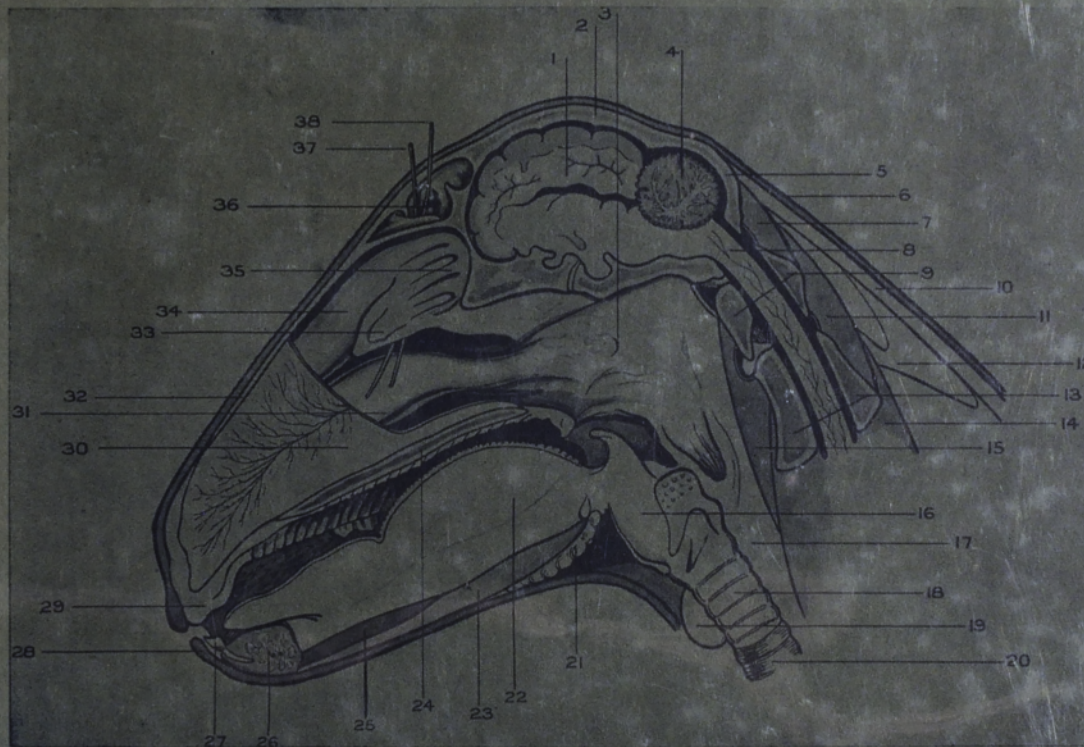


ANATOMICAL DIAGRAMS OF THE EWE.



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WELLINGTON.

BY AUTHORITY: JOHN MACKAY, GOVERNMENT PRINTER.

1904.

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EPUB ISBN: 978-0-908329-82-3

PDF ISBN: 978-0-908332-78-6

The original publication details are as follows:

Title: Anatomical diagrams of the ewe : a key to the large chart of a pregnant ewe, with explanatory notes

Author: Wilkie, Henry C. (Henry Charles)

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

ANATOMICAL DIAGRAMS OF THE EWE.

A KEY TO THE LARGE CHART OF A PREGNANT EWE,

WITH EXPLANATORY NOTES,

BY

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ANATOMICAL DIAGRAMS OF THE EWE.

PREFACE.

EVERY ONE who has undertaken the task of teaching the rudiments of veterinary anatomy to students, or the delivery of lectures on first-aid to farmers, has no doubt felt the want of large anatomical diagrams for use in the lecture-hall. I have attempted to supply some of the most commonly needed of these by a series of drawings, some in colours and some in black-and-white, of which the sectional diagram of the ewe is, perhaps, the most elaborated.

This has been built up from a large number of dissections which I made for the purpose, such parts as the *fetal envelopes*, the *placentalæ*, the *bladder*, &c., which do not lend themselves to direct representation, being rendered purely diagrammatically for the sake of clearness.

The original drawing, which was lithographed without reduction, measures 50 in. by 36 in., the figure being the natural size of a moderately large ewe.

In the key to this diagram I have made special drawings of the *head*, the *thorax*, and the *lamb as it lies in the uterus immediately before birth*.

In preparing the letterpress I have aimed at giving such a concise description of all the principal parts represented as will enable any one unacquainted with anatomy to gain a correct idea of their uses in the economy.

The *technical terms* used are explained by their derivations, as I believe even a casual inquiry into the origin of anatomical terms in common use is sufficient not only to arouse much interest in the student, but to impress the position of parts and the names of parts indelibly upon his memory.

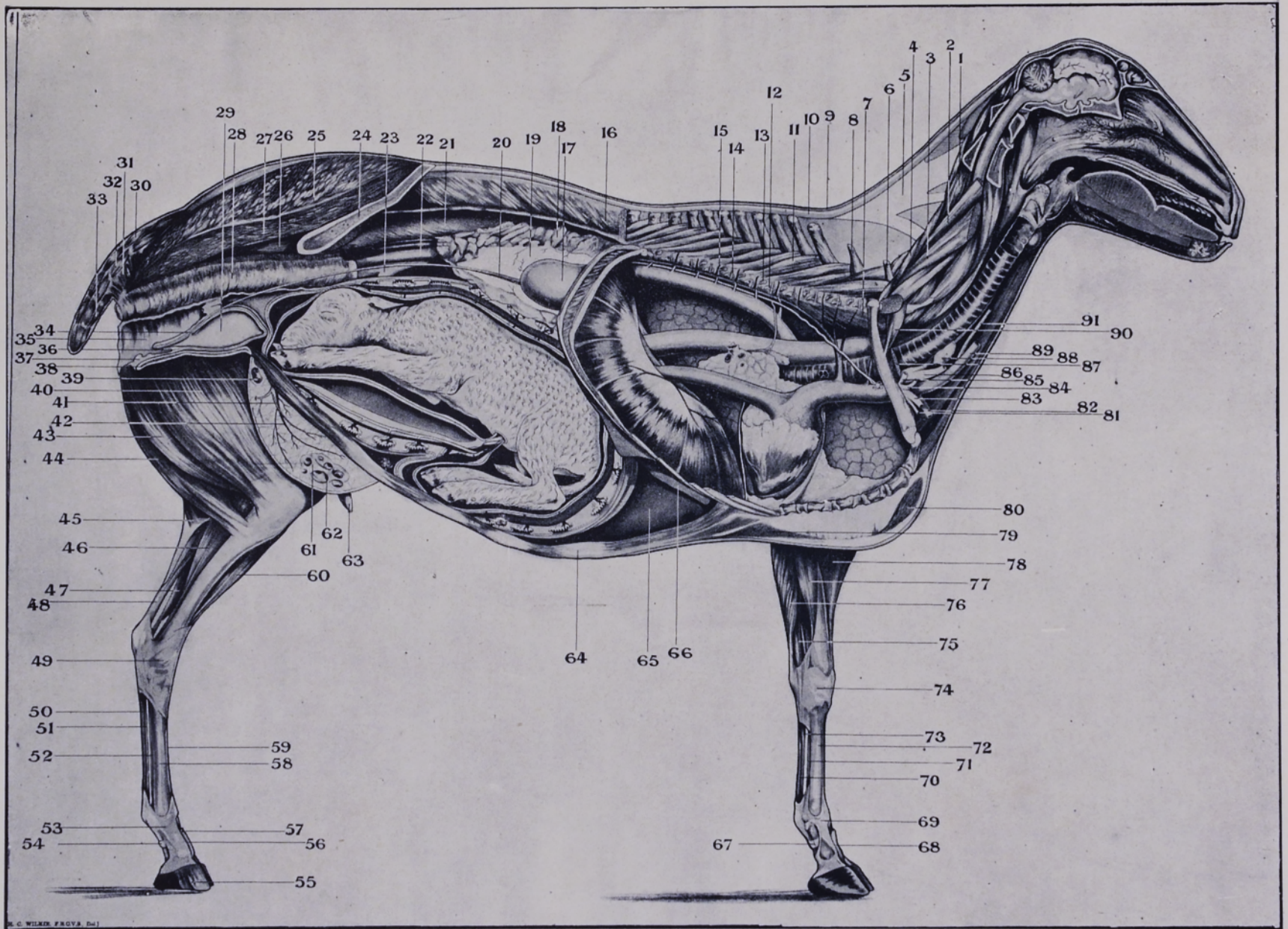
H. C. W.

