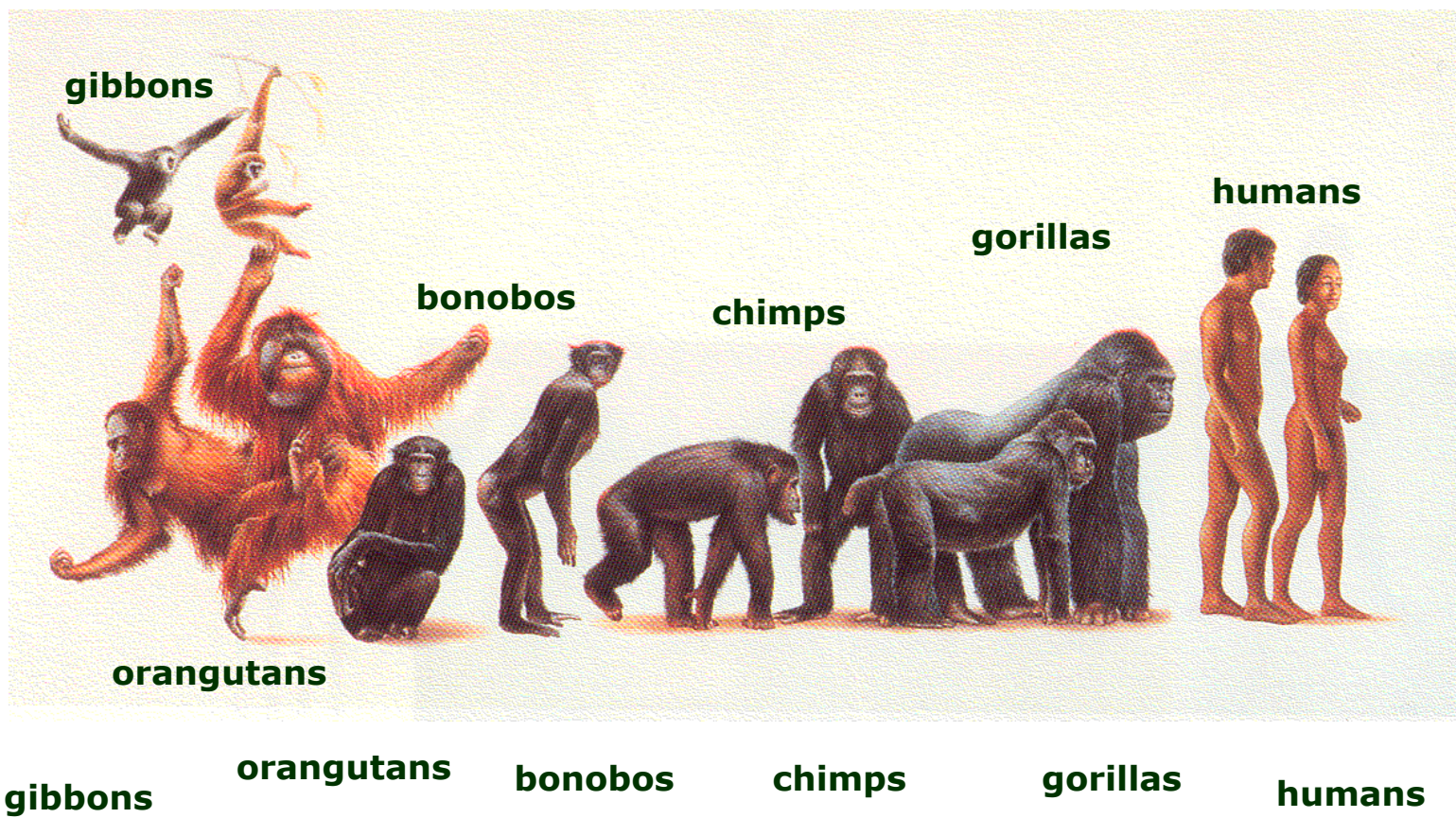




Campbell and Loy, *Humankind Emerging*, 8th ed, p. 138f

Is Bipedalism is bad for your health?

🌍 Pulled muscles, slipped discs & rheumatism

🌍 Varicose veins

🌍 Calluses/flat feet

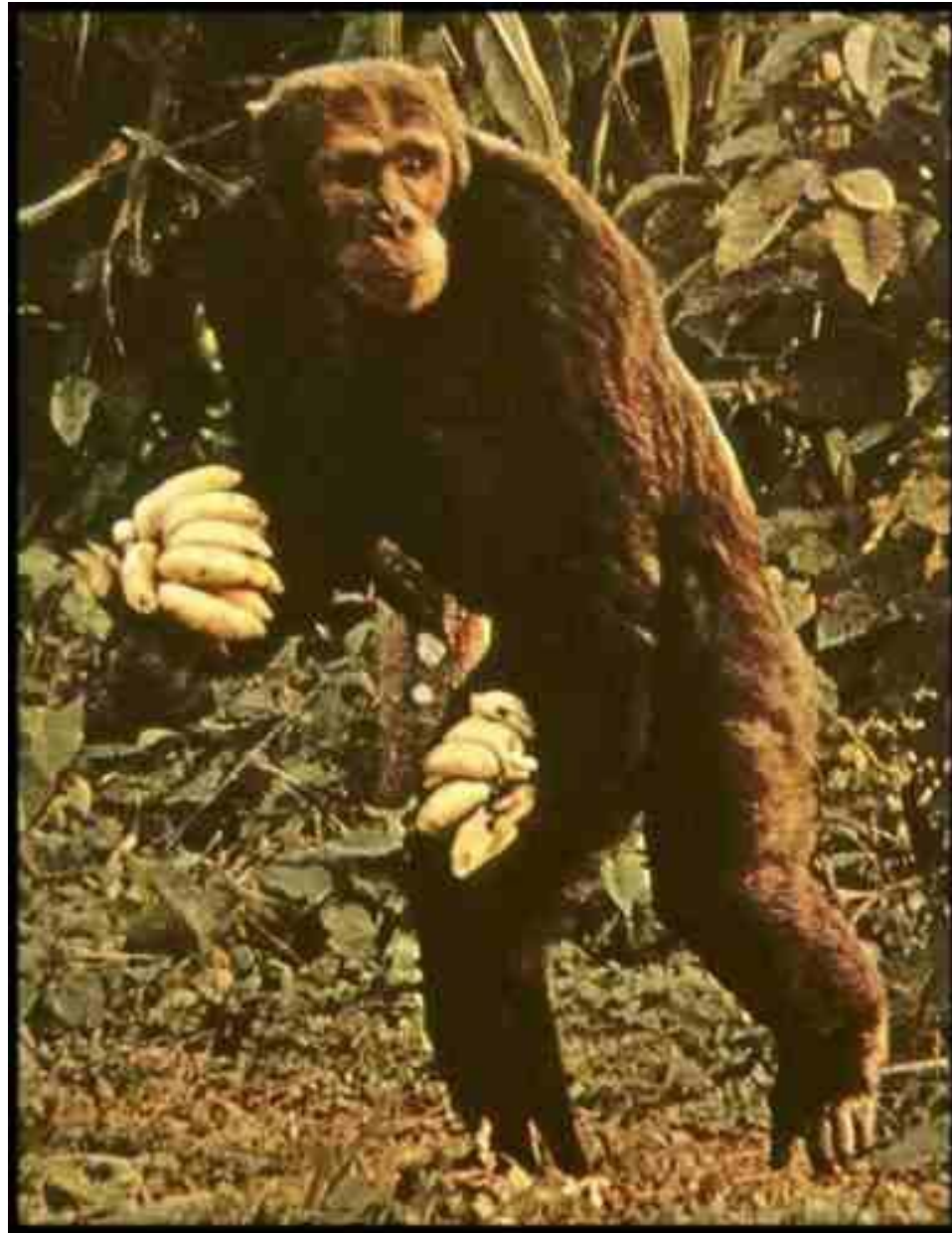
🌍 Haemorrhoids !!!!

Bipedal Locomotion

Why bipedalism?

Apes

**The ability to assume a fairly
erect posture produced
important changes**



Chimpanzee

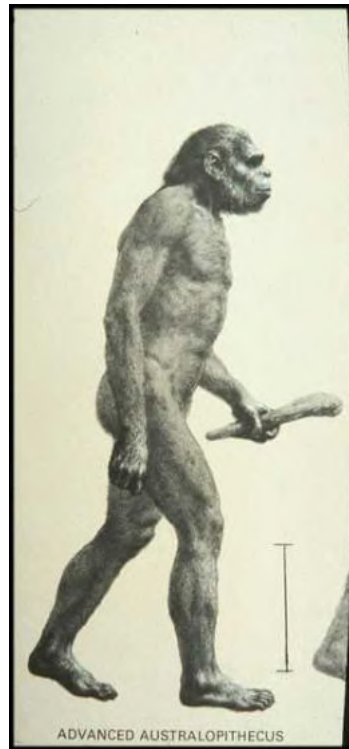
The Primates, Time-Life (1974) p. 71

Bipedalism

**Bipedalism is related to tool
use**

Bipedalism

**Bipedalism also makes hunting
more energy efficient**

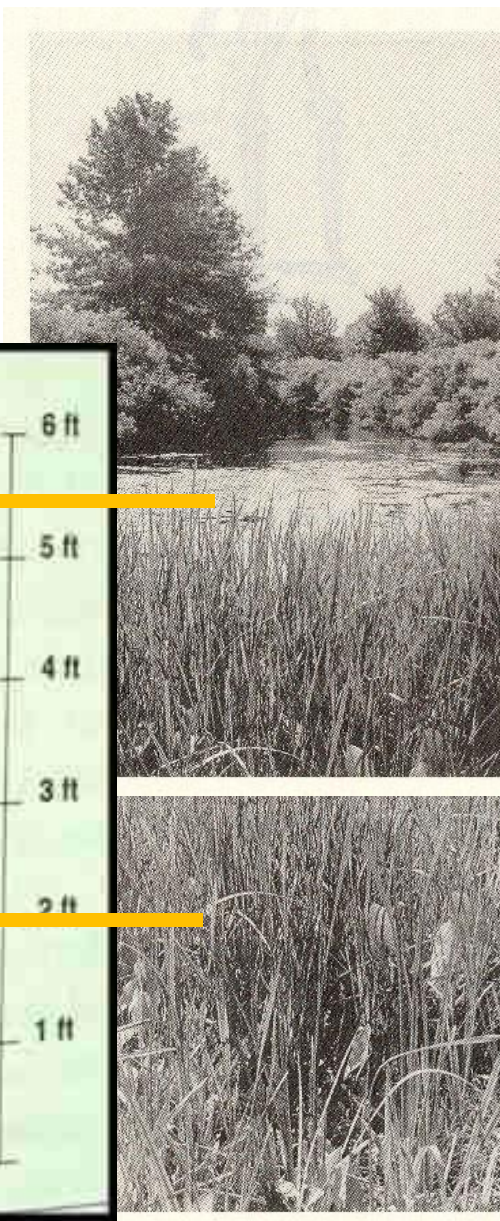
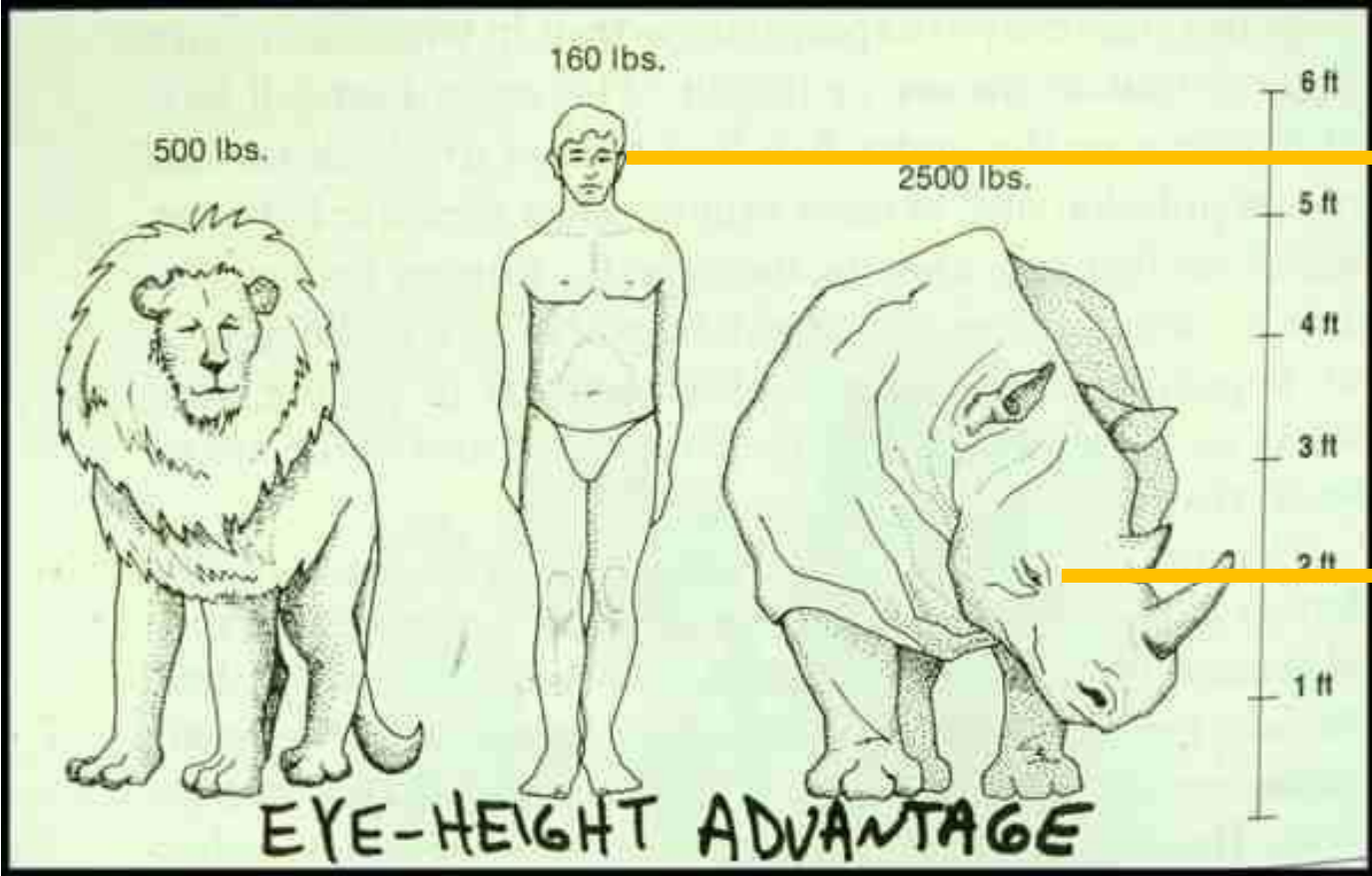


Bipedalism

**Seed and nut gathering
and
Feeding from bushes**

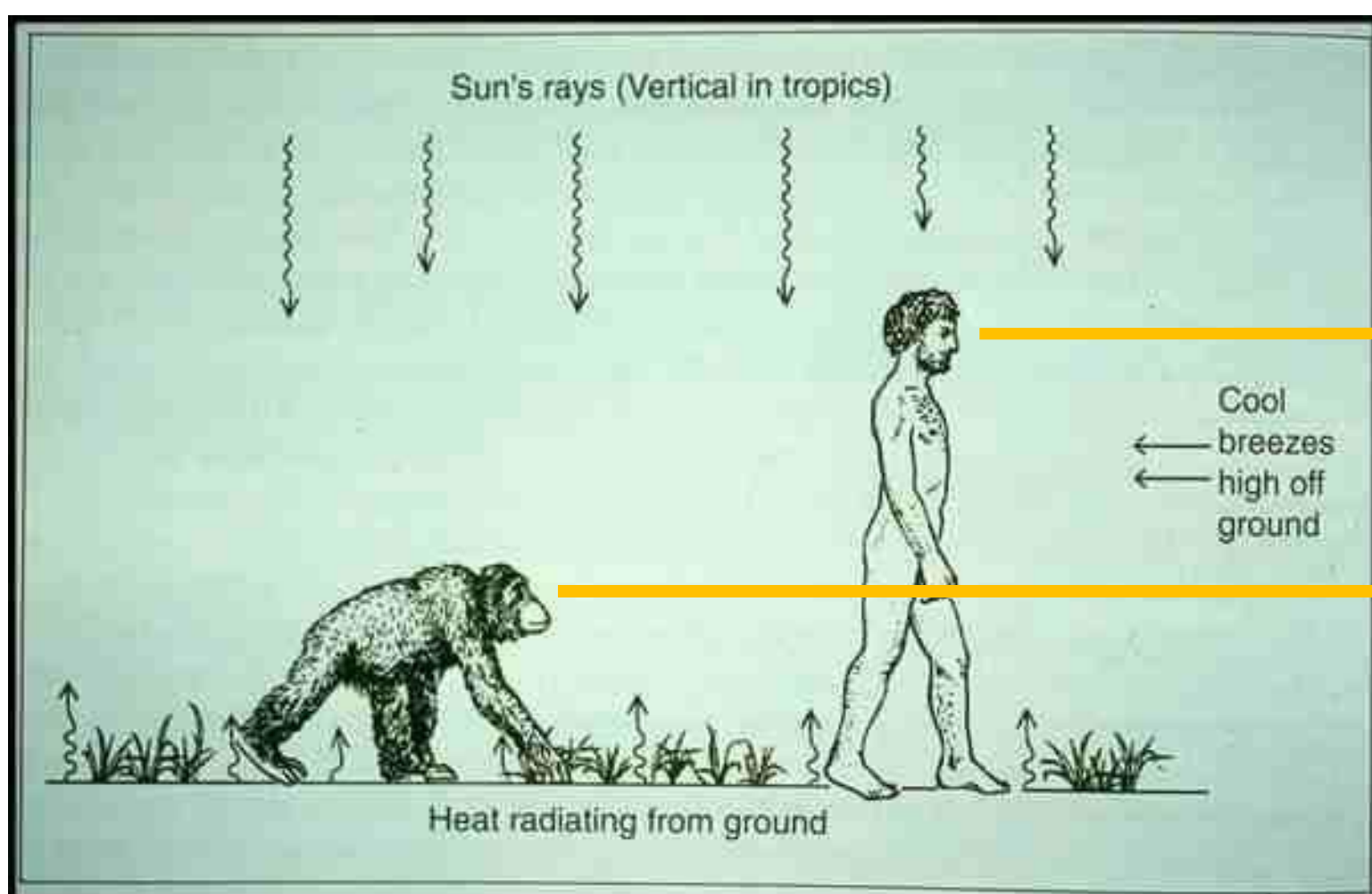
Bipedalism

Bipedalism and vision (visual surveillance)



Bipedalism

body temperature

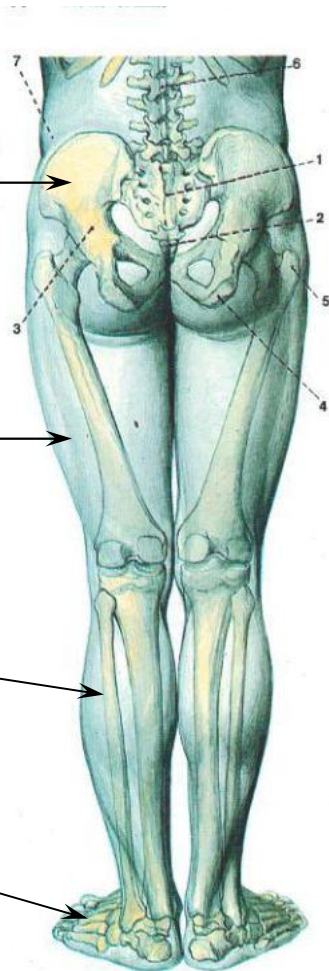


Organization of the Lower Limb



Segments of the Lower Limb

- Limb Girdle
 - pelvic girdle (gluteal)
- Free limb
 - thigh
 - leg
 - foot



1 Sacrum
2 Coccyx
3 Coxal bone
4 Ischial tuberosity
5 Greater trochanter
6 Spinous process of the 2nd lumbar vertebra
7 Iliac crest

Parts and regions of the lower limb

- **Gluteal region:** between iliac crest superiorly and gluteal fold inferiorly
- **Thigh:** between hip and knee
- **Knee:** joint between leg and thigh
- **Leg:** between knee and foot
- **Ankle**
- **Foot**

