When lecithin undergoes putrefaction glycerin-phosphoric acid and cholin are formed: the latter is readily decomposed into marsh gas and trimethylamine. Under some little understood conditions a small amount of the highly poisonous base neurin is formed from cholin (and so presumably from lecithin) by the action of bacteria.[6] Apparently such a decomposition may also take place in the intestine.[7]

Lecithin is decomposed by the pancreatic juice into cholin, glycerin-phosphoric and stearic (or other fatty) acids.[8] These products are absorbed and the urine of a dog fed upon the yelk of eggs contains an increased amount of phosphoric acid. As the fatty acid is absorbed, lecithin may serve, to a limited extent, as a food.

Nothing definite is known as to the origin of lecithin or as to its use in the plant and animal economy. That it serves a very important purpose, however, is made probable by its very wide, perhaps universal, distribution in living matter. Burow[9] showed that the quantity of lecithin in the milk of an animal varies with the weight of the brain of the young of that animal. Thus, in a series of experiments the following results were obtained. Ratio of weight of brain to body weight: calf, 1:370; dog, 1:30; man, 1:7. Ratio of lecithin to proteid of milk: calf, 1:71; dog, 1:47; man, 1:33.

Attention was called above to the fact that lecithin combines with acids; thus, one molecule of lecithin combines with one molecule of carbon dioxide. The red blood corpuscles contain about 0.75 per cent. of lecithin, so that 100 gm. of red blood corpuscles might hold 22 c.c. of carbon dioxide in loose chemical combination; these facts may be shown to have a bearing upon the manner in which carbon dioxide is held combined in the blood.

Lecithin and its decomposition products have attracted some attention from the standpoint of pathology; thus, Mott and Halliburton think the cholin formed from its decomposition may account for some of the symptoms observed when there is a breaking down of nervous tissue (see *Cholin*), and Nesbitt's work suggests the possibility of poisonous effects resulting from the formation of neurin from lecithin in the intestines.

Lecithin, either in the pure form or in the yelk of eggs, has been used occasionally in therapeutics. Huchard[10] claims to have obtained good results from the administration of lecithin to patients suffering from diabetes, anæmia, tuberculosis and other wasting diseases; he thinks pure lecithin, rather than the yelk of eggs, should be employed, as the latter give rise to an increased production of uric acid.

The presence of lecithin in an organ or liquid may be detected in the following manner. An alcoholic extract is prepared; this is evaporated to almost dryness at a temperature of about 60° C., care being taken to keep the reaction of the solution neutral. The residue is then extracted with a mixture containing equal parts of alcohol and ether; this extract is evaporated to almost dryness and the residue extracted a number of times with ether. The residue, after evaporation of the ether, is fused with sodium hydrate and potassium nitrate and tested for phosphoric acid by one of the usual methods; the presence of phosphoric acid shows that lecithin was present in the original extract, for the salts of neither phosphoric nor glycerin-phosphoric acid are soluble in alcohol and ether. Another method consists in decomposing the lecithin with barium hydroxide and examining the solution for the decomposition products of lecithin, viz., cholin, glycerin-phosphoric and stearic acids. The lecithin may be determined quantitatively by determining the amount of phosphoric acid obtained on its decomposition. If the organ or tissue contains jecorin, however, the figure for lecithin will be too high, for this body (which contains phosphorus in the form of glycerin-phosphoric acid) is also extracted by alcohol and ether (see *Jecorin*).

Burow used the following method for determining the lecithin of milk. To 200 c.c. of a mixture containing equal parts of ether and alcohol and a little acetic acid, 100 c.c. of milk is added one drop at a time. After standing for fourteen hours in a well-stoppered vessel, the liquid is filtered off and evaporated to a syrup at a temperature not exceeding 50° C. The syrup is extracted several times with ether, the ether evaporated, and the phosphorus determined in the residue in the usual way.

Reid Hunt.

[1] Hoppe-Seyler: Med. Chem. Untersuch., p. 215.
[2] Liebermann: Archiv f. d. ges. Physiol., 50 and 54, p. 573.
[3] See Diakonow, Hoppe-Seyler's Med. Chem. Untersuch., p. 223.
[4] Hundeshagen: Journ. f. prakt. Chemie, n. F., 28, p. 219, 1883.
[5] Lippman: Ber. d. deutsch. chem. Gesellsch., 20, p. 3206. See also E. C. Shorey: Journ. Amer. Chem. Soc., 20, p. 113.
[6] Schmidt: Archiv d. Pharmacie, 229, p. 485.
[7] Nesbitt: Journ. of Exper. Med., 4, p. 1, 1899.
[8] Bokay: Zeit. f. physiol. Chemie, 1, p. 162.
[9] Burow: Zeit. f. physiol. Chemie, 30, p. 495.
[10] Huchard: Journ. des Praticiens, 1901, p. 439.

