The surgical anatomy of the horse / by J.T. Share-Jones.

THE SURGICAL ANATOMY OF THE HORSE

PART III.

JOHN T. SHARE-JONES

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BY

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PART III.

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PREFACE TO PART III

The method of dealing with consecutive treatment in Volume II. met with such general approval that I have been led in the present volume to handle this branch of work at still greater length, in the hope that it will make the work more useful to the Practitioner and Final Year's Student. This has slightly increased the size of the volume; for it has been done without in any way curtailing the anatomical descriptions of the parts, in order that this Part may be of no less service than the second volume to the student of Anatomy. With this exception the lines of Part II. have been closely followed.

To my friend and former colleague, Professor Macqueen, who once again undertook the task of revising the proofs as they were passed for the press, I am indebted for many valuable suggestions. On the wide experience and sound judgment of my colleague, Mr. Henry Sumner, M.R.C.V.S., I have freely drawn; nor have I ever sought for information concerning the practical points of the work which has not been most generously given. To both alike I would express my sincere gratitude; for whatever merit might be attached to the work it will in great measure be due to their generous help.

For the loan of blocks of Plates XV. and XXVII. indebtedness is expressed to the kindness of Mr. Hunting and the publishers of the

Veterinary Record, who, with characteristic generosity, placed the whole of the material of that journal at my disposal.

In conclusion I venture to hope that the present volume may prove both at home and abroad at least as acceptable as the preceding volume both to students and practitioners in the study and practice of the important branch of veterinary work to which it relates.

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THE HIND LIMB

CHAPTER I

SUPERFICIAL EXAMINATION

In the region of the hip the first point which strikes an observer is the marked prominence indicating the position of the underlying external angle of the ilium. The lower the condition of the animal the more prominent does this elevation become. It is frequently and erroneously indicated by laymen as the position of the hip joint, and owing to its great prominence and exposed situation is the most common seat of fracture connected with the pelvis. It may be fractured by the animal falling on its broadside, since in accidents of this kind it is the part of the body which comes most forcibly into contact with the ground. Fracture of it is also very commonly due to the animal's being carelessly led or driven through a doorway.

When fracture occurs the severed piece is usually displaced in the downward direction, and remains in the position to which it has been displaced on account of the action of the muscles which are attached to it, namely, the anterior arm of the superficial gluteal, the tensor vaginæ femoris, and the internal and external oblique muscles of the abdomen. In this position, however, union to the main portion of the ilium usually occurs by ossification, but occasionally a false joint may be formed by the union taking place through the formation of fibrous tissue. In the former case the fracture has little effect upon the action and working ability of the animal, but has a marked effect

upon its conformation in the dropping of the quarter, which becomes particularly apparent when the animal is viewed by the observer standing behind him. In the case of fibrous union the action of the animal is affected to a greater degree, and there is observed a peculiar jerky movement in the region of the fracture, owing to the part to which the muscles are attached having lost its rigidity.

Passing the hand upwards from the angle of the haunch, a large muscular mass is felt : this is the elevation caused principally by the middle or great gluteus muscle. In well-nourished animals the mass is rounded, but in subjects which are emaciated the surface is somewhat flat. Near the spine another osseous elevation is felt : this is the angle of the croup or internal angle of the ilium.

Taking a line obliquely downwards and backwards from the angle of the haunch, we feel a hard, upwardly projecting piece of bone which terminates bluntly at its superior extremity : this is the summit of the great femoral trochanter, which is over the hip joint, and its distance from the external angle of the ilium in an animal about fifteen hands high, is thirteen inches. Two inches downwards and forwards from this the convexity of the great trochanter may be felt, but much less distinctly. Careful manipulation will enable the observer to feel a tendon which plays over the outer side of the convexity. This is the tendon of the middle gluteus muscle, which runs to be inserted into the ridge of bone on the outer side of the convexity, and which is called the crest. An imaginary line should now be drawn from the summit of the great trochanter obliquely upwards and backwards to a point seven inches below the root of the tail. The most prominent point here indicates the position of the underlying tuberosity of the ischium. It is not immediately subcutaneous, but is covered by the semitendinosus muscle. Another imaginary line should be drawn from the summit of the great trochanter, but in this case downwards and forwards to the front of the stifle joint. This indicates the direction of the shaft of the femur, and about one-third of the distance along this line is placed the external or third femoral

trochanter. Two slight and elongated elevations are seen to converge and meet at the third trochanter. These elevations are due to the underlying arms of the superficial gluteal muscle. Running obliquely downwards and forwards behind the imaginary line indicating the direction of the femur are three elevations which are caused by the bellies of the three divisions of the triceps abductor femoris or biceps femoris muscle. The most anterior of the three bellies takes a course which is almost exactly parallel to that taken by the femoral axis, whilst the remaining two take courses which approach progressively nearer the vertical direction.

An imaginary line connecting the external angle of the ilium and the summit of the great trochanter will, with the axis of the femur, form sides including an angle which is mainly filled by the quadriceps extensor cruris muscles. The normal bulk of these muscles should be carefully noted, since there is a marked falling away in this region in advanced cases of paralysis of the anterior crural nerve. A delicate sheet-like muscle runs from the angle of the haunch almost vertically downwards to be inserted into the fascia of the thigh. This is the tensor vaginæ femoris muscle.

Attention should next be directed to the region of the stifle joint, and the first point which strikes one here is the prominence in front of the joint caused by the patella. The bone should be carefully manipulated, its outline mapped out, and its vertical movement on the trochlea of the femur demonstrated to the observer's satisfaction by taking the limb up and flexing and extending the joint. In this manner also the lips of the trochlea may be made more apparent to the touch. On the anterior aspect of the patella a broad flattened tendon should be found. This is the tendon of the quadriceps or crural muscles, the action of which is transmitted to the limb through the medium of the straight ligaments of the patella.

Below the patella is a transverse indentation. This invites most careful observation, since a symptom of several affections of the stifle

joint is a filling up of this depression. The external lateral ligament of the stifle will be found to take a course downwards to the head of the fibula, which will be felt as a slight hard elevation at a distance of one inch below the femoro-tibial articulation. The three straight ligaments are felt below the patella running to their attachments into the anterior tuberosity of the tibia.

In front of the head of the fibula is a powerful tendon, which if followed upwards will be found to be inserted between the outer condyle of the femur and the external lip of the trochlea. This is the tendon which is common to the extensor pedis muscle and the tendinous or superficial portion of the flexor metatarsi. The tendon is succeeded by a prominent belly, which forms a well-marked and rounded elevation at the front of the tibial region. This elevation is due chiefly to the underlying extensor pedis muscle, deeply seated to which is the flexor metatarsi. The outline of the extensor pedis is easily visible, since it forms a prominent surface marking, and manipulation is not necessary to define it.

Running in a vertical direction parallel to the elevation formed by the extensor pedis is another elevation which indicates the course of the peroneus muscle. This muscle arises from the external lateral ligament of the stifle, from the head of the fibula, and the aponeurotic septum between it and the deep flexor of the digit.

The elevation formed by the peroneus muscle is not so prominent as is that formed by the extensor pedis, as its belly is much less bulky and is not so well developed. The surface of the extensor pedis is convex in the longitudinal direction and markedly so from side to side, whereas the surface of the peroneus is much more flattened.

Between the two elevations just described is a vertical depression into which the anterior tibial nerve dips. This nerve may be distinctly felt as it crosses the outer surface of the peroneus muscle obliquely prior to its disappearing between the two muscles. A little lower down the musculo-cutaneous branch of the anterior tibial nerve crosses the

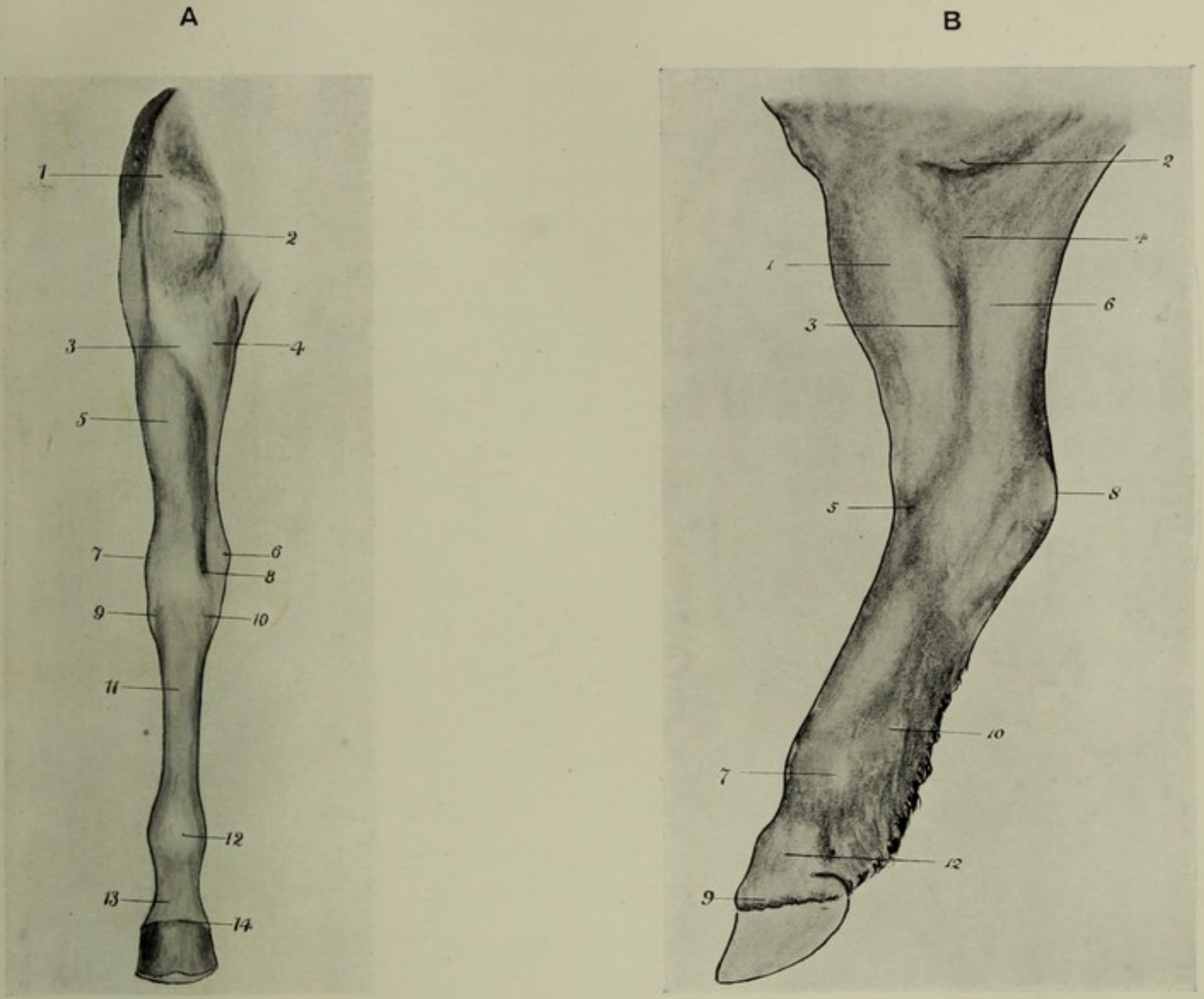

PLATE I.--ANTERIOR AND OUTER ASPECTS OF HIND LIMB

A.—RIGHT HIND LIMB, ANTERIOR ASPECT

1. Elevation formed by tendon of quadriceps muscle. 2. Elevation formed by patella. 3. Position of tibial crest. 4. Elevation formed by inner subcutaneous surface of tibia. 5. Elevation formed by belly of extensor pedis. 6. Position of internal malleolus. 7. External malleolus. 8. Depression (seat of bog spavin). 9. Position of cuboid. 10. Seat of spavin. 11. Metatarsal region. 12. Fetlock joint. 13. Position of pastern joint. 14. Coronet.

B.—OUTER ASPECT OF LEFT HIND LIMB

1. Elevation formed by belly of extensor pedis. 2. Position of head of fibula. 3. Seat of lower anterior tibial neurectomy. 4. Seat of upper ditto. 5. Bend of hock. 6. Elevation caused by belly of peroneus. 7. Fetlock. 8. Point of hock. 9. Coronet. 10. Seat of higher plantar neurectomy. 12. Position of pastern joint.

peroneus muscle. In some animals this nerve may also be felt beneath the skin and fascia. It takes a direction across the superficial aspect of the muscle downwards and forwards, which approaches nearer the vertical than that taken by the anterior tibial nerve. A large branch is given off by this nerve for the supply of the peroneus muscle, and the nerve, much reduced in size, continues its downward course along the line of the apposition of this muscle with the extensor pedis. During this part of its course, however, the nerve is more deeply seated, is wedged in between the two muscles, and cannot be felt in an examination such as we are now making.

The depression just mentioned is of great importance, since it is the seat of the operation of anterior tibial neurectomy.

The belly of the extensor pedis will be found to be succeeded by a tendon which passes beneath one of the annular bands at the inferior extremity of the tibia, and plays over the front of the hock slightly to the outer side of the middle line. Its subsequent course will be traced later, as also will the tendon of the peroneus, which runs in a vertical direction and plays through a groove on the outer side of the external malleolus of the tibia.

The back of the thigh is very fleshy, owing to the enormous bulk of the hamstring muscles, which extend to a much lower level than in man, so that in the horse the back of the stifle is well protected, and the posterior common ligament of the joint is deeply seated. The muscles of the hamstring also clothe and protect the great sciatic nerve with its accompanying vessels.

The inner aspect of the thigh will be found to be very flat, and the bone is here also clothed by muscles which are the adductors of the limb. Those which form the superficial layer, and are subcutaneous, are the sartorius anteriorly and the gracilis posteriorly. The gracilis occupies about four-fifths of the area described, and its surface is quite flat, whilst the skin covering the sartorius is slightly raised, since the muscle forms an elevation which runs downwards and backwards.

Behind the gracilis is another elevated area due to the underlying semimembranosus muscle.

Running obliquely upwards and forwards across the gracilis is the internal saphena vein, a vessel of large calibre which is formed by the union of the upward continuations of the outer and inner metatarsal veins. It dips in between the sartorius and gracilis about the junction of the upper and middle thirds of their line of apposition, and empties itself ultimately into the femoral vein. The application of pressure will cause the vessel to be raised, when its course becomes much more evident. It is occasionally adopted as a seat for the operation of venesection.

In front of the saphena vein is the saphena artery, a long and slender vessel which follows the course of the vein, and divides into two branches which accompany the outer and inner roots of the saphena vein.

Anteriorly placed to the saphena artery again is the internal saphena nerve. This arises from the anterior crural nerve at the brim of the pelvis, and emerges from between the sartorius and gracilis with the artery and vein. It will be further dealt with in the chapter on nerves.

The slight depression which indicates the position of the interstice between the sartorius and gracilis should be carefully examined, particularly in its upper part, which is the situation of the deep inguinal lymphatic glands. In this region the glands cover the underlying femoral vessels, and they become very evident in cases of lymphangitis.

If the hand be now passed down the inner aspect of the limb, it will be ascertained that the inner surface of the tibia is immediately subcutaneous, and it will also be found that the subcutaneous bone is widest above and gradually tapers as we descend. Manipulation of this part is of importance in the diagnosis of deferred fracture, of which particular injury the shaft of the tibia is the most common seat.

The very important region of the hock is next to be considered.

Assuming that the "near" hock is the one to be examined, the student should first stand with his face directed towards the horse's head, and should pass the palmar aspect of his right hand over the front of the hock. In this manner the tracing of the tendon of the extensor pedis may be made, and the tendon may be caused to stand out prominently if the hock be flexed. The main portions of the tendons of the flexor metatarsi muscle may also be traced to their insertion into the anterior face of the upper extremity of the large metatarsal bone, though these tendons are not quite so evident as is that of the extensor pedis.

On the inner aspect of the joint two prominent elevations are seen, the upper of which is caused by the internal malleolus of the tibia, and the one below it by the well-defined tubercle on the inner surface of the astragalus. The tubercle just mentioned varies considerably in size in different animals. The size of the tubercle is not a matter of great consequence, provided both tubercles are alike and well defined. The tubercle is only in rare and advanced cases involved in spavin, and when such happens it loses its well-defined outline, and in its place we have a diffused enlargement.

Running almost vertically across the internal malleolus of the tibia is a faint depression which, when we come to study the deeper anatomy of the joint, we shall find gives passage to a tendon, namely, that of the flexor accessorius muscle.

The usual *seat of spavin* is on the antero-internal aspect of the inferior third of the joint, and the touch of the fingers should be carefully educated to appreciate the exact normal conformation of this area. This is only brought about by constant practice, since the difference in external contour presented by a normal hock and many hocks affected with spavin is so slight that it is only appreciable to a sense of touch which has been cultivated to a considerable degree of delicacy.

Below the elevation caused by the tubercle of the astragalus a slight horizontally disposed elevation is found which curves round from the anterior to the internal aspect of the joint. This elevation corresponds

to the anterior and inner surfaces of the scaphoid bone. Immediately below this is a faint depression which runs parallel to the elevation just described. This depression is situate between the most prominent portion of the anterior and inner surfaces of the scaphoid above, and the anterior surface of the cuneiform magnum together with the inner surface of the cuneiform parvum below. These surfaces of the cuneiform bones cause another horizontal elevation, which, however, is not so well-defined as the one already described, being simply a faint upheaval of the surface. It differs moreover from the first-mentioned elevated area, inasmuch as it is not continuous, being interrupted by a little depression which is placed between the two cuneiform bones. This depression therefore is disposed vertically.

The horizontal elevation corresponding to the two cuneiform bones forms the superior boundary of a second transverse depression which is not so apparent as that already described, and which is bounded inferiorly by the prominent upper extremity of the large metatarsal bone and the head of the inner small metatarsal bone. This depression is crossed at right angles by the one which has been mentioned as running vertically, and the latter is continued in the downward direction between the prominences which indicate the position of the head of the inner small metatarsal bone and the large metatarsal bone.

The subjacent osseous structures to which the various elevations mentioned correspond, and their disposition one to the other will be easily understood by a reference to Plate XVIII.

Running inwards and slightly downwards from the front of the joint to the small cuneiform bone is a broad, flat tendon, which can be felt only when a considerable amount of pressure is applied. This is the cunean division of the tendon of the flexor metatarsi muscle.

The insertion of the cunean tendon will be found to be in line with a horny excrescence which is confined to the skin and which is called the chestnut.

The branch from the superficial tendon of this muscle may be felt,

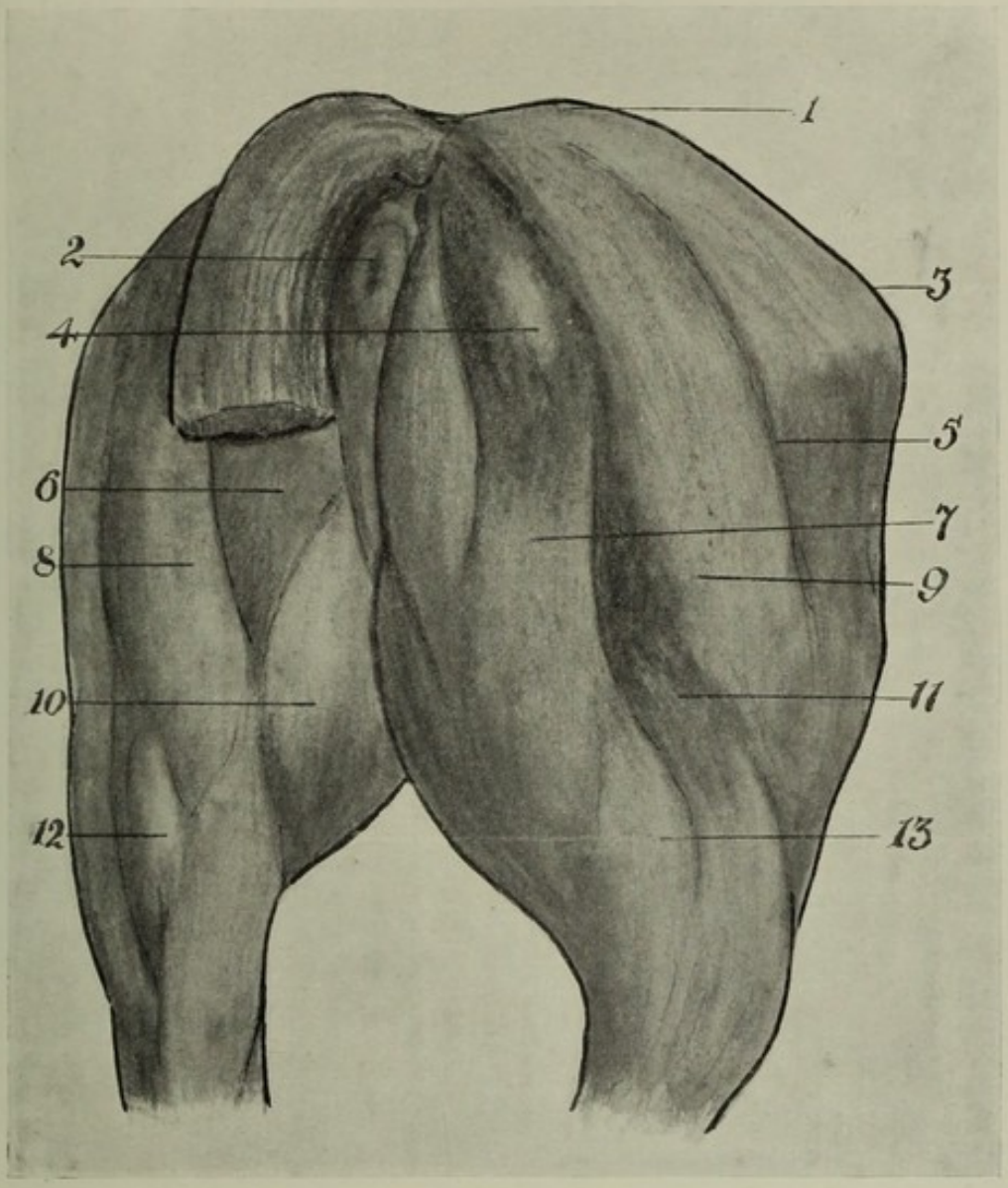

PLATE II.—THE HIND QUARTER VIEWED FROM BEHIND

1. Croup. 2. Anus. 3. Angle of haunch. 4. Elevation formed by tuber ischii. 5. Groove between biceps femoris and posterior arm of superficial gluteus. 6. Elevation formed by semimembranosus. 7 and 8. Elevations formed by semitendinosus. 9. Elevation formed by anterior or great head of biceps femoris. 10. Elevation formed by gracilis. 11 and 13. Elevations formed by two remaining heads of biceps femoris. 12. Gastrocnemius.

though less distinctly, to run outwards and with a slight downward inclination to its insertion into the cuboid bone.

The outer aspect of the hock should now be examined. It will be found that there is no tubercle on the external lateral aspect of the astragalus, but a faint depression will be felt in the part which corresponds to the position of the tubercle on the inner lateral surface of this bone.

Below the astragalus and calcis on this side of the joint is the cuboid, and inferiorly to this bone the head of the external small metatarsal bone will be easily located; and the observer should make himself quite familiar with its normal size, since an abnormally large head of the small metatarsal bone frequently leads to considerable confusion and constitutes the condition designated as false curb.

The outer aspect of the left hock is best examined with the left hand, with one's back directed towards the patient's head.

If the hand be now passed down the back of the leg the bulging bellies of the gastrocnemius will be felt, and from them the succeeding tendon may be traced. From two to three inches above the point of the hock it will be ascertained that another tendon twists round that of the gastrocnemius, passing from the deeper aspect of the latter to its inner side and subsequently being placed superficially to it.

This tendon is that of the superficial flexor of the digit (*i.e.*, the flexor perforatus), and it will be found to become very much flattened out as we approach the summit of the calcis which forms what is known as the point of the hock. This is the seat of the affection known as the capped hock.

At the middle or the summit of the calcis the tendon of the perforatus leaves that of its gastrocnemius, and the latter will be found to terminate. The perforatus tendon, however, plays over the upper extremity of the bone, and between it and the bone is interposed a small synovial bursa, to facilitate the gliding movement of the tendon.

The further course of the perforatus tendon may be traced, and it

will be found to run straight down the posterior border of the tuber calcis. It should be carefully noted that the surface in this region is straight, for a slight convexity of the surface of the postero-inferior aspect of the hock would most probably indicate the presence of a curb.

Below the hock another tendon makes its appearance, and is easily felt to be placed immediately in front of that of the perforatus. This is the tendon of the perforans muscle, and it has resumed its former position in front of the perforatus after leaving the tarsal sheath, to pass through which it left the perforatus above the hock.

Immediately below the hock on the antero-external aspect of the limb two tendons may be clearly detected as being subcutaneous. The tendon which is the nearer to the middle line is that of the extensor pedis muscle. The other is the peroneal tendon. If the course of each tendon be followed in the downward direction they will be found to become united to one another about four inches below the hock.

The tendon of the peroneus should next be traced in the upward direction, when it will be found to run obliquely upwards and backwards to gain the outer aspect of the hock joint, where it has already been followed to the groove on the external malleolus of the tibia.

On the inner and outer surfaces of the metatarsal region a groove is felt which takes a vertical direction. These grooves are situate between the large and small metatarsal bones.

Along part of the groove between the large metatarsal bone and the outer small metatarsal the large metatarsal artery runs, the position of which may be ascertained by the pulsation of the vessel, which can be detected without much difficulty. Tracing the vessel upwards, we find that the peroneal tendon crosses it obliquely in passing from the groove in the external tibial malleolus to its attachment to the tendon of the extensor pedis.

A tiny muscle runs in front of, and parallel to the tendon of the

peroneus muscle. This is the extensor brevis, and, like the peroneal tendon, this muscle also crosses the large metatarsal artery.

By tracing the tendons of the extensor pedis and peroneus, and the large metatarsal artery, upwards from the metatarsal region, it will be found that they become suddenly lost to the touch at the upper extremity of the large metatarsal bone, and further manipulation will reveal the presence of a transverse subcutaneous thickening. This is the most inferior of the three annular bands which are found at the hock, and under it the structures named, together with the extensor brevis muscle, pass.

The subtarsal or check ligament is not so easily felt as the corresponding structure in the fore limb.

In the inferior two-thirds of the metatarsal region only one tendon is felt on the anterior aspect of the limb, namely, that of the extensor pedis muscle. In the fore limb two tendons are present, for, in addition to the tendon of the extensor pedis, there is the tendon of the extensor suffraginis running to its insertion on the second phalanx.

CHAPTER II

SUPERFICIAL DISSECTIONS

OUTER ASPECT OF LIMB

Such a dissection is represented in Plates III. and IV.

The Bones

Near the upper extremity of the limb, the patella is seen to bulge prominently forwards (5). To its anterior face is attached the tendon of insertion of the quadriceps muscles (1) and also the external straight patellar ligament.

Below the patella is the anterior tuberosity of the tibia, which is continued downwards into the ridge of bone known as the tibial crest. The crest disappears as we descend the limb, since it gradually subsides to blend with the anterior face of the bone.

The external condyle of the femur (2) is placed behind the patella, and is partially concealed by a flat piece of muscular tissue which is the inferior extremity of one of the divisions of the biceps femoris muscle.

Inferiorly placed to this condyle, but separated from it by the outer semilunar cartilaginous disc, is the external tuberosity of the tibia, of which only the anterior portion is visible. It is separated from the anterior tuberosity by a well-marked notch, through which the tendon common to the extensor pedis and the superficial tendinous portion of the flexor metatarsi plays.

Descending from this tuberosity in a vertical direction for a

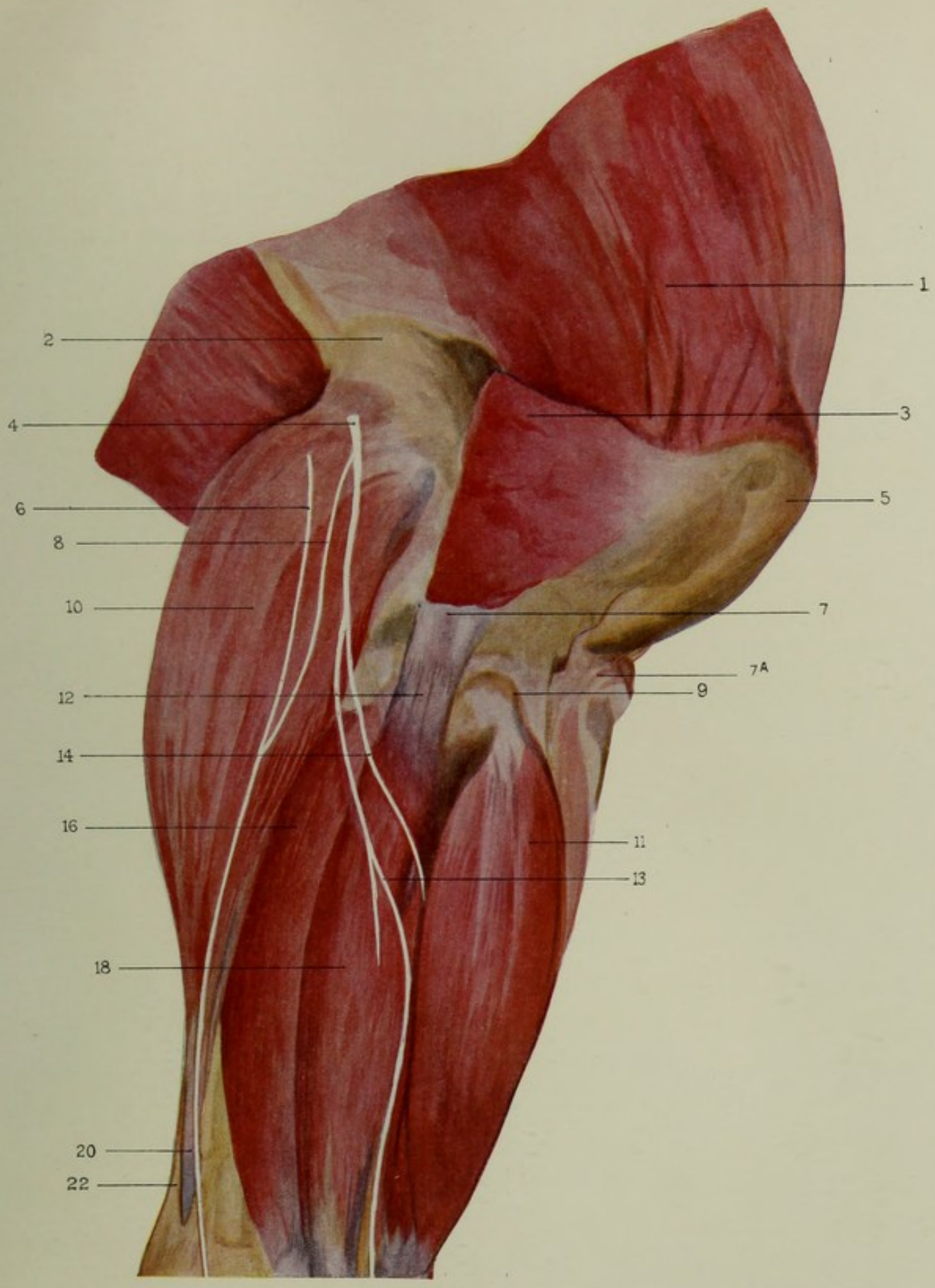

PLATE III. SUPERFICIAL DISSECTION.

HIND LIMB (RIGHT), OUTER ASPECT.—1. Quadriceps muscles. 2. Outer condyle of femur. 3. Insertion of superior division of biceps femoris. 4. External popliteal nerve. 5. Patella. 6. External saphenous nerve. 7. External lateral ligament of stifle. 7A. Insertion of external straight patellar ligament into anterior tuberosity of tibia. 8. Communicating branch from external popliteal nerve to external saphenous nerve. 9. Common tendon of extensor pedis and tendinous division of flexor metatarsi. 10. Outer belly of gastrocnemius. 11. Extensor pedis. 12. Tendon of origin of peroneus. 13. Musculo-cutaneous nerve. 14. Anterior tibial nerve. 16. Perforans muscle. 18. Peroneus muscle. 20. Tendon of gastrocnemius. 22. Tendon of perforatus playing over summit of tuber calcis.

N.B.—The soleus muscle has been removed.

distance of about twelve inches in the living animal, bone is again found to be superficially placed, and here we have the external malleolus of the tibia, which presents a well-marked vertical groove for the passage of the tendon of the peroneus muscle (23). The outer lateral surface of the astragalus is situate below the malleolus, and behind these two elevations is the prominent tuber calcis. This is concealed by the tendon of the perforatus, which is here very much flattened (22). Inferiorly to the calcis is the cuboid, and below this again we have the head of the outer small metatarsal bone (29). Extending obliquely downwards and forwards from the head is the body of the last-mentioned bone, which gradually tapers from above downwards. It terminates inferiorly in the rounded nodule termed the *button*, which is placed about two inches above the fetlock joint (35). The button is easily located in the living animal, since between it and the large metatarsal bone there is a slight interval, and the button springs a little upon the application of pressure.

In front of the small metatarsal bone is a groove down which the large metatarsal artery runs. The groove is bounded anteriorly by the large metatarsal bone. The greater part of the lateral surface of this bone is visible in the plate, and in the living animal is immediately subcutaneous (33).

The sesamoid bones are concealed from view by the broadened-out perforatus tendon and the lateral division of the suspensory ligament, but below the fetlock a considerable portion of the lateral surface of the suffraginis is represented, as is also the tuberous lateral aspect of its inferior extremity.

The Ligaments

The External Straight Patellar Ligament (7*a*).—This ligament runs downwards in a vertical direction from the anterior surface of the patella to the outer division of the anterior tuberosity of the tibia. In

the Plate the ligament is relaxed and dips inwardly between the patella and the tibia, owing to the fact that the former is placed at the lower end of the trochlea since the quadriceps muscles are relaxed.

The External Lateral Ligament of the Stifle (7).—This is represented as being attached to the external surface of the outer condyle of the femur above and to the head of the fibula below. The fibres of the peroneus muscle are seen to arise from this ligament.

At the front of the hock the three transverse *fibrous bands* are shown which hold the tendons playing over this part in position (15, 17, and 19).

The Great Suspensory Ligament (30) first becomes visible about three inches below the head of the small metatarsal bone, the upper portion of the ligament being concealed by the greater thickness of this bone.

Above the fetlock the ligament divides into two parts, and the outer division may be followed obliquely across the outer aspect of the fetlock-joint to the front of the limb, where it becomes united to the tendon of the extensor pedis, as in the fore limb.

The Muscles and Tendons

The Quadriceps Extensor Cruris (1).—These are the muscles which clothe the anterior and lateral surfaces of the shaft of the femur. Only the outer half of the inferior third of these muscles is shown, since the limb has been severed across the line of division between the middle and inferior thirds of the femur. The muscles are inserted on the anterior face of the patella.

They are the great extensors of the stifle joint, their action being transmitted to the limb through the medium of the straight ligaments of the patella.

They are supplied by the anterior crural nerve, and are the muscles which are affected in crural paralysis.

The Biceps Femoris (3).—This muscle is in three divisions: one is inserted into the patella, another into the tibial crest, and the third into

the fascia of the leg. Only about three inches of the insertion of the first-mentioned part are represented, the rest of the muscle having been removed to display the parts beneath it.

The Gastrocnemius (10).—This muscle has two heads: the outer is represented in the Plate, and it arises from the outer lip of the supracondyloid fossa. The two heads unite, forming the prominent bulging mass which corresponds to the calf in the human leg. This mass is succeeded by a powerful tendon, which descends in a vertical direction to the summit of the tuber calcis, where it obtains insertion in the depression separating the two elevations on this bone. The gastrocnemius is a powerful extensor of the hock joint, and is also a slight flexor of the stifle. It is supplied by the internal popliteal nerve.

The Flexor Perforatus (22 and 26).—Deeply seated to the gastrocnemius is the flexor perforatus, which is therefore concealed from view. It arises from the depth of the supracondyloid fossa, and runs down the limb in front of the gastrocnemius. At the summit of the calcis its tendon is superposed to that of the latter muscle and forms a cap. It gives off a slip of insertion to the tuber calcis on either side and takes a course straight down the back of the calcis, where it is concealed by the thick layer of fascia represented in the Plate.

Below the hock the tendon is plainly visible, and its edge has been displaced slightly backwards to display more effectively the structures which lie in front of it. At the fetlock it forms the tube through which the tendon of the flexor perforans passes, and it ultimately obtains insertion into the os coronæ. This muscle is an extensor of the hock, and a flexor of the fetlock and pastern joints. It is supplied by the internal popliteal nerve.

The Flexor Perforans (16).—On this aspect of the limb a considerable portion of this muscle is visible. It is placed between the peroneus muscle in front and the gastrocnemius behind, occupying most of the space between these two muscles from the stifle to the hock. It arises from the external tuberosity and posterior surface of the shaft of

the tibia, from the head of the fibula, and from the tibio-fibular interosseous membrane.

The muscular portion keeps in close relationship to the peroneus throughout its course, and its tendon disappears through the tarsal sheath, where it glides over the supero-posterior aspect of the body of the calcis to the inner side of the tuber. The tendon again makes its appearance below the hock as it leaves the sheath. It is plainly visible owing to the slight displacement of the tendon of the perforatus (28). It continues its course down the limb between the suspensory ligament in front and the perforatus tendon behind, and along its edges run the plantar nerves and vessels. It next plays through the ring formed by the perforatus, leaves the ring below the fetlock, and becomes ultimately inserted into the semilunar crest of the pedal bone.

The perforans is an extensor of the hock and a flexor of the fetlock, pastern, and corono-pedal joints. It is supplied by the internal popliteal nerve.

The Peroneus Muscle (18).—This muscle arises from the external lateral ligament of the stifle, from the outer tuberosity of the tibia, and from the head of the fibula. The tendon of origin is plainly visible, and is succeeded by a well-defined elongated muscular belly, which is represented throughout its extent. Its inferior tendon commences above the hock. It then passes along the groove on the external malleolus, over the large metatarsal artery, and under the most inferior of the three annular bands to become united to the tendon of the extensor pedis from three to four inches below the hock (23).

The peroneus muscle assists the extensor pedis, and is supplied by the musculo-cutaneous division of the external popliteal nerve.

The Extensor Pedis (11).—This muscle is also represented from its origin to its insertion : it arises in common with the tendinous division of the flexor metatarsi from the pit which is placed between the external femoral condyle and the outer lip of the trochlea.

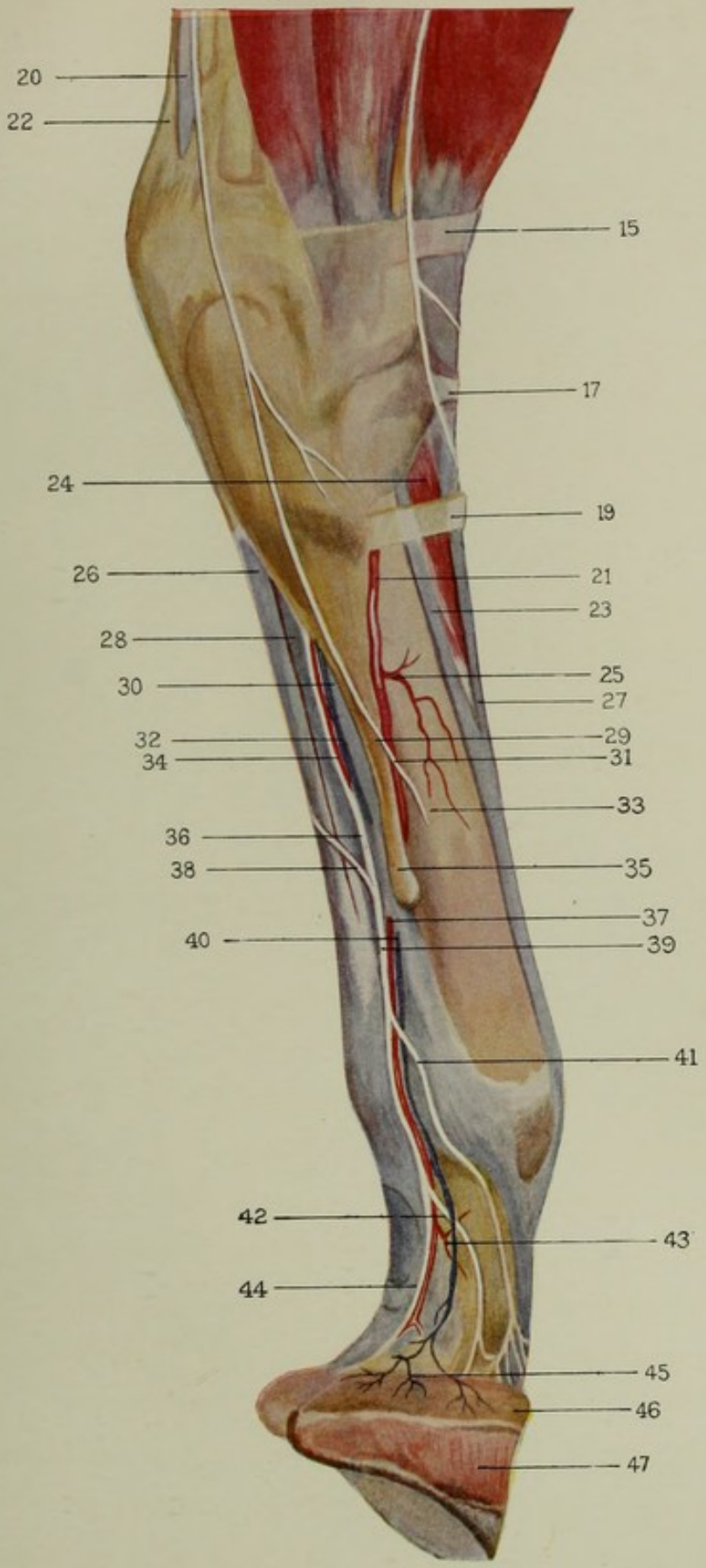

PLATE IV. SUPERFICIAL DISSECTION (continued).

HIND LIMB (RIGHT), OUTER ASPECT.—15. Superior annular band. 17. Middle annular band. 19. Inferior annular band. 20. Tendon of gastrocnemius. 21. Large metatarsal artery. 22. Tendon of perforatus playing over summit of tuber calcis. 23. Tendon of peroneus. 24. Extensor brevis. 25. Branch of large metatarsal artery. 26. Perforatus tendon below hock. 27. Tendon of extensor pedis. 28. Tendon of perforans. 29. Outer small metatarsal bone. 30. Suspensory ligament. 31. Terminal filament of external saphenous nerve. 32. External metatarsal vein. 33. Large metatarsal bone. 34. Unnamed artery descending with plantar nerve. 35. Button of outer small metatarsal bone. 36 and 39. External plantar nerve. 37. External digital artery. 38. Communicating branch from internal plantar nerve. 40. External digital vein. 41. Anterior digital nerve. 42. Middle digital nerve. 43. Perpendicular artery of pastern. 44. Posterior digital nerve. 45. Plexus of veins on external surface of lateral cartilage. 46. Coronary cushion. 47. Sensitive laminæ.

N.B.—The external metatarsal vein usually emerges from the venous arch near the fetlock slightly lower down than represented in the plate.

The tendon passes through the deep notch between the anterior and external tuberosities of the tibia, and is immediately succeeded by the belly of the muscle. The latter is even better defined than is that of the peroneus, and forms a prominent fusiform mass, which causes a well-marked elevation of the skin in this region.

The inferior tendon commences just above the hock, and passes beneath all three annular bands. It then takes a course down the limb, slightly to the outer side of the middle line. It is joined below the hock by the tendon of the peroneus and below the fetlock by both branches of the suspensory ligament.

As it passes over the fetlock it is related to the anterior common ligament, but at the pastern-joint it takes the place of the anterior ligament and gives support by its deep face to the synovial membrane of the joint as in the fore limb.

This muscle is a flexor of the hock and an extensor of the fetlock and inter-phalangeal joints. It is also a slight extensor of the stifle. It is supplied by the anterior tibial nerve.

The Extensor Brevis (24).—This small muscle is placed between the tendons of the peroneus and extensor pedis. It arises from the astragalus and os calcis, and is inserted into the tendon of the extensor pedis, near where the peroneal tendon becomes united to the latter. It assists the extensor pedis, and is supplied by the anterior tibial nerve.

THE BLOOD-VESSELS

The Arteries

No vessels are represented in the upper half of the limb.

Below the hock the *Large Metatarsal Artery* (21) makes its appearance after having passed beneath the extensor brevis and the tendon of the peroneus. It runs down the limb in the groove between the large metatarsal and outer small metatarsal bones. Just above the

button of the small metatarsal it disappears through the interval between this bone and the large metatarsal to gain the back of the limb, where it divides between the two divisions of the suspensory ligament into the external and internal digital arteries.

The External Digital Artery (37).—This appears behind the outer division of the suspensory ligament and takes a vertical course across the outer aspect of the fetlock-joint, being behind the digital vein, and in front of the plantar nerve on the outer edge of the perforans tendon. Near the middle of the os suffraginis it gives off the *perpendicular artery* (43) of the pastern, which runs forwards along this bone and divides into ascending and descending branches.

The digital artery divides on the inner aspect of the lateral cartilage into the plantar and preplantar (ungual) arteries.

The Veins

The External Digital Vein (40).—This is formed by the union of vessels which drain the plexuses of the foot. One of these plexuses is represented, namely, that on the outer aspect of the external lateral cartilage (45). This plexus communicates with that on the deep face of the cartilage through the cartilage itself.

The vein thus formed runs upwards in front of the corresponding digital artery, crossing the anterior and middle digital nerves. Above the fetlock it disappears from view, since it dips in between the suspensory ligament and perforans tendon, to assist in the formation of the venous arch which is here placed. From this arch three veins are given off, namely, the external, middle, and deep metatarsals.

The External Metatarsal Vein (32) leaves the arch, runs outwards, and appears on the edge of the perforans tendon. It takes an upward course on the tendon in front of the small unnamed artery (34), which descends from the tarsal arterial arch, and disappears with the tendon through the tarsal sheath.

Above the hock it will be seen on the inner aspect of the limb, where it forms the smaller of the two roots of the internal saphena vein.

The Nerves

The External Saphena Nerve (6).—This is a branch of the great sciatic nerve. It is given off from the latter at a point which varies from two to six inches from the place where it dips between the two heads of the gastrocnemius muscle.

It passes along the external aspect of the outer head of the muscle named, and receives a reinforcing branch (8) from the external popliteal nerve. This branch leaves the external popliteal above the stifle, and runs downwards and backwards across the gastrocnemius muscle.

The external saphena nerve continues its course down the limb in front of the tendo-achilles, and gives off cutaneous branches, which are distributed on the outer lateral aspect of the hock. The nerve usually terminates in the skin about midway between the hock and fetlock, but occasionally it is continued much lower down the limb, to be distributed to the skin covering the phalanges.

The External Popliteal Nerve (5).—This nerve is a branch of the great sciatic, from which it is given off almost immediately after the latter leaves the pelvic cavity. It runs obliquely downwards and forwards, and passes between the biceps femoris and the outer head of the gastrocnemius. The former muscle having been removed, the nerve is first visible in the Plate where it lies on the gastrocnemius.

Immediately below the point of detachment of the communicating branch to the external saphena nerve, this nerve gives off its peroneal-cutaneous branch. The latter nerve runs along the inferior border of the biceps femoris, and splits up into a number of branches, which are distributed to the skin in front of the stifle and the leg. The peroneal-cutaneous nerve being more superficially placed, is not represented in the Plate.

The external popliteal nerve takes a downward course behind the external lateral ligament of the stifle, and divides into the anterior tibial and musculo-cutaneous nerves.

The Anterior Tibial Nerve (14).—This is one of the terminal divisions of the external popliteal nerve. It runs obliquely downwards and forwards across the outer aspect of the peroneus muscle, and from one and a half to two inches below the head of the fibula it disappears by dipping between the last-named muscle and the extensor pedis.

This nerve supplies the extensor pedis, the flexor metatarsi, and the extensor brevis muscles, and it terminates in the skin of the metatarsus.

The Musculo-Cutaneous Nerve (13).—This nerve also runs obliquely downwards and forwards, but behind the anterior tibial nerve. It gives off a large branch to the peroneus muscle, and then continues its course along the line of apposition of this muscle with the extensor pedis. It distributes cutaneous branches to the front of the hock, and terminates in the skin towards the middle of the metatarsal region.

The External Plantar Nerve (36).—This leaves the tarsal sheath on the edge of the perforans tendon, being placed behind the unnamed artery which descends from the arterial arch at the tarsus. Near the button of the splint bone it receives the communicating branch from the internal plantar nerve, and it ultimately terminates by splitting up into the anterior, middle, and posterior digital nerves, which are distributed after the manner of the corresponding nerves of the fore limb.

INNER ASPECT OF LIMB (PLATES V. AND VI.)

THE BONES

THE inner half of the patella forms the bulging near the upper end of the Plate, which somewhat resembles that caused by the outer half of this

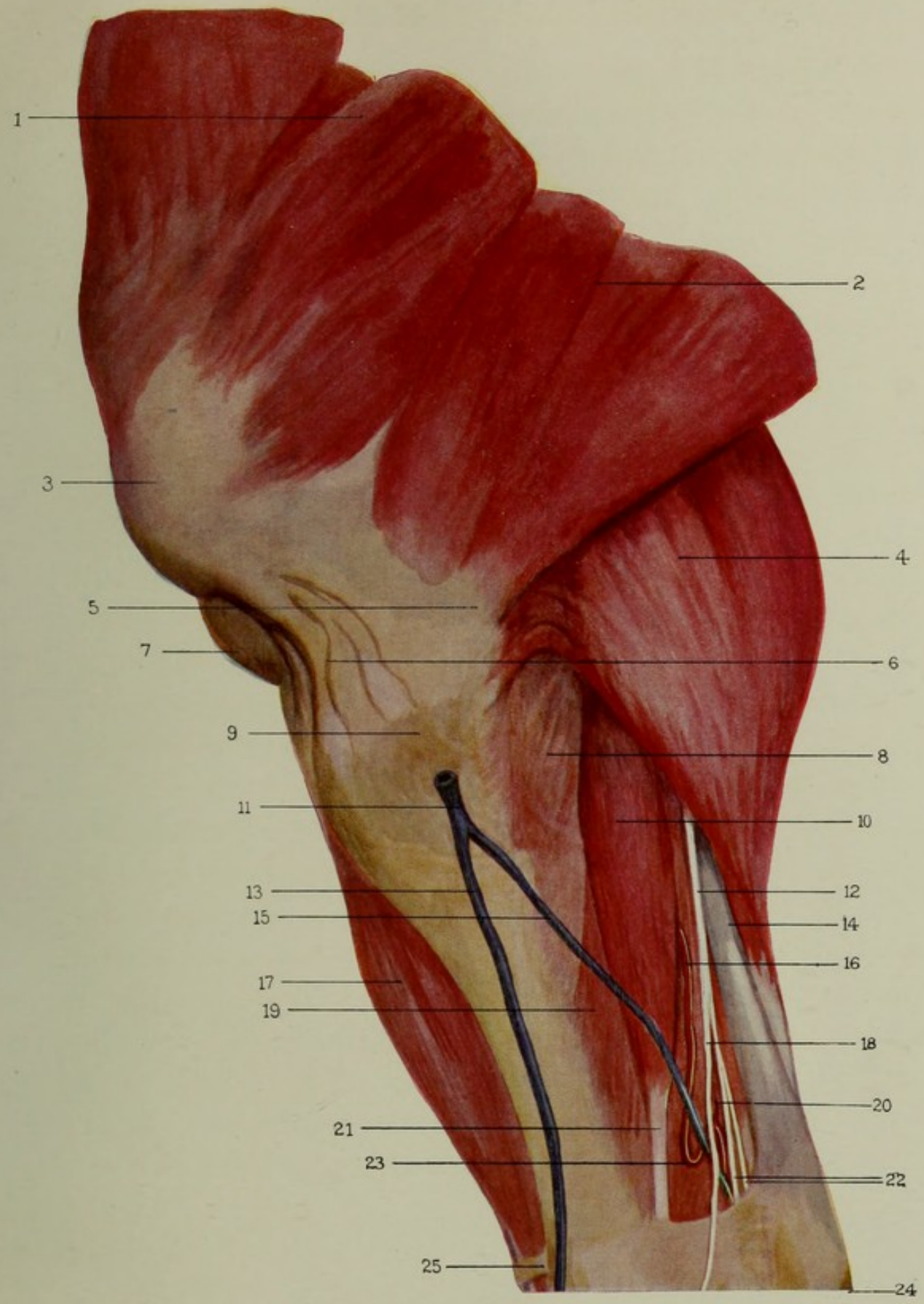

PLATE V. SUPERFICIAL DISSECTION.

HIND LIMB (RIGHT), INNER ASPECT.—1. Quadriceps muscles. 2. Sartorius and gracilis. 3. Patella. 4. Gastrocnemius (inner belly). 5. Internal lateral ligament of stifle. 6. Internal straight ligament of patella. 7. Trochlea of femur (inner lip). 8. Popliteus muscle. 9. Internal (subcutaneous) surface of tibia. 10. Flexor accessorius muscle. 11. Internal saphena vein. 12. Posterior tibial nerve. 13. Anterior root of internal saphena vein. 14. Perforatus tendon. 15. Posterior root of internal saphena vein. 16. Posterior tibial artery. 17. Flexor metatarsi (deep or muscular division). 18. Cutaneous branch of posterior tibial nerve. 19. Flexor perforans. 20. Retrograde branch of posterior tibial artery. 21. Tendon of flexor accessorius. 22. Plantar nerves. 23. Sigmoid curve of posterior tibial artery. 24. Summit of tuber calcis covered by perforatus tendon. 25. Superior annular band.

N.B.—The belly and tendon of the gastrocnemius have been drawn slightly backwards in order to display more fully the posterior tibial nerve.

bone. It differs, however, in being much more pointed. To it the inner portions of the quadriceps muscles are attached (3).

Below the patella is the anterior tuberosity of the tibia, a better view of which is obtained on this aspect of the limb, and its continuity inferiorly with the tibial crest, is well marked (9).

The patella in this case is drawn well up the trochlea of the femur, and the inner condyle of the latter bone is concealed by the gracilis muscle, as is also the internal lateral ligament of the stifle-joint.

The internal tuberosity of the tibia forms a prominent elevation to which the gracilis is attached (2).

The inner lateral surface of the tibia is visible in the Plate throughout its extent, since it is immediately subcutaneous and corresponds to the human shin. It is widest above, and becomes gradually narrower as it nears the hock. It is slightly convex in the transverse direction, and almost straight from above to below. Inferiorly this surface is seen to terminate in a well-marked tuberous elevation, which is the internal malleolus of the tibia.

This malleolus presents a vertical groove for the passage of the tendon of the flexor accessorius muscle (21).

Below the internal malleolus is the tubercle of the astragalus, inferiorly to which come successively the scaphoid, cuneiform magnum, and large metatarsal bones. The small cuneiform bone is for the greater part concealed by the cunean branch of the tendon of the flexor metatarsi muscle. Behind the malleolus, and at a slightly higher level, is the summit of the tuber calcis (24).

The inner aspect of the large metatarsal bone is represented throughout its extent (33), as is also that of the inner small metatarsal (39).

Part of the lateral aspect of the first phalanx is also shown, upon which ramifies the perpendicular artery of the pastern (49).

The Ligaments

The Internal Straight Ligament (6) of the patella is seen to be much more tense than was the outer ligament. This is due to the position of the patella. The ligament runs from the anterior surface of the patella to the inner division of the anterior tuberosity of the tibia. The internal lateral ligament of the stifle is, as already stated, covered by the insertion of the gracilis.

The *Great Suspensory Ligament* is plainly visible, and makes its first appearance a short distance below the hock. Behind the ligament is the perforans tendon. The ligament is crossed upwards and forwards by the internal metatarsal vein. Above the fetlock, as already described, it divides into two portions, and the inner branch is seen to cross this aspect of the fetlock joint and to join the extensor pedis tendon in a manner resembling that of the outer branch.

The inner portions of the three annular bands already referred to are now seen. Underneath the most superior of the bands the tendons of the flexor metatarsi and extensor pedis muscles run, whilst the remaining two bands arch over the tendon of the last-named muscle only.

Muscles and Tendons

The Quadriceps Extensor Cruris.—Of these muscles only the inferior third of the vastus internus and of the inner portion of the rectus femoris is represented (1). Their insertion, action, and nerve-supply have already been given.

The Gracilis (2).—The inferior third of this muscle is shown as a broad, flat sheet, which conceals to a great extent the corresponding portion of the sartorius. The gracilis arises from the ischio-pubic symphysis, and is inserted into the internal tuberosity of the tibia. It is a powerful adductor of the limb, and derives its nerve-supply from the obturator nerve.

The Gastrocnemius (4).—The inner head of this muscle appears from beneath the gracilis. The origin of this head from the supra-condyloid crest is concealed by the muscle just mentioned. This portion of the gastrocnemius has been displaced backwards in order to display more fully the posterior tibial nerve, which emerges from beneath the muscle.

