

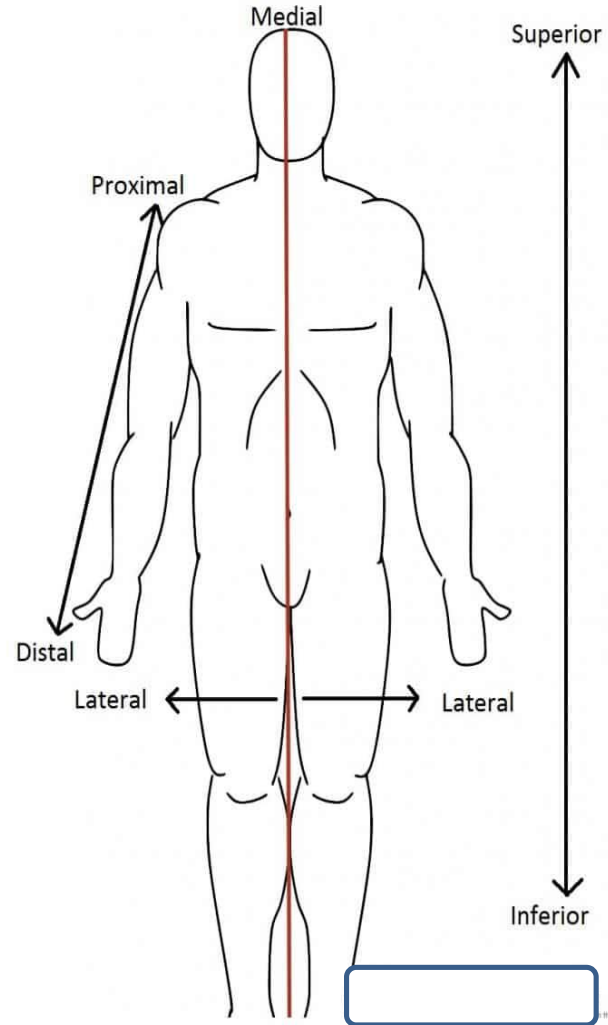
AL MUSTAQBAL UNIVERSITY

College of Medicine / First Year

ANATOMY

(L5) The Leg

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Learning Objectives

Define the regions and boundaries of the leg from the knee to the foot

- Explain leg compartmentalization by describing the role of deep fascia, intermuscular septa, and the interosseous membrane

- Identify the functions of ankle retinacula in positioning tendons and preventing "bowstringing"

- Detail the contents of the three compartments, including the origin, insertion, action, and innervation of all muscles

- Map the neurovascular courses, tracing the major arteries (anterior/posterior tibial) and nerves (fibular/tibial) through the leg

- Describe superficial anatomy, including cutaneous nerves, the saphenous venous system, and lymphatic drainage

- Apply clinical reasoning to diagnose and treat Anterior Compartment Syndrome and Ruptured Tendo Calcaneus

Regions of lower limb

The lower limbs have six major regions

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



LEG

The leg is the middle part of the lower limb proper, that is the part between the knee and the ankle.

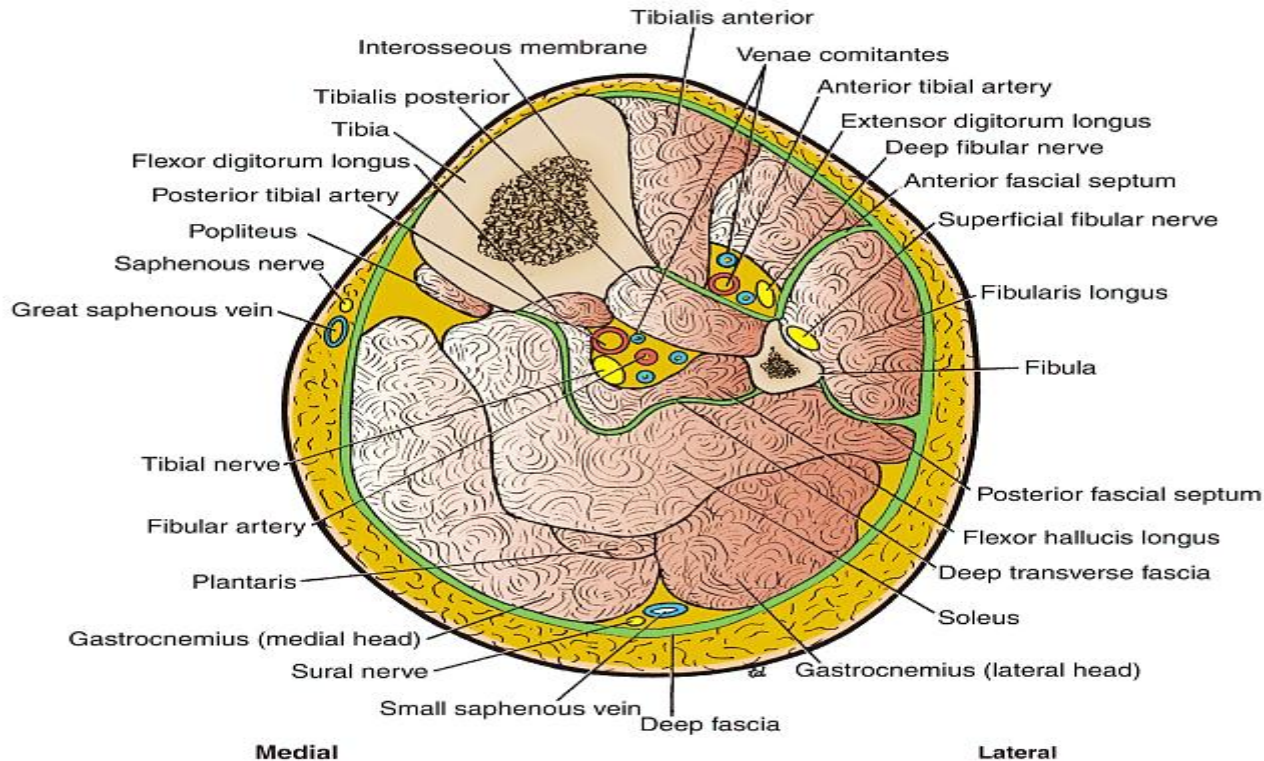
Fascia

The deep fascia of the leg forms the **compartments** of the leg and also forms a series of **retinacula** that aid the mechanical efficiency of the muscles of the leg.

Interosseous Membrane

The interosseous membrane binds the tibia and fibula together and provides attachment for neighboring muscles.

Transverse section through the middle of the right leg as seen from above.



Ankle Retinacula

The retinacula are thickenings of the deep fascia that keep the long tendons around the ankle joint in position, prevent the long tendons from bowstringing, and act as pulleys.

Superior Extensor Retinaculum

The superior extensor retinaculum is attached to the distal ends of the anterior borders of the fibula and the tibia.

Inferior Extensor Retinaculum

The inferior extensor retinaculum is a Y-shaped band located in front of the ankle joint. Fibrous bands separate the tendons into compartments, each of which is lined by a synovial sheath.

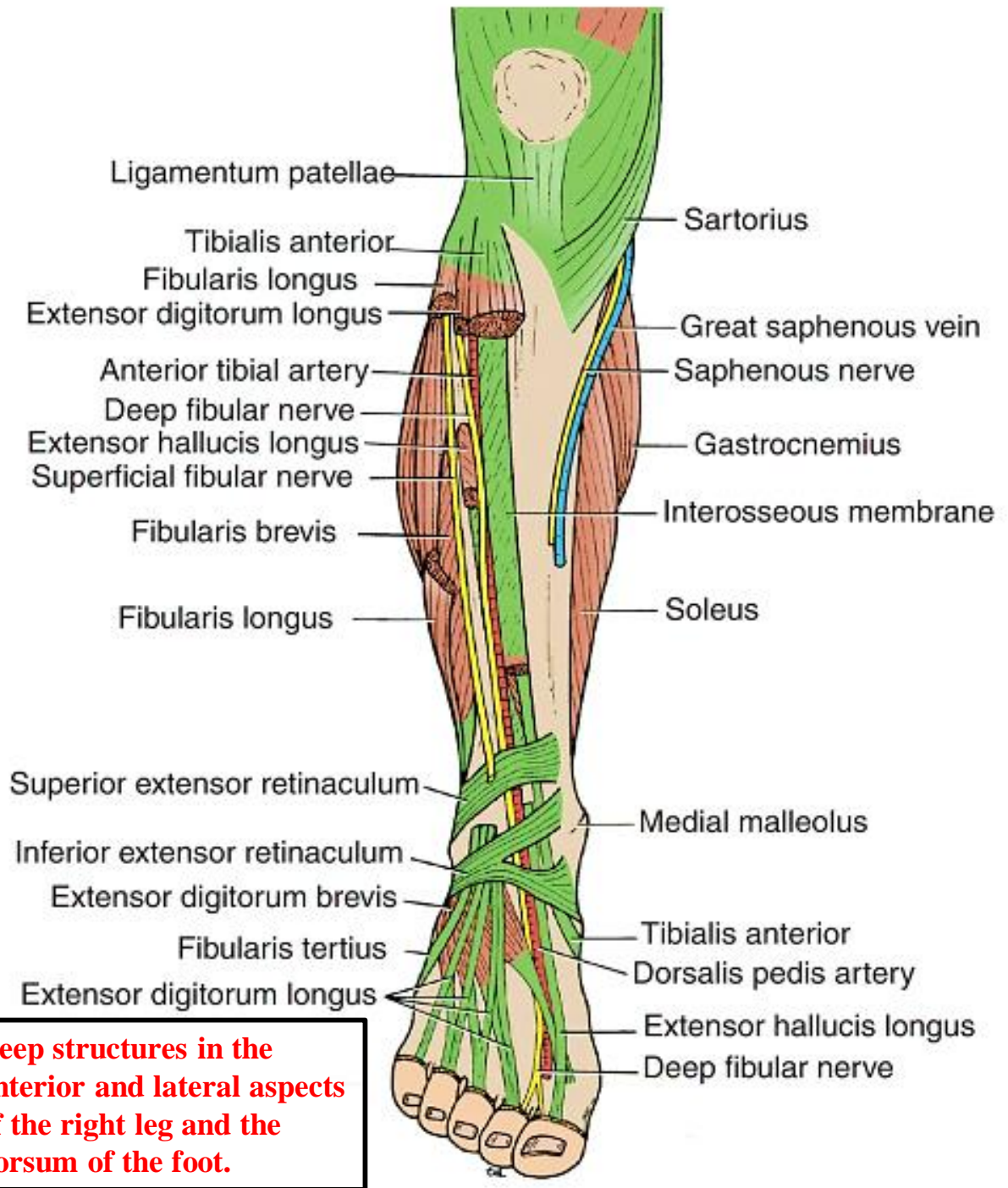
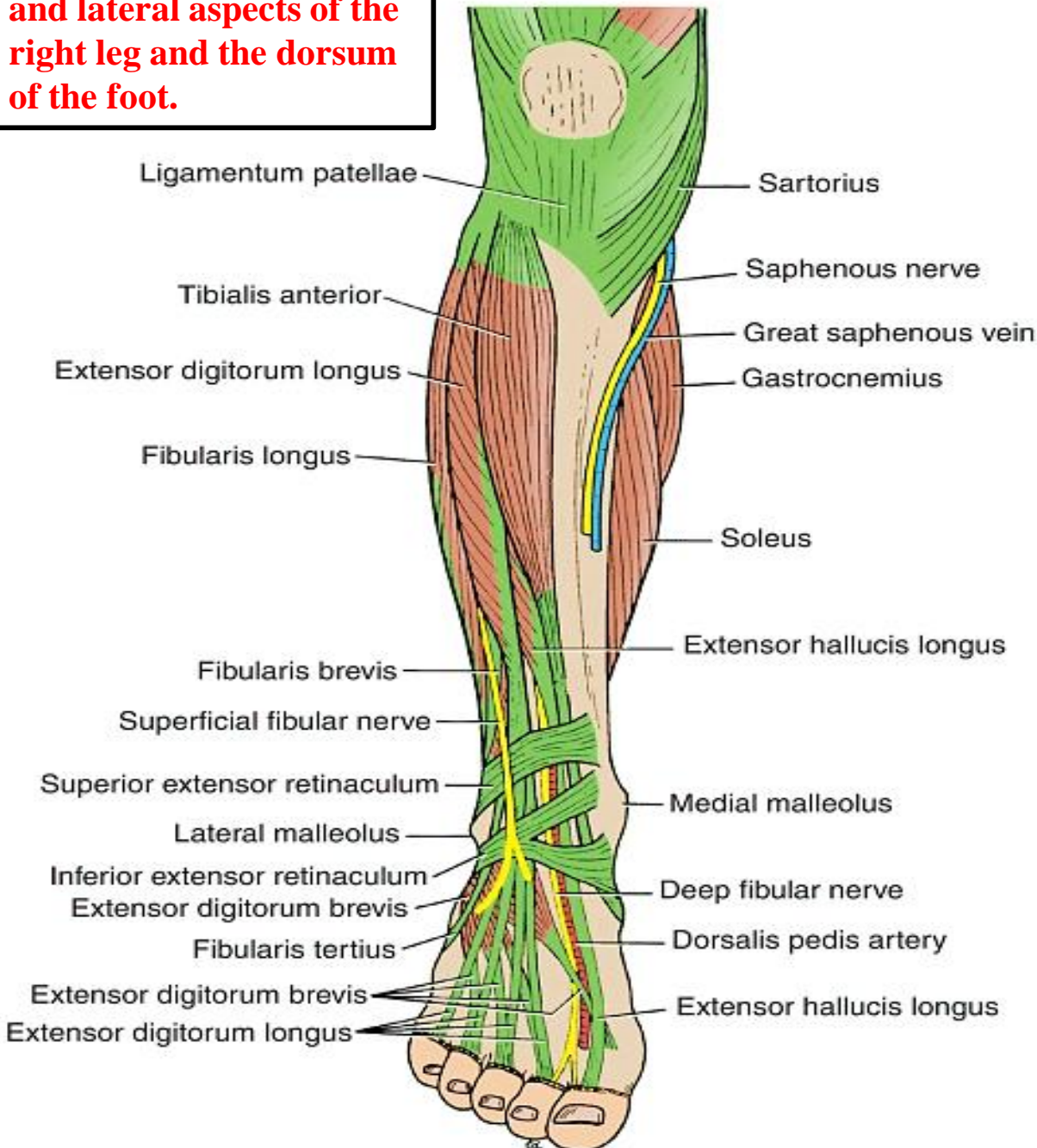
Flexor Retinaculum

The flexor retinaculum extends downward and backward from the medial malleolus to attach to the medial surface of the calcaneum. It binds the tendons of the deep muscles of the back of the leg to the back of the medial malleolus as they pass forward to enter the sole. The tendons lie in compartments, each of which is lined by a synovial sheath.

