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XX.—*On the Horns, Viscera, and Muscles of the Giraffe; with a Record of the post mortem Examination of two Specimens killed by a fire.* By Dr. JAMES MURIE, F.L.S., F.G.S., &c.

[Plates VII. & VIII.]

THOSE desiring information respecting the vast amount of literature devoted to the genus *Camelopardalis* I would refer to the “Recherches Historiques, Zoologiques, Anatomiques et Paléontologiques sur la Girafe”*, by Profs. N. Joly and A. Lavocat of Toulouse. They not only give a chronological list from the time of Moses downwards, but in addition three plates, facsimiles from the ancient Egyptian monuments and old engravings; then follows a very good anatomical memoir.

The skeleton of this abnormal ruminant has been ably described and figured by many leading zoologists,—Pander and D’Alton, Rüppell, Cuvier, St. Hilaire, Owen, De Blainville, Gervais, &c. &c. The fullest accounts of the soft parts of its anatomy are in the original monograph of Prof. Owen † and the “Recherches” above spoken of; but upon certain parts of its internal structure Drs. Cobbold ‡ and Crisp § and others have supplied interesting observations.

Withal it may be asseverated that a quarter of a century ago, when comparative anatomy held less sway than at present, and in spite of the then scarcity of this great creature, its entire organization was much better worked out than that of many very common animals. Till recently a few points have been disputed, or at least opposing observations not harmo-

* Mém. de la Soc. des Sci. Nat. de Strasbourg, 1846, tome iii.

† Trans. Zool. Soc. vols. ii. & iii.

‡ Ann. Nat. Hist. ser. 2. vol. xiii. (1854) &c. § Proc. Zool. Soc. 1864.

niously adjusted, to effect which is one of the intents of this communication.

1. *Early and late Stages of Growth of the Lateral and Median Horns.*

All writers have been unanimous in according to the giraffe possession of two short elevations from the summit of the head, which in general have gone by the name of horns, though covered with hairy skin, like other parts of the body. To the early naturalists their nature was conjectural; but ultimately, when critically examined, their more or less solid bony structure became evident.

Fig. 1.

Sketch of the posterior horn of the young (2 months) male giraffe, seen from the outside and with the skin removed, of natural dimensions: *h*, the osseous elongation or horn; *sk*, portion of the skull.

The question then arose whether they were most like the antlers of deer or the core of the horns of antelopes, goats, and oxen, &c. Towards the former, objection was raised that they were persistent and not annually deciduous; towards the latter, that they were not porous or canaliculate, neither was their covering horny. Hence, separated from either class, the problem arose, what was the relation of the giraffe's horns to the bones beneath. A few naturalists promulgated the idea that the pair of posterior prominences were prolongations of the frontal bone; but more accurate observers

detected that this was not the case. Although in very aged animals they are pretty firmly soldered to the cranium, still in younger specimens their junction by a tough base is looser, so that, on maceration, they drop off. This led to their being acknowledged as bony epiphyses, not apophyses of the cranium; and, moreover, their situation or implantation over the coronal suture excluded them virtually from the cervine, bovine, and antilopine category. The best sectional views that I know of, showing the constitution of these appendages and their relation to the skull itself, are those of Owen* in an animal nine days old, and of Joly and Lavocat† in the adult.

Fig. 2.

A mesial longitudinal section of the same horn, its soft basal substance, and portions of the frontal bone and brain: *h*, osseous substance of the horn; *v*, vascular channels penetrating the same; *fc*, fibro-cartilaginous matrix; *sk*, the bony tables and diploë of the skull; *dm*, dura mater; *br*, brain.

So far the opinion of the majority tallies with the fact of the giraffe's pair of rear horns being primarily epiphysial, ultimately coalescing with the bone beneath, so that trace of separate origin is with difficulty recognized. It rests with me to place on record additional demonstrative evidence of the early relation of these horns to the skull in an animal two months old. The accompanying woodcuts (figs. 1 & 2) are quite as suggestive and more explanatory than long de-

* Trans. Zool. Soc. vol. iii. p. 26, pl. 2. fig. 4.

† *Op. cit.* pl. 9. figs. 1 & 2.

scription. The second clearly establishes intervention of fibro-cartilaginous matrix between the skull and the partially porous osseous substance of the horn. The first brings out the rough irregularly channelled exterior.

The existence of a third or median horn in the giraffe has likewise been a subject of controversy among anatomists. By some this peculiar middle frontal elevation has been regarded as but an osseous eminence, and not representative of an abnormally placed additional horn. Other authorities have not hesitated to class it as analogous to the rearmost pair, though developed over the sagittal suture, and short and squat. My colleague Dr. Cobbold * has been at some pains to collate the statements of several excellent zoologists and anatomists, which sustain his independent observation—viz. that the anterior median prominence of the giraffe's skull, situate at the junction of the nasals and prefrontals and over the sagittal suture, is a separate independent structure, analogous therefore to the so-called hinder horns.