Dunedin, New Zealand, 14th May, 1904.

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FIG. I.



LONGITUDINAL SECTION OF THE PREGNANT EWE.

Entered at Stationers' Hall, 1903.]

[Drawn by H. C. WILKIE.

REFERENCES TO FIG. I.

1. ONE of the fasciculi of the *transversalis colli*, a muscle which covers the sides of the last five bones of the neck—the cervical vertebræ. The action of this muscle is to extend and flex, or bend, the neck.
- 2, 3. Two of the six *intertransversales* muscles, the action of which is to bend the neck sideways.
4. A fasciculus of the *transversalis colli* muscle.
5. The middle portion of the *ligamentum nuchæ*, a ligament which is the chief support of the head in quadrupeds. The analogue of this ligament in man is a thin fibrous band extending from the tubercle and spine of the occiput to the spinous process of the seventh cervical vertebra. In the sheep the *ligamentum nuchæ* has a specially strong white middle portion, as here represented.
6. The *superior spinous process* of the seventh cervical vertebra. This bone is distinguished by the name of *prominens*, which it better deserves in the sheep and the ox than in the horse, in which animal the process is relatively very much smaller.
7. The *longus colli* muscle, which is attached to the under-surface of all the bones of the neck and the first six bones in the back. Its action is to bend the neck.
8. The *superior spinous process of the first dorsal vertebra*.
9. Skin.
10. The *common superspinous ligament*, which extends to the sacrum, or roof of the pelvis.
11. One of the fasciculi of the *transverse spinous muscles*, which is continuous with the *transversalis colli*. It is an extensor of the spine.
12. A *facet* for articulation with the head of a rib. In the formation of these facets two vertebræ take part, as is seen in the diagram.
13. A *facet* for the reception of the tubercle of a rib.
14. An *intervertebral cartilage*. This is a thick fibrous cartilage interposed between the bodies of the vertebræ.

FASCICULI.—Latin, *fasciculus*, a small bundle.
 TRANSVERSALIS.—Latin, *transversalis*, lying across.
 COLLI.—Latin, *collum*, the neck.
 CERVICAL.—Latin, *cervicis*, of the neck; *cervix*, the neck.
 VERTEBRÆ.—Bones of the spinal column. Latin, *vertebra*, a joint: from *verto*, I turn.
 INTERTRANSVERSALES.—Latin, *inter*, between; *transversus*, lying across.
 LIGAMENTUM.—Latin, *ligo*, I bind.
 NUCHÆ.—Latin, *nuchæ*, of the nape of the neck.
 OCCIPUT.—Latin, *occiput*, the back part of the head.
 DORSAL.—Latin, *dorsum*, the back.
 FACET.—French, *facette*, a small face, a smooth circumscribed surface.
 ARTICULATION.—Latin, *articulus*, a joint.
 INTERVERTEBRAL.—Latin, *inter*, between; English, vertebral, between the vertebræ.
 CARTILAGE.—Latin, *cartilago*, gristle.

15. A branch of the *great vena azygos* described under Fig. III.
16. A portion of the *longissimus dorsi*, the most powerful muscle of the body. This muscle is cut in front to show underlying structures, and also at the side. It is mainly an extensor of the spine, or when one muscle acts singly it bends the body to the side.
17. The *right kidney*. The kidneys are organs which secrete urea and other waste products from the system, and are situated in the lumbar region behind the peritoneum. They are not lobulated in the sheep as in the ox, and are situated in a mass of fat which extends from behind the twelfth rib to the transverse process of the fifth lumbar vertebra.
18. Fat.
19. Cut surface of the *renal or kidney fat*.
20. The *ureter*, a tube which conveys the urine from the kidney to the bladder.
21. The *great psoas muscle*. This muscle is attached to the bodies of the two last dorsal and the lumbar vertebræ, under the transverse processes of which it is seen to be lying in the diagram. Its posterior attachment is to a process on the femur (the internal trochanter). Its action is to bend the thigh and turn it outwards, or when the thigh is a fixed point it bends the loins.
22. The *posterior vena cava*. Described under Fig. III.
23. The *abdominal or posterior aorta*. Described under Fig. III.
24. Cut bone. This is a portion of the pelvis, the *ilium*.
25. Cut section of the *gluteus externus muscle*, an extensor and a rotator of the thigh.
26. Cut section of the *gluteus internus*, or deep gluteal muscle. This is an abductor of the thigh.

LONGISSIMUS.—Latin, *longissimus*, very long.

DORSI.—Latin, *dorsi*, of the back.

KIDNEY.—Old English, *kidnere*, or *kidnei*.

LUMBAR.—Latin, *lumbus*, the loin.

PERITONEUM.—A serous membrane which lines the whole of the abdomen, and is stretched over or envelopes more or less completely the contained viscera. The kidneys, however, are behind the peritoneum. Greek, *peritonaiion*, that which is stretched over—*peri*, around; *tenio*, I stretch.

RENAL.—Latin, *renes*, the kidneys.

URETER.—Greek, *oureter*. One of the passages through which the urine flows from the kidneys to the bladder.

PSOAS.—Greek, *psoa*, the loins.

FEMUR.—Latin, *femur*, the thigh.

TROCHANTER.—Greek, *trochao*, I roll round.

PELVIS.—Latin, *pelvis*, a basin.

ILIUM.—A bone which forms the major part of the pelvis. Latin, *ilia*, the flanks.

GLUTEUS.—Greek, *gloutos*, the hip.

ABDUCTOR.—Latin, *abductor*, that which draws outwards.

