

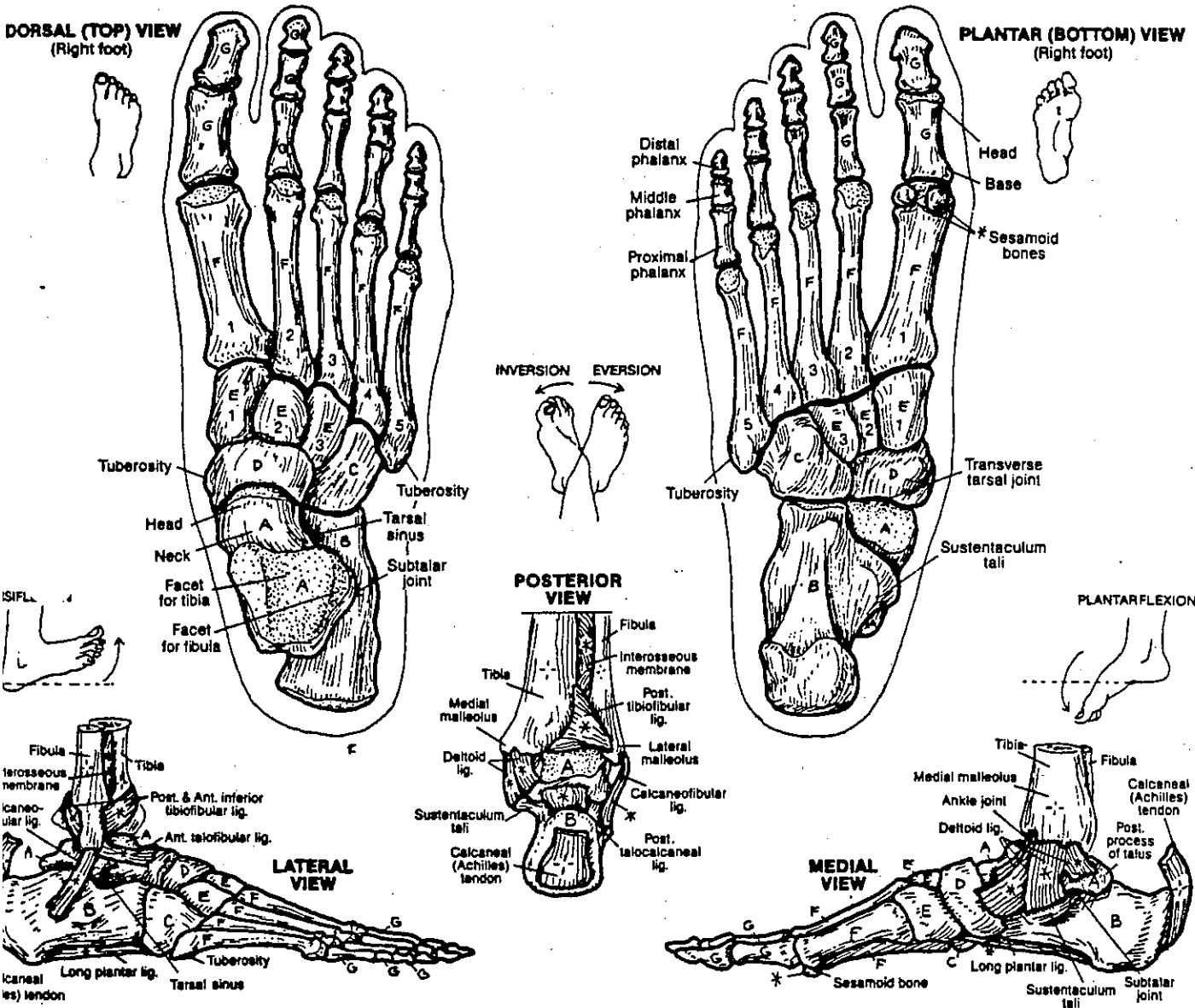
ANKLE & FOOT BONES

TARSALS: (7)*

**TALUS: CALCANEUS,
CUBOID, NAVICULAR,
CUNEIFORMS (3)_E**

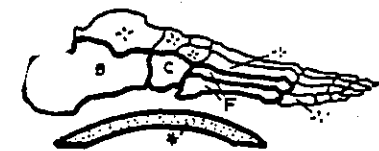
**METATARSALS (5)_F
PHALANGES (14)_G
LIGAMENTS***

CN: Use different colors from those used for the ilium on Plate 29 and for the femur, tibia, fibula, and patella on Plate 30. (1) Begin with the talus (A); color that bone wherever it appears on the plate. Follow that procedure with each of the other bones. (2) Color gray all of the ligaments.