The proofs of its separate ossification and, therefore, epiphyseal nature, which I advance in support of those who maintain such a view, rest chiefly on two specimens—one a section of the skull of the young animal already referred to (*vide infra*), the other a completely ossified cap removed from the cranium of an adult. In the calf stage, complete absence of bone or germ of ossific centre is indubitable, a thickening of the periosteum alone denoting the future position of the subsidiary piece in question. My sketch from the fresh specimen (fig. 3), whilst substantiating Dr. Cobbold's observation on the immature giraffe, more clearly displays the structural condition of the parts than in his diagram (*l. c.* p. 15).

Fig. 3.

Longitudinal vertical section of the mid fronto-cranial bone and superincumbent fibro-periosteal covering of the young ♂ giraffe, nat. size. It illustrates the rudiment or basal matrix of the as yet undeveloped third horn: *fc*, fibroid or semicartilaginous periosteal thickening upon which the future so-called horn is established; *sk*, portion of the skull just in front of the brain.

* The Intellectual Observer, Aug. 1862, p. 12, with a plate and woodcut.

In my second example, from a female eleven and a half years old, the so-called third horn was a distinct cap of bony material fixed to the fronto-nasal elevation and lying directly over the longitudinal suture. It was oval in figure, convex above and concave below; and its anterior edge reached to about 6 lines behind the most forward portion of the nasal elevation. The cap accurately fitted the skull-contour, being adherent thereto by a dense cartilaginous-like periosteum, 0·15 inch at its thickest part. The representations A and B in fig. 4 give the precise shape of the piece as seen in profile and inferiorly.

Considerable force was required to remove it, so adherent was the fibro-plastic material to the skull. In effecting this,

Fig. 4.

Separated third or median horn of the ♀ giraffe, 11 years 7 months old, in two aspects and of natural size. A, right lateral view; the dotted lines indicate the skull-contour; B, its interior; C, sketch of portion of the frontal bone wherefrom the third horn springs. The triradiate roughened exostosis corresponds to the hollows within the cap, B.

part of the periosteum on each side of the cranial suture was torn off along with it, and the bone beneath partially exposed. I did not notice any special vascular structures at the points of union. From the skull, however, there projected a triradiate rough exostosis, which was adapted to corresponding hollows in the interior of the osseous cap or horn (*vide* C and B, fig. 4). I have found the respective sizes of the third horn in aged animals of the two sexes to be, in inches and decimals:—

	♂	♀
Extremo length	5	2.2.
„ breadth	3	1.3.
Greatest height	3	0.6.

2. The *Ligamentum nuchæ*.

For several reasons this most remarkable body of contractile tissue in the giraffe has been looked upon with an eye of wonder as well as curiosity. Its immense length, volume, and resiliency give it a conspicuous character, added to which it is unique in the ultimate fibre being striated.

In 1846 my late valued friend Prof. Quekett announced the discovery* of the above-mentioned microscopical structure, carefully noting (as was his wont) that whilst the outer portion of the ligament possessed the peculiarity in question, yet fibres from the centre were deficient in transverse markings, and, on the contrary, exhibited an occasional linear stripe, as if tubular. It has since been asserted by other observers (Dr. Cobbold †, I believe, for one) that the *ligamentum nuchæ* of *Camelopardalis* is deficient in the attribute of transverse striæ. For my own part, I can say that, examined in the fresh condition, the ligament does contain the varieties of tissue demonstrated by Quekett. But I may also mention another curious circumstance—to wit, that having had an opportunity of testing the matter at issue by re-examination of a portion of Quekett's original ligament ‡, I was surprised to find no indication of striated fibres whatsoever. Might one infer therefrom that long preservation in spirit destroys the said character of this yellow elastic tissue? and does the un-

* Trans. Microsc. Soc. of Lond. vol. iii. p. 45, pl. x. figs. 3, 4, striate, and figs. 5, 6, non-striate condition.

† Paper quoted, in the 'Annals' for 1854, p. 488.

‡ On the demise of the worthy Professor, a great many of his specimens from which sections had been cut passed into the hands of Mr. Norman, the microscopist, to whom I am indebted for the chance of investigating the point, besides his testimony as to correctness.

equal distribution of striate and non-striate fibrillæ in the ligament explain the (supposed rather than real) discrepancy of competent observers?

En passant I may refer to figs. 6 & 7, Pl. VIII. as illustrating transverse sections of the giraffe's ligamentum nuchæ, respectively from the shoulder and neck. These are of natural dimensions, and from the fresh subject, the peculiarities of the pieces being wide distinction in size and shape.

3. Observations respecting the Viscera.

The thoracic organs in the several specimens coming under my scalpel quite agreed with the published descriptions of such—this even to the disposition of the fleshy columns in the ventricles of the heart*. In the juvenile male there was no cardiac ossicle present, as Dr. Crisp† has already stated was the case in the young creature dissected by him. This fact helps to bear out the general rule applicable to ruminants; viz. the bony structure developed at the base of the heart is coincident with the age of the individual; in other words, its full size is contemporaneous with the fully adult condition.