The Tendon of the Perforatus (14) will be observed to be placed at first in front of that of the gastrocnemius. It then passes round the inner aspect of the latter and becomes placed superficially to it, to continue its course over the summit of the tuber calcis and down the limb in the manner already described.

The Popliteus (8).—This muscle arises from the lower and more anterior of the two pits on the outer aspect of the external condyle of the femur. Its origin is not displayed in the Plates representing the outer aspect of the limb, since it is concealed by the external lateral ligament of the stifle, under which the tendon of the muscle runs.

The popliteus covers the posterior common ligament of the joint. Its fibres take an oblique direction downwards and inwards, and are inserted into the special tubercle on the postero-internal aspect of the shaft, and the upper two-thirds of the inner edge, of the tibia.

The greater portion of the muscle lies in the triangular, smooth, depressed area with its apex directed downwards, which is found on the back of the upper third of the tibia. This muscle is a flexor and slight inward rotator of the stifle, and its nerve-supply is derived from the internal popliteal nerve.

The Flexor Accessorius (10).—Running obliquely downwards and inwards, and placed in a groove along the line of apposition of the popliteus and flexor perforans, is the flexor accessorius. The greater portion of this muscle is visible, but its origin is concealed by the gastrocnemius. It arises at the back of the external tuberosity of the tibia. Its tendon of origin is succeeded by a somewhat flattened but

well-defined muscular portion, and this in turn is followed by a long tendon of insertion.

The latter tendon is observed to disappear at the tarsus, on the inner side of which it plays through a synovial passage. It leaves this tube and unites with the tendon of the flexor perforans immediately below the hock, the position where they unite being just visible in the Plate.

The flexor accessorius assists the flexor perforans, and is supplied by the internal popliteal nerve.

The Flexor Perforans (19).—A portion of this muscle is represented, namely, that part which arises from the vertical ridges on the back of the tibia, below the insertion of the popliteus. Along this part of the muscle the tendon of the flexor accessorius runs.

The tendon of the perforans plays through the tarsal sheath and runs down the limb in the manner already described, being related to the corresponding vessels and nerves on this aspect of the limb.

The Perforatus Tendon (30) is better defined than in the Plates representing the outer aspect, and the resumption of its relationship behind that of the perforans, after the latter has left the tarsal sheath, is evident.

THE BLOOD-VESSELS

The Arteries

The Posterior Tibial Artery (16).—This vessel is one of the terminal divisions of the popliteal artery, which splits up into the anterior and posterior tibial vessels just below the stifle. It is much the smaller of the two branches. The larger branch—the anterior tibial artery—passes forwards through the tibio-fibular arch, and runs down the front of the tibia beneath the flexor metatarsi muscle. It is therefore deeply seated, and is in consequence not represented in the preceding Plate. At the tarsus it divides into the *perforating tarsal and large metatarsal arteries*, the

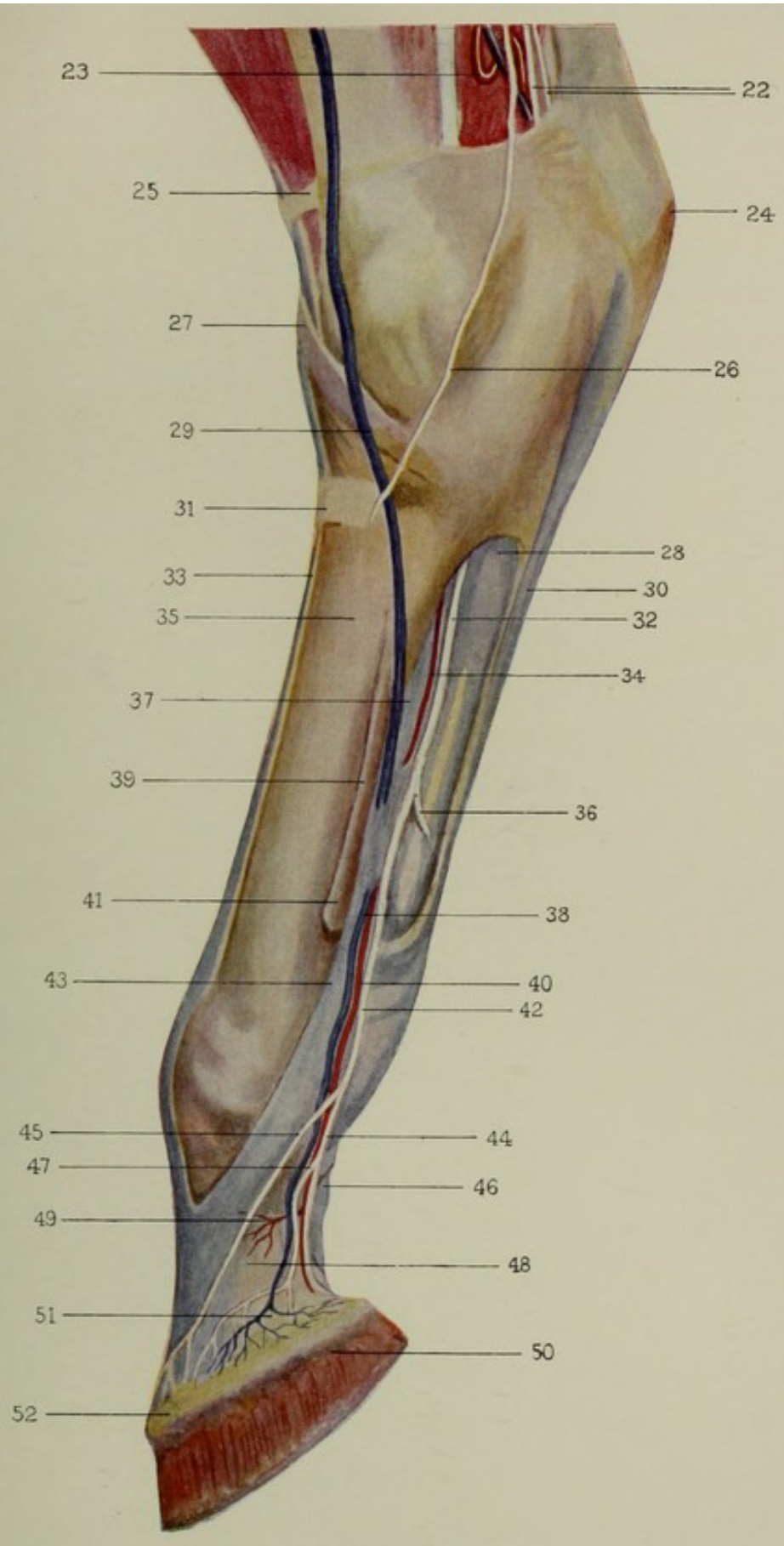

PLATE VI. SUPERFICIAL DISSECTION (continued).

HIND LIMB (RIGHT), INNER ASPECT.—22. Plantar nerves. 23. Sigmoid curve of posterior tibial artery. 24. Summit of tuber calcis covered by perforatus tendon. 25. Superior annular band. 26. Cutaneous branch of posterior tibial nerve passing over seat of spavin. 27. Cunean tendon. 28. Tendon of perforans leaving tarsal sheath. 29. Internal metatarsal vein passing upwards to form anterior root of internal saphena vein. 30. Perforatus tendon. 31. Inferior annular band. 32. Internal plantar nerve. 33. Extensor pedis tendon. 34. Unnamed artery descending with plantar nerve. 35. Large metatarsal bone. 36. Communicating branch from internal plantar nerve. 37. Suspensory ligament. 38. Internal digital vein. 39. Internal small metatarsal bone. 40. Internal digital artery. 41. Button of small metatarsal bone. 42. Internal plantar nerve. 43. Inner branch of suspensory ligament. 44. Posterior digital nerve. 45. Anterior digital nerve. 46. Tendon of perforans leaving ring formed by perforatus. 47. Middle digital nerve. 48. Os suffraginis. 49. Perpendicular artery of pastern. 50. Sensitive laminæ. 51. Plexus of veins on lateral cartilage. 52. Coronary cushion.

N.B.—The internal metatarsal vein usually emerges from the venous arch near the fetlock slightly lower down than represented in the plate.

latter of which has already been followed. The former passes from front to back of the tarsus through the canal formed between the cuboid, scaphoid, and cuneiform magnum, and assists the plantar arteries in forming the arterial arch of the tarsus.

The posterior tibial artery first becomes visible in the Plate where it makes its appearance from beneath the flexor accessorius. It here lies on the flexor perforans muscle. It runs down the limb on the last-named muscle, and is crossed by the posterior root of the internal saphena vein, and also by the cutaneous branch of the posterior tibial nerve.

Just above the hock it forms a peculiar **S**-shaped curve, and from the second portion of this curve a *retrograde branch* is given off which ascends the limb in front of the posterior tibial nerve.

The artery then divides into the external and internal plantar vessels. These accompany the perforans tendon through the tarsal sheath, and contribute to the formation of the arterial arch referred to above.

From this arch four branches are given off. Two of these run down the limb, one on either edge of the suspensory ligament, being placed between the ligament and the small metatarsal bones. These are the *Plantar Interosseous Arteries*. The outer anastomoses with the small recurrent branch of the large metatarsal artery, and the inner, which gives off the nutrient artery to the large metatarsal bone, unites with the large metatarsal artery itself.

The remaining branches of the arch are the *two small unnamed vessels* which accompany the plantar nerves. The inner one is represented in the Plate.

The arrangement and distribution of the arteries and veins, from the fetlock downwards, conform to the description given of the corresponding vessels on the outer aspect of the limb.

The Veins

The Internal Metatarsal Vein (29).—This is a large vessel which is given off from the venous arch formed across the limb immediately above the fetlock. It runs for a short distance along the edge of the perforans tendon, and then leaves the tendon to pass obliquely upwards and forwards across the inner edge of the suspensory ligament and the inner splint bone. The vein is crossed by the cutaneous branch from the posterior tibial nerve, and then inclines slightly forwards, running across the seat of spavin, to be continued upwards on the inner surface of the shaft of the tibia as the internal saphena vein of which it forms the anterior root.

The external metatarsal vein has already been followed in the description of the outer aspect of the limb until it disappears in the tarsal sheath. It is now represented as it leaves the sheath, where it is found in front of the posterior tibial artery (15). It inclines upwards and forwards, crossing the artery above the sigmoid flexure, and also the flexor accessorius and popliteus muscles. Arriving at the broad upper portion of the inner aspect of the tibial shaft it joins the internal saphena vein of which it is regarded as the posterior root.

The Nerves

The Posterior Tibial Nerve (12).—This is the direct continuation of the internal popliteal nerve. It is seen as it leaves the inner head of the gastrocnemius muscle, being more fully displayed owing to the slight displacement of this muscle. It takes a vertical course downwards in front of the tendo-achilles, and just above the hock divides into the two plantar nerves (22), which accompany the perforans tendon through the tarsal sheath.

About five inches above the point of the hock the nerve gives off an important cutaneous branch (18), which crosses the posterior tibial

artery and the posterior root of the internal saphena vein. It runs obliquely downwards and forwards across the seat of spavin to terminate in the skin of the metatarsus. The nerve is displayed in the Plate, and is important in the treatment of spavin by neurectomy.

The Internal Plantar Nerve (32) is visible where it leaves the tarsal sheath. Its course down the limb on the edge of the perforans tendon, and the distribution of its terminal divisions, coincide with the description already given of the external plantar nerve. About midway down the metatarsal region it gives off the communicating branch which joins the external plantar nerve just above the level of the button of the splint bone (36).

CHAPTER III

THE LIMB IN SECTION

A TRANSVERSE section is made across the stifle joint and the principal nerves and vessels, ligaments, etc., are represented in Plate VII.

The anterior tuberosity of the tibia has been sawn through and the joint then disarticulated below the fibro-cartilaginous discs, so that the superior surfaces of the two articular tuberosities of the tibia are represented. This surface of the internal tuberosity is seen to be continued upwards on the inner aspect of the tibial spine.

On the outer aspect of the spine is seen the attachment of the anterior or external crucial ligament, in front of which the anterior coronary ligament from the internal disc is observed to be inserted.

Projecting outwardly from the postero-external angle of the internal tuberosity, and placed just below its articular surface, is a well-defined tubercle. This is the special tubercle to which the posterior crucial ligament of the joint is attached inferiorly. The ligament is plainly visible in the Plate.

On the inner aspect of the joint the internal lateral ligament of the stifle will be observed to be attached to the internal tibial tuberosity, the attachment being just below the articular surface.

Placed anteriorly in the Plate, three ligaments will be observed. These are the external, middle, and internal straight ligaments of the patella. The external ligament is attached to the outer or more prominent division of the anterior tuberosity. The upper end of this portion is visible since the saw has passed through it. The middle ligament is inserted

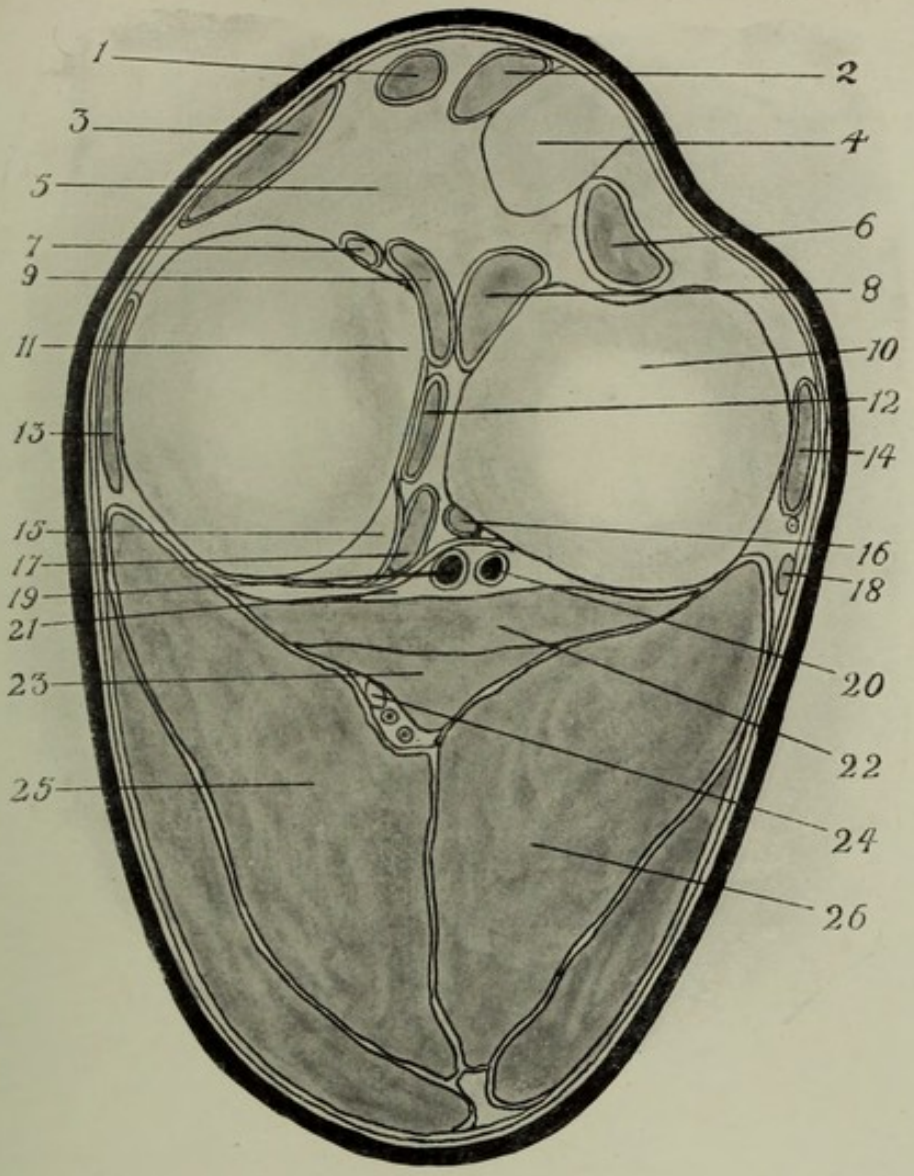

PLATE VII.—TRANSVERSE SECTION OF LEFT STIFLE, INDICATING BONES, LIGAMENTS, THE POPLITEAL VESSELS AND NERVES, AND PRINCIPAL MUSCLES

1. Middle straight patellar ligament. 2 and 3. External and internal ditto. 4. Outer portion of anterior tuberosity of tibia. 5. Adipose tissue. 6. Common tendon of extensor pedis and tendinous division of flexor metatarsi, with its sheath. 7 and 12. Anterior and posterior coronary ligaments from internal disc. 8 and 16. Ditto from external disc. 9. Insertion of anterior crucial ligament. 10. External tuberosity. 11. Tibial spine. 13. Internal lateral ligament. 14. External ditto. 15. Tubercle at back of internal tuberosity. 17. Insertion of posterior crucial ligament. 18. External popliteal nerve. 19 and 20. Popliteal vein and artery. 21. Posterior common ligament. 22. Popliteus muscle. 23. Flexor perforatus. 24. Internal popliteal nerve. 25 and 26. Inner and outer heads of gastrocnemius.

N.B.—See descriptive text, chapters ii., iii. and v. for other muscles, vessels and nerves.

into the lower end of the groove, which runs vertically down the front of the anterior tuberosity, whilst the internal ligament is inserted into the inner portion of the anterior tuberosity, slightly below the level of the section.

In the interval between the portion of the anterior tuberosity represented and the anterior aspect of the external tuberosity, is a well-defined tendon surrounded by a plainly visible sheath. This is the tendon which is common to the extensor pedis, and the superficial or tendinous division of the flexor metatarsi muscle. It arises from the deep pit which is placed between the outer lip of the trochlea and the external condyle of the femur. The tendon is thick and very powerful, and is not attached to either of the two tibial tuberosities mentioned, but plays freely through the notch between them.

The articular surface of the external tibial tuberosity is usually referred to as being saddle-shaped. It is separated from the tibial spine by a roughened area which affords attachment to ligaments already described. To the outer surface of this tuberosity the external lateral ligament of the stifle is attached. The ligament is plainly visible in the Plate, and the position of its attachment is represented on the dried bone by a roughened area just below the articular surface.

Posteriorly the joint is closed by the posterior common ligament. It is attached to the back of the posterior tuberosities of the tibia.

Lying on the posterior surface of the ligament, and consequently in intimate relationship to the joint are two large vessels, the outer and smaller is the popliteal artery, whilst the inner is the popliteal vein. It will be noticed that the vessels are covered posteriorly by a muscle, which stretches across the back of the joint. This is the popliteus muscle, the tendon of origin of which arises from the more inferior of the two roughened depressions on the outer side of the external condyle of the femur.

Crossing the popliteus muscle, and placed almost in the median

line the flexor perforatus, which arises from the supracondyloid fossa of the femur and which plays over the back of the stifle joint, will be observed. Behind the flexor perforatus again there are two large muscles. These are the outer and inner heads of the gastrocnemius. The outer head arises from the outer lip of the supracondyloid crest. At the level of the section the two heads will be observed to come into apposition with each other in the median line, and a little lower down they become united to one another.

Near the anterior border of the outer head of the gastrocnemius, and placed superficially between the outer aspect of the muscle and the deep layer of fascia, is the external popliteal nerve. This is one of the branches of the great sciatic nerve, which it leaves soon after the latter emerges from the greater sacro-sciatic foramen. The external popliteal, in turn, divides into the anterior tibial and musculo-cutaneous nerves a little below the level of the section.

The internal popliteal nerve will be observed to lie on the anterior aspect of the inner head of the gastrocnemius. This nerve is directly continued as the posterior tibial nerve, which lower down the limb emerges from beneath this muscle and becomes ultimately split up into the external and internal plantar nerves.

Other structures are represented in the Plate which have comparatively little surgical importance.

Plate VIII. represents a transverse section at the seat of posterior tibial neurectomy (*i.e.*, 5.5 inches above the summit of the tuber calcis). The section is one of the left limb.

In the middle of the Plate, but towards the inner side, is observed the tibia. The outline of the bone here in section, is peculiar, its inner aspect being rounded, whilst outwardly it is drawn out to a point. This indicates the edge to which the tibio-fibular interosseous membrane is attached.

Lying on the anterior face of the bone we have a large, transversely elongated muscular mass. This is the flexor metatarsi, the muscular

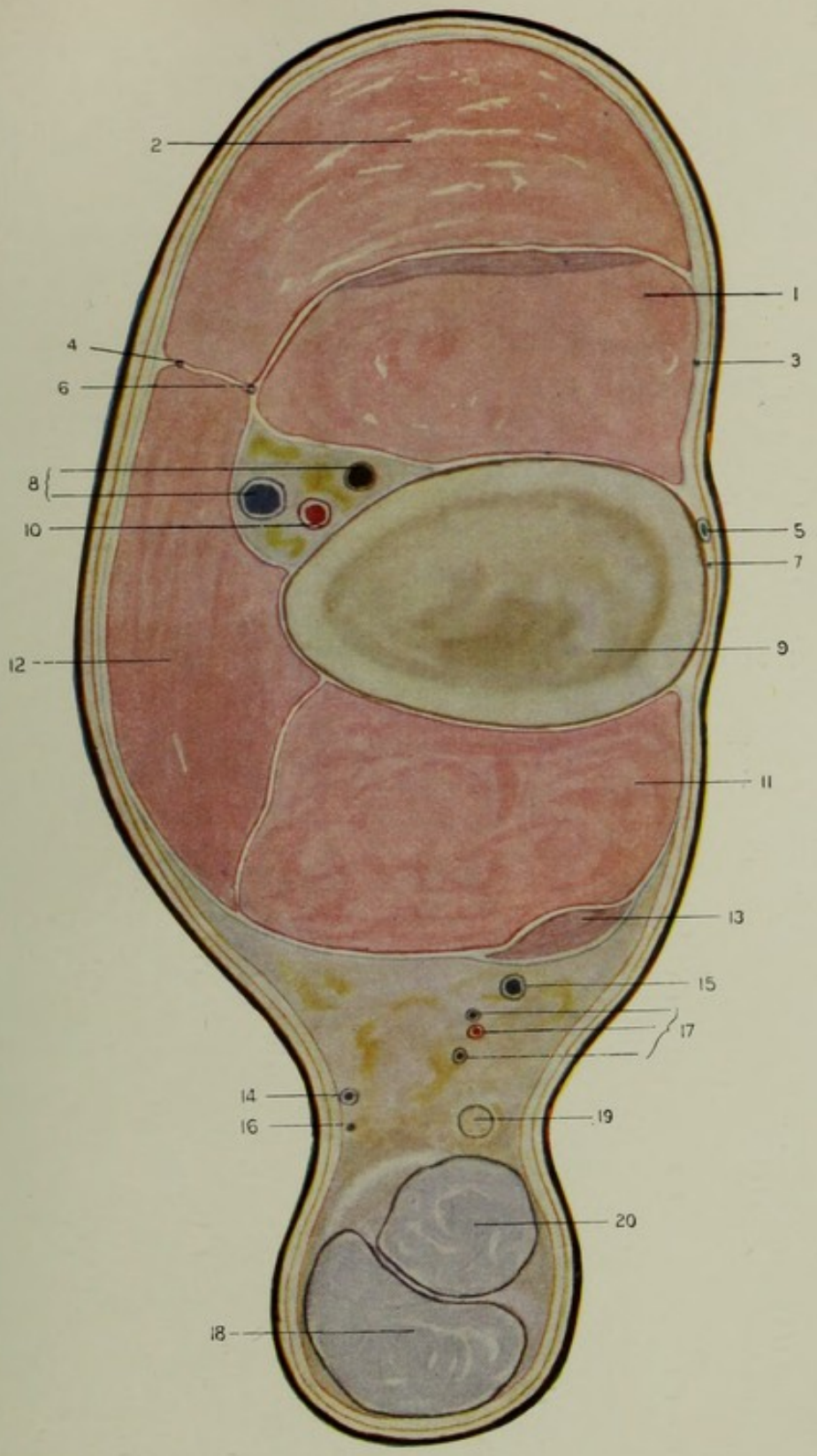

PLATE VIII.—TRANSVERSE SECTION OF RIGHT HIND LIMB THROUGH SEAT OF POSTERIOR TIBIAL NEURECTOMY.
1. Flexor Metatarsi. 2. Extensor pedis. 3 & 7. Branches of internal saphena nerve. 4. Musculo-cutaneous nerve. 5. Anterior root of internal saphena vein. 6. Anterior tibial nerve. 8. Anterior tibial veins. 9. Tibia. 10. Anterior tibial artery. 11. Perforans muscle. 12. Peroneus muscle. 13. Tendon of flexor accessorius. 14. External saphena vein. 15. Posterior root of internal saphena vein. 16. External saphena nerve. 17. Posterior tibial artery with venæ comites. 18. Tendon of gastrocnemius. 19. Posterior tibial nerve. 20. Tendon of flexor perforatus.

portion being related anteriorly to a thin sheet more deeply coloured, which is the tendinous division.

The anterior face of the flexor metatarsi muscle is embraced by the posterior face of another large muscle. This is the extensor pedis, and its anterior face will be observed to be markedly convex. This surface forms the rounded elevation which is such a prominent surface landmark in the living animal. A portion of the extensor pedis extends backwards to the outer side of the flexor metatarsi and comes into apposition posteriorly with a forwardly projecting portion of another large muscle lying on the outer side of the limb. This latter muscle is the peroneus. Between it and the extensor pedis there is placed a small nerve. This is the musculo-cutaneous division of the external popliteal, and it occupies a superficial position immediately beneath the deep layer of fascia which passes from the surface of the extensor pedis on to that of the peroneus. Between the two muscles named, but at a deeper level, and lying on the flexor metatarsi, is the anterior tibial nerve, which, it will be observed, is here very small.

The flexor metatarsi, the anterior portion of the inner border of the peroneus, and the outer portion of the anterior border of the tibia form the boundaries of a triangular area, in which we find a large artery and two veins. The artery is the anterior tibial, and the veins are its venæ comites.

Two subcutaneous branches of the internal saphena nerve are visible. One is placed on the inner face of the flexor metatarsi muscle. The other is found on the inner surface of the tibia. This surface is observed to be slightly convex, and to be immediately subcutaneous, a point which is of importance in considering fracture of this bone. In front of the more posterior of the two branches of the internal saphena nerve is a large vessel. This is the anterior root of the internal saphena vein, and it will be observed to lie in intimate relationship to the bone itself. It is joined by the posterior root a little higher up this surface of the bone.

A large muscle is applied to the posterior surface of the tibia. This is the muscular portion of the deep flexor of the digit (flexor perforans) which arises from the roughened ridges found on the back of this bone.

Inwardly the muscle is subcutaneous, whilst outwardly it comes into contact with the peroneus. On the posterior aspect of this muscle and towards the inner side of the median line is a depression, which accommodates the flexor accessorius muscle, a section of which approaches the elliptical in outline. Behind the outer third of the flexor accessorius muscle a large vein will be observed. This is the upward continuation of the external metatarsal vein, which, having passed through the tarsal sheath, forms the posterior root of the internal saphena vein. Slightly more deeply seated than this vein, and a short distance behind it, is the posterior tibial artery, which has emerged from beneath the flexor accessorius muscle a little higher up the limb. The artery is accompanied by two small veins.

The posterior tibial nerve will be found behind the posterior tibial artery. The two structures are well separated from one another by a quantity of fatty areolar tissue. It will be observed that it is a very large nerve, and that it is placed in a slightly more superficial plane than the artery.

On the outer aspect of the limb, and almost in a direct line with the posterior tibial nerve, is the external saphena nerve. This is a small nerve, and it occupies a very superficial position. In front of the external saphena nerve is the vein of the same name.

The posterior tibial nerve will be observed to lie in front of a large tendon. This is the tendon of the flexor perforatus muscle. It should be noticed that the nerve and tendon are not in immediate relationship to one another (*i.e.*, the nerve does not lie on the tendon). The tendon inclines towards the inner side of the limb, and is here almost circular in outline. The posterior surface of the tendon of the flexor

perforatus is embraced by the anterior surface of another tendon, which is here somewhat crescentic in outline. This is the tendon of the gastrocnemius muscle, which is inserted into the depression at the summit of the tuber calcis.

A short distance lower down the limb than the plane of section the tendon of the flexor perforatus winds round the inner side of that of the gastrocnemius and becomes placed behind it to play over the summit of the tuber calcis, and pass down the limb in the manner already described.

In Plate IX. we have a representation of a longitudinal antero-posterior section of the hock of the left limb. In the upper half there is, shown slightly in front of the middle of the Plate, the inferior third of the tibia, and it will be observed that the antero-posterior dimension of the bone increases progressively from the upper end of the portion represented, to its inferior extremity. Lying on the front of the bone, and in intimate relationship to it, is the muscular division of the flexor metatarsi, and in front of that, again, is the superficial or tendinous portion of this muscle. Anteriorly, at the upper extremity of the Plate, is a small portion of the inferior end of the belly of the extensor pedis. This is followed by a tendon, which plays beneath the uppermost of the three annular fibrous bands. This band is plainly seen in section.

Lying on the back of the tibia superiorly is the flexor perforans muscle. This will be observed to be succeeded by a tendon which plays through the tarsal sheath above and behind the body of the calcis, and to the inner side of the tuber. The tendon is, however, separated from the inferior extremity of the bone by the posterior common ligament of the true hock joint (*i.e.*, the joint between the tibia and the astragalus) which is plainly represented, and which it will be noticed separates the synovial capsule of the true hock joint from the tarsal sheath.

Behind the muscular portion of the flexor perforans there is a quantity of adipose and areolar tissue, and still more posteriorly is

the tendon of the gastrocnemius muscle which is seen running to its insertion into the summit of the tuber calcis. Behind the gastrocnemius tendon is that of the flexor perforatus. Superiorly the two tendons are intimately related to one another, but at the summit of the tuber calcis they are seen to be separated by a small synovial bursa. This bursa lies on the summit of the tuber and extends upwardly for a short distance between the tendons. Its function is to facilitate the play of the tendon of the flexor perforatus over the summit of the tuber calcis. It is of importance, as it is sometimes implicated in the surgical condition known as capped hock.

It is plainly seen that the perforatus tendon runs over the summit of the tuber calcis and does not, therefore accompany the tendon of the flexor perforans through the tarsal sheath—an important difference between the relationship of these two tendons and the corresponding tendons in the fore limb.

The section of the tuber calcis is elongated from above to below and approaches the elliptical in outline. Below the tuber, it will be observed that the tendon of the flexor perforatus becomes placed immediately behind that of the flexor perforans after the latter has left the tarsal sheath, and the two tendons bear this relationship to each other for the remainder of their course down the metatarsal region.

Articulated to the inferior extremity of the tibia is the astragalus. In outline a section of this bone presents a peculiar appearance, somewhat approaching the circular with a well-marked outcut posteriorly for articulation with the body of the calcis. This latter bone is broader above than below. Anteriorly it is articulated to the astragalus, as stated. Posteriorly it is related to the tarsal sheath with the perforans tendon. Inferiorly it is articulated in front to the scaphoid, whilst behind it gives attachment to the tarso-metatarsal ligament. This ligament, it may be noticed, closes in posteriorly the joints formed by the small tarsal bones, and is directly continued inferiorly as the subtarsal or check ligament which proceeds in the downward direction

between the perforans tendon behind and the superior sesamoidean or great suspensory ligament in front, to become ultimately attached to the perforans tendon, a short distance below the hock. The origin of the suspensory ligament from the back of the lower row of tarsal bones and the upper end of the large metatarsal is also plainly visible.

Below the astragalus is the scaphoid, and immediately beneath this is the cuneiform magnum. Both these bones are slightly concave superiorly whilst their inferior surfaces are slightly convex. They give attachment posteriorly to the tarso-metatarsal ligament and in front to some fibres of the astragalo-metatarsal ligament, which are seen in section, since they run obliquely across the front of the joint.

Closing in the front of the tibio-astragaloid joint is the anterior common ligament, which is attached above to the front of the inferior extremity of the tibia and below to the front of the upper extremity of the large metatarsal bone. Lying on the anterior face of this ligament are the tendons of the superficial and deep divisions of the flexor metatarsi muscle. The tendon of the deep portion will be noticed to pierce that of the superficial division, and both are observed to run to their insertion into the roughened elevation at the front of the upper extremity of the large metatarsal bone. The continuation of the tendon of the extensor pedis will be observed, in front of those of the flexor metatarsi, to pass beneath the two remaining annular bands, which are seen in section, and to continue its course down the front of the large metatarsal bone the upper end of which is represented.

A very important transverse section is represented in Plate XIX. The section is taken across the right hind limb, and its importance is enhanced inasmuch as it passes through the seats of the serious surgical affections of spavin and curb.

A transverse section of a tendon is shown posteriorly in the middle line. This is the tendon of the flexor perforatus, and it is separated

from the skin by a thick layer of dense fascia. The tendon is placed at the back of the hock, as will be readily understood from Plate IX.

In front of the tendon is a thick and powerful ligament, to which the anterior face of the tendon is intimately related and which extends for some distance round to the outer aspect of the joint. This is the calcaneo-metatarsal ligament, which runs from the back of the tuber calcis down the whole length of the back of the cuboid to be attached inferiorly to the head of the outer small metatarsal bone. This ligament is implicated in curb. On the superficial aspect of the ligament, and towards the outer side of the joint, is the external saphena nerve. This nerve, however, may frequently be found running further forwards and clear of the ligament. A little more anteriorly, and also slightly more superficially, is a cutaneous branch of the musculo-cutaneous nerve which, in turn, is one of the terminal divisions of the external popliteal.

A large bone is seen in section, the major portion of which is placed to the left of the middle line. In outline it appears somewhat reniform, and to its posterior surface the calcaneo-metatarsal ligament is attached. It will be readily gathered, from what we have said, that this bone is the cuboid. On the outer aspect of the cuboid will be observed the external lateral ligament of the joint.

At the back of the joint there will be seen in the Plate, to the right of the middle line and in line with the calcaneo-metatarsal ligament, another tendon. This is the tendon of the flexor perforans. In section it is elliptical the long axis of the ellipse being directed transversely.

Two nerves are seen, one on either edge of the tendon just mentioned. These are the outer and inner plantar nerves, into which the posterior tibial nerve divides just above the hock, and which then pass through the tarsal sheath with the perforans tendon. In front of each nerve is the corresponding artery, whilst in front of the external plantar artery is the external metatarsal vein.

Running from the back of the cuboid transversely, in front of the

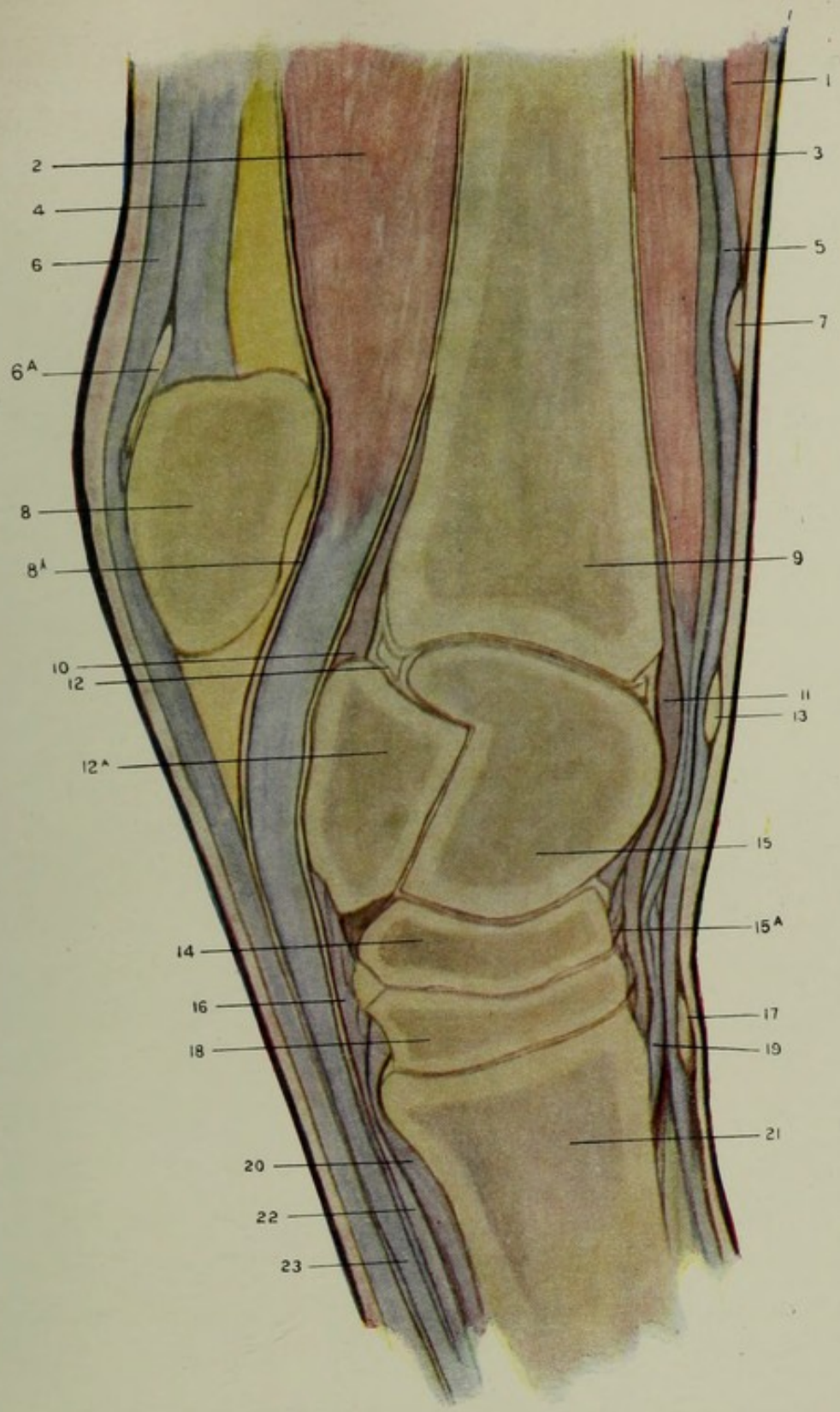

PLATE IX.—LONGITUDINAL MESIAL SECTION OF LEFT HOCK SHOWING INNER FACE OF OUTER PORTION.
1. Extensor pedis muscle. 2. Flexor perforans muscle. 3. Flexor metatarsi (tendinous and muscular divisions). 4. Tendon of gastrocnemius. 5. Tendon of extensor pedis. 6. Tendon of flexor perforatus 6A. Bursa beneath Perforatus Cap. 7. Superior annular band. 8. Tuber calcis. 8A. Tarsal sheath. 9. Tibia. 10. Posterior common ligament. 11. Anterior common ligament. 12. Synovial membrane of true hock joint. 12A. Body of calcis. 13. Middle annular band. 14. Scaphoid. 15. Astragalus. 15A. Astragalo-metatarsal ligament (see Text). 16. Tarso-metatarsal ligament. 17. Inferior annular band. 18. Cuneiform magnum. 19. Insertion of flexor metatarsi into large metatarsal bone. 20. Suspensory or superior sesamoidean ligament. 21. Large metatarsal bone. 22. Subtarsal or check ligament. 23. Tendon of flexor perforans.

perforans tendon, is the tarso-metatarsal ligament, and towards the inner side of the joint this ligament is attached to a small bone, which in section appears elongated from before to behind. This bone is the cuneiform parvum. The deep metatarsal vein is observed to be in front of the tarso-metatarsal ligament. In front of this vein is the largest bone represented in the Plate. This is the cuneiform magnum. It is somewhat triangular in outline, the apex of the triangle being directed backwards. Outwardly the bone is articulated to the cuboid and these two bones are attached to one another by a powerful interosseous ligament which is attached to their concentric non-articular areas, and which is plainly represented in the Plate. Inwardly the cuneiform magnum is articulated to the cuneiform parvum, and these two bones are similarly connected by an interosseus ligament which is also visible. Running from the inner aspect of the cuneiform magnum on to the cuneiform parvum is the internal lateral ligament, whilst superficially placed to this, and immediately subcutaneous, are two small nerves. These are cutaneous branches from the internal saphena nerve and they are placed one opposite each of the two cuneiform bones.

Still more anteriorly, and also superficially placed on the antero-internal aspect of the joint, is another small nerve, which is the cutaneous branch from the posterior tibial nerve, referred to in connection with posterior tibial neurectomy in the chapter dealing with nerves.

On the anterior aspect of the cuneiform magnum is the astragalo-metatarsal ligament, some of the fibres of which are attached to this bone. Superficially placed to this ligament is the anterior common ligament of the joint, which is a thin sheet extending right across the front of the joint, which it closes anteriorly. Placed superficially on this ligament, and on the antero-internal aspect of the joint, is the anterior root of the internal saphena vein. This is the upward continuation of the internal metatarsal vein, and is the vessel concerned in that fictitious ailment, "blood spavin." In the middle line

anteriorly two tendons are seen closely applied and superposed to one another. These are the tendons of the superficial and deep divisions of the flexor metatarsi muscle. To the outer side of these tendons the tendon of the extensor pedis muscle will be observed.

On the antero-external aspect of the joint there will be noticed the large metatarsal artery, a short distance behind the tendon of the extensor pedis. Behind the artery is the extensor brevis muscle, also superficially placed ; and behind this again is the tendon ot the peroneus muscle, posteriorly to which we have the external lateral ligament of the joint extending on to the outer aspect of the cuboid.

In Plate X. is shown a transverse section of the middle third of the metatarsal region of the left hind limb. The Plate is chiefly taken up by the large metatarsal bone. This, it will be observed, is, in section, almost circular in outline, being much less compressed from before to behind than the corresponding bone of the fore limb (*i.e.*, the large metacarpal).

On the anterior aspect of the bone, but slightly removed towards the outer side from the median line, is a large tendon. This is the tendon formed by the union of the tendon of the peroneus muscle with that of the extensor pedis, which union takes place slightly higher up the limb than the level of the section.

Articulated posteriorly to the large metatarsal are the small metatarsal bones, one on either side. These are placed closer together than are the corresponding bones of the fore limb. In section, each approaches the triangular in outline, the apex of the triangle being directed forwards.

Each of the small metatarsals forms anteriorly with the large metatarsal, a groove. In the outer of these two grooves a large vessel will be observed. This is the large metatarsal artery, which runs down the limb in this groove to pass between the outer small and large metatarsal bones just above the fetlock, where it divides under the bifurcation of the suspensory ligament into the two digital

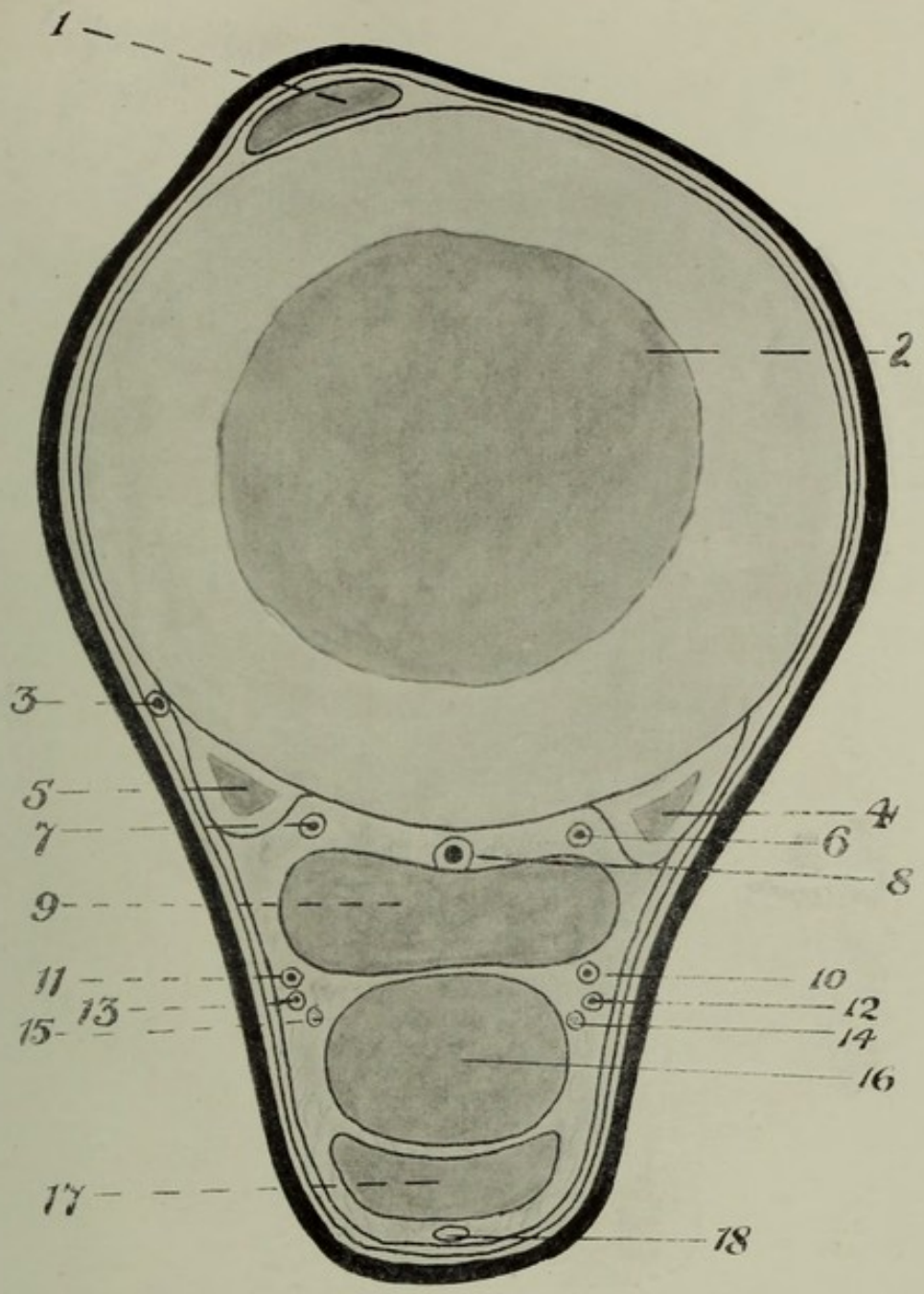

PLATE X.—TRANSVERSE SECTION OF MIDDLE THIRD OF METATARSAL REGION OF LEFT HIND LIMB

1. Tendon of extensor pedis muscle. 2. Large metatarsal bone. 3. Large metatarsal artery. 4. Internal small metatarsal bone. 5. External ditto. 6. Internal plantar interosseous artery. 7. External ditto. 8. Deep metatarsal vein. 9. Suspensory ligament. 10 and 11. Internal and external metatarsal veins. 12 and 13. Small unnamed arteries descending with plantar nerves. 14 and 15. Internal and external plantar nerves. 16. Tendon of flexor perforans. 17. Tendon of flexor perforatus. 18. Branch of communication between internal and external plantar nerves.

arteries. It should be observed, as a matter of considerable surgical importance, that the artery is here quite superficially placed, being immediately subcutaneous, and consequently very much exposed to risk of injury—a risk which is added to by the fact that the vessel is on the outer side of the limb.

The small metatarsal bones form, also, two grooves posteriorly with the large metatarsal. In each of these grooves a vessel is seen. These vessels are the inner and outer plantar interosseous arteries, which, descending from the tarsal arterial arch, run down on either edge of the suspensory ligament, to terminate in the manner already described.

Lying on the posterior surface of the large metatarsal bone in the middle line, we find the deep metatarsal vein, which runs up the limb in this position from the venous arch which is formed just above the fetlock. It continues its upward course to the back of the tarsus, when it passes from back to front of the limb through the canal formed between the cuboid, scaphoid and cuneiform magnum.

The posterior surface of the large metatarsal bone forms, with the inner surfaces of the two small metatarsals, a channel in which the suspensory ligament will be observed to be placed. In the Plate the ligament has been drawn slightly backwards. A section of the ligament is transversely elongated, and it will be noticed that it is a structure of considerable thickness. Immediately behind the ligament is the tendon of the flexor perforans. This is not so broad as the ligament, but it has a greater antero-posterior dimension. On either edge of this tendon we find a nerve. These are the outer and inner plantar nerves. In front of each nerve is a small vessel. These vessels are unnamed. They are two small arteries which descend from the tarsal arch. In front of each artery is a vein. The outer is the external metatarsal vein, whilst the inner is the internal metatarsal, which is continued, as we have already remarked, as the anterior root of the internal saphena vein which crosses the seat of spavin.

Lying on the posterior surface of the tendon of the flexor perforans muscle is the tendon of the flexor perforatus. This is not so thick as that of the perforans. It is somewhat crescentic in outline, its concave anterior border embracing the posterior border of the perforans.

The oblique branch which places the internal and external plantar nerves into communication with one another will be seen on the posterior aspect of the perforatus tendon near the median line.

CHAPTER IV

THE BONES—FRACTURES AND EXOSTOSES

THE INNOMINATE BONE

This is a bone which is very irregular in shape. It is made up of three segments. These are named respectively the ilium, ischium, and pubis. In the fœtus these segments are separate, but in the adult animal they become completely ossified to one another, so that it becomes impossible to mark out the lines of division of the different bones. The two innominate bones meet at the ischio-pubic symphysis where, in the adult animal, they also are firmly ossified to one another. The bones thus united form the floor and the osseous lateral boundaries of the pelvic cavity.

The three parts of the innominate bone meet one another in the cotyloid cavity or acetabulum. This cavity is placed on the outer aspect of the innominate bone, and it looks downwards and outwards. The acetabulum is deep and cup-like. It is articular, but not entirely, since it presents a triangular non-articular roughened area, the apex of which is placed near the centre of the cavity from whence the non-articular area extends to the inner portion of the circumference. The cotyloid cavity has a well-marked rim which gives attachment to the cotyloid ligament. This ligament serves to deepen the cavity and thus afford better accommodation for the articular head of the femur. Inwardly the rim of the cavity is deeply notched along the base of the triangular non-articular area mentioned above. The notch is bridged over by a continuation of the cotyloid ligament, this particular

portion of which is termed the transverse ligament. Through the notch, and over the transverse ligament, the pubio-femoral ligament passes to its insertion into the triangular sulcus in the head of the femur. The ligamentum teres, or round ligament, is inserted superiorly in the roughened portion of the acetabulum.

In the floor of the pelvis there is formed, in each innominate bone, a large foramen, which in outline approaches the elliptical. Its long axis is directed forwards and slightly outwards. Anteriorly it is bounded by the pubic bone and posteriorly by the ischium. This is the thyroid, or obturator foramen, which in the recent state is almost completely closed by a sheet of fibrous tissue, to which the name obturator membrane is given. A small aperture is left anteriorly, and through this the obturator vessels and nerve leave the pelvic cavity and descend to the thigh.

For descriptive purposes it is usual and convenient to take the segments of the innominate bone separately.

The Ilium.—Of the three portions into which the innominate bone is divided this is the largest, and from a surgical point of view it is the most important. The bone is of irregular shape and extends upwards and forwards from the acetabulum, or what has been indicated in our superficial examination as the position of the hip joint. The upper portion of the ilium is flattened from above to below, and therefore expanded in the lateral direction. The inferior portion is " narrow and prismatic," and this part is frequently referred to as the shaft.

Three surfaces may be described. The upper surface looks upwards, outwards, and backwards. It is widest superiorly and becomes very narrow towards its inferior end. The upper portion is slightly depressed and is smooth. This part accommodates the middle or great gluteus muscle. Inferiorly the surface is convex and roughened, and this portion presents a number of roughened ridges from which the deep gluteus muscle arises. This is the gluteal surface. The sacral or pelvic surface is so called since in part it bounds the pelvic cavity.

Like the other two surfaces, this is widest superiorly and becomes much narrower towards its inferior end. On the upper part of this surface there is presented the auricular facet which, by coming into apposition with a like facet on the superior aspect of the sacrum, forms the sacro-iliac joint. The area above the facet is roughened for the attachment of ligaments of this joint. Below the facet the surface is almost entirely smooth, and this portion presents the obturator groove so named since along it run the obturator nerve and vessels. The groove runs in a longitudinal manner along this surface towards the obturator foramen, so that it takes a direction, therefore, which is downwards and slightly backwards. This is a point of considerable surgical import, and will be referred to again in dealing with obturator paralysis.

The remaining surface of the ilium is the iliac, and this surface looks forwards and slightly downwards. It is so named because it is clothed by the iliacus muscle throughout almost the whole of its extent. The nutrient foramen of the bone, which is of considerable size, will be found on this surface near the line of division between the middle and lower thirds.

On the dried bone two sets of faint grooves or depressions will be observed. The inferior grooves are placed near the nutrient foramen and take a downward direction. They are the impressions caused by the iliaco-femoral vessels. The other set will be found in the upper third of this surface. These grooves are not usually so well marked as are those of the lower set. They take a forward direction and indicate the course taken by the ilio-lumbar vessels.

These three surfaces are separated from one another by three more or less well-defined edges. The edge which runs inferiorly to the cotyloid cavity is the cotyloid edge. It is curved in its length, the concavity of the curve being directed outwards. Towards its superior end this edge is very narrow, but becomes much thicker as we descend to the acetabulum.

This edge separates the gluteal and iliac surfaces. Separating the

gluteal and sacral surfaces we have the ischiatic edge. This edge is thin and sharp, and for the greater part of its extent it presents a greater degree of curvature than the cotyloid edge, the concavity being directed upwards and backwards. Towards its middle third this edge forms the anterior boundary of the greater sacro-sciatic foramen. Above the foramen it gives attachment to the inferior ilio-sacral ligament. A small but well-defined tubercle, which is placed towards the inner aspect of the bone indicates the inferior limit of the ligamentous attachment. The inferior portion of this edge is raised into a prominent ridge which is placed above the cotyloid cavity. This ridge forms part of the superior ischiatic spine. On its outer aspect it is roughened and affords attachment to the great sacro-sciatic ligament.

The remaining edge separates the iliac and pelvic surfaces. This is the pubic edge, and is so named because it conducts inferiorly to the pubic bone. Superiorly it will be observed that the iliac and pelvic surfaces are blended with one another for the upper portion of the pubic edge is obliterated. The ilio-pectineal eminence will be found in the inferior third of this edge. To the eminence the tendon of the psoas parvus muscle is attached. The pubic edge is also termed the ilio-pectineal line.

The ilium possesses three angles which, according to their position, may be termed the antero-internal, antero-external, and inferior. The antero-external angle, or the angle of the haunch, forms the most prominent landmark in the living subject in this region, and to it attention has already been drawn in our superficial examination. It is now seen to be very massive and to be made up of two pairs of roughened tuberosities, one pair being placed above and the other below. Several muscles are attached to this angle, including the oblique muscles of the abdomen, the tensor vaginæ femoris, &c. The antero-internal angle, or angle of the croup, is that portion of the ilium which is placed above and rests upon the sacrum. The angle itself is acute and is formed between the crest and the ischiatic border. The

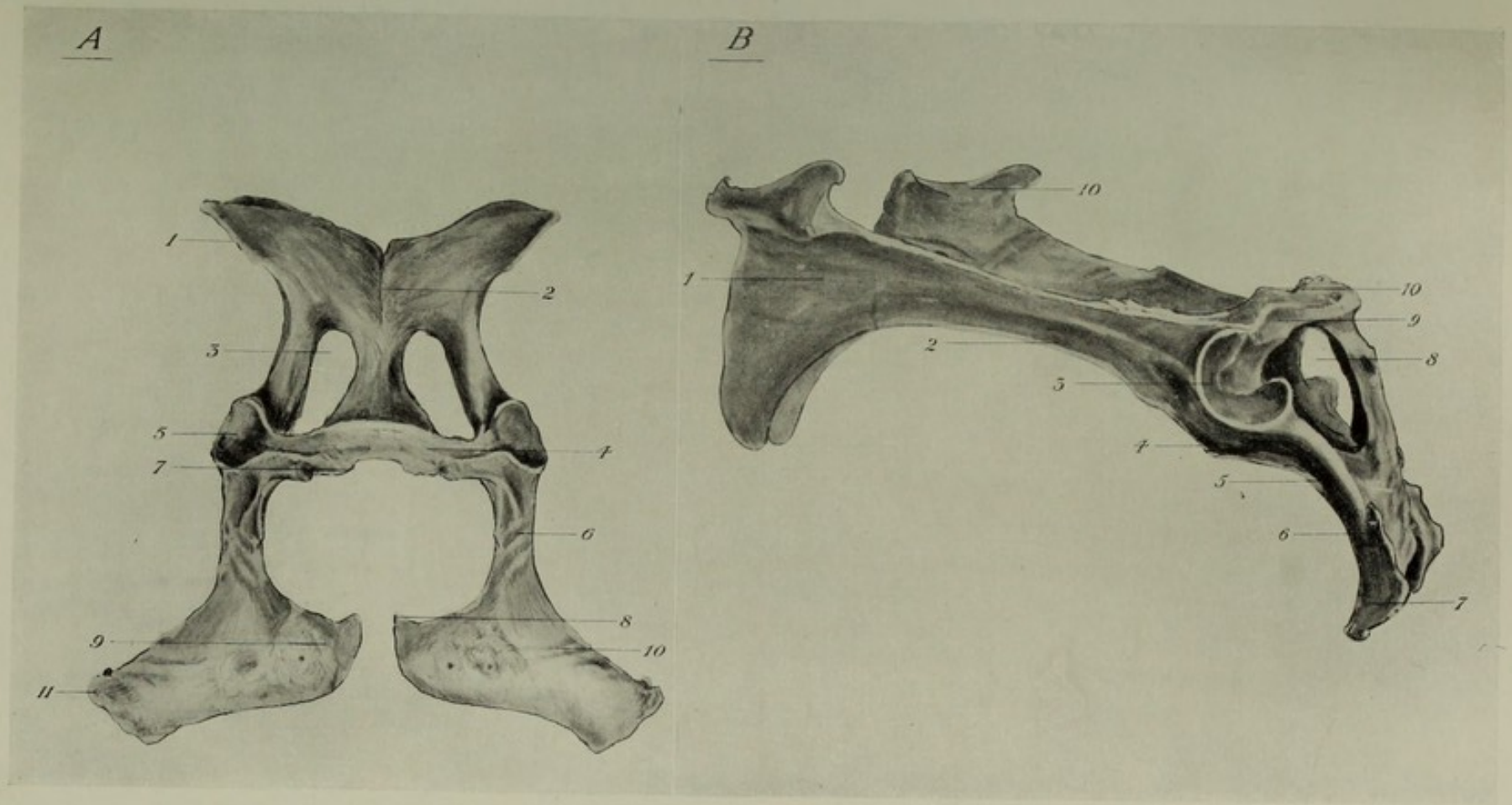

PLATE XI.—THE INNOMINATE BONES

A.—INFERIOR ASPECT

1. Inferior ischiatic spine. 2. Ischiatic symphysis. 3. Obturator foramen. 4. Pubio-femoral groove. 5. Cotyloid cavity. 6. Grooves for ilio-femoral vessels. 7. Brim of pelvis. 8. Angle of croup. 9. Auricular facet. 10. Grooves for ilio-lumbar vessels. 11. Angle of haunch.