The foot is a mobile, weightbearing structure. The ankle joint (hinge-type synovial joint) between tibia, fibula, and the talus forms a mortise, permitting only flexion (plantar flexion) and extension (dorsiflexion) here. With excessive rotation of this joint, characteristic fractures and torn ligaments occur. The foot can adjust to walking/running on tilted surfaces by virtue of the subtalar (talocalcaneal) and transverse tarsal (talocalcaneonavicular and calcaneocuboid) joints. Here inversion and eversion movements occur. The ankle has strong medial ligamentous (deltoid ligaments) and weaker lateral

ligamentous support. The relatively high frequency of inversion sprains (tearing the lateral ligaments) over eversion sprains seems to reflect this fact. The bony architecture of the foot includes a number of arches that are reinforced and maintained by ligaments and influenced by muscles. The medial longitudinal arch transmits the force of body weight to the ground when standing and to the great toe in locomotion, creating a giant lever that gives spring to the gait. Both longitudinal arches function in absorbing shock loads and balancing the body.



LATERAL LONGITUDINAL ARCH*



TRANSVERSE ARCH*



MEDIAL LONGITUDINAL ARCH*

MUSCLES OF THE FOOT (INTRINSICS)

CN: Feel free to use the colors used for the letter labels on plates 65 and 66. Those letters are presented here for identification, and the muscles they refer to are not meant to be colored. Also note that plantar surface attachment sites for those extrinsic foot muscles have been omitted in the illustration of the fourth layer but can be found on the two preceding plates. (1) Begin with the fourth layer and complete each illustration before going on to the next.

The dorsal intrinsic muscles of the foot (those that arise and insert within the dorsum of the foot) are limited to two *small extensors* of the toes, shown at right, most of the extensor function being derived from extrinsic extensors.

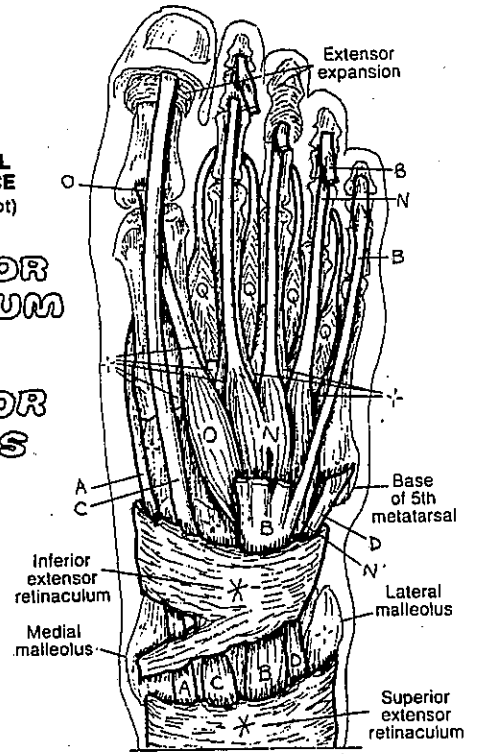
The intrinsic muscles of the plantar region of the foot are shown here in four layers. The *plantar interossei*, wedged between the metatarsal bones, constitute the deepest (4th) layer. They adduct toes 3-5, flex the metatarsophalangeal (MP) joints of these toes, and contribute to extension of the interphalangeal (IP) joints of these toes through the mechanism of the extensor expansion. The *dorsal interossei* abduct toes 3-5 and facilitate the other actions of the plantar interossei.

The third layer of muscles acts on the great toe (hallux) and 5th digit (digi minimi). The second layer includes the *quadratus plantae*, inserting into the lateral border of the common tendon (H) of flexor digitorum longus (FDL). It assists that muscle in flexion of the toes. The *lumbricals* arise from the individual tendons of FDL and insert into the medial aspect of the extensor expansion (dorsal aspect). They flex the MP joints and extend the IP joints of toes 2-5 via the extensor expansion.

The superficial (first) layer consists of the *abductors* of the 1st and 5th digits and the *flexor digitorum brevis*. The plantar muscles are covered by the thickened deep fascia of the sole, the plantar aponeurosis, extending from calcaneus to the fibrous sheath of the flexor tendons.

