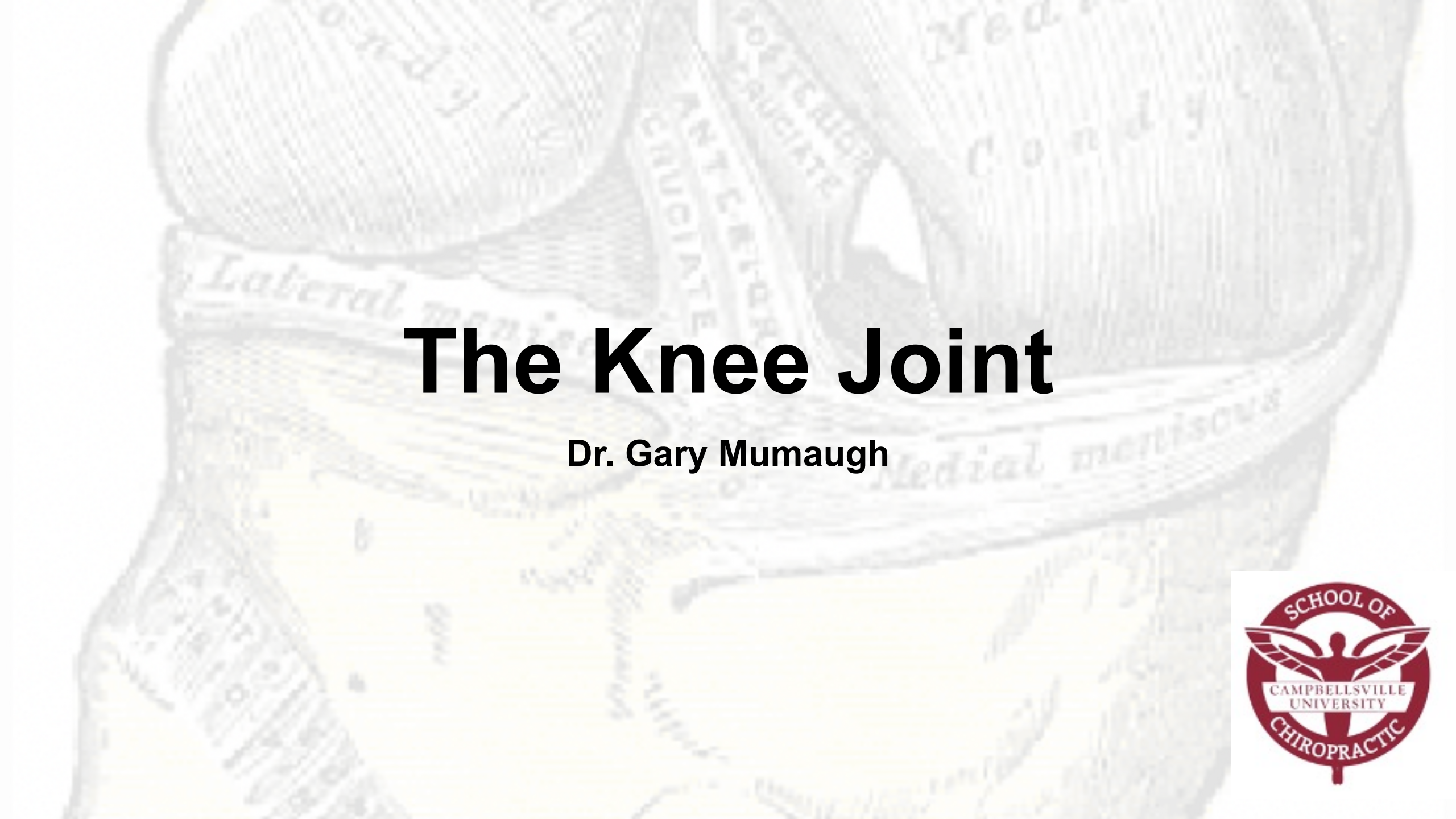
The Knee Joint

Dr. Gary Mumaugh



Why is it such a complicated joint?

- The knee joint is the largest and arguably the most stressed joint in the body.
- The arrangement of the bones in the joint provides a fulcrum that translates the actions of the flexor and extensor muscles of the knee.
- The arrangement of the extracapsular and intracapsular and ligaments, as well as extensions of muscles that cross the joint, provide the much needed stability that counters the considerable biomechanical stress brought upon the joint.

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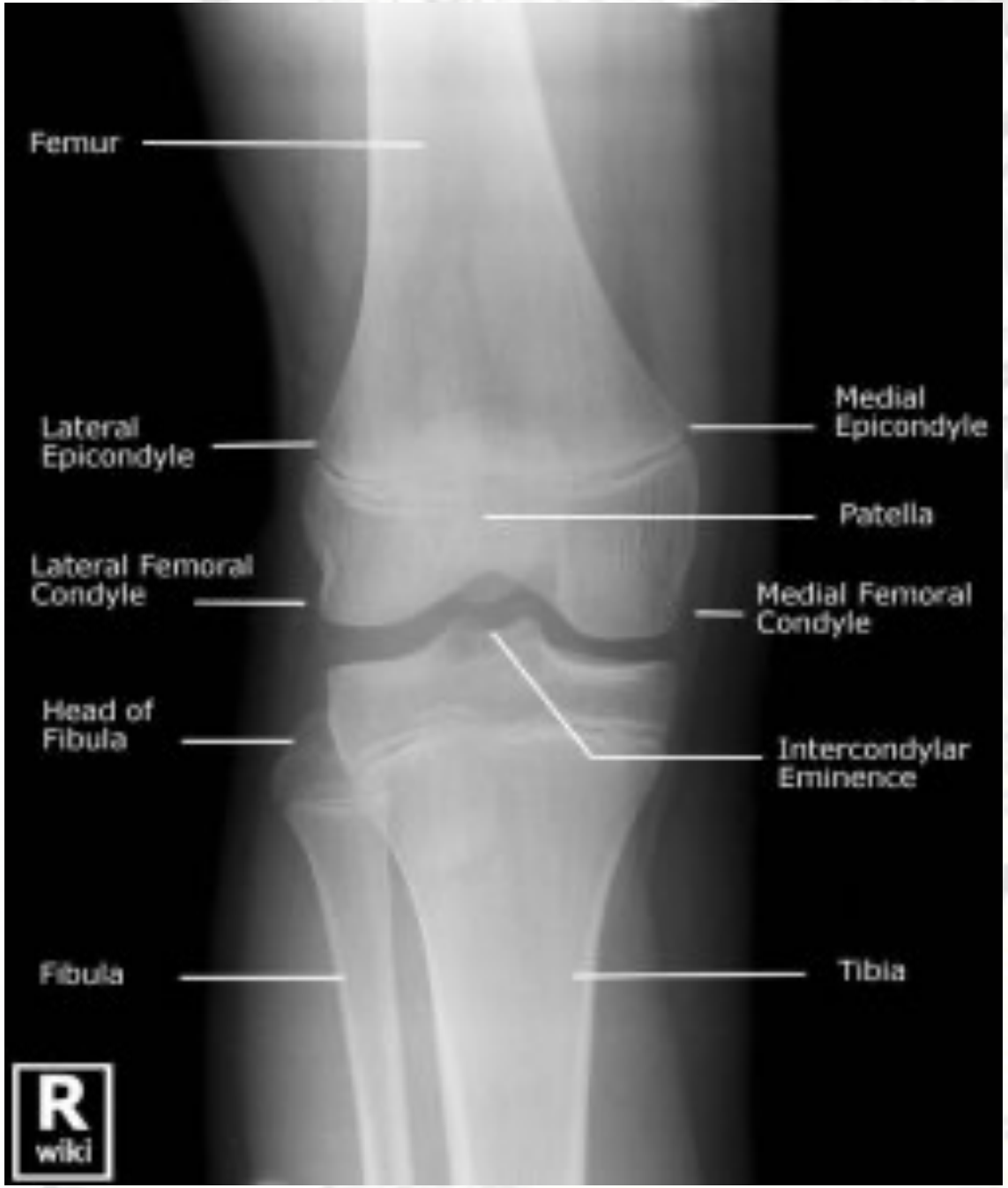
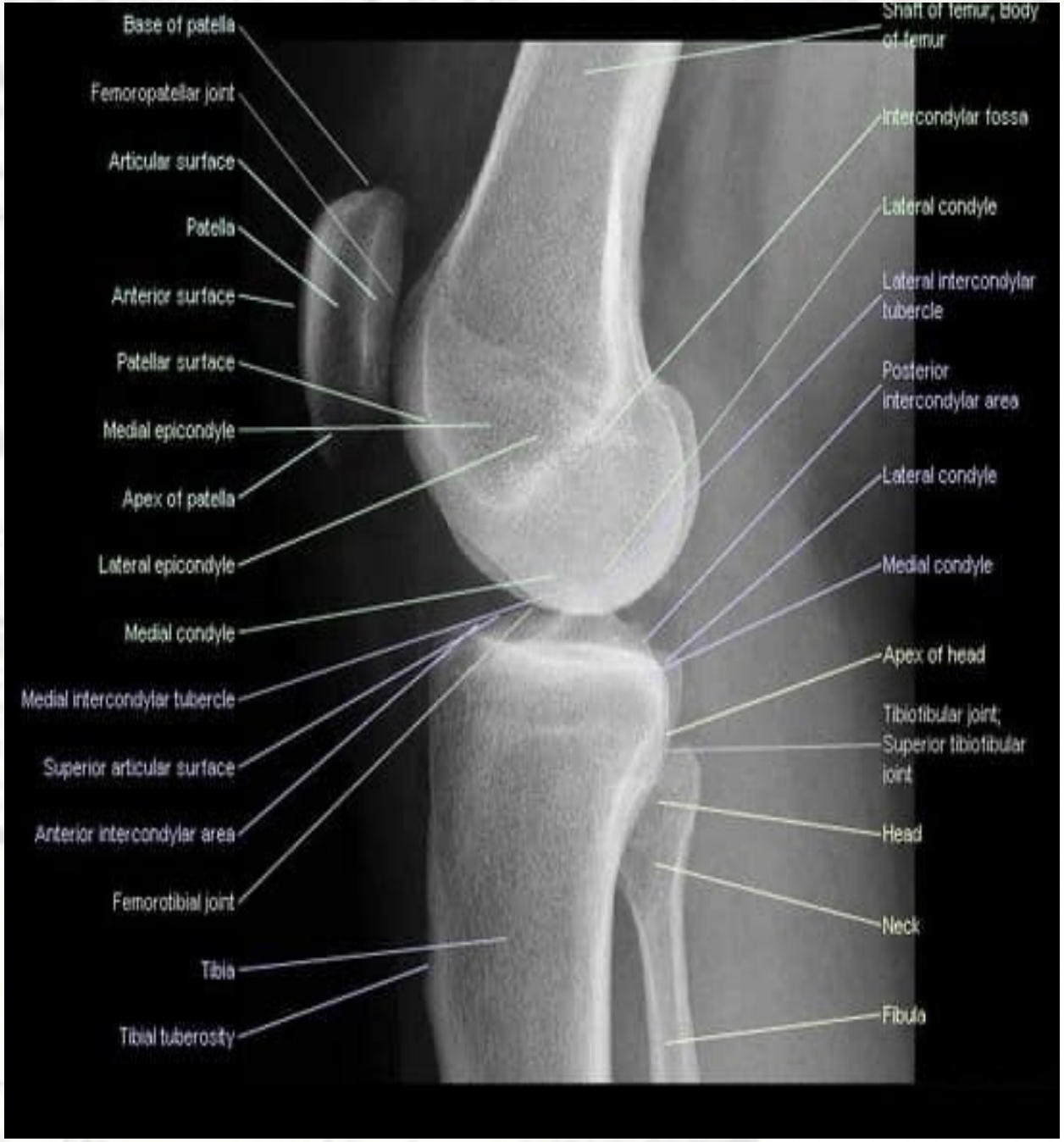
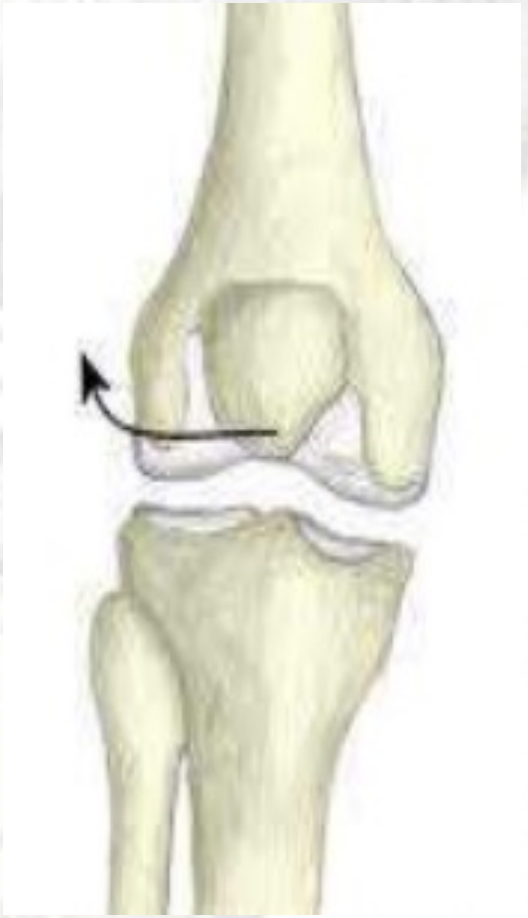

Femur
Lateral Epicondyle
Medial Epicondyle
Patella
Lateral Femoral Condyle
Medial Femoral Condyle
Head of Fibula
Intercondylar Eminence
Fibula
Tibia
R
wiki


Base of patella
Femoropatellar joint
Articular surface
Patella
Anterior surface
Patellar surface
Medial epicondyle
Apex of patella
Lateral epicondyle
Medial condyle
Medial intercondylar tubercle
Superior articular surface
Anterior intercondylar area
Femorotibial joint
Tibia
Tibial tuberosity
Shaft of femur; Body of femur
Intercondylar fossa
Lateral condyle
Lateral intercondylar tubercle
Posterior intercondylar area
Lateral condyle
Medial condyle
Apex of head
Tibiofibular joint; Superior tibiofibular joint
Head
Neck
Fibula

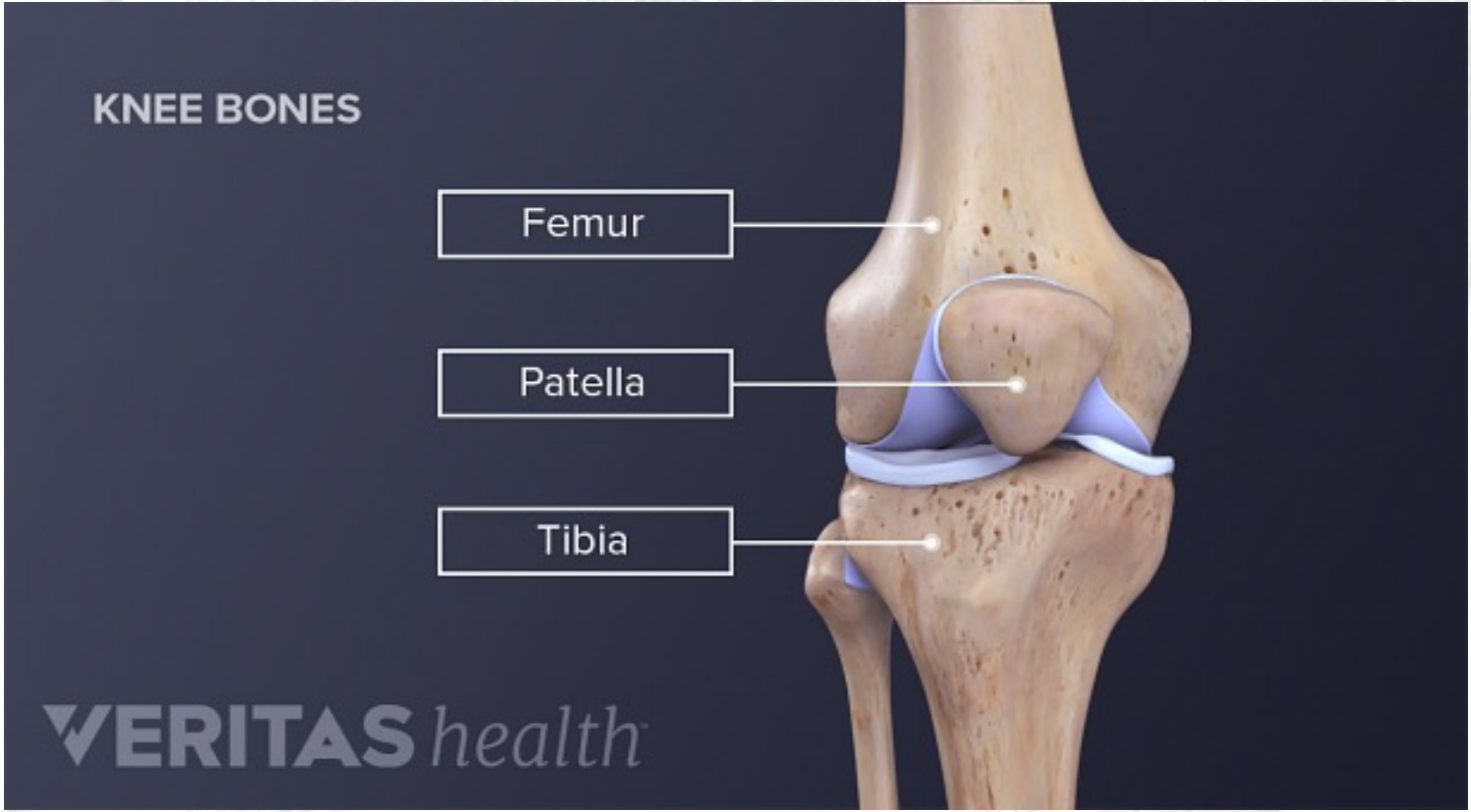
Bones in the knee joint

Femur

Tibia



Patella

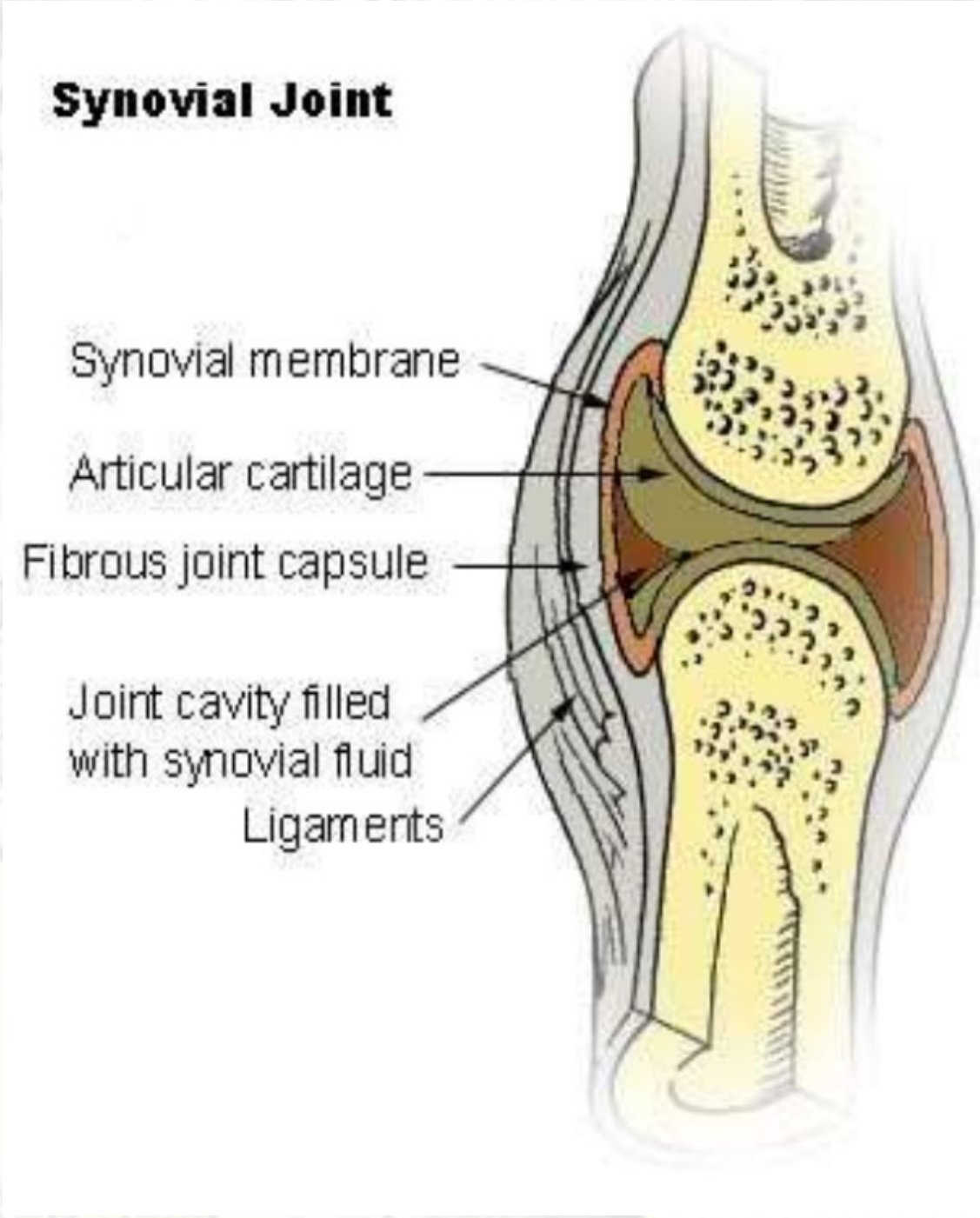

KNEE BONES
Femur
Patella
Tibia
VERITAS health

The Fibula is not directly involved with the knee joint

- The knee joint is a synovial joint that connects the femur, tibial and patella
- It is a complex hinge joint composed of two articulations
  - The tibiofemoral joint is an articulation between the tibia and the femur.
  - The patellofemoral joint is an articulation between the patella and the femur.

Synovial Joint

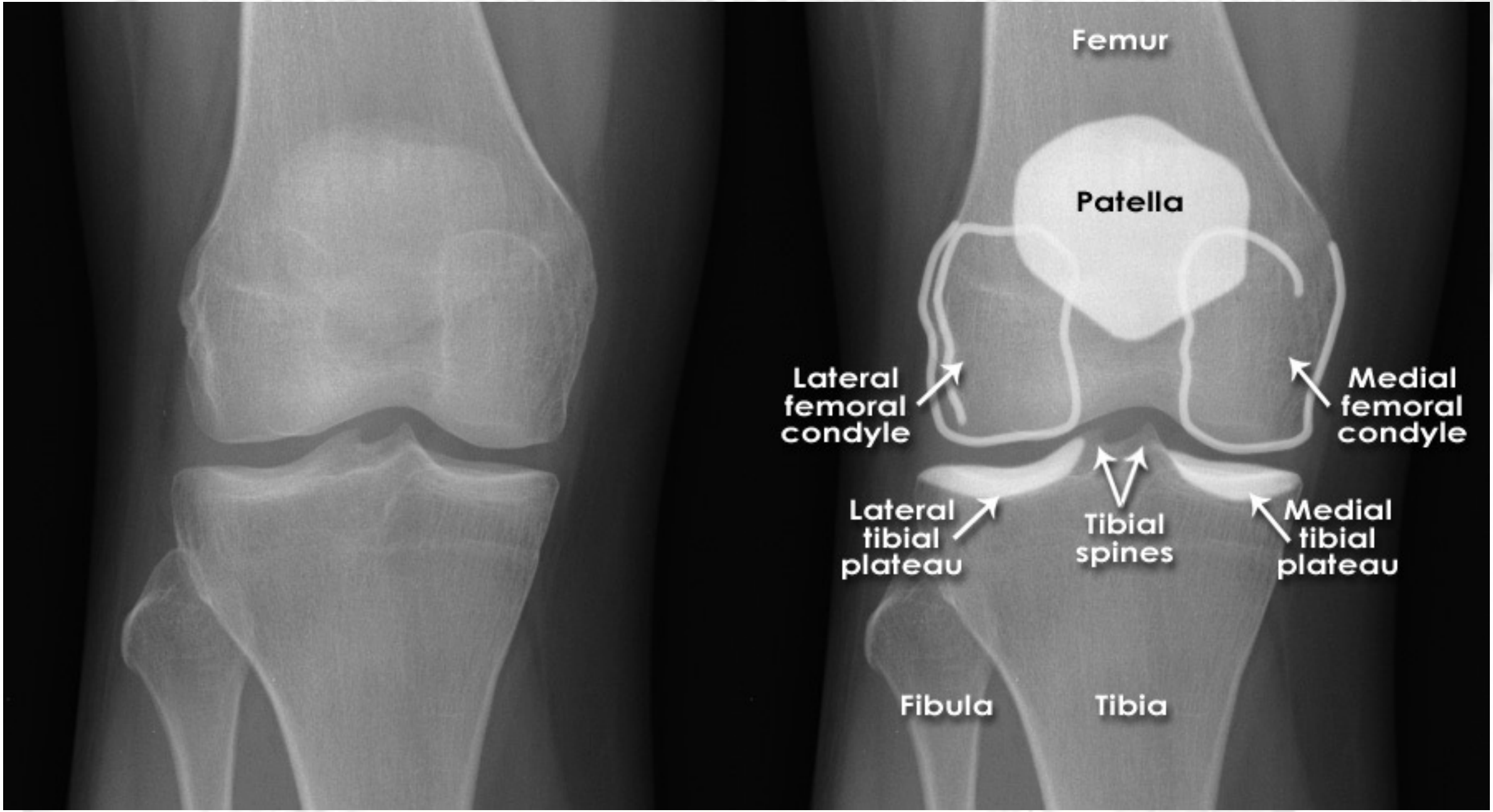
- The knee joint is a synovial joint enclosed by a ligament capsule and contains synovial fluid that lubricates the joint.



The Tibiofemoral Joint

- The tibiofemoral joint is an articulation between the lateral and medial condyles of the distal end of the femur and the tibial plateaus, both of which are covered by a thick layer of hyaline cartilage.
- The lateral and medial condyles are two bony projections located at the distal end of the femur, which have a smooth convex surface, and are separated posteriorly by a deep groove known as the intercondylar fossa.

- The medial condyle is larger, more narrow and further projected than its lateral counterpart, which accounts for the angle between the femur and the tibia.
- The roughened outer surfaces of the medial and lateral condyles are defined as medial and lateral epicondyles, respectively.
- Along the posterior aspect of the distal femur, there are paired rough elevations above the medial and lateral epicondyles known as the medial and lateral supracondylar ridges.

