DIAGRAMS

OF THE

FOOT OF THE HORSE.

WITH KEYS AND EXPLANATORY NOTES

BY

HENRY C. WILKIE, F.R.C.V.S.,
VETERINARY DIVISION, DEPARTMENT OF AGRICULTURE, NEW ZEALAND.

WELLINGTON.
BY AUTHORITY: JOHN MACKAY, GOVERNMENT PRINTER.
—
1904.

EPUB ISBN: 978-0-908329-85-4

PDF ISBN: 978-0-908332-81-6

The original publication details are as follows:

Title: Diagrams of the foot of the horse : with keys and explanatory notes

Author: Wilkie, Henry C. (Henry Charles)

Published: Govt. Printer, Wellington, N.Z., 1904

DIAGRAMS

OF THE

FOOT OF THE HORSE.

WITH KEYS AND EXPLANATORY NOTES

BY

HENRY C. WILKIE, F.R.C.V.S.,
VETERINARY DIVISION, DEPARTMENT OF AGRICULTURE, NEW ZEALAND.

WELLINGTON.
BY AUTHORITY: JOHN MACKAY, GOVERNMENT PRINTER.

1904.

THE FOOT OF THE HORSE.

THE present series of drawings, to illustrate the anatomical construction and mechanisms of the foot of the horse, while not professing anything like an exhaustive rendering of the subject, aim, however, at presenting in a simple manner to those unacquainted with comparative anatomy such essential facts as should be known to every agriculturist, horse-owner, and shoeing-smith. It has been found desirable to include in the series a short account of the construction of the leg as far as the knee, in order to indicate the course of the tendons which move the foot, the arrangements for their perfect sliding-action, the pads or bursæ over which they pass, the action of the fetlock-joint as a preventive of concussion, and many other important details which would not be apparent had only the hoof and its contents been delineated. It may, however, be explained that in a zoological sense the foot of the horse commences at the hock and knee joints respectively, but in this monograph the term "foot" is used in the commonly accepted way to denote the last joint of the toe with its surrounding structures.

1. NOTES ON DIAGRAMMATIC SECTION OF THE FORE LEG AND FOOT OF THE HORSE.

THIS diagram shows the structures which are disclosed by making a longitudinal section of the fore leg and foot of the horse, from the knee to the ground surface.

The *bones* forming the framework upon which the limb is built consist of a central column seen at Nos. 45, 29, 20, 3, with two small ones (only one of which is seen in this section) at the back of the fetlock (32); the sesamoids; and a single little bone within the hoof, called the navicular, from its similarity in shape, when seen lengthwise, to a boat (8).

Some of the *ligaments* which bind the bones together and support the synovial membranes are seen at Nos. 34, 26, 21, 16, 12, &c.

SESAMOID.—Greek, *sesamon*, the grain sesame; *eidos*, like to. These bones are somewhat like a grain in form.

NAVICULAR.—Latin, *navicula*, a boat; from *navis*, a ship.

SYNOVIAL.—Greek, *sun*, together; *oon*—Latin, *ovum*, an egg. From the appearance synovia has to the white of egg.

The *synovial membranes of the joints* are the secreting or manufacturing agents of the synovia or "joint-oil," a viscid fluid which bathes the inside of the joints, thus facilitating rapid movement with the minimum of friction.

The *tendons*, which are cord-like continuations of the muscles of the forearm, placed in front for extension and behind for flexion of the limb, are seen at Nos. 40, 43, 39. These tendons in many cases glide through sheaths, which are lined by a membrane secreting a viscid fluid identical with the synovia of joints. This gives the sheaths a highly slippery surface, and enables the tendons to glide to and fro with great rapidity and the least possible friction. Some of these tendon-sheaths are seen at Nos. 48, 44, 23, 10.

The *bursæ* are cushions placed beneath the tendons in certain situations to minimise friction, protect parts from injury, and to render more rapid the movements of tendons over resisting surfaces. They are little sacs containing a fluid allied to the synovia of joints. That bursæ are subject to injury from strain and overwork is seen in the frequency of bursal enlargements and disease among horses which have to do heavy or continuous work. Two large bursæ are seen at Nos. 31 and 19.

The *check ligament* (51) is one of the principal of those ligaments which act as stays or checks to tendons. Relieving the muscles of work by cutting off the strain, they enable the tendons to maintain independent rigidity. The check ligaments of the horse, of which the one under consideration is the most powerful, aided by the fascia of the arm (and thigh) and the great suspensory ligament of the fetlock, together form an anatomical peculiarity of equine animals which enables them to sleep in the standing position.

The *great suspensory ligament* of the fetlock (41) is seen to originate by two heads (47 and 49), and to divide into two branches (38), each branch being firmly attached to the summit of one of the sesamoid bones. Between these two branches of the ligament the synovial membrane of the fetlock-joint is prolonged as a blind sac. It is overdistension of this sac which causes the common swelling known as windgall.

SECRETING.—Latin, *secretus*, separated. The separation from the blood or its constituents of specialised substances such as synovia, horn, &c.

SAC.—Latin, *saccus*, a sack, a bag, pouch-like.

FASCIA.—Latin, *fascia*, a bandage. Used to designate a membranous bandage which envelopes the muscles of the forearm, the thigh, &c.