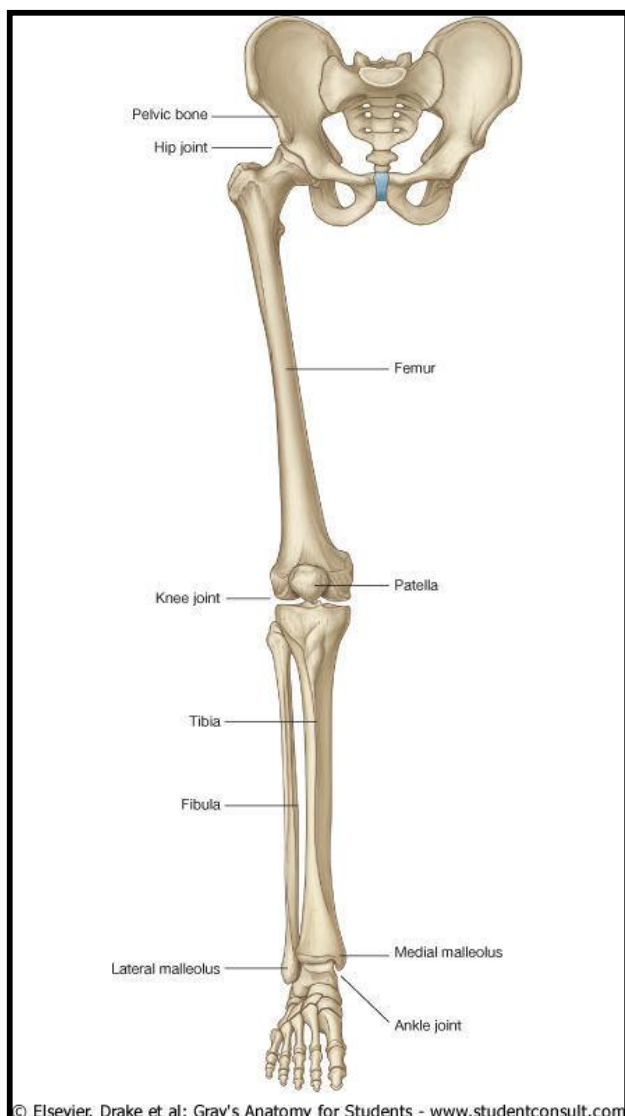


Composition of Lower Limb

- Skeleton (homologous with upper limb)
- Muscles--anterior, posterior compartments
- Nerves--sciatic, femoral, Obturator
- Surface anatomy

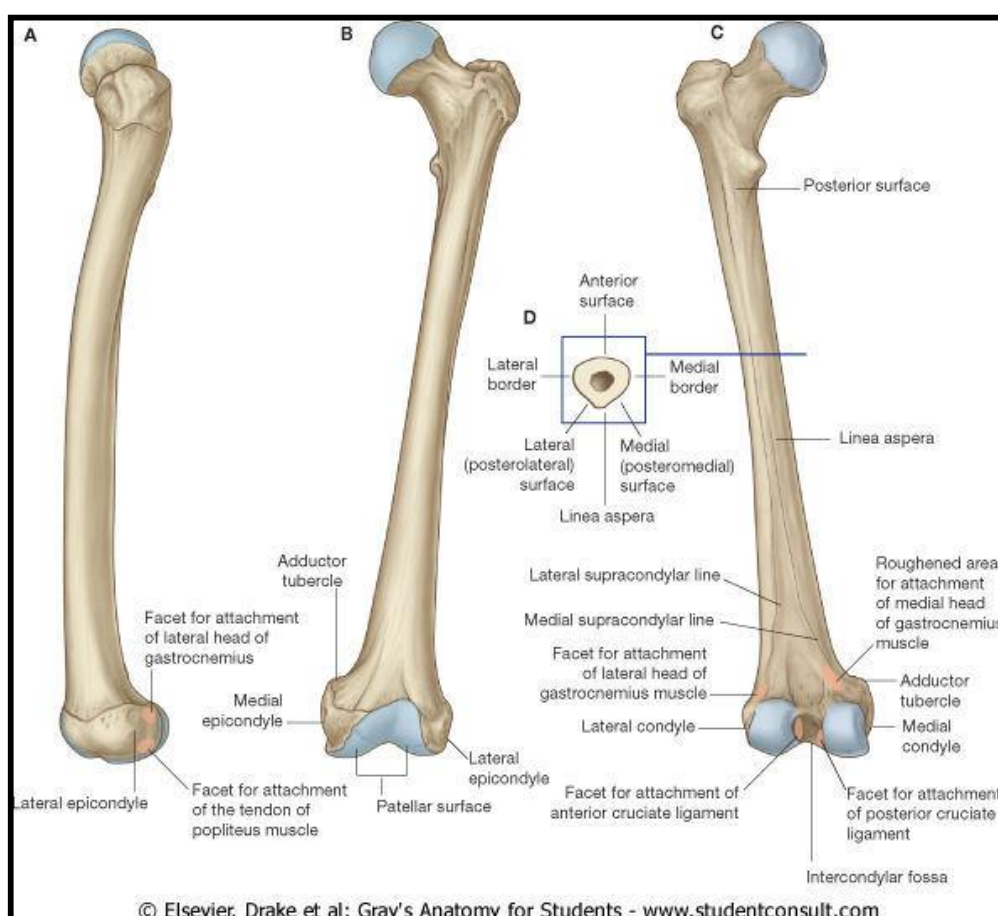
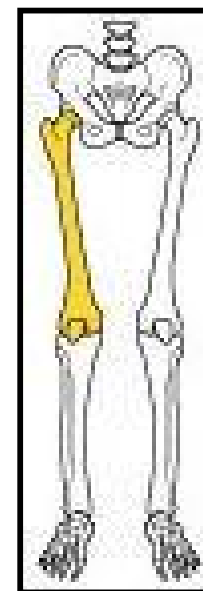


Bones of the Lower Limb



- Function:
 - Locomotion
 - Carry weight of entire erect body
 - Support
 - Points for muscular attachments
- Components:
 - Thigh
 - Femur
 - Knee
 - Patella
 - Leg
 - Tibia (medial)
 - Fibula (lateral)
 - Foot
 - Tarsals (7)
 - Metatarsals (5)
 - Phalanges (14)

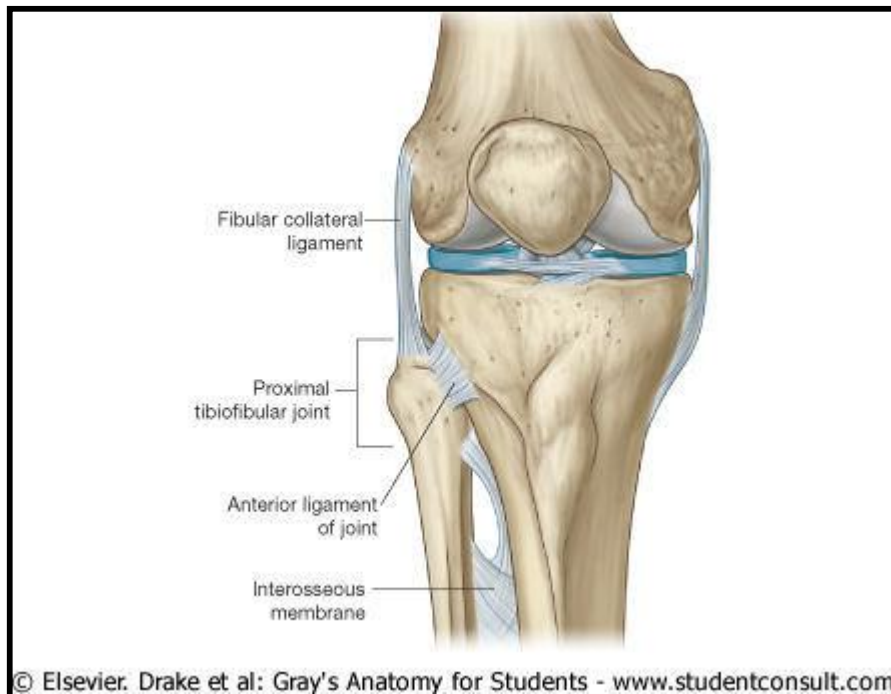
Thigh



- Femur
 - Largest, longest, strongest bone in the body!!
 - Receives a lot of stress
 - Courses medially
 - Articulates with acetabulum proximally
 - Articulates with tibia and patella distally

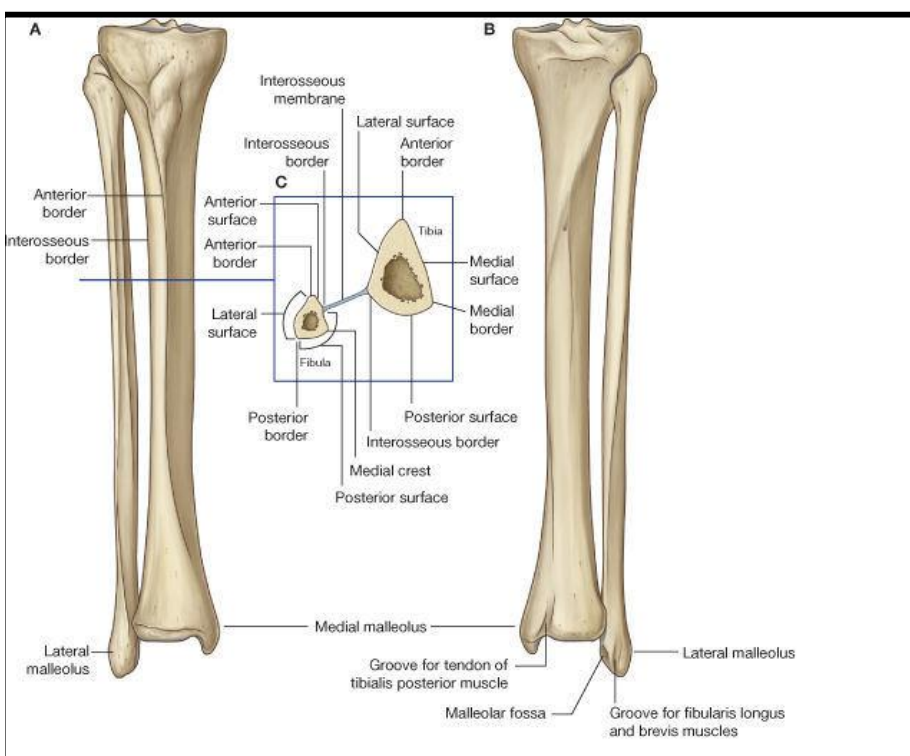
Knee

- Patella
 - Triangular sesamoid bone
 - Protects knee joint
 - Improves leverage of thigh muscles acting across the knee
 - Contained within patellar ligament

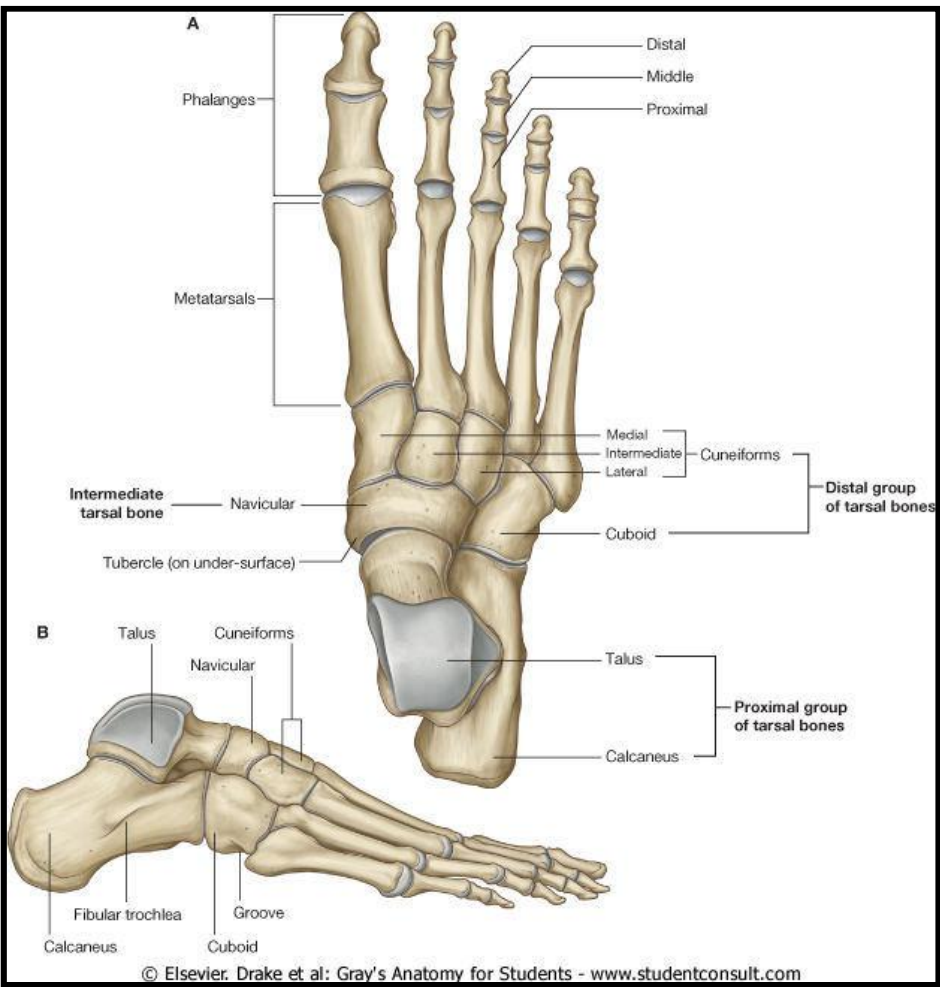


Leg

- Tibia
 - Receives the weight of body from femur and transmits to foot
 - Second to femur in size and weight
 - Articulates with fibula proximally and distally
 - Interosseous membrane
- Fibula
 - Does NOT bear weight
 - Muscle attachment
 - Not part of knee joint
 - Stabilize ankle joint

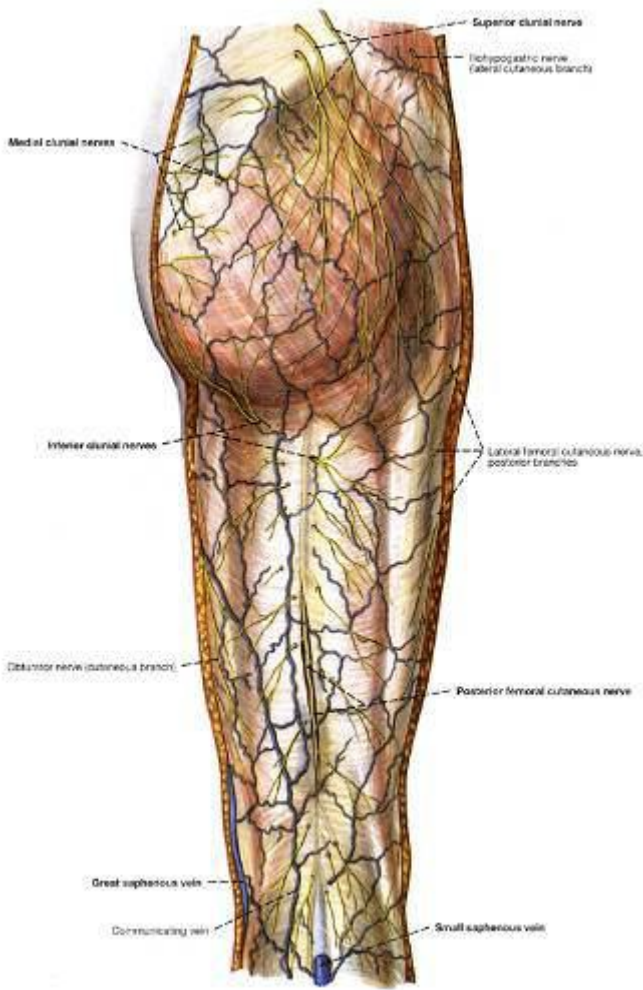


Foot

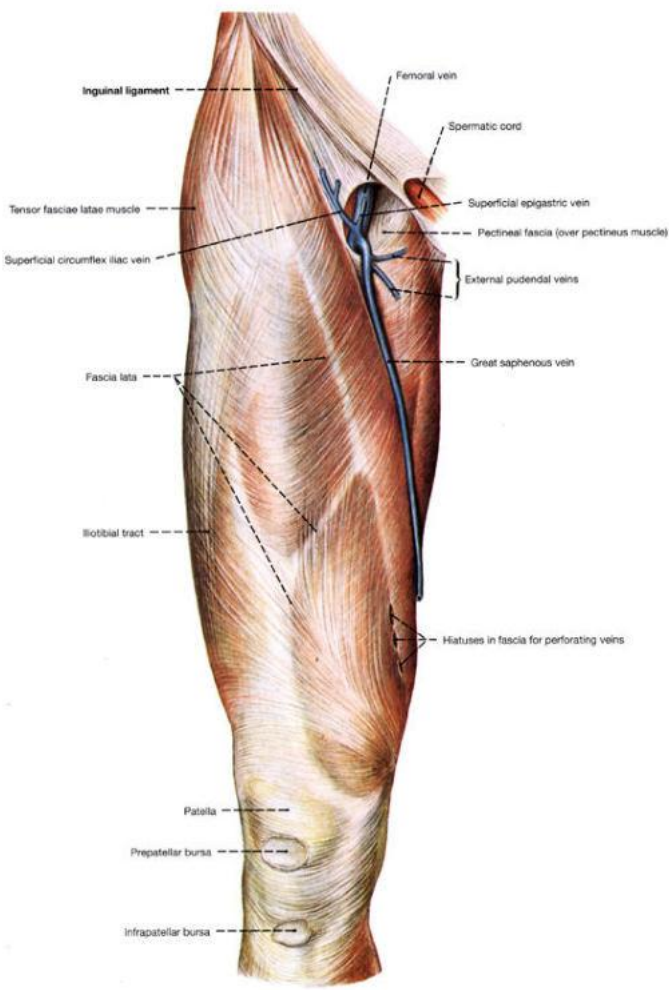


- Function:
 - Supports the weight of the body
 - Act as a lever to propel the body forward
- Parts:
 - Tarsals
 - Talus = ankle
 - Calcaneus = heel
 - Navicular
 - Cuboid
 - Medial, lateral and intermediate cuneiforms
 - Metatarsals
 - Phalanges

