Ankle and Foot

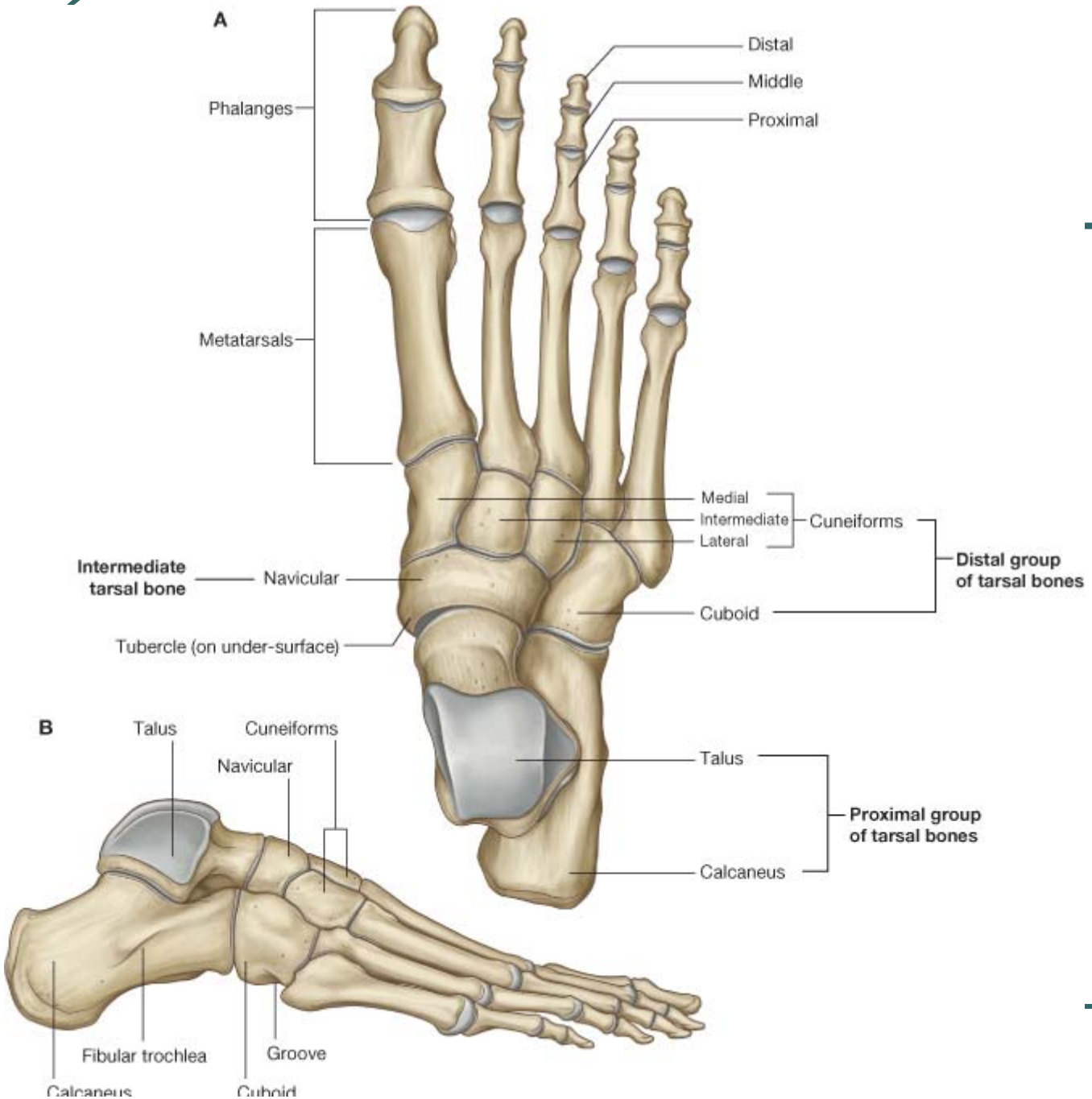
Foot

- Serves as
  - A base of support
  - A shock absorber
  - A mobile adapter
  - A rigid lever

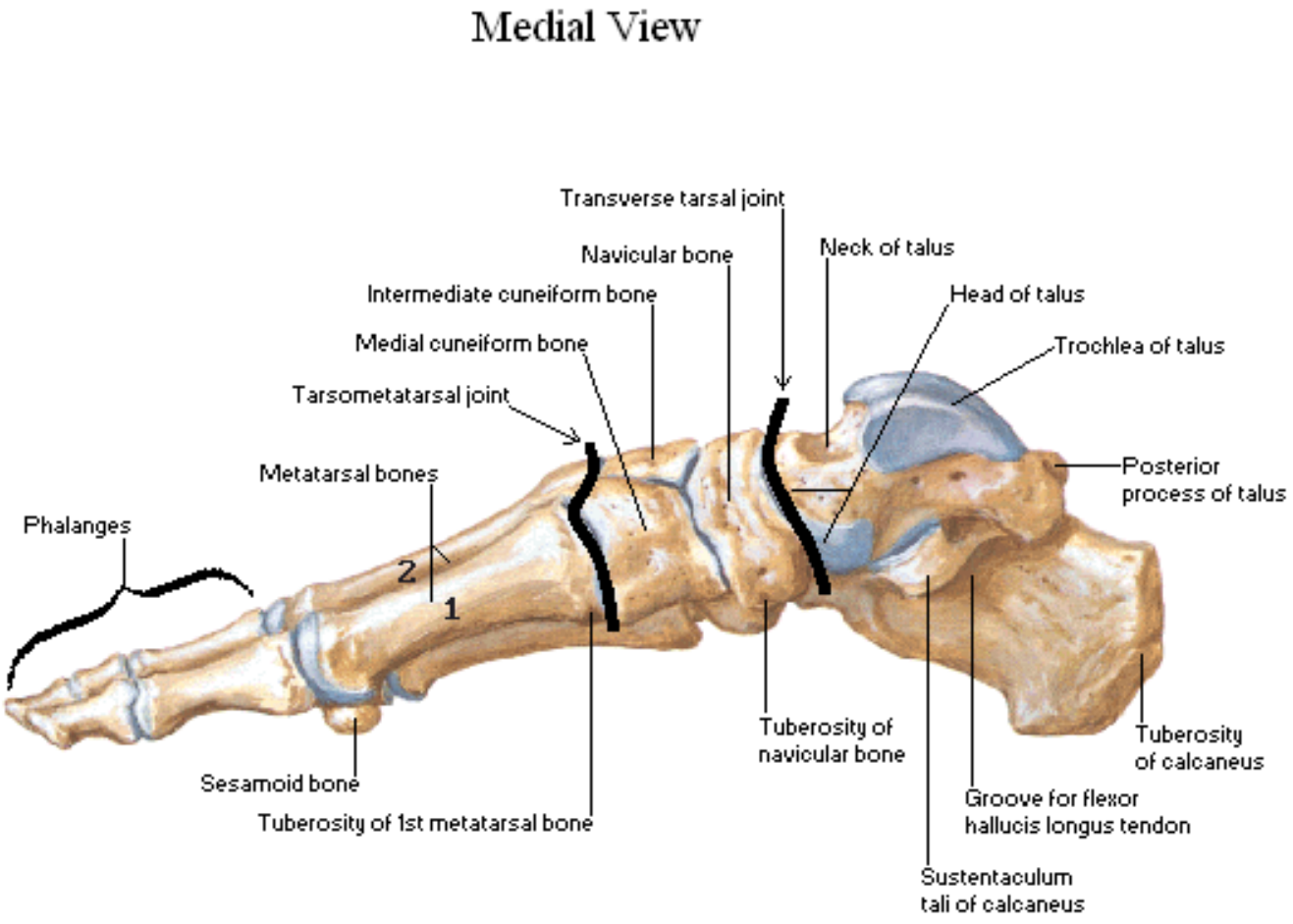
Bones of the Foot

- Talus – N.B., body, neck, head, trochlea, med. and lat. and posterior process
- Calcaneus – N.B., sustentaculum tali, tuberosity
- Cuboid
- Navicular
- Three cuneiforms, medial, intermediate and lateral
- 5 metatarsals
- Phalanges – prox., middle and distal

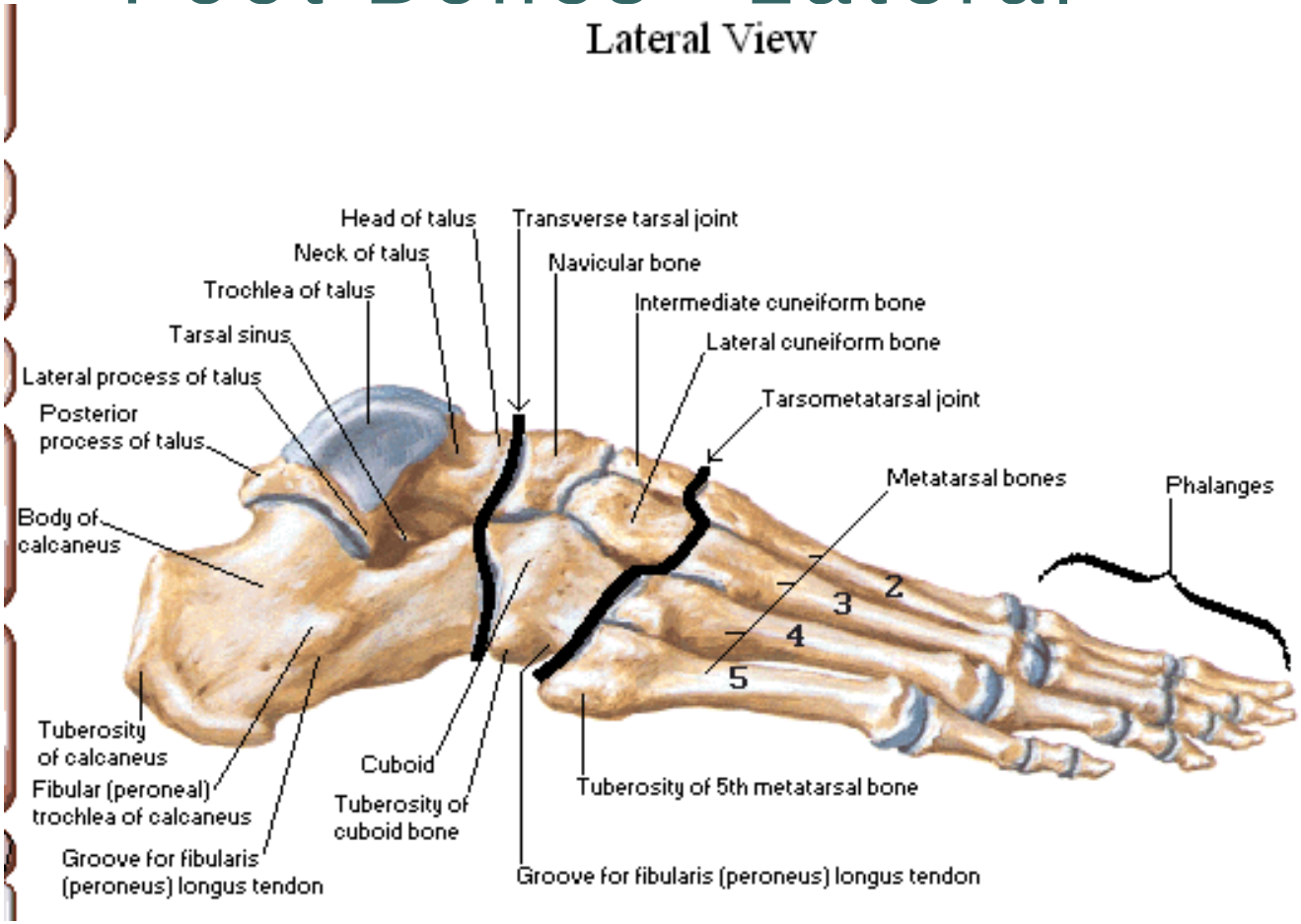
Bones


A
Phalanges
Distal
Middle
Proximal
Metatarsals
Medial
Intermediate
Lateral
Cuneiforms
Distal group of tarsal bones
Intermediate tarsal bone
Navicular
Cuboid
Tubercle (on under-surface)
B
Talus
Cuneiforms
Navicular
Talus
Proximal group of tarsal bones
Calcaneus
Fibular trochlea
Groove
Calcaneus
Cuboid

