AL MUSTAQBAL UNIVERSITY

College of Medicine / First Year

ANATOMY

(L1) Osteology & Joints of Lower Limbs

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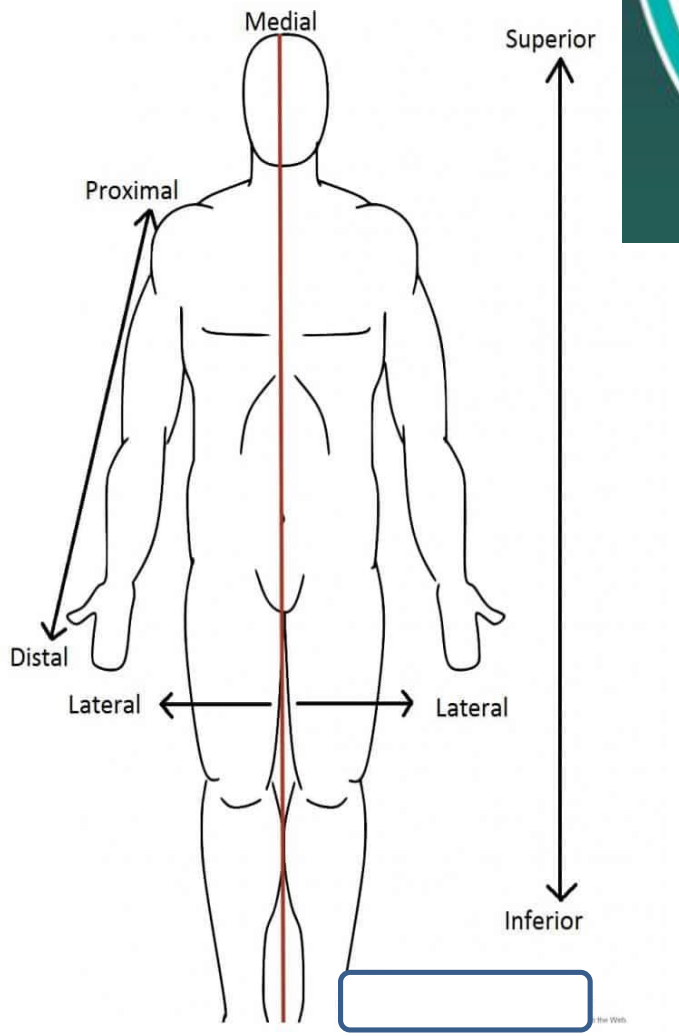


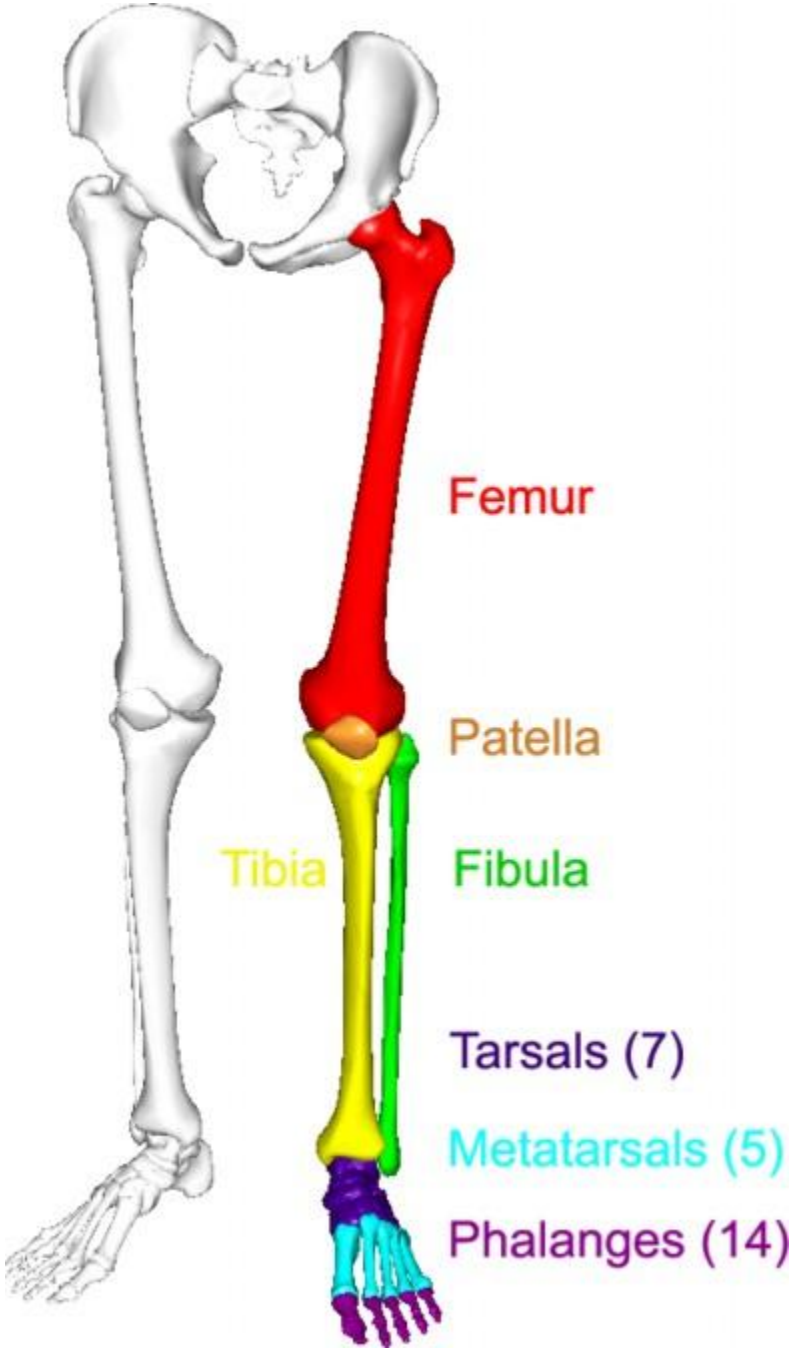
Learning Objectives

- Morphological Identification: Identify and describe the major bony landmarks of the femur, tibia, fibula, patella, and foot (tarsals, metatarsals, and phalanges).
- Mechanics: Explain the anatomical structure and classification of the hip, knee, tibiofibular, and ankle joints, including the specific bony surfaces involved in each articulation.
- Stability and Support Systems: Analyze the role of the menisci, cruciate ligaments, and collateral ligaments in knee stability.
- Osteology: Correlate specific bony features with vulnerable neurovascular structures (e.g., fracture femur neck)

OVERVIEW

The primary functions of the lower limbs are to support the weight of the body and produce locomotion. The lower limbs are very stable and can bear the weight of the body because the two hip bones articulate posteriorly with the trunk at the strong **sacroiliac joints** and anteriorly with each other at the **symphysis pubis**. This stability also provides the foundation for standing in the upright posture, walking, and running.

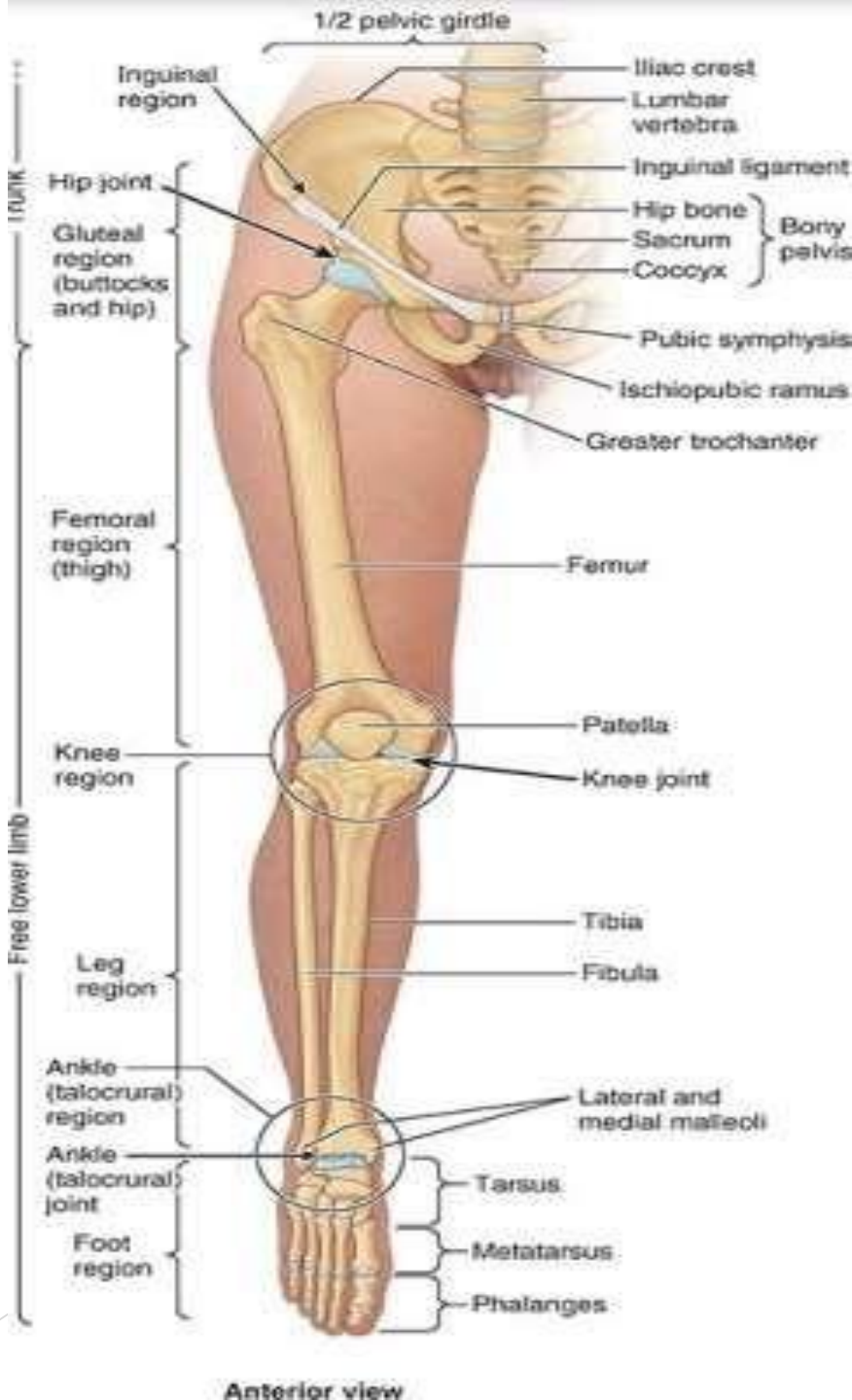
Each lower limb is organized into the **gluteal region**, **the thigh**, **the popliteal fossa**, **the leg**, **the ankle**, and **the foot**. The thigh and the leg are compartmentalized, and each compartment has its own muscles that perform group functions and its own distinct nerve and blood supply.



Regions of lower limb

The lower limbs have six major regions

- ❑ **The gluteal region:** transitional region between the trunk and free lower limbs.
- ✓ **the buttocks**
- ✓ **hip region** overlies the hip joint and greater trochanter
- ❑ **The femoral region (thigh)**. The transition from trunk to free lower limb occurs abruptly in the inguinal region or groin.
- ❑ **The popliteal fossa (The knee region)**
- ✓ condyles of the distal femur and proximal tibia,
- ✓ the head of the fibula
- ✓ the patella
- ✓ the joints between these bony structures.
- ❑ **The leg region** includes most of the tibia and fibula
- ❑ **The ankle** includes the medial and lateral malleoli that flank the ankle joint.
- ❑ **The foot region** containing the tarsus, metatarsus, and phalanges



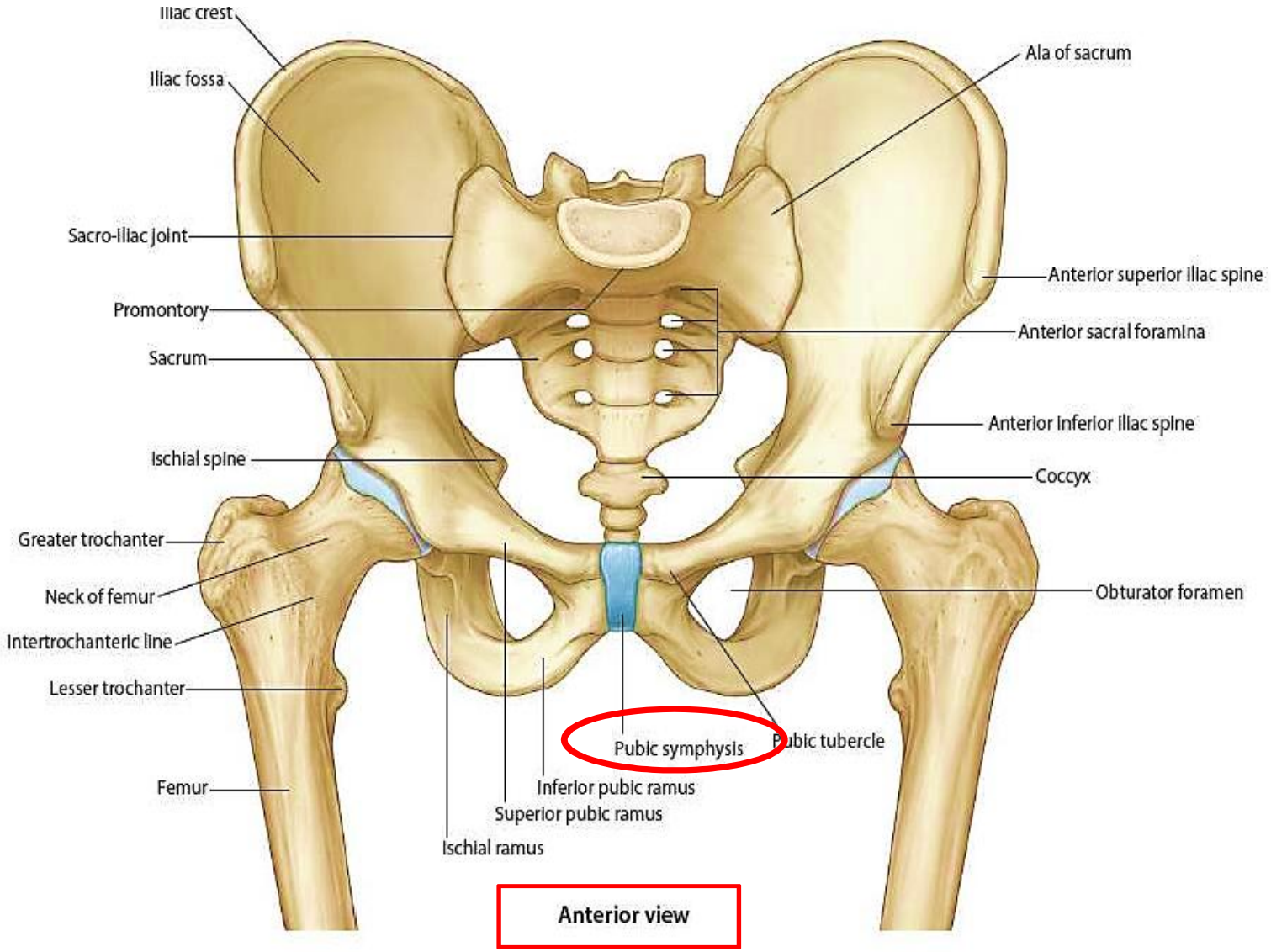
OSTEOLOGY

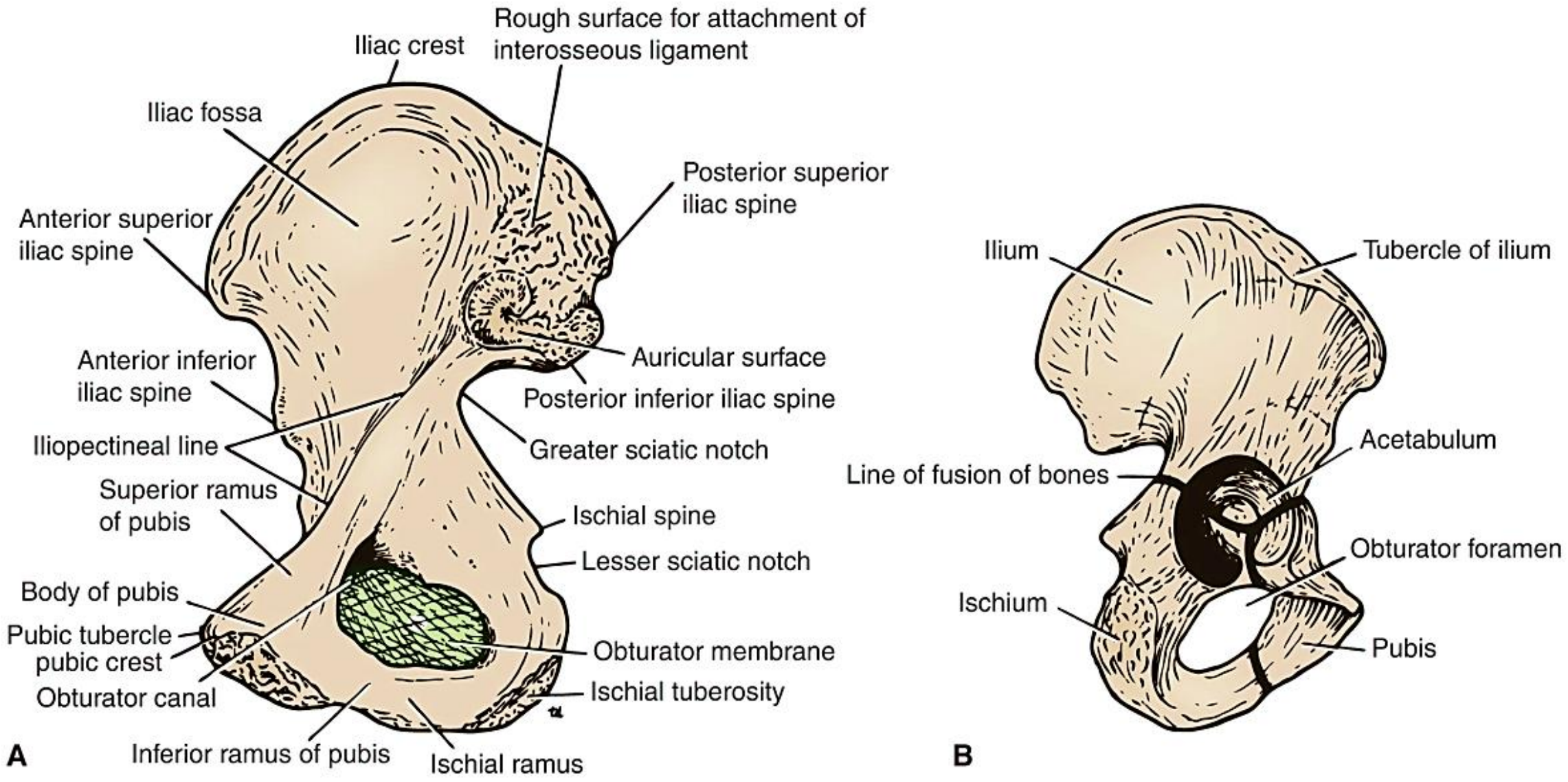
The bones of the lower limb are the os coxae (hip bone), femur, patella, tibia, fibula, metatarsal bones, tarsal bones, and phalanges. The general arrangement of the bones is very similar to that in the upper limb.