B.—LATERAL ASPECT (THE BONES INVERTED)

1. Gluteal surface of ilium. 2 Shaft of ilium. 3. Cotyloid cavity 4. Superior ischiatic spine. 5. Ischium. 6. Inferior ischiatic spine. 7. Tuber ischii. 8. Obturator foramen. 9. Pubio-femoral groove. 10. Brim of pelvis.

apex of this angle forms the highest portion of the skeleton in the region of the croup. The remaining angle is the inferior extremity of the bone, and this is the portion which meets the ischium and the pubis in the cotyloid cavity. Almost immediately in front of the cotyloid cavity we find two small pits. They are placed one on either side the cotyloid edge of the bone, and in them the tendons of origin of the outer and inner heads of the rectus femoris muscle are attached.

Connecting the angle of the croup with that of the haunch, we have the crest of the ilium.

The ischium, in size, is the second largest of the three constituent parts of an innominate bone. It is placed posteriorly, is flattened from from above to below, and may be said to present, for the purposes of description, two surfaces, four edges, and four angles. The superior surface is very slightly depressed and forms the posterior part of the floor of the pelvis. It is smooth, and upon it the urethra rests. The inferior surface is almost flat and is slightly roughened. To this surface the tendons of origin of the adductor muscles of the thigh are attached.

The anterior border is curved and forms the posterior boundary of the obturator foramen. The posterior edge is also curved, and is directed downwards and inwards. With the corresponding edge of the opposite ischium it forms the ischial arch. The outer edge is likewise curved. It is smooth and rounded, and forms the inferior boundary of the lesser sacro-sciatic foramen. Across this border the common tendon of the obturator internus and pyriformis muscles passes to obtain insertion in the trochanteric fossa of the femur. The inner edge meets the corresponding edge of the opposite bone, forming the ischiatic symphysis.

The antero-internal angle meets the posterior angle of the os pubis. The antero-external angle enters into the formation of the cotyloid cavity where it meets the os pubis and the ilium. The postero-internal

angle comes into apposition with the corresponding angle of the opposite ischium at the symphysis, whilst the postero-external angle forms the tuber ischii. This is a thick, roughened projection, the summit of which may be readily located in the living animal by palpation, since it forms the projection a few inches below and slightly to the side of the root of the tail, which is not infrequently referred to as the point of the hip. On the inferior aspect of the tuber ischii there is found a prominent and well-defined ridge. This is the inferior ischiatic spine, and to it the erector muscles of the penis are attached.

The os pubis is placed in front of the ischium and forms the anterior portion of the floor of the pelvis. It is much the smallest of the three component parts of the innominate bone, and in connection with it there may be described two surfaces, three edges, and three angles.

The superior surface is smooth and concave, and on the slight depression which it forms with the opposite bone, the urinary bladder rests. The inferior surface is slightly convex, and is roughened for muscular attachment. Running obliquely backwards and outwards across this surface from the symphysis to the cotyloid cavity is a well-marked groove. This is the pubio-femoral groove, and it derives its name from the ligament which it accommodates and which is peculiar to the equidæ.

The anterior border forms part of the brim of the pelvis. Towards the pubic symphysis this edge is thin and sharp, but outwardly it is roughened, thick, and tuberous. The inner edge comes into apposition with the corresponding edge of the opposite bone, thus forming the pubic symphysis. The remaining or outer border is curved, the concavity of the curve being directed backwards and outwards. This edge forms part of the anterior and inner boundaries of the obturator foramen.

The angles are termed antero-internal, antero-external, and posterior. The first-named angle meets the corresponding angle of the opposite bone at the symphysis. The antero-external angle enters the cotyloid cavity, where it is articulated to the ilium and ischium. The posterior

angle meets the antero-internal angle of the ischium to the inner side of the obturator foramen.

The innominate bone develops from three principal centres of ossification, one for each of the three divisions. In addition to these there are three supplementary centres, one for the crest of the ilium, one for the cotyloid cavity, and the third for the tuber ischii.

FRACTURE OF THE INNOMINATE BONE

To the surgeon the innominate bone is of great importance. It is one of the most common seats of fracture, and amongst the lower animals fracture is most frequently met with in the horse.

We have already pointed out, in our superficial examination, the very important surface landmarks which are caused by parts of this bone, and reference has been made above to the numerous muscles to which it gives attachment. Quite a number of vessels and nerves bear an intimate relationship to the bone, and fractures are very frequently complicated by injuries to these structures. Within the pelvic cavity we have the rectum, bladder and urethra, vagina (in the female), &c., and these may also be injured by inward displacement of fractured pieces.

As one would most naturally expect from its exposed position the external angle of the ilium is the most common seat of fracture.

The angle of the croup is also a common seat, as is also the tuber ischii. Other parts frequently fractured are the shaft of the ilium, the pubis and ischium either through or parallel to the ischio-pubic symphysis, the pubis in front of the obturator foramen, the pubis slightly anterior to its posterior angle, *i.e.*, to the inner side of the obturator foramen, the ischium just behind the acetabulum, *i.e.*, behind its antero-external angle, through the cotyloid cavity, &c. Two or more of these fractures may occur simultaneously.

Fracture, through the angle of the haunch, may be due to the part being caught in a narrow doorway, or in young animals through their

rushing through gateways. It has already been remarked that this angle is one of the prominent points which come into contact with the ground when the animal falls on its broadside. Falling in such manner on a hard road or pavement frequently results in fracture, or it might be the result of a blow, as also may be fracture of the internal angle. As already stated, this latter angle is the highest point of the body in the region of the croup. In colliery ponies it is frequently fractured by falling spars, by a fall of the roof or by "roofing" whilst going down an incline, when, owing to the extended position of the fore limbs, the fore part of the body is depressed in such a manner that the croup becomes the highest part of the body, and is therefore the most likely to come into contact with the supporting spars of the roof. Other fractures may be due to violent muscular contraction. These are most commonly met with in old animals in which the bones are more brittle. Fracture along or parallel to the symphysis may be caused by the two hind legs slipping outwards and thus being violently and simultaneously abducted. The effect of this is to throw enormous and sudden tension on the adductor muscles, which are attached to these bones near the line of fracture. Fracture through the acetabulum may result from a severe blow received over the great trochanter of the femur, when the articular head of this bone becomes forcibly driven into the cotyloid cavity and we have fracture with, usually, some internal displacement. Similarly, fracture of the tuber ischii may result from a blow, and is by no means an uncommon result of a kick from another animal.

In colliery ponies, again, the expanded portion of the ilium is not infrequently smashed by a fall of the roof on to the quarter. Fracture of some part of the innominate bone at times also results from casting on hard ground or struggling violently when secured by hobbles.

Sudden lameness is almost a constant symptom of fractured innominate bone. It will be readily understood, however, that lameness varies according to the seat of the fracture and the muscles affected in consequence.

Diagnosis of fracture of either of the two angles of the ilium or of the tuber ischii is not difficult, since the fractured piece may be readily detected by palpating the part. In cases of fracture of the angle of the haunch or of the expanded portion of the ilium, by observing the animal from behind there will be noticed a marked alteration in the conformation of the affected quarter and a striking difference when the two hind quarters are compared. The prominence caused by the underlying iliac angle will now be found to have disappeared, and the affected quarter is rounded off. The fractured piece of bone is displaced in the downward direction owing to the pull exerted upon it by the tensor vaginæ femoris and the abdominal muscles, which are attached to it.

When fractured, the tuber ischii is similarly subjected to downward displacement owing to the weight of the muscles to which it gives attachment.

Diagnosis of some of the other fractures is much more difficult. Fracture through the acetabulum may occasionally be detected by pressing on the great trochanter with the palm of the hand, when it will be found that the parts beyond the trochanter have lost their ordinary firm resistance. If the hand be passed along the rectum, or, in the mare, the vagina, and the palmar aspect be directed outwardly fractures through the cotyloid cavity may frequently be felt, particularly if an assistant apply pressure over the great trochanter as indicated above. Of course the observer is always on the alert for crepitation, and in this case it is best to place the ear slightly in front of the summit of the great trochanter of the femur and near the upper border of its convexity. Similar exploration by the rectum or vagina is of utility in diagonising fractured symphysis, fractures of the pubic bone, and fracture behind the antero-external angle of the ischium. Fracture of the os pubis, in front of the obturator foramen and towards the inferior extremity of the obturator groove, gives rise to a most peculiar lameness, which will be more fully dealt with in the chapter on nerves. (See Obturator Paralysis.)

When the fracture is either through, or in front of, the cotyloid cavity the action of the hip and stifle joints is affected, owing to the attachments of the rectus femoris and tensor vaginæ femoris muscles to the innominate bone. In fractures through the ischio-pubic symphysis, or parallel to it, the limb is held in a position of abduction, for it will be remembered that the muscles which adduct the limb are attached to the inferior surface of these bones.

The most serious fractures of the innominate bone are those in which the cotyloid cavity is involved. Here the different segments meet and are ossified to one another, and when fracture occurs it is usually comminuted. Another very serious fracture occurs through the shaft of the ilium immediately in front of the acetabulum. These cases are usually incurable, so that slaughter is indicated.

In treating fractured pelvis complete rest should be provided and the patient immediately placed in slings. After a period of about six weeks the slings should be let down so that the weight of the body may be borne by the limbs. But the slings should not be removed, otherwise the animal is very likely to fall and a recurrence of the fracture take place. Should the limbs be incapable of supporting the weight of the body, the slings should be again tightened and kept so for a period of two or three weeks longer. If the animal stands without difficulty he should be caused to move from side to side frequently, in order that he may become accustomed to the free use of the limbs before the slings are removed. These precautions, to be taken before the patient is allowed complete freedom, are of considerable importance.

Through such prolonged inactivity the muscles of the part will rapidly atrophy unless some artificial assistance to their circulatory apparatus is afforded. This may be provided by frequently kneading and massaging the parts, and in the later stages by the application of a mild counter-irritant.

A pitch plaster or charge applied to the quarter is frequently of great use in supporting the parts and maintaining fractured pieces of bone in position after replacement.

THE FEMUR

This is a long bone which extends obliquely downwards and forwards from the hip joint above to the stifle joint below. It is the most massive bone in the whole body. It possesses a shaft and two expanded extremities.

The shaft may be said to present for description four surfaces. The anterior and lateral surfaces are blended with one another, are markedly convex in the transverse direction, and almost straight from above to below. These three surfaces are clothed by the vastus externus, vastus internus, rectus femoris, and rectus parvus muscles, which are collectively called the quadriceps extensor cruris.

The posterior surface is widest superiorly where it presents a four-sided, somewhat flattened area. This area extends outwardly into a well-marked depression, which is placed to the inner side of the trochanteric ridge, and hence receives the name trochanteric fossa. In the fossa the obturator externus, obturator internus, pyriformis, and gemelli muscles are inserted. Inferiorly and towards the outer side of the bone, the above-mentioned area extends on to the back of the external or third trochanter. Here is found a roughened elevation with a somewhat circular base, which gives attachment to the femoral slip from the biceps femoris or triceps abductor femoris muscle. Almost in line with this elevation and towards the inner side of the bone is a roughened area to which the quadratus femoris muscle is attached. Below the tubercle to which the biceps femoris is attached, and where the shaft of the bone becomes very much narrowed down, are two or three roughened ridges. These give attachment to the great and small adductor muscles of the thigh.

The nutrient foramen is placed in the middle third of the bone and towards its inner edge. The canal into which the nutrient artery passes is disposed at right angles to the surface of the bone. Quite

close to the nutrient foramen is a roughened, slightly elevated area to which the tendon of insertion of the pectineus muscle is attached. On the inner border, and about two inches above the nutrient foramen, is the internal or small trochanter. This is elongated from above to below and is roughened. It gives attachment to the iliacus and psoas magnus muscles, and from it the inner edge extends upwardly in the form of a sharp, well-defined ridge, to the articular head.

Immediately below the nutrient foramen we find a broad, well-defined depression. This is the femoral groove, in which the femoral vessels lie in intimate relationship to the bone. The groove is consequently smooth, and it crosses the back of the bone in an oblique direction downwards and outwards. Since the groove accommodates the femoral artery, and the nutrient artery of the femur is a branch of this vessel, it will be seen that the nutrient artery is very short, for it passes directly to the nutrient foramen.

Below the femoral groove and towards the inner side of the back of the bone we find the supracondyloid crest. This is a roughened elongated elevation, and from it the inner head of the gastrocnemius muscle arises. Opposite this and towards the outer side of the bone is a deep depression. This is the supracondyloid fossa, and it is bounded by two well-defined edges or lips. These are curved, and meet one another above and below in acute angles. The outer lip is roughened, and from it the outer head of the gastrocnemius muscle arises. The floor of the fossa, which is also roughened, gives origin to the superficial flexor of the digit. Above the fossa the outer edge gradually rises from the surface of the bone and curves outwardly to form the inferior border of the piece of bone which projects prominently outwards with a slight forward inclination. This projection is the external or third trochanter, to which we have already referred. Its extremity is roughened and gives attachment to the superficial gluteus muscle. From the third trochanter the stout trochanteric ridge extends upwardly to the back of the great trochanter. The posterior border of the ridge

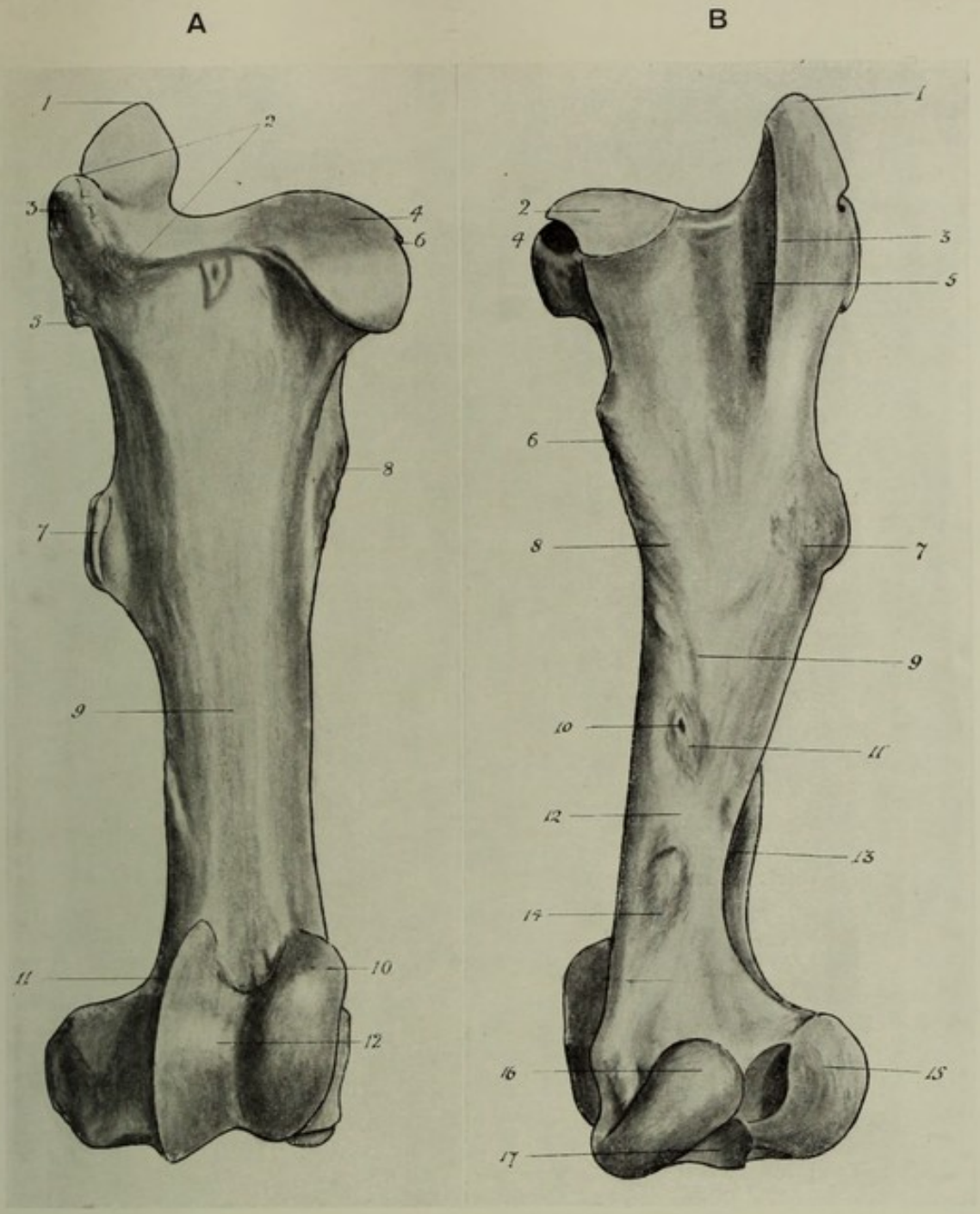

PLATE XII.—RIGHT FEMUR

A.—ANTERIOR ASPECT

1. Summit of great trochanter (insertion of one of tendons of middle gluteus muscle). 2. Insertion of deep gluteus into inner face of convexity. 3. Outer surface of convexity (seat of synovial bursa beneath tendon of middle gluteus). 4. Articular head. 5. Crest of great trochanter, into which is inserted tendon of middle gluteus, which plays over outer surface of convexity. 6. Sulcus in head. 7. External or third trochanter, to which is attached tendon of superficial gluteus muscle. 8. Internal or small trochanter, into which are inserted the psoas magnus and iliacus muscles. 9. Anterior surface (this and the lateral surfaces are clothed by the quadriceps extensor cruris muscle). 10. Inner ridge of trochlea. 11. Outer ridge of trochlea. 12. Groove of trochlea.

B.—POSTERIOR ASPECT

1. Summit of great trochanter. 2. Articular head. 3. Trochanteric ridge. 4. Sulcus in head. 5. Trochanteric fossa. 6. Internal or small trochanter. 7. Tubercle for attachment of slip from biceps femoris. 8. Roughening for insertion of quadratus femoris. 9. Ridges for insertion of adductor muscles. 10. Nutrient foramen. 11. Roughening for insertion of pectineus. 12. Groove for femoral vessels. 13. Supracondyloid fossa. 14. Supracondyloid crest. 15 and 16. External and internal condyles. 17. Intercondyloid groove.

is roughened, and it gives attachment to one of the tendons of insertion of the middle or great gluteus muscle.

The superior extremity of the bone is very massive, and is made up of the great trochanter, the articular head, and a non-articular, slightly depressed area.

The great trochanter is placed outwardly, and is divided into three parts, termed respectively the summit, convexity, and the crest. The summit surmounts the upper border of the convexity and also the level of the articular head by an inch to two inches, according to the size of the subject. Superiorly the summit is roughened for the attachment of one of the tendons of insertion of the middle gluteus muscle. Its posterior border is continuous with the trochanteric ridge. This is roughened, as is also its outer surface, which is slightly convex. The convexity is placed in front of the summit, from which it is separated by a well-defined, semi-circular outcut. The outer surface of the convexity is smooth and convex, and upon it is placed, in the living subject, a synovial sac or bursa, which facilitates the play over the convexity of one of the tendons of the middle gluteus muscle. This bursa is of great importance, since inflammation of it sets up what is known as false hip lameness, which is described in the chapter dealing with bursæ. Inwardly a portion of the convexity just below its superior border is very rough, the roughest portion being in the form of a curved line. This indicates the insertion of the deep gluteus muscle.

The crest is in the form of a roughened ridge, attached as it were to the inferior portion of the outer surface of the convexity. It extends from the base of the summit across the convexity in a direction which is downwards and forwards, forming the inferior limit of the smooth area upon which the bursa referred to lies. To the crest the tendon of the middle gluteus muscle, which plays over the bursa, is attached.

The articular head is a large hemispherical process which is placed to the inner side of the superior extremity. Its surface is markedly

convex in all directions, and in the articulated joint is accommodated in the cotyloid cavity of the innominate bone. It is not entirely articular however, for it presents inwardly a deep triangular, non-articular, roughened area termed the sulcus, the apex of which extends towards the centre of the head for a distance which is about two-thirds the radius of the articular surface. The base of the sulcus is represented by an arc of the circumference removed. The sulcus gives insertion to the pubio-femoral and round ligaments of the hip joint. The smooth articular surface of the head is surrounded by a roughened line which is continued, but more faintly marked, across the base of the sulcus. To this roughened line the capsular ligament of the hip joint is attached. Below this line the head is almost completely encircled by a well-marked constriction termed the neck. The neck however is ill-defined outwardly where the surface of the head has, in the dried bone, but a faint line of demarcation between it and the non-articular area which extends to the great trochanter. This latter area is slightly concave from side to side, but from before backwards it presents a slight degree of convexity. Anteriorly it extends on to the inner surface of the convexity, whilst posteriorly it passes on to the inner surface of the summit. Near the convexity this area presents a large number of foramina, some of which are of considerable size. They transmit blood vessels into the cancellated tissue of the bone.

The lower extremity of the femur is made up of the trochlea, two condyles, and an intercondyloid groove. The trochlea is placed anteriorly and consists of a vertical articular groove bounded by two parallel ridges termed the lips. The articular area extends on to the concentric surface of each ridge. The inner lip is much the more prominent, and at its superior extremity it presents a well-marked enlargement which projects forwards and which terminates abruptly, a point which is of considerable importance in dealing with luxation of the patella. The anterior border of the outer ridge is sharp and well defined, as distinguished from that of the inner ridge, which is blunt. This border of the outer ridge

passes superiorly insensibly into the anterior surface of the shaft of the bone. Superiorly the articular surface of the trochlea is bounded by a faint, roughened, irregular line which indicates the attachment of the femoro-patellar capsular ligament.

The excentric surface of each ridge is roughened, and to these surfaces the outer and inner lateral patellar ligaments are attached.

The condyles are two large ovoid eminences. The inferior aspect of each is convex in the antero-posterior and transverse directions, and is smooth for articulation with the upper surface of the fibro-cartilaginous disc which lies on the superior surface of the corresponding tuberosity of the tibia. The excentric surface of each condyle is roughened. That of the inner condyle presents a well-defined, roughened tubercle, to which is attached the internal lateral ligament of the stifle. The external surface of the outer condyle presents two shallow pits. To the upper pit the external lateral ligament of the stifle is attached, whilst from the lower the tendon of origin of the popliteus muscle arises. The condyles are separated from one another by a deep furrow or trench. This is the intercondyloid groove. It is roughened and non-articular. Placed posteriorly on the surface of the outer condyle which bounds the groove, is a deep pit which indicates the superior attachment of the anterior crucial ligament. At the posterior extremity of the groove, and towards the inner condyle, is a much smaller and shallower pit. To this is attached the femoral coronary ligament which is the additional slip from the outer fibro-cartilaginous disc. The posterior crucial ligament is attached near the anterior end of the groove and to the internal condyle. Into the groove, in the articulated joint, the spine of the tibia projects.

The femur has the three usual centres of ossification of a long bone, one for the shaft and one for each extremity. There is an additional centre, however, from which the great trochanter ossifies.

FRACTURE OF THE FEMUR

It will be seen, from the above description, that the femur is well protected. Its anterior and lateral aspects are clothed by the thick quadriceps extensor cruris muscle. Posteriorly we have the entire thickness of the powerful hamstring muscles. The parts which may be felt to be superficially placed are the external or third trochanter, the great trochanter, and the distal epiphysis. Fracture of the third trochanter sometimes occurs as a result of a fall on the broadside. In such cases the fracture may be detected by palpation, particularly if the case be seen before there is much swelling of the part. Fracture of the summit of the great trochanter may result from a severe blow or kick received over the part. These fractures are not very serious since they do not affect the animal's ability to stand on the limb. The parts concerned, however, give attachment to the superficial and middle gluteal muscles and with the action of these there is, therefore, interference. Fracture through the neck of the femur is rare in the horse. This is due to the strengthening of the neck outwardly where it passes almost insensibly into the non-articular area between the head and great trochanter. The neck is thus more ill-defined and the head is not drawn out from the shaft of the bone to such degree as it is, for instance, in the human subject, and some of the smaller domesticated animals.

The most common fractures of the femur pass through the diaphysis, and these may be due to a severe blow received over the part, or the fracture may arise as a complication when the animal is cast for an operation. In the latter case fracture is said to be most likely to occur when the leg is fixed with the stifle in a condition of flexion, the fracture being the result of vigorous efforts on the part of the quadriceps muscles to extend the joint. When the fracture passes through the inferior third of the shaft fatal hæmorrhage not infrequently occurs, due to laceration of the femoral artery, which, it will be remembered, is here in

the femoral groove and lies on the bone. Fracture through the shaft is diagnosed without much difficulty if the palm of one hand be pressed against the outer surface of the thigh and an effort be made to pull the stifle outwardly. This may be accomplished with much less difficulty in cases of fracture. This is particularly so if the fracture be across the shaft near or below the inferior end of the groove for the femoral vessels.

Inability of the muscles will depend upon the seat of the fracture. Should the fracture be in the lower third of the shaft, the adductors of the thigh are not affected, and we get marked increased mobility of the limb below the seat of fracture, abduction of this part being accentuated by the fact that the adductors keep the upper two-thirds of the femur in a state of adduction.

When one or both condyles are fractured displacement usually takes place in the backward direction, the extensor muscles of the stifle are relaxed, and the joint held in a condition of flexion. The symptoms presented in these cases are not unlike those of stifle joint disease (gonitis). In cases of fracture, however, lameness appears suddenly.

Fracture through the neck, shaft, or condyles is as a rule followed by unfavourable results, particularly when the condyles are fractured. Cases where favourable results have been achieved have not, however, infrequently been reported.

Plate XIV. represents a case of fracture of the femur of the right limb. Both condyles and the trochlea were fractured. Nevertheless firm union took place. The affected limb was slightly shorter than the sound one and the stifle remained deformed, bulging outwardly not unlike some cases of crural paralysis. The articular surfaces were not affected, and the animal was able freely to flex and extend the joint.

Treatment of fractured femur consists in resting the animal and placing him in slings. Some assistance in reducing the fracture may be obtained by placing the animal under an anæsthetic. This should be

done if the patient be already down, but if not, it is scarcely worth while running the risk of further complications by endeavouring to cast him. A pitch plaster or charge should be applied to the affected quarter.

THE PATELLA

This small bone is placed at the front of the stifle joint. It is a floating bone and is not weight-bearing, its function being to give increased power to the quadriceps extensor cruris muscle. This tendon is inserted into the anterior straight ligaments of the patella which are attached to the anterior face of the bone, and the action of the muscle named is transmitted to the limb through the medium of these ligaments.

The patella presents for description three surfaces, of which the anterior surface is the most extensive. This surface is slightly convex in all directions, and is rough for the attachment of the femoro-patellar straight ligaments and also for the attachment of muscles. The posterior surface is entirely articular, and is moulded on to the articular surface of the trochlea. To be accommodated in the vertical groove of the latter, therefore, we find on the patella a vertical ridge, and this separates two areas which are moulded, though not very accurately, on the trochlear ridges. The outer of these areas is broadest superiorly, and tapers towards the inferior border of the bone. The inner area is triangular in outline, the base of the triangle being directed towards the articular ridge and the apex towards the inner border of the bone where the bone appears to be drawn out to a point. This feature enables the observer to distinguish readily between the patella of the right limb and that of the left.

Of the three surfaces the superior is the least extensive. It is non-articular and roughened. In the antero-posterior direction it is concave, whilst from side to side it presents a slight degree of convexity.

The patella develops from one centre of ossification.

FRACTURE OF THE PATELLA

This is usually due to a blow, such as a kick, or it may be caused by the stifle being flexed to an extraordinary degree. Owing to the manner in which the ligaments and tendons are inserted into the front of the patella, fractures which are due to violent muscular contraction are usually in the horizontal direction. When the fracture is due to a blow, the bone is usually broken into several pieces, and the fracture is of the comminuted variety. The numerous ligaments and tendons which are attached to the patella are more or less connected with one another by a plentiful supply of fibrous tissue in the part. After the infliction of the injury, therefore, this binding structure has the effect of keeping the fractured pieces in position, so that there is rarely any displacement. It will thus be understood that crepitation is not frequently a symptom of fracture of the patella, and on account of the numerous structures which are attached to the bone, there will be inability on the part of the animal to move without being subjected to great pain.

The patella is not a bone which lends itself readily to the healing of fractures, and this is particularly so when the fracture concerns the inferior portion of the bone. This is due to the fact that the nutrient vessels of the bone pierce its superior surface and the lower portion is very poorly supplied with blood.

Treatment of fractured patella in the human subject by the insertion of ivory connecting pegs or screws of steel or silver, has in recent years met with a considerable amount of success. In equine practice, however, prognosis is usually unfavourable, particularly when the joint is associated with the injury, as is very frequently the case. The animal should be placed in slings, and adhesive strapping applied to the joint to keep the part as still as possible. Further than this, little can be done.

THE TIBIA

The tibia is placed obliquely in the limb, running downwards and backwards from the stifle joint above to the hock joint below. It belongs to the class of long bones, and consequently possesses a shaft and two extremities.

The shaft presents for description three surfaces which are named respectively, posterior, external and internal. The external surface, in its upper third, looks outwards, and the upper portion of the surface is widest and is slightly depressed. In its middle third, the surface becomes slightly convex, whilst its lower third, which looks directly forwards, is almost flat. It will thus be seen that the external surface takes a somewhat spiral direction. This surface is clothed by the muscular or deep division of the flexor metatarsi.

The inner surface of the shaft is also widest superiorly, and it tapers gradually as we descend. This surface is slightly convex. Superiorly it is roughened for the attachment of muscles, but for the rest of its extent it is smooth and is immediately subcutaneous. It corresponds to the human "shin."

The posterior surface may be divided into three areas. The uppermost is triangular in outline, the apex of the triangle being directed downwards and inwards. This area is concave and smooth, and it accommodates the popliteus muscle. The central area is also triangular, but in this case the apex is directed upwards and outwards. It presents a number of parallel ridges which are roughened and from which the fibres of the flexor perforans muscle arise.

On the line of division of the two areas just described, and slightly to the outer side of the middle line of the back of the bone is the nutrient foramen, the direction taken by the canal into which the foramen opens being obliquely downwards and inwards.

The most inferior of the three areas is flattened and somewhat

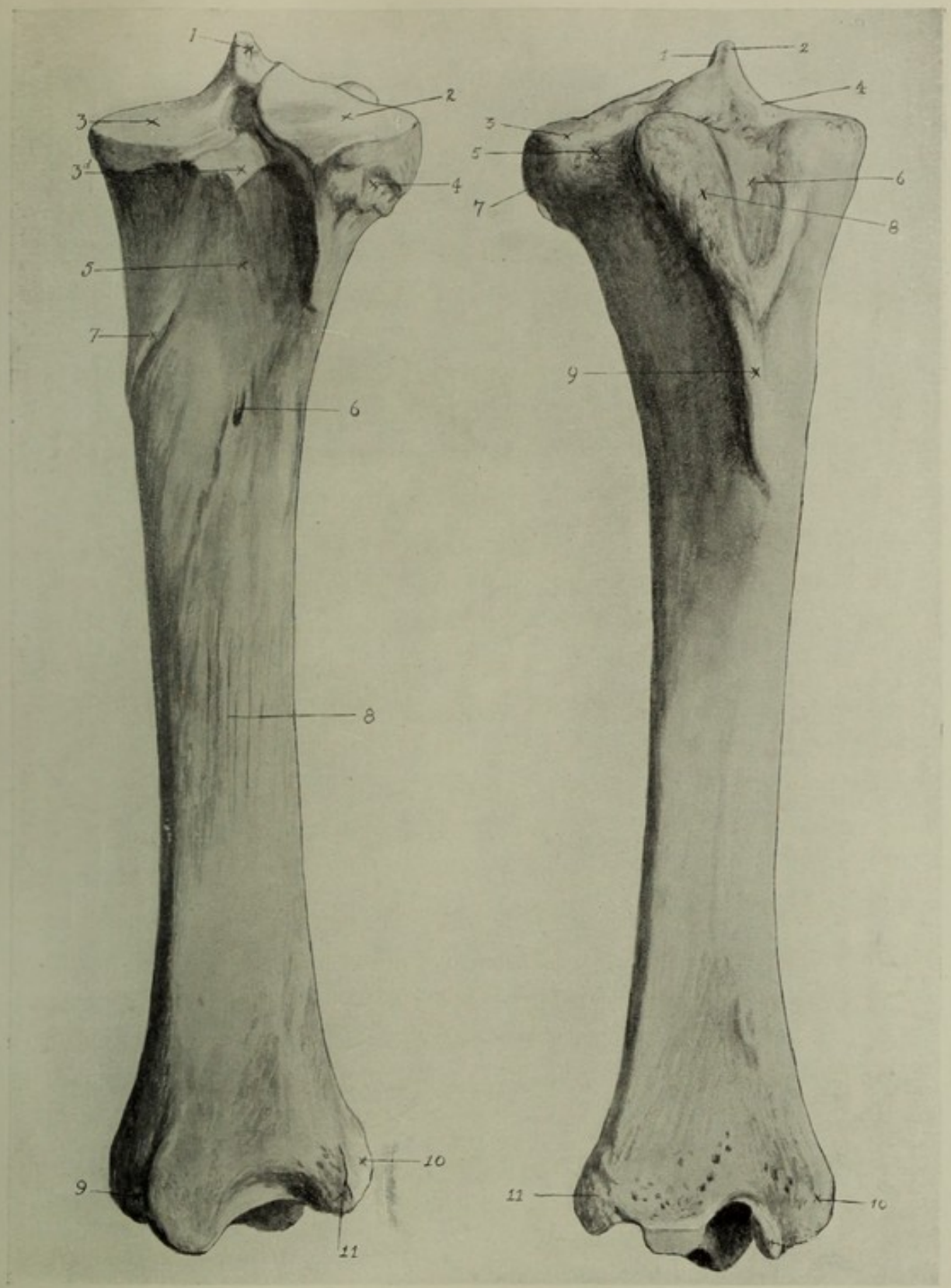

Plate XIII.—The Right Tibia

A.—posterior aspect

1. Spine of tibia. 2 and 3. External and internal tuberosities. 3*d*. Tubercle for attachment of posterior crucial ligament. 4. Depression for head of fibula. 5. Depression for accommodation of popliteus muscle. 6. Nutrient foramen. 7. Tubercle for insertion of popliteus muscle. 8. Ridges for attachment of flexor perforans muscle. 9. Groove for passage of tendon of flexor accessorius. 10. Groove for tendon of peroneus muscle. 11. External malleolus.

B.—anterior aspect

1. Insertion of anterior crucial ligament. 2. Spine of tibia. 3 and 4. External and internal tuberosities. 5. Notch for passage of common tendon of extensor pedis and superficial division of flexor metatarsi. 6. Groove in anterior tuberosity. 7. Articulation for head of fibula. 8. Outer division of anterior tuberosity. 9. Crest of tibia. 10 and 11. Internal and external malleoli.

four-sided. It is smooth and upon it the flexor perforans muscle lies.

Three edges separate the surfaces which we have described above. In the upper third of the bone the anterior edge stands out prominently and is sharp and well defined. This portion constitutes what is known as the crest of the tibia. For the remainder of its extent this edge is ill-defined.

The outer edge is concave in the longitudinal direction, and slightly convex transversely. This edge forms with the deep face of the fibula, the tibio-fibular arch, through the upper portion of which the anterior tibial vessels pass, leaving a well-marked vascular impression on the tibia.

The inner edge is almost straight. In the upper third of this edge there will be observed a well-defined tubercle, to which the popliteus muscle is attached.

The superior extremity of the tibia is very massive, and is made up of three tuberosities, the tibial spine, and a non-articular, roughened area, which serves for the attachment of ligaments. One of the tuberosities is placed mesially in front, and the remaining two alongside one another posteriorly.

The anterior tuberosity is roughened and non-articular. Inferiorly it is continuous with the crest of the tibia. This tuberosity is divided into two parts by a well-marked groove, which is disposed vertically. That portion to the outer side of the groove is much the more prominent. It extends to the higher level, and outwardly it projects over the notch through which the common tendon of the extensor pedis muscle and superficial division of the flexor metatarsi plays. Anteriorly this portion is roughened, and it gives attachment to the external straight ligament of the patella. The portion of the anterior tuberosity to the inner side of the groove is much less pronounced, and inwardly it passes insensibly into the roughened border of the internal tuberosity. Anteriorly this portion is also roughened, and to it the internal straight ligament of the

patella is attached. The middle straight patellar ligament is attached to the groove mentioned.

The external tuberosity is articular on its superior aspect, where it presents a large facet which is usually described as being saddle-shaped. It articulates indirectly with the external condyle of the femur, the outer semilunar disc being interposed between the two bones. On the outer side of this tuberosity, below its articular surface, is a roughened depression, to which the head of the fibula is articulated.

The superior aspect of the internal tuberosity is also articular. For the most part it is almost flat, but inwardly it extends upwards on the inner surface of the tibial spine. Upon this surface the inner semilunar disc rests, the upper surface of which articulates with the internal condyle of the femur. On its posterior aspect, and towards the middle line of the bone, this tuberosity presents, slightly below the level of its articular surface, a small tubercle, to which the posterior crucial ligament is attached.

The tibial spine is an upwardly-projecting, peak-like process placed near the middle of the upper extremity of the bone. As already stated, the articular surface of the internal tuberosity is continued upwards on the inner surface of the spine. Its outer surface is roughened, and affords attachment to the anterior crucial ligament.

On the roughened areas between the tuberosities will be seen a large number of small foramina, which transmit the vessels of the cancellated tissue.

The inferior extremity presents on its lower surface an articular area for the astragalus. On this area are two deep grooves, which take a direction outwards and forwards. They are separated from one another by a prominent articular ridge. The ridge and grooves articulate with the groove and ridges of the astragalus, thus forming the true hock joint.

Each groove is bounded excentrically by a large tuberous piece of bone termed a malleolus. The external malleolus is smooth and articular inwardly where it bounds the outer groove. Outwardly it is convex

and roughened for the attachment of the external lateral ligament of the hock. This surface is crossed by a groove, which is disposed almost vertically, and through which the tendon of the peroneus muscle plays. The internal malleolus is similarly smooth and articular where it bounds the inner groove, the other surface being convex and roughened for the attachment of the internal lateral ligament of the hock.

The tibia develops from three main centres of ossification, one for each epiphysis and one for the diaphysis. In addition there are two other centres, from one of which the external malleolus is developed, whilst the other is for the anterior tuberosity at the proximal epiphysis of the bone.

FRACTURE OF THE TIBIA

It will be gathered from the foregoing description that the most exposed parts of the tibia are the inner surface, which is subcutaneous, and the inferior extremity, where the malleoli stand out prominently.

Cases of fractured tibia are very common. Next to the innominate bone, this bone is the most frequently fractured. It is estimated that of all fractures of the bones of the horse five per cent. are fractures of this bone.

Its outer surface is well protected, being clothed by the extensor pedis and flexor metatarsi muscles.

The bone is commonly fractured in its inferior third, about two inches above the malleoli. The author has frequently seen cases of fracture in this situation. Some have occurred in steeplechasers, whilst others have resulted from the animals being cast in the stall by catching the shoe of the hind foot in the chain where the block has been of insufficient weight to keep the chain taut.

The bone is also frequently fractured as a result of a kick received on the inner surface of the bone whilst the animal is lying down.

A peculiar feature in connection with fracture of the tibia is that this bone is the most common seat of what is known as deferred fracture, by which term is meant a fracture in connection with which displacement does not occur until some time after the injury to which the fracture is primarily due, has been inflicted. Regarding the cause of the delay in the displacement, there are two theories. One is that the fracture is complete at the time of the injury, but that the fractured pieces are held in position by the dense layer of deep fascia which covers the part, displacement occurring later when some sudden strain is thrown upon the limb. The other theory is that at the time of the receipt of the injury the fracture is only partial, the bone being fissured but not completely fractured. The fracture is completed by some subsequent strain thrown upon the limb, aided by the pressure of the inflammatory exudate which has been poured into the line of the partial fracture.

Little difficulty is experienced in diagnosing cases of complete fracture with displacement, particularly when the inferior third of the bone is affected, as the seat of the fracture may be readily located with a little manipulation. Frequently it may be seen, and manipulation is unnecessary owing to the pronounced lateral bend presented just above the hock and the swinging of the limb below it. Cases of compound fracture are, of course, still more apparent. In these cases there is, in addition, considerable systemic disturbance.

In cases of deferred fracture accurate diagnosis is much more difficult. There is lameness, the degree of which varies considerably, and occasionally attention is attracted by the presence of an abrasion of the skin over the part. When the injury has been received some time before the surgeon has been called in, the difficulty is increased by the swelling of the inner aspect of the leg. In such cases the part should be carefully palpated, when it is possible to trace out the painful area, which will indicate the line of the fissure.

These remarks apply only to fissures on the inner aspect of the bone.

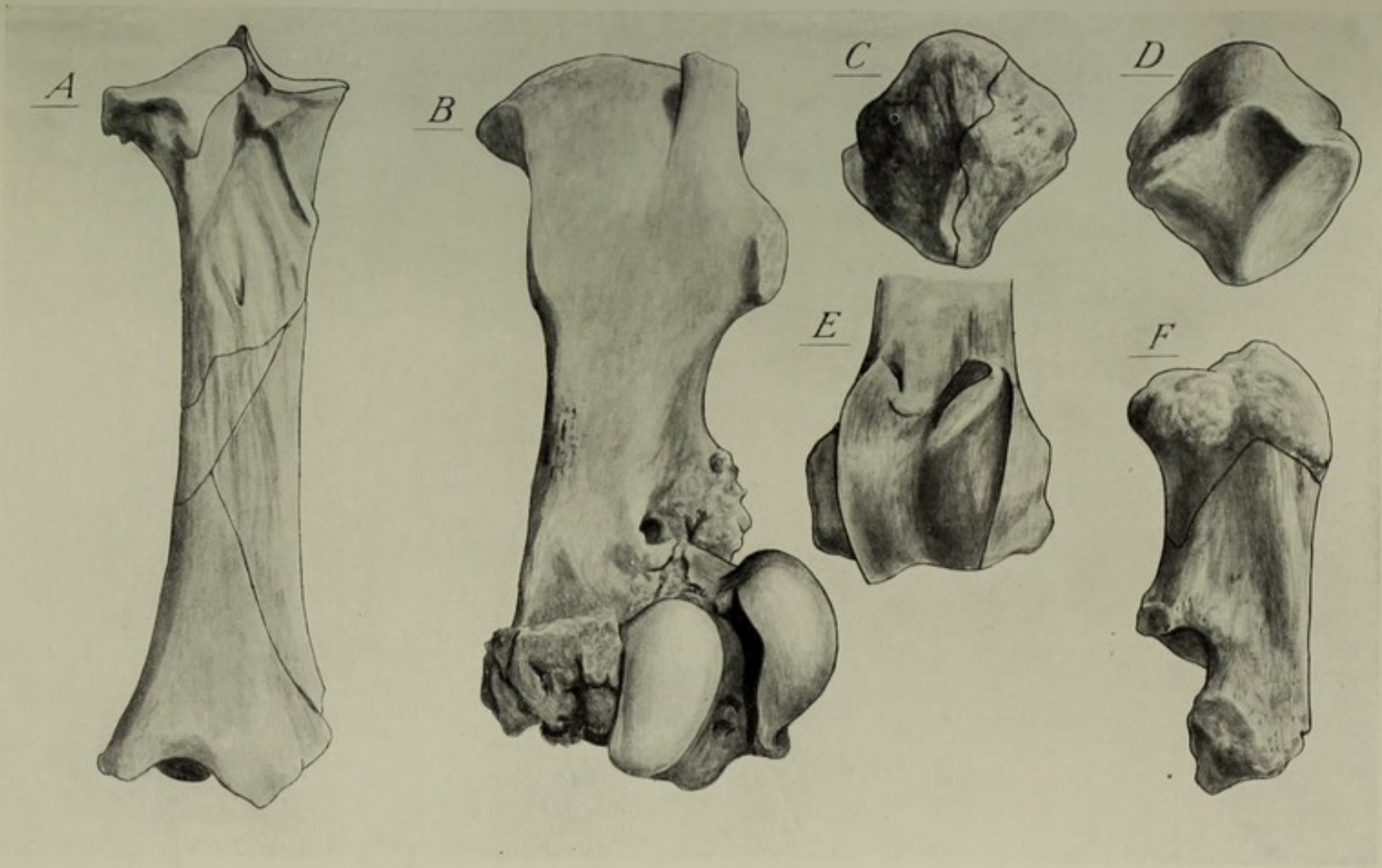

PLATE XIV.—FRACTURED FEMUR, TIBIA, PATELLA, ETC.

A.—Posterior aspect of left tibia showing fracture.

B.—Posterior aspect of right femur showing seat of fracture above condyles where parts have united irregularly, with large amount of callus formation.

C.—Right patella, anterior aspect, showing vertical fracture.

D.—Posterior aspect of normal right patella, showing articulation for trochlea of femur.

E.—Trochlea of right femur.

F.—Left os calcis, showing fracture just below summit of tuber.

It will be evident that such tracing is impossible on the outer aspect, owing to the amount of muscular tissue clothing the bone. In these latter cases the fracture can only be suspected.

From what we have said it will be readily gathered that a rational method of procedure in treating the case is to place the animal in slings immediately, and this applies to cases of complete or partial fracture. It is also applicable to cases where fracture is merely suspected. If displacement has already occurred, the fractured bones should be replaced, and a plaster bandage applied to keep them in position. Should the fracture be compound, an aperture should be made in the bandage to permit of the subsequent dressing of the wound with antiseptics. The immediate slinging of the animal in cases of complete fracture without displacement may be the means of preventing displacement, whilst, accepting the theory that the fracture may be incomplete and that the bone is only fissured, it may prevent the completion of the fracture. In cases of simple fracture or fissure so placed in slings recovery frequently occurs in from three to four weeks.

Another method of treatment is to apply the iron splint designed by Bourgelat, which "extends from the ground (inserted into a square hole in a projection at the toe of the shoe) up the front of the limb, as high as the stifle, where it forms two expanded branches, one for each side of this joint. Two clips at its lower part and middle (movable) enclose the fetlock and hock, and there are slots to fasten it to the limb." *

THE FIBULA

A peculiar feature in connection with this bone in the horse is its small size as compared with the other bone of the leg, namely, the tibia. It possesses a head and a slender tapering body.

The head is placed superiorly, and is the thickest part of the

* Fleming.

bone. Its external surface is slightly convex, and roughened for the attachment of the external lateral ligament of the stifle. Its inner surface is also roughened. It is somewhat flattened, and is accommodated in the depression on the outer aspect of the external tuberosity of the tibia.

The body is a slender rod of bone, which tapers to a point inferiorly. For two or three inches at its inferior end it is closely applied to the outer edge of the tibia, but above this portion there is an interval between the two bones which in the living animal accommodates an interosseous membrane which binds the two bones together.

The fibula develops from two centres of ossification, one for the head and the other for the body.

This bone is very rarely fractured. The peroneus muscle affords it a considerable degree of protection. In cases where fracture does occur diagnosis is difficult, owing to its concealed position, the head being the only part which can be felt in the living animal. Moreover, fracture of this bone is not of great consequence, since it does not materially affect the action of the limb, and the tibia performs the function of a natural splint in maintaining the parts in position. The most serious complication which might possibly occur is injury to the vessels passing through the tibio-fibular arch when the bone is fractured just below the head and there is inward displacement.

THE BONES OF THE TARSUS

The Astragalus.—In shape this bone is very irregular, but for purposes of description it may be said to possess six surfaces, which may be named anterior, posterior, superior, inferior, external lateral, and internal lateral.

The superior and anterior surfaces are blended, and present two parallel articular ridges, separated from one another by a deep articular

groove, the whole being for articulation with the inferior end of the tibia. The surface presented is thus pulley-like, and it winds half-way round the bone with a direction which is forwards, downwards, and outwards.

The posterior surface is irregular, and presents three or four facets for articulation with like facets on the anterior surface of the body of the calcis.

The inferior surface is slightly convex. It presents a large facet for articulation with the superior surface of the scaphoid. For the rest of its extent this surface is non-articular and roughened for the attachment of the astragalo-scaphoid interosseous ligament.

The external lateral surface is roughened, and presents a pit for the attachment of one of the slips of the external lateral ligament of the hock. The inner lateral surface is also roughened, and presents a well-defined, prominent tubercle from which the astragalo-metatarsal ligament arises. This tubercle forms a very important superficial landmark in the living animal. The size of the tubercle varies considerably in different animals, irrespective of the size of the animal, as also does the size of the prominence caused by the internal malleolus of the tibia, which is found just above that caused by the tubercle mentioned. It is thus of considerable surgical importance to compare the prominences on both hocks when subjecting them to examination.

The Os Calcis.—This bone is made up of a body and a large process termed the tuber calcis. Together with the astragalus, it forms what may be called the upper row of tarsal bones.

The body is very irregular in shape. Anteriorly it presents three or four facets for articulation with the facets already described on the back of the astragalus, whilst between them the bone is roughened for the attachment of the calcaneo-astragaloid interosseous ligament. On the inferior surface of the body is an elongated facet, which is slightly concave, and which articulates with the cuboid. Superiorly and towards its outer side the body is continued by the tuber, whilst the

remainder of this surface is smooth and blends with the posterior surface. This is the surface which forms the anterior boundary of the tube through which the perforans tendon plays at the tarsus.

The lateral surfaces of the body are roughened for ligamentous attachment.

The tuber is a massive piece of bone which projects upwardly from the outer portion of the body. It presents two surfaces, two borders, and a summit. The outer surface is almost flat. The inner surface is slightly concave and is smooth. This surface forms the outer boundary of the tarsal sheath. The anterior border is curved in its length, with the concavity directed forwards. It terminates inferiorly in a projecting, peak-like process. The posterior border is much thicker and longer, and is almost straight. To it is attached the thick calcaneo-metatarsal ligament. The summit of the tuber forms the point of the hock in the living animal, and corresponds to the human heel. It presents a central, roughened depression, in which the tendon of the gastrocnemius muscle is inserted. In front of this is a convexity upon which this tendon rests when the hock is flexed. Behind the depression is another, much larger convexity. This is smooth, and over it the tendon of the flexor perforatus muscle plays. Between this tendon and the bone there is interposed a small synovial bursa.

The Scaphoid.—This bone is placed between the astragalus and the cuneiform magnum. It is flattened from above to below, and may be said to have two surfaces and four edges. The superior surface is slightly concave. It presents a large facet for articulation with the astragalus. A non-articular area runs from the centre of the bone outwardly. This area gives attachment to the astragalo-scaphoid interosseous ligament. The inferior surface is slightly convex, and for the most part smooth and articular. The larger portion of the smooth area articulates with the cuneiform magnum, but postero-internally the bone presents a small convex facet which articulates with the cuneiform parvum. For the rest of its extent the inferior surface is roughened

for the attachment of the interosseous ligament which unites this bone to the cuneiform magnum.

The anterior and inner edges are convex and blended with each other. They present a curved, roughened ridge, which gives attachment to the astragalo-metatarsal and internal lateral ligaments. The posterior edge is irregular and roughened for the attachment of the tarso-metatarsal ligament. The outer edge is concave, and presents two facets which articulate with like facets on the cuboid. This surface also presents a roughening for the attachment of the cuboido-scaphoid interosseous ligament.

The Cuneiform Magnum.—This bone is situate below the scaphoid, and rests on the upper extremity of the large metatarsal bone. It is flattened from above to below, and is not unlike the scaphoid. It is, however, a smaller bone, and is somewhat triangular in outline, presenting for description, therefore, two surfaces and three edges.

Its superior surface is slightly concave and presents two articular facets, separated from one another by a transverse, non-articular groove. The anterior facet is much the larger, and both facets articulate with the scaphoid. To the non-articular groove the scaphoido-cunean interosseous ligament is attached. The inferior surface is somewhat similar, possessing facets for articulation with the large metatarsal bone and a roughened area for ligamentous attachment. This surface is slightly convex. The outer edge is concave, and possesses two facets for articulation with the cuboid. Between the facets the edge is roughened for the attachment of the cuboido-cunean interosseous ligament. The inner edge is also concave, slightly more so than the outer. It presents a single facet for articulation with the small cuneiform bone. The anterior edge forms the base of the triangle. It presents a curved, roughened ridge, which gives attachment to the astragalo-metatarsal and internal lateral ligaments. This ridge is of great surgical importance. It is subject to a considerable degree of variation in size, variations being more frequently met with in the size of this ridge

than in that on the scaphoid. Moreover, it not uncommonly happens that the ridge on one cuneiform bone is much larger than the ridge on the cuneiform magnum of the other hock in the same animal. This materially affects the external contour of the joint, and frequently gives rise to considerable discussion as to whether the animal is or is not affected with spavin. The hock with the larger ridge presents a much coarser appearance. This point will be further referred to in dealing with spavin.

The Cuneiform Parvum.—This is the innermost of the bones of the lower row, and is much the smallest bone in the tarsus.

For the purpose of description it may be said to possess two surfaces, two edges, a base, and an apex, although it is very irregular in shape.

The superior edge presents a concave facet for articulation with the scaphoid. The inferior edge shows two facets, the more anterior of which is much the smaller and is flat. This facet is for articulation with the large metatarsal bone. The other facet is concave, and is for articulation with the inner small metatarsal. The base of the bone is placed posteriorly. It is roughened and rounded. Inferiorly it is drawn out into a nodular process. The apex projects forwards, and carries a small facet for articulation with the cuneiform magnum. The two surfaces are non-articular, the inner being convex and roughened, whilst the outer is slightly concave.

The Cuboid.—Of the tarsal bones this is the most regularly shaped. It presents six surfaces. The superior surface is smooth and articular. It is slightly convex, and articulates with the astragalus and calcis. The inferior surface presents four articular facets in two pairs, one pair being in front and the other behind. The inner facet of each pair articulates with the large metatarsal bone, whilst the outer articulates with the outer small metatarsal.

The inner surface presents an antero-posterior groove, which, when the tarsal bones are articulated with one another, completes with the scaphoid and cuneiform magnum, a canal through which the perforating

metatarsal artery passes with its accompanying vein. Above the groove there are two facets for articulation with the scaphoid, and below it are two other facets, which are articulated to like facets on the cuneiform magnum.

The anterior, external, and posterior surfaces are roughened and non-articular.

The cuneiform parvum ossifies from two centres. A slight constriction passes round the bone, and this indicates the line of fusion of the two parts. Each of these parts is represented in the dog, in which animal they remain separate bones. Such is the case also in the human subject. In rare cases the parts remain separate in the horse.

Each of the remaining tarsal bones ossifies from a single centre, with the exception of the os calcis, which, in addition to its main centre, has a centre from which the summit of the tuber calcis ossifies.

FRACTURE OF THE TARSAL BONES

Of the bones of the tarsus the calcis is the one which is most exposed to risk of injury since its tuber stands out prominently at the back of the limb, its summit forming the point of the hock.