EXTENSOR DIGITORUM BREVIS_N
EXTENSOR HALLUCIS BREVIS.

DORSAL SURFACE (Right foot)



FLEX. HALLUCIS BREVIS_R

ADDUCTOR HALLUCIS:

FLEX. DIGITI MINIMI BREVIS_T

ABDUCTOR HALLUCIS_W

ABDUCTOR DIGITI MINIMI_X

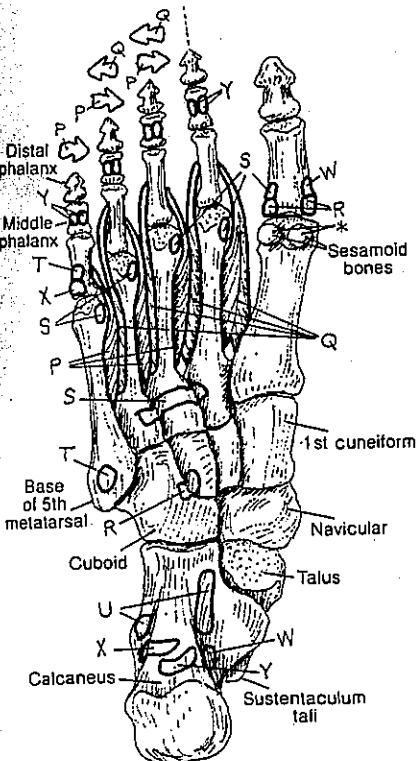
FLEX. DIGITOR. BREVIS_Y

3 PLANTAR INTEROSSEI.

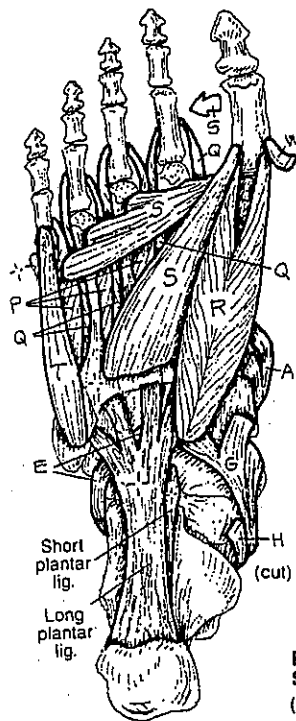
4 DORSAL INTEROSSEI.

QUADRATUS PLANTAE.

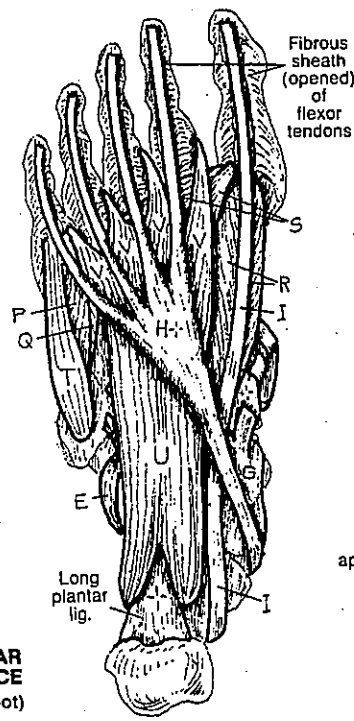
4 LUMBRICALS.



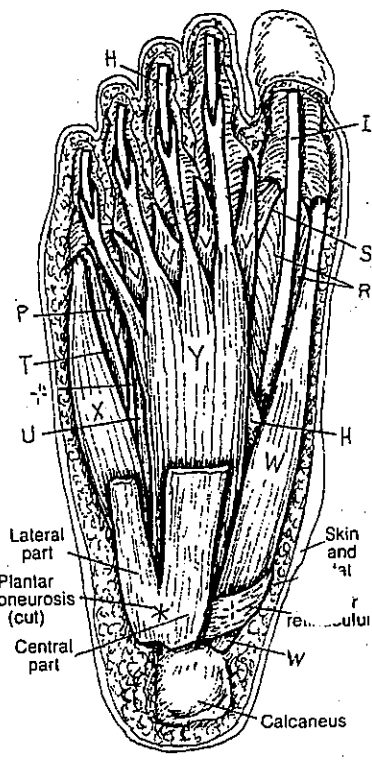
FOURTH LAYER



THIRD LAYER



SECOND LAYER



FIRST LAYER (superficial)

