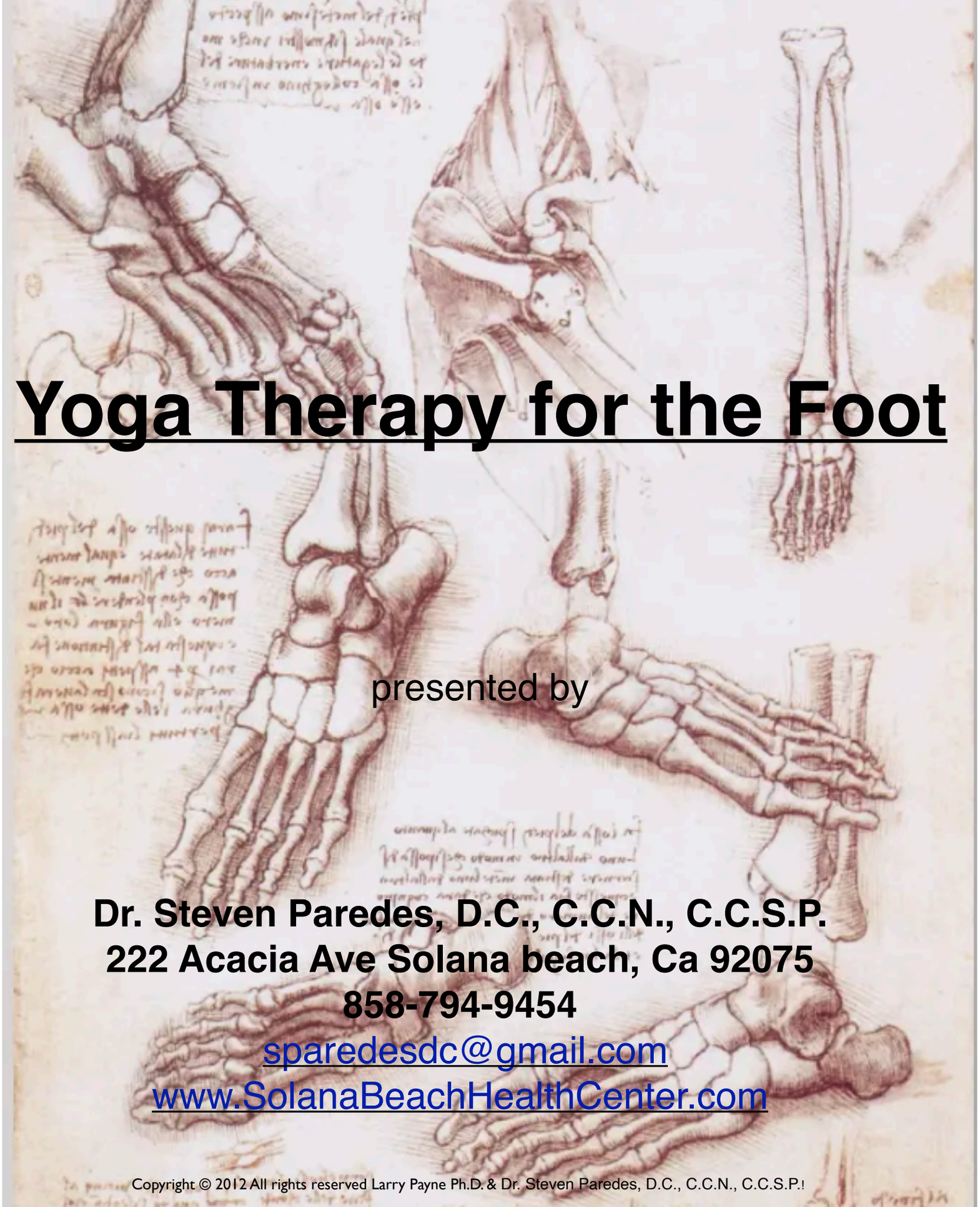


Yoga Therapy for the Foot

presented by

Dr. Steven Paredes, D.C., C.C.N., C.C.S.P.
222 Acacia Ave Solana beach, Ca 92075
858-794-9454
sparedesdc@gmail.com
www.SolanaBeachHealthCenter.com

Anterior view with ligament attachments

Iliotibial tract
Posterior } Cruciate
Anterior } ligaments
Fibular collateral ligament
Medial collateral ligament
Biceps femoris tendon
Head of fibula
Patellar ligament
Anterior ligament of head of fibula
Tibial tuberosity
Anterior border
Anterior border
Interosseous border
Interosseous border
Interosseous membrane
Lateral surface
Lateral surface
Fibula
Tibia
Anterior tibiofibular ligament
Lateral malleolus
Medial malleolus
Anterior talo-fibular ligament
Deltoid ligament
Calcaneofibular ligament

Superior view

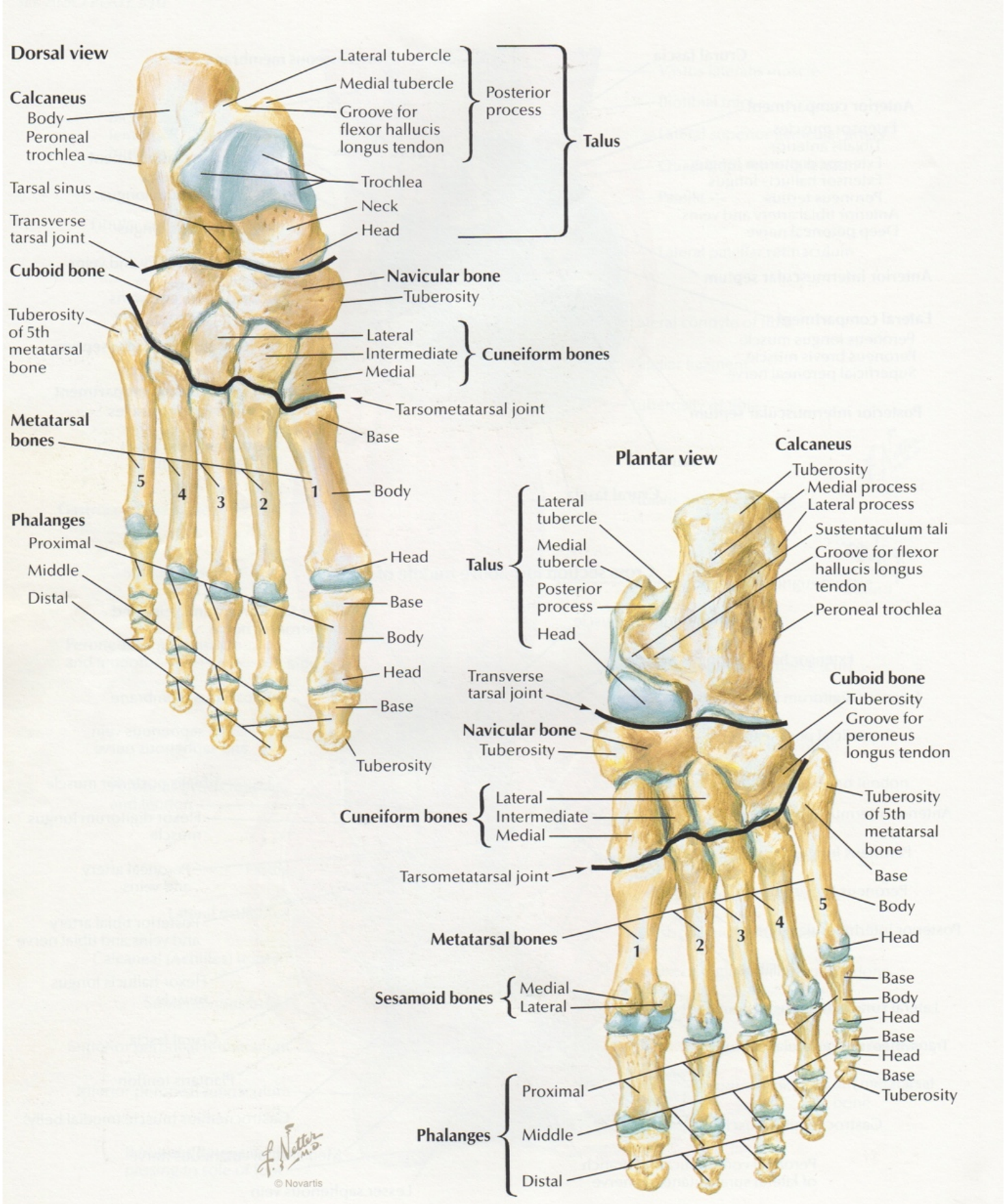
Posterior ligament of head of fibula
Posterior intercondylar area (origin of posterior cruciate ligament)
Apex
Head
Intercondylar eminence
Fibula
Posterior
Tibia
Anterior ligament of head of fibula
Medial condyle
Lateral condyle
Superior articular surface (medial facet)
Superior articular surface (lateral facet)
Anterior
Medial } Intercondylar
Lateral } tubercles
Anterior intercondylar area (origin of anterior cruciate ligament)
Tibial tuberosity

Cross section

Interosseous border
Lateral surface
Interosseous membrane
Anterior border
Interosseous border
Medial surface
Tibia
Anterior border
Medial border
Lateral surface
Posterior surface
Fibula
Medial surface
Posterior border
Medial crest
Posterior surface

Inferior view

Anterior tibiofibular ligament
Anterior
Articular surface of medial malleolus
Articular surface of lateral malleolus
Fibula
Medial malleolus
Tibia
Fossa of lateral malleolus
Posterior
Posterior tibiofibular ligament
Inferior articular surface of tibia


Dorsal view
Calcaneus
Body
Peroneal trochlea
Tarsal sinus
Transverse tarsal joint
Cuboid bone
Tuberosity of 5th metatarsal bone
Metatarsal bones
5
4
3
2
1
Phalanges
Proximal
Middle
Distal
Lateral tubercle
Medial tubercle
Groove for flexor hallucis longus tendon
Posterior process
Talus
Trochlea
Neck
Head
Navicular bone
Tuberosity
Lateral
Intermediate
Medial
Cuneiform bones
Tarsometatarsal joint
Base
Body
Head
Base
Body
Head
Base
Tuberosity
Plantar view
Calcaneus
Tuberosity
Medial process
Lateral process
Sustentaculum tali
Groove for flexor hallucis longus tendon
Peroneal trochlea
Lateral tubercle
Medial tubercle
Posterior process
Talus
Head
Transverse tarsal joint
Navicular bone
Tuberosity
Cuboid bone
Tuberosity
Groove for peroneus longus tendon
Tuberosity of 5th metatarsal bone
Base
Body
Head
Base
Body
Head
Base
Head
Base
Tuberosity
Lateral
Intermediate
Medial
Cuneiform bones
Tarsometatarsal joint
Metatarsal bones
1
2
3
4
5
Sesamoid bones
Medial
Lateral
Phalanges
Proximal
Middle
Distal
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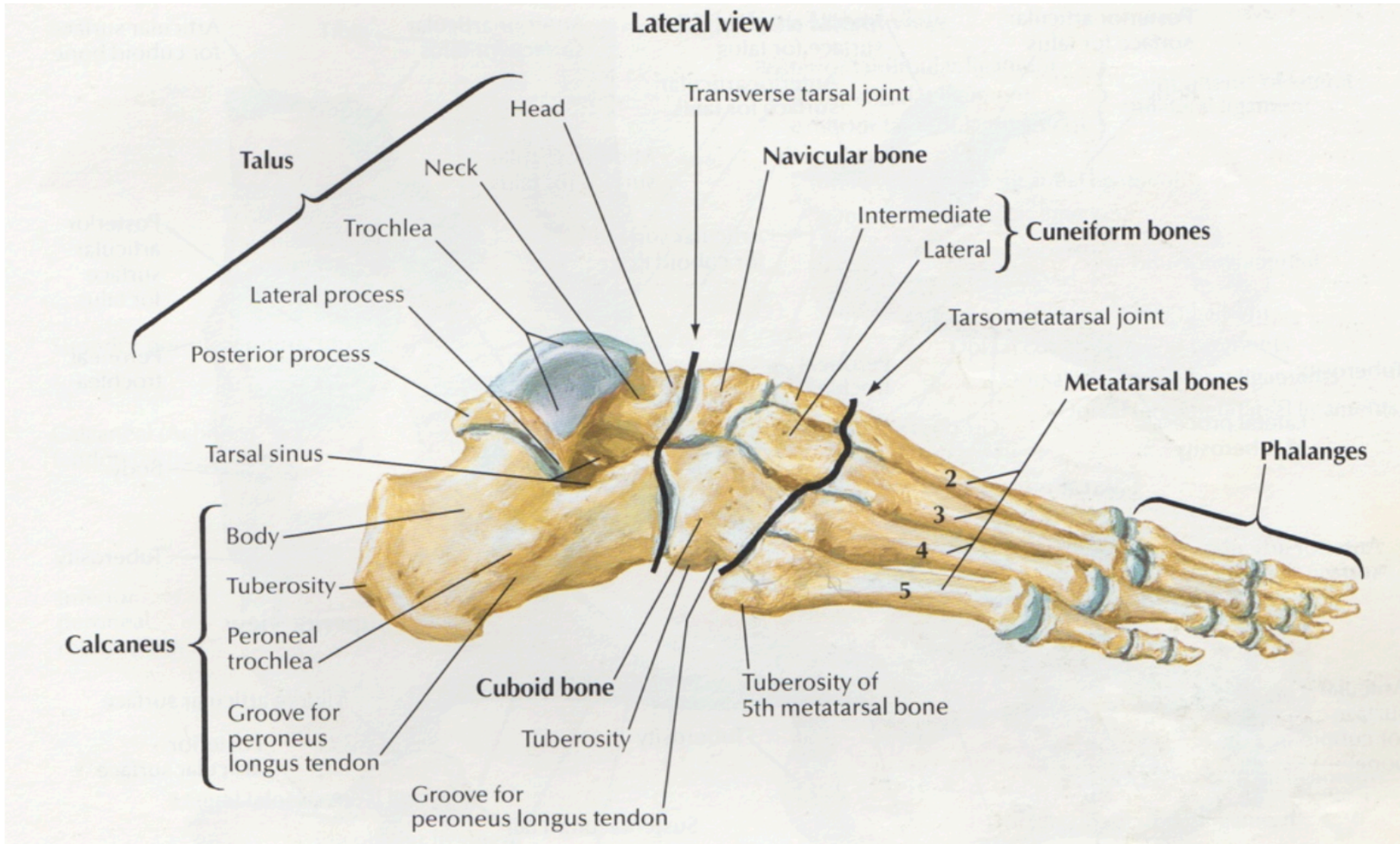
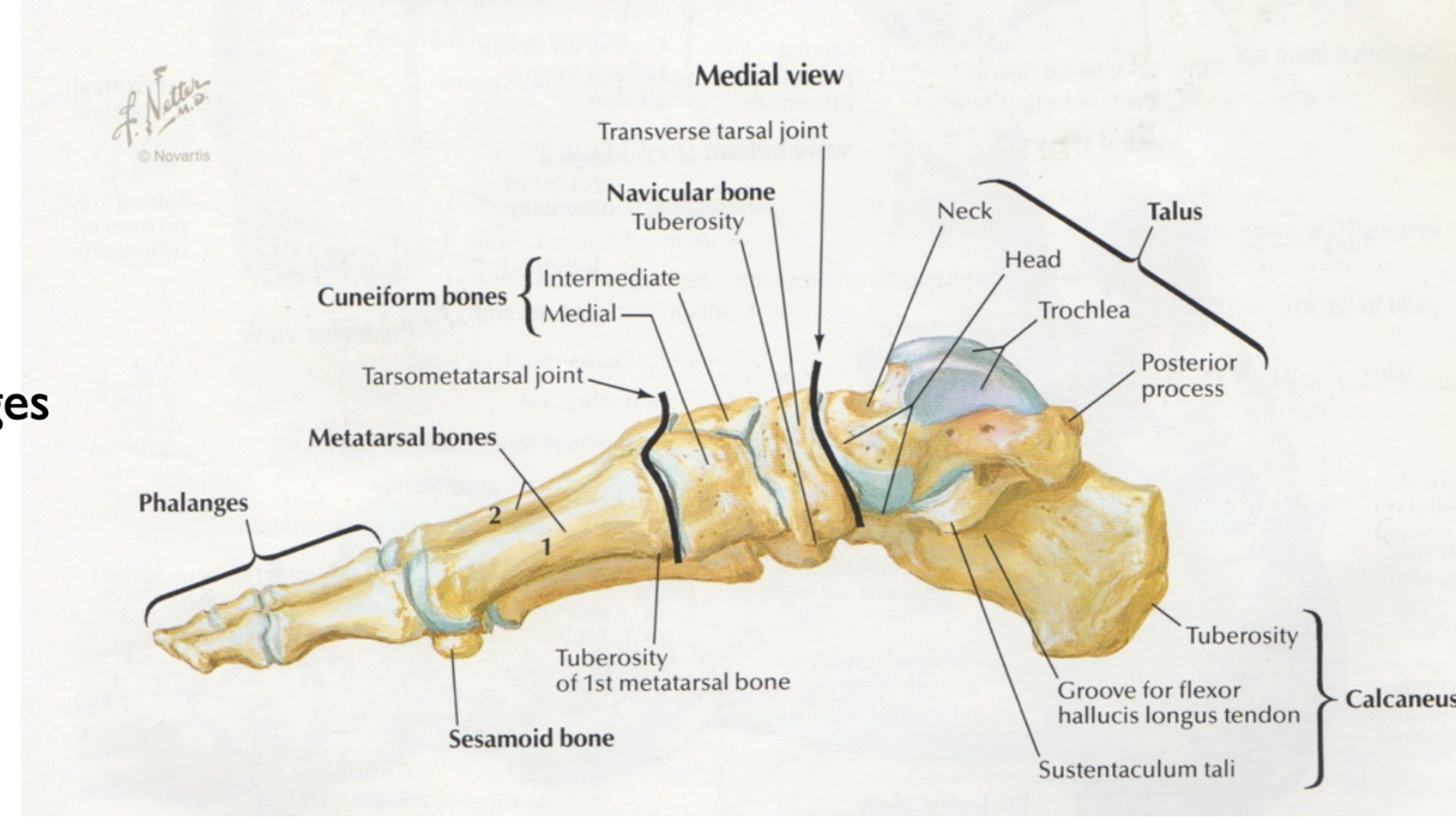
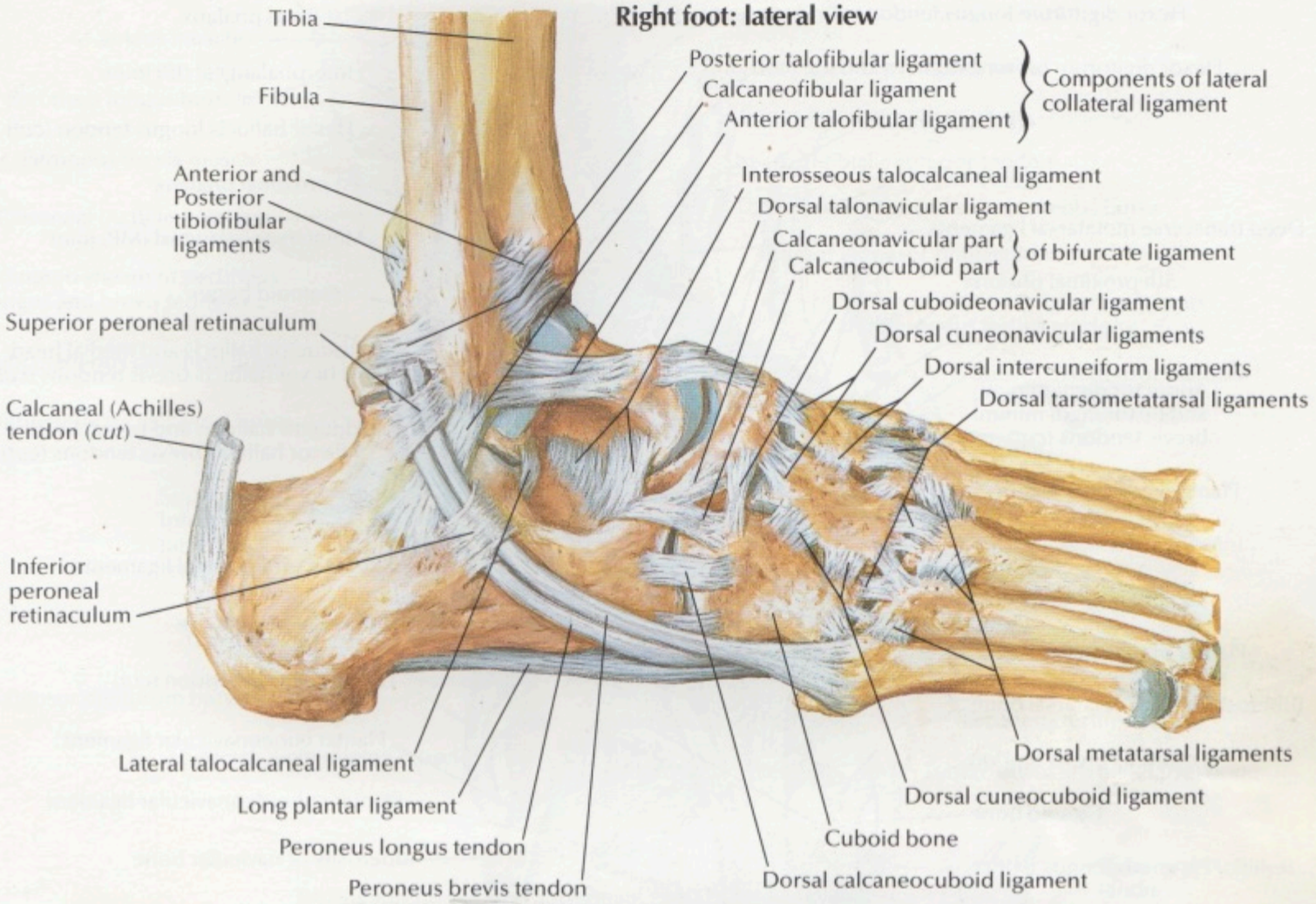
Bones of the Foot

- Hind Foot : talus,calcaneus
- Mid Foot : navicular, cuboid and cuneform bones
- Fore Foot : metatarsal and phalanges

