

Systemic Module

PNS

“Anatomy

Lumbosacral Plexus

Dr. Ayman Alzubi

Faculty of Medicine, Yarmouk University

Lumbosacral Plexus

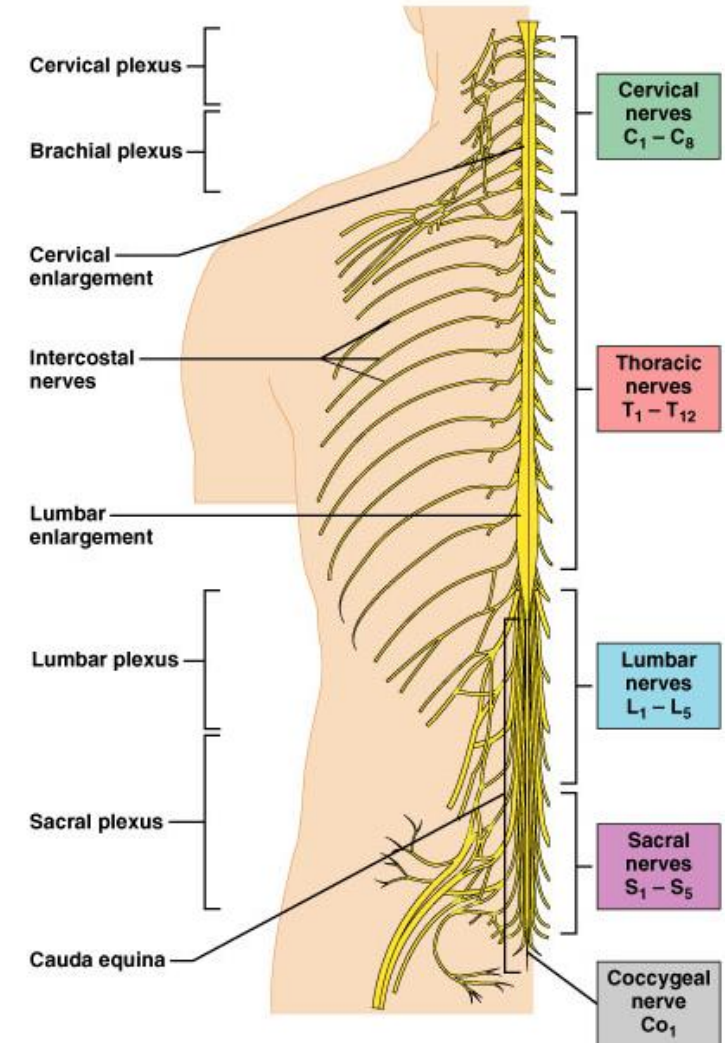
- The Lumbosacral plexus is basically combination of two plexuses:

1. Lumbar Spinal nerves → Lumbar plexus

2. Sacral spinal nerves → Sacral plexus

➤ Together form the Lumbosacral plexus

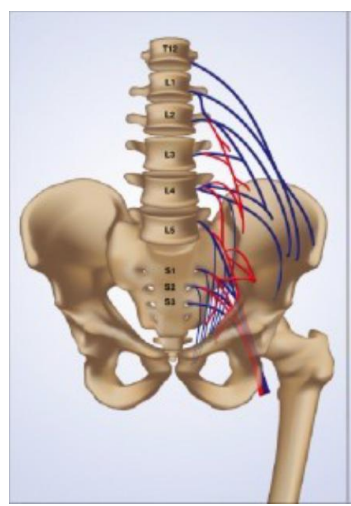
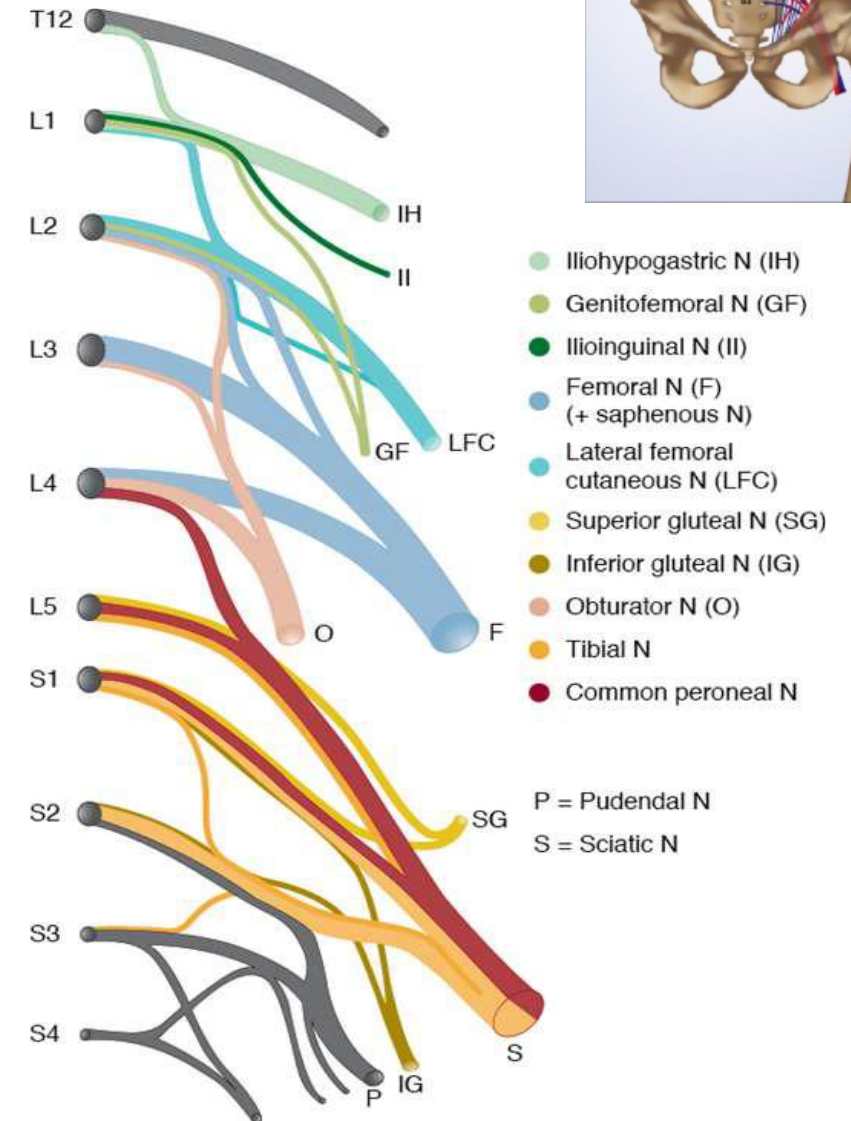
- Lumbar plexus is the upper portion.
- Sacral plexus is the lower portion.



Lumbar Plexus

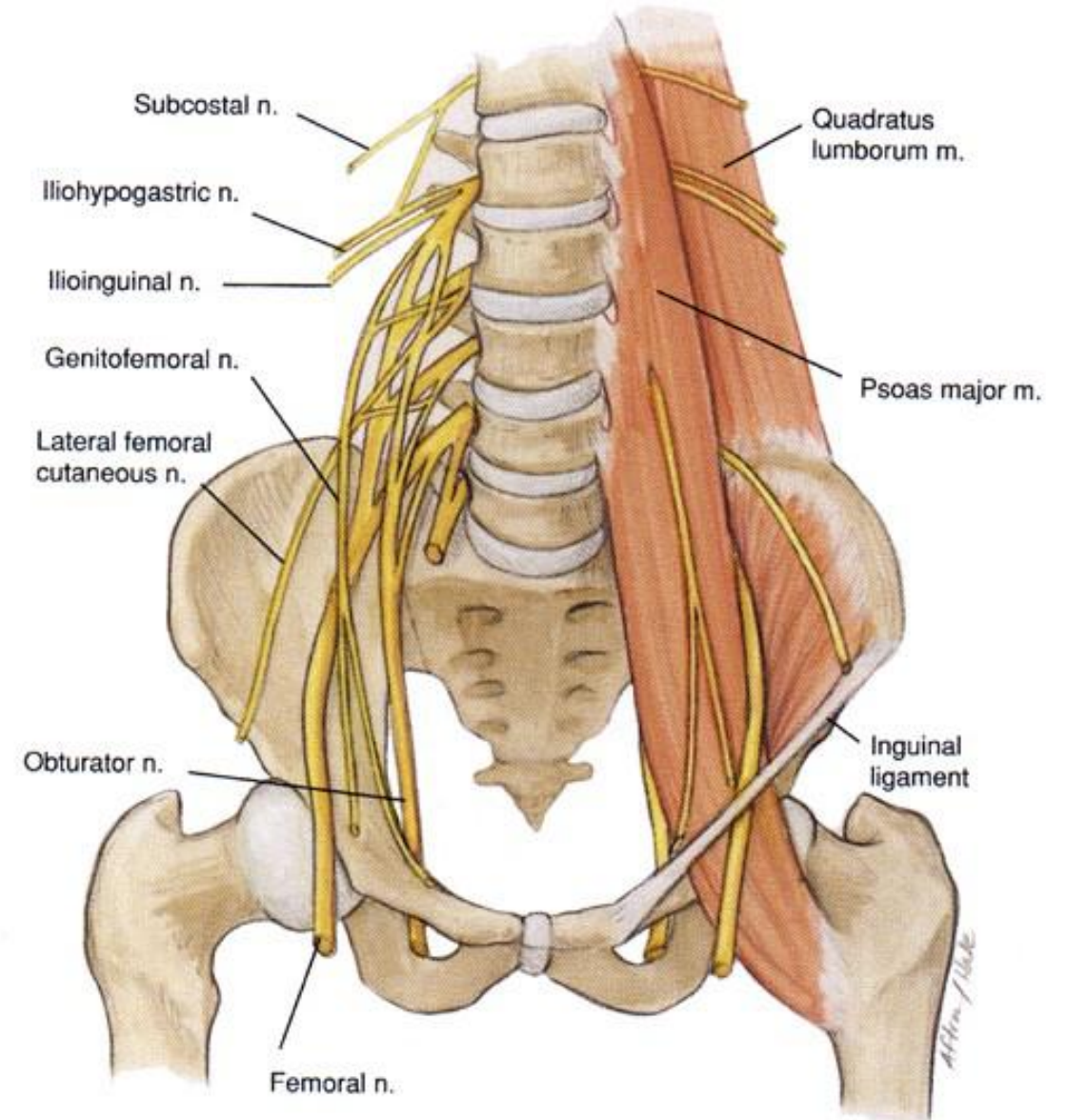
Lumbar Plexus

- Larger part of lumbosacral plexus
- Formed by the ventral rami of first four lumbar nerves (**L1-L4**).
 - 50% of cases it receives a contribution from T12.
- The anterior rami of L4 and L5 give a communicating branch, **the lumbosacral trunk**, to the sacral plexus.



Lumbar Plexus

- It is formed in the psoas major muscle.
- The branches of the plexus emerge from the **lateral** and **medial borders** of the muscle and from its **anterior surface**.
- The plexus is responsible for motor innervation of the lower anterior abdominal wall and certain muscles of the thigh (anterior and medial muscles).
- Also is responsible for sensation in the skin of the thighs, the pubic area, the external genitalia, and medial leg.



Lumbar Plexus

Branches:

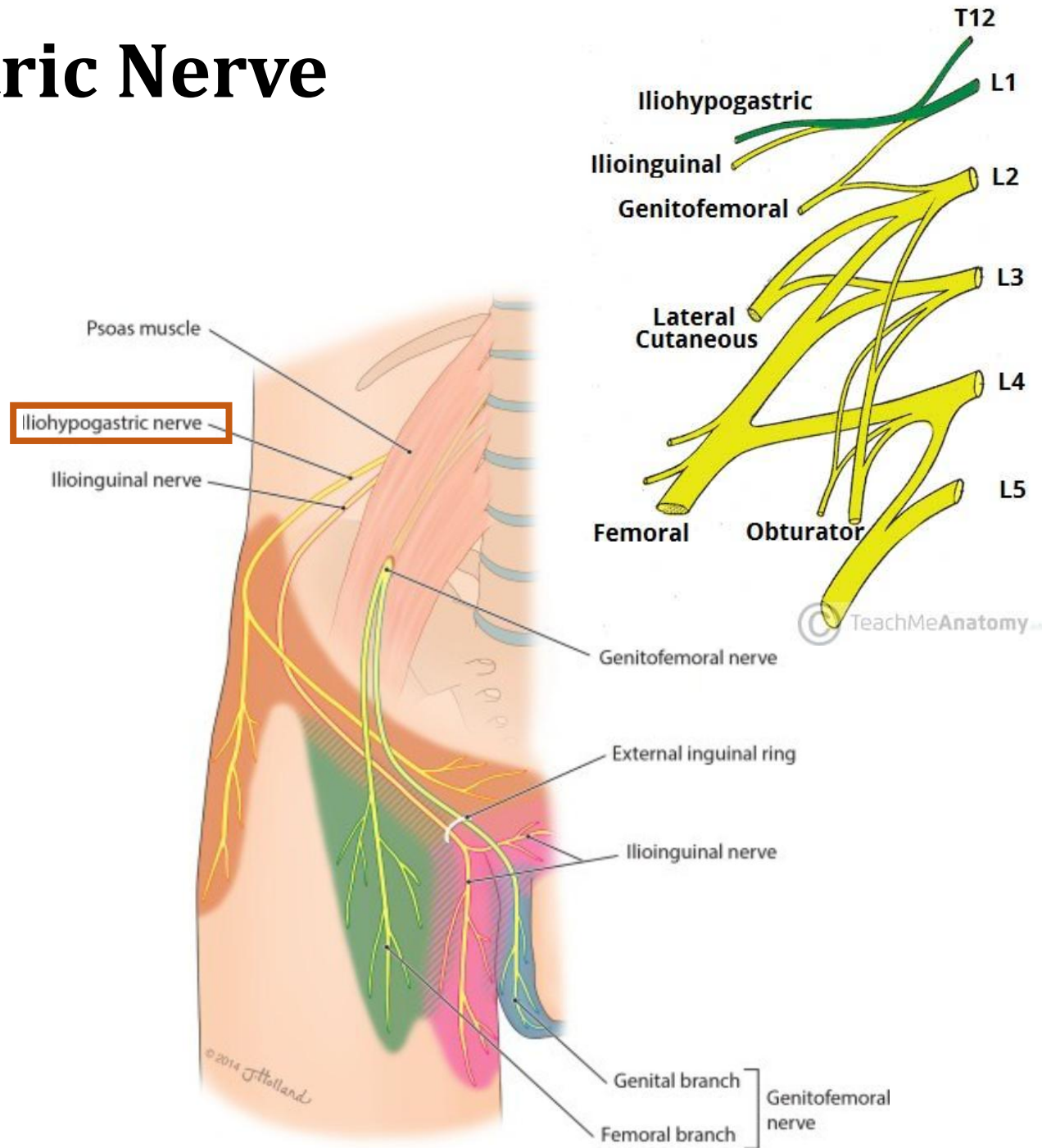
- 1. Femoral nerve**
- 2. Obturator nerve**
- 3. Lateral femoral cutaneous nerve**
- 4. Iliohypogastric nerve**
- 5. Ilioinguinal nerve**
- 6. Genitofemoral nerve**

Lumbar Plexus

- **Nerves leave the lateral border of psoas major muscle:**
 - **Iliohypogastric nerve**
 - **Ilioinguinal nerve.**
 - **Lateral cutaneous nerve of the thigh**
 - **Femoral nerve**
- **Nerve leaves the psoas major muscle from its anterior surface:**
 - **Genitofemoral nerve**
- **Nerve leaves the medial border of psoas major muscle:**
 - **Obturator nerve**

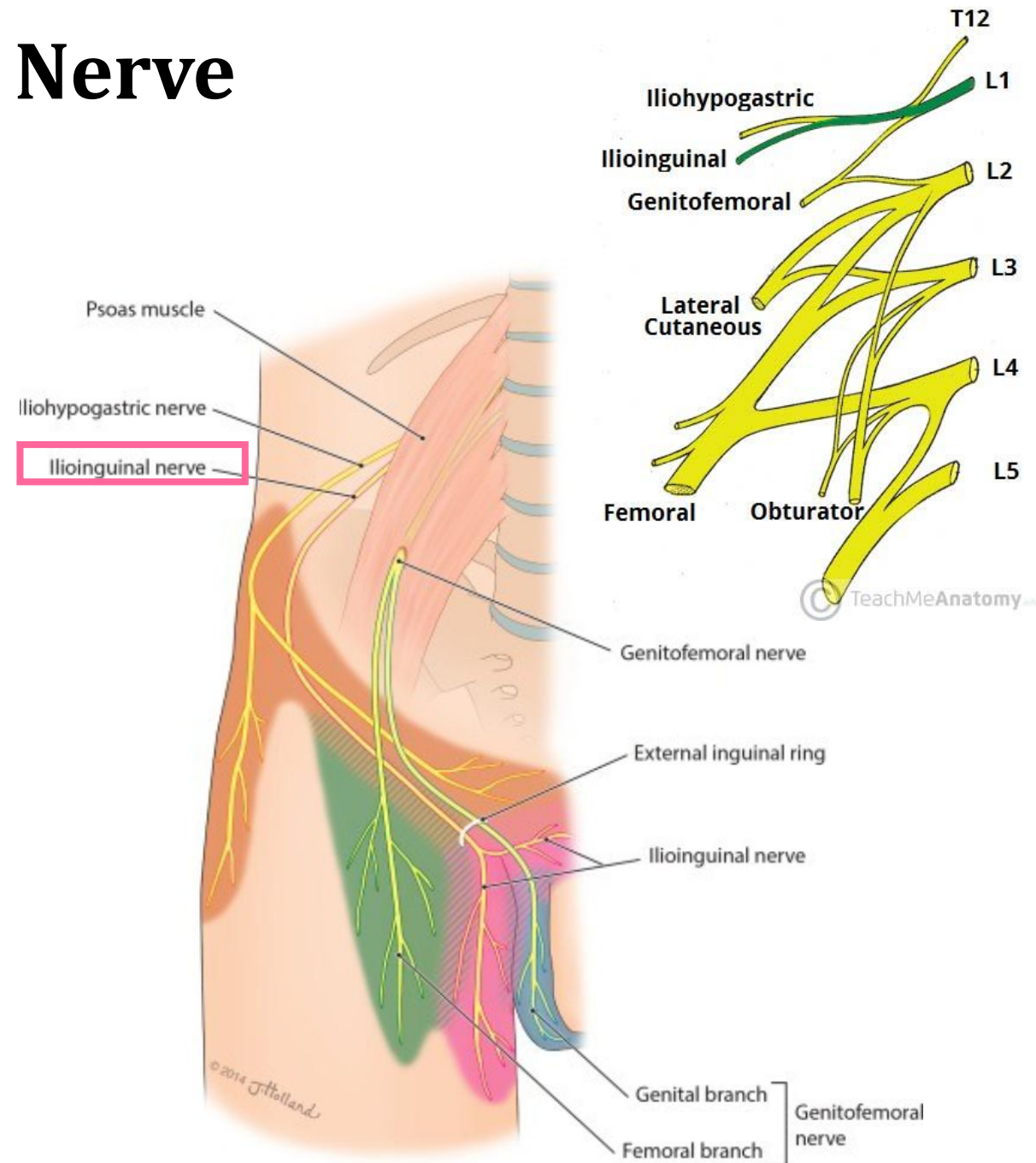
Iliohypogastric Nerve

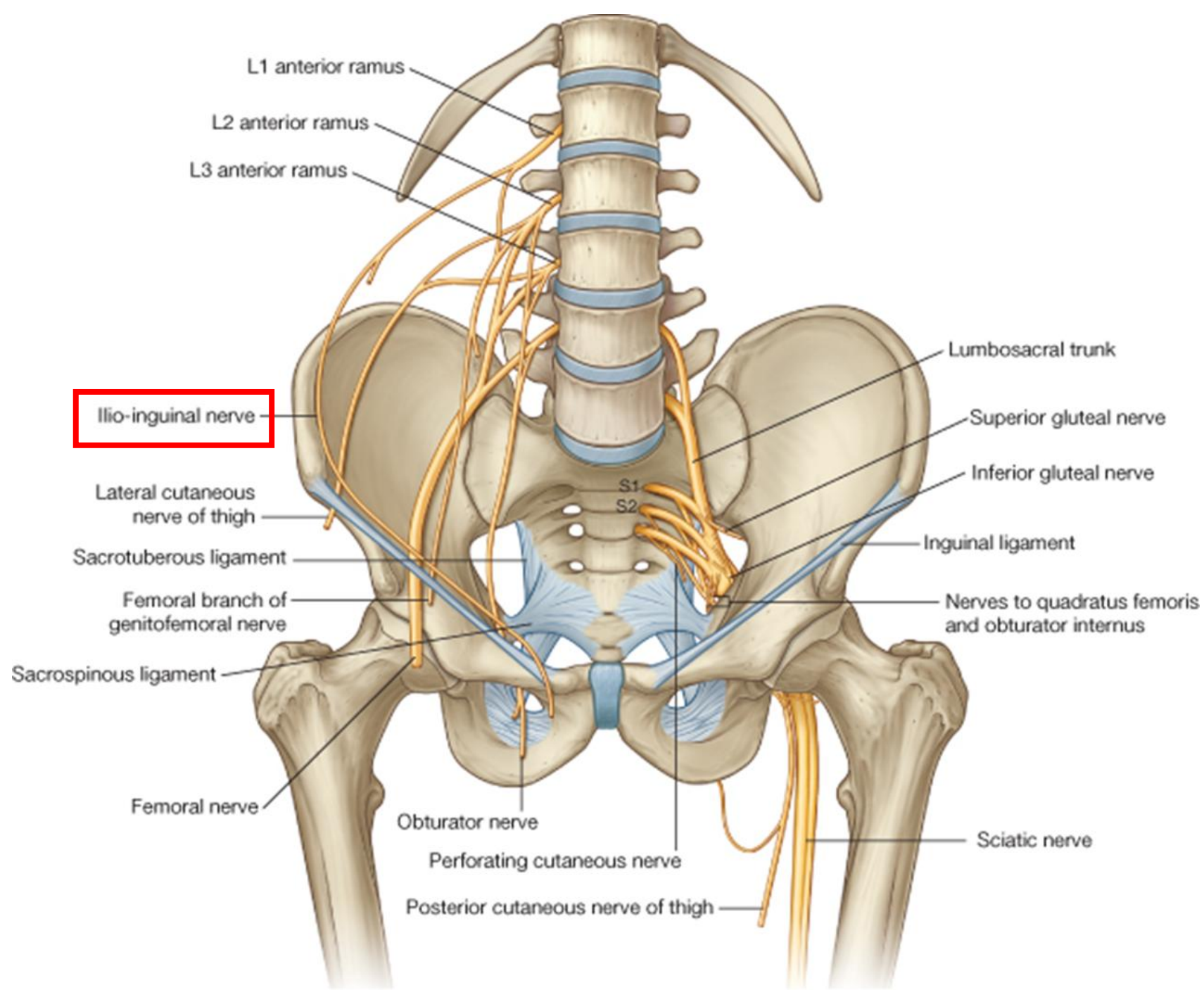
- **Root:** L1+ contributions from T12.
- **Course:** It runs to the iliac crest on the anterior side of quadratus lumborum. It then perforates the transversus abdominis and divides into its terminal branches.
- **Sensory innervation:** skin of the lateral hip, and skin above the inguinal ligament (lower part of the anterior abdominal wall).
- **Motor innervation:** Internal Oblique and Transversus Abdominis.