This bone is therefore the most frequently fractured, the fracture being usually due to a severe blow or kick received over the part. Owing to its superficial position, when the tuber is fractured diagnosis may be readily made, for the fracture may be detected by simple manipulation. The tendon of the gastrocnemius muscle is inserted into the tuber. When the latter is fractured the tendon is relaxed, as is also that of the flexor perforatus (which gives off slips of insertion into the tuber just below its summit), so that we have the peculiar wobbling of the tendo-achilles which is seen also in rupture of the flexor metatarsi muscle or tendon. The animal is unable to place any weight on the

limb, and the joints below the hock are all held in a condition of flexion.

In rare cases the astragalus is fractured, fracture of this bone being usually due to the limb being forcibly twisted whilst the foot is in a fixed position. More rarely still are the other tarsal bones found to be fractured, and when such fractures occur they are the result of some violent injury, such as a heavy fall of roof in mines or the passage of a heavy vehicle over the limb. In these cases diagnosis is more difficult. There is considerable swelling of the joint, owing to the pouring out of inflammatory exudate. The symptoms presented are not unlike those of a wrenched hock. Crepitation may, however, be detected. In the case of the astragalus the best method is to hold the joint in the palms of both hands whilst an assistant flexes and extends it. Careful and precise palpation is necessary to detect fracture of the smaller bones.

Prognosis in fractured tarsal bones is usually unfavourable. In the case of the tuber calcis little difficulty is experienced in replacing the fractured piece, but it is extremely difficult to maintain it in position, owing to the pull exerted on it by the tendons of the flexor perforatus and gastrocnemius muscles each time the animal moves the limb. To rivet the fractured piece to the fixed portion of the tuber would be the most rational method.

The application of Bourgelat's splint is another useful method, since it effectively prevents the movement of the joints. A pitch plaster or charge should be placed over the point of the hock, arranged as a cap, and should extend downwards on either side of the joint. This would assist in preventing the fractured piece of bone from being pulled upwards and displaced by the tendons. When the astragalus is fractured treatment is usually hopeless, since the articular ridges are most frequently involved, so that the fracture extends into the true hock joint, with the result that, should healing take place, permanent interference with the action of the joint remains, and the animal is not workable.

SPAVIN

This is one of the most serious and troublesome diseases with which the surgeon has to contend. It is an affection of the antero-internal portion of the hock, and our reasons for treating the disease here will be gathered from the description which follows. It is a disease which is extremely common, and, notwithstanding the great amount of work which has been done in this connection in the past, several phases remain to this day in obscurity. There is scarcely a veterinary writer who has not at some time or other had his attention attracted to it, whilst it is more or less exhaustively dealt with in all surgical text-books.

The area affected is usually the inferior third of the antero-internal portion of the joint. The bones of this portion are the cuneiform magnum, cuneiform parvum, scaphoid, the upper end of the inner small metatarsal, together with the inner portion of the proximal extremity of the large metatarsal. These bones form between them a number of synovial joints of the arthrodial class. Movement is, however, restricted in the joint formed between the large and inner small metatarsal bones by the ossification of the interosseous ligament which unites these bones to one another in the immature animal. There is free movement, however, in the joints formed by the cuneiform bones and the scaphoid, and also between the cuneiform bones and the metatarsals. These joints are all supplied by synovial membranes, and the surfaces of the bones which come into apposition with one another at the joints are clothed, with articular cartilage (for a fuller description see the chapter on joints).

From our description of the bones it will be remembered that a roughened ridge extends transversely across the front of the scaphoid, and that this ridge is continued on to the inner edge of the bone. Another ridge, parallel to the one just mentioned, is found on the cuneiform magnum. This latter ridge is slightly the more prominent, and extends on to the inner aspect of the joint. Between these two ridges is a transverse groove, at

the bottom of which is the line of apposition of the articular surfaces. The ridge on the cuneiform magnum forms the upper boundary of a second transverse groove, the lower boundary of which is formed by the prominent anterior border of the upper extremity of the large and the head of the inner small metatarsal bones. There is also a groove disposed vertically connecting these, and continued downwards between the large metatarsal bone and the head of the inner small metatarsal (see Plate XVIII. and chapter i.).

Passing over the anterior aspect of the scaphoid and cuneiform magnum is the thin, sheet-like astragalo-metatarsal ligament, whilst the cunean branch of the flexor metatarsi tendon passes to its insertion into the small cuneiform bone. The joint is closed anteriorly by the thin anterior common ligament. The anterior root of the internal saphena vein runs upwards and forwards across the cuneiform magnum and the scaphoid, but subcutaneously placed, whilst a slender cutaneous branch from the posterior tibial nerve runs obliquely downwards and forwards over these bones.

The ridges and grooves above are considered by some to be of great diagnostic importance in connection with spavin. Others, again, treat them with indifference. Amongst the latter are some who base their opinion on the ground that the presence of the ligaments renders the detection of the grooves by palpation impossible. In support of this contention Wooldridge drove nails into hocks in those situations where he presumed the grooves to be present, and these experiments led him to conclude that the grooves could not be located. His experiments were obviously performed on the dead subject, and much value cannot be attached to them, on account of the greater pliability and suppleness of the structures in the living animal, together with the power to relax the ligaments, &c., by flexing and extending the joint at will, which the observer of the living animal possesses. It will be readily conceded that in animals with thick, coarse skins there will be greater difficulty experienced in locating the grooves and ridges, and in some such subjects it might be even

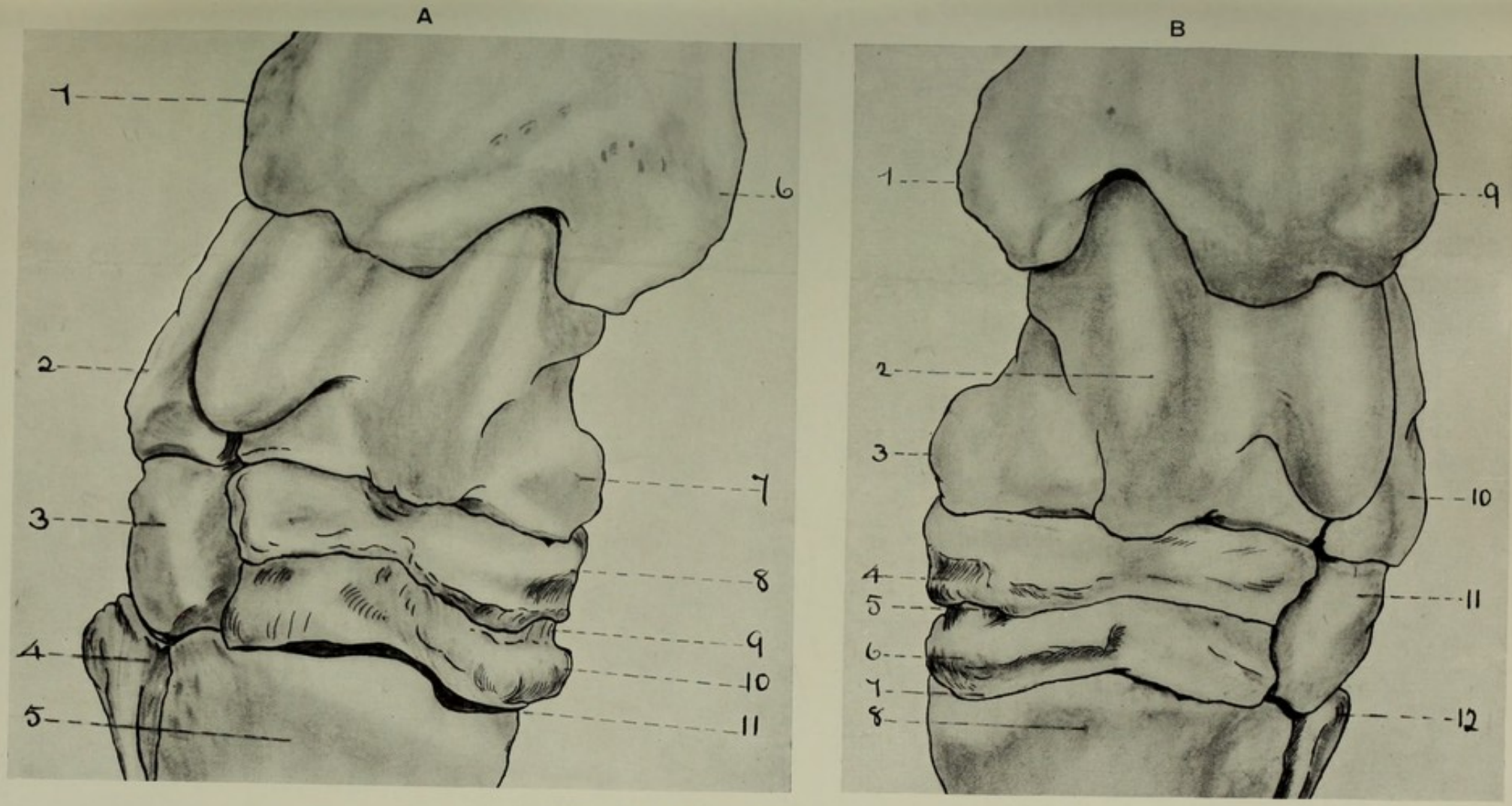

PLATE XV.—TARSAL BONES OF AMBUSH II.

A.—RIGHT TARSUS

1. External malleolus of tibia. 2. Calcis. 3. Cuboid. 4. External small metatarsal bone. 5. Large metatarsal. 6. Internal malleolus of tibia. 7. Tubercle of astragalus. 8. Ridge on scaphoid. 9. Transverse groove between scaphoid and two cuneiform bones. 10. Ridge on cuneiform magnum. 11. Transverse groove between cuneiform bones above and large and inner small metatarsal bones below.

B.—LEFT TARSUS

1. Internal malleolus of tibia. 2. Astragalus. 3. Tubercle of astragalus. 4. Ridge of scaphoid. 5. Groove between scaphoid and two cuneiform bones. 6. Ridge on cuneiform magnum. 7. Groove between cuneiform bones above and large and inner small metatarsal bones below. 8. Large metatarsal bone. 9. External malleolus of tibia. 10. Calcis. 11. Cuboid. 12. External small metatarsal.

impossible. A simple study of the bones, however, will reveal the fact that the ridges are present, and they must necessarily affect the external contour of the part, however slightly. It is not claimed that the grooves are such as would readily accommodate a finger. If such were the case there would be no art in detecting them ; but by educating the sense of touch, and with a knowledge of the underlying osseous structures, a keen observer should be able to differentiate between a levelling up of a surface where normally there should be a slight depression, and still more so should he be able when there is present on that surface, an elevation. One has only to refer to the Sheather *v.* Simmons case for ample proof that importance in diagnosis can be attached to the grooves (see Plate XVI.), and these remarks particularly apply to the finer, thin-skinned animals.

Now spavin has for one of its characteristics an enlargement which appears sooner or later on the area we have mapped out. The earliest observers considered the enlargement to be of an osseous nature. There were others who considered it as a thickening of the ligaments, but the oldest view is now generally accepted ; but contention still wages round the exact seat of origin of the affection, some maintaining that it commences in the extra-osseous structures and extends to the bones, whilst others contend that it commences as an inflammation of the bones (*i.e.*, an ostitis) and extends from them to the surrounding structures.

The late Professor Williams defined spavin as "an exostosis on the inner and lower part of the hock, arising from inflammation of the cuneiform and metatarsal bones, terminating generally in anchylosis of one or more of the gliding joints of the hock." Moller and Dollar state (1903) that "the view that the bone tissue is the primary seat of the disease is old, but has again quite recently been advanced by Eberlein. Eberlein's views are supported by the experiments of Gotti, and consist in regarding the bone substance as being primarily attacked, after which the cartilage of the joint, the periosteum, and the ligamentous apparatus are successively

invaded. He considers spavin to consist in an ostitis rarefaciens et condensans."

We have indicated what is the common, in fact the usual, seat of spavin. But cases have been recorded where the seat has been the external aspect of the hock, with a history exactly coinciding with that of spavin in the usual situation. Several theories have been put forward in explanation of the greater frequency of the occurrence of spavin in the position stated. The one which appears to be the most satisfactory, and is the most generally accepted, attributes it to the arrangement of the bones of the limb, claiming that the oblique disposition of the long axis of the tibia downwards, backwards, and inwards causes, during the necessarily slight rotation of the tibio-astragaloid joint, greater pressure to be thrown upon the inner side of the joint than the outer.

Hence it is stated that spavin is found most frequently in animals in which the pelvis is broad, in consequence of the greater degree of obliquity taken by the shaft of the tibia. This applies to the effect on the rotation in the hock. On the other hand, the articular surfaces of the bones are more likely to be injured by concussion when the degree of inclination of the long axis of the tibia to the horizontal axis of the tarsus approaches too nearly the perpendicular.

Regarding the conformation of the hock itself, there is considerable divergence of opinion as to the particular kind of hock which is most susceptible to the disease. Most maintain that animals with sickle or cow hocks are very susceptible. In this connection it is interesting to note the comparative shortness of the flexor metatarsi in relation to the length of the limb. Even in animals with the tibia disposed less obliquely than usual this muscle appears too short, and is generally in a condition of tension, a point which becomes very evident in cases of rupture of this muscle. In sickle-hocked animals, then, there must be considerable pressure thrown upon the articular surfaces of the small bones when either the flexor metatarsi or its antagonist, the gastrocnemius, is acting. "Tied-in hocks," in which the heads of the metatarsal bones, and the

cuneiform bones are abnormally small, are also said to be frequently affected, owing to the smallness of the articular surfaces. In animals with broad hocks the bones present a much greater articular area over which the concussion received at the joint is distributed.

At the same time it may be stated that no form of hock can be said to be immune, for spavin is found in hocks considered to be extremely well formed and symmetrical, whilst, on the other hand, cases of ill-formed hocks are frequently met with which wear well throughout life under the most trying circumstances.

That there may be inherited a predisposition to the disease appears to be generally conceded—a point which is fully appreciated by most breeders. So far as conformation is concerned, the influence of heredity cannot be doubted. In connection with this question of predisposition it is even now interesting to give the following remarks of Percival, as quoted by W. Williams :

"I am very much disposed to believe in the existence in the system of what I would call an ossific diathesis. I have most assuredly seen unbroke colts so prone in their economy to the production of bone that, without any assignable outward cause—without recognisable injury of any kind—they have at a very early age exhibited ringbones, and splints, and spavins. There might have been something peculiar in the construction of their limbs to account for this ; at the same time there appeared a more than ordinary propensity in their vascular system to osseous effusion. Growing young horses—and particularly such as are what is called 'overgrown'—may be said to be predisposed to spavin simply from the circumstance of the weakness manifest in their hocks as well as other joints. When horses whose frames have outgrown their strength, with long and tender limbs, come to be broke—to have weight placed upon their backs at a time when the weight of their own bodies is as much as they are able to bear—then it is that the joints in an especial degree are likely to suffer, and windgall and spavin to be the result. Indeed, under such circumstances, spavin, like splint and other transfor-

mations of soft and elastic tissue into bone, may be regarded as Nature's means of fortification against more serious failures."

A reference to our chapter on joints will make clear the fact that the small bones concerned in this disease are intimately connected with one another by short, strong interosseous ligaments, and it will be evident that the greater the gliding movement produced by the bones the greater the danger of these ligaments being sprained and becoming inflamed. Hence sickle or cow hocks are cited amongst those predisposed to the disease, since greater movement is produced between the bones by the action of the flexor metatarsi and gastrocnemius.

Somewhat similarly may be regarded the action of violent exercise, particularly in young and immature animals. The bones are injured at the attachments of the ligaments, and ostitis results. The jar on the articular surfaces resulting from concussion is stated to be the most important local or exciting cause. Macqueen holds this view. Hence we find spavin frequently developed in young animals with good hind action, but which, through lack of elasticity in their movements, put their feet down with a considerable amount of force, particularly when such animals are worked regularly on hard roads or pavement.

Peters, quoted by Möller, "thinks soft, moist ground and rough pavements particularly injurious, because the unavoidable rotary movement of the hoof on the ground is interfered with, and consequently takes place, not at the extremity of the limb, but in the joints, especially in the hock joint." From what we have said regarding the effect of undue tension on the ligaments, this view of Peters appears to be very logical.

External injuries, such as blows, kicks, &c., may be almost entirely disregarded, since the usual situation of spavin is such that the seat is particularly favourable to its protection.

The disease runs an insidious course. At first in many cases lameness is not very apparent, and what is noticed is that the hock is not flexed with the former freedom. Later there is marked stiffness in the joint, and still later there is pronounced lameness, particularly when the animal is first

brought out. After exercise the lameness disappears. There is, then, a peculiar similarity between these cases in this respect and navicular disease. "It is a supporting leg lameness, and in consequence the quarter is carried low, and in the trot the quarter sinks a little."* Incomplete extension of the joints below the hock leads to pressure being placed almost entirely on the toe, so that the shoe at the toe becomes worn. As a later result of inaction at the heel we find the foot becomes more upright and blocky, and the frog atrophies and is carried up out of function. When the animal is turned sharply towards the sound side there is obviously greater pressure thrown upon the inner aspect of the affected limb, and this tends to accentuate the lameness, on account of the pain to which the animal is subjected. It is usual to apply what is known as the spavin test. This consists in forcibly flexing the affected hock for about a minute, and then causing the animal to move on suddenly. This causes the lameness to be more apparent. Too great stress, however, must not be attached to this test, since most horses will move off stiffly afterwards, particularly if the test be severely applied.

The seat should be carefully palpated, and an attempt be made to locate the grooves and ridges which we have described. There is no difficulty in coming to a conclusion when a marked exostosis is present, but there is much greater difficulty when the external indication is simply a filling up of the grooves and a levelling of the surface. In such cases the hock should be compared with the hock of the other limb, and a reasonable diagnosis made if the grooves on the sound limb are even slightly more distinct. In connection with this method of comparison it should be mentioned that animals with odd hocks are not infrequently met with in which there is an enlargement on one hock at the seat of spavin. This enlargement is usually due to an abnormally large ridge on the cuneiform magnum ; and although to the sight there would appear to be an enlargement on the seat of spavin which not infrequently attains

* Macqueen.

the size of half a walnut, palpation will reveal the fact that in these cases the grooves are even more distinct. Plate XV. represents a good example of a case of this kind. The bones represented are those of the hocks of Ambush II., which skeleton is in the Museum of Veterinary Anatomy of the University of Liverpool. In the Plate it will be seen that the ridge on the cuneiform magnum of the off hock is very much larger than that on the corresponding bone of the near, and it is reasonable to assume that this abnormally large ridge would cause a marked difference in the conformation of the two hocks in the living animal. Yet the bones are perfectly healthy, and the articular surfaces quite normal.

This method of comparison, and also the palpation of the affected hock, must therefore be taken in conjunction with evidences deduced from the action of the animal, and from *all* the premises thus obtained our conclusion must be drawn.

Regarding the cause of lameness in spavin, there is little doubt but that, as Macqueen maintains, it is due to the pain experienced as a symptom of the active inflammatory process which is proceeding. That it is not due to mechanical interference with the action of the joint is conclusively proved by the fact that the tibio-astragaloid or true hock joint is only affected in cases which are extremely rare, and it is in this joint that almost the whole of the flexion and extension of the hock takes place. Further contributory evidence in support of this view is found in the fact that cases are frequently met with in which lameness has disappeared and yet a prominent exostosis is present. In such cases a post-mortem examination will reveal the fact that the small bones concerned are firmly united with one another ; *i.e.*, anchylosis is complete, with the result that the active inflammatory process has subsided and the animal is not subjected to pain. The small bones now perform the function of a single bone, and the hock may be flexed and extended with freedom.

We are thus led to a rational method of treating the disease ; for

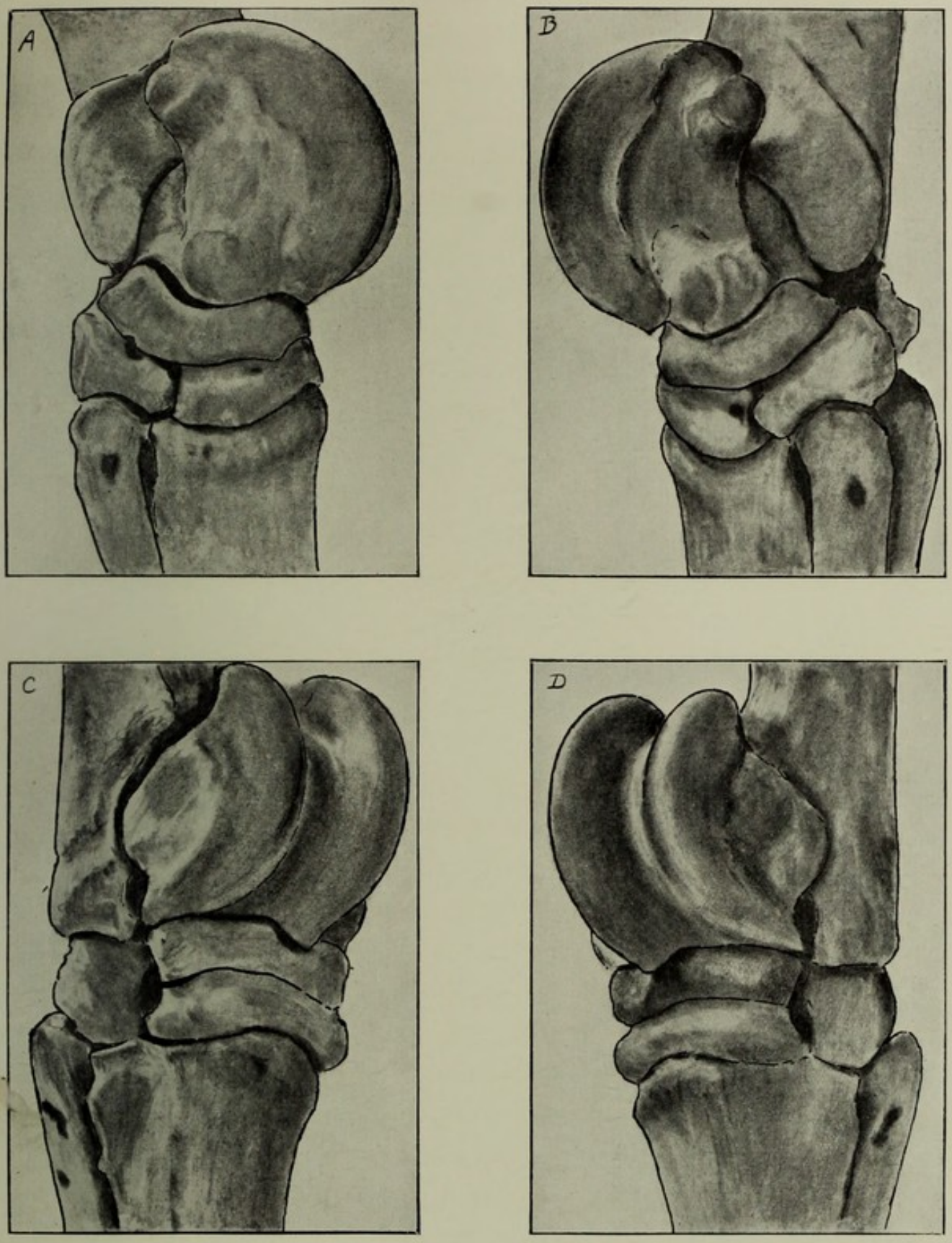

PLATE XVI.—THE BONES OF THE HOCKS IN SHEATHER'S CASE

A. Left hock (inner aspect). B. Right hock (inner aspect). C. Right hock (outer aspect). D. Left hock (outer aspect).

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it is obvious that if the inflammatory process be hastened, the sooner will anchylosis occur, the pain subside, and lameness disappear. The application of counter-irritants has this effect ; consequently blistering the hock is in some cases indicated. But, acting on this principle, pyro-puncturing the hock is considered by many to be the most effective method of treatment, and the author has frequently found this method attended with successful results, particularly in cases in which there is a fairly well-defined exostosis. For the purposes of this operation either a ball-headed iron with a needle, or an iron in which the head is drawn out very gradually to a point, should be utilised. This is in order that the needle or iron may be pushed well into the exostosis without producing a large cutaneous opening. The position of the internal saphena vein is easily located, and it should, of course, be avoided. One puncture is usually sufficient, though two or three may be made if the exostosis be a large one ; but more than two or three are quite unnecessary. A blister should then be rubbed well into the part, biniodide of mercury being preferable, on account of its antiseptic properties.

Another method of treatment, with a similar object, is to insert a seton or rowel beneath the skin over the exostosis, the seton or rowel being coated with ointment blister.

Line-firing is sometimes adopted, a feather pattern being selected, with the central line running obliquely over the seat. This method, however, is not nearly so effective as that of pyro-puncture.

Some operators sever the cunean division of the flexor metatarsi tendon, scrape the parts beneath, subsequently applying a blister. The object in this case is the same as in pyro-puncturing. In performing the operation the tendon is located in the manner described in dealing with cunean tenotomy. The tendon is not exposed, but the blade of the knife is pressed through the skin, and the tendon severed transversely. That the tendon is severed will be evident from the fact that the portion which is still attached to the muscle will be found to be relaxed. This may be felt on manipulation. The cutaneous incision

made is thus very small. The author has frequently performed this operation, with a fair measure of success, but the effect is not so satisfactory as that produced by some of the other methods of treatment; neither does it appeal to one as being very surgical, particularly so far as the scraping part of the operation is concerned, since the operator is working, as it were, in the dark.

Closely allied to the above operation is another which has been frequently performed in the treatment of this disease. This consists in incising the skin and then slitting the coverings of the exostosis. To this operation the term periosteotomy has been applied, and it was performed with the object of relieving the pressure of the exostosis on the sensitive structures covering it. Objection has been taken to the term periosteotomy on the ground that there is little if any periosteum covering the bones in this situation. A great proportion of the superficial surfaces of the bones here is undoubtedly taken up in affording attachments to ligaments.

Other operations performed in the treatment of spavin are neurectomy of the anterior and posterior tibial nerves and tenotomy of the cunean branch of the tendon of the flexor metatarsi muscle. These operations are described in the chapters dealing with the nerves and tendons. The object in neurectomy is to destroy sensation in the part by excising a portion of the nerve by which it is supplied, and in tenotomy to relieve pressure on the area.

THE METATARSAL BONES

The Large Metatarsal Bone.—This bone bears a close resemblance to the large metacarpal bone, but a distinction is easily made between the two bones by the fact that the metacarpal bone is longer and in transverse section is much the more cylindrical. It possesses a shaft and two slightly expanded extremities. For descriptive purposes the shaft may be said to present four surfaces.

The anterior surface is smooth. In the transverse direction it is markedly convex, and blends with the lateral surfaces, which are likewise convex and rounded. On the outer surface is a groove, which commences at the upper extremity of the bone, and which runs obliquely downwards and backwards to the channel formed anteriorly between the external small and the large metatarsal bones. This groove is for the accommodation of the large metatarsal artery. A much fainter vascular imprint is left on the inner aspect of the bone near its upper extremity by the internal metatarsal vein.

The posterior surface is comparatively flat. This surface presents on either side a roughened triangular area, the apex of which is directed downwards. To these areas the small metatarsal bones are articulated. They are placed in the upper two-thirds of the bone. In its lower third the posterior surface is smooth, as is also the area between the two small bones. The nutrient foramen is found on the line of division between the upper and middle thirds of this surface. Occasionally two such foramina are present.

The upper surface of the superior extremity articulates with the lower row of tarsal bones. On this surface two small facets are presented outwardly for articulation with the cuboid. Between these facets there is an area which is roughened and non-articular, and which extends inwardly to the middle of the surface. The main portion of the upper surface is articulated to the large cuneiform bone, but a single small facet is found postero-internally, which articulates with the cuneiform parvum. Anteriorly the upper extremity presents towards its inner side a roughened elevation, to which the tendon of insertion of the flexor metatarsi muscle is attached, whilst at the back of this extremity we find on either side two small facets, which articulate with like facets on the heads of the small metatarsal bones.

The inferior extremity of the bone is very similar to that of the large metacarpal, and presents an antero-posterior articular ridge separat-

ing two articular convexities. As in the fore limb, it is articulated to the two sesamoid bones and to the os suffraginis.

The Small Metatarsal Bones.—These also bear a close resemblance to the corresponding bones of the fore limb. They have, however, a slightly greater length, and their heads are more massive.

FRACTURE OE THE METATARSAL BONES

The metatarsal bones are sometimes fractured as a result of a kick, or it might be the result of the animal's having been run over. In collieries it sometimes occurs when the animal becomes wedged between the " tubs." Young animals not infrequently get the leg fixed in a gate or hurdle when attempting to jump, and the bones are completely fractured. Occasionally as the result of a kick the bone is not completely fractured, but we have a number of fissures radiating from a centre, which is the spot where the blow was received. Profuse hæmorrhage is a not uncommon complication, and when this occurs it will usually be found that the large metatarsal artery has been opened. The position of the artery may be located without much difficulty. An incision should be made in the groove between the large and outer small metatarsal bones above the seat of the injury, when there will be no difficulty in picking the vessel up and applying a ligature (see " Peroneal Tenotomy " and Chapter on vessels).

If the fracture be complete and treatment is desired, the animal should be placed in slings and Bourgelat's splint applied.

The affections of the remaining bones of the hind limb are similar to those already described in the second volume, dealing with the corresponding bones of the fore limb.

CHAPTER V

THE JOINTS

THE SACRO-ILIAC JOINT

This is the joint which is formed between the auricular facet on the sacral surface of the ilium and a similar facet on the superior surface of the sacrum. It is a paired joint, and is of the arthrodial variety.

The ligaments of this joint are four in number, which were named by Rigot sacro-iliac, superior ilio-sacral, inferior ilio-sacral, and great sacro-sciatic.

The *sacro-iliac ligament* consists of fibres which are attached to the roughened impressions which surround the articular surfaces.

Superior Ilio-Sacral Ligament.—This is cord-like, and it runs from the angle of the croup backwards along the tips of the superior spines of the sacrum, becoming continuous with the supraspinous ligament of the lumbar region. It is applied closely to the corresponding ligament or the opposite side of the body.

Inferior Ilio-Sacral Ligament.—This is a triangular membranous sheet, the fibres of which run obliquely downwards and backwards. It arises from the ischiatic border of the ilium, the limit of its attachment to this bone being the angle of the croup superiorly, and the special tubercle found on this border about three or four inches from this angle inferiorly. Near the angle of the croup this ligament is confounded with the one previously described.

Sacro-Sciatic Ligament.—This is the great membranous expansion which forms the greater part of the lateral boundary of the pelvic

cavity. It cannot be said to take any great part in maintaining the solidity of the sacro-iliac joint, and its utility seems to be more in the direction of enclosing the cavity of the pelvis.

In form it is somewhat quadrilateral, and has therefore four borders. These may be termed respectively superior, inferior, anterior, and posterior. Its superior edge is attached to the roughened lateral border of the sacrum. Inferiorly it is attached to the superior ischiatic spine and to the tuber ischii. Its anterior border forms the posterior boundary of the greater sacro-sciatic foramen, an important opening to be shortly described. Its posterior border is related to the semi-membranosus muscle, and is confounded superiorly with the aponeurotic covering of the coccygeal muscles.

The outer surface of this big ligament is crossed by the great sciatic and external popliteal nerves, and is clothed by the gluteal, biceps femoris, and semitendinosus muscles, many of the fibres of which arise from the ligament. The deep face of this ligament is covered in front by the peritoneum, and posteriorly it is related to the coccygeal muscles, and also to those of the anus, whilst anteriorly it is related to the rectum and in the female to the vagina.

Near the upper border of the ligament, when the gluteal muscles have been removed, the ischiatic artery, which is one of the terminal divisions of the lateral sacral, will be seen.

The Greater Sacro-Sciatic Foramen.—This is an elliptical opening which is disposed with its long axis directed downwards and backwards. It is bounded posteriorly, as already stated, by the anterior edge of the great sacro-sciatic ligament, whilst its anterior boundary is the ischiatic border of the ilium.

This is the opening through which the great sciatic nerve and the gluteal nerves and vessels gain exit from the pelvic cavity.

The Lesser Sacro-Sciatic Foramen.—As its name implies, this opening is much less than the one just described. It is also elliptical in outline, the long axis of the ellipse in this case being directed horizontally. It

is bounded superiorly by the free portion of the inferior edge of the great sacro-sciatic ligament—*i.e.*, that portion of the edge which is situate between the superior ischiatic spine and the tuber ischii. Its inferior boundary is formed by the outer border of the ischium. The common tendon of the obturator internus and pyriformis muscles passes out from the pelvis by this foramen.

The sacro-iliac joint possesses a synovial membrane which lines the sacro-iliac ligament. The membrane secretes a scanty amount of synovial fluid.

The movements of the joint are very restricted, and consist only of a very slight antero-posterior gliding. The use of the joint appears to be to restrict the concussion to which the bones of the part are subjected during propulsion of the body. Anchylosis of the joint occasionally takes place, when the bones are rendered very much more liable to be fractured.

LUXATION OF THE SACRO-ILIAC JOINT

From the anatomical description of this joint it will be readily understood that luxation is very rare. This is on account of the firm manner in which the bones are united to one another. It is so firm, in fact, that the ilium is much more likely to be fractured than the joint dislocated.

Luxation is occasionally met with in colliery ponies, as a result of a heavy fall of roof on to the region of the croup. In these cases there is little difficulty in diagnosis, on account of the marked alteration in the conformation of the part.

The sacrum is pressed downwardly, and the internal angles of the ilium are much more distinct, forming sharp, prominent bulgings, which may be easily felt, and which appear to be subcutaneous. That there is no fracture of the ilium may be ascertained on manipulation, which is

less difficult on account of the greater prominence given to this bone. The animal is down, since of course it cannot stand, and is unable to rise.

Pain is evinced on palpation in the middle line.

Exploration by the rectum will confirm the alteration in position of the sacrum.

Prognosis is not favourable. If it is decided to treat, all that can be done is to prescribe a long rest. The animal should be allowed to lie, with a plentiful supply of bedding.

THE ISCHIO-PUBIC SYMPHYSIS

This is the articulation of the coxæ which become united to each other along the inner border of the pubis and ischium.

In the early period of life this joint is of the amphiarthrodial variety since the bones are united by an interosseous cartilage and peripheral fibres. The fibres run transversely from the pubic and ischial bones of one side of the body to those on the other, on their superior and inferior surfaces. Those on the inferior aspect are much the more powerful. Assistance is also afforded in the maintaining of the bones in apposition by the pubio-femoral ligaments, which will be described in connection with the hip joint.

In adult life the interosseous cartilage becomes ossified, and the two coxæ become firmly united.

It will thus be evident that there is no movement at the symphysis during adult life, and that movement is very restricted during the early period.

THE COXO-FEMORAL OR HIP JOINT

This joint is of the enarthrodial or ball and socket variety, and consequently permits of flexion, extension, abduction, adduction, rotation,

and circumduction. The joint is formed by the reception of the articular head of the femur into the cotyloid cavity of the innominate bone.

The cotyloid cavity is a depression with an almost circular boundary. The cavity is placed in the position where the ilium, ischium, and pubis meet, and all these bones therefore enter into its formation, though in varied proportion. The rim of the cavity is not complete, being interrupted towards its inner side by a well-marked notch. The interior of the cavity is entirely articular with the exception of a triangular area which extends from the before-mentioned notch in the rim, towards the centre of the cavity, the base of the triangle being directed towards the notch, and the apex therefore inwardly. Apart from this triangular roughened area, the cotyloid cavity is covered by articular cartilage.

The articular head of the femur is a smooth, hemispherical eminence, which is placed towards the inner side of the bone. It is so moulded as to be accommodated in the cotyloid cavity, and, like the latter, is wholly articular with the exception of a triangular outcut placed towards its inner side.

The ligaments of the hip joint are as follows :

(*a*) *Pubio-Femoral.*—This is a ligament which is peculiar to the horse tribe. It is in the form of a flattened band which arises from the prepubic tendon of the abdominal muscles of the opposite side of the body. It runs first obliquely backwards and outwards, crossing its fellow ligament on the median line. Its course is next directed transversely outwards along the pubio-femoral groove on the inferior aspect of the pubic bone. Passing through the notch in the rim of the acetabulum, it runs to its insertion into the non-articular sulcus in the head of the femur. To arrive at its insertion it has to pass therefore, as we shall see later, over the transverse ligament.

This ligament, owing to the manner of its disposition, materially restricts the degree of abduction of the hip joint in the horse. It is

only present in solipeds, and its absence in the cow enables that animal to abduct the thigh to a much greater degree, a point which is well illustrated in "cow kicking."

(*b*) *Ligamentum Teres or Round Ligament.*—This is in the form of a short cord, which in thickness is about equal to the small finger. Its length is from an inch to an inch and a half, and it runs from the non articular area of the acetabulum above, to the sulcus in the head of the femur below, where it is inserted in common with the pubio-femoral ligament. It will thus be seen that it plays a very important part in maintaining the head of the femur within the cotyloid cavity.

Chauveau describes the above two ligaments together under the name of the coxo-femoral ligament or ligamentum teres. To this point in nomenclature attention will be drawn later in connection with one of the surgical affections of the joint.

(*c*) *The Capsular Ligament.*—This ligament is in the form or a double-mouthed sac, which is attached superiorly to the rim of the cotyloid cavity and also to the cotyloid and transverse ligaments. Inferiorly it is attached to the roughening which surrounds the articular head of the femur. The fibres of the ligament intercross, and anteriorly it is strengthened by a bundle which runs obliquely downwards and outwards to be attached to the anterior aspect of the shaft of the femur. The internal face is lined by the synovial membrane of the joint, and outwardly it is related to the following structures :

Anteriorly are the tendons of the rectus femoris and rectus parvus muscles ; posteriorly are the gemelli, the obturator internus, and the pyriformis muscles. Below the ligament is the obturator externus, whilst above it is the deep gluteus muscle. Between these various muscles and tendons and the ligament itself is a considerable quantity of adipose tissue which enables these structures to play over the ligament without any undue friction.

The three ligaments which have been described bind the bones

together in building up the joint, and they therefore perform the usual function of ligaments. The following ligaments of the hip take part in binding the bones only in so far as they are the seat of attachment of some of the fibres of the capsular ligament. Their real function is, however, that of deepening and completing the cotyloid cavity, thus making the latter a more efficient receptacle for the head of the femur.

(*d*) *The Cotyloid Ligament* runs around the rim of the cotyloid cavity, to which it is attached. Where the rim of the cavity is interrupted by the notch for the passage of the pubio-femoral ligament the cotyloid ligament crosses the notch, thus forming an arch and completing the ligamentous circle.

(*e*) *The Transverse Ligament.*—This is the name which is frequently given to that portion of the cotyloid ligament which bridges over the notch in the rim of the acetabulum.

DISEASES OF THE HIP JOINT

TRAUMATIC ARTHRITIS

The articular surfaces which enter into the formation of the hip joint are extremely well protected from injury from without. Externally we have a powerful protective agent in the great trochanter of the femur, and superiorly the joint is abundantly clothed by muscles. Moreover, the actual articulation is deeply seated, its distance from the cutaneous surface being nearly four inches in an average-sized animal. As one would naturally expect, therefore, an open arthritis of the hip is an extremely rare occurrence.

LUXATION OF THE HIP JOINT

A reference to the description of the joint will recall the fact that the articular head of the femur is kept in the cotyloid cavity by the ligamentum teres. This is a very short ligament, its length being sufficient only to allow the articular head to rotate freely whilst within the cavity. It will be evident, therefore, that before luxation can occur, the ligamentum teres must be ruptured. This rupture, then, is a constant accompaniment of luxation.

Falke (quoted by Möller) performed experiments on the dead subject which proved that dislocation could occur without injury to the bones or their articular surfaces.

The disposition of the capsular ligament renders it necessary that this ligament must be ruptured. But rupture of the pubio-femoral ligament need not necessarily occur, since this ligament is inserted only into the sulcus in the head of the femur and has no attachment to the cotyloid cavity.

Luxation may be due to a variety of causes and the symptoms presented vary with the cause.

Abnormal abduction at the hip is most likely to rupture the ligaments, particularly the ligamentum teres; but some very violent movement of the joint is necessary to produce luxation.

When luxation occurs the animal is unable to place any weight upon the limb, and the limb is therefore "carried." Manipulation will reveal a loss of mobility in the joint. Some movements may be more easily carried out, whilst others are completely restricted, the particular movements depending upon the position taken up by the head of the femur after dislocation. If the head is displaced in the downward direction there will be a depression over the joint, whilst an elevation will be present if the head has moved upwardly, in which case the limb

will also be perceptibly shortened. Occasionally the head is displaced downwards and inwards and becomes fixed in the obturator foramen, where it may be felt on exploration through the rectum.

The treatment consists in casting the animal on the sound side. The patient should then be placed under a general anæsthetic and the limb extended as fully as possible, when efforts should be made to replace the head of the femur in the acetabulum. The method of replacing depends entirely upon the manner in which the head has been displaced. If the head is displaced upwardly, adduction of the limb with slight rotation is the best method. If the displacement is downwards a thick piece of wood is placed between the thighs and pressed upwards towards the pubic symphysis. Pressure is then applied to the region of the tibia and the proximal epiphysis of the femur thus levered upwards. Whilst this is being done the operator should place his hand over the upper end of the bone and endeavour to bring the articular head over the cotyloid cavity as the assistant pulls the limb backwards and forwards. If successful the head will enter the acetabulum with a loud snap, and that it is in the cavity will be evident from the greater freedom of movement now possessed by the limb.

The animal should then be placed in slings to prevent a recurrence of the luxation, and complete and prolonged rest prescribed.

MYOSITIS OF THE GLUTEAL MUSCLES

Inflammation of these muscles is sometimes the result of a strain through some abnormal effort being thrown upon them. Occasionally it arises as a result of a blow received over the quarter. This is a common cause in colliery ponies, which are particularly exposed to risk of injury to the upper parts of the body through falls of the roofs. At times the muscles are partially ruptured. Severe lameness results and there is evidence of much pain when the parts are palpated. If there

be an extensive rupture of the muscles an indentation may be felt without much difficulty, as may also be felt an extensive rent in the thick fibrous covering of the gluteus maximus. Later there is considerable swelling and there is much heat in the affected region and inability on the part of the muscles concerned, which act, as has already been stated, on the hip joint.

Prognosis is usually favourable. In the earlier stages complete rest should be prescribed and the pain relieved by the application of hot fomentations.

Frequently, owing to rupture of small muscular blood-vessels a hæmatoma is formed. This may be neglected whilst there are evident symptoms of acute inflammation. When these symptoms have subsided the hæmatoma should be incised and its contents evacuated. The incision should be made at the lowest level of the swelling with the usual antiseptic precautions. The cutaneous opening should be kept patent in order that the cavity may be syringed out with weak antiseptic solutions, and healing take place from the bottom.

Sprain of the ligamentum teres (true hip lameness) and inflammation of the bursa beneath the tendon of the middle gluteus muscle (false hip lameness) are dealt with in the chapter on Ligaments and Bursæ (chapter V.).

THE STIFLE JOINT

The distal extremity of the femur, the proximal end or the tibia, and the patella enter into the formation of the stifle joint.

This joint is one of the most complicated in the whole of the body, and it is not surprising, therefore, to find that it is the seat of so many varied and obscure surgical affections.

The Articular Surfaces.—At the inferior extremity of the femur there are three surfaces, one of which articulates with the posterior surface of the patella and the remaining two with the proximal end of the

tibia, through the medium of the two intervening fibro-cartilaginous discs.

The articulation of the patella is on the trochlea, which is at the front of the femur. This trochlea is made up of two parallel ovoid ridges, which run in an almost vertical direction. The upper extremity of the inner ridge is very much more massive than that of the outer, and it also extends to a higher level. This is a point of clinical importance, since it renders the dislocation of the patella in the internal direction a very difficult matter.

The outer ridge has a sharp, well-defined anterior edge, whilst that of the inner ridge is blunt and smooth. These ridges are separated from one another by a groove, and the groove, together with the surfaces of the ridges which bound it, is articular.

The posterior surface of the patella presents an articular face which is moulded, though somewhat imperfectly, upon the articular portion of the trochlea which has just been described. It thus presents a mesial ridge which separates two vertical shallow grooves. In accordance with the larger size of the inner lip of the trochlea, the inner depression on the patella is much the broader. In addition, the area of this depression is increased by a fibrocartilaginous thickening of the internal straight patellar ligament. The movement of the trochlea on the patella is in a vertical plane.

The parts of the femur which enter into the femoro-tibial joint are the condyles. These are two ovoid convexities which run parallel to one another in the antero-posterior direction. They are separated by a deep notch called the intercondyloid groove which is non-articular, and which, in the articulated limb, accommodates the upwardly projecting piece of bone at the superior extremity of the tibia termed the spine.

The Interarticular Meniscii or Semilunar Fibro-Cartilages

These are two discs of fibro-cartilage, which are interposed between the condyles of the femur and the articular surfaces of the tibial tuberosities. In outline they are crescentic and they present two surfaces and two edges. The inner edge is very thin, concave and sharp, and embraces the tibial spine. The outer edge is convex and much thicker. The inferior surface of each disc is moulded to the articular facet of the tuberosity upon which it is placed.

The superior surface of each shows a depression for the accommodation of the femoral condyle.

Upon articulating the distal end of the femur with the proximal extremity of the tibia, it will be seen that there is a marked want of adaptability between the articular surfaces. This is compensated by the presence of the semilunar discs, the upper surfaces of which are moulded on the femoral condyles. An additional function of the discs is to limit concussion in the joint.

The discs are fixed on the lateral tuberosities by means of five little slips to which the name *Coronary Ligaments* is given. There is great freedom of flexion and extension between the condyles and the discs, and also slight rotation and lateral movement.

These discs are important from a surgical point of view inasmuch as they are the seat of *Stifle Joint Disease*. This takes the form of a chronic chondritis, in the first stages of which post-mortem specimens show simply a dryness of the upper surfaces of the cartilages. This surface later becomes roughened and subsequently a number of small erosions make their appearance, the cartilage being worn through in parts and small areas of bone being visible. This is particularly so in the portion of the cartilage which is next the spine. The cause of the affection is unknown, and it is usually met with in heavy draught horses. Animals so affected will stand for several minutes with the stifle and hock flexed

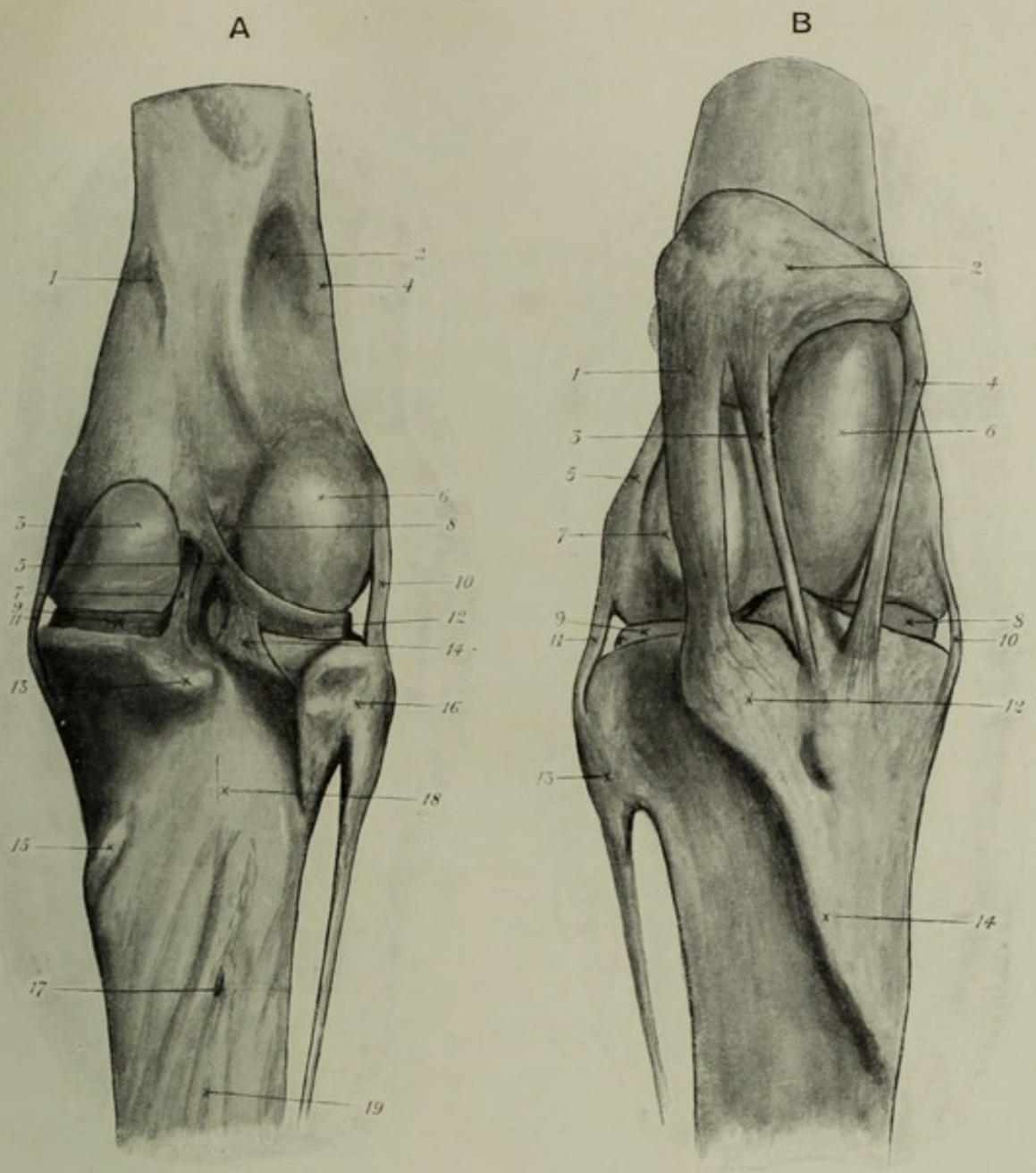

PLATE XVII.—THE STIFLE-JOINT—BONES, LIGAMENTS AND CARTILAGES

A.—POSTERIOR ASPECT

1. Supracondyloid crest. 2. Supracondyloid fossa. 3. Inner condyle of femur. 4. Outer lip of supracondyloid fossa. 5. Femoral coronary ligament. 6. Outer condyle. 7. Posterior crucial ligament. 8. Anterior ditto. 9. Inner semilunar cartilage. 10. External lateral ligament. 11. Internal ditto. 12. Outer semilunar cartilage. 13. Special tubercle, to which internal crucial ligament is attached 14. Posterior coronary ligament of outer cartilage. 15. Tubercle for insertion of popliteus muscle. 16. Head of fibula. 17. Nutrient foramen of tibia. 18. Depression for accommodation of popliteus muscle. 19. Ridges from which perforans muscle arises.

B.—ANTERIOR ASPECT

1, 3, and 4. External, middle, and internal straight patellar ligaments. 2. Patella. 5. External condyle. 6. Inner lip of trochlea. 7. Outer ditto. 8 and 9. Inner and outer semilunar cartilages. 10 and 11. Internal and external lateral ligaments. 12. Anterior tuberosity of tibia. 13. Head of fibula. 14. Crest of tibia.

and the foot raised from the ground. This is one of the diagnostic symptoms. The disease is generally accounted as not being amenable to treatment.

The Coronary Ligaments.—Three of these little slips are attached to the outer meniscus and two to the inner. One from each disc is attached to the tibia in front of the spine, and one from each disc is attached similarly behind the spine. The additional slip from the external disc takes a course upwards, and is attached to the femur at the back of the intercondyloid groove.

In the human subject rupture of the coronary ligaments is a common occurrence, and *displacement of a disc* follows. This is frequently found in athletes, and treatment causes much annoyance on account of the liability which the displacement has to recur.

Ligaments of the Patella.—These are six in number, three of which are femoro-patellar, and three tibio-patellar.

(*a*) *Femoro-patellar Ligaments.*—These consist of :

(1) Femoro-Patellar Capsule. This is membranous, and is attached posteriorly around the edge of the articular surface of the femoral trochlea, and anteriorly around the edge of the articular surface of the patella. Superiorly the ligament is very thin and delicate, and laterally it is much thicker and stronger. It is lined by the femoro-patellar synovial membrane. It is clothed superiorly by the crural muscles.

(2) Lateral Patellar Ligaments. These are two in number, one on either side. They are commonly described as separate ligaments, but occasionally simply as lateral thickenings of the capsule. They are thin bands which run from the excentric sides of the lips of the trochlea to the patella.

(*b*) *Tibio-Patellar Ligaments.*—These are usually designated as the external, middle, and internal straight ligaments of the patella. All three are attached superiorly to the anterior face of the patella, the internal one, as already stated, being provided with a fibro-cartilaginous thickening

which extends the articular surface of this bone. The inferior insertion of each of these ligaments is into the anterior tuberosity of the tibia. The middle ligament is attached to the lower part of the vertical groove which this tuberosity presents, and the remaining two to the elevated portions of the tuberosity, which bound this groove. The middle ligament is more deeply seated than the other two, and is embedded in a pad of fat. Between this ligament and the groove on the anterior tibial tuberosity, is placed a small synovial bursa which facilitates the movements of the ligament.

The external ligament is the largest and most powerful of the three. It is in the form of a strong, flattened band. A tough aponeurotic sheet, which is a dependency of the Fascia Lata, runs from this ligament over the middle band to be attached to the internal ligament.

The internal ligament is also in the form of a flattened band. It is longer than the external but it is not so powerful. The aponeurosis of the adductor muscles of the leg is confounded with the inner aspect of this ligament.

The anterior face of the straight patellar ligaments gives attachment to the common tendon of insertion of the quadriceps extensor cruris muscles. When these muscles contract, therefore, the patella is drawn upwards, and the straight ligaments are made tense, the stifle being extended by the action of the muscles being transmitted to the tibia through the medium of the ligaments.

The Femoro-tibial Ligaments.—Of these there are five, namely, two crucials, two laterals and a posterior.

The Crucial Ligaments.—These are termed anterior and posterior respectively. They are placed in the middle of the joint, and to expose them satisfactorily a vertical and antero-posterior section of the joint should be made.

The Anterior Crucial Ligament.—This is the more external of the two ligaments. It is much the shorter. It is a strong, fibrous cord which is attached superiorly to the posterior part of the inner surface

of the external condyle of the femur—*i.e.*, the surface of this condyle which bounds the intercondyloid groove. Its fibres run downwards and forwards and are inserted inferiorly into the outer and roughened aspect of the spine of the tibia.

The Posterior Crucial Ligament is attached to the anterior portion of the surface of the internal condyle which bounds the intercondyloid groove. Its fibres run downwards and backwards and cross those of the anterior crucial ligament. They also cross the postero-external aspect of the internal semilunar disc and become inserted into a special tubercle which is placed at the back of the internal tuberosity of the tibia immediately below its articular surface.

The crucial ligaments separate the two joints, which are formed by the condyles of the femur and the tibial tuberosities.

The External Lateral Ligament.—This is a strong, fibrous band which arises from the higher of the two pits on the outer surface of the external femoral condyle. The lower pit gives origin to the popliteus muscle the tendon of which is concealed by the ligament. The ligament passes over the outer surface of the condyle and the external semilunar disc, to be inserted into the outer aspect of the head of the fibula.

The Internal Lateral Ligament is longer than the external, but is not so powerful. Superiorly it is attached to a tubercle on the excentric surface of the inner condyle of the femur. It descends vertically over the edge of the articular surface of the internal tuberosity of the tibia, where there is placed a small facet covered with articular cartilage. Its play over the facet is facilitated by a little *cul-de-sac* of the synovial membrane of the internal femoro-tibial joint. The ligament is inserted inferiorly into the roughened area on the internal tuberosity of the tibia.

The Posterior Common Ligament.—This is in the form of a membranous sheet. It is made up of two layers, which are separated superiorly, but blend with each other inferiorly. The superficial

layer is strong and fibrous, and it is perforated by a number of foramina for the passage of blood-vessels. Its fibres intercross. It is attached superiorly to the back of the femur immediately below the origin of the outer head of the gastrocnemius muscle. The deep layer is closely applied to the condyles of the femur, and is attached to the superior edge of their articular surfaces. The two divisions become united and are attached inferiorly to the back of the tibia immediately below the articular surface of the tuberosities. The anterior face of this ligament is covered almost throughout its extent by the two synovial membranes of the femoro-tibial joints and these synovial membranes it supports.

It also covers the posterior borders of the semilunar discs, and the posterior coronary and insertion of the posterior crucial ligaments. The posterior surface of the ligament is crossed by the popliteal vessels, and is covered by the popliteus muscle.

Synovial Membranes.—The stifle possesses three synovial membranes, a superior or femoro-patellar, and two laterals or femoro-tibial.

The superior synovial membrane is very large and loosely applied in order that the patella may glide freely over the femoral trochlea without causing injury to the membrane. It is strengthened and supported by the femoro-patellar capsule. A diverticulum of this membrane is prolonged beneath the insertion of the tendon of the quadriceps extensor cruris muscle.