27. Cut section of the *gluteus maximus*, or middle gluteal muscle. This muscle extends the thigh, or, when the thigh is a fixed point, assists in raising the body, as in rearing.
28. The *rectum*, the posterior portion of the digestive canal. Its mode of attachment is here seen in the semi-transparent folds of the meso-rectum.
29. The *bladder*, the reservoir for the urine, is thin and of great capacity as in all ruminants.
At the closed end of this organ a small blunt point is seen, on which there is a cicatrix. This scar is caused by the obliteration of the *urachus*, a tube which, before birth, conveys the urine of the lamb into the sac of the allantois, as described under Fig. IV.
30. A fasciculus of the *erector coccygis*, a muscle which raises the tail.
31. A portion of the *compressor coccygis*, a muscle which depresses the whole tail.
32. A fasciculus of the *curvator coccygis* which bends the tail sideways.
33. A fasciculus of the *depressor coccygis* which bends the tail downwards.
34. Shows the *entrance of one of the ureters into the bladder*. The ureters do not enter directly into the bladder, but they first penetrate the muscular coat of the organ, and then lie for a little distance between this and the inner coat or mucous membrane before opening into the cavity of the viscus. In this way any flowing-back of the urine into the ureter is prevented.
35. The *vagina*.
36. The *meatus urinarius*, or opening of the urethra, showing the small valve surmounting a cul-de-sac on the floor of the passage.
37. The *clitoris*.
38. *Bone*, the floor of the pelvis.
39. One of the kidney-shaped *lymphatic glands of the udder*.
40. The *gracilis*—a muscle which is an adductor of the limb.

RECTUM.—Latin, *rectus*, straight.

MESO-RECTUM.—Greek, *mesos*, middle. A fold of peritoneum which supports the rectum from the front of the sacrum.

CICATRIX.—Latin, *cicatrix*, a scar.

URACHUS.—Greek, *ouron*, urine; *echo*, I hold.

COCCYGIS.—Latin, *coccyx*, the cuckoo—so named from the resemblance of the four terminal bones of the spinal column in man to the beak of the cuckoo.

VAGINA.—Latin, *vagina*, a sheath.

CLITORIS.—Greek, *kleitoris*: from *kleio*, I shut.

LYMPHATIC GLANDS.—The lymphatic or absorbent vessels, which convey waste material from the tissues to the blood-stream by way of the thoracic duct (as described under Fig. III.), pass in their course through certain rounded bodies, the lymphatic glands. In their passage through these the lymph has corpuscles added to it which afterwards become white blood-corpuscles. Latin, *lymphā*, water; *glans*, an acorn.

GRACILIS.—Latin, *gracilis*, slender. This muscle is so named on account of its flat thin conformation.

ADDUCTOR.—Latin, *adductor*, that which draws inwards.

41. The *mammary artery*.

42. The *mammary vein*.

43. The *semimembranosus muscle*, or great ischio-femorals. This is an adductor of the limb and an extensor of the thigh. When the thigh is a fixed point it raises the body, as in rearing.

44. The *semitendinosus muscle*, or ischio-tibialis medius. This is a flexor of the limb, and when the thigh is a fixed point its action is similar to that of the preceding muscle.

45. The *gastrocnemius externus muscle*, whose tendon is fixed upon the point of the hock. It extends the foot upon the leg.

46. The *oblique flexor of the phalanges*. The tendon of this muscle becomes united to the perforans tendon below.

47. The *flexor pedis perforans*, the tendon of which bifurcates opposite the fetlock-joint, the branches being ultimately attached to the third phalange of each digit. It is a flexor of the limb.

48. The tendon of the *gastrocnemius internus muscle* which turns round the tendon of the externus above the joint from the inside, and passes over the point of the hock, where it is widened to form a cap. It then extends down the back of the limb as the perforatus tendon.

49. The *external superficial ligament* of the hock.

50. The *perforatus tendon* bifurcates at the fetlock-joint to form two branches—an internal and an external. These branches pass down behind the two branches of the perforans and become attached to the upper and posterior part of the second phalange. Before reaching their attachment each branch bifurcates to allow of the passage of the underlying branch of the perforans.

51. The *perforans*. This tendon bifurcates just above the fetlock, each branch passing down behind a digit. These two branches, after passing through the two branches of the perforatus, reach the inferior surface of each third phalange, where they become blended with the plantar cushion.

52. The *superior suspensory ligament of the fetlock*.

53. The *capsular ligament of the fetlock-joint*.

54. A reinforcing *ligamentous band*.

55. The *foot*. The foot of the sheep consists of two digits, each covered with a horny claw. The heel of the claw consists of elastic rubber-like horn which immediately covers a large

MAMMARY.—Latin, *manna*, the breast.

SEMIMEMBRANOSUS.—Latin, *semi*, half; *membrana*, membrane.

SEMITENDINOSUS.—Latin, *semi*, half; *tendo*, I stretch: half-tendinous.

GASTROCNEMIUS.—Greek, *gaster*, the belly; *kneme*, the leg. So named from these muscles forming the calf or belly of the leg in man.

PHALANGES.—The bones of the fingers or toes. Greek, *phalangx*, a line of battle.

PEDIS.—Latin, *pes*, a foot.

- pad called the *plantar cushion*. The union of the claw and the underlying structures is, on the wall, by means of *laminæ*, and, on the sole, by *papillæ*, as in the foot of the horse. The leaves or laminæ are, however, finer and much more numerous in the sheep than in equine animals. Behind and above each claw is a small horny growth called the *ergot*.
56. The *interungulate gland* is a long pouch formed by an inversion of the skin. Its blind end is firmly attached behind the digits at the *bifurcation of the perforans tendon*. It passes forwards between the digits and terminates in a pointed extremity in front of the limb just below the fetlock-joint, where it is attached to the skin, in which it has a circular orifice. This pouch, which is also known as the *sinus cutaneus ungularum*, is lined with fine hairs and secretes a thick sebaceous matter. So far as the domesticated animals are concerned, it is peculiar to the sheep, and it appears to act the part of a pad or buffer between the claws.
57. The *orifice of the interungulate gland*.
58. The *large metatarsal bone*.
59. The *extensor pedis tendon*.
60. The *extensor pedis muscle*.
61. The *galactophorous sinus*, or milk-cistern. This is a reservoir in the udder for the collection and retention of the milk.
62. *Orifice of one of the lactiferous ducts* which convey the milk from the acini of the gland, where it is secreted, to the milk-cistern.
63. The *teat* of the ewe exhibits some characteristics which are found in all ovine animals. It is long, thin, and pointed, laterally placed on the udder, and projects considerably forwards as well as downwards. Its walls are thin, and it has a distinct sphincter of circular muscular fibres around the single orifice of its free extremity, which is marked by a peculiar lip-like prominence.
64. A portion of the cut *abdominal wall* turned over in section.
65. A portion of the *cavity of the abdomen* is seen here, the stomach and intestines having been removed.

PLANTAR.—Latin, *plantaris*, belonging to the sole of the foot.

LAMINÆ.—Latin, *lamina*, a thin plate or leaf.

PAPILLÆ.—Latin, *papilla*, a pimple.

ERGOT.—French, *ergot*, a cock's spur.

