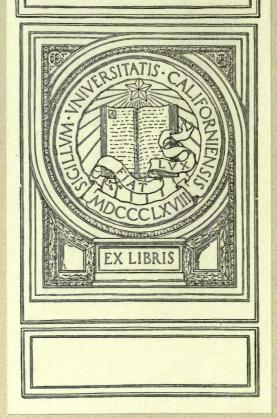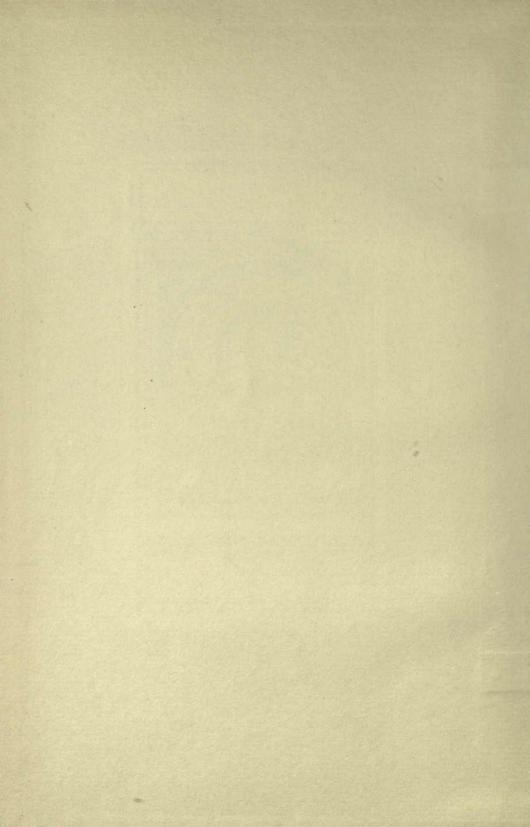# THE HORSE
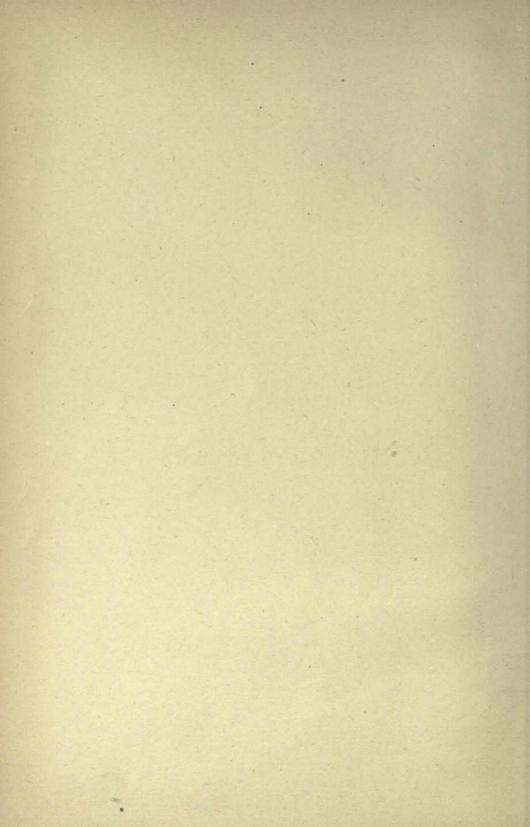
By J. H. WALSH, F.R.C.S.

AND

HAROLD LEENEY, M.R.C.V.S., Etc.

A TYPICAL RACEHORSE (PETRARCH).

In his day one of the best sires in England.

THE HORSE

IN THE STABLE AND THE FIELD

HIS VARIETIES

MANAGEMENT IN HEALTH AND DISEASE

ANATOMY, PHYSIOLOGY, Etc.

By J. H. WALSH, F.R.C.S. (Stonehenge)

EDITOR OF 'THE FIELD'
AUTHOR OF 'BRITISH RURAL SPORTS,' ETC.

REVISED BY HAROLD LEENEY, M.R.C.V.S., Etc.

WITH TWO HUNDRED AND THIRTEEN ILLUSTRATIONS BY HARRISON WEIR, ZWECKER, AND OTHERS

SIXTEENTH EDITION, IN TWO VOLUMES

WITH FOUR COLOURED PLATES

VOL. II

UNIV. OF
CALIFORNIA

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ARCH AND HIND EXTREMITIES—THE TAIL—THE FORE AND HIND EXTREMITIES
CONSIDERED AS ORGANS OF LOCOMOTION.

CLASSIFICATION OF THE VARIOUS ORGANS

THE BODY OF THE HORSE, like all the vertebrate animals, may be con-
sidered as made up of several distinct apparatuses or systems. Of these, the
first is a machine composed of the bony SKELETON, or framework, the various
parts of which are united by JOINTS and moved by MUSCLES. *Secondly*, there
are contained within the thorax the organs which supply the whole body with
the means of nutrition in the form of blood, and purify this fluid. *Thirdly*,
in the abdomen are presented to view the important organs which assimilate
the food to the condition of the blood; while in the adjoining cavity, the
pelvis, are the urinary and generative apparatuses. *Fourthly*, the nervous
system may be considered, as comprising the grand centre of the mental
faculties, and, also, as presiding over and controlling the whole of the
functions performed by the several organs; and *fifthly*, certain special
organs, as, for example, those of sense, and likewise the foot, will complete
the whole circle of systems to be reviewed. Each of these groups will,
therefore, be described in a separate chapter.

OF THE STRUCTURE OF BONE

THE BONES are composed of a tissue peculiar to them, enveloped by a
membrane, the *periosteum*. They contain a semi-fluid of a fatty nature, the
marrow, and are pierced in various directions by *blood-vessels* and *nerves*.

A A

THE PROPER TISSUE of the bones is made up of two distinct substances, either of which may be removed by artificial means, leaving the other entire. If, for instance, a bone is submitted to the heat of a furnace, it retains its shape and rigidity, but becomes much whiter in colour, and is rendered extremely brittle. In fact, the mineral salts entering into its composition are left, but the animal matter binding them together is completely decom-posed and carried off in a gaseous form. On the other hand, by immersing a bone for two or three weeks in diluted hydrochloric acid, the earthy salts are dissolved, while the animal matter is untouched. Here the bone retains its original shape, but it is soft and flexible; and instead of presenting its usual opaque yellowish-white colour, it is semi-transparent, and resembles the ordinary gelatine of the shops. According to Berzillius, bone is chemically composed of the following constituents—namely, cartilage, reducible to gelatine by boiling; blood-vessels; phosphate of lime; carbonate of lime; fluate of lime; phosphate of magnesia; soda and chloride of sodium.

Considered mechanically, the bones form the framework of the animal machine. In the limbs they are hollow cylinders, admirably fitted by their shape and texture to resist violence and support weight. In the trunk and head they are flattened and arched, to protect the contents of the cavities they form, and to provide an extensive surface for the attachment of muscles. In certain situations their exterior is raised into projections called *processes,* which serve as levers for the muscles to act upon; in others they are grooved into smooth surfaces for the easy gliding of tendons, when these are stretched between the fleshy part of a muscle and one of its attachments. Lastly, they sometimes present a large hollow for the lodgment of the belly of a muscle, as in the case of the scapula. These differently shaped bones may, therefore, be classed under the following three heads :—

1st. The *long bones* consist of the humerus, radius, ulna, femur, tibia, and fibula; the metacarpal and metatarsal bones (called, in horsemen's language, the cannon bones), the phalanges (pastern bones), and the ribs. These bones are all divisible into a central cylindrical shaft, and two heads or extremi-ties. The shaft is usually of a prismoid form, dense in texture, and presenting a longitudinal tube in the interior, called the medullary canal, which contains marrow. The heads are broad, to articulate with the next adjoining bones, and are covered with a thin layer of cartilage, which will be described in the chapter treating of the joints. Their outer surface is a hard osseous layer, within which is a mass of cells containing red medullary matter, to be presently described.

2nd. *The flat bones* are composed of two layers of dense tissue, one on each surface, having between them another of a cellular nature, called the diplöe. As a matter of course, from their shape, they have surfaces, borders, and angles; in addition to which they have projections, called processes, of various shapes. They consist of the chief bones of the head, the scapula, and pelvis.

3rd. *The irregular bones* comprise the lesser bones of the head and face, the vertebræ, sacrum, sternum, carpal and tarsal bones, the sesamoid bones, the bones of the foot, and the patellæ. They resemble the flat bones in their structure.

When microscopically examined, bone is seen to be made up of a dense and homogeneous substance (basis substance), in which are numberless

minute cells (corpuscles of Purkinje). The basis substance is partially fibrous and slightly lamellated, the layers being concentric in long bones and parallel in flat; it is traversed in all directions (more especially in the long axis, where there is one) by canals (Haversian canals), which frequently branch and inosculate, giving passage to vessels and nerves. In certain situations the lamellæ separate, and leave between them spaces of various sizes, called *cancelli*. Besides entering into the composition of the basis substance, the lamellæ are collected concentrically round the Haversian canals, the boundaries of which they form, generally to the extent of ten to fifteen layers. Both the compact and spongy tissues are, therefore, composed of the same elementary structure, the former being especially intended to afford resistance to violence with as little weight as is consistent with its office, for which reason it is hollowed into a tube; while the latter is enlarged as much as possible without unnecessarily adding to its weight, the problem being solved by its development in a cellular form.

The periosteum is a dense fibrous membrane which covers every part of the surface of the bones, excepting their extremities when they enter into the composition of a joint, its place being then occupied by cartilage (see Joints). When this membrane covers the bones of the skull it is called *pericranium*, and when it invests the cartilages of the ribs it receives the name *perichondrium*. It is full of blood-vessels, especially in the young, and they freely communicate with those of the surrounding soft parts. Hence it is extremely liable to inflammation, either caused by injury to itself or to the parts which cover it.

The marrow, or medullary substance, is contained in the cavities formed within the bones, being of a yellow colour and oily nature in the shafts of the long bones; and more or less red, from the admixture with blood, in the flat and irregular bones, and in the heads of the long bones. It is contained within the areolar meshes of a membrane, which lines these cavities, answering to the periosteum, which has been already described. This medullary membrane is of excessive tenuity, and is composed of blood-vessels ramifying in fine cellular tissues. The use of marrow in the animal economy is not very clearly demonstrated.
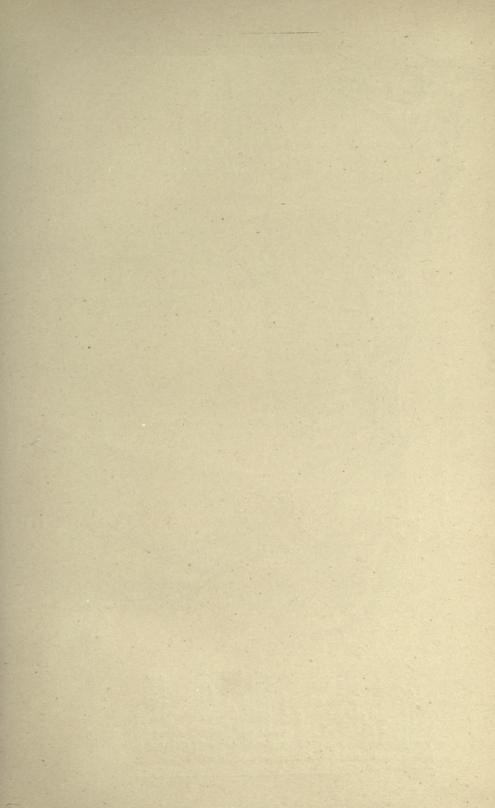
In the embryo, all the bones originally exist in the state of cartilage, being soft and flexible. By degrees vascular canals are developed within its substance, by the union of its cells in rows. These concentrate towards some one or more points, which in a long bone are one in the centre of the shaft and one at each extremity. Starting from this point (*punctum ossificationis*), fibres run out, embracing clusters of cells, and sending branches between the individuals composing each group. In this manner the network, characteristic of bone, is formed, the cells uniting to form the permanent areolæ and Haversian canals. At first the contents of the cells are transparent, then granular, and finally opaque, from the pressure of amorphous mineral matter. The several ossified portions are quite distinct for a long time in the young animal, and may readily be separated by boiling or maceration.
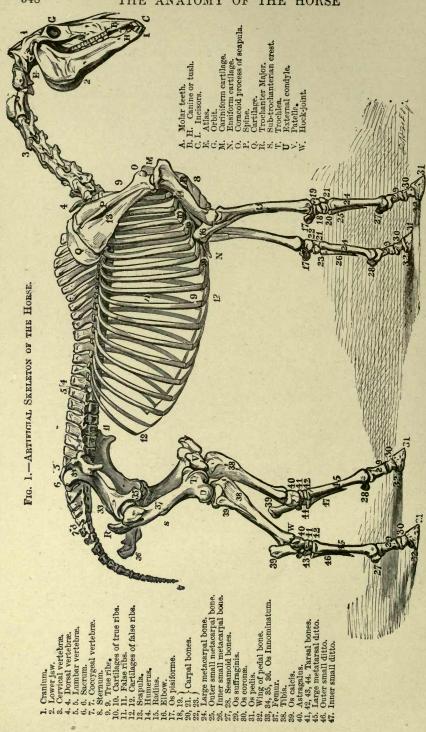
OF THE SKELETON IN GENERAL

THE NAME SKELETON has been given from the Greek word σκέλλω (*to dry*), it being the only part of the body which will bear desiccation without change of form. In the *vertebrata* it is an internal bony framework, but in the *crustacea* it invests the soft parts, and forms an insensible covering to them, while at the same time it serves the purpose of locomotion. In both these divisions of the animal kingdom the skeleton forms a series of arches or rings, capable of moving on each other, but so firmly attached as to secure protection to the important organs contained within them. In the horse, as in all the higher mammalia, these rings or arches are double—one set, the superior, being continuous throughout the whole length of the animal from the head to the root of the tail, and containing the nervous system; while the other lying below, but closely connected to them, is interrupted in certain localities, being found to exist chiefly in three regions: —1st, where it forms the jaws and bone of the tongue; 2nd, where, by means of the ribs and sternum, it constitutes the thorax and its appendages, the anterior extremities; and, 3rdly, where, in the shape of the pelvic arch, it protects the organs of generation, and, through the posterior extremities prolonged from it, assists in locomotion. The superior of these arches, from containing the brain, and its prolongation, the spinal cord, is called the neural arch. The inferior is termed the hæmal arch (αἶμα, *blood*), because it protects the heart and its large blood-vessels as the latter pass from the thorax towards the head and posterior extremities. In all the vertebrata the neural arch consists of one continuous cavity, defended from end to end by bony plates, strongly joined together; and in some of the lower forms (lizards) the hæmal arch is nearly as complete, these animals having cervical ribs; while the dugong and some others are furnished with ribs in their tails. Consequently, it is fair to consider the whole skeleton in the superior forms of the animal kingdom as composed of two series of arched plates, firmly united together, but still allowing more or less motion, and serving to protect the centres of the nervous and sanguineous systems, from which they have received their names.

THE ARTIFICIAL SKELETON

THE BONES of the Horse, as of the other mammalia, may be preserved with their natural ligamentous attachments connecting them in a dry state, in which condition the skeleton is called a natural one. It is usual, however, to macerate them so long that all the soft parts readily separate, leaving the bones without any of the ligaments or cartilages which are firmly fixed to them during life. They are then put together by wires, etc., the cartilages being represented by leather and cork. In this way it often happens that the proportions are not exactly preserved, and, on reference to an articulated skeleton in any museum, the inexperienced eye may be greatly misled. Thus it is very common to represent the thorax in the artificial skeleton as much shallower than it is in nature, where its lower margin is on the average about midway between the top of the withers and the ground. Again,

Fig. 1.—Artificial Skeleton of the Horse.

1. Cranium.
2. Lower jaw.
3. Cervical vertebræ.
4. 4. Dorsal vertebræ.
5. 5. Lumbar vertebræ.
6. 6. Sacrum.
7. 7. Coccygeal vertebræ.
8. Sternum.
9. 9. True ribs.
10. 10. Cartilages of true ribs.
11. 11. False ribs.
12. 12. Cartilages of false ribs.
13. Scapula.
14. Humerus.
15. Radius.
16. Elbow.
17. Os pisiforme.
18, 19. ⎫ Carpal bones.
20, 21. ⎬
22, 23. ⎭
24. Large metacarpal bone.
25. Outer small metacarpal bone.
26. Inner small metacarpal bone.
27, 28. Sesamoid bones.
29. Os suffraginis.
30. Os coronæ.
31. Os pedis.
32. Wing of pedal bone.
33, 34, 35, 36. Os Innominatum.
37. Femur.
38. Tibia.
39. Os calcis.
40. Astragalus.
41, 42, 43, 44. Tarsal bones.
45. Large metatarsal ditto.
46. Outer small ditto.
47. Inner small ditto.

A. Molar teeth.
B. H. Canine or tush.
C. I. Incisors.
E. Atlas.
G. Orbit.
M. Carniform cartilage.
N. Ensiform cartilage.
O. Coracoid process of scapula.
P. Spine.
Q. Cartilage.
R. Trochanter Major.
S. Sub-trochanterian crest.
T. Trochlea.
U. External condyle.
V. Patella.
W. Hock-joint.

in the fresh state, the intervertebral fibro-cartilage is in some parts of the spine of considerable thickness ; and if the proper substance is not artificially supplied, the skeleton will be too short, or if too thick a material is added it will be too long.   In the engraving of the skeleton occupying the opposite page, which is drawn from the skeleton in the Museum of the Royal Veterinary College, London, the spine is correctly represented, but the thorax is too shallow, and the scapula, together with the whole fore extremity, is placed too far forward.

NUMBER OF BONES COMPOSING THE SKELETON

THE SKELETON is composed of two hundred and forty-seven separate bones, which are united by joints to form the spine, thorax, pelvis, tail, and fore and hind extremities.   The spine is finished anteriorly by the head, which is divided into the cranium and face, and contains the teeth.   Separated from the head is the os hyoides, which completes the number of bones. Thus :—

THE SPINE consists of 7 cervical, 18 dorsal, and 6 lumbar vertebræ— Total 31
THE THORAX is made up of the dorsal vertebræ, with 18 ribs on each side, and the sternum in the middle—Total 37
THE PELVIS comprises 2 ossa innominata (or ilium, ischium, and pubes), and 1 sacrum—-Total 3
THE TAIL contains on the average 17 bones 17
THE FORE EXTREMITY is made up on each side of the scapula, humerus, os brachii, and 8 carpal bones, 3 metacarpal, os suffraginis, os coronæ, os pedis, os naviculare, 2 ossa sesamoidea—Total on both sides . . 40
THE HIND EXTREMITY has the femur, patella, tibia, fibula, 6 tarsal bones, 3 metatarsals, os suffraginis, os coronæ, os pedis, os naviculare, 2 ossa sesamoidea—Total 38
BONES OF THE CRANIUM 10
BONES OF THE FACE AND LOWER JAW 18
TEETH [1]. 40
BONES OF THE INTERNAL EAR, 4 in each organ 8
OS HYOIDES, OR BONE OF THE TONGUE, made up of five sections . . . 5

Grand total 247

GENERAL ANATOMY OF THE SPINAL COLUMN

THE VERTEBRAL OR SPINAL COLUMN is the first rudiment of internal skeleton seen in the lower vertebrate animals, and this constitutes the type of that great division of the animal kingdom.   In the horse, also, it is the portion of the skeleton first developed in the embryo, and forms the centre around

[1] The teeth are not strictly speaking bones, but as the general reader usually regards them as such, and the distinction is a purely scientific one, we have allowed them to count in the usual way

which all the other parts are framed. At its first appearance it is a cartilaginous cylinder, surrounding and protecting the primitive trace of the nervous system ; but as the embryo increases in growth, points of ossification are developed corresponding to each vertebra, the whole tube being finally divided into distinct pieces called *vertebræ*, to which the bones of the head are a prolongation, corresponding in their nature, though differing out-wardly in form.

The vertebræ are divisible into true and false, the former reaching from the head to the pelvis, and the latter extending thence backward, being respectively called the sacrum and coccyx.

The true vertebræ comprise the 7 cervical, 18 dorsal, and 6 lumbar vertebræ. Each consists of a body, from which two laminæ or plates project upwards, terminating in a spinous process. In addition to these are two lateral projections (transverse processes), which serve the purpose of firmly connecting the vertebræ together by means of the muscles attached to them, and also to the ribs and extremities below. Lastly, each vertebra has two small surfaces before and the same number behind (articular surfaces), which form distinct joints between them. The details of these parts, and the peculiarities met with in each set, will be described in the next chapter.

Between the body, the laminæ, and the spinous process is an opening more or less triangular in shape, in which lie the spinal cord and its investments. The edges of this opening are attached to those before and behind by ligamentous tissues (*ligamenta subflava*), which, opposite each intervertebral space, are pierced by openings on each side to give exit to the vertebral nerves passing out to the exterior of the body and to the ex-tremities. Opposite to these openings the bone is notched above and below, and these *intervertebral notches* complete the parts common to the whole series. Thus the vertebral or spinal column serves as a firmly secured but flexible tube for the lodgment of the spinal cord, while at the same time it gives passage to its nerves. By this formation it is far less liable to injury, and also more useful as an aid to locomotion, than if it were made of one solid piece of bone, which, from its length, would be readily broken.

OF THE HEAD AND FACE, AND OF THE HYOID ARCH

MODERN ANATOMISTS, following out the idea first suggested by Maclise and Owen, consider the head as made up of six vertebræ ; the posterior one, or that nearest to the neck, being the occipital bone, the next two being made up of the temporal bone, and the ultimate vertebræ consisting of the sphenoid and æthmoid bones. This is a somewhat fanciful hypothesis, when worked out in detail ; but it is obvious that the several bones of the skull subserve the same purposes as the vertebræ, and resemble those parts of the skeleton in forming a series of irregular arches to protect the brain, the division into separate pieces being far more secure than if the whole were in one.

THE BONES OF THE FACE, including the lower jaw and os hyoides, depend from the neural arch or brain-case much in the same way as the ribs and

pelvic bones posterior to them are attached to the vertebræ, and though they inclose organs of less vital importance, yet they are perfectly analogous to these parts in their types and in the offices which they perform.

OF THE THORACIC ARCH AND ANTERIOR EXTREMITIES

LYING IN THE HORSE AT SOME DISTANCE POSTERIORLY to the three first segments of the hæmal arch (the bones of the face, lower jaw, and os hyoides), and separated from them by the neck, where there is a hiatus, the thoracic arch and anterior extremities depend from the vertebræ corresponding to them. In many of the higher vertebrates the fore extremity is firmly united by a joint to the thorax, and may be considered with it; but in the horse it is only attached by muscles, the thorax being slung between the upper edges of the blade-bones by means of two broad sheets of muscular fibres. Hence the collar-bone is entirely absent in this animal; and thus, while he is free from dislocations and fractures of that bone, to which he would be constantly subject if it were present, he is rendered more liable to strains and rheumatic inflammations of the muscular sling, by which freedom of action is impaired.

IN THE ARTICULATED SKELETON it is usual to consider the thorax as made up by the eighteen dorsal vertebræ superiorly, the eighteen ribs and their cartilages on each side, and the sternum with its cartilages below. But the cavity of the thorax, as bounded by the diaphragm posteriorly, is not nearly so large as would be supposed from a consideration of the dry skeleton, for though the diaphragm is attached to the twelve posterior ribs near their cartilages, yet its surface is so convex towards the thoracic cavity, that a very large space within the bony thorax is really occupied by the abdominal organs. This will be hereafter more fully explained in examining these parts at page 456 *et seq.*

THE PELVIC ARCH AND HIND EXTREMITIES

BEHIND THE THORAX occurs a second interval corresponding to the loins, where the hæmal arch is deficient; but at the pelvis the circle is completed by the bones of the ischium, ilium, and pubes, united to the sacrum above, and having the hind extremities firmly articulated to them at the hip joints. The pelvis constitutes not only a firm and solid case for the protection of the large blood-vessels, and of the urinary and genital organs, but it is also intimately connected with locomotion, to which the posterior extremities largely contribute.

THE TAIL

THIS ORGAN appears to be intended chiefly to protect the body from insects; but it also serves to some extent as an aid in balancing the body when rapidly moving in any new direction. It is made up of from fifteen to eighteen bones, which will be described in the next chapter.

THE FORE AND HIND EXTREMITIES CON SIDERED AS ORGANS OF LOCOMOTION

THE SEVERAL BONES which are connected together to form the extremities must be regarded, first, as organs of support, and, secondly, as the primary means of locomotion. Each extremity consists of corresponding divisions, the ilium being the analogue of the scapula; the femur of the humerus; the tibia and fibula of the ulna and radius; the tarsus of the carpus; and, lower down, the bones of the fore and hind extremities being precisely similar in their forms. There is, however, a want of exact correspondence in the form and direction of the joints, which has been much insisted on by homologists, and which Mr. Maclise has attempted to explain in his very interesting article on "The Skeleton," contained in the *Cyclopædia of Anatomy and Physiology* edited by Dr. Todd. It appears to me that this does not make matters more simple, but the reverse, and that the proper point of view is to regard the humerus and femur as homologous, and the tibia, with the patella, as analogous to the ulna and its olecranon process. The intervention of the ligament between the patella and tibia does not affect the use of the former as a lever; and both joints being perfectly hinge-like in their actions, there is no other important difference. Descending to the next joint, the os calcis stands out as an important lever, and is represented in the carpus by the os pisiforme (called by Percivall os trapezium), each having important muscles inserted in their upper edges. It is true that the one is an agent in what is called extension, while the other is engaged in flexing the limb; but this is only dependent upon the limit to motion in either direction. Below the carpus and tarsus there is no necessity for continuing the comparison.

REGARDING THE LIMBS AS MEANS OF SUPPORT, it must be remembered that the fore-limbs are nearer the centre of gravity, and, therefore, sustain more weight than the hind. The fore-quarter is suspended between the bases of the two shoulder-blades, chiefly by the serrati magni, and in such a way as to require no special muscular contraction. The four parts of which the limb itself is composed being bent at various angles, are prevented from giving way by the muscular actions of the extensors of the humerus and ulna, the carpus (or knee) having little tendency to yield, and the pastern being supported by the flexor muscles and suspensory ligament. The hinder limbs, though sustaining less weight, are not so favourably circumstanced for this purpose, the angles between their several parts being generally more acute. But if these are attentively regarded, there is not so much difference as is generally supposed. Thus, the first joint, the ilio-femoral, forms a less acute angle than its analogue, the shoulder joint (see Fig. 1, R, M). Again, though the stifle joint is considerably bent, it is not more so than the elbow joint, which will be clear on comparing the two in the skeleton given at page 348. The chief disadvantage sustained by the hind-limbs as means of support will be found in the hock, as compared with the knee, the latter being nearly straight, while the former is much bent: but as it has a long lever to assist it (the os calcis), and as this is kept in position by the powerful hamstring muscles, each of which serves its purposes far more completely than the flexor of the carpus inserted in the os pisiforme, it may readily be

understood that the hind-limb is not greatly at a disadvantage in supporting the weight of the body.

As AGENTS OF LOCOMOTION, the offices of the fore and hind limbs are widely different. Each has been already described as consisting of four sections, bent at angles on each other. In the fore-limb these angles are framed to serve as springs, so that when the feet touch the ground, they are enabled to adapt themselves so as to avoid altering the line of progression of the body. In those animals which have small and short fore-legs, as the kangaroo and hare, the most rapid locomotion ever consists in a series of curves; whereas, in the horse at full speed, the body progresses in one straight line, owing to this elastic structure of the anterior limbs. So, also, in descending from an extraordinary leap, the springy action of the fore-limbs of the horse is so powerful that he can get off again without dwelling, whereas the kangaroo and hare must depend almost entirely upon their hind-legs, and consequently stop for a second after their descent. On the other hand, the angular formation of the hind-limbs is intended to enable the animal to drive its whole body forward, by first flexing all the joints, and thus drawing their feet under the belly; and then suddenly extending them with the feet fixed on the ground, the weight is necessarily propelled. Or if the feet are not fixed they are lashed out backwards, developing the action so well known as "kicking." The difference between the powers displayed by the two limbs, in straightening their component parts, is well displayed in comparing kicking with the striking out of the fore-foot, which is common enough among vicious horses. It is true that the latter will sometimes cause a severe blow; but it could very rarely break a limb, which is the least amount of mischief to be apprehended from the full force of a lash out with the hinder-limb.

CHAPTER XVIII

DESCRIPTIVE ANATOMY OF THE SEVERAL BONES

THE HEAD—BONES OF THE CRANIUM—BONES OF THE FACE—THE LOWER JAW—THE TEETH
—OS HYOIDES—CHARACTERS OF VERTEBRÆ IN GENERAL—GENERAL CHARACTERS OF
THE CERVICAL VERTEBRÆ—PECULIARITIES OF CERTAIN CERVICAL VERTEBRÆ—GENERAL
CHARACTERS OF THE DORSAL VERTEBRÆ—PECULIARITIES OF THE DORSAL VERTE-
BRÆ—GENERAL CHARACTERS OF THE LUMBAR VERTEBRÆ—PECULIARITIES OF THE
LUMBAR VERTEBRÆ—THE SACRUM—THE COCCYGEAL VERTEBRÆ—THE RIBS AND THEIR
CARTILAGES—THE STERNUM, OR BREAST-BONE—SCAPULA, BLADE-BONE OR SHOULDER-
BLADE—HUMERUS, THE UPPER ARM-BONE—THE BONES OF THE FORE-ARM (OS BRACHII)
—THE CARPUS (KNEE) AND METACARPUS (CANNON)—THE PHALANGEAL BONES (PAS-
TERNS AND FOOT)—THE PELVIS—THE FEMUR (ROUND-BONE) AND PATELLA—BONES
OF THE LEG—METATARSAL AND POSTERIOR PHALANGEAL BONES.

THE HEAD

Is COMPOSED of the bones of the cranium, face, and jaw.
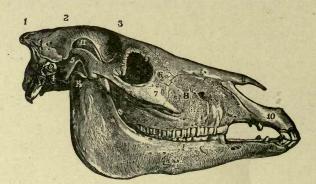
FIG. 2.—PROFILE VIEW OF THE HEAD AND FACE.

1. Occiput.	7. Malar bone.
2. Parietal bone.	8. Posterior maxillary bone.
3. Frontal bone.	9—11. Nasal bone.
4. Petrous portion of temporal bone.	10. Anterior maxillary bone.
5. Zygomatic arch.	11. Temporal fossa.
6. Lachrymal bone.	12, 13. Lower jaw.

BONES OF THE CRANIUM

THE CRANIUM, or brain-case, is small as compared with that of man, and
occupies less than one-fourth of the whole head. It is made up of nine
bones, three of which are pairs and three single ones. These bones are
in most parts made up of two tables, with a cellular structure interposed,
called the *diplöe*, which is in certain situations expanded into large cells, as
in the frontal sinuses. They are connected together by serrated sutures,
except where the temporal bone overlaps the parietal, and in that situation,
on each side the skull one thin scale (squama) overlaps the other. The two

frontal bones unite to form the anterior part of the cranial cavity and the upper walls of the orbits, leaving a space between them for the reception of the æthmoid bone. The *two parietals* are situated at the upper and lateral parts of the brain-case, and are of an irregularly quadrilateral figure —each meeting its fellow in the median line on the top of the head. The *temporal bone* overlaps the parietal on each side, with its squamous portion, while the petrous part runs in towards its fellow on the opposite side, constituting a part of the floor of the brain-case, and separating that cavity into two. It contains within its bony structure the true organ of hearing. The *occipital bone* occupies the back part of the cranium, and makes up the base. It has a large opening (the foramen magnum), for the passage of the medulla oblongata, and vertebral arteries ; and on each side of this are large smooth articulating surfaces, for the attachment of the atlas vertebra. The *sphenoid bone* is of a most remarkable shape, resembling slightly a bat, with its wings partially expanded. The body and wings complete the middle of the base of the skull, and the legs go to form part of the walls of the nasal cavity and mouth. Lastly, the *æthmoid bone* is made up of a cribriform plate supporting the anterior lobes of the brain, and giving passage to the olfactory nerves, which spread over the cellular structure that constitutes the whole substance of this bone. Another thin plate contributes to form the inner and posterior wall of the orbits.

BONES OF THE FACE

THE FACE is made up of the nasal, posterior, and anterior maxillary, molar, lachrymal, and palate bones, the four turbinated bones, vomer, and lower jaw.
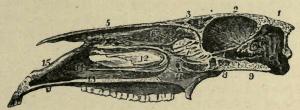
FIG. 3.—LONGITUDINAL SECTION OF HEAD.

1, 2, 3. The upper walls of the cranium.
4. Frontal sinus.
5. Nasal bones.
6. Superior turbinated bone.
7. Æthmoidal cells.
8. Sphenoid bone, uniting with
9. Occipital bone.
10. Petrous portion of temporal bone.
11. Vomer.
12. Inferior turbinated bone.
13. Palatine plate of posterior maxillary.
14. Posterior maxillary bone, outer wall.
15. Anterior maxillary bone.

The *nasal bones* are long and thin, forming the roof of the nostrils. Posteriorly they are broad, and taper gradually forwards to a sharp point. The *posterior maxillary bones* are triangular in shape, thick behind, and presenting thin edges in front. The *anterior maxillary bones* are of an irregular shape, being connected with the corresponding edges of the posterior maxillary and nasal bones, and completing with the former the roof of the mouth. The *malar bone* has an irregularly triangular shape,

presenting its broad base forwards, and is connected with the temporal, posterior maxillary, and lachrymal bones. The *lachrymal bones* form the internal corners of the orbits, where they are very thin, and are hollowed out to receive the lachrymal sac, and give passage to its duct. The *palate bones* are of a very irregular shape, and are connected with the frontal, æthmoid, sphenoid, posterior maxillary, inferior turbinated bones, and vomer. The *turbinated bones*, two in each nasal cavity, are attached to its outer walls one above the other, and appear to be intended merely for the purpose of extending the surface for the expansion of the olfactory nerve. The *vomer* resembles in shape the share of the plough, after which it is named, and rises up in the middle line of the back of the division between the nostrils.

THE LOWER JAW

THE LOWER JAW resembles in general shape the letter V, the point being rounded off forwards and receiving the incisor teeth, while the two branches are broad, thin, and slightly curved, being surmounted by the condyles for articulation with the glenoid cavity of the temporal bone, and giving lodgment to the tushes and grinders. The two lines of alveolar cavities are not so wide as those of the upper jaw, and consequently the two sets of teeth do not exactly correspond.

THE TEETH

THE TEETH are developed within their appropriate cavities or sockets, which are found exactly corresponding with their number in the upper and lower jaws, being narrower in the lower than in the upper. Before birth they are nearly all in a state of incomplete growth, covered and concealed by the gums, but soon afterwards they rise through it in pairs, the first set, or milk teeth, being in course of time superseded by the permanent teeth as in all the mammalia. The following is the formula of the complete dentition of the horse :—

Incisors $\frac{6}{6}$, canine $\frac{2}{2}$, molars $\frac{11}{12}$.

EACH TOOTH is developed within its corresponding cavity in the jaw, and is made up of three distinct substances—cement, enamel, and dentine. The *cement* of the horse's tooth (sometimes called crusta petrosa) closely corresponds in texture with his bone, and, like it, is traversed by vascular canals. The *enamel* is the hardest constituent of the tooth, and consists of earthy matter arranged in the animal matrix, but contained in canals, so as to give the striated appearance which it presents on splitting it open. *Dentine* has an organized animal basis, presenting extremely minute tubes and cells, and containing earthy particles, which are partly blended with the animal matter in its interspaces, and partly contained in a granular state within its cells. These three substances are shown in the annexed sections of an incisor tooth, one of which, Fig. 4, is of the natural size, while the other, Fig. 5, is shown under the microscope.

IN THE MOLAR teeth the arrangement of these three substances is the

same, except that the cement and enamel dip down into two or more cavities instead of one, and are also reflected in a sinuous manner upon the sides. This inequality in the hardness of the component parts of these teeth causes them to wear away with different degrees of rapidity, and thus leaves a rough surface, which materially aids in grinding down the hard grain which forms a large portion of the animal's food. In the upper jaw, the table presented by each molar tooth is much larger than those of the corresponding lower teeth, and therefore it is easy to distinguish the one from the other.
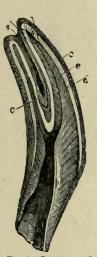
FIG. 4.—SECTION OF INCISOR.

c. Cement on external surface.
c. Cement reflected within the cavity.
e. Enamel also reflected.
d. Dentine.
s. Tartar, coloured black by decomposition of food, contained within the cavity.

FIG. 5.
SECTION OF A PORTION OF INCISOR (MAGNIFIED).

c. Cement.   *e.* Enamel.   *d.* Dentine.

THE TEMPORARY OR MILK INCISORS differ in shape a good deal from the permanent set. The milk teeth are altogether much smaller, but especially in the neck, which is constricted in them, whilst in the permanent set, which go on growing as they wear out, the diameter is nearly the same throughout. The former are also whiter in colour, and have grooves or indentations on their outer surfaces, running towards the gum. Lastly, the mark on the table is much slighter than in the permanent teeth. The temporary molars are not distinguishable from the permanent teeth of that class.

AS A CONSEQUENCE OF THIS ARRANGEMENT OF PARTS, the teeth, as they wear down, present a different appearance according to the extent to which their attrition has reached. On this fact is founded a means of arriving at

a knowledge of the age of the horse after he has shed his milk teeth, which as a rule he does in pairs at certain fixed periods. In order, therefore, to be able to estimate the age of the horse from his teeth, it is necessary to ascertain, as nearly as may be, the exact time at which he puts up each pair of his milk or sucking teeth, and afterwards the periods at which they are replaced by the permanent teeth. Finally, it becomes the province of the veterinarian to lay down rules for ascertaining the age from the degree of attrition which the permanent teeth have undergone. For these several purposes, the horse's mouth must be studied from the earliest period of his life up to old age.

In horseman's language the incisors are called *nippers*, the canine teeth *tushes*, and the molars *grinders*.

BY THE END OF THE FIRST YEAR the colt has cut his twelve nippers and sixteen grinders, which usually pierce the gums at the following months. Before birth, the eight anterior grinders have generally shown themselves, followed about a week after foaling by the two central nippers. At the end of the first month another grinder makes its appearance all round, and in the middle of the second the next nipper shows itself. By the end of the second month the central nippers have attained their full size, and the second are about half-grown, requiring another month to overtake their fellows. Between the sixth and ninth months the corner nippers are cut, and towards the end of the first year reach their full size. This first set of nippers consists of teeth considerably smaller in size than the permanent teeth, and somewhat different in shape. They are more rounded in front, and hollow towards the mouth, the outer edge being at first much higher than the inner. As they wear down, these two edges soon become level, but the corner nippers maintain this appearance for a long time. At six months the central nippers are almost level, with the black "mark" in their middle wide and faint; and about the ninth month the next nipper on each side above and below is also worn down almost to a level surface.

DURING THE SECOND YEAR the following changes take place :—In the first month, and sometimes towards the end of the first year, a fourth grinder is cut all round, which commences the set of permanent teeth, the three first molars only being shed. At a year and a half, the mark in the central nippers is much worn out, and has become very faint; the second is also worn flat, but is not so faint; and the corner nippers are flat, but present the mark clearly enough. In colts which have been reared on corn and much hay, the wearing down proceeds more rapidly than in those fed upon grass alone.

THE THIRD YEAR is occupied by the commencement of the second dentition, which is effected in the same order in which the milk teeth made their appearance. Both sets are contained within the jaw at birth, the permanent teeth being small and only partially developed, and lying deeper than the milk teeth. As the mouth grows, it becomes too large for its first set of teeth; and the roots of these being pressed upon by the growth of the permanent set, their fangs are absorbed, and allow the new teeth to show themselves, either in the places of the former, or by their sides, in which case they are known by the name of *wolf's teeth*. This change proceeds in the same order as the cutting of the milk teeth, commencing with the first grinder, which is shed and replaced by a permanent tooth early in the

third year, a fifth grinder (permanent) making its appearance about the
same time. Towards the end of this year the sixth grinder shows itself, but
grows very slowly, and the central nippers above and below fall out, and are
replaced by permanent ones, which, as before remarked, are considerably
larger in size and somewhat different in form.

AT THREE YEARS the mouth presents the appearance shown in Fig. 6,
the development of the permanent teeth varying a good deal in different
individuals. At three years and four or six months, the next nipper all

FIG. 6.—THREE-YEAR-OLD MOUTH.

B. Anterior maxillary bone.
1. 1. Central permanent nippers, nearly full-
        grown.
2. 2. Milk teeth worn down.

3. 3. Corner milk teeth, still showing central
        mark.
4. 4. Tushes concealed within the jaw.

round falls out, and is replaced by the permanent tooth. The corner
nippers are much worn, and the mark in them is nearly obliterated.
About this time also the second grinder is shed.

AT FOUR YEARS OF AGE the mouth should differ from that represented in
Fig. 6 in the following particulars :—The central nippers begin to lose their
sharp edges, and have grown considerably in substance. The next nipper
all round has grown nearly to its full size, but not quite, and its edges are
still sharp, with the mark deep and very plain. The corner milk nippers
still remain, unless they have been knocked out for purposes of fraud, which
is sometimes done to hasten the growth of the permanent teeth, and give
the horse the appearance of being four or five months older than he is.

BETWEEN FOUR AND A HALF AND FIVE YEARS, the corner nippers are shed, and the tush protrudes through the gum. These changes are shown in Fig. 7.

AT FIVE YEARS the mouth is complete in the number of its teeth; and from this date it becomes necessary to study their aspect in both jaws. Fig. 8 shows the upper teeth at this age, by comparing which with Fig. 7 the slight growth in the half-year may be traced. In the lower teeth of the same mouth, the edges of the central cavities are much more worn away,
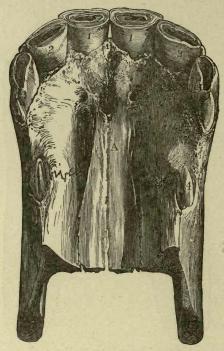
FIG. 7.—MOUTH OF THE COLT AT FOUR AND A HALF YEARS.

A. Anterior maxillary bone.
1.1. Central nippers, considerably worn down.
2. 2. The next pair, fully developed, with their edges slightly worn.
3. 3. Corner permanent nippers, in a state of growth, with the edges of the cavity sharp, and the mark very plain.
4. 4. The tushes showing themselves through the gum, but not full-grown.
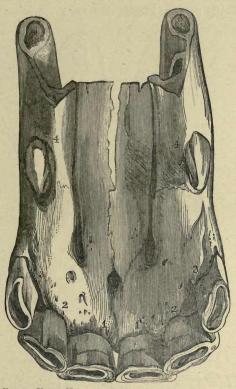
the central nipper having only a small black speck in the middle of a smooth surface, while the next is much worn, and the corner teeth, though showing the mark very plainly, bear evidence of having been used. The tush is much grown, with its outer surface regularly convex, and its inner concave, the edges being sharp and well defined. The sixth molar is at its full growth, and the third is shed to make room for the permanent tooth in its place. These two last-named teeth should always be examined in cases where there is any doubt about the age. After five years, no further shedding occurs in any of the teeth.

THE SIX-YEAR-OLD MOUTH is the last upon which any great reliance can be

placed, if it is desired to ascertain the age of the horse to a nicety ; but by attentively studying both jaws, a near approximation to the truth may be arrived at. It is ascertained that the nippers of the upper jaw take about two years longer to wear out than those of the lower ; so that until the horse is eight years old, his age may be ascertained by referring to them, nearly as well as by the lower nippers at six. But as different horses wear out their teeth with varying rapidity, it is found that this test cannot be implicitly relied on ; and in crib-biters or wind-suckers the upper teeth

FIG. 8.—UPPER NIPPERS AND TUSHES AT FIVE YEARS OLD.

1. 1. Central nippers, with the mark still un-
obliterated.
2. 2. Next nippers, with the mark still plainer.

3. 3. Corner nippers, with the edges very slightly worn.
4. 4. Tushes well developed, and still showing the groove on the outside plainly.

wear out wonderfully soon. Fig. 10 is taken from the lower jaw of a six-year-old horse, showing the marks of the central nippers almost obliterated but still presenting concentric circles of discoloured brown tartar in the middle ; next to which is the cement, then the enamel, and the dentine, with a thin layer of enamel outside. Up to this age the nippers stand nearly perpendicular to each other, the two sets presenting a slight convexity when viewed together, as seen in Fig. 2, page 354. Afterwards the nippers gradually extend themselves in a straight line from each jaw, and, in the very old horse, form an acute angle between them.

AT ABOUT THE EIGHTH YEAR the upper nippers present the same appearance as already described in the lower nippers at six years old. Both tushes are considerably worn away at their points, and the upper ones more so than the lower.

AT NINE YEARS OF AGE the upper middle nippers are worn down completely. The next pair have a slight mark left, but their surfaces are quite level, and the corner nippers have only a black stain, without any central depression.

AFTER NINE YEARS the age of the horse can only be guessed at from his teeth, which gradually grow in length, and are more in a line with the jaw.
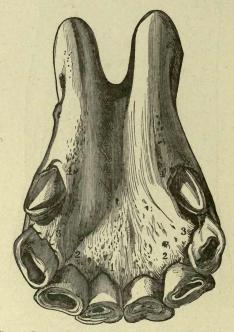
FIG. 9.—LOWER NIPPERS AND TUSHES AT FIVE YEARS OLD.

1. 1. Central nippers, with their marks almost entirely worn out.
2. 2. Next nippers, showing marks partially worn.
3. 3. Corner nippers, with the mark plainly seen, but the edges partially worn.
4. 4. Tushes, with the grooves inside almost obliterated.

The section of each nipper presented to the eye becomes more and more triangular instead of being oval, as seen in Figs. 10 and 11 ; but after about the twelfth year the triangular section disappears, and the tooth becomes nearly round. In accordance with the increase of length is the colour of the tooth altered, being of a dirty yellow in very old horses, with occasional streaks of brown and black. The tushes wear down to a very small size, and very often one or both drop out.

ALLUSION HAS ALREADY BEEN MADE to the practice of removing the milk nippers for the purpose of inducing a more rapid growth of the next set, which, however, is not materially affected by the operation, but dishonest dealers have recourse to another deception, called *bishoping*, by which an

aged horse may be passed off upon an inexperienced person for a six-year-old. The plan adoped is to cut off all the nippers with a saw to the proper length, and then with a cutting instrument the operator scoops out an oval cavity in the corner nippers which is afterwards burnt with a hot iron until it is quite black. It is extremely easy to detect the imposition by carefully comparing the corner nippers with the next, when it will be seen that there is no gradation from the centre to the corner nippers, but that the four middle ones are exactly alike, while the corners present a large black cavity, *without a distinct white edge to it*, the dentine being generally encroached
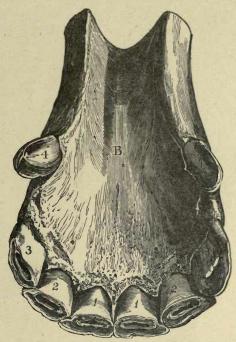
FIG. 10.—THE LOWER NIPPERS AND TUSHES OF A SIX-YEAR-OLD HORSE.

B. The lower jaw.
1. 1. The central nippers, with the marks worn out.
2. 2. The next nippers, with the marks disappearing.
3. 3. The corner nippers, showing the mark plainly enough, but with the edges of the cavity considerably worn.
4. 4. The tushes, standing up three-quarters of an inch, with their points only slightly blunted.

upon without any regularity in the concentric rings. Moreover, on comparing the lower with the upper nippers, unless the operator has performed on the latter also, they will be found to be considerably more worn than the lower, the reverse of which ought naturally to be the case. Occasionally a clever operator will burn all the teeth to a properly regulated depth, and then a practised eye alone will detect the imposition. In the present day there is not so great a demand for six-year-old horses as was formerly the case, and purchasers are contented with a nine or ten-year-old mouth if the legs and constitution are fresh. Hence bishoping is seldom attempted excepting with horses beyond the age of eleven or twelve; and the mere use

of the burning-iron without cutting off the teeth will seldom answer the purposes of the " coper." Formerly it was very common to see mouths with the corner nippers burnt to show a " good mark," and nothing else done to them ; but, for the reasons given above, the plan is now almost entirely abandoned.

IRREGULARITIES in the growth of teeth are by no means uncommon in the horse, often caused by the practice of punching out the milk teeth to hasten the growth of the permanent set. Instead of having this effect, however,
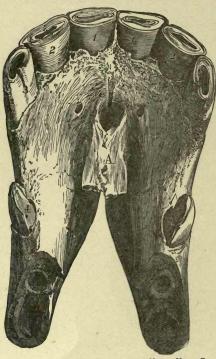
FIG. 11.—UPPER NIPPERS IN THE EIGHT-YEAR-OLD HORSE.

A. Anterior maxillary bone.
1. 1. Central nippers, worn to a plane surface.
2. 2. Next pair, still showing a slight remnant of the cavity.
8. 8. Corner nippers, showing the mark plainly enough.
4. 4. Tushes, more worn down than in the lower jaw of the six-year-old mouth.
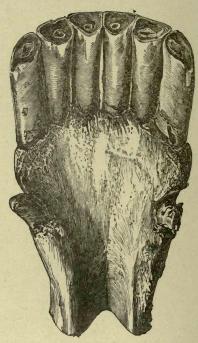
FIG. 11a.—LOWER NIPPERS AND LEFT TUSH OF A VERY OLD HORSE, THE RIGHT HAV- ING FALLEN OUT.

the teeth are induced to take a wrong direction, and not meeting their fellows they do not wear down as they naturally should. In punching out the corner nipper it is very often broken off, and the fang is allowed to remain in the socket. The consequence is that the picking up of the food does not hasten the removal of the fang of the milk tooth, and instead of accelerating the growth of the permanent tooth in the natural position, it retards it and sometimes drives it to seek a passage through the gums behind its proper socket. Here, not meeting the corresponding nipper of the upper

jaw, it grows like a tush, and has sometimes been mistaken for a second tooth of that kind. Some horses are naturally formed with "pig jaws"— that is to say, with the upper longer than the lower—and in these cases the whole set of teeth grow to a great length, and interfere with the prehension of the food.

OS HYOIDES

THE OS HYOIDES in the horse consists of five distinct pieces, contributing to the support of the tongue and larynx. One of these (the body) is central, the other four are in pairs called the greater and lesser horns. They are connected by ligaments.

THE BODY resembles a two-pronged fork in form, having a central portion flat, an *appendix*, or spur, which lies in the centre of the muscles of the tongue, and two branches. At the sides of the central portion are two little knobs for the articulation of the lesser cornua.
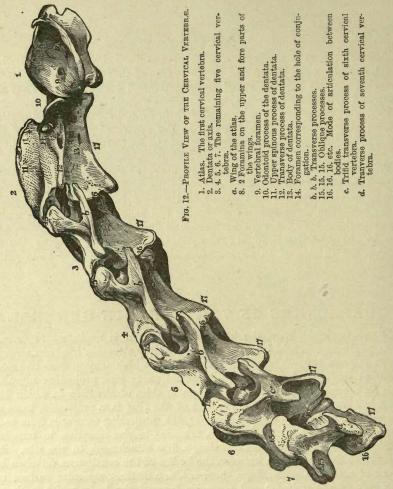
THE HORNS are four in number, two short and two long; the former ascend obliquely from the sides of the bodies, and end in oblong flattened smooth surfaces for the attachment of the long horns. These are much larger than the short horns, constituting two long, flat, thin bones, which give attachment to the stylo-hyoideus and hyoideus magnus muscles, and also to the constrictors of the pharynx. The bones composing the os hyoides are delineated in connection with the larynx in the twenty-first chapter.

CHARACTERS OF VERTEBRÆ IN GENERAL

EVERY VERTEBRA from the head to the sacrum is made up of certain parts, to the uses of which in the animal economy attention has been already drawn at page 350. These are—1st, a body, which may at once be recognized as the central and most substantial part; 2nd, projecting upwards from its upper edges are the two *laminæ*, or sides of the ring, in which lies the spinal cord; 3rd, at the upper part of the ring is a projection, more or less marked, called the spinous process; 4th, projecting outwards from each side of the body is a lateral process, intended to give insertion to muscles, and in the region of the back affording a firm attachment to the ribs. In addition to the connection between the bodies of the contiguous vertebræ by means of a thick fibro-cartilage, there is also a distinct articular surface on each side of the anterior and posterior faces of the body, which is placed upon a projection called the articular or oblique process. Thus, each vertebra has four oblique processes, two transverse processes, a spinous process, and two laminæ or sides to its large foramen, in addition to its body. This last part presents an anterior and a posterior surface, more or less oval, by which it is united to the next adjacent vertebræ; a superior face, which forms the floor of the spinal canal, and an inferior face, which is clothed with muscle on each side of a projecting rough line, called, wherever it is marked, the inferior spine.

Throughout the spine no two vertebræ are exactly alike, even the sixth

and seventh dorsal showing a slight change of form in the inclination of their spinous processes. But between the first and second cervical and the last lumbar the difference is so marked, that they are not at once perceived by the casual observer to belong to the same class of bones. In this change the transition is gradual, the sixth and seventh cervical

FIG. 12.—PROFILE VIEW OF THE CERVICAL VERTEBRÆ.

1. Atlas. The first cervical vertebra.
2. Dentata or axis.
3. 4. 5. 6. 7. The remaining five cervical vertebræ.
  a. Wing of the atlas.
8. 2 Foramina on the upper and fore parts of the wings.
9. Vertebral foramen.
10. Odontoid process of the dentata.
11. Upper spinous process of dentata.
12. Transverse process of dentata.
13. Body of dentata.
14. Foramen corresponding to the hole of conjugation.
  b. b. b. Transverse processes.
15. 15. 15. Oblique processes.
16. 16. 16. etc. Mode of articulation between bodies.
  c. Trifid transverse process of sixth cervical vertebra.
  d. Tranverse process of seventh cervical vertebra.

resembling the first and second dorsal, and so on in succession from before backwards.

GENERAL CHARACTERS OF THE CERVICAL VERTEBRÆ

IN THE HORSE THE CERVICAL VERTEBRÆ are each very long as compared with those of most of the mammalia, being, however, exceeded in this respect by the camelopard. They present an irregularly cuboidal shape, and may be

distinguished from those of the back and loins by the following characters :
—1st. The inferior spine of the body is strongly marked, and terminates
posteriorly in a tubercle (Fig. 12, $_{17}$). 2nd. The head of the body which
looks forward is very globular, and the corresponding cavity in the posterior
surface is of a cup-like shape (Fig. 12, $_{16}$), but larger than the head, in order
that it may receive the inter-articular cartilage which intervenes. 3rd. The
spinous processes (Fig. 12, $_{3, 4, 5, 6}$) are very slightly marked. 4th. The
transverse processes (Fig. 12, b, b, b) are unusually lengthened from before
backwards and downwards, and are each pierced with a hole for the passage
of the vertebral artery. 5th. The four articular or oblique processes (Fig.
12, $_{15, 15, 15}$) project greatly, and have an inclination from above downwards,
backwards and inwards. Each fossa for this purpose is large and deep.

PECULIARITIES OF CERTAIN CERVICAL VERTEBRÆ

THE FIRST CERVICAL VERTEBRA (counting from the head) has received the
name of *atlas* in human anatomy, from its surmounting all the others ; and
though in quadrupeds there is no longer the same reason for the appellation,
it has been extended to them. It deviates more completely than any of the
others from the type of all, the most remarkable differences consisting in
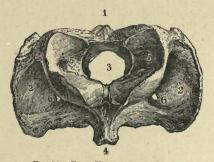
FIG. 13.—FORE VIEW OF THE ATLAS.

1. Upper spine.
2. 2. Wings or alæ.
3. Hole for the passage of the spinal cord.
4. Lower spine.

5. 5. Surfaces for articulation with the condyles of the occiput.
6. 6. Holes for the passage of the vertebral arteries.

the almost total absence of body, and in the division of the large foramen
into two portions by a projecting ridge on the inner side of each lamina.
This ridge is not well shown in the fore view of this bone (Fig. 13), where
it is concealed by the articular surfaces, but it is easily seen in Fig. 14.
Below it the foramen is occupied by the tooth-like (odontoid) process of the
second cervical vertebra, which is confined in its place by a ligament stretched
across from one ridge to the other. Upon this, as on a pivot, the atlas
turns, carrying with it the head, and allowing of those lateral movements
which could not otherwise be accomplished. On each side of the spinal
foramen are the articular surfaces (Fig. 13, $_5$), which are covered with
cartilage, and form a firm hinge-like joint between the atlas and the occiput.

Still more externally are the wings or extended lateral processes (Fig. 13, ₂),
having a hollow deeply cut in them, and ending in a small hole through
which the vertebral artery passes on each side to enter the cranium, making
a sharp convolution in the cavity thus formed for it.   The posterior surface
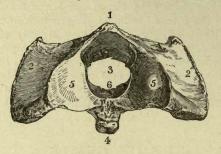
FIG. 14.—BACK VIEW OF THE ATLAS.

1. Upper spine.
2. 2. Wings.
3. Spinal foramen.
4. Lower spine.

5. 5. Surfaces articulating with dentata.
6. Surface articulating with the odontoid process
    of the dentata.

shows the corresponding margin of the spinal foramen (Fig. 14), of which the
one part (6) is occupied by the odontoid process, and the other (3) by the
spinal cord.   On each side of this are the articular surfaces, by which it is
attached to the corresponding surfaces of the second vertebra, and still
more externally are the alæ or wings.   The superior and inferior spinous
processes are shown at 1 and 4 in each engraving.
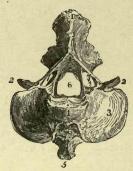
FIG. 15.—ANTERIOR VIEW OF THE SECOND VERTEBRA, CALLED DENTATA OR AXIS.

1. Superior spine.
2. 2. Transverse processes.
3. 3. Surfaces articulating with corresponding ones
    on the posterior part of the atlas.
4. Odontoid process.

5. Inferior spine.
6. Spinal foramen.
7. 7. Foramina for the passage of the vertebral
    arteries.

THE SECOND CERVICAL VERTEBRA, called *axis* from its being the centre
on which the atlas turns, and *dentata*, from its presenting a tooth-like
process for this purpose, approximates somewhat more nearly to the usual
type, but is remarkable for the process already alluded to, which is shown
at ₄ Fig. 15.   Inferiorly this part is smoothly rounded, to enable it to
play against the first vertebra, while superiorly it is flatter, and is in

apposition with the transverse ligament. The four articular processes are shown at ₃, ₃, Fig. 15 and ₅, ₅, Fig. 16. The lateral processes are well shown at ₂, ₂ in both engravings, and the posterior oblique processes at ₅, ₅, Fig. 16. In this latter engraving at ₄, the large hollow cavity (glenoid) is shown, by which the body of this vertebra unites with the head of the third.

THE THIRD, FOURTH, AND FIFTH CERVICAL VERTEBRÆ closely resemble the
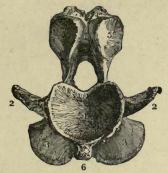
FIG. 16.—POSTERIOR VIEW OF SECOND CERVICAL VERTEBRA.

1. Spinal foramen.
2. 2. Transverse processes.
3. 3. Posterior view of the anterior articular surfaces.
4. Glenoid cavity articulating with the head of third cervical vertebra.
5. 5. Posterior oblique processes.
6. Inferior spine.

type of all; but the third has commonly a more elevated spine, and is thinner across the upper part of the body.

The SIXTH has no inferior spine; its transverse processes are trifid.

THE SEVENTH VERTEBRA is the shortest, and approaches in its characters to those of the dorsal region. Its body posteriorly presents two semilunar hollows for the articulation of the head of the first rib on each side. The superior spine is elevated and sharp, and the transverse process is short and obtuse, being sometimes without the foramen for the vertebral artery.

GENERAL CHARACTERS OF THE DORSAL VERTEBRÆ

THE EIGHTEEN DORSAL VERTEBRÆ differ greatly in general appearance from the cervical, though they still resemble the type of all. Thus, instead of being cuboidal in shape, and without prominent processes, they have each a long spinous process projecting upwards about two or three times the depth of the body, as shown at ₁, ₁, ₁, Fig. 17. The spinal hole is comparatively small, and the transverse processes short. On each side of the upper and lower margin of the body is a smooth hollow, which, together with its corresponding surface in the vertebra, above all (or below, as the case may be), lodges the head of a rib. There is also a second articulating surface on the transverse process, by which the tubercle of the rib is connected with the vertebræ.

PECULIARITIES OF THE DORSAL VERTEBRÆ

THE FIRST DORSAL VERTEBRA differs from the others in approaching to the form of the cervical, as manifested in the shortness of the spinous process, which terminates in a point, and by the large size of its oblique processes. The second and third gradually assume the dorsal type.

The seventeenth and eighteenth vertebræ are devoid of the articulatory sur-
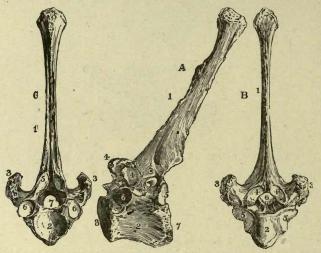
FIG. 17.—DORSAL VERTEBRÆ.

A. Profile view of a dorsal vertebra seen from the left.
  1. Spinous process.
  2. Body.
  3. Convexity on body.
  4. 4. Surfaces for the articulation of the rib tubercle.
  5. Posterior oblique process.
  6. Surface for articulation of the head of the rib.
  7. Concavity on body.

B. Fore view of a dorsal vertebra.
  1. Spinous process.
  2. Convexity on body.

3. 3. Transverse processes
4. 4. Anterior oblique processes.
5. 5. Surfaces for the articulation of the head of the rib.
6. Spinal hole.

C. Back view of a dorsal vertebra.
  1. Spinous process.
  2. Concavity on body.
  3. 3. Transverse processes.
  5. 5. Back oblique processes.
  6. 6. Surfaces for the articulation of the head of the rib.
  7. Spinal hole.

faces on their transverse processes; the eighteenth also is without the articular surfaces on the posterior and external faces of its body, there being no ribs here to articulate with it.

The spinous processes, as far back as the twelfth, take a direction upwards and backwards; the thirteenth takes a direction upwards, and those posterior to it take a direction upwards and forwards. The third, fourth, and fifth spinous processes are the longest, and afterwards they gradually diminish in length.

GENERAL CHARACTERS OF THE LUMBAR VERTEBRÆ

THESE ARE FIVE, and sometimes six, in number ; the body is short and thick ; broader from side to side than from before backwards ; flattened superiorly, convex inferiorly, but not presenting so prominent a spinous ridge as the dorsal. Its articular convexity before and concavity behind assume rather an oval shape. The superior spinous process is shorter than the average of the dorsal vertebræ ; it has broad, flat sides, and protuberates at the front of the summit, having a slight inclination forwards ; the transverse processes, large and flattened above and below, stand out horizontally at right angles to the body for a considerable distance, contrasting strongly with the corresponding parts of the dorsal and cervical regions.
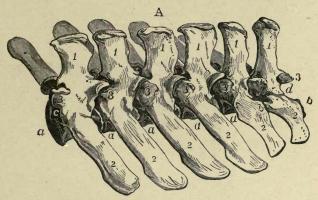
FIG. 18.—PROFILE VIEW OF THE LUMBAR VERTEBRÆ, SEEN FROM THE LEFT.

A. Profile view of lumbar vertebræ.
1. 1. 1. etc. Spinous processes.
2. 2. 2. etc. Transverse processes ; the analogues of the ribs.
3. 3. 3. etc. Oblique processes.
a. a. a. etc. Bodies.
b. b. Articulating surfaces on transverse processes, by means of which the fifth articulates with a similar surface on the sixth, and the sixth with a corresponding surface on the sacrum.
c. Surfaces articulating with corresponding ones on the last dorsal vertebra.
d. Surfaces articulating with the sacrum.

The oblique processes are larger than in the dorsal region ; they project from the roof of the arch in a horizontal direction ($_3$, $_3$, $_3$, Fig. 18) ; the anterior surfaces in each of these joints are concave, widely separated and look inwards ; the posterior are convex, nearer together, and look outwards.

PECULIARITIES OF THE LUMBAR VERTEBRÆ

THE FOURTH LUMBAR VERTEBRA possesses two surfaces of articulation on the posterior border of its transverse process.

THE FIFTH (or the sixth, if there is one) assumes somewhat the characters of the first sacral bone. The transverse processes, which are longest in the middle of this region, gradually shorten towards the sacrum. On the fifth

there is posteriorly an articular surface of an oval form, and on the sixth there is a similar one on each surface, the posterior being slightly concave, and fitting to a corresponding facette on the sacrum.

THE SACRUM

THIS BONE, in form irregularly prismatic, is made up from the conjunction by ossification of five vertebræ, in which latter condition it is found in the embryo. It is united in front with the last lumbar vertebra by three articulatory surfaces ($_{4, 6, 6}$, Fig. 19) posteriorly with the first bone
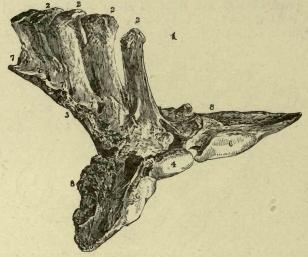
FIG. 19.—THE SACRUM.

1. Fore view of the sacrum.
2. 2. 2. etc. Spinous processes.
3. Lateral free surface.
4. Head articulating with the concavity on the head of the last lumbar vertebra.
5. 5. Oblique processes.

6. 6. Surfaces articulating with transverse processes of last lumbar vertebra.
7. 7. 7. etc. Foramina for the passage of the inferior sacral nerves.
8. 8. Surfaces articulating with the ilium.

of the coccyx, and on each side with the ilium or hip-bone, by a large rough surface ($_{8, 8}$ Fig. 19). The whole bone is slightly curved, with its concavity downwards. This inferior surface is broad and smooth, forming the superior boundary of the pelvic basin. On it are plainly traced four transverse lines, marking the situation of the original divisions into separate bones. Here are also four large holes on each side for the passage of the inferior sacral nerves. The superior surface is furnished with five spines ($_{2, 2, 2, 2}$, Fig. 19), corresponding to the spinous processes of the lumbar vertebræ. They unite at their bases, but are distinct above, terminating in a protuberance which is sometimes bifid. The two sides are thick and concave in the middle, and terminate posteriorly in a rough lip. Anteriorly they form an irregular surface, having an inclination from above downwards, backwards, and inwards. The inferior portion of this face is lined with cartilage, which is attached both to it and to the ilium, while

the superior has a set of strong ligamentous fibres similarly attached. The base looking forwards has been already described as consisting of three articular surfaces, above which is the spinal foramen. The apex is only marked by the surface of articulation with the first bone of the coccyx, above which is the spinal foramen, here obliquely cut and small, and presenting also the rudiments of oblique and transverse processes.

THE COCCYGEAL VERTEBRÆ

THESE BONES form the skeleton or bony basis of the tail, receiving their name from κόκκυξ, *a cuckoo*, whose bill was supposed to resemble this part in the human body. They vary in number from sixteen to eighteen. In the
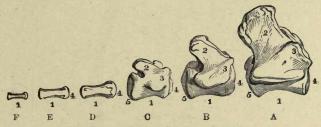
FIG. 20.—PROFILE VIEW OF COCCYGEAL VERTEBRÆ.

1. 1. 1. etc. Bodies.
2. 2. 2. Spines: the lips forming the first are joined, forming the neural arch, the second partially so, and the third are open.
A, first; B, third; C, eighth; D, sixteenth; E, seventeenth; F, eighteenth, or last coccygeal vertebra.

3. 3. 3. Transverse processes.
4. 4. 4. etc. Fore surfaces by means of which the bodies articulate.
5. 5. 5. Back surfaces of articulation.

first four or five all the characters of a vertebra are present, as shown below at A B; but these are gradually lost, and the bones at last assume the form of simple spines, D E F, the intermediate grade being seen at C. Here there are two little processes (2), evidently abortive neural arches or lateral laminæ, but not meeting together to form the spine. This whole set of bones is simply intended as a strong and flexible whip, to be moved by the four sets of muscles lying along, and attached to the sides of each.

THE RIBS AND THEIR CARTILAGES

THE RIBS (*costæ*) have been described at page 351 as forming the lateral boundaries of the thorax. They are eighteen in number, of which the nine anterior (true or sternal) extend by means of their cartilages to the sternum, while the cartilages of the remainder do not extend so far, and they are therefore styled false or asternal (see Skeleton at page 348).

The ribs are all long flattened bones, irregularly twisted on themselves, and so arranged that, when forming the walls of the thorax, they readily increase the volume of its contents by being drawn nearer together and towards the apex. In doing this they revolve upon their extremities as upon two centres, the superior admitting of motion from their formation as joints, and the inferior from their elastic cartilaginous structure.

Each rib is divisible into a body and two extremities. The body has two flat surfaces and two borders; the latter of which are concave and thin, anteriorly convex, and rounded posteriorly. The head or superior extremity varies in the true and false ribs, as will be better seen by reference to the
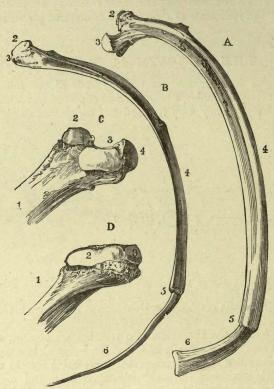
FIG. 21.—A TRUE AND FALSE RIB.

A. Profile view of a left true or sternal rib.
  2. Tubercle for attachment to transverse process of vertebra.
  3. Head, true.
  4. Body.
  5. Junction of rib and its corresponding sternal cartilage.
  6. Sternal cartilage.
B. Profile view of left false or asternal rib (eighteenth).
  2. Tubercle fused in one with the head.
  3. Head.
  4. Body.
  5. Junction of false rib and asternal cartilage.
  6. Asternal cartilage.
C. View of the upper extremity of sternal rib inverted to show the mode by which the articulating surfaces on the upper part of the rib correspond to the nine anterior dorsal vertebræ.
  1. Body.
  2. Tubercle, separate.
  3, 4. Head (true), showing the two surfaces of articulation, and the notch in which the round ligament is attached.
D. View of the last asternal rib, also inverted to show the fusion of tubercle and head together.
  1. Body.
  2, 3. Tubercle fused with head.

engraving (Fig. 21), where one of each kind is delineated. The cartilages are all attached to the ribs by firm union of their fibres to a deep pit in the extremity of each rib. They serve the double purpose of giving elasticity to the thorax in the act of respiration and of enabling it to bear severe shocks without fracture.

Among the several ribs, the first is the thickest and shortest, and is irregularly arched; the second is very slightly curved : from this point they

increase in length and breadth to the ninth; from the ninth to the last they become more curved and short. In the seventeenth and eighteenth the articulatory surface of the tubercle becomes confounded with that of the head, and the neck is wanting (see $_{2, 3}$ B, Fig. 21).

THE STERNUM, OR BREAST-BONE

THE STERNUM, which forms the inferior boundary of the thorax (see page 403), forms in the adult one long keel-like bone, of a spongy or cellular nature, more or less divided by cartilage; but in the embryo it, like the sacrum, is made up of distinct pieces, six or seven in number. Anteriorly
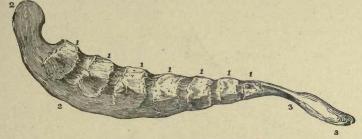
FIG. 22.—PROFILE VIEW OF STERNUM (BREAST-BONE).

1. 1. 1. etc. Pits for attachment of costal cartilages.
2. 2. Anterior extremity ending in cariniform cartilage.
3. 3. Posterior extremity with its ensiform cartilage.

the breast-bone is prolonged in a manner resembling the keel and figure-head of a ship, being clothed with cartilage, which is hence called cariniform (carina, *a keel*) ($_{2, 2,}$ Fig. 22). Posteriorly it terminates also in a cartilage of a thinner and more flexible form, and called, from its resemblance to a sword, ensiform (ensis, Lat. *sword*) or xiphoid (ξίψος, Gk. *sword*).

THE SIDES are occupied above by the cavities for the insertion of the costal cartilages, and below by a rough surface, to which the fibres of the pectoral muscles are attached. The superior face forms a very lengthened isosceles triangle, having its apex forward. It is slightly hollowed from before backwards.

THE THREE ANTERIOR DIVISIONS of the sternum present broad lateral surfaces; the three posterior have projecting sides inclining downwards, and forming the boundaries between the inferior surface and the sides. The ribs are received into cavities in the cartilage existing between the separate bones, the last posteriorly having, however, an additional pit in its middle for the cartilage of the eighth rib.

SCAPULA, BLADE-BONE OR SHOULDER-BLADE

INTERVENING BETWEEN the thorax and the fore extremity, and presenting large surfaces for the attachment of muscles to connect these two parts of the skeleton, is the scapula or shoulder-blade. It is a triangular flat bone, and lies obliquely on each side of the anterior part of the thorax, with its

apex looking downwards and forwards, and its base upwards and backwards (see page 348).

IT PRESENTS three fossæ, three borders, and three angles ; in addition to which there are the spine, the coracoid process, and the glenoid cavity.

THE FOSSÆ are two externally, (*a*) the anterior, and (*b*) the posterior fossa, divided by the spine (₁, Fig. 23). These lodge and give attachment to the fibres of the supra and infra-spinatus muscles, while the internal fossa, sometimes called the venter scapulæ (belly of the scapula), in the same way subserves the use of the subscapularis.
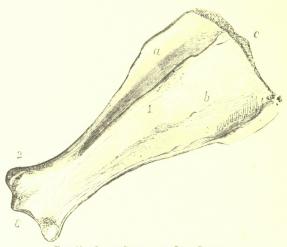
FIG. 23.—OUTER SURFACE OF LEFT SCAPULA.

1. Spine.
2. Coracoid process.
3. Glenoid cavity.
a. Anterior fossa.

b. Posterior fossa.
c. Superior costa, to which the cartilage is attached.

THE SUPERIOR BORDER is rough for the attachment of the broad strip of cartilage, which increases the length of the blade. The anterior border is thin, while the posterior is comparatively thick.

THE TWO SUPERIOR ANGLES present nothing very remarkable, but the inferior is occupied by the coracoid process anteriorly, and by the glenoid cavity posteriorly—which latter is a smooth oval cavity, lined with cartilage. It receives the head of the humerus.

ON ACCOUNT OF THE IMPORTANT offices belonging to the muscles which occupy the fossæ on this bone, and since it is found that in proportion to the extent of the latter will be the muscular power, horsemen examine with great care the due development of the scapula. Unless it is long and broad it may always be predicted that the hunter will be powerless in using his fore-legs "in dirt," or in getting out of other difficulties ; and though some hacks with short shoulders may go well enough, yet, in the majority, such will not be the case. Heavy draught-horses, in which a great thickness of muscle is heaped upon the blade, are not so dependent upon its length and breadth, as has been already shown in treating of the external form of the horse at page 107.

HUMERUS, THE UPPER ARM-BON

LIES between the scapula and elbow, in an oblique direction from the point of the shoulder downwards and backwards.

LIKE ALL THE LONG BONES, the humerus may be described as consisting of a body or shaft and two extremities.

THE BODY, which has a prismatic section, looks as if it had been twisted on itself. In the upper part it is expanded laterally to form the external tuberosity ($_5$, Fig. 24) on the outside and the scabrous tubercle ($_4$, Fig. 25) internally, both being for the attachment of muscles. Towards the lower extremity it becomes rounded, and then suddenly spreads out to present the

FIG. 24.—EXTERNAL VIEW OF LEFT HUMERUS.

1. Body of humerus with musculo-spiral groove.
2. Head.
3. External tubercle.
4. Tubercles in front of head.
5. External tuberosity.

6. Sigmoid fossa.
7. Olecranon fossa.
8. External condyle.
9. Internal condyle.

wide surface which ends in the condyles on each side with the intervening articular surfaces.

THE SUPERIOR EXTREMITY, larger than the inferior, presents for consideration a head and four tubercles. The head is the hemispherical smooth part, projecting posteriorly. It articulates with the glenoid cavity of the scapula, which it much exceeds in extent of superficies. Anteriorly, the head is surmounted by four tubercles; three directly in front are between two smooth grooves, which are covered with cartilage. The outer, or fourth tubercle, is joined with the tuberosities by a protuberant ridge, the external edge of which serves to guard against dislocation.

THE INFERIOR EXTREMITY is made up of two condyles, or knuckle-like projections ($_{8, 9}$, Fig. 24), having between them the smooth articular surface for the elbow joint. This surface is broad, and assumes a segmental form, being

divided into three portions by projecting lines—First, a middle groove, which terminates in front in the coronoid fossa and behind in the olecranon fossa, each being for the reception of the corresponding processes of the ulna and radius, thereby checking the motion of the joint. Second, the external

FIG. 25.—INTERNAL VIEW OF LEFT HUMERUS.

A. Body or shaft.
1. The head.
2. Tubercles on the head.
3. Internal tubercle.
4. Scabrous tubercle.

5. Internal depression to which the internal lateral ligament is attached.
6. Back part of inner condyle.
7. Internal condyle.

groove, which is comparatively slightly marked; and third, the smooth surface lining the internal condyle. All of these fit accurately into the articular surface of the ulna and radius, to be presently described, allowing of nothing but a hinge-like motion. Of the condyles, the inner is larger and more projecting than the outer.

In the young foal the two extremities are distinct epiphyses, united to the shaft by cartilage only.

THE BONES OF THE FORE-ARM (OS BRACHII)

In the human subject, and in the dog and cat among our domestic animals, the bones of the fore-arm are distinct, and may readily be separated from each other as the ulna and radius. In the early periods also of the life of the horse the same condition obtains, but when he is matured, these bones are indissolubly united by ossification. The line of junction can always be traced, and there is an opening left which is called the *radio-cubital arcade*, and gives passage to an artery and vein. It will be therefore understood that the term *os brachii* means the bone composed of the united ulna and radius, and that in alluding to each of these divisions we only speak of them, in analogy with human anatomy, as separate bones. By

drawing a line from the back of the condyle of the humerus till it cuts the posterior edge of the shaft of the os brachii about its middle, the line of demarcation may easily be arrived at.

THE RADIUS forms the bulk of the *os brachii,* supporting the weight of the body upon its head, and conveying it to the carpus through its lower extremity. Its *shaft* is long, smooth, and convex anteriorly ; rough for the attachment of muscles posteriorly. The *superior extremity* is expanded and presents an articular surface divided into two fossæ by a slight ridge, the inner of the two being broader and more circular. On each side of these pits is a slight projection, called the lateral process, to which the corresponding ligaments are attached. The *inferior extremity,* which is also expanded, is remarkable for the variously shaped pits slightly marked on its articular surface, each being intended to fit one of the carpal bones of which the knee is made up. There is a prominent internal lateral process, and one less distinct on the outside marked with a groove.

THE ULNA (or ulnar division of the os brachii) is much shorter than the radius, and can scarcely be considered as having two extremities, its lower end being cut off in an oblique direction and terminating in a sharp point, so as to look like a splicing of the one bone to the other. It may be considered as consisting of a short body ($_2$, Fig. 26), surmounting which is the olecranon process (3) behind, and the articular surface (4)

FIG. 26.—BONES OF THE FORE-ARM, KNEE, CANNON, PASTERNS, AND FOOT.

1. Semicircular fossa formed by the radius and ulna for the elbow joint.
2. Body of the ulna.
3. Olecranon process.
4. Articulating surface.
5. Body of the radius.
6. Surface articulating with the condyle of the humerus.
7. Tubercle to which the coraco-radialis muscle is attached.
8. Articulatory surfaces corresponding to the upper row of knee-bones.
9. Os pisiforme.
10. — cuneiforme.
11. — lunare.
12. — unciforme.
13. — magnum.
    } Bones of the knee.
14. Metacarpus or cannon-bone.
15. External small metacarpal bone.
16. Tubercle to which the tendon of the muscle (extensor metacarpi magnus) is attached.
17. Joint uniting with the os suffraginis.
18. Os suffraginis.
19. External sesamoid bone.
20. Os coronæ.
21. Os pedis.
22, 22. Wings of pedal bone.
23. Os naviculare.

in front. Descending from the body is the thin wedge of bone which is united indissolubly with the shaft of the radius at the point marked 5, and may be traced down to the carpal joint.

The *articular surface* comprises part of the elbow joint, and has below it some roughened inequalities for the attachment of ligaments.

The *olecranon process*, or elbow, is of considerable size and strength, forming a strong lever for the action of the triceps muscle, which is inserted in its point. Its anterior edge has a sharp point, which deepens the articular cavity, and checks the motion of the joint from being carried too far.

THE CARPUS (KNEE) AND METACARPUS (CANNON)

THE KNEE of the horse corresponds with the wrist of man, and though the name so well known to horsemen will probably always be maintained, yet scientifically each of the bones receives the corresponding names, and the whole group is called the carpus.

The anterior surface of the carpus is convex; the posterior, concave and irregular, and marked by bony prominences.

It consists of eight bones, disposed in two rows, one above the other, as follows:—

The first, or top row, beginning to enumerate from within outwards, consists of the scaphoid, lunar, cuneiforme, and pisiforme bones.

The second, or lower row, consists of the essa trapezoid, magnum, and unciforme, and sometimes of a small floating bone situated behind the trapezoid.

The superior row may be described as follows:—

Os SCAPHOIDES (σκάφη, *a cradle*), the largest of this row, articulates superiorly with the inferior and inner extremity of the radius, internally by means of two distinct facettes with the os lunare, and inferiorly with the os trapezoides and os magnum.

Os LUNARE (luna, *the moon*) articulates superiorly with the radius, internally as before mentioned with the os scaphoides, and externally through the medium of two facettes with the os cuneiforme.

Os CUNEIFORME (cuneus, *a wedge*) articulates superiorly with the inferior and outer extremity of the radius, inferiorly with the os unciforme, and posteriorly with the os pisiforme.

Os PISIFORME (pisum, *a pea*) is situated at the postero-external side of the top row, and presents for description two surfaces and four borders. The external surface is unevenly convex, and elevated for ligamentous attachment. The internal surface is concave and porous, and also roughened for ligamentous attachment. The anterior border
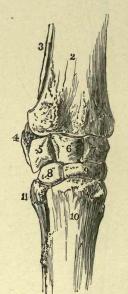

FIG. 27.—FORE VIEW OF THE CARPAL BONES, COMMONLY CALLED THE KNEE.

2. Lower extremity of radius.
3. Ulna, lower extremity of.
4. Os pisiforme.
5. — cuneiforme.
6. — lunare.
7. — scaphoides.
8. — unciforme.
9. — magnum.
10. Large metacarpal bone.
11. Small metacarpal bone.

presents two smooth ovoid surfaces: the superior one articulates with the radius; the inferior with a corresponding surface, mentioned as occurring on the posterior surface of the os cuneiforme. The three other borders, namely, the superior, posterior, the inferior, are unevenly convex, and roughened for the attachment of ligaments.

The bones of the inferior row, viz. the Os TRAPE-ZOIDES (τράπεζα, *a table*), Os MAGNUM (the large bone), and Os UNCIFORME (uncus, *a hook*), articulate laterally one with the other, superiorly with the top row of bones, and inferiorly with the three metacarpal bones.

THE METACARPAL BONES, answering to the bones in the palm of the hand of man, are three. One (metacarpus magnus) is much larger than the other two, which, from thus supporting, are sometimes called splint-bones.

THE METACARPUS MAGNUS, or cannon-bone, has a body and two extremities, the superior of which articulates with the carpus while the inferior rests upon the next phalanx, or great posterior bone (see Fig. 26).

THE BODY is convex and smooth, anteriorly and laterally; thus forming two-thirds of a cylinder. Posteriorly it is flattened; its sides, extending from above, downwards, to about three inches above its inferior extremity, present two triangular scabrous surfaces, on the upper parts of which two smooth articulatory spots occur, to which the small metacarpal bones are attached.

THE SUPERIOR EXTREMITY presents a smooth articulatory surface which is, for the most part, flat; it slopes off, however, on its outer side for articulation with the os unciforme. There is also another small spot which slightly declines, situated at the outer side of the head of the inner small metacarpal bone. This spot articulates with the postero-inferior surface of the os trapezoides. The flat surface articulates with the os magnum, to which it corresponds in figure. Its anterior and lateral edges are somewhat roughened.

THE INFERIOR EXTREMITY presents two smooth condyloid surfaces, separated by a smooth semicircular eminence, which articulate with a corresponding formation on the superior extremity of the os suffraginis. On the sides of each of the condyles a depression occurs.

OSSA METACARPI PARVA are in number, two; external and internal. In form they are pyramidal, presenting bases turned upwards, apices downwards, and bodies or middles.

FIG. 28.—OS PISIFORME.

1. Body of os pisiforme.
2. Surface articulating with inferior extremity of the radius.
3. Surface articulating with the cuneiform bone.

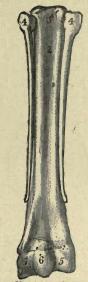FIG. 29.—BACK VIEW OF THE LARGE AND SMALL METACARPAL BONES.

2. Metacarpus magnus.
3. The surfaces above articulate with the lower carpal bones.
4. 4. External and internal small metacarpal bones.
5. 5. Condyloid surfaces articulating with corresponding ones on the upper extremity of the os suffraginis.
6. Eminence articulating with a corresponding depression on the upper extremity of the os suffraginis.

THE BASE is surmounted by a smooth articulatory surface, surrounded inferiorly by roughened tuberosities, except anteriorly, where two smooth articular surfaces occur, which articulate with corresponding surfaces mentioned as existing on the metacarpus magnus.

THE BODY is trifacial. The anterior surface is rough, and articulates with the metacarpus magnus. The inner surface is excavated. The outer surface is convex and smooth. The apex terminates in a bulbous extremity, which looks posteriorly, and does not articulate with the metacarpus magnus.

THE PHALANGEAL BONES (PASTERNS AND FOOT)

BEYOND THE METACARPUS in the horse, there is only a single bone in each joint, the five fingers being merged in one. The same number of phalanges, however, is maintained, counting from the metacarpus to the distal phalanx, which is the pedal bone. The whole may, therefore, be considered as analogous to one human finger, with the addition of the two sesamoid bones, and the navicular bone, all three of which are intended to assist in giving leverage to the tendons moving these parts. The highest of these is the *os suffraginis* or larger pastern, the next the *os corona* or lesser pastern, and the lowest the *os pedis* or coffin-bone.

THE OS SUFFRAGINIS and its OSSA SESAMOIDEA may be taken together, the latter lying on each side of the back of its superior extremity, but playing only on the large metacarpal. They are separately shown at Fig. 30. The os suffraginis has a body and two extremities.

THE BODY shows an anterior surface, which is convex and smooth ; and a posterior which is rough and flattened, and presents superiorly a triangular space, bounded laterally by two roughened ridges, which meet at a point inferiorly.

FIG. 30.—OSSA SESAMOIDEA.

THE SUPERIOR EXTREMITY presents two shallow concavities, which are separated one from the other by a deep transverse canal. Behind these concavities, two tuberosities exist for the attachment of the crucial ligaments.

THE INFERIOR EXTREMITY has two semi-cylindroid convexities, divided transversely by a shallow depression, which is widened posteriorly.

OS CORONÆ (corona, *a coronet*) is in form a parallelogram with four surfaces.

THE ANTERIOR SURFACE is convex and roughened, presenting two tuberosities below.

THE POSTERIOR SURFACE is smooth, and has superiorly a semilunar smooth surface.

THE SUPERIOR SURFACE presents two ovoid concavities, divided by an eminence running from behind forwards, and bounded, anteriorly and posteriorly, by two roughened projections. These form the lesser fetlock joint with the bone above.

THE INFERIOR SURFACE resembles the corresponding part of the os suffraginis.

Os PEDIS (*the bone of the foot*, formerly called the coffin-bone). In form it is semilunar, divided into wall, sole, articulatory surface, and retrossal processes, commonly called wings (see Fig. 31).

THE WALL, the semicircular prominent part, possesses some degree of declivity, increasing in circumference from above, downwards. It is full of foramina, and rough. Superiorly, the bone bulges out, forming the coronal process (8, 8). The middle part of it terminates in a peak, which looks slightly backwards—the cacumen coronæ (*the peak of the coronet*).

The wall terminates posteriorly in wings; THE RETROSSAL PROCESSES

FIG. 31.—POSTERIOR VIEW OF PHALANGES.

A. Os suffraginis.
  1. 1. Surfaces articulating with the lower extremity of the large metacarpal bone.
  2. Groove.
  3. Rough surface for the implantation of ligaments.
  4. 4. Inferior extremity articulating with
B. Os coronæ.
  5. 5. Superior articulatory surfaces.
  6. 6. Inferior articulatory surfaces.
C. Os pedis.
  7. 7. Articulatory surfaces.
  8. 8. Coronal process.
  9. 9. Scutiform processes.
  10. 10. Retrossal processes.
  11. Surface articulating with a corresponding one on the navicular bone (12.)
D. Os naviculare.
  12. Surface articulating with the os coronæ.
  13. Surface over which the flexor pedis perforans tendon glides.
  14. 14. Points attached to the pedal bone by ligaments.

(10,10); each wing is divided into two parts by a groove, which runs through it from before, backwards.

THE INFERIOR SURFACE or SOLE is divided into an anterior semilunar plantar surface, and into a posterior sharp semicircular edge which divides it from the tendinous portion. The former is slightly concave, porous, and bounded by the inferior circumferent edge of the wall.

THE SUPERIOR ARTICULATORY surface, semilunar in form, presents two lateral concavities, separated by an eminence. The eminence is bounded anteriorly by the cacumen coronæ, which stands before it, the point looking backwards. Posteriorly, it is bevelled off for articulation with the os naviculare.

Os NAVICULARE (navis, *a ship*), sometimes called the shuttle-bone, in form is semilunar and elongated. It is divided into four surfaces and two extremities.

THE SUPERIOR SURFACE presents, in its centre, an eminence, which declines laterally, leaving two slight concavities.

THE INFERIOR SURFACE presents two slightly convex divisions, with a prominent smooth ridge dividing them, running from behind forwards.

THE ANTERIOR SURFACE presents superiorly a smooth triangular articulatory surface, and inferiorly a porous, roughened face.

THE POSTERIOR SURFACE is triangular, roughened, and porous. The extremities, the internal and external, turned upwards, terminate obtusely.

THE PELVIS

THE GENERAL FEATURES belonging to the pelvis have been alluded to in the last chapter, and the sacrum which forms its upper wall has been described in this. It remains now to ascertain the shape and anatomical
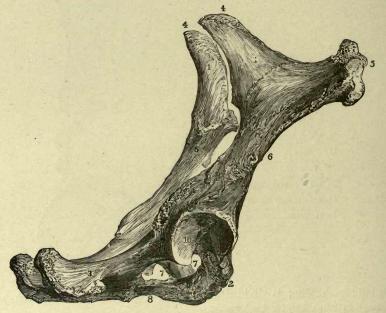
FIG. 32.—PROFILE VIEW OF THE TWO OSSA INNOMINATA.

1. 1. Wings of the iliac bones.
2. 8. Pubic bone.
3. Ischiac bone.
4. 4. Supero-posterior spinous process of the two ossa ilii.
5. Antero-inferior spinous process of the left ilium.
6. The narrow part or neck of the ilium.
7. 7. Obturator holes (foramina).
9. 9. Tuberosity of each ischium.
10. Acetabulum.

bearings of the bones which complete the arch. These in the embryo are three on each side, uniting below in the median line by symphysis, and above to the rough surface on the side of the sacrum. These three are 1st, *Os ischi*; 2nd, *Os ilii*, and 3rd, *Os pubis*. The whole bone, which is firmly united in the adult, receives the somewhat paradoxical denomination of *Os innominatum*, or the unnamed bone.

ON REFERRING TO THE SKELETON at page 348 it will be apparent that the attachment of this bone to the sacrum is so arranged that it shall act as a

spring in breaking the jars received by the hind extremity from the ground. Its oblique direction, its comparatively short surface of attachment to the sacrum, and its own great length show this most plainly, especially when compared with the human pelvis, in which a very different formation prevails. In the horse it forms, with the sacrum, the first of a series of angles, the second being between it and the femur, the third at the stifle joint, and the fourth at the hock.

In the embryo the three bones are quite distinct, the cartilaginous lines of separation being visible for some time after birth, running through the cup-like cavity which forms the socket of the hip joint. The portion lying above and in front of this cavity, and taking in also two-thirds of its own cup, is the os ilii. Posteriorly to the cavity, the bone is divided into two strong branches by a large opening, the *obturator foramen*, and that portion which lies above it is the *os ischii*, while the lower division is the os pubis. It is needless to describe these bones separately.

The bone as a whole may be considered as divided into two parts by the contracted neck which forms its middle. The anterior of them is hollowed out externally for the reception and attachment of the glutei muscles. Internally it is rough, and gives attachment to the strong cartilage and ligaments which bind it to the sacrum. The processes extending forwards are called the spinous processes of the ilium (see Fig. 44). Behind the neck the bone swells out slightly for the development of the cotyloid (κοτύλη, *a cup*) cavity, or acetabulum. This is nearly three inches in diameter, and is surrounded on all sides but that looking towards the obturator foramen by a prominent lip. The interval is called the notch, and corresponding with it is a rough depression in the cotyloid cavity, where the cartilage is absent, and to which the round ligament of the hip is attached. Behind the cotyloid cavity is the obturator hole, apparently intended to lighten the bone, being filled up by a strong membrane, the obturator ligament. Above this opening is the ramus of the ischium, which bone also enters into the composition of the hip joint as already described. Posteriorly the ischium terminates in a rough protuberance, the tuberosity (9–9, Fig. 32), which is the rounded projection felt and seen on each side the root of the tail in the living horse. Below the foramen is the os pubis, the anterior part of which is the ramus, and the small section of the cotyloid cavity which it forms, while posteriorly the body unites with the os ischii, to form, with the corresponding bones of the opposite side, the symphysis, or connecting joint between them.

By the conjunction of the two ossa innominata an oval ring is nearly completed, the deficiency being supplied by the sacrum above. The anterior margin of this ring is the brim of the pelvis, and it is upon the size of this as compared with the foal that parturition is in general rendered easy or difficult.

THE FEMUR (ROUND-BONE) AND PATELLA

The Os Femoris, the strongest and heaviest bone in the body, is situated between the os innominatum and the tibia. It takes an oblique direction from above downwards and forwards, and presents a central part or body,

and two extremities. It was formerly called the round-bone, from being in the centre of the part called by butchers "the round."

THE BODY, although compressed, is nearly cylindrical towards its centre; anteriorly, the bone is convex and smooth; posteriorly, flattened and rough; superiorly and inferiorly, it is expanded to meet the enlarged extremities.

THE SUPERIOR EXTREMITY is prolonged into a thick, flattened neck,
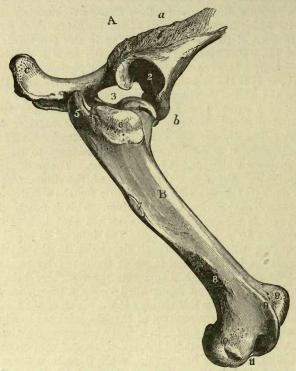
FIG. 93.—THE FEMUR, PARTIALLY DETACHED FROM THE COTYLOID CAVITY.

A. External view of posterior half of the os innominatum.
  a. Rough surface for the attachment of muscles.
  b. Cotyloid rim.
  c. Tuberosity of the ischium.
  1. Cotyloid cavity.
  2. Depression in which the round ligament (ligamentum teres) is fixed.
  3. Obturator hole.
B. External view of the right femur.

4. Head of the femur (round-bone).
5. Trochanter major externus.
6. Tubercle on the head of the femur.
7. Trochanter minor externus.
8. Fossa for muscular insertion.
9. 9. Trochlear surfaces for articulation with the patella (knee-cap).
10. External condyle.
11. Surfaces articulating with upper extremity of the tibia, or leg-bone.

directed upwards and inwards, so as to form an obtuse angle with the shaft. At the point of union are two eminences (trochanters, τροχὰν, to run or roll); one on the outer, and the other on the inner side; and it is from between these that the neck arises.

The trochanter major is prolonged from the postero-external margin of the body, and nearly in a line with its axis: it is a large irregular projection, rising into a pyramidal eminence. Posteriorly, at its base, it presents

an oval cavity, the digital fossa, for the attachment of several small muscles. Inwardly it presents a concavo-convex smooth surface ; outwardly, a convex and rough one. From the back of the great trochanter a prominent line runs vertically down, terminating in the trochanter minor externus (7. Fig. 33) ; and from this again a roughened ridge descends, taking a course downwards and slightly forwards to the oval fossa situated above the external condyle (8).

The neck is surmounted by a hemispherical smooth head, coated with cartilage, and lodged in the acetabulum ; on it is a deep ovoid fossa, which gives attachment to the ligamentum teres.

The trochanter minor internus, a conical rounded eminence, arises from the posterior and internal side of the bone. It is placed above the trochanter minor externus, which is on the opposite side.

THE INFERIOR EXTREMITY has on each side an eminence (the external and internal condyles), separated by a deep fossa. Between these anteriorly two articular surfaces occur (external and internal), separated by a semicircular groove, in which the patella plays.

The external condyle is larger and projects more forwards than the internal ; its articular surface is also broader : the internal presents a tuberosity on its inner surface.