Os Coxae

The os coxae (hip bone) is topographically and functionally the equivalent of the upper limb clavicle and scapula. It forms the lower limb girdle that attaches the limb to the vertebral column.

Three skeletal elements, the ilium, ischium, and pubis, form the os coxae. These bones meet one another at the acetabulum via the **Y-shaped triradiate cartilage**. The os coxae articulate with the sacrum at the **sacroiliac joints** and form the anterolateral walls of the pelvis. They also articulate with one another anteriorly at the **symphysis pubis**.

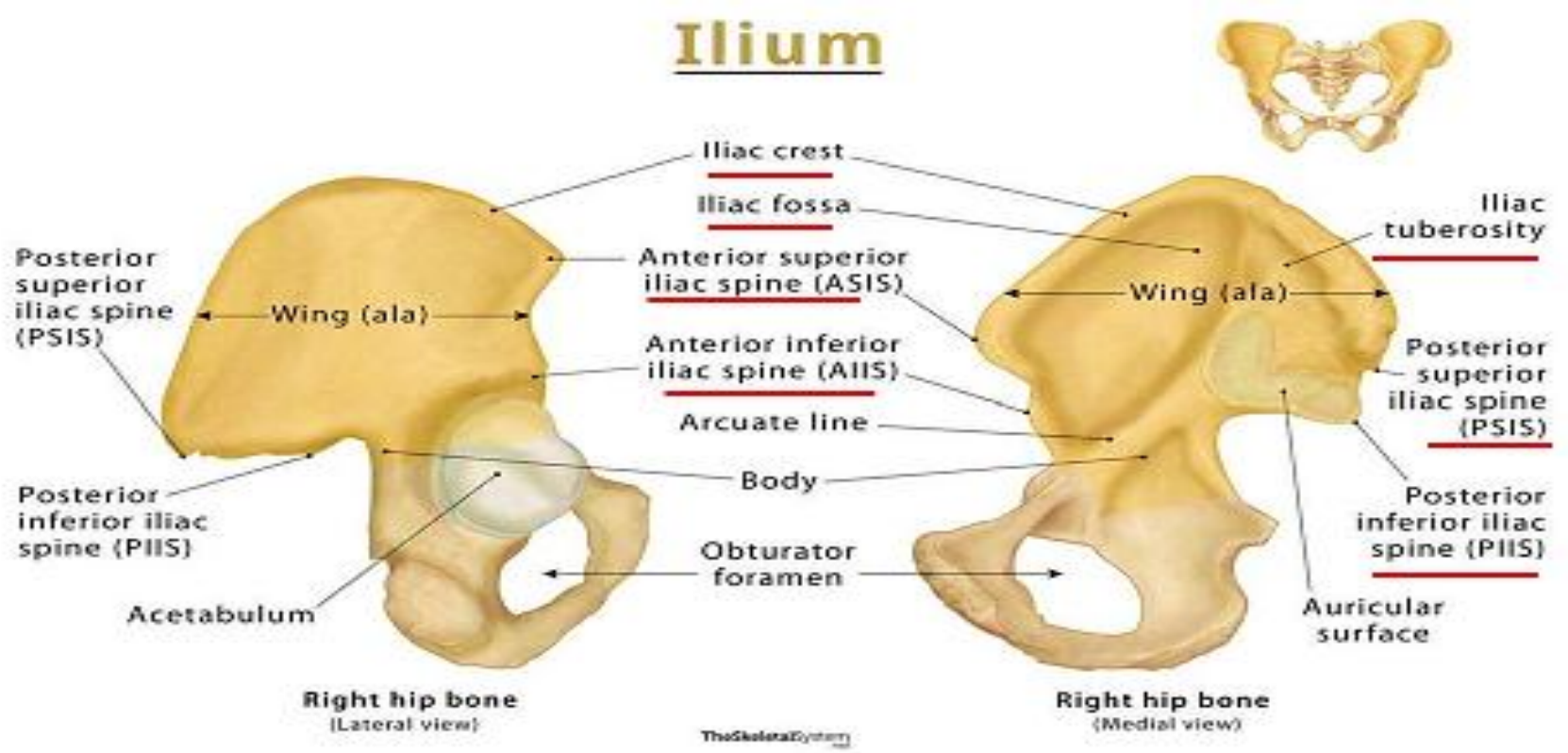




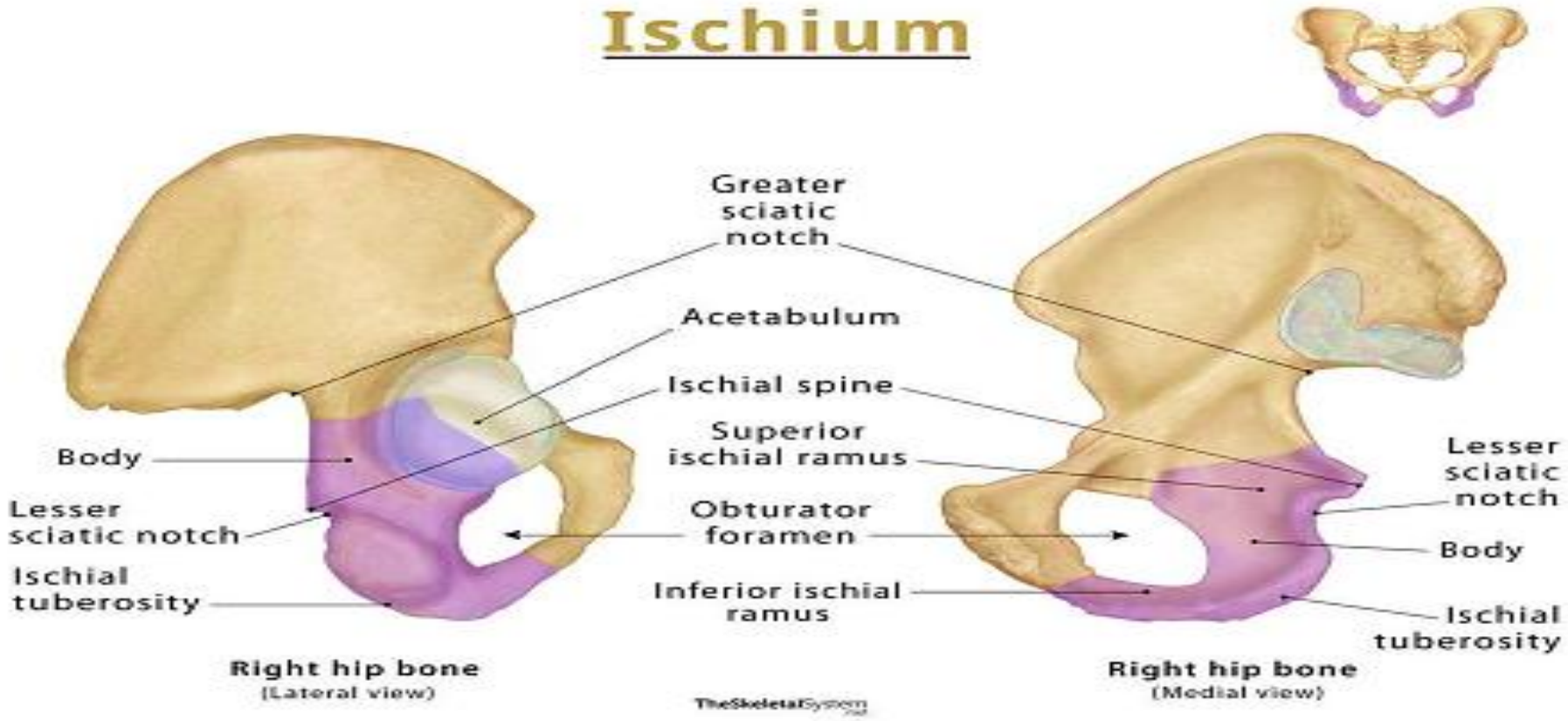
Medial surface (A) and lateral surface (B) of the right os coxae. Note the lines of fusion between the three bones (the ilium, the ischium, and the pubis) along the triradiate cartilage.

The ilium, which is the upper flattened part of the bone, possesses the **iliac crest**. This can be felt through the skin along its entire length. It ends in front at **the anterosuperior iliac spine** and behind at the **posterosuperior iliac spine**. **The iliac tubercle** lies about 2 in. (5 cm) behind the anterosuperior spine. Below the anterosuperior iliac spine is a prominence, **the anteroinferior iliac spine**. A similar prominence, **the posteroinferior iliac spine**, is located below the posterosuperior iliac spine.

The ilium possesses a large notch, the **greater sciatic notch**, above and behind the **acetabulum**.



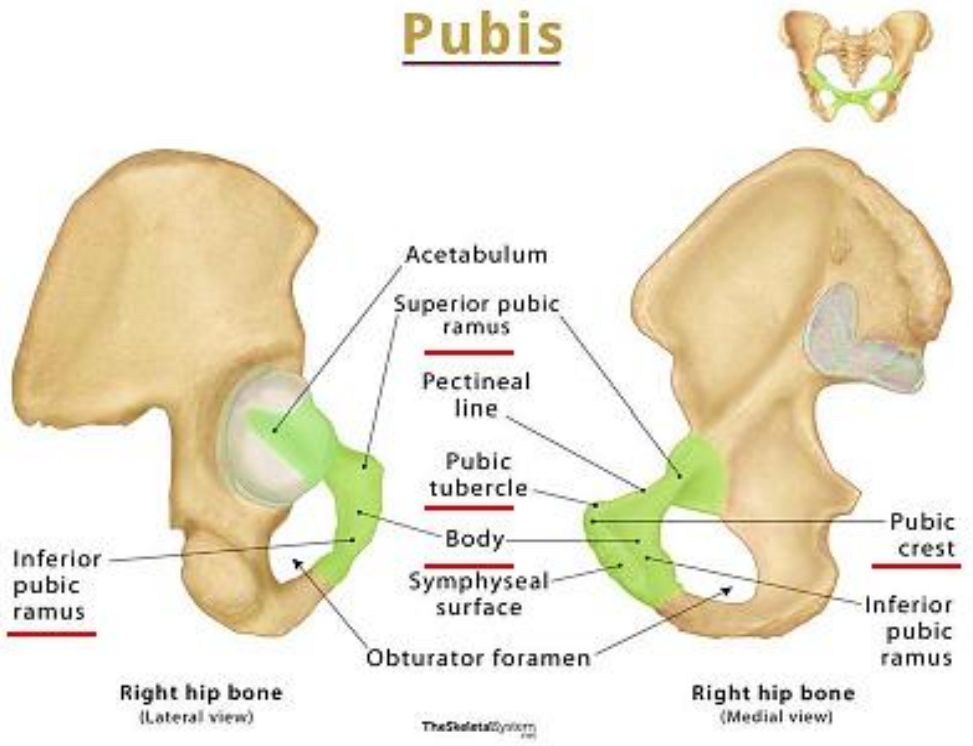
The ischium is L shaped, possessing an upper thicker part, **the body**, and a lower thinner part, **the ramus**. The **ischial spine** projects from the posterior border of the ischium and intervenes between the **greater and lesser sciatic notches**. The **ischial tuberosity** is the large roughened area that forms the posterior aspect of the lower part of the body of the bone. The greater and lesser sciatic notches are converted into **greater and lesser sciatic foramina** by the presence of the **sacrospinous and sacrotuberous ligament.**



The pubis is divided into a **body**, a **superior ramus, and an inferior ramus**. The bodies of the two pubic bones articulate with each other in the midline anteriorly at the **symphysis pubis**. The superior ramus joins the ilium and ischium at the **acetabulum**, and the inferior ramus joins the ischial ramus below the **obturator foramen**. The **obturator membrane** fills in the obturator foramen in life. **The pubic crest** forms the upper border of the body of the pubis, and it ends laterally as the **pubic tubercle**.

The outer surface of the hip bone has a deep depression termed the acetabulum. This articulates with the almost **spherical head of the femur** to form the hip joint. The inferior margin of the acetabulum is deficient and is marked by the **acetabular notch.** The articular surface of the acetabulum is limited to a horseshoe-shaped area and is covered with hyaline cartilage. The floor of the acetabulum is nonarticular and is called the **acetabular fossa**.

In the anatomic position, the front of the symphysis pubis and the anterosuperior iliac spines lie in the same vertical plane. This means that the pelvic surface of the symphysis pubis faces upward and backward and the anterior surface of the sacrum is directed forward and downward.



ACETABULUM

large **cup shaped** cavity on the **lateral aspect** of the hip bone that articulates with the head of the femur to form the hip joint

- All **three primary bones** forming the hip bone contribute to the formation of the acetabulum.
- The **margin of the acetabulum** is **incomplete inferiorly** at the **acetabular notch**
- **Non-articular surface (Acetabular fossa):** rough depression in the floor of the acetabulum extending superiorly from the acetabular notch
- **Articular surface (lunate surface):** receiving **the head of the femur.**

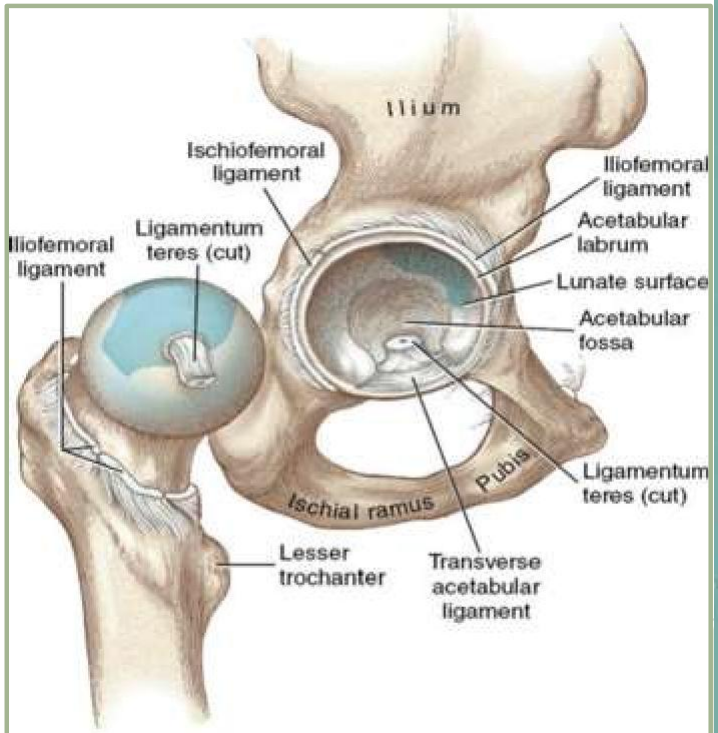
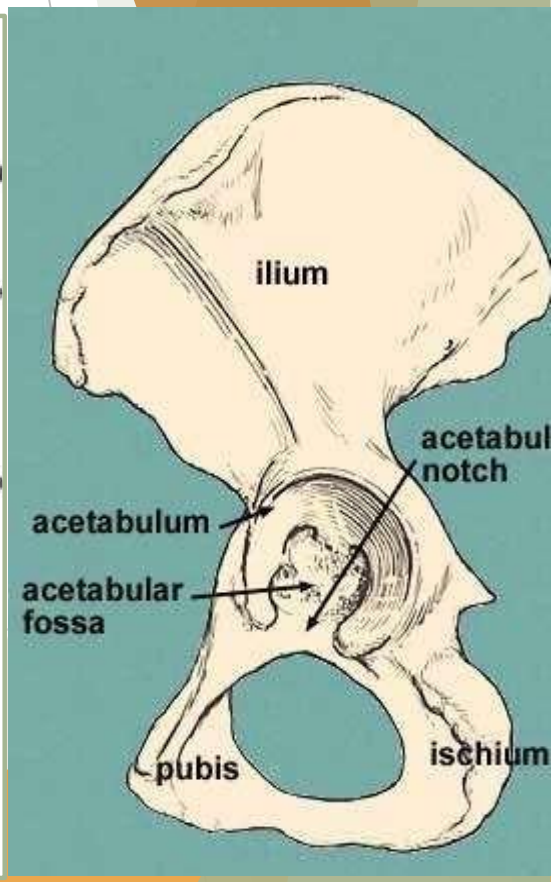
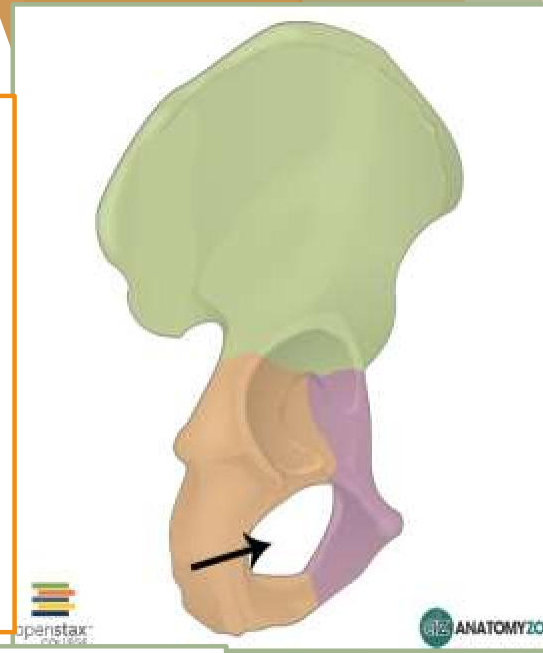


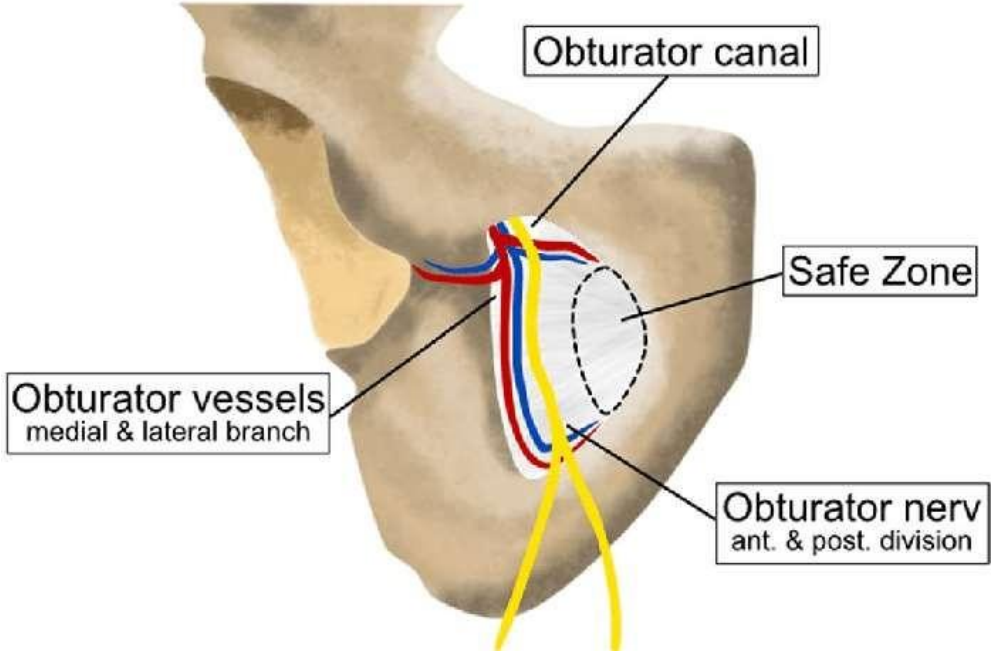
FIGURE 12-11. The right hip joint is opened to expose its internal components. The regions of thickest cartilage are highlighted (in blue) on the articular surfaces of the femoral head and acetabulum.

