

very small; interior blackish purple throughout, bordered with a narrow white zone; margins strongly crenate.

Long. 15, alt. 14, lat. 8 lin.

Hab. Unknown. Coll. late T. L. Taylor.

9. *PETUNCULUS ORBICULARIS*, n. sp. (Plate XXXV. fig. 9.)

Shell moderately solid, orbicular, depressed, subequilateral, equi-valve, a little compressed anteriorly; white, spotted very sparingly with brown; valves with about thirty rounded radiating ribs that become less prominent towards the sides, and crossed all over with fine concentric wavy lines taking the form of overlapping scabrous laminæ towards the base; cardinal area very small; umbones nearly approximate, interior white.

Long 12, alt. 11, lat. 4 lin.

Hab. Bass's Straits, Tasmania. Coll. Hanley.

This shell belongs to the same natural group as *P. vitreus*.

10. *PECTUNCULUS NOVA-GUINEENSIS*, n. sp. (Plate XXXV. fig. 10.)

Shell moderately solid, quadrately orbicular, slightly convex, equilateral, equi-valve; white, tinged with pale brown under the umbones; valves sculptured throughout with close-set prominent nodulous ribs, the interstices of which are crossed by extremely fine concentric striæ; dorsal margin straight, forming a sharp angle at its junction with the sides, which are flattened; ventral margin arcuate; cardinal area very narrow; umbones small, beaks approximate; interior white; margin broadly crenate.

Long. 16, alt. 15, lat. 7 lin.

Hab. New Guinea. Coll. T. L. Taylor.

This remarkable shell belongs to the same group as *P. vitreus* and *P. orbicularis*.

4. On the Anatomy of the African Elephant (*Elephas africanus*, Blum.). By W. A. FORBES, F.Z.S., F.L.S.

[Received April 23, 1879.]

Although the African Elephant was well known, both in their wars and games, to the Romans, till within the last few years hardly any specimens of this species had been seen in Europe since the days of the Roman Empire. With but one exception, as far as I can find out, all our knowledge of the soft structures of the Proboscidea has been, till the present year, derived from examination of the Asiatic species. In his 'Mémoires pour servir à l'histoire naturelle des Animaux'¹, published in 1734 by the Académie Royale des Sciences of Paris, Claude Perrault describes an African Elephant "du Royaume de Congo," which was presented to the King of France by the King

¹ Tome iii. partie 3, pp. 101-156, pls. 19-24.

of Portugal, and lived from 1668 to 1681 at Versailles, when it died and came into his hands for dissection¹. In his memoir on this specimen (which extends over fifty pages) the anatomy of most of the soft parts is described, though, as a rule, somewhat briefly, that of the trunk, structure of the nasal organs, and female reproductive organs only being described at greater length. In the following account I shall make reference, where necessary, to Perrault's figures and descriptions under the organs described².

Within the last fifteen years African Elephants have been imported in considerable numbers from Nubia and other parts of the Upper-Nile basin, via Egypt and Trieste into Europe³. Altogether considerably more than a hundred must have reached Europe alive; but although some of these must surely, ere now, have fallen victims to the numerous diseases that attack animals in captivity, nothing, as far as I can learn, has been published on the anatomy of any of these animals till the current year. In the first part of the 'Archiv für Naturgeschichte' for the present year (1879), Dr. August von Mojsisovics, of Gratz, has published an article "Zur Kenntniss des afrikanischen Elephanten,"⁴ in which he describes certain portions only of the visceral anatomy—namely, the structure of the pharynx, particularly as regards the existence of a "pharyngeal pouch" (hereafter to be alluded to), and of the bronchi, the pancreas and pancreatic duct, and the male genital organs; and of these figures are given on three plates.

During the past winter one of the African Elephants in the possession of the Alexandra Palace Company succumbed to the severity of the weather. By the courtesy of Mr. Jones, the Secretary of the Company, the body was made over to Mr. Bartlett, and was sent up to the Society's Gardens so as to be more easily examined⁵. As our anatomical knowledge of this species is still so rudimentary, I make no hesitation in laying before the Society the following notes on such parts of its anatomy as I examined, the more so as the very considerable differences which occur in the various accounts of those

¹ This animal was a female, and was supposed to be, when it arrived in Paris, about four years old. (It was probably much older.) It was then $7\frac{1}{2}$ feet high, but during the thirteen years it lived at Versailles only grew 1 foot in height. M. Perrault gives a figure of this specimen on pl. 19 of his memoir; this figure clearly shows the enormous ears characteristic of the African Elephant, but is very defective as regards the hind, and particularly the fore, feet.

² Besides this, there are a few short statements on various parts of the anatomy of *E. africanus* in Prof. Flower's lectures on the digestive organs of Mammalia (alluded to below) and in Prof. Macalister's recently published 'Morphology of Vertebrata.' Donitz has described the kidney (Reichert & Du Bois-Reymond's Archiv, 1872, p. 85).

³ For an account of the introduction of African Elephants into Europe, see a letter by Carl Hagenbeck, the well-known animal-dealer of Hamburg, in 'Land and Water,' March 29, 1879.

⁴ *L. c.* pp. 56-92, t. v.-vii.

⁵ Unfortunately this was not effected till about one week after the death of the animal. This fact, as well as the deaths of several other large animals requiring examination at the same period, made the preliminary dissections rather hurried, and must be an excuse for any errors or omissions in the following descriptions.

who have dissected the Indian species¹ make it advisable to put on record any observations, however fragmentary, for the benefit of future dissectors of either of these huge animals.

The subject of these notes was a young female, which had been in the possession of the Alexandra Company only about eighteen months, but was probably four or five years old at the time of its death. I took the following measurements of the carcass :—

	inches.
From forehead to root of tail (along back)	78
Length of tail, from root	26½
Height at shoulder (measured to spines of vertebræ over body)	58
Circumference of right foot, fore	25
Circumference of right foot, hind	25
Length of ear, from front of meatus	19
Greatest depth	27

These measurements show that the ordinarily accepted rule that the height of an Elephant = twice the circumference of its feet very nearly expresses the truth.

As usual in this species, the fore limbs were provided with four, the hind with three nails.

There were eight molars in all in place. In all those of the upper jaw I counted five plates; in those of the lower, there were six in the first, and seven in the second, tooth, of each side.

The most remarkable point observed, when the ribs and other walls of the right side of the body had been removed, was the enormous extent of the thoracic cavity, which extended backwards above till near the sacrum, and the comparatively small part occupied by the abdominal viscera; this was, as far as I could judge, not more than about one third of the whole trunk. As is usually the case with Elephants, there was no fat visible, either in the subcutaneous tissue or in any part of the abdominal cavity.

