ZSIA

PROCEEDINGS

OF THE

GENERAL MEETINGS FOR SCIENTIFIC BUSINESS

OF THE

ZOOLOGICAL SOCIETY

OF LONDON,

FOR THE YEAR

1894.

PART I.

CONTAINING PAPERS READ IN

JANUARY AND FEBRUARY.

JUNE 1st, 1894.

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SOLD AT THEIR HOUSE IN HANOVER SQUARE.
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OF THE

ZOOLOGICAL SOCIETY OF LONDON.

1894.

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By order of the Council,

P. L. SCLATER,

Secretary.

3 Hanover Square, London, W.,
April, 1895.

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P. L. SCLATER,
Secretary.

Dec. 21*st*, 1894.

ZOOLOGICAL SOCIETY OF LONDON,
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PROCEEDINGS

OF THE

GENERAL MEETINGS FOR SCIENTIFIC BUSINESS

OF THE

ZOOLOGICAL SOCIETY OF LONDON.

January 16, 1894.

Sir W. H. Flower, K.C.B., LL.D., F.R.S., President, in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of December 1893:—

The registered additions to the Society's Menagerie during the month of December 1893 were 62 in number. Of these 29 were acquired by presentation, 15 by purchase, 7 were born in the Gardens, and 11 were received on deposit. The total number of departures during the same period, by death and removals, was 91.

Mr. Sclater exhibited a coloured drawing of the head of *Cercopithecus erythrogaster* taken from the specimen of that Monkey in the Paris Museum, and read an extract from a letter addressed to him (enclosing it) by M. E. de Pousargues (Préparateur au Laboratoire de Mammalogie au Muséum, 55 Rue de Buffon). It appeared that in the adult of this species the hairs on the nose are white, and that the species should therefore probably be removed, in Mr. Sclater's arrangement of the genus, to "Section A. *C. rhinosticti*" (P. Z. S. 1893, p. 244), in the neighbourhood of *C. petaurista*. In the type in the British Museum these hairs were blackish, but there were indications of whitish at their bases, and the specimen was probably young.

The Secretary read the following extract from a letter addressed to him by Mr. C. B. Mitford, dated Freetown, Sierra Leone, 26th November, 1893:—

"I have one of the most interesting phenomena to tell you about, which has not been seen in Freetown for the last 60 or 70 years, but as it only commenced yesterday I can give you but a short account of it now. At 1.30 P.M. yesterday I noticed the hills at Wilberforce assuming a very dried-up appearance, which gradually extended to the water's edge, and on calling the attention of a native to the peculiar change in the appearance of the 'bush' he informed me that Locusts were coming.

"What he said proved to be correct, for in a very short time huge black clouds appeared above the hills, as if a severe storm were brewing, and those I at first saw, the advance guard, in the brilliant sunshine gradually gave one an idea that the whole of the sides of the hills were on fire; these hills, I should say, are three miles off in a bee-line.

"At 2.45 P.M. these supposed clouds reached Freetown, and proved to be a continuous mass of locusts, which passed without intermission till 5.10. P.M., and, as in their progress they were only 30 or 40 feet above the ground, a sound like a rushing stream at a distance could be distinctly heard.

"During their course the sky was obscured. Myriads settled on the houses, trees, roads, &c., but made no apparent difference in the size of the swarms passing over. The whole town was covered with their excrement.

"Last night, when I went out about 10 P.M. to see what was going on, I found plenty of locusts in the garden, but on a near approach to the plants they dropped suddenly on to the ground.

"This morning, when I got up about 6 A.M., only two or three were to be seen. At 9.45 A.M. the stream began again, but not in such dense masses as were seen yesterday, and continued up to 1 P.M.

"A more marvellous sight I have never seen, nor has, so far as I can ascertain, the oldest resident in Freetown, although I hear they appeared here sixty or seventy years ago, as I said before.

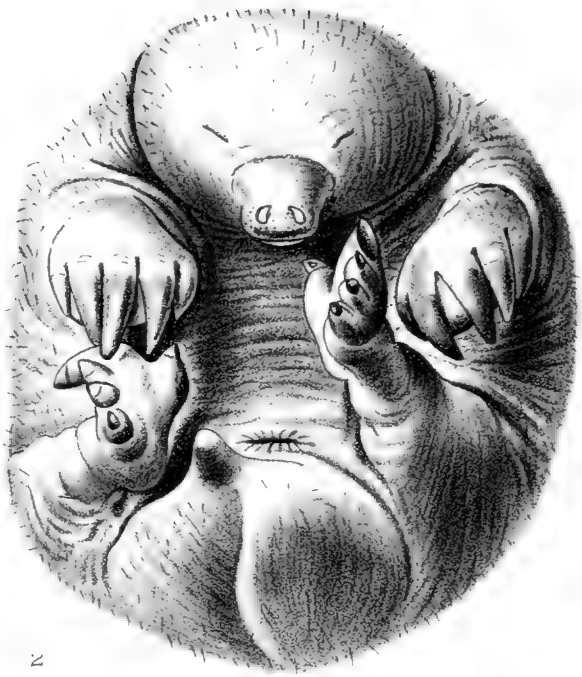
"As you walk along the roads they rise like a large flock of birds, most of them rising and joining the main band, but others coming down and taking their places."

The Secretary stated that Mr. C. O. Waterhouse, of the British Museum, in whose hands he had placed specimens of this Locust transmitted by Mr. Mitford for examination, had determined them to belong to *Pachytylus migratoroides* (Reiche et Fairmaire) (Ferr. et Gal. Voy. en Abyss. iii. p. 430), originally described from Abyssinia, but recently ascertained to occur also in West Africa.

A second extract from the same letter referred to the occurrence of the Elephant (*Elephas africanus*) in Sierra Leone:—

"In reference to the occurrence of the Elephant in Sierra Leone, I can only state, in continuation of what I told you before, that I have been informed, on, I think, very reliable information, that within a certain mountainous portion of the western district

1



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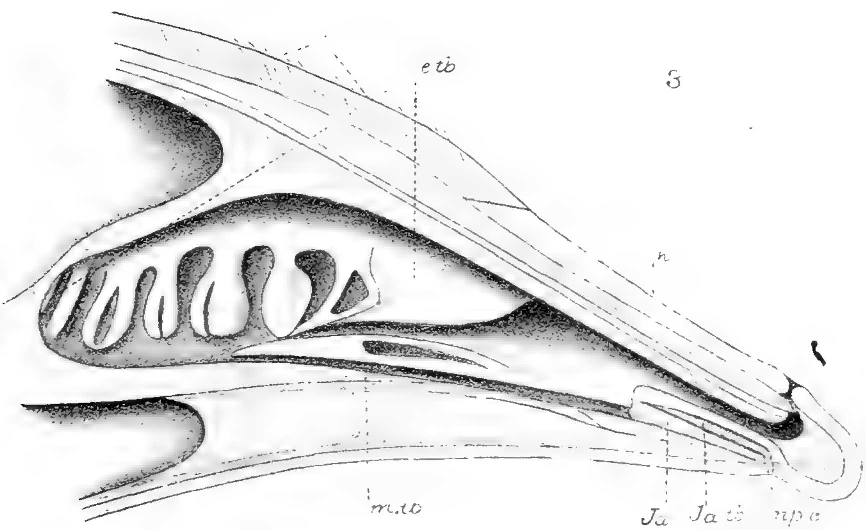