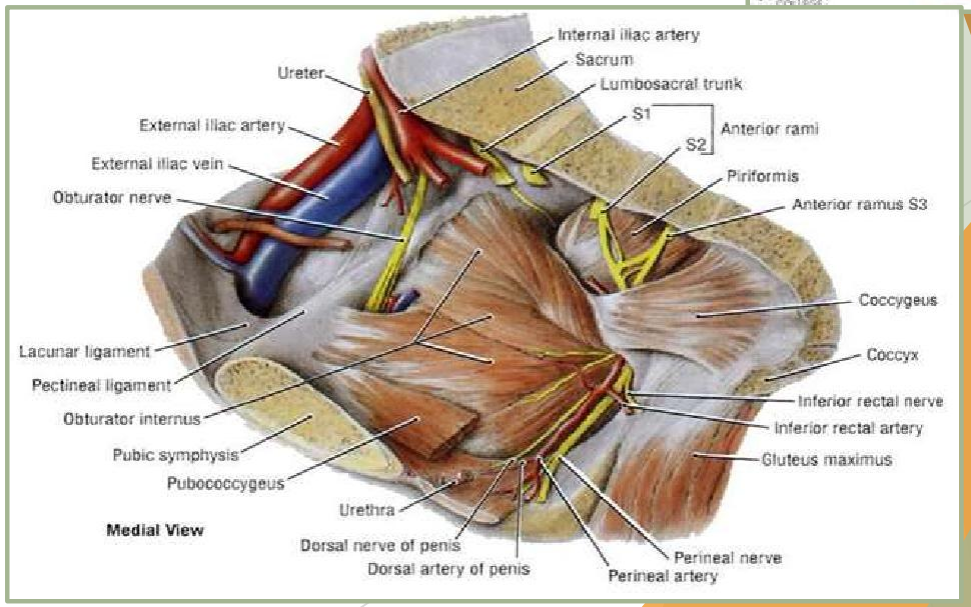


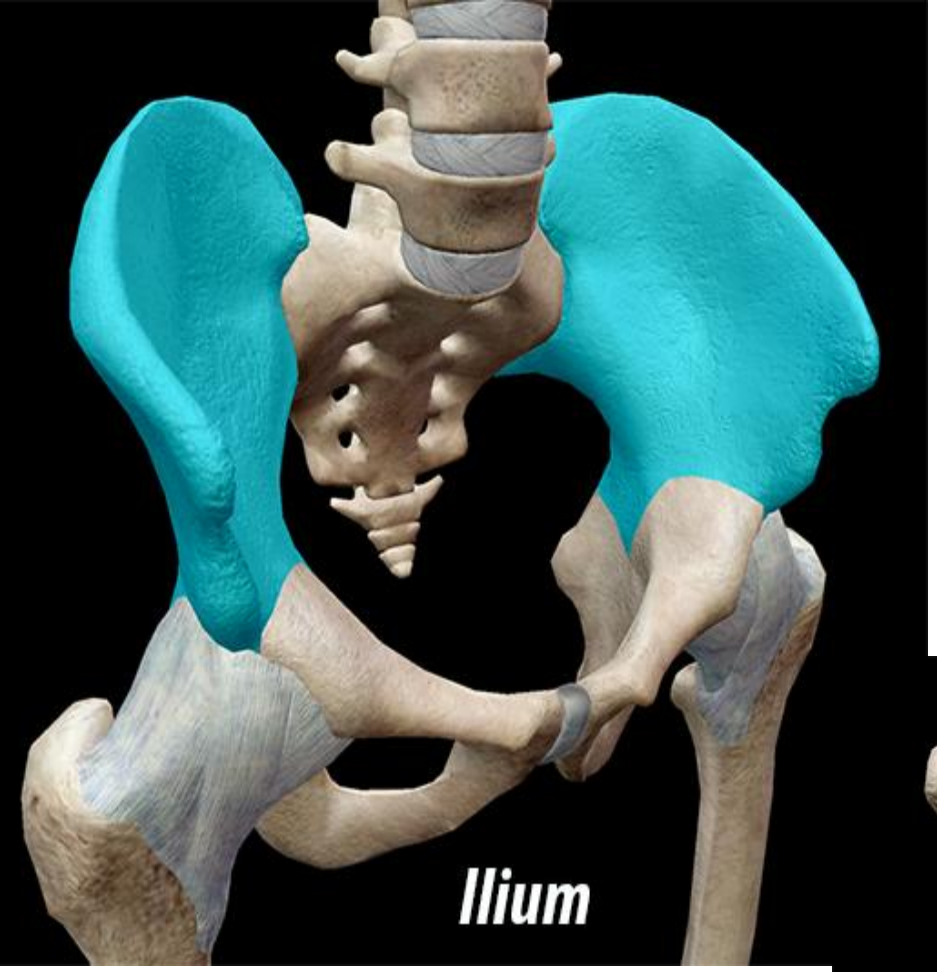
OBTURATOR FORAMEN

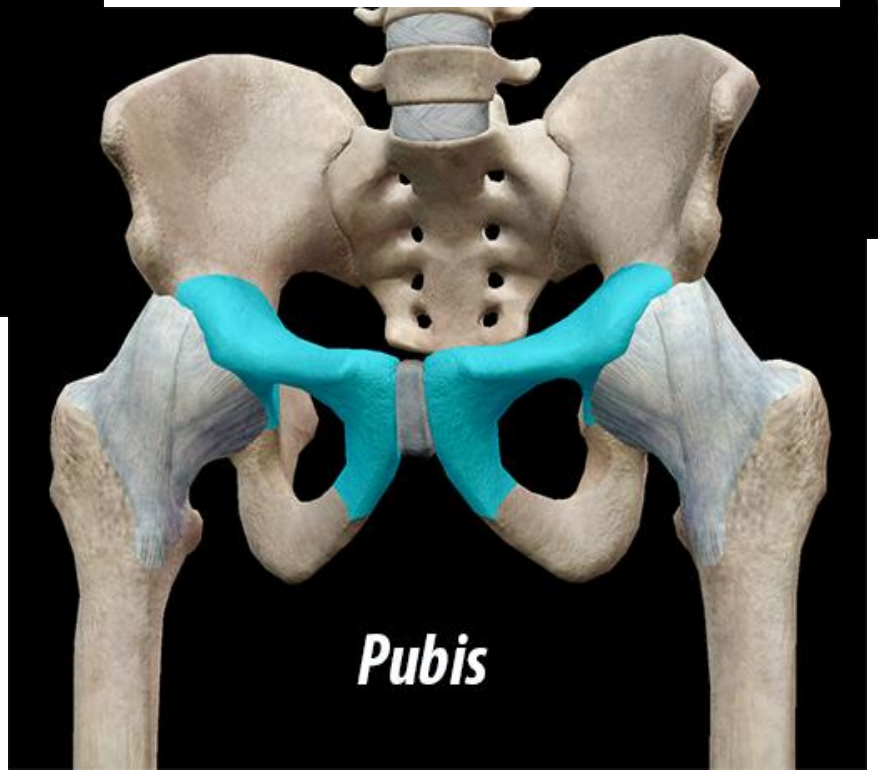
- large **oval** or **irregularly triangular opening** in the hip bone.
- **Oval in male, triangular in female**
- bounded by the **pubis** and **ischium** and **their rami**.
- is closed by the thin obturator membrane except for a small passageway for the obturator nerve and vessels (the obturator canal)
- The **presence of the foramen minimizes** bony mass (weight) while its **closure by the obturator membrane** still **provides extensive surface area** on both sides **for muscle attachment**.



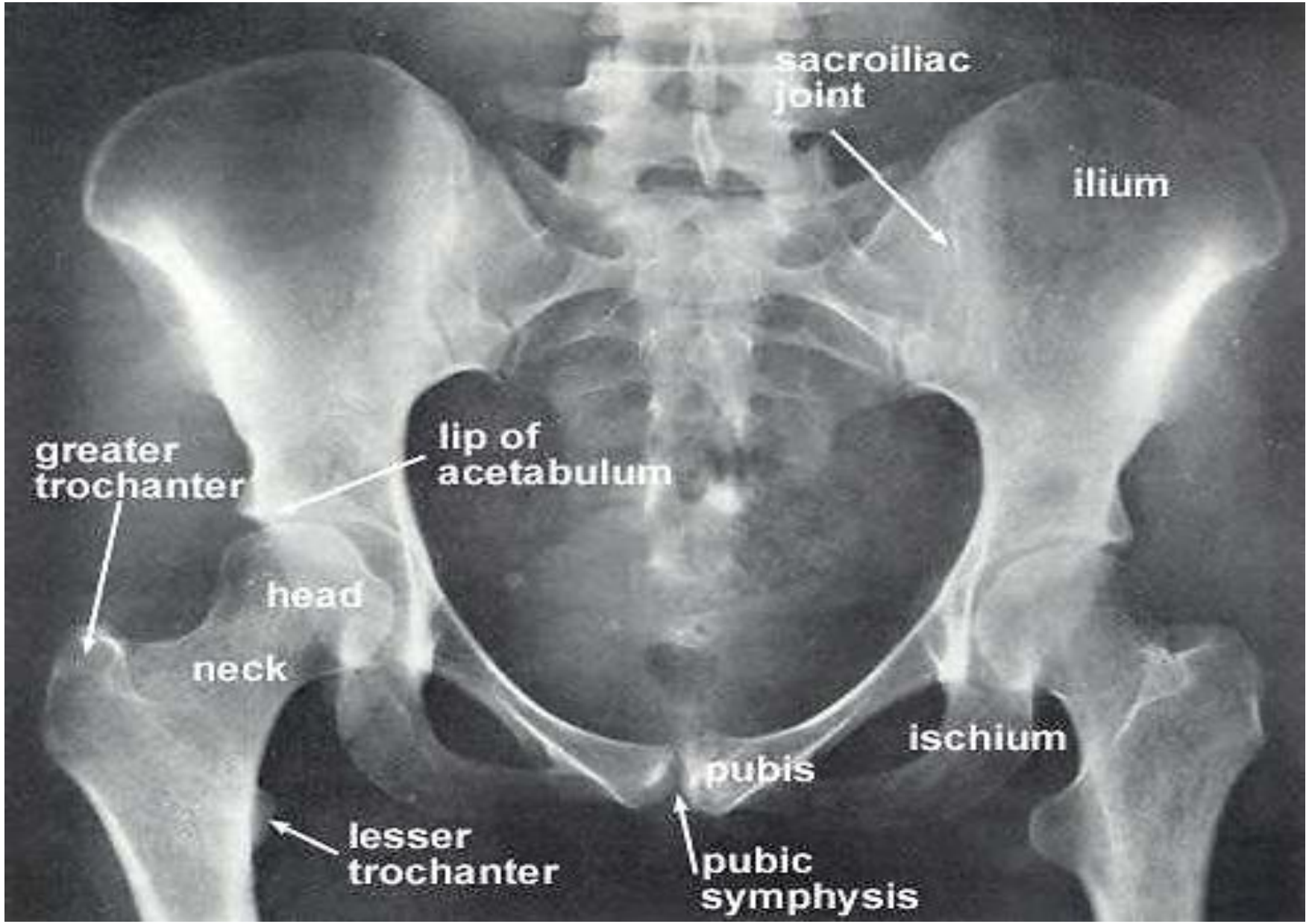





Ilium


Pubis

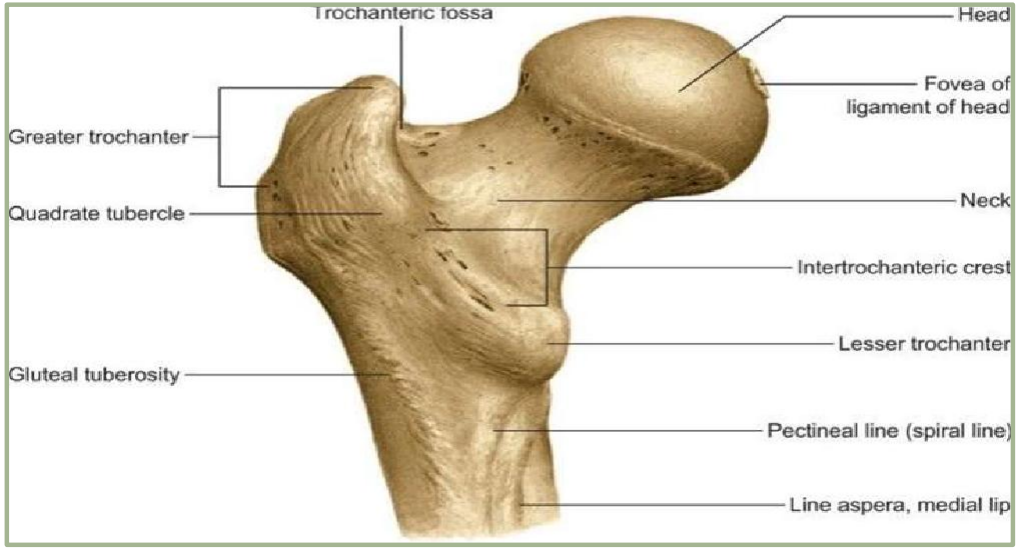

Ischium

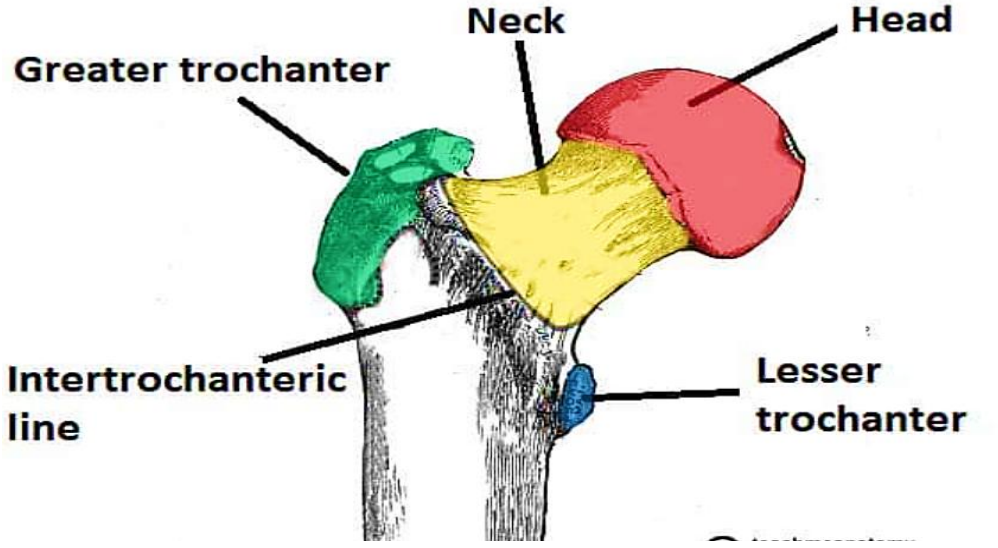

sacroiliac joint
ilium
greater trochanter
lip of acetabulum
head
neck
ischium
pubis
lesser trochanter
pubic symphysis

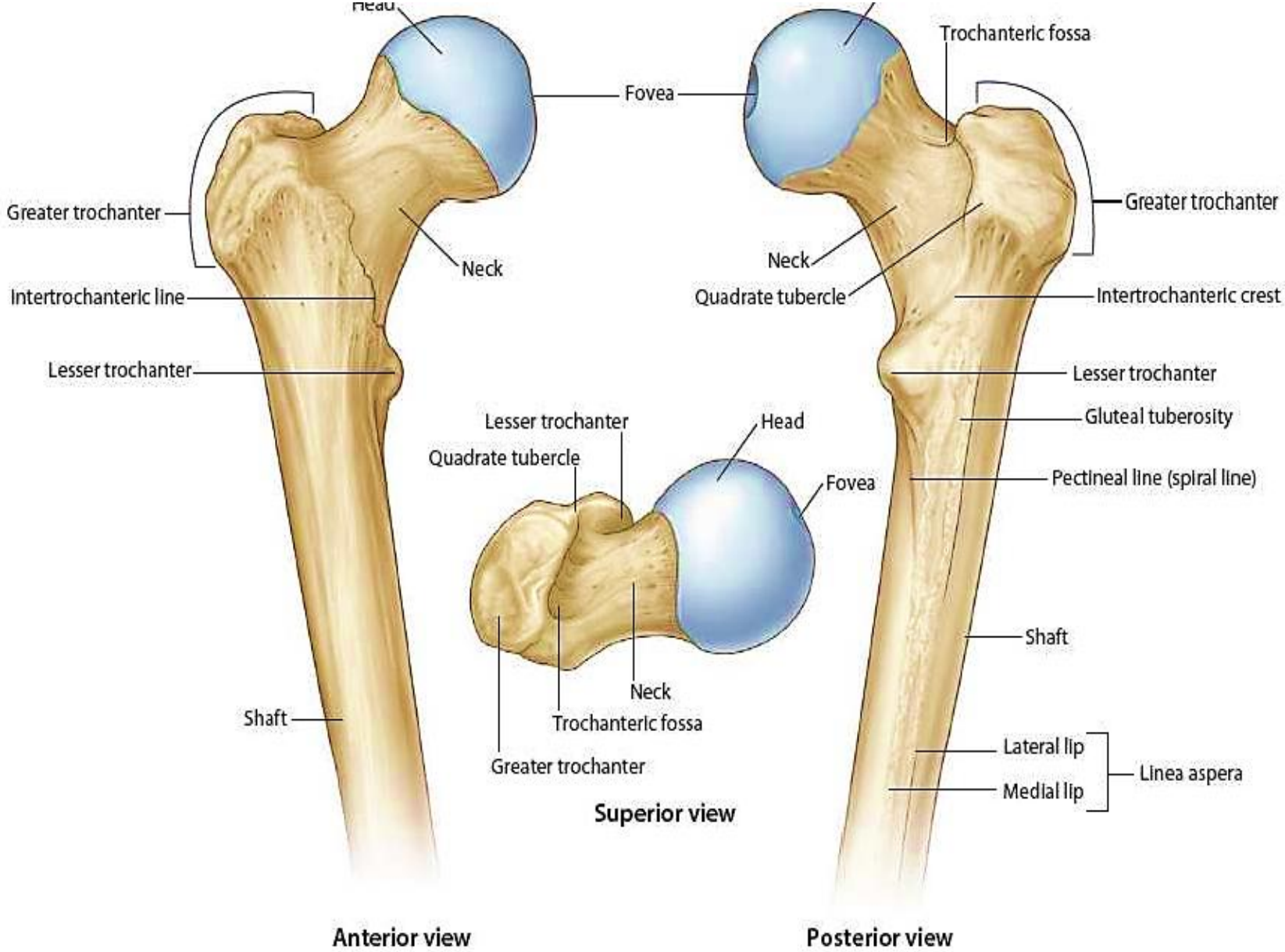
Femur

The femur articulates above with the acetabulum to form the hip joint and below with the tibia and the patella to form the knee joint. The upper end of the femur has a **head**, **a neck, and greater and lesser trochanters**. The head forms about two thirds of a sphere and articulates with the acetabulum of the os coxae to form the hip joint. In the center of the head is a small depression, called the fovea capitis, for the attachment of the ligament of the head. Part of the blood supply to the head of the femur from the obturator artery is conveyed along this ligament and enters the bone at the fovea.