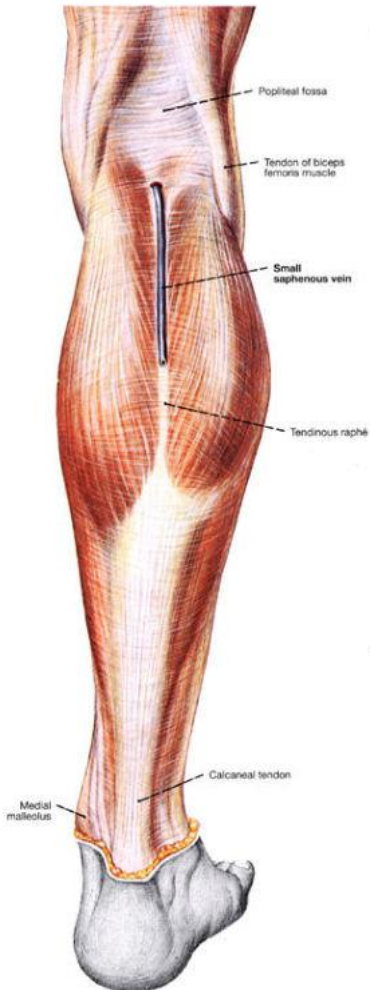
Fascia of the Lower Limb



Gluteal Fascia

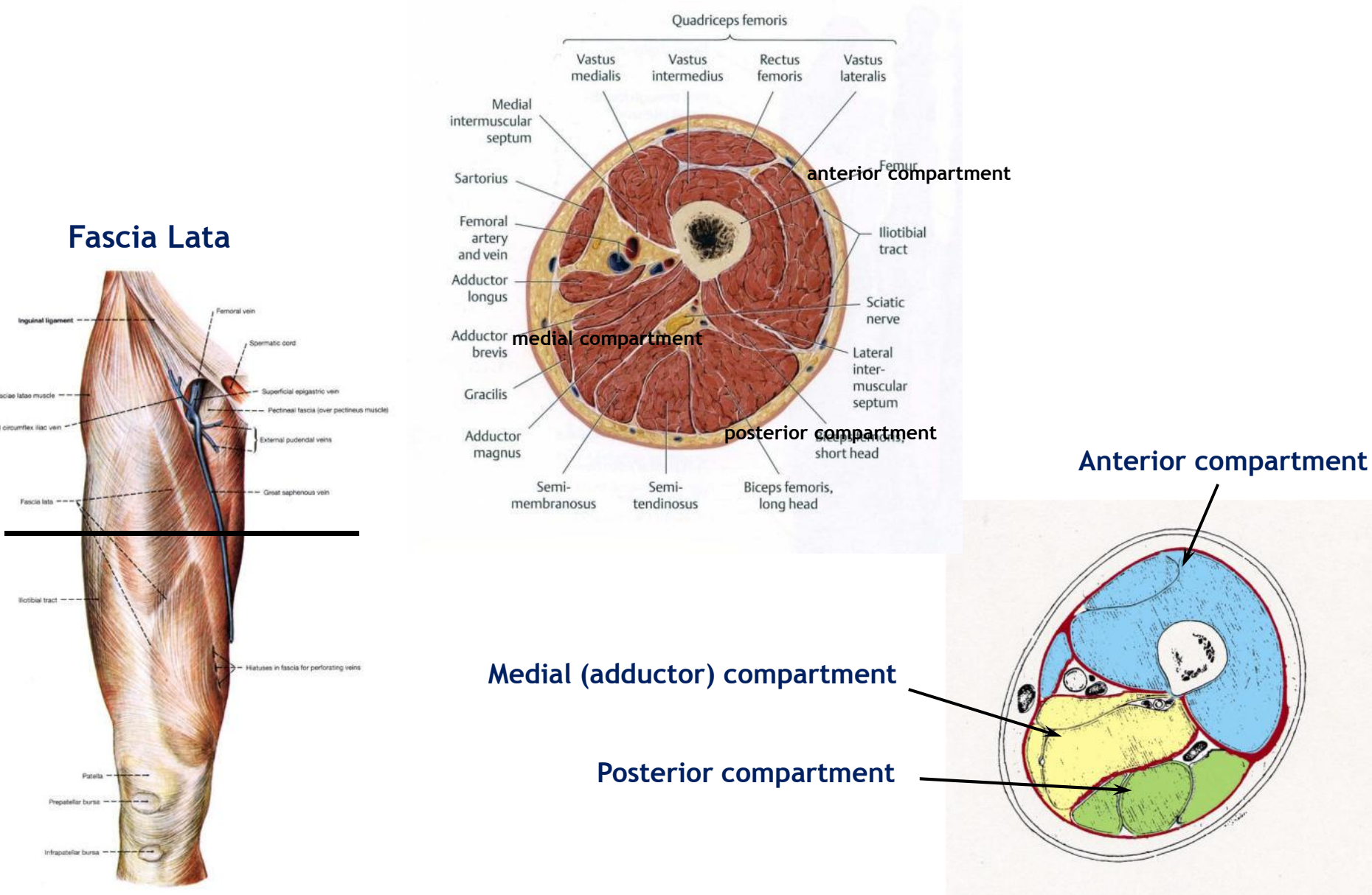


Fascia Lata



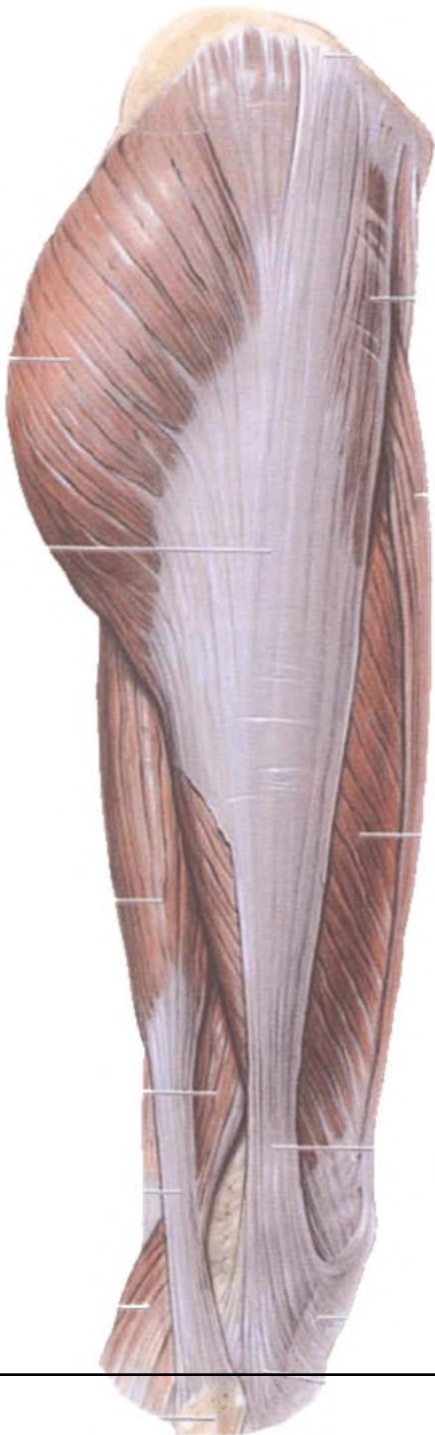
Crural Fascia

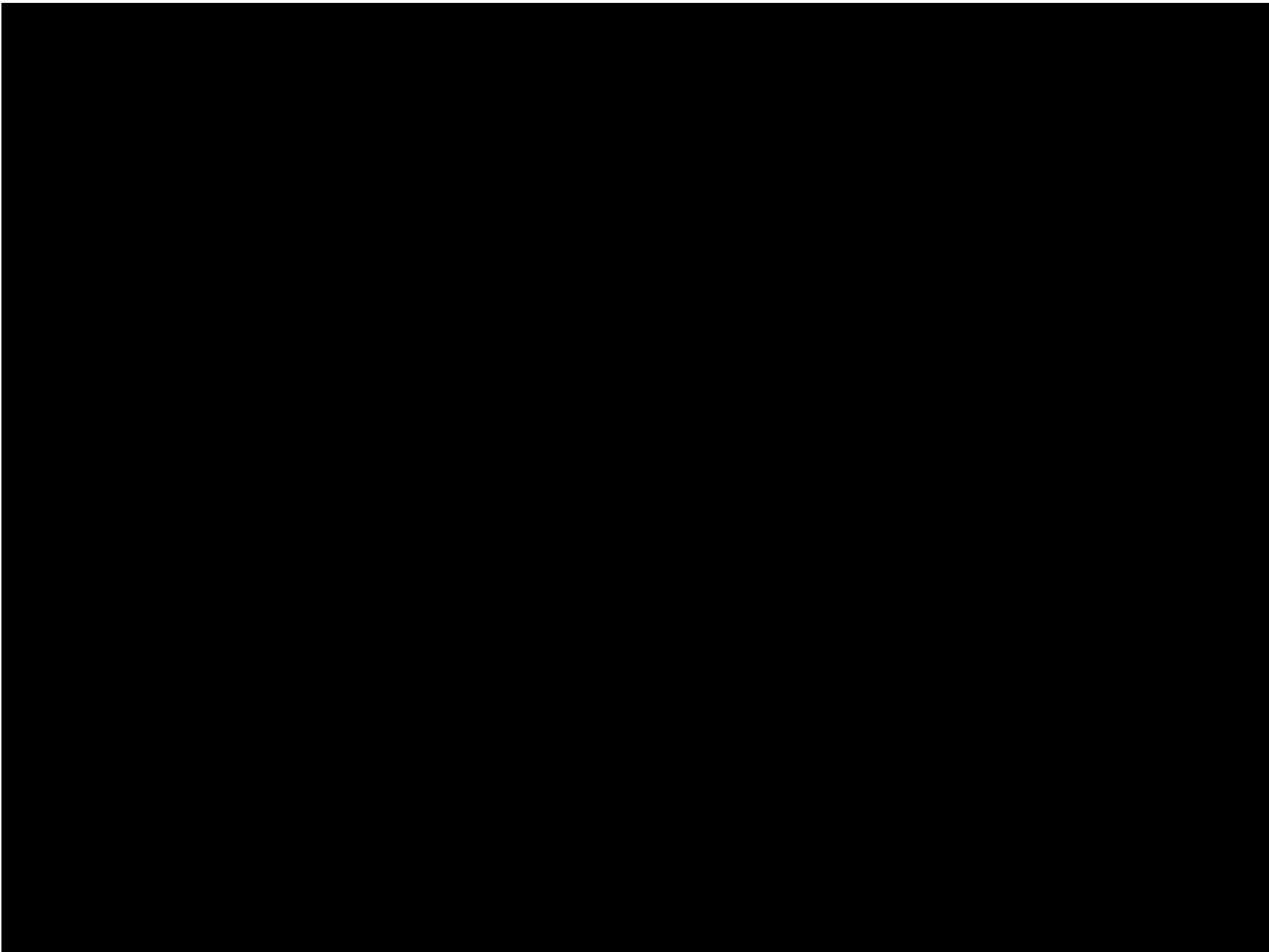
Fascial Compartments of the Thigh



Deep fascia – fascia lata

- Iliotibial tract
- Saphenous hiatus
- falciform margin
- cribriform fascia

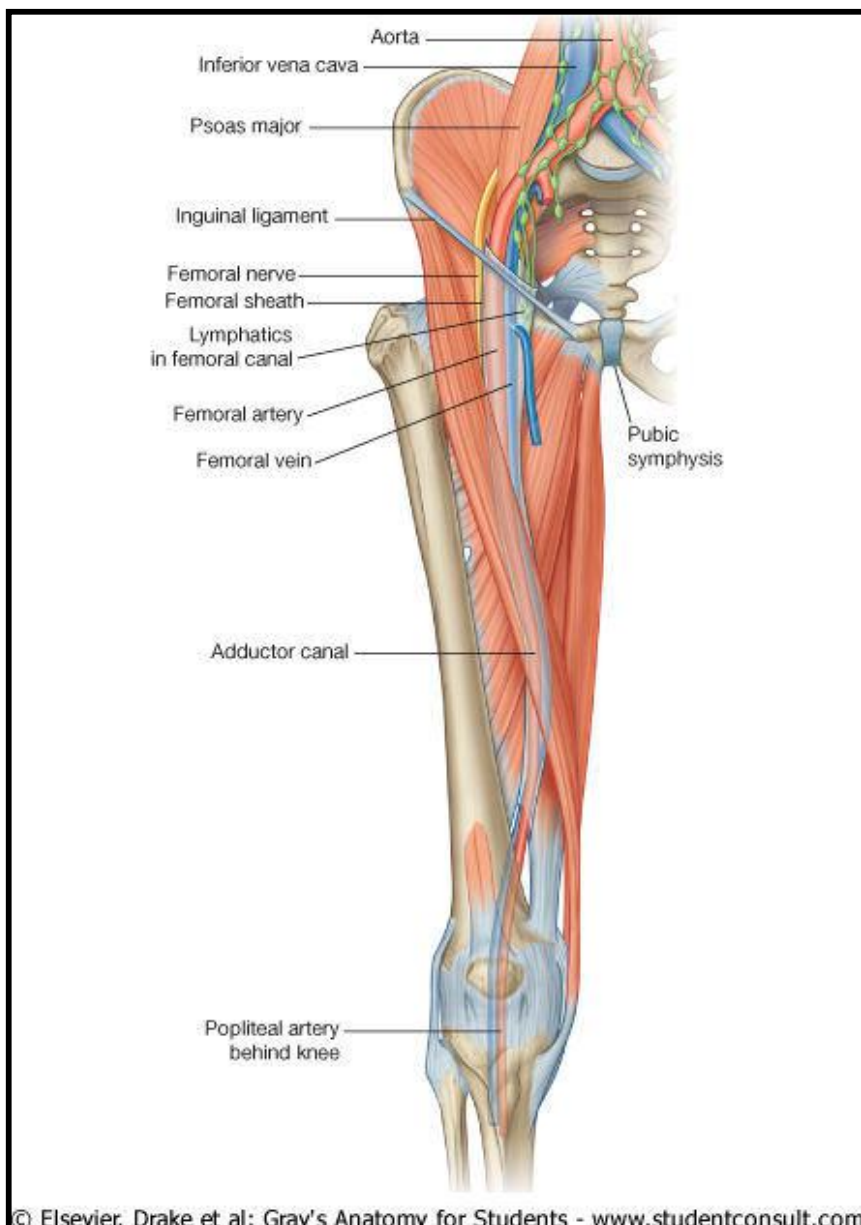




Anterior/Posterior compartments

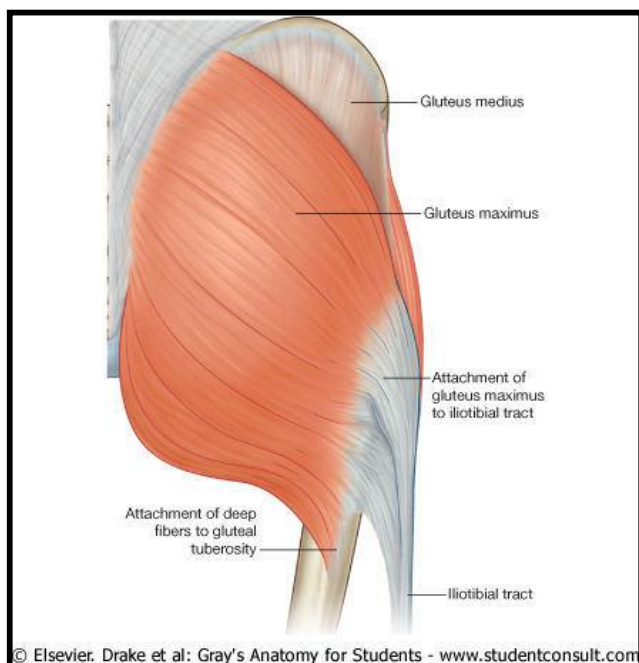
	ANTERIOR COMPARTMENT	POSTERIOR COMPARTMENT
MOVEMENT	Extension	Flexion
MUSCLES	Quads Shin	Hamstrings Gastrocs
NERVES	Femoral n. (lumbar plexus)	Sciatic n. (sacral plexus)

Muscles of Hip and Thigh



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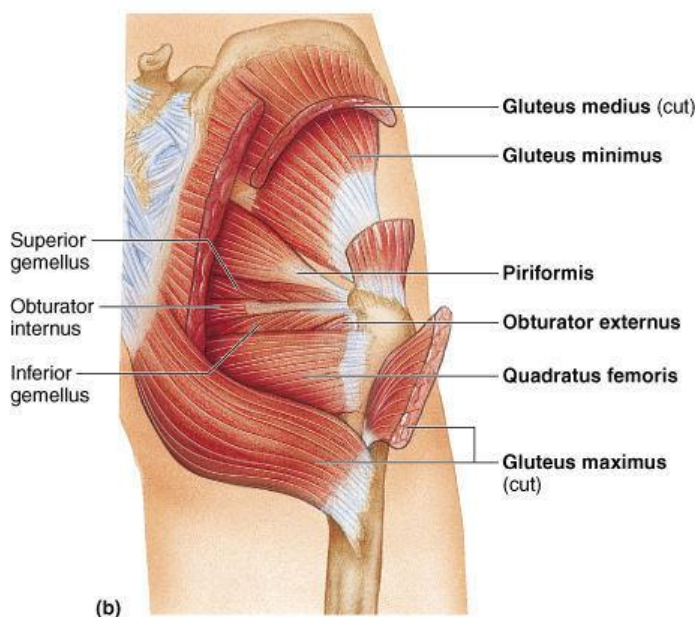
- Gluteals
 - Posterior pelvis
 - Extend thigh
 - Rotate thigh
 - Abducts thigh
- Anterior Compartment Thigh
 - Flexes thigh at hip
 - Extends leg at knee
- Medial/Adductor Compartment
 - Adducts thigh
 - Medially rotates thigh
- Posterior Compartment Thigh
 - Extends thigh
 - Flexes leg



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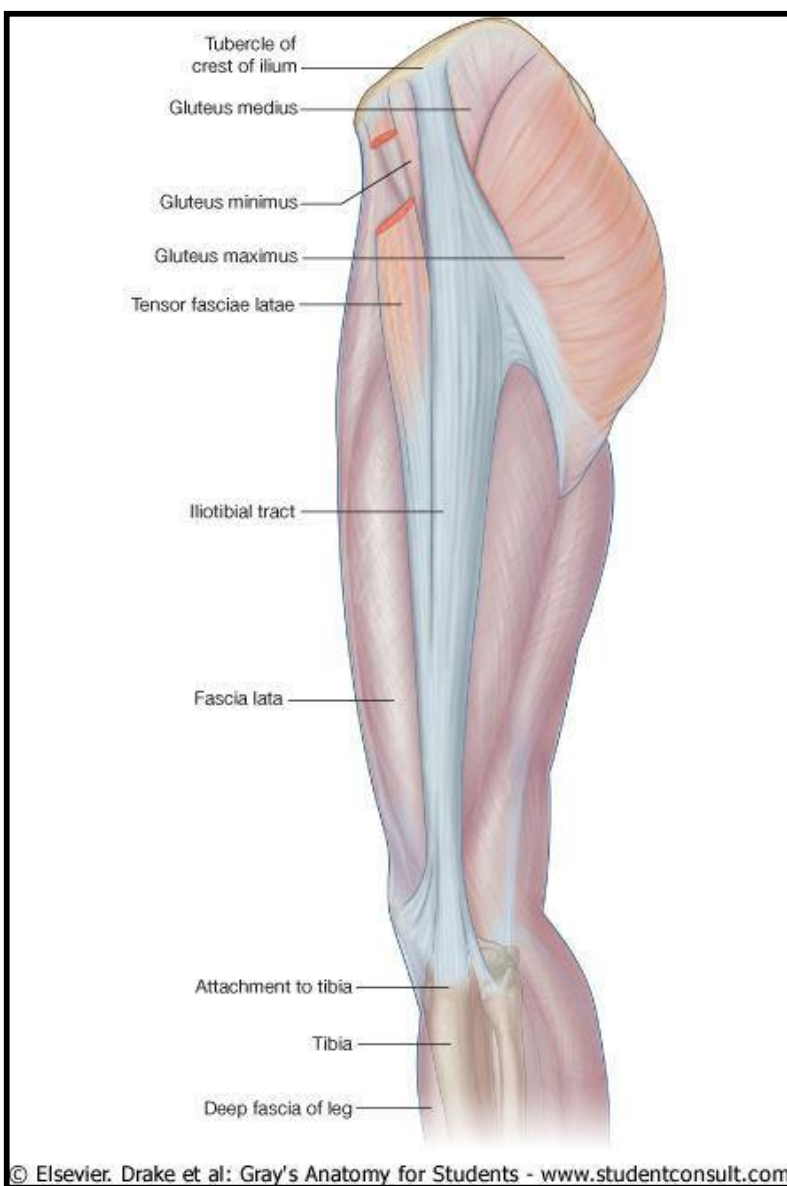
Gluteals

- Gluteus maximus
 - Action - Extends thigh, some lateral rotation and abduction
- Gluteus medius
- Gluteus minimus
 - Action - Abduction, medial rotation
- **Lesser Gluteals help stabilize hip to allow fluent bipedal walking**



(b)

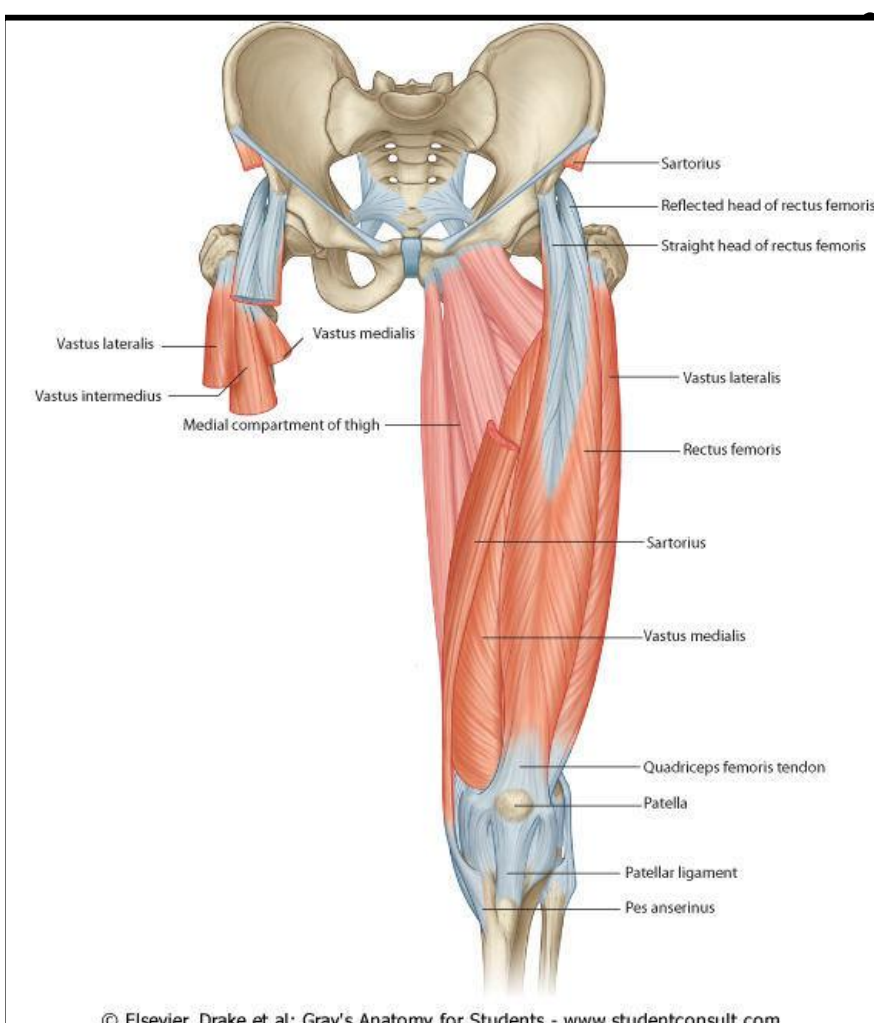
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Posterior Pelvis

