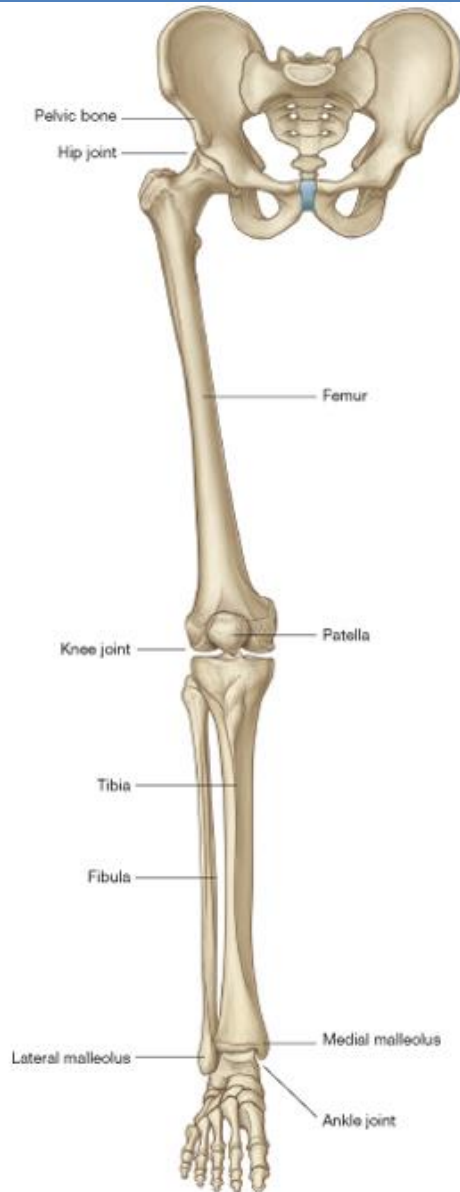




Pelvic cavity. Gross anatomy of the lower limb. Walking.

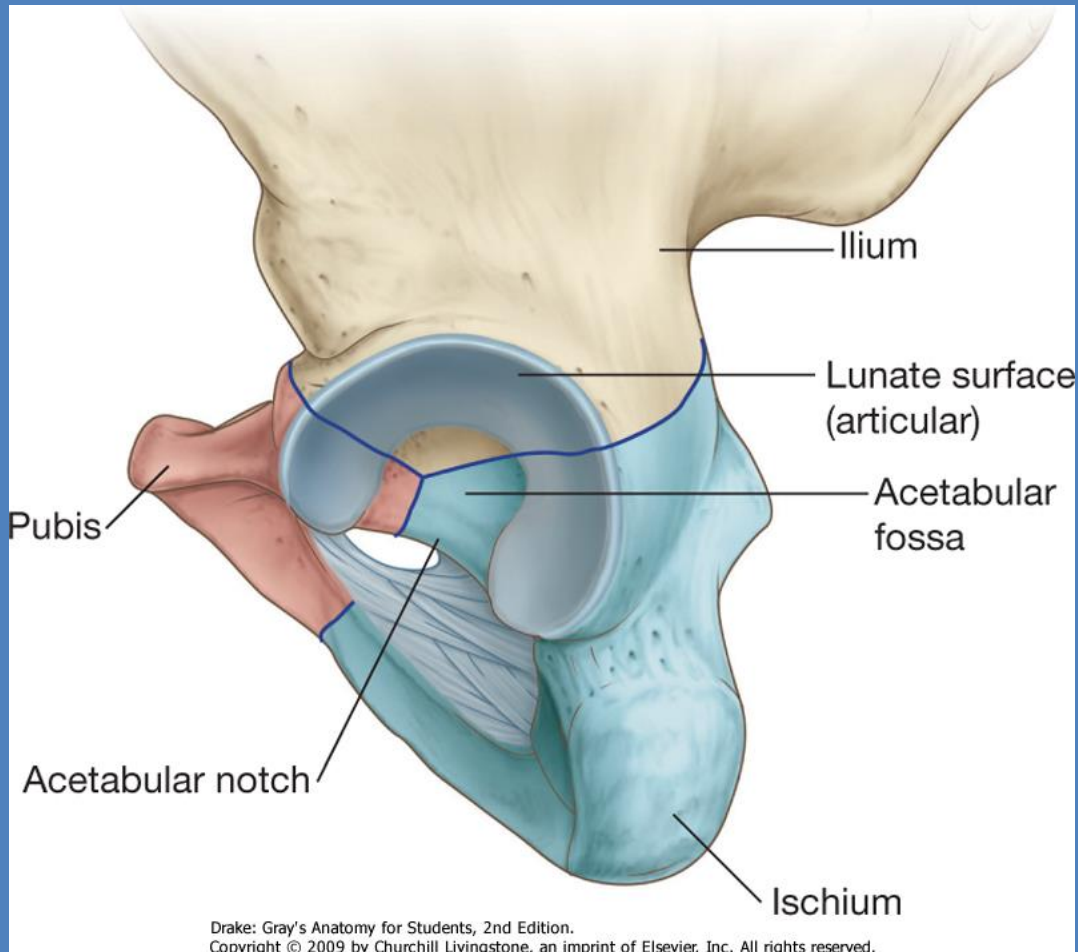
Sándor Katz M.D.,Ph.D.

Lower limb



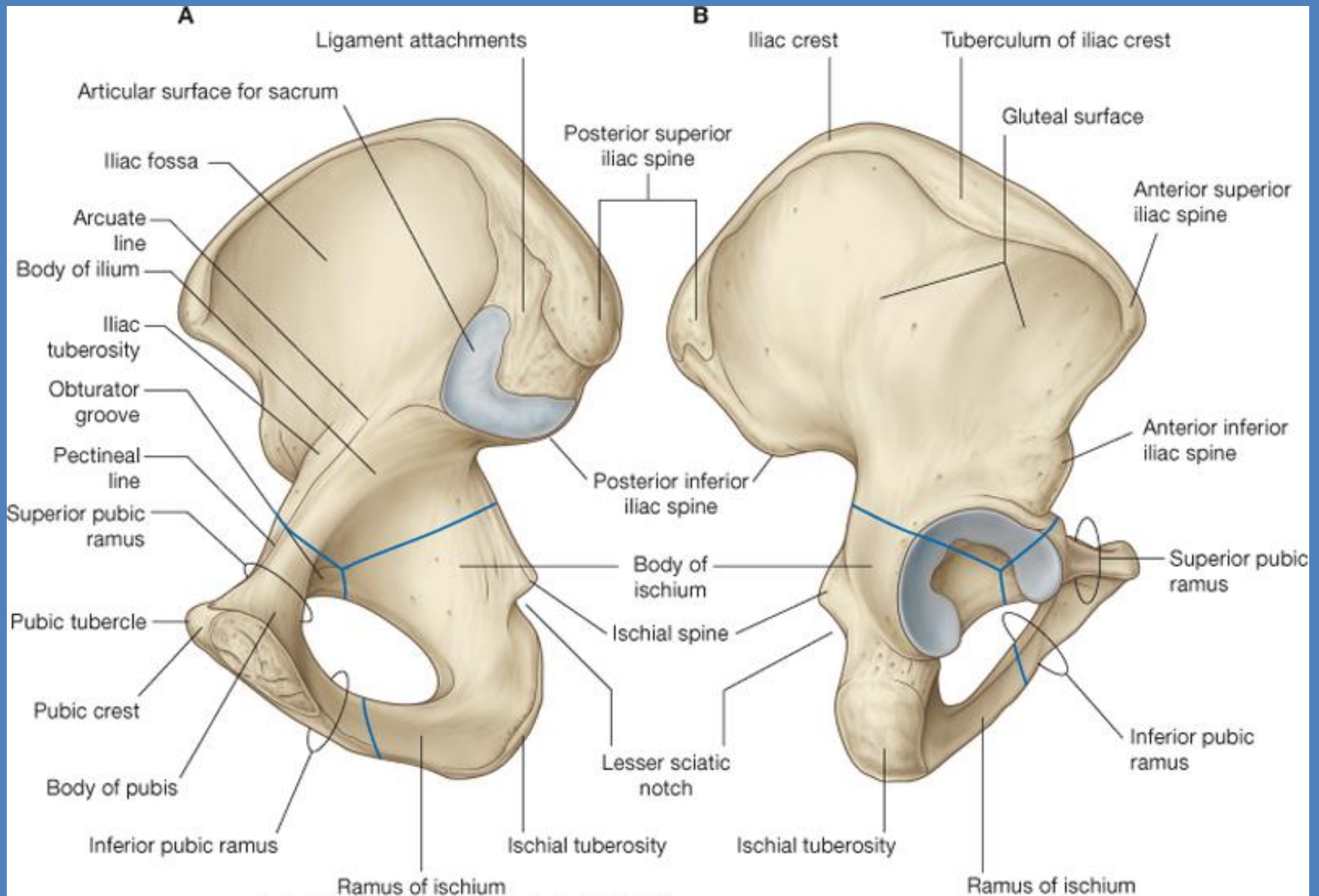
- Pelvic girdle
- Free lower extremity

Hip bone



Definitive fusion of the Y-shaped growth plate occurs 16th -18th year.

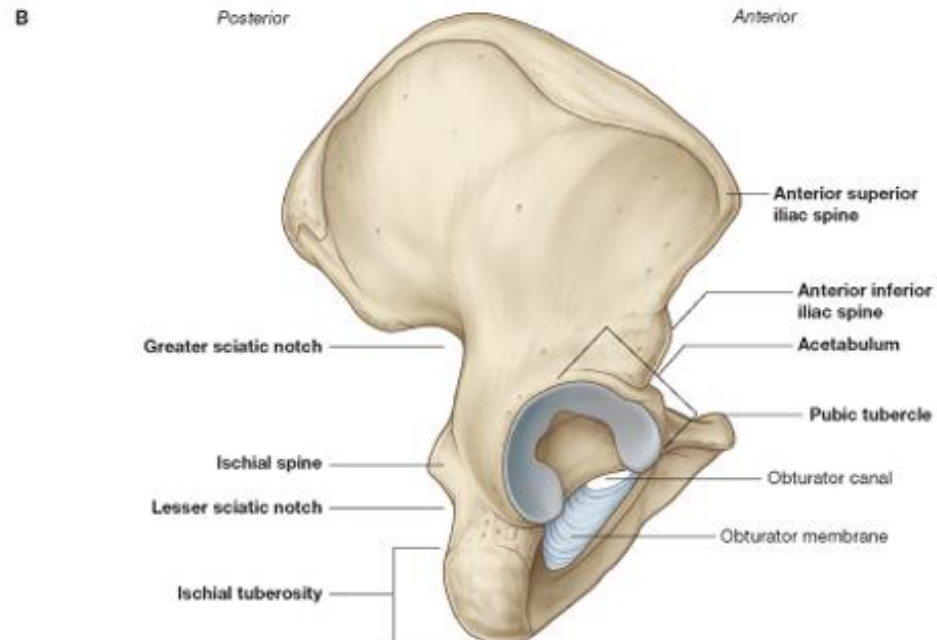
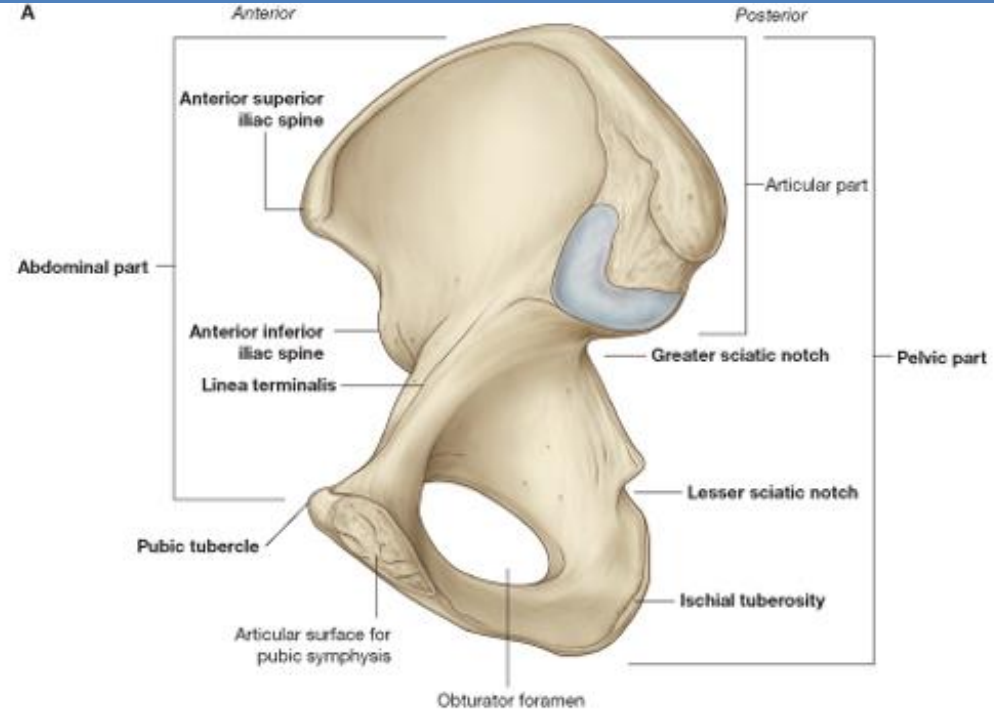
Hip bone



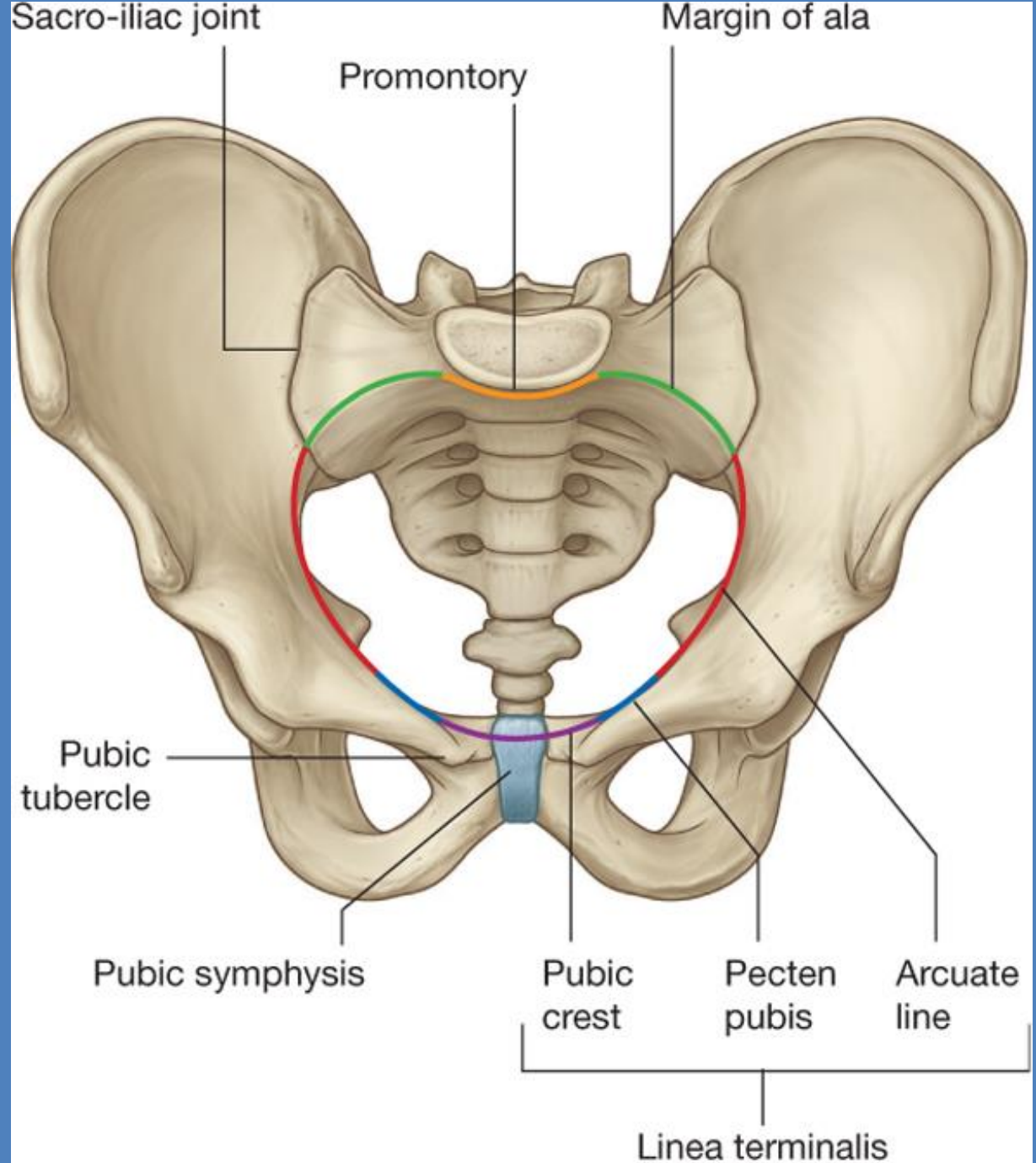
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Hip bone



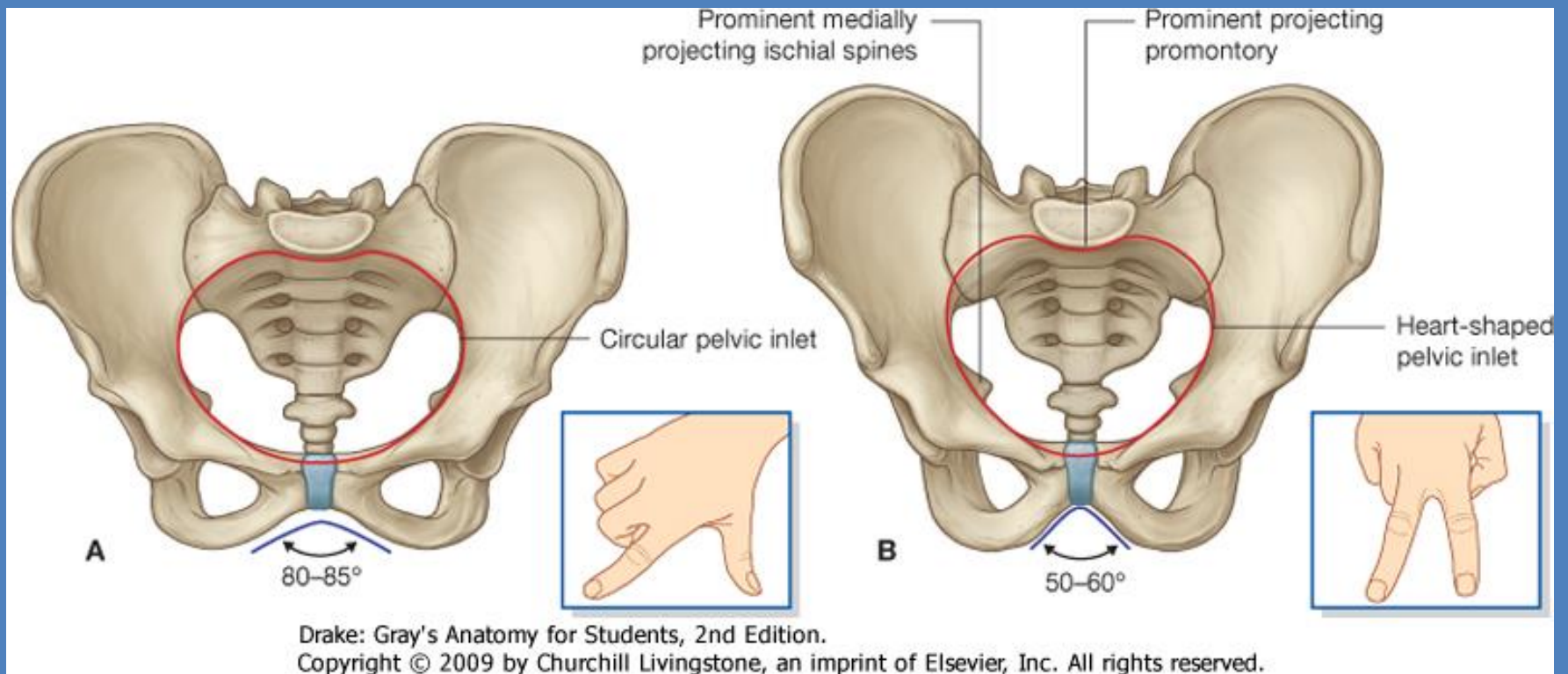
Pelvis



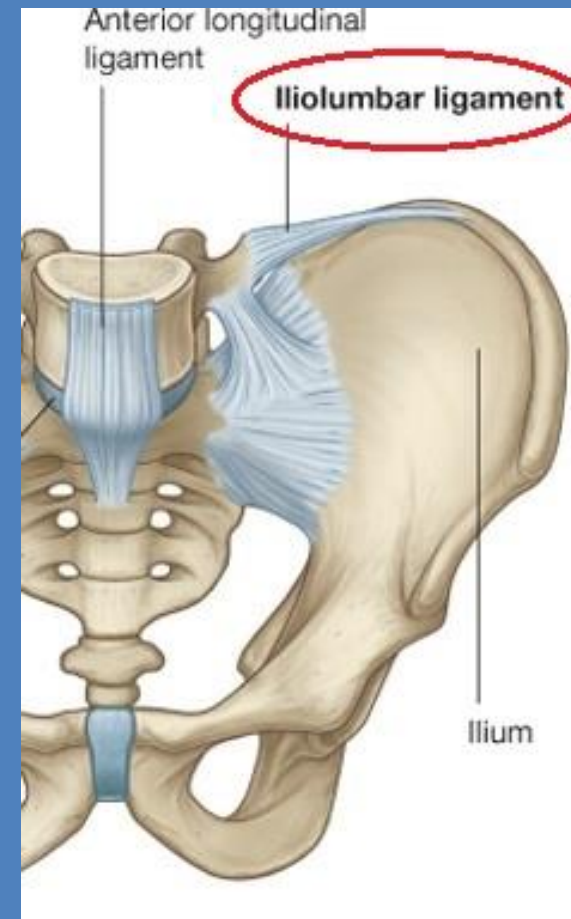
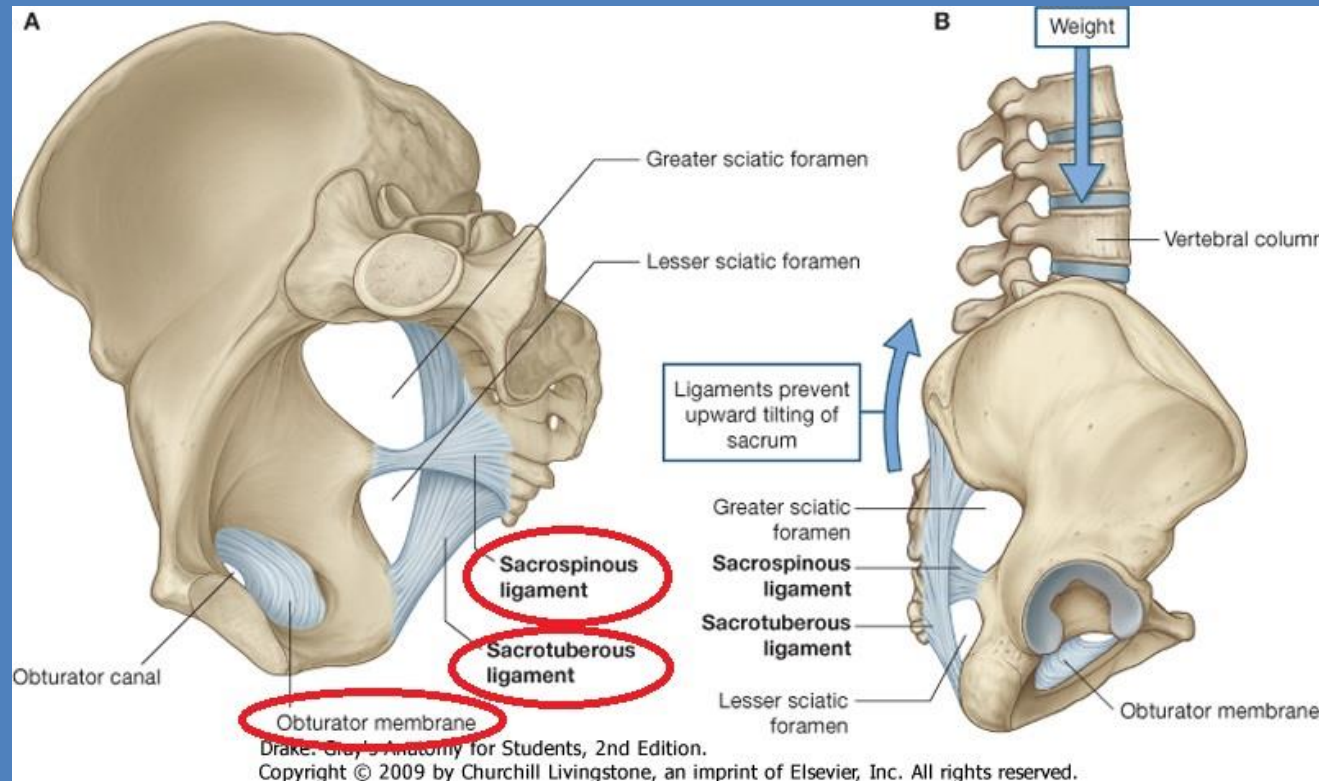
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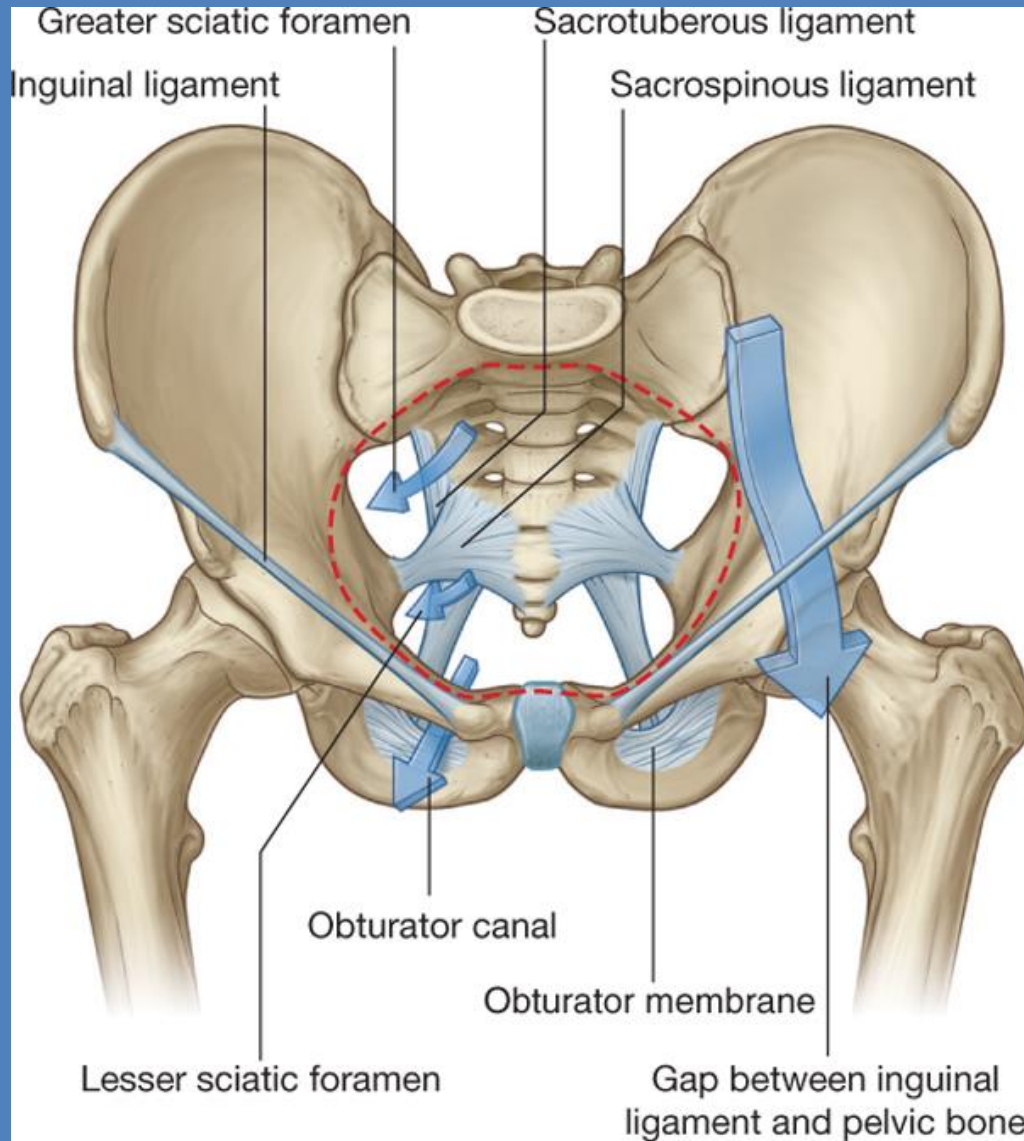
Comparison of the female and male pelvises