The *hoof* consists of an insensitive horny structure, which is, like the nail of the human subject, a modification of the skin. As the main scheme in the anatomical construction of the foot is not only to give protection to the more sensitive and delicate parts, but to provide mechanisms by which they are saved from the effects of concussion, the hoof is provided with sufficient elasticity to admit of some alteration in shape as the circumstances of bearing weight or not demand it.

The most elastic parts of the hoof are the coronary edge, the heels and the frog. When weight is placed upon the foot the following phenomena result: (1) The sinking backwards of the coronary edge from the front; (2) the sinking downwards of the coronary edge along its whole length, with expansion laterally; (3) the expansion backwards of the heels; (4) the expansion laterally of the heels and quarters; (5) a slight sinking of the sole, reducing its concavity. This alternate expansion and contraction, although very slight in degree, is sufficient to materially assist the circulation of the blood through the veins, which in the foot are extremely numerous, and being without valves allow of a certain amount of backward pressure.

The elastic horny pad called the *frog* (1), and the *plantar cushion*, a large mass of fibro-fatty tissue (13), with the lateral fibro-cartilages (to be considered hereafter), by their elasticity all assist in the expansion and contraction of the foot and the minimising of the effects of concussion. In any quick action it is upon the heels, where the greatest protection exists, that the horse first alights, the toe being more particularly used in giving propulsion.

The hoof is united firmly to its contents by means of a highly vascular structure—the *keratogenous membrane* (6). This membrane has been graphically described by Chauveau as enveloping the foot like a sock, while the hoof encloses the whole like a boot. The keratogenous membrane has upon its wall-surface a large number of "leaves," called the "sensitive laminæ," which dovetail with horny laminæ on the inside of the hoof. That portion of the keratogenous membrane which covers the sole is called the "velvety sole," and here also an intimate connection exists between it and the hoof, not, however, by laminæ, but by means of papillæ, the arrangement of which will be best understood by reference to the diagram (5). The papillæ in the drawing, however, are very greatly exaggerated in size, for demonstration purposes.

The *coronary cushion*, seen at No. 15, is a prominent ring around the upper edge of the foot, lodged in a special concavity of the horn termed the "cutigeral groove." This cushion is covered with highly vascular papillæ, and manufactures the horn of the wall of the hoof. Immediately above this is the *perioplic ring* (17), which manufactures a specialised kind of horn called the periople. This is thickest at the coronet, grows thinner as it passes downward, until it finally disappears just before the ground surface is reached. The periople, as it leaves the coronary region, assumes the character of a glaze or varnish, and it is to this that the horse's foot in a state of nature owes its hard glossy surface.

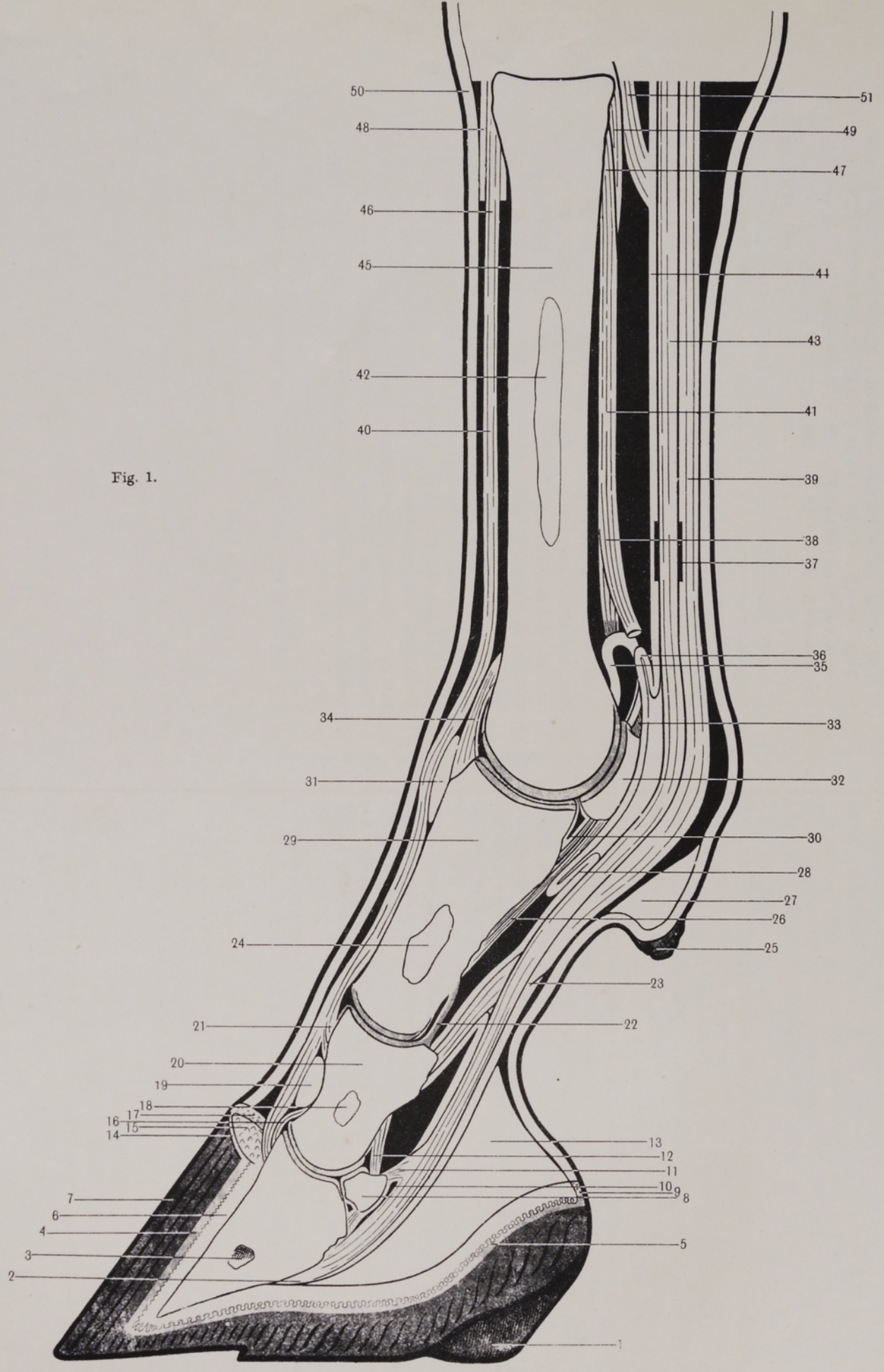
At No. 14 is seen a thin white substance called the *white zone*, which extends along beneath the coronary cushion, forming a separation between it and the laminæ.