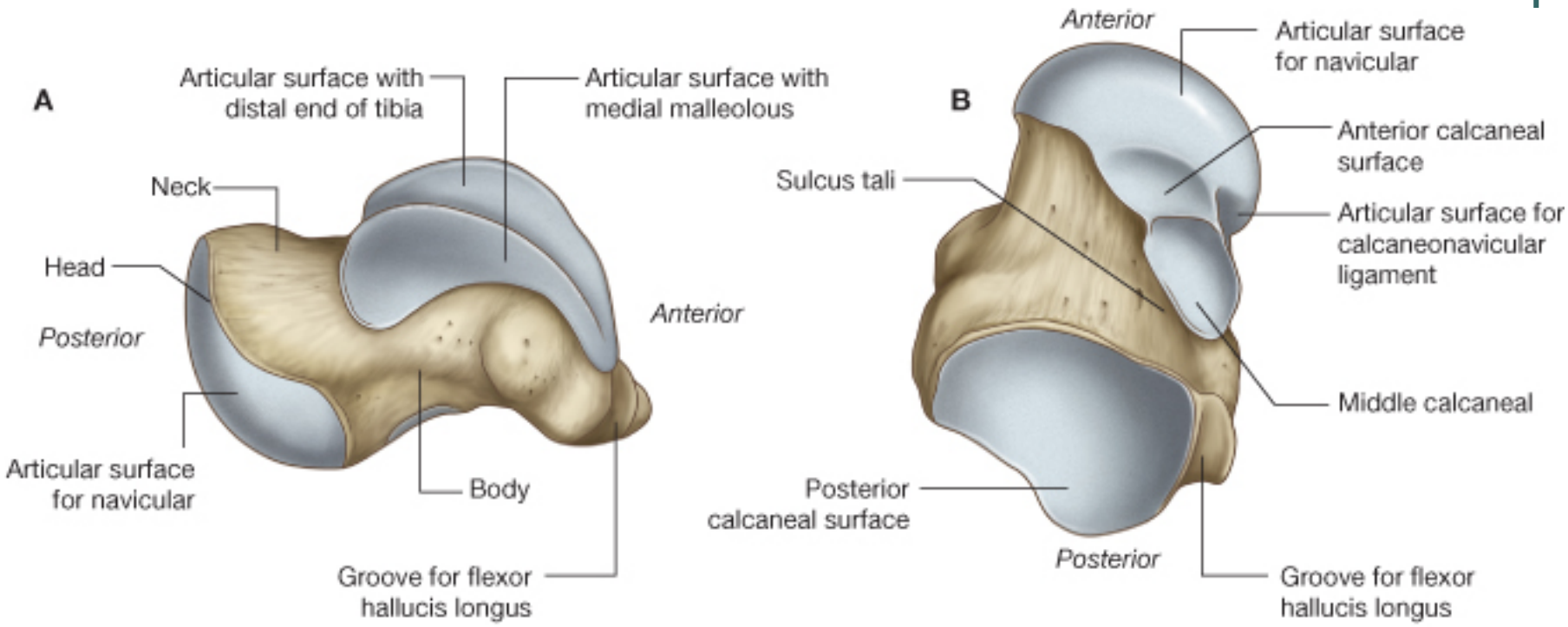
Foot Bones - Medial



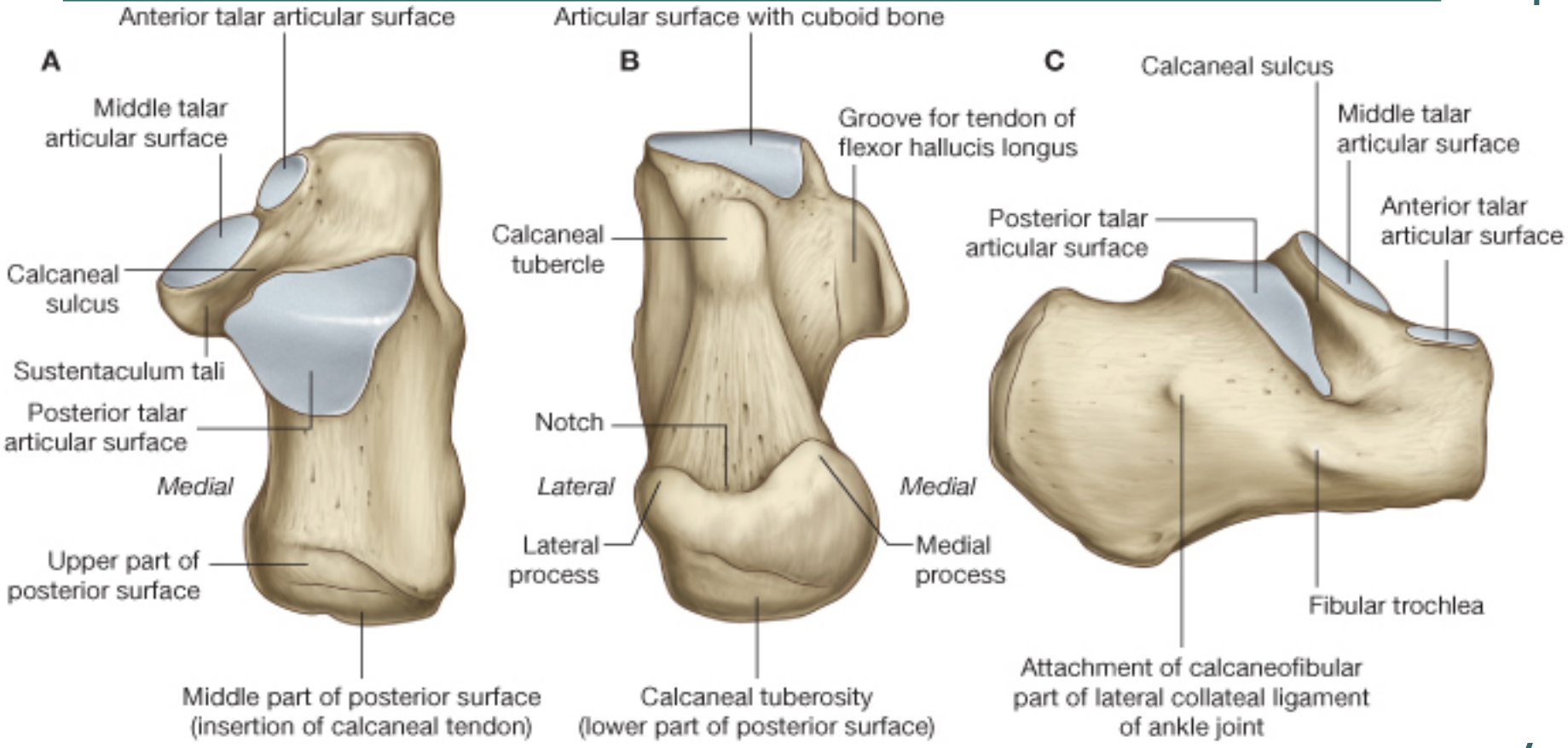
Foot Bones - Lateral



Talus



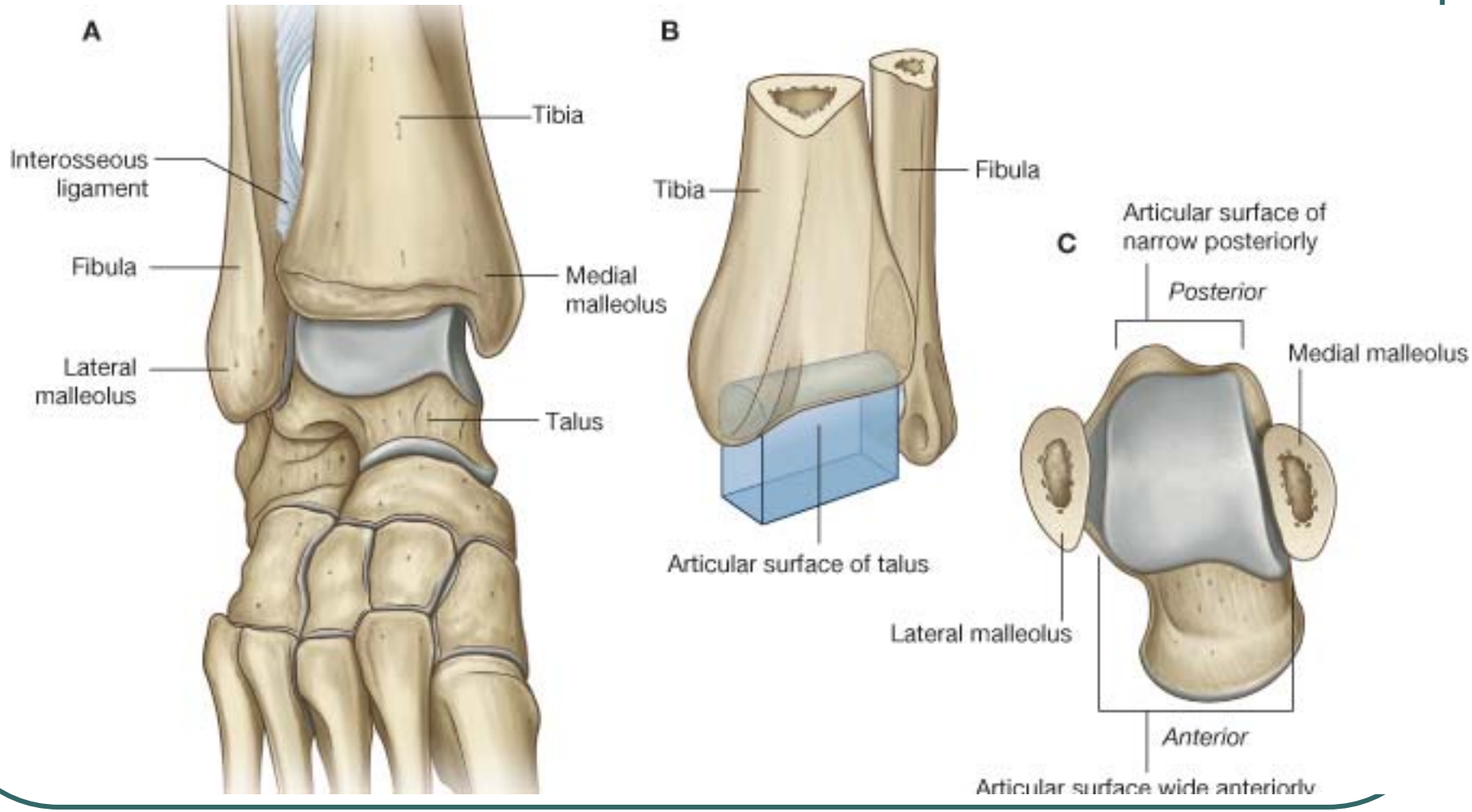
Calcaneus


A
Anterior talar articular surface
Middle talar articular surface
Calcaneal sulcus
Sustentaculum tali
Posterior talar articular surface
Medial
Upper part of posterior surface
Middle part of posterior surface (insertion of calcaneal tendon)
B
Articular surface with cuboid bone
Groove for tendon of flexor hallucis longus
Calcaneal tubercle
Notch
Lateral
Medial
Lateral process
Medial process
Calcaneal tuberosity (lower part of posterior surface)
C
Calcaneal sulcus
Middle talar articular surface
Anterior talar articular surface
Posterior talar articular surface
Fibular trochlea
Attachment of calcaneofibular part of lateral collateal ligament of ankle joint

Joints

- True Ankle, AKA Talo-tibial or talo-crural
- Synovial hinge joint
- The crus (inferior articular surface) of the tibia with talus
- Included in the joint are the medial and lateral malleolus of tibia (med) and fibula (lat) that grip the talus firmly – Don’t forget distal Tibio-Fibular Joint and its importance
- Note position of medial + lateral malleolus
- Dorsiflexion (25 degrees) and plantarflexion (50) only

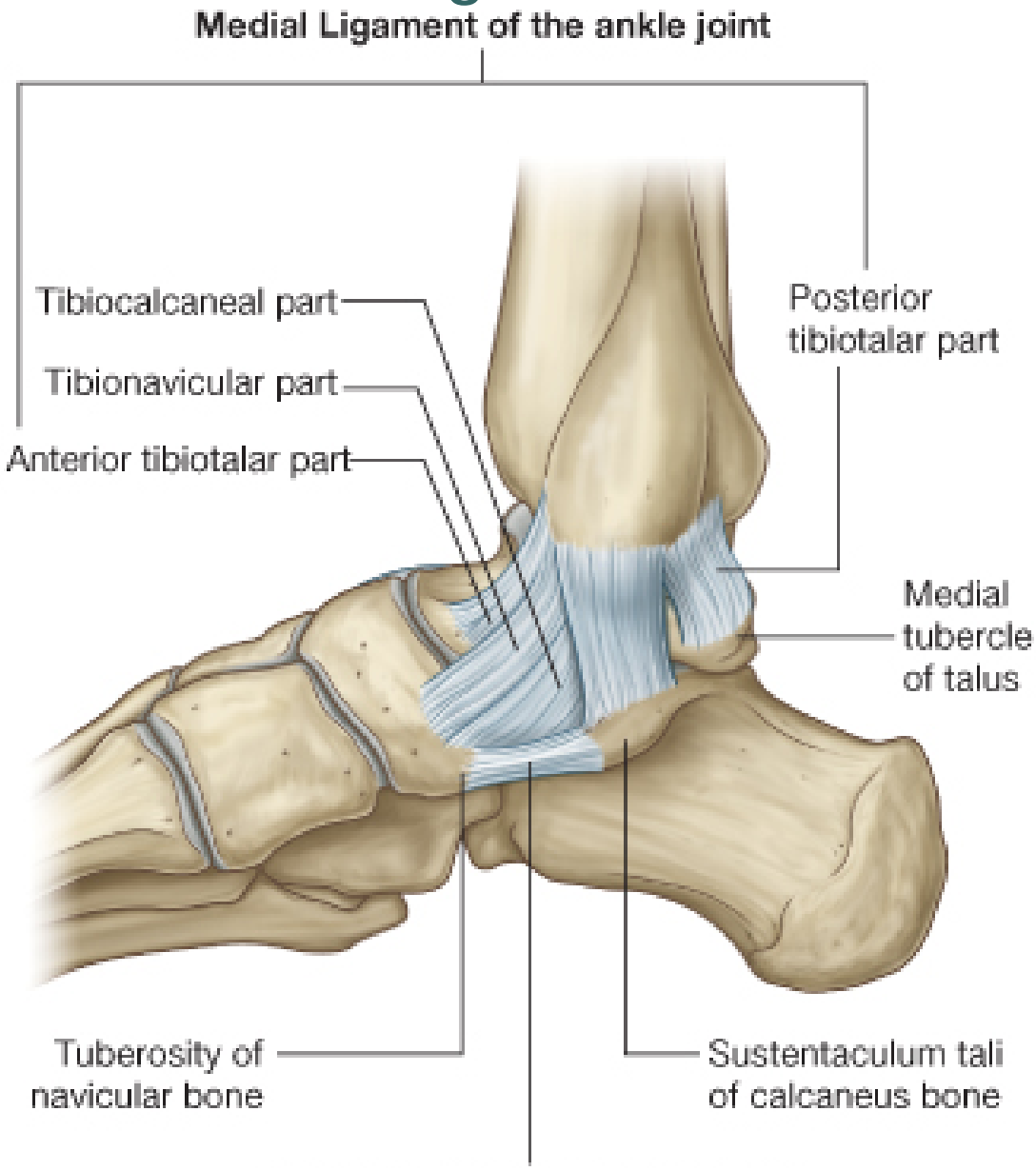
Talo-Tibial


A
Tibia
Interosseous ligament
Fibula
Medial malleolus
Lateral malleolus
Talus
B
Tibia
Fibula
Articular surface of talus
C
Articular surface of narrow posteriorly
Posterior
Medial malleolus
Lateral malleolus
Anterior
Articular surface wide anteriorly

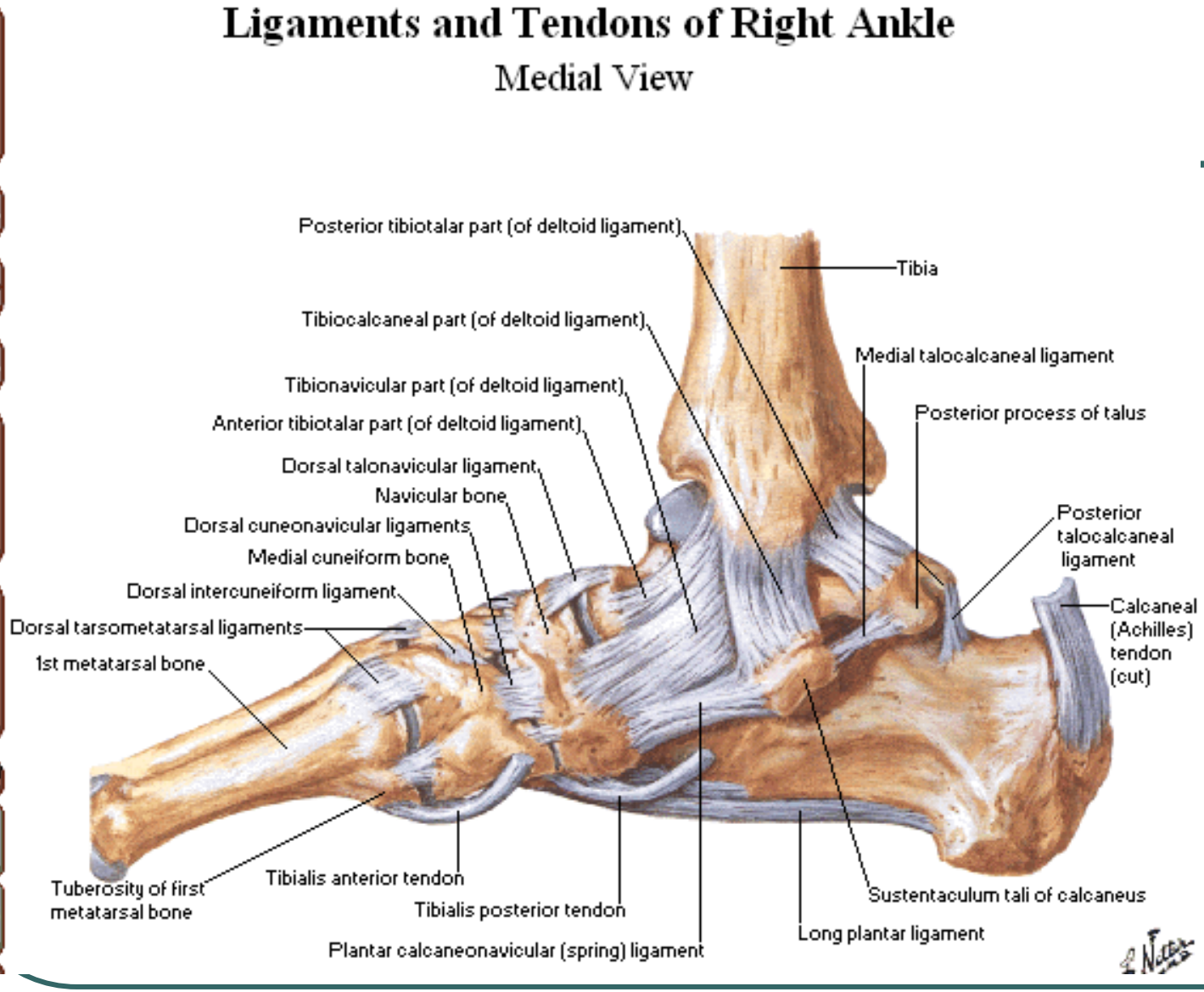
Ankle

- Capsule relatively thin A and P
- Thick on M and L sides – strong enough to resist forces that can actually cause fx to med or lat malleolus
- Medial side - Deltoid ligament; consists of
  - Ant. Tibiotalar
  - Post. Tibiotalar
  - Tibionavicular
  - Tibiocalcaneal
- Resists excessive eversion of the foot

Medial Ligament



Medial Ligaments

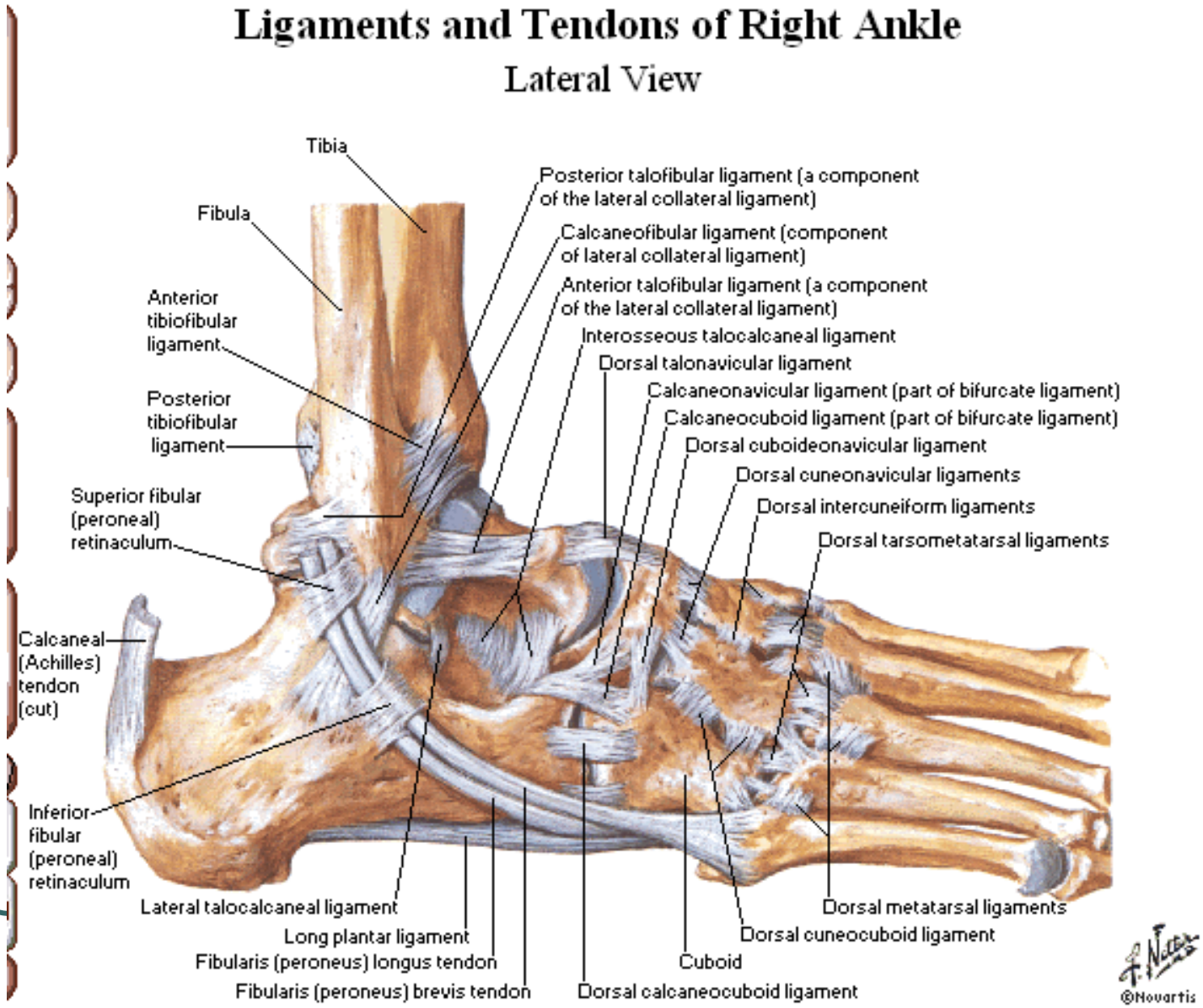


Ankle

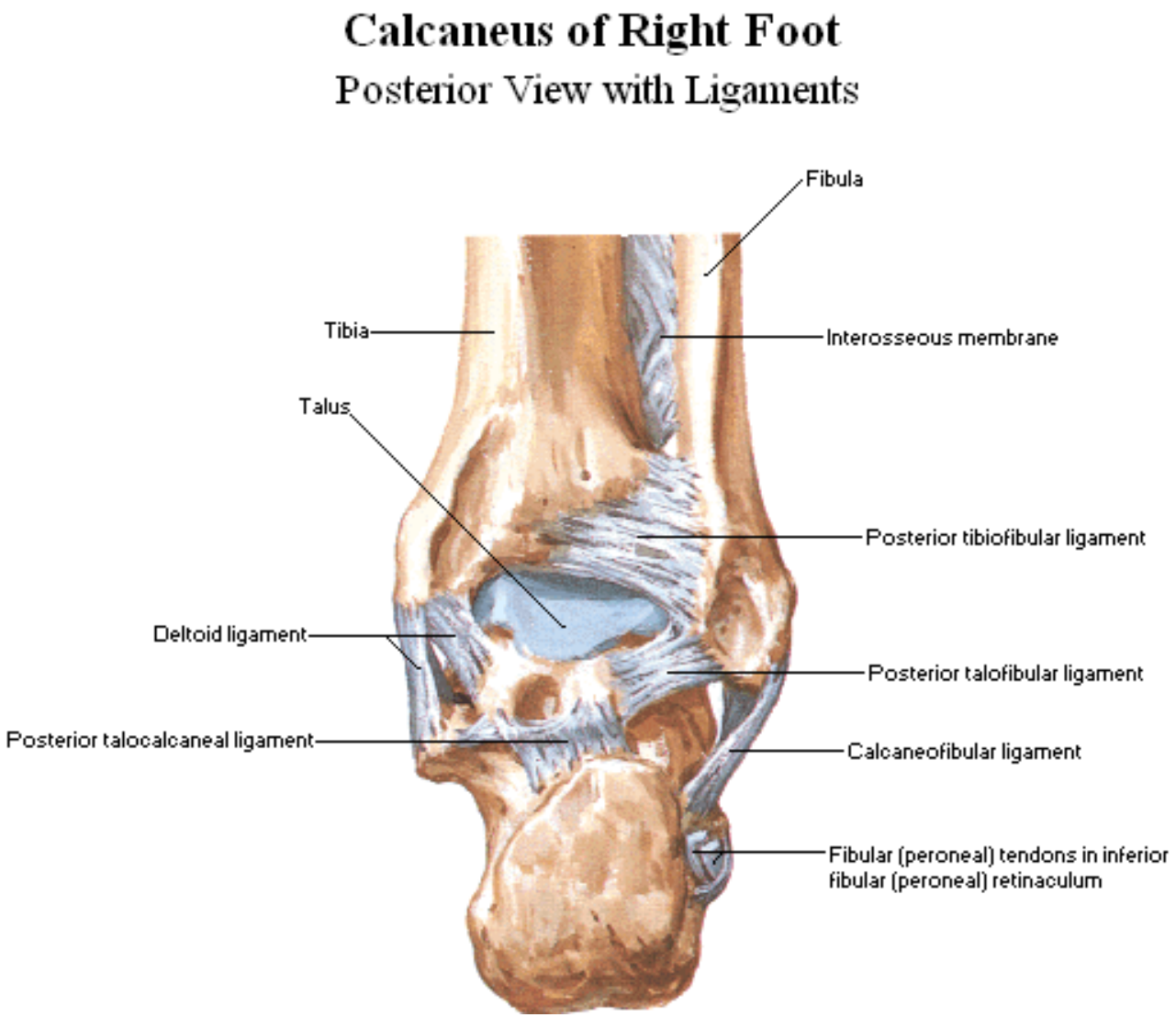
- Lateral side of the joint
- Lateral collateral ligament consists of
  - Anterior talofibular
  - Posterior talofibular
  - Calcaneofibular
  - Resists inversion
- Anterior and posterior tibiofibular ligaments are also important in this relationship
- “High” vs. “Low” ankle sprain