The neck, which connects the head to the shaft, passes downward, backward, and laterally and makes an angle of about 125° (slightly less in the female) with the long axis of the shaft. Disease can alter the size of this angle. **The greater and lesser trochanters** are large eminences situated at the junction of the neck and the shaft. The intertrochanteric line connects the trochanters anteriorly, where the iliofemoral ligament attaches. A prominent intertrochanteric crest connects the trochanters posteriorly.






Head
Fovea
Greater trochanter
Neck
Intertrochanteric line
Lesser trochanter
Shaft
Anterior view
Lesser trochanter
Head
Quadrate tubercle
Fovea
Neck
Trochanteric fossa
Greater trochanter
Superior view
Trochanteric fossa
Greater trochanter
Neck
Quadrate tubercle
Intertrochanteric crest
Lesser trochanter
Gluteal tuberosity
Pectineal line (spiral line)
Shaft
Lateral lip
Medial lip
Linea aspera
Posterior view

The shaft of the femur is smooth and rounded on its anterior surface but posteriorly has a ridge, the **linea aspera**, to which are attached muscles and intermuscular septa. The margins of the linea aspera diverge above and below. The medial margin continues below as the **medial supracondylar ridge** to the **adductor tubercle** on the **medial condyle**. The lateral margin becomes continuous below with the **lateral supracondylar ridge**. **The gluteal tuberosity** is on the posterior surface of the shaft below the greater trochanter. The shaft becomes broader toward its distal end and forms a flat, triangular area on its posterior surface called the **popliteal surface**. The lower end of the femur has **lateral and medial condyles**, separated posteriorly by the **intercondylar notch**. The anterior surfaces of the condyles are joined by an articular surface for **the patella**. The two condyles take part in the formation of the knee joint. The medial and lateral epicondyles are above the condyles. The adductor tubercle is continuous with the medial epicondyle.

Clinical Notes

Head of Femur Tenderness and Hip Joint Arthritis

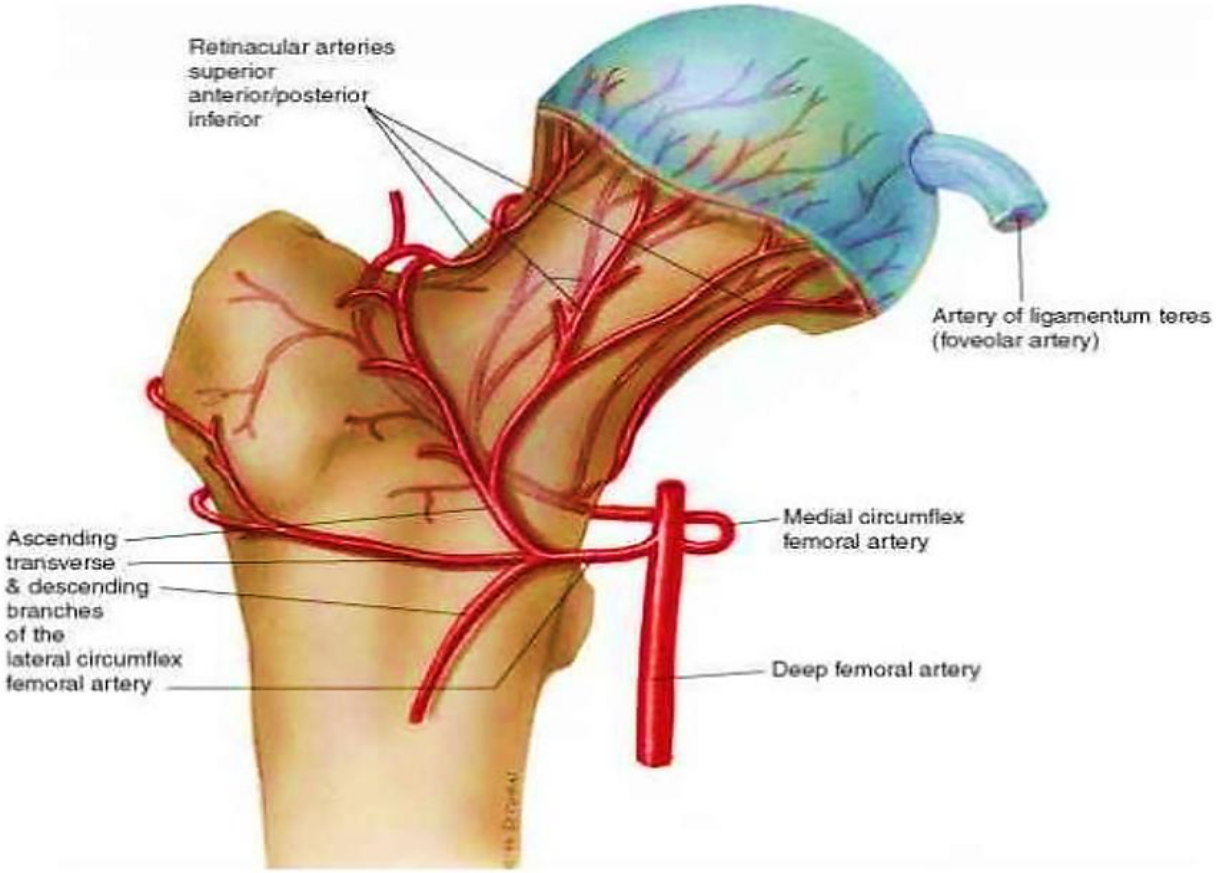
The part of the head of the femur that is not intra-acetabular can be palpated on the anterior aspect of the thigh just inferior to the inguinal ligament and just lateral to the pulsating femoral artery. Tenderness over the head of the femur usually indicates the presence of **arthritis of the hip joint.**

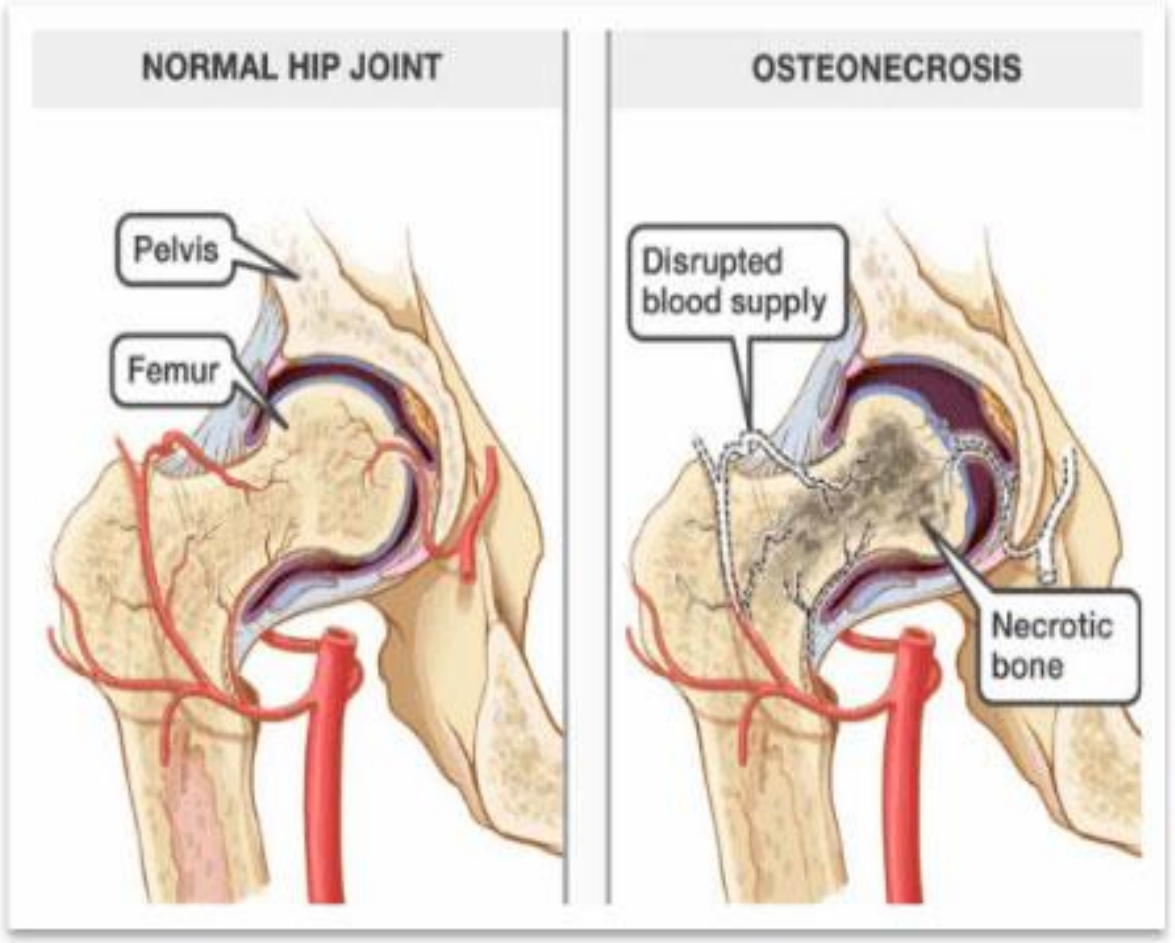
Blood Supply to Femoral Head and Neck Fractures

Avascular necrosis of the **head of the femur** can occur after fractures of the neck of the femur. In the young, the epiphysis of the head is supplied by a small branch of the **obturator artery**, which passes to the head along the **ligament of the femoral head**. The upper part of the neck of the femur receives a profuse blood supply from the **medial femoral circumflex artery**. These branches pierce the joint capsule and ascend the neck deep to the synovial membrane. As long as the epiphyseal cartilage remains, no communication occurs between the two sources of blood. In the adult, after the epiphyseal cartilage disappears, an anastomosis between the two sources of blood supply is established. Fractures of the femoral neck interfere with or completely interrupt the blood supply from the root of the femoral neck to the femoral head. The scant blood flow along the small artery that accompanies the round ligament may be insufficient to sustain the viability of the femoral head, and ischemic necrosis gradually takes place.

Neck of the Femur and Coxa Valga and Vara

The neck of the femur is inclined at an angle with the shaft. This angle is about **160°** in the young child and about **125°** in the adult. An **increase** in this angle is referred to as **coxa valga**, and it occurs, for example, in cases of congenital dislocation of the hip. In this condition, adduction of the hip joint is limited. A **decrease** in this angle is referred to as **coxa vara**, and 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. **Shenton's line** is a useful means of assessing the angle of the femoral neck on a radiograph of the hip region.





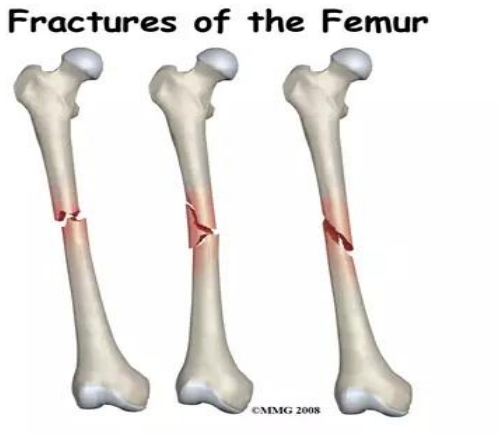
Avascular necrosis (AVN) of the femoral head is the **death of bone tissue due to interruption of its blood supply**. Because bone is a living tissue requiring continuous perfusion, loss of circulation leads to **ischemia → bone cell death → structural collapse of the femoral head**

The **medial circumflex femoral artery** is the **principal blood supply to the femoral head in adults**, and its disruption is the main cause of **avascular necrosis following femoral neck fractures**