Ilioinguinal Nerve

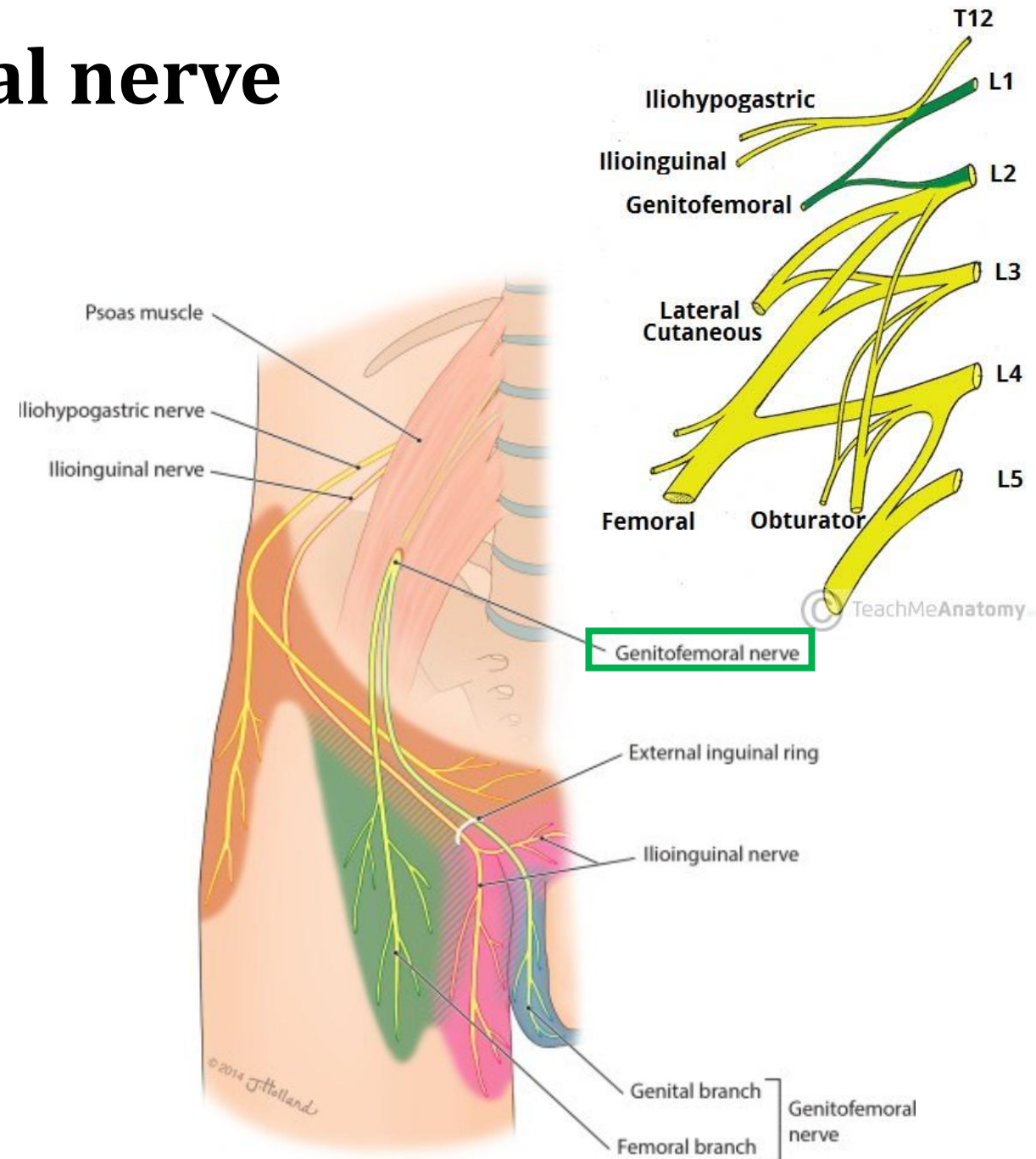
- **Root:** L1.
- **Course:** follows the same anatomical course of iliohypogastric nerve. After innervating the muscles of the anterior abdominal wall, it passes through the superficial inguinal ring.
- **Sensory innervation:** skin of the upper medial thigh and skin over the pubic symphysis and the lateral aspect of the scrotum or labia majora .
- **Motor innervation:** Internal Oblique and Transversus Abdominis.





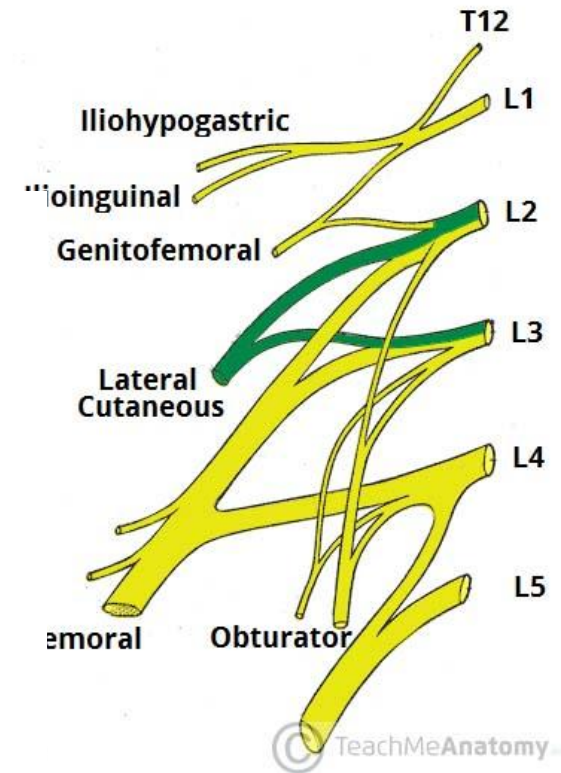
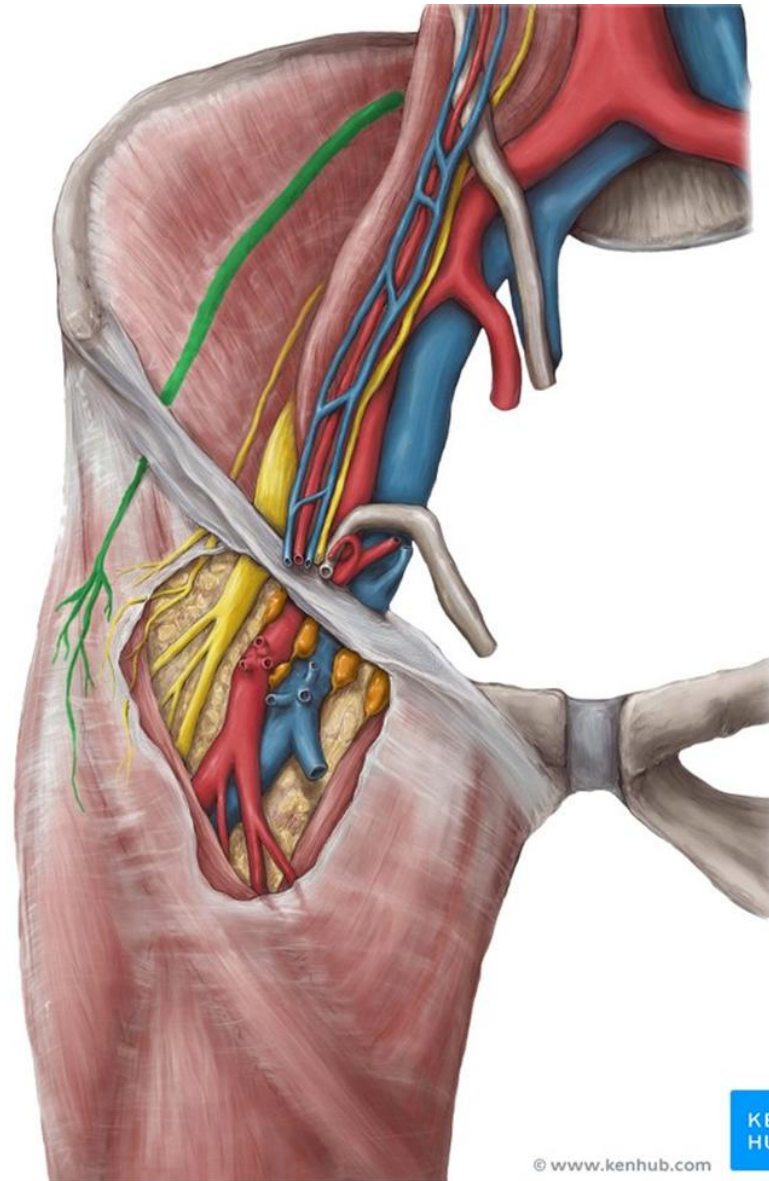
Genitofemoral nerve

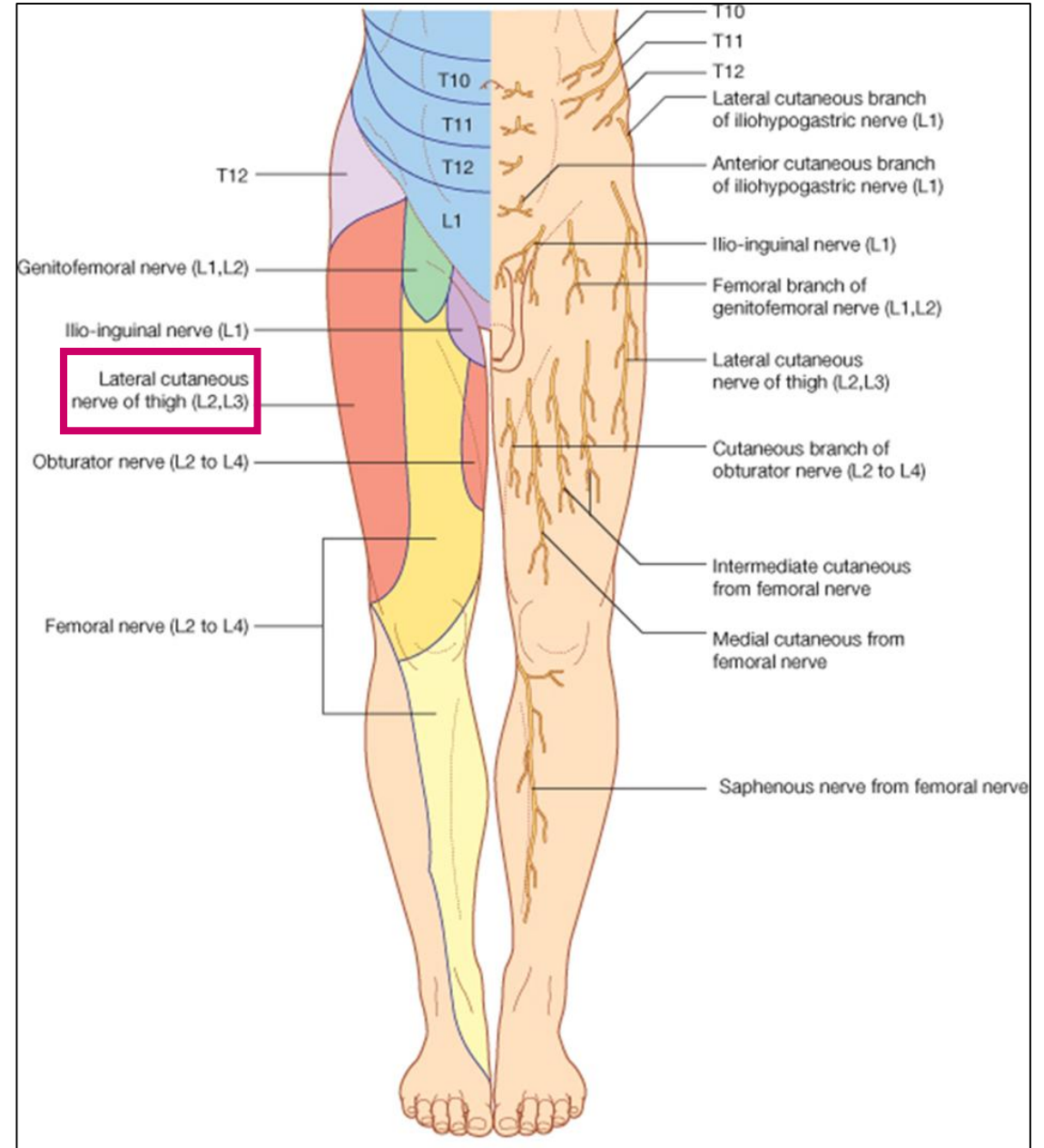
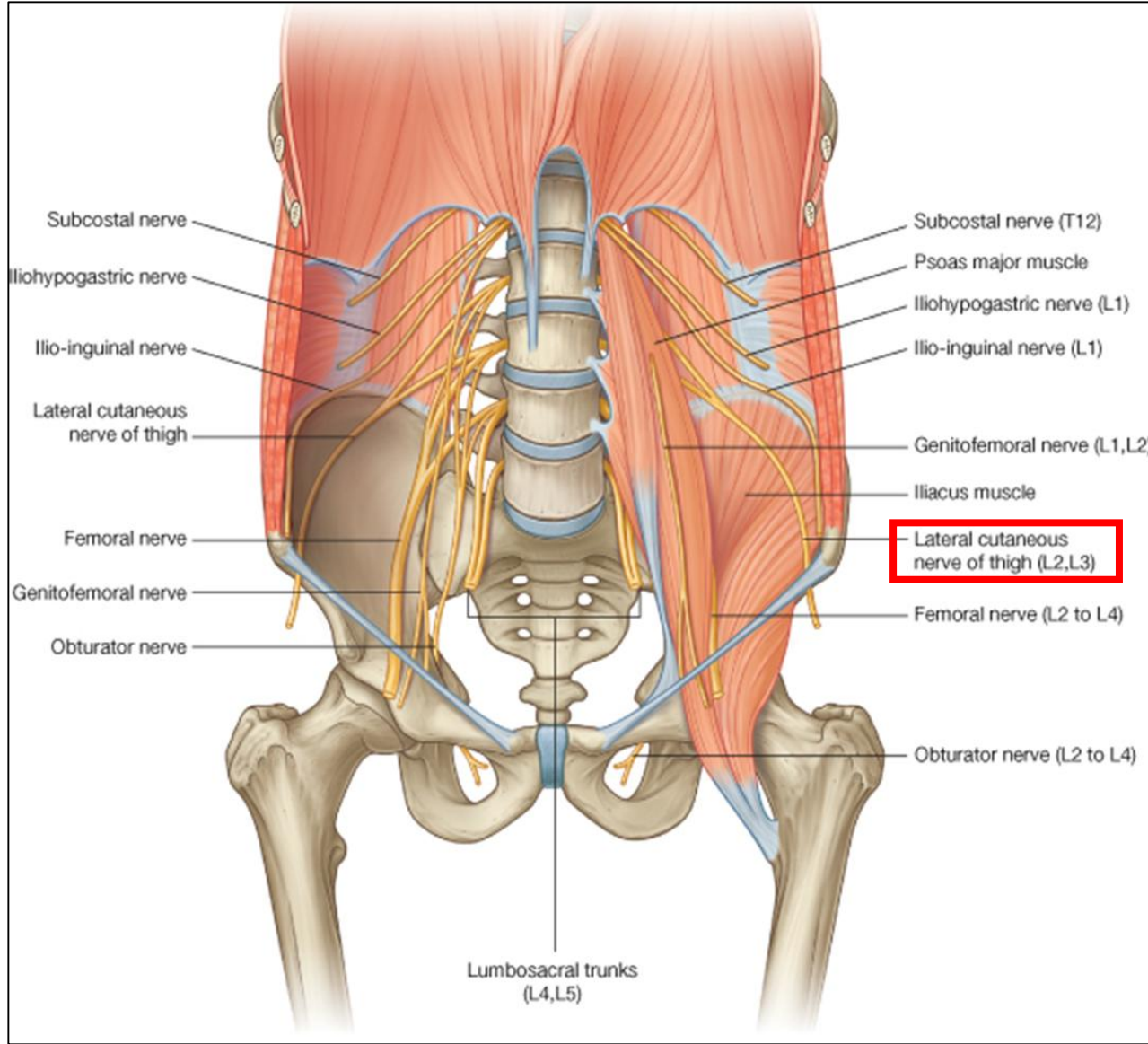
- **Root:** L1+ L2.
- **Course:** After leaving the anterior surface of psoas major muscle, it quickly divides into a **genital branch** (enters the inguinal canal), and a **femoral branch** (purely sensory).
- **Sensory innervation:** skin of middle upper anterior thigh, male scrotum and female labia majora.
- **Motor innervation:** Cremasteric muscle (genital branch).



Lateral femoral cutaneous nerve

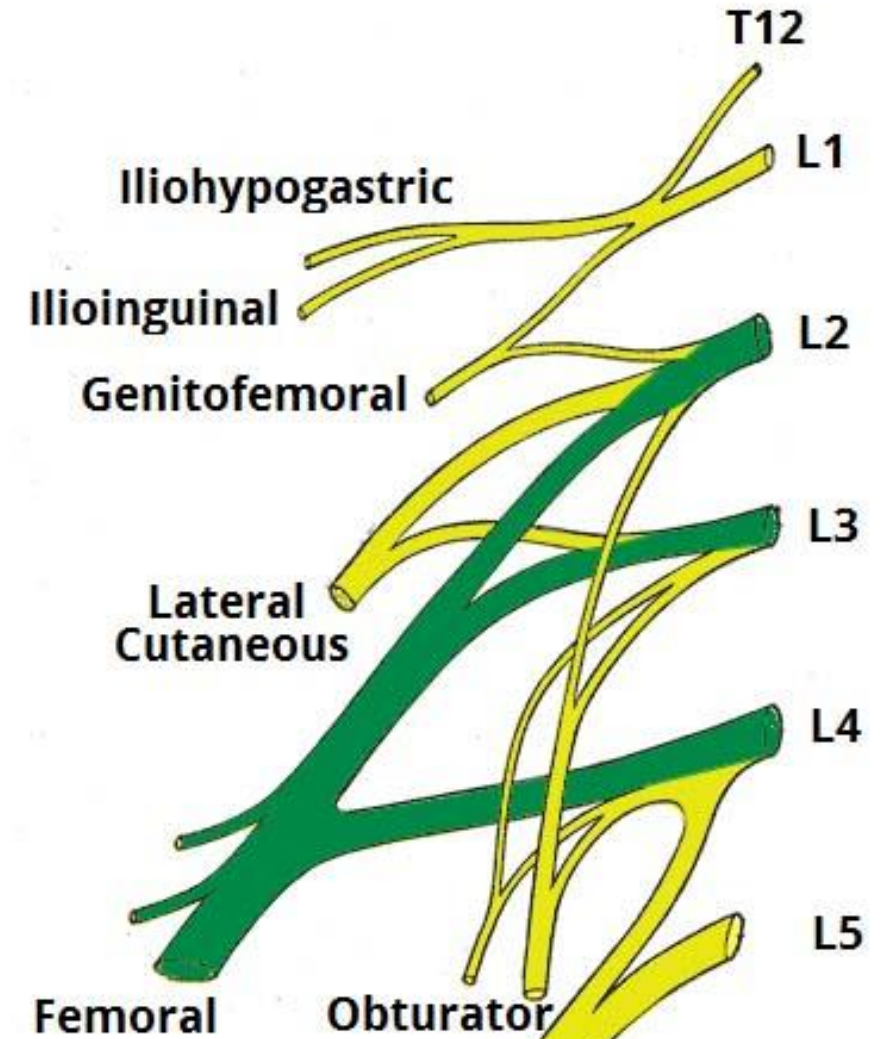
- **Root:** L2+ L3.
- **Course:** crosses the iliac fossa in front of the iliacus muscle and enters the thigh behind the lateral end of the inguinal ligament.
- **Sensory innervation:** supplies the skin over the anterolateral side of the thigh.

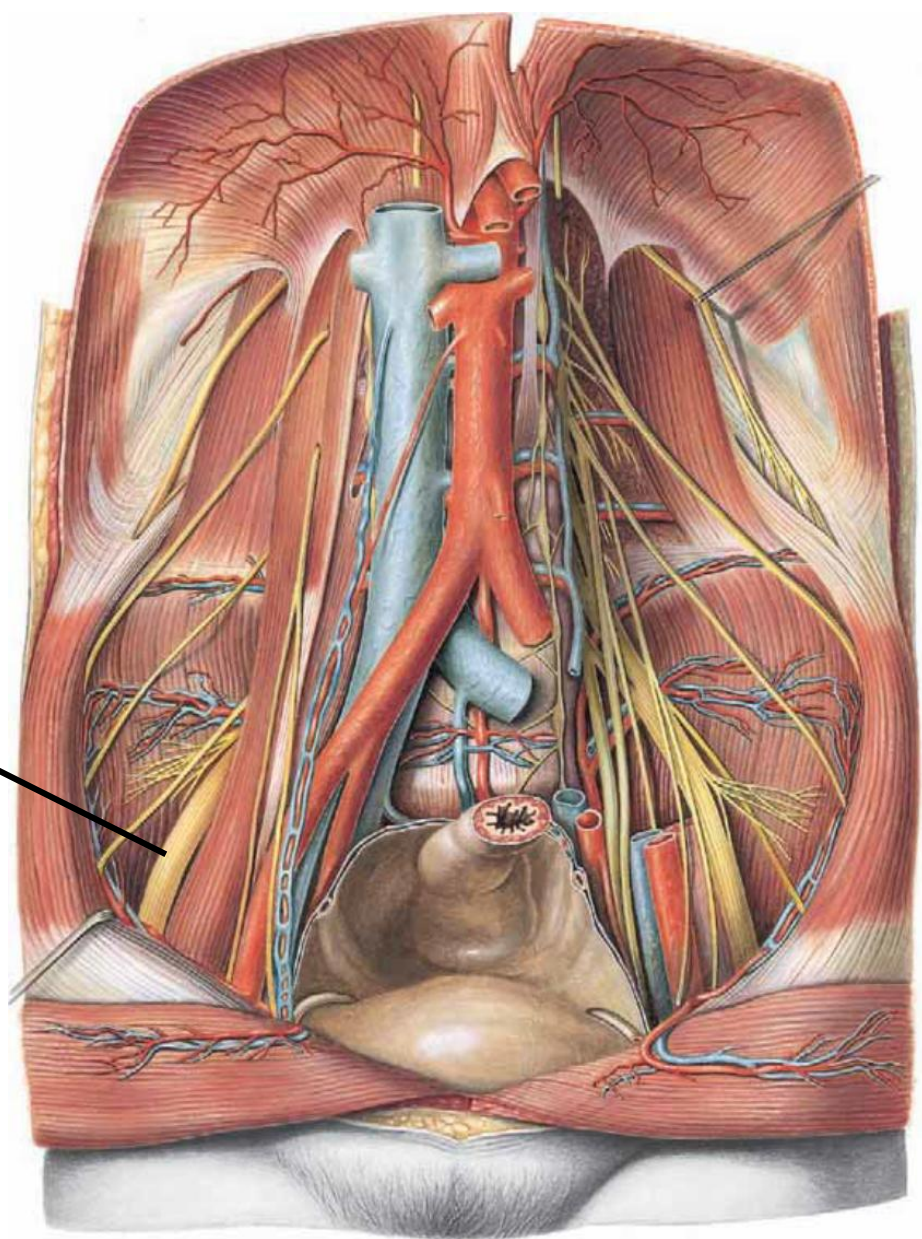
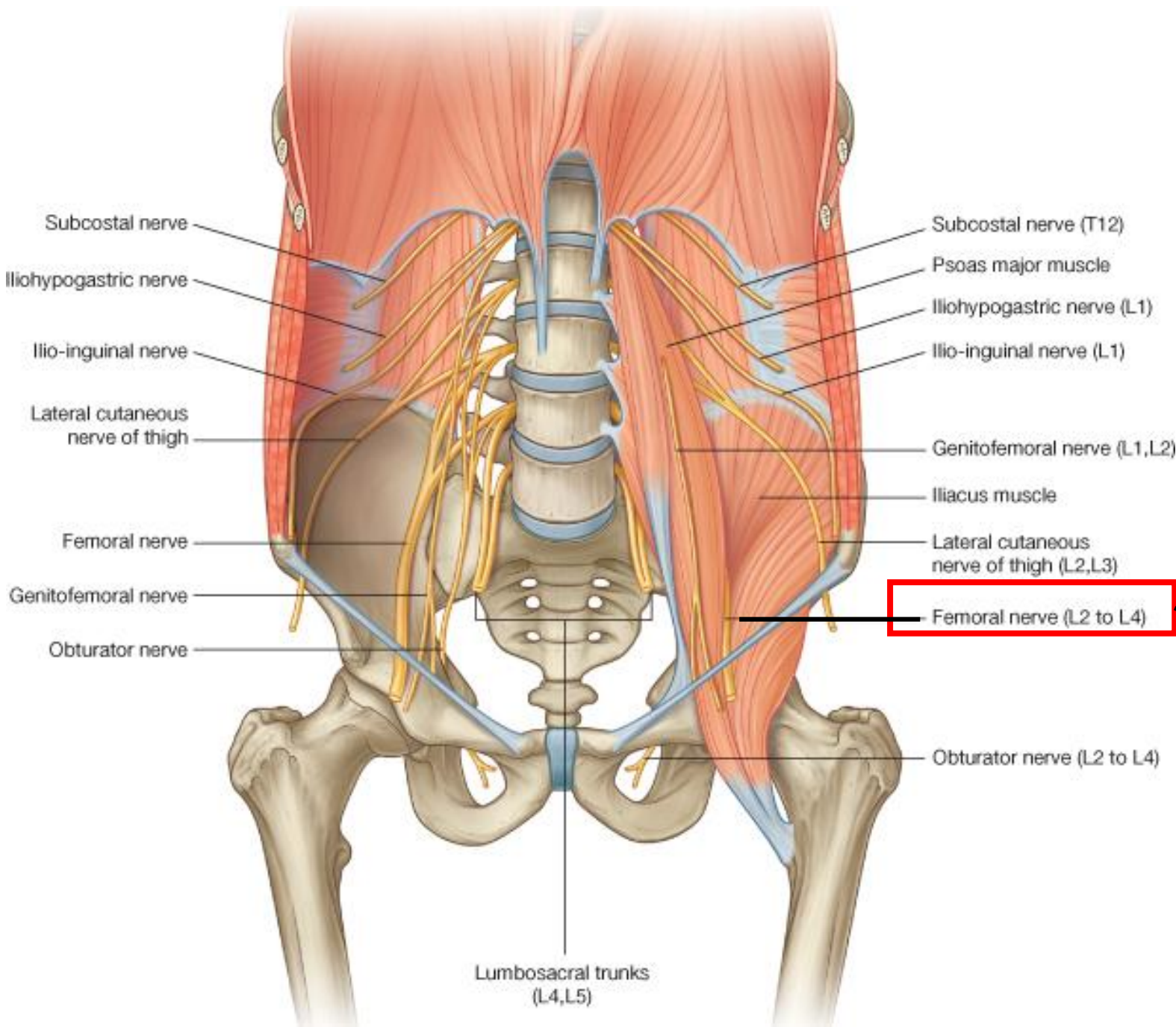