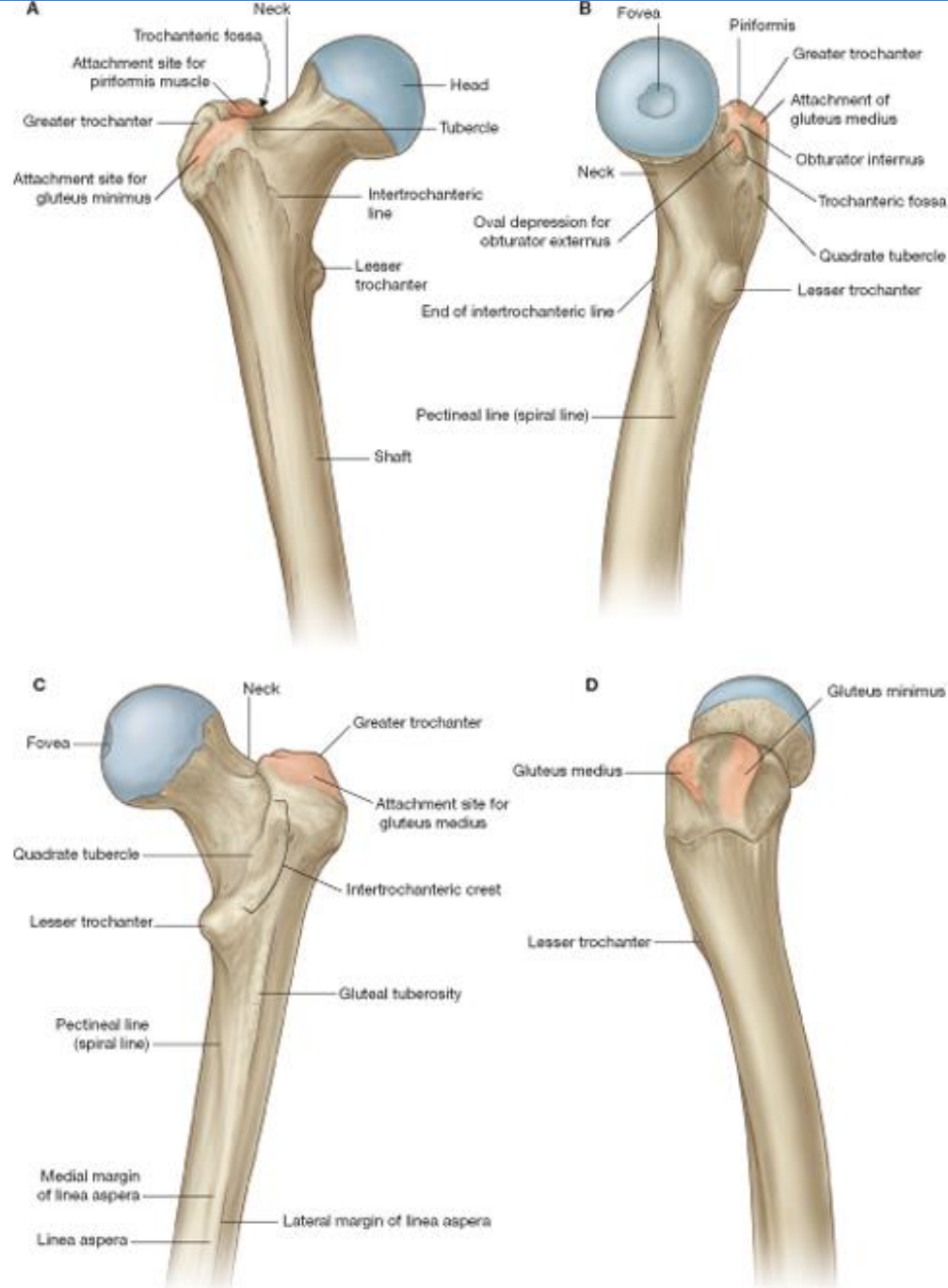
Pelvic ligaments



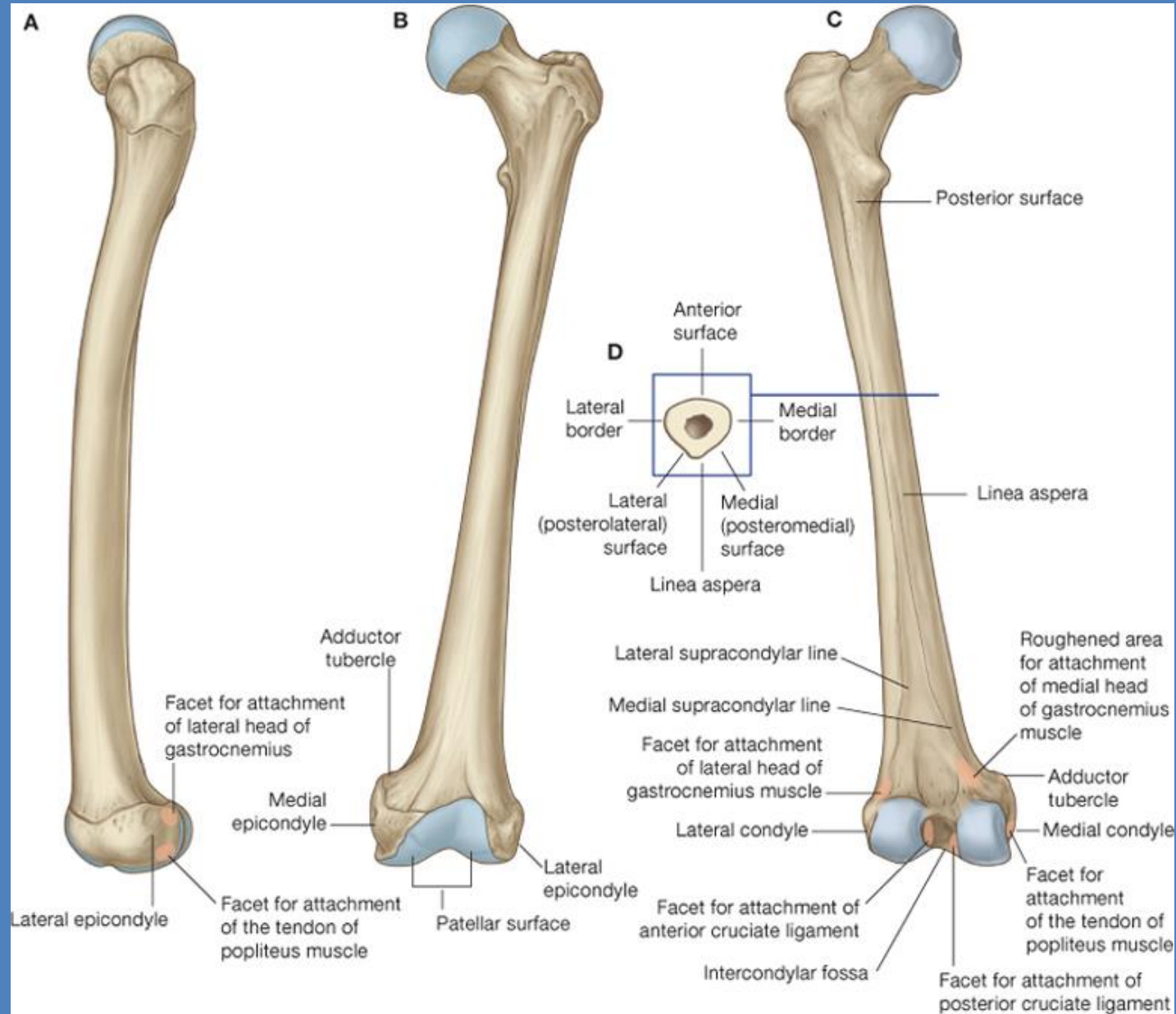
Pelvis

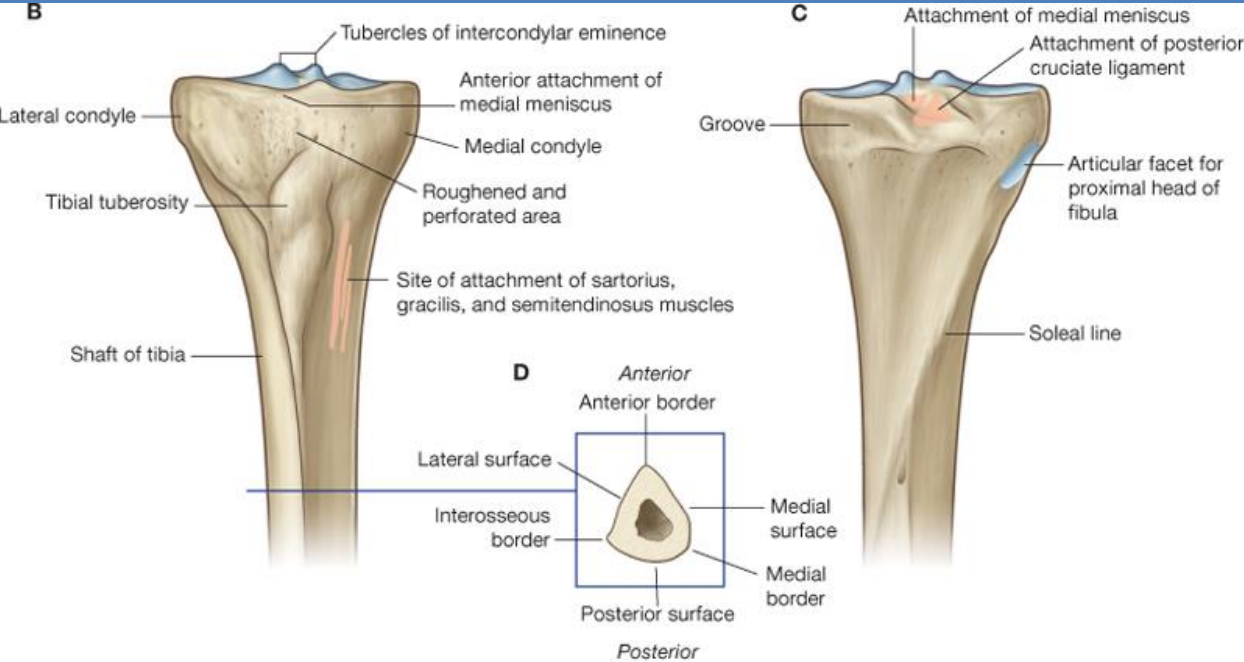


Femur



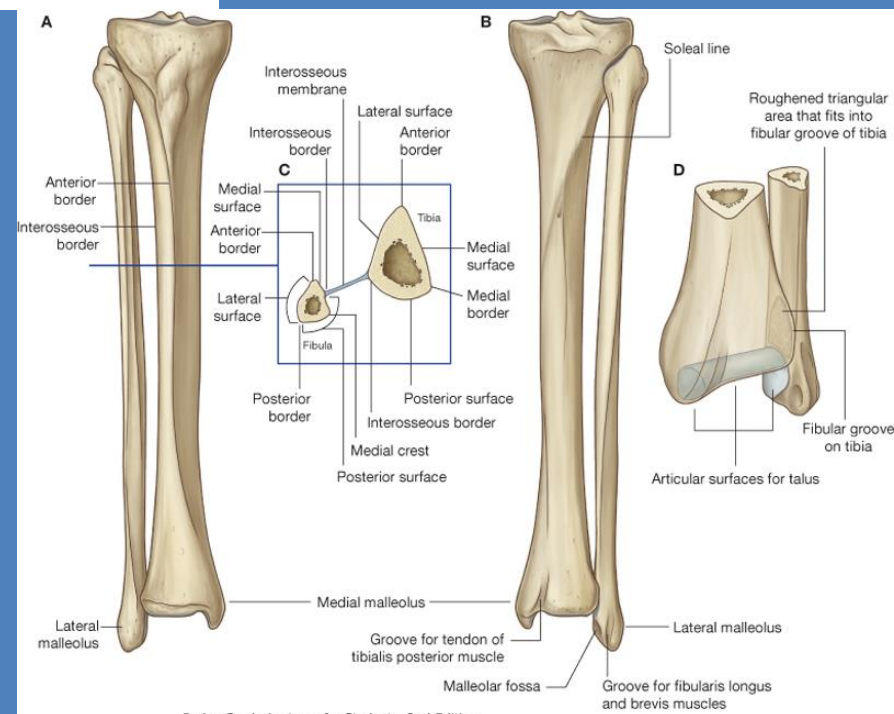
Femur





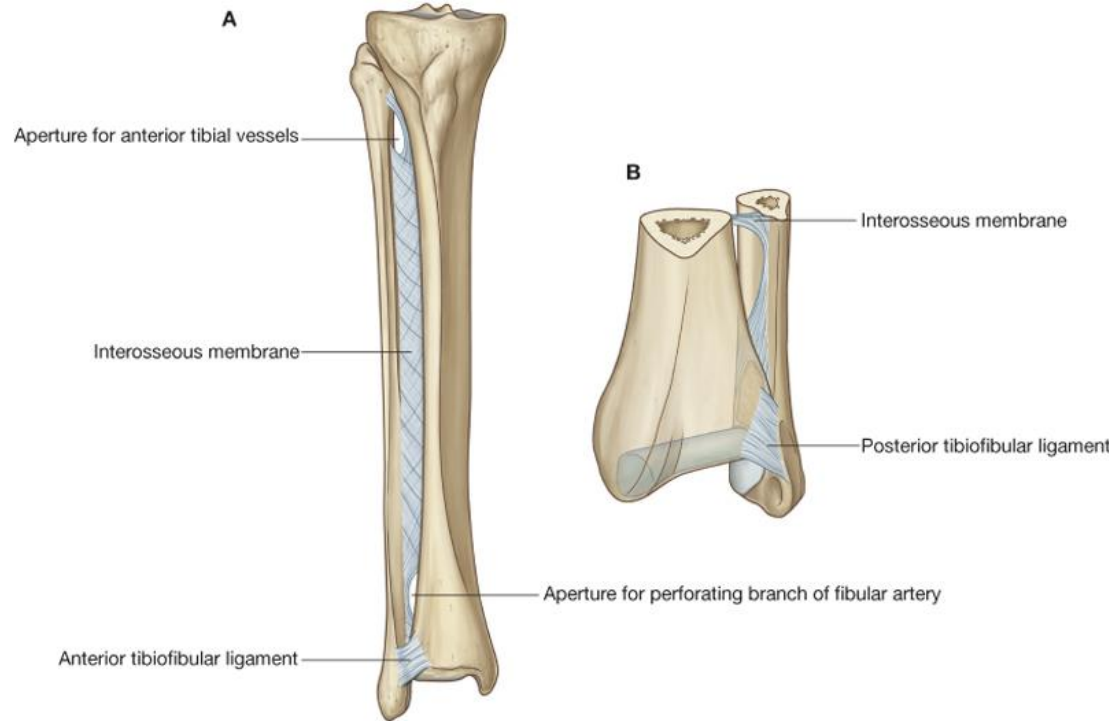
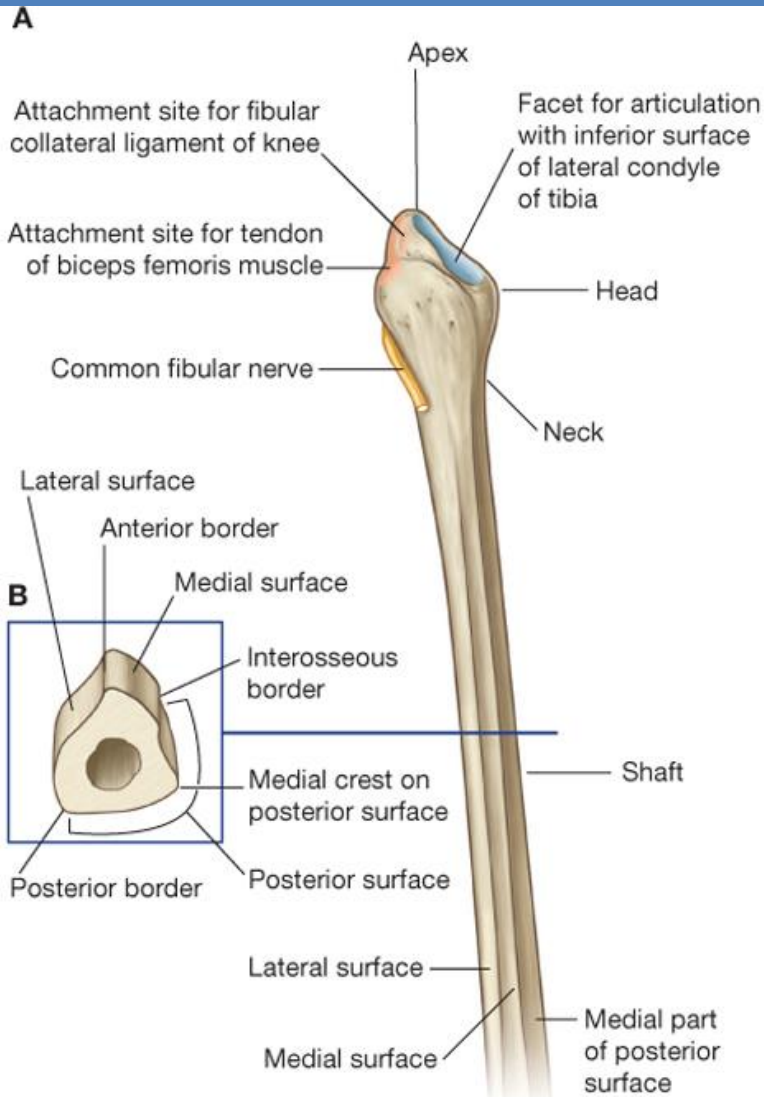
Tibia

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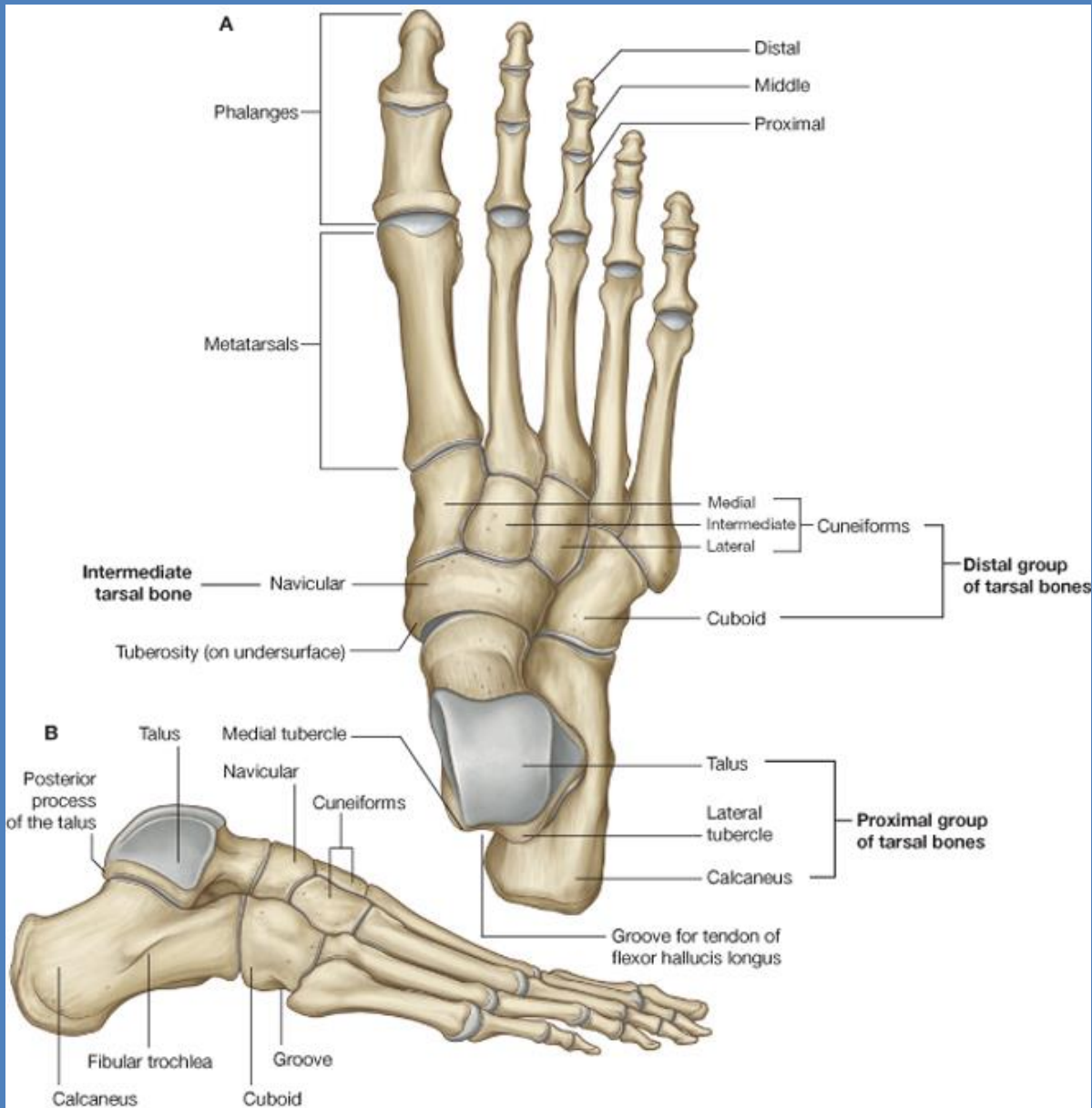
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Fibula



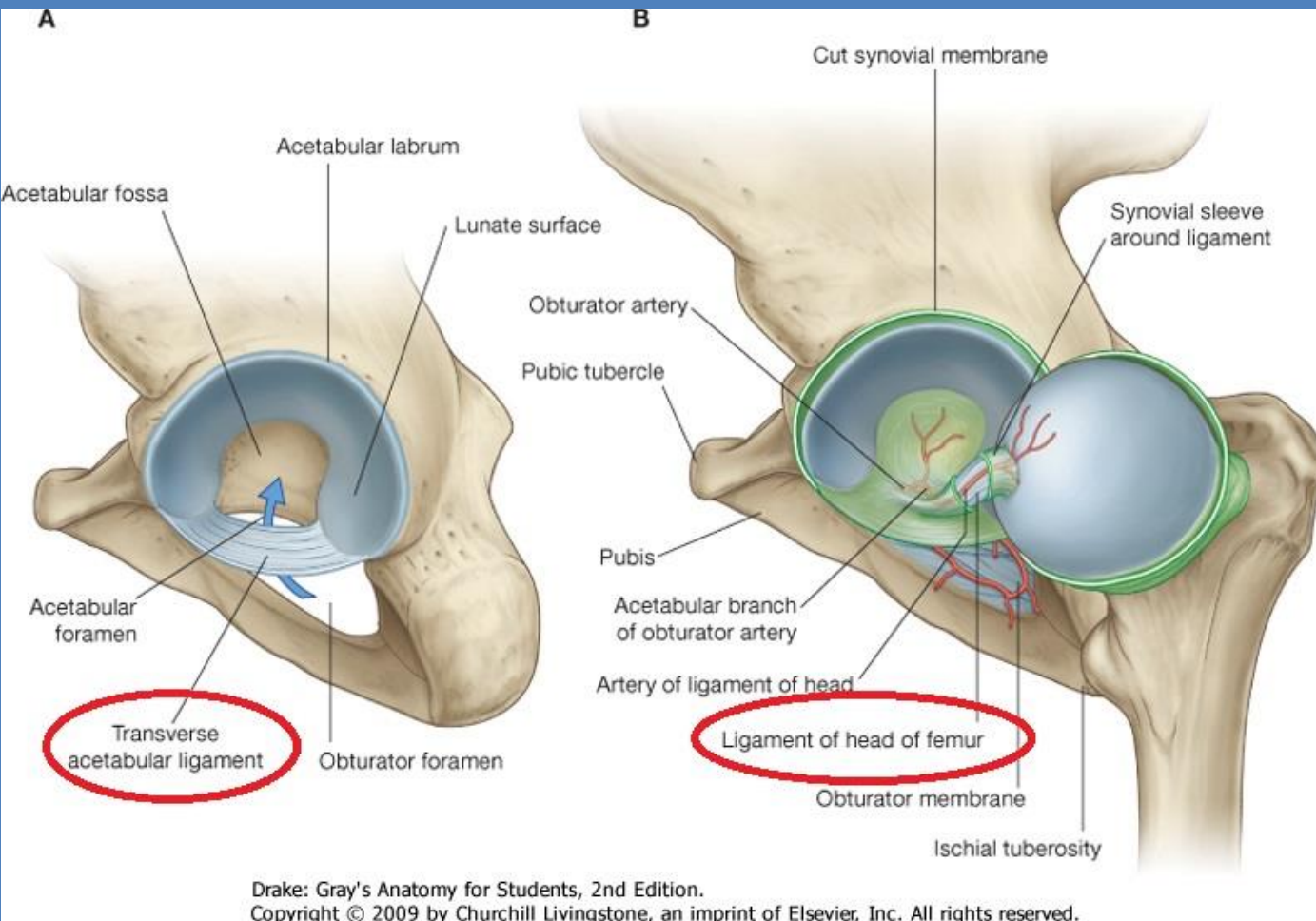
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Bones of the foot



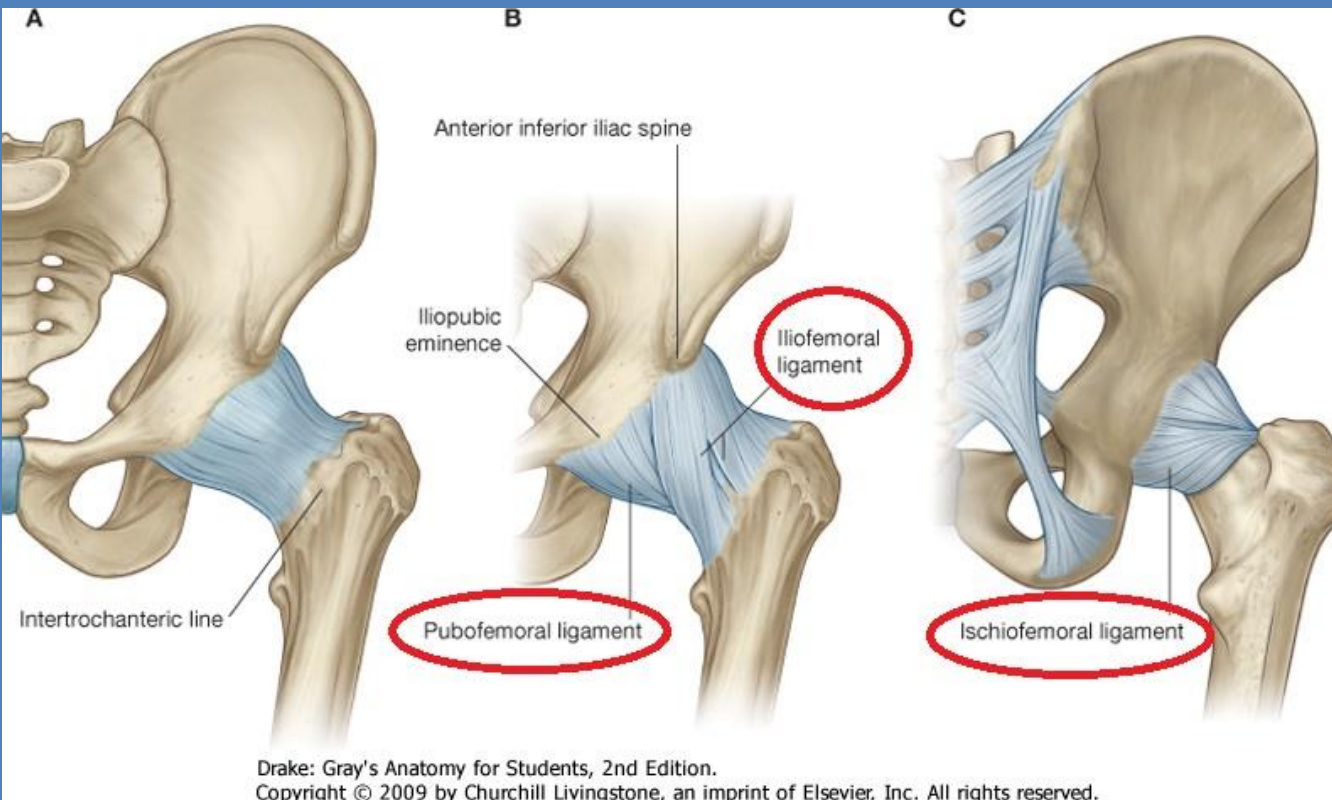
Hip joint

type: ball-and-socket



Intracapsular ligaments

Hip joint



Extracapsular ligaments:

When the hip is extended, these ligaments become twisted upon themselves, pushing the femoral head more firmly into the acetabulum (joint-stabilizing function). During flexion the ligament fibers are relaxed.