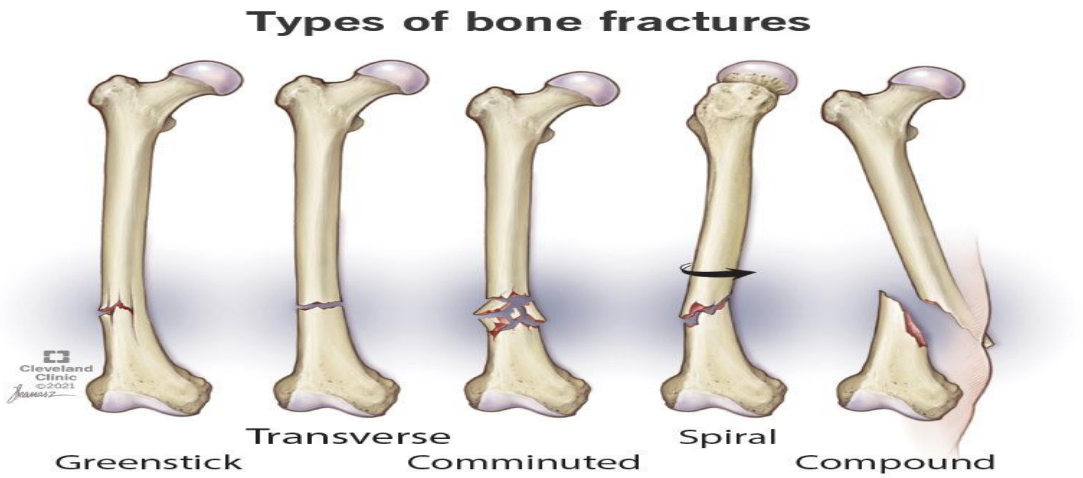
Anatomical Types of Femur Fractures

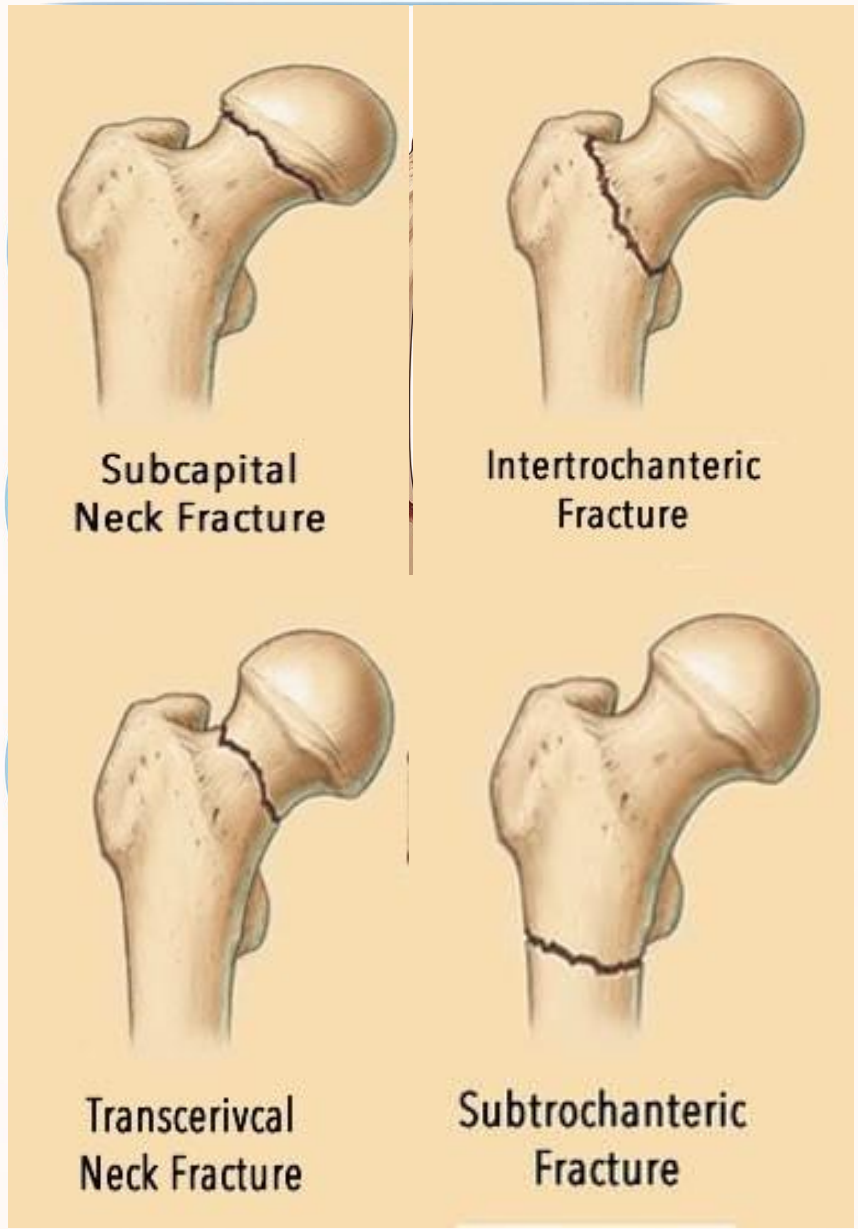
1. **Proximal Femur Fractures:**

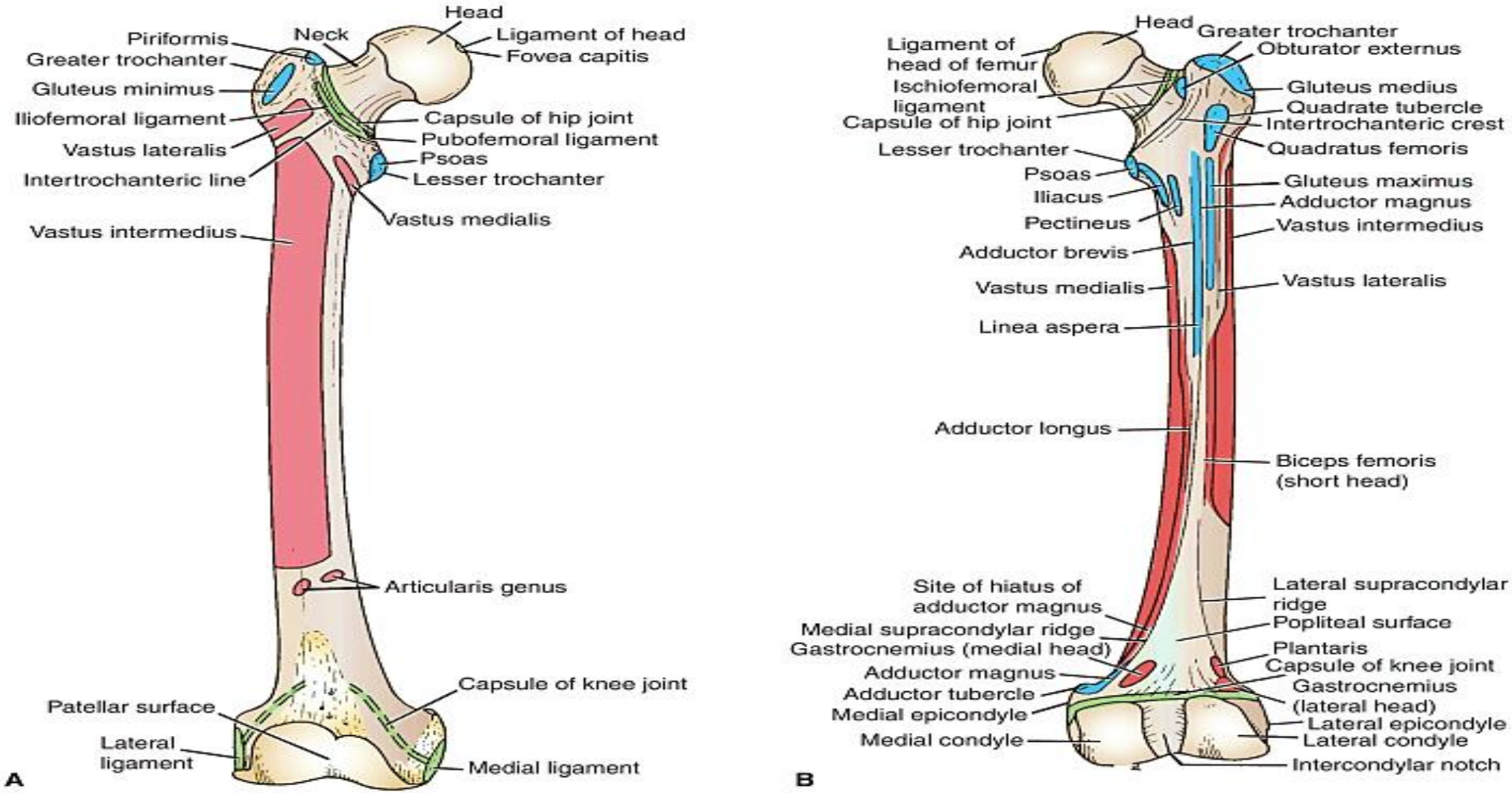
2. Shaft (Diaphyseal) Fractures



3. Distal Femur Fractures

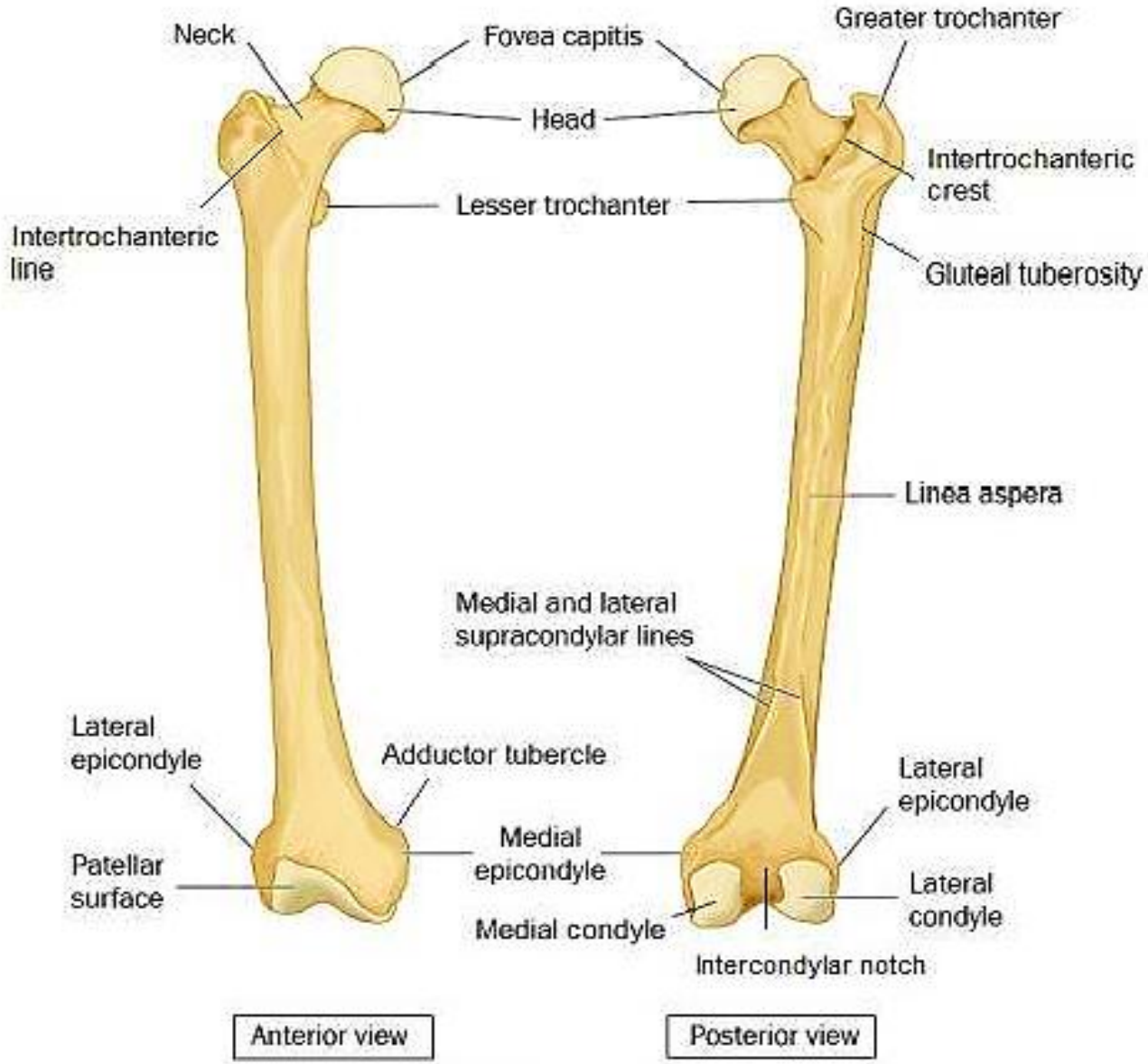






Bony features and muscle and ligament attachmentson the anterior (A) and posterior (B) surfaces of the right femur.

Femur Bone



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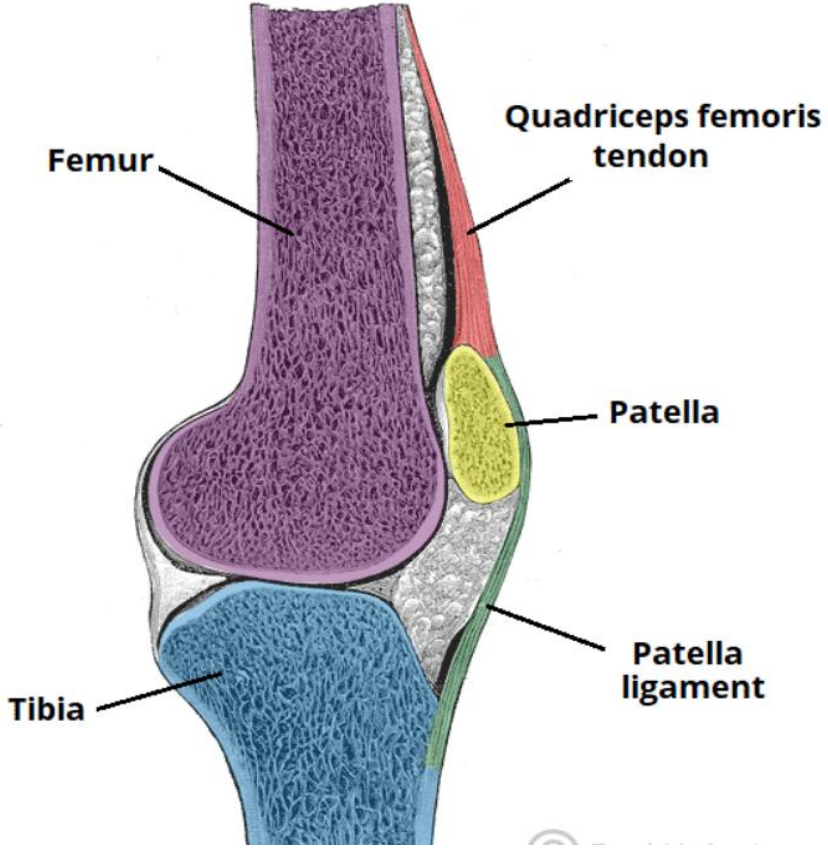
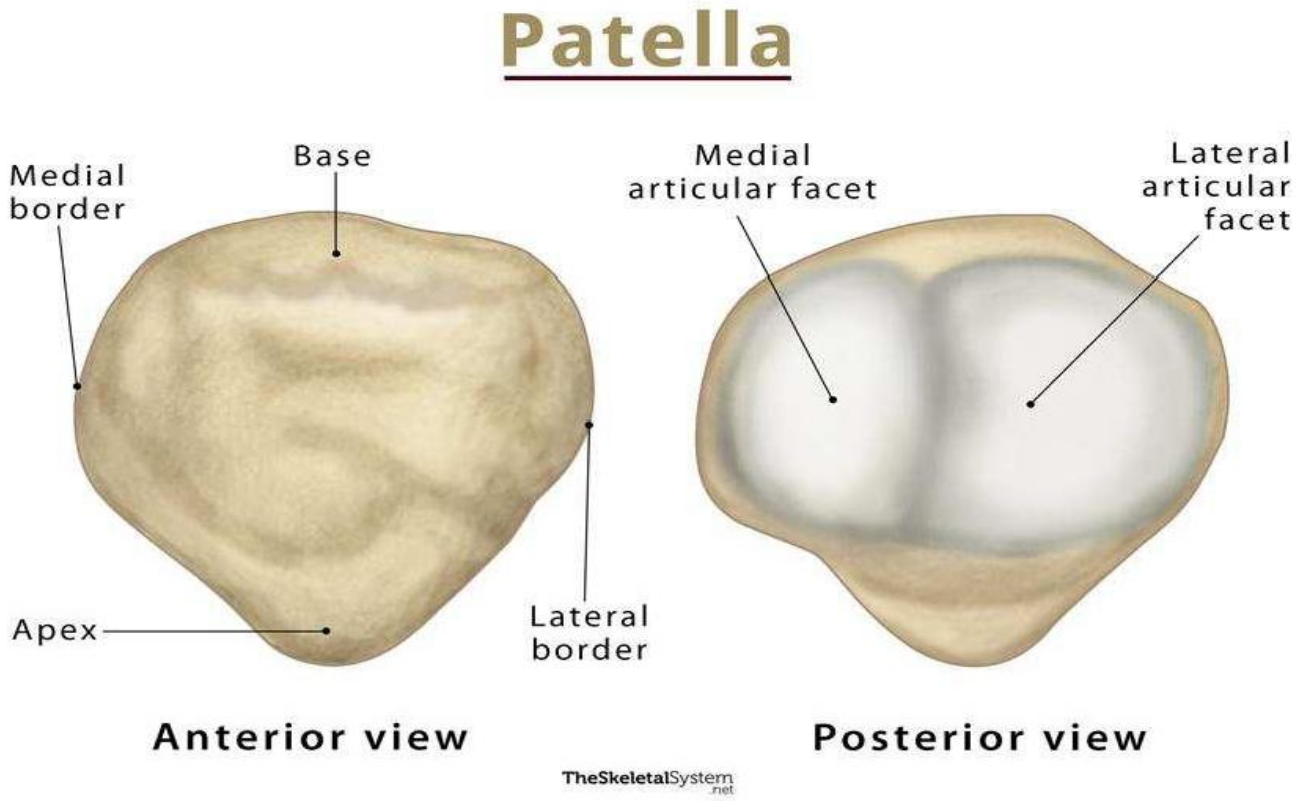
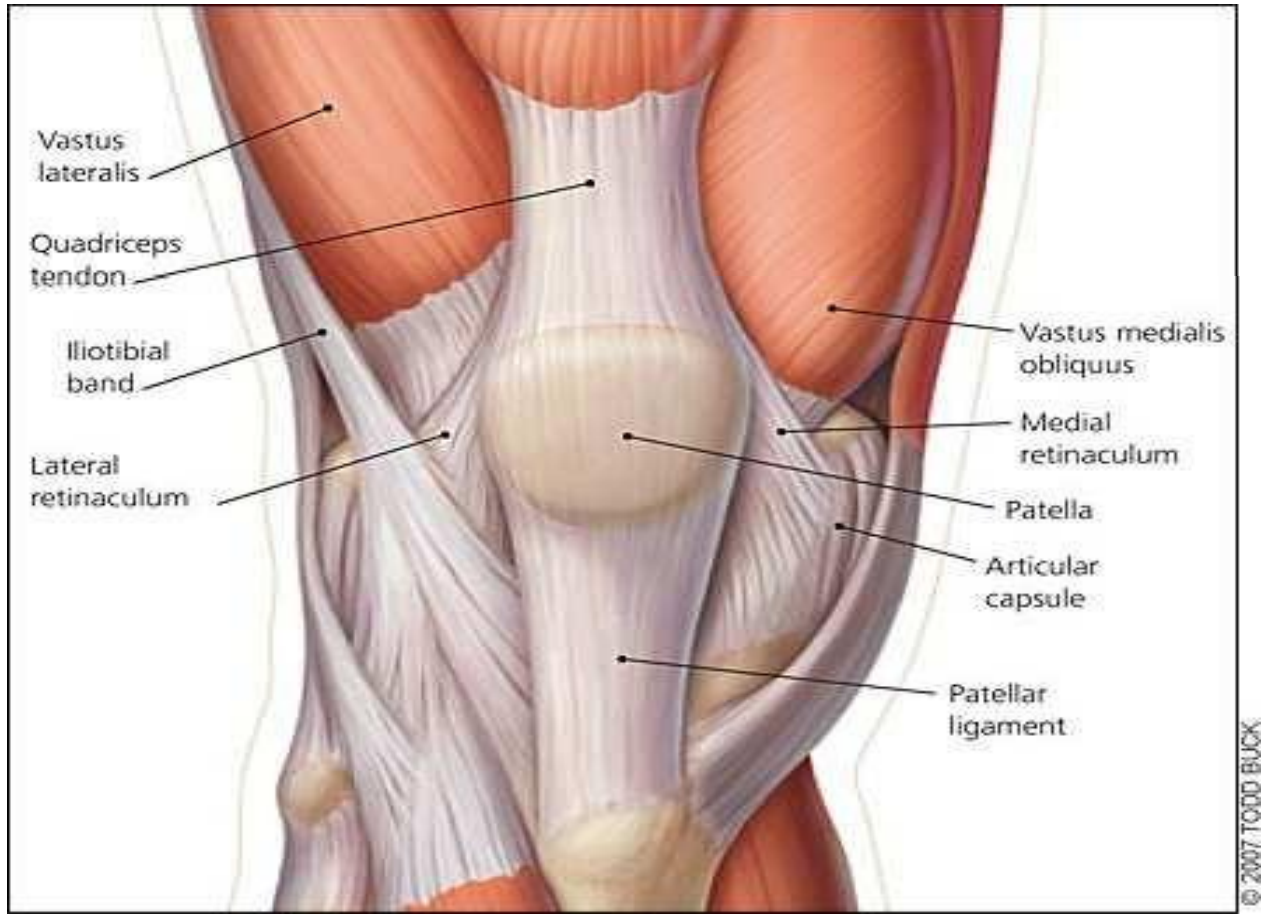
Patella

The patella (kneecap) is the largest sesamoid bone (i.e., it develops within the tendon of the quadriceps femoris muscle in front of the knee joint).

It is triangular, and its apex lies inferiorly. The apex is connected to the tuberosity of the tibia by the ligamentum patellae (patellar ligament). The posterior surface articulates with the condyles of the femur. The patella is situated in an exposed position in front of the knee joint and is easily palpable through the skin. It is separated from the skin by an important subcutaneous bursa, the prepatellar bursa. The upper, lateral, and medial margins give attachment to the different parts of the quadriceps femoris muscle.






Vastus lateralis
Quadriceps tendon
Iliotibial band
Lateral retinaculum
Vastus medialis obliquus
Medial retinaculum
Patella
Articular capsule
Patellar ligament
© 2007 TODD BUCK