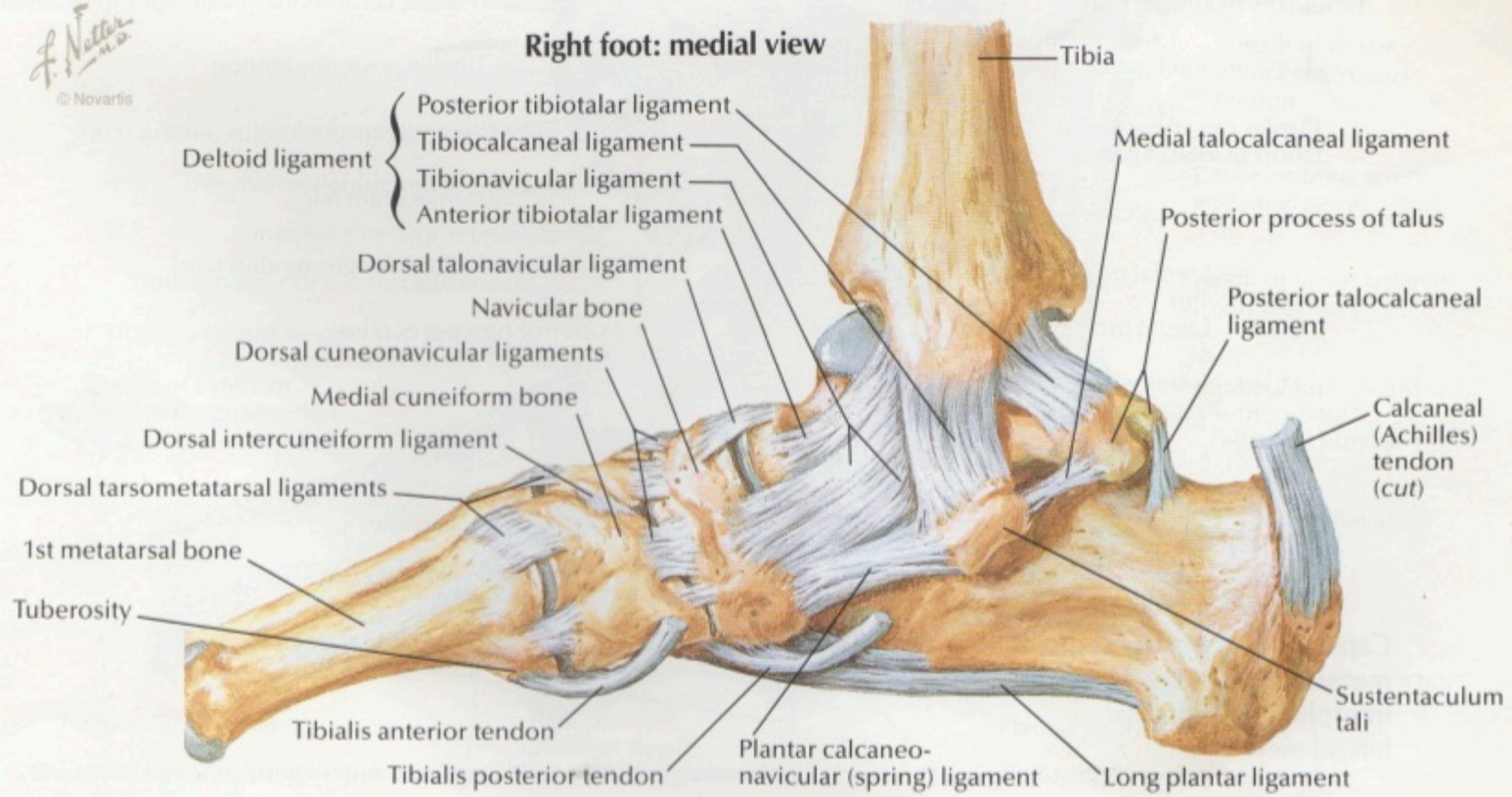


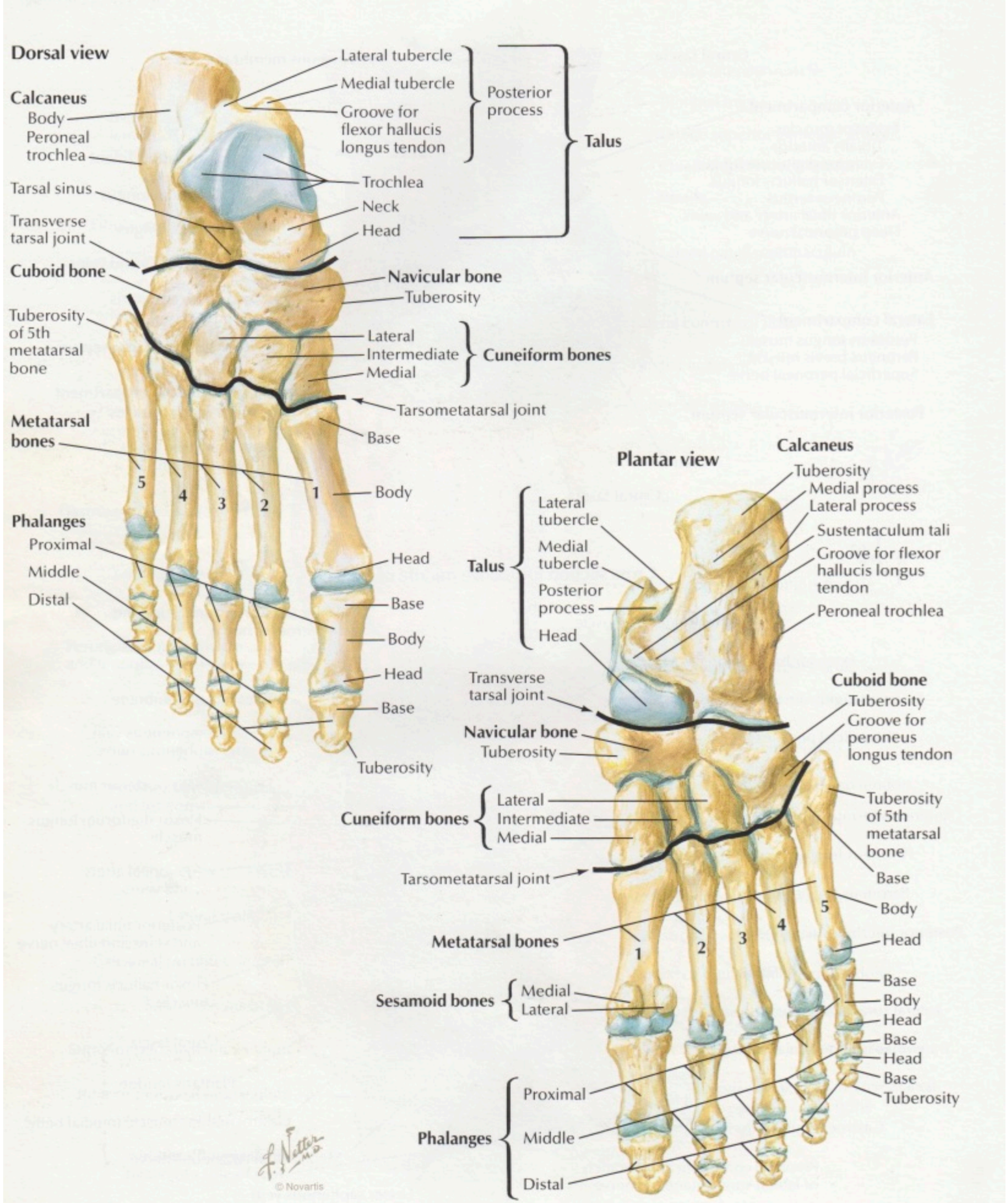


Right foot: lateral view



Right foot: medial view




Dorsal view
Calcaneus
Body
Peroneal trochlea
Tarsal sinus
Transverse tarsal joint
Cuboid bone
Tuberosity of 5th metatarsal bone
Metatarsal bones
5
4
3
2
1
Phalanges
Proximal
Middle
Distal
Lateral tubercle
Medial tubercle
Groove for flexor hallucis longus tendon
Posterior process
Talus
Trochlea
Neck
Head
Navicular bone
Tuberosity
Lateral
Intermediate
Medial
Cuneiform bones
Tarsometatarsal joint
Base
Body
Head
Base
Body
Head
Base
Tuberosity
Plantar view
Calcaneus
Tuberosity
Medial process
Lateral process
Sustentaculum tali
Groove for flexor hallucis longus tendon
Peroneal trochlea
Talus
Lateral tubercle
Medial tubercle
Posterior process
Head
Transverse tarsal joint
Navicular bone
Tuberosity
Cuboid bone
Tuberosity
Groove for peroneus longus tendon
Cuneiform bones
Lateral
Intermediate
Medial
Tarsometatarsal joint
Tuberosity of 5th metatarsal bone
Base
Body
Head
Metatarsal bones
1
2
3
4
5
Sesamoid bones
Medial
Lateral
Base
Body
Head
Base
Head
Base
Tuberosity
Phalanges
Proximal
Middle
Distal
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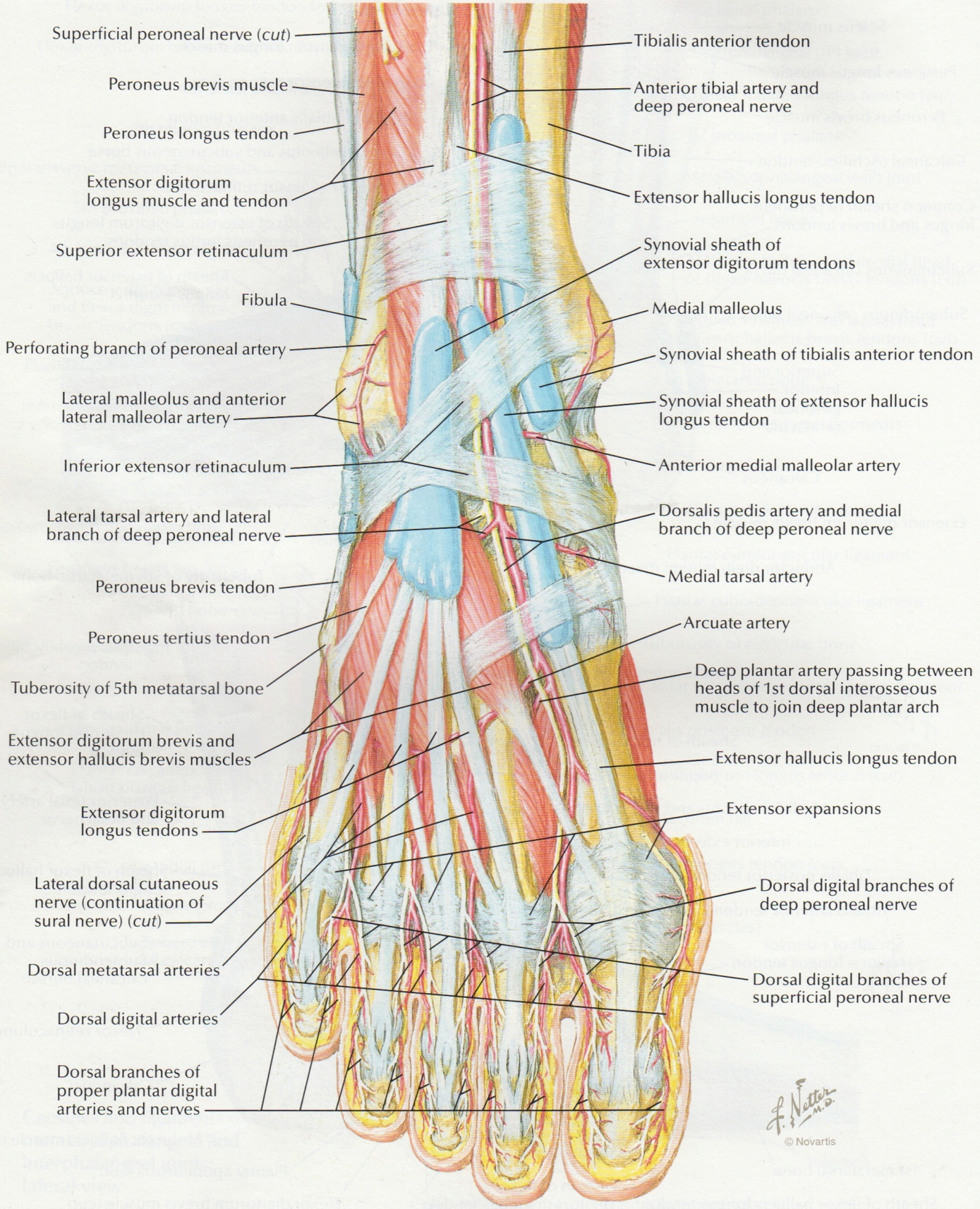
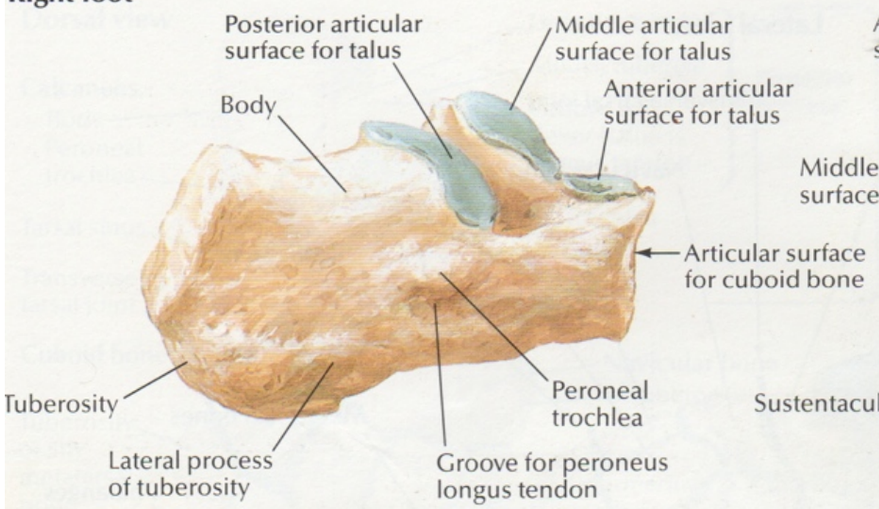
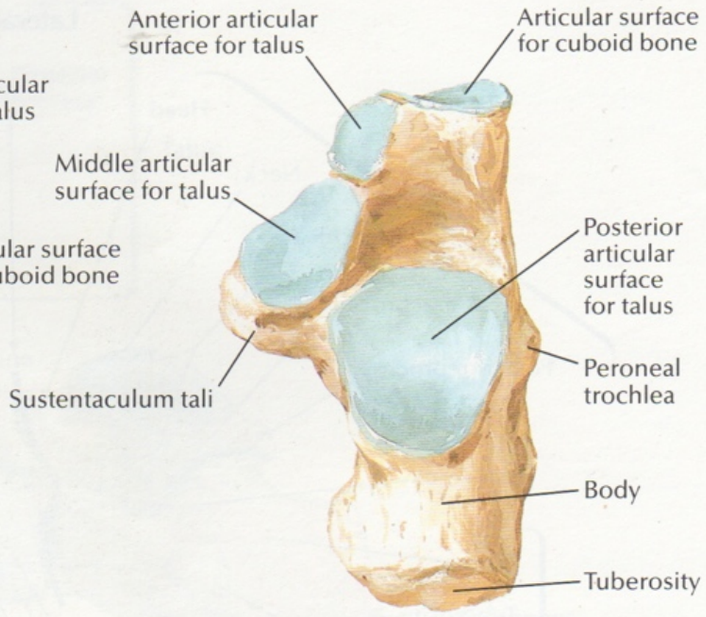
Muscles of Dorsum of Foot: Superficial Dissection



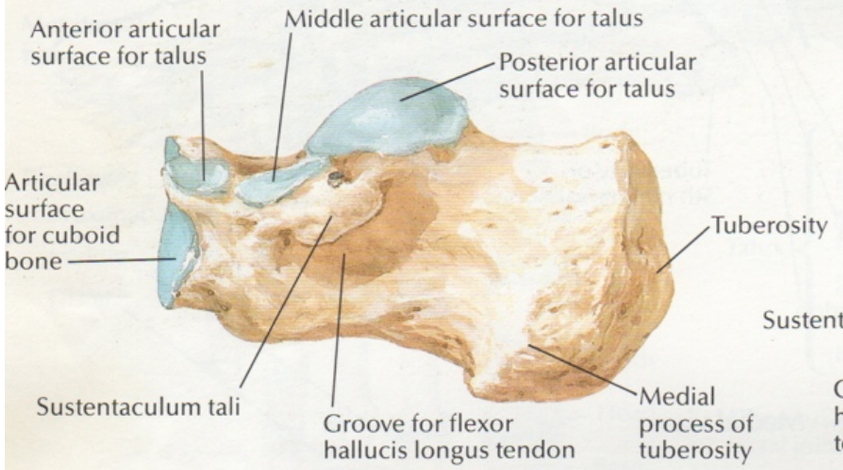
Right foot



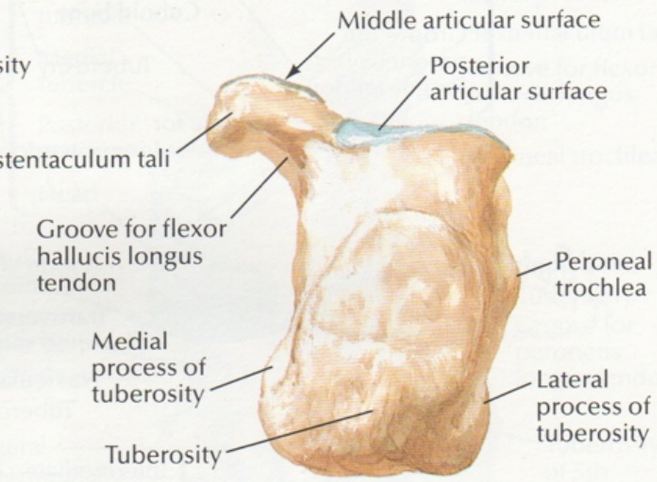
Lateral view



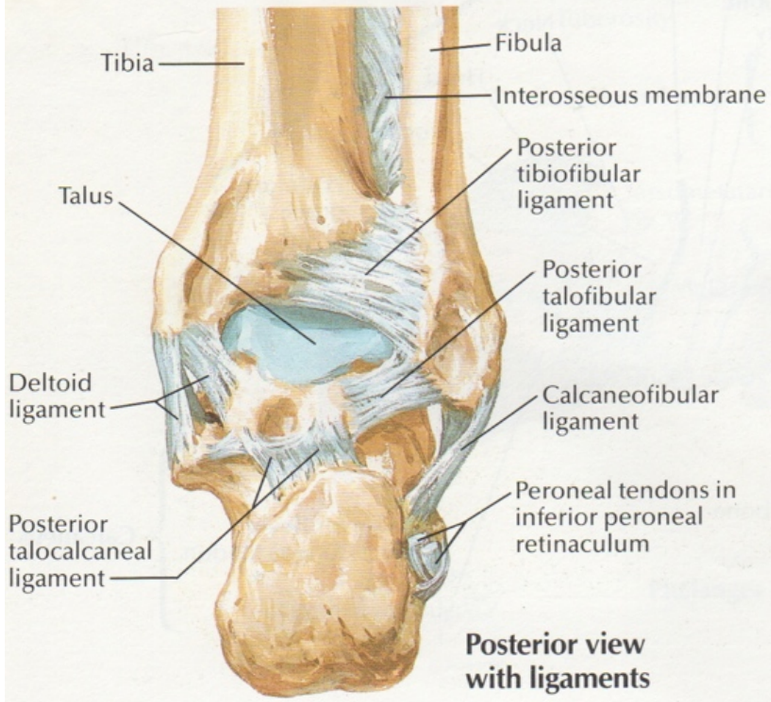
Superior view



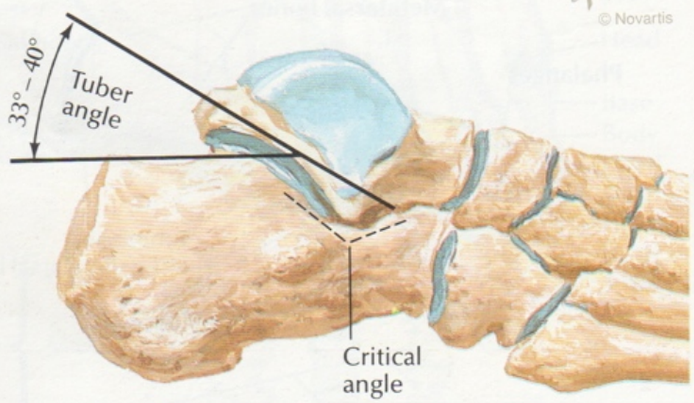
Medial view



Posterior view

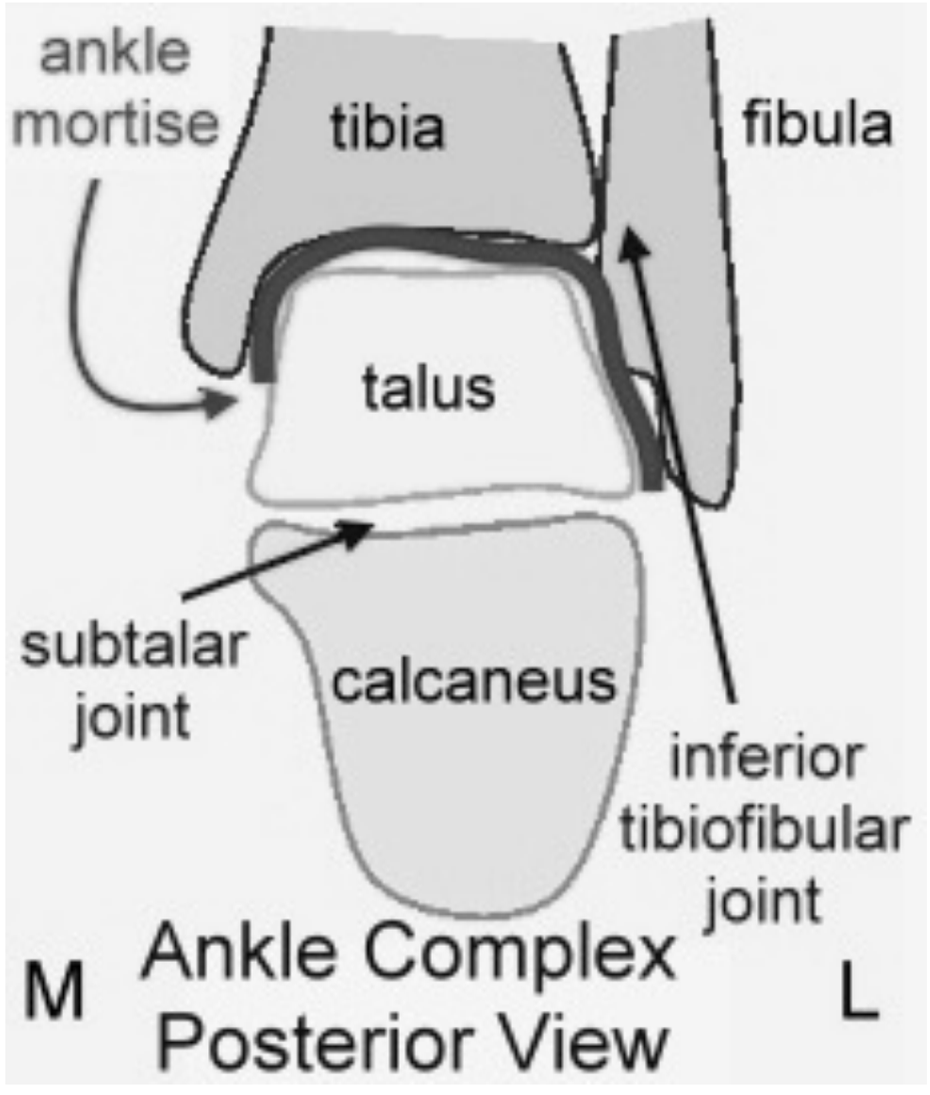


Posterior view with ligaments



Functional relations of calcaneus

Hind Foot

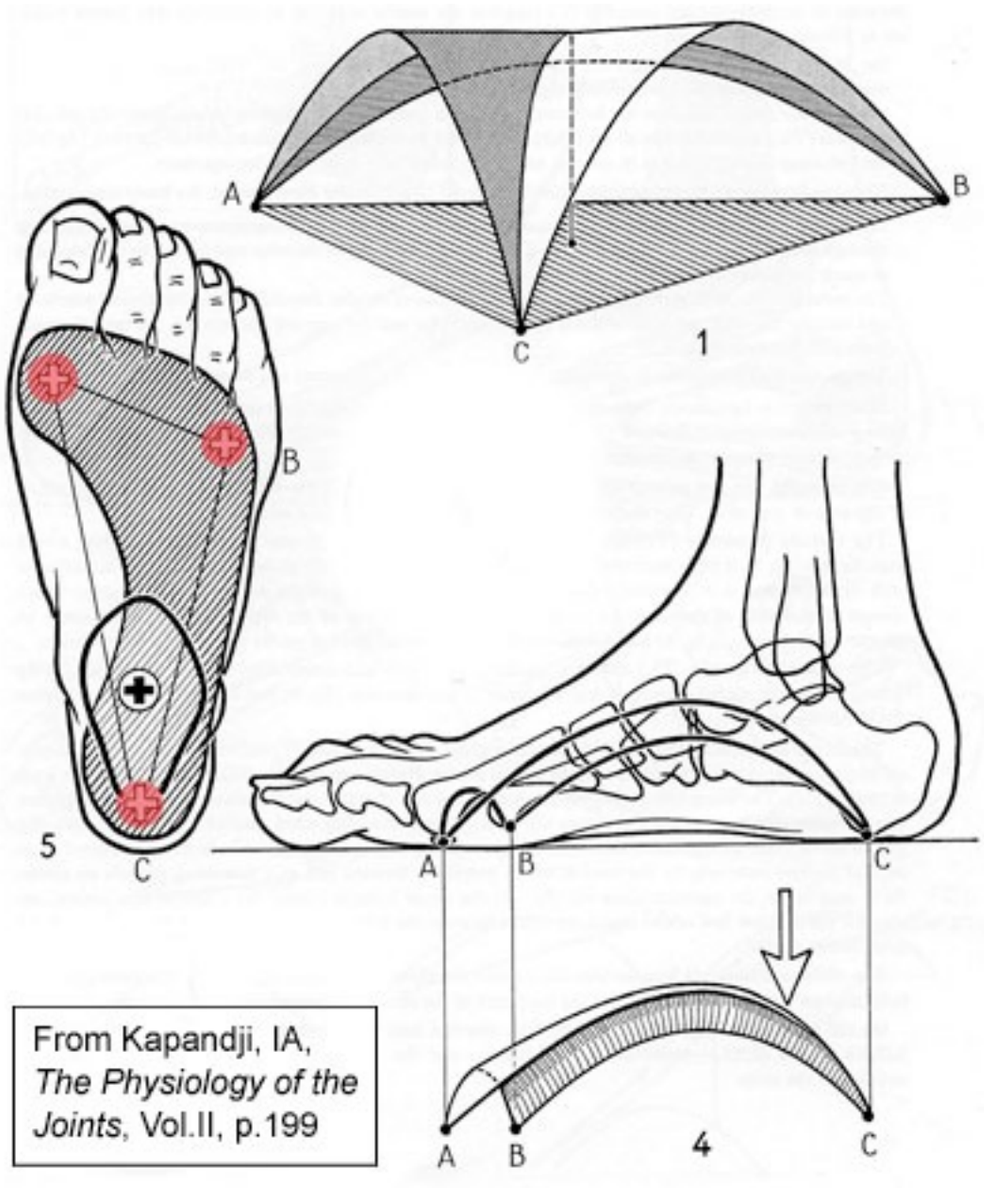

ankle
mortise
tibia
fibula
talus
subtalar
joint
calcaneus
inferior
tibiofibular
joint
M
Ankle Complex
Posterior View
L