Mouth and Tongue.—The palate, gums, and cheeks were throughout smooth, with no ridges or papillæ, except a few small caruncular projections near the anterior ends of the lower gums.

The tongue (fig. 1, p. 423), as in the Indian species, is small for the size of the animal, much compressed, and rather deep². Its anterior end alone is free for about 2½ inches, and is bent down at an angle with the rest of the organ, and somewhat pointed. The length of the tongue in a straight line was 13½ inches, along the curve 15 inches. The filiform papillæ are extremely fine and small, so that the tongue has an almost velvety touch. At the sides of the anterior part, ex-

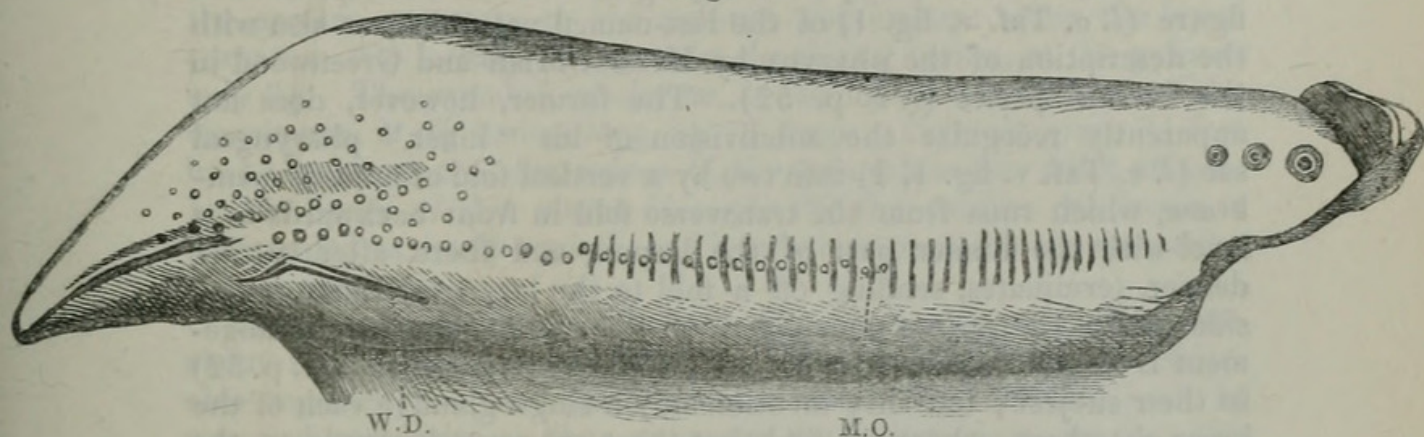
¹ The amount of literature on the anatomy of the Indian Elephant is very considerable. A *résumé* of the principal papers on the subject will be found in Messrs. Miall and Greenwood's 'Anatomy of the Indian Elephant' (pp. 6, 7), recently published, a book which is itself a useful compendium of our present knowledge of Proboscidean anatomy. The myology, however, is described at greater length than any other parts.

² Dr. Mojsisovics's figure (*l. c.* Taf. v. fig. 1) is evidently taken from a preserved and distorted specimen, and fails to show accurately the real shape of the tongue when fresh.

tending from near the papilla of Wharton's duct towards the tip, where it becomes obsolete, is a slightly raised longitudinal line. Below this are the openings of a considerable number of small glands, situated, apparently, in the substance of the tongue itself. Above and behind this line are scattered about a few fungiform papillæ; but these get smaller, and ultimately disappear, towards the middle line, and extend but a small distance backwards over the sides of the tongue.

In a line with, and continued back from, this raised line, a single

Fig. 1.



Tongue of the African Elephant (reduced).
W.D. Wharton's duct; M.O. Mayer's organ.

series of rather conspicuous, elevated papillæ, apparently of a glandular nature, is seen. These are continuous behind with "Mayer's organ"¹, a series of vertical slit-like depressions, the larger of which are each provided with a pair of glandular papillæ, probably connected with mucous glands in the substance of the tongue. I counted about thirty-three slits in this organ, which extends backwards on the sides of the tongue for $5\frac{1}{4}$ inches, till within about an inch of the circumvallate papillæ. The slits are largest and deepest, and have their glands proportionately larger, a little before the end of the organ: the longest slit is $\frac{1}{2}$ inch long. In the anterior part of the organ the papillæ of the sides of the tongue stand on the ridges between the slits; but more posteriorly this arrangement disappears. The circumvallate papillæ are situated near the back of the tongue, and nearer the middle line than the glands and papillæ just described. On the right side there are four, on the left three, with indications of a fourth. The posterior ones are considerably the larger ($\frac{3}{8}$ inch in diameter). The tongue is rounded off and considerably narrowed behind the circumvallate papillæ. In the walls of the pharynx in this region are a few irregular, raised, glandular patches, which attain a considerable size in the middle line.

The tonsils are rather large and deep depressions. In the bottom are seen the openings of many conspicuous and rather large solitary

¹ So called in honour of its discoverer, Dr. C. Mayer (*cf.* Nov. Act. Acad. C. L. vol. xx. p. 746).

glands. The length of each tonsil is about 2 inches. Between the tonsils the root of the tongue is narrowed to about an inch, so that the fauces become extremely small. Between the two posterior pillars a few thin wrinkled folds of mucous membrane run across in front of the epiglottis, forming the "*plica palato-epiglottica*" of Mojsisovics¹. The epiglottis is short, thick, and evenly rounded. I failed to detect any "pharyngeal pouch," such as that described by Dr. Watson², or even to recognize the "leicht zu übersehende, seichte Grube," which Dr. Mojsisovics (*l. c.* p. 60) found as its sole representative in the animal he examined. In other respects my observations on the pharynx closely agree with the descriptions and figure (*l. c.* Taf. v. fig. 1) of the last-named naturalist, as also with the description of the pharynx by Messrs. Miall and Greenwood in the Indian species (*l. c.* p. 52). The former, however, does not apparently recognize the subdivision of his "inner" pharyngeal sac (*l. c.* Taf. v. fig. 1, I) into two by a vertical fold of mucous membrane, which runs from the transverse fold in front backwards to a level with the hinder part of the larynx, and there, after getting deeper, terminates, sending off a fold to the laryngeal mass on one side and to the *palato-pharyngeus* on the other. Such an arrangement is clearly described by Messrs. Miall and Greenwood (*l. c.* p. 52) in their subject; but they mention only a single gland in each of the inner chambers, whereas I find that there are several glands on the *outer* walls only of each of the two innermost chambers of each side. The external chamber on each side is free from glands, as noticed by Dr. Mojsisovics (*l. c.* p. 62).