The articular surfaces of both condyles are covered with cartilage, and united anteriorly to the prominences before mentioned, where they form a pulley-like surface, concave from side to side, over which the patella glides. Inferiorly, from before backwards, these prominences converge together, and terminate abruptly on the postero-interior surface of the bone ; thus leaving a space between them and this interval, which has been denominated the intercondyloid fossa.

THE PATELLA, STIFLE-BONE, OR KNEE-CAP, lies on the lower extremity of the femur, at the anterior part of the stifle joint. It is quadrangular in form ; its anterior surface is converse and rough ; its posterior being covered with cartilage is smooth, and is divided by an eminence running over it into two shallow cavities (the superficies of the internal being the larger), which correspond with the trochlear prominences, situated anteriorly to the condyles of the femur. Superiorly it presents a triangular roughened space, bounded by its two lateral angles, which gives attachment to muscles, and inferiorly we notice a fourth angle. These angles are all blunt and slightly rounded off.

FIG. 34.—POSTERIOR VIEW OF THE PATELLA.

1. Superior angle.
2. 3. Surfaces gliding on the trochleæ of the femur.

BONES OF THE LEG

THE TIBIA (so called because the ancient shepherds used this bone as a flute) lies between the femur and tarsus (hock), forming an angle with each. It is broad, and of a spongy texture above ; contracted and dense below, where it is felt immediately beneath the skin and tendons.

THE BODY is of a triangular or prismatic shape above, its angles gradually rounding off below, and then expanding laterally to meet the condyles of the

lower extremity. The anterior angle is the shin, and at the upper part of this is a strong tubercle (₃ Fig. 35).

THE SUPERIOR EXTREMITY has two irregularly oval and slightly hollowed articulatory surfaces, which revolve upon the condyles of the femur, the cavity being deepened in each by the intervention of the semilunar cartilage. Between them are to be seen a sharp elevation and two pits to which the
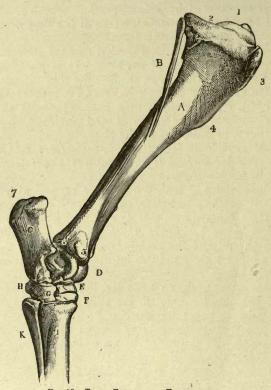
FIG. 35.—TIBIA, FIBULA, AND TARSUS.

A. Tibia.
   1. 2. Articulatory surfaces.
   3. Tuberosity.
   4. Spine.
   5. External malleolus.
   6. Surfaces articulating with astragalus.
B. Fibula.
C. Os calcis.
   7. Point of hock.

D. Astragalus.
E. Os scaphoides.
F. Os cuneiforme magnum.
G. Os cuboides.
H. Os cuneiforme parvum.
I. Upper part of large metatarsal bone.
K. Upper portion of the external small metatarsal bone.

crucial ligaments are attached. In front is the tuberosity to which the ligament of the patella is fixed. On the sides of the head are the condyles, rough for the attachment of the corresponding ligaments, and the external having an oval articular fossa for the head of the fibula.

THE INFERIOR OR TARSAL EXTREMITY is much smaller than the superior, but wider than the body, and nearly quadrilateral; its anterior border is flat and rough; its posterior border is also flat, and presents numerous foramina.

The external border is prominent and rough, and has a groove in its centre. Depending from each side is a process (the internal and external malleolus of human anatomy), serving to strengthen the articulation with the astragalus, and the internal being considerably the longer. Between these are two deep grooves, smoothly covered with cartilage, and having a projection in the middle similarly clothed. The direction of these grooves is obliquely forwards and outwards. Both the malleoli are lined with cartilage, which enters into the joint.

THE FIBULA is a slender bone, having a slight enlargement at its superior extremity to form the head. On its inner surface there is a layer of articular cartilage to form the joint with the tibia. Below it has a bulbous end, which is free, and affords attachment to the ligamentous fibres which connect it with the tibia. Between the two bones there is a considerable space, occupied by a thin membrane.

THE TARSUS, or hock, is made up of several bones connecting the tibia above with the metatarsus below. It corresponds with the ankle of man; and if the term wrist were to be applied to the knee of the horse, as suggested by certain writers, in order to be consistent the hock must be called the ankle, which would lead to endless confusion. The better plan is to retain the names by which these parts are known in our ordinary language, and to adopt the nomenclature of the anatomical school for any scientific description. Thus the carpus and tarsus of the anatomist are rendered into the knee and hock of the horseman without impropriety, and at the same time without any chance of a misunderstanding.

THE TARSUS consists of six bones, disposed in two rows, the astragalus and os calcis forming the upper one, but the former bone alone entering into the tibio tarsal, or hock joint, with the tibia.

THE ASTRAGALUS ($\grave{\alpha}\sigma\tau\rho\acute{\alpha}\gamma\alpha\lambda os$, *a die*) is an irregular bone, situated in front of the os calcis, between the tibia and the os scaphoides: it is divided into five sur-
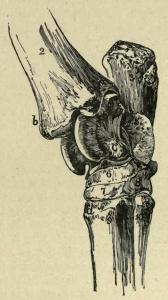
FIG. 36.—INTERNAL VIEW OF TARSAL BONES.

2. Inferior extremity of the tibia.
a. Internal malleolus.
b. External malleolus.
3. Os calcis.
4 and 5. Surfaces of articulation on the astragalus, which, together with corresponding ones on the tibia, form the great hinge-joint of the skeleton.
c. Tubercle on the astragalus for the attachment of ligaments
6. Os scaphoides.
7. — cuneiforme magnum
8. — cuneiform parvum.
9. — Large metatarsal bone.
10. Internal small metatarsal bone.

faces: first, the supero-anterior surface, pulley-like and articulatory, corresponds with the inferior extremity of the tibia, and consists of two semicircular prominences, separated by a deep groove, taking a course obliquely outwards and forwards; secondly, the inferior presents a smooth convex surface with a roughened depression posteriorly, for ligamentous attachment, and articulates with the superior face of the os scaphoides;

thirdly, the posterior is irregular, and presents on its surface four smooth faces for articulation with the os calcis, which are separated by roughened excavations. The external side is marked by ligamentous impressions; the internal, smoother than the external, presents behind and below a little tubercle, which gives attachment to ligaments.

THE Os CALCIS (*the heel-bone*).—This bone, forming the point of the hock, presents two surfaces, two borders, and two extremities; the external surface is almost plain; the internal is excavated as a groove; the anterior is slightly concave; the posterior is straight and roughened; on the superior extremity is a thick tuberous termination, to which the hamstrings are attached; its inferior extremity is large and concave, and presents four surfaces for articulation with the astragalus, os cuboides, and os scaphoides, and a median rough interspace to which ligaments are attached.

THE Os CUBOIDES (κύβος, *a cube*) is situated on the postero-external sides of os cuneiforme magnum and os scaphoides, between the inferior extremity of the os calcis and the head of the external small metatarsal bone and also a portion of the superior extremity of the large metatarsal bone. It presents six surfaces: a superior, which articulates with the os calcis: an inferior by two facettes corresponds to similar ones situated on the large and external small metatarsal bones just mentioned; internally two arthrodial surfaces occur, which face with similar surfaces on the os cuneiforme magnum and os scaphoides. The external, anterior, and posterior surfaces are roughened for ligamentous attachment.

THE Os SCAPHOIDES is in figure triangular; the superior surface, smooth and slightly concave, is entirely articulatory, with the exception of a little groove, running to its middle from the outer side; this surface corresponds with the under surface of the astragalus. The inferior surface is similar to the superior, except that it is slightly convex, and articulates with the superior surface of the os cuneiforme magnum, and also on its internal angle with the os cuneiforme parvum; it offers also, on its postero-external face, two small diarthrodial surfaces for articulation with the os cuboides; in the rest of its extent, it is roughened for ligamentous attachment.

THE Os CUNEIFORME MAGNUM.—This bone, although smaller than the scaphoid, at the same time greatly resembles it; its superior surface articulates with the inferior surface of that bone; the inferior surface articulates with the large metatarsal bone; its external border is provided with two arthrodial spots for articulation with corresponding ones on the os cuboides. The internal border also offers a spot which articulates with a similar one on the os cuneiforme parvum; its anterior border is roughened throughout.

THE Os CUNEIFORME PARVUM is situated on the internal side of the tarsus. This bone, smaller than all, is prolonged from before backwards, flattened from one side to the other, and articulates with the os cuneiforme magnum and with the large and internal small metatarsal bones, to which it corresponds by four surfaces covered with cartilage.

METATARSAL AND PHALANGEAL BONES

THE METATARSAL and Phalangeal bones, known to the horseman as the cannon-bones, the pasterns, and the hind-feet, resemble so closely those of the fore extremity, that it is unnecessary to repeat the description of them here.

CHAPTER XIX

OF THE JOINTS, AND THE TISSUES ENTERING INTO THEIR COMPOSITION

GENERAL REMARKS—CARTILAGE—FIBROUS TISSUE—FIBRO-CARTILAGE—SYNOVIAL MEM-
BRANES—CLASSIFICATION OF THE JOINTS—MOVEMENTS OF THE JOINTS—ARTICULATIONS
OF THE VERTEBRAL COLUMN—THE LIGAMENTUM NUCHÆ, OR GREAT CERVICAL LIGA-
MENT, AND OTHER PECULIARITIES IN THE LIGAMENTS OF THE NECK—MOVEMENTS OF
THE VERTEBRÆ IN GENERAL, AND OF CERTAIN OF THEIR JOINTS IN PARTICULAR—
THORACIC ARTICULATIONS—PECULIARITIES IN THE ARTICULATIONS OF THE LUMBAR
VERTEBRÆ—THE LUMBO-SACRAL ARTICULATION AND SACRAL LIGAMENTS—THE COCCY-
GEAL JOINTS—THE TEMPORO-MAXILLARY ARTICULATION—THE SACRO-ILIAC ARTICULA-
TION — ISCHIO-PUBIC SYMPHYSIS — THE SHOULDER JOINT — THE ELBOW JOINT — THE
KNEE JOINT (CARPUS, OR WRIST). — INTER-METACARPAL ARTICULATIONS — FETLOCK
JOINT—THE PASTERN JOINT—THE COFFIN JOINT—THE HIP JOINT—STIFLE JOINT OR
COXO-FEMORAL ARTICULATION—TIBIO-FIBULAR ARTICULATION—THE HOCK JOINT—
TARSO-METATARSAL ARTICULATION — TERMINAL ARTICULATION OF THE POSTERIOR
LIMBS.

GENERAL REMARKS

THE JOINTS are all formed between two or more separate bones, having a soft and elastic substance interposed, whose structure varies with the amount of motion. Where this is extensive, as in the joints of the limbs, the adjacent surfaces are covered with a peculiar kind of cartilage arranged in a thin and very smooth layer upon them. In addition to this protection against friction and vibration, the bones are firmly bound together by strong bands of white fibrous inelastic tissue under the general name of ligaments, each bundle receiving a distinct appellation. In those situations where the motion is limited, a mixture of cartilage and fibrous tissue is inserted between the ends of the bones and attached to both, as in the vertebræ, ischio-pubic symphysis, etc. ; while in order to reduce the vibration and friction in certain important joints fibro-cartilages are introduced, with both surfaces free, and in contact only with the usual layer of cartilage, as in the stifle and jaw. A lubricating fluid (called synovia) is required to reduce the amount of friction ; and to produce it, as well as to keep it within proper limits, a membrane (synovial) is developed. This is attached to each

bone in a peculiar manner, to be presently described. Lastly, an elastic fibrous tissue (yellow) is met with in certain situations, the most remarkable being the great ligament of the neck. Each of these different structures will require a separate description ; for as the diseases of the joints are of great importance, a knowledge of the structure of their component parts must be carefully obtained before entering upon the treatment with any hope of success.

CARTILAGE

TRUE CARTILAGE (which is familiarly known to all when it shows the large white masses in a breast of veal, as dressed for the table) is a homogeneous, white, semi-transparent substance, possessing a certain amount of elasticity, and easily cut with a knife. In the early embryo it exists as the sole foundation of the skeleton, bone being afterwards deposited in its meshes and finally substituted for it. This is called the temporary cartilage. In after life it invests those parts of the bones which enter into the composition of the joints (articular cartilage, which is what we are considering just now), and also forms the costal cartilages, the ensiform and cariniform cartilages, and those of the larynx, trachea, and nose. *Reticular* or *membraniform* cartilage, differing slightly from true cartilage, is met with in the Eustachean tube, the external ear, and the epiglottis.

STRUCTURE.—On putting a slice of true cartilage under the microscope, it is seen to consist of a number of minute cells disseminated through a vitreous substance. The cells are oval, oblong, or polyhedral in shape, and more or less flattened by packing. The membrane forming the cell-wall is usually blended with the matrix, but sometimes consists of concentric layers. White fibres usually enclose the mass of cells, and even dip sometimes into those cells more superficially placed. The cells or corpuscles are contained in hollow cavities, called lacunæ. Sometimes they do not entirely fill up the lacunæ, so that a vacant space is left. The corpuscles are usually dispersed in groups, varying in size and form, through the matrix ; the groups towards the surface of the cartilage are generally flattened conformably with the surface. *In articular cartilage*, the matrix in a thin section appears dim and presents a granular aspect, the cells and nuclei of which are small. The parent-cells enclose two or three younger cells. The groups they form are flattened near the surface and lie parallel with it. In the internal part of this cartilage the cells assume a linear direction, and point towards the surface. Near its attached surface cartilage blends with the bone, the cells and nuclei of which become surrounded by little granular bodies, which seem to be the rudimentary deposit of bone. *In costal cartilage* the cells are very large ; they contain two or more nuclei, which are clear and transparent, and some contain a few oil globules. The cells, internally situated, form oblong groups, disposed in lines radiating to the circumference. We observe a great quantity of intercellular tissue, in the form of white fibrous structure, the fibres of which are parallel and straight.

PERICHONDRIUM (περὶ, *around*, and χόνδρος, *cartilage*) is a white fibrous substance, which covers the external surface of all cartilages, except those

of the joints. In this membrane the blood-vessels which supply the cartilage with blood, ramify. It is analogous to the periosteum which covers the external surface of bones.

NERVES.—No nerves have been traced into any of the cartilages; they are destitute of sensation while free from inflammation.

BLOOD-VESSELS.—Cartilage is non-vascular; it receives its nourishment from the bone and perichondrium by imbibition. The law of endosmose coming into operation when the tissue is thick, as in the costal cartilages, canals are formed through which the vessels pass to supply the parts which are too far removed from the perichondrium. In articular cartilages no vessels enter. When cartilage is removed by mechanical means, or by absorption, it is not regenerated, and when fractured, as in the ribs, there is no reunion by cartilage, but by fibrous, or most frequently by osseous deposition.

CHEMICAL COMPOSITION.—True cartilage contains three-fifths of its weight of water. It is ascertained that the cells and the intermediate substance are composed of different materials. The membranes of the cartilage cells are not resolved by boiling, and offer a lengthened resistance to alkalies and acids. The contents of the cells coagulate in water and dilute acids, and are dissolved by alkalies. The intermediate substance consists of chondrine, which differs from gelatine in not being precipitated by the mineral acids.

FIBROUS TISSUE

FIBROUS TISSUE exists very generally throughout the body, being composed of fibres of extreme minuteness. It is found under three forms, as *white fibrous tissue, yellow fibrous* tissue, and *red fibrous* tissue.

WHITE FIBROUS TISSUE is composed of cylindrical fibres of exceeding minuteness, transparent, and undulating. They are collected first into small fasciculi and then into larger bundles, which, according to their arrangement, compose thin layers or membranes, ligamentous bands or tendons. *The membranous form* is seen in the periosteum and perichondrium, the fasciæ covering various organs, the membrane of the brain, etc.—*Ligaments* are glistening and inelastic bands, composed of fasciculi of fibrous tissue generally ranged side by side, sometimes interwoven with each other. These fasciculi are held together by separate fibres, or by areolar tissue. They are of all forms, from the round band to the expanded membrane known as a capsular ligament.—*Tendons* are constructed like ligaments, but usually in larger and more rounded bundles. Sometimes they are spread out in the form of aponeuroses.

YELLOW FIBROUS TISSUE is also known as elastic tissue, from its most prominent physical characteristic, in which it differs from white fibrous tissue. It is so elastic that it may be drawn out to double its natural length, without losing its power of returning to its original dimensions. Its fibres are transparent, brittle, flat or polyhedral in shape, colourless when single, but yellowish when aggregated in masses. When this tissue is cut or torn, the fibres become curved at their extremities in a peculiar manner. It is met with in the ligamenta subflava of the vertebræ, the

ligamentum colli, the chordæ vocales, and membranes of the larnyx and trachea, and the middle coat of the arteries.

RED FIBROUS TISSUE, also called contractile tissue from its possessing the power of contracting under certain stimulants, is intermediate between yellow fibrous tissue and muscular fibre. Its fibres are cylindrical, transparent, of a reddish colour, and collected in bundles. It has no connection with the joints, but is met with in the iris, around certain excretory ducts, and in the coats of the veins.

Chemical Composition.—The flexibility of fibrous tissue is owing to the presence of water in it, of which it contains about two-thirds of its weight. A tendon or ligament will readily dry and become brittle. Acetic acid causes it to swell up, and here the acid discloses the existence of nuclei and elastic fibres. It is chiefly composed of gelatine, which is extracted by boiling.

Blood-vessels.—White fibrous tissue contains few blood-vessels. They usually follow the course of the fasciculi; in ligaments they run in a longitudinal direction, sending off communicating branches across the fasciculi, and eventually forming an open network. The periosteum is much more vascular, but the vessels do not strictly belong to the membrane, as the ramifications found in it are chiefly intended for supplying blood to the bone which it covers.

Nerves.—Small tendons contain no nerves, and large ones only small filaments. In the periosteum, nerves are abundant; they exist there chiefly for supplying the bones with sensibility. The pain caused in rheumatism, which is an intensely painful disease, is a proof of the sensibility of white fibrous tissue.

FIBRO-CARTILAGE

THIS SUBSTANCE, intermediate in structure and uses between cartilage and fibrous tissue, is composed of a network of white glistening fibres collected into fasciculi of various sizes, and containing within its meshes cells and a sub-fibrous tissue resembling that of true cartilage. Fibro-cartilage admits of arrangement in four groups :—

1. INTERARTICULAR FIBRO-CARTILAGE is placed between the moving surfaces of bones. It serves to connect them together, to facilitate their gliding motion, and to act as a cushion, thus preserving the articular surfaces from attrition, and the bones from the effects of sudden concussion. It is usually placed where much motion is enjoyed, as in the lower jaw and knee, in the form of round oval plates growing thinner in the centre. Marginal cartilages such as that around the cotyloid cavity are of the same kind.

2. STRATIFORM FIBRO CARTILAGES form a thin coating to the bony grooves over which tendons play.

3. INTEROSSEOUS FIBRO-CARTILAGE occurs between the vertebræ, at the ischio-pubic symphysis, etc.

4. FREE FIBRO-CARTILAGES are met with in the tarsal cartilages of the eyelids, etc.

SYNOVIAL MEMBRANES

THE SYNOVIAL MEMBRANE is a thin layer, which invests the articular cartilages of opposite bones, and is continued from one to the other by being reflected beneath the ligaments which connect them. It resembles the serous membrane in being a shut sac or bladder, and a synovial capsule may be compared to a small bladder, containing only as much fluid as will adhere to its interior, placed between the opposite ends of two bones forming a joint. The secretion formed by it, synovia (σὺν, *together*, ᾠόν, *an egg*), is alkaline, and contains albumen, which is coagulable by boiling. Heale has ascertained, by the aid of the microscope, that this membrane is actually reflected over the articular cartilage, a point which has been long disputed. Besides the joints, the synovial membranes also form smaller sacs which lubricate the tendons as they pass over the ends of the bones, and which are called *bursæ mucosæ*. The epithelium lining these membranes is of the kind called tesselated ; it is developed in the same manner with that of other free surfaces, being continually reproduced as it is worn away. Synovial membranes, in many situations, are closely and completely invested externally by fibrous layers—the fibrous capsules, as they are termed. These fibrous coats are met with especially in situations where the articulation is either wholly unprotected or but thinly covered by soft parts ; or where a very firm connection is required, as in the hip joint. They are absent where muscles or ligaments rest upon the articulation ; or where, for special purposes, the synovial membrane is exposed to more considerable movements, as in the knees.

The synovial capsule is attached, either simply to the cartilaginous surface, extending thence directly to the other bone, or it may, in the first place, besides the cartilage, also invest a larger or smaller extent of the surface of the bone itself, and then pass to the second bone, with which it is connected in the one way or the other.

SYNOVIA is a viscid transparent fluid, of a pale straw colour, slightly alkaline. In chemical and general characters it is like the serum of the blood. A drop of synovia is found to contain—fat molecules, epithelial cells, and small granular corpuscles, bearing a close resemblance to the white corpuscles of the blood. This fluid on account of the presence of albumen, is coagulable by heat.

CLASSIFICATION OF THE JOINTS

THE skeleton has already been described as composed of different pieces of bone, united to each other in various manners : from this union result the articulations, which are sometimes very movable ; sometimes joined to each other through the medium of long digitations or teeth, which fix them, if not to immobility, at least to a very constrained movement ; and, lastly, united together through the medium of cartilage, the elasticity of which permits latitude of movement. In the first case, the articulations take the name of diarthrosis or movable articulations (διὰ, *through*, and ἄρθρον, *a limb*) ; in the second, synarthrosis (σὺν, *together*, and ἄρθρον, *a limb*) ; and

thirdly, amphiarthrosis ($\dot{\alpha}\mu\phi\iota$, *about*, and $\ddot{\alpha}\rho\theta\rho\sigma\nu$), partaking, at the same time, of the two classes of articulation above mentioned—namely, synarthrosis, in the continuity established by the articular surfaces ; and diarthrosis, in the limited extent of movement it permits.

The guide to the classification of joints is the configuration of their articular surfaces, and the movements they allow.

DIARTHRODIAL JOINTS are arranged under three distinct classes :—

1. Enarthrosis. This kind of joint is characterized by the reception of an articular head into a cavity of appropriate form. It is the seat of most extensive movements ; namely, flexion, extension, adduction, abduction, circumduction, and rotation. Example : Acetabulum with femur.

2. Ginglymus. A perfect hinge-joint, the articular surfaces of which are configured in a trochlear arrangement, in such a manner that two or more prominences may fit into two or more excavations of appropriate form for their reception. Their only movements are flexion and extension. Example : Tibia with the astragalus.

3. Arthrodia (a kind of shallow articulation), consisting almost of plain surfaces. Gliding is the only possible movement. Example : the Carpometacarpal articulation.

SYNARTHRODIAL JOINTS are included under four heads, all of which should be examined as parts of the bony skeleton :—

1. Harmonia, in which the bones are joined by apposition, as in the nasal bones.

2. Schindylesis, in which a ridge or keel projects into a cleft. Example : Vomer with sphenoid.

3. Gomphosis. Like a nail in its socket, as the teeth in the alveoli.

4. Sutura. Indented, and subdivided into sutura serrata, as in the frontal bones, and sutura squamosa, as in the union of the parietal and temporal bones.

THE AMPHIARTHRODIAL JOINTS are often smooth, and formed after the manner of diarthrodial surfaces. At other times they are more or less rough. These joints are united together for the most part by fibro-cartilage. Their extent of movement depends on the thickness and elasticity of the interarticular fibro-cartilage. They do not glide, therefore, one over the other. Only one species of amphiarthrosis exists of which the articulations of the vertebræ, the ischio-pubic symphysis, and the intermetacarpal joints are examples.

MOVEMENTS OF THE JOINTS

THE MOTIONS permitted in the joints are four—namely, gliding, angular motion, circumduction, and rotation.

1. GLIDING is the simple motion of one bone upon the other, without materially altering their relations.

2. ANGULAR MOTION may be either limited to one plane, as in the trace-hinge, or it may be extended to more, when the motion becomes nearly allied to circumduction. The elbow and hock are examples of the former, as, indeed, are most of the horse's joints.

3. CIRCUMDUCTION is a motion very little seen in the large joints of this

animal, and is confined to the hip and shoulder joints, in which it is far more limited than in the corresponding joints of the human frame. It is displayed when a limb is made to describe a segment of a large circle around the joint which connects it to the body.

4. ROTATION is the movement of a bone on its own axis, and is only seen in the horse in the joint between the two first vertebræ of the neck.

ARTICULATIONS OF THE VERTEBRAL COLUMN

THE VERTEBRÆ are connected together by ligaments, fibro-cartilage, and synovial membranes; the first two serving to retain them in position; the last to facilitate motion. They correspond, firstly, by their bodies; secondly, by their spines; and thirdly, by their oblique and transverse processes. It is necessary to state, that the general details into which this study leads us will apply only to the articulations which unite the six lower cervical vertebræ, the dorsal and lumbar vertebræ, and the sacrum.

THE BODIES connect themselves by their surfaces, which in the cervical region represent, 1st, the anterior, or true head; 2nd, the posterior, or glenoid cavity, which receives the head of the vertebra immediately behind it. In passing from the first dorsal to the sacrum, these tend to efface themselves, and become plainer; nevertheless, they preserve throughout the one its convexity, and the other its concavity. Their means of union are—(1) fibro-cartilages, interposed between the articular surfaces; (2) a common superior vertebral ligament; (3) a common inferior vertebral ligament.

The intervertebral fibro-cartilages are circular or elliptical discs, convex before, concave behind; firmly fixed to the surfaces of the bones which they separate. The fibro-cartilaginous substance which forms them is composed of an external laminar part, constituting the circumference of an internal soft or pulpy part, which occupies the centre. The laminar part forms more than half the whole mass, and consists of laminæ, or plates of fibro-cartilage, and fibrous tissue, alternating one with the other. The central part is a pulpy, elastic material, which is of a yellowish colour, and destitute of the concentric arrangement seen externally. The fibro-cartilages join at their circumference the two common vertebral ligaments, and in the vertebræ of the back help to form the intervertebral cavities destined for the reception of the heads of the ribs.

The superior vertebral ligament within the spinal canal, and attached to the posterior surface of the bodies of the vertebræ, extends from the dentata to the sacrum. In the neck, it spreads across the bodies; but in the back and loins it is broader opposite the intervertebral cartilage than opposite the bodies of the bones. It adheres firmly to the fibro-cartilages and to the contiguous margins of the bodies of the vertebræ; but it is separated from their middles by a transverse venous plexus.

The inferior vertebral ligament reaches from the fifth dorsal vertebra to the first bone of the sacrum; becoming broader and broader as it approaches the sacrum, along its course it connects itself to the inferior spines of the bodies of the vertebræ and to the intervertebral discs.

THE UNION OF THE VERTEBRÆ THROUGH THEIR SPINAL PART is effected by a superior spinal ligament and an interspinal ligament.

The supra-spinous ligament consists of small compressed bundles of longi tudinal fibres, extending from the last cervical spine to the spine of the anterior coccygeal bone, and thus forms a continuous chain.

The interspinal ligaments consist of fibrous plates, filling up the spaces between the spines, and attached before and behind to their opposite borders. One set of these fibres passes from the anterior border of one spine to the posterior border of the one before it, taking a direction from below, forwards and upwards ; another set runs from the posterior border of the spine to the anterior border of that situated behind it, taking a direction from below, upwards and backwards.

THE ARCHES OR PLATES are connected together by the ligamenta vertebra tum subflava. These ligaments consist of yellow and white fibrous tissue. Their attachment extends from the roots of the oblique processes to the origin of the spinous processes. Their anterior edges are attached to the posterior edges of the vertebral plates which are in front. Their posterior edges are attached to the anterior edges and inferior faces of the plates which are
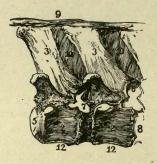

FIG. 37.—PROFILE VIEW OF THE LIGAMENTS COMMON TO THE VERTEBRÆ.

2. 2. Bodies of vertebræ.
3. 3. Spines.
4. 4. Transverse processes.
5. Head of the body.
6. Oblique process.
7. Hole of conjugation.
8. Glenoid cavity.
9. Supra-spinous ligament.
10. Intra-spinous ligament.
11. Intervertebral fibro-cartilage.
12. 12. Inferior common vertebral ligament.

behind. The ligamenta subflava do not exist between the occiput and atlas, or between the atlas and dentata.

INTER-TRANSVERSE LIGAMENTS are situated between the transverse processes, running from the transverse process of one vertebra to the same process of the one next to it.

THE OBLIQUE PROCESSES are united by synovial capsules one to the other. These capsules, throughout the vertebræ of the back, are pro tected by white fibrous tissue, but in the cervical region the fibres covering the capsules are yellow and elastic, and on this account, and owing to the size of their arthrodial surfaces, latitude of movement is permitted to a greater extent than is noticed in any other vertebral region.

THE LIGAMENTUM NUCHÆ, OR GREAT CERVI-CAL LIGAMENT, AND OTHER PECULIARITIES IN THE LIGAMENTS OF THE NECK

IN THE NECK a much greater latitude of motion is required, to admit of the lowering of the head in grazing, and of raising it for various purposes, as well as balancing its great weight at all times. Lateral flexion and

rotation on its own axis are also necessitated for the purpose of directing the muzzle right and left of the straight line, and for these several motions the following deviations from the ordinary vertebral joints are developed.

THE LIGAMENTUM NUCHÆ, or great cervical ligament, is intended to relieve the muscles of the neck in supporting the head by its natural or inherent elasticity. It is entirely formed of yellow elastic tissue, and occupies the angle formed posteriorly by the anterior dorsal spines, and inferiorly by the cervical spinous processes, thus separating the cervical muscles of the right side from those of the left.
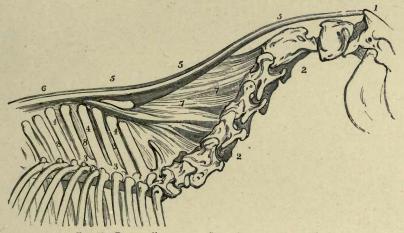

FIG. 38.—PROFILE VIEW OF THE GREAT LIGAMENT OF THE NECK.

1. Crest of the occiput.
2. 2. Cervical vertebræ.
3. 3. Dorsal vertebræ.
4. 4. 4. Dorsal spines.
5. 5. 5. Cordiform or funicular portion of the ligamentum nuchæ.
6. Cordiform portion of the ligamentum colli mixing with the supra-spinous ligament.
7. 7. Lamellary portion of the ligamentum nuchæ.
8. 8. 8. Interspinous ligaments.

It is divided for description into two parts—a funicular and lamellary portion. The first, designated under the name of the cord of the cervical ligament, is represented by a large band, which extends immediately from the dorsal spinous processes to the top of the head, divided into two lateral lips by a mesian line. The cord is connected posteriorly with the supra-spinous ligament, and is inserted anteriorly into the scabrous pit, situated just below the crest of the occiput. It is covered superiorly by a mass of thick adipo-fibrous tissue, much developed in low-bred animals. Inferiorly it gives off the lamellary portion, which is composed of two plates united by cellular membrane. These lie between the two sets of muscles, and give off six tongues or slips, which unite with the spines of the six posterior cervical vertebræ, mixing with the fibres of the interspinous ligaments.

THE ATLAS IS UNITED TO THE OCCIPUT by lateral ligaments, which bind its articular surfaces to the condyles of the bone—also by two inferior ligaments and synovial capsules.

The two lateral ligaments, broad and membranous, arise from the supero-

lateral border of the arch of the atlas, and are attached to the sides of the condyles of the occiput, or rather between the condyles and the styloid processes.

The long inferior ligament arises from the tubercle on the inferior surface of the atlas, and is attached to the basilar process of the occiput.

The short inferior ligament arises from the tubercle on the inferior surface of the atlas, is attached to the foramen magnum of the occiput, and is connected with the theca vertebralis.

A thin fibrous ligament (the *occipito-atloid*) surrounds the entire articulation ; it is attached anteriorly to the condyles of the occiput, and posteriorly to the articulatory surface of the atlas. This membrane is thin and elastic inferiorly ; superiorly it is formed of two bundles of fibres, which cross one another like the letter X. Internally it is lined by synovial membrane.

THE AXIS, OR VERTEBRA DENTATA, is united to the atlas, and partially also to the occiput, as follows :—

1. *Articular surfaces* are formed on the odontoid process of the axis, and also on the sides of its body close to the root of that part. These correspond with similar faces on the inside of the ring of the atlas, and also on its posterior side.

2. *The ligaments connecting the rings of the two vertebræ together*, or the *superior* and *inferior atlo-axoid ligaments*. The former represent the interspinous ligaments of the other vertebræ—being yellow, elastic, and formed of two layers, which are continuous with the capsular ligaments—the latter is a large thin band, which is stretched from the inferior face of the axis to the inferior spine of the atlas, lying concealed by the longus colli muscle. Besides these two ligaments, there is also a capsular ligament, which commences from the sides of the superior atlo-axoid ligament, and after uniting with the borders of the odontoid ligament is confounded with the fibres of the inferior atlo-axoid. In fact, it is a mesh of white fibrous tissue connecting the three together.

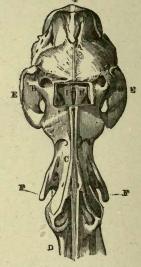3. *The odontoid ligaments*, which are covered by the superior atlo-axoid ligament. On cutting through

FIG. 39.—SUPERIOR VIEW OF THE JOINTS FORMED BETWEEN THE FIRST TWO VERTEBRÆ OF THE NECK AND BETWEEN THE ATLAS AND OCCIPUT.

A. Superior fibres of the occipito-atloid ligament.
B. Atlas.
C. Vertebra dentata, showing the superior atlo-axoid ligament.
D. Third cervical vertebra.
F. F. Transverse processes of dentata.
1. 1. Odontoid ligament.

these the following sets of fibres will be made apparent :—*First*, a transverse band arises from the root of the odontoid process, and dividing into two like the letter V, is attached on each side to the ridge on the inferior part of the ring of the atlas, a few thin fibres passing on to be attached to the basilar process and condyles of the occiput. *Secondly*, a strong band arises from the point of the odontoid process, and is attached to the middle of the ridge on the inferior part of the atlas. *Thirdly*, a few fibres pass across from the inside of the ring of the atlas on one side to the corresponding part of the other. These serve to strengthen the capsule, but they have not the substance of the corresponding ligament in the human frame.

MOVEMENTS OF THE VERTEBRÆ IN GENERAL AND OF CERTAIN OF THEIR JOINTS IN PARTICULAR

THE AMOUNT OF MOTION between any two vertebræ is extremely limited, with the exception of the atlo-axoid articulation, in which the degree of rotation is considerable. But when the spine is viewed as a whole, these slight individual movements multiplied together are sufficient to allow of flexion and extension, as well as of inclination to either side. In the region of the back the joints are rigid, in the loins less so, but in the neck and tail great liberty is allowed. Flexion and extension, as well as lateral motion, are dependent entirely upon the elasticity of the intervertebral substance, which allows of one part being compressed while the other is extended. Thus, when the loins are arched upwards the lower edge of this substance is compressed, while the upper part assumes a more expanded condition, and at the same time the spinous processes are separated more widely, and their ligaments are stretched. The reverse of this takes place when these bones are arched downwards, while in lateral inclination the sides are compressed and expanded in a corresponding manner. Very slight rotation of the whole spine, or more properly twisting, is permitted by the elastic nature of the intervertebral substance ; but in the atlo-axoid articulation a perfect rotation occurs around the centre of the odontoid process, allowing the muzzle to be turned in either direction, which could not be done without an arrangement of this nature. The capsular ligaments and the superior and inferior atlo-axoid ligaments are necessarily lax to allow of this motion. Lastly, the great ligament of the neck serves to support the weight of the head, which would be too great for the muscles of the neck, in consequence of the length of leverage which is presented.
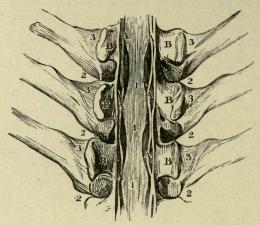
THORACIC ARTICULATIONS

THE ARTICULATIONS which unite the bones composing the thorax may be divided *first* into costo-vertebral articulations, or those which unite the ribs with the spine ; *secondly*, chondro-costal, or those which unite the ribs with their cartilages ; *thirdly*, the chondro-sternal, or those which unite the cartilages with the sternum ; *fourthly*, the articulations of the cartilages among themselves.

EACH RIB (with the exception of the first and last) is connected with the bodies of two vertebræ, the three bones, together with the intervertebral substance, forming two joints which are separated from each other by a band of fibres passing from the head of the rib to the intervertebral substance. Besides these there is also an articulation between the rib and the transverse process of the vertebra behind it.

The superior costo-vertebral ligament connects the head of each rib to the sides of the bodies of the vertebræ, and is divided into three bundles, of which one bundle (the middle) passes to the corresponding intervertebral fibro-cartilage, whilst the anterior passes to the body of the vertebra before, the posterior to the body of the vertebra behind. This ligament is called

the superior stellate ligament. From the inferior surface of the neck there is a ligament, which is disposed in the same way inferiorly as the foregoing is superiorly, in attaching the ribs to the bodies of the vertebræ. This is called the inferior stellate ligament.

The inter-articular ligament, or *ligamentum teres,* consists of a thin bundle of longitudinal fibres, and arises from the ridge dividing the two articular

Fig. 40.—Superior View of Costo-Vertebral Articulations.

A. A. A. etc. Points where the vertebral arches are removed in order to expose.
1. 1. etc. Superior common vertebral ligament.
B. B. etc. Transverse processes.

2. 2. etc. Superior costo-vertebral or stellate ligament.
3. 3. 3. etc. Superior costo-transverse ligament.

surfaces on the head of the rib from which it passes to be implanted on the side of the intervertebral substance.

There are two distinct synovial capsules—an anterior and a posterior—set back to back, and separated by the inter-articular ligament.

THE COSTO-TRANSVERSE ARTICULATION.—On the superior surface of the tubercle of the rib is a smooth convex articular surface, which is in apposition with a smooth concave surface, situated on the transverse process.

Two ligaments strengthen this articulation. *First,* the posterior costo-transverse ligament consists of a short fasciculus of fibres, which passes from the posterior surface of the summit of the transverse process, to the rough surface uncovered by cartilage at the postero-lateral part of the tubercle. *Secondly,* the anterior transverse costal ligament is formed of a bundle of white, thick, short fibres, which take a course from the anterior surface of the transverse process near its base, to the excavation which is close to the neck of the rib. This ligament is clothed behind by synovial membrane and in front by adipose tissue, which separates it from the costo-vertebral articulation.

The last two, namely, the 17th and 18th costo-transverse articulations, are confounded with the corresponding costo-vertebral joints.

THE CHONDRO-COSTAL ARTICULATION may be referred to the subdivision gomphosis of the synarthrodial joints. It is formed by the implantation of the inferior extremity of the rib into the superior extremity of the cartilage,

which presents a surface corresponding with the rough depression in the end of the rib. Further strength is given to this articulation by the periosteum,
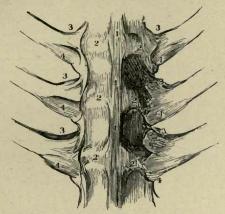

Fig. 41.—Inferior View of the Costo-Vertebral Articulations.

1. 1. etc. Inferior common vertebral ligament.
2. 2. etc. Inter-fibro-cartilaginous disc.
3. 3. etc. Inferior costo-transverse ligament.
4. 4. etc. Inferior costo-vertebral ligament.

which, in passing from the bone to the cartilage, forms a strong uniting band.

THE CHONDRO-STERNAL ARTICULATIONS occur between the inferior extremity of the cartilage of each rib, and the oblong cavities existing along each side of the sternum. The eight anterior cartilages form, with the fossæ in the sternum, eight corresponding articulations.

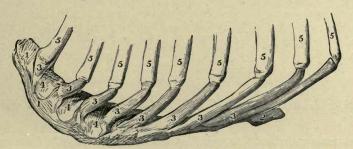The joints which result from the union of these two surfaces are

Fig. 42.—Profile View of Sterno-Costal and Chondro-Costal Articulations.

1. 1. Anterior end of sternum and cariniform cartilage.
2. Ensiform cartilage.
3. 3. etc. Sternal cartilages.
4. 4. etc. Chondro-sternal articulations.
5. 5. etc. Ends of the true ribs with the articulations between them, and the cartilages seen between 3 and 5.

enveloped on all sides by fasciculi of white and extended fibres, the whole of which constitute a ligamentous capsule. The superior fibres are sometimes described as the superior chondro-sternal ligament. The inferior are continuous with the origin of the pectoral muscles.

The foremost chondro-sternal articulation is not separated from the corresponding one on the opposite side. The two cartilages being close together,

their synovial capsule is continuous, and the two oblong *fossæ* on the sternum unite one with the other. It must be further noticed that this articulation frequently occurs on the cariniform cartilage, which is anterior to the first bone of the sternum.

As regards the two posterior sternal cartilages, they are in close apposition one with the other, and fit into one common fossa situated on the posterior bone of the sternum, and with it form one synovial joint.

A thin fasciculus of fibres connects the cartilages of the 8th and 9th ribs to the ensiform or xiphoid cartilage, called the *chondro-xiphoid ligament*.

A similar fasciculus to the foregoing connects the cariniform and xiphoid cartilages together—the *carino-xiphoid ligament*.

The asternal or *false cartilages* are united one to the other by a yellow elastic ligament, which extends from the fore extremity of each to the posterior border of the preceding cartilage.

ON THE SUPERIOR AND INFERIOR SURFACES of the sternum, ligamentous fibres may be observed running longitudinally, called the superior and inferior sternal ligaments. The longitudinal fibres are mixed with those radiating from the costal cartilages, especially inferiorly, where they blend with aponeuroses of the pectoral muscles.

PECULIARITIES IN THE ARTICULATIONS OF THE LUMBAR VERTEBRÆ

THE FOUR ANTERIOR lumbar vertebræ have nothing remarkable about them, but the fifth differs in having on the posterior part of each transverse process an articular surface furnished with a synovial capsule, for uniting it with the sixth. This last has also four articulatory surfaces on its transverse processes—two anteriorly, which unite with the corresponding ones on the fifth vertebra just described, and two posteriorly, which are similarly furnished with synovial capsules, and which unite it with the sacrum.

THE LUMBRO-SACRAL ARTICULATION AND SACRAL LIGAMENTS

THE FIBRO-CARTILAGE intervening between the last lumbar vertebra and the sacrum is unusually thick, and the joint is protected also externally by some strong longitudinal fibres passing from bone to bone. The last lumbar vertebra joins the sacrum not only by its body and articular processes (which latter are oval, with their long diameter from side to side), but also by two oval and slightly concave articular surfaces, which articulate with corresponding faces on the last lumbar vertebra already alluded to.

BESIDES THE ARTICULATIONS between the lumbar vertebræ and the sacrum, there are also ligaments between the spines of the sacrum itself, which are no longer of much use after the separate bones of which it is composed are united by ossification.

THE COCCYGEAL JOINTS

THE SACRO-COCCYGEAL AND INTER-COCCYGEAL ARTICULATIONS are constructed much after the same principle as the other vertebral articulations. The coccygeal bones, however, are only united together by their bodies. The anterior and posterior articulatory surfaces of each vertebra
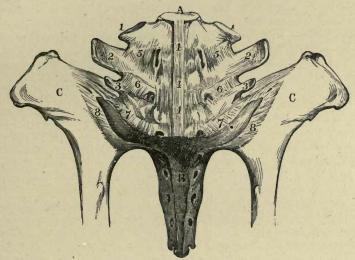

FIG. 43.—ARTICULATIONS OF THE LUMBAR VERTEBRÆ WITH THE SACRUM.

A. Last three lumbar vertebræ.
B. Sacrum.
C. C. Iliac bones.
1. 1. Transverse process of fourth lumbar vertebra.
2. 2. Transverse process of fifth lumbar vertebra.
3. 3. Transverse process of sixth lumbar vertebra.
4. 4. etc. Inferior common vertebral ligament.
5. 5. Ligamentous fibres covering the capsules between the transverse processes of the fourth and fifth lumbar vertebræ.
6. 6. Capsular ligaments uniting together the fifth and sixth lumbar vertebræ.
7. 7. Lumbo-sacral ligaments.
8. 8. Sacro-iliac ligaments.

are both convex, and their inter-articular fibro-cartilage is hollow on both surfaces. As to ligaments, they are represented by bundles of longitudinal fibres spread on the surfaces of these bones, which they envelop in a common sheath.

THE TEMPORO-MAXILLARY ARTICULATION

THE LOWER JAW articulates on each side by one of its condyles with the glenoid cavity of the temporal bone. Between them is placed an inter-articular fibro-cartilage, with one synovial membrane above and another below it.

The articular surfaces above mentioned do not exactly fit one into the other. This, however, is corrected through the interposition of a fibro-cartilaginous disc between them. This disc represents an irregular plate, flattened above and below, thicker in front than behind, moulded on each

surface, which it separates, so that its superior face presents in front a con-
cavity to receive the tubercle on the zygomatic process of the temporal bone,
and a convexity behind, which is lodged in its glenoid cavity. As to its
inferior face, it is indented by an oblong furrow, in which the condyle of the
inferior maxillary bone is imbedded.

These bones are united by a capsular ligament, covering a synovial capsule,
and two lateral ligaments, one external and the other internal.

A fibrous cover, a true capsular ligament, surrounds this articulation, and
is attached by its edges to the articular surfaces which it unites, as well as
to the borders of the inter-articular fibro-cartilage ; thus forming two distinct
capsules, namely, one superiorly, and one inferiorly, which are lined inter-
nally by synovial membranes. The larger of the two, after lining the upper
surface of the disc, is reflected upward to the glenoid cavity of the temporal
bone. The inferior synovial membrane is interposed between the inferior
surface of the cartilage and the condyle of the lower jaw ; and thus a double
joint is constituted.

The external lateral ligament is a short fasciculus of fibres, attached
superiorly to a tubercular prominence, situate on the supero-external part
of the squamous temporal bone, and inferiorly to the external surface of
the condyle, and to the postero-external surface of the neck of the lower
jaw, just below the condyle ; its fibres take a backward and downward
course.

The internal lateral ligament is looser and more elongated than the external.
It extends from the inner surface of the squamous temporal bone to the
cartilage and inner surface of the condyle of the superior maxillary bone,
reaching down to the inner part of its angle.

MOVEMENT.—The temporo-maxillary articulation is the centre of every
movement of the lower jaw. These are—elevation, lowering, lateral
movement, and horizontal sliding, which motions together accomplish the
grinding action necessary to triturate the hard grain upon which the
horse feeds.

THE SACRO-ILIAC ARTICULATION

THIS JOINT establishes the union of the posterior members with the spine,
and is formed by the sacrum and os innominatum. It belongs to the arthro-
dial order of joints. On each of these two bones is a large and irregular
articular surface, lined with a thick layer of cartilage, which is firmly united
to them. The joint thus formed is strengthened by four ligaments, namely
—1, the sacro-iliac ; 2, the superior ilio-sacral ; 3, the inferior ilio-sacral ;
and 4, the sacro-sciatic.

The sacro-iliac ligament is composed of large ligamentous fibres, which
everywhere envelop the articulation, by firmly attaching themselves at their
extremities to the impressions around the articular surfaces, situated on the
sacrum and internal border of the ilium. The inferior half of this ligament
is covered by the psoas muscles. Its posterior half, much stronger than the
former, is hidden by the ilium.

The superior ilio-sacral ligament is a large, strong, short ligament, which,
arising from the internal part of the ilium, is carried backwards and fixes

itself upon the sacral spines, where it mixes its fibres with the supra-spinous ligament of the lumbar vertebræ.

The inferior ilio-sacral ligament is a triangular and very resisting membranous band, formed of parallel fibres running obliquely from above downwards, and from before backwards. It is attached by its antero-inferior edge to the superior half of the ischiatic border and the internal angle of the ilium, mixing itself with the preceding ligament; its superior
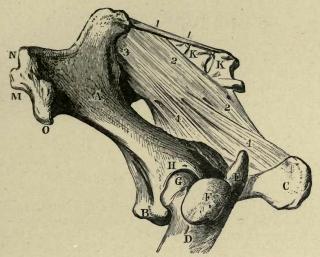

FIG. 44.—PROFILE VIEW OF THE ILIO-SACRAL AND SACRO-SCIATIC LIGAMENTS.

A. Os ilium.
B. Os pubis.
C. Os ischium.
D. Femur.
E. Trochanter major externus.
F. Large tubercle at the head of femur.
G. Head of the femur.

H. Rim of the cotyloid cavity.
K. K. Sacral spines.
N. M. O. Tubercles on the antero-inferior spinous process of the ilium.
1. 1. Superior ilio-sacral ligament.
2. 3. 4. Sacro-sciatic ligament.

border inserts itself upon the roughened ridge which bounds the sacrum laterally; its posterior border is united to the aponeuroses which cover the coccygeal muscles.

The sacro-sciatic ligament is a vast membranous expansion, stretched upon the side of the pelvis, between the sacrum and the os innominatum; it serves rather as an inclosure for the pelvic cavity than as a means of securing the firmness of the sacro-iliac articulation. Its form is irregularly quadrilateral, presenting four borders—a superior, attached to the lateral roughened edge of the sacrum; an inferior, inserted in the ridge below the cotyloid cavity; an anterior, unattached in a great part of its course, and serving as a protection to the large vessels and nerves which pass through the sciatic notch; and lastly, a posterior margin, which splits into two laminæ, between which the semi-membranous muscle takes its origin.

A synovial membrane covers the sacro-iliac ligament, but furnishes a small quantity of synovia.

MOVEMENTS.—The two sacro-iliac articulations, through which all the

efforts of impulsion are communicated to the trunk by the posterior members, without interfering with the transmission of locomotive force, permit but a slight gliding movement of their arthrodial surfaces. Indeed, this articulation seems exclusively designed to prevent the fractures to which these bones would be incessantly exposed, were they attached in a more intimate manner, as, for example, by bony union.

ISCHIO-PUBIC SYMPHYSIS

THE TWO OSSA INNOMINATA are firmly united together in the median line below, by the corresponding edges of the ischium and pubes. In the foal this is a distinct joint, possessing an inter-articular cartilage, and some transverse ligamentous fibres above and below ; but in the adult horse the two bones are firmly united by ossification, and the ossa innominata together form a complete arch, without the slightest movement between them.

THE SHOULDER JOINT

THE SCAPULO-HUMERAL ARTICULATION, commonly known as the shoulder joint, belongs to the division Diarthrosis ; subdivision, Enarthrosis. It is formed by the scapula uniting with the humerus, at an obtuse angle.

THE ARTICULAR SURFACES which compose this joint are the head of the humerus, and the glenoid cavity of the scapula. On examining these bones, described and illustrated at pages 376-7, it will be seen that the head of the humerus is semi-globular, while the cavity in the scapula is very superficial, and incapable of maintaining the former in its place without some collateral aid. It is somewhat remarkable that the ligaments of this joint are extremely weak, being confined to the lax fibres surrounding the synovial capsule, which is so loose that after removing all the other soft parts, and making a small opening into the joint, the two bones may be readily separated for some distance ; these fibres are superiorly fixed around the margin of the glenoid cavity, and inferiorly round the head of the humerus. Chauveau states that a ligament descends from the coracoid process of the scapula, which diverges and becomes inserted into the tubercles at the anterior part of the head of the humerus. He also states that it is loose, and therefore facilitates much motion, but it is not easy to separate it from the capsular ligament. This is longer posteriorly than anteriorly, and presents postero-laterally two stays, similar to two pieces of tape. The external one, arising from the outer lip of the glenoid cavity, is attached to the outer and back part of the head of the humerus. The internal one arises from the inner edge of the glenoid cavity, and is attached to the inner and back part of the head of the humerus.

But this deficiency in ligaments is made up by a much more powerful material in resisting dislocations. The whole joint is surrounded by elastic muscular fibre or by tendinous bands, having the same kind of support—thus it has in close apposition the following muscles, viz.—

Anteriorly, the Coraco Humeralis, and Flexor Brachii.

Externally, the Antea Spinatus, and Postea Spinatus.

Posteriorly, the Scapulo-Humeralis Posticus, etc.

Internally, the Subscapularis, etc.

Whenever, therefore, any violent strain is thrown upon the joint, which would force the head of the humerus forwards, the Coraco Humeralis and Flexor Brachii contract and prevent the accident. In the same manner, each of the above muscles acts in its own direction, and the result is that dislocation of the humerus in the horse is extremely rare.

THE MOVEMENTS OF THE SHOULDER JOINT in the horse are much more limited than in man, and indeed they are almost confined to flexion and extension. When all the muscles are cut away from the joint, rotation and circumduction may be easily effected ; but in examining its movements during life, it will be evident that neither one nor the other of these acts can be effected in any appreciable degree ; this is at once proved if it is attempted to turn the foot inwards or outwards, when it is flexed at the knee, during the life of the horse, for beyond the slight motion of the whole limb, including the scapula, the foot is firmly fixed, and there is not the slightest rotation or circumduction at the shoulder joint. Without the power of pronation and supination possessed by man, and partially by the dog and cat, the above actions would be worse than useless, and it is altogether a mistake to ascribe to any other of the domestic animals, as Chauveau has done, in addition to flexion and extension of the shoulder joint, the four movements of abduction, adduction, circumduction, and rotation.[1] It would much puzzle that generally accurate anatomist to turn the horse's foot up in front so that its possessor could see the sole ; yet if circumduction and adduction were permitted, this could readily be done as by the domestic cat or dog in licking the inside of the fore-. The shoulder joint is, in fact, a true hinge (ginglymus) in the horse, ass, cow, sheep, and goat, but in the first of these animals it is more especially limited in its movements, by the enormously powerful muscles which surround the joint, and which are constantly tense, though extremely elastic, and giving way to every voluntary movement. It is a beautiful provision of nature, to enable the horse to bear the shocks which his shoulders have to sustain in coming down from a leap with a great weight on his back, and without it he would be rendered comparatively useless to man.

FIG. 45.—PROFILE VIEW OF THE SCAPULO-HUMERAL, OR SHOULDER JOINT.

A. Inferior third of scapula.
B. Coracoid process of scapula.
C. Analogue of the acromion process.
D. Rim of glenoid cavity.
E. Superior third of humerus.
1. Capsular ligament.
2. Tendon of the coracoradialis muscle.

[1] Under certain circumstances, lame and otherwise injured horses prove the possession of those movements claimed by Chauveau, but only to a very limited extent.—EDITOR.

THE ELBOW JOINT

Or the humero-radio-ulnar articulation.—This joint is formed between the lower extremity of the humerus above, and the junction of the radius and ulna below. It is a complete hinge, and has no power of pronation or supination as in man, consequently there is no necessity for the peculiar additional joint between the radius and ulna, observable in man and partially in the dog and cat; but the two bones are firmly ossified together in the adult, as already described at page 379.

These bones are connected together by three ligaments, two lateral (an internal and an external), a capsular ligament, and a synovial capsule.

The internal lateral ligament arises from a fossa on the side of the internal condyle of the humerus; it takes a vertical course, expanding as it descends: and is inserted partly on the roughened inner border of the articular cavity of the radius. Its middle fibres, which are the longest, take the same course as the former, assuming while passing over the radius the shape of a cord, which is inserted into the inner and fore part of the radius about three inches below the former insertion.

The external lateral ligament is shorter but stronger than the internal. It arises from the superior fossa and ridge surrounding it, on the outer surface of the external condyle of the humerus, and is inserted into the tuberosity on the upper and external part of the radius. Its superficial fibres take a vertical course, whilst its internal fibres take an oblique direction, from top to bottom and from back to front.

The capsular ligament is attached by its superior border to the surfaces surrounding the condyles of the humerus; by its inferior border, to the circumference of the superior part of the radius; and by its posterior border to the circumference of the articular surface of the ulna.

The synovial membrane is short anteriorly, very extended, and spread out posteriorly; where it forms three sacs, which tend to facilitate flexion of the joint.

The movements of the elbow joint are confined to flexion and extension, it being a pure hinge, but these actions do not take place exactly in the same plane. For instance, if the knee is bent and the foot brought up to the elbow, the frog will not correspond with that projection, but will be almost entirely outside it, while the knees will also be wider apart when both are flexed and raised towards the bosom, than when the horse is standing. This arrangement is brought about by the oblique direction of the pulley-like articular surfaces on the humerus, ulna, and radius, and appears to be designed to prevent the foot from hitting the opposite leg as it passes it in trotting. When the obliquity is insufficient, either cutting of the

Fig. 46.—Posterior View of left Elbow Joint.

A. Inferior third of the humerus.
B. B. External and internal condyles.
C. Olecranon process of ulna.
D. Radius.
1. External lateral ligament.
2. Internal lateral ligament.
3. 3. Fibro - cartilaginous substance uniting the ulna to the radius.

fetlocks or speedy cutting is sure to be manifested ; if too great, the awkward gait known as "dishing" is established. Extension is not nearly so complete as in the human subject, being limited by the greater length and breadth of the olecranon process, the upper part of which forms a prominence which fits into the corresponding fossa of the humerus, and thus serves as a check to the extension of the fore-arm. In most men the upper arm and fore-arm can be made to fall into one straight line, but in the horse there is always a considerable angle.

THE KNEE JOINT (CARPUS, OR WRIST)

This ARTICULATION is a very complicated one, and in order to understand it thoroughly, it will be necessary to examine the parts composing it under three divisions. 1st. The articulations between the several carpal bones. 2nd. The Radio-carpal articulation ; and 3rd. The Carpo-metacarpal joint ; to which must be added (4) the examination of certain ligaments common to all three.

1. The two rows of carpal bones, which have been described in the dry state at page 380, are furnished with cartilages on the faces, by which they correspond, thus forming a series of nearly plane arthrodial surfaces, having synovial capsules, but embracing several of them in one. It may be remembered that these bones are arranged in two rows, the upper one consisting of the scaphoid, lunar, cuneiform, and pisiform bones, while the lower comprehends the os magnum, the trapezoid, and the unciform bones.

The upper row is united together by six ligaments, *three anterior* and *three interosseous*. The anterior ligaments consist of flattened bands of fibres which lie in front of the knee, and connect the four bones together, passing laterally from one to the other. The interosseous are strong and short fibres concealed between these bones, and attached to the rough excavations between the distinct facettes on the several bones to which allusion has been made at page 380, the ligament connecting the pisiform bone with the scaphoid being particularly well marked.

The bones of the second row are, in a similar way, united by *anterior* and *interosseous ligaments*, but instead of being three, there are only two of each, in correspondence with the diminished number of bones. It is unnecessary to describe them more minutely.

The two rows again, between which is a partial hinge joint, are united by three *special ligaments*, in addition to those common to the whole knee joint, which will be presently described. Two of the special ligaments consist of very short fibres lying behind the carpal bones, and covered by the great posterior ligament. The third is larger than these, and extends from the pisiform bone to the unciform, and to the head of the external small metacarpal bone (see $_5$, Fig. 48). It is united on the outer side with the external lateral ligament, and internally with the common posterior ligament. To its posterior border are attached the outer fibres of the sheath of the flexor tendons.

The synovial capsules proper to these articulations line all the above ligaments and articular surfaces, being reflected from one to the other, and forming also pouch-like prolongations upwards between the bones of each

row, as far as the interosseous ligaments, and downwards in a similar manner Neither of the ascending pouches is continuous with the radio-carpal capsule, but the external of the two lower communicates with that of the carpo-metacarpal joint. This fact is sometimes important in punctured wounds of the knee joint.

2. THE RADIO-CARPAL ARTICULATION, formed by the union of the lower end of the radius with the upper surfaces of the scaphoid, lunar, cuneiform, and pisiform bones, is a true hinge, but somewhat limited in the amount of its motion. The lower end of the cannon-bone can describe fully ninety degrees of a circle around the knee joint as a centre; but the full extent of this motion is divided between the three several articulations to which I have alluded, the radio-carpal taking considerably the largest share. *The lower end of the radius* presents an irregular articular surface, longer from side to side than from before backwards, and a non-articular pit or fossa hollowed out to receive a projection of the lunar bone during the flexion of the joint. On each side of these are the lateral processes. *The upper surfaces of the carpal bones* are moulded exactly to fit the inferior extremity of the radius, and a loose *synovial capsule* passes from one to the other, extending downwards between the three innermost carpal bones as far as their interosseous ligaments, and sometimes also to the capsule between the pisiform and cuneiform bones.

FIG. 47.—ANTERIOR VIEW OF THE LEFT KNEE JOINT.

A. Inferior third of the radius.
B. Cuneiform bone.
C. Lunar bone.
D. Scaphoid bone.
E. Unciform bone.
G. The great bone.
H. Trapezoid bone.
K. Superior third of metacarpus.
1. Scapho-radial ligament.
2. External lateral ligament.
3. 3. Internal lateral ligament.
4. 4. Ligaments existing between upper row of carpal bones.
5. 5. Carpo-metacarpal ligament.

The ligaments proper to this articulation, in addition to those common to the whole knee joint, are *three*. Of these one forms a large rounded cord, attached to the radius above, and to the cuneiform bone below, taking an oblique direction downwards and inwards beneath the common posterior ligament. The second, much smaller in size, is extended between the external lateral process of the radius and the pisiform bone, being partially covered by the common external lateral ligament, but allowing a small triangular space to intervene, through which the synovial capsule is sometimes protruded in diseased conditions of this joint. The third, still more thin and weak in its fibres, is situated beneath the second, and arising from the radius is inserted in the lunar bone, and into the interosseous ligament which unites the pisiform and the scaphoid bones (see ₃ Fig. 49).

3. THE CARPO-METACARPAL ARTICULATION is formed above by the three inferior carpal bones, and below by the heads of the three metacarpal bones, together constituting a limited hinge joint. These surfaces above and below are in close apposition, and are lined by one common synovial capsule, which, as already mentioned, communicates with that between the two rows of carpal bones.

Besides the common ligaments, there are seven proper to this joint—three anterior, two posterior, and two interosseous.

Of the three anterior ligaments, the external one, covered by the external lateral ligament, unites the unciform bone to the outer small metacarpal bone. The middle one unites the os magnum to the large metacarpal bone. The internal one unites the trapezoid to the inner small metacarpal bone.

FIG. 48.—BACK VIEW OF LEFT KNEE JOINT, SEEN OBLIQUE-LY FROM THE RIGHT, AND SHOWING THE DEEP-SEATED LIGAMENTS.

A. Inferior third of radius.
B. Pisiform bone.
C. External small metacarpal bone.
D. Internal small metacarpal bone.
1. External lateral ligament.
2. 3. Scapho - metacarpal liga-ment.
4. Radio-lunar ligament.
5. Ligament between the pisi-form, unciform, and ex-ternal small metacarpal bone.

FIG. 49. — BACK VIEW OF RIGHT KNEE JOINT, SHOW-ING THE SUPERFICIAL LIGA-MENTS.

A. Inferior third of radius.
B. Superior third of large metacarpal bone.
C. Internal small metacarpus.
D. External small metacarpal bone.
1. Internal lateral ligament.
2. External lateral ligament.
3. Ligament between the ra-dius, lunar, and pisi-form bones.
4. 5. Ligament between the unciform, pisiform, and between the ex-ternal small metacar-pal bones.
6. Strong band of ligamentous fibres, binding down the flexor tendons in their sheath or groove.
7. 7. Groove for the passage of the perforans and perforatus tendons.

The two posterior ligaments, described by Rigot, are very difficult of demonstration, being only with the greatest care separated from the common posterior ligament. One of them, however, is capable of being made out by dissection, as a strong band of fibres passing from the back of the scaphoid bone to the inner small metacarpal bone (see 2, 3, Fig. 48).

The two interosseous ligaments ascend from the roughened depressions existing between the three metacarpal bones to the interosseous ligaments of the second row.

4. THE LIGAMENTS COMMON TO THE WHOLE KNEE JOINT are four—two lateral, an anterior, and a posterior.

The external lateral ligament is a thick cord, formed of two kinds of fibres, a deep-seated and a superficial set, which take a crucial direction. It arises from the external lateral process of the radius, and descends vertically on the side of the knee joint. In its passage, it gives off a band to the pisiform bone, and also to the os unciforme, and terminates at the head of the external small metacarpal bone. This ligament lies on the carpal bones and capsular ligament.

The internal lateral ligament, analogous to the preceding, and situated on the opposite side, is thicker and larger. It arises from the internal lateral process of the radius, and terminates on the supero-anterior and internal surface of the large metacarpal and head of the internal small metacarpal bones. The fibres of this ligament take a crucial direction; in its passage downwards, it gives off three little bands, namely, one to the scaphoid bone, one to the os magnum, and one to the trapezoid.

The anterior or capsular ligament covers the anterior face of the carpal articulations. Its superior edge is attached to the inferior extremity of the radius; its inferior edge is attached to the superior extremity of the large metacarpal bone; its right and left borders are in contact with the lateral ligaments; its external face is connected with tendons, etc.; its internal face is lined, at certain points, by synovial membrane. This ligament is formed of transverse fibres, more or less oblique, crossed and re-crossed.

The posterior ligament—one of the strongest of the animal economy—covers the posterior surface of the knee. It is inserted superiorly into the transverse ridge which bounds the articular surface of the radius. At the posterior part of the carpal bones, it becomes attached to the inner border of the pisiform bone, the posterior surface of the os magnum, the cuneiform and scaphoid bones terminating on the postero-superior extremity of the large metacarpal bone. The scapho-metacarpal ligament, described as part of the posterior ligament of the carpo-metacarpal joint, is with difficulty separated from this ligament.

THE KNEE IS THE CENTRE OF TWO VERY EXTENSIVE MOVEMENTS, namely, extension and flexion; to which three others, very limited in their extent, may be added, namely, adduction, abduction, and circumduction.

As already mentioned, all the carpal articulations do not take an equal part in the execution of these movements; in fact, it is evident that they chiefly take place in the radio-carpal ginglymus, and in the imperfect hinge formed between the two rows of carpal bones. Each of these articulations participates in the movements of the knee, nearly in the same proportion, the superior perhaps being slightly the more extensive, and both perform their office in the same manner.

In flexion, the first row of bones turns from before backwards on the radius; the inferior row moves in the same way on the superior row. The metacarpus is carried backwards and upwards, thus relaxing the common posterior ligament. The anterior ligament, on the contrary, is rendered tense. The articular surfaces, especially those of the second joint, separate in front from one another.

In extension, the metacarpus is carried below and forwards by an inverse

mechanism. This movement is arrested when the radius and the meta-carpus are placed in the same vertical line, as in the standing position.

In flexion, the bony radii do not directly approach each other; the inferior extremity of the metacarpus is always carried outwards. The movements of *abduction, adduction,* and *circumduction* are not able to be performed until the foot is bent up under the fore-arm, and are then only capable of being very partially carried out.

The plain arthrodial surfaces existing between the lower row of carpal bones and the superior metacarpal extremity, only admit of a simple sliding of the surfaces in contact. The limited motion of this articulation can have but a secondary influence over the general movements of the knee; but it favours them by permitting the carpal bones to change their reciprocal connections, and thence lends itself, through the medium of the radio-carpal and inter-carpal ginglymi, to a more exact coaptation of the articular surfaces which constitute them.

INTER-METACARPAL ARTICULATIONS

EACH SMALL METACARPAL BONE articulates with the large metacarpal bone through the medium of two diarthrodial surfaces, situated on the inner part of their heads; a third, of a synarthrodial character, occurs on the anterior part of the body. Each of these articulates with corresponding surfaces on the large metacarpal bone.

An interosseous ligament, composed of very short and strong bundles, is interposed between the synarthrodial surfaces, and fixes them solidly one on the other.

THE INTER-METACARPAL ARTICULATIONS allow only of a very slight vertical sliding movement.

FETLOCK JOINT

THE FETLOCK JOINT is formed by the junction of the inferior condyloid extremity of the large metacarpal bone with the biconcave surface of the os suffraginis, and by the anterior smooth surfaces of the ossa sesamoidea with the posterior part of the condyles of the same metacarpal bone. It is a perfect hinge.

The ligaments forming the bond of union between these surfaces are as follow :—First, those which belong to the ossa sesamoidea; secondly, those which connect the os coronæ and pastern together; thirdly, a ligament common to both. Besides which, there is a synovial capsule.

1. *The first* have received the general names of the sesamoideal ligaments, and are six in number, namely, three inferior, two lateral, and an inter-sesamoideal.

The inferior sesamoideal ligaments are divided into three, namely, the superficial, the middle, and the deep. Of these *the first* is a narrow band, flattened behind and before; arising from the middle of the fibro-cartilaginous mass, which completes behind the superior articular surface of the os coronæ, it continues slightly expanding as it ascends, until it reaches the

bases of the ossa sesamoidea, to which it is inserted, mixing also with the inter-sesamoideal ligament. *The middle* is of a triangular shape, and is formed of three bands, two lateral and a median. It is often confounded with the first ligament, although easily distinguishable from it by its lower insertion. Fixed in common, inferiorly, to the apex of the triangular ridge situated on the posterior surface of the os suffraginis, these three

FIG. 50.—ANTERIOR VIEW OF FETLOCK
AND PASTERN JOINTS.

1. 1. 1. Lower row of carpal bones.
2. Metacarpal bone.
3. External sesamoid bone.
4. Suffragineal bone.
5. Coronal bone.
6. Pedal bone.
7. Tendon of the extensor pedis.
8. Long ligament which blends inferiorly with the tendon of the extensor pedis.
9. Point where the extensor tendon begins to expand.
10 & 11. Points to which the extensor tendon is attached.
12. 12. Lateral cartilages.

FIG. 51.—POSTERIOR VIEW OF FETLOCK AND
PASTERN JOINTS.

A. Metacarpal bone.
B. B. Sesamoid bones.
C. Suffragineal bone.
D. Coronal bone.
E. E. Lateral cartilages.
F. Navicular bone.
1. 1. 1. Lower row of carpal bones.
2. 2. Suspensory ligament.
3. 3. Bifurcation of same, in order to join the sesamoid bones.
4. 4. Inter-sesamoideal fibro-cartilaginous substance.
5. Point over which the tendon of the flexor pedis perforans plays.
6. Inferior superficial sesamoideal ligament.
7. 7. Middle inferior sesamoideal ligament, under which the deep-seated ligament is placed.
8. 9. 10. Ligament connecting the navicular and coronal bones.
11. Ligament connecting the pedal and navicular bones.

bands diverge, the two lateral to be attached to the bases of the ossa sesamoidea, the median becoming confounded with the surrounding ligaments. *The deep-seated ligament* is formed by two little bands, hidden by the middle ligament, thin and short. These are fixed above to the bases of the ossa sesamoides, and below to the superior extremity of the os suffraginis near the edge of its articular surface. This ligament is in close contact with the synovial membrane.

The lateral sesamoideal ligaments are formed by two thin plates, which

extend from the base of each sesamoid bone to the tubercle which exists on the superior side of the os coronæ. On their internal faces they are lined with synovial membrane.

The inter-sesamoideal ligament consists of fibro-cartilaginous substance, which runs from the posterior part of one sesamoid bone to that of the other, spreading over the external surface of the outer, and internal surface of the inner bone. It is composed of the fibro-cartilaginous substance in which the ossa sesamoidea were originally developed. This mass of fibrous matter, in common with the posterior and internal faces of the two bones, forms the smooth pulley-like groove over which the flexor tendons play.

2. *The ligaments connecting the cannon-bone to the pastern* (or, in scientific language, the metacarpus to the os suffraginis) are three, namely, two lateral and a capsular.

Each lateral ligament consists of two bundles of fibres, one superficial and one deep-seated, firmly united together at their adjacent surfaces. The superficial arises from a projection on the infero-lateral part of the large metacarpal bone, just above the condyloid surface. It descends vertically, so as to terminate on the lateral parts of the superior extremity of the os suffraginis. The deep-seated one is attached strongly to the excavation on the lateral surfaces of the anterior extremity of the large metacarpal bone, and directs its course from the ossa sesamoidea to the superior extremity of the os suffraginis, where it is fixed, by mixing its fibres with the lateral sesamoideal ligaments.

The capsular ligament is a very resisting membranous expansion, which is attached to the edges of the cartilaginous articular surfaces of the bones composing this joint. It is internally lined with synovial membrane.

The suspensory ligament, which should be carefully studied on account of the numerous accidents to which it is liable, is attached to all four of tl e bones entering into this joint, and may be described as being composed of a strong band of white fibrous tissue, sometimes having intermixed a few bundles of muscular tissue. It is thin and comparatively weak towards the knee, but as it approaches the fetlock joint, it almost equals the back sinews in substance, and its volume and wiriness to the touch may be taken as some test of the power of any particular leg in resisting a " break down." Occupying the space between the two small metacarpal bones, and lying close against the large metacarpal, it arises from the posterior common ligament of the knee joint, from a projection on the back of the large metacarpal bone just below it, and from the inner sides of the heads of the small metacarpals. Descending thence close to the large metacarpal bones, it splits into two strong bands, each of which is attached to the upper edge of the corresponding sesamoid bone, a few fibres passing on to re-unite below the joint and become continuous with the tendon of the extensor pedis in front of the os coronæ.

The *synovial capsule* of the fetlock joint is prolonged forwards in the form of a *cul de sac* lining the bifurcation of the suspensory ligament. There is also frequently developed, in front of the joint, a pouch communicating with this capsule which lines the posterior surface of the extensor tendons.

THE MOVEMENTS of the fetlock joint are almost entirely confined to flexion and extension, a very slight lateral motion being permitted when the ligaments are relaxed, as in passive flexion of the leg.

THE PASTERN JOINT

The several parts which enter into the formation of this joint are the two lateral condyles on the inferior extremity of the os suffraginis, and the corresponding cavities on the os coronæ. This last surface is completed behind by a very dense and thick fibro-cartilage, which acts partly as a ligament, and partly by increasing the depth of the articular surface. It is attached above by six fibrous bands, of which two are continuous with the inferior sesamoideal ligaments, and four pass on to the sides of the os suffraginis. Below it is fixed to the os coronæ, between the articular surface and the tubercle behind it. This fibro-cartilage forms a smooth surface posteriorly for the flexor pedis perforans to play over, and is continuous on

FIG. 52.—EXTERNAL VIEW OF THE PASTERN JOINT.

A. Inferior third of the large metacarpal bone.
B. External sesamoid bone.
C. Suffragineal bone.
D. Coronal bone.
E. Navicular bone.
F. Pedal bone.
1. One division of the suspensory ligament.
2. Lateral sesamoideal ligament (external).
3. Ligamentous fibres given to the extensor pedis tendon by the suspensory ligament.
4. Inferior superficial sesamoideal ligament.
5. 6. 7. Extensor pedis tendon.
8. External lateral phalangio - pedal ligament.
9. External lateral cartilage.

each side with the two divisions of the flexor perforatus. In addition to these structures, and the synovial capsules lining them, the joint is protected by two lateral ligaments, and in front by the extensor tendon.

The lateral ligaments, thick and strong, take an oblique direction from above downwards, and from before backwards, one on each side of the joint. They arise from two depressions, just below the tubercles on the lateral parts of the os suffraginis, and terminate at the superior edge of the os coronæ. Their lowest fibres prolong themselves beyond this bone to gain the extremities of the os naviculare, and constitute the posterior lateral ligaments of the coffin joint.

The synovial membrane lines the posterior surface of the extensor tendons anteriorly, the lateral ligaments, and the fibro-cartilage ; it forms posteriorly a *cul de sac*, which mounts up between this and the posterior surface of the os suffraginis.

THE MOVEMENTS of this joint are simply of extension and flexion when the muscles are in action ; but when they are relaxed there is some slight lateral motion.

THE COFFIN JOINT

THE COFFIN JOINT is made up of the lower end of the os coronæ, inserted in the concavity of the pedal bone, and supported behind by the navicular bone. These are lined by one continuous synovial capsule, and protected by ligaments which may be divided into two sets. *First,* those connecting the os coronæ to the os pedis. *Secondly,* that between the os naviculare and the os pedis, which is of an interosseous character, being short, and composed of very strong fibres ; and *thirdly,* the ligament on each side connecting the os naviculare with the coronet.

1. *The corono-pedal ligaments* are two on each side, one anterior and the other posterior. The former consist of two large, thick and short bundles of

FIG. 53.—POSTERIOR VIEW OF
the COFFIN JOINT.

A. Coronal bone.
B. Navicular bone.
C. Pedal bones.
1. Corono-navicular ligament.
2. 2. Lateral ligaments of the navicular bone.
3. Pedo-navicular ligament.

fibres attached above to the sides of the os coronæ, and below to the lateral edges of the cacumen coronæ of the pedal bone (see page 418). Each is partly covered posteriorly by the lateral cartilage in which it becomes lost, while the anterior edge is continuous with the tendon of the extensor pedis. *The posterior lateral* ligament on each side commences above from the lower fibres of the lateral ligament of the pastern joint, and from the sides of the lower end of the os coronæ. It descends obliquely backwards, and is inserted in the retrossal process of the pedal bone, and in the upper edge of the lateral cartilage.

2. *Between the os naviculare and the os pedis* is a very short but strong band of fibres in the nature of an interosseus ligament. It arises from the groove on the lower and fore edge of the os naviculare, and passes forward to be attached to the back part of the plantar surface of the pedal bone.

3. *Two lateral ligaments,* one on each side, attach the os naviculare to the sides of the coronal bone.

THE SYNOVIAL MEMBRANE is inserted around the margins of the cartilaginous articular surfaces of the os coronæ, os pedis, and os naviculare ; in front it is attached to the tendon of the extensor pedis, at the posterior part of the os naviculare, and between this surface and the tendon of the flexor pedis perforans another capsule occurs.

THE MOVEMENTS of the coffin joint are similar to those of the fetlock and pastern, with the addition of a very limited gliding motion enjoyed between the os naviculare and os pedis.

THE HIP JOINT

THE COXO-FEMORAL ARTICULATION, OR HIP JOINT, is formed by the cotyloid cavity of the os innominatum receiving the globular head of the femur. The articular surfaces of each are clothed with cartilage, excepting at the notch in the former, and a rough surface on the internal side of the latter, to which the round ligament is attached.

THE LIGAMENTS of this articulation are the pubio-femoral, cotyloid, trans verse, round or ligamentum teres, and capsular.

The pubio-femoral is situated above the cotyloid ligament, but takes a course under the transverse ligament. It arises from the edge of the
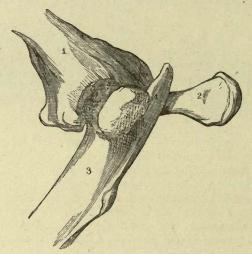
FIG. 54.—PROFILE VIEW OF LEFT HIP JOINT.

1. Iliac portion of os innominatum.	5. Cotyloid ligament.
2. Ischium.	6. 6. Capsular ligament covering the
3. Femur.	cotyloid ligament.
4. Trochanter major externus.	

acetabulum, and from the notch in the head of the os femoris, in company with the ligamentum teres, and is inserted at the symphysis pubis, where it meets its fellow on the opposite side.

The edge of the acetabulum is deepened by a layer of fibro-cartilage, called the cotyloid ligament. This bridges across the notch, and forms a complete circle.

At the notch in the edge of the acetabulum, where the fibres of the cotyloid ligament cross one another, and are continued from side to side, so as to render the circumference complete, some fibres are added distinct from the fibro-cartilage, and being both looser and broader, have been named the *transverse ligament*.

The inter-articular round ligament, or ligamentum teres, is composed of three fasciculi of fibres, forming a thick, dense body, attached by one extremity, which is round, to the pit in the head of the os femoris, and

by the other, which is broad and trifid, to the margins of the cotyloid notch, where its fibres are blended with the fibro-cartilaginous ring and transverse ligament.

The capsular ligament is attached by one extremity to the margin of the acetabulum, and by the other to the edge of the cartilaginous surface of the
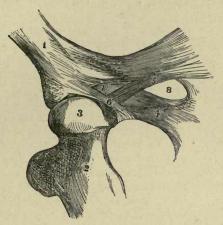
FIG. 55.—VIEW OF HIP JOINT.

1. 1. Iliac portion of os innominatum.
2. Femur.
3. Head of femur.
4. Ischium.
5. Pubio-femoral ligament.
6. Transverse ligament.
7. Ligamentum teres, or round ligament.
8. Obturator foramen.

head of the femur. The superior circular edge of this capsule is chiefly attached to the bone within four or five lines of the cotyloid ligament.

MOVEMENTS.—The coxo-femoral articulation is one of the joints which enjoys the most extensive and varied movements; namely, flexion, extension, abduction, adduction, circumduction, and rotation of the thigh upon the pelvis. The mechanism of these diverse movements is most simple.

STIFLE JOINT, OR COXO-FEMORAL ARTICULATION

THE STIFLE JOINT is formed by the union of the inferior extremity of the femur, with the superior extremity of the tibia, and the posterior surface of the patella.

ARTICULATORY SURFACES.—To constitute this articulation, the femur opposes at one part its two condyles to the large undulating surfaces on the upper extremity of the lateral tuberosities of the tibia: at the other part its trochlear articulatory surface, to the posterior face of the patella. Between the tibia and femur are the two semilunar cartilages.

The semilunar fibro-cartilages are two crescent-shaped bodies, placed on the articulating surfaces at the head of the tibia, and interposed between these and the condyles of the femur. The outer border of each is thick and convex, the inner thin and concave; leaving the central parts of the superior surface of the tibia uncovered by them. *The internal semilunar*

cartilage is nearly of a semi-circular form ; larger and thinner than the external, it is inserted by its anterior extremity to an excavation in front of the tibial spine, and by its posterior extremity to a little pit behind the spine : it is in close relation with the posterior crucial ligaments. *The external semilunar cartilage* fixes itself in front, near the anterior insertion of the opposite fibro-cartilage : its posterior extremity gives off two cords, one superior, the other inferior. The former, which is the longer and stronger of the two, is attached to the fossa at the back of the space between the condyles. The latter, thinner and broader, is spread out upon the posterior edge of the external tibial articulating surface.

The synovial membrane lines the contiguous surfaces of the parts entering into the composition of the stifle joint. Commencing to trace the reflections of this membrane at the border of the patella, it will be found to line the capsule, but below that bone it is separated from the anterior ligaments by a considerable quantity of adipose tissue, which prolongs itself to the inter-condyloid hollow, where it is attached ; from this it is reflected over the semilunar cartilages, around the crucial ligaments, and forms a partial covering for them, inclosing them as far as their attachments. At the sides of the patella it forms two slight folds, the ligamenta alaria. Finally it ascends in front of the femur, and passes downward to the margin of the patella.

FIG. 56.—POSTERIOR VIEW OF STIFLE JOINT.

A. Inferior third of femur.
B. B. Condyles.
D. Superior third of the tibia.
E. Fibula.
F. Patella.
1. Internal lateral ligament of the patella.
2. External lateral ligament of the femoro-tibial articulation.
3. Internal lateral ligament of the femoro-tibial articulation.
4. Posterior crucial ligament.
5. 5. Semilunar cartilages.

The ligaments are, first, those which unite the femur to the tibia, consisting of the lateral, the crucial, the posterior, the transverse, and the capsular ; and, secondly, those uniting the patella to the tibia, which are three, an external, a middle, and an internal.

1. *The lateral ligaments* are fibrous bands, situated on the sides of the articulation, more behind than in front ; they become relaxed during flexion, and hold the bones strongly together during extension. The External, a rounded, cord-like fasciculus of fibres (the longer and stronger) passes from the tuberosity of the external condyle of the femur to the head of the fibula ; its direction is almost vertical. The Internal, broad and flat, connects the tuberosity of the internal condyle of the femur with the upper and inner edge of the tuberosity of the tibia. It adheres to the internal semilunar cartilage.

The crucial or interosseous ligaments are placed at the posterior part of the joint, external to the synovial membrane, but partially invested by it. Their direction is oblique, so that they cross or decussate somewhat like the letter X. One is named the anterior, the other the posterior. The Anterior is fixed by its inferior extremity to the groove formed on the summit of the tibial spine, and by its superior extremity to the inter-condyloid hollow, and to the inner part of the external condyle. The

fibres which enter into its composition are slightly bent and spiral. The Posterior, longer than the preceding, and oblique, is attached inferiorly to the back part of the pit behind the tibial spine, and superiorly to the fore-part of the inter-condyloid hollow, as well as slightly to the side of the inner condyle of the femur; its fibres are directed upwards and forwards.

The posterior ligament, ligamentum pasticum, belongs to the class of membranous ligaments; it is formed of white and yellow fibres, which interlace with one another in different ways, and is pierced by numerous openings for the transit of blood-vessels, etc. It is attached by its superior border beneath the condyles of the femur, and by its inferior to the posterior circumference of the superior tibial surface. Its internal surface embraces the condyles of the femur, and adheres to the posterior crucial ligament, as well as to the inter-articular semilunar cartilages.

The transverse ligament.—Towards the front of the joint the convex borders of the inter-articular fibro-cartilages are connected together by a transverse band, denominated the transverse ligament.

Under the head of the capsular ligament are described certain strong portions of fibrous membrane which cover exposed parts of the synovial sac. The first, the longest and strongest, terminates in the pit situated on the inter-condyline hollow. The second, thin and flattened, is inserted upon the external surface of the tibia. The third passes from the outer edge of the patella to the external condyle of the femur (see $_1$, Figs. 57 and 58). The fourth corresponds with this on the inner side of the joint. These are sometimes described as independent ligaments.

FIG. 57.—EXTERNAL VIEW OF THE LEFT STIFLE JOINT.

A. Femur.
B. External condyle of femur.
C. Trochlea.
D. Tibia.
E. Fibula.
F. Patella.
1. Strong band of fibres.
2. External lateral ligament, or the capsular ligament, connecting the patella with the external condyle.
3. 3. Great ligament of the patella.
4. 4. External ligament of the patella.
5. 5. Semilunar fibro-cartilage.

2. LIGAMENTS OF THE PATELLA. The external lateral ligament is the longest and strongest, being a flattened band attached by its inferior extremity to the supero-anterior point of the tuberosity of the tibia, and by its superior to the anterior surface of the patella. This ligament is united to the internal ligament by an aponeurotic expansion, which is very resisting.

The internal ligament of the patella forms also a flattened band, longer, but not so large as, and thinner than, the preceding. Its inferior extremity is attached to the internal side of the anterior tuberosity of the tibia. Its superior extremity, much thickened, becomes fibro-cartilaginous, and is inserted in the projection on the inner and upper border of the patella.

The middle ligament, a rounded cord (situated, as its name indicates, between the two preceding ligaments), covers and assists in protecting the synovial capsule in front.

MOVEMENTS.—During flexion and extension, which are the chief motions permitted, the semilunar fibro-cartilages which are fixed on the

superior tibial surfaces, transforming them into glenoid cavities, move upon the condyles of the femur, from before backwards, or from behind forwards, according to the movement executed. But at the same time they glide, in a very appreciable manner, upon the superior extremity of the tibia. Thus, at the time of flexion, they move from behind forwards upon this extremity, and are brought backwards during extension. Rotation takes place from within to without, or *vice versâ*, and is produced not only by the first movement of the condyles in their glenoid cavities, but by the displacing of the semilunar cartilages on the superior extremity of the tibia.

TIBIO-FIBULAR ARTICULATION

THIS ARTICULATION is formed by the union of the little arthrodial spot, found at the internal surface of the head of the fibula, with a corresponding surface upon the external and superior tuberosity of the tibia. Short and strong fibres envelop these surfaces on the sides, and keep them firmly in contact. The fibula is again attached to the tibia—1st, above, by little ligamentous bundles, crossed in the shape of an X, which form the superior part of the arcade, or bridge, formed between the tibia and fibula; 2nd, in the middle, by a sort of aponeurotic membrane, of which the breadth diminishes from above downwards, like that of the interval which it fills; 3rd, below, by a ligamentous band, which joins the fibula to the external tuberosity of the inferior extremity of the tibia, where this cord divides and unites with the two external lateral ligaments of the tibio-tarsal articulation.

THE MOVEMENTS of this articulation are very limited.

THE HOCK JOINT

TWO BONES only concur to form the ginglymus, or true hinge, constituting the hock joint : these are the tibia and astragalus. *Two articulatory surfaces* are situated on the sides of the inferior extremity of the tibia, presenting two cavities, separated by an eminence, upon which a little spot often exists, uncovered by cartilage of incrustation. The astragalus presents, on its antero-superior border, two semicircular prominences, separated by a deep cavity which exactly corresponds to the inferior tibial eminence just mentioned, all being covered by cartilage.

The tibia and astragalus are united by seven ligaments : two external lateral, three internal lateral, one anterior, and a posterior.

The external lateral ligaments are two, distinguished according to their relative position. *The superficial external ligament* is a large cord, flattened in its inferior half. It descends from the external tuberosity of the tibia, behind the groove which separates this into two parts : taking a vertical course, it attaches itself successfully to the astragalus, the os calcis, os cuboides, the large metatarsal bone, and to the head of the small external metatarsal bones. This ligament gives off fibres, anteriorly to the tendon of the extensor pedis, and behind it mixes with the calcaneo-metatarsal

ligament. *The deep-seated external ligament,* much shorter than the preceding, is attached superiorly upon the anterior part of the external tuberosity of the tibia; it takes a course obliquely downwards, to the outer side of the astragalus and os calcis, where it is attached.

FIG. 58. — EXTERNAL VIEW OF THE HOCK JOINT.

A. Tibia.
B. External malleolus of tibia.
C. Os calcis.
D. Large metatarsal bone.
E. Capsular ligament opened and partially removed.
F. Prominence in head of external small metatarsal bone, sometimes mistaken for curb.
G. Astragalus.
H. Cuboid bone.
I. Scaphoid bone.
K. Cuneiform bone.
2. 2. Calcaneo-tibial ligament.
3 & 4. Ligaments between the astragalus and os calcis.
5. Cuboido-metatarsal ligament.
6. Great calcaneo-cuboid ligament.

The internal lateral ligaments.—These are three cord-like bands, of which there is one superficial, one median, and one deep-seated. *The superficial internal ligament,* the strongest and largest of the three, arises from the infero-internal tuberosity of the tibia, and inserts itself on the astragalo-

FIG. 59. — INTERNAL VIEW OF THE HOCK JOINT.

A. Tibia.
B. Internal malleolus.
C. Os calcis.
D. Large metatarsal bone.
E. Internal small metatarsal bone.
F. External small metatarsal bone.
G. Astragalus.
H. Scaphoid bone.
I. 1. Ligament common to the os calcis, astragalus, and internal small metatarsal bone.
2. Ligament between the tibia and astragalus.
3. Calcaneo-astragalan ligament.
4. Ligament between the astragalus and os calcis.
5. Calcaneo-cuboid ligament.
6. Calcaneo-metatarsal ligament.

metatarsal ligament, to the tuberosity on the internal surface of the astragalus, the small cuneiform bone, and to the internal borders of the two remaining tarsal bones, viz. the scaphoid and cuneiform, and to the upper and inner surface of the large metatarsal bone, and head of the inner small splint bone. *The median internal ligament* is composed of two cords, attached in common beneath the preceding, to the internal tuberosity of

the tibia; they take a course backwards and downwards, and terminate, one on the astragalus, the other upon the lower and inner surface of the os calcis. *The internal deep ligament* is an extremely thin band; it is attached above to the tibia, just below the attachment of the middle ligament, and below to the astragalus, nearly at the same point as the superior insertion of the middle ligament.

The anterior ligament is a thin layer, formed of decussating fibres, stronger without than within, attached by its superior edge to the tibia, and by its inferior edges to the astragalus and to the os cuneiforme parvum.

The posterior ligament, similar in structure to the anterior, is attached to the same bones, behind their articular surfaces.

The synovial membrane is developed on the internal surface of the two capsular ligaments, covered also by the three internal and the external deep ligaments.

MOVEMENTS.—This joint allows only of flexion and extension; but to avoid contact between the foot and the tibia in the act of flexion, the tibio-astragalan articulation causes the bones below to deviate outwards, owing to the obliquity of the articular surfaces.

ARTICULATIONS BETWEEN THE BONES OF THE TARSUS

THE CALCANEO-ASTRAGALAN ARTICULATION between the bones of the first row is a compound arthrodia, resulting from the coaptation of three or four articular surfaces on the posterior face of the astragalus to corresponding facettes on the antero-inferior part of the os calcis. The lateral ligaments of the tibio-tarsal articulation are common to this joint; and we also have four ligaments proper to it, a superior, external, internal, and an interosseous ligament.

The superior astragalo-calcanean ligament, formed of very short and parallel fibres thrown from one bone to the other, is situated near the superior extremity of the trochlear astragalan surface, and lined by the synovial membrane of the tibio-tarsal articulation.

The lateral ligaments are two very thin bundles, which unite the os calcis to the astragalus laterally, hidden under the ligaments which bind the tibia to the tarsus.

The interosseous ligament is very strong, and occupies a great part of the roughened excavations which separate the arthrodial surfaces of the os calcis and astragalus. These do not possess proper synovial membranes, that is, membranes proper to each, with the exception of one, formed on the upper and outer part of this articulation, where a distinct synovial membrane exists. The superior arthrodial surface is, however, sometimes supplied with synovial membrane, by a prolongation from the tibio-tarsal capsule. Two prolongations ascend from the capsule of this articulation below the inferior arthrodial surfaces of the os calcis and astragalus, and thus facilitate a gliding motion, which is very limited.

THE MOVEMENTS are so limited as to be almost null.

IN THE ARTICULATIONS OF THE BONES OF THE SECOND ROW among themselves, the cuboid bone joins with the os scaphoides by two arthrodial sur-

faces, one anterior, the other posterior; and also with the os cuneiforme magnum by two similar surfaces. The os scaphoides articulates with the magnum by a vast convex surface; the cuneiforme and magnum articulate internally and laterally with the parvum.

THE LIGAMENTS which keep these diarthrodial surfaces in contact are numerous. The astragalo-metatarsal and the posterior tarso-metatarsal ligaments are common to this articulation. They consist of—

Two anterior ligaments, running from the cuboid to the os scaphoides and magnum, one above and the other below the groove between these three bones.

Two interosseous ligaments from the superior and inferior sides of the forenamed groove.

An interosseous ligament, running from the os scaphoides to the cuneiforme parvum.

An interosseous ligament running from the os scaphoides to the cuneiforme magnum.

THE SYNOVIAL MEMBRANE is formed between the os scaphoides and os cuneiforme : this membrane belongs also to the two arthrodial surfaces existing on the upper parts of the internal surface of the os cuboides and os cuneiforme parvum. A capsule proper also exists between the superior surface of the astragalus, the superior surface of the os scaphoides, and os cuboides. As to the arthrodial surfaces between the os cuneiforme medium on the one side, and the os cuboides and cuneiforme parvum on the other, they are supplied with synovial membranes by two prolongations from the tarso metatarsal synovial capsule.

MOVEMENTS.—Scarcely any.

ARTICULATIONS BETWEEN THE TWO ROWS.—This arthrodia is formed by the union of the inferior extremity of the astragalus and os calcis, on the one part, with the superior extremity of the os scaphoides and os cuboides on the other. This articulation has six principal ligaments.

The two superficial lateral ligaments of the tibio-tarsal articulation.

The calcaneo-metatarsal ligament, which unites the posterior border of the os calcis to the cuboid bone and to the head of the external small metatarsal bone.

The astragalo-metatarsal ligament is a large radiating fasciculus, whose fibres run from the tuberosity of the astragalus, diverge, and become confounded with the internal superficial tarsal ligaments on the ossa cuneiforme magnum, scaphoides, and the superior extremity of the large metatarsal bone.

The posterior tarso-metatarsal ligament is very strong, and unites, posteriorly, the tarsal bones to the three metatarsal bones; it is continuous below with the suspensory ligament; it mixes at the sides with the calcaneo-metatarsal ligament, and with the internal and superficial tarsal ligament.

An interosseous ligament is attached to the four bones which form this articulation.

IT IS PROVIDED WITH A SYNOVIAL CAPSULE, which always communicates in front with the tibio-tarsal capsule. This capsule prolongs itself superiorly between the os calcis and astragalus, to lubricate the two inferior arthrodial surfaces between these bones. It also descends between the

os scaphoides, os cuboides, and the little arthrodial spots between the os cuneiforme and os cuboides.

MOVEMENTS.—Very limited ; gliding motion is only enjoyed.

THE TARSO-METATARSAL ARTICULATION

THIS JOINT is formed by the meeting of three bones of the tarsus (the cuboid, os cuneiforme magnum, and os cuneiforme parvum), with the superior extremities of the three metatarsal bones, which are kept in contact through the medium of the superficial lateral ligaments of the tibio-tarsal articulation, the calcaneo-metatarsal and astragalo-metatarsal ligaments, and by a strong interosseous ligament, divided into three fasciculi, which are attached inferiorly to the three metatarsal bones.

THE PROPER SYNOVIAL CAPSULE of this joint mounts between the cuboido-scaphoid arthrodial surfaces and those which unite the ossa cuneiforme magnum and parvum ; it descends between the inter-metatarsal articulations.

MOVEMENTS.—Similar to the preceding.

INTER-METATARSAL ARTICULATIONS

These are precisely similar to the inter-metacarpal articulations described at page 412.

REMAINING ARTICULATIONS OF THE POS-TERIOR MEMBERS

The descriptions of the several joints of the fore-limbs at pages 395, 396, 397, will suffice for those of the hind-legs.

