Ibn Khaldoun University – Tiaret
Medicine Annex
Academic Year 2024-2025

Anatomy of the Pelvic Limb
"Arthrology Unit"

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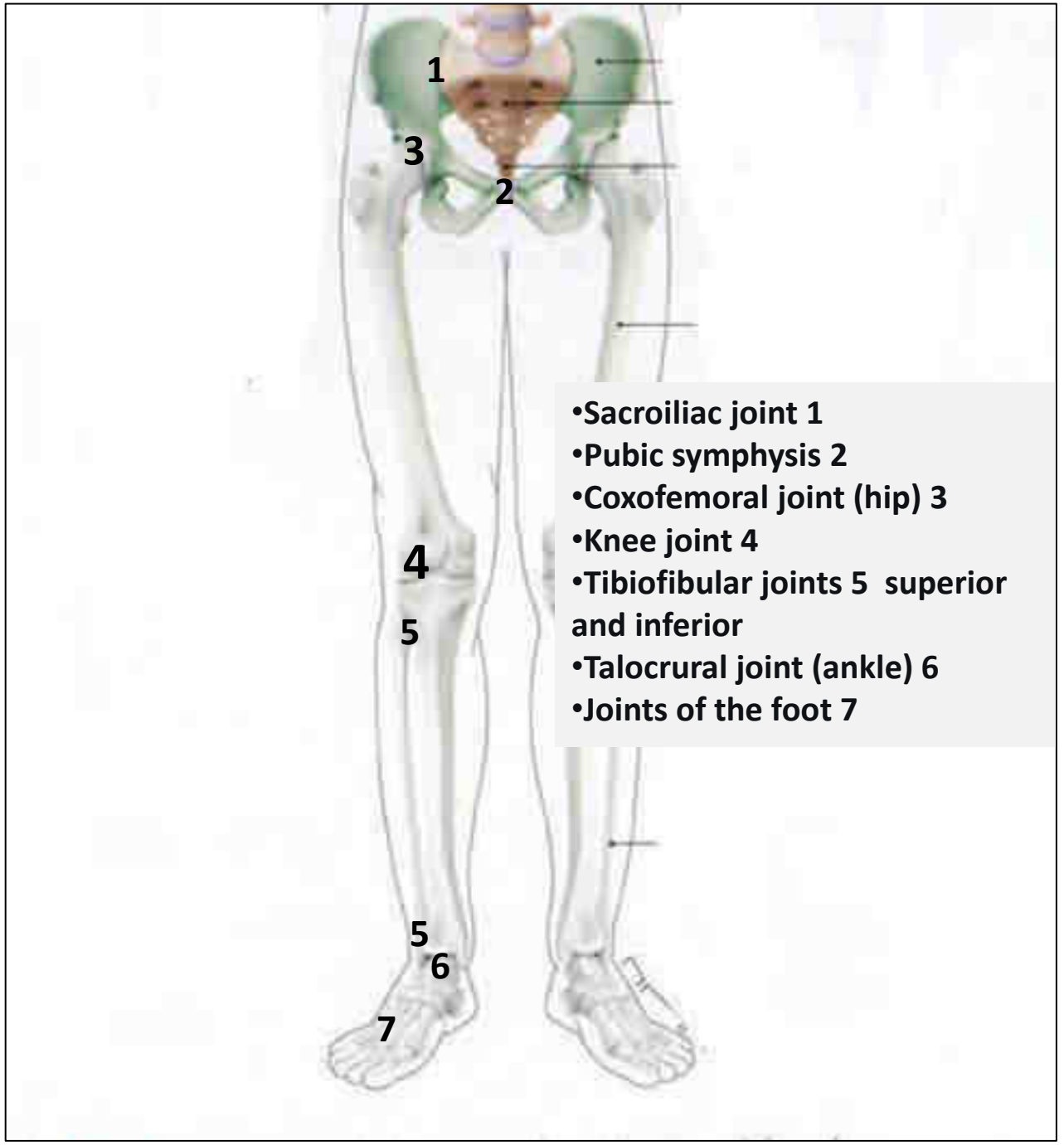
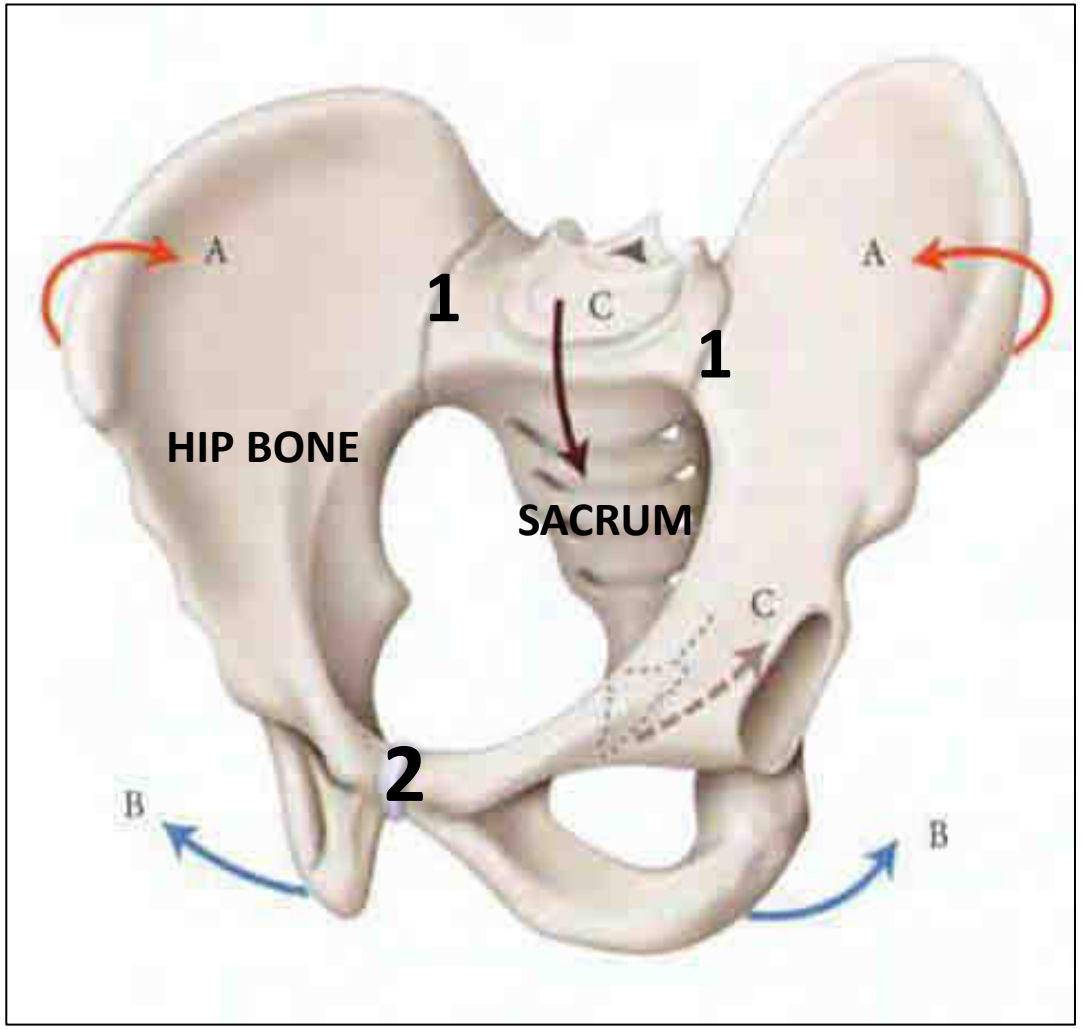
Introduction to Arthrology of the Pelvic Limb

The arthrology of the pelvic limb studies the joints that connect the bones of the lower limb to each other and to the trunk. This articular system plays a fundamental role in two major functions of the human body:



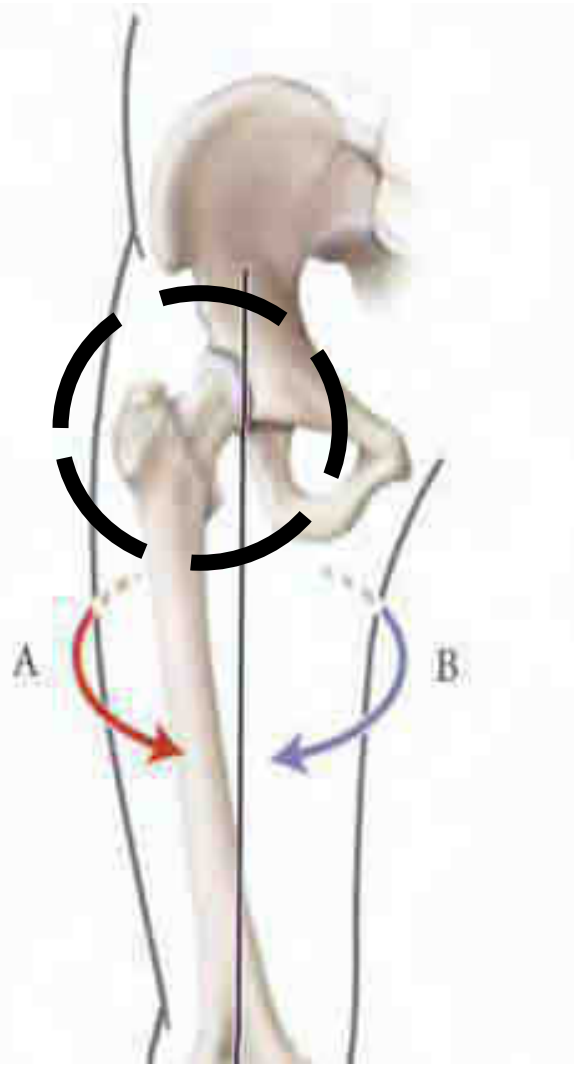
Pelvic Girdle Joint

The pelvic girdle joint includes the structures that unite the **two hip bones to each other** and **connect them to the sacrum**. It mainly comprises:
The **sacroiliac joints 1** (between the sacrum and the hip bone),
The **pubic symphysis 2** (between the two pubic bones anteriorly). These joints ensure the **strength of the pelvic ring**, the **transfer of forces** between the trunk and lower limbs, and contribute to the **stability of upright posture**.



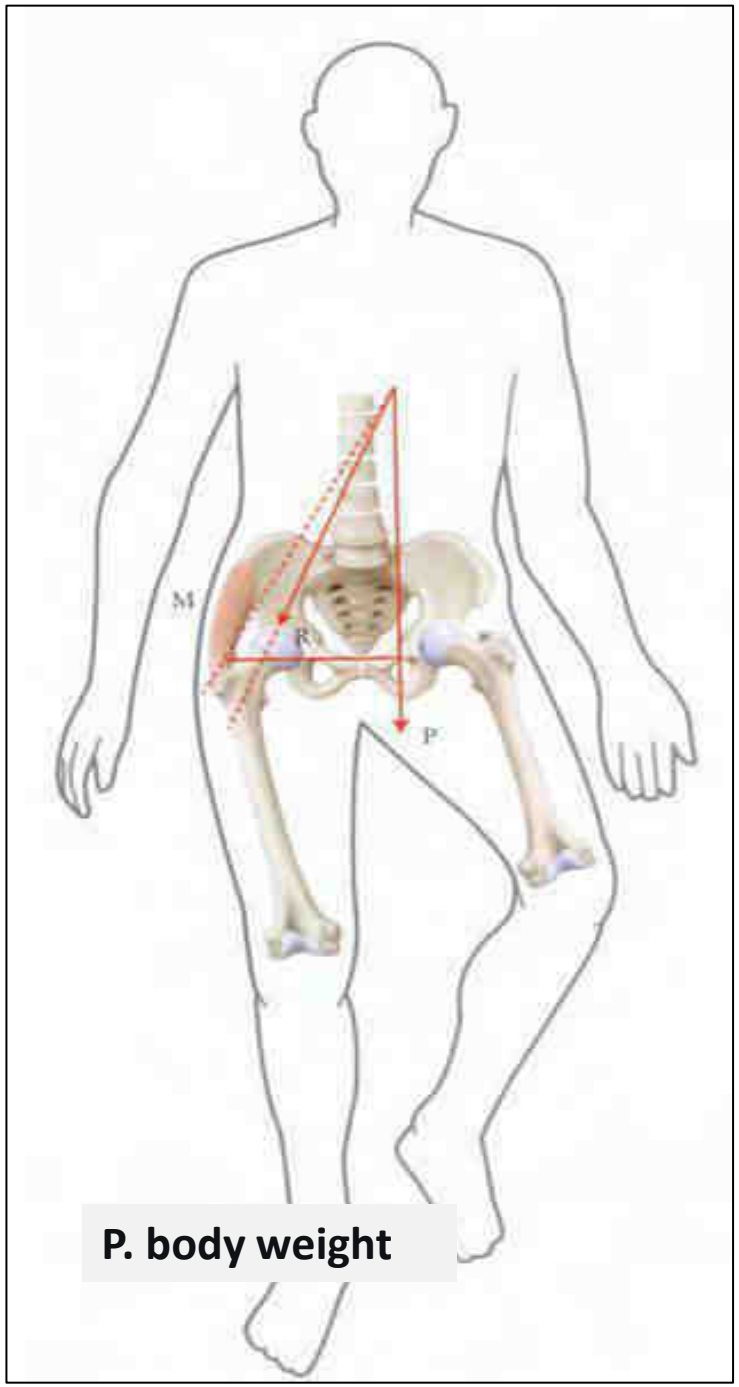
Coxo-femoral Joint

1.Definition
2.Location
3.Descriptive Anatomy:
•Articular surfaces
•Ligaments and supporting structures
•Structures facilitating gliding
4.Functional Anatomy



1-Definition

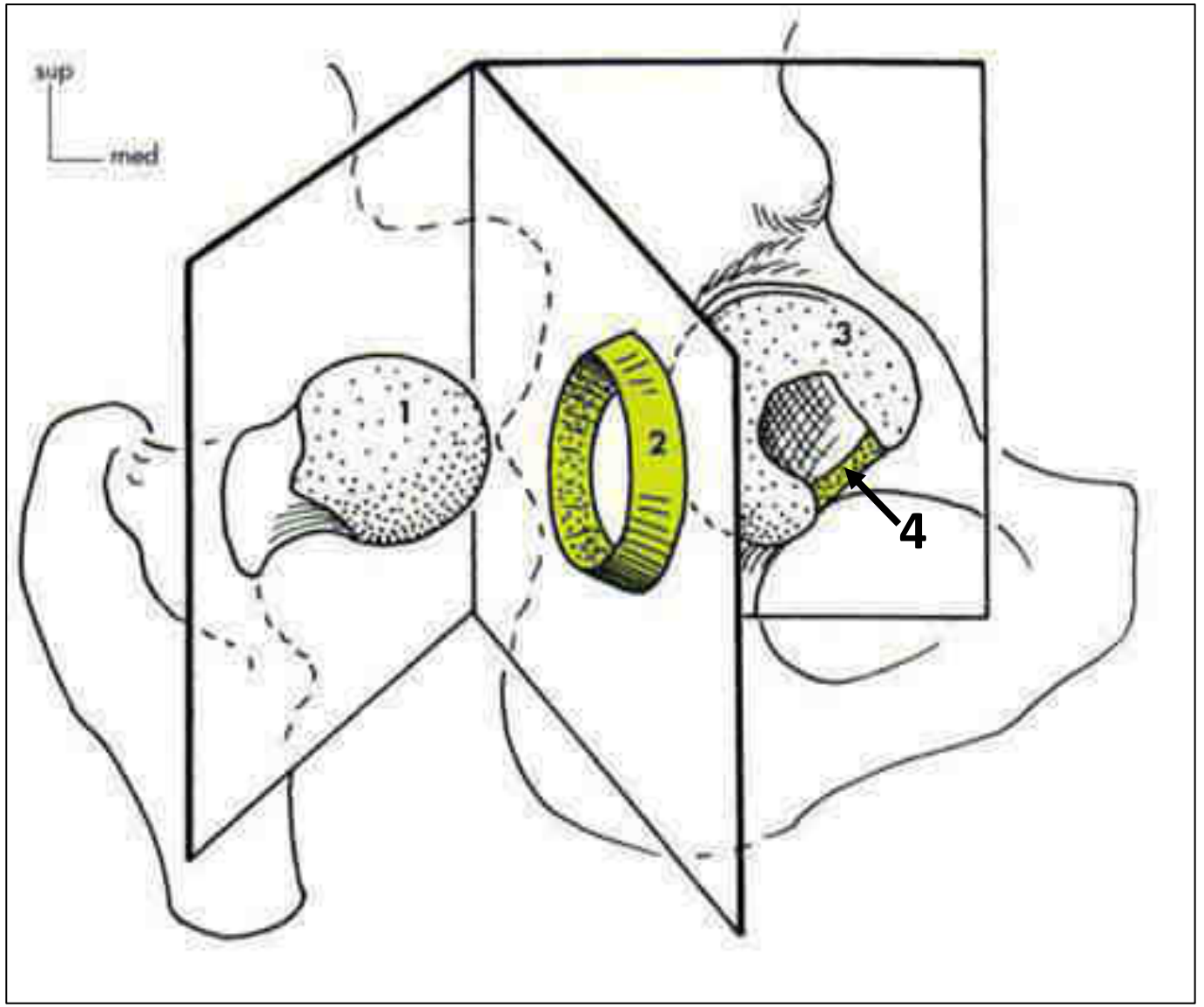
This is the **proximal** joint of the lower limb; a **ball-and-socket synovial** joint (enarthrosis, 3 degrees of freedom), it unites the hip bone to the femur and transmits body weight to the lower limb,
highly **mobile** and **stable**



P. body weight

3-Articular Surfaces

The femoral head 1
The Labrum (fibrocartilage) 2
The acetabulum 3
Transverse ligament 4



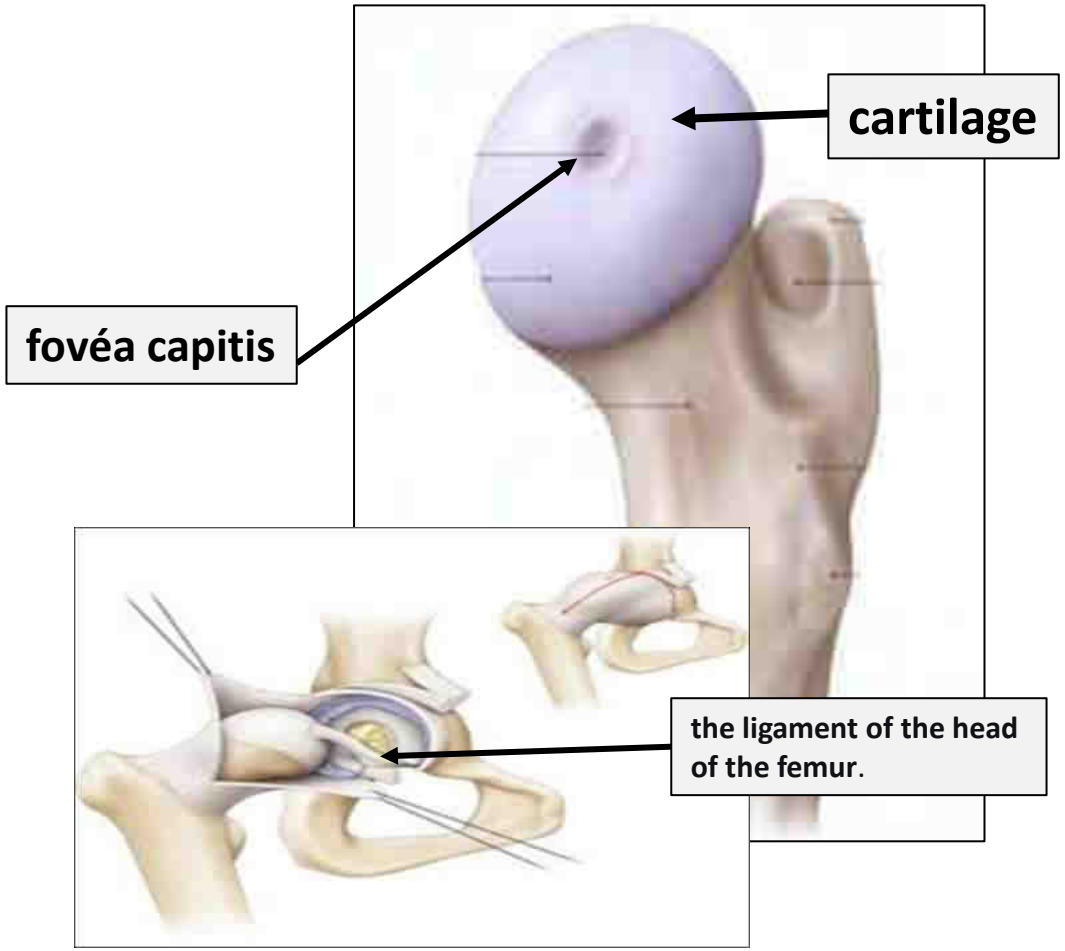
A-The Femoral Head

Shape: **2/3** of a sphere, **radius of 25 mm**

Located at the superomedial part of the proximal end of the femur, **completely covered with cartilage except for the fovea capitis**, attachment site **of the ligament of the head of the femur**.

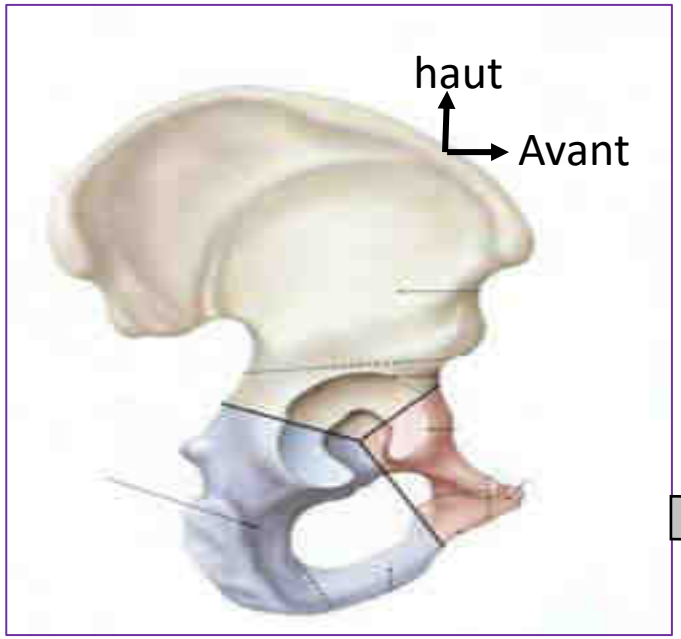
Orientation:

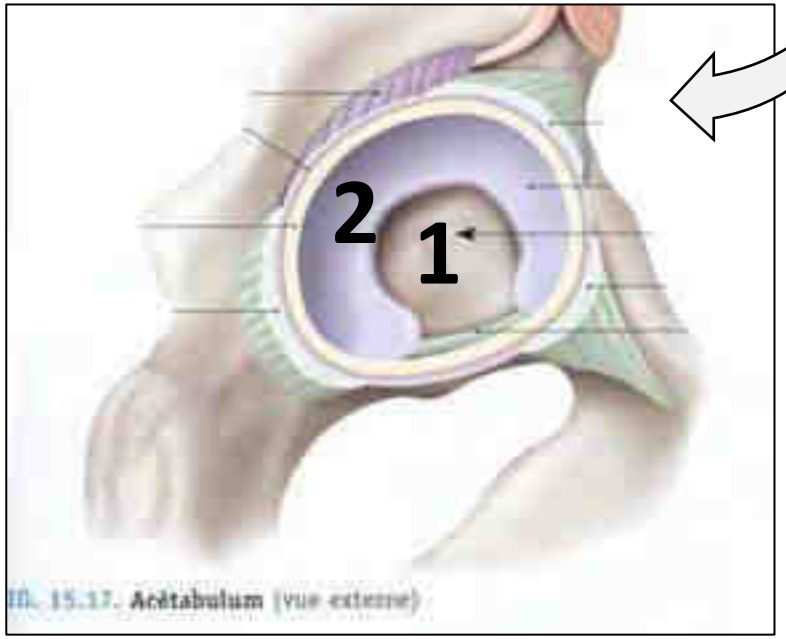
•faces upward, inward, and forward



B-The Acetabulum: hemisphere

Orientation: downward, outward, and forward
with a central non-articular rough part: **the acetabular fossa 1**, and a peripheral articular part articulating with the femoral head: **the lunate surface 2**

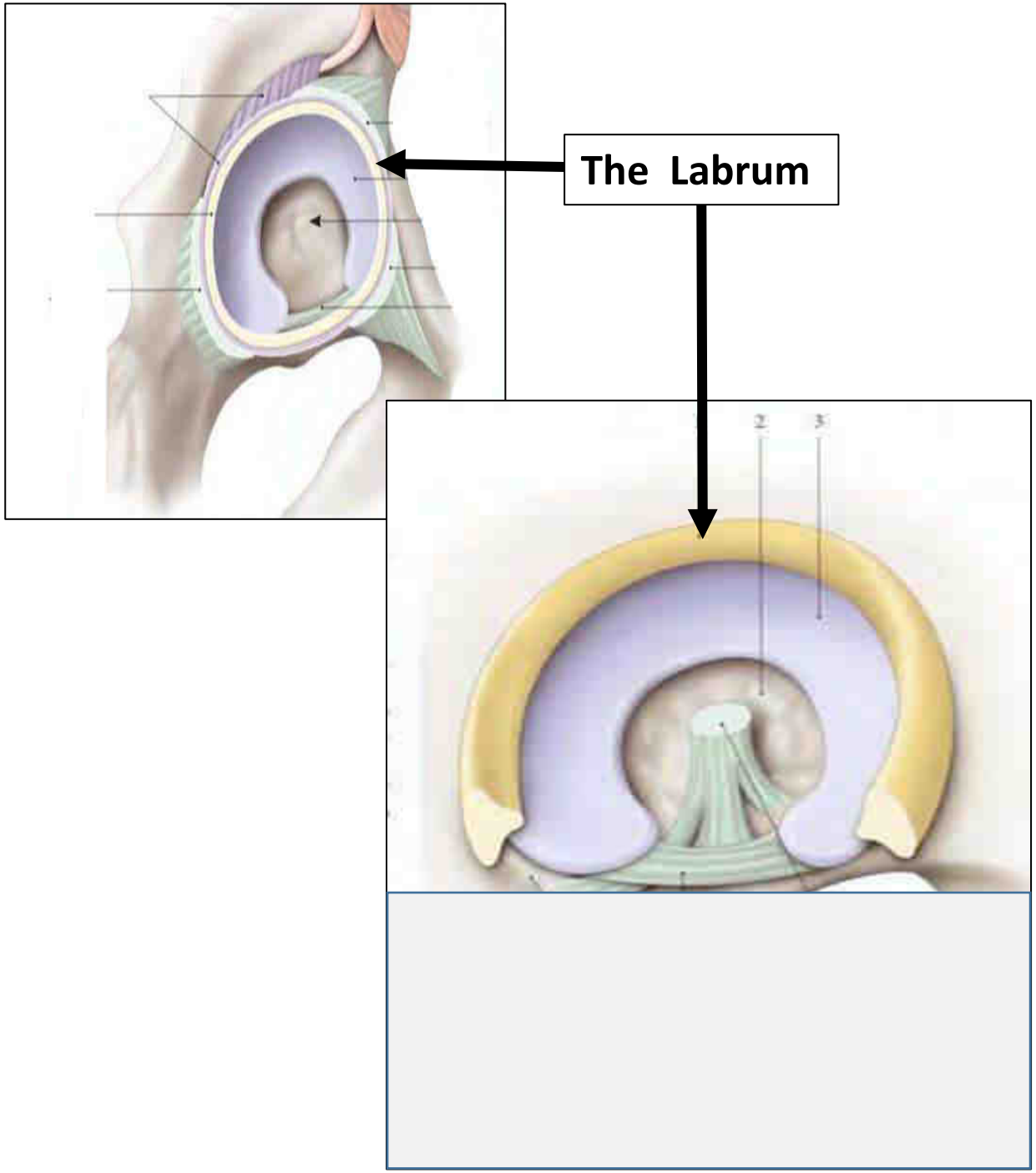




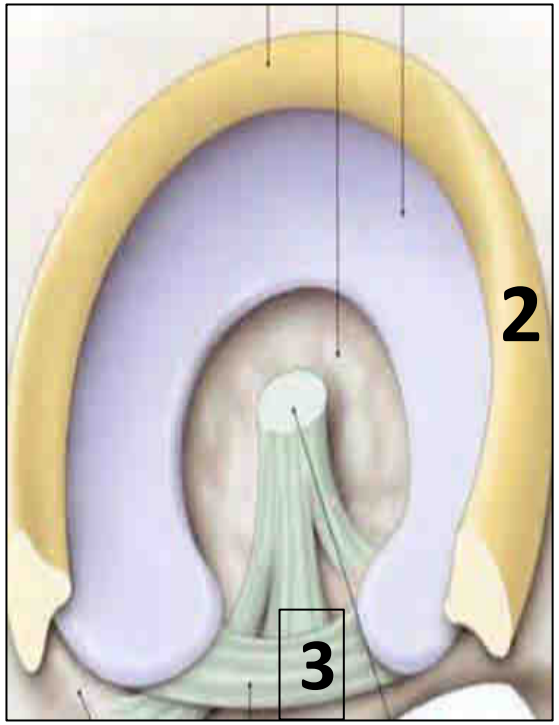
C-The Labrum (fibrocartilage)

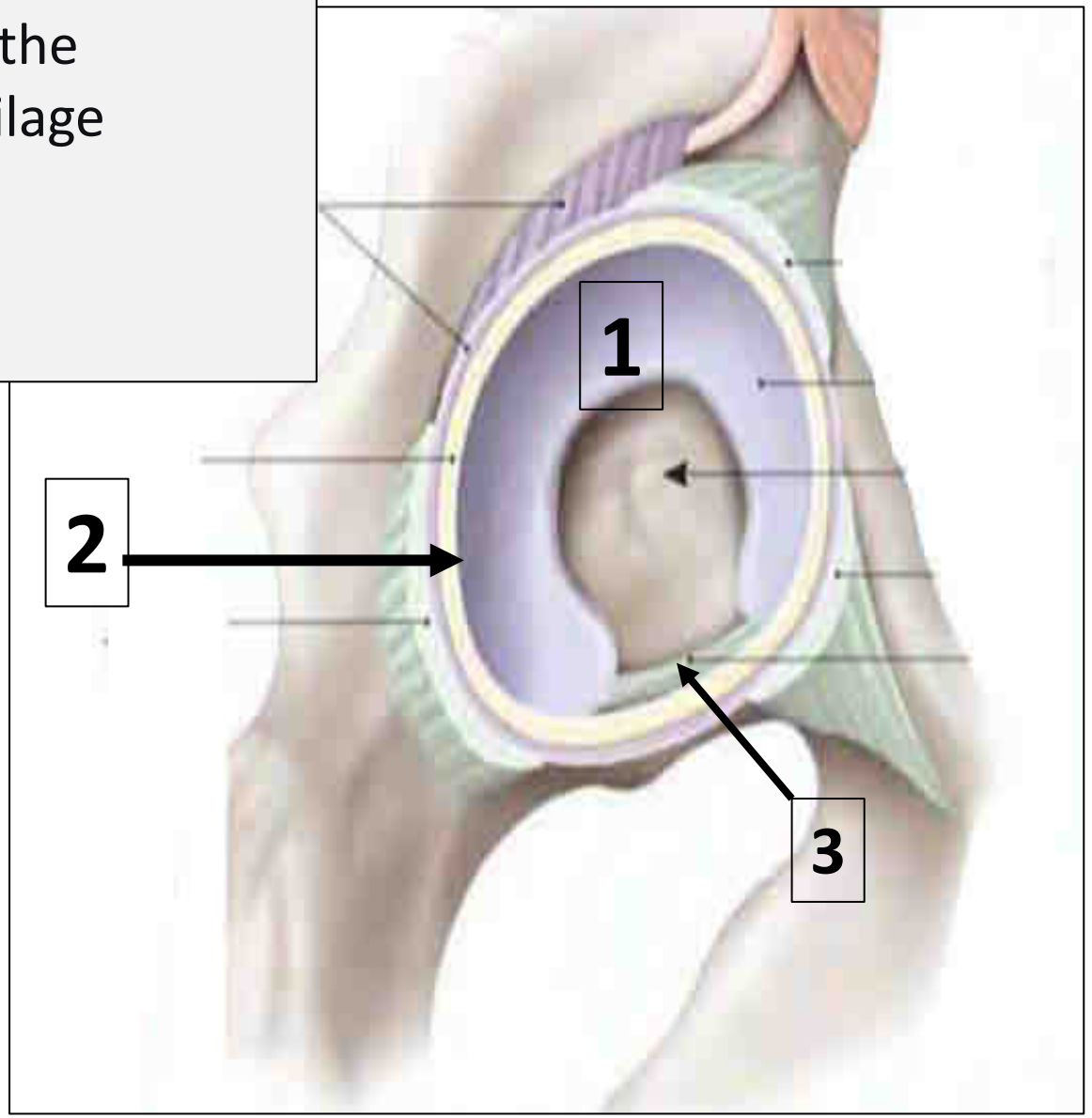
Acetabular Labrum

Attaches to the external periphery of the lunate surface, and the inferior border of the transverse ligament (lined with cartilage). It increases the depth and congruence of the articular surfaces.