The relations of the various parts of the hyoid arches to each other, and to the muscles in connexion with them, exactly agree with those that obtain in the Indian species, as first pointed out by Prof. Garrod³. Between the digastric and the stylo-pharyngeus pass the vessels supplying the thyroid glands.

Salivary Glands.—The parotid gland is large⁴; Stenson's duct opens in the cheek in the usual position.

The submaxillary gland is small and oval; it measured 2 inches long by $\frac{3}{4}$ inch deep and $\frac{1}{8}$ inch thick. Wharton's duct, 8 inches long, opens on each side on a single linear papilla beneath the tongue on the *frænum linguæ*, about 3 inches from the tip.

The sublingual is 5 inches long, 1 inch wide, and $\frac{1}{8}$ inch thick. It opens by many ducts beneath the tongue.

Besides the above glands, which are usually present in Mammalia, there is a large, more superficially situated, gland that lies in front of the angle of jaw on its inner side. This gland is much lobulated, is about 8 inches long, 1 inch wide at its greatest width, and $\frac{1}{2}$ inch thick. It opens by many ducts, some situated on raised papillæ, in the cheek⁵. It probably corresponds to the molar glands found in

¹ *L. c.* p. 62, Taf. v. fig. 1, *p. e.*

² *Journ. Anat. Phys.* viii. 1873, p. 91.

³ *P. Z. S.* 1875, p. 365, and figure.

⁴ This was unfortunately damaged in removing the brain; consequently I can give no details.

⁵ My friend Mr. W. Ottley, of University College, was kind enough to help me by dissecting out and measuring these glands.

many animals, particularly Rodents. Dr. Watson and Messrs. Miall and Greenwood only found the parotid gland present in their examples¹.

Alimentary Canal.—The œsophagus is of but small calibre; at its entrance into the stomach, when cut open and stretched out, it measures 4 inches.

The stomach in shape resembles that of the Indian Elephant as figured by Camper and others. Its long axis lies almost vertically in the animal, with the cardiac end directed upwards, the pyloric being downwards. In a straight line it measures 26 inches from the cardiac to pyloric ends; from the extremity of the cul-de-sac, along the greater curvature to the pylorus, $35\frac{1}{2}$ inches; along the lower curvature $18\frac{1}{2}$ inches. Its greatest depth is 9 inches, at the pylorus only $3\frac{1}{2}$. The rounded cul-de-sac, to the left of the entrance of the œsophagus, is $9\frac{1}{4}$ inches long by $7\frac{3}{4}$ deep. Perrault gives $3\frac{1}{2}$ feet by 14 inches as the dimensions of the stomach in his adult animal. In his figure of this viscus (*l. c.* pl. 20) the cardiac cul-de-sac is represented as nearly conical; and in other respects his representation is not good.

The mucous membrane of the cardiac cul-de-sac is raised up into about fifteen thick zonary folds, which are arranged with considerable regularity in that part of the stomach, but decrease both in size and regularity as they approach the pyloric part; so that the posterior third of the inner part of the stomach is almost smooth, with only slight and irregularly disposed rugæ². The folds are very expansible; but in the ordinary state none exceeds about 1 inch in depth. The greater part are continuous all round the stomach; but others blend with adjacent folds; so that it is not possible to count the exact number with any great accuracy. The mucous membrane of the œsophagus is sharply marked off from that of the stomach: here it is covered by numerous short slit-like depressions (probably mucous canals) in the anterior two thirds; but in the posterior third these disappear or become obsolete.

About $4\frac{1}{2}$ inches from the œsophagus, in the middle line of the lesser curvature, is a small, blunt, slightly elevated, circular prominence, pitted in the centre, of $\frac{1}{6}$ inch diameter, which is probably glandular in nature. Prof. Garrod, in his MS. notes, records small glands, apparently formed by the aggregation of several of these, as occurring in a similar position in the Indian species. The pylorus has no distinct valve.

The length of the small intestine was 27 feet 4 inches, of the very

¹ Mr. Bartlett tells me that in both sexes of the African Elephant the peculiar temporal gland, which is found in the Indian species, and opens externally between the eye and ear, is certainly present. I omitted, unfortunately, to look for it.

² Mayer's figure (Nov. Act. Acad. C. L. vol. xxii. pt. 1, pl. iv. fig. 3, 1847) of the stomach of the Indian species does not sufficiently indicate the regularly zonary nature of these folds; in that of Sir James Emerson Tennent ('The Wild Elephant,' p. 59 [1867]), on the other hand, these folds are represented as much too regular and sharply defined.

Fig. 2.