INTERUNGULATE.—Latin, *inter*, between; *ungula*, a hoof or claw.

BIFURCATION.—Latin, *bis*, twice; *furca*, a fork.

SEBACEOUS.—Containing fatty matter. Latin, *sebum*, tallow.

METATARSAL.—Greek, *meta*, beyond; *tarsus*, the hock.

GALACTOPHOUS.—Greek, *gala*, milk; *phoreo*, I carry.

LACTIFEROUS.—Latin, *lac*, milk; *fero*, I bear.

SPHINCTER.—Greek, *sphingktēr*, that which contracts.

66. The *liver*. Most of the blood from the alimentary canal passes through the liver on its way back to the heart, and this organ secretes bile, produces glycogen (which is concerned in the production of muscular energy and heat), and in other ways changes the blood which passes through it.
67. A reinforcing *ligamentous band*.
68. The *interungulate gland*.
69. The *capsular ligament of the fetlock-joint*.
70. The *perforatus tendon*.
71. The *superior suspensory ligament of the fetlock*.
72. The *large metacarpal bone*.
73. The *perforans tendon*.
74. The *capsular ligament of the knee-joint*.
75. The *flexor pedis perforatus muscle*. This is composed of two portions in the sheep, whose tendons unite about midway between the knee and the fetlock.
76. The *oblique flexor of the metacarpus*.
77. The *internal flexor of the metacarpus*.
78. The *extensor metacarpi magnus muscle*.
79. Cut portion of the *transverse pectoral muscle*.
80. Cut portion of the *anterior pectoral muscle*.
81. The *external thoracic artery*.
82. The *axillary vein*.
83. The *axillary artery*.
84. The *inferior cervical artery*.
85. The *subscapular artery*.
86. The *carotid artery*.
87. Cut end of the inferior portion of the *scalenus muscle*. With the rib as a fixed point this muscle flexes the neck to one side or the other, or if both muscles act together the neck is flexed directly downwards. If the neck is the fixed point the first rib is drawn forward, and thus this muscle aids in inspiration.
88. A large *lymphatic gland*—one of the prepectoral group.
89. The *jugular vein*.
90. The superior portion of the *scalenus muscle*.
91. The *accessory jugular vein*.

LIVER.—Anglo-Saxon, *lifere* or *lifer*; German, *leber*.

AXILLARY.—Latin, *axilla*, the armpit.

SUBSCAPULAR.—Latin, *sub*, under; *scapula*, the shoulder-blade.

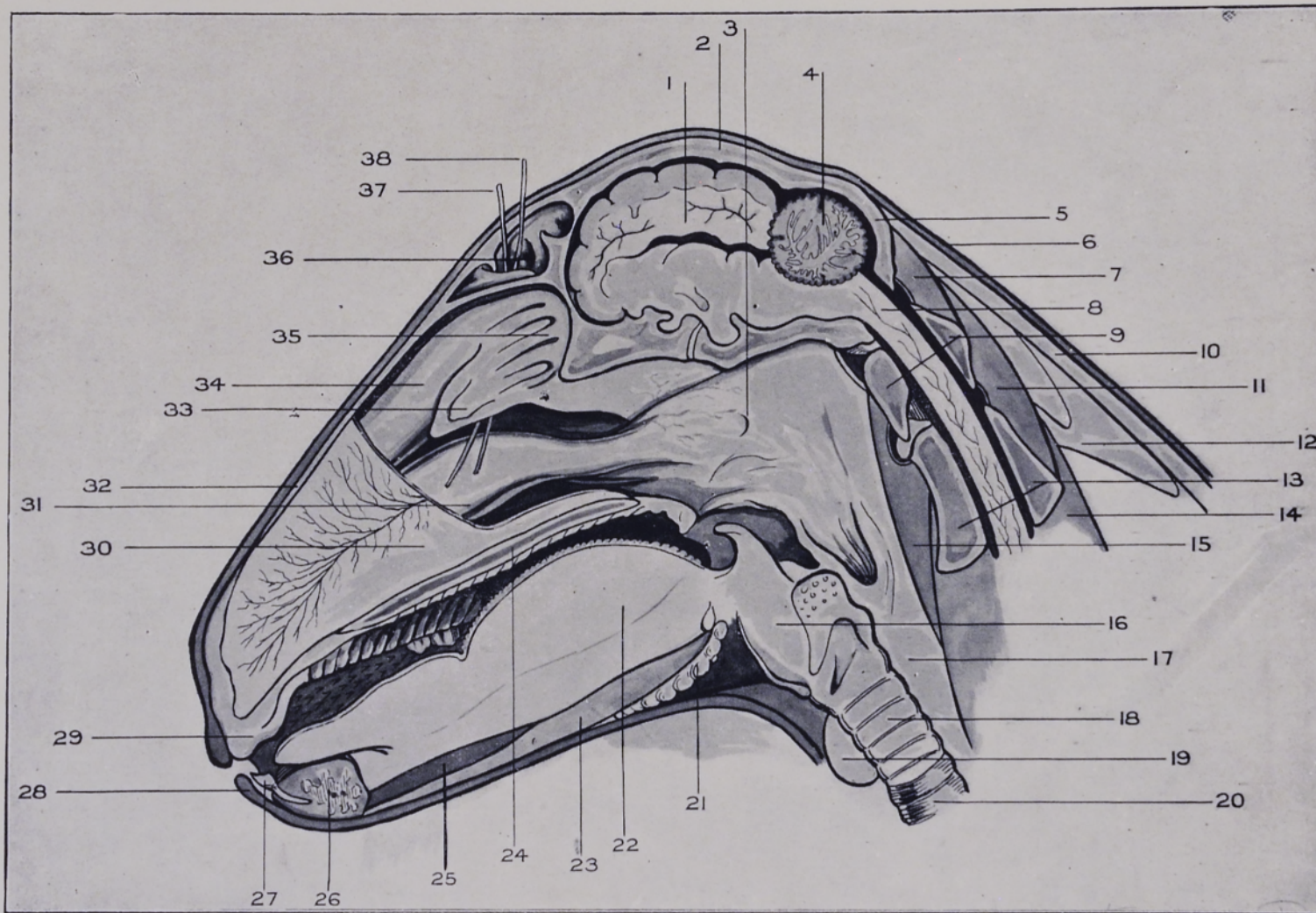
CAROTID.—Greek, *karoo*, I stupefy; deep sleep. From the idea the ancients had that deep sleep was produced by an increased flow of blood in these arteries.

SCALENUS.—Latin, *scalenus*, a triangle of unequal sides and angles.

JUGULAR.—Latin, *jugulum*, the collar-bone. This vein was so named from its proximity to the collar bone.

PREPECTORAL.—Latin, *pre* or *præ*, before; *pectoris*, of the breast.

FIG. II.



LONGITUDINAL SECTION OF THE HEAD OF THE EWE.

Entered at Stationers' Hall, 1904.]

[Drawn by H. C. WILKIE.

REFERENCES TO FIG. II.