Femur
Patella
Fibula
Tibia

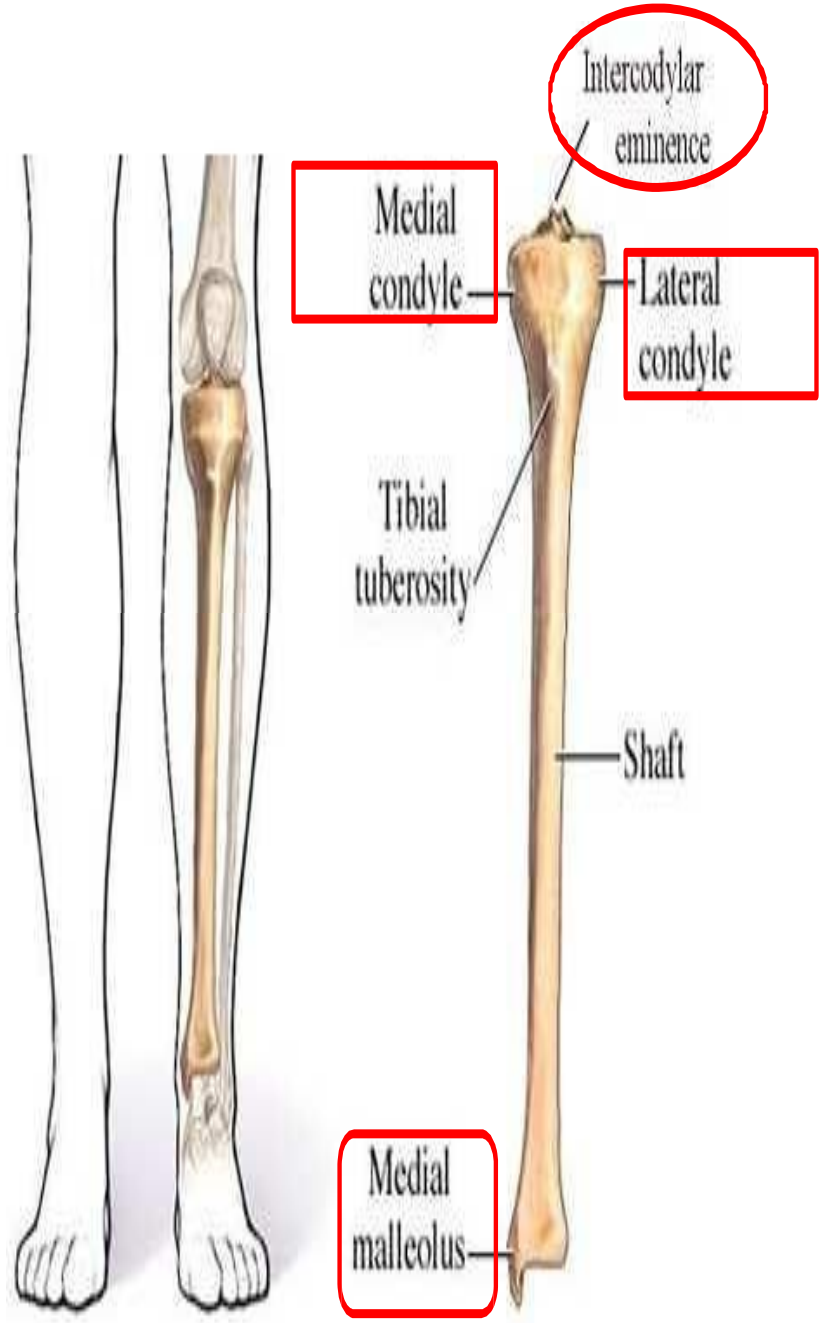
Tibia

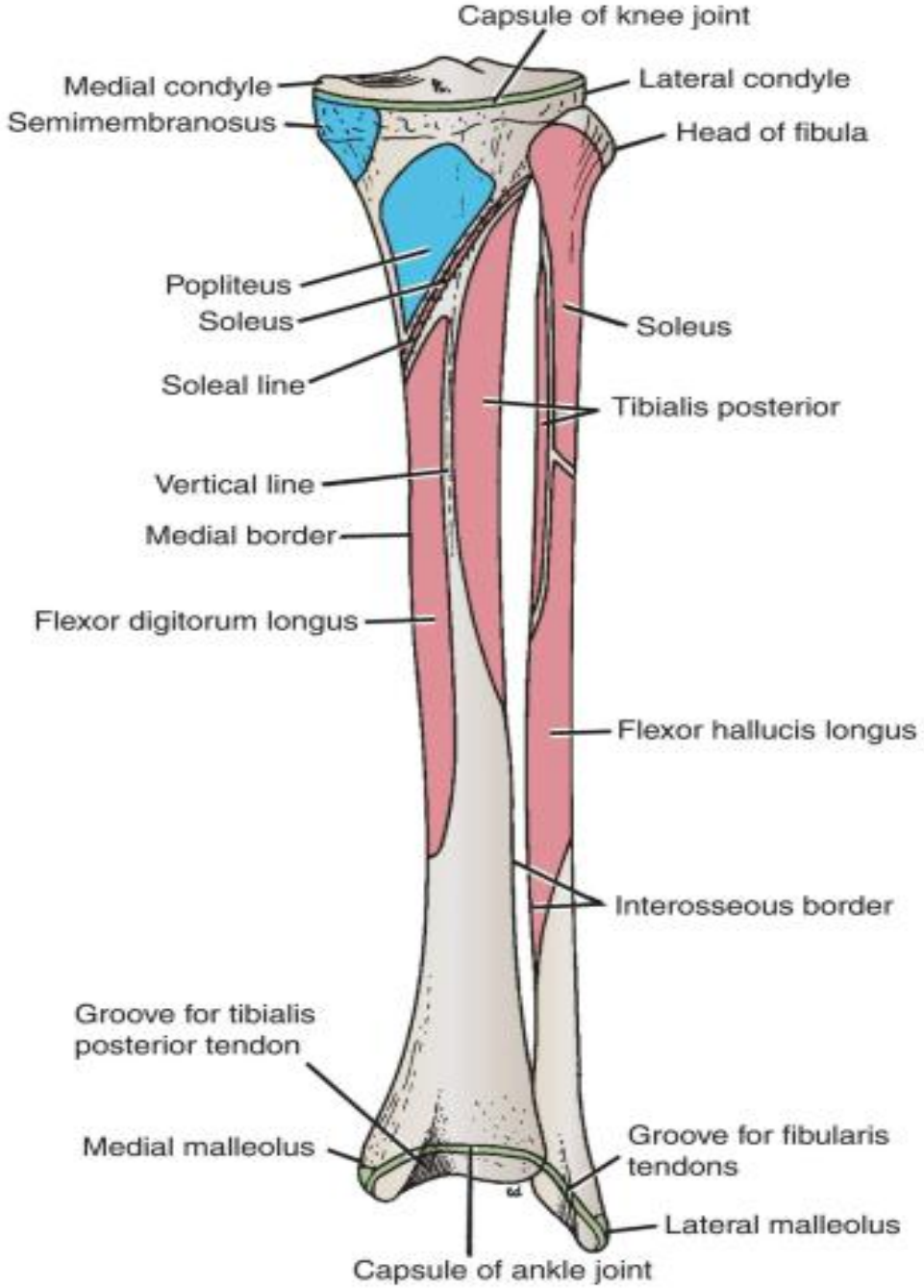
The tibia is the large weight-bearing medial bone of the leg. It articulates with the **condyles of the femur** and the **head of the fibula** above and with **the talus** and the **distal end of the fibula** below. It has an expanded upper end, a smaller lower end, and a shaft.

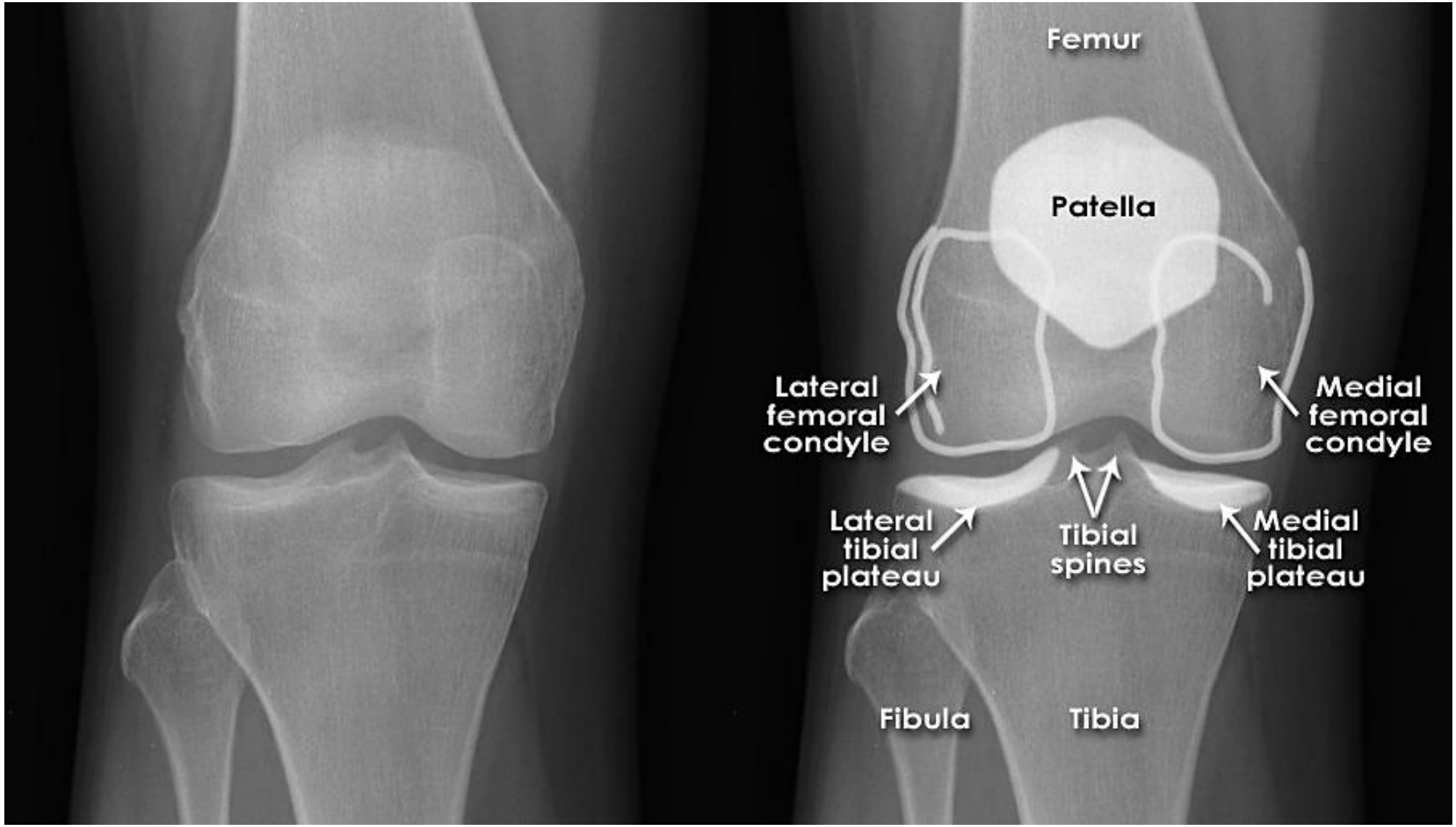
The lateral and medial condyles (sometimes called lateral and medial tibial plateaus) are at the **upper end**. These articulate with the lateral and medial condyles of the femur and the intervening **lateral and medial menisci**. Anterior and posterior intercondylar areas separate the upper articular surfaces of the tibial condyles. The **intercondylar eminence** lies between these areas. The lateral condyle possesses a small circular articular facet for the head of the fibula on its lateral aspect.

The shaft of the tibia is triangular in cross section, presenting three borders and three surfaces. Its anterior and medial borders, with the medial surface between them, are subcutaneous. **The anterior border** is prominent and forms **the shin**. **The tuberosity** of the tibia is at the junction of the anterior border with the upper end of the tibia and receives the attachment of **the ligamentum patellae**. The anterior border becomes rounded below, where it is continuous with the **medial malleolus**. The **lateral (interosseous) border** gives attachment to the **interosseous membrane**. The posterior surface of the shaft shows an oblique line, **the soleal line**, for the attachment of the soleus muscle.

The lower end of the tibia is slightly expanded and shows a saddle-shaped articular surface **for the talus** on its inferior aspect. The lower end is prolonged downward medially to form the large **medial malleolus**. The lateral surface of the medial malleolus articulates with the talus. The lower end of the tibia shows a wide, rough depression on its lateral surface for articulation **with the fibula**.






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

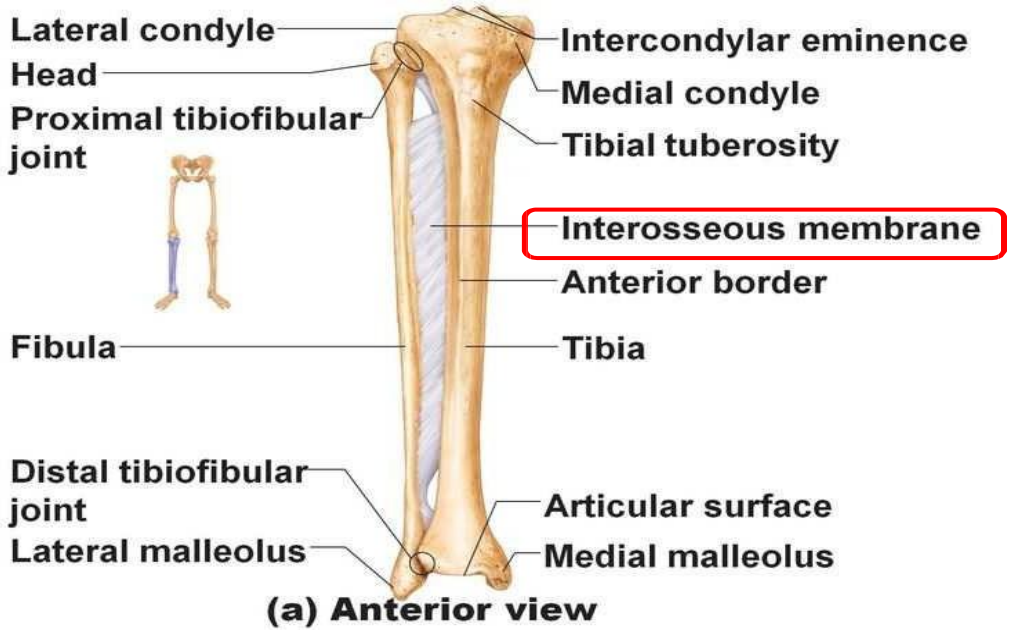
Fibula

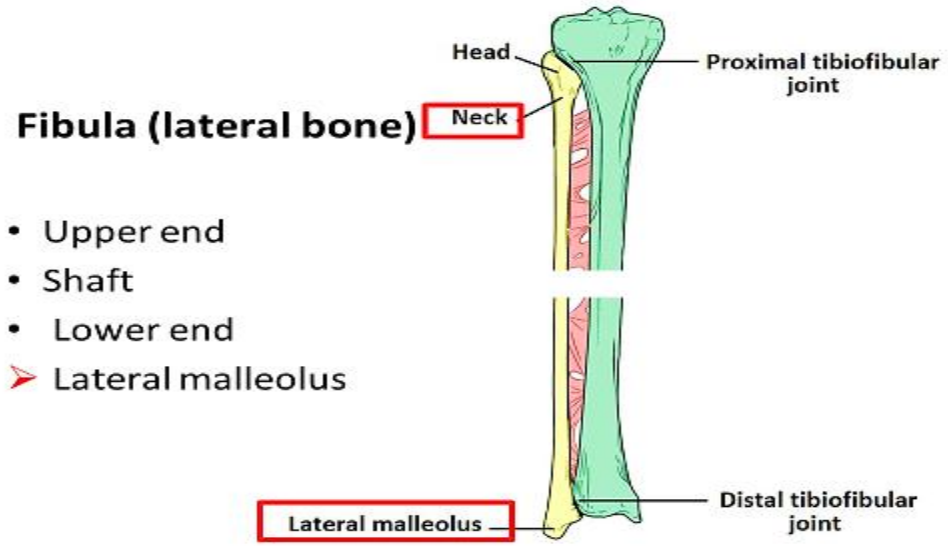
The fibula is the slender lateral bone of the leg. It takes no part in the articulation at the knee joint, but it participates in the ankle joint below. It takes no part in the transmission of body weight, but it provides attachment for muscles. The fibula has an expanded **upper end, a shaft, and a lower end**.

The upper end, or head, possesses a styloid process and an articular surface for articulation with the lateral condyle of the tibia.

The shaft of the fibula is long and slender. Typically, it has four borders and four surfaces. The medial (interosseous) border gives attachment to the interosseous membrane.

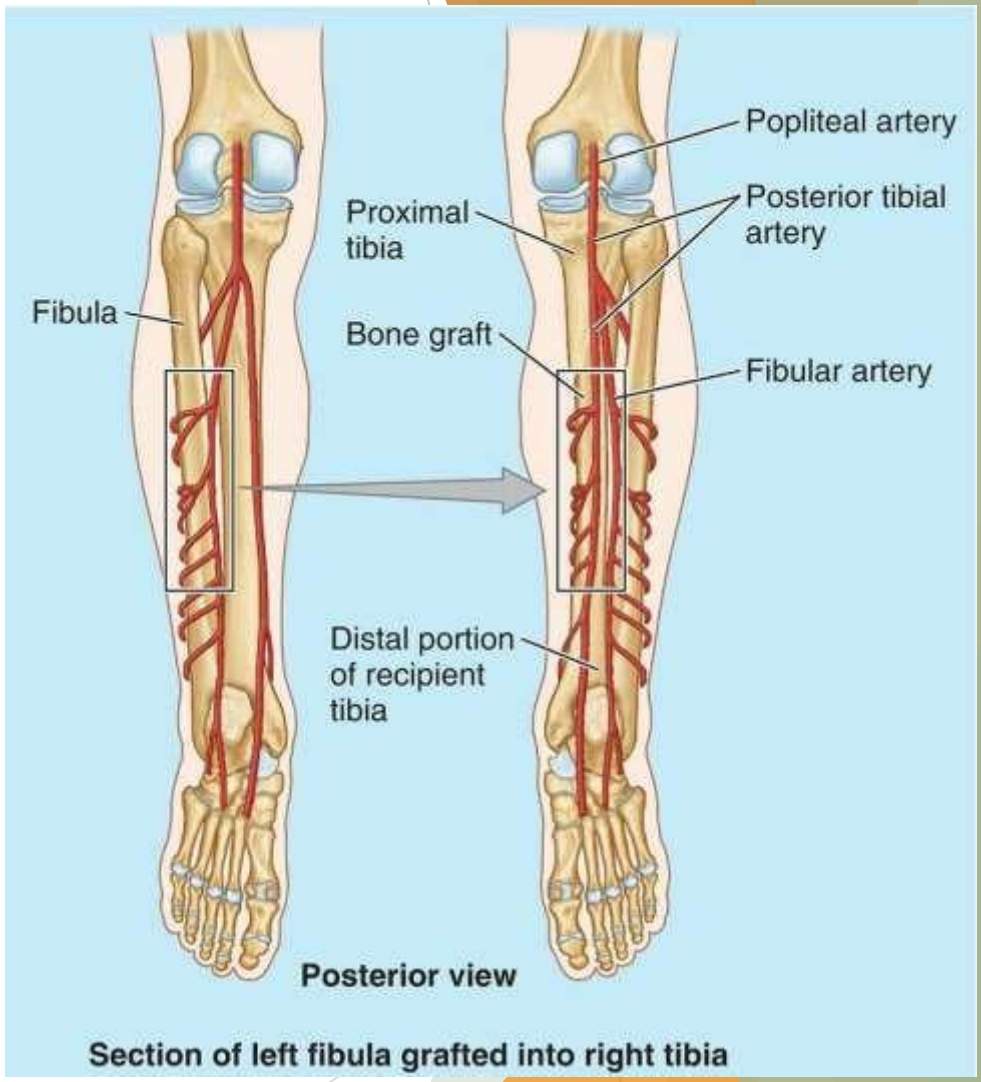
The lower end of the fibula forms the **triangular lateral malleolus**, which is subcutaneous. A triangular articular facet for articulation with the lateral aspect of the **talus** is on the medial surface of the lateral malleolus. A depression called the malleolar fossa lies below and behind the articular facet.





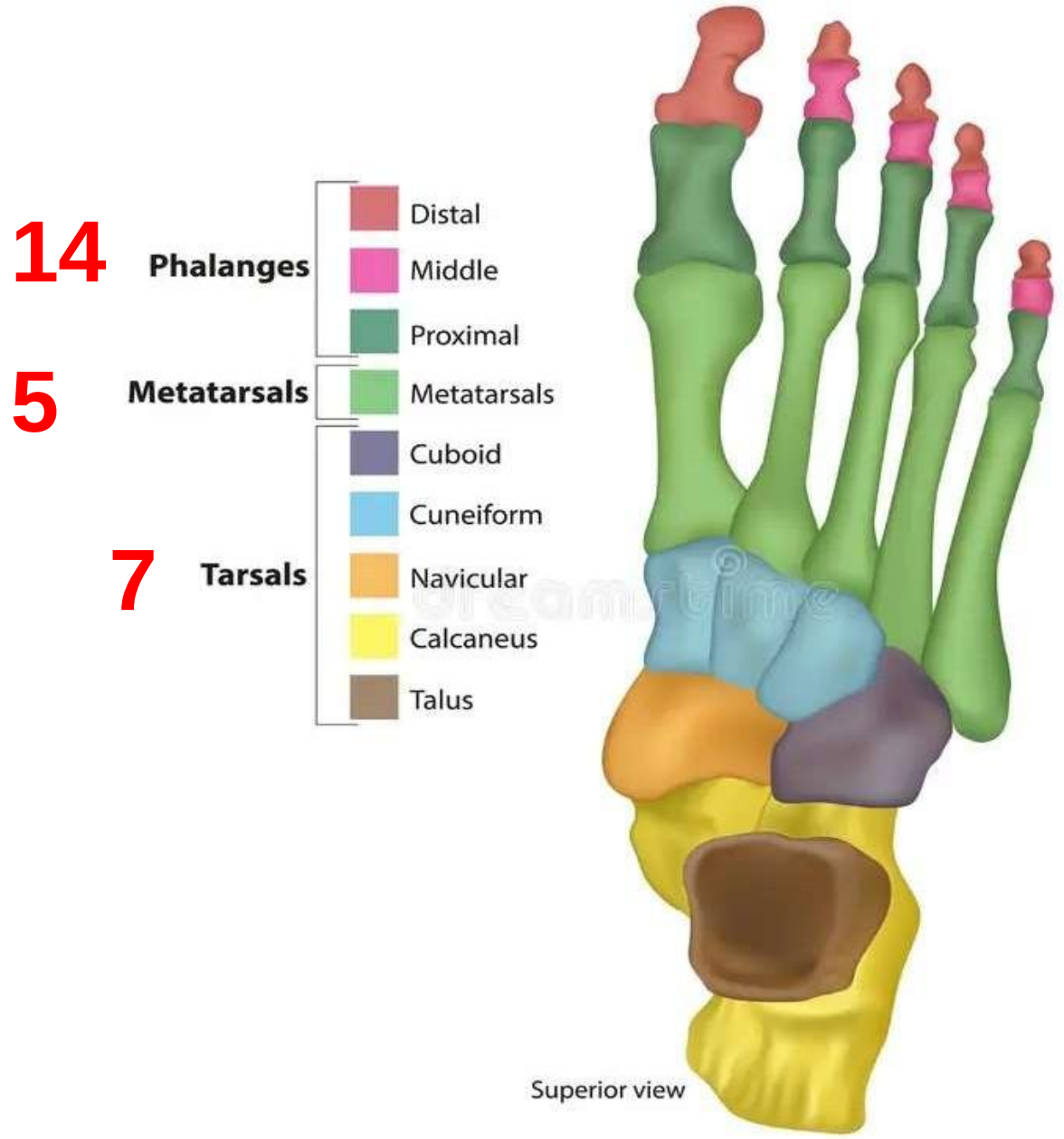
Bone Grafting

- Fibula is a common source of bone for grafting . Even after a segment of the shaft has been removed, walking, running, and jumping can be normal.
- The periosteum and nutrient artery are generally removed with the piece of bone.
- Because the nutrient foramen is located in the middle third of the fibula in most cases; this segment of the bone is used for transplanting



Section of left fibula grafted into right tibia

Bones of Foot



Tarsal Bones

The tarsal bones are the calcaneum, the talus, the navicular, the cuboid, and the three cuneiform bones. **Only the talus** articulates with the tibia and the fibula at the ankle joint.