The abdominal viscera, examined in each case with some care, corroborated in the main what has been noted by previous observers. I shall mention such variation as seems worthy of record.

There was no trace of a gall-bladder in any of the animals examined by me. Indeed notification of only two instances of such a viscus in the giraffe, met with by Gordon‡ and Owen§, is to be found in the anatomical history of this animal—a weighty argument in support of Owen's suggestion that its absence is the rule or normal condition. As to the liver, it weighed 3 lbs. 2½ ozs. in the male calf, and 11 lbs. 10 ozs. in the mother, in the former the dimensions being 11 inches by 8½ inches, and in the latter 17 inches by 14 inches in diameter, and 3 inches thick—thus corresponding closer to Crisp's than to Owen's or Cobbold's data.

With regard to the length of the alimentary canal, which has been made the subject of dissentient remarks by Dr. Crisp|| *versus* Owen, Joly, and Lavocat, it may not be out of place for me to register my observations, and, in comparing notes, see wherein discrepancies lie.

* Owen, *l. c.* p. 229.

† Proc. Zool. Soc. 1864, p. 269.

‡ Buffon, *Hist. Nat. Supp. t. vii.* p. 348.

§ *Loc. cit.* p. 228.

|| Proc. Zool. Soc. 1864, p. 64.

Table containing Proportional Measurements of three out of four Animals examined by me.

	♂ of 2 months.	♀ 11 years 7 months.	♂ 21 years 3 months.
	ft. in.	ft. in.	ft. in.
Length of the cesophagus . . .	5 0	6 2	8 4
" " four stomachs . .	2 3	5 9	6 8
" " small intestines	82 3	130 6	132 8
" " large intestines	19 5	83 0	92 4
Total length of alimentary tract	108 11	225 5	240 0

The length of the cæcum, which has been included with the large intestines in the above, was 19, 21, and 18 inches in the three respectively.

As far as I can read the evidence, the animal dissected by Joly and Lavocat, which had an alimentary tract equivalent to 211 English feet, appears to offer a fair sample; or it may be very slightly under the average of what obtains in the adult but not aged giraffe. Owen's admeasurements of a female and male about three years old, and a male of four years old, taken *seriatim*, yield 136 feet 4 inches, 133, and 124 feet. Crisp gives 254 feet in a female of eighteen years, 209 feet in a young male, and 107 feet 11 inches in a specimen two months old, besides acquiescing in my measurements of the ♀ (*vide* tab.), = 225 feet 5 inches*. It is due moreover to Prof. Owen to state that he does not include in his calculations the prolongation of the cesophagus and four stomachs.

Now, if we take into consideration the records of measurements of the *primæ viæ* of both young and old animals given by the several observers, including the present table, it follows that the extent of the alimentary canal of the giraffe (as verily that of other mammals) is in direct and relative proportion to their age—a fact which in most respects would modify any charge of error against either party.

To the published accounts of the generative organs in both sexes I can only annotate as subjoined. Ovary 2·7 inches long by 1 inch broad, and as much thick. A dark-coloured corpus luteum, 0·5 inch in diameter, lay imbedded in the pinkish stroma of the right ovarium; its edge had just reached the free surface of the latter. The remains of a similar corpus luteum, lately burst, existed in the left ovarium; and close beside it there was a second, smaller one, 0·3 inch in diameter. The vagina answered to Owen's description; but the distance

* See Crisp's second contribution, Proc. Zool. Soc. 1866, p. 564.

from the urethra to the os tincae was about 9, and the diameter 4·7 inches. Uterus 10 inches long. Each cornu was relatively wide, and a foot long following the curve. From the slightly enlarged and wavy appearance of the cotyledons, and the increased vascularity of the right horn, I believe gestation had occurred on that side. The sacculated condition of the broad ligament lodging the ovarium was well displayed.

4. *Muscles, their adaptation to the long flexible neck and slender limbs*.*

Professor Owen's summary of the more important features of the myology, and MM. Joly and Lavocat's list of head and pharyngo-laryngeal muscles, with fair survey of those of the body and legs, render it unnecessary for me to describe the whole of the musculo-tendinous structures, which nevertheless I minutely dissected. In the English memoir, excepting the under surface of the tongue, no figures of the fleshy parts are given. Whilst three myological plates accompany the Strasbourg "*Recherches*," the views are of such a diversified kind, regionally separate, that one fails to comprehend the beautiful muscular symmetry bestowed upon this towering ruminant. My object, therefore, is, by a rapid revision, to indorse and supplement the labours of these authors, and by a carefully executed profile drawing of the animal in life-like attitude, with some additional sketches, to depict such striking myological peculiarities as heretofore have not been illustrated.