(4th ligament: zona orbicularis)

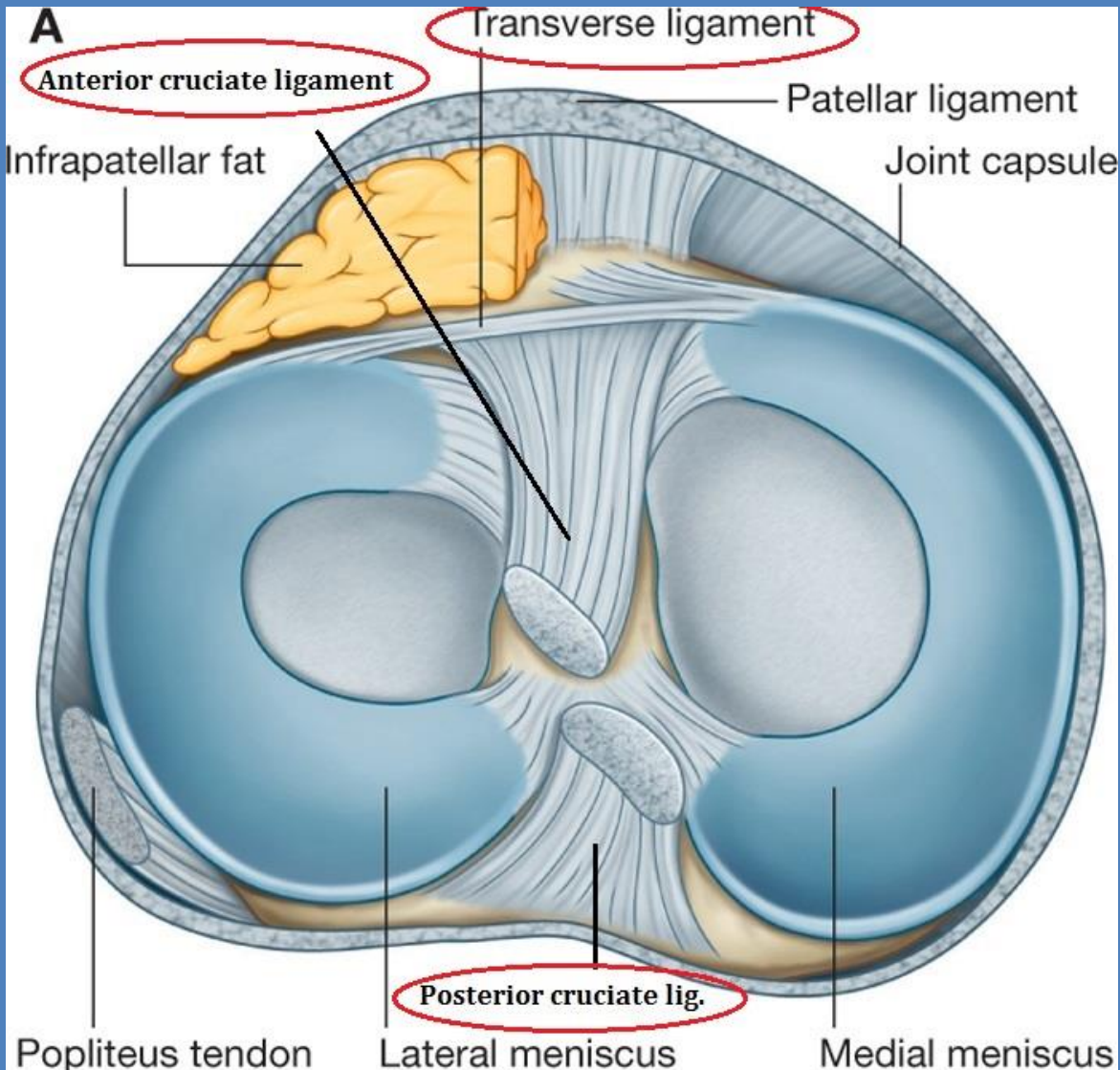
Hip joint- movements

- Flexion: 120°
- Extension: 20°
- Abduction: 40°
- Adduction: 0° (30°)
- Rotation: 90°

Circumduction

Knee joint

type: trochoginglimus (hinge and pivot)

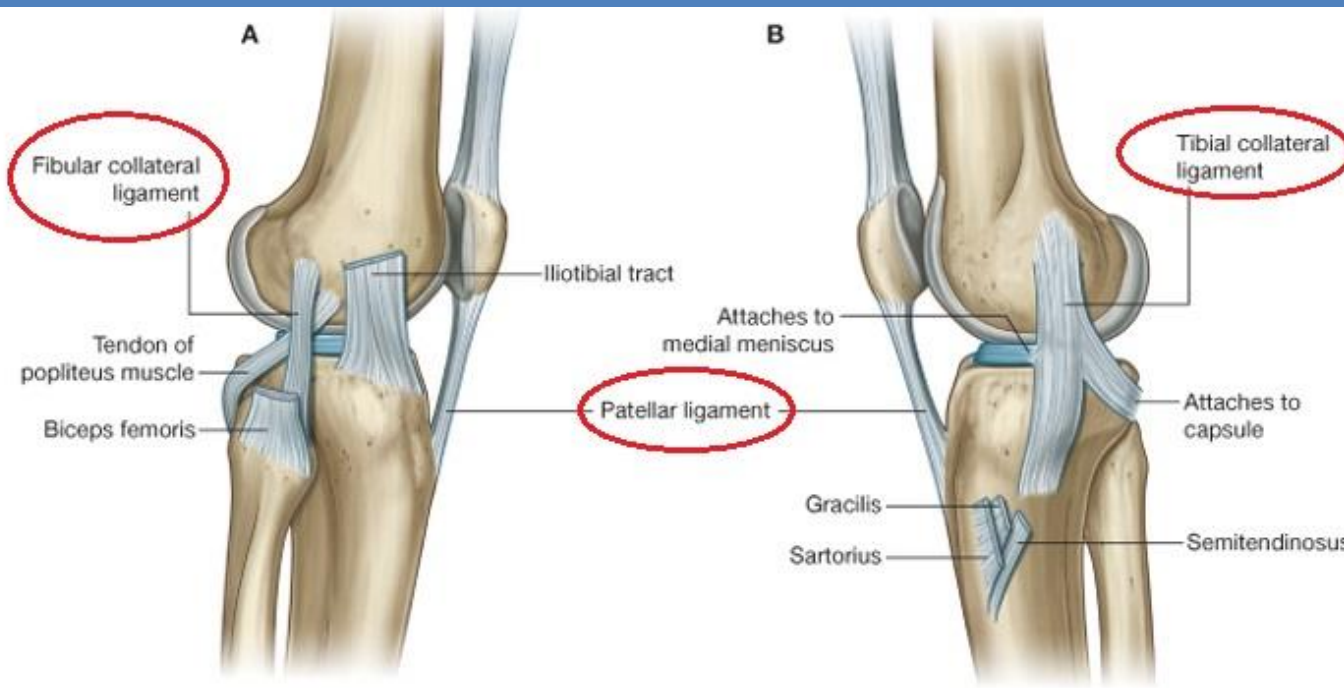


- Intracapsular ligaments:
- *Anterior cruciate lig.*
 - *Posterior cruciate lig.*
 - *Transverse lig.*
 - *Posterior menisiofemoral .lig.*

Medial meniscus: C-shaped.

Lateral meniscus: almost a complete ring.

Knee joint

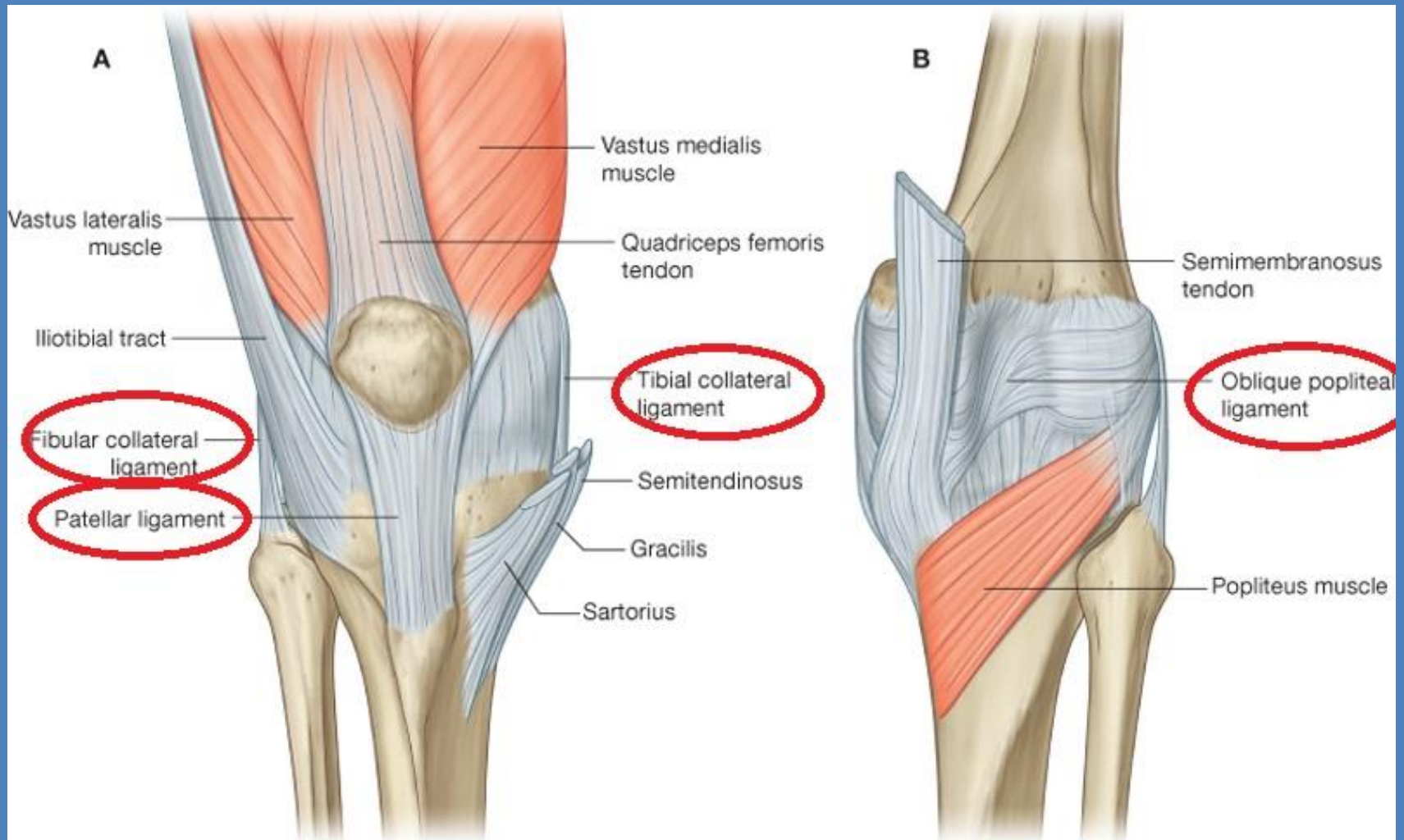


Extracapsular ligaments.

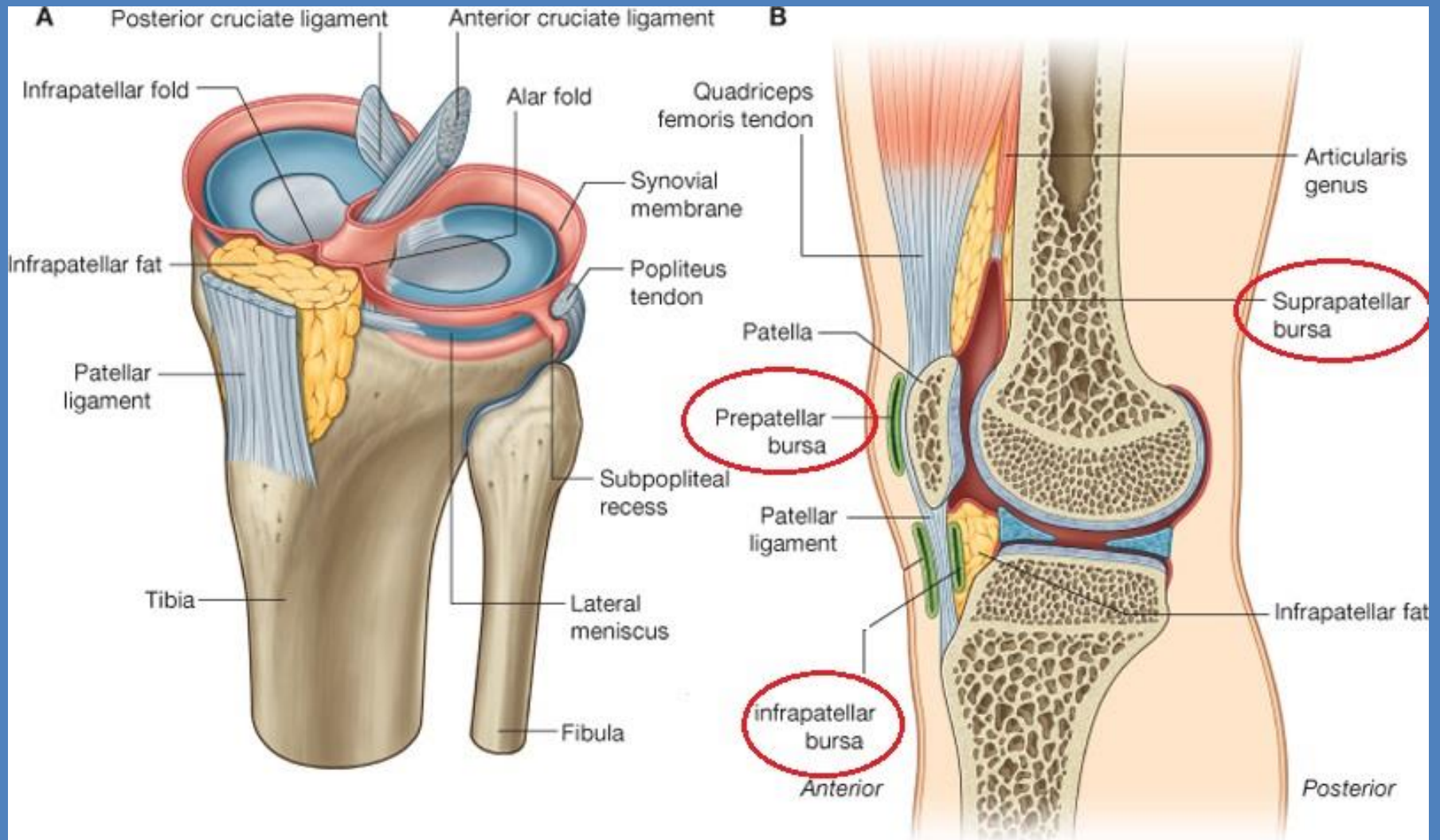
Tibial collateral lig. is broader and fuses with the articular capsule and medial meniscus.

Fibular collateral lig. is cord-like and separates from the articular capsule.

Knee joint-extracapsular ligaments



Knee joint-bursae

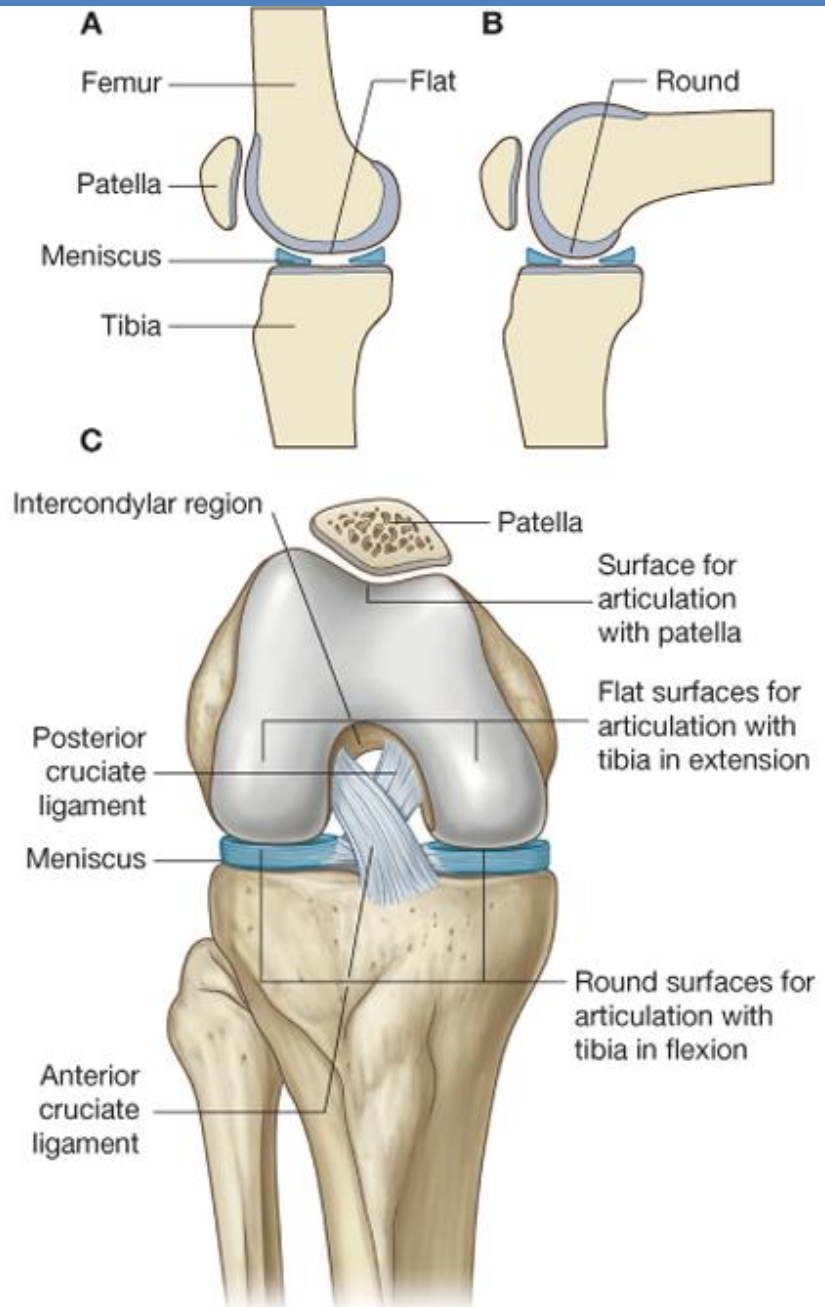


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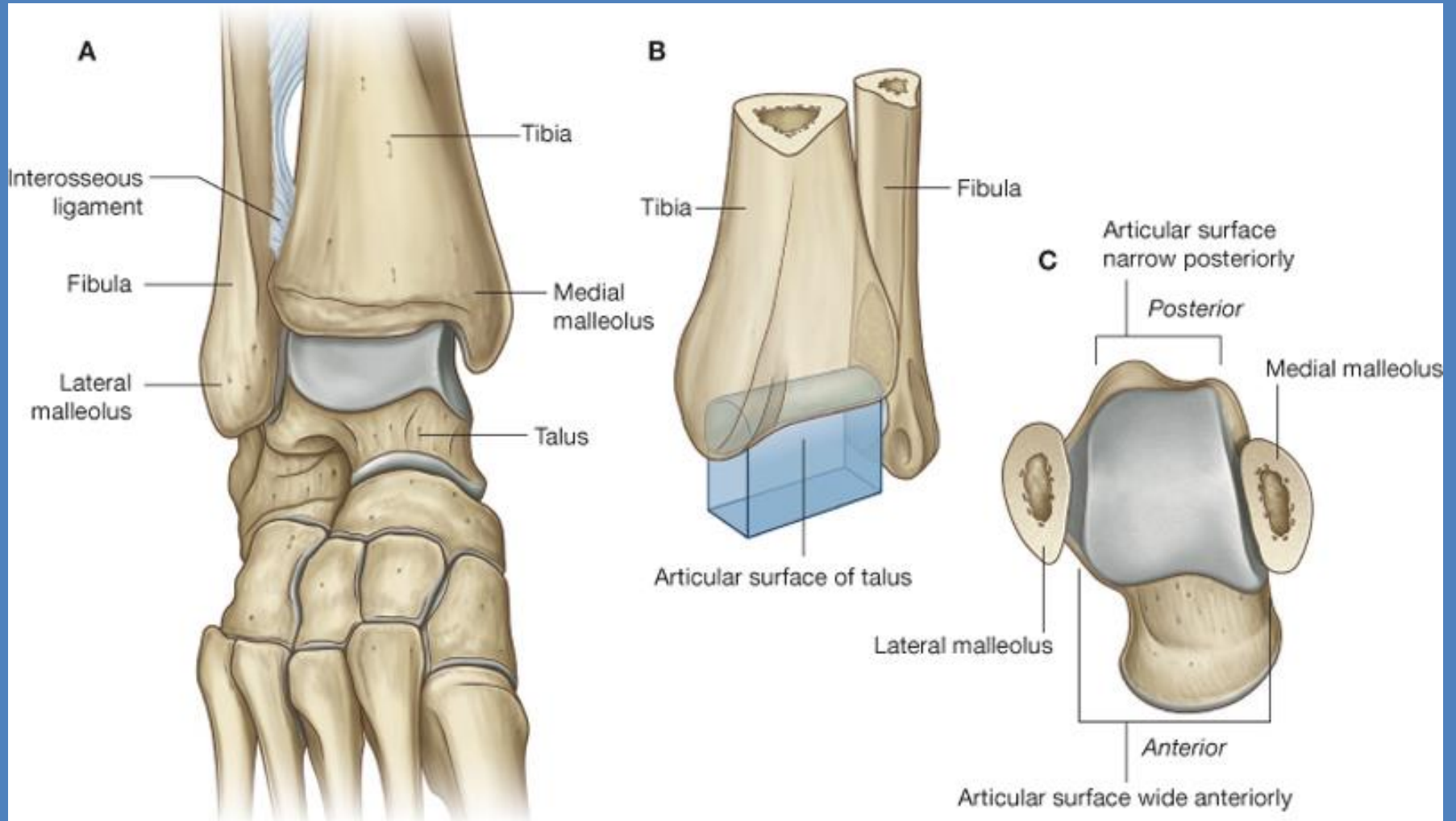
Knee joint-movements

- Flexion: 120-130°
- Hyperextension: 5°
- Voluntary rotation: 50-60° (internal rotation: 10°, external rotation: 30-40°)
- Conjunct/terminal rotation: 10°