The Transverse Ligament 3:
Spans transversely between the two horns of the acetabulum; its axial surface is lined with cartilage
1-Lunate surface
2-The Labrum - fibrocartilage
3-The Transverse ligament

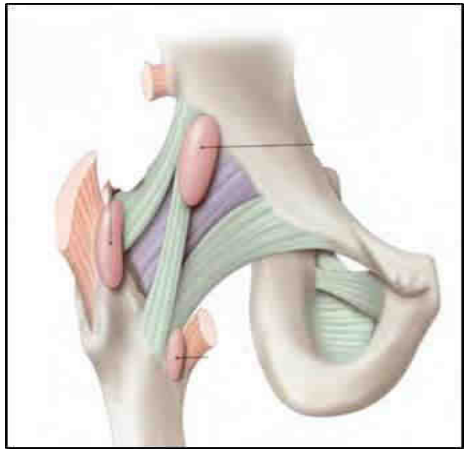




4-Supporting Structures

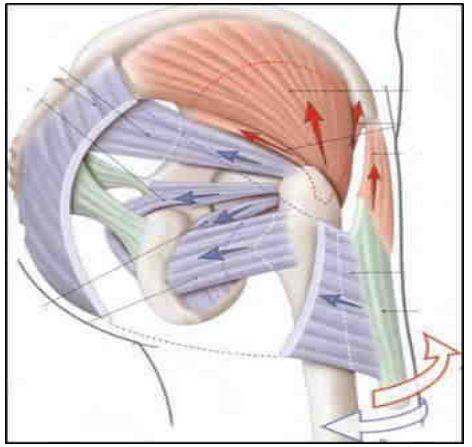
Passive Support

- **Capsule and ligaments**



Active Support

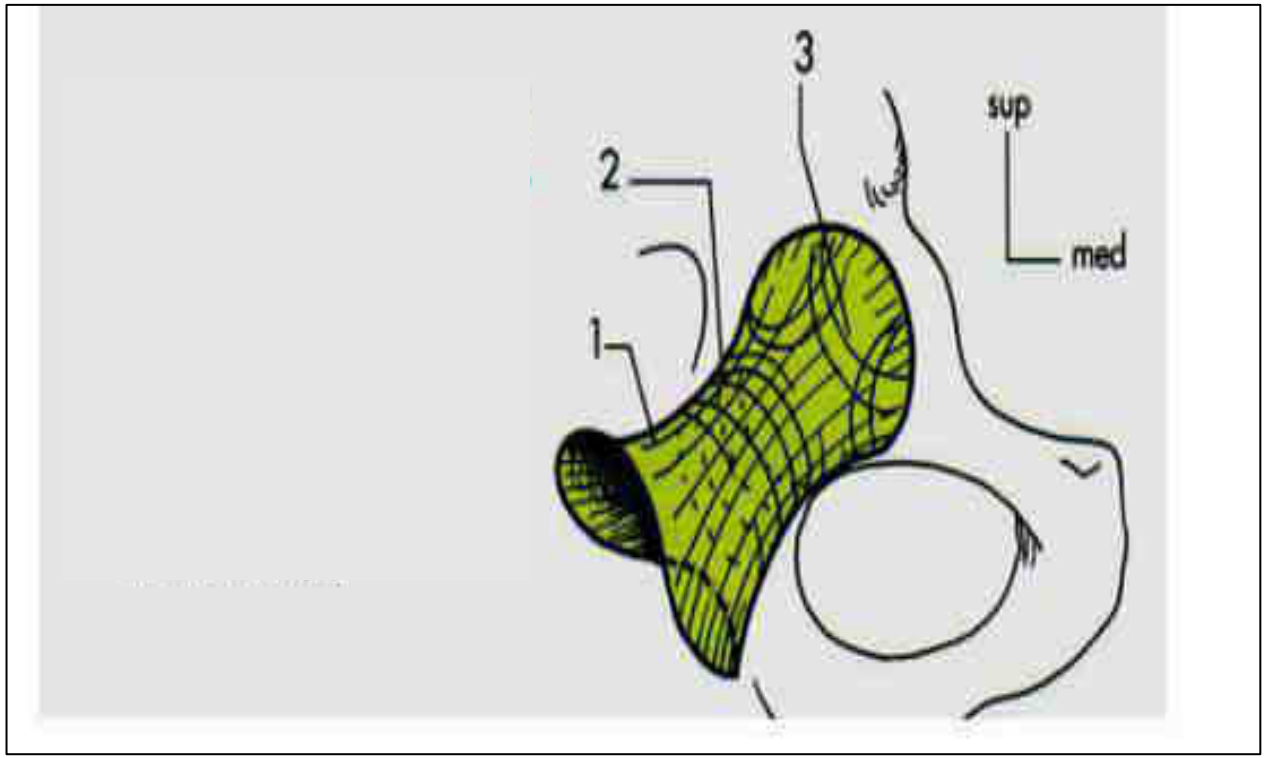
- **Muscles**



1.The Capsule:

A cylindrical fibrous sleeve constricted at its middle part - Attaches to the peripheral face of the labrum. Along the intertrochanteric line of the femur anteriorly and at the middle part of the dorsal surface of the femoral neck

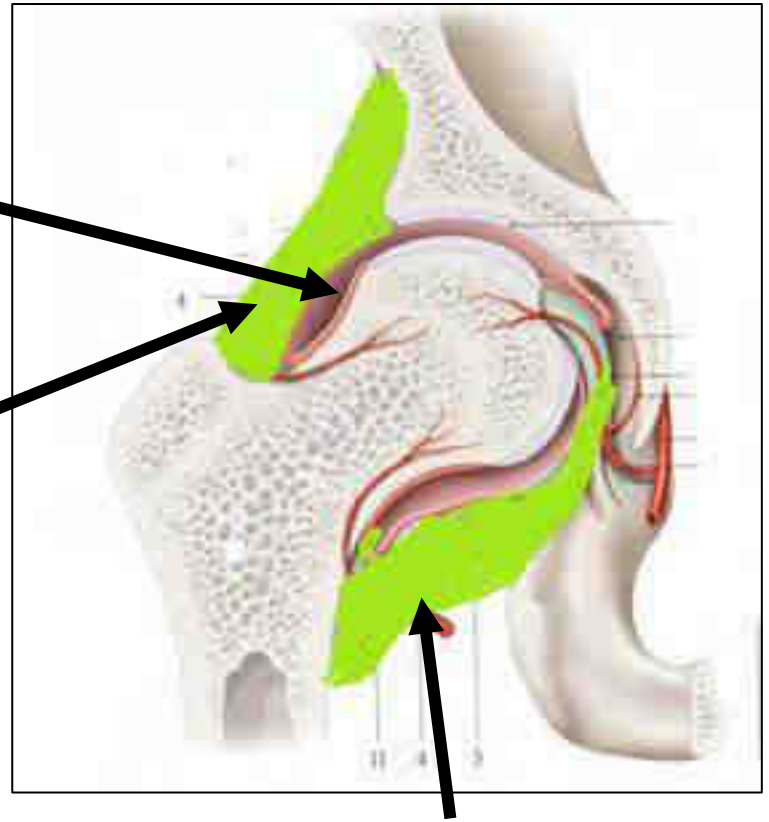
It presents a reinforced zone: the orbicular (circular) fibers which accentuate **the retention of the femoral head**



Anterior view of the coxofemoral capsule, constricted in the middle. Longitudinal fibers (1), circular (2), arcuate (3).

Synovial Membrane: secretes **Synovial Fluid** nourishes cartilage by imbibition. It lines the deep surface of the capsule

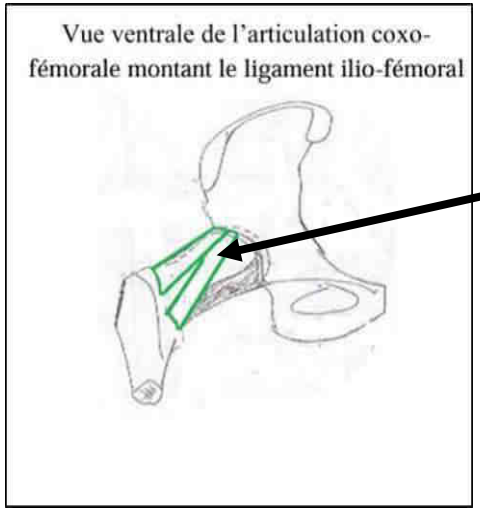
External fibrous membrane



2-Ligaments
-Extra-capsular-

2-a -Anterior

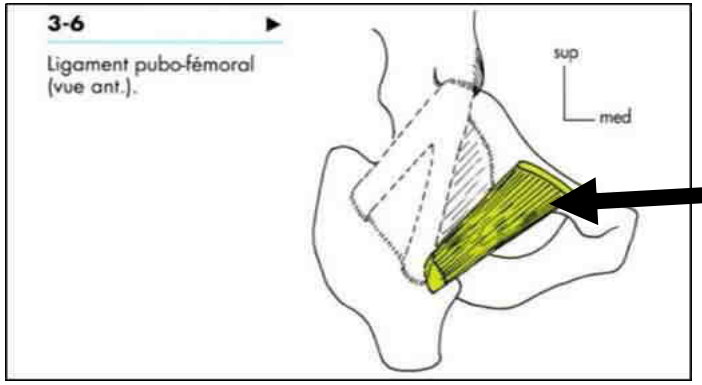
<u>Iliofemoral ligament:</u> <u>(Bertin's ligament)</u>
powerful – resistant composed of two bands



Iliofemoral ligament

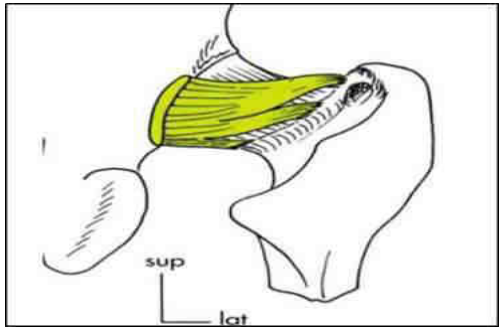
<u>Pubofemoral Ligament</u>

•Pubofemoral ligament
(ant. view).

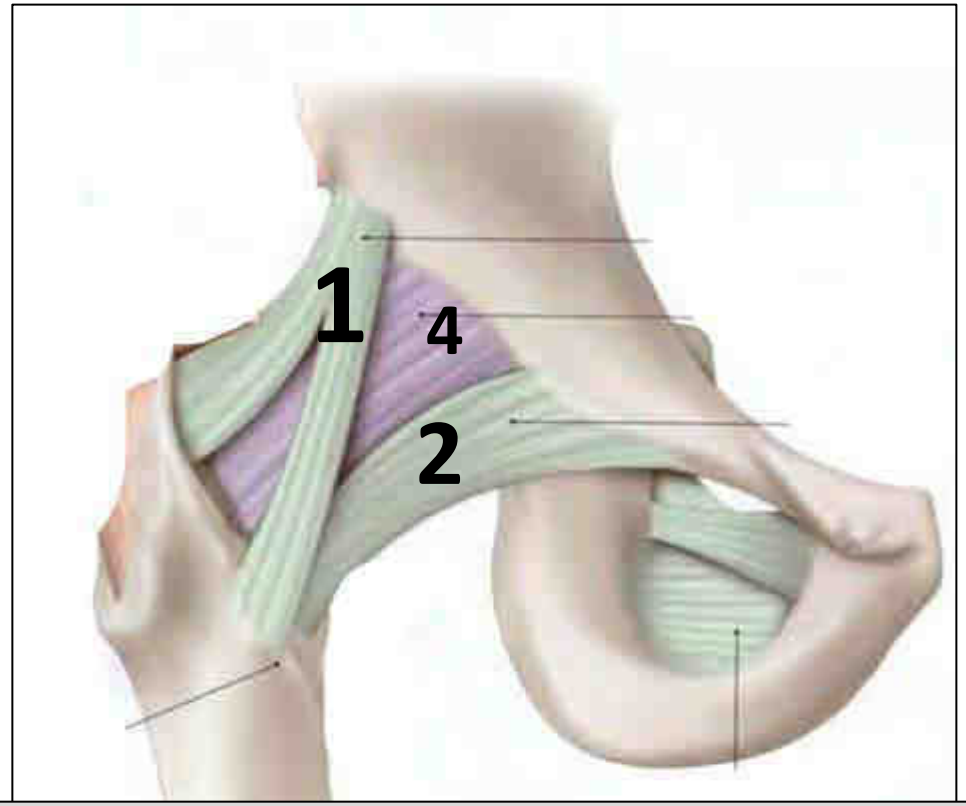


Pubofemoral Ligament

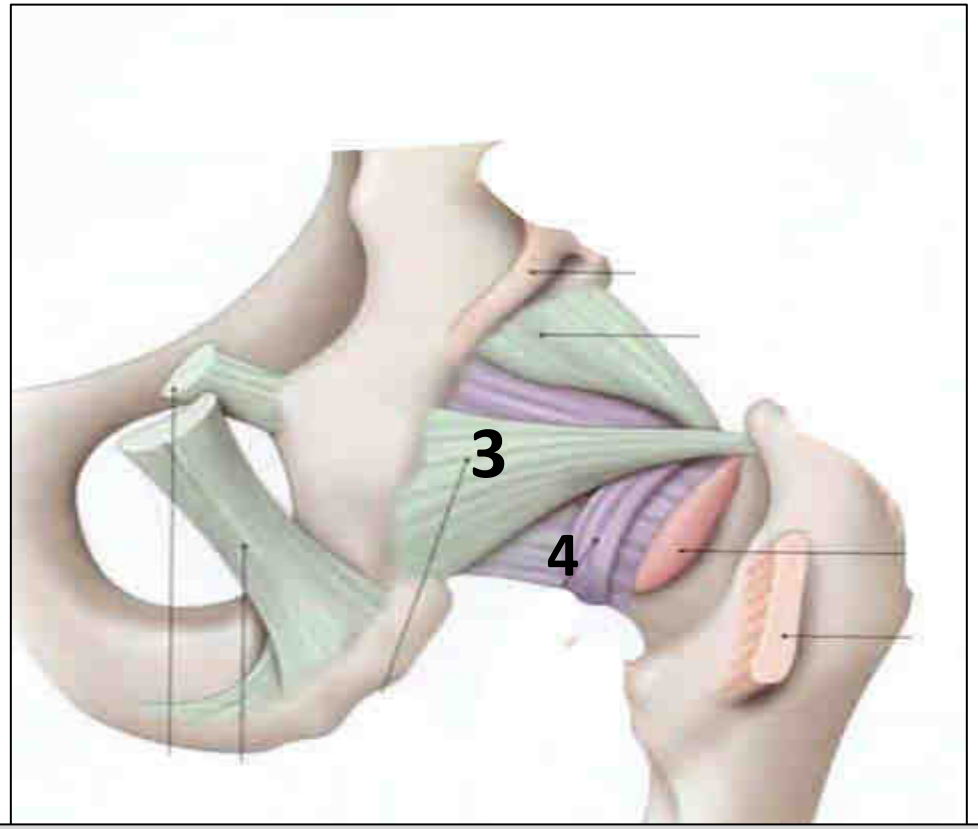
<u>2-b-Posterior</u>
Ischiofemoral ligament: Spiral



The ligaments slacken during flexion and tighten during extension.

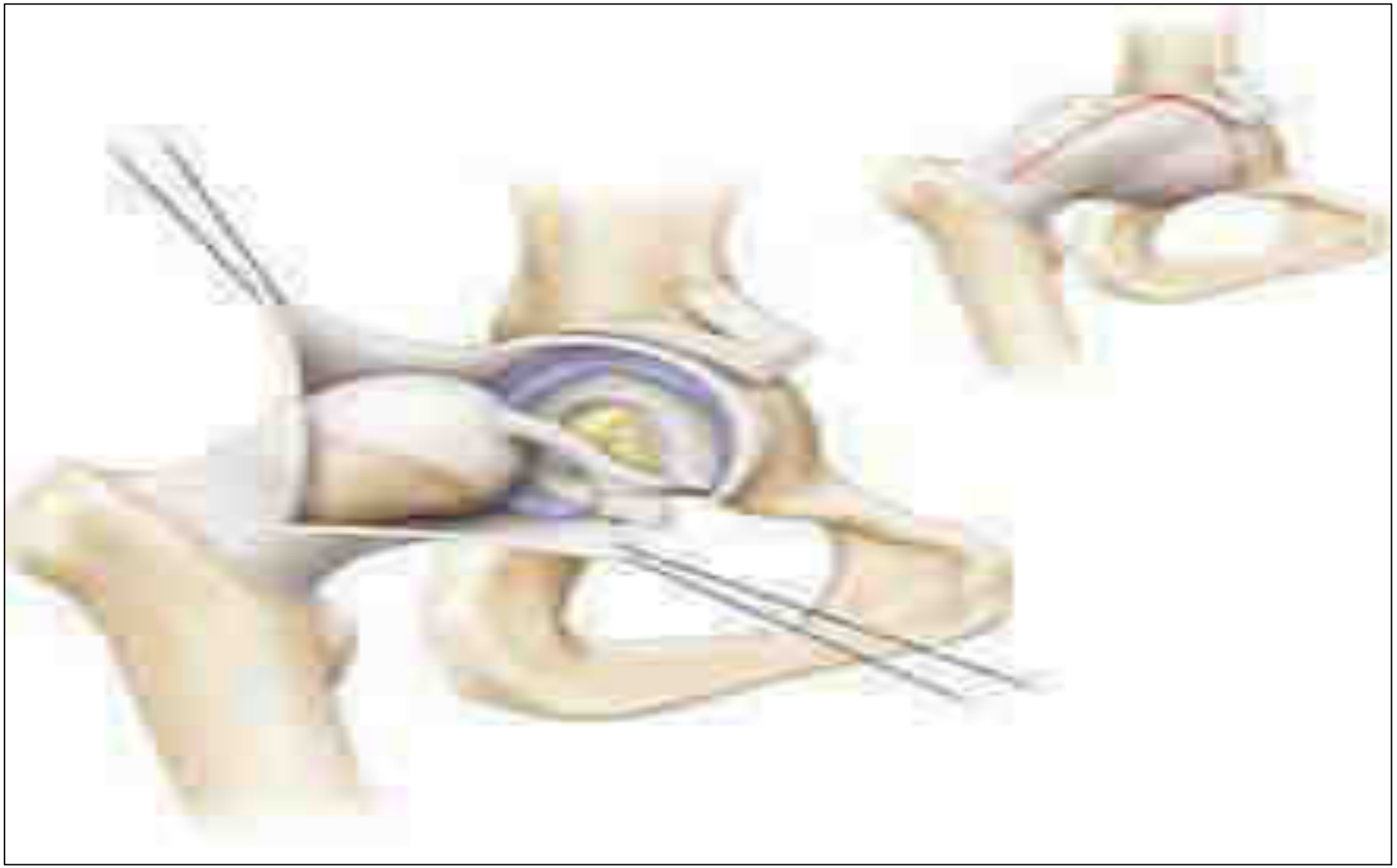


- Coxofemoral joint (anterior view)
- Iliofemoral ligament 1
- Pubofemoral ligament 2



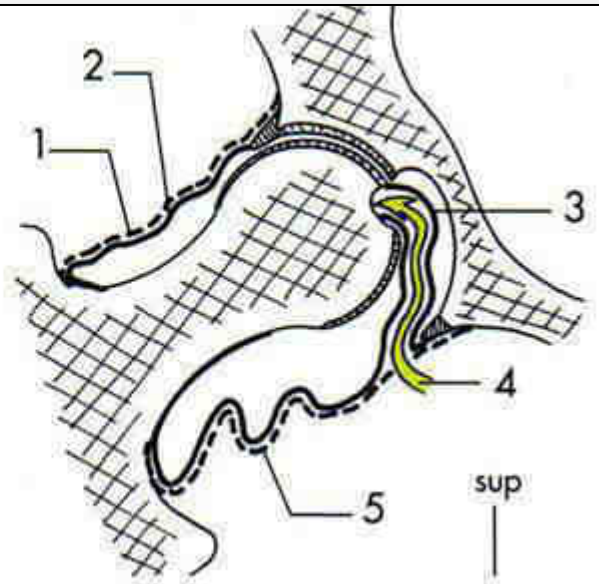
Coxofemoral joint (posterior view)
Ischiofemoral ligament 3
4-capsule

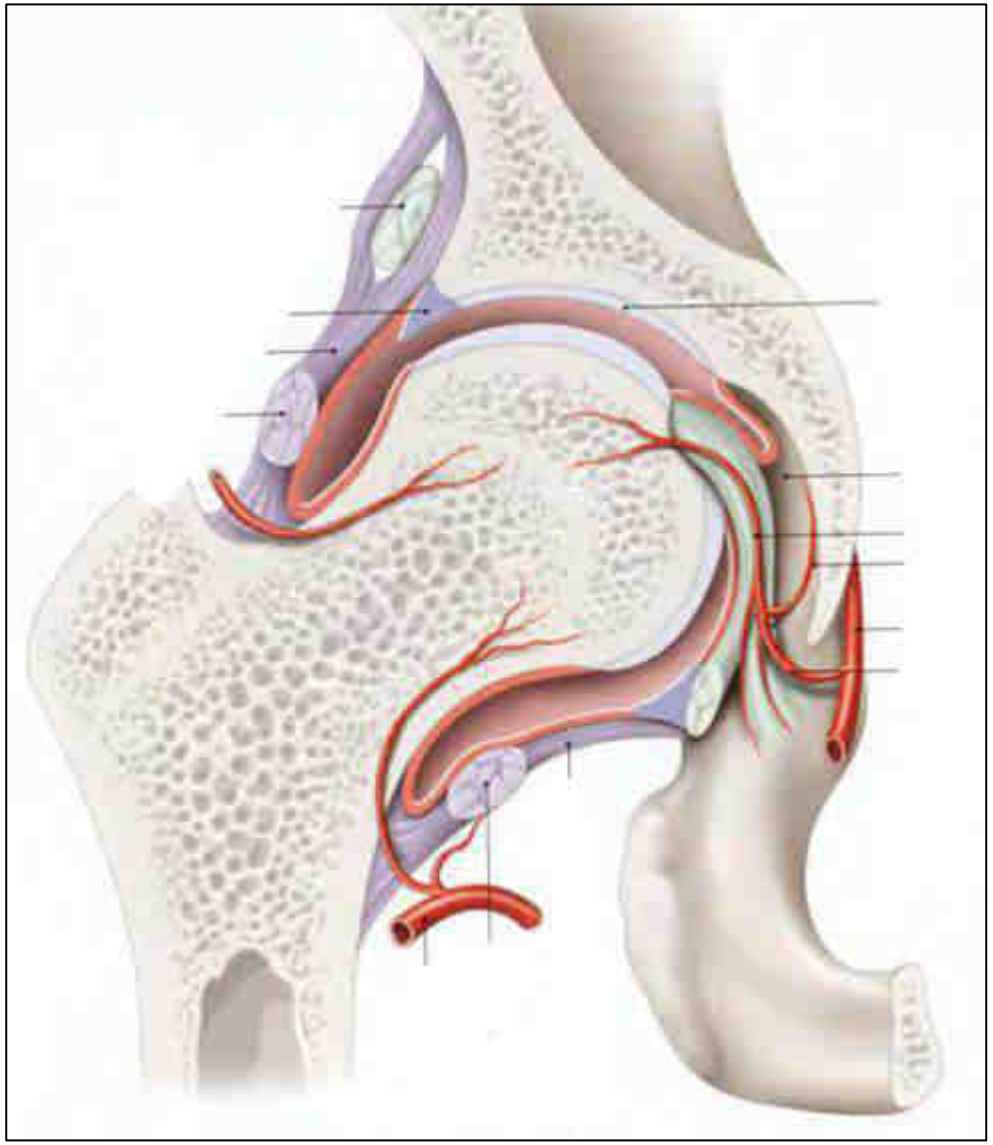
Intra-capsular Ligament
Ligament of the Head of the Femur



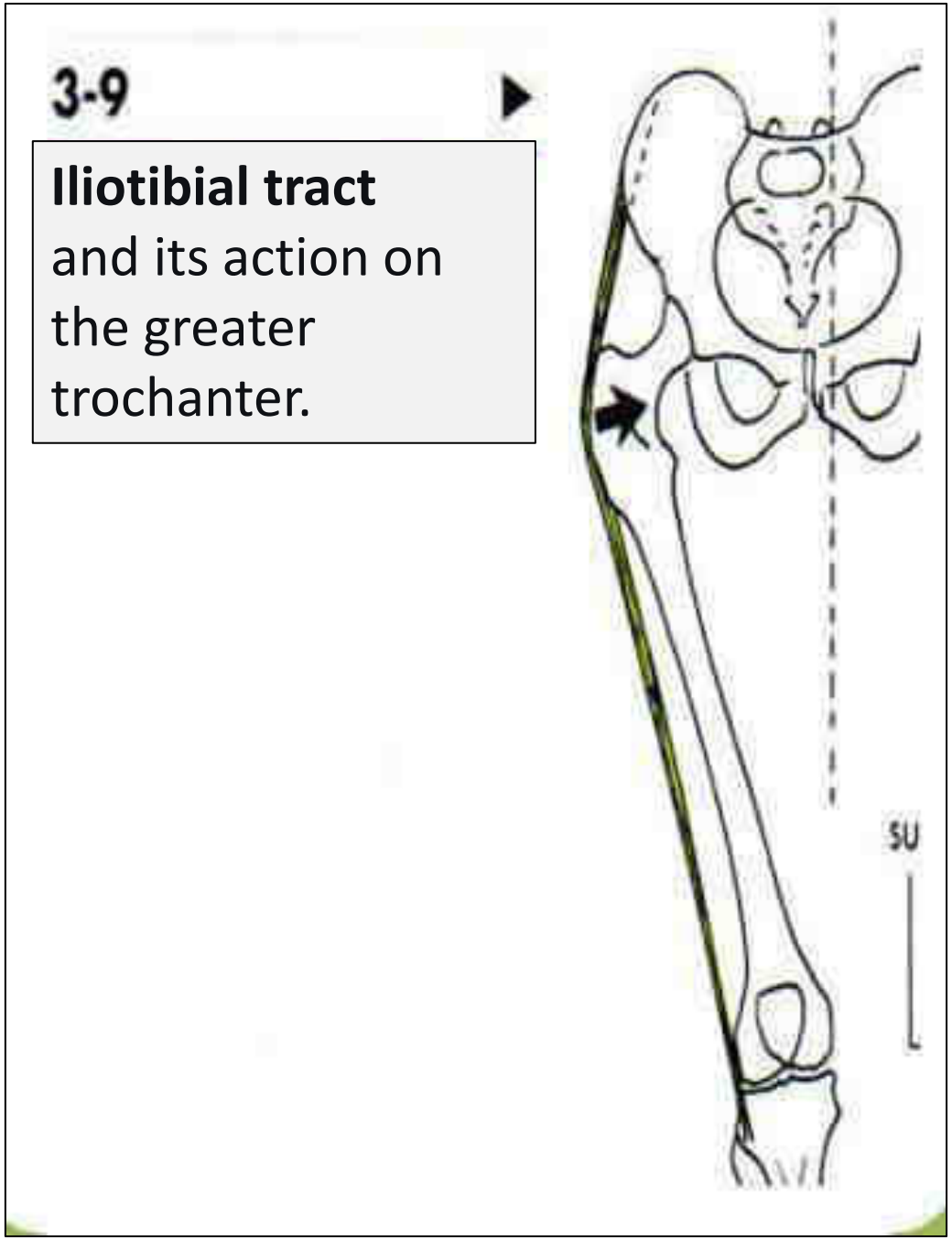
Ligament of the Head of the Femur 3
role of a guide for the artery of the head of the femur
(**Intra-capsular – extra-synovial)**
+++, Resistant and flexible
its origin at the acetabular fossa terminates in the **fovea capitis** of the femoral head
Contribution to the vascularization of the femoral head

Frontal section of the coxofemoral joint
1.capsule
2.synovial membrane
3.sheath of the ligament of the head
4.ligament of the head
5.capsular restraints





Remote ligaments: Iliotibial tract **fibrous**
Lateral fibrous stay,
Origin: iliac crest
Insertion: Tibial infracondylar tubercle
Function: Joint coaptation +++