- Tensor fasciae latae
 - Action - Flex thigh, abduct thigh, medial rotation of thigh

Anterior Compartment Thigh



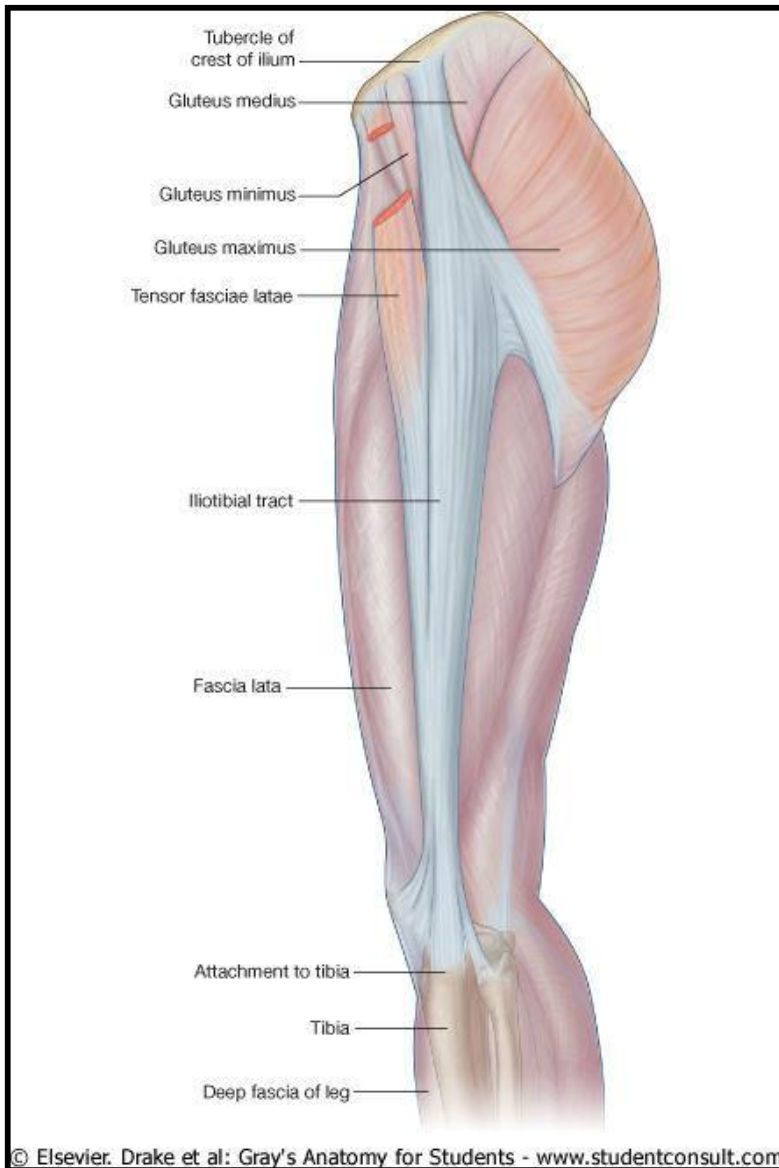
Quadriceps femoris

- Rectus femoris
- Vastus lateralis
- Vastus medialis
- Vastus intermedius
- Action – extends knee

Sartorius

All above innervated by the femoral nerve!!!

Anterior Compartment Thigh

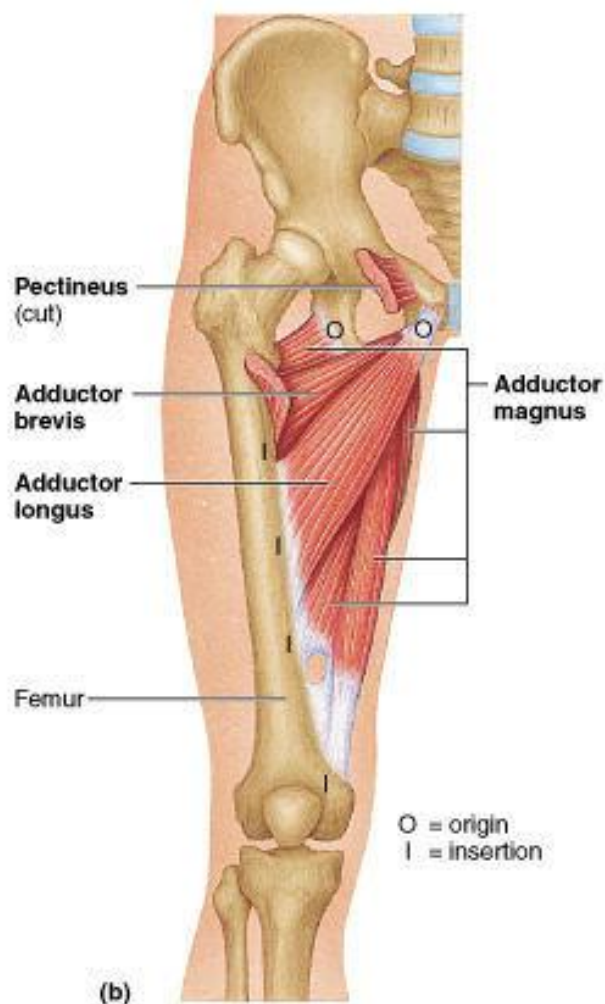


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- Iliopsoas

—

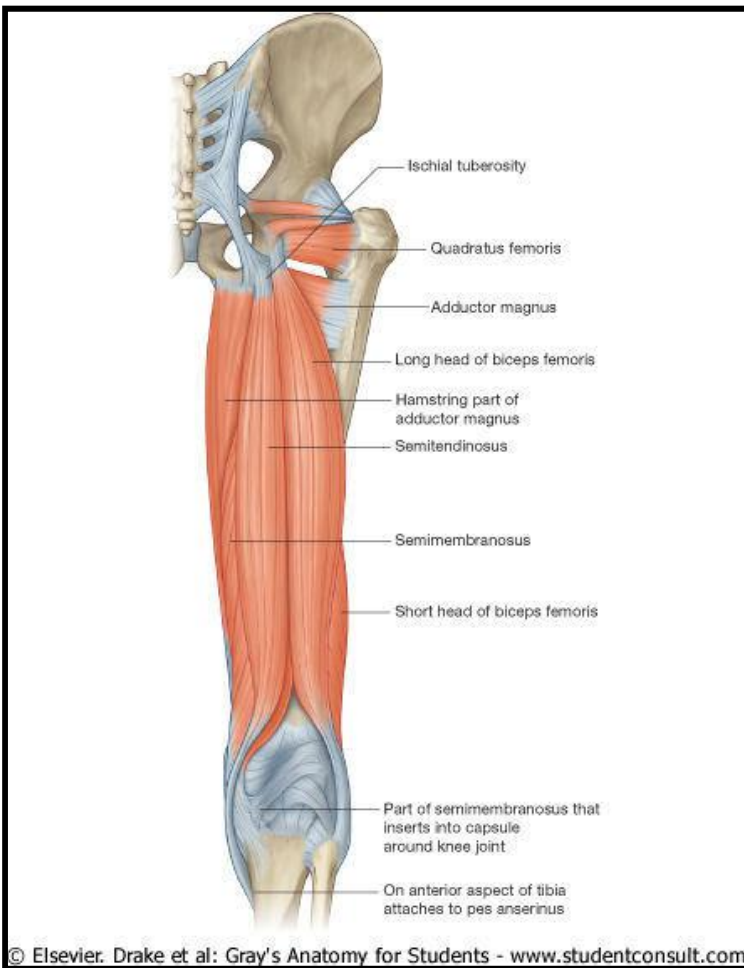
Medial compartment (obturator n.)



- Adductor muscles
 - Gracilis
 - Adductor
 - Magnus
 - Longus
 - brevis

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Posterior Compartment - Hamstring

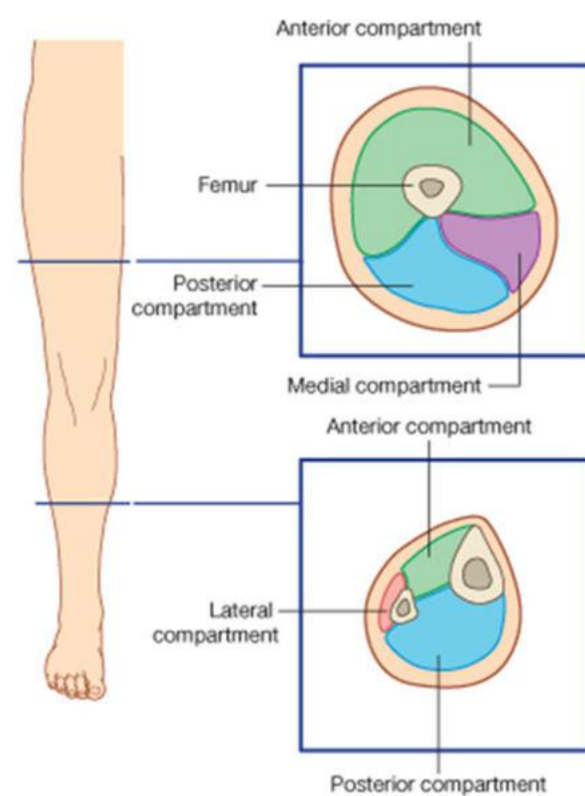


- Biceps femoris (2 heads)
 - Action - thigh extension, knee flexion, lateral rotation
- Semitendinosus
- Semimembranosus
 - Action - thigh extension, knee flexion, medial rotation

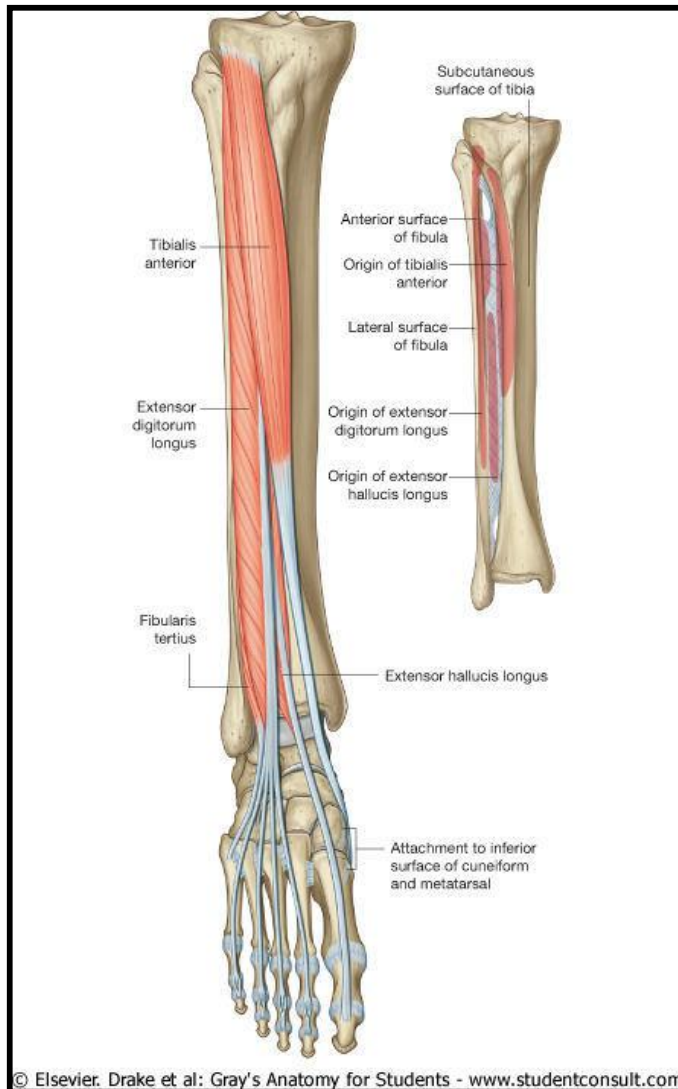
Sciatic nerve innervates all of the above muscles!!!

Muscles of the Leg

- Anterior Compartment
 - Dorsiflex ankle, invert foot, extend toes
 - Innervation: Deep fibular nerve
- Lateral Compartment
 - Plantarflex, evert foot
 - Innervation: Superficial Fibular nerve
- Posterior Compartment
 - Superficial and deep layers
 - Plantarflex foot, flex toes
 - Innervation: Tibial nerve



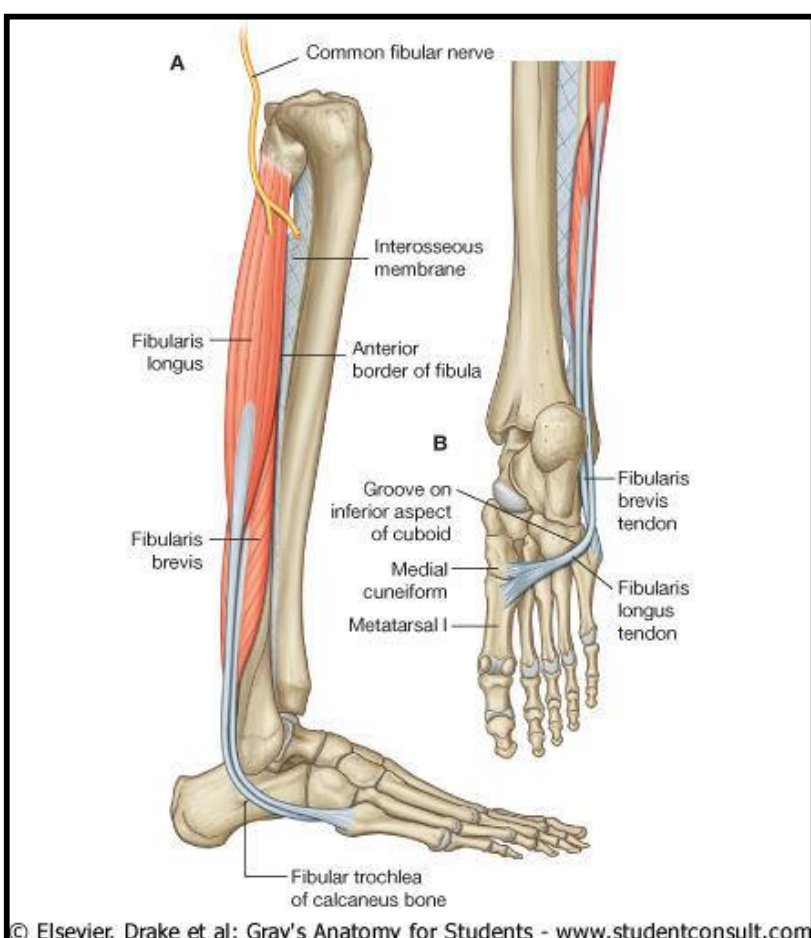
Anterior Compartment



- Tibialis anterior
 - Action - dorsiflexion, foot inversion
- Extensor digitorum longus
 - Action – toe extension
- Extensor hallucis longus
 - Action - extend big toe, dorsiflex foot

All innervated by deep fibular nerve

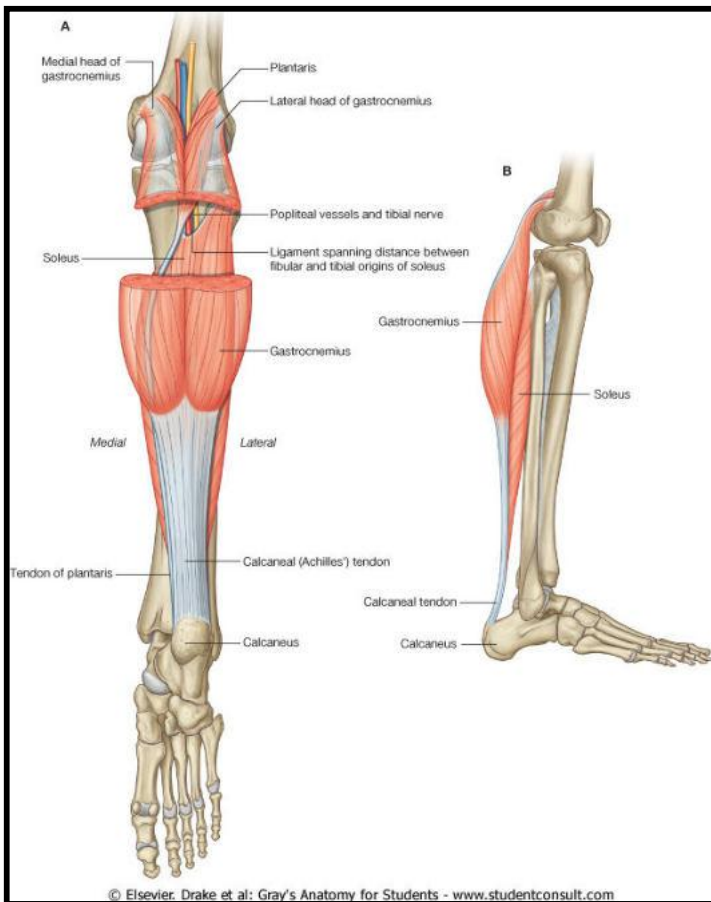
Lateral Compartment



- Fibularis (peroneus) longus
 - Action - plantarflex, evert foot
- Fibularis (peroneus) brevis
 - Action – same as above!!

