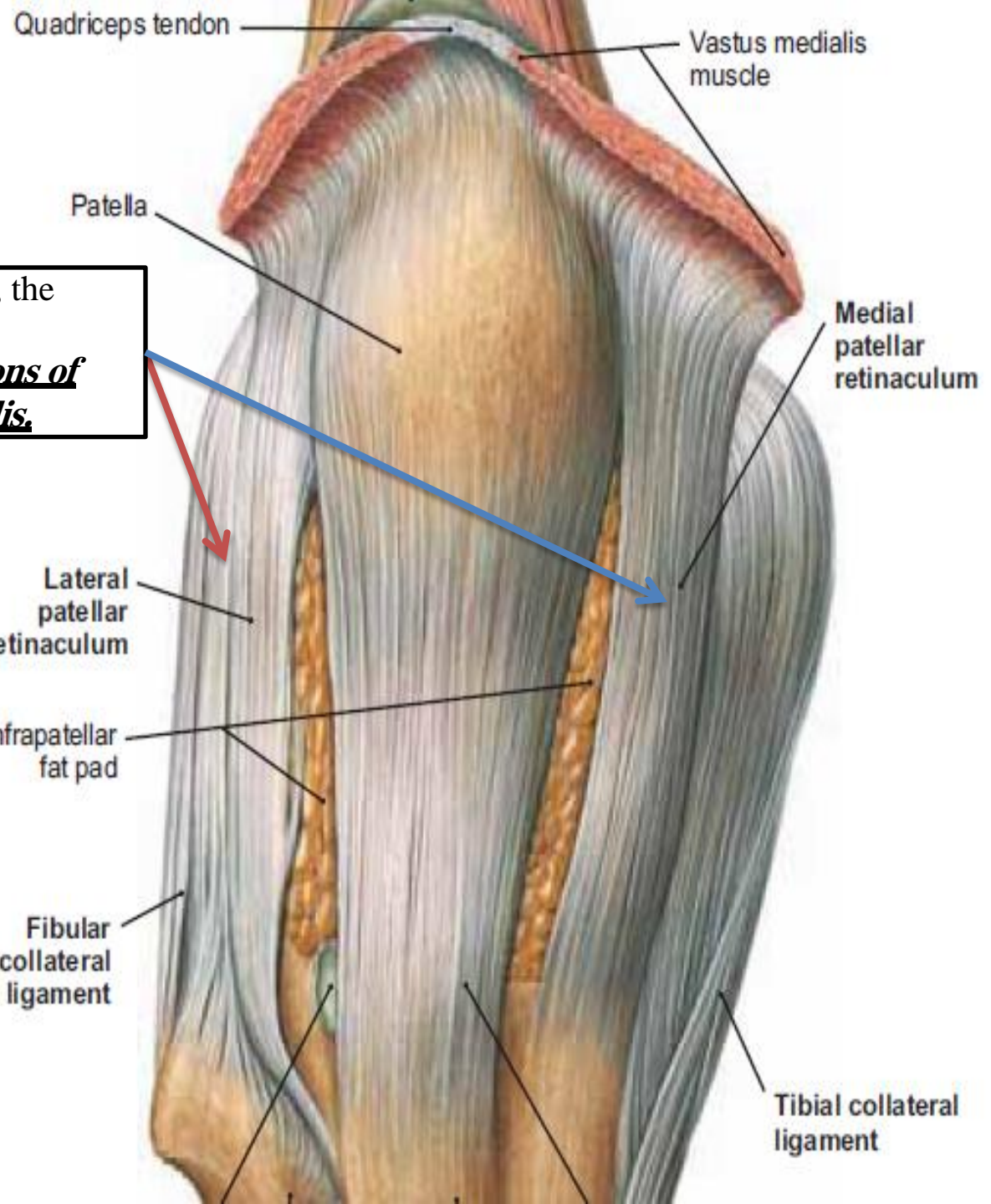
MEDIAL AND LATERAL ROTATION

### 3 - Capsule

- ❖ The capsule is attached to the margins of the articular surfaces
- ❖ surrounds the sides and posterior aspect of the 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**



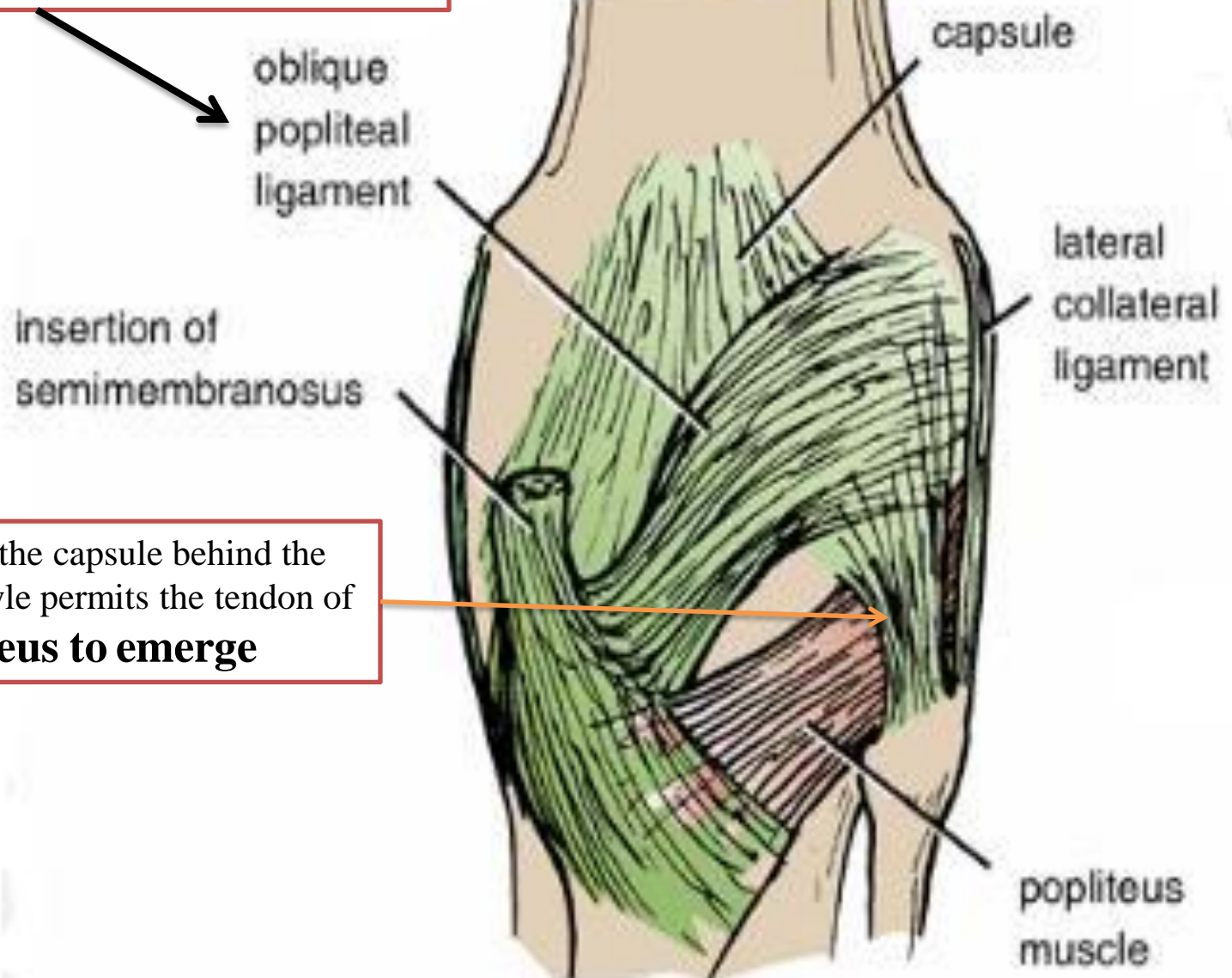




❖ On each side of the patella, the capsule is strengthened by ***expansions from the tendons of vastus lateralis and medialis.***

❖ Behind the joint, the capsule is strengthened by an expansion of the semimembranous muscle called the **oblique popliteal ligament**

### Posterior view of the knee joint



❖ An opening in the capsule behind the lateral tibial condyle permits the tendon of the **popliteus to emerge**

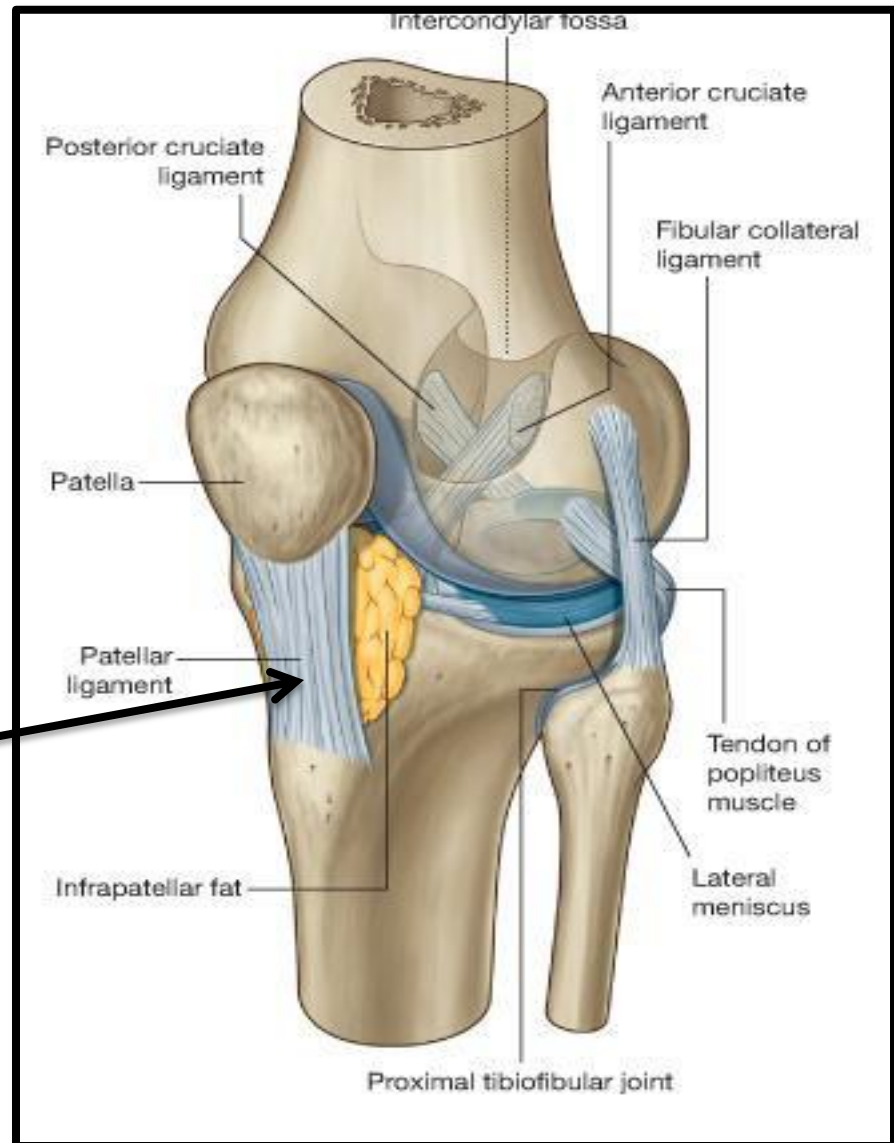
## 4-Ligaments of the knee joint

❖ *The ligaments may be divided into*

A-Extracapsular  
Ligaments

### The ligamentum patellae

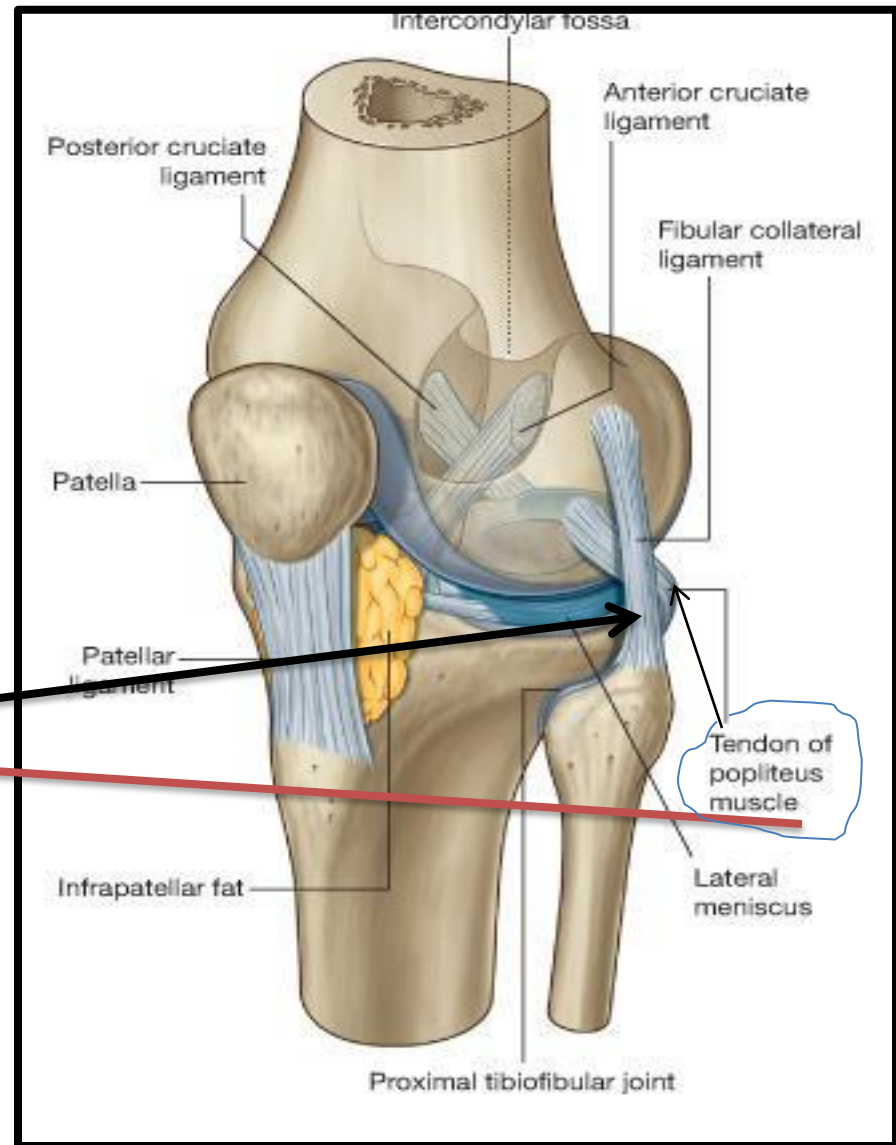
is attached  
above to the lower border  
of the patella and below to  
the tuberosity of the tibia.