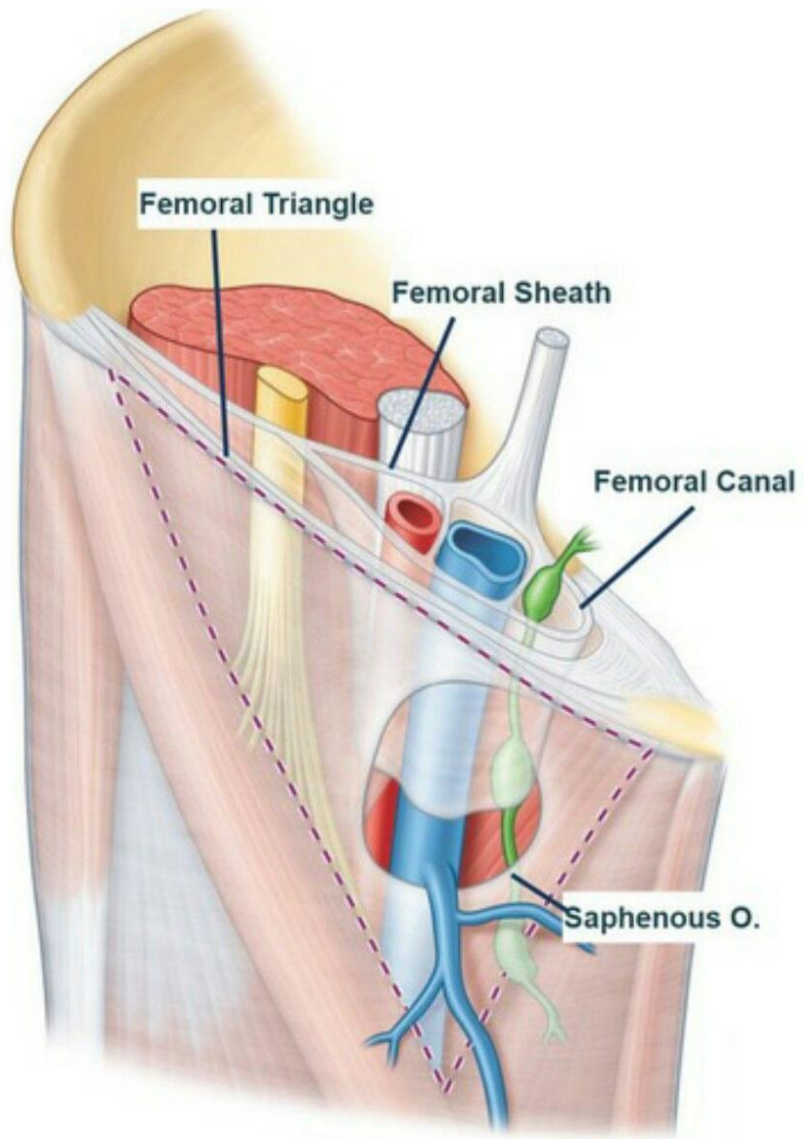


Femoral Nerve

- Largest branch of the lumbar plexus.
- **Root:** Posterior divisions of L2 - L4.
- **Course:** It runs downward and laterally between the psoas and the iliacus muscles and enters the thigh behind the inguinal ligament and lateral to the femoral vessels and the femoral sheath.
 - About 4 cm below the inguinal ligament, it terminates by dividing into **anterior** and **posterior** division.







Note 'femoral sheath' does NOT cover the femoral nerve.

Femoral Nerve

- Motor branch above the inguinal ligament supply the iliopsoas and pectineus.
- **Anterior division:** supplies sartorius and forms the **anterior cutaneous nerve of the thigh** which supplies the skin over the anteromedial thigh.
- **Posterior division:** supplies quadriceps femoris and also sends articular branch to the hip and knee joint.
 - also give off the branches for the **saphenous nerve** which supplies the medial side of the leg and foot (as far as base of the big toe).

Femoral Nerve

Saphenous nerve is the longest of the branches of the femoral nerve.

Beginning below the inguinal ligament, passes through the femoral triangle and go to the medial side of the thigh .



Passing behind the medial condyle of the femur and tibia.

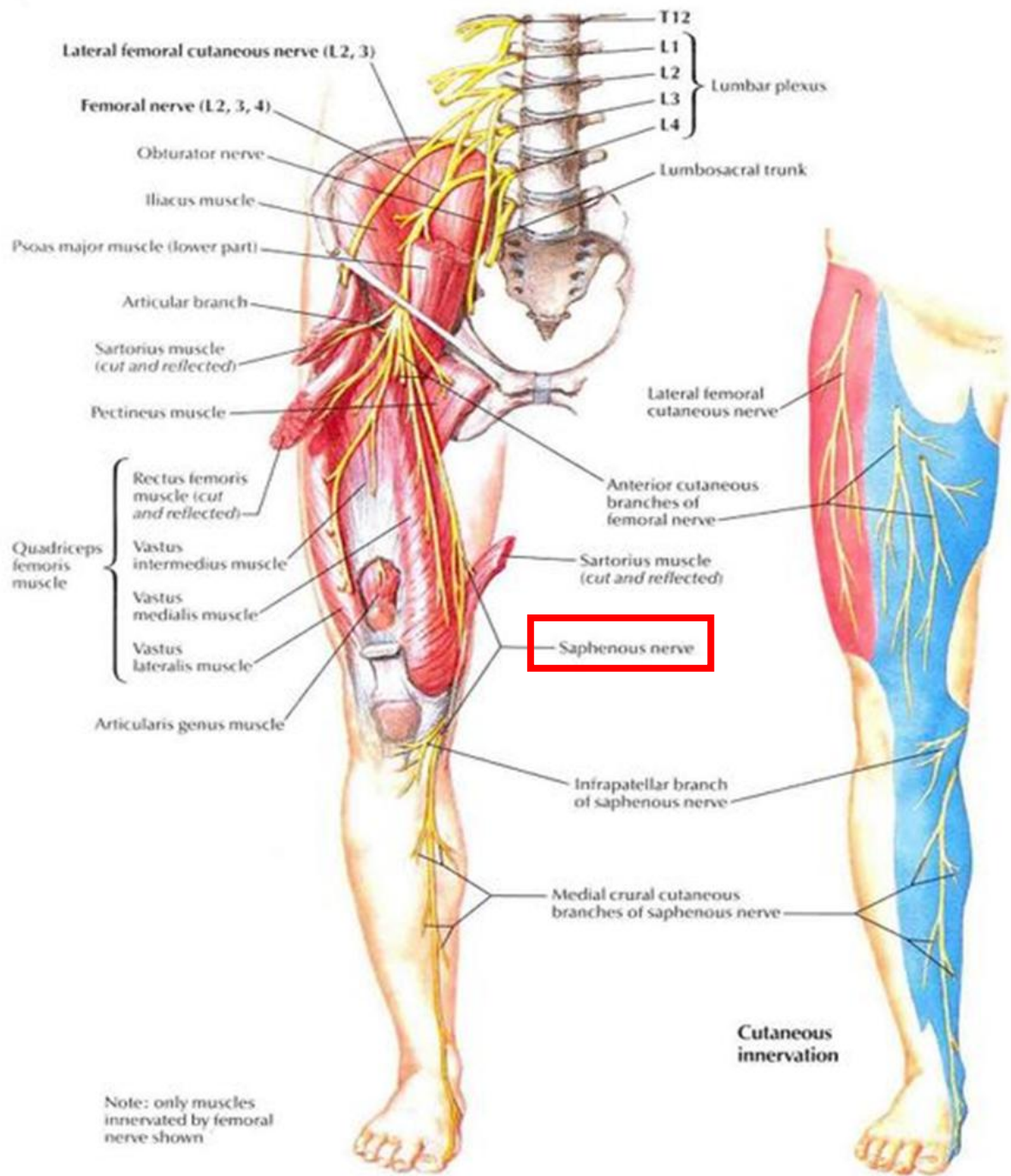
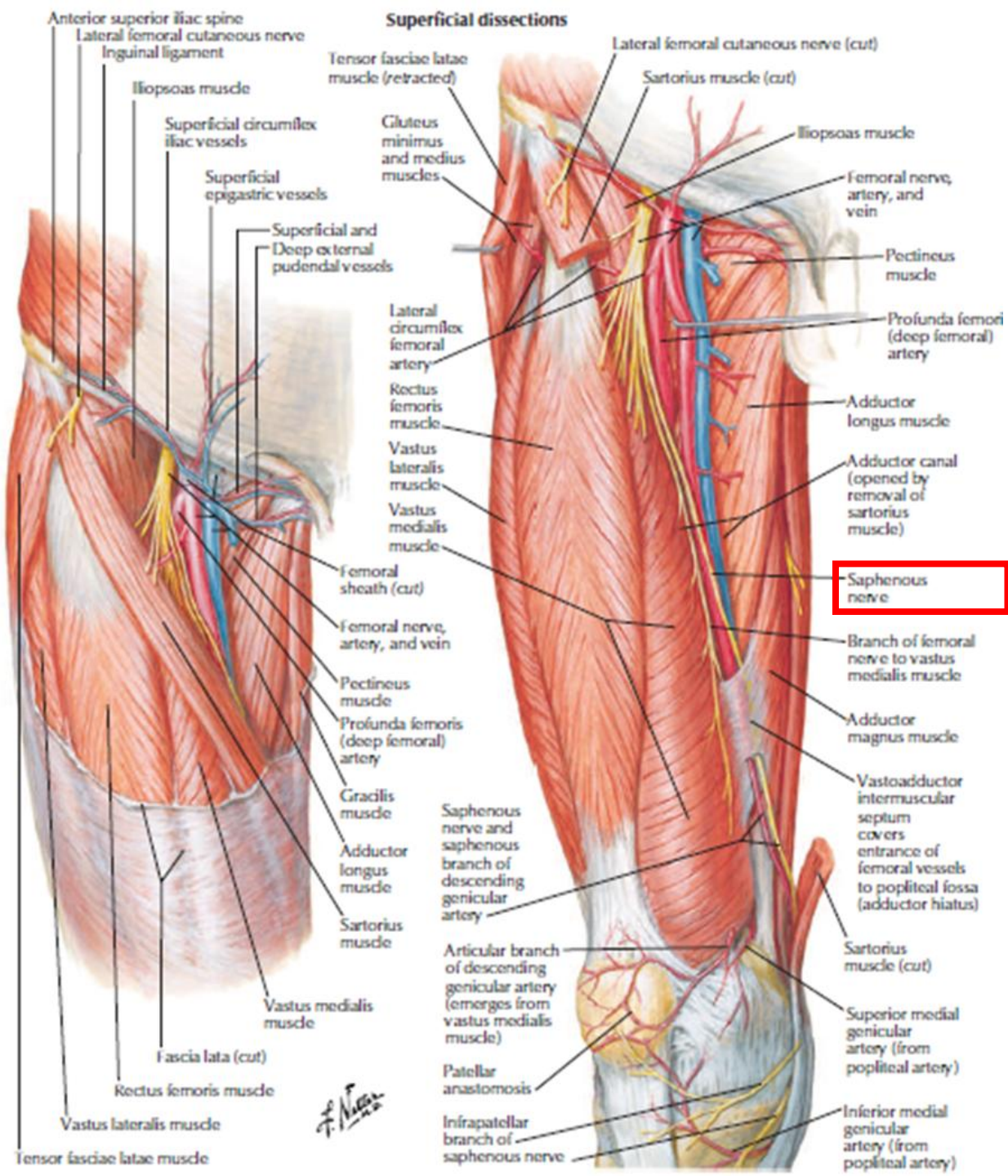


The descends along the medial side of the leg and lie anterior to the medial malleolus.



Then passes too the medial side of the foot as far as head of the 1st metatarsal.

Superficial dissections



Sum Up of the Femoral Nerve

Function:

Motor innervation :

- Flexor of the hip & extensor of the knee (iliacus, pectineus, sartorius, quadriceps femoris)

Sensory innervation:

- Anterior cutaneous nerve of the thigh supplies skin at the anteromedial aspect of the thigh.
- Saphenous nerve supply skin at the anteromedial aspect of the knee, leg and foot

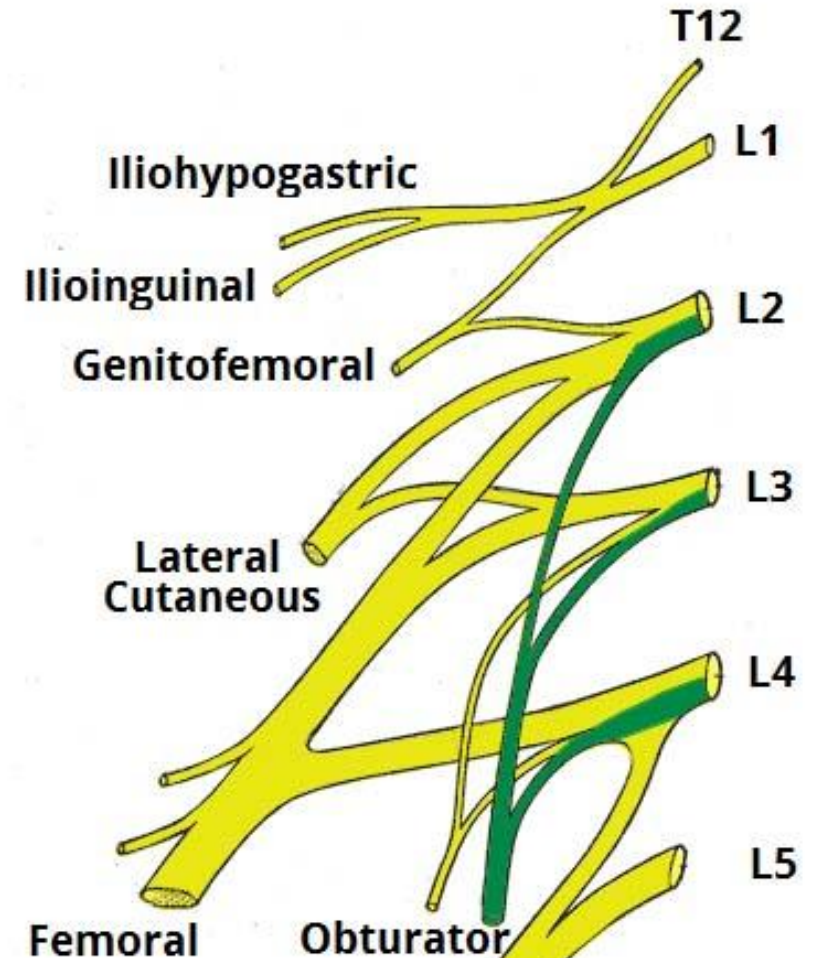
Obturator Nerve

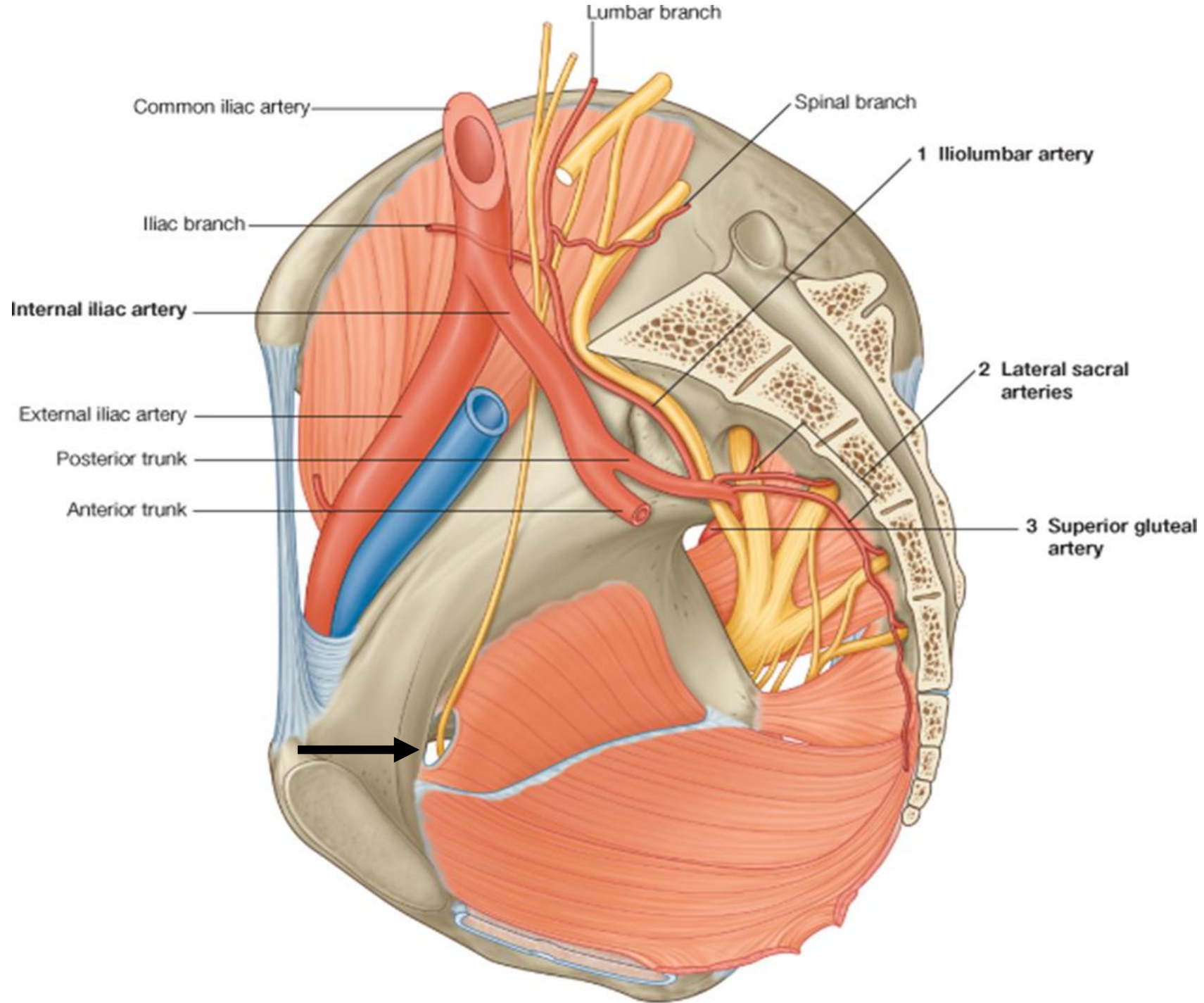
- **Root:** Anterior divisions of L2 - L4
- **Course:** Emerges from the medial border of the psoas muscle near the brim of the pelvis.



Descends through the lateral wall of pelvis to exit through the obturator canal in the upper part of the obturator foramen to the medial side of the thigh.

- It then splits into **anterior** and **posterior** division.





Obturator Nerve

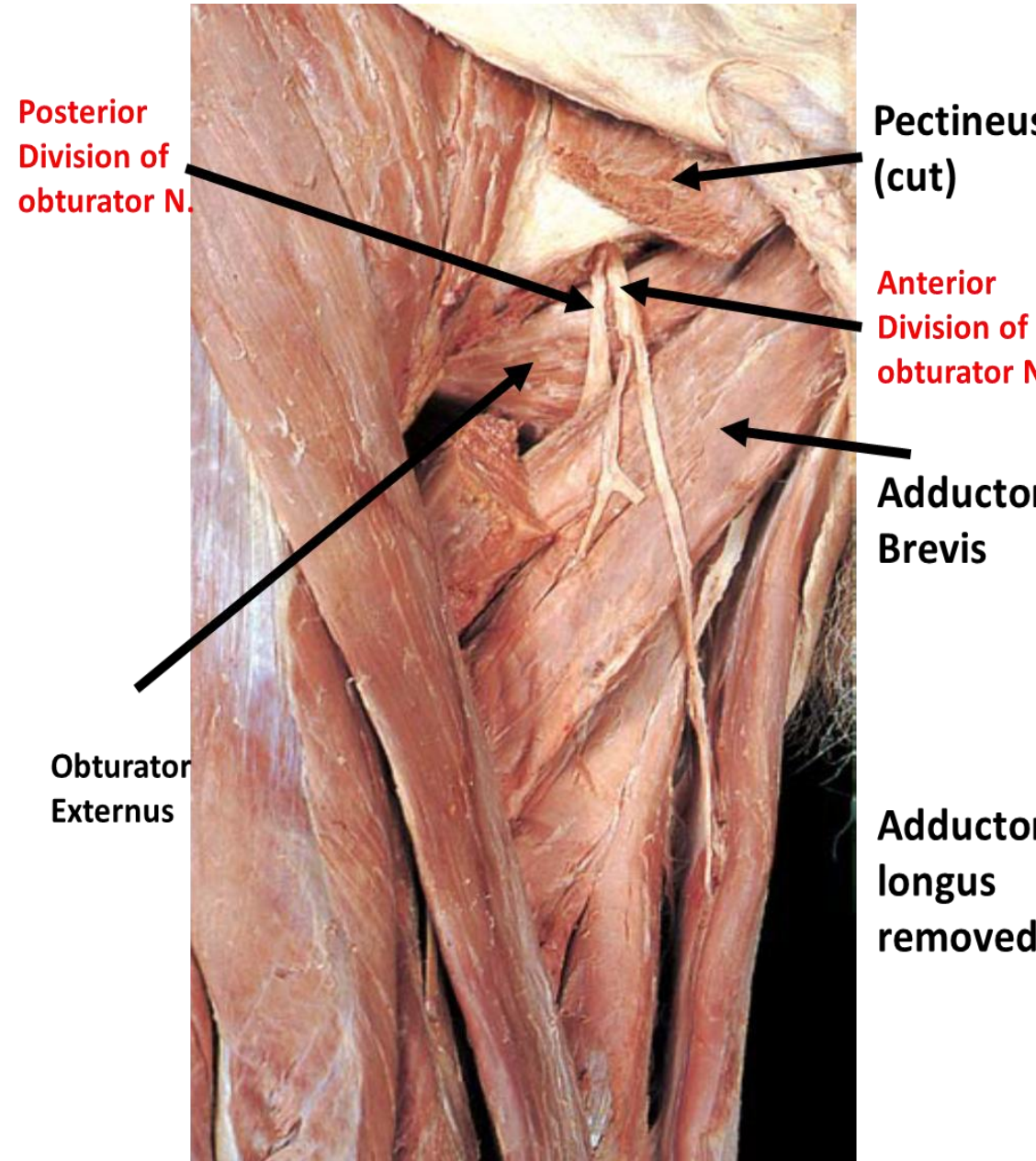
Anterior division:

Descends between the adductor longus and adductor brevis. Here, it supplies the adductor longus, adductor brevis and gracilis.

It then pierces the fascia lata to become the **cutaneous branch of the obturator nerve** which supplies small area of skin on the medial internal aspect of the thigh.