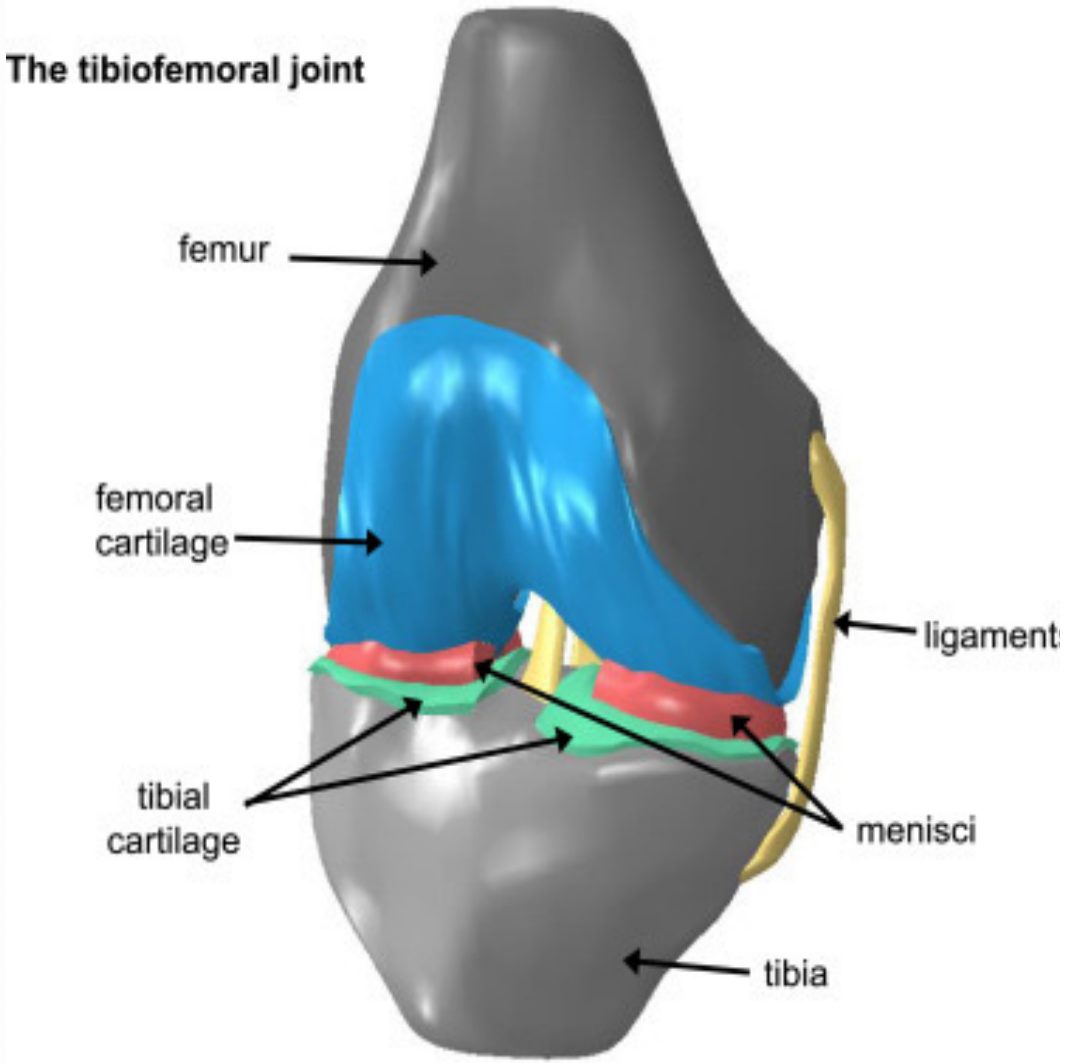

Femur
Patella
Lateral femoral condyle
Medial femoral condyle
Lateral tibial plateau
Tibial spines
Medial tibial plateau
Fibula
Tibia

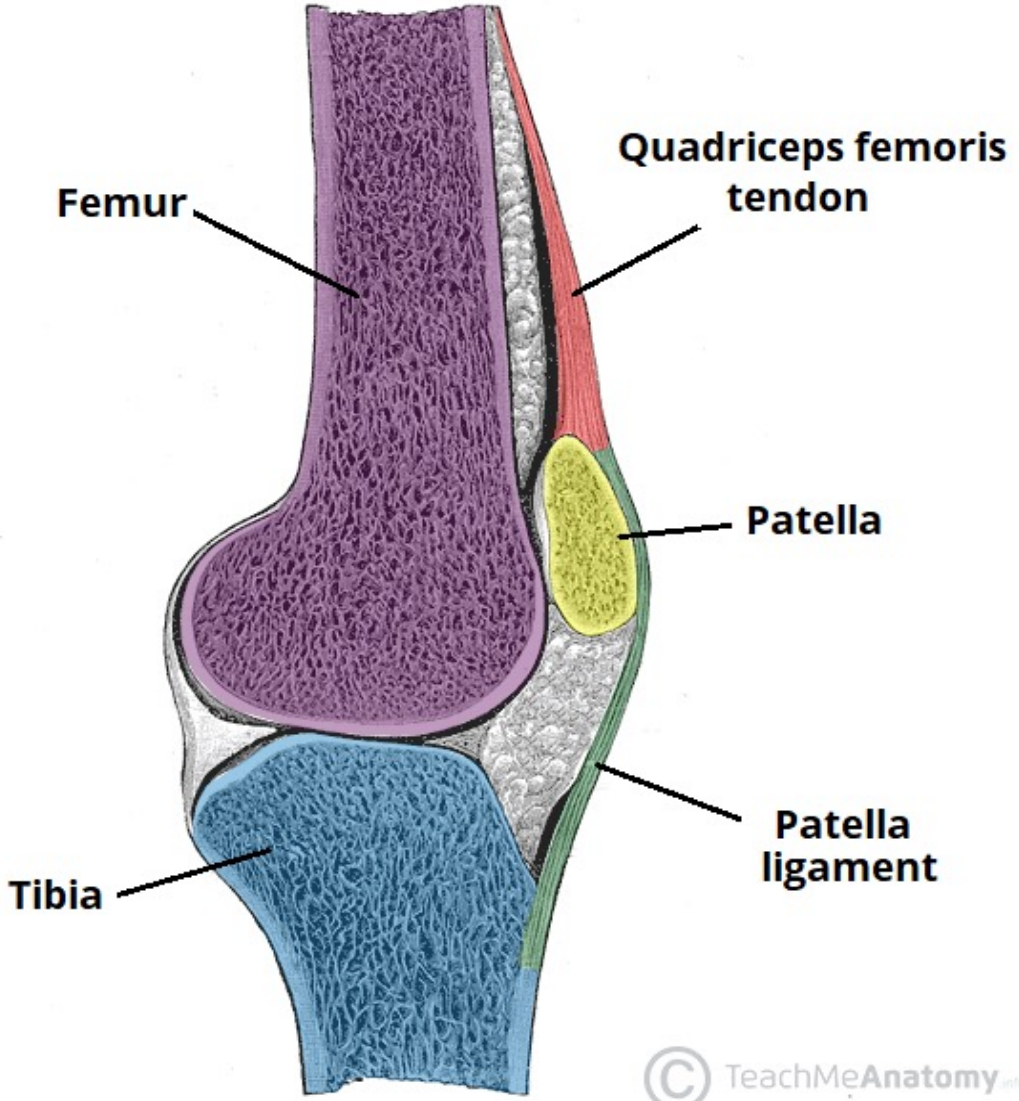
Tibial Plateau

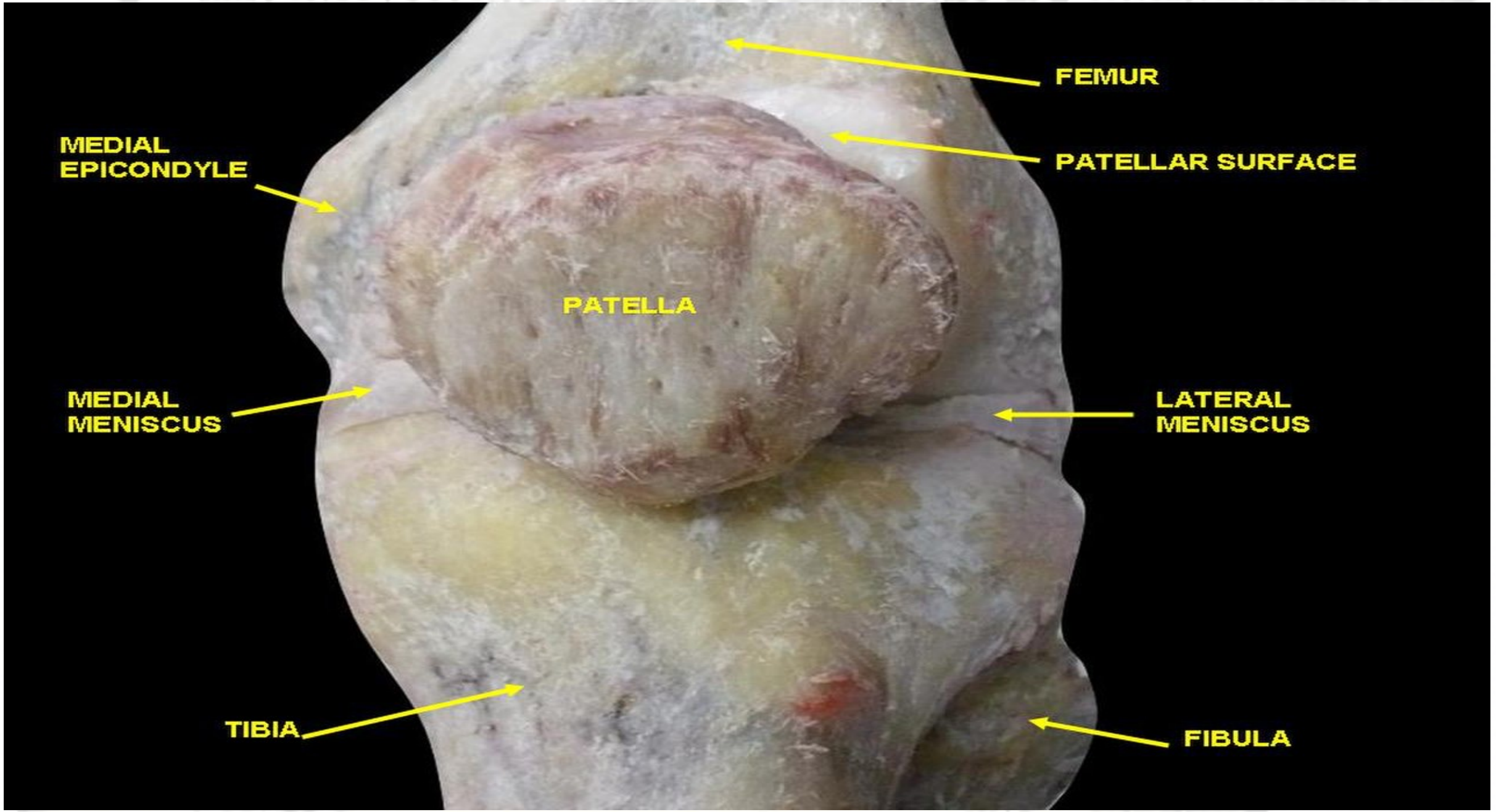
- Condyles of Femur rest on the top surface of Tibia.
- This surface is called as “Tibial Plateau”.
- The tibial plateau has two articular surfaces, the medial and lateral tibial condyles, also called the medial and lateral plateaus.
- The medial tibial condyle bears 60% of the knee's weight and is a thicker structure.
- It is concave in shape and located slightly more distally compared to the lateral tibial condyle.

- The articular surfaces of the tibiofemoral joint are generally incompatible, and the boney surfaces do not perfectly line up.
- Compatibility is provided by the medial and lateral meniscus.
- These are crescent-shaped fibrocartilaginous structures that allow a more even distribution of the femoral pressure on the tibia.

The Tibiofemoral Joint

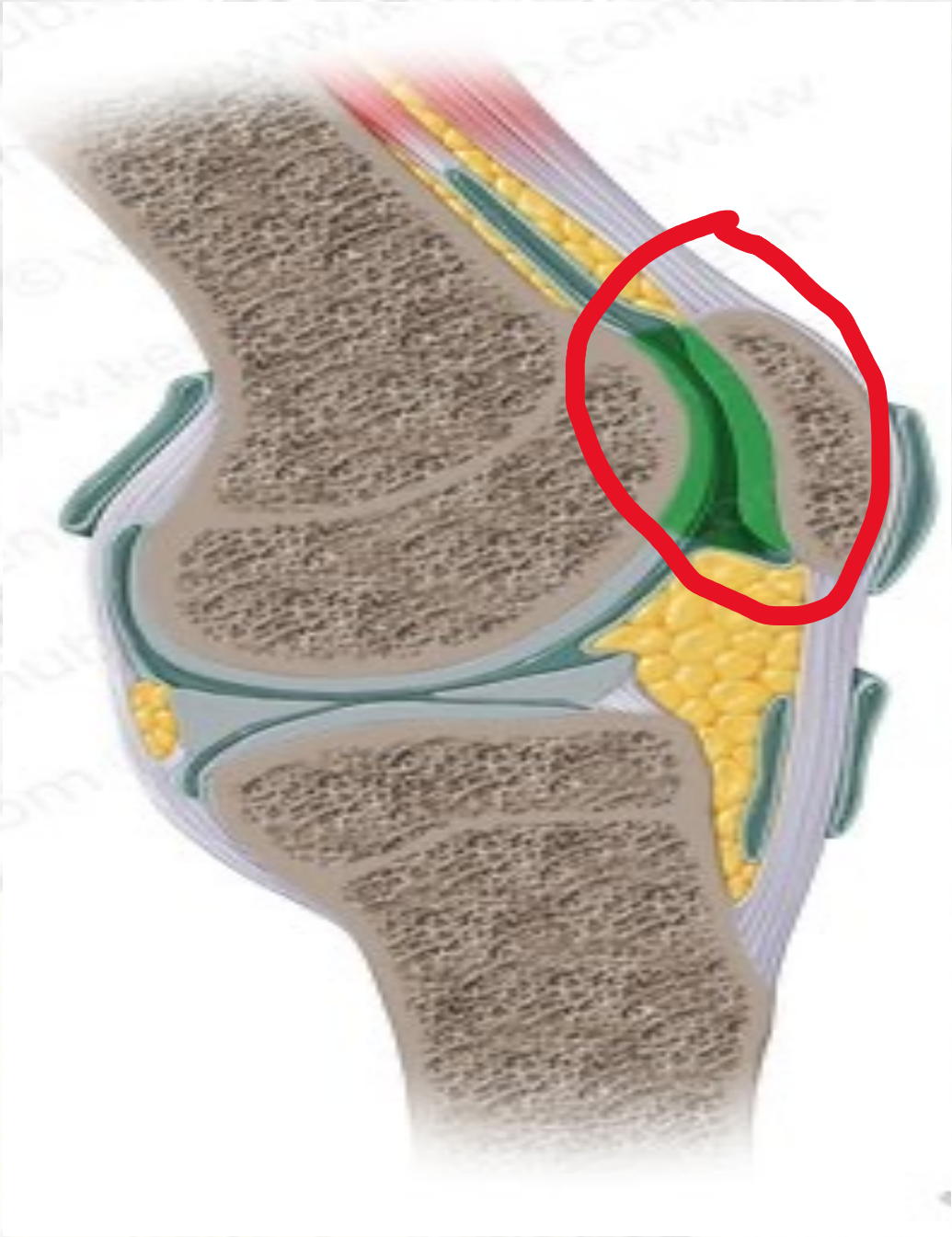





FEMUR
MEDIAL EPICONDYLE
PATELLAR SURFACE
PATELLA
MEDIAL MENISCUS
LATERAL MENISCUS
TIBIA
FIBULA

Patellofemoral Joint

- The patellofemoral joint is a diarthrodial plane joint that consists of the posterior surface of the patella and the trochlear surface of the distal anterior femur.
- The patella is the largest sesamoid bone in the body.

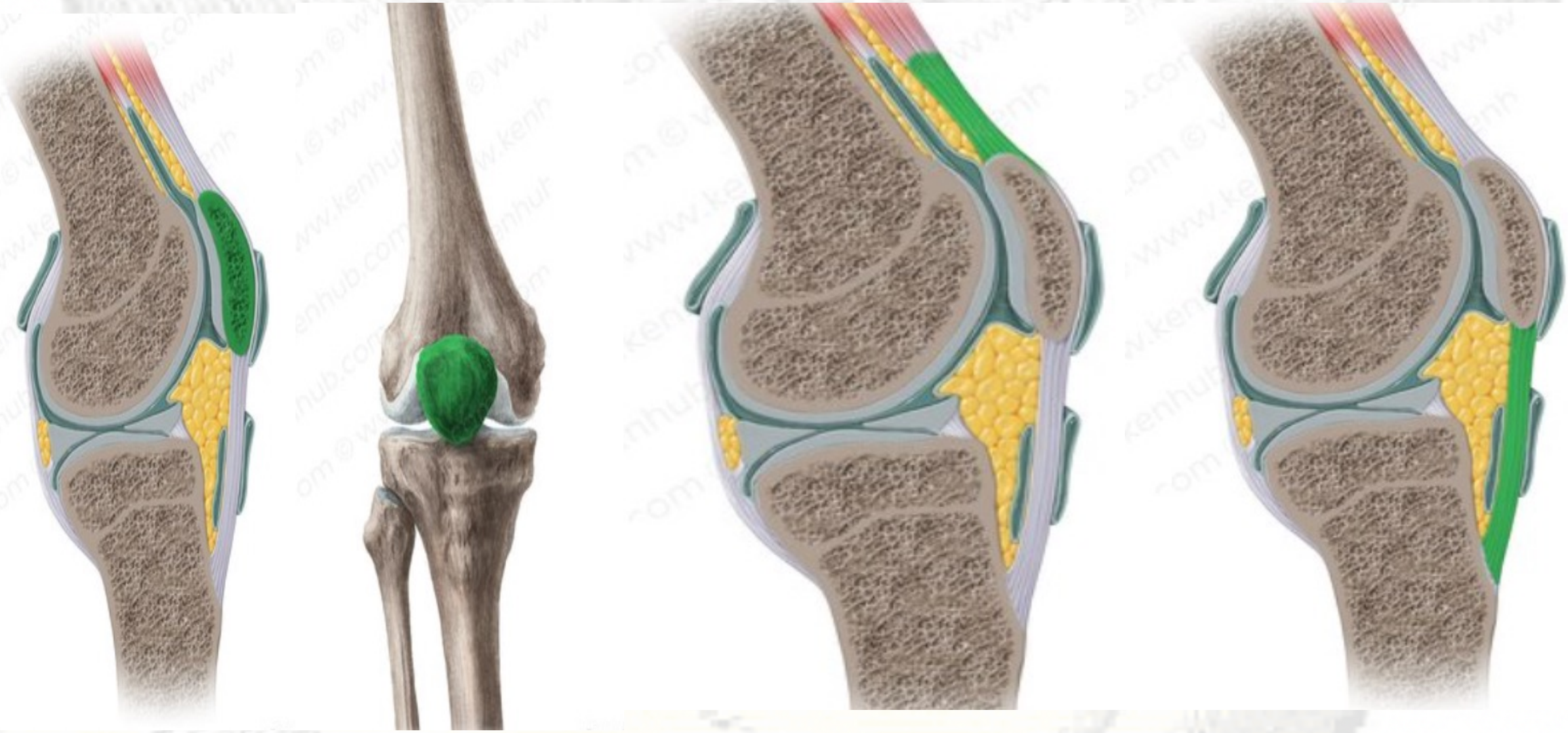


- The patella is a triangular shaped bone, with a curved proximal base and a pointed distal apex.
- Being a sesamoid bone, the patella is tightly embedded and held in place by the tendon of the quadriceps femoris muscle.
- On the distal (bottom) part of the patella, an extension of the quadriceps femoris tendon forms a central band called the patellar ligament.
- It is a strong, thick ligament that extends from the patellar apex to the superior area of the tibial tubersoty.

Patella

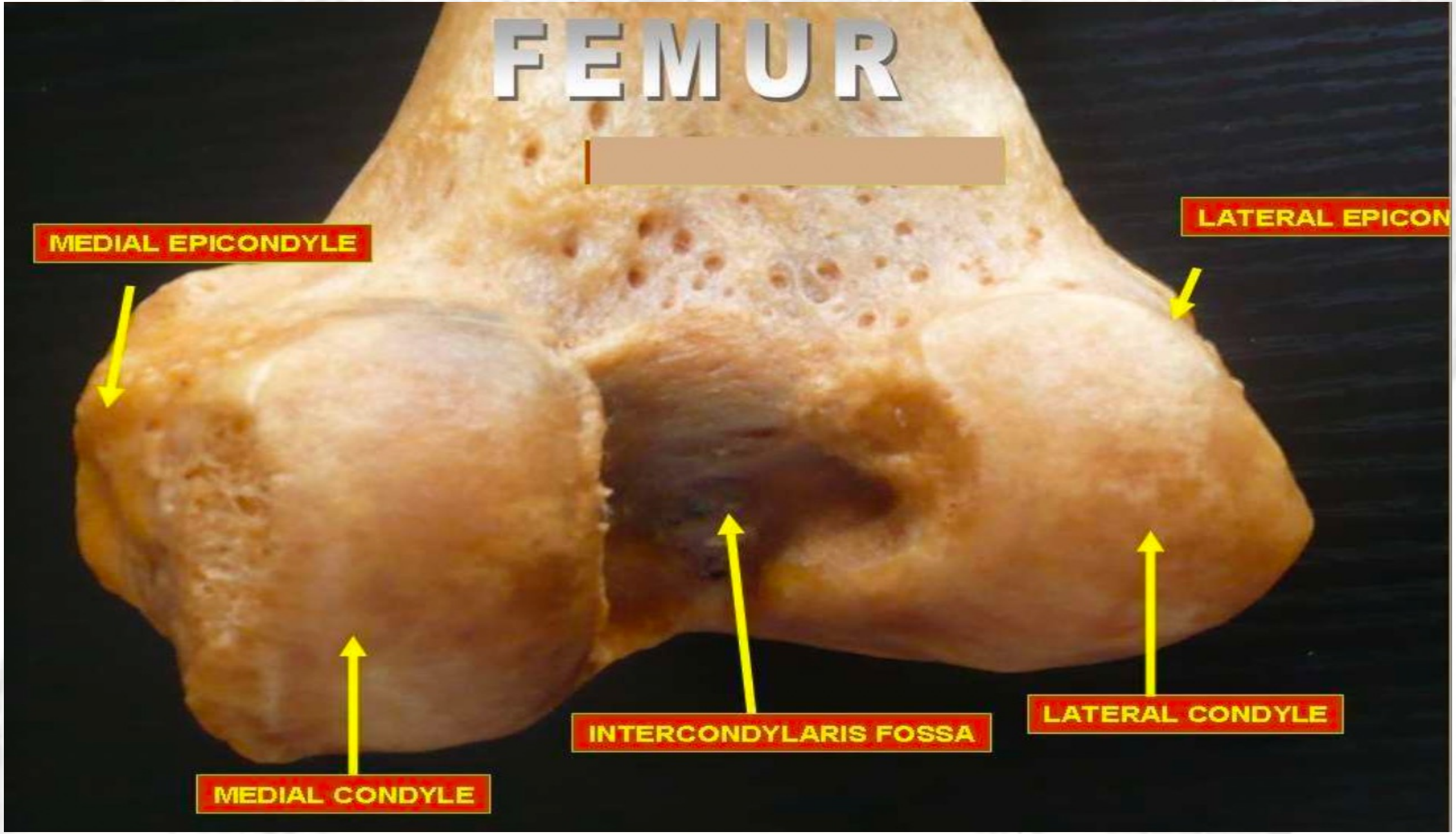
Quadriceps Femoris Tendon

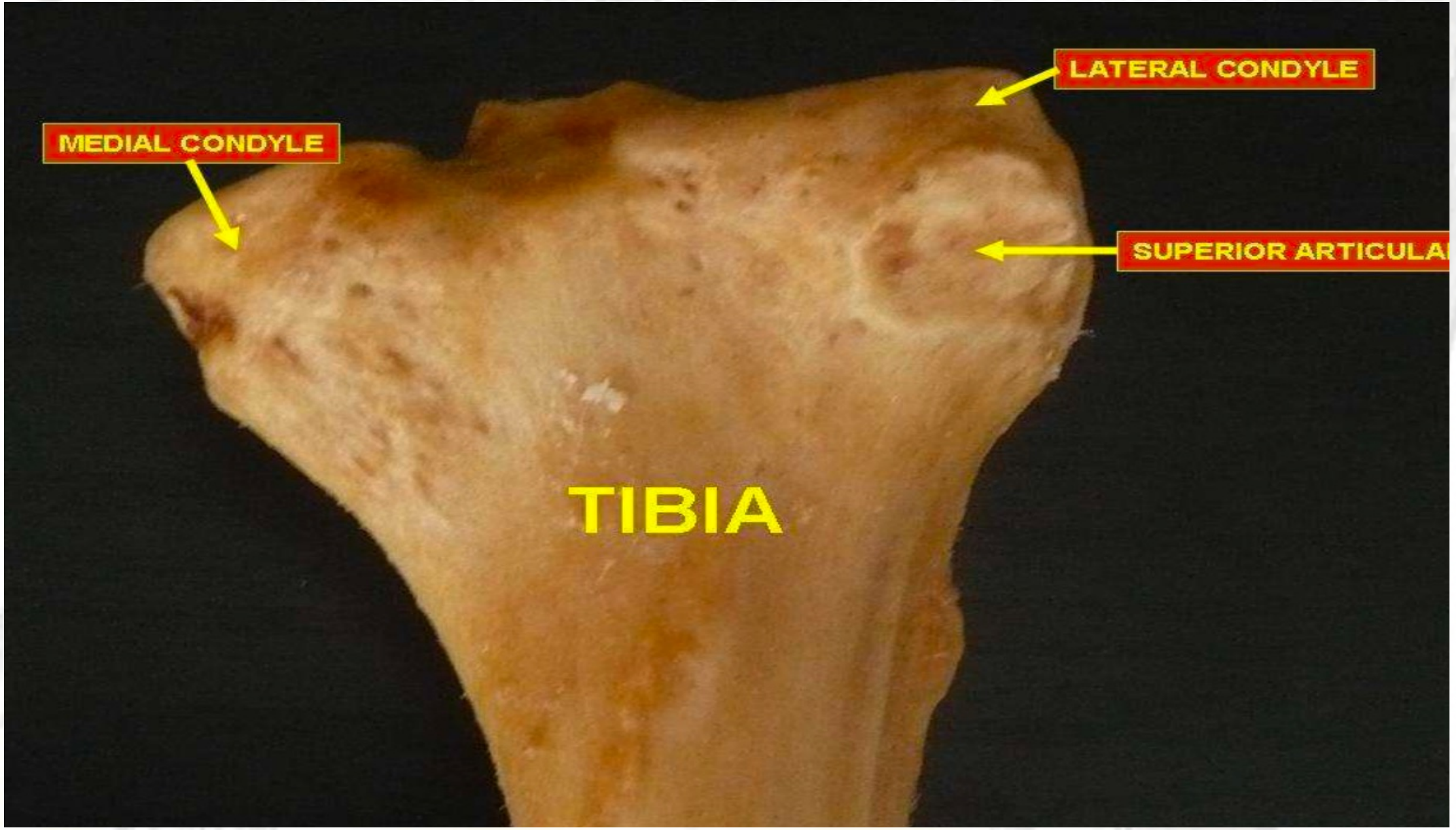
Patellar Ligament

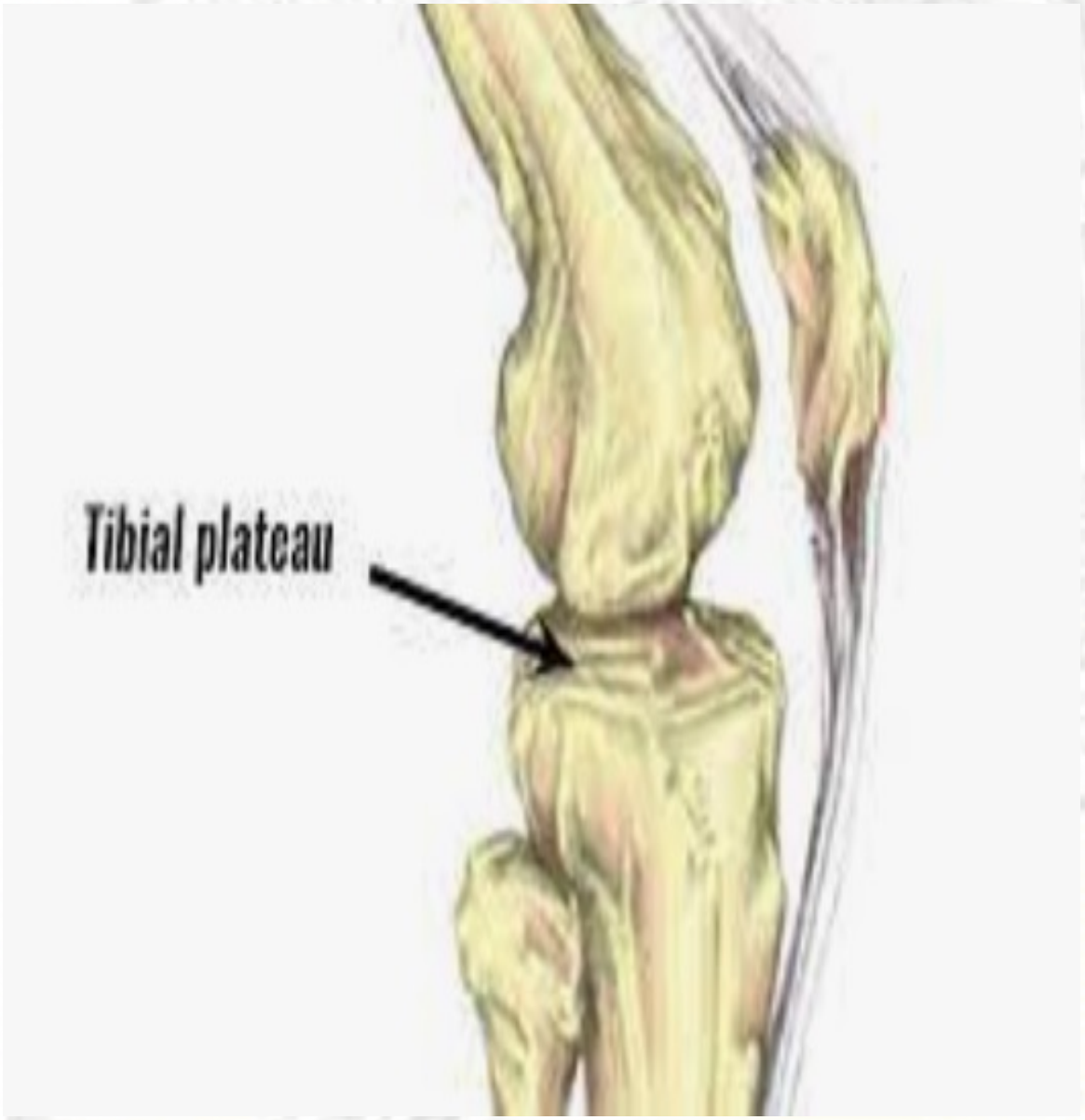


It consists of 3 Joints within a single synovial cavity :

- Tibiofemoral Joint - Medial Condyle
  - Between the medial condyle “of the femur” & the medial condyle “of the tibia”.
- Tibiofemoral Joint - Lateral Condyle
  - Between the lateral condyle “of the femur” & the lateral condyle “of the tibia .
- Patellofemoral Joint
  - Between the patella & the patellar surface of the femur.


