The **lateral surface** is the space between the antero-lateral and postero-lateral borders. It is broad, and often deeply grooved; it is directed lateralward in the upper two-thirds of its course, backward in the lower third, where it is continuous with the posterior border of the lateral malleolus. This surface gives origin to the Peronæi longus and brevis.

The Lower Extremity or Lateral Malleolus (*malleolus lateralis; distal extremity; external malleolus*).—The lower extremity is of a pyramidal form, and somewhat flattened from side to side; it descends to a lower level than the medial malleolus. The **lateral surface** is convex, subcutaneous, and continuous with the triangular, subcutaneous surface on the lateral side of the body. The **medial surface** (Fig. 262) presents in front a smooth triangular surface, convex from above downward, which articulates with a corresponding surface on the lateral side of the talus. Behind and beneath the articular surface is a rough depression, which gives attachment to the posterior talofibular ligament. The **anterior border** is thick and rough, and marked below by a depression for the attachment of the anterior talofibular ligament. The **posterior border** is broad and presents the shallow **malleolar sulcus**, for the passage of the tendons of the Peronæi longus and brevis. The **summit** is rounded, and give attachment to the calcaneofibular ligament.

Ossification.—The fibula is ossified from *three* centers (Fig. 263): one for the body, and one for either end. Ossification begins in the body about the eighth week of fetal life, and extends toward the extremities. At birth the ends are cartilaginous. Ossification commences in the lower end in the second year, and in the upper about the fourth year. The lower epiphysis, the first to ossify, unites with the body about the twentieth year; the upper epiphysis joins about the twenty-fifth year.

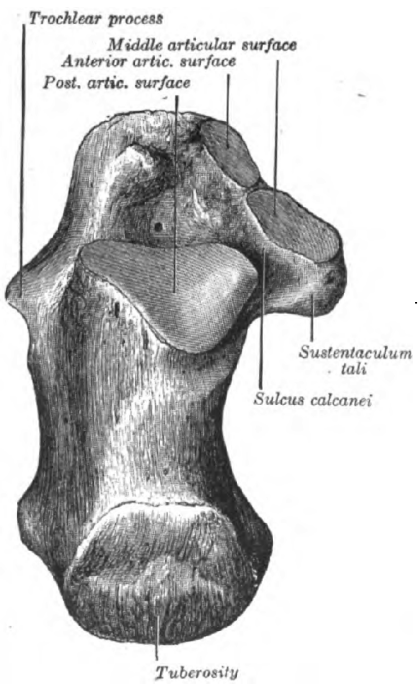

Fig. 264.—Left calcaneus, superior surface.

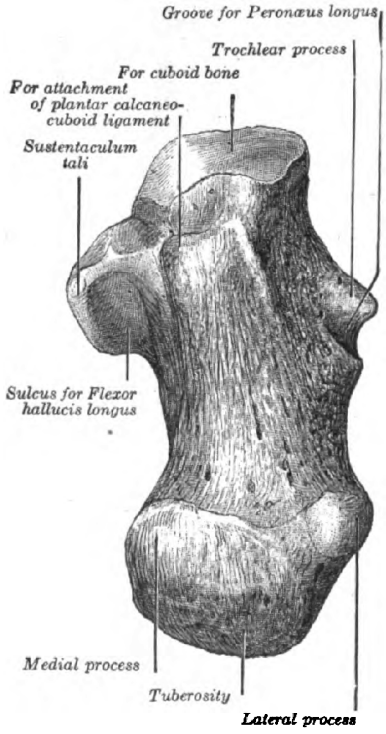

Fig. 265.—Left calcaneus, inferior surface.

THE FOOT.

The skeleton of the foot (Figs. 268 and 269) consists of three parts: the **tarsus**, **metatarsus**, and **phalanges**.

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The Tarsus (Ossa Tarsi).

The **tarsal bones** are seven in number, viz., the **calcaneus, talus, cuboid, navicular,** and the **first, second,** and **third cuneiforms.**

The Calcaneus (*os calcis*) (Figs. 264 to 267).—The calcaneus is the largest of the tarsal bones. It is situated at the lower and back part of the foot, serving to transmit the weight of the body to the ground, and forming a strong lever for the muscles of the calf. It is irregularly cuboidal in form, having its long axis directed forward and lateralward; it presents for examination six surfaces.

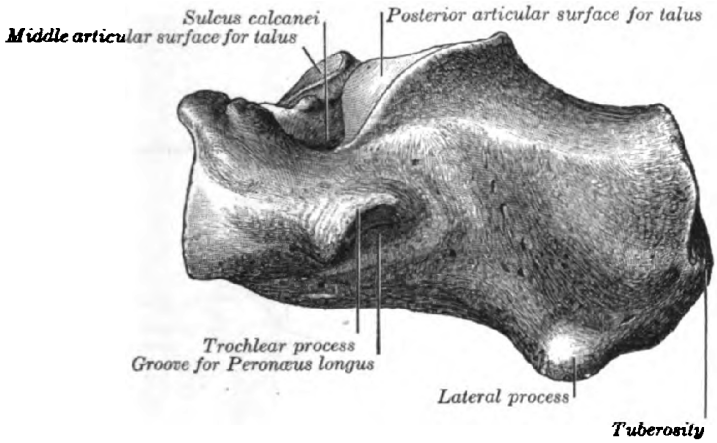

FIG. 266.—Left calcaneus, lateral surface.

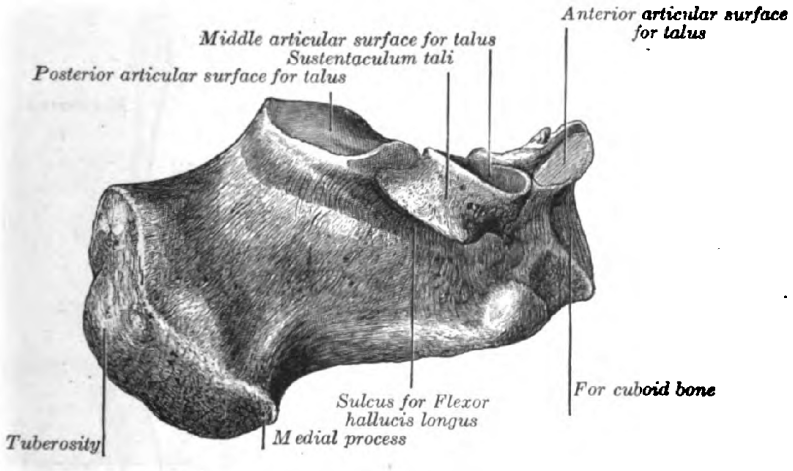

FIG. 267.—Left calcaneus, medial surface.