CHAPTER XX

THE MUSCULAR SYSTEM

PHYSIOLOGY OF MUSCLE

WITH trifling exceptions the whole of the movements of the body and limbs are performed by the agency of that peculiar substance, known in our butchers' shops as "flesh," and recognized by anatomists as muscular tissue. This constitutes the chief bulk of the soft parts external to the three great cavities (the cranial, thoracic, and abdominal), and in the half-starved subject of the knacker or highly-trained race-horse, in which the fat has almost entirely disappeared, the ordinary observer will detect nothing but muscles (with their tendons) and bones beneath the skin covering the limbs. On the trunk they are spread out into layers varying in thickness, sometimes interrupted by flat tendons, so as to form, at the same time, a protection to the organs within, easily capable of extension or contraction, and a means of moving the several parts upon each other.

TENDONS resemble ligaments in being composed of white fibrous tissue, described at page 393. They serve to connect muscle with bone, and are useful as affording an agent for this purpose of much less compass than muscle itself, and also of a structure not so easily injured by external violence. Thus they are generally met with around the joints, the muscular substance chiefly occupying the space between them. There are three varieties of tendon. 1. *Funicular*, consisting of cord-like bands; 2 *Fascicular*, including bands of a flatter and more expanded nature; and 3. *Aponeurotic*, which are membranous, and are chiefly met with around the abdomen. The fibres are firmly attached to the bones, which generally present rough surfaces for this purpose, and are also closely incorporated with the periosteum. This union is so strong that it very rarely gives way; and when extreme violence is used, either the bone itself breaks, or the tendon snaps in its middle. Tendons are non-elastic.

To THE NAKED EYE an ordinary muscle appears to be composed of a number of small bundles of fibres, arranged in parallel lines, and connected by a fine membrane. These bundles may still further be separated into what seems at first to be elementary fibres; but when placed in the microscope, they are found to be themselves made up of finer fibres united into fasciculi by delicate filaments. These ultimate fibrillæ are polyhedral in section, according to the observations of Mr. Bowman, so as to pack closely together, and are variable in size in different classes and genera of animals. They also differ in appearance, one class presenting stripes while the other is without them. The former includes all the muscles whose movements are under the control of the will as well as those of the heart, and some of the fibres of the œsophagus, while the latter is composed of the muscles investing the stomach, intestines, bladder, etc., which are comprehended under the general term involuntary.

THE SARCOLEMMA is the name given by Mr. Bowman to the areolar tissue investing each fibre, sometimes also called *myolemma*. It is very delicate and transparent, but tough and elastic; in general it has no appearance of any specific structure, but sometimes it presents an aspect as if there was an interweaving of filaments.

WHEN A FIBRILLA of striated muscle is examined under the microscope of a high magnifying power, it is seen to present a beaded appearance, as if made up of a linear aggregation of distinct cells, alternately light and dark. When the fibrilla is relaxed, each cell is longer than it is broad; but, during the action of the muscle, it assumes the opposite dimensions, the increase in one diameter being always in proportion to the diminution of the other. As the contraction takes place the substance becomes firmer than before, but the bulk remains the same, the mass merely gaining in thickness what it has lost in length. The application of certain stimulating agents will produce the contraction for a certain period after life is destroyed, varying according to the vitality of the animal experimented upon and the nature of the individual muscle. This is called *irritability* in the striated muscles, which exhibit powerful contractions, alternating with relaxations—while in the involuntary muscles a more steady, permanent, and moderate contraction is met with, to which the name of *tonicity* has been given.

PURE MUSCULAR FIBRE appears to be identical in composition with the fibrine of the blood, being made up of about seventy-seven parts water, fifteen and a half parts fibrine, and seven and a half parts of fixed salts. The whole of the flesh of the body is largely supplied with blood, and it is found by experiment, on the one hand, that if this is cut off contraction ceases very speedily after; and on the other, that in proportion to the amount of muscular action will be the demand for fresh supplies of blood. None of the striated muscles, except the heart and the muscles of respiration, can go on acting without intervals of rest, during which repairs in their structure are effected. If, therefore, the voluntary muscles are to be brought into the highest state of vigour and development of size, they must be regularly exercised and rested at proper intervals. During the former condition blood is attracted to them, and at the same time that fluid itself is rendered more fit for the purposes of nutrition; while during the latter period the increased flow of blood continuing allows for a complete reparation of the

tissues. Thus we find the muscles of the well-trained race-horse full and firm to the touch ; but if sufficient intervals of rest are not allowed between his gallops, they will present a very different feel, being flabby and wasted, and indicating that he has been " overworked."

THE VOLUNTARY muscles assume various shapes, according to their positions and offices. Sometimes they are merely long strips of muscular tissue, with a very short tendon at each end, as in the levator humeri, and are then called *fusiform.* At others their fibres radiate, as in the latissimus dorsi, which is hence called a *radiating* muscle. A third set are called *penniform,* from their fibres being attached to one side of a tendon, or *bipenniform,* when they are fixed to both sides like the full tail or wing feather of a bird. A muscle with two masses of its tissue connected in the middle by a tendon is called *digastric.*

THE SPECIAL NOMENCLATURE of muscles is founded upon : 1st, their position, as tibialis, pterygoideus, zygomaticus ; 2nd, upon their action, as flexor, extensor, levator ; 3rd, upon their direction, as obliquus, rectus, transversalis ; 4th, upon their attachments, as scapulo ulnaris ; and 5th, upon their division into separate portions or heads, as biceps, triceps, digastricus, etc.

IN DESCRIBING EACH MUSCLE it is usual to speak of it as having an *origin* from one bone, or set of bones, and an *insertion* into another, the former term being generally assigned to the more fixed division of the two. This is, however, merely for the sake of convenience, and is entirely arbitrary.

BURSÆ MUCOSÆ, which are shut sacs, varying in size from that of a pea to a moderate pear, and lined with synovial membrane (see page 395), are placed on all the prominent points of bone over which tendons glide. Thus there is a large one on the point of the hock, and another on the elbow, both of which sometimes inflame and become filled with synovia, constituting the states known as capped hock and elbow. A third situation is just above the sesamoid bones, where the swelling from inflammation receives the name of windgall. Where, as in the legs, the tendons have to glide to a great extent, they are invested with SYNOVIAL SHEATHS, which are bound down by white fibrous tissue at the points where the strain is the greatest. In the LIMBS the muscles are bound up into masses by strong but thin layers of intercrossed white fibrous tissue, which receives the name of FASCIA. In the horse this is very firmly attached to the surface of the muscles beneath, and greatly interferes with the clean dissection of them.

CUTANEOUS MUSCLES

IMMEDIATELY BENEATH THE SKIN there is a thin layer of muscle, spread over nearly the whole surface of the body, and called PANNICULUS CARNOSUS. It is attached internally to some of the most prominent points of the skeleton, chiefly through the intervention of the fascia, which binds down the various groups of muscles. Externally it is inserted at short intervals into the inner surface of the skin, and into the cellular membrane beneath it. Its *action* is to throw the skin into folds or wrinkles, in so sudden a manner as to dislodge flies or other irritating insects. It is also powerful enough to shake off particles of dust or dirt which have fallen upon the part, and are not glued to it by any adhesive matter

MUSCLES OF THE HEAD

THE MUSCLES OF THE HEAD are in number above sixty, chiefly arranged in pairs, which correspond exactly with each other. Want of space will not permit a minute description of each; but the most important will be found alluded to sufficiently to give an idea of their position and action—
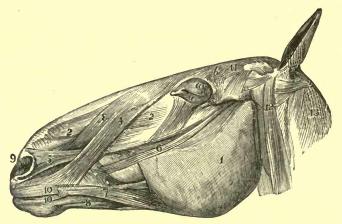

FIG. 60.—SUPERFICIAL MUSCLES OF THE HEAD.

1. Masseter.
2. Nasalis longus labii superioris.
3, 4. Levator labii superioris alæque nasi.
5. Dilatator naris lateralis.
6. Zygomaticus.
7. Retractor labii inferioris.
8. Depressor labii inferioris.

9. Dilatator naris anterior.
10. 10. Orbicularis oris.
11. *a. a.* Orbicularis palpebrarum.
— *b.* Levator palpebræ superioris, *or* corrugator supercilii.
12. Parotido auricularis.
13. Splenius.

ANTERIOR MAXILLARY REGION

ZYGOMATICUS.—Situation on the middle of the side of the face. *Origin*—from the anterior two-thirds of the zygomatic ridge. *Insertion*—to the angle of the mouth. *Action*—to retract the angle of the mouth.

LEVATOR LABII SUPERIORIS ALÆQUE NASI is situated on and above the side of the face. *Origin*—from the lachrymal, malar, and superior maxillary bones. *Insertion*—to the supero-posterior part of the nasal opening, and to the antero-inferior part of the nostril and upper lip. *Action*—to dilate the nostrils and to retract the upper lip.

RETRACTOR LABII SUPERIORIS is situated on the side of the face. *Origin*—from the anterior part of the zygomatic ridge, and from the corresponding part of the superior maxillary bone. *Insertion*—to the sides of the nostril and supero-lateral parts of the upper lip. *Action*—to retract the upper lip.

NASALIS LONGUS LABII SUPERIORIS is situated on the upper part of the face. *Origin*—from the infero-external part of the lachrymal and malar bones, and from the inferior part of the superior maxillary bone; at the cartilages

of the nose the tendons, the one on the right side and the other on the left, blend together and unite in one common tendon, which is *inserted* upon the superior part of the upper lip. *Action*—to corrugate the upper lip, and thence to raise it.

CANINUS is situated over the two anterior molar teeth. *Origin*—from the superior maxillary bone, near its junction with the anterior maxilla. *Insertion* —to a roughened depression on the inferior maxillary bone, just behind the lower tush. *Action*—to assist in closing the mouth.

DILATATOR NARIS ANTERIOR is situated in front of and between the nostrils. *Origin*—from the supero-anterior surface of the os nasi. *Insertion*—to the anterior part of the alar cartilages, blending with the orbicularis oris. *Action*—to raise the upper lip.

NASALIS BREVIS LABII SUPERIORIS is situated behind the nostrils. *Origin* —from the superior and anterior maxillary bones, and from the suture uniting them. *Insertion*—to the supero-anterior part of the septum nasi, and to the skin of the false nostrils. *Action*—to dilate the nostrils.

BUCCINATOR is situated between the upper and lower jaws. *Origin*— from the tuberosity of the superior maxillary bone, and from the outer walls of the alveolar cavities of the upper molar teeth. *Insertion*—to the outer walls of the alveolar cavities of the lower molar teeth. In front it is blended with the orbicularis oris. *Action*—to draw back the angle of the lips, and tighten the outer wall of the mouth.

RETRACTOR LABII INFERIORIS is situated on the anterior part of the lower jaw. *Origin*—from the external part of the lower jaw, just behind the last molar tooth. *Insertion*—to the inferior part of the lower lip. This muscle blends with the orbicularis oris. *Action*—to retract the lower lip.

NASO TRANSVERSALIS is situated between the two alar cartilages. This muscle runs between the antero-internal borders of each cartilage to which it is attached, and its *action* tends to approximate them.

DEPRESSOR LABII SUPERIORIS lies upon the anterior part of the upper jaw. *Origin*—from the anterior maxillary bone, and from the outer border of the alveoli of the incisor teeth, extending as far back as the tush. *Insertion*— to the upper lip and inferior nasal cartilages. *Action*—to assist in dilating the nostrils, and in retracting the upper lip.

ORBICULARIS ORIS.—This sphincter muscle is situated within the border of the lips. *Origin*—from the outer surfaces of the superior and inferior maxillary bones. *Insertion*—it interlaces with its own fibres at the angles, and is also attached to the glandular substance and skin of the lips. *Action* —to contract the opening of the lips, and compress them against the jaws.

DEPRESSOR LABII INFERIORIS lies along the side of the lower jaw. *Origin* —from the side of the lower jaw, close to that of the buccinator. *Insertion*— into the fat of the prominence of the chin.

LEVATOR MENTI is a little square muscle bracing the soft parts, covering the chin, up against the jaw. It arises from the edge of the alveolar process of the corner tooth on one side, passes beneath the chin, and meets there its fellow of the opposite side.

MUSCLES WHOSE OFFICE IT IS TO MOVE THE LOWER JAW

Temporalis is situated on the top and sides of the head. *Origin*—from the occipital, parietal, squamous plate, and zygomatic process of the temporal bones. *Insertion*—to the coronoid process of the lower jaw. *Action*—to raise the lower jaw, and thus to assist in mastication.

Masseter forms the prominence of the cheek. *Origin*—from the inferior surface of the zygomatic ridge. *Insertion*—to the whole of the external surface of the angle of the lower jaw. *Action*—to elevate the lower jaw, and thus assist in mastication.

Stylo maxillaris lies behind the lower jaw. *Origin*—from the styloid process of the occipital bone. *Insertion*—to the angle of the lower jaw. *Action*—to retract the jaw and assist in opening the mouth.

Pterygoideus externus lies within the jaw. *Origin*—from the ala of the sphenoid bone. *Insertion*—into the rough depression at the inner side of the root of the condyle of the jaw. *Action*—to raise the jaw and draw it forwards.

Pterygoideus internus is situated below the external pterygoid, and passes in a more horizontal direction. *Origin*—from the ala of the sphenoid bone, from the palate bone, and the tuberosity of the superior maxillary bone. *Insertion*—to the inner side of the angle of the jaw. *Action*—each muscle acting separately draws the jaw towards the opposite side, and the two acting alternately produce the grinding motion necessary for reducing the food.

MUSCLES OF THE EXTERNAL EAR

Six pairs of muscles move the cartilage of the ears in all directions; but they are not of sufficient importance to require any description here.

EXTERNAL MUSCLES OF THE EYELIDS

Orbicularis palpebrarum is a layer of thin muscular fibre, shown at Fig. 60 *a a*. It forms a plane around the edge of the lids, extending upwards and downwards, and having a tendon at the inner angle, by which it is attached to the frontal and lachrymal bones. Its *action* is to close the lids and draw them towards the inner angle.

Levator palpebræ superioris.—Fig. 60 *b* is a thin slip of muscle which is attached above to the aponeurotic expansion and skin of the forehead, and below to the orbicularis palpebrarum. Its *action* is to raise the upper eyelid and wrinkle the brow.

OCULAR REGION

EIGHT MUSCLES are lodged within the orbit for moving the eyelid and eye. They are severally named from the offices which they perform.

MUSCLES OF THE TONGUE

TEN MUSCLES are attached to the os hyoides, or bone of the tongue, for the purpose of moving it backwards and laterally, and also to serve as agents in the various movements of the tongue.

MUSCLES OF THE PHARYNX

As THE MOUTH CONTRACTS to form the funnel-shaped tube which ends in the œsophagus, the latter is clothed with several muscles, which aid in driving the food backwards. These are the hyo-pharyngeus and palato-pharyngeus and the three constrictors of the pharnyx.

LARYNGEAL REGION

THE CARTILAGES OF THE LARYNX are moved by seven pairs of small but beautifully defined muscles, named after their attachments.

PALATINE REGION

TWO MUSCLES move the soft palate, the tensor palati and circumflexus palati ; but they can only be made out by a careful dissection of these parts.

SUPERFICIAL MUSCLES OF THE NECK AND TRUNK

THE MUSCLES OF THE NECK AND TRUNK are so intimately blended together by their several attachments that they must be examined together. It will be impossible to describe more than the superficial ones ; but the most important being those which connect the trunk with the extremities, they will be selected as more especially deserving attention.

LATERAL CERVICAL REGION

SPLENIUS is situated on the superior part of the neck. *Origin*—from the three anterior dorsal spines. *Insertion*—to the mastoid process of the petrous portion of the temporal bone, crest of the occiput, wing of the
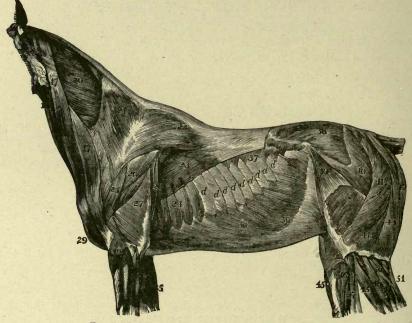
FIG. 61.—SUPERFICIAL MUSCLES OF THE NECK AND TRUNK.

16. Paratido auricularis, turned back, showing parotid gland.
17. 17. Levator humeri.
18. Sterno-maxillaris.
19. Splenius.
20. Cervical portion of serratus magnus.
21. Cervical portion of trapezius.
22. Dorsal portion of trapezius.
23. Latissimus dorsi.
24. Costal digitations of serratus magnus.
— *d. d. d. d.* etc. Intercostal muscles.
25. Deltoid.
26. Postea spinatus.
27. Triceps extensor brachii.
28. Scapulo ulnaris.
29. Pectoralis transversus.
31. Extensor pedis.
32. Extensor ossis suffraginis.
33. Flexor metacarpi externus

34. Flexor metacarpi internus.
35. ———————— medius.
36. 36. Obliquus abdominis externus.
37. Superficialis costarum.
38. Gluteus maximus.
39. Tensor vaginæ femoris.
40. Gluteus externus.
41. Triceps abductor femoris (part).
42. Semi-membranosus and semi-tendinosus.
43. }
44. } Triceps abductor femoris (remainder).
45. 45. Extensor pedis.
46. Flexor pedis accessorius.
47. Flexor pedis perforans.
48. Peroneus.
49. Flexor pedis perforatus.
50. Gastrocnemius internus.
51. Tendon of gastrocnemius externus.

atlas, transverse process of the second, third, fourth, and fifth cervical vertebræ, and to the lateral parts of the ligamentum nuchœ. *Action*—to draw the head on one side, when one muscle acts; when both together to erect the head.

COMPLEXUS MAJOR is situated under the splenius. *Origin*—from the

transverse processes and spines of the six anterior dorsal vertebræ. *Insertion* —to the oblique processes of all the cervical vertebræ, wing of the atlas, tubercle on the occipital crest, lateral parts of the ligamentum nuchœ, and by blending with the tendon of the splenius to the mastoid process of the petrous portion of the temporal bone. *Action*—to erect the head.

TRACHELO MASTOIDEUS is deeply seated under the splenius. *Origin*— from the transverse processes of the two anterior dorsal spines. *Insertion* —to the oblique processes of all the cervical vertebræ, wing of the atlas, and mastoid process of the petrous portion of the temporal bone. *Action* —similar to the splenius.

SPINALIS COLLI lies close to the bodies of the vertebræ, between their oblique and spinous processes. *Origin*—from the oblique processes of the five posterior cervical vertebræ and the first dorsal. *Insertion*—to the spinous processes of all the cervical vertebræ but the atlas. *Action*—to bend the neck upwards and backwards.

INFERIOR CERVICAL REGION

STERNO-MAXILLARIS is situated on the inferior part of the neck. *Origin* —from the supero-anterior part of the cariniform cartilage. *Insertion*— (opposite the thyroid body it becomes tendinous) to the posterior angle of the inferior maxillary bone. *Action*—to depress the lower jaw, and, through it, the whole head.

STERNO-THYRO HYOIDEUS is situated above the sterno-maxillaris. *Origin* —from the infero-internal part of the first rib, and from the supero-anterior part of the cariniform cartilage. *Insertion*—half-way up the neck it bifurcates, one part going to the postero-external part of the body of the thyroid cartilage, the other to the spur process of the os hyoides. *Action* —to draw the tongue and larynx backwards and downwards.

SUBSCAPULO HYOIDEUS is situated on the antero-superior part of the neck. *Origin*—from the supero-internal part of the body of the humerus, just below the inner tubercle. *Insertion*—to the under side of the root of the spur process of the os hyoides. *Action*—to depress the os hyoides, or if that is fixed, to aid the last muscle in lowering the head.

SUPERIOR CERVICO-OCCIPITAL REGION

FIVE PAIRS of small and short muscles connect the atlas and dentata with the head, occupying the space known as the poll. These are com- plexus minor, rectus capitis posticus major and minor, obliquus capitis superior and inferior. Their *action* is to raise the head and preserve the union of the bones intact.

SCALENUS connects the first rib with the two posterior cervical vertebræ. *Action*—to depress the neck, and, when that is fixed, to raise the first rib in forcible inspiration.

LONGUS COLLI is deeply seated on the under side of the vertebræ. *It arises* by fleshy digitations from the bodies of the six anterior dorsal vertebræ, and

is *inserted* into the bodies, transverse processes, and lower spines of all the cervical vertebræ, except the atlas, which has a tendinous insertion only into its body. *Action*—to flex the neck.

INFERIOR CERVICO-OCCIPITAL REGION

THIS IS OCCUPIED by three muscles, antagonists to those of the poll. They are rectus capitis anticus major and minor and obliquus capitis anticus, and connect the bodies and transverse processes of the cervical vertebræ with the cuneiform process of the occipital bone. Their *action* is to bend the head on the neck.

MUSCLES CONNECTING THE SCAPULA WITH THE HEAD, NECK, AND CHEST

BESIDES THE SUBSCAPULO HYOIDEUS, which has been described in con nection with the inferior cervical region, the following nine muscles connect the shoulder with the head, neck, and chest. When these are dissected, the anterior extremity may be removed and separately examined. The two first may be considered as occupying the humero-cervical region, the three next the dorso-scapular region, and the four last the scapulo-thoracic region.

LEVATOR HUMERI is situated on the antero-inferior and lateral parts of the neck. *Origin*—from the mastoid process of the petrous portion of the temporal bone, crest of the occipital bone, wing of the atlas, and transverse processes of the second, third, fourth, and sometimes fifth cervical vertebræ. *Insertion*—slightly to the spine of the scapula and shoulder-joint; to the inferior part of the ridge of the humerus, that extends from the outer part of the outer tubercle; and to a depression, "scaber canalis," on the antero-inferior part, with the pectoralis transversus. *Action*—to raise and draw the shoulder forwards; to turn the neck on one side; or, should both muscles act at one and the same time, to depress the head.

RHOMBOIDEUS LONGUS is situated on the supero-lateral part of the neck. *Origin*—from the lateral part of the ligamentum nuchæ as far anteriorly as the third cervical vertebra, and posteriorly as far as the anterior part of the second dorsal spine. *Insertion*—to the inner surface of the superior angle, border, and cartilage of the scapula. *Action*—to draw the scapula upwards and forwards.

TRAPEZIUS is situated upon the side of the withers and neck It presents the figure of a right-angled triangle. *Origin*—from the ligamentum nuchæ and spines of the dorsal vertebræ as far back as the eleventh. *Insertion*—to a tubercle on the spine of the scapula. *Action*—to elevate the scapula, and to draw it forwards and backwards.

LATISSIMUS DORSI is situated on the lateral part of the chest and back. *Origin*—from the ligamentum nuchæ as far anteriorly as the second dorsal spine, and posteriorly as far as the fascia lumborum at the eleventh dorsal

spine. *Insertion*—to the rough tubercle on the inner side of the body of the humerus. *Action*—to draw the humerus upwards and backwards.

RHOMBOIDEUS BREVIS, lying upon the side of the withers, has its *origin* from the spines of the second, third, and fourth dorsal vertebræ. *Insertion* —to the inner part of the superior border and cartilage of the scapula. This muscle is clothed externally with yellow elastic tissue. *Action*—to elevate the scapula.

PECTORALIS TRANSVERSUS is placed on the lateral, anterior, and posterior parts of the breast. *Origin*—from the lateral and posterior parts of the cariniform cartilage, over which it plays, being lubricated by a bursa, and meets its fellow by a white tendinous line. *Insertion*—to the antero-inferior part of the body of the humerus, " scaber canalis," and the fascia covering the leg. *Action*—it forms a sling to support the trunk, and to keep the arm close to the chest during locomotion.

PECTORALIS MAGNUS is situated on the infero-lateral part of the thorax. *Origin*—from the fourth, fifth, and sixth bones of the sternum, ensiform cartilage, and the cartilages of the four posterior true ribs. It is attached by fascia to the external oblique muscle of the abdomen. *Insertion*— bifid : one portion to the internal tubercle at the head of the humerus ; the other consists of a few fibres, which pass over to the external tubercle at the head of the humerus. *Action*—to draw the shoulder downwards and forwards.

PECTORALIS PARVUS lies between the fore-leg and side of the thorax. *Origin* —from the lateral parts of the cariniform cartilage, and slightly from the four anterior bones of the sternum. *Insertion*—to the outer tubercle at the head of the humerus, and to the supero-anterior border of the scapula, reaching nearly to its antero-superior angle. *Action*—to assist the last-named muscle.

SERRATUS MAGNUS is situated between the shoulder-blade and side of the chest. *Origin*—from the transverse processes of the four posterior cervical vertebræ, and from the entire length of the first, second, third, fourth, and fifth ribs as low as their cartilages ; from the sixth, seventh, and eighth as low as their middles ; digitating with four portions of the external oblique muscle. *Insertion*—to the superior border, and by a few fibres to the ventral surface and cartilage of the scapula. *Action*—it tends greatly to support the trunk in a sling, especially when the weight of the body comes down with a sudden shock, as in jumping. The two muscles are more or less concerned in all the motions of the scapula, and will become dilators of the chest, whenever they are contracted, while the limbs remain fixed points.

MUSCLES OF THE THORAX

THE RIBS are approximated to each other by two layers of muscles, which cross each other, so that when acting together the greater length of fibre given by this arrangement increases their power. These are the INTERCOS- TALES EXTERNI and INTERNI.

LATERALIS STERNI and STERNO COSTALES assist the intercostals in contract- ing the chest.

Superficialis costarum lies on the back in the form of a thin layer of aponeurosis, edged with fleshy slips, which indigitate with those of the obliquus abdominis externus (see Fig. 61). Its *action* is to raise the ribs and increase the capacity of the chest.

Transversalis costarum is situated on the supero-lateral part of the thorax. *Origin*—from the ribs close to the spine. *Insertion*—to the transverse process of the last cervical vertebræ. *Action*—to aid the last-named muscles.

Levatores costarum are fifteen or sixteen muscular slips, which con nect the transverse processes of the dorsal vertebræ with the anterior borders of the ribs, in the spaces between their tubercles and angles. *Action*—to raise the ribs and enlarge the cavity of the thorax.

DORSAL REGION

Longissimus dorsi lies along the back beneath the muscles of the superior extremity (which have been removed). It is a large powerful muscle, and forms the chief mass of the soft parts constituting the loins and back. *Origin*—from the crest of the ilium, side of the sacrum, and spinous and transverse processes of all the lumbar vertebræ. *Insertion*—to the angles of the twelve posterior ribs, and to the transverse processes of all the dorsal vertebræ, and of the three posterior cervical. *Action*—to bend the back, and thus raise either the fore or hind-quarter, when the other is fixed. It is the main agent in rearing and kicking, and is strongly called into play in galloping and leaping.

Spinalis dorsi is situated deeply on the sides of the withers. *Origin* —it is closely connected posteriorly with the last muscle, being attached to the spinous processes of the posterior dorsal vertebræ. *Insertion*—to the spines of the six or seven anterior dorsal vertebræ, and the three or four posterior cervical. *Action*—to assist the longissimus dorsi in rearing and in raising the fore-quarters in galloping.

Semi-spinalis dorsi is deeply buried beneath the two last muscles, with which it co-operates in its *action.*

MUSCLES OF THE ABDOMEN

These are naturally divided into two groups, according to the positions which they occupy and the offices they perform. Thus the superficial abdominal muscles form the lower walls of the cavity of the abdomen, while the deep abdominal muscles bound it anteriorly and superiorly.

SUPERFICIAL ABDOMINAL REGION

The abdominal muscles, four in number, constitute the lower walls of the belly, and together form, as it were, a strong sheet, by means of which the intestines and abdominal organs are kept in position. After reflecting the

skin, they are seen to be covered by the panniculus carnosus and a thick layer of yellow fibrous tissue, through which their division into tendon and muscle can faintly be discerned. These must be dissected off to bring into view the true abdominal muscles, when the following lines of demarcation will be discerned—

1. The LINEA ALBA, which occupies the median line from the os pubis to the ensiform cartilage, and consists of a tough layer of white fibrous tissue, which unites the muscles of the abdomen together. At a little more than a third of its length from the pubes is found a lozenge-shaped space in which the tissue is almost entirely absent, and through which in the fœtus the umbilical vessels pass. This is the umbilicus, or navel, of the adult.

2. On the surface of the rectus are several transverse white lines—the lineæ transversales.

3. Near the edge of the rectus muscle commences the linea semilunaris, which marks the union of the fleshy and tendinous portion of the external oblique.

OBLIQUUS ABDOMINIS EXTERNUS is situated on the lateral parts of the belly. *Origin*—by fleshy slips from the fourteen hindermost ribs, where it indigitates with the serratus magnus and latissimus dorsi, and from the fascia lumborum, reaching to the antero-superior spinous process of the ilium. *Insertion*—tendinous into the whole length of the linea alba, and by two strong divisions into the os pubis, between which is formed the triangular space called the *external abdominal ring*. The posterior of these, stretching from the ilium to the os pubis, is called the *crural arch*, and corresponds with Poupart's Ligament in human anatomy. *Action*—it flexes the pelvis on the thorax, and has the power of contraction, and, by this means, of expelling the fæces, and in the mare the fœtus; it also serves to force up the diaphragm, and thus to aid in expiration.

OBLIQUUS ABDOMINIS INTERNUS lies deeper than the foregoing muscle. *Origin*—from the transverse processes of the lumbar vertebræ and antero-inferior spinous process of the ilium and crural arch. *Insertion*—to the inner surface of the cartilages of the three or four last ribs, and to the ensiform cartilage; also in close union with the tendon of the external oblique to the linea alba. *Action*—to expel the fæces and urine, and to act as above. Like the last, it is also a muscle of respiration.

TRANSVERSALIS ABDOMINIS is still deeper than the last-mentioned muscle. It has its origin from the transverse processes of the lumbar vertebræ, antero-inferior spine of the ilium, and symphysis pubis. *Insertion*—to the inner surface of all the ribs, except the three last, linea alba, and ensiform cartilage. *Action*—to assist the two muscles above, and to support the burden of the viscera.

RECTUS ABDOMINIS is placed on each side the median line beneath the viscera. *Origin*—from the symphysis pubis. *Insertion*—to the cartilages of all the ribs, except the three first, linea alba, ensiform cartilage, and four posterior bones of the sternum: it blends with the lateralis sterni, covering the sides of the sternum. *Action*—to brace the middle parts of the belly, and to contract the thoracic cavity.

THE PARTS CONNECTED WITH HERNIA formed by the above muscles are :—

1st. The umbilicus, which leaves a weak place in the abdominal parietes, especially at and soon after birth, through which umbilical rupture takes place. 2nd. The external ring, and the canal of which it is the outer boundary, together with the internal ring, which should be carefully examined by the student of veterinary surgery. Want of space will, however, forbid more than a general description here. The external ring has already been described as formed by the posterior tendinous fibres of the external oblique, and through this descends the spermatic cord to the scrotum. In tracing backwards and outwards this cord to the point where it enters the wall of the abdomen, it will be found to lie between the fibres of the crural arch and those of the internal oblique, supported by the peritoneum and a thin fascia, which is continued from the edge of the transversalis muscle, but is not so distinct as the corresponding part in the human subject. About three or four inches from the external ring this fascia is pierced by the cord, and this part is called the internal abdominal ring, the space between the two rings being the inguinal canal. (See Spermatic Cord, Chapter xxii.)

DEEP ABDOMINAL REGION

The abdomen is bounded by a muscular wall anteriorly, which forms a movable septum between it and the chest, and is called the diaphragm. Superiorly also there are the muscles which serve to bend the spine downwards, in opposition to the dorsal muscles.

The diaphragm consists of a large flat muscle and two crura, with a thin circular layer of tendon in the centre. The former *arises* by fleshy digitations from the cartilages of the ribs, from the eighth to the sixteenth inclusive, and from the ensiform cartilage. It is *inserted* into a central flat tendon of a circular shape. Each crus *arises* from its corresponding side of the bodies of the lumbar vertebræ : the two cross each other opposite the seventeenth dorsal vertebra, and again decussate after allowing the œsophagus to pass through, being finally attached to the central tendon. Between the crura and the bodies of the vertebræ the aorta passes backwards, and in the central tendon is the opening for the vena cava posterior. The *action* of this muscle is to diminish the capacity of the thorax by reducing the convexity of its surface.

Semi-spinalis lumborum, intertransversalis lumborum, and sacro lumbalis, are three muscles having numerous attachments to the transverse processes of the posterior dorsal and lumbar vertebræ and sacrum. Their *action* is to approximate the pelvis to the thorax, and thus to oppose the dorsal muscles by rounding the back.

Psoas magnus is a long and strong muscle lying beneath the spine. Its *origin* is from the necks of the last two ribs, and from the bodies and transverse processes of the last dorsal and all the lumbar vertebræ. *Insertion* —into the trochanter minor internus of the femur. *Action*—to flex the haunch upon the pelvis, or, if the hind-leg is fixed, to assist the three last muscles in rounding the back.

Psoas parvus lies along the inner side of the P. magnus. *Origin*—from

the heads of the last three ribs, and from the bodies of the three last dorsal and all the lumbar vertebræ. *Insertion*—into the brim of the pelvis. *Action*—to assist the last muscle in rounding the back.

ILIACUS is situated in the iliac fossa. *Origin*—from the crest of the ilium external to the sacrum, from the venter and anterior spinous process. *Insertion*—with the psoas magnus into the trochanter minor internus of the femur. *Action*—to flex the haunch.

PELVIC REGION

SEVERAL MUSCLES are attached to the pelvis : 1st, for the control of the anus ; 2nd, for the genital organs, and accelerating the flow of urine ; 3rd, for the movements of the tail.

RETRACTOR ANI is a funnel-shaped layer of thin muscular fibres *arising* within the pelvis, and *inserted* into the margin of the anus. *Action*—to prevent the anus from being forced outwards by the expulsive efforts of the abdominal muscles.

SPHINCTER ANI is attached above to the coccyx, and encircles the anus with fleshy fibres, which serve to close it.

CREMASTER is a thin layer of muscle which is attached to the yellow fascia covering the abdomen, and to the internal oblique, from which it descends upon the spermatic cord after it passes through the external abdominal ring, and is inserted into the fibrous covering of the testicle.

The muscles of the penis, vagina, and clitoris have no general interest; they are, erector penis, triangularis penis, and accelerator urinæ, in the male ; and sphincter vaginæ and erector clitoridis in the female.

THE COCCYGEAL MUSCLES are described as in four sets, ERECTOR, DEPRESSOR, CURVATOR, and COMPRESSOR COCCYGIS, the names of which bespeak their *actions.* They all *arise* from the pelvis and pelvic ligaments, and are *inserted* into the corresponding sides of the bodies and transverse processes of the coccygeal bones.

MUSCLES OF THE FORE EXTREMITY

The muscles of the fore extremity are classed in three divisions—viz. those of the shoulder, arm, and leg. In the two first of these great confusion exists, in consequence of the different names given to them by English and French veterinary writers. Percivall only enumerates twelve, while Chauveau gives fifteen ;[1] the former not considering the long extensor of the fore-arm as a distinct muscle, but as a part of the triceps. The scapulo humeralis posticus (or grêle of Chauveau) is omitted altogether by Mr. Percivall, though quite a distinct muscle, and playing a most important part in supporting the capsular ligament of the

[1] Chauveau's arrangement is now generally accepted. For the detailed anatomy of the muscles see McFadyean's *Anatomy of the Horse.*

shoulder joint, and preventing it from being pinched in the motions of the joint. The omission of the scapulo humeralis externus by our chief English authority is most unaccountable, as it is recognized by all previous writers on the subject.

EXTERNAL SCAPULAR REGION

ANTEA SPINATUS lies upon the anterior fossa of the scapula. *Origin*—from the anterior angle, border, fossa, and anterior surface of the spine of the scapula. *Insertion*—bifid : one part to the outer, the other to the inner tubercle at the head of the humerus, the insertion extending from the tubercular summits to a roughened depression, just posteriorly placed to each. This bifid insertion embraces the tendon of the flexor brachii. *Action*—to draw the scapula into the same line with the humerus.

POSTEA SPINATUS is situated upon the posterior fossa of the scapula. *Origin*—from the posterior angle, border, fossa, and posterior surface of the spine of the scapula. *Insertion*—bifid : one portion to the postero-external tubercle ; the other is tendinous, and passes over the postero-external tubercle to a depression just below the outer tubercle. *Action*—to fix the scapula on the humerus or *vice versâ*.

FIG. 62. — EXTERNAL VIEW OF THE MUSCLES OF THE FORE EXTREMITY

1. Antea spinatus.
2. Postea spinatus.
3. Scapulo humeralis externus.
4. Teres externus vel minor.
5. Insertion of antea spinatus.
6. Humeralis externus and flexor brachii above.
7. Scapulo ulnaris.
8. Triceps extensor brachii.
9. Extensor metacarpi magnus. *a. c.* Tendon of the same receiving ligamentous slips.
10. Extensor pedis.
11. Extensor suffraginis.
12. Flexor metacarpi externus.
13. Flexor pedis perforans. *c.* Tendon of the same.
14. Flexor pedis perforatus. *d.* Tendon of the same.

ANTERO-INFERIOR SCAPULAR REGION

CORACO HUMERALIS is situated on the infero-internal part of the shoulder. *Origin*—from a tubercle on the inner side of the coracoid process of the scapula. *Insertion*—bifid : one portion on a tubercle on the middle third of the antero-internal part of the body of the humerus ; the other passes over the insertions of the teres internus and latissimus dorsi, just below which points it is inserted. *Action*—to extend the humerus and draw it inwards.

FLEXOR BRACHII is placed upon the antero-inferior part of the shoulder. *Origin*—from the antero-inferior part of the coracoid process of the scapula, passing over the trochlea formed by the tubercles of the humerus. *Insertion*—to the supero-anterior and inner part of the body of the radius. *Action*—to extend the radius, and at the same time to elevate it.

THE INTERNAL SCAPULAR REGION

SUBSCAPULARIS fills up the venter scapulæ. *Origin*—from the two inferior thirds of the ventral surface, extending from the anterior to the posterior border of the scapula. *Insertion*—to the inner ridge just below the lesser tubercle of the humerus. *Action*—to draw the humerus inwards and upwards.

TERES INTERNUS VEL MAJOR is situated upon the posterior part of the shoulder. *Origin*—from the inner surface of the supero-posterior angle and from a slight indentation internally placed to the posterior border of the scapula. *Insertion*—to the rough tubercle on the inner side of the body of the humerus, in company with the latissimus dorsi. *Action*—to draw the humerus inwards.

SCAPULO ULNARIS lies upon the posterior part of the shoulder. *Origin*—from the supero-posterior and inner part of the scapula, extending from its angle to just above its glenoid cavity. *Insertion*—to the olecranon and to the postero-internal part of the ulna, extending from its summit to where the ulna joins the radius. *Action*—to assist the caput magnum of the triceps.

SCAPULO HUMERALIS POSTICUS is situated upon the posterior part of the shoulder. *Origin*—bifid ; one part from the superior two-thirds of the inner surface of the posterior border of the scapula, the other from above the postero-internal surface of the glenoid cavity. *Insertion*—to the supero-posterior part of the humerus. *Action*—it serves as a ligament, protecting the joint.

TRICEPS EXTENSOR BRACHII (CAPUT PARVUM) is situated on the infero-internal part of the shoulder. *Origin*—from the internal and middle third of the humerus. *Insertion*—to the olecranon and to a tubercle on the supero-internal part of the ulna, close to the olecranon. *Action*—to extend the arm.

POSTERO-EXTERNAL SCAPULAR REGION

TRICEPS EXTENSOR BRACHII (CAPUT MAGNUM) is situated upon the infero-posterior part of the shoulder, occupying the angular interspace between the scapula and humerus. *Origin*—from the whole length of the posterior
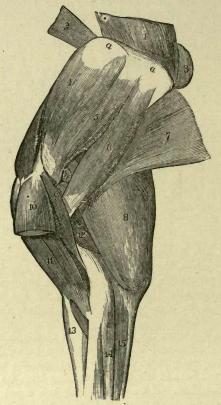
FIG. 63.—INTERNAL VIEW OF THE MUSCLES OF THE SHOULDER AND ARM.

a, a. Cartilage at the base of the scapula.
1. Insertion of serratus magnus turned up.
2. Insertion of rhomboideus longus.
3. Insertion of rhomboideus brevis.
4. 5. Subscapularis.
6. Teres internus vel major.
7. Insertion of latissimus dorsi.
8. Triceps extensor brachii (caput magnum).
9. Coraco humeralis.
10. Insertion of pectoralis.
11. Flexor brachii.
12. Triceps extensor brachii (caput tertium).
13. Extensor metacarpi magnus.
14. Flexor metacarpi internus.
15. Flexor metacarpi medius.

border as high up as the supero-posterior angle of the scapula. *Insertion*—to the inner and upper part of the olecranon. *Action*—to approximate the scapula and humerus, and thus raise the elbow joint; if the former is fixed, to extend the arm.

TRICEPS EXTENSOR BRACHII (CAPUT MEDIUM) lies upon the infero-external part of the shoulder and humerus. *Origin*—from the humerus, just behind

a ridge at the postero-external part of the superior third. *Insertion*—to the supero-external and posterior part of the olecranon. *Action*—to extend the arm.

TERES EXTERNUS is situated upon the postero-external part of the shoulder. *Origin*—from a little tubercle just below the supero-posterior angle, and from the lower border of the scapula. *Insertion*—to a ridge descending from the outer tubercle of the humerus, and to the ligament which extends from the outer tubercle to the outer condyle of the same bone. *Action*—to flex the scapula on the humerus, or the humerus on the scapula.

SCAPULO HUMERALIS EXTERNUS lies upon the postero-external part of the shoulder. *Origin*—from the inferior two-thirds of the posterior border of the scapula, just above the glenoid cavity, and from its dorsal surface. *Insertion*—to the middle of the ridge extending from the outer tubercle of the humerus. *Action*—to flex the humerus, and draw it outwards.

THE ANTERO-EXTERNAL HUMERAL REGION

HUMERALIS EXTERNUS lies on the infero-external side of the upper arm. *Origin*—from the infero-posterior, inner, and outer surface of the body of the humerus, and winds round that bone. *Insertion*—to the supero-anterior and internal part of the radius. *Action*—to flex the arm.

THE POSTERO-INTERNAL HUMERAL REGION

ANCONEUS is situated upon the hollow space between the condyles. *Origin*—from the supero-posterior part of the lower third of the humerus. *Insertion*—to the antero-external border of the ulna and capsular ligament of the joint. *Action*—to extend the elbow, and to protect the capsular ligament during the movement between the two bones.

MUSCLES OF THE ARM AND FORE-LEG

EXTENSOR METACARPI MAGNUS is situated on the anterior part of the arm *Origin*—from a ridge situated at the antero-external part of the humerus, and also from a depression just above the external condyle of the humerus. *Insertion*—to the antero-superior part of the os metacarpi magnum. *Action*—to extend the leg.

EXTENSOR PEDIS is situated upon the antero-external part of the arm. *Origin*—from the fore-part of the external condyle of the humerus, and from a ridge just superiorly placed to it; from the outer part of the head, and from the anterior and supero-external part of the body of the radius; and from the capsular ligament of the elbow joint. *Insertion*—to the coronal process of the os pedis, adhering firmly to the capsular ligament of the fetlock joint. *Action*—to extend the knee, metacarpals, and pasterns, and to elevate the toe.

FLEXOR METACARPI EXTERNUS is situated upon the postero-external side of the arm. *Origin*—from a ridge on the external surface of the heel process of the external condyle of the humerus. *Insertion*—bifid : one to the supero-posterior part of the pisiform bone ; the other passes through a sheath to the head of the external small metacarpal bone. *Action*—to flex the leg.

FLEXOR METACARPI MEDIUS lies on the postero-internal part of the arm. *Origin*—bifid : one from the middle of a ridge extending along the internal condyle of the humerus ; the other from the supero-internal and posterior part of the ulna. *Insertion*—bifid : one part to the supero-posterior part of the os pisiforme, and to the posterior annular ligament ; the other to the postero-internal part of the head of the inner small metacarpal bone. *Action*—to flex the leg.

FLEXOR METACARPI INTERNUS is situated on the postero-internal side of the arm. *Origin*—from a ridge behind the internal condyle of the humerus. *Insertion*—to the head of the os metacarpi parvum : previous to its insertion, it enters a sheath formed by the annular ligament. *Action*—to flex the leg.

FLEXOR PEDIS PERFORANS ET PERFORATUS is situated on the posterior part of the arm. *Origin*—common to both muscles, from a ridge on the heel process of the internal condyle of the humerus. *Insertion*—of perforatus bifid, to the external and internal border of the supero-posterior part of the os coronæ. *Insertion*—of perforans ; after receiving a strong bundle of ligamentous fibres from the posterior carpal ligament, it pierces the two divisions of the flexor perforatus, opposite the pastern, and spreading out is attached to the postero-inferior part of the os pedis. *Action*—to flex the knee, and bend the fetlock and pastern joints.

ULNARIS ACCESSORIUS is deeply seated at the posterior part of the arm. *Origin*—from the whole of the internal concave surface of the ulna. *Insertion* —to the tendon of the flexor pedis, with which it

FIG. 64.—ANTERO-EXTERNAL VIEW OF THE MUSCLES OF THE FORE-LEG.

1. Antea spinatus.
2. Postea spinatus.
3, 4. Scapulo humeralis externus.
5. Teres externus.
6. Triceps extensor brachii (caput magnum).
7. Pectoralis transversus, divided.
8. Triceps extensor brachii (caput medium).
9. Flexor brachii.
10. Extensor metacarpi magnus.
11. Humeralis externus.
12. Extensor pedis : *a.* tendon ; *b.* band from external lateral ligament ; *c* insertion.
13. Extensor suffraginis.
14. Flexor metacarpi externus.
15. Extensor metacarpi obliquus.

blends. *Action*—to assist the perforans and perforatus in flexing the knee, etc.

Extensor suffraginis is situated on the postero-external part of the
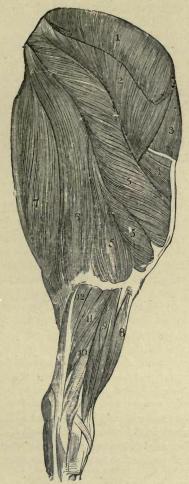
Fig. 65.—View of the External Muscles of the Haunch and Thigh.

1. Gluteus maximus.
2. Gluteus externus.
3. Tensor vaginæ femoris.
4. Vastus externus.
5. 5. 5. Triceps abductor femoris.
6. 7. Biceps rotator tibialis, or semi-membra-
nosus and semi-tendinosus.

8. Extensor pedis.
9. Peroneus.
10. Plantaris.
11. Gastrocnemius internus.
12. Gastrocnemius externus.

fore-arm. *Origin*—from a tubercle in the posterior and external part of the radius; from the above bone as far down as the ulna reaches, and from the shaft border of the ulna. *Insertion*—to the supero-anterior part of the os suffraginis, and to the capsular ligament of the fetlock joint. *Action*—to extend the fetlock.

EXTENSOR METACARPI OBLIQUUS is situated on the infero-anterior part of the arm. *Origin*—from the infero-anterior and outer part of the radius, extending as high up as the middle. *Insertion*—after passing underneath the tendon of the extensor pedis, and over the tendon of the extensor metacarpi magnus, to the supero-anterior part of the os metacarpi internum. *Action*—to confine the tendon of the extensor metacarpi in its place during action and to extend the leg.

RADIALIS ACCESSORIUS is situated on the infero-posterior part of the arm. *Origin*—from the posterior part of the middle of the radius. *Insertion*—to the tendon of the perforans, which it joins opposite the carpo-metacarpal articulation. *Action*—to assist the perforans.

MUSCLES OF HAUNCH

THE DIFFICULTIES experienced by the student in distinguishing the muscles of the shoulder are as nothing when compared with those he will encounter in making out the muscles of the haunch. The latter are firmly connected together by fascia, so that their fibres must be divided by the knife in order to make them agree with any description which is given of them by comparative anatomists. To comply with the desire to retain the names used in human anatomy, this has been done to a most ridiculous extent; but unfortunately, as the analogy is very slight, the imagination of the dissector has been called into play and different anatomists have pursued a varied nomenclature, to the great annoyance of the student. Thus the triceps abductor femoris of our text is the biceps of Percivall, and the long vaste of Chauveau, but it should either be regarded as one large mass of muscle, in common with the semi-membranosus and semi-tendinosus, or if it is divided from them it must itself be described as a tricipital muscle, for it has three distinct insertions. Again, Mr. Percivall describes the rectus as a separate muscle from the two vasti and crureus, and appends a fifth, to which he gives the name of rectus parvus. This appears to correspond with the grêle antérieur of Chauveau, and if the analogy of human anatomy is to be taken as a guide, it should properly be described as the crureus. By adopting the same plan as with the muscles of the shoulder joint, the student will be able to ascertain at a glance to which description, in the two authorities I have quoted, each particular muscle can be referred.

SYNONYMS OF THE MUSCLES OF THE HAUNCH.

NAMES USED IN THE TEXT.	MR. PERCIVALL'S NOMENCLATURE.	CHAUVEAU'S NAMES.
Gluteus externus	Gluteus externus	Fessier superficiel.
,, maximus	,, maximus	,, moyen.
,, internus	,, minimus	,, profond.
Tensor vaginæ femoris	Tensor vaginæ	Muscle du fascia lata.
Triceps abductor femoris	Biceps abductor	Long vaste.
Biceps rotator tibialis	Adductor tibialis	{ Demi-tendineux. Demi-membraneux.
Trifemoro rotulæus	{ Rectus. Vastus ext. and int.	} Triceps crural.
Rectus parvus	Rectus parvus	Grêle antérieur.
Sartorius	Sartorius	Long adducteur.

NAMES USED IN THE TEXT.	MR. PERCIVALL'S NOMENCLATURE,	CHAUVEAU'S NAMES.
Gracilis	Gracilis	Court adducteur.
Pectineus	Pectineus	Pectiné.
Adductor longus . . .	{ Adductor longus . . . { ,, magnus . . .	} Grand adducteur de la cuisse.
,, brevis	Adductor brevis	Petit adducteur de la cuisse.
Pyriformis	Pyriformis	Pyramidal.
Obturator externus . . .	Obturator externus . . .	Obturateur externe.
,, internus . . .	,, internus . . .	,, interne.
Gemini	Gemini	Jumeaux du bassin.

GLUTEAL REGION

GLUTEUS EXTERNUS forms the top part of the haunch. *Origin*—from the spine of the third sacral bone and lower tubercle on the antero-inferior spinous process of the ilium. *Insertion*—to the anterior part of the trochanter minor externus.

GLUTEUS MAXIMUS is situated on the middle part of the haunch. *Origin* —from the ligamentous structure of the longissimus dorsi, from the spine of the second and third sacral bones, the sacro-sciatic ligament, the top of the supero-posterior spine, the antero-inferior spine, crista, and dorsal surface of the ilium. *Insertion*—to the posterior part of the trochanter major externus and superior part of the tubercle.

GLUTEUS INTERNUS is situated under the maximus. *Origin*—from the posterior half of the dorsum ilii and a small portion of the ischium. *Insertion*—to the upper part of the tubercle at the head of the femur. The *action* of the glutei is, to extend the femur on the pelvis, and to assist in the acts of kicking and rearing. They are the main propellers of the body.

TENSOR VAGINÆ FEMORIS is placed on the antero-external part of the haunch. *Origin*—from the outer part of the lower tubercle on the antero-inferior spinous process of the ilium. *Insertion*—to the superior part of the patella. *Action*—to assist in extending the thigh.

EXTERNAL - ILIO FEMORAL REGION

TRICEPS ABDUCTOR FEMORIS occupies the postero-external side of the haunch and thigh. *Origin*—from the third and fourth spines of the sacrum, and from the anterior part of the tuberosity of the ischium. *Insertion*—by three attachments. *First*, to the posterior part of the femur and lateral part of the patella. *Secondly*, to the lateral part of the ligament extending from the patella to the spinous ridge on the tibia. *Thirdly*, to the ridge on the tibia and fascia, which binds down the flexors and extensors. *Action* —to rotate the leg and to turn the hock outwards.

BICEPS ROTATOR TIBIALIS is situated on the postero-external side of the haunch. *Origin*—from the last bone of the sacrum, the two anterior coccygeal bones, and posterior part of the tuberosity of the ischium. *Insertion*— to the antero-internal and mesian part of the tibia and fascia of the leg. *Action*—to rotate the leg.

ANTERIOR ILIO-FEMORAL REGION

TRIFEMORO ROTULÆUS consists of a mass of muscle lying beneath the tensor vaginæ, and forming the anterior prominence of the haunch. It consists of three divisions—the rectus, vastus externus, and internus. Rectus femoris is anterior and superior to the other portions. *Origin* —from the ilium, just above the acetabulum. *Insertion*—to the anterior part of the capsular ligament and supero-lateral part of the patella. *Action*—to extend the thigh and draw it under the body. The two vasti consist of a mass of muscle occupying the front and sides of the femur, and lying beneath the rectus. *Origin*—from the whole of the upper part of the femur to the roots of the trochanters. *Insertion*—to the upper edge and sides of the patella. *Action*—to assist the rectus in extending the thigh and lifting the stifle under the body in progression.

RECTUS PARVUS is an humble imitation of the human crureus, lying deep beneath the rectus femoris on the upper part of the femur. It is a small cylindrical muscle, having its *origin* from the ilium external to that of the rectus femoris, and its belly lying between the two vasti close upon the bone; it is *inserted* on the anterior face of the femur. Its *action* is chiefly to defend the capsular ligament of the ilio-femoral articulation.

INTERNAL ILIO-FEMORAL REGION

SARTORIUS lies on the antero-internal part of the haunch. *Origin*— from the inferior part of the transverse process of the first sacral bone and venter ilii. *Insertion*—to the inner and inferior part of the lateral ligament of the patella, and through the medium of the gracilis to the supero-internal part of the tibia. *Action*—to bend the leg and to draw it inwards.

GRACILIS is situated on the internal part of the haunch. *Origin*—from the anterior and posterior ends of the symphysis pubis. *Insertion*—to the spinous ridge on the supero-internal part of the tibia. *Action*—to raise the leg and draw it inwards.

PECTINEUS lies close to the sartorius. *Origin*—from the anterior surface of the os pubis, near the symphysis and acetabulum. *Insertion*—to the ridge of the femur, leading downwards from the trochanter internus. *Action*—to flex and adduct the femur.

ADDUCTOR LONGUS lies at the back of the mass of internal muscles of the haunch. *Origin* from the inferior surface of the ischium, and from the adjacent fascia. *Insertion*—by two portions, which are distinguished as separate muscles by some anatomists. One (A. magnus) into the posterior face of the femur external to the adductor brevis; the other (A. longus), to the inner and upper part of the internal condyle. *Action*—to adduct and rotate the femur inwards.

ADDUCTOR BREVIS lies covered by the adductor magnus. *Origin*—from the inferior surface of the os pubis. *Insertion*—to the square rough surface on the posterior face of the femur. *Action*—to adduct the femur.
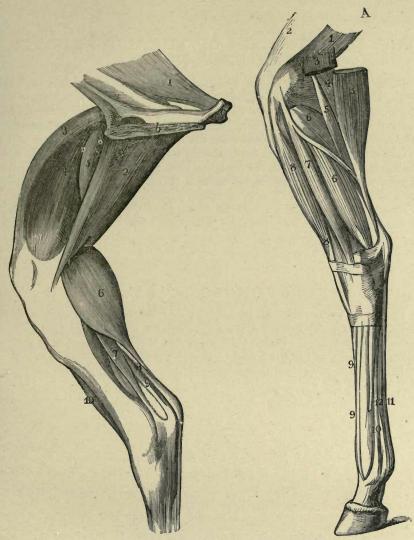
FIG. 66.—INTERNAL VIEW OF THE DEEP MUSCLES OF THE THIGH AND LEG.

a. b. c. Ischium and pubes divided at the symphysis.
1. Sacro-sciatic ligament.
2. Adductor (brevis et longus).
3. Rectus.
4. Vastus internus.
5. Pectineus.
6. Gastrocnemius externus.
7. Flexor pedis accessorius.
8. Tendon of the gastrocnemius passing down over the hock to become the flexor pedis perforatus.
9. Flexor pedis perforans.
10. Extensor pedis.

FIG. 67.—EXTERNAL VIEW OF THE MUSCLES OF THE LEG.—(THIGH OF THE HORSEMAN.)

1. Vastus externus.
2. Rectus.
3. 3. Gastrocnemius externus (divided).
4. Gastrocnemius internus.
5. Plantaris.
6. 6. Flexor pedis perforans.
7. Peroneus.
8. 8. Extensor pedis.
9. 9. Tendon of the same.
10. Suspensory ligament.
11. Long tendon of gastrocnemius (flexor pedis perforatus).
12. Tendon of flexor pedis perforans.

THE DEEP MUSCLES OF THE ILIO-FEMORAL REGION

FOUR SMALL MUSCLES attach the fossa of the trochanter major to the pelvis, and rotate the femur outwards.

PYRIFORMIS.—*Origin*—from the transverse processes of the sacrum, and the internal face of the ilium by fleshy fibres, which are *inserted* into the trochanteric fossa. *Action*—to rotate the femur outwards.

OBTURATOR EXTERNUS and INTERNUS are attached, one to the outside and the other to the inside of the margins of the obturator foramen, and to the two faces of the fascia which fills it up. *Insertion*—by separate tendons into the trochanteric fossa.

GEMINI *arise* by two bundles of fibres from the supero-posterior part of the ischium. *Insertion*—to the trochanteric fossa. *Action*—the same as the three last-named muscles.

ANTERIOR FEMORO-CRURAL REGION

EXTENSOR PEDIS lies superficially on the anterior part of the leg. *Origin*—from a depression on the antero-inferior and external part of the external condyle of the femur. *Insertion*—to the coronal process of the os pedis. *Action*—to flex the hock and extend the foot.

PERONEUS lies on the antero-external side of the leg. *Origin*—from the head of the fibula and outer part of the tibia. *Insertion*—to the supero-anterior part of the os suffraginis. *Action*—to assist the foregoing muscle.

FLEXOR METATARSI is situated on the antero-internal side of the leg. *Origin*—in common with the extensor pedis, from the outer condyle of the femur, and from the upper part of the anterior face of the tibia. *Insertion*—to the os cuboides and to the large and small metatarsal bones. *Action*—to flex the hock.

POSTERIOR FEMORO-CRURAL REGION

GASTROCNEMIUS EXTERNUS lies along the posterior part of the leg. *Origin*—in two portions from the fossa just behind and above each condyle of the femur. *Insertion*—to a depression on the centre of the point of the os calcis. *Action*—to elevate the point of the hock, and thus to extend the leg.

GASTROCNEMIUS INTERNUS is situated on the postero-mesian part of the leg. *Origin*—from the inner part of the ridge which surrounds the fossa behind and between the two condyles of the femur. *Insertion*—above the hock it becomes tendinous, and passes over the point (from which it is separated by a large bursa mucosa, the seat of capped hock), and descends along the back of the flexor tendons, where it corresponds with the flexor

perforatus of the fore-leg, to be finally attached to the supero-posterior part of the os coronæ. *Action*—to extend the hock and flex the fetlock and pastern joints.

PLANTARIS is situated on the postero-external part of the thigh. *Origin*—from the superior part of the head of the fibula. *Insertion*—to the supero-external part of the os calcis. *Action*—to assist in extending the hock.

POPLITEUS lies at the back part of the stifle. *Origin*—from the lateral part of the external condyle of the femur, from which it winds round the head of the tibia. *Insertion*—to the supero-internal and posterior part of the tibia. *Action*—to flex the stifle joint.

FLEXOR PEDIS PERFORANS is situated on the postero-external side of the leg. *Origin*—from the supero-external part of the tibia, from the body of that bone and to the posterior part of the fibula. *Insertion*—to the posterior part of the plantar surface of the os pedis. *Action*—to extend the hock and to flex the fetlock and pasterns.

FLEXOR PEDIS ACCESSORIUS lies on the postero-internal part of the leg. *Origin*—from the supero-external part of the tibia and side of the fibula. Its *insertion* is blended with the tendon of the flexor pedis.

CHAPTER XXI

THE THORACIC ORGANS AND THEIR APPENDAGES

CONTENTS OF THE THORAX—THE BLOOD—GENERAL PLAN OF THE CIRCULATION—THE HEART
AND ARTERIES—THE VEINS—PHYSIOLOGY OF RESPIRATION—MECHANISM OF THE
PULMONARY APPARATUS—THE NASAL ORIFICES AND CAVITIES—THE LARYNX—THE
TRACHEA AND BRONCHI—THE LUNGS—PULMONARY GLANDS, ETC.

CONTENTS OF THE THORAX

THE THORAX, OR CHEST, is that cavity formed by the bodies of the dorsal vertebræ superiorly; by the ribs and their cartilages with the connecting muscles laterally; by the sternum inferiorly; by the diaphragm posteriorly; and by the inner margins of the first ribs and body of the first dorsal vertebra anteriorly. It contains the central parts of the important organs of circulation and respiration, and gives passage to the œsophagus, as it connects the pharynx with the stomach. As these lie within it, they are allowed to play freely in performing their functions, by being enveloped by smooth serous membranes, called the *pleura* and the *pericardium*, the latter being also protected by a fibrous layer. A section of the thorax, as shown in the plan, Fig. 68, will give some idea of the relative situation of these organs and their investments, as well as of the shape of the cavity itself in this direction. The heart is shown at A, lying between the two bags of the pleura, in the space called the *mediastinum*. The lungs are shown at B B, covered by a fine serous membrane (H H), *pleura pul-*

FIG. 68.—SECTIONAL PLAN OF THORAX AND ITS CONTENTS (THROUGH THE GIRTH-PLACE).
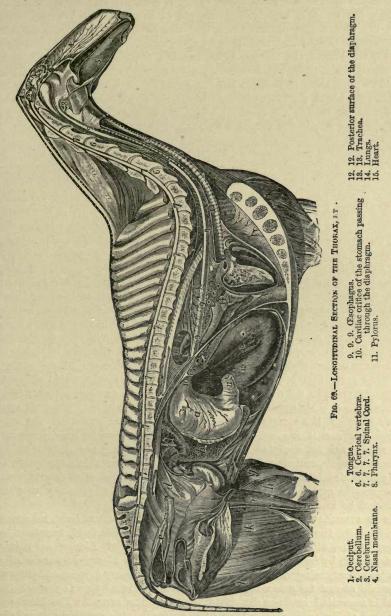
A. Heart.
B. B. Lungs.
C. E. D. F. Walls of the thorax.
G. G. Pleura costalis.
H. H Pleura pulmonalis.

monalis, except at their roots, where the air-tubes and blood-vessels pass into their substance. This portion of the pleura is continuous with the serous membrane lining the ribs (G G, *pleura costalis*), which thus allows them to expand and contract freely, by allowing one surface to glide against the other. Thus, the pleura on each side covering the lungs, and reflected thence to the inside of the ribs, and the thoracic side of the diaphragm, forms a shut sac or bag, which in the natural state contains only sufficient serum to lubricate its walls; but in disease this is often increased to an enormous extent, ending in dropsy of the chest, or in a collection of pus when the membrane is greatly inflamed. The shape of the thorax in a longitudinal direction is shown at Fig. 69, in which its posterior wall, the

diaphragm (12, 12), is seen separating the stomach (a10, 11) and the liver (a small section of the left lobe of which only is shown) from the lungs

FIG. 69.—LONGITUDINAL SECTION OF THE THORAX, ET .

1. Occiput.
2. Cerebellum.
3. Cerebrum.
4. Nasal membrane.

. Tongue.
6. 6. Cervical vertebræ.
7. 7. 7. 7. Spinal Cord.
8. Pharynx.

9. 9. 9. Œsophagus.
10. Cardiac orifice of the stomach passing through the diaphragm.
11. Pylorus.

12. 12. Posterior surface of the diaphragm.
13. 13. Trachea.
14. Lungs.
15. Heart.

(14) and the heart (15), while the trachea (13, 13) is seen entering through its anterior boundary, below the œsophagus (9, 9, 9), and the aorta passes close to the spine above the latter.

As the walls of the thorax expand by the action of the muscles which move the ribs, as well as by the contraction of the diaphragm, rendering its thoracic surface less convex, the cavity is enlarged and air is drawn in through the trachea, constituting the act of inspiration.   On the other hand the contraction of the walls, and the forcing upwards against the diaphragm of the stomach and liver, by the action of the abdominal muscles, reduces the size of the thorax, forces out the air, and induces expiration. The repetition of these two actions is known by the general term respiration.

Before proceeding to describe the heart and lungs, it will be necessary to examine the blood, for transmitting which fluid to all parts of the body the heart and its vessels are formed ; while, for its proper aeration, the lungs, windpipe, and larynx are intended by nature.

THE BLOOD

THE BLOOD, supplied from the food by the digestive process hereafter to be described, furnishes all the tissues of the body with a constantly renewed stream of the materials which they severally require, whether for their nutrition or for the functions of secretion and excretion performed by the various organs devoted to these purposes.   It is necessary, therefore, that this fluid should be composed of elementary matters capable of combining to form the materials required, or of those substances ready prepared. Thus, the muscles demand for their proper action fibrine and oxygen, both of which are largely combined in arterial blood, while the nervous system cannot respond to the calls of its grand centre without having a due supply of fatty matter, also, in combination with the oxygen obtained by respiration, which, however, is not only intended to afford this gas, but also to remove the carbon that would otherwise accumulate to a prejudicial extent. For these several purposes the blood must be supplied with liquid elements by absorption from the digestive organs, and with its oxygen, by imbibition through the delicate membrane lining the lungs on which it is spread as it passes through the system of blood-vessels especially set apart for that purpose.   When it is considered that the stomach, bowels, liver, pancreas, and spleen are all occupied almost solely in supplying the fluid with its grosser materials, and that the heart, lungs, kidneys, and skin are constantly engaged in circulating it, supplying it with oxygen, and purifying it from noxious salts and gases, its importance in the animal economy may be estimated as it deserves.

As IT CIRCULATES in, or immediately after it is drawn from, its appropriate vessels, the blood consists of an opaque, thickish fluid, composed of water, fibrine, albumen, and various salts, and called *Liquor sanguinis*, coloured red, by having suspended in it a quantity of red *corpuscles* of a peculiar nature, being white.   When drawn from an artery or vein, and allowed to remain at rest for a few minutes, a coagulation takes place, by which the blood is separated into the clot (coagulum) and the serum.   The former is composed of fibrine, having entangled in its meshes the corpuscles ; and the latter is the liquor sanguinis, without its fibrine.   As in all of the mammalia but the camels, these bodies are circular flattened discs, and are of the same size (nearly) in all animals of the same species, whatever may be the age or

sex.   According to Messrs. Prevost and Dumas, the blood of the horse
contains less solid matter than that of man, in the proportion of 9·20 to 12·92
in 1000 parts.   The temperature is about 99·5 degrees of Fahrenheit's
thermometer; the pulse varies greatly according to the breed of horse, being
as slow as 32 to the minute in some heavy cart-horses, and as high as
42 in high-bred and sensitive specimens of the race.   The shade of colour
in the red corpuscles depends upon the proportion of carbonic acid and
oxygen combined with them.   If the former preponderates, a deep purple-
red is developed, known as that of venous blood : while a liberal supply of
oxygen develops the bright scarlet peculiar to arterial blood.   The saline
matters dissolved in the liquor sanguinis consist chiefly of the chlorides of
sodium and potassium (which comprise more than one-half of the whole
salts), the tribasic phosphate of soda, the phosphates of magnesia and lime,
sulphate of soda, and a little of the phosphate and oxide of iron.

GENERAL PLAN OF THE CIRCULATION

THE BLOOD IS CIRCULATED through the body, for the purposes of nutrition
and secretion, by means of one forcing pump, and through the lungs, for its
proper aeration, by another; the two being united to form the heart.   This
organ is therefore a compound machine,
though the two pumps are joined together,
so as to appear to the casual observer to
be one single organ.   In common lan-
guage, the heart of the mammalia is said
to have two sides, each of which is a
forcing pump; but the blood, before it
passes from one side to the other, has to
circulate through one or other of the sets
of vessels found in the general organs of
the body, and in the lungs, as the case
may be.   This is shown at Fig. 70, where
the blood, commencing with the capillaries
on the general surface at A, passes through
the veins which finally end in the vena
cava (B), and enters the right auricle (C).
From this it is pumped into the right
ventricle (D), which, contracting in its
turn, forces it on into the pulmonary
artery (E), spreading out upon the lining
membrane of the lungs, to form the capil-
laries of that organ at F, from which it is
returned to the left auricle (G) through
the pulmonary veins.   From the left auricle
it is driven on to the left ventricle; and
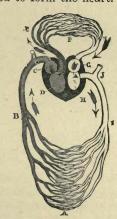
FIG. 70.—PLAN OF THE CIRCULATION.

A. Capillaries on the general surface.
B. Vena cava.
C. Right auricle.
D. Right ventricle.
E. Pulmonary artery.
F. Capillaries of the lungs, uniting to form
   the pulmonary veins, which enter
G. The left auricle.
H. The left ventricle.
I. The aorta posterior, dividing into smaller
   arteries, and united with the capilla-
   ries at A.
J. The trunk of the aorta anterior.

this, by its powerful contractions, forces the blood through the aorta (I), and
the arteries of the whole body, to the capillaries (A), from which the descrip-
tion commenced.   But though this organ is thus made up of two pumps, yet
they are united into one organ, and the two auricles and two ventricles each

contract at the same moment, causing only a double sound to be heard, instead of a quadruple one, when the ear is applied to the chest. In the diagram it will be seen that one half of the cavities and vessels is shaded, indicating that it contains dark blood, while the other contains blood of a bright red colour. But though we commonly call the one venous, and the other arterial, the distinction only applies to the general circulation; for that of the lungs is exactly the reverse, the pulmonary artery (E) containing dark blood, and the pulmonary veins bringing it back to the heart after it is purified, and has again received oxygen sufficient to develop the scarlet colour again. Between the auricles and ventricles, and again at the openings of the latter cavities into their respective arteries, valves of a form peculiar to each are placed, so as to allow of the free passage onwards of the blood, but not of its return by regurgitation. If they become diseased, the action of the heart is impeded, and the circulation of the blood is more or less seriously interfered with. So, also, if the muscular fibres, of which the walls of the auricles and, in much thicker layers, of the ventricles are composed, become weak by want of proper exercise, or from the deposit of fat in their interspaces, a corresponding degree of mischief is effected in the passage of the blood. The force with which the left ventricle contracts may be estimated from the fact, that if a pipe is inserted in the carotid artery of a horse, and held perpendicularly, the blood will rise in it to a height of ten feet; and the rapidity of his circulation is such, that a saline substance will pass from the veins of the upper part of the body to those of the lower in little more than twenty seconds. Now, as this transmission can only take place through the current that returns to the heart, and passes thence through the lungs and back again, afterwards being forced into the lower vessels through the aorta, it follows that every particle of this fluid passes completely through the whole circulation in the above short period of time.

THE HEART AND ARTERIES

THE HEART OF THE HORSE (composed, as has been already mentioned, of two auricles and ventricles, with their several valves, and placed within the thorax in the space called the mediastinum, between the two sacs of the pleura) is covered by a fibro-serous sac of its own called the *pericardium.* It is situated opposite the third, fourth, fifth, and sixth ribs, immediately in front of the diaphragm, and above the sternum, as shown in Fig. 69, at page 457. It presents an irregular cone, with the base turned upwards, and the apex directed towards the sternum. It is about ten and a quarter inches from the base to the apex, seven inches in its antero-posterior diameter, and five and a quarter from side to side. In weight it varies from six and a half to seven pounds; but these dimensions can only be taken as an approximation to the actual average. The right auricle and ventricle are directed forwards, and the left backwards. The auricles have much thinner walls than the ventricles, and the muscular substance of the left ventricle, occupying the apex of the heart, is very much thicker than that of the right. The organ is supplied with blood for its nourishment by two arteries (the coronary), which leave the aorta close to its origin, and their

trunks lie in the space on each side between the two ventricles.   The movements of the heart may be carried on independently of the brain and spinal cord, if these parts are gradually removed; but if they are suddenly destroyed or partially injured, it ceases to beat.   Its nerves are derived from the pneumogastric and sympathetic.

THE PERICARDIUM is made up externally of a thin layer of white fibrous matter, attached to the roots of the great vessels above, and by a few prolongations to the sternum below, and the central tendon of the diaphragm behind.   Within this the heart lies, loosely covered with a serous bag, which also lines the fibrous coat above mentioned, and forms with it the pericardium as a whole.   The use of the external layer is to restrain the movements of the heart within due bounds, and of the serous layer to allow it to play freely without being restrained by the friction of its exterior against the surrounding parts, which would be the case in the absence of the double sac of serous membrane which it is endowed with.   Like the pleura, this sac, during health, contains only sufficient serum to lubricate it; but after inflammation or congestion, serum, lymph, or pus are thrown out, so as to interfere with its proper functions.

EACH ARTERY has three distinct coats: an outer cellular coat, capable of great distension; a middle coat, consisting in part of yellow fibrous tissue and in part of non-striated muscular fibres, which is highly elastic; and an inner serous coat, intended to diminish the friction of the blood as it rushes on.   It is in the elastic middle coat that the power resides of equalizing the flow of blood, retarding its velocity when the vessel containing it is near the heart, and accelerating it at a distance from it.   In this way the intermittent jets which are produced by the ventricular contraction become at length converted into a continuous stream, having midway between the two extremities developed the arterial pulse, which can be felt in all the arteries of any size throughout the body, and most conveniently within the lower jaw, at the submaxillary artery.

THE CAPILLARIES are generally spoken of as a distinct system of small blood-vessels, but no line of demarcation can be demonstrated either at their junction with the larger branches of the arteries, or with the veins; and they should be regarded simply as the minute terminations of the one set and commencement of the others, together making a fine network of vessels which vary greatly in the mode of their ramifications, according as they minister to muscular fibre, gland, or membrane.   Like the arteries themselves, they possess the power of contraction and dilatation, which is, apparently, under the influence of the nervous system.   Thus, on the application of a local stimulus, the capillaries of the part admit more blood without any increase of the heart's action, and this may go on to the states known as *congestion* and *inflammation* according to the presence or absence of other circumstances bearing upon their action.
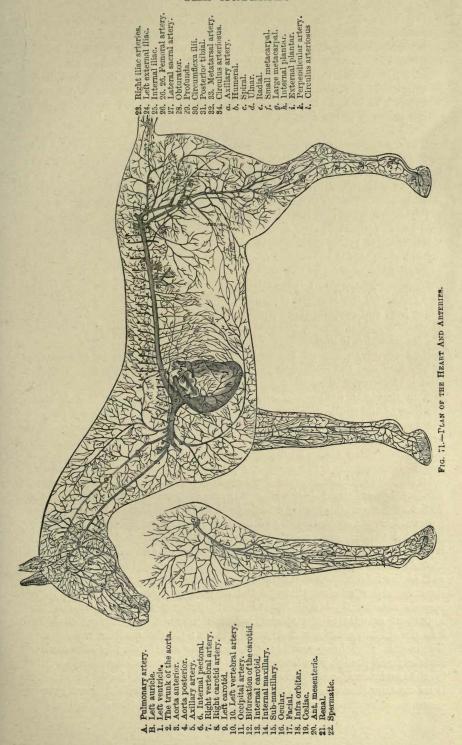
THE ARTERIES are arranged in two great groups, one of which has been sufficiently alluded to at page 460, as conveying black blood to the lungs; the other commences at the left ventricle as the aorta, and dividing at once into the anterior aorta and posterior aorta, supplies the corresponding parts of the body with arterial blood, after branching off into innumerable subdivisions.   This is clearly marked in the accompanying plan, which indicates the position of the heart in the thorax, and most of the principal

arteries of the body; but being on so small a scale, it can only convey a general idea of their numbers and the situation at which they each leave the parent trunk.

THE AORTA, or great artery of the body, as it emerges from the substance of the heart and rises towards the spine, describes a curve whose convexity looks upwards and forwards. Immediately above the valves at its root are the origins of the two coronary arteries, supplying the heart as described at page 460. About two inches above these it gives off a large branch—the anterior aorta—supplying the anterior extremities, the neck, and the head; the hinder portion is called the posterior aorta, and is destined to afford blood to the walls of the thorax and abdomen, to the contents of these cavities, and to the hinder extremities.

THE ANTERIOR AORTA is about an inch and a half in length before it gives off any of its branches. It ascends between the two laminæ of the anterior mediastinum, lying above the right auricle and below the trachea, with the vena cava on its right hand. Opposite the body of the third dorsal vertebra it divides into the right and left arteria innominata. The former is considerably the larger of the two, being nearly double the diameter of the left. This is owing to its supplying both the carotids in addition to those which it has previously given off in correspondence with the left arteria innominata. These branches common to both are seven in number :—

1.—*A. dorsalis* branches backwards, and supplies a twig to the superior mediastinum, and the four or five first intercostal arteries.

2.—*A. servicalis superior*, distributed to the muscles of the neck lying above the spine.

3.—*A. vertebralis*, a vessel of considerable size, is given off behind the first rib, and passes beneath the transverse process of the seventh cervical vertebra to enter the foramen in that of the sixth. From this it proceeds through the foramina of all the cervical vertebra in succession, and enters the foramen magnum to supply the base of the brain with blood.

4.—*A. thoracica interna*, given off opposite the last artery, descends at once to the upper and inner surface of the sternum, on each side of which it lies, supplying the intercostal muscles, and, inosculating with the intercostal arteries, terminates by meeting the ascending branches from the epigastric artery.

5.—*A. thoracica externa*, a small branch which is given off externally to the first rib, and descends at once to the inferior surface of the sternum, on the muscles covering which it terminates.

6.—*A. cervicalis inferior* is a short branch, and supplies the muscles and glands at the root of the neck.

7.—*A. axillaris* descends at once to the inside of the fore extremity, and supplies the scapula, arm, and leg. It is the continuation of the main artery after it has given off the above branches, and lies deeply imbedded in the cellular membrane which fills up the space between the sternum and the shoulder joint. Here it supplies (*a*) three or four thoracic branches; (*b*) the A. dorsalis scapulæ; (*c*) A. subscapularis; the destinations of which will be explained by their names. It

A. Pulmonary artery.
B. Left auricle.
1. Left ventricle.
2. The trunk of the aorta.
3. Aorta anterior.
4. Aorta posterior.
5. Axillary artery.
6. Internal pectoral.
7. Right vertebral artery.
8. Right carotid artery.
9. Left carotid.
10. Left vertebral artery.
11. Occipital artery.
12. Bifurcation of the carotid.
13. Internal carotid.
14. Internal maxillary.
15. Sub-maxillary.
16. Ocular.
17. Facial.
18. Infra orbitar.
19. Ocular.
20. Ant. mesenteric.
21. Renal.
22. Spermatic.

23. Right iliac arteries.
24. Left external iliac.
25. Internal iliac.
26, 26, Femoral artery.
27. Lateral sacral artery.
28. Obturator.
29. Profunda.
30. Circumflexa ilii.
31. Posterior tibial.
32, 33. Metatarsal artery.
34. Circulus arteriosus.
a. Axillary artery.
b. Humeral.
c. Spiral.
d. Ulnar.
e. Radial.
f. Small metacarpal.
g. Large metacarpal.
h. Internal plantar.
i. External plantar.
k. Perpendicular artery.
l. Circulus arteriosus

FIG. 71.—PLAN OF THE HEART AND ARTERIES.

then runs along the inner side of the head of the os humeri, where it receives the name of A. humeralis, and gives off three or four muscular branches, having the ulnar and spiral nerves on its inner side, and in front the radial nerve, with the humeral veins behind. Above the elbow joint, and in front of the humerus, it splits into three, A. ulnaris, spiralis, and radialis; the last again dividing into two, A. plantaris externa and A. P. interna, which will again be alluded to in describing the anatomy of the foot.

THE COMMON CAROTID ARTERY, which is the continuation of the right A. innominata, after it has given off its axillary branches, ascends along the lower face of the trachea for a very short distance, and then divides into the right and left carotids, which lie on each side the trachea, gradually sinking deeper among the muscles of the neck till they arrive at the level of the larynx, when they respectively divide into three branches—A. carotidœa externa, A. occipitalis, and A. carotidœa interna. In this course they supply the thyroideal artery and several small muscular branches. The external carotid gives off (a) the submaxillary artery, which has a number of branches supplying the muscles of the pharynx, palate, and face; (b) the parotideal; (c) internal pterygoid; (d) branches to the masseter and auricular muscles; and finally (e) the internal maxillary, which penetrates deeply behind the lower jaw, and supplies those parts; then going on to the eye, for which it gives off a special branch, the ocular, destined to the muscles of the eye and the fat in which it lies.

THE OCCIPITAL ARTERY passes backwards, deeply hidden by the muscles of the neck and the transverse process of the atlas, where it unites with the vertebral artery.

THE INTERNAL CAROTID, a comparatively small artery, ascends towards the base of the skull, which it enters at the point of the petrous part of the temporal bone, and supplies the brain in common with the vertebral artery, with which it freely anastomoses.

THE POSTERIOR AORTA must now be described. It is much longer and of larger diameter than the anterior, commencing opposite the fourth dorsal vertebra, where it lies at some little distance below the body of that bone. Passing upwards and backwards it becomes closely connected with the bodies of the vertebra, lying a little to the left, and having the œsophagus and vena azygos on the right, and the thoracic duct on the left. Here it is called the thoracic aorta; but passing through the crura of the diaphragm it enters the abdomen, and receives the name of abdominal aorta. The thoracic division supplies small branches to the bronchi and œsophagus, as well as the intercostal arteries to all but the four or five anterior intercostal spaces. After passing through the diaphragm, the aorta gives off the phrenic arteries right and left to the diaphragm, and then supplies the important arteries of the viscera, namely: (a) the Cœliac artery, dividing into the splenic, gastric, and hepatic arteries; (b) the anterior mesenteric; (c) the renal; (d) the spermatic; (e) the posterior mesenteric; (f) the lumbar arteries; and finally, just below the last lumbar vertebra, it subdivides into (g) the two internal, and (h) the two external iliac arteries. In the horse there is no common iliac artery, as in man, the four being given off in one group, out the two internals generally forming a short continuation of the trunk.

THE INTERNAL ILIAC ARTERY has a very short trunk, which passes backwards and outwards in close connection with the sacrum. Its first branch is (a) the umbilical artery. It then gives off (b) the artery of bulb, after which and just opposite the sacro-iliac articulation it divides into a leash of
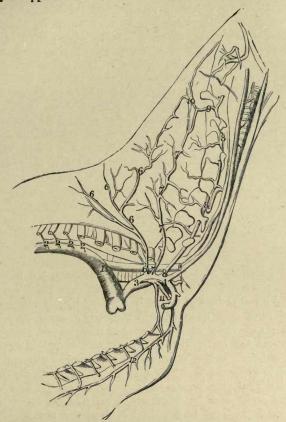
FIG. 72.—BRANCHES OF THE RIGHT ARTERIA INNOMINATA.

1. Posterior aorta.
2. 2. 2. 2. Intercostal branches of posterior aorta.
3. Anterior aorta.
4. Right arteria innominata, ending in common carotid and
5. Axillary artery.

6. 6. 6. A. dorsalis.
7. 7. A. cervicalis superior.
8. 8. 8. Vertebral artery.
9. 10. Inosculations of these three arteries.
11. Origins of the internal and external thoracic arteries.

branches, which are (c) the obturator, (d) the lateral sacral, and (e) the gluteal artery. The *umbilical* artery is almost entirely obliterated in the adult, but a small branch still remains passing along the cord which exists as the only remnant of the large artery which in the foetus carries on the circulation peculiar to that condition. *The artery of the bulb* supplies the bladder and the internal organs of generation. *The obturator* artery gives off branches to the muscles of the haunch, and finally ends in the internal pubic artery, which gives blood to the penis and adjacent organs. *The lateral sacral artery* proceeds backwards along the side of the sacrum

to the bones of the tail, along which it ramifies.   Lastly, *the gluteal artery* passes out of the pelvis through the hole in the sacro-sciatic ligament in company with the sciatic nerve, and supplies muscular branches to the glutei.

THE EXTERNAL ILIAC ARTERY is smaller than the internal, and takes the same course as far as the articulation, beyond which it passes, lying just within the brim of the pelvis, in close contact with the psoas and iliacus muscles and covered by the peritoneum.   About midway between the symphisis pubis and the anterior spinous process of the ilium it gives off the circumflex artery of the ilium, and then receives the name of the *femoral artery*.   At this point the femoral vein lies posterior to it, and it is also accompanied by the internal saphena nerve.   Proceeding in an oblique direction down the middle of the haunch, it reaches the hollow at the back of the stifle joint, where it is called the *poplitæal artery*, and opposite the head of the tibia this bifurcates into the *anterior and posterior tibial arteries*.   Just after emerging from the pelvis it gives off a considerable branch, *profunda femoris*, then the *epigastric;* and in running down through the muscles of the thigh it gives off numerous small branches to them.

THE VEINS

THE VEINS generally correspond with the arteries, the blood of which they return to the heart.   Thus there is a large vein which conveys all the blood from the anterior half of the body supplied by the anterior aorta, and this is called *vena cava anterior*.   In a similar manner the *posterior vena cava* is made up of veins which accompany the several arteries that are found throughout the body, with one remarkable exception connected with the secretion of bile.   If the splenic and mesenteric veins are traced they will be found to unite together into a large trunk, which, instead of going on to empty itself into the vena cava posterior, enters the liver, where it is called the *vena portæ*, and branches out again like an artery, the general purposes of which it serves by furnishing blood for the secretion of bile. This will be more fully described under the head of the liver, in the next chapter.   From the terminations of the portal veins and hepatic artery the hepatic veins arise, and these empty themselves into the posterior vena cava, just behind the diaphragm.   Besides that brought by the two venæ cavæ, the blood from the heart itself enters the auricle through the coronary veins.

ALTHOUGH, IN GENERAL, the veins and arteries correspond in their ramifications, yet there is a large class of superficial veins which are not accompanied by any of the latter vessels.   In horses which for many generations have been accustomed to fast work, these superficial veins are strongly developed, and are particularly plain in the Arab and his descendants.   As a consequence of this, and of the fact that many of the arteries are accompanied by two veins, the whole number of veins is much greater than that of the arteries, and the internal area of the former may be considered to be nearly double that of the latter.   In their walls the veins are much thinner than the arteries, though like them they have

three coats, the serous and cellular being very similar in structure, but the fibrous is very much thinner and devoid of muscular fibres. A feature peculiar to the veins is the existence of valves, which are sometimes single, at others double, and occasionally arranged in threes and fours around the interior of the large veins. They vary in numbers, and are altogether absent in the pulmonary veins, in the venæ cavæ, and the vena portæ.

THE ANTERIOR VENA CAVA is made up of the jugular vein, the pectoral, vertebral, axillary, and cervical veins, and the vena azygos. The jugular vein, which is that usually selected for bleeding, returns the blood from the brain, jaws, and neck, along each side of which it lies, separated from the carotid artery in the upper part of the neck by a layer of oblique fibres belonging to the levator humeri. In the lower half the vein becomes more deeply seated, approaches more closely the carotid artery, and, entering the chest with it, falls into the vena cava anterior between the first and second ribs. Near its termination it receives the *superficial brachial vein* (the plate vein), which passes up in front of the arm, along the anterior edge of the flexor, and winding upwards in the hollow between the arm and sternum joins the jugular vein. The *vertebral* and *axillary* veins correspond with the arteries of the same name, the divisions of the latter contained within the foot being described with that organ. The left axillary vein receives the contents of the thoracic duct which opens into it close to its junction with the vena cava.

THE POSTERIOR VENA CAVA commences by the junction of the two common iliac veins (each made up of an external and internal iliac corresponding to the arteries of the name). It is then joined by the lumbar veins, the spermatic and renal veins, after which, and close to its termination, the hepatic and phrenic veins empty themselves into it.

THE PULMONARY VEINS, commencing with eight trunks as they emerge from the lungs, soon unite into four, in which number they enter the left auricle. They carry arterial blood, and differ in this respect from all the other veins of the body, as has been already mentioned.

PHYSIOLOGY OF RESPIRATION

THE ESSENCE of the act of breathing consists in the absorption of oxygen from the air, and the excretion of carbonic acid from the blood which is circulated through it. In a state of rest this interchange must go on with regularity, for carbonic acid is constantly developed by the decay of the tissues, arising from the peculiar necessities of the muscular and nervous tissues, and by the conversion of the carbon of the food which appears to be required for the development of heat. But when the muscles of the whole body are called into play with unusual rapidity and force, the development of carbonic acid is largely augmented, and thus, not only is there a necessity for extra means of excreting the carbonic acid, but there is also a demand for more oxygen to unite with the carbon, which is the result of the disintegration of the muscular fibres employed. Hence the acts of respiration are more complete and rapid during exercise than in a state of rest, and while much more carbonic acid is given off, a greater volume of oxygen is absorbed from the air which is inspired.

IT IS FOUND BY EXPERIMENT that if venous blood is exposed to the action of oxygen, through a thin membrane such as bladder, it absorbs a portion of that gas, and changes its colour from dark red to a bright scarlet. This is in accordance with the recognized laws of endosmose and exosmose ; and as the blood circulates in very fine streams within the vessels of the lungs, whose walls are much thinner than an ordinary bladder, it may readily be understood that it is placed in more favourable circumstances for this interchange of gases than when tied up in a large mass within a comparatively thick membrane. On examining the structure of the lungs, they are found to be made up of a pair of cellular sacs, communicating with the trachea, which admits air into them ; and these sacs are furnished with a fine network of capillary vessels distributed on their walls, and on those of the numerous cellular partitions of which they are composed. Thus the blood, as it enters the lungs in a venous state, is submitted under very favourable circumstances to the agency of atmospheric air ; it readily absorbs the oxygen while it gives off large volumes of carbonic acid gas, the result of the combination of previously absorbed oxygen with the carbon given off by the various organs of the body already alluded to.

THE EXACT CHEMICAL CHANGES which have taken place in the atmospheric air exhaled from the lungs and in the blood itself are believed to be as follows :—1. A certain portion of oxygen has disappeared from the air. 2. It has received a considerable volume of carbonic acid. 3. It has absorbed fresh nitrogen. 4. It has parted with some of the nitrogen of which it was previously made up. The last two changes cannot readily be demonstrated, but are inferred from the fact that, under varying conditions of the body, the nitrogen in the exhaled air may be either above or below the proper proportion. Besides these, the air also receives a considerable quantity of moisture, and some organic matters, which in certain cases are largely increased. The changes in the blood are not so fully known ; but it is now the general opinion of physiologists that the formation of carbonic acid does not take place in the lungs, but that the blood arrives there surcharged with it already made, and not with carbon, as was formerly believed. The action chiefly consists in the excretion of this carbonic acid, and in the absorption of oxygen, which is stored up for the several purposes for which it is required in the course of its circulation through the body. Magnus demonstrated by experiment that arterial and venous blood contain very different quantities of carbonic acid, oxygen, and nitrogen in a free state, for on obtaining, by means of the air-pump, a volume of the gas contained in each kind of blood, and analyzing them, he found them to be made up as follows :—

	Arterial.	Venous.
Carbonic acid	62·3	71·6
Oxygen	23·2	15·3
Nitrogen	14·5	13·1

It appears, therefore, that in passing through the capillaries, the gas in the arterial blood loses about eight per cent. of oxygen, and receives about nine per cent. of carbonic acid, which action is reversed as it passes through the lungs.

MECHANISM OF THE PULMONARY APPARATUS

ALTHOUGH THE WHOLE of these parts are not contained within the thorax, it will be convenient to examine them together, since they all mutually bear upon each other both in health and disease.

THE PULMONARY APPARATUS of the horse consists of four parts—First, the nasal cavities, destined to prepare the air for entering the larynx ; second, of the larynx, which acts as a portal or guard against the admission of noxious matters floating in it ; third, of a set of tubes, consisting of the trachea and bronchi, which convey the air from the larynx to the air-cells ; and fourthly, of the air-cells themselves, where the changes are effected in the blood, for which the lungs are specially designed.

THE NASAL ORIFICES AND CAVITIES

THE NASAL ORIFICES in the horse and ass differ from those of the other domestic animals, and also from the human nostrils, in being the sole means of admitting air to the lungs. The ox, sheep, dog, cat, etc. can breathe either through the nostrils or the mouth, but the horse is prevented, by the formation of his soft palate, from drawing in air through his mouth, and hence he requires nostrils of a size calculated to admit an extra supply of air.[1] *The orifices or nostrils* consist of an oblong opening on each side of the nose, separated from each other externally by the skin covering the carti-laginous *alæ*, which encircle three-fourths of the opening. These alæ, together with the *septum*, which divides the two nostrils vertically, con-stitute the five cartilages of the nose, all being lined by the Schneiderian membrane, upon which the nerves of smell are freely distributed. Each nostril has two flexible and easily dilated alæ—a superior or internal ala, having a broad cartilaginous plate, and an inferior ala, of a crescentic shape, with its concavity turned inwards. The four alæ, when in position, resemble the letter X, and form a framework which keeps the openings always patulous, while it resists the actions of the muscles when they draw the external folds of the skin away from it in order to enlarge the openings. Two little pouches of skin are found internally above the true nostrils, and are called the false nostrils, the use of which is not clearly demonstrated. At the inner and inferior part of the nasal fossa, underneath the fold of skin covering the inferior ala, is the orifice of the nasal duct, which leads down from the eye, and conveys the surplus secretion of lachrymal fluid from that organ to the nose. In the ass and mule this orifice is found just within the superior ala. If these alæ are not of full size and the nostrils patulous, it may generally be surmised that the other organs of respiration are equally undeveloped, and that the horse's wind will be proportionally bad.

THE NASAL CAVITIES, OR FOSSÆ, are partly bounded by bone, and partly by the cartilage known as the *septum nasi*. The surface of membrane is much increased by the convolutions of the turbinated bones, so that the air, as it passes through these chambers, is warmed if cold, and if

[1] It is often observed that horses breathe through an open mouth shortly before they die.

dry it is moistened, so as to render it fit for respiration. The frontal, æthmoidal, sphenoidal and maxillary sinuses also open into these fossæ, the whole of them being lined by a continuation of the Schneiderian membrane.

THE LARYNX

IMMEDIATELY BEHIND and below the nasal cavities is the larynx, which serves the double purpose of acting as a portal to the inspired air, and of forming the few vocal sounds uttered by the horse. It consists of five cartilages, united together by ligaments, and moved by a number of delicate muscles. It is lined with a fine mucous membrane, and is supplied,
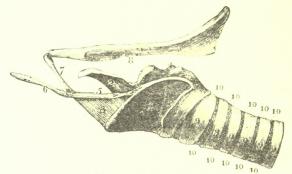
FIG. 73.—PROFILE VIEW OF THE OS HYOIDES AND LARYNX.

1. Lateral plates of the thyroid cartilage.
2. Epiglottis.
3. Thyro-hyoid membrane.
4. Body of the thyroid cartilage.
5. Branch of the body of the os hyoides.
6. Spur process, or appendix.
7. Short horn.
8. Long horn of the os hyoides.
9. 9. 9. 9. Cartilaginous rings of the trachea.
10. 10. 10. Membranes connecting these rings.

like all other parts of the body, by its proper vessels and nerves. It is suspended from the os hyoides, or bone of the tongue, by a strong but thin membrane, and terminates posteriorly in the trachea, or air tube leading to the lungs.

THE THYROID CARTILAGE (θυρεός, *a shield*, εἶδος, *like*) is composed of two lateral plates, each presenting the form of an oblique-angled parallelogram, joined together in front, and separated by a considerable space behind, which is occupied by the cricoid cartilage. The point in front which corresponds with the pomum Adami in man, is called the body. The posterior angles of the lateral plates are each terminated by a prolongation, called a cornea or ala—the two superior being united by ligaments to the os hyoides, and the two inferior to the cricoid cartilage. In the upper part of the anterior angle is fixed the epiglottis, by means of the union called amphiarthrosis.

THE CRICOID CARTILAGE (κρίκος, *a ring*, εἶδος, *like*) is a complete ring, but it is much deeper behind than before. It is somewhat depressed from side to side, especially in those horses which are deficient in wind. On the upper edge behind it has two rounded surfaces, which articulate with the

arytenoid cartilages. In the middle is a vertical ridge, to which the œsophagus is united by cellular membrane, and on each side of this is a hollow for the lodgment of muscles.

THE ARYTENOID CARTILAGES (ἀρύταινα, *a pitcher*, εἶδος, *like*), two in number, are triangular in form, broad and thick below, and pointed above. They give attachment to the vocal chords, and are the means by which these are rendered tense or lax, open or close, by the action of the muscles of the larynx.

THE EPIGLOTTIS (ἐπιγλῶττις) is a cartilage of a heart shape, attached to the angle between the lateral plates of the thyroid cartilage. When pressed backwards, it closes the rima glottidis or fissure between the vocal chords, and in this way prevents the food from passing into the larynx.

BY THE AID OF THESE CARTILAGES, and of the ligaments connecting them, as well as by means of the muscles which move them, a triangular opening called the rima glottidis is formed, having its base behind at the arytenoid cartilages and its apex in front, below the epiglottis. The sides of this opening are formed by ligamentous bands, attached to the arytenoid cartilages, so that as these are drawn backwards they are rendered tense ; and if they are drawn apart the rima or fissure is widened and admits more air. When this fissure is contracted, either by thickening of the edges or by the wasting of the muscles which keep it open, roaring or whistling is produced ;

FIG. 74.—POSTERIOR VIEW OF THE OS HYOIDES AND LARYNX.