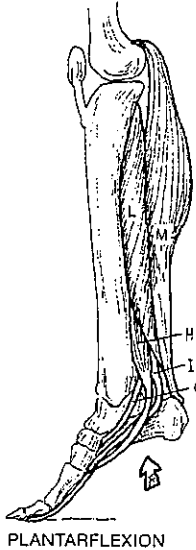
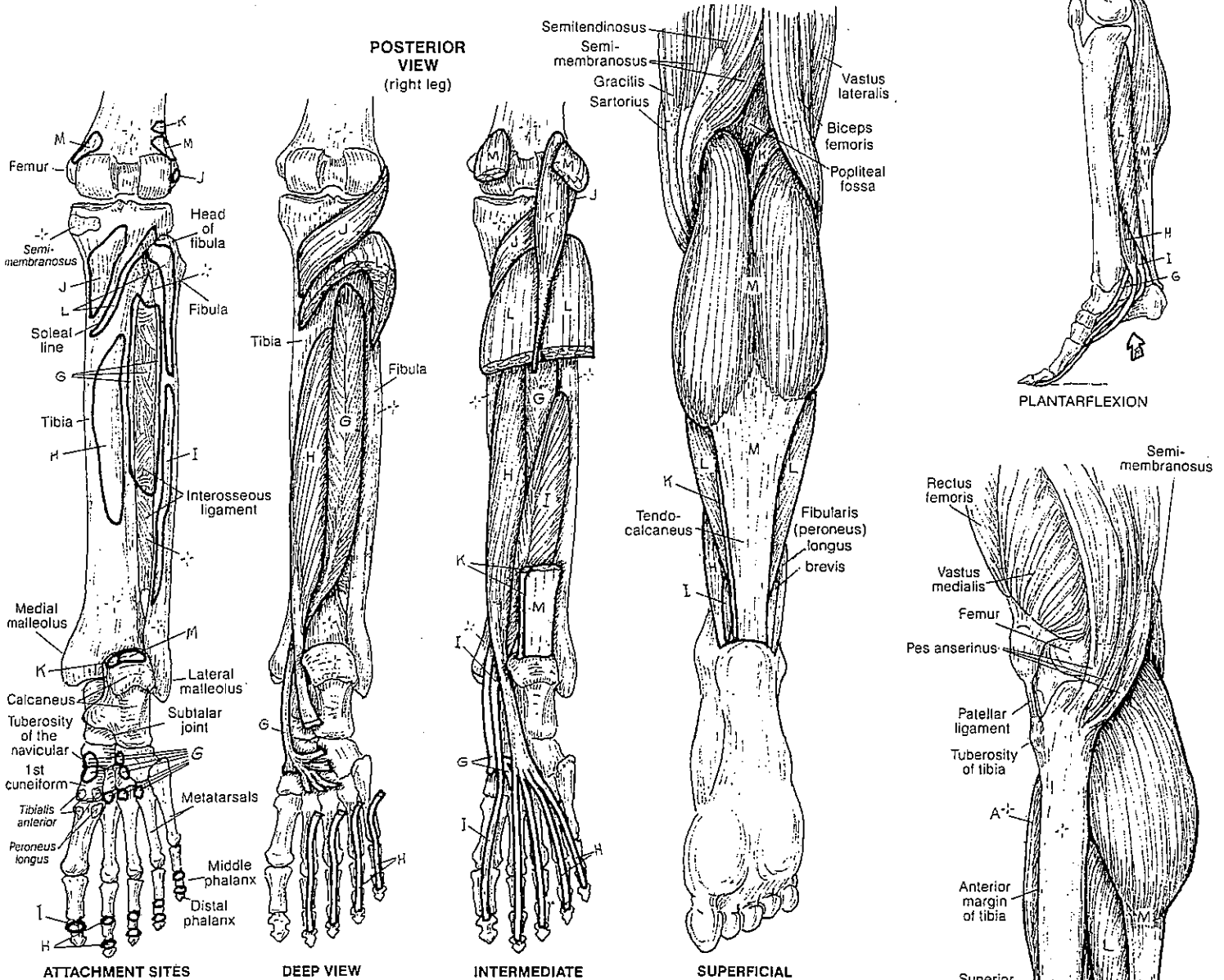
PLANTAR SURFACE (Right foot)