## ❖ The lateral collateral ligament

is ***cordlike*** and is attached above to the ***lateral condyle*** of the femur and below to the ***head of the fibula***.



The tendon of the popliteus muscle intervenes between the ligament and the lateral Meniscus (thus, the ligament is not attached to the lateral meniscus)

What does this mean?

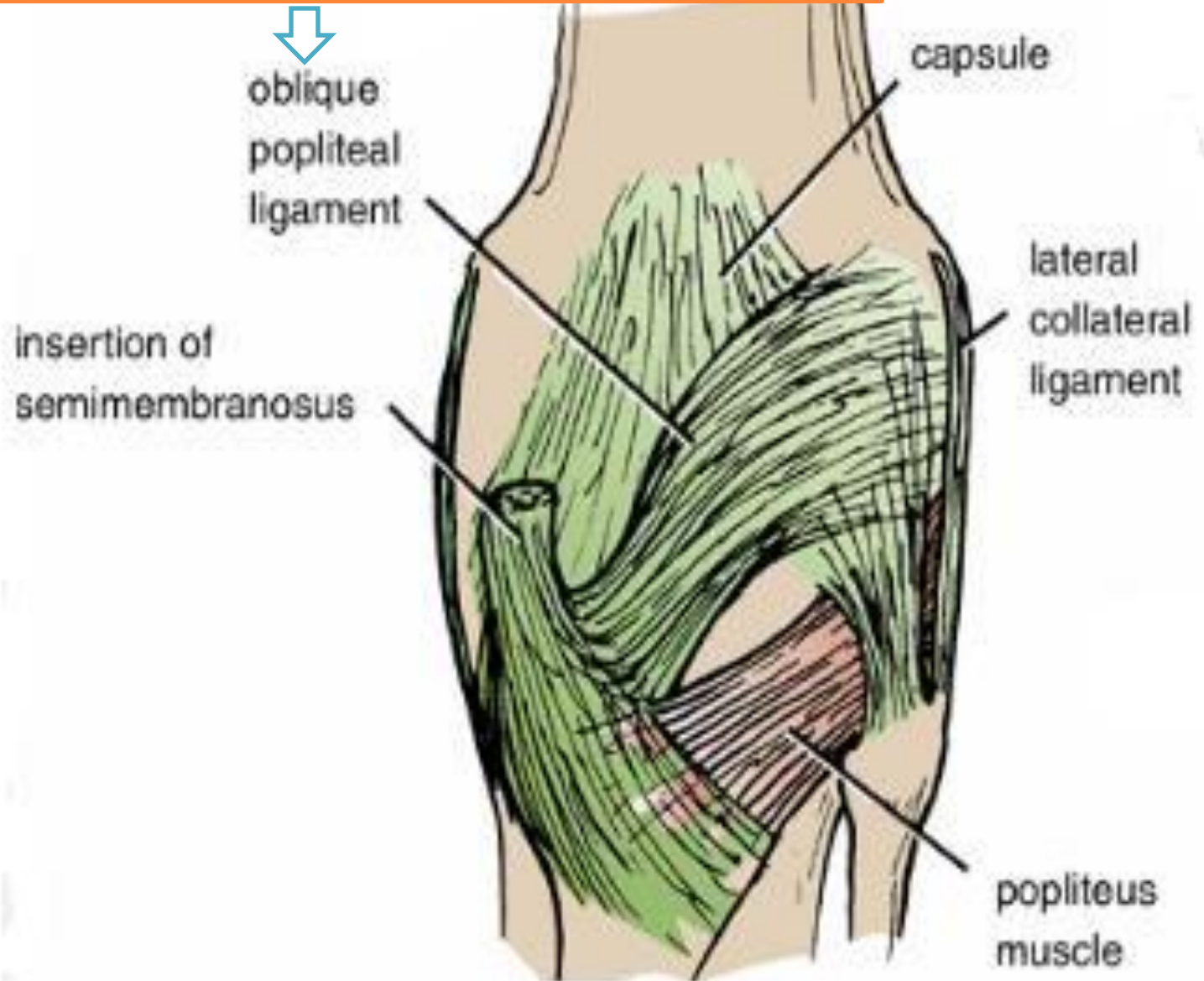
The medial collateral ligament  
is a ***flat band*** and is attached above to ***the medial condyle*** of the femur and below ***to the medial surface*** of the ***shaft of the tibia***.  
**It is firmly attached to the edge of the medial meniscus ?!**

↓  
What does this mean?



## ❖ The oblique popliteal ligament

Is a tendinous expansion derived from the semimembranosus muscle.  
It strengthens the posterior aspect of the capsule

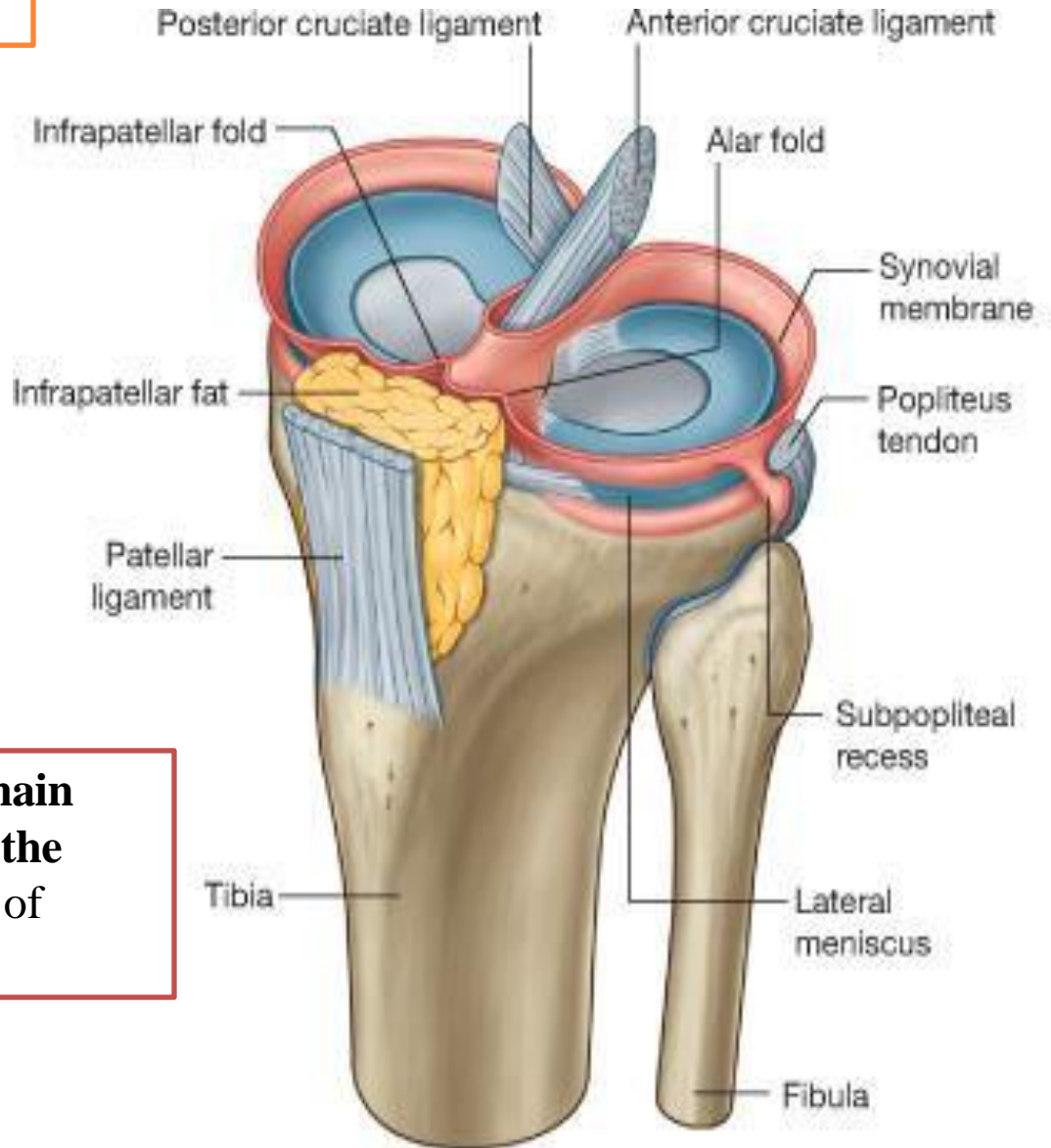


## B-Intracapsular Ligaments

### The cruciate ligaments

They are named  
anterior and posterior,  
according to their  
tibial attachments

**The cruciate ligaments are the main  
bond between the femur and the  
tibia during the joint's range of  
movement.**



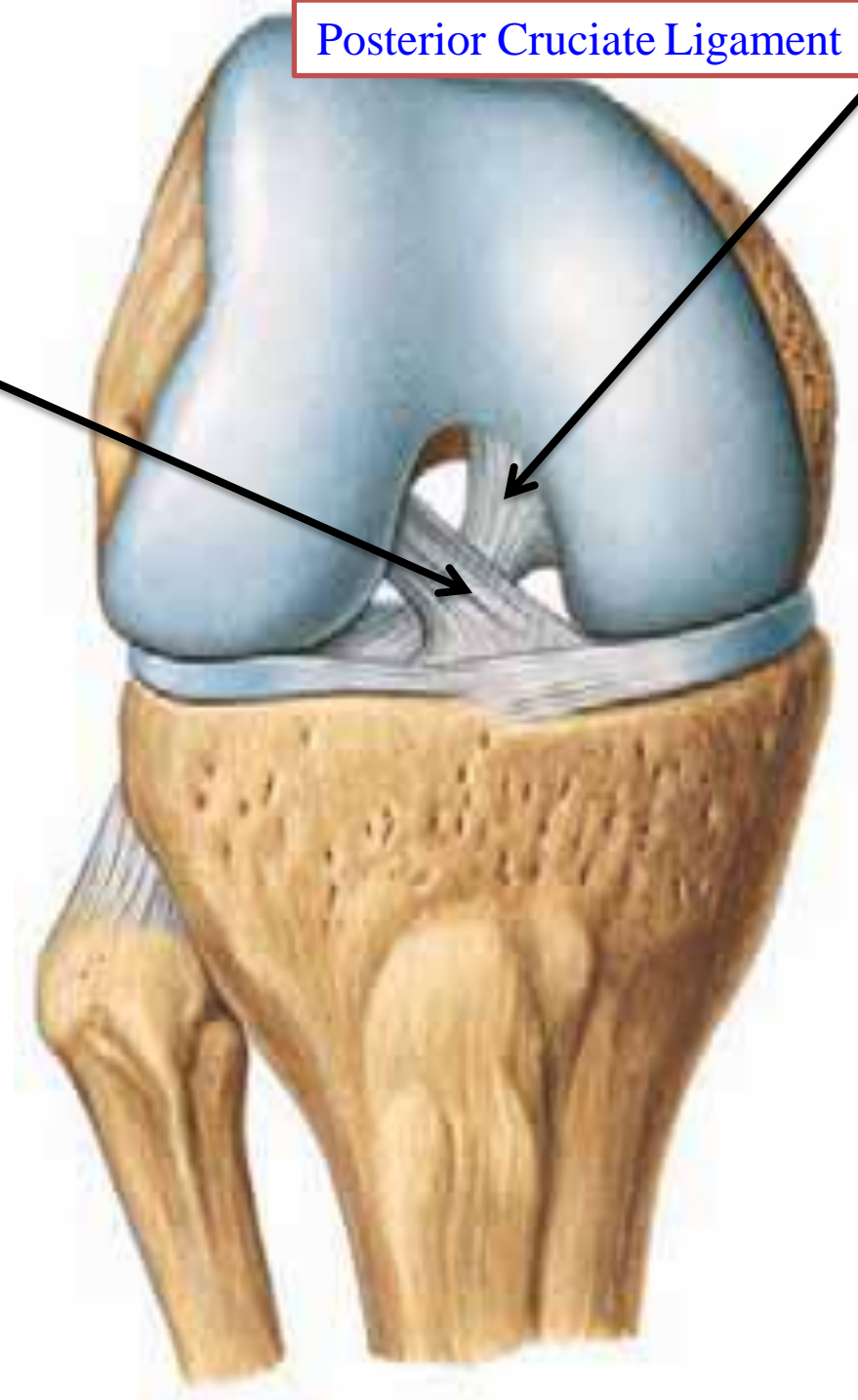


### Anterior Cruciate Ligament

➤ Is attached to the anterior intercondylar area of the tibia and *passes upward, backward, and laterally*, to be attached to *the posterior part of the medial surface of the lateral femoral condyle*

➤ Prevents ***posterior displacement*** of the femur on the tibia. With the knee joint flexed, the anterior cruciate ligament prevents the tibia from being **pulled anteriorly**.