1. Epiglottis.
2. Arytenoid cartilages.
3. Cricoid cartilage.
4. Spur process, or appendix of the os hyoides.
5. 5. Branches of the body of the os hyoides.
6. 6. Short horns.
7. 7. Long horns of the os hyoides.
8. Membrane completing the back of the trachea.
9. 9. 9. Tracheal rings incomplete behind.
10. 10. 10. Membrane between the rings of the trachea.

so that it is important to arrive at a correct idea of its mechanism.

THE TRACHEA AND BRONCHI

THE TRACHEA is a flexible and elastic tube, formed of a series of incomplete cartilaginous rings, about fifty in number, connected together by an elastic membrane, which also fills up the space left at the back of each ring. It passes down the lower margin of the neck, and, on arriving at the level of the base of the heart, it divides into two bronchi or lesser tubes, of somewhat the same character and structure as itself. In its course, it has the sterno-hyoideus and thyroideus in front, the œsophagus behind ; and the carotid artery, with the pneumogastric, recurrent, and sympathetic nerves on each side ; the jugular vein being more superficial

than these, but also on the side of the trachea. At the upper and back part of the trachea a layer of muscular fibre is found, connecting together the posterior edges of the cartilages. The office of these muscular bands is to diminish the area of the trachea.

THE BRONCHI consist at first of the two tubes into which the trachea divides, the right being the more capacious of the two. Afterwards they subdivide, like the branches of a tree, into lesser tubes, still called bronchial, which finally open into the air-cells of the lungs. These tubes differ from the trachea in that each ring of cartilage is made up of several distinct pieces, which overlap each other, and thus allow of considerable dilatation during forcible expiration. The rings are held together by an elastic cellular substance, and are lined first by a fibrous layer, with which it is supposed that some muscular tissue is mixed up, as in the larger bronchi, and internally by fine mucous membrane.

THE LUNGS

THE LUNGS consist of two conical spongy bodies, adapted to the shape of the thorax, the left being the smaller of the two. Between these halves of the lungs is a space called the mediastinum, already described, occupied by the heart, great blood-vessels, nerves, and glands; they are capable of great dilatation by the act of inspiration, and of being again reduced in size by expiration. In structure, they are made up of three distinct parts—(1) an external or serous coat, called the pleura, described at page 456 ; (2) a middle or true pulmonary tissue, consisting of the intercellular passages and air-cells, of the arteries and veins, lymphatics and nerves, bound together by an areolo-fibrous tissue, and called the *parenchyma ;* (3) the terminal branches of the bronchial tubes. The *pleura* is simply a layer of serous membrane, liable to its peculiar accidents and diseases, hereafter to be described. The *parenchyma* has a beautiful pale rose colour in the healthy subject. Though very delicate, it strongly resists external violence, and is not easily torn. It is divided into a vast number of little polyhedral lobules, each of which receives one of the terminating branches of a bronchial tube, and is again broken up into a cluster of air-cells, on the walls of which the capillary branches of the pulmonary arteries and veins are thickly spread out. The extent of surface upon which these vessels ramify is enormous, probably ten or twelve times that of the skin. The parenchyma of the lungs appears to be entirely passive in respiration, being filled with air by the expansion of the cavity in which it lies ; and that, again, being due to the act of the inspiratory muscles.

THE BRONCHIAL TUBES divide and subdivide until they diminish to a diameter of $\frac{1}{25}$ of an inch, when they terminate in the intercellular passages, by which they communicate with the air-cells. At their terminations, the mucous membrane ceases abruptly, the fibrous envelope being alone continued, together with the vascular network common to both. Thus the mucous membrane lining the bronchi, and the fibrous walls of the air-cells, are quite distinct ; and this will account for each being often the seat of a peculiar inflammation, without extending to the other.

PULMONARY GLANDS, ETC.

IN CONNECTION WITH THE LUNGS are three bodies, the uses of two of which are not very clearly made out. These are the thyroid body, just below the larynx ; the thymus gland, chiefly developed in the fœtus ; and the bronchial glands, which are merely lymphatic glands of the usual character, situated around the principal divisions of the bronchi.

THE THYROID BODY is not very fully developed in the horse, and has little interest connected with it, seldom being enlarged, as in the dog and in the human species. It consists of two oval masses, about the size of an egg, lying on each side of the trachea, just beneath the larynx, and connected by a band or middle lobe. The use of the thyroid body is not ascertained.

JUST WITHIN THE THORAX, and in close contact with the trachea, a somewhat similar body to the preceding is met with in the fœtus and young foal ; but it soon wastes away as the young animal grows up. This is the thymus gland (known to cooks as the sweetbread), resembling in shape the thyroid body, but of a paler colour. Like it, the use of this gland is not fully known ; but in structure it is more like the conglomerate glands, and Sir Astley Cooper, who examined it most minutely, supposed that it is intended " to prepare a fluid, well fitted for the fœtal growth and nourishment, from the blood of the mother, before the birth of the fœtus."

THE BRONCHIAL GLANDS are merely lymphatic glands, similar to those in other parts of the body, and grouped around the large bronchial tubes. They are of a greyish colour, stained with black in patches.

CHAPTER XXII

THE ABDOMEN AND PELVIC VISCERA
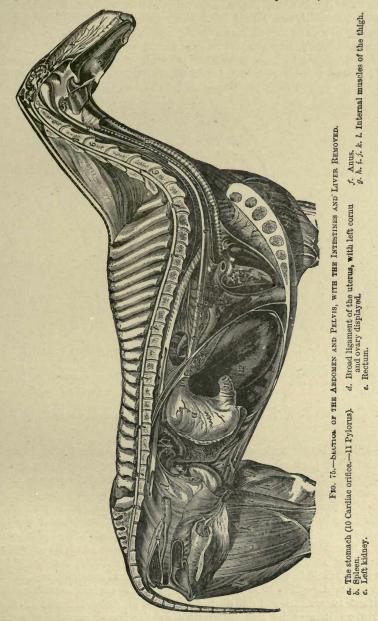
THE ABDOMEN AND ITS CONTENTS—PHYSIOLOGY OF DIGESTION—STRUCTURE OF GLANDS
AND PHYSIOLOGY OF SECRETION—DEPURATION, AND ITS OFFICE IN THE ANIMAL
ECONOMY—ANATOMY OF THE SALIVARY GLANDS, PHARYNX, ŒSOPHAGUS, AND STOMACH
—THE INTESTINES—THE LIVER—THE SPLEEN—THE PANCREAS—THE KIDNEYS—THE
PELVIS—THE BLADDER—THE ORGANS OF GENERATION, MALE AND FEMALE.

THE ABDOMEN AND ITS CONTENTS

LYING IMMEDIATELY BEHIND THE THORAX, from which they are separated
only by the diaphragm, are the important organs of digestion, and the
space in which they are closely packed is called the abdomen. This part
is capable of being distended downwards and sideways to an enormous
extent, or of contracting till the lower walls approach very closely to the
upper. The anterior boundary, as before remarked, is the diaphragm, the
plane of which moves considerably in active respiration, causing the flanks,
or postero-lateral walls of the abdomen, to rise and fall, in a corresponding
manner, and thus to indicate the extent of distress in an exhausted animal,
or any peculiarity of breathing, as in "broken wind," or in the several inflam-
matory conditions of the lungs. Posteriorly, the boundary is an open one,
being the anterior boundary of the pelvis, and corresponding with the brim
of that cavity. Superiorly are the crura of the diaphragm, the lumbar
vertebræ, and psoas and iliacus muscles ; and laterally, as well as inferiorly,
the abdominal muscles, and cartilages of the false ribs. Although the
abdominal muscles are capable of great dilatation, yet in the natural con-
dition they maintain a gentle curve only from their pelvic to their costal
attachments, and hence the depth and width of the back ribs and pelvis
are the measure of the ordinary capacity of the abdomen. Shallow and
narrow back ribs give a small abdominal cavity, and generally speaking a
correspondingly weak condition of the digestive organs ; for though this
rule is not invariable, yet it is one which may be held as a sufficient guide
for practical purposes. Instances do occur of stout and hearty horses
possessed of contracted middle-pieces, but they are so rare as to be merely
objects of curiosity. The small space which is devoted to the organs of
digestion in the horse whose back ribs are shallow will be readily under-
stood by reference to the annexed section, in which the enormous mass of
intestines and the liver have been removed, leaving only the stomach and
spleen. When the walls of the abdomen are distended laterally and down-
wards, as they always are in horses at grass, the capacity of the abdomen
is at least doubled.

THE CONTENTS OF THE ABDOMEN are the stomach, the liver, the pancreas,
the spleen, the small and large intestines, the mesenteric glands and
chyliferous ducts, and the kidneys, together with their vessels and nerves.
Some of these organs are fixed close to the spine, as the kidneys and

pancreas; but the others glide upon each other as they are alternately empty or full : and to facilitate this motion they are (like the lungs)

FIG. 75.—SECTION OF THE ABDOMEN AND PELVIS, WITH THE INTESTINES AND LIVER REMOVED.

a. The stomach (10 Cardiac orifice.—11 Pylorus).
b. Spleen.
c. Left kidney.
d. Broad ligament of the uterus, with left cornu and ovary displayed.
e. Rectum.
f. Anus.
g. h. i. j. k. l. Internal muscles of the thigh.

invested with a serous coat, the *peritoneum*. They may be divided into the hollow organs, which form one continuous tube (the alimentary), and the solid viscera, which, with the exception of the spleen, are all of a

glandular structure, though differing in their minute anatomy. The alimentary canal consists throughout of three distinct layers : the external serous coat (*peritoneal*), the middle or *muscular coat*, and the internal *mucous* coat, which are united by cellular membrane, sometimes regarded as forming two distinct additional coats.

THE PERITONEUM, like the pleura, is a serous membrane, forming a shut sac, and arranged in such a manner that all the abdominal organs are behind it, and two layers of it must be divided before reaching the interior of any of the organs from the lateral or inferior boundaries of the abdomen.
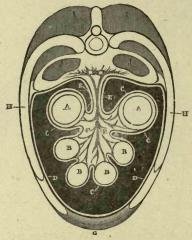
FIG. 76.—SECTIONAL PLAN OF THE HORSE'S ABDOMEN BEHIND THE STOMACH AND LIVER.

A. A. Large intestines.
B. B. B. B. Small intestines.
C. C. C. Peritoneum covering intestines.
D. D. Peritoneum lining the walls of the abdomen.
E. E. Folds connecting the large intestine with the parietal peritoneum, called mesocolon.
F. F. Folds connecting the small intestines with the same, and called the mesentery.
G. Abdominal muscles.
H. H. Ribs.
I. I. Lumbar muscles.
J. J. Kidneys embedded in fat.

This will be better understood by examining the annexed plan, in which the solid black part represents the interior of the peritoneal sac, a space usually extremely small, but capable of being distended to a great extent by a secretion of serum from the internal surface, as in abdominal dropsy. The white line indicates the whole continuous surface of the peritoneum inclosing the black space, which is exaggerated, in order to render the plan more distinct. It will thus be readily understood that unless the peritoneum is detached from the upper walls of the abdomen, and its layers are separated, as at E E, the viscera cannot be reached without dividing it twice ; first, as it lines the walls of the abdomen ; and secondly, as it closely covers the organ which it is desired to open. In certain conditions it is important to remember this, as for instance in distended states of the colon, when it may be a question whether the bowel may be punctured from the flank without wounding the peritoneum. It is a very delicate and irritable membrane in the horse, and should never be interfered with if it is possible to avoid it. Its secretion is a clear serum, merely sufficient

in health to lubricate the surface, but in disease becoming very profuse and greatly altered in character.

THE MUSCULAR COAT OF THE HOLLOW VISCERA varies in thickness; but the whole of it belongs to the unstriped division of muscles, and its action is purely involuntary. In all but the large intestines the fibres are arranged in a circular direction, but in these they are divided into sets, one circular, and the other collected in separate longitudinal bands. By the consecutive action of these fibres (called peristaltic), the food is driven onwards from one end to the other of the alimentary canal.

THE MUCOUS MEMBRANE, which lines the whole length of the alimentary canal, from the mouth to the anus, is continuous with the skin at these two orifices—with the mucous membrane lining the air-passages of the lungs at the entrance to the larynx—with that investing the nasal passages and cavities at the antero-superior part of the pharynx—and, lastly, with the internal ear through the eustachian tubes which open into the back of the pharynx. It is also reflected into the ducts of the salivary glands, which open into the mouth, and into those of the liver and pancreas, so that it has very extensive communications with these several organs. Like the skin, this membrane has a base composed of primary membrane, called the *corium*, on which are scattered the glands that secrete the gastric juice, imbedded in loose areolar tissue. In the intestines we shall find it extensively supplied with absorbents, which open upon its velvety pile or *villi*, and the whole protected by epithelium, which serves an important part in the production of the mucus everywhere found upon its surface when in a healthy state. In the œsophagus it is thick, and disposed in longitudinal folds, allowing of lateral distension. In the stomach it exists in coarse folds or *rugæ*, and in the intestines it is gathered into sharp folds, chiefly manifested in the duodenum. It is extensively supplied with blood throughout its whole surface, but especially where it lines the stomach and small intestines, and it is also liberally furnished with nerves, chiefly derived from the great sympathetic system.

THE ABDOMINAL VISCERA ARE SUPPLIED WITH BLOOD by branches from the aorta, passing between the folds of the peritoneum to reach their destination, excepting in the cases of the kidneys and pancreas, which have no such folds. The same folds also include the veins returning the blood to form the vena portæ (see page 466), and also the lymphatics and chyliferous absorbents, to be hereafter described.

THE NERVES are chiefly derived from the great sympathetic system; but branches from the cerebro-spinal system are also distributed to the contents of the abdomen, and especially to the stomach, by means of the pneumogastric nerve.

PHYSIOLOGY OF DIGESTION

BEFORE PROCEEDING TO EXAMINE into the anatomy of the abdominal organs, it may be well to investigate the nature of the processes which are carried out by them. To do this, the food must be traced from its prehension by the lips and teeth to its expulsion from the anus. Thus, commencing with the mouth, we find it there ground into a coarse pulp,

and mixed with the saliva, which acts as a kind of *ferment* in converting the starchy matters, which form so large a proportion of the horse's food, into sugar, and, with the aid of the gastric juice, into the proteine compounds necessary for the formation of flesh. Perfect mastication and insalivation are therefore highly important processes to healthy digestion. When it reaches the stomach, the food undergoes still further changes by the agency of the gastric juice and of maceration; but this organ being small in the horse, it cannot remain there long enough to be converted into perfect *chyme* (the result of the first process of digestion), but is passed on into the duodenum for that purpose. Here it is further elaborated, and receives the bile and pancreatic juice, which are poured out through their ducts opening on the internal surface of this intestine. The nutritious parts of the food are now gradually converted into *chyle;* and as it passes into the jejunum and ilium, it is there absorbed by the lymphatics (here called *lacteals*), whose mouths open upon the villi thickly lining this part of the canal. These unite into one duct (the *thoracic*), and the chyle is by it carried into the veins through an opening at the junction of the left vena cava anterior with the axillary vein. From the small intestines, the food, minus its nutritive portions, is passed on into the large intestines, and finally reaches the rectum and anus, in the form known as fæces. The peculiar offices performed by the bile and pancreatic fluid will be described under the sections treating of each of those organs.

THE ABSORPTION OF FLUID from the interior of the alimentary canal is effected in two different modes—first, by the lacteals, which take up the chyle through their open mouths; secondly, by the veins, which absorb it through their walls by the process known as endosmose. In the former case, the chyle is at once carried to the heart; but in the latter it passes through the liver, and becomes purified and chemically altered in that organ. The lacteals pass through the mesenteric glands, which lie between the layers of the mesentery.

STRUCTURE OF GLANDS AND PHYSIOLOGY OF SECRETION

A GLAND may be defined to be an organ whose office it is to separate from the blood some peculiar substance, which is poured out through an excretory duct, whose internal surface is continuous with the mucous membrane, or skin. A simple gland is, in fact, nothing more than a pouch of mucous membrane; and a collection of these pouches constitutes a compound one, which, if the groups of which it is composed are loosely bound together like grapes, as in the salivary glands, is called *conglomerate;* while if they are united into a solid mass, such as the liver, the term *conglobate* is applied.

BY SECRETION is understood the process of separation of various matters from the blood; the term being also applied to the products of the process, such as saliva, bile, etc., which are commonly known as secretions. These are all removed from the blood for one of two purposes—first, in order to be employed for some ulterior object in the various processes going on in the body, either for its own preservation, or that of others; or, secondly, as

being injurious to its welfare, and therefore to be discarded. The term secretion is sometimes confined to the former, while the latter action receives the distinguishing term *excretion*: but as in many cases the fluid which is removed as being injurious to the system is also used for beneficial purposes, the distinction is not capable of being strictly maintained. The nature of the process is essentially the same in all cases, being carried out by the development of simple cells, each possessing its own independent vitality. These cells select certain ingredients from the blood, and then set them free by the rupture of their walls; and being situated on the free surface of the lining membrane of the gland, which is continuous with the mucous membrane or skin, the secreted fluid gradually reaches the one or the other. It is impossible, at present, to ascertain the precise means by which each gland is made up of cells having special powers of selection; but that the fact is so is capable of demonstration. Thus, the cells of the liver select the elements of bile; those of the salivary glands saliva; and so on. But, as we shall hereafter find, there are minute points of difference in the arrangement of these cells in the different glands. It is now ascertained that the elements of the various secretions exist in the blood; and therefore the office of the glands is confined to the selection and separation of their products, and they have little or nothing to do with their conversion.

DEPURATION, AND ITS OFFICE IN THE ANIMAL ECONOMY

THE WHOLE OF THE VARIOUS SECRETIONS which go on in the body are necessary for the due preservation of its health; but the most important of the class alluded to above as *excretions*, must be removed from the blood, or death will speedily ensue. Thus, if saliva and gastric juice, as well as the other secretions aiding digestion, are not mixed with the food, the nutrition of the body will be imperfectly carried on, and its health will suffer. But if the elements of bile and urine are retained in the blood, not only is the system upset, but absolute death is produced in severe cases. Hence it follows, that attention to the state of the organs of depuration, or excretion, is of more importance even than to those of secretion, using these terms in the sense explained in the last paragraph. The chief organs of depuration are the lungs, which remove carbon from the blood; the liver, which secretes the bile; the kidneys, which get rid of the urea; and the skin, which relieves it of its superfluous watery and some small proportion of its solid particles. Experiment shows that the retention of carbon, or urea, in the blood is speedily followed by death; while the non-secretion of bile, if entire, poisons the system; and in milder cases, its absence from the alimentary canal interferes with the due elaboration of the chyle.

ANATOMY OF THE SALIVARY GLANDS, PHARYNX, ŒSOPHAGUS, AND STOMACH

THE SALIVARY GLANDS are grouped around the jaw, three on each side, and are named the parotid, submaxillary, and sublingual glands.

THE PAROTID (so named from its proximity to the ear, παρὰ, near; οὖς, ὦτος, the ear) is the largest of the three, and lies in the space between the ramus of the lower jaw and the petrous part of the temporal bone, covered by the parotido-auricularis muscle (see Muscles, Fig. 60). It is enveloped in a case of dense cellular membrane, being itself made up of a number of little lobes, each of which has an investment continuous with the external one. The lobes have each an excretory duct, and these unite together like the stalks of a grape, to form one single duct, which passes along the inner part of the angle of the jaw, along the border of the masseter, piercing the mucous membrane of the mouth opposite the second molar tooth. THE SUBMAXILLARY GLAND lies within and before the angle of the jaw, and is of the same structure as the parotid. Its duct passes forward by the side of the root of the tongue, and opens on the side of the frœnum. THE SUBLINGUAL GLAND is the smallest of the three, and is situated between the middle of the tongue and the lower jaw. Its ducts, which are several in number, open on the side of the frœnum of the tongue, close to the orifice of the submaxillary gland. THE SALIVA secreted by these glands contains various saline and earthy matters identical with those of the blood, and a peculiar substance called *ptyaline*, which is the ferment used in the digestive process. The earthy phosphates in the saliva collect around the teeth, being held together by animal matter, and forming what is known as *tartar*.

THE PHARYNX AND ŒSOPHAGUS receive the food from the back of the mouth and convey it to the stomach. The former is a funnel-shaped bag, lined with mucous membrane, and covered by the three constrictors of the pharynx, which suspend it to the os hyoides and palate bones. Posteriorly it lies close to the spine, being only separated by a thin layer of muscles (see anterior cervico-occipital region). Anteriorly and superiorly it opens into the mouth and nasal cavities, from which it is separated by the soft palate and epiglottis. Posteriorly and superiorly the eustachian tubes open into it bell-mouthed; and inferiorly it contracts to connect itself with the œsophagus. The velum-palati is so arranged as to act as a valve in preventing the entrance of air into the larynx through the mouth, but in the act of coughing the latter is convulsively drawn down, and the valve ceases to cover its orifice, so that forcible expiration can then be effected.

THE ŒSOPHAGUS commences where the pharynx ends, being at first placed behind the larynx and in front of the cervical vertebræ. It soon inclines to the left, where for several inches the passage of a bolus may be observed in the living horse, again ascending and passing into the thorax above it. On reaching the crura of the diaphragm it passes through the opening made for it by the decussation of their fibres (see Diaphragm), and is connected with the stomach about the centre of its anterior curve. Throughout this course it has a muscular coat, composed of striped fibres at its commencement, but afterwards they are unstriped. It is lined by mucous membrane, which is very thick and white.

THE STOMACH is situated on the left side of the abdominal cavity, immediately behind the diaphragm. It resembles in shape the bag of the Scotch bag-pipes, having two openings, two curvatures (a lesser and a greater), two surfaces, and two sacs, which are generally divided by a constriction as shown in the accompanying engraving. Its volume varies with its contents, but in the horse of average size it will not contain more than three gallons, while the stomach of man, whose weight is only

FIG. 77.—THE STOMACH AND SPLEEN.

1. Pylorus (tied with a ligature).
2. 2. The pyloric sac.
3. Cardiac orifice (tied).
4. 4. The cardiac sac.
5. 5. 5. The greater curvature.

6. 6. 6. The lesser curvature.
7. 7. The spleen.
8. 8. 8. Omentum attaching the stomach to the spleen.

one-eighth that of the horse, holds three quarts. It lies across the abdomen, with its anterior surface in contact with the diaphragm on the left side, and in the middle having the liver between it and the central tendon of that muscle. Its posterior face is in contact with the colon; its inferior or larger curvature with the spleen, attached to it by the omentum, and separated from the abdominal muscles by the curvatures which the colon here makes. The left, or cardiac sac, is in contact with the supero-lateral walls of the abdomen and the left extremity of the pancreas, approximating to the anterior border of the left kidney. The right, or pyloric sac, is in contact with the right lobe of the liver, and the curvatures of the colon. Like the rest of the alimentary canal within

the abdomen, the stomach is made up of three coats; the external serous, which is a continuation of the peritoneum; the middle or muscular; and the internal, or mucous coat. On slitting it open and examining the interior, it is at once apparent that the two sacs are very differently lined. The cardiac mucous membrane resembles in appearance the interior of the œsophagus, being whitish brown, tough, comparatively dry, and covered with a thick layer of epithelium. On tracing the mucous membrane to the left sac, it presents an abrupt line of demarcation opposite the constriction between the two sacs. Beyond this, to the right, it is of a brownish red, marbled with lighter shades of the same colour, easily torn, and covered with a very thin epithelium. The left sac is in fact a simple reservoir of food, while the right is the true organ of digestion. Each of the two orifices also presents a peculiarity. The cardiac is slightly constricted, and has several small folds of mucous membrane around it, which accounts for the rarity of vomition in the horse. On the other hand the pyloric orifice is larger, and is merely surrounded by a raised cushion, which no doubt *can* be closed by the muscular sphincter, the fibres of which envelop it, but which is most probably kept patent during the ordinary process of digestion. The *muscular* coat of the left sac is composed of three planes, the fibres of which pass in different directions, all tending to empty its contents into the right. The latter sac is, however, surrounded by only one plane of muscular fibres, all passing in a circular direction, forcing the contents towards the pylorus. The *arteries* of the stomach are large and numerous, being derived from the aorta through the superior gastric, the right and left gastric, and the vasa brevia, which are given off by the trunk of the splenic artery. The veins empty themselves into the vena portæ; and the nerves are derived from the pneumogastric and solar plexus of the sympathetic.

THE MUCOUS MEMBRANE OF THE PYLORIC SAC OF THE STOMACH is made up almost entirely of tubular follicles closely applied to each other, their blind extremities resting upon the submucous cellular membrane, while their mouths open into the stomach; they are arranged in bundles or groups, bound together by a fine areolar membrane, and the follicles from each of these groups open into small pits or depressions, which may be seen in the interior of this part. They secrete the *gastric fluid*, which contains besides other matters, of which the acid, so variable in its nature, is 'the most remarkable, a peculiar organic compound known as *pepsine*, which seems to be a main agent in the digestive process, acting, like ptyaline, as a species of ferment, but of a more powerful kind. From the researches of physiologists it appears that the acid is the solvent, while the pepsine acts in converting the dissolved materials into a condition fit for absorption into the blood, there to be used for the general purposes of that fluid.

THE INTESTINES

THE INTESTINES, large and small, constitute a hollow tube, very variable in diameter, and measuring from eighty to ninety feet in length in an average-sized horse. They extend from the stomach to the anus: and

though nature has only divided them into two portions, the small and large, yet anatomists have subdivided each of these into three more— namely, duodenum, jejunum, and ileum : cæcum, colon, and rectum. All have three coats : the external, or peritoneal, which is very partial in the duodenum and rectum ; the middle, or muscular ; and the internal, or mucous ; but the last two are also differently arranged in the large and small intestines.

THE SMALL INTESTINES are about seventy feet long, and vary from an inch to an inch and a half in diameter, except at their commencement, where there is a considerable dilatation, forming a sort of ventriculus or lesser stomach. They are gathered up into folds, in consequence of the mesentery, which attaches them to the superior walls of the abdomen, being of very limited extent as compared with their length ; and thus they may be described as presenting two curves, a lesser mesenteric curvature, and an outer or free one covered by the peritoneum. The outer layer of the muscular coat consists only of a few scattered fibres, while the inner one is circular in its arrangement, and though thin as compared with the stomach, yet it is easily distinguished. The mucous coat is gathered into a few longitudinal folds when empty, which are very marked at its commencement ; but there are no valvular appendages, as in the human intestines. It is everywhere studded with *villi* or little projections, like the pile of velvet, through the open mouths of which the chyle is taken up ; and beneath it are numerous glands, named after their discoverers. The small intestines are liberally supplied with blood by the anterior mesenteric artery. Commencing at the pyloric opening of the stomach, the small intestine swells out into a second little bag, having, like that organ, a large and small curvature, the former being presented to the lesser curvature of the stomach. The enlargement soon ceases, and this part of the intestine (in England called duodenum) is bound up against the walls of the abdomen by the root of the mesentery and mesocolon. It then crosses the spine and enters the left lumbar region, where it becomes loose or floating in the cavity of the abdomen, being only retained by the mesentery (see plan, Fig. 76, page 476). About twenty-four inches from the commencement it receives the name of jejunum, which it retains until within the same distance of its termination, when it becomes ileum : but in the French school it is divided only into the fixed portion or duodenum, and the loose or floating portion, comprehending what is here called the jejunum and ileum. In this course it receives the biliary and pancreatic fluids ; the duct from the liver, and that from the pancreas, opening together into the duodenum, six or seven inches from the pylorus. At its termination in the cæcum there is a valve, called *ileo cœcal*, which prevents the return of the contents of the cæcum into the ileum.

THE LARGE INTESTINES, as their name implies, are of much greater diameter than the small ; but they are not above one-third of their length. Instead of being convoluted, they are puckered into pouches by a peculiar arrangement of the longitudinal muscular fibres, which are collected into bundles or cords (*a a*, Fig. 78), and, being shorter than the intestine, gather it up into cells. The mucous membrane also has very few villi, which become more and more rare towards the rectum. At the commencement the gut is enlarged to an enormous size, and forms a *cul de sac* called the

cæcum, which is about four feet long, and terminates in a point, the whole being compared to a jelly-bag, and forming a reservoir, where the watery particles of the food are absorbed, leaving the fæcal matter in a comparatively solid state. Indeed this gut at once receives nearly all the water which is swallowed, it passing through the stomach and intestines without

FIG. 78.—THE LARGE AND SMALL INTESTINES, DETACHED.

1. The duodenum, with its cul de sac removed.
2. 2. 2. 2. 2. 2. The convolutions of the jejunum and ileum.
3. 3. The mesentery.
4. The apex of the cæcum.
5. Its body.

6. 6. Commencement of colon.
7. 7. Transverse colon.
8. Terminal portion of the colon.
9. Rectum.
a. a. Muscular bands of colon.

any delay, when of course, as this sac has only one opening, it must alternately receive and disgorge its contents, the valve at the entrance of the ileum preventing its return into the small intestine. The cæcum occupies the right flank, and takes an oblique direction from above downwards and forwards.

THE COLON extends from the ileo-cæcal valve, occupying the right flank, in an elliptical direction to the left flank, where it ends in the rectum, and thus ends very near the point where it began, after traversing nearly the whole abdominal cavity. It is of such an enormous capacity that it will

hold from twelve to thirteen gallons of water. Its largest diameter is at the commencement, from which it begins to contract, and as it crosses from the right of the abdomen near the liver to the other side, where it is in close proximity to the stomach, it is contracted to a comparatively small diameter, but enlarges again as it lies in the left flank. Like the cæcum, it has three longitudinal muscular bands for three-fourths of its course, but these afterwards are reduced to two, and as it merges in the rectum they disappear altogether, the longitudinal fibres being then equally distributed. The cæcum and colon are supplied with blood by the posterior mesenteric artery.

THE RECTUM, or straight gut, begins on the margin of the pelvis, from which it extends in a straight line to the anus. It gradually expands to form a considerable reservoir for the fæces, and is uncovered by peritoneum after its commencement.

THE LIVER

THIS IMPORTANT organ is in close contact with the right side of the diaphragm. It is of an irregular figure, thick in the middle and thin at the edges; divided into three lobes; convex on its anterior surface, where it is adapted to the concave aspect of the diaphragm; concave posteriorly. The colour is that which is so well known, and peculiar to itself. It is everywhere invested by the peritoneum, excepting the spaces occupied by the large veins as they enter and pass out, and the coronary ligament which suspends it, as well as the three other folds of peritoneum, which have also received particular names.

THE STRUCTURE of the liver is most peculiar; but it will be impossible to enter fully into its minute anatomy for want of space. Suffice it to observe that it is composed of lobules, of an areolo-fibrous connecting medium (which has received the name of the capsule of Glisson), of the ramifications of the vena portæ, hepatic artery, hepatic veins, hepatic duct, lymphatics and nerves, enclosed in the investing peritoneal coat. The portal vein returns the blood from the stomach and small intestines to be circulated through the lobules, and from this the bile is secreted. It distributes its numberless branches through canals which are everywhere worked out in the substance of the liver, and from which the lobules are supplied. From these, which are each a small gland perfect in itself, the bile is received by a network of minute ducts, ultimately coalescing to form the hepatic duct, which opens into the duodenum. The secretion of bile is entirely from the venous blood, and the hepatic artery is solely destined to nourish the gland. The nerves are chiefly from the sympathetic system, a few small branches being derived from the pneumogastric through the solar plexus. The horse has no gall bladder like the cow, as well as the human species.

THE FUNCTION of the liver is doubtless chiefly of a depuratory nature; besides the separation from the blood of the compound known as bile, it appears to be the manufactory in which glycogen is produced. The fluid which it pours into the intestine has the quality of arresting putrefactive action in the ingesta, emulsifying fats with the assistance of the pancreatic and other secretions, and stimulating the walls of the intestines to perform their duties.

THE SPLEEN

THE SPLEEN can scarcely be considered as a gland, inasmuch as it has no excretory duct, but it contains within its substance a number of little bodies, called Malpighian corpuscles, which most probably perform the same office as the absorbent glands. Its weight as compared with the whole body is about the same as in man, whose spleen weighs six ounces, while that of the horse rarely exceeds three pounds. It is attached by the lesser omentum (a fold of the peritoneum) to the stomach (see Fig. 77, page 481), and occupies the left side of that organ. It is covered by a serous coat continuous with the peritoneum, and its internal structure is spongy, and made up of cells which contain a large quantity of blood.

THE FUNCTION of the spleen is not positively ascertained, but it is believed to perform the office of a reservoir for the blood required by the stomach, with which it is closely connected by a set of vessels (vasa brevia), and also to effect some change in the blood itself.

THE PANCREAS

THE PANCREAS is an elongated gland resembling in structure the salivary glands, placed close to the spine, above the stomach. It has two excretory ducts, which carry the pancreatic fluid secreted by it into the duodenum through a valvular opening common to it and the hepatic duct. THE USE of the pancreatic fluid appears to be similar to that of the saliva.

THE KIDNEYS

THE KIDNEYS are two oval organs situated beneath the psoas muscles, and only retained in their position by the fatty cellular membrane which envelops them, and by the upward pressure of the other abdominal viscera below them. The right kidney is completely within the ribs, but the left scarcely advances at all beyond the eighteenth rib : each averages about forty ounces in weight, but there is a considerable variation in size and form. Unlike the corresponding organ in the cow, the horse's kidney is not split up into lobules, though there is some little irregularity of outline and surface, as may be seen in the annexed figure, which was taken from a specimen somewhat remarkable in these respects. A transverse section shows the internal structure, which is composed of a central cavity, the pelvis, into which the urine flows, and from which it is carried to the bladder by the ureter. In this pelvis several conical projections are visible, having minute openings around their apices, which are the terminations of the tubuli uriniferi composing the substance of the internal part of the organ. The external is the true secreting portion, and in this are contained a multitude of minute red globular bodies, composed of a flexus of capillary vessels, and of a coil of tube in connection with the uriniferous tubuli, both

being enclosed in a membranous capsule. Each cone is contained within a cup-like pouch of the pelvis, which is called a calyx.
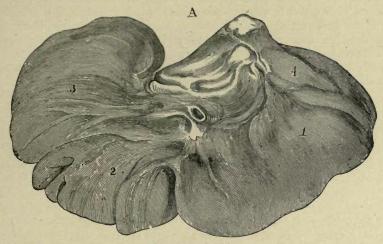
FIG. 79.—THE KIDNEY.

A. Fissure through which the vessels enter and the ureter passes out.
1. 2. 3. 4. Surface of kidney.

AT THE ANTERIOR extremity of each kidney is a small body called the suprarenal capsule, the use of which is not ascertained.
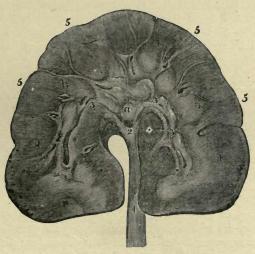
FIG. 80.—TRANSVERSE SECTION OF KIDNEY.

a. Pelvis.
1. 2. Ureter.
3. 3. Papillæ or cones.

4. 4. 4. 4. Tubular portion.
5. 5. 5. 5. External cortical portion.

THE PELVIS

THE CAVITY OF THE BODY known as the pelvis is situated behind the abdomen, with which it communicates freely, each being lined by a continuation of the peritoneum. A ridge of bone (the brim of the pelvis) is the line of demarcation anteriorly. The sacrum and os coccygis bound it superiorly, the anus posteriorly, and the ossa innominata inferiorly and laterally. It contains the bladder and rectum in both sexes, and in each the organs of generation peculiar to it.

THE BLADDER

THE BLADDER is a musculo-membranous bag destined to contain the urine as it is gradually received from the ureters, which bring it down from the kidneys. It lies in the middle of the pelvis, occupying also more or less of the abdomen according to its condition in point of repletion or emptiness. It is of an oval shape, with its posterior extremity somewhat more pointed than the other, and called its neck. At this point it gives origin to the urethra, a canal for carrying off the urine. It receives the two ureters at its superior surface, about an inch in front of the neck, where they pierce the several coats in an oblique direction forming a complete valve, which prevents the return of the urine, and so invisible that the presence of two openings is scarcely ever suspected by the ordinary observer. Only about one-third of the bladder is covered by the peritoneum, the remainder being made up solely of the muscular and mucous coats, which compose all the hollow viscera. It is retained in its place by the cellular membrane which connects it with the lower walls of the pelvis, posteriorly by the urethra, and by the folds of the peritoneum, which are continued from it to the sides of the pelvis, and are called the broad ligaments of the bladder.

THE ORGANS OF GENERATION, MALE AND FEMALE

THE MALE ORGANS OF GENERATION consist of the testes and their ducts, the vasa deferentia, the latter conveying the semen to the urethra or to the vesiculæ seminales, which are oval bags connected with the upper surface of the neck of the bladder. Here the seminal fluid is stored up for use, and when wanted is conveyed into the vagina by means of the external organ or penis. The anatomy of the testicles is that which mainly concerns the horse-master, as they are generally removed by operation. They are contained within the scrotum, which is externally composed of skin, wrinkled in the foal, but subsequently distended by the size and weight of its contents. Beneath this is a layer of a pale yellowish fibrous membrane called the dartos, which envelops the testes and forms a separation between them. A thin coat of cellular membrane alone separates this from the double serous membrane, the tunica vaginalis, which almost entirely envelops each testis, just as the pleura does the lung. In the early stages of fœtal life the testes

are contained within the abdomen above the peritoneum, but being attached to the scrotum by a thin muscle (the cremaster), they are gradually dragged downwards through the inguinal canal; and each brings a double layer of peritoneum, which continues its connection through life, so that fluid injected into the cavity of the tunica vaginalis will flow into the peritoneum. Hence inguinal hernia in the horse becomes scrotal in a very short space of time, and rarely remains confined to the former position. The testicles with their appendages, the vesiculæ seminales, form the semen by the usual process of secretion. They are of about the size of a duck's egg, and besides their attachment by the reflexions of the tunica vaginalis to the scrotum, they have also the spermatic cord which suspends them to the inguinal canal through which it passes. This cord it is which is divided in castration, and it is well to ascertain its component parts. They are, 1st. The artery which supplies the testicles with blood, and is of considerable size and tortuous in its course. 2nd. The artery of the cord, small and unimportant. 3rd. The veins which accompany these arteries. 4th. The nerves and absorbents, the division of the former giving great pain and causing a slight shock to the system. 5th. The vas deferens or duct carrying the semen to the urethra, and possessing walls of such thickness that it feels like whipcord under the finger. These several parts are connected together by cellular membrane and covered by the two layers of reflected peritoneum, namely, the tunica vaginalis and tunica vaginalis reflexa, by the thin layer of cremaster muscle, as well as by a fourth investment, a continuation of the superficial fascia of the abdomen. All these parts must be divided before the canal is reached, for operating in castration.

THE FEMALE ORGANS OF GENERATION are essentially the ovaries, the uterus and its appendages forming the bed in which the embyro is nurtured to maturity. The ovaries are two small oval bodies, about the size of large walnuts, situated behind the kidneys, and having the fimbriated extremities of the fallopian tubes hanging loosely adjacent to them. These tubes, one on each side, terminate in the uterus, which is of a remarkable shape in the mare. It consists of a body and two horns. The body has a mouth, or *os*, which opens into the end of the vagina, while, in itself, it is oblong, and in the unimpregnated state it is entirely contained within the pelvis. Anteriorly it divides into two horns (cornua), which diverge towards the loins, turning upwards, and lying under the wings of the ossa ilii (see Fig. 75, page 475). They terminate in rounded extremities. Each cornu receives the fallopian tube of its own side, the opening being so small as scarcely to admit a silver probe. The vagina lies between the bladder and rectum, and is about eighteen inches in length; it is lined with mucous membrane, and surrounded with muscular fibres, which form the sphincter vaginæ.

CHAPTER XXIII

THE NERVOUS SYSTEM

PHYSIOLOGY OF THE NERVOUS SYSTEM—CHIEF DIVISIONS OF THE NERVOUS SYSTEM—THE SPINAL CORD—THE MEDULLA OBLONGATA—THE ENCEPHALON—THE SYMPATHETIC SYSTEM.

PHYSIOLOGY OF THE NERVOUS SYSTEM
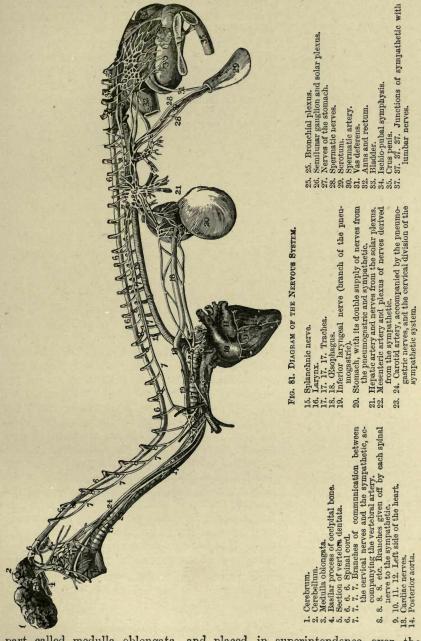
HITHERTO we have been engaged in examining into the conformation of the framework of the body; into the structure and action of the muscles, which serve to move this framework; and into the several organs which afford nourishment to the whole, and keep it sound and in good order. We have now to consider the prime mover of all these several agents, the nervous system, which may be compared to the fuel that heats the water of the steam-engine, and converts that apparently most simple and innocent fluid into the powerful agent which is capable of developing almost any amount of force. This fuel, however, is itself inactive until it is endowed with life by the agency of fire; and, in the same way, the nervous system of the animal being must be provided with the living principle, of whose nature we can only judge by its effects when present, and by the cessation of all action when absent. There are many processes which are carried on in the animal as in the vegetable without the necessity for any direct stimulus from a nervous centre, such as the growth of each separate tissue throughout the body, which takes place in the former, just as it does in the latter, by a species of cell-development and metamorphosis independent of nervous energy; but though this growth is thus accomplished, yet it would soon be starved out for want of pabulum, were it not for the supply of food to the stomach, which requires the mandate of the nervous system for its performance, and so on with every corresponding action of the body.

THE NERVOUS SYSTEM is made up of two distinct substances, one grey in colour, and granular in structure, which is the seat of all nervous power; the other white and fibrous, which is the telegraph wire by which this power is communicated. Sometimes the grey matter envelops the white, and at others it is enclosed within it, but in every case each has its peculiar office as above mentioned. Each collection of grey matter is called a ganglion, whatever its shape may be; but the white fibres may be either in the form of commissures for connecting the ganglia together, or they may be agents for communicating with other organs, and are then called nerves.

CHIEF DIVISIONS OF THE NERVOUS SYSTEM
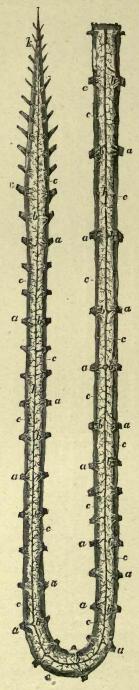
IN THE HORSE, as in all the vertebrata, the nervous system is made up of the following parts. 1st. The ganglia, which are intended to subserve what are called the reflex actions of the organs of locomotion, etc., and which

occupy the whole length of the spinal cord, one on each side.   2nd. The
respiratory ganglia, situated higher up towards the brain, constituting the

FIG. 81. DIAGRAM OF THE NERVOUS SYSTEM.

1. Cerebrum.
2. Cerebellum.
3. Medulla oblongata.
4. Basilar process of occipital bone.
5. Section of vertebræ dentata.
6. 6. 6. 6. Spinal cord.
7. 7. 7. 7. Branches of communication between the cervical nerves and the sympathetic, accompanying the vertebral artery.
8. 8. 8. etc. Branches given off by each spinal nerve to the sympathetic.
9. 10. 11. 12. Left side of the heart.
13. Cardiac nerves.
14. Posterior aorta.
15. Splanchnic nerve.
16. Larynx.
17. 17. 17. Trachea.
18. Œsophagus.
19. Inferior laryngeal nerve (branch of the pneumogastric).
20. Stomach, with its double supply of nerves from the pneumogastric and sympathetic.
21. Hepatic artery and nerves from the solar plexus.
22. Mesenteric artery and plexus of nerves derived from the sympathetic.
23. 24. Carotid artery, accompanied by the pneumogastric nerves, and the cervical division of the sympathetic system.
25. 25. Bronchial plexus.
26. Semilunar ganglion and solar plexus.
27. Nerves of the stomach.
28. Spermatic nerves.
29. Scrotum.
30. Spermatic artery.
31. Vas deferens.
32. Anus and rectum.
33. Bladder.
34. Ischio-pubal symphysis.
35. Crus penis.
37. 37. 37. Junctions of sympathetic with lumbar nerves.

part called medulla oblongata, and placed in superintendence over the
functions of respiration, mastication, and deglutition.   3rd. A series of

ganglia controlling the organs of special sense, situated at the base of the brain. 4th. The cerebellum, which seems specially intended to combine and balance the several muscular actions of the body. 5th. The cerebrum, which is the seat of intelligence and will. 6th. The sympathetic system of ganglia, which specially controls the vital organs of circulation, digestion, and depuration. The first five divisions are generally included under the head of the nervous system of *animal* life, the last being considered to be peculiar to *organic* life. The diagram on the preceding page will show at one view the chief component parts of the two systems.

THE SPINAL CORD

THE SPINAL CORD may be considered to be the primary division of the nervous system, because it represents the lowest development of this organ in the animal kingdom. But instead of consisting of a series of locomotive ganglia, as in the *articulata*, it is here found in the shape of two long masses of grey matter, covered with white fibres, which serve to communicate between the several parts of which it is composed.

Opposite each joint, between the vertebræ, a nerve is given off, which passes out in the foramen specially contrived for its exit, and thence goes on to its destination. Each of these nerves has two distinct origins; one from the upper part of the grey central matter (the sensitive root), the other from its inferior surface, which is the motor portion. The superior has an accession of grey matter around it, soon after the union of its nervelets, called its ganglion, beyond which the two divisions unite to form a large nerve, which soon begins to subdivide again for supplying the several parts of the body. The terminating branches reunite in loops, so that these nerves may be considered to form a complete circle, those of sensation receiving impressions from the parts on which they are distributed, and conveying them to the central ganglion, while the motor nerves cause the muscles which they supply to

FIG. 82.—SPINAL CORD REMOVED FROM ITS CANAL.

a. a. a. a. Roots of the spinal nerves.
b. b. b. The filaments going to unite to form each of these nerves.
c. c. c. Clear spaces between the roots of the nerves.

contract on receipt of the proper stimulus from the centre. The spinal nerves are from forty-two to forty-three in number on each side; namely, eight pairs of cervical, seventeen pairs of dorsal, six pairs of lumbar, five pairs of sacral nerves, and six or seven coccygeal. Each of these nerves divides at once into a superior and inferior branch, the latter giving off a small nervelet to communicate with the sympathetic, and then going on to supply the lower parts of the body and the extremities. The cord varies somewhat in size in the several regions of the spine. It commences at the occiput of full size, then diminishes to the fifth cervical vertebra, where there is a slight swelling, after which it is gradually reduced in dimensions to the loins, where it spreads out into a wide but thin plate, after which it divides into its terminal branches, which have been compared to a horse's tail.

THE MEDULLA OBLONGATA

The MEDULLA OBLONGATA is the anterior enlarged portion of the spinal cord, of a conical shape, which extends to the pons varolii. On its inferior face it presents two pyramidal bodies, and on its superior two flattened cords, the corpora restiformia, while between the two are the corpora olivaria. On making a section of this part, the corpus olivare is seen to be chiefly composed of grey matter, and is a ganglion, superadded for the special purpose of establishing the respiratory function. From its lower border proceed the filaments, which unite to form the hypoglossal nerve, while from the upper side emerge the glosso-pharyngeal and pneumogastric nerves.

THE ENCEPHALON (ἐν, in, κεφαλή, head)

The CEREBELLUM TOGETHER WITH THE CEREBRUM form the mass of the encephalon, and they may be examined together with advantage. The two completely fill the cavity of the cranium, and are invested by three membranes;—the dura mater, fibrous and strong; the pia mater, vascular and tender; and the arachnoid, a serous membrane of the ordinary character. The dura mater also dips down between the lobes of the cerebrum to form a protection against lateral displacement called the falx, and is spread across from one petrous bone to the other, constituting the tentorium cerebelli. The mass of the encephalon in the horse is small as compared with that of man, weighing not quite a pound and a half, while the human brain averages three pounds in the male, and four or five ounces less in the female. Taking into consideration that the body of the horse weighs at least eight times as much as a man's, it follows that the brain of the latter is relatively sixteen times as large as that of the horse. The cerebellum occupies the postero-superior part as the head is usually carried, and is much smaller than the cerebrum, being only one-sixth of its volume Examining it from above it presents three lobes; a middle and two latera lobes. The former is prominent, and subdivided into lobuli by severa grooves, constituting the anterior and posterior vermiform processes. The

lateral lobes are flattened and oval, to correspond with the inferior surfaces of the tentorium cerebelli. The cerebellum is made up of alternate layers of grey and white matter, the former being distributed throughout the interior in such a way that when sliced it presents an arborescent appearance. On parting the hemispheres of the cerebrum, the convolutions on the surface of which are composed of grey matter, a white band slightly striped from
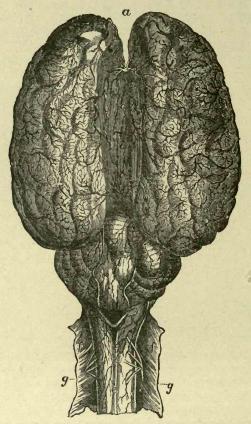
FIG. 83.—VIEW OF THE SUPERIOR SURFACE OF THE ENCEPHALON.

a Anterior termination of the longitudinal fissure.	*d.* Middle lobe of the cerebellum.
b. b. Lateral hemispheres of the cerebrum.	*e. e.* Superior median fissure.
c. c. c. Corpus callosum.	*f. g.* Membranes covering the spinal cord.

side to side makes its appearance. This is the corpus callosum, which is the great commissure, and consists entirely of white fibrous matter, uniting the two halves. Beneath this, on each side, are the lateral ventricles, and within each are the optic thalamus and corpus striatum, with the choroid plexus lying between. Turning the brain with its inferior surface in view it presents anteriorly the continuation of the longitudinal fissure. On each side of this are the olfactory nerves, which look like prolongations of the hemispheres. Close behind these two are the optic or second pair of nerves, connected together by their commissure. Then two small white bodies, the

corpora albicantia, and behind these again the third pair of nerves, supplying the muscles of the eye. Still further back is a square eminence, the pons varolii, from the sides of which the fourth and fifth pairs of nerves arise, while its posterior border gives origin to the sixth pair in the middle and the seventh externally to these. The eighth and ninth nerves have already been alluded to, as arising from the medulla oblongata.

THE SYMPATHETIC SYSTEM

THIS DIVISION OF THE NERVES consists of a series of ganglia, lying on each side the spine, from the head to the coccyx, communicating with the cranial and spinal nerves, and distributing branches to all the internal organs of digestion, circulation, depuration, and generation. The branches of distribution accompany the arteries, forming a plexus, or series of meshes, around each of them. In the head there are four small ganglia, in the neck three, and posteriorly a small ganglion lies opposite each vertebra. The posterior cervical ganglion communicates with the spinal nerves of that region by a branch which accompanies the vertebral artery, and sends forward filaments to form the bronchial and cardiac plexus, the former being largely supplied also with branches from the pneumogastric nerve. From the dorsal ganglia a large nerve is formed, the greater splanchnic nerve, and also the lesser splanchnic, which enter the abdomen close beneath the crus of the diaphragm, where they give off a number of branches which, together with filaments of the pneumogastric nerve, unite on both sides to form the semilunar ganglion, or collection of ganglia arranged somewhat in that shape. They lie close to the posterior aorta, and surround the root of the cœliac artery, supplying branches to form the phrenic and the splenic plexus, the gastric plexus, the hepatic plexus, the anterior and posterior mesenteric plexus, the renal plexus, and the spermatic plexus, all surrounding the corresponding arteries and supplying the important organs whose names they bear.

CHAPTER XXIV

SPECIAL ORGANS

THE ORGAN OF SMELL—THE EYE—THE EAR—THE ORGAN OF TOUCH—THE FOOT

THE ORGAN OF SMELL

THE NOSE of the horse, like all the solipedes, is endowed with a sensibility far greater than that of man ; but in this respect he is not equal to many other animals, such as the dog and cat kinds, and the sole use which he makes of this sense is in the selection of his food.   I have already alluded to the nasal fossæ at page 469, and need only here remark that the large mass of nervous matter composing the olfactory nerves pierces the cribriform plate of the æthmoid bone in numerous fibrillæ, which spread over the membrane (Schneiderian) lining the æthmoidal cells, the turbinated bones, and the septum nasi.

THE EYE

THE ORGAN OF SIGHT may be considered as consisting, first of all, of an optical instrument very similar to the camera obscura, now so commonly used in photography, and, secondly, of the parts which are employed to move, adjust, and protect it from injury.

THE EYE itself consists of three transparent humours, which answer the purpose of the lens of the camera, by collecting the rays of light upon the back of the eye.   There are the aqueous in front, the crystalline lens in the middle, and the vitreous humour behind.   The first is a perfectly transparent and limpid fluid, secreted by the lining of the chamber in which it lies, and capable of being rapidly renewed in case of a puncture letting it out.   The lens, on the contrary, has the consistence of very hard jelly, and is arranged in concentric layers, like the coats of an onion.   It is merely a double convex lens, precisely like that of the camera in its action, and is the chief agent in producing the impression of an object upon the sensitive part of the eye.   Behind it is the vitreous humour, composed like the aqueous of a limpid fluid ; but instead of being unconfined except by the walls of the chamber in which it lies, it is bound up in a network of transparent cells, which give it the consistency and appearance of a delicate jelly.   Upon the perfect transparency and proper shape of these humours depends the sight of the animal.   But in addition to the risk of blindness from any defect in these parts, if the investing coats or membranes are inflamed or disorganized, their functions are not performed, and the sight is either impaired or destroyed.   Thus the rays of light may be fairly collected, so as to throw the impression of every object within the sphere of vision upon the back of the eye, and yet the horse may be blind, because

the retina or expansion of the optic nerve is disorganized by disease. When inflammation attacks the coats of the eye, it generally extends to the investments of the humours, and to the substance of the lens itself, producing cataract or opacity of that part; but it is possible to have the sight impaired from a mere defect of shape in the anterior coat, so as to make the surface too convex, and thus alter the focus of the sight. This is the "buck-eye," which leads to shying, and is perfectly incurable. The membranes are, first, the cornea, a perfectly transparent coat, placed in front of the eye, and inserted, like a watch-glass, in the sclerotic coat covering the posterior four-fifths of the globe. The latter is a white fibrous membrane, strong and inelastic, so as to afford protection to the parts within it from external violence. This forms the white of the eye, which, however, is only occasionally visible in the horse. Beneath the sclerotic is the choroid coat, consisting of a network of blood-vessels, and lined with a black pigment, which again has on its internal surface, at the part opposite the pupil, a greenish-white iridescent lining, called tapetum lucidum, or luminous carpet. Lastly, within the whole of this surface is spread a beautiful expansion of the optic nerve, called the retina, which receives the impressions derived from the rays of light, forming a distinct figure upon it exactly similar to the objects which are presented to it, except in point of size, and in being inverted. Beyond these parts, there is a provision made for moderating the rays of light, according to their intensity. This is effected by means of an opaque septum, pierced with an oval hole; the former being called the iris, and the latter the pupil. The substance of the iris itself is composed of contractile tissue, which has the power of expanding or contracting the pupil in obedience to the impression produced upon the retina; and thus, if the eye is examined in a strong light, the pupil will appear large when shaded by the hand, but contracts immediately on exposing the eye. The horse's iris is brown, varying somewhat in shade in different individuals, and at the upper part of the pupil it presents one or two little floating appendages, which serve to moderate the sun's rays. Sometimes the brown colour is absent, and the iris is either partially white or light blue, in which case it is called a "wall eye"; but though this is considered unsightly, it does not interfere with vision. The iris is stretched across the chamber of the aqueous humour, and is thus enabled to act freely. There are many other delicate structures worthy of being examined, but want of space must prevent any further allusion to them.

THE APPENDAGES of the eye are: 1st. The conjunctiva or membrane protecting the exposed surface of the eye. 2nd. The eyelids. 3rd. The membrana nictitans or haw. 4th. The muscles of the eye. 5th. The lachrymal apparatus. *The conjunctiva* covers the whole front of the eye, being thin, and perfectly transparent in a healthy state, but on the occurrence of inflammation speedily becoming red and puffy. It is reflected from this face to the inside of the eyelids, and the whole membrane is extremely liable to inflammation from any external irritation. The *eyelids* have nothing very remarkable about them, being merely cartilaginous shutters covered with fine skin, and lined with conjunctiva, and raised and lowered by muscles peculiar to them. The *membrane nictitans* or haw is a cartilage lying just within the inner corner of the eye, but capable of being thrust

outwards so as to partially cover it when the muscles retract the eye, and for want of space drive it forward. This happens whenever the eye is irritated either by an insect or by the dust or hayseeds which are so often deposited upon the conjunctiva, and which, causing the eye to be drawn back, displace the fat deposited on the back of the orbit, and this again pushes forward the haw. For this reason in all irritable states of the eye the haw is prominent.

THE BARBAROUS PRACTICE of excising it as an offending body has happily ceased with the advent of skilled veterinary surgeons. The *muscles* move the eye in all directions, and have the peculiar property of keeping the long diameter of the pupil always nearly in a line parallel with the horizon. Practically they are not of any great importance. The *lachrymal apparatus* consists of the lachrymal gland, situated beneath the outer wall of the orbit, and secreting the tears, which are intended to wash the conjunctiva clear of any foreign body. The secretion is thrown out upon its surface through a number of small ducts, and traversing from the outer angle to the inner, is conducted through two small openings in the lids to the lachrymal sac, and from that by the nasal duct to the nose.

THE EAR

THIS ORGAN is divided into the external ear for collecting the waves of sound, and conveying them inwards, and the internal ear which is situated within the petrous part of the temporal bone. The latter is a very complicated and delicate organ ; but its formation does not differ in any essential features from that of the other vertebrate animals, nor are the diseases attacking it in the horse of any particular importance, so that its description will be omitted.

THE ORGAN OF TOUCH

THE SENSE OF TOUCH is necessary for the proper appreciation of the mechanical form and nature of the objects placed in apposition to the body, and of their temperature. It is seated generally in the terminations of the nerves of sensation on the skin ; but there are certain parts specially endowed with these nerves, which in the horse are the lips and the four extremities.

THE SKIN is composed of two layers, one internal and living termed the *dermis* or chorion, the other a secretion from it, and called the *epidermis*, the inner and freshly secreted layer of which is the *rete mucosum* of the old authors. The dermis constitutes nearly the whole substance of the skin, and varies in thickness in different regions of the body, and also in the nature of its attachment to the subjacent parts, being very loosely connected in some, and in others so tight that it cannot be pinched up. It consists of a layer of cellular and elastic fibres crossing each other in all directions, and abundantly supplied with blood-vessels and nerves. Its external surface is provided with numberless little elevations termed *papilliœ*, each of which contains the termination of a nerve : and it is pierced with an immense

number of holes, some of which allow the hairs to pass through, others are the pores through which the sweat is poured out, and others again are follicles for the secretion of sebaceous or half-oily fluid, for the purpose of lubricating the skin. These last are particularly numerous at the flexures of the joints, as at the inner part of the hock, knee, and heel, in each of which situations they are liable to become clogged, leading to the conditions known as mallenders, sallenders, and cracked heels, which will be hereafter described.

THE EPIDERMIS, cuticle, or scarf-skin, is very thin but tough, and in the horse its innermost layer is generally of a dark slate colour, the better to protect the dermis from the rays of the sun. It is composed of scales agglutinated together, and its internal surface is reflected in the form of
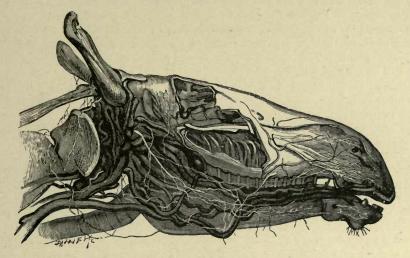
FIG. 84.—NERVES OF SENSATION SUPPLIED TO THE LIPS OF THE HORSE, SHOWING ALSO THE ORIGIN OF THE JUGULAR VEIN.

fine sheaths around all the hairs which pierce it, and of linings to the sweat pores and sebaceous follicles. As fresh cuticle is secreted the outer layers fall off; and in the horse this growth is very rapid, so that in a very few days the coat of hair becomes loaded with them if it is not regularly cleansed. They afford a great protection against wind and rain, and for that reason they should not be removed by friction from those horses which are about to be turned out of doors.

THE HAIRY APPENDAGES of the skin of the horse are of two kinds :—1st. The general coat. 2nd. The horsehair, which is of a thicker and stiffer kind, and grows from the top of the neck, forming the mane, from the dock as the tail, from the backs of the legs, and from the eyelids and lips to act as feelers in enabling them to avoid injury. Each hair is secreted by its bulb, which is seated partly in the dermis and partly in the cellular membrane, closely subjacent to the true skin. Unless, therefore, the whole thickness of the dermis is destroyed, the bulb may be safe, and the hair is restored in the course of time. The coat is shed twice a year, in spring and autumn, the secretion from the bulb ceasing for a short period, and the

hair, losing its connection, falls out ; but the young hair soon takes its place and grows to a length suited to the temperature to which the skin is exposed. The horsehair on the contrary is not shed, but if it is plucked out it is reproduced, though slowly.

EVERY PART OF THE SKIN is sensible to impressions from external objects, but the sense of touch, such as we possess in the fingers, can only be said to reside in the lips, and partially in the feet. All these parts are profusely supplied with nerves of sensation, and the horse may often be observed to use them in examining external objects, especially his lips, which are the most delicate of his organs of touch. The engraving on page 499, of a preparation of the nerves of the face, shows this distribution very clearly, and will give an idea of the numerous ramifications of sensitive nerves supplied to the lips. The feet are also largely supplied with nerves, though not to the same extent as the human fingers ; and being covered with horny matter, the sensibility of the surface is greatly reduced : still there can be no doubt that the horse uses them occasionally in making out the nature of objects presented to him : and this is especially the case with the fore-feet, though it will sometimes happen that the hind extremities are used for the same purpose ; as, for instance, in ascertaining the nature of a hard body before kicking at it.[1]

THE FOOT

IT IS NECESSARY TO EXAMINE the structure of the foot most carefully, not as an object of curiosity connected with the sense of touch, but on account of the numberless diseases and accidents to which it is subject. No part of the horse is so liable to the effects of hard work and mismanagement as this, and there is consequently none which more requires our care both in health and disease. The bones and ligaments entering into the composition of this organ have already been described ; the former at page 383, the latter at page 419. We have now to examine into the structure of the sensible and insensible parts which cover these bones.

THE PARTS entering into the composition of the foot will be better understood by a reference to the annexed section of the phalanges or fingers terminating the metacarpal or metatarsal bones, as the case may be, with their investments. It will be seen that there is very little space between the pedal-bone and the crust, which, together with the sole, forms a horny case or natural shoe, for the sensible and delicate investments of the bone. So small is this space, that when inflammation takes place there is no room for any swelling (the invariable accompaniment of that disease) and intense pain is occasioned, as well as rapid disorganization of the structure itself. The horny case is attached to the foot by a delicate membrane, which lies in folds upon the pedal-bone, and it can be torn away by violence, or when putrefaction has commenced, with great ease. These parts are here separately displayed. The several parts which we shall have

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[1] The editor has had hundreds of unnerved horses under observation, but failed to discover any difference in their manner of using the front feet, to ascertain the nature of an object in which they were interested. Do they not employ the feet merely to move an object for better inspection or more convenient application of the lips ?

to examine, commencing from without, are—1st. The horny case or hoof ; 2nd. The parts which secrete it ; 3rd. The arteries which supply it with blood ; and 4th. The pedal-bone and cartilages, as well as the navicular bone, which it encases.

THE HOOF consists of three distinct parts, which, though in the recent state they are inseparably united, may be readily separated after maceration for a few days in strong soda-water. These are the external wall or crust, the sole or slightly concave surface forming the bottom or floor of the case, and the triangular central portion of this called the frog. The *crust* reaches from the edge of the hairy skin to the ground, and averages about three
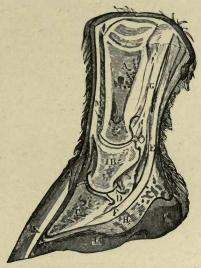
FIG. 85.—SECTION OF THE PARTS ENTERING INTO THE COMPOSITION OF THE FOOT AND THE FETLOCK AND PASTERN JOINTS.

A. Os suffraginis.	H. Cleft of frog.
B. Os coronæ.	I. Side of frog cleft.
C. Os pedis.	J. Sole.
D. Os naviculare.	K. Crust.
E. E. The perforans and perforatus tendons.	L. Coronary substance.
G. Inferior sesamoideal ligament.	
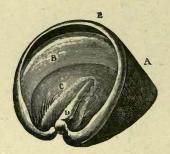
inches and a half in depth. The front is the toe, the back the heel, and the intermediate part the quarter on each side. It is described as a section of a truncated cone. When examined from the side, the anterior surface should form an angle of about forty-five degrees with the line of the sole, and the upper edge or coronary band should join the sole, so as to leave a moderate substance at the heel ; for if too great the foot does not expand, and is liable to disease from that cause ; or if too thin and narrow, the foot is weak and gives way downwards, ending in a convexity of the sole instead of the reverse. The front of the crust is rather more than half an inch in thickness, and in a strong foot of average size gradually diminishing to the quarters, at the back of which it is generally barely a quarter of an inch thick, especially at the inner of the two. This proportion is however confined to the fore-foot, for in the hind there is little difference between the toe and quarters in point of thickness. The superior border, or coronary

band, is marked by its whitish colour.   On its external surface it resembles
the crust below ; but internally it differs in being smoothly   excavated,
whilst the crust exhibits perpendicular striæ, corresponding with the laminæ;
but this is not well shown in Fig. 86.   In examining the cut of the sole, Fig.
88, it will be seen that the crust is bent inwards towards the frog at the
heel on each side : these are the bars, which in the natural foot appear as
sharpened prominences, extending from the heels into the centre of the foot,
between the sole and the frog, and which are useful as buttresses, supporting
the crust from being crushed inwards by the superincumbent weight.   The
sole is the plate at the bottom of the foot, which should be slightly concave
downwards, and is fixed to the inner edge of the crust, and the outer sides
of the bars, and not to their lower surfaces.   Its usual thickness is about
one-sixth of an inch, but it will vary greatly in different horses, and it is
thicker where it runs back between the bars and the crust.   It is secreted

FIG. 86.—THE HOOF.

A. Outer surface of crust.
B. Inner surface of crust.
C. Upper surface of sole.
D. Part corresponding with the cleft
    of the frog.
E. Coronary band.

FIG. 87.—FRONT VIEW OF THE
FOOT, WITH THE HOOF RE-
MOVED.

A. Coronary substance.
B. 5000 Laminæ.

FIG. 88.—THE UNDER SURFACE
OF THE FOOT.

A. Cleft of frog.
B. B. Sole.
C. Cleft between heels.

in plates, which can readily be separated with a knife in that direction.
The *frog* is the prominent, triangular, and elastic substance, which fills up
the space between the heels posteriorly, the bars on each side, and the sole
in front.   In the middle is a longitudinal fissure, called the cleft, the sides
of which should form an angle of about forty-five degrees.   In front of this
cleft is a solid wedge of the elastic horny substance, constituting the frog,
which lies immediately beneath the navicular bone, and has received the
name of the *cushion*.   Posteriorly it is spread out into a thin band on each
side which covers the bulbs of the heels, and passes round the upper part of
the wall constituting *the coronary frogband* of Bracy Clark, which is con-
tinuous with the coronary substance.   The structure of the horn which
forms these three divisions varies a good deal.   In the crust it is fibrous,
somewhat resembling whalebone in this respect, but not quite so hard ;
these bristly fibres are united by a gelatinous substance, but they are
arranged so as to lie in straight lines descending from the coronary circle
to the ground.   The wall may, therefore, be considered as composed of hairs
agglutinated together, and each secreted by one of the villi, which are so
thickly spread over the surface of the coronary circle.   The sole is also

fibrous, but not nearly so much so as the wall ; and the fibres are not arranged in so parallel a manner, taking rather an oblique direction from behind forwards, and being more easily separated into scales. The frog differs from both, in possessing finer fibres and in smaller quantity, in comparison with the gelatine, which formation renders it more soft and elastic and also more prone to decomposition. The horny matter is sometimes coloured a greyish brown, sometimes white, and sometimes marbled by a mixture of the two colours. (These parts are shown more clearly in the article treating of Shoeing in Chapter xxxii.)

THE HOOF is developed by secretion, which has its seat in the coronary substance and laminæ. It consists in a pouring out on their surface of a plasma, in which rounded cells develop themselves, in correspondence with the villi from which the secretion is poured out. These cells are arranged in layers, corresponding with the secretory surface. In the crust this growth takes place from the superior border to the inferior, but in the sole and frog, from the internal surface to the external. This growth is constant through the life of the animal, and it would give the hoof an excessive development if it were not either for the wear of the soil in the unshod horse, or the action of the smith's knife in the shod one ; but the increase of the wall being solely from above downwards, it does not require any reduction on its external surface. The *coronary substance*, sometimes called the coronary ligament, is a fibro-cartilaginous band intervening between the skin of the leg and the hoof, covered with cuticle externally, and with villi, which form a secretory surface on the edge towards the hoof. It is most liberally supplied with blood, as we shall presently see, and is attached to the upper part of the
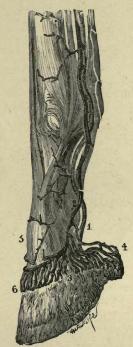
FIG. 89.—VIEW OF VESSELS OF THE FOOT, INJECTED.

1. Plantar vein.
2. Plantar artery.
3. Branches to the coronary substance and laminæ.
4. Posterior division of plantar artery.
5. Perpendicular branch.
6. Anastomosis with opposite plantar artery.

coffin-bone and extensor tendon by cellular tissue. It gradually becomes thinner as it descends upon the pedal-bone, and ends in puckers or folds, which are continuous with those of the laminæ, and are not even separable from them by maceration. The *laminæ* thus continuing upon the pedal-bone, consist of about five hundred parallel folds or plaits, plentifully supplied with blood, and forming a secretory surface, which aids the coronary substance to form the horn. They lie upon an elastic substratum of fibrous periosteum, which is of great service in taking off the jar from the foot in its battering upon hard roads, for it appears that the weight of the

body is suspended *from* these plates, and not carried *upon* the sole. The laminæ are continuous at the toe with the sensible sole, which is a vascular membrane covering the floor of the pedal-bone, and secreting the horny sole. In the centre of the posterior part of this is the sensible frog, which is of nearly the same shape as the horny frog, and is still more liberally supplied with blood than the sensible sole.

THE ARTERIES supplying these vascular structures with blood, and the veins taking it back, are of great importance. Commencing with the large metacarpal artery, which is the continuation of the radial below the knee, we find it descending by the side of .the tendo-perforatus under the posterior-annular ligament. Immediately above the fetlock joint it splits into three branches; the middle one passing to the deep parts of the leg, and the two others, forming the plantar arteries, descend on each side the posterior joint to the postero-lateral parts of the coronary substance. Here they divide into two leading portions, the anterior running round to meet its fellow of the opposite side, and giving off with it a complete fringe of vessels, which are displayed in the accompanying representation of an injected preparation of the foot. The branches uniting in front of the foot and encircling the coronary ligament are called the superior coronary circle. The posterior division of the plantar artery gives off, opposite the pastern joint, the artery of the frog, which descends obliquely inwards through the substance of the sensible frog, and divides into two branches within it, after which it supplies the whole of that substance with numerous vessels, and then goes on to the sole, to which it gives off a number of radiating branches. After giving off the artery of the frog, the plantar artery ends posteriorly in the lateral laminal branch which passes through the foramen in the ala of the os pedis, and supplies the laminæ. Thus the whole of these structures are full of blood-vessels, for not only are the arteries above described ramifying thus extensively upon them, but the blood is returned by corresponding veins.

THE PEDAL AND NAVICULAR BONES have been minutely described at page 383, but there are also two cartilaginous plates at the back of each ala of the pedal-bone, which are of considerable importance. These are called the lateral and inferior cartilages. The *lateral cartilages* extend backwards and outwards from the posterior and upper borders of the coffin or pedal-bone. They are united in front with the expanded terminations of the extensor

FIG. 90.—VIEW OF THE ARTERIES OF THE FROG AND SOLE, INJECTED.

A. Lower porous surface of pedal-bone.
B. Lateral surface of pedal-bone.
C. C. The plantar veins.
D. D. The plantar arteries.
E. Lateral cartilage contracted by drying.
F. Veins of the frog, injected.

tendon, and by cellular membrane with the lower end of the os coronæ. Posteriorly they wind upwards around the ala of the pedal-bone, to which they are firmly fixed, forming the foundation for the heel. But in addition to these lateral or true cartilages, there are also two others, of a fibro-cartilaginous nature, which commence from the sides of the former and proceed forwards towards the heels of the pedal-bone, and spread inwards upon the surface of the tendo-perforans. They are scarcely worthy of being described as distinct cartilages, and appear more like ordinary condensed cellular membrane.

It will thus be seen that the foot of the horse is a most complicated structure, which is liable to derangement whenever the hoof or horny case is interfered with, and this may occur either from mismanagement in shoeing, causing mechanical injury, or from inflammation of the secreting surface, which will end in the formation of imperfect horn, or from punctures or other wounds of the foot. Perhaps in no organ does an injury so soon produce a return at compound interest, for the inevitable first result is a malformation of the hoof, and this again only adds to the original mischief. Hence it is that in the foot, more than in any other part even, prevention is better than cure, for in many of its diseases it happens that a cure cannot be obtained without rest; and yet it is also the fact that the secretion of horn will not go on perfectly without the stimulus of necessity afforded by exercise. The position of the leg is such that its veins have a hard task to perform at all times in returning the blood from the feet, but when the horse is not exercised at all they become doubly sluggish, and congestion in them is almost sure to occur.

THE DISEASES OF THE HORSE

AND

THE ACCIDENTS TO WHICH HE IS LIABLE
WITH THEIR TREATMENT

CHAPTER XXV

THE DISEASES AND INJURIES OF BONE

GENERAL REMARKS—SPLINTS—RINGBONE AND SIDEBONE—BONE SPAVIN—EXOSTOSIS OF THE HUMERUS AND SCAPULA—FISTULA—POLL EVIL—CARIES OF THE JAW—OSTEO SAR-COMA—FRACTURES—SPLIT PASTERNS.

GENERAL REMARKS

THE DISEASES OF BONE are not commonly attended by any constitutional disturbance, and neither require an examination of general symptoms, nor the adoption of any but local treatment, beyond that attention to the health which is always necessary. They may all be included under the heads of, —1st. Exostosis, or increased growth of bone. 2nd. Caries, or ulceration. 3rd. Anchylosis, or unnatural union of two bones, in consequence of exostosis, or caries, or both. 4th. Fractures, or disunion by external force. Malignant diseases of the bone also occur very rarely in the horse, so that it will be scarcely necessary to occupy any space with their description, especially as they are perfectly incurable.

EXOSTOSIS is the result of increased action in the nutrition of the part, and is much more prevalent in young horses than in old. It may be recognized by a hard swelling of the part, which in recent cases is painful on pressure ; but sometimes its site cannot be reached with the finger, and the disease can then only be detected by its effects. A blow upon any of the bones when unprotected by anything but skin will produce inflammation followed by exostosis ; but the most ordinary cause is the over-stimulus of hard work. Heavy horses are more prone to exostosis than light ones, partly from the weight of their bodies and their high lumbering action

jarring their limbs in a greater degree, but also from the more spongy and open texture of their bones which admit of the pressure of large blood-vessels within them, and are thus more liable to congestion, and consequent morbid secretion. Exostosis is shown in the form of splints, ringbone, sidebone, or ossified lateral cartilages, spavin, as well as in the growths which occur occasionally in other parts of the body which have received no distinguishing name.

CARIES (ulceration) occurs as a consequence of inflammation, and in the horse either results from external injury, as in poll evil and fistulous withers, or from mismanagement, or heredity as in navicular disease, which latter affection will be considered under the diseases of the foot. It is always attended with pain, and in severe cases with the formation of sufficient matter to require an outlet, but in very restricted ulcerations, such as occur in navicular disease, the pus passes into the joint, and is reabsorbed with the synovia.

ANCHYLOSIS, when it is the result of caries in the two adjacent surfaces of a joint, produces union between them, but in the horse it is generally of a secondary kind, the result of bony growths (exostosis) thrown out from the surfaces of the two bones near the joint, which, coalescing, unite into one mass, and thus destroy all motion.

SPLINTS

THE STRICT DEFINITION of this disease is "an exostosis from the lower part of the small metacarpal bone, connecting it by bony union with the large metacarpal bone," but among horsemen, any bony growth from the cannon-bone is considered a splint, and the latter is almost as common as the former. The regular splint rarely attacks the outer small metacarpal bone alone, but sometimes in very bad cases both are implicated in the disease, a specimen of which is given in Fig. 92, on next page. It is difficult to give a valid reason for this greater frequency of splint on the inside than on the out, but it is commonly said that the inner splint-bone receives more of the weight of the body than the outer one, and that it is more under the centre of gravity, but as it is merely suspended from the carpus, and is not supported from below (in any way, mediately or directly), this can produce no injurious effect upon it. The fact is so, however, whatever may be the cause.

The Symptoms of splint are generally a greater or less degree of lameness during its formation, but sometimes it may go on to attain a large size without any such result, especially if its growth is slow, and the horse is not severely worked. While the periosteum or membrane covering the bone is inflamed and stretched, much lameness is often present, but when the first inflammatory action subsides the animal may go sound again. Thus we find a young horse come out sound and fall lame on the journey when splint is the cause, while a foot lameness may be marked on the starting, but pass off on the road with the increased circulation of the blood, and additional secretion of synovia or joint oil. A night's rest and a cold bandage may appear to restore the animal to soundness, but on being put to work or even moderate exercise the lameness will often recur. Though splints or exostoses which

would be so called on the front legs often occur on the hind-limbs they are seldom a cause of lameness. There are some horses with what has been called a bony diathesis, prone to throw out bony deposits with the slightest provocation and sometimes with no other cause than the weight of their own bodies. Chargers and other light horses that have been sound enough

FIG. 91.—SPLINT ATTACHING INTERNAL SMALL METACARPAL BONE.

1. Internal small metacarpal bone.
2. External small metacarpal.
3. Large metacarpal bone.
4. 4. Bony growth constituting a large splint, and attaching the small to the large metacarpal bone.

FIG. 92. ENORMOUS SPLINT, ATTACHING BOTH SMALL METACARPALS TO THE LARGE.

1. Large metacarpal bone.
2. 3. Mass of exostosis connecting the three metacarpal bones together.

at their duty are apt to form these bony deposits when enforced idleness and good feeding combine to overload them with fat.

The importance or otherwise of a splint depends both upon its position and the age of the subject. Those situated high up and near the knee or backward, so as to involve the tendons or their sheaths, are of serious import, while there is no great objection to their presence if well forward, not long and diffuse, and upon the lower third of the splint-bone. If large enough to be in danger of being struck by the foot of the opposite leg, they are dangerous as well as unsightly, and may bring down the rider without a preliminary stumble. Very few mature horses are to be met with that are

absolutely free from some callosity that may be called a splint, and notwith-standing the fact that they seldom give trouble, they are, as it were, sleeping dogs, and may at any time be awoke to activity and be a source of lameness when the subject is put to unusual exertion.

The Treatment of a splint will depend upon the state in which it exists, and upon the purpose to which the horse possessing it is destined. If no lameness exists, and the blemish is not objected to, it is far better not to meddle with it, for in the course of a few years it may disappear by absorption. Although lameness from splint will generally cease with complete rest, there will in the majority of cases be a larger growth when thus left to nature, than if treated with some blistering material. Of these there are a great variety, but probably for the particular purpose under review none answers so well as biniodide of mercury in the form of an ointment, and in the proportion of one to seven, eight, or ten parts of any convenient vehicle, as lard, vaseline, lanolin, or butter. Before applying it the patient should have an aperient dose of from three to five drachms of aloes (see Physic). The patient should be secured to the pillar reins when blistered for this or any other cause in front, and there is a right and a wrong way of setting about it. Two stout hempen halters, the one put on in the usual way and the other left-handed, are to be preferred to any kind of bridle and bit, since some horses are very violent when suffering the pain of a blister, and not a few mouths have been injured by a reckless disregard of consequences in trying to get at the seat of pain. The halters should be so fastened that the patient cannot get his head low enough to touch the blistered parts by raising the limb. The veterinary surgeon takes all necessary precautions, while the damaged muzzles and eyes one often sees as the result of amateur blistering are generally to be traced to the neglect of these very necessary restraints. The morning should be chosen for operations of the kind when the groom is in attendance, and can pacify the patient and see that he does not get into any difficulty. The worst of the pain will then have passed off before the attendant leaves his charge for the night. Many of the destructive blisters advertised at extravagant prices should be avoided, as they too often contain bichloride of mercury and induce sloughing of the skin and permanent blemishes which no after-treatment can avail to remove. Splints vary so much in size, as well as in their production of lameness, that no absolute rule can be laid down as to their treatment—in one case a single application and two or three weeks' rest may prove all that is needed, while in another it should be repeated at short intervals several times. In some of the diffuse splints before referred to, the seton may have to be adopted, or scarification. Neither of these operations should be attempted by the horse-master, who had better seek the aid of a capable veterinary surgeon when any but a simple splint has to be treated. It is the custom to clip the hair closely over the part to be blistered, and it certainly looks more workmanlike, but is not at all necessary if the inunction of the blistering material is thorough. Some eminent veterinarians prefer not to clip any but a coarse, hairy leg, giving as a reason the probable greater amount of absorption to follow from the pressure of a dry hard scab. The "quality of mercy" makes one wish to soothe an inflamed leg next day with warm fomentations, but it had better be left alone, taking care only to anoint with some simple dressing, as lard or

vaseline, the skin below the blistered portion in order to avoid scalding the sound skin with matter from above. To the judgment of the professional attendant should be left the question of firing in those cases where other means have failed, or from the nature of the exostosis make it probable that they would so fail. Pyro-puncture is the name given to the operation which leaves the minimum of blemish if the actual cautery must be used. It is done with an instrument having a number of fine steel points, or else by the insertion at regular intervals of a pointed iron or an aluminium point heated by passing the vapour of benzol through an apparatus designed for the purpose, and of great utility to the expert, but not to be recommended to the amateur, since it requires a good deal of practice for its efficient use, is very costly, and liable to get out of repair. Line firing, or "diamond," is also adopted with success in many instances, and would appear to have the effect claimed by its advocates of binding down the parts, as it were, with a permanent bandage and support, but the value of an animal so operated upon is, of course, very much lessened, as he will never lose the marks.

RINGBONE AND SIDEBONE

These terms, often indifferently used by the horseman, are quite distinct, as affecting different structures. Ringbone, like splint, is a growth of bone upon bone, while sidebone is the conversion of cartilage into bone.

Ringbone for convenience of description is generally divided into high and low, and first received its appellation from the growth surrounding or nearly surrounding the bones affected. It is called high when growing upon the long pastern (os suffraginis), and low when the short bone (os corona) is affected. Both may be involved and include the pedal or coffin-bone as well in one mass of bony deposit, uniting them into a common anchylosis and destroying their natural movements.

The fore-limbs are more prone to this disease than the hind, but any or all may be affected. Heavy draught-horses are such frequent subjects of sidebone (ossification of the lateral cartilage) that it is probable in time to come it will have to be no longer considered as a cause of unsoundness, but an example of evolution.

Symptoms.—Lameness as a rule accompanies the formation of ringbone, but in many heavy animals used only at a walking pace a considerable deposit often takes place without being observed, until some unlucky twist or slip excites active inflammation, and calls attention to the cause. With light horses the concussion produced by faster paces is pretty sure to produce early lameness, the animal as a rule failing in his work rather than showing a "stable" lameness. Careful manipulation will generally demonstrate the seat of pain, and early treatment is hopeful.

Treatment of ringbone is very similar to that of splint, but more time should be allowed for rest before putting the animal to work. Care should be taken to avoid irritating the hollow of the heel by filling it first with lard before using a blister.

Sidebone.—The lateral cartilages described elsewhere as prolongations of the pedal-bone should in a sound horse yield to the pressure of the thumb, and in the very young animal be easily compressed towards the heel, but in

the heavy draught-horse they become dense at an early age, and to find a mature animal that has been long at town work without some degree of ossification is the exception rather than the rule. Many horses so affected work sound year after year without suspicion of lameness, but in their case the gradual deposition of ossific matter in place of cartilage cells never amounts to inflammatory action but merely degeneration. With others, particularly the carriage-horse and the hack, lameness is a first symptom,
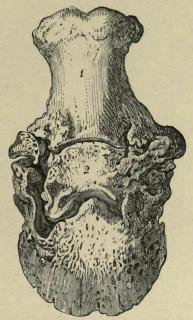
FIG. 93.—CASE OF RINGBONE AND SIDEBONE OCCURRING IN A HEAVY DRAY-HORSE.

1. Os suffraginis.
2. Os coronæ.
3. Os pedis.
4. Complete union by ossific matter between the os pedis and os coronæ, but still incomplete in the joint above.
5. Complete union of the three bones.

and the affection is of much more serious import in horses destined for fast work. Causes are heredity, concussion, and blows, as from treads. Bad shoeing undoubtedly contributes toward its production.

The Treatment.—While splints, ringbones, and other ossific deposits may be wholly absorbed in course of time, and as the result of exciting the absorbent vessels with blisters, the same cannot be said of sidebones. They may be greatly modified by similar treatment, and " cured " for all practical purposes, but the cartilage never parts with the bone cells that have been deposited within its proper structure. The diminution of a sidebone so noticeable as a result of successful treatment is due to absorption of the surrounding deposit upon the other structures adjacent, hence it does not make the horse *sound* from a buyer's point of view—the expert will still detect it.

The lameness of sidebone is not merely the result of change of structure,

as we have seen in those cases that have continued at work without detection, but is caused by pressure of the growth upon some sensitive part. The application of blisters where sidebone is the trouble should include the whole coronary band, as stimulating it to increased activity results in the early formation of a new ring of hoof larger than before, and giving room to the morbid growth of bony material which may be undergoing absorption at the same time.

Bad cases are treated with the firing-iron both by puncture and lines, when it is usual to draw the hot iron through the coronet with a view to "opening it out," as it is called. Recognizing the need of giving additional

FIG. 94.—SIDEBONE.

1. Pedal-bone.   2. 3. The lateral cartilages ossified.

room in the foot in bad cases of sidebone, Major Fred Smith has adopted the plan of sawing through the hoof and putting the horse to work almost immediately.

The shoes should be removed and tips take their place to protect the toe from breaking away. This should be done either before operation or else deferred for two or three weeks till the first soreness has passed away, and it becomes possible to handle the parts without giving pain or causing blemish, but the foot should never be deprived of protection during the action of a blister, as the crust is very liable to be broken by the horse pawing with the pain. The necessary restraint which adds so much to the discomfort of a blistered horse may be the sooner relaxed by using what is known as a cradle. These can be purchased of saddlers ; but a handy man can make one in an hour with a bundle of sticks and some string. When this appliance is adjusted round the neck so that the patient cannot gnaw the tender spot, he may have the liberty of a loose box or paddock. In case of a horse scratching his head with a hind-foot, the cord employed in the cradle should never be so stout and strong as not to break away if he hangs up in it. For the same reason an orchard is a bad place to turn out, as offering inducements to rub, and adding to the risks of getting hung up.

BONE SPAVIN

THIS DISEASE, so frequently the cause of lameness in those horses which use their hocks severely (as for example race-horses, hunters, carriage-horses, cavalry, and more particularly cart-horses), consists in exostosis from the

adjacent external surfaces of the tarsal bones, always showing itself at the inner side of the hock joint, on the scaphoid and cuneiform bones, and extending to the head of the internal small metatarsal bone. As in the case of splint, the occurrence of exostosis on the internal rather than on the external side of the hock has been accounted for by the supposition that increased weight is thrown upon the internal small metatarsal bone, from the turning up of the outer heel of the shoe, which is the common practice of smiths. It appears to me, however, that the contrary is the case, and that though more stress is laid upon the foot on that side, there is less weight on the inner side of the hock, which has a tendency to spring open in that direction. This will cause a strain upon the ligaments connecting the tarsal bones, and nature coming to their aid throws out bone, which ultimately substitutes anchylosis for ligamentous union between these bones. In all the actions of the hind-leg, from the natural shape of the hock, and more especially in those horses which are naturally "cow-hocked," there is a tendency to yield inwards rather than in the opposite direction. The consequence is that there is more strain upon the ligamentous fibres which connect the scaphoid with the two cuneiform and the internal metatarsal, than upon those uniting the cuboid with the os calcis and external metatarsal bone. Hence, although exostosis does sometimes show itself in other parts of the tarsal bones, it here, as in the foreleg, is almost always confined to what is called the "spavin place," namely, the contiguous surfaces of scaphoid, cuneiform, and internal metatarsal bones. In very bad cases the articular cartilage

FIG. 95.—ANTERO-INTERNAL VIEW OF EXOSTOSIS CONSTITUTING SPAVIN.

1. Os scaphoides.
2. Os cuneiforme parvum.
3. Morbid growth of bone, constituting the disease known as bone spavin.
4. Large metatarsal or cannon bone.

becomes involved, and there is not only an external casing of new bone, but the internal surfaces absolutely coalesce or anchylose.

Symptoms.—Lameness is an almost invariable symptom at the commencement, and may continue throughout the life of the animal. As a rule, the pain and consequent lameness is most manifest when first coming out of the stable or after a rest. Many horses continue to do useful work though spavined, as they "warm up" as it is called, and throw off all symptoms of pain when they have gone a little way, as many an inexperienced purchaser has learned to his cost; though he may not have "swopped horses in crossing a stream," he may have purchased a horse with spavin that comes out dead lame after the day of the fair at which he was sold.

In the early stages of this affection it is often difficult to detect, and

needs the trained hand and eye of the expert whose intimate knowledge of the anatomy of the joint enables him by careful comparison and the particular action of hock lameness to decide as to its nature. When developed, a hard bony enlargement can be both seen and felt.

The Treatment should be directed to the abatement of the inflammation which gives rise to pain, and also to promote absorption of the new growth. It is often asserted that the disease cannot be cured, and that a spavined horse will always remain the subject of it, and therefore unsound. But practically it is known that many a hock which has been the seat of undoubted spavin loses all external enlargement, and no lameness is shown in it, although tried most severely through a series of years. Still on dissection after death, the ligaments will not show their natural white and glistening structure, and the tarsal bones will be to a certain extent united by anchylosis. In very bad cases there will be also caries of the articulatory surfaces, and with it inflammation of the synovial membranes, which may and often does exist without the caries. Now as these are much more formidable diseases than exostosis, and far more difficult either to cure or palliate, it follows that although certain remedies will be generally successful with genuine bone spavin (exostosis), yet they will fail when the above complication exists. This ulceration of cartilage is known as *occult* spavin, and often puzzles experts to decide positively as to its existence. Experiments have been recently made with the Rontgen rays which may lead to a more certain method of diagnosis. A correspondent of *The Field*, July 18, 1896, writes :—

"By the courtesy of the Dean of the Royal Veterinary College, Professor J. M'Fadyean, I witnessed within the last few days further experiments in the new photography by Professor Hobday and Dr. Rowland. This time the subjects were a dead horse and a living donkey. Each exposure lasted about five minutes. The parts examined were the near knee and hock of the horse and the near hock of the ass. The photographs show well-marked spavin in the anchylosed condition of the hock joints. The results in each case may be considered satisfactory, and give promise of considerable utility in the future, after further experiment and experience shall have perfected the application of the new photography to veterinary purposes.

"The living animal—the ass—had to be subjected to chloroform ; and here one of the great difficulties in applying the new science to animals arises. They cannot be made to keep still long enough to be photographed by the process without the use of anæsthetics, and even then the operation may not at all times prove satisfactory.

"Professor Hobday and Dr. Rowland are, I believe, the first—at least in this country—to apply Rontgen rays to veterinary diagnosis."

The treatment must therefore be adapted to the exact nature and extent of the disease. Prior to the adoption of any plan the joint should be rested, the outer heel of the shoe should be lowered, the corn should be taken away, and the system cooled by appropriate treatment. After these precautions are taken, the next thing is to decide upon the remedies which will be suited to the case. They consist in—1st. Blisters, which have a tendency to cause absorption ; 2nd. Firing ; 3rd. Setons, with or without subcutaneous scarification ; 4th. Division of the nerve. If there is simply a slight exostosis, with little lameness, and no evidence of the joint being implicated, the biniodide of

mercury may be applied as described at page 509. Repeated dressings will be necessary, and the joint must have at least two months' absolute rest, the horse being placed in a loose box. This remedy is often successful, but it will fail utterly where the exostosis is extensive, or there is caries, or even severe inflammation of the synovial membrane. Firing is the usual plan adopted for spavin, and on the first intimation of the disease it is often adopted. Its chief advantage is, that while it is a certain means of establishing a strong counter-irritation, it has no tendency to cause any increase of inflammation in the structures beneath the skin, and therefore the good it does is unalloyed by any counterbalancing evil. It is now the fashion to deny its use, and horse-masters are often tempted to try some substitute for it in the hope of escaping a blemish ; but too often they are compelled to submit to it at last, and probably after the disease has been aggravated by some "unfailing" remedy. If there is a strong desire expressed to avoid a blemish, the veterinary surgeon is perfectly warranted in doing all in his power to effect a cure without the use of the irons ; but the mere fashion of the day should not induce him to decry a plan which has for so many years been proved to be successful. In human surgery the same course has been adopted, and for the last thirty or forty years the actual cautery has been voted "barbarous" in this country. Now, however, a counter current is setting in, and it is the general opinion of the first hospital surgeons of the day that, in certain diseases of the joints, no remedy is so efficacious. All sorts of attempts are made to render the use of the hot iron less repugnant to the senses ; but in the case of the horse it is only necessary to measure its comparative utility and the amount of pain which it gives. The former has been already considered, and as to the latter, if the irons are properly heated, I much doubt whether their action is not less painful than that of any other counter-irritant.

Setons, perhaps, give less pain if skilfully inserted, and they are admirable remedies, having nearly the same beneficial effects as firing, and leaving a far slighter blemish. They should be passed beneath a considerable track of the skin, covering the "spavin place," and the tape requires to be smeared with blistering cerate to produce sufficient irritation. Their use by themselves is often sufficient, but when preceded by subcutaneous scarification they seem to act even more certainly than firing. Mr. Holmes, of Beverley, has obtained great celebrity for his treatment of spavin on this plan, and undoubtedly not without foundation. Some of his cures have been very remarkable, as even old-standing and extensive growths of bone have been reduced, and the hocks have remained sound afterwards. It requires an intimate knowledge of the anatomy of the parts to avoid doing mischief by cutting into one of the joints. There is always afterwards considerable effusion into the subcutaneous cellular membrane, demanding two or three months for its removal : but as the spavined horse requires that interval of rest, this is of little or no consequence. When the disease has gone so far that no method of treatment will remove it, the nerve above the hock may be divided, which will enable the horse to work without pain for a time, but the disease goes on the faster, and the benefit derived is only temporary.

EXOSTOSIS OF THE HUMERUS AND SCAPULA

THE HEADS OF THE BONES adjacent to most of the joints of the body are more or less subject to exostosis, though not so frequently as those of the pastern-bones and tarsus. Next to these probably comes the shoulder joint, the neighbourhood of which is often the seat of this disease, but seldom to
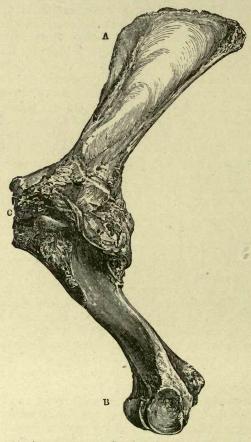
FIG. 96.—ANCHYLOSIS OF THE SHOULDER JOINT FROM EXOSTOSIS.

A. Scapula.
B. Humerus.

C. D. Exostosis around the shoulder joint producing anchylosis.

the extent shown in the case from which the accompanying engraving is taken. It represents the left scapula and humerus of a horse, which were completely anchylosed, and of course there co-existed a proportionate amount of lameness during the progress of the disease, while after the anchylosis took place the want of action must have been complete. An examination by the hand of the point of the shoulder would readily detect so large a growth of bone as this; but smaller ones are occasionally thrown out beneath

the mass of muscles surrounding the shoulder joint, and consequently beyond the reach of the most accomplished finger.

Treatment.—If a correct diagnosis could be made it is extremely doubtful if any treatment would be successful, such cases generally are not seen except at post-mortem examinations of subjects that have long been valueless. It has only a pathological interest to the veterinary student, and may be dismissed as beyond the scope of this work.

FISTULA

FISTULOUS WOUNDS are met with in other parts besides the withers, but to the horseman fistula means an open wound following upon a swelling in or near the shoulder-blades or that part of the animal designated the withers. It is at all times a troublesome disease, and not rarely incurable for reasons that will presently be seen.