FEMUR
MEDIAL EPICONDYLE
LATERAL EPICON
MEDIAL CONDYLE
INTERCONDYLARIS FOSSA
LATERAL CONDYLE


LATERAL CONDYLE
MEDIAL CONDYLE
SUPERIOR ARTICULA
TIBIA

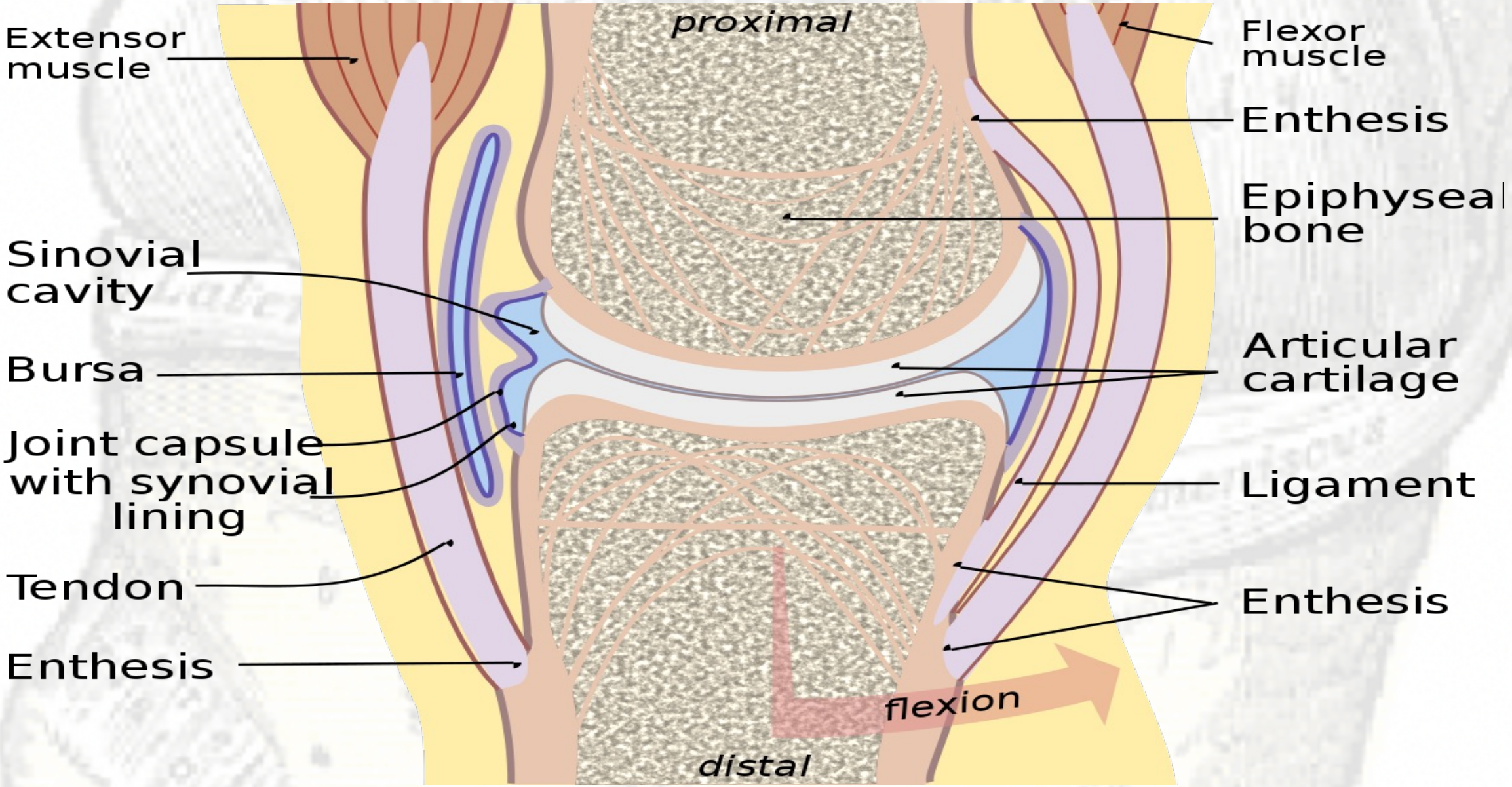

Tibial plateau


Femur
Patella
Proximal Tibia
"Plateau"
Fibula
Tibial
Shaft


Femur
Patella
Proximal Tibia
"Plateau"
Fibula
Tibial
Shaft
X-Tabl

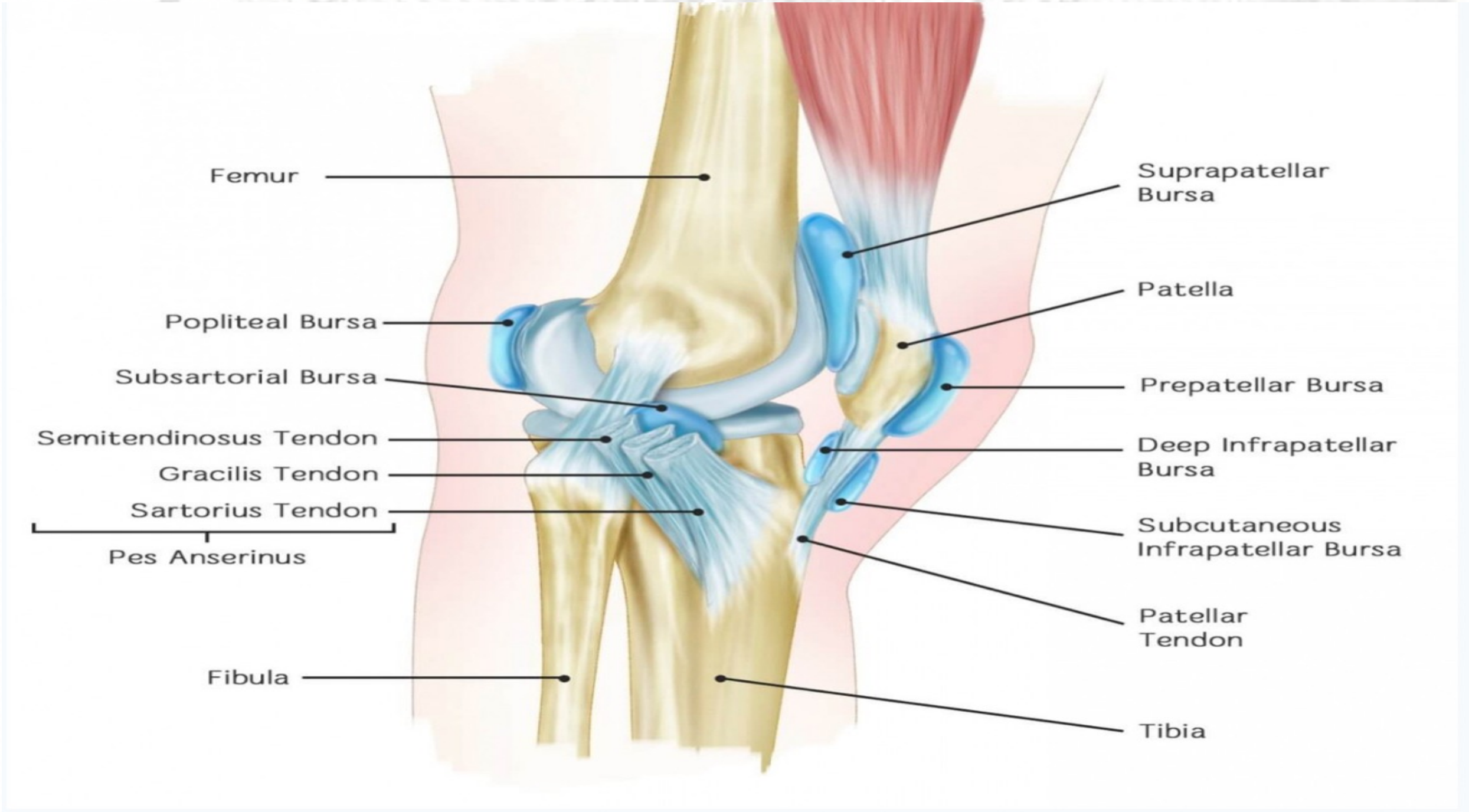
Joint Capsule

- The joint capsule of the knee joint is one of a composite nature, mainly formed by muscle tendons and their expansions, forming a thick ligamentous sheath around the joint.
- The capsule is relatively weak and attached to the margins of the femoral and tibial articular surfaces.
- The anterior portion of the capsule features an opening, whose margins attach to the borders of the patella.
- A second gap is also present in the lateroposterior portion of the capsule to give passage to the tendon of the popliteus muscle.



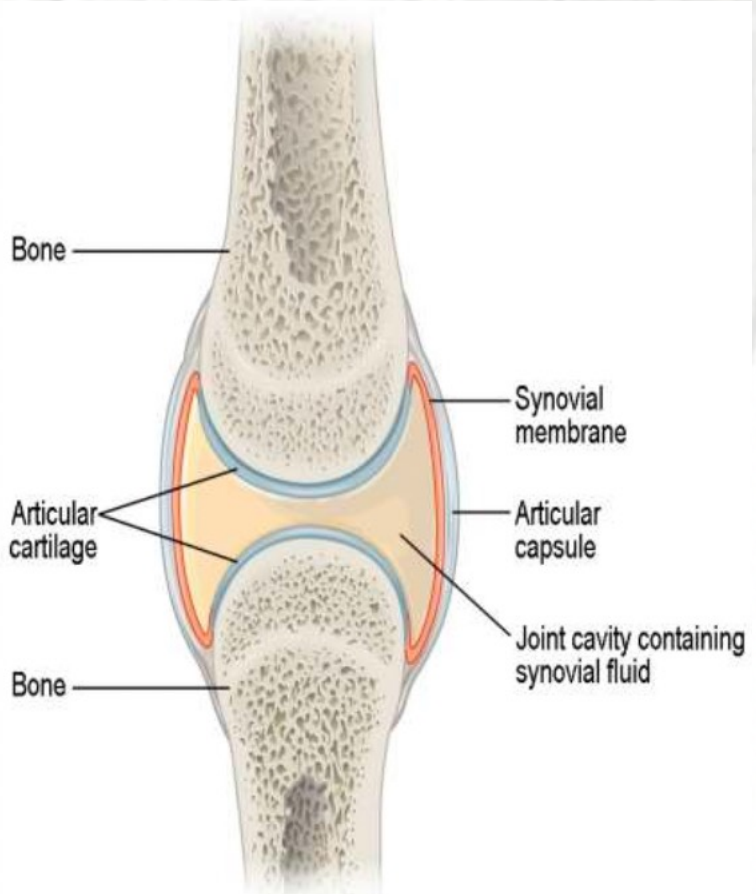
An enthesis is the site of attachment of tendon, ligament, fascia, or capsule to bone

- The capsule is formed from an outer fibrous layer (which is continuous with adjacent tendons) and an inner synovial membrane that lubricates the articular surfaces, reducing friction in addition to providing nourishment to the cartilage.
- The joint capsule forms several fluid filled pouches called bursae, that reduce friction within the knee joint. Notable bursa of the knee joint include the:
- Suprapatellar bursa
  - Superior to the patella between the femur and the tendon of the quadriceps muscle
- Prepatellar bursa
  - In front of the patella between the patella and the skin
- Infrapatellar bursa
  - Under the patella between the patellar ligament and the tibia


Femur
Popliteal Bursa
Subsartorial Bursa
Semitendinosus Tendon
Gracilis Tendon
Sartorius Tendon
Pes Anserinus
Fibula
Suprapatellar Bursa
Patella
Prepatellar Bursa
Deep Infrapatellar Bursa
Subcutaneous Infrapatellar Bursa
Patellar Tendon
Tibia

Articular Cartilages

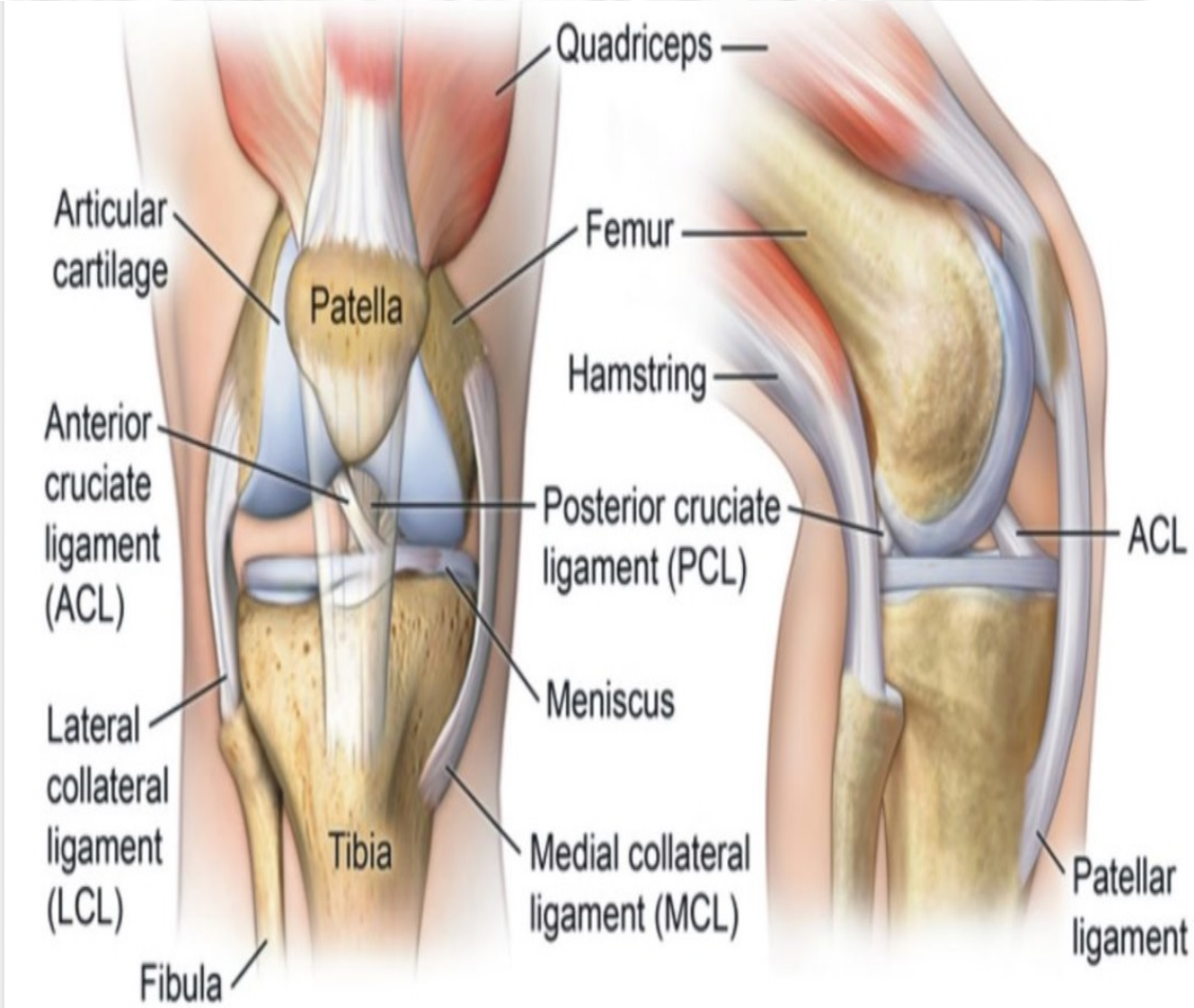
- Hyaline articular cartilages are material that covers ends of bones of the joints.
- These are 6.35mm or 1 quarter inch thick in most large joints.
- It is white shiny with rubbery consistency.
- Articular cartilages are slippery substance that allows the surfaces to slide against one another without damage to either surface .



- Function of articular cartilage is to absorb shock and provide extremely smooth surface to facilitate motion.
- Articular cartilage are present everywhere where two bony surfaces moves against one another were articulate.
- In the knee hyaline articular cartilage covers the ends of femur, top of the tibia and back of the patella.

Ligaments and Menisci

- The ligaments of the knee joint can be divided into two groups; extracapsular ligaments and intracapsular ligaments.
- These ligaments connect the femur and tibia, holding them in place, providing stability, and preventing dislocation.



- Extracapsular ligaments are found outside the joint capsule
  - Include the patellar ligament, fibular (lateral) and tibial (medial) collateral ligaments, and oblique and arcuate popliteal ligaments.
- Intracapsular ligaments are found inside the joint capsule
  - Include the cruciate ligaments being the most well known of this subgroup.

The Patellar Ligament

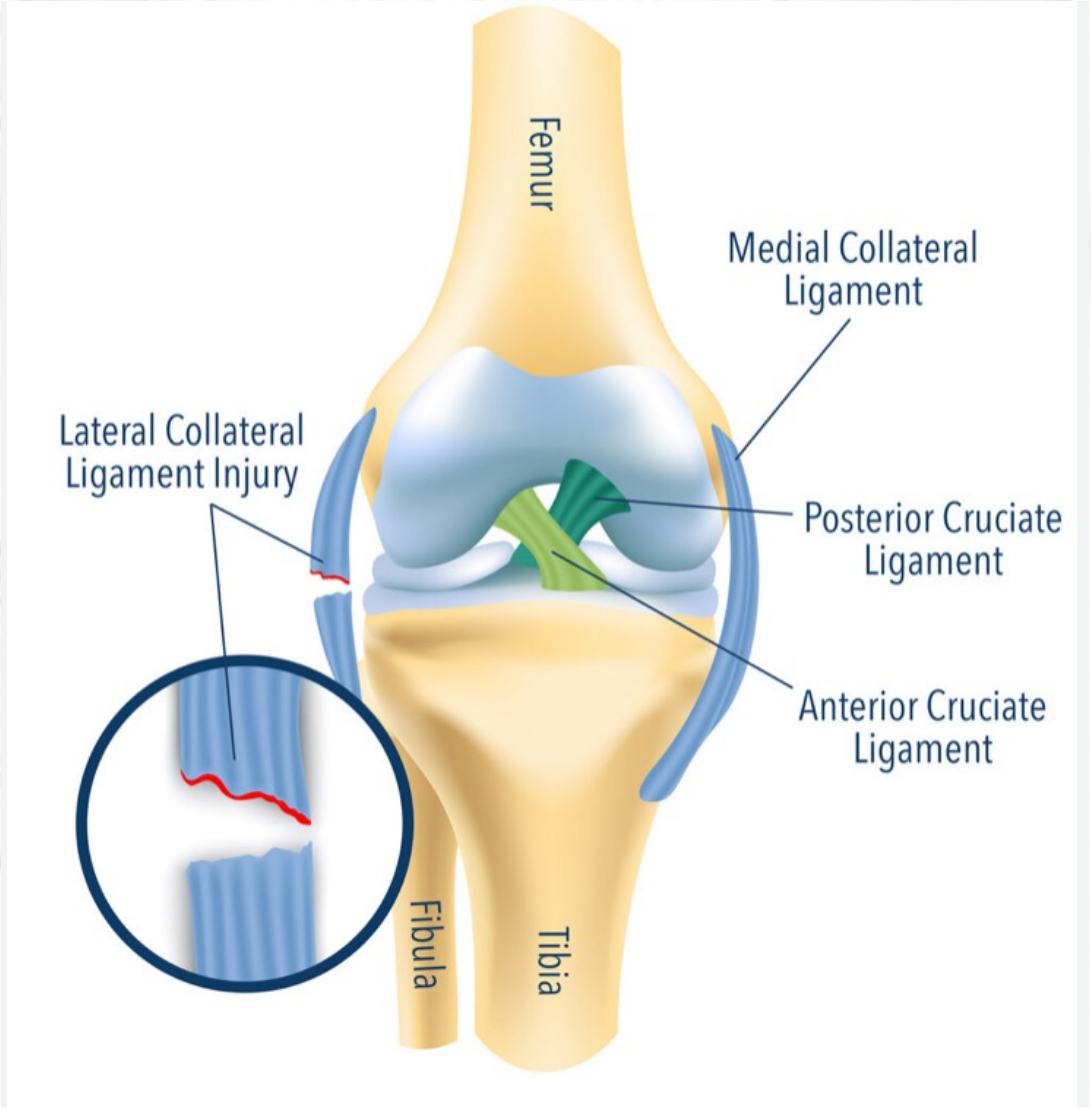
- The patellar ligament is a strong, thick fibrous band that is a distal continuation of the quadriceps femoris tendon.
- It is found superficial and anterior to the infrapatellar bursa and extends from the apex of patella to the tibial tuberosity.

- Along its outer margins, the patellar ligament blends with the medial and lateral patellar retinacula, which are extensions of the vastus medialis and lateralis muscles, respectively, as well as the overlying fascia.
- The patellar ligament plays a major role in stabilizing the patella and preventing its displacement.

Lateral (fibular) collateral ligament

- The fibular collateral ligament is a strong ligament that originates from the lateral epicondyle of the femur, just posterior to the proximal attachment of the popliteus, and extends distally to attach on the lateral surface of the fibular head.

- As it attaches to the fibular head, the ligament splits the tendon of biceps femoris muscle in two.
- The fibular collateral ligament is found deep to the lateral patellar retinaculum, and superficial to the tendon of popliteus muscle, which separates the ligament from the lateral meniscus.



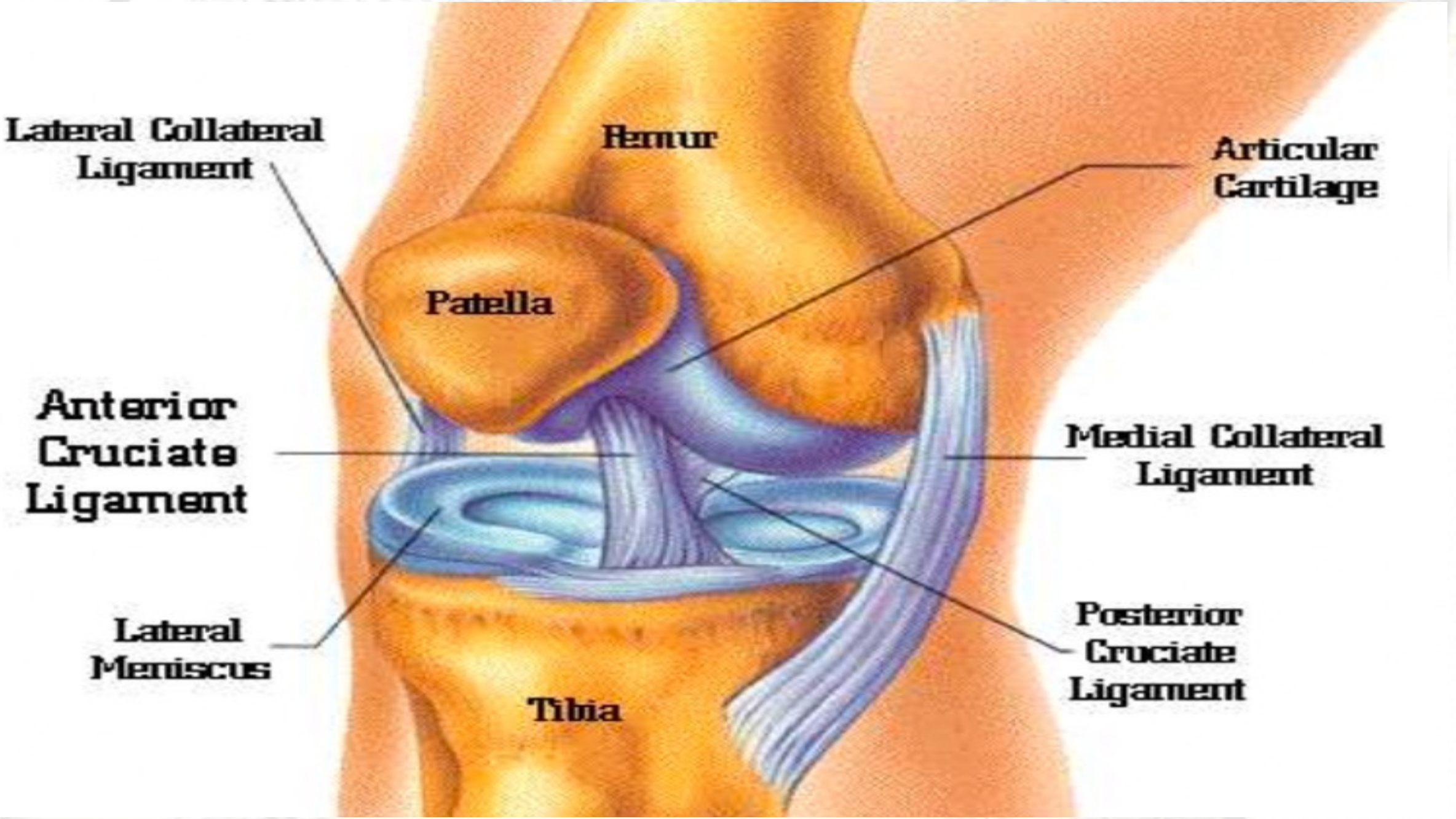

Patella (knee cap)
Femur
Lateral collateral ligament tear
Tibia
Fibula
Cleveland Clinic ©2021
Frontal View of Right Knee


Lateral knee ligament

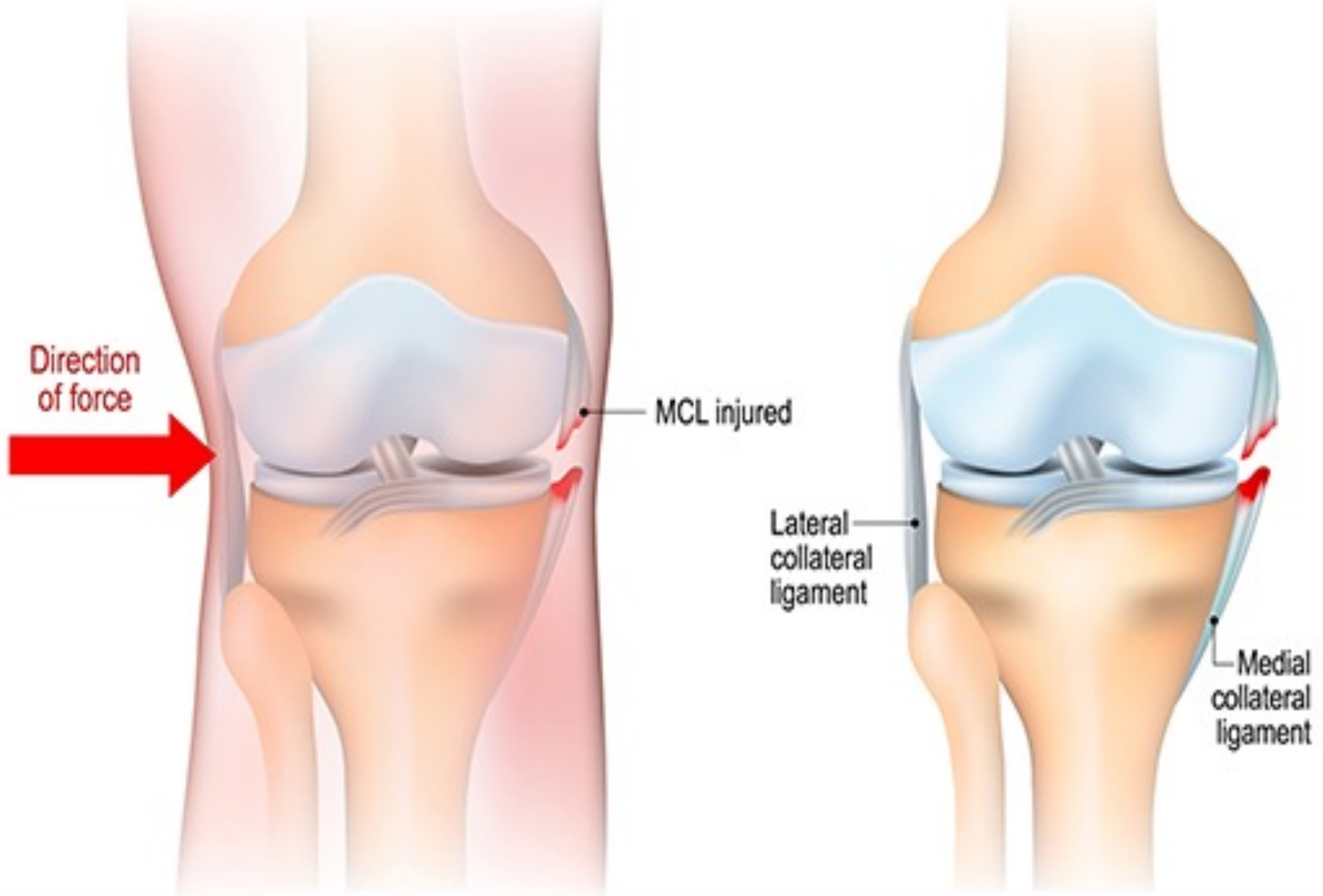
Medial (tibial) collateral ligament

- The tibial collateral ligament is the strong, flat ligament of the medial aspect of the knee joint.
- The tibial collateral ligament, in addition to its fibular counterpart, acts to secure the knee joint and prevent excessive sideways movement by restricting external and internal rotation of the extended knee.
- The tibial collateral ligament is sometimes divided the literature into superficial and deep parts.