Posterior division:

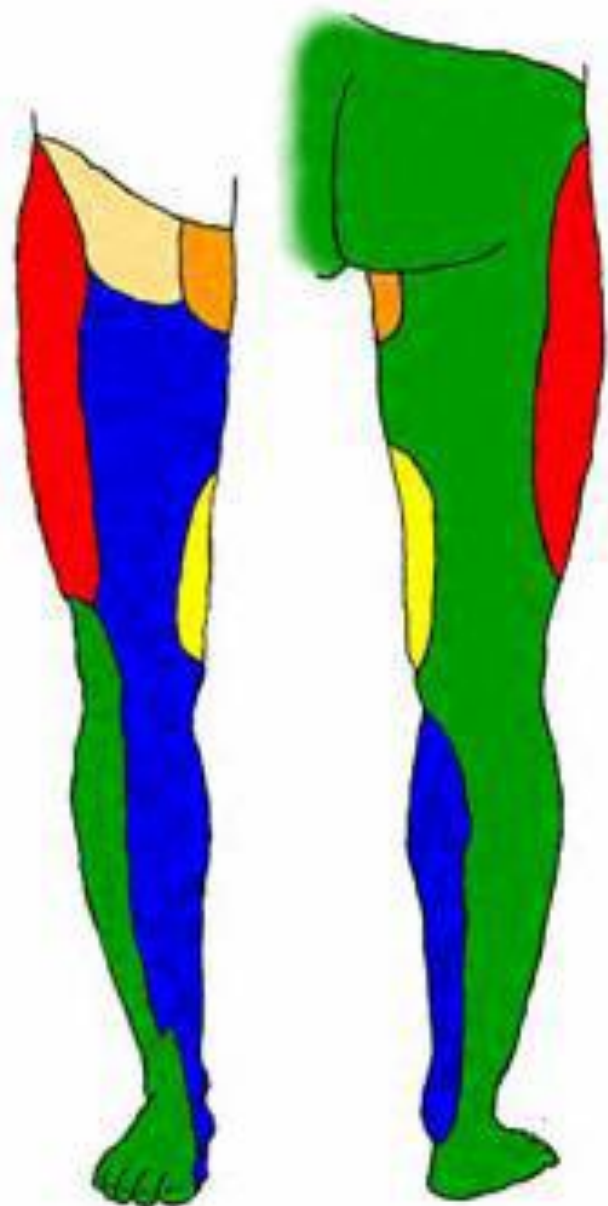
Passes through the obturator externus muscle, posterior to adductor brevis, and supplies the obturator externus and adductor magnus muscles.



Lumbar plexus

(somatic, ventral primary rami)

Branch	Spinal segments	Function: motor	Function: sensory
Iliohypogastric	L1	Internal oblique and transversus abdominis	Posterolateral gluteal skin and skin in pubic region
Ilio-inguinal	L1	Internal oblique and transversus abdominis	Skin in the upper medial thigh , and either the skin over the root of the penis and anterior scrotum or the mons pubis and labium majus
Genitofemoral	L1,L2	Genital branch-male cremasteric muscle	Genital branch-skin of anterior scrotum or skin of mons pubis and labium majus; femoral branch-skin of upper anterior thigh
Lateral cutaneous nerve of thigh	L2,L3		Skin on anterior and lateral thigh to the knee
Obturator	L2 to L4	Obturator externus, pectineus, and muscles in medial compartment of thigh	Skin on medial aspect of the thigh
Femoral	L2 to L4	Iliacus, pectineus, and muscles in anterior compartment of thigh	Skin on anterior thigh and medial surface of leg



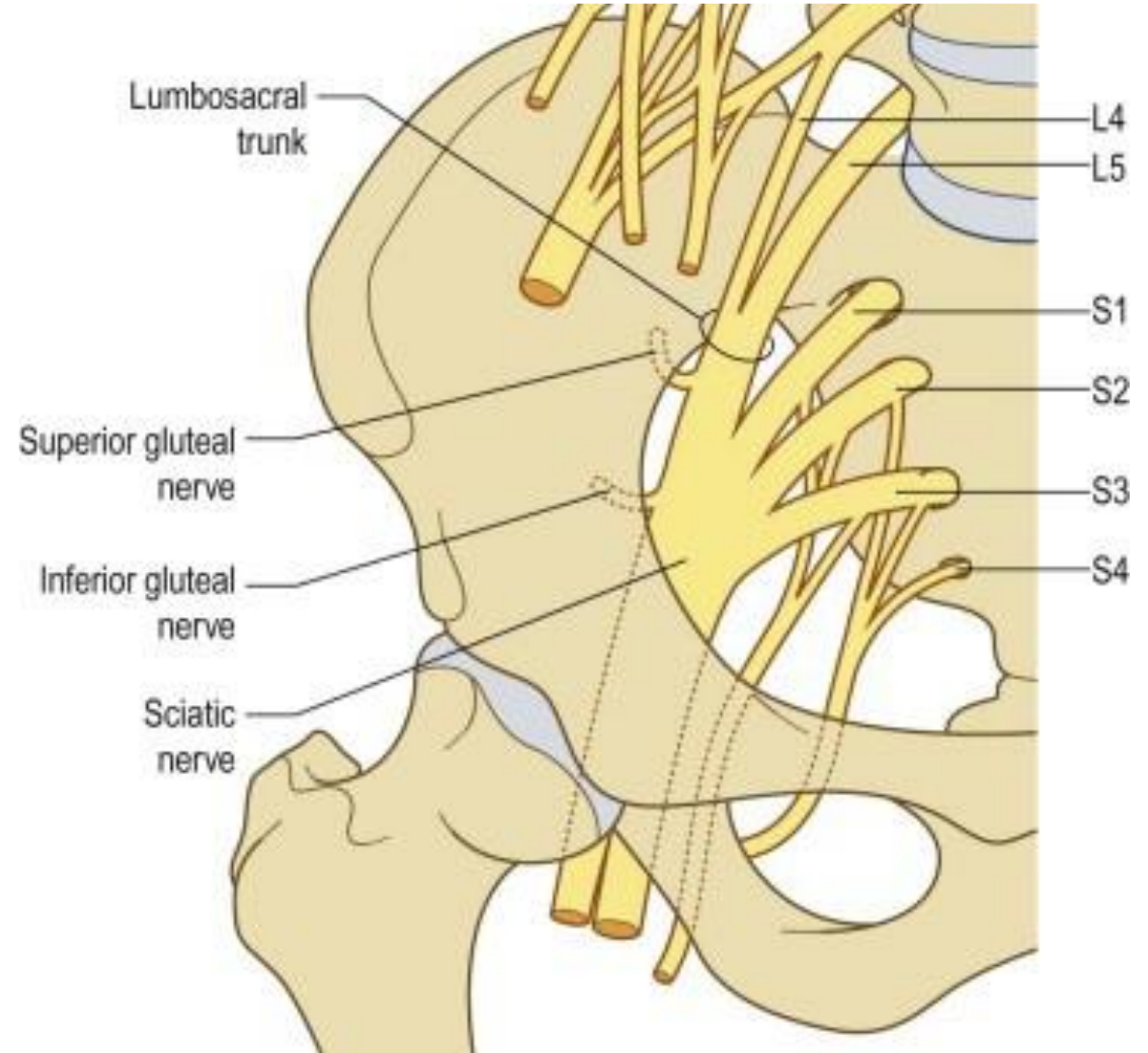
Innervation of Lumbar Plexus

- Genitofemoral nerve,
- Iliohypogastric and ilioinguinal nerves,
- Femoral nerve,
- Lateral cutaneous nerve of the thigh,
- Obturator nerve
- Sciatic Nerve

Sacral Plexus

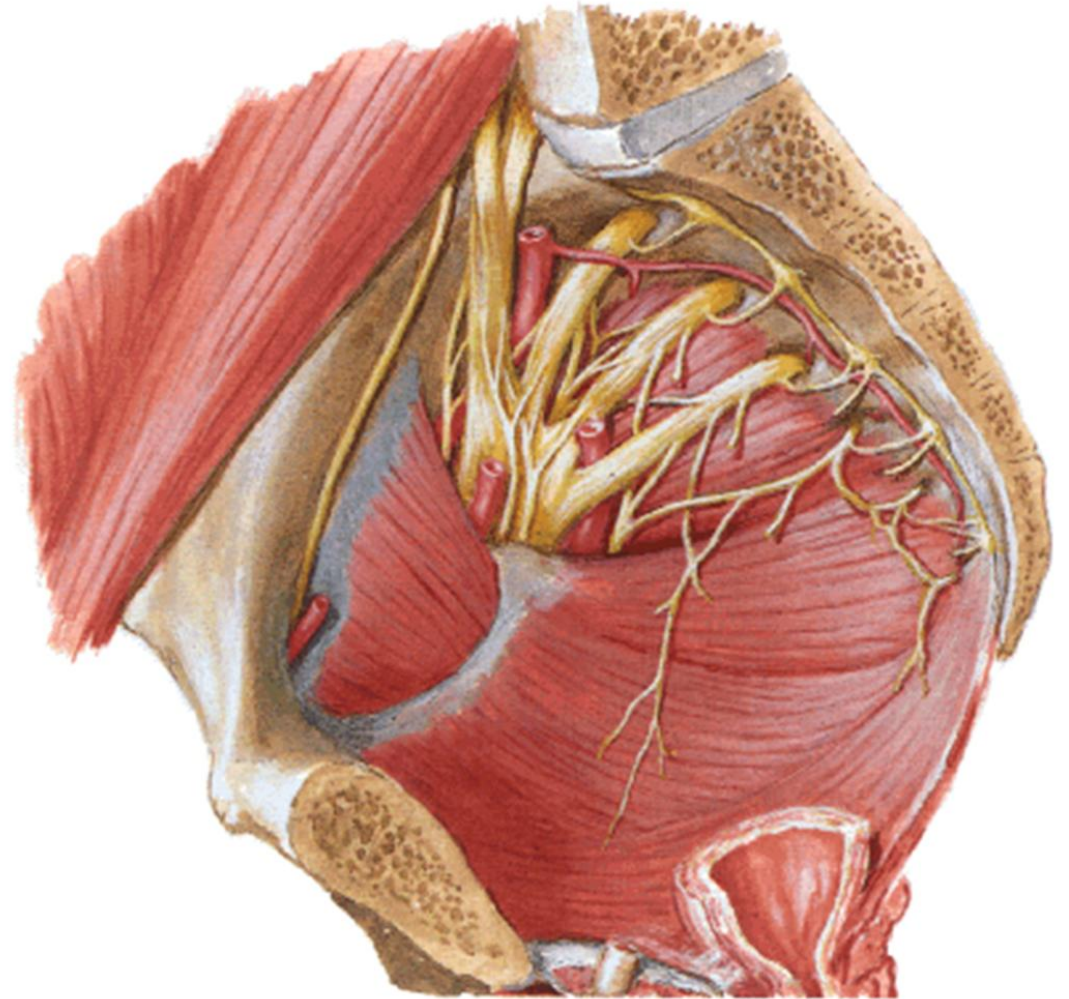
Sacral Plexus

- Formed by the ventral rami of **S1-S4**. it also receives contributions from **L4-L5** (Lumbosacral trunk).
- The lumbosacral trunk passes down into the pelvis and joins the sacral nerves as they emerge from the greater sacral foramen.



Sacral Plexus

- The major peripheral nerves of the sacral plexus descend down the posterior pelvic wall. They have two main destinations:
 1. Leave the pelvis via the **greater sciatic foramen** – these nerves enter the gluteal region of the lower limb, innervating the structures there.
 2. Remain in the pelvis – these nerves innervate the pelvic muscles, organs and perineum.



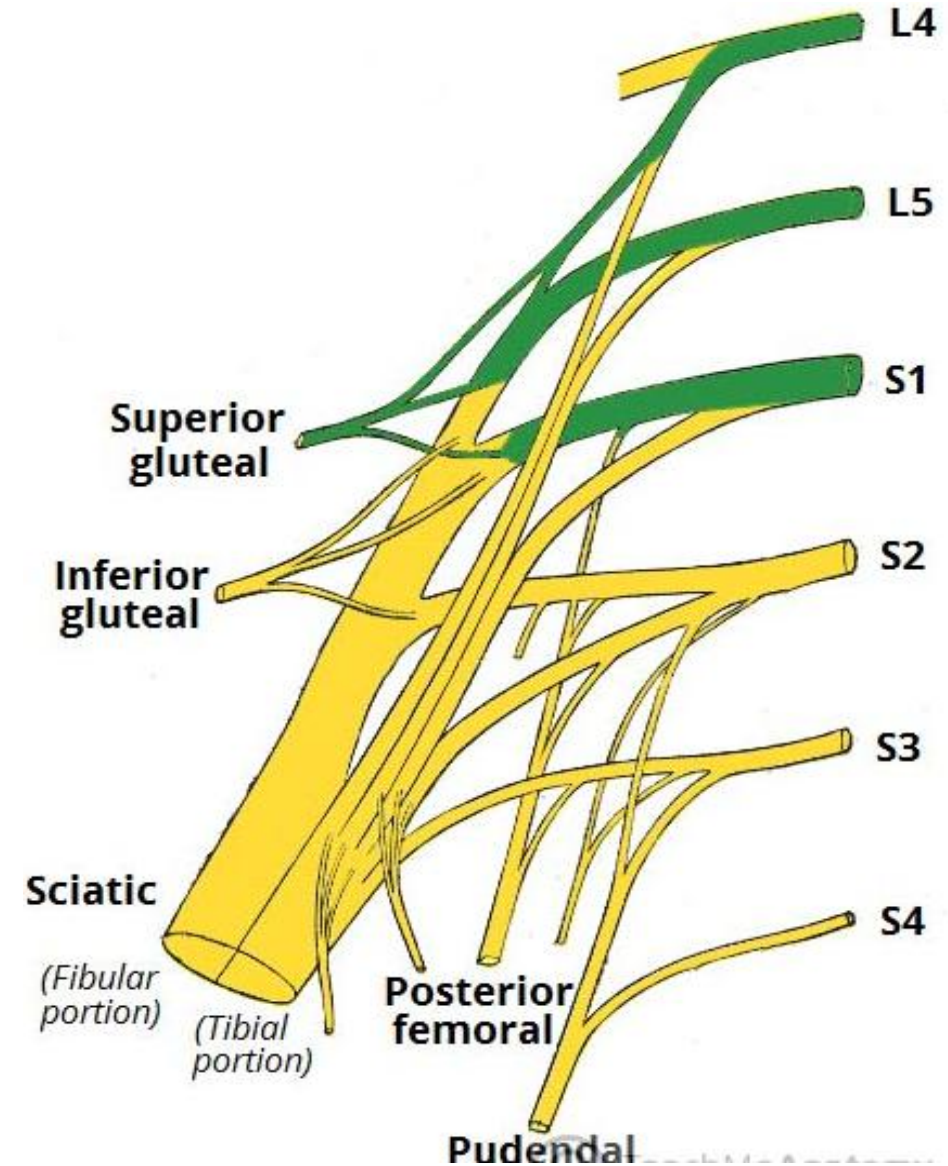
Lumbar Plexus

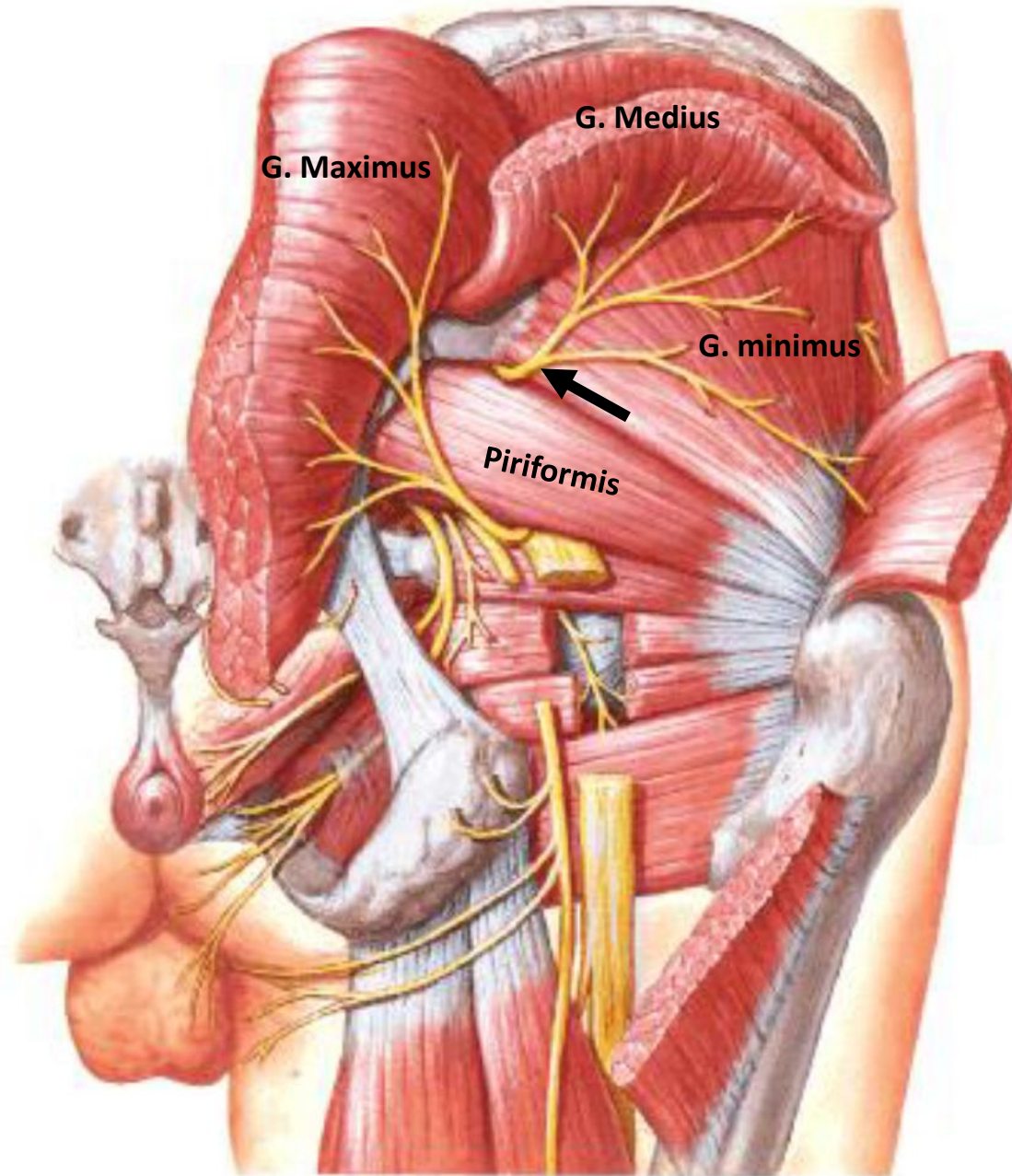
Major Branches:

- 1. Sciatic nerve**
- 2. Superior gluteal nerve**
- 3. Inferior gluteal nerve**
- 4. Posterior cutaneous nerve of thigh**
- 5. Pudendal Nerve**

Superior Gluteal Nerve

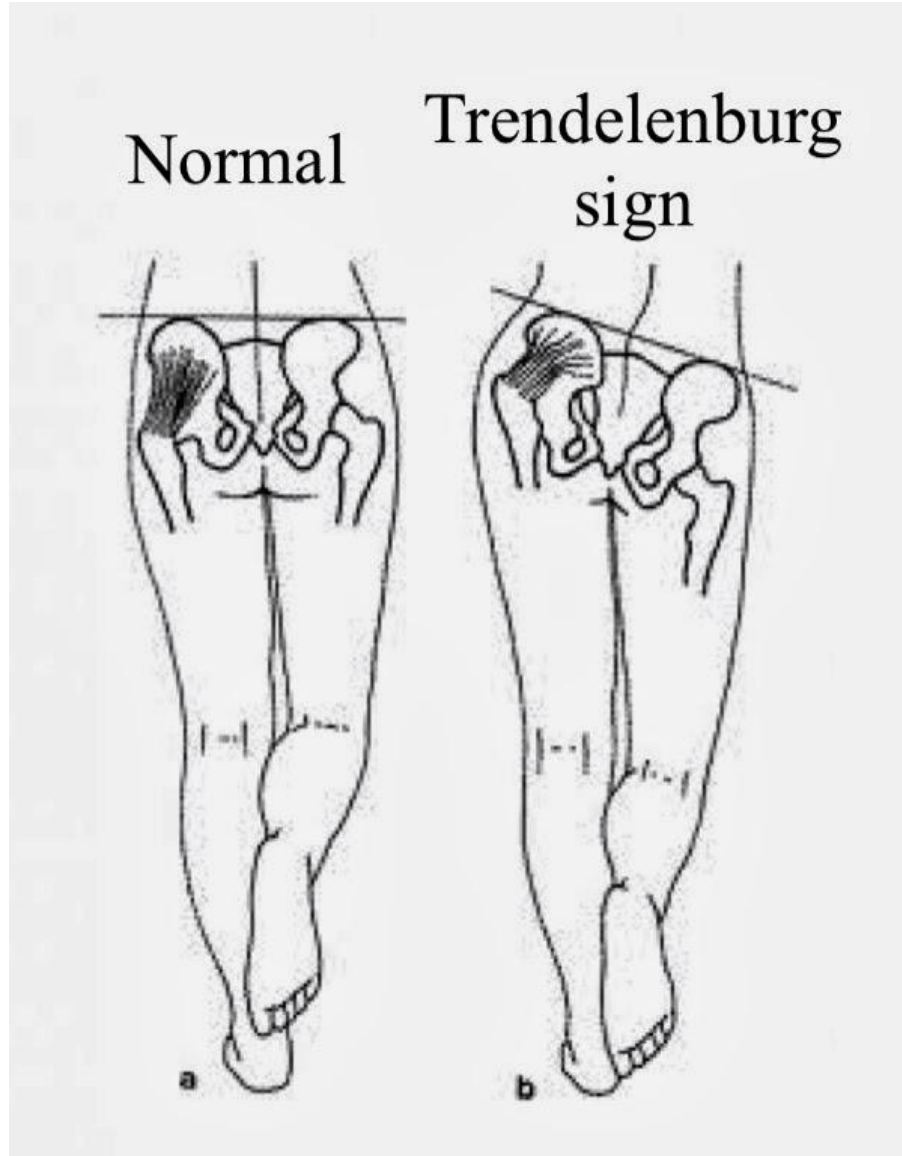
- **Root:** Posterior divisions of L4, L5, and S1
- **Course:** leaves the pelvis via the greater sciatic foramen, entering the gluteal region above the piriformis muscle.
- **Motor Functions:**
Innervates the gluteus minimus, gluteus medius and tensor fascia lata.