Arches of Foot

-A to C is the Medial Arch or Longitudinal

-B to C is the Lateral Arch

-A to B is the Transverse Arch



From Kapandji, IA, *The Physiology of the Joints*, Vol.II, p.199

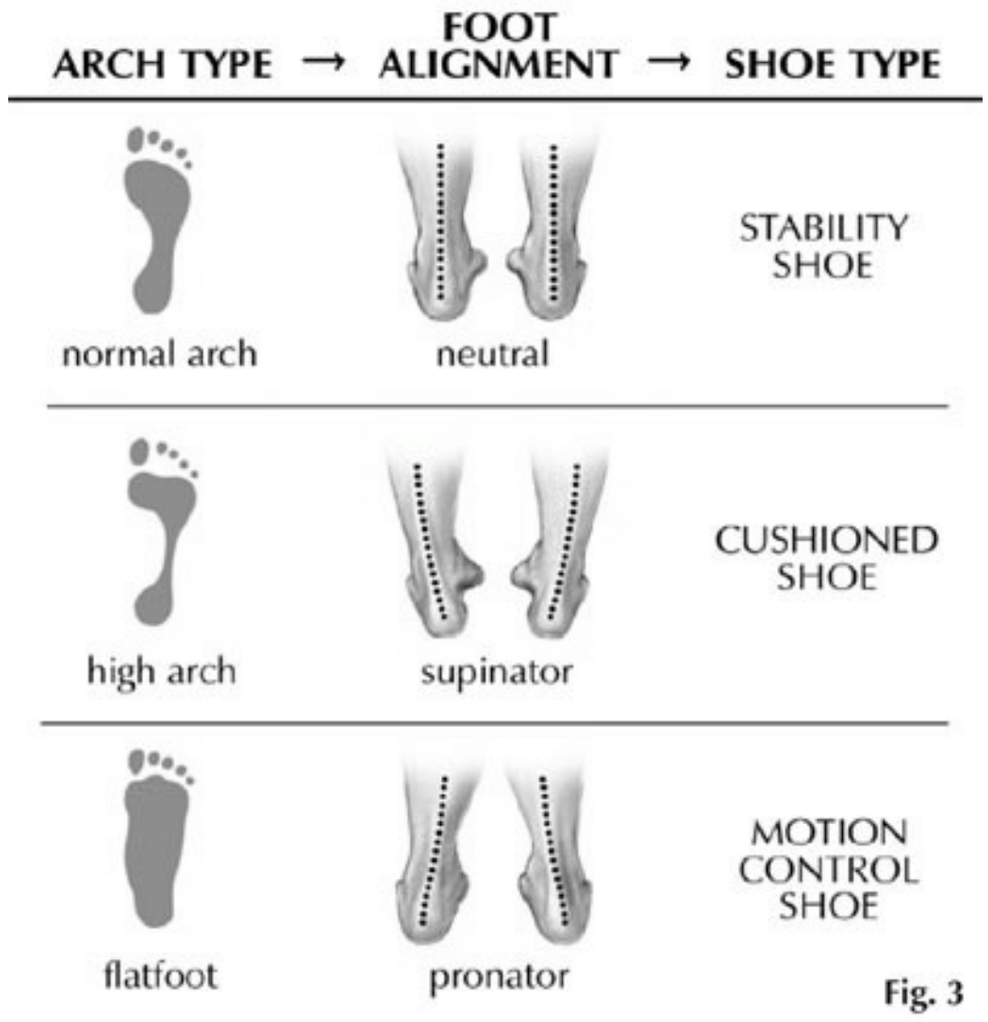
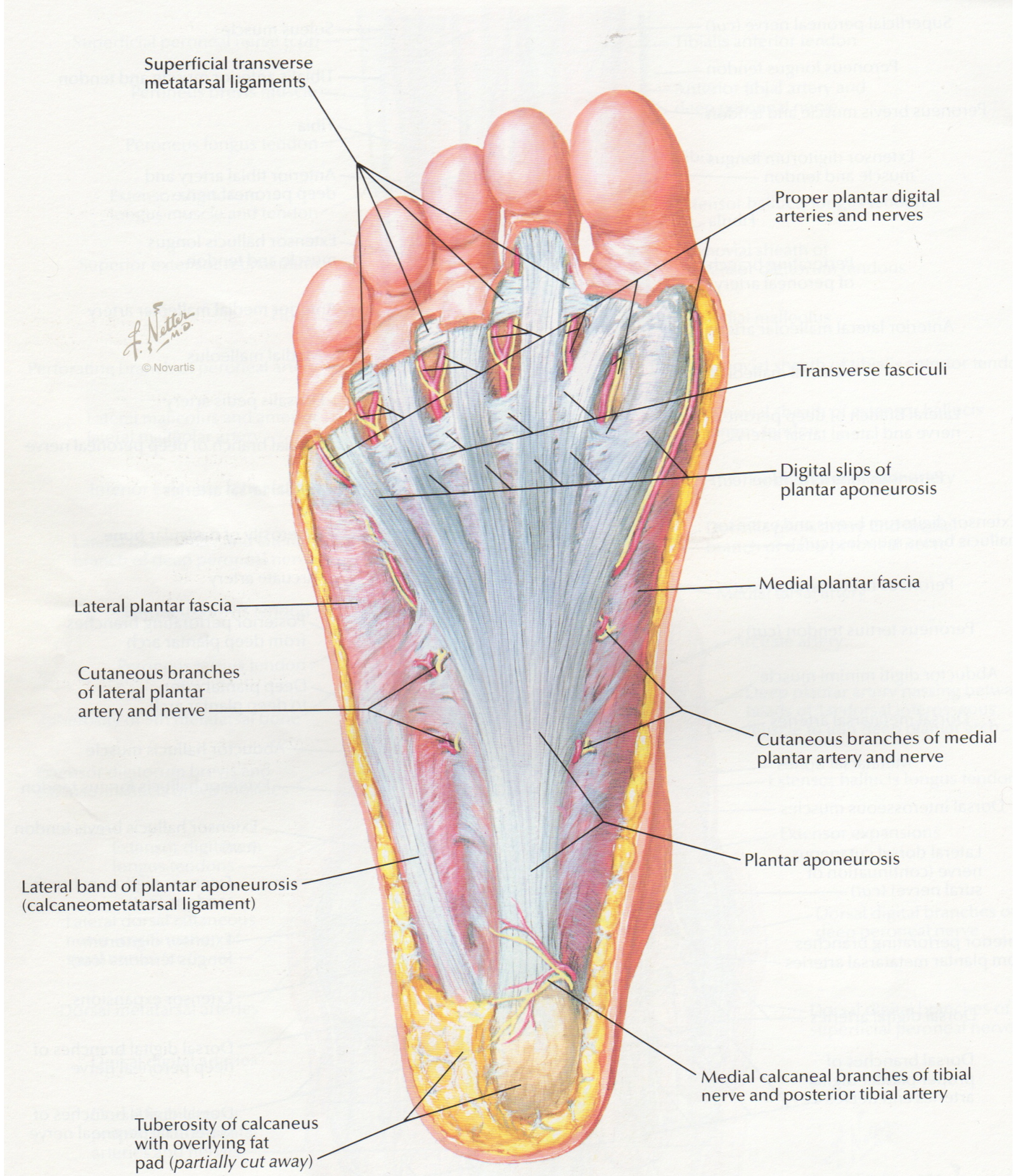
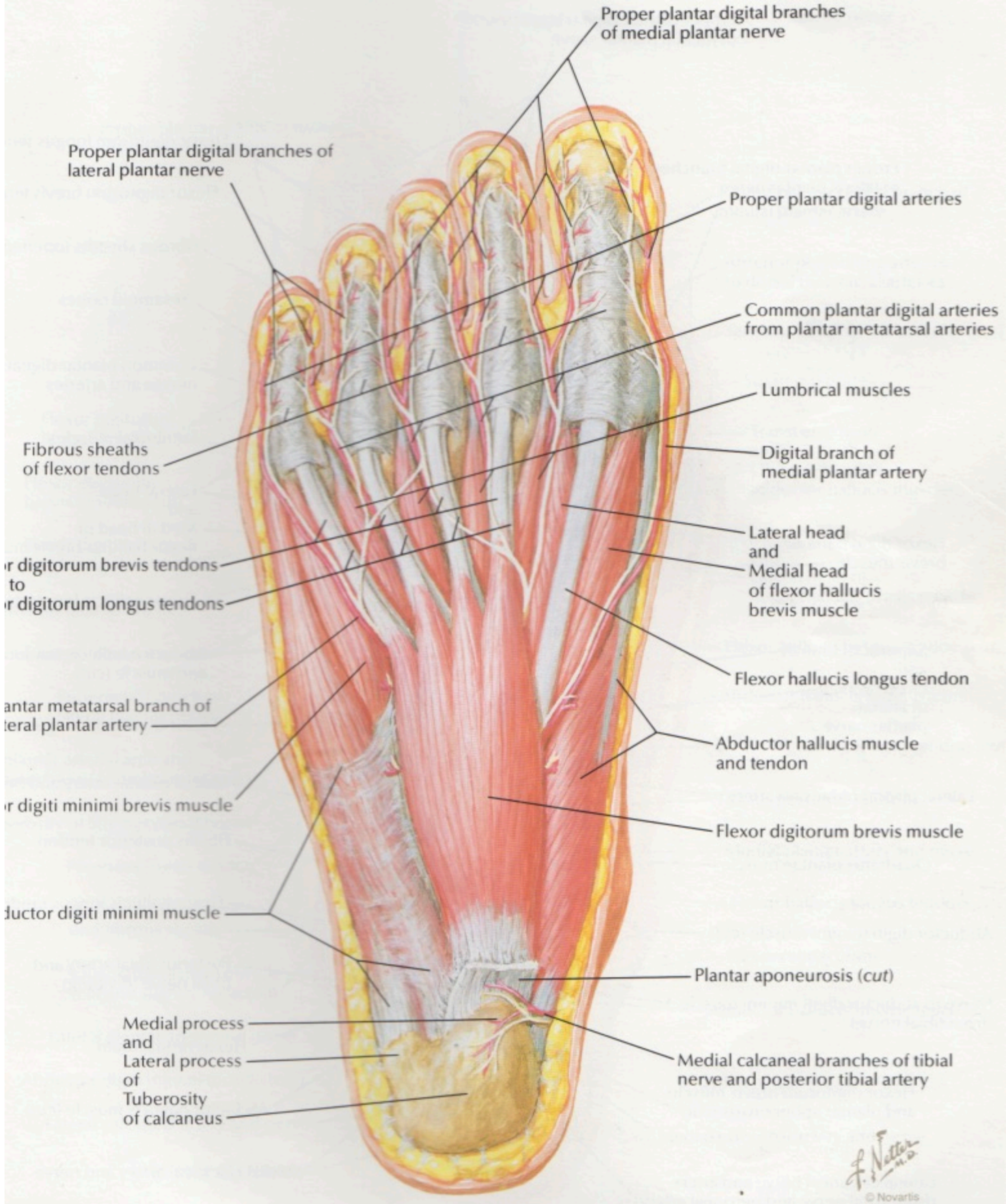


Fig. 3




Proper plantar digital branches of medial plantar nerve
Proper plantar digital branches of lateral plantar nerve
Proper plantar digital arteries
Common plantar digital arteries from plantar metatarsal arteries
Lumbrical muscles
Fibrous sheaths of flexor tendons
Digital branch of medial plantar artery
Lateral head and Medial head of flexor hallucis brevis muscle
r digitorum brevis tendons to r digitorum longus tendons
Flexor hallucis longus tendon
antar metatarsal branch of teral plantar artery
Abductor hallucis muscle and tendon
r digiti minimi brevis muscle
Flexor digitorum brevis muscle
ductor digiti minimi muscle
Plantar aponeurosis (cut)
Medial process and Lateral process of Tuberosity of calcaneus
Medial calcaneal branches of tibial nerve and posterior tibial artery
F. Netter M.D.
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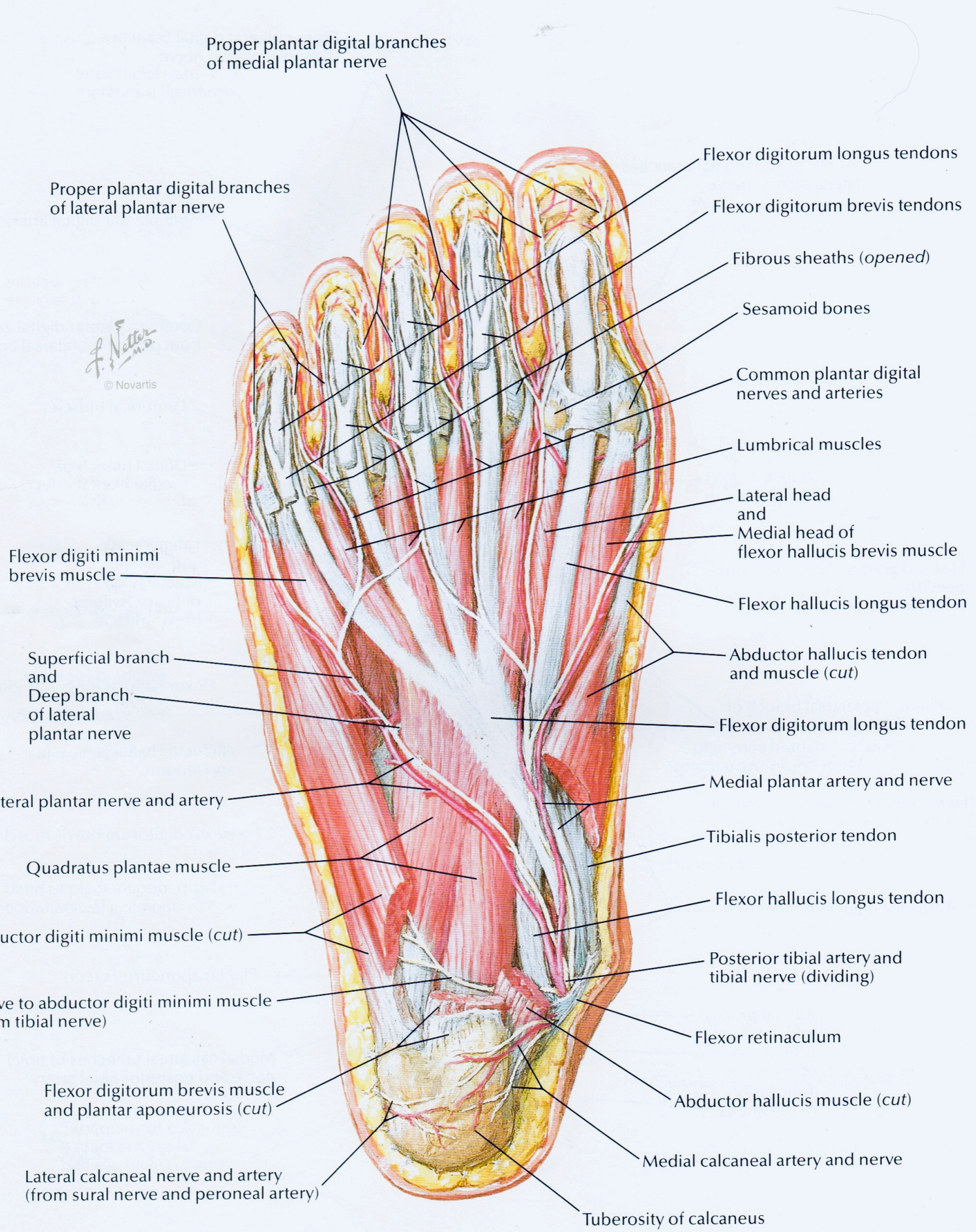

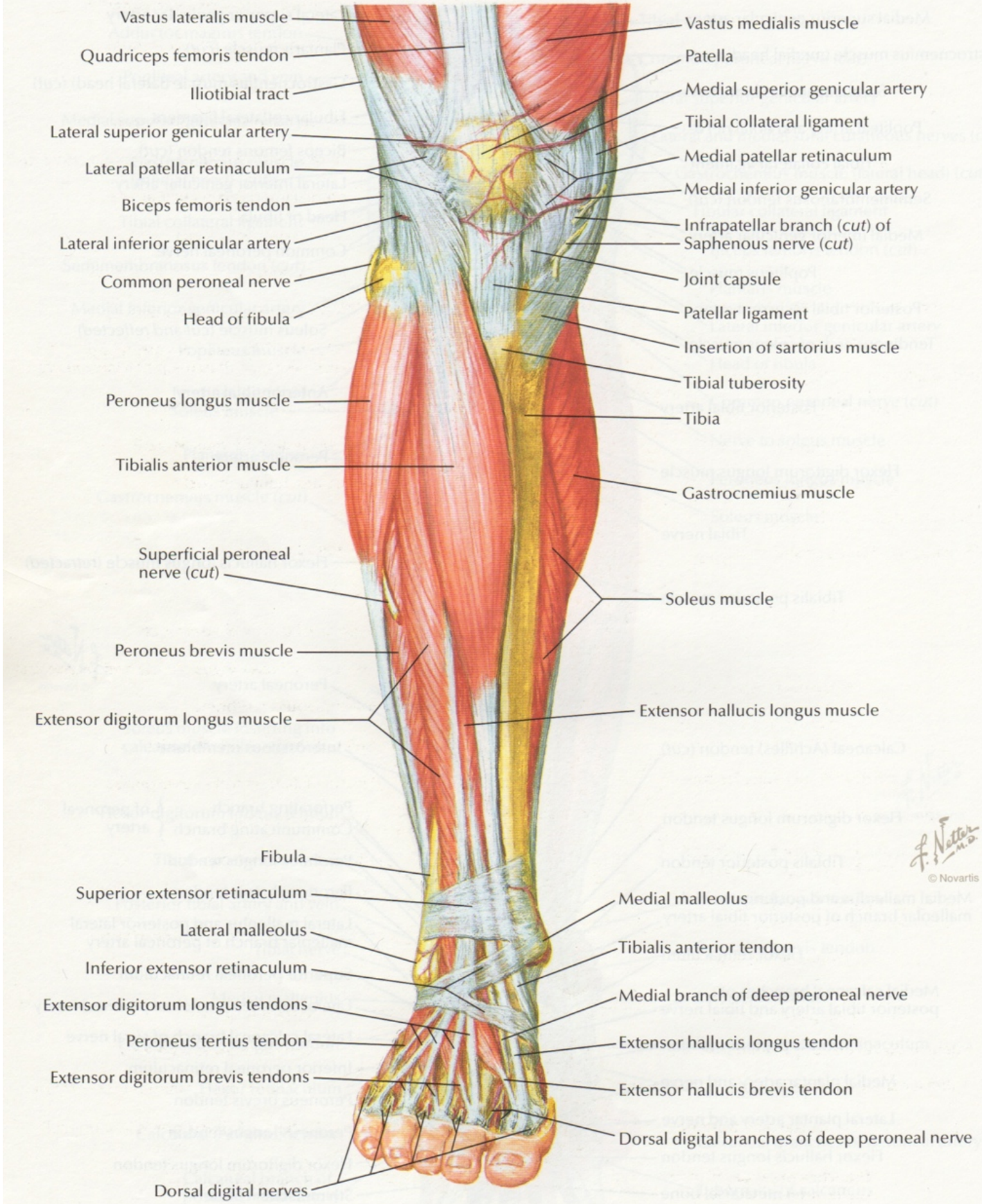
Vastus lateralis muscle
Quadriceps femoris tendon
Iliotibial tract
Lateral superior genicular artery
Lateral patellar retinaculum
Biceps femoris tendon
Lateral inferior genicular artery
Common peroneal nerve
Head of fibula
Peroneus longus muscle
Tibialis anterior muscle
Superficial peroneal nerve (cut)
Peroneus brevis muscle
Extensor digitorum longus muscle
Fibula
Superior extensor retinaculum
Lateral malleolus
Inferior extensor retinaculum
Extensor digitorum longus tendons
Peroneus tertius tendon
Extensor digitorum brevis tendons
Dorsal digital nerves
Vastus medialis muscle
Patella
Medial superior genicular artery
Tibial collateral ligament
Medial patellar retinaculum
Medial inferior genicular artery
Infrapatellar branch (cut) of Saphenous nerve (cut)
Joint capsule
Patellar ligament
Insertion of sartorius muscle
Tibial tuberosity
Tibia
Gastrocnemius muscle
Soleus muscle
Extensor hallucis longus muscle
Medial malleolus
Tibialis anterior tendon
Medial branch of deep peroneal nerve
Extensor hallucis longus tendon
Extensor hallucis brevis tendon
Dorsal digital branches of deep peroneal nerve
F. Netter M.D.
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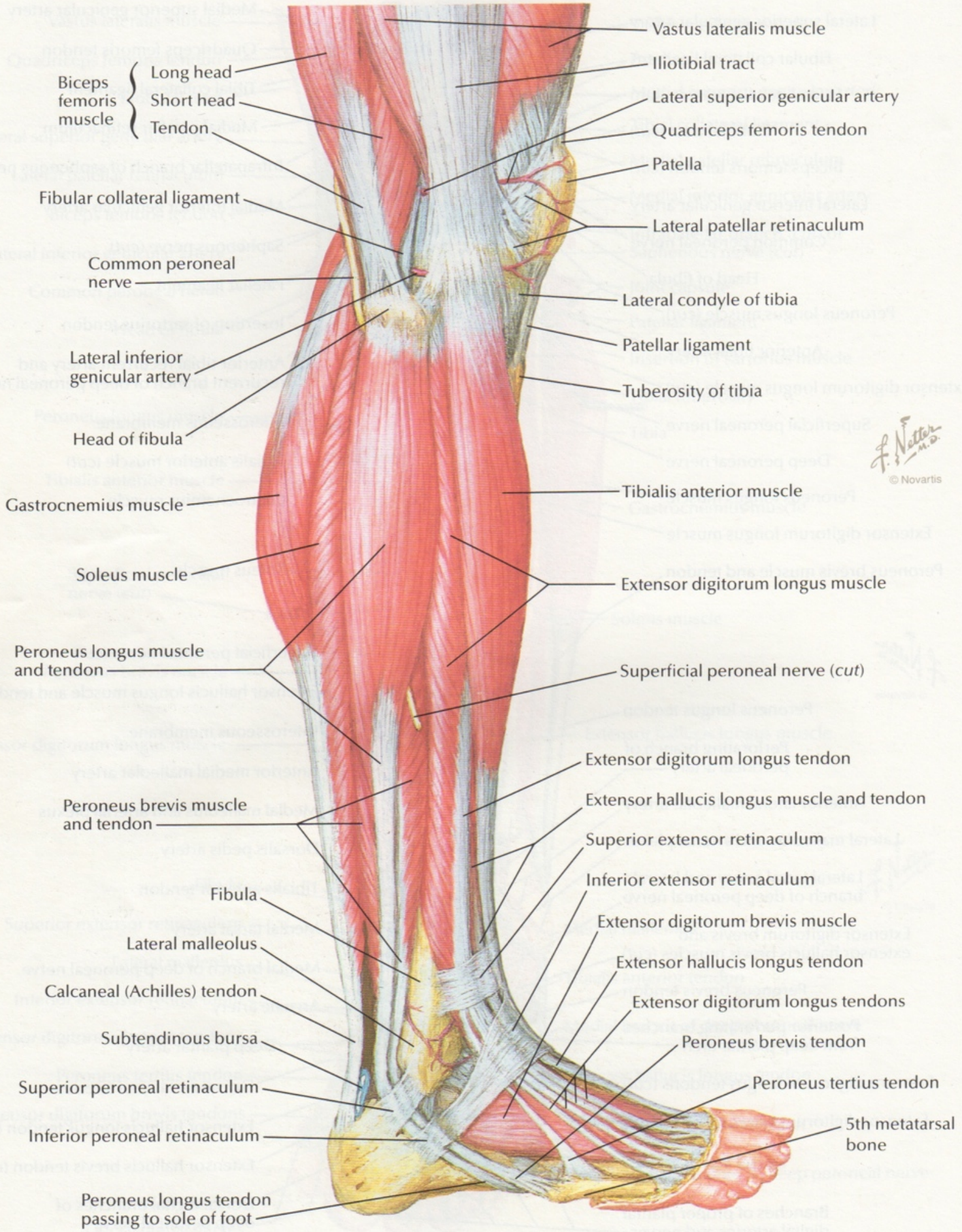
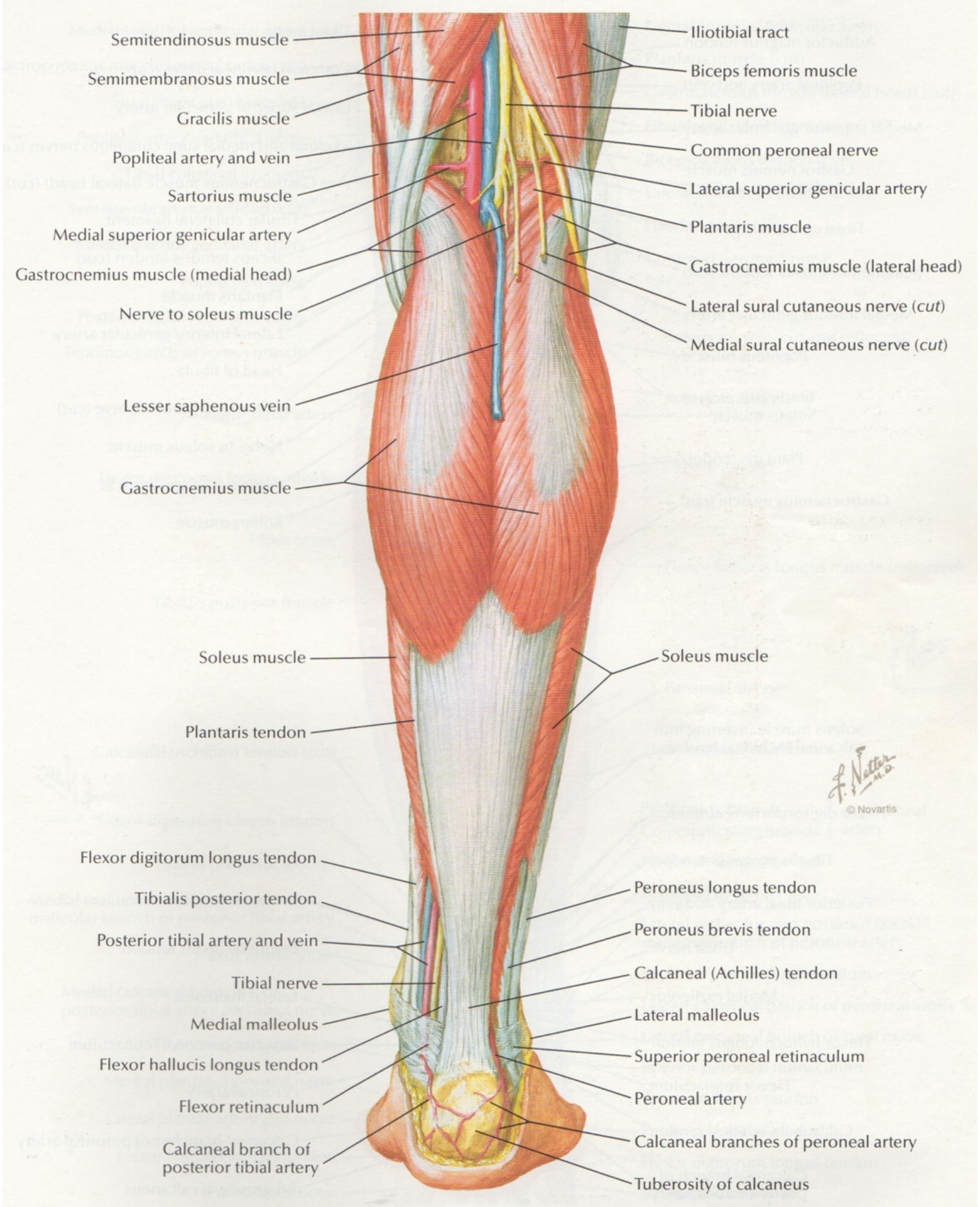