Superior Fibular (Peroneal) Retinaculum: connects the lateral malleolus to the lateral surface of the calcaneum. It binds the tendons of the fibularis longus and brevis to the back of the lateral malleolus. The tendons have a common synovial sheath.

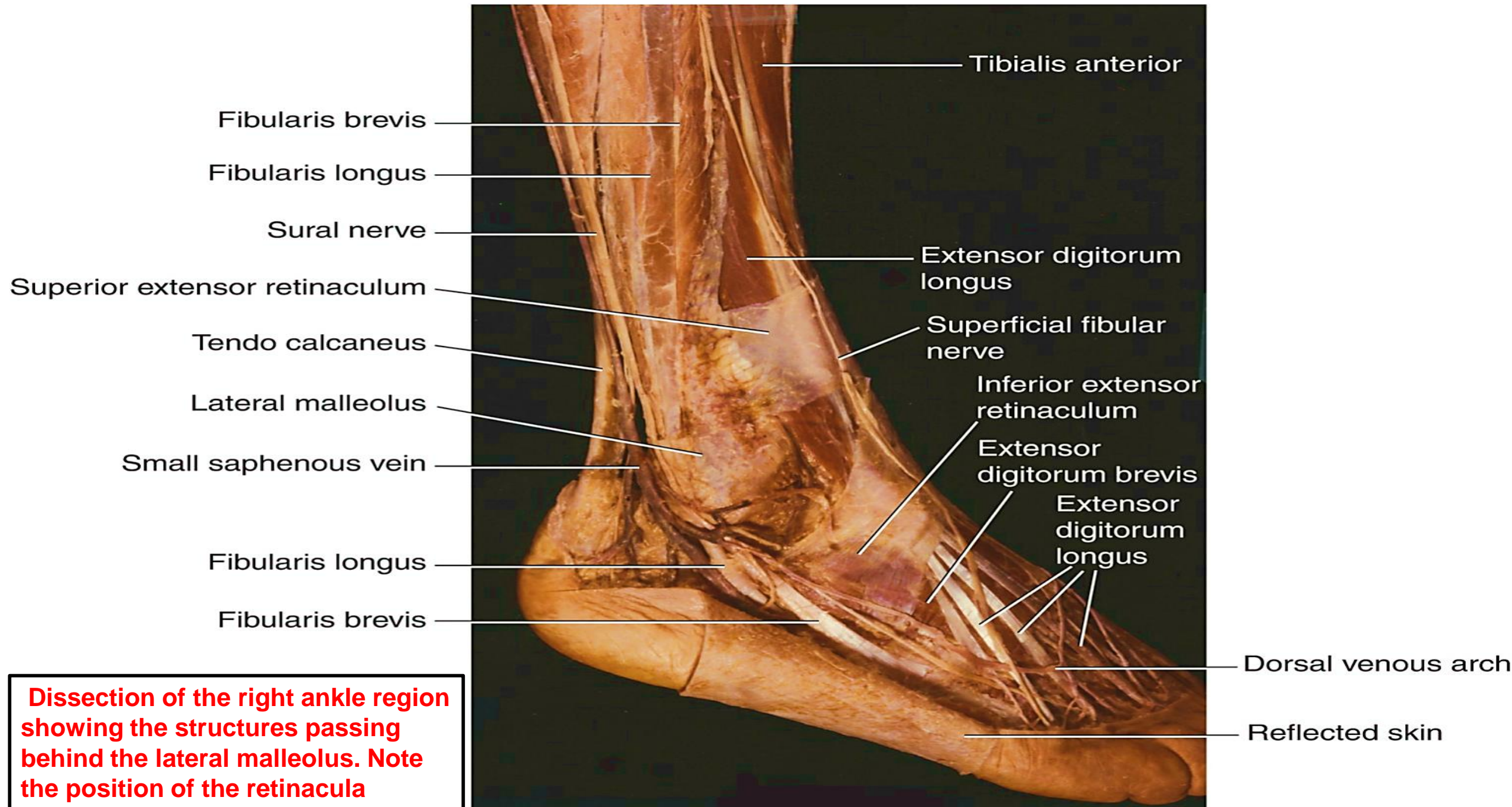
Inferior Fibular (Peroneal) Retinaculum: binds the tendons of the fibularis longus and brevis muscles to the lateral side of the calcaneum. The tendons each possess a synovial sheath, which is continuous above with the common sheath.

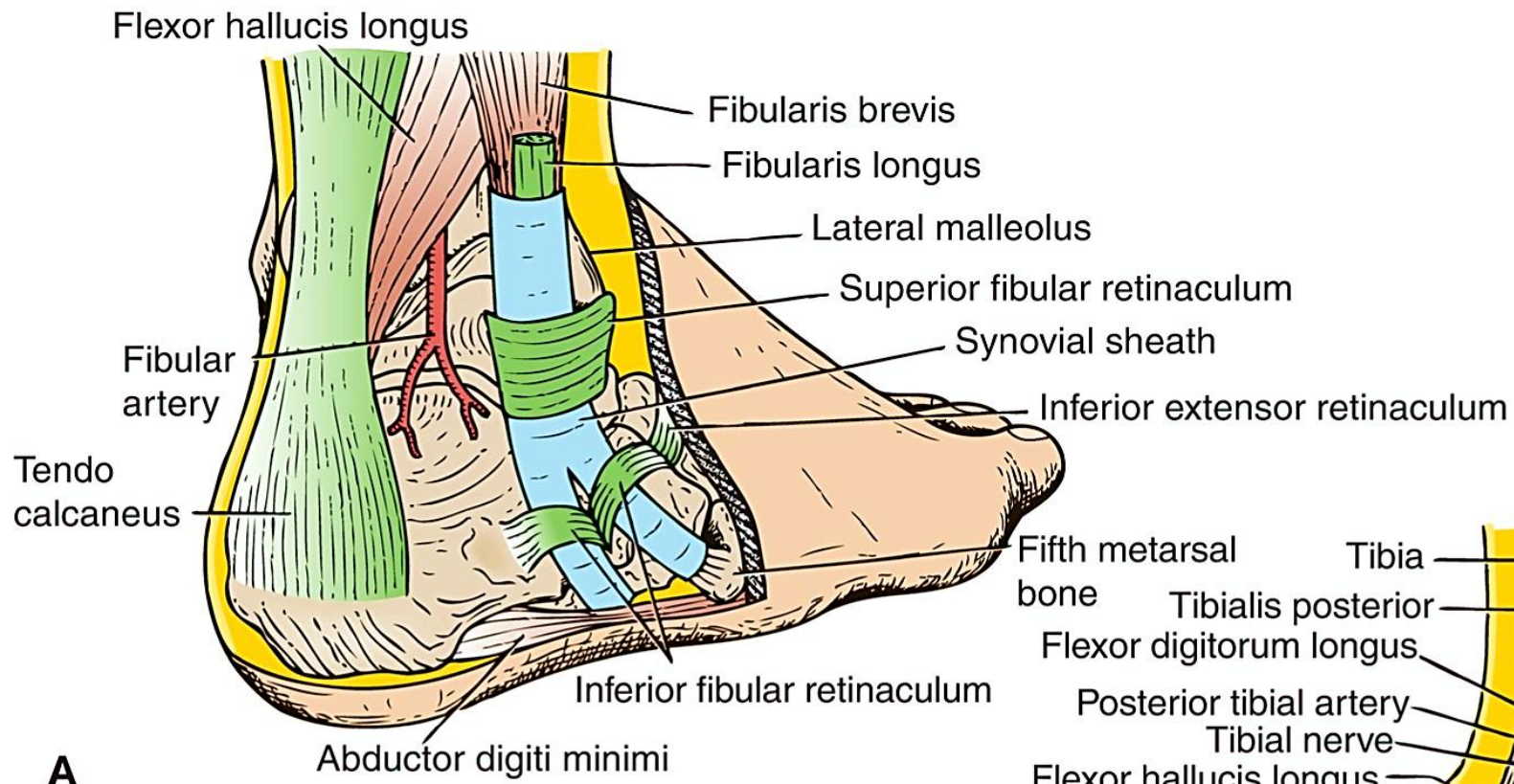
Structures in the anterior and lateral aspects of the right leg and the dorsum of the foot.



Deep structures in the anterior and lateral aspects of the right leg and the dorsum of the foot.