Causes.—These are blows and contusions, not necessarily violent but repeated, as when an ill-fitting collar jolts upon the withers in going downhill, or a saddle too narrow or in want of stuffing pinches the tissues beneath. In the gentleman's stable fistula is now of rare occurrence, and was becoming less common in agricultural districts until the general adoption of mowing-machines, which have proved very fruitful of wrung and fistulous withers. The first indication may be " collar pride," or the patient slave may endure the pain of a forming abscess until an enlargement is observed by the attendant. The swelling, at first hard and extremely painful, becomes softer as matter forms beneath and gradually comes to a point, when it breaks, discharges a quantity of thick pus as in the case of an ordinary abscess, but instead of healing up, there is subsidence of the swelling and the establishment of a drain from which a thin but variable discharge is poured out, a puckered opening in the skin shows a distinct tube inside from which the matter flows, and if this is traced to its source branches may have been established which run under the blade-bone (scapula), and ramify among the loose connective tissue, where, in the living subject, it is impossible to reach except by the forcible injection of fluid agents. These constitute the incurable division, but there is often very little pain and perhaps no lameness in an old-established case, and such horses are worked for years in country districts where visits are not expected from officers of the Royal Society for the Prevention of Cruelty to Animals. No doubt many horses with this disease can work in a breast-collar without pain or inconvenience, but it can hardly be supposed that an ordinary collar can be so fitted as to avoid pressure upon the parts affected.

Treatment.—Early recognition of the injury and fomentation with hot water may bring the abscess to a head so quickly as to avoid the burrowing which causes the establishment of the drain. When the soft place or "point" of the abscess yields very readily to the pressure of the finger, it may be assumed to be ready for the lancet, which should be boldly plunged into it, and the matter evacuated by gentle pressure of a sponge dipped in moderately hot water. A pledget of tow dipped in turpentine and pushed into the cavity will ensure its pretty complete evacuation the next day, and

promote the healing process by granulation within. It is an old-fashioned method, but attended with so much success as to merit notice as an alternative to the more modern treatment, which consists in syringing out the cavity with dilute carbolic acid, a solution of bichloride of mercury or of Condy's Fluid, and attempting to retain a lotion similarly constituted on a wetted pad in contact with the wound. The patient generally frustrates these attempts on the part of the surgeon, and it is usually best to apply dry powders in the shape of iodoform, boric acid, or salicylates which can be dusted over the parts from time to time.

If a fistula is once formed, or there is even reason to suspect it, heroic measures should be taken. There is really nothing to be feared from the use of the most powerful agents, and those men to be met with in different parts of the country who undertake to cure on the principle of "no cure no pay" meet with a large measure of success, because they have no fear of bad consequences from the use of those destructive agents whose properties they do not understand in any other connection. A cure is often effected without obtaining a depending orifice or introducing a seton ; the powerful escharotics employed appear to have the effect of sloughing out all the impediments to discharge of the deep-seated matter, and granulation taking place from the bottom of the wound eventual recovery is certain.

This rough, and, as we have said, often successful method of treatment does not commend itself to the modern surgeon, who will accomplish his aim with greater certainty by observing the usual rules and seeking for effectual drainage, sometimes by the introduction of a drainage tube, at others by a seton, as circumstances may dictate. A tube may be pushed into the furthermost extremity of the sinus when it is not possible, from its situation, course, and direction, to obtain a dependent orifice. The tubing sold by chemists for infants' feeding-bottles answers the purpose well, when notches have been cut at intervals of about an inch throughout the length to be used. It may be retained in place by a couple of stitches through the lips of the wound. Caustic solutions should be introduced by means of a syringe each time that the drainage tube is taken out and cleared of the matter which has a tendency to accumulate within it. The remedies usually selected are chloride of zinc, bichloride of mercury, sulphates of copper and zinc, and acetate of lead. The first-named has such an affinity for water, that when a solid stick of it is pushed into a sinus it will do its work more rapidly than any other agent, finding its way to the branches of a fistula, and occasionally succeeding when others have failed. Its chief disadvantage is, that when it has done its work the parts are so long a time in commencing to granulate. Bichloride of mercury either alone or in combination with sulphate of copper is most affected by the hereditary "specialist" referred to above. Nitrate of silver, in the large quantities often needed for established fistula, is expensive, and no better than the remedies named for destruction of the sinus, but promotes healthy and durable granulations in the final stage. If the discharge decreases in quantity and becomes thicker, assuming the appearance of healthy pus, and a probe brings up a stain of bright-red blood, it may be assumed that repair is taking place, whether or no a slough or "core" has been cast out of the wound. The caustic dressings will be no longer needed, cleanliness and free drainage being all that is necessary.

Setoning is a generally successful plan where enlargement takes place on both sides of the withers, and one is higher than the other. If the long needle used for the purpose is made to follow the direction of the sinus and passed from above downwards, coming out on the other side in such a manner as to form a drain, both abscesses are simultaneously drained. Tape or stout cord is generally employed, and the ends secured by knotting, or a piece of wood. Tying the ends in a loop has the objection that it may hang up. The seton is dressed with one or more of the agents before mentioned, and from time to time drawn backwards and forwards until there is reason to suppose from the character of the discharge that its presence is no longer necessary.

POLL EVIL

Poll evil is now rarely met with in good stables, but almost confined to the low dark dens in which the poorer class of townsmen stable their horses, or the mean hovels that do duty in some agricultural districts. The disease is of similar character to that of fistula and caused in the same way. It has been frequently traced to blows on the poll in going through low doorways, or from the pressure of ill-fitting and heavy harness, and occasionally, it must be added, from wilfully striking a horse between the ears.

The Symptoms are restiveness when the collar is put over the head and the bridle placed upon it, soon to be followed by swelling and the formation of an abscess. This is often a very long time in forming, but sooner or later it breaks, discharges, and leaves a fistulous wound.

Treatment is the same as for fistulous withers, but more care must be exercised in the use of powerful caustics, as that portion of the spinal cord between the two first bones of the neck (Atlas and Dentata) is comparatively open and liable to injury. Many cases prove incurable as the sinus runs under the wing of the atlas and cannot be reached by surgical or other means.

CARIES OF THE JAW

The upper jaw, from its exposed situation, and the lower from the same cause, and also from the abuse of the bit, are liable to mechanical injury, which ends in caries (ulceration), or sometimes in necrosis (mortification), of the part. Caries of the lower jaw, between the tushes and grinders, is extremely common, owing to the barbarous punishment which is inflicted by the use of long levers to curb bits, together with tight curb chains. The bony plate forming the roof of the mouth is also often injured by the pressure of the part when a tight nose-band is employed to keep the mouth shut. Either may be known by the existence of a sore of a peculiar character; there is a depression indicating a loss of substance, and in this lies a mass of unhealthy granulation (proud flesh), *which is not attached to the surrounding surface, being only fixed to the bottom of the cavity,* or perhaps partially on one side. A watery and offensive discharge goes on constantly, but this is lost in the saliva, and very often the only circumstance that draws attention to the disease is the constant bleeding from the

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mouth, on the slightest contact of the bit. When this occurs, the mouth being full of *pink* froth, it should be carefully examined, and the state of things here described will generally be found to exist. The *treatment* should consist in the adoption of a bit pressing upon another part of the mouth, changing the curb for a snaffle. The wound should be kept open by the use of caustic (lunar) daily, which should be pushed deeply into it for a couple of seconds, and will destroy the unhealthy granulations. By continuing these measures, taking care not to do more with the caustic than necessary to keep down the fungous growth, a cure can always be effected in course of time, without the aid of the trephine or chisel to cut away the diseased bone.

OSTEO SARCOMA

THE JAWS are occasionally attacked by a malignant growth from their cellular structure of a substance partaking of the nature both of cartilage and bone. It increases sometimes to an enormous size, and forms a large irregular tumour, which interferes terribly with their functions, often
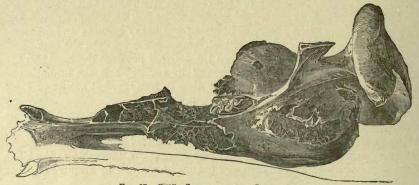
FIG. 97.—OSTÉO SARCOMA OF THE LOWER JAW.

growing so as to prevent the closure of the teeth. This disease is represented in Fig. 97, as far as the osseous tissue is concerned; but the soft growths, which occupied the central parts of the tumour, have been removed by maceration. The *symptoms* are entirely local, and when a large, unwieldy, and irregularly hard swelling on either of the jaws is met with, it may safely be set down as belonging to this class of disease. No *treatment* is of any avail except excision, which can rarely be carried through without rendering the horse unserviceable for his ordinary duties.

FRACTURES

BONES are not unfrequently broken in the horse; but as the accident generally occurs either during the violent exertion of the muscles of the limb, or from great external force, it follows that in most cases the injury to the soft parts is so great as to forbid the hope of a perfect reparation.

The veterinary as compared with the human surgeon is at a great

A TYPICAL RACEHORSE (PLUTUS).

Sire of a famous progeny.

disadvantage, his patient will not lie in bed restrained by the fear of being a cripple for life, but as a rule uses his best endeavours to undo every kind of appliance that ingenuity can invent. Neither is it enough to have saved his life and turned him out of hospital on crutches; he must be absolutely sound again or he will never repay the owner for maintenance—not to mention his doctor's bill. It is for this reason that horses with broken bones are usually slaughtered, and not as many people suppose because nature will not repair fractures in this animal. Broken bones are, however, often successfully treated by country practitioners in colts and young horses on grass or farm keep, where as a matter of mere business calculation it would not pay to attempt it in the town-kept and adult horse, unless for some exceptional reason, as in a mare sufficiently valuable to be retained for breeding.

THE SYMPTOMS OF SIMPLE FRACTURE are a greater or less degree of deformity of the limb, swelling, pain on motion, and a peculiar grating or jarring which is felt rather than heard, and which has received the name of "crepitus." The last symptom can only be made out when the broken ends of the bone can be brought together; but when this is impossible, the alteration of form is in itself sufficient to lead to a detection of the nature of the accident. In fractures of the head and spine there is no crepitus felt, and the effect of pressure upon the brain and spinal cord will be often the sole means of coming to a correct diagnosis. Fractures of the pelvis are very difficult to make out, unless the ala of the ilium is broken off, which is a common accident, for here the unnatural flatness of the hip, showing itself without any great difficulty of moving the hind-leg of that side, plainly marks that there is no dislocation, and that the case can only be one of fracture. It is always the result of a blow, either when the horse is cast in a stall or in passing through a narrow doorway, or from a similar cause; and there will therefore be some swelling of the soft parts which will interfere with the examination at the time, but as nothing can be done to restore the broken portion to its place, and as there is no doubt about the diagnosis from dislocation, this is of little consequence. Fractures of the ribs cannot be readily detected; but as they almost always follow a kick on the part, and as they do not require any treatment unless their broken ends press upon the important viscera of the thorax or abdomen, it will be well to wait for the symptoms which are caused by this mechanical irritation before resorting to bandages, etc. When a fracture occurs in any of the bones of the limbs which are concealed by a large mass of muscle, the total inability to use the member, and the loose way in which it is connected to the body, so as to allow it to be moved in any direction, indicate the general nature of the case without difficulty, though a careful examination must be made by a skilful surgeon before the exact particulars relating to it can be ascertained.

The Treatment will depend upon the bone which is broken, and whether the fracture is simple or compound. In most cases of the latter description none will avail, and the horse had better be destroyed.

IF THE BONES OF THE SKULL are fractured, unless there are symptoms of pressure on the brain, it is advisable to leave all to nature, simply keeping the patient quiet and low, and, if in a high state of plethora, bleeding and physicking.

A BROKEN LOWER JAW is by no means uncommon as the result of a kick. The best treatment is to set the fracture, and then mould some gutta-percha to it, which may be confined behind by strips round the forehead and poll, and before by a padded strap passed through the mouth between the nippers and tushes, and beneath the tongue. The horse must be fed upon mashes and steamed food. A special apparatus known as a face cradle has been invented by Mr. Walker, Veterinary Surgeon, of Bradford, and is illustrated in Professor Williams' work on veterinary surgery.

IN FRACTURES OF THE SPINE AND PELVIS nothing can be done beyond rest and lowering, if necessary, by physic.

BROKEN RIBS, when they cause inflammation of the lungs or liver by their sharp ends pressing upon these organs, may be treated by buckling two or three ordinary rollers abreast of one another tightly round the chest, so as to prevent the natural dilatation of the thorax, which takes place in inspiration, and which keeps up the irritation by constantly moving the ends of the ribs. The general means necessary to adopt to relieve the internal mischief will depend upon its extent.

WHEN EITHER THE SCAPULA, HUMERUS, OR FEMUR is broken, all that can be done is to sling the horse, and by bandages endeavour to bring the limb into as natural a position as possible, and keep it there. There must of necessity be great displacement of the ends of the bones, and these cannot by any means be brought into apposition; but the sides in contact with one another, as they over-ride, will unite in course of time, and this is all that can be achieved by the utmost efforts of the veterinary surgeon.

FRACTURES of the lower part of the tibia, of the radius, of the cannon-bones, if simple, must be treated by adjusting the ends (which is the chief difficulty, and will often require strong extension to be employed), and then adapting to the sides of the bones splints of wood, gutta-percha, plaster of Paris, lead, or other flexible metal.

If, by the aid of assistants, the parts can be brought into a good position, these may be carefully adjusted to maintain it, and may be kept in place by tapes or straps fastened moderately tightly around them. It is useless, however, to attempt a minute description of the means to be employed, which can hardly be understood without a demonstration. Many horses have recovered a fair use of the limb by the application of splints, without slinging, as they will take care to avoid resting on that foot in consequence of the pain it gives; but under the care of an accomplished veterinary surgeon slings will afford the best chance of recovery.

SPLIT PASTERNS

IN THE ADULT HORSE THE FRACTURE most often treated with success is that occurring in the long or short pastern (os suffraginis and os corona). If broken transversely the case is not very hopeful, or if splintered into numerous fragments as sometimes happens; but in what is called a split pastern, where the fracture occurs in the long axis of the bone, the probabilities are in favour of recovery. There may result a considerable ring of bone around the pastern, but much of it will be afterwards absorbed.

Treatment consists in a cooling dose of aperient medicine and mechanical

support.   This may be given in a variety of ways, but there is probably none better than a preliminary wrapping with tow (to avoid making the skin sore), and then a series of starch or glued bandages which are retained in their proper place if the heel is filled up with tow or wool and they are put on from the hoof upwards.   With three legs to rest the weight upon the patient generally learns to get up and down without injury to the affected limb.   If he does not do so, slings may be tried, but they always need a watchful eye to see that they do not cause sores or get too slack when the horse has learned to depend on them.   Patients in slings for whatever cause vary very much in behaviour; with some they are the means of saving life and with others of practically no use.

CHAPTER XXVI

INJURY AND DISEASES OF THE JOINTS, MUSCLES, AND TENDONS

DISEASES OF MUSCLE, TENDON, AND LIGAMENT—INFLAMED TENDINOUS SHEATHS—IN-FLAMED BURSÆ MUCOSÆ—STRAINS—THOSE OF THE BACK AND LOINS—OF THE SHOULDER—OF THE KNEE—OF THE FETLOCK—OF THE COFFIN JOINT—OF THE SUS-PENSORY LIGAMENTS—OF THE BACK SINEWS—BREAKING DOWN—STRAINS OF THE HIP JOINT, STIFLE, AND HOCK—CURB—DISLOCATION—WOUNDS OF JOINTS.

DISEASES OF MUSCLE, TENDON, AND LIGAMENT

MUSCLE is subject to simple atrophy, with or without fatty degeneration The disease shows itself by a wasting away of the part, accompanied by a flabby feel to the touch.   It is often difficult to account for the sudden wasting of a part that has not been thrown out of use by lameness or other recognized cause.   The theory most generally accepted at the present day is some injury to the nutrient nerves of the part.

In agricultural districts it is by no means rare for colts, which are put to plough at two or three years, to manifest a sudden atrophy of the shoulder muscles, particularly those on the blade-bone (antea and postea spinatus), but in such a case it can easily be imagined that the position of one foot on the ridge and the other in the furrow may result in some injury to the immature tissues of the animal.   Recovery is however the rule, and it is generally supposed that friction with some stimulating liniment assists to restore the muscles, whether by rousing the nerves to greater action or merely by bringing increased nutrition to the part by a greater blood supply is not clear, probably both.

ACUTE INFLAMMATION OF THE SYNOVIAL MEMBRANE is seldom met with ; but a chronic state, inducing an excessive secretion of synovia, is extremely common.   The most usual situation is at the hock, where the swelling has

received the name of bog-spavin and thoroughpin; but they also occur at the fetlock and knee joints; in the former case being sometimes confounded with windgalls, which are inflamed bursæ mucosæ (see Windgalls).

BOG-SPAVIN is very apt to attack young horses when they are overworked before being fully seasoned, but it may occur at all ages. It shows itself at the inner side of the joint, because here the ligaments are wider apart, and there is more room for distension. Its seat is the capsule between the tibia and astragalus, which is here unprotected by any strong fibrous covering, and readily yields to the gradual pressure of the secretion from its internal surface (see Fig. 58, G H, page 425).

THOROUGHPIN may be either an increased secretion of the synovial capsule, between the astragalus and os calcis, or between the scaphoid and cuneiform bones, or of the bursa mucosa lying between the tendo Achillis and the tendo perforatus. In the first of these cases it often coexists with bog-spavin, and the synovia may be made to fluctuate from one bag to the other, the only line of demarcation being the astragalo-calcanean ligament (see Fig. 58, G, page 425).

Both bog-spavin and thoroughpin may exist, or either separately, without occasioning lameness; but where they are just established, there is generally some small degree of active inflammation, which causes a slight lameness on first going out of the stable, but soon disappearing.

The Treatment should be by pressure, kept up for a long time, by means of a carefully-adjusted truss. Failing success by pressure, a blister-charge and a long rest may succeed. These are made of pitch, resin, and bees-wax with the addition of a small quantity of cantharides or Spanish fly. They are applied hot and covered with chopped tow or wool, which prevents the bedding from sticking to the part when the horse lies down. A slight amount of irritation of the skin is produced and some effusion under it, which acts as a cushion; the contraction and pressure of the charge acts for a considerable time as a bandage, as it does not as a rule come off until the hair of the part is moulted.

Line firing is also adopted for the production of a permanent support, as wherever the lines heal up a new and inelastic tissue takes the place of true skin, but this should only be resorted to when other measures have failed; it should be done thoroughly if done at all, the whole hock being covered. These dropsical conditions are successfully treated by an operation for the removal of the redundant fluid by an aspirator, under aseptic conditions, and an injection of a special preparation of iodine.

DELICATE YOUNG FOALS are subject to a rheumatic inflammation of their synovial membranes, specially displayed in the knees and hocks, and apparently caused by exposure to cold. It seldom goes on to produce disorganization of the cartilages, but the capsular ligaments are distended with thin yellow synovia, causing considerable stiffness. The cellular tissue around the joints also becomes œdematous, and the legs fill all the way down to the feet. It is commonly known among breeders as the "joint evil," and though in itself it is not dangerous, yet it marks the existence of constitutional weakness which is likely to occasion some more fatal malady.

The Treatment should consist in attending to the general health by strengthening the mare, which is best done by giving her a drachm of sulphate of iron in her corn twice a day. The joints of the foal should be

rubbed with equal parts of soap liniment and spirit of turpentine, and it should be assisted to stand for the purpose of sucking at regular short intervals if it is unable to help itself. In aggravated cases, however, the foal is not likely to recover its general strength, and it may be better to destroy it, but so long as it can stand and feeds well, hopes may be entertained of the joints recovering.

INFLAMED TENDINOUS SHEATHS

EVERY PRACTICAL HORSEMAN is aware that the sheaths in which the back sinews and other tendons are lodged are liable to inflammation and thickening, without the tendon itself being involved. By passing the hand down the leg, an irregular network may be felt surrounding the tendons, which move up and down without disturbing it ; and the surrounding cellular membrane is also thickened, and become hard and unyielding. There may be considerable heat about the part, but often it is quite cool ; and the disease may continue for months without any great lameness, and with nothing to draw attention to it (excepting a slight stiffness on leaving the stable) but the sensation communicated to the hand. At length, an unusually severe day's work sets up active inflammation, the leg rapidly fills, and there is so much lameness as to cause the horse to be thrown by.

Treatment.—In the early stage Captain Hayes recommends a compress of dry cotton-wool under a bandage, applied with a moderate degree of pressure. It is often surprising what this simple remedy will accomplish, but if it fail an evaporating lotion may be tried. Linen bandages should be saturated with it and frequently renewed, and only walking exercise permitted. In established cases where the thickening has become permanent a fly-blister may be necessary and a two or three months' rest. Chamois leather adapted to the shape of the leg and neatly sewn on is used both as a preventive and curative measure.

INFLAMED BURSÆ MUCOSÆ

THESE SYNOVIAL BAGS are liable to inflammation, either from hard work, as in windgalls and thoroughpin, or from blows, as in capped hock and elbow. The latter take on the character of serious abscesses. In all horses a subcutaneous bursa exists on the cap of the elbow and hock ; and these become inflamed and filled with a very thin synovia, when they are bruised. They never extend beyond a certain size, and have no tendency to burst ; nor are they inclined to a healthy termination of their own accord, but go on in the same condition from year to year.

CAPPED ELBOW can be successfully operated upon when it has passed the stage when friction may be expected to reduce it, and fresh injury prevented by a pad or cushion made specially to prevent bruising when the horse is lying down. The swelling, which is at first of a fluid nature, is sometimes cured by passing a drainage tube through it from above downwards. It may consist of india-rubber piping about a quarter of an inch in diameter, and having notches at frequent short intervals. Irritant agents are forced into the tube, and in this way the secreting membrane is destroyed. With-

out such treatment the tumour becomes solidified. The method of procedure then is to first cast the patient with hobbles, and then having secured him in a favourable position, make a bold incision the whole length of the tumour, dissecting out the cyst completely so that only the loose folds of skin remain. No portion of this apparently superfluous skin must be removed, as in a few days it will appear as if the operator had introduced a larger tumour instead of removing the existing one, so great is the subsequent swelling. This may be induced to subside and the tendency to fill up with new material prevented by the application of a fly-blister to the skin on either side of the surgical wound. In the majority of cases nothing more is left than a slight thickening and a coarseness of the hair around the parts not previously observable.

WINDGALLS, OR PUFFS, are the most usual forms of these enlargements, and may be observed in the legs (hind as well as fore) of nearly every hard-worked horse, after a time. Great care in the management of the legs by bandaging will sometimes keep them off, and some horses have naturally no tendency to form them ; but in most cases, on examining the legs, just above the fetlock joints, of horses at work, a little oval bag may be felt on each side, between the back sinew and the bone. If recent, it is soft and puffy ; but if the work is hard, and the windgall is of long standing, it will be as tense as a drum. The synovial bag has no communication with the fetlock joint ; but there is another sac in front of the joint, and beneath the tendons of the extensors, which is often enlarged, though not so much so as the seat of the true windgall, and which is generally, though not always, continuous with the synovial capsule of the joint. The *treatment* consists in pressure by means of bandages, and the application of cold lotions, if the legs are hot and inflamed. Blistering and rest will remove them entirely ; but no sooner is the horse put to work again, than they return as badly as ever. There is no radical cure but subcutaneous puncture and scarification, and this will produce too much adhesion to be advantageously applied.

THE FORM OF THOROUGHPIN in which the bursa mucosa between the tendo Achillis and the tendo perforatus is inflamed and filled with synovia, has been alluded to at page 524, and its *treatment* is there described.

CAPPED HOCK is always the result of a bruise of the superficial bursa, which is situated on the point of the hock, immediately beneath the skin. It is generally caused by lying on a bare floor. Some horses have a habit of getting the bedding from under them, and this is one of the results ; it may also indicate either that the possessor has kicked in the stable or in harness ; but it is more frequently caused in the former way than in the latter. The swelling is sometimes slight, being then just sufficient to show the point slightly enlarged, and to give a soft, puffy sensation to the fingers, where there ought to be nothing but bone felt beneath the skin. The bursa always rolls freely on the bone, and when large, it can be laid hold of and shaken like a bladder of water.

Treatment.—In recent cases massage aided by equal parts of soap liniment and water may succeed in dispersal of this unsightly but otherwise harmless swelling. Evaporating lotions are also recommended, and these may be applied on a piece of stout calico or fine canvas shaped into a cap, carefully fitting the point of the hock ; and this being tied by several pieces of tape in front of the leg, will allow not only of the application of cold

lotions, but of pressure also. By this plan, continued for some weeks, considerable enlargements have been removed, but they are very apt to return on the slightest bruise. Special trusses are made for the prevention of capped hock, and they often effect a cure by removing the cause when absorption of the fluid follows, if not of long standing.

STRAINS

THE FIBRES OF MUSCLES, LIGAMENTS, AND TENDONS, AND THE FASCIA covering them, are all liable to be overstretched, and more or less mechanically injured. This is called a strain, the *symptoms* of which are similar to the inflammation of the part occurring idiopathically. They are heat, swelling, and pain on pressure or movement, shown by flinching in the one case, and lameness in the other. In some cases there is considerable effusion of blood or serum, the former occurring chiefly in the muscles, and the latter among the torn fibres of the tendons or ligaments.—The *symptoms* and *treatment* will depend upon the part injured, which will be found described under the following heads.

STRAIN OF THE BACK AND LOINS

WHEN A YOUNG HORSE has been hunted or ridden with hounds over any kind of fence, he is very apt to over-exert himself in his awkward attempts to clear the obstacle, and next day he will often show a stiffness of the loins and back, which is seated in the large muscles connecting the pelvis with the thorax. He is said to have " ricked his back," in the language of the stable, and if the mischief is confined to the muscles alone, he may generally be permanently cured, though he will be more liable to a return than an animal which has never suffered from any accident of the kind. If, however, the spinal cord is injured, either from fracture of the vertebræ, or from effusion of blood or serum pressing upon it, the case is different, and a perfect cure is seldom obtained. It is, however, very difficult to form a correct diagnosis between the one case and the other, and the treatment may generally be conducted with a hope that the more important organ is uninjured. When there is complete paralysis of the hind extremities, so that the horse can neither feel nor use them in the slightest degree, the case is hopeless (see Diseases of the Nervous System). For the management of the strain of the loins, an aperient dose may be given, and the diet lowered, green meat if obtainable, perfect rest and quietude enjoined. When the sprain affects the muscles under the loin (the Psoæ muscles or "undercut" of the butcher), diuretic medicines, as nitrate of potash, appear to act advantageously, but if the muscles on the top (Longissimis dorsi, etc.) are the seat of mischief, much may be done to relieve them with external remedies. A warm compress composed of a double fold of thick flannel or serge dipped in warm water, frequently renewed, and covered over with oiled silk or india-rubber sheeting, answers well, or a pillow-case may be filled with bran previously scalded and applied when the temperature is such that one's naked elbow can comfortably be placed in it. This takes a long time to cool if covered

with some material that will prevent evaporation.   If good nursing cannot
be ensured, and the poultices or compress properly attended to, it will be
better to trust to a stimulating liniment which will not allow the skin to
get cold, as in the invervals of poulticing by an indifferent attendant.
In large establishments where casualties must necessarily be expected,
the Fomenting Rug invented by Mr. Field, and manufactured by Mr.
C. H. Huish, will be found an invaluable appliance ; it will maintain a com-
fortable heat to the part required for five or six hours without requiring
attention.   If in about ten days the animal is not making good progress a
charge may be spread over the loins, and a long rest enjoined.

STRAIN OF THE SHOULDER

SHOULDER STRAIN was formerly very often chosen as the seat of lameness
in the fore extremity, solely because the case is so obscure that it is beyond
the knowledge of the unskilful examiner.   Many cases of navicular disease
and other lameness in the foot not clearly defined are often attributed to
the shoulder.   Chronic lameness of the shoulder is comparatively rare, but
drop jumps in the hunting-field, and collisions with the stall post, or street
accidents cause temporary and often very acute lameness.

The Symptoms are dragging the toe, and an inability to extend the
limb ; when compelled to move, the leg is moved in an outward direction
in the form of a half-circle.   When the muscles are strained (serratus
magnus, pectoralis transversus, etc.) the animal may evince acute pain
when the limb is pulled up forcibly or drawn back.

Treatment.—Rest, but not absolute inaction, is necessary, compulsory
gentle exercise for a few minutes night and morning at a walking pace
being found the best restorative.   There is so much tendency to effusion
which must needs be again absorbed that the absolute rest formerly pre-
scribed for man and beast is not found to be desirable.   Many a black-
smith (not in receipt of club pay) will recover a sprained wrist with a
leathern strap around it by continuing at his work in less time than if he
carried the arm in a sling.   Warm fomentations relieve tension, and rubbing
with a saponaceous embrocation tends to give mobility to the parts rendered
stiff by the reparative process going on within.   Tempel, Büttner, and other
Continental veterinary authorities, advocate the injection into the affected
parts of morphia and atropine, which is said to give immediate relief ; but
the curative effect must be due to the fact that the animal, freed from pain,
can be induced to take the necessary exercise above recommended.   Unless
there is a known history of the cause the amateur should not trust himself
to diagnose shoulder lameness, since the great majority of lamenesses attributed
to that region prove to be in the foot.

STRAINS OF THE KNEE

THE KNEE, unlike its analogue in the human subject (the wrist), is
seldom strained in the horse, in consequence of the strong ligaments which
bind the bones of the carpus together.   Still it sometimes happens that
the internal lateral ligaments are overstretched, or, in calf-kneed horses,

the posterior common ligaments, or that connecting the scaphoid with the pisiform bone, or probably all these, will suffer from over extension. The accident may be recognized by the heat and swelling of the part affected, as well as by the pain given on using the joint. The anterior ligaments are seldom strained, but are liable to injury from blows received in various ways. The *treatment* should be conducted on the same principles as those of strains in the shoulder. Cold applications will seldom do anything but harm in the early stage ; but after hot fomentations have relieved the active mischief, by encouraging the effusion of serum into the surrounding cellular membrane, the former may be used with advantage. When the heat and other signs of active inflammation have disappeared, the biniodide of mercury ointment may be rubbed in, avoiding the back of the joint (see Blistering).

STRAIN OF THE FETLOCK

This ACCIDENT shows itself at once, in consequence of the superficial nature of the joint, by swelling, heat, soreness to the touch, and lameness. It may be of a slight and temporary nature or involve important ligaments and be of a lasting character. *Treatment.*—Warm fomentations, a bran or linseed poultice, an aperient dose if in full corn, followed by cold applications and the support of a bandage. If these fail a cantharides blister may be necessary, followed by a long rest in a loose box or very small paddock, where the patient cannot gallop about.

STRAIN OF THE COFFIN JOINT

Dissection proves that this joint is sometimes the seat of strain ; but it is almost impossible to ascertain its existence with certainty during life. The diagnosis is, however, not of much consequence, as the *treatment* will be the same, whether the coffin joint or the navicular joint is the seat of the mischief. In the absence of corns and all other evidence pointing to previous lameness or shoeing troubles, in the sudden demonstration of acute pain, pointing of the foot, considerable heat around the coronet, and tenderness on pressure of the heel, we have some of the symptoms indicating a strained joint. As in any acute foot lameness some benefit may be anticipated from an aloetic purge, the animal should be at once prepared (see Physic, page 302), and a dose proportioned to his age, size, and condition administered. Poulticing or warm fomentations give relief by permitting expansion of the foot and the engorged vessels in the neighbourhood of the joint. After the acute symptoms have passed away, cold lotions or wet swabs should be constantly applied, and the treatment concluded with a mild blister around the coronary band. In all joint injuries a long rest should be prescribed in a roomy box where the patient will take just sufficient exercise to promote the secretion of healthy synovia.

STRAIN OF THE SUSPENSORY LIGAMENTS

The suspensory ligament not being elastic like the back sinews (which, though not in themselves extensible, are the prolongations of muscles which

have that property), is very liable to strains, especially in the hunter, and to a less degree in the race-horse. On reference to pages 444, 448, the inferior connections of this part will be seen to be the two sesamoid bones, by a bifurcation of its substance, and as these bones support the pastern joints by the inferior sesamoideal ligaments, when the suspensory ligament is strained the whole apparatus is rendered useless, because the pain occasioned by the extension of the upper part prevents the horse from putting his weight upon the foot. The accident is readily made out, for there is local swelling and tenderness, and in the well-bred horse, which is alone likely to meet with a strain of this kind, the leg is rarely sufficiently gummy to prevent the finger from making out the condition of the ligaments and tendons. There is no giving way of the joints as in "break down," but on the contrary the leg is flexed, and if the case is a bad one, the toe only is allowed to touch the ground. In ordinary cases, however, there is merely slight swelling of the suspensory ligament in a limited spot usually near its bifurcation, or sometimes in one division only, close above the sesamoid bone to which it is attached. The horse can stand readily on that leg, but on being trotted he limps a good deal. Sometimes, however, there is a swelling of the part without lameness, but in this case the enlargement is generally due to an effusion of serum into the cellular covering of the ligament, and not to an actual strain of its fibres. The *treatment* will depend greatly upon the extent of the mischief; if there is no great injury done, and the enlargement is chiefly from effusion of serum, rest and cold applications by means of bandages or otherwise will in the course of two or three months effect a cure. Generally, however, the case will last six or eight months before the ligament recovers its tone, and in a valuable horse no attempt should be made to work him before that time. Where the swelling is small, as it generally is, bandages have no power over it, as the projection of the flexor tendons keeps the pressure off the injured part. Here, dipping the leg in a bucket of water every hour will be of far more service than a bandage, and the sudden shock of the cold water will be doubly efficacious. After all heat has disappeared the biniodide of mercury may be used as a blister two or three times, and then the horse may either be turned out, or put into a loose box for three or four months, after which walking exercise will complete the cure.

STRAIN OF THE BACK SINEWS

In this accident the position of the leg is the same as in strain of the suspensory ligament, and there is no giving way of the joints. The flexor tendons are enlarged, hot, and tender, and there is great lameness, the horse having the power to flex the joints below the knee, but resolutely objecting to extend them, by bearing what little weight is unavoidable upon his toe. The case is often confounded with a "break down," but it may readily be distinguished by the fact that in the latter the joints give way on putting the weight upon them, whilst in mere strains they do not, and the tendency is to the opposite extreme. Frequently after a bad strain of the flexor tendons, the fetlock is "over shot," or beyond the upright, in consequence of the continued flexion of the joint, to prevent pressure upon the injured

fibres, and in the management this result should be carefully guarded against. The injury is generally confined to the sheath of the tendons, which in most cases gradually puts on an inflammatory condition for some time before actual lameness is observed. In bad cases, however, the ligamentous fibres which are given off by the posterior carpal ligament to the flexor tendons are ruptured, greatly increasing the amount of inflammation and subsequent loss of strength. In any case the tendon feels spongy, and slightly enlarged, and there is more or less soreness on pressure and on being trotted, but in the latter case exercise removes the tenderness, and very often temporarily causes an absorption of the effused fluid, which is again deposited during rest. This state of things goes on for a time, the groom doing all in his power to alleviate it by wet bandages, etc., but at last a severe race or gallop brings on an extra amount of inflammation, with or without actual strain of the fibres of the tendon, and then there can be no doubt about the propriety of rest and severe treatment. It often happens that both legs are slighty affected, but one being more tender than the other, the horse attempts to save it by changing legs, the consequence of which is that the comparatively sound tendons are strained, and he returns to his stable with both legs in a bad state, but with one of them requiring immediate attention.

Treatment.—An aloetic purge and warm fomentations. A high-heeled shoe (called a patten) should be put on the foot, so as to allow the horse to rest part of the weight upon the heel without distressing the tendon, and this will have a tendency to prevent him from over-shooting at the fetlock joint, which he will otherwise be very apt to do, from constantly balancing his leg on the toe. After three or four days the hot fomentations will have done what is wanted, and a cold lotion may be applied by means of a loose linen bandage. The best is composed as follows :—

Take of Ammonium Chloride . . . . . . 2 oz.
  Vinegar . . . . $\frac{1}{4}$ pint.
  Methylated Spirit . . . . $\frac{1}{4}$ pint.
  Water . . . . 2 quarts. Mix.

With this the bandage should be kept constantly wet, the application being continued for a fortnight at least, during which time the patient must be kept cool, by lowering his food. At the end of three weeks or a month from the accident, the leg must be either blistered or fired, the choice depending upon the extent of injury, and the desire to avoid a blemish if such a feeling exists. The latter is the more efficacious plan, no doubt, but blistering will frequently suffice in mild cases. If, however, the tendons at the end of a month continue greatly enlarged, a cure can hardly be expected without the use of the "irons."

BREAKING DOWN

GREAT CONFUSION exists among trainers as to the exact nature of this accident, which is considered by the veterinary surgeon to consist in an actual rupture of the suspensory ligament either above or below the sesamoid bones, which, in fact, merely separate this apparatus of suspension into two portions, just as the patella intervenes between the rectus femoris and

the tibia. Whichever part of the suspensory apparatus is gone (whether the superior or inferior sesamoidal ligament is immaterial), the fetlock and pastern joints lose their whole inelastic support; and the flexor tendons, together with their ligamentous fibres which they receive from the carpus, giving way, as they must do, to allow of the accident taking place, the toe is turned up, and the fetlock joint bears upon the ground. This is a complete " break down "; but there are many cases in which the destruction of the ligamentous fibres is not complete, and the joint, though much lowered, does not actually touch the ground. These are still called breaks down, and must be regarded as such, and as quite distinct from strains of the flexor tendons. The accident generally occurs in a tired horse, when the flexor muscles do not continue to support the ligaments, from which circumstance it so often happens in the last few strides of a race. *The symptoms* are a partial or entire giving way of the fetlock joint downwards, so that the back of it either touches the ground or nearly so, when the weight is thrown upon it. Usually, however, after the horse is pulled up, he hops on three legs, and refuses altogether to put that which is broken down to the ground. In a very few minutes the leg "fills" at the seat of the accident, and becomes hot and very tender to the touch. There can, therefore, be no doubt as to the nature of the mischief, and the confusion to which allusion has been made is one of names rather than of facts. *Treatment* can only be directed to a partial recovery from this accident, for a horse broken down in the sense in which the term is here used can only be used for stud purposes or at slow farm work. A patten shoe should at once be put on, and then fomentations followed by cold lotions should be applied, as directed in the last section. As there must necessarily be a deformity of the leg, there can be no objection on that score to firing, and when the severe inflammation following the accident has subsided this operation should be thoroughly performed, so as to afford relief not only by the counter-irritation which is set up, and which lasts only for a time, but by the rigid and unyielding case which it leaves behind for a series of years.

STRAINS OF THE HIP JOINT, STIFLE, AND HOCK

THE HIP JOINT, OR ROUND BONE, is liable to be strained by the hind-feet slipping and being stretched apart, or by blows against the side of the stall, when cast, which are not sufficient to dislocate the femur, but strain its ligaments severely. The consequence is an inflammation of the joint, which is evidenced by a dropping of one hip in going, the weight being thrown more upon the sound side than upon the other. This is especially remarkable on first starting, the lameness soon going off in work, but returning after rest. The case, however, is a rare one, and its description need not, therefore, occupy much of our space. When it does happen, it is very apt to lead to a wasting of the deep muscles of the haunch, which nothing but compulsory work will restore to a healthy condition. The only *treatment* necessary in the early stage of strain of the hip joint is rest and cooling diet, etc.; but, after six weeks or two months, a gradual return to work is indispensable to effect a cure.

STRAINS OF THE STIFLE, independently of blows, are rare; but the latter

often are inflicted upon this joint in hunting, leaving little evidence externally, so that it is almost always doubtful whether the injury is the result of a blow or strain. The *symptoms* are a swelling and tenderness of the joint, which can be ascertained by a careful examination; and on trotting the horse, there is manifested a difficulty or stiffness in drawing forward the hind-leg under the belly. *Treatment.*—Physicking in the early stage, together with hot fomentations to the part, continued every hour until the heat subsides. After a few days, if the joint is still painful, a large blister should be applied, or a seton should be inserted in the skin adjacent.

THE HOCK ITSELF is liable to strain, independently of the peculiar accident known as "curb." When it occurs, there is some heat of the part, with more or less lameness, and neither spavin, thoroughpin, nor curb to account for them. The injury is sometimes severe, and is known as "sprung" hock, or trifling, and relieved by fomentations for a day or two, followed by cold lotions, as prescribed for strain of the back sinews.

CURB

BY A REFERENCE TO PAGE 425, it will be seen that the lower part of the posterior surface of the os calcis is firmly united to the cuboid and external metatarsal bone by two strong ligamentous bands, called the calcaneo-cuboid and calcaneo-metatarsal ligaments. The centre of these ligaments is about seven or eight inches below the point of the hock, and when a soft but elastic swelling suddenly makes its appearance there, it may with certainty be asserted that a "curb" has been thrown out. The accident occurs somewhat suddenly; but the swelling and inflammation do not always show themselves until after a night's rest, when the part is generally enlarged, hot, and tender. The precise extent of the strain is of little consequence; for whatever its nature, the treatment should be sufficiently active to reduce the ligaments to their healthy condition. Some horses have naturally the head of the external small metatarsal bone unusually large, and the hock so formed that there is an angle between the large metatarsal bone and the tarsus, leaving a prominence, which, however, is hard and bony, and not soft and elastic, as is the case with curb. Such hocks are generally inclined to throw out curbs: but there are many exceptions, and some of the most suspicious-looking joints have been known to stand sound for years. Curbs are seldom thrown out by very old horses, and usually occur between the commencement of breaking-in and the seventh or eighth year, though they are not unfrequently met with in the younger colt, being occasioned by his gambols over hilly ground. The *treatment* should at first be studiously confined to a reduction of the inflammation; any attempt to procure absorption till this is effected being injurious in the extreme. If there is much heat in the part, the corn should be removed, and a dose of physic given as soon as practicable. The curb should then be kept wet (by means of a bandage lightly applied with the lotion recommended for capped hocks), and this should be continued until the inflammation is entirely gone. During this treatment, in bad cases, a patten shoe should be kept on, so as to keep the hock as straight as possible, and thus take the strain off the ligaments which are affected. After the

part has become cool, it may be reduced in size, by causing absorption to be set up; which is best effected by the application of mercury and iodine (both of which possess that power), in such a shape as to cause a blister of the skin. The biniodide of mercury has this double advantage, and there is no application known to surgery which will act equally well in effecting the absorption of a curb. It should be applied in the mode recommended at page 509, and again rubbed on at an interval of about a week, for three or four times in succession, when it will generally be found that the absorption of the unnatural swelling is effected; but the ligaments remain as weak as before, and nothing but exercise (not too severe, or it will inflame them again) will strengthen them sufficiently to prevent a return. Friction with the hand, aided by a slightly stimulating oil (such as neats-foot and turpentine mixed, or neatsfoot and oil of origanum, or, in fact, any stimulating essential oil), will tend to strengthen the ligaments, by exciting their vessels to throw out additional fibres; and in course of time a curb may be considered to be sufficiently restored to render it tolerably safe to use the horse again in the same way which originally produced it.

In many instances firing is necessary, and if the blemish of a few lines drawn across the seat of curb is not an insuperable objection on the part of the owner, it will prove more lastingly successful than any other treatment. As a surgical blemish it is less to be objected to than any other, as it was formerly the custom with some breeders, especially in Ireland, to fire colts on this part as a preventive measure.

DISLOCATION

By DISLOCATION is meant the forcible removal of the end of a bone from the articulating surface which it naturally occupies. In the horse, from the strength of his ligaments, the accident is not common; those that do occur being chiefly in the hip joint, and in that between the patella and the end of the femur.

DISLOCATION OF THE HIP JOINT is known by the rigidity of the hind-leg, which cannot be moved in any direction, and is carried by the horse when he is compelled to attempt to alter his position. There is a flatness of the haunch below the hip, but the crest of the ilium is still there, and by this the accident may be diagnosed from fracture of that part. *No treatment* is of the slightest avail, as the part cannot be reduced, and the horse is useless except for stud purposes. The accident is not very common.

DISLOCATION OF THE PATELLA

THIS IS A NOT UNCOMMON ACCIDENT of colthood on hilly ground or where drop jumps are taken sideways while at play with others. The symptoms are lameness, deformity, tucking up of the flank, and loss of flesh. There is a partial dislocation also which is due to weak ligaments becoming elongated. With some adult horses this form becomes habitual, occurring repeatedly. The external vastus muscle contracting spasmodically draws the patella outwards; with relaxation of the muscle the patella goes into its place again with a click that can be heard at several paces distant.

Treatment.—In a true or complete dislocation no time should be lost in placing the patient under the influence of chloroform, so as to completely relax the muscles. There is no objection to casting him with hobbles previous to administering the anæsthetic, as the only accident likely to happen is reductiou of the dislocation itself. When sufficiently under its influence the hobble on the affected leg should be undone, the toe drawn forcibly forward by an assistant while the operator by manual pressure induces the patella to pass over the eminence and into its trochlea. It can be seen, felt, and heard as a rule to go into its place. Great care should be exercised in letting the animal get up again lest luxation occur again in the act of rising. The hobbles should be noiselessly removed, and the patient allowed to remain on the ground as long as he likes. When the attendants see that he is determined to rise, the affected stifle and leg should be pressed upon during the act. As soon as he has gained his feet a smart blister should be applied, covering plenty of space, as the greater the tumefaction the better ; the effusion under the skin and around the joint acts as a cushion and a support, while the soreness induced will restrain the patient from undue exertion of a part requiring repose.

THE INTRODUCTION OF A LONG SETON has a somewhat similar effect and is in favour with a good many country practitioners, whose familiarity with the accidents of colthood should make their opinion valuable.

WOUNDS OF JOINTS

THE KNEE is the joint most frequently suffering from wound, as in the majority of falls it is the part brought in contact with the ground. Whether the joint itself is injured, or only the skin, the accident is called a "broken knee," and for convenience' sake it will be well to consider both under the present head.

WHEN A BROKEN KNEE consists merely in an abrasion of the skin, the attention of the groom is solely directed to the restoration of the hair which will grow again as well as ever, if the bulbs or roots are not injured. These are situated in the internal layer of the true skin, and therefore, whenever there is a smooth red surface displayed, without any difference in the texture of its parts, a confident hope may be expressed that there will be no blemish. If the skin is penetrated, either the glistening surface of the tendons or ligaments is apparent, or there is a soft layer of cellular membrane, generally containing a fatty cell or two in the middle of the wound of the skin. Between a simple abrasion, wounded tendons, and open joint, there is so wide a difference that all sorts of treatment may be required.

IN ALL INJURIES TO THE KNEE, the general rule may be laid down to reduce inflammatory action, as far as possible by fomentation and poultices, in the first instance, as the case is from the first, and by its cause, removed from the category of wounds to be treated antiseptically or by dry processes. There is generally so much bruising of the tissues adjacent, that the final mobility of the knee and usefulness of the horse depends upon early relief and preventing the formation of adventitious material as a result of continued inflammatory action. Nor is it an objection that increased swelling results

from warmth and moisture continuously applied, since these conditions favour absorption by giving room to the vessels.

IF CONTINUED TOO LONG such treatment will result in the production of soft and spongy granulations, but for the first few days there will be none to contend with. In order to retain a poultice on the knee without tying the tapes too tight either above or below it, a couple of bandages or a foundation of tow should be wrapped round the leg below. A dose of aloes and a reduced diet should be enforced, as there is much tendency to sympathetic fever in serious injuries to joints, and as the animal cannot in such cases lie down, he had better have his head tied up, since some horses will eat their poultices and others will gnaw a wound, though the majority will not interfere with it. When the reduction of pain and inflammatory symptoms warrant the discontinuance of poultices, the knee may be carefully cleaned and a pad of soft lint or calico dipped in carbolized oil, bandaged lightly over the surface and renewed at least twice a day. With the appearance of healthy granulations all covering may be discontinued and the wound only dressed with carbolized oil. The evaporation that follows exposure, causes contraction in the direction desired, and the object to be studied is to so treat the wound as to obtain only the minimum of blemish. Profuse granulations threatening to rise above the level of the knee should be lightly touched at the most prominent points with nitrate of silver (lunar caustic), while the less vigorous growths in the depressions are making progress towards a level surface, which, being attained, is made to form a scab by an equal dressing all over with the caustic. If this scab is roughly removed and the raw surface touched over again with the silver nitrate every few days a smaller one is each time formed, and the edges of the skin made to approximate much more closely than if left to nature. The " bumbley " knees one often sees are quite unnecessary, for however badly a knee is broken, it may be made level by good surgery.

WHEN THE JOINT ITSELF is opened the case is much more serious, and there is a risk not only of a serious blemish, which can seldom be avoided, but of a permanent stiffness of the leg, the mischief sometimes being sufficient to lead to constitutional fever, and the local inflammation going on to the destruction of the joint by anchylosis. *The treatment* should be directed to cleanse and then close the joint, the former object being carried out by a careful ablution with warm water, and an antiseptic, as Condy's fluid, continued until there is no doubt of all the dirt and grit having been removed. Then, if there is only a very small opening in the capsular ligament, it may be closed by a careful and light touch of a pointed iron heated to a red heat. Generally, however, it is better to apply some dry carded cotton to the wound, and a bandage over this, leaving all on for four or five days, when it may be removed and re-applied. The horse should be physicked, taking care to prevent all chance of his lying down by racking him up. He will seldom attempt to do this on account of the pain occasioned in bending the knee, but some animals will disregard this when tired, and will go down, somehow. When the cotton is re-applied, if there are granulations above the level of the skin, they must be kept down as recommended in the last paragraph, and blister may be applied. By these means a very extensive wound of the knee may be sometimes cured, but it is doubtful whether the majority of open joint cases are

worth treatment. Many so-called cures were never open joints at all, but the persons treating them have mistaken the saffron-coloured discharge from an open bursa for the inflamed synovia of the joint.

THE KNEE IS SOMETIMES punctured by a thorn in hunting, causing great pain and lameness. If it can be felt externally it is well to cut down upon it and remove it; but groping in the dark with the knife among important tendons in front of the knee is not on any account to be attempted. The knee should be well fomented five or six times a day, until the swelling, if there is any, subsides, and, in process of time, the thorn will either show its base, or it will gradually free itself from its attachments and lie beneath the skin, from which position it may be safely extracted with the knife or forceps.

CHAPTER XXVII

DISEASES OF THE THORACIC ORGANS AND THEIR APPENDAGES

GENERAL REMARKS—CATARRH OR COLD—INFLUENZA—BRONCHITIS—CHRONIC COUGH —LARYNGITIS, ROARING, WHISTLING, ETC.—PNEUMONIA AND CONGESTION OF THE LUNGS—PLEURISY—BROKEN WIND—THICK WIND—SPASM OF THE DIAPHRAGM DISEASES OF THE HEART—DISEASES OF THE BLOOD-VESSELS OF THE CHEST AND NOSE.

GENERAL REMARKS

THE IMPORTANCE OF SOUNDNESS in the respiratory apparatus is so fully recognized, that in common *parlance* it is put before the organs of locomotion, a popular expression being "sound in wind and limb." It is true that good wind is useless without legs; but the diseases of the latter are known to be more under control than those of the chest, and hence it is, perhaps, that the wind is so carefully scrutinized by all purchasers of horses. There is, also, much greater difficulty in ascertaining the condition of the lungs and their appendages, and the ordinary observer can only judge of them by an absolute trial; while the state of the legs may be seen and felt, and that of the feet can be tolerably well ascertained by a very short run upon hard ground. So, also, with the acute diseases of these parts; while the legs and feet manifest the slightest inflammation going on in them by swelling and heat, the air-passages may be undergoing slow but sure destruction, without giving out any sign that can be detected by any one but the practised veterinarian. In most of the diseases of the chest there is disturbance of the breathing, even during a state of rest; but in some of them, as in roaring, for instance, no such evidence is afforded, and the disease can only be detected by an examination during, or immediately after, a severe gallop. Roarers will often grunt when threatened with a stick, but it is not a reliable test.

CATARRH, OR COLD

CATARRH may be considered under two points of view; either as an inflammation of the mucous membrane of the nasal cavities, accompanied by slight general fever; or as an ephemeral fever of three or four days' duration, complicated with this condition of the nose. The latter is, perhaps, the more scientific definition, but for common purposes it is more convenient to consider it as mainly consisting in the most prominent symptom. There is invariably some degree of feverishness, sometimes very considerable, at others so slight as to be easily passed over. Usually the pulse is accelerated to about forty or fifty, the appetite is impaired, and there is often sore throat, with more or less cough. On examining the interior of the nostrils, they are more red than natural, at first dry and swollen, then bedewed with a watery discharge which soon becomes yellow, thick, and, in bad cases, purulent. The eyes are generally involved, their conjuctival coat being injected with blood, and often some slight weeping takes place, but there is always an expression of sleepiness or dulness, partly owing to the local condition of the organ, and partly to the general impairment of the health.

Causes.—Chills from exposure to draught or sudden alternations of temperature, as from a hot stable to a cold one, or *vice-versâ*. Horses more often suffer from catarrhal fever when brought in from a cold pure air to the vitiated atmosphere of the stable than when turned out to grass without proper preparation.

Treatment.—Consists in good nursing while combating special symptoms, these varying in individuals as well as in type in different years.

IF SORE THROAT IS A PROMINENT SYMPTOM, counter-irritation should be resorted to. Few things answer better than mustard mixed as for the table and rubbed over the affected part. Ammonia and soap liniment have an advantage over mustard, inasmuch as the application may be repeated at short intervals, but as a rule one moderate vesication with mustard is all that is necessary. Constipation being common, with increased internal temperature, a saline aperient or small dose of linseed oil may be given, but on no account aloes. The inhalation of Friar's Balsam upon scalded bran suspended by a nosebag is calculated to give relief where the discharge is thick and got rid of with difficulty.

THE FOOD should be moistened and of a laxative character; cut grass and vetches in summer; carrots, scalded chaff and corn with linseed tea, etc., when green food is not obtainable. The extremities should be kept warm by bandaging and the body clothed, pure but not necessarily warm air being desirable.

AN APPARENTLY SIMPLE COLD may at any time lead to more serious disorders, as pneumonia or bronchitis, and upon the exhibition of any symptom the horseman does not understand he should call in the veterinary surgeon ere it is too late.

INFLUENZA

By THIS TERM is generally meant an infectious febrile disease in which a common symptom is a catarrhal condition of the mucous membranes of the respiratory tract. It varies greatly, not only in its manifestation in individuals, but in different years it assumes varying forms, at one time having all the appearances of a feverish cold, at others causing glandular swellings, and an abscess like that of strangles, liver complications, resulting in jaundice, lameness of the right fore-limb in supposed sympathy with the liver, and sometimes partial paralysis of a limb or limbs. Our forefathers described it as the "distemper," and naturally so since it makes its presence felt in as many shapes as the distemper of dogs. It is found almost simultaneously on three continents, but whether the germs are carried through the air faster than by ocean steamers is not proved. In North America and in South Africa it takes on a type in which intense redness of the conjunctival membrane is a conspicuous feature, and for this reason is known as "pink eye" among the many other names accorded it. Its history in varying forms has been traced for centuries; but what climatic or other conditions favour its spread or increase its intensity does not appear. There are many theories and perhaps a specific bacillus, but there is certainly no specific with which it can be treated.

The Symptoms are at first those common to febrile attacks, in which dulness, staring coat, perhaps shivering and loss of appetite are among those most usually observed; sore throat, cough, difficulty in swallowing, and general malaise. Increased temperature, which may be ascertained by the clinical thermometer *per rectum.*

Treatment.—Is directed especially to the amelioration of the prominent symptoms in each case, but with a general regard to the fact that great prostration and loss of nerve force is to be guarded against. Powerful doses of quinine, gentian, and the mineral acids in small quantity tend to maintain the patient's strength, while local applications in the form of stimulating liniments to the throat or other parts are undoubtedly useful. The appetite should be tempted with variety in the way of food, and only a little at a time offered to the patient. Carrots, linseed, crushed oats, and damped chaff should be tried in turns, and if the animal is very low and absolutely refuses his food he may be for a time sustained by the administration of eggs and milk, gruel, etc. With a falling temperature appetite returns, and restoration to health and vigour may be aided by iron and quinine, gentian and calumba, a little table salt in the food—in a word, good nursing, which comprises bandaging, clothing, exercise when capable of benefiting by it, and all those attentions to the wants of the sick which to some men devoted to animals appears to be a natural gift, while others never acquire it. Unless some serious complication accrues or the catarrhal symptoms invade the bronchi, or substance of the lungs, horses seldom die of influenza, but like their nurses succumb to sequelæ brought on by resuming their ordinary avocations too soon.

BRONCHITIS

BRONCHITIS is an inflammation of the mucous membrane lining the bronchi, and almost invariably extending to these parts through the trachea, from the larynx and nasal passages, which are primarily affected as in ordinary cold. The membrane in the early stage becomes filled with blood, and as a consequence, the diameter of the tubes is diminished, attended by some difficulty and increased rapidity of breathing. After a time a frothy mucus is poured out from it, and this still further interferes with respiration, and necessitates a constant cough to get rid of it. *These symptoms* are always present, but they will vary greatly in intensity, and in the rapidity with which they progress, from which circumstances bronchitis is usually said to be *acute* or *chronic*, as the case may be. *In the acute form* there are also several variations, and veterinary writers are in the habit of again subdividing it into acute and sub-acute, but the two leading divisions are sufficient for all practical purposes. It begins with the usual premonitory appearances of a severe cold, accompanied by a staring coat and entire loss of appetite. The breathing is somewhat accelerated, the temperature increased, and the pulse of greater frequency and less force. The ears and legs vary in temperature, the visible mucous membranes are injected, and a cough which is hard, dry, and painful. On auscultation there is a dry rattling sound, very different from the crepitation of pneumonia, and as soon as mucus is secreted, succeeded by gurgling and soap-bubble sounds easily distinguished when once heard. If the attack goes on favourably, the cough becomes loose, and there is a free discharge of mucus, both from the lungs, as evidenced from the nature of the cough, and from the nostrils, as shown by the running from them.

On the other hand the prognosis is unfavourable when the breathing is very laborious, with the legs extended, and the cough constant and ineffectual in affording relief.

Treatment.—Counter-irritation still commends itself to the majority of veterinary practitioners as likely to afford the most immediate relief combined with those internal remedies which in human medicine are known as expectorants.

BRONCHITIS pure and simple without the larynx being involved is infrequent, and it is usually advisable to apply mustard to the throat and down the course of the trachea till the thick muscles of the brisket are reached, where the application would be useless as being so far from the affected tubes. The sides of the chest immediately behind the elbows may receive a share of attention in some cases, but as a rule the veterinarian contents himself with covering the parts already named.

Where laryngeal symptoms do not preclude the administration of a ball, the following will be found suitable and may be given twice a day :—

Take of Digitalis	½ drachm.
Calomel	⅓ drachm.
Tartar Emetic	60 to 80 grains.
Nitre	2 drachms.

Mix with treacle.

CHRONIC BRONCHITIS seldom exists except as a sequel to the acute form,

and after adopting the balls recommended for that state, it may be treated by attention to the general health, and the exhibition of an expectorant ball twice a day, composed of the following materials :—

Take of Gum Ammoniacum	½ ounce.
Powdered Squill	1 drachm.
Castile Soap	2 drachms.

Mix and make into a ball.

CHRONIC COUGH

By THIS TERM is understood a cough that comes on without any fever or evidences of the horse having taken cold. It differs in this respect from chronic bronchitis, which generally supervenes upon the acute form, and is always attended in the early stage by feverishness. It appears probable that chronic cough is dependent upon an unnatural stimulus to the mucous membrane, for it almost always makes its appearance when much corn is given without due preparation, and ceases on a return to green food. It is, therefore, very commonly termed a stomach cough. The *symptoms* are all summed up in the presence of a dry cough, which is seldom manifested while in the stable, but comes on whenever the breathing is hastened by any pace beyond a walk. Two or three coughs are then given, and the horse perhaps is able to go on with his work, but after resting for a few minutes, and again starting, it comes on again, and annoys the rider or driver by its tantalizing promise of disappearance followed by disappointment. Very often this kind of cough is caused by the irritation of worms, but any disorder of the digestive organs appears to have the power of producing it. *The usual treatment* for chronic bronchitis seems here to be quite powerless, and the only plan of proceeding likely to be attended with success, is to look for the cause of the irritation, and remove it. Sometimes this will be found in a hot stable, the horse having previously been accustomed to a cool one. Here the alteration of the temperature by ten or fifteen degrees will in a few days effect a cure, and nothing else is required.

Again, it may be that the corn has been overdone, in which case a gentle dose of physic, followed by a diminished allowance of corn, and a bran-mash twice a week, will be successful. If the stomach is much disordered, green food will be the best stimulus to a healthy condition, or in its absence a few warm cordial balls may be tried. The existence of worms should be ascertained in doubtful cases, and if they are present, the proper remedies must be given for their removal. Linseed oil and spirit of turpentine, which are both excellent worm remedies, are highly recommended in chronic cough, and whether or not their good effect is due to their antagonism to worms, they may be regarded as specially useful.

A very successful combination is the following mixture :—

Take of Spirit of Turpentine	2 ounces.
Mucilage of Acacia	6 ounces.
Gum Ammoniacum	½ ounce.
Laudanum	4 ounces.
Water	2 quarts.

Mix, and give half-a-pint as a drench every night : the bottle must be well shaken before pouring out the dose.

LARYNGITIS, ROARING, WHISTLING, ETC.

ONE OF THE MOST COMMON diseases among well-bred horses of the present day is the existence of some mechanical impediment to the passage of the air into the lungs, causing the animal to "make a noise." The exact nature of the sound has little or no practical bearing on the cause that produces it; that is to say, it cannot be predicated that roaring is produced by laryngitis; nor that whistling is the result of a palsy of some particular muscle, but undoubtedly it may safely be asserted that all lesions of the larynx, by which the shape and area of its opening (rima glottidis) are altered and diminished, are sure to have a prejudicial effect upon the wind, and either to produce roaring, whistling, wheezing, or trumpeting, but which would result it might be difficult to say, although the precise condition of the larynx were known, which it cannot be during life. Veterinary surgeons were formerly puzzled by often finding on examination of a roarer's larynx after death no visible organic change in the opening, and many were led to imagine that this part could not be the seat of the disease. On a careful dissection, however, it is found that a muscle or muscles whose office it is to dilate the larynx is wasted and flabby (crico-arytenoideus lateralis and thyro-arytenoideus). The other muscles are perhaps equally atrophied, but as their office is to close the opening, their defects are not equally injurious, and at all events are not shown by producing an unnatural noise.

THE CAUSE OF THIS WASTING is due to some defective nerve supply, and careful examination and dissection shows it is degeneration of its structure and interruption of the current. It is a subject which has occupied the most eminent veterinarians with hitherto very little progress towards an accurate knowledge of its pathology. It was hoped at one time that excision of a portion of cartilage would prove a success, but experiments upon a goodly number of army horses proved that the relief was only temporary, and that falling in of the larynx and a still greater diminution of its calibre followed, so that the operation was early abandoned.

A MORE SUCCESSFUL OPERATION is that of tracheotomy, which consists in the introduction of a metal tube into the trachea, permitting the air to be breathed direct into the lungs instead of passing through the ordinary way. The place usually selected is between the third and fourth rings of the trachea, where the windpipe has the smallest amount of muscular covering, but the plan adopted and the instrument invented by Mr. Jones, M.R.C.V.S., of Leicester, has certain advantages over the old method. This gentleman inserts the tube very high up, where it can only be seen by a person looking under the horse's head, and in a position where it is less likely to meet with external violence. The tube is provided with a plug which can be kept in it at night only, and must not be left out in swimming or the creature may be drowned. The owner of a favourite hunter so operated on is generally satisfied with about two seasons, and such horses find their way into cabs at a nominal sum. For several reasons it will be necessary to examine first of all into the several kinds of inflammation, etc., to which the larynx is subject, and then to investigate as far as we may, the nature,

mode of detection, and treatment of the several conditions known to horse-men by the names of roaring, whistling, etc., which are only symptoms of one or other of the diseases to which allusion will presently be made.

By ACUTE LARYNGITIS is meant a more than ordinary inflammation of the larynx, and not that slightly morbid condition in which the mucous membrane of that organ is always involved in "the passage of a cold into the chest."   In the latter state the ear detects no unusual sound, and indeed there is plenty of room for the air to pass.   But in true laryngitis, on placing the ear near the throat, a harsh rasping sound is heard, which is sufficient at once to show the nature and urgency of the symptoms. The mucous membrane is swollen, and tinged with blood; the rima glottidis is almost closed, and the air in passing through it produces the sound above described, which, however, is sometimes replaced by a stridulous or hissing one.   In conjunction with this well-marked symptom there is always a hoarse cough of a peculiar character, and some con-siderable fever, with frequent respiration, and a hard, wiry pulse of seventy to eighty.
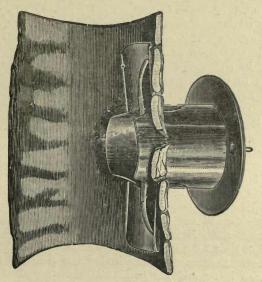
FIG. 98.—JONES' PATENT TRACHEOTOMY TUBE.

Treatment.—No time should be lost in producing counter-irritation, and mustard, which is everywhere obtainable, is as good as anything else for the purpose ; the most distressing cases are usually relieved by its application in a very short time.   If it fails and suffocation threatens, the tracheotomy tube referred to at page 542 must be inserted without loss of time.   Large doses of emetic tartar, digitalis, and calomel were formerly prescribed, but modern treatment with electuaries is much safer, and probably more effectual.   A given quantity, as a teaspoonful, is smeared upon the back of the tongue, with the double advantage of acting topically as well as

through the ordinary medium of the circulation. The following is a suitable preparation :—

Extract of Belladonna	1 drachm.
Nitrate of Potash	2 drachms.
Honey	2 drachms.

Mix for one dose.

This quantity may be safely given three times a day. With abatement of the acute symptoms extract of gentian may be substituted for belladonna as calculated to restore appetite and enable the animal to recover from the weakness induced by a severe attack. The administration of both balls and drinks is attended with some danger, and if the latter are given the head should not be held up for long together, and only small "go-downs" at a time attempted. The electuary is undoubtedly the form of medicament to be chosen for cases of the class under consideration.

Gruel and soft food generally should be given, and the bedding must not be of a kind that a greedy animal would eat during convalescence. The greatest care must be taken to prevent a relapse, by avoiding all excitement either by stimulating food or fast exercise.

CHRONIC LARYNGITIS may occur as the result of the acute form above described, or it may come on gradually, without any violent inflammation preceding it. In either case *the symptoms* are similar in their nature to those met with in the acute form, but less in degree. The noise made is not nearly so harsh, and can often hardly be heard on the most careful examination. The peculiar harsh, grating cough is, however, always present, and by it the nature of the case may generally be easily made out. The disease often accompanies strangles, although in nine cases out of ten it is overlooked by the careless attendant. Very commonly, however, it makes its ravages in so insidious a manner that no suspicion is felt of its presence, until the horse begins to make a noise, though he must in all probability have shown by the cough peculiar to the complaint that it has been working its way for some weeks at least. Such cases chiefly occur in the training stable, and are due, according to my belief, to the enormous quantity of oats which it is now the fashion to give to colts from the earliest period of their lives, increased to seven and eight feeds a day during the second year. Continued spirit-drinking has precisely the same effect upon the human being, and the harsh stridulous cough of the confirmed drunkard marks the existence of ulceration of the larynx, in the only way which he will allow it to be displayed, for he is not, like the horse, made to exert his powers of running, whether his wind is good or bad. There is, of course, a considerable difference between the two diseases, but there is sufficient analogy between them to explain why the stimulus of over-corning should affect the larynx in preference to any other part. It would be difficult to show the connection between the two in any other way, beyond the simple fact that roaring has become general in an exact proportion to the prevalence of the present fashion of feeding. The advocates of the plan will say that though the two have come in together, yet it is merely a coincidence, and not a consequence, the one of the other ; but if it can be shown that in man a similar cause produces a similar effect, the argument is strengthened to such a degree as to be almost unanswerable. But what-

ever may be the cause there can be no doubt that the *treatment* is most troublesome, and often baffles the skill of the most accomplished veterinarian.

Blistering and occasionally line firing has been attended with good results. The frequent application of a remedy that is slightly vesiccating, as white oils, turpentine diluted with oil, oil of cantharides, etc., is often beneficial, but before any definite line of treatment is decided upon it will be well to thoroughly examine the back of the mouth with the aid of Huish's speculum or gag. This instrument (Fig. 99) enables one to get a good view of the fauces, and by drawing out the tongue with the hand it may be possible to detect an ulcerated condition of the rima glottidis. If this is found to be
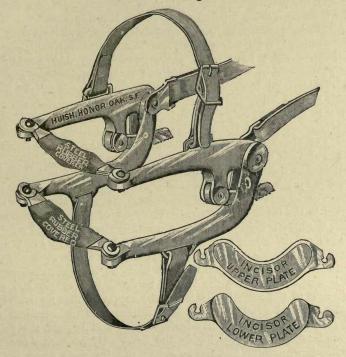
FIG. 99.—GAG SHOWING RUBBER-COVERED BARS FIXED FOR OPERATION ON INCISORS.

the case an application of solution of nitrate of silver on a camel-hair pencil may do more towards effecting a cure than any other treatment, however long continued.

Careful dieting in all cases of laryngitis, or of chronic cough from whatever cause, will do much to alleviate the symptoms. Linseed in various forms is among the most valuable agents to be employed either as a food to be eaten or the expressed oil poured over the usual feed. Most horses will take it readily in this way and even acquire such a liking for it as to look round with dissatisfaction if at any time it is omitted.

ROARING is the bugbear of the purchaser at the hammer, and not without good reason. The most experienced veterinarian or dealer will often fail to ascertain its existence, in spite of all the artifices he may call into play.

Not the slightest sound is heard during a state of quiescence, or even when the horse is trotted or galloped for the short distance which "the ride" will afford. The blow on the side given with due artistic effect elicits no grunt, and yet the animal is a confirmed roarer, and not worth a shilling, perhaps, for the purpose to which he is intended to be devoted. On the other hand, many a sound horse is condemned as a roarer for giving out the obnoxious grunt; and though there is no doubt that this sign may be relied on in a great many cases, yet it cannot be accepted as either negatively or positively a certain proof. The only real trial is the noiseless gallop on turf or plough, when the ear can detect the slightest sound, and can distinguish its exact nature, and the precise spot from which it proceeds. Many a horse will, when he is excited, make a harsh noise in his breathing, accompanied by a kind of "gluck," proceeding from a spasmodic flapping of the velum palati, but on galloping him all this goes off, and he may probably exhibit excellent wind. Such cases I have many times known, and they would be condemned as unsound by those who have had little experience, or are content with a careless and inefficient trial. Stallions are particularly prone to make this kind of noise, and it is extremely difficult to ascertain their soundness in this respect by any means which can be safely resorted to. The causes of roaring are of three kinds : 1st. Inflammation, which has left a thickening or ulceration of the mucous membrane, or a fungous growth from it ; 2nd. Paralysis of the muscles ; and 3rd. An alteration of the shape of the cartilages of the larynx, produced by tight reining.

In roaring produced by an ulcerated or thickened condition of the mucous membrane, or by a fungous growth, the sound elicited is always the same in proportion to the rapidity of respiration. None of the ordinary expedients by which the breath is introduced in a modified stream (such as a full meal, or pressure on the nostrils or windpipe) will be of much avail, and the horse roars sturdily whenever his pace is sufficiently accelerated. If a horse so affected can be made to grunt by the blow on the side, the sound will always indicate the disease, for it will be harsh and rough, and not the natural grunt of the animal. It is usually supposed that no *treatment* can be of the slightest avail here. Setons, blisters, and embrocations are all useless, as has been proved in numberless cases ; and beyond the palliation which can be afforded by employing the horse only at such a pace as his state will allow, nothing else can be suggested. In some cases the roarer will be able to do ordinary harness work, which, however, in hot weather, will try him severely ; in others he may be so slightly affected as to be fit to hunt in a country where, from its nature, the pace is not very severe ; but by confirmed roarers the slow work of the cart is all that can be performed without cruelty.

WHISTLING, PIPING, AND WHEEZING, are terms applied to those horses which do not actually roar but make abnormal sounds which are perhaps best described by such names.

There is no longer any question as to the hereditary nature of roaring, and it may be hoped that its recognition may lead in the near future to a diminution in the number of animals so affected.

PNEUMONIA AND CONGESTION OF THE LUNGS

THESE DISEASES, associated as they are in human practice, and spoken of as different stages of the same affection, have quite a different significance for the veterinarian. Pneumonia he understands as inflammation of the paraxchyma or lung substance, but congestion of the lungs is a condition in which the pulmonary vessels are engorged as a result of over-exertion in an unfit state, and not caused by cold or invasion from other parts of the respiratory tract.

PNEUMONIA.—The causes are much the same as those which produce catarrh or common cold, such as exposure to cold, draughts when heated, damp stables, injudicious clipping, crowding aboard ship and other unhealthy conditions by which an adequate supply of pure air is not provided. By invasion, or extension, as when bronchitis primarily exists, and the parenchyma becomes associated with it, when it is called broncho-pneumonia, or by extension from the pleura, when the condition is known as pleuropneumonia.

Symptoms.—Rigors, or shivering fits, usher in most acute inflammatory affections, but are not always observed by the attendants. Refusing the food may be the first symptom noticed, and further examination show that the coat is staring, the extremities cold, the visible membranes more or less injected, the breathing hurried and shallow, with cough variable in character. It is not the loud, harsh cough of laryngitis, but deeper and infrequent, as if the pain caused in coughing were so great as to induce the animal to suppress it altogether. There are to be met with unmistakable cases of pneumonia in which cough is not present at all. The internal temperature rises rapidly, and the animal wears a dejected aspect. As the disease progresses, the breathing becomes more and more difficult and the lungs consolidated or else gangrenous, and death ensues.

Treatment.—As with the other inflammatory disorders of the respiratory tract counter-irritation with mustard, applied early, is usually good treatment, but many eminent practitioners prefer hot compresses around the chest, and special appliances are made for the purpose similar to those referred to in connection with sprains of the lumbar region (see page 527). A sheet dipped in hot water and wrung out quickly may be applied with a sufficient covering of other materials to prevent rapid evaporation. Pure air, and that as cool as the circumstances permit, should be obtained while clothing the body and bandaging the extremities to keep up the circulation. To reduce the temperature of the body and the frequency of the pulse while increasing its force will be the chief object of any medicines prescribed. Aconite and digitalis have the reputation of bringing about this desirable result, and three or four doses may be given at intervals of as many hours, but they are not remedies to be persisted in for any length of time, and a change may be made to belladonna and nitrate of potash. Bicarbonate of potash may be given in the drinking water, or salicylate of soda, but in this way of giving medicines care must be exercised to dissolve the medicament in only just so much water as the horse will drink, or he will never get two doses of equal proportion.

If the application of mustard is quickly followed by the usual results it

is regarded as a hopeful symptom, but the animal that appears indifferent
to the sting of it, and upon whose skin no visible effect is produced, is not
very likely to recover. Good nursing and suitable environment is of the
utmost importance, and every inducement offered to the animal to lie down.
It is not true to say that horses affected with this disease never lie down,
but it is a common symptom, and doubtless militates against their recovery,
as a few minutes' sleep is more likely to be obtained at intervals if the
animal assumes a recumbent posture. Tonics, as quinine, vegetable bitters,
and mineral acids are helpful in restoring the patient's strength when the
temperature has come down to nearly normal, but some considerable time
should be allowed to elapse before he is put to work, as the products of
inflammation must have time to be carried away before it is safe to call
upon the lungs for any great effort.

CONGESTION OF THE LUNGS.—To clearly understand the difference between
congestion and inflammation of the lungs the reader is referred to the
Physiology of Respiration at page 467. It is not congestion of the lung
substance itself, though it has that appearance to the unaided eye when
seen *post-mortem.* It is engorgement of those pulmonary vessels whose
office it is to carry venous blood to the lungs for removal by contact with
the oxygen of inspired air. The known causes are several besides others
not so clearly understood. To put a typical case before the reader we
will choose the hastily conditioned hunter, or the grass-bellied yeomanry
horse which the recruit in his pride parades on the first day of " permanent "
duty. The first has had too much corn and too little exertion, while the
latter is soft and full of blood, conditions altogether unfavourable for severe
muscular exertion. In the excitement of the chase (or under orders and a
heavy kit), the animal is overtaxed and the blood forced into the lungs is
not carried away ; the animal's distress tells a practised horseman that it is
time to pull up and turn his head to the wind, slacken his girths, and retire
from the field. If he has a flask in his holster the rider will give its con-
tents to his horse rather than himself, and probably no further trouble
will result. On the other hand, if the animal is urged to further exertion
his life may be the forfeit. Though ridden to a standstill he may presently
be induced to walk to the nearest hostelry, but he will not feed. His
ears and legs will be found to be cold, his eyes injected, not with the same
tint as in ordinary inflammation, but darker in colour ; blowing, trembling,
perhaps partial sweats, hanging his head in a corner and looking altogether
a picture of dejection. If successful treatment is not adopted he succumbs
in a day or two from literal " want of breath," or a portion of the lungs
may remain patent and he dies a few days later when the engorged part
has become putrid. Congestion of a less severe nature may show itself only
in dulness and shallow breathing, staring coat, loss of appetite, and the
symptoms above described only in a modified form. It is nevertheless ex-
tremely dangerous, and such cases after a few days suddenly take a turn for
the worse and death ensues when the owner may not have thought at all
seriously of the case. From what has been said it will be seen that con-
gestion of the lungs is sudden in its development and dangerous to the
animal's life

Treatment.—The disease being one of obstructed circulation, the rational
treatment is to give such remedies as enjoy the reputation of urging on the

blood stream and diffusible stimulants which will enable the heart to carry on the work at which it has failed. One may be a long way from a veterinary surgeon or medical aid, but half-a-pint of whisky can generally be obtained, and should be given in a quart of water in the absence of professional assistance.

Once in a stable, and provided the disease has not made too much progress, bleeding from the jugular vein may be the means of saving the patient's life. The attentive reader will have observed that the practice of blood-letting is very rarely advocated in this work, but the disease we are considering is one in which that operation is especially beneficial if performed at the right time. It is a good plan to give a stimulant first and use the lancet some ten minutes afterwards, there being a difficulty in getting the blood to flow. There was a time when every farmer almost could and did bleed a horse or a cow for any and every complaint, but since the evil has been generally recognized and the custom fallen into desuetude, the subject of congestion of the lungs may have to wait for the attendance of a veterinary surgeon before it can be effected. He will judge by the character of the pulse whether bleeding is likely to be beneficial, and may deem it advisable to abstract two or three quarts of blood. With less blood to deal with and an artificial impulse given to the heart by stimulants, a more general distribution of the fluid may be effected, and some very excellent " cures " are brought about in this way. There is a difference of opinion as to the application of mustard to the sides of the chest, but the majority of experienced practitioners are still in favour of it. Besides the popular forms of alcohol, heart stimulants may be given of a more lasting character, as digitalis, ether, aromatic spirit of ammonia, or the carbonate in solution. Every effort should be made to re-establish the circulation in the parts most distant from the centre, and the legs and ears should be wisped and pulled, clothed and bandaged. While keeping the surface warm, the patient should be placed in a box where he can obtain the largest amount of pure air, tying up his head to the open door, if he is found to persistently hang it down in the worst corner of the box. If the appetite is entirely lost the patient may be sustained with milk and eggs given with the drenching-bottle. Constipation should be guarded against by the use of laxative foods, as bran, green meat, carrots, etc., or a soap-and-water clyster, a dose of sulphate of magnesia or soda, but on no account should an aloetic ball be given. Only walking exercise should be prescribed until the patient has made considerable progress towards recovery.

PLEURISY

Is an inflamed condition of the membrane which lines the walls of the chest and is reflected over the surface of the lungs. In health this serous surface secretes a fluid intended to lubricate the chest and permit of the movements necessary to respiration without the possibility of friction. If the pleuræ become inflamed, whether by association with pneumonia (pleuro-pneumonia) or bronchitis (broncho-pneumonia) or the condition of pleuritis exist alone, there will be an altered secretion. A period of congestion is

rapidly followed by one of effusion, which may go on to such an extent as to constitute water on the chest (hydrothorax).

The causes are the same as pneumonia and bronchitis (see pages 540, 547).

The Symptoms differ somewhat in the tenderness on pressure against the ribs, and a difficulty in turning, which is often accompanied with a grunt of pain. In the congestive stage, if the ear is applied to the sides of the chest a friction sound may be detected as of two pieces of paper rubbed together between the fingers, and as the disease progresses the presence of fluid may be made out by a splashing or tinkling sound as of drops of water falling into a well.

Treatment.—This should be the same as for other inflammatory diseases of the chest (see Pneumonia, p. 547), but there should be no hesitation about the application of mustard, since the diseased tissue is so comparatively near to the skin, the very best results may be anticipated from counter-irritation.

BROKEN WIND

A BROKEN-WINDED HORSE can be detected at once by any horseman possessed of experience, from the peculiar and forcible double expiration. Inspiration is performed as usual, then comes a rapid but not violent act of expiration, followed by a forcible repetition of the same, in which all the muscles of respiration, auxiliary and ordinary, are called into play. This is, of course, most marked when the horse has been galloped, but even when he is at rest the double expiration is manifest at almost any ordinary distance from the observer.

More or less emphysema of the lungs is usually found after death, but in not a few broken-winded horses is it absent, and the cause cannot be stated with certainty. Over and above the residual air which is normal in health, there is in broken wind an increased amount which the single and usual act of expiration fails to expel. The causes are bad and innutritious food—musty hay, outsides of hay-ricks, chopped straw and other food entailing a large amount of digestion for very small results. It is also largely hereditary.

Treatment.—Though no hope of curing broken wind can be held out, there are many horses doing good work while badly affected with it. The *symptoms* may be very much ameliorated by judicious feeding and management. No large quantity of food or water should be allowed at one time. All the food given should be damped, and a bed provided, such as sawdust, or peat-moss, that the animal will not eat: instead of dry hay, cut grass and clover, lucerne, rye, carrots, boiled linseed or linseed oil mixed with the kibbled corn. Treacle or molasses is a favourite remedy in France, and there is no doubt that it is beneficial, as also occasional dosing with tar and fats, as suet and lard.

THICK WIND

THICK WIND is the horseman's term for any defective respiration unaccompanied by a noise, or by the signs of emphysema just alluded to. It usually follows pneumonia, but it may arise from chronic bronchitis, occasioning a thickening of the mucous membrane lining the bronchial tubes

and thus lessening their diameter. No *treatment* will be of any service except such as will aid the play of the lungs mechanically, by avoiding overloading the stomach, as mentioned in the last section.

Careful dieting, as for broken wind, has a modifying influence, and considerable improvement may take place in recent cases by the absorption of the morbid products of inflammation.

SPASM OF THE DIAPHRAGM

SOME HORSES, when at all distressed by the severity of their gallops, communicate to the rider a most unpleasant sensation, as if some internal part was giving a sudden blow or flap. This is not only a sensation, but a reality, for the diaphragm being naturally weak, or overstrained at some previous period, acts spasmodically in drawing in the air. If the horse thus affected is ridden onwards afterwards, he will be placed in danger of suffocation and death, either from rupture of the diaphragm, or from its cessation to act, or from its permanently contracting and refusing to give way during expiration. There is no cure for the weakness which tends to produce the spasm, and all that can be done is to avoid using the horse affected with it at any very fast pace, and over a distance of ground. Urgent *symptoms* may be relieved by a cordial-drench, such as the following :—

Take of Laudanum . . . . 6 drachms.
Ether . . . . 1½ ounces.
Aromatic Spirit of Ammonia . . . . . . 3 drachms.
Tincture of Ginger . . . . 3 drachms.
Ale . . . . 1 pint. Mix.

Or if there is any difficulty in giving a drench, a ball may be made up and given—

Take of Carbonate of Ammonia . . . . 1 drachm.
Camphor . . . . ½ drachm.
Powdered Ginger . . . . 1 drachm.
Linseed meal and water sufficient to make into a ball.

Either of the above may be repeated at the end of three hours, if relief is not afforded. Increased strength may be given to the diaphragm by regular slow work, and the daily mixture of a drachm of powdered sulphate of iron with the feed of corn.

DISEASES OF THE HEART

THE HORSE is subject to inflammation of the substance of the heart (carditis) of a rheumatic nature, and of the fibro-serous covering (pericarditis), but the symptoms are so obscure that no one but the professional veterinarian will be likely to make them out. Dropsy of the heart is a common disease in worn-out horses, and hypertrophy, as well as fatty degeneration, is often met with among well-conditioned animals.

DISEASES OF THE BLOOD-VESSELS OF THE CHEST AND NOSE

THE HORSE IS VERY SUBJECT TO HÆMORRHAGE from the nose, coming on during violent exertion, and many a race has been lost from this cause. Fat over-fed horses are the most likely to suffer from hæmorrhage; but most people are aware of the risk incurred in over-riding or driving them, and for this reason they are not so often subject to this accident (for such it is rather than a disease) as they otherwise would be. It is unnecessary to describe its *symptoms*, as the gush of blood renders it but too apparent, and the only point necessary to inquire into is, whether the lungs or the nasal cavities are the seat of the rupture of the vessel. In the former case the blood comes from both nostrils, and is frothy; while in the latter it generally proceeds from one only, and is perfectly fluid. The *treatment* should consist in cooling the horse down by a dose of physic and a somewhat lower diet; but if the bleeding is very persistent, and returns again and again, a saturated solution of alum in water may be syringed up the nostril daily, or, if this fails, an infusion of matico may be tried, which is far more likely to succeed. It is made by pouring half-a-pint of boiling water on a drachm of matico-leaves, and letting it stand till cool, when it should be strained, and is fit for use.

HÆMORRHAGE FROM THE LUNGS is a far more serious affair, and its control requires active remedies if they are to be of any service. It may be caused by the rupture of a large vessel, or on the contrary only some small capillaries, and its volume will to a great extent indicate which. Perfect repose in an airy box is a first necessity, and an avoidance of all excitement and fuss on the part of attendants. Only such agents as act through the medium of the circulation can be used, and of these gallic acid and sugar of lead are the most likely to be of service in arresting the flow of blood. Suitable doses (see Table of Doses) should be administered every hour if necessary, or until the hæmorrhage ceases. When it has been arrested there necessarily remains an area of lung in which the cells are blocked up, and this has to undergo certain changes before the parts can be restored, and cease to be a source of danger. Pneumonia may follow from the presence of a blood-clot, or one of these entering a vessel may be arrested in some other part and set up a new area of inflammation. Apparently rapid and complete recoveries often take place, but should be treated with the greatest care, not suffering the animal to exert himself beyond what is necessary for gentle exercise. No attempt should be made to train such a horse either for racing or hunting for some months, and even then he will be liable to a recurrence of the accident and had better be put to work of a slower character.

CHAPTER XXVIII

DISEASES OF THE ABDOMINAL VISCERA AND THEIR APPENDAGES

GENERAL REMARKS—DISEASES OF THE MOUTH AND THROAT—DYSPEPSIA—GASTRITIS—
STOMACH STAGGERS—GRASS STAGGERS—RUPTURE OF THE STOMACH—COLIC: GRIPES
OR FRET—FLATULENT COLIC—INFLAMMATION OF THE BOWELS—TWISTED GUT—
PERITONITIS—CONSTIPATION—DIARRHŒA—CALCULI IN THE BOWELS—DISEASES OF
THE LIVER—DISEASES OF THE KIDNEYS—DIABETES—INFLAMMATION OF THE BLADDER
—DISEASES OF THE GENERATIVE ORGANS—CANCER OF THE PENIS.

GENERAL REMARKS

THOUGH NOT OFTEN PRODUCING what in horse-dealing is considered unsound-
ness, yet diseases of the abdominal viscera constantly lead to death, and
frequently to such a debilitated state of the body, that the sufferer is
rendered useless. Fortunately for the purchaser, they almost always give
external evidence of their presence, for there is not only emaciation, but
also a staring coat and a flabby state of the muscles, which is quite the
reverse of the wiry feel communicated to the hand in those instances
where the horse is "poor" from over-work in proportion to his food.
In the latter case, time and good living only are required to restore the
natural plumpness; but in the former, the wasting will either go on
until death puts an end to the poor diseased animal, or he will remain in a
debilitated and wasted condition, utterly unfit for hard work.

DISEASES OF THE MOUTH AND THROAT

SEVERAL PARTS ABOUT THE MOUTH are liable to inflammation, which would
be of little consequence in itself, but that it interferes with the feeding, and
this for the time starves the horse, and renders him unfit for his work,
causing him to "quid" or return his food into the manger without swallow-
ing it.

Injuries to the lips, tongue, lining membrane of the mouth, dental
troubles, eruptions, glandular swellings, and lodgment of foreign bodies are
among the causes of quidding.

Where any difficulty either in the prehension of the food or in mastication
is observed, the mouth should be carefully examined, and if nothing is to be
seen by the ordinary method of opening it and pulling the tongue on one side,
a proper mouth-gag (see page 545) should be used to make further search.

If a temporary tooth has become wedged it must be removed, and the
same remark applies to any other body that may have become impacted
between the teeth. Young horses, particularly yearlings at grass, are
subject to the formation of a bladder or blain inside the lips and upon the
side of the tongue, giving rise to distressing symptoms; food is refused and
long ropes of viscid and perhaps discoloured saliva hang from the angles of the

mouth. If this is found to be the case the bladder should be immediately lanced and with the evacuation of its contents early relief may be expected. The sore surface should be sponged with a solution of alum or boric acid. Vinegar diluted is a favourite remedy among breeders, but not so effectual as those above named, since in a few instances a ragged ulcer is left with a disinclination to heal up and foul-smelling breath. Alum is perhaps of all remedies the best for mouth sores, and in the days of foot-and-mouth disease, large ragged sores might be seen almost healed with a few applications. Old horses through irregularities of the teeth are liable to lacerated cheeks, and the tooth-rasp must be used to prevent a recurrence of the trouble.
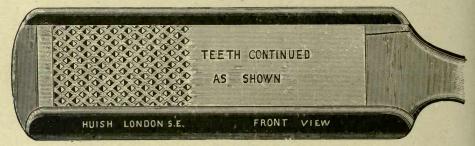
FIG. 99a.—C. H. HUISH'S TOOTH-RASP.

The old-fashioned instrument was a clumsy contrivance, needing a very large amount of manual power and some dexterity, but with the instrument here illustrated the horse-owner will effect a saving in his corn that will soon pay the cost of one.

SORE THROAT.—By this term it is not intended to convey the idea of disease of the respiratory tract, although an inflammatory condition of the fauces often leads by sympathy or invasion to affections of the larynx (see Laryngitis).

When the throat inflames, as is evidenced by fulness and hardness of this part, and there is difficulty of swallowing, the skin covering it should immediately be severely sweated, or the larynx will be involved and irreparable injury done. The tincture of cantharides diluted with an equal part of spirit of turpentine and a little oil, may be rubbed in with a piece of sponge, until it produces irritation of the skin, which in a few hours will be followed by a discharge from the part. Six or eight drachms of nitre may also be dissolved in the water which the horse drinks, with some difficulty, but still, as he is thirsty, he will take it. Sometimes eating gives less pain than drinking, and then the nitre may be given with a bran mash instead of the water.

CHOKING.—This accident, which is of comparatively frequent occurrence in other animals, is rare in the horse but attended with considerable danger. It may occur in any part of the food passage from the back of the mouth to the distant or cardiac end of the gullet.

The Causes.—Bad teeth, imperfect mastication, fright, drinking with food in the mouth, impaction of foreign bodies or diseased condition of the oesophagus. Imperfect mastication, either from bad teeth or greediness, may result in a pellet of food passing into the pharynx in a condition unfit for

swallowing ; the muscles are unable to contract upon it with sufficient force, and it becomes lodged, or, in the case of long hay or straw, it may be entangled among the long and ragged molars at the back of the mouth. An apple, round, smooth, and slippery, may pass beyond control of the tongue, and lodge in the pharynx or any part of the œsophagus ; so also with pieces of turnip or whole eggs, administered by the groom for conditioning purposes. Nails, pins, needles, and other foreign bodies finding their way into the manger are also occasional causes of choking. The term is further applied to obstructions in the windpipe.

The Symptoms are very distressful ; the animal suddenly ceases feeding, a spasmodic contraction of the throat and neck muscles gives him the appearance of having a stiff neck, the nose is poked out, the breathing hurried and loud, the eyes bloodshot, and gulping efforts alternated with attempts at vomition and coughing.

Treatment.—The patient's fear and excitement must be allayed as far as possible by a soothing manner on the part of the attendant, and an immediate effort made to ascertain the nature and situation of the obstacle. A glance at the left channel of the neck may show an enlargement, or an examination of the mouth may lead to the detection of the offending body, or it may be so low down in the thoracic portion of the gullet as to be invisible. If seen from the outside and felt to be of a compressible nature, it may be so manipulated as to pass on with but very little mechanical aid. It often happens that only a very slight additional power is needed by the muscular tube which for the moment has become paralyzed ; failing to remove the obstacle with gentle pressure, other measures should be adopted. A little linseed oil poured into the throat, and repeated in a few minutes, may alone accomplish the purpose by lubricating the passage and softening the pellet. If it fail to do so and the obstruction is not discovered to be in the pharynx, the mouth speculum should be adjusted to enable the operator to pass a probang. This is a long tube either of coiled wire or other material, covered with leather, and having a cup-like portion at one end, and a ball at the other. The end chosen for insertion should be oiled and passed over the tongue with gentle but continuous force until the object is reached, when, if the resistance is not too great, it should be pushed on without hesitation right down to the stomach, and the instrument withdrawn. It may be necessary to remove the probang and give a little more oil and pass it again : the operator, unless he is an experienced veterinary surgeon, being liable to fall into the error of too much haste. An obstruction such as an apple will often yield at the second or third attempt, when the oil has had a softening effect. Nails, needles, and the like, cannot of course be removed in this way, and must be carefully sought. They do not cause such acute symptoms, and if not lodged in the chest portion of the gullet may be found and cut down upon.

After treatment consists in abstinence, sloppy food, and if there is reason to suppose that the lining membrane is injured, small quantities of oil or glycerine and water may be given in sips or small " go-downs." Linseed tea at frequent intervals will be found to have an emollient effect. If a horse is subject to choking, it is not worth while keeping him, as it may be due to a sacculated condition of the gullet for which there is no remedy.

DYSPEPSIA

EVERY DOMESTIC ANIMAL suffers in health if he is constantly fed on the same articles, and man himself, perhaps, more than they do. Partridges are relished by him early in September, but *toujours perdrix* would disgust the most inveterate lover of that article of food. Dogs are too often made to suffer from being fed on the same meal, flavoured with similar flesh or broth, from one month to another. It is well known that cattle and sheep must change their pasture, or they soon lose condition; and yet horses are expected to go on eating oats and hay for years together without injury to health; and at the same time they are often exposed to the close air of a confined stable, and to an irregular amount of exercise. We cannot, therefore, wonder that the master is often told that some one or other of his horses is " a little off his feed "; nor should we be surprised that the constant repetition of the panacea for this, " a dose of physic," should at length permanently establish the condition which at first it would always alleviate. It is a source of wonder that the appetite continues so good as it does, in the majority of horses, which are kept in the stable on the same kind of food, always from July to May, and often through the other months also. The use of a few small bundles of vetches, lucerne, or clover in the spring, is supposed to be quite sufficient to restore tone to the stomach, and undoubtedly they are better than no change at all; but at other seasons of the year something may be done towards the prevention of dyspepsia, by varying the quality of the hay, and by the use of a few carrots once or twice a week. In many stables, one rick of hay is made to serve throughout the whole or a great part of the year, which is a very bad plan, as a change in this important article of food is as much required as a change of pasture when the animal is at grass. When attention is paid to this circumstance, the appetite will seldom fail in horses of a good constitution, if they are regularly worked; but without it, resort must occasionally be had to a dose of physic. It is from a neglect of this precaution that so many horses take to eat their litter, in preference to their hay; but if the same animal was placed in a straw-yard for a month, without hay, and then allowed access to both, there would be little doubt that he would prefer the latter. Some horses are naturally so voracious that they are always obliged to be supplied with less than they desire, and they seldom suffer from loss of appetite; but delicate feeders require the greatest care in their management. When the stomach suffers in this way, it is always desirable to try what a complete change of food will do before resorting to medicine; and, if it can be obtained, green food of some kind should be chosen, or if not, carrots. In place of hay, sound wheat or barley straw may be cut into chaff, and mixed with the carrots and corn; and to this a little malt-dust may be added, once or twice a week, so as to alter the flavour. By continually changing the food in this way, the most dyspeptic stomach may often be restored to its proper tone, without doing harm with one hand while the other is doing good, as is too often the case with medicine. The use of the fashionable " horse-feeds " of the present day will serve the same purpose; and if the slight changes I have mentioned do not answer, Thorley's food may be tried with great probability of success.

GASTRITIS

In the horse this affection may be acute or chronic. It is an inflamed condition of the stomach, in which the secreting glands participate, and result in failure to digest the food and a pouring out of excessive quantities of fluid.