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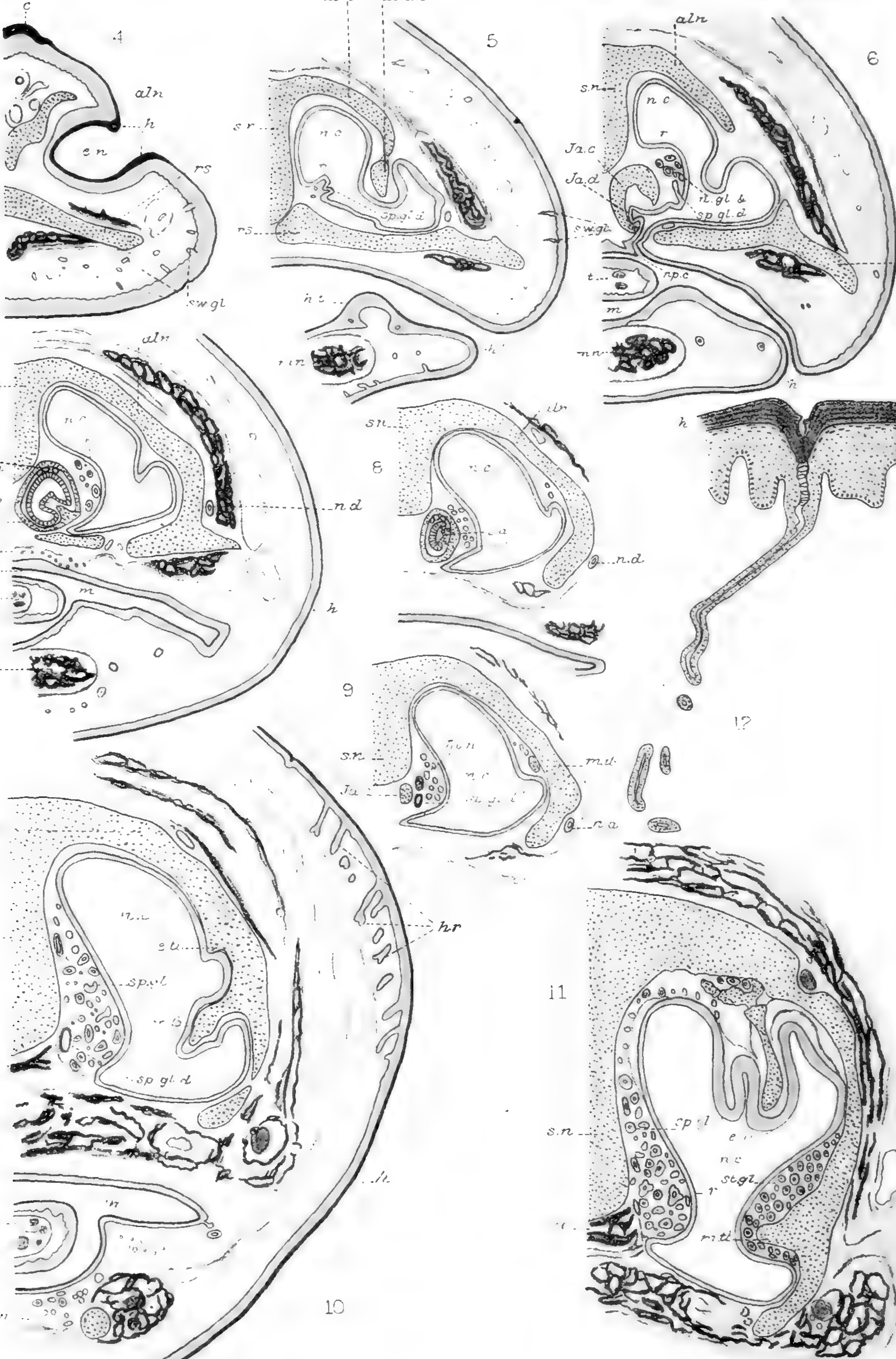
Structure of young Echidna.



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Structure of young Echidna.

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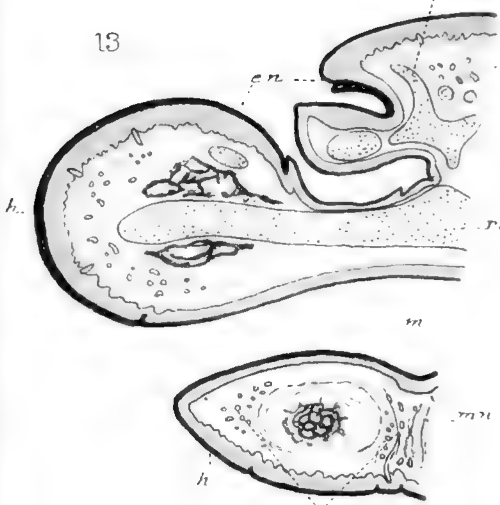

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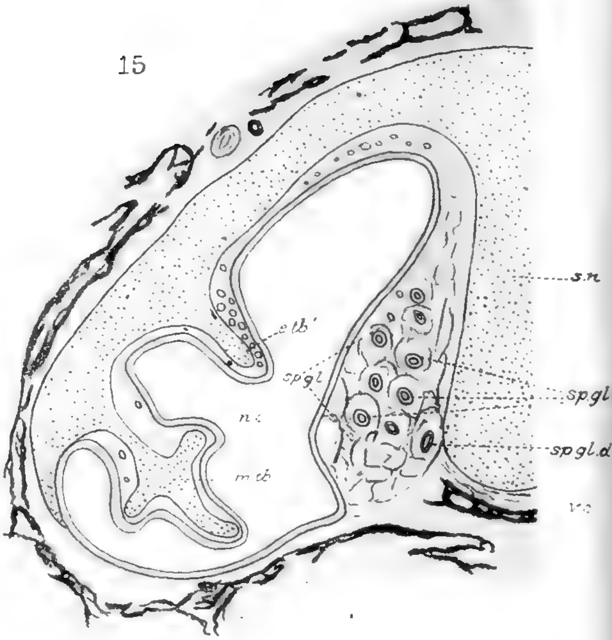

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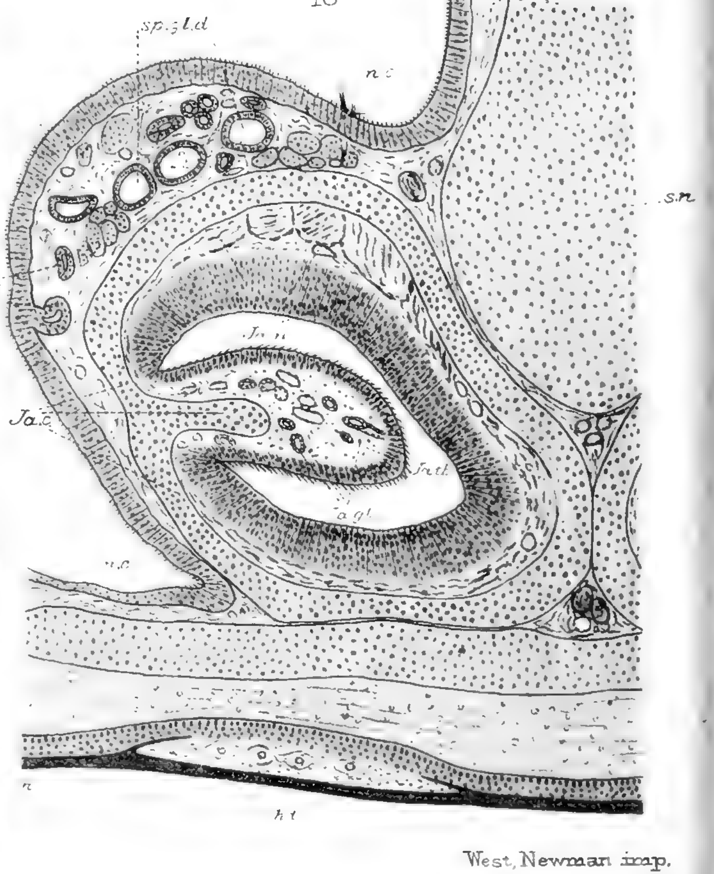

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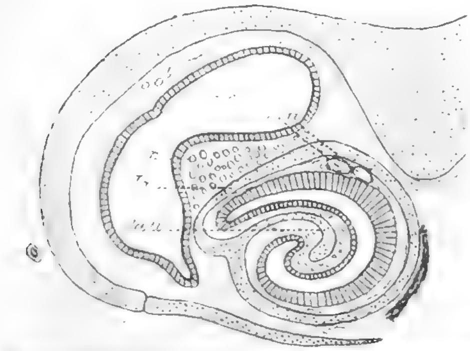

W.N.P. del. ad nat.
M.P.P. lith.

West, Newman imp.

Structure of young Echidna.

bounded by the farms or villages of York, John Obey, and Tombo, on the sea-shore, and by Pickett Hill in an easterly direction inland from Kent, Elephants do exist.

"Another dead one was found not long ago and a regular scramble took place for the flesh. The skull of the one which I got was found 12 hours' walk from the beach.

"A farmer named Wise often complained recently to the late acting manager that Elephants did a good deal of damage to his crops and made deep holes in the ground when they came down to drink.

"I am assured that if there is one Elephant in the district there are at least a hundred. This statement I accept with reservation, but that they do exist I have not the slightest doubt.

"At John Obey, a place about halfway between York and Kent, the spoor of Elephants can be found on many farms not quite a mile away from the village."