Lateral Liagaments

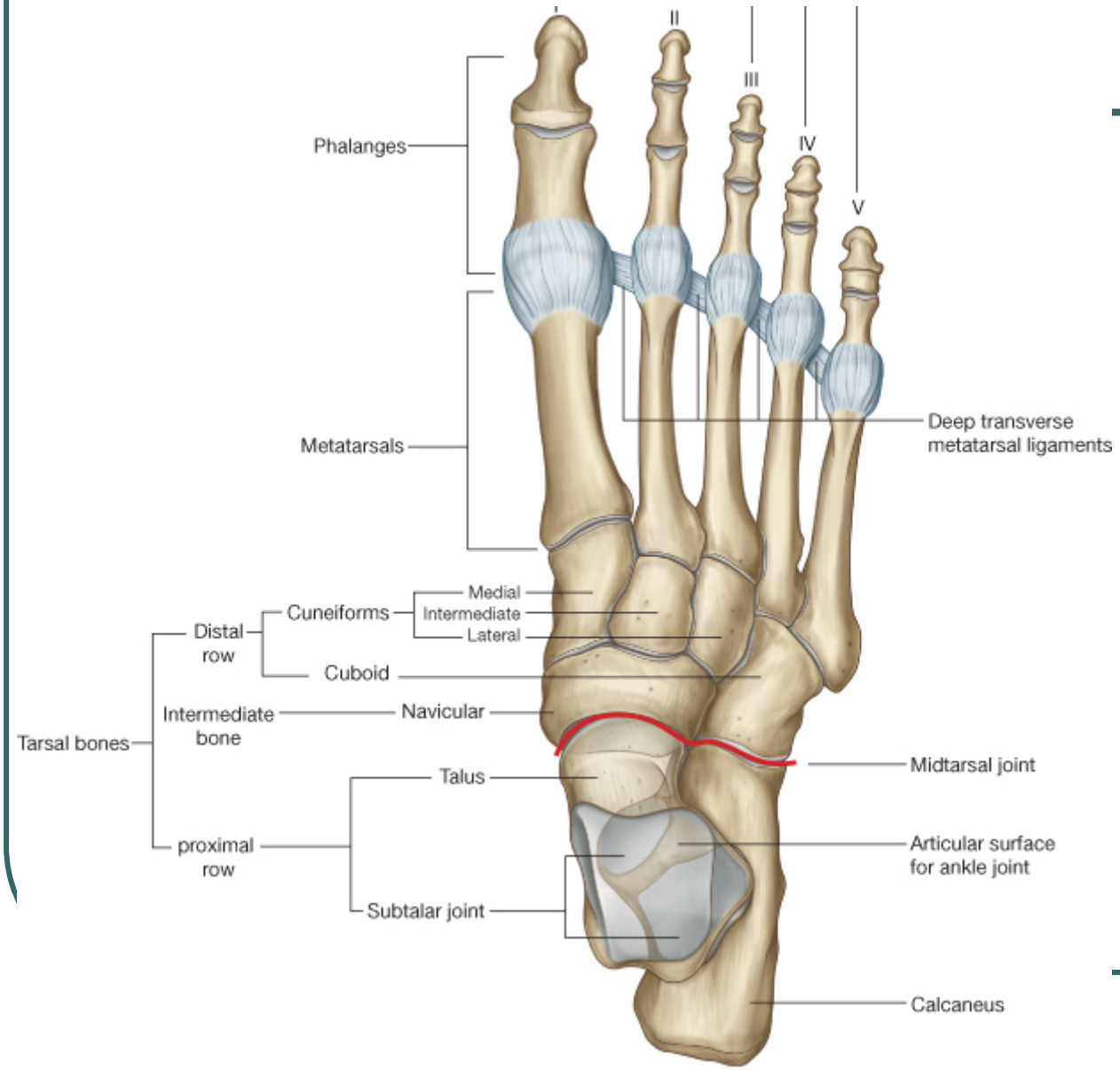
Lateral Ligaments



Posterior View



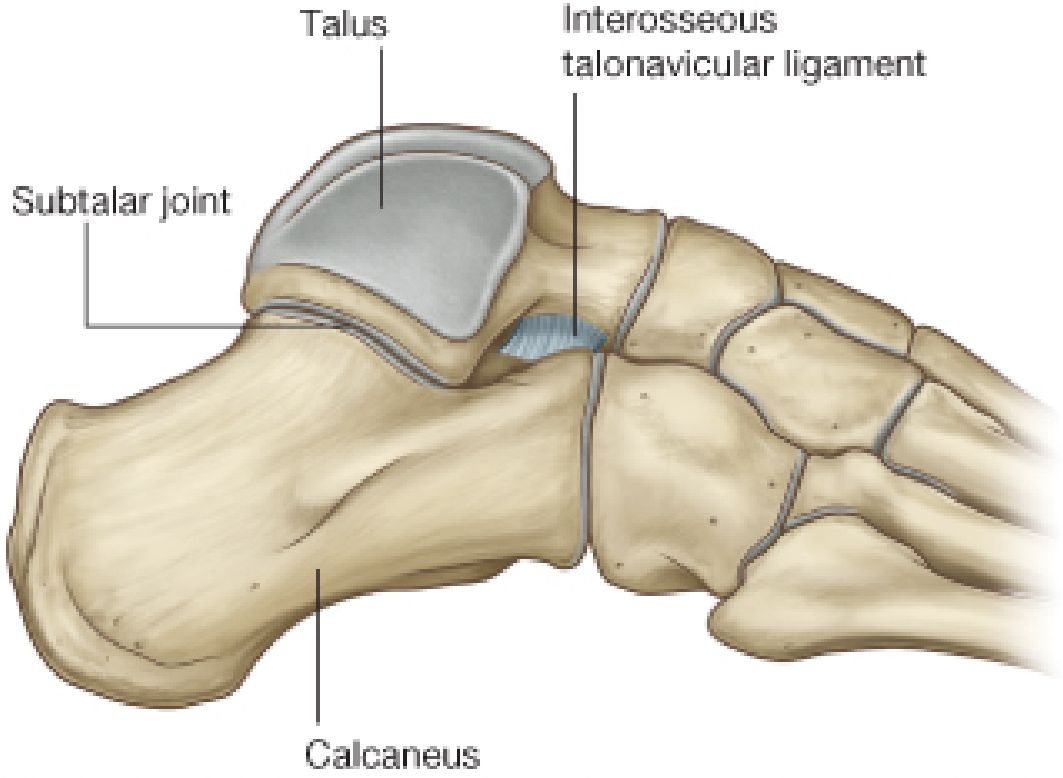
Overview of Joints



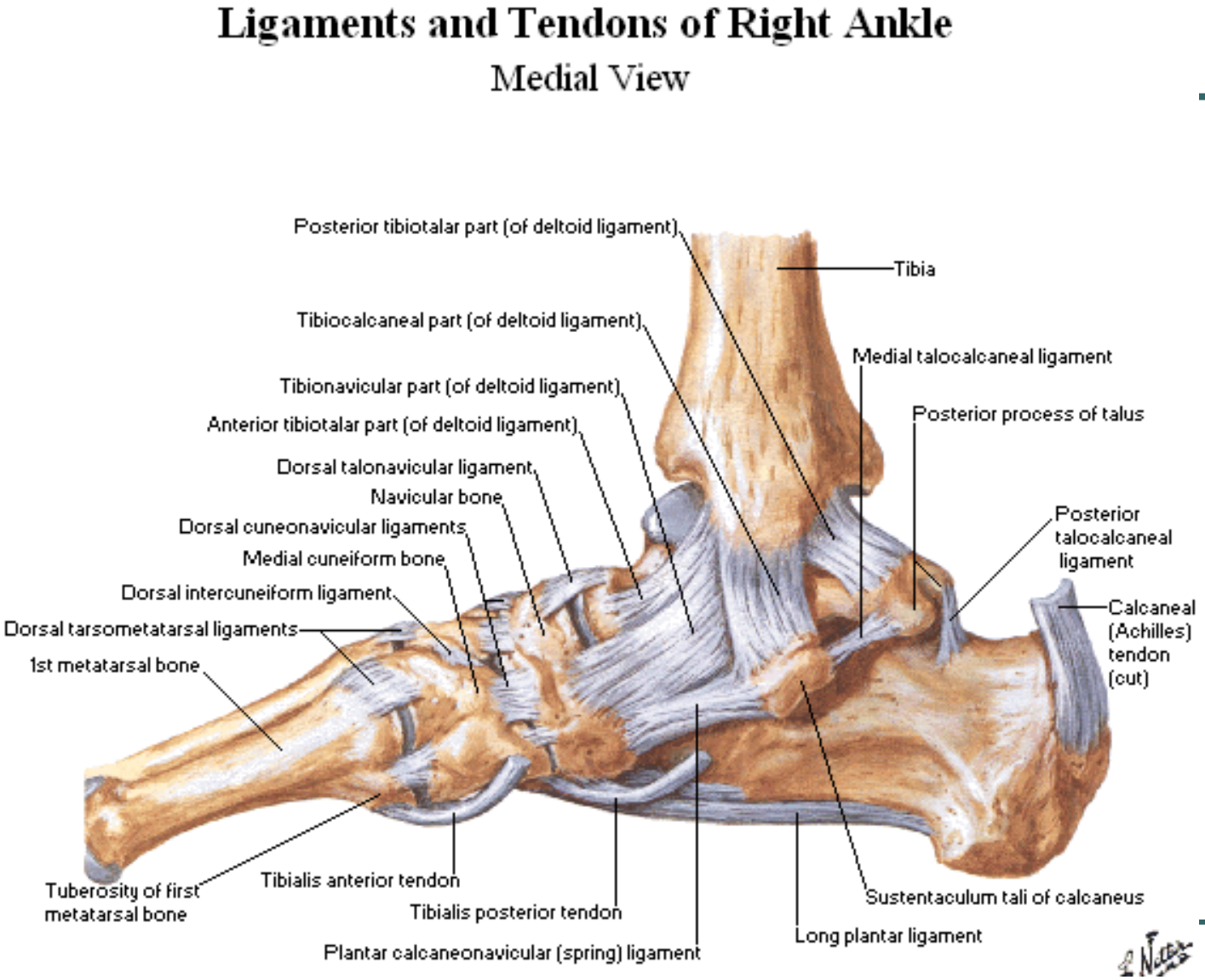
Talo-Calcaneal Joint AKA Sub Talar Joint

- Post, middle, and anterior relationships
- Inversion and eversion
- Ligaments
  - Calcaneonavicular
  - Dorsal Talonavicular superiorly
  - Interosseous talocalcaneal
  - Posterior talocalcaneal
  - Medial talocalcaneal
  - Lateral talocalcaneal
  - Anterior talocalcaneal - deep

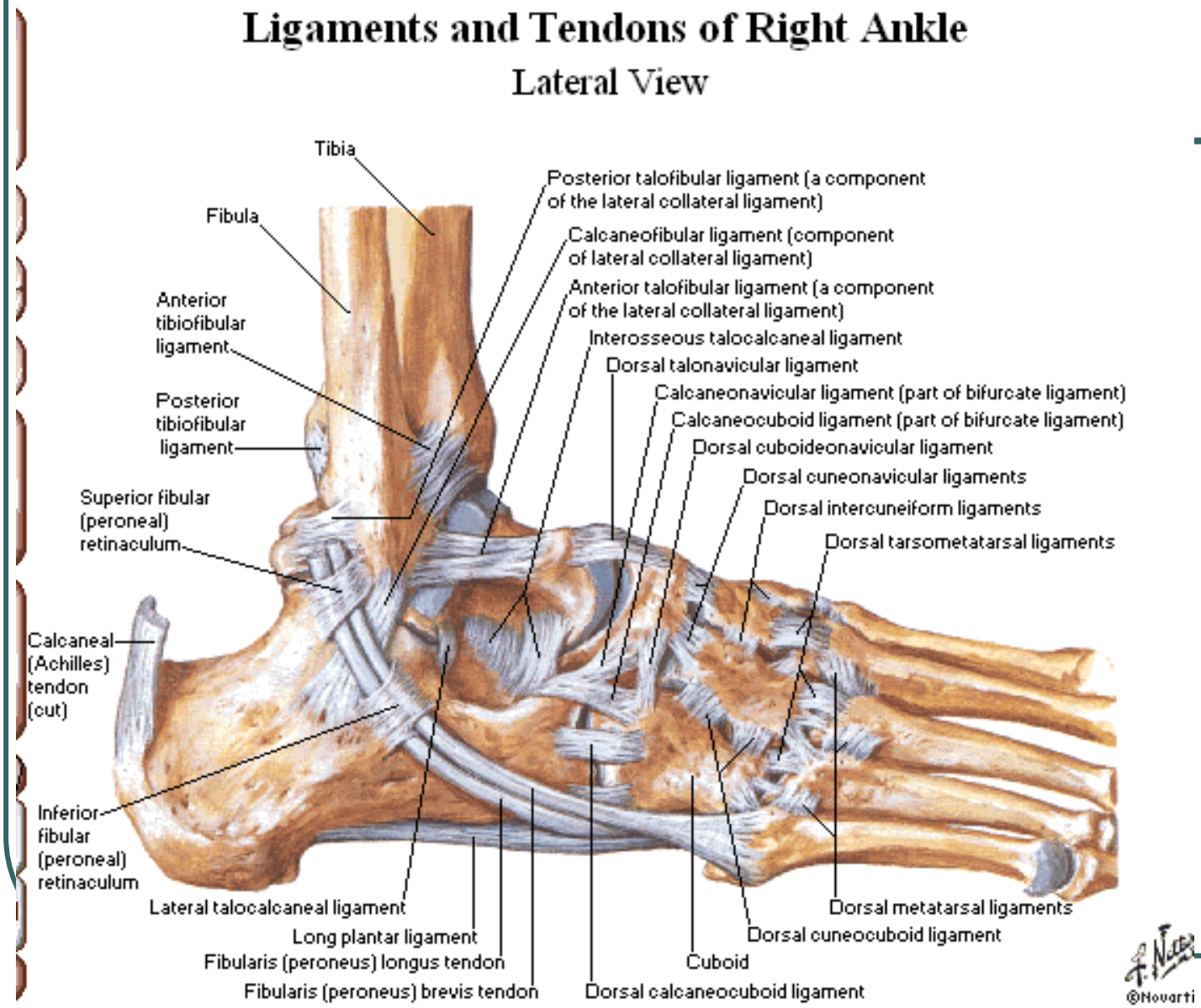
Sub Talar Joint



Ligaments


Ligaments and Tendons of Right Ankle
Medial View
Posterior tibiotalar part (of deltoid ligament)
Tibia
Tibiocalcaneal part (of deltoid ligament)
Medial talocalcaneal ligament
Tibionavicular part (of deltoid ligament)
Posterior process of talus
Anterior tibiotalar part (of deltoid ligament)
Dorsal talonavicular ligament
Navicular bone
Posterior talocalcaneal ligament
Dorsal cuneonavicular ligaments
Medial cuneiform bone
Dorsal intercuneiform ligament
Calcaneal (Achilles) tendon (cut)
Dorsal tarsometatarsal ligaments
1st metatarsal bone
Tuberosity of first metatarsal bone
Tibialis anterior tendon
Tibialis posterior tendon
Sustentaculum tali of calcaneus
Plantar calcaneonavicular (spring) ligament
Long plantar ligament

Ligaments


Ligaments and Tendons of Right Ankle
Lateral View
Tibia
Fibula
Anterior tibiofibular ligament
Posterior tibiofibular ligament
Superior fibular (peroneal) retinaculum
Calcaneal (Achilles) tendon (cut)
Inferior fibular (peroneal) retinaculum
Lateral talocalcaneal ligament
Long plantar ligament
Fibularis (peroneus) longus tendon
Fibularis (peroneus) brevis tendon
Dorsal calcaneocuboid ligament
Cuboid
Dorsal cuneocuboid ligament
Dorsal metatarsal ligaments
Posterior talofibular ligament (a component of the lateral collateral ligament)
Calcaneofibular ligament (component of lateral collateral ligament)
Anterior talofibular ligament (a component of the lateral collateral ligament)
Interosseous talocalcaneal ligament
Dorsal talonavicular ligament
Calcaneonavicular ligament (part of bifurcate ligament)
Calcaneocuboid ligament (part of bifurcate ligament)
Dorsal cuboideonavicular ligament
Dorsal cuneonavicular ligaments
Dorsal intercuneiform ligaments
Dorsal tarsometatarsal ligaments
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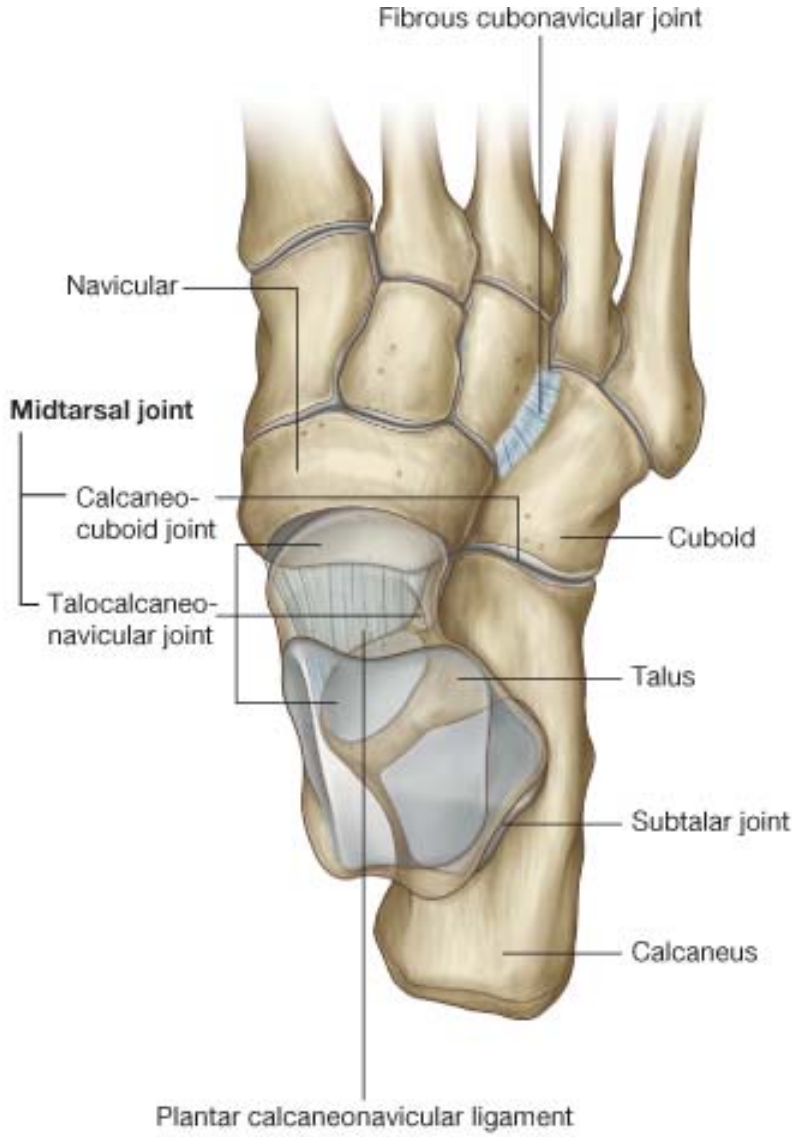
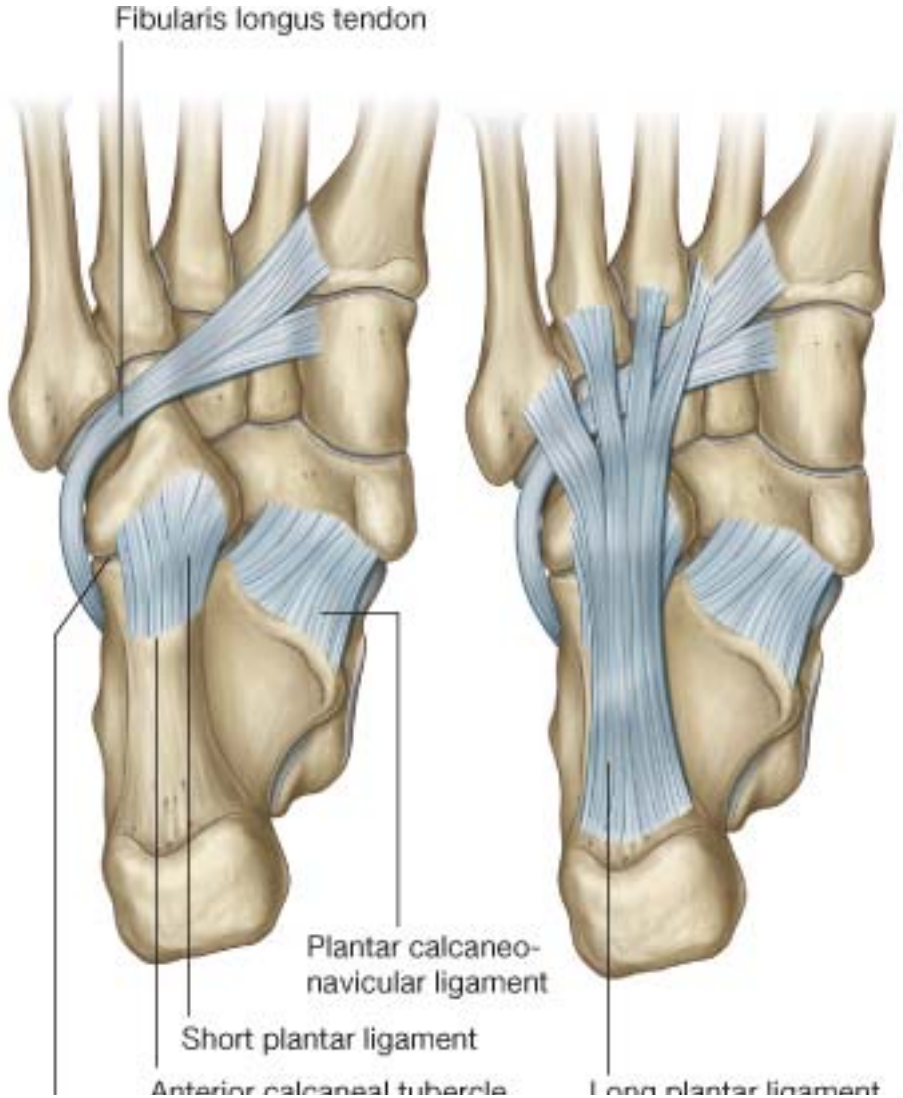
Transverse Tarsal Joint – AKA MidTarsal