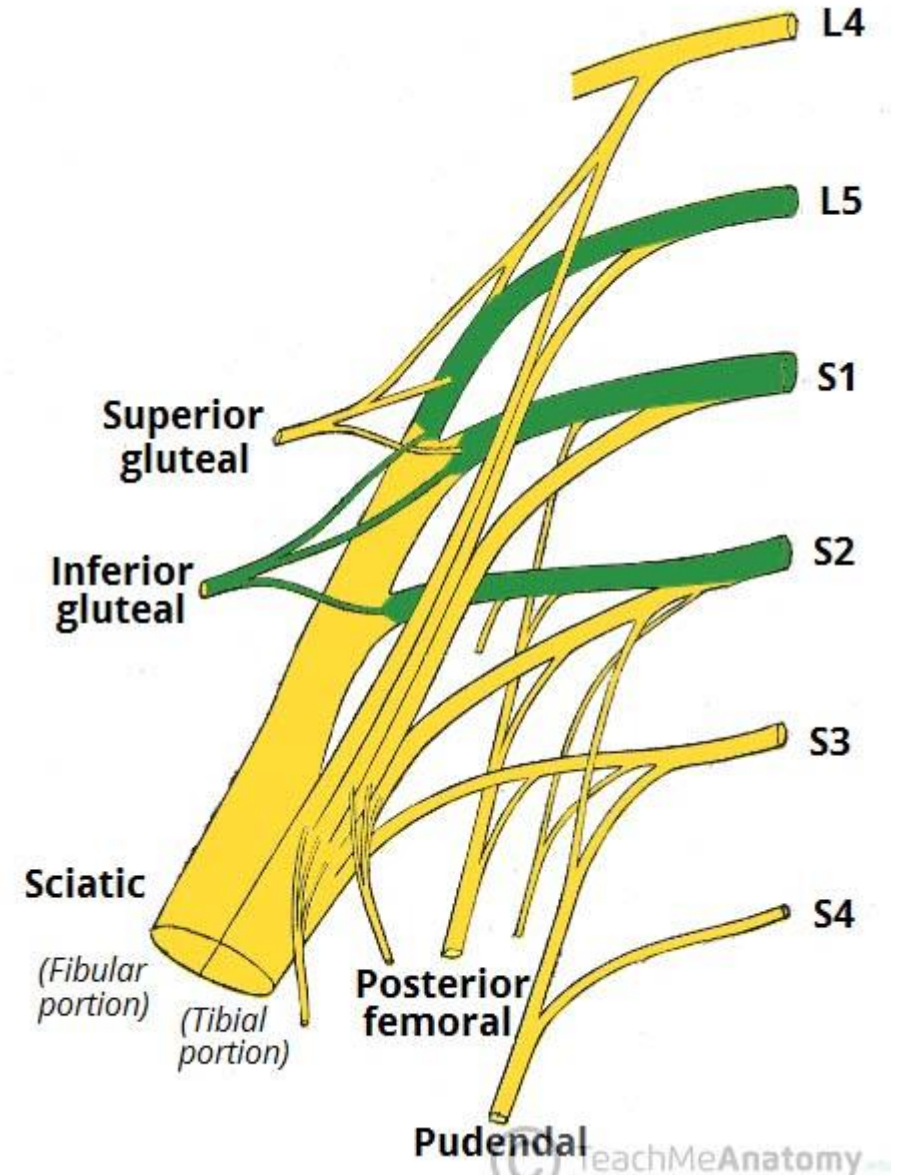
Damage to Superior Gluteal Nerve

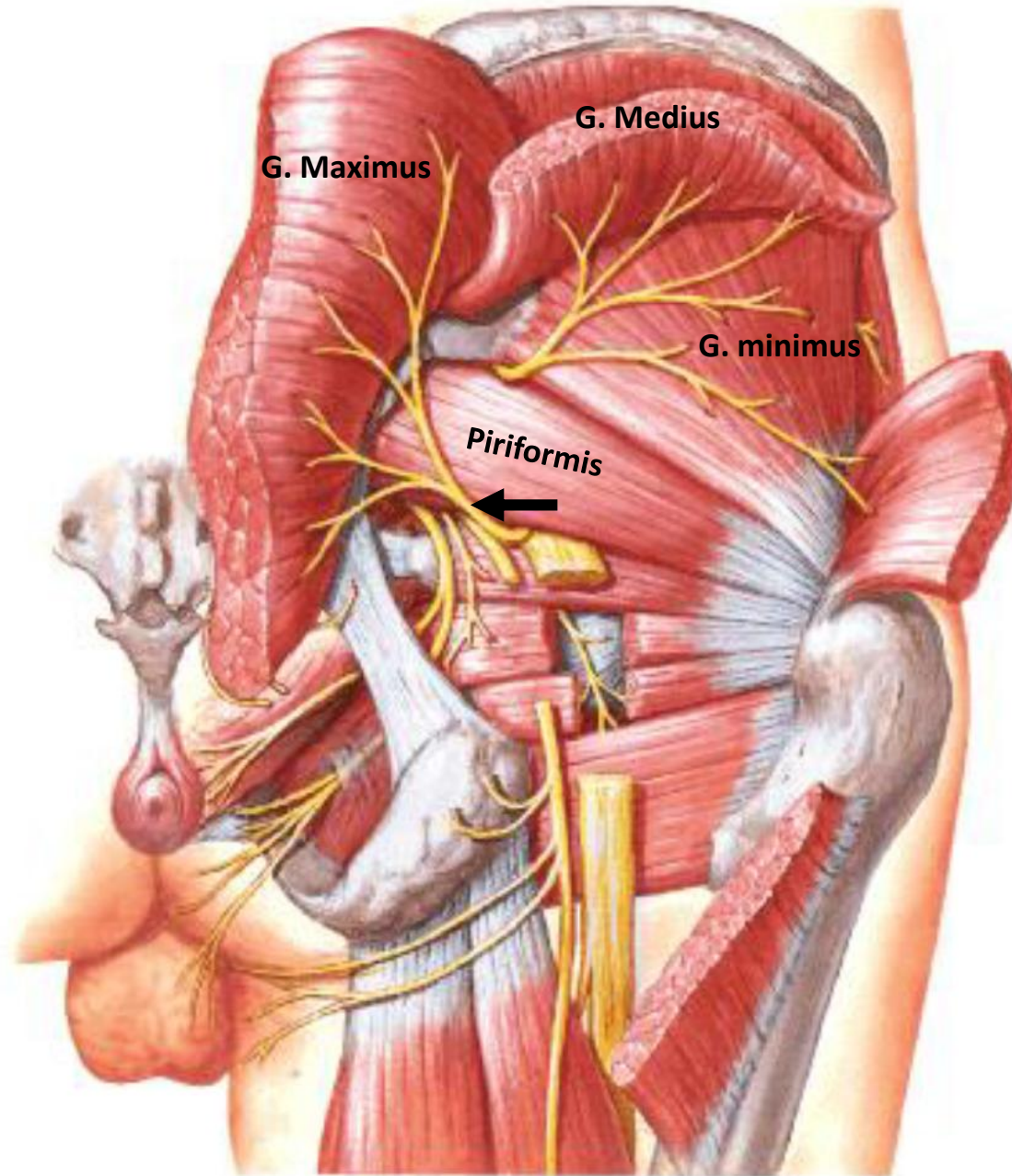
TRENDELENBURG'S SIGN



Inferior Gluteal Nerve

- **Root:** Posterior divisions of L5, S1 and S2
- **Course:** leaves the pelvis via the greater sciatic foramen, entering the gluteal region below the piriformis.
- **Motor Functions:**
Innervates the gluteus maximus





G. Maximus

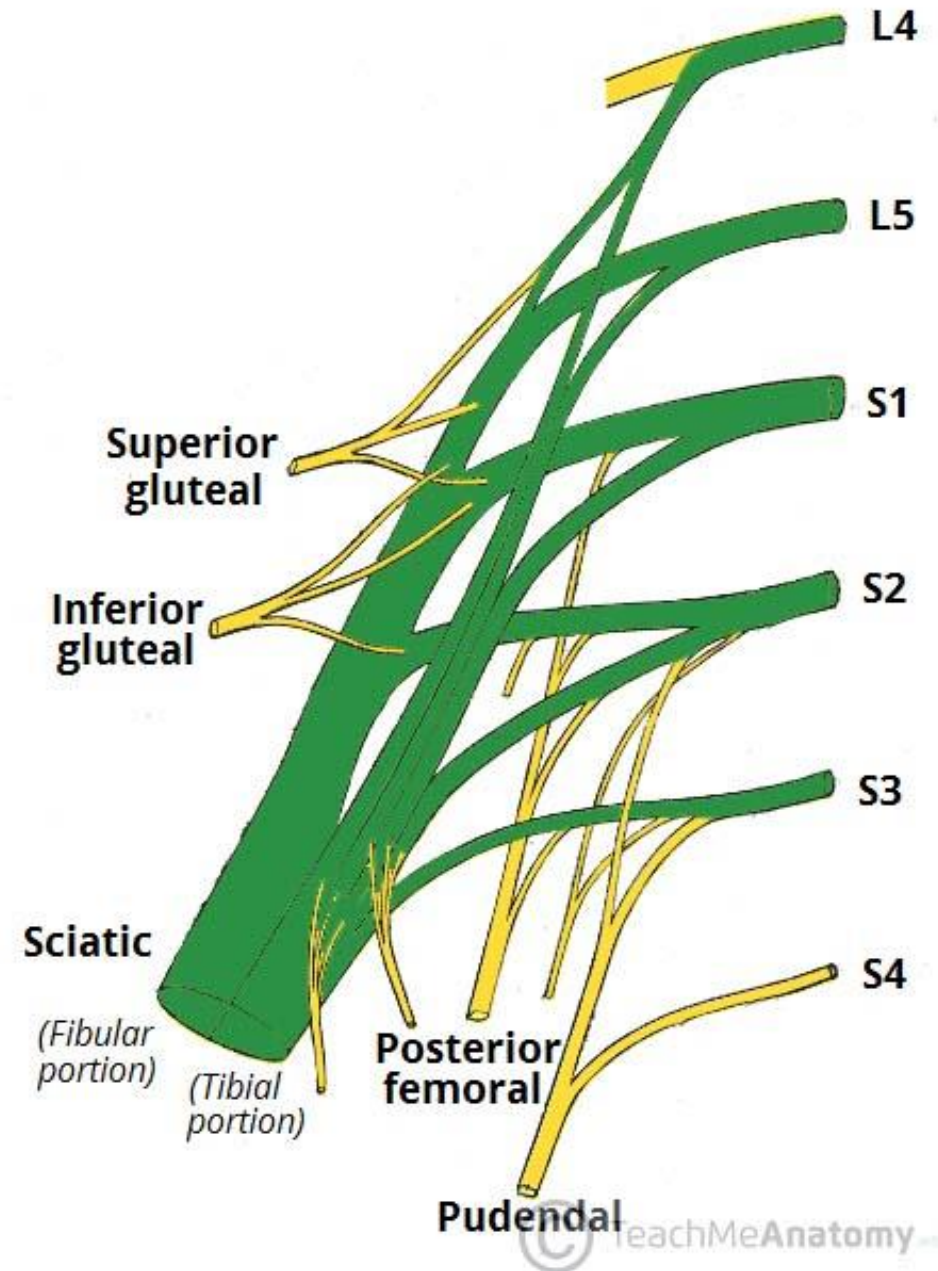
G. Medius

G. minimus

Piriformis

Sciatic Nerve

- It is the largest nerve in the body.
- It consists of 2 separate nerves in one sheath:
 1. **Common peroneal Nerve**
 2. **Tibial Nerve**
- **Common peroneal nerve** is formed by the upper 4 posterior division of the sacral plexus (L4-S2).
- **Tibial nerve** is formed from all anterior divisions of the sacral plexus (L4-S3).



Sciatic Nerve

Leaves the pelvis through the greater sciatic foramen (below the piriformis)



Crosses the posterior surface of the superior gemellus, obturator internus, inferior gemellus and quadratus femoris muscles

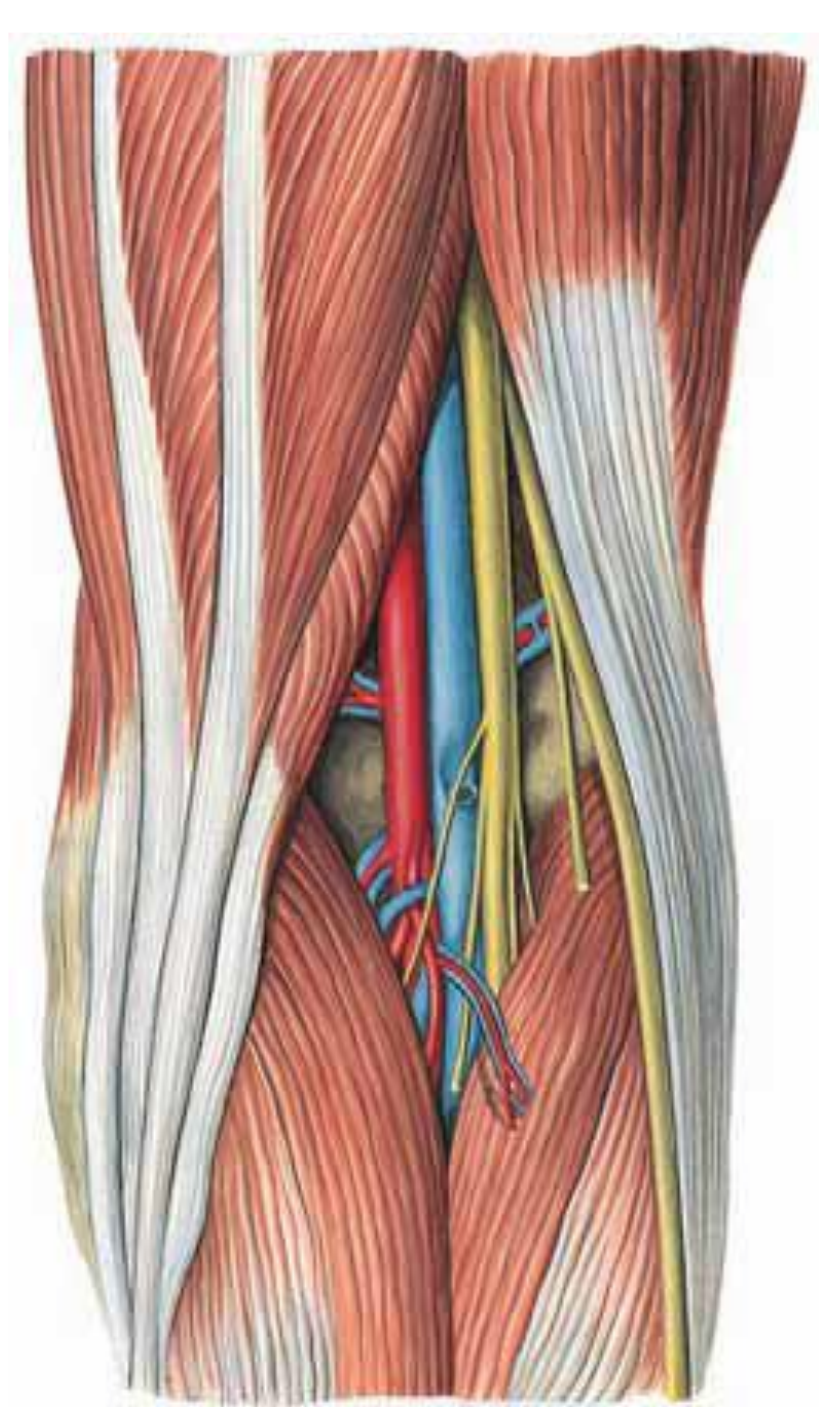
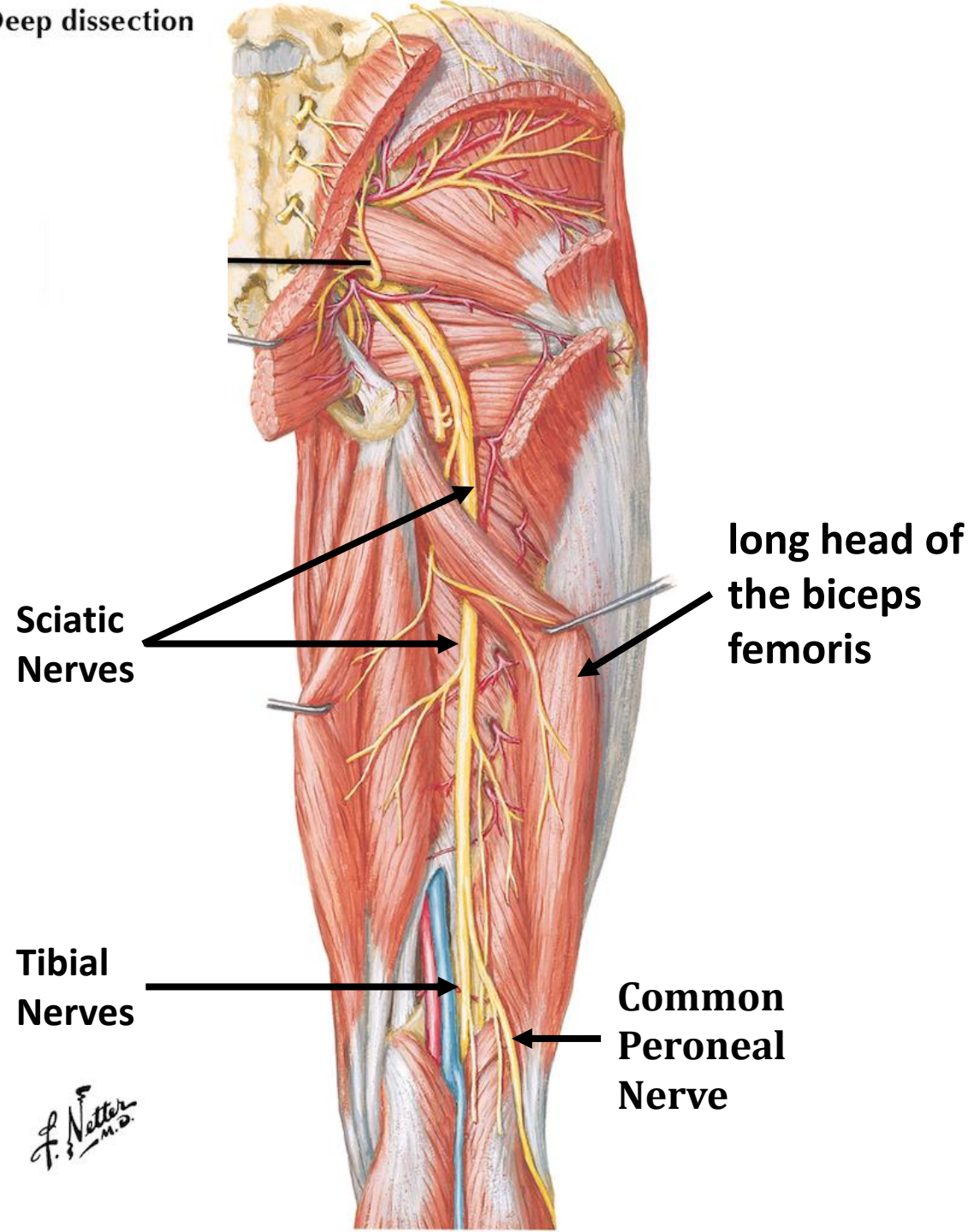


Enters the posterior thigh by passing deep to the long head of the biceps femoris



Reaches the apex of the popliteal fossa at the posterior knee joint, and terminates by bifurcating into the tibial and common peroneal (fibular) nerves

Deep dissection



Sciatic Nerve

- Branches in the thigh, supply the **hamstring muscles**
 - Rami from tibial trunk pass to the semitendinosus, semimembranosus, long head of biceps and adductor magnus.
 - Rami from common peroneal trunk supply short head of biceps.

Tibial Nerve

- Medial terminal branch of the sciatic nerve.
- **Course:**

Travels through the popliteal fossa, gives off the branches to the *gastrocnemius*, *plantaris*, *popliteus* and *soleus*. Also gives rise to **medial sural cutaneous nerve**,



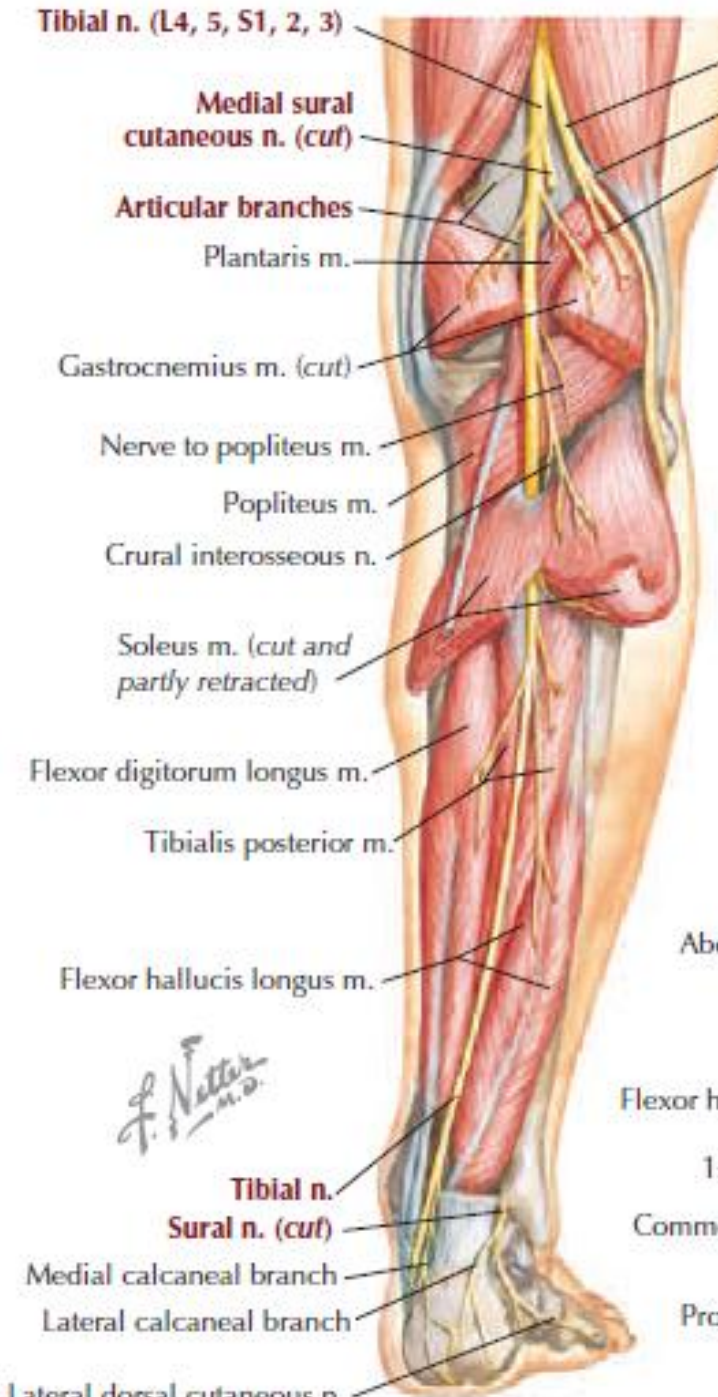
Pass below the arch of soleus. Below the soleus muscle the nerve lies close to the tibia and supplies *tibialis posterior*, *flexor hallucis longus* and *flexor digitorum longus*.



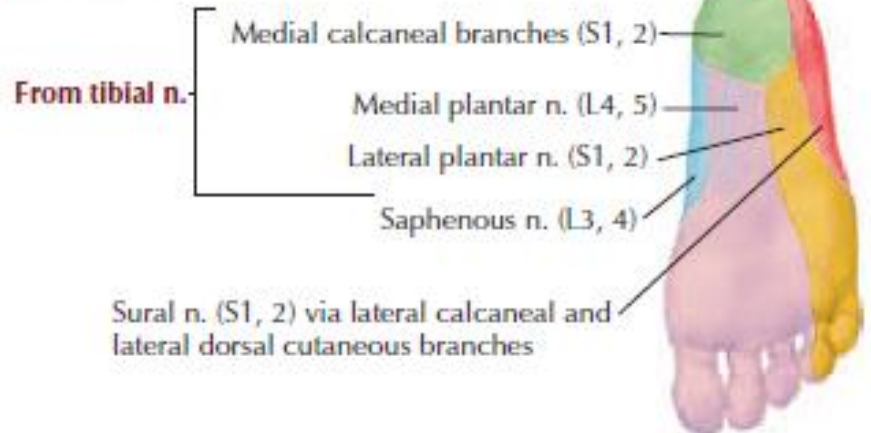
The nerve pass into the foot running posterior to the medial malleolus (in **tarsal tunnel**)



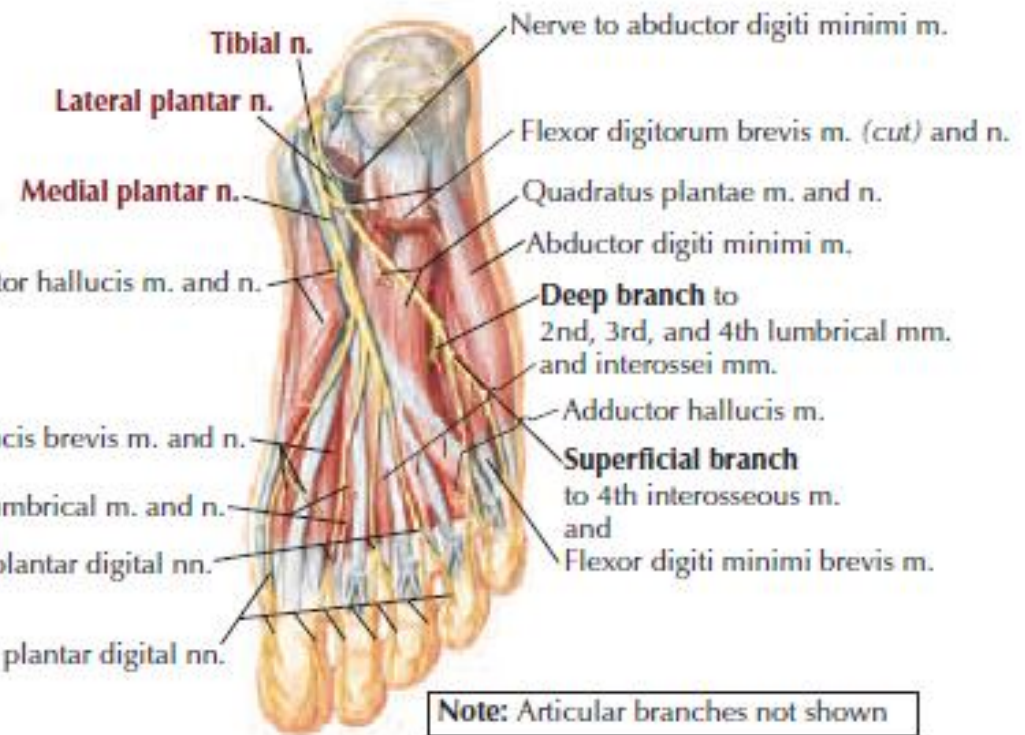
In the foot the tibial nerve divides into **lateral** and **medial plantar nerves**.