1. THE *cerebrum*, the principal portion of the brain, which consists of two hemispheres—here seen in section.
2. The vault of the cranium.
3. The *eustachian* tube, opening into the pharynx. This is a cartilaginous canal which conveys the external air to the middle ear.
4. The *cerebellum*, or lower brain, showing the white substance enveloped on every side by the grey. This substance, ramifying from two nuclei, forms a tree-like figure which was formerly called the *arbor vitæ*.
5. The *occipital* bone.
6. Skin.
7. Muscle. The *rectus capitis posticus* minor, a small muscle which lies upon the occipito-atloid articulation, and assists in extending the head upon the neck.
8. The spinal cord as it emerges through the *foramen magnum*.
9. The *atlas*, or first bone of the neck.
10. The *cordiform* portion of the *ligamentum nuchæ*. This powerful ligament, which is the main support of the head and neck in quadrupeds, consists of two portions, a cord-like one and a lamellar. The cordiform portion extends directly from the cervical tuberosity of the occipital bone to the spinous process of the second dorsal vertebra, where it becomes continuous with the common superspinous ligament, and in this way extends right along the back to the sacrum, or that portion of the spinal column which forms a roof to the pelvis. The lamellar portion is a flat triangular ligament which fills up the space between the last six dorsal vertebræ, its cordiform portion,

- and the spinous process of the second dorsal vertebra. In the sheep this part of the *ligamentum nuchæ* shows a distinct arrangement of very strong white fibres, as is shown in Fig. 1.
11. Muscle—the great oblique muscle of the head, the *axoideo-atloideus* or *obliquus capitis inferior*. This is the special rotator of the head.
 12. The lamellar portion of the *ligamentum nuchæ*.
 13. The *axis*, or second bone of the neck.
 14. Muscle. This is a portion of the *transversalis colli*, a muscle which covers the sides of the last five cervical vertebræ. It is both an extensor and a flexor of the neck.
 15. Muscle—the *longus colli*. This muscle is attached to the under-surface of all the cervical and the first six dorsal vertebræ. That portion of it which enters the chest is seen in Fig. 1. It flexes the neck.
 16. The *larynx*—the upper portion of the windpipe, specialised as the organ of voice.
 17. The *œsophagus*, or gullet, the entrance to which is seen immediately above.
 18. The inner surface of the windpipe or *trachea*, the outer half having been cut away.
 19. The *thyroid* gland, named from its nearness to the thyroid cartilage—a shield-shaped body which forms most of the anterior wall of the larynx.
 20. The external surface of the windpipe.
 21. The *sublingual salivary* gland.
 22. Muscle—the *great hyo-glossus*. This muscle retracts the tongue.
 23. Muscle—the *genio-hyoideus*. This muscle draws the os hyoides, or bone of the tongue, forwards and downwards.
 24. The *palatine* bone, the bony basis of the palate.

CEREBRUM.—Latin, *cerebrum*, the brain.

EUSTACHIAN.—So named after the anatomist Eustachius, who first described this tube.

CEREBELLUM.—Latin, *cerebellum*, the lower or small brain.

NUCLEI.—Latin, *nucleus*, a kernel: from *nux*, a nut.

OCCIPITAL.—Latin, *occiput*, the back of the head.

RECTUS.—Latin, *rectus*, straight.

CAPITIS.—Latin, *caput*, the head.

POSTICUS.—Latin, *posticus*, behind.

FORAMEN.—Latin, *foramen*, an opening: from *foro*, I bore. The *foramen magnum* is a large opening in the occiput which allows of the passage of the spinal cord.

ATLAS.—Greek, from *a*, intensive, and *tlao*, I bear. In Greek mythology the god Atlas bore the earth upon his shoulders as the atlas, or first bone of the neck, bears the head.

LIGAMENTUM.—Latin, *ligamentum*, a band: from *ligo*, I bind.

NUCHÆ.—Low Latin, *nucha*, the nape; *nuchæ*, of the back or upper part of the neck.

LAMELLAR.—Latin, *lamella*, a small plate: from *lamina*, a plate.

CERVICAL.—Latin, *cervix*, the neck.

OCCIPITAL.—Of the *occiput*.

DORSAL.—Latin, *dorsum*, the back.

VERTEBRA.—Latin, *verto*, I turn.

SUPERSPINOUS.—Above the spine.

AXOIDEO-ATLOIDEUS.—*Axis*, the second bone of the neck; *atlas*, the first bone.

TRANSVERSALIS.—Latin, *transversalis*, lying across.

COLLI.—Latin, *collum*, the neck.

LONGUS.—Latin, *longus*, long.

LARYNX.—Greek, *larunx*, the upper part of the windpipe.

ŒSOPHAGUS.—Greek, *oisophagus*, the gullet: from *oio*, I bear; *phago*, I eat.

TRACHEA.—Greek, *tracheia*, the windpipe.

THYROID.—Greek, *thureos*, a shield; *eidōs*, a resemblance.

SUBLINGUAL.—Under the tongue. Latin, *lingua*, the tongue.

SALIVARY.—Secreting saliva. Latin, *saliva*, the spittle.

HYO-GLOSSUS.—*Hyo*, from the Greek letter upsilon, the shape of the hyoid bone, a U-shaped bone between the tongue and the larynx; *Glossus*—Greek, *glossa*, a tongue.

GENIO-HYOIDEUS.—*Genio* signifies a connection with the jaw. Greek, *geneion*, the chin.

OS.—Latin, *os*, a bone.

PALATINE.—Latin, *palatus*, the palate.

25. Muscle—the *genio-glossus*. The action of this muscle is much diversified, as it can bring the tongue forward, draw it downward to the floor of the mouth, or carry it upward into the cavity of the mouth.
26. Bone in section where the two branches of the lower jaw have been sawn through.
27. One of the incisor teeth.
28. The lower lip.
29. The dental pad—a thick cartilaginous pad which in ruminants represents the upper incisors of other animals.
30. The middle cartilaginous septum of the nose. This is covered by a membrane variously known as the *pituitary*, the *olfactory*, and the *schneiderian membrane*. This membrane also covers the inside of the nasal cavities and the *turbinated bones*, the great *ethmoidal cell* or *olfactory antrum*, and is continuous with the mucous membrane of the *pharynx*.

PITUITARY.—That which secretes mucus or phlegm. Latin, *pituita*, phlegm.

OLFACTORY.—Latin, *olfactum*, to smell.

SCHNEIDERIAN.—Named after the anatomist who first described this membrane.

TURBINATED.—Latin, *turbinatus*, pointed like a cone.

ETHMOIDAL.—Greek, *ethmos*, a sieve. The ethmoid bone is perforated like a sieve to allow of the passage of the olfactory nerves.

ANTRUM.—Latin, *antrum*, a cavern.

PHARYNX.—Greek, *pharungx*, a muscular pouch at the mouth which terminates in the gullet.

This is a highly specialised membrane, in which the fibres of the *olfactory nerve* ramify. The olfactory nerve is one of special sense—that of smell.