- Two joints in one complex – calcaneocuboid and talonavicular
- Motions = forefoot ABD and ADD
- Ligaments
  - Bifurcate – calcaneonavicular and calcaneocuboid
  - Long plantar – calcaneous to bases of metarsals 2-5
  - Short plantar – calcaneous to cuboid
  - Plantar calcaneonavicular (spring) – note split
  - Plantar cuboideonavicular

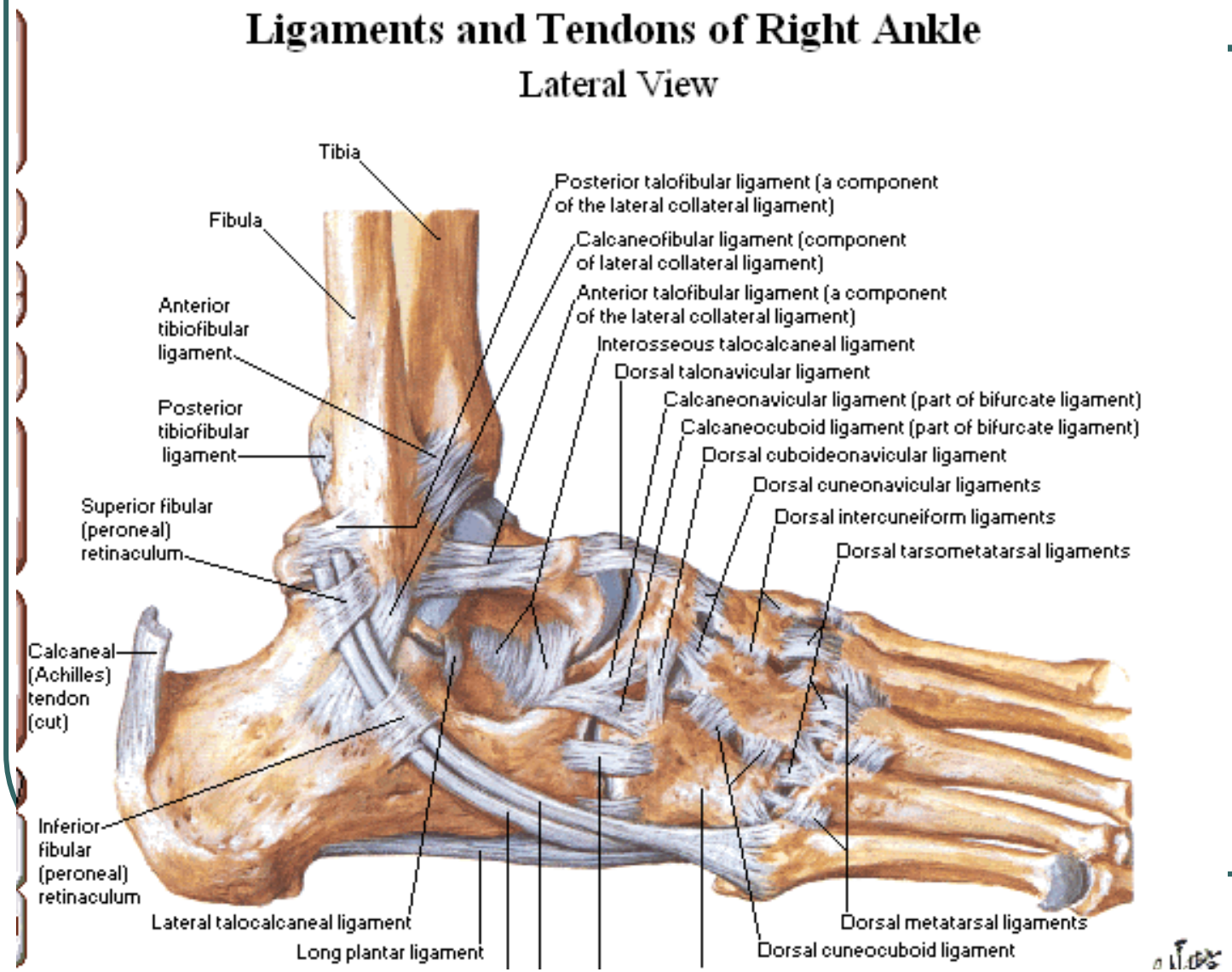
Transverse Tarsal Joint



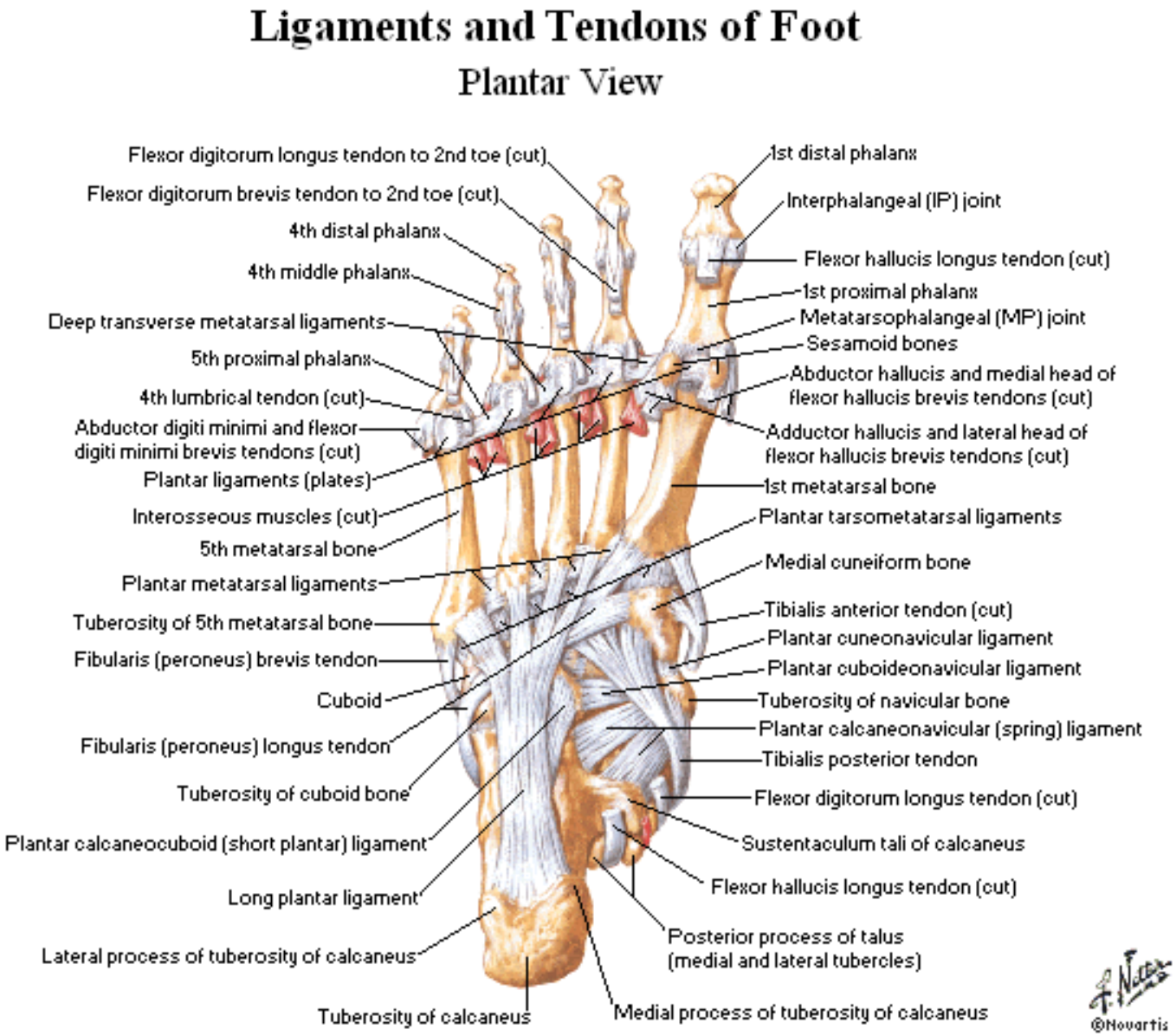
Ligaments


Fibularis longus tendon
Plantar calcaneo-
navicular ligament
Short plantar ligament
Anterior calcaneal tubercle
Long plantar ligament

Ligaments


Ligaments and Tendons of Right Ankle
Lateral View
Tibia
Fibula
Anterior tibiofibular ligament
Posterior tibiofibular ligament
Superior fibular (peroneal) retinaculum
Calcaneal (Achilles) tendon (cut)
Inferior fibular (peroneal) retinaculum
Lateral talocalcaneal ligament
Long plantar ligament
Posterior talofibular ligament (a component of the lateral collateral ligament)
Calcaneofibular ligament (component of lateral collateral ligament)
Anterior talofibular ligament (a component of the lateral collateral ligament)
Interosseous talocalcaneal ligament
Dorsal talonavicular ligament
Calcaneonavicular ligament (part of bifurcate ligament)
Calcaneocuboid ligament (part of bifurcate ligament)
Dorsal cuboideonavicular ligament
Dorsal cuneonavicular ligaments
Dorsal intercuneiform ligaments
Dorsal tarsometatarsal ligaments
Dorsal metatarsal ligaments
Dorsal cuneocuboid ligament

Ligaments


Ligaments and Tendons of Foot
Plantar View
Flexor digitorum longus tendon to 2nd toe (cut)
Flexor digitorum brevis tendon to 2nd toe (cut)
4th distal phalanx
4th middle phalanx
Deep transverse metatarsal ligaments
5th proximal phalanx
4th lumbrical tendon (cut)
Abductor digiti minimi and flexor digiti minimi brevis tendons (cut)
Plantar ligaments (plates)
Interosseous muscles (cut)
5th metatarsal bone
Plantar metatarsal ligaments
Tuberosity of 5th metatarsal bone
Fibularis (peroneus) brevis tendon
Cuboid
Fibularis (peroneus) longus tendon
Tuberosity of cuboid bone
Plantar calcaneocuboid (short plantar) ligament
Long plantar ligament
Lateral process of tuberosity of calcaneus
Tuberosity of calcaneus
Medial process of tuberosity of calcaneus
Posterior process of talus (medial and lateral tubercles)
Flexor hallucis longus tendon (cut)
Sustentaculum tali of calcaneus
Flexor digitorum longus tendon (cut)
Tibialis posterior tendon
Plantar calcaneonavicular (spring) ligament
Tuberosity of navicular bone
Plantar cuboideonavicular ligament
Plantar cuneonavicular ligament
Tibialis anterior tendon (cut)
Medial cuneiform bone
Plantar tarsometatarsal ligaments
1st metatarsal bone
Adductor hallucis and lateral head of flexor hallucis brevis tendons (cut)
Abductor hallucis and medial head of flexor hallucis brevis tendons (cut)
Sesamoid bones
Metatarsophalangeal (MP) joint
1st proximal phalanx
Flexor hallucis longus tendon (cut)
Interphalangeal (IP) joint
1st distal phalanx
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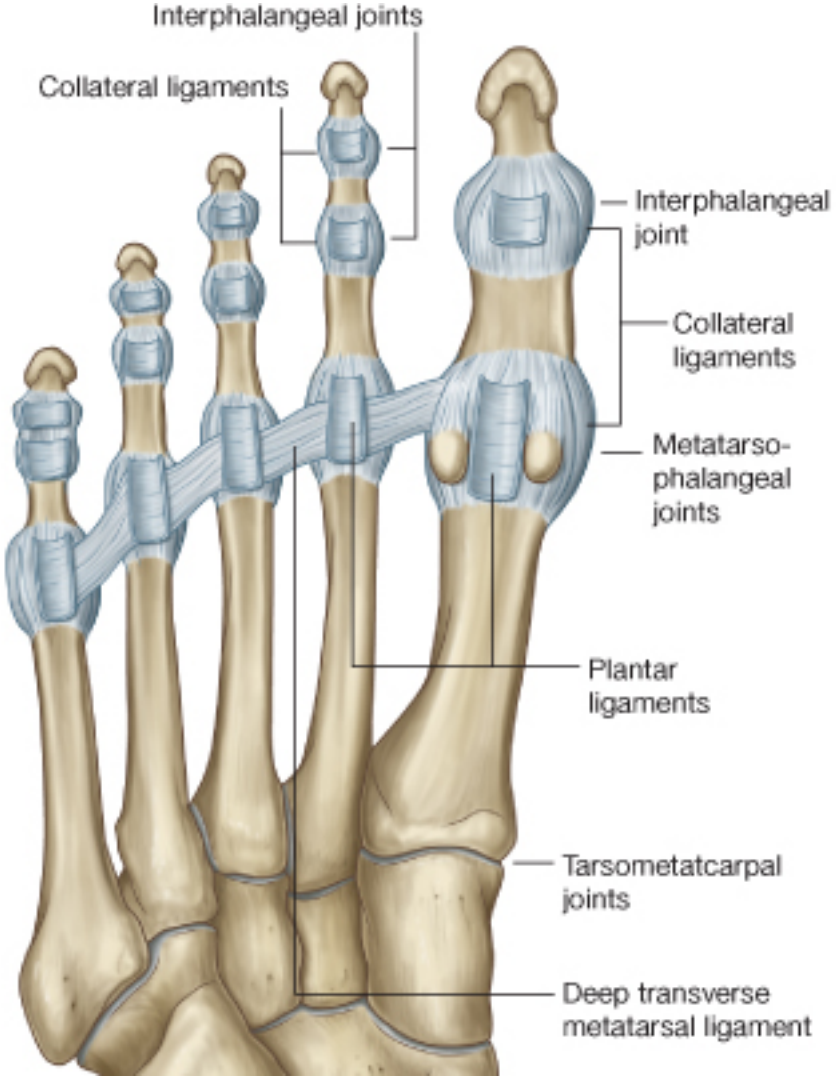
Combined motions

- Supination = forefoot ADD, inversion and plantarflexion
- Pronation = forefoot ABD, eversion and dorsiflexion

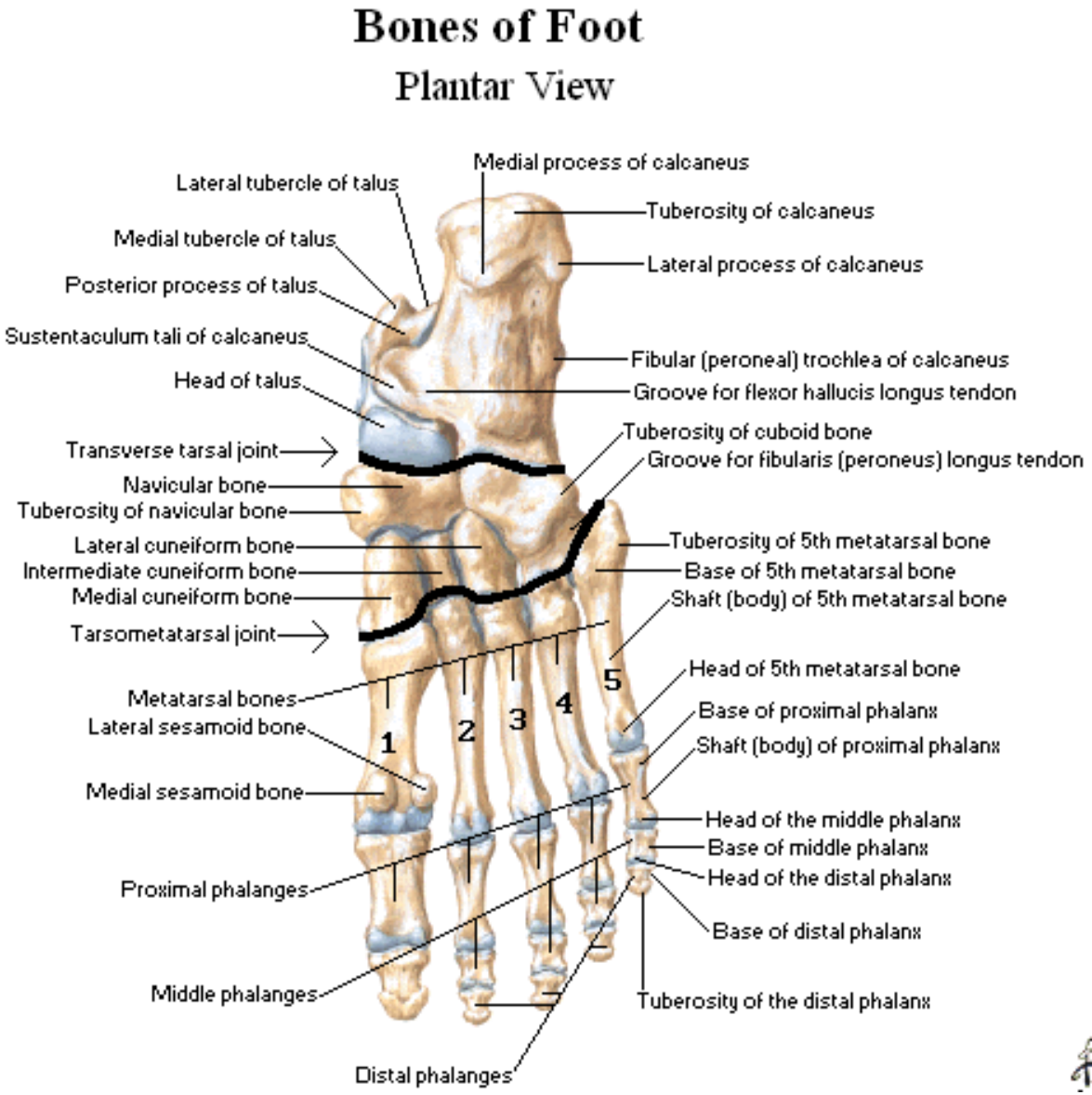
Tarsometatarsal

- Med cuneiform with 1st met
- Intermediate cuneiform with 2nd met
- Lat cuneiform with 3rd met
- Cuboid with 5th and 6th met
- Small gliding joints, motion = accessory
- Ligaments
  - Dorsal tarsometatarsal ligaments
  - Plantar tarsometatarsal ligaments
  - Plantar metatarsal ligaments
  - Long plantar

