JOINTS OF THE LOWER LIMB
1-Type: Synovial ball-and-socket joint

2-Articular surfaces:
   a- head of femur
   b- lunate surface of acetabulum

Which is deepened by the fibrocartilaginous
labrum acetabulare

3-Nerve Supply:
   Femoral nerve
   Obturator nerve
   Sciatic nerve

Remember referred pain
posteriorly, to the femoral neck about 0.5 in (12mm) from the trochanteric crest.

From this distal attachment, capsular fibres are reflected on to the femoral neck as retinacula and provide one pathway for the blood supply to the femoral head.

Distally, it is attached along the trochanteric line, the bases of the greater and lesser trochanters.
The synovial membrane of the hip joint lines the fibrous layer as well as any intracapsular bony surfaces not lined with articular cartilage. Thus, where the fibrous layer attaches to the femur, the synovial membrane reflects proximally along the femoral neck to the edge of the femoral head. The synovial folds (retinacula), which reflect superiorly along the femoral neck as longitudinal bands, contain subsynovial ret inacicular arteries (branches of the medial and a few from the lateral femoral circumflex artery), which supply the head and neck of the femur.
6-Subsynovial retinacular arteries (branches of the medial and a few from the lateral femoral circumflex artery), which supply the head and neck of the femur.

Anterior view

Posterior view
Blood supply of the head of the femur

-Acetabular (foveolar) br. of post division of obturator a. (patent in approx. 30% )
1-Medial and lateral circumflex femoral arteries
The main blood supply is from the retinacular arteries arising as branches from the circumflex femoral arteries (especially the medial circumflex femoral artery).

2-Artery to the head of femur, a branch of the obturator artery that traverses the ligament of the head.
Practice the blood supply of the head of femur.
The upper end of the femur is a common site for fracture in the elderly.

The neck may break:
1. Immediately beneath the head
   - subcapital
2. Near its midpoint
   - cervical
3. Adjacent to the trochanters
   - basal
4. The fracture line may pass between, along or just below the trochanters
   - pretrochanteric
(a) A pertrochanteric fracture does not damage the retinacular blood supply—aseptic bone necrosis does not occur. (b) A subcapital fracture cuts off most of the retinacular supply to the head—aseptic bone necrosis is common. Note that the blood supply via the ligamentum teres is negligible in adult life.
MRI revealing Left Femoral neck Fracture
a- Iliofemoral: is a strong, inverted Y-shaped ligament. Prevents hyperextension of hip joint during standing.

b- Pubofemoral: limits extension and abduction.

c- Ischiofemoral: limits extension.
D-The ligament of head of femur *ligamentum teres* primarily a synovial fold conducting a blood vessel, is weak and of little importance in strengthening the hip joint. Its wide end attaches to the margins of the acetabular notch and the transverse acetabular ligament; its narrow end attaches to the femur at the fovea for the ligament of the head of femur. Usually, the ligament contains a small artery to the head of the femur.

The non-articular lower part of the acetabulum, the *acetabular notch*, is closed off below by the *transverse acetabular ligament*.
- **Flexion** is performed by the iliopsoas, rectus femoris, and sartorius.
- **Extension** is performed by the gluteus maximus and the hamstring muscles.
- **Abduction** is performed by the gluteus medius and minimus, assisted by the sartorius, tensor fasciae latae, and piriformis.
- **Adduction** is performed by the adductor longus and brevis and the adductor fibers of the adductor magnus. These muscles are assisted by the pectineus and the gracilis.
- **Lateral rotation** is performed by the short lateral rotator muscles and assisted by the gluteus maximus.
- **Medial rotation** is performed by the anterior fibers of the gluteus medius and gluteus minimus and the tensor fasciae latae.
9- **Angle of Inclination**

It is the angle between the neck and shaft of the femur. Typically, it ranges from 115 to 140 degrees. In the young child, it is about 160°, and in the adult, it is about 125°.
it occurs in fractures of the neck of the femur and in slipping of the femoral epiphysis. In this condition, abduction of the hip joint is limited

for example, in cases of congenital dislocation of the hip. In this condition, adduction of the hip joint is limited
Note that the inferior margin of the neck of the femur should form a continuous curve with the upper margin of the obturator foramen (Shenton's line).

Shenton's line is a useful means of assessing the angle of the femoral neck on a radiograph of the hip region.
10-There is a pattern of hip injuries;

In children may sustain greenstick fractures of the femoral neck

Schoolboys may displace the epiphysis of the femoral head

In adult life the hip dislocates

In old age fracture of the neck of the femur again becomes the usual lesion
Dislocation of the hip
The hip is usually dislocated backwards and this is produced by a force applied along the femoral shaft with the hip in the flexed position (e.g. the knee striking against the opposite seat or in car accident)

The sciatic nerve, is in a close posterior relation with the hip joint therefore, it is in a danger of damage in these injuries
**Knee Joint**

- Is the most **complicated** joint in the body
- Consists of two condylar joints between:
  - The **medial and lateral condyles** of the **femur** and **The condyles of the tibia**
  - and a **gliding joint**
- between **the patella and the patellar surface of the femur**

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

**Type**

- 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**.
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 THINNER
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.
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.