- Superficial part originates just proximal the medial epicondyle of the femur.
- This ligament has two attachment points; a proximal attachment on the medial condyle of the tibia, and a distal attachment on the medial shaft of the tibia.
- Deep part: a vertical thickening of the knee joint capsule found underneath the superficial part of the tibial collateral ligament.
- These two parts of the ligament are defined as meniscofemoral and meniscotibial ligaments


Lateral Collateral Ligament
Femur
Articular Cartilage
Patella
Anterior Cruciate Ligament
Medial Collateral Ligament
Lateral Meniscus
Posterior Cruciate Ligament
Tibia

Medial Colateral Ligament Injury



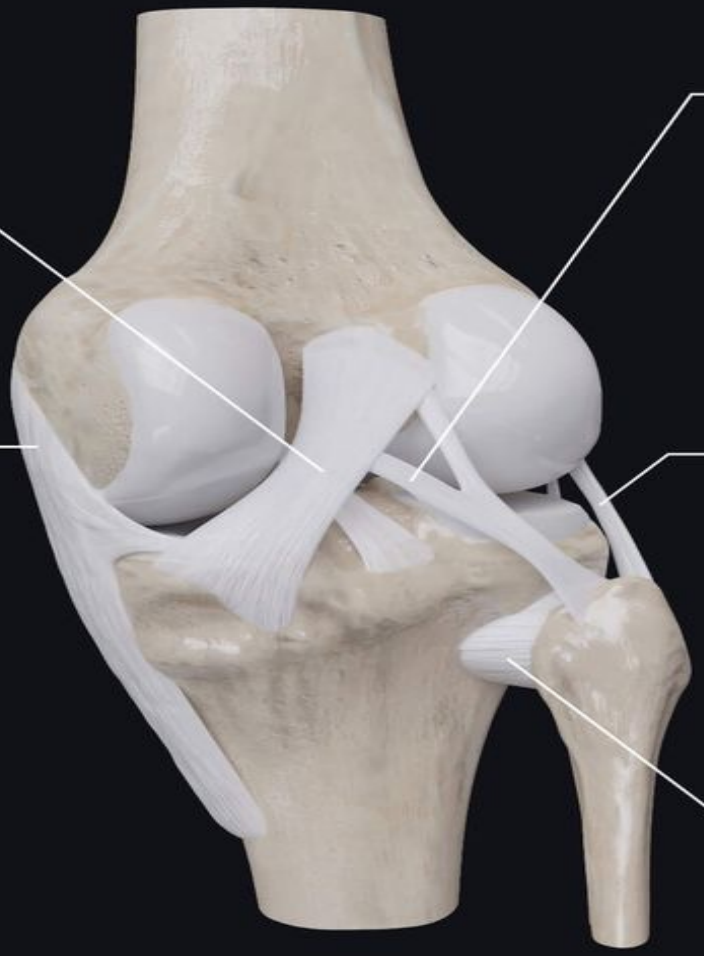
Oblique Popliteal Ligament

- The oblique popliteal ligament is an expansion of the semimembranosus tendon which originates posterior to the medial tibial condyle and reflects superiorly and laterally to attach on the lateral condyle of the femur.
- As it spans the intercondylar fossa, the oblique popliteal ligament reinforces the posterior part of the joint capsule and blends with its central portion.

Arcuate Popliteal Ligament

- Arcuate popliteal ligament is a thick, fibrous band that arises on the posterior aspect of the fibular head and arches superiorly and medially to attach on the posterior side of the joint capsule of the knee.
- The arcuate popliteal ligament reinforces the posterolateral part of the joint capsule, and together with the oblique popliteal ligament, prevents overextension of the knee joint.

Extracapsular ligaments of knee joint



Oblique popliteal ligament

Tibial collateral ligament

Arcuate popliteal ligament

Fibular collateral ligament

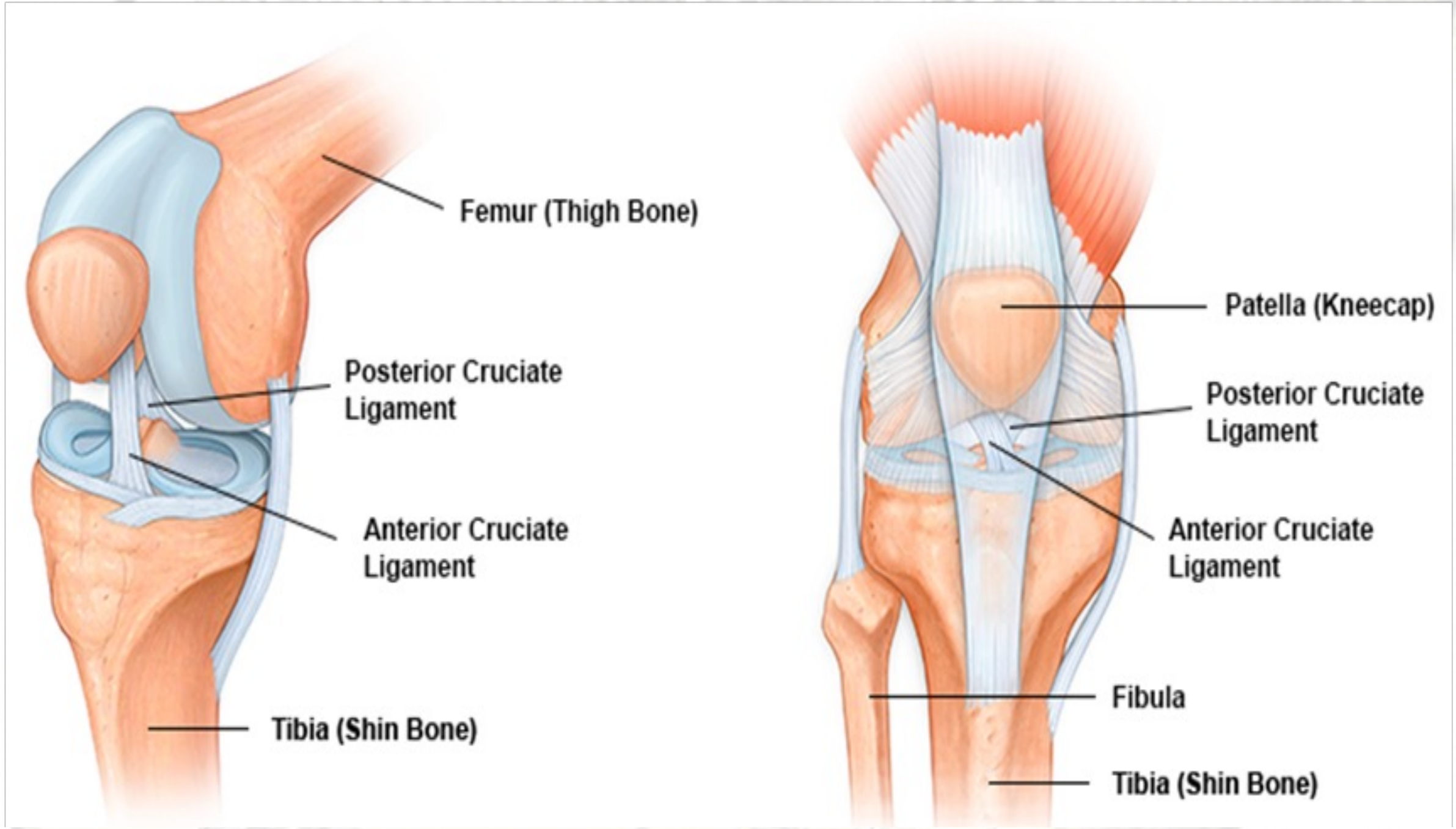
Joint capsule of proximal tibiofibular joint

Posteromedial view

Anatomy.app

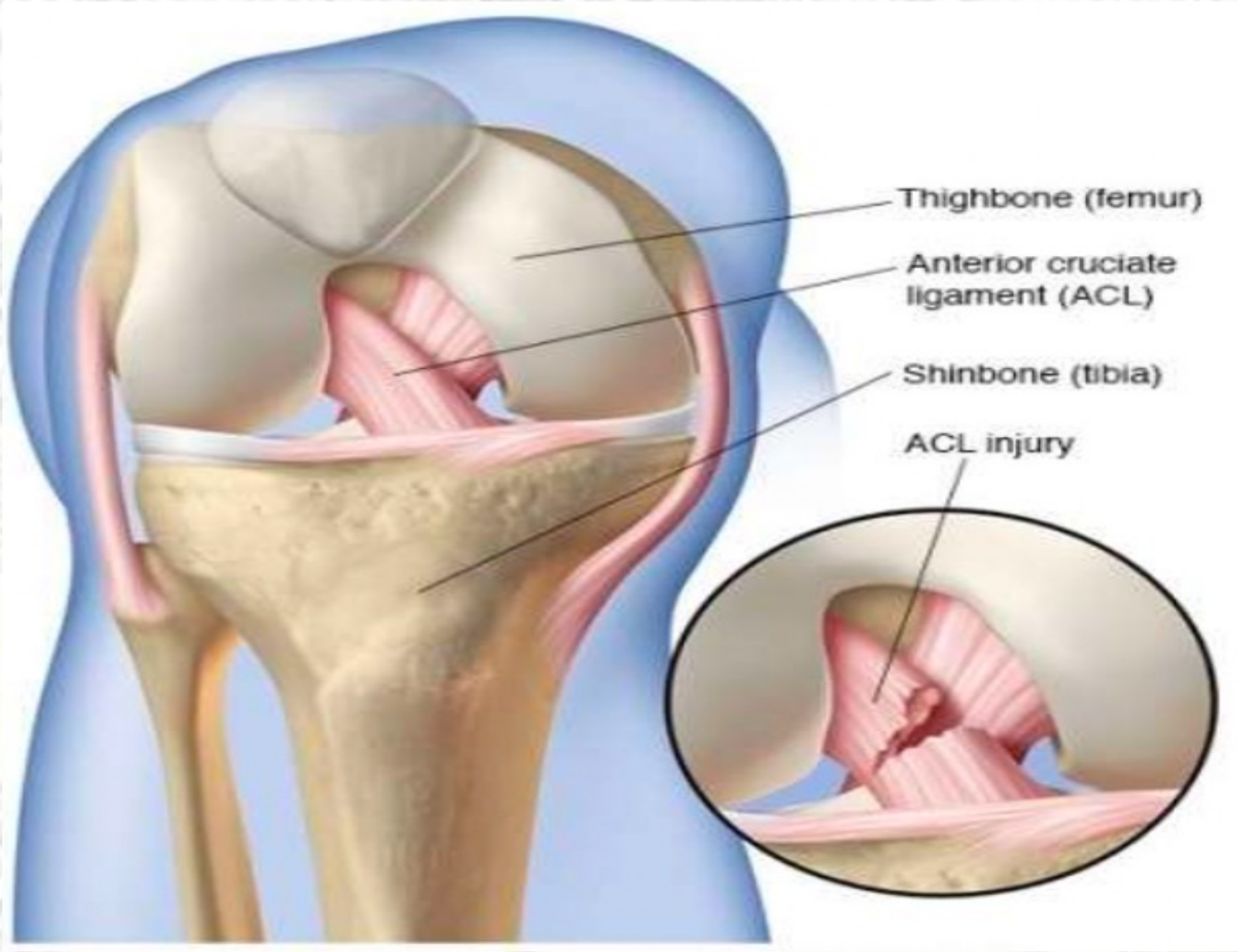
Cruciate Ligaments

- The paired cruciate ligaments got their name due to the fact that they cross each other obliquely within the joint in a way that resembles a cross (latin = crux), or a letter X.
- They cross within the joint capsule, however remain external to the synovial cavity.
- The cruciate ligaments are divided as follows:
  - Anterior cruciate ligament
  - Posterior cruciate ligament


Femur (Thigh Bone)
Posterior Cruciate Ligament
Anterior Cruciate Ligament
Tibia (Shin Bone)
Patella (Kneecap)
Posterior Cruciate Ligament
Anterior Cruciate Ligament
Fibula
Tibia (Shin Bone)

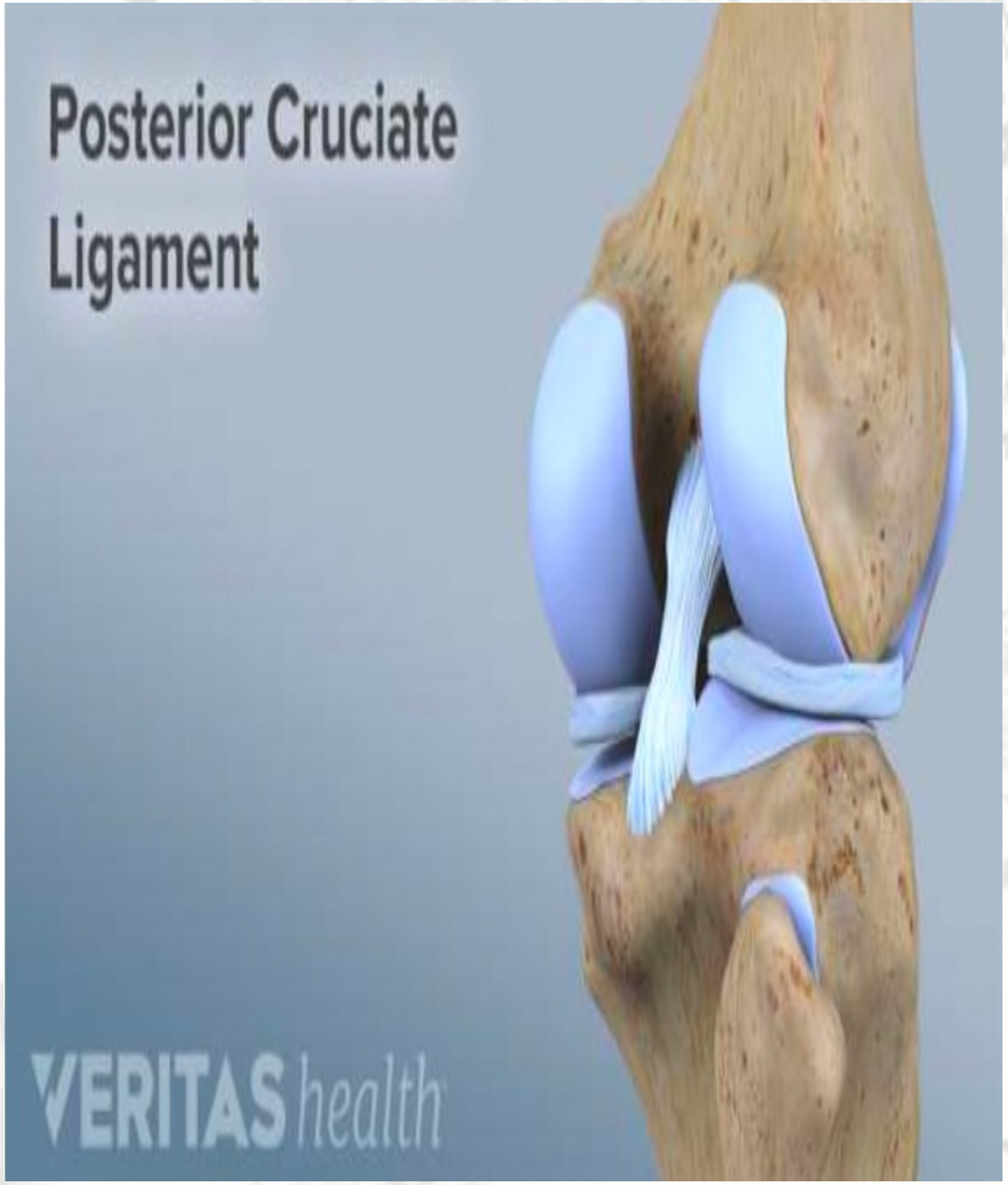
Anterior Cruciate Ligament

- From the anterior intercondylar area to attach on the posterior part of the medial surface of the lateral femoral condyle.
- As it crosses to the other side of the knee joint, the ligament passes underneath the transverse ligament and blends with the anterior horn of the lateral meniscus.
- The anterior cruciate ligament is important to prevent posterior rolling and displacement of the femoral condyle during flexion, as well as to prevent hyperextension of the knee joint.


Thighbone (femur)
Anterior cruciate ligament (ACL)
Shinbone (tibia)
ACL injury

Posterior Cruciate Ligament

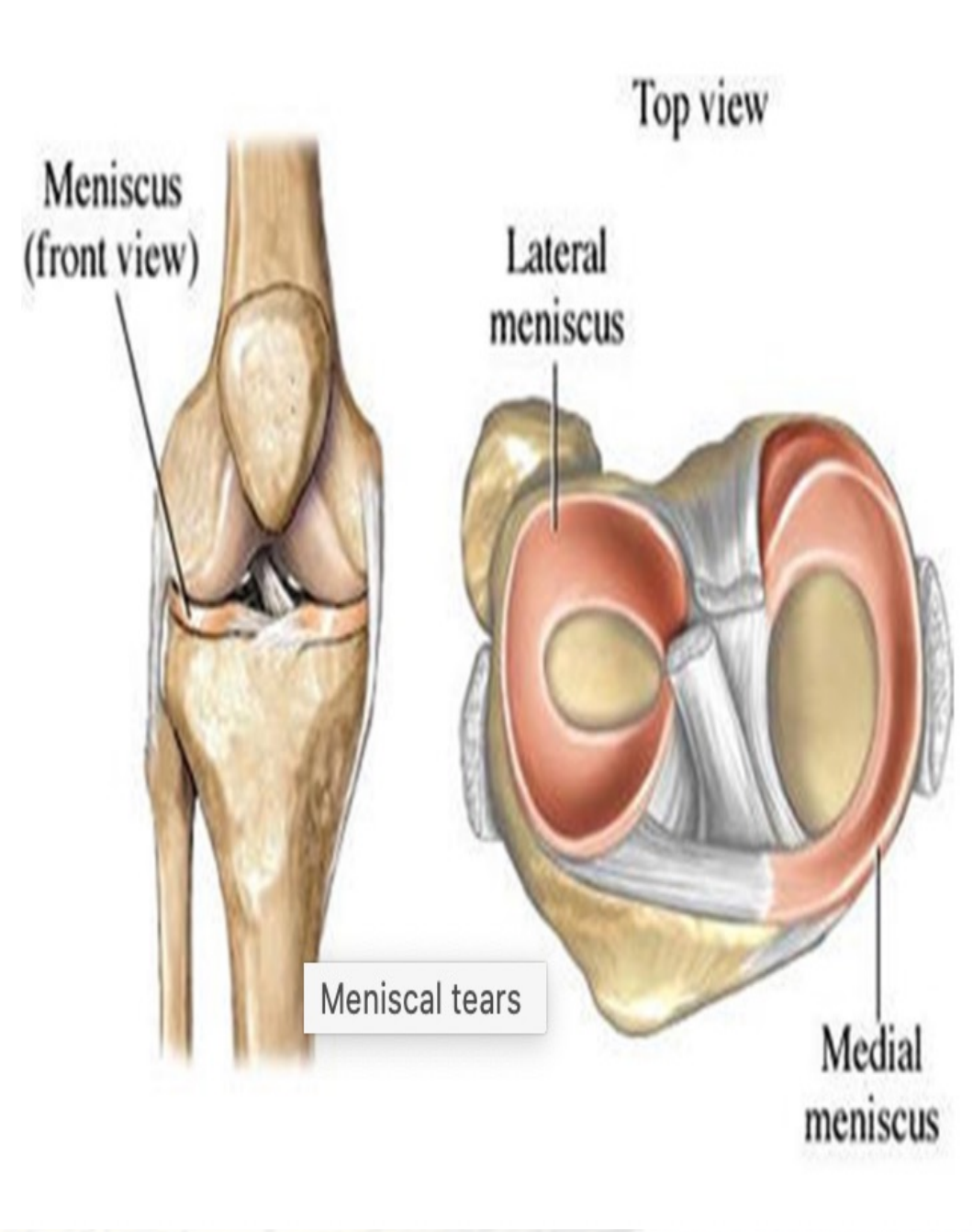
- Arises from the posterior intercondylar area of the tibia and extends to attach on the anterior part of the lateral surface of the medial femoral condyle.
- This ligament is almost twice as strong and has better blood supply than the anterior cruciate ligament.
- The posterior cruciate ligament has the opposite function of the anterior cruciate ligament, serving to prevent anterior rolling and displacement of the femoral condyle during extension, as well as to prevent hyperflexion of the knee joint.


Posterior Cruciate Ligament
VERITAS health


Thighbone (femur)
Anterior cruciate ligament (ACL)
Shinbone (tibia)
ACL injury

Menisci

- The menisci are crescent-shaped plates found between the articular surfaces of the femur and tibia and serve to provide their congruence and shock absorption.
- The menisci are thick and vascularized in their outer one third, while their inner two thirds are thinner and avascular.