All innervated by the superficial fibular nerve

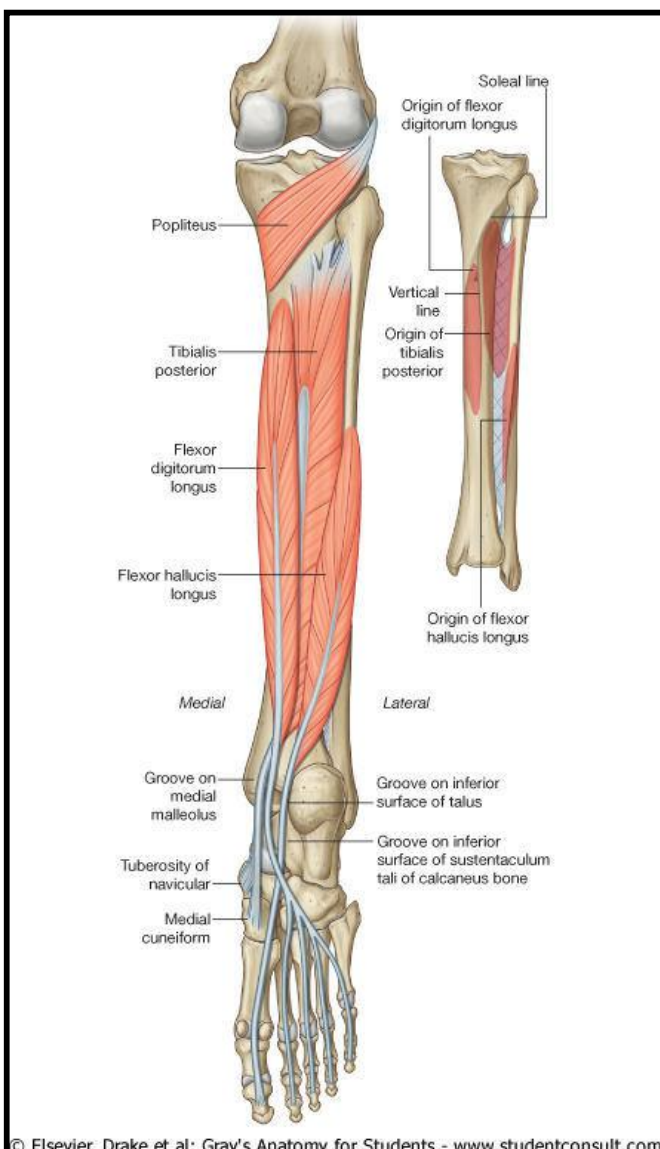
Superficial Posterior Compartment



All innervated by the tibial nerve

- Triceps surae
 - Gastrocnemius (2 heads)
 - Origin - medial and lateral condyles of femur
 - Insertion - posterior calcaneus via Achilles tendon
 - Soleus
 - Origin – tibia and fibula
 - Insertion – same as above
 - Action of both – plantarflex foot
- Plantaris (variable)
 - Origin – posterior femur
 - Insertion – same as above!
 - Action – plantarflex foot, weak knee flexion

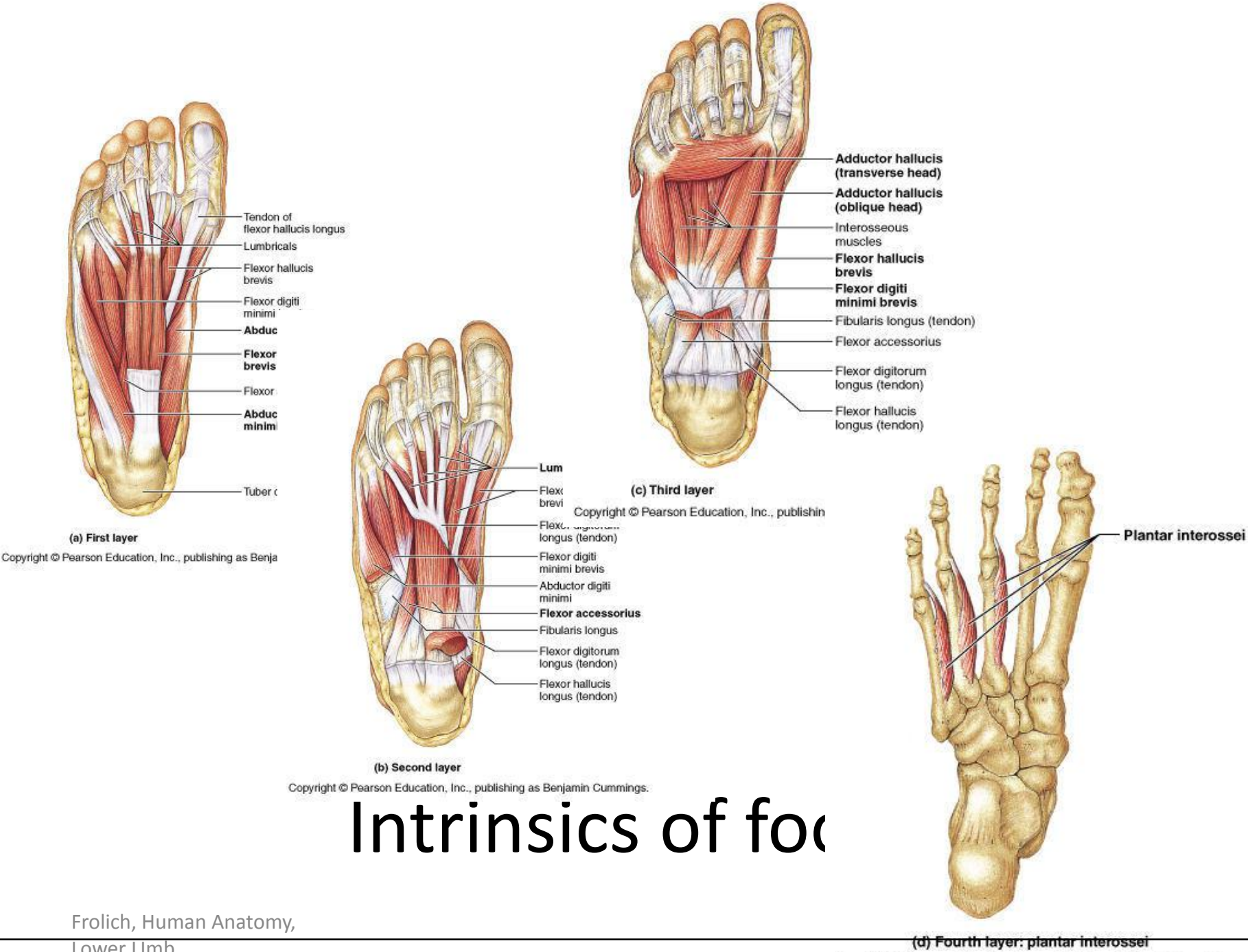
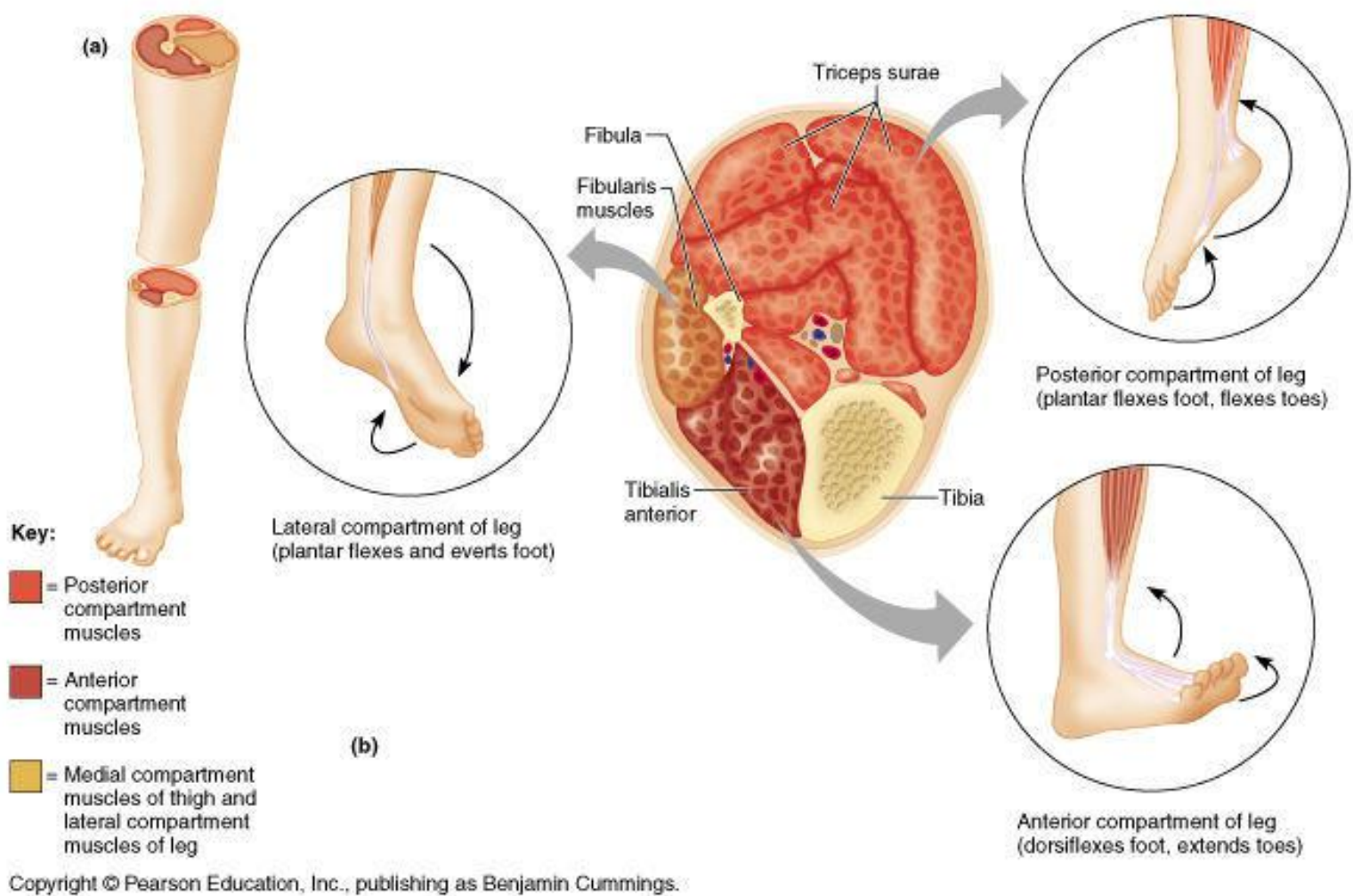
Deep Posterior Compartment



- Popliteus
 - Origin - lateral condyle femur and lateral meniscus
 - Insertion – proximal tibia
 - Action – flex and medially rotate leg
- Flexor digitorum longus
 - Origin - tibia
 - Insertion - distal phalanges of toe 2-5
 - Action – plantarflex and invert foot, flex toe
- Flexor hallucis longus
 - Origin - fibula
 - Insertion - distal phalanx of hallux
 - Action - plantarflex and invert foot, flex toe
- Tibialis posterior
 - Origin – tibia, fibula, and interosseous membrane
 - Insertion - tarsals and metatarsals
 - Action - plantarflex and invert foot

All innervated by the tibial nerve

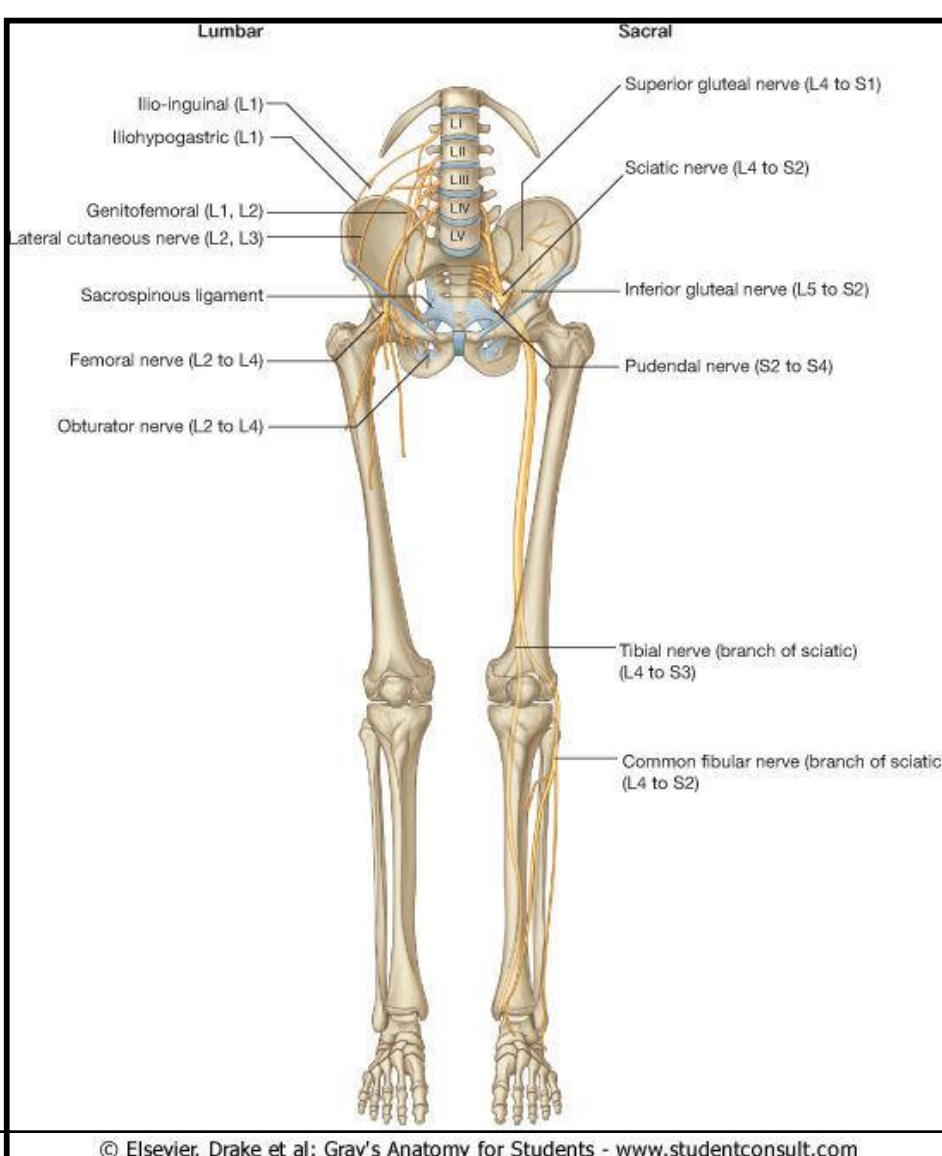
Leg movements by compartment (in leg all nare branches of sciatic)



Intrinsics of foot

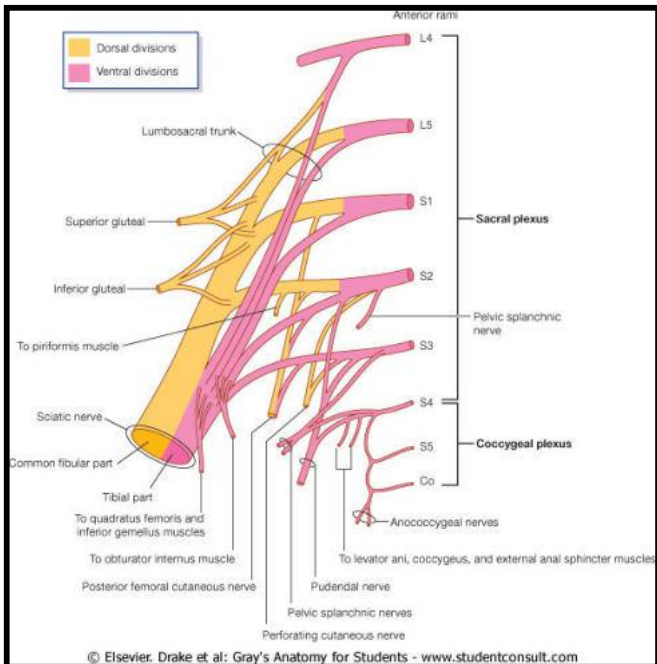
Innervation

Plexuses of the Lower Limb



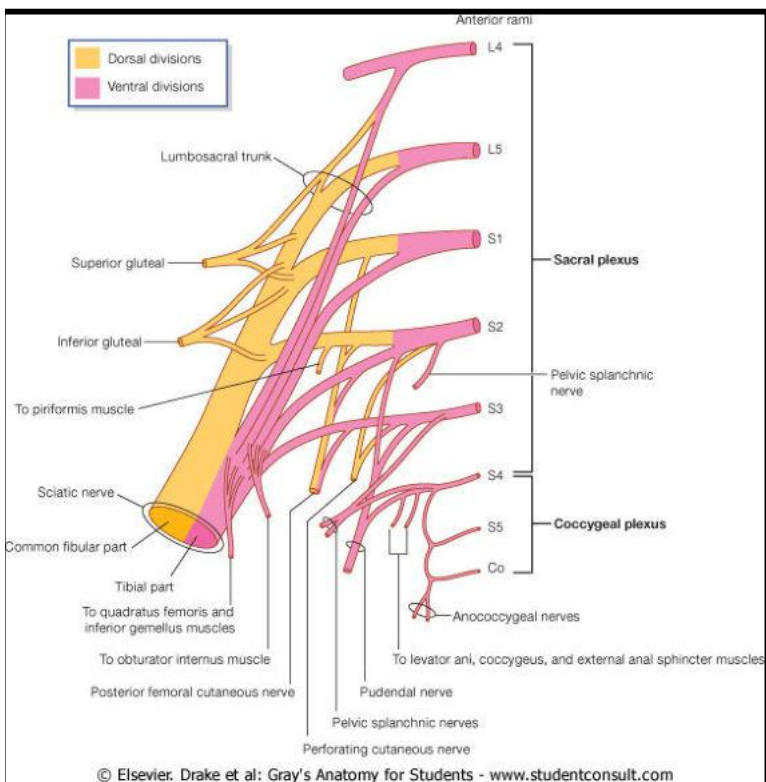
- “Lumbosacral plexus”
- Lumbar Plexus
 - Arises from L1-L4
 - Lies within the psoas major muscle
 - Mostly anterior structures
- Sacral Plexus
 - Arises from spinal nerve L4-S4
 - Lies caudal to the lumbar plexus
 - Mostly posterior structures

Lumbar Plexus



- Femoral nerve
 - Cutaneous branches
 - Thigh, leg, foot (e.g. saphenous nerve)
 - Motor branches
 - Anterior thigh muscles (e.g. quadriceps, sartorius, iliopsoas)
- Obturator nerve
 - Sensory
 - Skin medial thigh; hip, knee joints
 - Motor
 - Adductor muscles
- Lateral femoral cutaneous
 - Sensory
 - Skin lateral thigh
- Genitofemoral
 - Sensory
 - Skin scrotum, labia major, anterior thigh
 - Motor
 - Cremaster muscle

Sacral Plexus

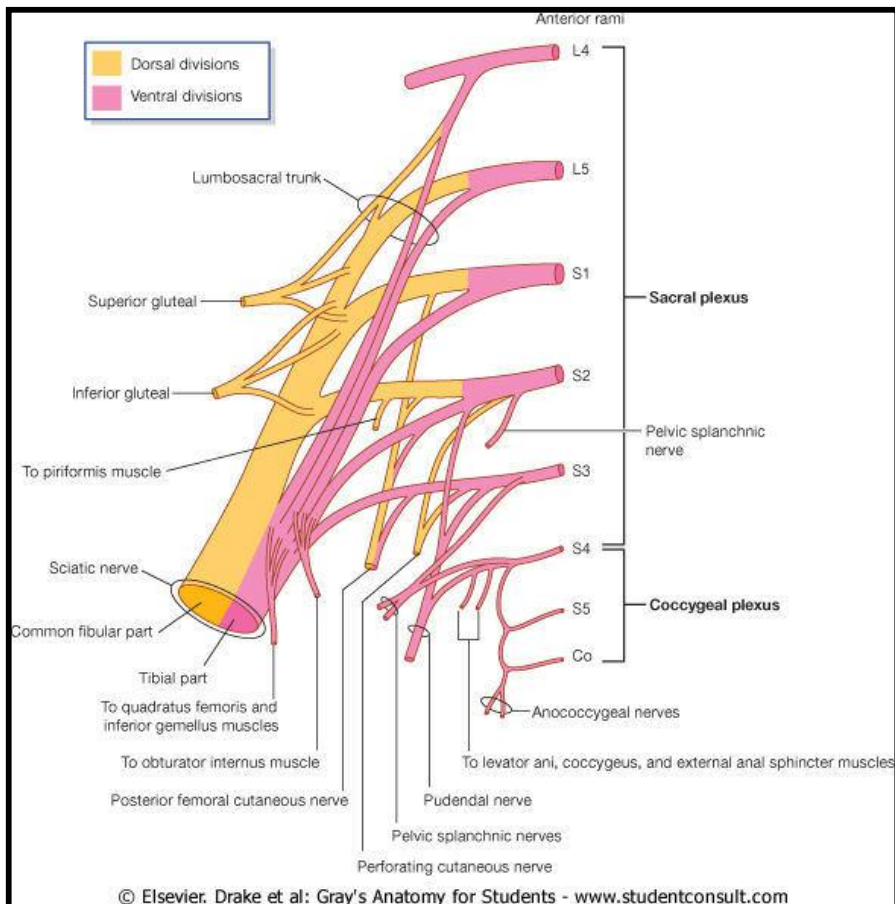


- Sciatic
 - Motor:
 - Hamstring
 - Branches into:
 - Tibial nerve
 - Cutaneous
 - » Posterior leg and sole of foot
 - Motor
 - » Posterior leg, foot
 - Common fibular (peroneal) nerve
 - Cutaneous
 - » Anterior and lateral leg, dorsum foot
 - Motor
 - » Lateral compartment, tibialis anterior, toe extensors