Mr. R. Lydekker, F.Z.S., gave an account of some of the principal objects observed during his recent visit to the La Plata Museum, calling special attention to the series of remains of Dinosaurian Reptiles, of Cetaceans, and of Ungulates of three different suborders. Mr. Lydekker also made remarks on some of the specimens of Edentates and of the gigantic birds of the genus *Brontornis* contained in the Museum.

Mr. Lydekker also exhibited a painting of the head of a Wild Goat (*Capra ægagrus*) of unusual dimensions.

Mr. J. Jenner Weir, F.Z.S., sent for exhibition a specimen of the "Tsetse," *Glossina morsitans* (P. Z. S. 1850, p. 261[1], pl. xix.), which had been transmitted to him from the Transvaal by Dr. Percy Rendall, F.Z.S.

Mr. W. B. Tegetmeier, F.Z.S., exhibited and made remarks on a Pheasant with abnormal plumage assimilating to that of "Pencilled Fowls."

The following papers were read:—

1. On some Points in the Structure of the Young of *Echidna aculeata*. By W. N. Parker, Ph.D., F.Z.S., Professor of Biology in the University College of S. Wales and Monmouthshire, Cardiff.

[Received November 7, 1893.]

(Plates I.–III.)

At the meeting of the British Association held in Cardiff in 1891 I exhibited some young specimens of *Echidna*[1], and made a

[1] Brit. Assoc. Report, 1891, p. 693.

few remarks on the structure of certain parts of the head. The present paper refers to the same individuals, and treats of the external characters and the structure of the fore part of the head only; at a future time I hope to deal with other regions.

The specimens are from the collection of my father, who received them from Dr. E. P. Ramsay, Curator of the Australian Museum, Sydney. I do not know of any description of the external characters of the young *Echidna*; and as such young specimens are very rarely obtained, I have thought it worth while to figure the two stages in my possession (Plate I. figs. 1 & 2), the older of which is rather smaller than the young *Ornithorhynchus* figured by my father in his 'Mammalian Descent' (p. 25).

I. *External Characters.*

Stage I. (Plate I. fig. 1).—The dorsal side is very convex, the head being bent so far round that the snout points directly backwards. The ventral side of the body is flattened, and the trunk passes insensibly into the conical tail, the apex of which is directed backwards. The length of the animal along the dorsal curve from the end of the snout to the tip of the tail is 12·5 cm., and the greatest diameter of the body 3 cm.; the head measures 2·8 cm. in length. The integument has a pitted appearance in the dorsal and lateral regions of the body, and though no hairs have yet appeared at the surface, the places in which the strong spines later break through can be plainly seen. The gape is narrow, and extends less than halfway along the snout, the anterior part of which is distinctly horny, the horn fading off posteriorly, so that the hinder part of the snout is covered with a soft integument like that of the rest of the head. The nostrils are ovoid and oblique, and a projecting septum extends into each from the inner side, about halfway across. Between the nostrils a distinct caruncle or "egg-breaker," like that of the young *Ornithorhynchus*[1], can be seen at this stage. Narrow slits indicate the position of the eyes, the upper and lower eyelids being confluent. The external auditory aperture is also slit-like, and extends into the thick layer of muscles covering the hinder part of the skull. The cloaca is shallow, and the vent is plugged by a rounded projection from its walls.

The fore limbs are larger and stronger than the hind, and the digits are provided with well-developed claws, those of the 1st and 5th being smaller than, though forming a regular series with, the others. The hallux is short and small, and situated more proximally than the other digits of the pes: it has a well-marked claw. The hind toe is very large, its strong claw projecting far beyond those of the remaining three digits, which are of considerably less diameter than the 1st, and bear small claws.

Stage II. (Plate I. fig. 2).—The flexure of the body is similar to that seen in Stage I., except that the end of the tail is now bent under the body, so that its conical end points towards the snout.

[1] *Cf.* W. K. Parker, 'Mammalian Descent' (London, 1885), pp. 45 & 49.

My two specimens of this stage measure respectively along the dorsal curve from the end of the snout to the tip of the tail 21·5 cm. (see fig. 2) and 25·5 cm., the greatest diameter of the body being about 6 cm., and the head 4 cm. in length. The rough integument is covered with papillæ, and the stiff bristles now project about 3 mm.; the position of the stronger and sparser spines amongst these can be seen more plainly than in the earlier stage, though they still hardly project above the surface. The snout is more plainly marked off from the rest of the head than in Stage I., and is relatively flatter: it is entirely covered with horn, and much resembles the "beak" of *Ornithorhynchus* except in the relative extent of the gape. The nostrils are now more completely valvular, and the caruncle is no longer recognizable. The eyelids are beginning to separate, the conjunctival chamber communicating with the exterior by a small aperture. The cloaca has become deeper, folds of the integument radiating out from the vent.

The integument on the ventral side of the body is much folded; and in the larger of the two specimens, which is probably a female, a shallow triangular pouch, the apex of which points backwards, can be seen between and rather anteriorly to the hind limbs. There can be little doubt that this represents the mammary pouch as described by Haacke [1]; and as it is so distinct at this stage, it seems improbable that it would altogether disappear in the adult between the periods of suckling. I do not propose to treat of its structure or of its relation to the pouch of Marsupials in the present paper [2].

The pes is now nearly as large as the manus, though its claws are not so strongly developed. The calcaneal spur can be seen in both specimens, but is considerably larger in the smaller of the two, which is probably a male.

II. *Integument of the Head.*

The resemblance of the snout to that of *Ornithorhynchus* has already been remarked upon; and this is more particularly the case in the later stage, in which it is relatively flatter than in the younger one. As in *Ornithorhynchus*, the lips, as well as the whole integument of the snout, are immobile, owing to the development of a thick horny layer from the epidermis (Plates II. & III.). The horn is much thicker in the older of the two stages, and this is all the more remarkable as in the adult the skin in this region can hardly be said to be horny at all. The horny layer extends over the margins of the gape, and then thins off gradually: it also passes inwards to line the external narial passages (Plate II. fig. 4 and Plate III. fig. 13). The caruncle (figs. 1 and 4) is formed by a ridge of the epidermis on which the horn is especially thick [3].

[1] W. Haacke, "On the Marsupial Ovum, the Mammary Pouch, and the Male Milk-glands of *Echidna hystrix*," Proc. Roy. Soc. vol. xxxviii. p. 72; and Biol. Centralblatt, viii.

[2] *Cf.* H. Klaatsch, Morph. Jahrbuch, Bd. xvii. p. 483.

[3] *Cf.* Carl Röse, "Ueb. die Zahnleiste und die Eischwiele der Sauropsiden," Anat. Anz. vii. Jahrgang, 1892, p. 748.

An examination of the end of the snout with a hand-lens shows the presence of a number of fine dots on both jaws extending about as far back as the gape. These are indicated in figs. 1 and 2. Sections show them to be due to the presence of funnel-shaped apertures in the horny layer, which extend inwards, surrounded by a continuation of the horn, and gradually become narrower (figs. 4, 5, 12, and 13). Just beneath each aperture the epidermis is prolonged inwards to form an elongated oval process (fig. 12), which, slightly below the base of the dermal papillæ, narrows somewhat to form a tube extending for some distance into the derma, where it becomes convoluted; its walls are composed of a double layer of cells, and the lumen becomes greatly coiled on passing into the swollen base of the epidermal process and then communicates with the aperture at the base of the horny ingrowth. It will thus be seen that these glands are precisely similar in structure to ordinary sweat-glands. I should mention that the lumen is not developed in the young stages.

Poulton[1] has described structures in *Ornithorhynchus* which are apparently similar to these, and suggests that they may correspond to modified hairs; this, however, seems to me improbable. I have found nothing which could correspond to the sensory organs of the bill of *Ornithorhynchus* described by Poulton.

No hairs, nor any structures resembling hairs, are present on the horny snout. Behind this, hairs are developed in abundance (figs. 2 and 10), and in the older stage the sebaceous glands can be seen arising as buds from the hair-follicles. No sweat-glands are present on the hairy part of the head; the rest of the body I have not yet examined. It should, however, be remembered that Gegenbaur[2] has shown that the mammary glands are modified sweat-glands in these animals.