Menisci

- It is believed that the inner portion is more adapted for weight-bearing and resisting compressive forces, while the outer portions are suited for resisting tensional forces. The menisci are divided as follows:
  - Medial meniscus
  - Lateral meniscus

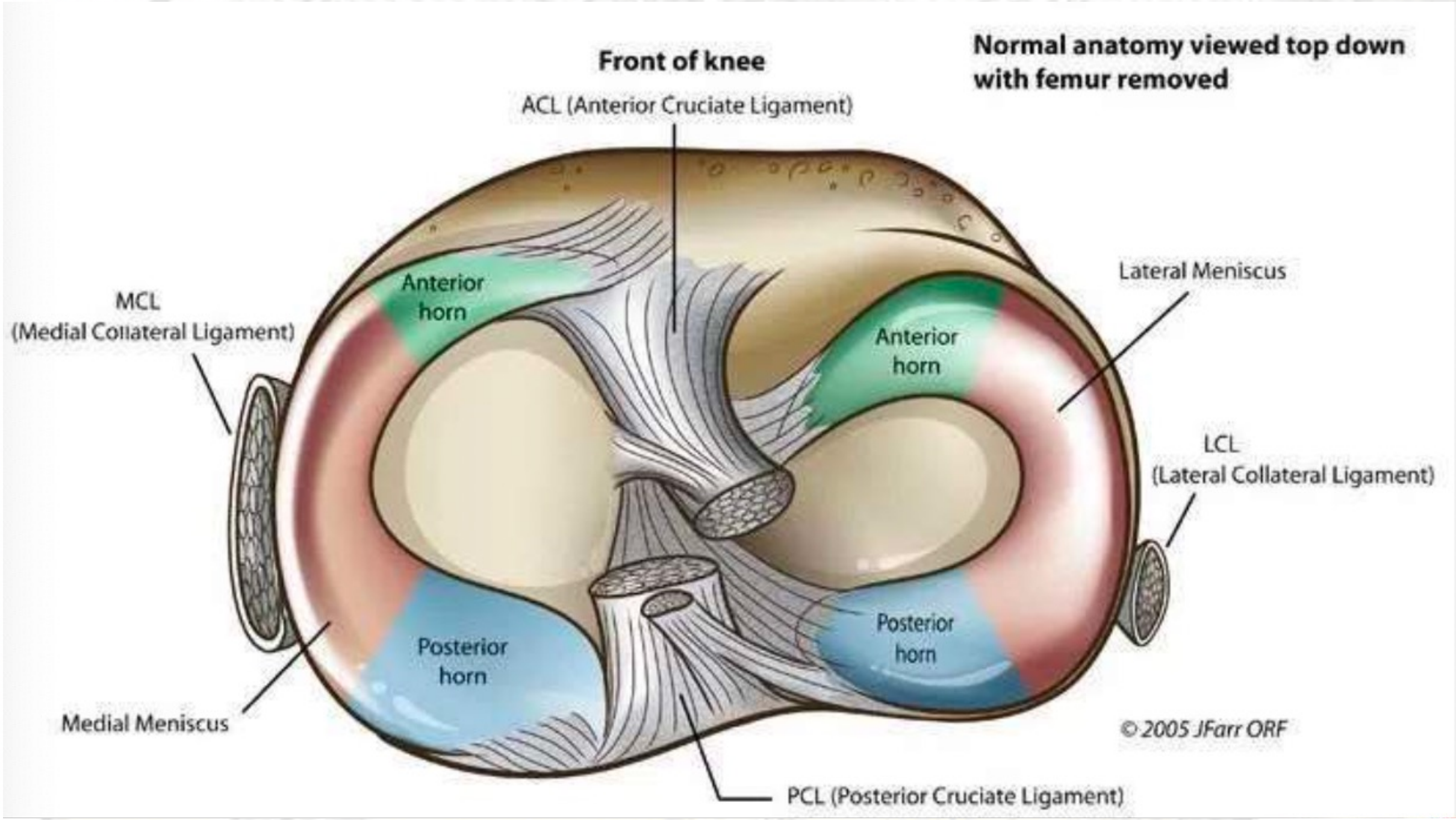
Medial Meniscus

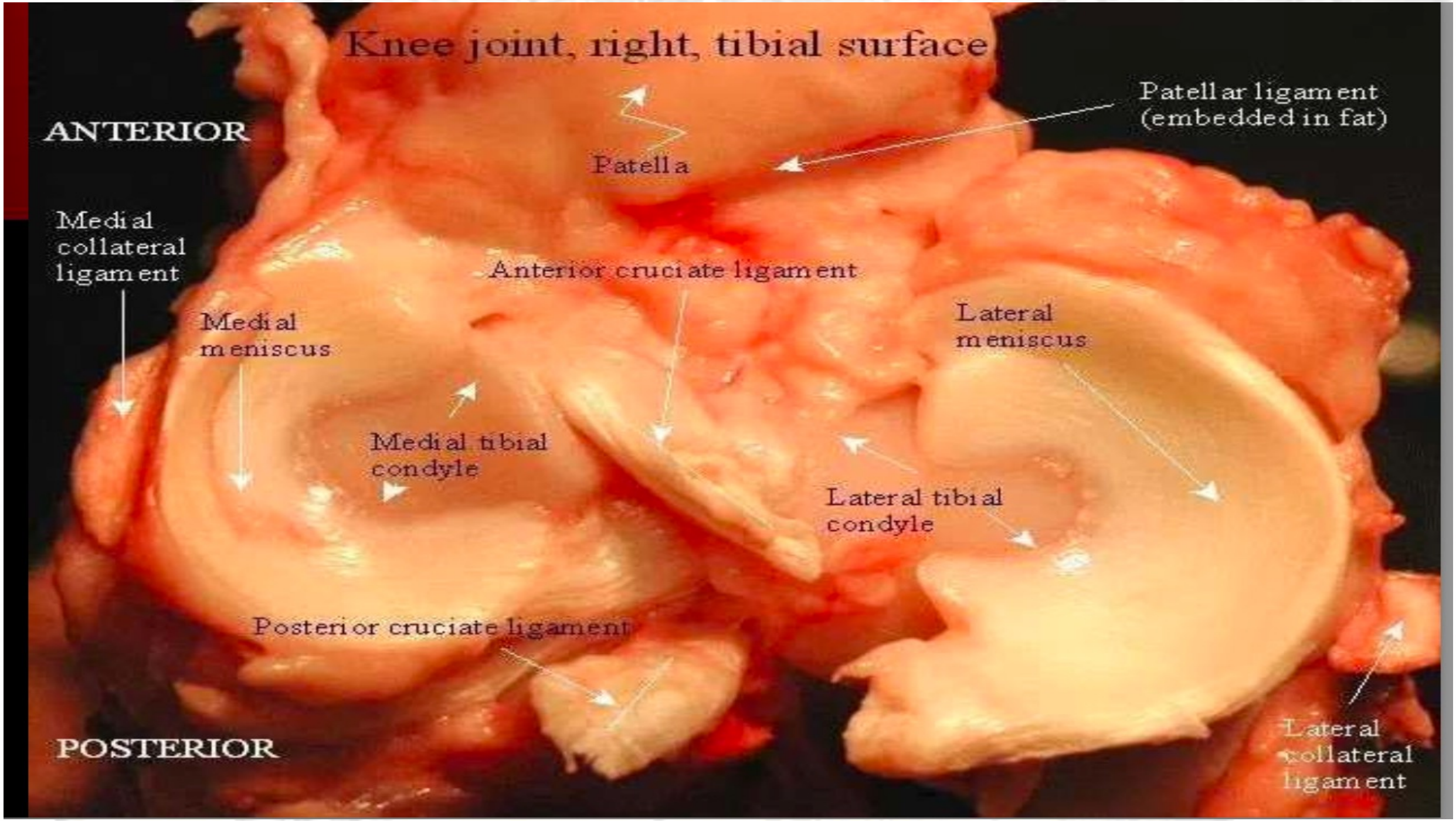
- C-shaped, almost semicircular fibrocartilaginous plate that overlies the surface of the medial tibial plateau.
- Its anterior horn attaches on the anterior intercondylar area of tibia and blends with the anterior cruciate ligament.
- Its posterior horn is attached to the posterior intercondylar area of the tibia, between the attachments of the lateral meniscus and the posterior cruciate ligament.

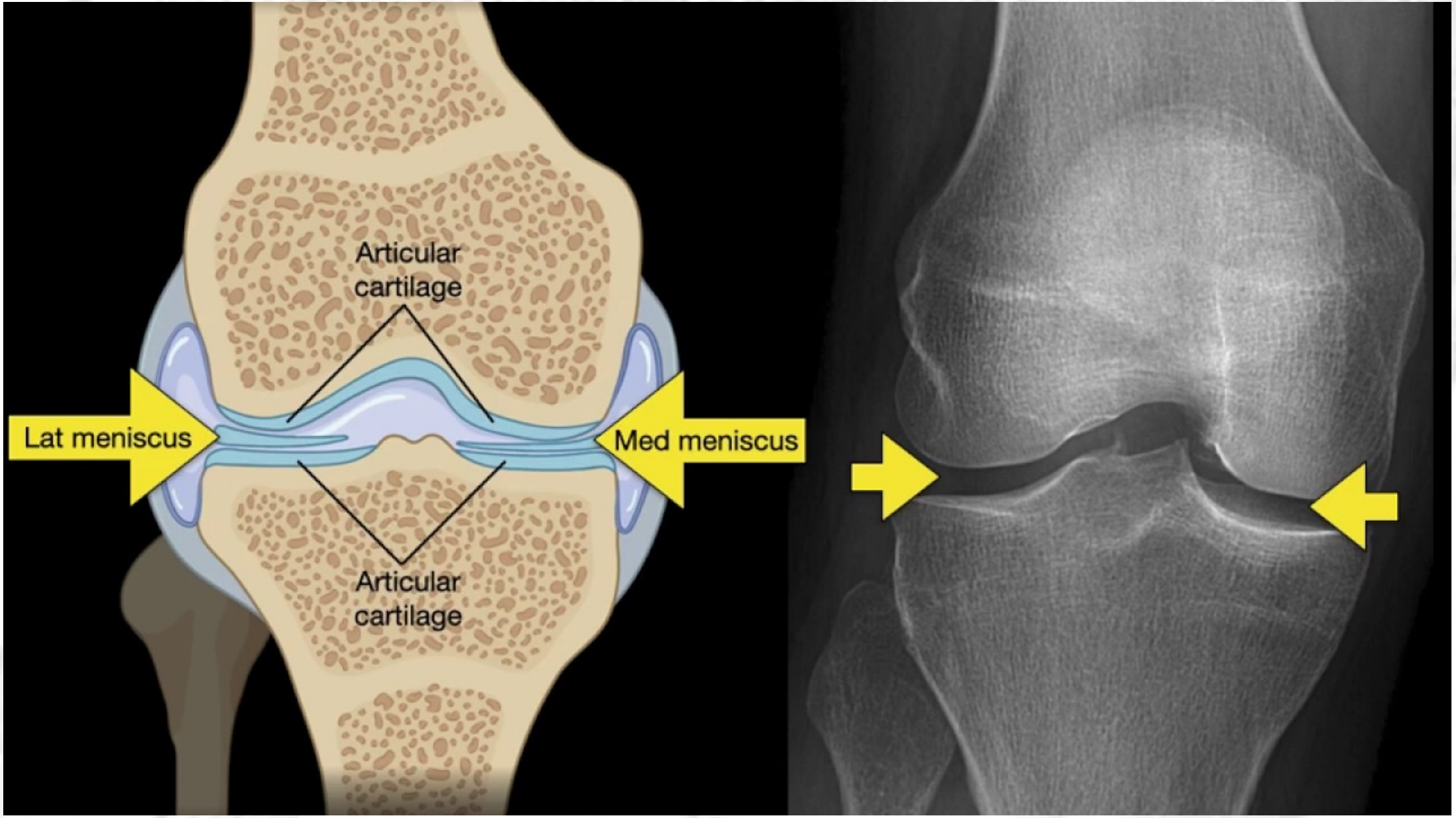
Lateral Meniscus

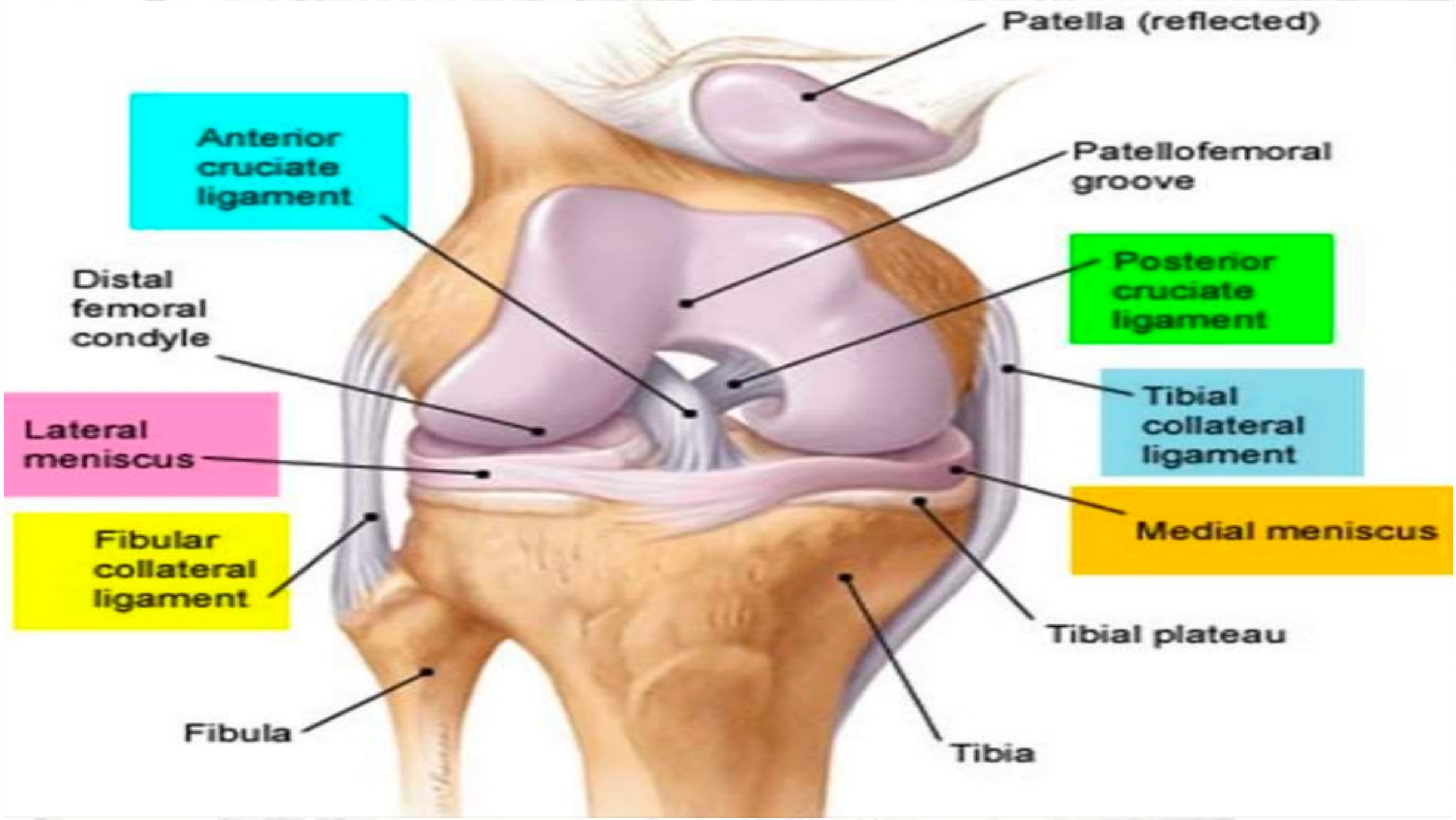
- An almost circular fibrocartilaginous plate that overlies the surface of the lateral tibial plateau.
- Its anterior horn also attaches to the anterior intercondylar area of tibia and partially blends with the anterior cruciate ligament.
- Similarly, its posterior horn attaches to the posterior intercondylar areas anterior to the posterior horn of the medial meniscus.

- The menisci are held in place by several ligaments, including the transverse ligament, meniscofemoral ligaments and meniscotibial (coronary) ligaments.
- By stabilizing the menisci, these ligaments are also indirectly involved in preventing displacement of the knee joint.
  - Transverse ligament
  - Meniscofemoral ligaments
  - Meniscotibial (coronary) ligaments
  - Patellomeniscal ligament:


Front of knee
Normal anatomy viewed top down
with femur removed
ACL (Anterior Cruciate Ligament)
MCL
(Medial Collateral Ligament)
Anterior
horn
Anterior
horn
Lateral Meniscus
LCL
(Lateral Collateral Ligament)
Posterior
horn
Posterior
horn
Medial Meniscus
PCL (Posterior Cruciate Ligament)
© 2005 JFarr ORF


Knee joint, right, tibial surface
ANTERIOR
Patellar ligament (embedded in fat)
Patella
Medial collateral ligament
Anterior cruciate ligament
Medial meniscus
Lateral meniscus
Medial tibial condyle
Lateral tibial condyle
Posterior cruciate ligament
POSTERIOR
Lateral collateral ligament


Articular cartilage
Lat meniscus
Med meniscus
Articular cartilage


Patella (reflected)
Anterior cruciate ligament
Patellofemoral groove
Distal femoral condyle
Posterior cruciate ligament
Lateral meniscus
Tibial collateral ligament
Fibular collateral ligament
Medial meniscus
Tibial plateau
Fibula
Tibia

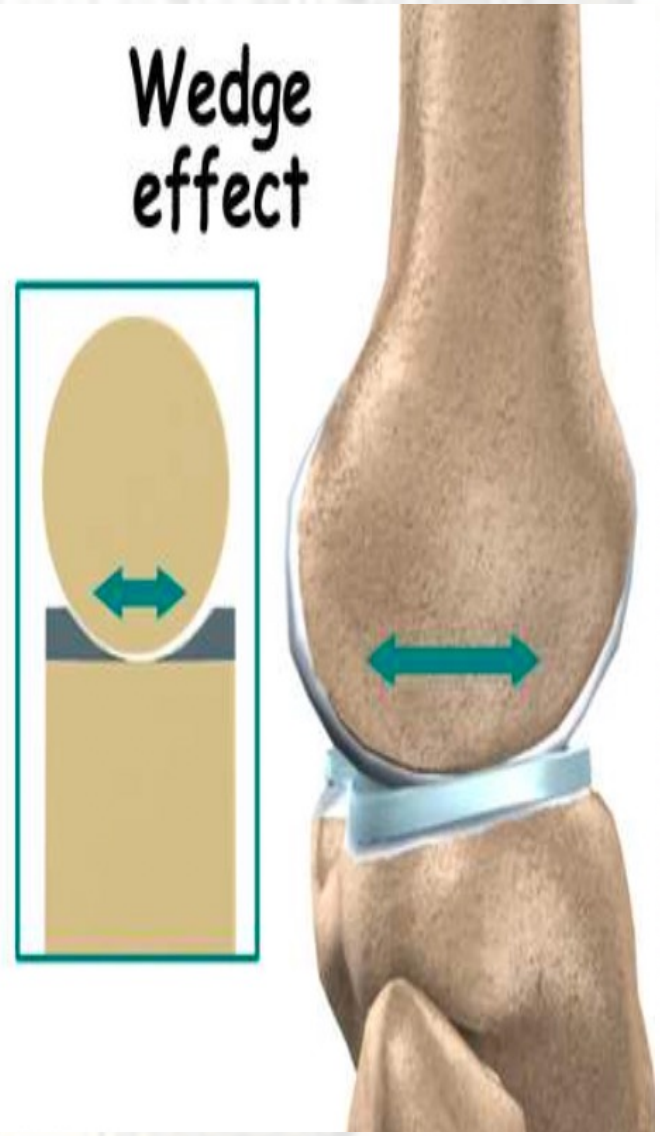
The Wedge Effect

- Imagine a ball resting on plate. Here ball is condyles of the femur and flat plate is the tibial plateau.
- Menisci actually wrap around round the condyles to fill the space between it and flat tibial plateau.
- The menisci act like a gasket helping to distribute the weight from the Femur to the tibia.
- Without the menisci any weight on the Femur will be concentrated to one point of the tibia.
- With a Menisci weight is spread across the tibial surface.

Without the Menisci the concentration of force into a small area on the Articular cartilage can damage the surface leading to the degeneration overtime.

In addition to protect the Articular cartilage the menisci help the ligament in stability of Knee joint.

Menisci make the Knee joint more stable by acting like a ‘Wedge Shape’ set against the bottom of the condyle.



Ligament Wrap Up

- The MCL and LCL prevent the knee to move too far in a side-to-side direction.
- ACL and PCL controls front and back motion of knee joint.
- ACL keeps tibia sliding too far forward in relation to the femur.
- PCL keeps the tibia sliding too backward in relation to femur.

Ligament Wrap Up

- The Menisci convert the tibial surface into a shallow socket.
- The socket is more stable, more efficient in transmitting weight from the upper body .
- Menisci enhances the stability of the knee and protect the articular cartilage from excessive concentration of force.
- Ligaments all taken together are most important structures controlling stability of the knee.

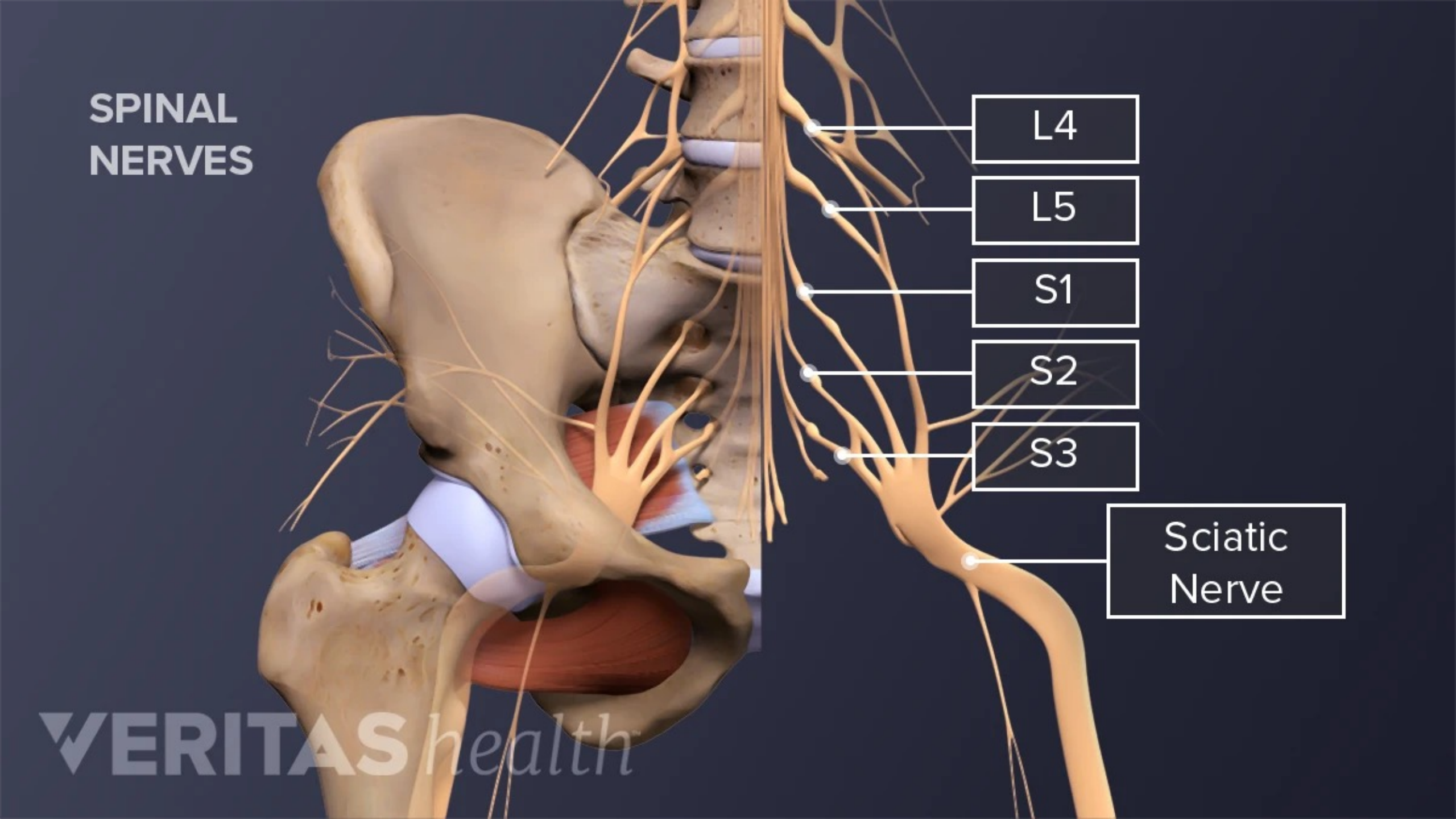
Innervation

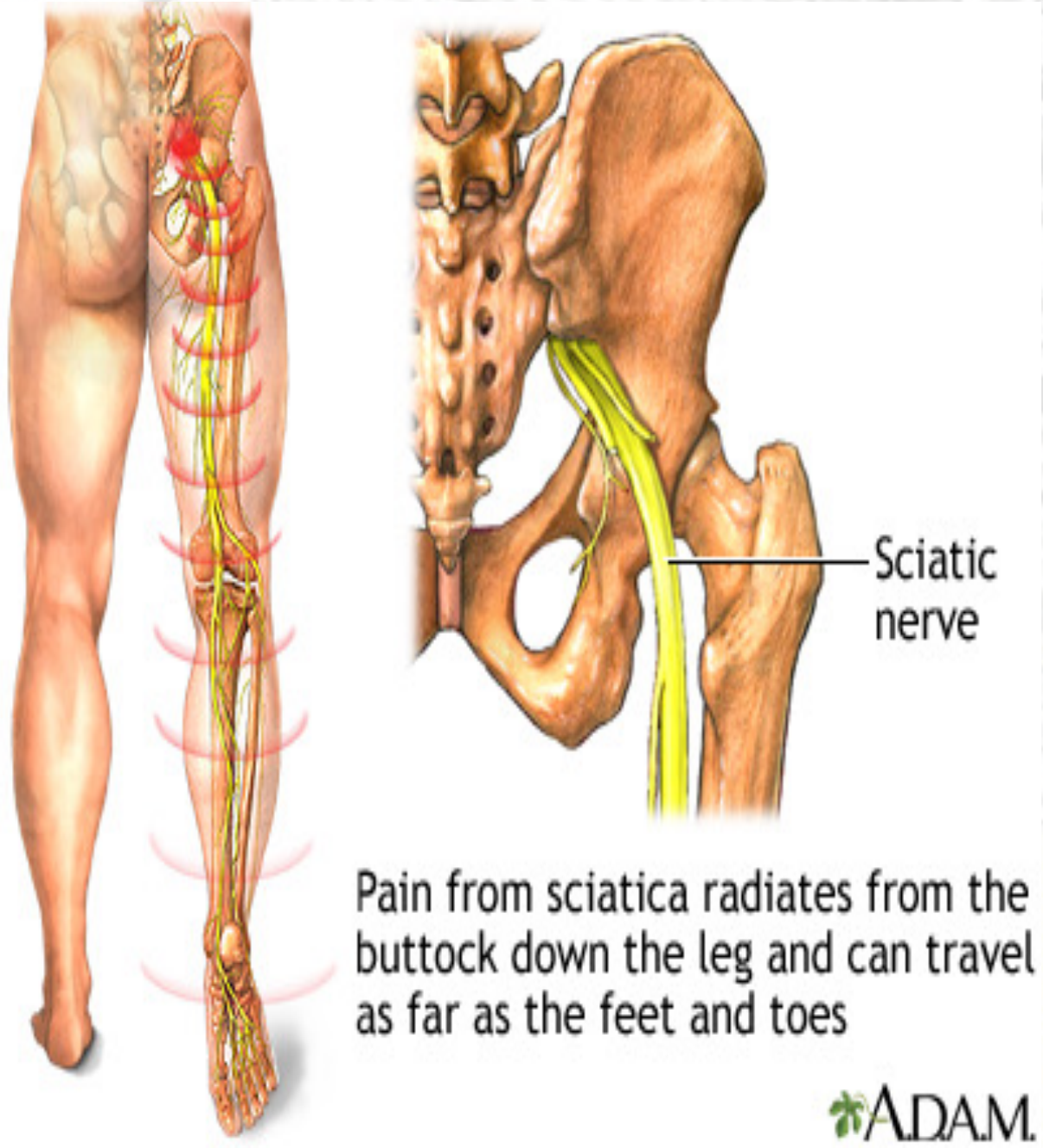
- The knee joint receives innervation from the femoral nerve, via the saphenous nerve and muscular branches.
- The joint also receives contributions from the tibial and common fibular (peroneal) nerves, and the posterior division of the obturator nerve.