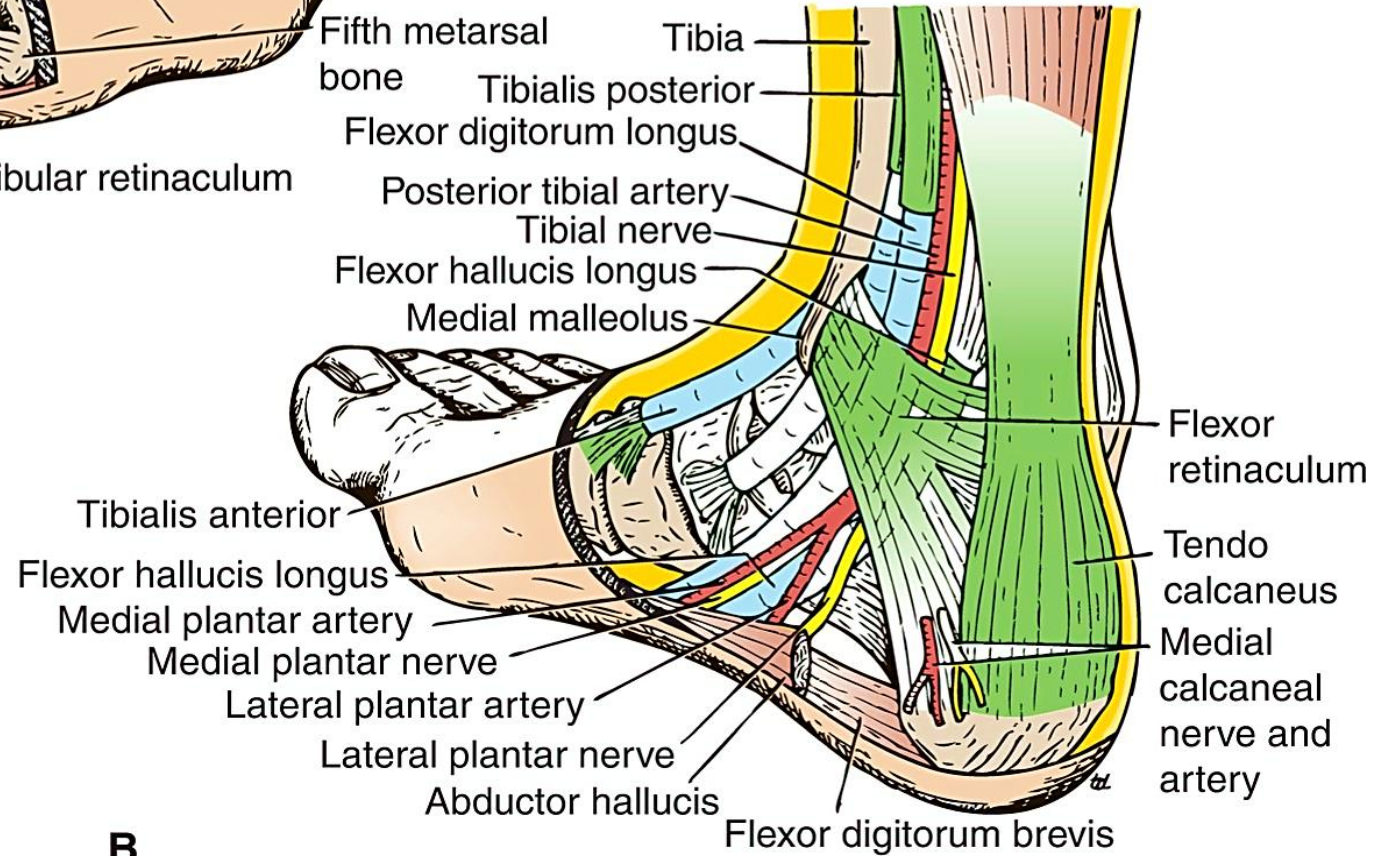




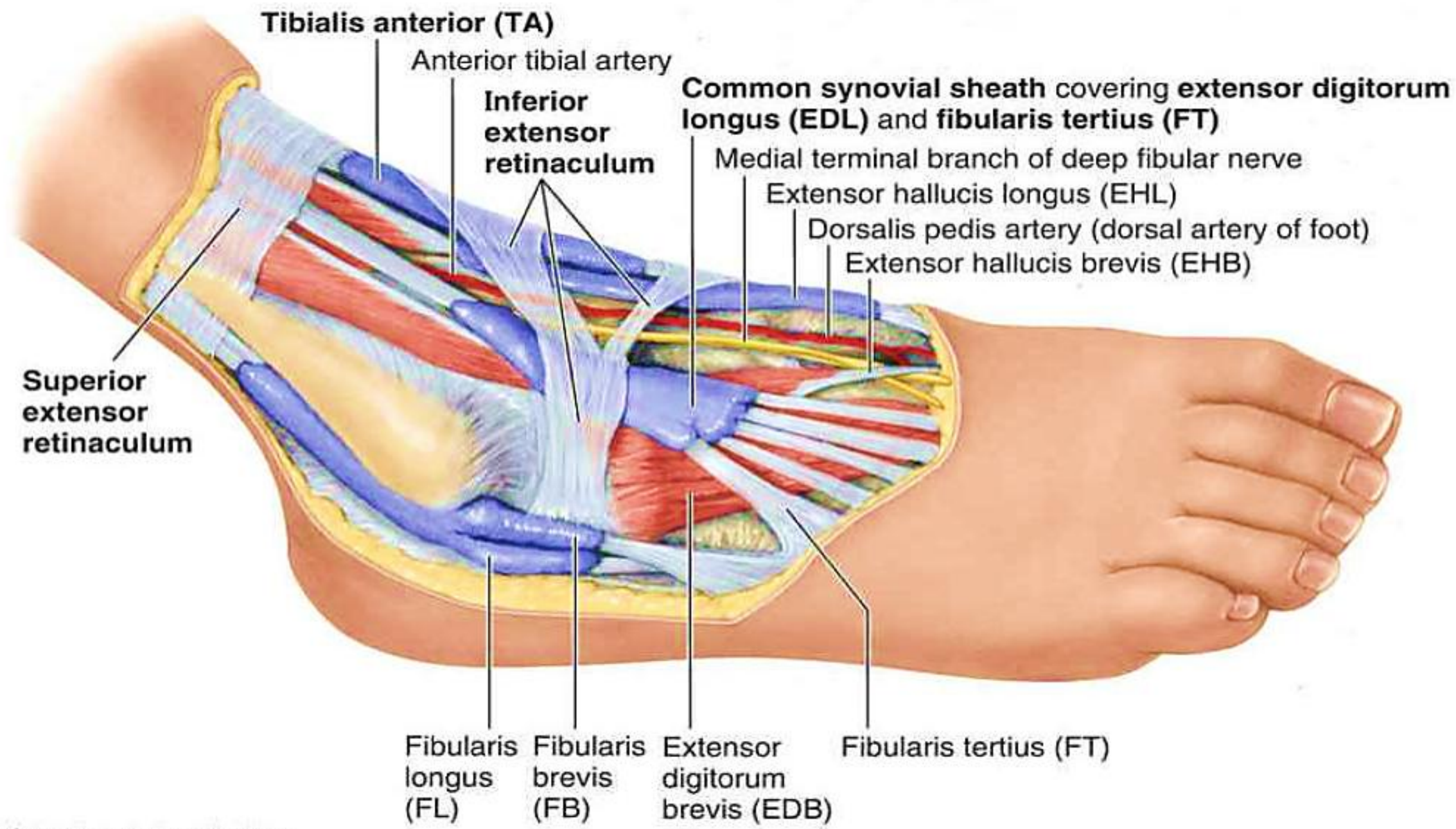


A

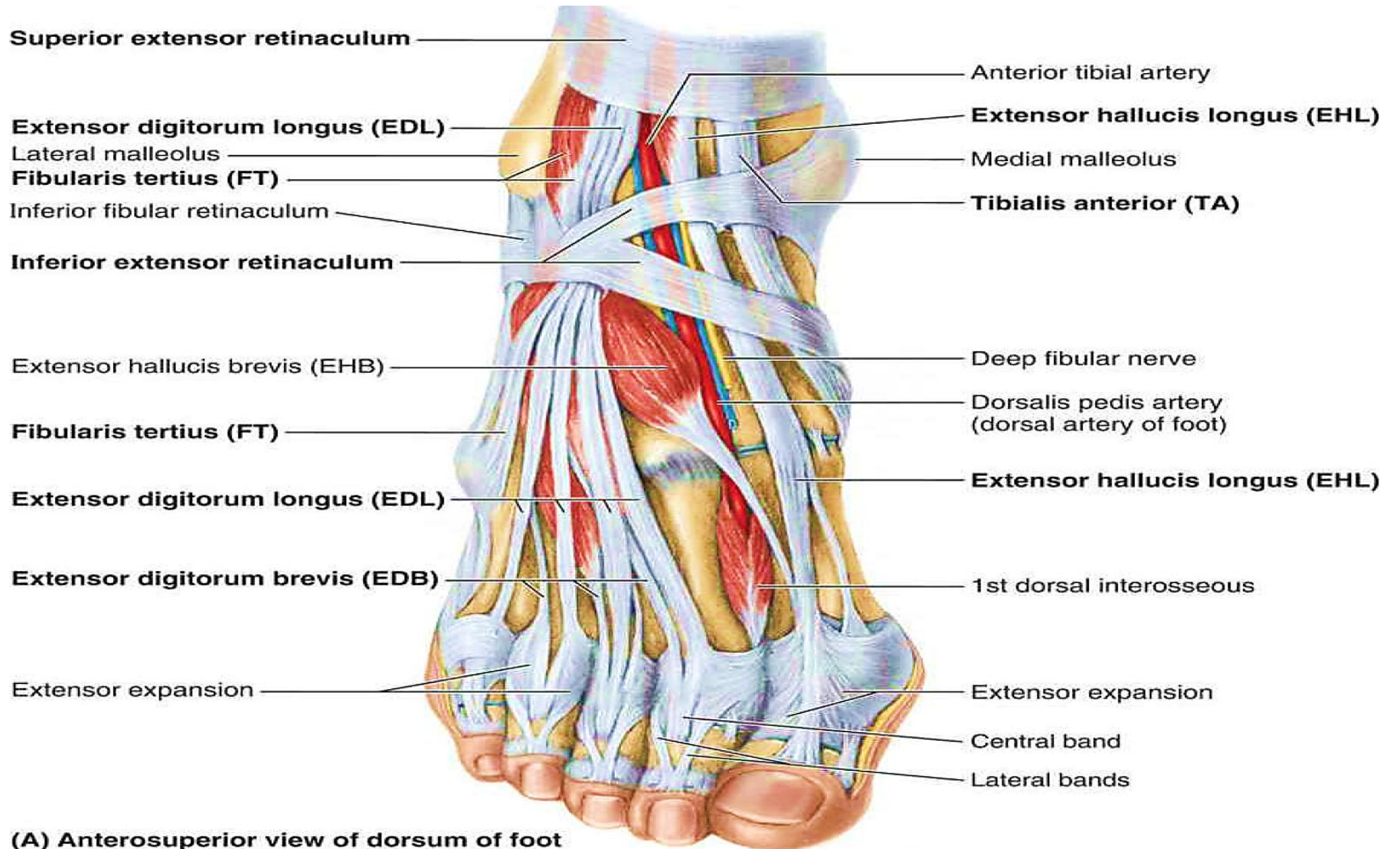
Structures passing behind the lateral malleolus (A) and the medial malleolus (B). Synovial sheaths of the tendons are shown in blue. Note the positions of the retinacula.



B



(B) Anterolateral view



(A) Anterosuperior view of dorsum of foot

Cutaneous Nerves

The lateral cutaneous nerve of the calf, a branch of the common fibular (peroneal) nerve, supplies the skin on the upper part of the lateral surface of the leg.

The superficial fibular (peroneal) nerve, a branch of the common fibular (peroneal) nerve, supplies the skin of the lower part of the anterolateral surface of the leg.

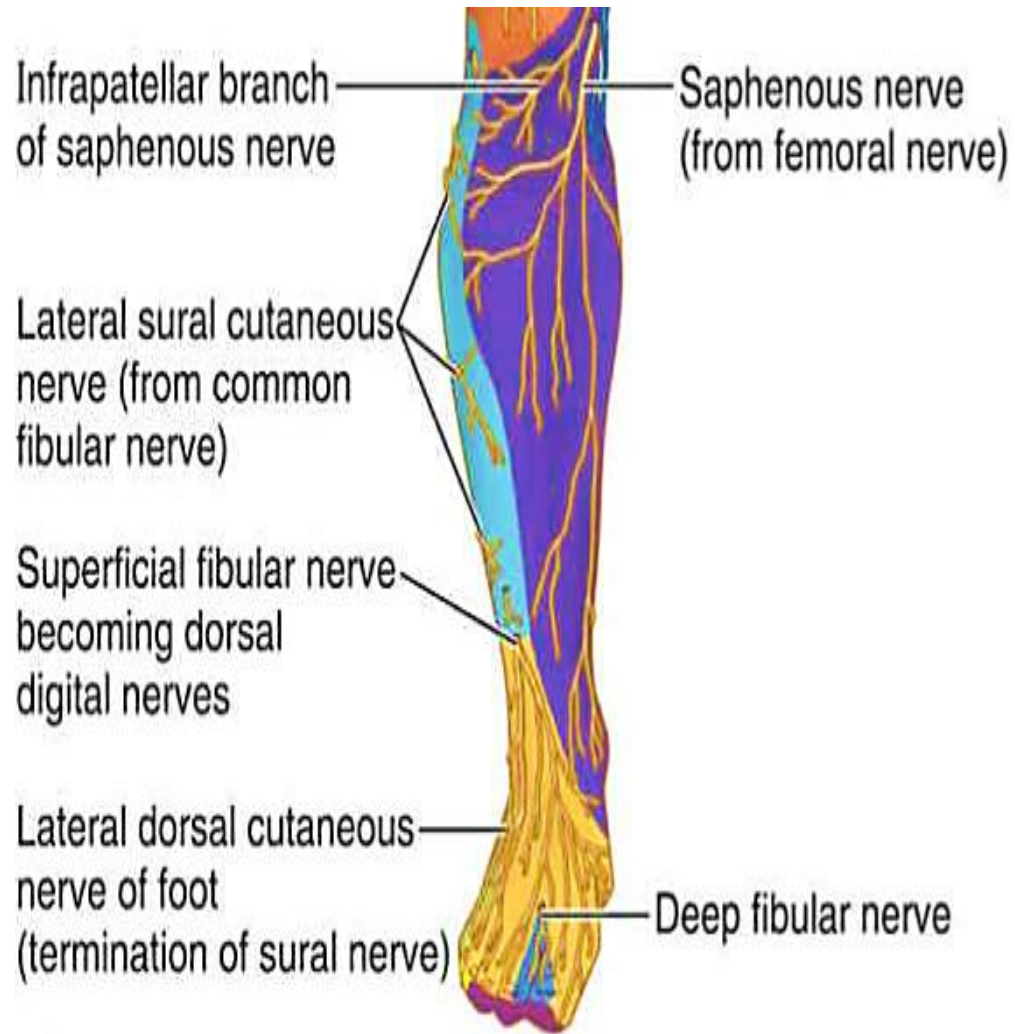
The saphenous nerve, a branch of the femoral nerve, supplies the skin on the anteromedial surface of the leg.

The posterior cutaneous nerve of the thigh descends on the back of the thigh. It supplies the skin over the popliteal fossa and the upper part of the back of the leg.

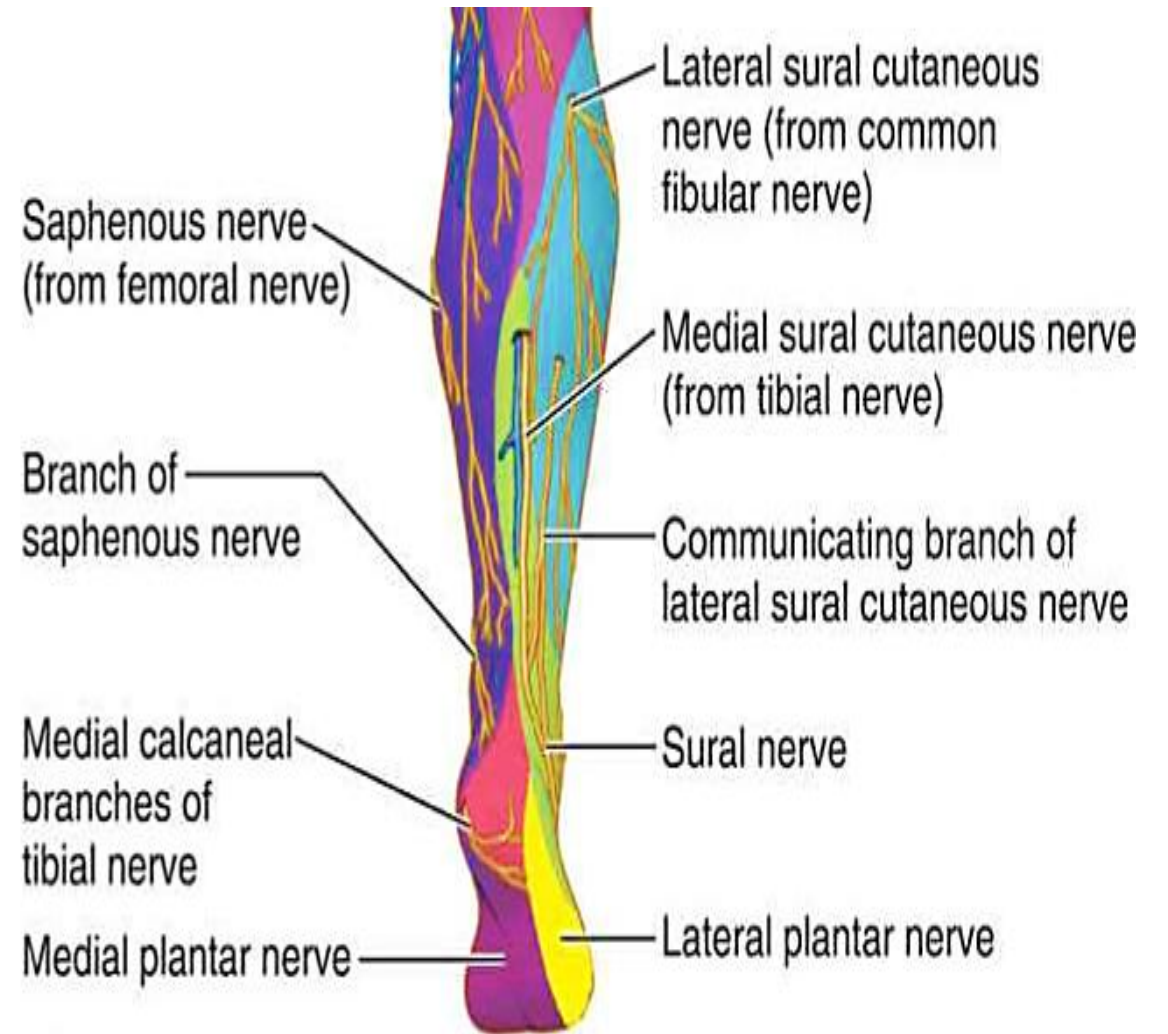
The lateral cutaneous nerve of the calf, a branch of the common fibular (peroneal) nerve, supplies the skin on the upper part of the posterolateral surface of the leg.