An important structure, and one deserving of special notice, is seen at No. 10. This is a *synovial sheath*, which has incorrectly been termed a bursa—the *navicular bursa*.

Coronary.—Latin, *corona*, a wreath or crown.
Plantar.—Latin, *planta*, the sole of the foot.
Keratogenous.—Horn-producing. From the Greek *keras*, horn; *gennao*, I produce.

Laminæ.—Latin, *lamina*, a plate or leaf.
Papilla.—Latin, *papilla*, a pimple.

Fig. 1.



DIAGRAMMATIC SECTION OF THE FORE LEG AND FOOT OF THE HORSE.

Entered at Stationers' Hall, 1903.]

[Drawn by H. C. Wilkie.

REFERENCES.

Figure 1.

1. Bulb of the frog.
2. Attachment of the flexor pedis perforans tendon to the plantar surface or sole of the pedal bone.
3. Os pedis, or pedal bone.
4. Horny laminæ.
5. Junction of the horny sole and the sensitive sole.
6. Sensitive laminæ.
7. Wall of the hoof.
8. Navicular bone.
9. Coronary cushion.
10. Navicular sheath.
11. Ligamentous band from the tendon of the flexor pedis perforans to the summit of the navicular bone.
12. The superior navicular, or posterior lateral ligament.
13. The plantar cushion.
14. The white zone.
15. The coronary cushion, or wall-secreting substance.
16. Anterior lateral ligament.
17. The perioplic ring.
18. The medullary canal of the os coronæ or second phalanx.
19. Coronal bursa under the extensor pedis tendon.
20. The os coronæ, or second phalanx.
21. Band of attachment from the extensor pedis tendon to the second phalanx, acting as a ligament to the joint formed by the first and second phalanx.
22. A glenoidal fibro-cartilage acting as a ligament. This is a continuation of the articular cartilage seen at the ends of the bones.
23. The flexor pedis perforans tendon is here seen passing through the space left by the two branches of the tendon of the flexor pedis perforatus.
24. Medullary canal of the os suffraginis or first phalanx.
25. The "ergot."
26. The inferior sesamoidean ligaments.
27. The cushion of the fetlock; a small mass of loose fibro-fatty substance sometimes called the fatty cushion of the "ergot."
28. Showing the disposition of the metacarpo-phalangeal tendon-sheath at the lower part of the sesamoid region.
29. The os suffraginis, or first phalanx.
30. A portion of the synovial membrane of the fetlock-joint supported by the inferior sesamoidean ligament.
31. Bursa on the front of the fetlock under the tendon of the extensor pedis.
32. Sesamoid bone.
33. One of the branches of the great suspensory ligament of the fetlock attached to the summit of the sesamoid bone.
34. Capsular or anterior ligament of the fetlock-joint.
35. Prolongation of the synovial membrane of the fetlock-joint between the two branches of the great suspensory ligament.
36. Showing the disposition of the metacarpo-phalangeal tendon-sheath at the upper portion of the sesamoidean ligament.
37. Fibrous band separating the metacarpo-phalangeal synovial sheath from the carpal synovial sheath.
38. The point at which the great suspensory ligament of the fetlock divides into its two branches.
39. Tendon of the flexor pedis perforatus.
40. Tendon of the extensor pedis.
41. The great suspensory ligament.
42. The medullary canal of the large metacarpal bone.
43. Tendon of the flexor pedis perforans.
44. The carpal synovial tendon-sheath.
45. The large metacarpal bone.
46. Tendon of the extensor pedis emerging from its synovial sheath below the knee.
47. Inferior head of the suspensory ligament attached to the posterior and upper part of the large metacarpal bone.
48. Vaginal synovial sheath of the extensor pedis tendon.
49. Superior head of the suspensory ligament coming from its attachment to the os magnum.
50. Skin.
51. Check ligament.