Biceps femoris muscle
Long head
Short head
Tendon
Fibular collateral ligament
Common peroneal nerve
Lateral inferior genicular artery
Head of fibula
Gastrocnemius muscle
Soleus muscle
Peroneus longus muscle and tendon
Peroneus brevis muscle and tendon
Fibula
Lateral malleolus
Calcaneal (Achilles) tendon
Subtendinous bursa
Superior peroneal retinaculum
Inferior peroneal retinaculum
Peroneus longus tendon passing to sole of foot
Vastus lateralis muscle
Iliotibial tract
Lateral superior genicular artery
Quadriceps femoris tendon
Patella
Lateral patellar retinaculum
Lateral condyle of tibia
Patellar ligament
Tuberosity of tibia
Tibialis anterior muscle
Extensor digitorum longus muscle
Superficial peroneal nerve (cut)
Extensor digitorum longus tendon
Extensor hallucis longus muscle and tendon
Superior extensor retinaculum
Inferior extensor retinaculum
Extensor digitorum brevis muscle
Extensor hallucis longus tendon
Extensor digitorum longus tendons
Peroneus brevis tendon
Peroneus tertius tendon
5th metatarsal bone


Semitendinosus muscle
Semimembranosus muscle
Gracilis muscle
Popliteal artery and vein
Sartorius muscle
Medial superior genicular artery
Gastrocnemius muscle (medial head)
Nerve to soleus muscle
Lesser saphenous vein
Gastrocnemius muscle
Soleus muscle
Plantaris tendon
Iliotibial tract
Biceps femoris muscle
Tibial nerve
Common peroneal nerve
Lateral superior genicular artery
Plantaris muscle
Gastrocnemius muscle (lateral head)
Lateral sural cutaneous nerve (cut)
Medial sural cutaneous nerve (cut)
Soleus muscle
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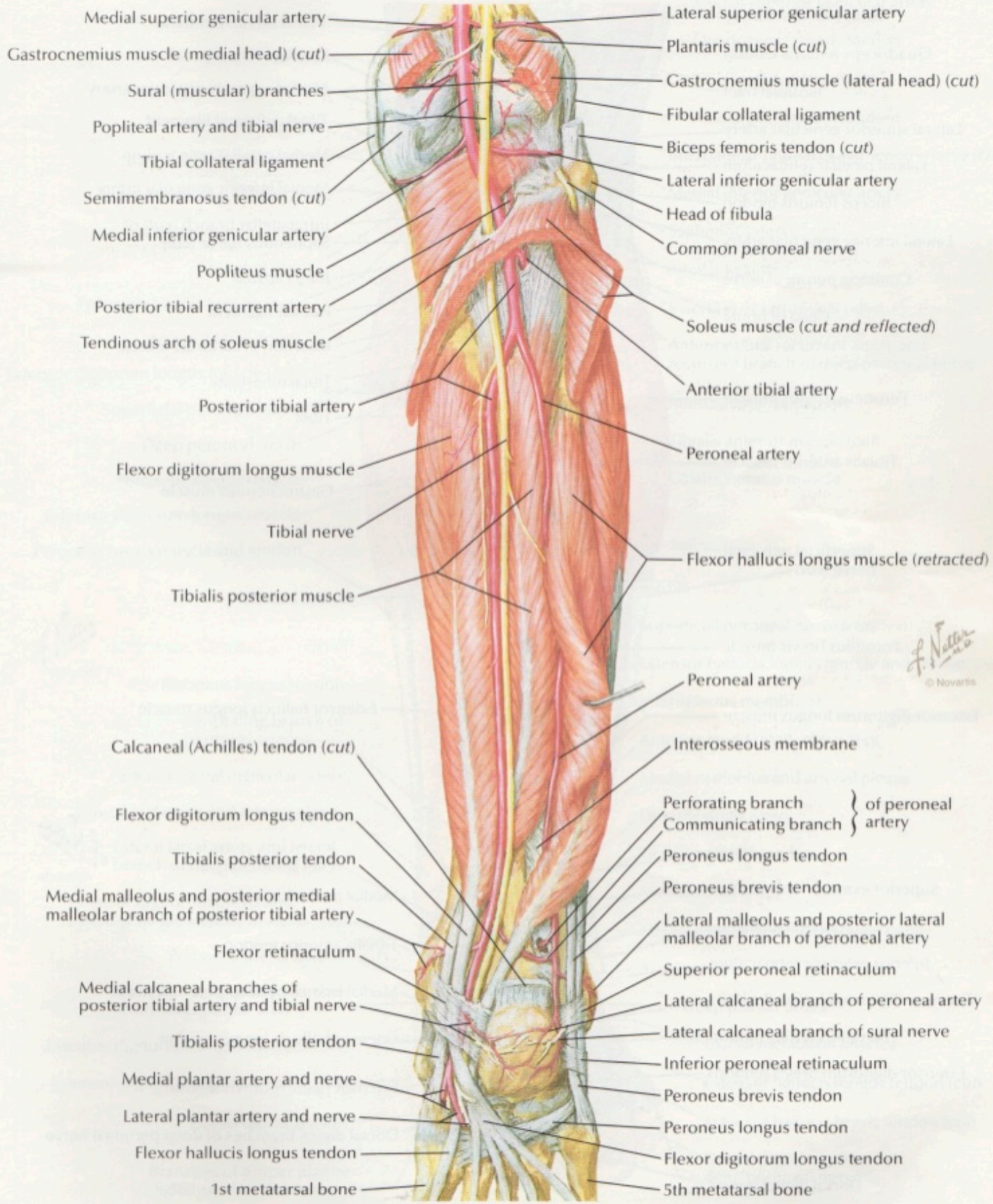
Flexor digitorum longus tendon
Tibialis posterior tendon
Posterior tibial artery and vein
Tibial nerve
Medial malleolus
Flexor hallucis longus tendon
Flexor retinaculum
Calcaneal branch of posterior tibial artery
Peroneus longus tendon
Peroneus brevis tendon
Calcaneal (Achilles) tendon
Lateral malleolus
Superior peroneal retinaculum
Peroneal artery
Calcaneal branches of peroneal artery
Tuberosity of calcaneus

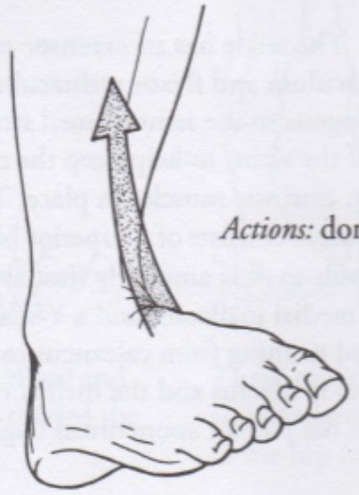
Muscles of Leg (Deep Dissection): Posterior View

SEE ALSO PLATE 509



Extrinsic anterior muscles

Tibialis anterior originates from the lateral condyle and superolateral shaft of tibia, passes under the extensor retinaculum, and inserts on the medial cuneiform (inferomedial surface) and base of metatarsal I. This muscle is the strongest dorsiflexor.

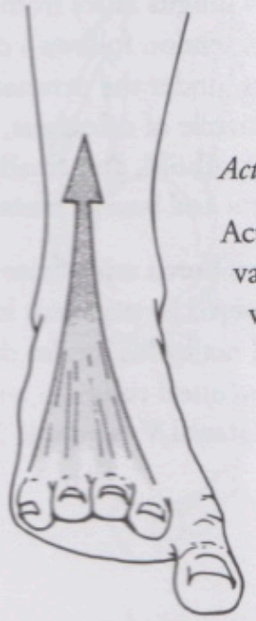


Actions: dorsiflexion and inversion

Extensor hallucis longus arises from the central medial fibula and interosseous membrane, passes under the extensor retinaculum, and inserts dorsally on distal phalanx I.

Action:
dorsiflexion of big toe and foot

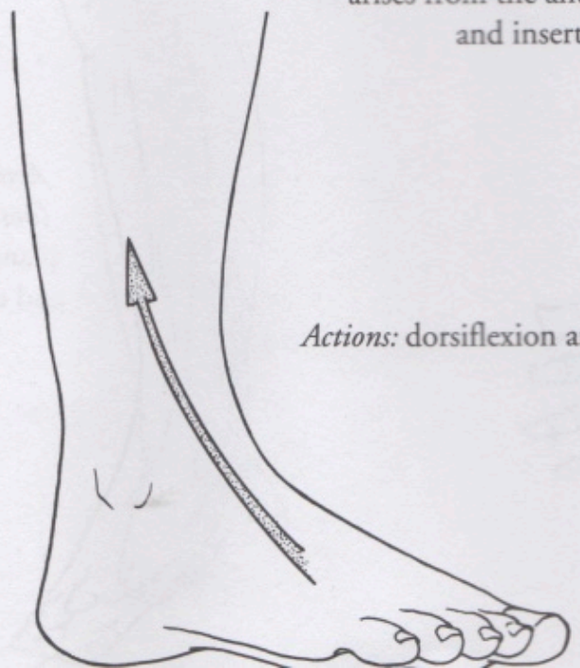
Extensor digitorum longus originates from the lateral tibial condyle, most of the anterior fibular shaft, and interosseous membrane. Its tendon passes under the extensor retinaculum, splits into four parts, and inserts on toes II-V. Each of the four tendons further splits into two slips attaching to the sides of the middle phalanx, and a central slip attaching to the base of the distal phalanx. This is reminiscent of the extensor digitorum of the hand (see page 167).



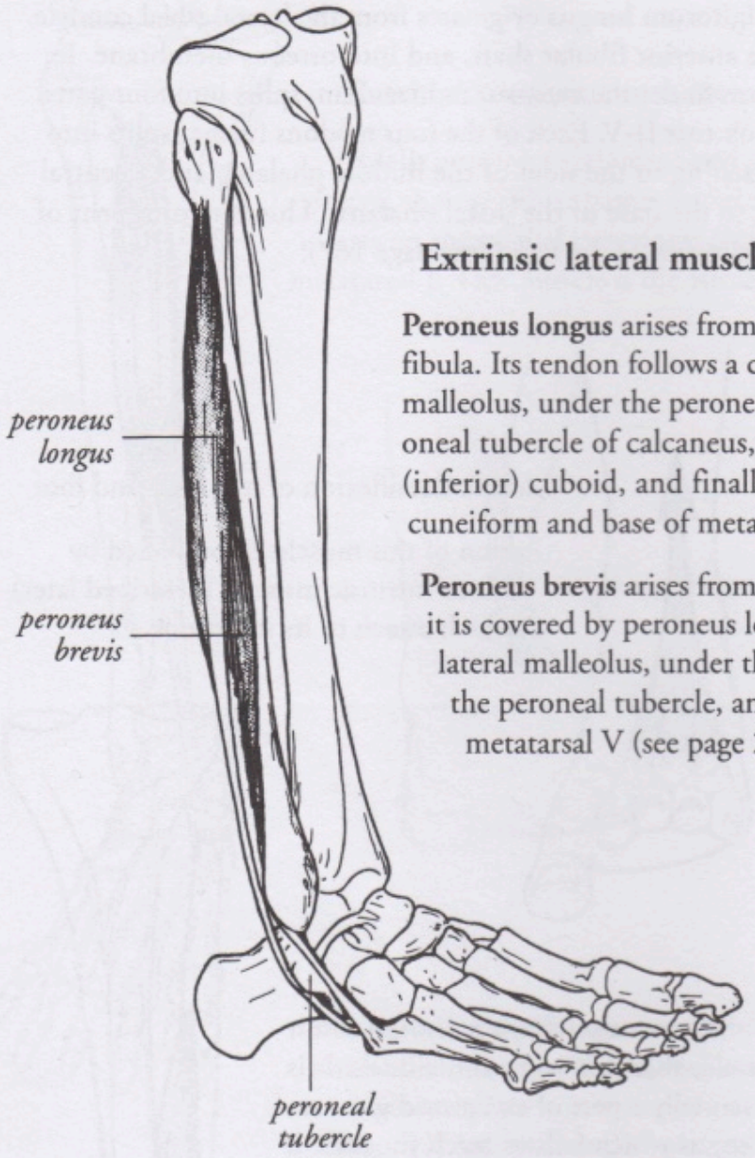
Action: dorsiflexion of toes II-V and foot

Action of this muscle is completed by various intrinsic muscles (described later) which attach to its insertions.

Peroneus tertius is an insignificant muscle, absent in some individuals. It is essentially a part of extensor digitorum longus which fails to reach the toes. It arises from the anteroinferior fibula and inserts on metatarsal V.



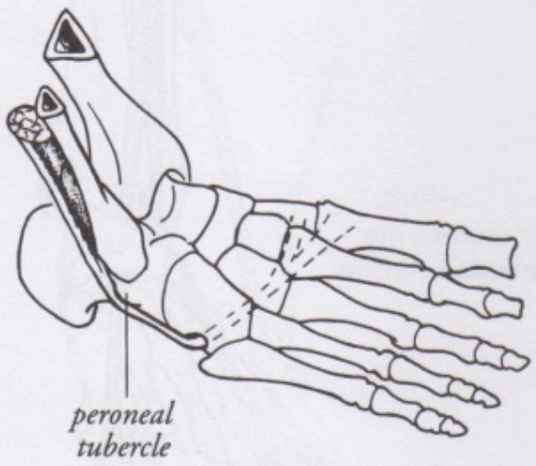
Actions: dorsiflexion and eversion

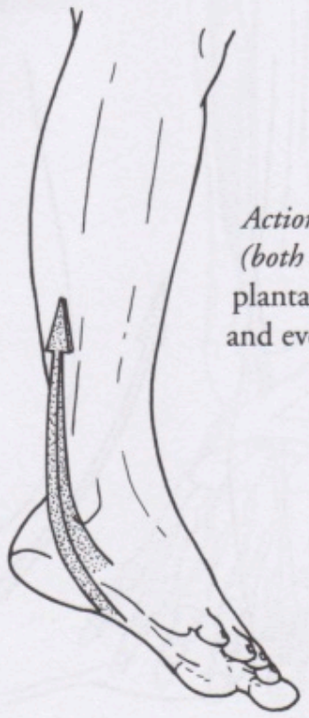


Extrinsic lateral muscles

Peroneus longus arises from the head and superolateral shaft of fibula. Its tendon follows a complicated path behind the lateral malleolus, under the peroneal retinaculum, *inferior* to the peroneal tubercle of calcaneus, along the groove of the plantar (inferior) cuboid, and finally inserts inferiorly on the medial cuneiform and base of metatarsal I (see left and lower left).

Peroneus brevis arises from the inferolateral fibular shaft, where it is covered by peroneus longus. Its tendon passes behind the lateral malleolus, under the peroneal retinaculum, *superior* to the peroneal tubercle, and inserts on the lateral tubercle of metatarsal V (see page 254).

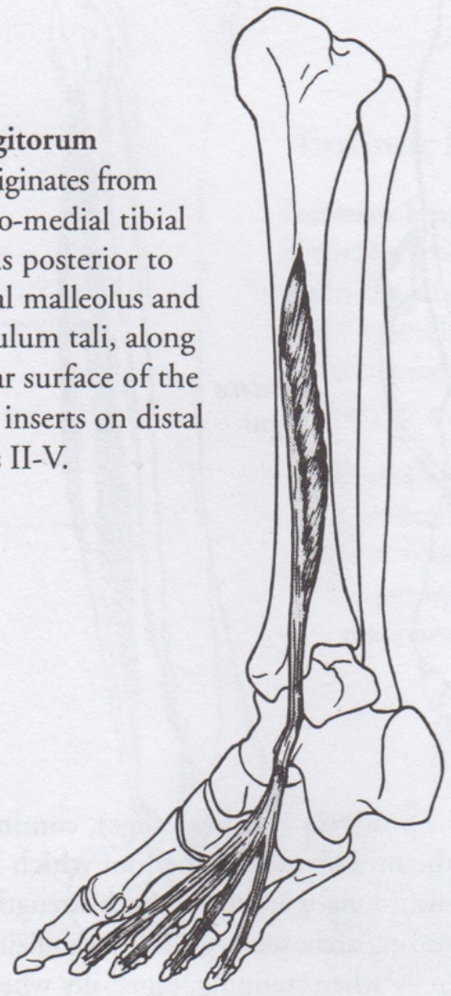




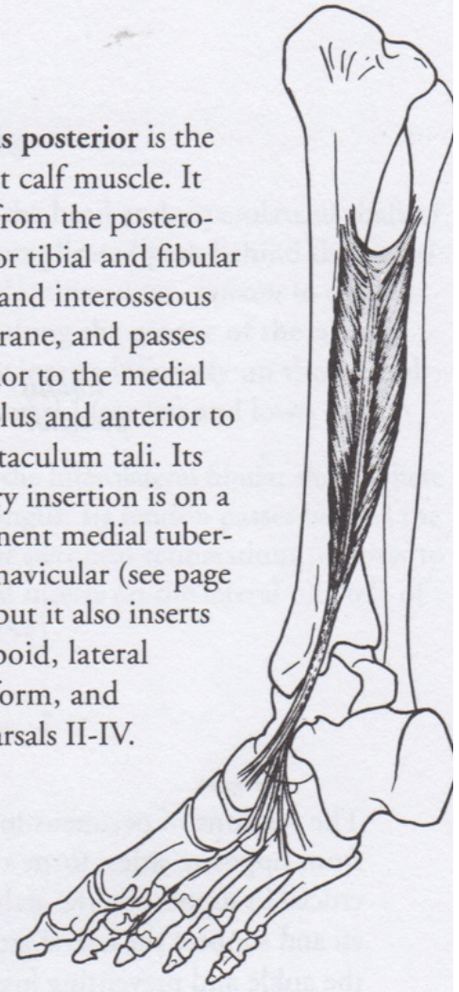
Actions (both muscles): plantar flexion and eversion

Extrinsic posterior muscles

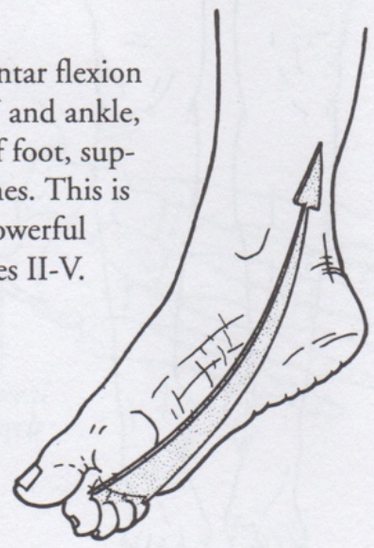
Flexor digitorum longus originates from the postero-medial tibial shaft, runs posterior to the medial malleolus and sustentaculum tali, along the plantar surface of the foot, and inserts on distal phalanges II-V.



Tibialis posterior is the deepest calf muscle. It arises from the postero-superior tibial and fibular shafts and interosseous membrane, and passes posterior to the medial malleolus and anterior to sustentaculum tali. Its primary insertion is on a prominent medial tubercle of navicular (see page 241), but it also inserts on cuboid, lateral cuneiform, and metatarsals II-IV.

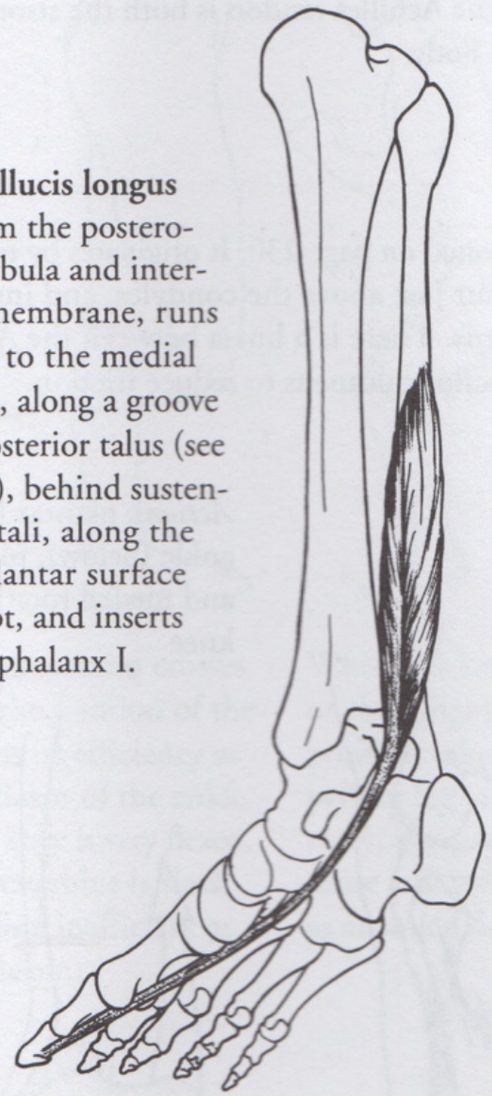


Actions: plantar flexion of toes II-V and ankle, inversion of foot, support of arches. This is the most powerful flexor of toes II-V.

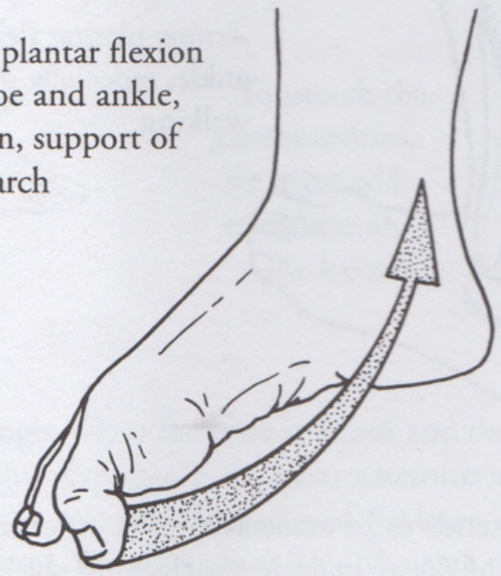


Actions: plantar flexion, inversion, support of arches. The role of tibialis posterior, in conjunction with peroneus longus, in forming a "sling" for the middle foot, was mentioned on the preceding page.

Flexor hallucis longus arises from the postero-inferior fibula and inter-osseous membrane, runs posterior to the medial malleolus, along a groove on the posterior talus (see page 240), behind susten-taculum tali, along the medial plantar surface of the foot, and inserts on distal phalanx I.

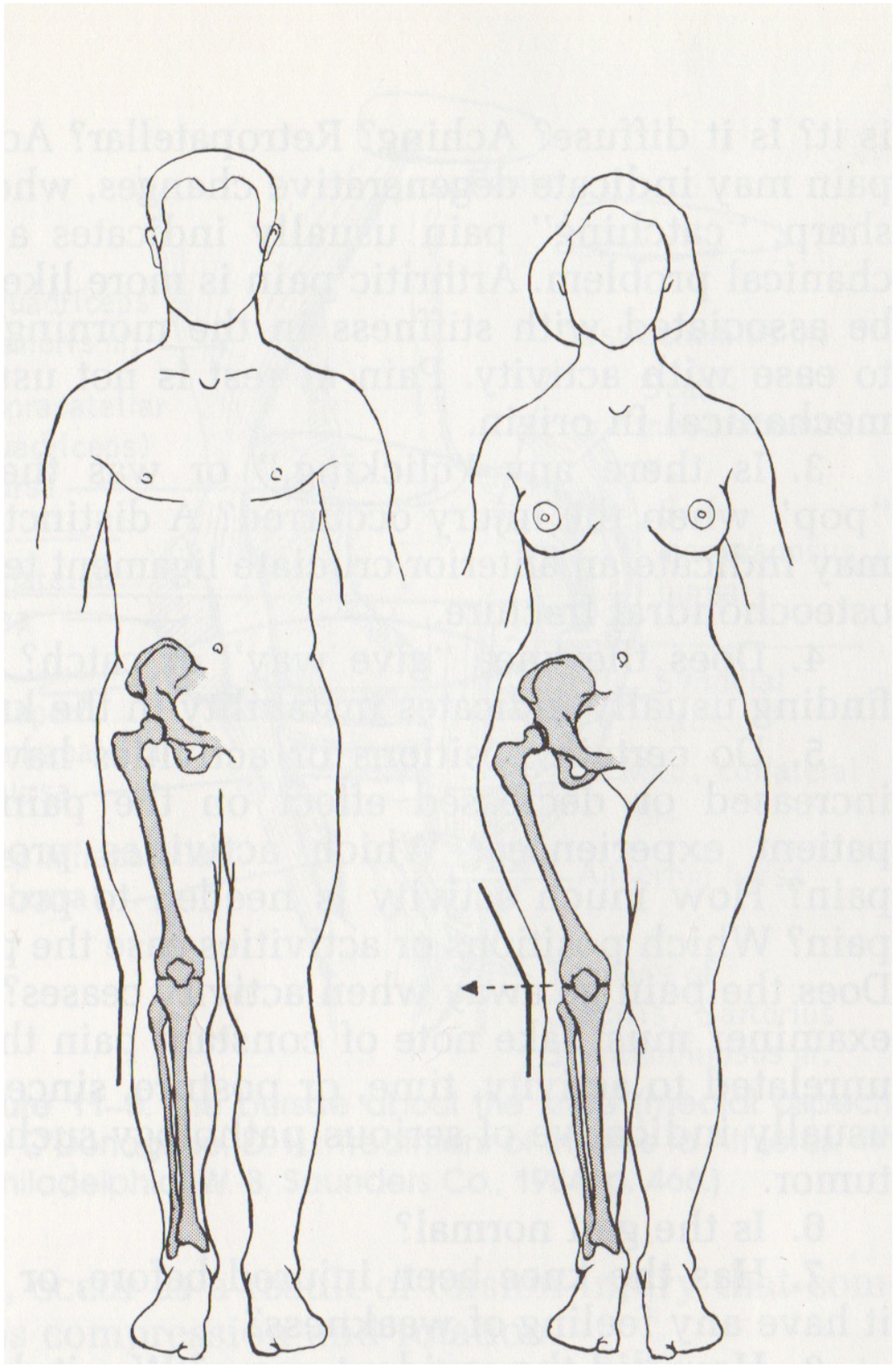


Actions: plantar flexion of big toe and ankle, inversion, support of medial arch

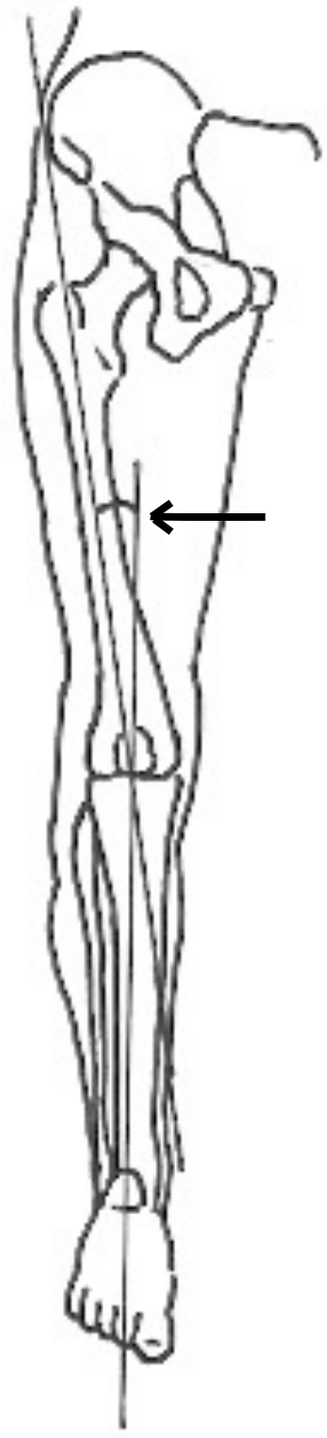


This muscle is important in the propulsion phase of walking (see page 243), and also in preventing anterior loss of balance when standing on tiptoe.