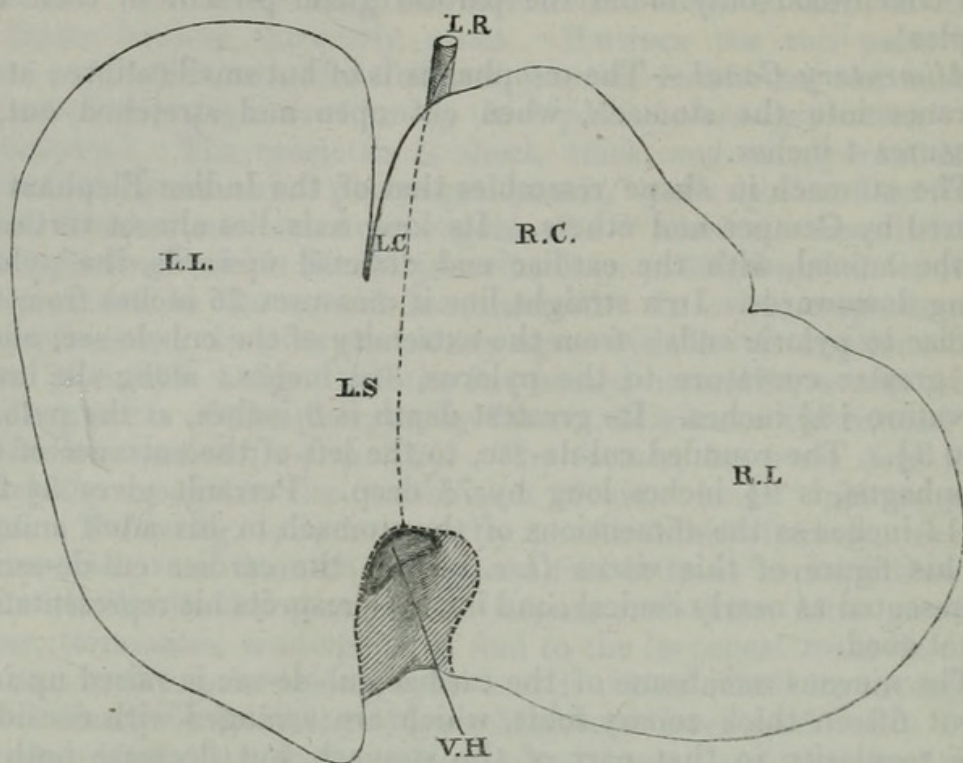
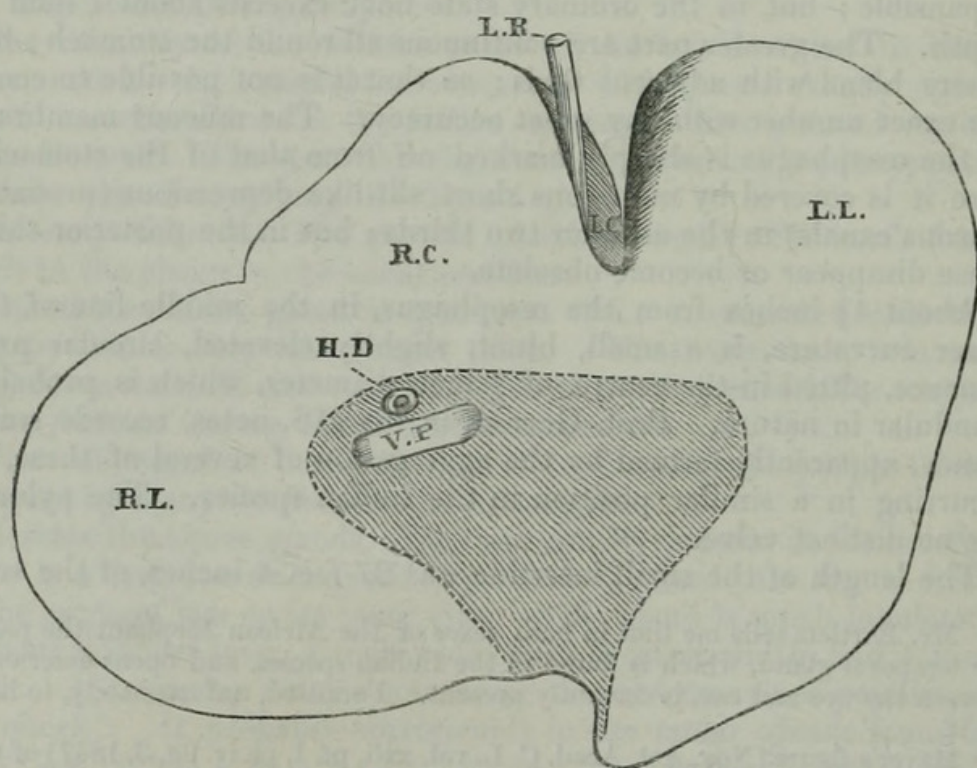
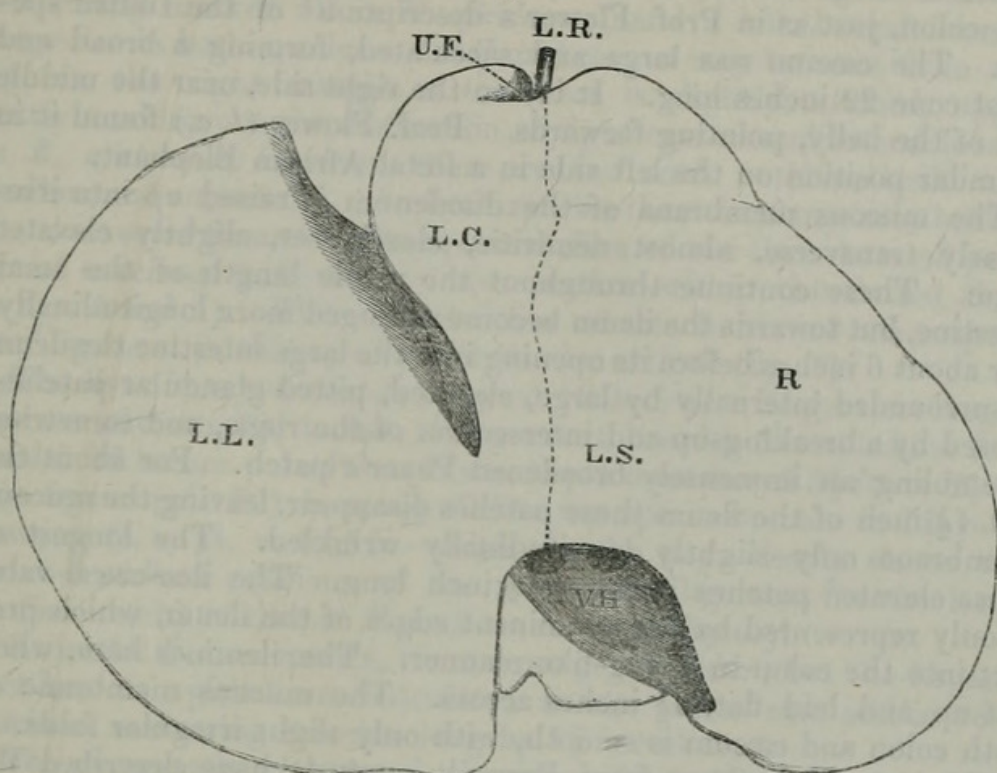
View of liver of *E. indicus*, from above.

Fig. 4.

View of liver of *E. indicus*, from below.