The sural nerve, a branch of the tibial nerve, supplies the skin on the lower part of the posterolateral surface of the leg.

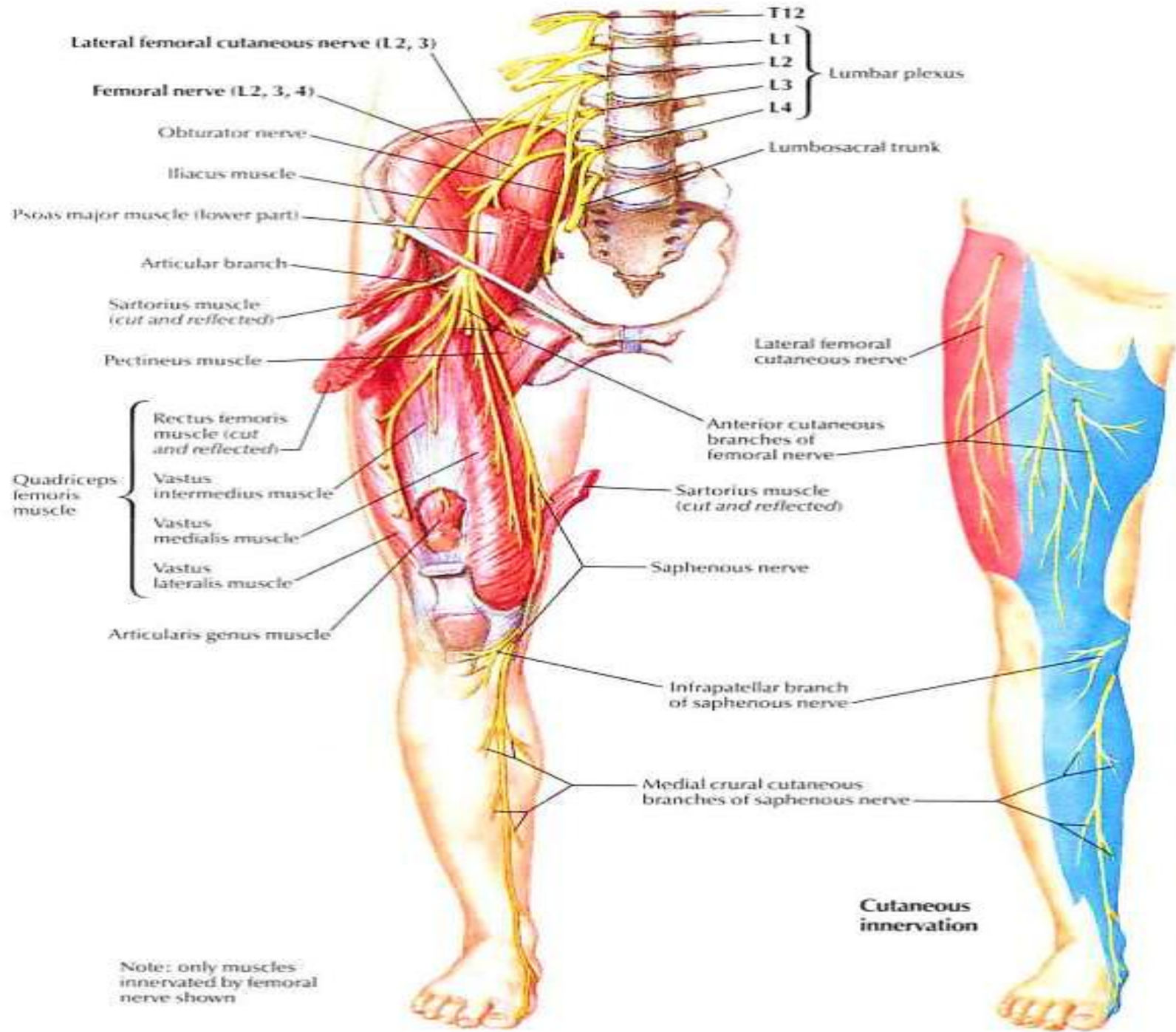
The saphenous nerve, a branch of the femoral nerve, gives off branches that supply the skin on the posteromedial surface of the leg.



(A) Anterior view



(B) Posterior view



Note: only muscles innervated by femoral nerve shown

Superficial Veins

Numerous small veins curve around the medial aspect of the leg and ultimately drain into the **great saphenous vein**. **The small saphenous vein** arises from the lateral part of the dorsal venous arch of the foot. It ascends behind the lateral malleolus in company with the sural nerve, follows the lateral border of the tendo calcaneus, and then runs up the middle of the back of the leg. The vein pierces the deep fascia, passes between the two heads of the gastrocnemius muscle in the lower part of the popliteal fossa, and ends in **the popliteal vein**. The small saphenous vein has numerous valves along its course. The termination of this vein is variable. It may join the popliteal vein. It may join the great saphenous vein. Or, it may split in two, one division joining the popliteal and the other joining the great saphenous vein.

Tributaries

Numerous small veins from the back of the leg

Communicating veins with the deep veins of the foot

Important anastomotic branches that run upward and medially and join the great saphenous vein

Lymph Vessels

The greater part of the lymph from the skin and superficial fascia **on the front of the leg** drains upward and medially in vessels that follow the great saphenous vein, to end in the vertical group of **superficial inguinal lymph nodes**. A small amount of lymph from the upper lateral part of the front of the leg may pass via vessels that accompany the small saphenous vein and drain into the **popliteal nodes**.

Lymph vessels from the skin and superficial fascia **on the back of the leg** drain upward and either pass forward around the medial side of the leg to end in the vertical group of superficial inguinal nodes or drain into the popliteal nodes.

Leg Fascial Compartments and Muscles

The deep fascia tightly surrounds the leg and is continuous above with the deep fascia of the thigh. Below the tibial condyles, it is attached to the periosteum on the anterior and medial borders of the tibia. Two intermuscular septa pass from its deep aspect to attach to the fibula.

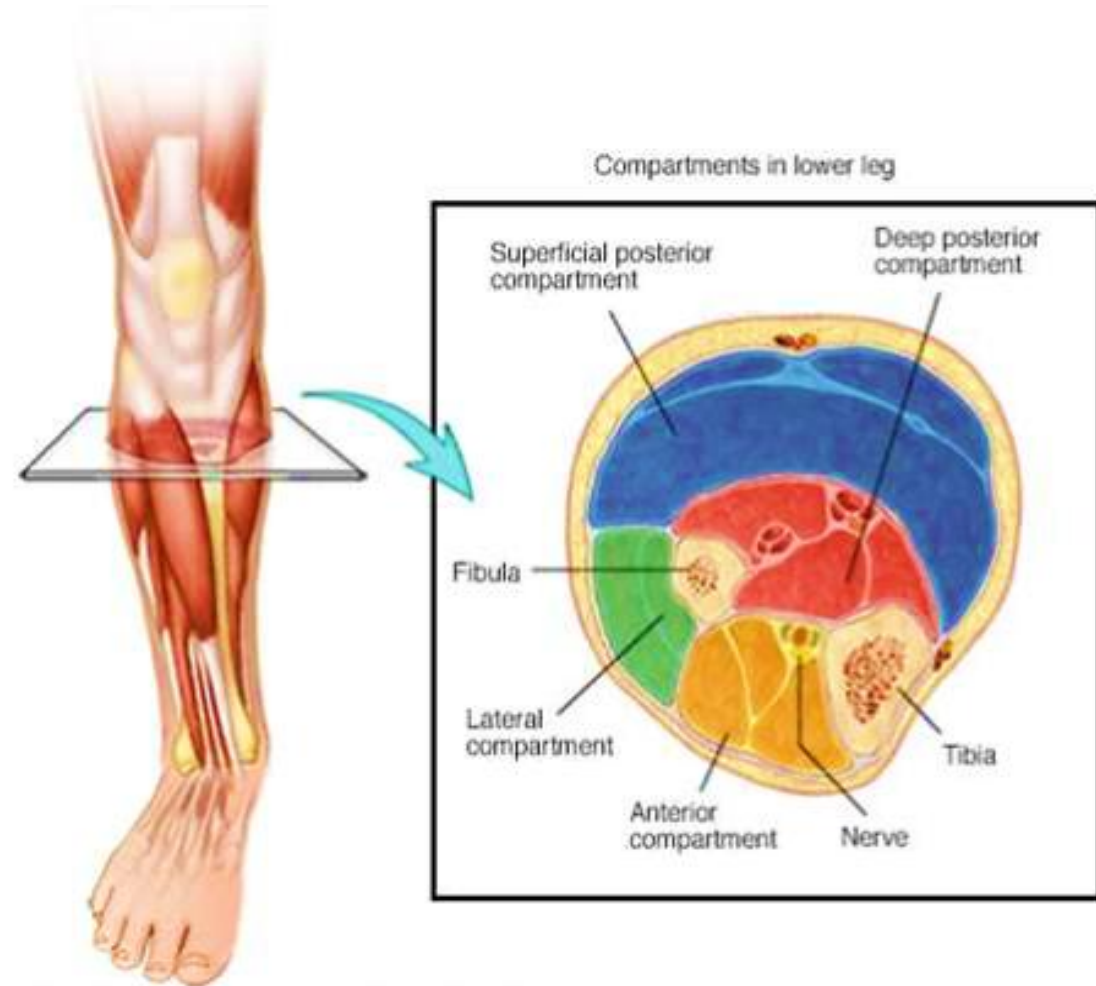
These, together with the interosseous membrane, divide the leg into three compartments: anterior, lateral, and posterior. As with the thigh, each compartment has its own muscles, blood supply, and nerve supply.

Anterior Fascial Compartment Contents

Muscles: The tibialis anterior, extensor digitorum longus, fibularis tertius, and extensor hallucis longus

Blood supply: Anterior tibial artery

Nerve supply: Deep fibular (peroneal) nerve



Anterior Fascial Compartment Muscles

MUSCLE	ORIGIN	INSERTION	NERVE SUPPLY	NERVE ROOT ^a	ACTION
Tibialis anterior	Lateral surface of shaft of tibia and interosseous membrane	Medial cuneiform and base of first metatarsal bone	Deep fibular nerve	L4, 5	Extends ^b foot at ankle joint; inverts foot at subtalar and transverse tarsal joints; holds up medial longitudinal arch of foot
Extensor digitorum longus	Anterior surface of shaft of fibula	Extensor expansion of lateral four toes	Deep fibular nerve	L5; S1	Extends toes; extends foot at ankle joint
Fibularis tertius	Anterior surface of shaft of fibula	Base of fifth metatarsal bone	Deep fibular nerve	L5; S1	Extends foot at ankle joint; everts foot at subtalar and transverse tarsal joints
Extensor hallucis longus	Anterior surface of shaft of fibula	Base of distal phalanx of great toe	Deep fibular nerve	L5; S1	Extends big toe; extends foot at ankle joint; inverts foot at subtalar and transverse tarsal joints

Note the following:

Extension (dorsiflexion) at the ankle is the movement of the foot away from the ground, as in lifting the foot up toward the shin.

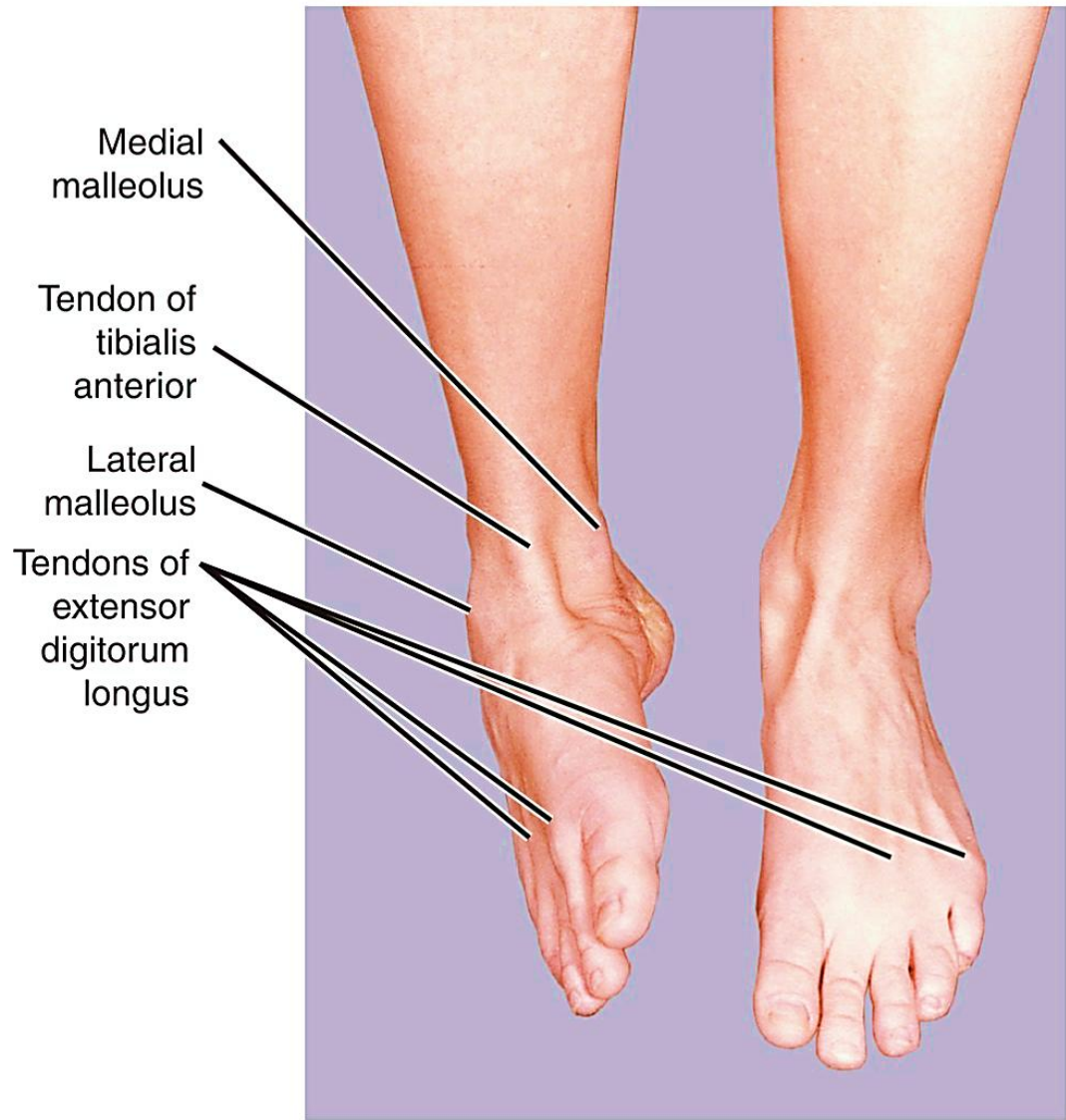
Flexion (plantar flexion) is movement of the foot toward the ground, as in standing on the toes.