MUSCLES OF THE POSTERIOR LEG

TIBIALIS POSTERIOR,
FLEXOR DIGITORUM LONGUS_H
FLEXOR HALLUCIS LONGUS_I
POPLITEUS,
PLANTARIS_K
SOLEUS_L
GASTROCNEMIUS_M

CN: The muscles to be colored on this plate are labeled G-M; any other letter label found here (A-F from Pl. 65; N-Y from Pl. 67) is for identification only, and those muscles should be left uncolored. You may repeat colors used for muscles on Plate 57 on this and/or the next plate. (1) Color one muscle at a time in each of the posterior views. Note that the plantaris (K), the soleus (L), and the gastrocnemius (M) all insert into the same tendon (tendocalcaneus), which receives the color M. (2) Color the upper and lower medial views.

POSTERIOR VIEW (right leg)



The muscles of the posterior leg are arranged into two compartments separated by a fascial septum (deep transverse fascia, not shown). The superficial group (gastrocnemius, soleus, and plantaris) inserts by way of a common tendon, tendocalcaneus (Achilles tendon; see glossary). These fascial compartments are fairly inelastic. Muscle swelling secondary to vascular insufficiency can result in serious muscle compression/death (compartment syndrome) in the absence of fascial (surgical) decompression.

The major calf muscle is gastrocnemius, which flexes the knee and, with its two fellows, plantarflexes the ankle joint. In knee flexion it is aided by *popliteus*, which also rotates the tibia medially. The other deep flexors plantarflex the ankle joint (both toe and great toe flexors and *tibialis posterior*), flex the toes (the flexors), and invert the foot (*tibialis posterior*).

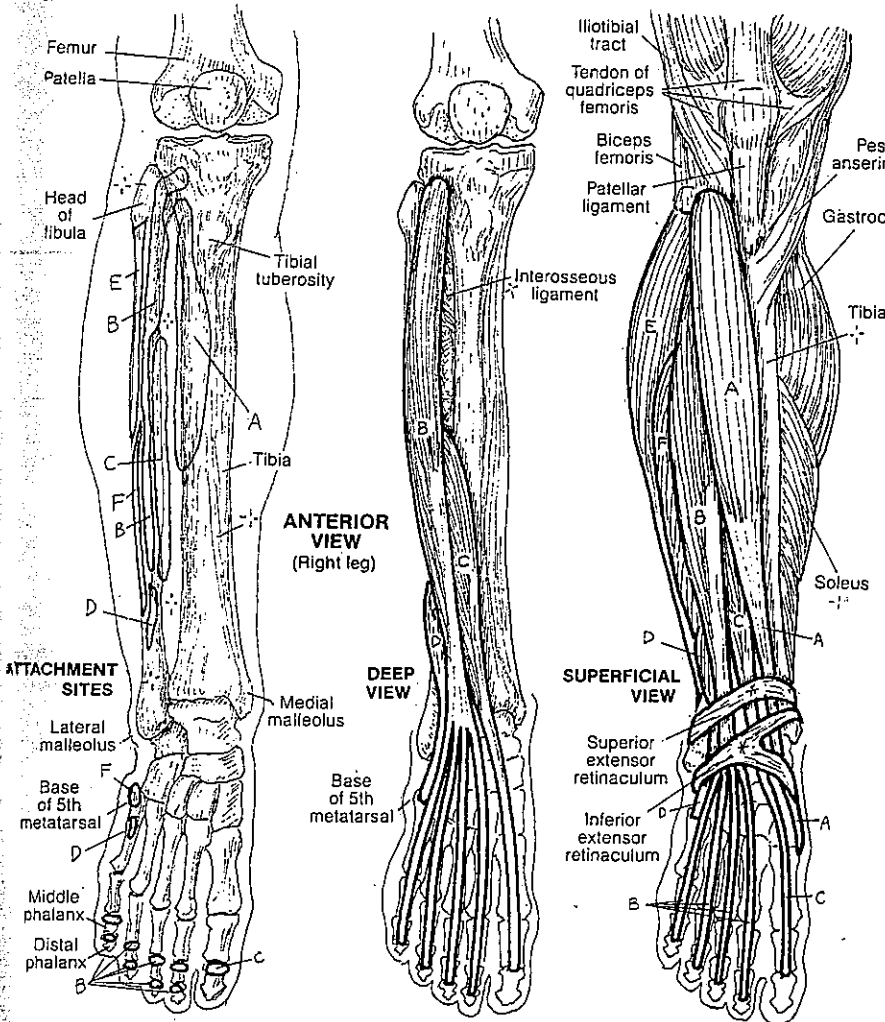
MUSCLES OF THE ANTERIOR & LATERAL LEG

CN: Take care with the narrow attachment sites of the anterior leg. Although the muscles A, B, and C arise from the interosseous ligament as well as the tibia and the fibula, the ligament has been left out of the attachments illustration for purposes of simplification. Attachment sites on the plantar surface of the foot are shown at upper right.