Causes.—Engorgement with food, particularly when it is of a coarse and innutritious nature, as in the case of hill-ponies subsisting upon heath and ligneous fibres with but little grass. Over-stimulating food given in excessive quantity is another cause, or it may be induced by diseases in adjacent structures, as the liver. The accidental or intentional administration of irritant poisons, as arsenic, lead, and zinc, or by eating poisonous compounds out of curiosity. Sheep-dips composed largely of arsenic and having a saline taste are readily eaten when left within reach by careless persons. The leaves of yew trees and the young shoots of some rhododendrons are also causes of gastritis.

Symptoms.—These are abdominal pain evinced by restlessness, looking round at the side, scraping with the front feet or striking at the belly with the hind limbs; and to differentiate between pain caused by any other abdominal affection, we must look for other symptoms, as a frothy discharge of saliva from the mouth, or hanging ropes of thick glassy mucus from the corners of it, a depressed and anxious countenance and nausea exhibited by turning up the lip. The breath is more often sour and offensive than in cases of prolonged colic, which in many respects it resembles. The conjunctival membranes are reddened, the pulse is quick and irritable, and the breathing hurried.

Treatment.—Before any remedial measures can be taken, it is of the utmost importance to obtain a history of the case, and if possible ascertain which of the causes enumerated is to be held responsible for the result. If dietetic errors alone are traceable, in the correction of these, aided by stomachic medicines, success may be looked for. A gentle purge with linseed oil or saline doses consisting of Epsom or Glauber salts should be first given, in order to get rid of offending material and prepare the way for suitable food, which should be given in small quantities only and assisted by such agents as nux vomica, calumba root, and either a course of alkalies, bicarbonate of soda or potash, or else the mineral acids. When the alkalies prove unsuitable a mixture of acids, as nitro-hydrochloric, may have the desired effect, and although in theory it would seem that what is known as an acid condition would be necessarily benefited by ant-acids, it is not always the case in practice.

If acute gastritis is the result of irritant poisons, and their nature can be ascertained, direct antidotes may be given to neutralize chemically any remaining portion that may not have been already absorbed, or physiological ones administered to counteract their effect. With the horse we are precluded from the use of emetics, and as a rule too much time is lost to neutralize the poison or employ agents which will render it innocuous. If either of the mineral acids have been given, or carbolic, an effort should be made to neutralize them with chalk, carbonate of soda or potash, or whitewash from the walls. Eggs and milk also mask the bad effects, and may be

given in large quantities. The foregoing are very rare causes, and can only get into a horse's stomach by an ignorant poisoner intentionally.

Arsenic, in the form of weed-killer or sheep-dip, has proved fatal to not a few, either from getting mixed with the food, or being discovered and eaten by horses. It is also given, but happily less often in the present day, as a vermifuge, and to make the coat shine, by lazy attendants. All that the horseman can do in such accidental poisonings, is to give milk and eggs and linseed tea while sending for a professional man, who should be informed of the probable cause, an omission of common occurrence in the excitement and hurry of dispatching a message. It is only by coming prepared with antidotes that the veterinary surgeon can hope for any success.

With an abatement of the symptoms, careful nursing and diet may succeed in restoring the patient to health, as the stomach is capable of effecting wonderful repairs, as may be seen by the industrious student who examines a large number at the slaughterer's yards.

CHRONIC GASTRITIS presents the same symptoms only in a less marked degree, and the treatment is much the same, diet being the primary consideration.

STOMACH STAGGERS

THIS disease is induced by over-gorging the stomach, and is a frequent result of feeding upon cooked foods, which the animal swallows without sufficient insalivation (see Digestion). Watering after a full meal, long fasting and greedy feeding, also contribute to distend the stomach beyond its capacity to contract upon the food within it.

Symptoms.—Colicky pain with eructations, pawing with the front feet, trembling, sometimes vomiting and discharge through the nostrils. These symptoms are common to gastritis, but a comatose condition follows. In so-called staggers the animal stands in a dazed and stupid condition, resting his forehead against the manger or leaning against a wall or post, and if compelled to move staggers as if intoxicated. The breathing is slow and laborious, actual snoring being not uncommon. The pulse is full in volume and slow.

Treatment.—The comatose condition is best treated by copious bleeding, without which a fit of delirium or rupture of the stomach may occur before other remedies have had time to act. A full dose of aperient medicine may be given at the same time, four to eight drachms of aloes in the form of a bolus being a suitable one.

With convalescence great care in the matter of diet must be observed, and the subject of this disease will always be liable to its recurrence.

GRASS STAGGERS

WITH THE ADVANCE OF SUMMER and when the grasses are in seed, it is supposed that some narcotic principle is developed in them, for it is at such times this affection is met with. It does not come on with the suddenness of sleepy or stomach staggers, and may appear among a number of horses at the same time. If noticed early, the animal is seen to walk with

his head down, or almost between his knees, and may even be made to trot in that peculiar attitude. With the progress of the malady he becomes paralyzed, is troubled to keep on his feet, staggers in his walk, and supports himself against a tree or gate. Convulsions may cause his death.

Treatment.—If detected early in its manifestation, the disease may be cut short with a full dose of aperient medicine, which should be combined with calomel—aloes and calomel, in the form of a ball—but if it has gone on for some time and the symptoms are severe, bleeding from the jugular vein should be at once resorted to, the rectum unloaded with the hand, and a clyster of soap and water thrown up. As soon as the aperient acts grass staggers pass off. Change to another pasture, or hay in limited quantities, may be advisable.

RUPTURE OF THE STOMACH

This accident is usually the result of previous engorgement and weakening of the walls, when upon some extra exertion, the stomach being full, its coats give way and more or less of the contents escape into the cavity of the abdomen. It has been known to happen from casting horses when full of grass, and from falls while hunting or in harness. It is also attributed to the action of great numbers of bots and the lesions produced by habitual wind-sucking.

The Symptoms are similar to those of impaction of the stomach or acute gastritis, and vomition is almost diagnostic, so seldom does it occur under other conditions. The returned food comes through the nostrils (by way of the posterior nares). There is every sign of collapse, as running down pulse, cold extremities, haggard face, and panting breath, while partial sweats, trembling, and reeling generally precede the fall of the animal in his death struggles.

No Treatment can be attempted, but if there is any doubt in the mind of the owner, the remedies advised for gastritis and engorgement should be prescribed.

COLIC, GRIPES OR FRET

ACUTE ABDOMINAL PAIN is generally known by the above terms. It may be evanescent and of very little importance, or have its origin in serious diseases of the abdominal viscera. It is frequently observed to be hereditary, and the subjects of it are more liable to a recurrence than horses that have never suffered.

Causes.—Indigestion, excessive fatigue, watering on a full stomach, boiled foods, constipation, impaction, and heredity. Diseases of the liver and other organs taking part in digestion. Tumours, stones, and foreign bodies.

The common forms of colic have two principal causes, namely, spasmodic contraction of the muscular coat of a portion of the intestine or distension by gases eliminated by retained and fermented food. The first is known as spasmodic colic and the second as flatulent, but they may both be present at the same time.

The Symptoms of spasmodic colic are acute abdominal pain evinced by pawing and scraping with the front feet, stamping and striking at the belly with the hind ones, looking round at the flank, crouching, lying down, rolling, sometimes groaning, partial sweats, laying back the ears, anxious countenance, ineffectual attempts to pass urine. Intervals of ease in which the patient may resume the meal he had suddenly ceased to eat ; again all the acute symptoms returning when the attendants imagine the attack has passed away.

The passing of urine generally follows relaxation of the spasm, and this has given rise to a very general belief among stablemen that cases of colic are nearly always attributable to the kidneys or " in the water."

Treatment. — Diffusible stimulants and anodynes. Among the former, aromatic spirit of ammonia, ether, nitrous ether, turpentine, brandy, whisky, old ale, etc., have long enjoyed a reputation, while preparations of opium, as the tincture (laudanum), chlorodyne, and other mixed sedatives are generally employed with good effect. Unloading the rectum with an oiled hand (back-raking), clysters of warm soap and water, tobacco-smoke, etc., are recommended. The modern veterinarian, armed with subcutaneous syringe and tabloids of concentrated drugs, may inject morphia and aconite, or belladonna, choosing the loose thin skin behind the elbow or other convenient situation. Hand-rubbing and kneading the abdomen with the knuckles appears to be grateful to the patient in some instances. Walking him about when in acute pain is a long-established custom based upon the fear of twisted gut or rupture occurring in the animal's struggles upon the ground if allowed to choose those attitudes which suggest themselves alike to man and beast ; there can be no proof adduced that the former lesion is brought about by rolling, but that rupture of an organ already distended may so occur has some support in the fact that horses cast for surgical operations, or falling in harness or the chase, occasionally come to an untimely end in this way.

When an attack has passed off an aperient dose may be advisable, and a general inquiry into the feeding and management in order to prevent a recurrence through any error of diet.

FLATULENT COLIC

WHILE resembling spasmodic colic in the symptoms of pain and distress and the suddenness of the attack, has the additional one of distended flank, a drum-like condition is observed on striking the space between the last rib and the hip, besides which there may be eructations and frequent flatus from the rectum. A quantity of fermented food may generally be surmised, and a dose of aloes proportionate to the size and constitution of the animal should be prescribed. It will be doing its work in removing the mass of ingesta, while anti-spasmodic remedies are administered to relieve pain, decompose gases, and reduce the tension of the bowels and stomach. These gases are of variable composition, and remedies intended to act chemically by decomposing them into harmless salts are not so successful in practice as might be expected if an accurate knowledge of them were possessed. For the most part they are composed of carbonic

acid and sulphuretted hydrogen. Ammonia, otherwise than in the form of carbonate, may have a speedy effect in reducing the tympany. Chlorinated lime in small doses, and freely diluted, is often beneficial, and carbolic acid, with the same precautions as to dilution, appears to prevent or retard the elimination of noxious gas. Linseed oil is a good remedy both for its well-known effect in keeping down fermentation in the ingesta and for its subsequent action as a laxative. Back-raking and clysters are particularly useful in giving increased facilities for breaking off wind, and of softening and assisting in the removal of hardened fæces.

Puncture of the large gut (colon) with a suitable trochar and canula is a comparatively safe and very effectual remedy in the hands of the skilled veterinarian, but without an intimate knowledge of anatomy it will not be advisable for the horseman to attempt it.

Only during the paroxysms of pain is the pulse very much disturbed, and the temperature is but slightly raised, or not at all in cases of short duration.

INFLAMMATION OF THE BOWELS

Enteritis and Peritonitis often pass under this name. The former is a disease of the middle or muscular coat of the intestine, or it may affect the mucous layer also when it is known as muco-enteritis. It is a very fatal disease, and not much is known of its true nature. There are some farms and stables where it is prone to occur, and the most thorough investigation may fail to discover any defect in the water or food. The death of horses suffering from this malady in such a short time has led to the supposition that some disease germ gets introduced into the intestinal wall, and post-mortem examination of a superficial nature goes to confirm it by the patchy character of the discoloured and diseased portion of the bowel. While enteritis usually comes on without any apparent cause, it may also be a sequel to colic, impaction or other disease. Chills and excessive fatigue are also supposed to produce it.

Symptoms.—These have a common likeness to colic, but the patient's behaviour is usually more temperate; in the place of violent pawing and rolling, he scrapes the ground uneasily and lies down carefully, not with the *abandon* of a horse with spasmodic colic. He remains longer prone and looks mournfully round from time to time, gets up again, scrapes, crouches, and soon resumes his old attitude on the floor of the box. The membranes of the eye and nostrils, in sympathy with the bowels, are very much injected, the pulse irritable and small, and a high temperature is persistently maintained throughout. There are no intervals or remissions of pain as in colic. Clammy sweats alternate with coldness of the body surface, and the legs and ears vary greatly—one leg will be warm and another cold, the ears at one time warm and at another cold. As the disease progresses, he will, if in a loose box, wander round and round unhappily, with tail somewhat erect and trembling when he comes to a halt. He may die in a fit of delirium, or gradually sink; the quietness which is often mistaken for improvement in his condition is but a precursor of death.

Treatment.—In a disease the origin of which is so ill understood, it is

not surprising that much difference of opinion exists as to the proper treatment. Captain Hayes thus summarizes the "principles of treatment."—"1. Give to the inflamed part rest, which is best accomplished by opium, as that drug has a special action in arresting the motion of the intestines. 2. Administer a strong sedative to allay the pain which threatens the life of the animal, and allow him to tide over the attack, for which purpose opium is also suitable. 3. Check the action of disease germs, or, at least, of decomposing food in the bowels, as may be done by Jeyes' Fluid or carbolic acid."

Half-ounce doses of powdered opium in the form of extract, or like doses of extract of cannabis indica may be given. Jeyes' Fluid may be administered in half- or three-quarter-ounce doses in a pint of linseed oil or other bland fluid, as mucilage of acacia, starch, or linseed tea. Hot fomentations to the abdomen, and the injection of warm water per rectum have a soothing effect, and are now very generally adopted by veterinary surgeons in the treatment of this fatal complaint, from which but a small number of recoveries take place.

TWISTED GUT

THIS ACCIDENT is as a rule a sequel to some other disease, as colic, spasmodic or flatulent, and is generally believed to result from struggling on the ground (see Colic). Captain Hayes, whose experience as a breaker as well as a veterinary surgeon, is perhaps unequalled, is "strongly of opinion that these violent movements never induced twist of the bowel, unless, possibly, the relative positions of its parts are altered from their normal condition by some unusual cause, such as distension."

The Symptoms during life are those of colic with some variations, but there is practically no diagnostic one by which we can say with certainty that a twist will be found after death. The pain is more continuous than in ordinary colic, and before the animal dies a quiescent period is usual. There is a flickering pulse which finally becomes imperceptible, sighing, trembling, and deadly cold extremities, the animal generally trying to keep on his feet till the last.

Treatment for twist, intussusception, and other accidental displacements of the bowels is "expectant"—that is to say, all we can do is to treat the spasm and pain in the hope that relaxation of the parts affected may follow. If displacement of a portion of the small intestine could be diagnosed with certainty before any great amount of inflammation had arisen it would be possible under the influence of chloroform to cut through the abdominal parietes and reduce it, indeed it has been done, but the difficulties are great and the prospects of recovery very small, as the predisposition of the horse to peritonitis even under the most favourable aseptic conditions is almost a fatal objection.

PERITONITIS

INFLAMMATION OF THE LINING MEMBRANE of the abdomen which also invests the viscera is an extremely dangerous disease, and may be excited by com-

paratively trivial causes. It is often idiopathic, arising from no known cause, or may result from external violence, abdominal operations, castration, punctured wounds, escape of food into the cavity, as in ruptured stomach and bowel, or from sympathy with any inflamed organ in the abdomen.

Symptoms.—Hurried breathing, maintaining a fixed attitude with disinclination to change it, icy cold extremities, total loss of appetite, quick irritable pulse, depressed and anxious countenance.

Treatment.—The same as for enteritis (see page 561).

CONSTIPATION

THIS is usually due to dietetic errors, and is best corrected by laxative food. Healthy fæces should be so well known to the practical horseman that he should not fail to recognize constipation in its early stage when the dung balls are small and glassy, and passed with an expulsive effort amounting to straining, erecting the tail, and arching the back. If these signs are disregarded, impaction and stoppage may follow.

Treatment.—An oily aperient, as a pint of linseed oil, and a few bran mashes are all that is needed as a rule; the chief concern of the owner should be to prevent a recurrence by a judicious admixture of laxative food. When constipation is the result of inactive liver an aloetic ball may be necessary, and less stimulating food for a time until the bowels are properly regulated.

DIARRHŒA

WHILE some horses are liable to constipation others are disposed to looseness of the bowels, although there may be nothing in the food to excite it. Horses with this predisposition to looseness are called " washy," and frequently occasion a good deal of trouble to their keepers. Besides those whose dung is habitually too soft in the stable there are nervous, irritable animals that begin to unload the rectum at the sight of saddle or harness and become looser and looser upon the road, the diarrhœa ceasing again when stabled.

Super-purgation is diarrhœa induced by too large or too oft repeated a dose of physic. It generally happens through failure of the first dose to act, when the inexperienced give another and the medicine appears to be cumulative in its effects.

Treatment.—This will vary according to the cause. The " washy " may have a proportion of pea-meal and only dry foods allowed them. For the excitable very little can be done except to carry one's own feed upon a journey and avoid excitement and over-taxing the animal. When too much aperient medicine is responsible, astringents may be given. Of these, opium and catechu with chalk or bismuth may be chosen, and if there is a distinctly acid odour with the evacuations, benefit may be derived from the drinking of alkaline bicarbonates, as those of potash and soda, and a portion of lime water added to the drinking water. Arrowroot and starch gruel with eggs whipped up in them are also recommended. No bran or other laxative food should be allowed, but as much well-seasoned hay as the animal will take.

CALCULI IN THE BOWELS

A STOPPAGE IN THE BOWELS sometimes obstinately persists, in spite of all kinds of remedies, and, death taking place, it is found on examination that a large calculus has blocked up the area of the canal. Sometimes one of these calculi is found in the stomach, but this is extremely rare. On making a section they are found to consist of concentric layers of bran, chaff, and other hard particles of the food, mixed generally with some small proportion of earthy matter, and arranged around some foreign body, such as a piece of stone from the corn, or the head of a nail. Treatment is out of the question, as it is impossible to discover the calculus during life, and even if it could be ascertained to exist, no remedy is known for it. Those who are curious about the composition of these calculi, will be pleased with the following letter by Mr. Buckland, surgeon to the 1st Life Guards, in reply to an inquiry made in *The Field* as to the composition of a calculus found in a horse belonging to a correspondent :—

"Mr. C. Pemberton Carter having, in his interesting letter, requested me to throw some light upon this subject, I have great pleasure in giving what little information I am able to afford, with apologies for delay, as Aldershot camp is by no means a favourable spot for scientific investigations or literary pursuits. As regards the actual composition of calculi such as he has sent, we learn from the catalogue of the museum of the Royal College of Surgeons that they are composed for the most part of the phosphate of magnesia and ammonia, with small quantities of phosphate of lime. They also contain an animal and extractive matter, to which the brown colour of the calculus is owing. They also contain muriates of soda, and various alkaline salts derived from the intestinal juices. The animal matter resembles that of all other concretions, and separates in concentric laminæ when the calculus is dissolved in an acid. In more impure varieties, grains of sand, portions of hay, straw, etc., are frequently found embedded in the calculus, and there is one specimen in the museum which contains an entire layer of vegetable hairs. Mr. Carter remarks that 'his impression is that the calculus is made up of bran' (chemically speaking). He is not far wrong, for we read in the College catalogue, 'Most authorities agree that these calculi are formed from phosphate of magnesia, *contained in wheat, oats, hay,* etc., and this opinion derives confirmation from the circumstance that they occur most frequently in *millers' and brewers'* horses, which are fed upon grains, bran, and substances known to contain a much larger proportion of magnesian salts than other vegetable matters.' Mr. Carter has detected minute portions of wheat, oats, and hay in the calculus, which therefore may be said to consist of two substances, viz. the vegetable and the mineral. So much, then, for the composition of the calculus ; now for its mechanical structure. Most decidedly it may be compared to an onion, layer being packed over layer, so as in section to present a ringed appearance. We may also liken it to other objects. It has lately struck me to examine the structure of a common cricket-ball, which combines hardness, lightness, and elasticity in such an admirable way. Upon making a section, I found the cricket-ball to be composed of layers, one over the other, round a central nucleus. The layers are composed of leather, alternated with a vegetable fibre, the nucleus being

a bit of cork. The calculus in the horse is formed in a similar way. The nucleus in Mr. Carter's specimen is a bit of flint; in a capital instance I have in my own collection, of a common shot, about No. 5 size, which has been crushed by the horse's teeth, and subsequently swallowed; in another instance, of a chair nail of brass; in another of a single oat-seed; in another of a minute bit of cinder, and so on, as it seems to be absolutely necessary that these calculi should have a commencement—a starting-point. Where is the school-boy who can make a gigantic snowball without beginning with a small lump of snow or a stone, as a nucleus upon which he builds all the rest?

"Mr. Carter seems to wonder at the weight of the specimen, 5 lbs.; this is by no means a large size; in the museum of the Royal College of Surgeons we have a very fine collection of calculi; the largest, taken from the intestines of a horse, weighs no less than 17 lbs., and is about the size and shape of an ordinary skittle-ball. In the case where this is contained he will see many other specimens, cut in sections to show the nuclei; he will observe that calculi also form in the intestines of the camel and of the elephant, and even in the wild horse, for there is a good specimen from the intestines of a Japanese wild horse. Stones, not true calculi, are sometimes found in animals, which have been actually swallowed by them, and have not been chemically formed in this walking laboratory. There is a case containing several pebbles—thirty in number—found in the stomach of a cow at Barton-under-Needwood, Burton-on-Trent. These stones belong to the geological formation of the neighbourhood; it is curious to see how they have been acted on by the action of the stomach, for they are highly glazed and polished. I have seen specimens of gravel pebbles which I took from the gizzard of an ostrich, which are as highly polished as an agate marble. The bird swallowed the stones to assist its digestion; the cow out of a morbid appetite. I know of a somewhat similar instance that lately happened: A young lady was taken ill, and died of very strange symptoms; it was subsequently ascertained that the stomach was quite filled with human hair, which had moulded itself into the shape of the interior of that organ. The poor girl had naturally very long and beautiful hair, and she had an unfortunate habit of catching the loose hairs with her lips and swallowing them; in time they felted together, became a solid mass, and killed her— a warning to other young ladies which should not be neglected. In the lower animals we frequently find rolled balls of hair from the creatures licking themselves. I have seen one at Bristol from a lioness; it is formed of hairs licked with her rough tongue from her cubs. Curious concretions are found in goats, etc., called 'bezoar' stones; they were formerly supposed to have medicinal virtues: of this at another time.

"F. T. Buckland."

DISEASES OF THE LIVER

The farmer's horse and those subsisting largely upon grass are rarely subject to liver diseases, but the corn-fed and stalled horse of towns participates in the evils of town-life in common with his master. Not only do we stimulate our horses with excessive quantities of nitrogenous food,

but keep them in impure air, and the consequences are impaired function or actual disease of this important organ.

The exact nature of liver disorders can seldom be ascertained during life, yet treatment is generally successful, blind empiricism it may be called, but the practical horseman will not mind that, if the result is good.

Symptoms.—If the liver fail in its office of pouring bile of a proper quality and of sufficient quantity into the intestinal canal, digestion is interfered with, the fæces are altered in colour and of offensive odour, there is a loss of thriftiness on the part of the animal, the skin loses its bloom and may be hide-bound, and the hairs feel harsh, while constipation may be followed by diarrhœa. A sourness of breath and irregular appetite and increased thirst is observable. The foregoing symptoms may be all due to simple congestion or excessive blood supply, and a dose of calomel and aloes put the matter right. On the other hand, there may be slow but certain degeneration of structure taking place, that can only be arrested in its progress by a return to the natural life of a horse at grass.

JAUNDICE

Is commonly spoken of as a special disease of the liver, but it is really one of the symptoms or proofs of liver disease whereby the colouring matter of the bile has been thrown into the general circulation, making its presence easily seen in the mucous membranes, particularly those of the conjunctivæ. Jaundice may be the result of acute or chronic congestion of the liver, of interruption of the gall ducts, or of the common duct (ductus communis collidicus), of cirrhosis or hardening and enlargement of the connective tissue between the true liver cells which are thereby squeezed out of existence. Abscesses and other tumours and malignant growths in a few instances account for jaundice. We might summarize for the guidance of the horse-owner, and say that a yellowness of the membranes that disappears with physic after a short time is probably but a temporary functional derangement of no serious importance, while a permanent staining of the membranes is indicative of chronic disease, and probably serious degenerative changes of structure.

Treatment.—Change of diet from stimulating food to grass if possible. A summer's run will often do wonders even in cases of long standing, and in which it is almost certain there is structural change. The sound portion of the liver appears to make an effort to do the work of a whole one, and the subject of disease may do much useful work again. The livers both of horses and men one has known during life as comparatively cheerful and healthy, often show an amount of degeneration which, without experience, one would suppose to be inconsistent with continued existence. Salines in the form of sulphates of magnesia and soda combined with nux vomica may serve to keep a useful horse going, but no medicaments can compare with the beneficial effects of grass keep and pure air. In winter a straw-yard in the country is to be preferred to continued drugging in the stable, as the coldness of the atmosphere does good alike to the liver and legs of a stale town horse.

DISEASES OF THE KIDNEYS

THESE are by no means so common as is generally believed by stablemen, who are too fond of dosing with nitre and diuretics generally. Because a horse passes thick urine there is not necessarily anything the matter with him, but many coachmen and grooms on seeing a little milky urine passed are alarmed for the health of their charges. The salts and organic matter are but feebly held in solution, and any change of diet may cause them to be precipitated. The first bundle of green meat after a winter of dry food will almost invariably result in thick urine, but a few days suffice for it to become normal again. If, as many old writers state, the kidneys of the horse are very liable to disease, it is because they are so liable to abuse at the hands of their masters and of the quacks who attribute every abdominal pain to " something wrong with the water."

INFLAMMATION OF THE KIDNEYS (*nephritis*) is generally produced by an exposure of the loins to wet and cold, as in carriage-horses standing about in the rain during the winter season. Sometimes it follows violent muscular exertion, and is then said to be caused by a strain in the back ; *under* the back it really is, for horses in jumping do occasionally strain the psoæ muscles, and by invasion or extension, one or more kidneys may be affected. Usually only one, but that is no argument against the theory of loin-sprain producing it, since the kidneys are not parallel or very close together. Exposure to cold in a state of exhaustion, abuse of diuretic medicines, absorption of cantharidine blisters, the presence of calculi, and in rare instances parasites.

The Symptoms are a constant desire to void the urine, which is of a very dark colour—often almost black. Great pain, as evidenced by the expression of countenance and by groans, as well as by frequent wistful looks at the loins. On pressing these parts there is some tenderness, but not excessive, as in rheumatism. The pulse is quick, hard, and full. The attitude of the hind-quarters is peculiar, the horse standing in a straddling position with his back arched, and refusing to move without absolute compulsion. It is sometimes difficult to distinguish nephritis from inflammation of the neck of the bladder, but by attending to the state of the urine, which is dark brown or black in the former case, and nearly of a natural colour in the latter, the one may be diagnosed from the other. To make matters still more clear, the oiled hand may be passed into the rectum, when in nephritis the bladder will be found contracted and empty (the urine being so pungent as to irritate that organ), while in inflammation or spasm of the neck it will be distended, often to a large size.

The Treatment to be adopted must be active, as the disease runs a very rapid course, and speedily ends in death if neglected. The skin must be acted on energetically, so as to draw the blood to its surface. The application of hot water, as recommended at page 528, may be tried, and in many cases it has acted like a charm. Failing the means for carrying out either of these remedies, the loins should be rubbed with an embrocation consisting of olive oil, liquor ammoniæ, and laudanum in equal parts, but cantharides and turpentine must be carefully avoided, as likely to be

absorbed, when they would add fuel to the fire. A fresh sheepskin should be warmed with hot (not boiling) water, and applied over the back, and the liniment should be rubbed in profusely every hour, restoring the skin to its place immediately afterwards. Mustard is sometimes used instead of ammonia, and as it is always at hand it may form a good substitute, but it is not nearly so powerful an irritant to the skin as the latter, especially when evaporation is prevented by the sheepskin, or by a piece of any waterproof article. A mild aperient may be given, as linseed oil; if the bowels continue obstinate give Epsom salts, great care being taken to assist its action by raking and injection, the latter being also useful as a fomentation to the kidneys. The *diet* should consist of scalded linseed and bran mashes, no water being allowed without containing sufficient linseed tea to make it slightly glutinous, but not so much so as to nauseate the patient. Salicylate of soda among the newer remedies has been found valuable, and may be given (in solution) in half-ounce doses at intervals of two or three hours. Homœopathic doses of cantharides are said to have acted beneficially in the hands of persons whose testimony may be relied on.

DIABETES

TRUE DIABETES rarely, if ever, exists in the horse, but a spurious form is comparatively common. Diabetes insipidus, polyuria or profuse staling is not diabetes in the sense used by medical men, as sugar is not present in the urine, and the disease is generally curable. The cause does not appear to be in the kidneys themselves, they being merely agents in the elimination of urine of low specific gravity. Long before physiologists suggested an explanation, it was known by practical horse-keepers to result from certain damaged forage, as musty hay or that which has been overheated in the rick, kiln-dried oats and feeding upon roots (*i. e.* swedes and mangolds, carrots, and in former times parsnips). The explanation is now given in the fact that irritation of a particular portion of the brain causes excessive urination, and that blood influenced by disease germs derived from forage may prove so poisonous in the brain as to set up this train of symptoms.

The Symptoms need but little description, as the groom's attention will be arrested by the frequent desire of his horse to stale. Considerable thirst accompanies the malady. The heart loses tone and the pulse is consequently weak, there is loss of flesh, unthrifty coat, unnatural pallor of the gums, sour breath, constipation, a disposition to sweat upon slight exertion, and dropsical swellings.
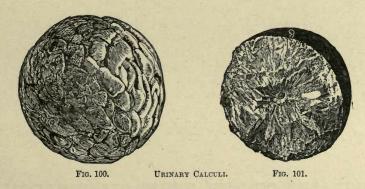
Treatment.—A moderate dose of aloes, linseed tea, drachm doses each of powdered nutgalls and sulphate of iron or iodine in similar doses for a few days only. The amount of drinking water should be unlimited, and a complete change of diet should be ordered whether or no the forage appears to be good.

INFLAMMATION OF THE BLADDER

Is an extremely painful affection caused by retention of urine, injuries, the presence of calculi, irritation of abnormal urine, by extension from the kidneys, and occasionally from foreign bodies whose presence it is most difficult to account for in such a situation.

The Symptoms are much the same as nephritis, but examination per rectum may discover the bladder to be full and unable to contract upon its contents, the muscular coats being paralyzed. Frequent attempts at micturation with constantly protruded penis, arched back, anxious countenance, high temperature, quick and irritable pulse.

Treatment.—The same generally as for nephritis (see page 567), but by the use of the catheter something may be done to relieve the pain, and by forcibly syringing up the urethral passage a mixture of extract of belladonna and glycerine diluted with warm water. Belladonna is the one active drug for which the claim can be made that it has a special soothing effect upon the urinary apparatus, where opium for various reasons is inadmissible. Demulcent drinks, as linseed tea and barley-water, should be given freely.

FIG. 100.   URINARY CALCULI.   FIG. 101.

RETENTION OF URINE may be due either to inflammation of the neck of the bladder, occasioning a spasmodic closure of that part, or there may be spasm unattended by inflammation and due to the irritation of some offending substance, such as a calculus.

The Treatment in either case must be directed to the spasmodic constriction, which is generally under the control of large doses of opium and camphor, that is, from one drachm to two drachms of each, repeated every five or six hours. If the symptoms are urgent, bleeding may also be resorted to, and when the bladder is felt to be greatly distended, no time should be lost in evacuating it by means of the catheter, which operation, however, should only be entrusted to a regular practitioner accustomed to its use.
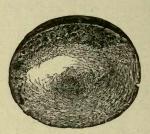
CALCULI IN THE BLADDER are formed of several earthy salts, and present various forms and appearances, which may be comprised under four divisions. 1st. The mulberry calculus, so named from its resemblance to a mulberry, possessing generally a nucleus (see Fig. 100). 2nd. A very soft kind resembling fuller's-earth in appearance, and being chiefly composed of phosphate of

lime and mucus (see Fig. 101.) 3rd. Calculi of a white or yellowish colour, rough externally and easily friable (see Fig. 102). 4th. Those which are composed of regular layers, and which are harder than the second and third varieties (see Fig. 103). These calculi sometimes attain an immense size, weighing several pounds.

The Symptoms are a difficulty of voiding the urine, which generally comes away in jerks, the penis remains protruded from the sheath, which evidently indicates that the horse feels as if his bladder was not relieved. Often there

FIG. 102.   URINARY CALCULI.   FIG. 103.

is muco-purulent matter mixed with the urine, which is rendered thick and glutinous thereby, but this only happens in cases of long standing.

The Treatment must be either palliative or curative. If the former, it should consist in the adoption of the means employed for subduing irritation and inflammation of the bladder which have been already described. The *cure* can only be effected by removing the stone. This requires the performance of a difficult and dangerous operation (lithotomy), the details of which can be only useful to the professed veterinary surgeon, and I shall therefore omit them here.

DISEASES OF THE GENERATIVE ORGANS

BALANITIS, or inflammation of the glans penis (βάλανος, glans), is not uncommon in the horse, being brought on by the decomposition of the natural secretions, when they have been allowed to collect for any length of time. At first there is merely a slight discharge of pus, but in process of time foul sores break out, and very often fungous growths spring from them, which block up the passage through the opening of the sheath, and cause considerable swelling and inconvenience. These are quite distinct from warts, which occur in this part just as they do in other situations.

The Treatment requires some skill and experience, because mild remedies are of no use, and severe ones are not unattended with danger. The parts must first of all be well cleansed by syringing, or if the end of the penis can be laid hold of, by washing with a sponge. The following wash may then be applied, and it should be repeated every day :—

Take of Solution of Chloride of Zinc (Burnett's Fluid) . . 2 drachms.
Water . . . . 1 pint. Mix.

If the morbid growths are very extensive, nothing but amputation of the penis or the use of corrosive sublimate will remove them. Severe hæmorrhage sometimes follows both of these measures, but it seldom goes on to a dangerous extent. Still it is scarcely advisable for any one but a professional man to undertake the operation.

CANCER OF THE PENIS

CANCER of the kind known as epithelioma sometimes attacks the penis of the horse, and if allowed to remain attains to great dimensions, making it impossible to withdraw the organ into the sheath. It generally begins at or near the urethral orifice, and when once diagnosed as a malignant growth no time should be lost in amputating the affected portion. It is not attended with serious danger, hæmorrhage being provided against by a competent surgeon, and precautions taken to avoid injury and swelling to the sheath from the discharges.

GONORRHŒA may affect either sex, but geldings are usually exempt unless by some traumatic cause, as the descent of small calculi, when urethral irritation is set up, which stimulates the true gonorrhœal discharge.

IN STALLIONS it is usually the result of too much sexual intercourse during the service season, and mares are infected *in coitu*. In this country it rarely passes the limits of a simple clap, but on the Continent it at times becomes malignant and even fatal.

Treatment consists in careful cleaning of the affected membranes by syringing with warm water, to which has been added some mild astringent as sulphate of zinc, alum, or boric acid. A cooling dose of physic may be necessary, and a horse so affected should not be used for stud purposes till perfectly recovered.

CHAPTER XXIX

DISEASES OF THE NERVOUS SYSTEM

PARALYSIS OF THE LIPS—EPILEPSY AND CONVULSIONS—MEGRIMS—MAD STAGGERS—SUN-STROKE—RABIES, OR MADNESS—TETANUS, LOCK-JAW—APOPLEXY AND PARALYSIS—STRING-HALT.

EXCEPT IN HOT CLIMATES these are not very numerous. In India a disease known as kumree with paralysis of the loins is described by Captain Meyrick, Captain Hayes and others, and is comparatively common. In the British Islands a somewhat similar affection is met with in the rich grazing districts, and affects chiefly the heavy types of horse. As two and three

year olds, when first put to work, it commences with all the appearances of muscular sprain of the loins, but instead of recovery gradual and progressive paralysis follows. At the same age an affection known as "shivering · makes its appearance, and it is probable that they have a common origin like the nervous form of distemper in dogs. I am not aware of any thorough investigation, extending over a number of cases, that has proved red softening, or any other degeneration of the cord, to be the cause of the one or the other, and although I have met with many cases of both, the opportunities of making careful post-mortem examination are so few for a busy man, and the dissection necessary so considerable, that I advance this opinion with some reticence. When shivering is established, paralysis does not follow during colthood, and the comparison holds good with the dog ; he either has chorea as a permanent condition, or is affected with paralysis at the time of the attack, but the one does not lead to the other. That some form of congestion initiates the attack cannot be doubted, as there are all the symptoms of pressure upon the spinal cord, which can be accounted for in no other way. Shivering resembles St. Vitus's Dance in the human subject and chorea in the dog. There is either a jerking movement of the fore- or hind-parts, or else an inability to co-ordinate the muscles.

Treatment is not likely to be successful for either of the nervous disorders alluded to in the previous paragraphs. That usually adopted is counter-irritation to the spine, bleeding, purging, and the administration, in the case of paralysis, of strychnine over a considerable period and until muscular twitchings are observed. Spinal sedatives, as chloral and the bromides of potassium and ammonium, are sometimes given in cases of shivering.

PARALYSIS OF THE LIPS

THIS is said to be produced by the pressure of ill-fitting and heavy bridles. Many low-bred horses have heavy pendulous lips from colt-hood, and old ones are also disposed to drop the lower one. It seldom exists to the extent of preventing prehension of the food, and as it is gradual in its approach the animal learns to seize his food with his teeth or buries his mouth in it instead of using the lips in the usual way.

Treatment, except in the early stage, is not likely to be of much use. All pressure should be avoided, and stimulating liniments or a mild blister applied over the nerves of supply (the seventh pair), beginning just below the ear and rubbing in the chosen agent along the cheek.

EPILEPSY AND CONVULSIONS

THESE DISEASES, or symptoms of disease, are not often met with in the adult, but in the foal they sometimes occur, and are not unattended with danger. The young thing will perhaps gallop after its dam round and round its paddock, and then all at once stop, stagger, and fall to the ground, where it lies, struggling with more or less violence, for a few minutes or longer, and then raises its head, stares about it, gets up, and is apparently as well as ever. It is generally in the hot days of summer that these

attacks occur, and it appears highly probable that the direct rays of the sun playing on the head have something to do with it. Death seldom takes place during the first attack, but sometimes after two or three repetitions the convulsions go on increasing, and the foal becomes comatose and dies. A mild dose of linseed or castor oil is the only remedy which can safely be resorted to, and as it is supposed that worms will sometimes produce these convulsive attacks, it is on that account to be selected. Epilepsy is so very rarely met with in the adult, and of its causes and treatment so little is known, that I shall not trouble my readers with any account of them.

MEGRIMS

This term is used to conceal our ignorance of the exact nature of several disordered conditions of the brain and heart. In fact, any kind of fit, not attended with convulsions, and only lasting a short time, is called by this name.

The most usual *symptoms* are the following: — The horse is perhaps trotting along, when all at once he begins shaking his head as if the bridle chafed his ears, which are drawn back close to the poll. The driver gets down to examine these facts, and observes the eyelids quivering, and the nostrils affected with a trembling kind of spasm. Sometimes the rest will allow of the attack going off, but most frequently the head is drawn to one side, the legs of that half of the body seem to be paralyzed, and the horse making a segment of a circle goes down, lies a few minutes on the ground, and then rises as if nothing had happened beyond a slight sweating, and disturbance of the respiration.

Treatment can be of little avail, however, unless a correct diagnosis is made, for remedies which would be suited to congestion would be prejudicial to a diseased heart. If the attack has happened while in harness, the collar should always be carefully inspected, and if at all tight it should be replaced by a deeper one. A "piped" collar, hollowed out, where it would otherwise press upon the trachea, will enable many horses to work that are otherwise liable to symptoms of brain pressure. Bleeding gives immediate relief, and if the driver lacks the skill and nerve to operate on the jugular vein he may prick the palate with his penknife. A dose of aloes should follow, and constipation be guarded against by judicious dieting. Horses liable to megrims are dangerous creatures to use, and are constantly changing hands at auction sales, where they become quite well known to *habitués*, who like to ascertain each new purchaser's address for their own purposes, when the owner discovers he has not drawn a prize and is willing to make a sacrifice.

MAD STAGGERS

Phrenitis or Mad Staggers are terms used to denote delirium and violence, which may arise from a variety of causes; as a sequel to inflammatory diseases, brain tumours, rupture of internal organs, and poisoning.

If the disease is caused by eating some toxic agent, as Indian vetches,

and the animal can be got at without too much risk, blood-letting is the most likely thing to control the delirium, after which a bold dose of aloes may be given, but, as stated above, it is usually a sequel to some disease and ends fatally.

SUNSTROKE

THIS DISEASE is rare in England though not by any means unknown. The condition is one of great prostration, and may be evinced by hanging the head and blowing, or banging the head about and falling. When on the ground the animal may struggle violently to get up again, and fail to do so, as the hind-legs are paralyzed. Those cases in which the animal lies on his side as if dead are the most likely to recover.

Treatment.—An ice-bag to the poll and cold water affusions over the body and subsequent friction to the body and legs. A powerful stimulant, as half-a-pint of brandy or whisky, should be given as soon as possible. A cool and shady situation is desirable, and if the patient cannot be moved some sort of awning erected to keep off the direct rays of the sun. Horses that have had one stroke are rendered more susceptible to the sun, and the paralysis may to some extent remain after the severity of the attack has passed away.

RABIES OR MADNESS

ONE REASON ONLY can be given for describing this disease, which is wholly beyond the reach of art ; but as the horse attacked by it is most dangerous, the sooner he is destroyed the better ; and for this reason, every person who is likely to have any control over him should be aware of the symptoms. Rabies is not idiopathically developed, but must follow the bite of a rabid animal. The dog, being constantly about our stables, is the usual cause of the development of the disease, and it may supervene upon the absorption of the salivary virus without any malicious bite, as has happened according to more than one carefully recorded case. The lips of the horse are liable to be ulcerated from the action of the bit, and there is reason to believe that in the early stages of rabies these parts have been licked by a dog, the saliva has been absorbed, and the inoculation has taken place just as it would do from any other wound. It is difficult to prove that this is the true explanation of those cases where no bite has been known to have occurred, but as the mouth has in each instance been shown to have been abraded, there is some reason for accepting it as such. To proceed however to the *symptoms*, Mr. Youatt, who had great opportunities for examining rabies, both in the dog and horse, described the earliest as consisting in "a spasmodic movement of the upper lip, particularly of the angles of the lip. Close following on this, or contemporaneous with it, are the depressed and anxious countenance, and inquiring gaze, suddenly, however, lighted up, and becoming fierce and menacing from some unknown cause, or at the approach of a stranger. From time to time different parts of the frame, the eyes, the jaws, particular limbs, will be convulsed. The eye will occasionally wander after some imaginary object, and the horse will

snap again and again at that which has no real existence. Then will come the irrepressible desire to bite the attendants or the animals within its reach. To this will succeed the demolition of the rack, the manger, and the whole furniture of the stable. Towards the close of the disease there is generally paralysis, usually confined to the loins and the hinder extremities, or involving those organs which derive their nervous influence from this portion of the spinal cord ; hence the distressing tenesmus which is occasionally seen." How paralysis can produce tenesmus is not very clear, but of the very general existence of this symptom there can be no doubt.

A craving thirst with inability to drink may be a symptom, or, as in some instances, a spasm may be induced by the sound of the bucket. Whenever, therefore, these symptoms follow upon the bite of a dog, unless the latter is unquestionably in good health, rabies may be suspected, and the bare suspicion ought always to lead to the use of the bullet, which is the safest way of killing a violent horse.[1] There is only one disease (*phrenitis*) with which it can be confounded, and in that the absence of all consciousness and, in milder cases, of fear, so that no moral control whatever can be exercised, marks its nature, and clearly distinguishes it from rabies, the victim to which is conscious to the last, and though savage and violent in the extreme, is aware of the power of man, and to some extent under his influence.

TETANUS—LOCK-JAW

TETANUS, one form of which is known as lock-jaw, has its seat apparently in the nervous system, but like many other diseases of the same class, the traces it leaves behind are extremely uncertain, and are displayed more on the secondary organs, through which it is manifested, than on those which we believe to be at the root of the mischief. Thus the muscles, which have been long kept in a state of spasm, show the marks of this condition in their softened and apparently rotten condition. They, in fact, have had no interval of rest, during which nutrition could go on, and have lost much of the peculiarity of structure which enables them to contract.

The stomach often shows marks of inflammation, but as all sorts of violent remedies are employed, this may be due to them rather than to idiopathic disease. The lungs also are generally congested, but here, like the state of the muscles, it may be a secondary effect of the long-continued exertions of the latter, which nothing but the absence of all important lesions of the brain and spinal cord would induce the pathologist to pay the slightest attention to. It almost always follows some operation, or a severe injury in which a nerve has been implicated, the most frequent causes being the piercing of the sole by a nail, or a prick in shoeing, or the operations of docking, nicking, castration, or accidental injuries, as broken knees.

TETANUS is now known to be due to a specific microbe, the tetanus bacillus, and can be cultivated in the usual media and reproduced with certainty.

The Symptoms are a permanent rigidity of certain voluntary muscles, and especially of the lower jaw (whence the popular name, lock-jaw). The mouth

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[1] As rabies is now known to run its course and end fatally in less than ten days, the afflicted horse may be given the benefit of the doubt, provided he is rendered secure against inflicting injury upon his attendants or other animals.

is kept rigidly shut, the masseter muscles feeling as hard as a deal board. One or both sides of the neck are rigid, in the former case the head being turned to one side, and in the latter stretched out as if carved in marble. The nostrils are dilated ; the eyes retracted, with the haws thrust forward over them ; the ears erect and stiff, and the countenance as if horror-struck. The tail erect or persistently held on one side and partially elevated ; as the disease progresses control of the extremities is lost, and then they become rigid, like the neck and head. The patient is scarcely able to stand, and plants his feet widely apart to prop himself up. The pulse varies a good deal, in some cases being quick, small, and hard, and in others slow and laboured. The bowels are generally costive, and the urine scanty; but this last symptom is not so well marked as the state of the bowels alluded to.

Treatment.—Anti-tetanin serum has not as yet proved a reliable remedy, and we must be content to combat symptoms or else do nothing, the latter policy being advocated by more than one eminent veterinarian ; cases of recovery being recorded where the patient has been locked up in a loose box with hay and water, no one being permitted to enter. The subcutaneous injection of morphia and other sedatives has been tried ; the administration of Indian hemp, chloral, sulphonal, bromides, and all the direct sedatives and narcotics, but it is doubtful if any recoveries are due to the remedies employed. Any interference with the sufferer is calculated to bring on the tetanic spasms. Chloroform inhaled subdues the spasm for a time, but it is doubtful if any permanent benefit is derived from it.

APOPLEXY AND PARALYSIS

Usually these are only different degrees of the same disease, but there are exceptions in which the latter is produced by some chronic affection of the spinal chord or brain. As a rule both depend upon pressure made on the brain by an overloaded state of the vessels, commonly known as congestion, or by extravasation of blood, in which it escapes from them.

Apoplexy, known among writers of the old school as sleepy staggers, is not often met with in the present day, owing to the improvement in the management of our stables, and specially to their better ventilation. It is marked by great sleepiness, from which the horse can be with difficulty roused, soon going on to absolute unconsciousness, attended by a slow snoring respiration, and speedily followed by death. The only *treatment* likely to be successful is copious bleeding, purgation, and blisters to the head and neck.

Paralysis is marked by a loss of power over the muscles of a part, and may be confined to one limb or organ or extend to more. It is a *symptom* of pressure on, or disorganization of, some part of the nervous system, and must be considered as such, and not as a disease of the affected muscles. Thus it requires a knowledge of anatomy to trace it to its seat, without which its treatment would be conducted on false principles. By far the most common form of paralysis is hemiplegia, or paralysis of the muscles of the hinder extremities and loins, generally arising from an injury to the spine. Sometimes the body of a vertebra is broken, and the parts being separated, their edges press upon the spinal cord and produce the disease. At others the vessels within the canal have received a shock, and the serous

membrane secretes (or allows to ooze out) a bloody fluid which presses upon the cord, and produces the same effect but in a more gradual manner.

WHEN A HORSE FALLS in hunting, and never moves his hind-legs afterwards, but lies with his fore-legs in the position to get up, groaning and expressing great pain and distress, it may be concluded that he has fractured or dislocated his spine and that the case is hopeless. Sometimes, however, after lying for a few seconds, he slowly and with difficulty rises and is led to a stable, but after two or three hours lies down and cannot be got up again. Here there will be some difficulty in ascertaining whether the mischief is confined to a strain of the muscles or is situated within the vertebral canal. If the former is the case the pain is extreme, and generally there will be some quivering or slight spasm of one or more of the muscles of the hinder extremity, which feel naturally firm, while in paralysis they feel soft and are as quiet as they would be after death. By attention to these signs the two cases may be distinguished, but when the case is made out to be true paralysis the *treatment* is not likely (even if successful in preserving life) to bring about a useful restoration to healthy action. In valuable horses an attempt may be made by bleeding, physicking, and blistering to produce an absorption of the effused serum or blood, but the recovered animal is seldom worth the outlay, and too often as soon as he is put to any kind of work is subject to a relapse. The most humane and certainly the most economical plan is to put him out of his misery at once by a pistol ball or knife, but if it is determined to try what can be done towards effecting a cure, no better means can be adopted than those I have alluded to.

STRING-HALT

THIS IS A PECULIAR SNATCHING UP of the hind-leg, and is supposed to depend upon some obscure disease of the sciatic nerve. It however is very doubtful whether this explanation is well founded, and there is evidence that in some cases the hock itself has been affected. The extensor pedis seems to be the muscle most severely implicated, though not the only one which is thrown into spasmodic action. No *treatment* is of the slightest avail. Horses with string-halt are able to do any kind of work, but it is considered to be a form of unsoundness.

CHAPTER XXX

DISEASES AND INJURIES OF CERTAIN SPECIAL ORGANS

DISEASES OF THE EAR—DISEASES OF THE EYE—TORN EYELIDS—INFLAMMATION OF THE EYES--PERIODIC OR CONSTITUTIONAL OPHTHALMIA—CATARACT—AMAUROSIS—BUCK EYE.

DISEASES OF THE EAR

DEAFNESS is sometimes met with in the horse, but I know of no symptoms by which its precise nature can be made out; and without ascertaining the seat of the disease, it is useless to attempt to treat it.

SOMETIMES FROM A BLOW on the external ear inflammation is set up, and an abscess forms; but all that is necessary is to open it, so that the matter can readily flow out as fast as it forms, without which precaution it will not readily heal. Fistulous wounds are also met with and should be traced to their source and laid open, unless the inner ear is involved, when operative interference is not desirable. Keeping the meatus clean and using a little antiseptic lotion, as carbolized oil or Condy's Fluid, is usually all that is necessary, but sometimes these discharges are very offensive, and a veterinary surgeon should be asked to investigate the cause.

DISEASES OF THE EYE

DISEASES OF THE EYE and its appendages are happily of less frequent occurrence in these days than they were under the old bad system of dark and ill-ventilated stables. Still, accidents will happen, and we will briefly glance at a few of the commoner ones.

TORN EYELIDS

RARELY DOES THIS OCCUR AT WORK, but as a result of *ennui* in stable or paddock. The veterinarian is frequently called in to patch up the most ghastly-looking injuries, and it may be added with a very large measure of success. In the stable the most frequent causes are nails in the walls or mangers, splinters of wood, and rough edges against which the horse rubs his face. Hunters in going through fences may get injuries to the eyes, but they are seldom torn.

Treatment consists in clearing the parts of any foreign body, and approximating the edges of the wounds by sutures as quickly as possible. A few horses can be induced by the persuasion of the twitch to stand while this operation is performed, and a painting of cocaine is a valuable aid, but with well-bred or very irritable horses it is sometimes necessary to cast them in order to get that perfect control which will enable the surgeon to bring the

lips of the wound together in such a manner as to avoid a "puckered" appearance afterwards. No atom of torn lid should be excised, and the most lacerated wounds should not be despaired of, as they have a wonderful knack of "piecing up" at last, and only a little notch is usually left. A wet pad of folded lint may be kept on by a very careful nurse, but if allowed to get dry it will do more harm than good. The chief thing is to keep the parts together, not even removing the clotted blood, which serves as a bandage until some amount of granulation has taken place underneath. The amateur's love of plaster is misplaced—it never answers upon a hairy skin, and sutures are the only reliable means of mechanical adjustment. A dark box is to be recommended in all cases of inflamed eyes or injuries to their appendages.

INFLAMMATION OF THE EYE

INFLAMMATION OF THE COVERING MEMBRANE, conjunctivitis, is not infrequent and is very painful, sometimes leading to opacity and interference with vision.

The causes are accidental, as from blows, the lash of the whip, hay seeds, flies, or other foreign bodies getting within the lids, or from constitutional causes as catarrh and influenza.

The Symptoms are drooping lid, extreme sensibility when approached from the affected side, tears overrunning the cheek and intolerance of light.

Treatment.—The eye should be examined with the aid of cocaine solution, and any foreign body deftly removed, frequently fomented with warm water and a cooling dose of medicine given. A large cool and somewhat dark box free from flies and dust should be provided, and the patient will probably recover in a few days. If the whip has caused the trouble it may be found in a day or so that there is a central spot of inflammation with a cloud shading off from it, and to prevent a permanent blemish it may be necessary to excite the absorbents by introducing a weak solution of sulphate of zinc or nitrate of silver. With the best of treatment a little nebula will often be left, and although it may not be any detriment to the animal's vision it depreciates his value and should not be disregarded in purchasing.

Injuries affecting the cornea and of a more severe nature than we have supposed in the above paragraph, may result in an ulcer and possible escape of the aqueous humour. These are capable of a good deal of amendment by good treatment. The ulcers may be induced to heal by judicious touching up with silver nitrate, and the aqueous humour will again fill up the chamber. Some disfiguration will remain, but if the patient is not a hunter and can see the ground under the scar he may remain as useful as before.

PERIODIC OR CONSTITUTIONAL OPHTHALMIA

THIS GRAVE CONDITION OF THE EYE is fortunately becoming less common than formerly. It appears to be hereditary and is prone to recur, ending at last in blindness if the horse attains to old age. It not only affects the conjunctiva and cornea but the middle eye, the iris becomes entangled in

bands of lymph which curtail its movements, and after repeated attacks the humours become opaque and the lens is also involved.

Symptoms.—These are very much like those of simple ophthalmia or conjunctivitis but not perhaps so acute, more gradual in their manifestation and more lasting. "Ten days in coming and ten days in going" is a common estimate of its duration.

Treatment.—An aloetic ball, followed by small does of iodide of potassium and the local treatment recommended for ordinary inflammation. With a view to keeping the iris moving alternate doses of belladonna and opium have been recommended.

CATARACT

CATARACT, or opacity of the lens, is very commonly the result of iritis, its capsule having been coated with a layer of white lymph, deposited by the inflamed vessels; but it also sometimes makes its appearance without being preceded by any of the signs of inflammation. In the former case, the early symptoms are those of iritis; but in the latter, the opacity often goes on increasing, without the owner of the horse, or his groom, having his attention drawn to the eyes, until he finds that he is nearly blind. This progress is generally marked by the development of an unusual timidity; the previously bold animal is alarmed at objects advancing on the road, and covered carts and waggons, of which he formerly took no notice, occasion him to shy in the most timid manner. On examining his eyes carefully, instead of the beautifully clear pupil, with the reflection of *tapetum lucidum* shining through it, there is seen either a mass of dull white, generally more opaque in the centre, or an appearance of mottled, semi-transparent soap, or, lastly, one or two distinct white spots, not quite circular, but with irregular edges. In confirmed cataract, the white pupil can be seen at any distance; but in the very early stage, only a practised eye can detect the opacity, which, however, is so manifest to him, that he wonders it is not visible to every one else. The reason of this difficulty of detecting the alteration of structure seems to be, that inexperienced examiners look at the eye in such a manner that they are confused by the reflection on it of their own faces, hiding all beneath. If, however, they will turn their heads a little more on one side, this will disappear, and they cannot fail to perceive the disease. When cataract is clearly proved to exist, all idea of *treatment* may be abandoned, as nothing but an operation can procure a removal of the opacity; and that would leave the horse in a more useless condition than before, since he could see nothing clearly, and would only be subject to continual alarms. In the human being, the operation is performed with great success, because the lens which is sacrificed can be replaced externally by means of convex glasses; but in the horse, nothing of the kind can be done. Hence, it is useless to dream of effecting any improvement in this disease; and if both eyes are the subject of cataract, the horse is incurably blind. But supposing there is a cataract in one eye only, is the other sure to go blind, or may a reasonable hope be entertained of its remaining sound? Here the history of the disease must be examined before any opinion can be formed. If the opacity followed an accident, there is no reason for concluding that the

other eye will become diseased; but if it came on idiopathically, either preceded by inflammation or otherwise, there is great risk of a repetition in the sound eye. Nevertheless, instances are common enough of one eye going blind from cataract, while the other remains sound to the end of life; and those are still more frequent in which the one sound eye continues so for six or seven years.

AMAUROSIS

THIS IS A PALSY of the nervous expansion called the retina, produced by some disease, either functional or organic, of the optic nerve, which is generally beyond the reach of our senses, in examining it after death.

The Symptoms are a full dilatation of the pupil, so that the iris is shrunk to a thin band around it, and is so insensible to the stimulus of light, in confirmed cases, that, even when the eye is exposed to the direct rays of the sun, it does not contract. In the early stages, this insensibility is only partial; and though there is such complete blindness that the horse cannot distinguish the nature of surrounding objects, yet the pupil contracts slightly, and the inexperienced examiner might pass the eye as a sound one. The unnaturally large pupil, however, should always create suspicion; and when, on closing the lids and re-opening them in a strong light, there is little or no variation in its size, the nature of the disease is at once made apparent.

The Treatment of amaurosis must depend upon the extent to which it has gone, and its duration. If recent, bleeding and a seton in close proximity to the diseased organ will be the most likely to restore it. Sometimes the disease depends upon a disordered condition of the stomach, and then a run at grass will be the most likely means to restore both the affected organs to a sound state. Generally, however, an amaurotic eye in the horse may be considered as a hopeless case.

BUCK EYE

A BUCK EYE is, strictly, rather a congenital malformation than a disease; but practically, in reference to the utility of the animal, it matters little. It depends upon an access of convexity in the cornea, by which the focus of the eye is shortened too much, the image being thus rendered indistinct as it falls on the retina. No *treatment* can be of the slightest use.

CHAPTER XXXI

SKIN DISEASES

MANGE—LICE—POULTRY LOUSINESS—RINGWORM—ECZEMA—ITCHY TAIL—MALLENDERS AND SALLENDERS—HARNESS GALLS AND SITFASTS—CHAPPED OR CRACKED HEELS— SWELLED LEGS—WARTS.

MANY of these are troublesome and annoying both to the horse and his rider, and the causes of some of them are still obscure. As they usually yield to treatment, and it is not necessary for us to enter minutely into their pathology, we will briefly consider those likely to be met with by the horseman

MANGE

THIS SCOURGE OF THE STABLE and of armies on the march, is caused by a parasite similar to that which causes itch in man, scab in sheep, and mange in dogs. It is extremely contagious, and is communicable by stall-posts and mangers as well as by actual contact of one animal with another. The irritation which they set up is caused in their quest for food, as they first bite the skin, and then introduce a poisonous principle which causes the serum of the blood to come up in little vesicles, and upon these they feed. There are three varieties of this insect with somewhat different habits.

1. THE DERMATODECTES OR PSOROPTES is the most common in Britain. These prick the skin only and revel in the scabs that result, the mane and tail having a special attraction for them. A large proportion remaining on the surface, their presence is easily determined by scraping and examining with a lens of moderate power. The irritation set up is intolerable, and the host is to be found constantly rubbing against every available object until the skin is hairless, raw and wrinkled. In some countries it is known as " sweet itch," and its contagious nature not properly appreciated because the habits of the parasite are such that he remains in a locality only so long as there is plentiful food. In this respect he differs greatly from the second variety, which is full of *wanderlust*, and known as

2. SARCOPTES.—This is essentially a burrower, not living on the surface, but tunnelling in every direction, and the subject of his ravages may be covered with mange in a week or two. The skin has the appearance of innumerable pimples, which, if carefully examined, will be found to consist of a tiny scab, to which a few hairs are adherent; when scratched off a small red sore is left. With constant rubbing the hairs come out, the skin becomes wrinkled, dry, and shrivelled, and there is loss of condition and spirits, as the victim gets little rest or sleep if badly attacked. As with all parasites, whether of animals or plants, there are seasons in which they are particularly active and aggressive, causing even the death of their hosts. Among Shetland ponies, sarcoptic mange takes on such a severe form as from time to time to destroy considerable numbers, and among the horses of a great London distributing company a few years ago, a number died or had

to be killed from this cause. Experiments upon the human skin have gone to prove that, if transferred to it, the sarcoptes of the horse will live and even multiply for a time, but not establish a permanent home.

3. THE SYMBIOTES are not nearly so active, and affect chiefly the hairy legs of heavy horses, seldom rising above the knee. They cause the animal to rub one leg against the other and to stamp the ground, which is a symptom of grease, and for which it is no doubt often mistaken.

Treatment.—For this disease we have fortunately a specific, discovered by the old Friars, whose piety was more remarkable than their cleanliness. Sulphur is a certain cure for the itch of man, and making some time allowance for hair and cuticular thickening in horses, we may make the same claim for it, but it must be used in such a manner as to come into actual contact with the enemy, who can also be attacked from within. A very good dressing can be made by mixing together a gill of oil-of-tar, a quarter-pound of sulphur (flowers of sulphur, also called sublimed sulphur), and half-a-gallon of linseed oil; olive or other seed oils are equally good, but expensive. This may be applied with a water brush, a certain amount of friction being not unwelcome to the patient, who will lean towards the hand that rubs him. In an established case, when a lot of white, dry scab has become deposited upon the surface, it may be necessary to first wash the horse with soft soap and warm water to enable the lotion to penetrate. Paraffin is a popular remedy, and effectual, but it is liable to blister, and if used should be diluted with two or three parts of some bland oil, as linseed or cotton-seed oil, together with sulphur. A second or third dressing should be used at intervals of three or four days, as the eggs may not be destroyed, and a fresh crop result.

Sulphur may also be given internally, as it is exhaled by the skin,[1] and in this way contributes towards the destruction of mange mites.

Sulphur and train-oil is an old remedy of repute, and mercurial ointment or the compound sulphur ointment may do for circumscribed patches of the first and third forms of mange.

All clothing should be destroyed unless it will admit of boiling. Harness and saddlery is to be thoroughly dressed over with the lotion.

LICE

IN FORMER DAYS LICE were not uncommon in the horse, but they are now comparatively rare. Still they are occasionally met with, and their presence is readily ascertained, being of a considerable size, and easily seen with the naked eye. They may be destroyed by rubbing into the roots of the hair white precipitate, in powder, taking care to avoid sweating the horse or wetting his skin for some days afterwards.

With farm horses, especially those which have wintered on barley straw, there may be too many to deal with as above, and the patients should be first washed on a sunny morning with soft soap and warm water, and afterwards treated to a dressing of Jeyes' Fluid, in the proportion of one to fifty of warm water, and then walked about until dry. If sufficient oil is used, lice may be suffocated without any other dressing, but it takes a great

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[1] Proof of this is given by the blackening of silver watches worn by persons taking sulphur for some time.

quantity to saturate a long winter coat, and the creosote emulsion is the cheaper and more effectual remedy.

POULTRY LOUSINESS

ALTHOUGH it is quite usual to have poultry among the horses of the farm, and in some cases roosting in the stable, not to mention the perverse old hen who will lay nowhere else but in a manger, and come flustering out when the horse comes in, and this arrangement may exist for years without trouble, yet every now and again horses become infested with poultry lousiness, and suffer more irritation than with the species peculiar to themselves. The same remedies will be found to answer as have been prescribed above.

RINGWORM

ANY ERUPTION upon the horse in the form of a broken circle is commonly called by this name, but true ringworm is caused by parasites. There are two principal varieties, known as *tinea tonsurous* and *favus ;* they are both contagious, and may also be transmitted to man ; a matter of quite common occurrence in hot climates.

It affects the roots of the hairs, causing them to become brittle and fall off. The ring which gives this disease its name in man is not so regular in horses, and the fungus spreads in any direction. The middle portion, which at first appeared sound, may presently be affected.

Treatment.—It is often troublesome to cure, and the more so because some article of clothing, or maybe stable brush or rubber, has not also been treated, or the bedding not destroyed. In one of the large London studs this disease seemed as if it had come to stay, until moss litter was made to give place to pine sawdust. There are many agents used in the destruction of the troublesome fungus, which will subdue it at one time and fail at another, and in such cases it is well to ring the changes. Jeyes' Fluid, carbolic acid, picric acid, creosote, iodine, and all the mercurials have been used with more or less success. Although it is usually good treatment to try mild remedies first, we would make an exception to ringworm, and first paint the patches with tincture of iodine, and on alternate days rub in citrine ointment (nitrate of mercury).

ECZEMA

THIS NAME serves to describe any simple eruption characterized by watery vesicles which break and leave more or less of a scab. They may be very small individually, but coming in clusters and coalescing, form an unsightly scab and some soreness. The parts most affected are the neck, breast, belly, and thighs.

Causes.—These are usually thought to be chills to the skin when heated, irritation from harness and clothing, infection, errors of diet, and possibly parasites.

Treatment.—For a topical dressing carbolized oil one part in thirty

answers well enough, and is to be recommended in hot climates, where raw surfaces are so likely to be poisoned by flies. A wash of glycerine and Goulard water is also calculated to allay irritation and heal the abraded surface. The diet should be carefully considered, and any doubtful meal or hay rejected and grass or bran mashes given, and a dose of aloes in the form of a physic ball. The attack generally passes off in a few days under a suitable *régime.*

There are some itchinesses, if we may be allowed to coin the term, which do not fall into any of the squares marked out by pathologists, and treatment must be experimental. Now and again a chronic case will suddenly yield to washings with sulphuretted potash, and cover the prescriber with glory, when all the Erasmus Wilsons of the stable have failed. It is a filthy compound, but has a place in the Pharmacopœia, and is used for some intractable skin diseases of men.

ITCHY TAIL

THIS ANNOYING AND DISFIGURING MALADY is one of the itchinesses which have not yet had a parasite or a bacillus definitely assigned to it. Captain Hayes, in his *Veterinary Notes*, throws a wide pathological net over it, thus—"The animal is usually prompted to do this (rub the tail) by skin disease—parasitic or non-parasitic—of the part, or by reflex irritation, such as that due to worms." If we add *ennui* nothing more need be said except how best to allay the itching. Thoroughly washing with an abundance of soft soap, and plentiful rinsings followed by a lotion composed of hydrocyanic acid 2 drachms, solution of potash (*liquor potassæ*) 4 drachms, and water 1 quart. This should be poured on to the tail while it is held up, so that the lotion does not run off, but among the roots of the hairs.

If parasites are known to be within the rectum the usual remedies may be adopted (see Bots). We have known horses to stop rubbing with no other treatment but the introduction of a little lard or vaseline, when it may be assumed that some dryness or itching within the sphincter has been the cause of rubbing.

Bandaging the tail or encasing it with leather helps to preserve its appearance, if it does little to stop the habit, but there is something, to me, extremely ludicrous about a horse with his tail in what looks like a carbine bucket, or even a bandage.

MALLENDERS AND SALLENDERS

THESE ERUPTIONS are both of the same nature, differing only in the locality where they are displayed. The former shows itself in the flexure at the back of the knee, and the latter at the bend of the hock.

The Symptoms are shown in the appearance of a foul scurf mixed with a few thin scabs, the skin underneath being stiff and unyielding. They are generally brought on by washing the legs and leaving them undried.

The Treatment required is merely the application of the following ointment, which should be well rubbed in every night :—

Take of Cerate of Superacetate of Lead . . . . 2 ozs.
Creosote. . . . . 10 drops. Mix.

If the skin continues to be very hard and stiff, a little glycerine should be brushed on two or three times a week.

There are, however, constitutional cases of mallenders where it is not advisable to dry up the sore, as lameness is the alternative. The parts can be kept clean and comfortable by the application of carbolic ointment or oil.

HARNESS GALLS AND SITFASTS

MUCH ANNOYANCE is caused the horse-owner by galls produced by saddlery and harness, and a good horseman will inspect it for himself from time to time, so that no carelessness on the part of his servants shall throw a horse out of work in this way. Some tender-skinned animals are so prone to gall that no amount of care can prevent it at all times.

Symptoms.—When the skin is not broken and the injury not patent to all, there may be only a crouching when the saddle is put on, or a swelling may be found, hot, tender, and hard to the feel. The formation of matter may follow, or instead, what is known as a sitfast.

Treatment.—Removal of the cause, fomentation or the application of cold lotions on linen or other material that permits of evaporation. This treatment will often disperse a gall if adopted early. If matter seems determined to form it is well to encourage it by poulticing, and when ripe, introduce the lancet and continue the poultices until the swelling subsides. No pressure should be put upon the parts again until thoroughly healed.

SITFAST.—When the swelling is not absorbed nor an abscess formed, the skin injured may die, and lifting up round the edges continue to retain its hold on the flesh by the central and living portion. It is a troublesome and tedious business waiting for it to come away, and no great harm is likely to accrue if the impatient owner cuts it out, but he should take care that he does cut it *out* and not *off*, or the delay will be all the greater. Whether by time or force the removal of the dead skin is essential before any healing can take place. Once removed the raw surface soon forms a healthy crust and heals up.

CHAPPED OR CRACKED HEELS

THE HEEL OF THE HORSE in health has a soft, unctuous feeling due to the secretion of certain glands under the skin whose function it is to keep this part supple during the many movements of the pastern and foot. From causes to be presently named these become inflamed, the skin cracks and lameness results, often accompanied with a good deal of pain and swelling. If neglected it may run on to "grease" and the formation of warty excrescences known as grapes from a slight resemblance to that fruit in shape.

Causes.—When the weather is for a long time dry and dust is thick upon the roads there is a continual shower of minute particles of powdered stones being thrown upon the hairless portion of the pastern we call the heel, and these summer cracks are often the worst of all to deal with. Long-continued wet weather, when wet instead of dry grit is in constant contact, and evaporation goes on whenever the horse is at rest. Snow and slush make red the heel during exercise and cause it to crack when at rest. Cold winds,

washing the legs in the stable, or any of those causes which roughen and chap our own skins are liable to produce the same effects on the horse's heels.

Treatment.—Avoid washing the legs and feet, or if absolutely necessary to do so, carefully dry them and anoint the heel with vaseline or any simple ointment. Simple chaps may be cured by a wash made of glycerine and water, by dusting over with flour and oxide of zinc, or by the application of carbolized oil, but cracks may need a poultice if the heel looks red and angry, and there is pain and lameness. A cooling dose of medicine may also be desirable. The cracks themselves are apt to remain open when the surrounding inflammation has subsided. They take on the character of indolent ulcers and need to be stimulated into reunion by the application of such agents as nitrate of silver, sulphate of copper, etc., but these caustics should not be too freely used, as a crack that heals up too quickly is the more liable to break open again. An excellent ointment for chaps and cracks is made of cacao butter one part and vaseline five parts. Goulard's extract in linseed oil is also a good application and especially suited to the inflamed heels produced by salt mixed with snow ; an abomination permitted on tramway tracks. Grease, so often associated with cracked heels, or following upon them, is not so much a disease of the well-bred horse as his hairy-legged brother in the cart. It may be distinctly constitutional and hereditary, without chapped or cracked heels, and when this is the case it is well to attack it from within. Before any eruption is seen or abrasion of the skin manifest, there may be stamping the ground and rubbing one leg over the other. This has been referred to in connection with symbiotes (see Mange), and as the result of a series of careful microscopic examinations, Mr. E. Martin, of the Royal Veterinary College, is of opinion that many so-called cases of grease are the result of these mange mites pricking for their food in cold weather, when the secretions of the skin are not so abundant as to supply them with food.

Treatment.—Wash the legs with soft soap and water to ensure the medicaments coming in contact with the affected parts, and when nearly dry rub in a lotion composed of—

Sulphate of Zinc	1 lb.
Sulphate of Iron	1 lb.
Sulphur	4 ounces.
Carbolic Acid	4 ounces.
Water	1 gallon.

Shake well and apply with a water-brush daily.

This has the effect both of repressing the fungoid growths and destroying any parasites that may have their habitat among them. As an internal remedy a ball twice a week may be given of the following ingredients :—

Sulphate of Copper	1 drachm.
Sulphur	4 drachms.
Nitre	2 drachms.

Treacle enough to form a bolus.

This may be varied with small doses of arsenic, but it is advisable in giving such powerful drugs to act only under the advice of a skilled veterinarian.

SWELLED LEGS

ORDINARY SWELLING OF THE LEGS, OR ŒDEMA, occurs in every degree, from a slight "filling," to which many horses are always subject whether

they work or stand in the stable, to an enlargement extending up to the stifles and elbows, sometimes rendering the legs almost as round and as hard as mill-posts. When horses are first brought in from grass their legs almost always fill more or less, and until they are regularly seasoned to their work there is seldom that clean condition of the suspensory ligaments and back sinews which one likes to see even before the daily exercise is given. The œdema appears to depend partly upon a deficient action of the kidneys, but chiefly on the vessels of the legs not acting sufficiently without constant walking exercise, such as is natural to the horse when at liberty, and which he takes at grass. Half-an-hour's walking will generally produce absorption completely, so that a daily remedy is forthcoming.

The Treatment will greatly depend on the exact cause. If the swelling is only due to the change from grass to the confinement of a warm stable, time alone is wanted, taking care not to overwork the horse in the meantime. Bandages will always assist in keeping down the swelling, but they should not be used without necessity, as when once the horse becomes accustomed to them his legs can hardly be kept fine without their aid. If weakness is the cause, a drachm of sulphate of iron given in the corn twice a day will often strengthen the system, and with it the legs. Diuretics may be adopted as an occasional aid to the kidneys, but they should be of the mildest kind, such as nitre, or they will do more harm, by weakening the body generally, than good by their stimulus to the kidneys. Indeed, they are often the sole cause of the legs filling, for some grooms use them so continually, whether they are wanted or not, that the kidneys become diseased and refuse to act, which is a sure fore-runner of œdema. Where swelling of the legs is confirmed, bandages must be regularly applied.

WARTS

WARTS are, generally, only to be considered as eyesores; for, unless they occur on the penis, they are not injurious to health; nor do they interfere with work unless they happen to appear on the shoulders beneath the collar in a harness horse, which is very rare indeed. They are, doubtless, very unsightly, and, for this reason, it is often desired to remove them, which may be done by first picking off the rough outer surface, so as to make them bleed, and then rubbing in, with a stiff brush, some yellow orpiment, wetted with a little water. This will cause considerable inflammation, and in a few days the wart will drop off, leaving a healthy sore, which soon heals. Sometimes the whole wart does not come away on the first application, in which case a second must be made. When the glans penis is completely covered with warts, the best plan is to amputate it, as it requires the greatest caution and tact to remove them by arsenic or any other caustic without destroying, also, as much of the penis as is taken away by the knife.

There are also to be met with, a variety of warts or encysted tumours which may occur on any part of the body, but most frequently affect the under surface of the belly and thighs. They are easily removed by cutting through the skin and squeezing them out, as they have no attachments, being simply contained within a sac or cyst. No other treatment is needed

CHAPTER XXXII

FEVERS AND SPECIFIC DISEASES

SPECIFIC FEVERS — STABLE FEVER—INFLUENZA — STRANGLES — BASTARD STRANGLES — ANTHRAX, OR LOODIANA FEVER—SOUTH AFRICAN HORSE SICKNESS—GLANDERS—FARCY —INFLAMMATORY ŒDEMA, OR WATER FARCY—PURPURA HÆMORRHAGICA—SCARLATINA —AZOTURIA—RHEUMATISM.

COMPARATIVELY small causes give rise to increase of temperature in horses and other symptoms of fever, as rigors, cold shivers, trembling, staring coat, cold extremities, loss of appetite, increased number and diminished force in the contractions of the heart whereby a small pulse is produced, and if the thermometer be introduced into the rectum a rise of several degrees above normal will be discovered. The temperature in health of the average horse is about 99·5 degrees of Fahrenheit, and may vary in individuals from 1·5 above or below that. A slight chill from a change of clothing, or standing in the wind when heated, a mild attack of indigestion, sudden changes from the field to the stable, any of these things may induce a simple attack of fever which may be evanescent in character, passing off without any treatment or yielding to one of the ordinary fever draughts which have so long been in use among horse-keepers. On the other hand a rise of temperature may indicate some serious disease, and taken in conjunction with other signs enable the attendant to diagnose the malady. The experienced veterinarian will know how much importance to attach to a rise of temperature, and its continuance for any length of time will put him on his guard against some specific fever-disease. A sudden elevation of temperature, even to the extent of four or five degrees, may run down again in a few hours, while a lower temperature maintained for a couple of days may be of the most serious import. Temperature as indicated by the thermometer is a valuable aid to diagnosis, but may easily lead the amateur astray if he be not able to review the other symptoms of disease and appreciate their significance.

SPECIFIC FEVERS

By these we mean such illnesses as follow upon the introduction into the animal's system of disease germs which will produce certain definite diseases, as glanders, influenza, anthrax, etc. Specific bacilli have been clearly made out as the cause of glanders and anthrax, and it is only a question of time and research when all the specific fevers will be known to be due to a particular microbe. By further study of bacteriology there will doubtless come a time when antagonistic microbes will be employed to cut short the lives and prevent the multiplication of those germs responsible for disease. Our present knowledge only enables us to select such agents as we know to be prejudicial to germ life. First among these may be mentioned quinine, for without knowing what germs cause the many forms of

fever met with in tropical climates we have blundered upon a remedy that undoubtedly cuts them short. Carbolic acid, salicine, arsenic, and other drugs and salts have also a reputation in certain specific diseases.

STABLE FEVER

In all large towns, and particularly in old and crowded stables, there appears to be an abiding fever germ which more or less affects new-comers until they acquire immunity from it by one or more attacks.

The Symptoms are loss of appetite, hurried breathing, quick pulse, increased internal temperature with extremities alternately warm and cold.

Treatment.—It may pass off without any, or develop a particular set of symptoms, and no very definite rules can be here given.

In hot climates MALARIAL FEVER and RELAPSING FEVER are well known to have a geographical distribution.

INFLUENZA

This is one of the specific fevers only too well known in the British Islands, though appearing from time to time in different guises (see Chapter XXVII., page 539).

STRANGLES

This INFANTILE DISEASE is commonly contracted between the second and fourth year of colthood, and varies in character in one season from that of another, being apparently infectious among colts in ordinary years, but from time to time it assumes a severe form and attacks horses of all ages. Beginning with a febrile attack, inappetence and the usual symptoms of sore throat, it soon runs on to the formation of an abscess between the branches of the lower jaw which in course of time breaks, discharges a quantity of pus, and finally heals up if the colt does not succumb to complications or starvation from inability to eat.

Symptoms.—If at grass, the colt ceases to play and stands about with an appearance of general depression, attempts to graze but soon relinquishes the effort owing to the pain of holding his head down. When brought into the stable the symptoms common to sore throat are observed, tenderness about the space under the jaws, and more or less swelling of the glands there situate. There is more or less fever as indicated by the thermometer.

Treatment.—The disease must run its course, and if it were possible to arrest it, the procedure would not be advisable. It is desirable to encourage the formation of an abscess. With the undisciplined colt we have to content ourselves with one or two stimulating applications such as turpentine and oil or ammonia liniment, but with horses properly broken, continuous poulticing offers the best prospect of early suppuration, besides giving a good deal of relief to the painful swelling. As soon as a soft place or "point" is discovered, it may be opened with the lancet and the contents

allowed to escape. This operation should never be undertaken prematurely, and some veterinary surgeons go so far as to prefer letting it break of its own accord, but the proper time being chosen to make an incision there is undoubtedly an advantage in releasing the pus and enabling the animal to feed again, and so save some days of unnecessary suffering and loss of strength. A simple digestive ointment such as the resin ointment of the Pharmacopœia will help the wound to take on healthy action, and the majority of cases will require no further treatment, granulation taking place rapidly; subsidence of the glandular enlargements, and a return to health may be assisted, however, by mineral tonics, as sulphate of iron in drachm doses daily in the food.

BASTARD STRANGLES

IN OLDER HORSES a milder form of strangles is met with and still passes under the name given above. The disease is very similar, but usually affecting only one side of the space under the jaw, the abscess being comparatively small and the constitutional disturbance less severe. The same treatment may be recommended as for ordinary strangles.

ANTHRAX, OR LOODIANA FEVER

THIS DISEASE is met with in many parts of the world, being common in tropical climates, and comparatively rare in Britain. In India it is well known by the second of the two names given above, and is prevalent in the Bengal Presidency and in Burmah. It is commonly divided into two varieties according to the parts it affects, but is always due to the anthrax bacillus. When affecting the throat and involving the tongue it is called gloss-anthrax or thoracic, and if the viscera are its centre it may be described as abdominal.

Symptoms.—Sudden loss of appetite, extreme prostration, pulse quick and feeble, membranes a yellowish or orange red, breathing hurried and shallow, while the nostrils are dilated. The temperature has been known to reach 108°, while 107° is quite common. The distress increases until the animal falls and dies.

Treatment.—In England no treatment is or should be attempted, as anthrax is one of those contagious diseases where slaughter and burial six feet deep are prescribed by law. If the so-called cures occasionally reported in this country were investigated, they would probably turn out to be glossitis or inflammation of the tongue from traumatic causes.

Major Fred Smith, who has had much experience in India, recommends giving one ounce carbolic acid in a quart of water, and a drachm every hour afterwards as long as required. If tumours appear, they may be laid open and the interior dressed with neat carbolic acid. Half-ounce doses of iodine given in form of ball are also recommended every four hours.

SOUTH AFRICAN HORSE SICKNESS

IN MANY RESPECTS this resembles anthrax, but Major Nunn, who was sent out to the Cape to investigate it, only found the anthrax bacillus, or a similar one, after death, and that the spleen was nearly normal instead of, as in true anthrax, containing tarry fluid and being enormously distended. The pathology of African horse sickness is therefore undecided, but its distribution is much wider than was supposed when first it was noticed at the Cape. The Italians at Massowah suffered from it, and it is known well among the Dervish cavalry. Horses that have survived it are comparatively immune and much valued, especially by travellers into the interior, who need " salted " animals more than any one else.

GLANDERS

THIS FRIGHTFUL CONSTITUTIONAL DISEASE is due to a specific bacillus gaining access to the blood. It is incurable, and therefore it is only necessary to study its *symptoms*, with a view to distinguish it from ozena, with which alone it is liable to be confounded. Its chronic character and insidious onset will serve to distinguish it from catarrh and strangles.

AT ITS COMMENCEMENT it seems to be confined to the internal lining of the nostrils, which is not reddened, as in chronic catarrh (ozena), but presents a leaden or purple colour, sometimes of a deep shade, but at first generally very light and pale. This is accompanied by a thin acrid discharge, transparent, and without odour. Generally, one nostril only is affected, which in this country is more frequently the left, and in France the right; but why this should be so has never yet been even conjectured with any appearance of probability. This state of things usually only lasts for a few weeks, but it may go on for an indefinite time, and is recognized as the first stage, during which the health does not suffer, and the horse can, and often does, go on with his ordinary work. It may be distinguished from ozena by the purple colour of the lining membrane, and by the transparency and freedom from smell of the discharge.

IN THE SECOND STAGE the discharge increases in quantity, and though still watery and transparent, it is slightly sticky, indicating the presence of mucus. The lymphatic glands below the jaw enlarge, *and become adherent to the bone*, feeling hard to the touch, and almost like exostoses. Here the permanent character of the discharge and the adherence of the glands to the bone are the diagnostic signs and distinguish it from ozena.

IN THE THIRD STAGE the discharge increases rapidly, and becomes yellow and opaque—in fact, it is pure pus. If the nose is carefully examined, its lining membrane will be seen to present one or more sores, with depressed centres and ragged edges, and surrounded by small varicose vessels leading to them from all directions. The appetite fails—the horse loses flesh and spirits—the coat is turned the wrong way—the skin is hide-bound, and the legs fill slightly during the day, but go down at night—the nose is, at last, frightfully ulcerated, the sores spreading to the larynx—ulcers break out on the body—and the horse finally dies, worn to a skeleton.

When the diagnosis of the disease is confirmed, as it is undoubtedly highly contagious, both to other horses and to man himself, the patient must be destroyed.

Doubtful cases are now decided by veterinary surgeons by the injection of a cultivation known as Mallein. It is on the principle of tuberculin, at which " all the world wondered " when the German Emperor forced the hand of Dr. Koch and the press lost its head. Unlike tuberculin, however, it is a reliable test and a means of preventing untold animal suffering and pecuniary loss to owners of horses.

FARCY

IS A SIMILAR DISEASE to glanders, ultimately developing into it, and so long as farcied horses are kept alive glanders will be always with us. If the reader desires to possess himself of all the information obtainable and in a condensed form, he should read Mr. Hunting's treatise on glanders and farcy, when he can hardly fail to be a convert to that eminent veterinary surgeon's views with regard to stamping it out. Farcy used to be considered amenable to treatment, and was certainly kept in check for a very long time by the use of drugs we need not name, and by the application of the hot iron to the so-called " buds " which form in the course of the lymphatics, especially of the hind limbs and on their inner aspect.

The Symptoms differ from glanders in not at first affecting the respiratory tract or that part of it which is visible, swelling of a hind-leg being a common warning of what may be expected, as also loss of condition and continued febrile symptoms. The owner of an animal having any doubt in his mind should call in an expert without delay and not tinker with a malady so dangerous. The only disease it is likely to be mistaken for is inflammatory œdema, which the old farriers called " water farcy."

The probable effect of the Glanders and Farcy Order of 1894 may be gathered from a perusal of the annexed report presented to the Public Control Committee of the London County Council. It is taken from *The Field* of July 18, 1896. It (the order) requires the local authorities to slaughter every glandered horse and to pay the owner compensation of not less than £2 or not more than a quarter the value of the animal before it became affected. It also gives power to slaughter suspected animals, with the consent of the owner, subject to the payment of full value as compensation if on post-mortem examination the animal is found not to be glandered. The following resolutions were passed by the Council for giving effect to the order : That every horse, ass, or mule certified by a veterinary inspector to be diseased under the Glanders or Farcy Order of 1894 be slaughtered as provided for in such order, and every such veterinary inspector is hereby authorized and required to cause the slaughter of every such diseased animal. That the sum of £2 be paid as compensation to the owner of every diseased horse, and the sum of 10s. to the owner of every diseased ass or mule which has been slaughtered in pursuance of Article 13 of the Glanders or Farcy Order of 1894, except in cases where there is reason to believe the owner knew of the existence of the disease and failed to give notice thereof. That a post-mortem examination be made by one of the Council's veterinary inspectors of the carcass of

every animal certified to be diseased and slaughtered in pursuance of Article 13 of the Glanders or Farcy Order of 1894, and that the results of such post-mortem examination be reported to the committee, but not communicated to owners unless under the committee's authority. That the chief officer do report to the committee any suspected cases of glanders where he considers it desirable that the suspected animal should, with the consent of the owners, be slaughtered under the powers given by Article 13 of the Glanders or Farcy Order of 1894. The Council's veterinary surgeons were required to take all the measures in their power to free their districts from glanders, to keep all suspected stables and all stables in which disease had existed within fifty-six days under observation, and to visit them fortnightly and carefully examine the horses therein, and especially horses that might have been in contact. Whenever a horse was suspected by the inspector, whether because of outward indications or because it had been working with or standing near to glandered horses, or for any other reason, it was marked "suspected," and whenever possible isolated from other horses. In doubtful cases the inspector was authorized, where he considered that course desirable, to advise the owner to cause suspected horses to be properly injected with mallein, and to adopt the precautions set out under the head "injection of mallein" issued by the Council. The committee desired it to be distinctly understood that the employment of mallein injections for the purpose of diagnosis of glanders should rest entirely upon the advice and responsibility of the veterinary inspector. The committee now reported that they had had before them reports from the chief officer of the Public Control Department showing the effects of the measures taken. These reports showed that during the year, from November 19, 1894, to November 18, 1895, the total number of glandered horses slaughtered was 1067, which was an increase on the previous year, when the numbers were 968. The chief officer, however, pointed out that the increase was more than accounted for by the increasing use of mallein with suspected or in-contact horses, as during the last six months alone 130 cases of disease had been diagnosed after the injection of mallein. The chief officer also pointed out that one reason for increase might be found in the importation of infected horses from Canada and America. In October last, in a consignment of 64 horses which reached Willesden from Canada, nine were found to be glandered, and ordered to be slaughtered by the Middlesex County Council. As a large proportion of the imported horses were purchased for use in London, it might reasonably be inferred that some of the disease in London was due to that source. The following statement showed the number of cases of glanders which occurred in London in the two years before and the two years after the passing of the order :

From Nov. 19, 1892, to Nov. 18, 1893 1734
From Nov. 19, 1893, to Nov. 18, 1894 986
From Nov. 19, 1894, to Nov. 18, 1895 1067

In the six months from November 19, 1895, to May 18, 1896, 414 cases of glanders were reported, of which 143 were diagnosed by the aid of mallein. The committee had had the following documents before them, which contained suggestions for the payment of increased compensation for the purpose of inducing owners to take prompt measures for the discovery

of disease and the slaughter of suspected horses : Resolutions signed by eighty-five of the largest horse-owners in London ; memorial from forty-five Metropolitan veterinary surgeons ; and a letter from the London General Omnibus Company. They had given careful consideration to the suggestions made, but were not prepared at present to recommend any departure from the practice adopted with regard to the payment of compensation. The experience gained in the administration of the order had, however, confirmed their opinion of the desirability—which they had on more than one occasion urged upon the Board of Agriculture—of provision being made for (1) Compulsory notification by veterinary surgeons of cases of glanders within their knowledge, and (2) inspection and sanitary supervision of trade stables. The committee further stated that they were also of opinion, having regard to the statement in the chief officers' reports as to the importation of infected horses, that precautions should be taken against that source of infection by requiring statutory evidence of freedom from disease before horses were allowed to be imported. They had accordingly asked the President of the Board of Agriculture to receive them as a deputation, in order that they might lay before him a statement of their views.

The use of mallein has had a quite unexpected effect in spreading glanders. Infected studs have been submitted to the test and a weeding process pursued, the suspects being sent to auction sales, the moderately affected kept at work, and stabled apart from the healthy, while the seriously ill have been slaughtered after proof to the local authority. While a local authority allows but £2 for a clinically affected animal, a quarter value is given for those apparently well but proved to be infected when voluntarily submitted to the mallein test.

INFLAMMATORY ŒDEMA, OR WATER FARCY

INFLAMMATORY ŒDEMA, "Monday morning leg," "weed," and some other local names are given to a painful and swollen condition of a limb, more frequently a hind one, which has been erroneously called water farcy as distinguished from true farcy. There is no connection, and the term is only used here for convenience of the amateur who might not look for it under its more scientific name.

Causes.—Over-feeding and insufficient exercise will account for most cases among light horses, but with the heavy breeds, confined in town stables and fed on beans, maize, and other highly-nitrogenous foods, there is an inability to carry off effete material when the exercise ceases, even for a day or two. The comparatively slow circulation in heavy horses and the less judicious keepers may have something to do with it. It has been called Monday morning disease, as after the day of rest it most frequently appears. No great stud of draught-horses is exempt, especially after the enforced idleness of public holidays. When these cause a cessation of work the opportunity is generally taken of giving the physic balls for which several members of the stud have been qualifying.

Symptoms.—Sudden and great swelling, which generally takes place in the night. Extreme tenderness to the touch, some blowing, and perhaps inappetence. On the limb being felt, the afflicted animal will sometimes

catch it up with so violent a jerk as to raise fears lest he will fall down. There is generally a clearly-defined portion of the limb affected, above which the patient is not sensitive. It has the appearance of having a cord drawn round, at or near the gaskin, or in a front-leg just below the elbow. Its sudden and acutely painful nature serves to distinguish it from farcy or the simple œdematous swelling of debility.

Treatment.—A dose of physic, as much as seven or eight drachms to a shire or dray-horse. Frequent fomentations with warm water, to which Goulard's extract and glycerine has been added. As the pain is in the distended skin, relief may be expected from anything that relieves the tension, hence oily applications and ointments made from colt's-foot or " grasshoppers " have that effect, the benefit being derived from the ointment base and not the ingredients. As soon as the physic has excited the absorbents to renewed activity the acute symptoms may be expected to abate, and not until then should exercise be prescribed, as the acute pain caused in moving the limb more than counteracts any possible benefit from it.

DIURETIC MEDICINES, as resin and nitre, are both curative and preventive, and their use can hardly be objected to where horses are habitually fed with too much corn in order to make them round and big. It is the price of plethora.

IN THE COUNTRY this disease is sometimes met with in under-fed and old animals, and bears the relationship of "poor man's gout" to the "pains arthritic that infest the toe of libertine excess." Tonics, as sulphate of iron and copper, nux vomica and gentian, with a more liberal diet, may in such cases prove helpful.

PURPURA HÆMORRHAGICA

THIS IS A DISEASE of the blood, which appears to undergo some sort of decomposition, either as the result of bad sanitation or following upon some exhausting disease, as strangles and influenza. It is not considered infectious.

Symptoms.—Sudden swellings about the head and face, neck, breast, or belly, with more or less fever and great debility, while constipation is generally present. Small purple spots the size of a flea-bite may be seen on the membrane inside the nostrils. The urine is very dark-coloured. The swellings may suddenly disappear, and others come up on different parts of the body, and the animal die when to all appearance he is convalescent.

Treatment.—To arrest the rupture of the red blood corpuscles and assist the emunctories in getting rid of effete matter is our object. Until quite recently the treatment generally recognized as the most successful was frequent dosing with perchloride of iron and turpentine, but this has been almost superseded by iodine in some form or other. Injection into the trachea was first recommended, but has given place to the administration of iodide of potassium in solution, in doses of about half-an-ounce every four hours. The bowels should be kept open with clysters, and if the appetite is retained a laxative diet consisting of bran, carrots, linseed, and cut grass.

SCARLATINA

IT must not be supposed that this disease resembles the fever known by that name in man, nor is it communicable from the horse. It is akin to purpura, showing the spots (*petechiæ*) on the membranes and swellings about the body, but with this difference : the petechiæ are scarlet instead of purple, and the swellings small and exuding a serosity like that of a blister. Sore throat is a prominent symptom in scarlatina and an exceptional one in purpura.

Treatment.—Good nursing and sanitary surroundings, freedom from draughts and avoidance of chills being most important. Chlorate of potash as a blood oxidizer is most in favour, and may be given in two drachm doses for several days, followed by mineral acids and quinine or gentian and calumba, if there is digestive feebleness.

AZOTURIA

Is THE RESULT of dietetic errors, and characterized by spasm and paralysis of the hind-quarters, which comes on very suddenly when at work. It was formerly called hysteria, as it was first observed in mares, but is not confined to one sex. As a consequence of high feeding and incapacity to appropriate the rich products in the blood, a form of self-poisoning ensues, which in some respects resembles both gout and lumbago in man.

Symptoms.—Sudden and acute lameness, followed by complete failure of the hind-quarters within a few seconds of what seems to be a false step. The subject has probably travelled but a short distance, after a few days' idleness in the stable, when this occurs. The pain evinced is very acute, and the animal wears an agonized and often angry expression. It is with great difficulty he is walked home, and it is probable that some horses are slaughtered under the impression that the back is broken. The urine is very dark-coloured and, if tested in the usual way, shows a great quantity of urea and of hippurates, besides, in some cases, albumen.

Treatment.—Remove with care to the nearest available stable and support in slings. Give a bold dose of aloes, back-rake and wash out the bowel with clysters of soap and water. A pillow-case, full of scalded bran, laid over the loins appears to give relief, but no blistering agents should be applied. If the urine is not passed—its scalding quality and the difficulty of posturing induces the animal to retain it—the catheter should be used to draw it off. Bleeding from the jugular vein is recommended early in the attack, and without waiting for the operation of the aloetic purge, half-ounce doses of salicylate of soda may be given three times in twenty-four hours. The debility produced in a short time is so great that a low diet should not be prescribed when the animal has recovered sufficiently to desire food. Exercise should be confined at first to a few minutes' walking, and increased daily.

Bad attacks often leave permanent lameness or "catching" of one limb, and the patient is predisposed to a recurrence of it.

RHEUMATISM

ALTHOUGH this is a convenient term used to describe obscure lameness, it is very doubtful if genuine rheumatism is ever met with in horses. That is to say, the rheumatic affection which in men and carnivorous animals is accompanied with acute fever. The sudden transference of pain and lameness from one limb to another is suggestive of rheumatism both in the muscles and joints.

Treatment.—Local stimulation with soap liniment, white oils or turpentine diluted with seven parts of any bland oil. Salines or the salicylate of soda internally in doses of two to four drachms twice daily.

CHAPTER XXXIII

DISEASES OF THE FEET

CORNS—SANDCRACK—FALSE QUARTER—QUITTOR—THRUSH—CANKER—LAMINITIS—SEEDY TOE—BRITTLE FEET—VILLITIS—TREAD—PRICKED FOOT—CONTRACTION OF THE FOOT—NAVICULAR DISEASE—ACCIDENTS TO THE LEGS AND FEET.