Functional Anatomy and Active Supporting Structures

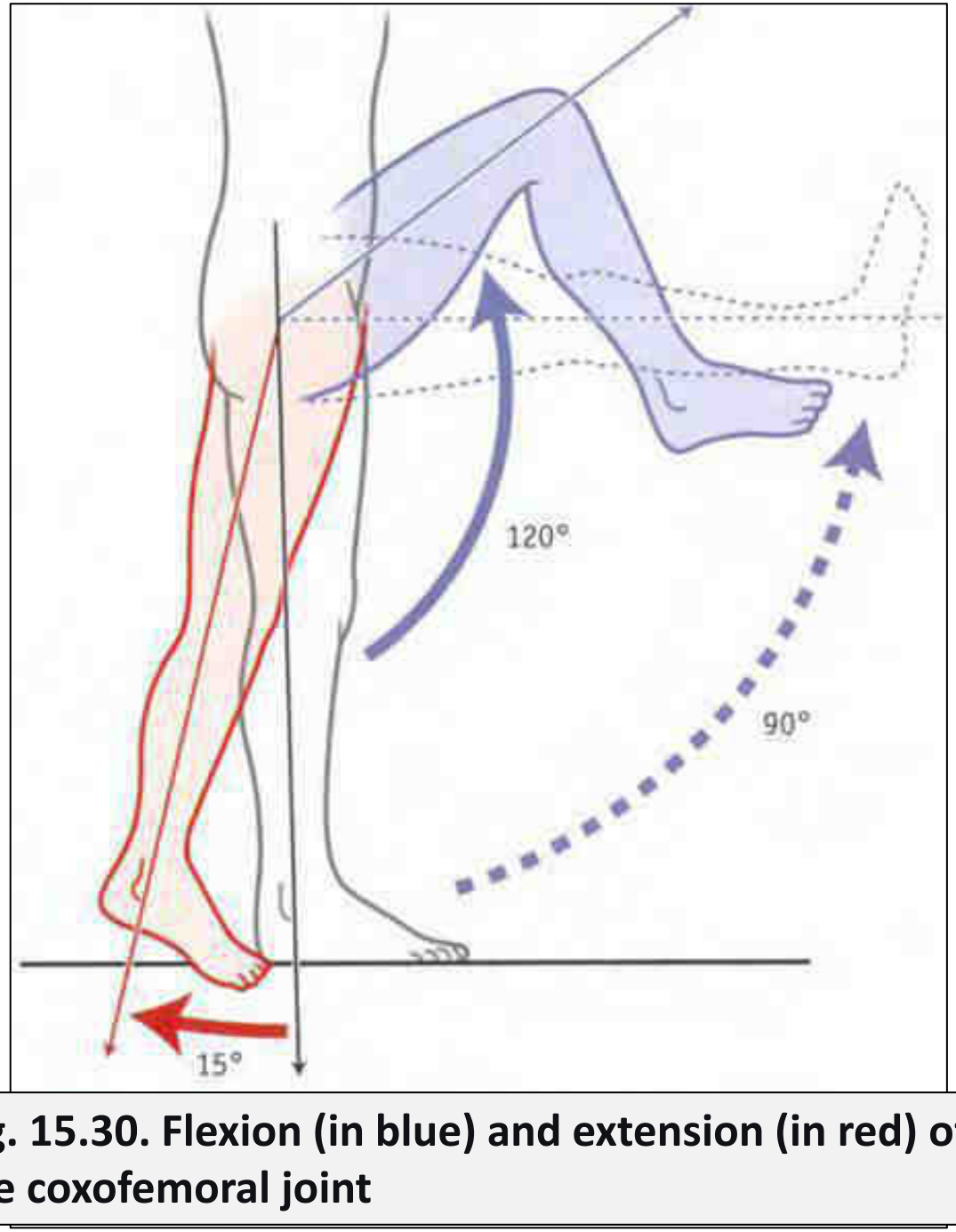


Fig. 15.30. Flexion (in blue) and extension (in red) of the coxofemoral joint

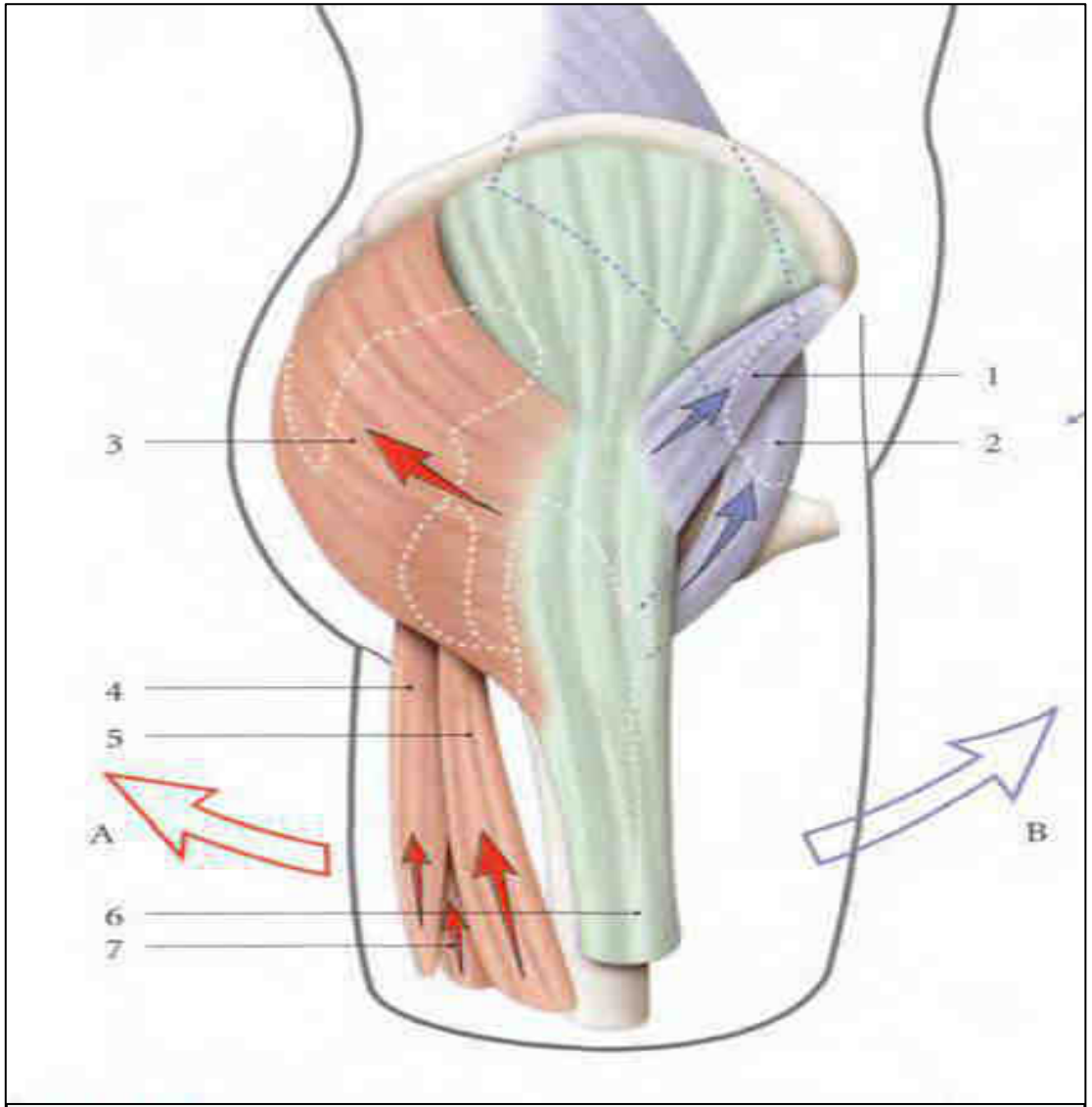


FIG. 15.31. Extensor (A) and flexor (B) muscles of the thigh

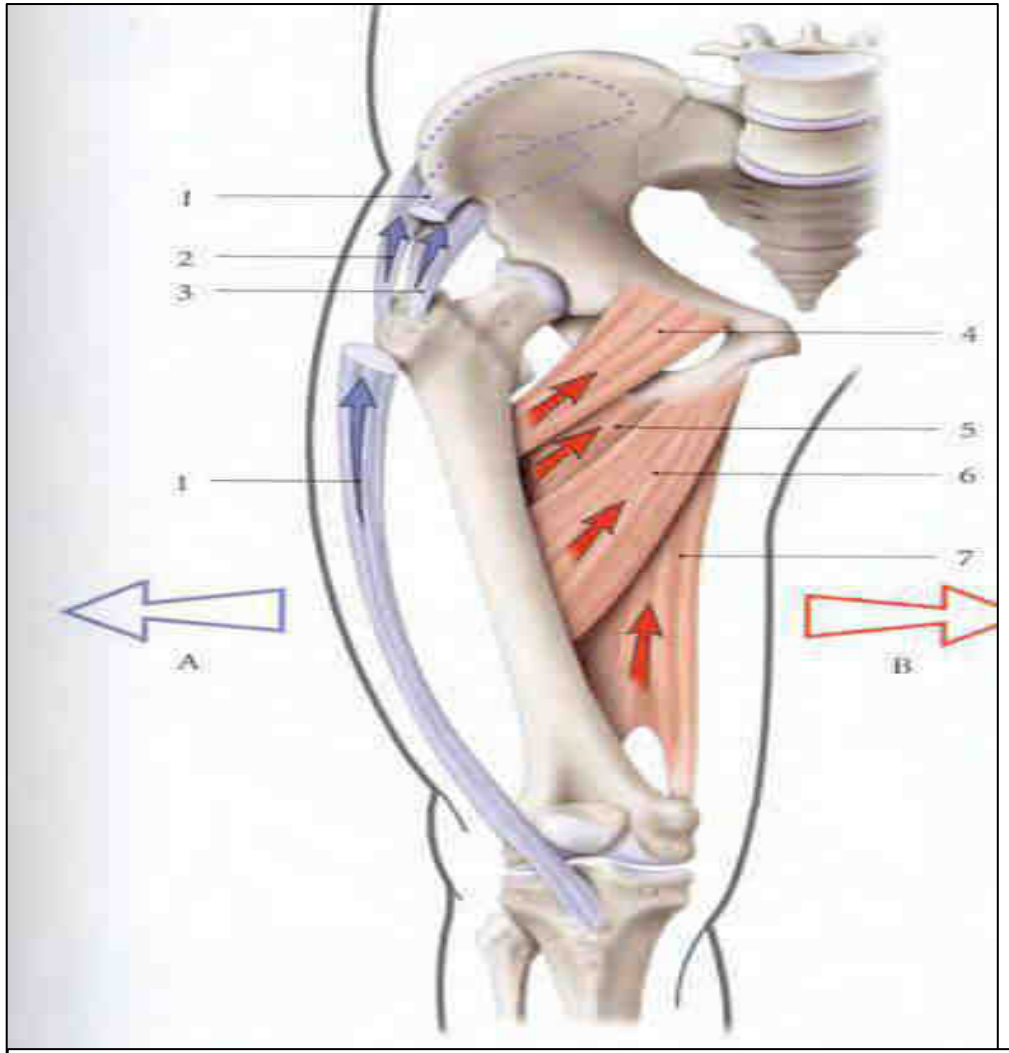


FIG. 15.32. Abduction (in blue) and adduction (in red) of the thigh

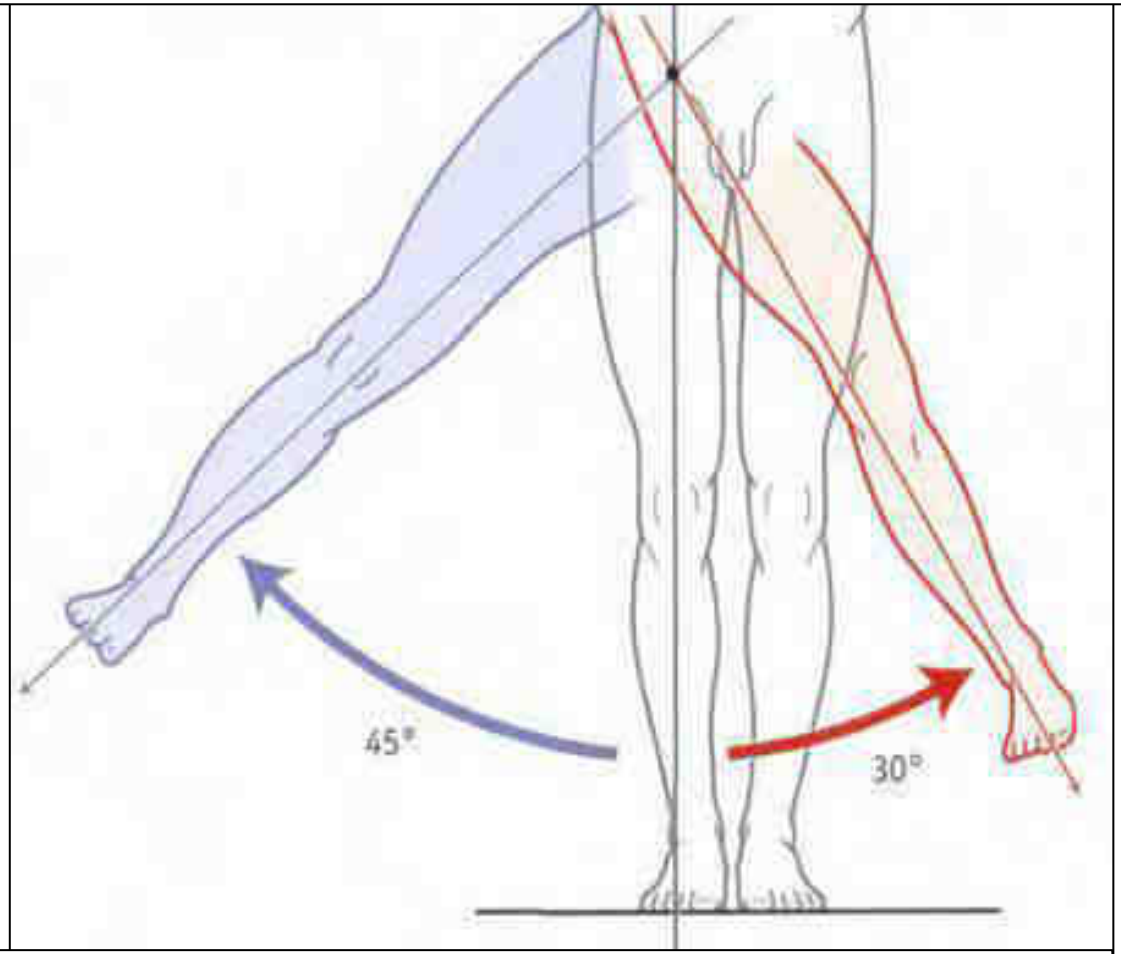
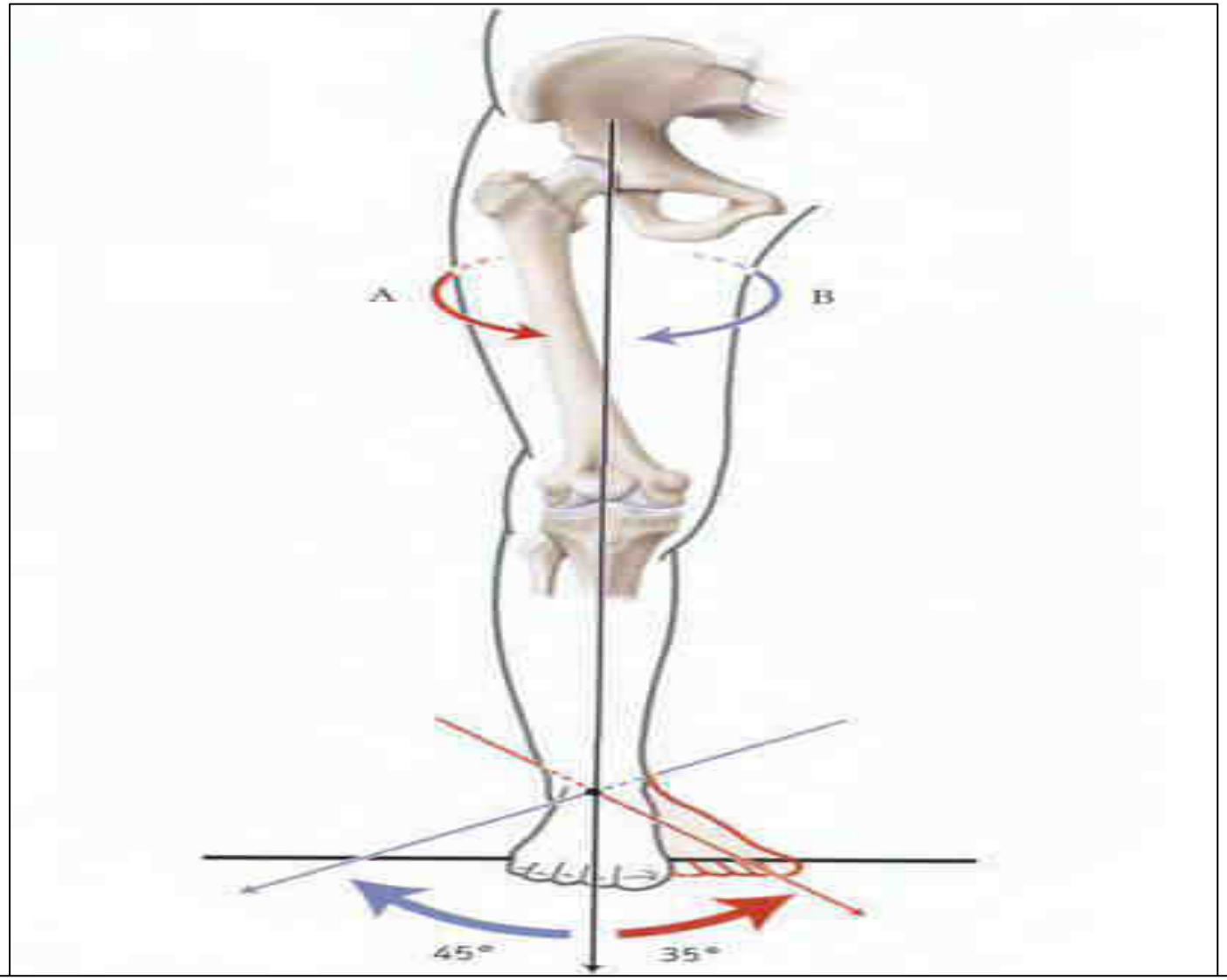


FIG. 15.33. Abductor (A) and adductor (B) muscles of the thigh



Medial rotation ***A*** and Lateral rotation ***B*** of the thigh

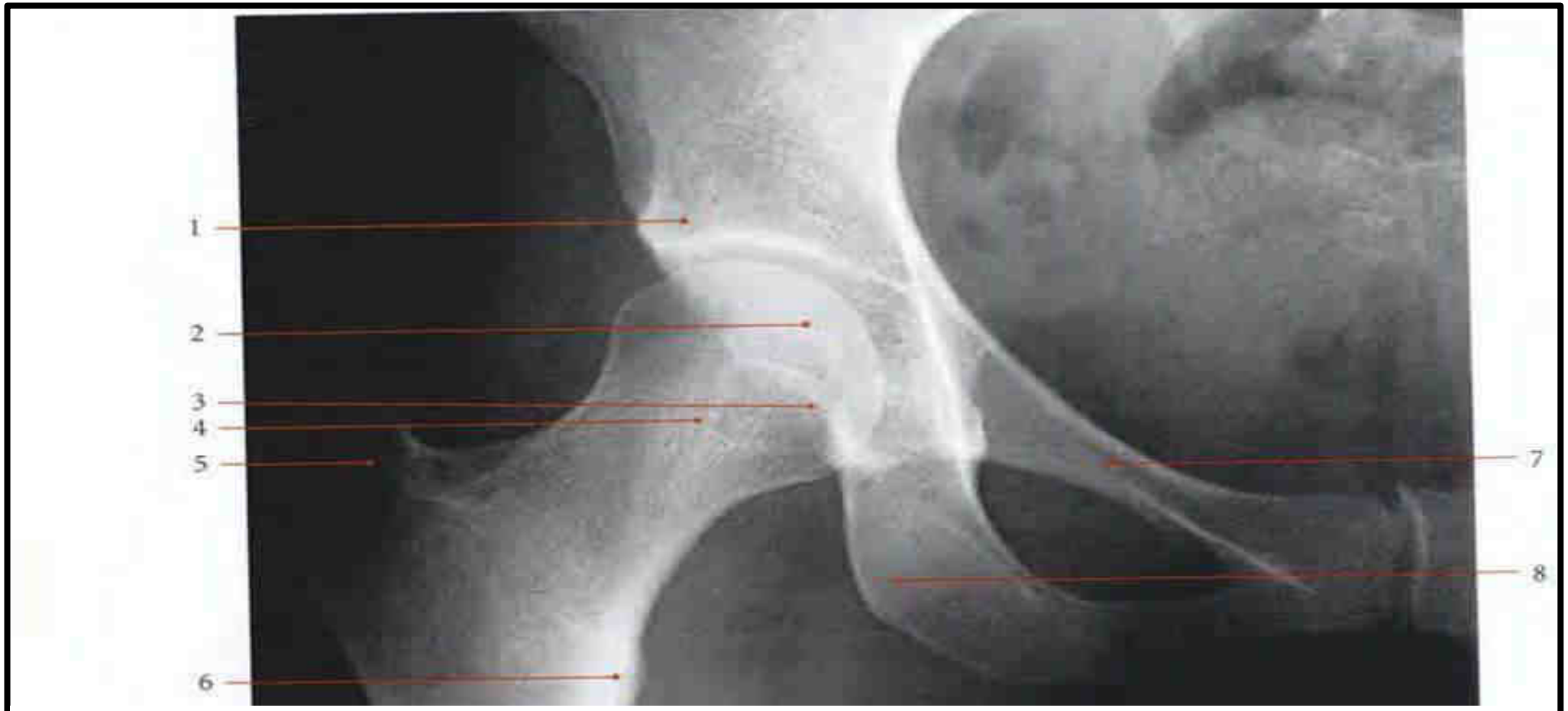


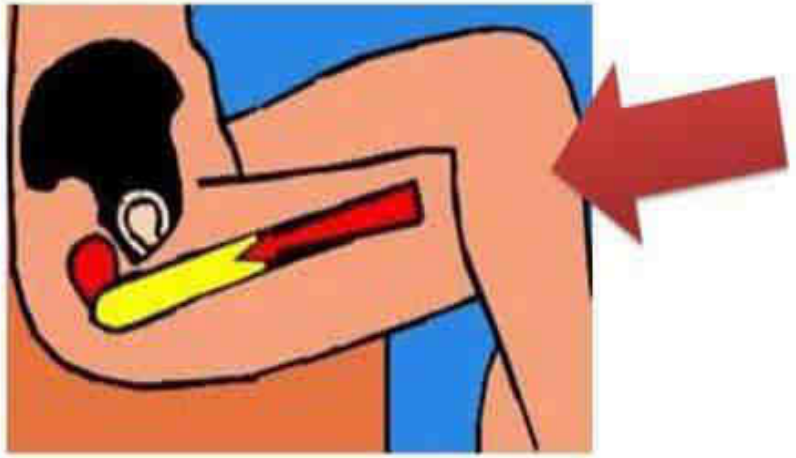
FIG. 15.16. Anteroposterior view of the coxofemoral joint (radiograph)

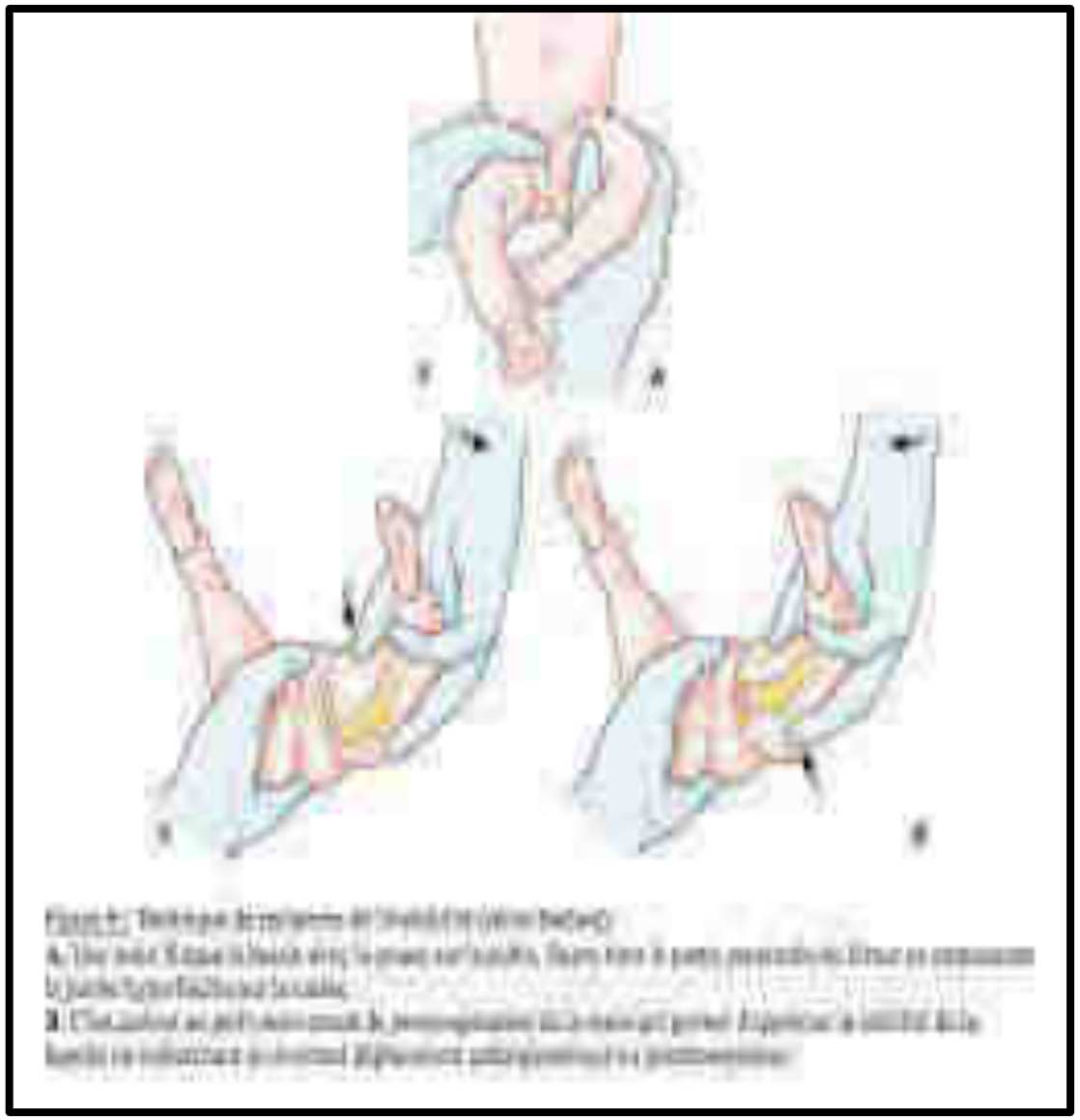
1.acetabular limbus
2.femoral head in the acetabulum
3.ant. border of the acetabulum
4.femoral neck
5.greater trochanter
6.lesser trochanter
7.superior pubic ramus
8.ischial tuberosity

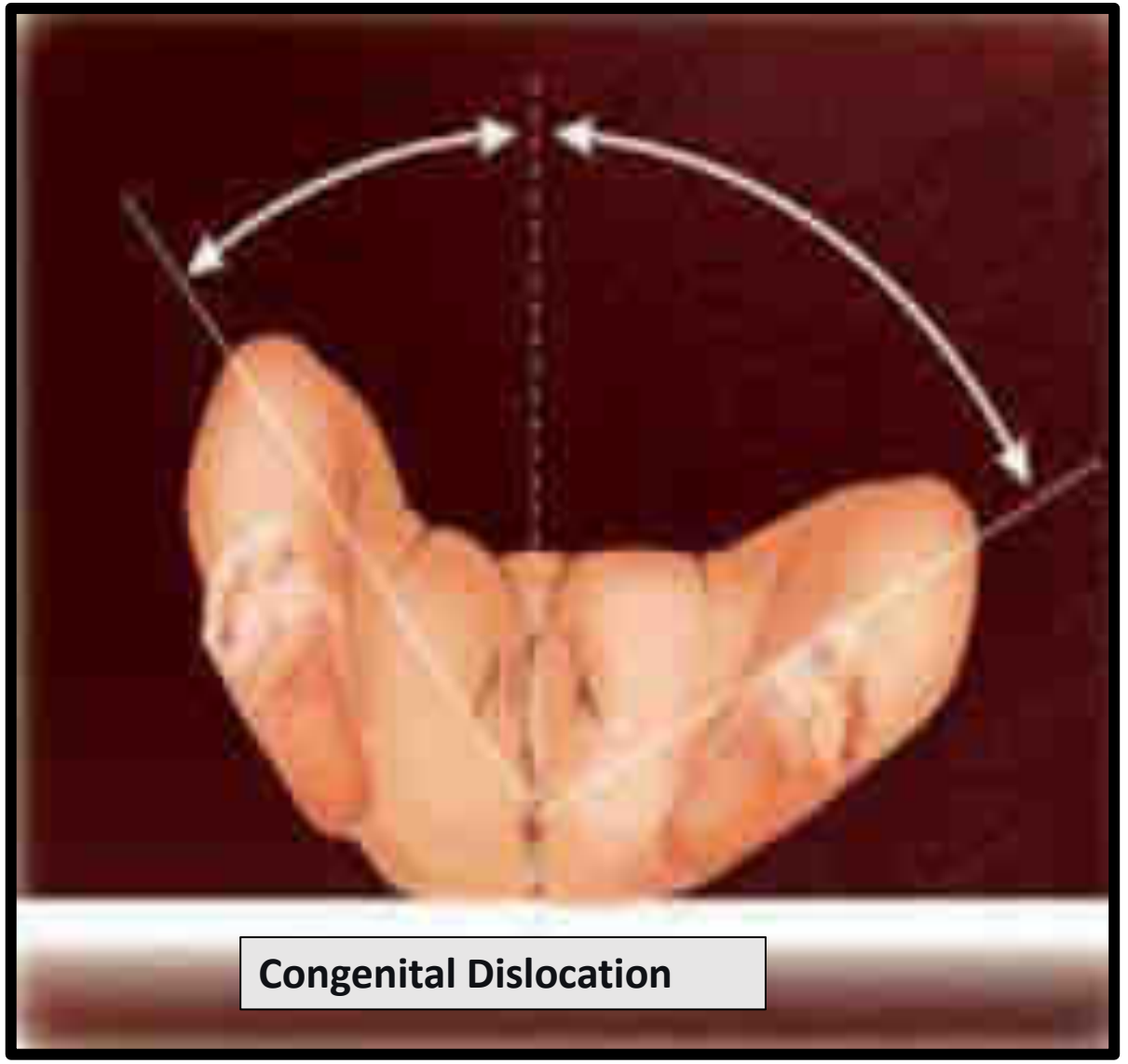
Traumatic Dislocation

Dashboard injury

(especially if the passenger's legs are crossed)



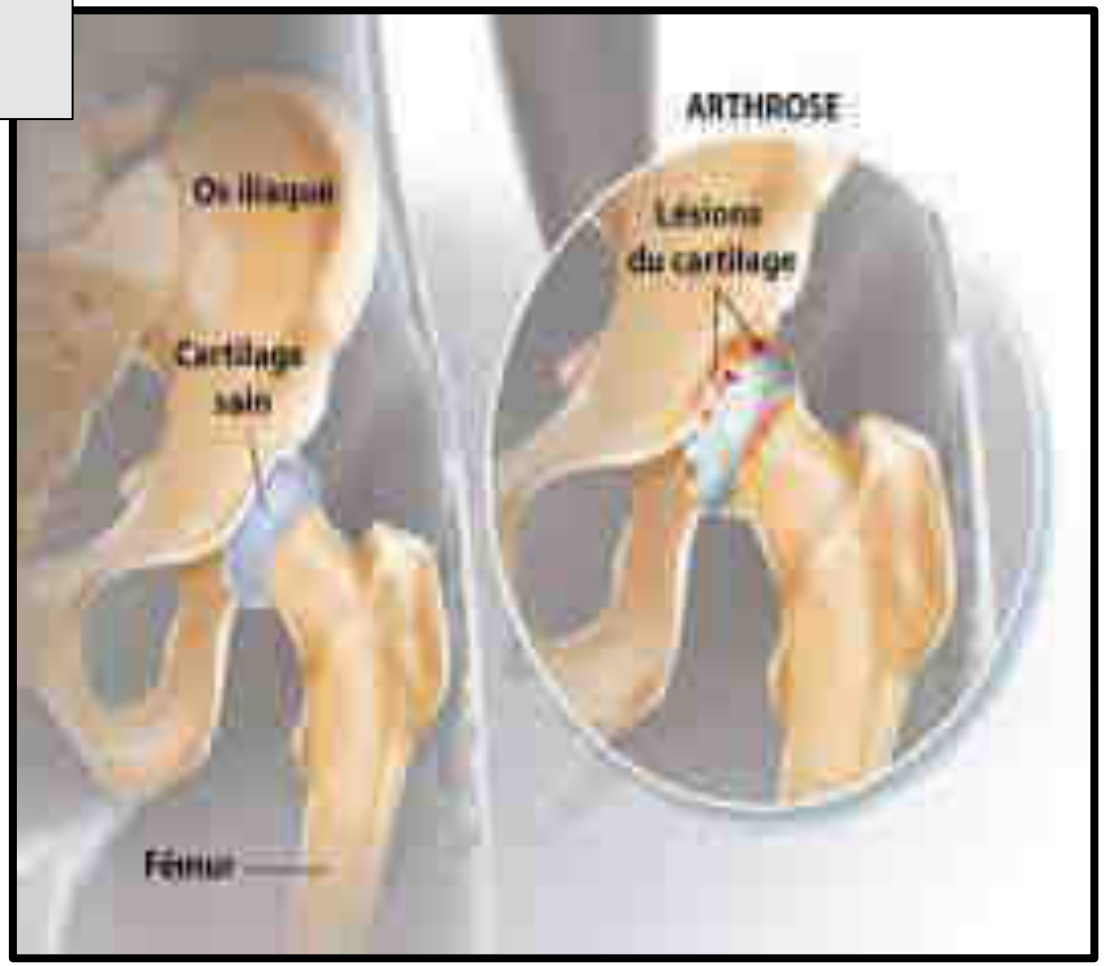


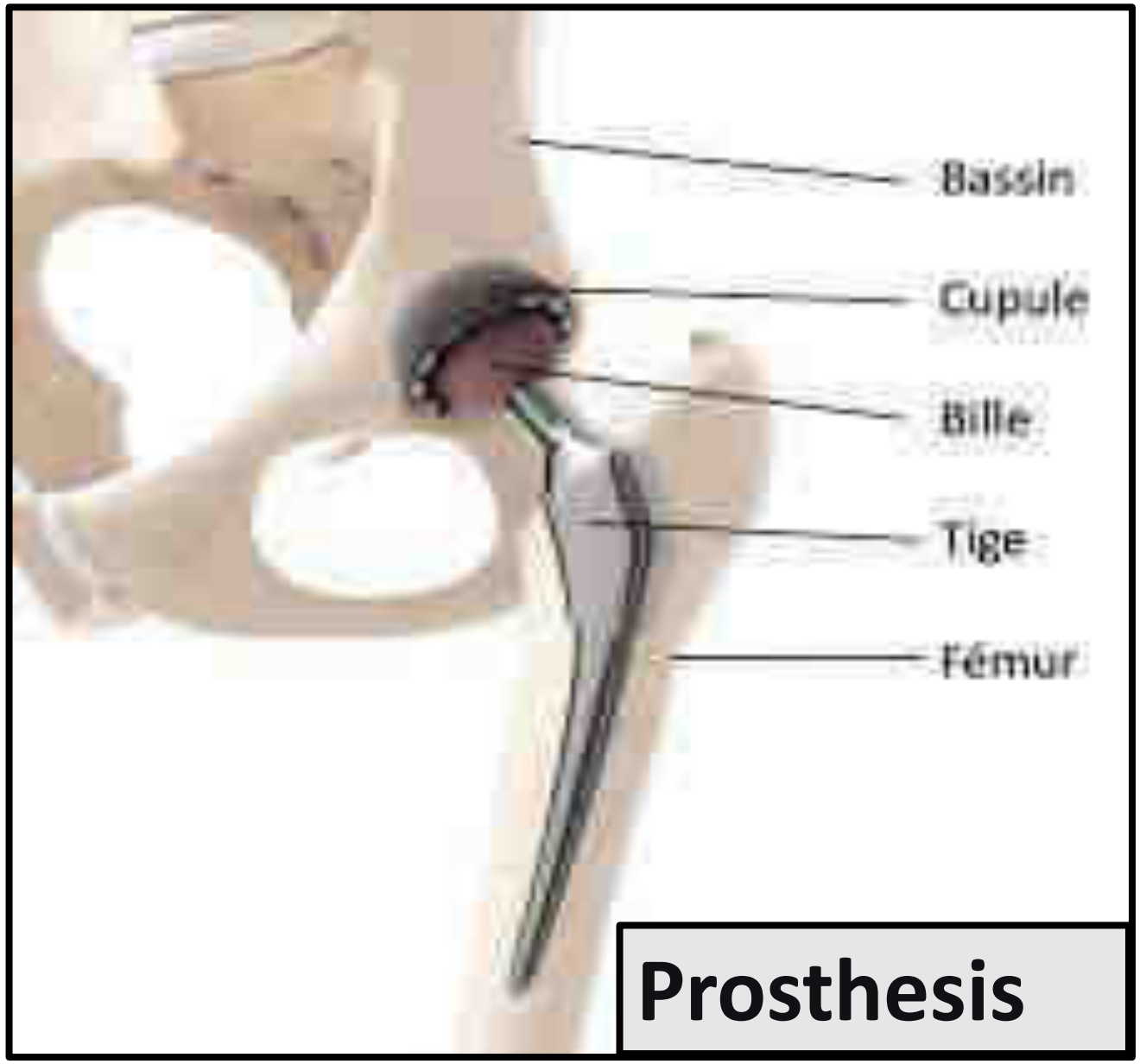


Congenital Dislocation

Inflammatory Diseases
Rheumatoid arthritis
of the hip

OSTEOARTHRITIS
Cartilage lesions



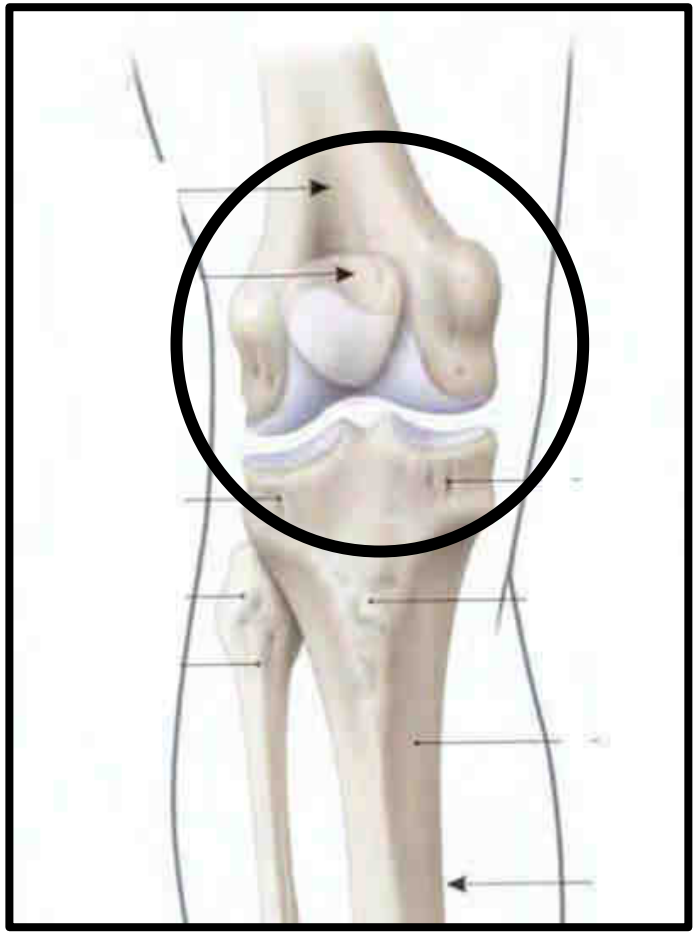


Prosthesis

The Knee Joint Complex

The Knee Joint Complex

1.Definition
2.Location
3.Descriptive Anatomy:
-Articular surfaces
-Supporting structures
-Structures facilitating gliding
4.Functional Anatomy

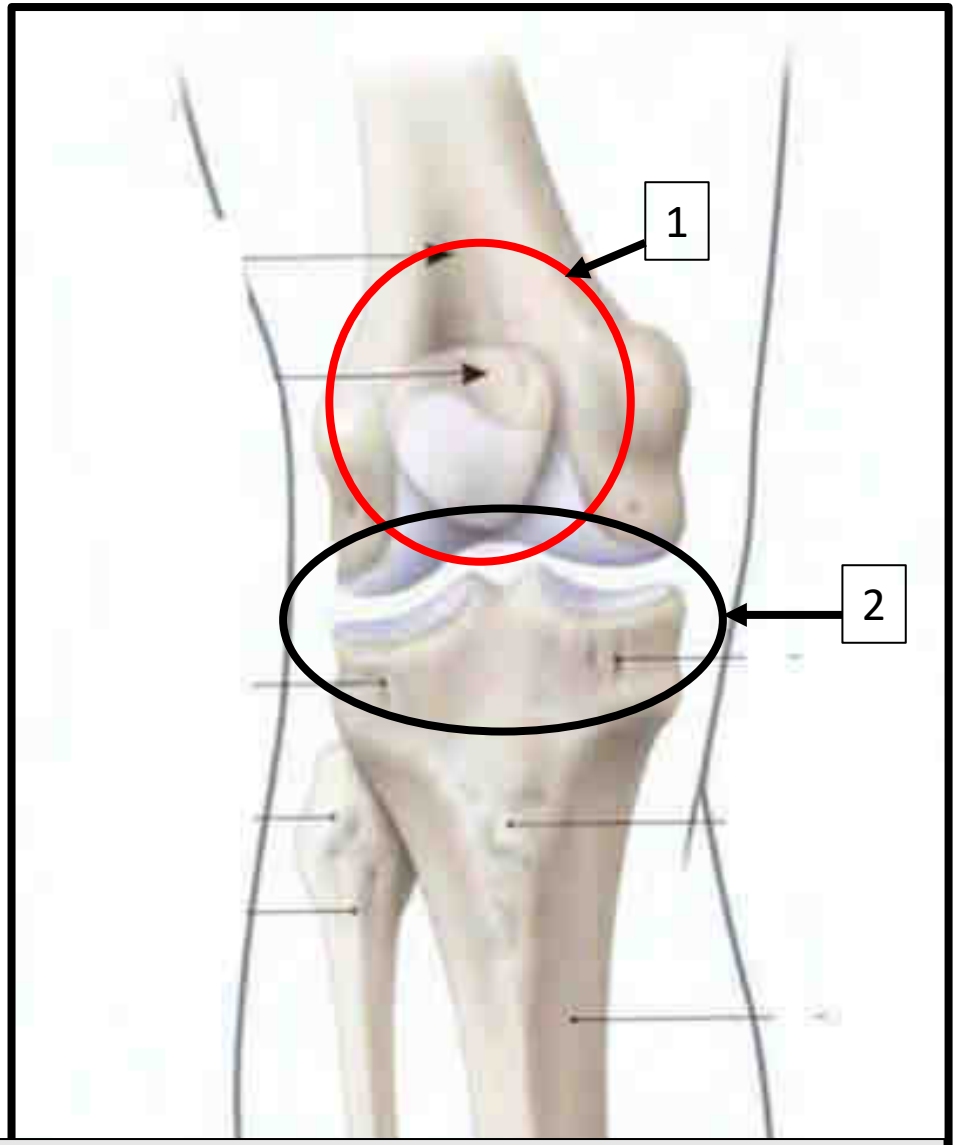


1) Definition

-**The knee** is a large, superficial, synovial, intermediate, weight-bearing and **stable joint**.