### Posterior Cruciate Ligament

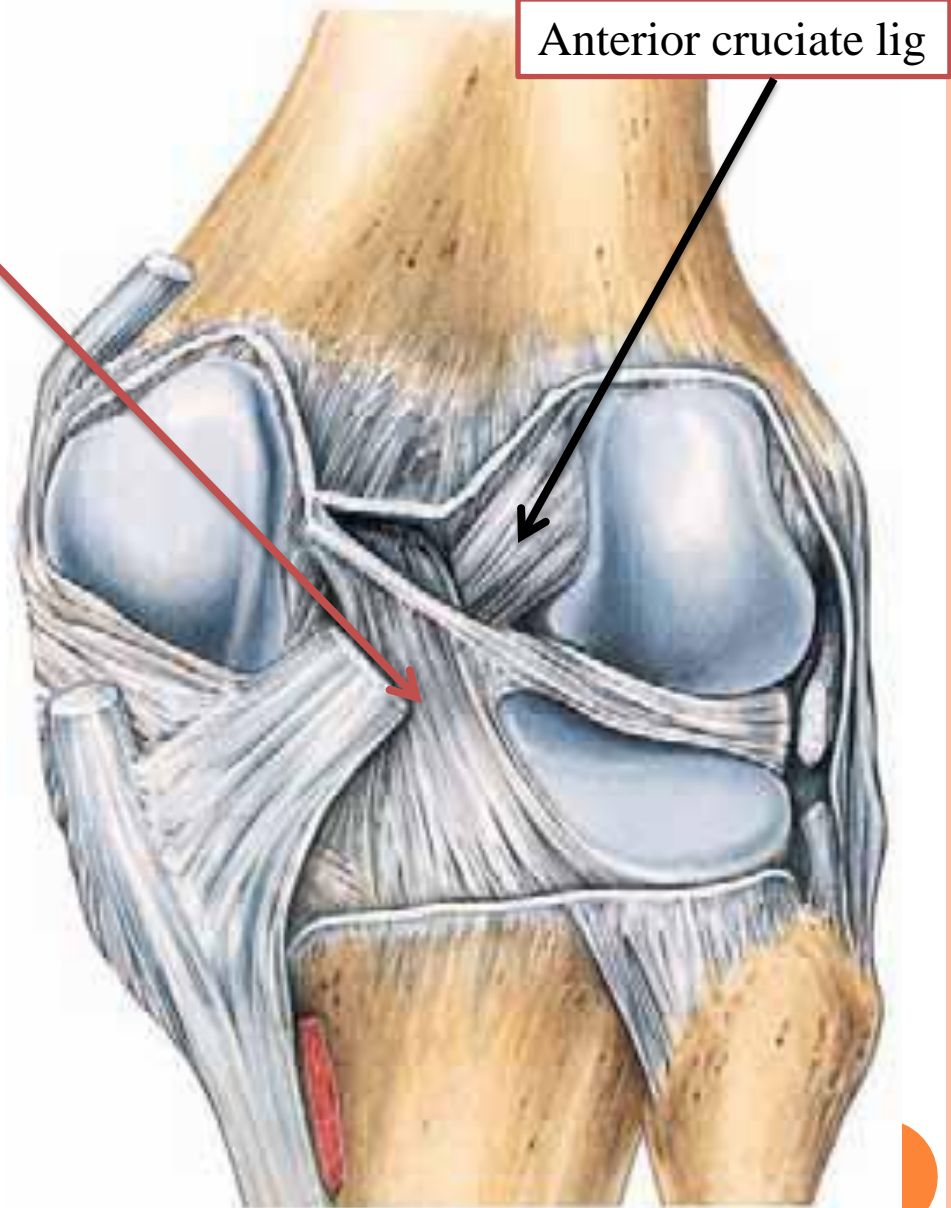




## Posterior Cruciate Ligament

➤ Is attached to **the posterior intercondylar area** of the tibia and ***passes upward, forward, and medially*** to be attached to the **anterior part of the lateral surface of the medial femoral condyle**

➤ Prevents ***anterior displacement*** of the femur on the tibia. With the knee joint flexed, the posterior cruciate ligament prevents the tibia from being **pulled posteriorly**.



Posterior view of the knee

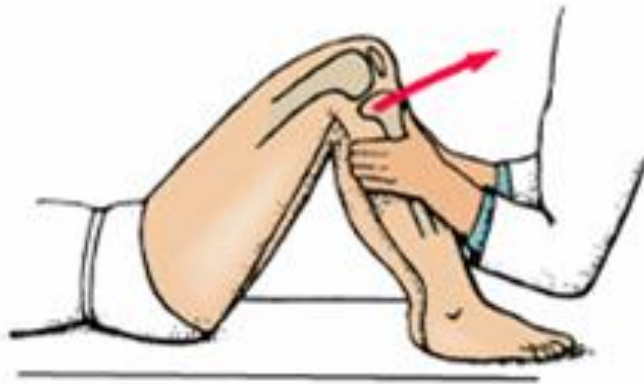
## Clinical Correlate

The tests for the integrity of the anterior and posterior cruciate ligaments are the **anterior and posterior drawer signs**.

Tearing of the anterior cruciate ligaments allows the tibia to be easily pulled **forward** (anterior drawer sign). Tearing of the posterior cruciate ligament allows the tibial to be easily pulled **posteriorly** (posterior drawer sign).

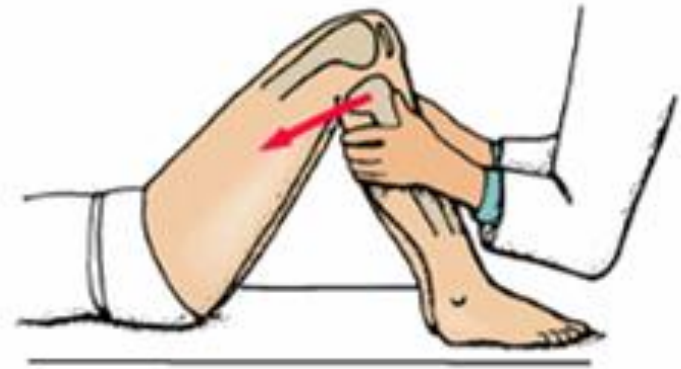
### LELLI'S TEST FOR ACL LESION

<https://www.youtube.com/watch?v=eEhpwTU3KXg>



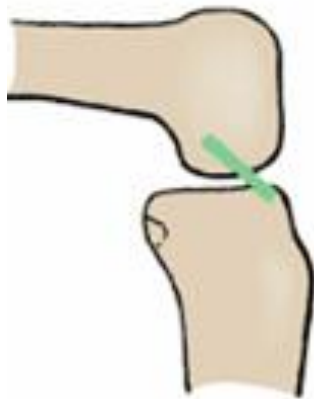
**B**

test for anterior  
cruciate ligament

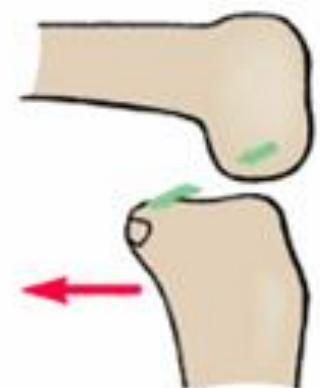
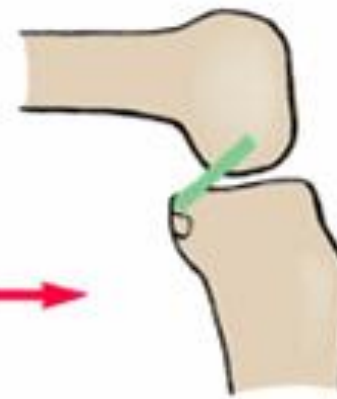


**C**

test for posterior  
cruciate ligament



ruptured anterior  
cruciate ligament



ruptured posterior  
cruciate ligament

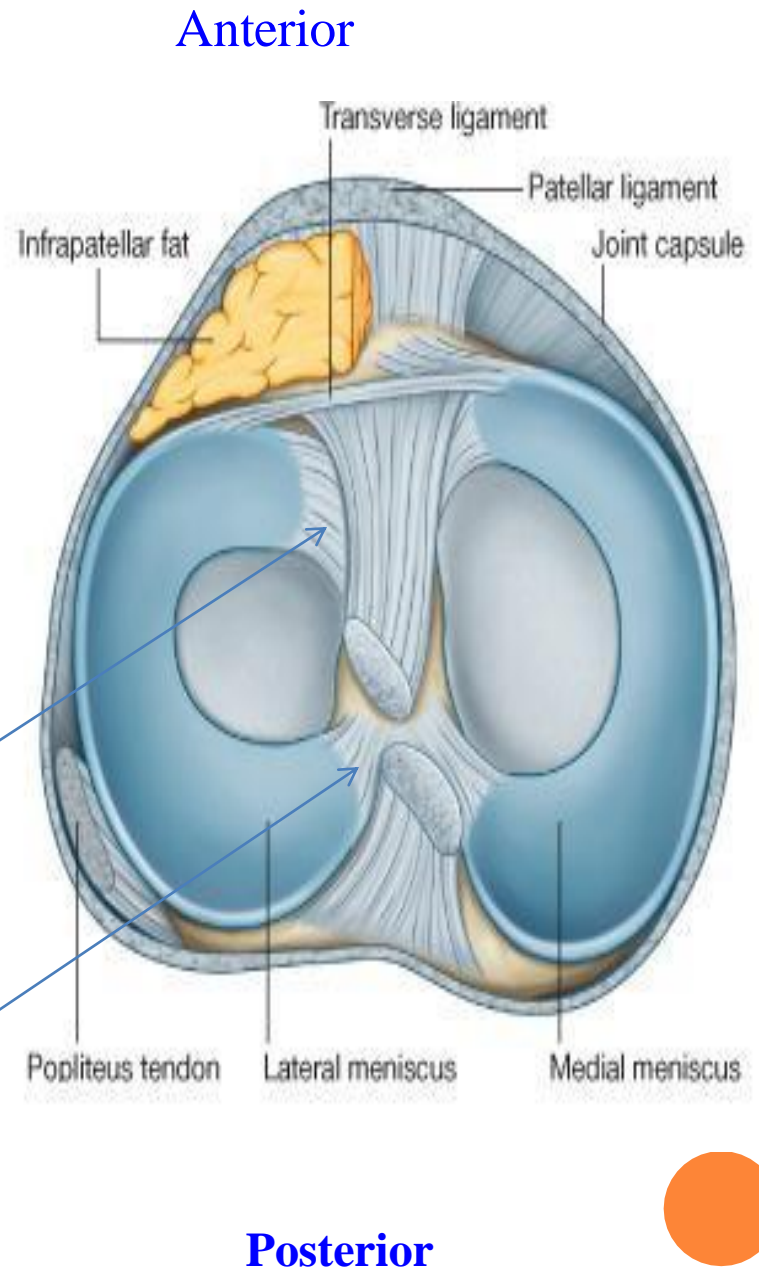
## 5-Menisci

➤ **Medial** and **lateral** menisci are C-shaped sheets of fibrocartilage. (composed of *fibrous connective tissue* and **NOT** of cartilage.