Ankle (talocrural) joint

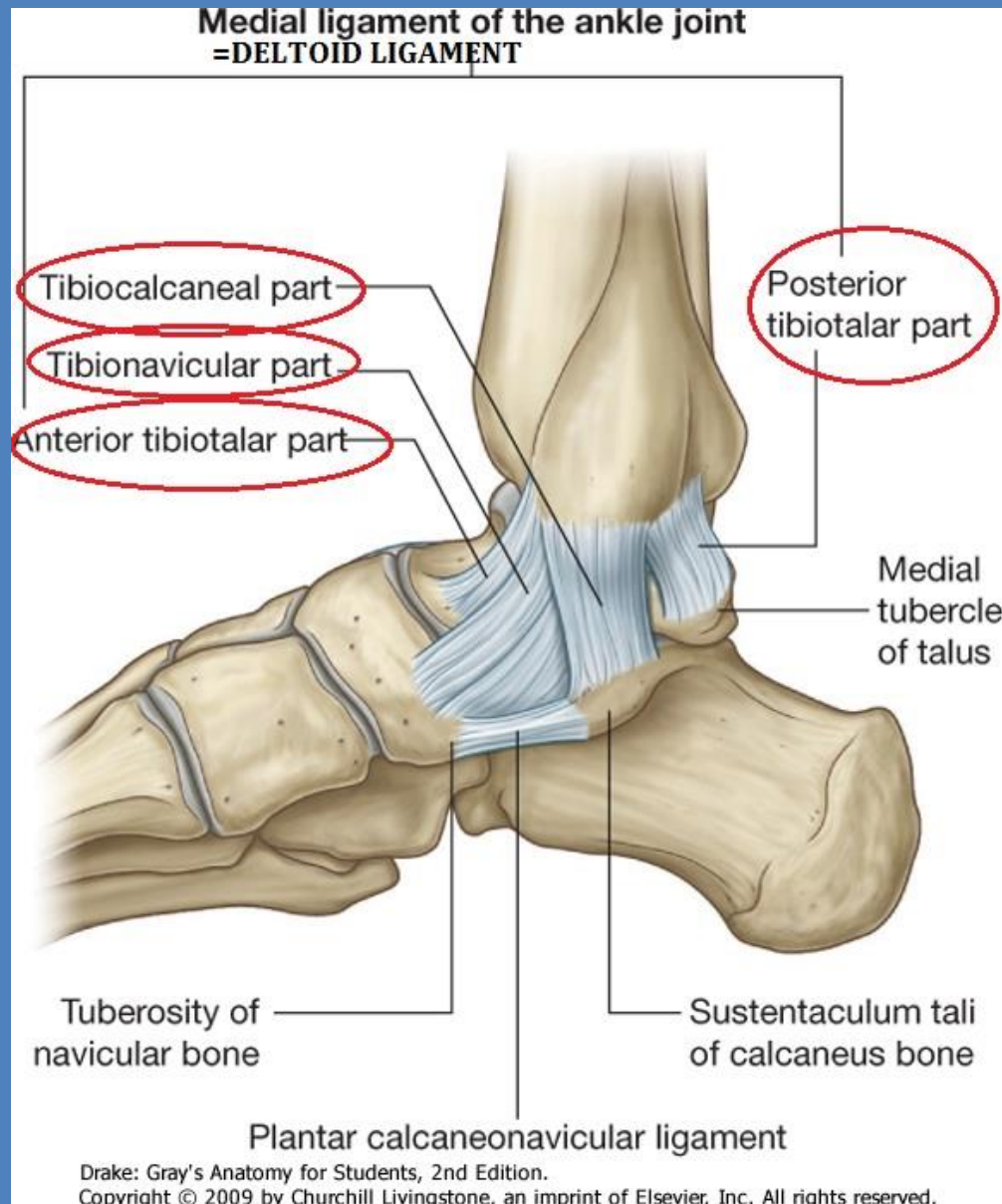
type: hinge



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Talocrural joint - medial collateral ligament



Medial collateral = deltoid ligament

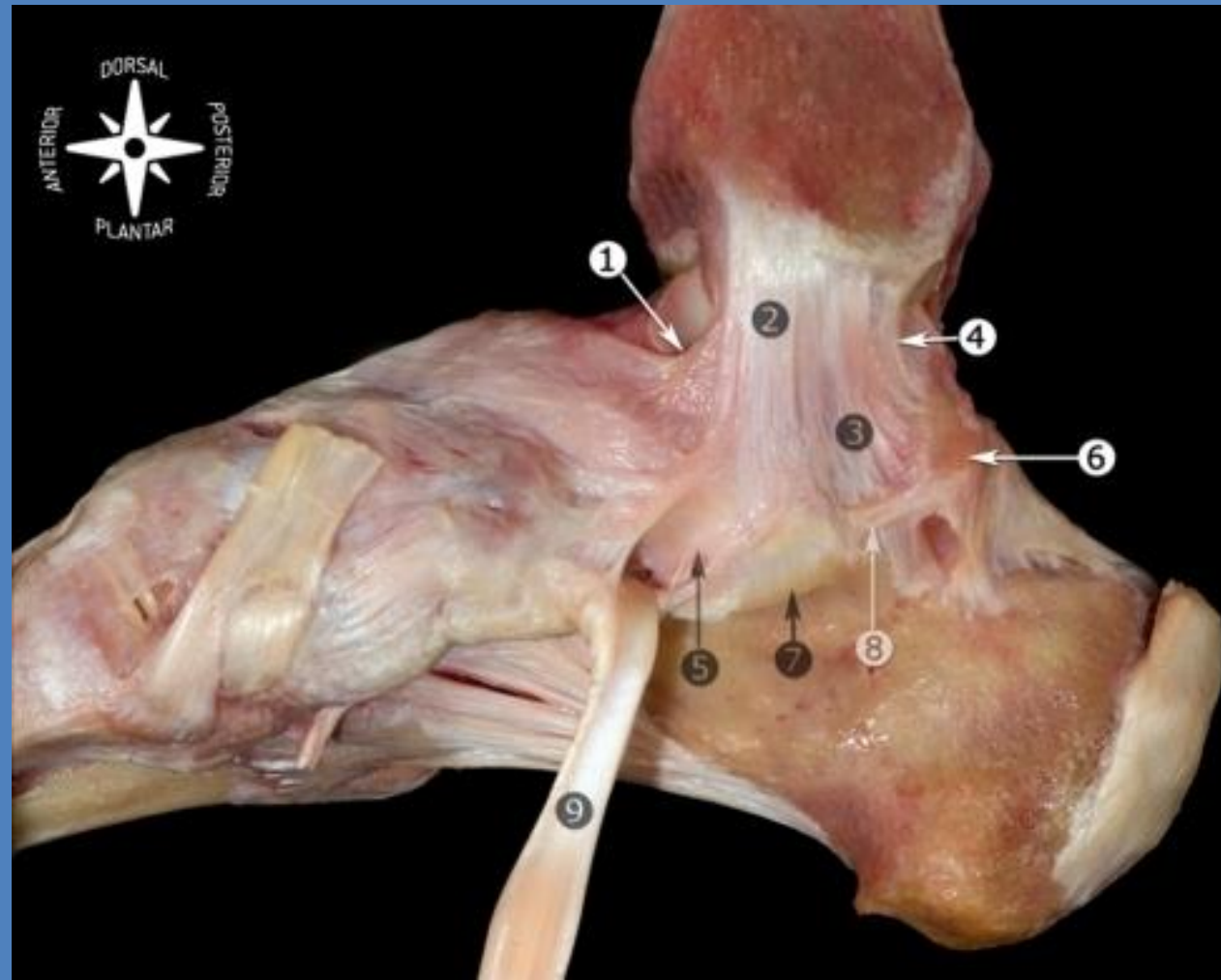
Tibionavicular part (1)

(partly covers the anterior tibiotalar part)

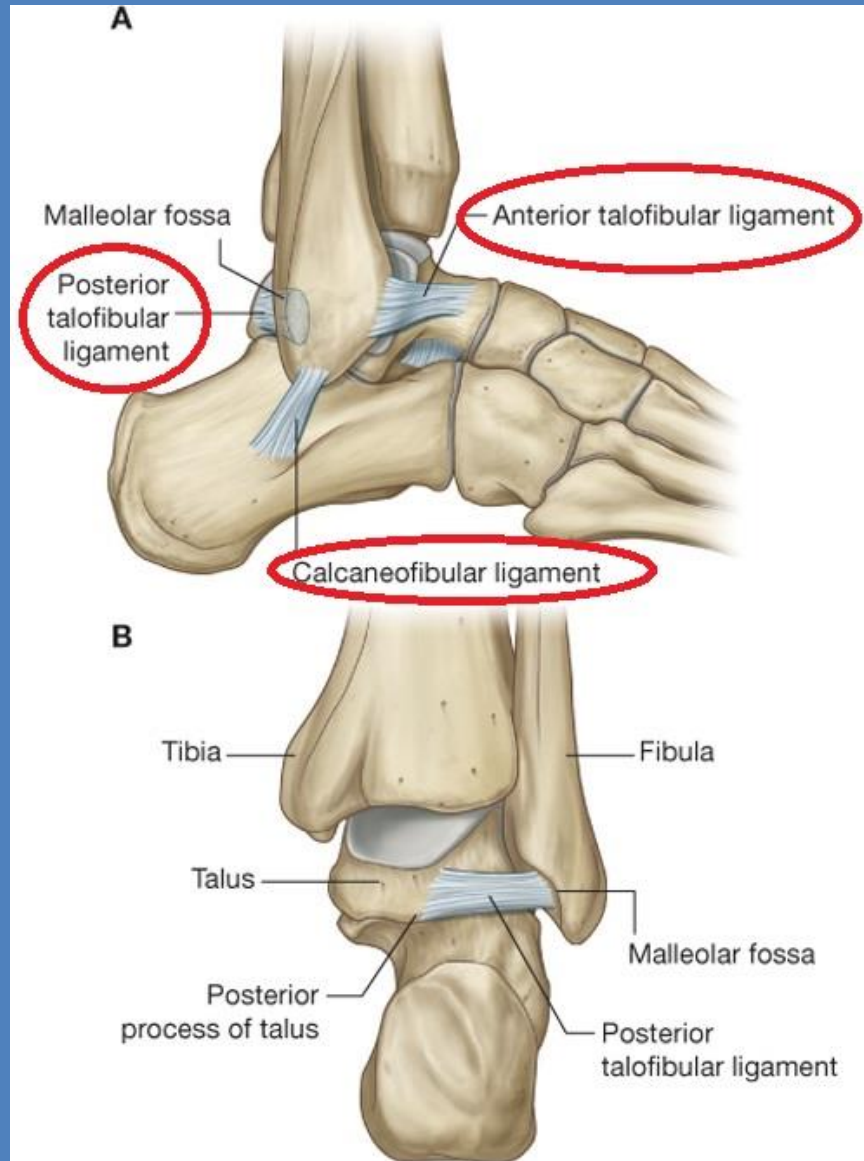
Tibiocalcaneal part (2-3)

Posterior tibiotalar part (4)

Medial process (6)
Sustentaculum tali (7)
Tendon of tibialis posterior muscles (9)



Talocrural joint - lateral collateral ligament



Lateral collateral ligament

Anterior talofibular ligament (5, 6)

Calcaneofibular ligament (10)

Lateral malleolus (1)

Tibia (2)

Syndesmosis tibiofibularis (3, 4)

Talus (7)

Collum tali (8)

Caput tali (9)

Interosseous talocalcaneal ligament (11)

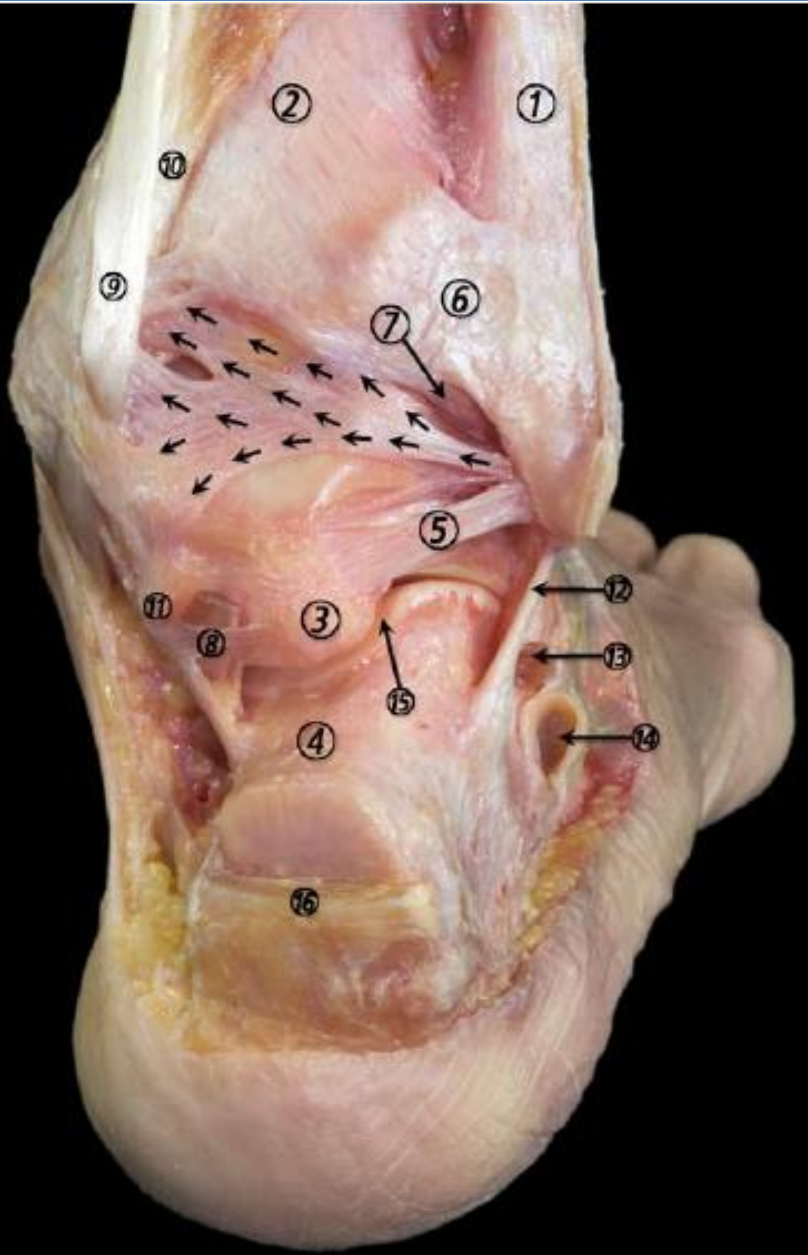
Cervical ligament (12)

Talonavicular ligament (13)

Navicular bone (14)



Lateral collateral ligament



Posterior talofibular ligament (5)

Fibula (1)

Tibia (2)

Proc. tali, tuberculum laterale (3)

Proc. tali, tuberculum mediale (11)

Tendo, musculus flexor hallucis longus (8)

Lig. calcaneofibulare (12)

Tendo, musculus peroneus brevis (13)

Tendo, musculus peroneus longus (14)

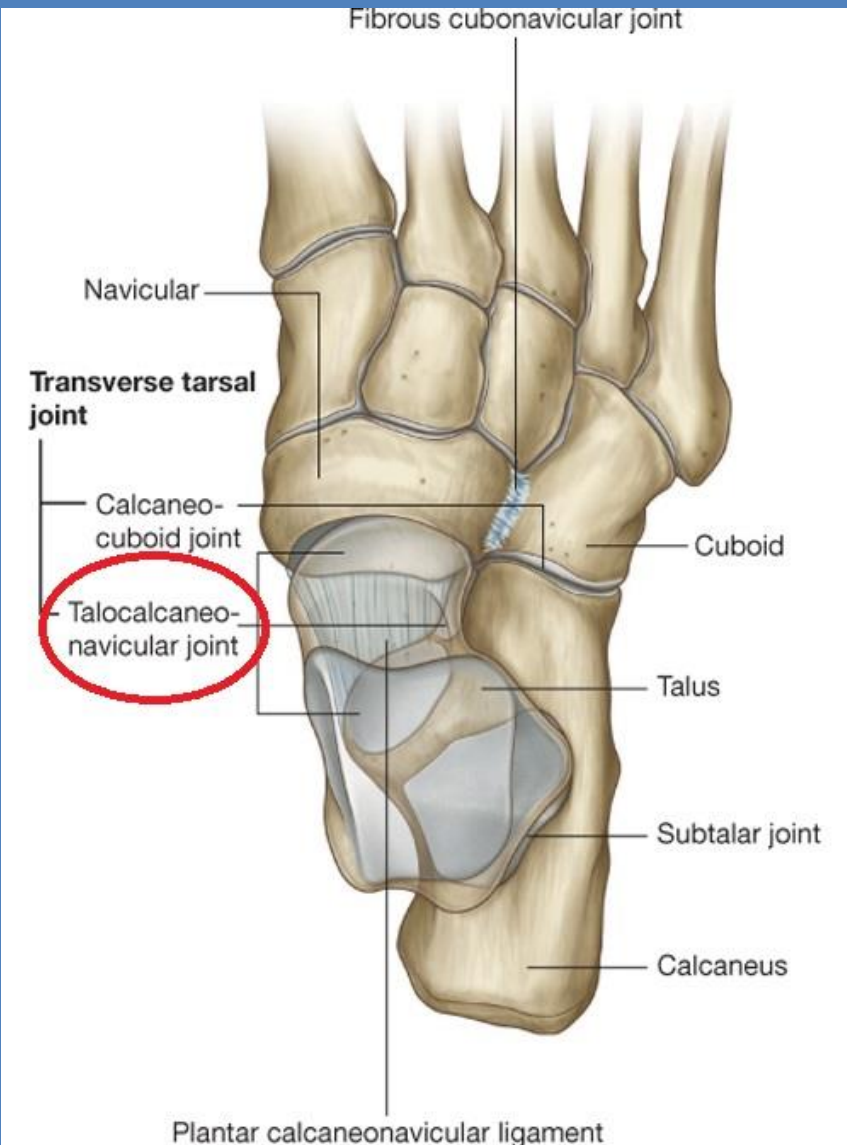
Art. subtalaris (15)

Talocrural joint - movements

Dorsiflexion: 15°

Plantarfelxion: 40°

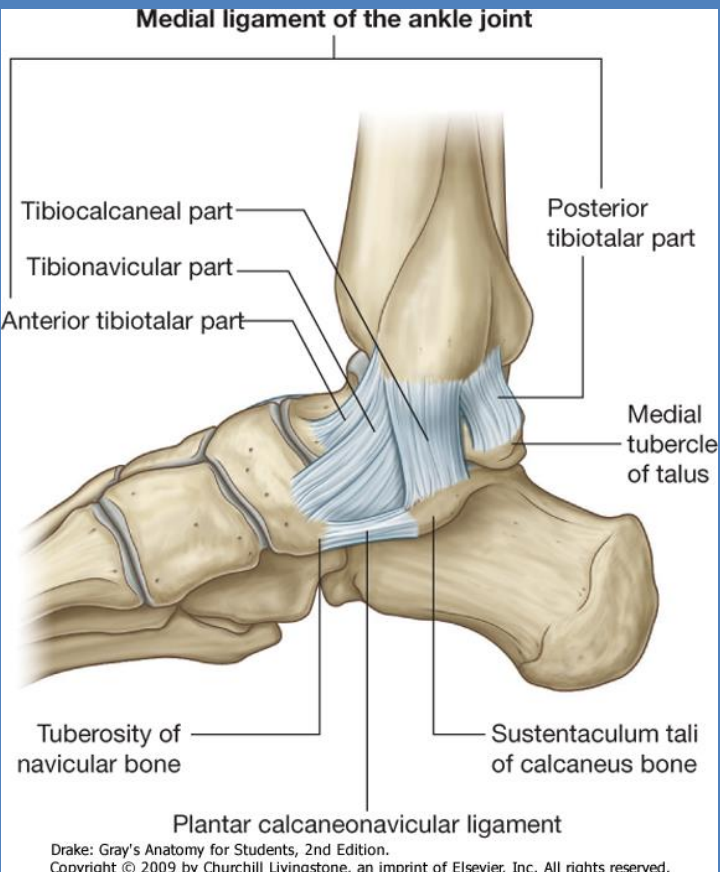
Talotarsal joint (lower ankle joint): talocalcaneonavicular joint and subtalar joint



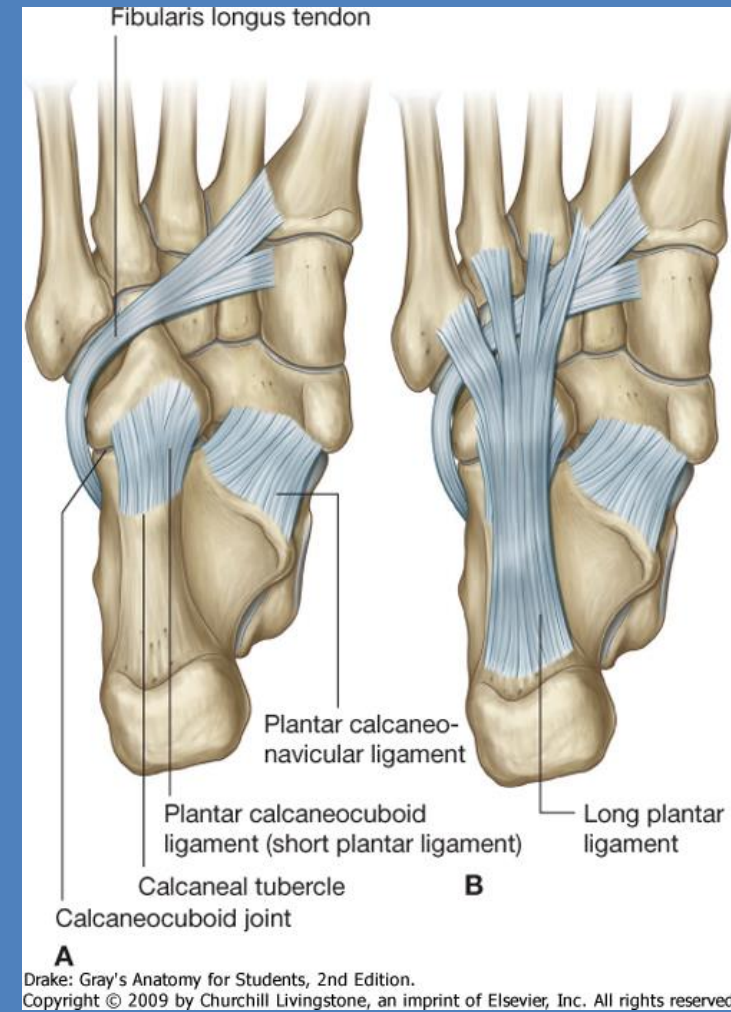
Bony surfaces: anterior and middle talar articular surfaces and head of the talus + anterior and middle calcaneal articular surfaces, navicular.

Type: restricted ball-and-socket

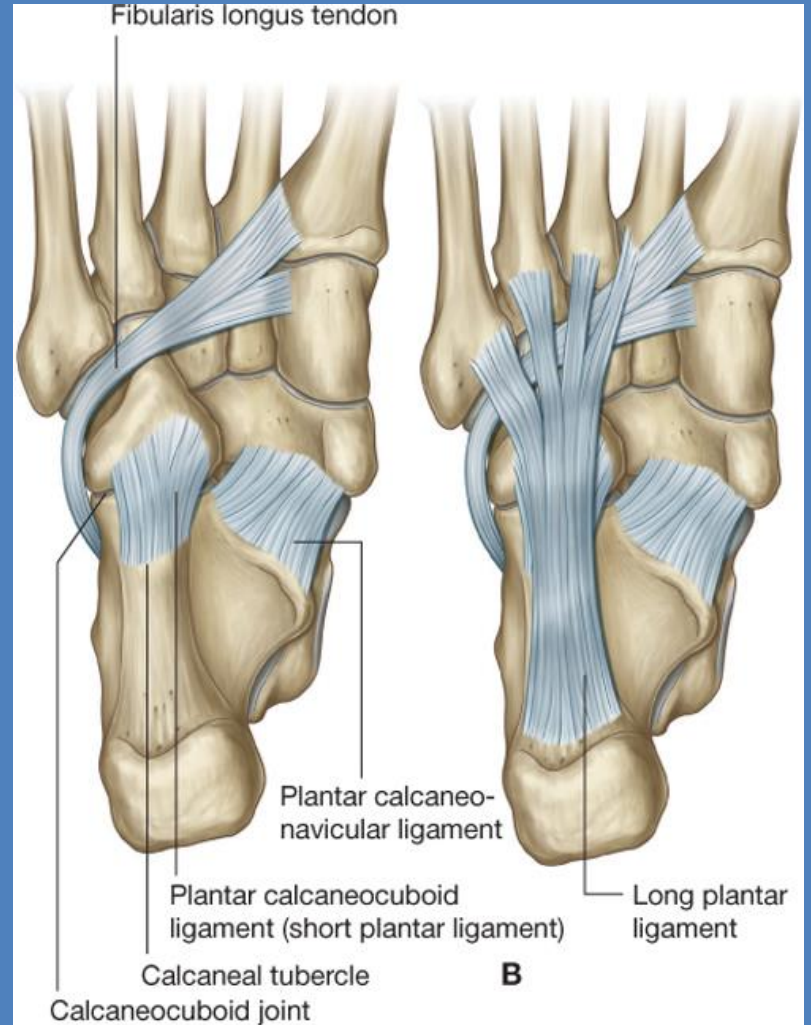
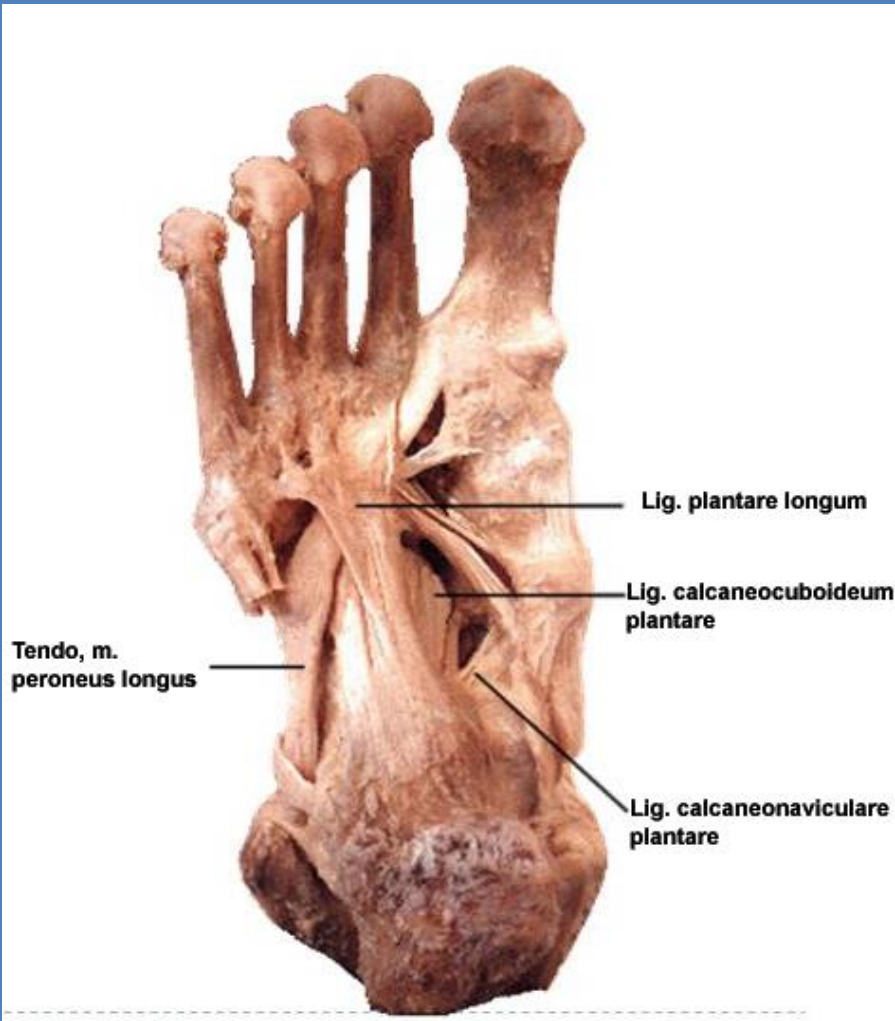
Talotarsal joint (lower ankle joint): talocalcaneonavicular joint and subtalar joint



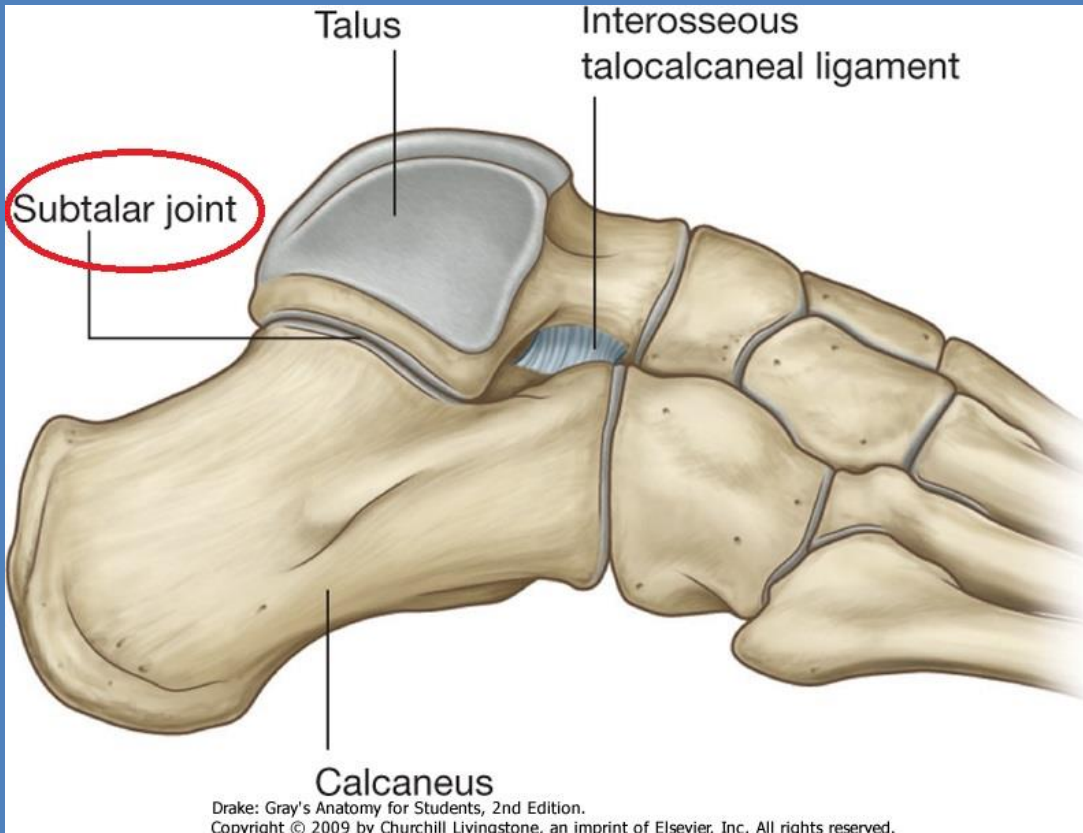
Plantar calcaneonavicular liament:
connects calcaneus to the navicular and keeps an articulating surface for the head of talus.