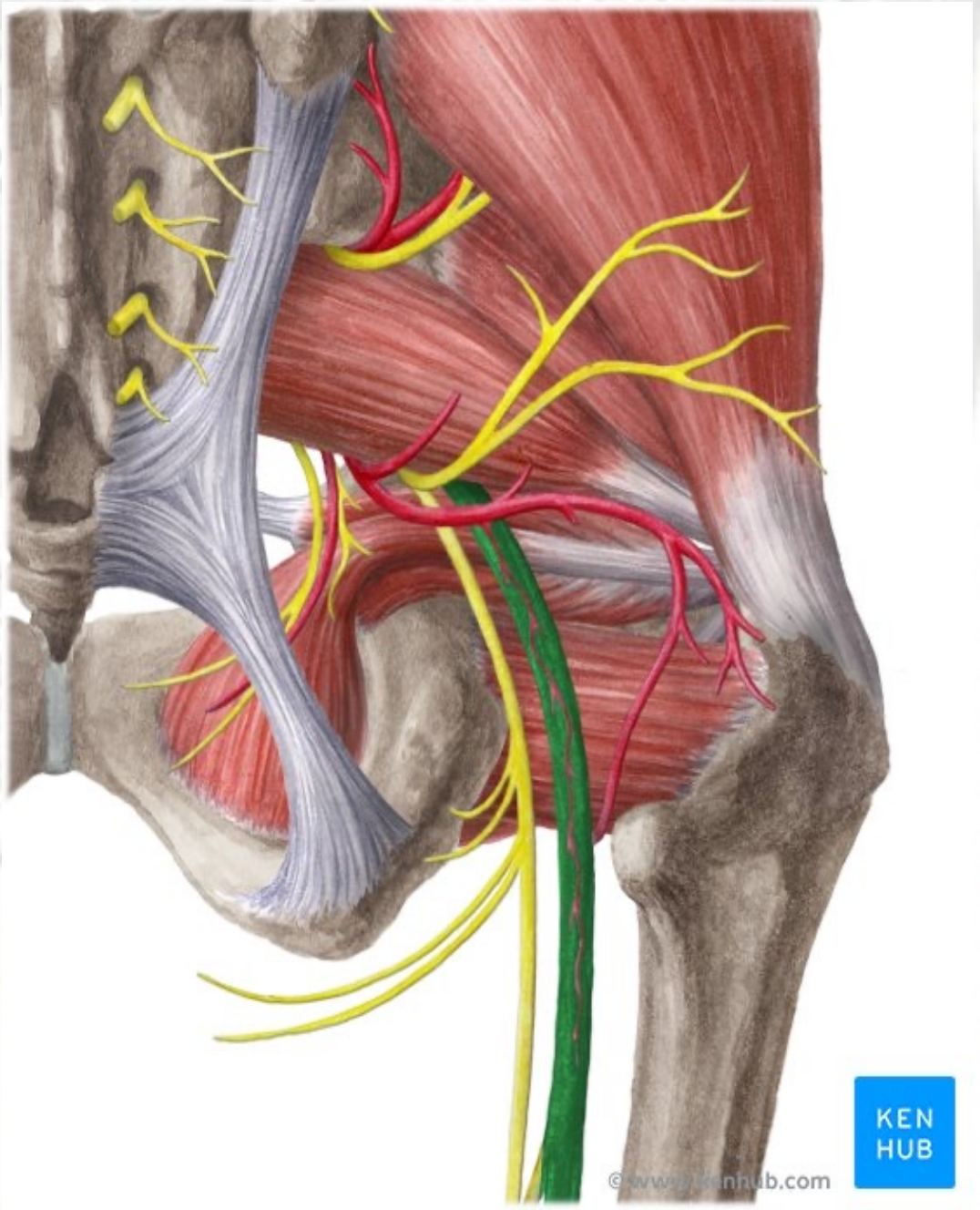
Sciatic Nerve

- (L4,5, S1,2,3) is a large nerve which runs down the back of the leg.
- It is made up of the tibial and common peroneal nerves which branch at different levels of the leg in different people.
- The sciatic nerve splits into the tibial and common peroneal nerves above the knee.
- The tibial nerve supplies the hamstring muscles (which bend the knee).
- It also supplies the muscles in the back of the calf.
- The common peroneal nerve supplies the front compartments of the leg.

SPINAL NERVES

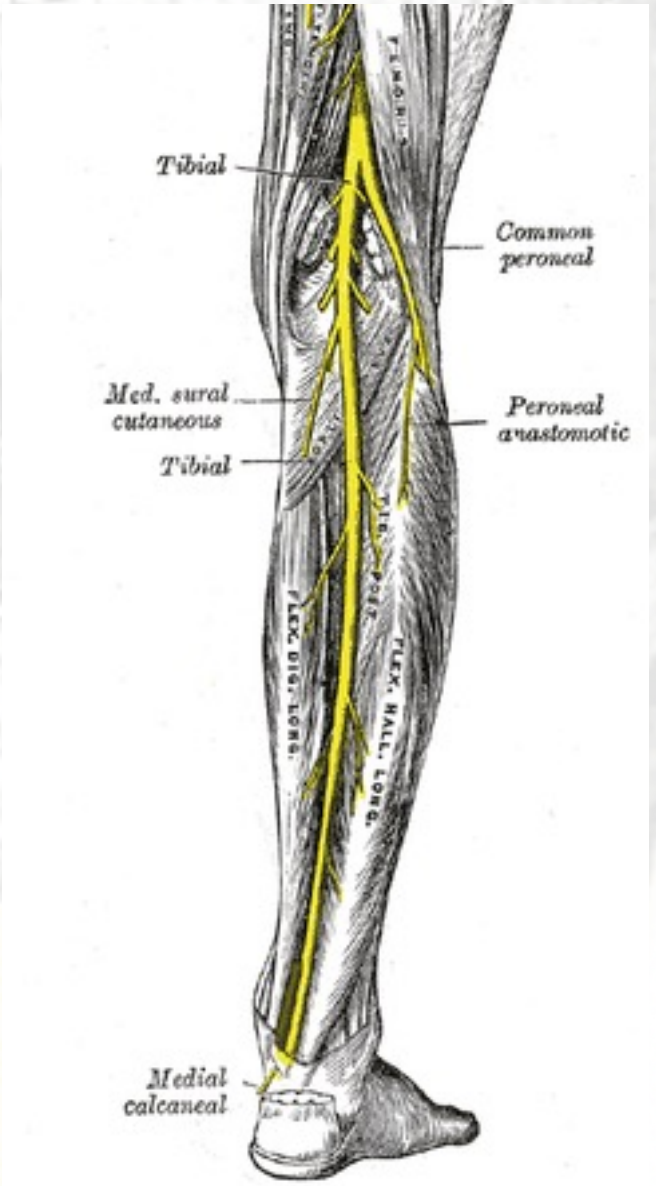


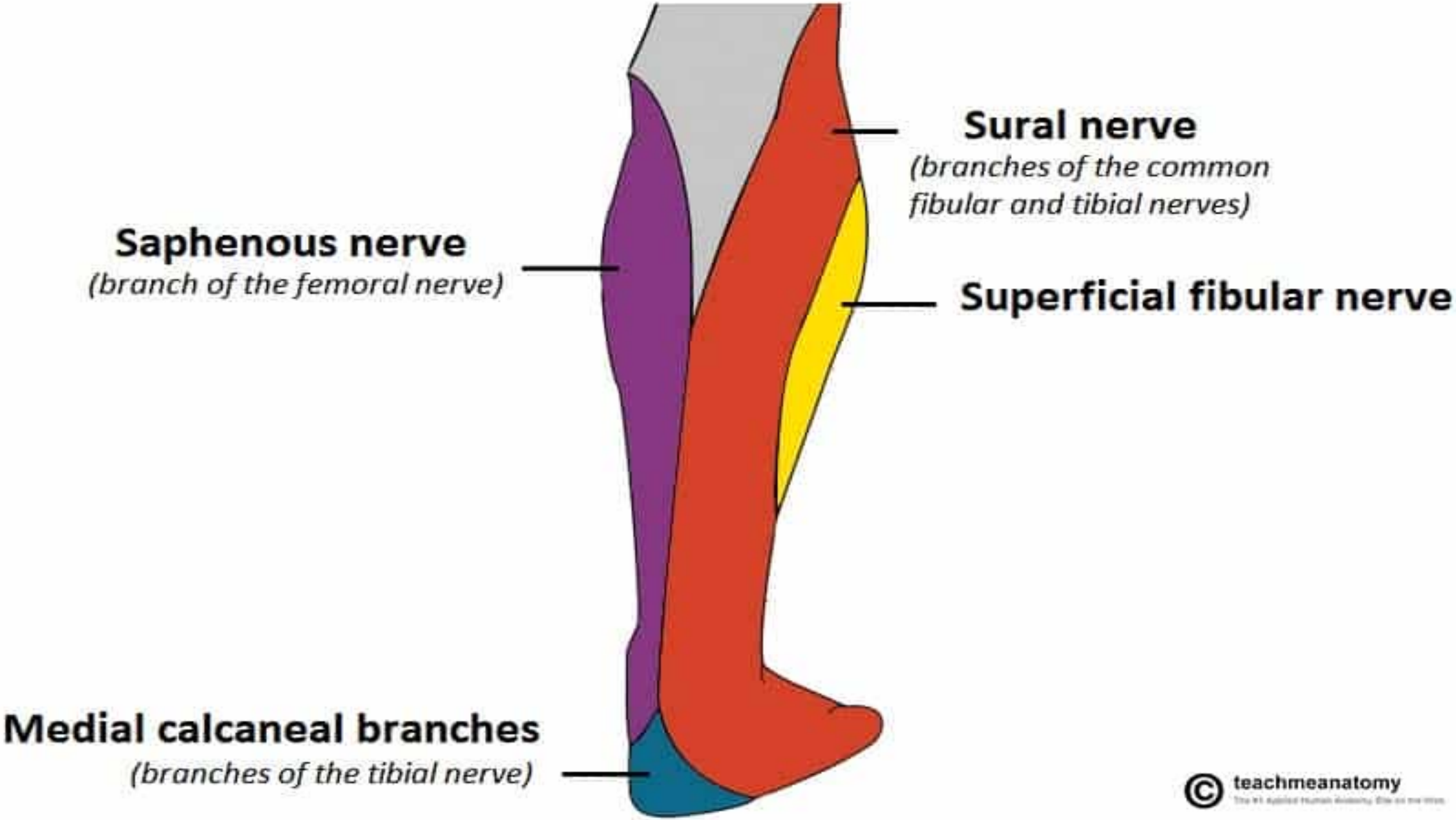

Sciatic nerve
Pain from sciatica radiates from the buttock down the leg and can travel as far as the feet and toes
A.D.A.M.


KEN HUB

Tibial Nerve

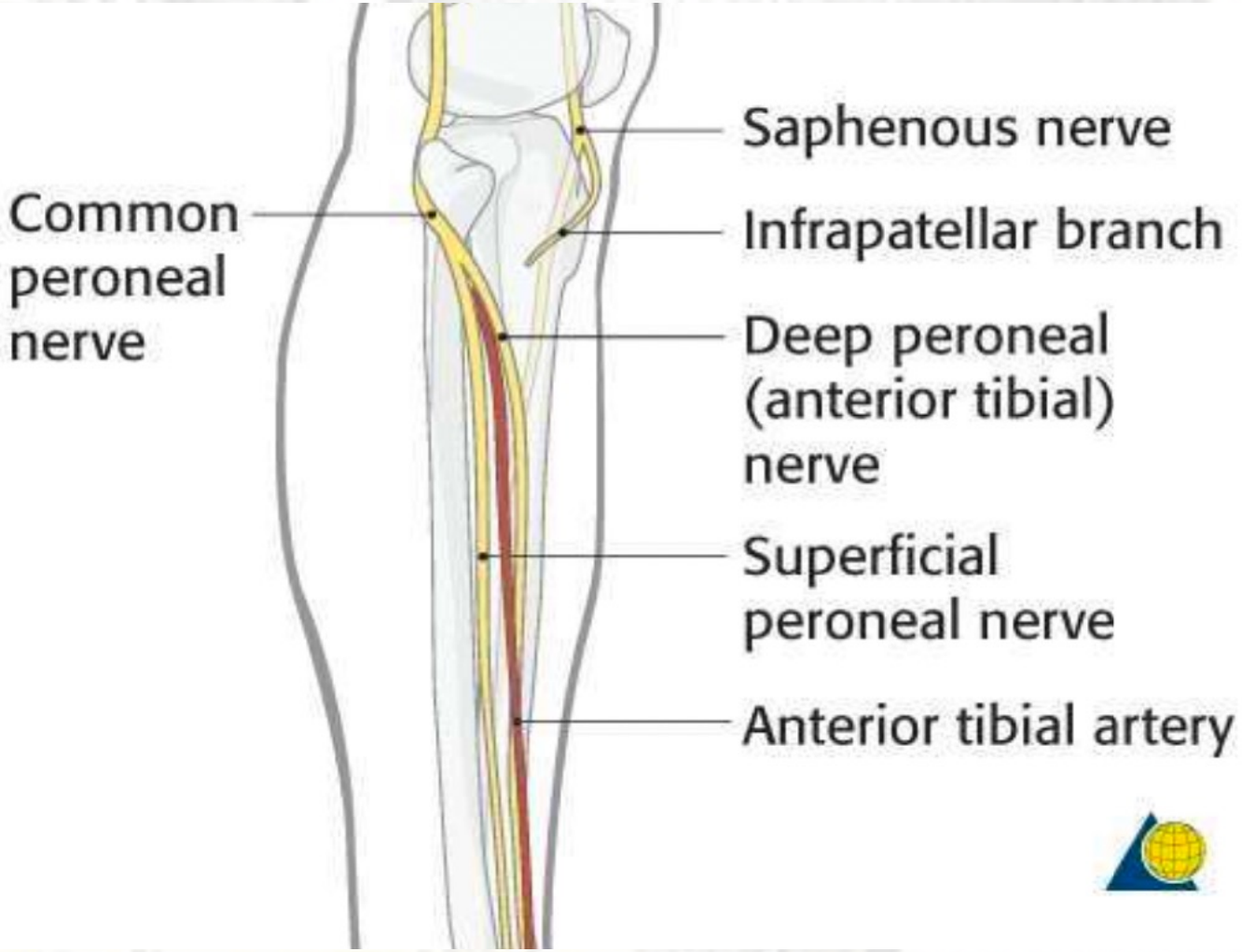
- The tibial nerve is one of the two terminal branches of the sciatic nerve, the largest nerve in the human body.
- The tibial nerve originates from the L4-S3 spinal nerve roots and provides motor and sensory innervation to most of the posterior leg and foot.




Sural nerve
(branches of the common fibular and tibial nerves)
Saphenous nerve
(branch of the femoral nerve)
Superficial fibular nerve
Medial calcaneal branches
(branches of the tibial nerve)
© teachmeanatomy

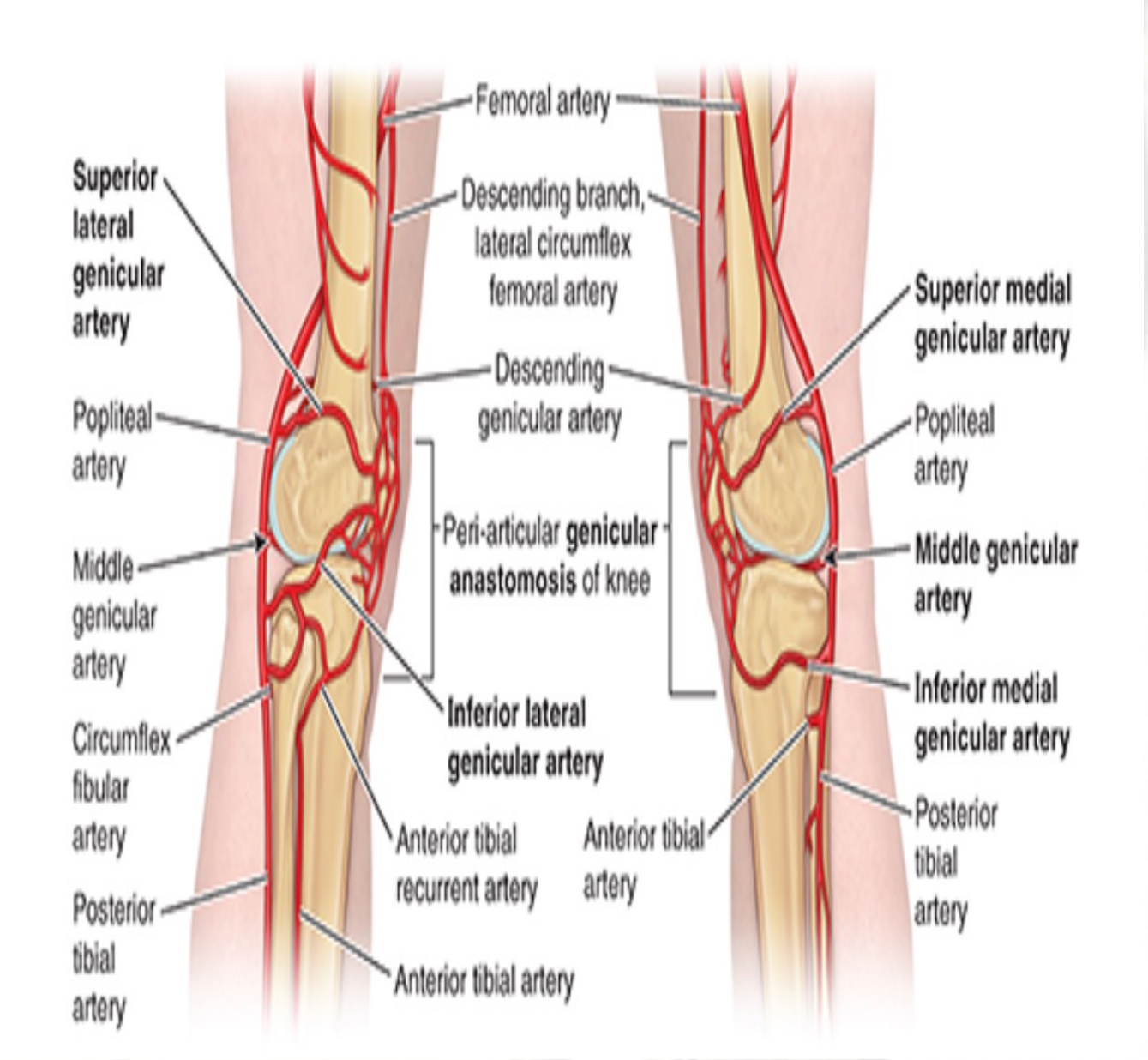
The Common Peroneal Nerve

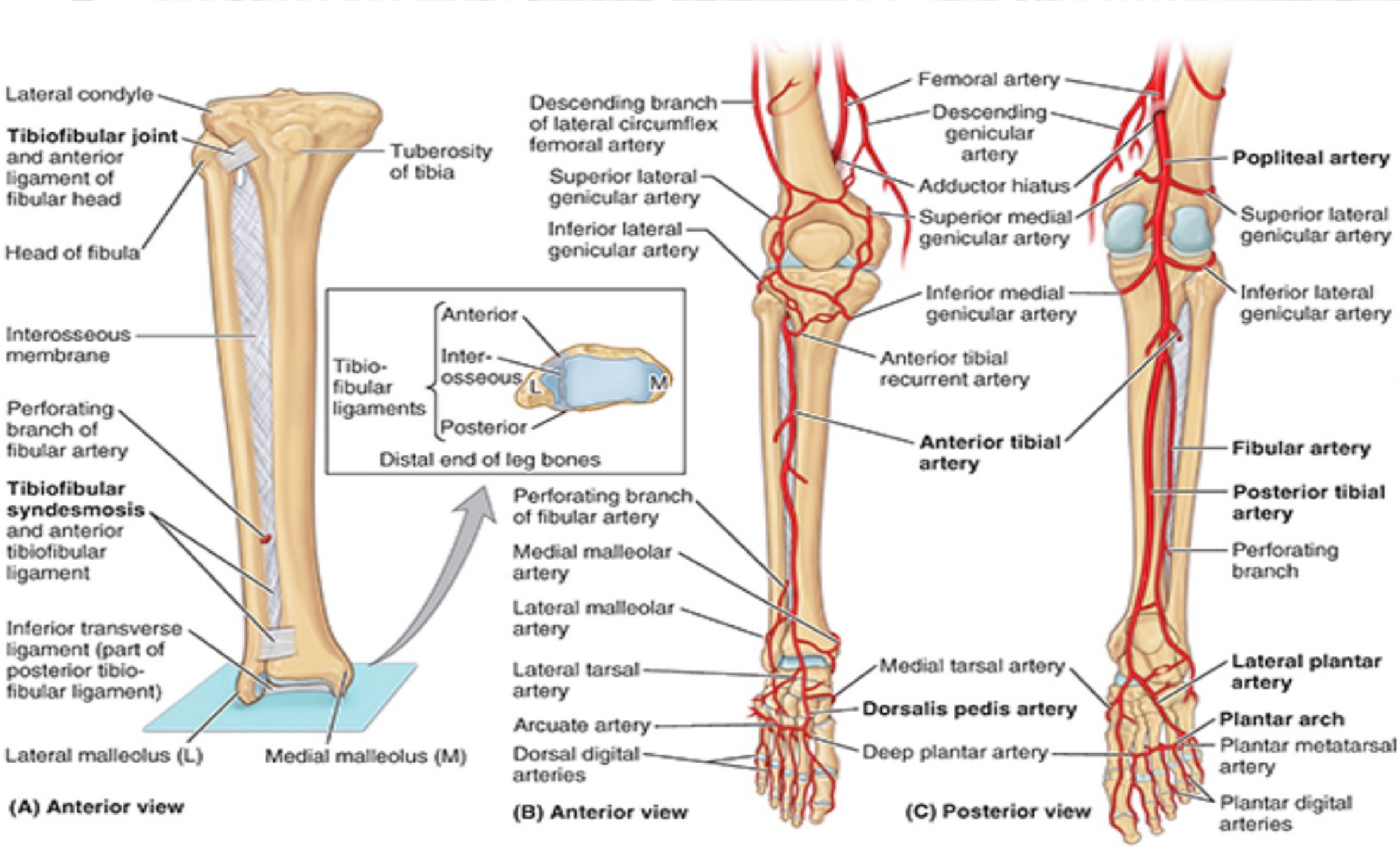
- The common peroneal nerve is one of two major branches of the sciatic nerves within the buttocks and into the thighs, along with the tibial nerves.
- It travels outside of Knee and down the front of the leg and foot.

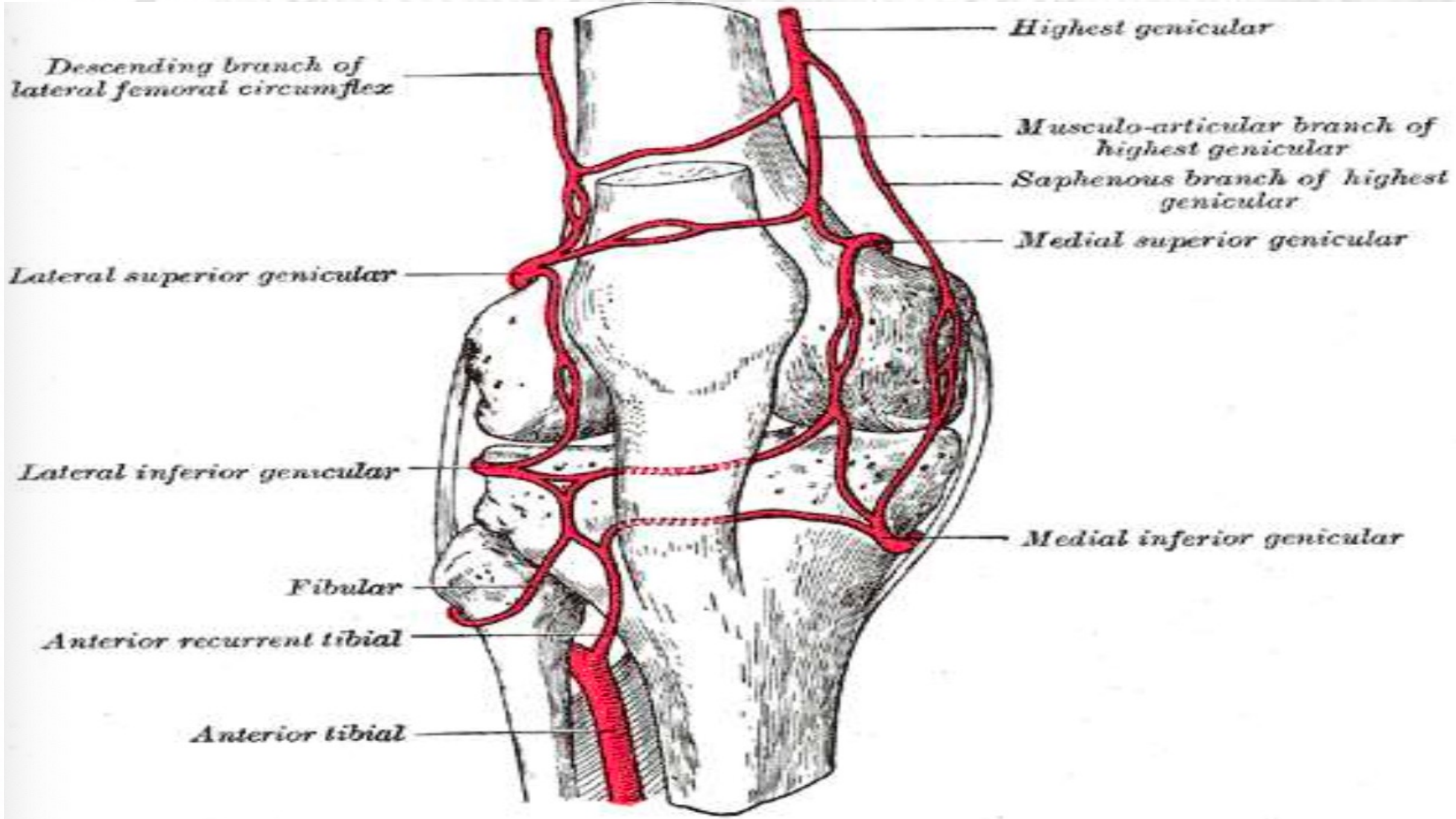


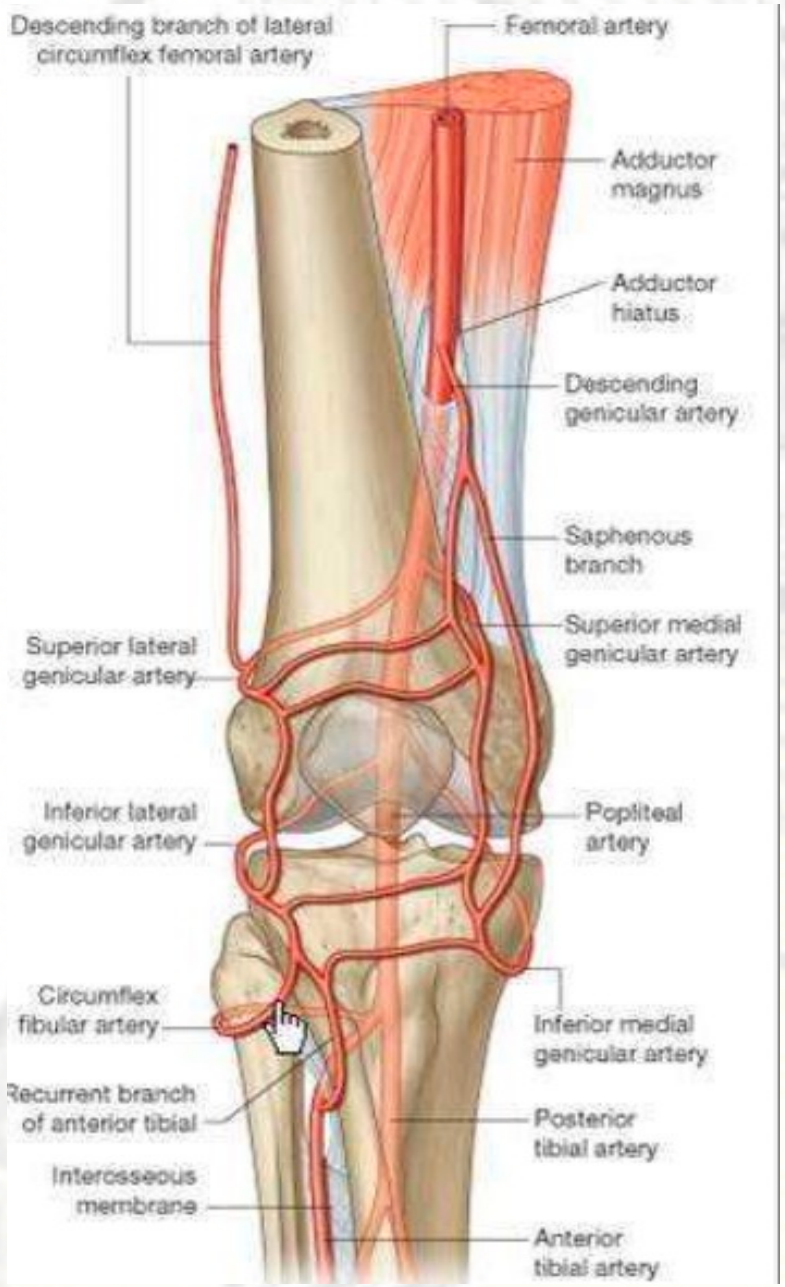
Blood Supply

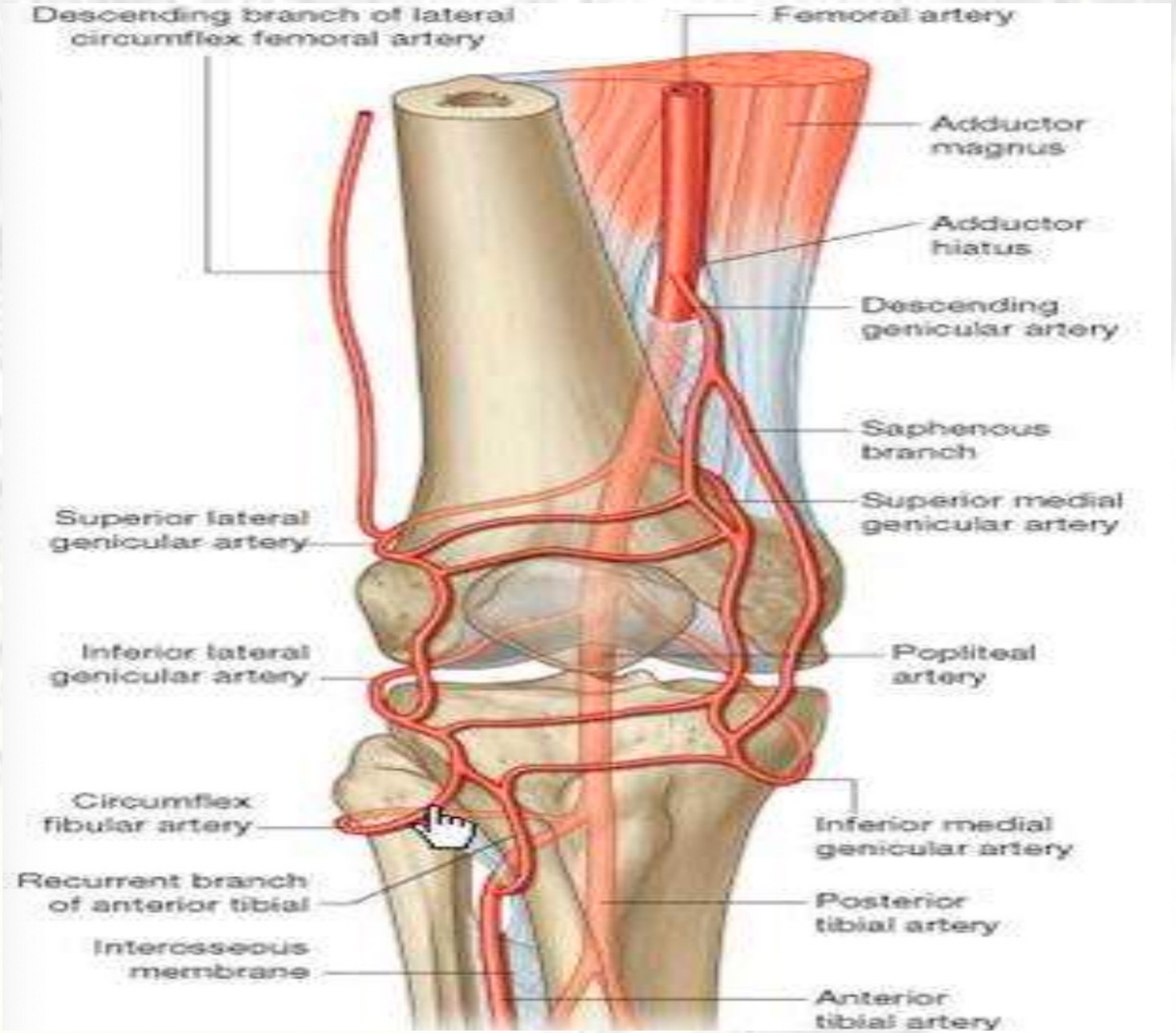
- The knee joint blood supply is derived from a rich anastomosis of the five major constant arteries, namely, the superior medial and lateral, the middle (posterior), and the inferior medial and lateral genicular arteries.