Q Angle

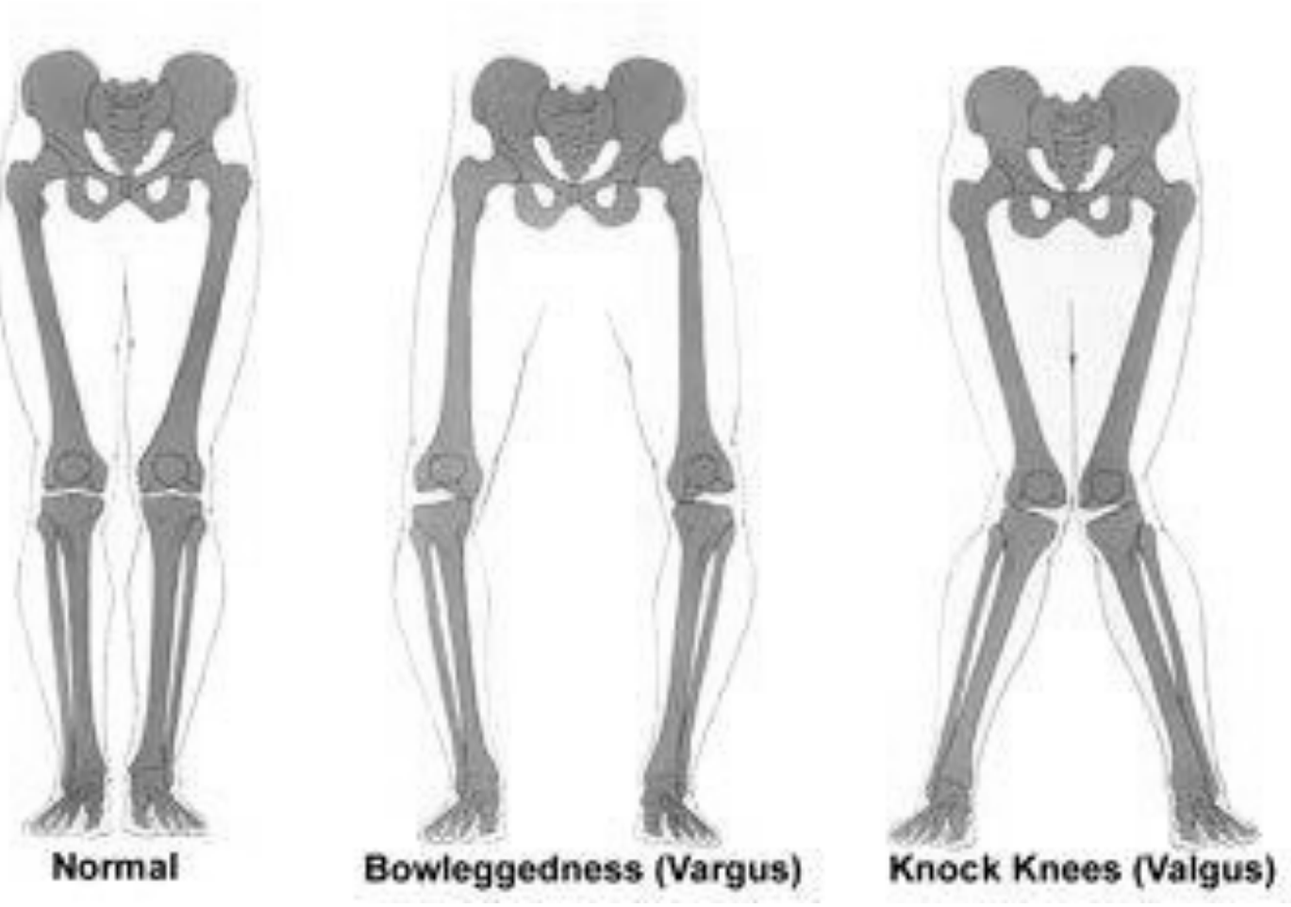


Magee



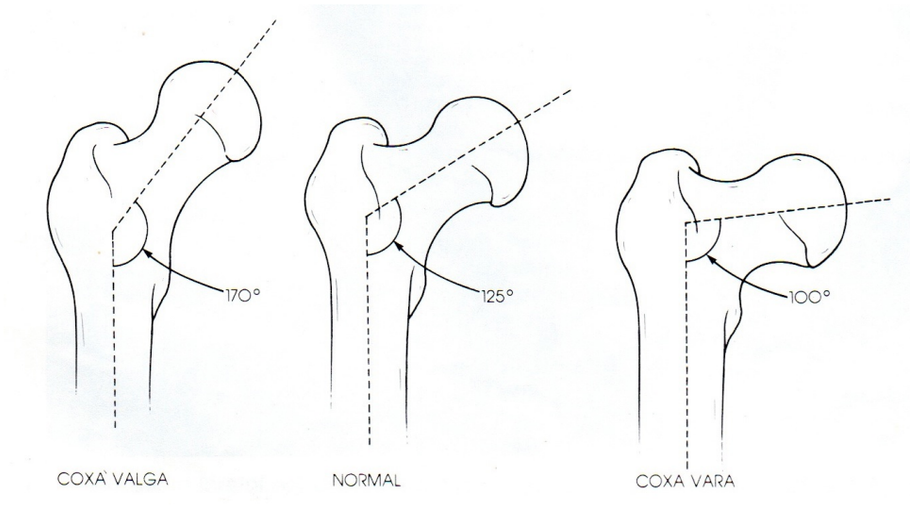
Q Angle

Genu Valgus / Varus



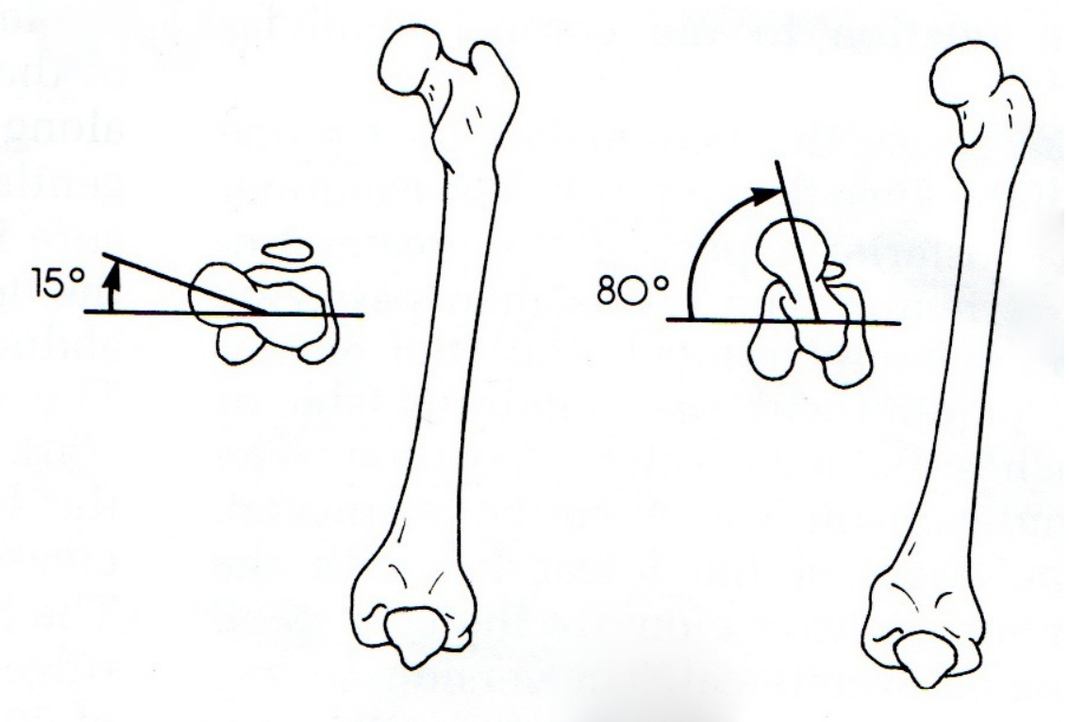
-Femur neck angle variance

- Pelvis Width

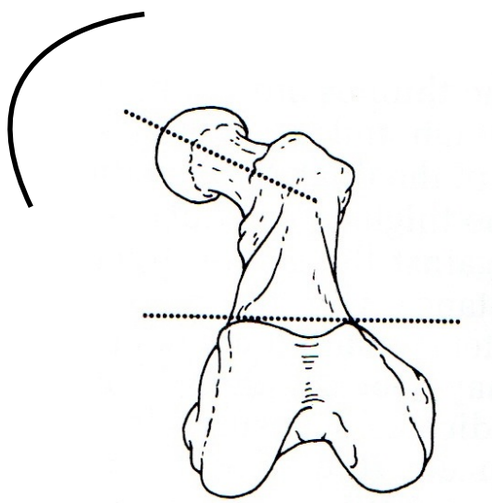


Magee

Femoral Anteversion / Winking Patella

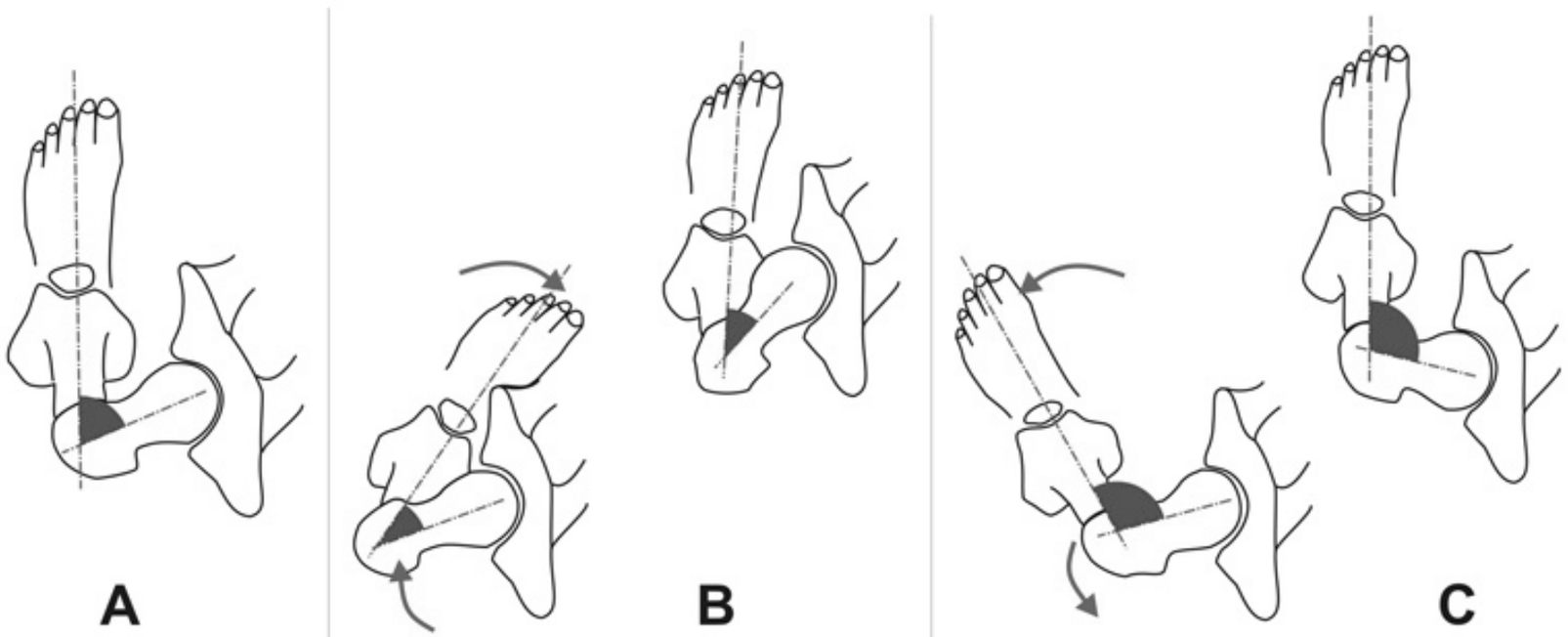


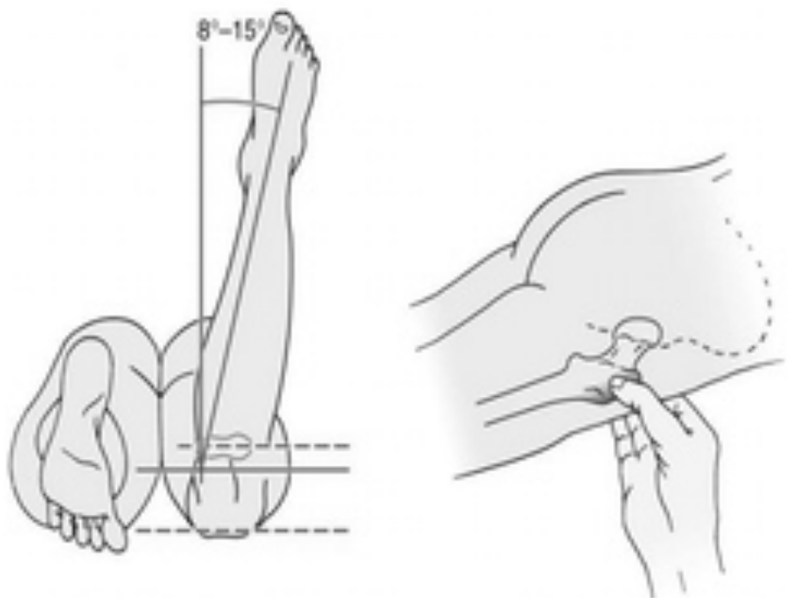
Normal Excessive

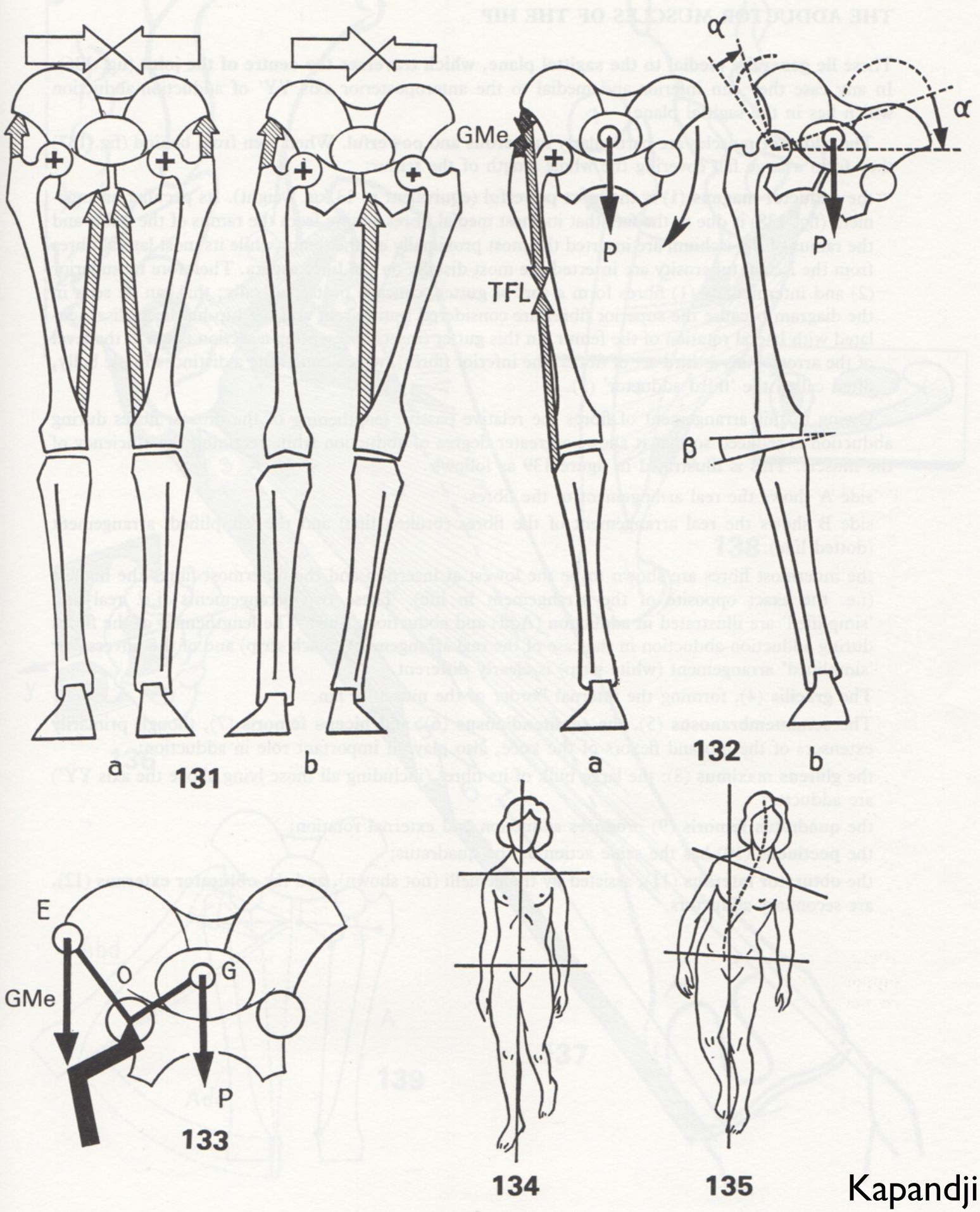


Magee

Femoral Anteversion / Retroversion







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135

Kapandji

Knee and Hip stabilization : a balance of adductors and abductors

- Trendelenburg Gait

Leg length Asymmetry

- Structural: Anatomical shortening of one or more bones of the lower extremity

- Functional: Due to Muscle Weakness or Ligament Laxity of SI joint, ankle or foot.

- Compensations include; Spine, Pelvis and Lower extremity.

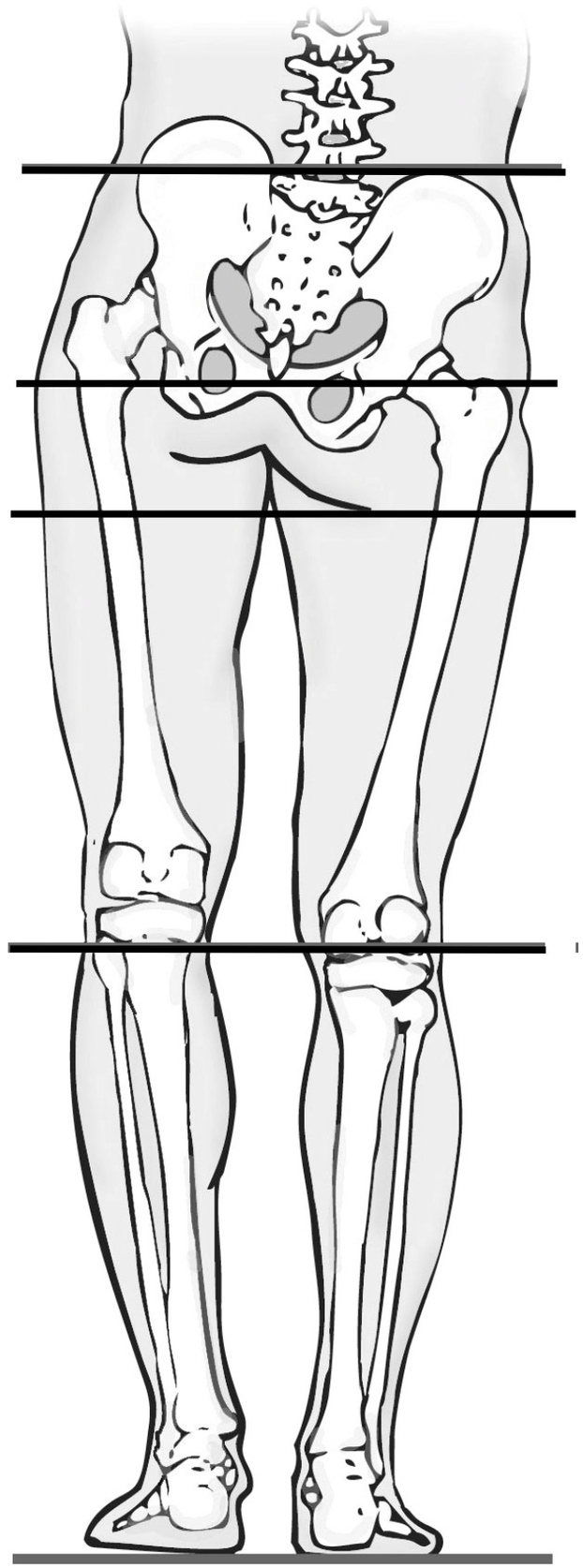
- Center of gravity shift to short side associated with Scoliosis.

- Symptoms can include foot, ankle, hip or low back pain.

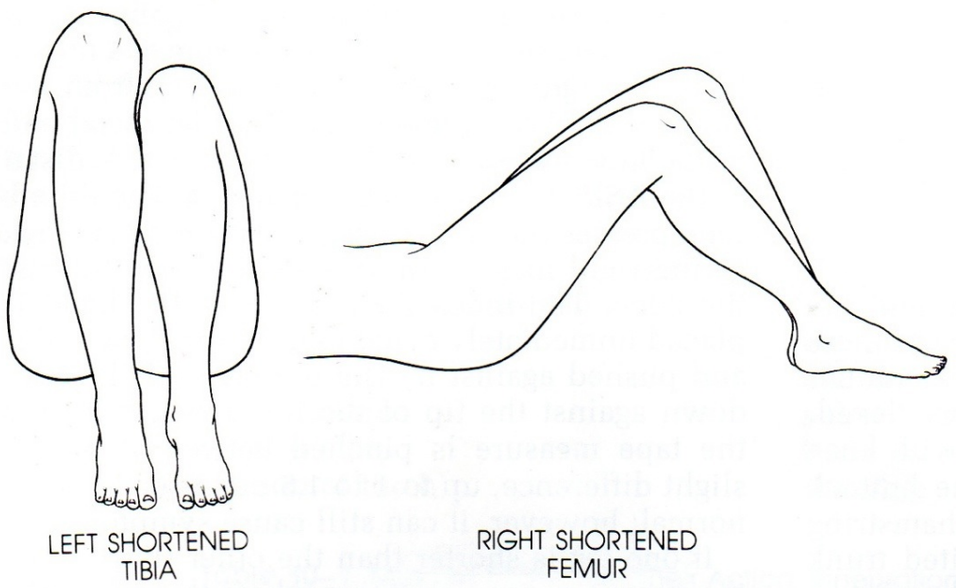
- Treatment includes; heel lifts starting at half the correction and progress slowly.

- Correct over pronation with Orthotics.