Common fibular n.
 Articular branch
 Lateral sural cutaneous n. (cut)

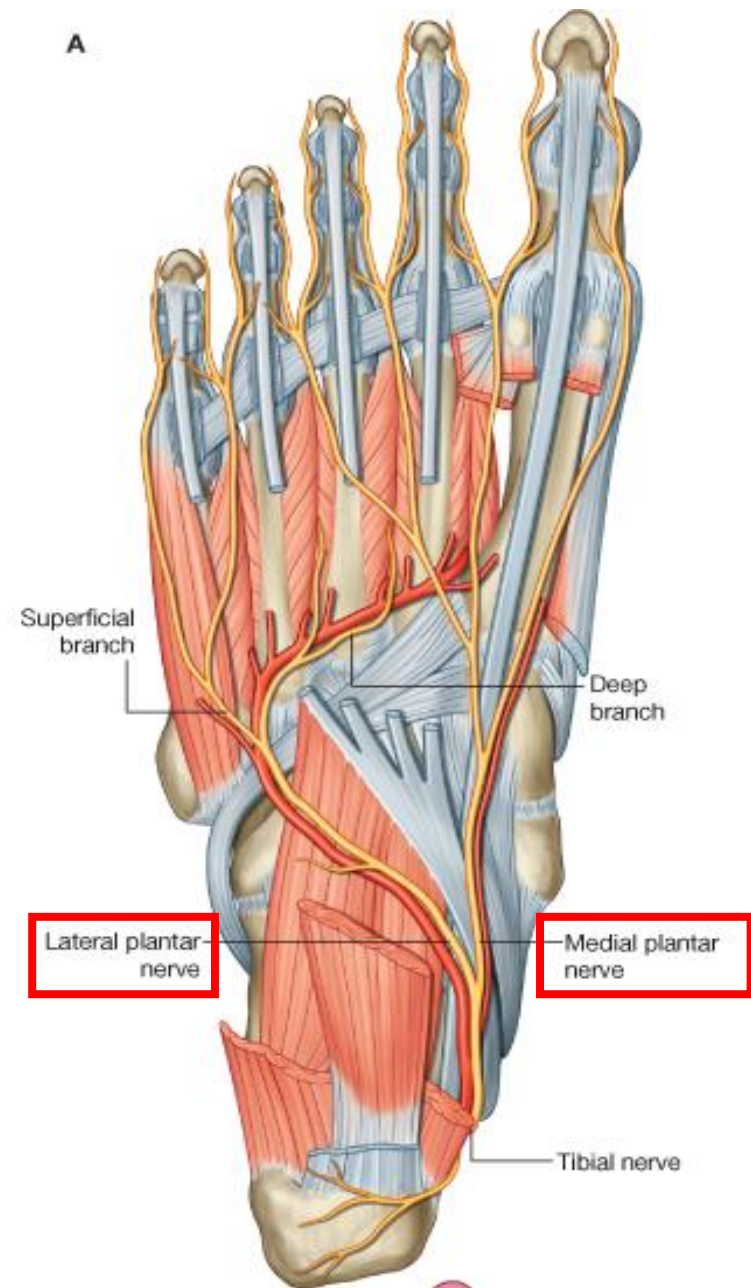
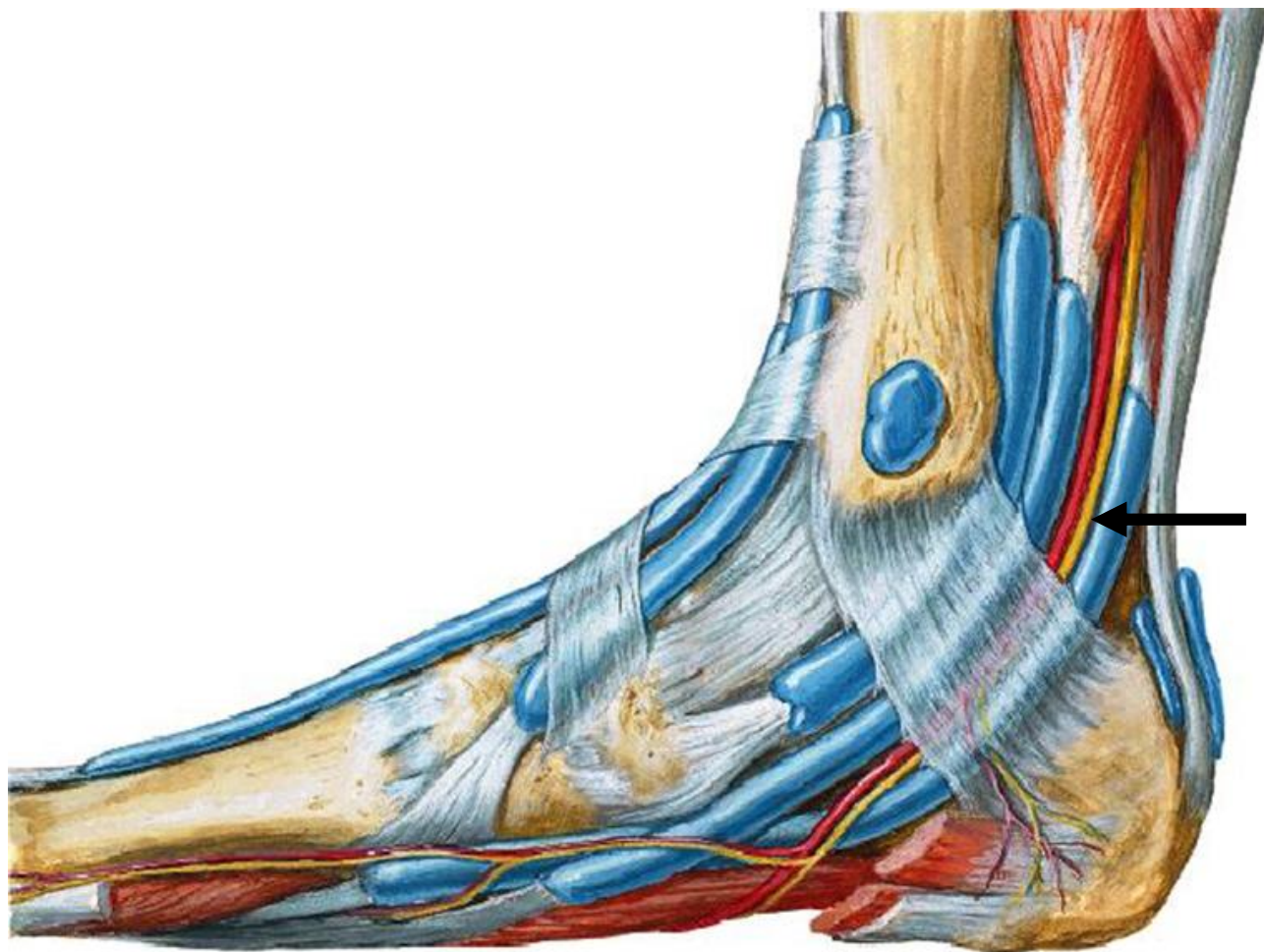


Cutaneous innervation of plantar region

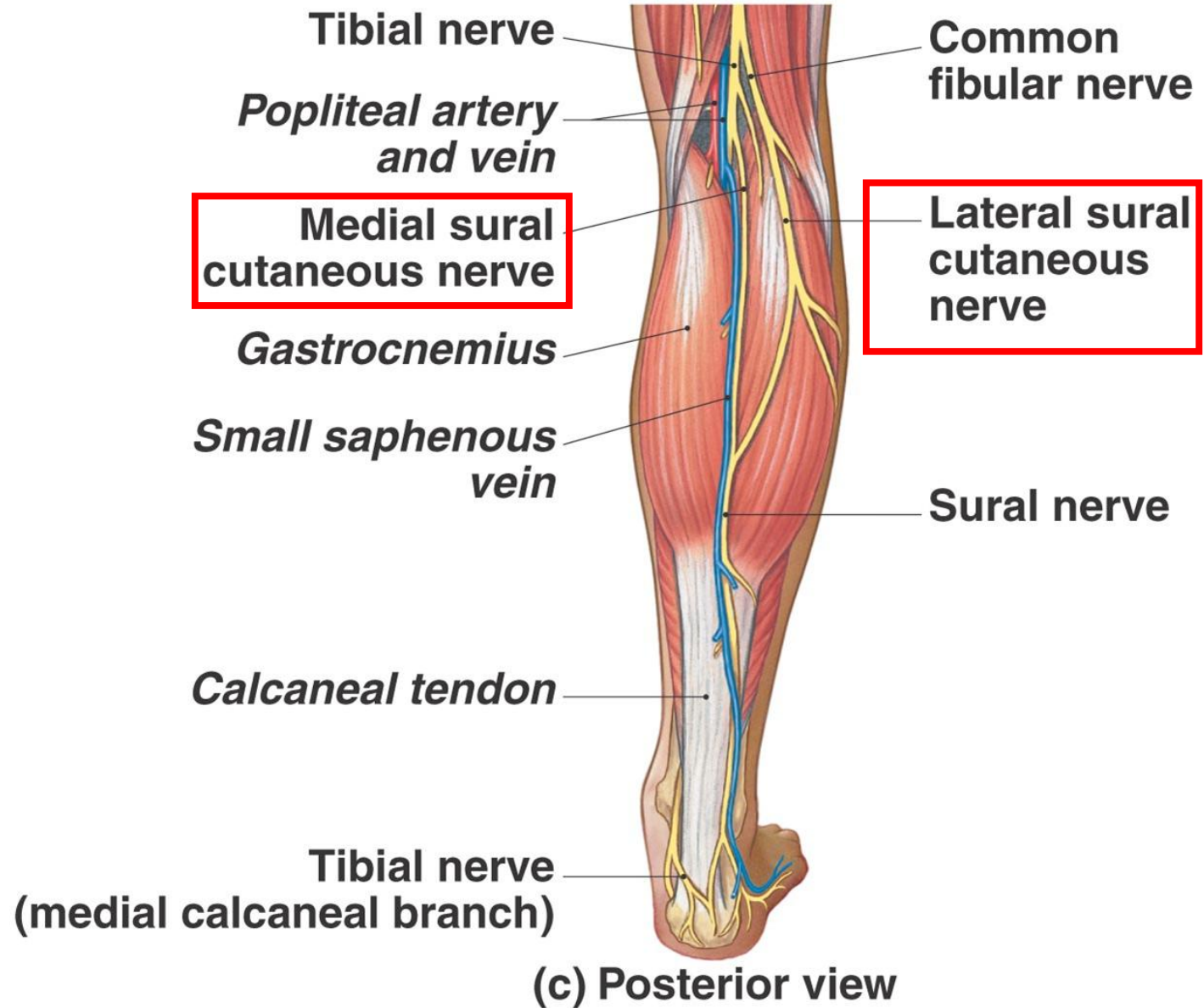


Note: Articular branches not shown

F. Netter M.D.



The **medial sural cutaneous nerve**, joins the **lateral sural cutaneous nerve** (from common peroneal nerve) to form the sural nerve, which is the skin of the posterolateral aspect of the leg and the lateral side of the foot.



Branches of Tibial Nerve in Foot

Medial Plantar Nerve

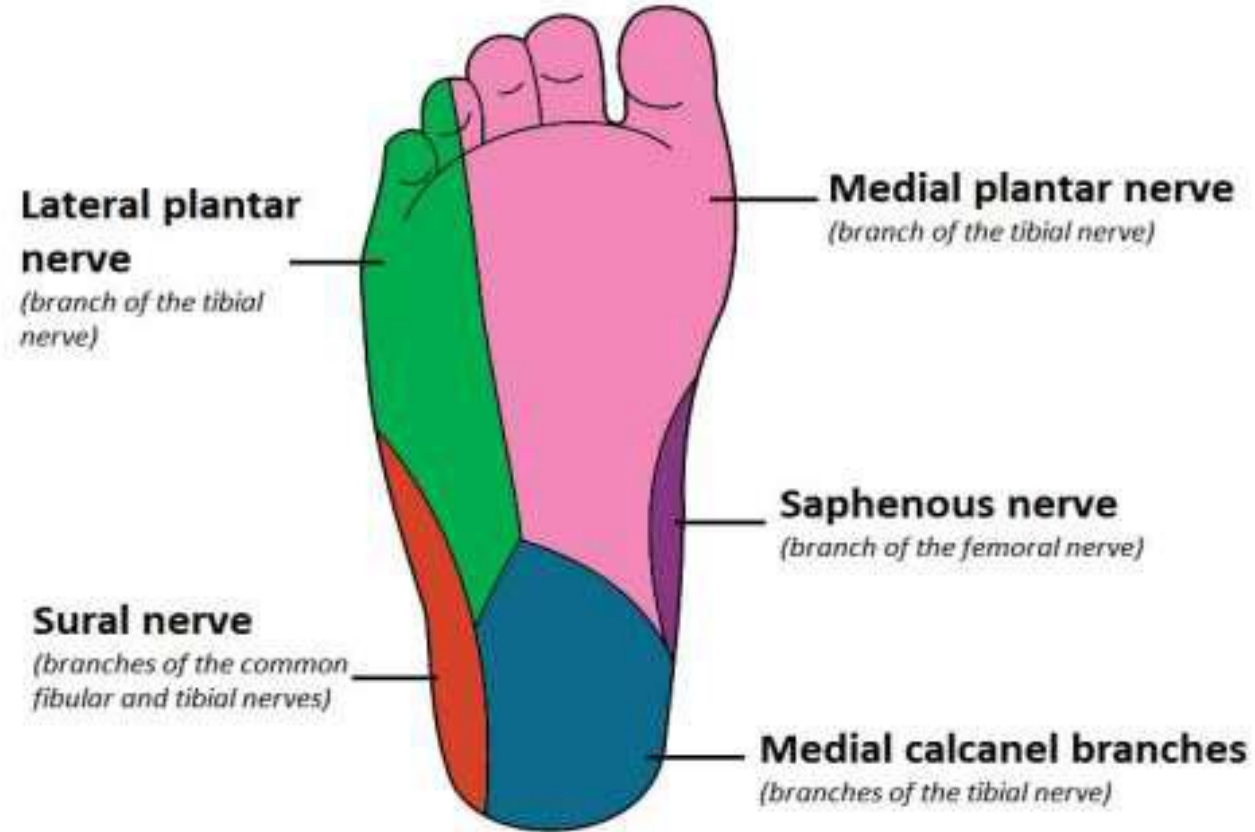
- Supply abductor hallucis, flexor digitorum brevis, flexor hallucis brevis and 1st lumbricals.
- Supply the skin of medial 2/3 plantar surface of the foot.

Lateral Plantar Nerve

- Supply remaining muscles of foot.
- Supply skin of lateral 1/3 palmar of the foot.

Medial Calcaneal Nerve

- Supply the skin of the heel



Common Peroneal Nerve

- Lateral terminal branch of the sciatic nerve.
- **Course:**

It descends obliquely along the lateral side of the popliteal fossa to the head of the fibula,



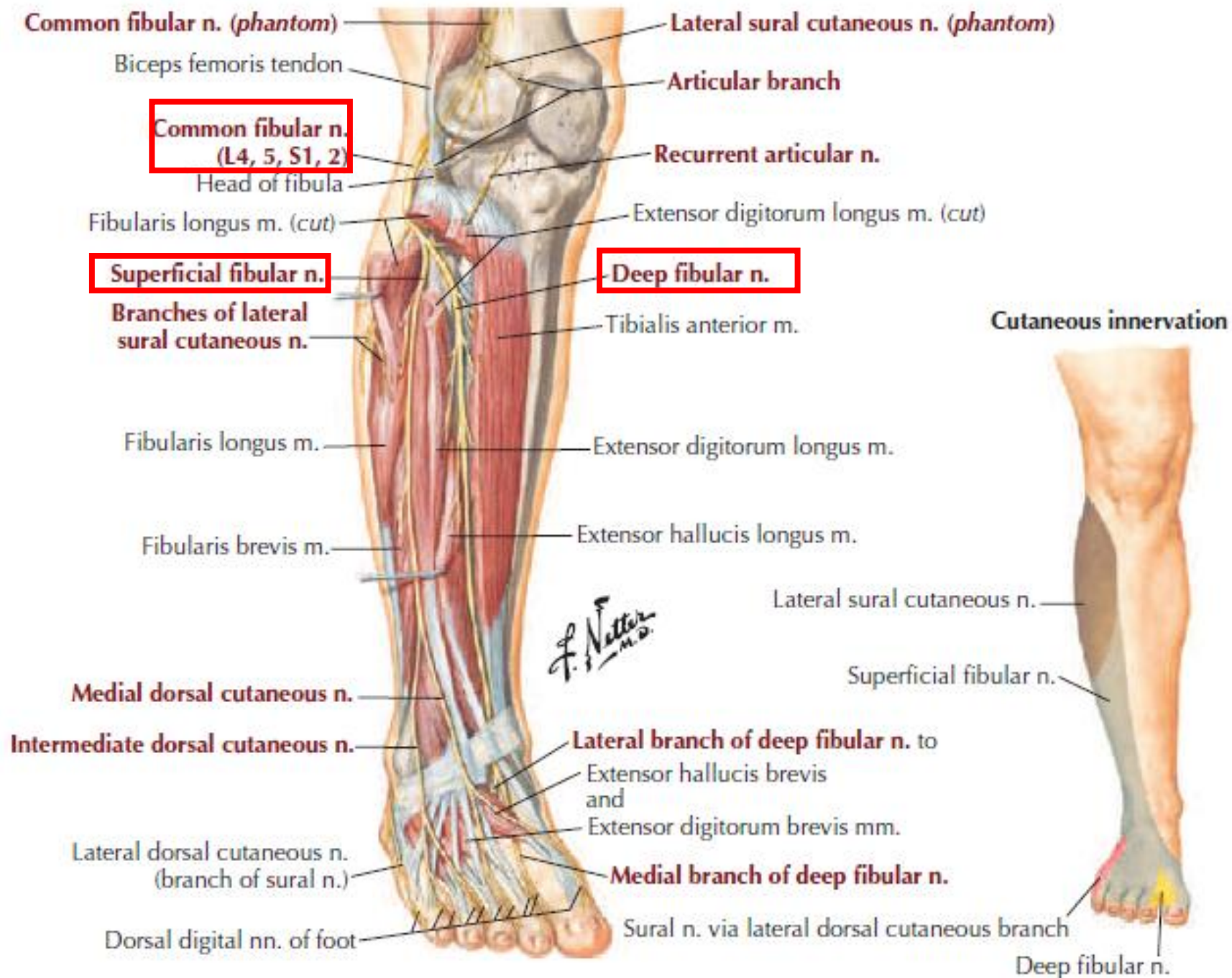
Lie between tendon biceps femoris and lateral head of gastrocnemius muscles and winds around neck of fibula.

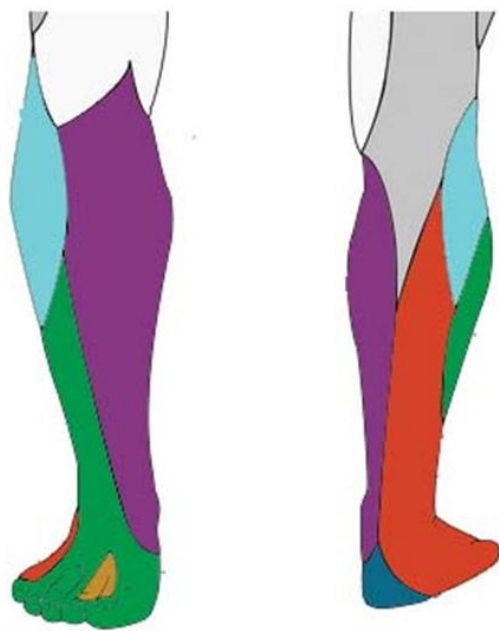
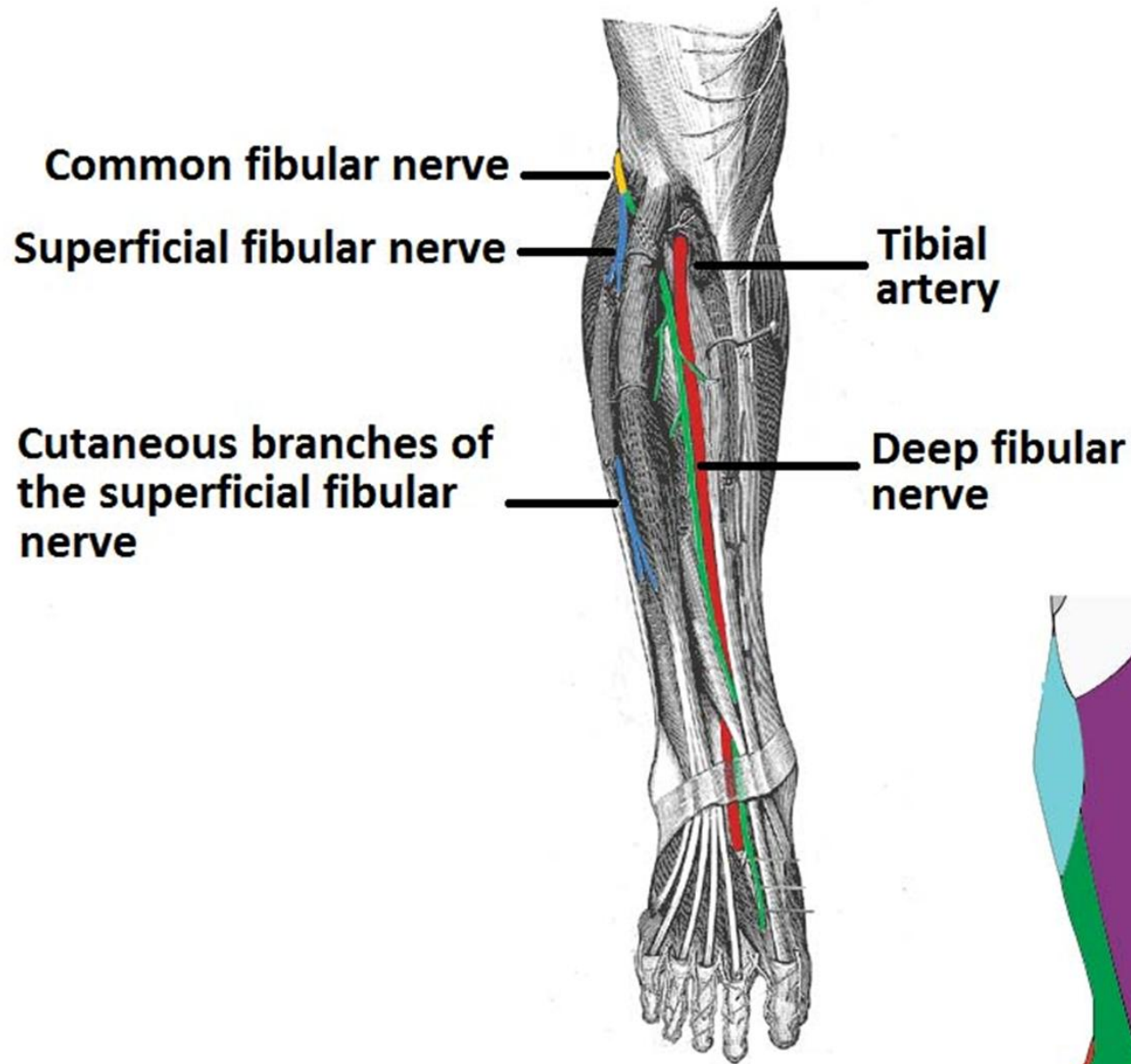


Then it divides to the **superficial** and **deep peroneal nerves**.