FLEXOR.—Latin, *flexor*, that which bends.
PEDIS.—Latin, *pes*, a foot.
PERFORANS.—Piercing.
OS PEDIS.—Latin, *os*, a bone; *pedis*, from *pes*, a foot.
PHALANX.—Greek, *phalangx*, a digit—one of the finger or toe bones.
GLENOIDAL.—Greek, *glene*, a socket; *eidos*, a resemblance.
PERFORATUS.—Latin, *perforo*, I pierce; *perforatus*, pierced.
ERGOT.—From the French *ergot*, a spur, a cock's spur.

METACARPO-PHALANGEAL.—Greek, *meta*, beyond; *karpos*, the wrist; phalangeal, pertaining to the phalanges—from the Greek *phalangx*, a digit, one of the small bones of the finger or toe.
CARPAL.—Of the carpus. From the Greek *karpos*, the wrist, the joint which in the human subject corresponds to the knee of the horse anatomically.
EXTENSOR PEDIS.—Latin, *extensor*, that which stretches out.
METACARPAL.—Greek, *meta*, beyond; *karpos*, the carpus.
VAGINAL.—Sheath-like. From the Latin *vagina*, a sheath.

2. SUPERFICIAL DISSECTION OF THE FOOT.

This drawing is of a fore foot from which the hoof and skin have been removed, and exhibits the superficial disposition of the larger blood-vessels, the plantar nerve, and those vascular structures which lie immediately beneath the hoof, and are often collectively termed the "*sensitive foot.*"

The blood-supply of the foot of the horse is extremely luxuriant, as not only are the horn-secreting structures very richly endowed with blood-vessels, but the pedal bone itself is pierced by foramina in all directions, and is the most highly vascular bone in the economy.

The *nutrient* or *arterial blood* is derived from the *digital arteries*, one on either side of the leg (B). These arteries originate in the following manner: Just behind the knee a large vessel—a continuation of the radial artery—passes down the back of the leg, and immediately above the fetlock-joint bifurcates or divides into two. A loop made up of the *ulnar artery* and an *innominate* branch constitutes below and at the back of the knee what is called the subcarpal arch. From this arch four small vessels arise—one pair on either side—which run down the leg, having a branch on the outer and one on the inner side of each of the small *metacarpal* bones. These four small vessels join or *anastomose* with the large vessel previously mentioned, at the point where it divides into two terminal branches—the *digital arteries*. These digital arteries—one on either side of the leg—pass over the fetlock-joint, following the course of the flexor tendons, being placed immediately behind the *digital veins*, and in front of the plantar nerves, which here partially cover them.

The blood-supply of the foot is so important, both from physiological and clinical points of view, that it is necessary to briefly consider specially some of the more important branches given off by the digital arteries and their terminals. At E on the drawing is seen a small branch—the artery of the *ergot*—while near the middle of the pastern the *perpendicular artery* originates, and soon divides into an *ascending* and a *descending* branch, the latter going to the capsular ligament of the fetlock-joint and the former to the front of the *os coronæ*, where its branches join with those of the *coronary circle* and the *circumflex artery* of the coronet. Behind this, but much lower down, the artery of the plantar cushion is given off, which, like the last-named vessel, anastomoses with the coronary circle. Immediately below this two vessels are given off from each *digital artery*—an anterior and a posterior. These vessels unite with those of the opposite side to form what is known as the coronary circle. At the anterior part of this circle two branches are given off, which form a fine arch called the *circumflex artery* of the *coronary cushion*. Within the *lateral fibro-cartilage*, and close to the pedal bone, the digital artery of each side terminates by dividing into two branches—a small vessel the *preplantar*, and a larger one the plantar artery. The preplantar passes round the *preplantar notch* between the *basilar* and the *retrossal* processes, breaking up into numerous branches which go to the sensitive laminæ and others which bury themselves in the os pedis. By a large foramen on the under-surface of the os pedis the plantar artery enters the substance of the bone and traverses a canal known as the semilunar sinus. Here, having a semicircular disposition, it is called the plantar arch, which gives off ascending branches to the bone and a number of descending branches called the *inferior communicating-arteries*. These arteries emerge from the bone by large foramina, which may be seen at the inferior edge of the pedal bone. On leaving the bone they give off numerous branches to the *sensitive laminæ*, and then unite together to form a semicircular vessel around the solar surface of the toe. This vessel is the *circumflex artery of the toe*, which supplies the velvety sole with blood and anastomoses posteriorly on each side with a branch from the *preplantar* which traverses a groove in the pedal bone directly downward from the preplantar notch. (See Figure 4.)

The veins of the foot are chiefly remarkable for their absence of valves, and for their general disposition to form intricate networks or *plexuses*. A portion of the coronary plexus, with its union of vessels to form the digital vein, is seen in the drawing at J, and this disposition is characteristic (although the mesh shown is much larger) of the other plexuses. The *external venous plexuses* are—the solar plexus of the sole; the *podophyllous plexus* of the laminæ; the *coronary plexus* of the coronary region. The *solar plexus* anastomoses with the *podophyllous*, and the *podophyllous* with the *coronary*. The internal system of *veins* of the os pedis follows exactly the *arterial* system just described.