Surfaces.—The **superior surface** extends behind on to that part of the bone which projects backward to form the heel. This varies in length in different individuals, is convex from side to side, concave from before backward, and supports a mass of fat placed in front of the tendo calcaneus. In front of this area is a large usually somewhat oval-shaped facet, the **posterior articular surface,** which looks upward and forward; it is convex from behind forward, and articulates with the posterior calcaneal facet on the under surface of the talus. It is bounded anteriorly by a deep depression which is continued backward and medialward in the form of a groove, the **calcaneal sulcus.** In the articulated foot this sulcus lies below a similar one on the under surface of the talus, and the two form a canal (**sinus tarsi**) for the

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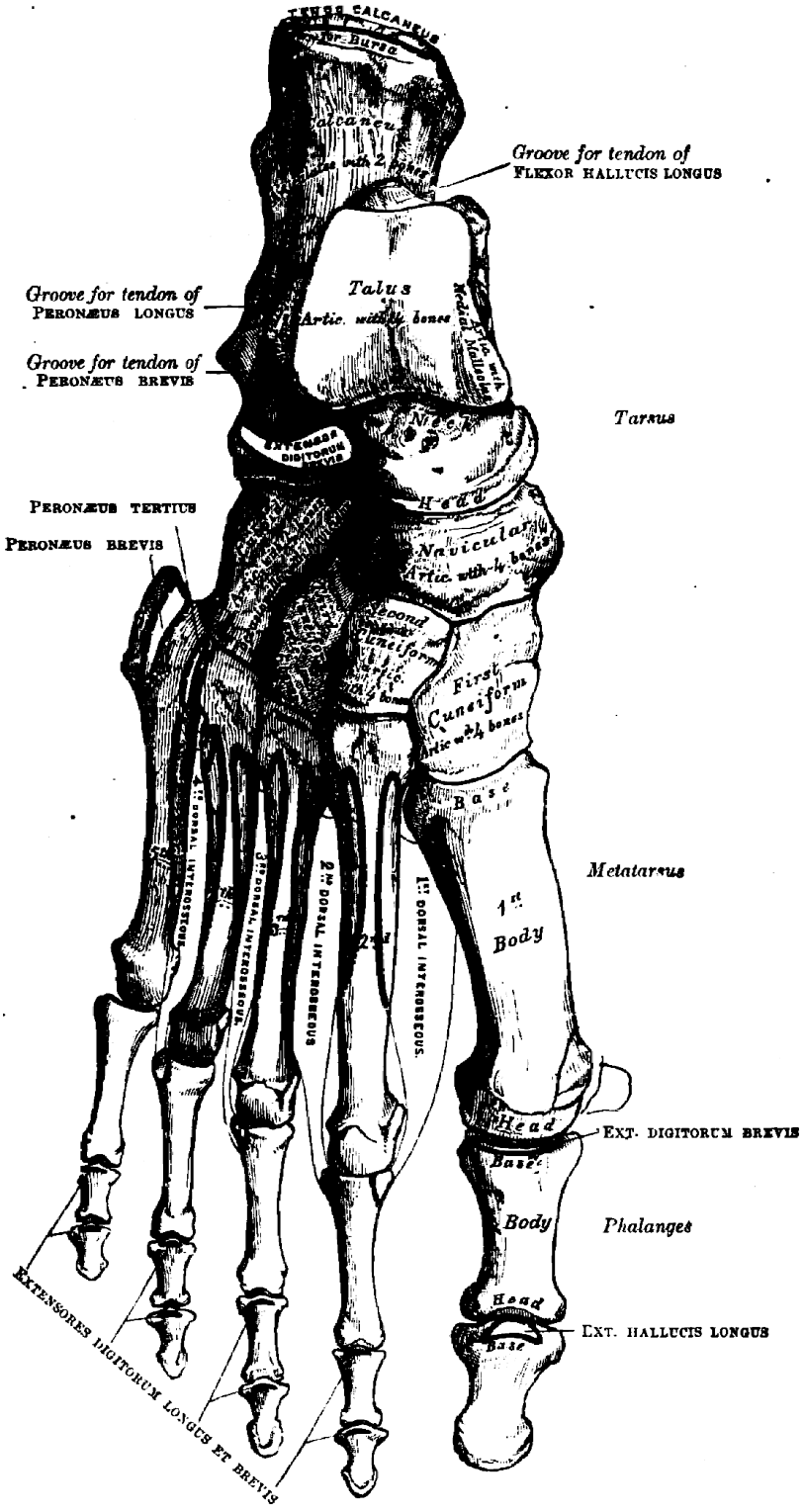

FIG. 268.—Bones of the right foot. Dorsal surface.

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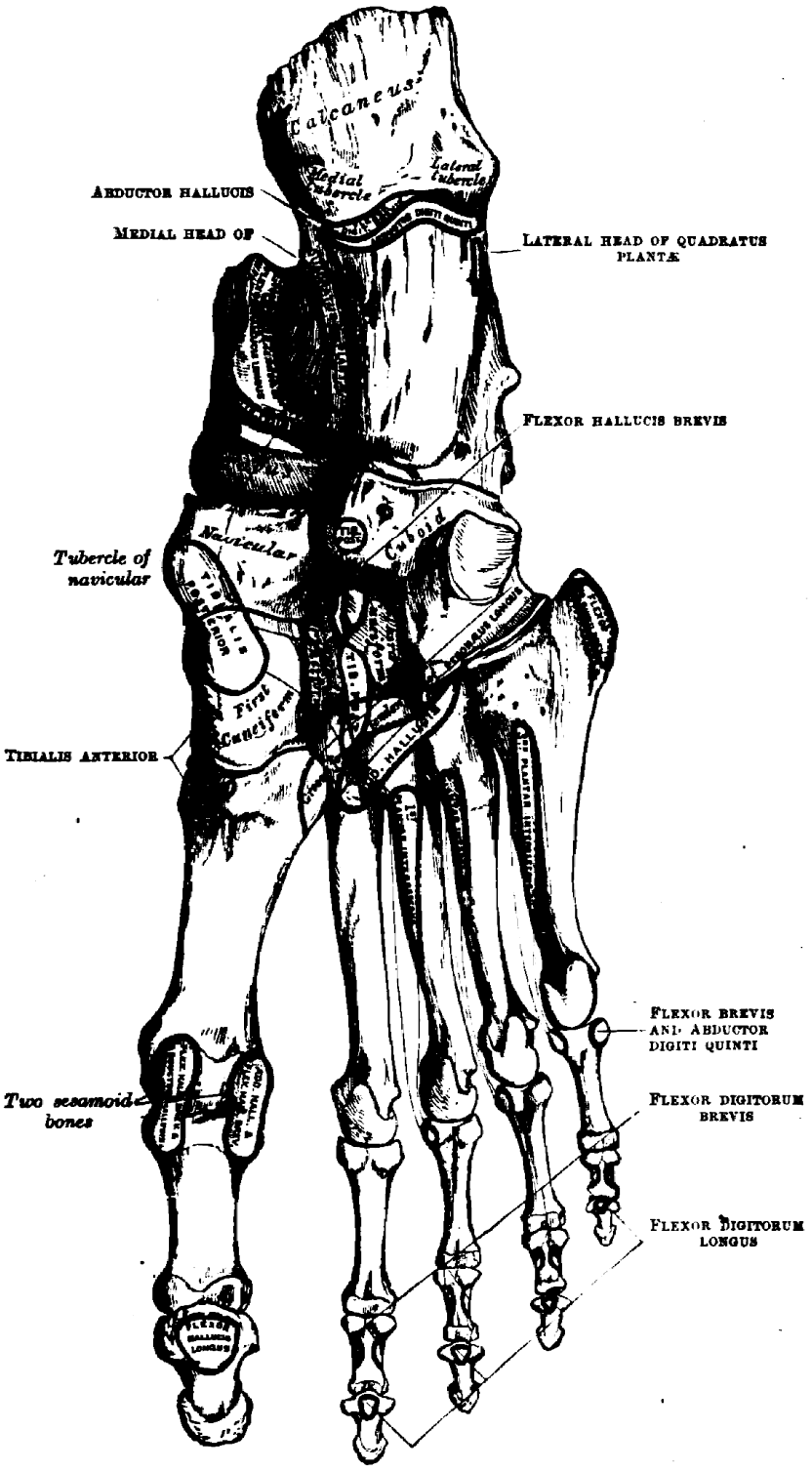

FIG. 269.—Bones of the right foot. Plantar surface.

