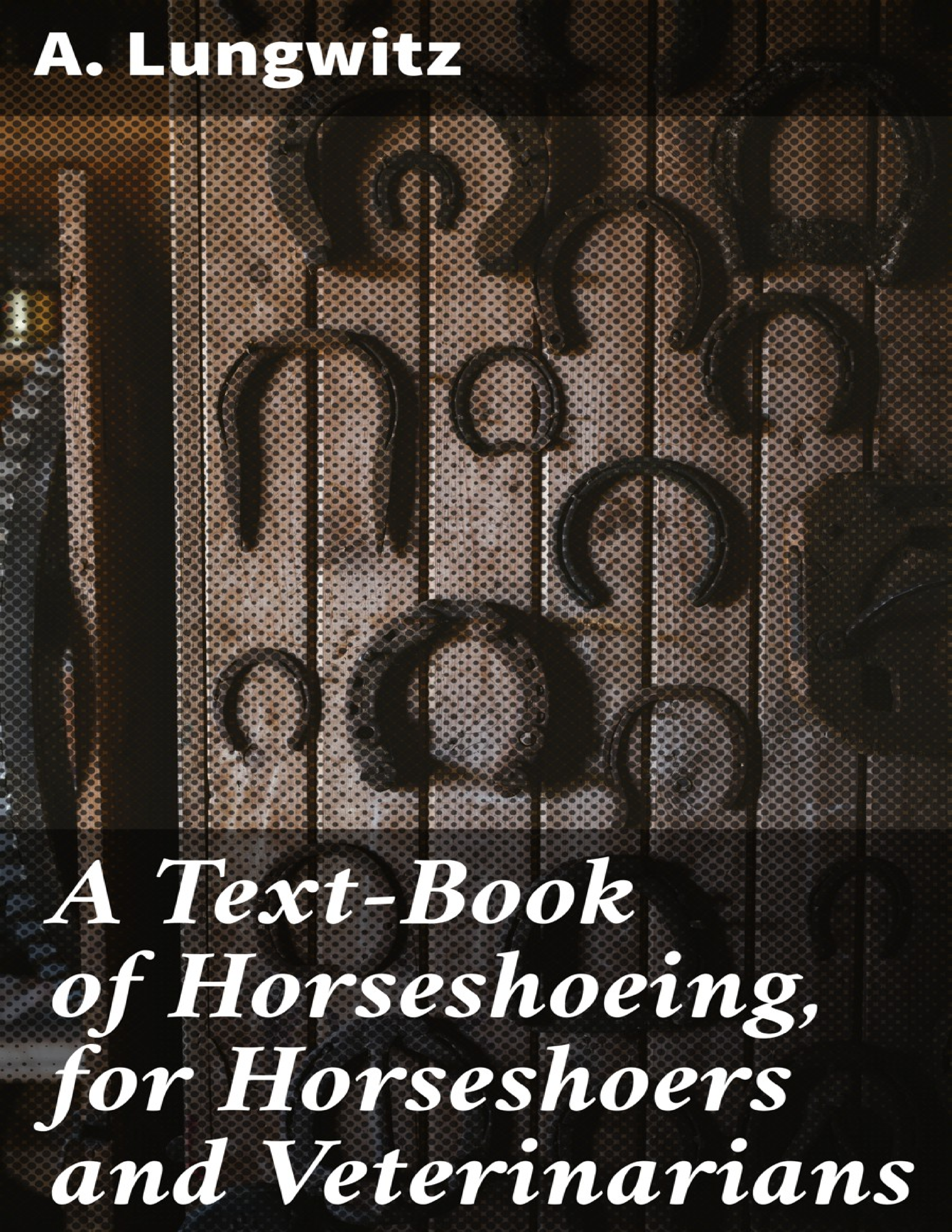

A. Lungwitz

A Text-Book of Horseshoeing, for Horseshoers and Veterinarians

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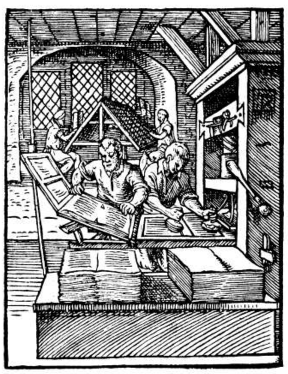

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INTRODUCTION.

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Horseshoeing is an industry which requires, in equal degree, knowledge and skill.

The word “horseshoeing” embraces various acts, especially preparing the iron sole, the horseshoe; forming it and fitting it to the hoof, whose ground-surface has been previously dressed in accordance with the direction of the limb, and fastening it to the hoof by means of nails.

Owing to the complicated structure of the hoof, success in the practice of horseshoeing requires a knowledge of the anatomy and physiology of the horse’s body in general and of the foot in particular.

The object of shoeing is,—

1. To protect the hoof from excessive wear, and thus render the horse continuously serviceable upon our hard roads.
2. To prevent slipping and falling during the winter season.
3. To so far remove the disadvantages of faulty positions of the limbs that horses may render good service, and, in some cases,
4. To cure or improve diseased or defective hoofs or feet.

Horseshoeing, though apparently simple, involves many difficulties, owing to the fact that the hoof is not an unchanging body, but varies much with respect to form, growth, quality, and elasticity. Furthermore, there are such great differences in the character of ground-surfaces and in the nature of horses' work that shoeing which is not performed with great ability and care induces disease and makes horses lame.

In view of these facts, a thorough training of the young horseshoer in the principles and practice of his trade is not only greatly to be desired, but is really essential to success; unreasoning work does as much harm in this as in any other vocation. *A good common-school education is necessary* (more will do no harm). Further requisites are a *healthy body*, not too tall, *liking for the work, aptness*, an active, *reasoning mind, fearlessness, dexterity, a good eye for proportion*, and, finally, *careful selection of a master-instructor*. Theoretically educated, practically experienced and approved masters, in whose shops all kinds of horses are shod, are to be preferred.