Talotarsal joint (lower ankle joint): *talocalcaneonavicular joint and subtalar joint*



Talotarsal joint: *talocalcaneonavicular joint* and *subtalar joint*



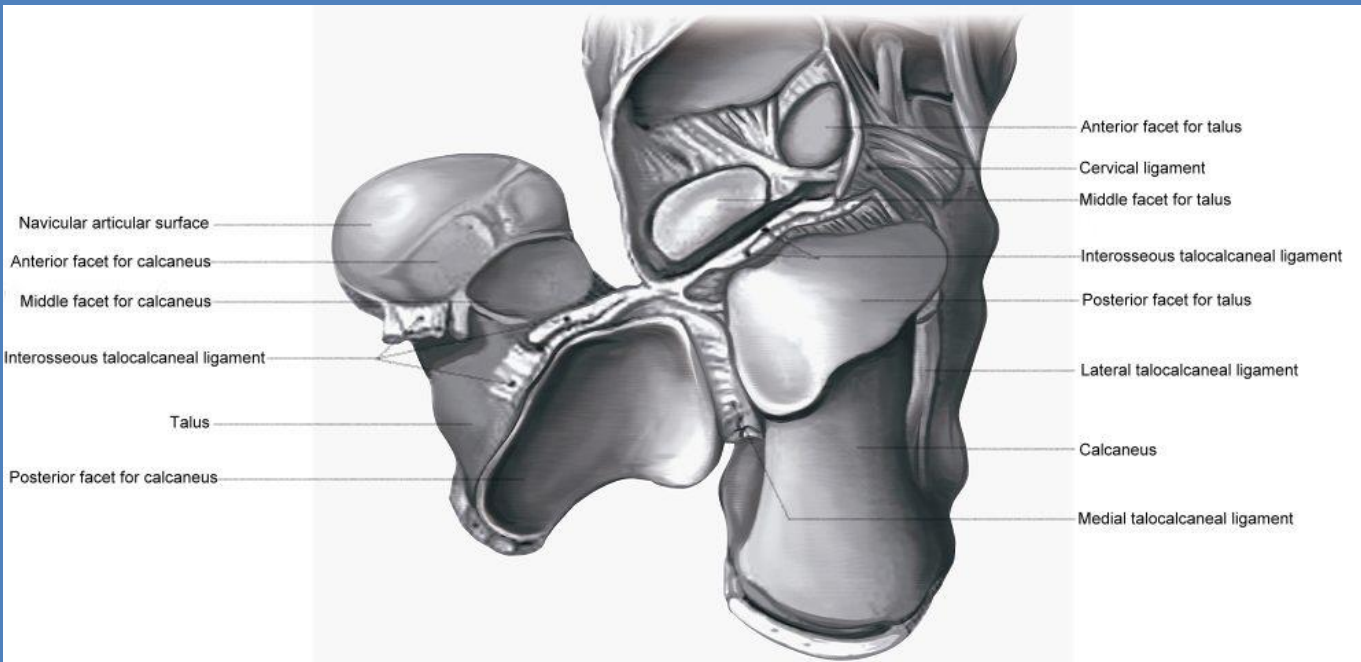
Bony surfaces:
posterior talar articular
surface

+

posterior calcaneal
articular surface

Type: pivot joint

Talotarsal joint: *talocalcaneonavicular joint and subtalar joint*



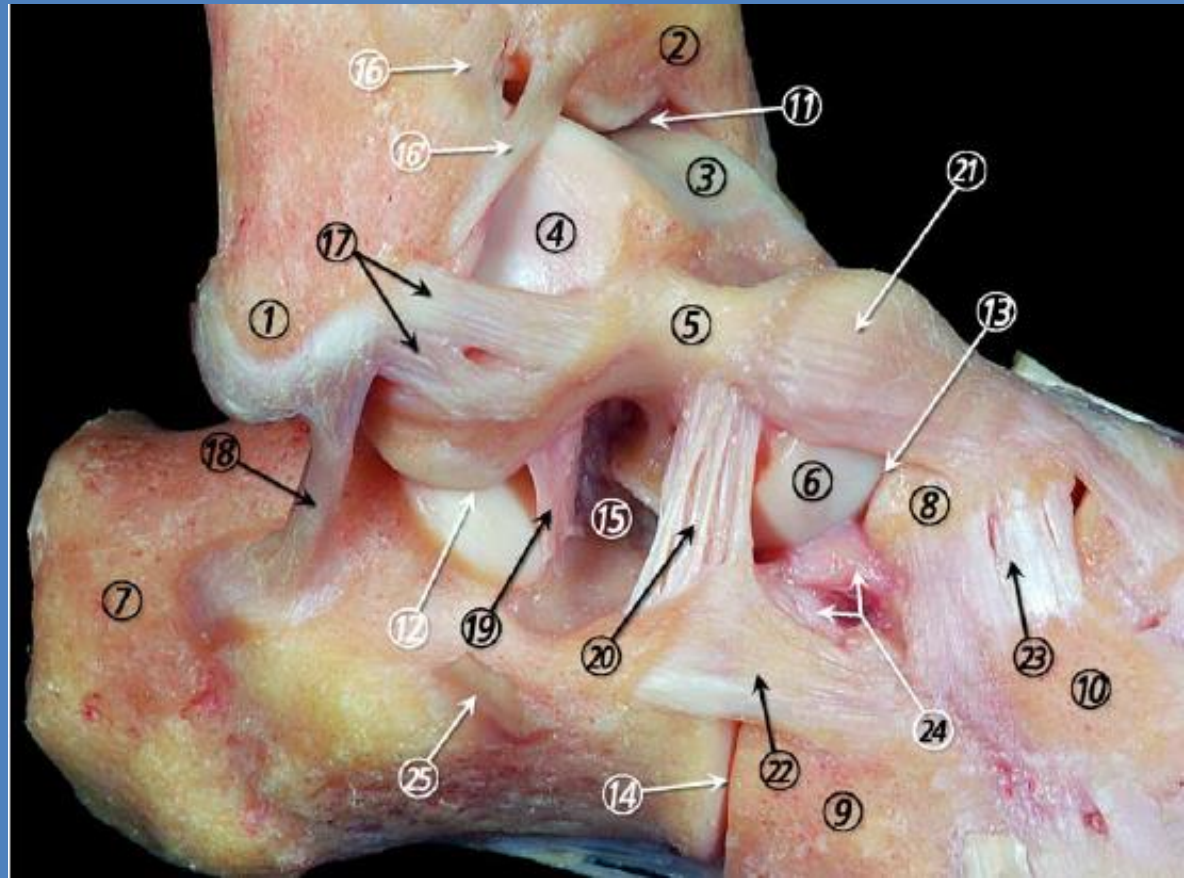
Lateral and medial talocalcaneal ligaments reinforce the articular capsule.

Type: pivot joint

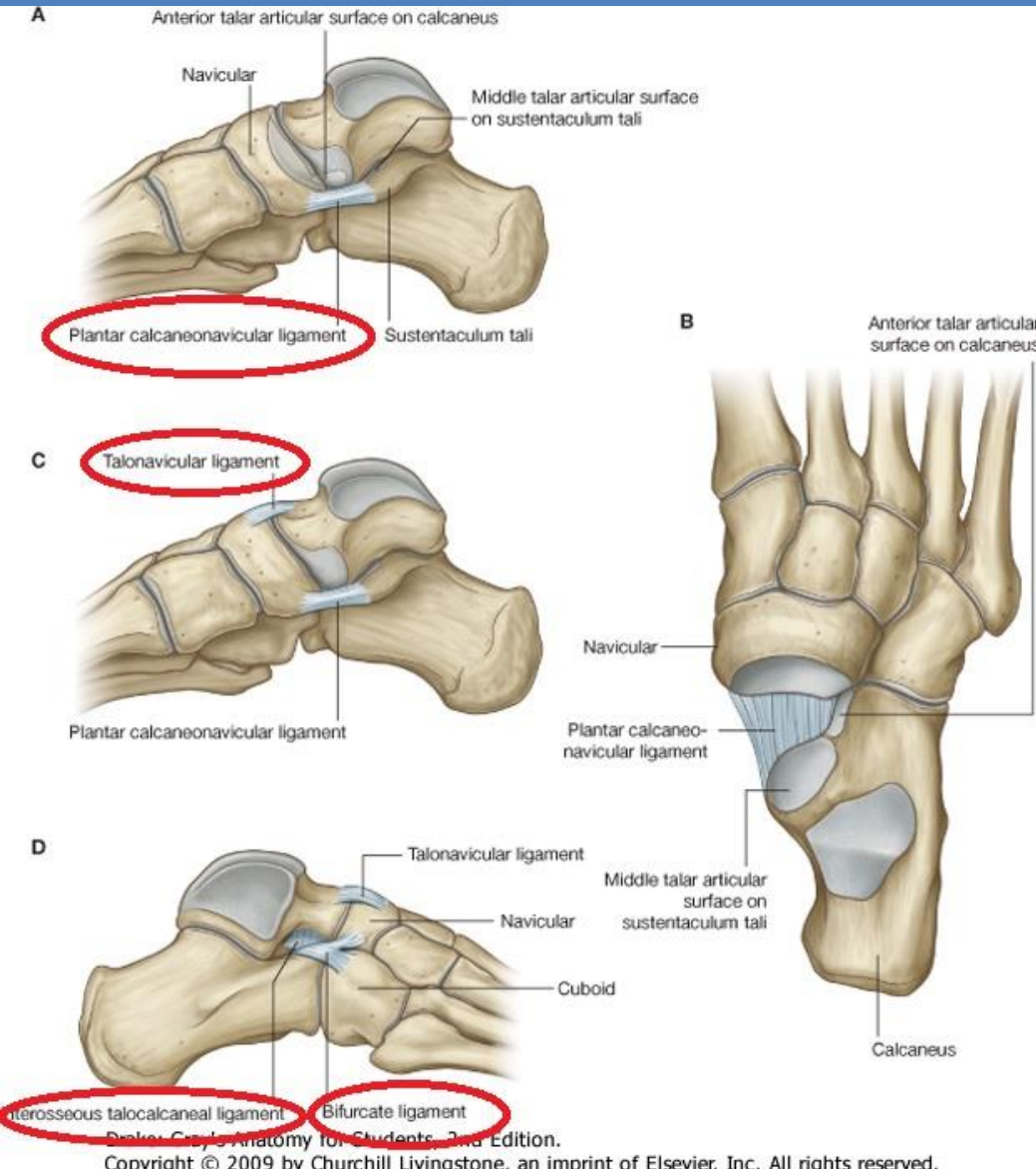
Talocalcaneonavicular joint

- **Interosseous talocalcaneal ligament (19) – in the sinus tarsi (15)**
- **Bifurcate ligament (24):
*calcaneonavicular lig. + calcaneocuboid lig.***

- Lig. talofibulare anterius (17)
- Lig. calcaneofibulare (18)
- Lig. cervicale (20)
- Lig. talonaviculare (21)
- Lig. calcaneocuboideum laterale (22)
- Lig. cuneonaviculare dorsale (23)



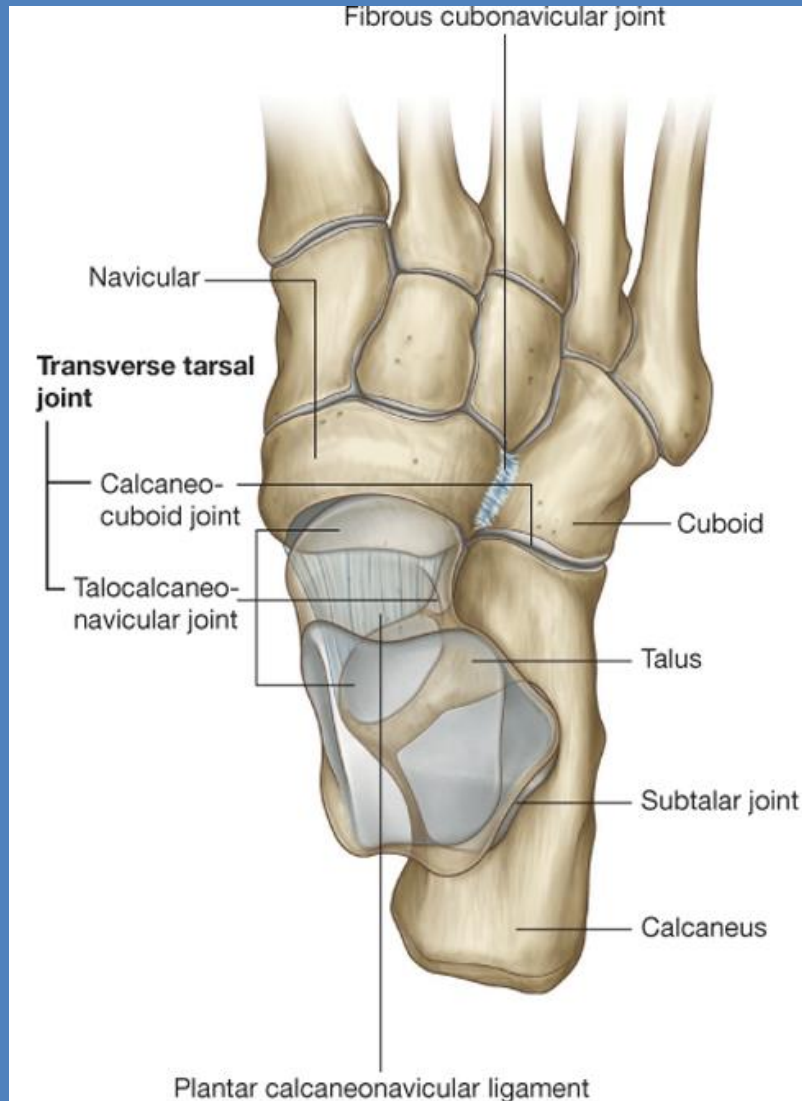
Talotarsal joint - ligaments and movements



„PADS“:
 plantarflexion+adduction+supination (inversion)

„DABP“:
 dorsiflexion+abduction+pronation (eversion)

Transverse tarsal (Chopart's) joint: *talocalcaneonavicular joint* and *calcaneocuboid joint*



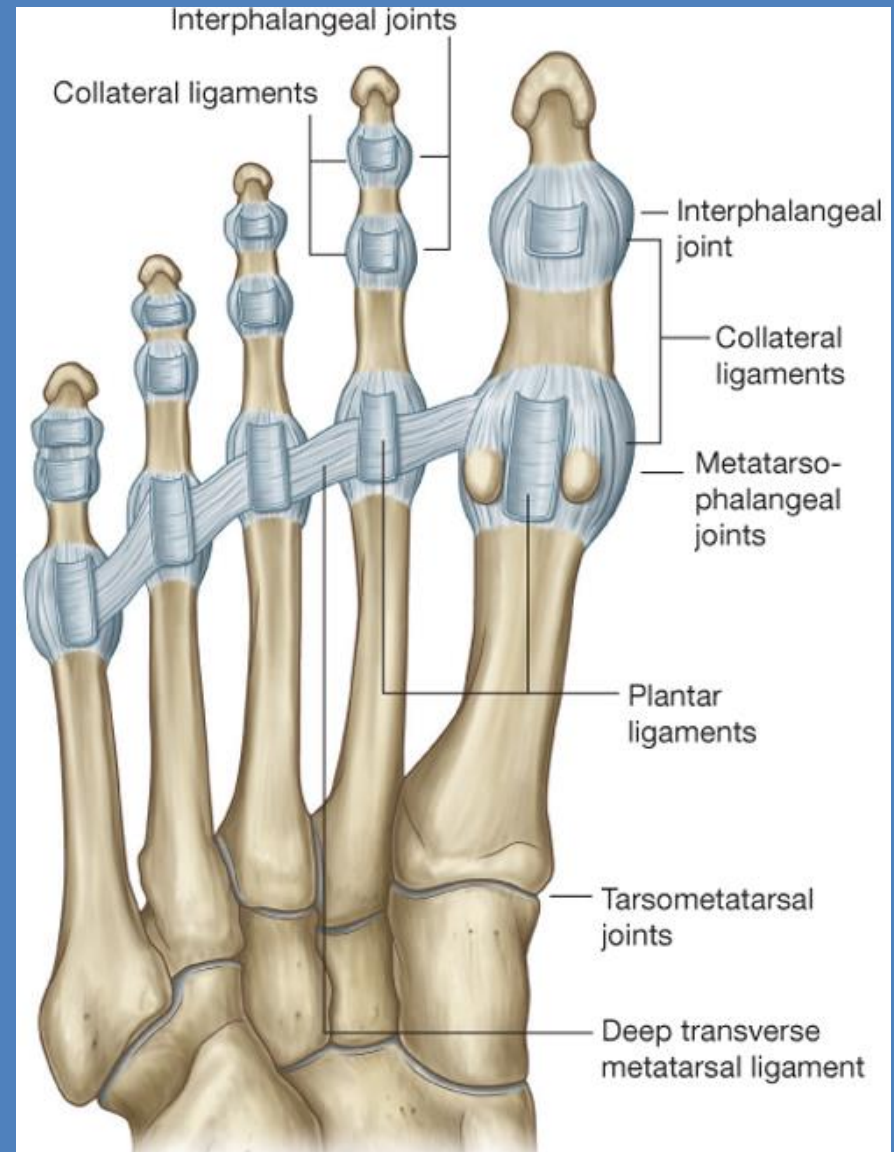
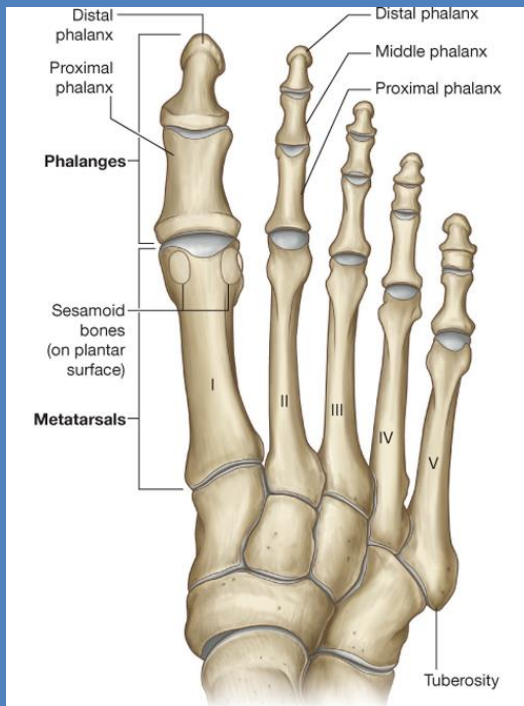
Type:
amphyarthrosis.

Minimal plantar
and dorsal
movements and
rotation.

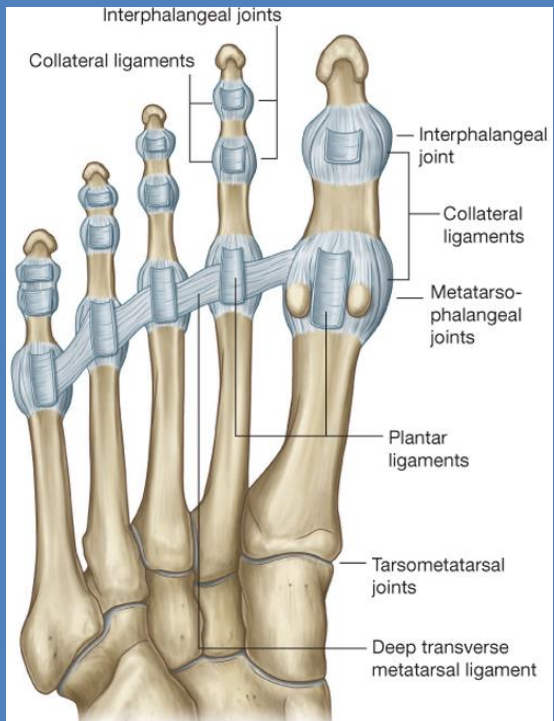
Supports the
longitudinal
arch of the foot.

Chopart's
amputation.

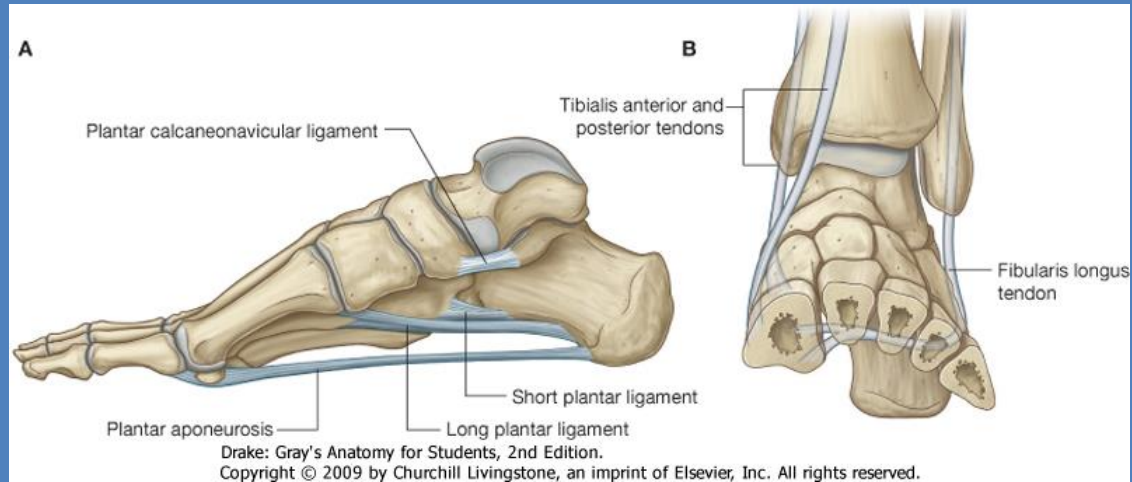
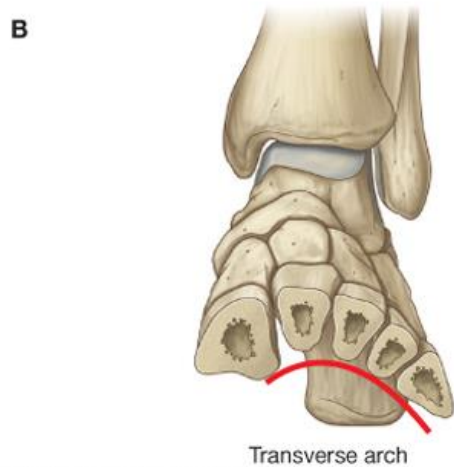
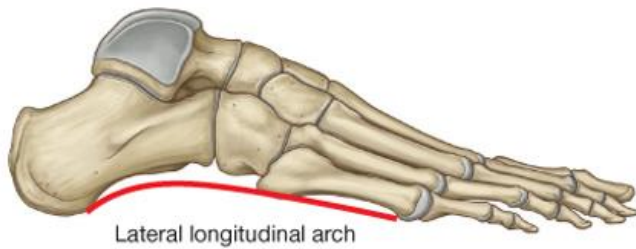
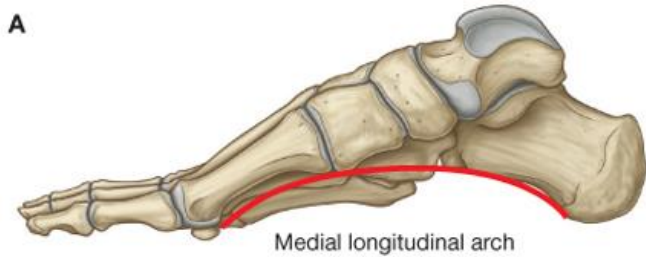
- **Intertarsal joints:** Amphiarthroses.
- **Tarsometatarsal (Lisfranc's) joints:** Amphiarthrosis. Lisfranc's amputation.
- **Metatarsophalangeal joints:** Restricted ball-and-socket. Collateral and plantar ligaments and deep transverse metatarsal ligament.
- **Interphalangeal joints:** Hinge. Collateral ligaments.



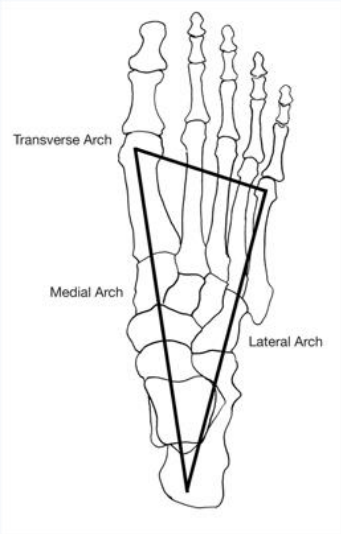
- **Intertarsal joints:** Amphiarthroses.
- **Tarsometatarsal (Lisfranc's) joints:** Amphiarthrosis. Lisfranc's amputation.
- **Metatarsophalangeal _____ joints:** Restricted ball-and-socket. Collateral and plantar ligaments and deep transverse metatarsal ligament.
- **Interphalangeal _____ joints:** Hinge. Collateral ligaments.