- Their function *is to deepen* the articular surfaces of the tibial condyles to receive the convex femoral condyles;
- They also serve as *cushions* between the two bones

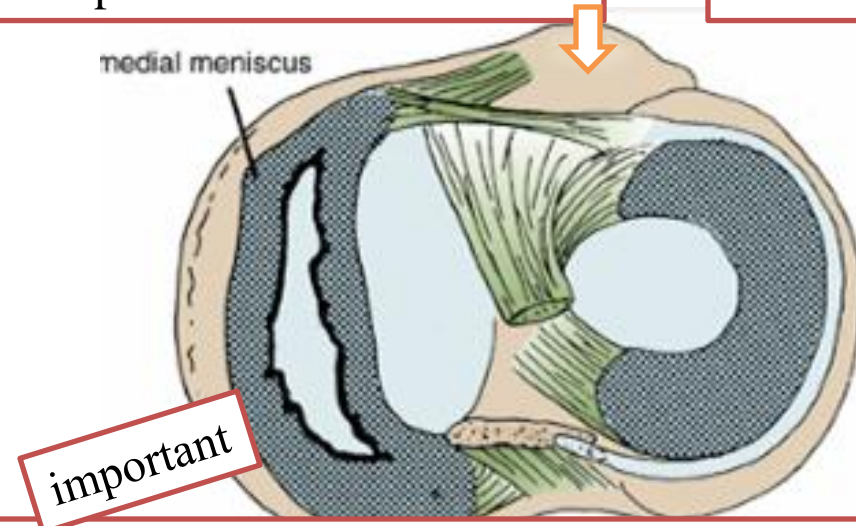
➤ Each meniscus is attached to the upper surface of the tibia **by anterior and posterior horns.**

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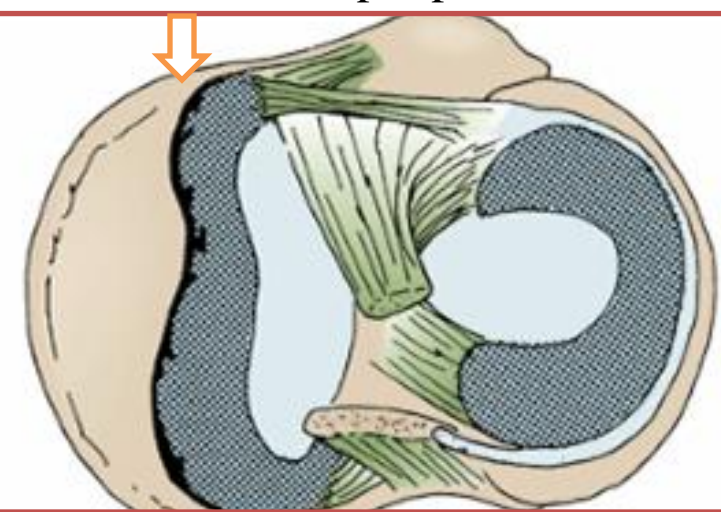




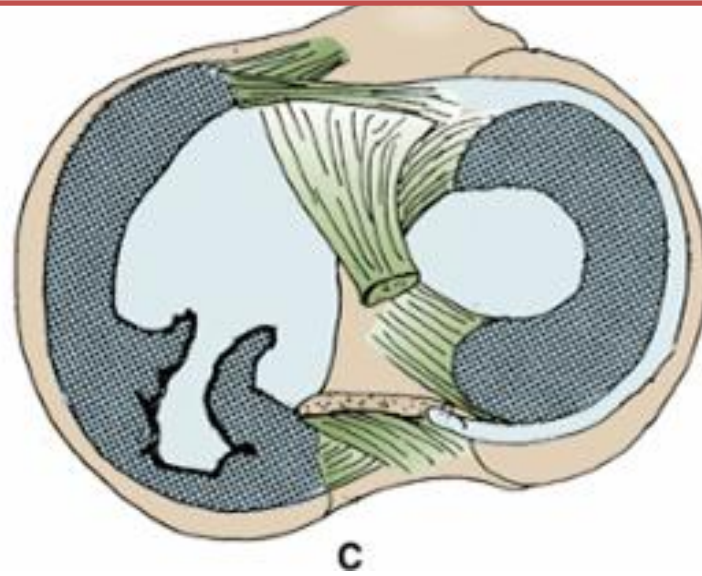
A. Complete bucket handle tear.



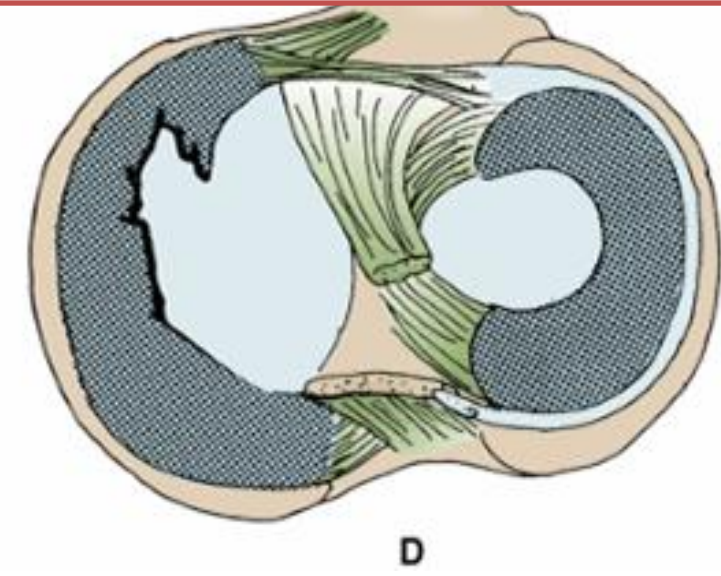
B. The meniscus is torn from its peripheral attachment.



The most common type of meniscus tear that causes locking is known as a bucket-handle tear. This is where part of the cartilage gets torn, but remains partially attached producing a moveable flap. As the knee moves around, if the flap is large enough it can get wedged in the wrong position, blocking the joint and causing **knee locking**.



C. Tear of the posterior portion of the meniscus



D. Tear of the anterior portion of the meniscus



## 6-Locking mechanism

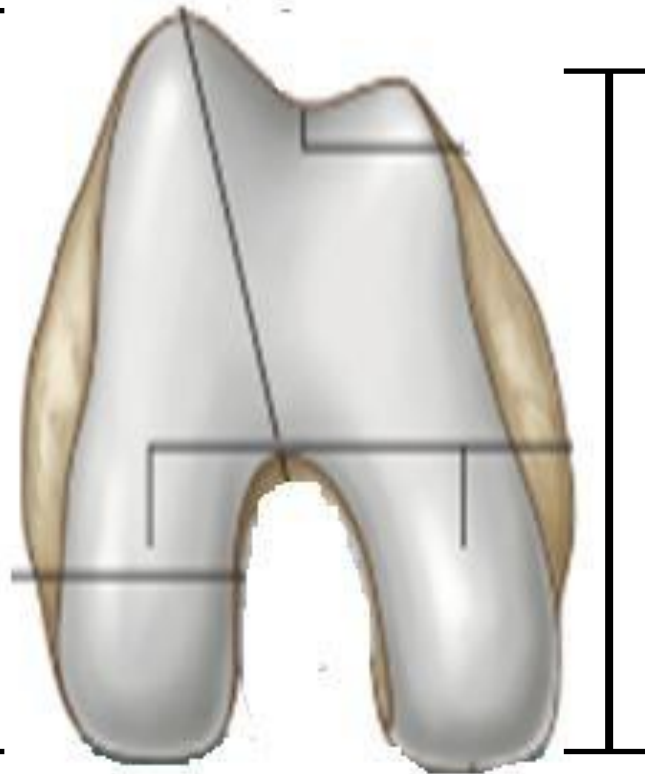
Notice that the lateral condyle of femur is a bit longer than the medial why?!

Lateral condyle of femur  
(OUTR)

THE OUTER IS STOUTER

prevents lateral dislocation  
of the patella

Longer than the medial



Medial condyle of femur  
(INNER)

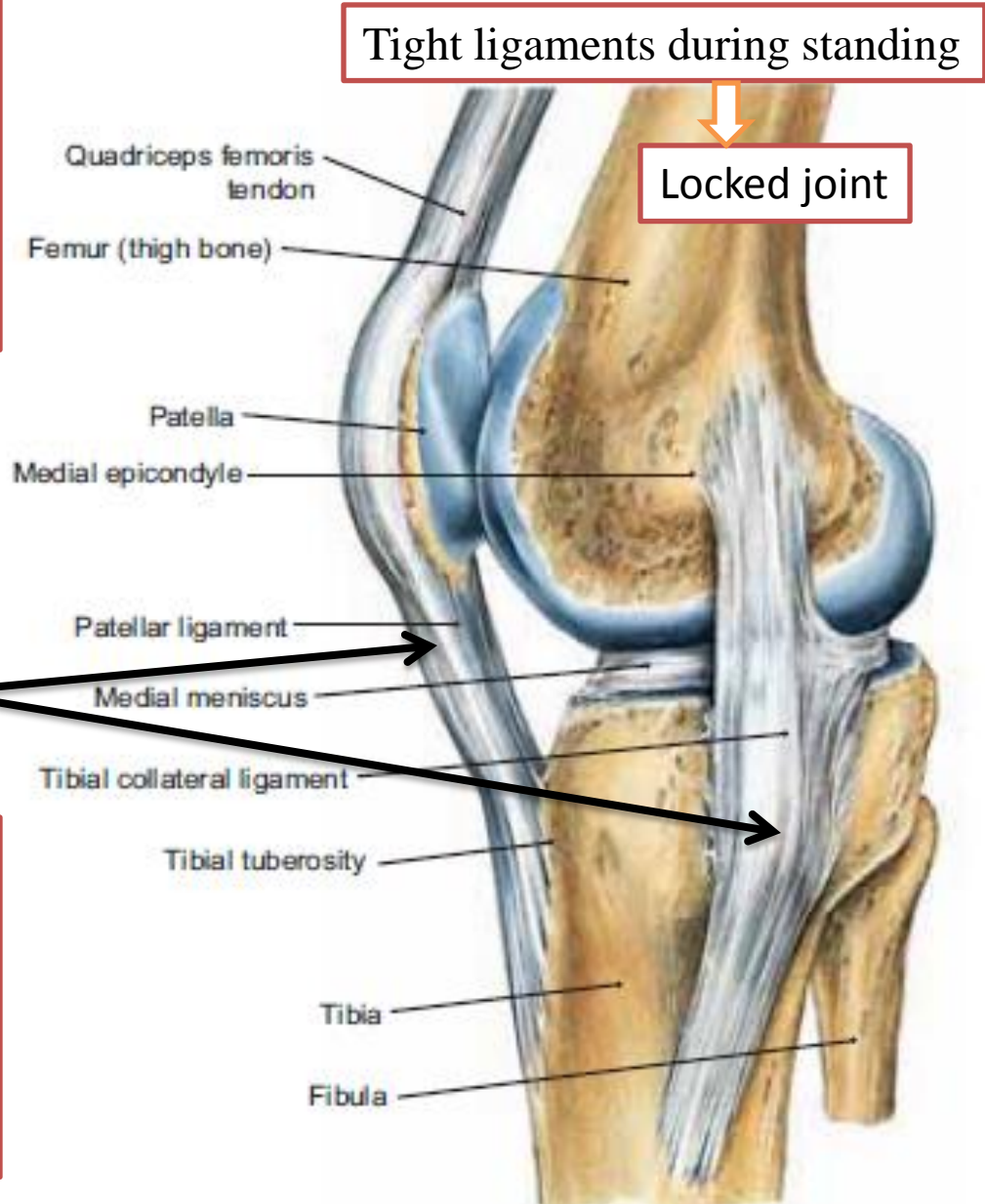
THE INNER IS THINER

## Locking mechanism

➤ When standing, the knee joint is '**locked**' which reduces the amount of muscle work needed to maintain the standing position

➤ The locking mechanism is achieved **by medial rotation of the femur on the tibia during extension**. Medial rotation and full *extension tighten all the associated ligaments*

Another feature that keeps the knee extended when standing is that the **body's center of gravity** is positioned along a vertical line that passes **anterior to the knee joint**.



*The extended knee is said to be in the locked position*

Before flexion of the knee joint can occur, it is essential that the major ligaments be untwisted to permit movements between the joint surfaces.