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lodgement of the interosseous talocalcaneal ligament. In front and to the medial side of this groove is an elongated facet, concave from behind forward, and with its long axis directed forward and lateralward. This facet is frequently divided into two by a notch: of the two, the posterior, and larger is termed the **middle articular surface**; it is supported on a projecting process of bone, the **sustentaculum tali**, and articulates with the middle calcaneal facet on the under surface of the talus; the **anterior articular surface** is placed on the anterior part of the body, and articulates with the anterior calcaneal facet on the talus. The upper surface, anterior and lateral to the facets, is rough for the attachment of ligaments and for the origin of the Extensor digitorum brevis.

The **inferior** or **plantar surface** is uneven, wider behind than in front, and convex from side to side; it is bounded posteriorly by a transverse elevation, the **calcaneal tuberosity**, which is depressed in the middle and prolonged at either end into a process; the **lateral process**, small, prominent, and rounded, gives origin to part of the Abductor digiti quinti; the **medial process**, broader and larger, gives attachment, by its prominent medial margin, to the Abductor hallucis, and in front to the Flexor digitorum brevis and the plantar aponeurosis; the depression between the processes gives origin to the Abductor digiti quinti. The rough surface in front of the processes gives attachment to the long plantar ligament, and to the lateral head of the Quadratus plantæ; while to a prominent tubercle nearer the anterior part of this surface, as well as to a transverse groove in front of the tubercle, is attached the plantar calcaneocuboid ligament.

The **lateral surface** is broad behind and narrow in front, flat and almost subcutaneous; near its center is a tubercle, for the attachment of the calcaneofibular ligament. At its upper and anterior part, this surface gives attachment to the lateral talocalcaneal ligament; and in front of the tubercle it presents a narrow surface marked by two oblique grooves. The grooves are separated by an elevated ridge, or tubercle, the **trochlear process** (*peroneal tubercle*), which varies much in size in different bones. The **superior groove** transmits the tendon of the Peronæus brevis; the **inferior groove**, that of the Peronæus longus.

The **medial surface** is deeply concave; it is directed obliquely downward and forward, and serves for the transmission of the plantar vessels and nerves into the sole of the foot; it affords origin to part of the Quadratus plantæ. At its upper and forepart is a horizontal eminence, the **sustentaculum tali**, which gives attachment to a slip of the tendon of the Tibialis posterior. This eminence is concave above, and articulates with the middle calcaneal articular surface of the talus; below, it is grooved for the tendon of the Flexor hallucis longus; its anterior margin gives attachment to the plantar calcaneonavicular ligament, and its medial, to a part of the deltoid ligament of the ankle-joint.

The **anterior** or **cuboid articular surface** is of a somewhat triangular form. It is concave from above downward and lateralward, and convex in a direction at right angles to this. Its medial border gives attachment to the plantar calcaneonavicular ligament.

The **posterior surface** is prominent, convex, wider below than above, and divisible into three areas. The lowest of these is rough, and covered by the fatty and fibrous tissue of the heel; the middle, also rough, gives insertion to the tendo calcaneus and Plantaris; while the highest is smooth, and is covered by a bursa which intervenes between it and the tendo calcaneus.

Articulations.—The calcaneus articulates with two bones: the talus and cuboid.

The Talus (*astragalus; ankle bone*) (Figs. 270 to 273).—The talus is the second largest of the tarsal bones. It occupies the middle and upper part of the tarsus, supporting the tibia above, resting upon the calcaneus below, articulating on either side with the malleoli, and in front with the navicular. It consists of **a body**, **a neck**, and **a head**

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The Body (*corpus tali*).—The **superior surface** of the body presents, behind, a smooth trochlear surface, the **trochlea**, for articulation with the tibia. The trochlea is broader in front than behind, convex from before backward, slightly concave from side to side: in front it is continuous with the upper surface of the neck of the bone.

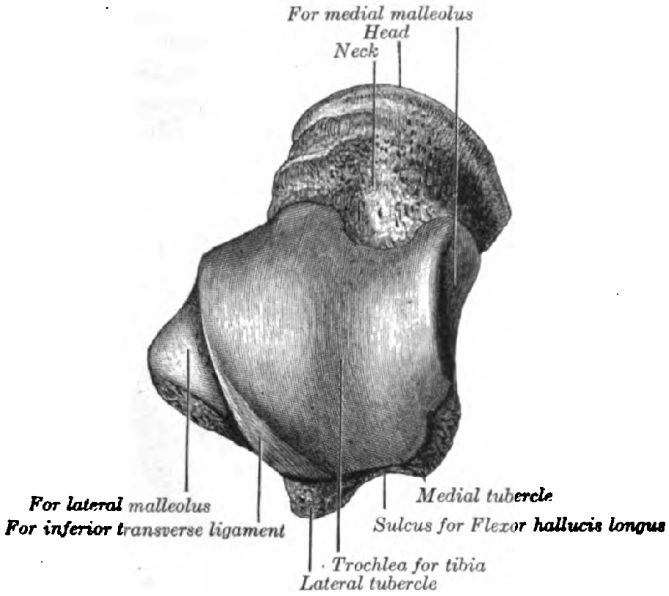

FIG. 270.—Left talus, from above.

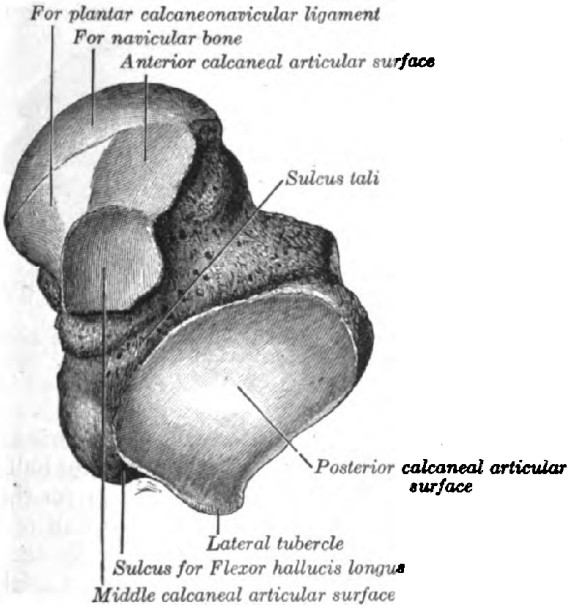

FIG. 271.—Left talus, from below.

The **inferior surface** presents two articular areas, the posterior and middle calcaneal surfaces, separated from one another by a deep groove, the **sulcus tali.** The groove runs obliquely forward and lateralward, becoming gradually broader and deeper in front: in the articulated foot it lies above a similar groove upon the upper surface of the calcaneus, and forms, with it, a canal (**sinus tarsi**) filled

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up in the fresh state by the interosseous talocalcaneal ligament. The **posterior calcaneal articular surface** is large and of an oval or oblong form. It articulates with the corresponding facet on the upper surface of the calcaneus,[1] and is deeply concave in the direction of its long axis which runs forward and lateralward at an angle of about 45° with the median plane of the body. The **middle calcaneal articular surface** is small, oval in form and slightly convex; it articulates with the upper surface of the sustentaculum tali of the calcaneus.