The function of the cephalo-humeral in the giraffe is elevation and protraction of the fore limb; or it may be that, when the shoulder and leg are fixed, the strain can be applied to the lower moiety of the neck, and thus drag it downwards. As the French authors very neatly put it, "*Cette disposition défavorable à l'action musculaire, est tout en faveur de la rapidité et de l'étendue des mouvements, par suite de la longueur des bras de levier sollicités.*" I can corroborate their account of the attachments, viz. its being fixed to the processes on the sides of the fifth and sixth vertebræ of the neck, whence from being narrow it broadens into a great sheet covering the

* I take this opportunity of expressing my admiration of some myological and other casts, coloured and of the natural size, in the anatomical galleries of the Jardin des Plantes, Paris. I may cite:—three layers of the neck-muscles of the giraffe; intestines, cæcum, &c. of the same animal; a varied myological and visceral series of the hippopotamus (classic, as being the original of Gratiolet's splendid monograph); the same of the chimpanzee, sheep, horse, kangaroo, jaguar, besides many other vascular and glandular peculiarities of the elephant, llama, ostrich, &c.—all testimony to that vigorous zeal for anatomy so characteristic of the French school.

shoulder sideways and in front, with an insertion into the humerus and sternumwards. I may add, however, that superiorly, where moderately tendinous, its short bifurcation embraces a portion of the intertransversales cervicis; lower down, at the root of the neck, it is thick, massive, and fleshy, again inferiorly thinning into glistening aponeurosis stretching as a wide semilune in the axillary region, and, along with the pectoralis major, being finally inserted into the anterior middle line of the humeral shaft, nearly its whole length. In the long-necked alpaca I have found this muscle well nigh identical, excepting less volume over the shoulder; but in sheep and oxen it is duplex and proceeds to the skull.

My dissections confirm the Toulouse Professors' assertion of there being but a single trapezius, as in cattle and the Camelidæ. Owen describes a double portion, the first of which undoubtedly applies to the cephalo-humeral—a view which of late* he seems inclined to admit. In the giraffe the trapezius barely passes into the neck, and is even still shorter in *Auchenia pacos*. These two forms therefore differ from the generality of heavy-necked Ruminantia and Perissodactyla, where it stretches forwards very considerably.

Between our English anatomist and the two French savants there is a further difference of opinion concerning the presence of a rhomboideus. The latter deny its existence. My own dissection of several specimens substantiates Owen's statement; as he observes, it is remarkable for its shortness. In one old fleshy male I made a memorandum of its being much stronger than as figured in Pl. VII. In this case the spinal origin reached from about the seventh cervical to the third dorsal vertebra, or equivalent to 8 inches measured along the ligamentum nuchæ.

The elevation of the shoulders causes the fibres of the latis-simus dorsi to be more obliquely set upwards than in ordinary ruminants, the diagonal line of force corresponding. It forms serrations with the four hindmost ribs, and goes to the humerus along with the teres major. The only peculiarity worth mentioning in the sacro-lumbalis and longissimus dorsi is that the latter massive muscle appears double, the upper half being tendinous. The spinalis dorsi has unusual width, on account of the length of the dorsal spines; the ligamentum nuchæ partially overlaps it for six or seven of the dorsal vertebræ. As the semispinalis reaches the neck (s. colli), it becomes much reduced in bulk, corresponding therefore to the nuchal slenderness—its highest tendon, as in other mammals, being

* Anat. and Physiol. of Vertebrates, vol. iii. p. 42.

fastened to the axis, but here to the salient posterior end. The interspinales, intertransversales, and rotatores are each fleshy.

Prof. Owen has not failed to recognize, as conducing to the elastic spring of the fore part of the trunk on its bony columns, how it is slung, through the serratus magnus, to the large terminal scapular cartilage, besides a third of the bone itself. There are serrations to the eleven anterior costæ; the two rearmost are the highest; and the first is attached to the vertebral process of the head of the first rib.

Each of the writers mentioned calls attention to the powerful development of the scaleni. Owen recognizes four, and Joly and Lavocat three masses. I have found the undermentioned disposition:—The *s. anticus* arises from the transverse processes of the third and fourth cervical vertebræ, and with two thick equal-sized bellies proceeds down the neck, and is inserted singly, but muscularly, into the first rib. What I consider the *s. medius* has origin by a very strong tendon from the transverse process of the last cervical vertebra. It divides as it goes to the ribs into two strong muscular bellies. The deepest and dorsal one is inserted into the first rib about its middle; the other, longer belly reaches much lower down, being fastened by a tendon upon both the first and second ribs. The *s. tertius* (or *s. posticus*) is a wider, flatter muscle than the preceding, and, springing from the sixth cervical, is inserted into the articular end of the first rib by a broadish bifid insertion. Superficial to this, and in a measure seeming almost a portion of the serratus magnus, is a little round fusiform muscle partly attached to the first rib. Above, it terminates in a long tendon, which goes to the transverse process of the sixth cervical. I presume this offshoot of the *s. tertius* is the same which Gurlt* terms *cervicalis descendens* in *Ovis*.