The *plantar nerve* terminates by three branches. The first goes to the *skin* and the *coronary cushion*, the second to the *coronary cushion* and the *laminæ*, while the third descends to the *basilar process*, follows the *preplantar artery*, gives a branch to the *plantar cushion*, a filament to the coronary circle, a number of filaments to the *podophyllous tissue* or sensitive laminæ, and several filaments follow the *plantar artery* into the substance of the pedal bone.

Plantar.—Latin, *plantaris*, belonging to the sole of the foot.
Foramina (plural).—Latin, *foramen*, an opening; *foro*, I bore.
Radial.—Latin, *radius*, a ray.
Bifurcates.—Latin, *bis*, twice; *furca*, a fork.
Ulna.—Latin, *ulna*, the elbow.
Innominate. Latin, *in*, not; *nomen*, a name.
Subcarpal.—Latin, *sub*, under; *carpus*, the wrist.
Anastomose.—Greek, *ana*, through; *stoma*, a mouth.

Circumflex.—Latin, *circum*, around; *flexus*, bent.
Basilar.—Latin, *basis*, foundation.
Retrossal.—Latin, *retro*, behind; *ossa*, bones.
Semilunar.—Latin, *semi*, half; *luna*, the moon.
Plexus.—Latin, *plexus*, twisted.
Podophyllus Tissue.—The sensitive laminæ or leaves. Greek, *podos*, of a foot; *phullon*, a leaf.

3. THE SOLE OF THE HOOF.

This drawing is a diagrammatic representation of the plantar surface of the foot, and is made to show the distinctive parts and the normal weight-bearing surfaces.

The *plantar surface* of the hoof is an unsymmetrical figure of which the outer half is the larger, and is divided into three regions—the toe or front portion, the quarters (the quarter of one side being seen between where the lines F and H cut the wall), and the heels, the remaining portion.

More especially the plantar surface consists of the *pyramidal elastic pad* called the *frog*, the inferior or ground surface of the wall, the inflection of the wall to form the bars seen on either side of the frog, the sole proper, and uniting structures—viz., the white line F and the commissures of the frog D.

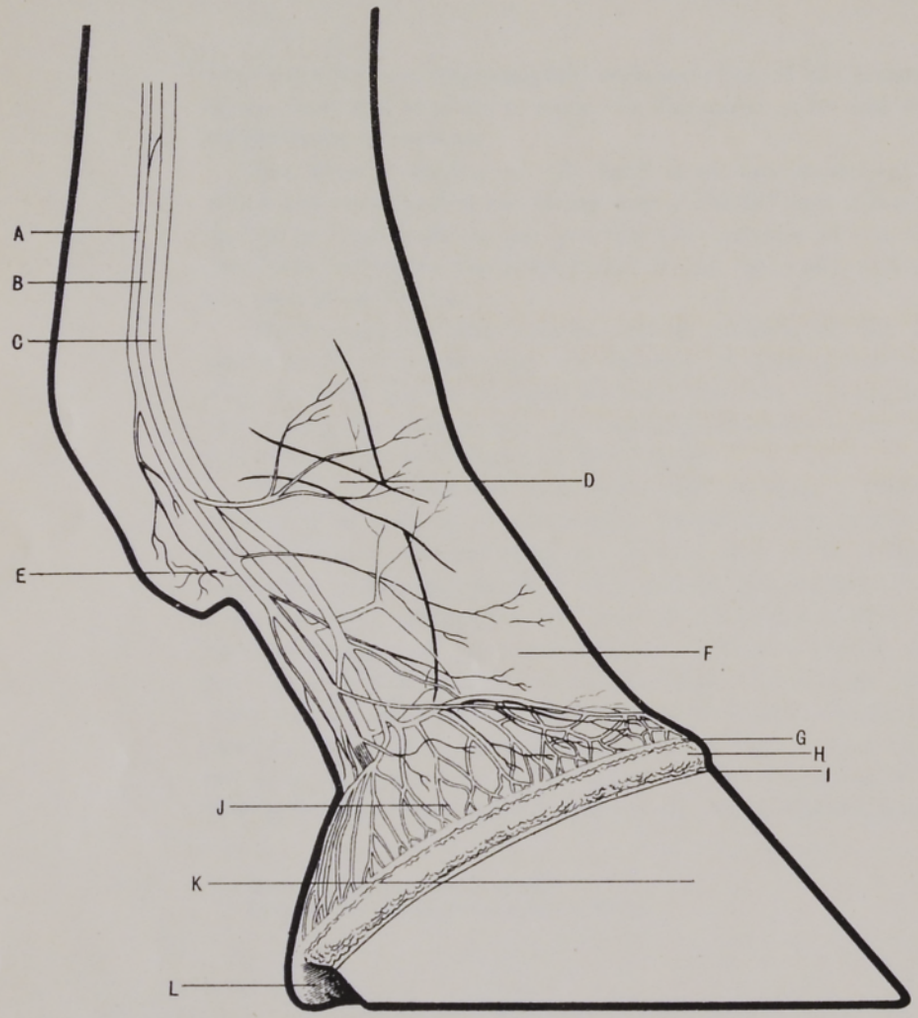
The frog consists of two *bulbs* and an *apex*. The bulbs are divided by a cleft called the *median lacuna* or *cleft of the frog*, and the apex which extends along the sole as seen at H. The horn of which the frog is composed is of a rubber-like consistency when in a normal state, and covers that mass of *fibro-fatty* matter called the *plantar cushion*. It has two principal functions—firstly, to act the part of a buffer, and in connection with the plantar cushion to minimise the effects of concussion; and, secondly, to afford a secure foothold, which it is eminently suited for doing. These two uses of the frog, together with its assistance in the expansion of the foot, clearly demonstrate the necessity for its being allowed contact with the ground. The shaded portions of the frog in the diagram show the extent of weight-bearing surface it should have when in a healthy state and not interfered with by the drawing-knife.