This ***unlocking*** or untwisting process is accomplished by the ***popliteus muscle***, which **laterally rotates** the femur on the tibia

untight ligaments during flexion

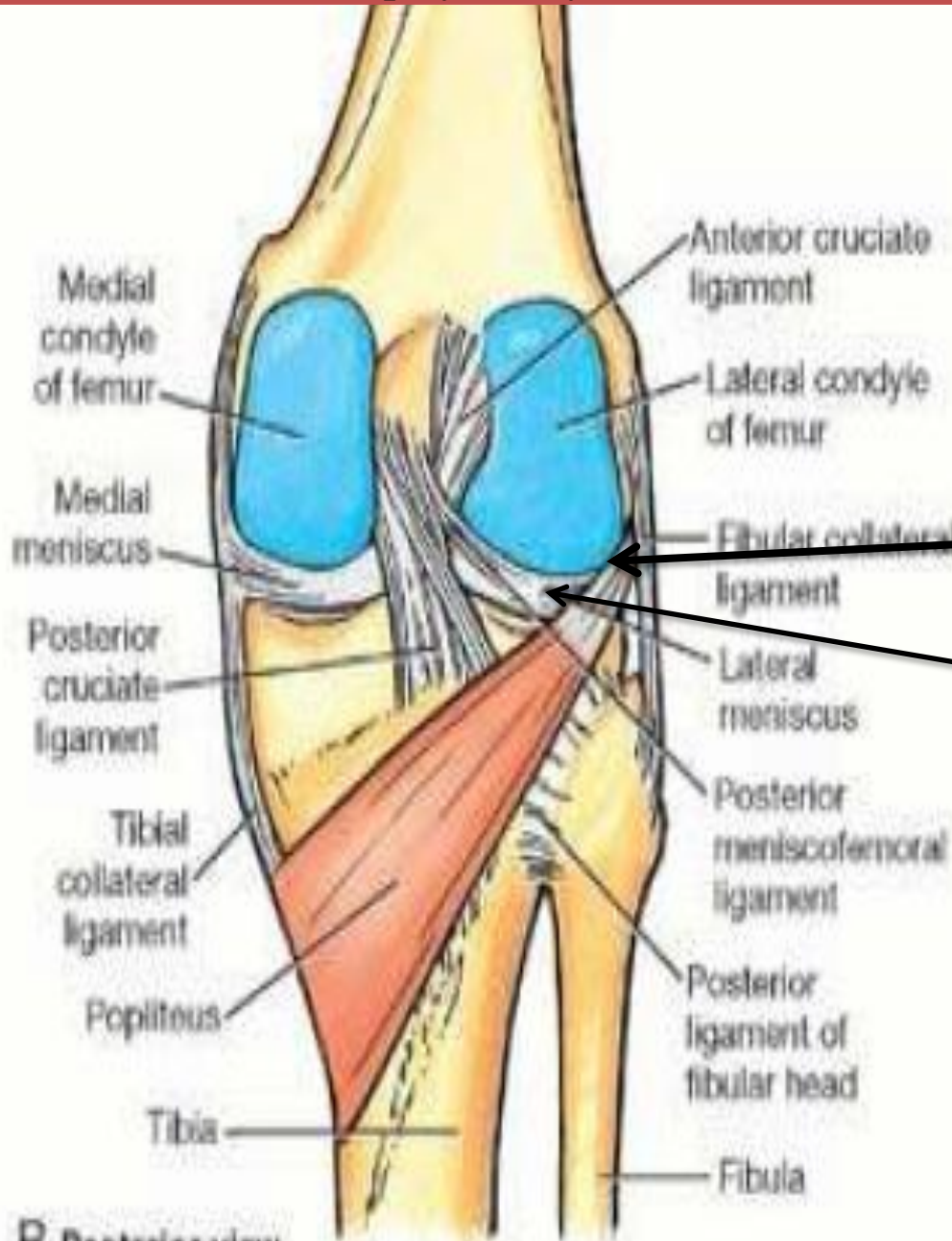


unlocked joint



# Popliteus Muscle

plays a key role in the movements of the knee joint



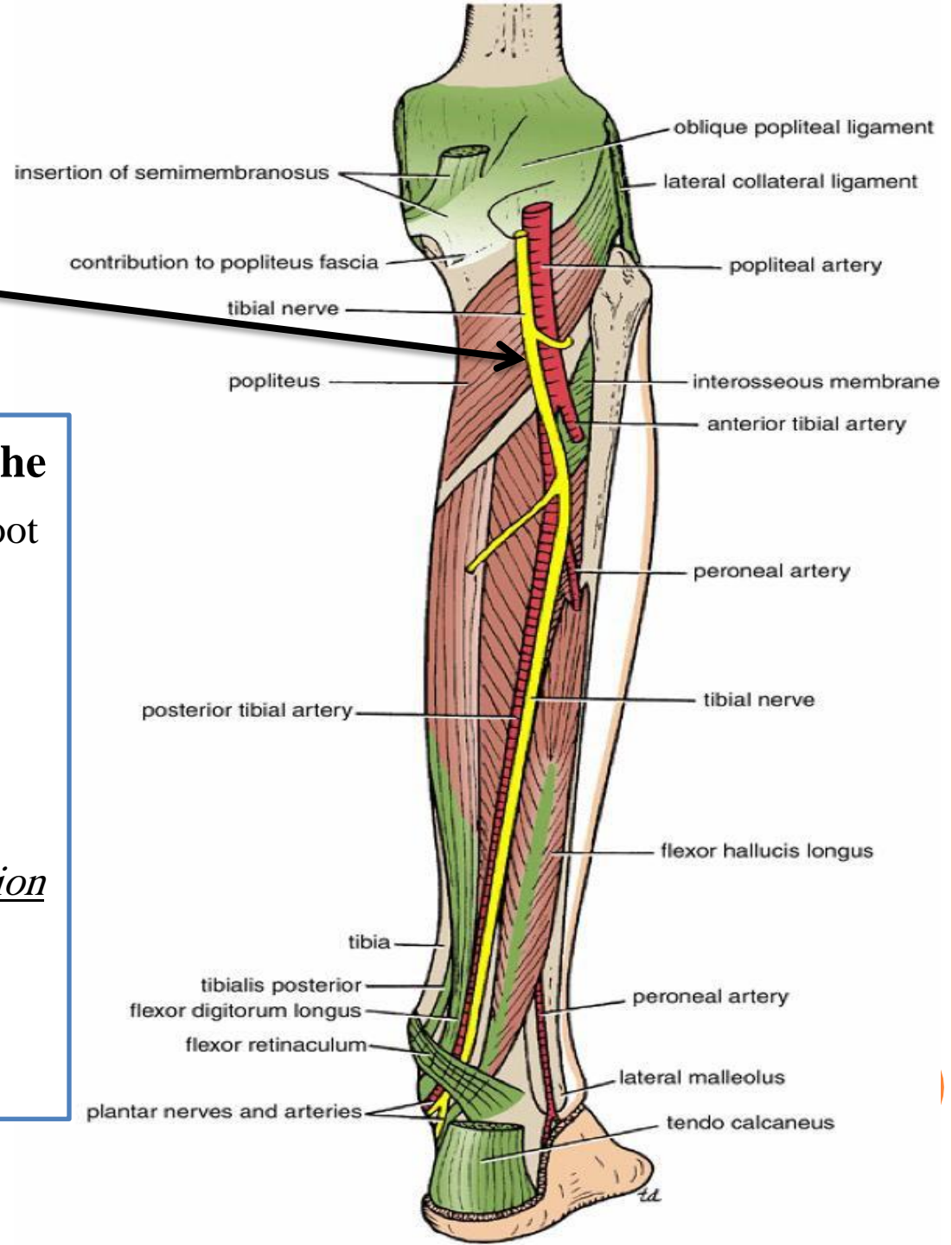
**Origin:** From the *lateral surface of the lateral* condyle of the femur by *a rounded tendon* and by a few fibers from *the lateral semilunar cartilage*



**Insertion:** The fibers pass downward and medially and are attached to the posterior surface of the tibia, above the soleal line.

**Action:** Medial rotation of the tibia on the femur or, if the foot is on the ground, lateral rotation of the femur on the tibia

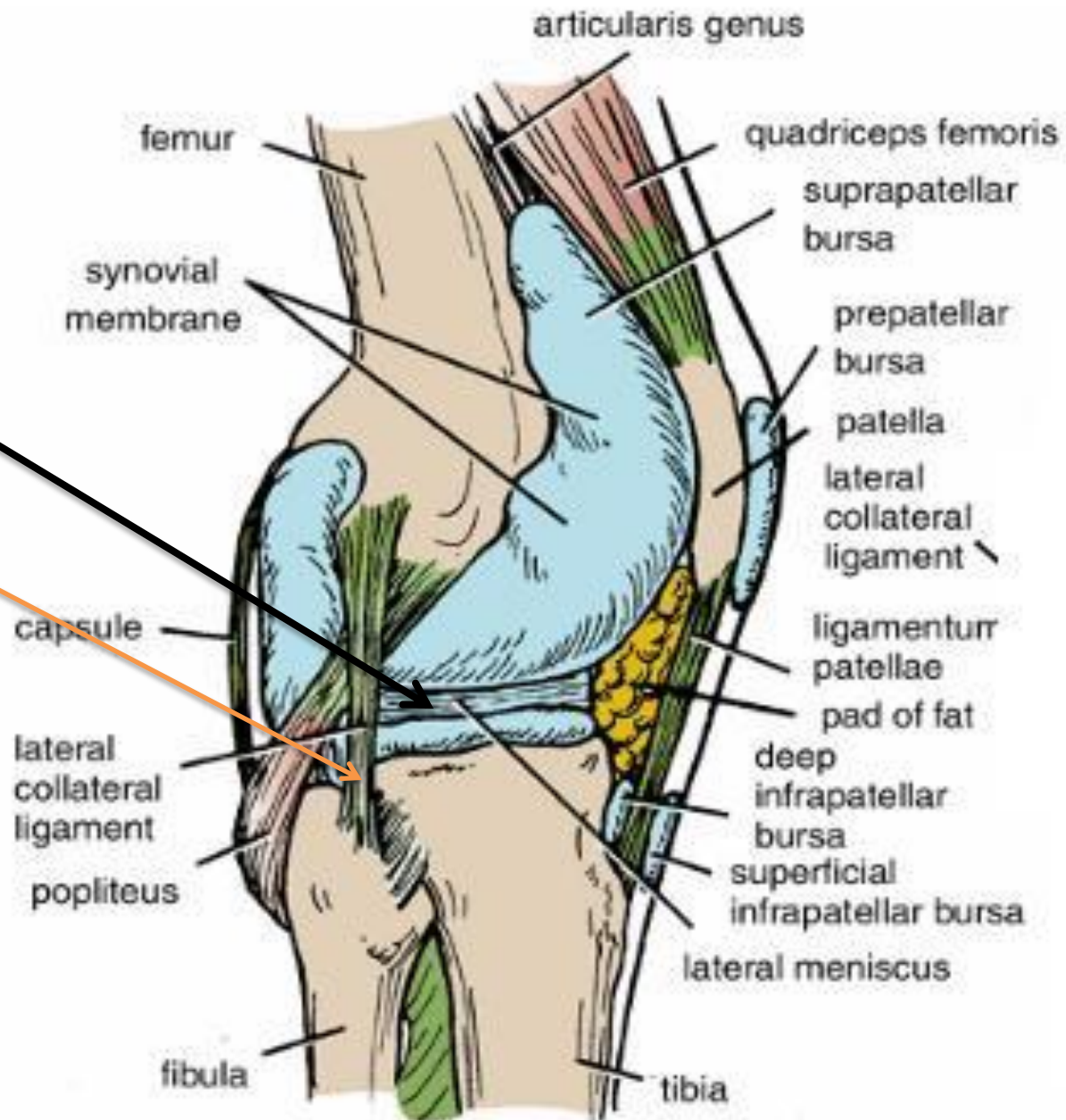
➤ The latter action occurs at the commencement of flexion of the extended knee, and its rotatory action slackens the ligaments of the knee joint, this action is sometimes referred to as **unlocking the knee joint**.





The muscle arises within the capsule of the knee joint

- its tendon separates the **lateral meniscus** **from the lateral ligament of the joint.**
- It emerges through the lower part of the posterior surface of the capsule of the joint to pass to its insertion.