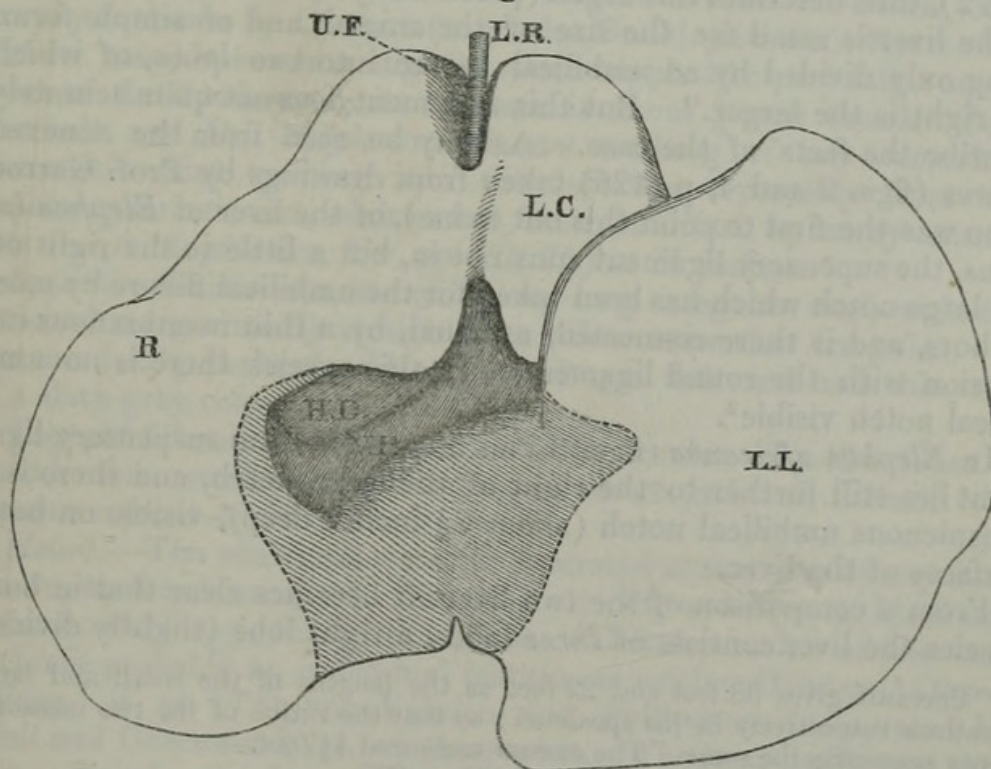
All the figures much reduced. Figs. 2 and 4 from drawings by Prof. Garrod.
 L.L. Left lateral. L.C. Left central. R.C. Right central. R.L. Right lateral.
 R. Right lobe of liver. V.H. Hepatic vein. V.P. Vena Portæ. H.D.

Fig. 3.



View of liver of *E. africanus*, from above.

Fig. 5.



View of liver of *E. africanus*, from below.

Hepatic duct. L.R. Round ligament. L.S. Suspensory ligament.
U.F. Umbilical fissure.

capacious large intestine 16 feet¹. The latter was arranged on a mesocolon, just as in Prof. Flower's description² of the Indian species. The cæcum was large and sacculated, forming a broad and blunt cone 22 inches long. It lay on the right side, near the middle line of the belly, pointing forwards. Prof. Flower (*l. c.*) found it in a similar position on the left side in a foetal African Elephant.

The mucous membrane of the duodenum is raised up into irregularly transverse, almost dendritic, closely set, slightly elevated rugæ. These continue throughout the whole length of the small intestine, but towards the ileum become arranged more longitudinally. For about 6 inches before its opening into the large intestine the ileum is surrounded internally by large, elevated, pitted glandular patches, caused by a breaking-up and intersection of the rugæ, and somewhat resembling an immensely broadened Peyer's patch. For about the last $1\frac{1}{2}$ inch of the ileum these patches disappear, leaving the mucous membrane only slightly longitudinally wrinkled. The longest of these elevated patches is about $1\frac{1}{2}$ inch long. The ileo-cæcal valve is only represented by the prominent edges of the ileum, which project into the colon in a ring-like manner. The ileum is here, when cut up and laid flat, $4\frac{1}{2}$ inches across. The mucous membrane of both colon and cæcum is smooth, with only slight irregular folds.

Liver.—All authors from Perrault onwards have described the Elephant's liver as being composed of two lobes. In his lectures on the organs of digestion of the Mammalia, published some years since in the 'Medical Times and Gazette,' Prof. Flower (*l. c.* Oct. 5, 1872, p. 372), thus describes this organ (presumably in the Indian form):—"The liver is small for the size of the animal and of simple form, being only divided by an umbilical fissure into two lobes, of which the right is the larger." But this statement does not quite accurately describe the facts of the case. As may be seen from the annexed figures (figs. 2 and 4, p. 426) taken from drawings by Prof. Garrod (who was the first to point this out to me), of the liver of *Elephas indicus*, the suspensory ligament runs not in, but a little to the right of, the large notch which has been taken for the umbilical fissure by most authors, and is there connected, as usual, by a thin membranous expansion with the round ligament. In this species there is no umbilical notch visible³.

In *Elephas africanus* (figs. 3 and 5, p. 427), the suspensory ligament lies still further to the right of the large notch, and there is a conspicuous umbilical notch (about $2\frac{1}{2}$ inches deep), visible on both surfaces of the liver.

From a comparison of the two livers it becomes clear that in both species the liver consists of *three* lobes, a right lobe (slightly divided

¹ Perrault gives 38 feet and 22 feet as the lengths of the small and large intestines respectively in his specimen; so that the ratios of the two measurements are nearly the same. The cæcum measured $1\frac{1}{2}$ foot.

² Med. Times and Gazette, Oct. 5, 1872, p. 372.

³ In a liver of *E. indicus*, in the Royal College of Surgeons (810 F) there is visible, at the place where the round ligament is lost in the substance of the liver, a narrow fissure, which runs obliquely for some way towards the margin, but does not reach it; so that there is no notch formed.

in both species), a left central lobe (extremely small in *E. indicus*, but clearly marked off in *E. africanus*), and a left lateral lobe, of large size in both species. In *E. indicus*, as may be seen from the figures, the right margin of the liver is slightly notched, apparently marking out the distinction of right central and lateral lobes: in *E. africanus*, however, there are two such notches, both very shallow and superficial. In both species there is a large area behind the transverse fissure on the under surface of the liver bare of peritoneal covering (indicated by the portion within the dotted lines in figs. 4 and 5). The angulated line of attachment of the suspensory ligament in this species will also be noticed (fig. 3).

The liver in my specimen weighed 13 lb. 5 oz.: its greatest length transversely was $20\frac{1}{4}$ inches, the greatest breadth (from behind forwards) 16 inches. In Perrault's example it measured $3\frac{1}{2}$ ft. \times $2\frac{1}{2}$ ft. His figure (pl. 20) is not at all like my specimen; nor is Mayer's drawing (*l. c.* pl. v. fig. 1—which, by the way, clearly shows the above-described relations of the suspensory ligament to the large median notch) of that of *E. indicus* very satisfactory.

As in the Indian species, there is no gall-bladder; but the hepatic duct has its epithelium reticulated at the lower end, and is very spacious, measuring 9 inches long by $1\frac{7}{8}$ broad.