III. *The Oral Cavity.*

Even in the younger stage the mouth has already acquired its narrow and tubular form (see figs. 5–7, 10, and 14). The elongated tongue is covered with a thin layer of horn at the tip. The sublingual glands are numerous, and open at various points into the floor of the mouth. The naso-palatine canals communicate with the oral cavity anteriorly (fig. 6, *np.c.*); and from this point backwards, some distance beyond Jacobson's organ, a number of simple gland-tubes, very similar to those already described in the snout, are present on the roof of the mouth (fig. 7). Similar glands are also present in this region in the young *Ornithorhynchus*.

The epithelium in certain regions both above and below gives rise to horny teeth, which on the anterior part of the lower jaw form marked ridges (figs. 5, 7, 14, 16). A dermal papilla extends into the thickened epithelial ridge, which produces a thick horny layer on its outer surface.

[1] "On the tactile terminal Organs and other Structures in the Bill of *Ornithorhynchus*," Journ. Physiol. vol. v. p. xv. (Proc. Physiol. Soc. 1884).

[2] 'Zur Kenntniss der Mammarorgane der Monotremen,' Leipzig, 1886.

The question as to the presence of rudiments of true teeth in *Echidna* is of especial interest. After a fruitless search through sections of the older stage, I hoped to be more successful in the younger specimen, but have not succeeded in finding any indication of the development of teeth at all, and am confident that earlier stages must be examined before any signs of these organs can be recognized. It is certainly remarkable for all traces of them to have disappeared so early, especially when we consider how well they are developed in *Ornithorhynchus*[1]: this is probably to be accounted for by the extreme and early specialization of the mouth in *Echidna*.

The fact that Röse[2] has succeeded in finding traces of teeth in a small embryo of *Manis* 7·6 cm. long, while they have entirely disappeared in older embyros from 17–30 cm. in length, further indicates the probable formation and early reduction of a "Zahnleiste" in *Echidna*.

IV. *The Nose and Jacobson's Organ.*

In the note already referred to I drew attention to the marked development of Jacobson's organ in *Echidna*, and to the fact that it possesses a "turbinal" supported by cartilage. The organ had been previously recognized in *Ornithorhynchus* by Sir W. Turner[3] and my father[4], and sections of a young specimen of this animal in my possession showed that it closely resembles that of *Echidna*. Since the publication of my note, however, Dr. Symington[5] has given such an excellent account of the nose of *Ornithorhynchus*, comparing it with that of other Mammals and also giving the literature of the subject, that it will be only necessary for me to refer to this animal for purposes of comparison with *Echidna*.

In each stage I bisected the head to one side of the septum nasi. The half in which the latter was intact was then decalcified and cut into serial sections, the other half being used for purposes of dissection.

Fig. 3 (Plate I.) represents a longitudinal section of the head at the older of the two stages, and shows the form and relations of the nasal cavity, which is 2·5 cm. in length. A comparison with a figure of the adult given by Zuckerkandl[6] shows that the nasal cavity is now comparatively short and broad (compare also transverse sections of both stages, figs. 5–11, 14, and 15, Plates II. & III.).

The cartilaginous nasal capsule is more complicated than in

[1] *Cf.* E. B. Poulton, Quart. Journ. Micros. Science, vol. xxix. 1888; and Oldfield Thomas, Proc. Roy. Soc. vol. xlvi.

[2] C. Röse, Anat. Anz. vii. Jahrgang, 1892, p. 618.

[3] "The dumb-bell shaped bone in the palate of the Ornithorhynchus compared with the pre-nasal bone in the Pig," Journ. Anat. and Physiol. vol. xxv.

[4] 'Mammalian Descent,' London, 1885, pp. 52 and 54.

[5] "On the Nose, the Organ of Jacobson, and the Dumb-bell-shaped Bone in the Ornithorhynchus," Proc. Zool. Soc. 1891, p. 575.

[6] E. Zuckerkandl, 'Das periphere Geruchsorgan der Säugethiere,' Stuttgart, 1887, pl. i. fig. 3.

Ornithorhynchus. The thick and solid septum nasi, which is rounded off below, gives rise to two lateral ali-nasal wings (*aln.*) above, and these extend anteriorly beyond the septum and support the external nostrils on the anterior, inner, and upper sides. Rather further back, each wing gives rise to a curved rod (fig. 5, *aln.tb.*) (the "ali-nasal turbinal" of W. K. Parker [1]), which passes into the valvular process already noticed as extending into the nostril from the inner side, and a turbinal-like ridge is thus formed from the roof of the anterior part of the nasal cavity—this ends anteriorly to the "maxillo-turbinal." In Stage II. the ridge supports a very complete valve, which can probably close the aperture of the nostril completely (fig. 13). It will thus be seen that there are no transverse connective-tissue septa in the front part of the nose as in *Ornithorhynchus*.

Posteriorly to the nostril, the two wings gradually extend further downwards, so as to form an outer projecting wall to the nasal chambers, and a short distance behind the naso-palatine ducts they are continuous ventrally with the partial cartilaginous floor, which supports about the outer half of the anterior part of the nasal cavities (figs. 7–11, and 14, Plates II. & III.).

The lower side of the snout, below the nostrils, is supported by a large transverse rostral cartilage (figs. 4–6 and 13, *rs.*), continuous dorsally with the two ali-nasal wings in front of the nostril and also with the septum nasi. This cartilage becomes constricted off from the septum slightly in front of the naso-palatine canals, and then forms an independent plate on either side, the swollen internal margins of which abut against the base of the septum (fig. 5). This thickened edge is separated off from the rest of the plate as a club-shaped mass in the region of the naso-palatine duct, which passes between the two portions. The inner club-shaped portion then becomes hollowed out on the external side, where Jacobson's duct enters its cavity as an offshoot from the naso-palatine canal, and the cartilage then forms a complete independent tube, enclosing Jacobson's organ (figs. 6–8, 14 and 16). The lateral part of the cartilaginous nasal floor sends up a process on the dorsal side (fig. 6), which soon meets with the roofing cartilage (figs. 7–9 and 14); a small plate becoming separated off from its inner edge (fig. 7), which then meets with its fellow to form a median plate lying beneath the two Jacobson's organs (figs. 14 and 16), and gradually fades off into a median and two lateral backwardly directed processes which end beneath the posterior part of Jacobson's organ. In the young *Ornithorhynchus* the nasal capsule is simpler and forms a more complete box (fig. 17).

Even in the older stage, none of the turbinals have begun to ossify. The ethmoid turbinals ("Riechwülste") are more numerous and complicated than in *Ornithorhynchus*, in which Zuckerkandl describes three only, and he therefore considers *Ornithorhynchus* to be "anosmatic," its ethmoid being reduced in

[1] *Cf.* "On the Structure and Development of the Skull in the Pig," Phil. Trans. 1874.

adaptation to its aquatic habits. Symington, however, thought he could recognize five, the number characteristic of most osmatic mammals, and therefore describes *Ornithorhynchus* as "microsmatic." *Echidna*, on the other hand, is, to use Turner's nomenclature, "macrosmatic"; and Zuckerkandl describes eight ethmoid turbinals in the middle line in this animal. In my younger stage I could only recognize six, and in the older seven, which are easily seen, and probably a smaller eighth behind these (fig. 3). The sphenoidal sinus is represented by a shallow groove.

In Stage I. the six ethmoid turbinals appear in my dissection as simple lobes, all being at about the same level and not reaching the septum nasi. Sections, however, show that some, at any rate, are becoming subdivided (fig. 11). In Stage II. this subdivision into secondary lobes has gone still further, the second to the sixth exhibiting distinct folds (fig. 3); and in transverse sections a considerable complication is seen. In the adult this branching is carried further still, so that in the dry skull about the posterior half of the nasal chamber is filled with a complicated mass of spongy bones (compare pl. i. fig. 3 of Zuckerkandl's memoir): from the fifth backwards these do not extend so far towards the median line as the others, on account of the folds on the septum nasi in this region, between which the turbinals extend. The proper olfactory region of the nasal chamber is thus very largely developed, and the cribriform plate is especially large, and perforated, as in all mammals but *Ornithorhynchus*. The first ethmoid turbinal (so-called "naso-turbinal") is a simple plate extending forwards some distance beneath the nasal bone (figs. 3 & 15, *e.tb.*[1]), with which it becomes united in the adult. The 7th (and ? 8th) are also quite simple in Stage II. A sensory and ciliated epithelium covers all these except the "naso-turbinal."