Superior gluteal nerve

- Motor
 - Gluteus medius and minimus, tensor fasciae latae

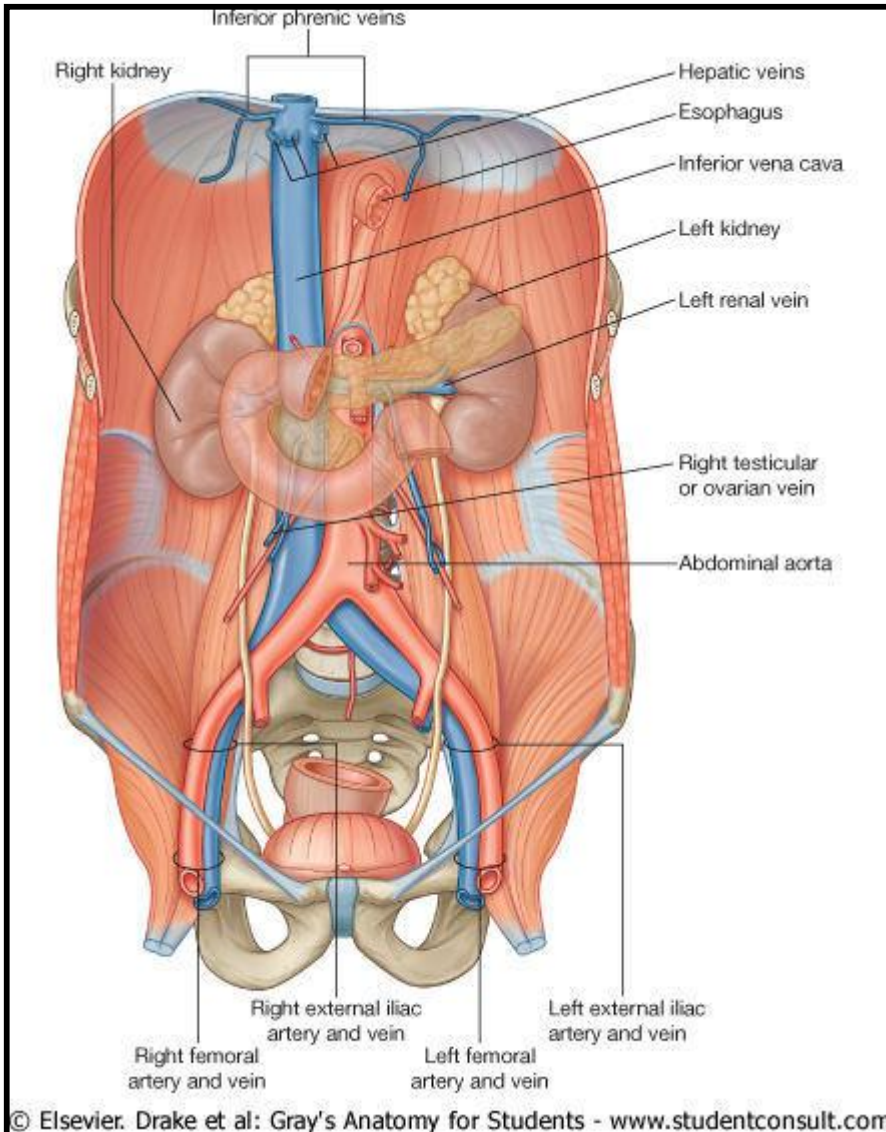
Sacral Plexus (continued)



- Inferior gluteal nerve
 - Motor
 - Gluteus maximus
- Posterior femoral cutaneous nerve
 - Sensory
 - Inferior buttocks, posterior thigh, popliteal fossa
- Pudendal nerve
 - Sensory
 - External genitalia, anus
 - Motor
 - Muscles of perineum

Vasculature

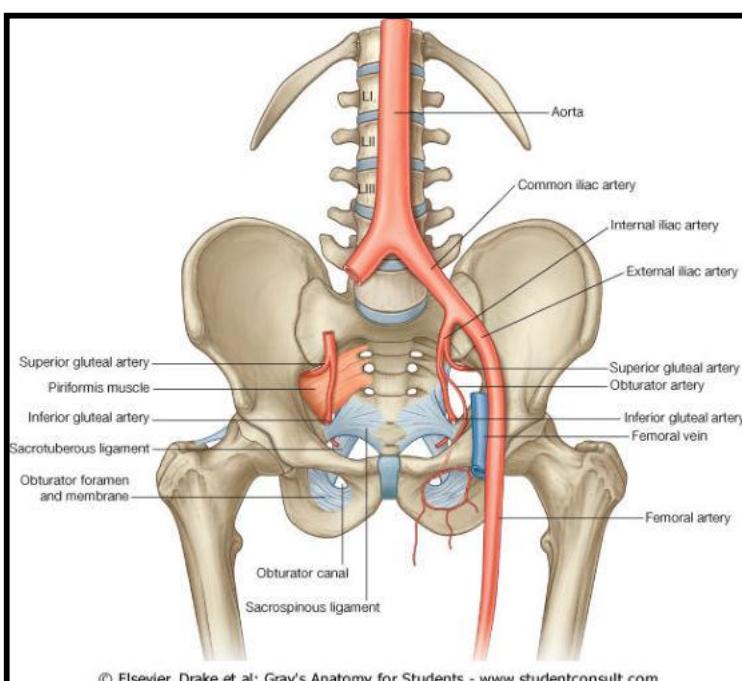
Arteries



- Common iliac (from aorta) branches into:
 - Internal iliac
 - Supplies pelvic organs
 - External iliac
 - Supplies lower limb

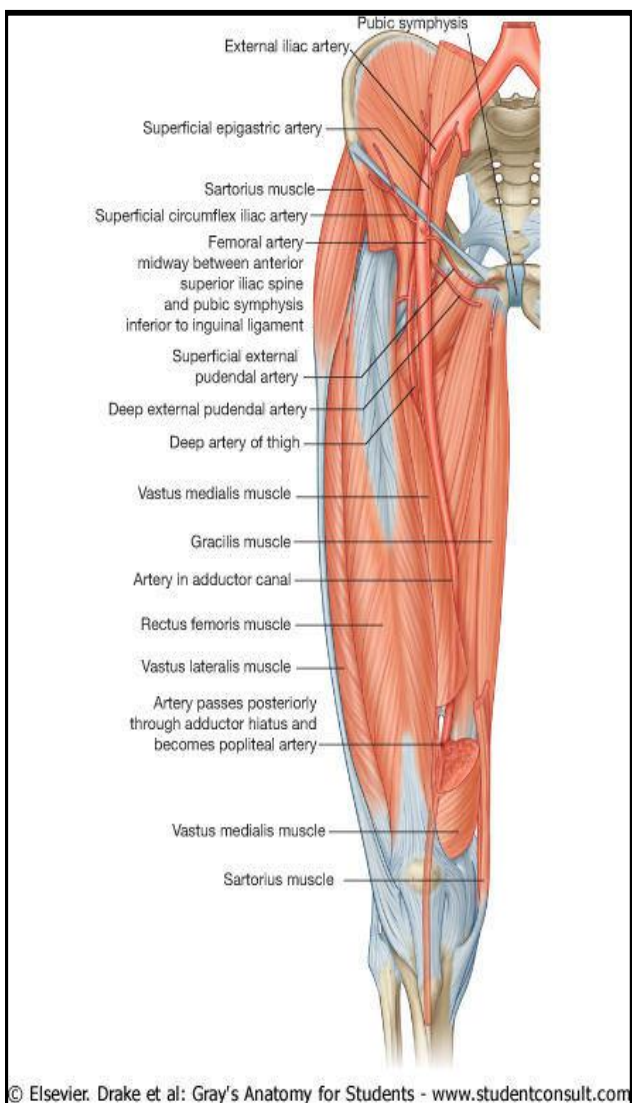
Arteries

- Internal iliac branches into:



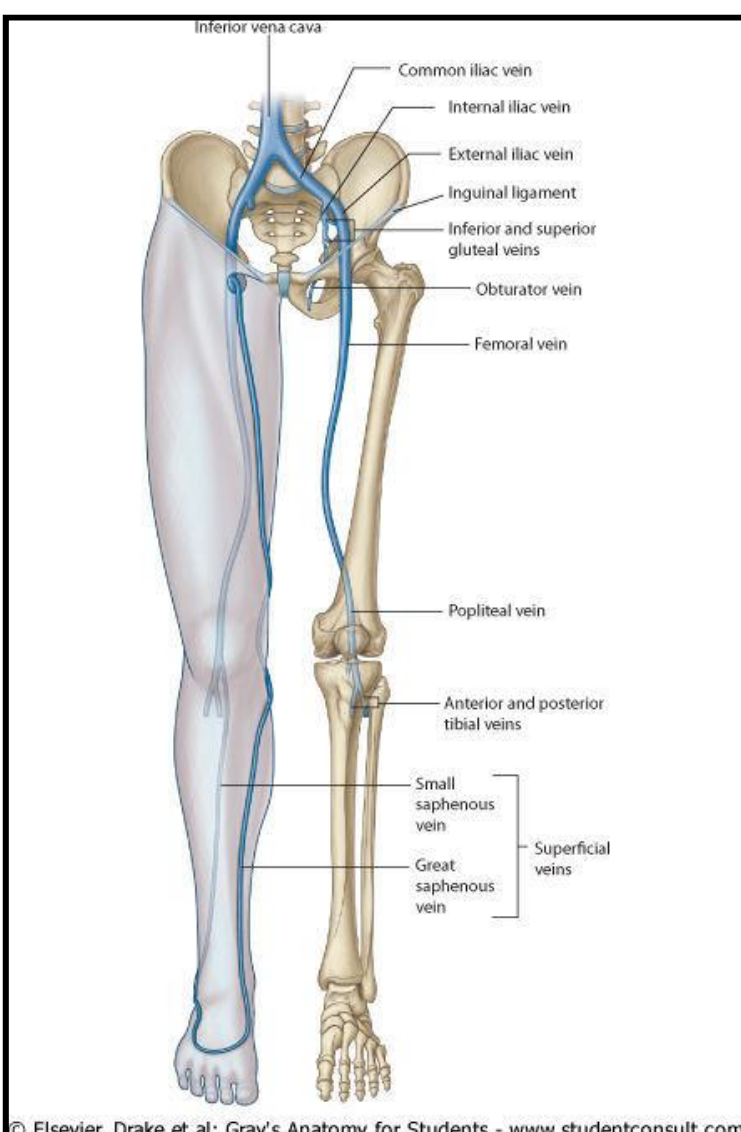
- **Cranial and Caudal Gluteals** (Superior and Inferior)
 - Gluteals
- **Internal Pudendal**
 - Perineum, external genitalia
- **Obturator**
 - Adductor muscles
- Other branches supply rectum, bladder, uterus, vagina, male reproductive glands

Arteries



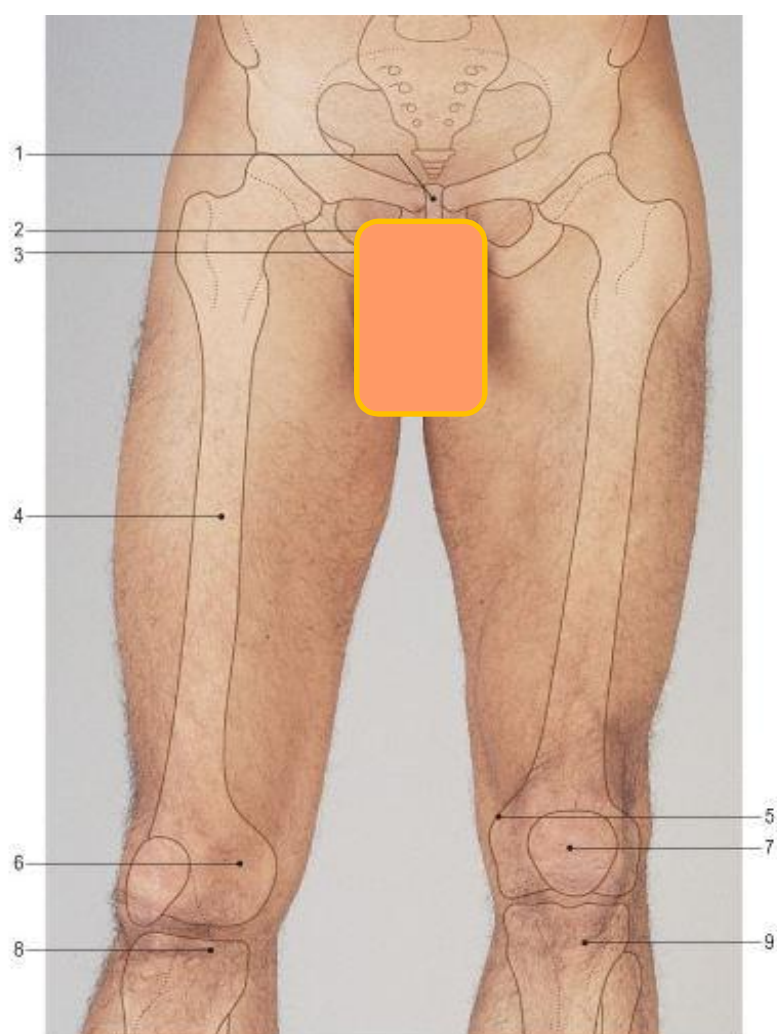
- External iliac becomes.....
 - **Femoral**
 - Once passes the inguinal ligament
 - Lower limb
 - Branches into **Deep femoral**
 - Adductors, hamstrings, quadriceps
 - Branches into **Medial/lateral femoral circumflex**
 - » Head and neck of femur
- Femoral becomes.....
 - **Popliteal** (continuation of femoral)
 - Branches into:
 - **Geniculars**
 - » Knee
 - Splits into:
 - **Anterior Tibial**
 - » Anterior leg muscles, further branches to feet
 - **Posterior Tibial**
 - » Flexor muscles, plantar arch, branches to toes

Veins



- Deep Veins: Mostly share names of arteries
 - Ultimately empty into Inferior Vena Cava
 - Plantar
 - Tibial
 - Fibular
 - Popliteal
 - Femoral
 - External/internal iliac
 - Common iliac
- Superficial Veins
 - Dorsal venous arch (foot)
 - Great saphenous (empties into femoral)
 - Small saphenous (empties into popliteal)

SURFACE ANATOMY



1. Symphysis pubis. 2. Body of pubis. 3. Inferior pubic ramus. 4. Femur. 5. Adductor tubercle.
6. Medial femoral condyle. 7. Patella. 8. Medial tibial plateau. 9. Tibial tuberosity.

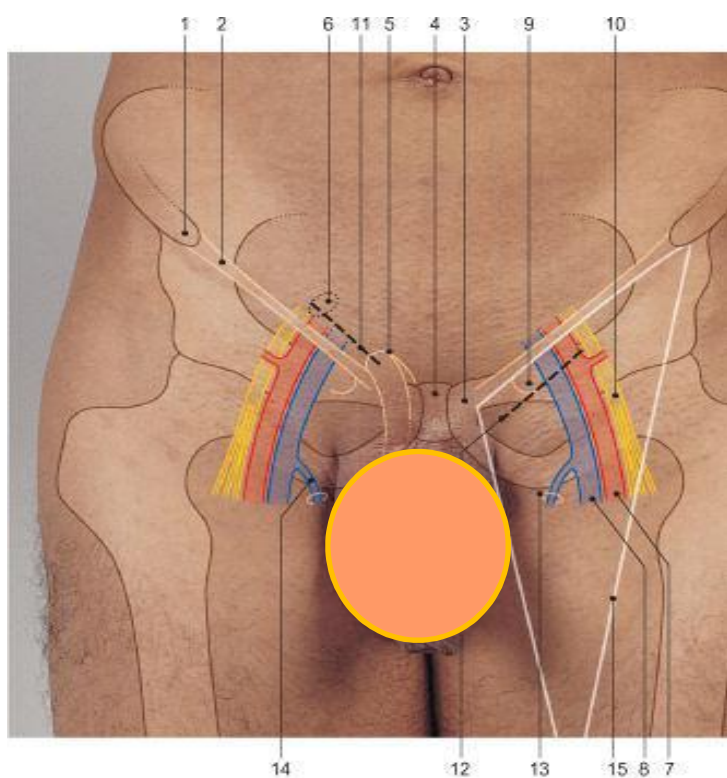
All of the following structures are palpable in the inguinal region:

Symphysis pubis.

Body of pubis.

Pubic tubercle.

Anterior Superior Iliac Spine.



1. Anterior superior iliac spine. 2. Inguinal ligament. 3. Pubic tubercle.
4. Symphysis pubis. 5. Superficial inguinal ring. 6. Deep inguinal ring.
7. Femoral artery. 8. Femoral vein. 9. Femoral canal. 10. Femoral nerve.
11. Inguinal hernia incision. 12. Femoral hernia incision. 13. Saphenous opening.
14. Long saphenous vein. 15. Femoral triangle.

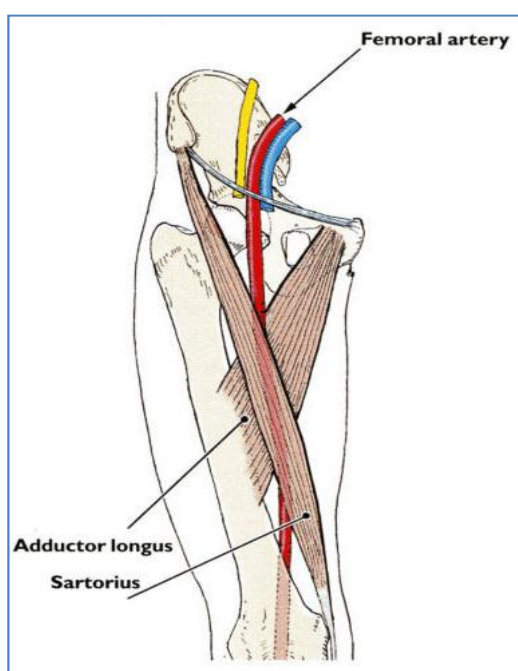
The inguinal ligament extends between:

pubic tubercle and ASIS.

In the **mid-inguinal point** you can feel the pulsations of the **femoral artery**.

The **femoral vein** lies on the medial side of the artery. While the **femoral nerve** lies lateral to the artery.

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- **Midinguinal point:**
- It is a point on the inguinal ligament midway between the symphysis pubis and the ASIS.
- The **femoral artery** is an important site for vascular access as a large number of arteriographic procedures are undertaken through its percutaneous puncture, (coronary angiography).

55

Anterior Compartment of Thigh

Superficial structures

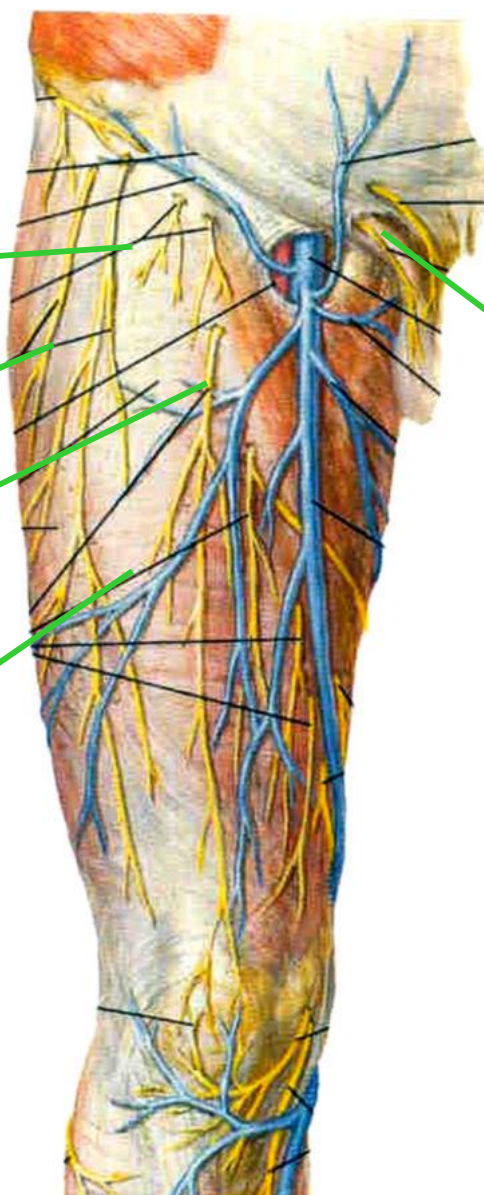
Cutaneous nerves:

Femoral branch of genitofemoral n.

Lateral cutaneous n. of thigh

Anterior cutaneous n. of thigh

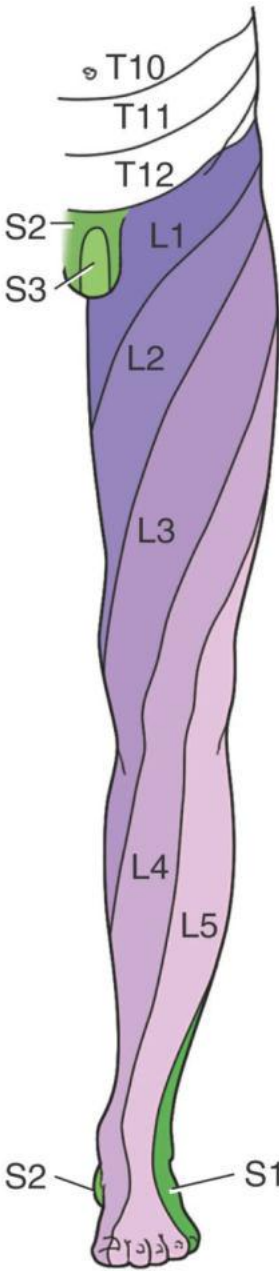
medial cutaneous n. of thigh



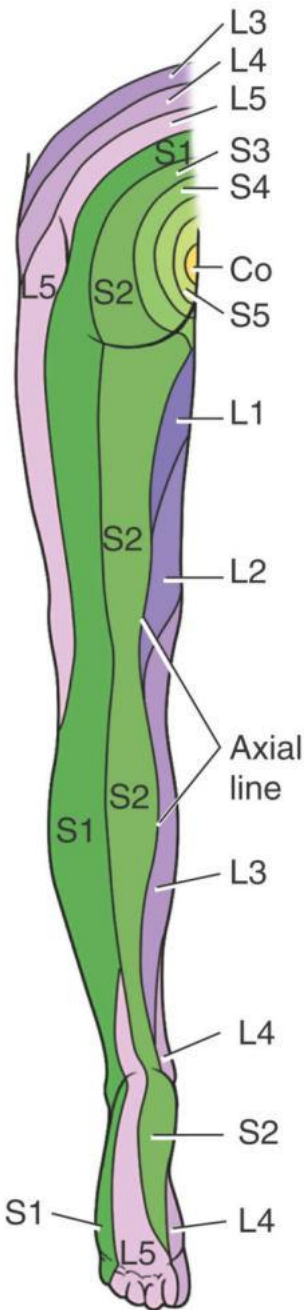
ilioinguinal n.