During his term of apprenticeship the young apprentice should *learn to make drawings of horseshoes, of tools of the trade*, and of hoofs of various forms, and should also make *one or more model shoes as an indication of his ability*. After completing his time he should seek a position in a first-class shop, either at home or abroad. A visit to foreign lands will widen one's mental horizon and make him a broader, abler man in every respect. Later, opportunity will be given to some (in Germany) to join the cavalry, and thus acquire a good education in shoeing under the patronage of the government. Finally, a course of instruction in a school of horseshoeing will convert an already practical and intelligent horseshoer into a thoughtful, capable, expert workman.

The scope of horseshoeing is by no means so narrow and insignificant as it may appear, and since a knowledge of the anatomy and physiology of the horse’s body in general, and of the foot in particular, is necessary, it is evident that the schools of horseshoeing in which one can get the best instruction are those in which there is not only a regularly graded course of instruction, with demonstrations upon dissected material and upon living horses, but also an abundance of daily work at the forge and on the floor in the shoeing of horses. A course of four to six weeks is not sufficient.

Furthermore, it should be borne in mind that schools of horseshoeing are not for the purpose of instructing young men in all matters which pertain to the trade, but only in the making of shoes, the critical examination and management of hoofs, and the rational and skilful performance of shoeing. For this reason it is not advisable for young men to attend a school of horseshoeing until they have at least completed their apprenticeship.

HORSESHOEING.

PART I.

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CHAPTER I.
THE GROSS ANATOMY OF THE HORSE.

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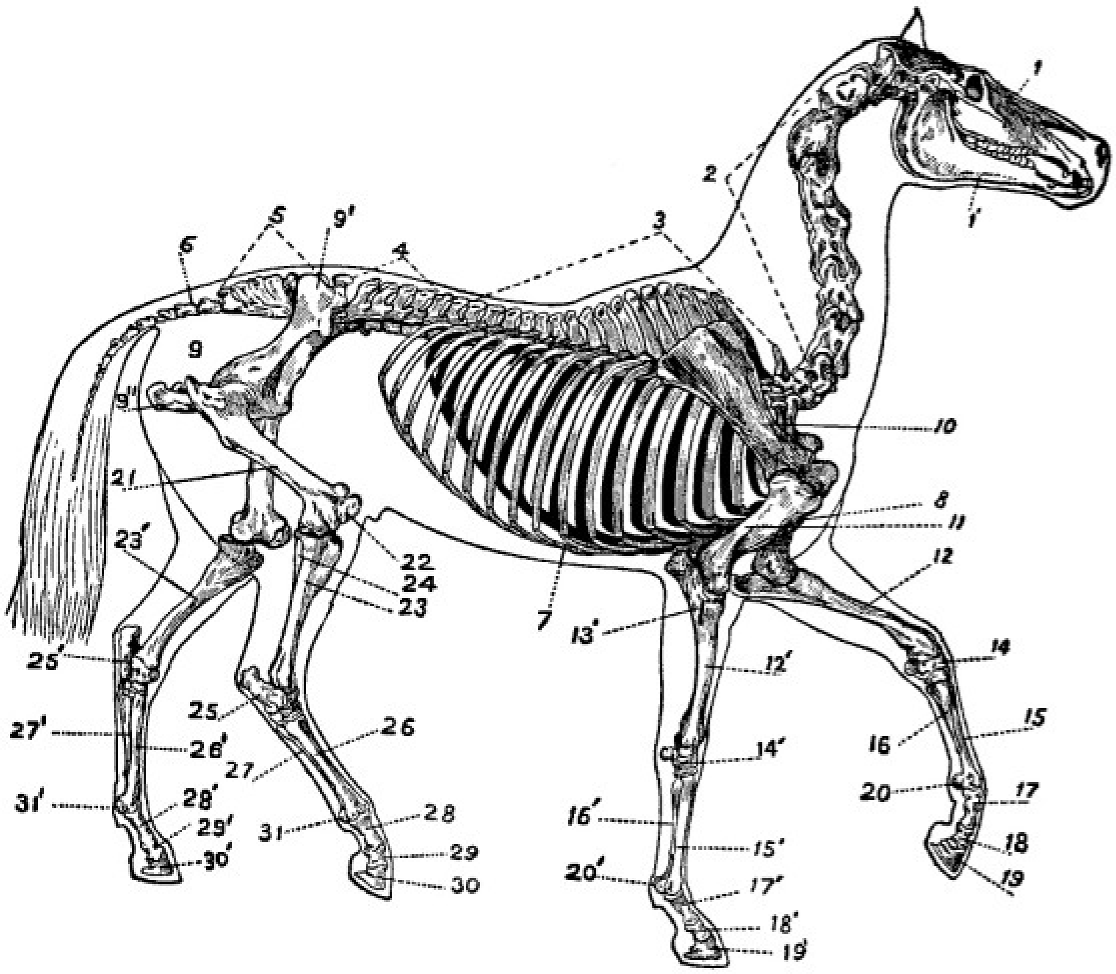
The supporting structure of the horse’s body is the **bony framework** or skeleton (Fig. 1, page 18). We distinguish in the skeleton the bones of the head, trunk, and limbs.

The **bones of the head** are numerous and, excepting the lower jaw, are solidly united with one another. In general, we distinguish in the head only the upper and lower jaws (1 and 1′). Both form various cavities; for example, the cranial cavity, in which the brain lies, the orbital cavities (eye-sockets), the nasal passages, and the mouth. Besides, the teeth are set in the jaws.

The **trunk** comprises the bones of the spinal column, thorax, and pelvis.

The *spinal* or *vertebral column* (2 to 6), which bears the head at its anterior end, is the chief support, of the entire skeleton. It consists of from fifty-two to fifty-four single and irregular bones called vertebræ, placed in the upper part of the median vertical plane of the body. Each vertebra, with the exception of those of the tail (coccygeal or caudal vertebræ), is traversed by a large opening called the vertebral foramen. The vertebræ are placed end to end in a row, and through them runs a continuous large canal called the *vertebral* or *spinal canal*, in which lies the spinal cord. The horse has seven cervical, eighteen dorsal, six lumbar, five sacral, and sixteen to eighteen caudal vertebræ. The sacral vertebræ are grown together to form one piece called the sacrum.