CORNS

THESE TROUBLESOME results of bad shoeing, or subsequent neglect of the feet, make their appearance in the sole of the foot, in the angle formed between the crust and the bar (see Fig. 118 (E E,) Chap. xxxviii.). Where the foot is properly prepared for the shoe, and the smith seats the heel of the crust and the bar on a level surface, no corn will make its appearance in a healthy foot; but if a corn has previously existed, or if the shoe is allowed to press upon the sole at this point, the delicate blood-vessels of the sensible sole are ruptured, and, instead of secreting a sound horn, capable of bearing the slight strain upon it which is required, a fungoid growth is formed, presenting a reddish appearance, and exquisitely sensitive. This morbid substance does not at all resemble the hard corn of the human subject, which is a thickened secretion of cuticle, but it bears some comparison with the soft corns that form so often between the toes, and give so much trouble in their removal. It is, in fact, a new growth, of a semi-fungoid character, partly made up of granulations and partly of horny matter, the two being closely united. The corn may arise from improper pressure made on this part of the sensible sole, either directly from the shoe, or indirectly by pressing a thin brittle crust inwards upon it. Generally,

however, it is met with at the inner heel, from the shoe being overgrown by that part of the foot when kept on too long. The outer nails do not allow it to work in the contrary direction, and if there is a clip on the outer quarter this is rendered still more improbable. If, therefore, shoeing is properly managed, corns may always be prevented, and we shall see in the directions for shoeing, at Chapter xxxviii., how this is to be managed. At present I have to consider how they are to be relieved or cured when they are already established.

THE ORDINARY MODE OF TREATING CORNS is simply to cut them out, leaving the bar and heel of the crust full, and thus taking all pressure off them. This enables the horse to do his work for about ten days, but then the shoe must be removed, and the paring-out repeated, a process which weakens the already weak crust by making additional nail-holes in it. The shoe at the same time is generally "sprung," that is, it is so bent or filed that the heel does not fully bear upon it; but this does not last many hours, and is of little real utility. The plan answers well enough for the purposes of fraudulent sellers, as the horse runs sound for about ten days; and when he fails, and on taking off his shoe he is discovered to have a corn, it is impossible to prove that it existed at the time of sale by any evidence but that of the smith who shod him previously to it. Excepting, therefore, in very slight and recent cases, in which it will sometimes be followed by success, this plan of treatment is only palliative, and what is worse, it tends to increase the weakness of the foot and consequent tendency to the disease.

FOR THE CURATIVE PLAN we must do something more than merely take the pressure off the sole; the bar and heel of the crust must also be relieved, and the sensible sole must be stimulated, by a proper application, to secrete healthy horn, as well as by pressure on the frog. If the horse is to be rested, this can be done easily enough by taking off his shoes, but he may be kept at work by putting on a bar shoe (Fig. 123, Chap. xxxviii.), and cutting down the bar and crust, so as to throw all the pressure off them upon the frog. A double purpose is effected in this way. First, the sensible sole is relieved of the constant pressure which the crust bears upon it laterally; and, secondly, the jar on the frog, communicated through the shoe, from the ground, induces a healthy action in the foot, and the sole has a greater tendency to secrete healthy horn. There is no doubt in my mind that all horses would work much better, and keep their feet in much sounder condition, if their frogs could be brought into use, without being guarded as they are by the ordinary shoe. This part is intended by Nature to take upon itself great pressure; and if it has not its natural stimulus it becomes weak itself, and, moreover, it does not stimulate the surrounding parts to a healthy action, as it ought to do. The bar shoe is inconvenient for many purposes, and, therefore, it is not generally applied; but as a curative agent these objections are to be dispensed with, and then it will be found to be extremely valuable, not only in relieving the diseased part (the corn), but in giving a healthy action to its seat, the sole. The smith should therefore pare down the crust at the heel, so that when the bar shoe is applied it will allow a penny-piece to be insinuated between the two surfaces. With this the horse does his work comfortably on the road; and in process of time, that is, in two or three months, the heel grows up, and takes its own share

of pressure, or a part of it, becoming gradually accustomed to the amount which it will have to bear when the bar shoe is discontinued. In the meantime a little of the following lotion may be applied daily to the situation of the corn by means of a feather :—

> Take of Chloride of Zinc . . . . 1 drachm.
> Water . . . . 6 ozs.
> Glycerine . . . . 2 ozs. Mix.

In every case the bar shoe must be continued until the heel of the crust and the bar grow down strongly ; and then a common shoe may be applied, as directed in Chap. xxxviii.

SANDCRACK

IN THE ANATOMICAL DESCRIPTION OF THE FOOT, at page 383, it will be seen that the crust is composed of fibres, running parallel to each other in a direction from the coronet to the ground surface These fibres are glued together firmly in a sound and strong hoof ; but, in a weak one, it sometimes happens that the gelatinous matter is not in sufficient quantity, and then the fibres separate, and leave a crack of greater or less extent, according to circumstances. This, called a sandcrack, happens at the thinnest part, which is the inner quarter in the fore-foot, and the toe in the hind. *To cure it*, the foot must be rested, or at least that part of it where the crack occurs, which in the fore-foot may be effected by the use of a bar shoe, throwing the pressure entirely on the frog, as recommended in the last section on corns, and taking care that the crust behind the crack is not in contact with the shoe. By adopting this plan, I have succeeded in curing sandcracks during moderate work ; but if it happens in the hind-foot, complete rest must be given, as the toe cannot be relieved by any possible contrivance. The next thing to be done is to open the crack slightly, so that any grit getting into it shall not cause its further expansion ; and in doing this, if there is any little cellular cavity, it should be exposed. If the crack extends to the coronet, a V-shaped groove should be made in the hoof with the firing-iron, the apex pointing to the ground and the lines terminating on either side of the breach in the coronary band. A mild blister may from time to time be applied to the coronary secreting surface, when the hoof may be expected to grow down and the crack gradually disappear. The V has the effect of diverting concussion from the weakest spot. The jar can also be reduced by cutting out a little hollow at the other end of the crack. In this way horses may be kept at work while the new material is forming. It takes about a year to grow down, but horses vary much in the rapidity with which their hoofs grow.

To prevent falling in or lapping over of the edges, a wedge is sometimes fitted into the space, and Mr. South, of New Bond Street, London, has invented an ingenious contrivance for the purpose.

FALSE QUARTER

WHEN, FROM AN ACCIDENT, the coronary substance is permanently injured, it ceases to secrete sound horn, and a strip of the crust, defective in strength, runs all the way down from the coronet to the plantar edge. This generally happens at the inner quarter, and is owing to the horse treading on his coronet; but it may also occur on the outside, either from the tread of another horse, or from some kind of external violence. The result is similar to that of a sandcrack; there is no strength in the affected heel, and lameness is produced.

The Treatment is very much the same as for sandcrack. In the first place, the pressure must be taken off the quarter, and a bar shoe applied, so as to convey the weight on the frog, as described under the head of Sandcrack. The heel of the affected quarter should be lowered, and thus further injury will be prevented. The next thing to be done is to stimulate the coronet to a healthy action by blistering it, which must be done two or three times, taking care that the blister is not of too violent a nature, and that the skin heals before a second is applied. By these means, a cure may sometimes be effected; but it takes a considerable time, and until the quarter is reproduced in full strength, or nearly so, the bar shoe should be continued. By its use, any horse with a sound frog can travel very well on the road, even if the quarter is entirely and permanently separated from the toe by inefficient horn; and without it, the chance of a cure is not to be reckoned on.

QUITTOR

BY THIS TERM IS UNDERSTOOD a chronic abscess of the foot, the matter always forming sinuses, from the difficulty which Nature has to overcome in finding a way for it to reach the surface. Generally, the mischief is occasioned by an overreach, or a bruise of the sole, or by the inflammation resulting from a neglected corn, or from a nail-prick. From any of these causes, inflammation of the delicate investment of the coffin-bone is set up, pus is secreted, and, in working its way to the surface, it burrows between the horn and the bone, and forms one or more sinuses, or pipes, as these fistulous tubes are called by the farrier. A quittor is recognized by the eye and nose detecting an opening in the horn, from which a foul discharge proceeds; and on introducing a probe, it will generally pass freely in two or three directions, sometimes giving a grating sensation to the finger, showing that the bone is denuded, and most probably carious. There is generally a considerable increase of temperature in the foot, and always more or less lameness, with, in most cases, swelling of the bulbous heels and coronet. On examining the sole carefully, some part will either show a difference of colour from the adjacent horn, or there will be a yielding on pressure, owing to its being undermined.

The Treatment must be conducted on the same principle as for fistulous wounds. In the first place, a dependent opening must be formed, so that no matter shall be confined, but it shall be allowed to come away as fast as it

forms. This can only be done by probing; and if the original opening is in the coronet, the probe must be passed down as low as possible, and then the sole should be pared away till the end can be reached. In tolerably recent quittors, this plan alone will allow the sinus to heal: but in old ones, the internal surface has become callous, and no granulations are thrown out. Here an injection should be thrown in every day with a syringe, a saturated solution of sulphate of zinc being that generally recommended; but I have found the chloride answer still better, using one drachm of the salt to a pint of water at first, and going on up to two drachms. By injecting this daily, and introducing a piece of lint, wetted with it, into the superior opening, leaving the lower one free, I have cured many bad quittors, even when there was evidence of caries of the coffin-joint. The disease requires a careful adjustment of the remedies to its extent and nature, and a theoretical description of it is of little use.

THRUSH

ANY OFFENSIVE DISCHARGE FROM THE FROG is called by this name, although the cause and treatment may be as different as possible. It varies greatly in the fore and hind feet; and, indeed, it must never be forgotten that, in every case, the cause which has produced the discharge must be clearly made out before any plan of *treatment* can be carried out with any prospect of success. Sometimes thrush is merely the result of the decomposition of the horny frog, from the foot being constantly kept wet with urine, which is most common in the hind-foot. Here the surface becomes soft, and is gradually dissolved: while the cleft, from its retaining the moisture, is increased in size. This state is often brought on by the too frequent use of cowdung-stopping in horses with soft frogs; and, instead of doing good by his treatment of the foot, the groom is really destroying it by encouraging the decomposition of the healthy defence which Nature has given to it. For this kind of thrush, very little treatment is required if the cause which produced it is withdrawn. Still, it is not always easy to keep the frog dry, and stop the decomposition, without the application of some astringent; and if the mere use of dry litter, and the application of tar ointment, do not seem to harden the frog at once, it may be touched with a wash composed of ten grains of bluestone to the ounce of water. This will soon dry it; or, if it fails by any chance, the chloride of zinc may be used in the same way, by dissolving five grains in an ounce of water.

THE SECOND KIND OF THRUSH is that in which from a gross habit of body there is a simple inflammation of the sensible frog, and instead of sound horn being secreted, a spongy substance is deposited, which breaks away in places, and the frog looks ragged and uneven, with a greasy surface, smells very foul, and *feels* hot to the touch. Here the *treatment* must be general as well as local. A dose of physic should be given, the food should be of a less stimulating quality, and care should be taken that regular exercise is allowed every day. The stable should be kept cool, and of course attention should be paid to the cleanliness both of the food and the litter. As to local remedies, they must not be of the stimulating kind which will suit the thrush from decomposition, or that presently to be described. The foot

should be placed in a bran poultice, and kept in it for some days, till the united action of the local and general treatment have reduced the inflammation. After a few days it will be well to dress the frog with tar ointment, or the poultice will do more harm than good, by causing the decomposition of its horny covering, and indeed it is seldom that this wet application should be employed for more than a few days. After this, all the good to be derived from it has been accomplished, and the subsequent treatment may generally be effected by attention to the health, and dressing the frog with tar ointment. Sometimes it may be necessary to employ a slight stimulus, and then the solution of chloride of zinc will be found to be the best.

THE THIRD KIND OF THRUSH occurs in contracted feet, and is due to the same cause, namely, chronic inflammation of the sensible frog, produced by overwork, aided in many cases by neglect in shoeing. There is a tendency to the secretion of unsound horn over the whole foot, sometimes too thick and hard, and at others of a cellular structure, without sufficient strength to bear the pressure of the road. The horny frog generally looks shrunken and withered, and in its cleft there is a foul discharge, on wiping out which a soft spongy matter may be seen at the bottom, which is the sensible frog itself, but in a diseased condition. In bad cases, the sides of the horny frog have separated, and even the toe is sometimes deficient of its covering; but generally the horn has only disappeared in patches, and there are ragged portions remaining. The disease here is of too chronic a nature to be easily cured, and if there is much disorganization of the laminæ it will be almost impossible to effect a perfect cure. The first thing to be done is to clear away all the ragged portions of horn, so as to be able to reach the sensible frog. Some tow is then to be smeared with the following ointment :—

Take of Ointment of Nitrate of Mercury . . . . 1 drachm.
Zinc Ointment . . . . 1 oz.
Creosote . . . . 4 drops. Mix.

and pressed into the cleft of the frog, where it can best be retained by a bar shoe lightly tacked on, and in this case taking its bearing on the heels and not on the frog. Sometimes a wash answers better than a greasy application, and then a strong solution of the chloride of zinc may be employed, about six grains to the ounce of water. Tow dipped in this may be applied in the same way as with the ointment, and either one or the other should be re-applied every day. As the new horn grows, it must be kept supple by tar ointment, and until it is fully developed the bar shoe should be kept on, applying some degree of pressure by means of the tow, which should be stuffed in so as to compress the frog, beginning with very light pressure, and, as the horn increases in substance, augmenting it in proportion. By attention to these directions a thrush of this kind may be cured, if the foot is not damaged throughout, and even the frog may be restored to a comparative state of health.

CANKER

CANKER is generally an extension of the third form of thrush, the fungus spreading to the sensible sole, and afterwards to the coffin-bone itself. At first the morbid surface is concealed by the old horn, but gradually this breaks away, and then the extent of the mischief may be seen. A part or the whole of the sole and the frog may be in a state of degeneration, generally depending upon the time during which the disease has been in existence, and the care which has been taken of it, or the reverse. The only *treatment* to be adopted is the careful removal of every loose piece of horn, so as to expose the unsound surface to the action of remedies, and at the same time to avoid poisoning it by the decomposing horn, which has a most irritating effect. The sulphate of copper, and chloride of zinc, are the best applications, and they must be used in full strength. These cases, however, require an experienced eye to enable the prescriber to judge of the proper amount of caustic required; and beyond suggesting the kind of remedy required, no good can be done by written prescriptions. If it is impossible to obtain the advice of a veterinarian, it will be better to begin by using a mild caustic, and then increase the strength as it is found to be wanted. Pitch ointment forms the best greasy application to the adjacent sound surfaces to protect them from the irritation of the discharge.

LAMINITIS

(*Founder or Fever of the Feet*)

THE TERM LAMINITIS is now familiar with every one at all accustomed to horses. The disease has been recognized for many years under the terms "founder" and "fever of the feet." It consists in an inflammation (which may be acute or chronic) of the parts between the crust or wall and the pedal-bone, including the laminæ, whence the name by which it is now distinguished. These parts are supplied with a profusion of blood-vessels (see page 504), and when inflammation is set up in them, the progress which it makes is rapid, and the constitutional disturbance is unusually great, owing probably to the want of space for the swelling which accompanies all inflammations, and especially of vascular substances. The *causes* are either—1st. Localization of fever, whence the name "fever in the feet." 2nd. The mechanical irritation of hard roads upon feet not accustomed to them; and 3rd. Long confinement in a standing position on board ship. Laminitis is also metastatic, making its appearance very suddenly in a horse suffering from quite another disease, as congestion of the lungs and in mares after foaling, there being a peculiar sympathy between the feet and the mucous membranes. When it is recollected that in our system of shoeing, the laminæ are made to support the whole weight of the body in consequence of the shoe being in contact with the crust only, it can only occasion surprise that this disease is not more frequent. Nature framed the horse's foot so that an elastic pad should interpose between its back parts and the ground, intending that the edge of the crust should take its share, but not *all* of the

weight. The laminæ are therefore called upon to do far more than their structure is designed for, and when there is the slightest weakness or tendency to inflammation, they are sure to suffer.

THE ACUTE FORM is generally the result of fast work upon hard roads, and especially liable to it are the fat and over-fed ponies so loved of old ladies, and those of the sporting publican who " corns " his trotter all the week and drives him fast and far on a Sunday. The chronic form is often not suspected until irreparable mischief is done, the elasticity of the laminæ being destroyed, and the foot having assumed a shape which utterly unfits it for bearing the pressure of the shoe upon hard roads. When the disease has been going on for a long time, the elastic substances between the laminæ and the pedal-bone, as well as the fine horny laminæ between them and the crust, lose the property of extension, and the horn of the crust is secreted by Nature of a more spongy character, and much thicker in substance, than in health. On making a section of such a foot, the arrangement of parts will be such as here delineated in Fig. 104, in which 1 is the os suffraginis, 2, the os coronæ, and 3, the pedal-bone, with its anterior surface separated from that of the crust (7) by a wide space occupied by spongy matter. Here the toe of the pedal-bone projects into the sole and renders it convex, instead of being concave, and corresponding with the lower surface of the pedal-bone.

FIG. 104.—SECTION OF THE FOOT IN CONFIRMED LAMINITIS.

1. Os suffraginis.
2. Os coronæ.
3. Pedal-bone.
4. Navicular bone.
5. Frog.
6. Sole.
7. Wall or crust greatly thickened.

The laminæ and elastic substances between them and their contiguous structures no longer suspend the pedal-bone to the crust, but the weight falls partly upon the sole by means of the toe of the pedal-bone, and partly on the frog, which descends so low that in spite of the thickness of the shoe it touches the ground. This descent of the frog is a very marked feature in laminitis, and whenever it is apparent that disease may be suspected.

BUT TO PRODUCE SUCH A MARKED ALTERATION OF FORM as is here delineated and described takes a long time, and even then it is only in a few cases that the disease reaches to this stage. It will, therefore, be necessary to trace its progress from the commencement, and the effects which are exhibited as it goes on.

WHEN ACUTE LAMINITIS SETS IN, there is a considerable amount of fever, indicated by a rapid pulse, usually full and hard, and hurried respiration. It may affect the front feet only, or all four. The animal puts all the weight he can on the heels, and is unable to move. By putting his hind-feet under his body and leaning somewhat backward with an arched loin, he appears to find most relief, and this attitude often leads the attendant to suppose that his back is hurt. If he is made to move, he does so with great difficulty, after swaying his body undecidedly. On examining the feet, there is

great reluctance to allow one to be picked up, on account of the necessity which is thrown upon the other of taking the whole weight of the fore-quarter. The coronet and hoof feel very hot, and if this state of things is not speedily stopped, the laminæ cease to secrete horn, and the connection between them and the hoof ceases, causing the latter to separate, and the sensible parts to be exposed, covered with a thin scaly horn. This has happened in many cases which have afterwards secreted new hoofs ; but the horn is not so strong and useful as before, and a horse with such feet is not fit for hard work on the road. If proper treatment is adopted, the inflammation either subsides entirely, leaving no mischief behind it, or there is a chronic inflammation left which induces the alterations of structure which have been alluded to.

The Treatment should be by first removing the shoes, and then, after paring down the sole so as to allow of the expansion of the sensible parts, a large quantity of blood is taken from the toe, making sure that a vessel of sufficient size is opened to produce a strong shock on the heart and arteries, as well as to relieve the local affection. If the blood does not flow freely, the foot may be placed in a pail of warm water, but when the operation is properly performed there is never any difficulty in obtaining any quantity of blood which may be required. Next tack the shoes on lightly again, and then give a smart dose of physic, or else, what is perhaps a better plan, give the following :—

> Take of Barbadoes Aloes
> Tartar Emetic, of each . . . . 1 drachm.
> Powdered Digitalis . . . . ½ drachm.
> Syrup enough to form a ball.

which should be given every six hours, until the bowels act, when the other materials may be continued without the aloes. The feet should be kept constantly wet and cool by tying a piece of felt or flannel around each pastern, and allowing it to fall over the hoof, when it is to be continually wetted, or poultices of bran and linseed may be continually applied. Any application of moisture is calculated to relieve pain by permitting of expansion. The administration of aloes is thought by some veterinary surgeons to increase the risk of pulmonary congestion by metastasis, and there is some doubt as to the advisability of enforced movement. Mr. Broad, of Bath, who is an eminent authority on the subject, advocates gentle exercise, and putting on a shoe as early as possible made of iron " twice the ordinary thickness and thinned from behind the quarters, so that the heel part of the shoe is wide and thin, and fitted rocker fashion, which enables the horse to throw his weight where he tries to, much better than he can in ordinary shoes or without any."

CHRONIC LAMINITIS is generally first shown by a slight soreness or lameness, generally appearing in both fore-feet, and, therefore, being often overlooked by casual observers. In coming in from work the coronets feel warmer than natural ; but this goes off during the night, and, for a time, no great fears are entertained of the feet recovering their former condition, the blame being, perhaps, laid upon the shoe. In a month or two, however, the smith (who has, perhaps, been ordered to take off the shoes two or three times, by which the injury is increased) finds that his nails do not hold, and the quarters break away ; while the action of the horse

becomes more shambling every day, and he cannot make a sound trot on any hard road, *especially with a weight on his back.* In many cases a horse with chronic laminitis can run in hand sound enough for an ordinary observer; but when the extra weight of a rider is placed on him the feet cannot bear the pain, and the gait is shambling in the extreme. Such animals have a strong propensity to save their toes, and prefer (if their shoulders will allow it) bringing their heels to the ground first, so that, although their action is excessively low and shuffling, they seldom fall. An experienced horseman at once detects this peculiar style of going, and condemns its possessor for laminitis. Indeed, it may be assumed as a rule, that wherever the heel is put carefully down upon the ground *with low action*, the foot is the subject of laminitis to some extent. When the heel is naturally brought to the ground first, the knee is well bent, and the foot is raised high in the air; but in process of time work tells on it, the laminæ become inflamed, and then the action is reduced in height, and the feet are moved in the manner peculiar to foundered horses, including those which before they were foundered perhaps exhibited " toe action," or, at all events, a level fall of the foot. This state of disease ought to be well studied, and compared with the remarks on sound action at page 7 *et seq.*, which it will serve to illustrate and explain. The foot itself is changed in form, and the toe and sole have more or less altered their relations, as explained already. Sometimes there is a large space or cavity between the outer surface and the inner, shown at 7, Fig. 104, page 605. This hollow in the crust is more or less cellular, and the disease is called a " seedy toe," but for what reason I am at a loss to know. The sole, moreover, is always either flatter than natural or absolutely convex, and its horn is brittle and spongy, constituting what is termed the "pumiced foot." The frog is generally large and spongy; and on placing a straight-edge across the shoe, from heel to heel, it is found to touch that part, or nearly so, indicating that the relations between it and the crust, as well as the sole, are altogether changed from a natural state. The laminæ are no longer slings for the foot, but the whole pressure is taken by the parts lying beneath the pedal or coffin-bone and the navicular bone. Such being the *symptoms*, the next thing is to consider what can be done? If the disease is of long standing, little hope can be given of a perfect recovery. The shape of the external parts may be partially restored, but the internal delicate structures no longer have the power of performing their offices; and the elastic action of the horse suffering from the effects of laminitis can seldom be restored on hard ground. After proper treatment he may, and generally does, go on turf well; but either on hard ground or on plough (on the latter of which, though soft enough for the laminæ, the sole has to bear considerable pressure) he is dreadfully sore and lame. This is shown after all inflammation has ceased, the foot being as cool as possible, and sometimes exhibiting very slight evidences of previous mischief. In *treating* such cases, if there is no heat or other sign of inflammation, bleeding and similar lowering measures will be of no avail. They may be required soon enough, it is true, for a foundered foot is always in danger of inflammation when battered; but until symptoms of this kind of mischief are exhibited it is better to avoid all depletory measures. At the same time, everything which will tend to keep off increased action should be avoided; the horse should be

fed on the least heating food which will serve the purpose for which he is intended, and his stable should be kept as cool as possible. Beans ought never to be allowed to the possessor of feet with the slightest suspicion of founder ; and no more oats should be used than are necessary for the condition required. For horses at slow work, bran mashes and nitre, with small doses occasionally of physic, will serve to keep down the tendency to inflammation, and by their use, joined to cold applications *after work* (they are of no use at other times), and a cool stable, the horse may be enabled to do moderately fast work. If the frog is not very prominent, a leather sole, put on in the usual way, will save the jar, and in some measure supply the place of the natural elastic tissue, destroyed in this disease. Usually, however, it only adds to the mischief by increasing the pressure on the frog, and then the leather must be introduced between the foot and the shoe, but cut to the same shape as the latter, so as not at all to bear on the frog. Many horses with slight traces of laminitis can work for years with leather applied in this way, and it may be said to be the most useful mode of treating this disease when exhibited in a mild form. Sometimes by throwing a horse by for six months, taking off his shoes, and blistering his coronets two or three times, a great deal of good may be done, but he must be made to stand on tan or sawdust during the whole time, and never allowed to go on hard ground, even for half-a-mile at a walking pace. A modification of the shoe recommended by Mr. Broad will enable many a horse to do useful work.

SEEDY TOE

Is the name given to a condition of the foot in which a defective toe results from a cavity within the wall of the hoof extending from the plantar surface upwards. It may spread in either direction and affect both front and hind feet, but the toe of a front foot is its most frequent situation. It is a common result of laminitis, but there are many cases in which no inflammatory disease has been the precursor so far as can be ascertained. The shoeing-smith is usually the first to observe it, and if not attended to, the crust is soon broken and appears shelly and brittle. When the shoe is removed there will be discovered a cheesy material between the sound parts.

Treatment consists in picking out all the morbid deposit and pouring in warm tar so as to thoroughly fill up the space, and replace the shoe in such a manner that no clip shall press upon the defective parts, and no direct bearing be imposed on them. The coronet should be gently stimulated from time to time with a mild blister and the tar dressing repeated as often as the removal of the shoe or opportunity affords. Many cases of seedy toe are in this way cured or the progress of the disease at least so far arrested as not to interfere with the animal's usefulness.

BRITTLE FEET

IN some feet the proportion of gelatinous material appears to be inadequate, and the wall of the foot is consequently brittle and difficult to shoe, as the clinches of the nails chip away the foot, and if a shoe should be cast on the road, serious damage to the crust may follow before the shoe can be replaced. The defect may be congenital and is observed among colts, or it may be the result of chronic indigestion according to Captain Hayes, who points to the sympathy existing between the sensitive laminæ and the mucous membrane lining the stomach and intestines.

Tar has the reputation of improving the quality of horn, and lanoline also appears to supply in a measure the material required.

VILLITIS

INFLAMMATION OF THE CORONET. Swelling all round above the foot; heat and some tenderness distinguish the cause of lameness, which is the result of concussion, and therefore most frequent among roadsters with high action, and in dry, hot climates. When a subject of this malady has been rested, and wet swabs applied for a day or so, he may come out fairly sound, but with work the pain returns and a shuffling gait, and ends in lameness before a moderate journey can be accomplished.

Treatment.—Remove the shoe and poultice; give a mild aperient, laxative food, preferably grass or lucerne, and when all inflammatory symptoms have passed off, replace the shoe and blister the coronet with a one-to-sixteen biniodide ointment. A turn-out on marshy land, but not a salt marsh, should be obtained if possible, to complete the cure.

TREAD

THE name describes the cause of an injury often met with in heavy horses who tread *themselves* while turning in harness, or are trodden upon by their fellows when harnessed side by side. It happens also to other classes of horses when, from fatigue or debility, slippery roads or shoes that have been "roughed," a false step is made. The amount of injury done may be so slight as to be amenable to a dressing or two with Friar's balsam or tincture of myrrh; or it may be so severe as to cause death of the skin; injury to the coronary secreting substance, and eventually quittor. Fomentation and efficient poulticing in the first instance may prevent the more serious consequences, but if a slough begins to show it must be patiently poulticed until it detaches itself from the living parts. This process is sometimes facilitated by a mild fly-blister.

PRICKED FOOT

BECAUSE a horse is pricked in shoeing it must not be too hastily assumed that the farrier is to blame, since the most careful and skilful practitioners of the art cannot avoid once in a way driving a nail awry. The nail may " sliver " if a hand-made one, or be turned aside by an old " stub " which could not be seen or felt. A restive horse may plunge at the moment of striking, indeed one might find a great many excellent excuses for an accident which is not after all so common as it is represented to be when the number of nails driven in a given time is considered. The unpardonable sin in the smithy is trying to cover up the accident, when a poultice for one night might have prevented the most disastrous consequences which a prick will sometimes bring about. The smith does not always know himself, if he has " put on the shoe too tight," as he calls it, for the horse may have a habit of snatching his foot while in the lap of the farrier, and the moment in which he flinched may not have been decisive. He may go sound for a day or two, or even a week, before the pressure of a nail which does not actually prick, but presses on the sensitive part, causes him to go lame.

Symptoms.—Lameness, at first slight, and perhaps decreasing with exercise, but returning when rested. Pointing the foot in the stable. More heat at one part of the foot than another when carefully felt and compared. Absence of other causes of lameness.

Treatment.—There is a veterinary tradition to the effect that " you should have the shoe off if the horse is lame in the head," and it is no bad rule to insist upon, so often is a lameness ascertained to be in the foot after the shoulder and other parts of the limb have been treated without benefit. Each nail should be examined for blood-stains or matter, the height of each clench upon the crust carefully noted, the marks of drawn nails upon the plantar surface examined and probed. The foot pinched round to see if it is more susceptible to pressure in one place than another, and if it should prove to be tender opposite a nail that was driven too high, or where a drawn nail has left its mark, the place should be cut down upon, and the direction ascertained. A farrier who neither pritchelled the holes in the shoe nor put it on will be more expert in finding a prick than the man who did it, as a rule, but an honest effort may fail to discover it at first, and with the removal of the pressure of the shoe and a few poultices the lameness may pass away. If it does not do so matter will form at the seat of injury, and the lameness be very acute. Further search must be made, and will end in liberating a drop of green sappy fluid which has been responsible for such intense pain, owing to its confined situation, where no swelling can relieve it. The orifice should be enlarged to permit of free drainage, and poulticed till no matter can be found, when a little astringent application, as tincture of iron or Friar's balsam, may be applied to prevent a soft spongy granulation rising above the level of the wound. Neglected pricks run on till the matter, now consisting of pus, and finding no exit, seeks the least line of resistance, coming through at the coronet. This is also the case with festered corns or any injury which causes suppuration within the horny box. A dependent orifice should be obtained and poulticing assiduously practised, or quittor may result.

CONTRACTION OF THE FOOT

THIS REPUTED DISEASE has long been the bugbear of the horsemaster; but it is now discovered to be a complete mistake. Some of the most contracted feet in point of width are particularly free from all risk of disease, and on the other hand many open ones are as liable to it. The donkey, whose heels are shaped exactly like those of the contracted horse's foot, is so seldom lame, that few can recall having seen one in that condition, and, therefore, reasoning from analogy, one would be led to doubt that this shape renders the horse prone to lameness. At the same time it is quite true that in the disease which will next be investigated, the frog withers and contracts, and the heels are thereby drawn in; but here the contraction is a consequence and not a cause of disease, and certainly cannot be considered as a disease in itself. Bad shoeing will do much to cause either laminitis or navicular disease, and it will certainly produce corns and inverted heels, but it will not waste the frog, or induce that condition of the foot where the sole is arched so high that the frog does not touch the ground when the shoe is off. Such a state of things can only be brought on either by thrush or navicular disease, and is never the result of the mechanical mismanagement of the foot, to which what used to be called contraction was generally attributed. All sorts of plans have been suggested for expanding the heels and for allowing them to expand; but the real truth is that so long as the frog is sound and the parts above it, allowing the proper amount of pressure to be communicated to the sole, bars, and heel of the crust, these latter divisions of the foot have no room to contract, and of a certainty they never do.

NAVICULAR DISEASE

THIS FORMIDABLE DISEASE, called also the navicular *joint lameness*, and *navicularthritis*, is the chief danger to be apprehended from a good-looking strong foot, just as the open flat one is prone to laminitis, and is rarely subject to disease in the navicular joint. The reason of this immunity on the one hand, and the contrary on the other, is this. The open foot, with a large spongy frog, exposes the navicular bone and the parts in contact with it to constant pressure in the stable, so that these parts are always prepared for work. On the other hand, the concave sole and well-formed frog are raised from the ground by our unfortunate mode of shoeing, and when the whole foot is exposed to injury from battering, and in addition the tendon which plays over the navicular bone presses it against the os coronæ, the unprepared state in which this part is allowed to remain is sure to produce inflammation, if the work is carried far enough. Thus in each case the weak part suffers, but occasionally, though very rarely, the foot with an arched sole contracts laminitis, and the flat one is attacked by navicular disease; the exceptions, however, are so few that they may be thrown out of the calculation, and from the shape of the foot alone it may almost invariably be pronounced, when a horse is known to be subject to chronic lameness, whether its seat is in the laminæ or in the navicular joint.

WHEN A FOOT IS EXAMINED AFTER DEATH which is known to have been the subject of navicular disease, the parts implicated are invariably either the navicular bone, or the soft parts in contact with it, or often all together. Most frequently on dividing the tendon of the flexor perforans and turning it down so as to expose the back of the joint between the navicular and coronal bones, that part will be greatly thickened and inflamed, the tendon being often adherent to it. In the healthy condition there ought to be no adhesion of the fibres of the tendon to any part of the navicular bone but its postero-inferior edge, to which the tendon is fixed by some few fibres, the bulk passing on to be inserted in the os pedis. The posterior face of the navicular bone should be beautifully smooth, and lined by synovial membrane which forms a lubricating sac for it to play upon, and thus take off the friction between the tendon and the bone. Such is Nature's provision
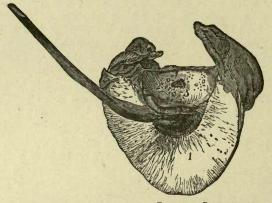
FIG. 105.—ULCERATION OF THE POSTERIOR SURFACE OF THE NAVICULAR BONE.

1. Lower or plantar surface of pedal-bone.   2. Small specks of exostosis.
3. Carious patch.

against mischief in this delicate part of the machinery of the foot, which she keeps in order by the constant supply of synovia or joint-oil. But when the sac is not stimulated to a healthy action by the pressure of the frog below it indoors and out, synovia is no longer secreted in proper quantity, and as soon as the horse is put to hard work inflammation takes place for want of it. The result is some one of the consequences of inflamed joints. Either ulceration takes place in the postero-inferior surface, where the tendon glides over it as shown in Fig. 105 (at 3), sometimes ending in caries of the bone itself; or adhesion takes place without ulceration of the tendon with the surface of the bone, or there are small exostoses thrown out, see Fig. 105 (2), or lastly there is simple inflammation without either adhesion or ulceration, and in this stage the disease is amenable to treatment without leaving any trace behind.

The Symptoms of navicular disease are the same, whether the mischief has extended to ulceration or not; but the history will guide us in ascertaining how far it has gone. Of course they vary in degree, for there may be only a slight extent of ulceration, or a high degree of simple inflammation;

but in the former case the lameness will not be so marked as in the latter, though the prospect of recovery will be much less. There is always more or less lameness; but, in consequence of its affecting both feet, it is not so marked to the careless observer as in some much more trivial cases where only one is diseased. The distinguishing sign, though not absolutely infallible, is the pointing of the toe, and at the same time resting the hind-leg on the opposite side so as to relieve the navicular bone of any weight. In laminitis, the object of the sufferer is to relieve all pressure as much as possible, by bringing the hind-legs under the body, and by bearing the weight of the fore-quarter on the heels. Here, the reverse of the latter attitude is observed—the heels are not allowed to take any pressure, and the toes alone are placed at all firmly on the ground. This is marked in the stable by the pointing of the toe (in each foot alternately, if both are diseased, but in the one only, if they are not both affected). Out of doors, the toes dig into the ground, the heel never being brought firmly down, and frequent stumbles mark the difference between this species of lameness and laminitis. The subject of navicular disease generally walks sound; but the moment he is trotted, he goes as if his legs were tied together, his stride being shortened in a remarkable manner, but without exhibiting the peculiar fumbling gait of the foundered animal. As in his case, soft ground suits him, and he has no fear of plough, because his sole is hard and unyielding. Many tolerably confirmed cases of navicular disease may, therefore, be hunted, except when the ground is hard, supposing of course that they are kept off the road; but no plan of management will enable them to bear the jars incidental to harness-work or hacking. When one foot only is the subject of navicular disease, it often happens that it is smaller altogether than the other; but it is somewhat difficult to say whether this is a cause or a consequence of inflammation. One thing is quite clear, that many horses are met with, still perfectly free from lameness, in which there is a difference of size in their fore-feet; but whether or no these are afterwards invariably the subjects of navicular disease, it is almost impossible to ascertain. It is, however, the general opinion, founded on experience, that when this variation exists, navicular disease is extremely likely to attack the smaller foot, if it is not already there; and for this reason, horses with such feet are generally avoided by the intending purchaser.

The Treatment of navicular disease, as before remarked, is only successful in the early stage, before either ulceration or adhesion has taken place. If a horse with strong concave soles suddenly becomes lame, points his toe, and shows other signs that his navicular bone is inflamed, he should be treated in the usual way suited to inflammation, and at the same time liberty should be given to the vascular tissues to expand, by reducing the substance of the horn. Bleeding at the toe has the double good effect of abstracting blood, and at the same time weakening the sole, so as to allow of the expansion which is desired. The operation should, therefore, at once be performed; at the same time, the whole sole may be reduced in thickness, and the heels lowered in proportion. The foot should then (after the shoe is tacked on) be placed in a cold bran poultice, which will soften the horn; and the system should be reduced by the exhibition of the medicines recommended under Laminitis, at page 606. But when the disease itself is mastered, there is still a good deal to be done to prevent

the injurious effects which are so apt to follow. The horse contracts a habit of stepping on his toes, to prevent hurting his navicular structures; and hence the frog is not used, the heels of the crust and the bars are not strained, and there being no stimulus to the soft parts which secrete them, they waste and contract in size. If the human hand is allowed to lie idle, the palm and the insides of the fingers are covered with a delicate cuticle, which affords so poor a protection to the cutis, that, on using it with any kind of hard work, it actually separates, and leaves an exposed surface, which speedily inflames. But by gradually exposing the same hand to pressure, a thickened and tougher cuticle is secreted; and this will bear any moderate amount of pressure or friction without injury. Nevertheless, even the hand so prepared must be continually stimulated by work, or the skin returns to its original delicate state, and is then exposed to the same risk of injury as before. So it is with the horse's foot, even in a state of health; but this is far more marked after an attack of disease. The tendency then is to produce the natural horny growths of a smaller substance than before; and if the secreting surfaces are not stimulated by pressure, they become doubly idle, and the frog, as well as the adjacent parts beneath the navicular bone, shows a wasted and shrivelled appearance. To avoid the risk of these ill consequences, the horse should be placed, for two or three hours daily, on a bed of wet clay, which will allow the shoe to sink into it, but will yet be tenacious enough to make firm and steady pressure on the frog, while its low temperature will keep down inflammation. No plan is of so much service in producing what is called expansion of the heels and growth of the frog as this; not, as is commonly supposed, from the clay mechanically pressing the heels out, but from the stimulus of its pressure causing the soft parts to secrete more horn, and of a sounder quality than before.

SHOULD THESE REMEDIES FAIL in restoring the foot affected with navicular disease to a healthy state, recourse can only be had to the operation of neurotomy, which is perfectly efficacious in removing the lameness; and if there is no ulceration, and merely an adhesion of the tendon to the bone, it will, by causing the horse to step more on his heels, effect an absolute improvement in the shape of the foot, and hence it is considered to have produced a cure. And for all practical purposes it is a cure, inasmuch as a horse previously useless can be made to work sound and perhaps continue so for years. A good deal of unreasoning prejudice exists against this operation, as many persons cannot be convinced that a horse is not more likely to fall because he cannot feel his feet, and the very unfair comparison is made between a really sound horse and an unnerved one, whereas the comparison should be as between a hopeless cripple and a serviceable animal. The late Mr. George Williams, who for so many years held the appointment of veterinary surgeon to the Queen, was an earnest advocate of unnerving, and perhaps operated on more horses than any other surgeon of his day. He, like the present editor, who is proud of having been his pupil, rode many unnerved horses and found them as sure-footed as others. I have known unnerved horses die of old age and of all sorts of diseases, but subjects that have not been operated on until the bone is extensively diseased are liable to break down either by fracture of the navicular bone itself or rupture of the tendons, and then the toe turns up, the pastern goes

down, and the knacker may be sent for without delay. The chief danger lies in undiscovered pricks and festered corns which may lead to losing the hoof, because no pain is evinced and separation may take place before it is ascertained that anything is wrong. It should, however, be clearly understood that there is no reason why, if detected, an injury to the foot cannot be treated successfully, as the nerves of nutrition are not divided, and I have worked a horse with a seton through a festered corn, the horse trotting sound, until he recovered. I mention this merely as a proof, and not as a practice to be recommended, as it was done to demonstrate the practicability of treatment.

ACCIDENTS TO THE LEGS AND FEET

THESE PARTS ARE SUBJECT to a variety of accidents, trifling perhaps in the cause which produces them, but serious in their effects, from the lameness which ensues. The chief of these are ordinary cutting, speedy cutting, and pricks of the foot either from putting the sole down upon a nail or a piece of glass. Bruises and over-reaches also come under this head.

ORDINARY CUTTING may occur either in front or behind, the latter being the more common. It is often met with in poor horses, where the flesh is so reduced in substance that the legs are brought nearer together than in a proper condition. Here all that is required is patience, till the legs are restored to their proper relative position, taking care in the meantime that there is no permanent injury done. Usually the inside of one or both feet strikes the fetlock joint of the other leg in passing it, but some-times the blow is given higher up, and it may occur anywhere on the cannon-bone except just below the knee, when it is called "speedy cutting," which will be separately considered. Sometimes this blow on the side of the cannon-bone is either the cause or the effect of a splint, the blow of the foot having a tendency to produce exostosis (see Splints, page 507). But if a splint is thrown out on a part of the cannon-bone which comes in the way of the natural action, the horse whose foot previously passed clear of that part of the other leg will hit it, and not only give pain, but cause a considerable access of inflammation in the previous enlargement.

In the Treatment, therefore, of cutting, it is necessary to prevent the habit being continued from the swelling produced either by a splint or by previous blows. A horse perhaps, either from weakness or bad shoeing, hits his leg and produces considerable swelling and soreness. Here, unless the swelling is reduced or protected, there is no chance of preventing the cutting, because there is a projection of the swollen soft parts right in the way of the other foot. No alteration of the shoeing, and no increase of strength or flesh, will be of service until the inflammation is reduced, and the sore, if any exists, is healed, and this can only be done either by rest or by protecting the leg with a boot. The latter is the better plan, and wherever a horse cuts it is, in my opinion, advisable to let him wear a boot for some weeks, until the skin is quite sound again and reduced to its proper thickness. A piece of an old rug folded round the leg so as slightly to overlap-

and then tied with a tape and turned down over the fetlock joint, is quite sufficient to serve this temporary purpose, and being soft it is well calculated to protect a swollen joint; but if it is worn for any length of time, the pressure of the tape and the friction of the grit from the road wear away the hair, and cause an unsightly appearance, which is sometimes permanent. If, therefore, the cutting is not rectified completely in the course of a month or six weeks, a leather or india-rubber boot should be nicely adapted to the joint and buckled round it, the flat surface of the strap not having so injurious an effect as the tape of the cloth boot. When the cutting takes place above the joint, a pad must be adapted to its inside, and fastened round the cannon-bone by two or three buckles, according to the height at which the injury takes place.

SUCH IS THE BEST MODE of guarding against the injury done by cutting, but we must also consider how it can be entirely prevented. In the first place it should be carefully ascertained by what part of the foot or shoe the blow is given. Most commonly it will be found, by chalking the inside of the foot, that a small patch is rubbed clear of chalk, about half-an-inch above the middle of the quarter, and corresponding with the hinder-most nail-hole, especially when four inside nails are used. When this is the hitting-point, if great care is taken to avoid driving in a nail there, the tendency to cut can never be increased, as it often is by a raised clench, and at the same time the rasp may safely be used to reduce the thickness of the hoof at least the eighth of an inch, or often much more. The crust is usually here about three-eighths of an inch thick, and very often it is so sound that it will bear to be rasped down till there is only one-eighth left, *provided it has not to bear the pressure of a nail near it*, and that the reduction is not carried up too near to the coronet. In the hind-foot the quarter is fully half-an-inch thick, and it therefore will bear reduction better even than the fore-foot. Sometimes the blow is given by the shoe itself, which is fixed on so as to overlap the crust, and then the remedy is simple enough, for this ought never to occur, and can easily be prevented by any smith. But supposing, in spite of these precautions, the cutting still continues after the horse is restored to his natural strength and flesh, can anything be done by shoeing? In most cases this question may be answered in the affirmative, by the use of what is called a feather-edged shoe, which will be described under the head of Shoeing in Chapter xxxviii. By its aid the heels are both raised, not the inner one only (which is entirely useless and even prejudicial, for then the ground surface of the shoe is not a true plane), but both heels, the inner one being narrow, and having no nail-holes beyond the two near the toe, so that there is no danger of the web projecting; nor is there any nail-hole required, with the fear of a clench rising, or of the crust being weakened so as to prevent its being thinned to a proper degree. By thus raising the heels (in the hind-foot especially), the fetlock is less bent, and as in horses that cut there is almost always a tendency in their fetlock joints to bend inwards as well as backwards, this diminution of the angle will not only strengthen the leg in a forward direction, but will also increase the distance between the joints, which is the object to be desired. In the fore-foot the obliquity in this direction is not so frequent, and then the high heel will be of no use; indeed, it is only when the toes are much turned

out that this plan of shoeing the fore-foot is ever successful. When cutting occurs before, unless there is this turn out, it is better to put the shoes on in a perfectly level manner, and trust to the reduction of the thickness of the quarter, and the absence of the third nail. If, with these precautions, the horse, when in good condition, still strikes his fore-legs, it will be better to put up with the constant use of a boot. Generally, however, if the inflammation is first subdued, and the foot is shod in a perfectly true and level manner, taking care to rasp away the particular part which strikes the other leg, it will be found that the cutting is avoided.

SPEEDY CUTTING is more dangerous than ordinary cutting, because the pain given by the blow is generally more severe, and is often so great that the horse falls as if he were shot. On examining the leg of a confirmed speedy cutter there is always apparent a small scab or bruise on the inside of the cannon-bone, immediately below the knee; but in slight cases rest may have been used to allow the skin to heal, and then no mark may possibly be left. A careful examination will, however, generally detect a small bare place, partially concealed by the growth of the adjacent hair. In bad cases the periosteum is swollen, and there is a considerable enlargement of the surface of the bone.

In the Management of slight cases of this kind of cutting, the action should be examined while the hoof is covered with chalk, and the latter should be treated in the same way as already described. If, however, this fails, as it generally does in this form of cutting, there is no remedy but to put on a regular speedy-cut boot, in which there is a pad buckled on the inside of the leg, and reaching from the knee to the fetlock. It must be of this length, because otherwise it cannot be kept in its place, as the leg allows it to slip down until it reaches the larger circumference presented by the joint. Where there is pain and swelling, caused by the contusion, it must be treated in the ordinary way, by the application of cold water and tincture of arnica, a wineglassful of the latter in two quarts of water.

WHEN A NAIL IS PICKED UP ON THE ROAD, the prognosis will depend upon the part which it has penetrated. If it has entered deeply into the toe of the frog, the probability is that the navicular joint has been wounded, or possibly the tendon of the flexor at its insertion into the pedal-bone, either of which are very serious accidents. If the wound is further back, there is less risk of permanent injury, as the bulbous heel or cushion of the frog will bear a considerable amount of injury without permanent mischief.

In any case the *Treatment* should consist in cutting away the horn round the opening, so as to allow of a free escape of matter if it forms. At the same time inflammation should be kept under by cold "swabs" to the coronet, or, better still, by putting the whole foot into a bran poultice.

OVER-REACHES, when slight, may be treated by the application of Friar's balsam, or tincture of arnica in full strength, which will have a tendency to dry them up and prevent suppuration. If, however, the heel is very much bruised, a poultice must be applied, but even then a little tincture of arnica should be sprinkled on it. When the bruise is so severe that a slough or core comes away, the wound may be dressed with a piece of

lint, dipped in a solution of nitrate of silver, eight grains to the ounce of distilled water, and over this a bran poultice. In most cases, however, it is better to foment the part well, and then apply the tincture of arnica neat.

A BRUISE on a thin sole will sometimes cause matter to form, in which case the horn must be cut away, and the case treated as for quittor. Before matter forms, the horn should be reduced, and the foot should be placed in a cold bran poultice.

CHAPTER XXXIV

PARASITES

WORMS

THERE are a number of worms that cause loss of condition in horses, and even death, when by their habits they pierce vital structures and form nests, as with the strongulus armatus, who chooses for a home the junction of some important artery. Professor Cobbold, who made helminthology a life study, says in his *Internal Parasites of the Domesticated Animals*, " Although the parasites of the horse and ass are sufficiently numerous as species, their importance in relation to disease of these animals is, speaking generally, far less than that which obtains in the case of other domestic animals similarly affected. The large round worms (*Ascaris megalocephala*), though occasionally present in great numbers, are readily got rid of by a dose of aloes. The flukes (*Fasciola hepatica*) are too unimportant and rare to merit attention. As to the strongles, which give rise to aneurisms in old horses and donkeys (*Strongulus armatus*), no doubt they are sometimes the cause of death, but the amount of mortality from this cause is exceedingly trifling.

" A very small strongle (*Strongulus tetracanthus*) is in some seasons a source of serious loss among young horses, and for a long time defied all remedies. At the suggestion of Dr. Blanc, the well-known head of the Indian Medical Department, and one of the Abyssinian captives, the experiments tried by Miss Dillon on desperate cases proved that thymol, in sufficient doses, is a certain destroyer of the pest. The doses, to be efficacious, should be not less than fifteen grains in the early morning, the same quantity at night, and a dose of castor-oil at midday the next day. To be repeated in a week, if any sign remains of undestroyed ova.

' The sharp-tailed thread-worms or maw-worms (*Oxyuris curvula*) certainly

may occasion considerable irritation within the larger bowel, but we can easily expel them with purgatives. The worm in the eye (*Filaria papillosa*) is confined to tropical countries, and moreover the inconvenience it creates is readily cured by its removal. Lastly it is almost superfluous to mention the occurrence of the gid hydatid (*Cœnurus cerebralis*) and other forms of cestode larvæ (*Cysticercus fistularis*), since the assistance of the veterinary practitioner is rarely demanded for the treatment of the disorders they produce.

" It assuredly does so happen that bad forms of parasitism in the horse are comparatively rare ; and this I take to be due, not so much to the alleged innocuousness of the individual parasites themselves, as to the circumstance that horses are, as a rule, much more closely looked after, in a sanitary sense, than most animals. The scrupulous cleanliness observed in all large stables is eminently destructive to the welfare of parasites, and the large proportion of dry and artificially prepared fodder consumed by
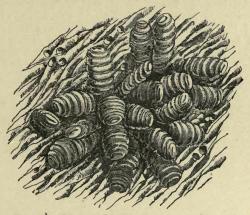
FIG. 105*a*.—GROUP OF BOTS ATTACHED TO THE STOMACH.

horses leaves little opportunity for the transference of the ova of cestodes and nematodes, which require a certain amount of moisture for their preservation in the free condition. Moreover, the drinking water supplied to horses is, generally speaking, tolerably pure."

This summary on the part of the best helminthologist of the century makes it unnecessary to trouble the reader with the life history and detailed anatomy of worms with which the late professor was wont to regale his classes.

Remedies.—For the intestinal worms of the round varieties, turpentine, santonine, emetic tartar, iron, aloes, and thymol. For tapeworms—Areca nut, iron and oil of male fern, infusion of kousso, aperients generally. For doses see Anthelmintics.

BOTS

THE LARVÆ of the *œstrus equi*, a species of gadfly, are often found in large numbers, attached by a pair of hooks, with which they are provided, to the cardiac extremity of the stomach ; they are very rarely met with in

the true digestive portion of this organ, but sometimes in the duodenum or jejunum in small numbers.   A group of these larvæ, which are popularly called bots, are here represented, but sometimes nearly all the cardiac extremity of the stomach is occupied with them, and upon the interstices are found little projections which are caused by those that have let go their hold, and have been expelled with the food.   Several of these papillæ are shown on the engraving, which delineates also the appearance of the bots themselves, so that no one can fail to recognize them when he sees them. Another variety, known as fundament bots, are observed to attach themselves to the inside of the rectum, where they cause a good deal of irritation. The fly watches its opportunity to deposit the ova while the animal is in the act of defæcation.

STOMACH BOTS appear to do no harm in moderate numbers, but they undoubtedly rob their host of a good deal of food.

Treatment.—Destroy the eggs with paraffin or mercurial ointment rubbed upon the hairs where they are deposited about the knees and shoulders by the bot fly, and the fundament bots by inunction of the rectum with the ointment.   The latter may be picked off with the fingers by the groom if he watches his opportunities.

CHAPTER XXXV

METHODS OF CONTROL

THE TWITCH—THE HALTER TWITCH—SIDE LINES—HOBBLES—SLINGS—ANÆSTHESIA

BESIDES those referred to in the part of this work dealing with the breaker's art, there are occasions when for medical treatment or surgical operations it is necessary to control the patient by methods which form no part of the ordinary education of the horse. There are simple contrivances known to horsemen, and others requiring hobbles and expensive gear, or else the production of local or general anesthesia. Horses differ so in temperament that while one individual will submit to firing with no greater restraint than holding up a foot, another will have to be cast for the removal of a wart.

THE TWITCH

THIS CONSISTS of a stout stick with a hole near one end through which a loop of cord of about the thickness of box-cord or clothes-line is fastened. The operator passes the loop over his left hand, and with the thumb and fingers grasps the upper lip, on to which he places the loop, and with his right hand proceeds to wind it tight so as to enclose and compress this highly sensitive part of the animal (it will be remembered that there is a plexus of nerves here situated), until he realizes that it hurts him more to resist the twitch than to submit to some minor operation for which this cruel implement is used. Cruel it undoubtedly is, and to be avoided when any other safe and effectual method of control can be devised, but there are circumstances where its use is justifiable, and the safety of human beings must ever take precedence over the comfort of animals. There are not wanting foolish people who would expose the lives and limbs of stablemen to great danger rather than *their* pets should be put to the least pain or inconvenience, the base selfishness of which does not strike them until after an accident has happened.

THE HALTER TWITCH

AN ORDINARY HEMPEN HALTER and rope answers well enough. This is put on in the usual way, but there must be no knot or check in the rope, which is made into a half-hitch, passed over the ears and the loop carried

under the horse's upper lip. Jerking the loose end inflicts pain, and to avoid a repetition of it the animal may consent to remain steady. With each jerk the word of command should be given, "Steady! steady!" being at all times a better word than "Woa," since the horse is taught to understand by the latter that he is to halt, and a young one may show the same confusion as the infant who has to learn that a certain word of one syllable may mean "Thank you" or something nasty, and to be avoided. Both the infant and the horse learn to differentiate, but it is by the tone only.

STRAPPING UP A FORE-LEG with a stirrup leather may answer when some operation has to be performed on the head or opposite fore-leg, or upon the hind-leg of the same side as that in the strap. A horse cannot, or does not, cow-kick, that is to say kick with one leg without raising the loins, if the fore-leg on the same side is held up, but he may kick with the opposite hind-leg. A knee-cap should be put on, and a bandage from below the knee, so that, in the event of the horse throwing himself down, the skin may escape blemish. The leg can be secured by either passing the strap round the pastern and the fleshy part of the arm, or suspended from a loop in a surcingle.

BLINDFOLDING, says Captain Hayes in his *Illustrated Horse Breaking*, is an efficient means of control with the majority of horses, although it excites some to offer more vigorous resistance than they would otherwise do. I have never found a horse which would, when blindfolded, attempt to kick or strike out on the chance of hitting his man, unless he was touched about the limbs or body.
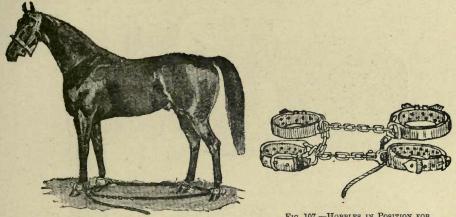
SIDE LINES

THESE are either for securing a hind-leg, preventing kicking, or else for the purpose of throwing the animal down altogether. An ordinary rope such as wagoners use, preferably one that has become supple with work, may be passed round the horse's neck like a collar and then between his hind-legs, and picked up again in such a manner as to bring it round the pastern: it is then turned once round itself so as to make a loop near the fetlock, and the end pulled through the collar or loop which was first formed. If the foot is drawn forward sufficiently to prevent much slack, the animal is not likely to get out of it, and it can be fastened off with an ordinary hitch. It is a useful contrivance when a torn quarter has to be sewn up and there are reasons for not casting.

THE DOUBLE SIDE LINE is adjusted in much the same way, only that the rope is first folded in the middle, and a knot made so that when put over the horse's head it will be about the same size as his collar. The free ends are carried between the hind-legs and passed through in exactly the same way as a single line. Some operators allow the knot to fall on the chest and pass the lines between all the legs, but more power for throwing is obtained by keeping the knot on the top of the withers, and the lines outside the fore-limbs. With nothing more than an ordinary thirty-six-foot wagon rope the castrator has performed for ages, and it is a very effectual way of getting a horse down, if the assistants pull well together and behind the horse, instead of, as often happens, in a zigzag, or in any position but the right one. Side lines are now made by all the veterinary instrument makers

with rings or D's fitted in the collar portion, and with wide soft webbing for the hollows of the heels.   The latter is a decided improvement on the old rope,
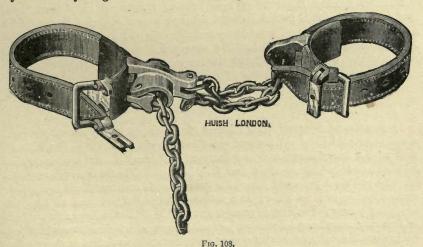
FIG. 106.—HOBBLED READY FOR THROWING ON THE OFF SIDE.

FIG. 107.—HOBBLES IN POSITION FOR CASTING ON THE NEAR SIDE.

as sore heels, cracks, etc., often date from the casting of a colt for castration. When an animal has been cast the hind-legs are drawn up tight to the belly and secured by half-hitches, and he is perfectly helpless until released.
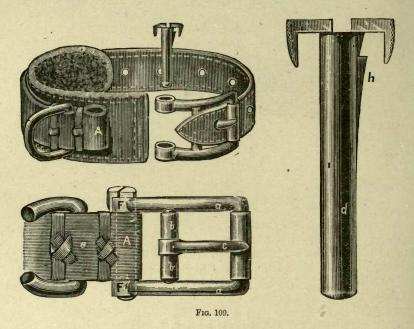
HOBBLES

CASTING by means of leather hobbles is the method generally adopted by veterinary surgeons.   Four stout straps with steel eyes or loops are

HUISH LONDON.

FIG. 108.

severally buckled round the pasterns, and a rope is passed through the

eyes, so that the legs being brought together the horse is thrown upon his side. As soon as he feels his legs going he generally assists by his struggles to secure his own downfall. No hitches are required with these modern

FIG. 109.

appliances, which will be better understood by the accompanying engravings than any verbal explanation.
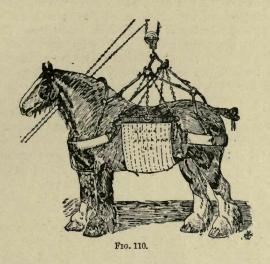
PEARD'S PATENT HOBBLES.—These hobbles gather up their own slack, and each link as it is pulled forward through a steel cylinder is caught by a spring and secured. They are most easily adjusted or removed from the legs by means of a hinged lock-bar over the straps, the hole of which fits over a stud. One man can throw the heaviest animal.

SLINGS

IT SOMETIMES HAPPENS that instead of throwing horses down we have occasion to hold them up, perhaps get them up when prone. It is a difficult task with a heavy horse, and in a cramped stable with no " head-room," as butchers call height in their slaughter-houses. Whatever appliances are used for raising a prostrate horse, the first thing to be ascertained is whether or no a pulley can be placed at a sufficient height above him to give the necessary power for raising so great a weight. With low ceilings a floor-board or two may sometimes be removed, or in the case of hovels with roofs of less value than the tenant, three holes may be made to accommodate as many poles, and these being placed after the manner of the gipsy's camp kettle and lashed aloft, the necessary power can be obtained. It is not possible to

describe the methods of getting the slings under the horse, but by judicious lifting and pulling it can always be managed. The annexed engraving shows where the slings are wanted, with breastplate and breeching to prevent the

FIG. 110.

patient slipping out at either end. The chain is an "endless" one and does not slack; the relaxing of the slings was always a difficulty with the old-fashioned ones made with wooden pulleys and ropes.

ANÆSTHESIA

IN ADDITION to the mechanical contrivances already described for gaining control over horses, we are able to practise both local and general anæsthesia. Cocaine in solution, 2 to 4 per cent., is a most valuable agent for reducing the sensibility of the eye and of mucous membranes generally, so that tumours and foreign bodies may be removed without the additional pain of twitch and gag and hobble. If injected under the skin by a proper instrument, it so reduces the pain of firing that it can often be done without casting. Ether spray is not favoured by veterinary practitioners because wounds so treated are apt to slough or be very slow in healing. Chloroform alone is found to suit horses better than the A.E.C.[1] mixture so much favoured by human surgeons. There is practically no danger in the use of it, as it is found most difficult to kill a horse intentionally even by prolonged inhalation of large quantities. There are several approved muzzles invented by veterinary surgeons, but they are quite unnecessary, there being safe and convenient methods of chloroforming without any of these appliances. It is of course presumed that the horse is already cast in hobbles, for, if not, a muzzle must of necessity be used. The animal's head being firmly held by two assistants, one nostril is thoroughly lubricated with vaseline inside and out, a sponge the size of an orange is saturated with chloroform

[1] Alcohol, ether, and chloroform.

and squeezed out with the hand before being introduced inside the greased nostril, where it is to be retained by gentle pressure, and the horse compelled to inspire through the sponge only and expire through the other nostril. It is convenient to use the left hand for retaining the sponge in position and the right for compressing the other nostril during each act of drawing air into the lungs, and relaxing it during each expiration. The patient not only succumbs to the method quicker than by any muzzle we have seen used, but is under such complete control that one can increase or diminish the degree of insensibility in the patient at will. Those horses which go under quickly come out quickly, and there is no safety in the prolonged inhalation of a mixture of atmospheric air and the vapour of chloroform ; experience of a very large number of horses and other animals under the influence of this agent induces me to say that it is the better plan to subdue them quickly with pure chloroform alone.

IF CASTING is objected to, either from the absence of hobbles, or from fear of injury to the horse, a soft bed of straw should be provided, and a strong halter must be put over the muzzle with two cords, one of which should be held by a man on each side. These will serve to guide the horse in falling; but it is extremely difficult to make sure of his going down where he is wanted to lie ; and there is also considerable time lost in securing him after he is down, which the safety of the operator imperatively requires. The effect of the chloroform must therefore be kept up for a much longer time than if it is given after the horse is cast and secured.

CHAPTER XXXVI

OPERATIONS

BLEEDING — FIRING — SETONS AND ROWELS — BLISTERING — CASTRATION — DOCKING — UN-
NERVING—REDUCTION OF HERNIA—THE ADMINISTRATION OF MEDICINES—CLYSTERS—
BACK-RAKING.

BLEEDING

BLEEDING is either performed in the jugular vein, when the whole system
is to be affected ; or when a part of the body only is inflamed, it may be
desirable to abstract blood locally, as for instance from the toe or from the
plate vein, in inflammation of the foot, and in ophthalmia from the vein
which lies on the face just below the eye.

THE INSTRUMENTS USED are either the lancet or the fleam, the former
being the safer of the two, but requiring some practice to manage it pro-
perly. In bleeding from the jugular vein a string is sometimes tied round
the neck below the part to be opened, which is four or five inches below
the fork in the vein (shown at page 465) in the upper part of the neck.
The skilled operator, however, makes pressure with his left hand answer
the purpose of causing the vein to rise, and during this state either uses
the lancet with his right or the fleam with the aid afforded by the blow of
a short stick, called a "blood stick." When the blood begins to flow, the
edge of the bucket which catches it is pressed against the same part, and
as long as this is continued a full stream will run until faintness occurs.
After sufficient blood has been taken, the two lips of the wound are raised
between the fingers, and a *small* common pin passed through both, when
the point is cut off and some tow is twisted round, by which the edges are
kept together and the pin is retained in position. In a couple of days
the pin may be withdrawn without disturbing the tow, and the wound
will heal with little or no deformity. Sometimes the blood continues to
flow beneath the skin after it is pinned, and a swelling takes place in con-
sequence. When this happens, cold water should be freely applied and the
head kept up by racking to the manger.

INFLAMMATION OF THE VEIN will sometimes supervene upon bleeding, the
symptoms being a slight swelling appearing in the evening, or the next day,
with a little oozing from the wound. These are soon followed by a hard
cord-like enlargement of the vein, which feels hot to the touch, and the
parts at the angle of the jaw swell considerably. The consequence generally

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is that the vein is obliterated, occasioning some disturbance to the circula
tion, especially when the head is held down, as it is at grass.[1]

The Treatment consists in cold applications as long as there is heat. When
the heat has subsided, and the vein remains enlarged, the biniodide of
mercury will procure the absorption of the new deposit, by rubbing it in as
recommended at page 630.

FIRING

THE PURPOSE for which the heated iron is employed is twofold; first,
to produce immediate counter-irritation, by which the previous inflamma-
tion is reduced ; and secondly, to cause the formation of a tight compress
over the part, which is permanent. The blemish which it leaves, and the
pain which it occasions, both during and after the application of the irons,
should cause it to be avoided when any equally useful substitute can be
employed ; but, unfortunately, there are many cases where it stands without
a rival, as being at once the safest and the most efficient remedy which can
be adopted. Blisters and setons can be made to cause the same amount of
counter-irritation, but have not the same effect in producing pressure upon
the parts beneath. The pain of firing can be relieved entirely at the time
of the operation by chloroform; but the subsequent smarting is quite as bad,
and this is beyond the reach of any anæsthetic. Independently, however, of
the interests of the master, it is also to the advantage of the horse to get
thoroughly cured ; for if he is not, he will either work on in misery, or he
will be consigned to the knacker's yard ; and, therefore, the adoption of the
most efficacious plan of treatment, even if somewhat the most painful, is the
best for both.

FIRING MAY BE PERFORMED STANDING, by the use of the side line for the
hind-leg, or by fixing up one fore-leg when the other is to be operated on.
The firing-iron should have a smooth edge, about the thickness of a worn
shilling ; and it should be heated to the point when it shows a dull red in
the dark. When the disease for which the irons are used is slight, the skin
should not be penetrated ; but in bad cases, where the mischief is great, and
particularly when it is wanted to have a good permanent bandage, the
cauterization must be deeper ; but this requires some practical knowledge to
decide. The hair of the part should be cut very closely with the scissors,
or shaved ; then, having secured the leg, the iron is to be steadily but
rapidly passed in parallel lines over the skin, making just the proper pressure
which is required to burn to the requisite depth. A light brown mark
should be left, which shows that the proper effect has been produced ; and
the colour should be uniform, unless it is desired to penetrate deeper at
certain parts, which is sometimes practised with advantage. The lines are
sometimes made in a slanting direction round the leg, and at others straight
up and down ; but it is useless to describe the details of this operation,
which *can* only be learned by watching its performance by another hand.
Badly done firing is always an eyesore; but when the lines are evenly drawn,
and they have healed without any sloughs, caused by irregular or excessive

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[1] It is not found in practice to interfere with the health of horses at grass, as col
lateral circulation is established and effectual.

pressure, they show that a master hand has been at work, and that the poor beast has been treated scientifically. In very severe diseases, a blister is sometimes applied over the part, immediately after the firing; but this can seldom be required, and as it aggravates the pain tenfold, it should be avoided, if possible. On the following day, a little neat's-foot oil should be gently rubbed, or brushed with a feather, over the leg; and this should be repeated daily, until the swelling which comes on has nearly subsided. Less than three months' rest should never be allowed for the operation to have its full effect, as, if the horse is put to work before that time has elapsed, the disease will almost certainly return. Indeed, it is far better to allow double this time, especially if the horse is wanted for fast work.

SETONS AND ROWELS

SETONS are pieces of tape or other material, passed through and beneath the skin, leaving the two ends hanging out, either tied together or with a knot upon each. The latter is the safer plan, as the loop is always liable to be caught on a hook or other projecting body. The needle with which the passage is effected has a spear point, slightly turned up, and an eye at the other end (see Fig. 111), through which the tape or cotton is threaded. They are made in all sizes, and by their means a tape, smeared with blister cerate, may be passed through a long track of the cellular membrane, by pinching up the skin into a fold, and piercing this close to the body with the needle, which is then to be carried straight through. On drawing the tape out of the eye, it must be tied in a large knot at each ‿end, which will prevent its slipping out. In three or four days a profuse discharge will come on, and it must be kept up, if necessary, by repeated applications of blister cerate, or digestive ointment, as may be necessary. The ends should be sponged occasionally, to remove the accumulated matter.

A SMALLER CURVED NEEDLE, about five or six inches long, is used for introducing a seton into the frog, or beneath the eye. For the former operation, a twitch is first applied, and the foot is then buckled up to the arm, as described at page 622. The needle then, armed with the tape, greased with blister cerate, and a little oil to lubricate the surface, is thrust in at the heel and out at the cleft of the frog, taking care not to go deep enough to wound the tendon as it passes over the navicular bone. The needle is then forcibly drawn through, and the tape knotted, as already described. The openings must be kept clean by sponging daily; and in three or four weeks the tape will have nearly worked its way out, when it may be withdrawn.

Frog setoning is now rarely practised.
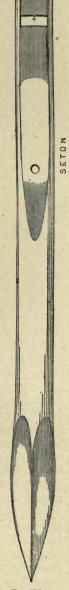
FIG. 111.

BLISTERING

WHEN IT IS DECIDED TO BLISTER any part, the hair should be cut off as closely as possible ; the ointment is then rubbed in with the hand for ten minutes, leaving a good quantity smeared on the surface.   If the legs are to be blistered, the heels should be protected by lard.   Considerable itching is caused after the first two or three days, and many horses, if allowed, gnaw the part to such an extent as to cause a serious blemish.   It is therefore necessary to keep the head away, which is done by putting a " cradle " on the neck.   The irritation of loose straw is very aggravating, and the stall or box should either be bedded with tan, or sawdust, or with used litter, so damp as to lie smoothly.   It is generally the practice to put the blistered horse on a bare floor, but he will often do great harm to his legs and feet (which are of course unsound, or they would not be treated in this way), by constantly stamping from the pain occasioned while the blister is beginning to rise.   When the legs are stiff and sore from the swelling, he stands still enough, but at first there is nothing of this kind to keep him quiet.   At the end of a week some neat's-foot oil should be applied every morning, with a feather or soft brush, to keep the scabs as supple as possible.   The various formulæ for blisters will be given in the list of materia medica.

CASTRATION

FOR REMOVING THE TESTICLES several methods of operation are in vogue. It is generally performed when the colt is about a year old, and the months of May and June are considered the most favourable, as being warm and too soon for the main crop of flies, this operation being done, of course, while the subjects are yet running free in pasture.   In this country castration has been successfully performed for centuries by men of very little education, but expert in the art, which as a rule is an hereditary one.   For the preliminary part of their method, see casting with side lines at page 622.   The colt being securely held down upon his left side, his hind-legs drawn forward and his head kept as much as possible in a line with his back, the operator first examines for possible rupture and then proceeds to wash out the sheath with soap and warm water to clear it of that accumulation which he calls " cod wax."   During this preliminary work his irons are getting hot in the fire basket which he carries about with him, if he has any regard for time.   He next grasps the scrotum with his left hand so as to squeeze the testicles up and render the covering tense, when with a bold sweep of his knife he makes a clean incision, nearly the whole length of the testis, which immediately escapes, and is seized with the left hand and held firmly during the momentary struggle that follows ; the cremaster muscle presently yields and the clam (see Fig. 112) is closed upon the cord and divided by a very hot iron ; a little powdered resin is put upon the divided surface and a partially cooled iron is brought to bear upon it, until a melted pellicle of resin appears to have sealed the artery.   The operator does not immediately release the clams but eases them a little, and if a drop of bright red blood comes up from the divided vessel he applies the actual cautery

again. Removal of the second testis is but a repetition of what has been here described. The traditions of the castrator vary in the different counties, and some not only smear the clams with an ointment of verdigris, but prefer to divide the scrotum with a keen-edged iron instead of a knife, using a special iron for searing the cord. The majority of colts are still castrated in this way, but among veterinary surgeons whose greater fitness makes the survival of the castrator only a question of time, several other methods are employed. An American, styling himself "Farmer Miles," created a good deal of sensation by introducing the Écraseur which is here illustrated (Fig. 113). The principle upon which it works
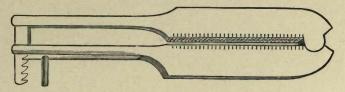
Fig. 112.—Castrating Clam.

is the crushing and squeezing together of the divided tissues in such a manner as to preclude hæmorrhage. It usually succeeds, but if the artery bleeds an hour or two after the operator has gone away it is a difficult matter to stop it, and some deaths have occurred in this way. A decided
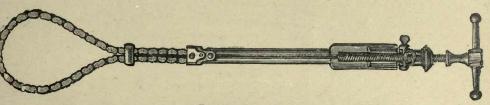
Fig. 113.—Ecraseur.

improvement upon it is the Huish-Blake castrator, which crushes the cord and artery by means of a serrated metal disc placed in the slot (see Fig. 114 on next page), and a serrated blade and outside ledge.

Such an instrument, which can be used with one hand, offers great advantages over the original Écraseur, and the patentee has been at some pains to collect reliable statistics respecting its use, which go to prove that hæmorrhage or other bad results are very rare. This instrument is specially favoured by those persons who practise what the Editor of the *Veterinary Record* has called "acrobatic surgery," by which term he describes the operation of castrating colts in the standing position. Why a man should accept a *serious* risk to his own person, rather than allow a *slight* risk to the owner's colt, I cannot conceive, but this method is becoming very common among the more athletic members of the veterinary profession.

Operation by Caustic Clam is a very old one, and has been revived with the "standing" operation. It is very much more painful than the actual

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cautery or the crushing instrument previously described, as it is so long in effecting its purpose.

Castration by Torsion and by Ligature are not suitable to the horse, and being but rarely practised in England need not be here described.
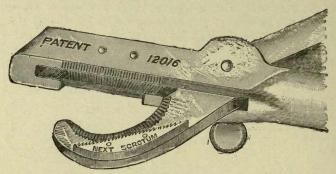
FIG. 114.—HUISH-BLAKE CASTRATOR.

The art of the instrument maker, and the competition among castrators, may account for a good deal of change in the present-day methods of perform-
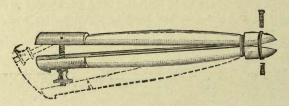
FIG. 114a.—HUISH'S CAUSTIC CLAM.

ing this indispensable operation, but as fire is the most aseptic method of all, it is not unlikely that the old plan will again come into favour when the

FIG. 115.—KROHNE AND SESEMANN'S CAUSTIC CLAM.

motives for a new departure no longer exist, and the old gelder will have gone with the dodo. A good deal of swelling after the operation is quite usual and may be disregarded so long as the animal feeds well and is not abnormally stiff in his hind-quarters. A finger dipped in carbolized oil may be introduced into the wounds on the third or fourth day, if there is reason to suppose that matter is imprisoned. Common tallow candles are much in favour for this purpose, and I see no objection to them even if they do con-

tain an infinitesimal quantity of arsenic, a popular belief which has not been verified to my knowledge.

DOCKING

ABOUT THE ADVISABILITY of this operation there has been much dispute, and especially since Dr. Fleming was chief veterinary surgeon to the Army. He was instrumental during his term of office in rejecting all remounts that had been docked, it being his opinion that horses suffer less from the annoyance of flies, and use a long tail as a rudder in making short turns. Whatever other
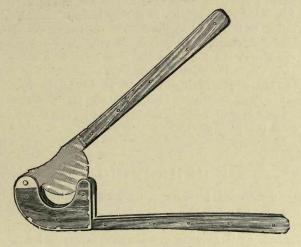
FIG. 116.—DOCKING KNIFE.

effect this order may have had, we know for certain that it keeps out of the ranks a great many suitable horses, since breeders do not keep long tails on their horses for the sake of the beggarly price given by the Army, while a short dock gives a smartness to most horses, displaying their quarters to advantage. Every drill season when the Yeomanry regiments are up for "permanent duty," as their ten days' fagging is called, an officer is deputed to purchase any likely-looking nags the troopers may have for sale, but as nine out of ten of them are docked there are very few purchased.

To say that an operation is not a severe one is not to justify cruelty, and if it is done only to enhance the smartness or the price of the animal it is not defensible, but there are many harness horses in which docking is absolutely necessary for the safety of persons using them ; they have long tails, which they swish round in a circle and are prone to catch the reins, a most awkward accident, liable with the best-tempered horse to cause a collision with another vehicle, or provoking a horse to kick in many instances. A great many prosecutions against persons for docking have been conducted at the instance of the Royal Society for the Prevention of Cruelty to Animals, but the results are indecisive. If the Bench is largely composed of country-gentlemen with a practical knowledge of horses, the verdict is usually in

favour of the defendant, unless some crude and clumsy method has been adopted, but if the case comes before a town stipendiary with more knowledge of the laws of evidence than the laws of driving, the decision may be in favour of the Society, whose officers are trained experts in giving evidence, though they may be quite free from a desire to add to the annual list of convictions which appeals so successfully to the pockets of subscribers. Many colts are docked at the same time that they are castrated, a practice which should long ago have been put a stop to by the above-named Society, if the zeal of its officers had been better directed.[1]

DOCKING is very rapidly performed by the aid of the docking knife, which is made on the principle of the guillotine. As the tail is removed at one sudden and forcible chop, the horse need not be confined in any way beyond holding up his fore-leg, unless he is a very violent animal. The exact length of the dock to be left being fixed upon, the hair is cut off close below and the remainder tied back to the root of the tail. A tight ligature immediately above the site chosen for operation does away with the necessity for searing with a hot iron, the method commonly adopted. The cut end may be bound up in tow with a little perchloride of iron if the ligature becomes slack or there is any disposition to bleed. It may be removed the next day. When the hot iron is used, resin is employed in the same way as described under Castration (see page 630).

UNNERVING

THE NERVES distributed to the foot are sometimes divided for navicular disease, as they lie on each side of the bone above the fetlock joint. No one, however, should attempt this operation without having previously seen it performed, as it requires considerable dexterity for its due execution. I have described such operations as can be wanted in the colonies, where a veterinary surgeon cannot always be reached, but unnerving is never required there, and I shall therefore omit any detailed account of it.

REDUCTION OF HERNIA

WHEN HERNIA OCCURS IN THE COLT, either at the navel or scrotum, it is often desired to effect a cure by returning the bowel and causing the opening to close by adhesive inflammation. If the colt is uncut, the performance of the covered operation on the French plan will generally succeed, great care being of course necessary to return the intestine before the clams are applied. In umbilical hernia a similar method has been tried, but the adhesion is too superficial to be of much use ; and the only successful one is the passage of one or two skewers through the opposite edges of the opening, and then winding some waxed twine round them, with a moderate degree of force. This should not be sufficient to cause mortifica-

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[1] Since the above lines were penned the Royal Agricultural Society of England has passed a resolution which will have the effect of gradually disqualifying horses which have had their tails docked. It may be hoped that docking for fashion's sake only will fall into desuetude.

tion, or the opening will only be increased in size, and the bowel will protrude without any covering of skin ; but it should be just sufficient to cause adhesive inflammation, experience in such matters alone enabling the operator to hit upon the right amount.
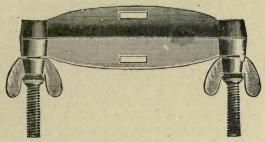
FIG. 117.—HUISH'S HERNIA CLAMP.

IN ALL OPERATIONS FOR HERNIA chloroform is of great assistance, as it prevents the risk of a protrusion of the bowel while the knife is being used, which will otherwise sometimes happen during the struggles of the horse.

This appliance is made by Mr. Huish in aluminium, thereby reducing the weight 75 per cent.

THE ADMINISTRATION OF MEDICINES

THE COUNTRY GENTLEMAN who has been more or less associated from childhood with the domesticated animals will hardly need to be reminded of the great difference in size, habits, and constitution of patients from time to time requiring medical treatment.

The difference between the management of the unhaltered colt on the hill-side and the ponderous dray-horse suffering from mad staggers in a narrow stall will sufficiently illustrate my meaning.

In the endeavour to administer medicaments we need to call into requisition all the arts of the pharmaceutical chemist, considerable strategy, and not a little physical courage, if we would succeed in regular dosing with the agents of our choice.   Drugs are not forced down the reluctant throats of animals in the wholesale manner of former times, but the difficulties attendant on their administration offer to the idle an inducement to trust too much to the *Vis medicatrix naturæ*.   Some of the methods adopted in menageries may be studied with advantage : every device rather than force is made use of, while in too many stables the twitch is employed without first making the attempt to give an ordinary draught by simply holding the head up.

The majority of horses accustomed to the restraint of bit and bridle will take a draught without serious opposition if the head is held up by placing the hand under the chin and introducing the fluid in small quantities.   It is the impatience of the operator which causes more than half the trouble in drenching.   One man will often succeed in giving a draught where half-a-

dozen have failed with twitch and gag and pulleys. It should be borne in mind that the objection to swallow a nauseous potion is an instinct of self-preservation displayed by all animals, and children too young to reason with, or not having implicit confidence in their nurses. The unnecessary use of the twitch, thereby adding pain to nausea, is a survival of that brutality which sanctioned nicking and cropping. A better use for the twitch, provided the cord is long enough, is to pass the loop into the mouth, over the nose and behind the upper incisors, holding up the head by means of the stick instead of the common and dangerous practice of using a stable fork, the tines of which are liable to inflict injuries when a restive animal throws his head from side to side. There are instances where twitching the nose may be justifiable, but a wide experience is in favour of the conclusion that it is very rarely indispensable. When an animal rears there are other methods of restraint, as putting him in a low building and hobbling one leg, or the plan adopted for strikers, of attaching a heavy bag of corn to a collar. Where spirituous preparations are prescribed, the tinctures for instance, they must of necessity be given in the form of draughts, but an intimate knowledge of modern pharmacy will enable the attendant in many instances to employ extracts or tabloids, electuaries, suppositories, pessaries or injections, subcutaneous or otherwise. The tabloid form of medicine naturally commends itself to the practitioner, whether human or veterinary ; but it is not yet absolutely demonstrated that the dry residues of evaporated tinctures are therapeutically of the same value as the tinctures themselves, nor does analysis prove that, because two substances give the same chemical formulæ they are physically the same thing. If it were so, we might flavour our *blanc-manges* with turpentine instead of oil of lemon.

Portability is a great point in veterinary medicine, and it is receiving increasing attention from our War Department. Balls and draughts are alike unsuitable forms of medication in cases of sore throat, setting up coughing and necessitating an attitude on the part of the patient both irritating and dangerous. Balls are occasionally coughed up into the nasal chambers, and draughts taken down the trachea, either accident producing serious inconvenience, and often very grave results. Electuaries, in which the medicinal agents are mixed with honey, treacle, or glycerine, are in such cases the best forms of medicine to be used, the prescribed dose being smeared upon a smooth spatula or flat piece of wood (as a lath) and freed from rough edges, then placed upon the back of the tongue, which may be drawn slightly forward with the left or disengaged hand. In cases of sore throat this form of medication has the double advantage of acting topically as a gargle would do, and further by its introduction into the circulating medium in the usual way.

Reduction of the bulky draught into the form of a powdered tabloid thrown upon the tongue is certainly "elegant pharmacy," as the disciples of that art are wont to claim, and if experience confirms the claims to physiological or therapeutic results and accurate dosage made by the various manufacturers, many difficulties will be overcome in physicking animals.

The adoption of subcutaneous injections by veterinary surgeons is a distinct advantage in many acute diseases. Active agents like morphine, aconitine atropine, etc., are sold in standardized solutions and the dose can

be accurately measured; the effect can be observed in a few minutes of a drug that by the usual channel would take half-an-hour. Chemical changes must necessarily take place in the stomach or duodenum before entering into the circulation, and some proportion be lost in the bulky contents of the stomach. That the fulness or otherwise of the stomach may have a modifying influence upon the action of remedies introduced into it may be proved by a familiar example in our own persons. A draught of mineral water or saline taken before breakfast will readily effect the desired purpose in the empty stomach, but fail altogether when taken after a meal. It may be said then, that some medicaments can with advantage be given subcutaneously, while others are better introduced into an empty or a "prepared" stomach.

Powders as a form of medicament to be given in the food are not likely to suffer in popularity among stablemen and horse-keepers not expert in the art of administering draughts and balls or provided with the appliances for subcutaneous injection. There is no difficulty in putting sulphur and nitre, or any favourite nostrum, into a bran mash or sprinkling it upon damped chaff or corn. It will always commend itself to the groom as a safe and easy method. While the habitual use of so-called condition powders or other medicines is to be condemned, it is often convenient to make use of the manger as a receptacle for medicines. If we take samples of the principal grasses in a pasture, or in the dried form, and chew them, the prevailing acrid, bitter taste will perhaps account for so dainty a feeder as the horse being willing to eat such bitter drugs as Epsom salts. It might be supposed that very few horses would voluntarily take a medicine that causes such wry faces when given to men, but actual experience proves that a very large proportion of horses will take food so adulterated. In fact, with the exception of pungent substances, as ammonia and camphor, tar, essential oils, etc., there are but few drugs which may not be given in food to horses whose appetite remains with them in illness. Nay, some horses have such gross palates, that they will take chlorodyne in a mash, this useful preparation being redolent of oil of peppermint, than which there is nothing more pungent, or it would be supposed more repulsive, unless it be assafœtida, and experience has proved that many horses will eat the latter.

In giving a ball, place a halter on the head without a knot, so that the jaws may be widely opened. Then turn the horse round in the stall and back him up to the manger, lay hold of the tongue and draw it out of the mouth, grasp it with the left hand, which must also hold the halter-cord so short that the strain is partly taken off the tongue, and then holding the ball in the right hand with the fingers enclosing it like a cone, and the arm bare, it should be rapidly carried to the back of the mouth and deposited there, holding the head up till it is seen to pass down the gullet. Cautious grooms use a balling iron, which gags the mouth and protects the arm, but a handy man will have less difficulty in introducing his hand than in inserting the gag, unless the horse is a determined biter, when it may be absolutely necessary. In that case the gag is insinuated with as much ease as a bit in a flat direction, and the handle being suddenly depressed, the mouth is made to open, and the teeth cannot be brought together. Then holding the handle together with the halter in the left hand, the right easily introduces the ball into the pharynx.

In giving a drench two persons are necessary, the operator standing at the right shoulder, while the assistant is ready to steady the head and aid him on the left. The operator raises the head with his left hand beneath the jaw, and with his right he forces the lip of the bottle or horn into the side of the mouth, and, raising the small end, pours the contents in. If the horse is violent, a twitch must be placed on the nose, and held by the assistant. The horn must not be passed far into the mouth, or any unnecessary violence used, for fear of producing a cough; in which case, the hand must be instantly lowered. A neglect of this precaution will probably cause some of the liquid to pass into the larynx.

CLYSTERS

Are most valuable agents, if properly administered. The best syringe for the purpose is Read's, by which any quantity may be thrown up; and in colic, some gallons of warm water are sometimes required to produce the desired effect. For an ordinary opening clyster, a handful or two of common salt may be dissolved in five or six quarts of warm water.

BACK-RAKING

Is effected by passing the greased hand and arm into the rectum, and withdrawing any hardened fæces which may have accumulated there. When the quantity of these is great, the hand must be passed several times, until it cannot reach any more. Whenever physic is given to an unprepared horse, as is sometimes necessary in severe disease, this precaution should never be neglected. There may be some trouble in passing an unusually large hand into the rectum of a very small pony, but no hand of average size is nearly so large as the mass of dung commonly present; and those who are *not above doing a dirty job when duty requires it*, well know by experience that the hand and arm may be passed to the shoulder without giving any pain whatever. Instruments are useful when they cannot be dispensed with, but they are always liable to cause laceration.

ON THE ACTION OF MEDICINES

AND

THE DOSES IN WHICH THEY CAN SAFELY BE ADMINISTERED

CHAPTER XXXVII

THE ACTION OF MEDICINES, AND THE FORMS IN WHICH THEY ARE PRESCRIBED

ALTERATIVES — ANÆSTHETICS — ANODYNES — ANTACIDS — ANTHELMINTICS — ANTISPASMODICS — APERIENTS — ASTRINGENTS — BLISTERS — CAUSTICS — CHARGES — CLYSTERS — CORDIALS — DEMULCENTS — DIAPHORETICS — DIGESTIVES — DIURETICS — EMBROCATIONS — EMULSIONS — EXPECTORANTS — FEBRIFUGES — LOTIONS — NARCOTICS — REFRIGERANTS — SEDATIVES — STIMULANTS — STOMACHICS — STYPTICS — TONICS — VERMIFUGES — ELECTUARIES — PESSARIES — SUPPOSITORIES.

ALTERATIVES

THIS TERM IS NOT VERY SCIENTIFIC, but it is in very general use, and easily explains its own meaning, though the *modus operandi* of the drugs employed to carry it out is not so clear. The object is to replace unhealthy action by a healthy one, without resorting to any of the distinctly defined remedies, such as tonics, stomachics, etc. As a general rule, this class of remedies produce their effect by acting slowly but steadily on the depuratory organs, as the liver, kidneys, and skin. The following may be found useful :—

1. IN DISORDERED STATES OF THE SKIN—
   Emetic Tartar . . . . 5 ounces.
   Powdered Ginger. . . . . 3 ounces.
   Opium . . . . 1 ounce.
   Syrup enough to form 16 balls : one to be given every night.

2. SIMPLY COOLING—
   Barbadoes Aloes . . . . 1 ounce.
   Castile Soap . . . . 1½ ounces.
   Ginger . . . . ½ ounce.
   Syrup enough to form 6 balls : one to be given every morning. Or,

3.   Barbadoes Aloes . . . . 1½ drachms.
   Emetic Tartar. . . . . 2 drachms.
   Castile Soap . . . . 2 drachms. Mix.

4. ALTERATIVE BALL FOR GENERAL USE—

Black Sulphuret of Antimony . . . . . . 2 to 4 drachms.
Sulphur . . . . 2 drachms.
Nitre . . . . 2 drachms.
Linseed meal and water enough to form a ball.

5. FOR GENERALLY DEFECTIVE SECRETIONS—

Flowers of Sulphur . . . . 6 ounces.
Emetic Tartar . . . . 5 to 8 drachms.
Corrosive Sublimate . . . . 10 grs.
Linseed meal mixed with hot water, enough to form 6 balls, one of which may be given two or three times a week.

6. IN DEBILITY OF STOMACH—

Calomel . . . . 1 scruple.
Aloes . . . . 1 drachm.
Cascarilla Bark, ⎫
Gentian Root, ⎬ of each in powder . . . . 1 drachm.
Ginger, ⎭
Castile Soap . . . . 3 drachms.
Syrup enough to make a ball, which may be given twice a week, or every other night.

ANÆSTHETICS

ANÆSTHETICS (ἀ, not, privative; αἴσθησις, sensation) produce insensibility to all external impressions, and therefore to pain. They resemble narcotics in their action, and, when taken into the stomach, may be considered purely as such. The most certain and safe way of administering them is by inhalation, and chloroform is the drug now universally employed. The *modus operandi* of the various kinds has never yet been satisfactorily explained; and when the comparison is made, as it often is, to the action of intoxicating fluids, we are no nearer to it than before. With alcoholic fluids, however, the disorder of the mental functions is greater in proportion to the insensibility to pain; and if they are taken in sufficient quantities to produce the latter effect, they are dangerous to life itself. The action of anæsthetics on the horse is very similar to that on man (see Methods of Control, page 625).

ANODYNES

SOMETIMES CALLED NARCOTICS, when taken into the stomach, pass at once into the blood, and there act in a special manner on the nervous centres. At first they exalt the nervous force; but they soon depress it, the second stage coming on the sooner according to the increase of the dose. They are given either to soothe the general nervous system, or to stop diarrhœa; or sometimes to relieve spasm, as in colic or tetanus. Opium is the chief anodyne used in veterinary medicine, and it may be employed in very large doses. Cannabis Indica and cocaine are also of service :—

7. ANODYNE DRENCH FOR COLIC—

Linseed Oil . . . . 1 pint.
Oil of Turpentine . . . . 1 to 2 ounces.
Laudanum . . . . 1 to 2 ounces.
Mix, and give every hour till relief is afforded.

8. ANODYNE BALL FOR COLIC (only useful in mild cases)—

Powdered Opium	½ to 2 drachms.
Castile Soap	2 drachms.
Camphor	2 drachms.
Ginger	1½ drachms.

Make into a ball with Liquorice powder and Treacle, and give every hour while the pain lasts. It should be kept in a bottle or tin.

9. ANODYNE BALL (ordinary)—

Opium	½ to 1 drachm.
Castile Soap	2 to 4 drachms.
Ginger	1 to 2 drachms.

10. EXTRACT OF CANNABIS INDICUS 4 drachms to 1 ounce as a ball mixed with any meal.

11.

Cocaine	5 grains.
Powdered Aniseed	½ to 1 ounce.
Oil of Caraway Seeds	½ drachm.

Syrup enough to form a ball.

12. ANODYNE DRENCH IN SUPERPURGATION, OR ORDINARY DIARRHŒA—

Gum Arabic	2 ounces.
Boiling Water	1 pint.

Dissolve, and then add—

Oil of Peppermint	25 drops.
Laudanum	½ to 1 ounce.

Mix, and give night and morning, if necessary.

13. IN CHRONIC DIARRHŒA—

Bismuth	½ ounce.
Powdered Chalk and Gum Arabic, of each . . .	1 ounce.
Laudanum	½ ounce.
Peppermint Water	10 ounces.

Mix, and give night and morning.

ANTACIDS

As THE TERM IMPLIES, these remedies are used to neutralize acids, whether taken into the stomach to an improper extent, or formed therein as products of diseases. They are often classed as alteratives, when used for the latter purpose. They include the alkalies and alkaline earths. The bicarbonates of soda and potash are those most often employed in veterinary medicine.

ANTHELMINTICS

DRUGS which are used to destroy worms receive this name in medical literature, when the author is wedded to the Greek language. The admirers of Latin call them vermifuges, and in English they receive the humble name of worm medicines. Their action is partly by producing a disagreeable or fatal impression on the worm itself, and partly by irritating the mucous lining of the bowels, and thus causing them to expel their contents. The following may be useful:—

14. WORM BALL (recommended by Mr. GAMGEE)—

Asafœtida	2 drachms.
Calomel	1½ drachms.
Powdered Savin	1½ drachms.
Oil of Male Fern	30 drops.

Treacle enough to make a ball, which should be given at night, and followed by a purge next morning.

15. MILD DRENCH FOR WORMS—
Linseed Oil . . . . 1 pint.
Spirit of Turpentine . . . . 2 ounces.
Mix, and give once a week, fasting.

ANTISPASMODICS

ANTISPASMODICS are medicines which are intended to counteract excessive muscular action, called *spasm*, or, in the limbs, *cramp*. This deranged condition depends upon a variety of causes, which are generally of an irritating nature ; and its successful treatment will often depend upon the employment of remedies calculated to remove the cause, rather than directly to relieve the effect. It therefore follows that, in many cases, the medicines most successful in removing spasm will be derived from widely separated divisions of the *materia medica*, such as aperients, anodynes, alteratives, stimulants, and tonics. It is useless to attempt to give many formulæ for their exhibition ; but there are one or two medicines which exercise a peculiar control over spasm, and I shall give them without attempting to analyze their mode of operation.

16. IN COLIC—
Spirit of Turpentine . . . . 3½ ounces.
Laudanum . . . . 1¼ ounces.
Solution of Barbadoes Aloes. . . . . 2 ounces.
Give as a drench in thin gruel.

17. CLYSTER IN COLIC—
Extract of Belladonna . . . . ½ ounce.
Glycerine . . . . 2 ounces.
Solution of Aloes . . . . 1 ounce.
Dissolve in three quarts of warm water.

18. ANTISPASMODIC DRENCH—
Gin . . . . 4 to 6 ounces.
Tincture of Capsicum. . . . . 2 drachms.
Laudanum . . . . 1 ounce.
Warm Water . . . . 1½ pints.
Mix, and give as a drench, when there is no inflammation.

19.
Chloral . . . . ⅓ ounce.
Chlorodyne . . . . 2 to 3 drachms.
Strong Liquid Ammonia . . . . 40 drops.
Ether . . . . 4 drachms.
Water . . . . 1 pint.
This may be repeated in two hours if no relief is obtained.

APERIENTS

APERIENTS, or purges, are those medicines which quicken or increase the evacuations from the bowels, varying, however, a good deal in their mode of operation. Some act merely by exciting the muscular coat of the bowels to contract ; others cause an immense watery discharge, which, as it were, washes out the bowels ; whilst a third set combine the action of the two. The various purges also act upon different parts of the canal, some stimulating the small intestines, whilst others pass through them

without affecting them, and only act upon the large bowels; and others, again, act upon the whole canal. There is a third point of difference in purges, depending upon their influencing the liver in addition, which mercurial purgatives certainly do, as well as rhubarb and some others, and which effect is partly due to their absorption into the circulation, so that they may be made to act, by injecting into the veins, as strongly as by actual swallowing, and their subsequent passage into the bowels. Purgatives are likewise classed, according to the *degree* of their effect, into laxatives, acting mildly, and drastic purges, or cathartics, acting very severely.