The external membrane lines the joint between the outer femoral condyle and the superior face of the disc of cartilage placed on the external tuberosity of the tibia. It also lines the tendon of origin of the popliteus muscle. An extensive pouch of this membrane descends in the groove between the anterior and external tuberosities of the tibia and envelops the tendon which is common to the extensor pedis and superficial division of the flexor metatarsi muscle.

The internal membrane lubricates the joint between the internal femoral condyle and the upper face of the inner semilunar disc.

Between the two lateral membranes the anterior and posterior crucial ligaments are placed. These two membranes line the posterior common ligament.

In front of the condyles and the intercondyloid notch the lateral synovial membranes are in close relationship to that of the femoro-patellar joint, and occasionally they communicate with the latter. There is also at times a direct communication between the two lateral synovial cavities, but according to Lesbre and quoted by Chauveau, such communication is of rare occurrence.

The two principal movements of the stifle joint are flexion and extension, but it is also capable of slight rotation. During flexion and extension the femoral condyles glide in the cavities on the superior aspect of the cartilages. Whilst the joint is being flexed there is a slight forward movement of the cartilages on the tibial facets, and they move in the opposite direction during the process of extension. The cartilages are also capable of very slight side to side displacement during rotation of the joint.

When the femoro-tibial joint is completely extended, the patella is placed on the upper part of the trochlea and the straight patellar ligaments are made very tense. The latter are relaxed and the patella descends along the trochlea during flexion of the stifle.

Tendons which play over the Joint

The common tendon of the quadriceps extensor cruris muscle has already been referred to as being inserted into the straight patellar ligaments. Arising from the lower and more anterior of the two pits, on the excentric side of the external condyle, is the tendon of origin of the popliteus muscle. This tendon is partially invested by the external lateral synovial membrane and it plays over the outer semilunar disc, so that it is in intimate relationship to the joint. The belly of the popliteus lies on the posterior surface of the posterior common ligament.

Superficially to the popliteus, on the posterior aspect of the joint, is placed the powerful tendon of origin of the flexor perforatus muscle which arises from the floor of the supracondyloid fossa. Still more superficially than the perforatus tendon are the tendons of origin of the gastrocnemius. The outer of these arises from the outer lip or the supracondyloid fossa and the inner from the supracondyloid crest.

Between the outer lip of the femoral trochlea and the outer condyle is placed a well-marked pit, from which arises a very powerful tendon which is common to the extensor pedis muscle and the tendinous or superficial division of the flexor metatarsi. The tendon plays through the notch which is situate between the anterior and external tuberosities or the tibia. The tendon runs obliquely downwards and slightly inwards to the outer side of, and a short distance behind, the external straight ligament of the patella. Its play through the above-mentioned notch is facilitated by an extensive diverticulum of the external synovial membrane of the stifle, which envelops the tendon. The muscles to which this tendon is common have very slight action on the stifle, their function being to flex the hock and extend the interphalangeal joints.

The outer aspect of the stifle is clothed by the thin aponeurotic insertions of the tensor vaginæ femoris and biceps femoris muscles.

Blood Supply

The Popliteal Artery.—This vessel is the direct continuation of the femoral, the name popliteal being given to the vessel after it has passed between the two heads of the gastrocnemius muscle. The vessel next passes under the popliteus muscle, and crosses the posterior surface of the posterior common ligament obliquely downwards and outwards to the tibio-fibular arch, where it divides to form the anterior and posterior tibial arteries. As the vessel crosses the upper portion of the ligament it gives off two or three small branches, which penetrate the ligament

through the perforations to which reference has already been made. These are the vessels which supply the stifle ioint.

Nerve Supply

The Internal Popliteal Nerve.—This is the direct continuation of the great sciatic nerve. It passes between the two heads of the gastrocnemius muscle in company with the popliteal artery, but unlike this artery it does not pass along the deep face of the popliteus muscle. It follows the border of the perforatus across the superficial face of the popliteus, and at the inferior border of the latter muscle it is continued as the posterior tibial nerve. This nerve supplies all the muscles at the back of the joint, namely the gastrocnemius, perforatus, and popliteus.

The External Popliteal Nerve.—A branch of the peroneal-cutaneous division of this nerve passes forwards subcutaneously and ramifies on the external lateral aspect of the joint.

The Internal Saphena Nerve.—A large branch is given off from this nerve about two inches above the stifle. It passes obliquely downwards and forwards, and splits up into four or five divisions which are distributed subcutaneously on the inner lateral aspect of the ioint.

DISEASES OF THE STIFLE

LUXATION OF THE PATELLA

The inner lip of the trochlea terminates at its upper extremity in a blunt ovoid protuberance which stands out in striking contrast to the appearance of the upper extremity of the outer lip. As the patella is pulled upwards by the quadriceps muscles during the process of extension of the stifle, it sometimes happens that the degree of extension is excessive and the patella is drawn upwards over

the projecting portion of the inner lip and gains its upper surface which is almost at right angles to the vertical surface.

As the patella ascends, the tension on the internal lateral patellar ligament progressively increases until the patella reaches the line of division between what we may appropriately term the vertical and superior surfaces of the inner trochlear ridge. This ligament, therefore, tends to restrain the extensor muscles from pulling the patella above the angle where these two surfaces meet. When the ligament is overpowered the patella passes over this angle and gains the upper surface of the ridge, when the tension on the ligament named is suddenly relaxed. The consequence is that the patella becomes fixed on the superior surface of the inner lip for a period of time which varies considerably in duration, and it is only by violent exertion of the muscles which flex the stifle that it can be replaced on the front of the trochlea again.

This condition is frequently termed *Subluxation of the Patella* and it is characterised by the peculiar snatchy flexion of the joint each time the patella passes on to the front of the trochlea, a symptom which is not uncommon. Owing to the fact that the numerous muscles which play over the stifle, *e.g.*, flexor metatarsi, gastrocnemius, extensor pedis and flexor perforatus, act also on the other joints, we find that in any case of interference with the movements of the patella, the remaining joints of the limb below the stifle become affected and lameness results.

The condition just described occurs most frequently in loose-jointed, weak young animals owing to the relaxation of the parts surrounding the joints generally, and in animals in poor condition owing to the diminution in the quantity of fat, which forms a kind of packing for the ligaments of the patella, and which is present in well-nourished animals. Owing to the increase in the length of muscles when their bulk diminishes through inactivity, we also find it a common sequel to severe attacks of depressing diseases such as influenza.

In young animals and those affected during convalescence it is

evident that as the general condition of the animal improves, the tendency to recurrence of the luxation will diminish, consequently good feeding and little exertion are indicated.

In some cases, however, the patella becomes fixed on the superior surface of the inner lip of the trochlea and remains in that position. In this case all the joints of the limb become rigidly extended and the animal is unable to flex them. Occasionally such a luxation may be reduced by causing the animal to make a sudden start, when the patella will descend with a snap. Most frequently, however, manual interference is necessary. If the sharp inferior border of the patella be raised from the flat superior surface of the trochlear ridge, descent of the patella is not difficult. The method of reduction was recommended by Meyer, who lifted the patella whilst the animal was simultaneously led forwards, thus allowing the patellar border to escape the angle of the trochlea, whilst the contraction of the flexor muscles caused the patella to be pulled downwards through the medium of the straight ligaments.

LATERAL LUXATION OF THE PATELLA

Again referring to the conformation of the trochlea, and to the articular surface of the patella, it will be seen that lateral displacement of the patella in the outward direction is not a difficult matter owing to the slight degree of prominence presented by the outer lip of the trochlea. Again considering the progress of the extraordinary degree of extension of the stifle if the tension on the internal lateral patellar ligament should be so great as to cause the ligament to be stretched (or, in rare cases, even ruptured), instead of fixation of the patella on the superior surface of the inner lip as already described, there will be nothing to prevent the patella from slipping off the trochlea over its outer lip, and this is what in reality occurs.

Weakness of the internal lateral ligament of the patella or anything which favours or contributes to its rupture, will, therefore, be a predisposing or contributory cause of external lateral luxation of the patella.

The quadriceps extensor cruris muscles act upon the patella by pulling it upwards on the trochlea. When the patella is displaced the mechanism of these muscles is subjected to considerable interference, and consequently symptoms are presented which are not very unlike some of those present in crural paralysis. To a slight extent, however, the animal is still occasionally able to extend the stifle, but it will be evident that the amount of space through which the foot can be drawn forward is materially diminished on account of the lack of leverage at the stifle, *i.e.*, the stride becomes very much shortened, but usually the luxated limb is projected backwards and fixed from the stifle downwards and the foot rests on the toe.

Diagnosis of lateral luxation of the patella is not difficult, since the displaced patella may be easily felt, and in some cases even seen. Lameness, of course, exists, and as in the case of any other inability at the stifle, all the joints inferior to it become affected. The patellar capsular ligament bulges out prominently below the stifle.

To replace the patella the horse should be made to move suddenly forward, the operator meanwhile pushing the bone upwards and inwards. Another method is to attach a sideline to the pastern of the affected limb and lead the free end of it through a collar on the animal's neck. The assistant should endeavour to draw the leg forwards by pulling at the sideline, whilst the operator pushes the patella upwards and inwards as before.

It is an easy matter to return the bone to its normal position, but much trouble arises in the prevention of recurrence of the luxation. This is due to the stretching of the ligaments which has necessarily occurred to admit of the bone being displaced in the first instance. As a precaution, some operators who use the sideline in reducing the

luxation subsequently tie the free end of the line to the collar and thus restrain the animal from carrying the foot backwards as is necessary in flexing the stifle. The result is that the patella is kept in a stationary position on the trochlea and the ligaments are relaxed. This contributes to their contraction after the undue tension to which they have been subjected.

TRAUMATIC INJURIES

Traumatic injuries in the neighbourhood of the stifle should be treated with great care. It will be remembered that a pouch of the synovial membrane of the external femoro-tibial joint extends some distance along the tendon of the flexor metatarsi and extensor pedis muscles, and also that a diverticulum from the anterior synovial membrane extends beneath the tendon of the quadriceps extensor cruris. Thus injuries in the region of the middle straight ligament of the patella may lead to inflammation and suppuration of the anterior or femoro-patellar synovial membrane, and subsequently, in those cases where communication between this membrane and the two lateral ones exists, to a spreading of these affections to the whole joint. Similarly, but in cases which are much more rare, an injury to the extensor pedis tendon some two inches below the upper level of the anterior and external tibial tuberosities, may lead to inflammation of the whole of the stifle joint. Most commonly, however, such an injury leads to an affection of the outer lateral synovial membrane only.

In such cases, when the whole joint becomes affected, there is great swelling, which is diffused and extends all around the joint. It is most prominent in front, since the powerful lateral ligaments prevent any very extensive bulging of the synovial capsules laterally. The indentation which is normally seen just below the patella in a healthy stifle, and to which attention was called in our superficial description, quickly

becomes filled up. The animal lies down and is disinclined to rise. When it does rise, the joints of the affected limb are held in the condition of flexion, and there is a discharge of synovia, which may be purulent, from the wound.

When the discharge is purulent and the whole joint considered to be affected, slaughter is usually recommended, since treatment is generally regarded as hopeless. But from what has been said it will readily be gathered that the precaution should be adopted of rendering all recent wounds in the neighbourhood of the joint aseptic, and closing them as quickly as possible.

STIFLE JOINT DISEASE—GONITIS

This is the name given to inflammation of the stifle joint which is chronic. It is usually met with in heavy draught horses, but it is not by any means uncommon in the lighter breeds. One or both stifles may be affected.

The disease is very insidious in its onset, and at first the patient is but very slightly lame. In the stable when only one limb is affected the animal stands with the stifle, hock, and fetlock flexed, and the foot resting on the toe.

Another characteristic attitude is to find the animal with the joints named markedly flexed and the foot raised some three or four inches from the ground. Where both stifles are affected the joints are eased in this manner alternately.

There is always an endeavour on the part of the animal to avoid extension of the stifle, so that we find during progression the steps are very much shortened, and the foot is but slightly raised from the ground. The toe is thus very apt to be caught in any slight elevations.

In the other, or femoro-patellar disease, the stifle is always held extended.

As the disease progresses the patellar capsule becomes much distended in some cases, and the indentation below the patella becomes obliterated. It is not uncommon, also, to find the inner femoral condyle much enlarged, a point which is revealed by manipulation and comparison.

On making a post-mortem examination of the joint in an advanced case the ligaments will be found to be very much thickened, as also the edges of the fibro-cartilaginous meniscii. The concentric portions of the cartilages, on the other hand, become much thinner, and frequently present numerous small eroded areas. The tibial surfaces are eburnated. The inner cartilage is the one mostly affected, and particularly the small portion of it which is related to the inner aspect of the tibial spine. Irregular elevations are present on the articular surfaces of the femoral condyles, the inner of which, as already stated, may be found to be enlarged to a considerable extent.

The disease is generally regarded as incurable.

Paton reported the following peculiar case (*Veterinary Record*, August 11, 1906), in which the common tendon of origin of the extensor pedis and superficial portion of the flexor metatarsi muscles, was interfered with owing to the presence of osseous deposits in the notch between the anterior and external tuberosities of the tibia. The condition was described under the heading of stifle joint lameness. The subject, a "bay draught gelding (one horse vanner), seven-year-old, naturally straight-hocked, was admitted to the hospital on March 1, very lame in the near hind leg owing to having slipped up at work a few hours previously.

"*Symptoms.*—Tremor of the quarter muscles and slight relaxation of the tendo-achilles whilst at rest or standing. On walking the leg was carried straight and whilst elevated dangled, conveying the impression that there was a fracture, the heel of the foot always touching the ground first. On manipulating the limb I failed to detect the seat of lameness, but when the leg was flexed and the foot as it were held in position for shoeing, the tendo-achilles fell into a distinct fold,

causing one to suspect the flexor metatarsi muscle was partially ruptured, although there was no sign of pain, heat, or swelling on the anterior aspect of the thigh. After three weeks' rest it was noticed the muscles of the stifle began to atrophy, which was put down to the inaction of the limb, and as there was no improvement of the lameness an order was given to have the animal destroyed and a post-mortem examination made, which revealed a large deposit of bone on the condyles of the femur, completely obliterating the groove from which the tendon of the flexor metatarsi and extensor pedis arises."

Hunting and Porch recently (*Veterinary Record*, November 2, 1907), described two cases of a peculiar disease of the stifle confined to the femoro-patellar articulation:

"Both animals were omnibus horses, and both were incapacitated for work a long time before being slaughtered.

"The first was a seven-year-old bay mare that showed symptoms of lameness about six months before she was slaughtered. She was rested and blistered, and resumed work, but fell lame again in a time. The same treatment was again tried but the lameness increased, and finally became so intense that recovery was despaired of.

"At the commencement of lameness the symptoms were not well marked—little more than stiffness of the hind limbs. Later the extensor muscles of the thigh showed excessive rigidity when the animal was moved. When made to walk the hind legs were carried forward stiff and straight as though jointless, and the muscles in front of the femur were spasmodically contracted. Both hind legs were affected, but the near hind leg showed rather more aggravated symptoms.

"The post-mortem examination disclosed no lesions save in the stifle-joint. The femoro-tibial articulation was normal, neither the interarticular cartilage nor the surface of the bones presenting any disease. There was no excess of synovia.

"On the trochlea of the femur the cartilage, covering the inner lip, was thin and roughened, it was not ulcerated and it retained its translucent

quality, so that through it could be seen a reddened and roughened surface of bone for nearly the whole length of the inner lip of the trochlea. The patella was unaltered except that the articular cartilage corresponding to the diseased part of the femur was thin.

"The second case occurred in a black mare about eight years old, which had done three years' work. The history of the lameness was the same as in the other case—at first not well-marked, chiefly stiffness. Then came the 'wooden' position of the hind limbs, for both were affected—the difficulty of movement when made to walk, and the striking rigidity of the extensor muscles of the thigh, especially the *vastus externus* and the *tensor vaginæ femoris*.

"The post-mortem examination disclosed just the same lesions as in the first case.

"These symptoms and lesions are entirely different from those found in the more common stifle-joint lameness known as 'Gonitis.' In the latter disease there is usually synovial distension, the lesions are on the articular head of the tibia, and the condyles of the femur, whilst during life a common attitude is to hold the affected limb, so that the foot is carried forward and raised from the ground."

THE HOCK JOINT

This is a joint of great importance since it is the seat of some of the most serious and troublesome affections with which surgeons have to deal.

It is a composite joint and consists of a number of articulations. The most important is that formed between the distal end of the tibia, and the astragalus. This is a joint of the ginglymoid variety and in it most of the movement of the hock joint takes place. The remaining joints are restricted to a simple gliding or arthrodial movement.

The articular surfaces of the tibio-astragaloid or true hock joint

consist of two parallel grooves separated by a ridge on the inferior extremity of the tibia, and two articular ridges separated by a groove on the astragalus. These surfaces are then accurately adapted for one another and form a hinge-like joint in which the movements of flexion and extension are permitted to a considerable degree.

The articular surfaces of the remaining bones have been described in the previous chapter, and the facets presented are for the most part flattened in accordance with the gliding movement to which the joints are restricted.

In dealing with the numerous ligaments of this joint, probably the best method to adopt is that recommended by McFadyean, namely, "to take first those that bind together the several tarsal bones, proceeding in imagination to build up the tarsus out of its separate elements, and leaving until the last those that are common to the whole tarsus and those that unite the tarsus, as thus built up, to the lower end of the tibia."

Adopting this method we find that the two cuneiform bones are united to one another by an interosseous ligament termed the inter-cunean. Another interosseous ligament, the scaphoido-cunean, unites the scaphoid to the cuneiform magnum, the areas to which the ligament is attached having already been described in dealing with the bones. So far as building up the joint is concerned the two cuneiform bones and the scaphoid may now be treated as a single bone. They, in turn, are united to the cuboid by four ligaments. Two of these pass from the cuboid to the scaphoid and are hence called cuboido-scaphoid. One is interosseous whilst the other, a thin slip, passes transversely from the upper portion of the anterior face of the cuboid to the anterior border of the scaphoid. The remaining pair are called the cuboido-cunean ligaments and they connect the cuboid with the cuneiform magnum. One of them is interosseous, whilst the other passes transversely from the lower portion of the anterior surface of the cuboid to the anterior border of the cuneiform magnum.

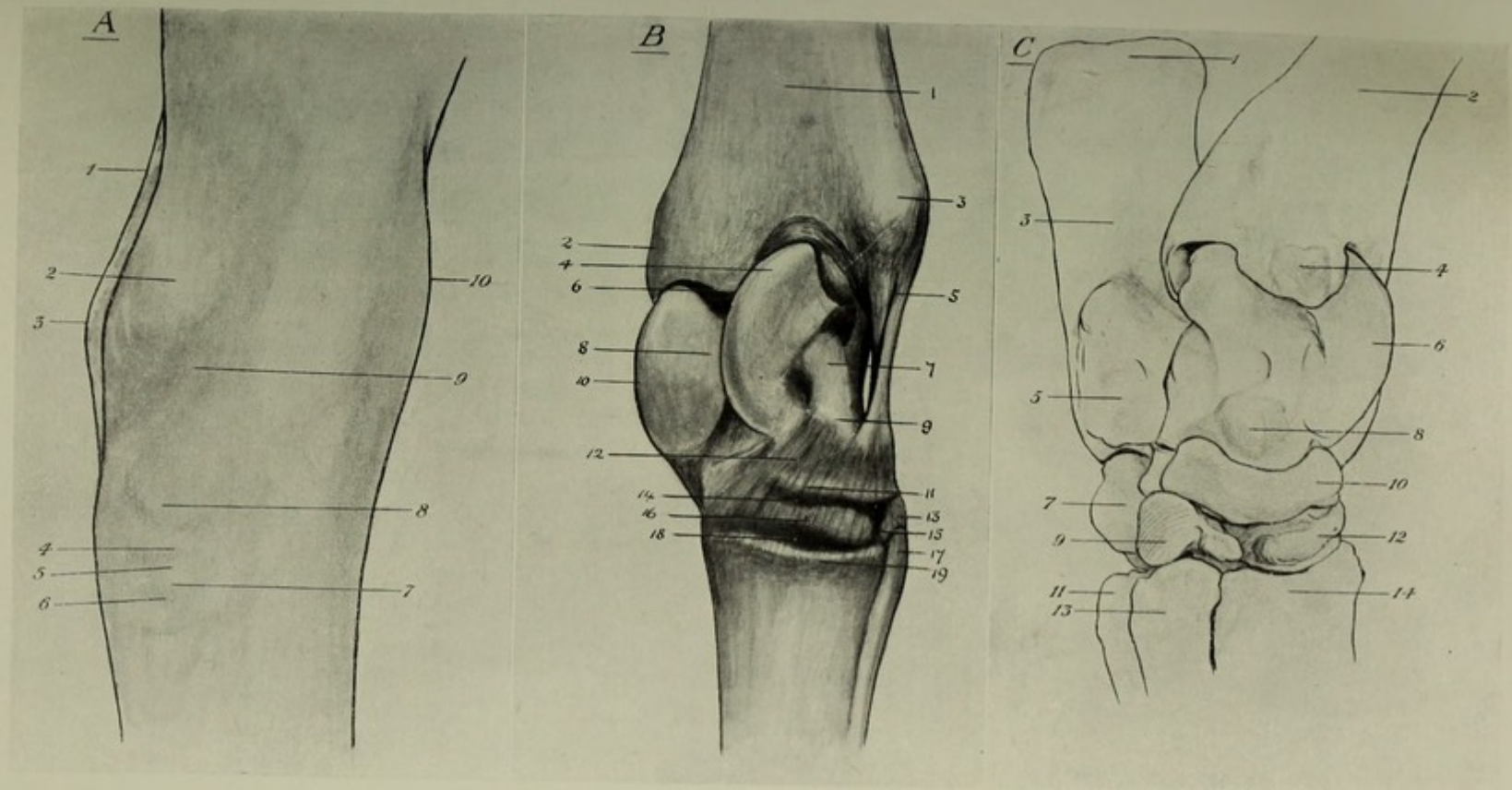

PLATE XVIII.—THE HOCK

A.—ANTERO-INTERNAL ASPECT OF LEFT HOCK—SUPERFICIAL MARKINGS

1. Tendo-Achilles. 2. Elevation formed by internal malleolus. 3. Summit of tuber calcis. 4. Position of ridge on scaphoid. 5. Position of groove between scaphoid and cuneiform magnum. 6. Position of groove between cuneiform magnum and large metatarsal bone. 7. Ridge on cuneiform magnum. 8. Tubercle or inner aspect of astragalus. 9. Depression (seat of bog spavin). 10. Elevation formed by external malleolus.

B.—THE RIGHT HOCK—BONES AND LIGAMENTS—ANTERO-INTERNAL ASPECT

1 Tibia. 2. External malleolus. 3. Internal malleolus. 4. Inner ridge of astragalus. 5. Internal lateral ligament. 6. Mesial ridge at inferior extremity of tibia. 7. Inner surface of astragalus. 8. Mesial furrow on astragalus. 9. Tubercle of astragalus. 10. Outer ridge of astragalus. 11. Ridge formed by scaphoid. 12. Astragalo-metatarsal ligament. 13. Cuneiform parvum. 14. Groove between scaphoid and cuneiform magnum. 15 Groove between cuneiform magnum and cuneiform parvum. 16. Ridge on cuneiform magnum. 17. Head of inner small metatarsal bone. 18. Groove between cuneiform magnum and large metatarsal bone. 19. Ridge at upper extremity of large metatarsal bone.

C.—BONES OF LEFT HOCK—INNER ASPECT

1. Summit of tuber calcis. 2. Tibia. 3. Groove on tuber calcis forming outer boundary of tarsal sheath. 4. Internal malleolus. 5. Body of calcis. 6. Inner ridge of astragalus. 7. Cuboid. 8. Tubercle of astragalus. 9. Cuneiform parvum. 10. Scaphoid. 11 and 13. External and internal small metatarsal bones. 12. Cuneiform magnum. 14. Large metatarsal bone.

The second set are the *Calcaneo-Astragaloid Ligaments* which, as may be inferred from the name, serve to bind the calcis and astragalus together. Of these ligaments there are four, namely, a *superior* ligament which passes from one bone to the other above the articular surfaces and which consists of short but powerful fibres. Two other ligaments connect the sides of the bones and are hence called the *laterals*, whilst a fourth strong *interosseous* ligament connects the two non-articular areas of the bones which are placed on their surfaces which come into apposition with one another.

The several bones of the tarsus are thus united into two sets, each of which, for our purposes, may be regarded as a single bone. The upper set consists of the calcis and astragalus, and the lower set of the cuboid, scaphoid, and the cuneiform bones.

We shall now proceed to consider the group of ligaments uniting these two already-united sets of bones together. Of these there are four, and they are of great importance. Firstly we have the *astragalo-scaphoid ligament*, which is interosseous in position and runs from the non-articular area on the inferior aspect of the astragalus, which forms its superior attachment, to the superior surface of the scaphoid to which the ligament is attached inferiorly. The *astragalo-metatarsal ligament*—another member of this group, arises from the tubercle on the inner surface of the astragalus. It passes obliquely downwards and forwards, its fibres spreading out as we descend so that they present a fan-like arrangement. The ligament passes over the anterior borders of the scaphoid and cuneiform magnum, to which some of its fibres are attached, and it ultimately obtains insertion into the anterior face of the upper end of the large metatarsal bone just below its articular surface. The most posterior of the fibres of this ligament are confounded with those of the superficial division of the internal lateral ligament which is one of the common ligaments of the joint. The astragalo-metatarsal ligament, therefore, crosses the seat of spavin and has before been referred to.

Another very important ligament of this set is placed at the postero-external aspect of the joint. This is the *calcaneo metatarsal*, sometimes referred to as the *calcaneo-cuboid ligament.* It is thick and powerful and arises from the roughened posterior border of the tuber calcis. It takes a course which is almost vertical and passes along the posterior surface of the cuboid. Some of the fibres are attached to this bone. The ligament terminates by obtaining insertion into the head of the external small metatarsal bone.

Posteriorly the calcaneo-metatarsal ligament is related to the tendon of the flexor perforatus muscle, which tendon becomes closely applied to the ligament after passing over the summit of the tuber calcis. The ligament just described is of importance inasmuch as it is concerned in the troublesome surgical affection known as curb.

The *tarso-metatarsal ligament.* This is the fourth ligament of the third set. It is a strong ligament, the fibres of which have a very complicated arrangement. It binds together all the small bones by its attachments to their posterior surfaces, and then, in turn, by its attachments to the posterior aspect of the upper extremities of the metatarsal bones, binds the small bones to those just mentioned. It is continued inferiorly as the subtarsal or check ligament which becomes attached to the tendon of the flexor perforans muscle in a manner closely resembling the subcarpal or check ligament of the fore limb.

The tarso-metatarsal ligament is crossed by the tendon of the flexor perforans muscle. It is also crossed by the perforating metatarsal artery and its accompanying vein, which run horizontally through the tarsus by passing through the canal formed between the cuboid, scaphoid, and cuneiform magnum. The posterior face of the ligament forms part of the anterior boundary of the tarsal sheath, the synovial lining of which covers the face of the ligament. Laterally its fibres are confounded, outwardly with those of the calcaneo-metatarsal ligament, and inwardly with those of the internal lateral ligament.

The remaining ligaments of the tarsus are the *Common Ligaments.*

Of these there are also four, namely, the external and internal laterals, the anterior common, and the posterior common.

The *external lateral ligament* consists of two fasciculi termed respectively, superficial and deep. The superficial division is cord-like superiorly, but becomes flattened out towards its inferior extremity. It arises from the outer surface of the external malleolus of the tibia—from the portion which is placed posteriorly to the groove through which the tendon of the peroneus muscle plays. The ligament passes downwards and becomes attached to the astragalus, calcis, cuboid, scaphoid, cuneiform magnum, and to the large and outer small metatarsal bones. Posteriorly, and towards its inferior end, its fibres are confounded with the calcaneo-metatarsal ligament, whilst it is related superficially to the tendon of the peroneus muscle which partially conceals it from view. The deep division of the external lateral ligament arises from the front of the outer aspect of the external malleolus anteriorly to the groove for the peroneus. It is much shorter than the superficial division and takes a course which is downwards and backwards, to be inserted into the outer aspect of the calcis and astragalus. The deep face of this division is lined by the synovial membrane of the true hock joint. From the directions which the two divisions take it will be seen that they cross one another like the arms of the letter X.

The *internal lateral ligament* is made up of three divisions which are termed respectively superficial, middle, and deep, owing to the fact that they are superposed to one another. All three divisions arise from the roughened surface of the internal malleolus of the tibia.

The superficial division is the longest and it is also much the most powerful. As it descends it diminishes in size and becomes inserted into the tubercle of the astragalus, the scaphoid, cuneiform magnum, cuneiform parvum, and the large and inner small metatarsal bones, its fibres becoming confounded with those of the astragalo-metatarsal and tarso-metatarsal ligaments in the manner already described. The middle

division arises beneath the superficial portion and resolves itself into two bundles which run downwards and backwards to be inserted into the inner aspect of the calcis and astragalus respectively.

The deep division is by far the most delicate of the three, and sometimes its fibres can only be made out with greatest difficulty. It arises beneath the middle division and is inserted into the astragalus in close proximity to the insertion of its astragaloid portion. This division is enveloped by the synovial membrane of the joint.

The *anterior common ligament* is sheet-like and somewhat membranous. It closes the front of the tibio-tarsal joint. Its fibres have a peculiar intercrossed arrangement, the outer portion of the ligament being much stronger than the inner. This is a point of surgical importance, inasmuch as the appearance of the bulging in cases of bog spavin in this situation is due to the weaker structure of the inner portion of this ligament. Superiorly this ligament is attached to the anterior face of the inferior extremity of the tibia. Inferiorly it is attached to the astragalus, scaphoid, the two cuneiform bones, and to the astragalo-metatarsal ligament. Through its fibres being confounded with those of the ligament just mentioned, it obtains insertion also into the large metatarsal bone. Its deep face is lined by the synovial membrane of the true hock joint, to which membrane the ligament gives support. Its superficial face is crossed by the tendons of the extensor pedis and flexor metatarsi muscles, and also by the anterior tibial artery. On this surface ramify also a number of veins, which unite with the vein passing forwards through the cuboido-scaphoido-cunean canal, to form the anterior tibial vein.

The *posterior common ligament* is also sheet-like, and it closes the tibio-tarsal joint posteriorly. It is attached superiorly to the posterior aspect of the inferior extremity of the tibia, and inferiorly it obtains insertion into the calcis and astragalus. This ligament is most powerful towards its centre, where it presents a fibro-cartilaginous thickening over which the tendon of the flexor perforans muscle plays.

The anterior surface of the ligament is lined by, and gives support to, the synovial membrane of the joint.

Its posterior face forms the upper portion of the anterior boundary of the tarsal sheath, by the synovial membrane of which it is covered. Laterally its fibres are commingled with the posterior fibres of the superficial division of the external and internal lateral ligaments respectively.

The Synovial Membranes.—Of the synovial membranes of the tarsus the one which belongs to the tibio-astragaloid articulation or true hock joint is much the largest and is also the most important. In front it is supported by the posterior face of the anterior common ligament. Behind it is similarly supported by the anterior face of the posterior common ligament. Towards the inner side of the joint it will be found to line the greater portion of the superficial, middle, and deep divisions of the internal lateral ligament, whilst the deep division of the external lateral ligament affords support to the membrane outwardly. The synovial membrane of the true hock joint sends a small diverticulum which supplies the upper articulation formed between the calcis and astragalus, and it communicates with the synovial capsule which supplies the intertarsal joint. The arrangement of the synovial membrane of the tibio-astragaloid joint is of great importance. This is the membrane which is concerned in bog spavin and articular thoroughpin.

The intertarsal synovial membrane supplies the joint formed between the calcis and astragalus as representing the upper row of bones, and the cuboid and scaphoid regarded here as the lower row. It sends an upward prolongation to supply the more inferior of the articulations formed between the calcis and astragalus, whilst the anterior articulation formed between the cuboid and scaphoid is supplied by a prolongation of this membrane.

A third principal synovial membrane of the tarsus is the tarso-metatarsal, and as its name implies this membrane supplies the joint

formed between the tarsal and metatarsal bones. The bones concerned then are the cuboid, cuneiform magnum, and cuneiform parvum above, and the large and two small metatarsal bones below.

Pouches are sent downwardly from this membrane to supply the articulations formed between the upper end of the large and two small metatarsal bones. Towards the inner side of the joint it sends upwardly a small pouch to supply the articulation formed between the two cuneiform bones, whilst more outwardly, and towards the front of the joint, another pouch is sent upwards which supplies the anterior of the two articulations formed between the cuboid and cuneiform magnum.

From our description of the above three chief synovial membranes it will be seen that there are certain small articulations which are not supplied by them. For the supply of the articulations referred to there is a fourth synovial membrane, which is very much smaller than those described. This is the scaphoido-cunean, so called because it is mainly taken up in supplying the joint formed between the scaphoid and cuneiform magnum. Upwardly it sends a prolongation to supply the posterior cuboido-scaphoid articulation, whilst downwardly a small diverticulum is sent which lubricates the posterior articulation formed between the cuboid and the cuneiform magnum.

Tendons playing over the Joint.—The tendons of the superficial and deep divisions of the flexor metatarsi muscle play over the superficial face of the anterior common ligament. The tendon of the superficial portion forms a kind of ring, through which the tendon of the deep division makes its appearance. The latter tendon then divides into two portions, one of which takes a vertical course to be inserted into the anterior face of the upper extremity of the large metatarsal bone, whilst the other portion runs downwards and inwards to be inserted into the cuneiform parvum. The tendon of the superficial portion of this muscle also splits into two divisions, one of which runs downwards to become attached to the large metatarsal,

whilst the other runs downwards and outwards to become inserted into the outer aspect of the cuboid. The tendon of the extensor pedis muscle crosses the anterior common ligament vertically a little to the outer side of the median line.

The tendon of the flexor perforans plays through the tarsal sheath the synovial membrane of which lines the posterior face of the posterior common ligament. It is therefore in close relationship to the tibio-tarsal, intertarsal, and tarso-metatarsal articulations. The tendon or the flexor perforatus is removed from the true hock joint, since it plays over the summit of the tuber calcis. It is, however, in close relationship to the calcaneo-metatarsal ligament at the back of the tuber, and a little lower down is found immediately behind that of the flexor perforans. The tendon of the gastrocnemius terminates at the hock, since it is inserted in the depression at the summit of the tuber calcis.

Running downwards and forwards over the outer aspect of the joint is the tendon of the peroneus muscle, whilst on the inner aspect the long, well-defined tendon of the flexor accessorius muscle runs downwards and slightly backwards.

The Blood-vessels

The anterior tibial artery, the larger of the two divisions of the popliteal artery, is found on the deep surface of the flexor metatarsi muscle. It passes downwards over the anterior face of the true hock joint. It then deviates slightly outwards and passes beneath the cuboid division of the tendon of the flexor metatarsi. Over the region of the scaphoid the vessel terminates by dividing into the large metatarsal and perforating metatarsal arteries. It gives off a number of small articular branches. The perforating metatarsal artery passes right through the hock from front to back in the canal formed between the cuboid, scaphoid and cuneiform magnum, and then joins the two plantar arteries to form the tarsal arch. From the entrance to the cuboido-scaphoido-

cunean canal the large metatarsal artery passes downwards, outwards, and backwards beneath the extensor brevis and the tendon of the peroneus, at first on the large metatarsal bone, and then down the groove formed between the large and external small metatarsals.

The posterior tibial artery makes its appearance on the inner aspect of the limb just above the hock and a short distance in front of the posterior tibial nerve. It forms the peculiar, S-shaped curve, to which reference has already been made, and then disappears within the fibrous tarsal arch, dividing at the back of the astragalus into the two plantar arteries which help to form the tarsal arterial arch. This arch runs across the upper extremity of the suspensory ligament. The posterior tibial artery gives off a number of collateral articular branches to the tarsus. Small articular tarsal branches are also given off by the plantar arteries.

The internal metatarsal vein is continued upwards as the anterior root of the internal saphena vein. This root inclines slightly forwards and upwards, to become placed towards the front of the inner aspect of the hock. Here it communicates with the anterior tibial vein, and is then continued up the leg on the inner (subcutaneous) surface of the tibia.

The external metatarsal vein communicates with the deep metatarsal vein at the upper end of the metatarsal region, and then runs upwardly through the tarsal sheath with the plantar arteries. It forms the posterior root of the internal saphena vein. This root also communicates with the external saphena vein which begins at the calcis, through a large network of veins which runs across the front of the tuber calcis. The deep metatarsal vein runs upwards between the suspensory ligament and the large metatarsal bone. At the tarsus it communicates with the external metatarsal vein, and it then passes forwards through the canal formed between the cuboid, scaphoid and cuneiform magnum, to reach the front of the hock, where it forms the principal root of the anterior tibial vein.

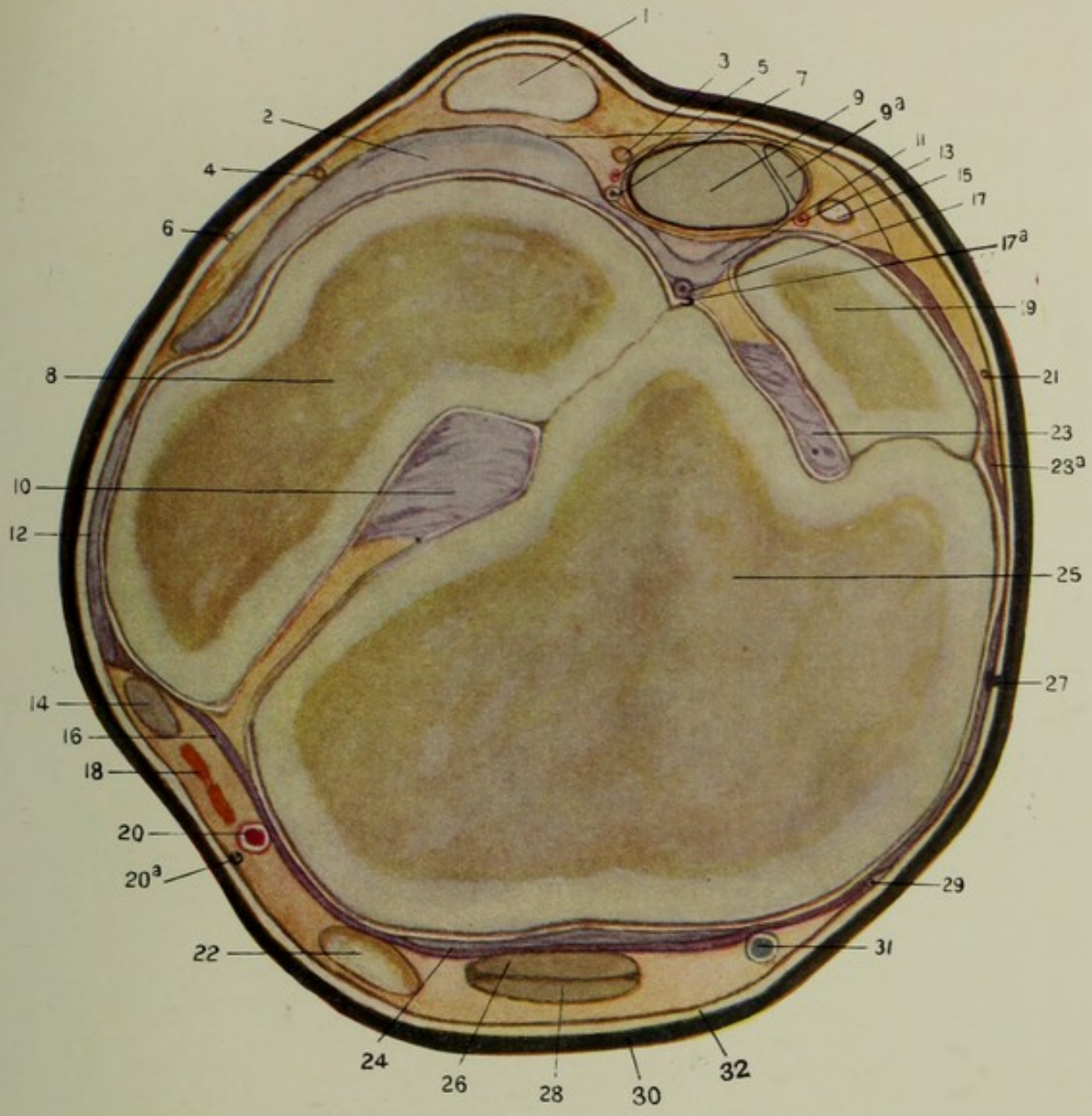

PLATE XIX.—TRANSVERSE SECTION OF RIGHT HIND LIMB THROUGH SEATS OF SPAVIN AND CURB.

1. Perforatus tendon. 2. Calcaneo-metatarsal ligament. 3. External plantar nerve. 4. External saphena nerve. 5. External plantar artery. 6. Cutaneous branch of musculo-cutaneous nerve. 7. External metatarsal vein. 8. Cuboid. 9. Perforans tendon. 9A. Flexor accessorius tendon. 10. Cuboido-cunean interosseous ligament. 11. Tarso-metatarsal ligament. 12. External lateral ligament. 13. Internal plantar artery. 14. Peroneal tendon. 15. Internal plantar nerve. 16. Anterior common ligament. 17. Deep metatarsal vein. 17A. Perforating metatarsal artery. 18. Extensor brevis muscle. 19. Cuneiform parvum. 20. Large metatarsal artery. 20A. Anterior tibial nerve. 21 & 27. Cutaneous branches from internal saphena nerve. 22. Tendon of extensor pedis. 23. Intercunean interosseous ligament. 23A. Internal lateral ligament. 24. Astragalo-metatarsal ligament. 25. Cuneiform magnum. 26 & 28. Tendons of flexor metatarsi muscle. 29. Cutaneous branch of posterior tibial nerve. 30. Skin. 31. Anterior root of internal saphena vein. 32. Fascia.

The Nerves

The external saphena nerve runs down the outer aspect of the limb in front of the tendo-achilles, occupying a position on this side of the limb corresponding to that in which the posterior tibial nerve is found on the inner aspect. It crosses the postero-external aspect of the hock, being very superficially placed. Similarly placed in a superficial position, we find, on the anterior and antero-external aspects of the joint, two (sometimes three) terminal divisions of the musculo-cutaneous nerve. The anterior tibial nerve is more deeply seated and passes over the front of the tarsus. Below the hock it follows the course of the large metatarsal artery. It gives filaments to the tarsus. The posterior tibial nerve descends the inner aspect of the limb in front of the tendo-achilles. About five inches above the point of the hock it gives off a small filament which runs obliquely downwards, forwards and inwards over the antero-internal aspect of the joint. It is a cutaneous branch. The posterior tibial nerve then divides into the external and internal plantar nerves, which run through the tarsal sheath one on either edge of the perforans tendon. Articular branches are also contributed by this nerve. Tiny branches of the internal saphena nerve may be found on the front and internal aspect of the joint. They are very superficially placed, and in many cases do not extend as far as the joint.

Movements of the Joints of the Tarsus.—Although the hock is of such complicated structure its movements are very simple. The only joint which is of any importance so far as movement is concerned is that formed between the tibia and astragalus, and in this joint the movements are restricted to simple flexion and extension. It is a typical member of the class of ginglymoid joints. Lateral movement is completely restricted on account of the conformation of the articular surfaces and the disposition of the lateral ligaments. When the animal stands with both hind feet in line and resting flat on the ground, the

angle formed at the tibio-tarsal ioint, by imaginary lines drawn along the longitudinal axes of the tibia and large metatarsal bone, is from 155° to 165° depending upon the conformation of the animal. The long axis of the large metatarsal bone is disposed almost vertically, whilst that of the tibia has a forward inclination, to the extent of forming an angle with the vertical of 15° to 25° at the hock. When the joint is flexed the distal end of the limb is carried forwards. This is brought about by the combined action of the flexor metatarsi and extensor pedis muscles, and this movement is so free that the grooves on the tibia pass along the whole length of the ridges on the astragalus. When thus carried forwards the metatarsus does not move in a vertical plane, but in a plane which runs obliquely downwards and outwards owing to the conformation of the articular surfaces. Extension cannot be carried out to a degree which will bring the long axes of the tibia and the large metatarsal bone into a straight line with one another. This is due to the disposition of the flexor metatarsi muscle, which appears normally too short, and not to the restraining influence of the lateral ligaments as maintained by some writers. This is conclusively proved in cases of rupture of the flexor metatarsi when the joint becomes straightened and the angle almost completely obliterated.

In the remaining tarsal articulations movement is very restricted, and consists merely of a slight gliding of the articular surfaces on one another. There is very little interference with the action of the joint as a whole in cases where these articulations are obliterated owing to anchylosis of the small bones, provided the process of inflammation has subsided.

DISEASES OF THE HOCK JOINT

WRENCHED HOCK

This is an affection which is much more common than is generally supposed. Attention was first directed to it in this country by Macqueen, who defined the condition as a momentary incomplete luxation. It will be readily understood that, in a joint of such complex structure, if the foot becomes fixed the various ligaments, synovial membranes, articular surfaces, tendons, vessels, nerves, &c., are easily damaged during violent efforts on the part of the animal to release it. Ligaments may be sprained or slightly lacerated. The synovial membranes may be torn, tendons may be sprained and the articulations bruised. It is a case, in fact, where the whole machinery or the hock has thrown upon it a sudden and severe sprain. A similar result may be due to slipping whilst jumping or whilst shafting heavy loads on slippery pavements. There is pronounced lameness. The hock rapidly swells and presents a rounded, clearly moulded appearance. It is very hot to the touch and during its manipulation the animal evinces signs of intense pain. The condition is accompanied by marked systemic disturbances. The patient declines to feed, its pulse is quick, small and hard, and its temperature may be elevated.

Complete rest should be provided and the joint dressed with cooling astringent applications. In addition a stimulating febrifuge draught should be administered. After the acute symptoms have subsided a mild blister should be applied and the animal allowed to run out for two or three weeks.

TRAUMATIC INJURIES

Acute inflammation as a result of traumatic injury to the hock joint is very common. Such injury may be due to a kick, a stab with a fork,

and quite commonly it is the result of an injury caused by barbed wire whilst taking a fence.

The extent of the injury depends to a considerable degree upon the seat of the wound. If on the outer aspect of the joint, which is the most common seat, and low down, there may be considerable hæmorrhage through laceration of the large metatarsal artery. This is dealt with elsewhere. A sharp calkin may inflict a clean-cut incision of considerable depth and lead to an open arthritis. A small punctured wound by barbed wire may produce a similar effect. In these latter cases the puncture is usually very small and has to be carefully sought for. If the limb be examined a thin streak of synovia will be observed, and at the upper end of the streak a very small puncture will be found. The seat of the wound having been discovered, the particular joint punctured will be gathered from the anatomical description given, and it will be obvious that the most serious wounds are those which open into the tibio-tarsal or true hock joint.

There is severe lameness. The animal rests its foot on the toe or may hold it two or three inches from the ground. The joint rapidly swells and all the symptoms of acute inflammation are presented.

At first the swelling is soft, but later it becomes much harder.

Treatment should be prompt. If the case is seen early and there is no evidence of suppuration, efforts should be immediately made to close the wound. In cases of small punctured wounds, probably the most effective method is to blister the surrounding area with biniodide of mercury ointment on account of its antiseptic properties. This quickly causes a swelling of the parts and brings about the closure of the wound. In other cases it may be necessary to bandage the joint. The wound should be washed out, and a pad of tow or cotton-wool, plentifully sprinkled with dry dressing, applied. Fairly tight bandaging is necessary, and the bandage should be left in position for two or three days, when it may be removed and re-applied with a fresh application of dry dressing. The patient is of course placed in slings.

In the treatment of open arthritis of the hock some clinicians depend entirely upon continuous irrigation with cold water, and this treatment is attended with a considerable measure of success. The animal is placed in slings and a hose pipe is passed over the croup, being attached loosely to the back-band. It is then allowed to hang down the affected limb and is attached to the breech-piece in such manner as to bring the nozzle immediately over the wound. When the wound has closed and the discharge of synovia has ceased, the acute symptoms having subsided, the joint is blistered and the animal allowed to run out for three or four weeks.

Another method is the frequent application of some synovial styptic such as oil of cloves or lime.

Should the wound become septic and suppuration occur, prognosis should be very guarded, for one of the most favourable results to be expected is healing with anchylosis. In such cases of suppuration there is usually a good deal of systemic disturbance, the animal declines to feed and the temperature is elevated. The attempt at treatment depends upon the seat of the wound. The further this is removed from the tibio-tarsal joint the more favourable is the result to be expected since, as we have already stated in our anatomical description, anchylosis of one or more of the small joints might occur, and yet the power to flex and extend the hock freely be retained, providing the inflammatory process has subsided. If the tibio-tarsal joint is affected, treatment as a rule is useless.

Treatment in these cases consists in keeping the wound open for a while, in order that free drainage may be provided, and the frequent application of antiseptics. In addition, febrifuge and stimulating draughts should be administered.

LUXATION OF THE HOCK JOINT

This is extremely rare, particularly as applied to the tibio-tarsal articulation, a point which will be readily conceded when we consider the conformation of the articular surfaces, and the firm manner in which the bones are held together by the intricate arrangement of the ligamentous apparatus. Recorded cases have usually been the result of some very serious injury associated with fracture of the malleoli of the tibia. Luxation occurs more readily in the dog and cat, owing to the fact that the ridges are not so prominent, and the grooves, consequently, not so deep in these animals. The small bones are united to one another in a particularly firm manner, and owing to the slight degree of movement naturally occurring between them, it is questionable whether luxation of the small articulations ever occurs.

Regarding luxation of the tibio-tarsal joint, Möller states that " the strong ligamentous apparatus, together with the prominences on the articular surfaces of the tibia and of the astragalus, produce so firm and so secure a union of the two bones that luxation of the astragalo-tibial joint is exceedingly rare." Jowett reported the following case of luxation of the astragalo-tibial joint :

" The subject, an ' unbroken ' Argentine mare, aged six years—whilst being exercised in a circle ' lunged ' and travelling to the left, slipped and fell to the ground. During the process it appears the left hind foot caught in the turf in some way, whilst the off hind leg slipped outwards. The mare immediately regained her feet without assistance —lameness was very marked and she was just able to hobble very slowly on three legs to the stable (a distance of about 500 yards), practically no weight being placed on the injured limb.

" On examination it was found that the portion of the leg from the astragalus downwards could be moved to a very considerable extent

outwards, in fact until it formed an angle of about 100° with the upper portion of the limb.

"Crepitation could not be detected, neither did the movement appear to occasion pain.

"Treatment being impracticable the animal was immediately slaughtered.

"A dissection of the joint disclosed rupture of a portion of the synovial membrane and the entire internal lateral ligament. The distal extremity of the tibia was displaced outwards but none of the bones were fractured" (*Veterinary Record*, November 9, 1907).

BOG SPAVIN

A description of the arrangement of the synovial membrane of the true hock joint has already been given. When this membrane becomes unduly distended owing to the accumulation of an abnormal amount of synovia within, the condition known as bog spavin is constituted. As the synovia accumulates, the membrane forms a bulging which is visible on the exterior in the position in which there is least resistance, and this is found to be in the depression which is visible on the antero-internal aspect of the upper half of a normal hock. The membrane is here only supported by the thin, sheet-like anterior common ligament. The first alteration in conformation will then be a filling of this depression. Later there will appear in its stead a rounded enlargement, which may attain enormous proportions. When the skin covering this part becomes very tense, resistance will be offered to the further distension of the membrane in this direction, with the result that a bulging of the membrane appears at the back of the joint. This appears in the hollow of the hock immediately behind the lateral ligaments. The posterior common ligament which here supports the synovial membrane, although a firmer structure than the anterior ligament, is

loosely applied to the back of the joint in order that the bones may move freely. The result is that it readily permits of distension of the membrane posteriorly. This enlargement is frequently referred to as articular thoroughpin. It must not be confused with distension of the sheath of the perforans tendon (tendinous thoroughpin). The enlargement in the latter case is situate more posteriorly and is elongated from above to below. Moreover in these latter cases there will usually appear a bulging at the postero-inferior aspect of the joint at the edge of the perforans tendon, due to distension of the lower end of the tendon sheath. Franck states that there is often a communication between the sheath of the flexor perforans tendon and the synovial capsule of the joint. Chauveau does not mention any such communication, and Franck's statement is probably due, either to a confusion of the two enlargements, or to cases in which there has been a rupture of the posterior common ligament. This ligament, it will be remembered, separates the two sheaths, and the separation is made more complete by the presence on the back of the ligament of a fibro-cartilaginous thickening over which the perforans tendon plays.

That the posterior bulging is due to distension of the synovial capsule of the joint may frequently be demonstrated by the application of pressure, when it will diminish in size and bring about a corresponding increase in the size of the anterior enlargement.

From our anatomical study of the joint it will be readily understood that the condition will be most common in those joints which are upright—*i.e.*, those in which the angle formed by the longitudinal axes of the tibia and large metatarsal bone is the largest. Young animals are more particularly affected owing to the greater elasticity of the anatomical structures of the joint. It is also common in animals in which great strain is thrown upon the hocks, such as entire horses.

The condition is generally attributed to a chronic inflammation of the synovial membrane as a result of severe strain, The inflammation in some cases is acute, when the enlargement is hot, tense, and painful,

and there is marked lameness. Usually, however, it is a dropsical condition, and the swelling is cold and fluctuating. No pain is evinced on palpation, and lameness is rare, the only cases being those in which the distension is so large as to interfere mechanically with the action of the joint.

Prognosis is generally favourable, since animals affected with bog spavin commonly work well throughout life without treatment, and experience little, if any, interference with the action of the joint. The condition is more unsightly than injurious.

In recent cases, where there is heat and pain, the part should be treated with cold applications, and when the acute symptoms have subsided the joint should be blistered.

Frequent applications of tincture of iodine commonly bring about a diminution in the size of the enlargement in young animals. Firing is frequently resorted to, the enlargement being either line-fired or pyro-punctured with needle-irons. Another method of treatment is to open the enlargement surgically. There is little difficulty in performing this operation and in evacuating the contents, but great difficulty is experienced in successfully preventing the appearance of an even greater enlargement. Dean's aspirator is the best instrument for this purpose. The aspirator has two barrels placed side by side. One is to accommodate the contents of the sac during the process of evacuation whilst the other contains the injection solution, and the principle is that the contents may be discharged from the sac and a solution injected into it without withdrawing the nozzle of the syringe. The subsequent treatment consists in blistering the joint.

CHAPTER VI

TENDONS, TENDON SHEATHS, LIGAMENTS, AND BURSÆ

THE ROUND AND PUBIO-FEMORAL LIGAMENTS

These important ligaments have already been described in dealing with the hip joint. Chauveau describes both ligaments under the name ligamentum teres, and sprain of this ligament is designated by surgeons as *True Hip Lameness*. The term as used in surgery, however, corresponds to the nomenclature of Chauveau, since the round and pubio-femoral divisions are involved.

From our description of the arrangement of these ligaments it will be gathered without difficulty that the greater the degree of abduction of the limb at the hip, the greater will be the tension thrown upon these ligaments. It will therefore be in cases of abnormally great and sudden abduction, such as occurs when the animal slips and spreads out its limbs after the manner of "doing the splits," that the ligaments will be sprained. The injury having been inflicted, there will be a natural tendency on the part of the animal to ease the tension on the sprained ligaments, and this will be brought about by the foot of the affected limb being carried nearer the median plane of the body when the animal is compelled to move.

Inflammation of the ligaments may also be the result of bruising, through such mechanical injuries as kicks, blows, &c.

The symptoms presented are very severe. The animal is disinclined

to move, and there will be evidences of intense pain if the head of the femur be pressed into the cotyloid cavity by applying the palm of the hand over the great trochanter. The animal is unable to lie down, and the muscles of the quarter rapidly atrophy. In addition, the temperature becomes elevated and the patient declines to feed.

Owing to the fact that the injured structures are so deeply seated, little can be done, and the disease usually becomes chronic. Post-mortem examination of chronic cases commonly reveals changes in the surrounding structures. Möller reports that "in a horse which had suffered from hip lameness for more than a year, the hip joint was found to be surrounded by fibrous connective tissue and to exhibit periarticular osteophytes, the synovial membrane was about two inches in thickness, the articular cartilage had partly disappeared from the cotyloid cavity, and its edges were undergoing degenerative change."

Osseous deposits are frequently found, both in the cotyloid cavity and on the articular head of the femur, and these are accumulated in the non-articular area of the acetabulum and in the sulcus on the femur, to which areas, it will be remembered, the round ligament is attached. The ligaments may be found to present lacerations, or they may be greatly increased in thickness. A peculiar feature is that anchylosis of the joint rarely if ever occurs in these cases, for cases have been observed in which the bony deposit almost completely filled up the cotyloid cavity, and yet the bones remained separate.

As already stated, treatment is of little use. During the process of observation a certain amount of relief may be afforded the patient by applying a high-heeled shoe, since by this means the tension on the parts is eased.