The pancreas is a lobulated, elongated gland, 17 inches long. It opens by a single, wide and short duct (one inch long) into the hepatic duct at the junction of the latter with the wall of the duodenum, through which the common duct is continued for $3\frac{1}{2}$ inches. The common duct is provided with distinct circular valve-like folds, exactly as shown by Camper (*conf.* also Dr. Mojsisovics's figure, *l. c.* Taf. vi.), and opens on a slightly raised nipple-like projection on the sides of the duodenum; its aperture is about $\frac{1}{8}$ inch broad. Like Perrault and Dr. Mojsisovics, I saw nothing of any secondary pancreatic duct opening into the intestine separately from the hepato-pancreatic one, such as has been described by many naturalists (*conf.* Mojsisovics, *l. c.* pp. 72, 75) in *E. indicus*.

Spleen.—This viscus was of a very long irregular oval, with the attached margin nearly straight, the other somewhat irregular. It measured $23\frac{1}{2}$ inches by $5\frac{1}{4}$ across¹: it was flattened and thin, and of a slaty-grey colour.

Thyroid Gland.—This consists of two circular cake-like lobes of considerable consistency, united by a short isthmus. Each lobe measures about $4\frac{1}{2}$ inches in diameter.

Heart.—The ventricles were not separated at the apex by any deep groove, such as is noticed by Mayer (*l. c.* p. 44) and Messrs. Miall and Greenwood (*l. c.* p. 68) in *E. indicus*. This separation of the ventricles is probably an individual feature, as neither Hunter ('Observations,' ii. p. 172) nor Vulpian and Philipeaux (as quoted by Miall and Greenwood, *l. s. c.*) observed it. The fossa ovalis was very deep, admitting the first two joints of the index finger. Hunter also (*l. c.*) found the remains of the foramen ovale distinct. The ductus arteriosus was of the size of a quill pen, and about one inch long,

¹ Perrault gives 3 feet by 7 inches.

but quite impermeable. The aorta gives off an innominate artery, which is only an inch long and then divides into right brachial and right and left carotids. The left brachial is given off immediately after the innominate. This agrees with the descriptions of *E. indicus* as given by Hunter, Owen, Vulpian and Philipeaux, Watson, and Miall and Greenwood. On the other hand, Cuvier and Mayer found three trunks, namely two brachials and a common carotid. I found no "*arteria thyroidea inferior simplex*" coming off from the point of division of the two carotids, such as is figured by Mayer (*l. c.* pl. 11. fig. 3) and Watson (*Journ. Anat. & Phys.* vi. pl. vi. fig. 1). The weight of the heart and great vessels, cut short and cleaned of blood, was 7 lb. There was no *os cordis*; and the same was the case in Perrault's specimen; nor is any such bone recorded in *E. indicus* by recent anatomists.

Respiratory System.—The lungs were very simple in form, each lung being undivided and bluntly triangular in general outline, the left being shorter and broader. In the undistended state they measured as follows:—Right lung 23 inches long by 12 broad, left 21 inches by 14. I found no accessory lobe on the right side, such as has been observed by some anatomists in *E. indicus*. There is no extra bronchus.

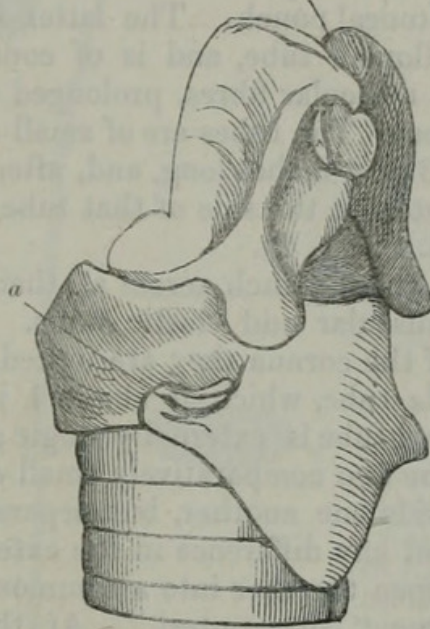
The trachea is short, measuring about a foot in length, and not quite two inches in external diameter. It is composed of 28 rings, which are nearly complete, leaving hardly any space behind between their ends. They vary considerably in size in different parts of their circumference. The first three rings, as in *E. indicus*, are truncated obliquely behind, the space so formed being covered in by the body of the cricoid cartilage.

The larynx (fig. 6, p. 431) is of considerable size. The epiglottis, when covered by its soft parts, is short, thick, and rounded. The thyroid consists of two rhomboidal wings, 4 inches long, and $3\frac{1}{4}$ deep, which are united in front superiorly for about one inch, the deep and narrow notch left between the remaining part of the wings being filled up by connective tissue. The superior cornua are short and scarcely project. The posterior are about one inch long, and are directed downwards and forwards in close proximity with the body of the thyroid cartilage, to which they are attached by connective tissue. The postero-inferior angle of the thyroid cartilage also develops an articular facet; and this is enclosed with that of the posterior cornu, in the common capsule of the crico-thyroid articulation. The cricoid (see fig. 6) is of the usual type. Its anterior part is 1 inch deep, the posterior (somewhat pentagonal) part 2 inches. The processes for articulation with the thyroid stand out in a step-like way, and are more or less clearly divided into two facets, corresponding to the double articulating surfaces of the thyroid.

The arytaenoids (see fig. 6) are vertically elongated. Each measures about $2\frac{1}{2}$ inches long by $1\frac{1}{2}$ broad. They have a conspicuous, vertically directed, raised spine-like process, and a large notch behind the supero-posterior angle. The cartilage of each side articulates with its fellow both above and below this notch. The *processus vocalis* is short and blunt. The true vocal cords are well-marked

and thick elastic folds, $2\frac{3}{4}$ inches long. The false vocal cords hardly exist. Between the two is a slight laryngeal pouch, which extends backwards a little way, as in the Indian Elephant (Miall and Greenwood, *l. c.* p. 76). The muscles of the larynx closely agree with those described by the last-named anatomists. The superior

Fig. 6.



Larynx of African Elephant (about half nat. size) viewed somewhat obliquely from behind. The thyroid cartilage has been removed. *a*, points to the double facet of the crico-thyroid articulation.

fibres of the *crico-arytænoideus posticus* run transversely across in the interval left above by the more inferior, diverging fibres of that muscle.