Under the name of “transversal des côtes (costo-sternal)” a fair-sized muscle is mentioned which I also have found and take to be what now goes by the denomination of supracostal. It simulates continuance of the scalenus anticus, but commences by tendon at the first rib, going on fleshy to the third, and by aponeurosis to the sixth. Whilst the levator anguli scapulæ seems but a continuation of the serratus magnus, yet, as Owen notes in the neck, it has a trifid division. The lowest portion, springing from the seventh cervical, is fleshiest and most massive; the two other slips, with tendons of origin from the fifth and sixth vertebræ, conform to the upward thinning of the neck.

The rest of the nuchal muscles of the giraffe are a perfect

* Anat. Abbild. der Haus-Säugethiere, pl. 33. fig. 3.

model of adaptation to purpose; and, just as in the long thin legs, tendons replace flesh where power has to be transmitted with at the same time diminution of volume in the member. In the neck, however, another function has to be subserved, viz. graceful flexion of this seven-jointed piece of the spine. To accommodate, then, all wants, and still retain the ruminant type, the ordinary superficial muscular layer appears to be absent, and the deeper ones cut into bands ending in long tendons—a method of subdivision which combines concentration of force, tenuity of figure, and pliancy.

What Joly and Lavocat name splenius (*l. c.* p. 92) I regard as trachelo-mastoid, their complexus as a biventer cervicis. The splenius is wanting, and the complexus a very diminutive muscle. The longus colli has normal attachments, but is extraordinarily subdivided into what seem to be separate muscles (*vide* Pl. VII. fig. 3 & Pl. VIII. fig. 4).

The singular felicity with which Prof. Owen describes and comments on the very long ribbon-like muscles passing between the sternum, hyoid bone, and thyroid cartilage requires no commentary. Neither do the short fleshy bundles of the hyo-laryngeal apparatus, fauces, and tongue. Joly and Lavocat give a full list of those of the eye, ear, and face, which correspond in nearly every particular with those of other ruminants, notably the slender-jawed deer and antelope tribe.

The majority of the muscles of the fore leg are explicitly treated in the Strasbourg memoirs; my addenda, then, have reference to moot points or imply variation. In one old male I observed a somewhat duplex condition of the deltoid. Besides the usual elongate diamond-shaped fleshy belly, a broad expanse of tendon covered the infrascapular region, and, inferiorly fleshy, was inserted into the humeral neck behind the first division.

The muscle denominated triceps has five divisions in the giraffe, according to the Toulouse Professors—their first head, “le long extenseur de l’avant-bras (long scapulo-olécranien)” unquestionably answering to what is now ordinarily known as the dorso-epitrochlear, being derivative of the latissimus dorsi minus scapular origin.

Teres major and minor are mentioned as being united; but I have found them tolerably distinct. The former, of goodly size, joins the latissimus dorsi four inches from the humerus, the two passing underneath the fibres of the short coracobrachialis. The t. minor, well defined, has an insertion outside the humeral head into a pit above where the deltoid is fixed, the second head of triceps passing underneath it. The supra- and infraspinati are typical of the Ruminantia, each

full and fleshy-bodied; the first mentioned, besides its bifid tendinous insertion along with the infraspinatus on the external humeral tuberosity, has a division almost worthy of specific identification. In the sea-lion (*Otaria*)*, where even greater differentiation obtains, I have named it, from position, episubscapularis. In the giraffe (*vide* Pl. VIII. fig. 5, *Eps*) a view looking down on the upper rim of the scapula shows that the muscular fibres of the supraspinatus towards the glenoideum divaricate, and the abnormal portion passes inside the tendon of the biceps; overlying subscapularis and coraco-brachialis, it is inserted by tendon upon the internal tuberosity of the humerus.

I concur with the French authors in their interpretation of the pectorales, limited to p. major and p. minor.

The biceps, as the authors of the joint memoir note, is inserted by tendinous-like fascia into the ulnar neck, but besides sends an aponeurotic expanse, partially intermingled with the supinator longus, to the proximal end of the cannon bone, equivalent to the fascia of the forearm in man. I likewise agree in there being a double-bellied coraco-brachialis, the longer fusiform portion reaching almost to the intercondyloid fossa, the shorter flatter division proceeding only to the humeral neck. The brachialis anticus has an ulnar insertion immediately below the biceps.

I need not enlarge on the remaining long extensors and flexors of the fore limb, which MM. Joly and Lavocat have already accurately described.

As regards the abdominal parietes, these, *cæteris paribus*, are relatively short; for the great depth and capacious enclosure by the ribs limit considerably the loose abdominal area. The form of the body of the giraffe is indeed remarkable in this respect. Whilst a certain amount of superficial strong elastic fascia obtains, lending support to the fleshy wall, this falls far short of the development attained in the Pachydermata.

In the male giraffe, as in the domestic bull, the "musculus præputialis" has a considerable expanse of fleshy fibres.

The psoas magnus and p. parvus are separate and well represented. Iliacus double, part springing from the iliac fossa and part from the first sacral vertebræ, the psoas magnus tendon and lumbar plexus of nerves coming between.