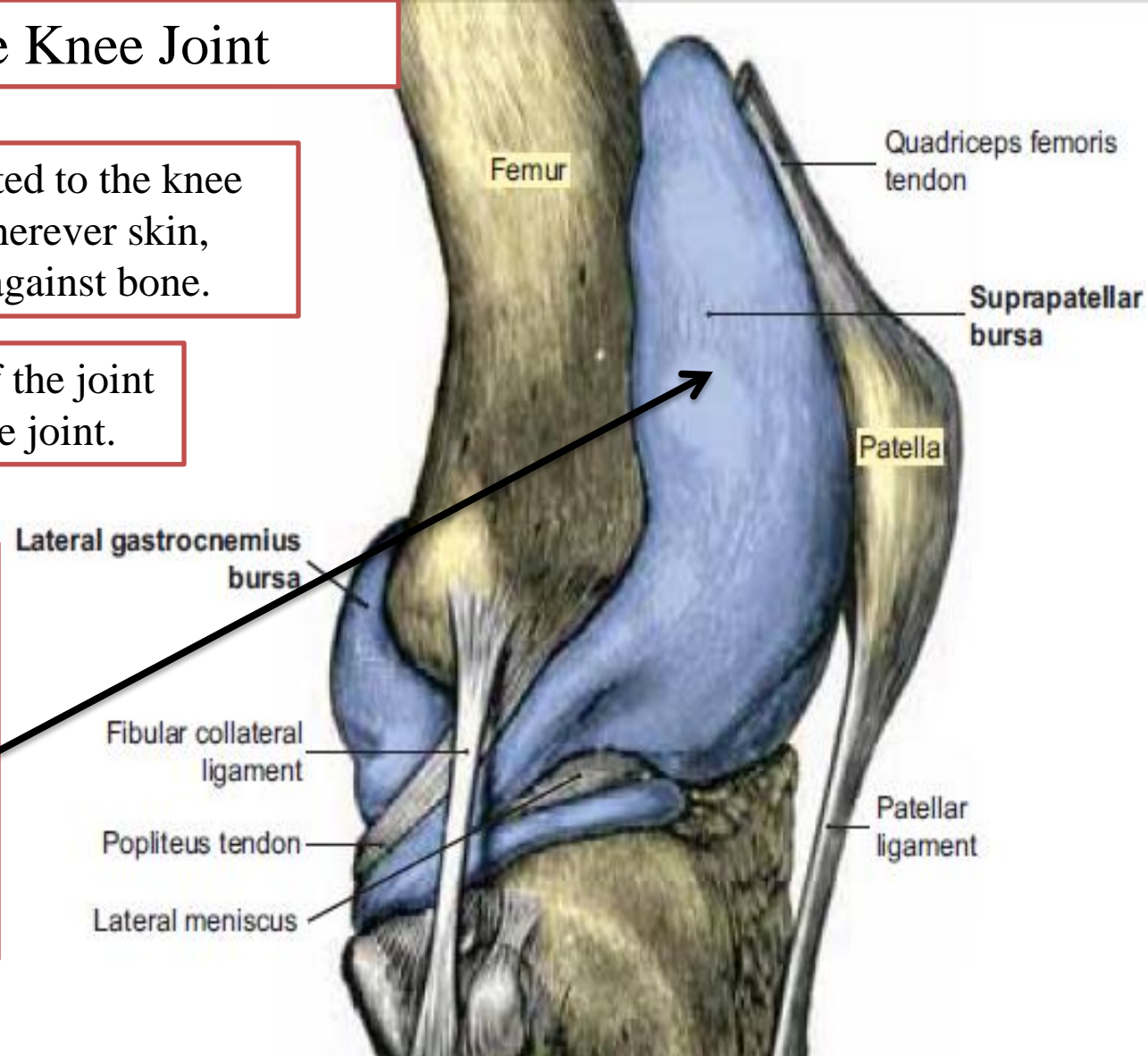


## 7-Bursae Related to the Knee Joint

Numerous bursae are related to the knee joint. They are found wherever skin, muscle, or tendon rubs against bone.

Four are situated in front of the joint and six are found behind the joint.

The suprapatellar bursa lies beneath the quadriceps muscle and **communicates with the joint cavity**

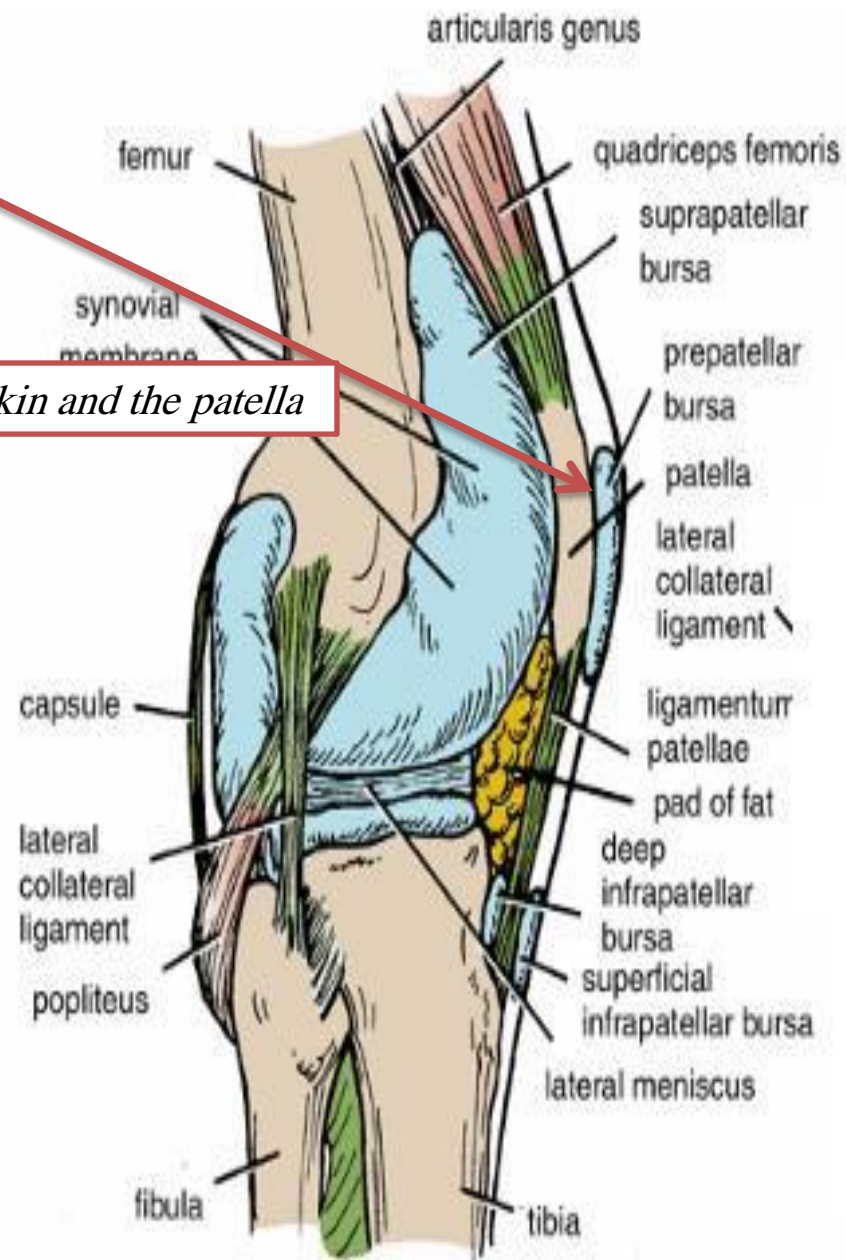


consequently, abrasions or penetrating wounds (e.g., a stab wound) superior to the patella may result in *suprapatellar bursitis* caused by *bacteria entering the bursa from the torn skin*. **The infection may spread to the knee joint.**

**The prepatellar bursa** lies in the subcutaneous tissue between the skin and the front of the lower half of the patella and the upper part of the ligamentum patellae

*Prepatellar bursitis* ("**housemaid's knee**")

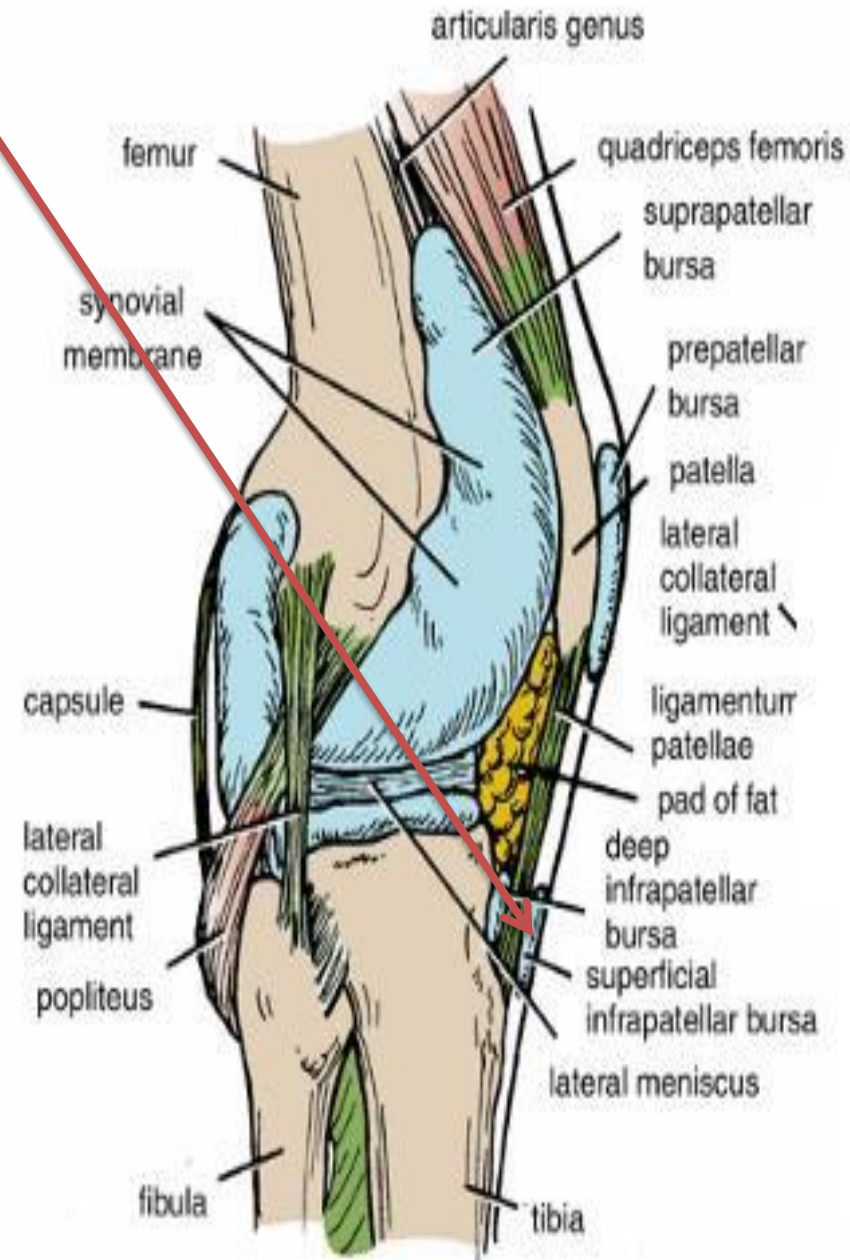
*is usually a friction bursitis caused by friction between the skin and the patella*





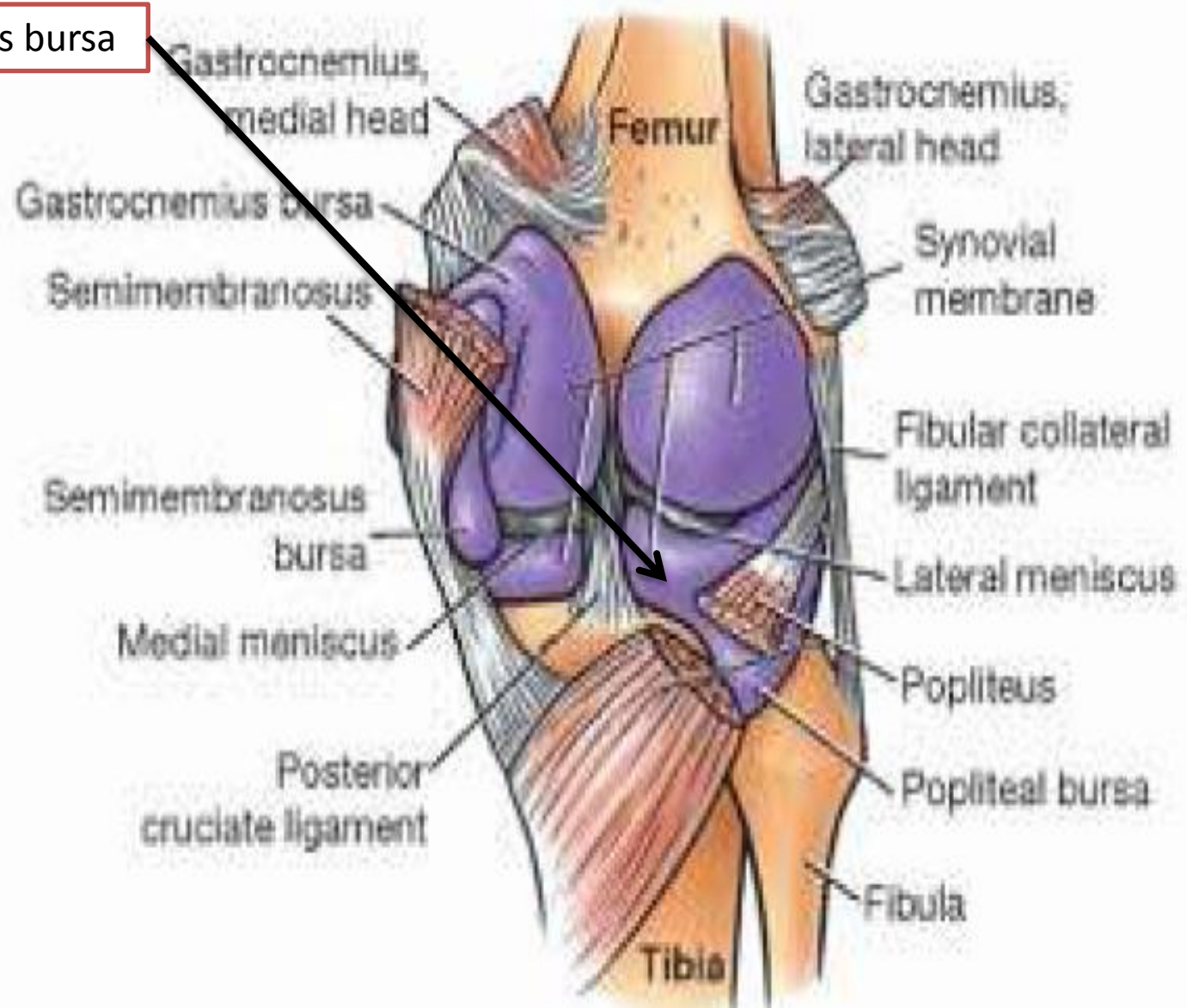
***Subcutaneous superficial infrapatellar bursitis*** results from excessive friction between the skin and the tibial tuberosity