The wall G as seen in the diagram is the inferior or ground surface of the wall of the hoof. It is inflected inwards at the heels to form two prominent ridges known as the *bars*. This arrangement allows room for the frog, and gives a far greater extent of weight-bearing surface than would otherwise be obtained. The whole of the wall and bars *are intended to bear weight*, and in a normal foot exhibit great development. In a foot where the bars have been constantly cut away they atrophy or waste for want of use, and in many cases are of very small size. They should, however, be as well developed as the other portion of the wall of which they are only a part, and therefore *should never on any account be removed*. The wall and bars are united to the sole by means of a dovetailing arrangement seen in what is known as the white line (F). This line of union is of a softer consistency than the adjoining parts, and by its elasticity allows of a certain amount of pressure outward by the sole which takes place when weight is placed upon the limb.

The sole is concave on the ground surface, a condition which is more pronounced in the hind than in the fore feet. It undergoes a slight amount of *flattening when weight is placed upon the limb*, but it is not intended to touch the ground. The horn of the sole should be thick and strong, as it has to protect the delicate structure beneath, and *should not therefore be thinned down* in preparing the foot for shoeing, as any extra growth of horn exfoliates or shells out as the normal thickness is reached.

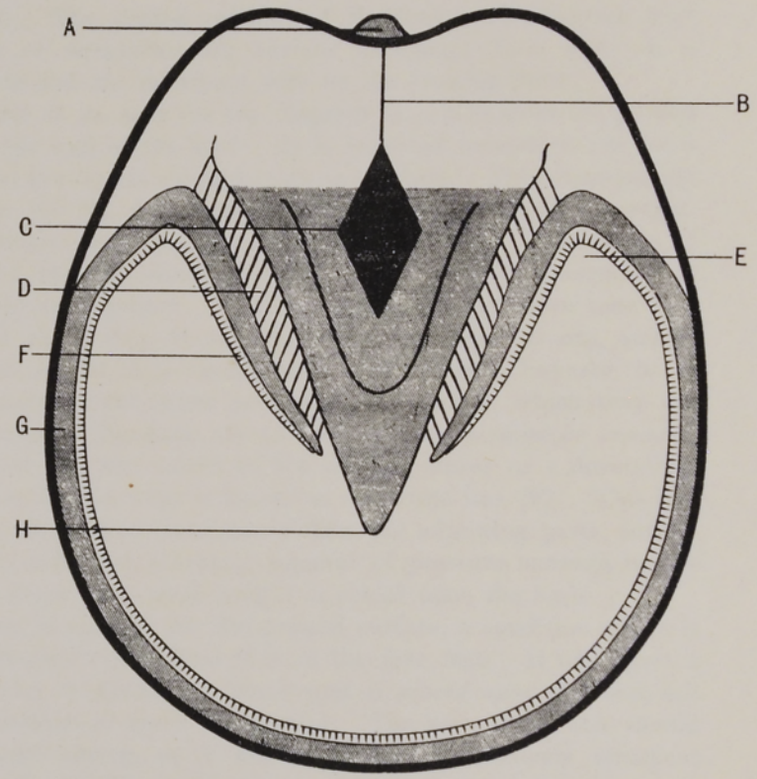
Median.—Latin, *medius*, middle.
Lacuna.—Latin, *lacuna*, a space or cavity.

Fig. 2.



SUPERFICIAL DISSECTION OF THE FOOT.

Fig. 3.



THE SOLE OF THE HOOF.

SHOWING THE NORMAL WEIGHT-BEARING SURFACES (DIAGRAMMATIC).

Entered at Stationers' Hall, 1903.]

[Drawn by H. C. WILKIE.

REFERENCES.

Figure 2.

A. The plantar nerve.
B. The digital artery.
C. The digital vein.
D. A reinforcing ligamentous band from the inferior extremity of the suspensory ligament to the extensor pedis tendon.
E. The artery of the ergot.
F. The expansion of the tendon of the extensor pedis.
G. The perioplic ring.
H. The coronary cushion.
I. The white zone.
J. The superficial layer of the coronary venous plexus.
K. The podophyllus tissue, or sensitive laminæ.
L. The fibro-fatty frog.

Figure 3.