Urino-genital System.—The kidneys lie in the usual position. Their shape is an irregular oval. The following details refer to the single kidney (right) which I preserved for further examination. The length is 10 inches, the breadth about 6. The hilus is not marginal, but lies about 1 inch from the side; its length is $4\frac{1}{2}$ inches. The weight of the kidney is 3 lb. The kidney is indistinctly divided into eight lobes, which are of varying size and shape; one lobe is scarcely visible on the hilar surface. These lobes are essentially distinct, each consisting of a cortical and medullary part, not, however, very clearly marked off from each other. The Malpighian corpuscles are clearly visible. Perrault's figure of the kidney (*l. c.* pl. 20) is too elongated and shows no lobes. The number of lobes in the kidney of *E. indicus* has been variously stated at from two to eight or nine. The suprarenal bodies resemble those of the Indian species.

The ureters open into the bladder by semilunar slits about 2 inches from its orifice. The neck of the bladder is short and thick.

The female organs are formed on precisely the same type as those of the Indian species¹, consisting of a long urino-genital passage ("the common vagina, which is common to the urine and penis" of Hunter),

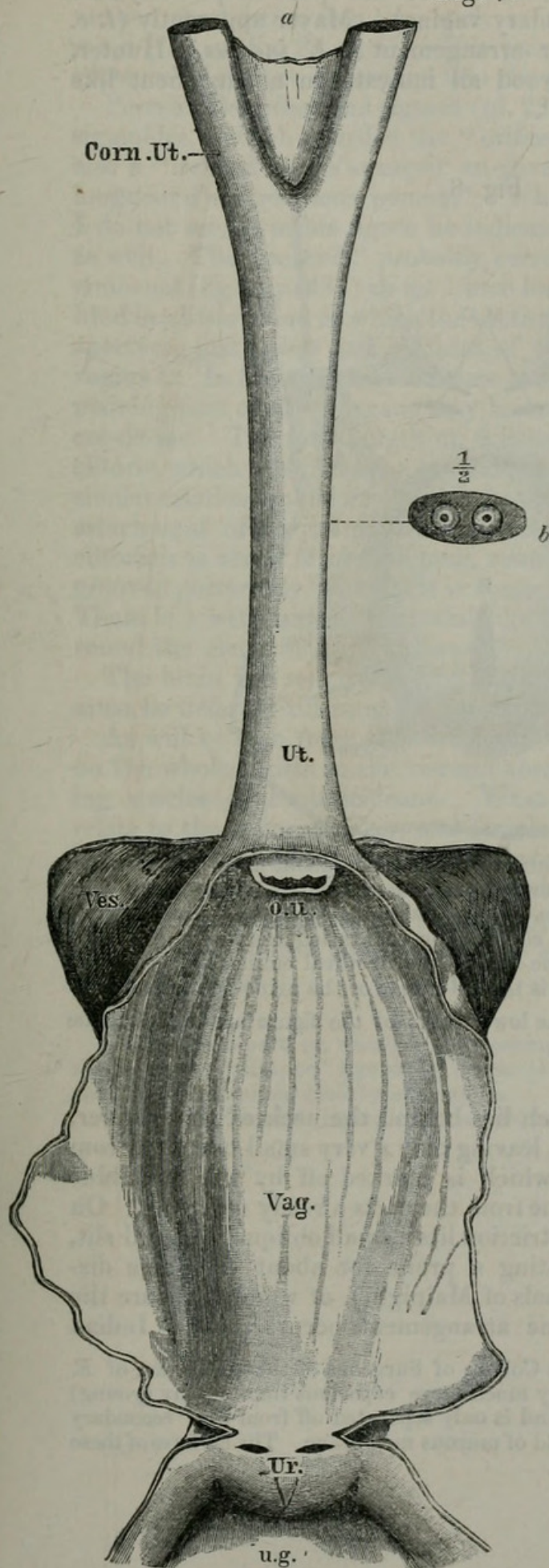
¹ Cf. Hunter, 'Observations,' &c. ii. p. 175; Mayer, *l. c.* p. 37, t. vi.; Owen, *Anat. Vert.* iii. p. 692; Miall and Greenwood, *l. c.* p. 62. pl. iv.

a secondary vagina ("the proper, or rather uncommon, vagina, which the penis cannot enter"), a corpus uteri, with two horns, and Fallopian tubes and ovaries. The ovaries lie in pouches of peritoneum, attached by peritoneal folds to the kidneys: the one I examined resembled in form those figured by Mayer in the Indian species. It was a little over an inch long, and generally smooth, with only a few small lobular processes and erupted Graafian follicles near the line of attachment to the peritoneal pouch. The latter is continuous with the opening of the Fallopian tube, and is of considerable size: its walls are thickened by muscular fibres, prolonged into it apparently from the Fallopian tubes. The tubes are of small calibre, of the size of a crow-quill, about 3 or 4 inches long, and, after a tortuous course, open into the cornua uteri at the side of that tube, as well shown in Mayer's figure (*l. c.* pl. vi. fig. 2).

The two cornua are about $\frac{1}{2}$ inch across at their commencement, and have very thick muscular and elastic walls. For the last $4\frac{1}{2}$ inches of the course of the cornua they are united together (as seen in fig. 7) into a single tube, which is about 1 inch across at the point of junction. This tube is externally single; but nevertheless, on cutting it across, the two comparatively small cavities of the cornua are seen lying beside one another, but separated by a considerable septum. Without any difference in the external calibre of the tube, the two cornua open together into a common cavity $2\frac{1}{2}$ inches long, which is the true "corpus uteri." At their opening each cornu admits a large knitting-needle. There is no valve of any kind at the opening. Both cornua and corpus are lined by smooth, longitudinally plaited, mucous membrane. A similar arrangement to that here described would seem to be indicated by Perrault's description:—"Ces cornes, au lieu de s'écarter et de se séparer comme elles font ordinairement, étoient jointes l'une contre l'autre, montant jusqu'au hauteur d'un pied, et n'étant séparés que par une cloison mitoyenne; ensuite elles se séparent en deux branches." In his example (nearly or quite adult) each horn measured 2 feet 8 inches, and was $1\frac{1}{2}$ inch across at the commencement. The female genital organs he pictures on pl. 21: this shows the conjoined cornua, which are separate till near their end, as seen in section.

The next part of the genital organs is the dilated, sac-like, "secondary," or "uncommon," vagina. This is about $5\frac{3}{4}$ inches long, and is lined by smooth mucous membrane, with slightly raised longitudinal folds, running from the opening into it of the corpus uteri. This opening is small, only admitting the tip of the little finger, and is provided behind with an irregularly bilobed thick valve of mucous membrane. This constriction and valve undoubtedly represent the "os uteri." Perrault describes this "secondary vagina" as the "corps ovale;" in his specimen it measured 18 inches by 6 inches, and was smooth and polished within. It is well shown in his figure (*l. c.* pl. 21); but the "valvule frangée aux embouchures des cornes de la matrice" is not quite like the valve in my specimen. In the text he says, "Deux trous au dedans...étoient entourés par un appendice de la membrane interne...en manière de la frange ou de pavillon." It would appear, then, that in his animal there was no "corpus uteri," such as that

Fig. 7.