The tarsal bones, unlike those of the carpus, start to ossify before birth. Centers of ossification for the calcaneum and the talus, and often for the cuboid, are present at birth. Ossification takes place in all the tarsal bones by the 5th year.

Calcaneum

The calcaneum is the **largest** bone of the foot and forms the prominence of the heel. It articulates above with the **talus** and in front with the **cuboid**. It has six surfaces.

The anterior surface is small and forms the articular facet that articulates with the cuboid bone.

The posterior surface forms the prominence of the heel and gives attachment to the tendo calcaneus (Achilles tendon).

Two articular facets for the talus, separated by a roughened groove, the sulcus calcanei, dominate the **superior surface**.

The inferior surface has an anterior tubercle in the midline and a large medial and a smaller lateral tubercle at the junction of the inferior and posterior surfaces.

The medial surface possesses a large, shelflike process, termed the sustentaculum tali, which assists in the support of the talus.

The lateral surface is almost flat. Its anterior part has a small elevation called the peroneal tubercle, which separates the tendons of the fibularis longus and brevis muscles.

Talus

The talus articulates above at the ankle joint with the tibia and fibula, below with the calcaneum, and in front with the navicular bone. It possesses a head, a neck, and a body. Numerous important ligaments attach to the talus, but no muscles attach to this bone.

The head of the talus is directed distally and has an oval convex articular surface for articulation with the navicular bone. This articular surface is continued on its inferior surface, where it rests on the sustentaculum tali behind and the calcaneonavicular ligament in front.

The neck of the talus lies posterior to the head and is slightly narrowed. Its upper surface is roughened and gives attachment to ligaments, and its lower surface shows a deep groove, the sulcus tali. The sulcus tali and the sulcus calcanei in the articulated foot form a tunnel, the sinus tarsi, which is occupied by the strong interosseous talocalcaneal ligament.

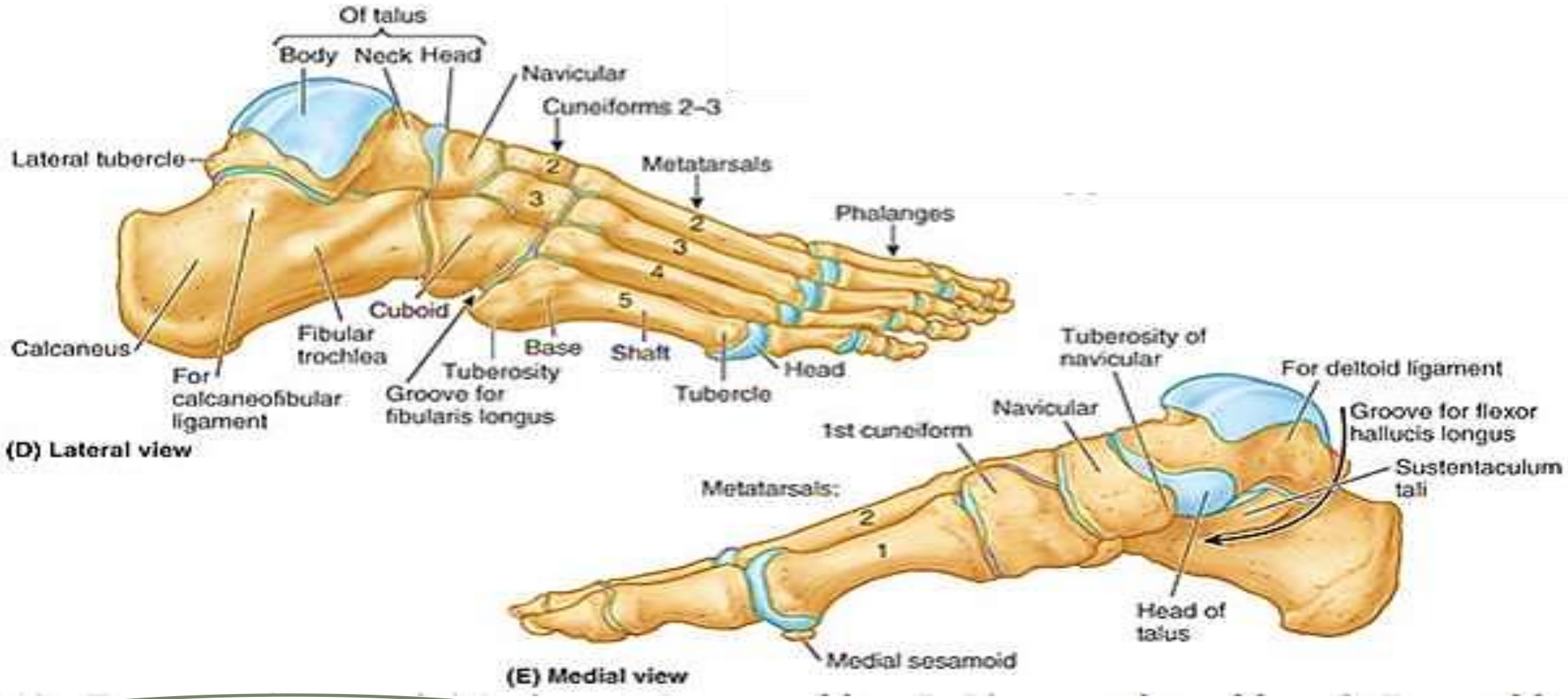
The body of the talus is cuboidal. Its superior surface articulates with the distal end of the tibia. Its lateral surface presents a triangular articular facet for articulation with the lateral malleolus of the fibula. Its medial surface has a small, comma-shaped articular facet for articulation with the medial malleolus of the tibia. The posterior surface is marked by two small tubercles, separated by a groove for the flexor hallucis longus tendon.

Navicular Bone
The tuberosity of the navicular bone can be seen and felt on the medial border of the foot 1 in. (2.5 cm) in front of and below the medial malleolus. It gives attachment to the main part of the tibialis posterior tendon.

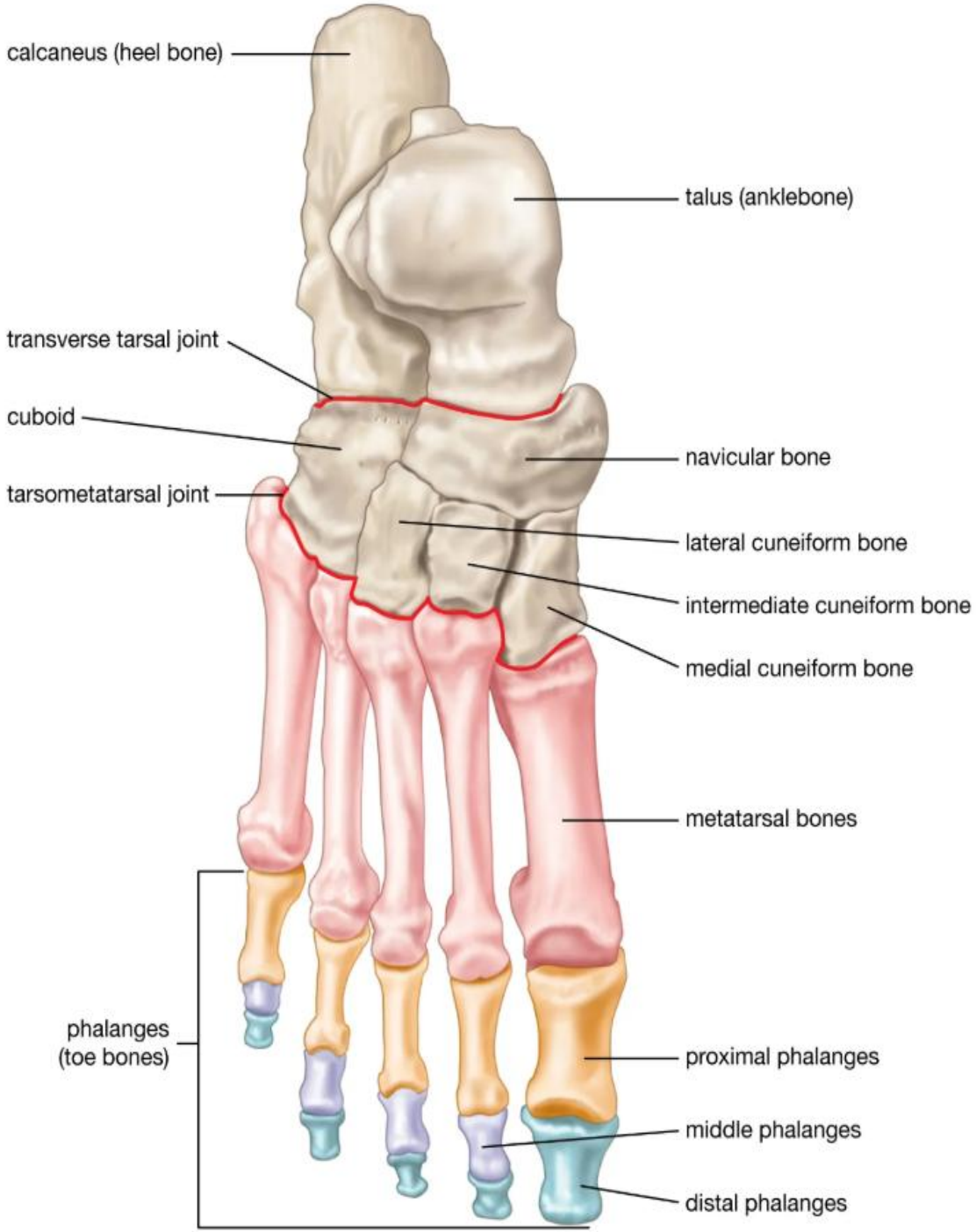
Cuboid Bone
A deep groove on the inferior aspect of the cuboid bone lodges the tendon of the fibularis longus muscle.

Cuneiform Bones
The three small, wedge-shaped cuneiform bones articulate proximally with the navicular bone and distally with the first three metatarsal bones. Their wedge shape contributes greatly to the formation and maintenance of the transverse arch of the foot.

Metatarsal Bones and Phalanges
The metatarsal bones and phalanges resemble the metacarpals and phalanges of the hand in that each possesses a head distally, a shaft, and a base proximally. The five metatarsals are numbered from the medial to the lateral side, that is the first metatarsal aligns with the big toe (hallux), and so forth across the foot.
The first metatarsal bone is large and strong and plays an important role in supporting the weight of the body. The head is grooved on its inferior aspect by the medial and lateral sesamoid bones in the tendons of the flexor hallucis brevis.
The fifth metatarsal has a prominent tubercle on its base that can be easily palpated along the lateral border of the foot. The fibularis brevis tendon attaches to the tubercle. As with the digits in the hand, each toe has three phalanges except the big toe, which possesses only two.



Bones of Foot



Radiographic anatomy of lower limb bones

Joints of Lower Limbs: The femur, the longest and strongest bone in the human body, performs two primary articulations: the **hip joint** proximally and the **knee joint** distally.

1. Proximal Articulation: The Hip Joint

The hip joint is a **synovial ball-and-socket joint** that connects the lower limb to the pelvic girdle.

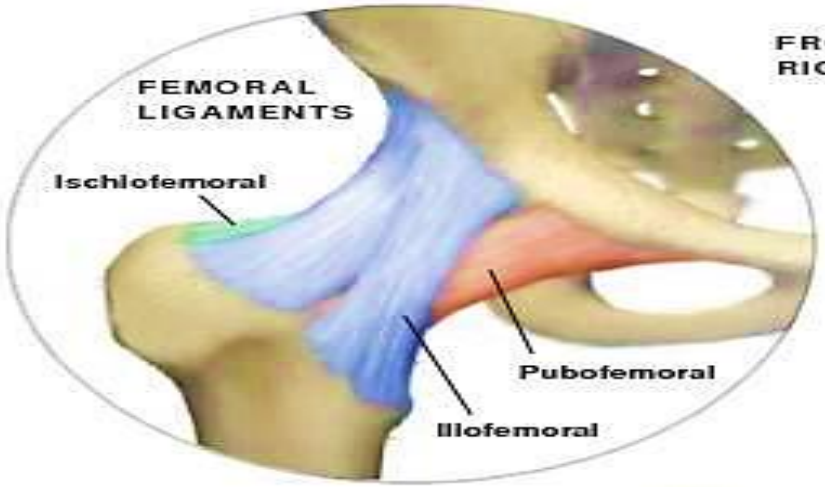
•**Articular Surfaces:** It consists of the nearly spherical **head of the femur** articulating with the **acetabulum** of the os coxae (hip bone). The acetabulum is deepened by a fibrocartilaginous rim called the **acetabular labrum**, which increases joint stability.

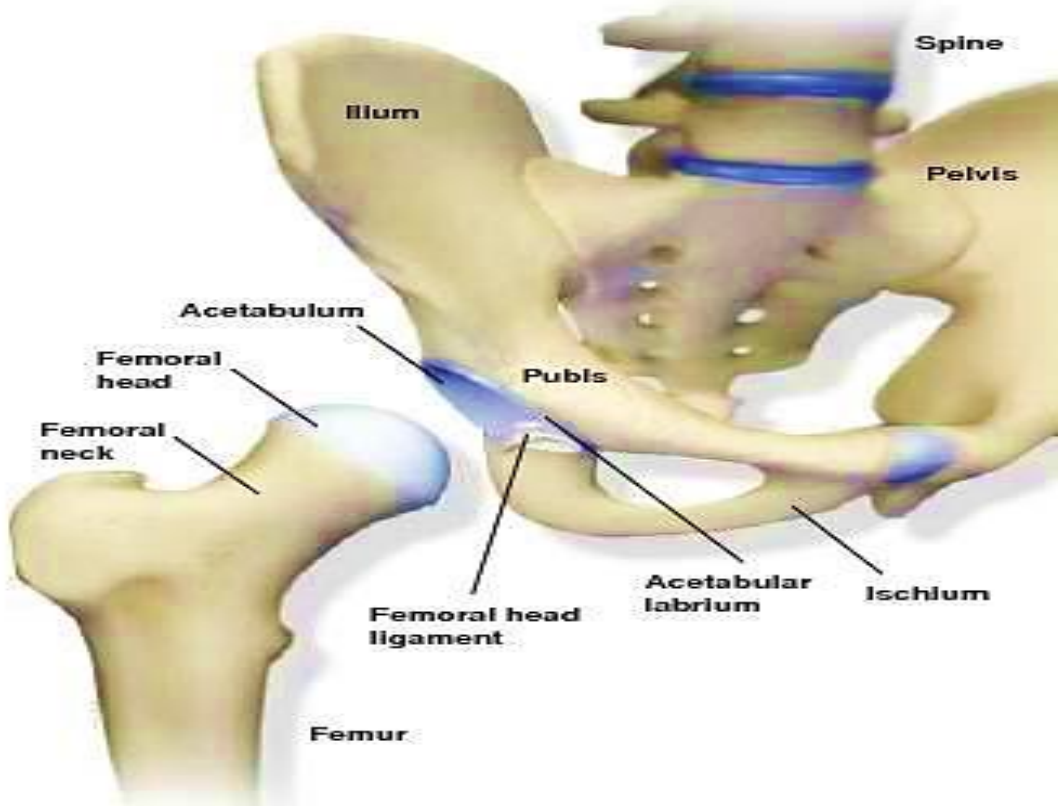
•**Capsule and Ligaments:** The joint is enclosed in a strong capsule and reinforced by three major extrinsic ligaments:

- **Iliofemoral ligament:** An inverted Y-shaped ligament that prevents overextension while standing.
- **Pubofemoral ligament:** Limits extension and abduction.
- **Ischiofemoral ligament:** Limits extension.

•**Intracapsular Structure:** The **ligament of the head of the femur** (ligamentum teres) connects the fovea capitis on the femoral head to the transverse acetabular ligament. It carries a small branch of the obturator artery that supplies blood to the femoral head.

•**Movements:** As a multiaxial joint, it allows for flexion, extension, abduction, adduction, lateral rotation, medial rotation, and circumduction.





Articulation of femur

- **Hip joint**

(Between the head of the femur and the acetabulum of the hip bone)

- **Knee joint**
  - (Between patellar surface of the femur and patella)
  - (Between the condyles of the femur and the tibia)

2. Distal Articulation: The Knee Joint

The knee joint is a complex **synovial hinge joint** (specifically a modified hinge or condylar joint) involving three separate articulations.

•**Articular Surfaces:**

- **Tibiofemoral joints:** The medial and lateral **condyles of the femur** articulate with the corresponding medial and lateral **condyles of the tibia** (tibial plateaus).
- **Patellofemoral joint:** The anterior surface of the distal femur articulates with the posterior surface of the **patella**.

•**Intra-articular Structures:**

- **Menisci:** C-shaped fibrocartilaginous discs (medial and lateral) that act as shock absorbers and improve the fit between the femoral and tibial condyles.
- **Cruciate Ligaments:** The **anterior (ACL)** and **posterior (PCL)** cruciate ligaments cross each other inside the joint to provide anteroposterior stability.

•**Extracapsular Ligaments:** The joint is further stabilized by the **medial (tibial) collateral ligament** and the **lateral (fibular) collateral ligament**, which prevent side-to-side (valgus/varus) displacement.

•**Movements:** The primary movements are **flexion** and **extension**. A small amount of medial and lateral rotation also occurs, particularly during the "locking" and "unlocking" of the knee.