Inversion of the foot is the movement of turning the sole of the foot medially, toward the midline.

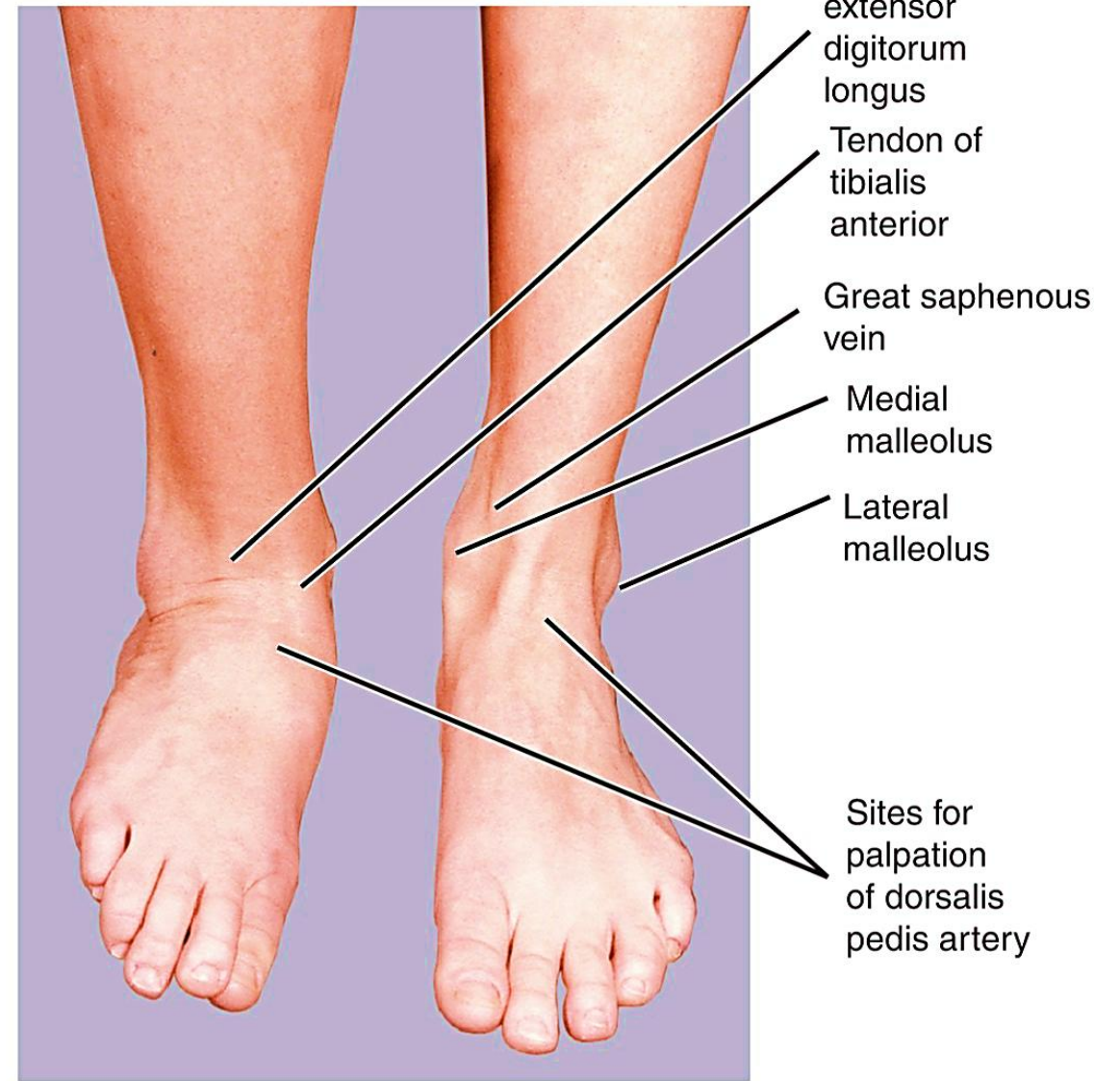
Eversion of the foot is turning the sole laterally, away from the midline.

The fibularis tertius muscle extends/dorsiflexes the foot at the ankle joint along with the other muscles in this compartment and is supplied by the deep fibular (peroneal) nerve. The muscle also everts the foot at the subtalar and transverse tarsal joints along with the fibularis longus and brevis muscles but receives no innervation from the superficial fibular (peroneal) nerve.

The extensor digitorum longus tendons on the dorsal surface of each toe become incorporated into a fascial expansion called the **extensor expansion**. The central part of the expansion is inserted into the base of the middle phalanx, and the two lateral parts converge to be inserted into the base of the distal phalanx. This is similar to the insertion of the extensor digitorum in the hand.



A



B

Anterior view of the ankles and feet showing inversion (A) and eversion (B) of the right foot.

Anterior Fascial Compartment Artery

The **anterior tibial artery** is the smaller of the terminal branches of the **popliteal artery**. It arises at the level of the **lower border of the popliteus muscle** and passes forward into the anterior compartment of the leg through an opening in the upper part of the interosseous membrane.

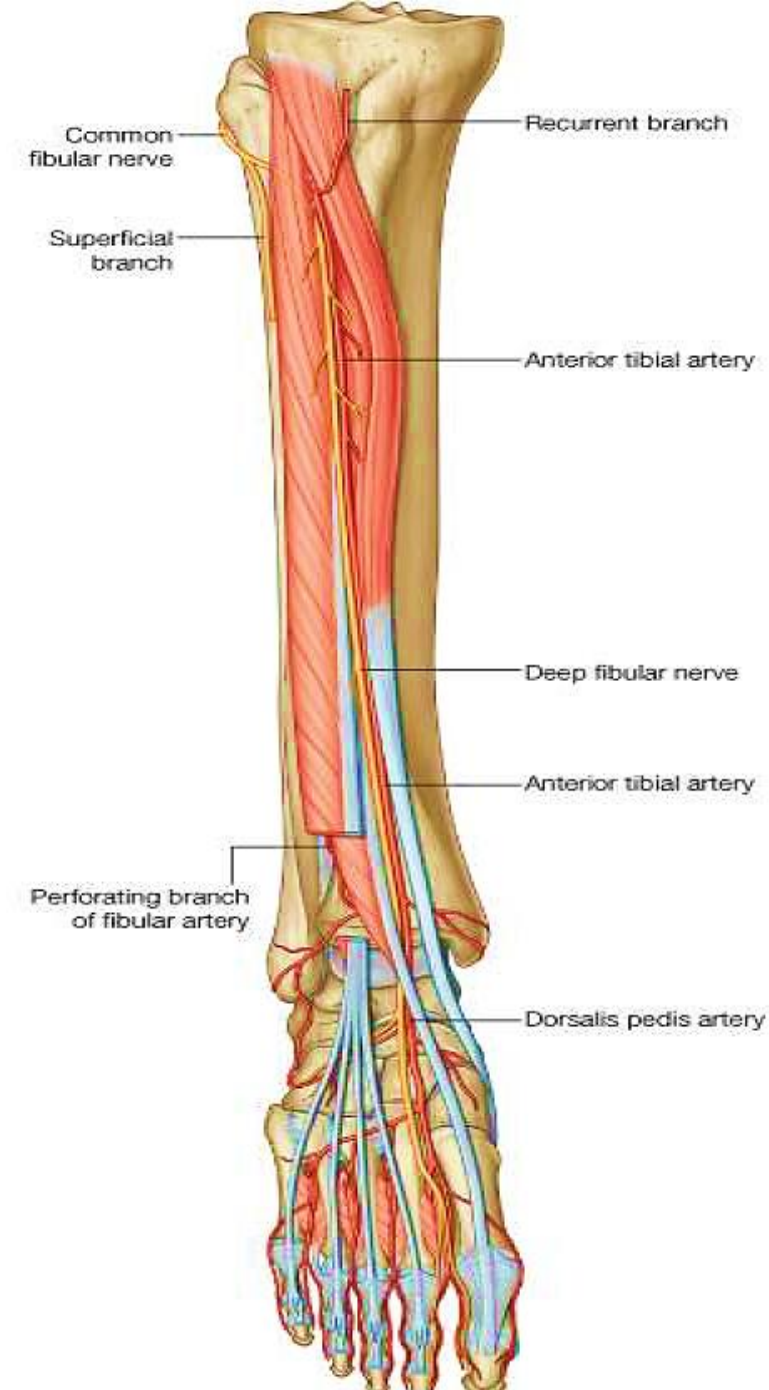
It descends on the anterior surface of the interosseous membrane, accompanied by the deep fibular (peroneal) nerve. In the upper part of its course, it lies deep beneath the muscles of the compartment. In the lower part of its course, it lies superficial, in front of the lower end of the tibia. After passing deep to the **superior extensor retinaculum**, it has the tendon of the extensor hallucis longus on its medial side and the deep fibular (peroneal) nerve and the tendons of extensor digitorum longus on its lateral side. Here, its pulsations can easily be felt in the living subject. The artery becomes **the dorsalis pedis** artery in front of the ankle joint, after passing the level of the malleoli.

Branches

Muscular branches to neighboring muscles.

Anastomotic branches that anastomose with branches of other arteries around the knee and ankle joints.

Venae comitantes of the anterior tibial artery join those of the posterior tibial artery in the popliteal fossa to form **the popliteal vein**.



Anterior Fascial Compartment Nerve Supply

The **deep fibular (peroneal) nerve** is one of the terminal branches of the **common fibular (peroneal) nerve**. It arises in the substance of the fibularis longus muscle on the lateral side of the neck of the fibula. The nerve enters the anterior compartment by piercing the anterior fascial septum. It then descends deep to the extensor digitorum longus muscle, first lying lateral, then anterior, and finally lateral to the anterior tibial artery. The nerve passes deep to the extensor retinacula and continues into the foot.

Branches

Muscular branches to the anterior compartment (tibialis anterior, extensor digitorum longus, fibularis tertius, and extensor hallucis longus)

Articular branch to the ankle joint



Clinical Notes

Anterior Compartment Syndrome

The anterior compartment syndrome of the leg is produced by an increase in the intracompartmental pressure that results from an increased production of tissue fluid. **Soft tissue injury** associated with **bone fractures** is a common cause, and early diagnosis is critical. The deep, aching pain in the anterior compartment of the leg that is characteristic of this syndrome can become severe. Dorsiflexion of the foot at the ankle joint increases the severity of the pain. Stretching of the muscles that pass through the compartment by passive plantar flexion of the ankle also increases the pain. As the pressure rises, **the venous return is diminished**, thus producing a further rise in pressure. In severe cases, the arterial supply is eventually cut off by compression, and the **dorsalis pedis arterial pulse disappears**.

The tibialis anterior, the extensor digitorum longus, and the extensor hallucis longus muscles are paralyzed. Loss of sensation is limited to the area supplied by the deep fibular (peroneal) nerve, that is the skin cleft between the first and second toes. The surgeon can open the anterior compartment of the leg by making a longitudinal incision through the deep fascia and thus decompress the area and prevent anoxic necrosis of the muscles.

Lateral Fascial Compartment Muscles

Muscles of Lateral Fascial Compartment of Leg

MUSCLE	ORIGIN	INSERTION	NERVE SUPPLY	NERVE ROOT ^a	ACTION
Fibularis longus	Lateral surface of shaft of fibula	Base of first metatarsal and the medial cuneiform	Superficial fibular nerve	L5; S1, 2	Plantar flexes foot at ankle joint; everts foot at subtalar and transverse tarsal joints; supports lateral longitudinal and transverse arches of foot
Fibularis brevis	Lateral surface of shaft of fibula	Base of fifth metatarsal bone	Superficial fibular nerve	L5; S1, 2	Plantar flexes foot at ankle joint; everts foot at subtalar and transverse tarsal joint; supports lateral longitudinal arch of foot

Note the following:

Both the fibularis longus and brevis muscles flex the foot at the ankle joint and evert the foot at the subtalar and transverse tarsal joints. They also play an important role in holding up the lateral longitudinal arch in the foot. In addition, the fibularis longus tendon serves as a tie to the transverse arch of the foot

Lateral Fascial Compartment Artery

Numerous branches from the **fibular artery**, which lies in the posterior compartment of the leg, pierce the posterior fascial septum and supply the fibular muscles.

Lateral Fascial Compartment Nerve

The superficial fibular (peroneal) nerve is one of the terminal branches of the common fibular (peroneal) nerve. It arises in the substance of the fibularis longus muscle on the lateral side of the neck of the fibula. It descends between the fibularis longus and brevis muscles and becomes cutaneous in the lower part of the leg.