LEECHES. See *Hirudinea*.

LEG, APPLIED ANATOMY OF.—In anatomy the term leg is used to indicate only that part of the pelvic limb between the knee and the ankle, the portion above the knee being known as the thigh.

In man the shape of this region is somewhat characteristic. In most other animals the bellies of the great muscles are above the knee, and the leg is comparatively slender; in man, however, the erect position requires the constant application of muscular force to hold the foot at right angles to the axis of the limb, and this causes very considerable bellies to be formed below the knee. The prominence of the calf is, therefore, not only characteristic of footmen, but, to a certain extent, marks the higher races of mankind generally. Australians and other low savages resemble children and apes in the slender calibre of their legs.

It is not quite correct to compare the leg to an inverted cone, as is often done. In a fully developed man the prominence of the calf is confined mainly to the upper and posterior part of the limb, and represents the two bellies of the gastrocnemius, the inner one being larger and descending somewhat farther than the outer. This prominence is enormously developed in ballet-dancers, who possess here a dense, hard ball of muscles, quite characteristic of the occupation. It may be brought out more fully by rising upon the toes. In women the calf has usually a somewhat different shape, the muscular prominence being masked to a certain extent by fat, and descending somewhat lower than in males. The bones being more slender, the ankle is more finely modelled, and the whole contour of the limb approaches more nearly those lines of grace which please the eye in the "Greek Slave" or in Canova's "Venus." It is this contraction of the leg toward the ankle that makes it necessary to take certain precautions in bandaging, by proceeding from below upward and making the necessary reverses. It is also the reason why the circular operation for amputation is not so easily performed here as above the knee, it being difficult sufficiently to retract the "sleeve." The shape of the ankle is, however, far from being cylindrical, the strong, flat tendo Achillis producing a prominent projection behind, as will be seen on inspecting Figs. 3183 and 3186. Anteriorly, the leg is remarkable for the considerable area throughout which the bone is quite subcutaneous. The inner surface of the tibia, along its whole length from the tuberosity downward to the end of the malleolus, is but slightly covered, and in case of fracture the ends are very apt to extrude, a compound fracture being more frequent here than in any other part of the body. The anterior edge, popularly termed the shin, may be followed down as far as the lower third, where it begins to be rounded and covered with tendons passing over the ankle into the foot. The lack of soft parts here to serve as a cushion under the skin causes it to be liable to certain injuries. A blow from a blunt instrument, which would elsewhere produce a contusion, will here cause an incised wound. Contusions may also produce the same blood tumors that we see occasioned in a similar way upon the skull.

The usual curve of the crest of the tibia may be exaggerated by various causes. One of the earliest signs of rickets is an increase of the bend at the lower part. If children are encouraged to walk too early there is usually an outward bend, causing the child to appear bandy-legged. It is probable, however, that when this is considerable, there is a defect in the nutrition of the bones. Where the potable water shows a marked deficiency of lime salts deformities of this kind are more common. Still, it is not unusual to see the limbs of a bandy-legged child straighten as puberty approaches, and it may be questioned whether a certain degree of this defect is not due to a reversion to the type of tibia found in our "frugivorous ancestors of arboreal habits." Among negro children bandy legs are very common. As this defect occasions an unusual prominence of the shin, and consequent liability to injury, it is probable that there may be some slight ground for the prevalent notion that the shin of the negro is one of his most vulnerable points.

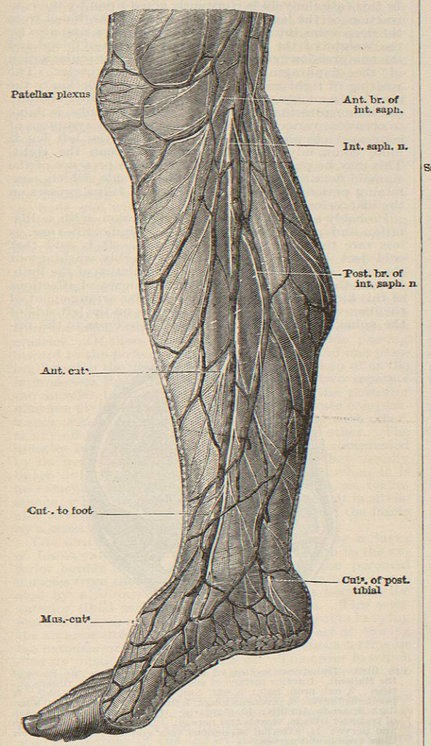

FIG. 3180.—Cutaneous Veins and Nerves of the Right Leg, Internal View.