Key dermatomes* of the Lower Limb

*area of skin supplied by a dorsal nerve root

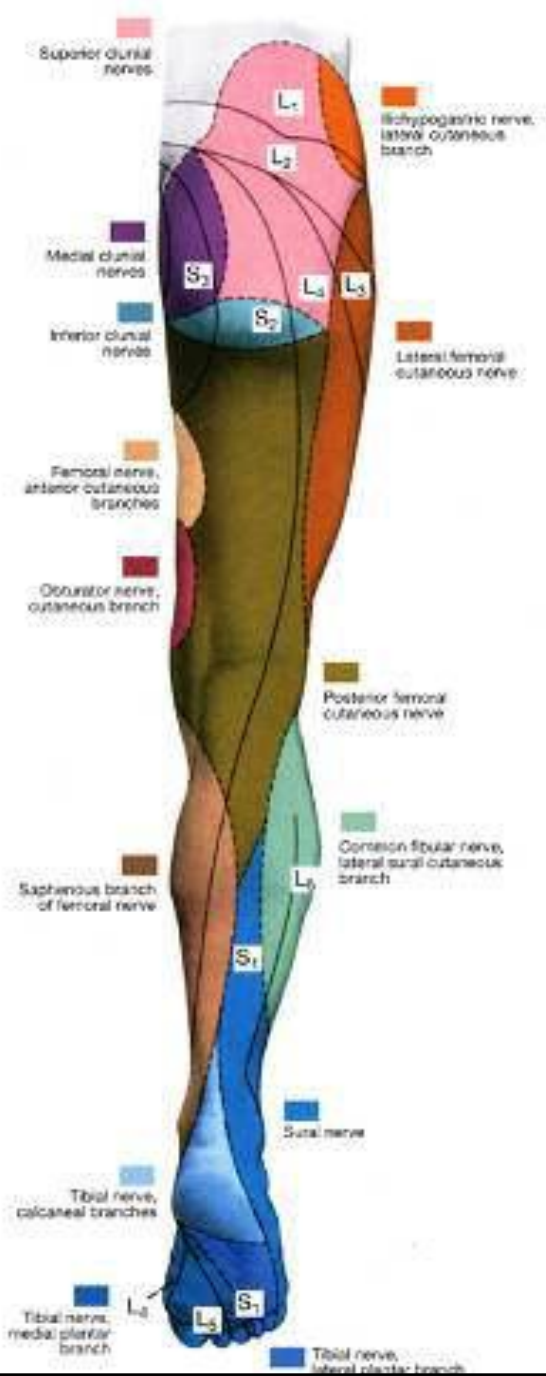
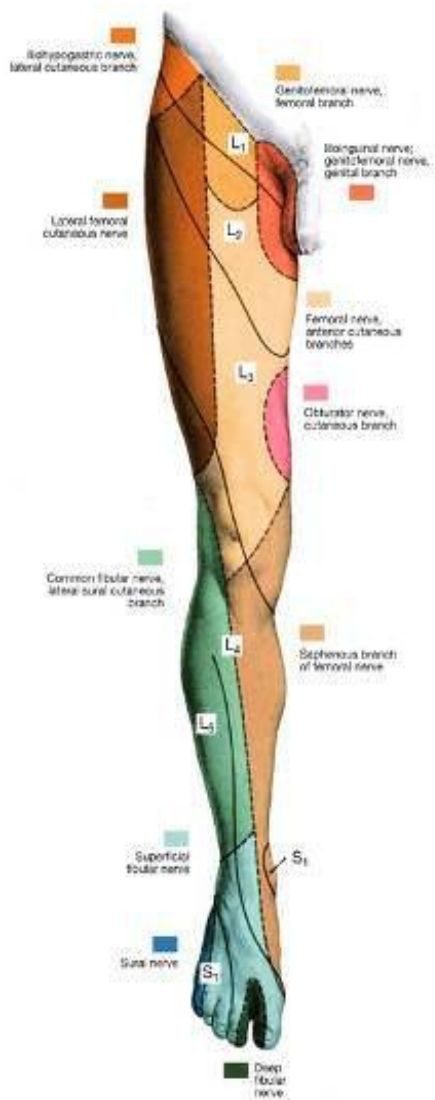


Anterior view



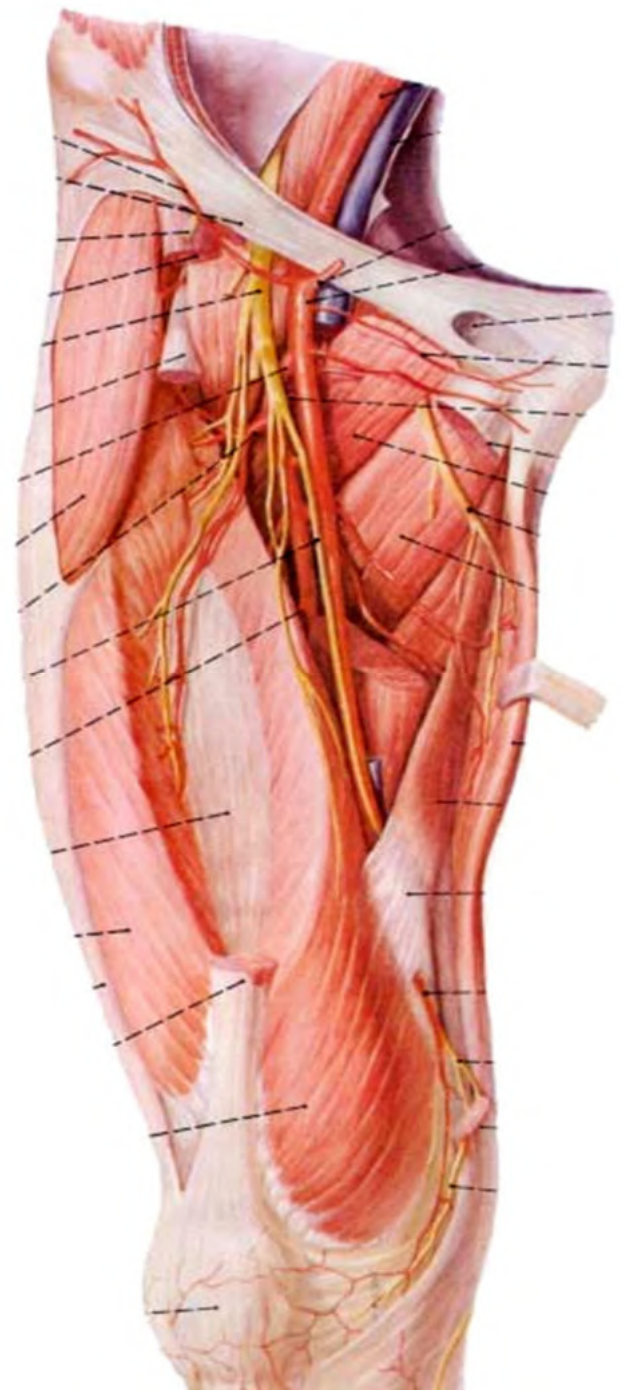
Posterior view

Cutaneous Nerve Innervation of the Lower Limb



Superficial arteries:

superficial epigastric
a.
superficial iliac
circumflex a.
external pudendal a.



Superficial veins

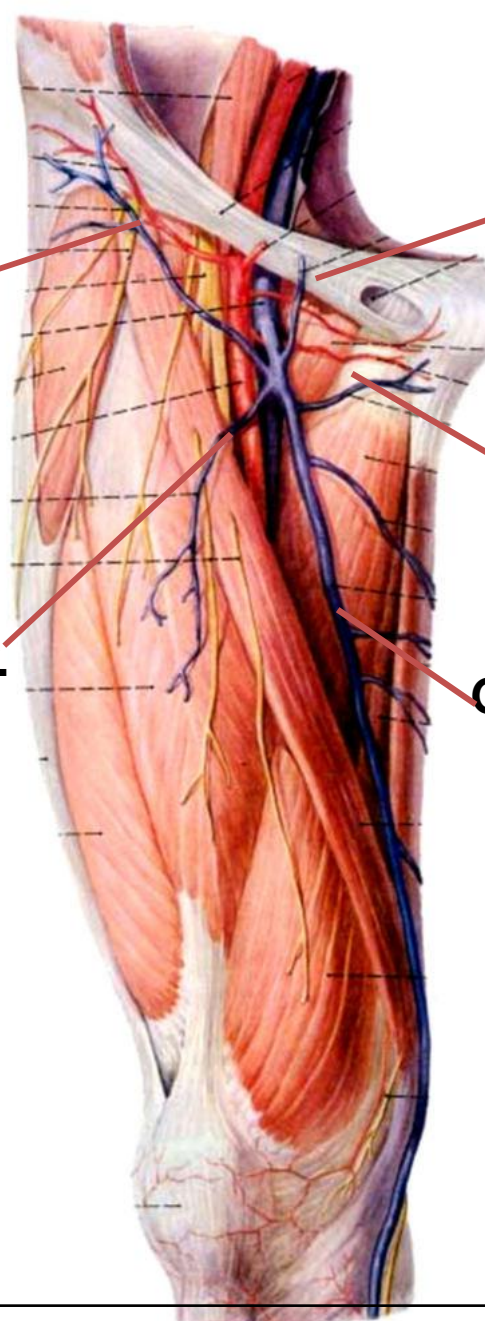
Superficial circumflex iliac v.

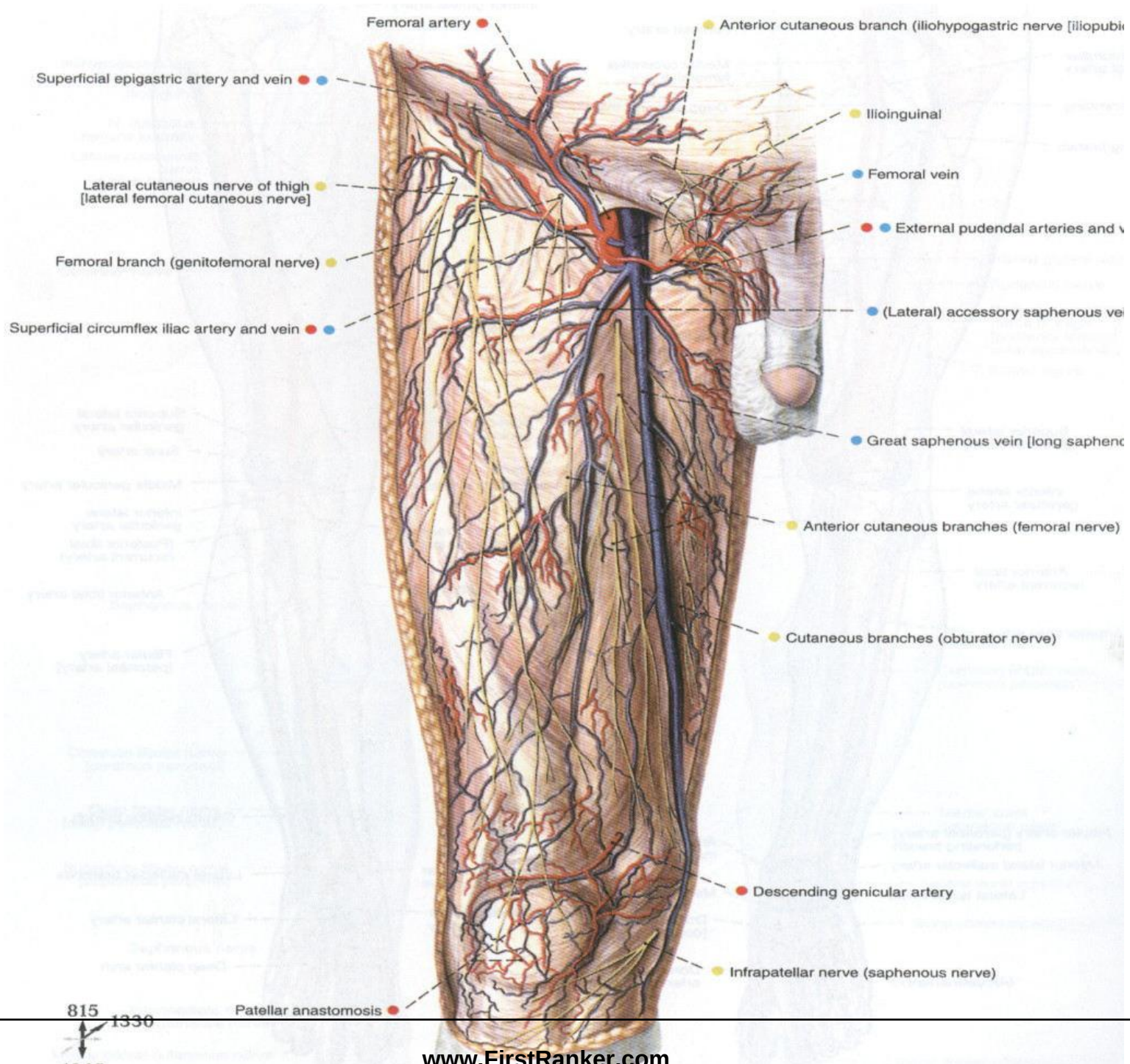
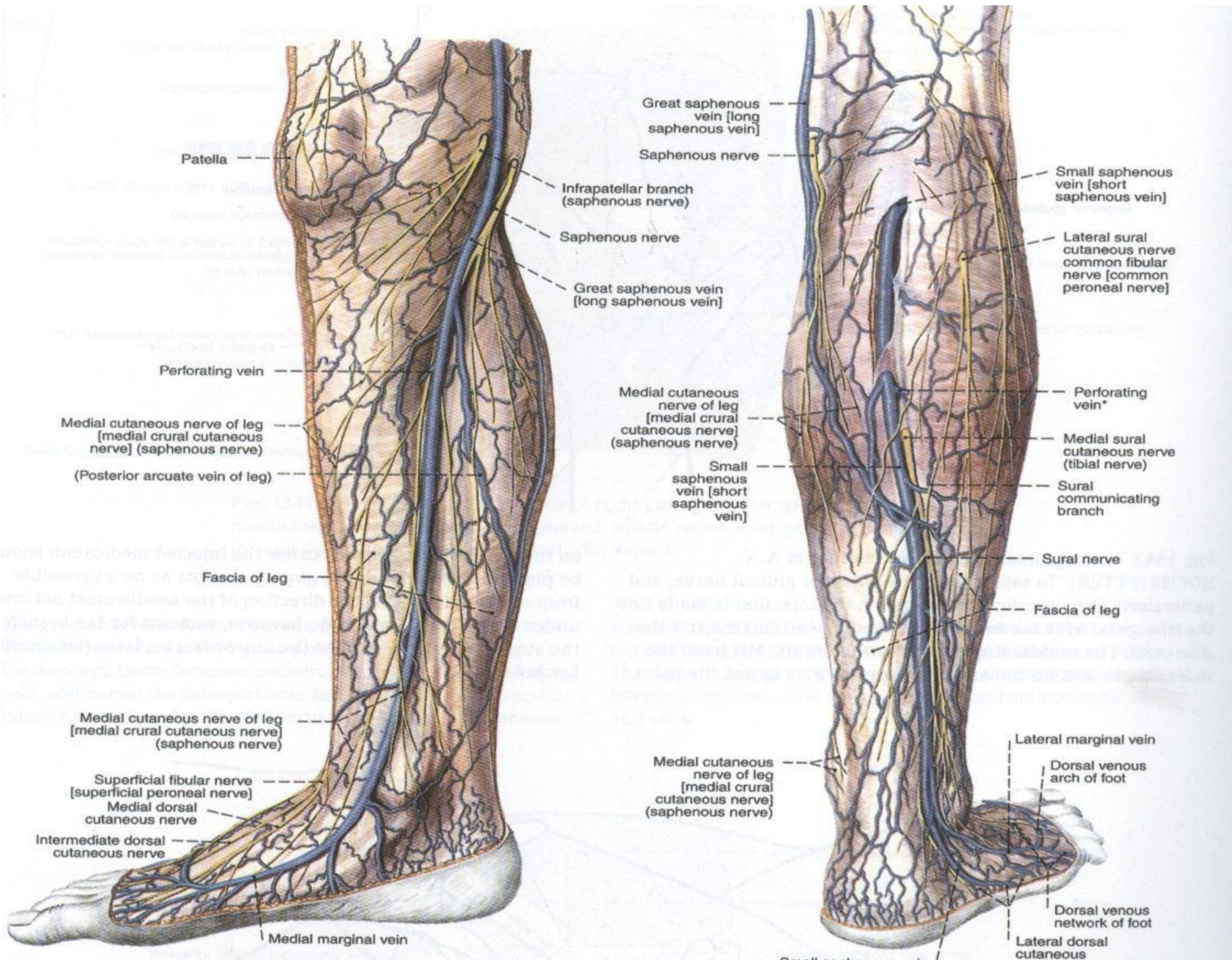
Superficial epigastric v.

Superficial External
pudendal v.

Superficial lateral femoral v.

Great saphenous v.