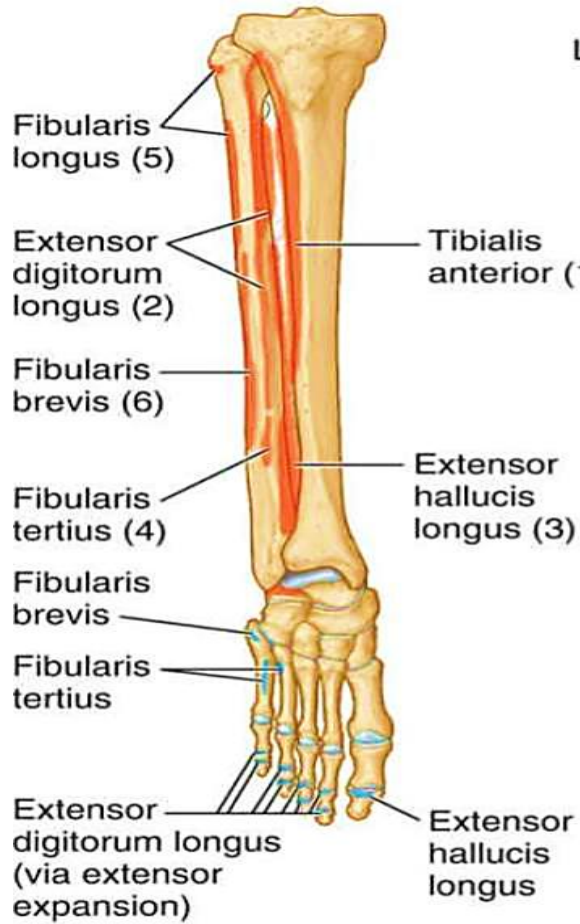
Branches

Muscular branches to the lateral compartment (fibularis longus and brevis).

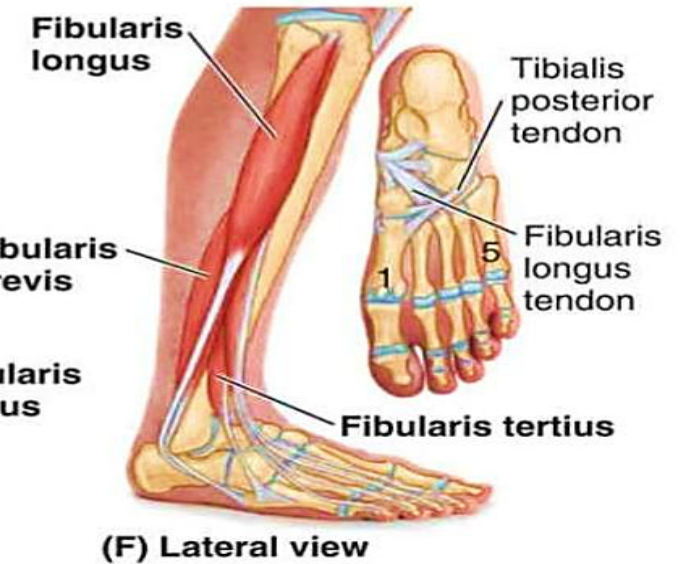
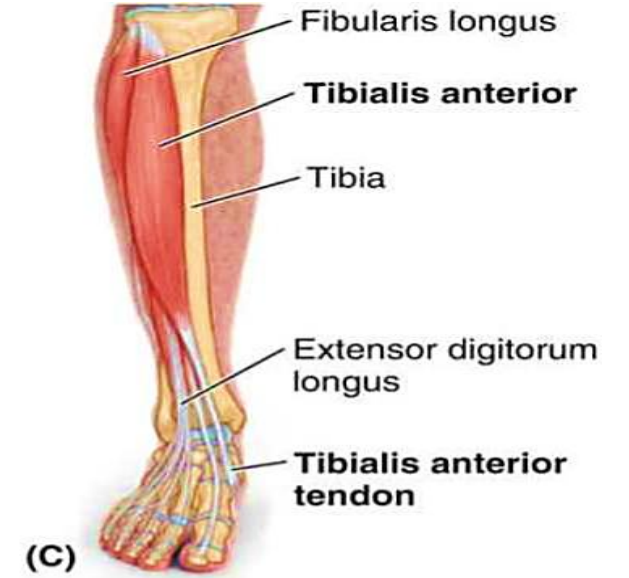
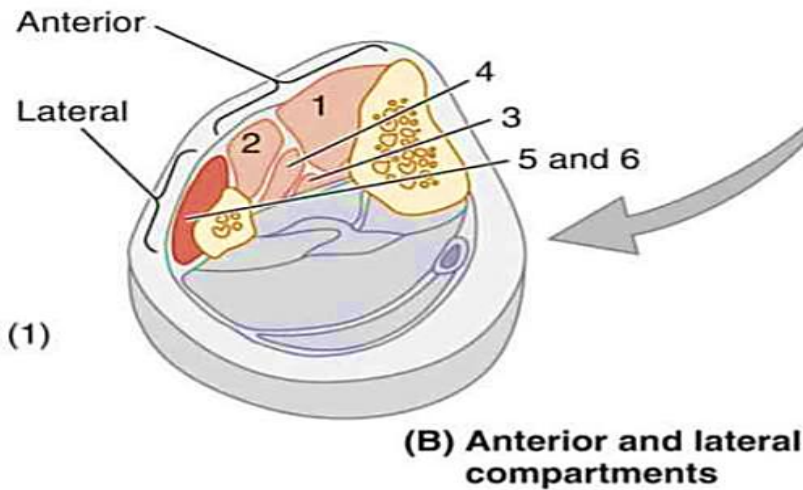
Cutaneous: Medial and lateral branches distribute to the skin on the lower part of the front of the leg and the dorsum of the foot.

In addition, branches supply the dorsal surfaces of the skin of all the toes, except the adjacent sides of the first and second toes and the lateral side of the little toe.

Muscles of anterior and lateral compartments of leg



(A) Anterior muscle attachments



(A-E) Anterior views

Posterior Fascial Compartment Contents

The deep transverse fascia of the leg is a septum that divides the muscles of the posterior compartment into superficial and deep group.

Superficial group of muscles: Gastrocnemius, plantaris, and soleus

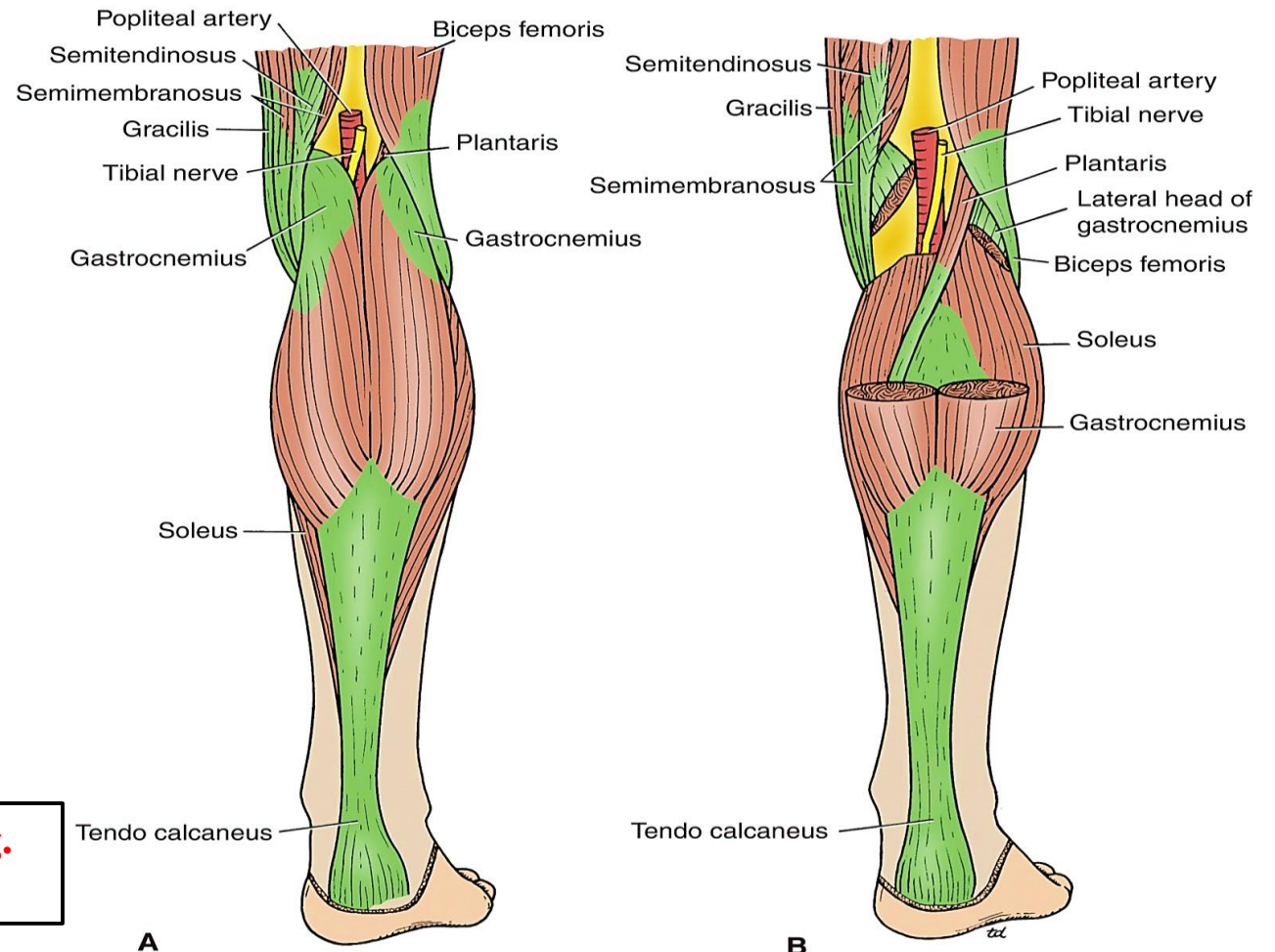
Deep group of muscles: Popliteus, flexor digitorum longus, flexor hallucis longus, and tibialis posterior