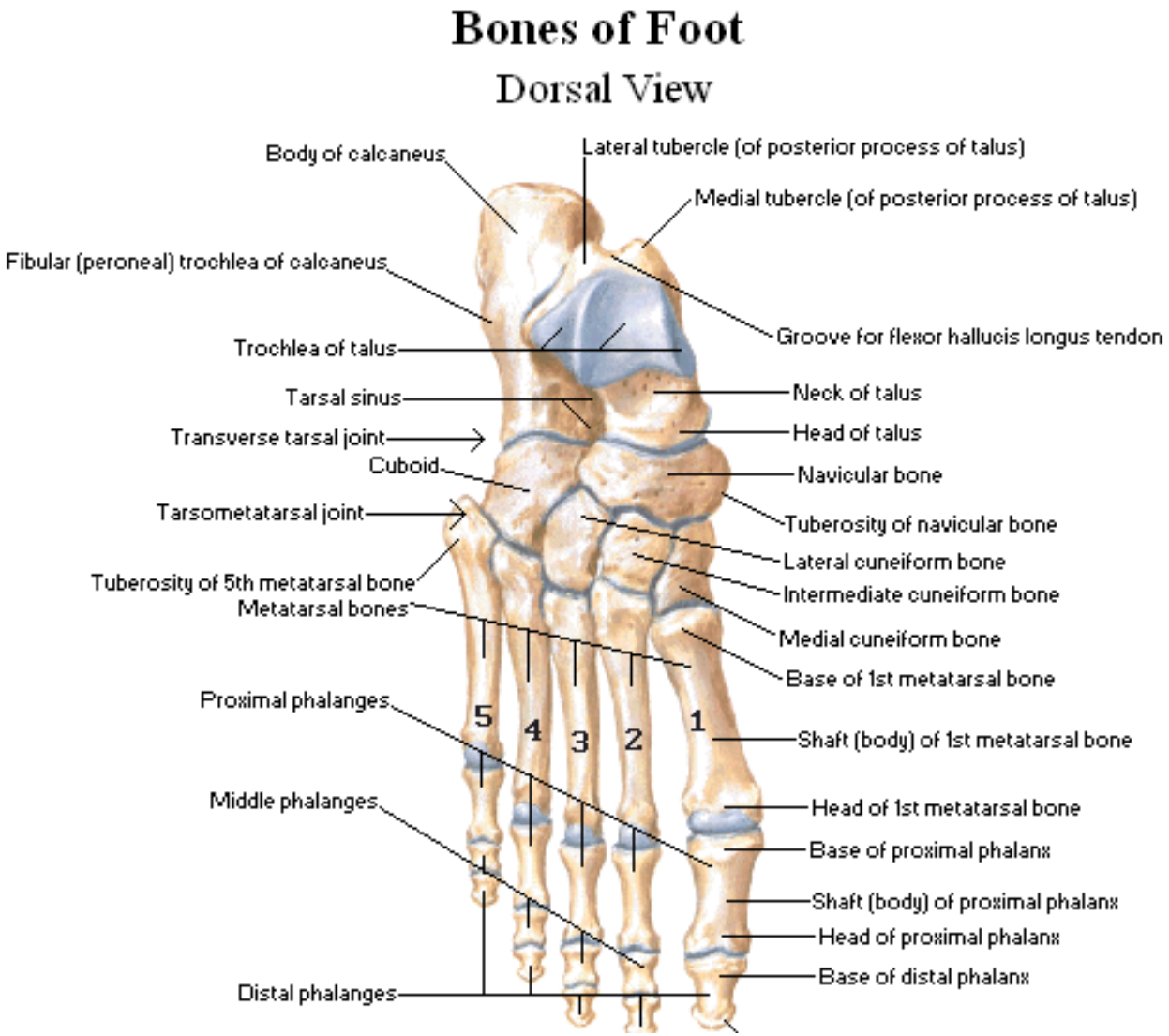
Tarsometatarsal Joints



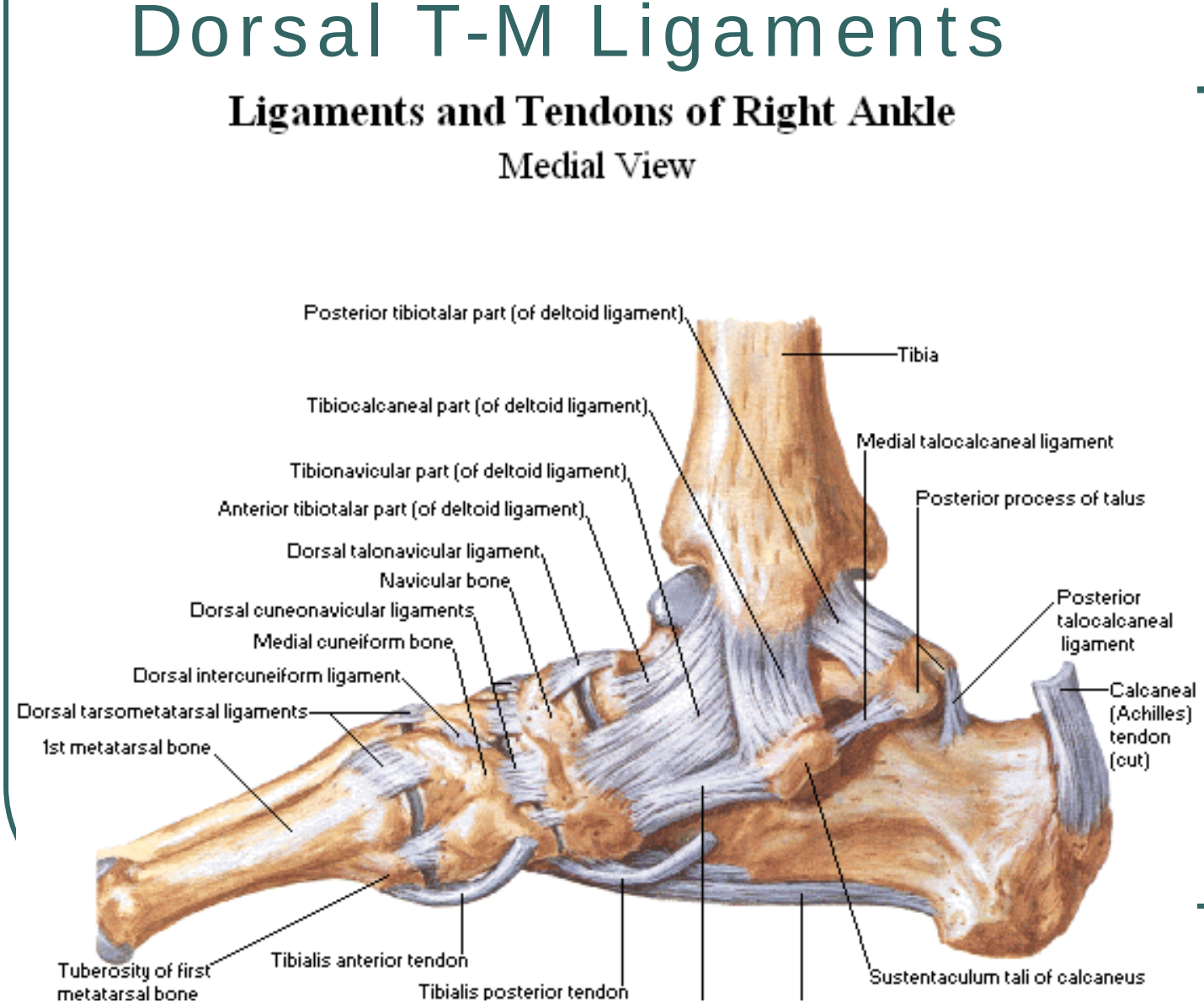
Tarsometatarsal Joints



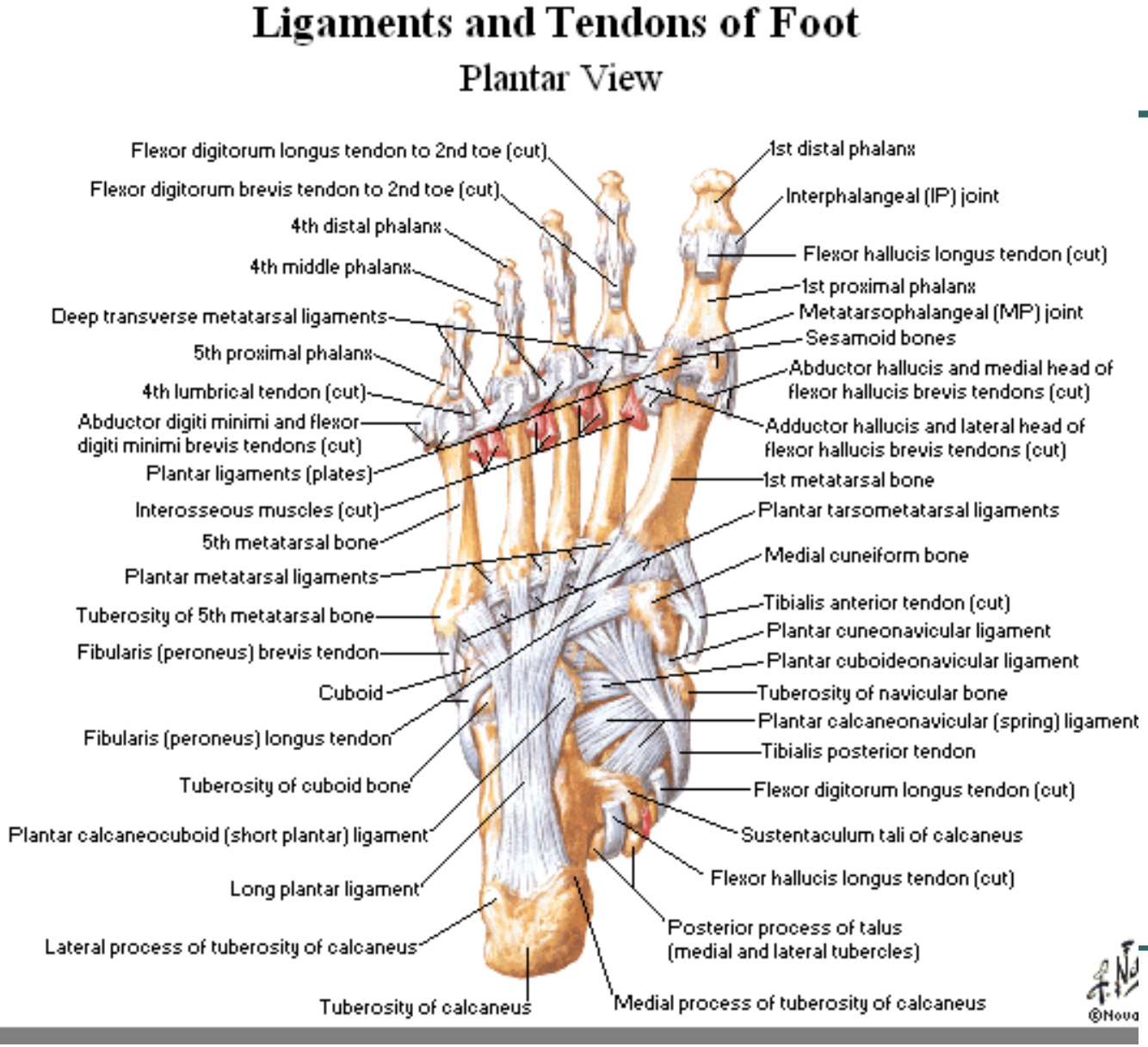
Tarsometatarsal Joints



Dorsal T-M Ligaments



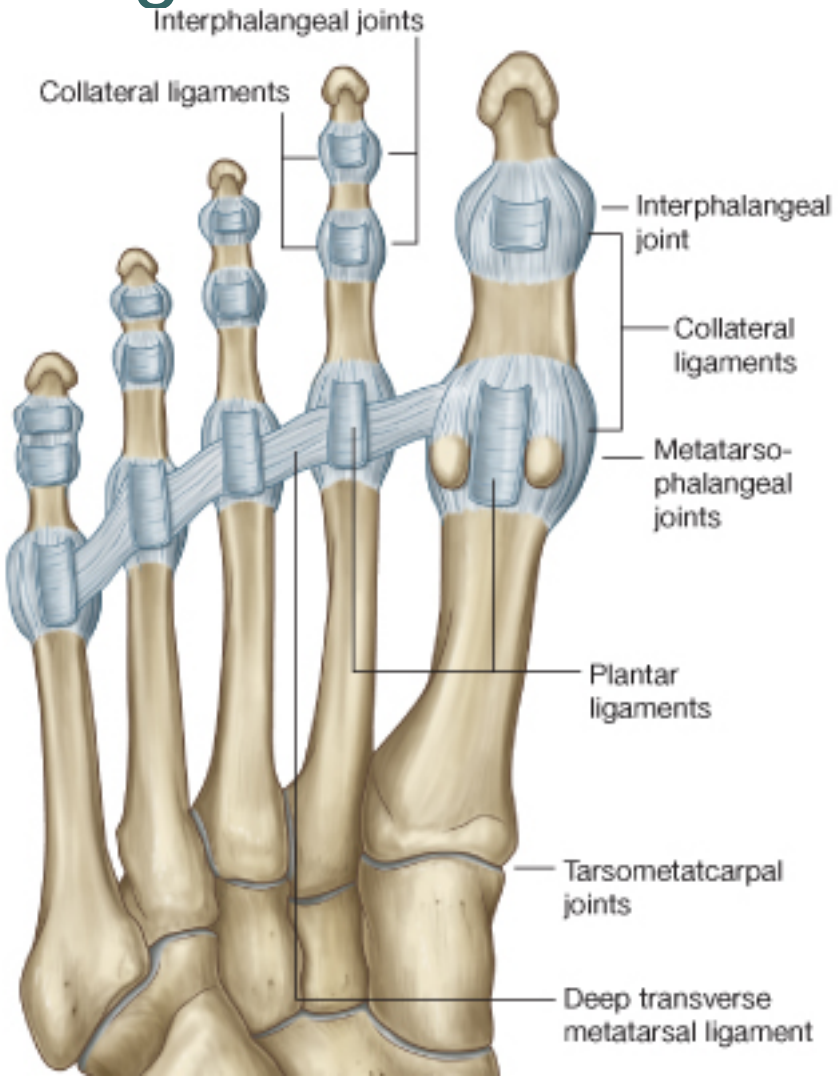
Plantar T-M Ligaments



Metatarsal Phalangeal

- Basically, all are ellipsoid joints
- Flexion/extension (dorsiflexion and plantarflexion), ABD/ADD, passive (accessory) rotation
- More dorsiflexion than plantar to allow body to pass over MP joints when walking
- Ligaments
  - Plantar ligaments (AKA plantar plates)
  - Deep transverse
  - Collateral ligaments

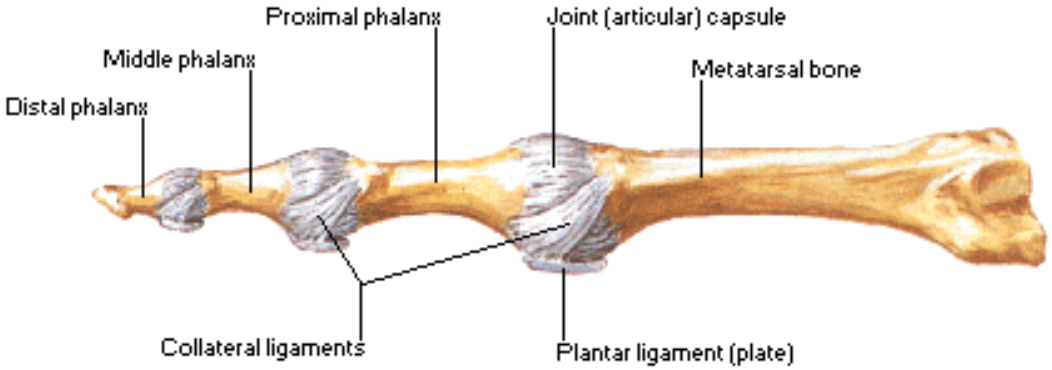
Ligaments


Interphalangeal joints
Collateral ligaments
Interphalangeal joint
Collateral ligaments
Metatarso-phalangeal joints
Plantar ligaments
Tarsometatcarpal joints
Deep transverse metatarsal ligament

Ligaments

Metatarsophalangeal and Interphalangeal Joints

Lateral View



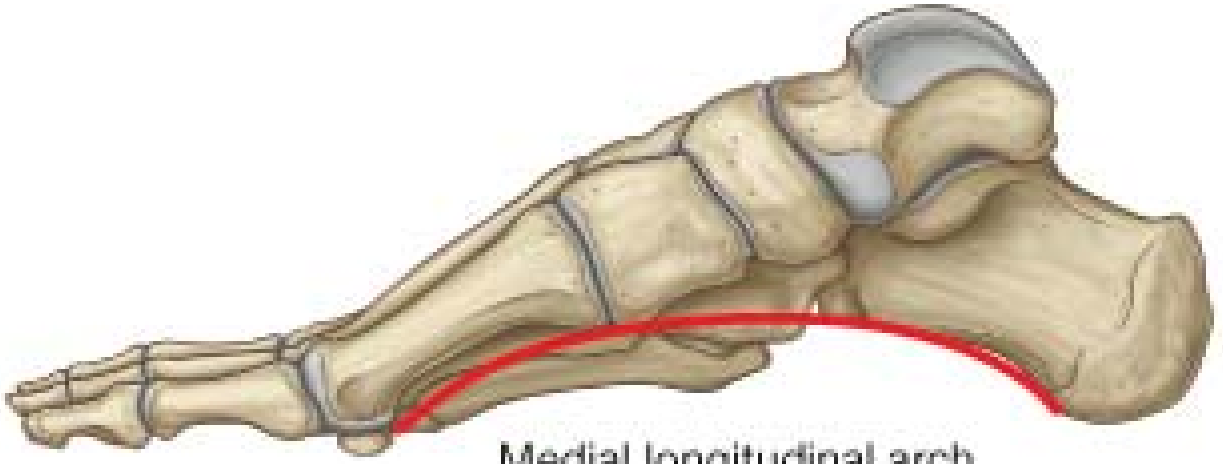
IP Joints

- True Hinge
- Flexion/extension
- Capsule with collaterals
- Plantar ligaments

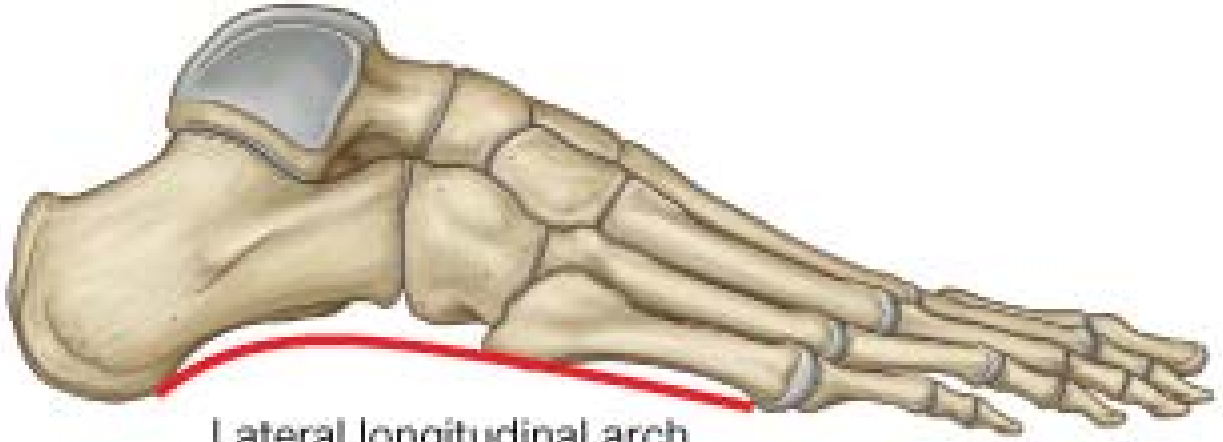
Arches

- Medial Longitudinal Arch
  - Calcaneous, talus, navicular, all 3 cuneiforms, and the 1st 3 metatarsal bones
- Lateral Longitudinal Arch
  - Calcaneous (laterally), cuboid and lat. 2 metatarsal bones
- Transverse arch – a half dome at the tarsometatarsal joints
- Arches depend on ligaments, especially long and short plantar
- Also depend on tone of intrinsic foot muscles