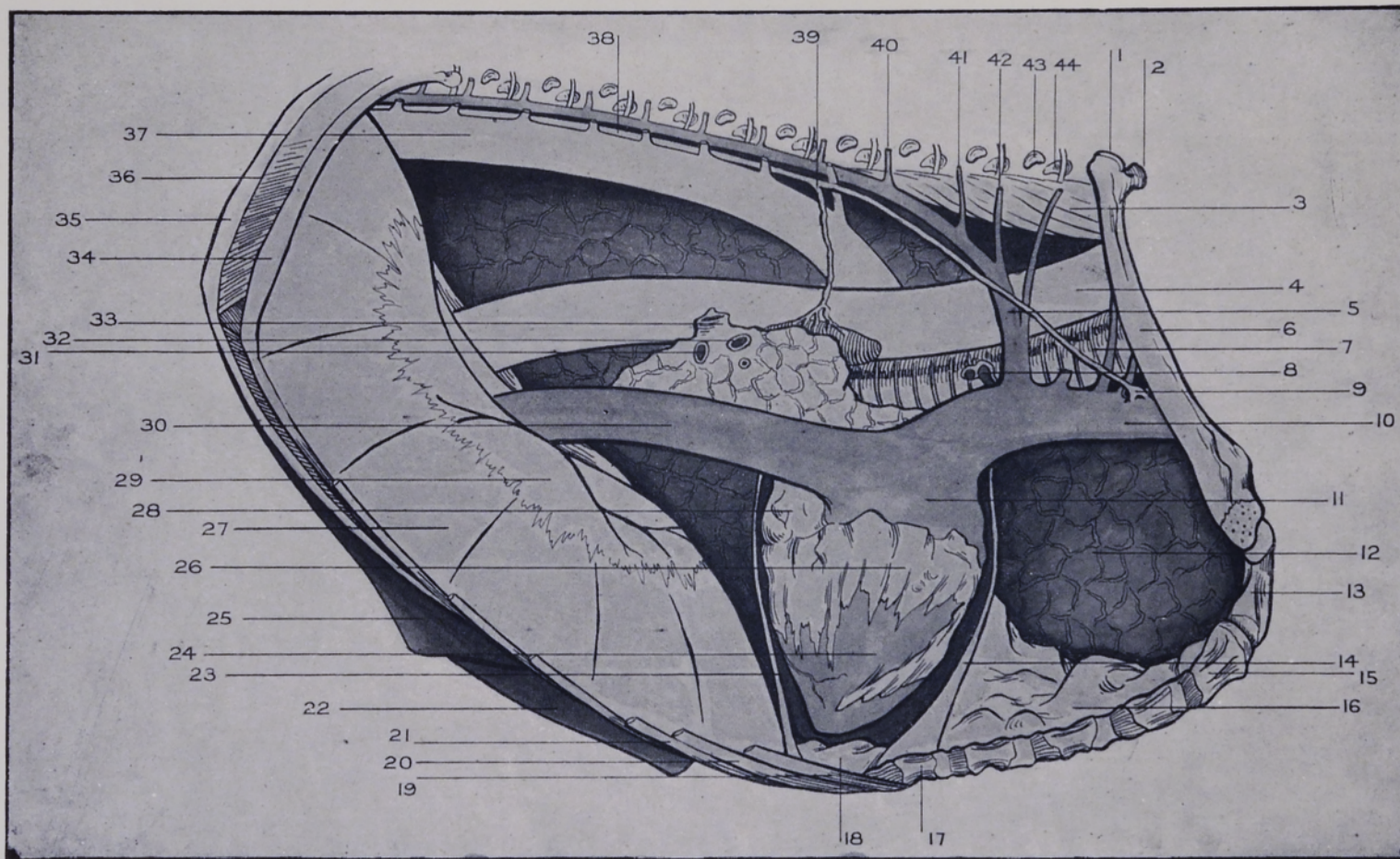
31. The *maxillary* turbinated bone. The turbinated bones are composed of compact tissue, but they are extremely thin and paper-like, and are so rolled upon themselves as to afford an extended surface for the display of the *pituitary* membrane.
32. The *nasal* bone.
33. The great *ethmoidal* cell, or *olfactory antrum*. This is very largely developed in ruminants, so much so as to appear almost like a *third turbinated bone*.
34. The *ethmoidal turbinated* bone.
35. The *ethmoidal volutes*.
36. The sinus or air-space between the outer and inner plates of the frontal bone. This communicates with the nasal cavity by means of two large circular openings which traverse a very thin convoluted bony partition and open into the nasal chamber beneath the *great ethmoidal cell*. In the diagram, at Nos. 37 and 38, these two openings are traversed by probes, which serve to show the direction of the air-passages.

MAXILLARY.—Latin, *maxilla*, the jaw.

NASAL.—Latin, *nasus*, the nose.

VOLUTES.—Latin, *volutus*, twisted: from *volvo*, I roll.

FIG. III.



LONGITUDINAL SECTION OF THE THORAX.

Entered at Stationers' Hall, 1904.]

[Drawn by H. C. WILKIE.

REFERENCES TO FIG. III.

1. THE tubercle of the *first rib*.
2. The head of the same rib.

Each rib articulates with two vertebræ by its head, which is received into an intervertebral articular cavity, as seen at No. 44, and the tubercle corresponds with a facet on the transverse process of posterior vertebra, No. 43.

3. The *longus colli* muscle. Described under Fig. II.
4. The *œsophagus*. This tube conveys the food from the pharynx to the stomach. It is here seen on its course through the chest and penetrating between the two portions of the right pillar of the diaphragm on its way to the stomach.
5. The *great vena azygos*. This is a long vein which commences in the region of the loins, passes along underneath the backbone, receiving numerous branches on the way—Nos. 40, 41, 42—and empties itself into the anterior vena cava, No. 10.
6. Middle portion of the first rib.
7. The *trachea*, or windpipe.
8. The *first bronchus*—the right lung having been removed.
9. The entrance of the *thoracic duct* into the anterior vena cava. The thoracic duct is a tube which originates in the region of the loins, with an irregular dilatation called the *cistern of pecquet*, and empties itself into the blood-stream, as seen at No. 9. The fluid it contains it receives from two sources. The drainage of all the tissues of the body supplies lymph, which is conveyed to the duct by the lymphatic vessels, and the chyle, or nourishment from the digested food, which is conveyed from the intestines by the lacteal vessels.
10. The *anterior vena cava*. This is one of the two largest veins of the body, and is the general confluent of all the veins of the head, neck, and fore extremity. Its blood, together with that of the posterior vena cava, No. 30, is poured into the right auricle of the heart, No. 11, from whence it is squeezed into the right ventricle. From here it is forced

TUBERCLE.—Latin, *tuberculum*, a little lump or protuberance: from *tuber*, a hump.
 INTERVERTEBRAL.—Between the vertebræ.
 DIAPHRAGM.—Greek, *diaphragma*, a partition: from *dia*, through; *phrasso*, I hedge in.
 VENA.—Latin, *vena*, a vein.
 AZYGOS.—Greek, *azugos*, unyoked or unattached.
 TRACHEA.—Greek, *tracheia*, the windpipe.
 BRONCHUS.—Greek, *brongchos*, a windpipe.
 CHYLE.—Greek, *chulos*, juice.
 LACTEAL.—Latin, *lactatum*, to contain milk. The lacteal vessels convey a milk-like fluid, the chyle.
 CAVA.—Latin, *cavus*, hollow.
 AURICLE.—Latin, *auris*, the ear. The two upper muscular cavities of the heart are termed auricles from their supposed resemblance to the shape of an ear.
 VENTRICLE.—Latin, *ventriculus*, the belly.

by a powerful contraction of the muscular walls of the ventricle through the lungs, where it passes into capillary vessels which penetrate into every part of the lungs and form close networks surrounding the air-cells at the terminations of the breathing-tubes.