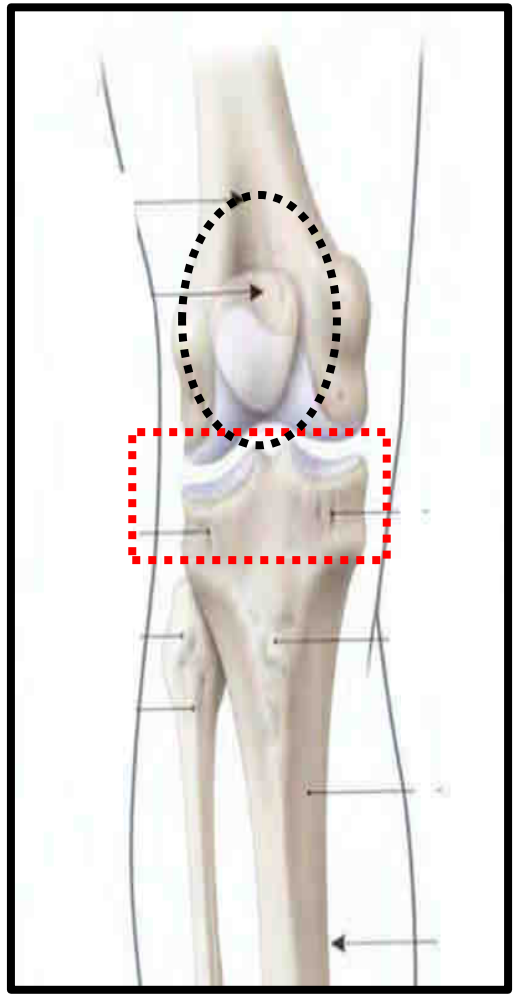
-It connects the thigh and the leg

-The knee is composed of two joints inseparable anatomically and functionally, they are contained within the same articular capsule



The femoropatellar joint is trochlear 1
The femorotibial joint is bicondylar 2

2-Articular Surfaces



patellar surface

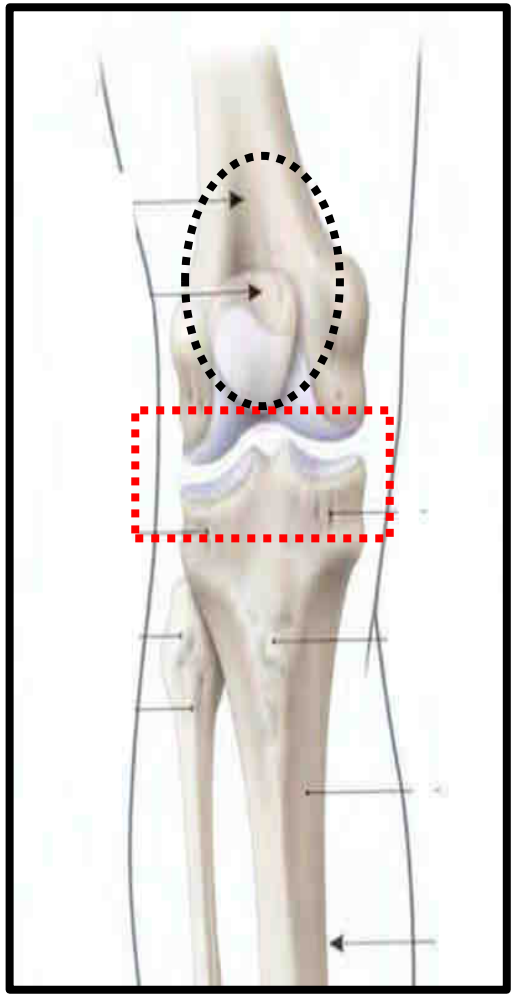
Femoral trochlea

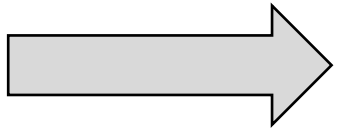
FEMORAL CONDYLES

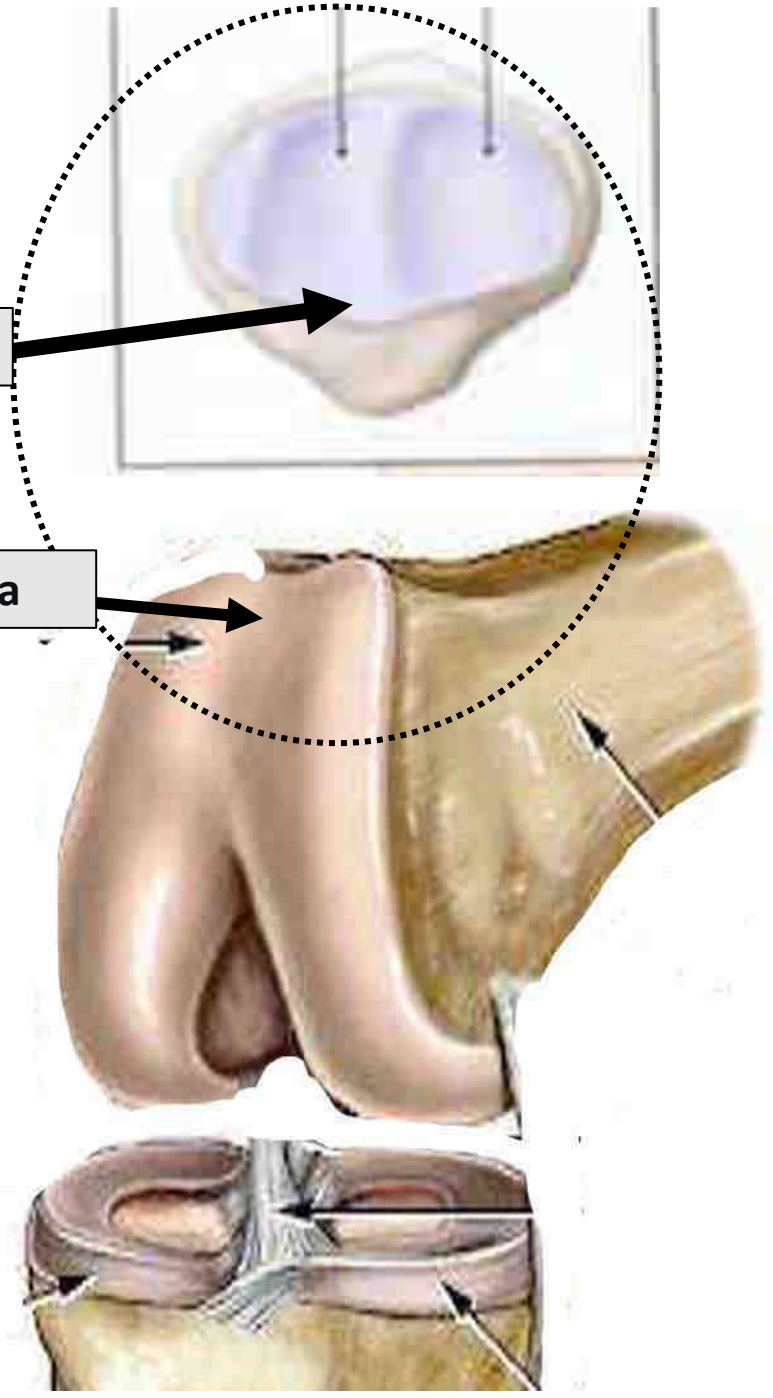
The menisci

The glenoid cavities

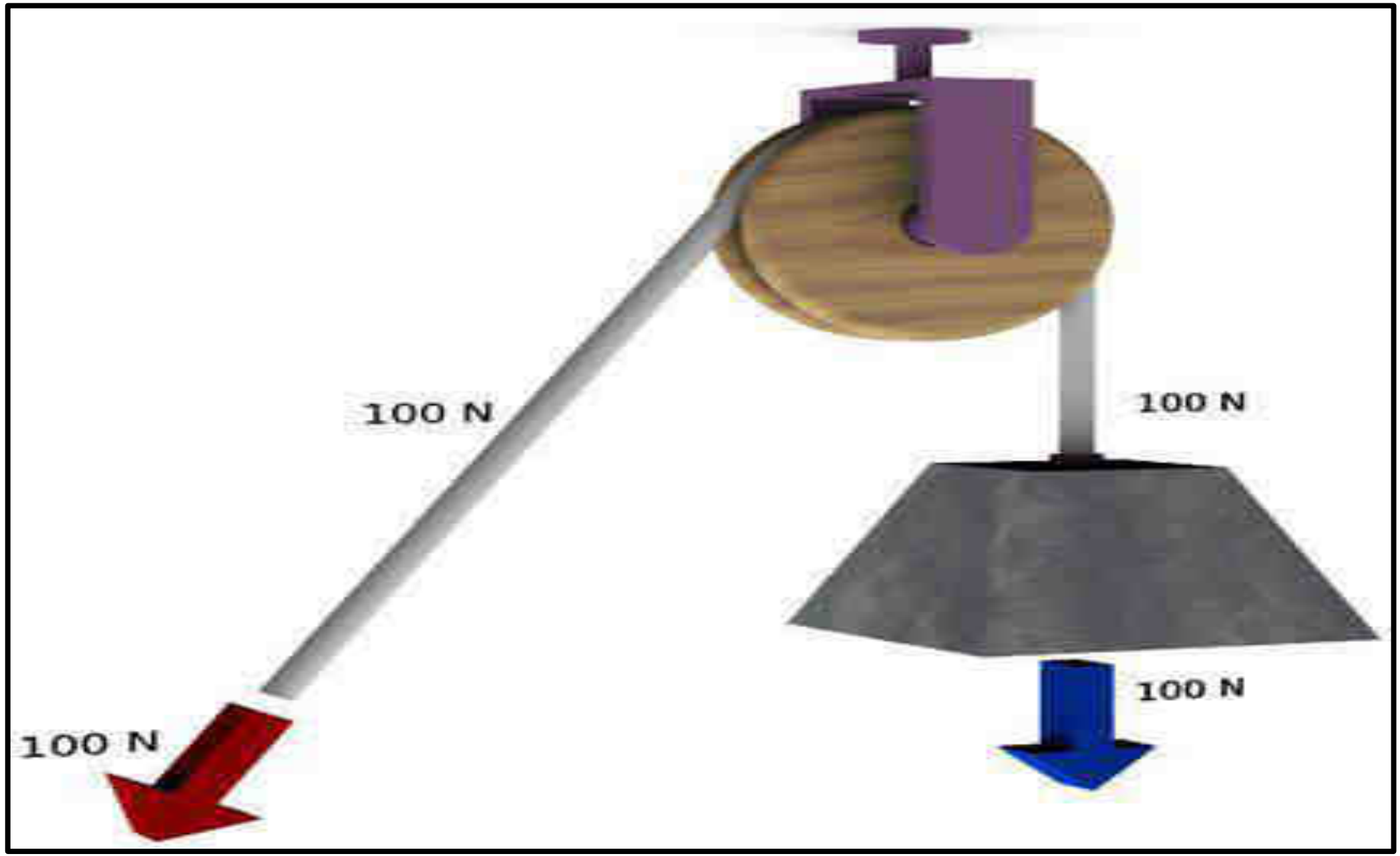
The femoropatellar joint is trochlear
The femoral articular surface is located on the posterior surface of the patella which is articular in its **superior 2/3**, corresponds to **the femoral trochlea**.







The trochlea is located on the anterior surface of the distal end of the **femur**. It articulates with the posterior surface of the patella. Its lateral facet is more extensive than the medial one


100 N
100 N
100 N
100 N

The femorotibial joint is bicondylar

The Femoral Condyles 1

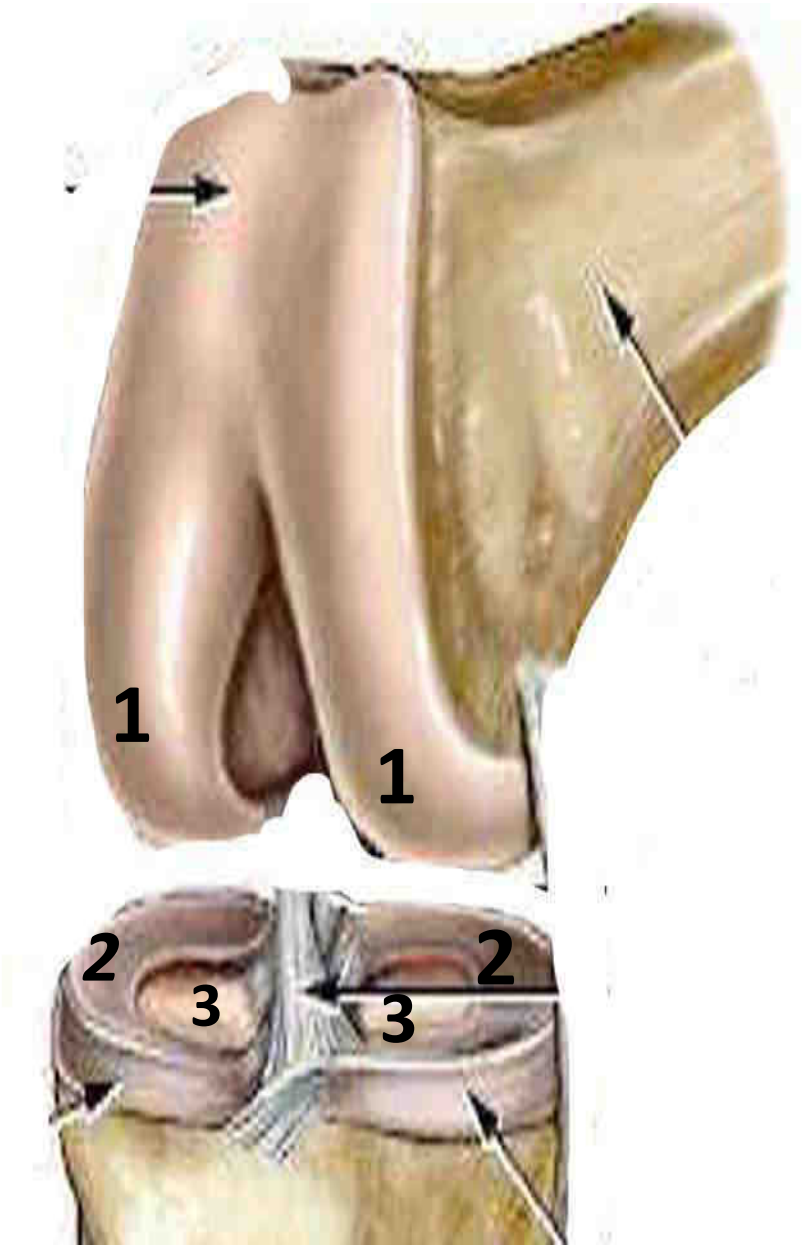
There are two, the **medial condyle and** the **lateral condyle**. They present a curved articular surface rolled upon itself which articulates: – Inferiorly: **with the menisci and the tibial glenoid cavities.**

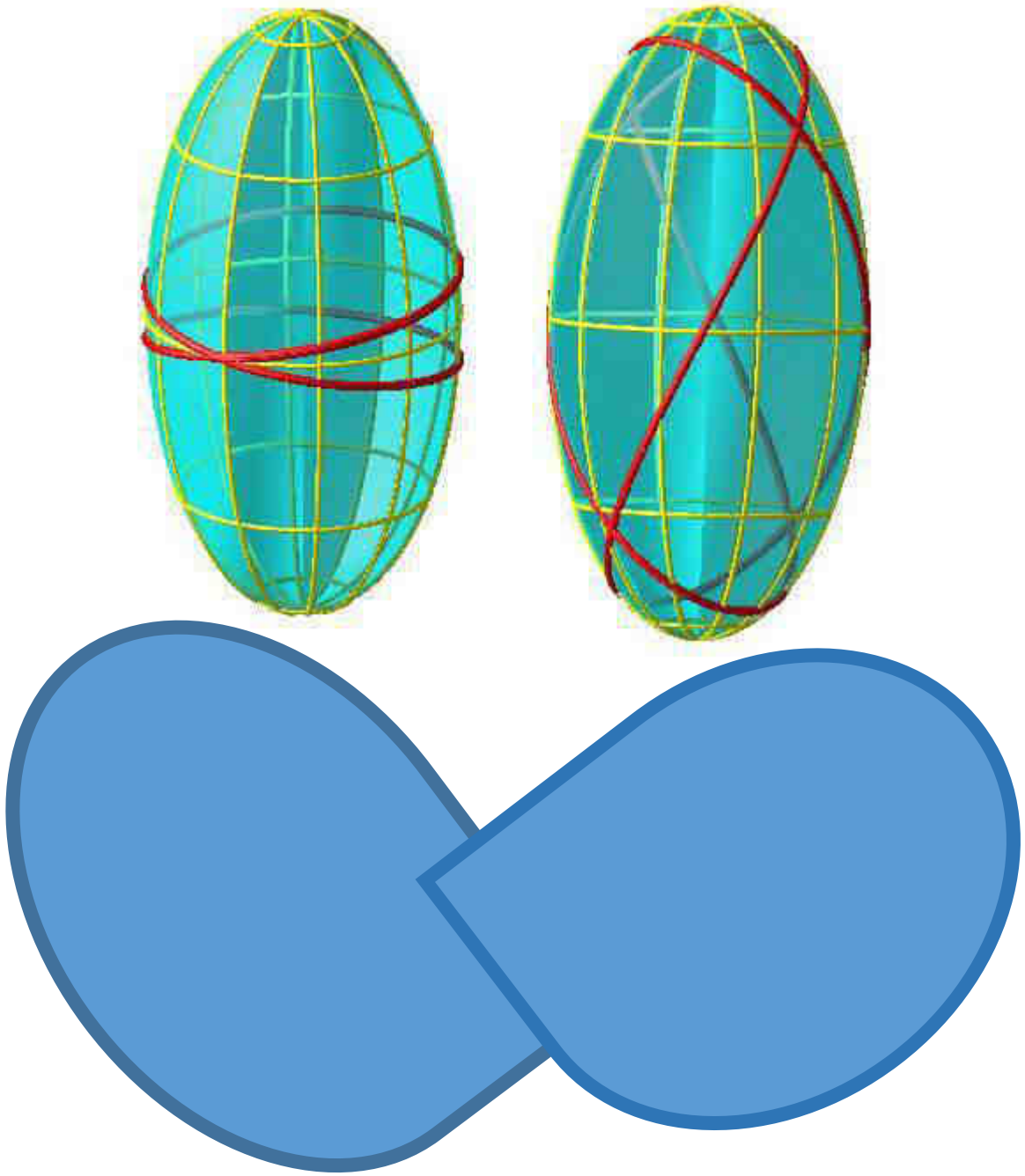
The Menisci 2

These are **intra-articular semilunar fibrocartilages** interposed between the **femoral condyles and the tibial plateaus. Lined with cartilage**

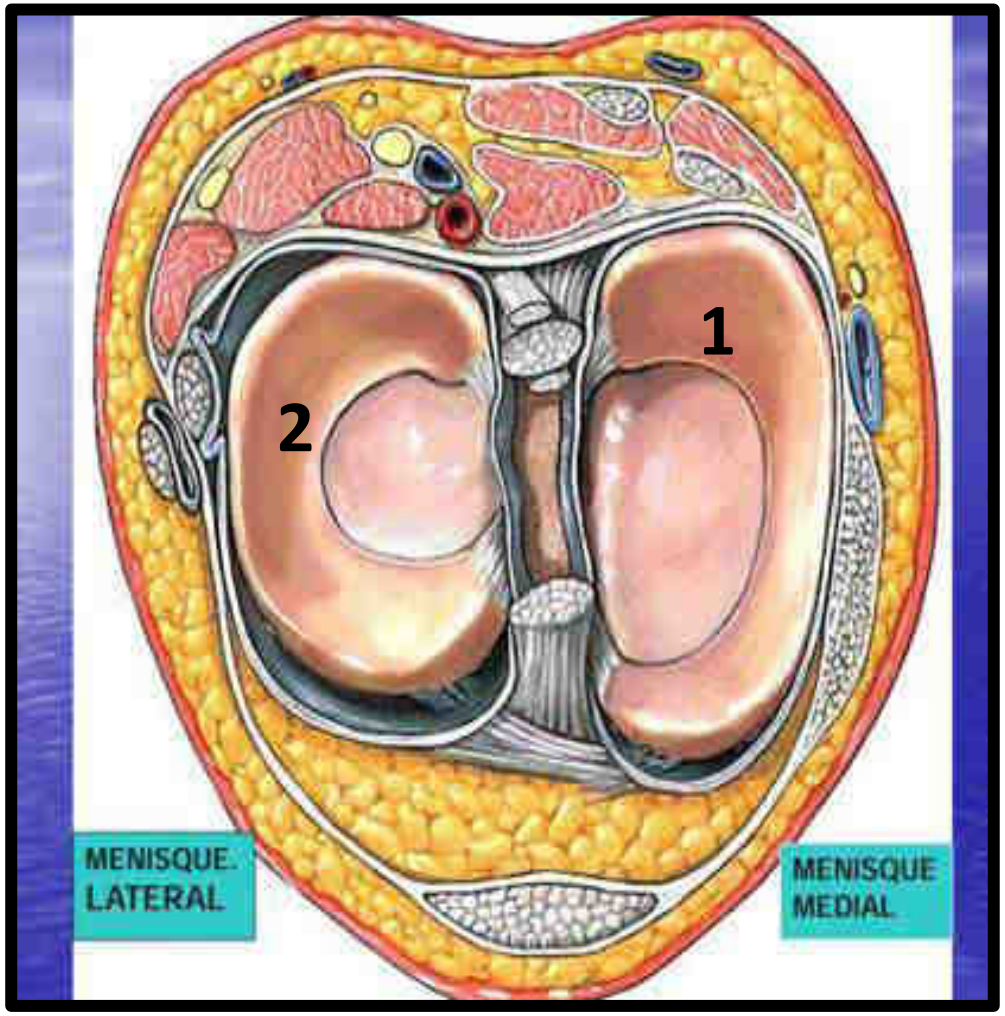
The Glenoid Cavities 3

which articulate with **the menisci and the femoral condyles.**





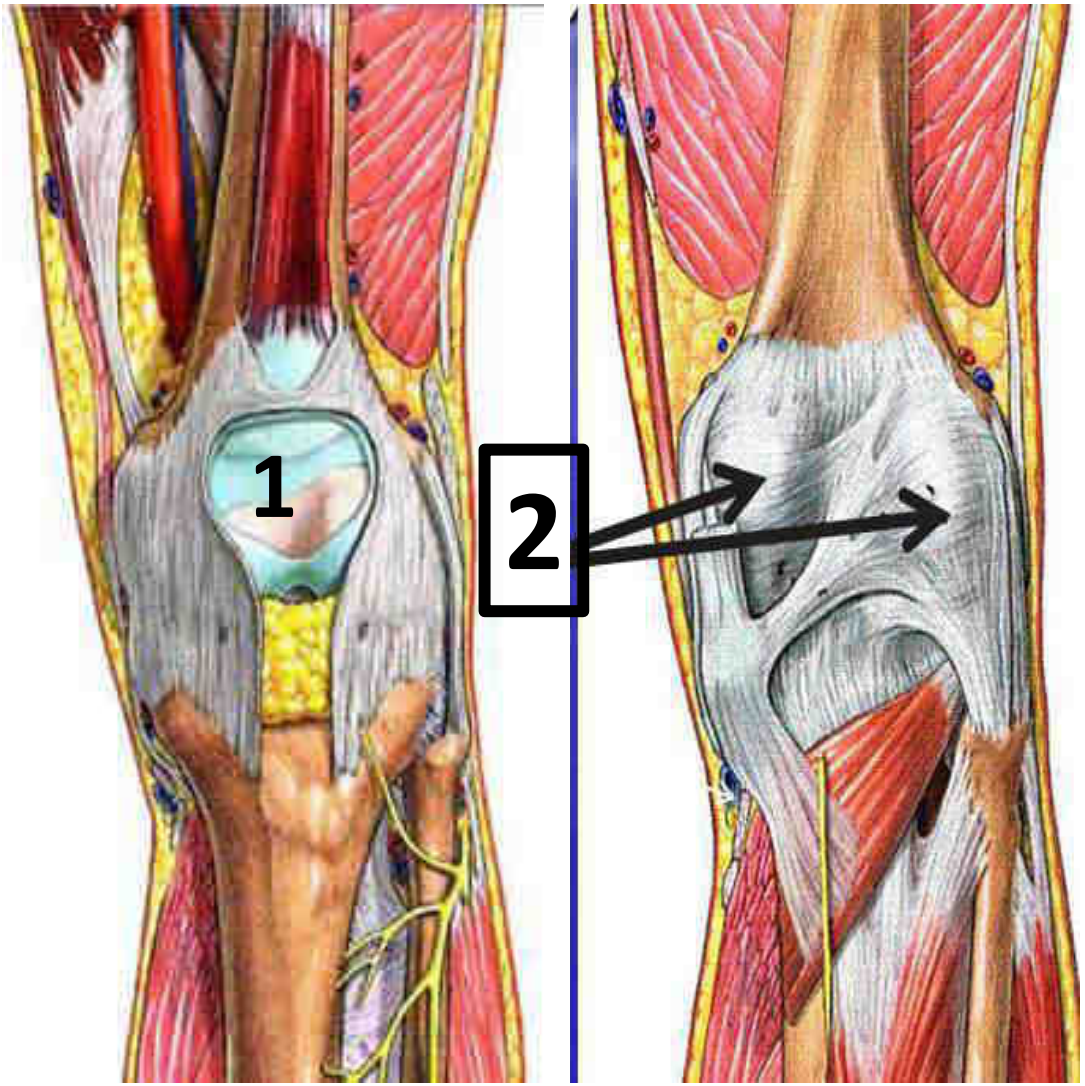
The menisci 2 are two in number, a medial one shaped like a "C" and a lateral one shaped like an "O".
The role of the **menisci** is to increase the concavity of the **tibial plateaus.**
LATERAL MENISCUS **2**
MEDIAL MENISCUS **1**



3-SUPPORTING STRUCTURES

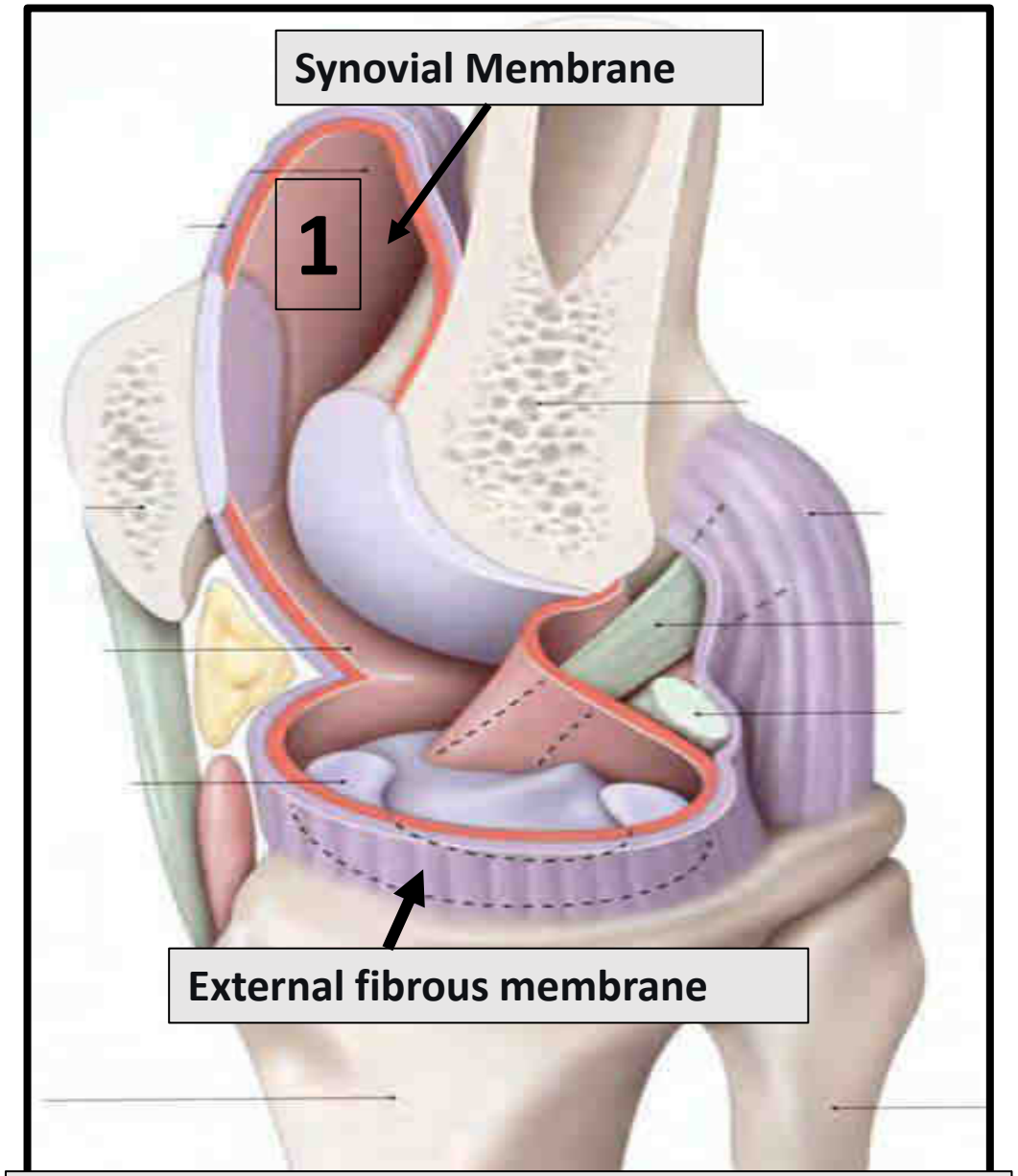
1-The Articular Capsule

It is a **fibrous sleeve** that connects the articular surfaces.
It presents an anterior window 1 in which the patella sits.
Laterally, the capsule adheres to the peripheral surface of the **menisci**.
Posteriorly, the capsule is thickened opposite the femoral condyles to form the **condylar shells 2**.