The **medial surface** presents at its upper part a pear-shaped articular facet for the medial malleolus, continuous above with the trochlea; below the articular surface is a rough depression for the attachment of the deep portion of the deltoid ligament of the ankle-joint.

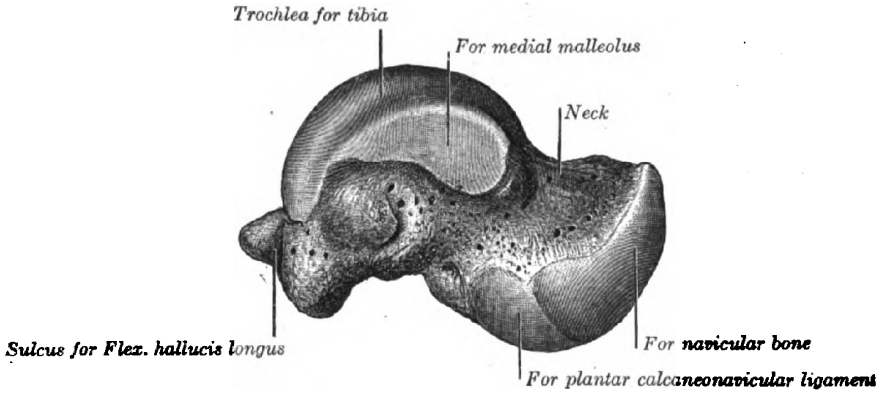

FIG. 272.—Left talus, medial surface.

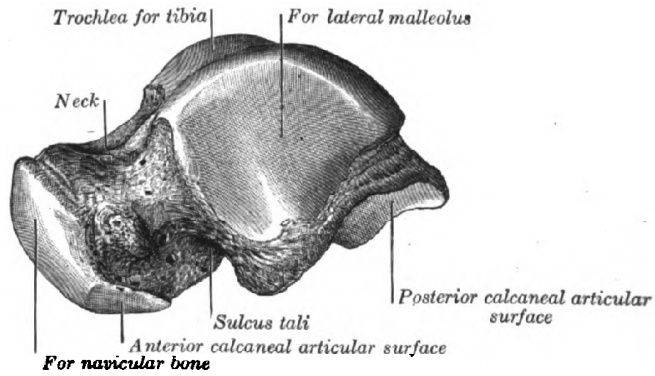

FIG. 273.—Left talus, lateral surface.

The **lateral surface** carries a large triangular facet, concave from above downward, for articulation with the lateral malleolus; its anterior half is continuous above with the trochlea; and in front of it is a rough depression for the attachment of the anterior talofibular ligament. Between the posterior half of the lateral border of the trochlea and the posterior part of the base of the fibular articular surface is a triangular facet (Fawcett[2]) which comes into contact with the transverse inferior tibiofibular ligament during flexion of the ankle-joint; below the base of this facet is a groove which affords attachment to the posterior talofibular ligament.

The **posterior surface** is narrow, and traversed by a groove running obliquely

[1] Sewell (Journal of Anatomy and Physiology, vol. xxxviii) pointed out that in about 10 per cent. of bones a small triangular facet, continuous with the posterior calcaneal facet, is present at the junction of the lateral surface of the body with the posterior wall of the sulcus tali.

[2] Edinburgh Medical Journal, 1895.

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downward and medialward, and transmitting the tendon of the Flexor hallucis longus. Lateral to the groove is a prominent tubercle, the **posterior process**, to which the posterior talofibular ligament is attached; this process is sometimes separated from the rest of the talus, and is then known as the **os trigonum**. Medial to the groove is a second smaller tubercle.

The Neck (*collum tali*).—The neck is directed forward and medialward, and comprises the constricted portion of the bone between the body and the oval head. Its **upper** and **medial surfaces** are rough, for the attachment of ligaments; its **lateral surface** is concave and is continuous below with the deep groove for the interosseous talocalcaneal ligament.

The Head (*caput tali*).—The head looks forward and medialward; its **anterior articular** or **navicular surface** is large, oval, and convex. Its **inferior surface** has two facets, which are best seen in the fresh condition. The medial, situated in front of the middle calcaneal facet, is convex, triangular, or semi-oval in shape, and rests on the plantar calcaneonavicular ligament; the lateral, named the **anterior calcaneal articular surface**, is somewhat flattened, and articulates with the facet on the upper surface of the anterior part of the calcaneus.

Articulations.—The talus articulates with *four* bones: tibia, fibula, calcaneus, and navicular.

The Cuboid Bone (*os cuboideum*) (Figs. 274, 275).—The cuboid bone is placed on the lateral side of the foot, in front of the calcaneus, and behind the fourth and fifth metatarsal bones. It is of a pyramidal shape, its base being directed medialward.

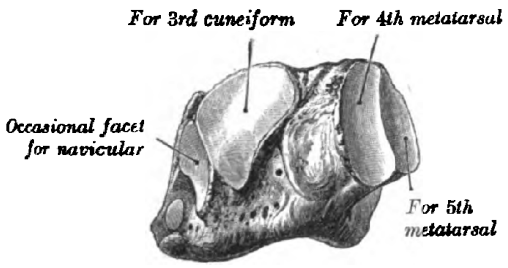

Fig. 274.—The left cuboid. Antero-medial view.

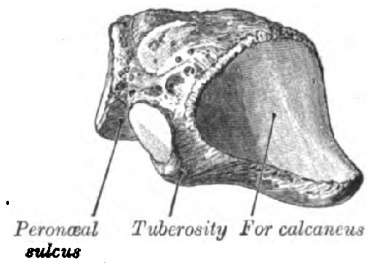

Fig. 275.—The left cuboid. Postero-lateral view.

Surfaces.—The **dorsal surface**, directed upward and lateralward, is rough, for the attachment of ligaments. The **plantar surface** presents in front a deep groove, the **peroneal sulcus**, which runs obliquely forward and medialward; it lodges the tendon of the Peronæus longus, and is bounded behind by a prominent ridge, to which the long plantar ligament is attached. The ridge ends laterally in an eminence, the **tuberosity**, the surface of which presents an oval facet; on this facet glides the sesamoid bone or cartilage frequently found in the tendon of the Peronæus longus. The surface of bone behind the groove is rough, for the attachment of the plantar calcaneocuboid ligament, a few fibers of the Flexor hallucis brevis, and a fasciculus from the tendon of the Tibialis posterior. The **lateral surface** presents a deep notch formed by the commencement of the peroneal sulcus. The **posterior surface** is smooth, triangular, and concavo-convex, for articulation with the anterior surface of the calcaneus; its infero-medial angle projects backward as a process which underlies and supports the anterior end of the calcaneus. The **anterior surface**, of smaller size, but also irregularly triangular, is divided by a vertical ridge into two facets: the medial, quadrilateral in form, articulates with the fourth metatarsal; the lateral, larger and more triangular, articulates with the fifth. The **medial surface** is broad, irregularly quadrilateral, and presents at its middle and upper part a smooth oval facet, for articulation with the third

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cuneiform; and behind this (occasionally) a smaller facet, for articulation with the navicular; it is rough in the rest of its extent, for the attachment of strong interosseous ligaments.