The muscles of the leg are arranged into anterior-lateral, lateral, and posterior compartments. The bony ridge (anterior margin) of the tibia creates two oblique surfaces, the anterolateral of which relates to the anterior leg muscles; the anteromedial surface is bony (ouch!) and devoid of muscle. The lateral compartment fibular muscles largely arise from the fibula and the interosseous ligament between the tibia and fibula.

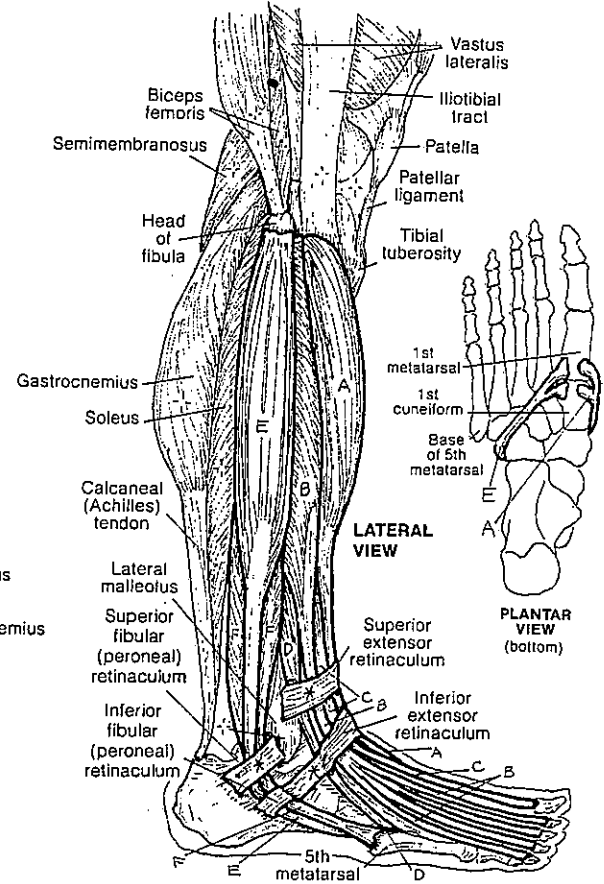
ANTERIOR LEG

- TIBIALIS ANTERIOR
- EXTENSOR DIGITORUM LONGUS
- EXTENSOR HALLUCIS LONGUS
- FIBULARIS TERTIUS

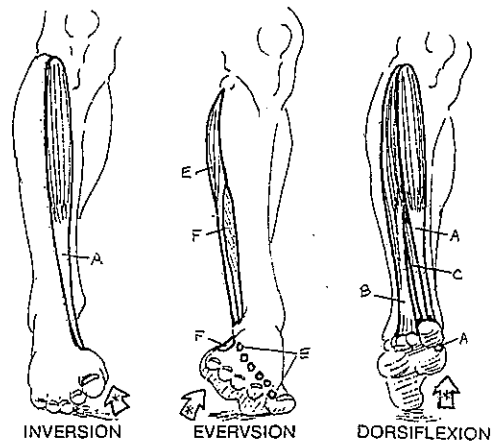


LATERAL LEG

- FIBULARIS LONGUS^E
- FIBULARIS BREVIS^F



The fibular (peroneal) muscles are principally evertors of the foot, and are especially active during plantar flexion, as in walking on the toes or pushing off with the great toe. Fibularis tertius arises in the fibular compartment but is actually part of extensor digitorum.



All of the anterior leg muscles are dorsiflexors (extensors) of the ankle; *extensors hallucis* and *digitorum longus* are toe extensors; *tibialis anterior* is an invertor of the subtalar joints as well, and *fibularis tertius* (the 5th tendon of *extensor digitorum*) is an evertor. Due to rotation of the lower limb during embryonic development, these extensors are anterior to the bones in the anatomical position (unlike the upper limb wrist extensors). *Tibialis anterior* is particularly helpful in lifting the foot up during the swing phase of walking to avoid striking the toes.