Lateral condyle
Tibiofibular joint and anterior ligament of fibular head
Tuberosity of tibia
Head of fibula
Interosseous membrane
Perforating branch of fibular artery
Tibiofibular syndesmosis and anterior tibiofibular ligament
Inferior transverse ligament (part of posterior tibiofibular ligament)
Lateral malleolus (L)
Medial malleolus (M)
(A) Anterior view
Tibiofibular ligaments
Anterior
Interosseous
Posterior
L
M
Distal end of leg bones
Descending branch of lateral circumflex femoral artery
Superior lateral genicular artery
Inferior lateral genicular artery
Perforating branch of fibular artery
Medial malleolar artery
Lateral malleolar artery
Lateral tarsal artery
Arcuate artery
Dorsal digital arteries
(B) Anterior view
Femoral artery
Descending genicular artery
Adductor hiatus
Superior medial genicular artery
Inferior medial genicular artery
Anterior tibial recurrent artery
Anterior tibial artery
Medial tarsal artery
Dorsalis pedis artery
Deep plantar artery
Popliteal artery
Superior lateral genicular artery
Inferior lateral genicular artery
Fibular artery
Posterior tibial artery
Perforating branch
Lateral plantar artery
Plantar arch
Plantar metatarsal artery
Plantar digital arteries
(C) Posterior view


Highest genicular
Descending branch of lateral femoral circumflex
Musculo-articular branch of highest genicular
Saphenous branch of highest genicular
Medial superior genicular
Lateral superior genicular
Lateral inferior genicular
Medial inferior genicular
Fibular
Anterior recurrent tibial
Anterior tibial


Descending branch of lateral circumflex femoral artery
Femoral artery
Adductor magnus
Adductor hiatus
Descending genicular artery
Saphenous branch
Superior medial genicular artery
Superior lateral genicular artery
Inferior lateral genicular artery
Popliteal artery
Circumflex fibular artery
Inferior medial genicular artery
Recurrent branch of anterior tibial
Posterior tibial artery
Interosseous membrane
Anterior tibial artery


Descending branch of lateral circumflex femoral artery
Femoral artery
Adductor magnus
Adductor hiatus
Descending genicular artery
Saphenous branch
Superior medial genicular artery
Superior lateral genicular artery
Inferior lateral genicular artery
Popliteal artery
Circumflex fibular artery
Inferior medial genicular artery
Recurrent branch of anterior tibial
Posterior tibial artery
Interosseous membrane
Anterior tibial artery

Knee Movements

- Being a hinge joint, the main movements in the knee joint are flexion and extension of the knee in the sagittal plane.
- It also allows limited medial rotation in a flexed position and in the last stage of extension, as well as lateral rotation when “unlocking” and flexing the knee.
- Unlike the elbow joint, the knee joint is not a true hinge since it has a rotational component, an accessory motion that accompanies flexion and extension, hence it is termed as a modified hinge joint.

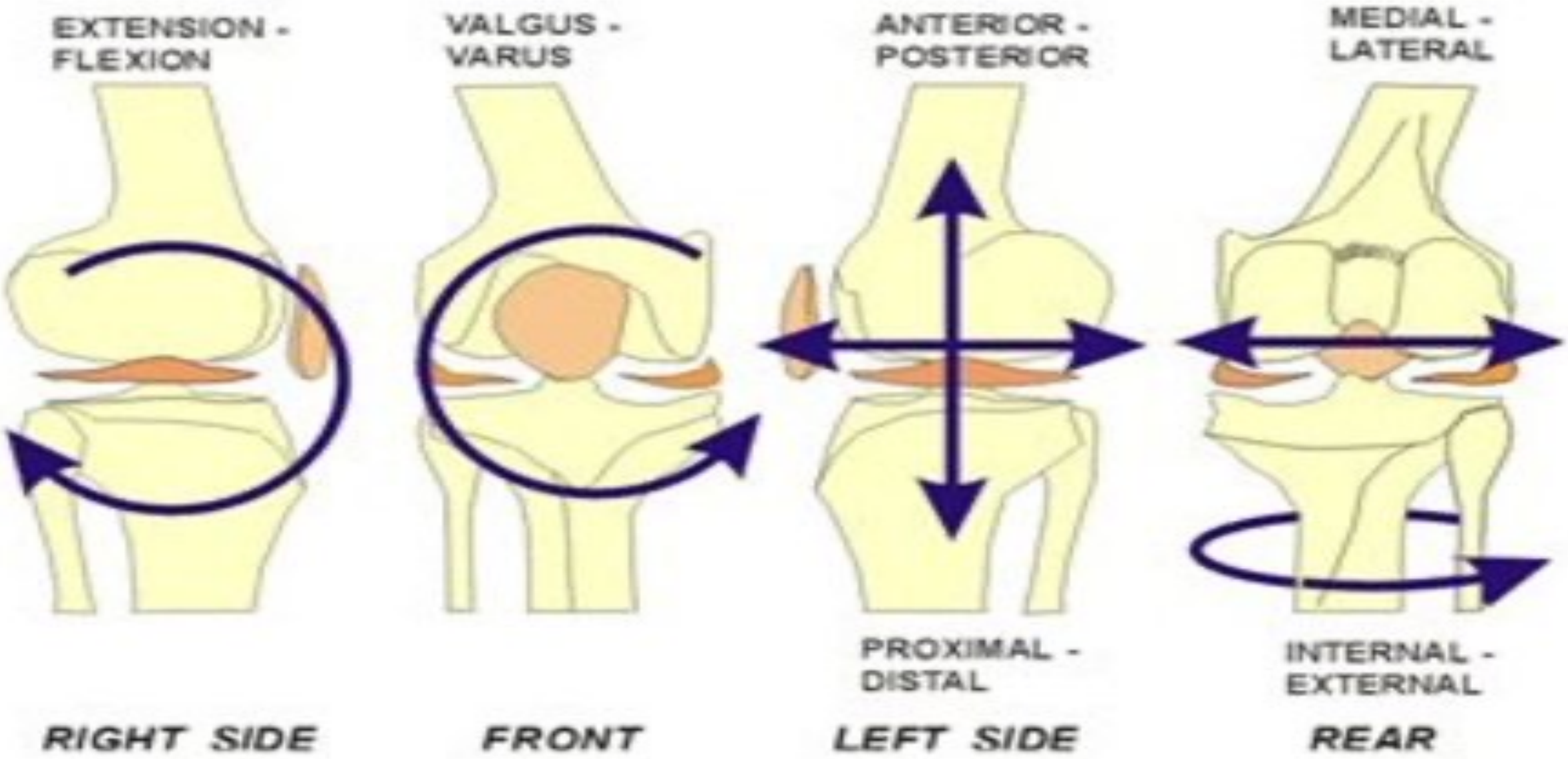
- The degree of possible knee flexion depends on the position of the hip joint and whether the movement is active or passive.
- When the hip is flexed, a maximum degree of flexion of 140° is achievable in the knee joint, whereas an extended hip allows for only 120°.
- This is due to the fact that the hamstrings are both extensors of the hip and flexors of the knee, so they lose some of their efficiency to flex the knee if the hip is extended, and vice versa.

- In addition, a wider range of motion in the knee joint is achieved with passive flexion of the knee, increasing it to 160°.
- The contact of the posterior leg (calf) with the thigh is the major limiting factor of flexion of the knee.
- In addition, the capsular pattern of the knee joint, in terms of most restriction, is flexion and extension to a lesser degree.

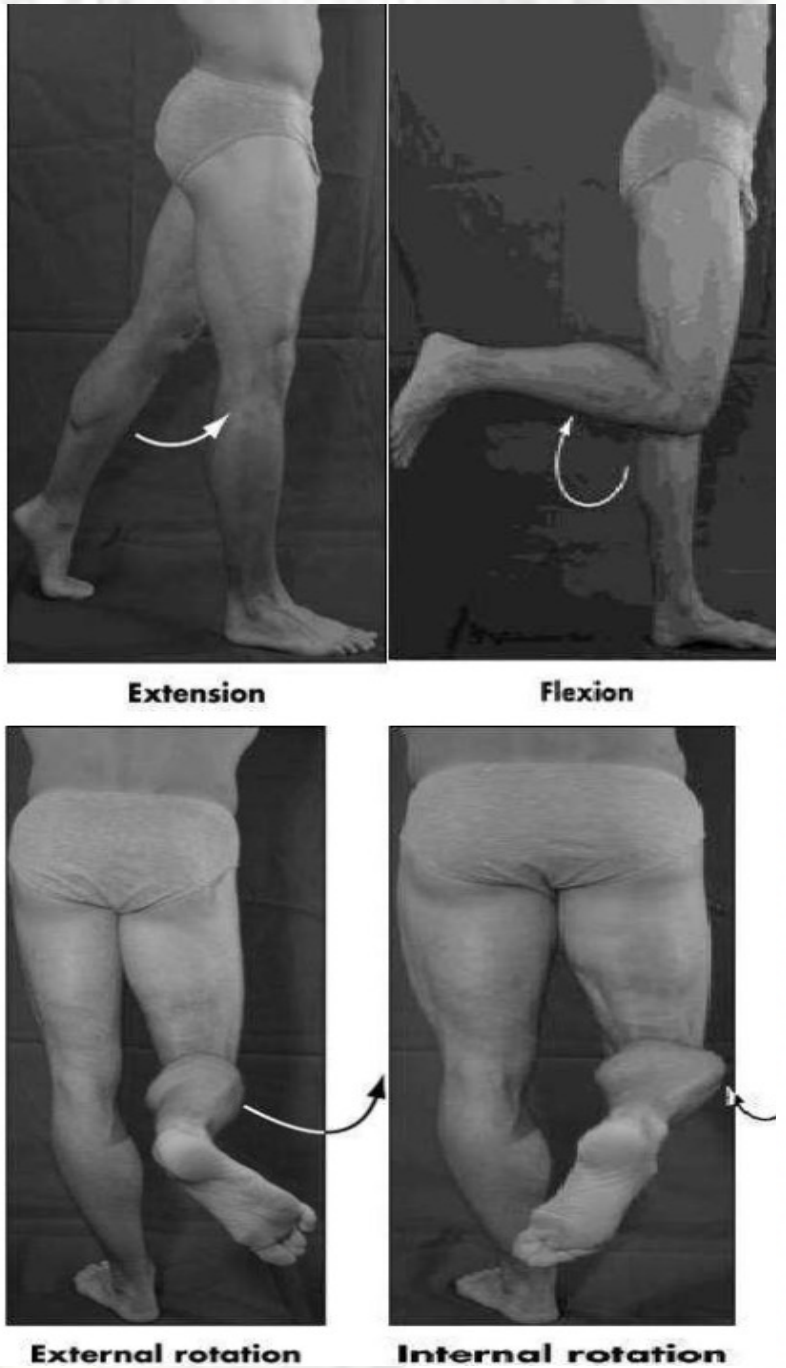
- During movement of the knee from flexion to extension, the femoral condyles roll and glide posteriorly over the tibial plateaus owing to their greater articular surface area.
- The posterior gliding motion is important because without it, the femur would simply roll off the tibia before full extension is complete.
- Additionally, as the articular surface of the lateral femoral condyle is less than its medial counterpart, the posterior gliding of the medial condyle during the last degrees of extension results in medial rotation of the femur on the tibia.

- During the last few degrees of extension, the femoral condyle rotates medially on the tibial plateau “locking” the knee.
- This is called the the “screw-home mechanism”, which allows for prolonged weight-bearing without the help from the muscles of the knee.

6 Degrees of Motion Present in the Human Knee



Flexion 120 -150	Biceps femoris Semitendinosus Semimembranosus Gracilis Sartorius Popliteus
Extension 5 -10	Quadriceps femoris
External rotation 30 -40	Biceps femoris
Internal rotation 10	Sartorius Gracilis Semtendinosus Popliteus Semimembranosus



Note: **LOCKING AND UNLOCKING KNEE JOINT**
- When moving to full extension of knee joint, femur rotates medially during last 30 degrees of movement; this pulls all major ligaments of the knee joint taut, 'locking' the knee and making it very stable; to flex knee from full extension, joint must first be unlocked by contracting the **popliteus muscle** which rotates the femur laterally (foot is firmly on ground) producing relaxation of ligaments. (LOCK femur rotates MEDIALLY; UNLOCK femur rotates LATERALLY)

femur rotates medially during last 30 degrees of extension, due to shape of condyles

FLEXED **EXTENDED**

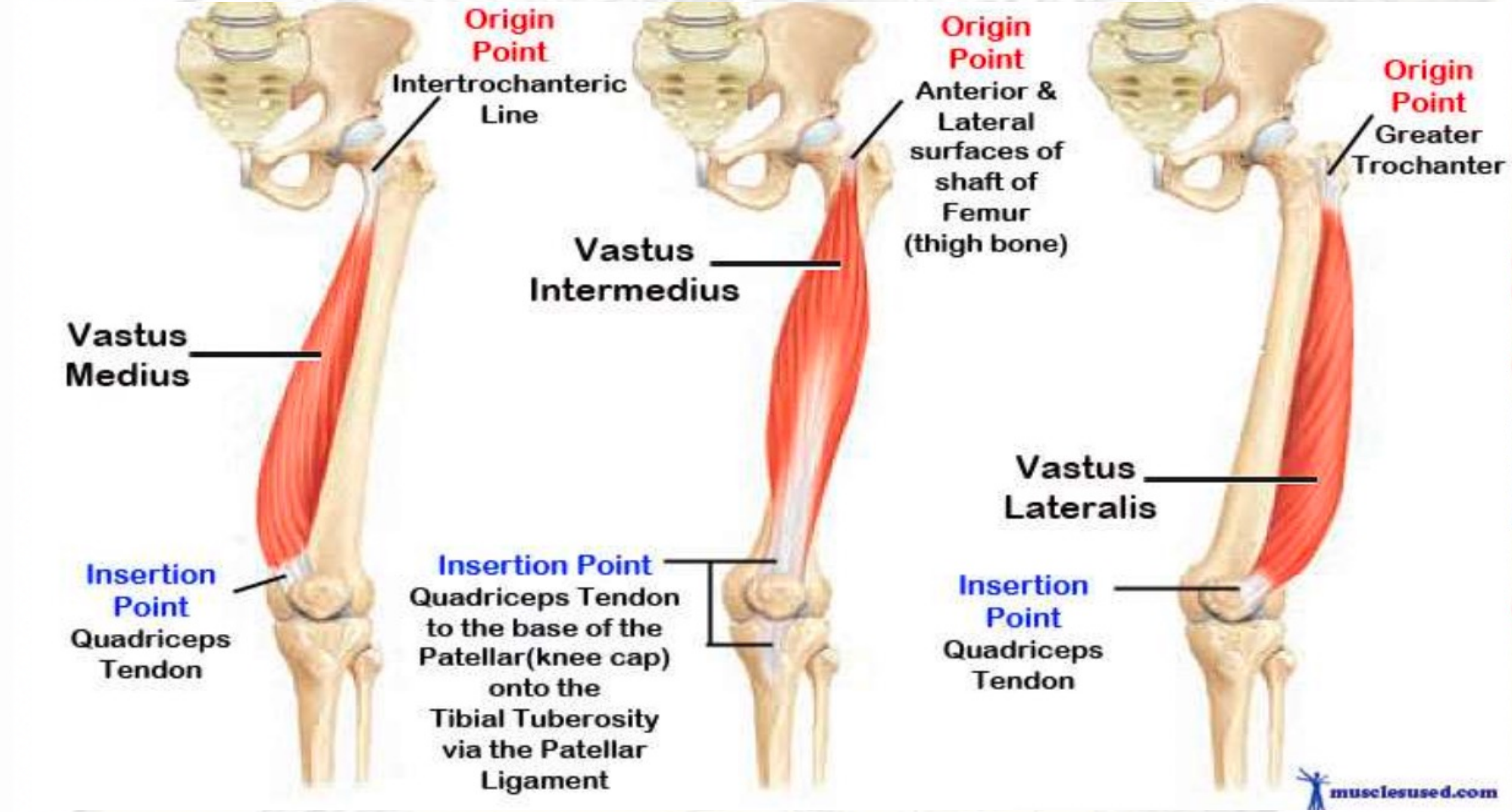
POPLITEUS UNLOCKS KNEE WHEN FLEX KNEE

Muscles acting on the knee joint

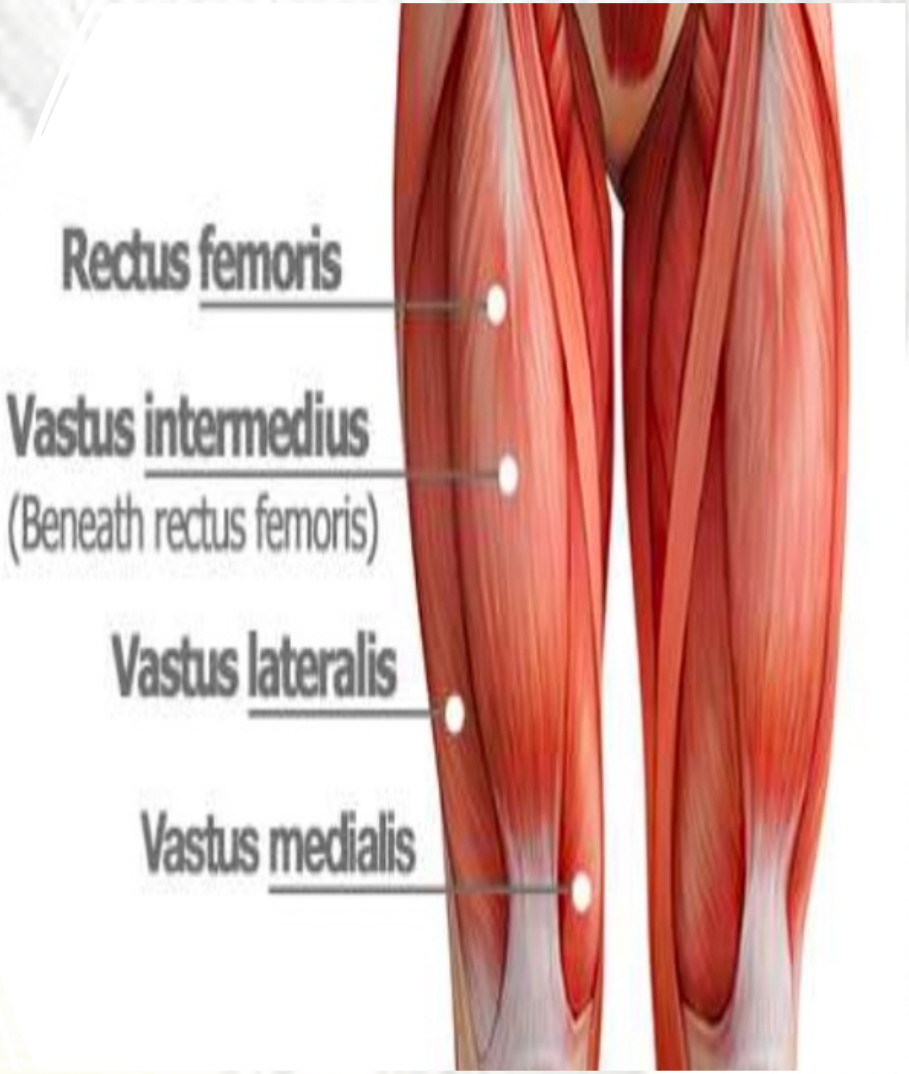
- Flexion
  - Biceps femoris, semitendinosus and semimembranosus; initiated by popliteus; assisted by gracilis and sartorius
- Extension
  - Quadriceps femoris (rectus femoris, vastus lateralis, vastus medialis and vastus intermedius) assisted by tensor fasciae latae
- Medial Rotation
  - Popliteus, semimembranosus and semitendinosus, assisted by sartorius and gracilis.
- Lateral Rotation
  - Biceps femoris

- The prime flexors of the knee joint are biceps femoris, semitendinosus and semimembranosus, whereas popliteus initiates flexion of the “locked knee” and gracilis and sartorius assist as weak flexors.
- The primary extensor of the knee joint is quadratus femoris, assisted by the tensor fascia latae.
- Quadriceps femoris of four muscle bellies; rectus femoris, vastus lateralis, vastus medialis and vastus intermedius, all innervated by the femoral nerve.

- Medial rotation, as discussed earlier, occurs when the knee is in the last stage of extension, with some also occurring when the knee is flexed.
- It is primarily produced by the actions of popliteus, semimembranosus and semitendinosus, which are assisted by sartorius and gracilis.
- Lateral rotation is produced by biceps femoris and also occurs when the knee is flexed.


Origin Point
Intertrochanteric Line
Vastus Medius
Insertion Point
Quadriceps Tendon
Origin Point
Anterior & Lateral surfaces of shaft of Femur (thigh bone)
Vastus Intermedius
Insertion Point
Quadriceps Tendon to the base of the Patellar(knee cap) onto the Tibial Tuberosity via the Patellar Ligament
Origin Point
Greater Trochanter
Vastus Lateralis
Insertion Point
Quadriceps Tendon
musclesused.com

- Of all four muscles, only the rectus Femoris crosses both the hip and knee joints.
  •Others cross only the knee joint and these muscles differ in their origin, but share a common Quadriceps femoris tendon which inserts into the patella.
- The function of the quadriceps femoris muscle is to extend the leg at the knee joint and to flex the thigh at the hip joint.