Articulations.—The cuboid articulates with *four* bones: the calcaneus, third cuneiform, and fourth and fifth metatarsals; occasionally with a fifth, the navicular.

The Navicular Bone (*os naviculare pedis; scaphoid bone*) (Figs. 276, 277).—The navicular bone is situated at the medial side of the tarsus, between the talus behind and the cuneiform bones in front.

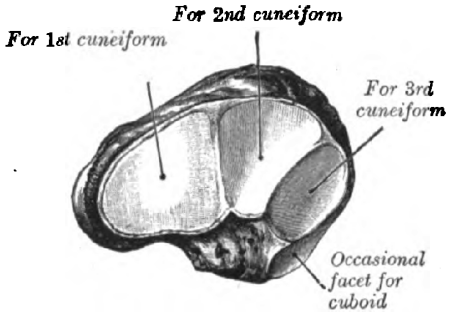

FIG. 276.—The left navicular. Antero-lateral view.

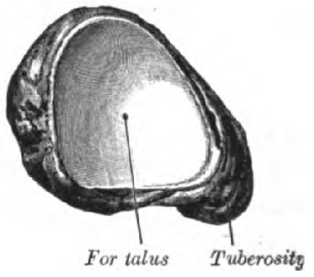

FIG. 277.—The left navicular. Postero-medial view.

Surfaces.—The **anterior surface** is convex from side to side, and subdivided by two ridges into three facets, for articulation with the three cuneiform bones. The **posterior surface** is oval, concave, broader laterally than medially, and articulates with the rounded head of the talus. The **dorsal surface** is convex from side to side, and rough for the attachment of ligaments. The **plantar surface** is irregular, and also rough for the attachment of ligaments. The **medial surface** presents a rounded **tuberosity**, the lower part of which gives attachment to part of the tendon of the Tibialis posterior. The **lateral surface** is rough and irregular for the attachment of ligaments, and occasionally presents a small facet for articulation with the cuboid bone.

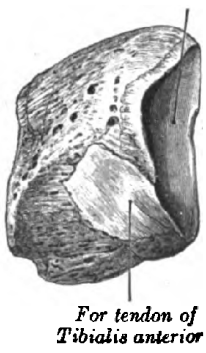

FIG. 278.—The left first cuneiform. Antero-medial view.

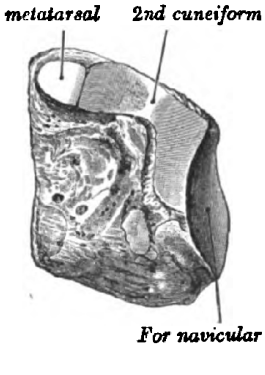

FIG. 279.—The left first cuneiform. Postero-lateral view.

Articulations.—The navicular articulates with *four* bones: the talus and the three cuneiforms; occasionally with a fifth, the cuboid.

The First Cuneiform Bone (*os cuneiform primum; internal cuneiform*) (Figs. 278, 279).—The first cuneiform bone is the largest of the three cuneiforms. It is situated at the medial side of the foot, between the navicular behind and the base of the first metatarsal in front.

Surfaces.—The **medial surface** is subcutaneous, broad, and quadrilateral; at its anterior plantar angle is a smooth oval impression, into which part of the tendon of the Tibialis anterior is inserted; in the rest of its extent it is rough for the attachment of ligaments. The **lateral surface** is concave, presenting, along its superior and posterior borders a narrow L-shaped surface, the vertical limb and posterior part of the horizontal limb of which articulate with the second cuneiform, while the anterior part of the horizontal limb articulates with the second metatarsal

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bone: the rest of this surface is rough for the attachment of ligaments and part of the tendon of the Peronæus longus. The **anterior surface**, kidney-shaped and much larger than the posterior, articulates with the first metatarsal bone. The **posterior surface** is triangular, concave, and articulates with the most medial and largest of the three facets on the anterior surface of the navicular. The **plantar surface** is rough, and forms the base of the wedge; at its back part is a tuberosity for the insertion of part of the tendon of the Tibialis posterior. It also gives insertion in front to part of the tendon of the Tibialis anterior. The **dorsal surface** is the narrow end of the wedge, and is directed upward and lateralward; it is rough for the attachment of ligaments.

Articulations.—The first cuneiform articulates with *four* bones: the navicular, second cuneiform, and first and second metatarsals.

The Second Cuneiform Bone (*os cuneiforme secundum; middle cuneiform*) (Figs. 280, 281).—The second cuneiform bone, the smallest of the three, is of very regular wedge-like form, the thin end being directed downward. It is situated between the other two cuneiforms, and articulates with the navicular behind, and the second metatarsal in front.

Surfaces.—The **anterior surface**, triangular in form, and narrower than the posterior, articulates with the base of the second metatarsal bone. The **posterior surface**, also triangular, articulates with the intermediate facet on the anterior surface of the navicular. The **medial surface** carries an L-shaped articular facet, running along the superior and posterior borders, for articulation with the first cuneiform, and is rough in the rest of its extent for the attachment of ligaments. The **lateral surface** presents posteriorly a smooth facet for articulation with the third cuneiform bone. The **dorsal surface** forms the base of the wedge; it is quadrilateral and rough for the attachment of ligaments. The **plantar surface**, sharp and tuberculated, is also rough for the attachment of ligaments, and for the insertion of a slip from the tendon of the Tibialis posterior.

FIG. 280.—The left second cuneiform. Antero-medial view.

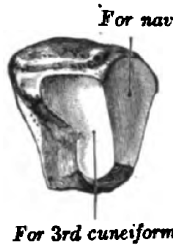

FIG. 281.—The left second cuneiform. Postero-lateral view.

Articulations.—The second cuneiform articulates with *four* bones: the navicular, first and third cuneiforms, and second metatarsal.

The Third Cuneiform Bone (*os cuneiforme tertium; external cuneiform*) (Figs. 282, 283).—The third cuneiform bone, intermediate in size between the two preceding, is wedge-shaped, the base being uppermost. It occupies the center of the front row of the tarsal bones, between the second cuneiform medially, the cuboid laterally, the navicular behind, and the third metatarsal in front.

Surfaces.—The **anterior surface**, triangular in form, articulates with the third metatarsal bone. The **posterior surface** articulates with the lateral facet on the anterior surface of the navicular, and is rough below for the attachment of ligamentous fibers. The **medial surface** presents an anterior and a posterior articular facet, separated by a rough depression: the anterior, sometimes divided, articulates with the lateral side of the base of the second metatarsal bone; the posterior skirts the posterior border, and articulates with the second cuneiform; the rough depression gives attachment to an interosseous ligament. The **lateral surface** also presents two articular facets, separated by a rough non-articular area; the anterior facet, situated at the superior angle of the bone, is small and semi-oval in shape, and articulates with the medial side of the base of the fourth metatarsal bone;

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the posterior and larger one is triangular or oval, and articulates with the cuboid; the rough, non-articular area serves for the attachment of an interosseous ligament. The three facets for articulation with the three metatarsal bones are continuous with one another; those for articulation with the second cuneiform and navicular are also continuous, but that for articulation with the cuboid is usually separate. The **dorsal surface** is of an oblong form, its postero-lateral angle being prolonged backward. The **plantar surface** is a rounded margin, and serves for the attachment of part of the tendon of the Tibialis posterior, part of the Flexor hallucis brevis, and ligaments.