Leg Length



Tibia v.s. Femur



Knee

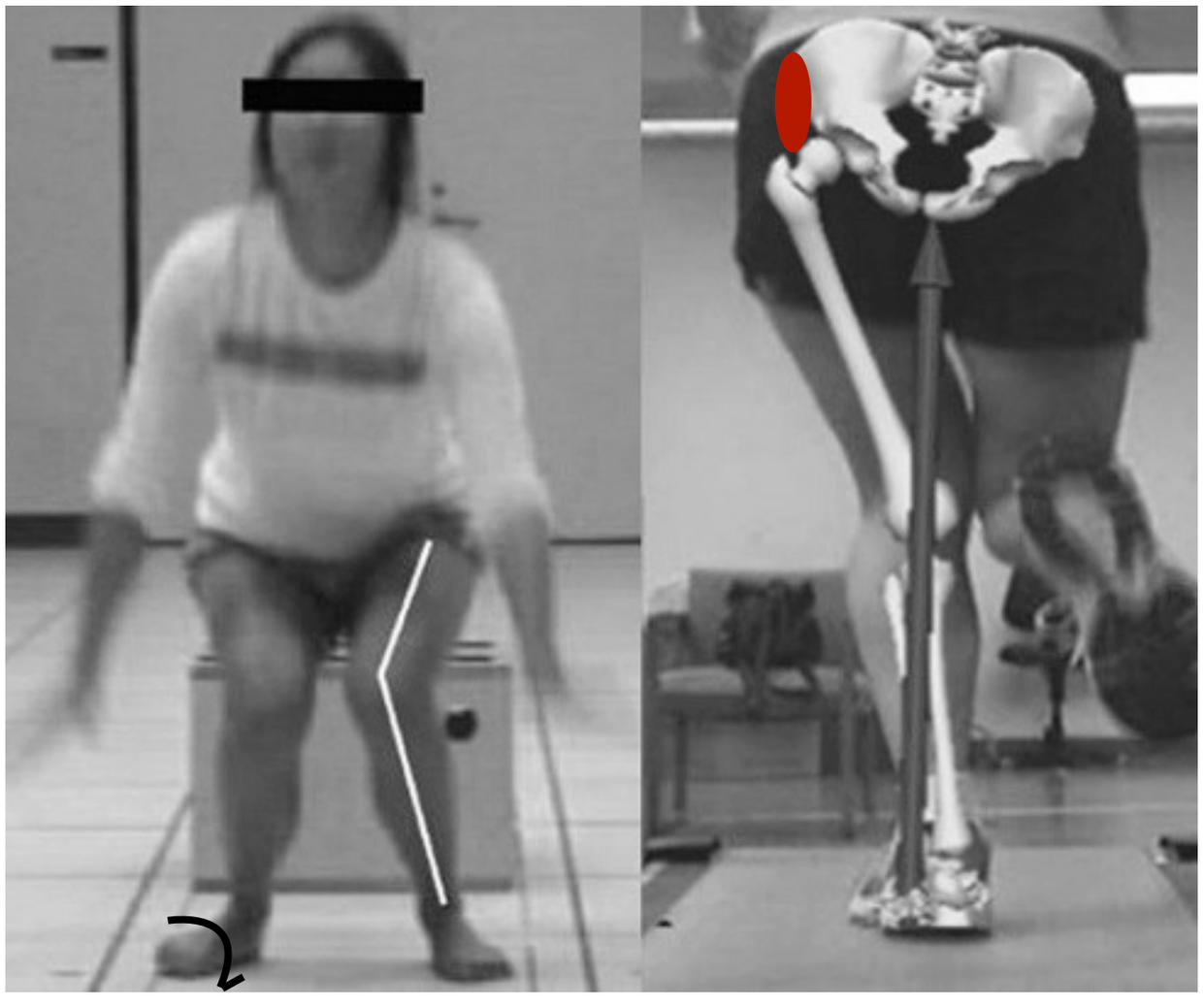
Hip and Knee functional assessment

- Single Leg Squat and Single Leg Lunge

- Double Leg Squat

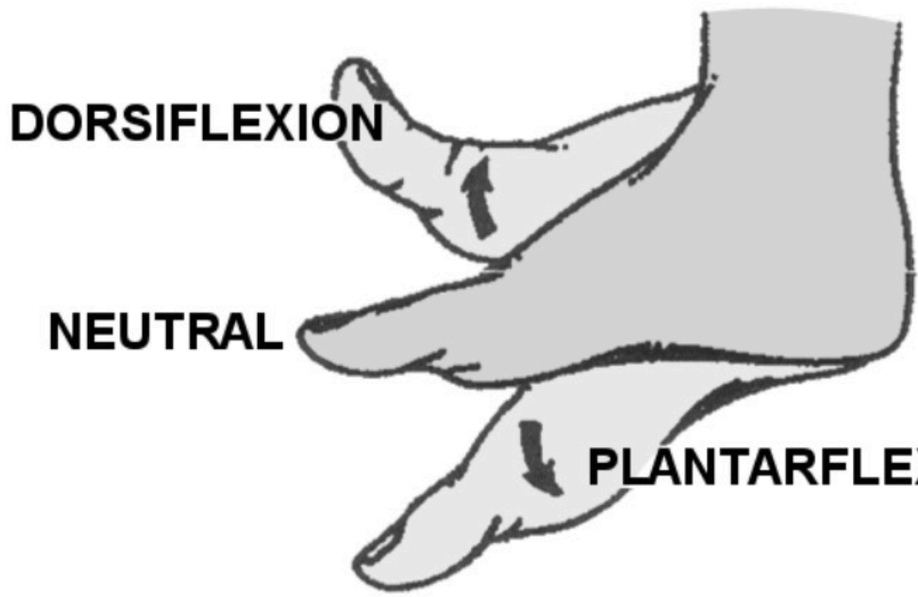
- 6 inch Step off

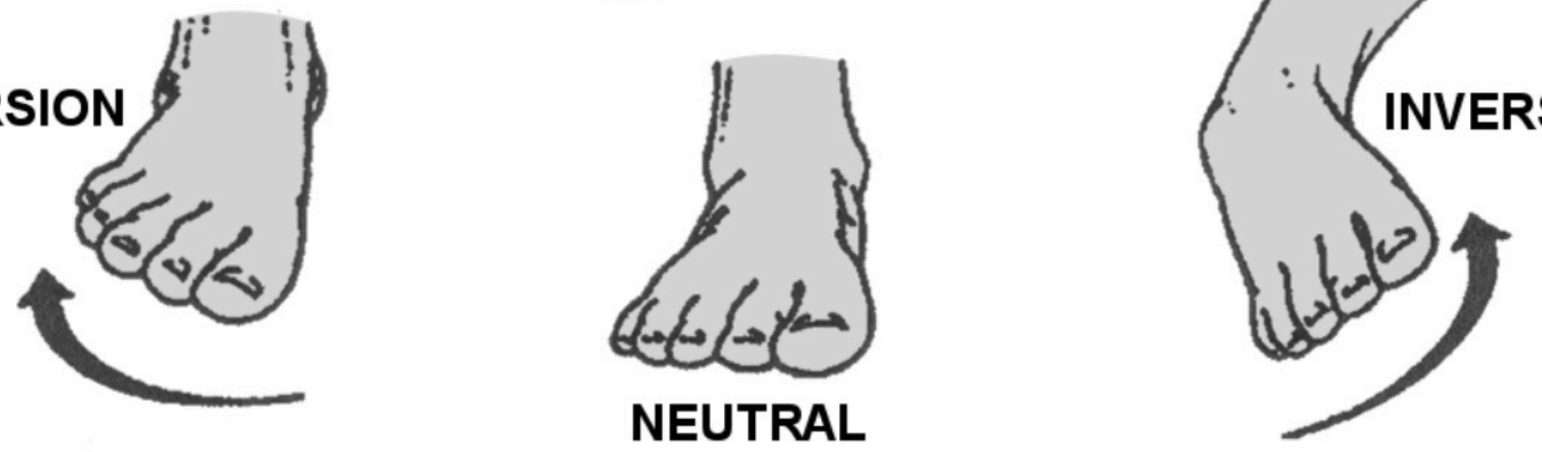
- Pelvic Instability
- Trendelenburg (weak hip adductors)



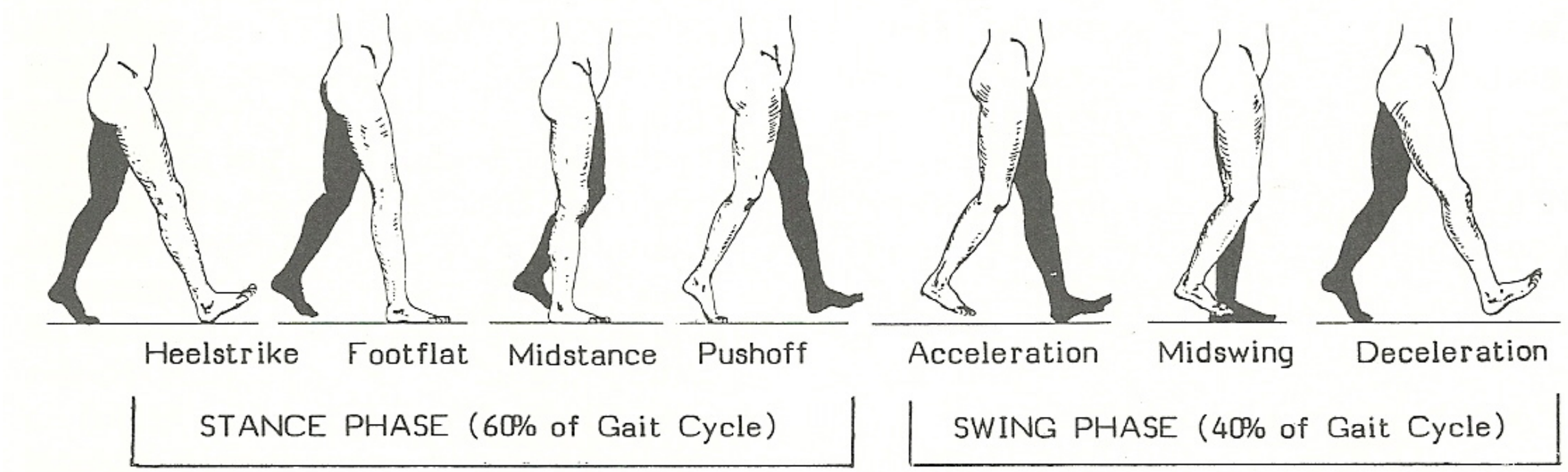
- Trunk Instability
- Valgus knee
- Hyperpronation

Foot Movements





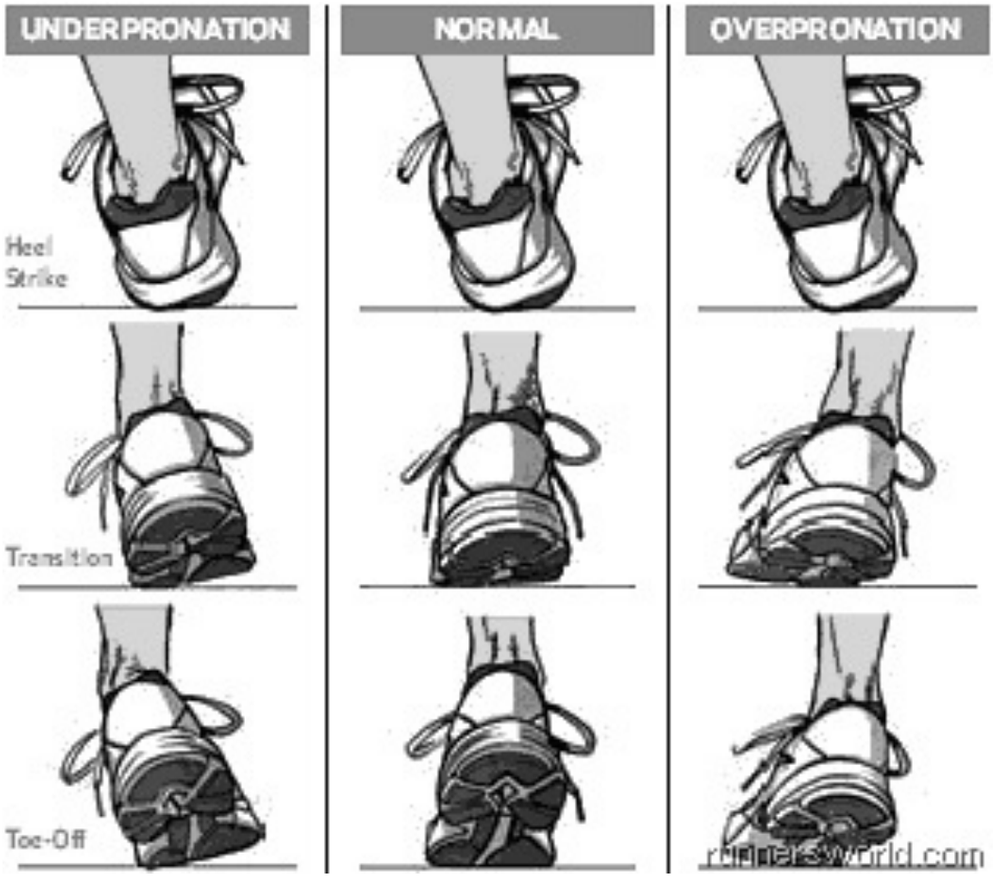
Running / Walking Gait

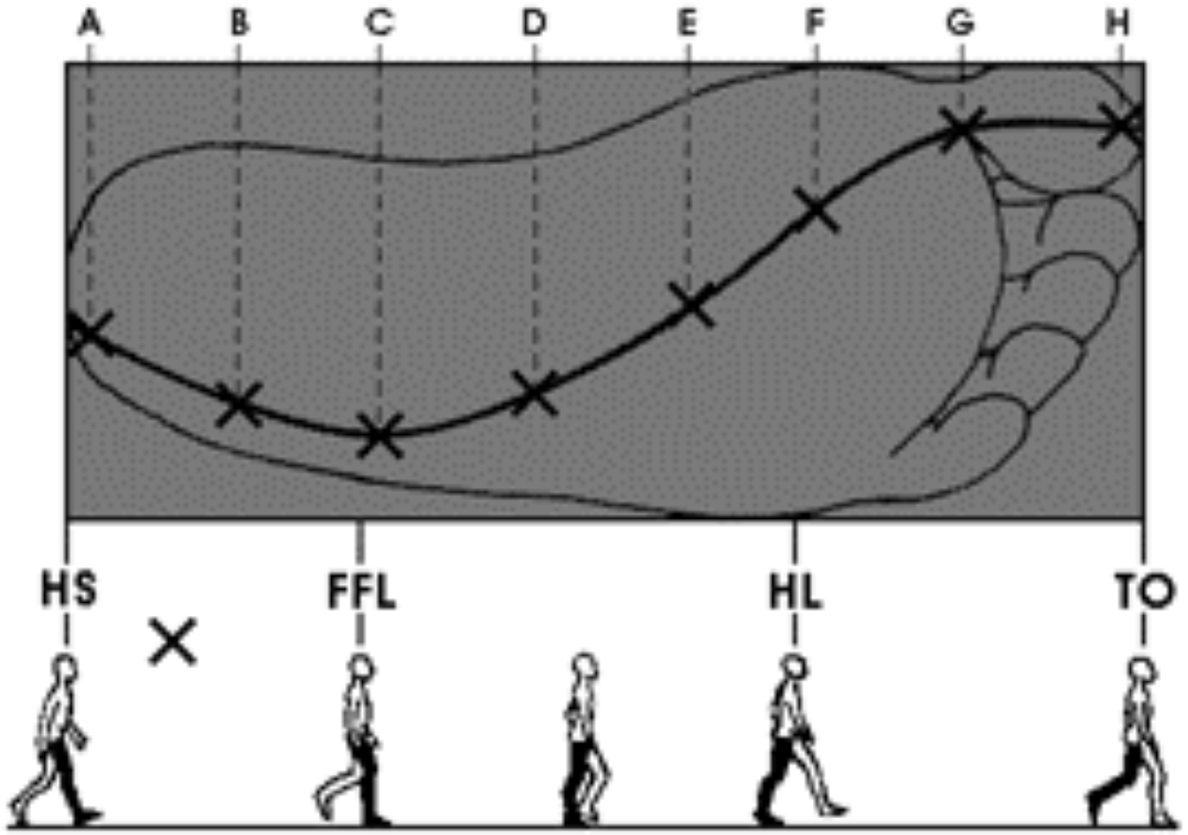


Foot Biomechanics Gait

Running/Walking

1. Heel Strike Phase; foot is dorsiflexed and heel lands in Supination at 4 degrees varum.
2. First half of Stance Phase; foot immediately pronates to absorb shock. This causes ankle dorsiflexion, knee flexion and internal rotation of lower extremity. more shock absorbtion.
3. Second half of Stance Phase and Heel lift; Foot begins to resupinate and starts to planter flex becoming more rigid in preparation of toe off.
4. Toe Off; Foot supinates, becoming a rigid platform as the ankle plantarflexes and the lower extremity externally rotates.





Over Pronation / Hyperinversion

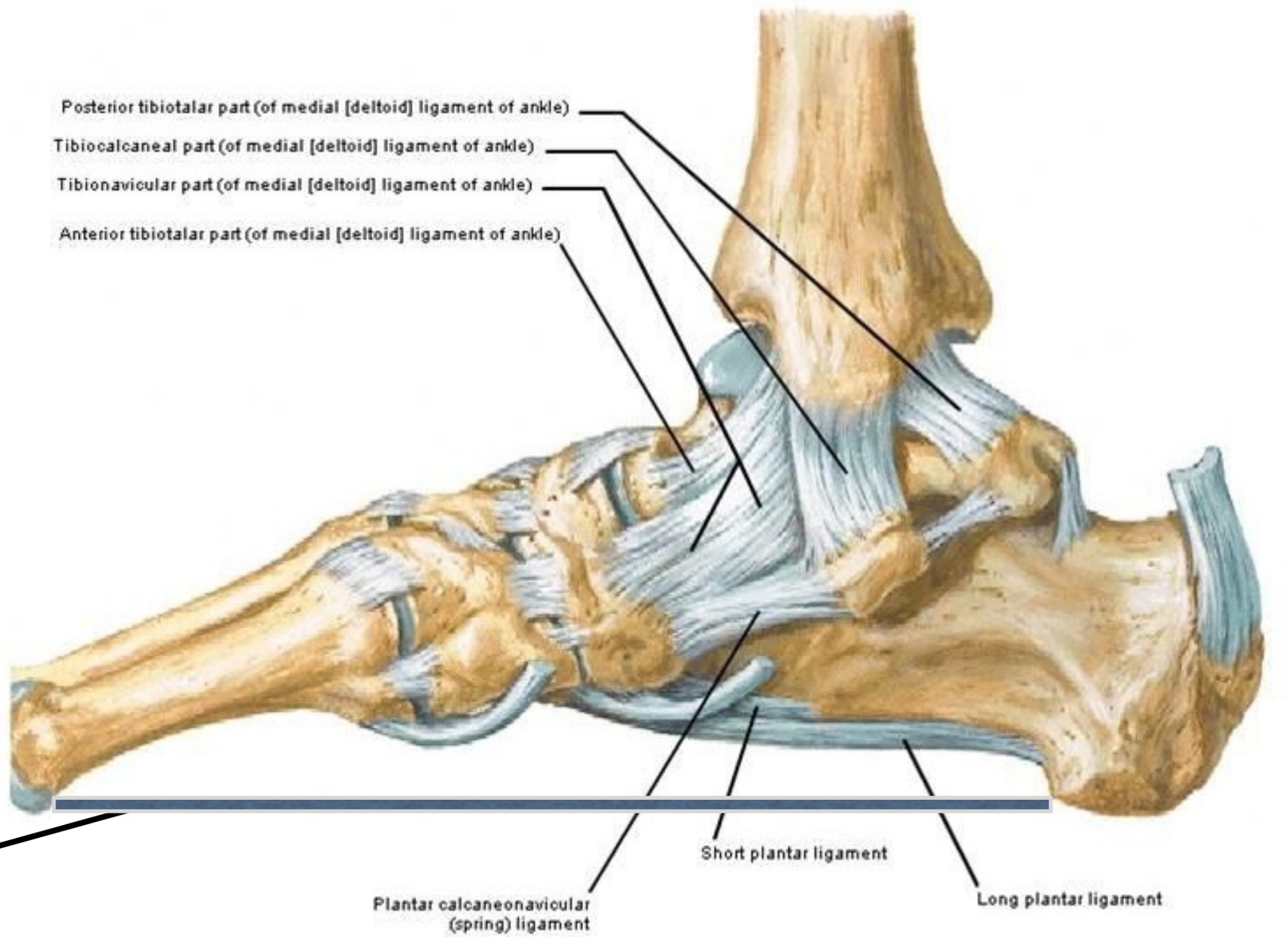
- Low Back and SI Pain
- Periformis Syndrome
- Medial knee pain (meniscus)
- Patella Tracking Dysfunction
- Tarsal Tunnel Syndrome
- Plantar Fascitis
- Hallux Valgus / Bunions
- Shin Splints
- Neuroma
- Achilles Tendonitis

Contributing Factors to Over Pronation

- Tight Calf Muscles (affect all the same conditions above)
- Ligament Laxity / Hypermobility
- Individual Biomechanics (bone structure)

Ligaments that control Pronation

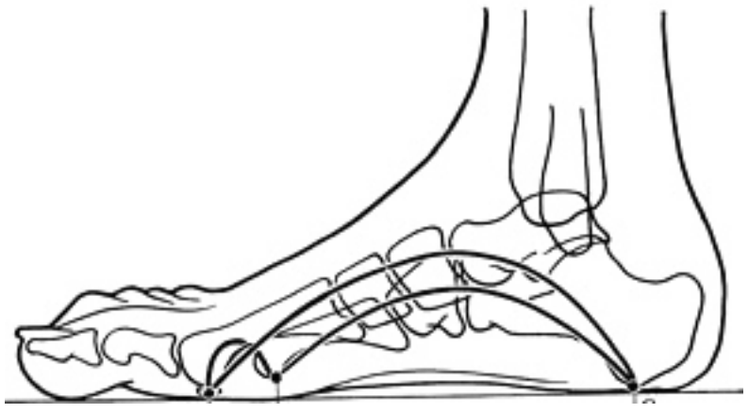
- Deltoid Ligament
- Spring Ligament
- Short and Long Plantar Ligaments
- Plantar Fascia