20. ORDINARY PHYSIC BALLS—
Barbadoes Aloes . . . . 3 to 8 drachms.
Hard Soap . . . . 4 drachms.
Ginger . . . . 1 drachm.

This old-fashioned formula answers well enough where one ball is to be made up, but since Professor Tuson's pharmacopœia has been generally adopted, *masses* of physic are kept containing a definite proportion of aloes, the excipient being glycerine and the condition of the mass always suitable for dispensing. Neither the veterinary surgeon nor the pharmaceutical chemist spends his time in the preparation of single balls of the kind used in routine practice, but the wholesale druggist supplies these things in convenient form and accurate doses.

21. A WARMER PHYSIC BALL—
Barbadoes Aloes . . . . 3 to 8 drachms.
Carbonate of Soda . . . . ½ drachm.
Aromatic Powder . . . . 1 drachm.
Oil of Caraway . . . . 12 drops.
Make into a ball.

22. GENTLY LAXATIVE BALL—
Barbadoes Aloes . . . . 3 to 5 drachms.
Rhubarb Powder . . . . 1 to 2 drachms.
Ginger . . . . 2 drachms.
Oil of Caraway . . . . 15 drops.
Mix, and form into a ball.

23. PURGING BALLS, WITH CALOMEL—
Barbadoes Aloes . . . . 3 to 6 drachms.
Calomel . . . . ½ to 1 drachm.
Rhubarb . . . . 1 to 2 drachms.
Ginger . . . . ½ to 1 drachm.
Castile Soap . . . . 2 drachms.
Mix as in No. 17.

24. LAXATIVE DRENCH—
Barbadoes Aloes . . . . 3 to 4 drachms.
Canella Alba . . . . 1 to 2 drachms.
Salt of Tartar . . . . 1 drachm.
Mint Water . . . . 8 ounces. Mix.

25. ANOTHER LAXATIVE DRENCH—
Castor Oil . . . . 3 to 6 ounces.
Barbadoes Aloes . . . . 3 to 5 drachms.
Carbonate of Soda . . . . 2 drachms.
Mint Water . . . . 8 ounces.
Mix, by dissolving the Aloes in the Mint Water by the aid of heat, and then adding the other ingredients.

26. A Mild Opening Drench—
　　　Castor Oil . . . . 4 ounces.
　　　Epsom Salts . . . . 3 to 5 ounces.
　　　Gruel . . . . 2 pints.　Mix.

27. A very Mild Laxative—
　　　Castor Oil . . . . 4 ounces.
　　　Linseed Oil . . . . 4 ounces.
　　　Warm Water or Gruel . . . . 1 pint.　Mix.

28. Purgative Clyster—
　　　Common Salt . . . . 4 to 8 ounces.
　　　Warm Water . . . . 8 to 16 pints.

ASTRINGENTS

Appear to produce contraction on all living animal tissues with which they come in contact, whether in the interior or on the exterior of the body; and whether immediately applied or by absorption into the circulation. But great doubt exists as to the exact mode in which they act; and, as in many other cases, we are obliged to content ourselves with their effects, and to prescribe them empirically. They are divided into astringents administered by the mouth, and those applied locally to external ulcerated or wounded surfaces.

29. For Bloody Urine—
　　　Powdered Catechu . . . . ½ ounce.
　　　Alum . . . . ½ ounce.
　　　Cascarilla Bark in powder . . . . 1 to 2 drachms.
　　Liquorice Powder and Treacle, enough to form a ball, to be given twice a day.

30. For Polyuriæ or Profuse Staling—
　　　Opium . . . . ½ drachm.
　　　Ginger powdered . . . . 2 drachms.
　　　Oak Bark powdered . . . . 1 ounce.
　　　Alum . . . . 2 drachms.
　　　Camomile Tea . . . . 1 pint.
　　Mix for a drench.

31. External Astringent Powders for Ulcerated Surfaces—
　　　Powdered Alum . . . . 4 ounces.
　　　Armenian Bole . . . . 1 ounce.

32.　　White Vitriol . . . . 4 ounces.
　　　Oxide of Zinc . . . . 1 ounce.　Mix.

33. Astringent Lotion—
　　　Goulard Extract . . . . 2 to 3 drachms.
　　　Water . . . . ½ pint.

34.　　Sulphate of Copper . . . . 1 to 2 drachms.
　　　Water . . . . ¼ pint.　Mix.

35. Astringent Lotion for Sore Heels—
　　　Solution of Diacetate of Lead . . . . . . 1 ounce.
　　　Linseed Oil . . . . 1 pint.　Mix.

36. Ointment for the Same—
　　　Nitrate of Silver powdered . . . . ½ drachm.
　　　Goulard Extract . . . . 1 drachm.
　　　Vaseline . . . . 1 ounce.
　　Mix, and use a very small portion every night.

BLISTERS OR VESICANTS

BLISTERS are applications which inflame the skin, and produce a secretion of serum between the cutis and cuticle, by which the latter is raised in the form of small bladders; but in consequence of the presence of the hair, these are imperfectly seen in the horse. They consist of two kinds—one, used for the sake of counter-irritation, by which the original disease is lessened, in consequence of the establishment of this irritation at a short distance from it; the other, commonly called "sweating" in veterinary surgery, by which a discharge is obtained from the vessels of the part itself, which are in that way relieved and unloaded: there is also a subsequent process of absorption in consequence of the peculiar stimulus applied.

37. MILD BLISTER OINTMENT (COUNTER-IRRITANT)—
Vaseline . . . . 4 ounces.
Venice Turpentine . . . . 1 ounce.
Powdered Cantharides . . . . 6 drachms.
Mix, and spread.

38. STRONGER BLISTER OINTMENT (COUNTER-IRRITANT)—
Spirit of Turpentine . . . . 1 ounce.
Sulphuric Acid, by measure . . . . 2 drachms.
Mix carefully in an open place, and add—
Hog's lard . . . . 4 ounces
Powdered Cantharides . . . . 1 ounce.
Mix, and spread.

39. VERY STRONG BLISTER (COUNTER-IRRITANT)—
Strong Mercurial Ointment . . . . 4 ounces.
Oil of Origanum . . . . $\frac{1}{2}$ ounce.
Finely-powdered Euphorbium . . . . . . 3 drachms.
Powdered Cantharides . . . . $\frac{1}{2}$ ounce.
Mix, and spread.

40. RAPIDLY ACTING BLISTER (COUNTER-IRRITANT)—
Best Flour of Mustard . . . . 8 ounces.
Made into a paste with water.
Add Oil of Turpentine . . . . 2 ounces.
Strong Liquor of Ammonia . . . . 1 ounce.
This is to be well rubbed into the chest, belly, or back, in cases of acute inflammation.

41. Biniodide of Mercury . . . . 1 part.
Lard or Vaseline . . . . 8 to 16 parts.

The last-named agent has almost superseded all the others, especially when applied as a remedy for bony growths, as splint, sidebone, ringbone, and spavin. The strength or proportion to be used is a matter of judgment, depending upon a variety of circumstances, as breed, thickness of skin, degree of ossification, and recent or chronic nature of the malady.

42. LIQUID SWEATING BLISTERS—
Cantharides . . . . 1 ounce.
Spirit of Turpentine . . . . 2 ounces.
Methylated Spirit of Wine . . . . 1 pint.
Mix, and digest for a fortnight. Then strain.

43. Powdered Cantharides . . . . 1 ounce.
Commercial Pyroligneous Acid . . . . . . 1 pint.
Mix, and digest for a fortnight. Then strain.

CAUSTICS, OR CAUTERIES

Caustics are substances which burn away the living tissues of the body by the decomposition of their elements. They are of two kinds— viz. first, the actual cautery, consisting in the application of the burning iron, and called firing; and, secondly, the potential cautery, by means of the powers of mineral caustics, such as zinc chloride, lunar-caustic, corrosive sublimate, etc.

Firing is described in the chapter on Operations, at page 628.

The following are the ordinary chemical applications used as potential cauteries :—

44. Fused Potass, difficult to manage, because it runs about in all directions, and little used in veterinary medicine.

45. Lunar Caustic, or Nitrate of Silver, very valuable to the veterinary surgeon, and constantly used to apply to profuse granulations.

46. Sulphate of Copper, almost equally useful, but not so strong as Lunar Caustic; it may be applied to all high granulations, as in broken knees, and similar growths.

47. Corrosive Sublimate in powder, which acts most energetically upon warty growths, but should be used with great care and discretion. It may safely be applied to small surfaces, but not without a regular practitioner to large ones.

48. Yellow Orpiment is not so strong as Corrosive Sublimate, and may be used with more freedom. It will generally remove warty growths, by picking off their heads and rubbing it in.

49. Muriate of Antimony, called Butter of Antimony; a strong but rather unmanageable caustic, and used either by itself or mixed with more or less water.

50. Chloride of Zinc is a most powerful caustic. It may be used in old sinuses in solution, 7 drachms in a pint of water.

Milder Caustics :—

51. Verdigris, either in powder or mixed with Lard as an ointment, in the proportion of 1 to 3.

52. Red precipitate, ditto, ditto.

53. Burnt alum, used dry.

Mild Liquid Caustics :—

54. Solution of Nitrate of Silver, 5 to 15 grains to the ounce of distilled water.

55. Solution of Blue Vitriol, of about double the above strength.

56. Chloride of Zinc, 1 to 3 grains to the ounce of water.

CHARGES

Are adhesive plasters which are spread while hot on the legs or other parts, and at once covered with short tow, so as to form a strong and unyielding support while the horse is at grass.

57. Ordinary Charges:

Burgundy pitch	4 ounces.
Barbadoes Tar	6 ounces.
Beeswax	2 ounces.
Red Lead	4 ounces.

The three first are to be melted together, and afterwards the lead is to be added. The mixture is to be kept constantly stirred until sufficiently cold to be applied. If too stiff (which will depend upon the weather), it may be softened by the addition of a little Lard or Oil.

Charges ready spread in the form of bandages can be purchased through wholesale druggists, and are much more convenient, but in many parts of the world the ingredients may be obtained where the finished article is not procurable.

CLYSTERS, OR ENEMATA

Clysters are intended either to relieve obstruction or spasm of the bowels, and are of great service when properly applied. They may be made of warm water or gruel, of which some quarts will be required in colic. They should be thrown up with the proper syringe, provided with valves and a flexible tube.

For the turpentine clyster in colic, see Antispasmodics.

Aperient clysters, see Aperients.

58. Anodyne Clyster in Diarrhœa :—
     Starch, made as for washing . . . . 1 quart.
     Powdered Opium . . . . 2 drachms.
   The Opium is to be boiled in water, and added to the starch.

COUGH BALLS

59.
     Extract of Belladonna . . . . ½ drachm.
     Nitre . . . . 2 drachms.
     Camphor . . . . 1 drachm.
   Linseed and treacle to make a ball.

60.
     Powdered Digitalis . . . . ½ drachm.
     Emetic Tartar. . . . . ½ drachm.
     Aniseed. . . . . 1 drachm.
     Camphor . . . . 1 drachm.
     Nitre . . . . 2 drachms.
   Linseed and treacle to make a ball.

CORDIALS

Are medicines which act as temporary stimulants to the whole system, and especially to the stomach. They augment the strength and spirits when depressed, as after over-exertion in work.

61. Cordial Balls.
     Powdered Caraway Seeds . . . . 6 drachms.
     Ginger . . . . 2 drachms.
     Oil of Cloves . . . . 20 drops.
   Treacle enough to make into a ball.

62.
     Powdered Aniseed . . . . 6 drachms.
     Powdered Cardamoms . . . . 2 drachms.
     Powdered Cassia . . . . 1 drachm.
     Oil of Caraway . . . . 20 drops.
   Mix with treacle into a ball.

63.
     Powdered Cinnamon. . . . . 1 drachm.
     Powdered Gentian . . . . 1 drachm.
     Powdered Ginger . . . . 1 drachm.
     Linseed Meal . . . . ½ ounce.
   Treacle enough to form a ball.

64. Cordial Drench—
     A quart of good ale warmed, and 2 drachms of grated ginger.

65. Cordial and Expectorant—
Powdered Aniseed . . . . ½ ounce.
Powdered Squill . . . . 1 drachm.
Powdered Myrrh . . . . 1½ drachms.
Balsam of Peru, enough to form a ball.

66.
Liquorice Powder . . . . ½ ounce.
Gum Ammoniacum . . . . 3 drachms.
Balsam of Tolu . . . . 1½ drachms.
Powdered Squill . . . . 1 drachm.
Linseed meal and boiling water, enough to form into a mass.

DEMULCENTS

Are used for the purpose of soothing irritations of the bowels, kidneys, or bladder, in the two last cases by their effect upon the secretion of urine.

67. Demulcent Drench—
Gum Arabic . . . . ½ ounce.
Water . . . . 1 pint.
Dissolve, and give as a drench night and morning, or mixed with a mash.

68.
Linseed . . . . 4 ounces.
Water . . . . 1 quart.
Simmer till a strong and thick decoction is obtained, and give as above.

69. Marsh-mallow Drench—
Marsh-mallows . . . . A double handful
Water . . . . 1 quart.
Simmer, as in No. 68, and use in the same way.

DIAPHORETICS

Have a special action on the skin, increasing functional activity.

70. Ordinary Diaphoretic Drench—
Solution of Acetate of Ammonia . . . . 3 to 4 ounces.
Laudanum . . . . 1 ounce.
Mix, and give at night.   Or,

71.
Solution of Acetate of Ammonia . . . . 2 ounces.
Spirit of Nitric Æther . . . . 2 ounces.
Mix, and give as above.

72. In Hide-Bound—
Emetic Tartar . . . . 1½ drachms.
Camphor . . . . ½ drachm.
Ginger . . . . 2 drachms.
Opium . . . . ½ drachm.
Oil of Caraway . . . . 15 drops.
Linseed meal and boiling water, to form a ball, which is to be given twice or thrice a week.

73. In Hide-bound (but not so efficacious)—
Antimonial Powder . . . . 2 drachms.
Ginger . . . . 1 drachm.
Powdered Caraways . . . . 6 drachms.
Oil of Aniseed . . . . 20 drops.
Mix as above.

These remedies require moderate exercise in clothing to bring out their effects, after which the horse should be wisped till quite dry.

DIGESTIVES

DIGESTIVES are applications which promote suppuration, and the healing of wounds or ulcers.

74. DIGESTIVE OINTMENT—
Red Precipitate . . . . 2 ounces.
Venice Turpentine . . . . 3 ounces.
Beeswax . . . . 1 ounce.
Hog's Lard . . . . 4 ounces.
Melt the three last ingredients over a slow fire, and when nearly cold stir in the powder.

The resin ointment of the British Pharmacopœia is that now in general use, but it is rather too stiff for convenient application, and many veterinary surgeons employ less wax or more oil.

DIURETICS

DIURETICS are medicines which promote the secretion and discharge of urine, the effect being produced in a different manner by different medicines ; some acting directly upon the kidneys by sympathy with the stomach, while others are taken up by the blood-vessels, and in their elimination from the blood cause an extra secretion of the urine. In either case their effect is to diminish the watery part of the blood, and thus promote the absorption of fluid effused into any of the cavities, or into the cellular membrane in the various forms of dropsy.

75. STIMULATING DIURETIC BALL—
Powdered Resin . . . . 3 drachms.
Nitre . . . . 3 drachms.
Castile Soap . . . . 3 drachms.
Oil of Juniper . . . . 1 drachm. Mix.

76. A MORE COOLING DIURETIC BALL—
Powdered Nitre . . . . ½ to 1 ounce.
Camphor . . . . 1 drachm.
Juniper Berries . . . . 1 drachm.
Soap . . . . 3 drachms.
Mix, adding linseed meal enough to form a ball.

77. DIURETIC POWDER FOR A MASH—
Nitre . . . . ½ to ¾ ounce.
Resin . . . . ½ to ¾ ounce. Mix.

78. ANOTHER MORE ACTIVE POWDER—
Nitre . . . . 6 drachms.
Camphor . . . . 1½ drachms. Mix.

79.
Gum Styrax . . . . ½ drachm.
Hard Soap . . . . 2 drachms.
Resin Powder . . . . 1½ drachms.
Nitre Powder . . . . 1½ drachms.
Ginger Powder . . . . 1 drachm.
Oil of Juniper . . . . 20 drops.
Linseed meal and treacle sufficient to form a convenient sized ball.

EMBROCATIONS

EMBROCATIONS OR LINIMENTS are stimulating or sedative external applications, intended to reduce the pain and inflammation of external parts when rubbed into the skin with the hand.

80. MUSTARD EMBROCATION—
Best Flour of Mustard . . . . 6 ounces.
Liquor of Ammonia . . . . 1½ ounces.
Oil of Turpentine. . . . . 1½ ounces.
Mix with sufficient water to form a thin paste.

81. STIMULATING EMBROCATION—
Camphor . . . . ½ ounce.
Oil of Turpentine. . . . . 1½ ounces.
Spirit of Wine. . . . . 1½ ounces. Mix.

82. SWEATING EMBROCATION FOR WINGALLS, etc.—
Strong Mercurial Ointment . . . . 2 ounces.
Camphor . . . . ½ ounce.
Oil of Rosemary . . . . 2 drachms.
Oil of Turpentine . . . . 1 ounce. Mix.

83. ANOTHER, BUT STRONGER—
Strong Mercurial Ointment. . . . . 2 ounces.
Oil of Bay . . . . 1 ounce.
Oil of Origanum . . . . ½ ounce.
Powdered Cantharides . . . . ½ ounce. Mix.

A popular embrocation universally used and sold as a proprietary article is made as follows :—

84. One whole Egg
Strong Acetic Acid . . . . 1½ fluid ounces.
Oil of Turpentine. . . . . 1½ fluid ounces.
Water. . . . . half-a-pint.
First whip the egg and add the turpentine slowly and with frequent agitation, then the acetic acid, and lastly the water.

THE AMMONIA LINIMENT of the British Pharmacopœia is a useful application for sprains, and is made by simply agitating one part of strong Liquid Ammonia with three parts of olive oil. Any other vegetable oil will do for veterinary purposes, but none emulsify so completely as to satisfy the pharmacist.

EMULSIONS

WHEN OILY MATTERS have their globules broken down by friction with mucilaginous substances, such as gum arabic or yolk of egg, they are called emulsions, and are specially useful in soothing irritation of the mucous membrane, of the trachea, and bronchi.

85. SIMPLE EMULSION—
Linseed Oil. . . . . 2 ounces.
Honey . . . . 3 ounces.
Soft Water . . . . 1 pint.
Carbonate of Potass . . . . 1 drachm.
Dissolve the honey and potass in the water ; then add the linseed oil by degrees in a large mortar, when it should assume a milky appearance. It may be given night and morning.

86. ANOTHER MORE ACTIVE EMULSION—
        Simple Emulsion, No. 85 . . . . 7 ounces.
        Camphor . . . . 1 drachm.
        Opium in Powder . . . . ½ drachm.
        Oil of Aniseed . . . . 30 drops.
Rub the three last ingredients together in a mortar with some white sugar ; then add
    the emulsion by degrees.

When bismuth and chalk and other heavy and insoluble agents are to be given as draughts they are suspended in mucilage of acacia, or tragacanth, glycerine, syrup, or treacle ; they are not strictly emulsified, but "held up" with shaking until they can be administered. Such arts as emulsification belong to the pharmacist, whose skill is but poorly remunerated, and they are only referred to here for the benefit of those readers who have not the advantage of a dispensary at which to get their medicines prepared.

EXPECTORANTS

EXPECTORANTS excite or promote a discharge of mucus from the lining membrane of the bronchial tubes, thereby relieving inflammation and allaying cough.

87. EXPECTORANT BALL IN ORDINARY COUGH WITHOUT INFLAMMATION—
        Gum Ammoniacum . . . . ½ ounce.
        Powdered Squill . . . . 1 drachm.
        Castile Soap . . . . 2 drachms.
Honey enough to form a ball.

88. IN OLD STANDING COUGH (STOMACH)—
        Asafœtida . . . . 3 drachms.
        Galbanum . . . . 1 drachm.
        Carbonate of Ammonia . . . . ½ drachm.
        Ginger . . . . 1½ drachms.
Honey enough to form a ball.

89. A STRONG EXPECTORANT BALL—
        Emetic Tartar . . . . ½ drachm.
        Calomel . . . . 15 grains.
        Digitalis . . . . ½ drachm.
        Powdered Squills . . . . ½ drachm.
Linseed meal and water enough to form a ball, which is not to be repeated without
    great care.

FEBRIFUGES

GENERALLY CALLED fever medicines, are given to allay the arterial and nervous excitements which accompany febrile action. They do this partly by their agency on the heart and arteries through the nervous system, and partly by increasing the secretions of the skin and kidneys.

90. FEVER BALL—
        Nitre . . . . 4 drachms.
        Camphor . . . . 1½ drachms.
        Calomel and Opium, of each . . . . 1 scruple.
Linseed meal and water enough to form a ball.   Or,

91.   Emetic Tartar . . . . 1½ to 2 drachms.
        Compound Powder of Tragacanth . . . . . 2 drachms.
Linseed meal as above.   Or,

92.   Nitre . . . . 3 drachms.
             Camphor . . . . 2 drachms.
      Mix as above.

93. COOLING POWDER FOR MASH—
             Nitre . . . . 6 drachms to 1 ounce.
      May be given in a bran mash.

94. COOLING DRENCH—
             Nitre . . . . 1 ounce.
             Sweet Spirit of Nitre . . . . 1 ounce.
             Water . . . . ¾ pint.

LOTIONS OR WASHES

CONSIST in liquids applied to the external parts, either to cool them or to produce a healthy action in the vessels.

95. COOLING SOLUTION FOR EXTERNAL INFLAMMATION—
             Goulard Extract . . . . 1 ounce.
             Vinegar . . . . 2 ounces.
             Spirits of Wine (Methd.) . . . . 3 ounces.
             Water . . . . 1½ pints.
      Mix, and apply with a calico bandage.

96. ANOTHER, USEFUL FOR INFLAMED LEGS, OR FOR GALLED SHOULDERS OR
      BACK—
             Sal Ammoniac . . . . 1 ounce.
             Vinegar . . . . 4 ounces.
             Spirits of Wine (Methd.) . . . . 2 ounces.
             Tincture of Arnica . . . . 2 drachms.
             Water . . . . ½ pint.   Mix.

97. LOTION FOR FOUL ULCERS—
             Sulphate of Copper . . . . 1 ounce.
             Nitric Acid . . . . ½ ounce.
             Water . . . . 8 to 12 ounces.   Mix.

98. LOTION FOR THE EYES—
             Sulphate of Zinc . . . . 20 to 25 grains.
             Water . . . . 6 ounces.   Mix.

99. VERY STRONG ONE, AND ONLY TO BE DROPPED IN—
             Nitrate of Silver . . . . 5 to 8 grains.
             Distilled Water . . . . 1 ounce.
      Mix, and use with a camel-hair brush.

100.   Cocaine 5 % solution for rendering the eye insensitive, previous to applica-
             ion of above, or for minor operations.

NARCOTICS

A DISTINCTION is sometimes made between anodynes and narcotics, but there is no necessity for separating them in a work of this character. (See Anodynes.)

REFRIGERANTS

LOWER THE ANIMAL HEAT by contact with the skin, the ordinary ones being cold air, cold water, ice, and evaporative lotions.   (See Lotions.)

SEDATIVES

DEPRESS THE ACTION of the circulatory and nervous systems. They are very powerful in their effects, and are conveniently divided into brain sedatives and heart sedatives. As examples of the first class may be cited chloral and the bromides, and of the second digitalis, opium and belladonna, and digitalis, which is the drug commonly used for this purpose, has a special quality known by the name of cumulative, that is to say, if repeated small doses are given at intervals for a certain time, an effect is produced almost equal to that which would follow the exhibition of the whole quantity at once. Besides digitalis, aconite is also sometimes used to lower the action of the heart, and by many it is supposed to be equal in potency to that drug, without the danger which always attends its use.

STIMULANTS

BY THIS TERM is understood those substances which excite the action of the whole nervous and vascular systems; almost all medicines are stimulants to some part or other, as, for instance, aperients, which stimulate the lining of the bowels, but to the general system are lowering. On the other hand, stimulants, so called *par excellence*, excite and raise the action of the brain and heart.

101.   Old Ale . . . . 1 quart.
     Carbonate of Ammonia . . . . ½ to 2 drachms.
     Tincture of Ginger . . . . 4 drachms.
  Mix, and give as a drench.

For other stimulants, see Cordials.

The term stimulant is here used in its popular acceptation. Alcohol in its various forms may be a true stimulant in very small doses, but it is usually regarded in medicine as a narcotic, because it first excites and then depresses nerve force, whereas a true stimulant is not followed by any reaction. The true stimulants in use for animals, such as ginger, capsicum, cinnamon and other drugs, we are accustomed from a horseman's point of view to regard as cordials, carminatives, or tonics.

STOMACHICS

STOMACHICS are medicines given to improve the tone of the stomach when impaired by bad management or disease.

102. STOMACHIC BALL—
    Powdered Gentian . . . . ½ ounce.
    Powdered Ginger . . . . 1½ drachms.
    Carbonate of Soda . . . . 1 drachm.
  Treacle to form a ball. Or,

103.   Cascarilla, powdered . . . . 1 ounce.
     Myrrh . . . . 1½ drachms.
     Castile Soap . . . . 1 drachm.
  Mix, with syrup or treacle, into a ball. Or,

104.   Powdered Calumba . . . . ½ to 1 ounce.
       Powdered Cassia. . . . . 1 drachm.
       Powdered Rhubarb . . . . 2 drachms.
Mix as in No. 103.

STYPTICS

STYPTICS are remedies which have a tendency to stop the flow of blood either from internal or external surfaces. They are used either by the mouth, or to the part itself in the shape of lotions, etc. ; or the actual cautery. Sometimes, however, the part cannot be reached, and is yet within the influence of an injection, as in bleeding from the nostrils, for which the following may be employed :—

105.   Matico Leaves . . . . ½ ounce.
       Boiling Water . . . . 1 pint.
Infuse, and when cold strain and inject into the nostrils.

For Internal Styptics, see Astringents.

TONICS

AUGMENT the vigour of the whole body permanently, whilst stimulants only act for a short time. They are chiefly useful after low fever.

106. TONIC BALL—
       Sulphate of Iron . . . . ½ ounce.
       Extract of Camomile . . . . 1 ounce.
Mix, and form into a ball.   Or,

107.   Quinine . . . . 30 grains.
       Ginger . . . . 1 drachm.
       Powdered Aniseed . . . . 1 ounce.
       Compound Powder of Tragacanth . . . . . . 2 drachms.
Syrup enough to make a ball.

VERMIFUGES, OR WORM MEDICINES

ARE DESCRIBED under the head of Anthelmintics, which see.

CHAPTER XXXVIII

SHOEING

To SHOE OR NOT TO SHOE, that is the question which every few years provides newspapers with cheap copy, when the sea-serpent's claims have for the time failed to draw. Why were horses first shod? There can be only one answer to that question, and it includes a refutation of the oft-repeated statement that present-day horses have had their feet so spoilt by shoeing that it has become a necessity. If it were true, which it is not, that Arab horses are never shod on the dry and sandy soil of Arabia proper, it would not prove that in this humid climate and on macadamized roads horses' feet are able to bear the attrition which ordinary work necessitates. Look in at the village farrier's, if you will, and choose a flat country as well, and examine the feet of colts about to be shod for the first time. How many will you find whose feet are not already broken and misshapen? Still more so is this the case when the ground is hilly and uneven, although nature provides a harder and more upright foot for those bred on high ground.

If, however, the feet of the unbroken colt are good enough to support his frolics at pasture without artificial covering, there are but very few capable of bearing the strain of work upon the roads. The few consist of horses used upon the fens for agricultural work, and now and again one belonging to a faddist, who can accomplish a journey of a few miles upon the level wooden or asphalt roads of the city and West-End of London. Experiments have again and again been made, but ended in failure. The evils of shoeing are many and great, but in accepting the services of the farrier we are choosing the lesser evil. Mr. Hunting, in his *Art of Horse Shoeing*, says: "The gentleman with a fad, who occasionally appears in England with unshod horses at work, is an unconscious impostor. He sets his little experience against the common-sense and universal practice of others. The shoeless experiment has been tried over and over again, but always with the same result—a return to shoeing. In dry weather the hoof becomes hard, and it is wonderful how much wear it will then stand on the hardest of roads. In wet weather the hoof becomes soft, and then the friction on hard roads soon prohibits work without shoes. If work be persisted in, under such circumstances, the hoof rapidly wears away and lameness results. Persons trying to prove a preconceived theory meet this difficulty by resting the horse until the horn grows, but business men, who keep horses for work

in all weathers, can afford no such luxury." The same excellent authority tells us that Napoleon's retreat from Moscow depended for most of its hardships and horrors upon the simple fact that his horses were not shod properly for travelling on snow and ice. The horses could not keep their feet, and were unable to drag the guns and wagons, which had to be abandoned. During the Franco-German war Bourbaki's retreat became a confused rout from a similar cause.

THE ANATOMY OF THE FOOT has been described at page 502 *et seq.*, and it is therefore unnecessary to return to it again. It will, however, be desirable, in describing the proper mode of preparing the foot for the
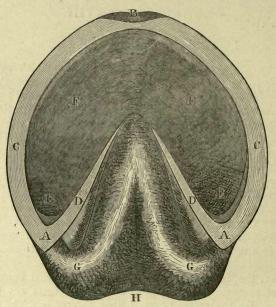
FIG. 118.—A SOUND FORE-FOOT PREPARED FOR THE SHOE.

A. The heel of the crust.
B. The toe cut out to receive the clip.
C. C. The quarters of the crust.
D. D. The bars as they should be left with the full frog between them.

E. E. The angles between the heel and bars where corns appear.
F. F. The sole.
G. G. The bulbous heels.
H. The cleft.

shoe, to recapitulate the several parts which the smith has to work upon. These are delineated in Fig. 118, of the proper form and proportions. In effecting this, the old shoe (excepting of course unshod colts) must first be taken off, to do which the clenches must be raised with the tool called the buffer, loosening any nails which may appear tight by driving them back with the punch. Then taking hold of one web of the shoe, raise it from its bed by lifting one side bodily and then the other, taking care not to draw it off completely on one side, or the crust will be broken. Next rasp the whole surface of the crust to a level, which will expose any stubs remaining, and if there are any they must be taken out. All this is a mere mechanical operation, requiring no thought; but now comes

the important part of the smith's work. It demands some knowledge of the anatomy of the foot and also of its diseases. He must remember that he has only about half-an-inch of horn at the thickest part between his knife and the sensitive internal parts; and though he can generally make a foot *look* well by the use of his tools, he often only does this at the expense of the destruction of a part which alone keeps the foot sound. Much will depend upon the natural or acquired formation of the foot he has to shoe. If it is very strongly covered with horn, great liberties may be taken with it, as compared with one where the sole is flat and thin, and the crust very shelly and weak. Generally he will only have to take an equal proportion off from the whole concave surface of the sole, that is, supposing the foot was properly prepared the last time it was shod; but sometimes it will have been allowed to grow greatly out of shape, and then much experience and skill are required to know how far to go with the knife. A perfect model must not always be carried in the eye, with a view to render the one before the smith exactly like it, but he must rather consider how he can make the best of the materials he has to work upon, which will generally be by preserving horn rather than by removing it. If the foot is strong, the toe may be slightly shortened, the heels of the crust and the bars may be lowered a little; the sole should not be pared out. The frog will only want to be cleared of any ragged portions depending from it, and the attachment of the bars to the crust must studiously be preserved. It is usual to clear out the sole in the angular interval between the bar and the crust, so as to avoid all risk of the shoe pressing upon the foot and causing a corn; but if care is taken to prevent the shoe from being twisted side-ways, this can never happen and the sole may be left here on a level with the bar, unless it has previously been the seat of a corn.

Such are the general directions for preparing the healthy foot for the ordinary English shoe; but supposing that there is any disease or tendency to it, or that some unusual form of shoe is decided on, there will be a necessity for certain modifications in the plan adopted.

THE FORM AND MANUFACTURE OF SHOES

In spite of the prolonged opposition of a powerful trades' union, machine-made shoes are now largely used, though never likely altogether to displace the hand-made article. There were many serious objections to them at first, but these have been practically overcome, and really good shoes, capable, if necessary, of cold fitting, are now turned out by the British and Colonial Company. A great many different materials have, from time to time, been tried, among them compressed leather, vulcanite, and *papier maché*. None answer so well as iron, although a mild steel is used for the short Charlier, to which Mr. South has given the name of the "Rational" shoe. The rapid cooling which is necessary in fitting shoes, makes steel too brittle or else too slippery. New bar iron, plain, fullered or Rodway, is commonly used for front shoes, and "doubles" for hind shoes of hard-working horses. Old shoes doubled and welded together and drawn out with heavy hammers are more lasting than new and less brittle than steel.

The chief objects to be attained in any particular pattern or form of

shoe are—that it be light, easily and safely retained by few nails, capable of wearing three weeks or a month, and that it afford good foothold to the horse.

The average weight of shoes—

Race Horses	2 ounces to 4 ounces.
Hacks and Hunters	15 ounces to 18 ounces.
Carriage Horses	20 ounces to 30 ounces.
Omnibus and Vanners	3 lbs. to 3½ lbs.
Heavy Dray	4 to 5 lbs.

1. THE COMMON ENGLISH SHOE for general purposes is represented in the annexed engraving, which shows both its surfaces. It is often made wider at the heels than the foot it is intended for, but this is a great mistake, and leads to the very mischief which it is intended to avoid. On examining the foot represented at page 656, it will be seen that at the back part of the crust on each side there is a considerable narrowing, or approach of the one heel to the other. This should be exactly copied, so that when the shoe is fitted neither heel will project a hair's-breadth beyond the other. The web will vary in breadth according to the nature of the sole which it has to protect, being made broader for a thin, weak sole, than for a strong one. On the internal or foot surface, the inner half or rather more is forged in a concave shape, so as to make the inner edge much thinner than the outer. This is called the concave seat, and is intended to keep all pressure off the sole, and to prevent the ordinary sized pieces of grit and gravel which insinuate themselves between the shoe and the foot from injuring the latter by their presence. The web of this shoe is perfectly flat on the ground surface, and is of the same thickness throughout.

Only the very best iron can be used to produce good nails. Nothing is dearer than bad nails, which cause injury to the foot and loss of shoes.

A good nail should present certain forms of head, neck and shank. The head should not be too broad at the top or it may become fixed in the nail-hole only by its upper edge, and when the shoe has had a few days' wear the nail loses its hold, and the shoe is loose. The neck should not be too thick, as it is then liable to press on the sensitive foot and to break the wall. The shank should not be too wide or too thick. The point should not be too long or too tapered as this leaves insufficient metal to form a good clinch.

There are two methods of putting nail-holes into shoes—by " fullering " and by "stamping." A stamped shoe is one in which the nail-holes are merely punched at certain distances, so as to leave four-sided tapered holes of the exact shape of a nail-head. A fullered shoe is one having a groove round the circumference through which the nail-holes are punched. Both processes, when well-done, admit of nails being driven into the hoof with equal safety and ease.

Whether stamped or fullered, there are a few more important points to remember about the nail-holes. The wall is not of the same thickness throughout, but becomes thinner towards the heels. The inner side of the foot is also somewhat thinner and more upright than the outer. The safest position, then, for the nails is in the front half of the foot, but should this position not present sound horn they may be placed further back. The danger of placing nails near the heels is due entirely to the greater risk in

driving them through the thin horn.   There need be no fear of interfering with expansion.
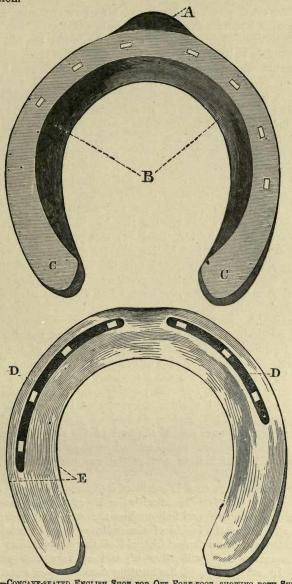
FIG. 119.—CONCAVE-SEATED ENGLISH SHOE FOR OFF FORE-FOOT, SHOWING BOTH SURFACES.

A. Clip at Toe.
B. Concave surface to lighten the shoe, and keep off pressure from the sole.
C. C. Level bearing for heel of crust and bar to rest upon.
D. D. Fullering for nail heads.
E. E. Flat web, ground side.

The distance of the nail-holes from the outer edge of the shoe should depend upon the thickness of the horn of the wall, and therefore be greater

in large shoes than in smaller, and greater at the toe than at the heels of the same shoe.

Seven is the usual number of nails used, four on the outer and three on the inner quarter, but for some horses five only will be made to answer well enough. Feet vary so much that no absolute rule can be laid down as to the proper number to be employed.

THE SHOE RECOMMENDED BY MR. SPOONER in his well-known and admirable work on *The Foot of the Horse*, is described by that gentleman as follows :—" It is then a seated shoe, with the flat part rather wider than common. The web of the shoe, for a moderate-sized horse used on the road, is about an inch in width, but varying according to circumstances, and being narrower at the heels, where the upper wearing surface is very slightly bevelled outwards, than at the other parts ; the ground part flat, sometimes fullered and sometimes stamped ; but when the former plan is adopted the fuller is not deep, or too near the edge, but somewhat wider than common. Three holes merely are stamped on the inside toe, and five on the outside toe and quarters, with a clip at the toe and another at the outer quarter. Sometimes, instead of a clip at the toe, the shoe is turned up in the French fashion, as recommended by Mr. Goodwin ; this plan is very advantageous when horses are in the habit of hitting the toe and tripping, or wearing it in undue proportion. In contracted feet the application of this shoe has materially enlarged the foot, quite as much as it is desirable to do ; indeed, I believe if it were applied early, contracted feet would be altogether avoided. It is also calculated in great measure to prevent corns, from bearing so easy on the inside heel."

These are admirable directions, with the exception of the clip on the outside, which I strongly object to as destroying so much of the crust for no useful purpose. Mr. Spooner's plan of filing the heels, with a slight inclination outwards, is excellent, as it has a tendency to prevent the heel of the crust from curling inwards, and may possibly cause it to expand slightly in the contrary direction. I confess, however, that I cannot see what there is in his shoe to make "the bearing so easy on the inside heel." On the contrary, the bevelling outwards of the heel of the shoe has a tendency to cause an increase of pressure on the seat of corn, rather than to relieve it. My own opinion is that it does neither the one nor the other, unless the shoe is twisted bodily outwards.

THE SHOE USED IN HUNTING is made of a different shape as regards the seating, being only slightly relieved with the file at this part, so as to avoid any approach to convexity, and hollowed on the outside, in a manner similar to the form adopted in the inside of the ordinary shoe, shown in Fig. 119. This is intended to give a firmer foothold of the ground than the smooth web of the common shoe will allow of, and answers that purpose most effectually. In other respects, the hunting shoe is made exactly like the common shoe, except that it is generally as light as possible, consistently with a necessary strength. Sometimes the outside nails must be carried considerably further back than I have here represented, and especially when the horse to be shod is apt to pull off his shoes, or when he is intended for a deep clay country ; but for grass or any light arable, seven nail holes, punched as I have represented in Fig. 120, and the nails well driven and clinched, will keep on the shoe, without any danger of its getting a twist.

Here, again, I shall insert Mr. Spooner's admirable description of the shoe recommended by him for this purpose: "For hunting, the shoe must be narrower than for the road, and an additional nail may be placed on the inside; no evil will result from this, because in the field the pressure on the crust is in a great degree relieved by the sole and frog. There must be space for a piece of paper to pass between the foot and inner rim of the shoe, but no more, as the foot can then be withdrawn from heavy soil with
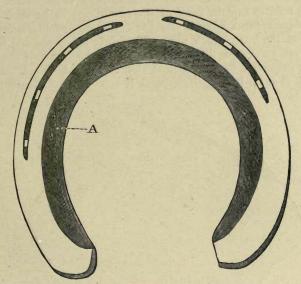
FIG. 120.—HUNTING SHOE FOR OFF FORE-FOOT, CONCAVE ON THE GROUND SIDE.

A. Concavity made to give foothold and lighten the shoe.

less difficulty than when the usual space is permitted. To avoid overreaching, the heels of the fore-shoe should scarcely project beyond the heels of the crust" (they should not at all), "and they should be rounded off, instead of being left square, as is usually the case. The hind-shoes should also, when there is any disposition to overreach, be square at the toe, set a little within the crust; and the inner rim at the toe should have a piece cut out, so that, instead of a sharp edge, there should be a rounded surface, which, of course, is not so likely to catch the heels of the fore-feet." It will be seen that this description tallies very closely with that which I have given above, the only point of difference being the external concavity of the web, which I believe to be of great importance in procuring a secure foothold. It also allows the foot to be pulled out of wet clay far more easily than the flat web; and there is a reduction of useless weight, as the hunting shoe does not wear out, except with those riders who keep to the roads, and they of course should have a road shoe.

2. THE FRENCH SHOE differs from the English form in both its surfaces, that which comes in contact with the foot being concave, while the other is convex. To make it fit the foot, the toe and heels of the latter must be pared away and made to fit the shoe, as here represented. The web is very

wide, and punched with eight counter-sunk nail-holes, the English plan of
fullering not being adopted.   The holes are also punched fully the third of
an inch from the edge of the shoe, and the nails are driven in a very great
slant, so that they come out little more than half-an-inch above the shoe, as
represented in Fig. 121.   By adopting this plan, several advantages are said
to be gained, as compared with the English method, which Mr. Goodwin, who
advocates the French shoe (yet proposes another on exactly the opposite
principles), enumerates as follows :—"If we refer to the action of the fore-
leg, it will tend to explain some of the advantages to be derived from the
curved shoe.   When a horse is about to move, the first indication of motion
is a bend at the knee, which necessarily raises the heels, and they become
more and more elevated, till the toe (which is the last part that leaves the
ground) is suspended for the moment that the foot is lifted.   The base of
the foot, just at its leaving the ground, is almost perpendicular ; when the
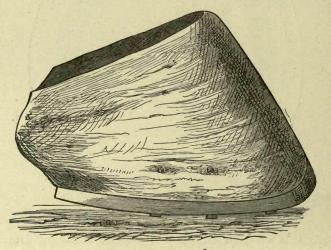
FIG. 121.—THE FRENCH SHOE.

knee is bent to its fullest extent, the foot is then in the same position, with
the heels of the shoe pointing upwards.   If we consider this final part of
the motion of the limb, we find the movement of the foot very nearly
describe a semicircle, and on viewing the form of the joints connected with
action, the necessity for a curve at the toe is clearly demonstrated.   Again,
the form of the shoe, worn out, at once shows that it must be more suitable
to put on a new one of that form, rather than to suffer the action of the
leg to be opposed until it is worn to that form.   In the second part of the
action, when the foot comes to the ground, the quarters and heels touch
first, and they are the only parts occupied in placing it on the ground again.
There may be deviations from this general rule, as in those horses that
have bad action ; also when horses are drawing heavy weights, it must
necessarily differ.   The fore-legs may be considered simply as pillars of
support, having no power of themselves to propel the body forward, pro-
gression being entirely performed by the hind parts ; and if it were not so,
the action would be different, as I have before observed it to be in those

horses which have great weights to draw, and this may be more readily observed in any draught-horse going up-hill. I have offered these few remarks on action, in order to bring the reader's attention to the curve of the French shoe at the *toe*. This form of shoe certainly harmonizes more with the motion of the fore-foot than the English does; it affords a greater surface of bearing at the toe than the projecting ridge of the straight ordinary shoe, and is much more calculated to allow of the motion of the leg and foot; the labour of the muscles is also diminished, and the limb being in its natural position, the ligaments have less imposed upon them; they are more at ease, and consequently are not so liable to be strained. The shape of the coffin-bone is also another proof of the French system being more consistent with the principles of nature than the straight ordinary shoe. If the coffin-bone of a fore-foot be placed on a level surface, the quarters and heels are the only parts in contact with it, which proves that they are intended by nature to meet the ground first, and to bear the greater proportion of weight; but if the quarters of the hoof be removed (lowered or diminished) to admit of the straight shoe, the portion of weight intended to be borne on the quarters must be thrown upon the heels; and hence the *great mischief* which ensues from the common (plain) English shoe. A reference to page 379, where the coffin-bone is carefully delineated in profile, will show the correctness of a part of this argument; for undoubtedly the lower surface of the edge of the coffin-bone is convex, and therefore there is no impropriety in cutting away the crust till it is left of an equal thickness between this bone and the shoe. But if it is decided to adopt the French shape, it must never be forgotten that it is not merely by cutting away the heels and toe that a foot prepared in the English way can be fitted to a French shoe, but by allowing the quarters to grow at the part where they are usually, in this country, sliced away to arrive at a plain surface. If this is not done, the heels will be too much weakened, and a corn will almost inevitably be produced in the inner one. The directions given by M. Bourgelat, and by M. Janze in his quarto on shoeing, are nearly the same; namely, that the convexity should be two and a half times the thickness of the shoe. This curvature is distributed so that the toe shall be raised twice the thickness of the shoe from the ground, and the heel the remaining half; the bend at the latter part beginning at the hind-most nail-hole, and that of the front of the shoe springing from the next nail. There is a great deal to be said in favour of this method of shoeing, grounded on the theory of action, which is not very clearly explained by Mr. Goodwin in the remarks which I have quoted; but the strongest argument is founded on the fact, that French horses are much sounder on their feet than the English. It must be remembered, however, that the roads in France are not like ours; they are either paved or composed of loose gravel, both of which surfaces are more likely to suit the convex shoe than our hard flint, gravel, or granite roads. But, independently of the difference in surface in the shoes of the two countries, there is also a great variation in the nail-holes, which in the French shoe are placed on both sides of the web, as I have represented them on the outside (Figs. 120 and 121); thus the outer heel is less confined in France than in this country, and to this fact I attribute a great part of their superior success. It would be a long time before so great a revolution could be accomplished as is necessary for the

introduction of the French shoe into general use; but I believe that it would, on the whole, be far superior to our own.

3. MR. GOODWIN has suggested an improvement on the French shoe, consisting in making the heels of the shoe slightly convex towards the foot, necessitating a double sweep in both surfaces. It is difficult to convey an accurate idea of Mr. Goodwin's shoe without an illustration, but his object is to place the heel of the crust on a sloping surface, so that when pressure is made downwards, it has a tendency to expand the heels. I believe, however, that all attempts to effect this object by mechanical means are fallacious, and that it is only by causing a due development of the frog and bars through the stimulus of pressure that it can be done. I therefore see no advantage in Mr. Goodwin's alteration, and should prefer the French plan, pure and simple.

4. MR. BRACY CLARK, in his great anxiety to prevent contraction, suggested a hinge at the toe of the shoe, by which it might be allowed to expand with the foot. At first sight this looks extremely simple, and likely to be efficacious, but there is one objection which completely explains the reason of its utter failure in practice. It must be nailed on firmly to both quarters, and at least four nails in each will be required. If, therefore, the heels are to expand, they must do so by a hinge or bend in the toe of the foot, since the quarters are nailed to the shoe, and no yielding can possibly take place between the four nails which are driven into each. Now the toe is not the faulty part in contraction, but the curve takes place at the back of the quarters, and moreover, the toe being guarded by the thickest part of the horn in front, and strengthened by the angle which the sole makes with it, cannot possibly expand or contract in the way which must be accomplished to carry out the object of the hinged shoe. The plan is therefore abandoned as practically useless, and theoretically founded on fallacious principles.

5. TURNER'S UNILATERAL SHOE. This name is not very descriptive of the plan which Mr. Turner, the well-known veterinary surgeon of Regent Street, introduced. It is not a one-sided shoe, but a shoe nailed only on the outside quarter and toe. Fig. 122 is a feather-edge hind-shoe, with somewhat similar nailing. Two clips are used, one at the toe and the other at the back of the outside quarter. He also reduces the thickness of the heel by filing away the ground surface, leaving a shoulder about three-quarters of an inch from the extreme point, and thus his shoe is nearly exactly similar in principle to the French plan, excepting in not continuing the curve to the toe. Mr. Turner considers that this prevents any pressure being made at the seat of corn; but he forgets that iron is of a most unyielding nature, and that a blow given to the middle of the shoe is distributed equally over the whole of the under surface of the foot, and is not confined to that part only immediately above it. I believe that his plan is more likely to produce corns than to prevent them, as by reducing the shoe up to a shoulder it is more likely to bend there, and then permanent pressure would be made on the heel, which would be far more likely to produce a corn than occasional blows. As far as the mode of nailing on the outside only is concerned, I believe it also is liable to objection, inasmuch as while it entirely frees the inside half of the foot, it sacrifices the outside in a terrible manner. It is quite true that the inner heel is weaker

than the outer, but a contracted foot is affected on both sides of the frog, and thus there is more mischief done to the outer heel than good to the inner. The principle of avoiding confinement of the heel by nailing is good, but the practice of sacrificing the outer one to the inner is not to be recommended, where it is possible to avoid injury to either. As I before remarked, contraction takes place in the back part of the foot and not at the toe, and a nail driven considerably in front of the middle of the quarter has no prejudicial effect in confining the heel.

6. THE HALF-MOON SHOE was strongly recommended by Professor Coleman, in the belief that unless the frog touches the ground it is impossible to keep up a due secretion of the parts which depend upon that organ for their
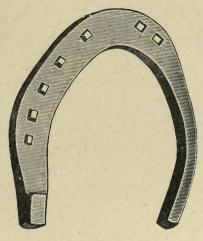
FIG. 122.

proper size and situation. His shoe was flat towards the foot, and concave like the hunting shoe (Fig. 120) on the ground side of the sole, and would allow of sufficient parting out to give space between the two. If this could not be done, the usual kind of concave seating (Fig. 119) was adopted. The toe was made of the usual thickness, the web becoming gradually thinner till it was reduced to one-third at the back of the quarter, where it ended. In preparing the foot the toe was lowered considerably, so as to make up for the difference in the thickness of the shoe, and thus take off the extra jar which would otherwise be thrown upon it, and the additional strain on the flexor tendons and suspensory ligament. Mr. Coleman did not expect that any unsound foot could bear this shoe, nor that it could be used on any horse whose heels had long been protected by iron, without a considerable preparation by gradual work, but he thought that if adopted from the first the frog and heels would bear the friction of our roads without suffering, and if so, that the contraction would be entirely prevented. The plan was tried on the Royal Artillery horses, and was reported on favourably, but it was not long persevered in, and has never since, so far as I know, been reintroduced. It is excellent in principle, but the general opinion is that,

when carried into practice, few of our horses would bear the battering of their heels which our hard roads would entail.

7. THE TIP is exactly similar in shape to the half-moon shoe, but is not so carefully seated on the foot, because it is merely wanted for horses intended to be turned out on soft ground. It is also generally made of equal thickness throughout, but it would be better if the substance of iron were reduced at the heels.

8. THE PLATE OR RACING SHOE is merely a narrow rim of iron, flat on
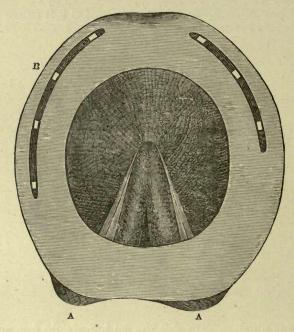
FIG. 123.—BAR SHOE FOR OFF FORE-FOOT: FITTED, BUT NOT NAILED ON.

A. A. Bulbous heels of the foot.   B. B. Fullering punched with seven holes.

the side towards the foot, and grooved on the other. This groove gives a good foothold, and conceals the nail heads also, so that no fullering or countersinking is required. The breadth of the web is generally about half-an-inch.

9. THE BAR SHOE is never used in this country for sound feet, but it is a great pity that some modification of it cannot be introduced so as to obviate all the objections which apply to the ordinary shoe. It consists of a complete ring of iron, similar in shape to the ordinary shoe, as far as the back of the quarters, but from that part bending inwards to meet the web of the opposite side, with which it is welded. It is now used for two purposes, exactly the reverse of each other. In the one case the foot is so prepared that the frog shall touch the shoe, while the heels are quite free, and are thereby relieved from all pressure. In the other the frog does not come in contact with the shoe, which is solely supported by the crust and

bars. It may thus be made either to defend the frog or the heels, which-ever may be in fault, and it is one of the most valuable aids to veterinary surgery. Should the frog be more prominent than the crust, the shoe may be made thin in proportion, at the part where it covers the former, and by this means it may be made exactly to fit the two when it is desired to divide the weight between them. There are many weak-heeled harness horses which would do their work far better if they were permanently shod in this way, and but for the danger of pulling these shoes off, and the little hold which they take of the ground, hacks might also sometimes be advan-tageously shod with the bar shoe. It is unsightly, certainly, and at present marks the existence of some disease, and for these reasons it is now seldom employed, except on compulsion.

10. THE PATTEN is merely a bar shoe made square at the heels and turned down at the back, so as to raise this part an inch from the ground. The object is to relieve the flexor tendons or suspensory ligament. It is also sometimes used in curb, with a view to relax the calcaneo-cuboid liga-ment, and the tendon of the gastrocnemius internus muscle.

WHEN THE CHOICE OF THE SHOE IS ARRIVED AT, the next thing is to make it and put it on. The former is a mechanical operation, which an scarcely
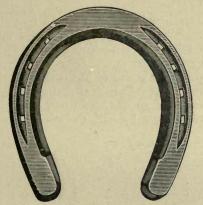
FIG. 124.—MACHINE-MADE SHOE—FORE-FOOT.   FIG. 125.—MACHINE-MADE SHOE—HIND-FOOT.
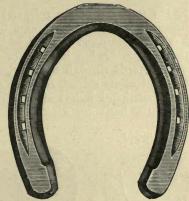
be learnt without actual demonstration, and I shall omit all account of it here, and refer the reader to Mr. Hunting's admirable treatise,[1] from which much of this chapter is derived, or to the larger work compiled by Messrs. Dollar and Wheatley.[2]

11. A LEATHER SOLE is often introduced between the shoe and the foot, for the double purpose of lessening the vibration and protecting the sole and frog from injury by blows against an irregular surface, such as new-laid gravel, or granite, or rough paving. Sometimes, when the frog and sole are sound, but from the action being very high there is a tendency to jar the foot, the leather is cut to the exact shape of the shoe inside and out, leaving the sole and frog uncovered; but in general a piece of leather

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[1] *The Art of Horse-Shoeing: A Manual for Farriers.*
[2] *Horse-Shoeing, and the Horse's Foot.*

is insinuated between the two, with a straight edge, crossing from heel to heel, and after the nails are driven and clenched, the outside edge is pared off level with the foot. Before, however, this is done, the space occupied
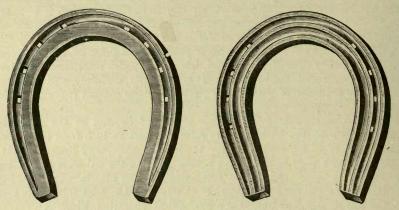
FIG. 126.—FRONT SHOES, MOST SUITABLE FOR RIDING AND CARRIAGE HORSES.[1]

by the concavity of the sole, and the crevices in the cleft of the frog and between it and the bars, must be carefully filled with tow, saturated with a mixture composed of equal parts of tallow and tar. This not only keeps the horn moist, but it prevents any grit or fine gravel from working its way forwards through the crevices which are presented in the cleft of the frog and at its sides. It is an extremely useful mode of saving the feet of high-actioned horses which are much used on our hard roads, especially where the heels are weak. The leather must be well soaked in water

GRIP (Regd.)   FROG   PATENT BAR   RING

1   2   3   4
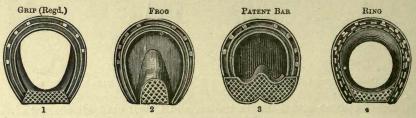
FIG. 127.—URQUHART'S PADS.

before it is used, and it will then accommodate itself to every slight irregularity in the foot. It is often alleged that this plan allows the frog to receive more pressure than with the ordinary shoe; but the leather is so yielding that this cannot really be the case, especially as it is of the same thickness throughout.

THE PADS illustrated above have now become general among those who can afford to double the cost of shoeing, and on London roads they are a comfort to the horse, enabling him to grip the greasy pavement, while providing just that frog pressure contended for by many of the authorities

[1] Manufactured by the British and Colonial Horse-Shoe and Machine Company.

quoted in different parts of this volume. Numbers 1, 2, 3, 4, are Mr. Urquhart's patterns, with which he claims to prevent slipping, contracted and diseased feet ; economize the wear and tear of legs through absence of concussion ; develop the healthy functions of the feet.

The "Grip" and the "Ring" pads do not cover the whole surface, and thereby prevent healthy evaporation, as do the other patterns here shown. Mr. Sheather, the well-known veterinary surgeon, seeks to obviate this objection by his pneumatic pad. It is not solid like the ordinary frog-pad, but hollow, and is compressed at each step, but immediately resumes its prominent form on being relieved of pressure.

In NAILING ON THE SHOE very little art is required if the holes are punched straight through far enough from the edge, and the crust is not broken or
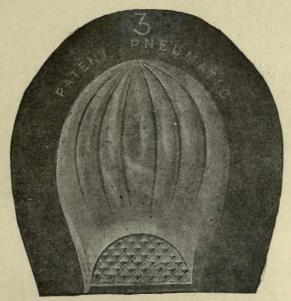
FIG. 128.—SHEATHER'S PAD.

unusually thin. If these precautions are not taken, the inclination of the hole gives a bias to the nail which it is difficult to rectify, while, if the holes are punched too near the edge, in order to get a sufficient hold they must be driven with a very slight slant far up into the wall of the hoof, and then the difficulty consists in bringing their points out at the proper place. When the nails are all driven through, a notch is made beneath each with the rasp ; they are then carefully turned down and twisted off with the pincers, leaving a proper length to clinch, when after a second hammering to secure their being driven well home they are clinched with the hammer by turning their points down into the notch previously made with the rasp. The whole foot is then slightly rasped over so as to remove any rough edges projecting beyond the shoe, and the operation is completed.

In THE HIND-SHOE there is not so much variation as in that used for the

fore-foot, because the hind-foot is not nearly so subject to disease as the fore. It is generally made thicker but narrower than the fore-shoe, and there is no necessity to make it concave-seated, because the sole is not often tender,
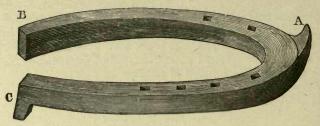
FIG. 129.—FEATHER-EDGED OFF HIND-SHOE.

A. Clip at toe.   B. Inside heel.   C. Outside heel, with "calking."

nor is it ever so thin and flat as is common enough before. As the horse stops himself by his hind-feet chiefly, he requires something to prevent his slipping, and the common practice is to turn up one or both heels, which
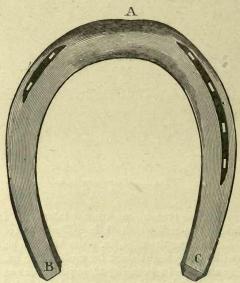
FIG. 130.—GROUND SURFACE OF NEAR HIND-SHOE.

A. The toe rounded off before and behind.   B. Inside heel, feather-edged.
C. Outside heel, with "calking."

projections are called "calkings" or "cogs" (see Figs. 129, 130, C). In horses for heavy harness work it is necessary to use these on both heels, but as the inner one is apt to cut the opposite fetlock joint, or bruise the coronet

by treading on it, and one suffices for light work, the usual practice is to turn up the outer heel only for all ordinary work, such as light, fast harness, hacking and hunting. If, however, this is done, the inner heel must be made proportionately thick, so as to give the horse a level bearing, without which he never works in comfort. Many smiths maintain that this is not necessary, because the calking sinks into the ground and does not therefore really raise that heel above the other. This is true enough when the roads are soft ; but when they are hard, as even macadamized roads often are, the calking sinks very little or not at all, and the twist complained of is actually felt. It is the best practice, therefore, to shoe the hind-feet in all light harness-horses, hunters, and hacks, with an outside calking, but the inner web narrow but deep, or what is called "feather-edged." This is shown in Figs. 122 and 129, which are views of such a shoe, specially adapted to prevent "cutting," but also, as before remarked, useful for general purposes. Mr. Miles recommends instead of this, for ordinary horses, that both heels should be made of double thickness for about an inch, leaving a shoulder in the ground surface at that distance from the heel, but this is just as likely to cause "cutting" as the "calking," as there need be no more projection in the one than in the other, and the nearer this is to the quarter the more likely it is to strike the opposite leg, this part of the foot being wider than the heels. I cannot, therefore, recommend the adoption of Mr. Miles' hind-shoe, which has all the disadvantages of the double calking and of the feather-edged shoe without the advantages of either. As I before remarked, there can be no objection to the feather-edged shoe, which is not necessarily without nails on the inside, and may be punched by using a deep fullering so as to take two or three nails on that side. The toe of the hind-shoe wears away very rapidly, being always brought to the ground before the heel on level roads and in going up hill, in the latter especially so, while in going down hill it wears away as fast as the heel. It should therefore be made stouter and thicker than the fore-shoe, with a small clip in the middle to prevent it from being driven back out of its seat. The back edge as well as the front side of the clip should be well rounded, as represented in Fig. 130, to prevent any risk from overreaches caused by a cutting blow from the latter, while the former, if left sharp, will be liable to catch hold of the projecting heel of a fore-shoe and pull it off.

THE TIME FOR REMOVING the shoes of a horse must depend upon the work he does, and the nature of his foot. If the quarters are thin or broken, the less frequently the shoes are removed the better, up to a month, beyond which no shoe should be allowed to remain on. Those that have plenty of horn are better for a "remove" at the end of a fortnight, and the shoes of horses doing no work should never be allowed to remain on for more than three weeks at the outside, as the feet are far more liable to contract while at rest than when at work, provided always that the latter is not so hard as to produce inflammation and consequent deficiency in the secretion of the horn.

DURING FROSTS, when the roads are rendered slippery by ice, the shoes must be "roughed" in some way, to enable the horse to go with safety upon it. The common method is to turn up the heels with a sharp "calking," and sometimes also to rivet a sharpened projection at the toe. These take hold of the ice and enable the horse to travel as easily as on the summer

road as long as they are sharp, but in a few days the points wear down and the shoe must be removed. In slight frosts a few of the nails may be punched out, and "frost-nails," with large heads, may be driven in their places; but these are of no use for any distance, as their heads soon wear down. To avoid the necessity for this removal of the shoe at the commencement and during the course of every frost, several plans have been invented, but none of them answer the purpose, except that introduced to general notice by Mr. White, in his *Farriery*, sixty years ago.

Alterations and improvements in the way of frost cogs have been made
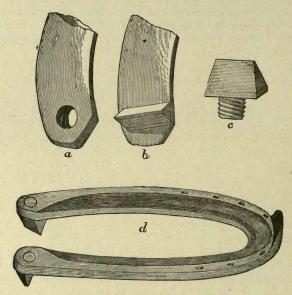
FIG. 131.—WHITE'S PLAN OF ROUGHING SHOES.

a. Hole drilled in each heel, and tapped to receive a sharpened calking or cog, shown full size.
b. Heel with calking screwed in, ready for use.

c. Calking shown separately.
d. Side view of concave-seated fore-shoe, with calkings screwed in (reduced size).

by Dr. Fleming, Mr. Hunting, Mr. Rogers and others, but they are all modifications of White's plan

I have used it for many years, and can speak from experience as to its great utility and extreme simplicity. The plan is as follows :—

A hole is drilled in each heel, and tapped to receive the screw at the base of a calking (see Fig. 131). This is all that is necessary to be done at the time of shoeing, as the cogs may be made in large numbers, and can be kept at home till they are wanted, when they may be fixed to the shoe in five minutes on the appearance of a frost, and even if the horses are from home, by merely carrying the necessary tool, which is simply a spanner made to fit them (see Fig. 132, e). I have always been charged 4d. per shoe extra for this punching of the heels and tapping, and finding the taps myself, which it is better to procure, together with the calkings, from an engineer, the

former costing 6s., and the latter 2d. to 3d. a-piece, if ordered by the score.

The extra cost, therefore, for shoeing horses during three months of the year in this way is about 3s. per month, which places the owner out of all risk of accident or delay, and it is certainly not more than is paid for roughing in the ordinary way on the average of seasons, while it saves the horse's feet from damage, and often prevents a broken knee or a worse accident.
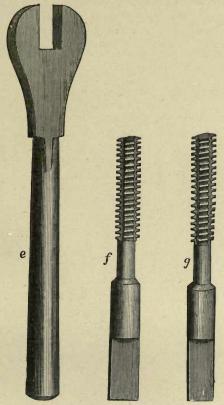
FIG. 132.—SPANNER AND TAPS FOR ROUGHING.

e. Spanner.   f. g. Taps for tapping.   ¼ inch size.

The tapped hole fills with dirt, which can readily be cleaned out with a bit of stick, and it will always last as long as the shoe. No one who is likely to want his horses roughed at a minute's notice should be without this apparatus; but there is always a difficulty with the smiths, as they object to it on account of the loss of work which it causes to them. But masters should remember that what is a loss to the one is · a gain to the other; and as the choice rests with them, they can adopt the plan if they like.

Since the first edition of this book was published, I have had so many

inquiries for the best means of procuring these cogs and tools, that I have arranged with a London engineer, who is to be depended on, to furnish them when required. His prices are slightly higher than the Birmingham charges, but the quality of his work is far superior, as the taps are all hand-made. The foregoing are the tools he supplies, with the prices. His address is S. Morris, 50 Rathbone Place, Oxford Street, London.

The price of these is 6s., and the cogs 3s. per dozen. If a larger screw is wanted—that is, three-eighths of an inch in diameter—the price is 8s. for tools, and 4s. 6d. a dozen for cogs.

CHAPTER XXXIX

A LIST OF VETERINARY DRUGS, WITH THEIR ACTIONS AND DOSES

As a BROAD RULE, but admitting of many exceptions, the doses for animals are calculated by their relative weight to man ; but veterinary therapeutics are in a very backward state, and many of the remedies which have a perfectly well-understood action on the human subject appear to be inert with most animals. Goats, for instance, will eat strong shag tobacco without experiencing any of its narcotic effects, and ergot is equally inoperative upon cattle in large doses, although there are still persons to be found who attribute abortion in cows to the small quantity of ergotized grasses in a pasture. The veterinary profession is not so blameworthy as might be at first supposed for this state of things. It has not the inherited wealth of the medical profession, whose best men have laboured for many centuries, to hand on knowledge to unborn generations, and only in quite recent years has it copied the faults of its richer sister by multiplying materia medica to such an extent that no practitioner can acquire a fair acquaintance with a tenth part of the Pharmacopœia. Again, experiments in doses upon healthy animals are not permitted by the Vivisection Act. The most barbarous practices are yet permitted by law, if done with the object of curing disease ; but a healthy mongrel may not be chosen to watch the effects of pharmaceutical agents for publication, and any information acquired in this way has to slowly filter into the student's note-book *viva voce*. It is to be regretted that none of the veterinary colleges have applied for licences and carried out a series of therapeutic experiments, which might have for their result far greater benefits than the bacteriological cultivations which have for so long engrossed some of the best men to the exclusion of more practical matter.

Until such experiments have been carried out, Voltaire's description will continue to hold good—*i. e.*

" Pouring in agents of which we know little, into bodies of which we know less."

The dose for a horse means for one 15 hands 2 inches high, and not less than five years old.

DOSES ACCORDING TO AGE.

For a yearling	...	...	One-third that for an adult.
For a two-year-old	...	...	One-half that for an adult.
For a three-year-old	...	...	Two-thirds.
For a four-year-old	...	...	Three-fourths.
For a five-year-old	...	...	The full dose.

For a hunter or hack	... ...	As above table.
For a heavy draught-horse	...	One-fourth more than a hunter.
For a cob 14 hands	... ...	One-fifth less than a hunter.
For a pony 13 hands	... ...	Two-fifths less than a hunter.

ACETIC ACID ; Distilled Vinegar.—Only used externally, as an ingredient in cooling lotions.

ACONITE ; Monkshood, Wolfsbane.—A most active poison in large doses. Used medicinally, it is a powerful general sedative, anti-spasmodic, and anodyne ; and by many practitioners it is preferred to Digitalis. It is generally given as a tincture, of which the dose is 10 to 15 drops.

ALCOHOL ; Spirit of Wine, known as rectified spirit, and proof spirit.— The latter is used as a stimulant, in the dose of 2 ounces to 6 ounces.

ALOES ; Barbadoes is the kind of this drug which is chiefly used in veterinary practice.—Its action is cathartic in large doses, nauseating in medium doses, and alterative in small. Dose, from 1 drachm to 6 drachms. For the foal, 5 grains may be given for every week of its age.

ALUM ; Sulphate of Alumina and Potass.—Action, irritant, astringent, and sedative. Dose, 2 drachms to 2 ounces.

AMMONIA, Aromatic Spirit of ; *Sal Volatile.*—Used in the same way as the Liquor, which is generally substituted for it in veterinary medicine.

AMMONIA, Carbonate of.—A strong diffusible stimulant. Dose, 1 drachm to 4 drachms.

AMMONIA, Liquor of; Caustic Ammonia, Spirit of Hartshorn.—A diffusible stimulant internally ; externally, a strong irritant. Dose, 1 drachm to 6 drachms.

AMMONIUM, Chloride ; *Sal Ammoniac.*—Only used externally, dissolved in water as a lotion, mixed with an equal quantity of nitre. One part of the mixture should be dissolved in sixteen parts of water, when it will lower the temperature 40° of Fahrenheit.

ANISEED.—Stomachic and carminative. Dose, 1 drachm to 1 ounce.

ANTIMONY, Chloride of ; Butter of Antimony.—Used as a caustic.

ANTIMONY, Oxide of; Antimonial Powder.—Little used in veterinary medicine.

ANTIMONY, Sulphuret of.—A somewhat uncertain drug, alterative and anthelmintic. Dose, 2 drachms to 1 ounce.

ANTIMONY, Tartarized ; Tartar Emetic.—A very common febrifuge and anthelmintic for horses, but of late asserted by the authorities of the Edinburgh Veterinary College to be almost inert ; and this assertion is supported by a number of experiments. Dose, 1 drachm to 6 drachms.

ARSENIC, Fowler's Solution of ; *Liquor Arsenicalis.*—A solution of white arsenic with potass in water, each ounce containing 4 grains of arsenious acid. Dose, $1\frac{1}{2}$ ounces to 2 ounces.

ARSENIC, White ; Arsenious Acid.—In large doses, an irritant poison ; in small ones, a tonic, and having also a peculiar effect on the skin. Dose, 5 to 10 grains.

ASAFŒTIDA, Gum.—A mild stimulant, carminative, and vermifuge. Dose, 2 drachms.

BELLADONNA ; Deadly Nightshade.—A narcotic acrid poison in large doses,

in small doses, anodyne and anti-spasmodic. Dose, of the extract, $\frac{1}{2}$ drachm to 2 drachms.

CALOMEL, Subchloride of Mercury.—Irritant, purgative, alterative, and antiphlogistic. Dose, 20 grains to 1 drachm.

CAMOMILE; Flowers of *Anthemis Nobilis.*—Stomachic, carminative, and mildly tonic. Dose, of extract, 1 to 4 drachms.

CAMPHOR; a peculiar concrete volatile oil from *Camphora officinarum.*— Slight stimulant; then sedative and anti-spasmodic. Dose, 1 drachm to 4 drachms.

CANTHARIDES; Blistering or Spanish Flies.—Given internally, irritant, stimulant, and diuretic; externally, rubefacient and vesicant. Dose, 4 grains to 20 grains. In homœopathic doses it is given for bloody urine.

CANTHARIDES, Ointment of; Blistering Ointment.—For recipes, see page 645.

CANTHARIDES, Tincture of; Liquid Blister.—Powdered cantharides, 1 ounce; proof spirit, 16 ounces; digest for several days, and strain. An active sweating or vesicating fluid.

CANTHARIDIS ACETUM.—A solution in ten parts of acetic acid of one of powdered Cantharides. More active than the liquid blister.

CASCARILLA; Bark of *Croton Eleuteria.*—A warm bitter tonic. Dose, 1 ounce to 2 ounces, generally made into an infusion.

CASTOR OIL; expressed from *Ricinus communis.*—Purgative. Dose $\frac{1}{2}$ to 1 pint.

CATECHU; extract from *Acacia Catechu.*—Astringent and antiseptic. Dose, 2 drachms to 5 drachms.

CHALK; Carbonate of Lime.—Antacid and astringent in diarrhœa. Dose, 1 ounce to 2 ounces.

CHARCOAL; Carbon.—A powerful antiseptic; chiefly used externally to foul wounds.

CHLOROFORM. — Anæsthetic, stimulant, and antispasmodic. Inhaled in doses of from $\frac{1}{2}$ to 2 ounces. Given internally—dose, 1 drachm to 2 drachms.

CINCHONA; Bark of several species of Cinchona.—Astringent and tonic. Dose, 1 ounce to 3 ounces.

COLCHICUM; Meadow Saffron.—Cathartic, diuretic, and sedative. Dose of the root or seeds, $\frac{1}{2}$ drachm to 2 drachms.

COPPER, Sulphate of.—Tonic and astringent. Used externally it is a mild caustic. Dose, 1 drachm to 2 drachms.

COPPER, Subacetate of; Verdigris.—An external application in grease and quittor.

CORROSIVE SUBLIMATE, Chloride of Mercury.—An irritant poison. Used as a caustic, or as a wash, dissolved in water, for mange, lice, etc.

CREOSOTE.—Sedative, anodyne, astringent, and antiseptic. Dose, 20 to 30 minims. Used externally in skin diseases, mixed with lead or oil —1 drachm to 3 or 4 ounces.

CROTON OIL AND SEEDS; *Croton Tiglium.*—Internally a strong cathartic; externally a counter-irritant. Dose, 10 to 15 seeds; of the oil, 15 to 20 drops.

DIGITALIS; Foxglove; leaves of *Digitalis Purpurea.*—A strong sedative and diuretic. Dose, of the powdered leaves, 20 to 30 grains.

ETHER, Sulphuric.—Stimulant, narcotic, and antispasmodic. Dose, 2 drachms to 2 ounces.

ETHER, Spirit of Nitric.—See Sweet Spirit of Nitre.

GALLIC ACID; Tannin exposed to air and moisture. Dose, ½ drachm to 1 drachm.

GALLS; Excrescences of *Quercus Infectoria.*—A powerful astringent. Dose, 4 drachms to 6 drachms. Used in polyuria.

GENTIAN; Root of *Gentiana Lutea.*—A bitter stomachic and tonic. Dose, 2 drachms to 1 ounce.

GINGER; Root of *Zingiber officinale.*—Stomachic, cordial, and carminative. Dose, ½ to 1 ounce.

GLYCERINE; one of the products of soap-boiling.—A most useful emollient external application, and an aperient introduced *per rectum.*

GUM ARABIC.—Useful for making a soothing mucilaginous emulsion. Dose, dissolved in water, 1 ounce.

GUM TRAGACANTH.—Similar in its action and dose to Gum Acacia.

HELLEBORE, WHITE.—See *Veratum.*

HEMLOCK; Leaves of *Conium Maculatum.*—Of little value as a medicine for the horse.

HENBANE; Leaves of *Hyoscyamus Niger.*—Not much used.

IODIDE OF POTASSIUM.—See Potassium, Iodide of.

IODINE is given internally to produce absorption of morbid growths. Dose, 1 drachm to 4 drachms. Externally it is applied in the form of tincture.

IRON, Sulphate of; Green Vitriol.—Astringent and tonic. Dose, 1 drachm to 3 drachms.

JUNIPER BERRIES.—Carminative and diuretic. Dose, 1 ounce to 3 ounces.

LEAD, Acetate of.—Internally astringent, but not powerfully so in the horse. Dose, 20 to 60 grains. Externally useful in the form of solution as Goulard's extract, and with lard, etc., as the cerate of acetate of lead.

LEAD, Oxide of; Litharge.—Used to make various plasters.

LINSEED; *Linum Usitatissimum;* Flax seeds. — Used scalded as an emollient food, and for fattening purposes, in quantities of 4 to 6 ounces.

LINSEED OIL.—A mild purgative. Dose, 1 pint to 2 pints.

MAGNESIA, Carbonate of.—A mild aperient for foals. See Rhubarb.

MAGNESIA, Sulphate of.—Epsom salts, an uncertain cathartic, but generally diuretic. Dose, 2 ounces to 1 pound.

MARSH-MALLOWS; Root of *Althœa officinalis.* — A mucilaginous emulsion is made by boiling. See page 648. Also an ointment for inflamed udders.

MERCURIAL OINTMENT; *Unguentum Hydrargyri.* — Used externally for mange and lice.

MERCURY, Ammonio-Chloride of; White Precipitate.—Used as a local application to kill lice.

MERCURY, Nitrate of.—Used mixed with lard, etc., to form an ointment, which is efficacious as a mild stimulant.

MURIATIC ACID; Hydrochloric Acid.—In small doses, tonic, ½ to 1 drachm diluted with water.

MUSTARD; Flour of the seeds of *Sinapis Nigra*. — Irritant applied externally.

NITRIC ACID.—A tonic when largely diluted. Dose, 1 drachm to 2 drachms.

NUX VOMICA. — A stimulant to the nerves, and useful in paralysis. Dose, 1 drachm of the powder.

OLIVE OIL.—Chiefly used as an ingredient in liniments.

OPIUM; Juice of the *Papaver Somniferum.*—Primarily stimulant. Then narcotic and anodyne. Dose, 1 drachm to 2 drachms.

POTASS, Acetate of.—The same as the nitrate, but milder in its effects on the kidneys.

POTASS, Nitrate of; Nitre ; Saltpetre.—Diuretic and febrifuge. Dose, 6 to 8 drachms.

POTASSIUM, Iodide of.—Diuretic and deobstruent, having the property of causing the absorption of morbid growths. Dose, 2 drachms to 4 drachms.

PRUSSIC ACID; Hydrocyanic Acid.—Used in the form of diluted hydrocyanic acid, as a gastric sedative in inflamed stomach. Dose, 20 to 30 minims.

PYROXYLIC ACID; Medicinal Naphtha.—Narcotic, having a special action on the bronchial mucous membrane. It is used in chronic cough. Dose, $\frac{1}{2}$ ounce.

RESIN, or Rosin.—An active diuretic. Dose, 1 ounce to 2 ounces.

RHUBARB; Root of *Rheum Palmatum.*—A mild purgative and stomachic, chiefly employed for foals, combined with magnesia.

SALT, Common.—See Chloride of Sodium.

SAVIN; Tops of *Juniperus Sabina.*—Anthelmintic. The essential oil is the best form. Dose, 3 to 4 drachms.

SILVER, Nitrate of ; Lunar Caustic; *Lapis Infernalis.*—Used externally in the solid form and in solution.

SODIUM, Chloride of ; Common salt.—A useful addition to the diet of horses.

SPERMACETI OINTMENT. — A very useful foundation for several external applications.

SULPHUR.—An efficacious remedy in several skin diseases.

SULPHUR OINTMENT, Compound.—Sulphur, $\frac{1}{2}$ pound ; white hellebore, 2 ounces ; nitre, 1 drachm ; soft soap, $\frac{1}{2}$ pound; lard, $1\frac{1}{2}$ pounds : mix. The most useful application in mange.

SULPHURIC Acid.—A powerful caustic, only used externally.

SWEET SPIRIT OF NITRE. — Diuretic, diaphoretic, antispasmodic, and stimulant. Dose, $\frac{1}{2}$ to 2 ounces.

TANNIC ACID.—Powerfully astringent. Dose, 20 to 30 grains.

TAR ; *Pix Liquida.*—Used externally as an ingredient in ointments, and as a stimulant to the growth of horn.

TURPENTINE, Spirit of ; Oil of Turpentine.—An excellent antispasmodic, diuretic, and vermifuge. Dose, 1 ounce to 2 ounces ; or as a diuretic, $\frac{1}{2}$ ounce to 1 ounce.

VASELINE—As a simple ointment or base.

VERATRUM ALBUM ; White Hellebore.—Sedative, for which purpose it is highly lauded by Mr. Percivall, who gave it in doses of 20 to 30 grains. Externally it forms an ingredient in several ointments.

ZINC, Carbonate of ; Calamine.—Used externally in the form of ointment.

ZINC, Chloride of.—A strong caustic and antiseptic. Generally known as Sir W. Burnett's disinfecting fluid, which contains 25 grains in each fluid drachm.

ZINC CHLORIDE, Sticks of.—For use as a powerful caustic instead of the solution.

ZINC, Oxide of.—Used externally as a mild soothing ointment, mixed with lard, and as a powder for chapped heels.

ZINC, Sulphate of ; White Vitriol.—Dissolved in water to form a wash for the eyes, and as an ingredient in grease lotion.

CHAPTER XL

ON SOUNDNESS; AND ON THE PURCHASE AND SALE OF HORSES

THE ELASTIC CONSCIENCE OF A HORSE-DEALER has become a by-word ; but I confess that my experience does not lead me to conclude that the class is more open to charges of unfair dealing than others. Few intending purchasers of a horse will be content with anything less than what they believe to be absolute perfection in him ; and if the seller tells the truth about the animal he has to dispose of, his chance of a sale would be a poor one. The dealer is, therefore, placed in the dilemma of being compelled either to give his horse a character which he does not deserve, or to forego all chance of a sale; and hence it is not surprising that he draws rather extensively upon his imagination. According to my experience, however, amateurs are not exempt from this failing ; and if I were compelled to purchase a horse from character alone, I should far prefer relying upon that given by a respectable dealer. The latter class are, no doubt, more skilled in hiding defects and disease, and therefore it requires a more practical knowledge of the horse to detect their artifices where they are sufficiently short-sighted to adopt them. On the whole, however, it may generally be concluded that unless a gentleman has had an extensive experience in purchasing horses, he will do well to place himself in the hands of a dealer, *telling him exactly what he wants*, and not pretending a knowledge which he does not possess.

In all large towns there are men of some character and standing, who may be selected for this purpose ; and in London, Dublin, Edinburgh, Birmingham, Liverpool, Cheltenham, and other places there are repositories, where horses are sold by auction on stated days. These auction-marts save the vendor from some responsibility, as there are conditions of sale at the head of the catalogue by which both buyer and seller are bound to abide.

In a few cases horses are entered as sound, but more often with a veterinary surgeon's certificate of recent date. A number of professional men, who from long practice are expert in the detection of unsoundness in the bustle of the auction-yard, are always in attendance, and the buyer does well to seek their advice.

Messrs. Tattersall's, of Albert Gate, London, and Messrs. Freeman's of " Aldridge's," St. Martin's Lane, may be taken as examples of the usual rules obtaining at permanent auction-marts, and are as follows :—

" All horses sold at this Repository as ' good hunters ' must not only be sound in ' wind and eyes,' but must be quiet to ride, have been hunted,

and be capable of being hunted. Horses described as hunters without the word 'good' must have been hunted and be capable of being hunted, but this description does not guarantee them sound in 'wind and eyes.'

" 4. Any horse sold at this establishment with a warranty, must, in case the buyer contend that it does not correspond with such warranty, be returned before five o'clock p.m. on the second day after the sale (Sunday excluded), otherwise it shall be deemed and taken to be in all respects as warranted as between all persons, and the non-return within the time limited shall be a bar to any claim on account of any breach of warranty, and the buyer shall be bound to keep and pay for the horse, whether it be or be not according to the warranty.

" 5. Should a horse warranted quiet in harness or to ride, be returned, it shall be tried by an impartial person, to be named by the proprietors of this establishment, whose decision shall be final and conclusive upon all persons, and a fee of ten shillings for the trial shall be paid by the party in error.

" 6. Should any horse, sold here, warranted to ride or draw, be considered by the buyer to be incapable of working, from any infirmity or disease, it may be returned here before five o'clock on the second day after the sale, with a certificate from a veterinary surgeon to that effect; if not so returned with such certificate, it shall be taken not to have been returned within the meaning of the 4th condition; and if such certificate be not confirmed by another, to be furnished by the vendor within two days, or in case the vendor shall neglect or refuse to furnish such certificate, the auctioneer shall immediately appoint a veterinary surgeon, whose decision shall be final and binding, and the whole expense must be paid by the party in error.

" 7. No horse considered to be affected with glanders, mange, or other infectious or contagious disorder, must, under any circumstances, be returned in accordance with the 4th condition, but in lieu of such return, a notice in writing, of the fact of the horse being so affected, and of the place where it stands, must be given at this establishment within the time mentioned in that condition, accompanied with the certificate of a veterinary surgeon that the horse is so affected; and in case of omission to give such notice, accompanied by such certificate within such time, the said horse shall be deemed and taken to be as between all persons not affected with any such disorder, and such omission shall be a bar to any claim on account of the said horse being so affected, and the buyer shall be bound to keep and pay for the same whether it be or be not so affected.

" 8. If such notice from the buyer, accompanied by a certificate, be given, the vendor will immediately be required to procure a certificate from his veterinary surgeon; and in case of non agreement of these two opinions, or in case the vendor neglect or refuse to furnish a certificate within two days after his receiving the notice, then the auctioneer shall appoint a veterinary surgeon, whose decision shall be final and binding upon all parties, and all expenses must be paid by the party in error.

" When a horse is sold as 'quiet to ride and drive' a warranty of 'workably sound' is implied, and he 'must be sound enough to be ridden or driven.' " [1]

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[1] Extract from a letter of Messrs. Tattersall, dated 1896.—EDITOR.

References have been made to a number of causes of unsoundness in the course of these pages, and following the plan adopted in previous editions, a list of diseases and accidents which have been settled as sufficient to entitle the purchaser to return a horse if warranted sound, and a further summary of those defects which are either insufficient or doubtful causes for rejection are given. The law of warranty is very unsatisfactory, and differs in England and Scotland, while custom to a great extent supplants law in Ireland. So well has it become known, that the custom of warranty is fast dying out, and in its stead a reasonable trial and veterinary surgeon's examination as to soundness is generally accepted by the purchaser, and agreed to by the vendor. A warranty in England holds good "for ever," while in Scotland it covers a lunar month, but neither is fair to the seller, as a horse may be perfectly sound and free from vice, and all or nearly all that the seller represents him, and in a day or a week be lame from accident or disease, or spoilt by bad handling. The vendor in giving a warranty undertakes an unfair risk, making himself responsible for the folly and incompetence of the purchaser or his servants.

THE DEFINITION OF UNSOUNDNESS is, " the existence of disease or alteration of structure which does or will impair the horse's natural usefulness." The judge's definition usually accepted by the veterinary schools is "anything that does now or may hereafter interfere with the usefulness of the animal."

VICE also may be defined, on a similar principle, as " the prevalence of a habit which interferes with the horse's natural usefulness." But these definitions must be taken with some modifications, for there is not one horse in a hundred which does not possess some disease or vice likely to impair his general usefulness to some slight extent; indeed, the proportion of strictly sound horses may be considered to be much smaller even than this. A bad feeder is so generally from a disordered state of stomach, and such a horse cannot stand work like one which will consume double the quantity of corn, yet he would not be considered unsound; nor would a horse be returnable as vicious if he showed the usual symptoms of being "fresh," though they might impair his usefulness in carrying a timid rider. But subject to such modifications, the above definitions may be accepted as sufficient to make intelligible the terms, Unsoundness and Vice.

THE FOLLOWING LIST comprises the diseases and injuries which have been settled as sufficient to entitle the purchaser to return a horse warranted sound :—

BOG SPAVIN, when it is so severe as clearly to interfere with the action of the joint; and BLOOD SPAVIN, as marking an aggravated form of the same disease.

BREAK-DOWN, even though the horse is restored so as to run without lameness.

BROKEN WIND.

CATARACT, in any degree.

CORNS, unless very trifling; but they should be discovered within a few days of the sale, or it may be alleged that they have been produced by subsequent mismanagement.

COUGH, as long as it lasts. A horse with chronic cough is clearly returnable.

CURBS constitute unsoundness; but they must be shown to exist at the

time of purchase, for a horse may throw one out immediately after he is transferred to the purchaser.

DISEASES of the organic kind, in any of the internal viscera.

FARCY.

FOUNDER, or LAMINITIS, whether it produces lameness or not, if it manifestly has existed, is to be accepted as unsoundness; for when there is evidence of its previous occurrence, the laminæ are injured so much as inevitably to lead to lameness when the horse is put to work.

GREASE, and GLANDERS.

MANGE.

MEGRIMS, when the attack comes on subsequently to the sale, and can be shown to have occurred before it.

AN UNNERVED HORSE is unsound from the existence of the disease for which the operation has been performed, as well as from the division of the nerves.

OPHTHALMIA, if it can be proved to have previously existed, and comes on soon after the purchase, is to be received as unsoundness. So, also, when any of the evidences of its previous presence can be detected, and are proved by a veterinary surgeon, the horse is returnable.

OSSIFICATION of any of the structures adjacent to the joints is unsoundness, and hence ossification of the lateral cartilages will be considered so, without doubt.

PUMICED FOOT, as evidence of laminitis.

QUIDDING.

QUITTOR.

RINGBONES, and SIDEBONES, whether large or small, are undoubtedly sufficient to constitute a horse unsound.

ROARING, whistling, etc., as interfering with respiration.

RUPTURES OF ALL KINDS.

SPAVIN (bone), although it may not have occasioned lameness, if it is clearly the disease so named.

STRINGHALT has been decided to be unsoundness (*Thompson* v. *Patterson*).

THICK WIND, as marking some impediment to respiration.

THRUSH, when it is in one of its severe forms, and not caused by mismanagement.

THICKENING OF THE BACK SINEWS, or suspensory ligament, when existing to any extent easily appreciable, is to be received as a proof of unsoundness.

RETURNABLE VICES are comprehended in the following LIST :—

BITING, when carried to any unusual extent.

BOLTING or running away.

CRIB-BITING.

KICKING, when more than usual.

RESTIVENESS, or refusal to proceed in the desired direction.

REARING.

SHYING, when marked.

WEAVING in the stable.

THE FOLLOWING DISEASES and accidents are generally considered not to render their possessors unsound :—

BOG SPAVIN in a slight degree only.

A BROKEN KNEE, unless the joint is injured so as to impair its functions, is not considered to be unsoundness.

CAPPED HOCKS AND ELBOWS do not produce any lameness, nor do they in any way interfere with the action of the joints to which they are adjacent.

CONTRACTION OF THE FOOT is no evidence of disease, and, taken by itself, is not sufficient to prove it to be unsound.

CRIB-BITING was decided, in the cases of *Broennenbury* v. *Haycock* and *Scolefield* v. *Robb*, not to be unsoundness; but Baron Parker ruled in the latter that it came within the meaning of the word " vice." Undoubtedly this is a habit which is generally attended by impaired digestion, and, as such, it comes strictly within the definition given above; but the law is as I have stated it.

CURBY HOCKS, though experience may tell us they are likely to be attended by curbs, are decided not to be unsoundness. In *Brown* v. *Elkington*, the attention of the vendor was directed to the hocks by the purchaser before the sale, as likely to spring curbs; but in the action on the warranty it was held by Lord Abington that "a defect in the formation of the horse, which had not occasioned lameness at the time of sale, though it might render the animal more liable to be lame at some future time, was no breach of warranty;" and the Court of Exchequer confirmed this view of the law, by refusing a rule for a new trial.

CUTTING, on the same principle, is no breach of warranty, unless the horse is lame from it at the time of sale.

A SPLINT is not, in itself, evidence of unsoundness; but if it is so situated as necessarily to interfere with the suspensory ligament or tendons, or if it has already produced lameness, it is to be accepted as a mark of unsoundness.

THOROUGHPIN, when existing to a moderate extent, is not sufficient to render the horse unsound; but this will always be a question of opinion, and a horse with thoroughpin is, therefore, not to be warranted with safety.

THRUSH, occurring from mismanagement only, and not from any defect in the horse, is clearly not to be considered as unsoundness.

SORENESS of the joints from work, as it soon goes off after a short rest, is not accepted as unsoundness.

WINDGALLS are also only evidences of work, and do not usually cause lameness. When this co-exists, it is sufficient to produce unsoundness, without reference to the windgalls.

WHEN A HORSE IS PURCHASED, with the conditions that he is warranted sound, or free from vice, or quiet to ride and drive, the warranty must either be in writing, or given in the presence of a disinterested third person. The form of warranty is as follows, and it is better that it should be on the same paper as the stamped receipt, though this is not absolutely necessary if it is shown that the receipt is properly given.

<div align="center">Date.</div>

Received of A.B.C. fifty pounds for a bay gelding, by Smallhopes, warranted five years old, sound, free from vice, and quiet to ride and drive.

50*l*.   X.Y.Z.
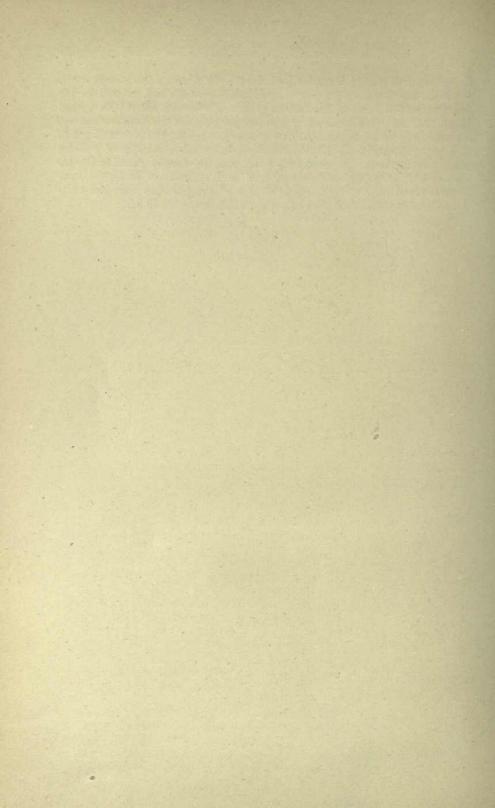
Any one or more of these points may be omitted, or the horse may simply be warranted "a good hack," in which case he must fairly answer that description. The terms " has been hunted," or " has carried a lady," are not to be trusted, as it is only necessary to prove in defence that the horse has seen hounds, and had a woman on his back.

WHETHER THE HORSE UNDER EXAMINATION is to be warranted or not the intending purchaser should never omit to look over every point where unsoundness is likely to occur. To do this effectually it should be done regularly, by which there is less chance of passing over any serious defect. The usual mode of proceeding is as follows. Under no circumstances, if it can possibly be avoided, should the horse be looked at immediately after having been out of doors ; and if he is of necessity brought to the purchaser, let him be put in the stable and quietly rested for one or two hours at the least, by which time the effects of most of the " coping " tricks will have gone off.

BEFORE THE HORSE PASSES THE STABLE DOOR, stop him with his head just inside, and in this position carefully examine his eyes. The light is exactly suited to this, and the sensibility of the iris may be well judged of. Any specks or opacities are also here readily seen. Then let him be led to a level surface, and then proceed to look over every part, beginning with that nearest the one already inspected, namely the mouth. Then " cough " him by tightly grasping the larynx, by which some idea may be formed of the state of his respiratory organs, after which the usual manœuvre with the stick may be practised if there is no opportunity of examining into his freedom from roaring in the saddle. When these points are satisfactorily disposed of, look to the position of the fore-legs, that is, whether they are turned in or out, and if the latter feel the elbows, and see if they are confined or " tied," that is too close to the ribs, also look for marks of cutting and speedy cutting. Pass the hand down the back sinews and suspensory ligaments, examine the knees for any marks, and then carefully feel the coronets and heels for any marks of oxostosis or ossification. Lastly, take a good look at the front of the foot, and then lifting it inspect the frog, heels, and sole. This will complete the front half of the body, after which the form of the middle and loins should be regarded, and then, lifting the tail, the openness or otherwise of the space round the anus will give some idea of the strength of constitution, while the resistance afforded by the dock will be a sign of the muscular strength of the back. Then look carefully at the hocks, examine the spavin and curb places, and finish the whole by passing the hand down the hind cannon bones to the fetlocks, and feel them in the same order as in the fore-legs. Now let the horse rest a minute if his groom will let him, with his head quite at liberty, and you will be able to judge of his ordinary habit of standing, when unexcited. At the conclusion of this careful examination while at rest, the action must be as minutely investigated, by first having the horse walked *with a loose rein*, and then trotted *in the same way slowly*, when if he is sound he will put his feet down regularly and firmly. Grooms, when they want to conceal defects, will not let the head be loose, nor will they trot slowly, but bustle the horse along with their hands as close as possible to the mouth, so as to prevent any nodding of the head as much as they can. A very good judge will be perhaps able to select a pleasant hack or harness horse by seeing him thus run

and afterwards ridden, but a far better test is to ride or drive him yourself, when his freedom from vice, or disease, may be ascertained, as well as his manners, and the ease of his various paces.   No trouble should be spared to get this real trial, which is worth ten per cent. on the purchase money, for many a horse which *looks* to go well does not *feel* so, and it is well worth that sum to be saved the trouble attending upon the possession of a horse which does not suit.   When, however, after such a careful examination by a competent judge, and subsequent trial in the saddle or in harness, the horse is found to be really likely to answer all the purposes for which he is wanted, a few pounds should never prevent his being obtained.

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