Articulations.—The third cuneiform articulates with *six* bones: the navicular, second cuneiform, cuboid, and second, third, and fourth metatarsals.

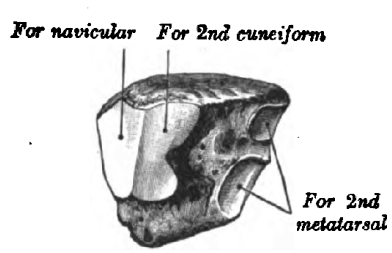

FIG. 282.—The left third cuneiform. Postero-medial view.

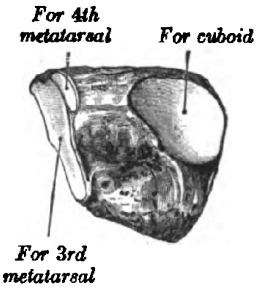

FIG. 283.—The third left cuneiform. Antero-lateral view.

The Metatarsus.

The **metatarsus** consists of five bones which are numbered from the medial side (*ossa metatarsalia* I.–V.); each presents for examination a **body** and **two extremities.**

Common Characteristics of the Metatarsal Bones.—The body is prismoid in form, tapers gradually from the tarsal to the phalangeal extremity, and is curved longitudinally, so as to be concave below, slightly convex above. The **base** or **posterior extremity** is wedge-shaped, articulating proximally with the tarsal bones, and by its sides with the contiguous metatarsal bones: its dorsal and plantar surfaces are rough for the attachment of ligaments. The **head** or **anterior extremity** presents a convex articular surface, oblong from above downward, and extending farther backward below than above. Its sides are flattened, and on each is a depression, surmounted by a tubercle, for ligamentous attachment. Its plantar surface is grooved antero-posteriorly for the passage of the Flexor tendons, and marked on either side by an articular eminence continuous with the terminal articular surface.

Characteristics of the Individual Metatarsal Bones. — **The First Metatarsal Bone** (*os metatarsale I; metatarsal bone of the great toe*) (Fig. 284).—The first metatarsal bone is remarkable for its great thickness, and is the shortest of the metatarsal bones. The **body** is strong, and of well-marked prismoid form. The **base** presents, as a rule, no articular facets on its sides, but occasionally on the lateral side there is an oval facet, by which it articulates with the second metatarsal. Its proximal articular surface is of large size and kidney-shaped; its circumference is grooved, for the tarsometatarsal ligaments, and medially gives insertion to part of the tendon of the Tibialis anterior; its plantar angle presents a rough oval prominence for the insertion of the tendon of the Peronæus longus. The **head** is large; on its plantar surface are two grooved facets, on which glide sesamoid bones; the facets are separated by a smooth elevation.

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The Second Metatarsal Bone (*os metatarsale II*) (Fig. 285).—The second metatarsal bone is the longest of the metatarsal bones, being prolonged backward

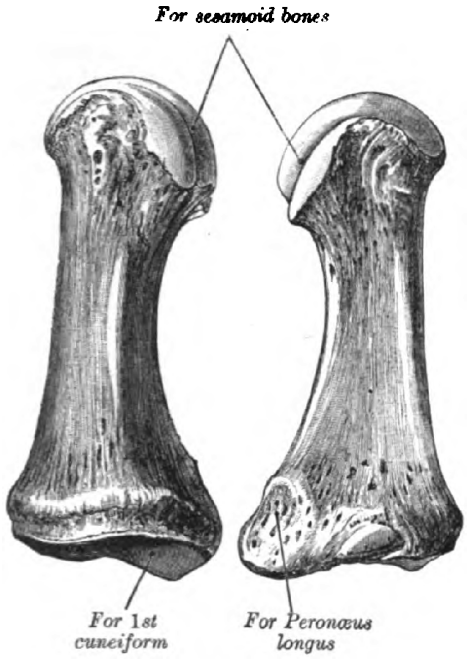

Fig. 284.—The first metatarsal. (Left.)

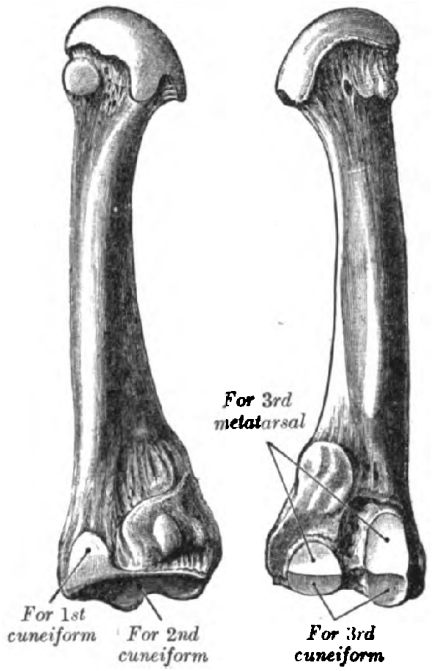

Fig. 285.—The second metatarsal. (Left.)

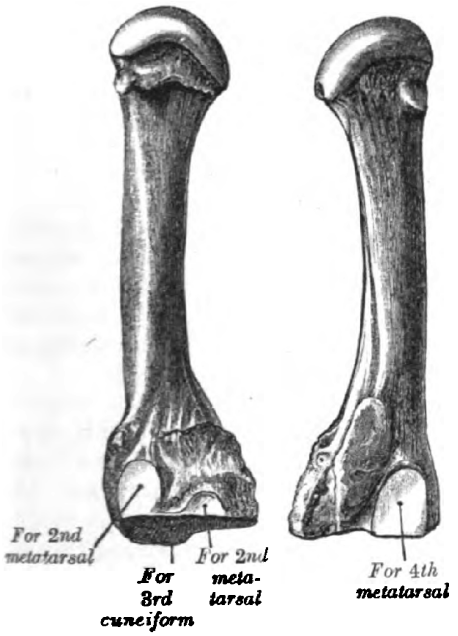

Fig. 286.—The third metatarsal. (Left.)

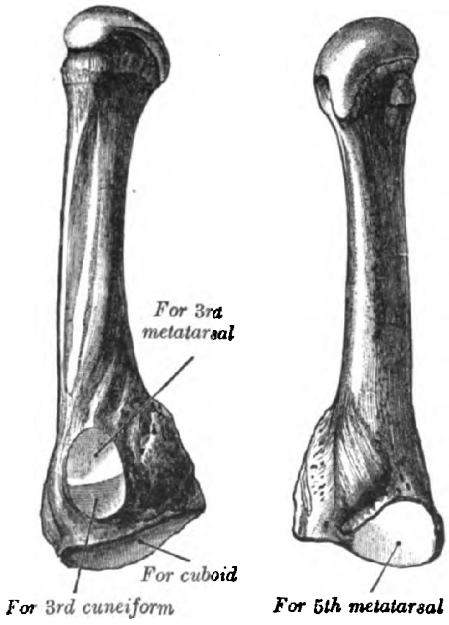

Fig. 287.—The fourth metatarsal. (Left.)

into the recess formed by the three cuneiform bones. Its **base** is broad above, narrow and rough below. It presents four articular surfaces: one behind, of a triangular form, for articulation with the second cuneiform; one at the upper part

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of its medial surface, for articulation with the first cuneiform; and two on its lateral surface, an upper and lower, separated by a rough non-articular interval. Each of these lateral articular surfaces is divided into two by a vertical ridge; the two anterior facets articulate with the third metatarsal; the two posterior (sometimes continuous) with the third cuneiform. A fifth facet is occasionally present for articulation with the first metatarsal; it is oval in shape, and is situated on the medial side of the body near the base.