Arches



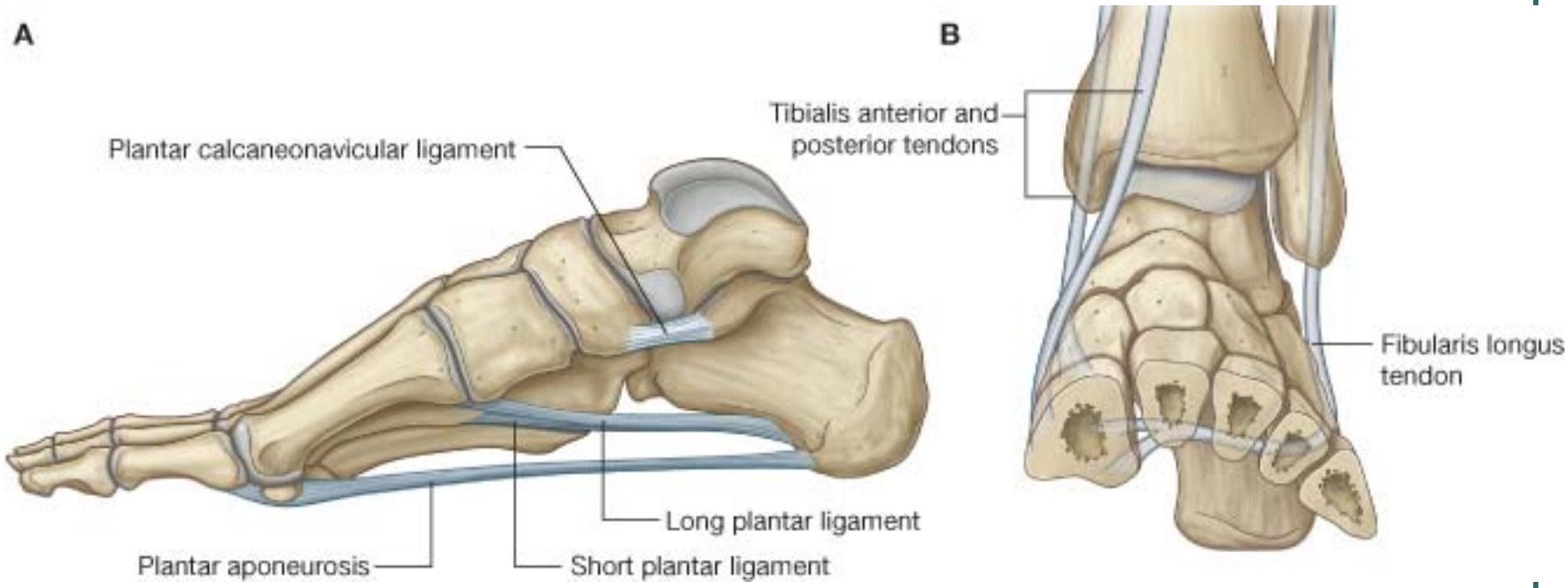
Medial longitudinal arch



Lateral longitudinal arch

Arches

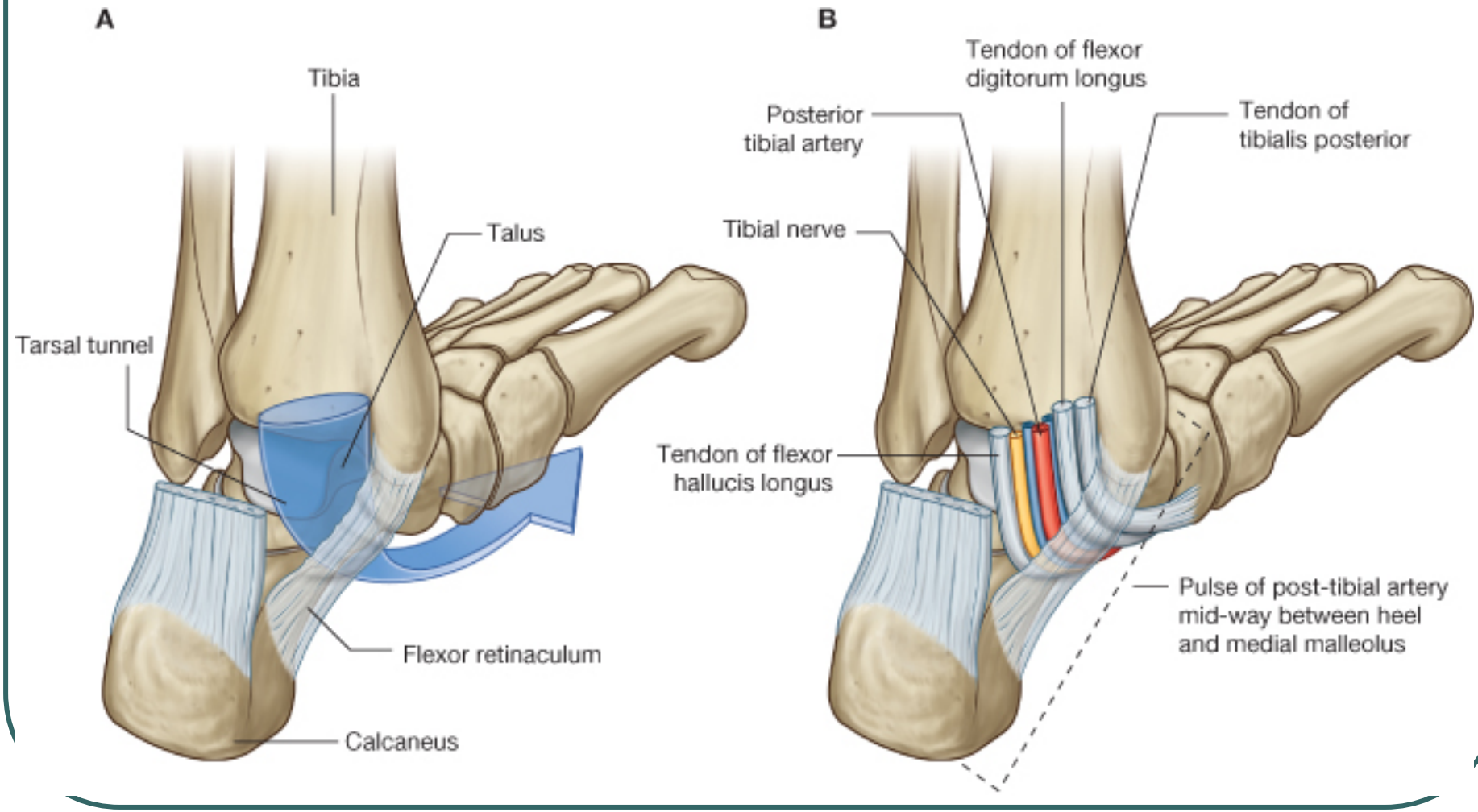
Arches


A
Plantar calcaneonavicular ligament
Long plantar ligament
Plantar aponeurosis
Short plantar ligament
B
Tibialis anterior and posterior tendons
Fibularis longus tendon

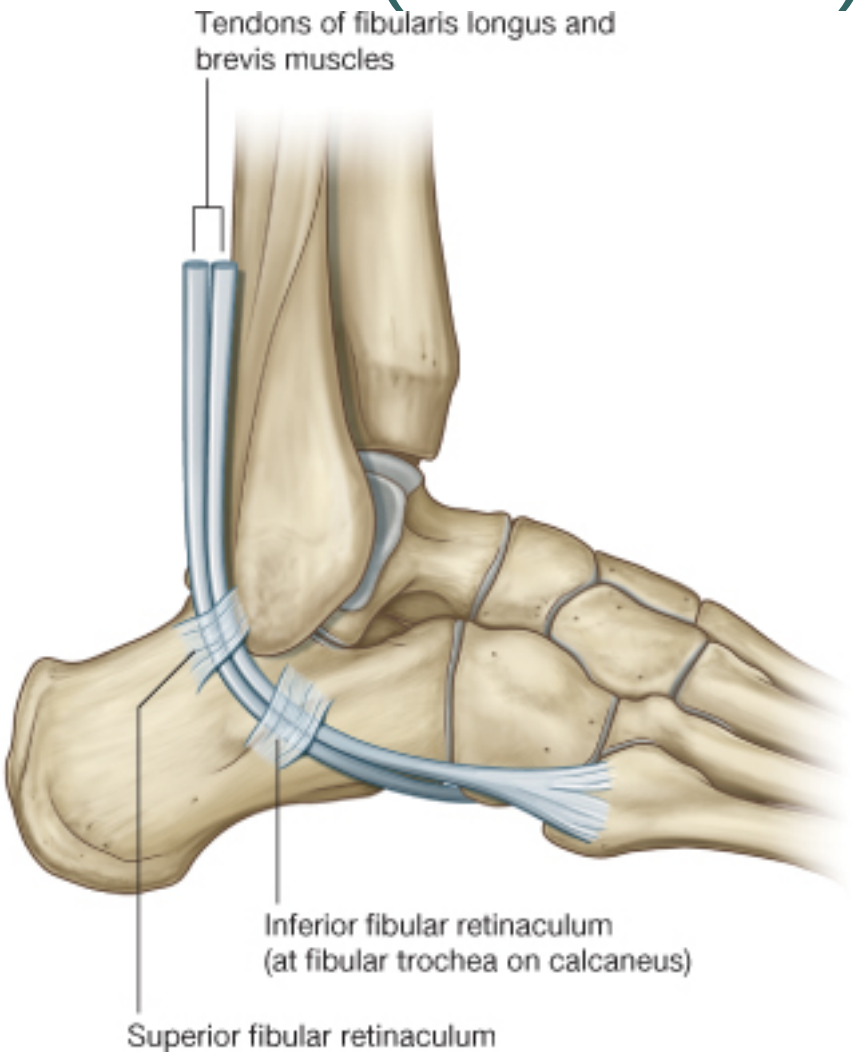
Tarsal Tunnel and Retinacula

- Formed on the posterior medial side of the ankle
- Flexor retinaculum overlies it
- Functional significance