FIG. 1.



SKELETON OF THE HORSE.—1, bones of the head; 1′, lower jaw; 2, cervical vertebræ; 3, dorsal vertebræ; 4, lumbar vertebræ; 5, sacral vertebræ (sacrum); 6, coccygeal vertebræ; 7, ribs; 8, sternum (breast-bone); 9, pelvis; 9′, ilium; 9″, ischium; 10, scapula (shoulder-blade); 11, humerus; 12, radius; 13, ulna; 14, carpus (knee); 15, large metacarpal bone (cannon); 16, rudimentary metacarpal bones (splint-bones); 17, os suffraginis (long pastern); 18, os coronæ (short pastern); 19, os pedis (hoof-bone); 20, sesamoid bones; 21, femur; 22, patella (knee-pan, stifle); 23, tibia; 24, fibula; 25, tarsus, or hock; 26, large metatarsal bone (cannon); 27, rudimentary metatarsals (splint-bones); 28, os suffraginis (long pastern); 29, os coronæ (short pastern); 30, os pedis (hoof-bone, “coffin bone”); 31, sesamoid bones.

The *thorax* is formed by the ribs and the breast-bone or sternum. The horse has eighteen ribs on each side (7), and all articulate with the dorsal vertebræ. The first eight pairs unite by their lower ends directly to the sternum or breast-bone, and are therefore called *true ribs*, while the last ten pairs are only indirectly attached to the sternum, and are consequently called *false ribs*. The sternum (8) lies between the forelegs, and helps to form the floor of the chest cavity. The space enclosed by the bones of the thorax is called the thoracic, pulmonary, or chest cavity, and contains the heart and lungs. The *bones of the pelvis* form a complete circle or girdle. The upper part, called the ilium (9′), articulates on its inner side with the sacrum (5), while its outer side is prolonged to form a prominent angle, which is the support of the hip, and is called the “point of the hip.” The posterior part of the pelvis is called the ischium (9″), and that part lying between the ilium and the ischium and forming part of the floor of the pelvis is called the pubis.

The space between the thorax and the pelvis, bounded above by the lumbar vertebræ and shut in below and on the sides by the skin and muscular walls of the belly (abdomen), is called the *abdominal cavity*. This cavity opens directly into the pelvic cavity, and contains the stomach, intestines, liver, spleen, pancreas, kidneys, and a part of the generative organs. The thoracic and abdominal cavities are separated by a muscular partition, the *diaphragm*.

The **bones of the limbs** may be likened to columns, upon which the body rests; they articulate with one another at various angles, are tubular in structure, and strong.

The bones of the **fore-limbs** *do not articulate directly with the bones of the trunk*, but are attached to the body by means of the skin and muscles. From above to below we distinguish the following bones:

1. The *scapula*, or shoulder-blade (10), a flat, triangular bone, prolonged at its upper border by a flat, very elastic cartilage, called the scapular cartilage. At its lower end the scapula articulates with—

2. The upper end of the *humerus* (11), forming the *shoulder-joint* (scapulo-humeral articulation). The humerus articulates at its lower end with—

3. The *radius* (12) and the *ulna* (13), to form the *elbow joint*. These two bones are the basis of the *forearm*. The ulna, smaller and weaker than the radius, lies behind and projects above it to form the point of the elbow. The lower end of the radius articulates with—

4. The *carpus*, or *knee* (14), which comprises seven small, cubical bones disposed in two horizontal rows, one above the other. The upper row comprises four bones and the lower row three. The lower row rests upon—

5. The large metacarpal or *cannon bone*, and the two rudimentary metacarpal or *splint-bones*. The lower end of the radius, the upper ends of the metacarpal bones, and the small carpal bones together form the carpal or *knee-joint*

(wrist of man). Of the metacarpals, the middle one is the largest, longest, strongest, and most important, and is called the *large metacarpal*, *cannon*, or *shin-bone* (15). It articulates at its lower end with the os suffraginis, or long pastern (17), and with the two small sesamoid bones (20). On each side of the upper part of its posterior surface lie the two long, slender splint-bones (16). The inner splint-bone is sometimes affected with bony thickenings (exostoses) called “splints.”

6. The bones of the *phalanges* (all bones below the cannon) will be fully described in another place.

The bones of the **hind limbs** articulate *directly* with the pelvis at the hip-joint. They are stronger than the bones of the anterior limbs. We distinguish the following bones in the hind legs:

1. The highest bone in the hind limb is the *femur* (21). It is the strongest bone in the entire body. It lies in an oblique direction downward and forward, and at its lower end articulates with—

2. The *patella* (22), the *tibia* (23), and the *fibula* (24), to form the *stifle-joint* (knee of man). The patella plays over the anterior surface of the lower end of the femur. The fibula is small, and lies against the upper and outer side of the tibia. The latter at its lower end articulates with—

3. The bones of the tarsus, or *hock* (25), which are six small, irregular bones disposed in three rows, one above another. The *os calcis*, or *heel-bone*, and the *astragalus* are in the uppermost row, and are the most important. The former projects above the true hock-joint from behind, to form a long lever, the upper end of which is called the

“point of the hock,” and the latter articulates with the tibia. The tarsal (hock) bones articulate below with—

4. The *metatarsal bones* (26 and 27), which are longer, and the cannon narrower from side to side, than the corresponding metacarpal bones, but are otherwise similar.