A. The medium point of the upper part of the hoof at the heel.
B, C. Median lacuna or cleft of the frog.
D. The commissures of the frog or lateral lacunæ.
E. The sole. The pointer is on that part where the inflection of the wall takes place.
F. The white line, or junction of the wall and the sole.
G. The wall.
H. The apex of the frog.

4. SECTION OF A FOOT.

This drawing was made from a preparation in which the side of the hoof had been removed, the bones and lateral cartilages, denuded of the softer structures, being seen *in situ*.

A portion of the internal structure of the hoof is seen at the heel and in the coronary region, where A indicates the inner surface of the periople, B of the groove for the reception of the coronary cushion, and D the *keraphylla* or horny laminæ which dovetail with the vascular laminæ of the *podophyllus* tissue.

The *sole* of the hoof is here shown as in a section through its greatest concavity, while the weight-bearing surface of the wall is somewhat exaggerated in extent.

The length of the weight-bearing surface of the frog, and its level with the ground surface of the wall, show the extreme extent of bearing which may be obtained by allowing a horse with a fairly long frog to retain this organ in its natural condition.

The *pedal* bone is drawn from a natural lateral aspect without section, and shows the articulation with the second phalanx and the numerous foramina by which the body of the bone is perforated. Along the inferior margin some large foramina are seen, which allow exit to the inferior communicating-arteries as they emerge from the bone to form the circumflex artery of the toe. The preplantar notch seen at I in this specimen has, as is often the case in adult horses, been converted into a foramen, and the groove continuing it shows the course of the preplantar artery forward. The small groove immediately beneath the preplantar foramen is for the reception of a branch of the preplantar artery as it goes to make its anastomosis or union with the posterior portion of the circumflex artery of the toe.

The drawing also shows the contour, extent, and attachments of the *lateral fibro-cartilage*. The anterior portion of the cartilage extends well forward over the body of the second phalanx, round which it is slightly curved. It does not meet its fellow of the opposite side, but the space between them is not very considerable. The anterior limit of the cartilage can be felt in the living animal, unless the skin is very coarse. It is firmly bound down to the anterior lateral ligament of the joint between the second and third phalanges. The upper edge of the cartilage presents a wavy line, the fourth wave from before backward being of considerable height and easily observed as the highest point of the heels in the living animal, being considerably above the upper edge of the hoof. The cartilage curves downwards at its posterior extremity on the side of the bulb of the frog, and then takes another sweeping curve to its attachment to the pedal bone. The space thus left between its posterior extremity and the attachment to the basilar and retrossal processes is normally filled up with dense fibrous tissue.

The *fibro-cartilages* are composed of an irregularly mixed mass of fibrous and cartilaginous tissue. The condition of these cartilages in cases of sidebone was for long considered by many to be a calcification, but, as Mr. J. A. Gilruth, M.R.C.V.S., proved some years ago by an extensive series of preparations, it is a true ossification or conversion of the cartilage into bone.

The *lateral fibro-cartilages* only occur in *solidungula*—viz., such animals as have a single solid hoof (horse, ass, zebra), and in these animals they give the well-known rounded form to the heels. Their use in the animal economy is—(1.) To assist in the expansion of the foot and recovery after expansion, which is necessary in order to prevent the untoward effects of concussion. (2.) The cartilages allow of an extended area for the attachment of the podophyllous tissue, and by their elasticity prevent the separation of these from the horny laminæ during contraction and expansion. (3.) They also afford support and protection to a number of blood-vessels, provide foramina for the passage of large veins, and by their movements facilitate circulation.

Keraphylla.—Greek, *keras*, horn *phullon*, a leaf.

Solidungula.—Latin, *solidus*, sol d ; *ungula*, a hoof.

5. SECTION OF THE WALL OF THE HOOF.

This is a diagrammatic representation of the manner of dovetailing which occurs between the horny and the *vascular laminæ*. The layers of horn A, B, and C represent respectively the periople or outer hard varnish-like horn, the horn of the wall proper, and the inner portion of the wall from which the keraphylla or horny leaves arise.

The circulation is diagrammatically represented by red vessels at F conveying the nutrient arterial blood to the sensitive laminæ while the blue vessels at E are bringing *venous* blood from the part.

The horn of all parts of the foot, except the horny laminæ, is perforated by tiny canals running from above downwards. These are funnel-shaped at their origin, and contain there the end of the *papillæ* by which the horn is manufactured. These canals are not quite empty, but contain at varying intervals a cellular substance. The use of the horn-tubes is to allow of the absorption and evaporation of water, in order to keep the horn in an elastic and sound condition. The amount of moisture contained in horn is very considerable. A dried specimen of a hoof which has been kept for years and has become very brittle from the evaporation of fluid will, if placed in water for a few hours, greedily absorb it to such an extent that it regains very much of the shape and appearance it had during the life of its owner.

Papillæ.—Latin, *papilla*, a small pimple.

The *periople* at its origin near the coronet is thick, and gradually becomes thinner as it passes down over the wall. At first its horn-tubes are exceedingly small, and later on are apparently lost. The object of the *periople* is to prevent the too-rapid evaporation of water from the wall, and the effect of its removal is easily seen in cases where it is constantly rasped away. On no account, therefore, should the rasp be applied to the wall of the foot, or the horn will become brittle and lose its elasticity. The horn of the frog contains a large amount of moisture, and if kept in contact with the ground, as it should be, rapidly absorbs water through its large tubes.