Plantar architecture

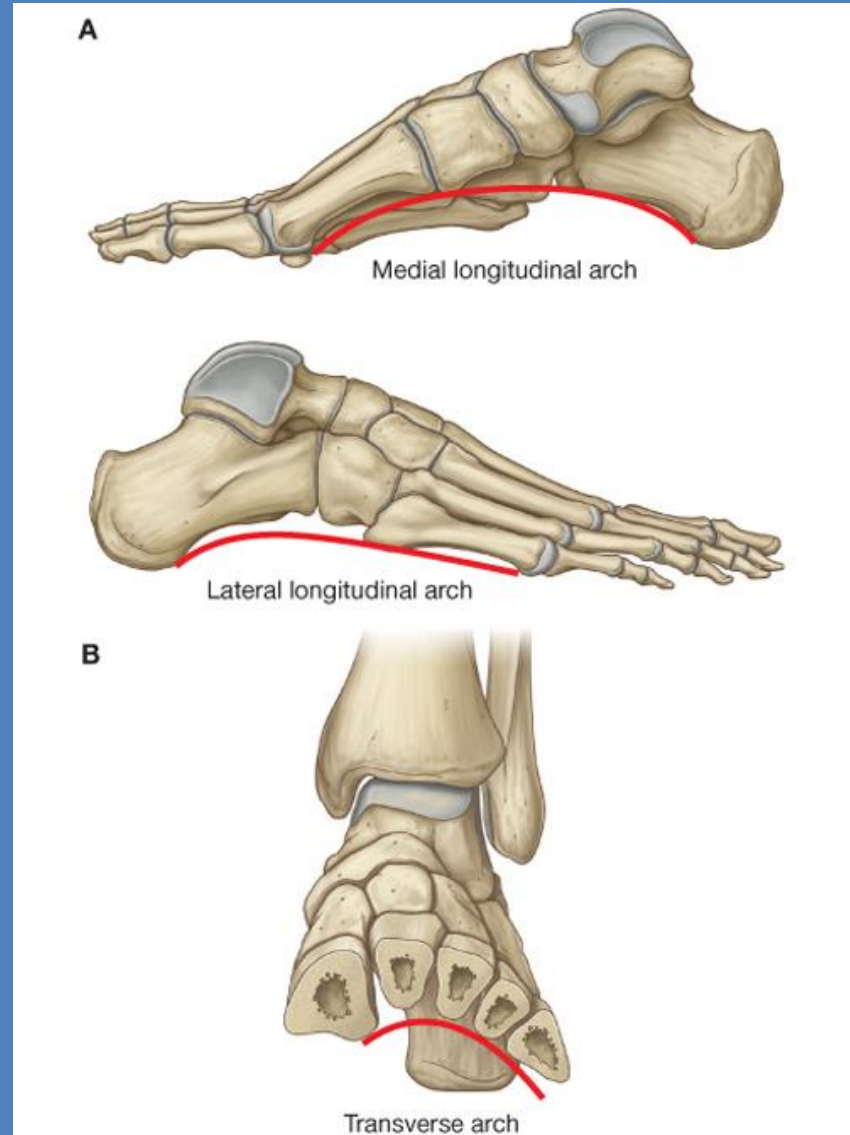


Arches of foot



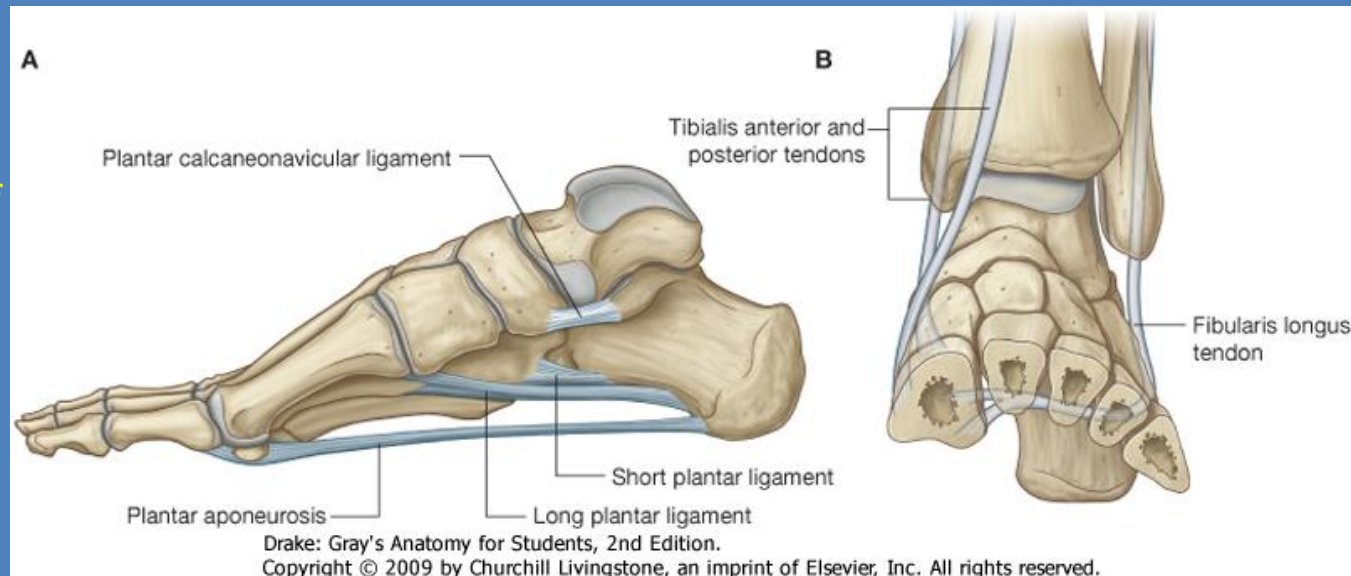
The weight of the body is transmitted to the talus from the tibia. Then it is transmitted posteriorly to the **calcaneal tubercle** and anteriorly to the **heads of the 1st-5th metatarsals**.

The cuneiforms and the bases of the metatarsals together form the **transverse arch**. Its uppermost point is the medial cuneiform.



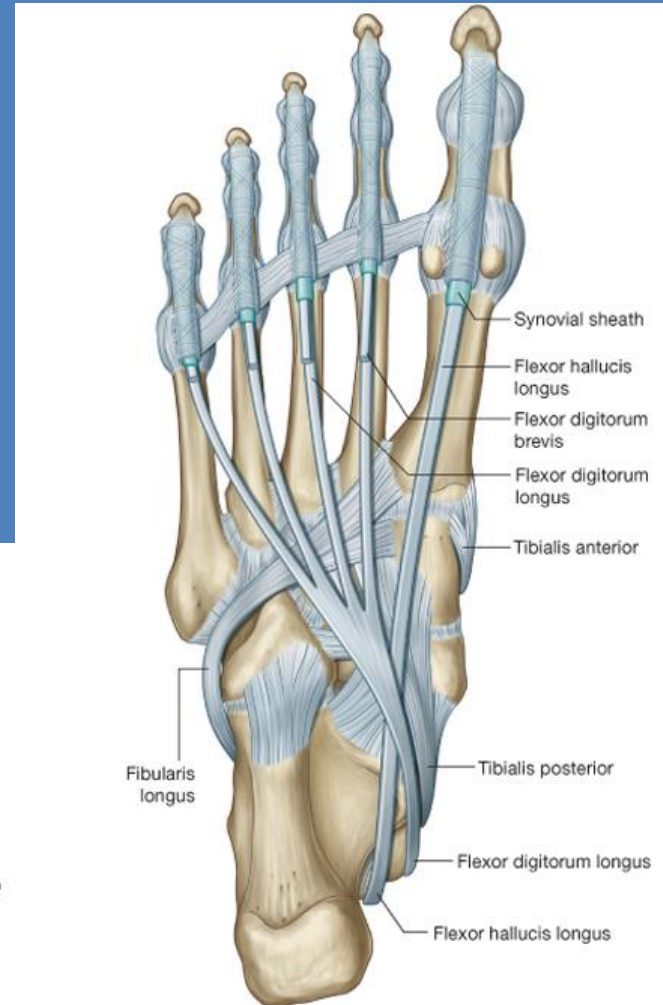
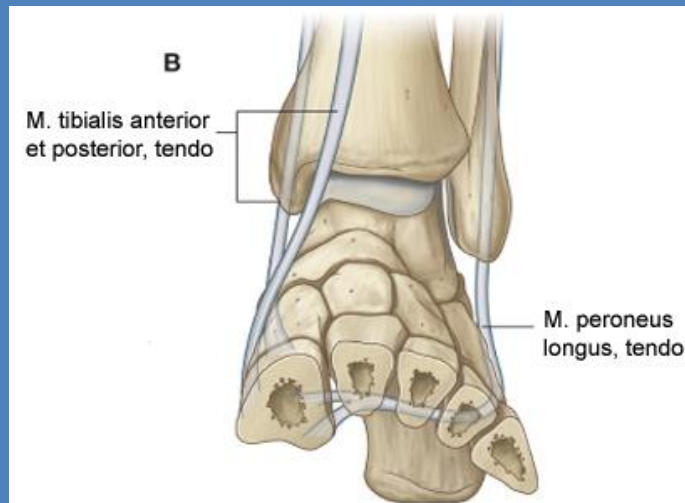
Arches of the foot - ligaments

- **Plantar aponeurosis:** from calcaneal tubercle to the plantar surfaces of toes. Works when the body is standing; stabilizes the transverse arch as well.
- **Long plantar ligament:** from calcaneus to the bases of metatarsals. Stabilizes the bones at the lateral side.
- **Plantar calcaneocuboid ligament:** from calcaneus to the cuboid bone. Stabilizes the bones at the lateral side.
- **Plantar calcaneonavicular ligament:** extends the articular surface for the head of talus.



Arches of the foot - muscles

- **Tibialis ant. + post.:** at the medial side
- **Tibialis ant. + fibularis longus:** stabilize the transverse arch
- **Fibularis tertius + fibularis brevis:** at the lateral side
- **Other stabilizers:**
 - flexor hallucis longus
 - abductor hallucis
 - abductor digiti minimi
 - flexor digitorum brevis

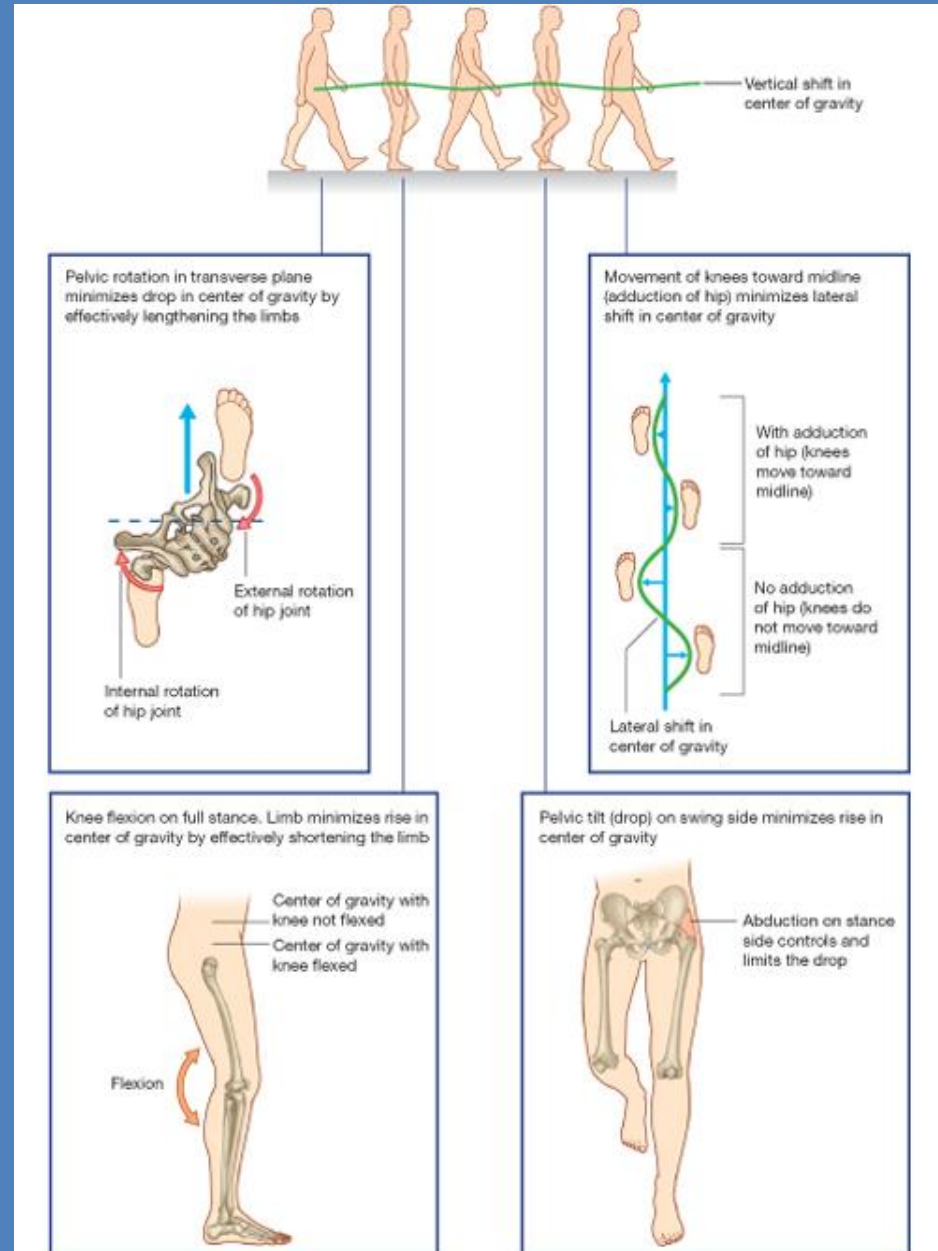


Walking

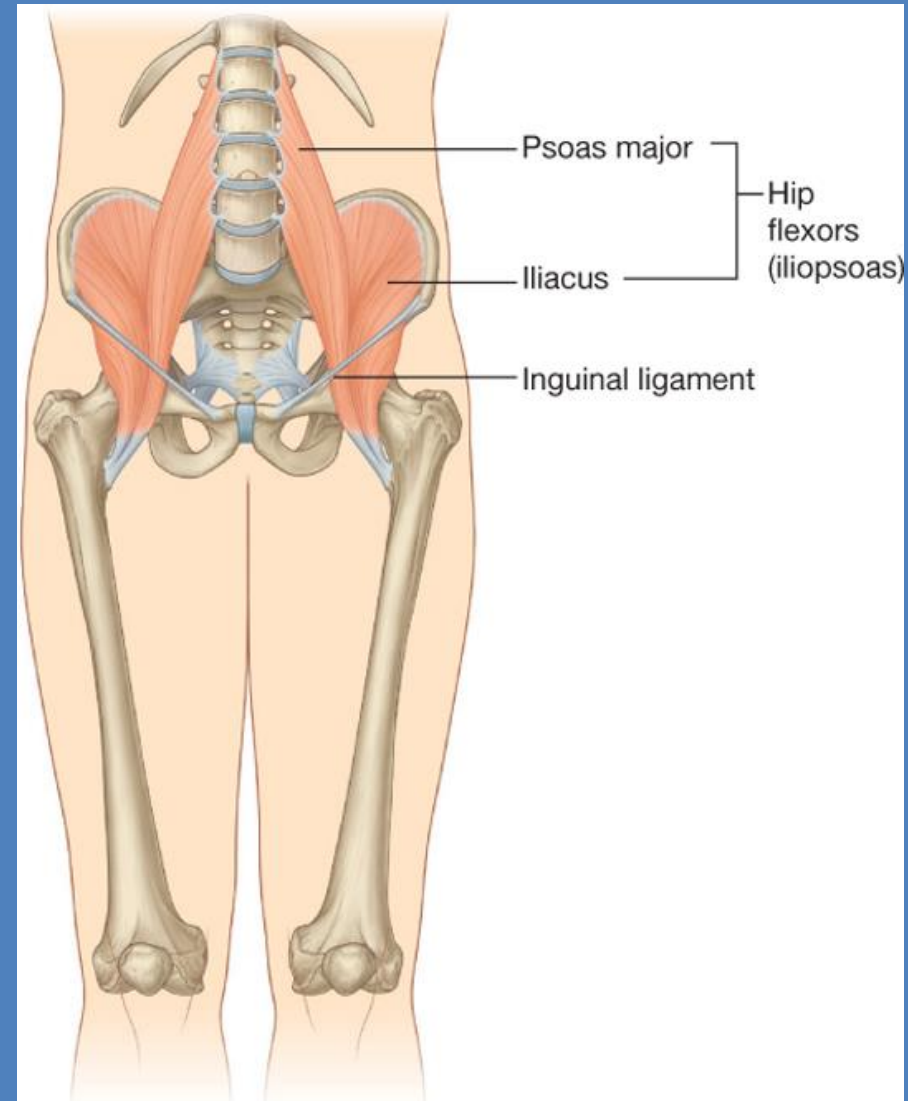
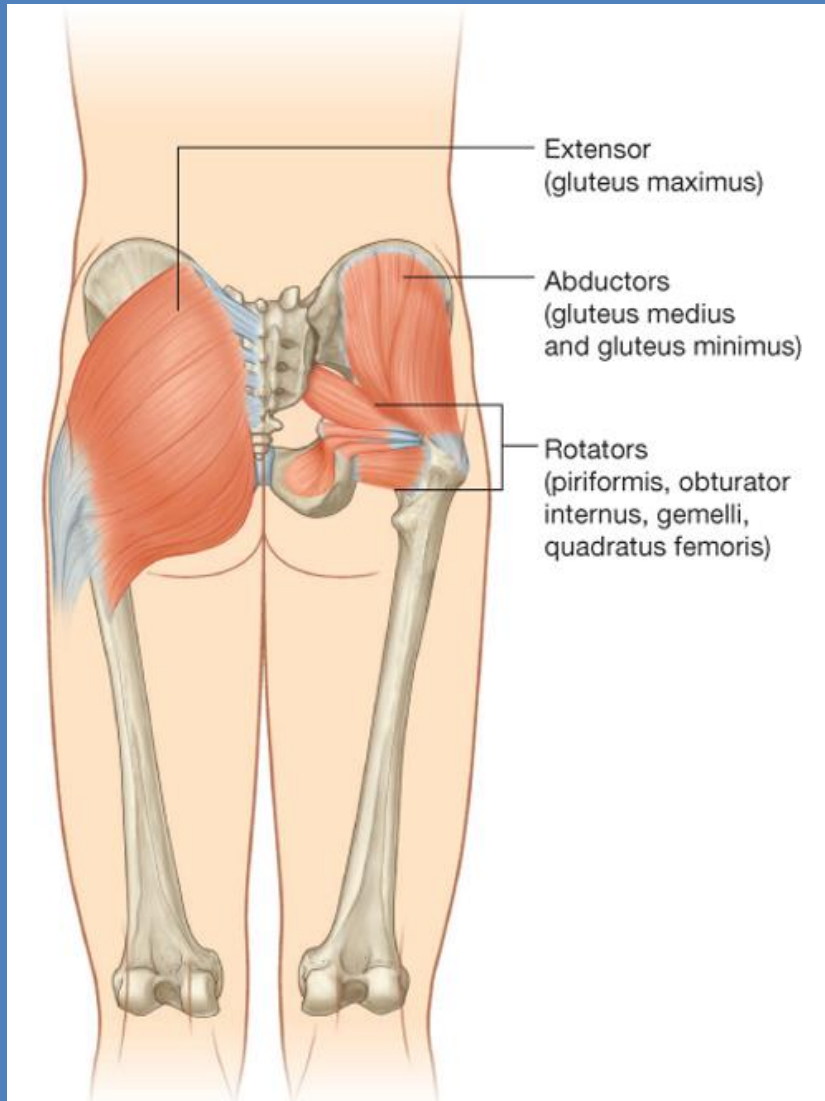
During walking, many anatomical features of the lower limbs contribute to minimizing fluctuations in the body's center of gravity and thereby reduce the amount of energy needed to maintain locomotion and produce a smooth, efficient gait.

They include pelvic tilt in the coronal plane, pelvic rotation in the transverse plane, movement of the knees toward the midline, flexion of the knees, and complex interactions between the hip, knee, and ankle.

As a result, during walking the body's center of gravity normally fluctuates only 5cm in both vertical and lateral directions.