Anterior view **Posterior view**

Synovial Membrane : secretes Synovial Fluid nourishes cartilage by imbibition. It lines the deep surface of the capsule; and forms an important anterior recess which is the quadriceps pouch 1.



Knee joint. Schematic aspect of the capsule

The passive ligaments

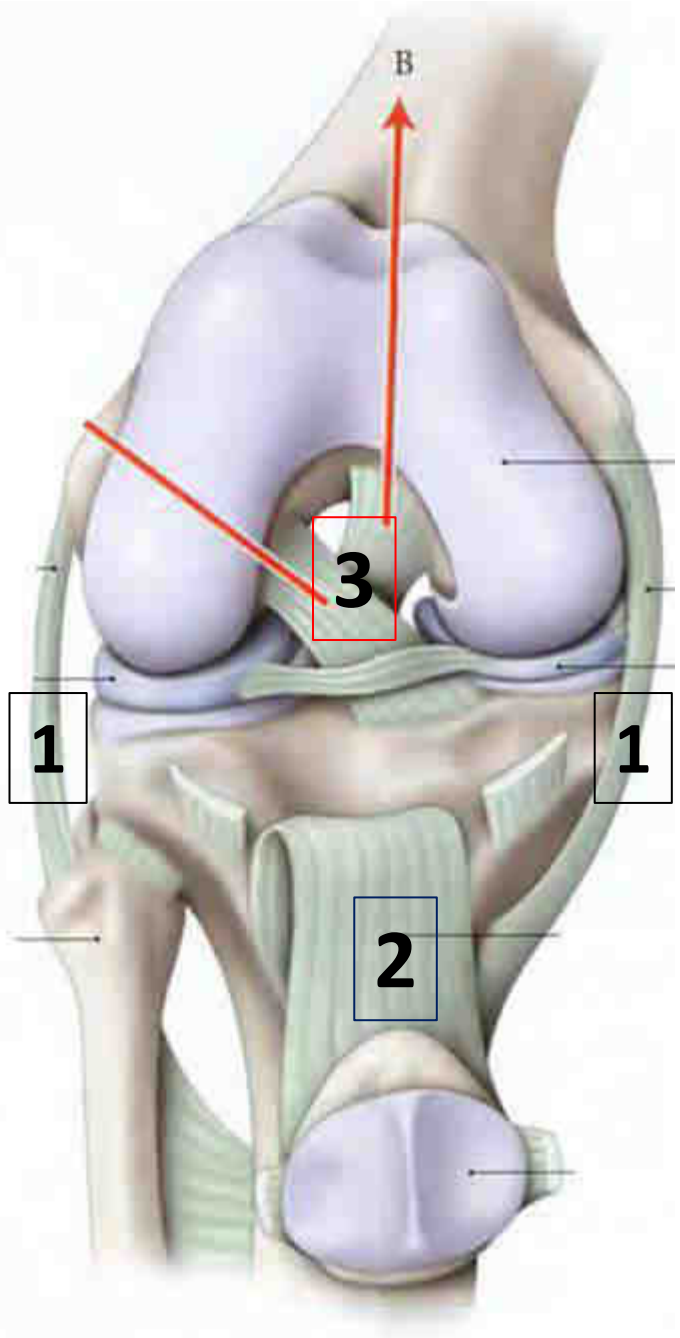
•They ensure the stability of the knee joint which is superficial and exposed to trauma, especially in athletes.

•They form three systems

The collateral system 1

The sagittal system 2

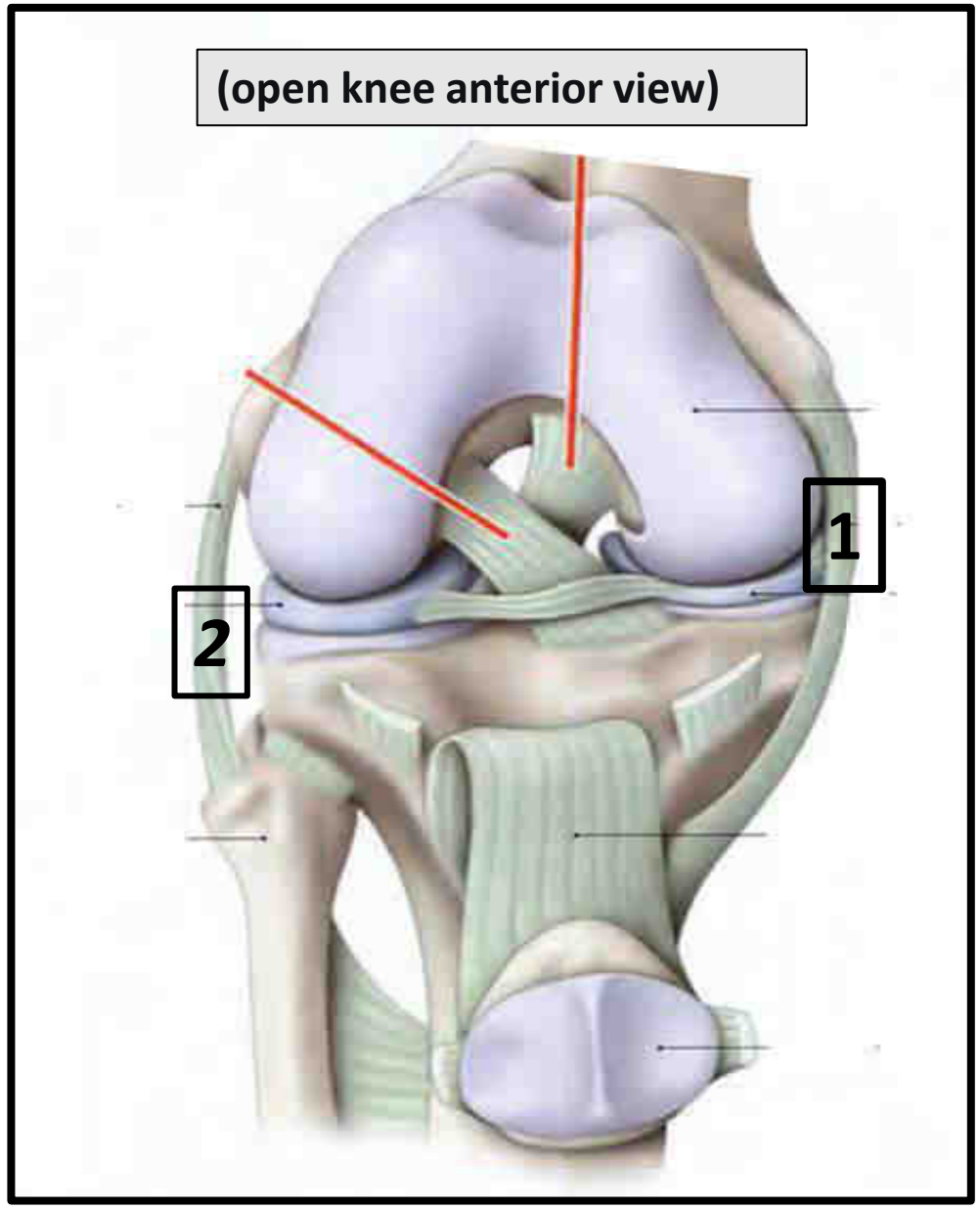
The central pivot (the cruciate ligaments) 3

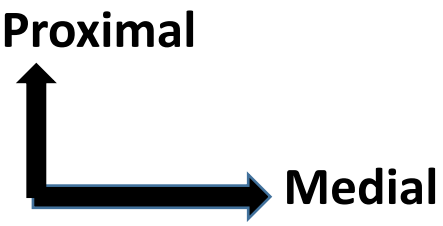


1-The Collateral System

They ensure the **lateral stability of the knee**.
•Injury to this system results in **lateral movement (laxity)**, sought clinically.

Medial collateral ligament (MCL) 1
Lateral collateral ligament (LCL) 2





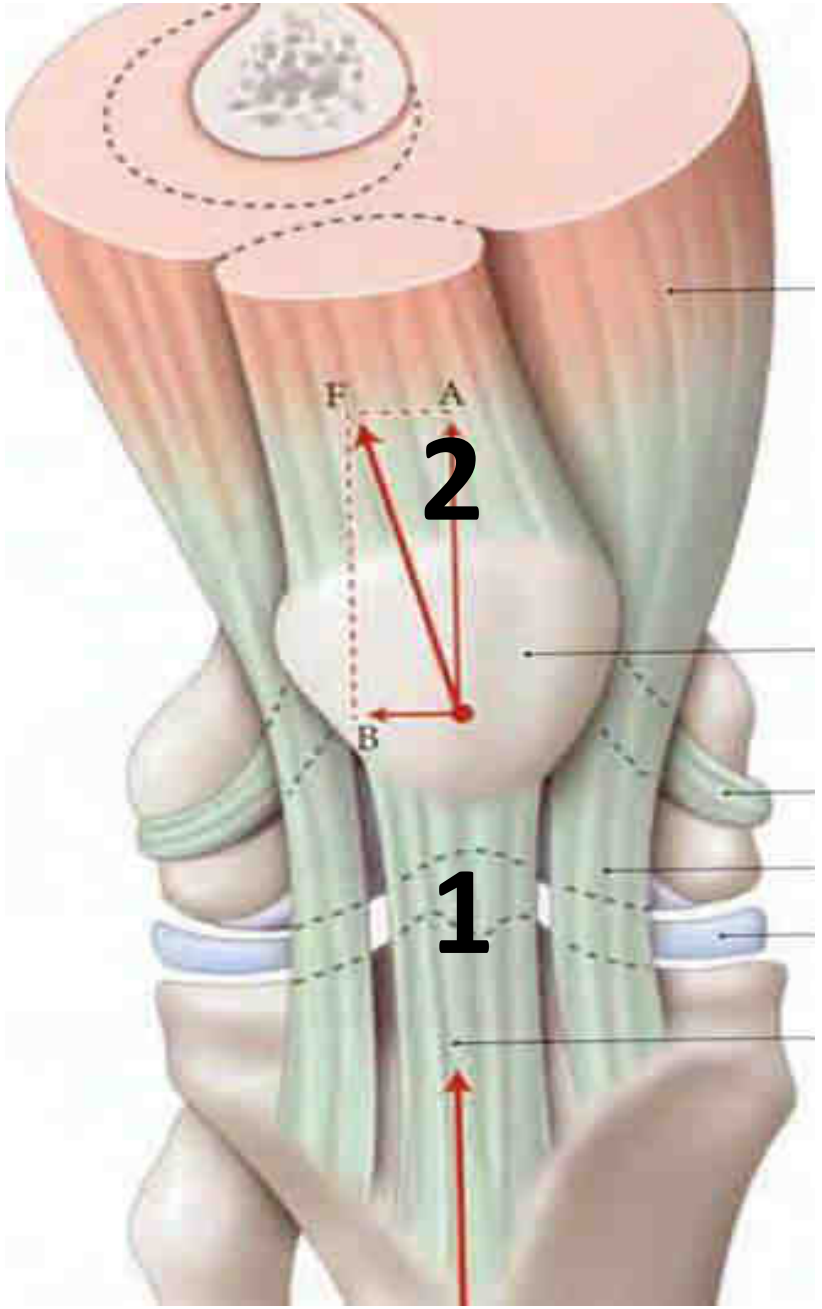
2-The Sagittal System

It includes:

Anteriorly

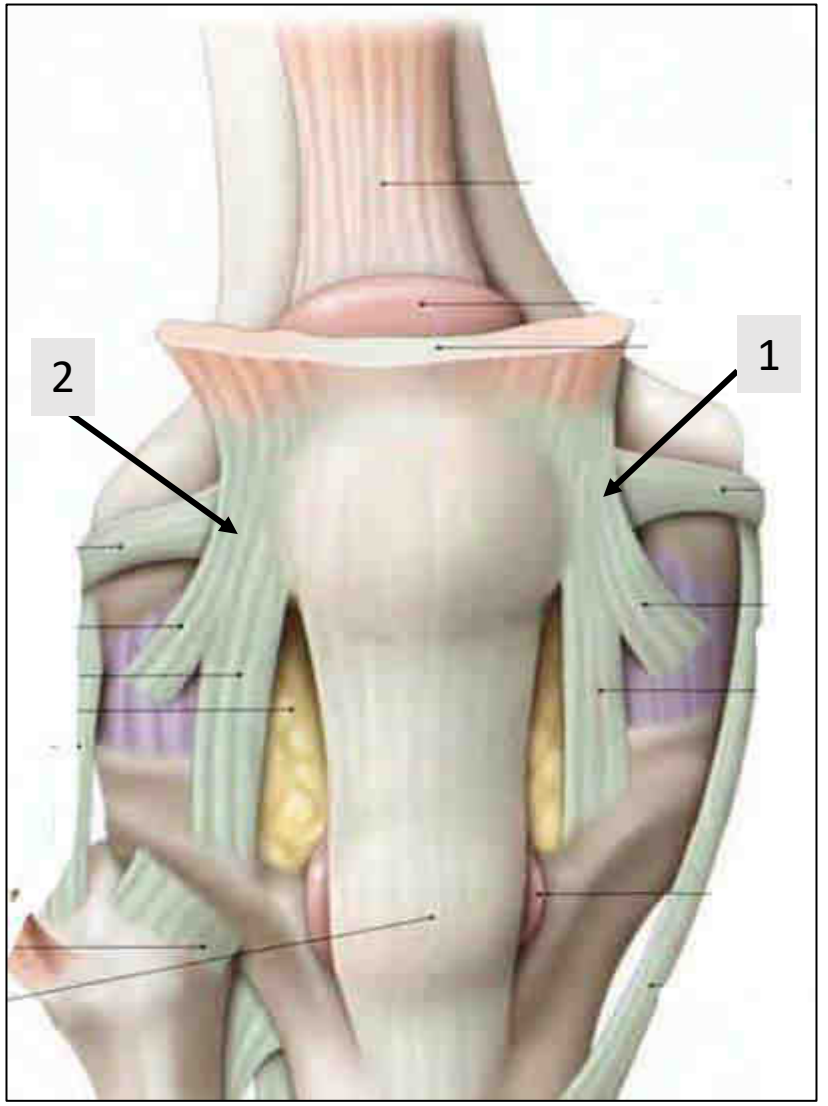
-**the Patellar ligament 1**, inseparable from the quadriceps tendon **2**; extends from the patellar apex to the anterior tibial tuberosity.

-**the quadriceps tendon 2** which continues as the patellar ligament 1. Thus is formed the **knee extensor mechanism** composed of: the quadriceps muscle, the patella and the patellar tendon.



Medial patellar retinaculum 1
Lateral patellar retinaculum 2

The Patella receives ligaments which are the retinacula, expansions from the lateral and medial side of the m. Quadriceps tendon



Proximal

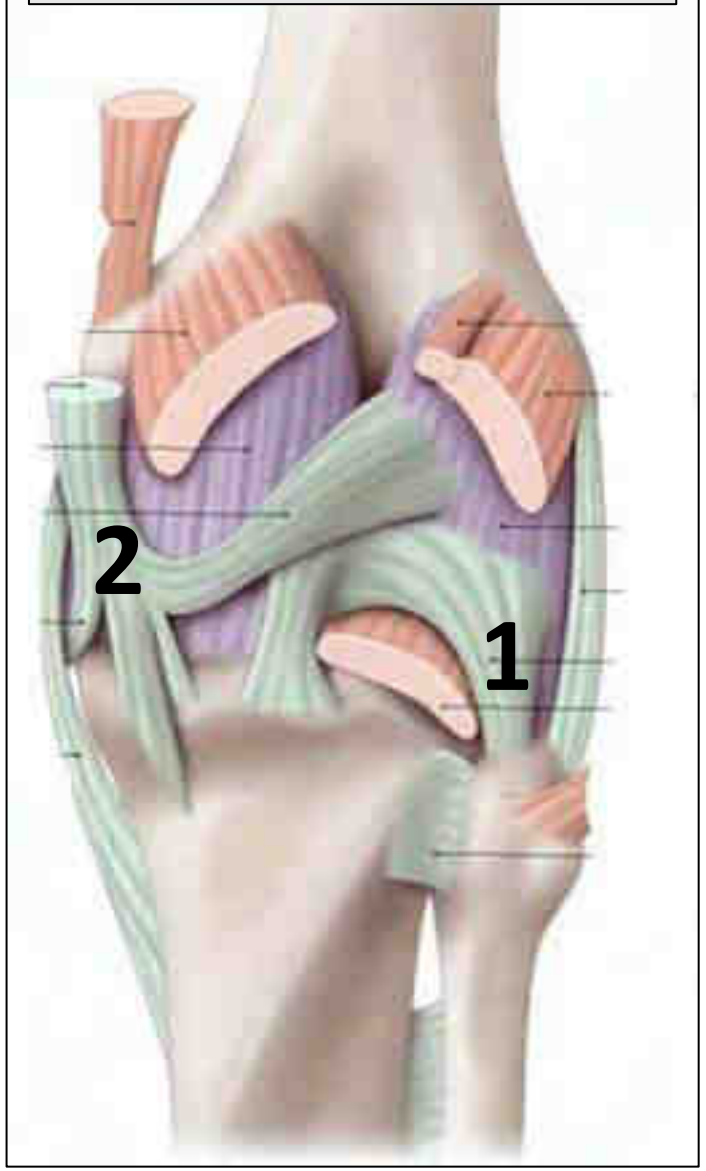
Medial

Posteriorly

The Arcuate Ligament 1
extends from the fibular head in a fan shape to insert on the lateral condylar shell.

The Oblique Popliteal Ligament 2
detaches from the lateral border of the tendon **of the semimembranosus muscle**

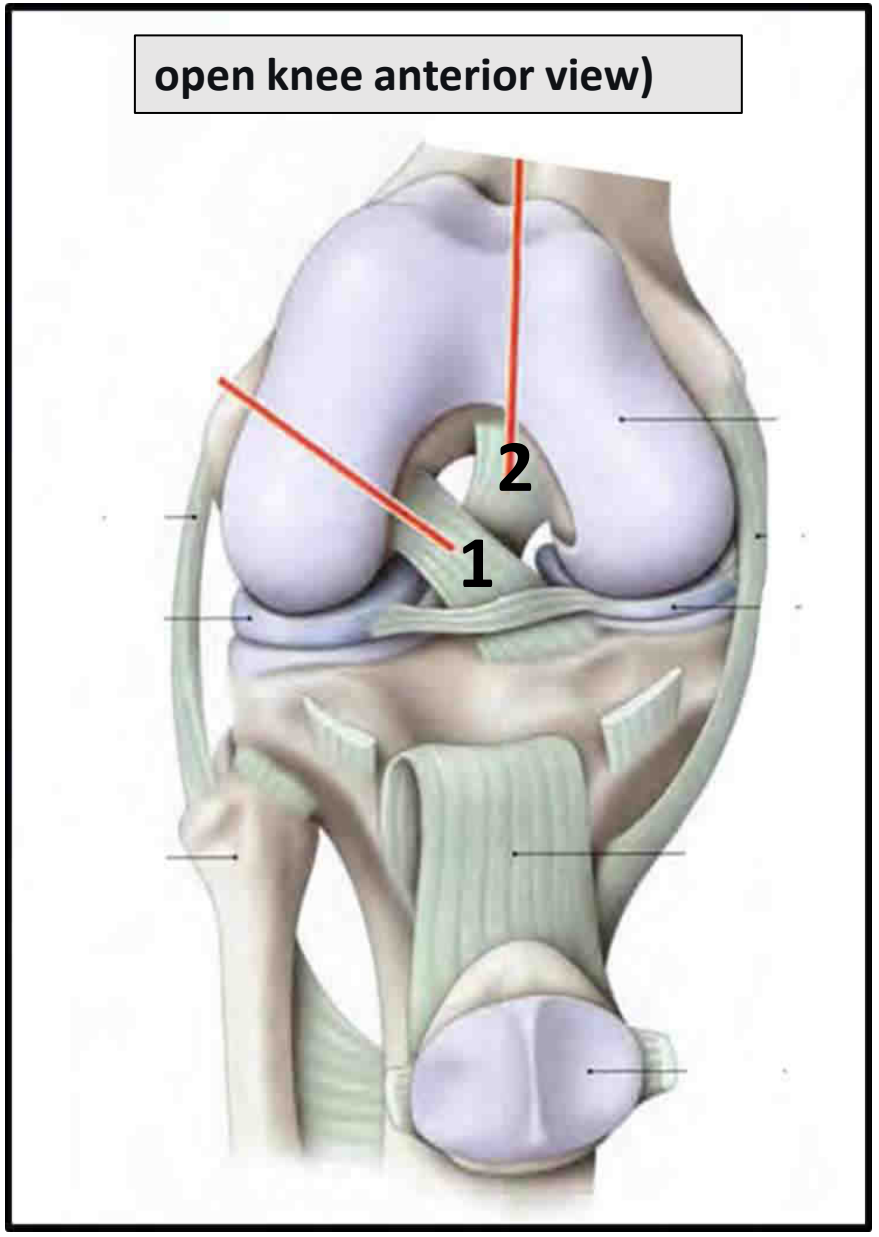
Knee joint (posterior view)



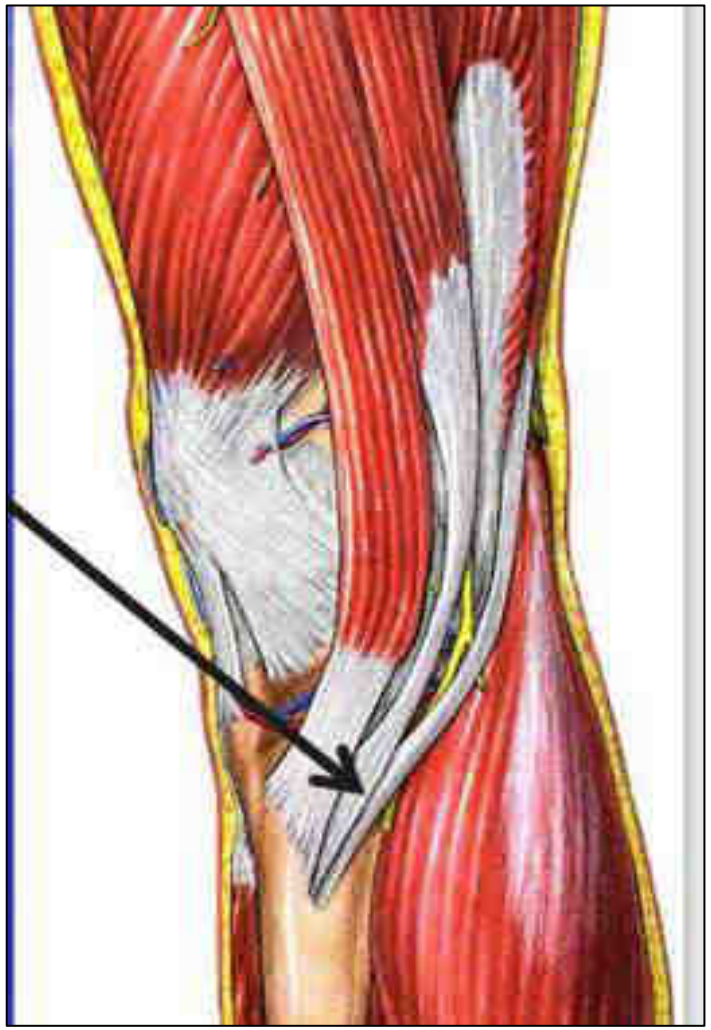
3-The Central Pivot (the Cruciate Ligaments)
They ensure **anteroposterior stability of the knee**.
Their injury results in the **drawer movement**, sought clinically.

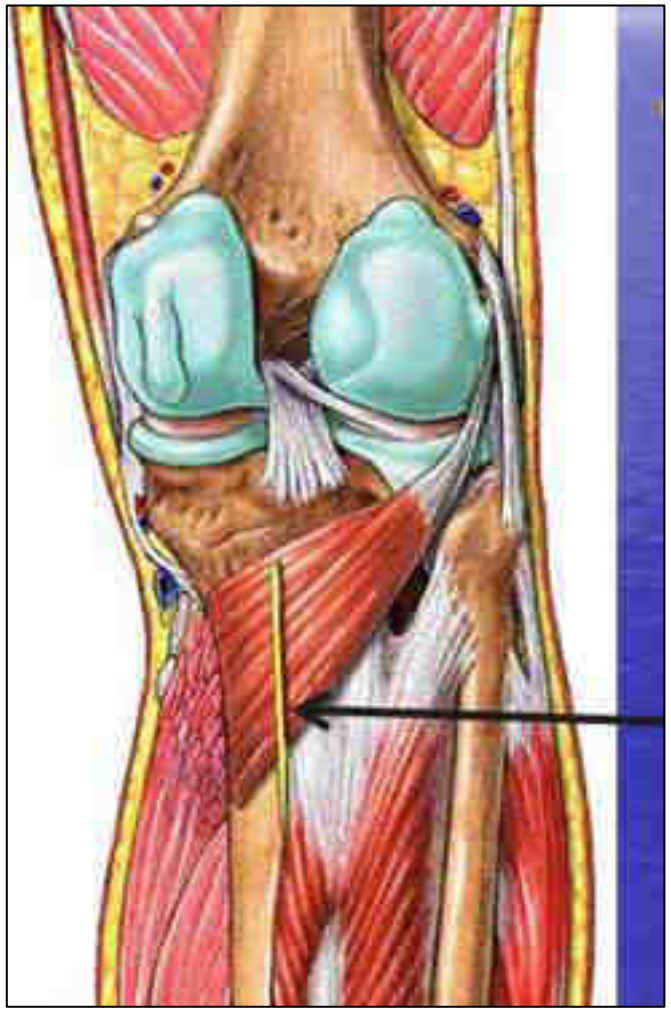
The Anterolateral Cruciate Ligament 1 (Anterior Cruciate Ligament, ACL) extends from the pre-spinal area, runs backward and outward. Terminates on the inner surface of the **lateral condyle**.

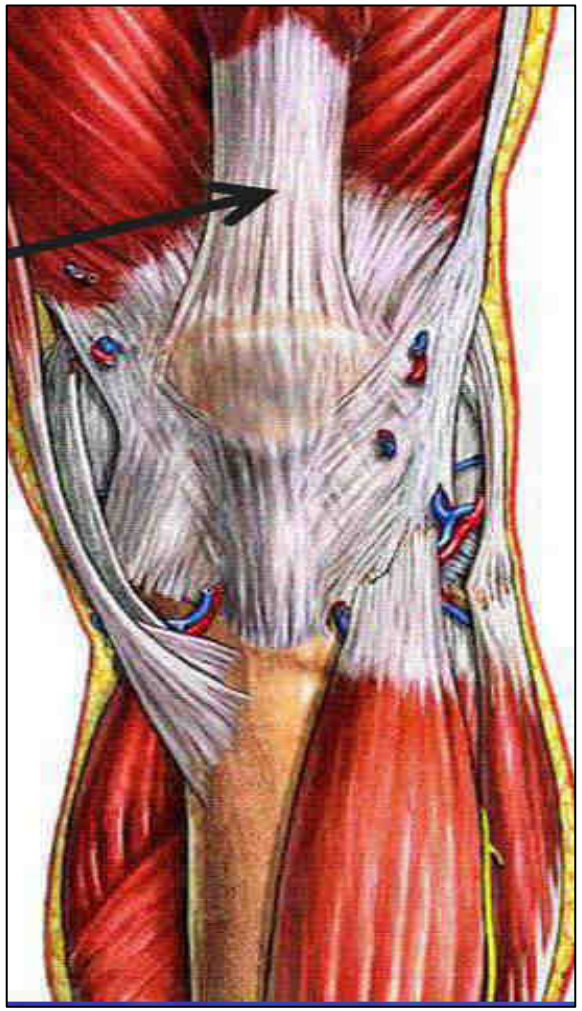
The Posteromedial Cruciate Ligament 2 (Posterior Cruciate Ligament, PCL) extends from the retro-spinal area, its course is vertical, it terminates on the outer surface of the **medial condyle**.



Active Supporting Structures







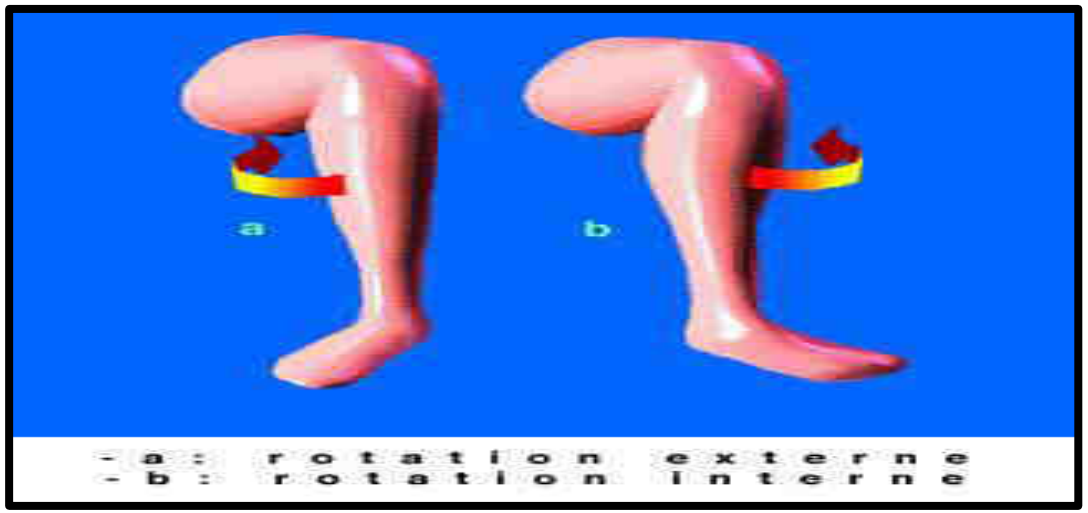
Functional Anatomy

Rotation

knee flexed at 90°,

Internal rotation b: brings the tip of the foot inward to 30°.

External rotation a: brings the tip of the foot outward to 40°.



•B : external rotation

Rotation of the knee can only occur with the knee flexed.

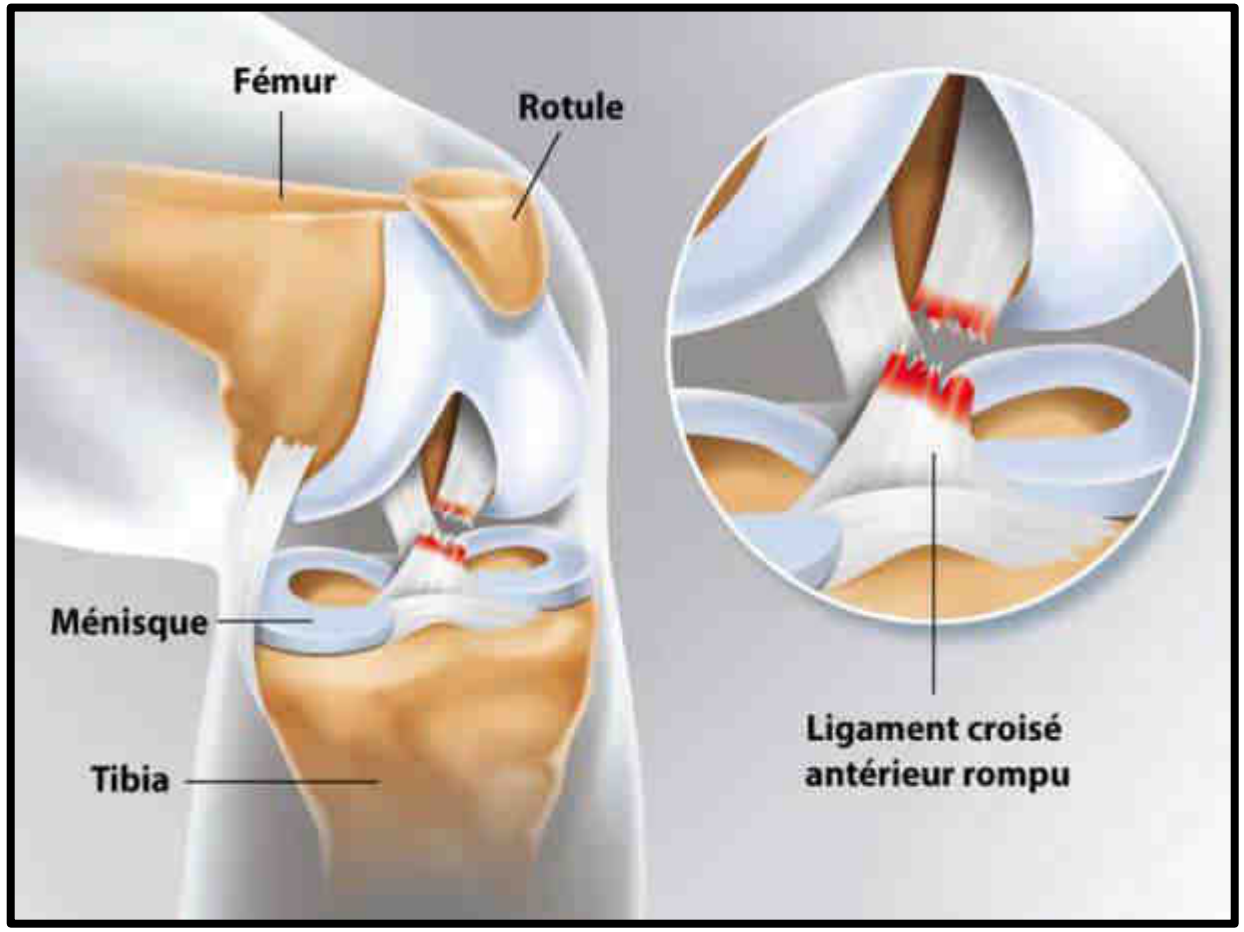
There is no rotation in knee extension, an articulation with two degrees of freedom 2D.