The Third Metatarsal Bone (*os metatarsale III*) (Fig. 286).—The third metatarsal bone articulates proximally, by means of a triangular smooth surface, with the third cuneiform; medially, by two facets, with the second metatarsal; and laterally, by a single facet, with the fourth metatarsal. This last facet is situated at the dorsal angle of the base.

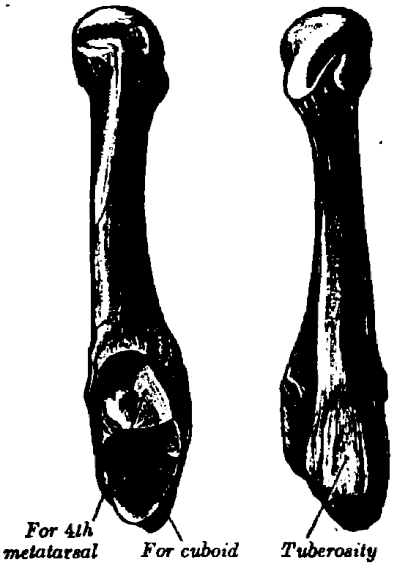

FIG. 288.—The fifth metatarsal. (Left.)

The Fourth Metatarsal Bone (*os metatarsale IV*) (Fig. 287).—The fourth metatarsal bone is smaller in size than the preceding; its **base** presents an oblique quadrilateral surface for articulation with the cuboid; a smooth facet on the medial side, divided by a ridge into an anterior portion for articulation with the third metatarsal, and a posterior portion for articulation with the third cuneiform; on the lateral side a single facet, for articulation with the fifth metatarsal.

The Fifth Metatarsal Bone (*os metatarsale V*) (Fig. 288).—The fifth metatarsal bone is recognized by a rough eminence, the **tuberosity**, on the lateral side of its base. The **base** articulates behind, by a triangular surface cut obliquely in a transverse direction, with the cuboid; and medially, with the fourth metatarsal. On the medial part of its dorsal surface is inserted the tendon of the Peronæus tertius and on the dorsal surface of the tuberosity that of the Peronæus brevis. A strong band of the plantar aponeurosis connects the projecting part of the tuberosity with the lateral process of the tuberosity of the calcaneus. The plantar surface of the base is grooved for the tendon of the Abductor digiti quinti, and gives origin to the Flexor digiti quinti brevis.

Articulations.—The base of each metatarsal bone articulates with one or more of the tarsal bones, and the head with one of the first row of phalanges. The first metatarsal articulates with the first cuneiform, the second with all three cuneiforms, the third with the third cuneiform, the fourth with the third cuneiform and the cuboid, and the fifth with the cuboid.

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The Phalanges of the Foot (Phalanges Digitorum Pedis).

The **phalanges** of the foot correspond, in number and general arrangement, with those of the hand; there are two in the great toe, and three in each of the other toes. They differ from them, however, in their size, the bodies being much reduced in length, and, especially in the first row, laterally compressed.

First Row.—The **body** of each is compressed from side to side, convex above, concave below. The **base** is concave; and the **head** presents a trochlear surface for articulation with the second phalanx.

Second Row.—The phalanges of the second row are remarkably small and short, but rather broader than those of the first row.

The **ungual phalanges**, in form, resemble those of the fingers; but they are smaller and are flattened from above downward; each presents a broad base for articulation with the corresponding bone of the second row, and an expanded distal extremity for the support of the nail and end of the toe.

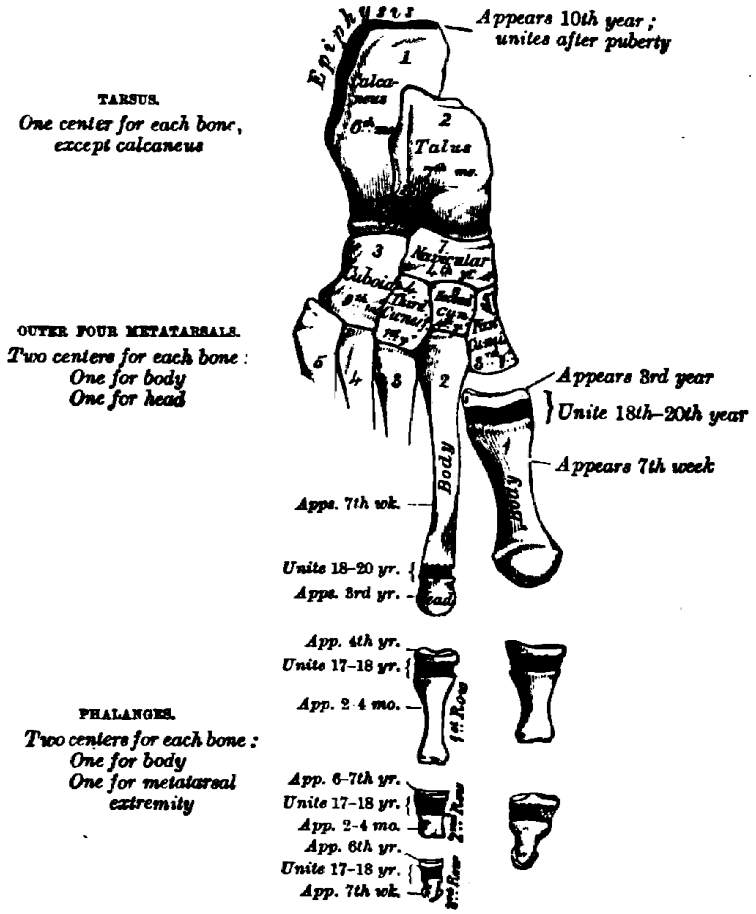

FIG. 289.—Plan of ossification of the foot.

Articulations.—In the second, third, fourth, and fifth toes the phalanges of the first row articulate behind with the metatarsal bones, and in front with the second phalanges, which in their turn articulate with the first and third: the ungual phalanges articulate with the second.

Ossification of the Bones of the Foot (Fig. 289).—The **tarsal bones** are each ossified from a *single* center, excepting the calcaneus, which has an epiphysis for its posterior extremity. The centers make their appearance in the following order: calcaneus at the sixth month of fetal life;

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talus, about the seventh month; cuboid, at the ninth month; third cuneiform, during the first year; first cuneiform, in the third year; second cuneiform and navicular, in the fourth year. The epiphysis for the posterior extremity of the calcaneus appears at the tenth year, and unites with the rest of the bone soon after puberty. The posterior process of the talus is sometimes ossified from a separate center, and may remain distinct from the main mass of the bone, when it is named the *os trigonum*.

The **metatarsal bones** are each ossified from *two* centers: one for the body, and one for the head, of the second, third, fourth, and fifth metatarsals; one for the body, and one for the base, of the first metatarsal.[1] Ossification commences in the center of the body about the ninth week, and extends toward either extremity. The center for the base of the first metatarsal appears about the third year; the centers for the heads of the other bones between the fifth and eighth years; they join the bodies between the eighteenth and twentieth years.