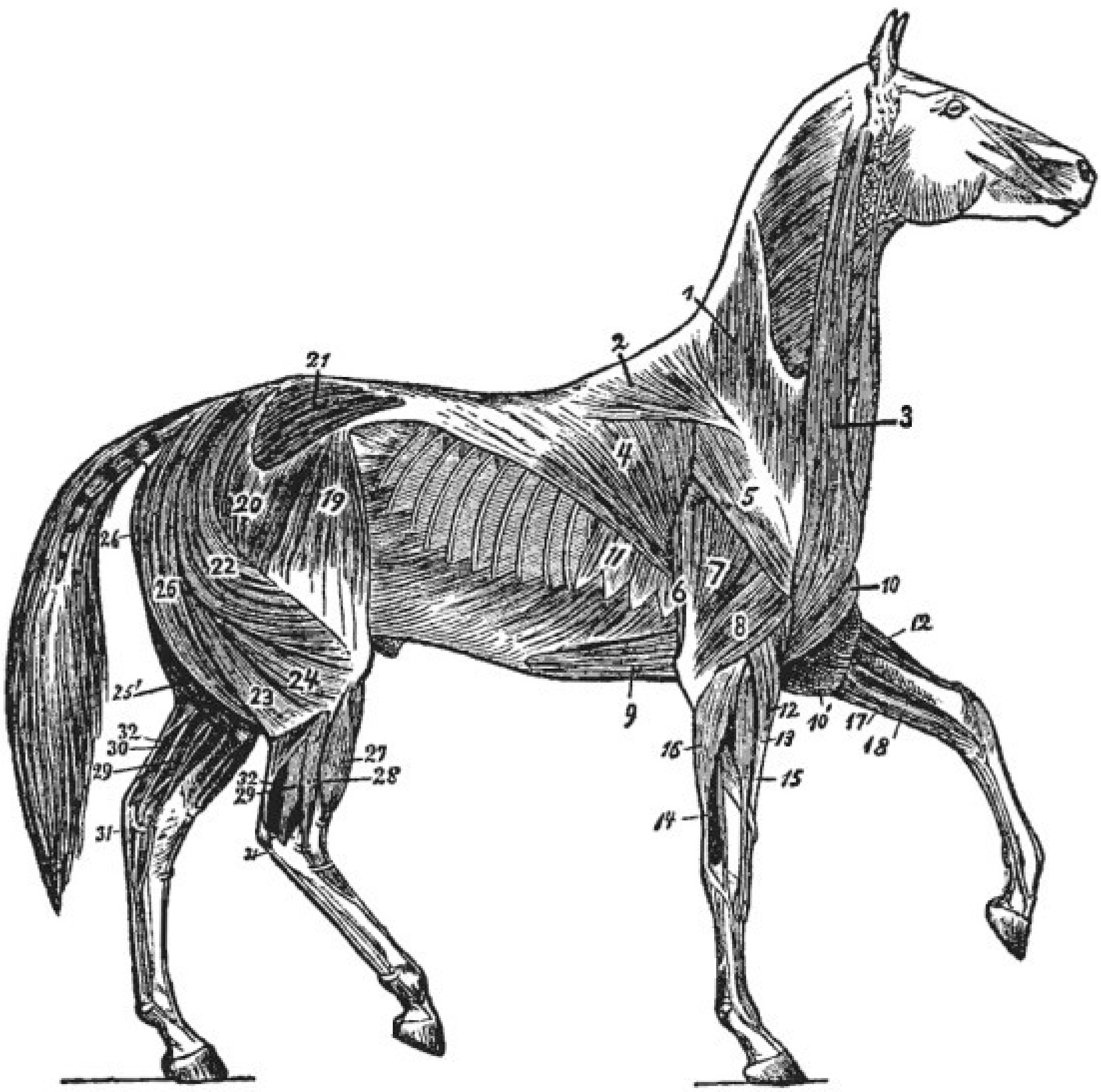
5. The *phalanges* of a hind limb (28 to 31) are also narrower than those of a fore-limb, but are nearly alike in other respects.

All the horse’s bones present small, but more or less distinct openings (nutrient foramina) for the passage of blood-vessels and nerves. Many bones possess roughened elevations and depressions, to which ligaments, tendons, or muscles are attached. With the exception of the os pedis, all bones are enveloped in a sort of “bone-skin” called **periosteum**. The bones unite among themselves to form either *movable* or *immovable unions*. A movable union between two or more bones is termed a “joint,” or **articulation**. The articulating ends of the bones, presenting on one side a convex surface (head or condyle) and on the other a corresponding concave surface (glenoid or cotyloid cavity), are covered with elastic *articular cartilage*. The bones are bound together by means of **ligaments**, which are tough, fibrous, cord-like, or sheet-like structures. Ligaments are either (1) *capsular* or (2) *funicular* (cord-like). Every articulation in the limbs possesses a capsular ligament, and all, except the shoulder-joint, have several funicular (cord-like) ligaments. The capsular ligaments are lined upon their inner face with a delicate membrane (synovial membrane) which secretes the *synovia*, or “joint-water,” whose function is to lubricate the joint and prevent friction; they enclose the joint in a sort of air-tight cuff or sack. The funicular ligaments are very strong and often large, and are the chief means of union of the bones. The immovable articulations are termed *sutures*; they are found principally in the head. The mixed joints are found between the bodies of the vertebræ, each two of which are united by an elastic fibro-cartilage which, in the form of a pad, lies between them, and by its elasticity allows of very slight movement, though the spinal column as a whole can execute manifold and wide movements, as shown by the neck and tail.

Joints which permit motion in all directions are known as **free joints**; such are the shoulder- and hip-joints (ball-and-socket joints). Those which admit of motion in but two directions (flexion and extension), and often to a very limited extent, are called **hinge-joints**,—*e.g.*, the elbow, hock, and fetlock. The joints between the long and short pasterns and between the latter and the pedal bone are imperfect hinge-joints, because they allow of some other movements besides flexion and extension. The articulation between the first and second cervical vertebræ (atlas and axis) is called a **pivot-joint**.

The skeleton represents a framework which closely approaches the external form of the body, and by reason of its hardness and stiffness furnishes a firm foundation for all other parts of the body. By reason of the great variety of position and direction of the bones, and of the fact that changes of position of each single part of this complicated system of levers may result in the greatest variety of bodily movements, we can readily understand how the horse is enabled to move from place to place. Of course, the bones have no power of themselves to move, but this power is possessed by other organs that are attached to the bones. These organs are the **muscles**, and, owing to their ability to contract and shorten themselves, and afterwards to relax and allow themselves to be stretched out, they furnish the motive power that is communicated to and moves the bones.