Flexion-extension

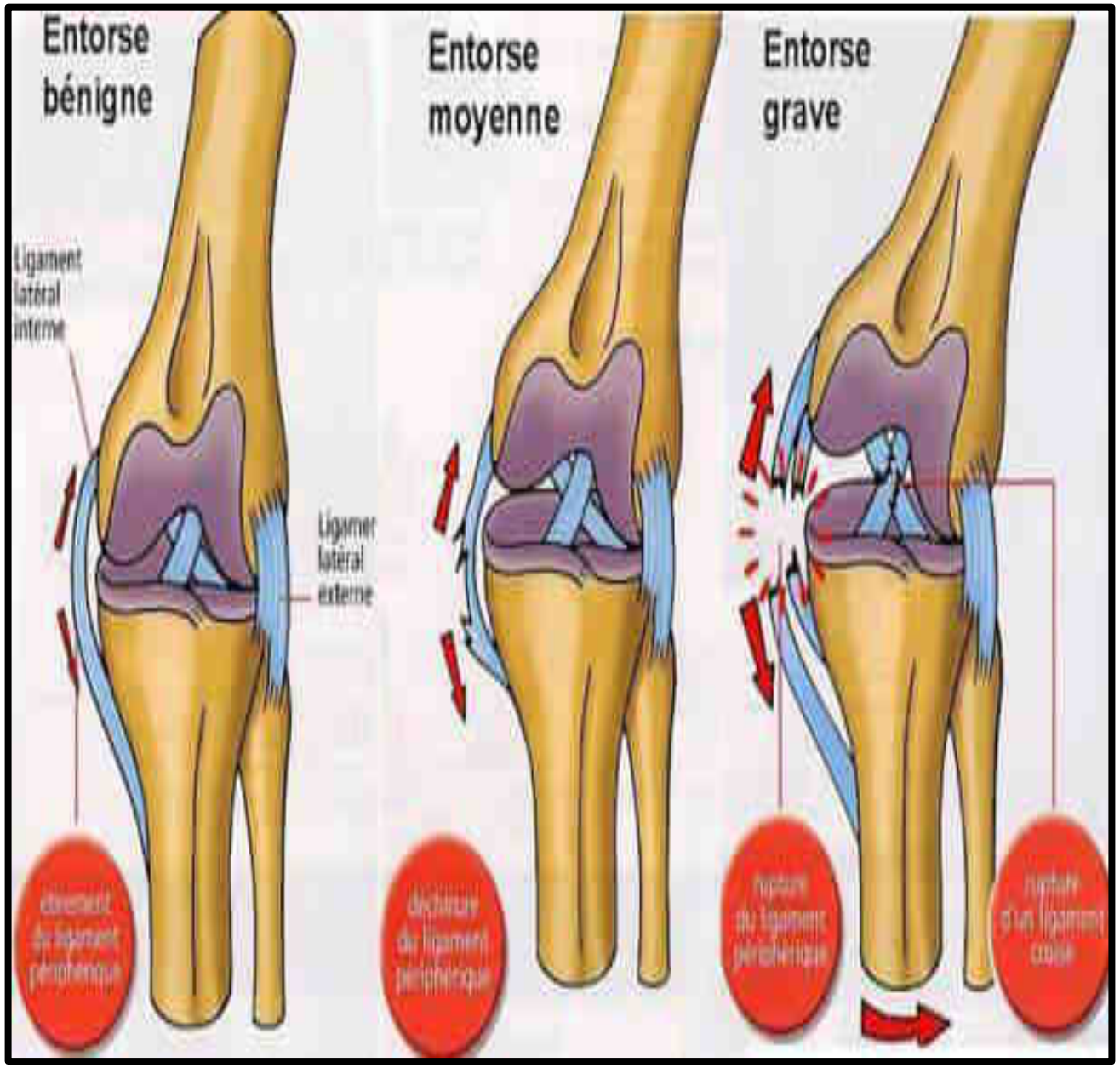
. Knee joint (radiographs)

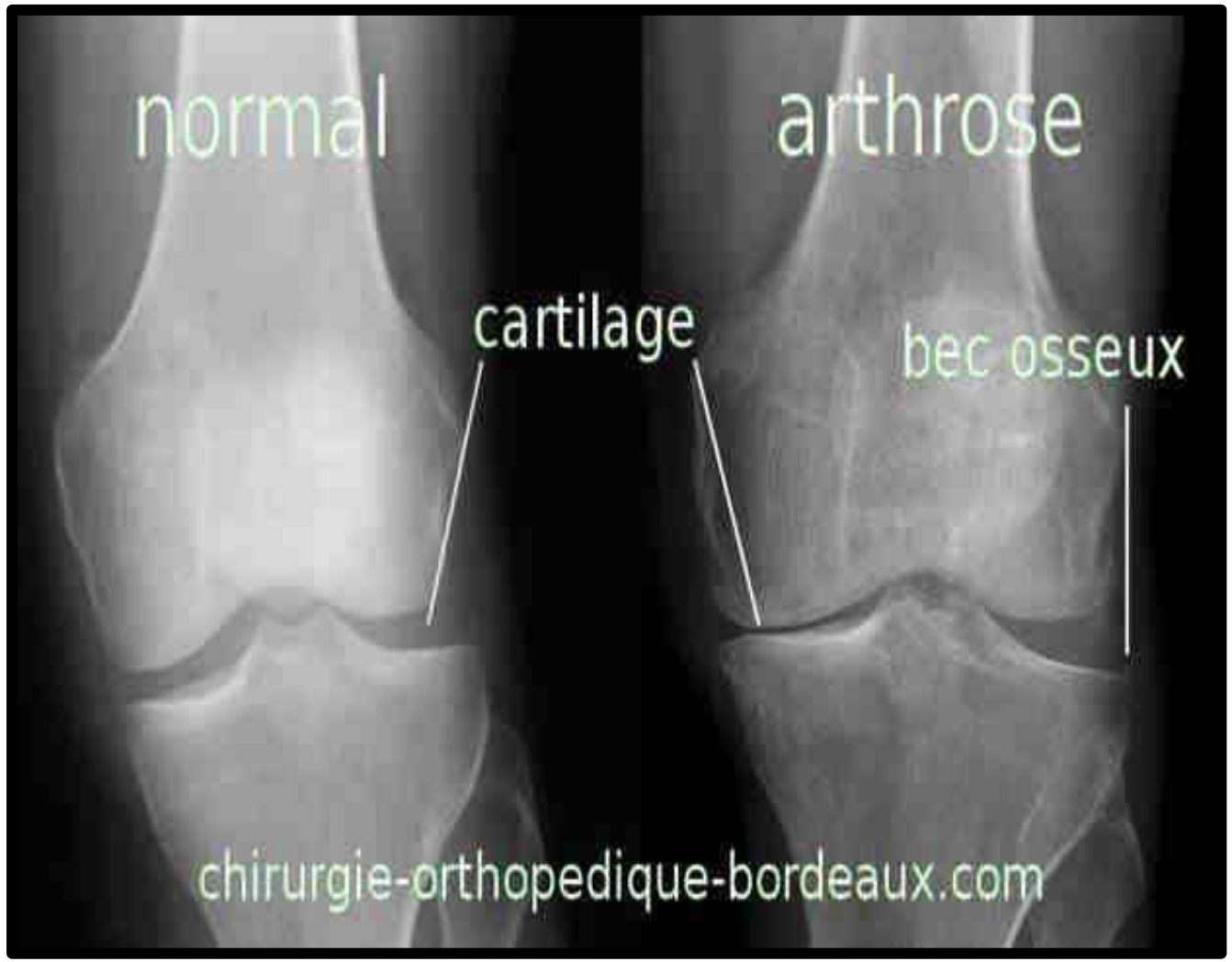
A. frontal view
B. lateral view, knee extended
1.lateral epicondyle
2.patella
3.medial epicondyle
4.lateral femoral condyle
5.medial femoral condyle
6.lateral tibial condyle
7.intercondylar eminence
8.medial tibial condyle
9.fibular head
10.fibular neck

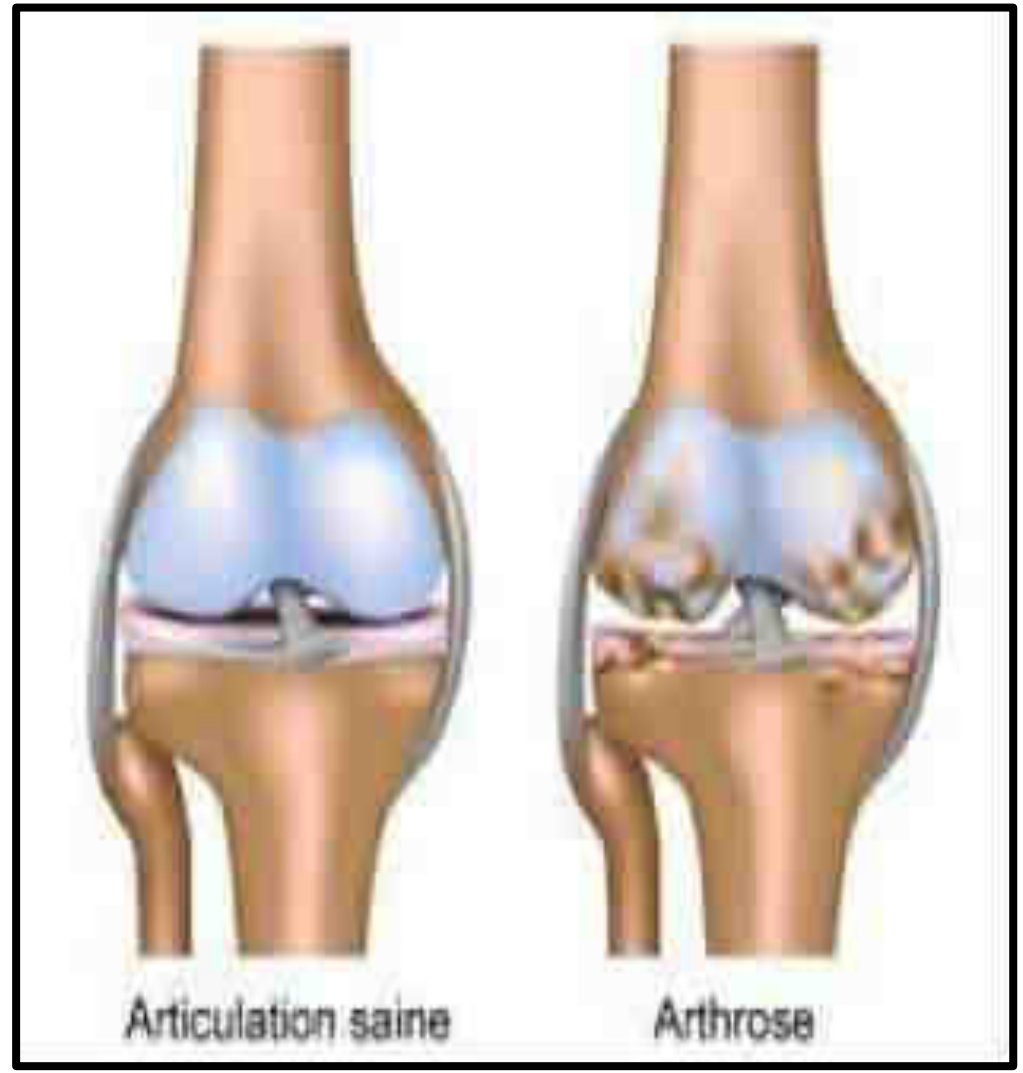
Meniscal Injuries
What You Need to Know
Meniscal rupture first manifests as knee locking followed by hydrarthrosis (effusion).



Mild Sprain
Medial collateral ligament
stretching of the peripheral ligament
Lateral collateral ligament
stretching of the peripheral ligament
Moderate Sprain
rupture of the peripheral ligament
Severe Sprain
rupture of a cruciate ligament




normal
arthrose
cartilage
bec osseux
chirurgie-orthopedique-bordeaux.com


Articulation saine
Arthrose

Proximal tibiofibular joint 1
plane synovial joint.
It only presents limited gliding movements.

Distal tibiofibular joint 2
a syndesmosis
Is almost **immobile**.

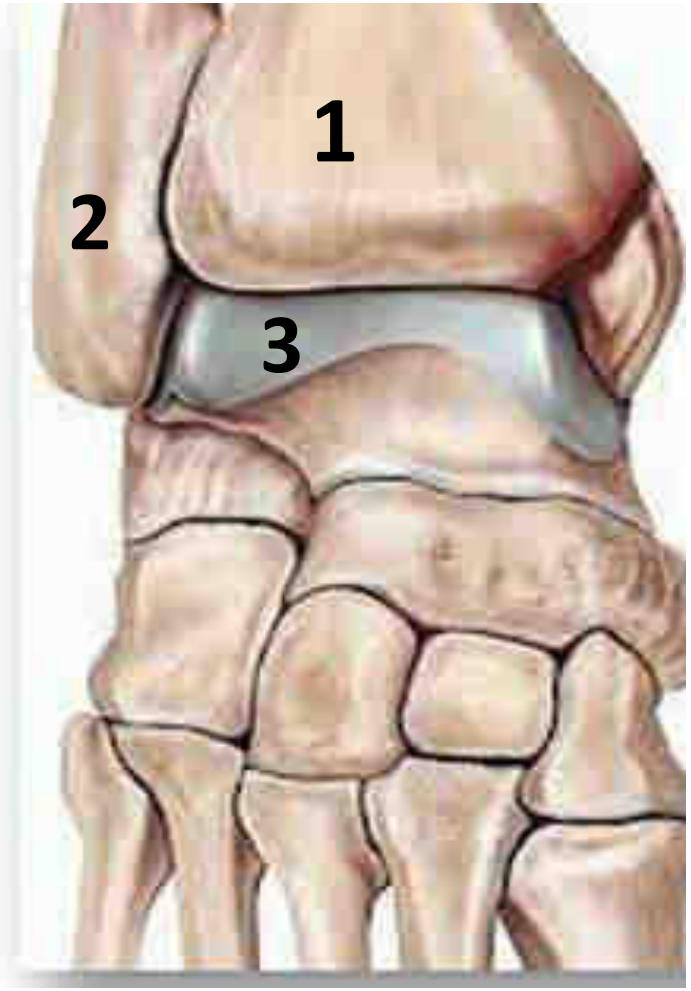
INTEROSSEOUS MEMBRANE OF THE LEG 3
It is a fibrous membrane stretched between the interosseous borders of the tibia and fibula.

The Tibiotalar or ankle joint or Talocrural joint

1.Definition
2.Location
3.Descriptive Anatomy:
•Articular surfaces
•Supporting structures
•Structures facilitating gliding
4.Functional Anatomy

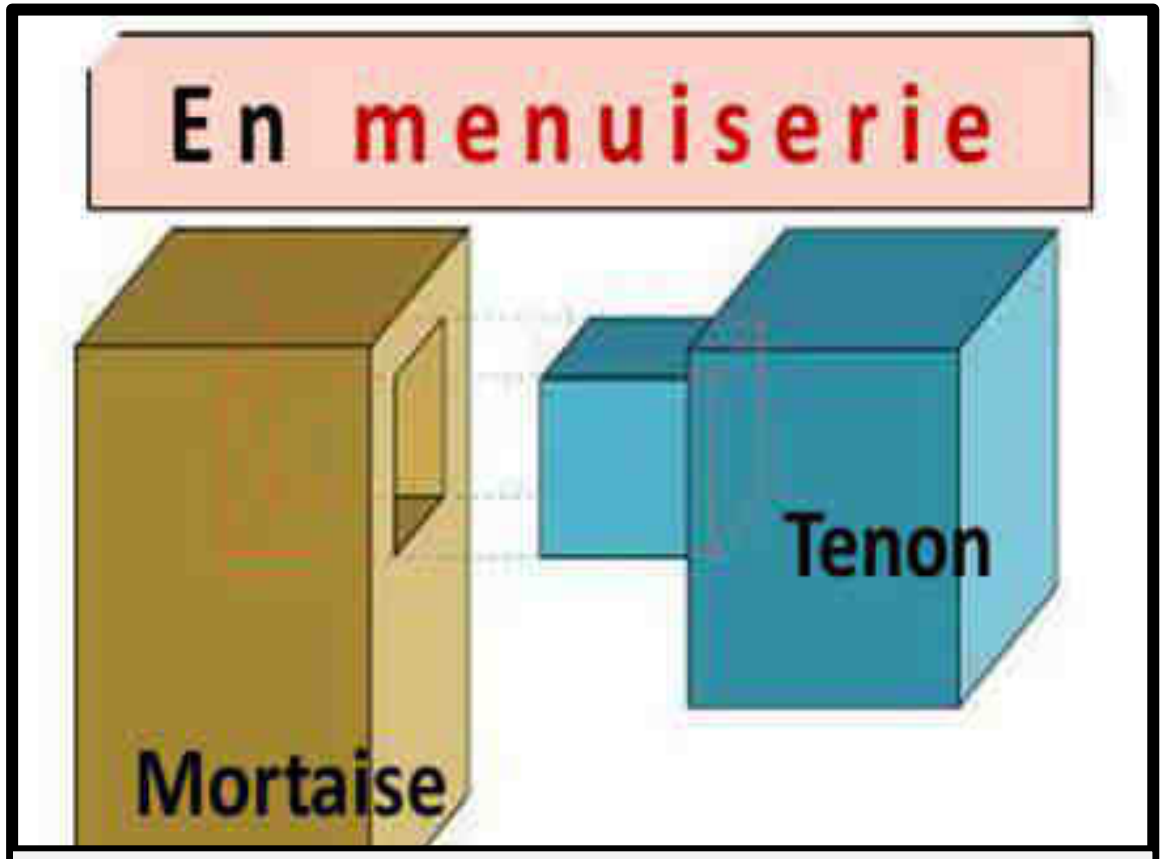
1) Definition

The **Tibiotalar** or **ankle joint** or **Talocrural joint** is a **hinge synovial joint (ginglymus)** that unites the **tibia 1**, the **fibula 2**, and the **talus 3**. A **mortise-and-tenon joint** ensures **stability of the foot** relative to the leg during walking and running movements.

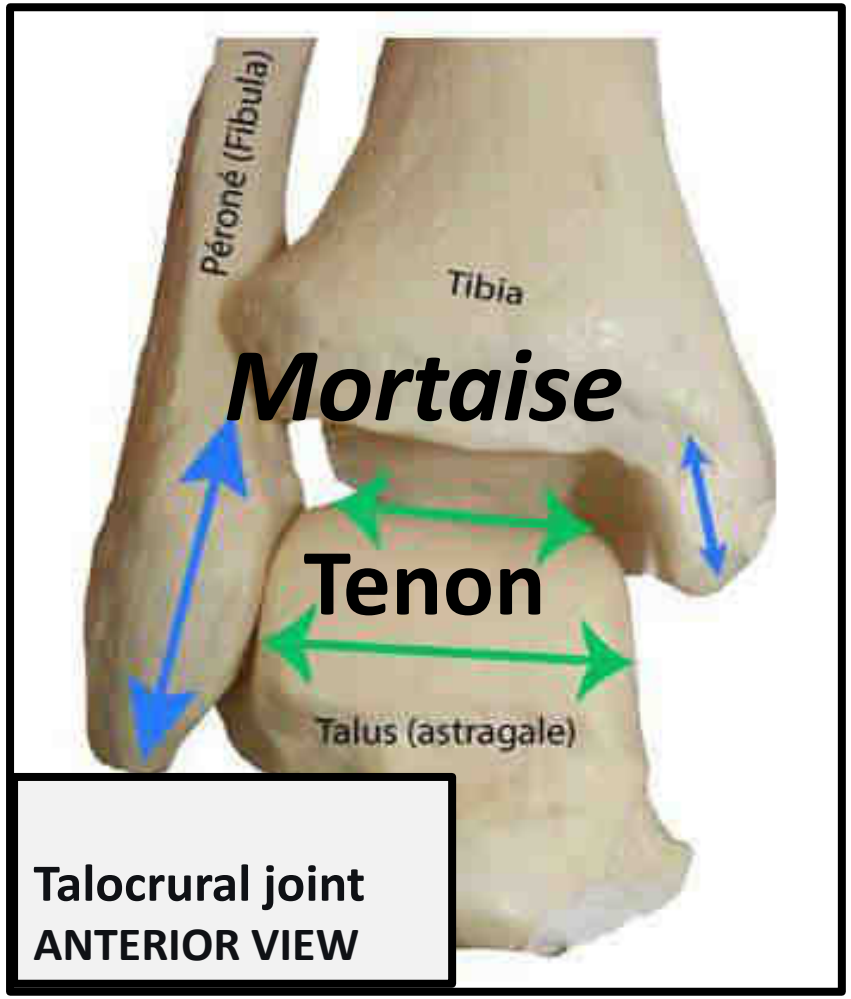


Proximal

Medial



In Carpentry
Tenon
Mortise
Fibula
Tibia
Mortise
Tenon
Talus (astragalus)

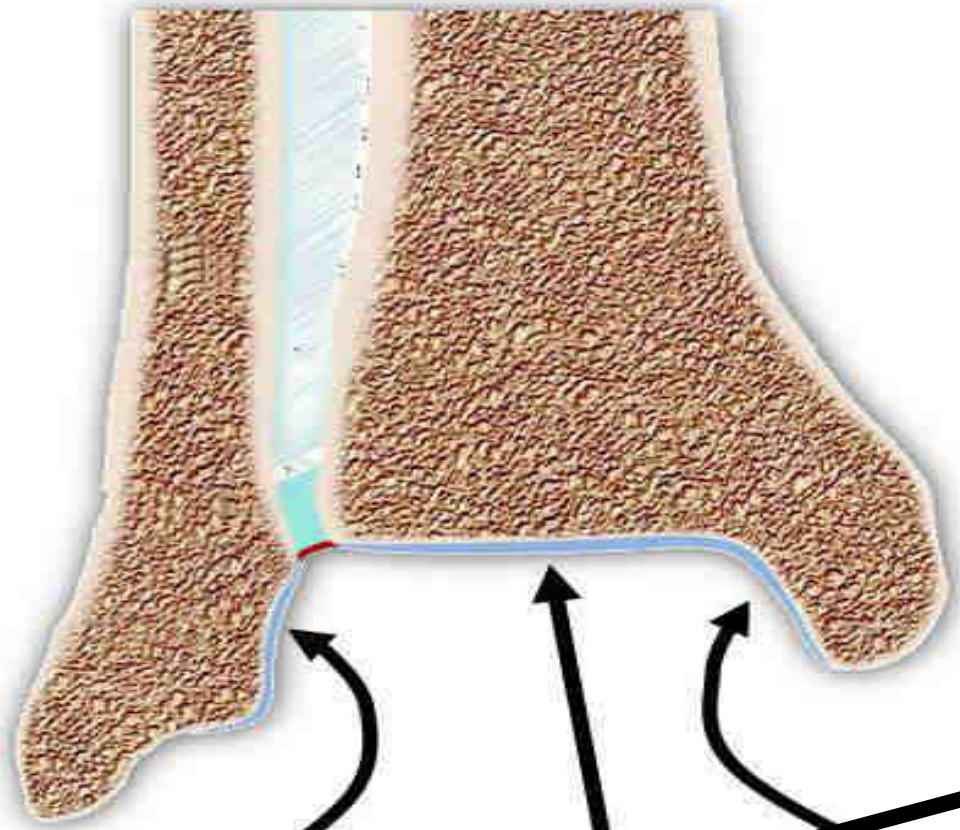


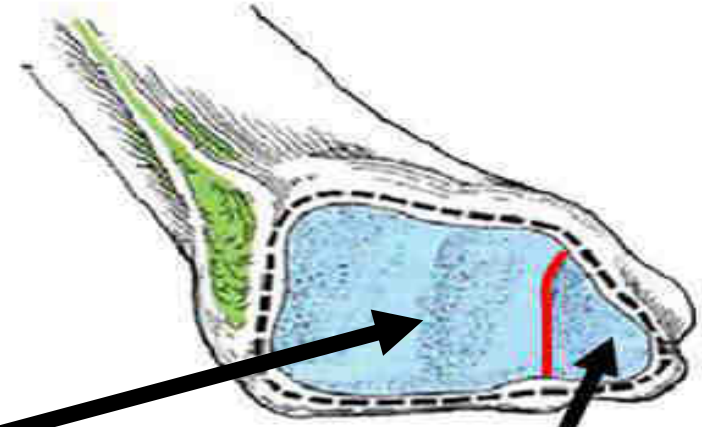
Talocrural joint
ANTERIOR VIEW

Proximal

Medial

The Tibiofibular Articular Surfaces





Articular surface of the lateral malleolus

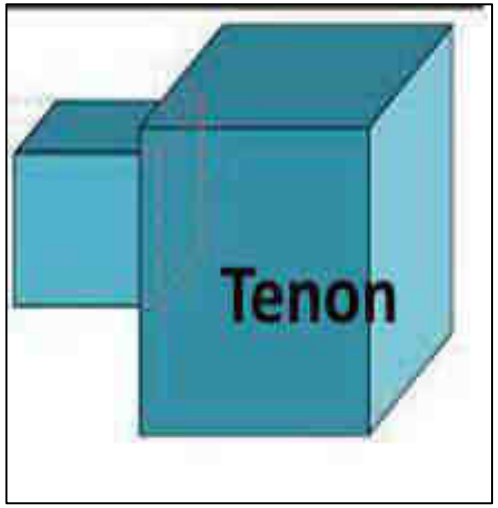
Inferior surface of the tibia

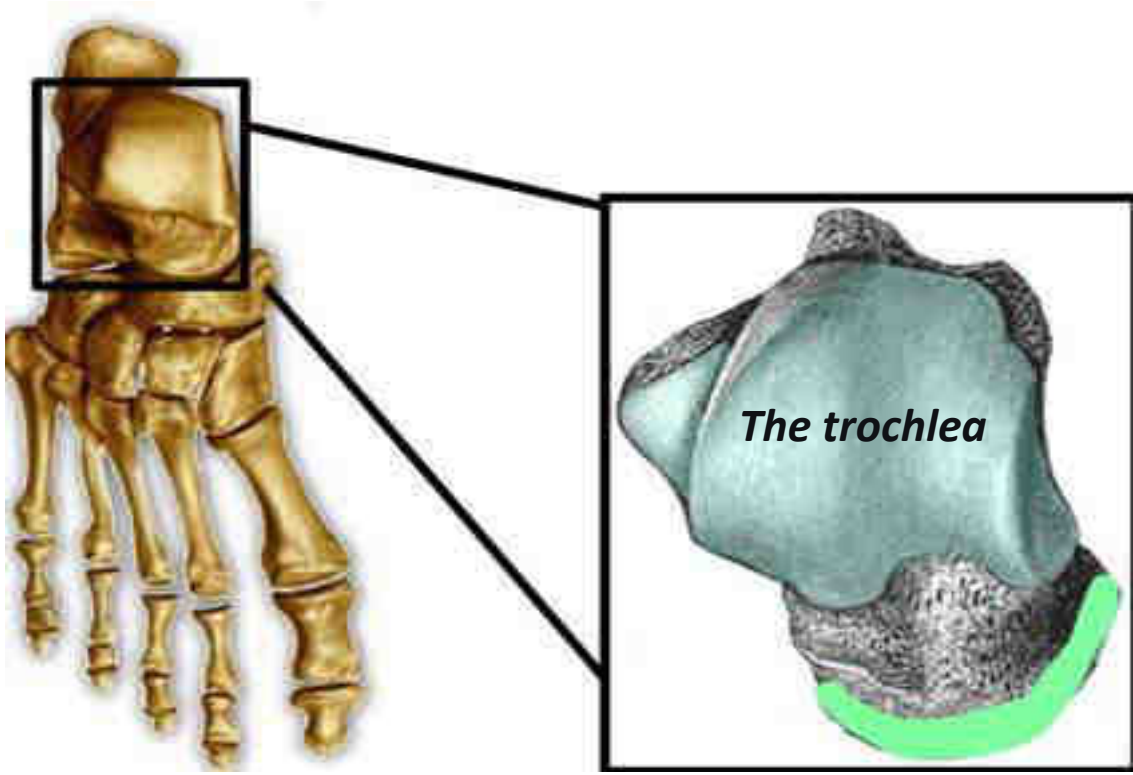
Articular surface of the medial malleolus

2-The Articular Surfaces of the Talus

The Trochlea of the talus ➡ **Tenon**

The trochlea is a voluminous articular prominence that presents ***3 articular surfaces***

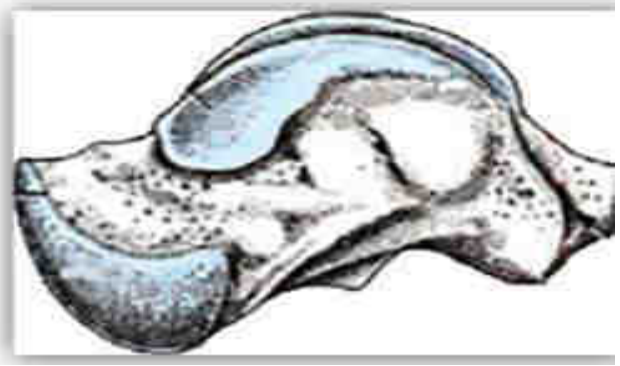




Lateral malleolar surface (triangular) articulates with the lateral malleolus

Superior surface of the trochlea (articulates with the inferior surface of the tibia)

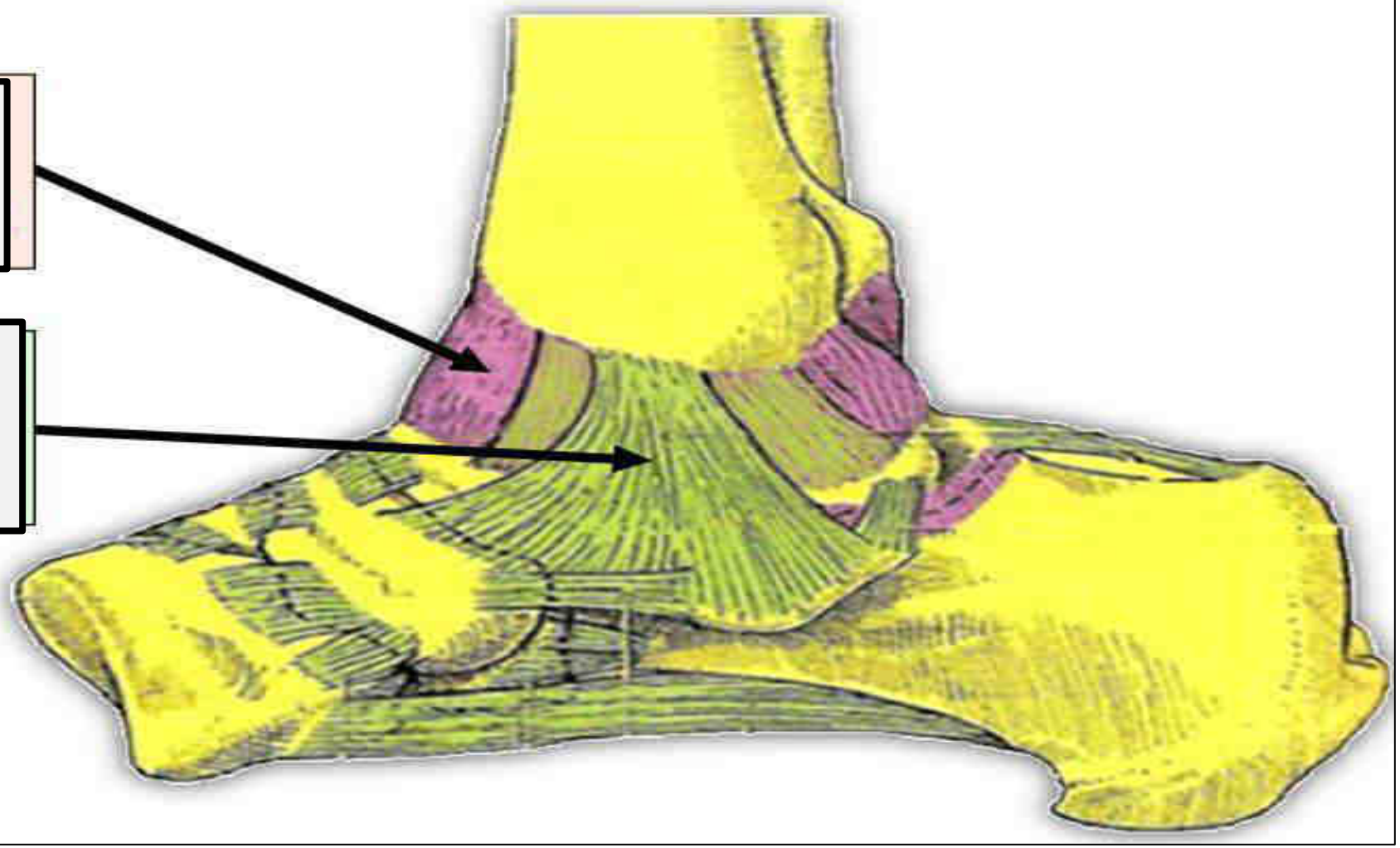
Medial malleolar surface (comma-shaped) articulates with the medial malleolus)