***Deep infrapatellar bursitis*** results in edema between the patellar ligament and the tibia, superior to the tibial tuberosity



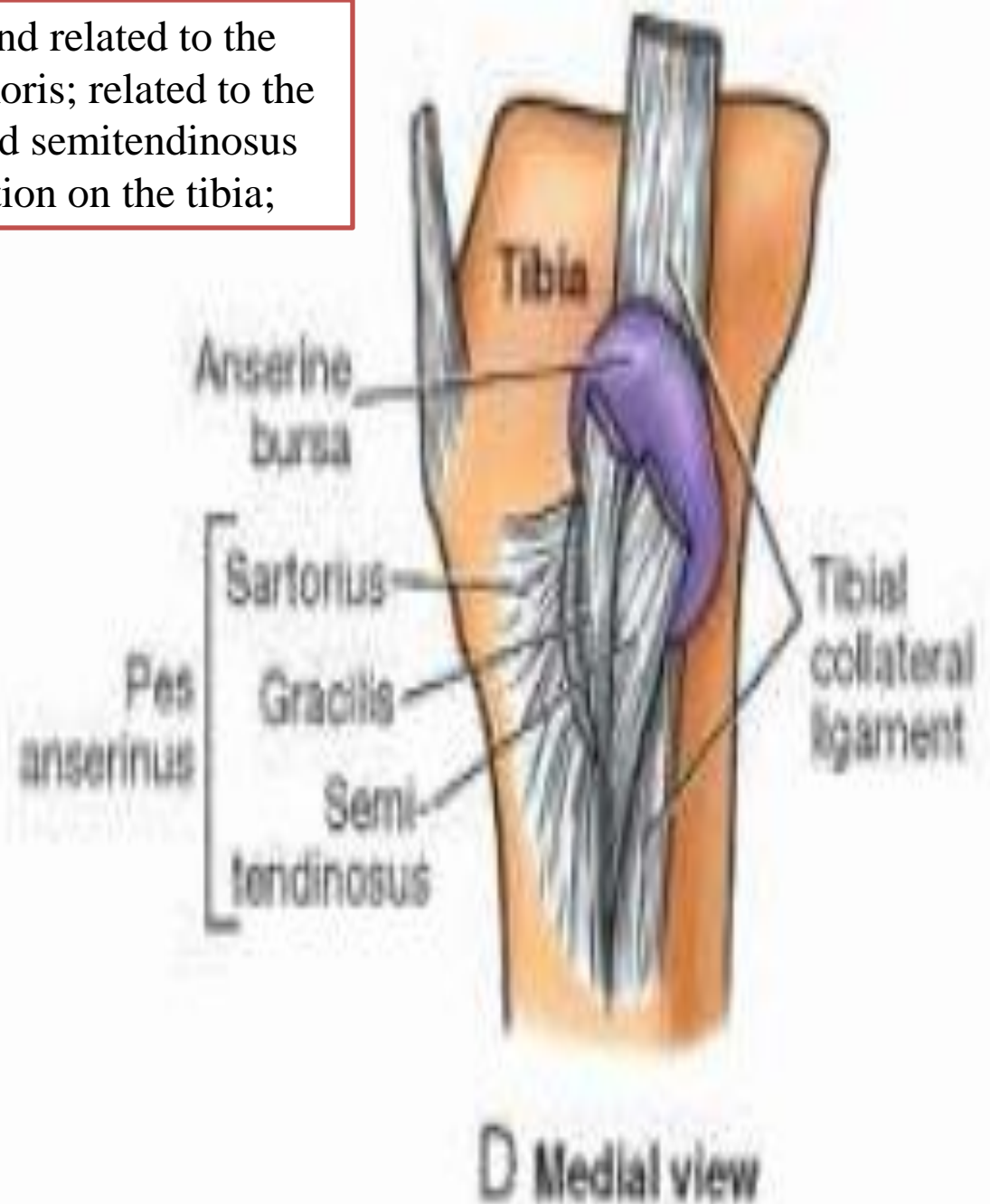
The popliteal bursa is found in association with the tendon of the popliteus and communicates with the joint cavity

The semimembranosus bursa





The remaining four bursae are found related to the tendon of insertion of the biceps femoris; related to the tendons of the sartorius, gracilis, and semitendinosus muscles as they pass to their insertion on the tibia;



8-Nerve Supply of knee joint  
The femoral, obturator, common peroneal, and  
tibial nerves supply the knee joint.

## 9-movements of the knee joint

### Flexion

The **biceps femoris**, **semitendinosus**, and **semimembranosus** muscles, assisted by **the gracilis**, and **sartorius**, produce flexion.

Flexion is limited by **the contact of the back of the leg with the thigh.**

### Extension

The **quadriceps femoris**.

Extension is limited **by the tension of all the major ligaments of the joint.**

### Medial Rotation

The **sartorius**, **gracilis**, and **semitendinosus**

### Lateral Rotation

The **biceps femoris**

Note:

The stability of the knee joint depends on the tone of the strong muscles acting on the joint and the strength of the ligaments.