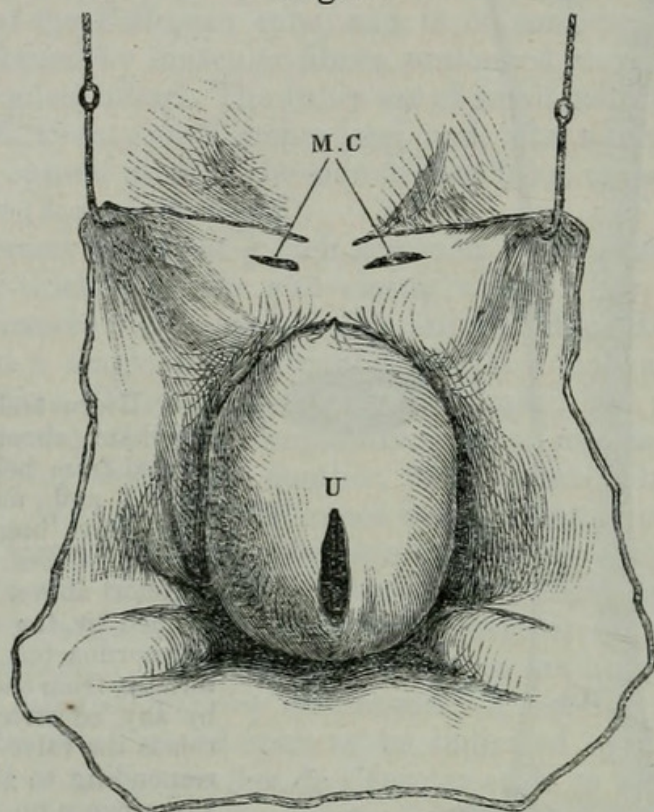


a. Uterus and vagina of African Elephant (about half natural size), viewed from behind. The vagina (*Vag.*) and urino-genital canal (*u.g.*) have been laid open from behind. (*Corn. ut.*) Cornua uteri cut short above. *Ut.* True uterus, formed by the coalescence of the two cornua, but not marked off externally from the conjoined cornua by any constriction. *o.u.* Above this is the valve-like structure corresponding to the *Os uteri*. *Ur.* Prominence on which the urethra opens; above it are seen the Malpighian canals; below the letters is the papilla-like free point (*vide* fig. 8). *Ves.* Bladder.

b. Section of the conjoined uterine cornua, half the natural size, to show the distinctness of the two tubes internally at this point.

which exists in mine, but that the two cornua opened separately into the "corps ovale" (=secondary vagina). Mayer apparently (*l. c.* pl. 6. p. 38) found a similar arrangement in *E. indicus*. Hunter, Owen, and Miall and Greenwood all indicate an arrangement like that which obtained in mine¹.

Fig. 8.



Opening of urethra (U) into the urino-genital canal, about natural size (somewhat diagrammatic). The walls of the urino-genital canal are cut close round the urethral eminence. M.C. Malpighian canals; below (anterior to) the letters is seen the constriction separating the vagina from the urino-genital canal; on the top of the urethral eminence is seen the small free point; below it is the cul-de-sac of the urino-genital canal.

N.B. In the natural position the lower parts of the figure are anterior, the upper parts posterior.

The secondary vagina, which lies behind the neck of the bladder, is separated by a constriction, leaving only a very small opening, from the urino-genital chamber, which is marked off by the livid blue colour of its mucous membrane from the parts already described. On each side of this median constriction lies a small obliquely-placed slit, about $\frac{1}{4}$ inch long, and admitting a probe for about the same distance into the small sacs (canals of Malpighi), of which they are the openings. Exactly the same arrangement occurs in the Indian

¹ In a specimen (2776 A) in the College of Surgeons of the uterus &c. of *E. indicus*, the "corpus uteri" is very much more capacious than in my (young) specimen, is about 7 inches long, and is only separated off from the "secondary vagina" by a prominent zonary fold of mucous membrane. The calibres of these two chambers are about the same.

Elephant. There is no trace of any hymen-like organ dividing this median constriction into two, such as noticed by Miall and Greenwood (*l. c.* pl. iv. fig. 3, *h*). This point about corresponds with the entrance of the genital organs into the pelvis.

Perrault describes and figures (pl. 22) in his example two "valves sigmoïdes," which guarded the "orifice interne de la matrice," and also a "rebord qui s'avantoit au-devant du col de la matrice de la longueur d'environ deux pouces." What the two sigmoid valves are I do not see, as in his figure he indicates the two Malpighian canals as well. The "rebord" probably corresponds to the tumid rounded eminence (fig. 8, p. 434) about 1 inch long, terminating above and behind in a little point, on which the urethra opens by a somewhat narrow aperture, just below and in front of the opening into the secondary vagina¹. In front of this eminence the urino-genital canal, as the remaining part of these organs may be called, is produced into a small cul-de-sac. The total length of this canal is about 20 inches²; the clitoris, which resembles the same organ in *E. indicus*, and which has similar relations to the urino-genital canal, is about 15 inches from the attachment of its crura to the pelvis to its extremity. The glans clitoridis is about 2 inches long, rounded anteriorly, flattened and grooved posteriorly, where it is in contact with the urino-genital canal. There is a well-marked preputial-like reversion of the integuments round the glans, as in *E. indicus*.

The brain was removed with but little injury; but its description must be deferred till some future occasion.

As will be seen from the foregoing account, but little difference, on the whole, exists in the visceral anatomy of the only two remaining species of Proboscideans. What differences there are chiefly relate to the stomach, liver, and female organs; but, till more specimens of *E. africanus* have been dissected, it is impossible to say how many of the points above noticed are due to individual peculiarities or those of age and the like. There appears, therefore, little ground, from an anatomical point of view, to separate *Loxodon* as a genus from *Euelephas*.

¹ This raised part, on which is the opening of the urethra, is probably identical with the "Klappe" figured by Mayer (*l. c.* pl. vi. fig. 1) as existing between the two orifices of the bladder and vagina.

² In Perrault's adult example the length was 3 feet 6 inches.



Forbes, W. A. 1879. "4. On the Anatomy of the African Elephant (*Elephas africanus*, Blum.)." *Proceedings of the Zoological Society of London* 1879, 420–435. <https://doi.org/10.1111/j.1096-3642.1879.tb02673.x>.

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