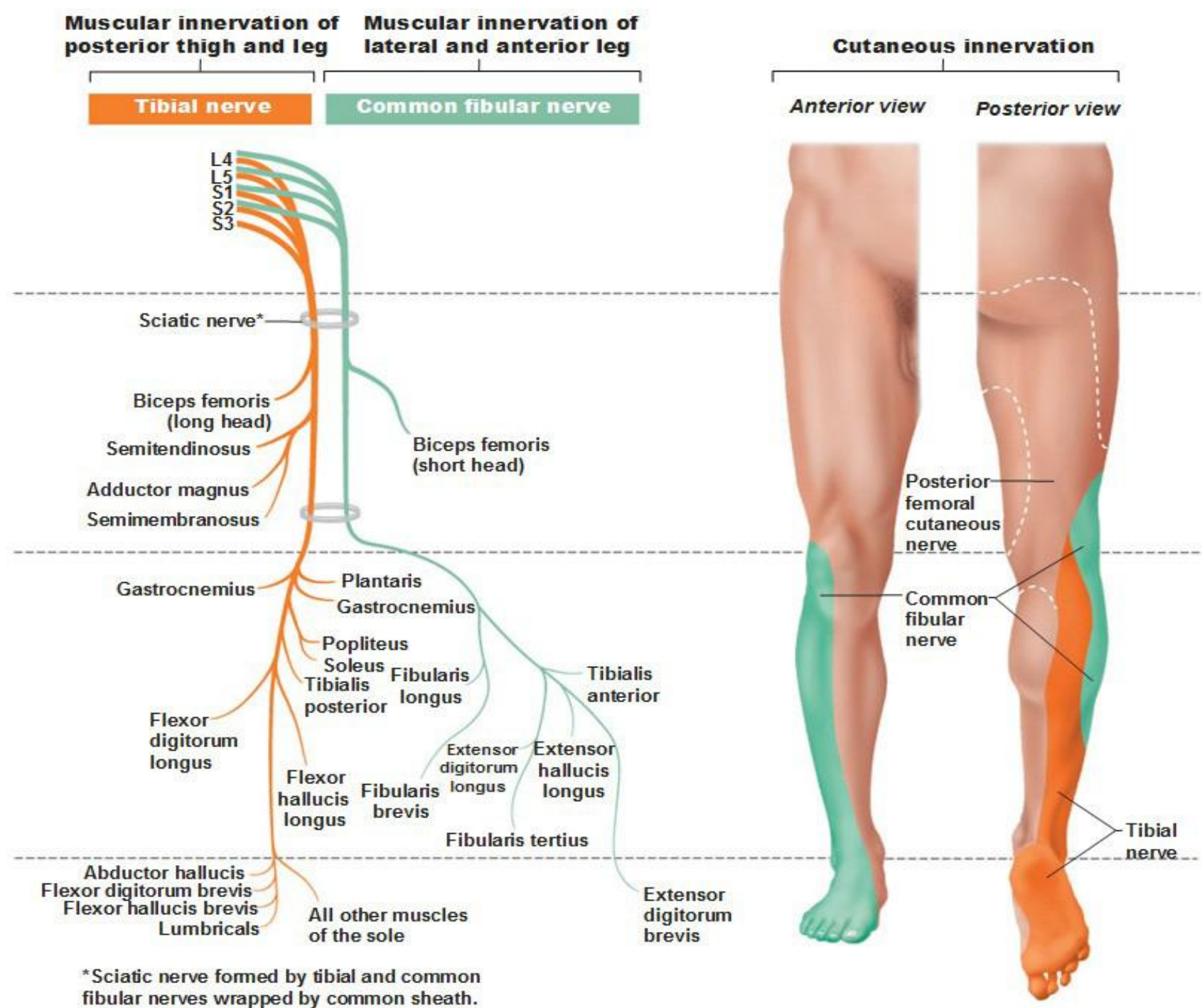
Common Peroneal Nerve

- **Superficial Peroneal Nerve** lies lateral aspect of the fibula and supplies muscles in the lateral compartment of the leg (*fibularis brevis and longus*) and terminal cutaneous branches to the *distal 1/3 anterior leg* and *greater part of dorsum surface of the foot.*
- **Deep Peroneal Nerve** lies anterior aspect of the leg and supplies *muscles anterior compartment of the leg* and dorsal foot muscle (*extensor digitorum brevis*). For cutaneous sensation supply *skin between great toe and 2nd toe.*





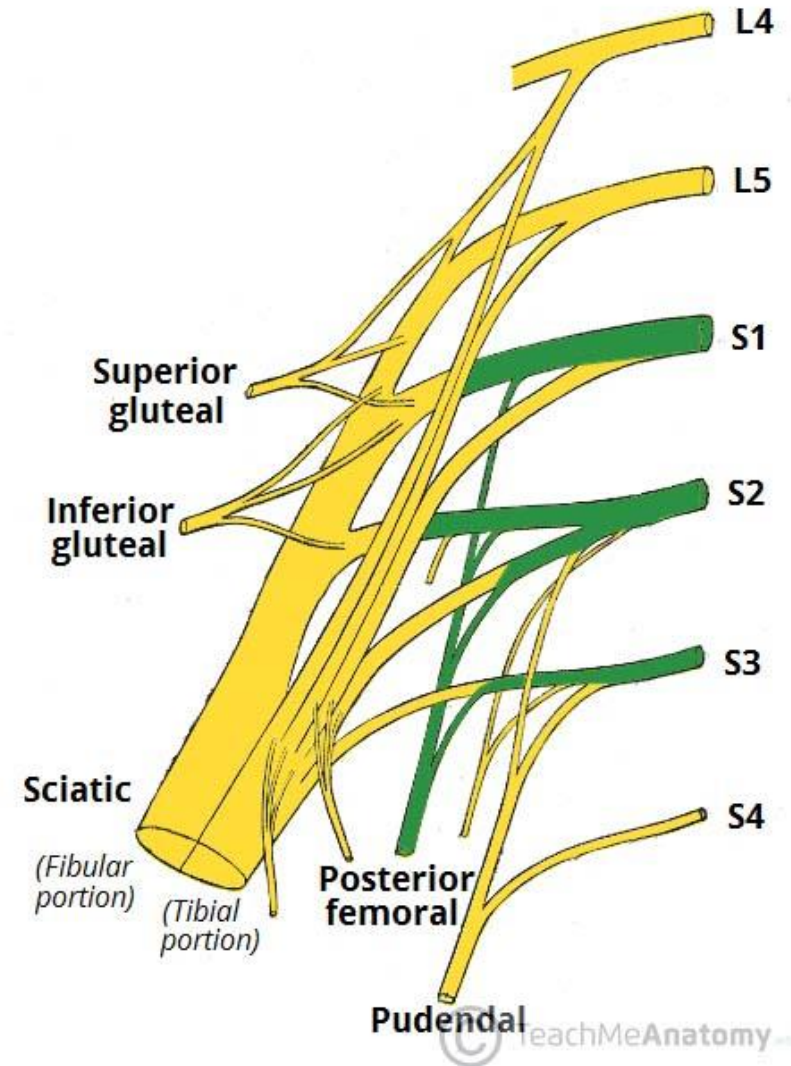
- Saphenous** *(from femoral)*
- Lateral sural** *(from common fibular)*
- Sural** *(from common fibular and tibial)*
- Superficial fibular**
- Deep fibular**
- Medial calcaneal** *(from tibial)*

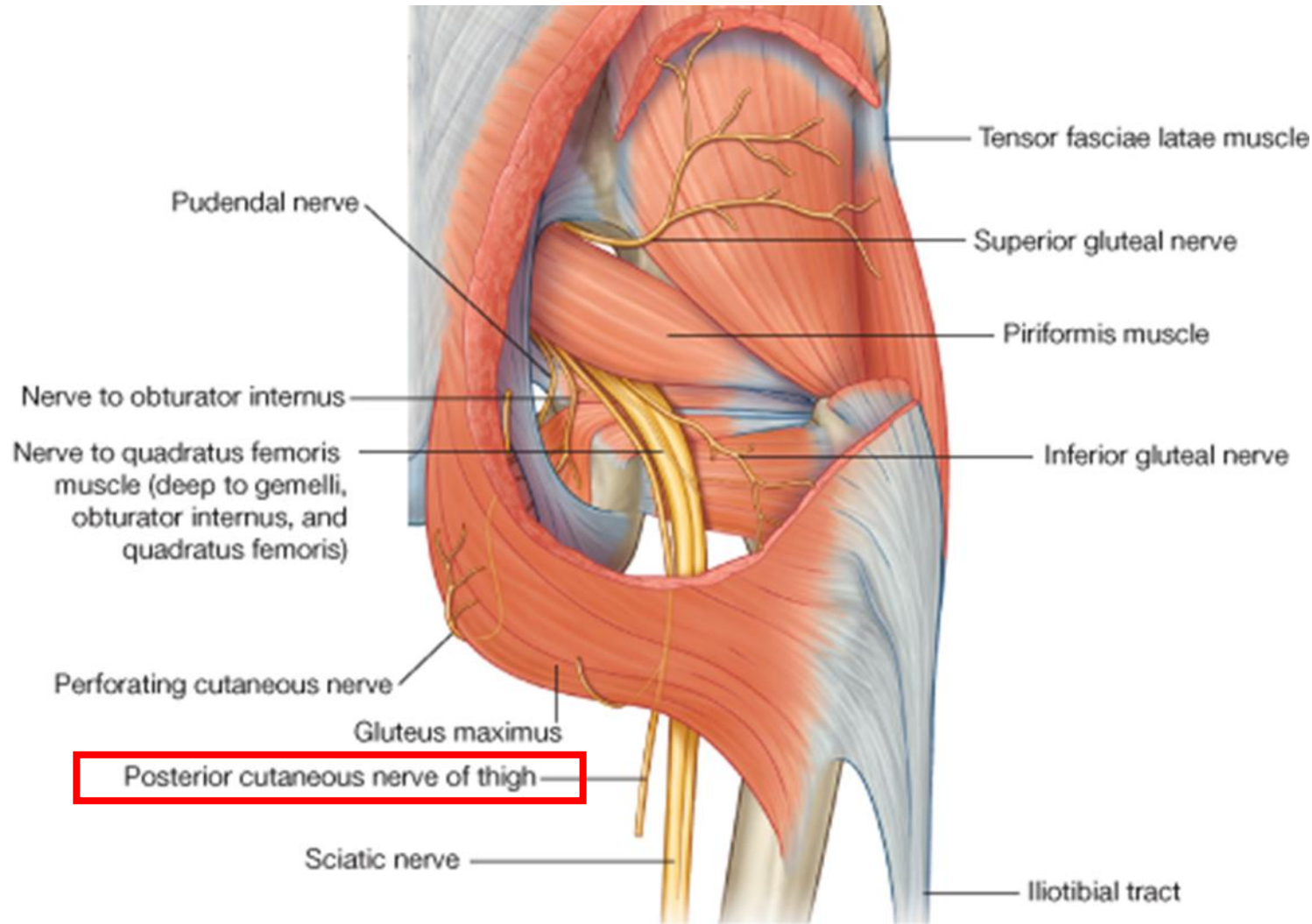


*Sciatic nerve formed by tibial and common fibular nerves wrapped by common sheath.

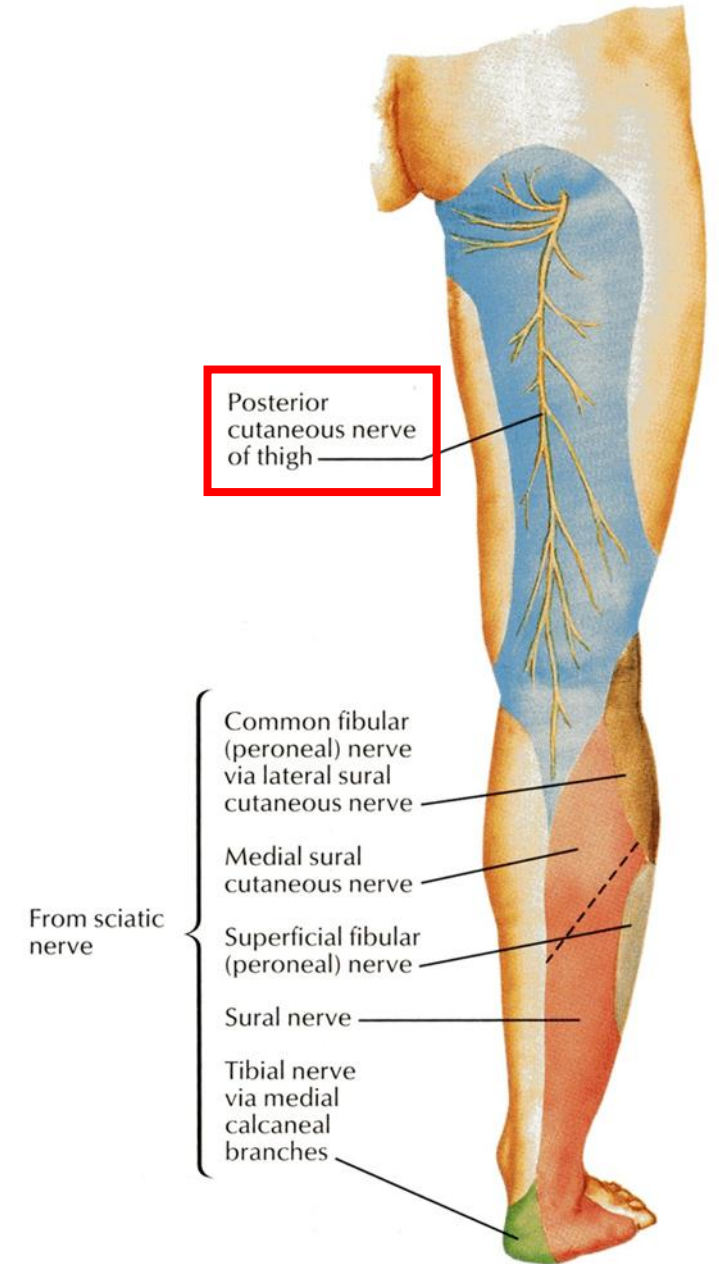
Posterior Cutaneous Nerve of thigh

- **Roots:** S1, S2, S3
- **Course:** leaves the pelvis via the greater sciatic foramen, entering the gluteal region below the piriformis. It descends deep to the gluteus maximus and runs down the back of the thigh to the knee.
- **Sensory Functions:** Innervates the skin on the posterior surface of the thigh and leg. Also innervates the skin of the perineum.





Cutaneous innervation



Pudendal Nerve

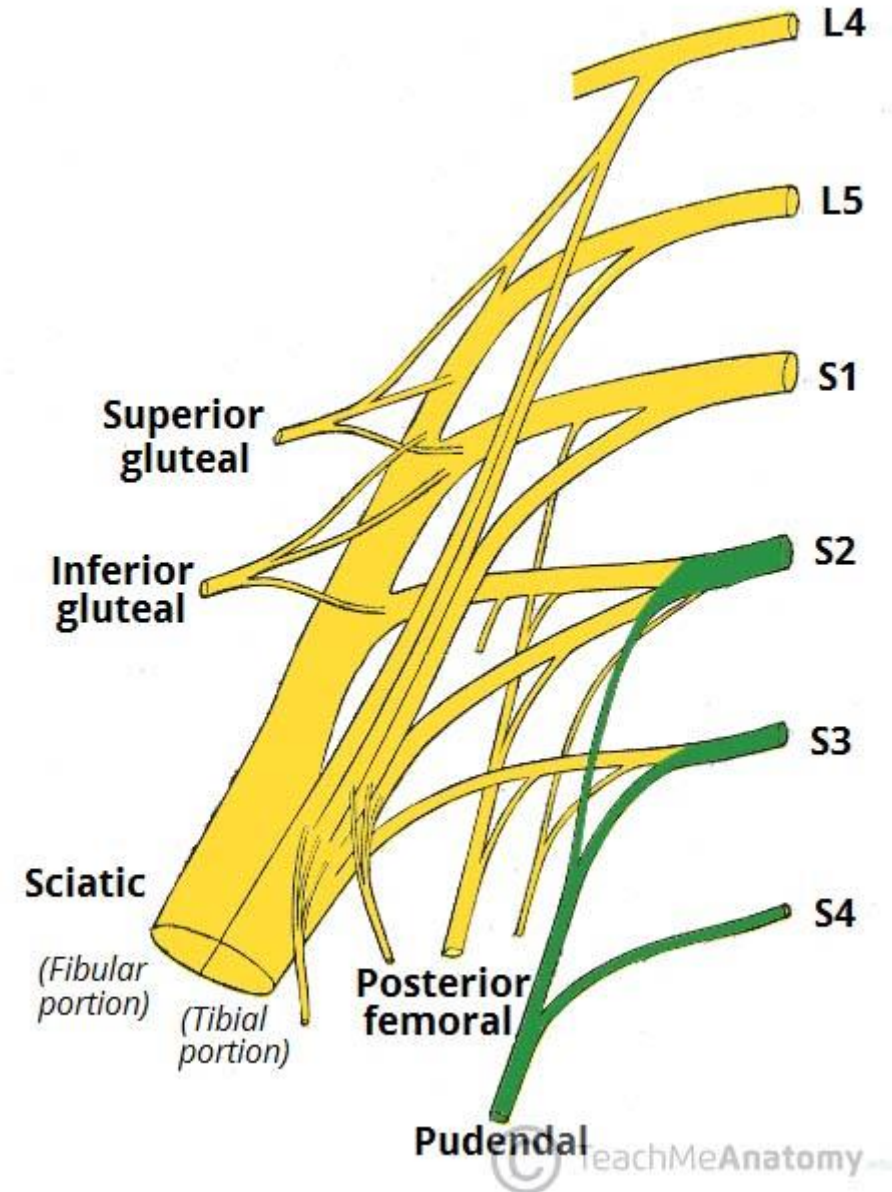
- **Roots:** S2, S3, S4

- **Course:**

leaves the pelvis via the greater sciatic foramen, entering the gluteal region below the piriformis.

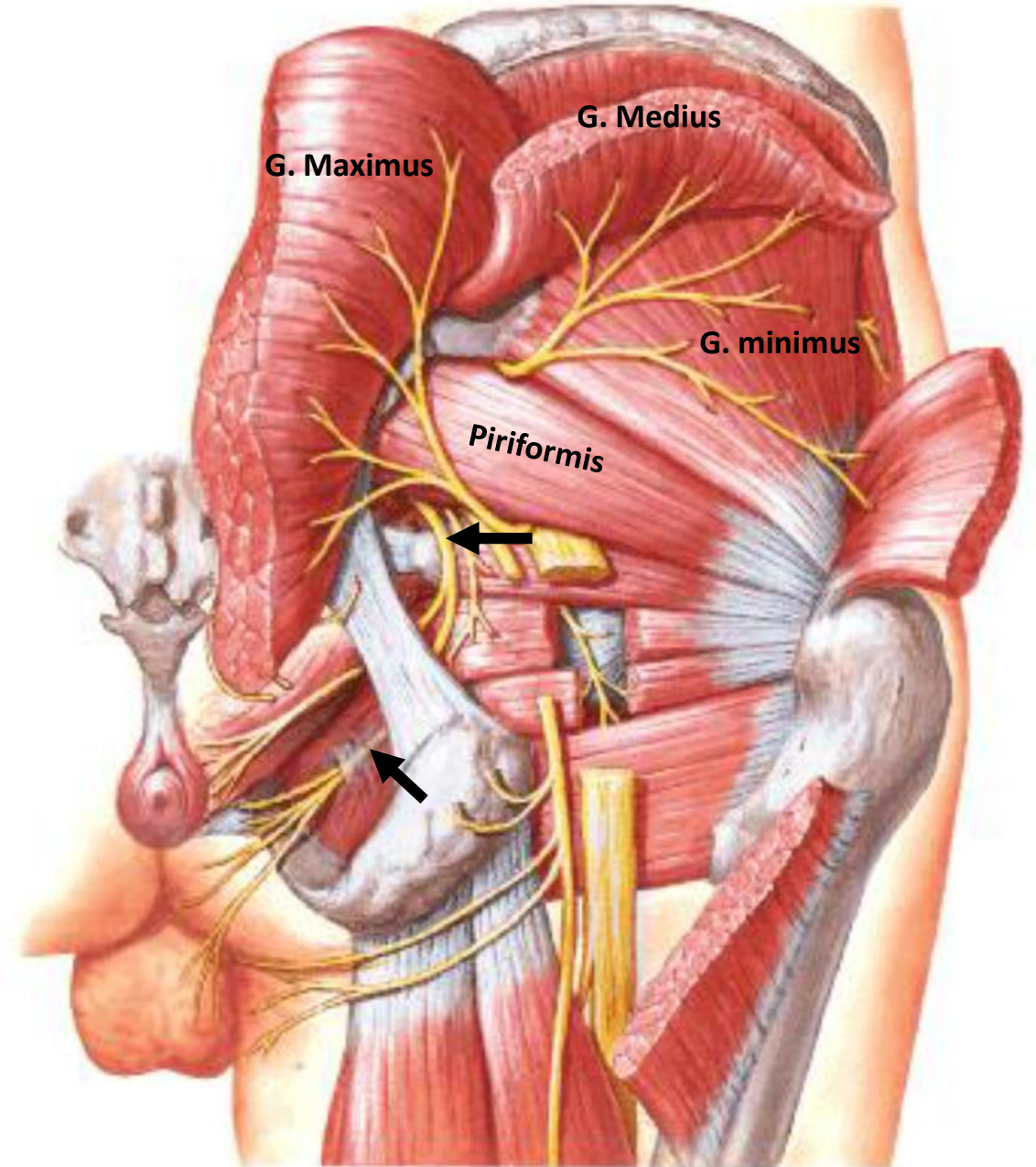
↓
re-enters via the lesser sciatic foramen to the perineum.

↓
It moves anterosuperiorly along the lateral wall of the ischiorectal fossa and terminates by dividing into several branches.

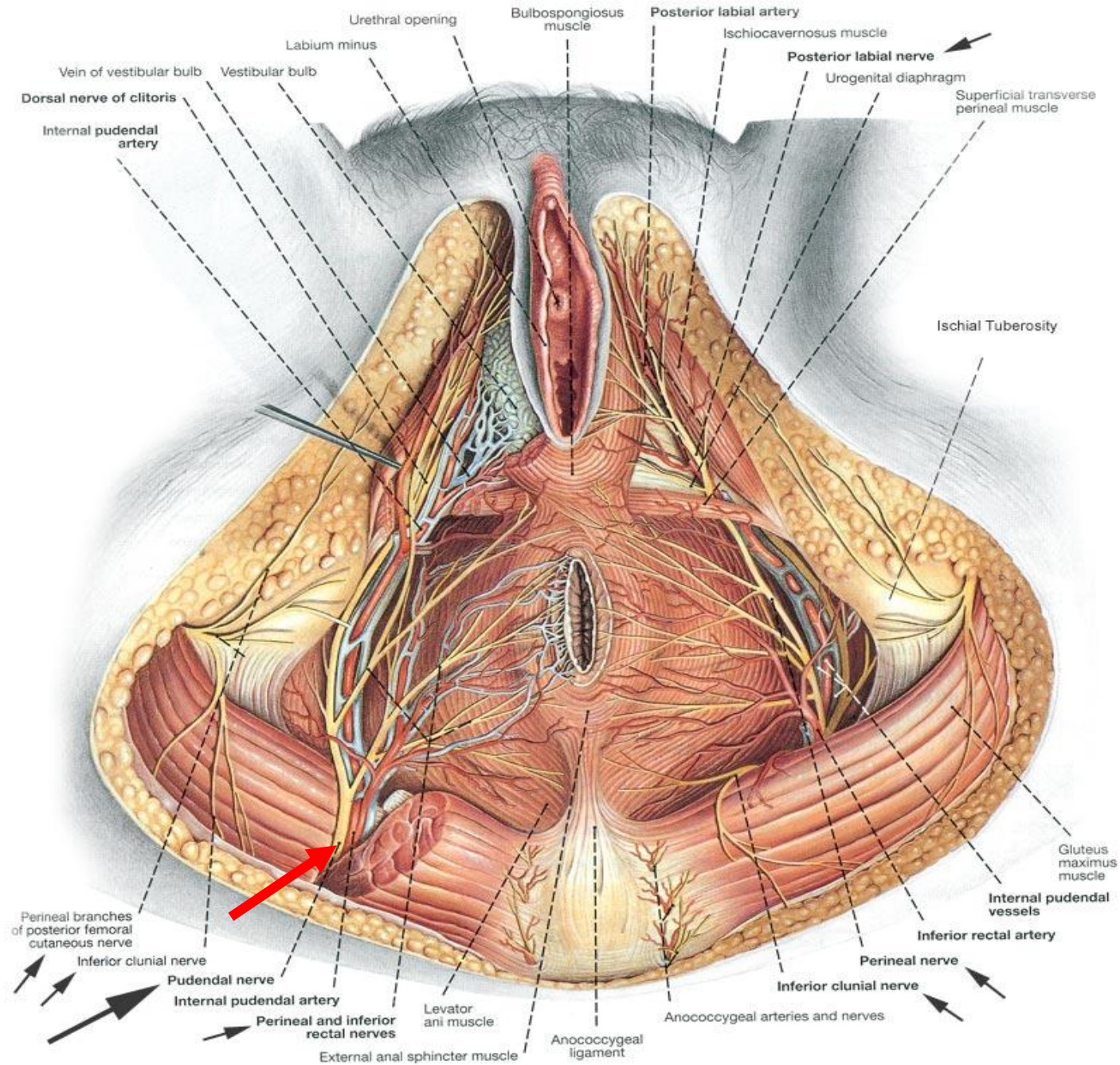


Pudendal Nerve

- **Motor Functions:** Innervates the skeletal muscles in the perineum, the external urethral sphincter, the external anal sphincter, levator ani.
- **Sensory Functions:** Innervates the penis and the clitoris and most of the skin of the perineum.