The pelvo-caudal muscles are tolerably well represented (Pl. VII. fig. 3). What appears to be the ilio-coccygeus (or perhaps inner division of ischio-coccygeus) is a broadish fleshy plane which springs from the inside of the pelvis close

* Trans. Zool. Soc. vol. vii. p. 557.

to the ischial spine and forwards to behind the acetabulum; crossing to the tail, it is attached laterally and below to the first and second caudals. Superficial to it is the ischio-coccygeus, about equal in volume. This, which Joly and Lavocat* say is absent, I find comes by a tendinous origin from the great ischiatic ligament, and, proceeding inwards with considerable obliquity, is inserted into the transverse processes of the three anterior caudal vertebræ. The infra- and sacro-coccygeus, the levator caudæ internus and externus respectively cover the under and upper surfaces of the sacro-coccygeal bones, each vertebra being supplied by tendon, as is usual. The intertransversarii diminish in the ratio of the size of the bones.

The musculo-tendinous levers of the hind limb have not been touched on by Owen; but this deficiency is amply compensated by the foreign workers.

The tensor vaginæ femoris has a considerable mass of muscular fibres above; but below these merge into a very strong elastic fascia lata, covering the groin and thigh to the knee-joint.

In the pelvic region of apes the designation "*scansorius*" has been applied to one of the muscles, as indicative of its supposed influence in their climbing movements. It appears, however, to be represented in the giraffe by an almost distinct anterior portion of the *pyriformis*. It arises from the middle of the anterior edge of the ilium, and is inserted outside the great trochanter, lower than the *gluteus minimus* and *g. medius* attachments.

Joly and Lavocat say, "*Le grêle antérieur [gracilis] des monodactyles n'existe pas.*" I did not note its presence. As they indicate rather than describe, a *sartorius* and *pectineus* are both well represented, the latter being a short thickish muscle. The *rectus femoris* is very thick indeed, and single in origin. The *vastus externus* exceeds it in volume, being literally of immense proportion, whilst the *v. internus* is only half the size of the latter. The *crureus* is both fleshy and strong; but its most noteworthy point is that the outer portion rolls round the femur, and in this presents a striking resemblance to the *brachialis anticus* of the fore limb—a fact suggesting their homology. I found two *adductores*; the French anatomists give only one; for their "*long adducteur de la jambe*" is veritably the *sartorius*. My *ad. longus* springs fleshy from the brim of the pelvis, passes under Poupart's ligament, and is fixed to the middle third of the femoral shaft. The *ad. magnus*, bulkier, comes from the ascending horizontal rami pubis and proceeds the whole length of the *linea aspera*.

* *Loc. cit.* p. 95.

A portion of the obturator internus appears to pass through the obturator foramen, therefore resembling in a degree what Mr. Mivart and I found in *Hyrax**, wherein we named a muscle which pierced the foramen obturator tertius.

The biceps femoris is double-headed and very fleshy; its anterior portion has coarse fibres, directed obliquely forwards and downwards. The semimembranosus is another very bulky muscle, the semitendinosus less so. In an old male the gastrocnemius had attained great fulness of proportion; both heads were strongly muscular, particularly the inner one. The Toulouse Professors remark that the plantaris is absent; but in the animal last spoken of I certainly met with it. Arising by a short tendon from the outer side of the linea aspera, its muscular belly terminates above the middle of the tibia. The continuation of its lower tendon winds round the inner side of the gastrocnemius, and, superficial to it at the os calcis, spreads out and has an attachment on each side.

The inferior tendon of the tibialis anticus is relatively very thick; and the extensor communis digitorum I observed to be double-bellied, these lying in close apposition. MM. Joly and Lavocat also mention two muscles; but, as they say, one "est l'extenseur propre du doigt interne," a muscle (the ex. long. pollicis) which I met with independent of the duality of belly above spoken of. They allude to but one peronæus: I satisfied myself of there being two, the smaller being situated most anteriorly. The disposition of the other flexors of the leg and foot corresponded pretty well with the description given by the authors of the "*Recherches*." Their remarks upon the mechanism of action of the leg-muscles and tendons are very appropriate.

5. Autopsy of two Animals killed through a fire

A few years ago a fire accidentally broke out at night in the giraffe-house of the Zoological Gardens. Three animals were occupants—an old male, and a female with her young about two months old. It was in the stall of the latter that combustion had set up, their bedding of straw and part of the boards being consumed before attention was drawn to the casualty. When entered, the atmosphere of the building was stifling through smoke. The male giraffe was got out safely to the adjoining yard; but the young one and her dam succumbed speedily amongst the smoky fumes and smouldering embers of the scorching straw. As no record of the autopsy has hitherto been published, it therefore forms a fit appendix to the present anatomical communication.

* Proc. Zool. Soc. 1865, p. 348.

The following appearances were noted on examination of the dead bodies of the two animals sixteen hours after the accident.