The walls of both the capillaries and the air-cells are extremely thin, and through them the blood parts with carbonic-acid gas—the product of decomposition of tissue—and receives oxygen from the air with which the lungs are filled. Thus venous blood—*i.e.*, blood from the veins—is changed into red arterial blood charged afresh with oxygen, which it conveys to the tissues by means of the arterial system.

The centre of this system is the left side of the heart, into the auricle of which the revived blood is poured. From here it is forced into the left ventricle, the muscular walls of which are extremely thick and strong. Contraction of the ventricle forces the blood into a very large vessel, the *common aorta*. The *common aorta* soon divides into two large branches, the anterior aorta and the posterior, and from these the arteries and arterioles convey the blood to all parts of the system.

11. The *right auricle*. The heart is a muscular organ which is divided into four compartments—an auricle and a ventricle on either side, right and left. The right side of the heart, as previously explained, receives the venous blood from the system, and passes it to the lungs; the left also receives the blood from the lungs, and passes it to the system. To prevent the backward flow from the *aorta* and *pulmonary artery* into the ventricles when these are relaxed, the opening of each of these vessels is guarded by three strong flaps—the *semiluna valves*. The openings between the auricles and ventricles are guarded in a similar manner—that between the right auricle and ventricle consisting of three flaps (the *tricuspid*), and that between the left auricle and ventricle of two flaps (the *bicuspid* or *mitral*).

Action of the Heart.—The pulse-rate of the sheep normally is from seventy to eighty beats per minute in the adult, and

CAPILLARY.—Latin, *capillus*, a hair, a hair-like vessel.
 AORTA.—Greek, *aorto*, suspended: from *aiero*, I raise.
 PULMONARY.—Latin, *pulmo*, a lung.
 SEMILUNAR.—Latin, *semi*, half; *luna*, a moon.
 TRICUSPID.—Latin, *tris*, three; *cuspid*, a point.
 BICUSPID.—Latin, *bis*, two or twice; *cuspid*, a point.
 MITRAL.—Latin, *mitra*, a mitre.

about ninety in the young. The action of the heart is characterized by two sounds and a pause. The two sounds are a long dull one, usually known as the first, and a short abrupt one, known as the second. The first sound is caused by the vibration of the column of blood in the ventricles and of the rendering tense of the auriculo-ventricular valves by the contraction of the ventricular walls. The second sound is caused by the sudden tension of the semilunar valves. Each phase of the heart's action is accompanied by the following phenomena:—

1. With the first sound—

- (1.) Contraction of the ventricles.
- (2.) The auriculo-ventricular valves are closed.
- (3.) The semilunar valves are opened, and blood is forced into the pulmonary artery and the aorta.
- (4.) The auricles begin to dilate.
- (5.) The impulse is felt.

2. With the second sound—

- (1.) The semilunar valves are closed.
- (2.) The auriculo-ventricular valves are opened.
- (3.) The auricles are filling.
- (4.) Some blood is obtaining entrance to the ventricles.

3. With the pause—

- (1.) At first blood is entering both auricles and ventricles.
- (2.) The auricles now contract, filling the ventricles and opening the auriculo-ventricular valves widely.
- (3.) The semilunar valves are closed.

In accelerated beating of the heart the frequency depends mainly upon the length of the pause.

12. The *left lung*.

13. The *first bone of the sternum*. The sternum, or breastbone, consists of six bones or sternibræ firmly united together by strong cartilage.

14. The *pericardium*, a membranous sac which encloses the heart. Its function is to fix that organ in the thorax and facilitate the cardiac movements by offering a smooth moist surface.

STERNUM.—Greek, *sternon*, the breast.

STERNIBRÆ.—The bones of the sternum.

CARTILAGE.—Latin, *cartilage*, gristle.

PERICARDIUM.—Greek, *peri*, round about; *kardia*, the heart.

CARDIAC.—Of the heart. Greek, *kardia*, the heart.

15. The second of the *sternibræ*.

16. Fat.

17. The sixth of the *sternibræ*.

18. Fat.

19. A cut portion of rib.

20. Ditto.

21. Ditto.

22. The edge of the *liver*, as seen behind the ribs.

23. The *pericardium*.

24. The *right ventricle* of the heart.

25. The *liver*.

26. Fat.

27. The *diaphragm*, a partition separating the thoracic from the abdominal cavity. This is a partly muscular and partly tendinous structure. It is the chief muscle of inspiration, as in contracting it recedes, draws the ribs outwards and forwards, and in this way increases the capacity of the chest.

28. A portion of the *left auricle* of the heart.

29. The *tendinous portion of the diaphragm* which occupies the central part limited by the irregular outline in the diagram—all the rest consists of powerful muscular tissue.

30. The *posterior vena cava*.

31 and 32. Two large branches of the *pulmonary artery* in the right lung. The remainder of this lung has been cut away.

33. A portion of the second *bronchus*.

34. The *twelfth rib*.

35. The *thirteenth rib*.

36. The *external intercostal muscles*. These are muscles of inspiration, and, as is seen in the diagram, their fibres take a downward and backward direction.

The *internal intercostals*, which lie immediately below them, have a downward and forward direction. These are muscles which assist in forced expiration.

37. The *posterior aorta*.

38. The *thoracic duct*.

39. A large lymphatic vessel from the largest of the bronchial lymphatic glands, passing into the thoracic duct.

40, 41, and 42. Veins entering into the great vena azygos.

43. A facet on the transverse process of a dorsal vertebra for the reception of the tubercle of the second rib.

44. The *intervertebral facet*, for articulation with the head of the second rib.

INTERCOSTAL.—Latin, *inter*, between; *costa*, a rib.

LYMPHATIC.—Latin, *lymphæ*, water, water-like.

FIG. IV.