Muscles that lift the Arch

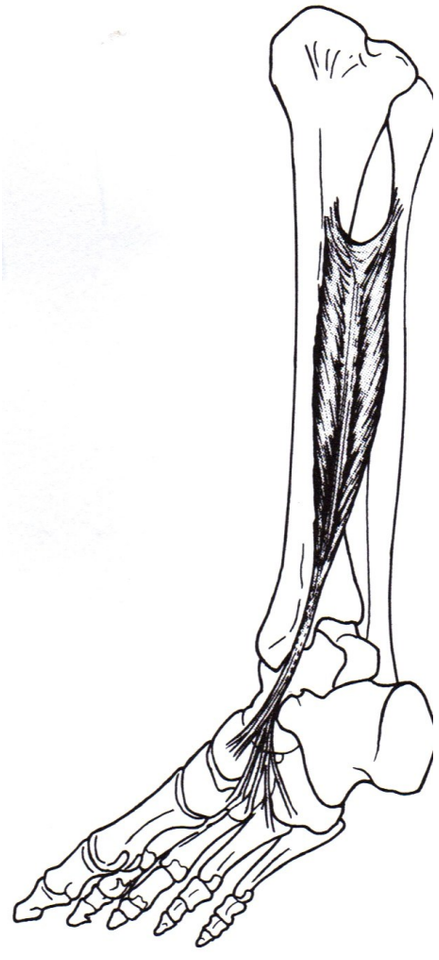
Tibialis Anterior

Dorsi flexion and
Supination



Calais-Germain

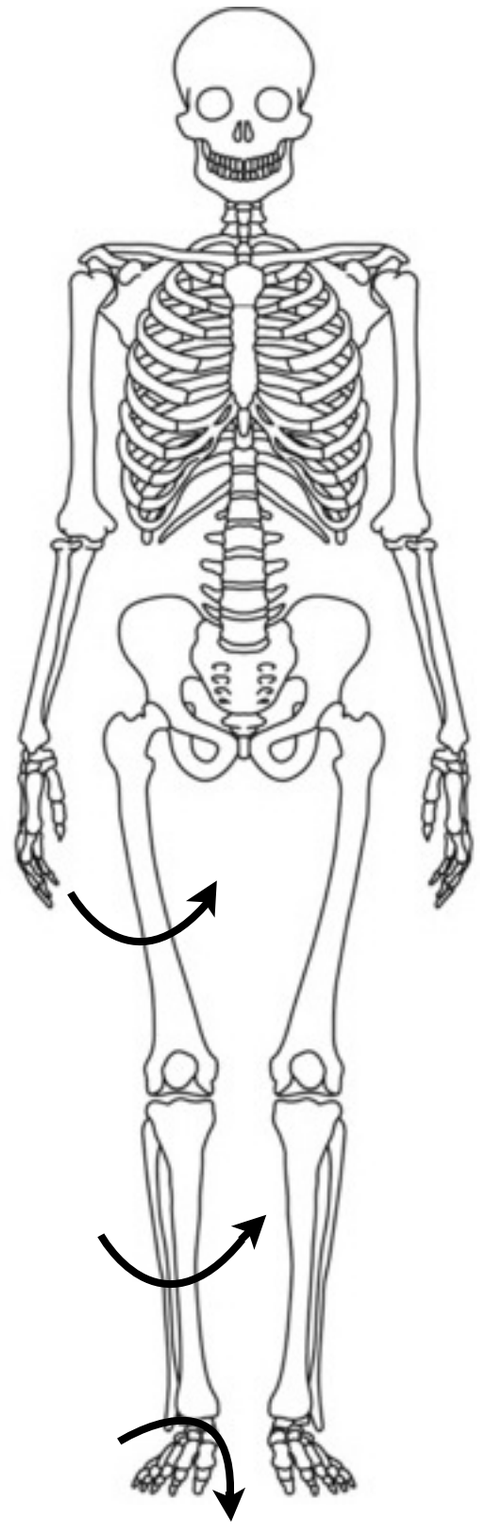
Tibialis Posterior



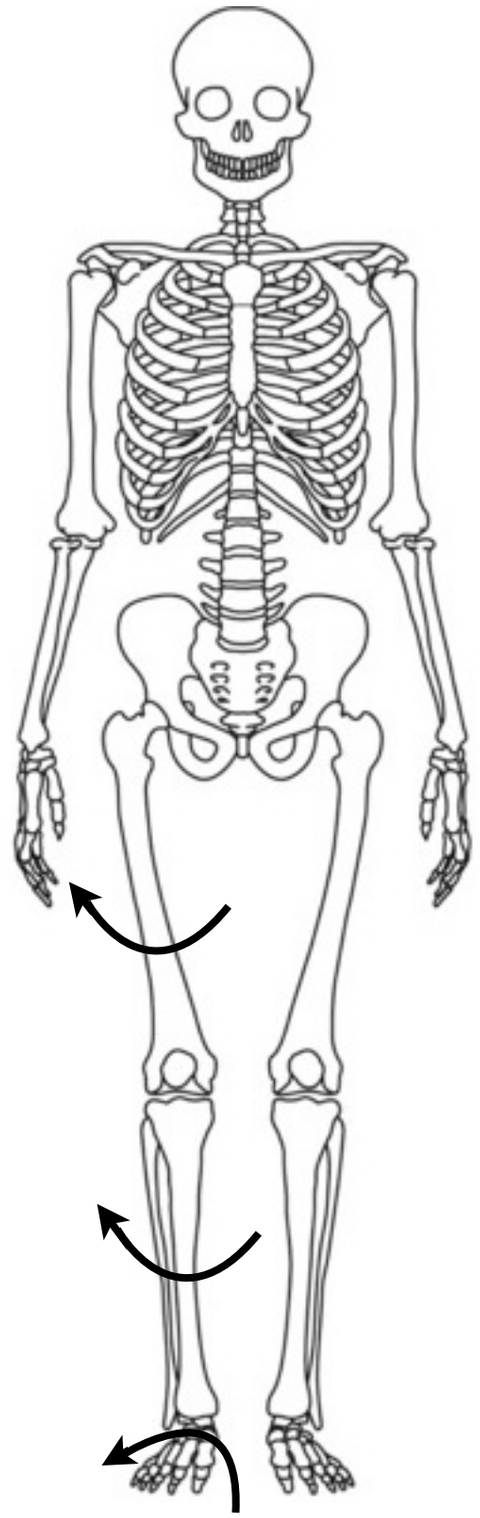
Plantar Flexion
and Supination

Kinetic Chain effects of Pronation / Supination

Pronated Foot

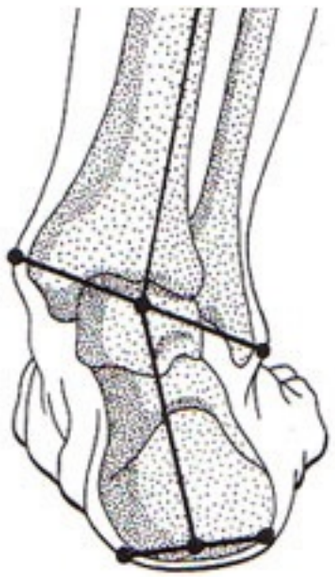


Supinated Foot

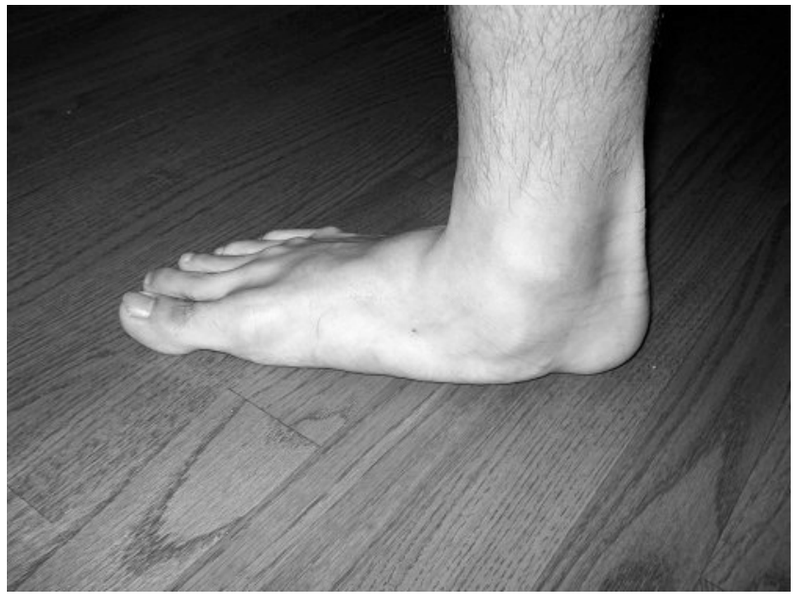


Over Pronated Foot / Sub Talar Eversion

Pes Planas / Flat Foot



Pronation

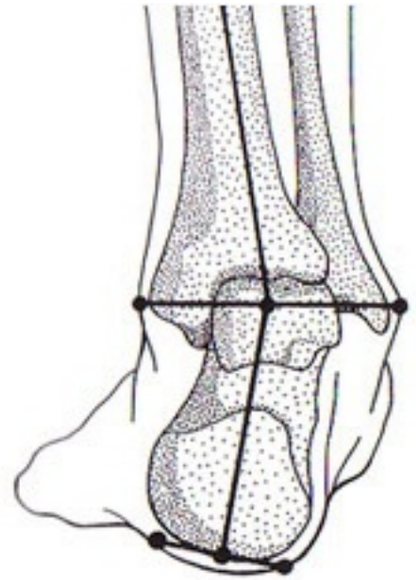


Normal Foot

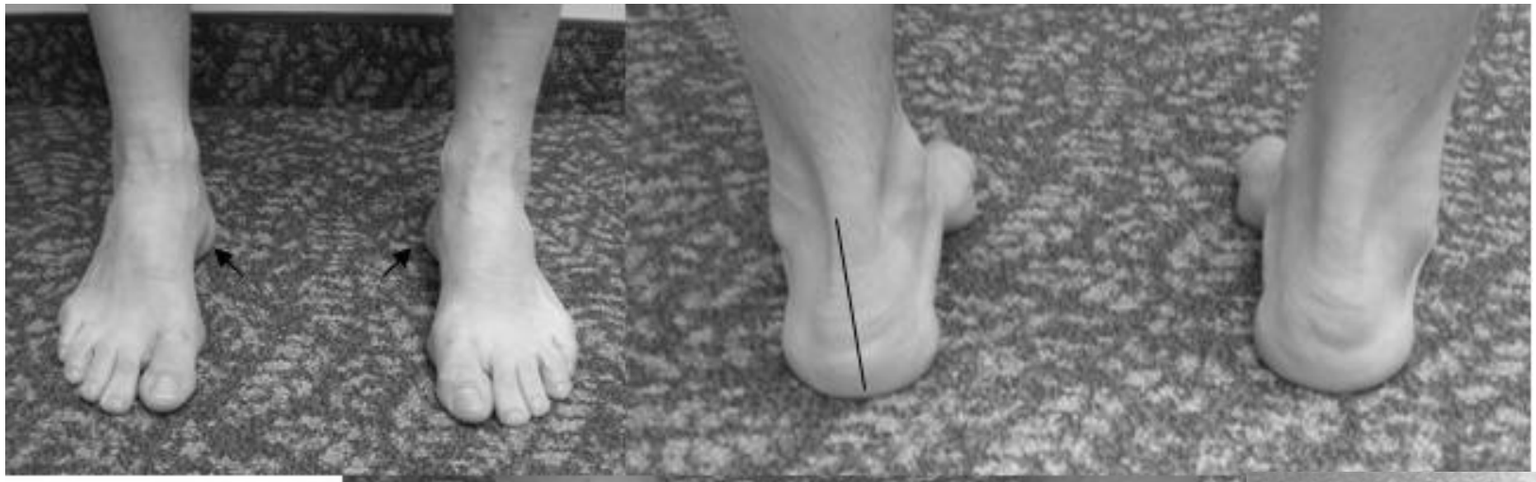
Cavus Foot

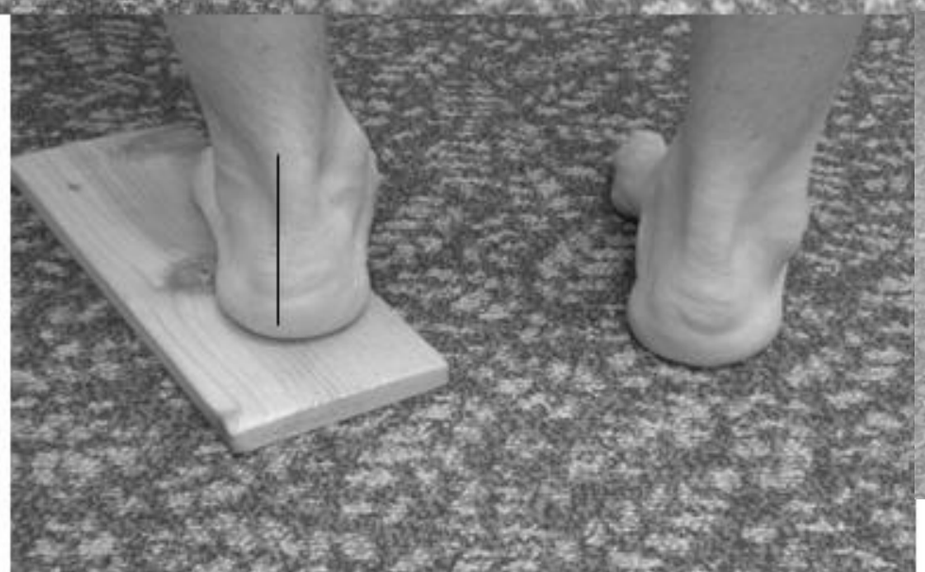
Supinated Foot

Pes Cavus / Equine Foot

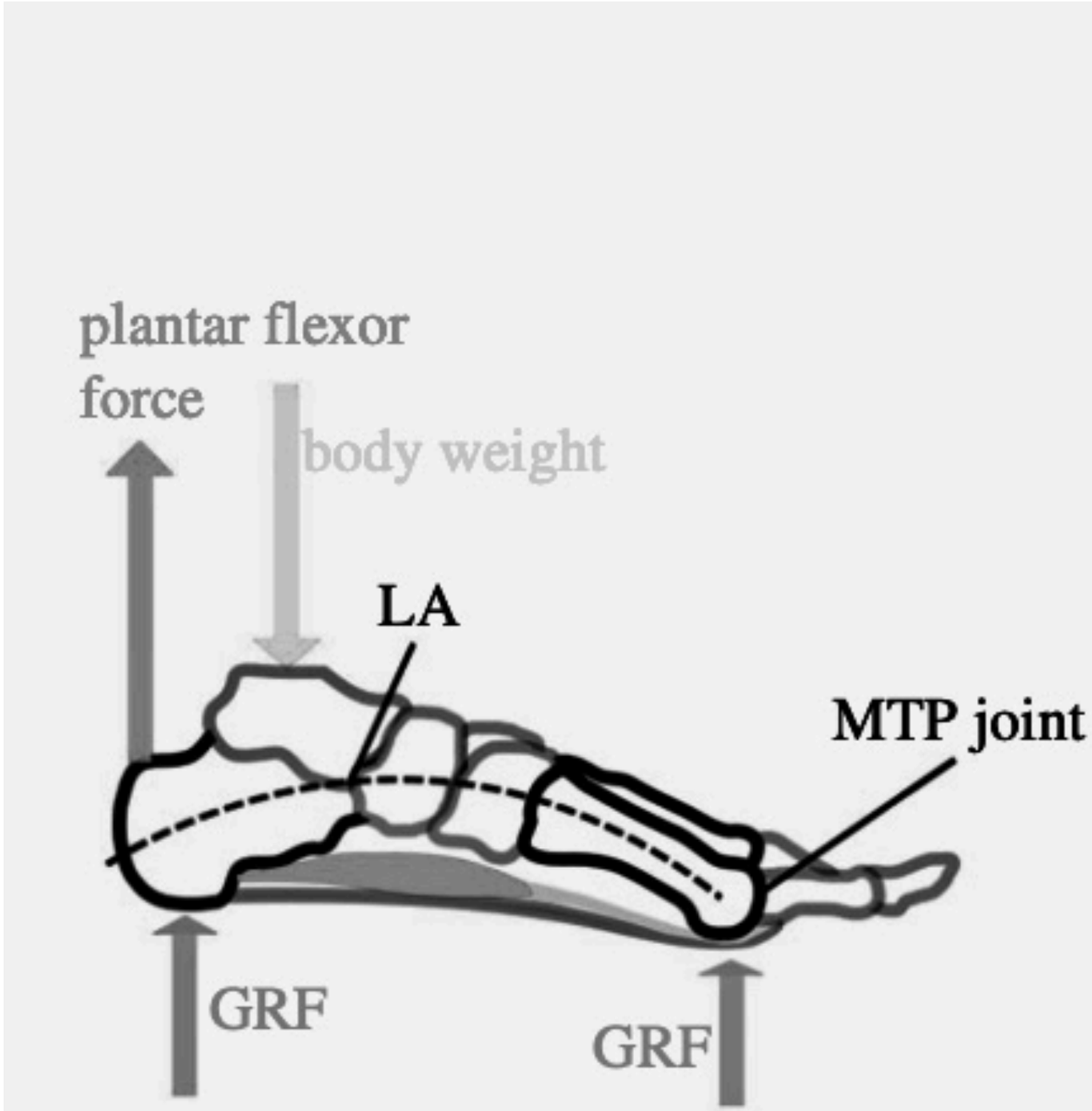


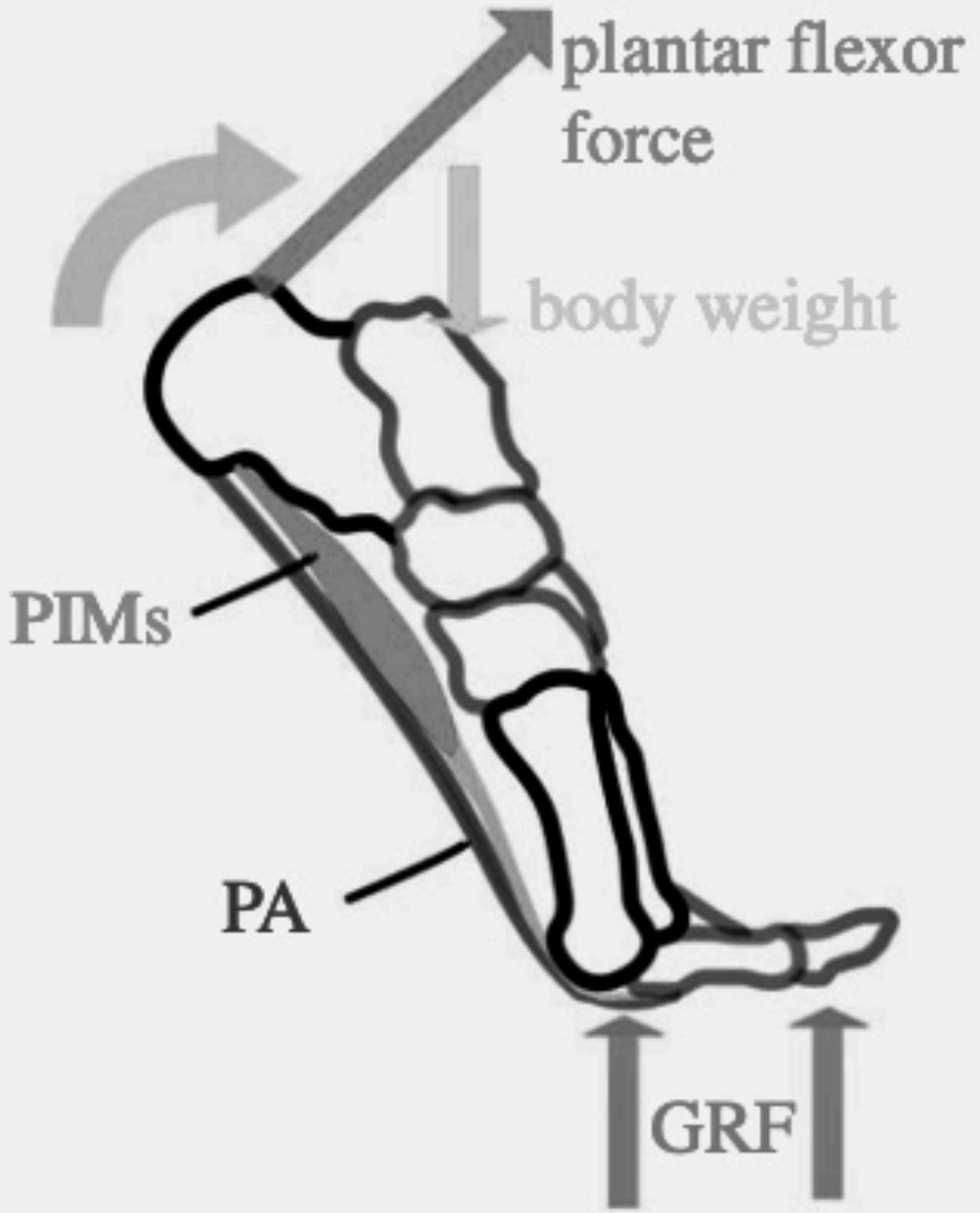
Supination



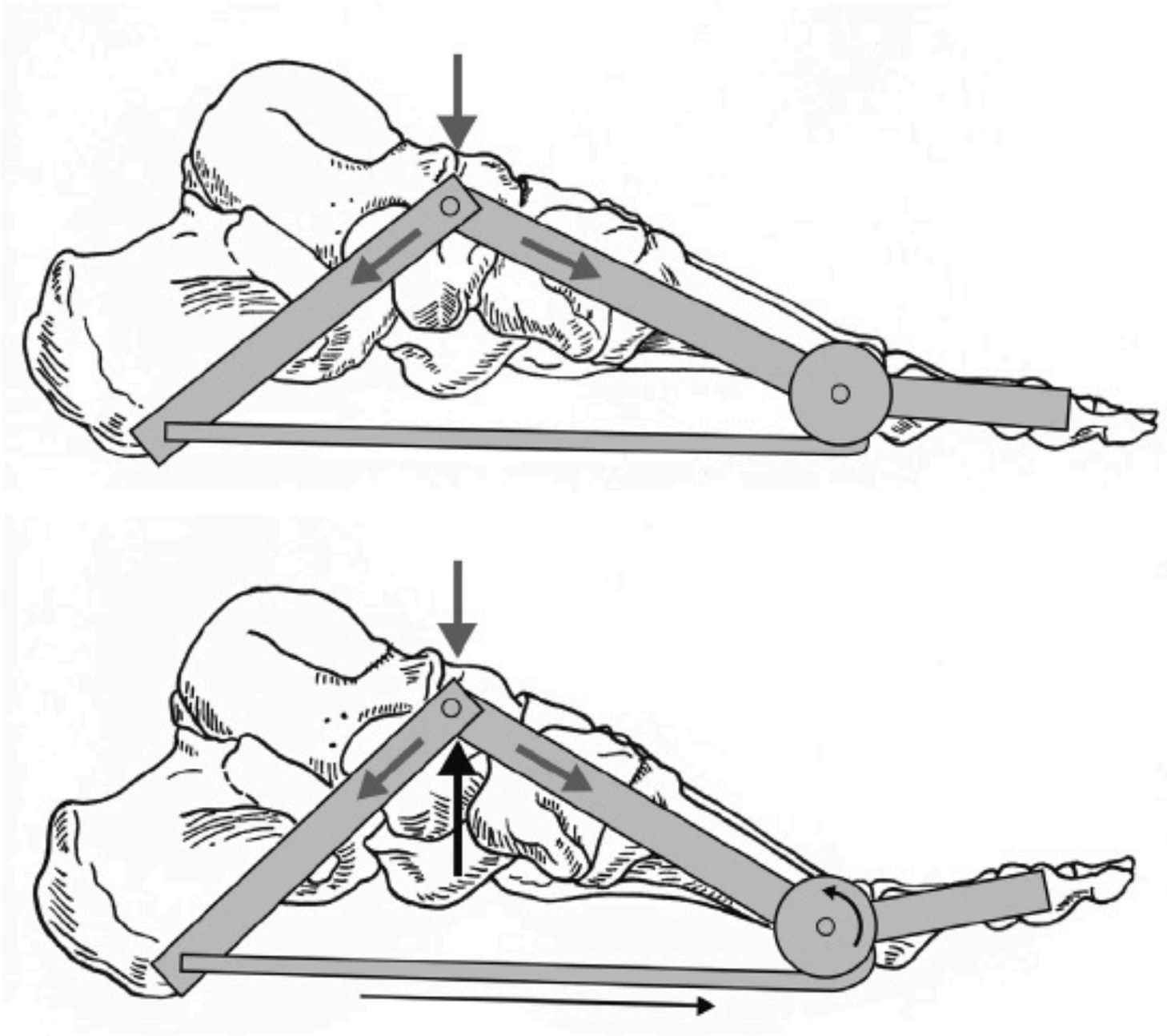


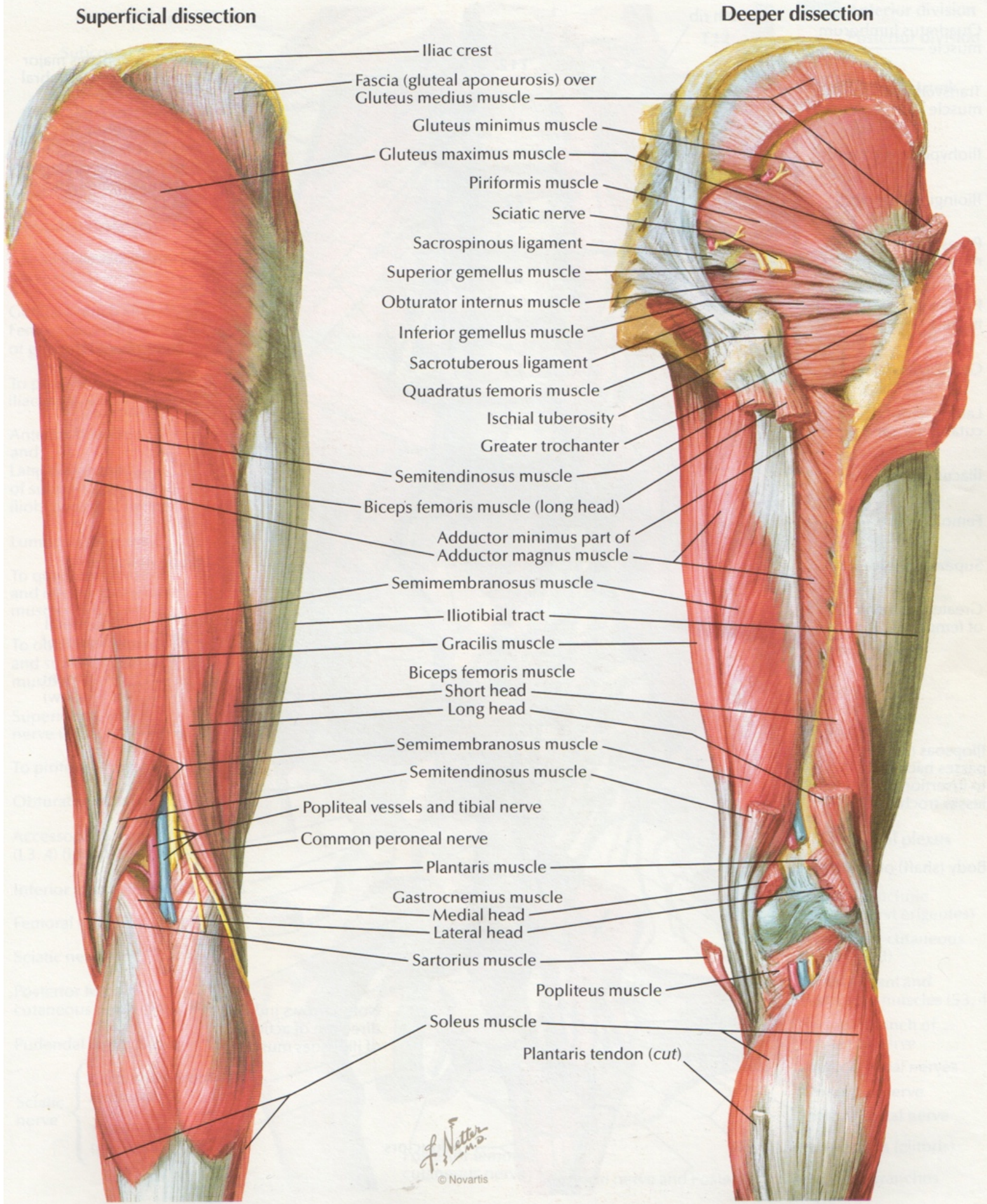
Windlass Mechanism





The ‘truss and windlass mechanism’ raises arch height, increasing foot stability




Superficial dissection
Deeper dissection
Iliac crest
Fascia (gluteal aponeurosis) over Gluteus medius muscle
Gluteus minimus muscle
Gluteus maximus muscle
Piriformis muscle
Sciatic nerve
Sacrospinous ligament
Superior gemellus muscle
Obturator internus muscle
Inferior gemellus muscle
Sacrotuberous ligament
Quadratus femoris muscle
Ischial tuberosity
Greater trochanter
Semitendinosus muscle
Biceps femoris muscle (long head)
Adductor minimus part of Adductor magnus muscle
Semimembranosus muscle
Iliotibial tract
Gracilis muscle
Biceps femoris muscle
Short head
Long head
Semimembranosus muscle
Semitendinosus muscle
Popliteal vessels and tibial nerve
Common peroneal nerve
Plantaris muscle
Gastrocnemius muscle
Medial head
Lateral head
Sartorius muscle
Popliteus muscle
Soleus muscle
Plantaris tendon (cut)
F. Netter M.D.
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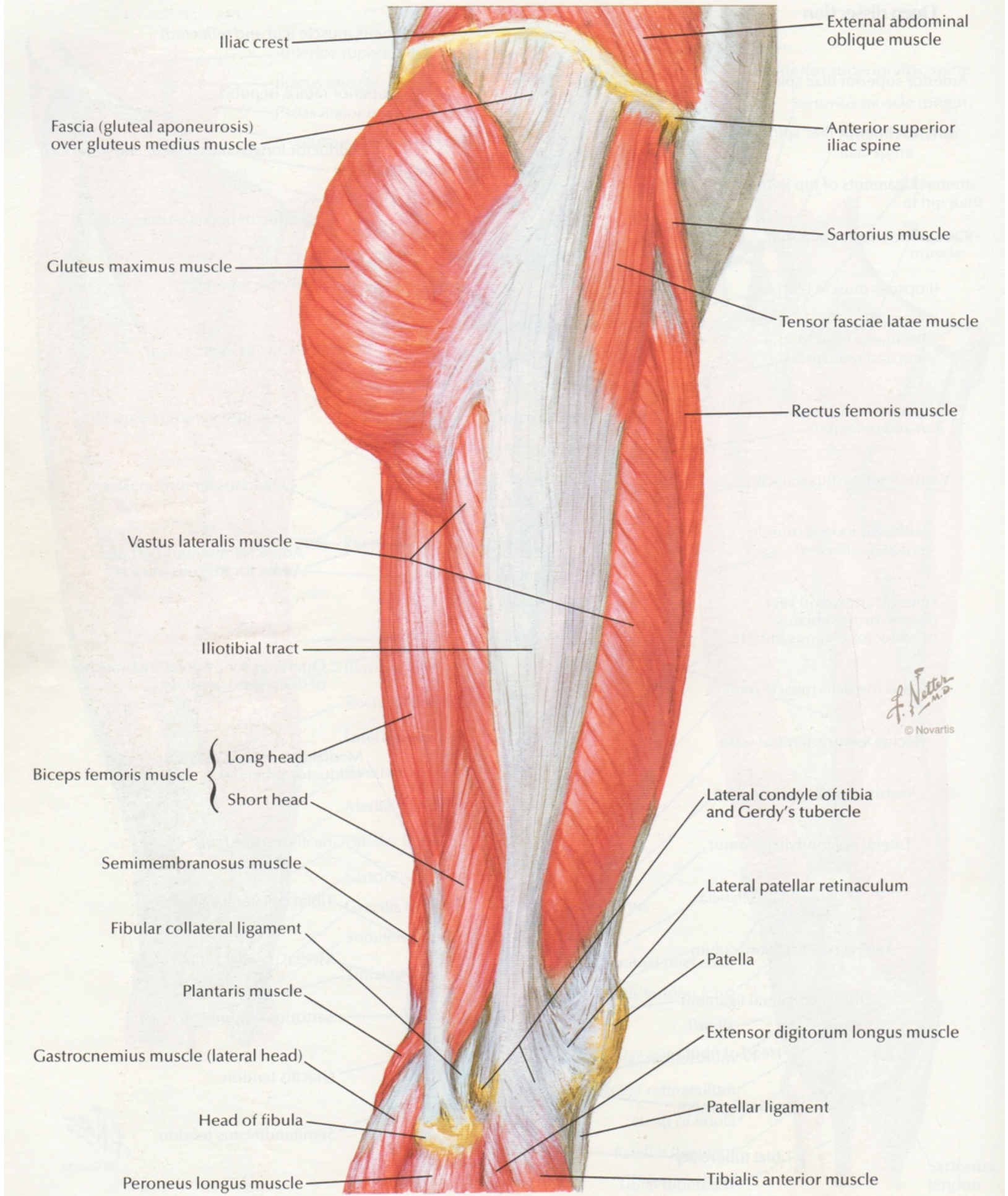
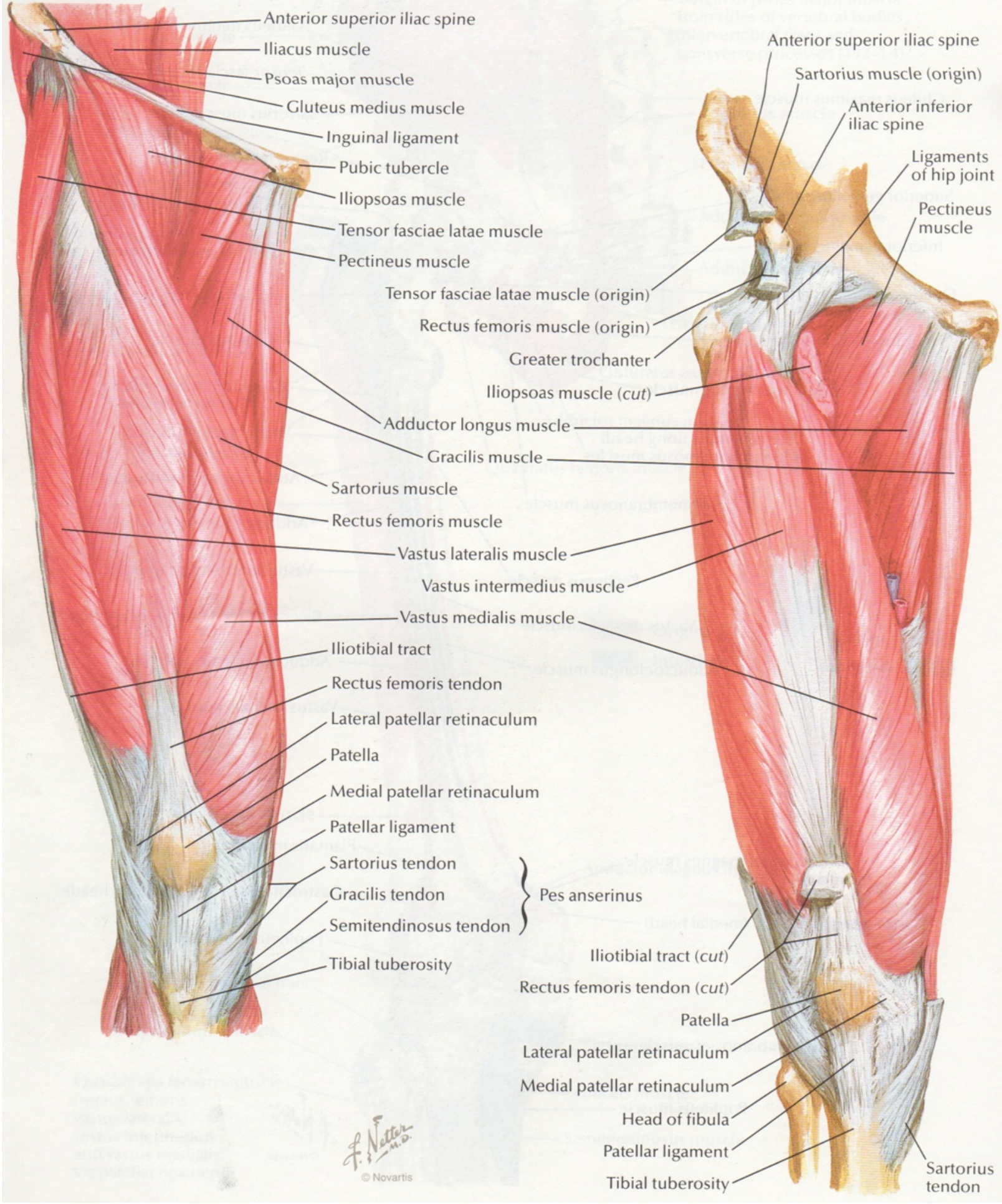

Iliac crest
External abdominal oblique muscle
Fascia (gluteal aponeurosis) over gluteus medius muscle
Anterior superior iliac spine
Sartorius muscle
Gluteus maximus muscle
Tensor fasciae latae muscle
Rectus femoris muscle
Vastus lateralis muscle
Iliotibial tract
F. Netter M.D.
© Novartis
Biceps femoris muscle
Long head
Short head
Lateral condyle of tibia and Gerdy's tubercle
Semimembranosus muscle
Lateral patellar retinaculum
Fibular collateral ligament
Patella
Plantaris muscle
Extensor digitorum longus muscle
Gastrocnemius muscle (lateral head)
Patellar ligament
Head of fibula
Peroneus longus muscle
Tibialis anterior muscle


Anterior superior iliac spine
Iliacus muscle
Psoas major muscle
Gluteus medius muscle
Inguinal ligament
Pubic tubercle
Iliopsoas muscle
Tensor fasciae latae muscle
Pectineus muscle
Adductor longus muscle
Gracilis muscle
Sartorius muscle
Rectus femoris muscle
Vastus lateralis muscle
Vastus medialis muscle
Iliotibial tract
Rectus femoris tendon
Lateral patellar retinaculum
Patella
Medial patellar retinaculum
Patellar ligament
Sartorius tendon
Gracilis tendon
Semitendinosus tendon
Pes anserinus
Tibial tuberosity
Anterior superior iliac spine