In Stage I. a simple "maxillo-turbinal" ("Nasenmuschel") extends from near the anterior end of the nasal cavity backwards as far as the fourth ethmoturbinal (fig. 3, *m.tb.*), narrowing off gradually posteriorly as well as anteriorly. Sections of Stage I. show that it has the form of a ridge, which is beginning to become branched (figs. 10 and 11), the branching being carried much further in Stage II. (fig. 15), a fold being visible even with the naked eye along its middle part (fig. 3). The folding is much more complicated in the adult, and from a comparison with the skeletal parts of an adult *E. spinosus* the maxillary turbinal apparently belongs to the folded ("gefalteten"), and not to the doubly-coiled ("doppelgewundenen") variety, as stated by Zuckerkandl; while in *Ornithorhynchus*, according to Symington, it "constitutes a well-marked example of the branching variety (verästigte Muschel)," though Zuckerkandl describes it as a "gefaltete Nasenmuschel." The epithelium covering this turbinal is, as usual, non-sensory, resembling that lining the general nasal cavity, and bearing cilia.

A communication between the two nasal cavities has been described by Home in *Ornithorhynchus*. Zuckerkandl was unable to observe this; but I have satisfied myself that both Monotremes agree in this respect, and that the left and right nasal chambers communicate by a slit-like passage beneath the septum just behind Jacobson's organ.

On either side of the septum nasi, a rounded ridge can be seen projecting into the nasal cavity ventrally (figs. 5–11 and 14–16), beginning close to its anterior end and passing right back into the ethmoidal region, where it is eventually continuous with the partition separating the nasal chamber from the posterior nares. Within the anterior part of this ridge Jacobson's organ is contained (*Ja.*), while posteriorly it encloses a racemose gland. This, which we may call the "septal gland" (*sp.gl.*), opens by a large duct into the posterior end of Jacobson's organ and by a number of others into the nasal cavity along the anterior part of the ridge, one extending even in front of Jacobson's organ (fig. 5). The anterior part of the ridge was noticed by Zuckerkandl, but he says no more about it. In fig. 3 the part behind Jacobson's organ is removed, so as to show the turbinals.

As already mentioned, Jacobson's cartilage forms a large and independent tube, into the anterior end of which an offshoot from the naso-palatine duct (fig. 6, *Ja.d.*) passes to open into the cavity of the organ [1], which does not extend anteriorly to this point, as it does in *Ornithorhynchus*. In other words, Stenson's duct is situated further from the end of the snout in the latter animal, so that Jacobson's organ does not extend so much beyond it posteriorly as in *Echidna*. From the outer side of the tube an ingrowth occurs so as to form a sort of shelf or turbinal cartilage along the greater part of its length (figs. 7, 14, and 16). This disappears posteriorly, and the tube itself ends about opposite the anterior extremity of the maxillary turbinal (figs. 8 and 9), in which region sections show a solid piece of cartilage, representing part of the wall of the tube, as well as the mass of nerves and duct of the septal gland which plug the end of the tube.

Passing now to the organ itself, it will be seen, by a glance at figs. 7, 14, and 16, that the lumen is narrow and horseshoe-shaped, owing to the projecting shelf on the outer wall. In *Ornithorhynchus* this "Jacobson's turbinal" is distinctly coiled towards the ventral side, and the cartilage follows the curve (fig. 17), so that if straightened out it would more than reach to the opposite wall of the organ. In *Echidna* the shelf extends almost straight across the organ, leaving a narrow lumen between it and the wall, and the supporting cartilage only passes about halfway along the shelf. In this respect the Jacobson's organ of *Echidna* may be said to be less highly developed than that of *Ornithorhynchus*: moreover in the young of the latter it is relatively slightly larger than in the adult and than in the young *Echidna*.

A sensory epithelium lines the concave margin of the lumen, and

[1] For details as regards Jacobson's organ in other mammals compare Herzfeld, P., "Ueb. das Jacobson's Organ des Menschen u. der Säugethiere," Zool. Jahrb., Abth. f. Anat. u. Ontog., Bd. iii.

this is much thicker than the non-sensory epithelium covering the shelf, which is columnar and stratified, and bears especially strong cilia (fig. 16). I was unable to recognize any cilia on the sensory epithelium. The function of "Jacobson's turbinal" must therefore be a purely mechanical, and not a sensory one. The subepithelial tissue on the dorsal and internal side of the organ encloses large bundles of olfactory nerves, which send branches to the other parts. A number of small gland-tubes are present in the connective tissue of the turbinal, and these open at intervals into the lumen of the organ.

On the dorsal and lateral side of Jacobson's cartilage a thick mass of tissue is present between it and the epithelium covering the ridge which projects into the nasal cavity and in which the whole organ is enclosed. This tissue contains a number of simple glands, which also extend posteriorly to Jacobson's organ, externally to the more complicated "septal gland," and open at intervals into the nasal cavity (figs. 6–11 and 14–16); the septal gland with its ducts is therefore of great extent, passing along almost the entire length of the nasal chamber.

The epithelium covering the whole ridge is columnar and ciliated like that lining the general nasal cavity, and passes into stratified pavement-epithelium behind the naso-palatine duct, the latter form extending back still further on the nasal floor.

Gland-tubes similar to those just described are also present in great abundance beneath the epithelium of the posterior part of the maxillo-turbinal (=Steno's gland?) (figs. 11 and 15), and also to a less extent beneath that of the ethmo-turbinals and other parts of the nasal cavity.

I do not propose to describe the structure of the eye here, and will only mention that in the young *Echidna* it lies some distance from the surface, and a groove, lined by a thick cuticle, extends inwards towards it from the integument.

In Stage I. the two layers of epithelium bounding this groove join at its base so as to form a solid band connecting the conjunctiva with the epidermis.

In Stage II. the eyelids are beginning to separate, a narrow slit being present in their middle part. There is a very large Harderian and a smaller lacrymal gland, and folds of the epithelium of the eyelids apparently represent the developing Meibomian glands. The naso-lacrymal duct (*n.d.*) opens into the outer side of the nasal chamber rather further back than Stenson's duct, in a bay between the "ali-nasal turbinal" and the floor of the chamber. From this point it extends directly backwards, just outside the nasal capsule, to the conjunctival chamber.

Neglecting their more obvious resemblances and differences, and confining ourselves to the observations recorded above, it will be seen that the young *Echidna* resembles *Ornithorhynchus* in possessing:—

1. A thick horny layer covering the snout, as well as horny teeth and a horny caruncle for breaking open the egg-shell.

2. Glands resembling ordinary sweat-glands opening on the snout as well as on the anterior part of the palate.

3. A highly developed Jacobson's organ, resembling that of Lizards and Snakes, enclosed in an independent tubular cartilage, and possessing a large "turbinal" supported by a cartilaginous shelf continuous with the investing tube.

4. A complicated "maxillo-turbinal."

5. A communication between the two nasal cavities, as in certain birds.

6. Numerous glands in connection with the nasal chamber and Jacobson's organ, including a specially large "septal gland" and a "Steno's gland." Most of these characteristics are peculiar to Monotremes amongst Mammals.

On the other hand, *Echidna* differs from *Ornithorhynchus* in:—

1. The absence of any rudiments of true teeth in the young of 12 cm. in length and onwards, and the early extreme specialization of the entire mouth-cavity.

2. The possession of a mammary pouch in the young female.

3. The less solid character of the nasal capsule, the much higher development of the ethmoid turbinals, and the absence of transverse connective-tissue septa in the anterior part of the nasal cavity.

4. The slightly smaller relative size of Jacobson's organ and of its turbinal, the organ also not extending anteriorly to the naso-palatine canal.

Since his communication already referred to, Dr. Symington [1] has shown that the Jacobson's organ of Marsupials conforms to the general type met with in the Eutheria, and thus differs markedly from that of the Prototheria. The former may very probably have arisen from the latter, but it has undergone various degrees of degeneration: a very slight step in this direction has possibly occurred in *Echidna*. Symington is probably correct in his opinion that Jacobson's organ reaches its highest development in the Monotremes—higher even than in Lizards and Snakes, in which it presents many points in common with that of the Prototheria.

It certainly seems probable that "*Ornithorhynchus* is far the most primitive type" [2] of the two Monotremes: the young *Echidna* resembles *Ornithorhynchus* much more than does the adult, and is very highly specialized as regards many characters besides those

[1] "On the Organ of Jacobson in the Kangaroo and Rock Wallaby (*Macropus giganteus* and *Petrogale penicillata*)," Journ. of Anat. and Physiol. vol. xxvi., n. s. vol. vi. 1892.