## 10- blood supply

**Branch of  
the  
femoral  
artery in  
the  
adductor  
canal**

From the popliteal artery

Descending genicular artery —

Articular branch of  
descending genicular  
artery

Saphenous branch  
of descending  
geniculate artery

Medial superior genicular artery

Tibial collateral  
ligament of  
knee joint

## Patellar tendon

Medial inferior genicular artery

Descending branch of lateral circumflex femoral artery

Lateral superior genicular artery

Fibular collateral  
ligament of  
knee joint

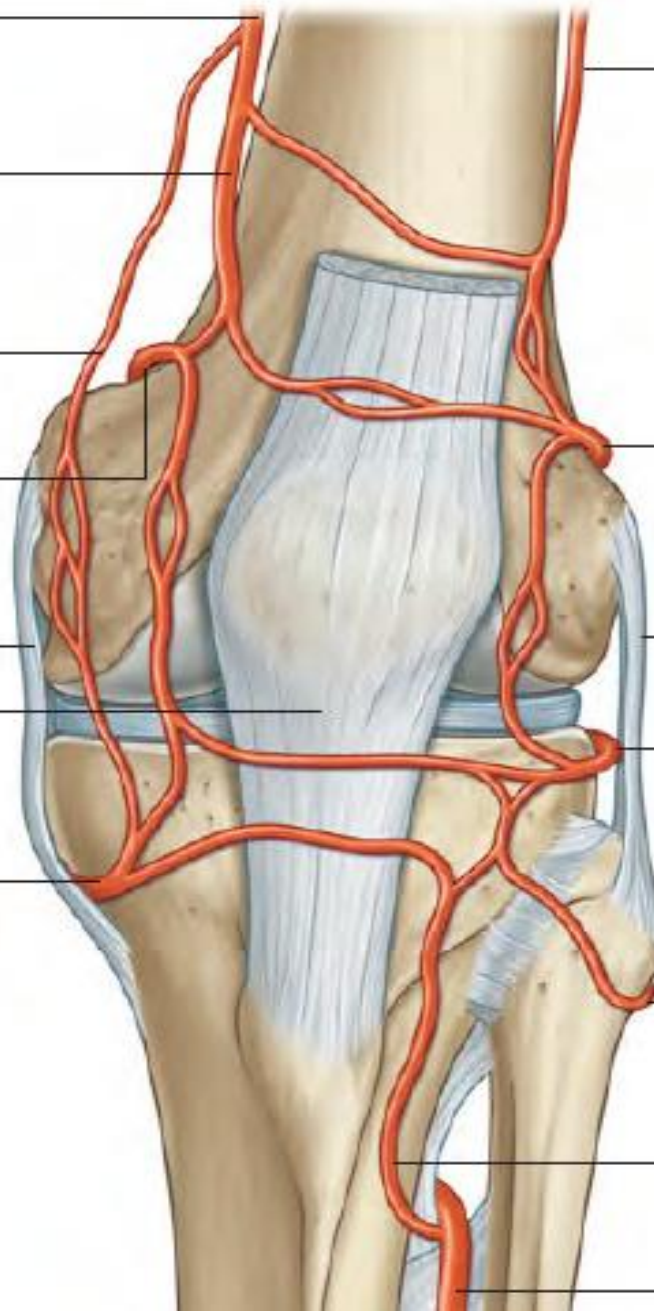
— Lateral inferior genicular artery ←

- Circumflex fibular artery

- Anterior tibial recurrent artery

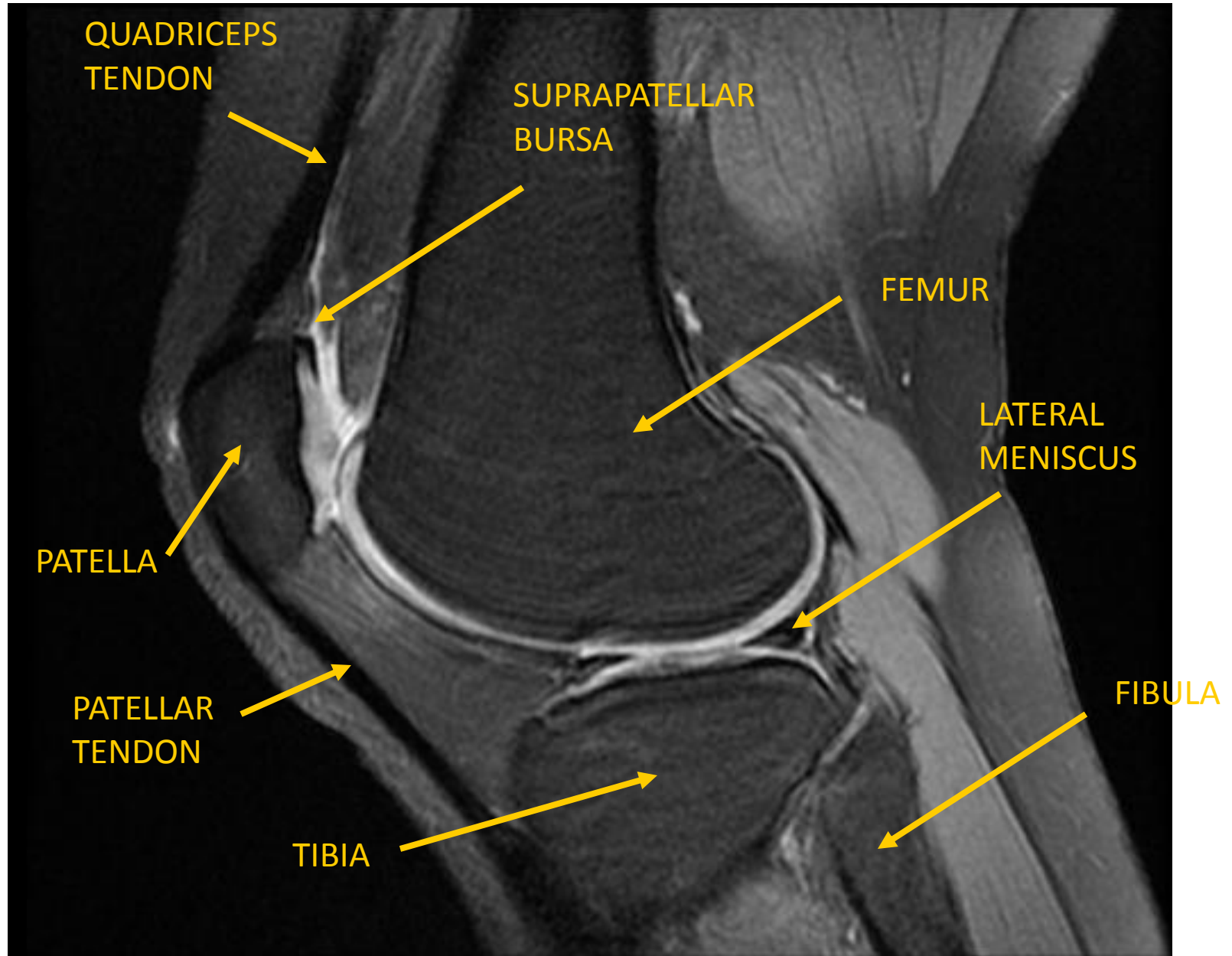
—Anterior

## From the popliteal artery



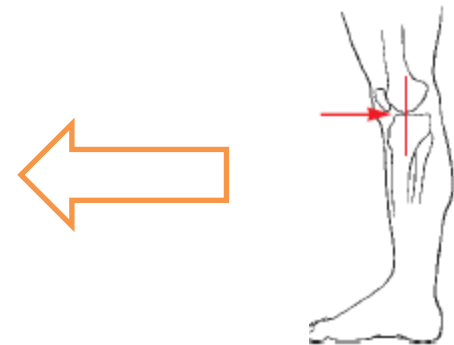
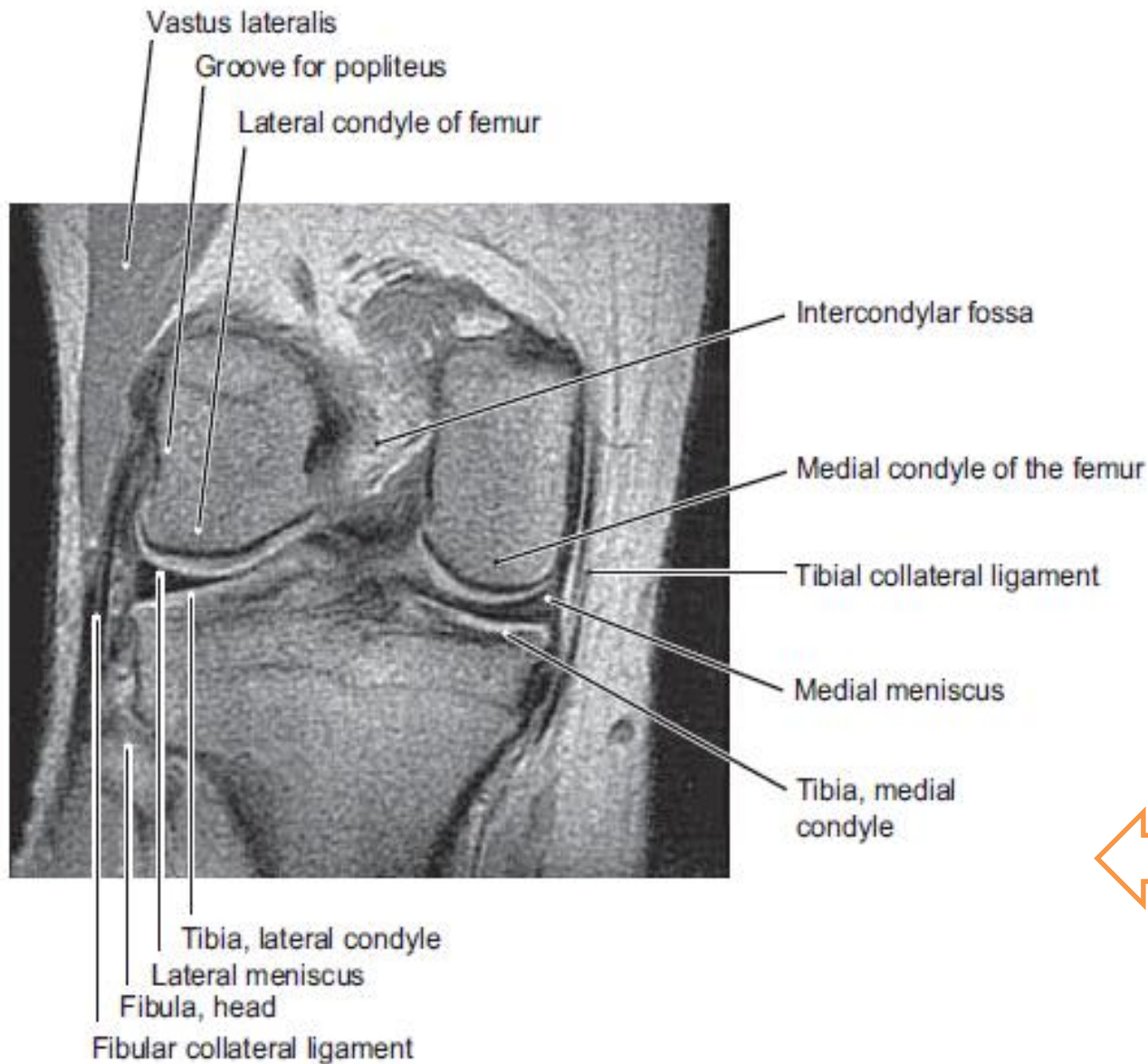


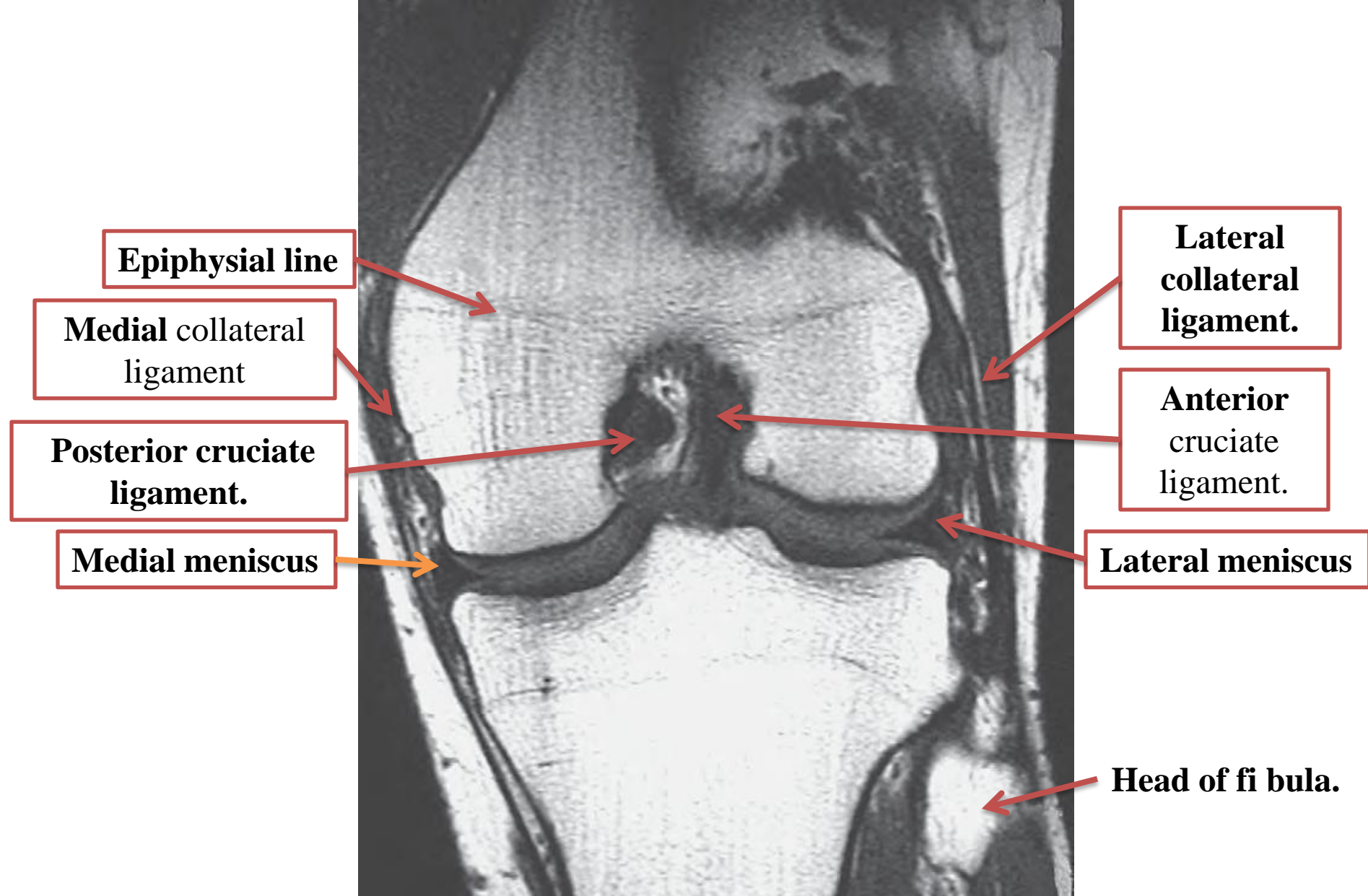
# 11-MRI of the knee: sagittal view



## MRI of the Knee Joint (Frontal Section)

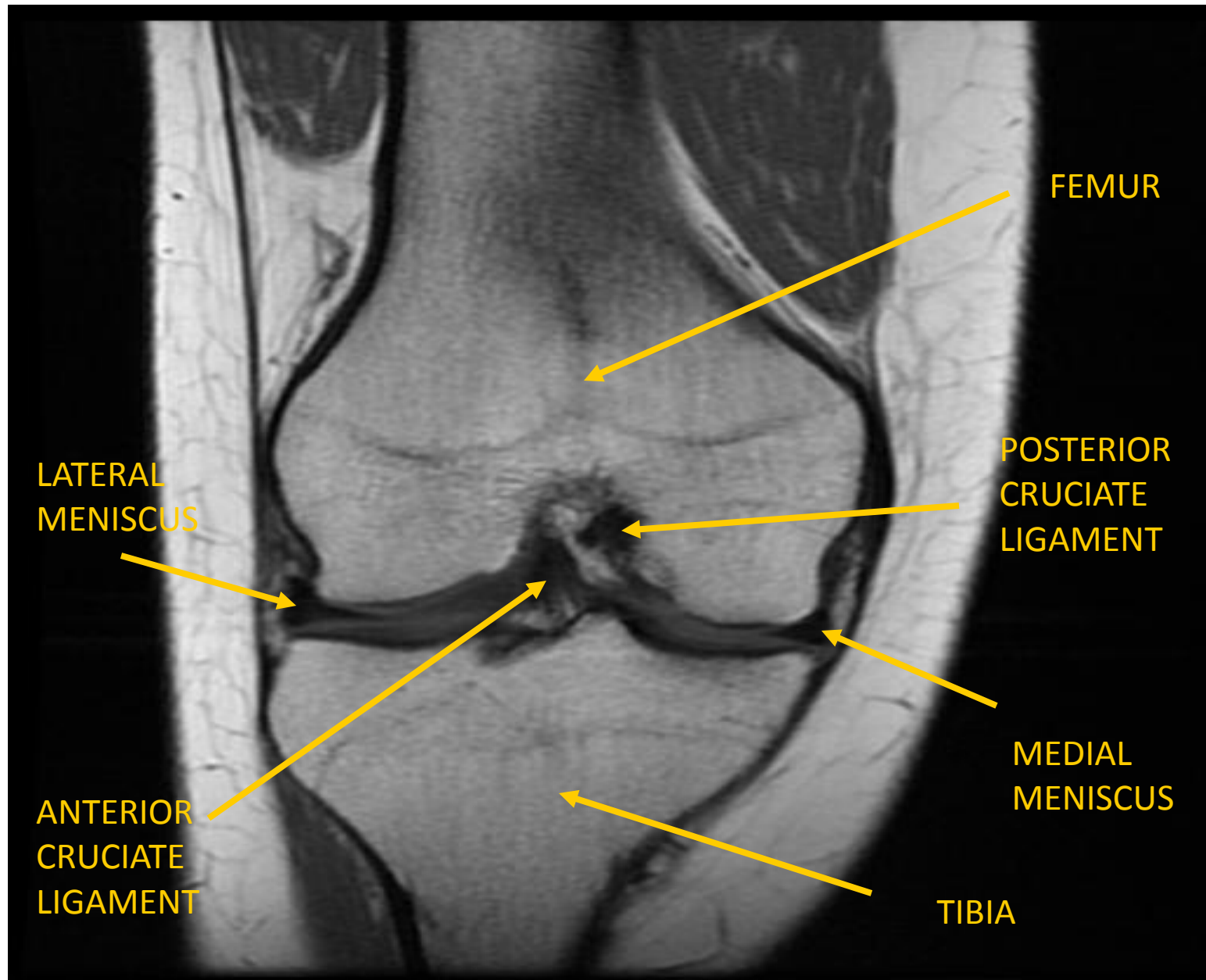
NOTE: This MRI frontal section cuts through the intercondylar eminence of the tibia (not labeled) and the intercondylar fossa of the femur. Observe the menisci, which in this frontal section, have a triangular shape.





**Fig. 82.10** Coronal T1-weighted magnetic resonance image (MRI) of the knee in an adult male. (By courtesy of Dr Justin Lee, Chelsea and Westminster Hospital, London.)

# MRI of the knee: coronal plane





## Tibial (medial) and fibular (lateral) collateral ligaments

**Tibial collateral ligament** extends from the medial epicondyle of the femur inferiorly to attach to the medial aspect of the tibia. It is firmly attached to the capsule and medial meniscus. The tibial ligament prevents **lateral displacement** (abduction) of the tibia under the femur.



## Common Knee Injuries

The 3 most commonly injured structures at the knee are the tibial collateral ligament, the medial meniscus, and the ACL (the terrible or unhappy triad)—usually results from a blow to the lateral aspect of the knee with the foot on the ground.