In the old female, during the short interval which had elapsed after death, the abdomen had become immensely swollen, in fact almost incredibly distended, by the evolution of gaseous material. The tongue protruded considerably out of the mouth, and was partially discoloured by fragments of charred straw. The eyeballs appeared as if starting out of their sockets, and were intensely bloodshot. There was protrusion and puffiness of the rectum and external organs of generation; and these parts exhibited signs of incipient decomposition, although the weather was agreeable and cool.

The hair on the right side of the body, that on which the animal had fallen, was slightly singed. All four limbs were in a similar condition; but the main part of the left side of the body and the neck were scarcely superficially injured.

On making an incision into the abdomen, an enormous volume of horribly smelling foetid gas escaped: this came partly from the general visceral cavity, and partly from the paunch, which latter was perforated when the outer parietes were transfixed.

All the digestive cavities contained more or less semidigested food; and the intestines were also abundantly filled with faecal substances. The animal had consumed its evening meal just previously to the fatal accident; and this circumstance, along with the manner of death, sufficiently accounted for the rapid decomposition of the tissues.

The liver and spleen were gorged with blood; both were dark-coloured and unusually soft. Decomposition of their tissues had already commenced. Though firmer than the above, the kidneys were far softer than natural, and intensely congested. The right cavities of the heart and the great veins leading thereto were all distended with black sanguineous clots. Lungs filled with bloody fluid and much bad-smelling gas. The submucous tissue of the bronchi and trachea were everywhere injected; but the latter organ, at its upper end and all around the region of the glottis, was very much infiltrated with discoloured bloody-tinged fluid.

The entire venous system was unnaturally injected; but on the skin being taken off, a still more remarkable feature was noticed, viz. the surface of the flesh streamed with blood oozing everywhere from the lacerated venous oscula.

In the young male, whilst the body exteriorly had suffered greater damage from the burning straw, the death-throes had evidently been of a less violent kind. The skin of the body

was more singed throughout than that of the mother; but the legs and especially the hoofs were very severely injured; of the latter, the right hind one was quite loose, from the intense heat. The tongue did not protrude; but the eyes were blood-shot and staring.

There was less swelling of the abdominal cavity than in the older animal; and the viscera of the thorax and abdomen, though gorged, contained but a moderate quantity of effused blood. The submucous tissue around the glottis and trachea did not exhibit such an amount of infiltration. In the first and fourth stomachs, milk, partly curdled, existed in plenty.

The sum of the morbid appearances bore testimony to the fact that death in each case had resulted from asphyxia, hastened doubtless by the shock and pain endured from the burning straw beneath them.

6. *Conclusions.*

The gist of the present paper, then, when put in the form of propositions, resolves itself somewhat as follows:—

1. Agreement with those who look upon the posterior pair of bony pedicels on the summit of the giraffe-skull as extraneous ossific centres adherent primarily in the manner of epiphyses.

2. Concurrence in testimony of the naso-frontal eminence being also epiphysial, developed after the same fashion, and therefore identical in nature with the posterior bony elevations.

3. If the term horn holds good, then the giraffe is tricorned. But zoologists are divided in their opinions respecting the precise homology of the said appendages in relation to other ruminants. De Blainville* regarded them as equivalent to the deer's pedicels; and I infer from what Is. Geoffroy Saint-Hilaire† says, that he looked upon them as representatives of the horn-cores in the Bovidæ. Dr. Gray's definition‡ draws them towards the latter; yet he justly appreciates difference. Withal, is it not possible that his fourfold separation of "coleocera," "komecera," "dermocera," and "epochocera," distinguishing respectively the Bovidæ, Antilocapridæ, Girafidæ, and Cervidæ, may be but textural shades of kind of but one organic homologue? Pedicel, core, and osseous epiphysis would then stand in unison, and antler and horn (bony, corneous, or hairy) present identity. In all ruminants, then, whether less or more developed, the osseous base necessarily would be

* Comptes Rendus de l'Institut, 1837.

† *Ibid.* p. 55.

‡ Ann. & Mag. Nat. Hist. 1866, vol. xviii. p. 326.

equally persistent, the superficial appendage or covering deciduous within narrow or wider limits. Do not the fossil Ruminantia reveal forms of intermediance which fill many an hiatus of our apparently trenchantly separate living fauna?

4. That the ligamentum nuchæ is composed of both transversely striped and non-striate fibres, unequally distributed; and that there is a probability of the former losing their characteristic differentiation when long preserved in spirit.

5. That the discrepancies of length in the alimentary canal are explicable on the grounds of age and sex; and the presence of a gall-bladder is of such unfrequent occurrence that it may be classed as an anomaly.

6. The muscles of the limbs and body closely assimilate to those of Ruminantia generally; but those of the neck and front of the shoulder present modifications in harmony with or adapting them to the exigencies of a long slender neck, &c.

EXPLANATION OF THE PLATES.

PLATE VII.