THE TENDON OF THE MIDDLE GLUTEUS MUSCLE AND ITS BURSA—FALSE HIP LAMENESS

It will be remembered that one of the tendons of insertion of the great or middle gluteus muscle plays over the outer surface of the convexity of the great femoral trochanter and obtains insertion into the crest. This is a very powerful tendon, and as it passes over the convexity it becomes very much flattened out. The outer surface of the convexity is covered by a layer of smooth fibro-cartilage, and still further to facilitate the gliding movements of the tendon, there is interposed between it and the convexity an ovoid synovial sac or bursa. This bursa is disposed with its long axis directed downwards and forwards. Inflammation of this tendon and its bursa constitutes what is known as *False Hip Lameness*, to which attention was first directed by Gunther and which Williams described under the name of trochanteric lameness. Williams states that "lameness in the hip is not at all an infrequent occurrence; still its seat is not the joint but the head of the trochanter major of the femur." Möller states that the disease is only occasionally seen in horses; the fact remains that the great trochanter, with the structures playing over it, are particularly exposed to risk of injury and form a prominent landmark in the living animal, especially in subjects of low muscular development in which less protection is afforded. The tendon may be sprained and the bursa injured by violent exertion on the part of the muscle. But the injury is most frequently the result of a blow or a fall when this part comes into contact with the hard road or pavement as the animal comes down on its broadside. Lameness occurs, regarding which Williams states "there is a hop and a catch in the lame limb and a want of movement in the quarter which, to a practised eye, is quite suggestive. The whole of the quarter on the lame side is elevated with as little motion of the hip as possible,

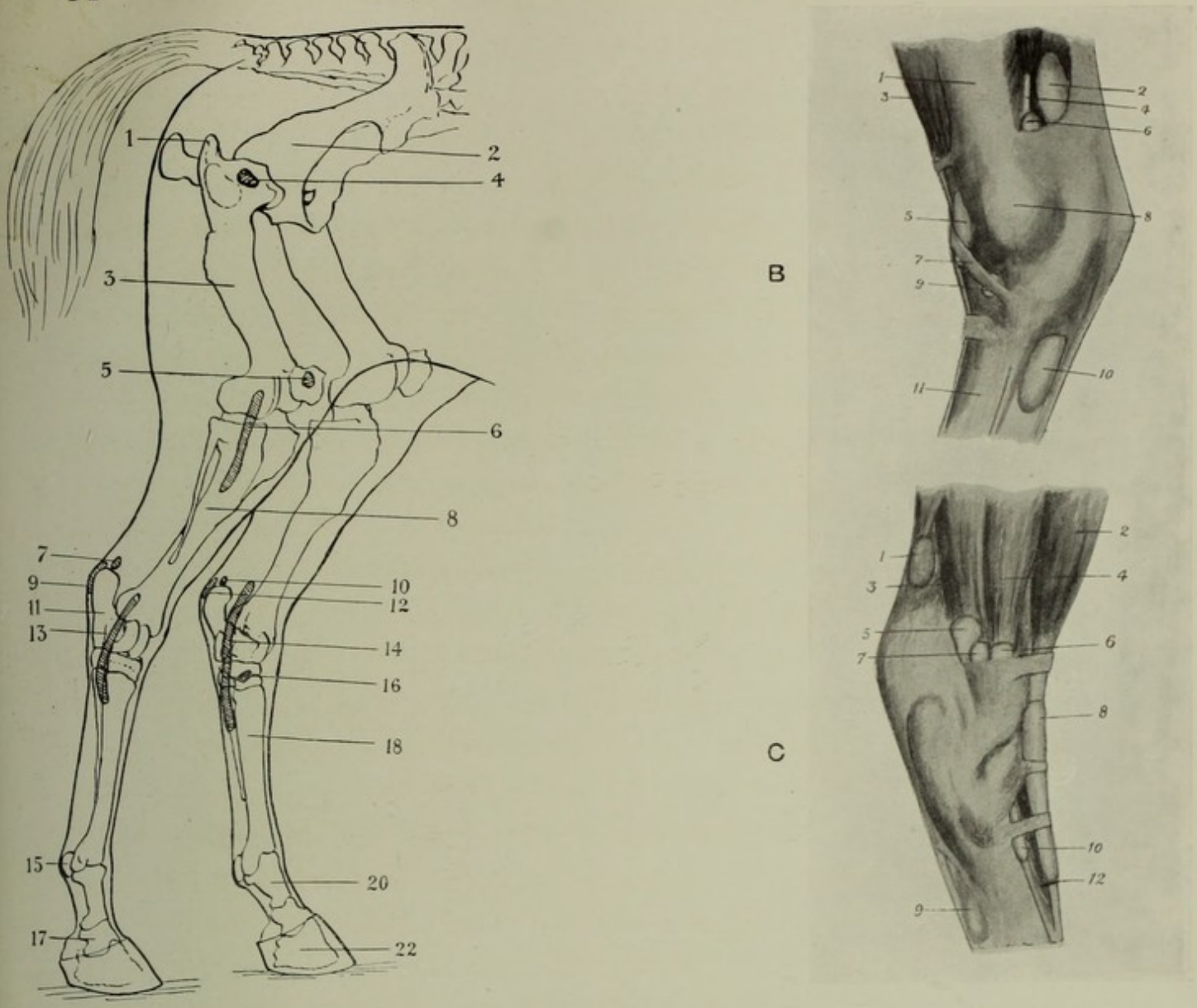

PLATE XX.

A.—BURSÆ AND SHEATHS IN RELATION TO THE BONES (SEMI-SCHEMATIC)

1. Summit of great trochanter. 2 Innominate bone. 3. Femur. 4. Bursa on outer surface of convexity. 5. Bursa on front of patella. 6. Sheath of common tendon of extensor pedis and superficial division of flexor metatarsi. 7 and 10. Bursa between tendons of flexor perforatus and gastrocnemius. 8. Tibia. 9 and 12. Bursa between perforatus tendon and skin. 11. Os calcis. 13. Sheath of tendon of peroneus muscle. 14. Sheath of tendon of flexor perforans. 15. Sesamoid bone. 16. Bursa beneath cunean tendon. 17. Os coronæ. 18. Large metatarsal bone. 20. Os suffraginis. 22. Os pedis.

B.—LEFT HOCK—INNER ASPECT, SHOWING SHEATHS AND BURSÆ DISTENDED

1. Tibia. 2. Superior dilatation of sheath of flexor perforans tendon (tendinous thoroughpin). 3. Flexor metatarsi. 4. Tendon of flexor accessorius. 5. Synovial capsule of tibio-astragaloid joint bulging anteriorly (bog spavin). 6. Ditto, bulging posteriorly (articular thoroughpin). 7. Cunean tendon. 8. Internal malleolus of tibia. 9. Bursa beneath cunean tendon. 10. Sheath of perforans tendon distended inferiorly. 11. Large metatarsal bone.

C.—LEFT HOCK—OUTER ASPECT

1. Distended sheath of perforatus tendon. 2. Extensor pedis. 3. Flexor perforans. 4. Peroneus. 5. Distension of sheath of perforans tendon. 6 and 10. Upper and lower distensions of sheath of peroneal tendon 7. Superior bulging of synovial capsule of tibio-astragaloid joint. 8. Sheath of extensor pedis tendon. 9. Sheath of perforans tendon bulging inferiorly. 12. Extensor brevis muscle.

there is a tendency during progression to move obliquely from the lame side."

Locally there is heat and tenderness over the region of the convexity and later there appears a swelling, which is also hot and painful to the touch. Careful observation will reveal a depression in the middle of the swelling due to the pressure of the tendon on the underlying enlarged bursa. Two bulgings appear, one on either side the tendon. These are diverticula of the bursa itself.

This form of lameness is very amenable to treatment particularly if attention be directed to it in its earlier stages. Complete rest should be prescribed and cold applications utilised. The acute inflammatory symptoms will frequently subside rapidly, when a mild counter-irritant should be applied and a period of rest allowed during convalesence. If quick recovery does not occur, the muscles of the quarter become atrophied. This is treated by the application of a blister or the insertion of seton tapes. It occasionally happens that we have septic infection of the bursa with the formation of an abscess. The ordinary treatment of an abscess elsewhere should be adopted, *i.e.*, the abscess should be opened surgically, its contents evacuated, and the abscess cavity injected with antiseptic solutions.

In cases where lameness persists, further structural changes occur. The walls of the bursa become very much thickened and hardened. The surface of the convexity becomes eroded, and irregular calcareous deposits form on the great trochanter, extending upwards to its summit and downwards even as far as the external or small trochanter, and filling up the trochanteric fossa. The tendency is for the disease to extend in this direction rather than inwardly to the articular cavity of the joint itself. From what we have said regarding the numerous tendons inserted into this area, it will be gathered that interference with the action of the quarter in such cases will be most pronounced, and it will be also quite obvious that treatment of such cases will be of no avail.

THE STRAIGHT LIGAMENTS OF THE PATELLA

These three ligaments attach the patella to the anterior tuberosity of the tibia. The external is the largest and is also the most powerful, but owing to its position it is most exposed to risk of injury and is occasionally ruptured, rupture in this case being due usually to violence, such as a blow or poke received from some projecting portion of a vehicle such as a shaft during a collision. Rupture of one or other, or both, of the remaining ligaments may be caused by some extra-ordinary and sudden effort on the part of the crural muscles the action of which, it will be remembered, is transmitted to the limb through the medium of the straight patellar ligaments.

When rupture of one or more ligaments occurs the animal is disinclined to place weight on the affected limb owing to the natural resistance to the action of the extensors of the stifle. The patella is kept in position on the trochlea by the fixed condition of these muscles. Diagnosis is best made by palpation and manipulation. The ligaments which remain intact may be located without much difficulty, but over the seat of the ruptured ligament a depression will be felt. Prognosis is usually favourable. Absolute rest should be provided, and after about ten to fourteen days a mild counter-irritant applied.

Beneath the lower portion or the middle straight ligament, and near its insertion into the anterior tibial tuberosity, is a small synovial bursa, which sometimes becomes enlarged owing to an abnormal accumulation of its synovial contents. At times the affection is of a dropsical nature and occasions no pain or interference with the limb. Most frequently, however, it is a bursitis, as a result of a blow received over the front of the stifle. The swelling which arises may be detected without much difficulty and appears in the depression which is normally present below the patella. The quadriceps muscles are relaxed, and

the patella is let down to relax the ligament and ease the pressure on the bursa.

In the acute stages there is heat in the part and evidence of pain on manipulation. Cold applications should be utilised, followed by a mild liniment, when there will usually be observed a marked diminution in the size of the swelling. Should the condition become chronic, a powerful blister may be applied or the method of treatment described in treating bog spavin adopted.

THE TENDONS OF THE FLEXOR METATARSI MUSCLE

This muscle is in two divisions, namely, superficial and deep. The superficial portion is almost wholly tendinous and arises in common with the extensor pedis from the pit between the outer lip of the trochlea and the external femoral condyle. It rests on the deep division, which is muscular and lies on the outer and anterior aspects of the tibia.

The arrangement of the tendons of insertion of these two divisions is somewhat peculiar. At the front of the tarsus the tendon of the superficial portion is pierced from within outwards by that of the deep division. This latter then splits into two parts one of which runs downwards to be attached to the anterior aspect of the upper extremity of the large metatarsal bone, whilst the other runs downwards and inwards across the scaphoid to be attached to the cuneiform parvum.

The tendon of the superficial portion also subdivides, one subdivision being attached to the upper end of the large metatarsal bone with the corresponding tendon of the deep portion of the muscle, whilst the other subdivision runs downwards and outwards to become inserted into the cuboid.

The superficial or tendinous portion is in the form of a long but powerful band which acts in antagonism to the gastrocnemius. This

band appears always to be in a degree of tension which causes a movement of the stifle to bring about a simultaneous movement of the hock and *vice versâ*.

Rupture of this muscle or its tendons gives rise to most alarming symptoms, to which attention has been frequently drawn during the past century. By some early observers the symptoms were attributed to some nervous affection. Others, again, thought that the hock was dislocated. Still others attributed them to fracture of the tibia ; whilst there were those whose attention was particularly attracted to the peculiar effect produced on the gastrocnemius, and were led to the conclusion that the condition was some affection of this muscle.

Dick appears to have considered the gastrocnemius as being paralysed. According to Möller, the first to give a complete account of this condition was Hertwig.

The superficial division of the muscle is the more frequently ruptured, owing to the slight degree of elasticity which it possesses and also to the condition of tensity to which it is continually subjected. Rupture is most commonly found towards the middle third of the muscle. Occasionally the muscular or deep division is also partially ruptured. Frequently neither the muscle nor one of its tendons is completely ruptured, and the symptoms result from a severe sprain, with laceration of some of the fibres. Occasionally the common tendon of origin of the extensor pedis and the superficial division of the flexor metatarsi is so affected. This, as we have already remarked, is an extremely thick and powerful tendon. Complete rupture of it is on this account very rare. When it is sprained in the manner indicated we have inability, not only of the flexor metatarsi, but also of the extensor pedis. It sometimes happens that the flexor metatarsi is neither ruptured nor sprained, but that one or more of its tendons of insertion have become detached from the bones into which they are inserted.

The symptoms presented depend to a great extent upon the seat of the injury. Certain symptoms are, however, somewhat constant. We

have already referred to the antagonism which exists between the tendo-Achilles and the flexor metatarsi. In any case of inability on the part of the latter, whether such inability be due to detachment of its tendons from the bones, to complete or partial rupture of the muscle, or simply to a sprain of its tendon with more or less laceration of its fibres, there will be a corresponding relaxation of the gastrocnemius muscle, with the result that we have the characteristic "wobbling" of the tendo-Achilles. If the superficial portion of the muscle is completely ruptured or the tendons of insertion are detached, we have an extremely well-marked increase in the tibio-metatarsal angle, and the hock becomes straightened. In all cases flexion of the hock is restricted and the joint is carried stiffly. The slight flexion which the animal is capable of bringing about in some cases, is due to the action of the extensor pedis muscle which, in the cases referred to, is not affected.

Most frequently, however, the limb is picked up, dragged forwards and let down again in a stiff and stilty manner which very closely resembles the movement of an artificial limb.

There is usually some swelling at the seat of the injury. This is particularly so when the rupture occurs in the middle third of the tendinous division, and part of the deep or muscular division is also involved. From our superficial examination it will be recalled that the muscular belly of the extensor pedis forms a prominent surface landmark on the antero-external aspect of this region. More externally another surface elevation, which is not so well marked, is formed by the belly of the peroneus muscle. The flexor metatarsi is deeply seated to these muscles. Injury leading to swelling of the flexor metatarsi, although not directly altering the external conformation of the part, does so indirectly, inasmuch as it causes greater prominence to be given to the elevations caused by the two muscles mentioned. Gentle palpation of the enlargements, therefore, may not reveal indications of pain, since the muscles palpated may be in no way injured. The application of pressure will, however, reveal the seat of injury to the underlying muscle. The

flexor metatarsi does not bulge inwardly, on account of the conformation of the tibia, the inner surface of which bone is immediately subcutaneous.

Careful manipulation is necessary to detect injury to the common tendon of origin to which we have referred. In this connection, however, the inability on the part of the extensor pedis will prove of assistance. When the lower tendons of insertion are involved the hock will be swollen, and occasionally the detached or ruptured tendons may be felt.

The animal does not appear to be subjected to great inconvenience. The limb will readily bear weight, a fact which immediately dismisses any suspicion of fracture. Moreover, the patient feeds well, and its condition is maintained. These points were particularly evident in two typical cases which came under the writer's observation, one at Baird's, in Edinburgh, in 1897, and the other at the private hospital of Mullet in Paris in 1901.

Regarding the cause of the rupture or sprain, it is usually due to some violent action causing an abnormal degree of extension of the hock, and thus throwing undue tension on the muscle.

Violent kicking and struggling when in hobbles and struggling to release a foot which has become fixed in railway points have been cited as causes. In colliery ponies it has been observed to occur as a result of the heel of the animal's shoe becoming fixed beneath an upraised rail. Williams states that "should the horse be old or of a weak constitution, the probabilities are that the rupture is a result of degenerative disease of the muscular tissue, and not a mere accident."

Treatment consists in providing rest. The animal should be placed in a box with a level surface and with scanty bedding. It is unnecessary to sling the animal, and for anatomical reasons, which will be gathered from what we have already stated, blistering the limb over the area which presents the enlargements will have little effect on the affected muscle. It is usual for repair to take place in from one to two months. If the patient is put to work too soon there is a possibility of repair taking place in such manner that the tendinous portion of the

muscle remains more elongated than the corresponding division of the muscle of the opposite limb, so that there will be permanent interference with the action of the affected limb. The animal should not be caused to resume work until lameness has entirely disappeared.

In very old animals, where it is suspected that the rupture is not due to accident, the process of repair will, as Williams states, be very doubtful and unsatisfactory.

THE GASTROCNEMIUS MUSCLE AND THE TENDO-ACHILLES

This muscle has two heads. The outer head arises from the outer lip of the supra-condyloid fossa of the femur, the inner from the supra-condyloid crest. The two heads unite and are succeeded by a thick, powerful tendon, which at first is placed immediately behind that of the flexor perforatus. A short distance above the hock the latter tendon twists round that of the gastrocnemius and becomes placed posteriorly to it. The gastrocnemius tendon becomes inserted into the depression which is found on the summit of the tuber calcis.

The gastrocnemius muscle is the great extensor of the hock, and it is also a flexor of the stifle. As already stated, it is the antagonist of the flexor metatarsi.

The tendon of the gastrocnemius is in a position where it is particularly exposed to risk of traumatic injury, and cases of such injury have been frequently reported. Malicious section of the tendon is not unknown. Accidental rupture of the tendon is usually due to violent and sudden contraction of the muscle, such as occurs in heavy draught horses when shafting loads down-hill on slippery ground. The limb slips forwards beneath the body, and the hock becomes suddenly and violently extended. Rupture also occurs in steeplechasers when jumping. Usually

the tendon is completely ruptured. Occasionally the tendon of the flexor perforatus is also involved.

The symptoms presented are in this case also somewhat characteristic, and diagnosis is not difficult. The part lends itself readily to accurate manipulation and palpation. Contrary to what we found in the case of the flexor metatarsi, the animal is now absolutely unable to bear weight on the limb. The hock becomes let down to a much lower level than that of the other limb. It is markedly flexed, as are the joints below it. The stifle is fully extended, and the animal stands with its foot resting on the toe.

Occasionally the tendon does not give way, but the summit of the tuber calcis becomes snapped off. This may be readily detected by manipulation. In other cases the tendon is torn away from the bone.

Prognosis is not usually as favourable as in rupture of the flexor metatarsi, and should be guarded. Complete rest should be provided, and the animal prevented from flexing the hock, in order that the severed ends may be kept in apposition.

Although cases have been recorded where the severed ends of the divided tendon have reunited in from two to three months without slinging, it is usual to place the animal in slings, since otherwise the whole of the weight in this part of the body becomes thrown upon the opposite hind limb, and laminitis of the opposite foot, and other complications, are likely to occur. The movements of the hock should be restricted by strapping with adhesive plaster. The most unfavourable cases are those in which the tendon is torn away from its insertion into the tuber calcis.

THE TENDON OF THE FLEXOR PERFORATUS—LUXATION

This tendon, which is at first placed in front of that of the gastrocnemius muscle, twists round the latter and becomes superposed to it in the manner already indicated. Just before the gastrocnemius tendon

becomes inserted into the depression on the summit of the tuber calcis the two tendons become separated from one another, and the tendon of the perforatus inclines backwards. It then loses its cord-like form and becomes very much expanded, so that it forms a kind of curved sheet, the anterior surface of which is concave and is moulded to the surface of the more posterior of the two convexities at the summit of the tuber after the manner of a cap. On either side a small slip of insertion is detached from the tendon, which becomes attached to the side of the tuber just below the summit. The tendon then becomes much thicker, and runs down the back of the calcis behind the calcaneo-metatarsal ligament. The function of the two lateral slips is to maintain the perforatus tendon on the summit of the tuber. Occasionally one or other of the slips is ruptured, with the result that the tendon becomes displaced. Displacement, of course, occurs towards the side opposite to that of the ruptured slip. The tendon of the perforatus passes from the inner side of that of the gastrocnemius to the summit of the calcis. The inner slip is the more frequently ruptured and outward luxation the more common.

Rupture with subsequent displacement of the tendon occurs as a result of heavy strain upon the part, or it may be due to kicks or other injuries.

When displacement is due to rupture without any external injury the animal does not show severe lameness. The hock is still extended by the gastrocnemius. But it will be evident that the animal does not possess complete control over the joint, which will be observed to "wobble" from side to side during progression.

In some cases the tendon may be seen to slip off the summit of the calcis every time the hock is extended, and to resume its position on the summit when the joint is flexed. In other cases where the tendon remains displaced diagnosis is easy, since the displaced tendon can be very readily felt.

When the rupture is the result of a kick or some other external

injury lameness is usually severe. There is heat in the part, which swells and presents the usual symptoms of acute inflammation.

Regarding the treatment, should there be a cutaneous wound, this should be dressed with antiseptics, and cold applications utilised to reduce the swelling. The tendon can usually be replaced without much difficulty, but great difficulty is experienced in keeping it in position until the ruptured slip has reunited. As a rule the result is unsatisfactory, and rarely can the animal be afterwards utilised for fast or heavy work. Macqueen replaces the tendon and fixes it in position by means of sutures with satisfactory results.

THE TARSAL SHEATH—TENDINOUS THOROUGHPIN

The tarsal sheath is the name given to a tube which is placed at the back of the hock. It is bounded anteriorly in its superior portion by the posterior face of the posterior common ligament of the tibio-astragaloid articulation, and below this by the back of the tarso-metatarsal ligament. Outwardly it is bounded by the grooved inner face of the tuber calcis, whilst posteriorly and inwardly its boundaries are completed by a fibrous arch which stretches across from the back of the calcis to blend with the internal lateral ligament.

There is thus formed a complete tube which is open above and below, and through the tube the tendon of the flexor perforans muscle, together with a number of vessels and nerves, passes. The tube is lined by an extensive synovial membrane, which covers the posterior surface of the ligaments to which we have referred above, and which also envelops the tendon playing through the tube. The membrane extends in the upward direction above the limit of the tube for a distance of from two to three inches, a little in front of the tendo-Achilles, whilst inferiorly it presents a cul-de-sac which extends to the middle third of the metatarsal region.

This synovial membrane is of great importance. Its function is to

facilitate the gliding movements of the tendon through the tube we have described, and it is the seat of the common surgical affection known as *tendinous thoroughpin*. This is the name given to an over-distended condition of the membrane. The enlargement may be recent, and due to inflammation of the sheath as a result of injury, in which case the swelling is hot, tense, and painful, but much more commonly it is a dropsical condition, and the swelling is cold and not tender to the touch. As the membrane becomes distended it bulges upwardly, and is particularly evident on the inner aspect of the joint, where it will be found to follow the course of the perforans tendon to the muscle from which it arises. The swelling is therefore about two inches in front of the tendo-Achilles. It is distinguished from a swelling of the capsule of the true hock joint, which sometimes appears near this situation, by the fact that the latter is more rounded and is placed immediately behind the tendon of the flexor accessorius muscle. The enlargement under consideration is elongated from above to below. Occasionally the swelling forms a similar bulging on the outer aspect, the size of which may be increased by applying pressure to that on the inner side. As a means of distinction, also, it should be remembered that by pressing the enlargement above the hock it is frequently possible to cause a distension of the sheath below the hock along the course of the perforans tendon.

Occasionally, as a result of a kick or other injury, we have a cutaneous wound and the sheath lacerated. Such cases should be dealt with immediately, the usual treatment for wounds being adopted and the strictest antiseptic precautions observed.

In recent enlargements with acute inflammatory symptoms, cooling, astringent applications should be utilised, followed by pressure bandages. These latter should be applied most carefully, a layer of cotton-wool being moulded over the swelling in order to obtain an even distribution of the pressure. A marked diminution in size and frequently the complete disappearance of the swelling may thus be brought about in a very short time. Occasionally the swelling becomes chronic. The

chronic form is, however, as we have already stated, much more frequently of a dropsical nature, and such enlargements are usually found in heavy horses with upright hocks in which the tuber calcis is short and ill-developed. In such hocks the gastrocnemius and flexor perforatus are not so effective in extending the hock, since the leverage with which they are provided is not so great as in animals in which the tuber calcis is large and well developed. Consequently much more work in extending this joint has to be undertaken by the flexor perforans. Since conformation is transmitted from sire and dam, a predisposition to the enlargement of this sheath may thus be inherited. These chronic swellings, although most unsightly, are not very serious, for they may attain large proportions without in any way interfering with the action of the joint. Should there be any interference at all, it is purely mechanical. Animals affected with thoroughpin frequently work hard throughout life without suffering any inconvenience whatsoever.

Various methods of treatment are in use. A reduction in the size of the thoroughpin may frequently be made by applying trusses or pressure bandages. Some rely on the application of a blister, whilst others claim good results for line-firing. The contents of the sheath may be evacuated ; and there is obviously much less danger in opening this sheath surgically than in performing the same operation in the treatment of bog spavin. Dean's aspirator should be used, and the membrane syringed out with a solution of iodine, the operation being exactly similar to that performed in the treatment of bursal enlargements elsewhere, which has already been described.

THE POINT OF THE HOCK—CAPPED HOCK

It has already been remarked in our superficial examination that the projection known as the point of the hock is caused chiefly by the underlying summit of the tuber calcis. The particular portion of the

summit is the more posterior of the two convexities we described when dealing with the bones. The skin is not in direct relationship with the bone, since the tendon of the flexor perforatus covers this portion of the summit like a kind of cap. But there are in addition other structures here which are of importance, since injury to them frequently results in the surgical affection well known as *capped hock*. The posterior convexity is covered by a smooth layer of cartilage, which, again, is clothed by the wall of a synovial sac or bursa. The wall of this bursa also lines the deep face of the tendon, so that there is no friction between the tendon and the cartilage-covered surface of the tuber calcis, for the concentric faces of the wall of the bursa are what come into apposition. The bursa extends upwards for a short distance between the tendon of the flexor perforatus and that of the gastrocnemius. Frequently there is present another more delicate bursa, and this is placed on the superficial aspect of the perforatus tendon, and between it, therefore, and the skin; its function being to prevent friction between the skin and tendon during the movements of the latter.

The prominent situation of the point of the hock renders it very liable to injury as a result of blows, kicks, &c., and the term capped hock is applied to any enlargement in this situation. Since the enlargement may be due to swelling or thickening of one or more of several different structures, it will be gathered that the term capped hock is not specific, but is more or less collective. Frequently the enlargement is due to a swelling of the bursa which is placed immediately beneath the skin, as a result of the accumulation within the bursa of a large quantity of serous, blood-tinged fluid, and to this enlargement the term capped hock is most commonly applied in this country. Such swellings are readily seen. They are circumscribed and well defined, and they give a marked prominence to the extreme point of the hock. That this bursa is the one affected may be easily detected by palpation, since the tendon cannot now be felt. When the swelling is due to an enlargement of the bursa or sheath beneath the tendon it is much more diffused, the tendon

may be felt on manipulation, and the swelling bulges laterally on either edge. Occasionally the swelling is due to a thickening of the tendon itself, and this is distinguished by its hardness.

Recent swellings are hot and painful to the touch, whilst when the condition becomes chronic there is usually no evidence of pain and the part is colder and harder.

Little inconvenience is experienced by the animal when the condition is confined to the subcutaneous bursa, and there is no sign of lameness. Frequently, also, such is the case in regard to the bursa beneath the tendon. Occasionally, however, we have septic infection of this bursa, which is attended by serious consequences, the cartilage on the summit of the tuber becoming eroded and the deep face of the tendon roughened, with the result that the animal suffers great pain during the movements of the tendon on the bone.

Recent cases should be treated with cold applications, followed by pressure caps or bandages. The entire removal of the swelling, however, is a matter of great difficulty. Removal of the contents is quickly followed by their reappearance. Good results have been claimed for a method of treating enlargement of the subcutaneous bursa by causing a rupture of its walls. The opposite foot is taken up and a tight bandage applied to the affected hock. When the other foot is released the animal, during its attempts to flex the bandaged hock, ruptures the walls of the bursa, and its contents are then discharged. Other operators have removed the bursa. Lanzillotti performed this operation by making a curved incision on the outer side of the swelling, through which the sac was removed by dissection.

When the tendon or cartilage-covered surface of the bone is affected little can be done.

Although the treatment of capped hock, so far as its complete removal is concerned, is by no means successful, it is satisfactory to know that the affection as a rule is not serious, and that the animal is capable of performing its work without inconvenience.

THE CALCANEO-METATARSAL LIGAMENT—CURB

The Calcaneo-Metatarsal Ligament.—This is a thick and powerful ligament which unites the calcis to the cuboid and the metatarsal bones. It arises from the back of the tuberosity of the calcis, the commencement of the ligament being a little below the summit of the tuber. It then runs straight down the posterior border of the tuber and the outer portion of the posterior aspect of the body of the calcis. Running on to the cuboid, it obtains a powerful insertion into the posterior surface of this bone. It is hence frequently termed the calcaneo-cuboid ligament, particularly in surgical text-books. From the cuboid it is continued on to the head of the external small metatarsal bone, to which the ligament is attached, and where the ligament terminates. Outwardly this ligament is confounded with the outer and more superficial division of the external lateral ligament, whilst inwardly it is confounded with the tarso-metatarsal ligament, and slightly also with its direct continuation—the subtarsal or check ligament of the hind limb. This ligament is coarsely fibrillated, and its fibres run in the longitudinal direction. Its posterior surface is almost perfectly straight from above to below—a point which is of great importance. In the transverse direction this surface is convex. It is in intimate relationship to the fibrous arch which stretches across and completes the tarsal sheath, and to which the name annular ligament is frequently given.

To appreciate the great importance of this ligament it is necessary to consider the action of the gastrocnemius and flexor metatarsi muscles. When the gastrocnemius muscle acts it becomes the power of a lever, the bar of which extends from the summit of the tuber calcis to the ground, the fulcrum being the lower end of the tibia. The flexor metatarsi during contraction forms the power of a lever of a different order, since the power in this case acts between the fulcrum, which is again the distal end of the tibia, and the weight, which is represented by

the limb from the tarsus downwards. The bar of the lever is, however, the same in both cases. Since the bar is made up of a number of separate osseous segments, it will be evident from the principles of leverage, that these must be united to one another in such manner as to give the bar that degree of rigidity which will permit of the transmission of the action of the power to the weight, and which will also resist the breaking action of the fulcrum. During the action of the gastrocnemius muscle, rigidity and resistance to the action of the fulcrum are afforded by the calcaneo-metatarsal ligament, so that this ligament plays a very important part in flexion and extension of the true hock joint.

Sprain or injury to the calcaneo-metatarsal ligament gives rise to the well-known and by no means uncommon surgical affection of "curb."

Commonly the term curb is applied to any enlargement which is placed on the postero-inferior aspect of the joint, and there has in the past been considerable divergence of opinion as to the particular structure which is thickened. Percival maintained that it was a thickening of the deep fascia. Others attributed the enlargement to a thickening of one or other of the flexor tendons in this situation. There can be little doubt that the structure upon which greatest strain is thrown, and which is most likely to be damaged at this particular seat, is the calcaneo-metatarsal ligament.

From what we have already said it will be gathered without difficulty that there are certain kinds of hocks which will be more predisposed to the formation of curbs than others. Thus, for instance, in hocks in which the bar of the lever is not straight but is naturally a little bent, with its convex surface directed backwards, there will obviously be much greater strain thrown upon the ligament in maintaining the necessary rigidity. Such are commonly known as "sickle hocks," and in these the bar is bent near the point of action of the fulcrum. Since, also, the force at which the power acts is in direct proportion to the distance of the fulcrum from the point of application of the power, the action of the gastrocnemius is most powerful in extending the hock

in those cases in which the tuber calcis is very long, for the summit of the latter is the point at which the power is applied. In such hocks, therefore, there is greater strain upon the calcaneo-metatarsal ligament during extension of the joint, and consequently a greater predisposition to the formation of curb. Hocks which are "tied in below" are also said to be very liable to curb formation. Conformation has thus a very important bearing on this affection, a point which should be borne in mind when selecting sires and dams for breeding purposes.

In many cases of curb the swelling appears suddenly as a result of severe sprain of the ligament, with occasionally laceration of some of its fibres. In these cases the swelling is diffused, and is hot and painful to the touch. The animal is lame, the degree of lameness being in proportion to the severity of the injury. In such cases diagnosis presents little difficulty. In other cases the swelling forms slowly, and is commonly in the form of a small nodular enlargement, which appears near the attachment of the calcaneo-metatarsal ligament to the cuboid. Such cases are more difficult to detect, and care must be taken not to confuse them with an abnormally large head of the external metatarsal bone. Both are quite hard. In many cases the former appears quite as hard as bone. To distinguish between them the observer should stand at the side of the patient, when he will be able to see whether or not the enlargement is along the course of the ligament. Diagnosis should be confirmed by palpation. Assuming that the left hock is being examined, the observer should stand on the left side of the animal with his back directed towards the horse's head. The palmar aspect of the middle finger should then be passed along the course of the ligament, the tip of the finger being directed downwards. In this manner a very slight convexity may be discovered without difficulty.

Should there be lamenesss in the chronic forms of curb in which the enlargement is cold and hard, it will be found that the interference with the action of the joint is by no means in proportion to the size of the enlargement.

In a hock which is well formed, curb may result from some very violent exertion which causes undue strain to be thrown upon the calcaneo-metatarsal ligament. Thus, for instance, if whilst jumping when the fore part of the body is raised the animal slips and is thrown back on its haunches, great tension is inevitably thrown upon the ligaments mentioned.

Regarding treatment, precautionary measures may be taken in the case of an animal with defective conformation of the hocks, which renders them particularly predisposed to curb formation, for if the heels of the shoes of such an animal be raised and the toes lowered this causes a decrease in the "tibio-metatarsal angle" when the foot rests on the ground, and consequently diminishes the amount of work required to be performed by the gastrocnemius muscle to bring about the necessary degree of extension of the hock.

Similarly, in recent cases of curb presenting acute inflammatory symptoms, the tension on the damaged ligament is eased and the pain relieved if the animal be shod temporarily with high-heeled shoes. In these cases, also, cold applications tend to reduce the swelling, and these should be followed by counter-irritation either in the form of a blister or by line-firing the part.

Treatment is quite unnecessary, and, in fact, practically useless, in old and chronic curbs which do not cause lameness.

Occasionally we get an exostosis near the seat of curb as an extension of a spavin, when the treatment should be similar to that adopted for spavin in the usual seat (see chapter on "Bones, Fractures, and Exostoses").

THE CUNEAN TENDON AND ITS BURSA—CUNEAN TENOTOMY

The cunean tendon is one of the branches of the tendon of the deep or muscular division of the flexor metatarsi. This branch may be said to commence immediately the tendon of the deep division of the muscle makes its appearance through the ring which is formed for its passage by the tendon of the superficial portion of the muscle. The course taken by the tendon is obliquely downwards and inwards across the front of the scaphoid and the antero-internal corner of the cuneiform magnum, to become inserted into the cuneiform parvum.

As it passes over the bones it becomes very much flattened, and its play over the scaphoid is facilitated by the presence of a small bursa. Occasionally this sac becomes inflamed as a result of an injury received over the antero-internal aspect of the joint. The bursa enlarges, and two small fluctuating swellings make their appearance, one on either edge of the cunean tendon. The ordinary treatment of acute bursitis elsewhere should be adopted.

It will be observed from our description of the cunean tendon above that it passes over the common seat of spavin, and consequently attention has been directed to the tendon and its bursa in the treatment of this very troublesome affection. Abildgaard and Lafosse were the first to practise section of the tendon in the treatment of spavin, the operation being based on the opinion that lameness in spavin was due to pressure of the tendon on the diseased area. The method of operation was to make a cutaneous incision across the course of the tendon, and then sever the latter.

During recent years this operation has been commonly practised in this country. Since 1900 it has been frequently performed by the writer, who has found the method described as follows to be the best. The patient should be cast on the side of the affected limb, and placed under

a general anæsthetic. The upper hind limb should be drawn well forwards and fixed to the upper fore limb by means of a side line or cross hobble. Cross hobbles should also be applied to the affected limb and the corresponding fore limb. The affected limb is then released from the ordinary hobble and drawn well back, to permit which the rope connecting the two cross hobbles has been loosely applied.

The hock is now carefully palpated, and the position of the tendon located. This frequently presents considerable difficulty, and it may be necessary to cause the hock to be flexed and extended by an assistant. An oblique incision is then made along the length of the tendon downwards and inwards, the incision passing through the skin and fascia down to the tendon. The tendon is then drawn through the cutaneous opening by means of a tenaculum and severed. In making the cutaneous incision care must be taken to avoid injury to the anterior root of the internal saphena vein. As a guide to the seat of the incision, it may be remarked that the insertion of the tendon is in line with the position of the chestnut. The writer has found the success of this operation to be very variable, and after examination of a large number of dissected hocks two conditions have been observed to be commonly present which render the operation ineffective. In many cases during the formation of the exostosis the tendon becomes displaced, and will be found not to run over the exostosis at all. In a great percentage of the remaining cases with an existing large exostosis, since the latter forms slowly, it was found that the tendon was accommodated in a groove on the exostosis. Consequently in both these cases there could be little, if any, abnormal pressure on the exostosis by the tendon.

Dieckerhoff treated spavin by making an incision into the bursa of the cunean tendon. Other operators simply sever the tendon by pressing the blade through the skin and tendon, and then scrape the area beneath. The object is similar to that in pyropuncturing the exostosis, namely, to hasten the inflammatory process. The part is subsequently blistered with biniodide of mercury ointment.

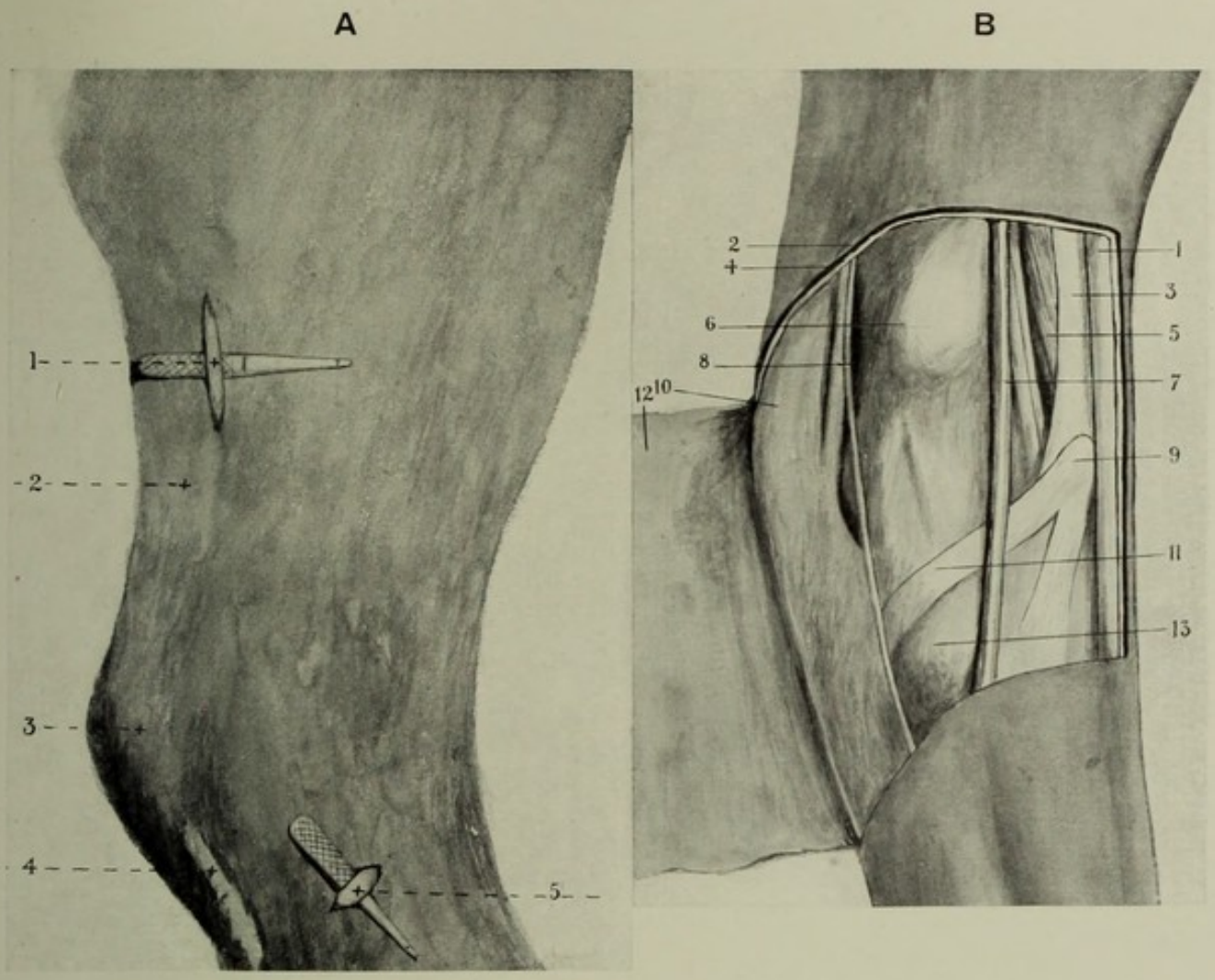

PLATE XXI.—POSTERIOR TIBIAL NERVE AND CUNEAN TENDON

A.—POSTERIOR TIBIAL NERVE AND CUNEAN TENDON EXPOSED

1. Posterior tibial nerve. 2. Tendo-Achilles. 3. Summit of tube calcis. 4. Chestnut. 5. Cunean tendon.

B.—SEAT OF CUNEAN TENOTOMY DISSECTED

1. Tendon of extensor pedis. 2. Skin. 3. Superficial division of flexor metatarsi. 4. Superficial fascia. 5. Deep division of flexor metatarsi. 6. Internal malleolus of tibia. 7. Anterior root of internal saphena vein (upward continuation of internal metatarsal vein). 8. Cutaneous branch from posterior tibial nerve. 9. Tendon of deep division of flexor metatarsi appearing through ring formed by tendon of superficial division. 10. Summit of tuber calcis. 11. Cunean tendon. 12. Skin and fascia reflected. 13. Exostosis.

Peters' method of operation, for which considerable success is claimed, as stated by Möller, is as follows :

"The horse is cast on the diseased side, and by a cord passed round the corresponding front limb the upper hind limb is drawn far enough forward to clear the seat of operation. The hair is then cut away from the inner surface of the hock joint, midway between its anterior and posterior borders, to the extent of about one square inch, the surface washed with soap, rinsed with sublimate or carbolic solution, and the other antiseptic precautions, such as cleansing the hands, placing the instruments in carbolic solution, &c., complied with. By means of a probe-pointed bistoury or scalpel, an incision, at right angles to the long axis of the limb, and about half an inch in length, is then made through the skin and fascia at the disinfected spot, a pair of curved scissors is introduced through the opening as far as the joint between the blades, and the skin divided from the underlying tissues in the form of a 'V,' the instrument being first thrust forward, then backward, severing the subcutis. The slightly curved knife is next introduced into the front pocket of skin, the cutting edge directed backwards to avoid injuring the vena saphena. As soon as it has entered up to the handle the cutting edge is directed towards the joint, and the back pressed with the fingers of the left hand while, by gently rocking the instrument, it is made to penetrate the bones of the joint. The tendon of the flexor metatarsi muscle and the periosteum part with a distinct 'crunching' sound. The same process is repeated in the posterior pocket of skin, the sharp edge of the knife, however, being directed forwards. After wiping away the small amount of blood which escapes from the wound, the surface is rinsed with a disinfectant, and an antiseptic dressing applied. The bandage should be carried down as far as the fetlock, so as to obtain a fair hold. The horse is then allowed to rise, and is placed in the stable. If during the next few days the bandage becomes soaked through with blood, it should be renewed; otherwise it is left in position for six to eight days, when the skin wound will be found to have closed.

"By the exercise of moderate care in operating, pus formation can be avoided; and even should it occur, it seldom entails grave consequences, for, on account of the flat position of the knife while making the incision, there is little danger of opening the joint, and thus producing dangerous arthritis.

"The horse must be rested for at least four to six weeks after operation, and during this time movement, as far as possible, avoided. Some operators even recommend fastening the animal up short to prevent it lying down."

THE TENDON OF THE PERONEUS MUSCLE AND ITS SHEATH—PERONEAL TENOTOMY

The peroneus muscle lies to the outer side of and behind the extensor pedis, and between this muscle and the flexor perforans. It is succeeded by a tendon which plays through a groove on the outer side of the external malleolus of the tibia, and subsequently through a synovial canal in the external lateral ligament of the hock. It then inclines slightly forwards and passes beneath the most inferior of the three annular bands, and ultimately terminates near the junction of the upper and middle thirds of the metatarsal region by joining the tendon of the extensor pedis. In close relationship to the peroneal tendon, and running parallel to it along its inner edge, is the extensor brevis muscle, whilst beneath this muscle and the tendon the large metatarsal artery runs. From the point where the anterior tibial artery divides at the front of the inferior portion of the hock the large metatarsal division takes a course which is obliquely downwards and outwards, and emerges from beneath the peroneal tendon just below the inferior edge of the annular band referred to above.

The peroneal tendon is supplied with an extensive synovial sheath, the superior limit of which is placed above the upper extremity of the

groove on the external malleolus, and which terminates inferiorly almost immediately after the tendon leaves the most inferior of the annular bands. The sheath facilitates the gliding of the tendon through the groove in the malleolus and the channel in the external lateral ligament. In cases of distension of this sheath an enlargement usually makes its appearance at its inferior extremity. It is peculiar inasmuch as it is not elongated from above to below, as would naturally be expected, but assumes a rounded form, and may attain the size of a tennis ball. The usual symptoms are presented according to whether the swelling is recent or chronic, but in either case there is little, if any, interference with the action of the limb. If it is decided to treat, the treatment which has already been given for enlarged bursæ should be adopted. It may be stated that there is little danger in operating surgically in cases of distension of this sheath.

PERONEAL TENOTOMY

Boccar and others attributed the peculiar snatchy action in stringhalt to defective action of the peroneus muscle, and hence introduced the operation of *peroneal tenotomy* in the treatment of that affection.

Stringhalt is dealt with in our chapter on nerves, but although our knowledge of the pathology of this disease is so indefinite, and on this account so many different causes are attributed to it, there is no doubt but that in some cases considerable improvement in action is brought about by section of the peroneal tendon. The author has frequently performed the operation in the treatment of very pronounced cases, and whilst admitting that in by far the greater number no improvement was manifest, in a few cases the result was most satisfactory. It may be, as Macqueen states, that the operation is only effective in bringing about an improvement in those cases which present an abnormal degree of abduction.

Section of the tendon of the peroneus muscle is a very simple operation. The animal should be cast on the side of the sound limb, and an anæsthetic administered. The area of operation should be carefully palpated, the usual preparatory treatment having been adopted. The tendons of the extensor pedis and peroneus muscles should be located, and traced down to the point where they become united to one another. We have already stated that the large metatarsal artery passes beneath the peroneal tendon just below the annular band. This vessel, of course, it is essential to avoid. Consequently the nearer to the extensor pedis tendon we make our incision the further shall we be from the artery. The incision should be made along the course of the peroneal tendon, and the latter exposed through the opening, on a tenaculum. Having exposed the tendon, it should be severed, and a slit also made in the fibrous aponeurosis which connects this tendon with that of the extensor pedis muscle. The wound should be disinfected and the cutaneous opening closed. As this need not be more than an inch long, one or two sutures are sufficient. Applications of dry antiseptic dressings are now all that is necessary, and healing should not take more than a few days.

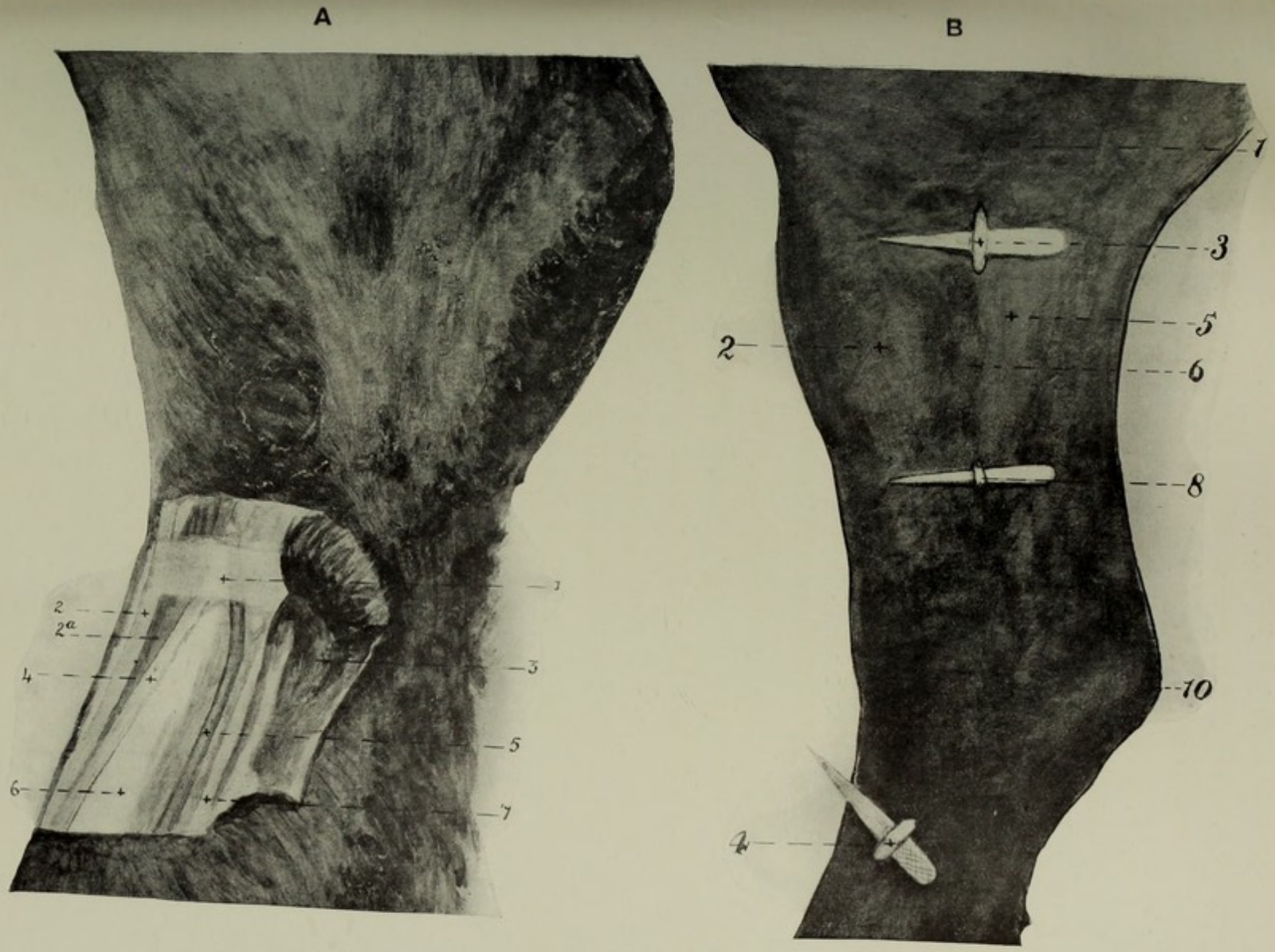

PLATE XXII.—SEATS OF PERONEAL TENOTOMY AND ANTERIOR TIBIAL NEURECTOMY

A.—SEAT OF PERONEAL TENOTOMY DISSECTED

1. Annular band. 2. Tendon of extensor pedis. 2a. Extensor brevis. 3. Reflected skin and superficial fascia. 4. Tendon of peroneus. 5. Large metatarsal artery. 6. Large metatarsal bone. 7. External small metatarsal bone.

B.—ANTERIOR TIBIAL NERVE AND PERONEAL TENDON EXPOSED

1. Elevation indicating head of fibula. 2. Belly of extensor pedis muscle. 3. Anterior tibial nerve (exposed at upper seat). 4. Exposed tendon of peroneus. 5. Belly of peroneus muscle. 6. Depression between peroneus and extensor pedis. 8. Anterior tibial nerve (exposed at lower seat). 10. Point of hock.

CHAPTER VII

THE NERVES

THE LUMBO-SACRAL PLEXUS

This is the name given to the great fasciculus from which the nerves which supply the hind limb are derived. In its formation it presents great similarity to the plexus from which the nerve-supply of the fore limb is derived—namely, the brachial plexus, which was described in Vol. II.

The plexus may be said to be made up of anterior and posterior divisions, each united to the other by a thick connecting trunk. To the formation of the plexus the inferior primary divisions of the fourth, fifth, and sixth lumbar and the first and second sacral nerves contribute. There is also a slender contribution from the third lumbar nerve. Each root is named from the vertebra which forms the anterior boundary of the intervertebral foramen through which it emerges. The slender branch from the third sacral nerve unites with the contribution from the fourth, which is also slender. The trunk thus formed passes backwards, and is joined by a much thicker contribution from the fifth lumbar. Thus is formed what we have termed the anterior division of the plexus. Two large nerves—the anterior crural and obturator—are detached from the fasciculus, which thus becomes very much reduced in size and passes backwards as the trunk referred to as connecting this portion with the posterior division. This trunk, together with much larger contributions from the sixth lumbar and the first and second sacral nerves, forms an enormous flat fasciculus, from which the anterior and

posterior gluteal sets of nerves and the great sciatic nerve are detached, the greater portion of the band being expended in the formation of the latter.

The plexus is related anteriorly to the superior surface of the psoas parvus muscle, which thus conceals this portion from view. Between the contributions from the fifth and sixth lumbar nerves, which, excluding the connecting trunk, may be regarded as the last contribution to the anterior division and the first contribution to the posterior division respectively, we find the internal iliac artery. This constitutes a very important relationship of the plexus. The posterior part of the plexus may be found supero-laterally in the pelvis, near the greater sacro-sciatic foramen. Outwardly it is related to the gluteal vessels, and inwardly to the lateral sacral artery.

From the situation of the plexus which we have described, it will be seen that it is extremely well protected from external injury, differing greatly in this respect from the plexus which supplies the fore limb. Its anterior portion is protected by the vertebral column, whilst its posterior portion lies within the pelvic cavity. Apart from the osseous protection afforded it, we find superiorly the great thickness of muscle presented by the longissimus dorsi and gluteus maximus.

The branches given off by the lumbo-sacral plexus from before backwards are :

1. The iliaco-muscular nerves.
2. The anterior crural nerve.
3. The obturator nerve.
4. The anterior gluteal nerves.
5. The great sciatic nerve.
6. The posterior gluteal nerves.

The Iliaco-Muscular Nerves.—There are several small branches which are given off by the anterior division of the plexus, and which were designated iliaco-muscular nerves by Girard. Frequently one such branch

leaves the plexus in conjunction with the anterior crural nerve, or it may be a branch of the latter nerve. The largest branch accompanies the iliaco-muscular artery and runs across the iliacus muscle. They supply the psoas and iliacus muscles.

THE ANTERIOR CRURAL NERVE

The anterior crural nerve is the largest branch given off by the anterior division of the plexus, and of the branches of the whole plexus it is second in size only to the great sciatic nerve. Its fibres are derived from the contributions to the plexus which come from the inferior primary divisions of the fourth and fifth lumbar nerves, and in part also from the slender contribution which is furnished by the third lumbar.

At first the nerve is found above the psoas parvus muscle, across the superior surface of which it runs. It then descends between this muscle and the psoas magnus, where in a dissection of the sublumbar region it may readily be found. The nerve next runs for a short distance downwards and outwards, following the course of the external iliac artery, and crosses the conical muscular mass which forms the common posterior extremity of the psoas magnus and iliacus muscles, where it is covered by the sartorius. Whilst under cover of this muscle it gives off the internal saphena nerve, and it then terminates by splitting up into a number of branches, which dip in between the vastus internus and rectus femoris muscles to supply these and the remaining two divisions of the quadriceps extensor cruris.

The internal saphena nerve is a branch of the anterior crural, from which it is detached a little above the brim of the pelvis. Near Poupart's ligament it is found slightly in front of the femoral artery, to which vessel it distributes branches. Running at first parallel to the sartorius muscle, to which it also furnishes branches, it splits up into two cutaneous

divisions, which make their appearance in the interstice between the sartorius and gracilis muscles in company with the saphena artery and vein. The more anterior of the two divisions descends in front of the internal saphena vein. It gives off a number of branches which are distributed superficially on the inner aspect of the stifle, and others which ramify similarly on the inner aspect of the leg, whilst its terminal filament may reach as far as the front of the hock. The posterior division runs down behind the internal saphena vein, and gives off branches which course downwards and backwards superficially on the inner side of the leg. It then passes beneath the posterior root of this vein, and continues its downward course behind the anterior root, its terminal ramifications being found superficially placed on the inner aspect of the hock.

PARALYSIS OF THE ANTERIOR CRURAL NERVE

Paralysis of the anterior crural nerve is by no means uncommon, and is a much more frequent occurrence than is generally conceded.