FIG. 2.



Outer Muscles of the Horse.—1, cervical trapezius; 2, dorsal trapezius; 3, mastoido-humeralis; 4, great dorsal muscle; 5, long abductor of the arm; 6, long extensor of the forearm; 7, large extensor of the forearm; 8, short extensor of the forearm; 9, sterno-trochinus (deep pectoral); 10, sterno-aponeuroticus; 11, great serratus; 12, common extensor of the metacarpus; 13, common extensor of the toe (anterior extensor); 14, common extensor of the long pastern (lateral extensor); 15, oblique extensor of the metacarpus; 16, external flexor of the metacarpus; 17, internal flexor of the metacarpus; 18, oblique flexor of the metacarpus; 19, fascia lata; 20, superficial gluteus (anterior portion); 21, middle gluteus; 22, superficial gluteus (posterior portion); 23 and 24, femoral biceps; 25, semitendinosus; 26, semimembranosus; 27, anterior extensor of the toe; 28, lateral extensor of the toe; 29, perforans muscle (deep flexor of toe); 30, oblique flexor of the phalanges; 31, perforatus tendon (superficial flexor of phalanges); 32, Achilles tendon (ham-string).

The muscles of the body massed together are the red flesh which we observe in every slaughtered animal. They are not, however, so shapeless as they appear while in this condition; on the contrary, they present well-arranged muscular layers of variable size, thickness, length, and position. (See Fig. 2.) The muscles clothe the skeleton externally, give the body its peculiar form, and, by their special power of contraction, change the relative positions of the bones and thus make it possible for the animal to move. For this reason, the muscles are called the **active**, and the bones the **passive**, organs of motion. By carefully examining a muscle it will be found to consist of actual, minute, reddish, *muscular fibres*. As a rule, muscles terminate in more or less strong, glistening, fibrous cords called **tendons**, or fibrous sheets termed aponeuroses, by which they are attached to the bones. In the limbs are muscles terminating in very long tendons, which act as draw-lines upon the distant bones of the foot (long and short pasterns and pedal bone) and set them in motion. Such long tendons are enclosed in sheaths of thin, membranous tissue, known as *tendon sheaths*. The inner surface of such a sheath is in direct contact with the surface of the tendon, and secretes a thin slippery fluid (synovia) which lubricates the tendon and facilitates its gliding within the sheath.

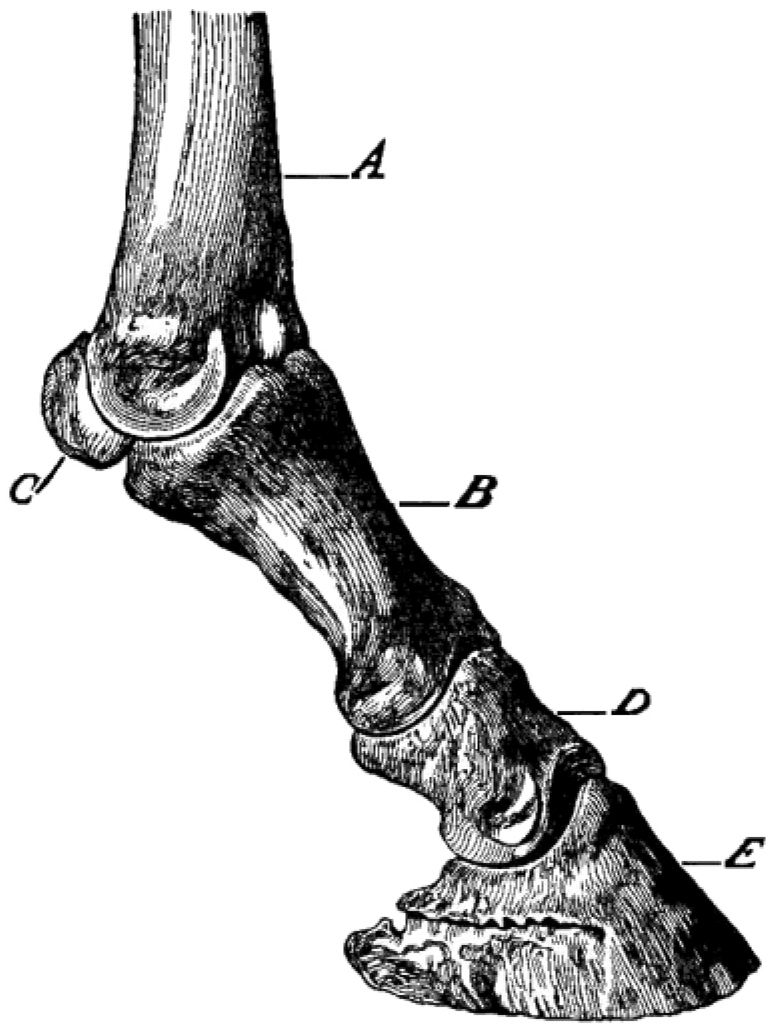
As long as the bones, articulations, muscles, and tendons of the limbs remain healthy, just so long will the legs maintain their natural direction and position. Frequently, however, this normal condition of the limbs is gradually altered by disease of the bones, joints, and tendons, and defects in the form and action of the lower parts of the limbs arise that often require attention in shoeing.

THE FOOT.

A. The Bones of the Foot.

Since the horse is useful to man only by reason of his movements, his foot deserves the most careful attention. The horseshoer should be familiar with all its parts. Fig. 3 shows the osseous framework of the foot, consisting of the lower end of the cannon bone (*A*), the long pastern (*B*), the two sesamoid bones (*C*), the short pastern (*D*), and the pedal bone (*E*). The lower end of the cannon, or large metacarpal bone (*A*) exhibits two convex articular surfaces (condyles) separated by a median ridge running from before to behind, and all covered by articular cartilage. On both the external and the internal aspects of the lower end of the cannon are small uneven depressions in which ligaments take their attachment.

Fig. 3.