The **phalanges** are each ossified from *two* centers: one for the body, and one for the base. The center for the body appears about the tenth week, that for the base between the fourth and tenth years; it joins the body about the eighteenth year.

Comparison of the Bones of the Hand and Foot.

The hand and foot are constructed on somewhat similar principles, each consisting of a proximal part, the carpus or the tarsus, a middle portion, the metacarpus, or the metatarsus, and a terminal portion, the phalanges. The proximal part consists of a series of more or less cubical bones which allow a slight amount of gliding on one another and are chiefly concerned in distributing forces transmitted to or from the bones of the arm or leg. The middle part is made up of slightly movable long bones which assist the carpus or tarsus in distributing forces and also give greater breadth for the reception of such forces. The separation of the individual bones from one another allows of the attachments of the Interossei and protects the dorsi-palmar and dorsi-plantar vascular anastomoses. The terminal portion is the most movable, and its separate elements enjoy a varied range of movements, the chief of which are flexion and extension.

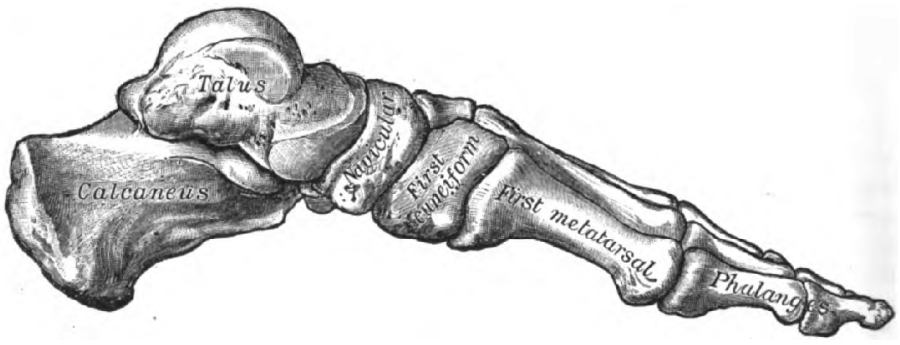

FIG. 290.—Skeleton of foot. Medial aspect.

The function of the hand and foot are, however, very different, and the general similarity between them is greatly modified to meet these requirements. Thus the foot forms a firm basis of support for the body in the erect posture, and is therefore more solidly built up and its component parts are less movable on each other than those of the hand. In the case of the phalanges the difference is readily noticeable; those of the foot are smaller and their movements are more limited than those of the hand. Very much more marked is the difference between the metacarpal bone of the thumb and the metatarsal bone of the great toe. The metacarpal bone of the thumb is constructed to permit of great mobility, is directed at an acute angle from that of the index finger, and is capable of a considerable range

[1] As was noted in the first metacarpal (see footnote, page 231), so in the first metatarsal, there is often a second epiphysis for its head.

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of movements at its articulation with the carpus. The metatarsal bone of the great toe assists in supporting the weight of the body, is constructed with great solidity, lies parallel with the other metatarsals, and has a very limited degree of mobility. The carpus is small in proportion to the rest of the hand, is placed in line with the forearm, and forms a transverse arch, the concavity of which constitutes a bed for the Flexor tendons and the palmar vessels and nerves. The tarsus forms a considerable part of the foot, and is placed at right angles to the leg, a position which is almost peculiar to man, and has relation to his erect posture. In order to allow of their supporting the weight of the body with the least expenditure of material the tarsus and a part of the metatarsus are constructed in a series of arches (Figs. 290, 291), the disposition of which will be considered after the articulations of the foot have been described.

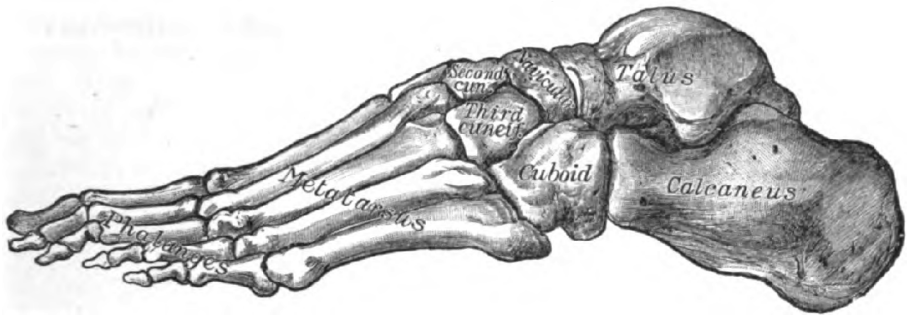

FIG. 291.—Skeleton of foot. Lateral aspect.

The Sesamoid Bones (Ossa Sesamoidea).

Sesamoid bones are small more or less rounded masses embedded in certain tendons and usually related to joint surfaces. Their functions probably are to modify pressure, to diminish friction, and occasionally to alter the direction of a muscle pull. That they are not developed to meet certain physical requirements in the adult is evidenced by the fact that they are present as cartilaginous nodules in the fetus, and in greater numbers than in the adult. They must be regarded, according to Thilenius, as integral parts of the skeleton phylogenetically inherited.[1] Physical necessities probably come into play in selecting and in regulating the degree of development of the original cartilaginous nodules. Nevertheless, irregular nodules of bone may appear as the result of intermittent pressure in certain regions, *e. g.*, the "rider's bone," which is occasionally developed in the Adductor muscles of the thigh.

Sesamoid bones are invested by the fibrous tissue of the tendons, except on the surfaces in contact with the parts over which they glide, where they present smooth articular facets.

In the upper extremity the sesamoid bones of the joints are found only on the palmar surface of the hand. Two, of which the medial is the the larger, are constant at the metacarpophalangeal joint of the thumb; one is frequently present in the corresponding joint of the little finger, and one (or two) in the same joint of the index finger. Sesamoid bones are also found occasionally at the metacarpophalangeal joints of the middle and ring fingers, at the interphalangeal joint of the thumb and at the distal interphalangeal joint of the index finger.

In the lower extremity the largest sesamoid bone of the joints is the patella, developed in the tendon of the Quadriceps femoris. On the plantar aspect of the foot, two, of which the medial is the larger, are always present at the metatar-

[1] Morpholog. Arbeiten, 1906, v, 309.

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sophalangeal joint of the great toe; one sometimes at the metatarsophalangeal joints of the second and fifth toes, one occasionally at the corresponding joint of the third and fourth toes, and one at the interphalangeal joint of the great toe.

Sesamoid bones apart from joints are seldom found in the tendons of the upper limb; one is sometimes seen in the tendon of the Biceps brachii opposite the radial tuberosity. They are, however, present in several of the tendons of the lower limb, viz., one in the tendon of the Peronæus longus, where it glides on the cuboid; one, appearing late in life, in the tendon of the Tibialis anterior, opposite the smooth facet of the first cuneiform bone; one in the tendon of the Tibialis posterior, opposite the medial side of the head of the talus; one in the lateral head of the Gastrocnemius, behind the lateral condyle of the femur; and one in the tendon of the Psoas major, where it glides over the pubis. Sesamoid bones are found occasionally in the tendon of the Glutæus maximus, as it passes over the greater trochanter, and in the tendons which wind around the medial and lateral malleoli.

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