In practice when dealing with the common paralyses of the nerves of the limbs, loss of power can generally be attributed to direct relationship of the nerve at some part of its course, to the skeleton, and it is thus found that undue pressure is exerted upon the nerve on account of some abnormal condition of the osseous structure to which it is related. Thus we have musculo-spiral paralysis due to pressure of the callus formed after fracture of the first rib, upon the roots of the brachial plexus from which the fibres of this nerve are chiefly derived; obturator paralysis resulting from severe pressure of the callus formed in front of the obturator foramen; suprascapular paralysis resulting from pressure on the nerve by the coracoid border of the scapula, &c. But from our description of the course and relationships of the anterior crural nerve we find that from the point of its detachment from the lumbo-sacral

plexus to the position where it disappears between the rectus femoris and vastus internus muscles the nerve does not pass in intimate relationship to any bone, but is related to comparatively soft structures. Hence it is not surprising that we have quite a number of different theories as to the causation of paralysis of this nerve.

A number of cases of paralysis are associated with attacks of hæmoglobinuria. Such cases are readily understood, since the psoas and iliacus muscles are involved in this disease, and the intimate relationship of the nerve to these muscles has been pointed out.

Moreover, it has been proved experimentally by Goubaux, who divided the nerve as it passes between the rectus femoris and vastus internus, that section of the nerve leads to the production of those symptoms of muscular paralysis which are observed in cases of hæmoglobinuria.

Tumours and abscesses have also been discovered along the course of the nerve in making post-mortem examinations of animals which had been subjects of this affection.

The condition has also been attributed to blows received over the region of the thigh. A study of the anatomical position and relationships of the nerve will immediately make evident the improbability of this, for the nerve is placed in a position which is decidedly favourable to its protection. Others have considered undue stretching of the nerve to be a common cause. Whilst admitting that some nerves are particularly prone to injury of this kind—such, for instance, as the suprascapular nerve, which appears to be too short for the distance it has to travel when the movements of the part are taken into consideration—the same cannot be said regarding the anterior crural nerve, the disposition of which appears to be such as will permit of a considerable degree of stretching of the parts without throwing great tension on the nerve itself. There are still numerous cases of this affection the cause of which remains in obscurity. In connection with this point it occurred to the author, in examining the course of the nerve, that, owing to its relation-

ship to the external iliac artery, some abnormal dilation of the artery, such as the presence of an aneurism, would exert a considerable amount of pressure upon the nerve, and might possibly bring about paralysis. Shortly afterwards an opportunity was presented to make observations on the point. A pony was purchased for dissection which was a typical case of crural paralysis. From the meagre history which it was possible to glean, the pony had not been the subject of hæmoglobinuria. Upon dissecting the sublumbar region it was found that there was a gradual contraction of the first two and a half inches of the external iliac artery, and this part was followed by a distended portion almost two inches in length, and possessing a diameter approximately two and a half times that of the remainder of the vessel. Upon making an incision into the vessel the distended portion was found to contain a quantity of disintegrated blood adherent to the vessel's wall, but the lumen of the vessel was not obliterated, and the thrombus was therefore parietal. There is little doubt in this case that the continuous pressure of the distended portion of the vessel upon the nerve interfered with the functional activity of the latter (*Veterinary Record*, July 27, 1907). Although the author has not had the good fortune to come across other cases of this kind in the meantime, from the anatomical relationship which the structures bear to one another he is under the impression that this case provides what is possibly an explanation of quite a number of the obscure cases of this disease to which reference has already been made.

Regarding the symptoms which are presented, there is inability on the part of the muscles supplied by this nerve. This inability at first may be but slight, and is evident only in a want of the former freedom in extending the stifle joint. Later on the animal becomes unable to fix the joint, and weight cannot be supported by the affected limb. Sensation is lost on the inner aspect of the thigh. The external and internal vasti, together with the two recti muscles, will now be observed to be losing their normal bulk, and later marked atrophy of these muscles will be

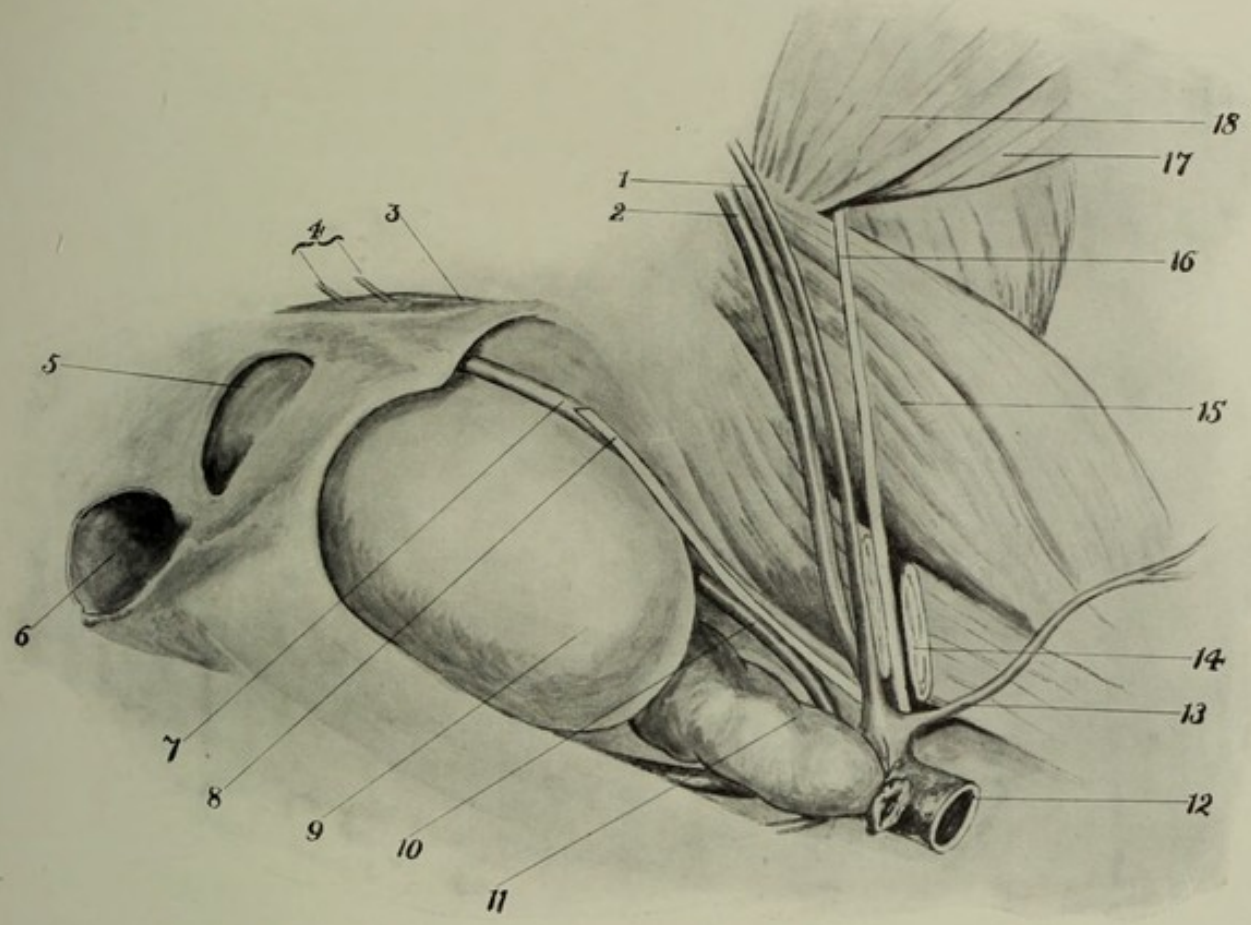

PLATE XXIII.—OBTURATOR AND ANTERIOR CRURAL NERVES

1. External iliac artery. 2. External iliac vein. 3. Obturator externus. 4. Filaments of obturator nerve. 5. Obturator foramen. 6. Cotyloid cavity. 7. Obturator internus. 8. Obturator nerve. 9. Bladder (distended). 10. Internal iliac artery. 11. Rectum. 12. Posterior aorta. 13 Circumflex-iliac artery. 14. Psoas parvus, cut through to expose anterior crural nerve. 15. Psoas magnus. 16. Anterior crural nerve. 17. Vastus internus. 18. Rectus femoris.

apparent from the large depression which is found above the stifle. The skin of the part is thrown into vertical folds, and the bellies of the muscles having lost their bulk, their longitudinal axes become more elongated, with the result that the stifle is let down to a lower level, a feature which has caused the name "dropped stifle" to be frequently given to this affection. At a still later stage the animal recovers the power to a certain extent of fixing the stifle, the abductors and adductors seemingly taking upon themselves the function of the extensors in this respect. During the course of the disease the animal feeds well, and its general condition is well maintained.

It not infrequently happens that an animal in an advanced stage of crural paralysis after a few days' rest moves well when brought out of the stable, and uses the limb without much apparent inconvenience. The author has frequently known such animals to have been put to work, the owner being under the impression that a complete recovery had been made. In chains, work may be performed without anything startling occurring, but if in shafts, as soon as weight is placed on the back the animal collapses towards the side of the affected limb, the waggoner being usually under the impression that the animal has broken its back.

Prognosis is most unfavourable in those cases in which the animal quickly loses complete control over the stifle joint.

The difficulties in treating cases of paralysis of this nerve will be readily appreciated from our description of its anatomical position, which renders external applications of little effect on the nerve itself. Treatment is therefore mainly directed to the affected muscles, the frequent massaging and kneading of which, together with the application of counter-irritants, tend to assist them to regain their normal bulk. Frequent exercise is also indicated; in fact, the treatment follows the general principles to be observed in treating paralysis, which were dealt with fully in Part II.

THE GREAT SCIATIC NERVE

This is sometimes termed the great femoro-popliteal nerve. It is an enormous nerve—in fact, at its origin it is the largest nerve in the body. Leaving the lumbo-sacral plexus, it emerges from the pelvis through the greater sacro-sciatic foramen as a broad flat band, which is closely applied to the outer surface of the great sacro-sciatic ligament, where it is covered by the middle gluteus muscle. The nerve now passes downwards and backwards across the outer aspect of the deep gluteus muscle, and between it and the middle gluteus. Leaving the deep gluteus, it passes across the gemelli and the common tendon of insertion of the obturator internus and pyriformis, and subsequently is related to the quadratus femoris. It then takes its course down the thigh in the groove which is bounded externally by the biceps femoris and semitendinosus muscles and internally by the semimembranosus and adductor magnus. It leaves the region of the thigh by passing downwards between the two heads of the gastrocnemius, where it is directly continued as the internal popliteal nerve.

During its course the great sciatic nerve gives off the following branches :

1. Shortly after leaving the greater sacro-sciatic foramen it detaches a slender filament, which most frequently runs down behind the parent nerve, but occasionally is found between it and the surface of the great sacro-sciatic ligament. This branch is distributed to the obturator internus, the pyriformis, the gemelli, and the quadratus femoris muscles. Occasionally the branches which supply the two last-named muscles arise separately from the parent nerve, when the branch for the quadratus femoris passes beneath the gemelli and the common tendon of the obturator internus and pyriformis to reach the muscle which it supplies.

2. The external popliteal nerve. This large branch will be found in

front of the great sciatic nerve, from which it is detached usually as the latter crosses the gemelli muscles. It takes a course which is downwards and forwards, and passes between the outer head of the gastrocnemius and the biceps femoris muscle, and thus appears on the outer aspect of the limb near the stifle joint, behind the external lateral ligament of which it will be found. Here the external popliteal nerve terminates by dividing into the musculo-cutaneous and anterior tibial nerves. These nerves will be dealt with later.

During its course the external popliteal gives off a branch which passes downwards and slightly backwards over the outer aspect of the gastrocnemius muscle to communicate with the external saphena nerve in the manner described below.

About two inches below the point at which the above branch is detached the *peroneal-cutaneous branch* is given off from the external popliteal nerve. It leaves the parent nerve just above the gastrocnemius muscle, and, passing across the inferior extremity of the biceps femoris, it becomes superficial and splits up into a large number of slender filaments, which ramify on the outer aspect of the stifle joint and the upper portion of the leg.

Occasionally the above nerve of communication with the external saphena nerve is given off as a collateral branch of the peroneal cutaneous nerve.

3. A short and thick branch is given off at the curve formed by the parent nerve before it descends the thigh and as it crosses the gemelli muscles. It splits up almost immediately into a number of branches, which are distributed to the semimembranosus, the lower two-thirds of the semitendinosus, and the inferior portion of the biceps femoris. Some filaments also run between the semimembranosus and the adductor magnus, and terminate in the latter muscle.

4. *The External Saphena Nerve.*—This branch is given off by the great sciatic nerve about four to six inches above the point where the latter disappears between the two heads of the gastrocnemius muscle. The

external saphena nerve then takes a downward course over the external aspect of the outer head of the gastrocnemius. At a point which is in line with the position where the anterior tibial nerve disappears between the peroneus and extensor pedis muscles it receives a branch of communication from the external popliteal nerve. It then takes its course down the limb in front of the tendo-Achilles, and immediately beneath the fibrous aponeurosis of the leg. It is in close relationship to the external saphena vein. Crossing the postero-external aspect of the hock, its terminal ramifications are distributed superficially in the metatarsal region.

PARALYSIS OF THE GREAT SCIATIC NERVE

Paralysis of this large nerve has not infrequently occurred. As would naturally be gathered from the number of muscles supplied by the nerve and its continuations, there is loss of power in almost the whole limb, particularly in those parts controlled by the hamstring muscles and the muscles in front of and at the back of the tibia. Flexion of all the joints from the hip downwards is interfered with, and the animal is capable of extending only the hip and stifle. Sensation is also lost in the skin, which, it will be remembered, derives its supply from the large number of cutaneous filaments which this nerve and its branches and continuations give off.

Since the extensors of the stifle are not affected, the animal can fix this joint, and in consequence weight can be placed on the limb.

Möller recorded a case which at first he thought was one of paralysis of the external popliteal nerve only, but afterwards discovered that the whole sciatic nerve was affected. The subject was an eight-year-old Belgian gelding, which was found to be lame in the stall without any apparent cause. Next day he appeared to show symptoms of partial paralysis, but the symptoms gradually became more definite, and it was seen that the right leg only was affected. "Whilst the left hind limb

was moved, and weight was placed on it in the usual way, the left leg was carried close to the middle line of the body (adducted), and was placed too far in advance and too near the right side, causing the animal to fall towards the right side ; the body was only saved from coming to the ground by a rapid spring with the left foot." The muscles supplied by the anterior tibial nerve and its continuations—namely, the flexor metatarsi, extensor pedis, and the peroneus—being unable to perform their ordinary functions, the stifle and hock were in a condition of excessive extension, and the limb appeared much longer than the corresponding limb of the other side. Owing to the inactivity of the extensor pedis and peroneus muscles, the animal was unable to extend the fetlock and interphalangeal joints, so that these remained excessively flexed, the foot resting with the anterior portion of the wall on the ground, and the sole being directed backwards. The leg was dragged forward only by the action of the crural muscles, and, owing to the loss of control over the joints below the stifle, the action was most insecure, and the movements described above recurred at every step. The excessive flexion of the lower joints caused the animal at times to walk even on the front of the fetlock joint. When assistance was rendered in extending the fetlock and lower joints by means of a rope passed round the fetlock, the animal walked with perfect ease, but the difficulties reappeared immediately such assistance was withdrawn.

At first no anatomical changes in the limb were noted, neither were there evidences of pain, but inability of the muscles in front of the tibia was detected by palpation during movement. That the areas supplied by the anterior crural and gluteal nerves were not affected was evident from the fact that these parts reacted to stimuli, but there was no such reaction in the lower portion of the thigh or phalangeal region.

" Three weeks after the first appearance of lameness an inflammatory swelling appeared between the anus and tuber ischii, showed fluctuation, and on incision discharged about two quarts of very offensive, lumpy pus. After enlarging the orifice the hand could be introduced into an exten-

sive cavity consisting of several divisions. . . . As the abscess cavity closed the difficulty in movement gradually diminished, though the gait for long remained uncertain, especially when the horse was on uneven ground, the phalanges failing to be extended and the animal 'knuckling over' at the fetlock.

"There can be no doubt that the abscess originated in the paraproctal connective tissue, in consequence of infection from the rectum. It then extended between the muscles of the quarter and pressed on the great sciatic nerve, so that both the external and internal popliteal nerves were affected. The symptoms due to injury to the external popliteal were more marked because the function of those muscles supplied by the internal popliteal (gastrocnemius, flexor perforans, perforatus, &c.) was partially replaced by their tendinous apparatus; this explains why weight could still be borne on the limb."

In 1899 the author saw a somewhat similar case of paralysis of the great sciatic nerve in a two-year-old short-horn bullock, which had been out to pasture and had not been seen by the owner for several months; consequently there was no evidence as to the length of time the animal had been lame. The position of the abscess was evident the first time the animal was seen by the writer, for there was an enormous swelling at the back of the thigh. Upon exploration with a searching needle the swelling was found to be due to the presence of an abscess some distance below the cutaneous surface. The abscess was opened by separating the hamstring muscles, and between two and three quarts of thick, offensive-smelling pus escaped. The cutaneous opening was kept patent, and the abscess cavity washed out frequently with antiseptic solutions. The cavity thus filled up from the bottom. Lameness gradually disappeared, and recovery was complete in three weeks.

The position of the great sciatic nerve affords it protection against external injury to such degree that it is difficult to see how paralysis can occur from causes other than the pressure upon it of such growths as abscesses or tumours which form along its course.

PARALYSIS OF THE EXTERNAL POPLITEAL NERVE

This nerve is in a position which renders it particularly exposed to risk of external injury. Almost immediately beneath the nerve we have a hard, resistant structure in the outer condyle of the femur, so that the parts beneath the nerve do not give when a blow is received over the outer aspect of the limb just above the stifle joint.

It is not surprising, therefore, that paralysis of this nerve has frequently been recorded, and the condition was observed by Goubaux as far back as 1848.

The muscles affected in these cases are the extensor pedis, the flexor metatarsi, and the peroneus, so that the hock becomes fully extended, whilst the fetlock and interphalangeal joints are extremely flexed, the foot being rested with the anterior portion of the wall on the ground. If a rope be passed round the fetlock and flexion of the hock and extension of the fetlock and interphalangeal joints be assisted artificially, the animal can walk without difficulty, and places its full weight upon the affected limb. The animal feeds well, and there are no signs of systemic disturbance. Sensation is lost over the area supplied by the continuations of this nerve, *i.e.*, the outer aspect of the leg (musculo-cutaneous and peroneal-cutaneous nerves) and the outer aspect and front of the hock and metatarsal region (cutaneous branches of anterior tibial, musculo-cutaneous, and peroneal-cutaneous nerves). There is no difficulty in detecting by palpation the inability of the muscles named above if the animal be compelled to move forwards.

Treatment consists in applying a blister along the course of the nerve, and exercising the patient.

THE INTERNAL POPLITEAL NERVE

As already stated, this nerve is the direct continuation of the great sciatic. It is a short nerve, beginning where the great sciatic passes between the two heads of the gastrocnemius muscle, and being directly continued under the name of the posterior tibial nerve when it arrives at the inferior border of the popliteus muscle. The nerve thus passes in an almost vertical manner over the back of the stifle joint, its position at the back of the joint being indicated in Plate VII. It follows for a short distance the posterior border of the flexor perforatus muscle, and for the remainder of its course it lies on the popliteus. It is a nerve of considerable thickness, and distributes filaments to both heads of the gastrocnemius muscle, the flexor perforatus, the soleus, the popliteus, the flexor accessorius, and the flexor perforans. It thus supplies all the muscles behind the tibia.

PARALYSIS OF THE INTERNAL POPLITEAL NERVE

The position of this nerve affords it such a considerable degree of protection against external injury that cases in which it is paralysed are extremely rare. A reference to Plate VII. will reveal its adequate protection by the gastrocnemius muscle, &c., against injury from without. Beneath the nerve again we have soft structures of considerable thickness, which include the popliteus muscle, so that there is little risk of the nerve being injured from a blow received externally over the area through which the nerve passes, during the movements of the joint, or from fracture of the neighbouring bones, except in cases of fractured femur when the fracture occurs immediately above the condyles and the healing is accompanied by the formation of an enormous amount of callus.

This nerve supplies the muscles which lie on the back of the tibia, so that we have inability of these muscles when the nerve is paralysed. The result is that the animal cannot extend the hock, owing to the inaction of the gastrocnemius and flexor perforatus muscles. Neither can he flex the fetlock and interphalangeal joints, since the flexor accessorius, flexor perforatus, and flexor perforans are involved.

In the resting condition, then, the foot is placed flat on the ground. The gastrocnemius and flexor perforatus being relaxed, the hock is let down to a much lower level than that of the opposite limb, and as the flexor metatarsi is active the hock does not become unduly extended, as in paralysis of the nerves supplying the anterior tibial region. The result is that the inferior end of the metatarsal bone becomes pressed forwards and there is "knuckling" at the fetlock.

If the patient is caused to move, all the joints are excessively flexed and the foot is raised abnormally high, giving an appearance not unlike stringhalt. The foot is set down flat when the flexors relax, without any force.

The above symptoms may be deduced from an anatomical study of the nerve. Möller recorded a typical case, and also proved that by experimentally dividing the nerve as it passes between the two heads of the gastrocnemius, the symptoms presented are coincident with destruction of the function of the nerve

THE OBTURATOR NERVE

This is another large nerve. Its fibres are derived from the fourth and fifth lumbar roots of the plexus, and the nerve leaves the plexus between the anterior crural nerve and the trunk which connects the anterior and posterior divisions.

It passes above the external iliac artery, and is then seen to be covered only by the peritoneum. Passing to the inner side of the

iliac vessels, it reaches the origin of the obturator artery, the course of which it now follows into the pelvis. Arriving at the upper face of the pubic bone, it runs obliquely downwards and backwards along the obturator groove to the obturator foramen. This foramen is covered superiorly by the obturator internus muscle, and beneath this muscle the nerve, with its accompanying artery, passes. The nerve now leaves the pelvis through the obturator foramen by dipping downwards and piercing the obturator membrane which closes the foramen in the living animal. Splitting usually into two filaments, these pass through the obturator externus muscle from above downwards, and make their appearance on its inferior aspect, where one nerve will be found towards the front of the muscle and the other posteriorly.

The terminal ramifications of the nerve are distributed to the obturator externus, the adductor magnus, the adductor parvus, the pectineus, and gracilis muscles. The longest is the filament which runs to the gracilis, along the inner face of which muscle it descends, after making its appearance in the space between it and the pectineus.

PARALYSIS OF THE OBTURATOR NERVE

From the anatomical description of the course, distribution, and relations of this nerve which has been given above it will be seen that the nerve comes into direct relationship with the pubic bone in front of the obturator foramen, and also that the muscles to which the nerve is distributed are adductors of the limb, all of which are placed on the inner aspect of the thigh. These are points of great importance in dealing with paralysis of the nerve, for it will be readily understood that the formation of a callus as a result of fracture of the pubic bone in front of the foramen, will undoubtedly cause pressure to be placed on the nerve, and paralysis is a very probable result.

Lameness due to inability of the muscles supplied by this nerve has

been frequently seen, and has been attributed to various causes, such, for instance, as the pressure of a tumour which had formed on the course of the nerve, &c.

For the first rational connection of the effect with its cause in this country we are indebted to the observations of W. Willis, who in 1903 described two cases of paralysis of this nerve due to the pressure of a callus formed as the result of fracture of the pubic bone in front of the obturator foramen. The cases were first diagnosed as fractured pelvis. A careful examination through the vagina revealed the presence of a soft swelling at the seat of the fracture in front of the foramen, which later on became very much harder. Regarding the alteration in the conformation of the muscles supplied by the nerve, much less assistance to diagnosis in this respect is rendered in the case of obturator paralysis than in paralysis of most other nerves, since the muscles, even when well developed, do not form very well-marked elevations, and present a more or less flattened appearance. When they become atrophied, therefore, there is not such a pronounced difference in the contour of the part as we find, for instance, in the parts supplied by the anterior crural and musculo-spiral nerves when these nerves are paralysed. During the earlier stages the animal can both abduct and adduct the limb, but the latter power becomes gradually lost, the period elapsing coinciding with that required for the formation of the callus. In the later stages there may be observed a falling away in bulk of the muscles on the inner aspect of the thigh, the skin covering the gracilis particularly appearing very much relaxed ; a fold of skin may easily be grasped with the hand. As during the healing of the fracture the callus becomes condensed and diminishes in size, the want of power of adduction becomes less marked, and is gradually regained, and after a period of about three months the muscles appear to be able to carry out their functions again.

Regarding the treatment, therefore, we find that complete rest for a prolonged period is indicated, and nerve tonics, such as strychnine, should be administered periodically.

THE GLUTEAL NERVES

These nerves are in two sets, designated respectively anterior and posterior. Collectively they form what is sometimes referred to as the small sciatic nerve. Both sets are given off by the lumbo-sacral plexus, and leave the pelvic cavity by the greater sacro-sciatic foramen in company with the gluteal vessels and the great sciatic nerve.

The nerves of the anterior set vary in number from three to five, and their fibres are derived almost exclusively from the first and second sacral roots of the plexus. They pass through the foramen mentioned in front of the great sciatic nerve and beneath the gluteal arteries. Covering the greater sacro-sciatic foramen we have the middle gluteus muscle, or gluteus maximus, and in this muscle most of the filaments of this set are expended. One of the nerves takes a course downwards and forwards between the middle and deep gluteal muscles, lying on the latter; crosses the neck of the ilium, and then passes outwards to supply the tensor vaginæ femoris muscle. Another passes to the outer surface of the anterior arm of the superficial gluteus, which it supplies. A third branch passes downwards over the outer surface of the deep gluteus, and is distributed to this muscle. The nerves of the anterior set are sometimes termed the ilio-muscular nerves.

In the posterior set there are two nerves, to which the name ischio-muscular is sometimes applied. They leave the greater sacro-sciatic foramen behind and above the great sciatic nerve, and lie on the outer surface of the great sacro-sciatic ligament. The superior nerve passes backwards on the ligament and between it and the middle gluteus muscle to terminate in the biceps femoris. During its course, whilst beneath the middle gluteus, it gives off a slender branch which is distributed to the posterior portion of that muscle. A second and much larger branch is detached which curves round the posterior

edge of the middle gluteus, and which is expended in the posterior arm of the superficial gluteus.

The inferior member of the posterior set appears in close proximity to the posterior border of the great sciatic nerve. It also runs downwards and backwards on the outer surface of the great sacro-sciatic ligament. It splits into two portions, the outer of which curves over the outer aspect of the tuber ischii, and about six inches below the summit of the tuber, becomes superficially placed and is distributed on the posterior aspect of the thigh. The inner of the two divisions ultimately joins a branch from the internal pudic nerve and is distributed to the perineal structures. During its course this division gives off a number of small branches, which are distributed to the semitendinosus muscle.

GLUTEAL PARALYSIS

From our description of the gluteal nerves it will be seen that they are in a position in which they are extremely well protected from injury. The nerves themselves are tiny filaments which leave the pelvis and pass almost directly to the muscles which they supply. The great thickness of the muscular mass which covers them affords them ample protection from external injury. One filament is, as already stated, intimately related to the neck of the ilium, and is in consequence subjected to risk of injury in cases of fracture in this situation. The only muscle supplied by this branch, however, is the tensor vaginæ femoris, and consequently paralysis of the nerve would not be followed by very serious consequences.

Similarly, one filament from the posterior set might be injured in cases of fracture of the tuber ischii. But this nerve does not supply any muscle, for it becomes cutaneous a few inches below the tuber. The filaments which supply the gluteal muscles are not subjected to any such risk of injury, since they do not bear an intimate relationship to any part of the skeleton. Consequently paralysis of these muscles is rare. Möller

states the following case, which was reported by Franck, in which the anterior set of nerves was paralysed owing to the presence of a neuroma: "The patient, a seven-year-old gelding, showed gradually advancing atrophy of the gluteal muscles of the left side, which became so marked as to result in five months in the bones being almost denuded of muscle and appearing almost like an osteological preparation; the muscles of the thigh and lower thigh also suffered severely. At first there was only insecure gait, but this symptom, always marked when the horse was turned, gradually became aggravated. Finally the lower part of the limb was kept permanently flexed, and during forced exercise was slid along the ground and set down with a tapping, insecure movement. The backward portion of the stride was shortened. On post-mortem examination a neuroma the size of a pigeon's egg was found on the anterior gluteal nerve four inches from its point of exit."

When the muscles supplied by the gluteal nerves are paralysed the animal loses the power of abducting the limb, and if compelled to move, the limb is carried with the foot much too close to the mesial line. The limb is carried forward by the action of the crural muscles, the flexors of the hock and the extensors of the interphalangeal joints, and whilst this is being done there is a tendency for the foot of the affected limb to strike that of the limb opposite. Any alteration in the conformation of the part as a result of atrophy of the muscles is easily detected, and becomes visible to the eye particularly if the animal be viewed from behind and the two quarters compared. The usual treatment for paralysis should be adopted.

THE POSTERIOR TIBIAL NERVE

This is the direct continuation of the internal popliteal nerve, the inferior border of the popliteus being the line of demarcation between the two. The first portion of the posterior tibial nerve is

deeply seated, and lies beneath the inner head of the gastrocnemius muscle, where it crosses the flexor perforatus. It then emerges from beneath the head of the gastrocnemius and appears on the inner aspect of the limb in front of the tendo-Achilles. It lies beneath the deep fascia of the leg. For the greater part of its course it is some distance behind the posterior tibial artery, for the latter makes its appearance at the inferior extremity of the muscular portion of the flexor accessorius, and then runs down the limb closely applied to the posterior aspect of the tendon of that muscle. Just above the hock, however, the artery forms an S-shaped curve, the first convexity of which is directed downwards and the second upwards, so that the vessel here approximates much more closely to the nerve. Moreover, from the second convexity of the S curve a retrograde branch is given off, which ascends in immediate relationship to the anterior aspect of the nerve. Notwithstanding the great reduction in size which the internal popliteal nerve has undergone in consequence of the number of muscular branches which it detaches, the posterior tibial nerve—its continuation—is still a nerve of considerable volume. Unlike the great sciatic nerve, which in the upper portion of the limb is a flat band, the posterior tibial nerve is rounded and cord-like. On a level with the summit of the tuber calcis the posterior tibial nerve terminates by dividing into the two plantar nerves, which pass downwards through the tarsal sheath with the perforans tendon. At a point which averages five inches above the summit of the tuber calcis the posterior tibial nerve gives off an important cutaneous branch, which runs downwards and forwards across the seat of spavin, and to which attention will be drawn later in dealing with posterior tibial neurectomy. Other small cutaneous branches are detached from the posterior tibial nerve, but these are of little importance.

POSTERIOR TIBIAL NEURECTOMY

We have stated above how the posterior tibial nerve divides into the internal and external plantar nerves just above the level of the summit of the tuber calcis, and that the two plantar nerves pass through the tarsal sheath in company with the perforans tendon. Whilst passing over the back of the hock joint the external plantar nerve detaches a branch of considerable size, and from this branch are given off a number of collateral twigs, some of which are distributed over the surface of the joint, whilst others penetrate the joint and supply its internal structures.

Consequently in persistent cases of spavin, neurectomy of the posterior tibial nerve has been practised.

In performing this operation the animal is cast on the side of the affected limb and placed under a general anæsthetic. Cross hobbles are then placed on the upper fore and hind limbs, and the latter is drawn as far forwards as possible before tying the rope connecting them. In short-backed animals the hind foot may be drawn so far forwards as to rest on the upper fore foot. If this can be done so much the better, as the area of operation on the inner aspect of the affected limb becomes thus more accessible to the operator. The inner aspect of the limb above the hock should be shaved and cleansed thoroughly.

Regarding the seat of our cutaneous incision, it will be gathered from our description of the nerve that it becomes placed superficially on the inner aspect of the limb where it emerges from beneath the inner head of the gastrocnemius muscle, some nine inches or so (varying, of course, with the size of the animal) above the hock, and then takes a course downwards in front of the tendo-Achilles. It does not run exactly parallel to the tendon; the distance between the nerve and tendon gradually increases as we approach the joint. Most writers on the subject of neurectomy of this nerve advocate a point between three and four inches above the hock as the seat of operation, and the fixing of the

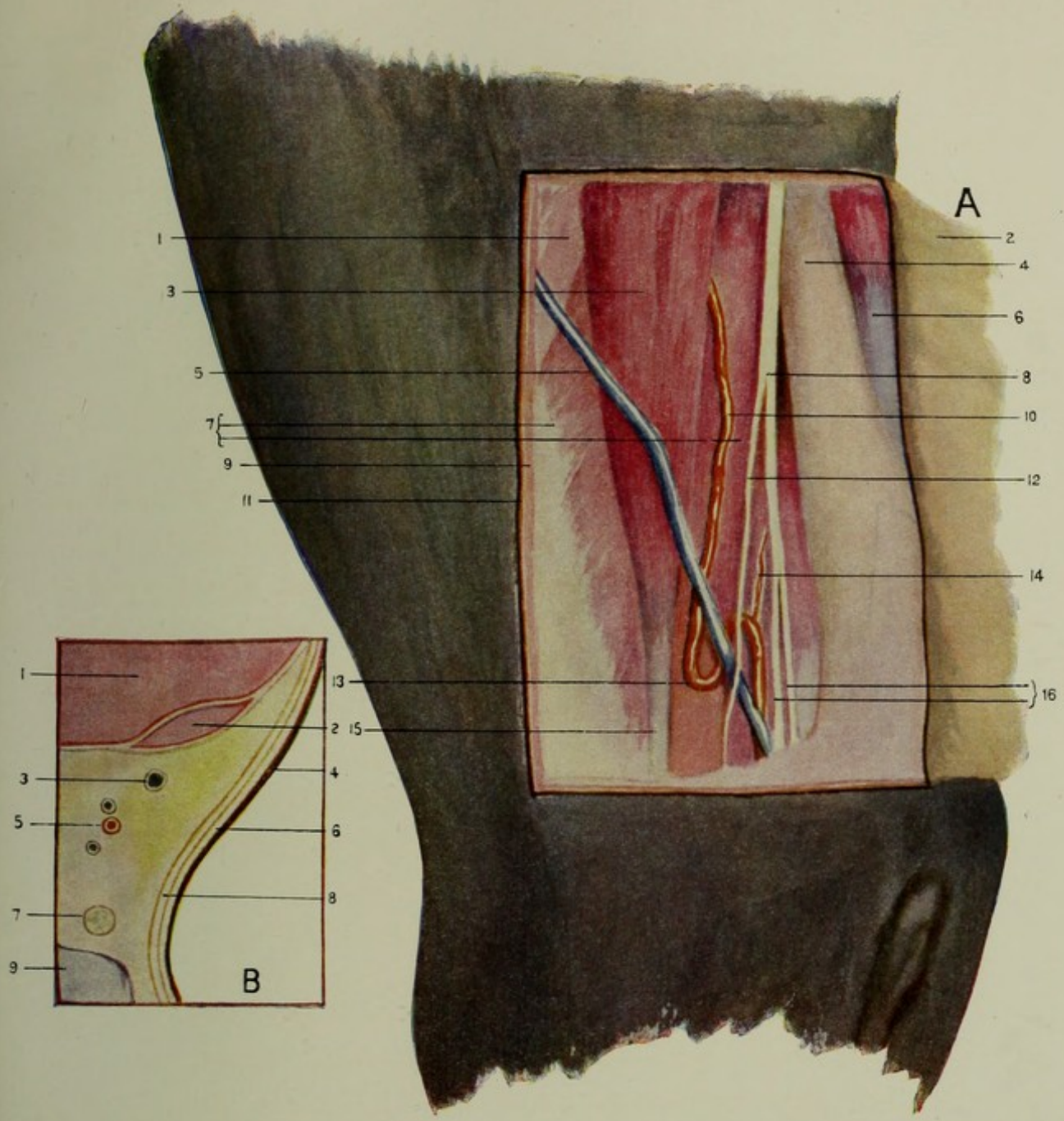

PLATE XXVI.—**A.**—SEAT OF POSTERIOR TIBIAL NEURECTOMY DISSECTED.

1. Popliteus muscle. 2. Skin and superficial and deep layers of fascia reflected. 3. Flexor accessorius. 4. Tendon of flexor perforatus. 5. Posterior root of internal saphena vein. 6. Tendon of gastrocnemius. 7. Flexor perforans. 8. Posterior tibial nerve. 9. Deep fascia. 10. Posterior tibial artery. 11. Superficial fascia. 12. Cutaneous branch of posterior tibial nerve. 13. Sigmoid flexure of posterior tibial artery. 14. Retrograde branch of ditto. 15. Tendon of flexor accessorius. 16. Plantar nerves.

B.—THE SEAT IN SECTION.

1. Flexor perforans. 2. Flexor accessorius. 3. Posterior root of internal saphena vein. 4. Skin. 5. Posterior tibial artery with venæ comites. 6. Superficial fascia. 7. Posterior tibial nerve. 8. Deep fascia. 9. Tendon of flexor perforatus.

seat at this point may possibly account for the somewhat frequent ineffectiveness of this operation in treating spavin. Upon careful dissection a very slender branch which runs right across the usual seat of spavin is found to be given off by this nerve. The branch for the greater part of its course lies immediately under the skin, and hence is rarely seen in an ordinary dissection, since it is usually removed in reflecting the skin. Special dissection has therefore to be made for it.

In a number of dissections where opportunity was presented for taking measurements it was found that the above-mentioned branch was given off from the posterior tibial nerve at a point the average distance of which from the point of the hock was five inches (*Veterinary Record*, April 29, 1905). It occurred to the writer that in cases where the exostosis is fairly prominent and well-defined, lameness might be due to pressure on this branch, and providing such were the case the seat usually recommended for the performance of the operation was too low to be effective. Shortly afterwards opportunity was presented for putting a higher seat into practice, and the incision was made between six and seven inches above the summit of the calcis, with satisfactory results. Other cases have been attended with similar results, one of which, operated upon in conjunction with Mr. G. H. Locke, M.R.C.V.S., of Manchester, is frequently under the latter's observation, and has worked regularly since.* There are several anatomical advantages in selecting a higher seat as suggested. In this situation the nerve is slightly more superficial and is more easily found. It is also further removed from the posterior tibial artery, which lower down forms its sigmoid curve in the direction of the nerve. Moreover, there is no risk of injuring the retrograde branch of this artery, which in the lower seat ascends from the second curvature of the flexure immediately in front of the nerve.

Having made our cutaneous incision, about the breadth of the handle of a scalpel in front of the tendon and parallel to it, the incision being carried through the skin and superficial fascia ; on separating the lips

* *Veterinary Record*, May 12, 1906.

of the incision the nerve is not seen, since it is covered by the layer of deep fascia. This should be seized with the forceps and drawn gently towards the operator, and a similar incision carried through it. By separating the lips of this second incision the nerve is brought into view, and may be readily brought out through the cutaneous incision, on the tenaculum. Should there be any difficulty this part of the operation will be greatly facilitated by applying a little pressure with the finger on the opposite side of the limb. The nerve is thus pressed towards the operator. The nerve is easily dissected clear of the surrounding tissue. It is unnecessary to remove much fascia, as frequently recommended, since this only leaves a larger gap to be filled up during the healing process, and, moreover, there is a greater tendency for the proximal end of the divided nerve to become fixed in the new tissue which forms near the cutaneous wound, and for the formation of a neuroma on the nerve in consequence of the irritation to which it is subjected. When the fascia is simply slit, after the excision of the necessary portion (about an inch) of the nerve the proximal end falls back into position and remains beneath the fascia. One or two simple interrupted sutures should now be inserted in the cutaneous wound, and the animal allowed to rise. Periodical applications of dry antiseptic dressing and the removal of the sutures in two or three days are now all that is necessary.

THE MUSCULO-CUTANEOUS NERVE

This is a nerve of considerable length, and is one of the two terminal divisions of the external popliteal nerve. It commences where the latter nerve divides on the outer aspect of the stifle, about an inch and a half behind the external lateral ligament, and usually on a level with the outer fibro-cartilaginous disc.

It takes a course which is obliquely downwards and forwards, running for a very short distance on the outer head of the gastrocnemius. Leaving

this muscle, it passes across the upper extremity of the deep flexor of the digit, and then runs on to the outer surface of the peroneus muscle. The nerve is here quite superficially placed, and in some animals it can be felt. It lies immediately beneath the deep fascia of the leg. Whilst on the outer surface of the peroneus it gives off a thick branch, which enters this muscle on its outer aspect, and the parent nerve, now very much reduced in size, runs down the limb along the line of apposition of the peroneus and extensor pedis. It is quite superficially placed between the two muscles, and maintains its position immediately beneath the deep fascia. Towards the hock it becomes still more superficial, and its terminal ramifications are distributed to the skin covering the outer and anterior aspects of the metatarsal region.

THE ANTERIOR TIBIAL NERVE

This is the second terminal division of the external popliteal nerve, and therefore commences where the latter divides just behind the external lateral ligament of the stifle. It may be said to continue the course of the parent nerve, and runs, therefore, obliquely downwards and forwards, the course taken by this nerve being less inclined to the vertical than is that taken by the musculo-cutaneous division. It passes across the upper extremity of the peroneus muscle above the last-mentioned nerve, and just below the origin of the muscle from the external lateral ligament. The anterior tibial nerve is here superficially placed, and its position may be detected in the living subject by careful palpation. Like the musculo-cutaneous nerve, it lies immediately beneath the deep fascia of the leg. Between two and three inches (the distance varying with the size of the subject) below the head of the fibula the anterior tibial nerve disappears by dipping inwardly between the bellies of the peroneus and extensor pedis muscles, and in its course down the leg it is covered by the last-mentioned muscle. It retains this position beneath the extensor pedis until

it arrives at the hock, when it follows the course taken by the large metatarsal artery, its size being now very much reduced. It terminates in cutaneous filaments, which are distributed to the skin on the outer side of the metatarsal region.

During its course the anterior tibial nerve gives off short, thick branches which supply the extensor pedis and the flexor metatarsi muscles, and near the inferior extremity of the tibia it detaches a number of small articular filaments which are distributed to the hock joint. It also supplies the extensor brevis.

ANTERIOR TIBIAL NEURECTOMY

Owing to the articular branches supplied by this nerve to the hock joint, the operation of anterior tibial neurectomy has been commonly performed in the treatment of cases of spavin which do not improve under the ordinary methods of treatment by counter-irritation, &c.

There are two seats in which this operation has been practised, which may be termed respectively the upper and lower. The upper seat has been commonly selected in this country, the object being to seize the nerve in the most accessible position for operation.

Upon examining the limb we find that the nerve is most superficially placed where it dips in between the extensor pedis and peroneus muscles on the outer aspect of the limb just below the stifle joint. An inspection of the part will reveal the fact that the contour of the belly of the extensor pedis muscle may be distinctly seen, since it forms a prominent and well-defined bulging of the skin. Behind this elevation is another which is less prominent, and which is slightly more elongated from above to below. This indicates the position of the peroneus muscle. Taking a vertical course upwards from the line of apposition of the two muscles, we feel the head of the fibula, and this is our guide, for the seat in which this nerve can be most easily picked up is that recom-

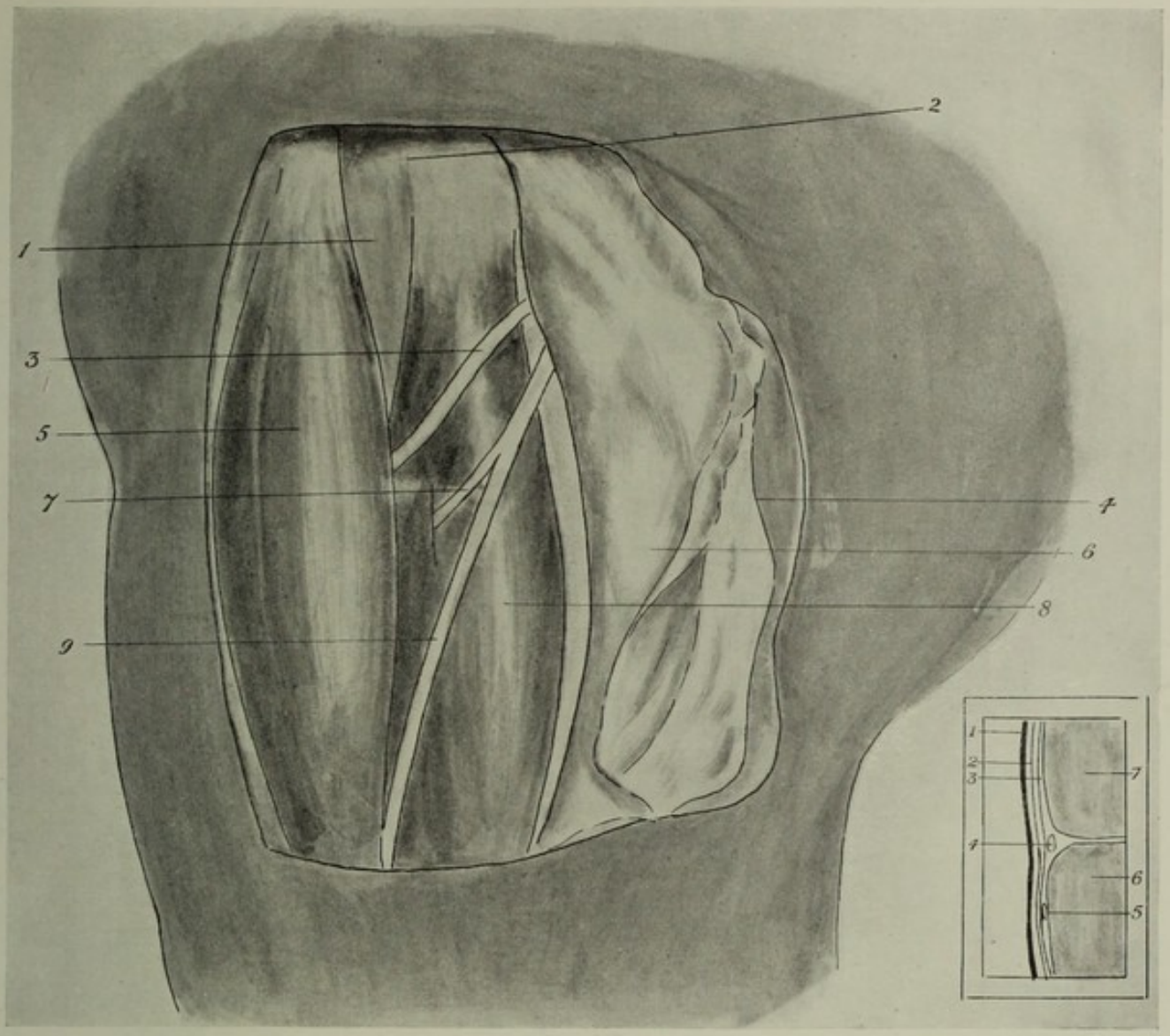

PLATE XXIV.—ANTERIOR TIBIAL NEURECTOMY (THE UPPER SEAT)

A.—THE SEAT DISSECTED

1. Tibia. 2. Head of fibula. 3. Anterior tibial nerve. 4. Skin and superficial fascia. 5. Extensor pedis. 6. Deep fascia. 7. Nerve to peroneus. 8. Peroneus. 9. Musculo-cutaneous nerve.

B.—THE SEAT IN SECTION

1. Skin. 2. Superficial fascia. 3. Deep fascia. 4. Anterior tibial nerve. 5. Musculo-cutaneous nerve. 6. Peroneus. 7. Extensor pedis.

mended in this country by Macqueen—*i.e.*, two inches below the head of the fibula.

The animal should be cast on the side of the sound limb, placed under a general anæsthetic, and an area about six inches square below the head of the fibula shaved and subjected to the usual preparatory treatment. A vertical incision should then be made from one to two inches in length in the depression between the extensor pedis and peroneus muscles, the incision commencing two inches below the head of the fibula and passing through the skin and superficial fascia. On separating the lips of this incision the shiny layer of deep fascia will be seen, and in this a similar incision should be made, when the nerve will usually be found lying in the direct line of vision of the operator. Occasionally the musculo-cutaneous nerve may also be seen, when it should be remembered that the anterior tibial nerve is the upper of the two. The anterior tibial nerve is thus caught as it dips between the extensor pedis and peroneus muscles, and if the two muscles be separated from one another the nerve may be severed below the point where it detaches branches to the anterior tibial muscles. The operation in this seat is quite simple, and there are no important vessels near. One or two cutaneous sutures are inserted, and the part dusted over with dry antiseptic dressing.

In the treatment of spavin Bossi performed neurectomy on both the anterior and posterior tibial nerves, and hence the name *Bossi's double neurectomy for spavin* has come to be applied to these operations. Bossi performed the operation on the anterior tibial nerve in what we refer to as the lower seat. In this seat the area selected is in the inferior half of the depression between the extensor pedis and peroneus muscles. Williams, of Cornell, selects the seat as follows: "Shave and disinfect the skin over an area 6 cm. long by 3 cm. wide directly over this depression, and extending upward from a point 6 or 7 cm. above the tibio-astragaloid articulation." Möller states that "the point selected is at the external surface of the

lower part of the thigh, a hand's breadth above the point of the hock."

It should be remembered that the anterior tibial nerve is here much more deeply seated, and lies beneath the extensor pedis on the flexor metatarsi muscle. This will be made clear by a reference to Plate XXV. An incision should be made in this situation through the skin and superficial fascia. The deep fascia will then be seen, and care must now be taken to avoid the musculo-cutaneous nerve, which runs along the line of apposition of the extensor pedis and peroneus, and the position of which is very superficial. A reference to the seat in section (Plate XXV.) will reveal the relative positions of the two nerves. The incision in the deep fascia should be made along the posterior border of the extensor pedis, and the operator should then dissect carefully along the posterior face of the muscle, when the anterior tibial nerve will be found lying on the flexor metatarsi. During this dissection the musculo-cutaneous nerve, with the posterior lip of the deep fascia, should be drawn backwards. Care must be taken when dealing with the anterior tibial nerve not to injure the anterior tibial vessels, which are in close proximity to it (see Plate).

In this seat it will at once be seen that the nerve is in a more difficult situation for operative purposes. At the same time the seat has an advantage, inasmuch as there is no danger of injuring the nerves which supply the extensor pedis and flexor metatarsi. In the upper seat, however, the anterior tibial nerve is much more easily found, and by making a fairly long cutaneous incision (to which there can be no objection) it is possible to avoid the branches referred to, since they are usually given off immediately the nerve passes in between the peroneus and extensor pedis, and are more deeply seated than the parent nerve.

One or two simple interrupted sutures should be inserted in the cutaneous opening, and the seat dusted over with dry dressing in the usual way, when the animal may be allowed to rise.

Frequently after Bossi's double neurectomy, or anterior tibial neurec-

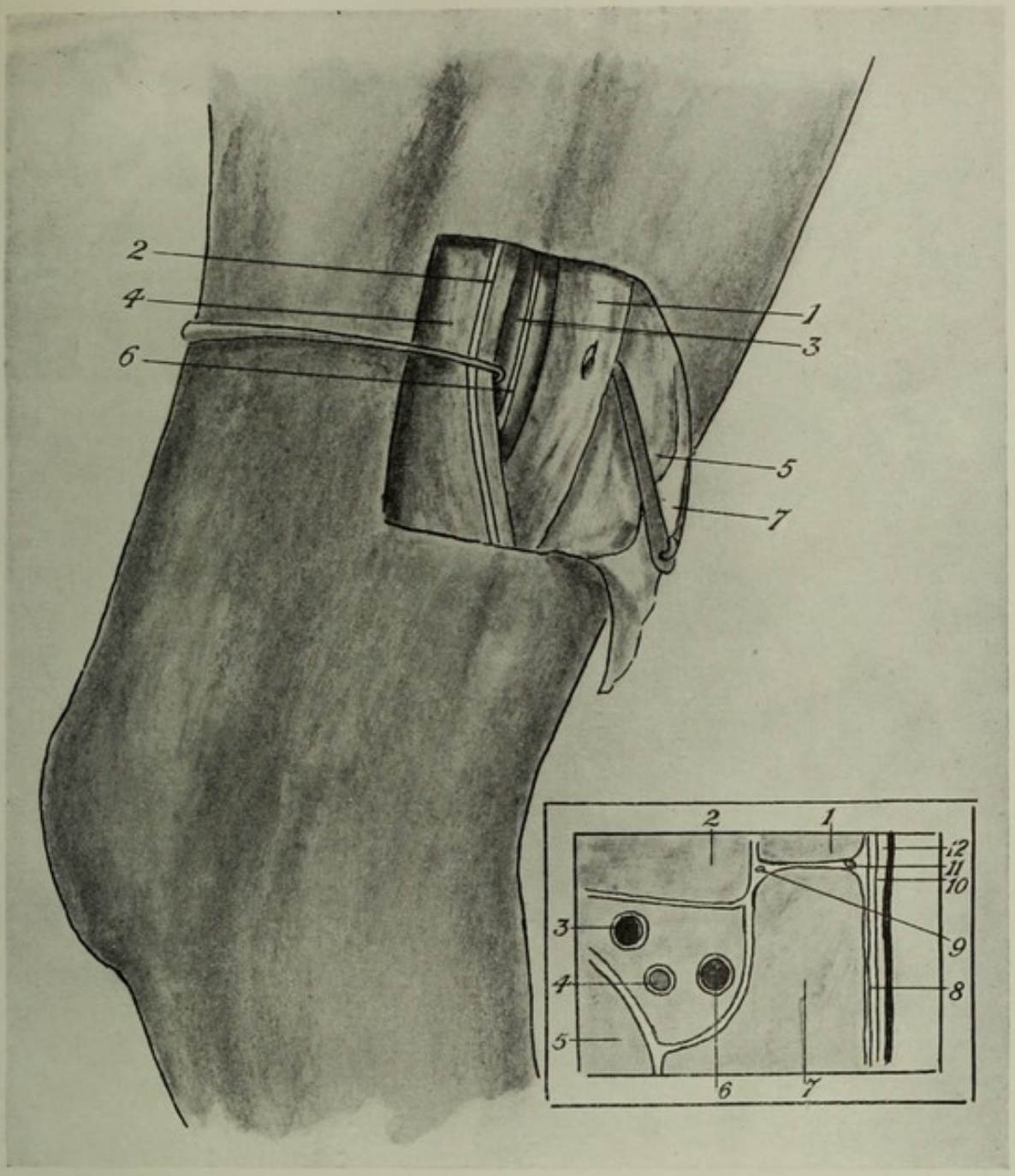

PLATE XXV.—ANTERIOR TIBIAL NEURECTOMY (LOWER SEAT)

A.—THE SEAT DISSECTED

1. Extensor pedis muscle hooked forwards. 2. Musculo-cutaneous nerve. 3. Flexor metatarsi muscle. 4. Peroneus hooked backwards with musculo-cutaneous nerve. 5. Deep fascia. 6. Anterior tibial nerve lying on flexor metatarsi. 7. Skin and superficial fascia.

B.—THE SEAT IN SECTION

1. Extensor pedis. 2. Flexor metatarsi. 3 and 6. Anterior tibial veins. 4. Anterior tibial artery. 5. Tibia. 7. Peroneus muscle. 8. Deep fascia. 9. Anterior tibial nerve. 10. Superficial fascia. 11. Musculo-cutaneous nerve. 12. Skin.

tomy alone, when the animal first rises an alarming symptom is presented in extreme knuckling of the fetlock, and the patient appears unable to extend the joint. This usually passes off in a short time with careful exercise. To prevent injury to the joint during this stage, however, it is usual to apply a protective bandage from the coronet upwards above the fetlock of the limb to be operated upon, before commencing the operation.

STRINGHALT

This is the name given to a peculiar condition commonly seen in the horse, in which the joints of the limb present an extreme degree of flexion, which is carried out with abnormal suddenness during the movement of the limb. The terms stringhalt and chorea were used synonymously by the late W. Williams, who defined the condition as "an irregular convulsive clonic action of the voluntary muscles."

The condition is usually confined to the hind limbs, one or both of which may be affected. In rare cases, however, it has been recorded as occurring in the fore limb. Beyond the extreme flexion and sudden manner in which the foot is picked up from the ground there appears to be nothing seriously affecting the limb, which is quite able to bear weight and carry out its other functions.

The symptoms may not be presented at every step, and are usually observed to occur with irregular intermittence. Frequently the condition is but slight, and is only to be noticed when the animal is turned round suddenly.

Stringhalt is an affection the cause of which has never been satisfactorily demonstrated, and remains to this day more or less in obscurity, notwithstanding the efforts of the large number of able observers who have devoted attention to it. The consensus of opinion amongst those

who have taken up the subject appears to connect the condition with some derangement of the nervous functions, and consequently it has been decided to deal with it briefly in this chapter, as being at present the most appropriate position for it.