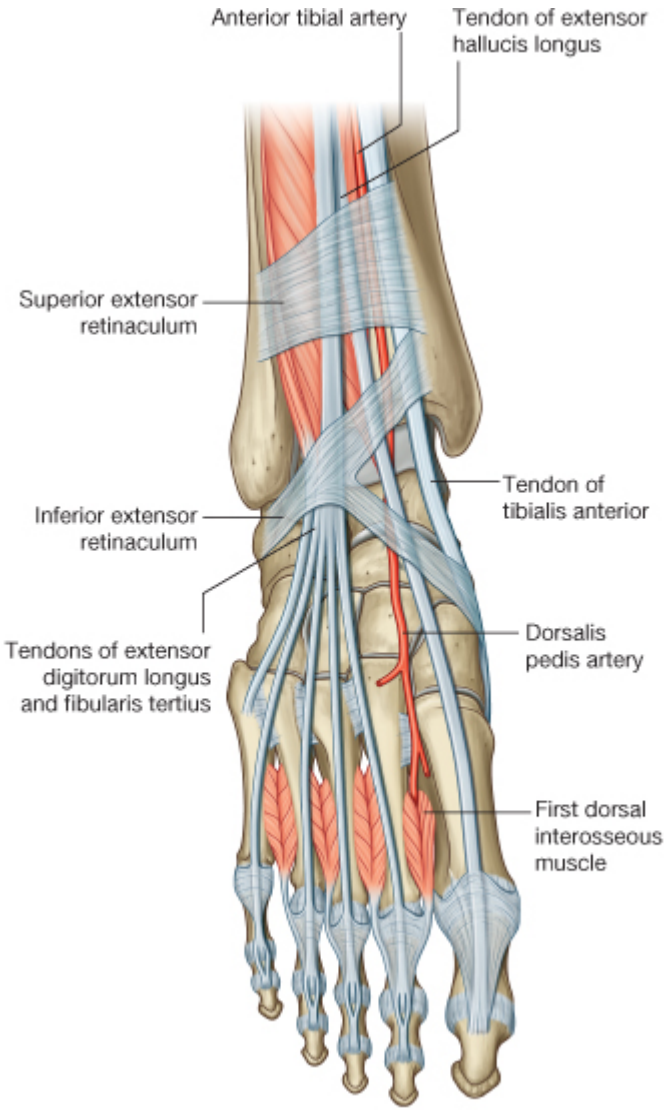
Tarsal Tunnel



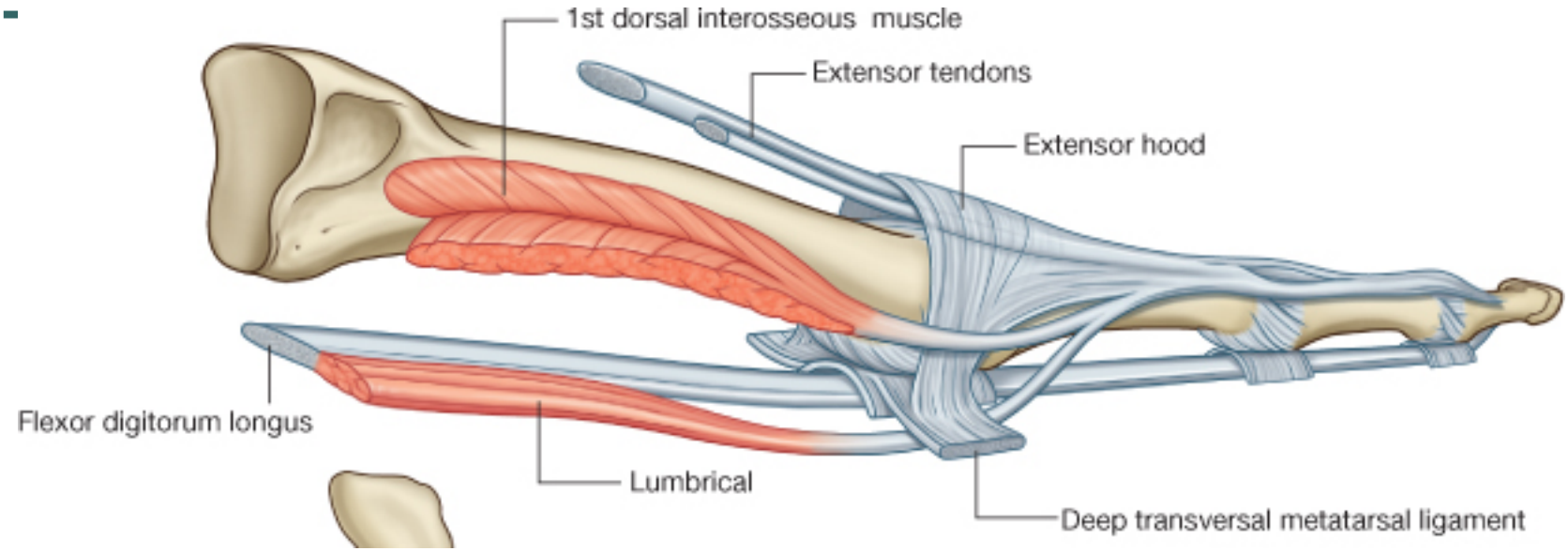
Fibular (Peroneal) Retinaculum



Extensor Retinaculum



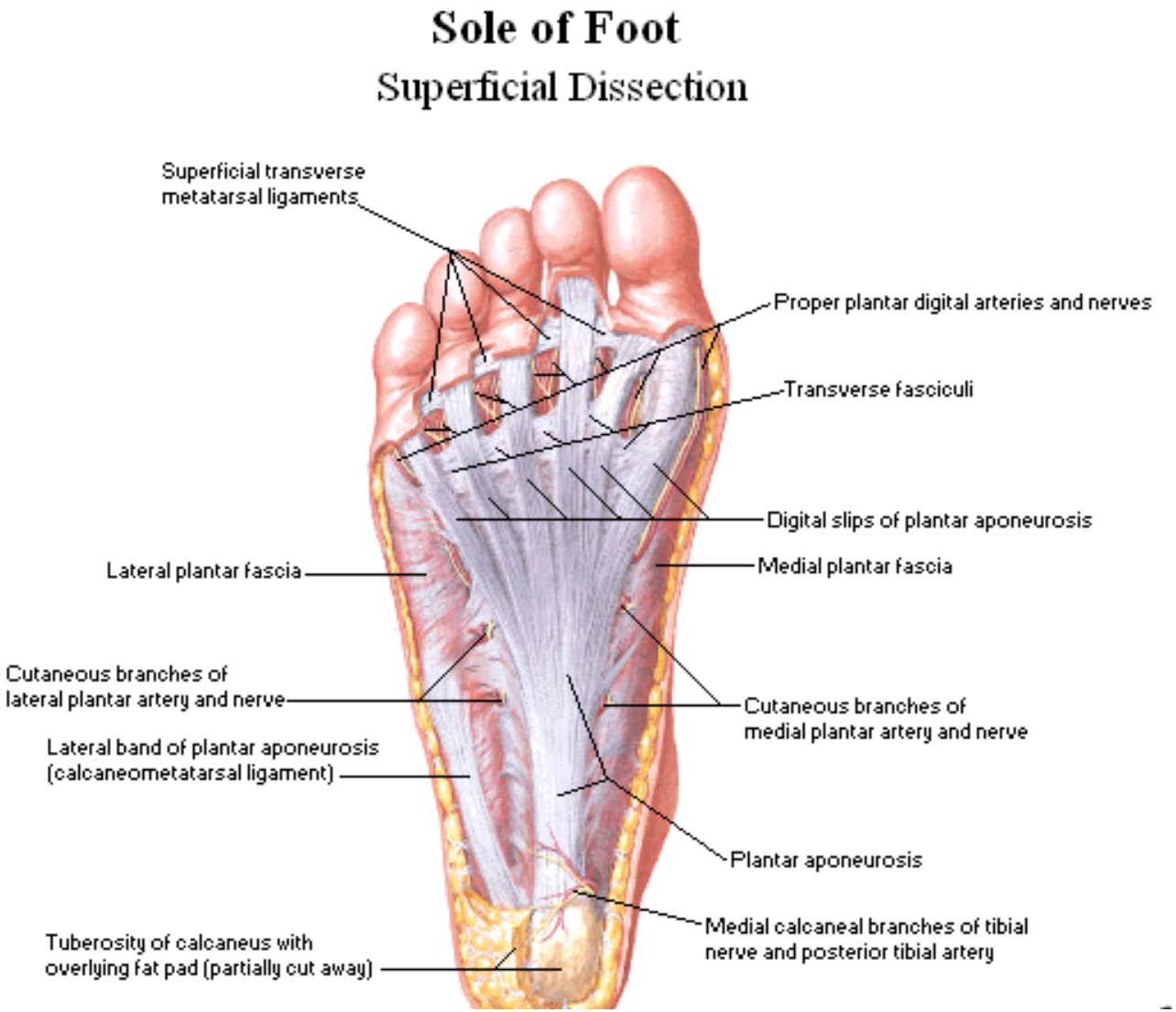
Extensor Mechanism



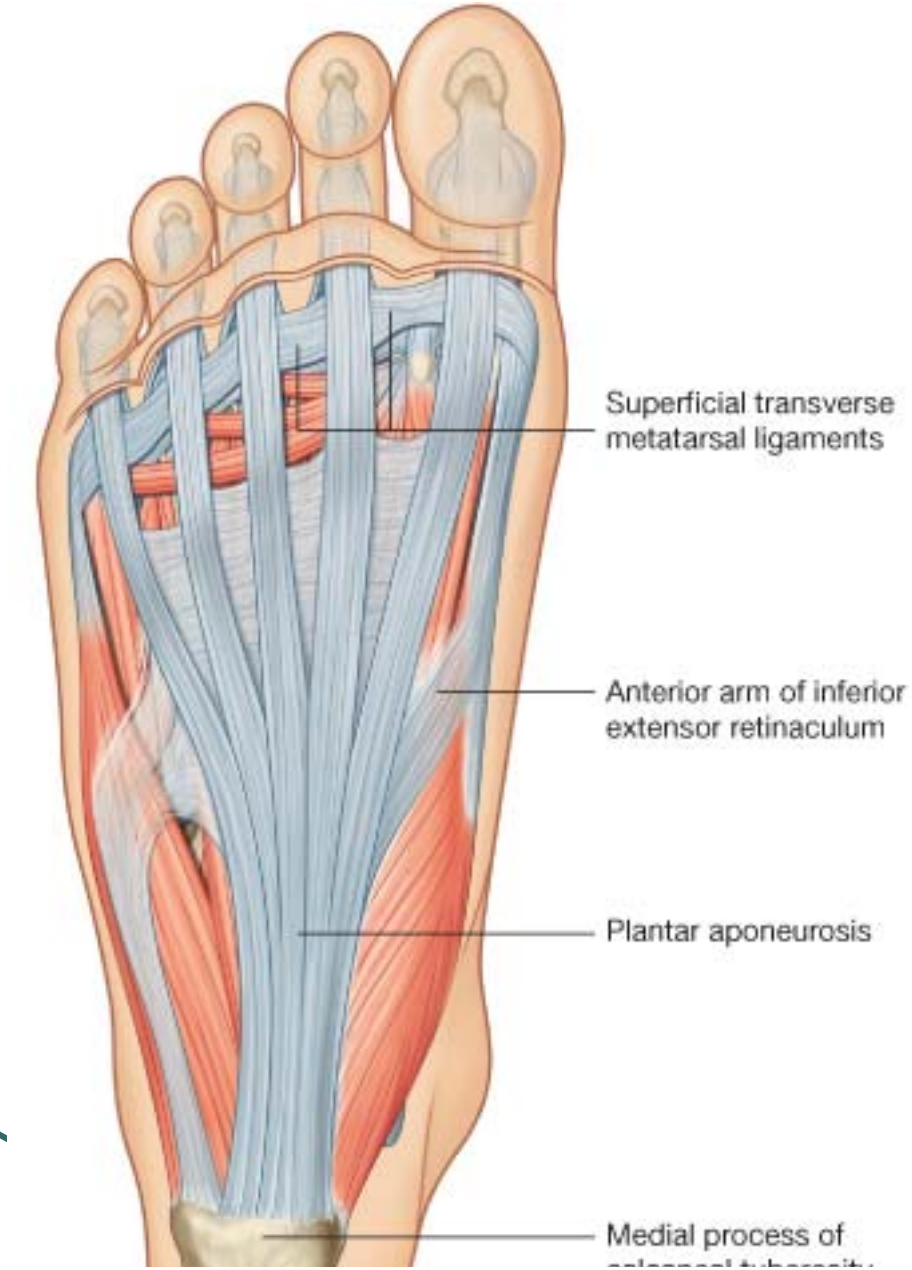
Foot

- Skin
- Fat
- Plantar aponuerosis, AKA plantar fascia = fascia from calcaneus to bases of metatarsals and continuing distally as digital slips
- Plantar fascitis

Superficial Foot



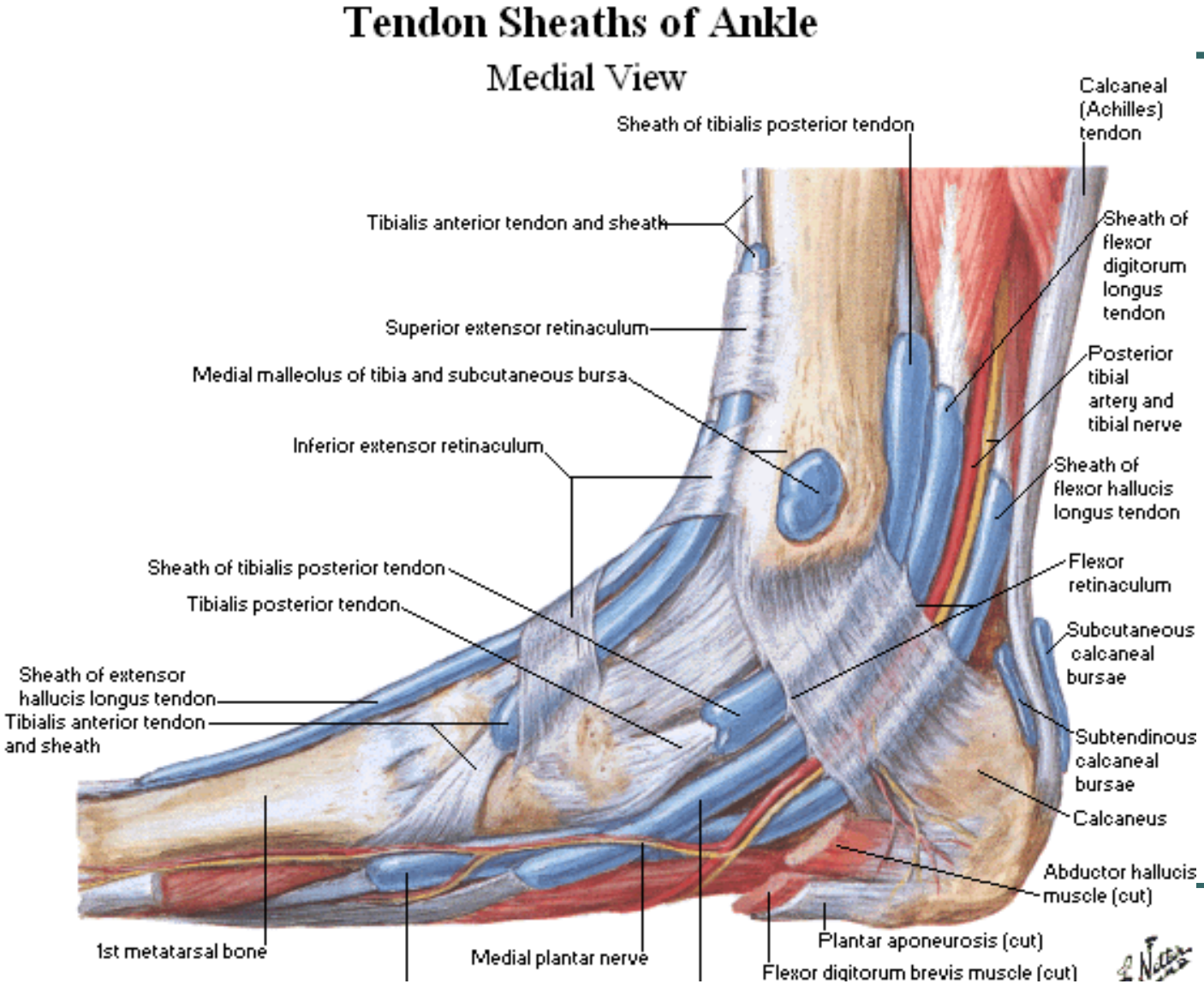
Plantar Fascia



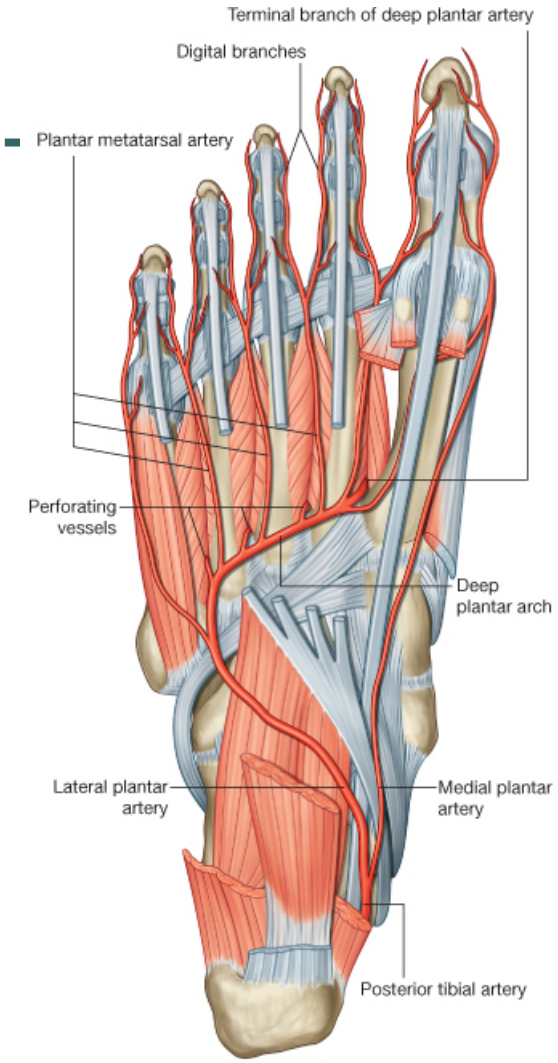
Blood and Nerve Supply to Foot

- Posterior tibial artery – enters the foot medially, under medial malleolus, and becomes the medial and lateral plantar
- On dorsum of foot – anterior tibial artery travels over ankle to become dorsal pedis aa, travels in proximity to extensor hallicus longus
- Both are palpable

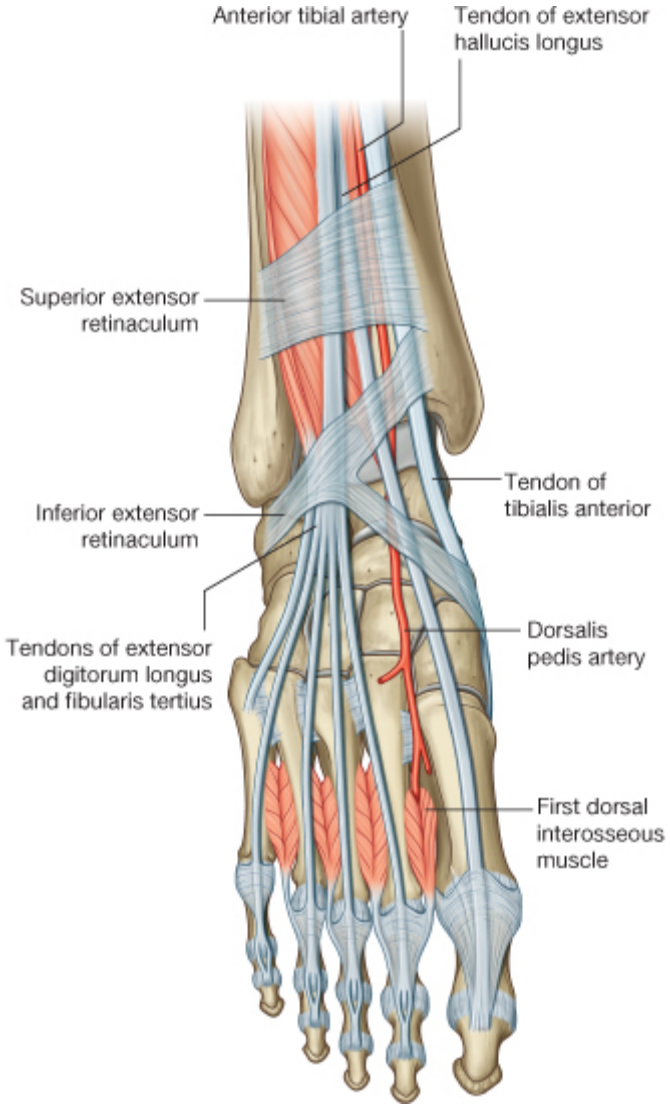
Posterior Tibial Artery



Blood Supply Plantar Surface



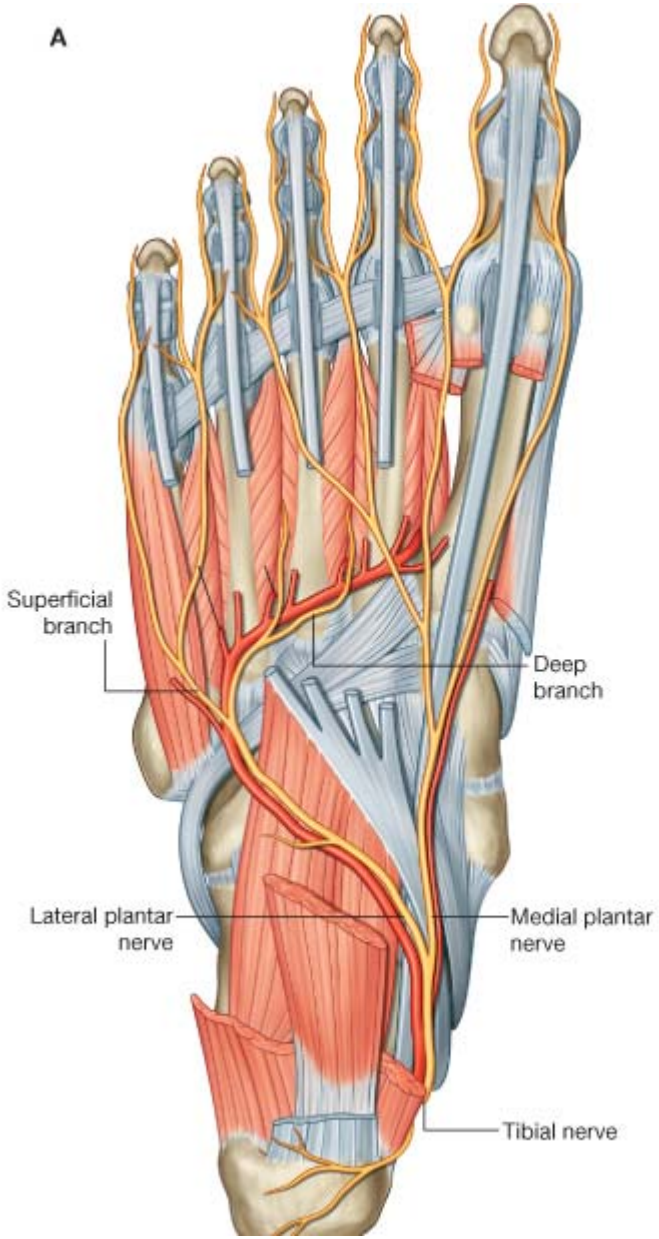
Blood Supply Dorsum of Foot



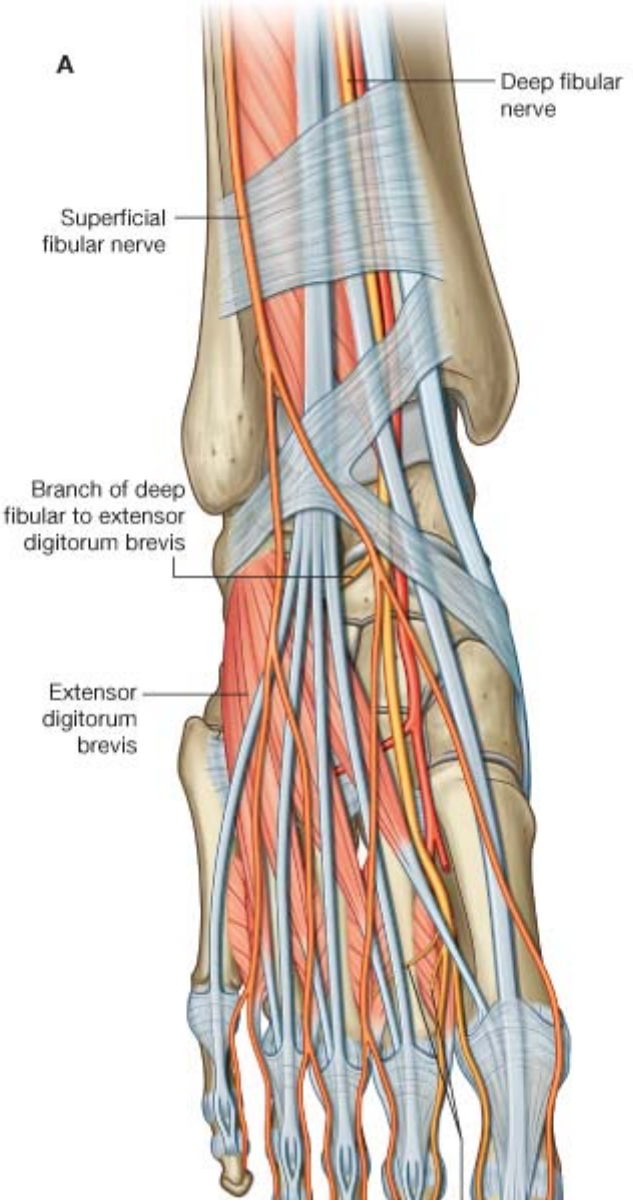
Nerves

- Main motor nerve from tibial nerve
- Innervates entire plantar surface which constitutes the bulk of the muscles
- Enters foot under medial malleolus and becomes medial and lateral plantar
- Dorsum of foot innervated by deep peroneal nerve

Innervation



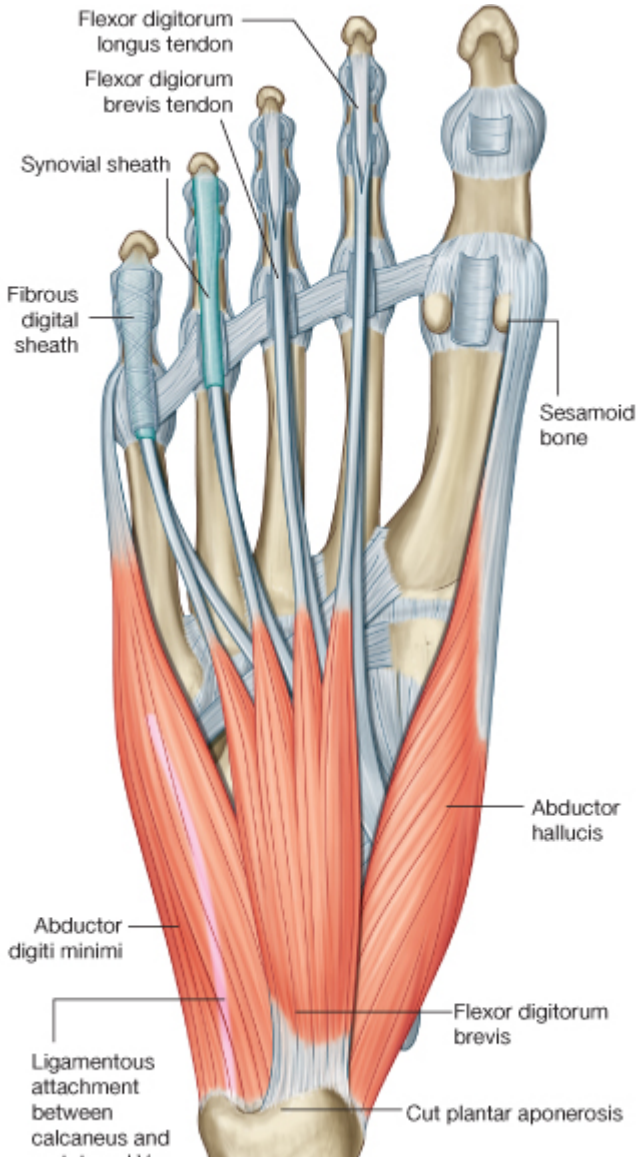
Innervation



Intrinsic Foot Muscles

- 1st Layer (Superficial)
- ABD Hallicus
- Flexor Digitorum Brevis
- ABD Digiti Minimi