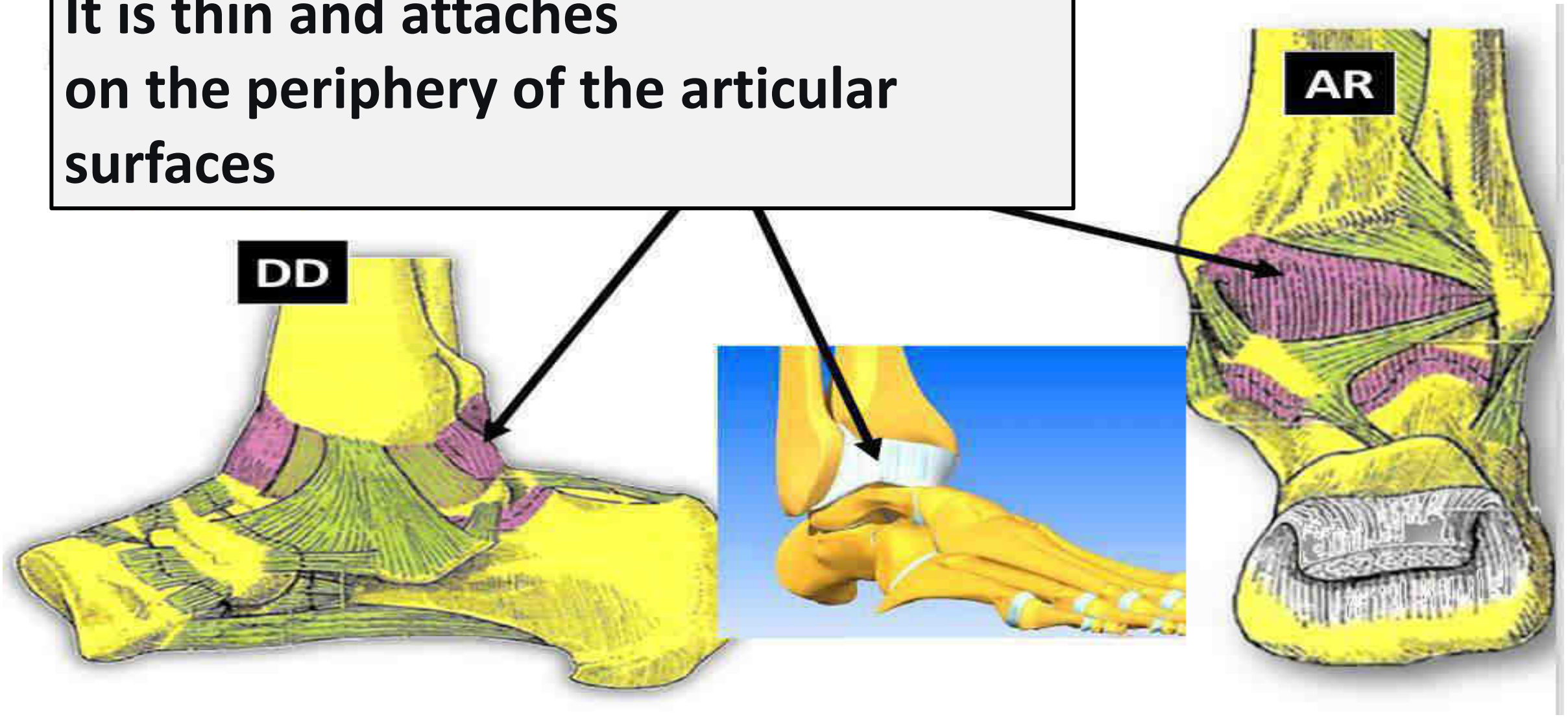
3-The Supporting Structures

Articular - Capsule

Passive ligaments

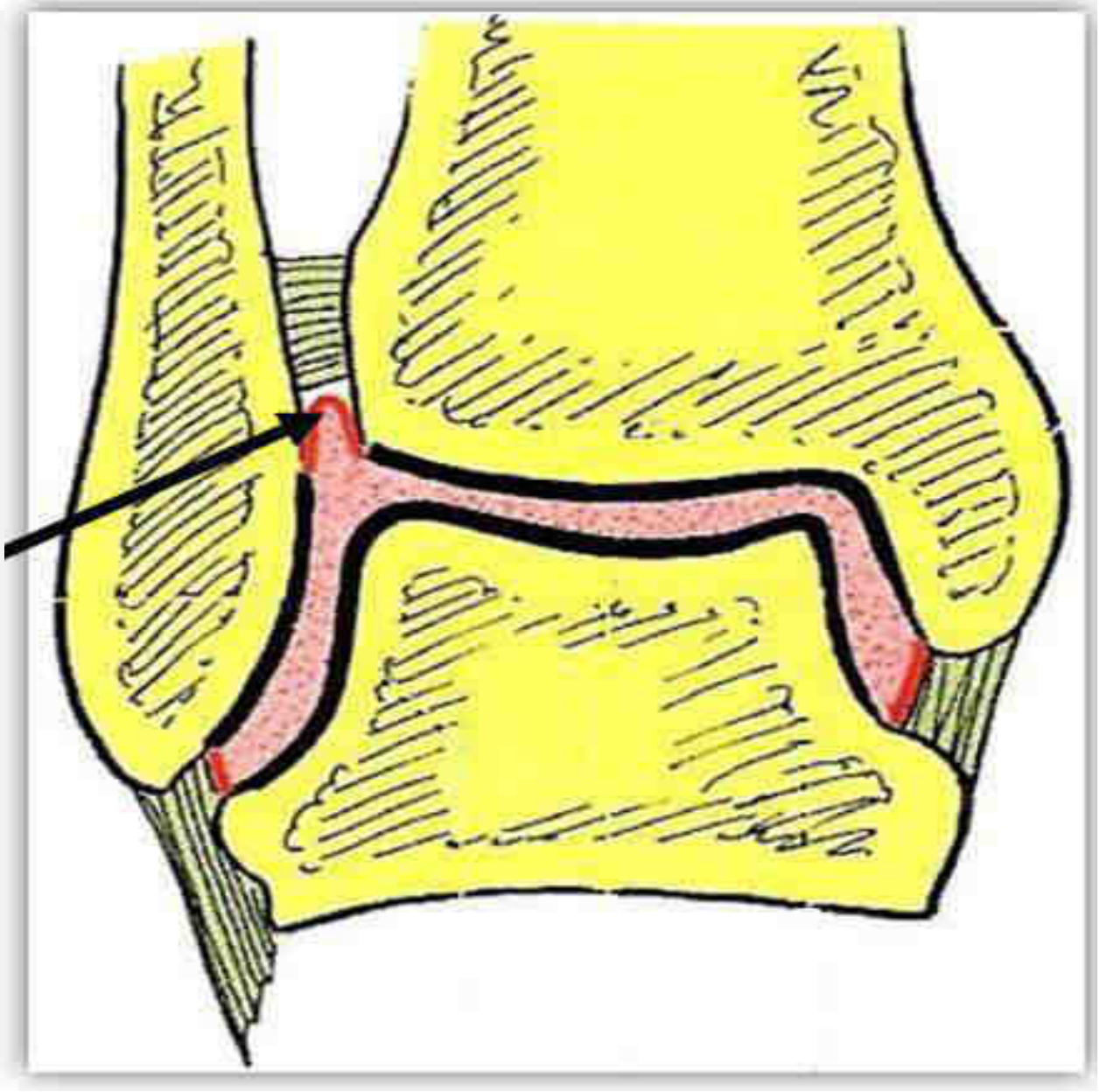


Articular Capsule
It is thin and attaches
on the periphery of the articular surfaces



The Synovial Membrane:

secretes Synovial Fluid nourishes cartilage by imbibition. It lines the deep surface of the capsule; and forms a recess.
Gives a cul-de-sac extension between the tibia and fibula.



The Passive Ligaments
are two in number

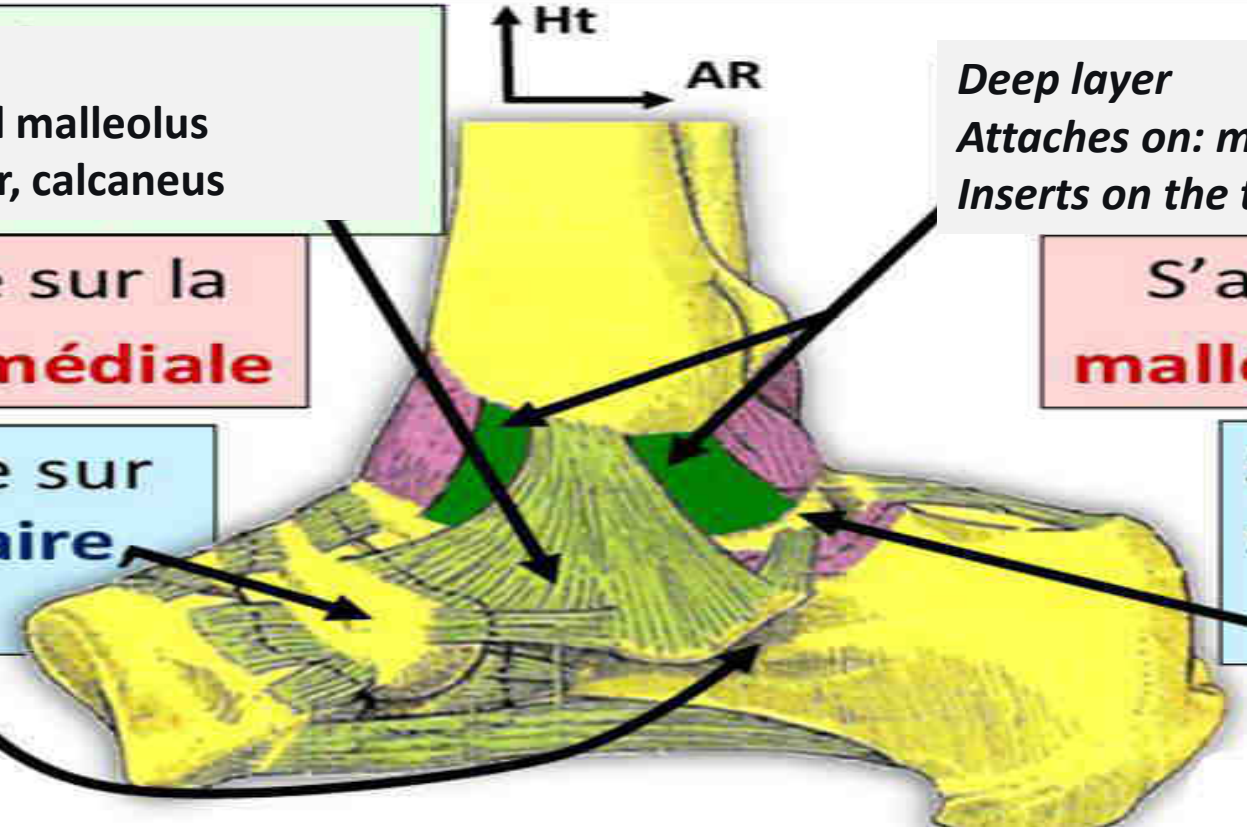
1.Medial collateral ligament with 2 layers

Superficial layer

1

1.**(deltoid ligament)**
Attaches on the medial malleolus
Inserts on the navicular, calcaneus

Deep layer
Attaches on: medial malleolus
Inserts on the talus



S'attache sur la
malléole médiale

S'attache sur:
malléole médiale

Se termine sur
le naviculaire
calcanéus

Se termine
sur le
talus

2 Ligament collatéral latéral

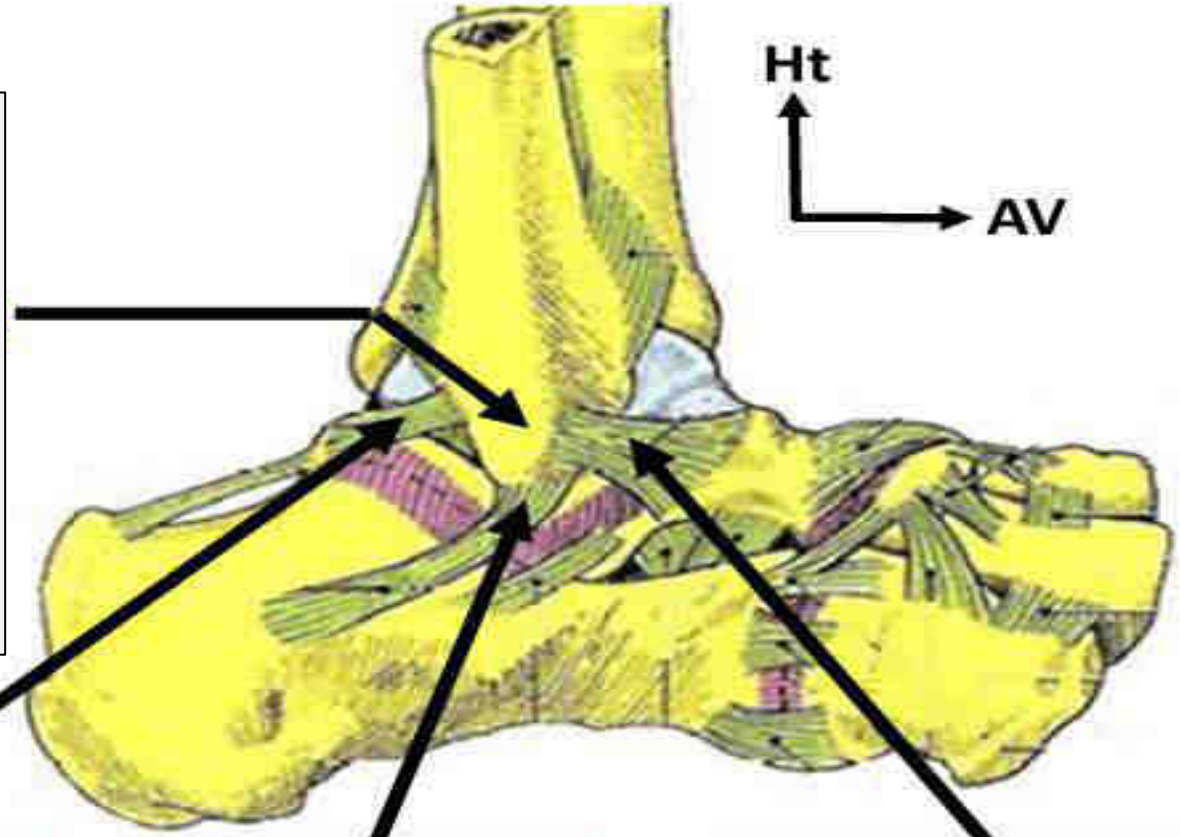
2 Lateral collateral ligament

- Extends from the **lateral malleolus**
- Terminates via **3 bundles**:

Posterior talofibular

Calcaneofibular

Anterior talofibular



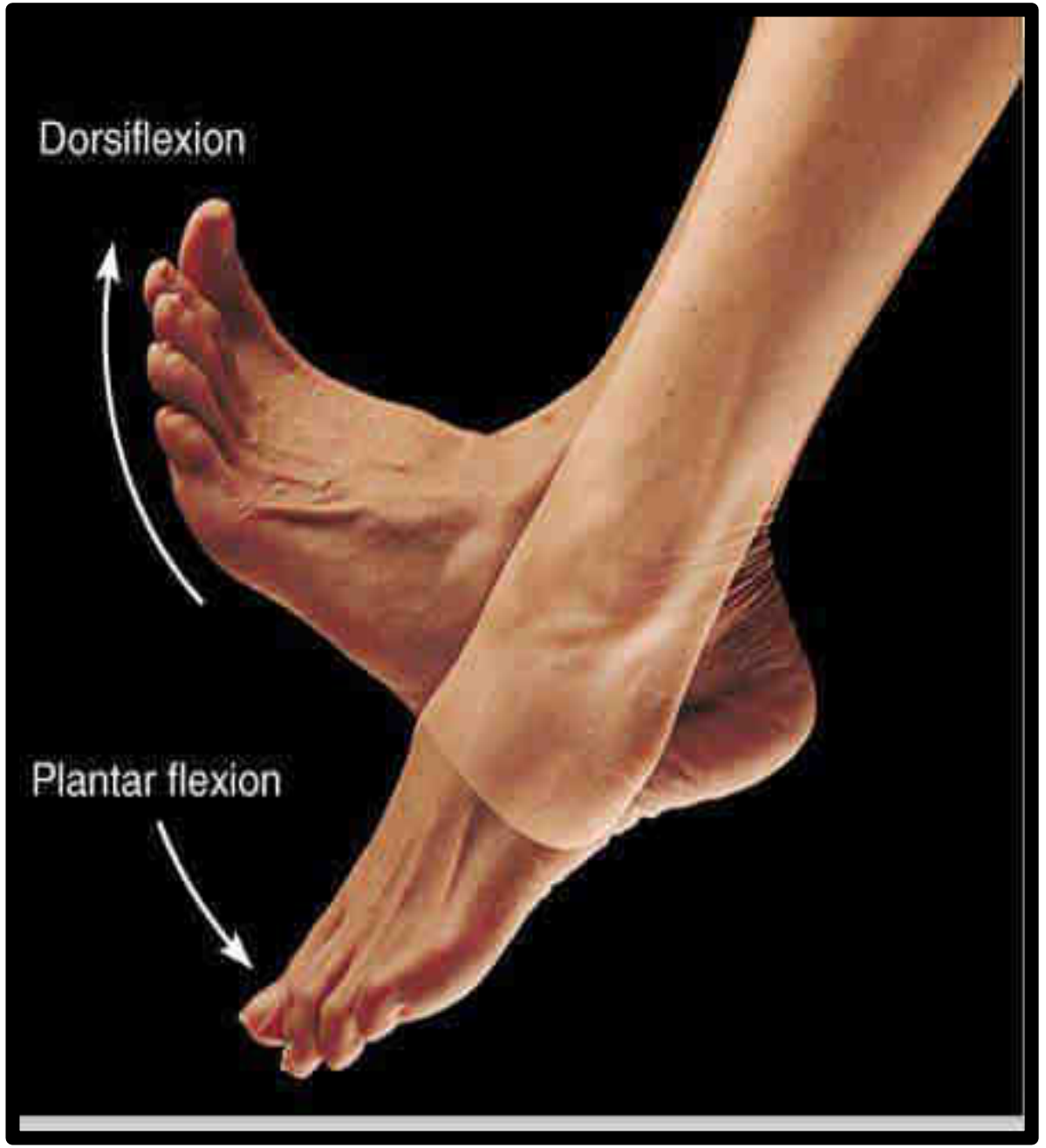
Talo-fibulaire postérieur

Calcanéo-fibulaire

Talo-fibulaire antérieur

The Lateral collateral ligament is
“the ligament of ankle sprain”
the most frequent sprain

Functional Anatomy
The ankle has one degree of freedom 1D, Allows: flexion-extension of the foot (elevation lowering of the forefoot), *around a transverse axis*



Dorsiflexion

Brings the dorsum of the foot closer to the anterior surface of the leg.

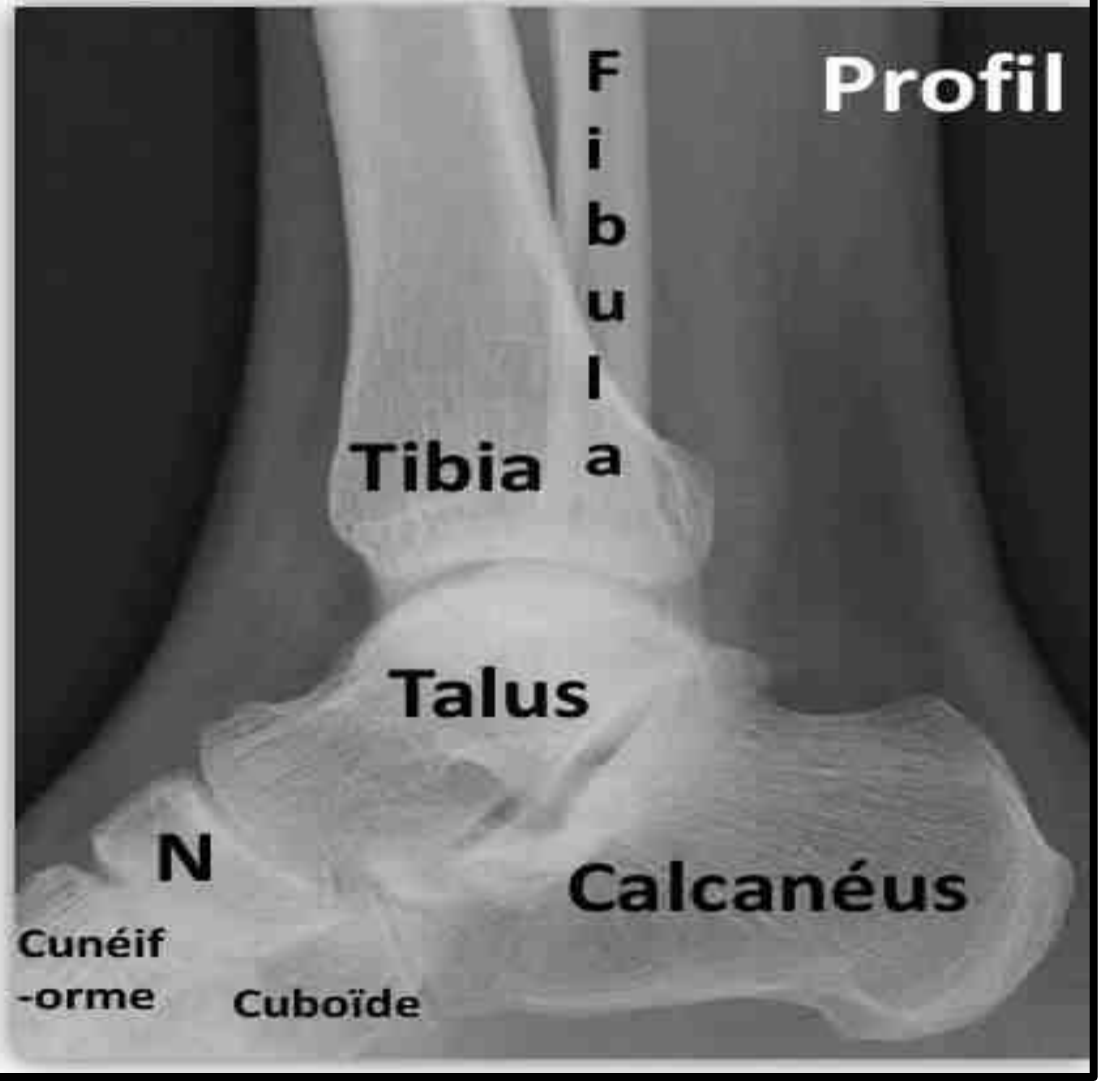
Amplitude = 20◦ to 25◦20◦to25◦

Plantar Flexion

Moves the dorsum of the foot away from the anterior surface of the leg.

Amplitude = 30◦ to 40◦30◦to40◦

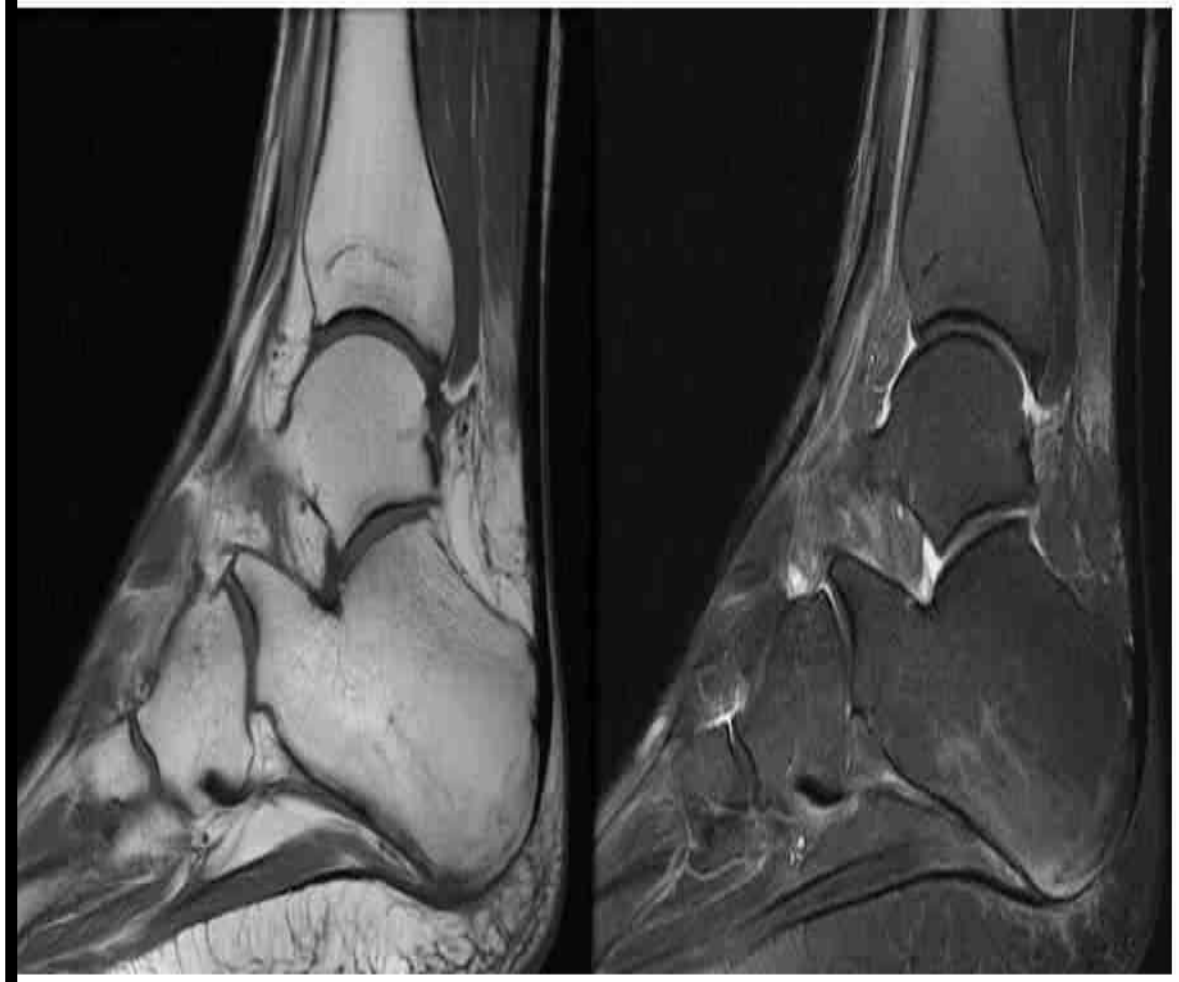
Standard Radiography



Arthrography

CT Arthrography

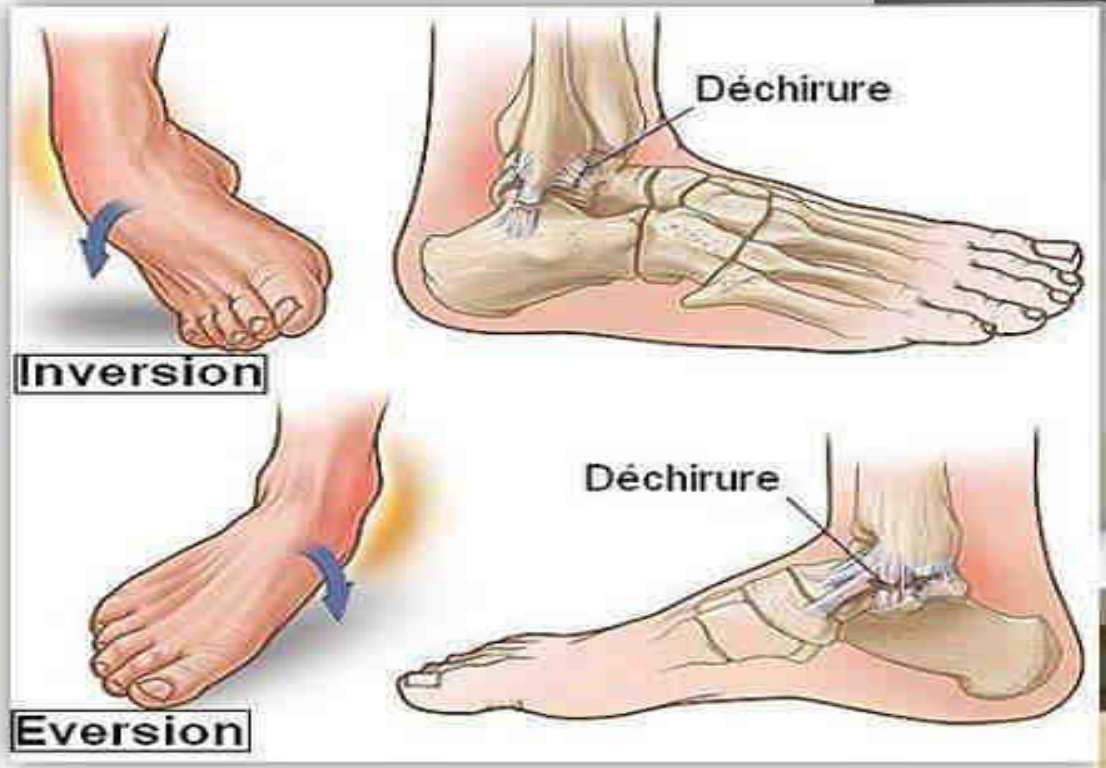
MR Arthrography



Entorse

Sprain

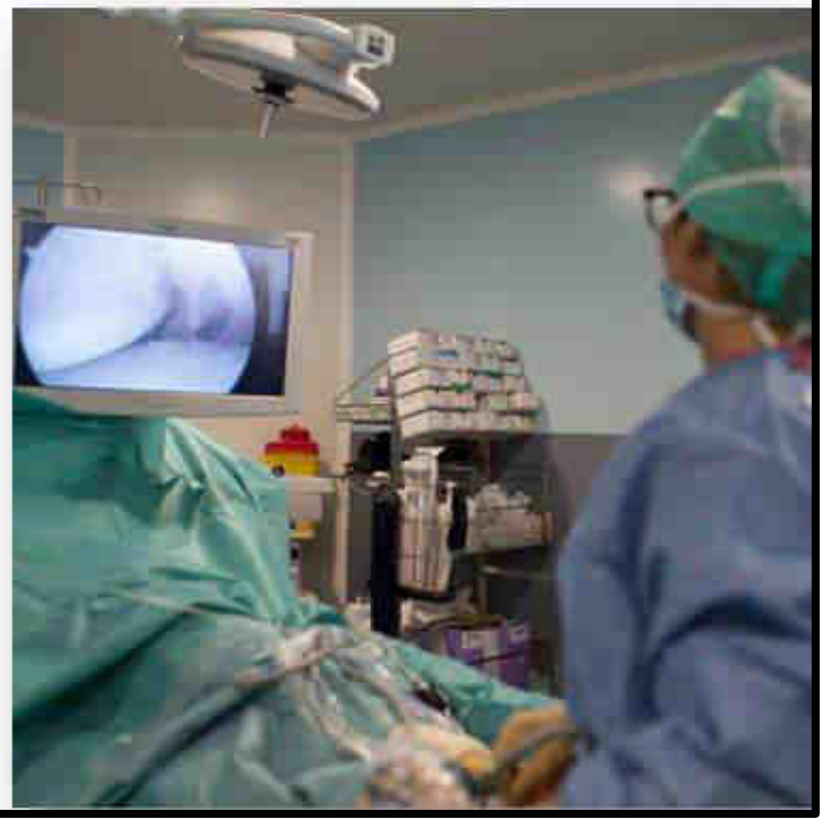
- **Lateral sprain**
  - Tear
- **Inversion**
  - Tear