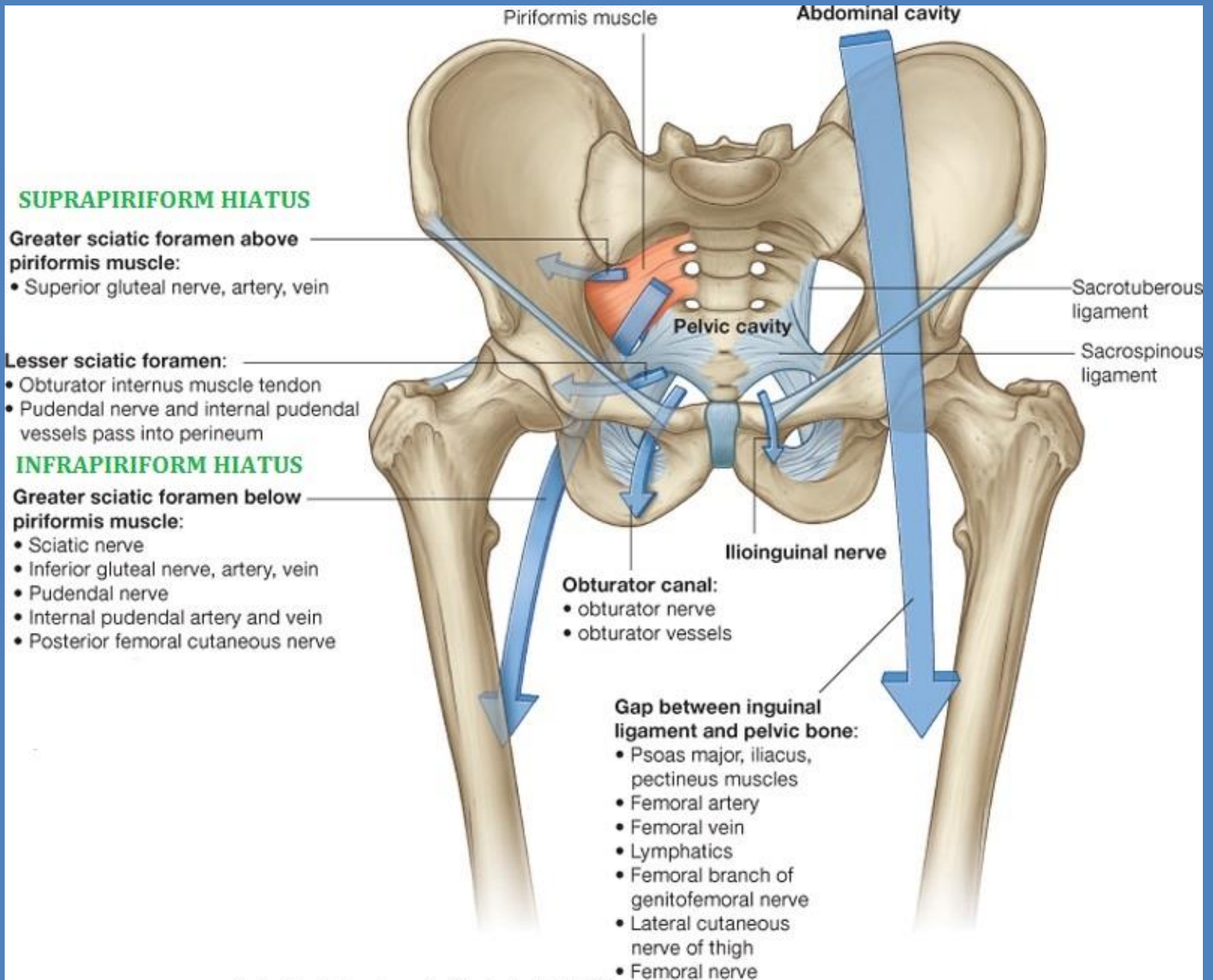
Hip muscles



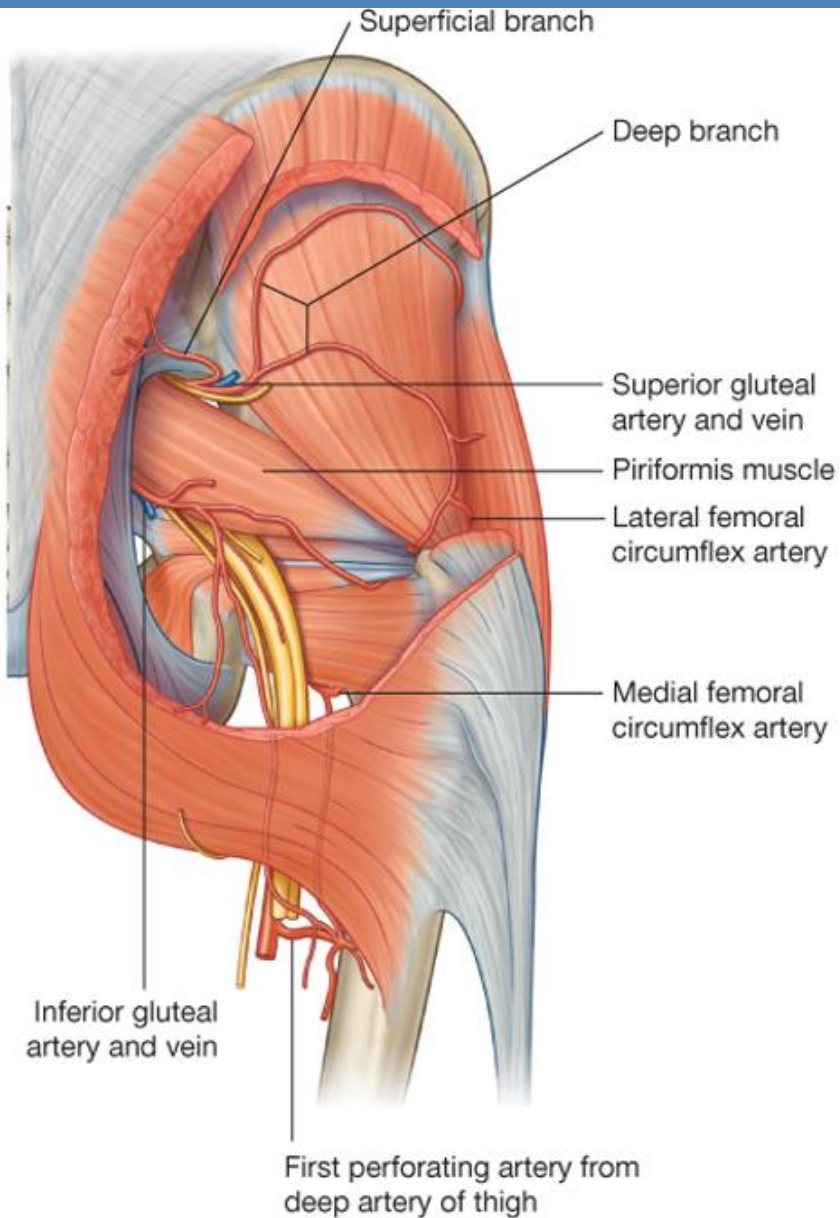
Hip muscles



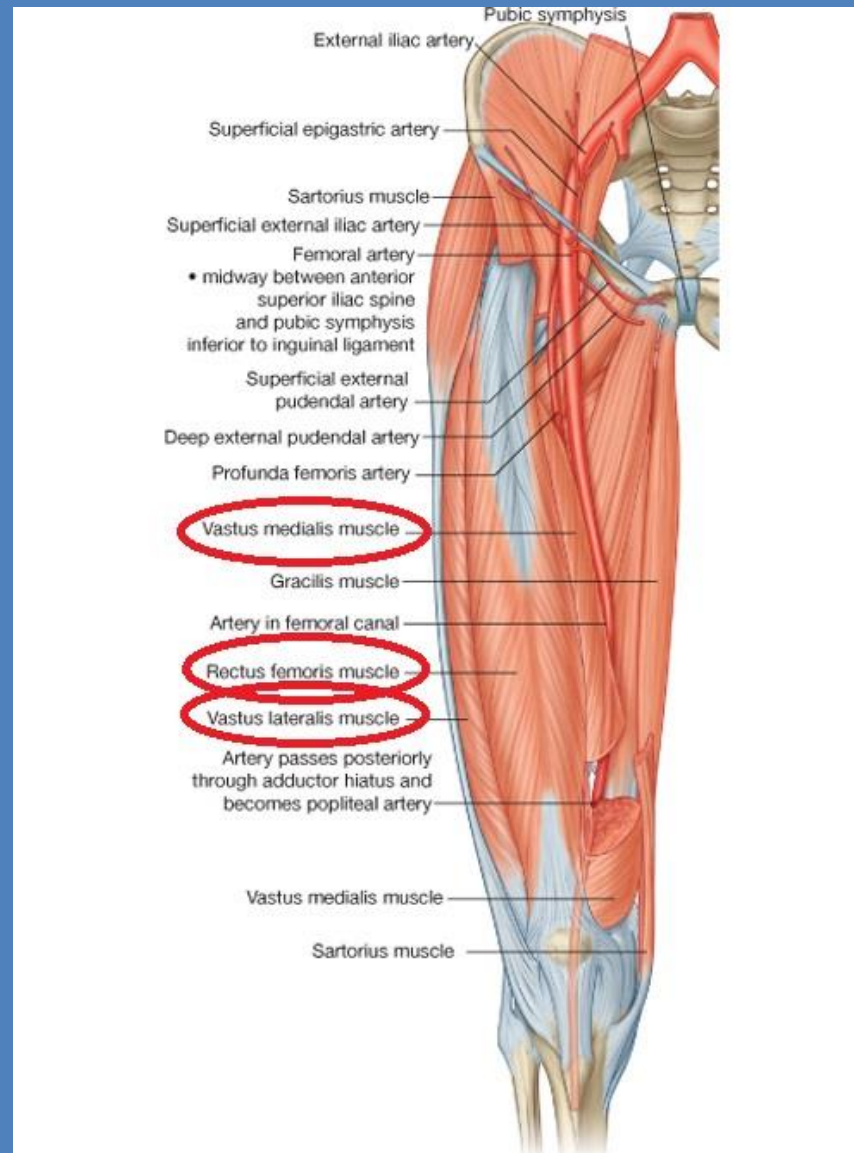
Pelvis



Pelvis



Hip flexors-knee extensors



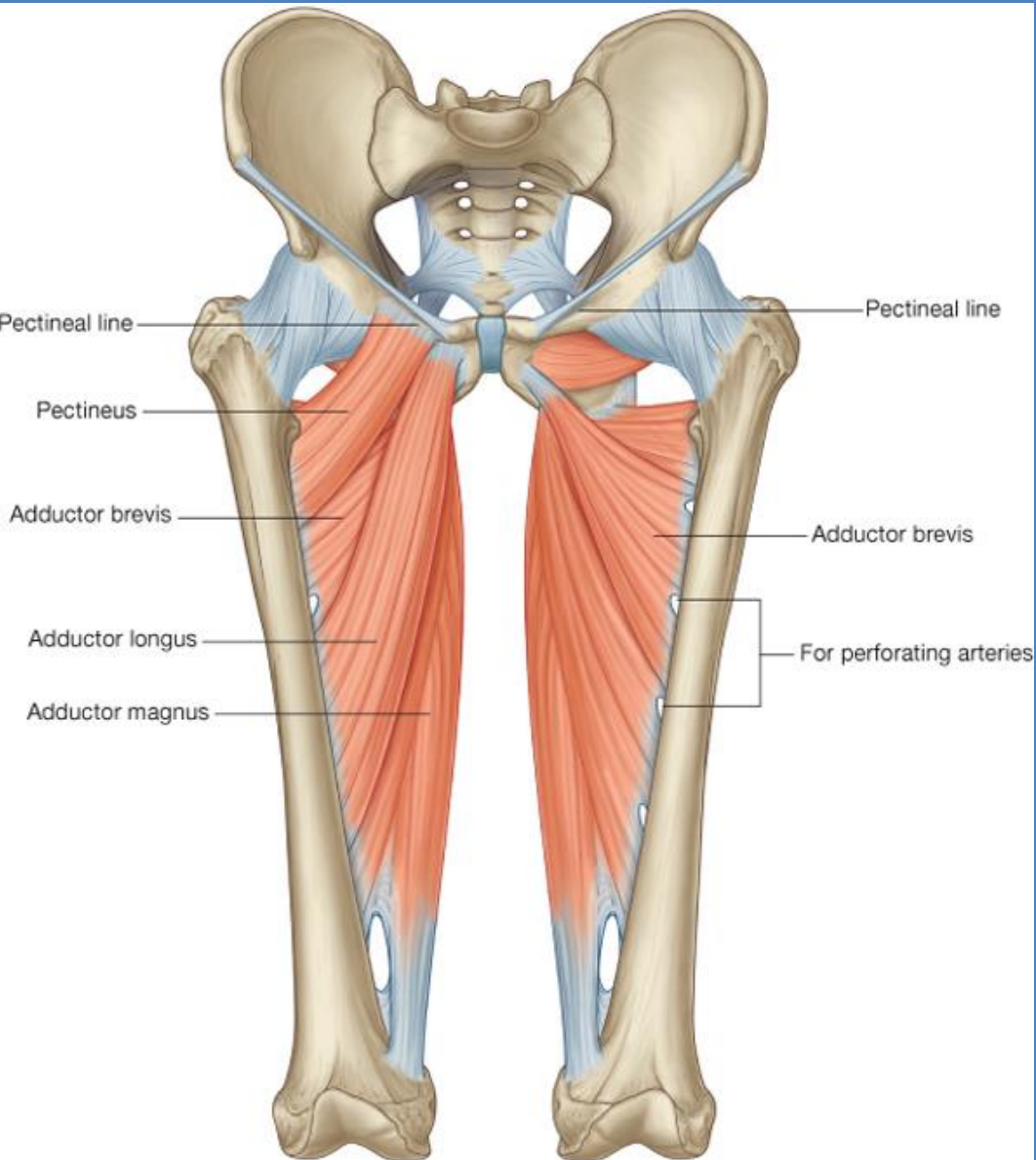
Hip flexors-knee extensors (quadriceps femoris)



Tensor fasciae latae and sartorius



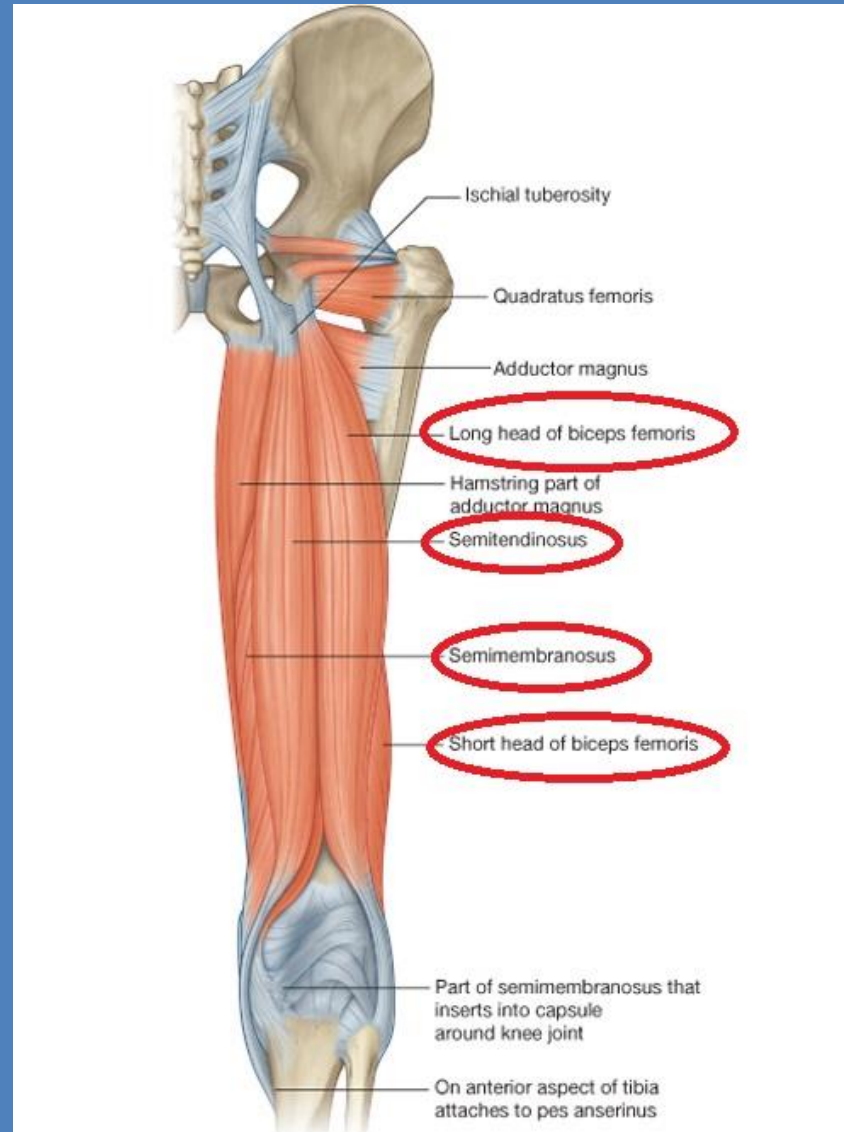
Adductors



Adductor brevis, gracilis and pectineus



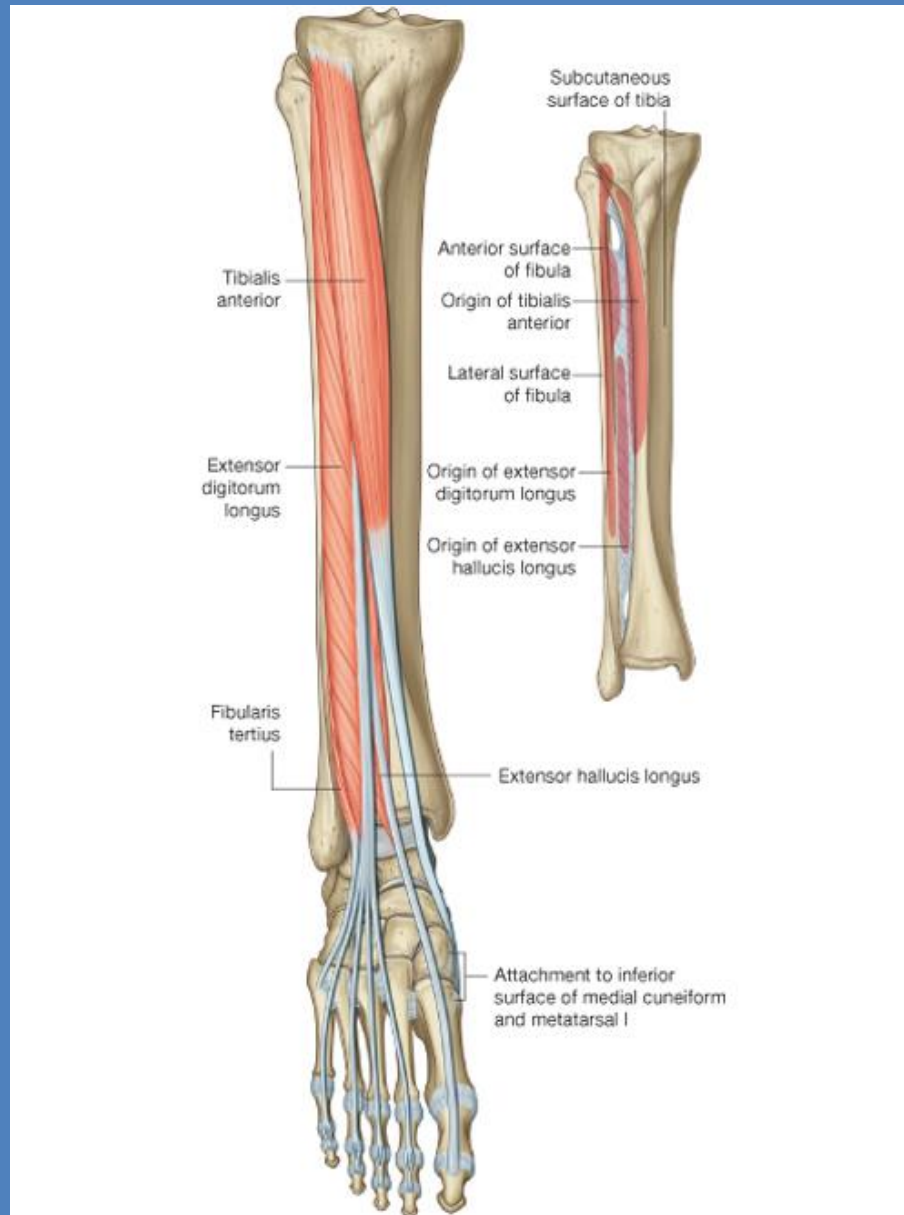
Hip extensors-knee flexors



Hip extensors-knee flexors (semitendinosus, semimembranosus, biceps femoris)



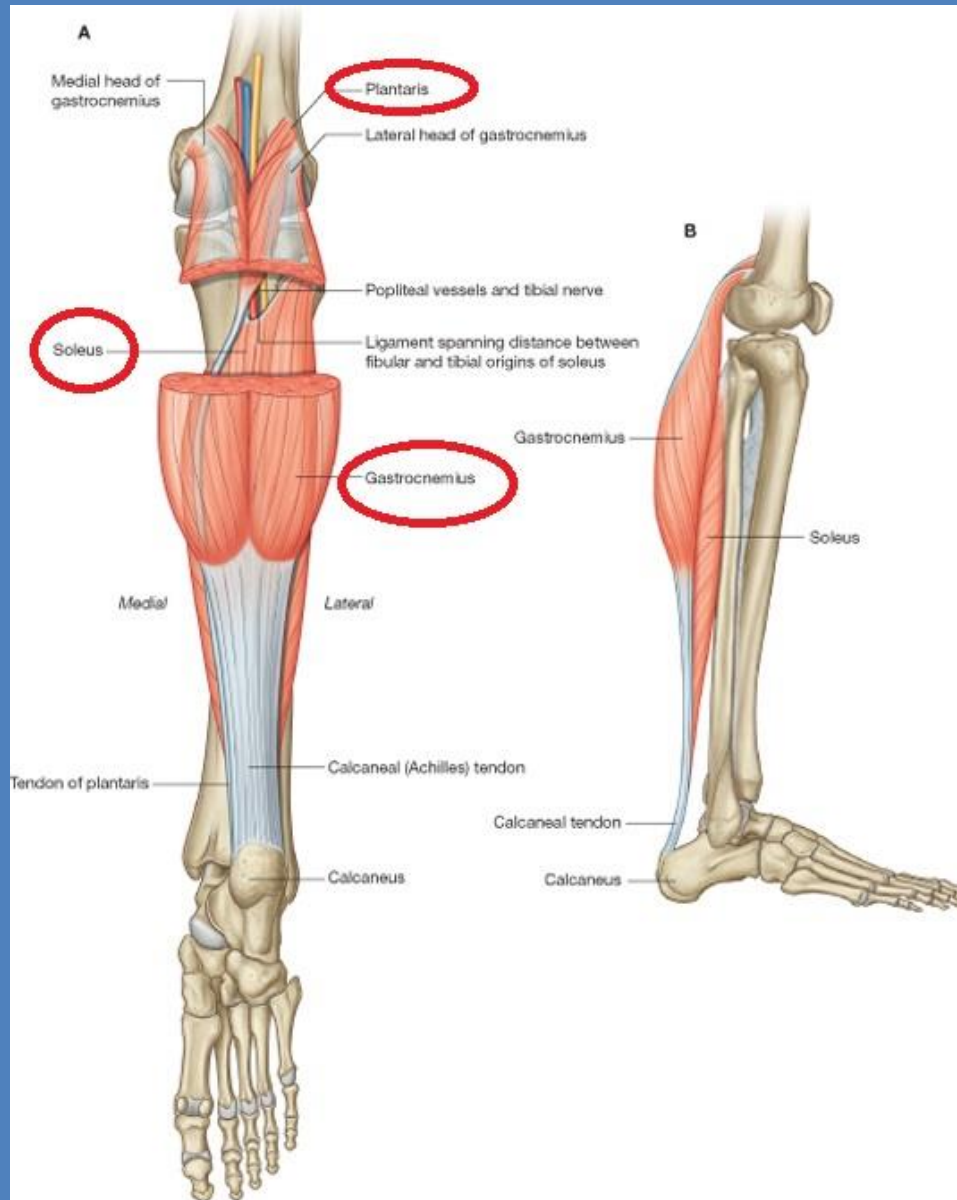
Extensors



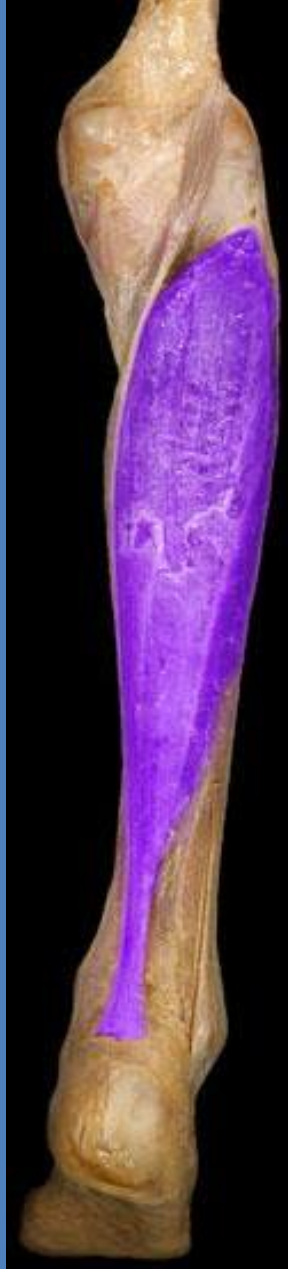
Extensors



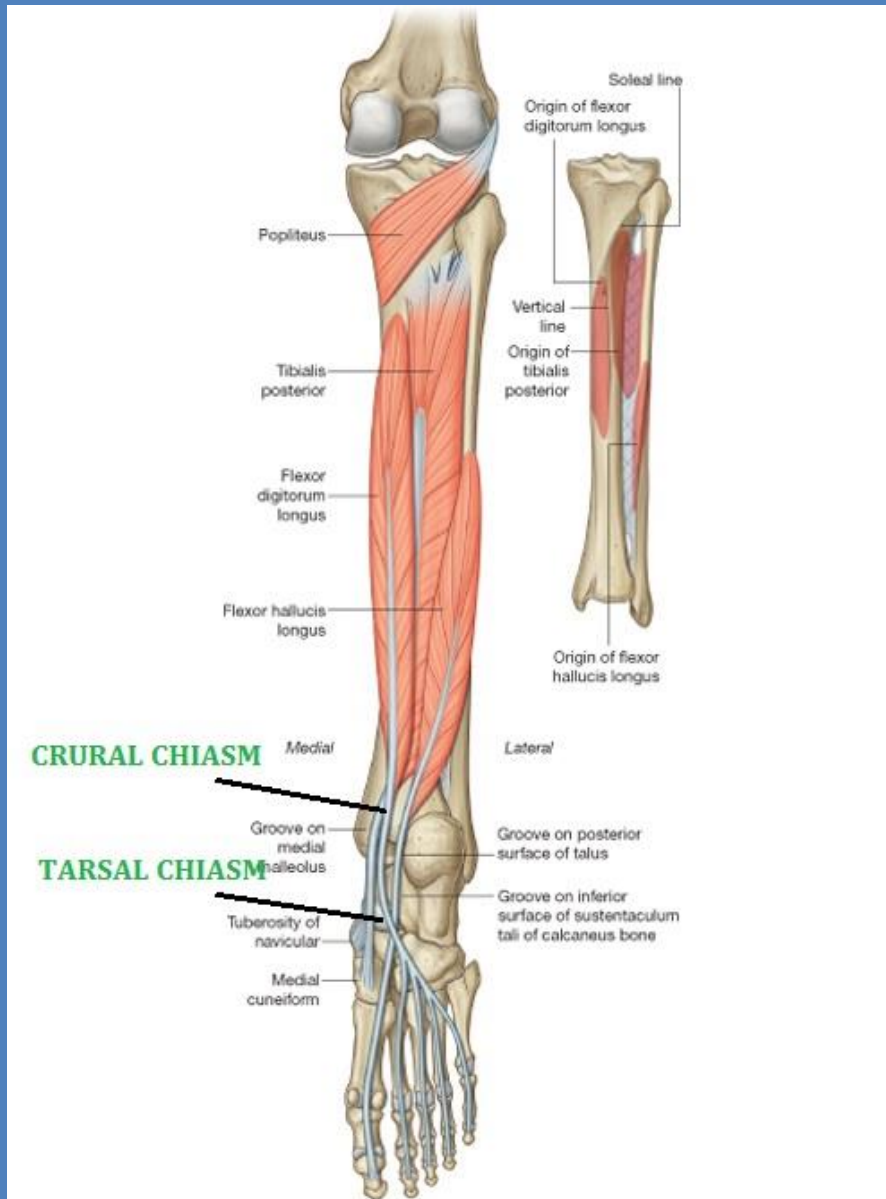
Superficial flexors



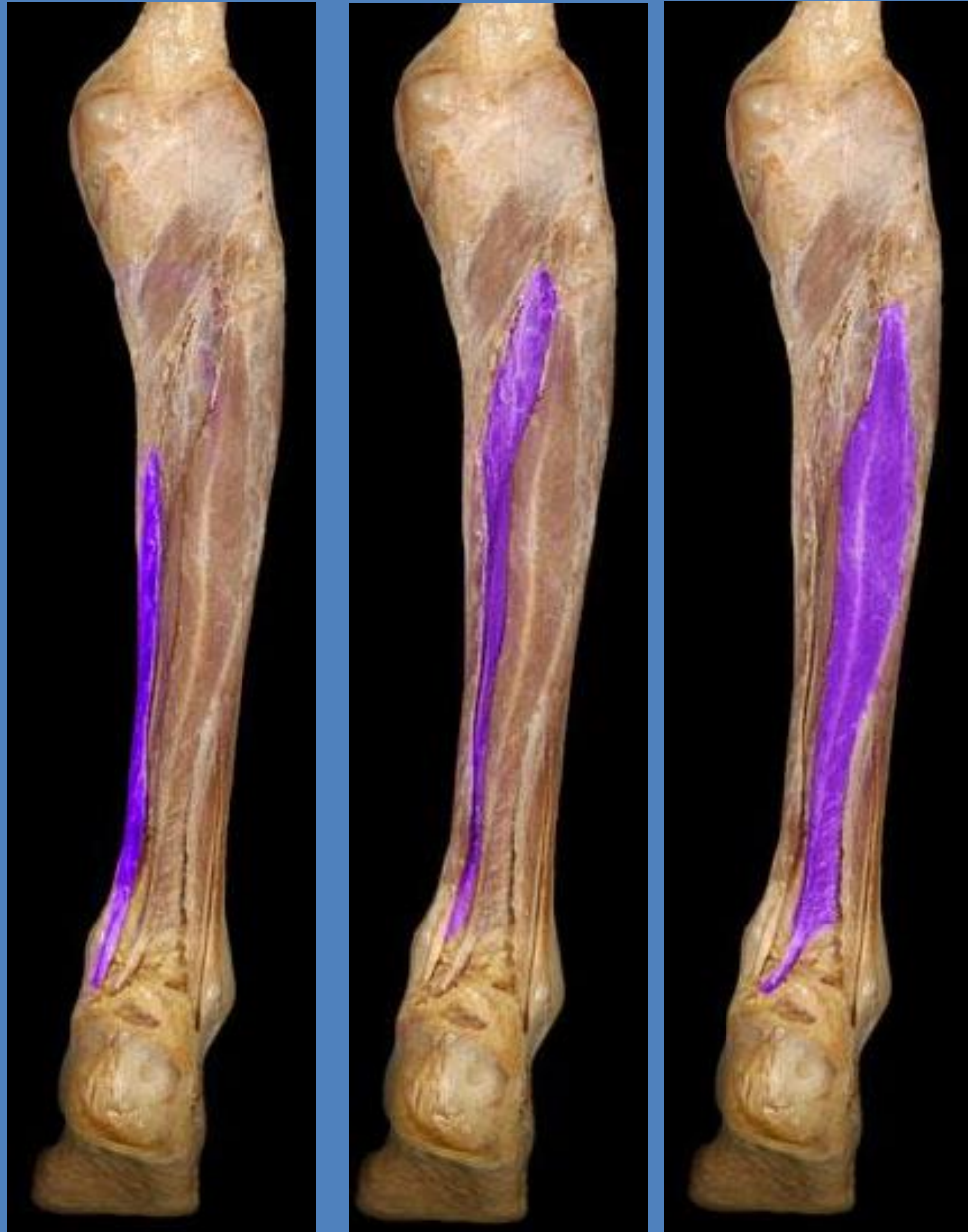
Superficial flexors



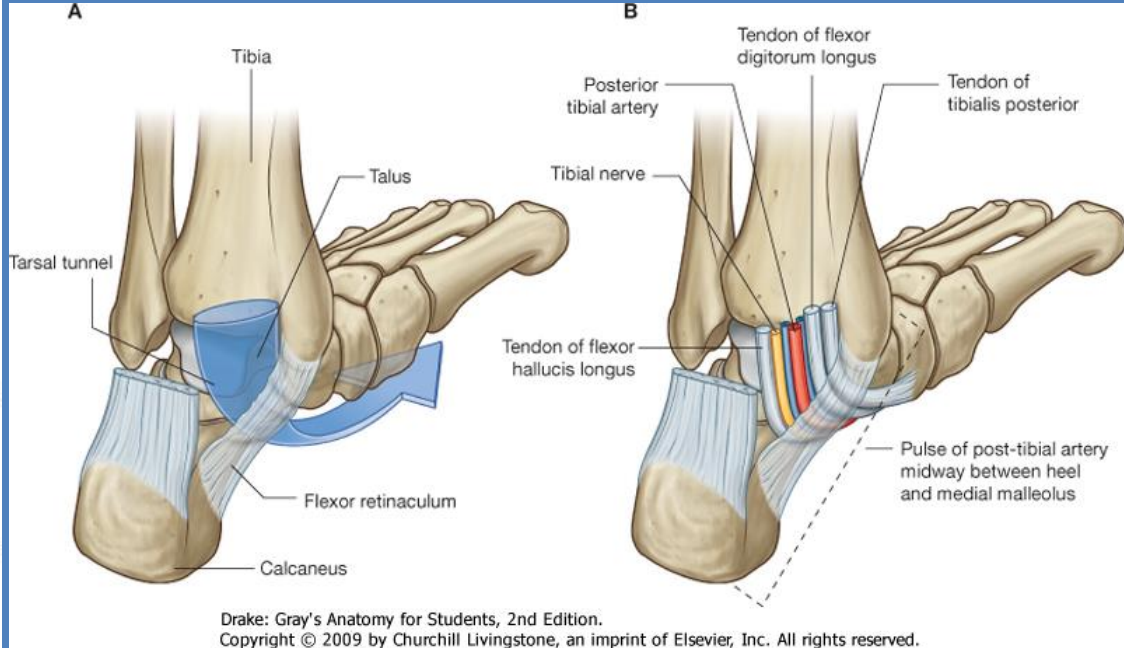
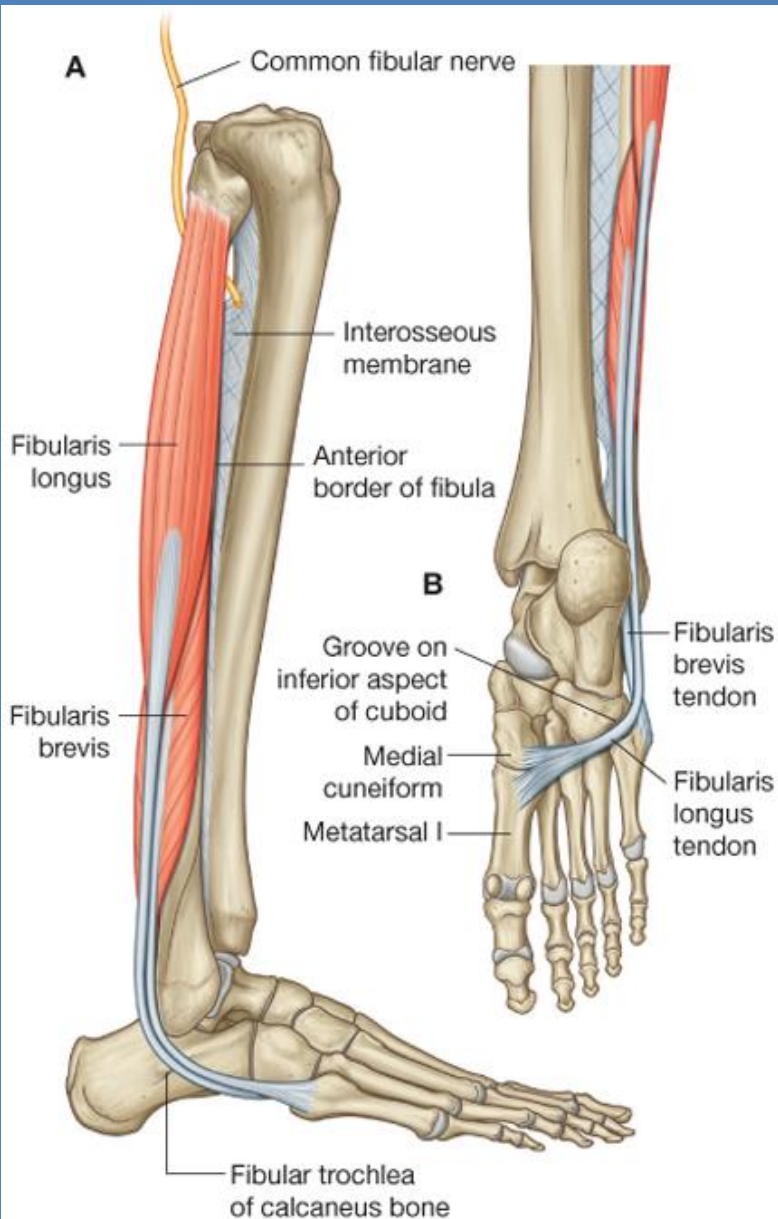
Deep flexors