Quite recently Röse has described the Jacobson's organ in embryos of the Wombat and Opossum, and has shown that in the former its duct is situated on the floor of the organ as in *Ornithorhynchus*, and not at its anterior end; and also that a large mucous gland is connected with its posterior end (Anat. Anz. viii. Jahrgang, 15 Sept. 1893, p. 766).

[2] W. K. Parker, *loc. cit.* p. 36.

referred to here. But though *Ornithorhynchus* has probably remained closer to the Prototherian stock than *Echidna*, the presence of a horny bill in both forms as well as the characters to which attention has recently been drawn by Westling[1] and Howes[2] seem to indicate the close genetic relation of the two genera, in spite of their special adaptive characters.

Note (Jan. 8th, 1894).—Since this paper was sent in for publication, I have received from Prof. Wilson and Mr. Martin a copy of their recent paper, "Observations upon the Anatomy of the Muzzle of *Ornithorhynchus*" (Macleay Memorial Volume, part 6), in which it is stated that "the epidermis of the muzzle of *Platypus* is no more 'horny' than that of a dog's nose, from the texture of which indeed it does not greatly differ." There is no doubt, however, that in my specimens of the young of both genera the horny layer of the epidermis covering the muzzle is so thick as to justify one in speaking of a "horny" snout, even though this is of course more flexible than the beak of a Turtle or Bird: and in these specimens there can have been no possibility of a partial desiccation.

I should also mention that "the peculiar rod-like tactile organs in the integument and mucous membrane of the muzzle of *Ornithorhynchus*," previously described by Poulton, have been treated of by the same authors in part 7 of the 'Macleay Memorial Volume,' in which it is stated that no such organs are present on the anterior portion of the snout and palate of *Echidna*: this agrees with my own observations.

EXPLANATION OF THE PLATES.

Plate I.

Fig. 1. Ventral view of a young *Echidna aculeata*, 12·5 cm. in length along the dorsal curve (Stage I.).

2. Ventral view of an older (male) specimen, 21·5 cm. in length (Stage II.).
3. The snout in longitudinal section (Stage II.), the cut having been made to the left side of the septum nasi, so as to show the left nasal chamber. The greater part of the glandular ridge on the septum has been removed, the anterior part, enclosing Jacobson's organ, being left *in situ*.

Plate II.

Figs. 4–11 represent transverse sections through the snout of Stage I.

Fig. 4. Through the external nostril and caruncle.

5. Through the "ali-nasal turbinal," just in front of Jacobson's organ.
6. Through the naso-palatine and Jacobson's ducts.
7. Through about the middle of Jacobson's organ.
8. Through the posterior end of Jacobson's organ.
9. Rather farther back than fig. 8, showing the end of Jacobson's cartilage.
10. Through the septal gland and maxillo-turbinal.
11. Through the septal gland, maxillo-turbinal, and ethmo-turbinal.
12. Section through the integument and a sweat-gland of the lower jaw (Stage II.).

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[1] Bihang till K. Svenska Vet.-Akad. Handl. (Stockholm), Bd. xv. 1890.

[2] "On the Mammalian Pelvis, with special reference to the young of *Ornithorhynchus anatinus*," Journ. Anat. and Physiol. vol. xxvii. (1893).

PLATE III.

Figs. 13–15 represent transverse sections through the snout of Stage II.

Fig. 13. Through the external nostrils.

14. Through about the middle of Jacobson's organ.

15. Through the septal gland, maxillo-turbinal, and 1st ethmo-turbinal ("naso-turbinal").

16. Jacobson's organ from the section represented in fig. 14, more highly magnified.

17. Transverse section of the snout of a young *Ornithorhynchus* slightly larger than Stage II. of *Echidna*. The section passes through Jacobson's organ behind the naso-palatine duct, and is drawn for comparison with fig. 14.

List of Abbreviations.

aln. Ali-nasal cartilage.
aln.tb. Ali-nasal "turbinal."
c. Caruncle.
e.n. External nostril.
e.tb. Ethmoturbinals.
h. Horny layer of snout.
hr. Hairs.
h.t. Horny teeth.
Ja. Jacobson's organ.
Ja.c. Cartilage of Jacobson's organ.
Ja.d. Duct of Jacobson's organ.
Ja.gl. Gland-tubes of Jacobson's organ.
Ja.n. Nerves of Jacobson's organ.
Ja.tb. "Turbinal" of Jacobson's organ.
m. Mouth-cavity.
mn. Lower jaw.
m.tb. Maxillo-turbinal.
n.c. Nasal cavity.
n.d. Naso-lacrymal duct.
n.gl. Small glands of the nose.
np.c. Naso-palatine canal.
p.gl. Palatine (sweat) glands.
r. Ridge on septum nasi.
rs. Cartilaginous rostrum or floor of nasal chamber.
s.n. Septum nasi.
sp.gl. Septal gland.
sp.gl.d. Ducts of septal gland.
sp.gl.d'. Duct of septal gland which enters Jacobson's organ.
St.gl. Steno's gland.
sw.gl. Sweat-glands.
t. Tongue.
vo. Vomer.

2. On a Collection of Butterflies made in Manica, Tropical South-east Africa, by Mr. F. C. Selous, in the year 1892. By ROLAND TRIMEN, F.R.S., &c., Curator of the South-African Museum, Cape Town [1].

[Received November 13, 1893.]

(Plates IV.–VI.)

In communicating to the Zoological Society this account of what I believe to be the first collection of Butterflies made in the Manica Country, I am fortunate in being able to preface it by the following interesting sketch of that hitherto very little-known

[1] Mr. A. G. Butler, who, in Mr. Trimen's absence, has kindly corrected the proofs of this paper, sends the subjoined remarks:—

"I think it would be well to call your attention to the fact that Mr. Trimen has unwittingly redescribed some of the species recorded in my paper on Mr. Johnston's collections from Nyasaland (P. Z. S. 1893, p. 643) not yet published. For example, the *Charaxes* (p. 45) which he calls *C. selousi* is palpably only a slight variety of my *C. whytei* (*op. cit.* p. 649); *Lycæna exclusa* (p. 47) is evidently the male of my *Castalius hypoleucus* (*op. cit.* p. 660) [N.B. Trimen does not adopt the modern genera proposed for the *Lycæninæ*]; *Cyclopides* tract from the pen of my friend Mr. Selous. It will probably be new to many who are well acquainted with his name as an explorer, a hunter, and a pioneer, to learn that Mr. Selous has not by any means restricted himself to large game, but has for many years kept an eye upon such "small deer" as the entomologist loves. From time to time I have had the pleasure of recording many specimens of his collecting, but the highlands of the South-African Interior generally are poor in Lepidoptera; and it was not until the beginning of last year that Mr. Selous found himself at the best season in an exceptionally rich field, and with characteristic energy set to work to make the most of the opportunity. To construct in the brief space of three months from 60 to 70 miles of waggon-road in Tropical Africa, with raw Mashuna labour and very scant European superintendence, and in the height of summer, is a task well calculated to tax to their utmost the powers of any man, however inured to such exertions; and it is amazing how Mr. Selous found both time and strength enough to form such a fine entomological collection and to note locality and date for every specimen.

Mr. Selous writes as follows :—

"I reached Umtali from Salisbury at the end of January, 1892, at the height of the rainy season, having been sent down by the British South Africa Company to construct a road from Umtali to Chimoia's Kraal. This work occupied me for three months—the three best months of the year, as it happened, for collecting insects—and during that period I devoted every spare hour of every single day to the diligent collecting of Butterflies and Beetles [1].

"I commenced to collect immediately upon leaving Umtali township. Umtali lies at a height of about 3800 feet above the sea-level in an open grassy valley surrounded by hills. The river Umtali flows just below the township. Beyond this river the road lies through an open grassy country to the foot of Christmas Pass, and then at once commences to ascend to the top of the Pass through shady cuttings bordering swift-running little streams shaded by trees and ferns. The hill-sides are all covered with open forest. Although all the conditions seemed so favourable for

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mineni (p. 72) is in my opinion the *Ceratrichia stellata* of Mabille; and *Pamphila zimbazo* (p. 74) is *Pamphila ranoha* of Westwood (which is a species of *Osmodes*). In Plate IV. my *Periplysia johnstoni* is figured as *Physcæneura pione* of Godman (this identification is, I think, correct; the genus *Physcæneura* being new to me), but Mr. Godman's figure is somewhat heavily coloured, and thus I failed to remember it. Mr. Trimen and I have both figured the male, Godman the female. Mr. Trimen, on the same Plate, figures *Precis simia*, Wallengr., which appears to me to be the insect described by me some years ago as *Junonia micromera* (Ann. & Mag. Nat. Hist. ser. 4, xviii. p. 482), but this name is not quoted as a synonym, either in this paper or in Mr. Trimen's work on South African Butterflies."—Ed.