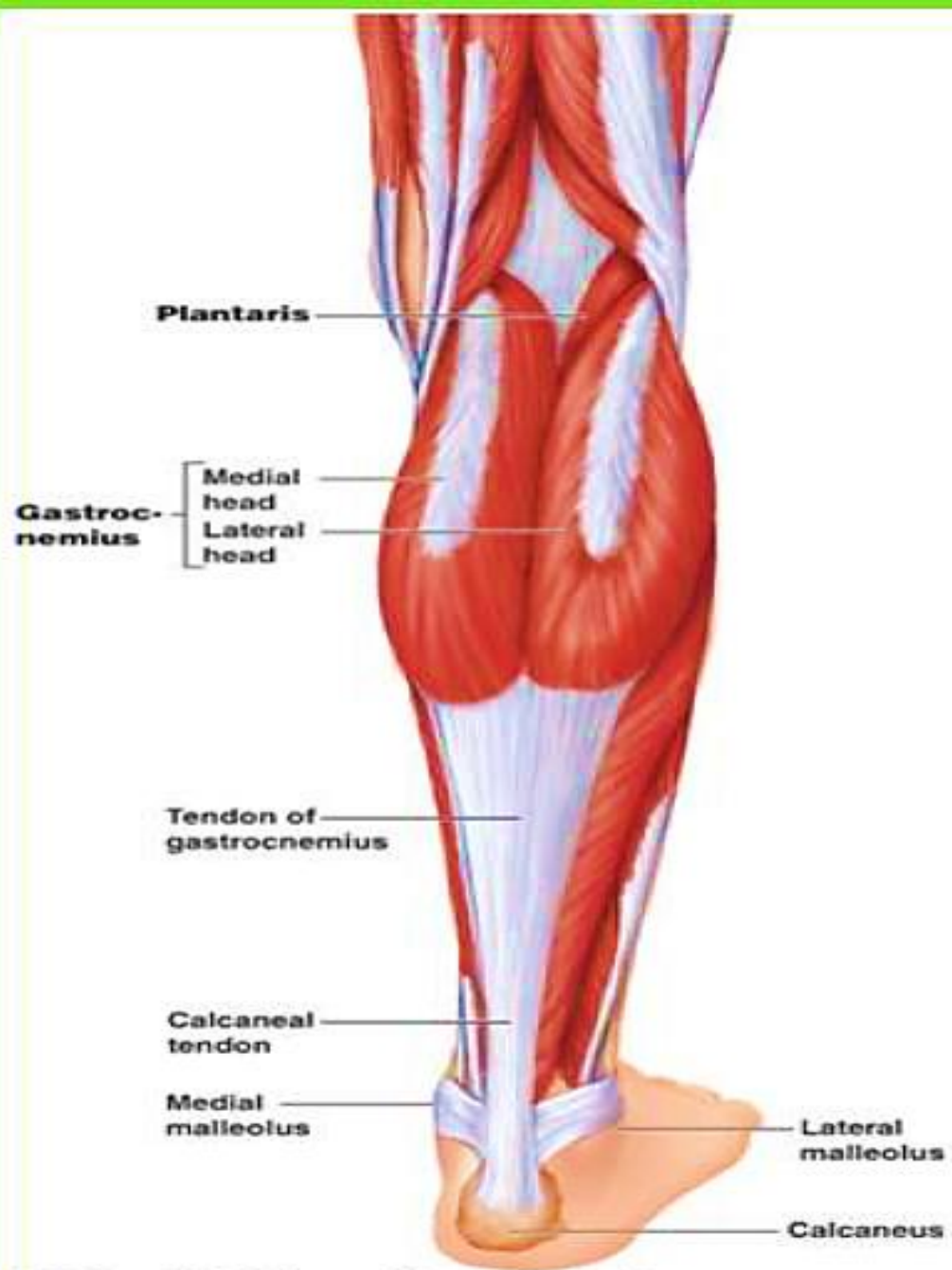
Blood supply: Posterior tibial artery

Nerve supply: Tibial nerve

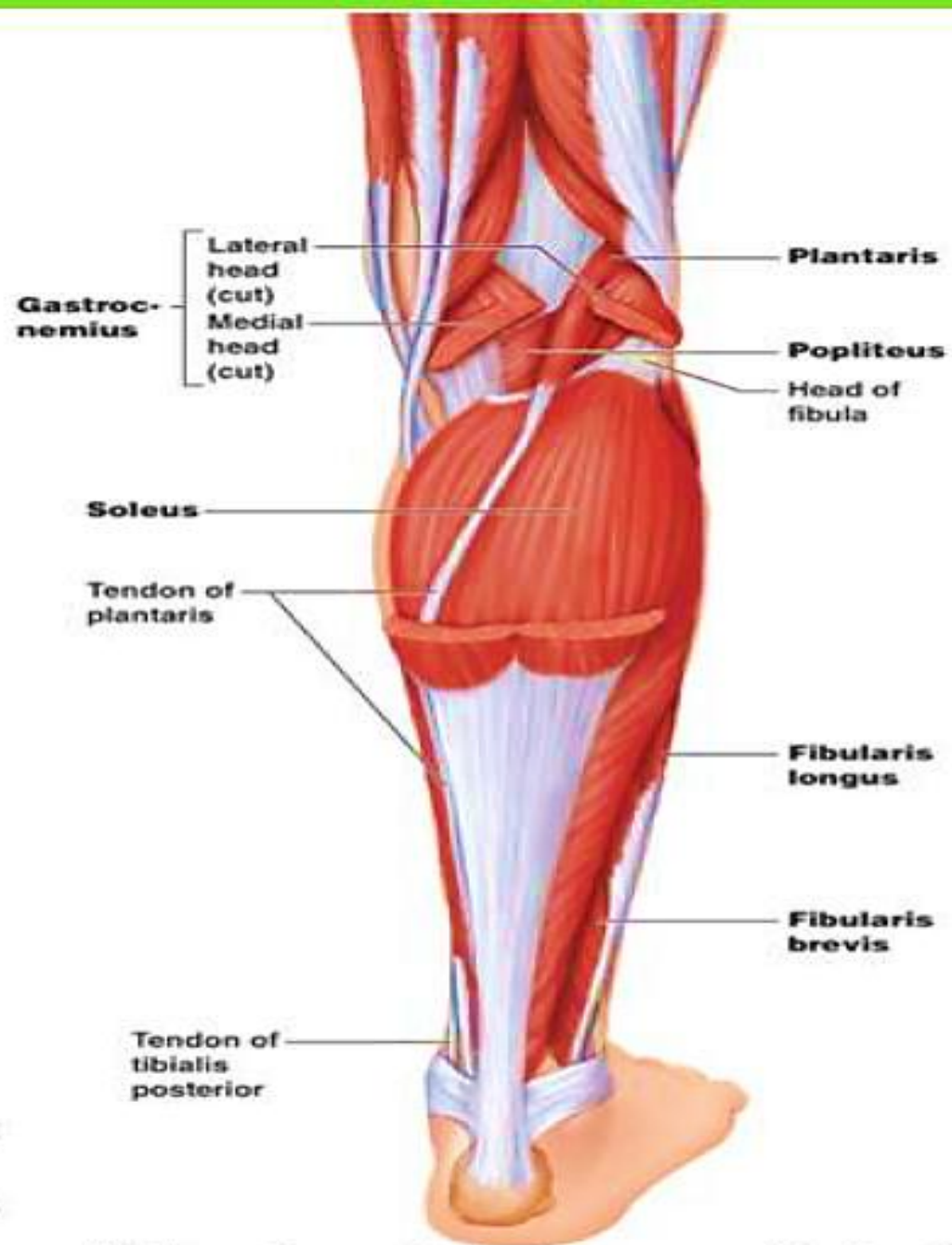
Posterior Fascial Compartment Muscles:
Superficial Group

Superficial aspect (A) of the posterior compartment of the leg. In B, part of the gastrocnemius has been removed.





(a) Superficial view of the posterior leg.



(b) The gastrocnemius has been removed to show the soleus immediately deep to it.

MUSCLE	ORIGIN	INSERTION	NERVE SUPPLY	NERVE ROOT ^a	ACTION
Superficial Group					
Gastrocnemius	Lateral head from lateral condyle of femur and medial head from above medial condyle	Via tendo calcaneus into posterior surface of calcaneum	Tibial nerve	S1, 2	Plantar flexes foot at ankle joint; flexes knee joint
Plantaris	Lateral supracondylar ridge of femur	Posterior surface of calcaneum	Tibial nerve	S1, 2	Plantar flexes foot at ankle joint; flexes knee joint
Soleus	Shafts of tibia and fibula	Via tendo calcaneus into posterior surface of calcaneum	Tibial nerve	S1, 2	Together with gastrocnemius and plantaris is powerful plantar flexor of ankle joint; provides main propulsive force in walking and running
Deep Group					
Popliteus	Lateral surface of lateral condyle of femur	Posterior surface of shaft of tibia above soleal line	Tibial nerve	L4, 5; S1	Flexes leg at knee joint; unlocks knee joint by lateral rotation of femur on tibia and slackens ligaments of joint
Flexor digitorum longus	Posterior surface of shaft of tibia	Bases of distal phalanges of lateral four toes	Tibial nerve	S2, 3	Flexes distal phalanges of lateral four toes; plantar flexes foot at ankle joint; supports medial and lateral longitudinal arches of foot
Flexor hallucis longus	Posterior surface of shaft of fibula	Base of distal phalanx of big toe	Tibial nerve	S2, 3	Flexes distal phalanx of big toe; plantar flexes foot at ankle joint; supports medial longitudinal arch of foot
Tibialis posterior	Posterior surface of shafts of tibia and fibula and interosseous membrane	Tuberosity of navicular bone and other neighboring bones	Tibial nerve	L4, 5	Plantar flexes foot at ankle joint; inverts foot at subtalar and transverse tarsal joints; supports medial longitudinal arch of foot

Note the following:

Together, the soleus, gastrocnemius, and plantaris act as powerful plantar flexors of the ankle joint. They provide the main forward propulsive force in locomotion by using the foot as a lever and raising the heel off the ground.

The gastrocnemius and soleus insert into the calcaneum together via the common **tendo calcaneus (Achilles tendon)**. Because this arrangement produces a functionally three-headed muscle in the calf, they are sometimes referred to as the triceps surae muscles.

Clinical Notes

Ruptured Tendo Calcaneus

Rupture of the tendo calcaneus is a common sport-related injury. The rupture occurs at its narrowest part, about 2 in. (5 cm) above its insertion. A sudden, sharp pain is felt, with immediate disability. The gastrocnemius and soleus muscles retract proximally, leaving a palpable gap in the tendon. It is impossible for the patient to actively plantar flex the foot. The tendon should be sutured as soon as possible and the leg immobilized with the ankle joint plantar flexed and the knee joint flexed.

Posterior Fascial Compartment Muscles: Deep Group

Note the following:

The popliteus muscle arises inside the capsule of the knee joint and inserts into the upper part of the posterior surface of the tibia. The popliteus muscle is responsible for “**unlocking**” the knee joint.

Posterior Fascial Compartment Artery

The posterior tibial artery is one of the terminal branches of the popliteal artery. It begins at the level of the lower border of the popliteus muscle and passes downward deep to the gastrocnemius and soleus and the deep transverse fascia of the leg. It lies on the posterior surface of the tibialis posterior muscle above and on the posterior surface of the tibia below. In the lower part of the leg, the artery is covered only by skin and fascia. The artery passes behind the medial malleolus deep to the flexor retinaculum and terminates by dividing into medial and lateral plantar arteries.

Branches: Fibular artery, which is a large artery that arises close to the origin of the posterior tibial artery. It descends behind the fibula, either within the substance of the flexor hallucis longus muscle or posterior to it. The fibular artery gives off numerous muscular branches and a nutrient artery to the fibula and ends by taking part in the anastomosis around the ankle joint.

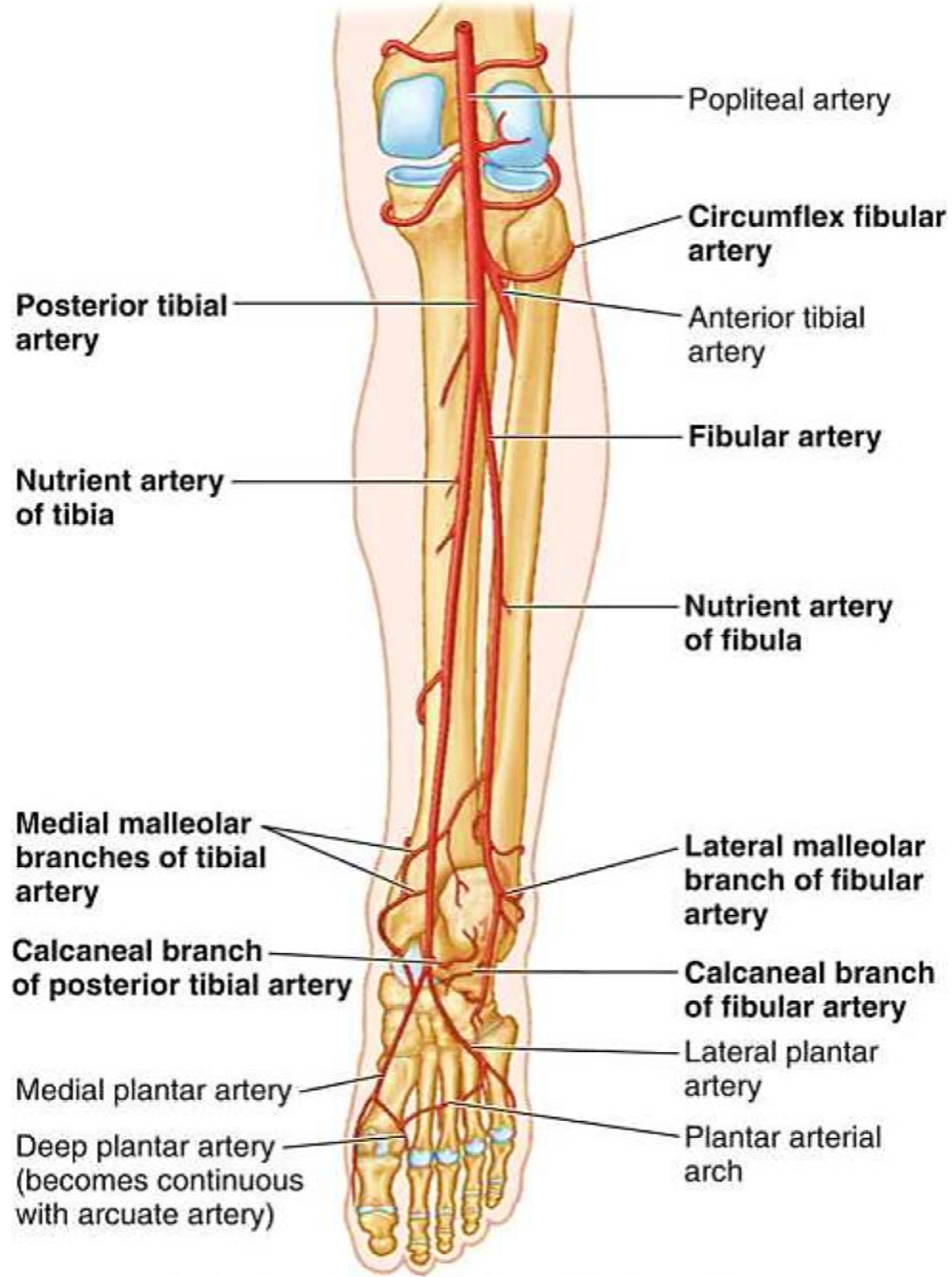
A perforating branch pierces the interosseous membrane to reach the lower part of the front of the leg.

Muscular branches are distributed to muscles in the posterior compartment of the leg.

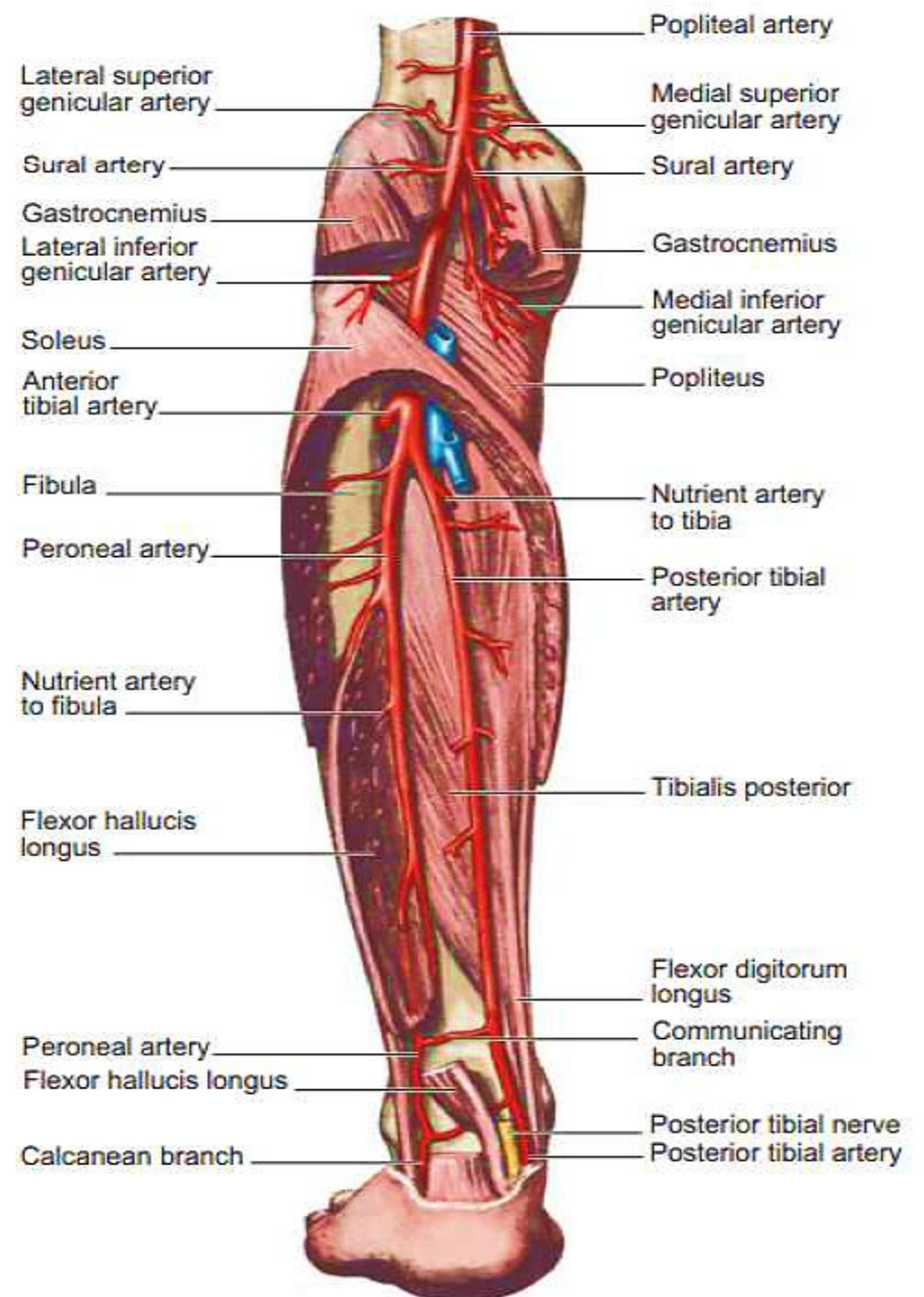
Nutrient artery to the tibia. **Anastomotic branches**, which join other arteries around the ankle joint.