In certain races, especially those that approximate to the prehistoric type, such as the Esquimaux, the Patagonians, certain Indians, early Europeans, and the mound-builders, a peculiar form of tibia is found which is decidedly simian in character. The bone is markedly flattened from side to side, and presents a sabre-like edge on the crest. This is known as the platycnemic tibia. Wyman found upon examination of a considerable number of skeletons of the mound-builders that about sixty per cent. of their tibiæ were platycnemic. It seems quite probable that in such legs the tibialis anticus muscle is larger and more deeply embedded between the bones than is the case in the usual type, adapting the foot to strong inversion of the sole, as is the case with apes, and thus making climbing easy.

The fibula, although not so superficial as the tibia,

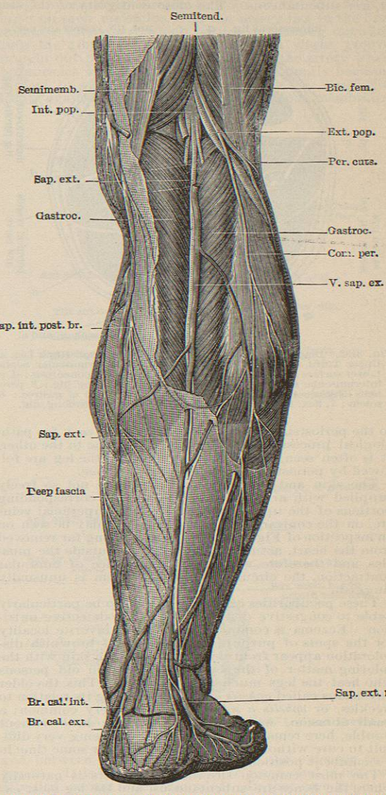

FIG. 3181.—Branches of Right External and Internal Saphenous Veins.

may be felt for a great portion of its course, especially below, where fracture is most common. The head and the external malleolus, with the triangular facet above it, are subcutaneous. The close contiguity of the skin

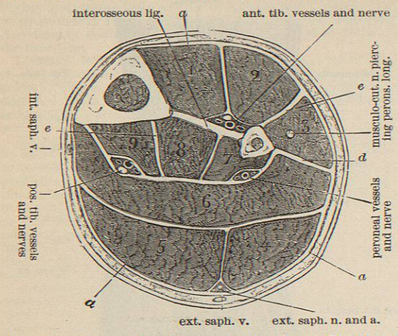

FIG. 3182.—Diagram of a Transverse Section through Right Leg, at Upper Third, to show the Disposition of the Intermuscular Septa. Lower surface of section. *a, a, a*, Deep fascia or aponeurosis; *d, e*, intermuscular septa; 1, tibialis anticus; 2, ext. long. dig.; 3, peroneus longus; 4, ext. head of gastroc.; 5, int. head of gastroc.; 6, soleus; 7, flex. long. hall.; 8, tibialis posticus; 9, flex. long. dig.

to the periosteum and bone makes it very easy for pathological processes to be continued from one to the other. It is often seen, therefore, that ulcers of the leg are followed by periostitis and necrosis of the bone.

The skin and subcutaneous tissues are not so freely supplied with arterial vessels as are the corresponding portions of the upper extremity. The superficial veins are, on the contrary, very numerous, as may be seen on an inspection of Figs. 3180 and 3181. Being far removed from the heart, acting against gravity, outside the muscles, and therefore without the assistance of muscular contraction, the circulation through them is unusually sluggish.

These peculiarities cause this region to be particularly liable to congestive disturbances and to defective nutrition. Eczema is common here; it is a favorite locality for the spots of purpura, and patches of brownish discoloration appear from the staining of the skin with the coloring matter of the blood, especially in old persons who heat the legs much before the fire. This the older physicians called *ephelis ab igne*, indicating its relation to freckles, or *ephelis a sole*. Ulcers are very common; a small abrasion, which would elsewhere heal without trouble, here remaining indefinitely, and being very difficult to cure without placing the patient for some time in a recumbent position.