[1] My colleague, Mr. Louis Péringuey, has mounted and arranged the Coleoptera collected by Mr. Selous. He finds 166 species, represented by 510 examples, and provisionally recognizes 15 species as probably new to science.

Butterflies, I did not take any great number on the Umtali side of Christmas Pass, partly doubtless owing to the fact that during the greater part of the time I was working there the weather was very rainy; but as soon as I had crossed the Pass and got to the coast side of the range of hills to the south of Umtali, I at once found myself in an excellent collecting ground. As I had to make a long cutting down the side of the mountain and blast away a lot of hard rock, I was luckily enabled to remain in this happy hunting-ground for nearly a month. Scarcely a day passed that I did not catch something new to me. Just below Christmas Pass was an isolated granite hill, very thickly wooded on its lower sides, and in the hollow between this hill and the main range was a deep shady ravine, at the bottom of which ran a small stream. At the top of the ravine the country was covered with bush interspersed with large granite boulders, and beyond this again open prairie-land running up the hill-sides, on which flowers of many varieties were very plentiful. Thus in a small extent of ground I found a great diversity of conditions and many different species of Butterflies. The elevation of this portion of the country is about 3000 feet.

"After leaving Christmas Pass the road leads through open prairie-land for four or five miles to the head of the Mineni Valley. This open grass country is intersected by the Sikuva River and several of its tributaries. I did not take many Butterflies in this part of the country.

"The Mineni Valley runs between two high ranges of hills, and is for the most part well wooded with open forest, intermixed with large open glades entirely free from forest or bush. Several large tributaries flow into the Mineni from the surrounding ranges of mountains, and innumerable smaller streams. The banks of these streams, overhung as they were by large shady trees and ferns, I found to be very favourable places for collecting, and I caught a great many sorts of *Charaxes* and Skippers drinking at the fords which we cut across the streams for the waggon road. It was also in the Mineni Valley that I was lucky enough to find a tree from one of whose branches some sap was exuding, which proved a constant attraction to many species of *Charaxes*; and on this tree I caught a fine series of *C. bohemani*, one of the handsomest of a genus that are often very difficult to catch.

"After leaving the Mineni Valley one gets out of the hills and enters upon a level country covered almost entirely with forest, sometimes free from underwood but in places becoming thick jungle. This country is intersected by many rivers, such as the Revué (into which the Mineni flows), and the Lusika and Lopodzi. The general altitude of this part is about 2500 feet above sea-level. At the river Lusika I found another tree, a species of Acacia, which was much frequented by Butterflies of the genus *Charaxes*, and here I captured the only specimen of *C. azota* that I saw—a female in very fine condition.

"I do not think there is anything more to be said about the country, except that during the whole of the time I was working between the Lusika River and Chimoia's the weather was dull and rainy and unfavourable for collecting. Had it been fine I might have seen and caught a few more specimens.

"P.S.—The Pungwe Valley, in which I caught a few Butterflies last September and October, is covered with forest and intersected by numerous streams. The altitude is here, however, below 1000 feet. Below Sarmento, and from there to the coast, there is a great deal of open country covered for the most part with excessively long grass."

The tract so well described by Mr. Selous is a belt of not more than about ten miles in width, running east and west between S. lat. 18° 50′ and 19°, and E. long. 32° 32′ and 33° 20′. From Chimoia's to Sarmento and the Pungwe River is a narrower continuation of the same belt to the eastward for another sixty miles, at first a little north but afterwards slightly south of the 19th parallel. From the existing maps the entire tract seems to be less than 200 miles south of the nearest reach of the Zambesi.

Including two forms of *Mycalesis* which I have not been able to determine with certainty, and two of *Terias* which I cannot satisfactorily place, Mr. Selous's collection contains representatives of 166 species, represented by over 1100 examples. This is a very good result of three months' collecting, but it must not by any means be regarded as completely representing the Butterfly fauna of the district, as there can be no doubt that many forms known to range both north and south of Manica, although not represented in Mr. Selous's collection, must occur in the intermediate tract. Fifteen such species, for instance, are recorded from the Zambesi Valley and from extra-tropical South Africa—ten of them ranging widely also in other parts of the continent—and these can hardly be absent from Manica. Moreover, a certain proportion of species are sure to be peculiar to the dry-season months, during which Mr. Selous had not the opportunity of collecting.

Of the 165 species in the collection 44 are of general distribution south of the Sahara; and of the remainder, 26 (of which 9 appear to be undescribed) seem peculiar to the South-Tropical area. As many as 51 inhabit both the South-Tropical and the South Extra-tropical areas, and 13 others are also found in both these areas, but hitherto, as regards the former area, have been recorded from Manica only. Twelve are dispersed through both these areas as well as in part of the West North-Tropical area, and eight through the two former and also the East North-Tropical area; while seven others inhabit both Tropical areas, but are unknown in the South Extra-tropical area. Three (*Deudorix cœrulea*, *Durbania hildegardi*, and *Pterygospidea galenus*) seem elsewhere to be recorded from the West of both Tropical areas, and one (*Lycæna antinorii*) from Abyssinia only.

The collection is disappointing in one respect, viz., its deficiency in *mimicking* species. There is no example of any form of *Euralia* or *Pseudacrœa*, and the only imitative Butterflies represented are the female *Diadema misippus* and two forms of the female *Papilio* *ceneu.* Among the rarer and more interesting species are:—*Physcœneura pione* and *Melanitis libya* (both hitherto represented by single specimens); *Pseudonympha vigilans*, previously unknown to extend into the tropical area; *Acræa asema* and *A. acrita*; *Planema johnstoni*, not hitherto known from south of Usambara; *Precis simia* (of which only the type and one other South-African example had before been recorded); *Precis artaxia*; *Charaxes lasti* (♀), *C. azota*, *C. pollux* (not apparently received before from any part on or near the East Coast), and *C. guderiana* (♀); *Lycæna antinorii* and *L. poggei*; *Teracolus celimene*; *Thymelicus capanas*; *Abantis zambesina*; and *Hesperia unicolor*.

The apparently undescribed species are the following, viz.:—

Nymphalidæ.
  (Nymphalinæ.)
    Charaxes manica, p. 43.
    „ *selousi*, p. 45.

Lycænidæ.
    Lycæna exclusa[1], p. 47.
    Lycænesthes lunulata, p. 51.
    Chrysorychia cruenta, p. 55.
    Durbania puellaris, p. 59.

Hesperidæ.
    Cyclopides mineni, p. 72.
    Pamphila zimbazo, p. 74.
    „ *chirala*, p. 76.

Mr. Selous personally brought down his collections towards the close of last year, and I thus had the advantage of obtaining and writing down his notes on the habits of each species as I unpacked the specimens.

Family Nymphalidæ.

Subfamily Danainæ.

Genus Danais, Latr.

1. Danais chrysippus (Linn.).

Three of the four specimens are of the ordinary typical form, but the fourth, taken at Sarmento on the Pungwe River, is of the var. *alcippus*, Cram., and has the white area in the hind wings almost as largely developed as in the West-African specimens.

Genus Amauris, Hübn.

2. Amauris echeria (Stoll).

The two specimens (male and female) were taken at Christmas Pass in February. They belong to the var. *albimaculata*, Butl.,

[1] In a footnote (p. 48) I have described as *Lycæna mashuna* a close ally of this species previously discovered by Mr. Selous in the adjacent district of Mashunaland.

characterized by having all the spots of the fore wings white and the underside paler and browner. These examples are small (*exp. al.* ♂ 2 in. 9 lin., ♀ 3 in.); and the male has the fore wings decidedly less elongated apically than usual, while the ochry-yellow band of the hind wings is in both sexes paler and rather narrower.

Judging from the brief description (Proc. Zool. Soc. 1888, p. 91), I should refer to this variety of *A. echeria* the *A. hanningtonii* of Butler, from Terta near Kilima-njaro. I also consider that *A. jacksoni*, E. M. Sharpe (*op. cit.* 1891, p. 633, pl. xlviii. fig. 2), from Sotik, Kavirondo, is inseparable from the same variety, only differing in the reproduction on the upperside of a good many more of the hind-marginal and submarginal spots of both wings always present on the underside.