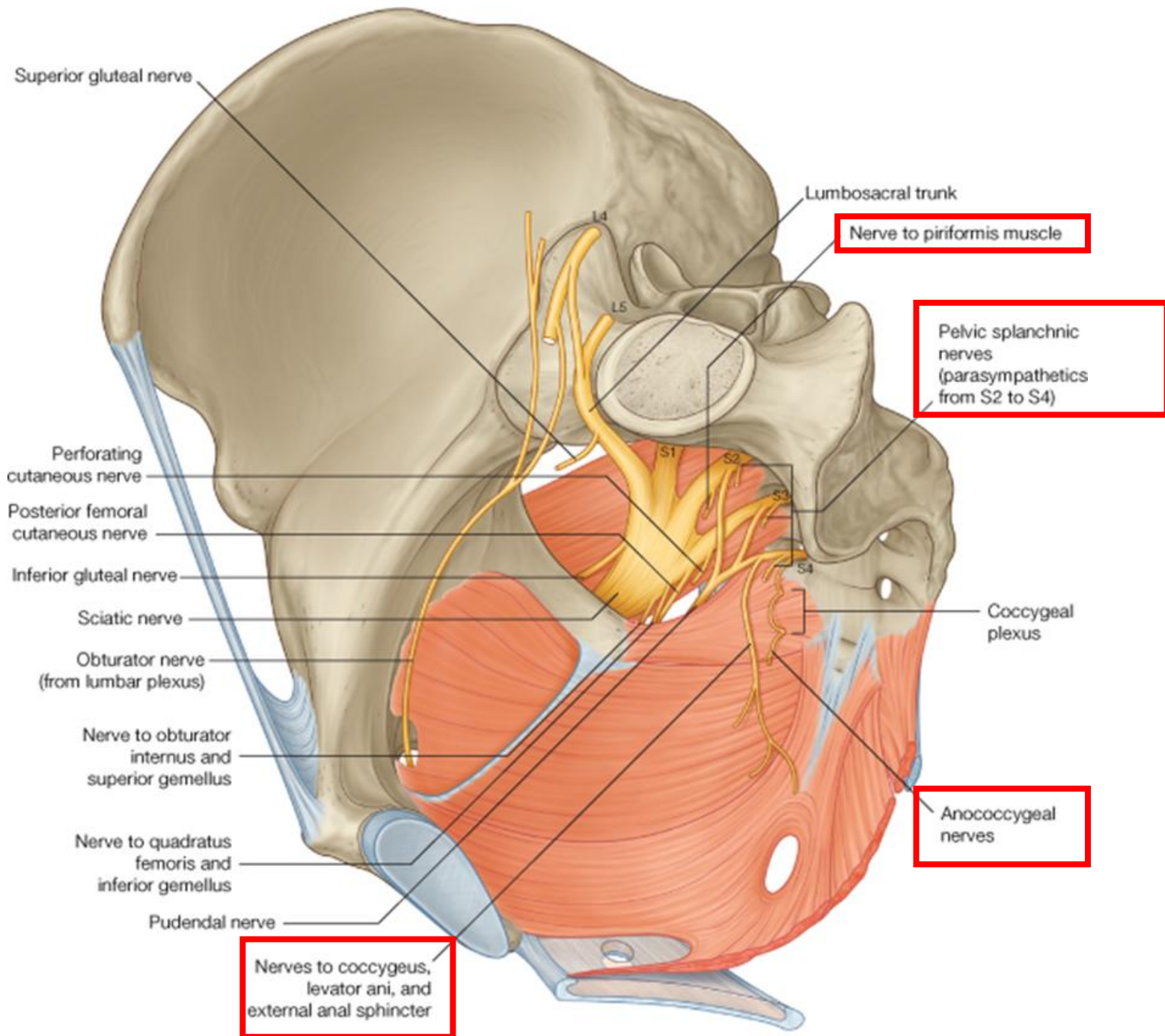


Female Pudendal Nerve

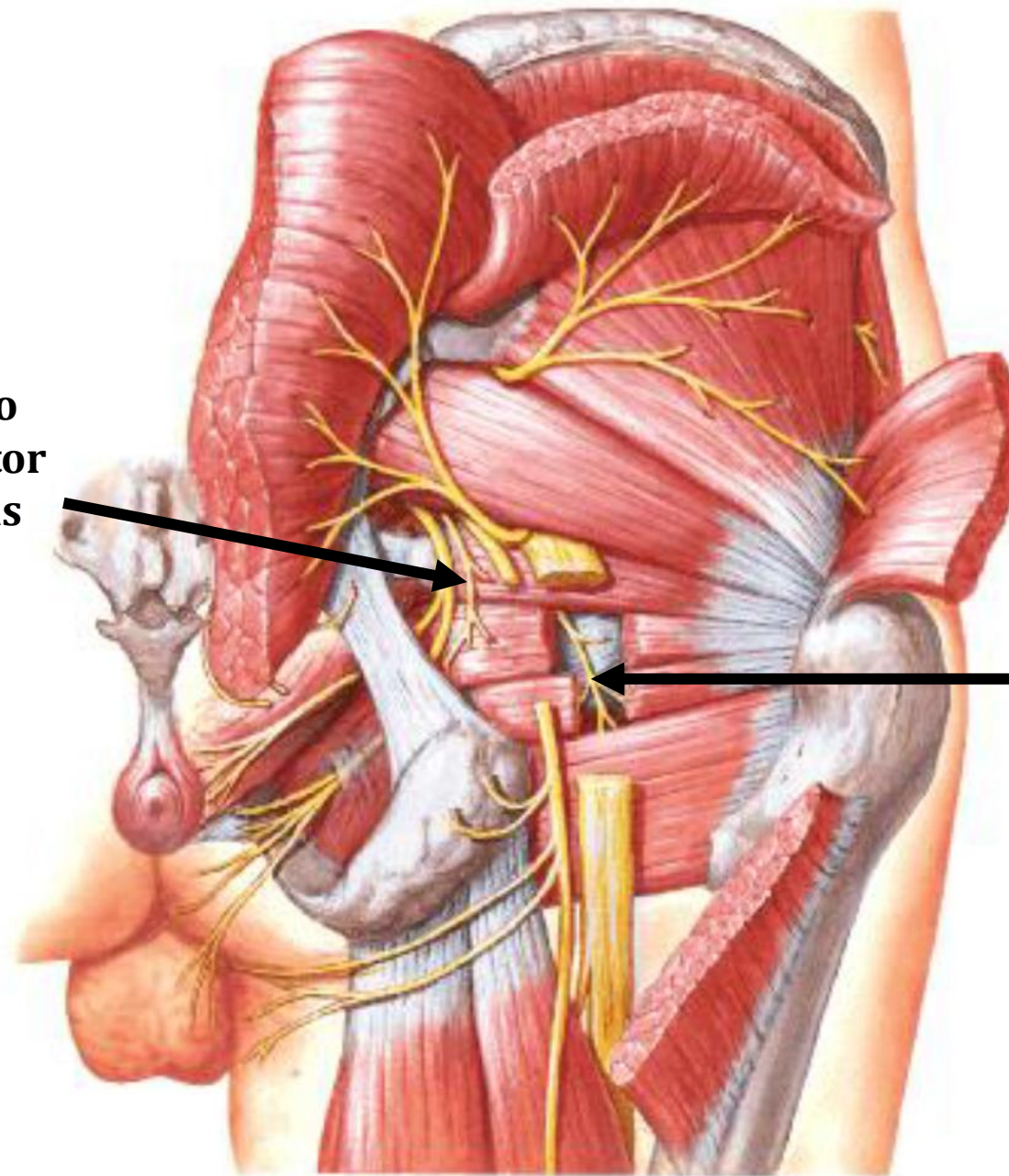


Other Branches of Sacral plexus

- These tend to be nerves that directly supplying muscles
- Ex:
 - **Nerve to piriformis**
 - **Nerve to obturator internus**
 - **Nerve to quadratus femoris**



**Nerve to
obturator
internus**



**Nerve to
quadratus
femoris**

Clinical Anatomy

Disorders Affecting the Plexus

- Trauma
- Intraoperative damage
- Retroperitoneal hemorrhage
- Radiotherapy
- Neoplastic invasion
- Idiopathic lumbosacral plexopathy

Upper Plexus

- Nerve roots: L2 - L4
- **Muscles involved:**
 - Weakness of thigh flexion (Psoas)
 - Thigh adduction
 - Knee extension (Quadriceps)
- **Sensory loss:**
 - Anterior thigh and medial leg
 - Absent knee jerk

Lower Plexus

- Nerve roots: L4 - S2
- **Muscles involved:**
 - Weakness of thigh extension (gluteal)
 - Knee flexion (hamstring),
 - Foot dorsiflexion & plantar flexion
- **Sensory loss:**
 - Posterior thigh,
 - Lateral leg and entire foot,
 - Absent ankle jerk

Femoral Nerve Injury

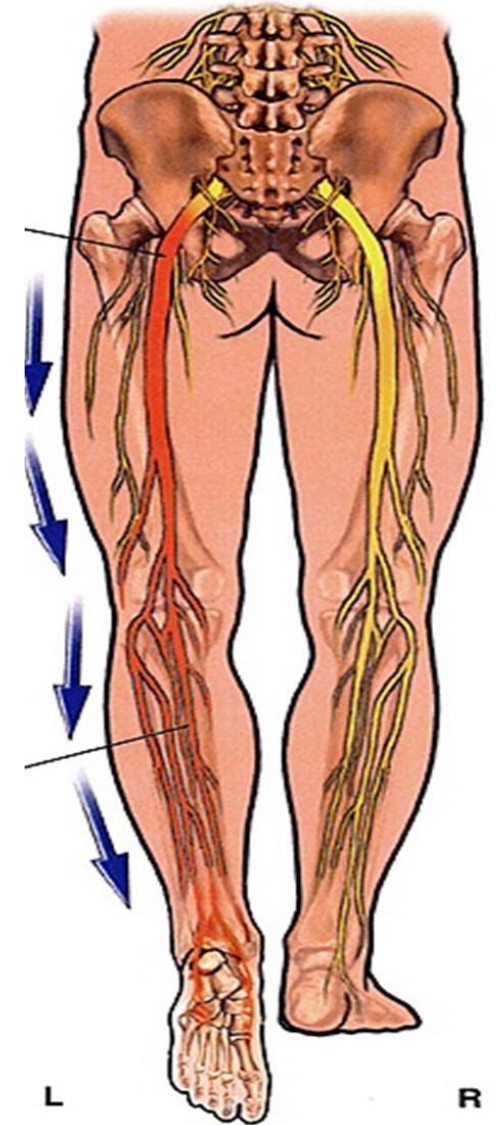
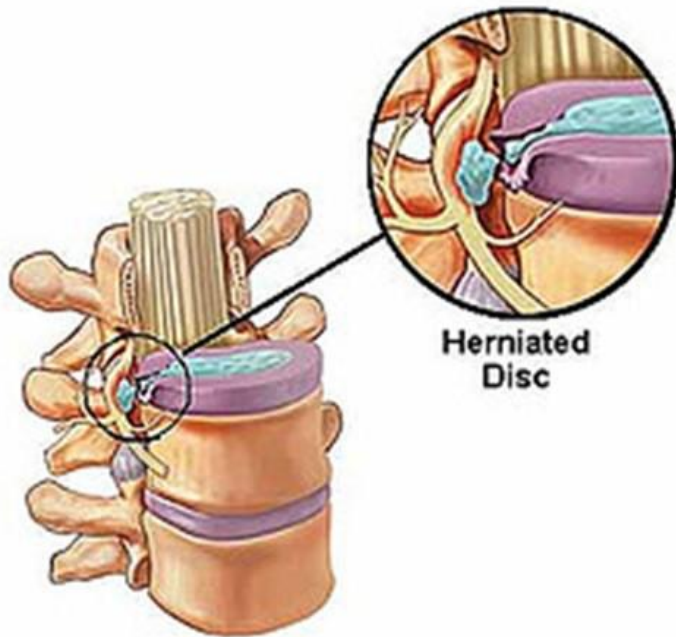
- **Causes of injury:**
 - Gunshot wound
 - by pressure or traction during an operation.
- **Clinical features:**
 - Quadriceps action is lacking: unable to extend the knee actively.
 - Numbness of the anterior thigh and medial aspect of the leg.
 - knee reflex is depressed.

Sciatic Nerve Injury

- **Causes of injury:**
 - Intervertebral disc prolapses
 - Dislocation of hip joint
 - Intramuscular injection
 - Penetrating wound and fracture of pelvis.
 - Inflammation of sciatic nerve

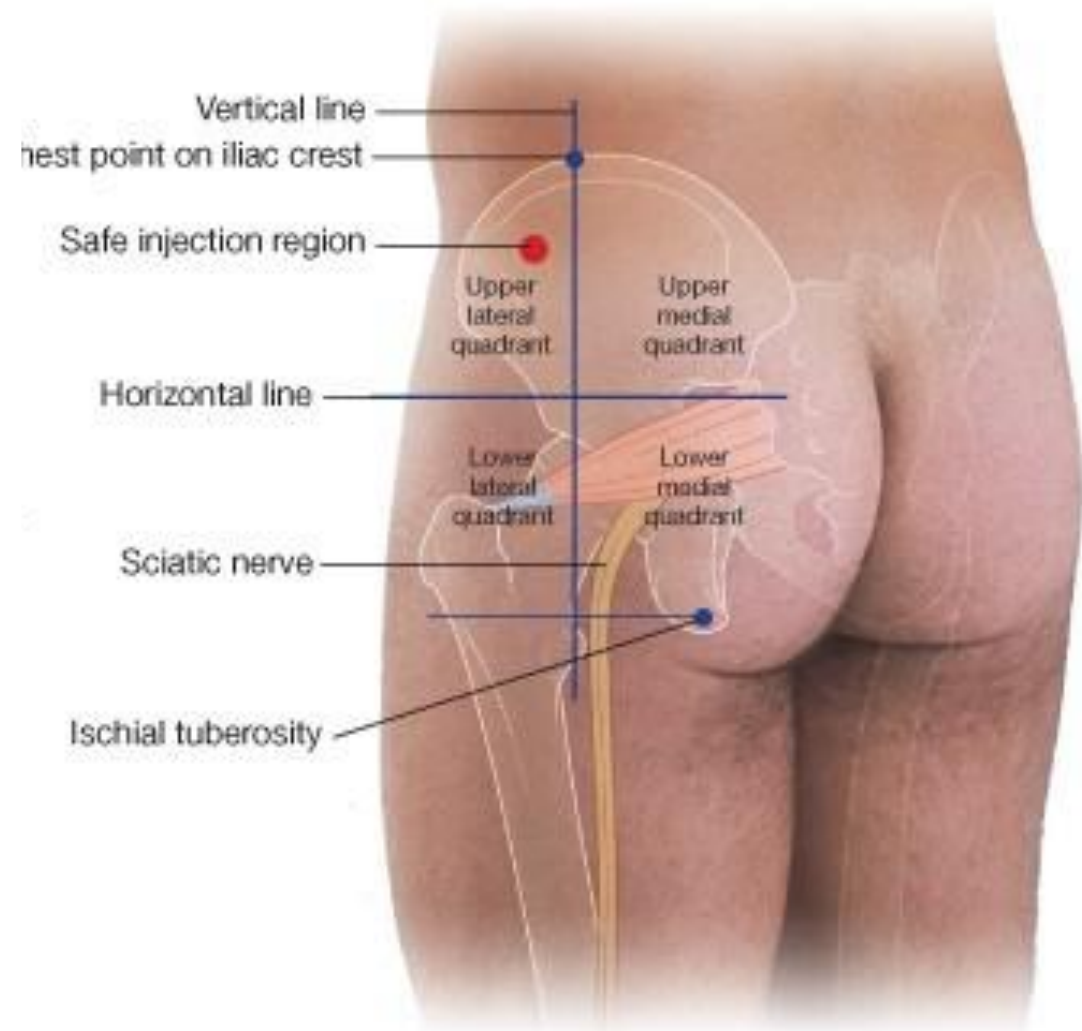
Sciatic Nerve Injury

- **Sciatic nerve injury in intervertebral disc prolapses**



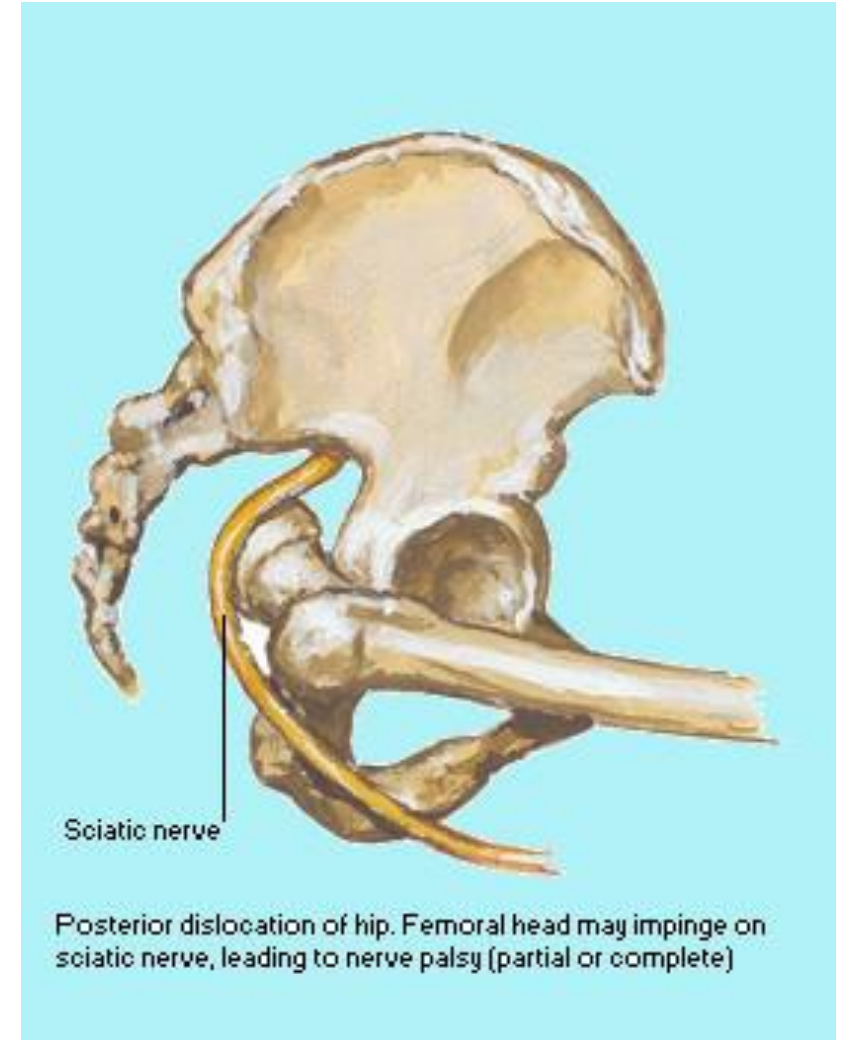
Sciatic Nerve Injury

- **Sciatic nerve injury in misplaced intra gluteal injection:**
 - Sciatic nerve passes midway between greater trochanter and ischial tuberosity.



Sciatic Nerve Injury

- **Sciatic nerve injury in dislocation of hip joint:**
 - Sciatic nerve travels in gluteal region on the posterior surface of hip joint.



Sciatic Nerve Injury

- **Clinical features:**

- Hamstring muscles and all the muscles below knee;
- Severe impairment in knee flexion
- Loss of all movements at foot
- Foot drop due to weight of foot.

- All sensation below knee except the medial aspect of leg and foot up to base of big toe.
- Loss of sensation of sole makes the patient vulnerable to trophic ulcers

Sciatic Nerve Injury

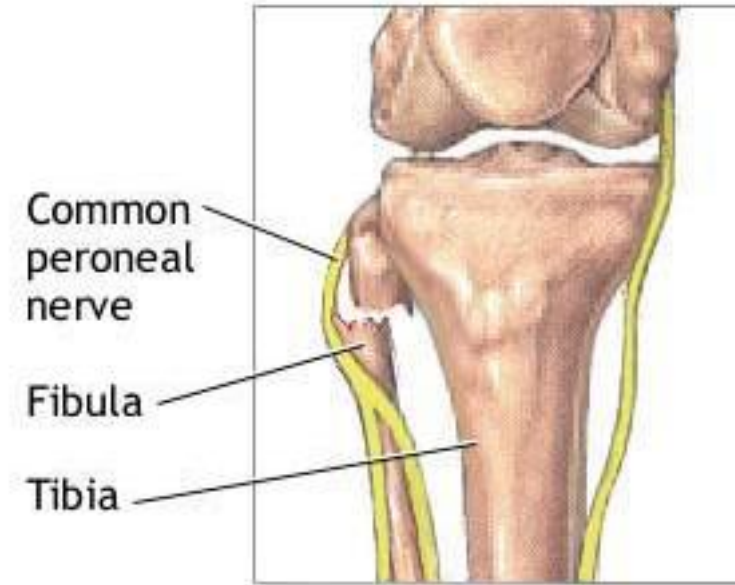
Sciatica

- **Pain along the sensory distribution of sciatic nerve:**
 - Posterior aspect of thigh
 - Posterior and lateral sides of leg
 - Lateral part of foot



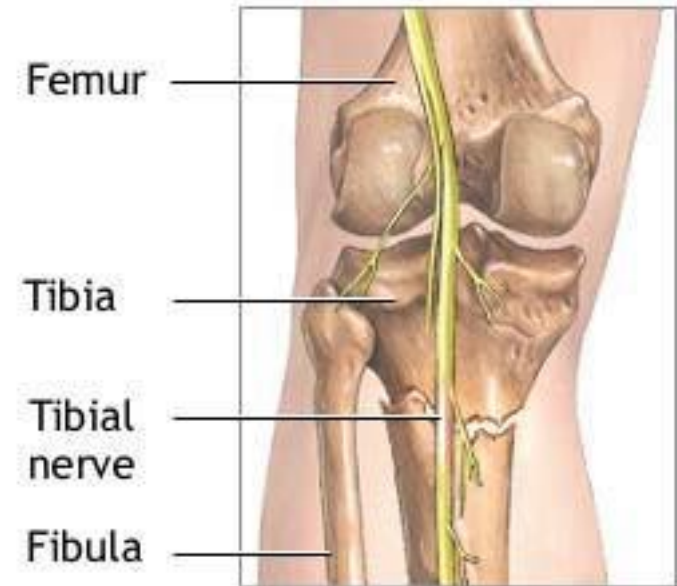
Injury to Common Peroneal Nerve

- **Causes of injury:**
 - Fracture of fibular neck
 - Entrapment by leg casts or splints
- **Muscles paralyzed**
 - Anterior and lateral muscles of leg
 - Deformity: foot is plantar flexed and inverted due to actions of unopposed plantar flexors and invertors.
- **Sensory loss:** Anterior and lateral side of leg, dorsum of foot and digits



Injury to Tibial Nerve

- **Causes of injury:**
 - Rarely injured in fractures of upper end of tibia
 - penetrating wound
- **Muscles paralyzed**
 - All muscles of back of leg and sole
 - Deformity: dorsiflexion and eversion of foot.
- **Sensory loss:** Whole of the sole of foot-- May result into trophic ulcers.



Break in tibia
causes damage
to tibial nerve

Thank You

Ayman.Alzubi@yu.edu.jo