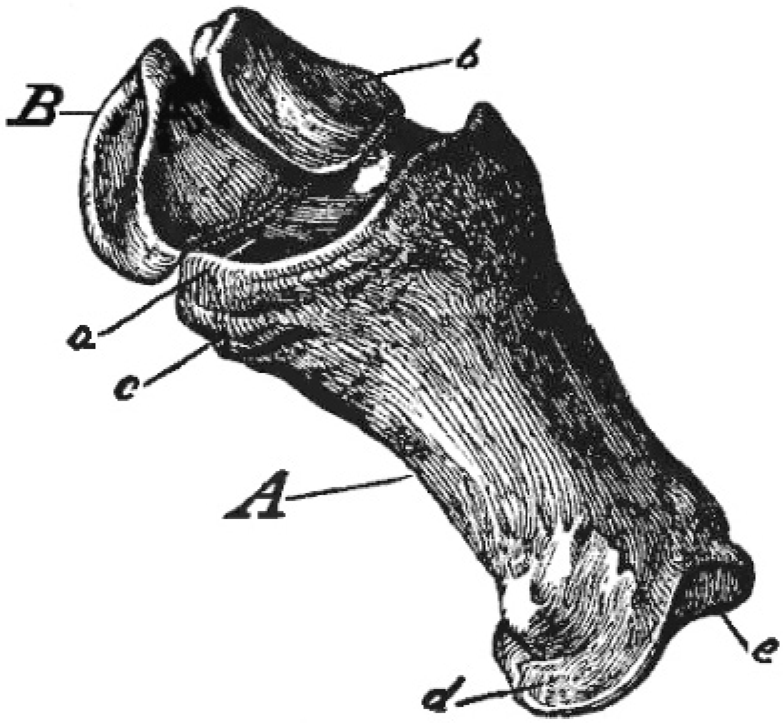


The condyles of the cannon articulate with the os suffraginis (long pastern) and the two sesamoids (Figs. 3, *C*, and 4, *B*) in such a manner that in the forefeet the cannon makes an angle with the long pastern of from one hundred and thirty-five to one hundred and forty degrees, and in the hind feet of from one hundred and forty to one hundred and forty-five degrees.

The **long pastern** (first phalanx) (Fig. 4, *A*) is about one-third the length of the cannon; its upper and thicker end presents two condyloid cavities (*a*) (glenoid cavities), separated by a median groove, which exactly fit the condyles and ridge at the lower end of the cannon. The lower end of the long pastern is smaller than the upper, and is provided with two condyles, between which is a shallow groove (*e*). The anterior face of the bone is smooth, rounded from side to side, and blends into the lateral borders. The posterior face is flatter, and shows a clearly marked triangle to which ligaments attach.

The two **sesamoid bones** (Fig. 4, *B*) are small, and somewhat pyramidal in shape, and, lying against the posterior part of the condyles of the cannon bone, increase the articular surfaces at the upper end of the long pastern.

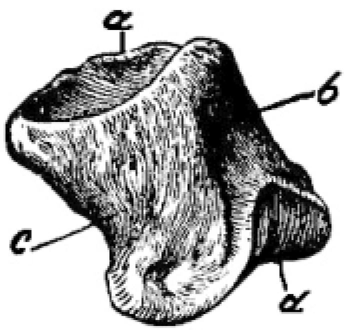
Fig. 4.



Os suffraginis with both sesamoid bones in position, as in Fig. 3. *A*, os suffraginis; *B*, sesamoid bones; *a*, upper joint-surface of long pastern; *b*, joint-surface of sesamoid bones; *c*, roughened surface at upper end; *d*, roughened surface at lower end, both for attachment of ligaments; *e*, lower joint-surface.

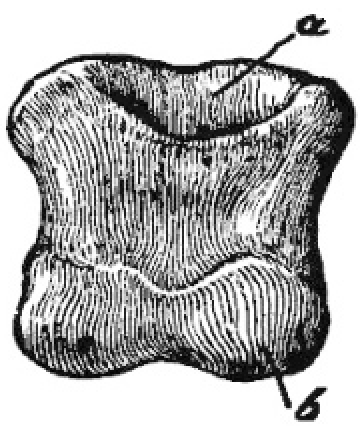
The **short pastern** (second phalanx) (Figs. 5 and 6) lies under the first phalanx and above the os pedis; it is somewhat cubical in shape. Its upper articular surface (Fig. 5, *a*) presents two glenoid cavities to correspond with the condyles of the first phalanx. The lower articular surface (Fig. 5, *d*) resembles the lower end of the first phalanx. The upper posterior border of this bone is prominent and prolonged transversely (Fig. 6, *a*), to serve as a *supporting ledge* for the first phalanx, as a point of attachment for the perforatus tendon, and as a gliding surface for the perforans tendon.

Fig. 5.



Short pastern (os coronæ)
viewed in front and in profile:
a, upper joint-surface;
b, anterior surface;
c, lateral surface;
d, lower joint-surface.

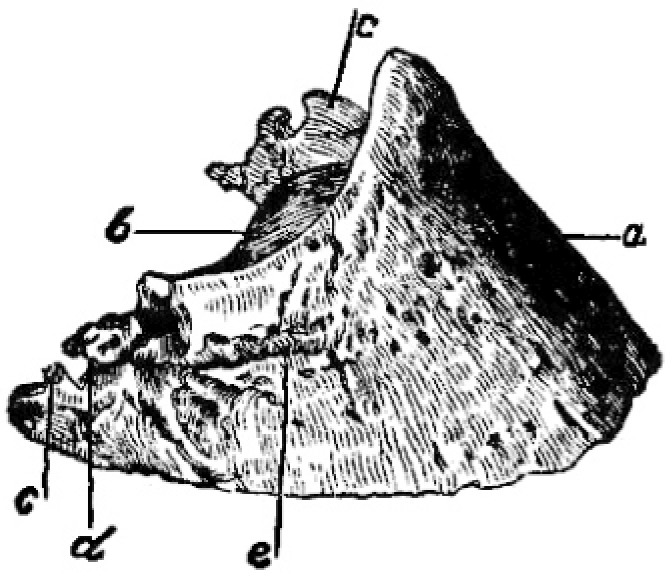
Fig. 6.