The most common situation for ulcers is naturally where the bones are subcutaneous, and the leg most exposed to violence. Syphilitic ulceration is also common, especially in front of the knee.

The principal venous trunks are two. The internal saphenous vein (Fig. 3183) arises on the inner side of the foot from the inner extremity of the dorsal venous arch, courses upward in front of the internal malleolus, then behind the internal border of the tibia, and passes into the thigh behind the inner condyle of the femur. It finally discharges into the femoral vein through the saphenous opening in the fascia lata. The external saphenous vein (Fig. 3183) arises from the external end of the dorsal venous arch of the foot, passes behind the external malleolus, upward along the tendo Achillis over the gastrocnemius, and penetrates the deep fascia to empty into the popliteal vein. Both of these veins communicate frequently with the deeper veins by short branches through the fascia, and both are accompanied by cutaneous nerves.

For the reasons before mentioned these veins are very liable to become varicose, especially with those who stand much in one position, like washerwomen; and these varicosities usually occur at those points where a communication exists between the superficial and deep systems. The enlargement is frequently accompanied by considerable pain, because of the pressure upon the accompanying nerves. Varicosities are also likely to occur in those whose occupations require them to use powerfully the muscles of the leg while the thoracic and abdominal muscles are comparatively fixed, as, for instance, in pushing a heavily loaded wheelbarrow uphill. In this case the vein is constantly acted upon by the contraction of the leg muscles, which force the blood from the deep veins into the more superficial ones, and also by the weight of the superincumbent column of blood and the compression exercised upon it by the muscular action of the diaphragm and the abdominal muscles. The wearing of tight garters, or any other obstruction to the circulation such as a gravid uterus or any other abdominal tumor pressing on the main vascular trunks, is liable to occasion varices, anasarca, or some other symptom of congested circulation. It is found that the left leg is more commonly affected in this way than the right. This may be partly accounted for by the presence of the sigmoid flexure of the colon on the left side, which, containing periodically an accumulation of fæces, presses on the iliac veins.

Probably atony of the walls of the colon, with a dilatation and partial impaction of the sigmoid flexure, is less rare than is commonly supposed. It is said that cold feet have been cured by thoroughly washing out the colon, and thus modifying the circulation of the limb. But another cause for the greater frequency of affections of this kind in the left leg is the peculiar arrangement of the iliac veins. Since the vena cava is on the left side of the spine, the left common iliac has to cross to the op-

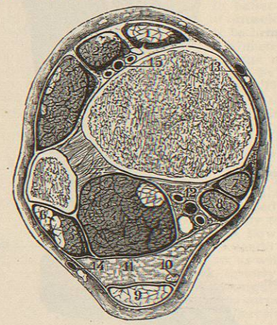

FIG. 3183.—Transverse Section of Left Leg, just above the Bases of the Malleoli. Inferior surface of section. 1, Tendon of tibialis anticus; 2, ext. prop. hall.; 3, ext. com. dig.; 4, flex. long. hall.; 5, peroneus brevis; 6, peroneus long.; 7, tibialis posticus; 8, flex. long. dig.; 9, tendo Achillis; 10, plantaris; 11, fatty tissue; 12, sheath of posterior tibialis, vessels and nerves; 13, internal saphenous vein and nerve; 14, external saphenous vein and nerve; 15, anterior tibial vessels and nerves.

posite side, and in doing so dips under the right common iliac artery, which is crossing in a similar way from the aorta to the right side. A little lower down, the iliac vein passes under the left common iliac artery. In both these cases the artery crosses nearly at right angles to the direction of the vein, and at every pulsation occa-

sions a certain amount of obstruction to the free flow of blood through the latter. On the right side the arteries which cross the veins do so obliquely, so that there is much less obstruction. Varices are not confined to the superficial veins. Verneuil thinks that they frequently occur in the venous plexus which exists between the superficial and deep muscles of the calf, and that this may explain the pain which occurs without obvious cause in those whose occupation requires them to stand a great deal. It is interesting to note that we may trace the ultimate cause of varices to the erect posture. Man is the only animal in which the weight of the whole column of blood contained in the vena cava presses directly upon the veins of the lower limbs. The cava has no valves, and, recalling the action of the hydraulic press, we see at once what a powerful effect the weight of its column of blood must have. This defect in the structure of the vascular system is explained when we remember that in other animals the vena cava is, in the ordinary posture, nearly horizontal, and the blood which it contains exerts no pressure upon the veins of the leg. The leg itself is amply provided with valves. The cessation of valves at just the point where they would be of most use is really one of the many proofs which anatomy gives that man has assumed the erect posture within so recent a period that the body is not yet perfectly adapted for it.