Regarding the particular nature of this derangement opinions are most diverse. Dick claimed to have proved that the symptoms were due to the presence of tumours in the lateral ventricles of the brain. In one case upon which a post-mortem examination was made by Sewell and Spooner a quantity of extravasated blood was found near the origin of the great sciatic nerve from the spinal cord. Others, again, attribute the condition to inflammation of the sciatic nerve. By some it has been attributed to peripheral irritation. Gunther, amongst others, has connected the affection with surgical diseases of the foot. It has been considered secondary to affections of the muscles, the fascia of the leg, the joints, and even the bones. It will thus be seen how indefinite our knowledge concerning the cause of this disease really is. Whatever the cause, it appears to be generally conceded that the peculiar movements observed are involuntary.

The condition most frequently develops slowly, but at times cases are observed in which the symptoms appear suddenly. Although in many cases of stringhalt the animals work regularly throughout life without any apparent inconvenience, the disease is usually considered to be progressive, and is looked upon with considerable suspicion by dealers and other purchasers of horses. W. Williams considered that "it should be looked upon as an unsoundness, and as a cause of depreciation of the animal's value."

If the symptoms presented are considered to be secondary to some surgical disease, as, for instance, one of the numerous affections of the foot, then our prognosis might be favourable, based upon a reasonable expectation that the symptoms of stringhalt will subside as the surgical affection to which they are subsidiary progresses towards recovery. Otherwise treatment of chronic stringhalt is generally of little use. Peroneal tenotomy

has, however, been performed, with successful results. The operation is described in Chapter VI., which deals with tendons.

THE PLANTAR NERVES

In general these nerves in their course and distribution resemble the corresponding nerves of the fore limb. In the hind limb, however, the large metatarsal artery does not run down alongside either of the plantar nerves. It is placed on the outer side of the limb, some distance in front of the external plantar nerve, and between the large and outer small metatarsal bones. Following the course of the nerves are the internal and external metatarsal veins, behind which the corresponding plantar nerves are found. Two small arteries, which are unnamed, descend from the tarsal arch. These run down the limb, one in front of each plantar nerve, and between it and the corresponding metatarsal vein. These arteries usually terminate in the inferior third of the metatarsal region, and not infrequently one of them is absent. Regarding the point at which the plantar nerves of the hind limb divide into the digitals, Craig made observations on a number of cases, and found that all divided below the level of the button of the splint bone. It was also found that in a number of cases the oblique branch which usually connects the internal and external plantar nerves was absent, and that the average point at which this branch (in those cases in which it was present) was detached from the internal plantar nerve, was two and a third inches above the lower extremity of the internal small metatarsal bone, whilst it joined the external plantar nerve at a point which was on an average half an inch below the level of the button of this bone. Consequently he recommended that the incision in external plantar neurectomy in this limb should commence about a quarter of an inch below the button of the external metatarsal bone, and should extend in the downward direction vertically for a length of an inch and a quarter. In operating on the internal plantar nerve the incision

is made opposite to or slightly above the button of the splint bone, and the length of the incision should be about one inch.

Other points in connection with the operations on these nerves, and also the operations on the digital nerves, resemble those which have already been given when dealing with the corresponding nerves of the fore limb.

CHAPTER VIII

THE BLOOD AND LYMPH VESSELS

THE ARTERIES

Synopsis of Origin, Distribution, and Anastomoses

The Internal Iliac Artery.—Although chiefly concerned in the supply of the walls of the pelvis and the contents of that cavity, this vessel is described here, since some of its branches also contribute towards the supply of parts of the hind limb.

The vessel is one of the terminal divisions of the posterior aorta, which divides beneath the fifth lumbar vertebra into two pairs of vessels, one pair on either side. The members of each pair are the external and internal iliacs.

From the body of the fifth lumbar vertebra the internal iliac artery takes a course which is obliquely backwards, downwards, and outwards. It runs across the articulation formed between the sacrum and the last lumbar vertebra, and then over the sacro-iliac articulation, where it terminates near the insertion of the psoas parvus muscle by splitting into three main divisions. Outwardly the internal iliac artery is related to the common iliac vein, which separates it from the external iliac artery. Inwardly it is related to the peritoneum.

During its course the internal iliac artery gives off the following collateral branches :

I. *The Umbilical Artery.*—In the fœtus this is a vessel of considerable calibre, and through it the blood of the fœtus passes to the placenta. In

the adult animal, however, the vessel is almost entirely obliterated, and is represented by a fibrous cord, which is pervious only for a short distance. It gives off one or two small branches to the fundus of the bladder, and after the detachment of these its lumen disappears.

II. *The Internal Pudic Artery.*—This is sometimes referred to as the artery of the bulb. In the male subject its description is as follows: Leaving the internal iliac artery near its origin by a trunk which is common to this and the umbilical artery, it runs obliquely downwards and backwards along the deep face of the great sacro-sciatic ligament, though it may be found in the texture of the ligament itself. Though very slender, it is a vessel of considerable length. It enters the pelvic cavity and runs alongside the prostate gland and the gland of Cowper, and then curves round the ischial arch to enter the bulb of the urethra.

During its course the internal pudic artery gives off a number of small branches to the muscles in relation to the great sacro-sciatic ligament. The *vesico-prostatic* artery is also a branch of this vessel. This branch takes a sinuous course backwards, and distributes branches to the posterior portion of the bladder, to the vesiculæ seminales, the prostate gland, and also to the urethra. The internal pudic artery also detaches hæmorrhoidal and perineal branches.

In the female the internal pudic artery ends near the vagina by splitting into a number of branches which are distributed to the vagina, vulva, and rectum. It gives off a branch which is analogous to the vesico-prostatic artery of the male and which is called the vaginal artery.

Probably the simplest method of dealing with the terminal divisions of the internal iliac artery is that recommended by Shave, who refers to them as three main trunks termed respectively internal, middle, and external.

I. The internal trunk is the *lateral sacral artery*, which commences near the lumbo-sacral joint and takes a course backwards along the inferior aspect of the sacrum near the inferior sacral foramina, crossing

the nerves which these foramina transmit. The vessel at its origin lies above the peritoneum. Near the posterior end of the sacrum it terminates by dividing into the ischiatic and lateral coccygeal arteries. During its course the lateral sacral artery gives off four collateral branches, which enter the spinal canal through the first four inferior sacral foramina. In the canal they give off branches to the posterior extremity of the spinal cord and to the cauda equina nerves, and then pass out by the superior sacral foramina to be distributed to the muscles which lie above the sacrum near the sacral spines. In addition, the lateral sacral artery gives off a number of small but unimportant branches which are distributed to the surrounding structures.

The terminal divisions of the lateral sacral artery are :

(*a*) *The Ischiatic Artery.*—This vessel runs for a short distance on the inner surface of the great sacro-sciatic ligament, which it then pierces from within outwards, where it may be found under the upper extremity of the posterior arm of the superficial gluteus muscle. It now takes a course downwards and backwards, and divides into a number of small branches which are distributed to the semimembranosus and semitendinosus muscles near the tuber ischii. Anastomoses are contracted by these branches with ascending branches from the femoro-popliteal artery and with branches of the obturator and deep femoral vessels.

(*b*) *The Lateral Coccygeal Artery.*—This may be regarded as the continuation of the lateral sacral artery, since it continues the course of the latter backwards. It is, however, much smaller than the parent vessel owing to the detachment of the ischiatic branch. It runs the whole length of the coccygeal region and is placed between the compressor coccygis muscle and the bones. It gives off a number of small collateral branches to supply the structures of the tail.

The Middle Coccygeal Artery.—This branch usually leaves the lateral sacral in common with the lateral coccygeal artery. It may, however, leave the former before its division into the ischiatic and lateral coccygeal vessels, as far forward even as the middle of the lateral

sacral. It is an unpaired vessel, and is usually a branch of the right lateral sacral artery. It may, however, come off from the left lateral sacral or the corresponding lateral coccygeal artery. It runs along the inferior aspect of the coccygeal vertebræ between the two compressor muscles to the end of the tail, distributing right and left collateral branches.

The coccygeal arteries are of surgical importance, since they are the vessels which are concerned in the operation of 'docking,' or amputation of the tail, an operation which is frequently performed, and which is described in Part IV.

II.—The middle trunk is the *Gluteal Artery*. This is much the largest of the divisions of the internal iliac artery so far as its diameter is concerned, but on the other hand it is a short vessel. It passes for a short distance on the inner surface of the ilium, and leaves the pelvic cavity by passing out through the greater sacro-sciatic foramen in front of the great sciatic nerve and in company with the anterior gluteal nerves. This foramen, it will be recalled, is covered by the middle gluteus muscle and in close proximity is the deep gluteus. To these muscles the terminal divisions of this vessel are distributed.

II.—The external trunk splits up into three vessels :

(*a*) *The Ilio-lumbar or Ilio-Muscular Artery.*—This vessel takes a course outwards behind the sacro-iliac joint, running between the iliacus muscle and the bone. On the iliac surface of the ilium a well-marked groove will be found which indicates the course of this vessel. A little below the angle of the haunch the vessel terminates by dividing into a number of branches, which curve upwards across the outer border of the ilium and which are distributed to the middle gluteus, the anterior arm of the superficial gluteus, or to the tensor vaginæ femoris muscle.

(*b*) *The Ilio-femoral Artery.*—This vessel is of considerable size only in solipeds, in which it is a larger vessel than the one just described. It passes obliquely downwards between the shaft of the ilium and the iliacus muscle, where there is a distinct groove on the bone for the accommoda-

tion of the vessel. It passes to the outer side of the tendon of insertion of the psoas parvus muscle and crosses the ilium above the origin of the rectus femoris. Descending the outer side of the last-named muscle it passes between it and the vastus externus and splits into a number of branches which are distributed to the quadriceps extensor cruris.

(*c*) *The Obturator Artery.*—This large vessel may be said to be the continuation of the external division of the internal iliac. It takes a course downwards and backwards, following the course taken by the obturator nerve and vein, being placed between the peritoneum and the ilium. It follows the inferior border of the pyriformis muscle, running along the obturator groove. Passing beneath the obturator internus muscle, it leaves the pelvis by curving downwards through the obturator foramen, and then takes a course backwards between the obturator externus and the inferior surface of the body of the ischium. Finally it divides into a number of branches, which curve downwards and terminate in the biceps and semitendinosus muscles. One of its branches is the *Artery to the Corpus Cavernosum.* This branch passes backwards and inwards along the inferior surface of the ischium and divides into a number of branches which enter the crus penis.

The Posterior Dorsal Artery of the Penis is a branch of the artery to the corpus cavernosum. As its name implies, this vessel runs along the upper aspect of the penis. It passes forwards between the ligaments which run from the organ to the pubic symphysis, and anastomoses with the anterior dorsal artery of the penis, which is a branch of the external pudic artery.

The External Iliac Artery.—There are two of these great vessels, one on either side, and they are the outer members of the pairs of terminal divisions of the posterior aorta. Each commences opposite the fifth lumbar vertebra and takes a course which is at first downwards and forwards, and then obliquely downwards, backwards, and outwards. It is covered by the peritoneum, which keeps it in position between the psoas parvus and iliacus muscles. Inwardly it is related to the common iliac vein

which separates it from the internal iliac artery. Arriving at the brim of the pelvis, we find the artery between the pectineus and sartorius muscles, and it now becomes directly continued as the femoral artery.

The collateral branches of the external iliac artery are :

1. *The Artery of the Cord.*—This vessel is sometimes called the small testicular artery, and occasionally also the cremasteric artery. It is a long and very slender vessel which is usually given off by the external iliac artery near the origin of the latter from the posterior aorta. In some cases it is a branch of the aorta itself.

Its course is downwards, backwards, and outwards across the ureter, when it runs parallel to the spermatic artery, which arises from the posterior aorta and behind which it is placed. It thus passes to the internal abdominal ring, where it becomes a constituent part of the spermatic cord. Before reaching the cord it gives off branches to the peritoneum, the iliac glands, the ureter and the vas deferens. It is distributed to the spermatic cord. In the mare it is represented by the *uterine artery* which is a larger vessel, and which passes between the two layers of the broad ligament. It divides into two branches, one of which—the ovarian—is distributed to the ovary, whilst the other passes to the horn of the uterus and anastomoses with the uterine artery.

2. *The Circumflex-Iliac Artery.*—This branch is given off from the parent vessel immediately after the latter leaves the posterior aorta. Occasionally it leaves the aorta itself, and takes a course outwards between the peritoneum and the aponeurosis covering the sublumbar muscles. It passes beneath the psoas magnus muscle and over the spermatic artery and ureter, and near the outer border of the psoas magnus it splits into anterior and posterior divisions. The anterior division descends in the flank and is distributed in the transverse and internal oblique muscles of the abdomen, its terminal ramifications anastomosing with those of the lumbar and last few intercostal arteries.

The posterior division also distributes filaments to the oblique and transverse muscles, and passes between the internal oblique and iliacus

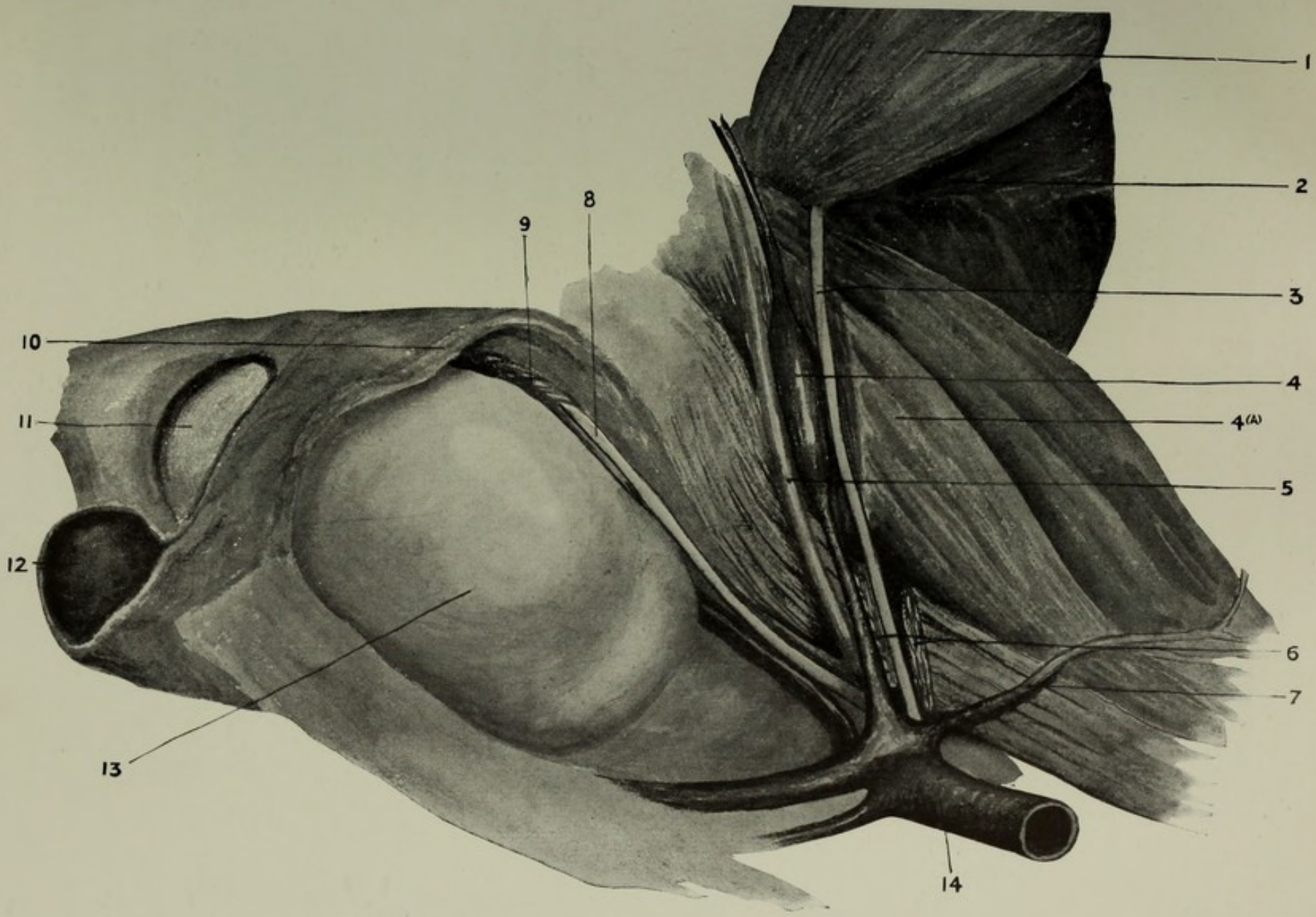

PLATE XXVII.—ANEURISM OF THE EXTERNAL ILIAC ARTERY

1. Rectus femoris. 2. Vastus internus. 3. Anterior crural nerve. 4. Enlargement of external iliac artery. 4A. Psoas magnus. 5. External iliac vein. 6. Cut ends of psoas parvus (the muscle is cut through to show the course of the nerve which runs above it). 7. Circumflex-iliac artery. 8. Obturator nerve. 9. Obturator internus muscle. 10. Brim of pubis. 11. Left obturator foramen. 12. Cotyloid cavity. 13. Bladder (distended slightly). 14. Posterior aorta.

muscles just below the angle of the haunch. It splits up into a number of divisions which are expended subcutaneously at the front of the thigh. This vessel is sometimes involved in fracture of the haunch.

THE FEMORAL ARTERY

This vessel is the direct continuation of the external iliac artery, the name femoral being applied to the vessel after it passes across the brim of the pelvis. At first the artery makes its appearance from beneath Poupart's ligament, and passes across the common tendon of insertion of the iliacus and psoas magnus muscles, being related anteriorly to the sartorius and posteriorly to the pectineus. Running downwards and backwards, it next lies on the vastus internus. Anteriorly it is still related to the sartorius and posteriorly for a short distance to the pectineus, but for the remainder of this portion of the vessel it is placed in front of the adductor parvus. The artery is here covered by the deep inguinal lymphatic glands, and its position corresponds to that of the groove which indicates the position of the interstice between the sartorius and gracilis muscles. At the brim of the pelvis the femoral vein lies behind the artery, but lower down the limb the vein lies beneath and partially behind it.

It crosses the back of the femoral shaft obliquely in the femoral groove, and runs between the two insertions of the adductor magnus muscle. Passing between the two heads of the gastrocnemius muscle, it is continued as the popliteal artery.

The branches of the femoral artery are as follows :

I. *The Prepubic Artery.*—This vessel arises from the femoral artery at the brim of the pelvis in common with the profunda or deep femoral artery. It passes across the anterior aspect of Poupart's ligament, and divides near the posterior border of the internal oblique muscle of the abdomen, into the external pudic and posterior abdominal arteries.

a. The External Pudic Artery. This branch descends on the posterior wall of the inguinal canal, at the back and slightly to the inner side of the spermatic cord. Leaving the canal by the external abdominal ring, it divides into the *subcutaneous abdominal artery* and *anterior dorsal artery of the penis.* The former distributes twigs to the superficial inguinal glands, the sheath and scrotum, and also to the skin, and passes forwards in the subcutaneous fascia of the abdomen to the umbilicus, where it anastomoses with the corresponding vessel of the opposite side. The anterior dorsal artery of the penis gives off one or two branches to the scrotum, and passes to the superior aspect of the penis, where it divides into two portions, one of which anastomoses with the posterior dorsal artery of that organ, whilst the other, which is a much longer and more voluminous vessel, passes forwards to the anterior extremity of the penis and is expended in the erectile tissue.

b. The Posterior Abdominal Artery.—This division of the prepubic artery crosses the direction of the spermatic cord, and passes between the internal oblique and transverse abdominal muscles. It then passes forwards along the outer border of the rectus abdominis, to which muscle it is distributed and in which its terminal ramifications anastomose with those of the anterior abdominal artery.

II. *The Profunda*, or *Deep Femoral Artery.*—This large branch forms a common trunk at its origin with the prepubic artery. After separating from the latter it passes backwards between the iliacus and pectineus muscles and then between the latter and the obturator externus. It then passes beneath the adductor muscles and divides into ascending branches, which anastomose with branches of the ischiatic artery, and descending branches which contract anastomoses with the terminations of the obturator artery. This vessel gives off collateral branches which supply the pectineus, gracilis, and both the adductor muscles, whilst its terminal branches are distributed to the biceps femoris.

III. *Muscular Branches.*—The largest of these leaves the parent vessel opposite where the profunda artery is given off. It passes forwards

and outwards between the sartorius and the common tendon of the iliacus and psoas magnus muscles. It then runs forwards to be placed alongside the anterior crural nerve and passes into the interstice between the vastus internus and rectus femoris muscles. It splits up into ramuscules which are expended in the mass of the quadriceps extensor cruris. During its course it gives off branches to the sartorius, the iliacus, and psoas magnus muscles. Other branches of the femoral artery are distributed to the pectineus, the gracilis, and both the adductor muscles.

IV. *The Nutrient Artery to the Femur.*—This is, perhaps, the largest vessel of its kind in the body. It is detached from the parent vessel near the tendon of insertion of the pectineus muscle, and passes obliquely downwards, forwards, and outwards to enter the bone immediately above the superior extremity of the femoral groove.

V. *The Saphena Artery.*—This is a very long but extremely slender vessel. It leaves the middle of the femoral artery at an acute angle, and passes obliquely downwards and outwards between the sartorius and gracilis muscles, to become superficially placed on the inner aspect of the thigh alongside the saphena vein. During this part of its course it may be found to pierce one or other of the two muscles mentioned. It then runs down the superficial aspect of the gracilis in front of the saphena vein, and divides on the inner aspect of the upper third of the tibia into two branches. One of these follows the course taken to the hock by the anterior root of the vein, whilst the other follows the posterior root and usually terminates near the calcis by anastomosing with a small branch of the posterior tibial artery.

VI. *Articular Branch to the Stifle Joint.*—This is a very slender branch which leaves the parent vessel just above its inferior extremity and which reaches the joint by passing downwards between the vastus internus and adductor magnus muscles.

VII. *The Femoro-Popliteal Artery.*—Where this branch is detached from the femoral artery the latter may be said to terminate. The

course taken by this branch is horizontally backwards and it passes into the semitendinosus muscle. It gives off a long collateral branch which ascends to supply the biceps femoris muscle, and which anastomoses with the profunda or deep femoral artery ; and descending branches which supply the gastrocnemius.

The femoral artery is in intimate relationship to the inferior third of the bone where it crosses the back of the shaft in the femoral groove. In fractures of this portion of the femoral shaft, therefore, the artery is usually involved, as already remarked in our chapter on Bones and Fractures.

THE POPLITEAL ARTERY

This vessel is the direct continuation of the femoral artery. It passes between the two heads of the gastrocnemius muscle and becomes insinuated beneath the popliteus. It then runs almost vertically over the femoro-tibial joint between the deep face of the latter muscle and the posterior surface of the posterior common ligament. The vessel is about six inches in length, and on arriving near the tibio-fibular arch it divides into the anterior and posterior tibial arteries.

As it passes over the back of the posterior common ligament, it gives off several small branches which penetrate the ligament and are distributed to the internal structures of the stifle joint. Several muscular branches are also given off, which are distributed particularly to the gastrocnemius and soleus muscles. One of these branches follows the course taken by the flexor perforatus muscle, and in front of the tendo-Achilles it anastomoses with a retrograde branch from the posterior tibial artery.

The femoro-popliteal artery is sometimes regarded as a branch of the popliteal artery.

THE ANTERIOR TIBIAL ARTERY

This is much the larger of the two divisions of the popliteal artery. From the termination of the latter this branch passes forwards through the tibio-fibular arch and becomes placed on the anterior aspect of the tibia. It then takes its course down the front of the bone, and between it and the deep face of the flexor metatarsi muscle. At the front of the hock it will be found to lie on the superficial face of the anterior common ligament beneath the flexor metatarsi and extensor pedis muscles, and near the line where these two muscles come into apposition with each other. It then passes outwards under the tendon of the extensor pedis, and terminates by dividing into two branches—namely, the large metatarsal and perforating metatarsal arteries.

During its course the anterior tibial artery gives off a large number or collateral branches. These are distributed to the extensor pedis, the flexor metatarsi, and the peroneus muscles, whilst others are articular and supply the hock joint.

THE POSTERIOR TIBIAL ARTERY

This artery at its origin is deeply seated beneath the popliteus muscle, and subsequently is found between the flexor perforans and flexor accessorius. As already stated, it is a much smaller vessel than the other terminal division of the popliteal artery. Running down the limb it inclines towards the inner side, and becomes superficially placed by emerging from beneath the flexor accessorius about an inch in front of the posterior tibial nerve, which is placed anteriorly to the tendo-Achilles. It follows the course of the tendon of the flexor accessorius muscle towards the hock, and is placed behind the tendon. Passing beneath the posterior root of the internal saphena vein and the cutaneous

branch from the posterior tibial nerve, it now forms a peculiar sigmoid curve from before backwards, the first convexity of which is placed anteriorly and is directed downwards. In this portion of its course the vessel is found immediately beneath the deep fascia. From the second portion of the curve its course is downwards in front of the tendo-Achilles, and in close proximity to the posterior tibial nerve and its continuations, passing with these through the tarsal sheath. Arriving at the back of the astragalus, the vessel terminates by dividing into the two plantar arteries.

The branches of the posterior tibial artery are as follows :

1. Numerous *muscular branches* are distributed to the deep layer of muscles on the back of the tibia—namely, the flexor perforans, the flexor accessorius, and the popliteus.

2. The *nutrient artery to the tibia.* This is a very short branch which leaves the posterior tibial artery near the line of apposition of the popliteus and flexor perforans muscles. The artery enters the nutrient foramen, which is placed on the posterior surface of the bone, near the line of division between the area for the accommodation of the popliteus muscle and the area from which the flexor perforans muscle arises.

3. *Articular branches* are distributed to the hock joint.

4. A *retrograde branch* is detached from the convexity of the posterior portion of the sigmoid flexure. This branch ascends in front of the tendo-Achilles in close proximity to the posterior tibial nerve and its continuations.

The anterior tibial artery is in intimate relationship to the tibia itself almost throughout the whole of its course. It is deeply seated, and protected from external injury by the muscles which cover it. It may, however, be damaged in cases of severe fracture of the tibia, and hæmorrhage from it may also arise as a result of deep punctured wounds received over the front of the hock, where the artery divides into the perforating metatarsal and large metatarsal arteries.

The posterior tibial artery is well protected from external injury until

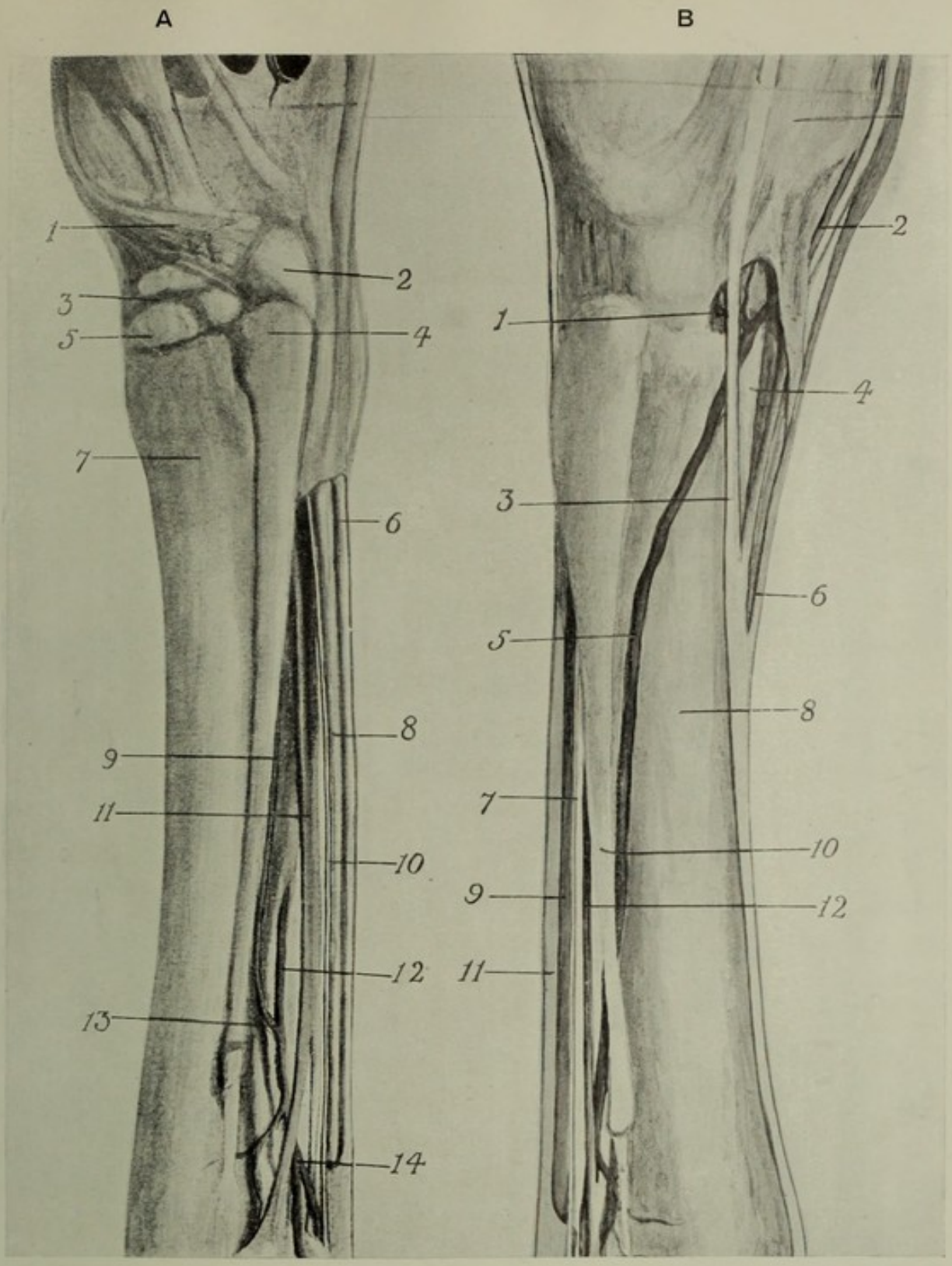

PLATE XXVIII.—METATARSAL REGION, SHOWING ARTERIES, TENDONS, LIGAMENTS, BONES, ETC.

A.—INNER ASPECT

1. Cunean tendon. 2. Cuneiform parvum. 3. Scaphoid. 4. Head of inner small metatarsal bone. 5. Cuneiform magnum. 6. Perforatus tendon. 7. Large metatarsal bone. 8. Perforans tendon. 9. Internal plantar interosseous artery. 10. Internal plantar nerve. 11. Suspensory ligament. 12. Large metatarsal artery. 13. Anastomosis of large metatarsal and internal plantar interosseous arteries. 14. Division of large metatarsal into the two digital arteries.

B.—OUTER ASPECT

1. Perforating metatarsal artery. 2. Anterior tibial artery. 3. Peroneal tendon. 4. Extensor brevis. 5. Large metatarsal artery. 6. Tendon of extensor pedis. 7. External plantar nerve. 8. Large metatarsal bone. 9. Perforans tendon. 10 External small metatarsal bone. 11. Perforatus tendon. 12. Suspensory ligament.

The flexor tendons and suspensory ligament have been displaced slightly backwards to display more fully the arteries. Part of the extensor brevis muscle has also been removed to show the division of the anterior tibial artery.

it emerges from beneath the flexor accessorius muscle, since the upper portion of the vessel is adequately clothed by muscles.

The inferior portion although much more superficially placed is protected inasmuch as it is found on the inner aspect of the limb. The retrograde branch, however, must be avoided in performing posterior tibial neurectomy, particularly if a low seat be selected for the cutaneous incision.

THE PLANTAR ARTERIES

These are the terminal branches of the posterior tibial artery, and they descend through the tarsal sheath with the tendon of the flexor perforans muscle and the plantar nerves. During their passage through the sheath they give off a number of very small branches which are distributed to the hock joint. The plantar arteries terminate by concurring in forming an arterial arch as described below.

THE PERFORATING METATARSAL ARTERY

This is the smaller of the two terminal branches of the anterior tibial artery. From the place where the latter divides this vessel takes a horizontal course backwards, and passes from front to back of the tarsus through the canal formed between the cuboid, scaphoid and cuneiform magnum bones.

Near the posterior extremity of this canal the artery unites with the two plantar arteries and forms an arch which stretches across the superior extremity of the suspensory ligament. Other names sometimes applied to this vessel are the perforating pedal, and perforating tarsal artery.

From this arterial arch four vessels are given off, two of which

follow the course taken by the plantar nerves, in front of which they are placed. These are *unnamed arteries*. They are long and very slender, and may extend as far as the sesamoid bones and anastomose with collateral branches of the digital arteries. The remaining two branches of the arch are the *plantar interosseous arteries*. The external plantar interosseous artery descends along the groove between the outer edge of the suspensory ligament and the inner surface of the outer splint bone. It terminates above the fetlock by anastomosing with a recurrent branch of the large metatarsal artery. The internal plantar interosseous artery is a much larger vessel. It descends similarly along the inner edge of the suspensory ligament, and from it the nutrient artery of the large metatarsal bone is derived. Just above the button of the inner splint bone it passes towards the middle of the limb and joins the large metatarsal artery.

The only point of surgical importance in connection with the four small vessels described is the relation of the two small unnamed arteries to the plantar nerves, and consequently to the seat of operation in plantar neurectomy.

THE LARGE METATARSAL ARTERY

This vessel may be regarded as the continuation of the anterior tibial artery, since it is so much the larger of its two terminal branches. From the division of the anterior tibial artery near the entrance to the cuboido-scaphoido-cunean canal this branch inclines obliquely downwards, outwards and backwards, passing beneath the extensor brevis muscle and the tendon of the peroneus. This part of its course is indicated on the large metatarsal bone by a smooth oblique groove which is placed in the upper fourth of its external lateral surface. The artery then arrives at the channel formed anteriorly between the large and external small metatarsal bones, down which it runs, being here

placed subcutaneously. It is accompanied by the very slender continuation of the anterior tibial nerve. Just above the button of the external splint bone the artery passes through the interval found between this bone and the large metatarsal, and inclines towards the middle of the posterior surface of the latter. In the angle between the two divisions of the suspensory ligament it terminates by dividing into the external and internal digital arteries.

During its course the large metatarsal artery gives off a number of collateral branches which are distributed to the skin and tendons on the anterior aspect of the metatarsal region. One or more of these branches are frequently found to be of considerable size. Branches are also distributed posteriorly to the tendons and other structures behind the metatarsal bones.

The superficial position of the large metatarsal artery on the outer aspect of the limb, renders it particularly exposed to risk of injury. Hæmorrhage from this vessel frequently follows kicks or blows received over the cannon region. It is also a common complication of lacerated wounds such as result from the animal's attempts to free the limb when it has become fixed in a fence, particularly one of barbed wire. Slight laceration of the vessel may be treated simply by applying antiseptic dry dressing and then bandaging the part. Should it be necessary to ligature the vessel at a higher level than the seat of the wound, the vessel may be picked up by making an incision along the course of the peroneal tendon, the exact position of which will be readily understood by referring to the operation of peroneal tenotomy and the plate illustrating it.

The course, relations and distribution of the digital arteries correspond with the description of the corresponding vessels of the fore limb.

THROMBOSIS

Thrombosis of arteries of the hind limb is not uncommon, the arteries most frequently affected being the external iliacs. The thrombus is usually the result of the arrest of an embolus which has been carried in the blood stream along the posterior aorta, and in this connection it may be remarked that the horse is occasionally the subject of a peculiar aneurism which affects the anterior mesenteric artery.

Emboli broken off from a thrombus in this situation thus get carried to the internal or external iliac arteries, or both, and when the lumen of the vessel becomes so small as to arrest its further progress, it leads to the formation of a thrombus in the vessel in which it has become fixed. If the emboli get into the small collateral branches before becoming arrested the consequences are usually not serious, since the parts are supplied with blood by the neighbouring collateral vessels. When the large vessels are blocked much more serious results follow, the blood supply of the muscles to which the vessel concerned is distributed, is cut off, so that these muscles are not able to perform their ordinary functions. Lameness thus frequently follows, the nature of which depends upon the muscles which are affected.

When the animal is at rest there is little to be observed, but the symptoms present themselves as soon as exercise is taken. Rest again quickly causes them to disappear, so that the lameness is intermittent. The animal may be brought out of the stable and placed in the shafts. He may travel for a short distance without inconvenience of any kind and then gradually collapse. After remaining down for a short time he is frequently able to rise and proceed for some distance without displaying signs of lameness when a second collapse occurs, and so on.

When the thrombus is in the external iliac artery, the quadriceps muscles are affected, so that the animal is unable to fix the stifle joint, and symptoms are presented which are not unlike those of crural paralysis, a point which will be readily appreciated.

It will easily be understood that those cases are much more serious in which the arteries of both sides are affected or the thrombus is placed in the posterior aorta itself. In such cases the animal frequently collapses even when at rest in the stable, the hind limbs being unable to sustain the weight of the body. The affected limbs are cold, but the other parts of the body perspire freely, and there is considerable disturbance in the action of the heart.

The condition is serious, and it is only in cases where the smaller vessels are blocked and where the muscles receive their blood supply from the collateral vessels that recovery can be expected. In most other cases the condition tends to progress, and the symptoms become more accentuated.

Little can be done in the way of treatment. Regular exercise or work should be recommended, with the object of assisting circulation through the collateral vessels.

In some cases the thrombus may be felt by passing the hand up the rectum, and in such cases attempts have been made to assist recovery by breaking down the thrombus by compression. The results, however, have not been satisfactory. But it will be evident that such exploration by the rectum may be of assistance in forming a positive diagnosis.

The following case, reported by Wallis Hoare, is interesting:

"The animal, aged about nineteen years, according to the owner, had been left idle in the stable from April 15 to April 17, in consequence of lameness in the near hind leg; she was put to walking exercise on April 18 for about one hour and appeared perfectly well. On the morning of April 19 she was put in double harness in order to drive the owner to town, and started very fresh, but after going a short distance from the stable, she appeared to go very lame in the off hind leg and quickly lost all power over the limb, and attempted to lie down.

She was with difficulty taken out of harness, and commenced to sweat profusely and to exhibit marked distress, pawing violently with each fore foot alternately. She was removed to the nearest stable and

immediately lay down and commenced to struggle, after a time this passed off and the hind limb seemed to be powerless.

The owner of the stable, a retired Army Surgeon, diagnosed a fracture of the bones in the region of the fetlock, and proceeded to apply sundry bandages all over the affected limb. After about an hour's delay, the mare was led to her own stable, a short distance away, walking with great difficulty.

There was slight hardening of the gluteal muscle, and when the animal was turned in the stall, marked loss of motor power in the off hind leg. The bladder, on examination was found empty, the pulse quick and irregular, and the animal was disinclined for movement of any kind.

A definite diagnosis was impossible, and the groom stated that no urine had been passed since the attack commenced.

Thinking it a case of Azoturia, a physic ball was given and fomentations applied to the loins and gluteal region and a few doses of spts. aeth. nit. prescribed.

April 20.—The mare appeared much brighter, but the lameness was the same as yesterday. The groom stated that a large quantity of dark-coloured urine had been passed. On examining the urine, none of the characteristics of Azoturia were observed.

On examining the affected limb, it was found from the hock to the foot was deathly cold, and there was no response to the prick of a pin in this region, nor could pulsation be detected in any of the superficial vessels. The coronet and foot were also cold. Above the hock the parts appeared normal.

A rectal examination as well as a vaginal, showed that the pulsations in the external iliac artery appeared smaller than normal. The termination of the posterior aorta appeared enlarged and more resistant to the touch than normal, and each pulsation communicated a peculiar thrill to the fingers. The vessels of the near hind limb seemed to be normal. An examination of the muscles of the off hip showed marked atrophy.

The pulse was irregular and rather weak, and also gave a peculiar thrill to the fingers ; cardiac examination showed the second sound of the heart slightly indistinct.

The affected limb was slightly swollen, and at times the animal would stand level on it. The rectal examination appeared to cause a great deal of distress.

April 21.—Lameness slightly improved, the owner stated at times he observed the mare to bend the hock of the near hind leg in a peculiar manner outwards and to place the foot behind the off hind fetlock for short periods.

A diagnosis of thrombosis of the iliac artery was given and destruction was advised. This the owner, at first, did not like, saying he preferred to have the animal on grass as she was an old favourite, so he decided to let her stay on for a week.

April 26.—Owner telegraphed to say that the mare was much improved, the lameness was slight, and that circulation had returned to the limb.

On attendance the limb was found normal to the touch, and the animal able to walk well. On trotting her for a short distance the want of power was apparent, and she knuckled over on the fetlock. The pulse still gave the peculiar thrill of the fingers.

Being very anxious for a post-mortem examination, the owner was persuaded to have the animal destroyed.

May 2.—After walking to the place arranged, about three and a half miles, the lameness became excessive, and the animal could not have gone much farther. It took 1 lb. 9 oz. of chloroform to destroy her, and on this point there are some interesting details for a future note on anæsthetics.

Autopsy.—Immediately after death. On removing the abdominal organs, a very large, dark-coloured tumour was apparent on the right side of the posterior aorta, a short distance above its division. This proved to be an enormous aneurism. Its walls were so thin that it was

surprising how rupture did not occur during the casting and struggling. It contained a large amount of blood clot in various stages of organisation, some portions being of quite recent origin. The right external iliac artery was completely plugged with a firm thrombus of a pale yellow colour, and the vessel was much smaller than normal, and felt like a firm cord. The muscles of the off quarter were wasted to a marked degree and very pale in colour.

Remarks.—The similarity between some of the symptoms of azoturia and those of the above case is a point worthy of attention. In such an instance the history of the case is apt to lead to an erroneous diagnosis.

This animal had been in her owner's possession for a period of twelve years, and was never known to have anything amiss with her. The coachman stated that of late years she appeared to show some weakness of the hind limbs when going down a hill, but this he attributed to the animal getting old. The owner stated that the above was pure imagination.

The case is thought interesting from many points of view, one of which is that affections of this nature may be in existence without showing any appreciable symptoms. Had this animal been cast and chloroformed for any operation, it is very likely that she would have succumbed, and unless a post-mortem were made the fatality would have been attributed to the anæsthetic. However, as events proved, she showed marked resistance to the toxic effects of this agent.

THE VEINS

The digital veins, in their origin and relationships, resemble the corresponding veins of the fore limb, and, like those of the latter, they form a venous arch across the back of the limb just above the fetlock and between the suspensory ligament and the perforans tendon.

From this arch the blood is carried by the *three metatarsal veins.*

The Internal Metatarsal Vein.—This is the largest of the veins of the metatarsal region. It leaves the venous arch referred to and ascends the inner aspect of the limb on the edge of the perforans tendon. Behind the vein is the internal plantar nerve, and between these two structures is the internal unnamed artery which descends from the tarsal arch. When it reaches the upper third of the metatarsus it inclines forwards and upwards, crossing the inner small metatarsal bone and also the large metatarsal ; upon the latter there is frequently present a faint groove indicating the course taken by the vein. It now passes obliquely over the seat of spavin being crossed by the cutaneous branch of the posterior tibial nerve, whilst the vein runs over the cunean division of the tendon of the flexor metatarsi muscle. It runs up the inner aspect of the leg as the anterior root of the internal saphena vein, and is joined by the posterior root on reaching the upper third of the inner aspect of the tibia.

The course of this vein is very apparent in the living animal, where it crosses the seat of spavin. Its position should be noted when pyro-puncturing an exostosis in this region, and also when performing the operation of cunean tenotomy. When the vessel is abnormally distended it gives rise to the condition commonly known as *blood spavin.* The vessel may be raised prominently owing to the pressure upon it of some enlargement, such as an exostosis, or the synovial capsule of the joint in cases of bog spavin.

The External Metatarsal Vein.—From the venous arch near the fetlock this vein runs up the outer aspect of the limb on the edge of the perforans tendon. The external plantar nerve and the external unnamed artery occupy similar relationships to this vein, as do the corresponding structures on the inner aspect of the limb to the internal metatarsal vein. Near the upper end of the metatarsal region it communicates with the deep metatarsal vein, and it then passes upwards through the tarsal sheath. It runs obliquely upwards and inwards, and when it leaves the sheath above the hock it is found on the inner

aspect of the limb in front of the tendo-Achilles, where is is regarded as the posterior root of the internal saphena vein. It takes a course up the leg which is obliquely upwards and forwards, crossing the posterior tibial artery and the popliteus muscle, and joins the anterior root of the internal saphena vein in the manner already described.

The Deep Metatarsal Vein.—This runs up the metatarsal region on the back of the large metatarsal bone, and between it and the suspensory ligament. Near the hock it is joined by a branch from the external metatarsal vein, and then passes forwards through the cuboido-scaphoido-cunean canal alongside the perforating metatarsal artery, and on leaving the canal it becomes the principal root of the anterior tibial vein.

The Anterior Tibial Vein.—This is a large vein which is frequently double, and it commences at the front of the tarsus by the union of a number of vessels, the chief of which is that which comes forward through the canal referred to above. The vein follows the course taken by the corresponding artery, and is therefore deeply seated. Running up the front of the tibia, it passes backwards through the tibio-fibular arch and joins the posterior tibial vein to form the popliteal vein.

The Posterior Tibial Vein.—This vein commences near the hock in front of the tuber calcis, its roots communicating with the saphena veins. It follows the course of the posterior tibial artery, and terminates by assisting to form the popliteal vein by uniting with the anterior tibial vein as already stated, the union taking place on the deep face of the popliteus muscle.

The Internal Saphena Vein.—This vein has two roots which are the upward continuations of the internal and external metatarsal veins, and which unite in the manner already described. The enormous vein thus formed continues its upward course on the surface of the sartorius muscle, and usually passes into the interstice between this muscle and the gracilis to join the femoral vein. Occasionally, however, it may be found to join the pudic vein.

The External Saphena Vein.—This vein begins at the hock on the outer aspect of the os calcis, where it communicates with the posterior root of the internal saphena vein through a network of small veins which runs across the front of the tuber calcis. It also communicates with the posterior tibial vein. It is very superficially placed and passes upwards along the outer side, and slightly in front of the tendon of the gastrocnemius muscle, following the course taken by the external saphena nerve. It communicates with the femoro-popliteal vein and terminates by joining the popliteal vein.

The Popliteal Vein.—This vein is formed by the union of the anterior and posterior tibial veins, and runs up the posterior face of the posterior common ligament of the stifle joint alongside the popliteal artery, where both are covered by the popliteus muscle.

The Femoral Vein.—This is the upward continuation of the popliteal vein, and is in turn continued upwards as the external iliac vein. It follows the course taken by the artery of the same name, and receives affluent vessels which are satellites of the branches of the artery. In addition it receives the internal saphena vein, and the prepubic vein.

The Internal Iliac Vein.—The satellite veins of the branches of the homonymous artery unite and form a short trunk which forms the common iliac vein by joining the external iliac, or they may open directly into the common iliac vein.

The External Iliac Vein.—This is the continuation of the femoral vein, and it forms the chief root of the common iliac vein, of which the internal iliac may be regarded as a collateral affluent. It begins at the brim of the pelvis and runs upwards behind the artery, receiving during its course the circumflex-iliac vein.

The Common Iliac Vein.—This is found between the internal and external iliac arteries, and is a vein of considerable size. Of the two veins the left is the longer, and it is related above to the body of the last lumbar vertebra and below to the posterior extremity of the

posterior aorta. The right vein is related inferiorly near its termination to the external iliac artery, which vessel it crosses to assist in forming the posterior vena cava.

THE LYMPHATICS

As in the fore limb, the lymph from the foot is carried by lymphatic vessels which follow the course of the digital veins. Leaving these veins, they run along the course of the metatarsal veins, so that in septic infection of the foot—such as we get in some cases of gathered nail, quittor, &c.—the infection quickly spreads up the limb, and the swelling appears in this limb also on either side of the tendons of the flexors of the digit. The swelling extends with rapidity from the metatarsal region up the leg, and is particularly evident along the course of the internal and external saphena veins.

Infection also spreads along the course of the anterior and posterior tibial veins. But these veins are more deeply seated, and, consequently, swelling along their course is not so apparent on the exterior of the limb.

The Popliteal Lymphatic Glands.—These small glands are placed near the popliteal artery between the biceps femoris and semitendinosus muscles. The group consists of four or five small lobules, and their afferent vessels are derived from the region of the hock. They drain also the lymph from the back and inferior portion of the gluteal region. Efferent vessels from this group pass to the deep inguinal glands.

The Precrural Glands.—These glands, which are from twelve to fourteen in number, are arranged in a chain along the course of the circumflex-iliac artery. Their afferent vessels drain the lymph from the anterior and inner aspects of the thigh, and the efferent vessels join the iliac glands.

The Iliac Glands.—These are fewer in number than the precrural glands. Of these there are usually five or six, and they are arranged in a cluster between the two divisions of the circumflex-iliac artery. In addition to the afferent vessels from the precrural glands, other vessels which run to this group drain the lymph from the wall of the abdomen. The efferent vessels pass to the sublumbar glands.

The Superficial Inguinal Glands.—In this group there are from ten to twelve lobules arranged in a short chain along the course of the subcutaneous abdominal artery. They are placed immediately in front of the external abdominal ring. The afferent vessels to this group drain the lymph from the sheath and scrotum, the abdominal wall, and the inner aspect of the thigh. The efferent vessels, which, of course, are fewer and larger, pass into the inguinal canal, following therein the course of the inguinal nerves and the external pudic artery. They leave the canal by the internal abdominal ring and pass to the deep inguinal glands.

The Deep Inguinal Glands.—This a group of large glands which are found in the upper part of the interstice between the sartorius and gracilis muscles in relation to the femoral vessels, the course of which they follow. They extend from the brim of the pelvis for a distance of eight to ten inches along the course of the artery. The glands vary in colour, some being grey, whilst others are brown or may be nearly black. In addition to the vessels which come from the superficial inguinal group, other afferent vessels to this group drain the lymph from the superficial vessels which follow the course of the internal saphena vein, whilst others are deeply seated along the course of the femoral vein. The afferent vessels proceed along the course of the external iliac artery to the sublumbar glands.

In cases of such infections as lymphangitis, in which the glands become very much enlarged, the deep inguinal glands may be distinctly felt by palpating between the sartorius and the gracilis muscles.

The Sublumbar Glands.—The afferent vessels to these glands drain the lymph from the hind limb, from the pelvis, the abdominal

wall, and the inguinal region. They may be described in three groups :

(*a*) A small group (or may be only a single gland) which is placed in the angle between the two internal iliac arteries.

(*b*) A group placed between the internal and external iliac arteries.

(*c*) A group placed around the roots of the spermatic and posterior mesenteric arteries.

MUSCLES OF THE HIND LIMB

MUSCLE	ORIGIN	INSERTION	ACTION	NERVE-SUPPLY
Gracilis	Ischio-pubic symphysis	Internal straight ligament of patella, interval between anterior and internal tuberosities of tibia, and into the deep fascia of the limb	Adductor of limb and inward rotator	Obturator
Sartorius	Iliac fascia	Internal straight ligament of patella	Adductor and inward rotator of limb and flexor of the hip joint	Internal saphena
Pectineus	Brim of pelvis and inferior surface of pubis, and part from pubio-femoral ligament	Inner surface of femoral shaft near nutrient foramen	Adductor of limb and flexor of hip	Obturator
Adductor parvus	Inferior aspect of pubis	Middle or back of the femur	Adductor of limb and outward rotator of hip	Obturator

MUSCLE	ORIGIN	INSERTION	ACTION	NERVE-SUPPLY
Adductor magnus	Inferior aspect of ischium and tendon of origin of the gracilis	Back of femur above femoral groove and supra-condyloid crest	Adductor of limb	Obturator
Semimembranosus	Inferior aspect of ischium, tuber ischii, and coccygeal fascia	Inner condyle of femur near internal lateral ligament of the stifle	Adductor of limb and extensor of hip; also assists in rearing	Great sciatic
Quadratus femoris	Body of ischium in front of tuber ischii	Back of femur on level with third trochanter	Extensor and outward rotator of hip	Great sciatic
Obturator externus	Inferior aspect of pubis and ischium	Trochanteric fossa	Extensor and outward rotator of hip	Obturator
Psoas magnus	Last two ribs and from sixteenth dorsal to fifth lumbar vertebræ	Internal or small trochanter of femur with iliacus	Flexor and outward rotator of hip	Lumbars
Iliacus	Iliac surface and external angle of ilium and great sacro-sciatic ligament	Internal or small trochanter of femur with psoas magnus	Flexor and outward rotator of hip	Lumbars
Semitendinosus	Spines of sacrum and sacro-sciatic ligament (1st division), and tuber ischii (2nd division)	Tibial crest and fascia of leg	Inward rotator of limb and flexor of stifle; also assists in rearing	Posterior divisions of gluteals and great sciatic

MUSCLE	ORIGIN	INSERTION	ACTION	NERVE-SUPPLY
Obturator internus	Area around obturator foramen within the pelvis	Trochanteric fossa	External rotator of hip	Great sciatic
Pyriformis	Pelvic surface of the ilium	Trochanteric fossa	External rotator of hip	Great sciatic
Gemelli	Outer border of ischium	Trochanteric fossa	External rotator of hip	Great sciatic
Superficial gluteus	Angle of haunch and gluteal fascia	Third trochanter of femur and slip to great sacro - sciatic ligament	Abductor of the hip	Gluteal nerves
Middle gluteus	Gluteal surface of ilium, gluteal fascia, and fascia covering the longissimus dorsi, great sacro-sciatic ligament, and superior and inferior iliosacral ligaments	Summit of great trochanter, trochanteric ridge and trochanteric crest	Abductor and extensor of hip	Gluteal nerves
Deep gluteus	Superior ischiatic spine and gluteal surface of ilium	Inner side of convexity of femur	Abductor and inward rotator of hip	Gluteal nerves
Tensor vaginæ femoris	Angle of the haunch	Fascia of the leg	Flexor of hip and slight extensor of stifle	Gluteal nerves

MUSCLE	ORIGIN	INSERTION	ACTION	NERVE-SUPPLY
Biceps femoris or triceps abductor femoris	Sacral spines, coccygeal fascia, tuber-ischii, and great sacro-sciatic ligament	Anterior face of patella, tibial crest, and fascia of leg, and also a slip to back of third trochanter of femur	One division extends stifle and abducts hip; two other divisions flex stifle and rotate it outwardly	Gluteal and great sciatic nerves
Vastus externus	Outer and anterior surfaces of femoral shaft	Anterior face of patella	Extensor of stifle	Anterior crural
Vastus internus	Inner and anterior surfaces of femoral shaft	Anterior face of patella	Extensor of stifle	Anterior crural
Rectus femoris	Two pits above acetabulum (on ilium)	Anterior face of patella	Extensor of stifle and flexor of hip	Anterior crural
Rectus parvus	Above acetabulum (on ilium)	Anterior surface of femoral shaft	Raises capsular ligament of hip	Anterior crural
Extensor pedis	Pit between external lip of trochlea and external condyle of femur	Pyramidal process of pedal bone	Flexor of hock and extensor of fetlock, pastern and coronopedal joints	Anterior tibial
Flexor metatarsi (sup. div.)	Pit between external lip of trochlea and external condyle of femur	Supero-anterior portion of large metatarsal, and to cuboid	Flexor of hock	Anterior tibial

MUSCLE	ORIGIN	INSERTION	ACTION	NERVE-SUPPLY
Flexor metatarsi (deep div.)	Outer surface of tibia near the superior extremity and deep face of tendinous portion	Supero-anterior portion of large metatarsal and to cuneiform parvum	Flexor of hock	Anterior tibial
Peroneus	External lateral ligament of stifle, head of fibula, and inter-muscular septum between it and perforans	Tendon of extensor pedis	Abductor of limb and assists extensor pedis	Musculo-cutaneous division of external popliteal
Extensor brevis	Outer side of calcis and astragalus	Common tendon of peroneus and extensor pedis	Assists extensor pedis	Anterior tibial
Gastrocnemius	Supra-condyloid crest and outer lip of supra-condyloid fossa	Upper extremity of tuber calcis	Extensor of hock	Internal popliteal
Soleus	Head of fibula	Tendon of gastrocnemius	Assists gastrocnemius	Internal popliteal
Flexor perforatus	Bottom of supra-condyloid fossa	Either side of os calcis and to os coronæ	Extensor of hock and flexor of fetlock and pastern joints	Internal popliteal
Popliteus	Anterior of two pits on external condyle of femur	Posterior surface and inner border of tibia	Flexor and inward rotator of stifle	Internal popliteal

MUSCLE	ORIGIN	INSERTION	ACTION	NERVE-SUPPLY
Flexor perforans	Outer tuberosity of tibia, head of fibula, tibio-fibular inter-osseous membrane, and back of tibia	Semilunar crest and tendinous area of pedal bone	Extensor of hock and flexor of fetlock, pastern, and coronо-pedal joints	Internal popliteal
Flexor accessorius	External tuberosity of tibia	Tendon of flexor perforans	Assists perforans	Internal popliteal
Lumbricales (two)	Tendon of perforans	Tissue at back or sides of fetlock		Plantar
Interossei (two)	Head of splint bone of own side	Band of suspensory ligament running to extensor pedis		Plantar

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