Medial and lateral plantar arteries, which enter the sole of the foot.

Venae comitantes of the posterior tibial artery join those of the anterior tibial artery in the popliteal fossa to form the **popliteal vein**.



Posterior view with foot plantar flexed



Posterior Fascial Compartment Nerve

The tibial nerve is the larger terminal branch of the sciatic nerve in the lower third of the back of the thigh. It descends through the popliteal fossa and passes deep to the gastrocnemius and soleus muscles. It lies on the posterior surface of the tibialis posterior and, lower down the leg, on the posterior surface of the tibia. The nerve accompanies the posterior tibial artery and lies at first on its medial side, then crosses posterior to it, and finally lies on its lateral side. The nerve, with the artery, passes behind the medial malleolus, between the tendons of the flexor digitorum longus and the flexor hallucis longus.

It is covered here by the flexor retinaculum and divides into the medial and lateral plantar nerves.

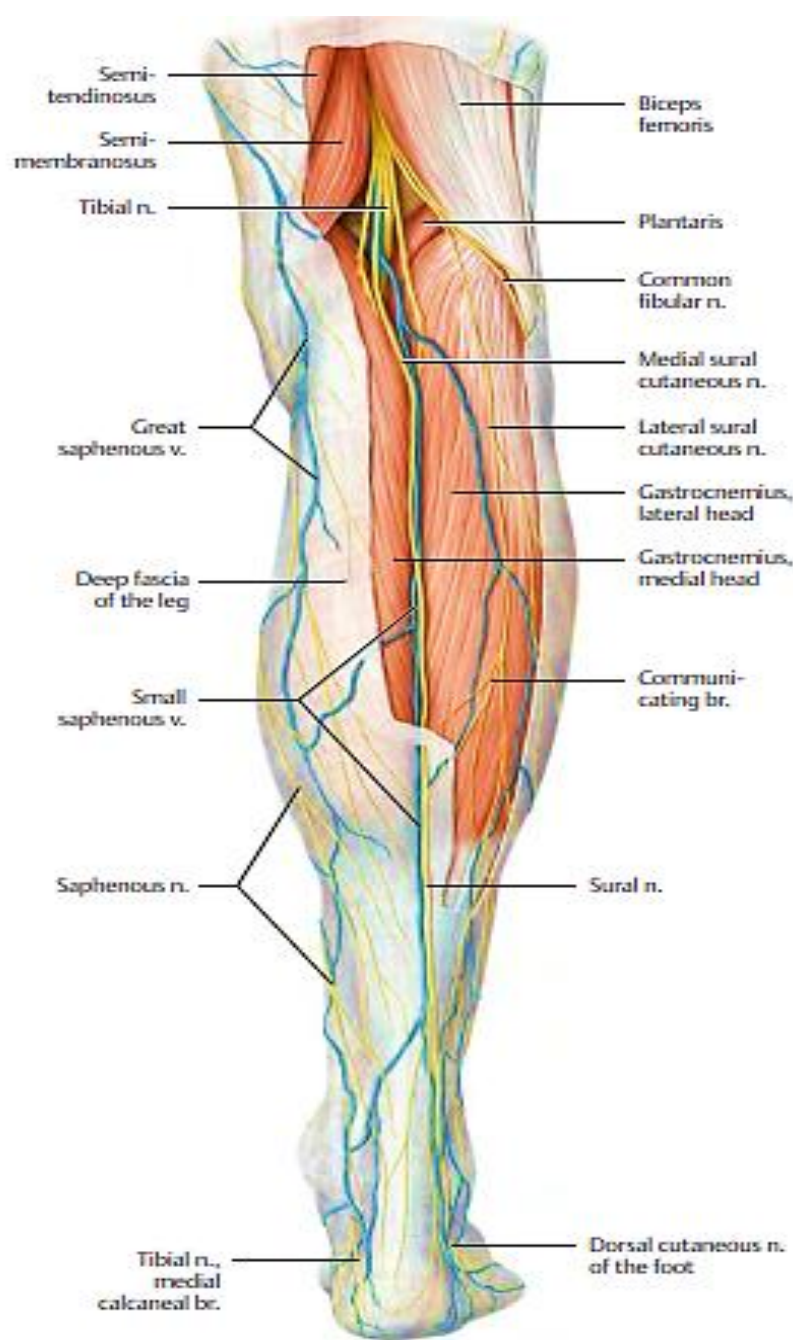
Leg Branches (below Popliteal Fossa)

Muscular branches to the posterior compartment (gastrocnemius, soleus, plantaris, flexor digitorum longus, flexor hallucis longus, and tibialis posterior).

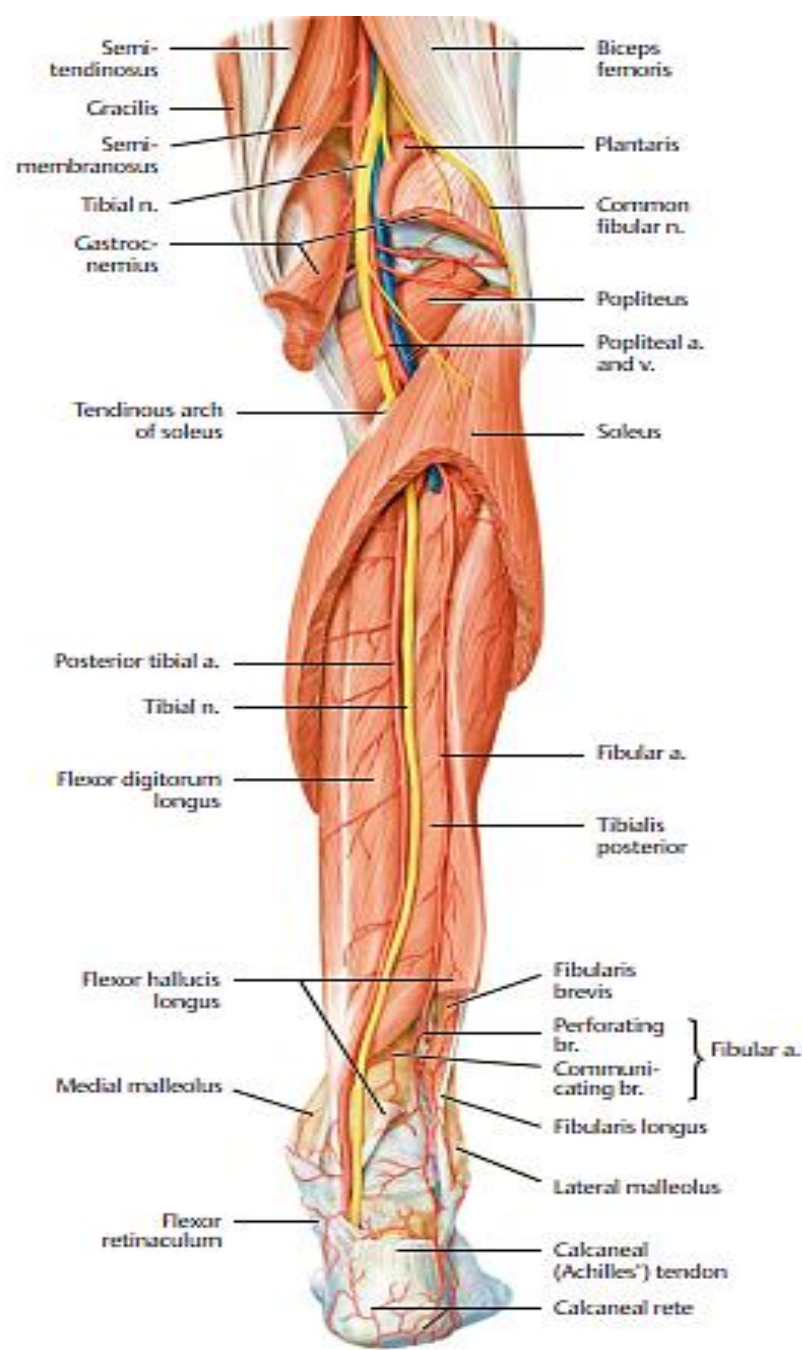
Cutaneous branch: The medial calcaneal branch supplies the skin over the medial surface of the heel.

Articular branch to the ankle joint.

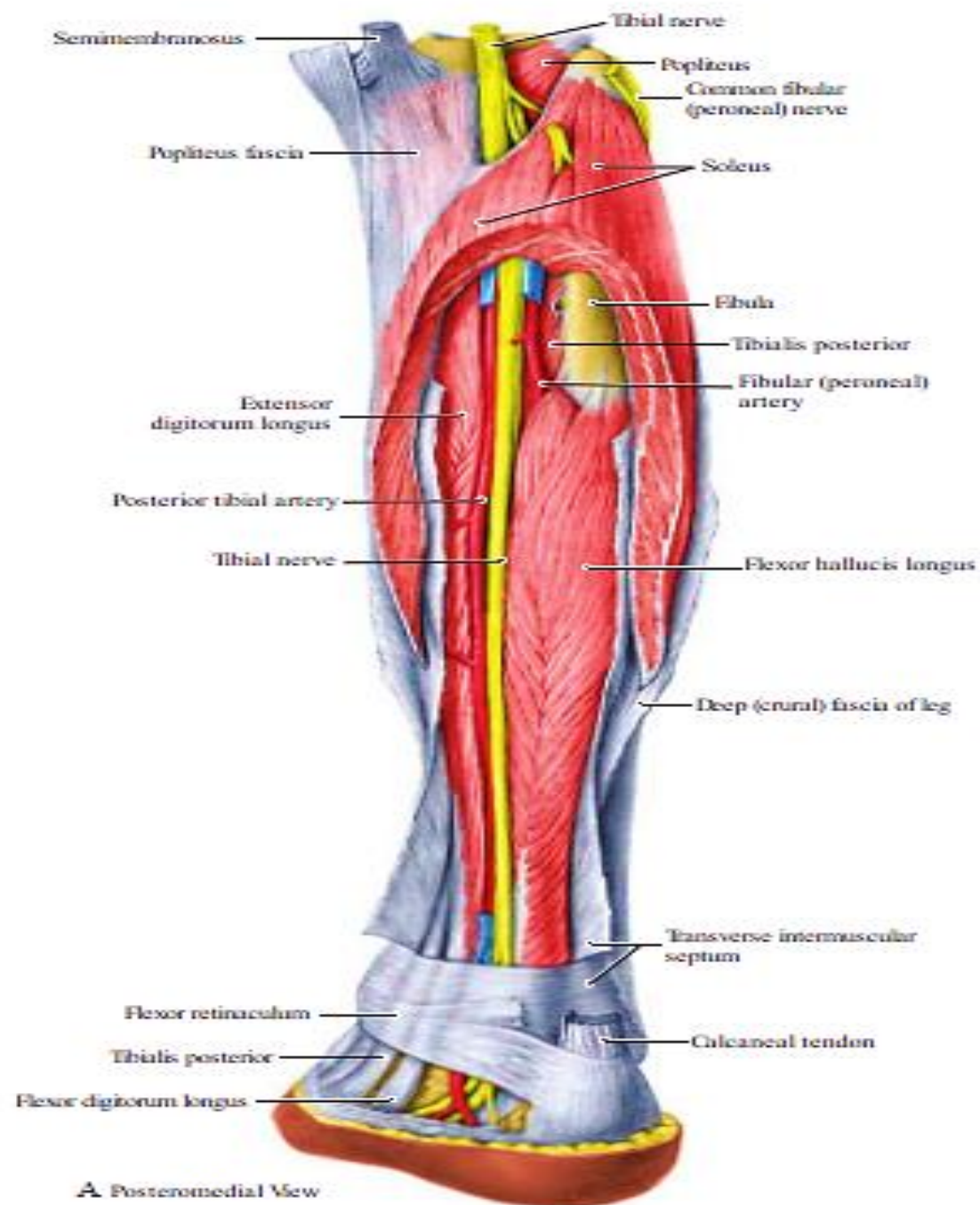
Medial and lateral plantar nerves: The terminal branches of the tibial



A Superficial neurovascular structures.



B Deep neurovascular structures. Removed: Gastrocnemius. Windowed: Soleus.



A Posteromedial View



THANK YOU!