Deep flexors



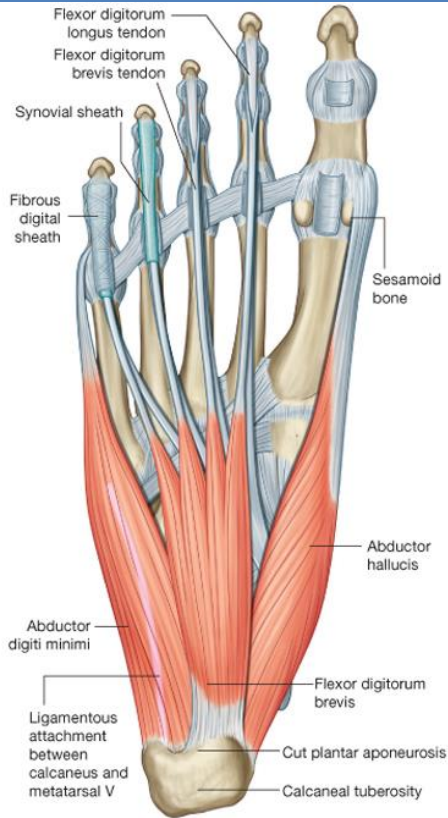
Pronators



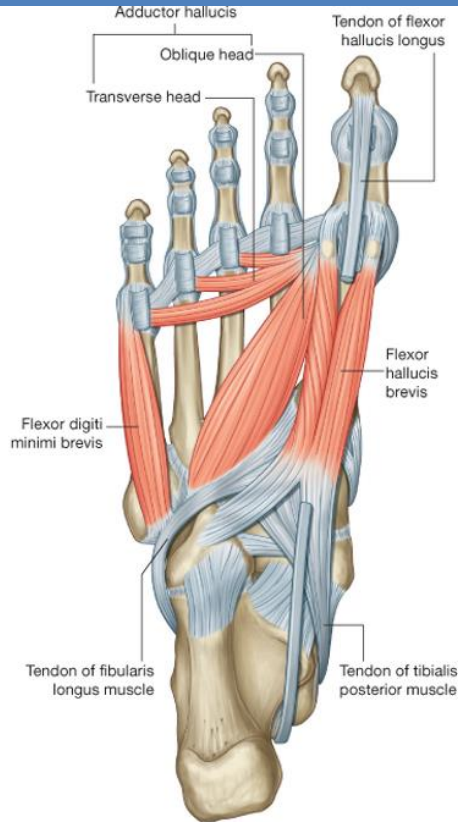
Pronators



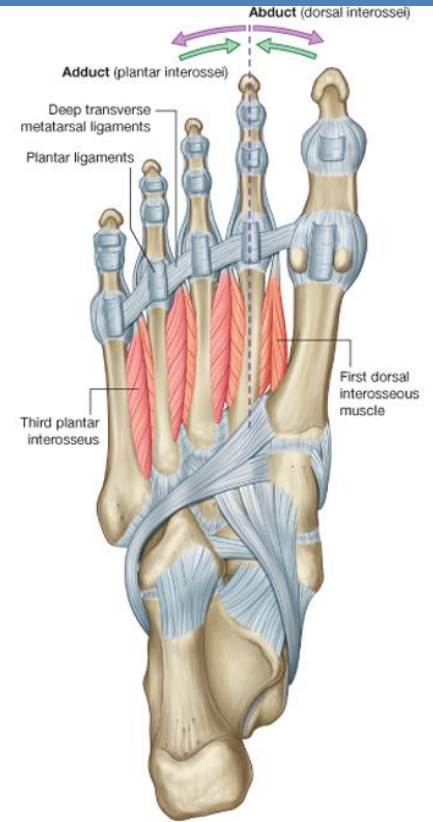
Foot muscles



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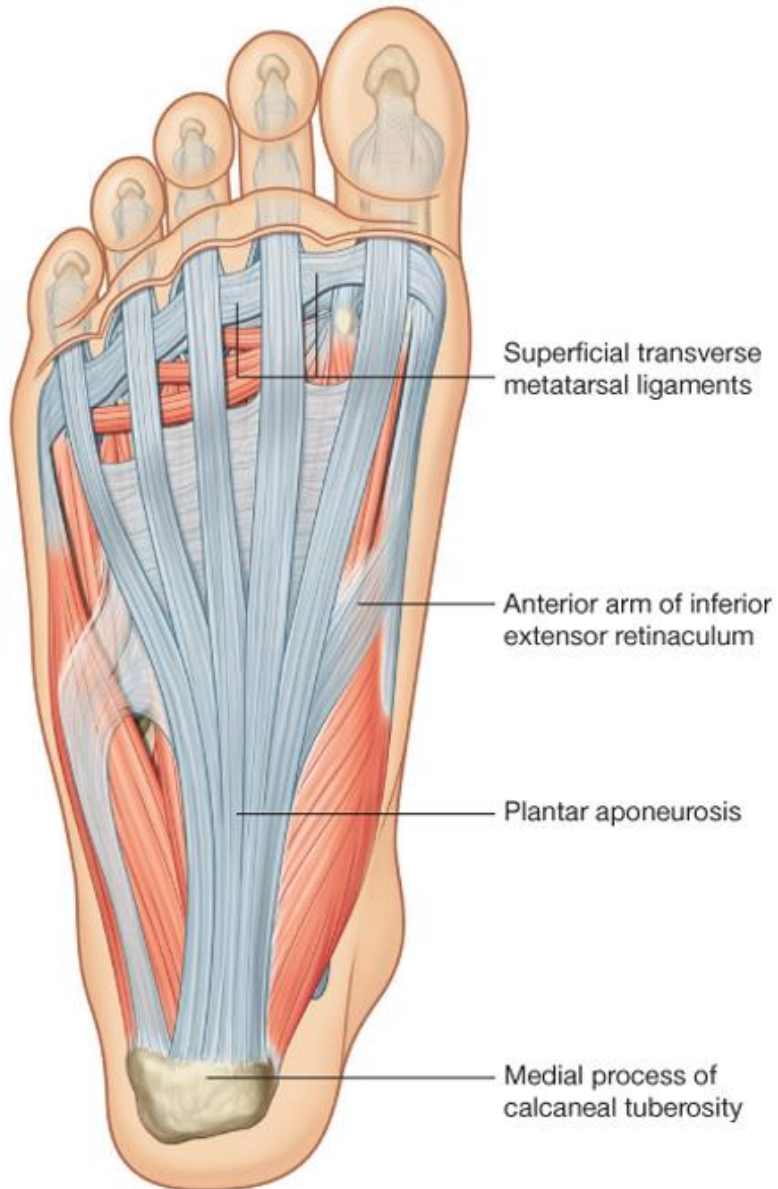


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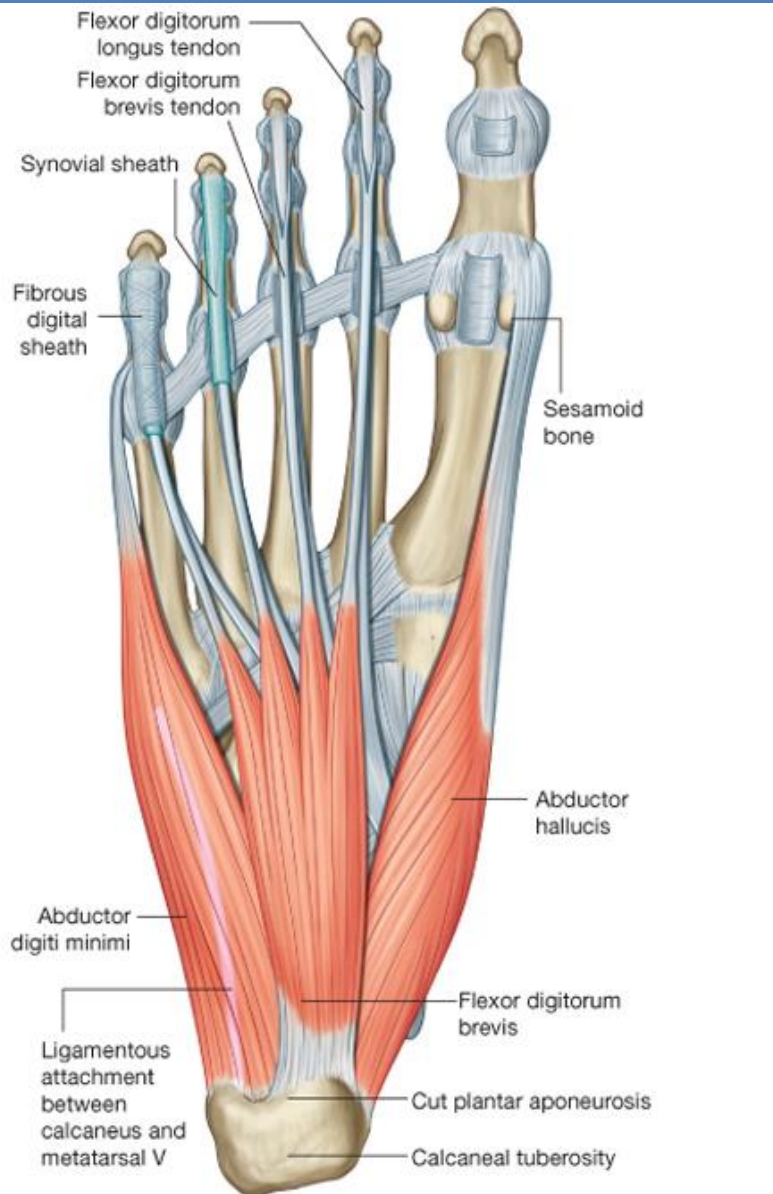


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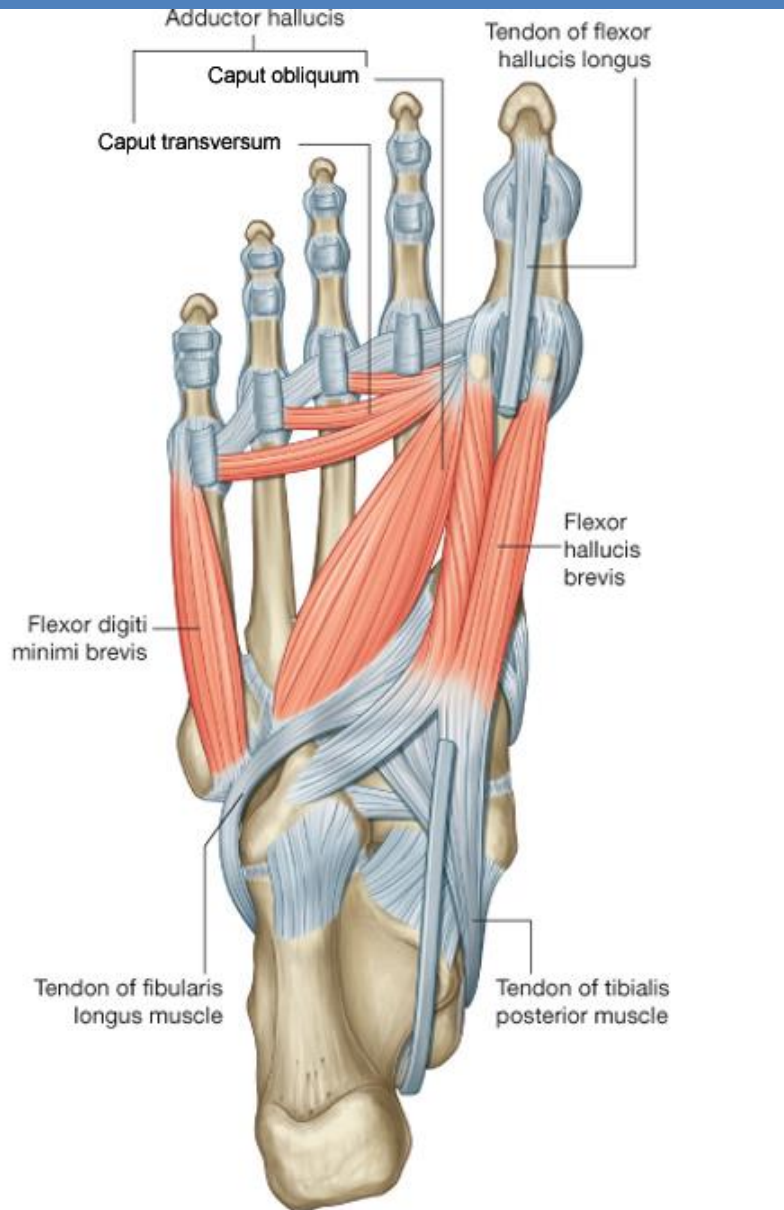
Foot muscles - plantar side



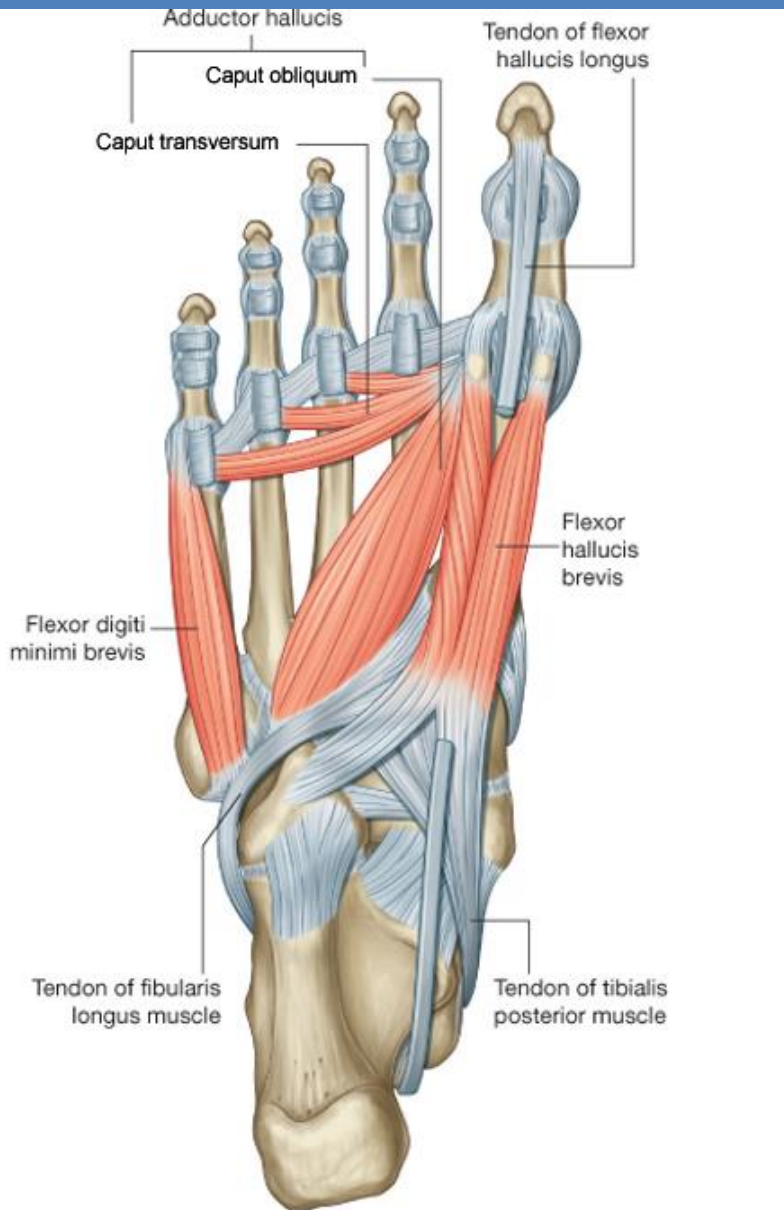
Foot muscles - plantar side



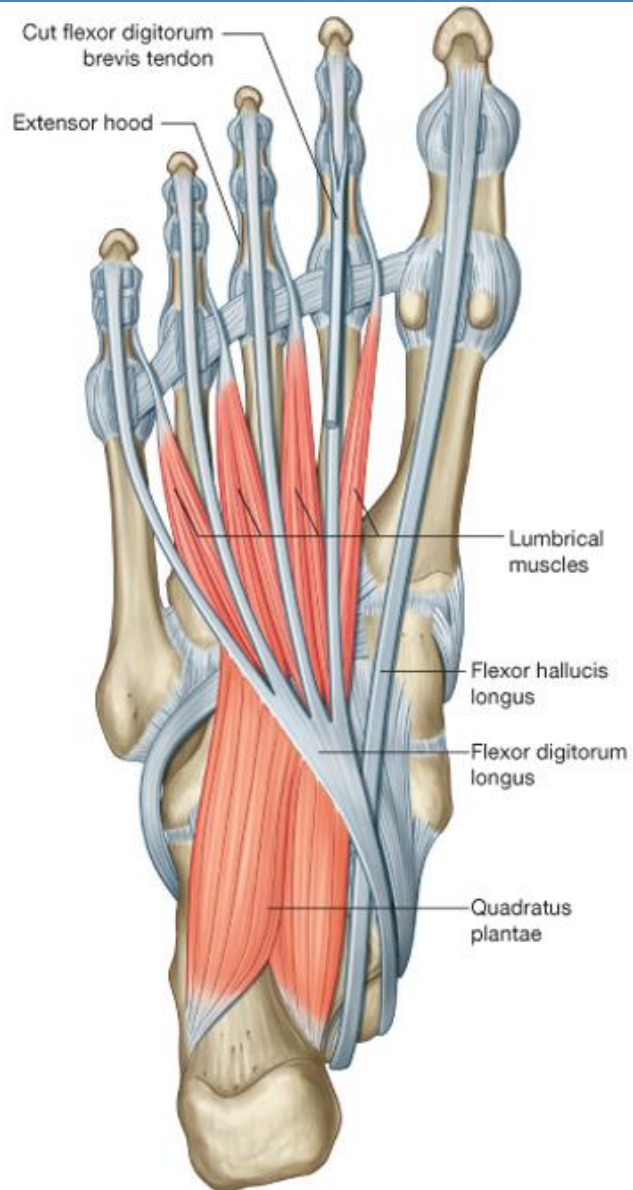
Foot muscles - plantar side



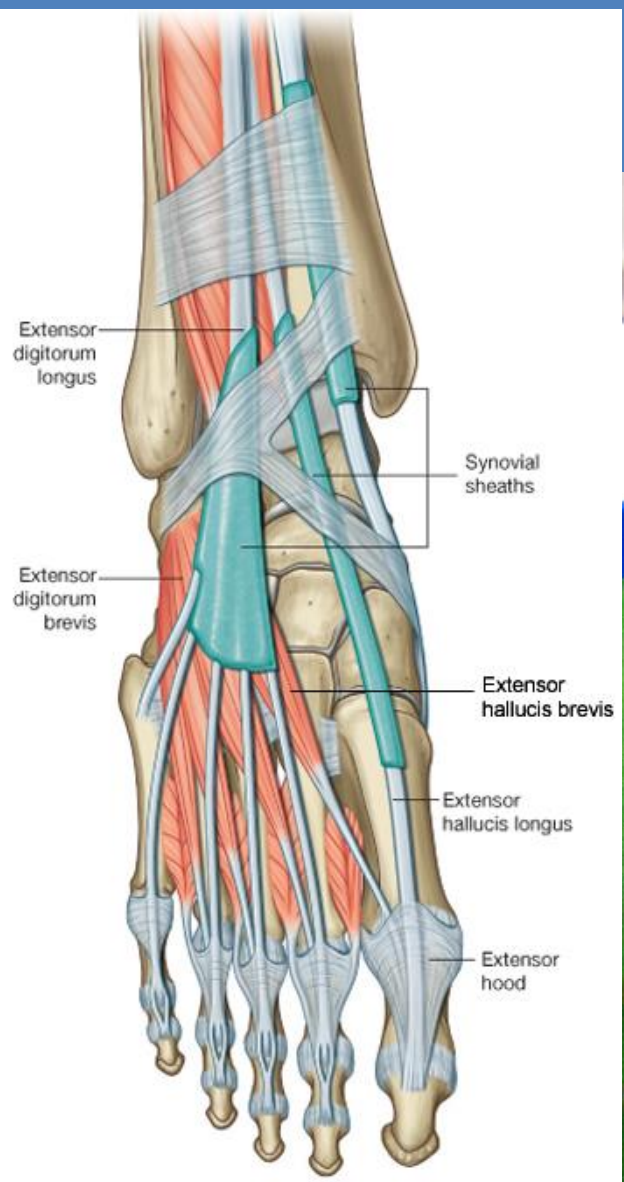
Foot muscles - plantar side



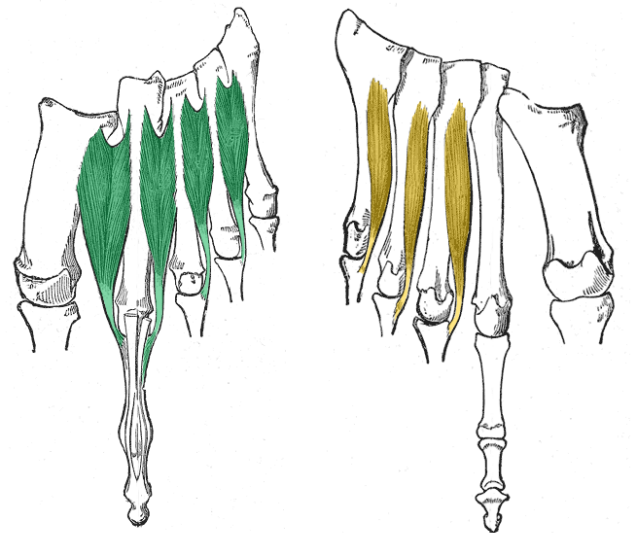
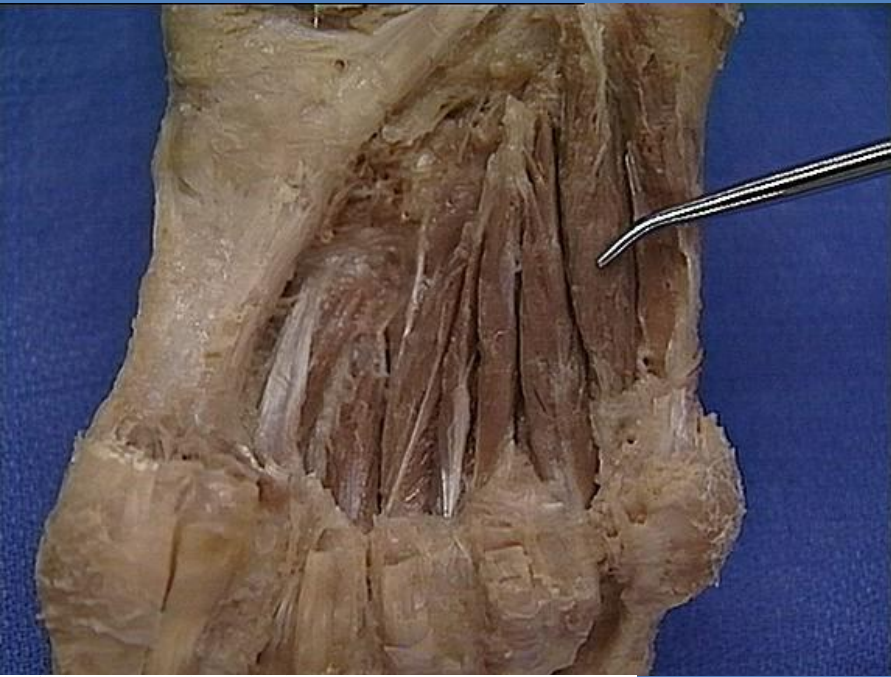
Foot muscles - plantar side



Foot muscles - dorsal side



Foot muscles - interossei



a) Dorsal Interossei

b) Plantar Interossei

Thank you for your attention.



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