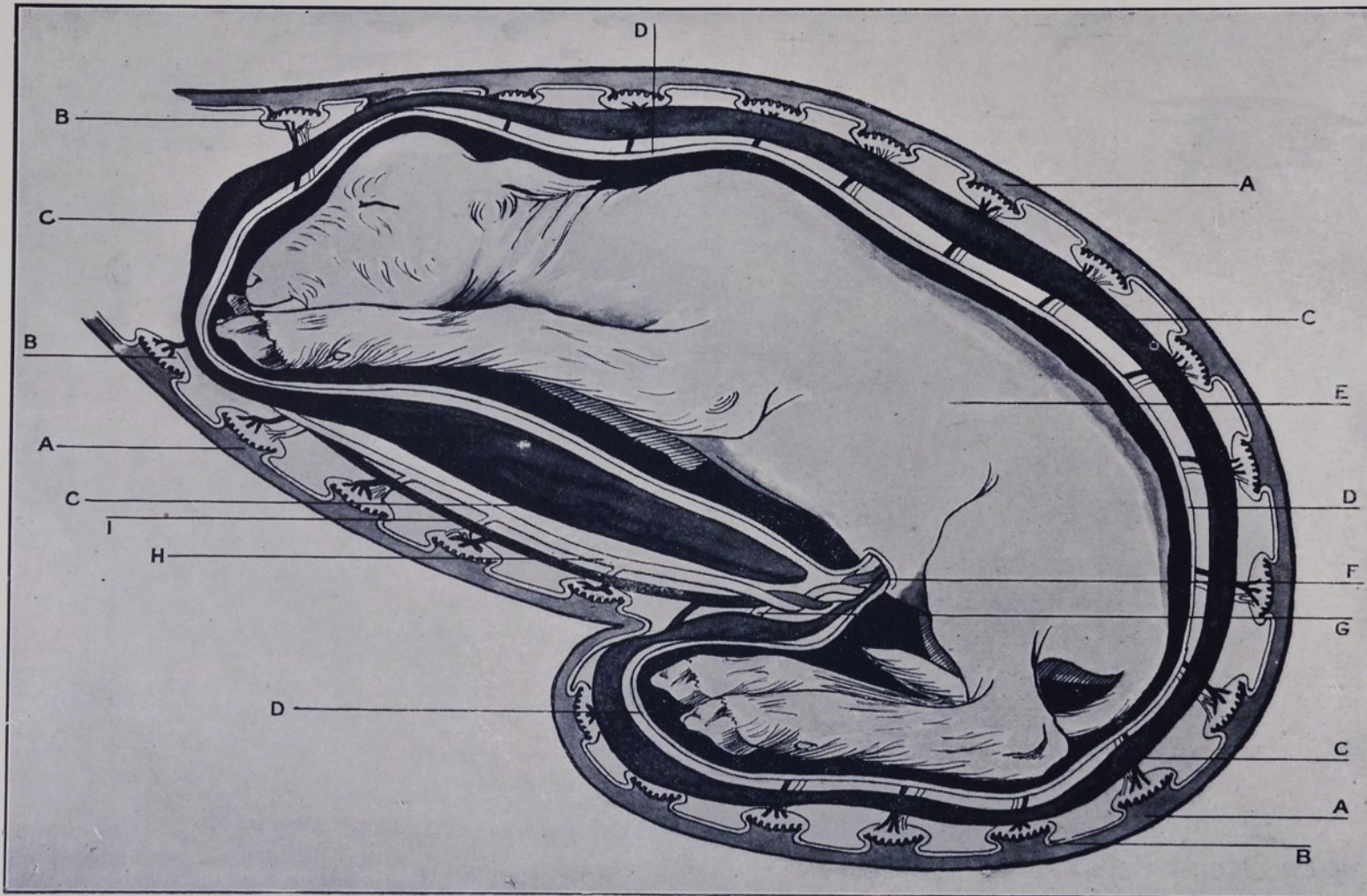


DIAGRAM OF THE FŒTAL LAMB AS IT LIES IN THE UTERUS OF THE EWE IMMEDIATELY BEFORE BIRTH.

Entered at Stationers' Hall, 1904.]

[Drawn by H. C. WILKIE.

REFERENCES TO FIG. IV.

THE period of *gestation* or pregnancy is that during which the female carries its young in the uterus. Its average duration in the sheep is 149 days. A few instances have been known and recorded by Magne where the period has not extended beyond 143 days, while Baumeister and Reuff give the maximum period as 160 days. It has been found that generally the male lamb is carried about one day longer than the female, and twins a day less.

A. The *uterus*.

During gestation certain changes take place in the general thickness, form, situation, and direction of the uterus. The blood-vessels become greatly enlarged in size, the coats of the arteries being much thickened to admit of the increased distension; the veins undergo even more enlargement than the arteries. The nerves of the uterus become considerably increased in size and *anastomose* freely. The whole uterus is much thickened and rendered denser.

The uterus of the sheep presents upon its inner surface a number of very vascular tufts or cotyledons, which are slightly concave in the centre.

B. The *chorion*. This is the outer envelope of the *fœtus*. It is a great membranous bag, completely closed, which corresponds to the inner face of the uterus. It has upon its surface a number of *placentulæ* or *cotyledons*, which are intimately attached to the *cotyledons* on the uterus.

C. The *allantois* is a membranous bag, the middle portion of which passes into the body of the *fœtus*. Here it forms the urinary bladder, and the tube communicating with the outer and larger portion is called the *urachus*.

Towards the end of pregnancy the sac of the allantois is filled with the *fœtal* urine. Prior to this it contains allantoic fluid, which probably serves the purpose of nourishment.

GESTATION.—Latin, *gestatio*, a bearing; *gesto*, I carry.

UTERUS.—Latin, *uterus*, the womb.

ANASTOMOSE.—To unite one with another, Greek, *ana*, through; *stoma*, a mouth.

CHORION.—Greek, *chorion*, skin or leather-like.

ALLANTOIS.—Greek, *allantos*, of a sausage.

FŒTUS.—The young animal in the womb. Latin, *fœtus*, pregnant.

D. The *amnion* is the inner membranous covering of the *fœtus*. It is a closed sac, and contains *liquor amnii*, an albuminous, alkaline fluid, in which the *fœtus* floats, attached only at one point, the *umbilicus*. The purposes which the *liquor amnii* serve are important.

(1.) It forms a water bed for the developing animal and favours its movements.

(2.) It preserves an even temperature.

(3.) It counteracts the effects on the *fœtus* of movements by the dam.

(4.) It protects the dam, towards the end of pregnancy, from the movements of the *fœtus*.

(5.) It is the principal agent in promoting the dilation of the mouth of the uterus at the time of parturition, and it protects the *fœtus* from injury.

E. The *fœtus*.

F. The *urachus*.

G. One of the *umbilical arteries*.

H. The second *umbilical artery*.

I. The *umbilical vein*. This vein has no valves. The *umbilical cord*, or navel-string, consists of an allantoic portion, the *urachus*, F, two arteries, G, H, and a large vein, I, imbedded in embryonic connective tissue (Wharton's jelly) and a covering by a portion of the *amnion*. The *placenta* in the sheep, as in other ruminants, is a multiple one, and consists of about eighty *placentulæ* or *cotyledons*. In them the capillary vessels containing blood from the *fœtus* come into contact with capillary vessels containing blood from the dam, and an interchange of elements takes place by which the *fœtal* blood is revived and passes back to the young animal to supply it with nutriment and the benefits of respiration.

AMNION.—Greek, *amnion*, a vessel for receiving the blood of animals in sacrifice.

UMBILICUS.—Latin, *umbilicus*, the navel.

URACHUS.—Greek, *ouron*, urine; *echo*, I hold.

PLACENTA.—Greek, *plakous*, a flat cake.

CAPILLARY.—Hairlike. Latin, *capillus*, a hair.

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