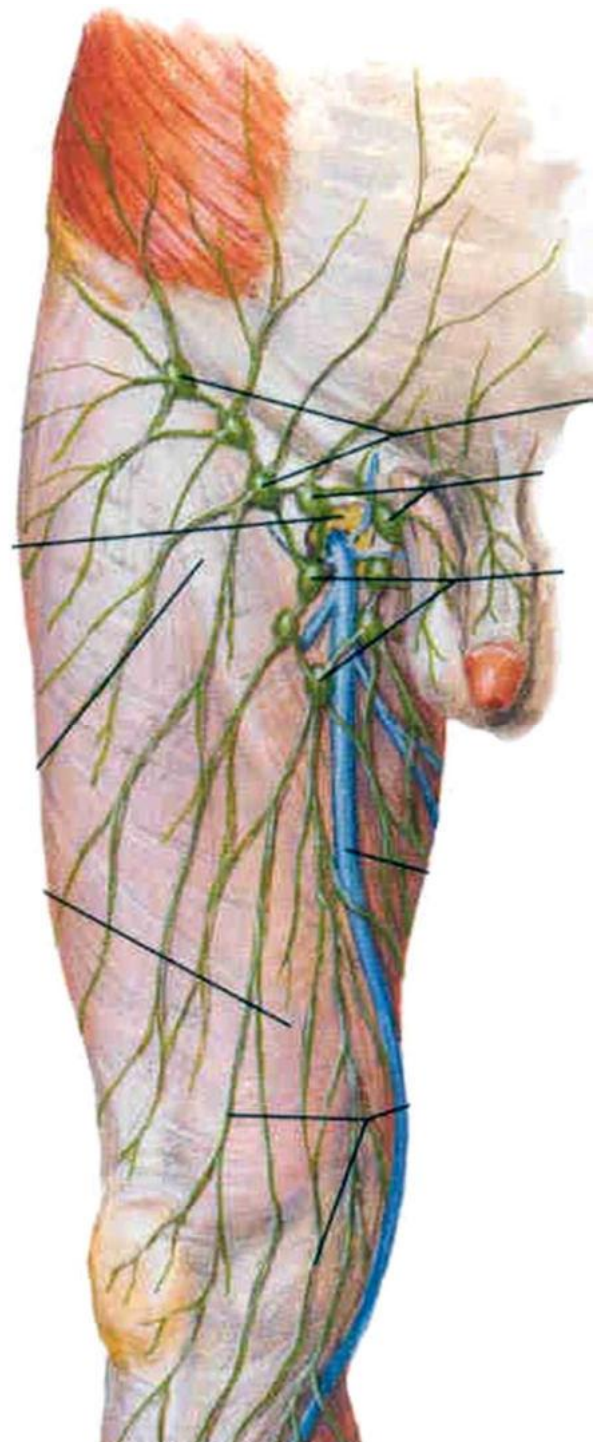




Superficial inguinal lymph nodes:

Horizontal group

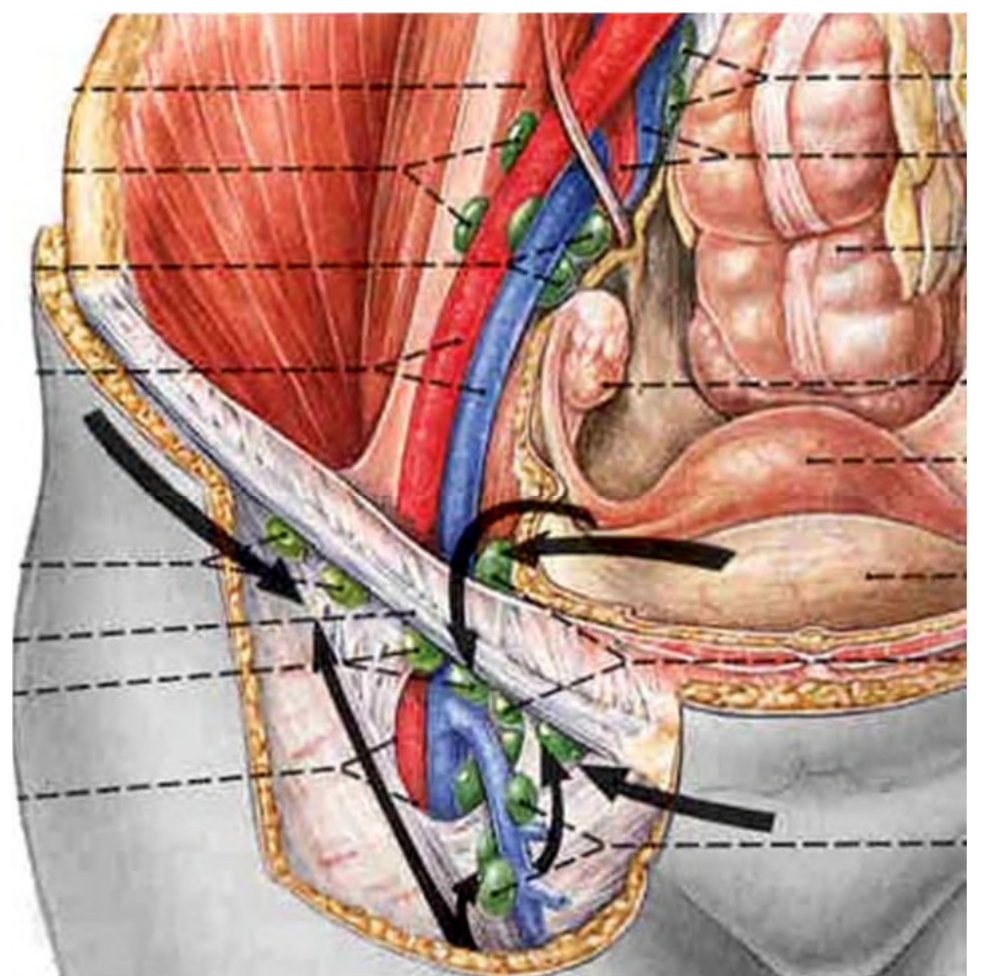
Vertical group



Superficial inguinal lymph nodes

Superior group:

Lies just distal to the inguinal ligament
Receive lymph from anterior abdominal wall below umbilicus, gluteal region, perineal region, external genital organs



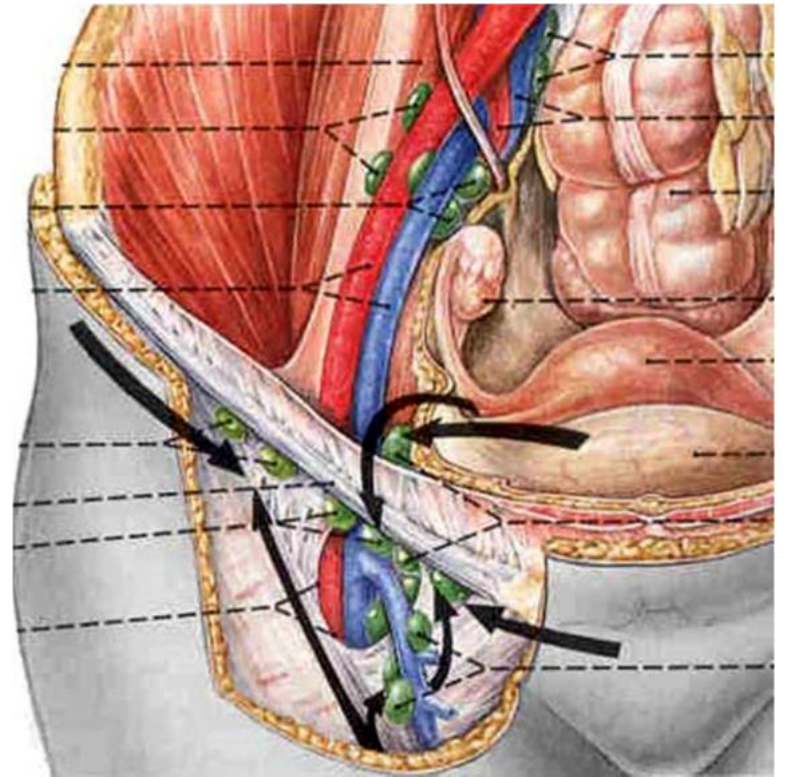
Superficial inguinal lymph nodes

Inferior group:

Lies vertical along the terminal great saphenous v.

Receives all superficial lymphatics of lower limb, except for those from the posterolateral part of calf

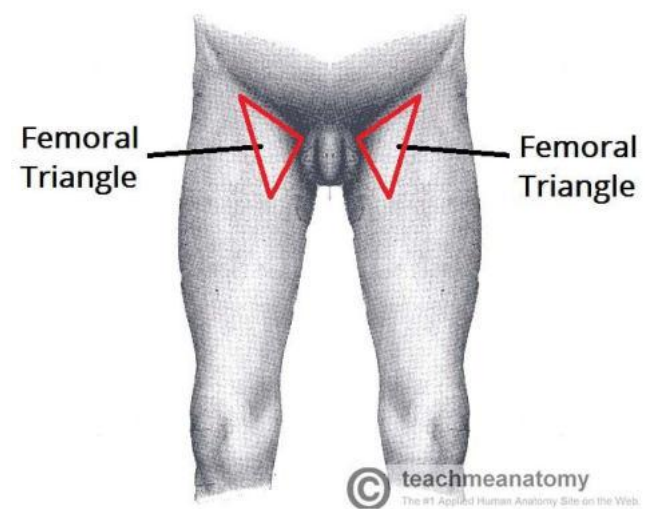
Efferent vessels drain into the deep inguinal ln. or external iliac ln.



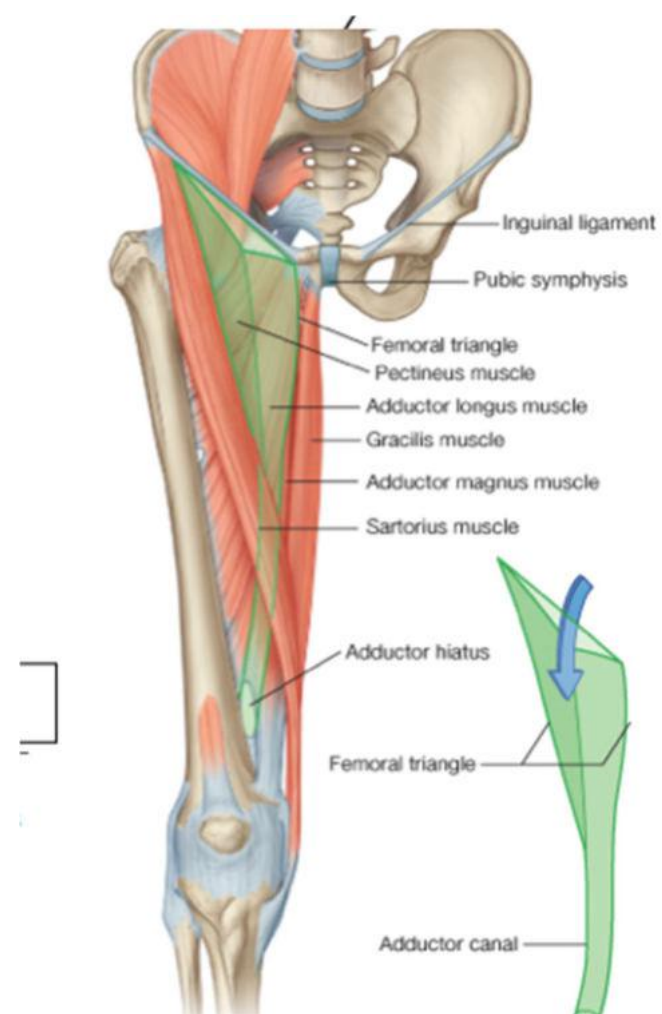
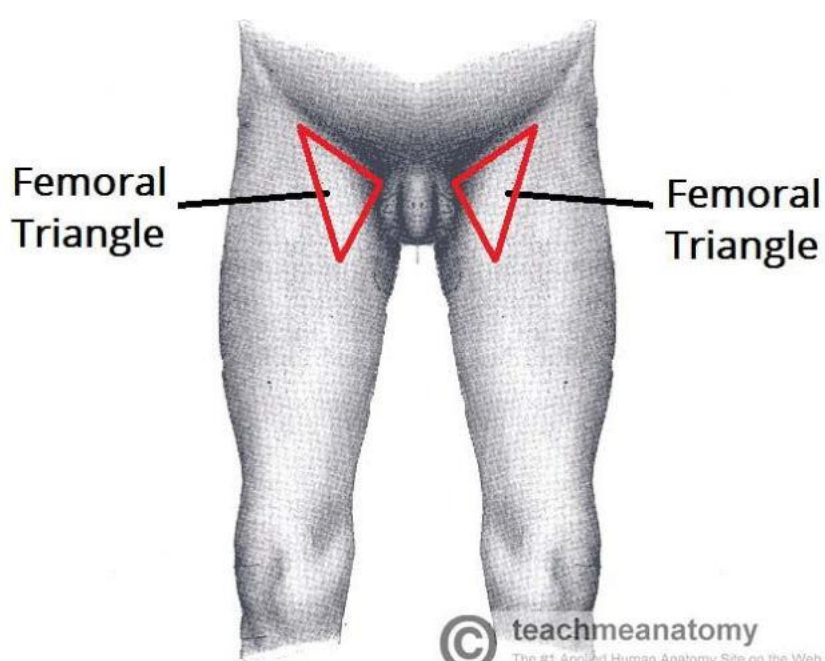
THE FEMORAL TRIANGLE

SIGNIFICANCE

- The femoral triangle is a hollow in the anterior thigh region.
- Many large neurovascular structures pass through this area, and can be accessed relatively easily.
- Thus, it is an area of both anatomical and clinical importance.

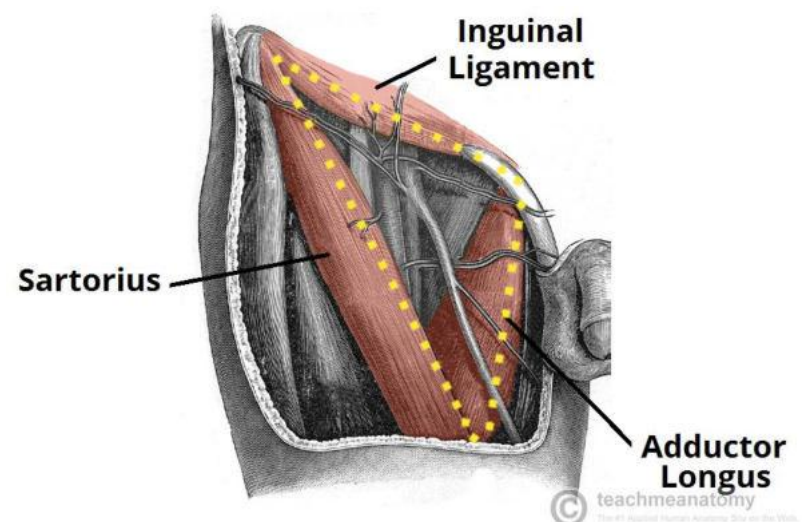


Surface anatomy of the femoral triangle



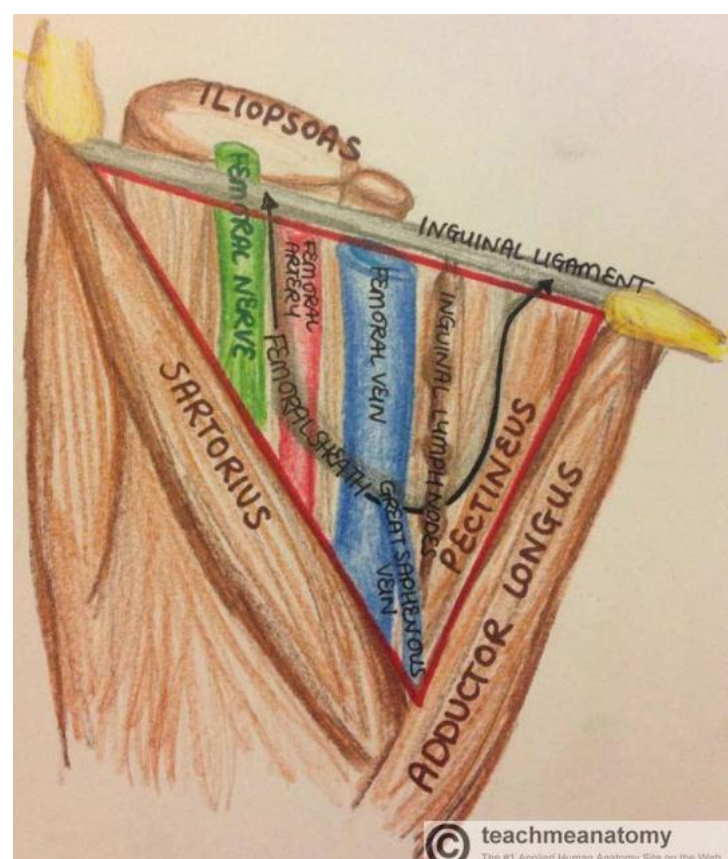
BOUNDARIES

- **Superior border** – Formed by the inguinal ligament.
- **Lateral border** – Formed by the medial border of the sartorius muscle.
- **Medial border** – Formed by the medial border of the adductor longus muscle. The rest of this muscle forms part of the floor of the triangle.



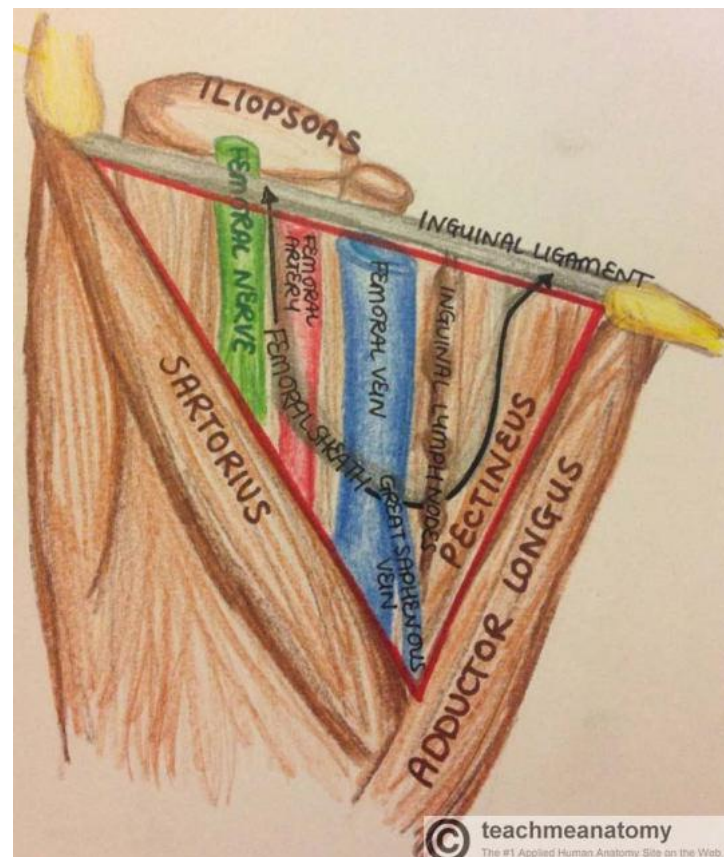
THE FEMORAL TRIANGLE

- It also has a floor and a roof:
- Anteriorly, the **roof** of the femoral triangle is formed by the fascia lata.
- Posteriorly, the **base** of the femoral triangle is formed by the pectineus, iliopsoas and adductor longus muscles.



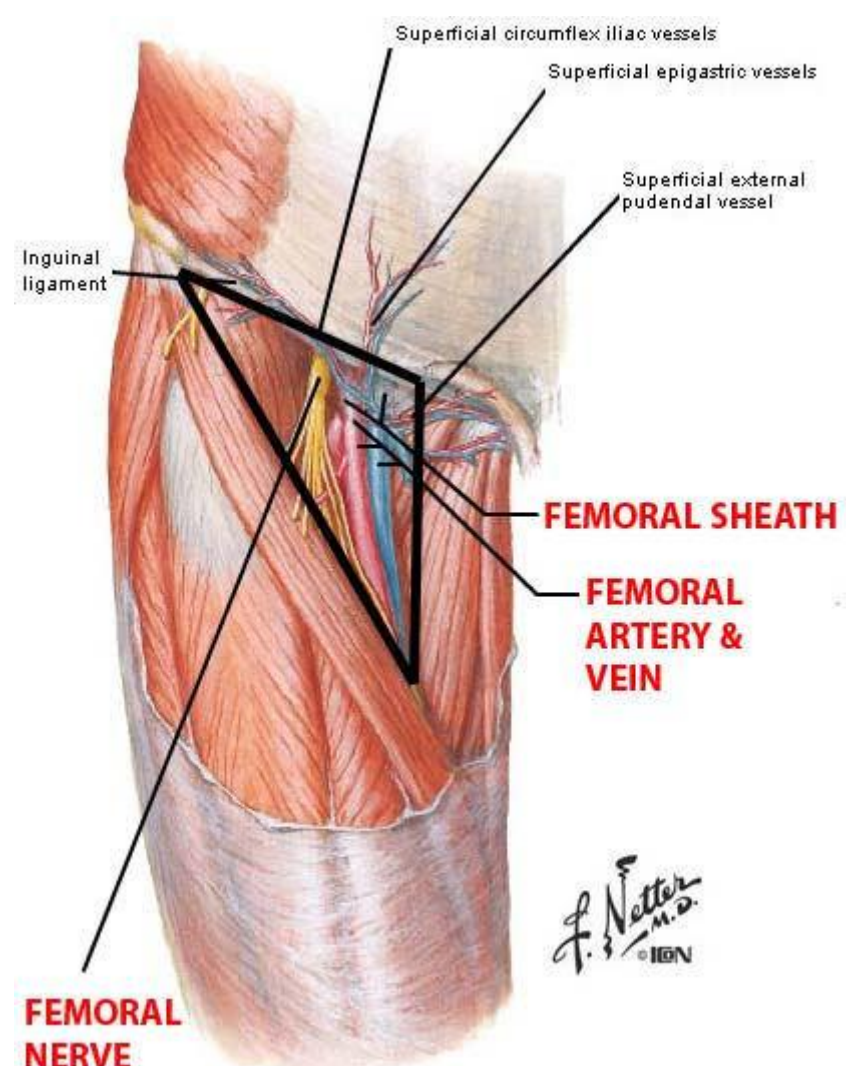
Inguinal Ligament

- The inguinal ligament acts as a **flexor retinaculum**, supporting the contents of the femoral triangle during flexion at the hip



The contents of the femoral triangle

- Contents**
- The femoral triangle contains some of the major neurovascular structures of the lower limb. Its contents (lateral to medial) are:
- Femoral nerve** – Innervates the anterior compartment of the thigh, and provides sensory branches for the leg and foot.



The contents of the femoral triangle

- **Femoral artery** – Responsible for the majority of the arterial supply to the lower limb.
- **Femoral vein** – The great saphenous vein drains into the femoral vein within the triangle.
- **Femoral canal** – A structure which contains deep **lymph nodes** and vessels