Anatomy of the Knee

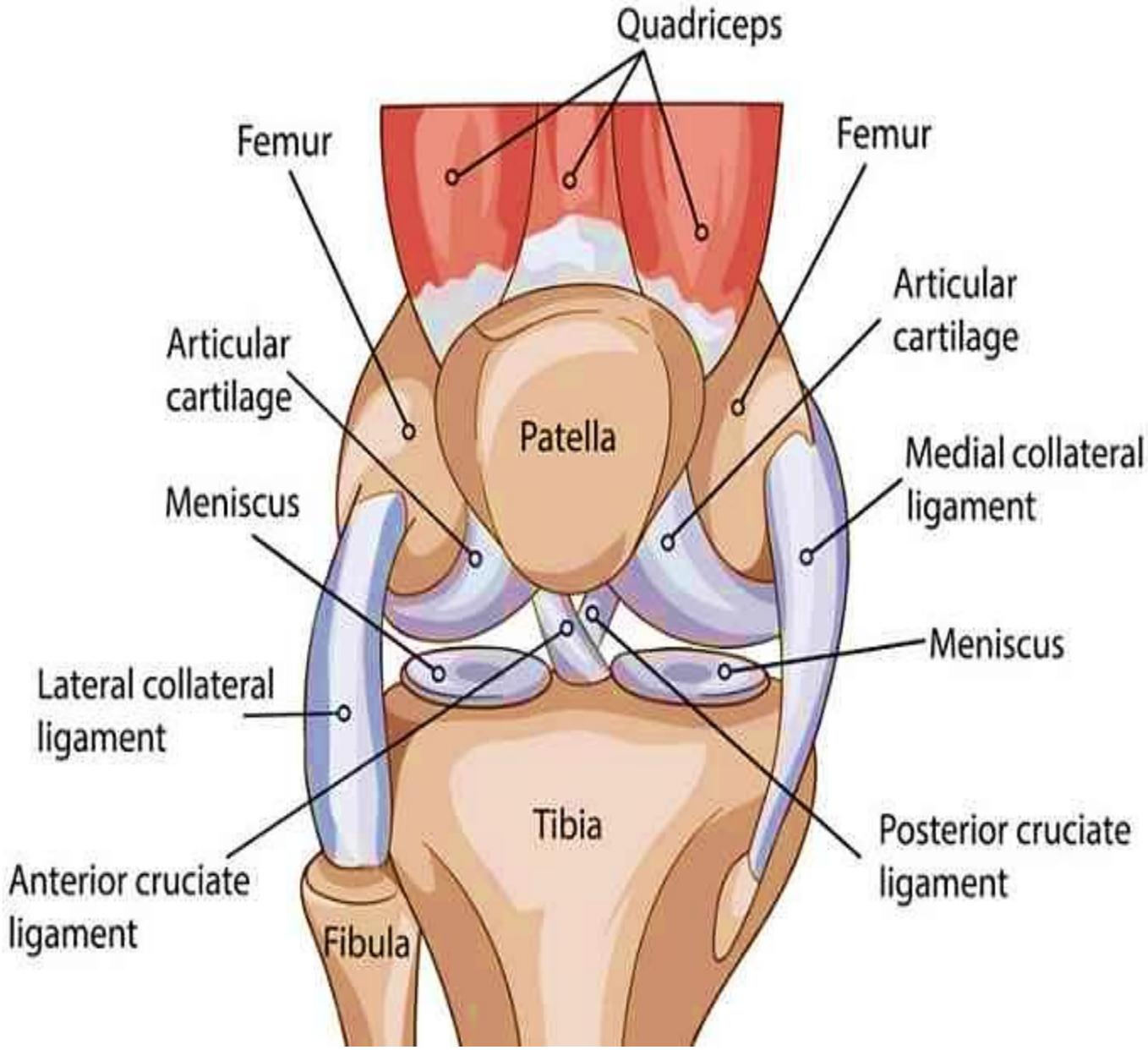
As the largest joint in the human body, the knee is composed of four main structures- bones, cartilage, ligaments and tendons.

Three bones connect to form the knee joint, including:

- **The thighbone (femur)**
- **The shinbone (tibia)**
- **The kneecap (patella)**

Another important structure connected to knee anatomy and the three bones is **articular cartilage**. Articular cartilage is a smooth, hard substance responsible for decreasing knee friction and allowing the bones to glide smoothly against each other as the knee joint bends and straightens.

Two wedge-shaped pieces of meniscal cartilage, known as **menisci,** serve as “shock absorbers” between the femur and tibia. The meniscal cartilage helps to decrease the load on the articular cartilage and prevents development of knee arthritis.



While often thought of as a single joint, it is anatomically composed of the following three distinct articulations:

1.Medial Tibiofemoral Articulation: This is the joint between the **medial condyle of the femur** and the **medial condyle of the tibia** (also called the medial tibial plateau).

2. Lateral Tibiofemoral Articulation: This is the joint between the **lateral condyle of the femur** and the **lateral condyle of the tibia** (the lateral tibial plateau).

3. Patellofemoral Articulation: This is the joint between the posterior surface of the **patella** and the **patellar surface of the femur** (the trochlear groove).

Articular Surface Coating: The articular surfaces of the femur, tibia, and patella are all covered with hyaline cartilage to reduce friction.

The Joint Capsule: These three articulations share a common synovial cavity. The capsule is absent on the anterior aspect, which allows the synovial membrane to pouch upward behind the quadriceps tendon, forming the **suprapatellar bursa**.

Role of the Fibula: It is important to note that the fibula is not directly involved in the knee joint articulations. It articulates with the tibia at the proximal and distal tibiofibular joints, but not with the femur.

Ligaments act like strong ropes to hold the bones together and provide stability to the knee joint.

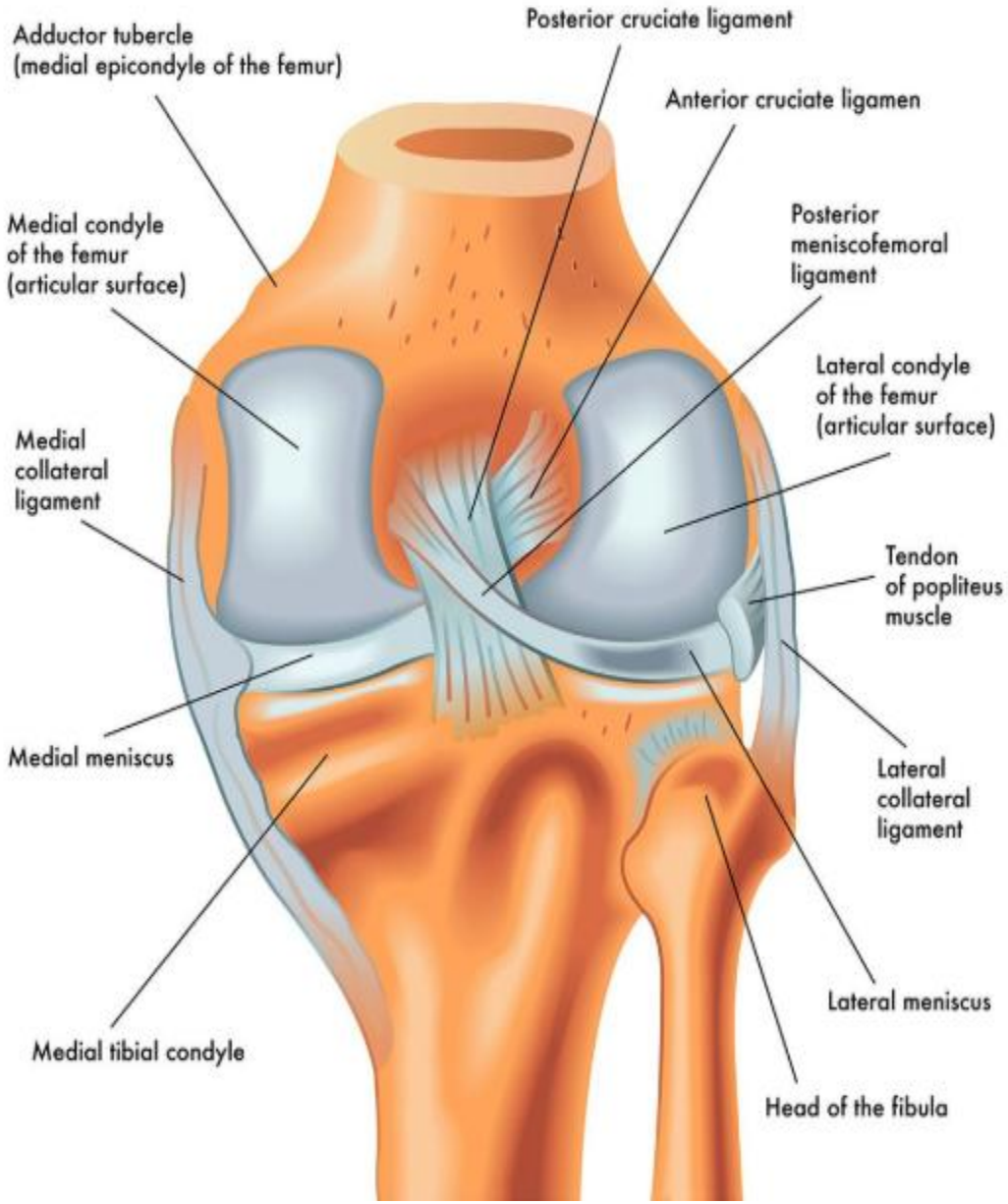
These ligaments include:

•**Anterior cruciate ligament (ACL)** – The ACL travels from the anterior of the tibia to the posterior of the femur and prevents the tibia from moving forward in relation to the femur. The ACL is one of the most important structures in the knee and is most commonly injured in movements that require twisting.

•**Posterior cruciate ligament (PCL)** – The PCL travels from the posterior of the tibia to the anterior of the femur and wraps around the ACL, preventing the tibia from moving backwards on the knee. It is the largest and strongest ligament in the knee joint and is not frequently injured.

•**Medial collateral ligament (MCL)** – The MCL is a band that runs between the inner surfaces of the tibia and femur and prevents the knee from collapsing inwards.

•**Lateral collateral ligament (LCL)** – The LCL is located on the outer surface of the femur and fibula on the outside of the knee joint. The LCL resists impact from the knee's inner surface and prevents the knee from collapsing outwards.

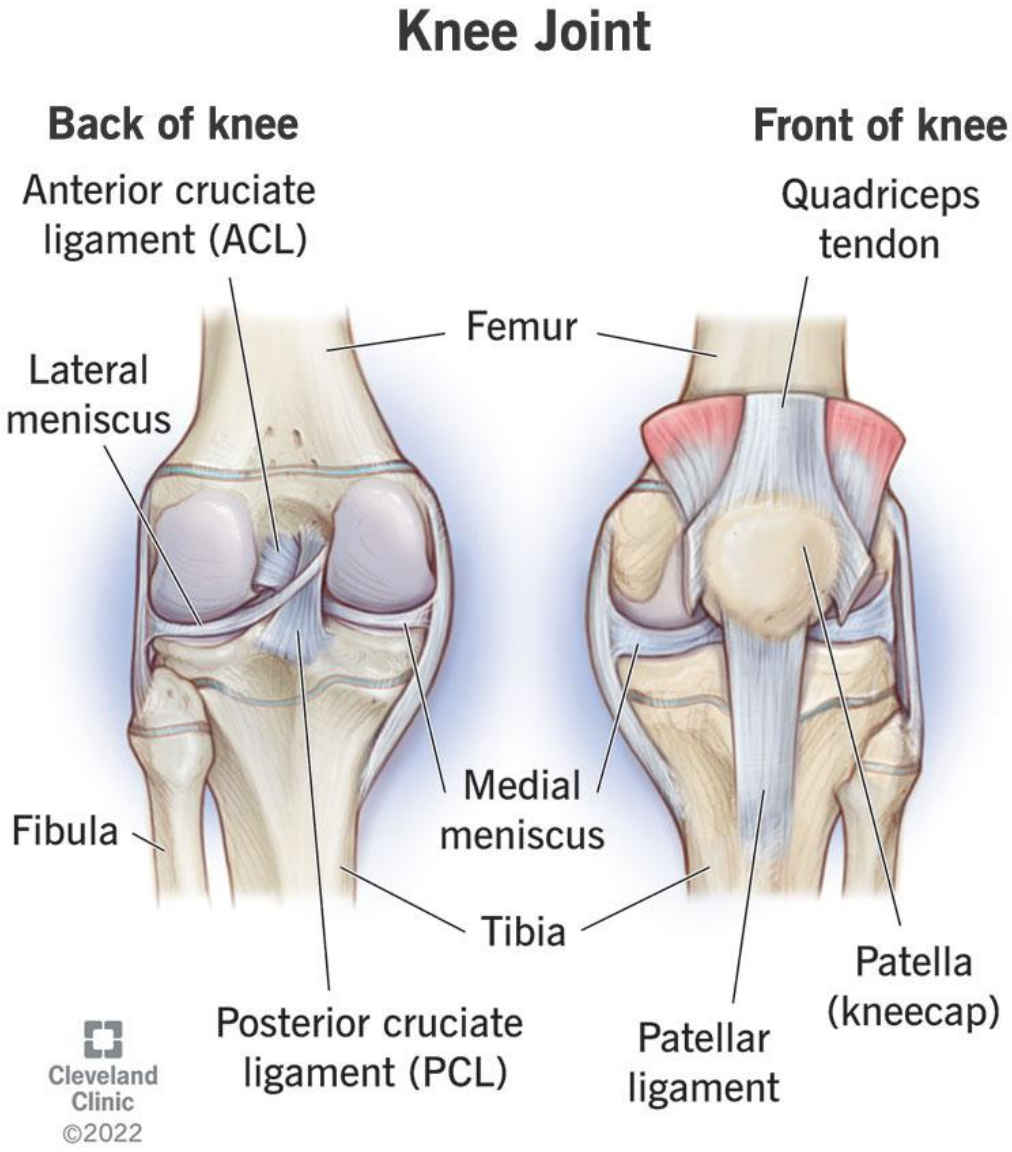


The cruciate ligaments (ACL and PCL) are responsible for controlling the back and forth motion of the knee joint, while the **collateral ligaments (MCL and LCL)** are responsible for controlling the sideways motion of the knee.

The remaining structures that compose knee anatomy are the **tendons and muscles**. The **quadriceps tendon** connects the front thigh muscles to the patella. The **patellar tendon** stretches from the patella to the shinbone. Both muscles allow the knee joint to extend and become straight.

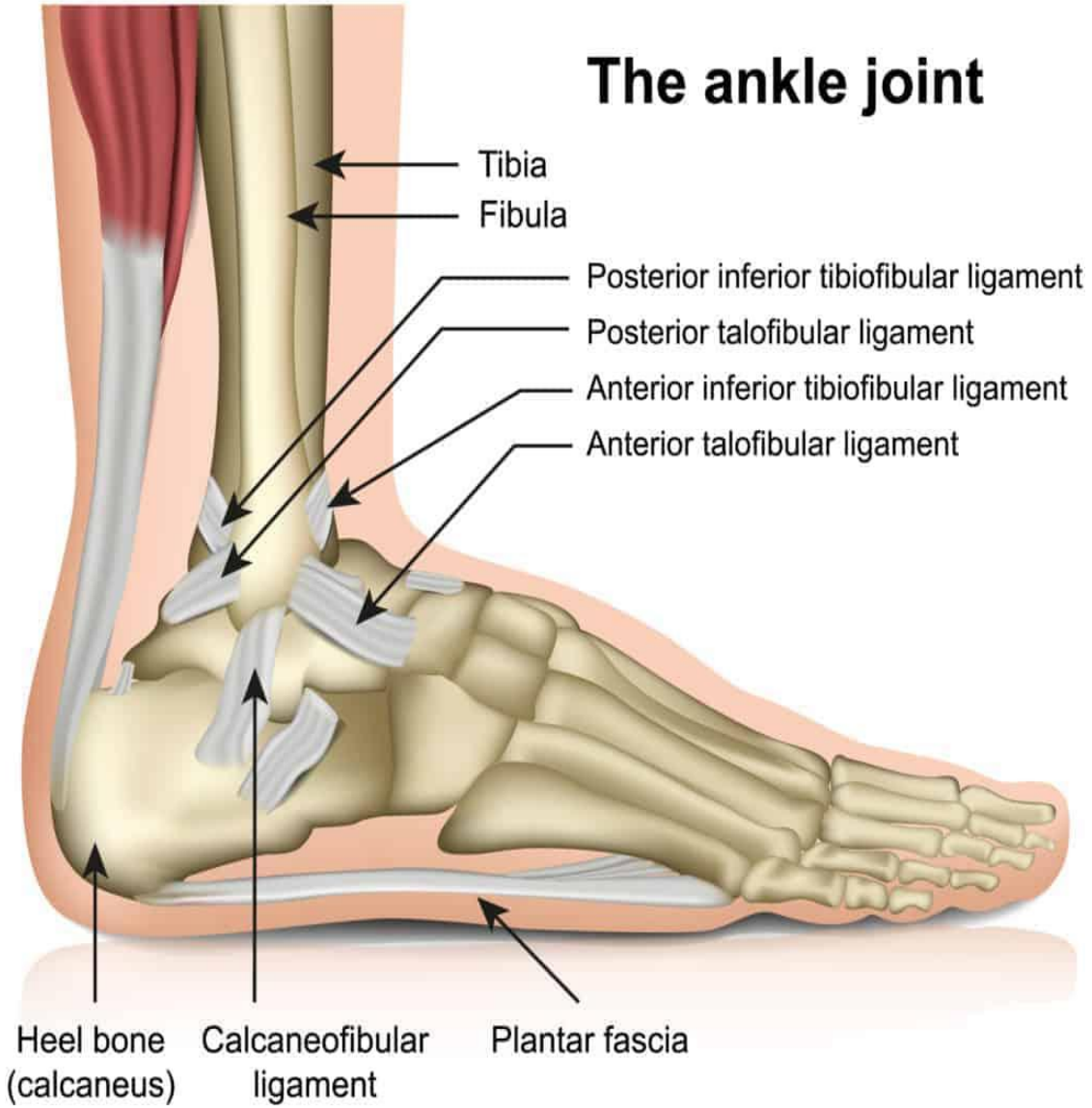
Since the knee joint is such as complex joint in the human body, it is prone to injuries from a fall, sports collision, overuse, a degenerative condition or automobile accident. Common knee injuries include:

- **Ligament injuries**
- **Meniscus tears**
- **Cartilage injuries**
- **Malalignment of the lower extremity**



Ankle Joint (Talocrural Joint):

The distal surface of **the tibia** and the medial surface of its **medial malleolus** form a deep socket (along with the lateral malleolus of **the fibula**). This socket articulates with the **body of the talus**. It is a **synovial hinge joint** primarily responsible for dorsiflexion and plantar flexion of the foot.



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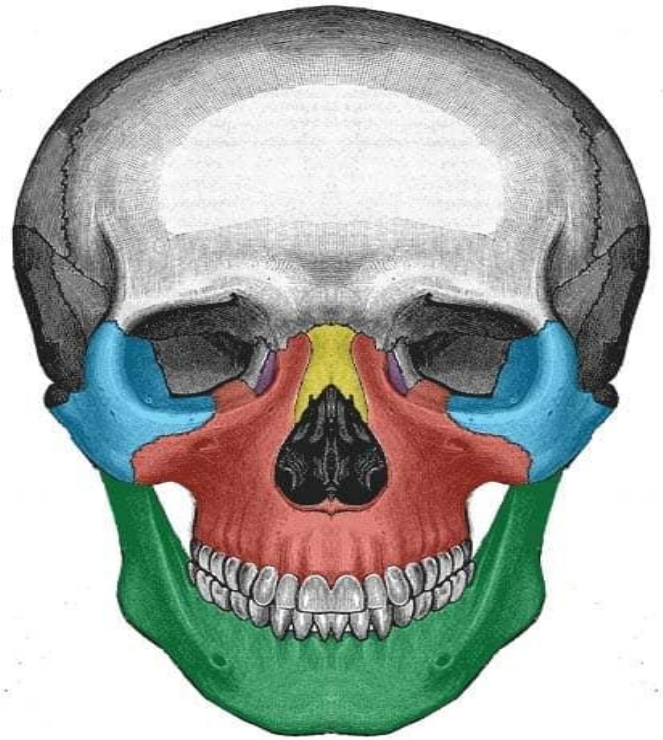

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