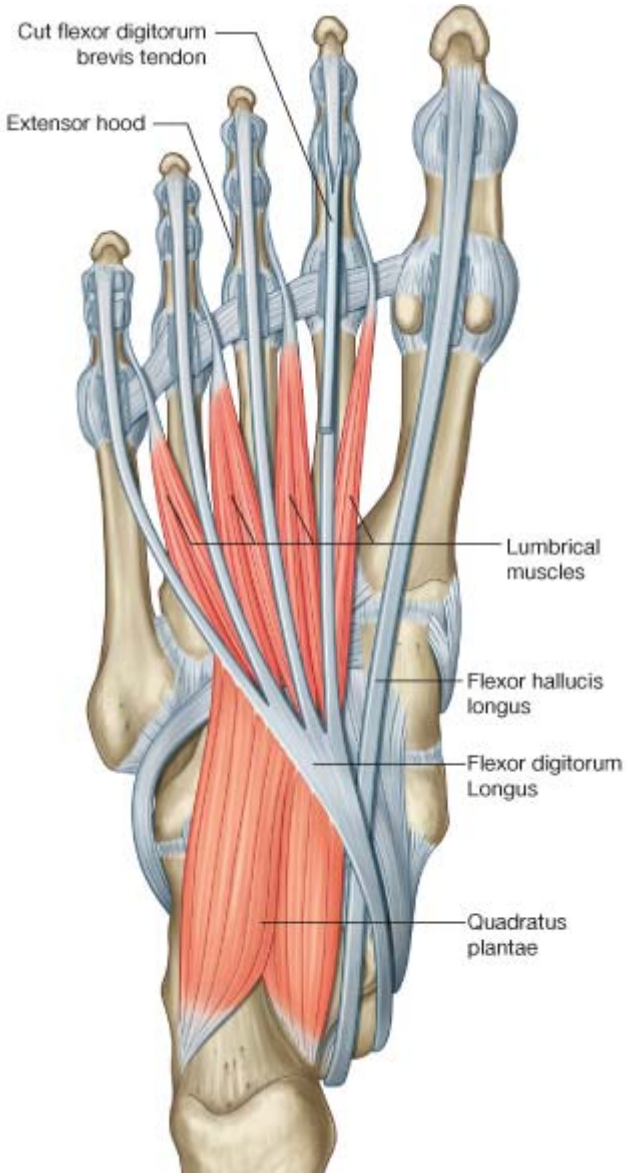
First Layer of Muscles



Foot Muscles

- 2nd Layer
- Quadratus Plantae AKA Accessory Flexor
- Lumbricales

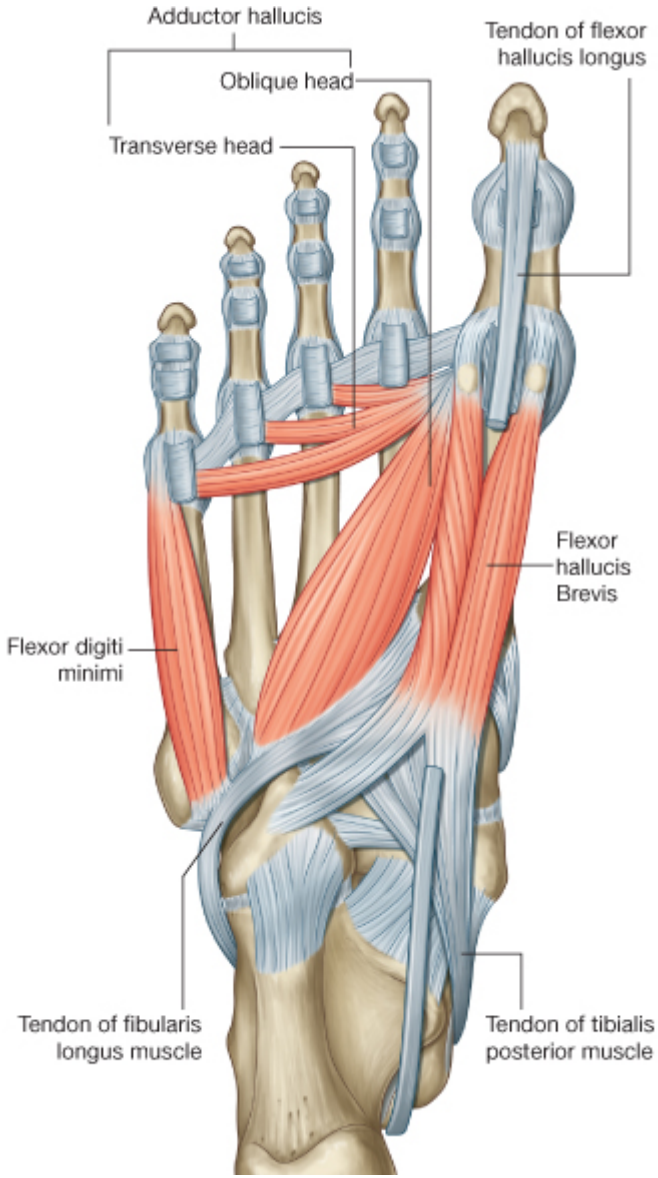
Second Layer



Foot Muscles

- 3rd Layer
- Transverse and Oblique Heads of ADD Hallicus
- Med and Lat Head of Flexor Hallicus Brevis
- Flexor Digiti Minimi

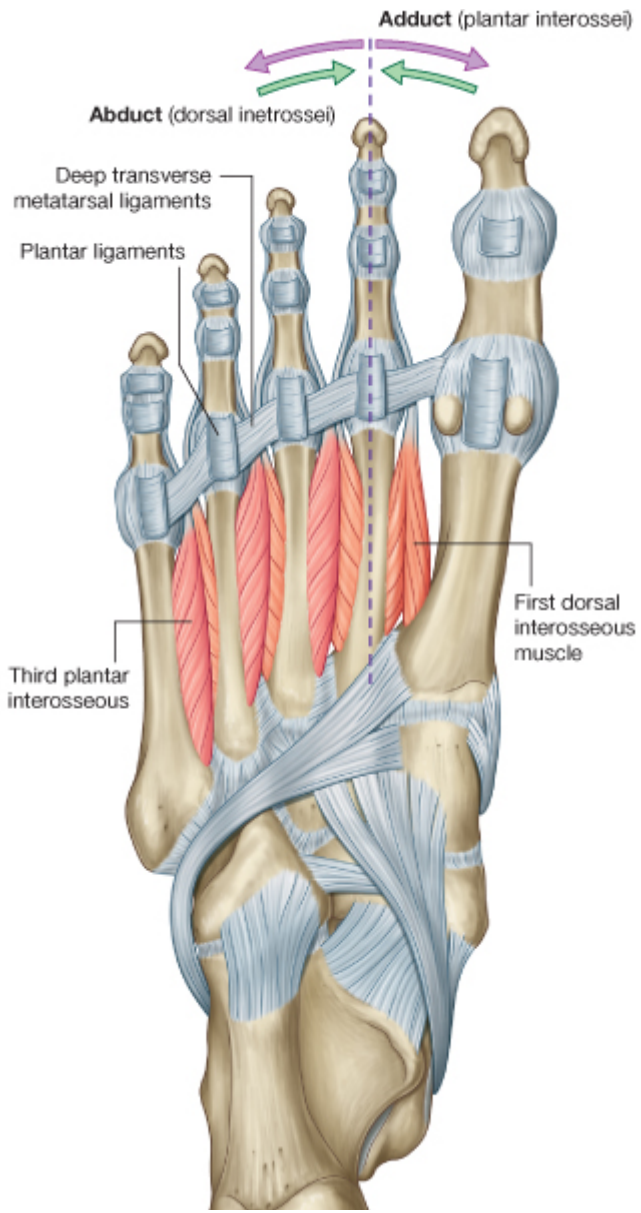
Third Layer


Adductor hallucis
Oblique head
Transverse head
Tendon of flexor hallucis longus
Flexor hallucis Brevis
Flexor digiti minimi
Tendon of fibularis longus muscle
Tendon of tibialis posterior muscle

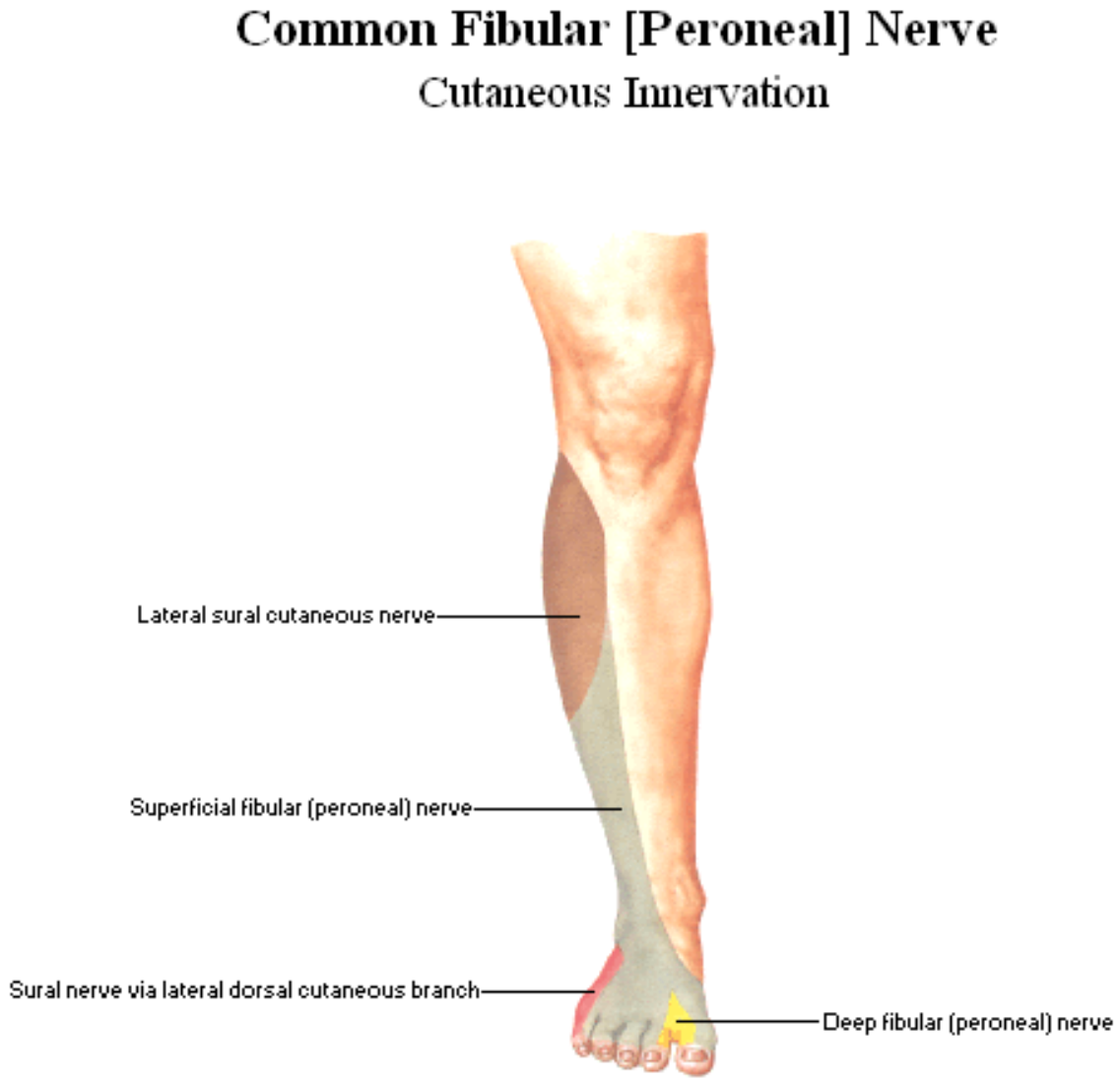
Foot Muscles

- 4th Layer
- Plantar Interosseous
- Dorsal Interosseous

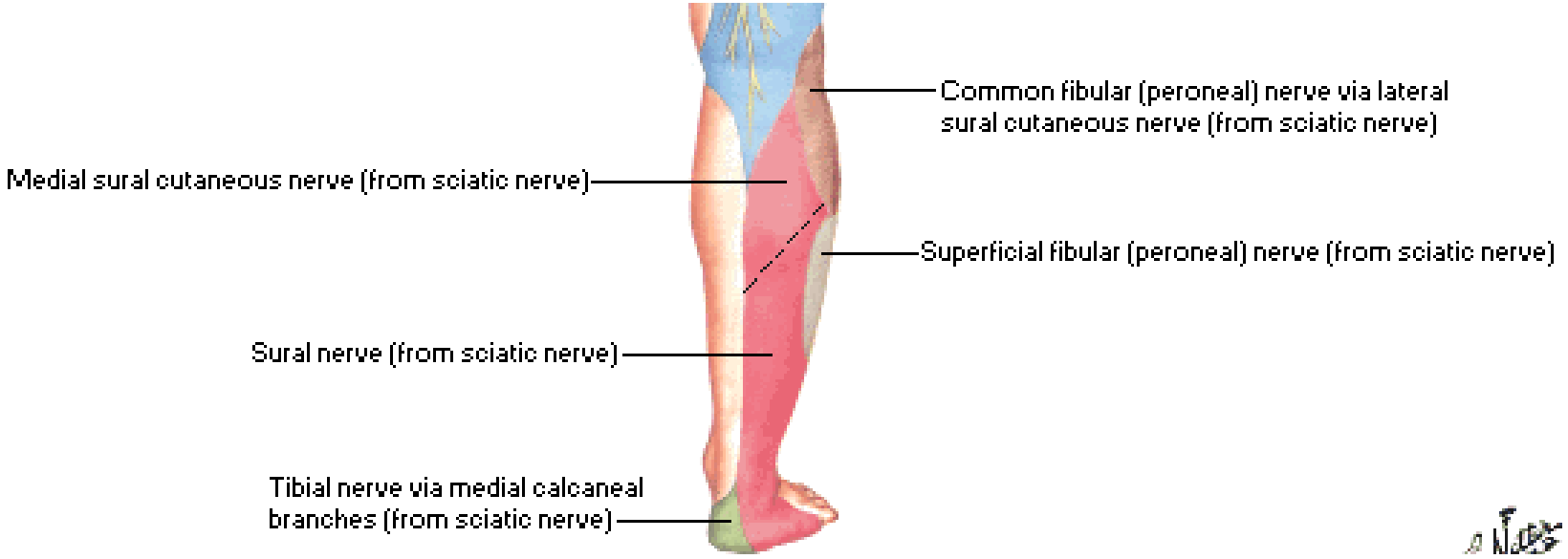
Fourth Layer



Common Peroneal Cutaneous



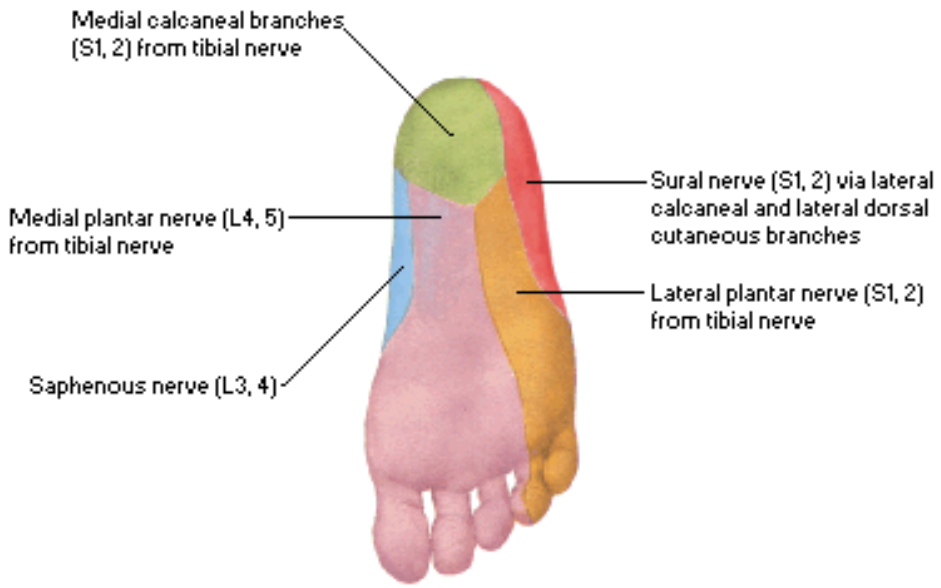
Posterior View Cutaneous



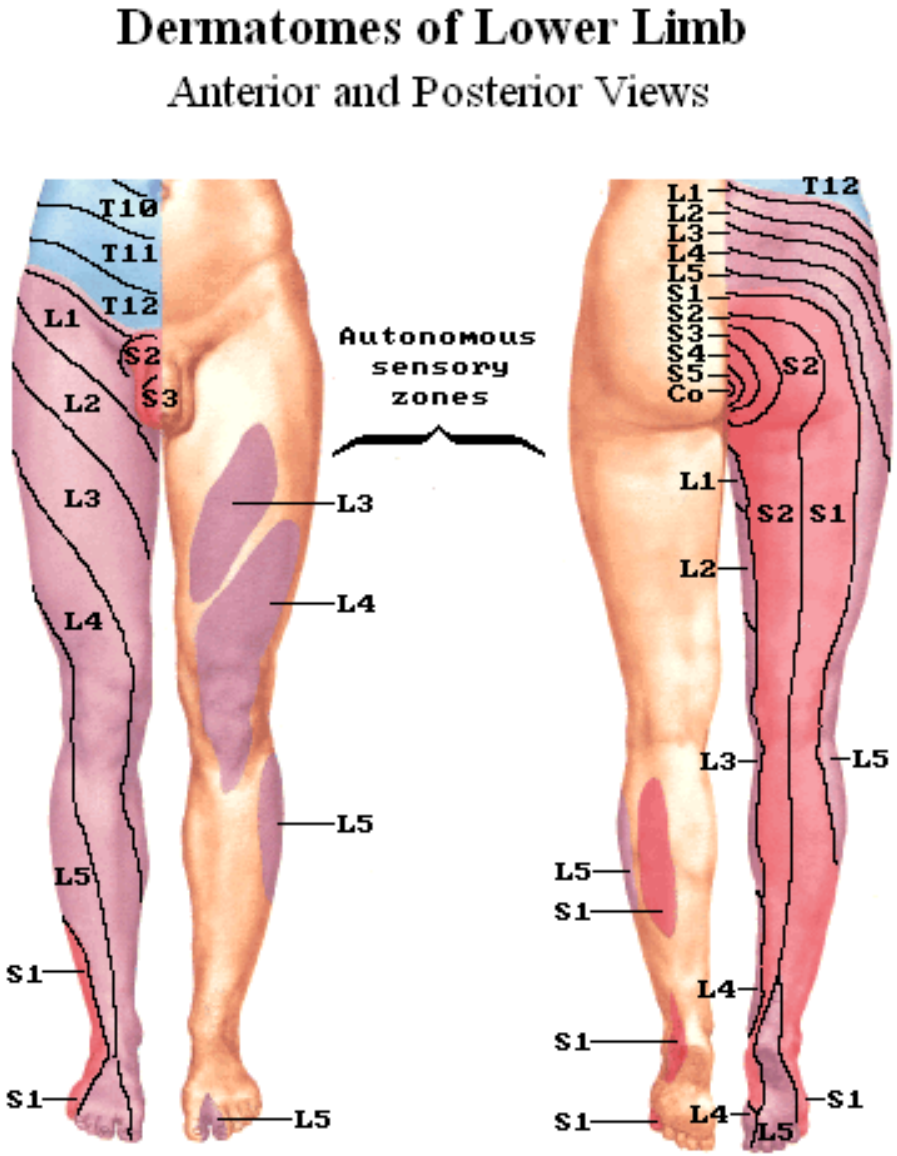
Tibial Cutaneous

Tibial Nerve

Cutaneous Innervation of Sole of Foot



Dermatomes


Dermatomes of Lower Limb
Anterior and Posterior Views
T10
T11
T12
L1
S2
S3
L2
L3
L4
L5
S1
S1
L5
Autonomous sensory zones
L3
L4
L5
L5
S1
S1
L5
L1
L2
L3
L4
L5
S1
S2
S3
S4
S5
Co
T12
S2
L1
S2
S1
L2
L3
L5
L5
S1
L4
S1
S1
L4
L5
S1