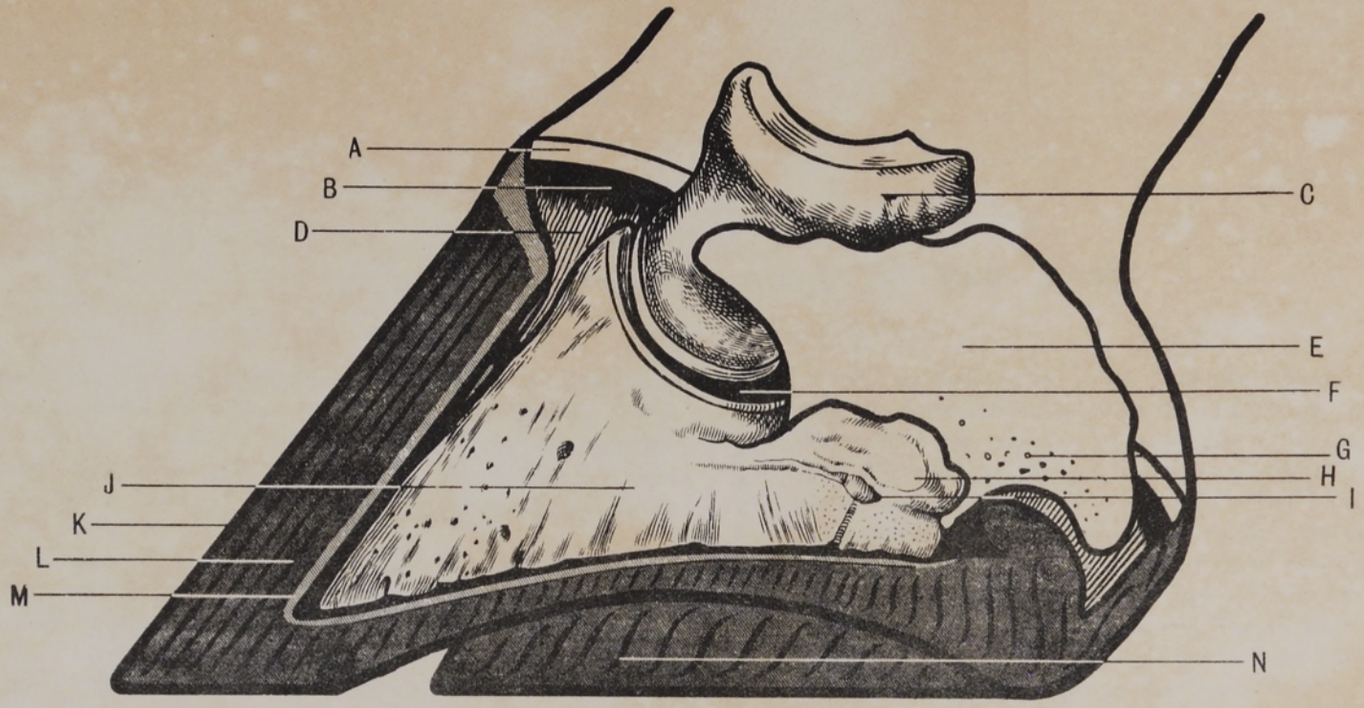
The horn of the bulbs of the frog differs from that of any other part of the hoof in that here, in addition to the ordinary horn-tubes, other tubes are found which are the ducts or outlets of sweat-glands situated in the *plantar cushion*. (Franck.)

The immediate union of the horny and the sensitive laminæ is seen in the diagram to be effected by secondary laminæ from each structure, and the secondary horny leaves are probably manufactured by the secondary sensitive.

The other parts of the hoof are secreted or manufactured in the following way: The periople by the perioplic ring; the wall by the coronary cushion (coronary secreting substance); the sole by the *keratogenous* membrane of the sole; the frog by the same membrane of the *plantar cushion*.

Keratogenous.—Greek, *keras*, horn; *gennao*, I produce.

Fig. 4.



SECTION OF A FOOT.

Fig. 5.

SECTION OF THE WALL OF THE HOOF.

Entered at Stationers' Hall, 1903.]

[Drawn by H. C. Wilkie.

REFERENCES.

Figure 4.

A. Inner surface of the periople or coronary frog-band.
B. Groove for the reception of the coronary cushion—the cutigeral groove.
C. The second phalanx, or os coronæ.
D. The horny laminæ.
E. The lateral fibro-cartilage.
F. The joint between the os coronæ and the os pedis.
G. Foramina in the lateral fibro-cartilage for the passage of veins.
H. The basilar process of the os pedis.
I. The preplantar notch converted into a foramen.
J. The body of the os pedis.
K. The periople.
L. The wall of the hoof.
M. The horny laminæ.

Figure 5.

A. The periople.
B. The wall.
C. The inner portion of the wall from which the keraphylla or horny leaves originate.
D. The vascular laminæ, showing the secondary leaves.
E, F. Blood-vessels.
G. Bone.

By Authority: John Mackay, Government Printer, Wellington.—1904.

[1000/6/1903–4998

p-19