Sartorius muscle (origin)
Anterior inferior iliac spine
Ligaments of hip joint
Pectineus muscle
Tensor fasciae latae muscle (origin)
Rectus femoris muscle (origin)
Greater trochanter
Iliopsoas muscle (cut)
Vastus intermedius muscle
Iliotibial tract (cut)
Rectus femoris tendon (cut)
Patella
Lateral patellar retinaculum
Medial patellar retinaculum
Head of fibula
Patellar ligament
Tibial tuberosity
Sartorius tendon
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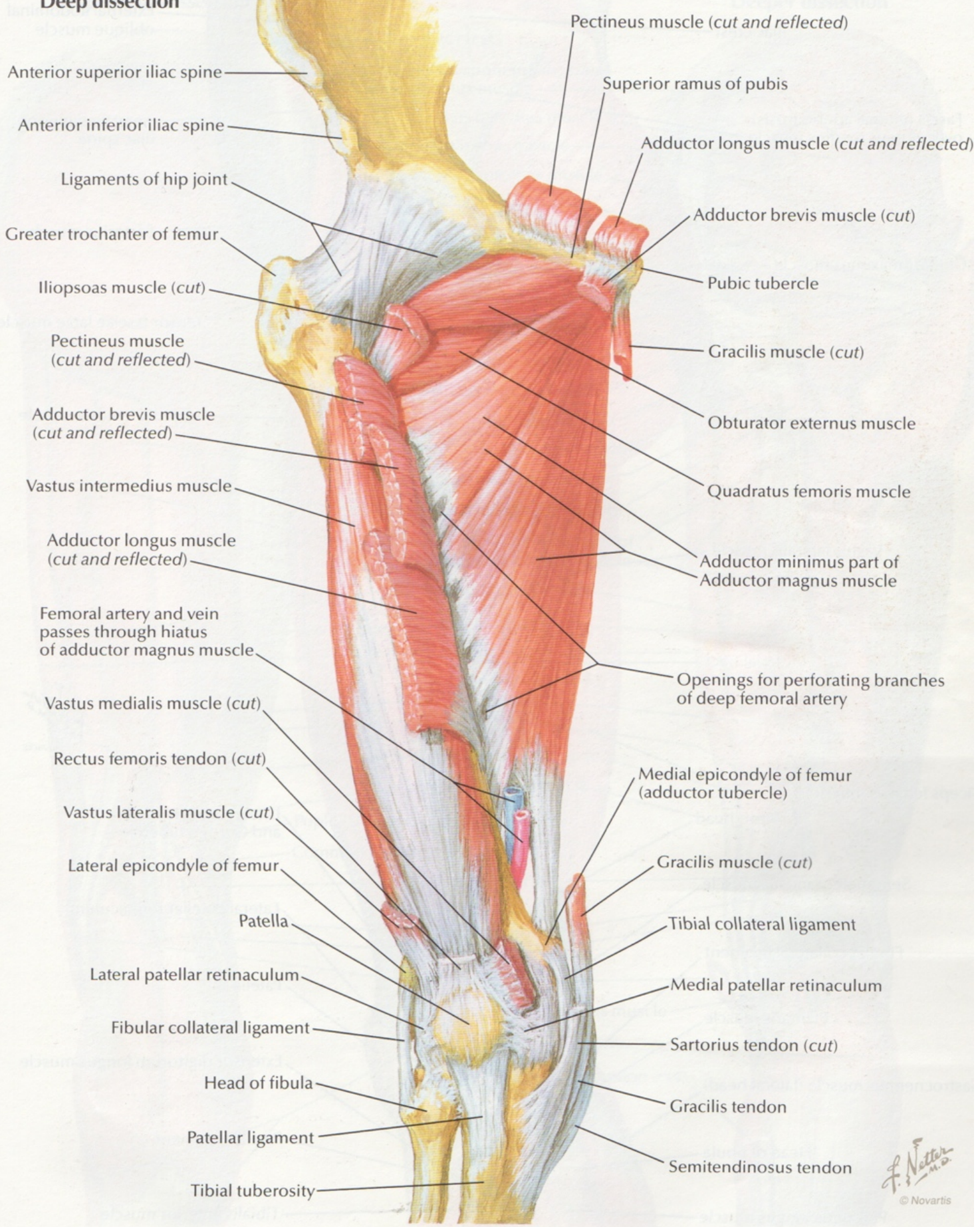
Deep dissection



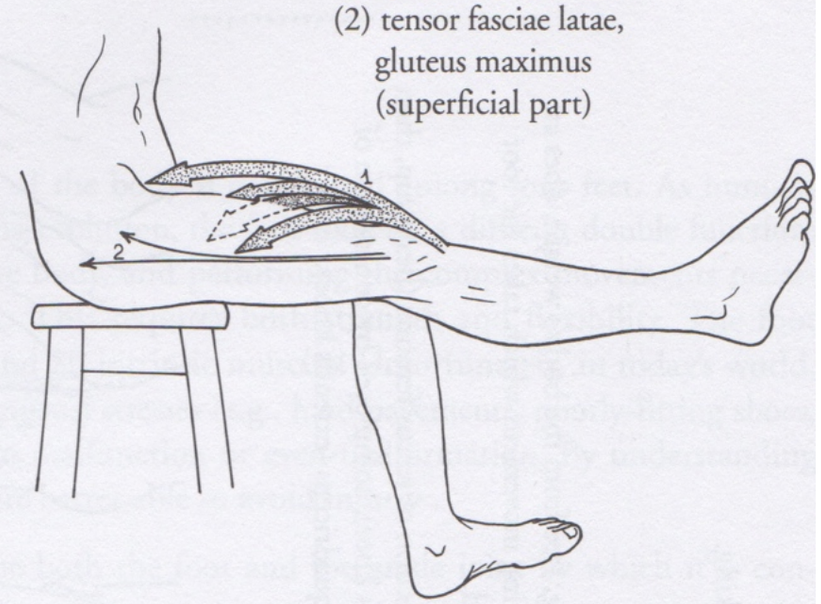
Summery of Muscle Movements of the Knee

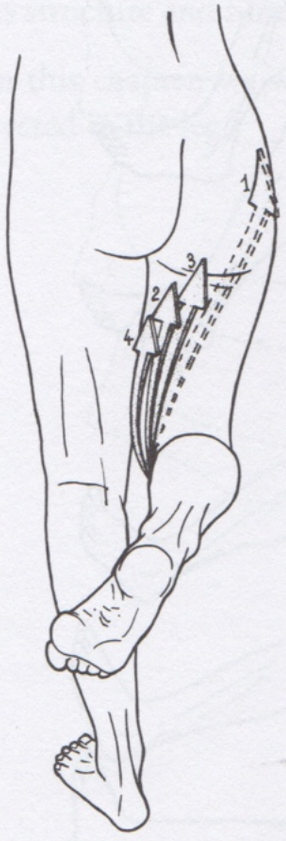
Flexion of knee (left):

(1) semitendinosus
(2) semimembranosus
(3) biceps femoris
(4) popliteus
(5, 6) gastrocnemius
not shown:
sartorius, gracilis

Extension of knee (below):

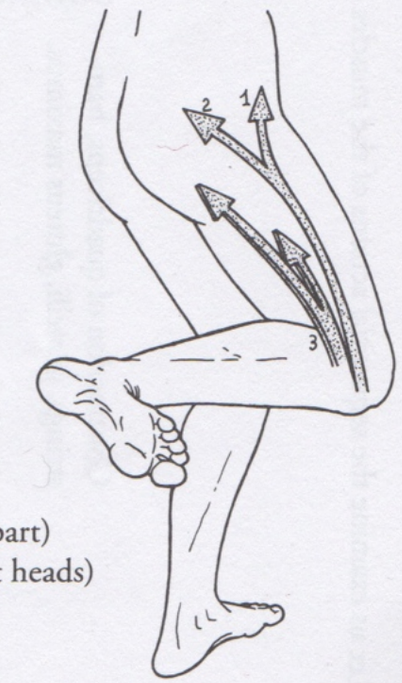
(1) quadriceps femoris
(2) tensor fasciae latae, gluteus maximus (superficial part)





Medial rotation of knee (left):

(1) sartorius
(2) semitendinosus
(3) semimembranosus
(4) gracilis
not shown:
popliteus



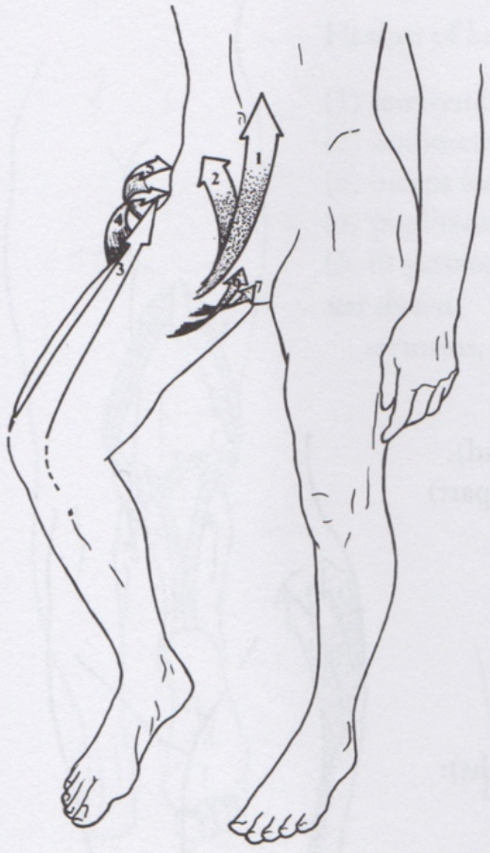
Lateral rotation of knee (right):

(1) tensor fasciae latae
(2) gluteus maximus (superficial part)
(3) biceps femoris (long and short heads)

Calais-Germain

Summary of movements

We have covered many muscles and movements. Let us summarize the muscles involved in the specific movements of the hip and knee. The arrows represent the forces produced by the various muscles.

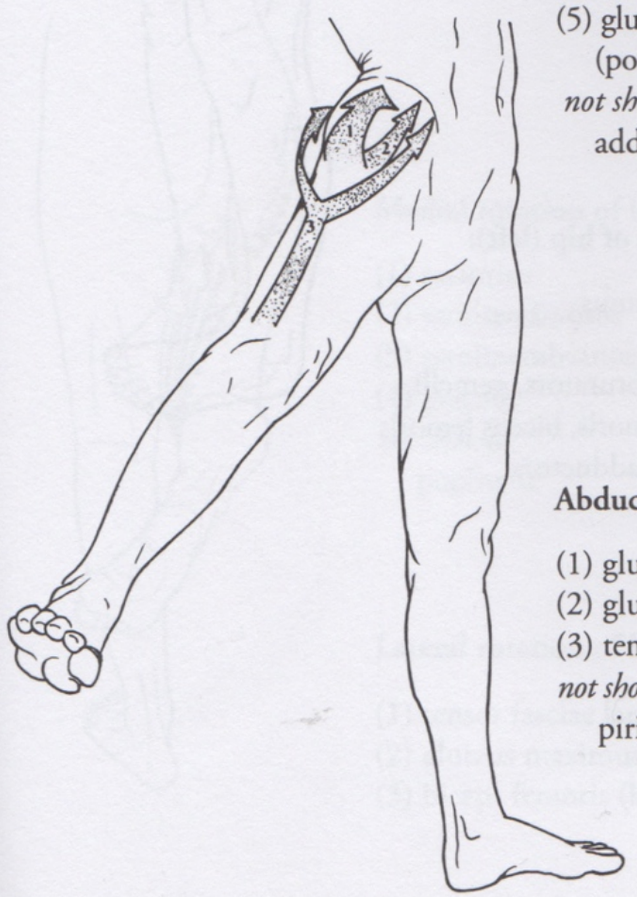


Flexion of hip (left):

(1) psoas
(2) iliacus
(3) rectus femoris
(4) tensor fasciae latae
(5) gluteus minimus and medius (anterior part)
(6) sartorius
(7) pectineus
not shown:
gracilis

Extension of hip (right):

(1) gluteus maximus
(2) biceps femoris (long head)
(3) semimembranosus
(4) semitendinosus
(5) gluteus medius (posterior part)
not shown:
adductor magnus



Abduction of hip (left):

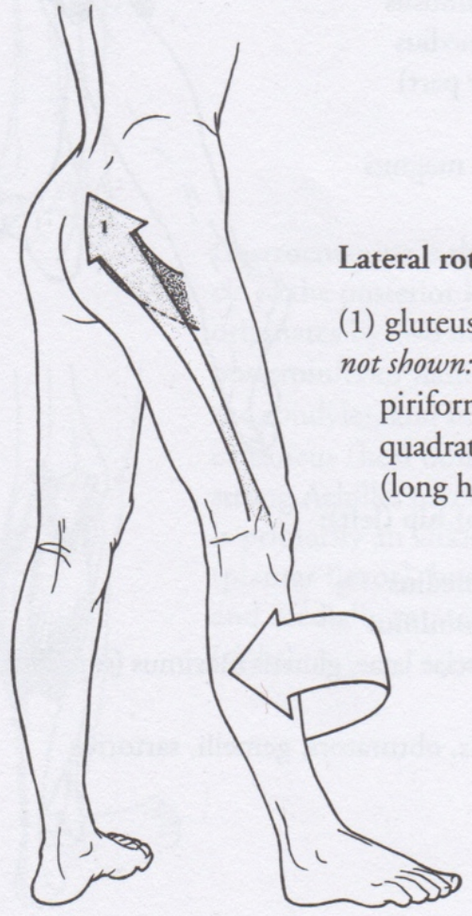
(1) gluteus medius
(2) gluteus minimus
(3) tensor fasciae latae, gluteus maximus (superficial part)
not shown:
piriformis, obturators, gemelli, sartorius

Adduction of hip (left):

(1) adductor magnus
(2) adductor longus
(3) adductor brevis
(4) pectineus
(5) gracilis
(6) psoas
(7) iliacus
not shown:
biceps femoris (long head), gluteus maximus (deep part)

Medial rotation of hip (right):

(1) gluteus medius
(2) gluteus minimus
(3) tensor fasciae latae



Lateral rotation of hip (left):

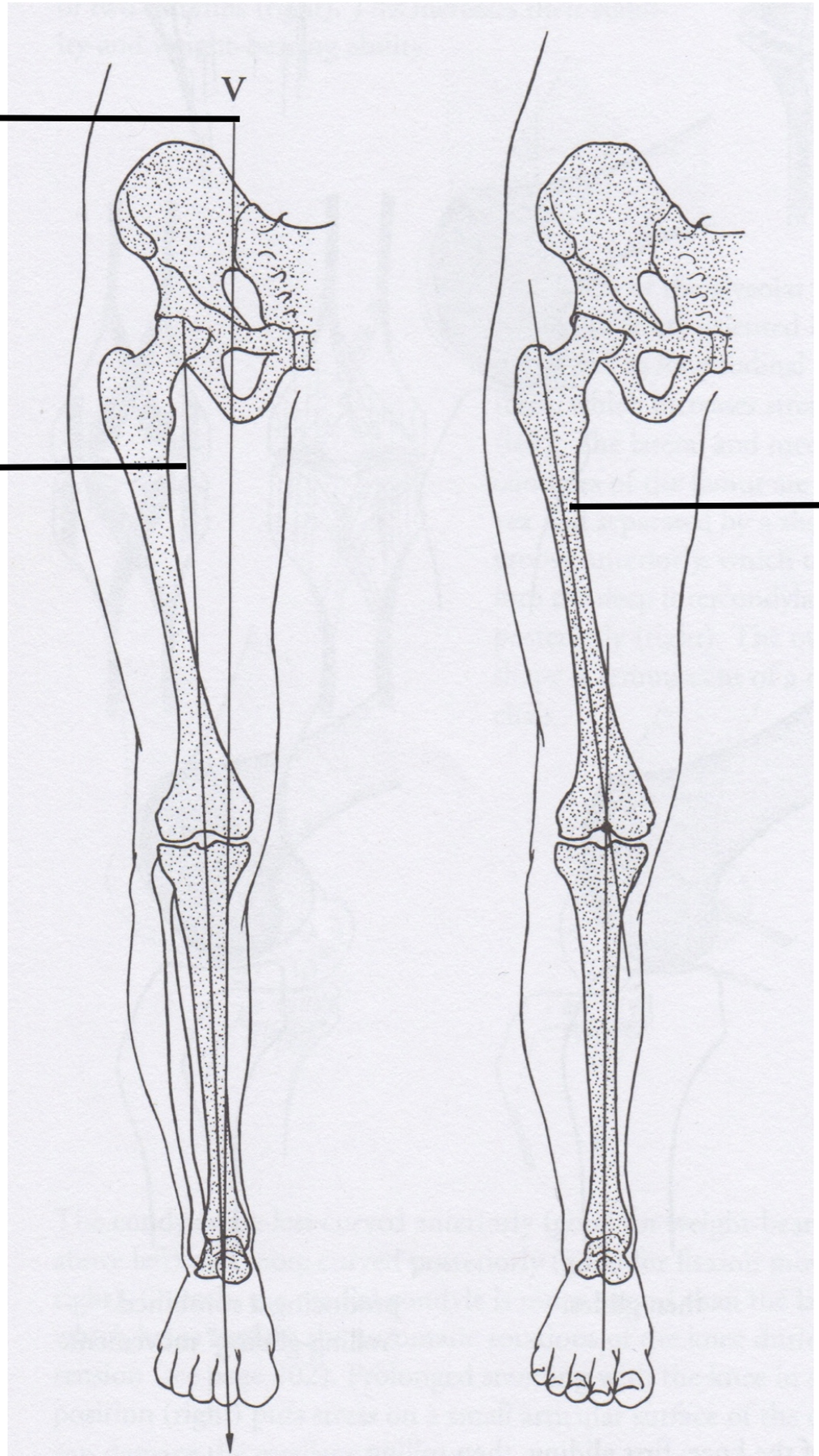
(1) gluteus maximus
not shown:
piriformis, obturators, gemelli, quadratus femoris, biceps femoris (long head), adductors

Mechanical Longitudinal axis of leg

Vertical Axis

Mechanical Axis

3 Degrees from Vertical



Femoral Shaft Axis 9 Deg

9 Degrees from Vertical

Calais-Germain

Suggested Reading List:

The Key Muscles of Yoga by Ray Long MD	Bandhayoga
The Key Poses of Hatha Yoga by Ray Long MD.	Bandhayogq
Anatomy of Movement by Calais-Germain	Eastland
Atlas of Human Anatomy by Frank Netter	Novartis
The Physiology of the Joints by I.A. Kapandji	Churchill Livingstone
Anatomy of Yoga by Paul Grillley	Pranamaya