Medial sprain

- **Eversion**

Arthroscopy

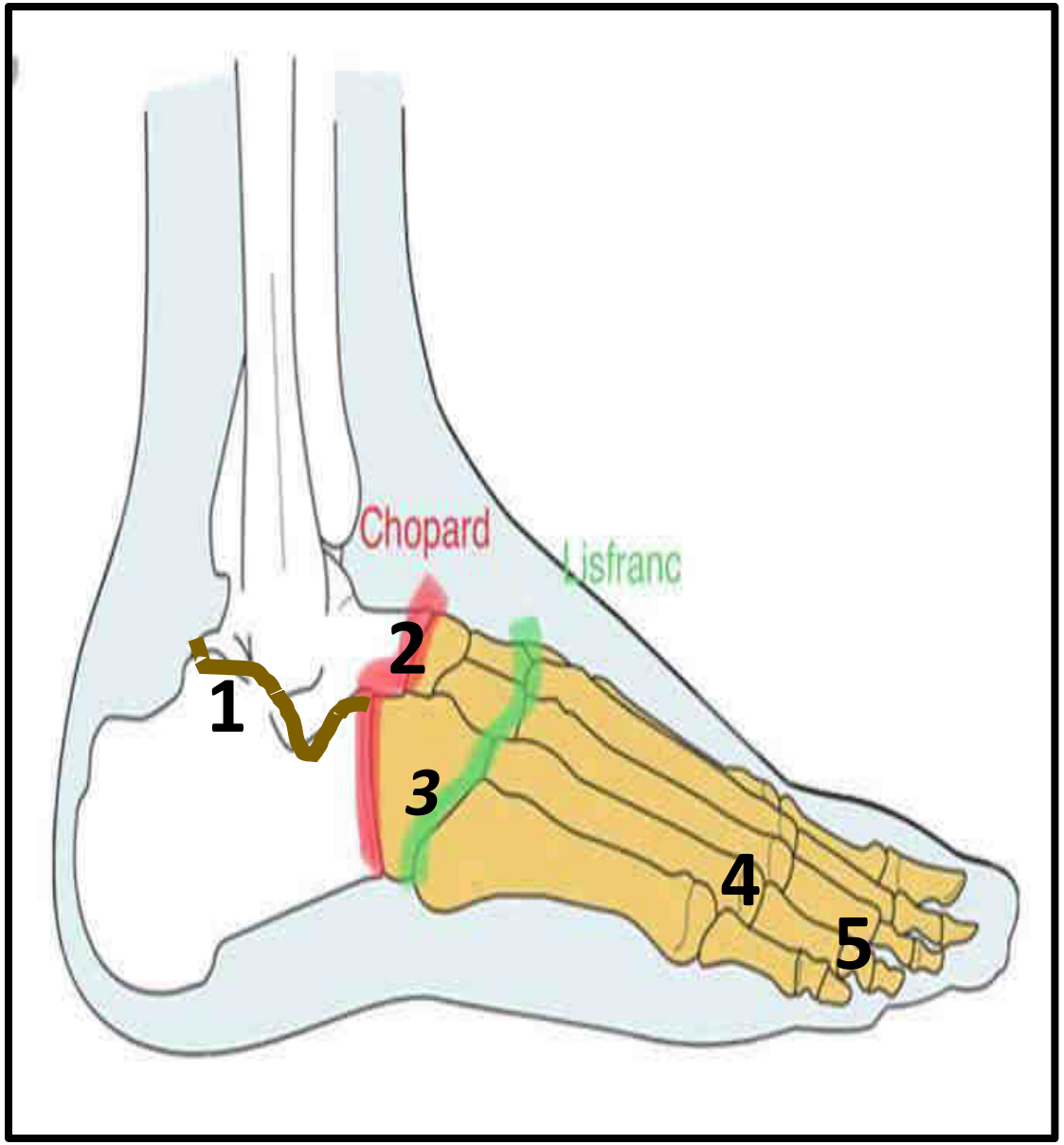


THE JOINTS OF THE FOOT

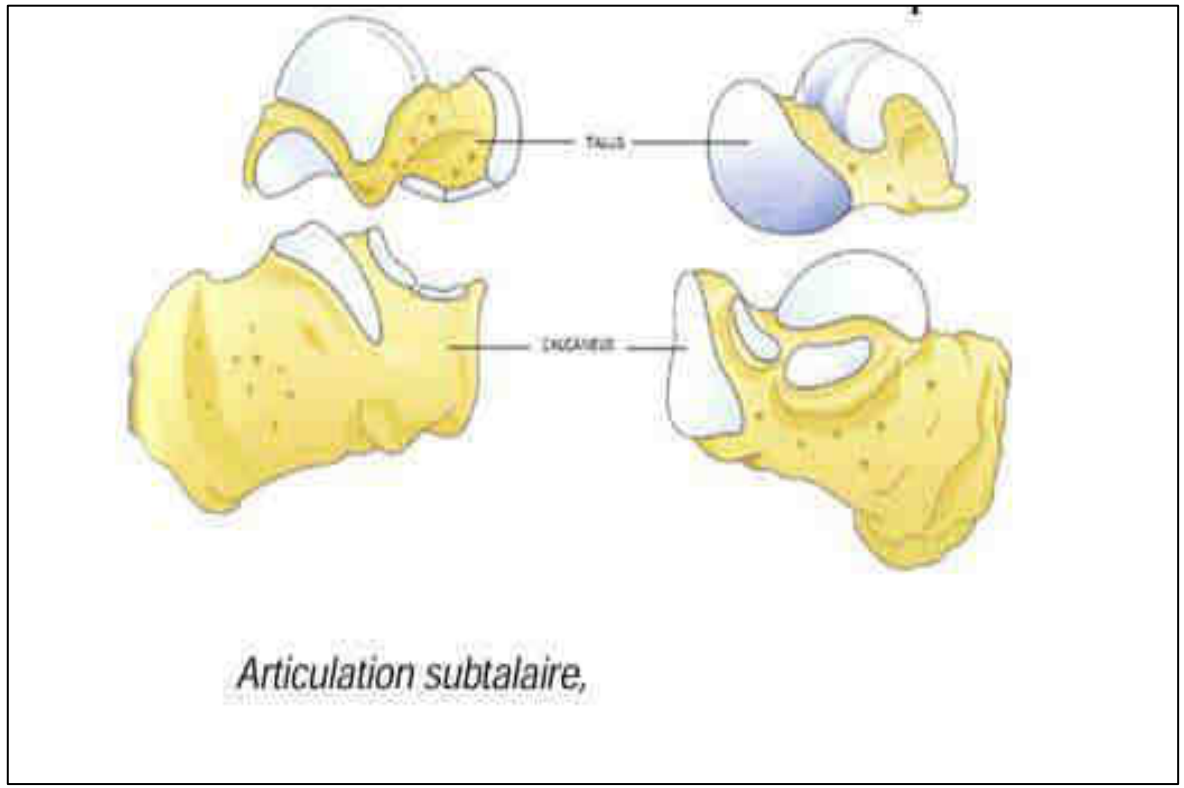
The joints of the foot are a functional ensemble dedicated to the adaptability of the foot to the ground as well as stability in single and bipedal stance. Numerous and complex, they allow **propulsion** and **shock absorption during the step**. They guide the foot in adapting to the **irregularities** of the ground.

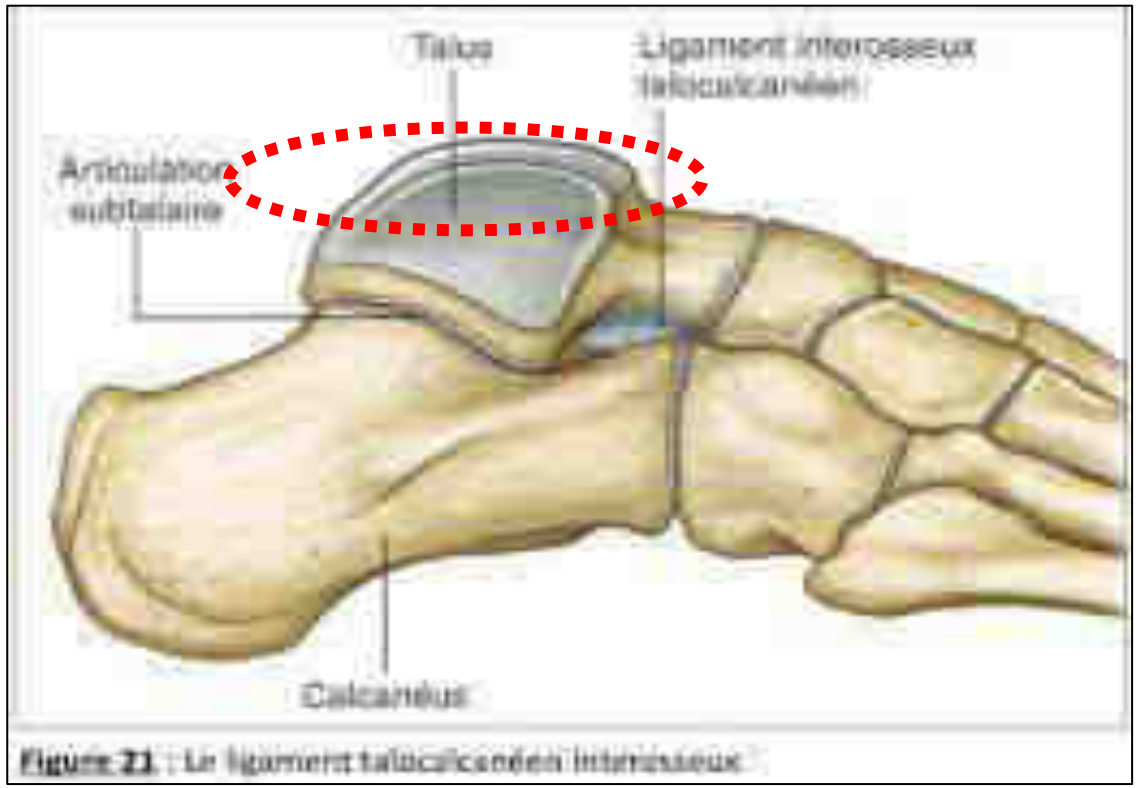
Forefoot Joints

- LISFRANC JOINT OR TARSOMETATARSAL JOINT 3
- METATARSOPHALANGEAL JOINTS 4
- INTER-PHALANGEAL JOINTS 5



1-Subtalar Joint: Also called the talocalcaneal joint.
It is a double pivot synovial joint (trochoid).
Subtalar joint,
Talocalcaneal interosseous ligament
Subtalar joint
Calcaneus
Figure 21: The talocalcaneal interosseous ligament





2-Chopart Joint or Mid-tarsal Joint

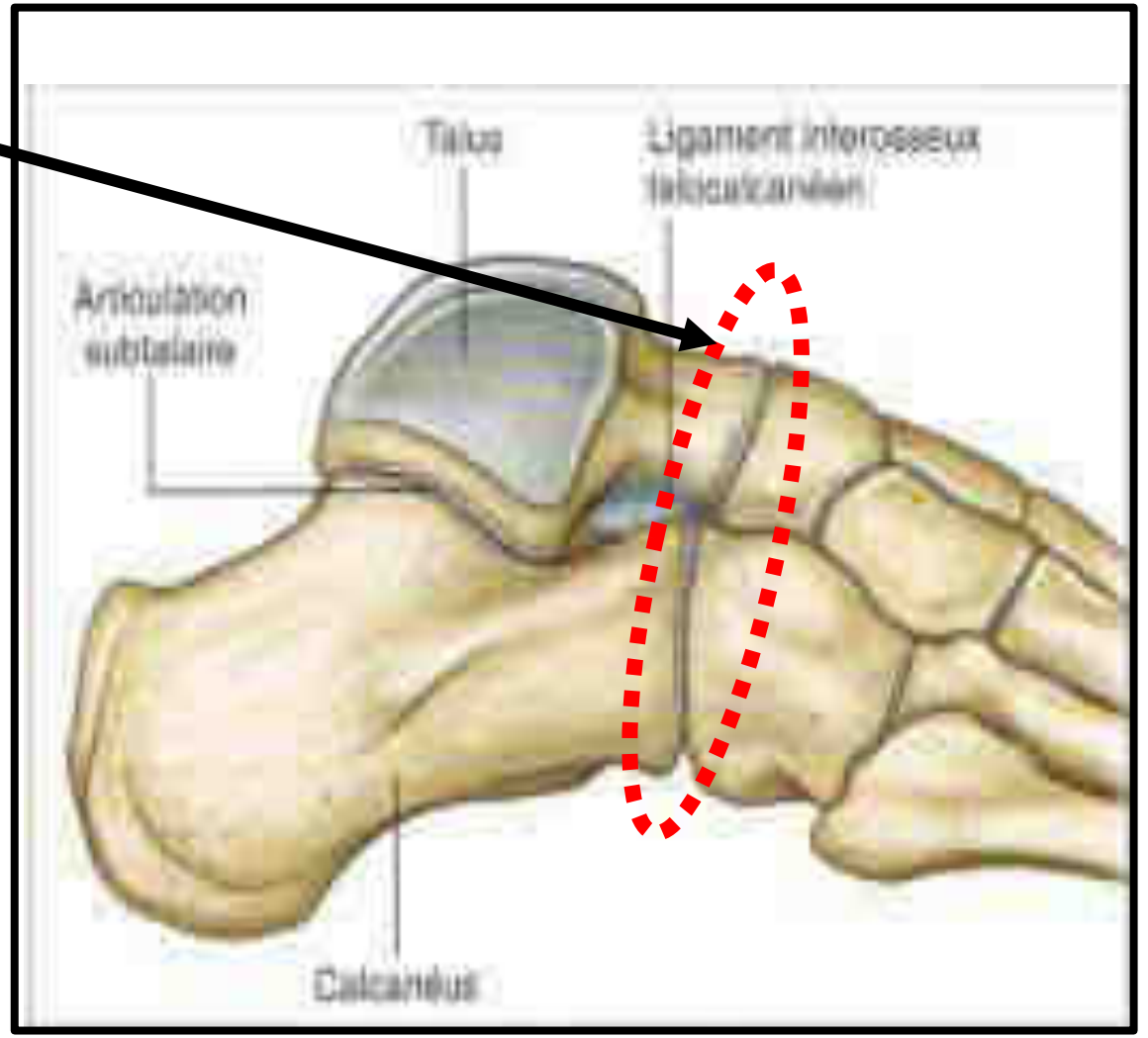
Unites the hindfoot to the midfoot.

Talus

Talo-calcaneal interosseous ligament

Sub-talar joint

Calcaneus



Functional Anatomy: The movements of the subtalar joint and the midtarsal joint are inseparable and allow complex inversion and eversion movements.

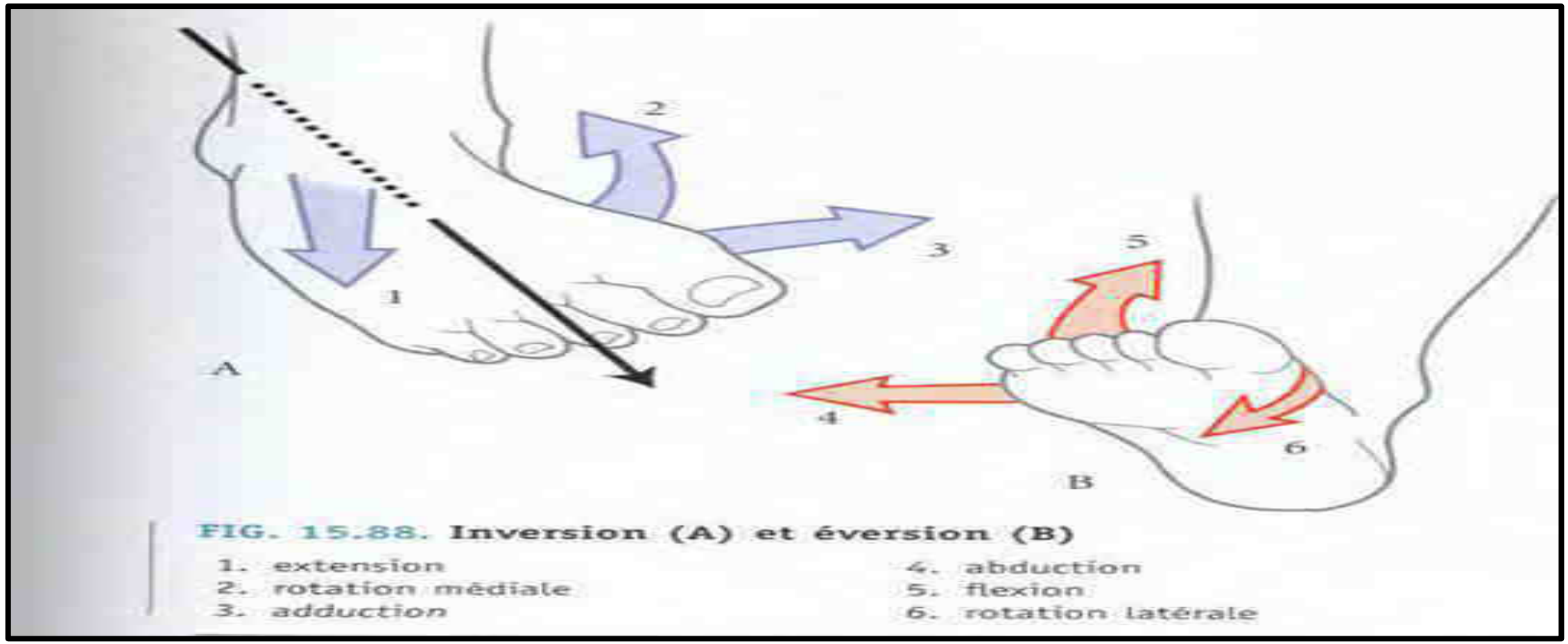


FIG. 15.88. Inversion (A) et éversion (B)

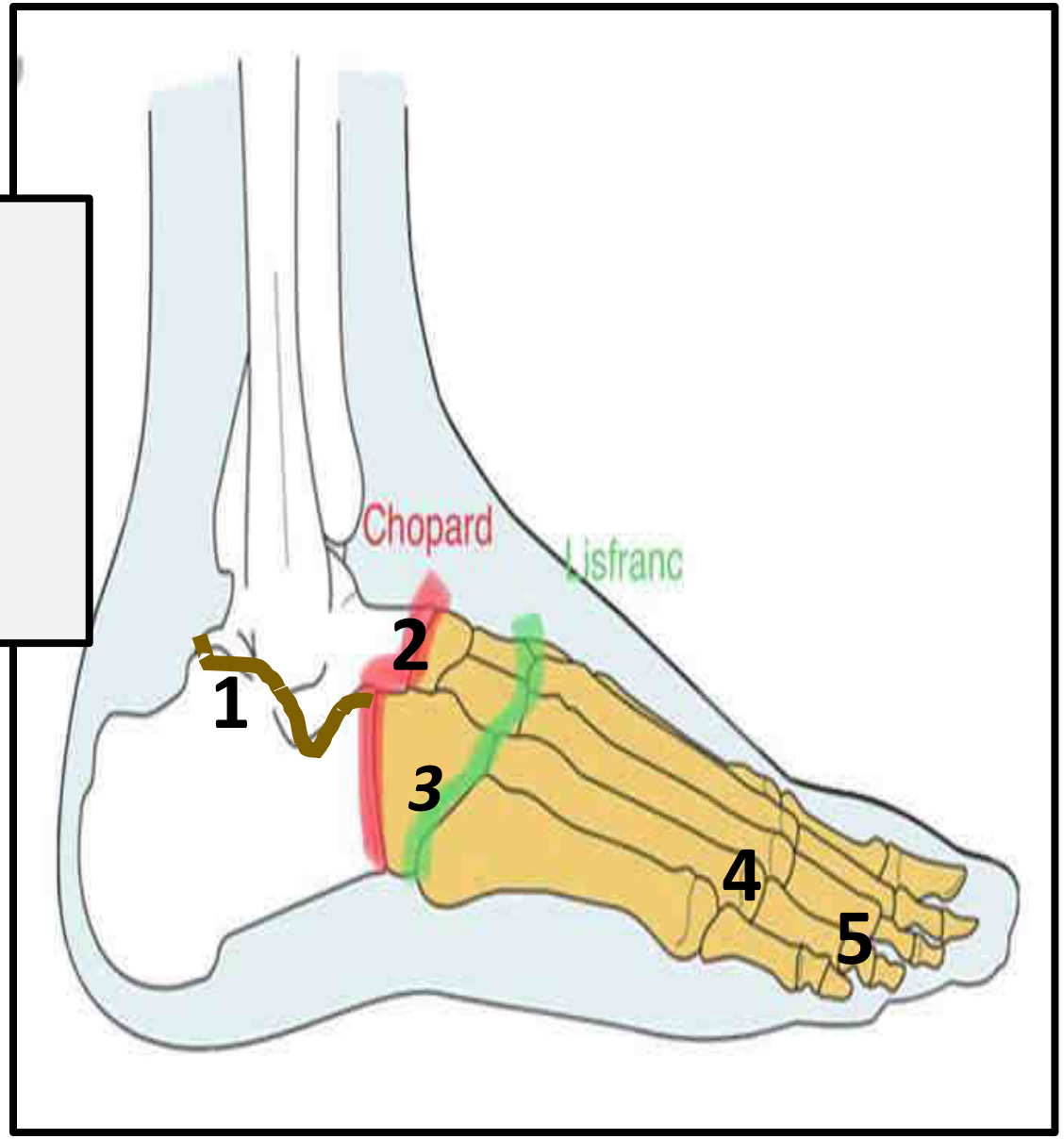
1. extension
2. rotation médiale
3. adduction
4. abduction
5. flexion
6. rotation latérale

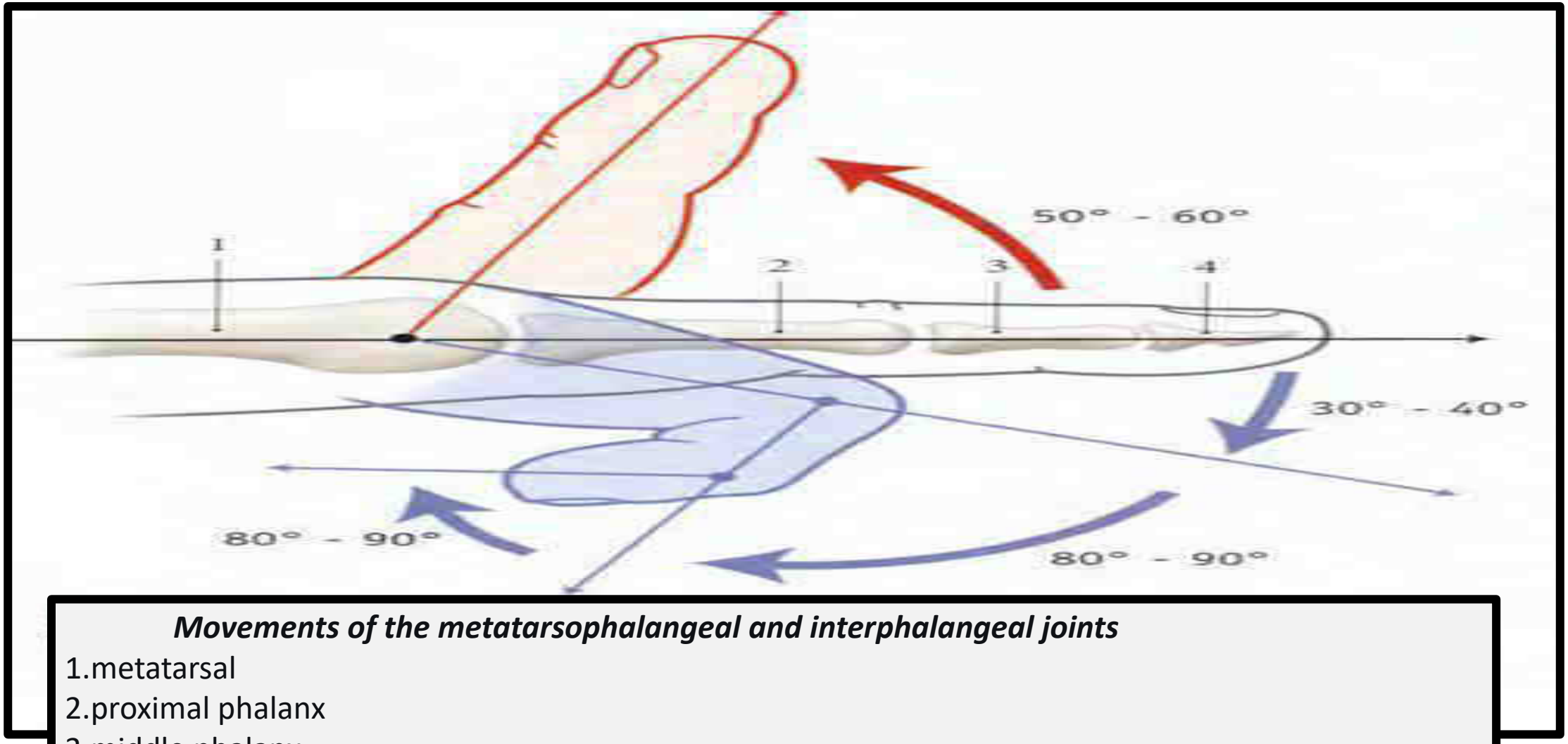
Forefoot Joints

LISFRANC JOINT OR TARSOMETATARSAL JOINT 3

METATARSOPHALANGEAL JOINTS 4

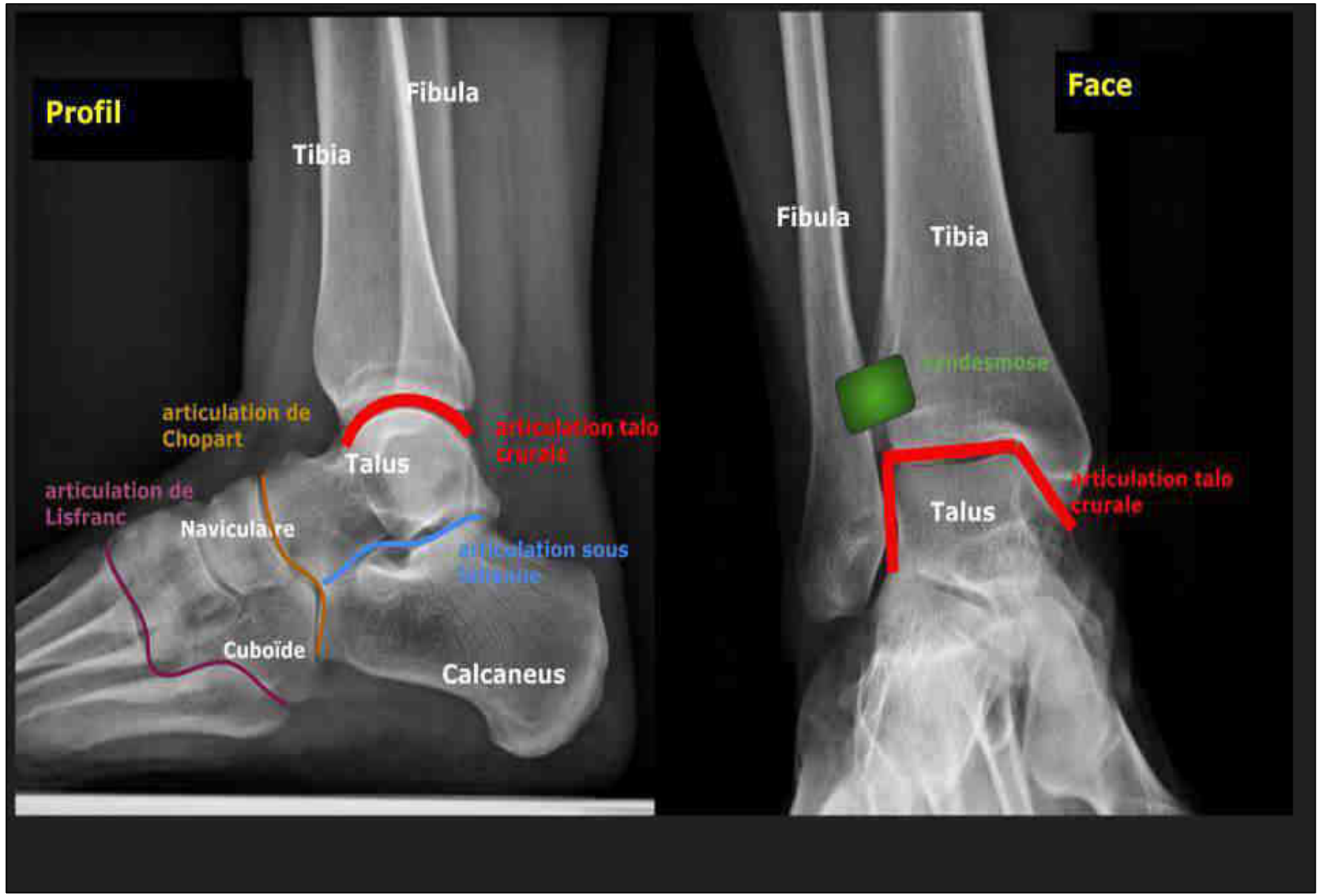
INTERPHALANGEAL JOINTS 5

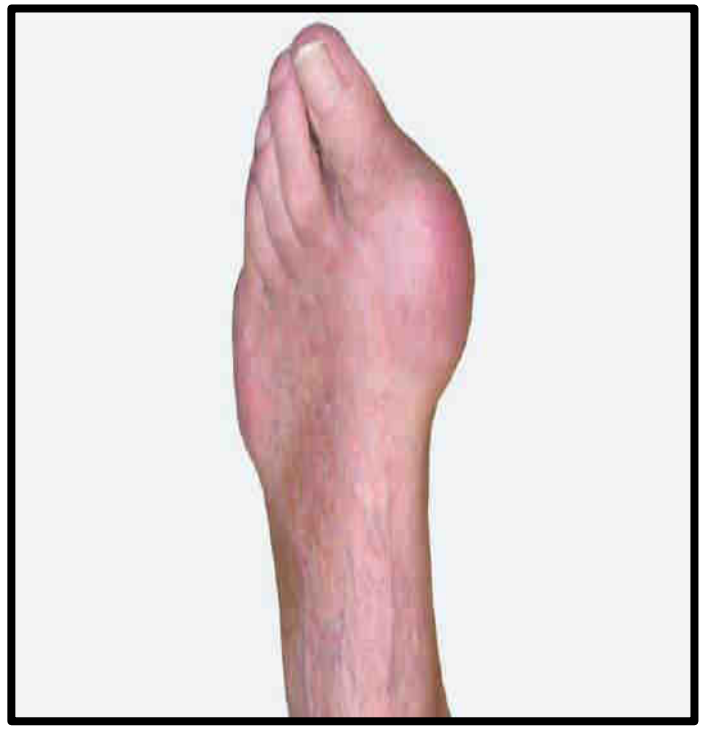


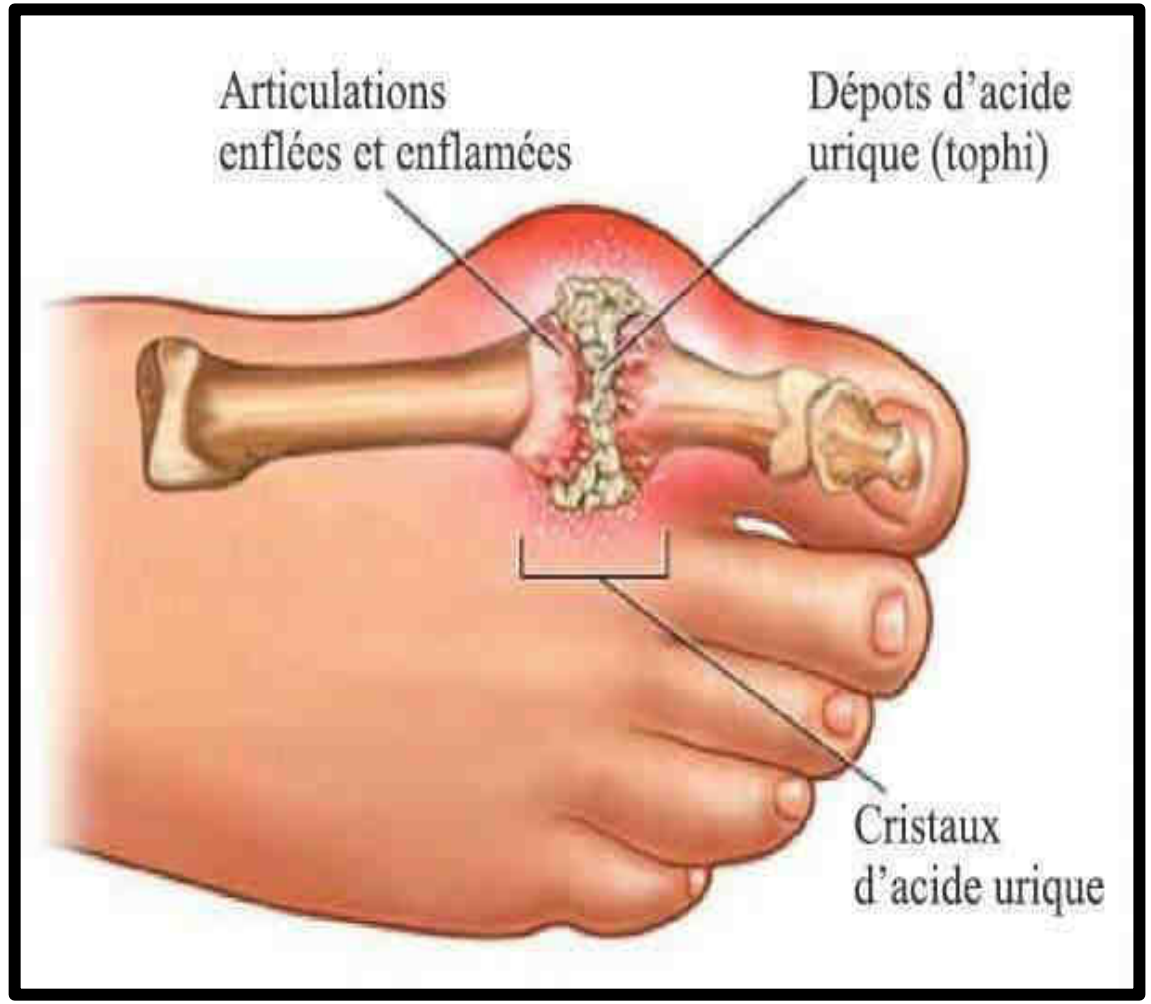


Movements of the metatarsophalangeal and interphalangeal joints

1.metatarsal
2.proximal phalanx
3.middle phalanx
4.distal phalanx


Profil
Fibula
Tibia
articulation de Chopart
articulation talo crurale
Talus
articulation de Lisfranc
Naviculaire
articulation sous talienne
Cuboïde
Calcaneus
Face
Fibula
Tibia
syndesmose
articulation talo crurale
Talus




Articulations
enflées et enflamées
Dépots d'acide
urique (tophi)
Cristaux
d'acide urique