- Fig. 1.* Upper surface of the skull, with the pericranium on it, of the old female giraffe, seen somewhat in front, and showing the relative position of the three horns: 3, the anterior median one.
- Fig. 2.* Side view of pelvic bones and tail-muscles: *l*, ischiatic ligament; *Ile*, ilio-coccygeus; *Is*, ischio-coccygeus; *Sc*, sacro-coccygeus; *Lce* & *i*, levator caudæ externus and internus.
- Fig. 3.* Profile of the giraffe in the attitude of walking, designed to show a dissection of the upper muscular layer throughout the body, neck, and limbs, in the natural position. Lettering as follows:—*Z*, zygomaticus; *Bu*, buccinator; *Ma*, masseter; *Lsp*, levator superioris proprius &c.; *Cn*, compressor nasi; *Pgl*, parotid gland; *Co*, complexus; *Oi*, obliquus internus; *Tms*, trachelo-mastoid; *ln*, ligamentum nuchæ; *Las*, levator anguli scapulæ; *Stm*, sterno-mastoid (or s.-maxillaris); *Mh*, mylo-hyoid &c.; *a+v*, carotid artery and vein; *Ite*, intertransversalis cervicis; *tr*, trachea; *lc*, longus colli; *Sh*, sterno-hyoid; *Ch, ch**, cephalo-humeral; *Tz*, trapezius; *Rh*, rhomboideus; *Lad*, latissimus dorsi; *Dep*, dorsi epitrochlearis; *T¹*, *T²*, *T³*, triceps; *Is*, infraspinatus; *D*, deltoid; *Sl*, supinator longus, and *Ecr*, extensor carpi radialis; *Pma*, pectoralis major; *Ba*, brachialis anticus; *P. lo*, palmaris longus; *Fcr*, flexor carpi radialis; *Fou*, flex. carpi ulnaris; *Fs* & *pd*, flexor sublimis et profundus digitorum; *Ecd*, extensor communis digitorum; *Abp*, abductor pollicis; *Ecu*, ext. carp. ulnaris; *Eo*, external oblique; *Tvf*, tensor vaginæ femoris; *Gmx*, gluteus maximus; *Bf*, biceps femoris; *Ve*, vastus externus; *Ga*, gastrocnemius; *So*, soleus; *Fld*, flex. long. dig.; *Pb*, peronæus brevis; *Pl*, peronæus longus; *Eld*, ext. long. dig.; *Ta*, tibialis anticus; *Sm*, semimembranosus; *Po*, popliteus; *Vi* & *Rf*, vastus internus and rectus femoris; *Sa*, sartorius; *Admg*, adductor magnus.

PLATE VIII.

- Fig. 4.* Reduced sketch of the deep muscles on the lower surface of the

neck, showing how they adapt themselves to the elongate character of the vertebræ and slender nuchal region generally. The numerals I. to VII. are placed opposite the cervical vertebræ. *R. a. ma*, rectus anticus major of right side; *R. a. mi*, rectus anticus minor of left side; *lc*, longus colli; *m*, muscular bellies interwoven with each other.

Fig. 5. Semidiagrammatic view of the scapular muscles seen from above or on their narrow upper edge: *B*, biceps tendon where passing over head of humerus; *I.s*, infraspinatus tendon; *S.s*, supraspinatus muscle; *Ep. s*, episubscapularis; *S*, superior border of subscapularis.

Fig. 6. A transverse vertical section of the spinal elastic ligament and muscles at the second dorsal vertebra.

Fig. 7. Similar slice of the ligament at the seventh cervical, both nat. size, from old ♂: *ln*, *ln**, ligamentum nuchæ; *m*, muscle in section; *v*, vascular channels.

XXI.—Descriptions of two new Species of Humming-Birds.

By JOHN GOULD, F.R.S. &c.

Helianthus micraster, Gould.

Bill black; on the forehead a band of glittering green; crown of the head, all the upper surface of the body, and the shoulders bronzy green; chest and flanks of the same hue, but rather brighter; centre of the abdomen mottled brown and green; on the throat an exceedingly lustrous spot of orange-scarlet, exceeding in brilliancy the colouring of the same part of any other member of this beautiful genus yet discovered; wings purplish brown; four central tail-feathers bronzy green, the remainder black; thighs brown; under tail-coverts white; feet dark brown, nearly black.

Total length $3\frac{3}{4}$ inches; bill $\frac{3}{4}$, wing $2\frac{1}{4}$, tail $2\frac{1}{8}$, tarsi $\frac{1}{4}$.

Habitat. St. Lucas, near Loxa, in Ecuador.

Remark. I have in my collection two specimens of this new bird, one of which is much brighter and finer than the other. They were collected in the locality above mentioned, by one of Mr. Clarence Buckley's hunters. In size this species is much smaller than any other member of the genus, even than *Helianthus mavors*. My specimens differ also from all of them in the absence of a white or buff band across the chest, in which respect they assimilate to *H. Parzudaki*, but not in the forked tail and other respects. I think it probable they are somewhat immature, and that, beautiful as they are, fully adult examples will be still finer.

Chlorostilbon pumilus, Gould.

Bill black; crown and the whole of the under surface glittering bronzy green, with a wash of blue on the chest; back and upper tail-coverts green, becoming somewhat brighter on