Short pastern seen from behind:
a, smooth surface over
which the perforans tendon glides;
b, lower joint-surface.

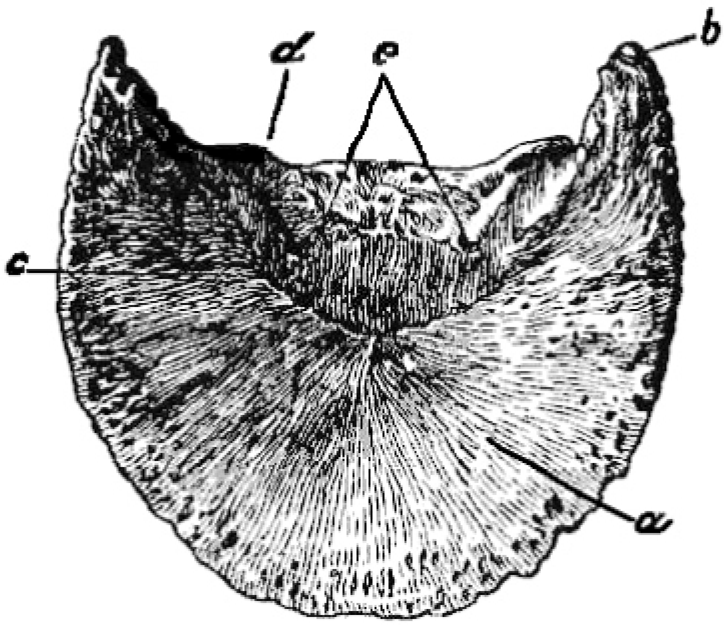
The lowest bone of the limb is the **third phalanx** or **os pedis** (Fig. 7). In form it is similar to the hoof. The *anterior or wall-surface* (*a*) is rough, like pumice stone. Above and in front is the *pyramidal eminence* to which the tendon of the anterior extensor of the phalanges attaches. Behind, the bone extends backward to form the *inner* and *outer branches* (*c, c*) or wings of the os pedis. The *upper*, articular surface (*b*) slopes backward and downward. The *lower*, solar or plantar surface (Fig. 8, *a*) is slightly concave, and presents posteriorly a half-moon-shaped excavation, with a roughened border called the *semilunar crest (c)*, to which the perforans tendon attaches; just above this crest are two small holes (*e*) known as the *plantar foramina*, through which the plantar arteries pass into the bone. The surfaces of wall and sole come together in a sharp edge, which is circular in its course. It is easy to tell whether a pedal bone is from a fore or a hind limb; the os pedis of a hind leg has a steeper and more pointed toe, and a more strongly concaved solar surface than the same bone of a fore-leg. Not only is the outline of the sharp inferior border of the os pedis of a *front foot more rounded at the toe*, but when placed on a flat surface the *toe does not touch* by reason of being turned slightly upward, much as a shoe designed to give a “rolling motion.” The os pedis of a *hind foot is narrower from side to side* (pointed), and *does not turn up at the toe*.

Fig. 7.



Os pedis seen in profile and in front; *a*, anterior face with pyramidal eminence above; *b*, joint-surface; *c*, wings or branches of hoof-bone; *d*, notch which, by the attachment of the lateral cartilage, is converted into a foramen and leads to *e*, the preplantar fissure.

FIG. 8.



Lower surface of hoof-bone; *a*, anterior portion covered by the velvety tissue of the sole; *b*, wing of the os pedis; *c*, semilunar crest, to which the perforans tendon attaches; *d*, plantar fissure leading to *e*, plantar foramen.

The right and left hoof-bones are also, as a rule, easily distinguished by variations in the surfaces of wall and sole. The shape of the os pedis corresponds to the form of the horny box or hoof, and therefore a knowledge of this bone is absolutely necessary.

The **navicular bone** (os naviculare, nut-bone, Figs. 9 and 10) is an accessory or sesamoid bone to the os pedis. It is a small bone, transversely elongated and situated behind and below the os pedis and between the wings of the latter. It adds to the articular surface of the pedal joint. Its under surface is smooth, and acts as a gliding surface for the perforans tendon, which is quite wide at this point.

Fig. 9.

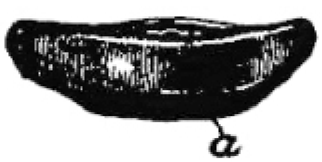


Fig. 10.

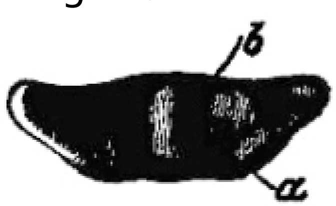


Fig. 9 represents the upper surface of the navicular bone; Fig. 10 the lower surface of the same: *a*, anterior border; *b*, slight elevation in middle of under surface.

The long axes of the three phalanges (os suffraginis, os coronæ, and os pedis) should unite to form a straight line, when viewed either from in front or from one side; that is, the direction of each of these three bones should be the same as the common direction of the three considered as a whole.

In young colts both the long and short pasterns are in three parts and the pedal bone in two parts, all of which unite later in life to form their respective single bones.