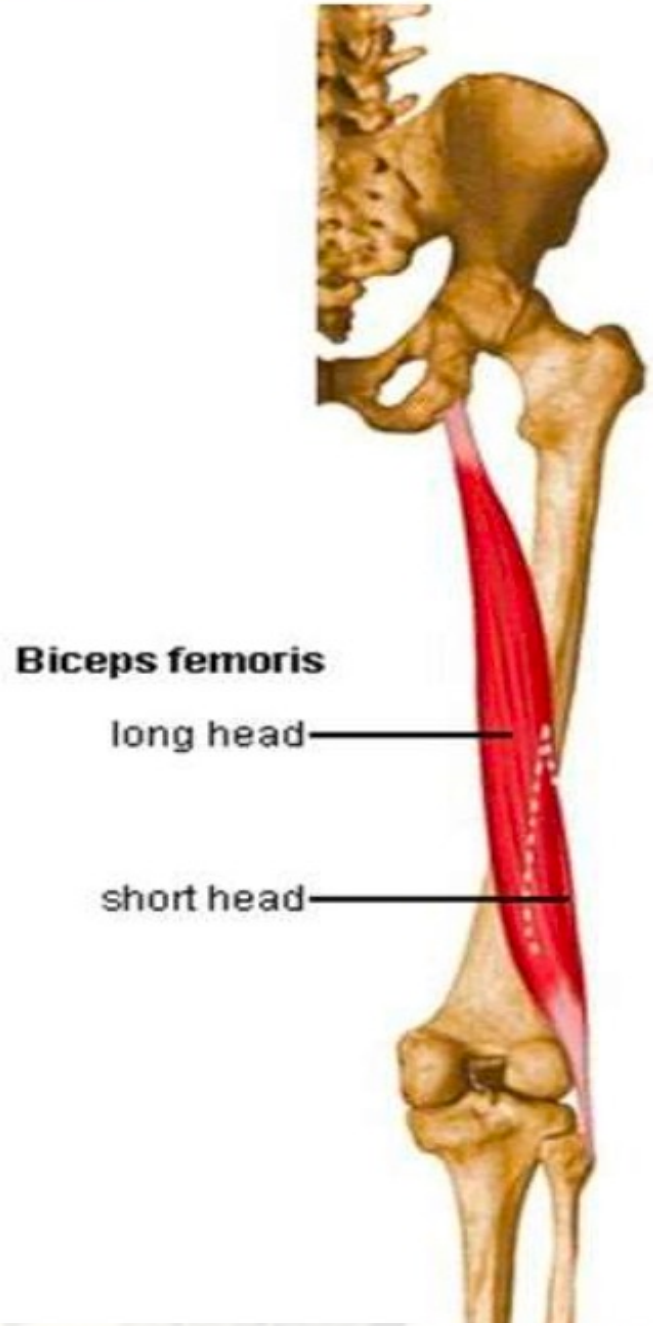


Posterior Muscles - Hamstring Group

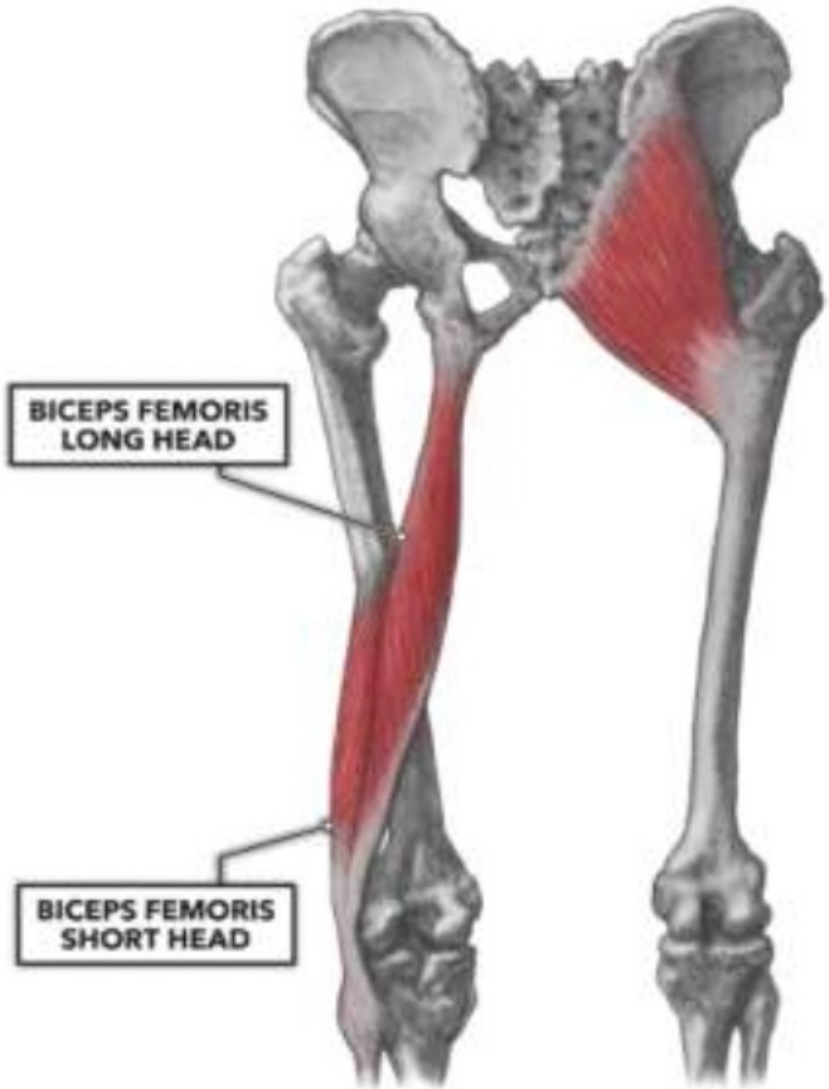
- There are three muscles in the posterior compartment of the thigh: the biceps femoris and two synergistic muscles (the semitendinosus and semimembranosus).
- The posterior region of the thigh displays similarity with the anterior region of the upper arm in both structure and function.
- Biceps Femoris: A similar muscle to the biceps brachii in the upper arm and also double-headed. Two synergistic muscles are associated with the biceps femoris, the semitendinosus and the semimembranosus.

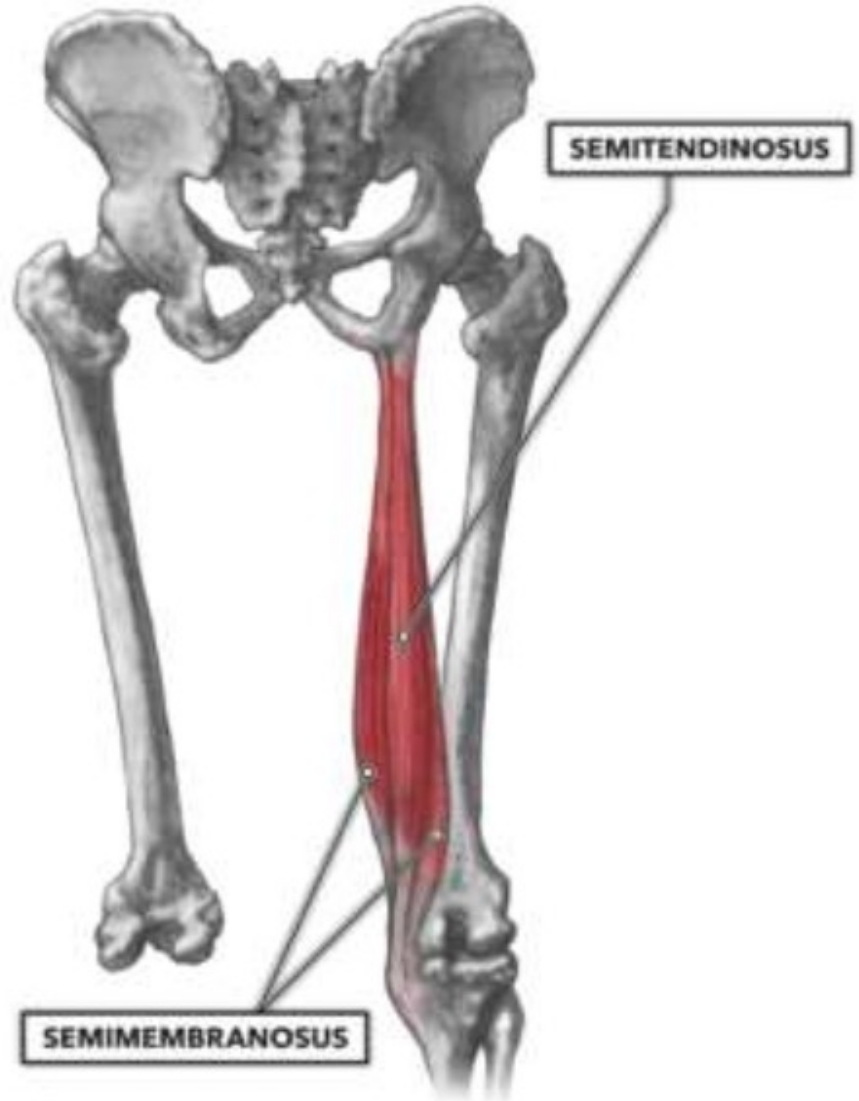
Biceps femoris

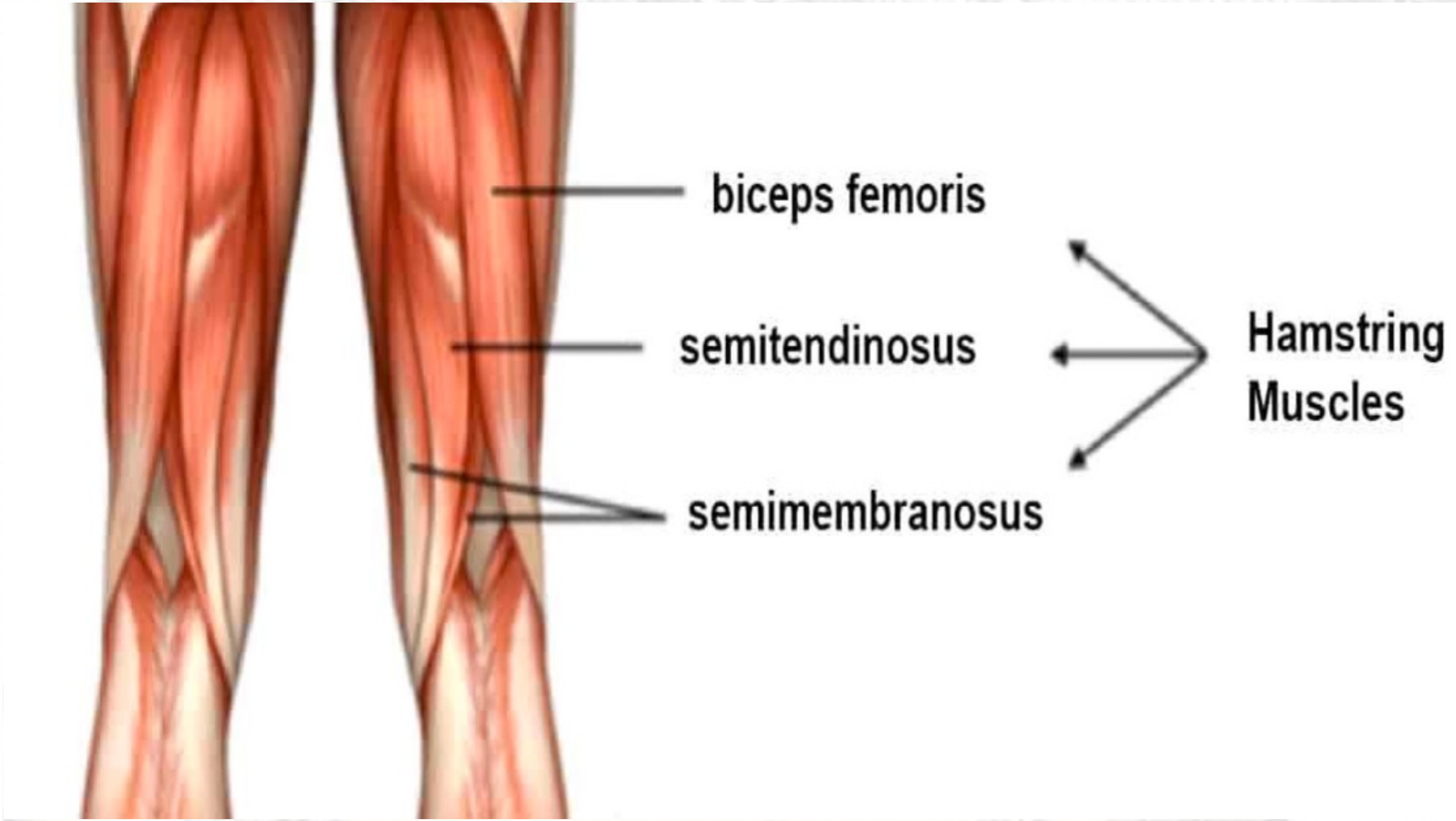
- Lateral side
- Origin:
  - 1.) Long head - ischial tuberosity;
  - 2.) Short head - lower half of the linea aspera
- Insertion: Head of the fibula
- Action:
  - Flexion of knee



POSTERIOR VIEW

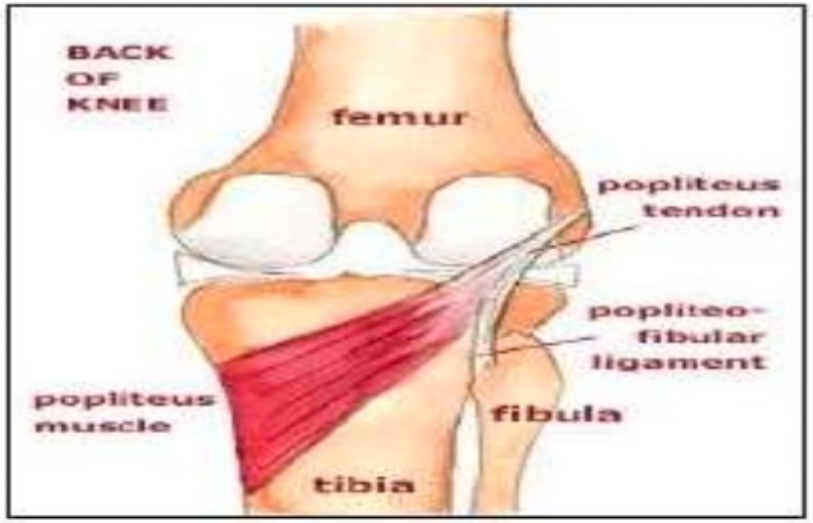





biceps femoris
semitendinosus
semimembranosus
Hamstring
Muscles

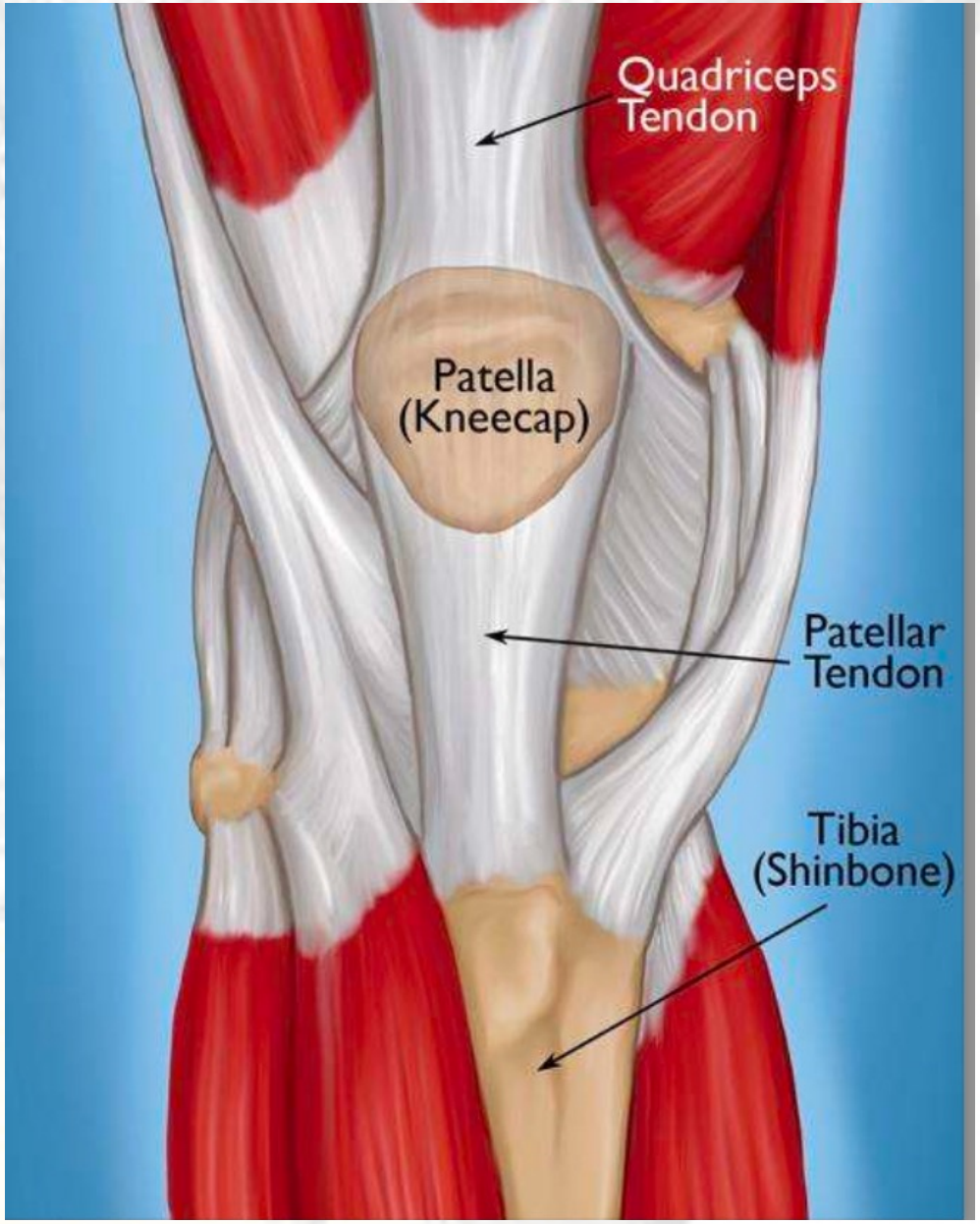
Other Muscles

- **Popliteus**
  - **Origin** - lateral condyle of femur and lateral meniscus
  - **Insertion** – proximal shaft of tibia
  - **Nerve** -Tibial nerve
  - **Action** – flex and medially rotate leg

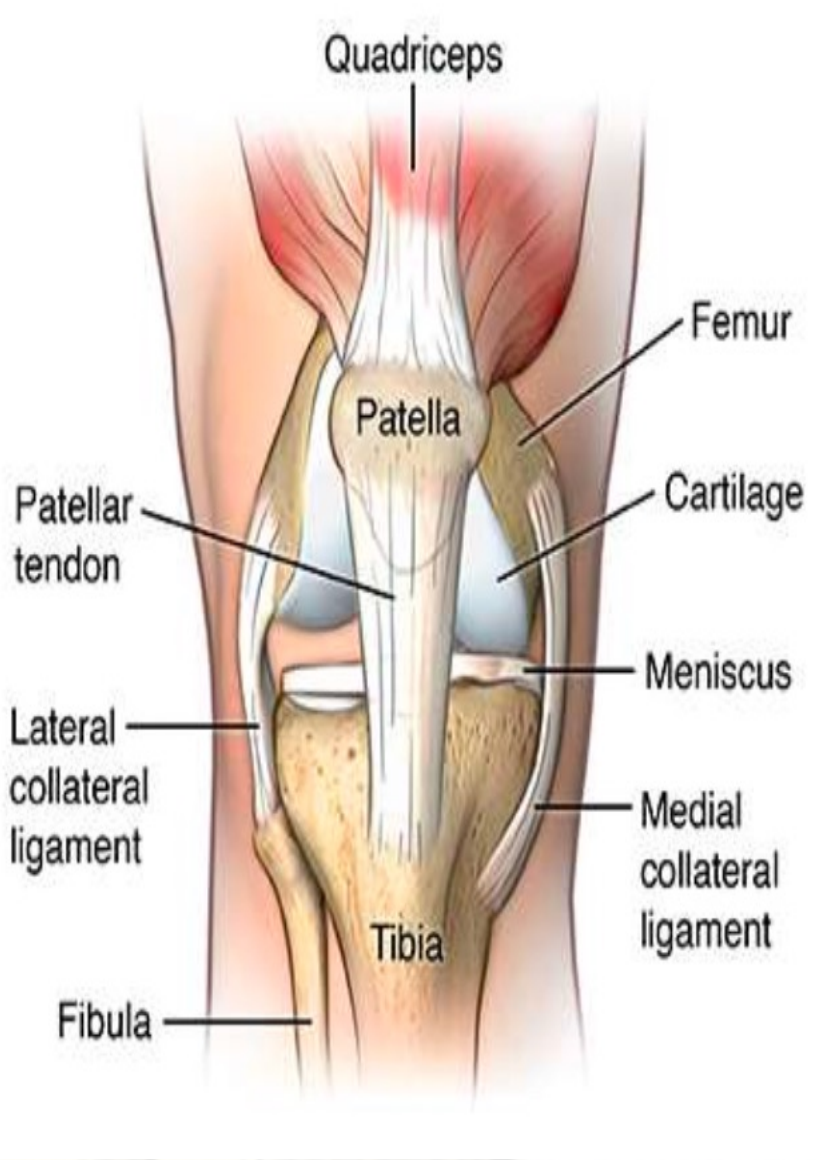


Tendons

- Tendons are similar to ligaments , except that tendons attached muscles to the bones.
- Quadriceps tendon connects the large quadriceps muscles of the thigh to the patella.



- This tendon continues across the patella over patella and blends into the Patellar Tendon.
- Patellar tendon connects the Patella to the Tibia.



Clinical significance

- As the knee joint is a complicated structure subjected to significant biomechanical stress every day, it is a common site of injury.
- As it is primarily stabilized by the ligaments mentioned above, any unnatural movement of the knee such as twisting, pivoting, sudden change of direction, or a forceful blow can cause injury to these structures.
- Common conditions include:
  - Patellar tendinitis
  - Anterior cruciate ligament
  - Collateral ligament tears injury
  - Terrible triad

Patellar tendinitis

- Is an inflammation of the patellar ligament due to overuse stress on the patellofemoral joint.
- It is also called “jumper’s knee” because it commonly occurs in sports such as basketball or volleyball, where the players exhibit a sudden impact on the joint when landing after a jump.
- It is also more common in overweight individuals, as the knee is subjected to more stress.

Patellar Tendonitis
(jumper's knee)

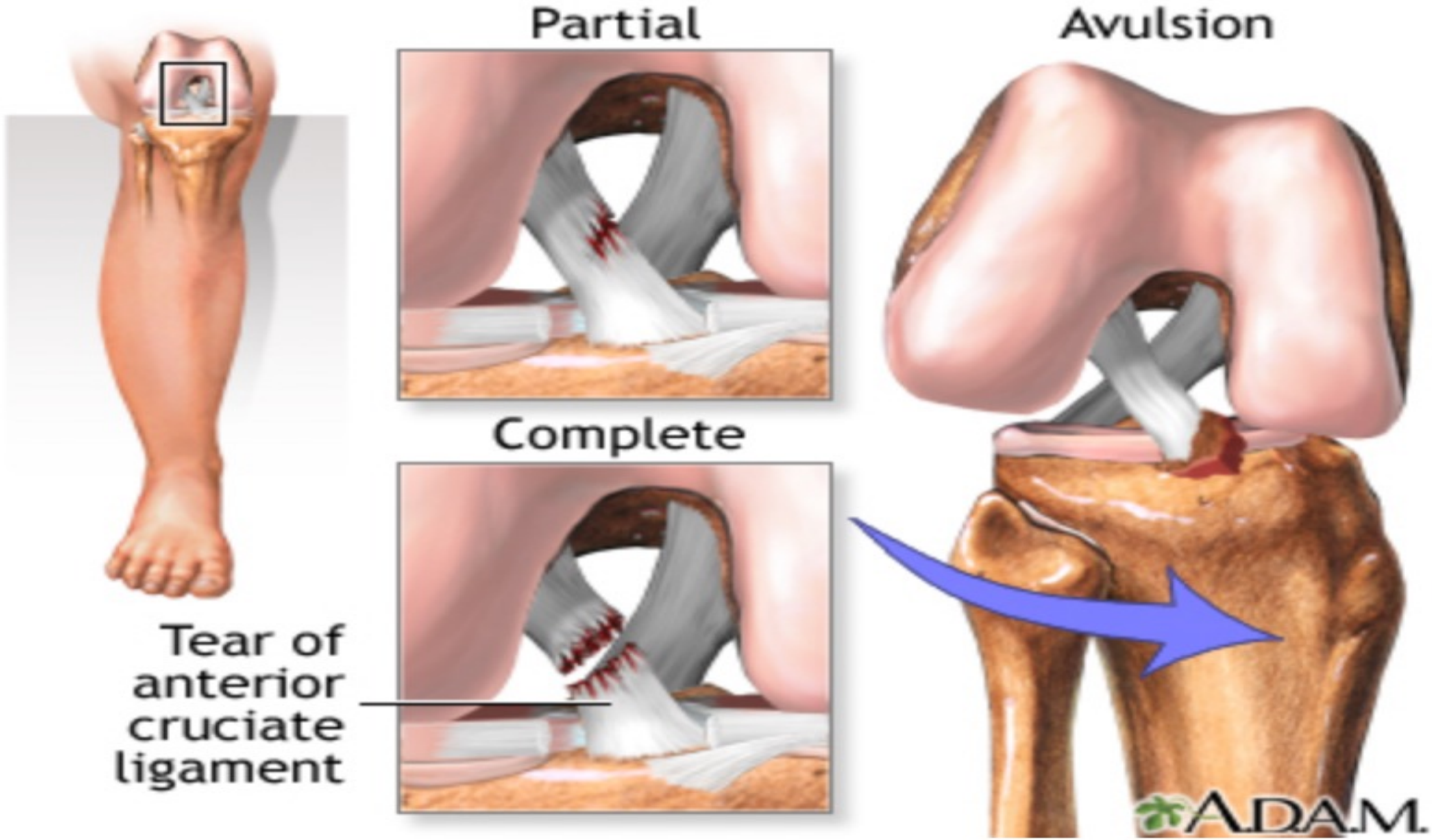
Patellar tendonitis commonly causes pain in the inferior patella area just below the knee cap and affects about 20% of jumping athletes.

Anterior cruciate ligament

- Anterior cruciate ligament (ACL) injury ranges from a mild sprain to complete tear of the ligament.
- This injury is common among athletes in contact sports, such as football or soccer occurring due to a sudden change of direction or improper landing after a jump.
- ACL injury causes pain, swelling and instability of the knee joint.

Normal anterior cruciate ligament (ACL)

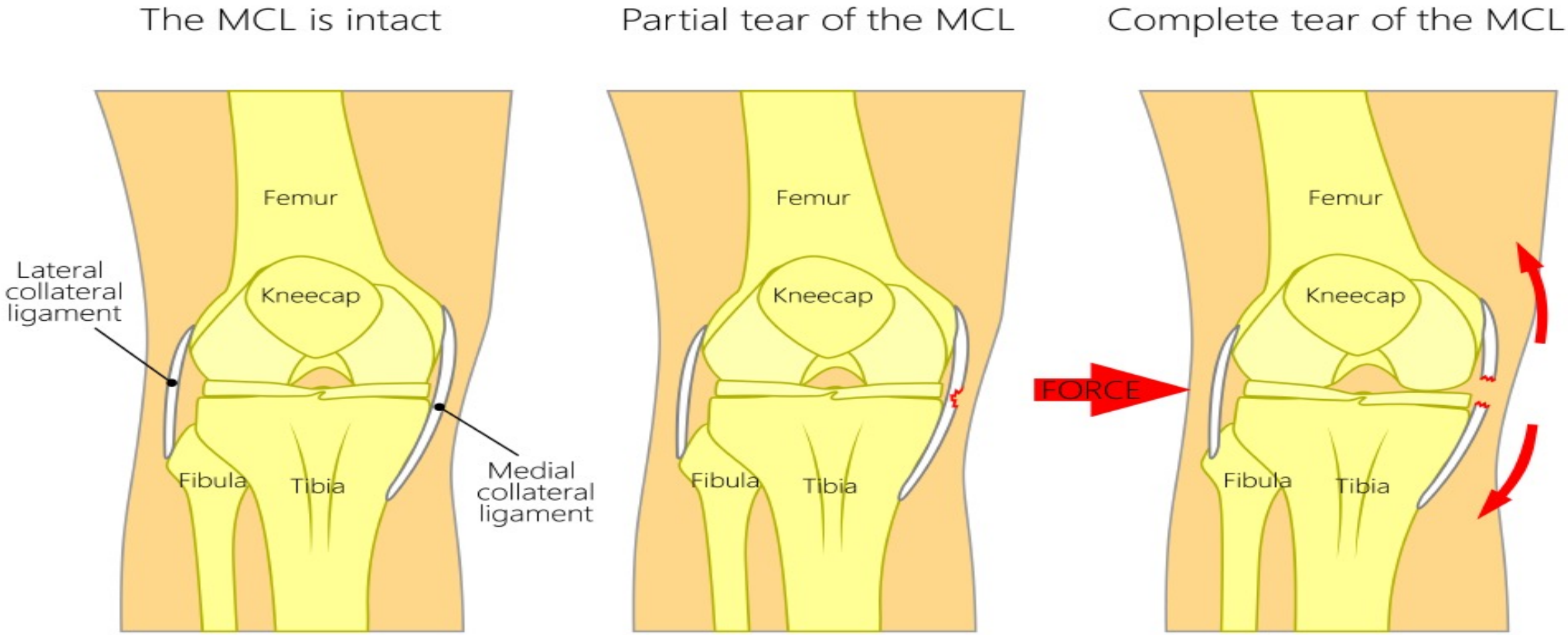
Injured anterior cruciate ligament (ACL)


Partial
Avulsion
Complete
Tear of anterior cruciate ligament
A.D.A.M.

Collateral ligament tears

- These injuries occur most commonly in contact sports due to a blow on the side of the knee.
- The tibial collateral ligament can be injured by a direct blow to the lateral side of the knee that pushes the knee inwards.
- Conversely, a fibular collateral ligament tear occurs due to a direct blow to the medial side of the knee.

TEAR OF THE MEDIAL COLLATERAL LIGAMENT (MCL)
FRONT VIEW OF THE KNEE



Terrible triad

- A knee injury characterized by tears of the cruciate ligament, the tibial collateral ligament, and the medial meniscus.
- It is commonly caused by a lateral blow to the knee, while the foot is fixed on the ground.
- This injury often occurs in sports such as rugby or football