The fascia covering the leg is arranged as in the other limbs. A single dense layer ensheaths the whole, blending intimately with the periosteum wherever it touches the bone, and with the ligaments both above and below. Its thickness prevents abscesses from readily appearing on the surface, and pus is more apt to burrow along the intermuscular septa.

The sartorius at its insertion sends a strong aponeurotic expansion to it, so that any action of the muscle makes the fascia tense. The superficial muscles of the leg have all a considerable origin from the fascia, and this greatly increases their effectiveness. They also arise from the septa which the fascia sends down between the muscles. Of these there is one on the outer side, passing inward to the posterior border of the tibia, and one passing between the tibia and fibula, usually spoken of as the interosseous ligament (Fig. 3182). These two separate the muscles in front and externally from the posterior muscles, dividing thus the leg into two separate compartments, which are practically independent of each other, as any effusion in one never passes into the other. The muscles in the anterior compartment are so compressed by the dense tissues surrounding them that they usually bulge out through an incised wound, and when it is necessary to make in it a longitudinal incision, as, for instance, when the anterior tibial artery is tied, it is advisable to relieve the sharp tension of the edge of the fascia by a cross cut.

The anterior compartment is subdivided by a layer of fascia extending from the external sheath to the anterior border of the fibula, separating off the peroneal muscles from the remainder. The latter again are separated by a fibrous partition, which passes between the anterior tibial and the extensor communis. This well-marked fibrous septum may be used as a guide in tying the anterior tibial artery. In the lower part of the leg the extensor of the great toe and the peroneus tertius lie directly outside the tibialis anticus. The order in which the tendons pass down over the instep is shown in the article on the *Foot*.

The anterior tibial artery (Fig. 3184) is the chief object of surgical importance in the anterior compartment. It is the smaller of the two divisions of the popliteal, and attains the front of the leg by passing between the two heads of the tibialis posticus muscle, and above the interosseous ligament, which is deficient in the upper part of the tibio-fibular interspace. It is here very firmly united with the denser fibrous tissues, and when wounded it is very difficult to secure it. As it is held open by its attachments, hemorrhage is usually profuse, and it is often necessary to tie the femoral artery to control it. The general direction of the vessel is under a line drawn from the inner side of the head of the fibula to midway between the malleoli. This latter point should be estimated by standing directly in front of the foot with a finger on each malleolus. As the artery lies in the first muscular interspace which occurs on passing outward from the tibial crest, there may be a slight groove brought out directly over the course of the artery when the muscles are caused to contract by strongly bending the foot upward. At its upper portion the vessel lies deeply against the tibia and the interosseous membrane,

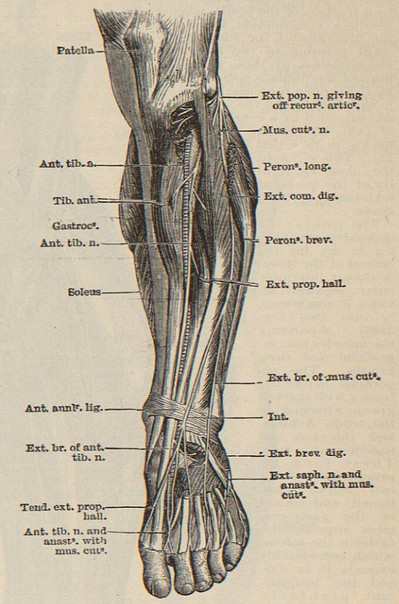

FIG. 3184.—Dissection of the Front of the Left Leg and Dorsum of Foot.

and between the tibialis anticus and the extensor communis. It is here very difficult to reach, and is not usually tied, except when wounded. In that case the usual rule is followed of enlarging the wound and securing the bleeding ends. Lower down, as the muscles become tendinous, it is more accessible and easily secured. It then lies between the tibialis anticus and the extensor proprius hallucis, the latter tendon covering it just as it passes under the annular ligament to become the dorsalis pedis. The artery is accompanied by the anterior tibial nerve, which reaches it by passing around the head of the fibula (Fig. 3185), where it is somewhat liable to injury. The nerve is, therefore, at first external to the vessel, but afterward it gets in front and occasionally crosses to the inner side. Venæ comites accompany the artery, and by their frequent anastomoses greatly increase the difficulty of securing it. It is not unusual for the artery to be wounded by splinters of bone when the tibia is fract-