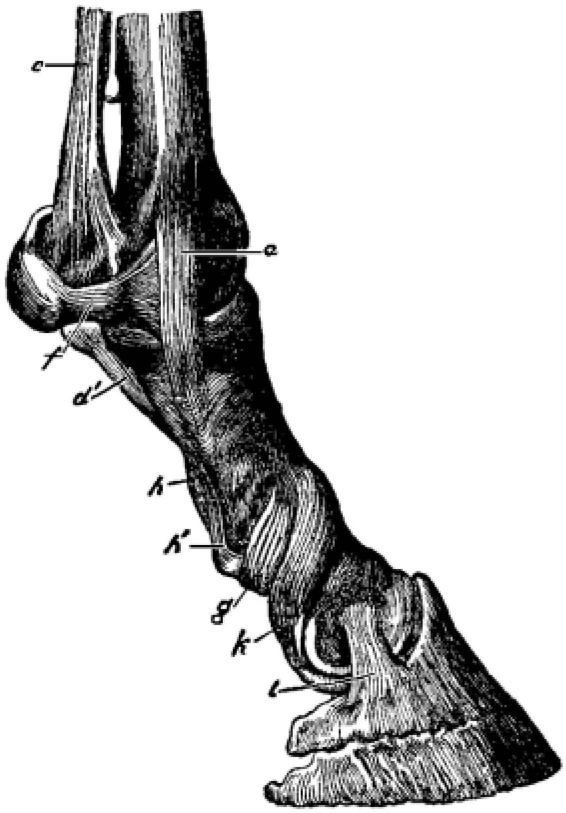
In mules and asses the os pedis is comparatively small and narrow. In cattle all three phalanges are double, and split hoofs cover the divided os pedis.

B. The Articulations of the Foot.

There are three articulations in the foot—namely, the fetlock, coronary, and pedal joints. All are hinge-joints, the fetlock being a perfect hinge-joint, and the other two imperfect hinge-joints. Each has a *capsular ligament*, and also several *funicular* or cord-like *ligaments* which are placed at the sides of (lateral ligaments), or behind (on the side of flexion) the joints.

I. The **fetlock** or **metacarpo-phalangeal articulation** is formed by the condyles at the lower end of the cannon bone and the glenoid cavities formed by the union of the articular surfaces of the sesamoids and the upper end of the first phalanx. The following ligaments are about this joint:

Fig. 11.



1. *Two lateral ligaments*, an external and an internal (Fig. 11, *a*).

2. *Two lateral sesamoid ligaments* (*f*).

3. An *intersesamoid ligament* (Fig. 12, *b*), a thick, fibrous mass, binding the sesamoid bones almost immovably together, extending above them and presenting on its posterior face a smooth groove, in which glide the flexor tendons of the phalanges (perforans and perforatus).

4. The *suspensory ligament* of the fetlock (Figs. 11, *c*, 12, *c*, and 13, *c*, pages 29 and 30). This may also be called the superior sesamoid ligament. It is a long and very powerful brace, originating on the lower row of carpal bones (bones of the hock in the hind leg) and on the upper end of the cannon between the heads of the two splint-bones, and dividing at the lower third of the cannon into two branches

(*c*), which are attached one to each sesamoid bone. Below these bones these two branches are prolonged obliquely downward and forward on opposite sides of the long pastern to pass into the borders of the anterior extensor tendon of the toe at about the middle of the long pastern (Fig. 14, *b′*, page 32).

Fig. 12.

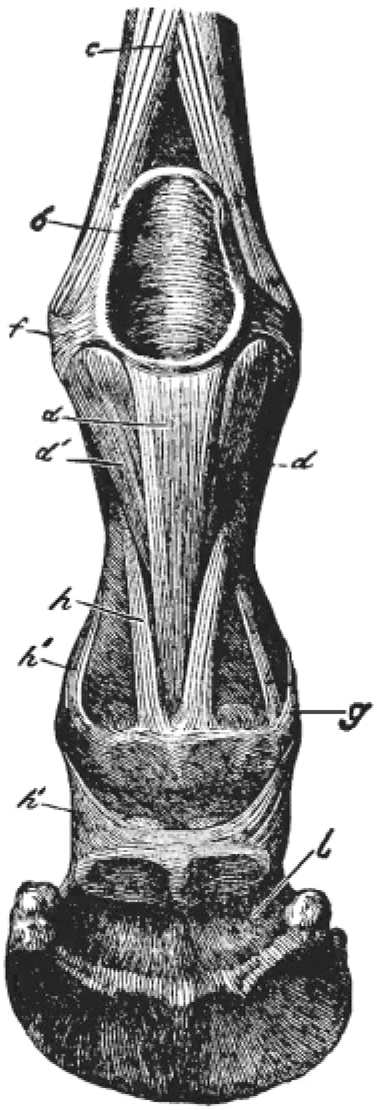


Fig. 13.

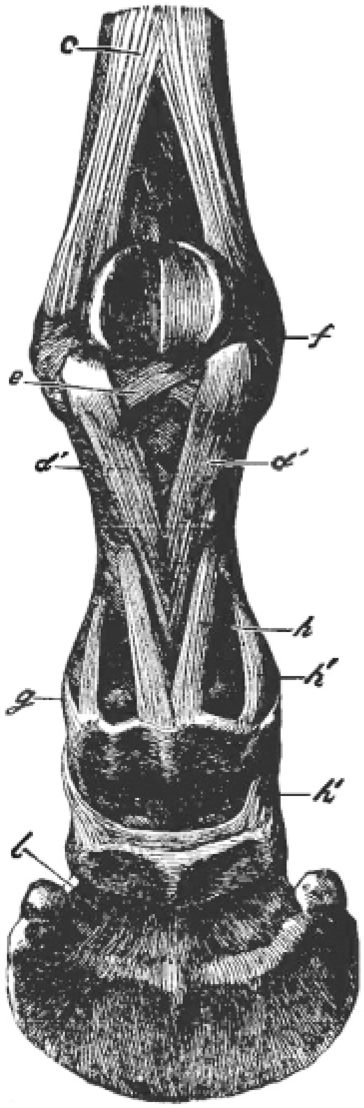


Fig. 11 shows a side view, and Figs. 12 and 13 a posterior view of the phalangeal bones, with their articular ligaments. The lettering is the same in all three figures: *a*, lateral ligament of fetlock-joint; *b*, intersesamoid ligament; *c*, suspensory ligament of the fetlock; *d*, median branch of inferior sesamoid ligament; *d′*, lateral branches of inferior sesamoid ligament; *e*, deep inferior sesamoid ligament; *f*, lateral sesamoid ligaments; *g*, inferior coronary ligaments; *h*, superior coronary ligaments; *h′*, median coronary