- 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.

**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.
Capsule

1- The capsule is attached to the margins of the articular surfaces

2- surrounds the sides and posterior aspect of the joint.

3- 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

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

5- Behind the joint, the capsule is strengthened by an expansion of the semimembranosus muscle called the **oblique popliteal ligament**

6- An opening in the capsule behind the lateral tibial condyle permits the tendon of the popliteus to emerge
Ligaments of the knee joint

- The ligaments may be divided into
  1- 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).
- 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 ?!
- The oblique popliteal ligament is a tendinous expansion derived from the semimembranosus muscle. It strengthens the posterior aspect of the capsule.
2-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

➢ 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.
Menisci

- Medial and lateral menisci are C-shaped sheets of fibrocartilage.
- 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.
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.
Ankle Joint

Type
The ankle is a synovial hinge joint.

Articulation
The lower end of the tibia, the two malleoli, and the body of the talus

Ligaments
The medial, or deltoid, ligament
The lateral ligament

Movements

Dorsiflexion is performed by the tibialis anterior, extensor hallucis longus, extensor digitorum longus, and peroneus tertius. (muscles of the anterior compartment of the leg)

Plantar flexion is performed by the gastrocnemius, soleus, plantaris, peroneus longus, peroneus brevis, tibialis posterior, flexor digitorum longus, and flexor hallucis longus. (all the muscles of lateral and posterior compartment except popliteus muscle)
Proximal Tibiofibular Joint

- **Articulation**
  Articulation is between the lateral condyle of the tibia and the head of the fibula. The articular surfaces are flattened and covered by hyaline cartilage.

- **Type**
  This is a synovial, plane, gliding joint.

- **Capsule**
  The capsule surrounds the joint and is attached to the margins of the articular surfaces.

- **Ligaments**
  *Anterior and posterior ligaments strengthen the capsule.*

- **Synovial Membrane**
  The synovial membrane lines the capsule and is attached to the margins of the articular surfaces.

- **Nerve Supply**
  The common peroneal nerve supplies the joint.

**Movements**
A small amount of gliding movement takes place during movements at the ankle joint.
Patellar Dislocations

The patella is a sesamoid bone lying within the quadriceps tendon. The importance of the lower horizontal fibers of the vastus medialis and the large size of the lateral condyle of the femur in preventing lateral displacement of the patella has been emphasized. Congenital recurrent dislocations of the patella are caused by underdevelopment of the lateral femoral condyle. Traumatic dislocation of the patella results from direct trauma to the quadriceps attachments of the patella (especially the vastus medialis), with or without fracture of the patella.
Distal Tibiofibular Joint

Articulation
Articulation is between the fibular notch at the lower end of the tibia and the lower end of the fibula

Type
The distal tibiofibular joint is a fibrous joint

Capsule
There is no capsule.

Ligaments
1- The **interosseous ligament** is a strong, thick band of fibrous tissue that binds the two bones together.

2- The **anterior and posterior ligaments** are flat bands of fibrous tissue connecting the two bones together in front and behind the interosseous ligament

3- The **inferior transverse ligament**
Tarsal Joints
1-Subtalar Joint
The subtalar joint is the posterior joint between the talus and the calcaneum.
Articulation
Articulation is between the inferior surface of the body of the talus and the facet on the middle of the upper surface of the calcaneum.
Type
These joints are synovial, of the plane variety
Ligaments
Medial and lateral (talocalcaneal) ligaments strengthen the capsule. The interosseous (talocalcaneal) ligament is strong and is the main bond of union between the two bones. It is attached above to the sulcus tali and below to the sulcus calcanei.
Movements
Gliding and rotatory movements are possible
2- Talocalcaneonavicular Joint

is the anterior joint between the talus and the calcaneum and also involves the navicular bone.

Articulation

Articulation is between the rounded head of the talus, the upper surface of the sustentaculum tali, and the posterior concave surface of the navicular bone.

Type

The joint is a synovial joint.

Ligaments

The plantar calcaneonavicular ligament is strong and runs from the anterior margin of the sustentaculum tali to the inferior surface and tuberosity of the navicular bone. The superior surface of the ligament is covered with fibrocartilage and supports the head of the talus.

Movements

Gliding and rotatory movements are possible.

3- Calcaneocuboid Joint

Articulation

Articulation is between the anterior end of the calcaneum and the posterior surface of the cuboid.

The calcaneocuboid joint is synovial, of the plane variety.

Ligaments

The bifurcated ligament