3. Amauris ochlea (Boisd.).

Euplœa ochlea, Boisd. App. Voy. de Deleg. dans l'Afr. Aust. p. 589 (1847).

Six examples captured in the Pungwe River present no variation from the Natalian type-form.

4. Amauris dominicanus, Trim.

Amauris dominicanus, Trim. Trans. Ent. Soc. Lond. 1879, p. 323.

Three specimens from Pungwe River quite agree with extra-tropical examples. Mr. Selous noted a good many of this conspicuous species settling on bushes among large trees in a shady ravine.

Subfamily Satyrinæ.

Genus Ypthima, Westw.

5. Ypthima asterope, Klug.

A male (Christmas Pass) and a female (Mineni Valley) are above the usual size and paler; in these respects, in the distinctness of the common submarginal dark streak, and in the well-defined pale space round the outlines of the fore wings they approach those brought from Tropical S.W. Africa by Mr. Eriksson; but as regards the underside, the minute striolation of both wings and the ocelli of the hind wings are much better developed and approximate these two examples to the smaller specimens received from Natal and Zululand.

6. Ypthima itonia, Hewits.

Ypthima itonia, Hewits. Trans. Ent. Soc. Lond. 3rd ser. ii. p. 287, pl. 18. fig. 13 (1865).

There are four males of this distinct species—three from Christmas Pass and one from Mineni Valley. In the hind wings the minute subapical and inferior anal-angular ocelli are wanting on the upperside, and in two examples the first and third in the series of seven ocelli are very minute and subobsolete on the underside. In addition to the median narrow brown fascia on the underside (described as "rufous" by Hewitson), there is a shorter parallel pre-median one, variable in distinctness but well marked in one example.

This species does not appear to have been met with so far to the South before now. It has a very wide range, the locality of the examples on which the species was founded being the White Nile; while Fernando Po, Gold Coast, and Angola are the habitats given in Kirby's 'Catalogue of the Hewitson Collection' (p. 125), and Mr. Butler (Proc. Zool. Soc. 1888, p. 59) records two examples as sent by Emin Pasha from two localities in the Equatorial Province of Central Africa. The South-African Museum possesses two specimens taken at Sierra Leone.

Genus PHYSCÆNEURA, Wallengr.

7. PHYSCÆNEURA PIONE, Godm. (Plate IV. fig. 1, ♂.)

Physcæneura pione, Godm. Proc. Zool. Soc. 1880, p. 183, pl. xix. figs. 2, 3 [♀].

This ally of *P. panda* (Boisd.), which in the creamy-white of the upperside exhibits some approach to *P. leda* (Gerst.), from Mombasa, was described from a single female example, recorded as taken by Mr. J. T. Last in the Gnuru Hills, opposite Zanzibar.

A good series is in the collection from Manica under notice, a few having been taken in Christmas Pass but many more in the Mineni Valley. I give the following description of the male:—

♂. *Exp. al.* 1 in. 4–6 lin.

Creamy-white, with fuscous borders. Fore wing: fuscous border rather narrow from base as far as extremity of discoidal cell, but broad apically and thence gradually narrowing to posterior angle; inner margin with a broad fuscous border from base, bounded superiorly by median nervure and its 1st nervule, and narrowing abruptly just before posterior angle, where it joins hind-marginal border; along inner edge of hind-marginal border, between 1st and 3rd median nervules, two more or less distinct black spots; basal swelling of costal nervure ochre-yellow, traces of the striolation of the underside visible, chiefly in basal half; two submarginal black streaks, parallel and close together, just perceptible in fuscous border. *Hind wing*: costa narrowly and faintly clouded with fuscous; apex and hind margin with a rather broad fuscous border, irregular along its inner edge, where it is more or less distinctly marked by a series of black spots; submarginal streaks as in fore wing, except that they are bordered, very unequally and interruptedly, towards anal angle by two white streaks; striolation of underside very apparent along inner-marginal area. Cilia whitish. UNDERSIDE.—Creamy, slightly yellower than upperside; each wing along costal and inner-marginal borders transversely marked with black striolæ of variable length and thickness (here and there confluent), and with a submarginal series of ochre-yellow ocelli centred with pale metallic golden; besides two parallel submarginal black streaks, an inner less regular catenulated one outwardly bounding the series of ocelli. *Fore wing*: basal swelling of costal nervure ochre-yellow; a few striolations usually completely across basal third, but otherwise the creamy middle area is clear from base to ocelli; the latter form a nearly straight series of five, of which the last (between 2nd and 3rd median nervules) is usually a little apart from and smaller than the rest, with the exception of the first. *Hind wing*: striolation well developed in inner-marginal area, but very rarely extending at any point into discoidal cell; ocelli seven, of which the first is separate from and considerably before the rest (being between subcostal nervules), while the others are contiguous (the 6th and 7th confluent).

The male is smaller than the female (*exp. al.* 1 in. $4\frac{1}{2}$–7 lin.), and has the fuscous borders much darker on the upperside, where also the ochre-yellow ocelli (always more or less well-marked in the female) are represented only by two or three indistinct black spots. On the underside the male differs constantly in the restriction of the black striolation to the costal and inner-marginal borders, whereas in the female this covers all the area in both wings except a small discal space immediately before the ocelli.

P. pione resembles *P. leda* in its whitish fuscous-bordered upperside, but in its striolation and position of the ocelli on the underside, as well as in its stouter structure throughout, is more nearly related to *P. panda*. The fuscous bar along the inner margin of the fore wings on the upperside is a very striking feature in *pione*, and gives the species a curious superficial likeness to some of the smaller female *Teracoli* and *Terias* in the distant group of *Pierinæ*.

This very interesting *Physcæneura* was found during the greater part of March, flying very slowly in open forest and settling on grass. In Natal I found its close ally, *P. panda*, quite away from forests, frequenting steep exposed hill-sides and often settling on the bare ground.

Genus Pseudonympha, Wallengr.

8. Pseudonympha vigilans, Trim.

Pseudonympha vigilans, Trim. S.-Afr. Butt. i. p. 84. n. 15 (1887).

The single good example (a female) of this Butterfly was captured in the Christmas Pass on the 11th February, a locality about 400 miles northward of the most northern of the previously recorded stations of this generally distributed South-African species, viz. the Lydenburg district of Transvaal. Mr. Selous's specimen comes nearest to the Natalian and Transvaalian examples, but is characterized on the upperside by the unusual restriction of the fulvous patch in the fore wing (which, though it extends rather nearer to the hind margin beneath the ocellus, does not impinge on the discoidal cell), and by the well-developed small ocellus near the anal angle of the hind wing; while on the underside the hoary-grey and brown mottlings are more sharply contrasted, and both ocelli of the hind wings, though small, are distinctly marked. A second much-worn female, taken in the same locality on 22nd February, appears to resemble the first very closely.

Genus Mycalesis, Hübn.

9. Mycalesis safitza, Hewits.

Mycalesis safitza, Hewits. Gen. Diurn. Lep. p. 394. n. 10, pl. 66. fig. 3 (1851).

All the examples (two from Christmas Pass and twelve from Mineni Valley) have the underside ocelli strongly or very strongly developed, a feature which, as I have pointed out (S.-Afr. Butt. iii. p. 395), is characteristic of the summer or wet-season form of this *Mycalesis*. The specimens in all respects agree with the tropical type-form more closely than with extra-tropical examples, one character being the feeble expression of the ocelli on the upperside of the fore wings, which in two of the males are obsolete, and a second the more strongly-marked common pale median streak on the underside.

Genus Melanitis, Fabr.

10. Melanitis leda (Linn.).

Papilio leda, Linn. Syst. Nat. i. 2, p. 773. n. 151 (1767).

Of nine specimens (six males and two females from Mineni Valley and one male from Christmas Pass) taken from 27th February to 26th March, all but one—a female from the former locality captured on 12th March—are of the typical smaller and darker form, with largely-developed underside ocelli, which is characteristic of the summer or wet season. All the dated material obtained on the Natal Coast by Mr. A. D. Millar and myself and at Delagoa Bay by the Rev. H. Junod confirms Mr. L. de Nicéville's discovery at Calcutta, that in this widely-distributed and highly variable species there are two well-marked seasonal forms, viz. 1, a summer or wet-season race, superiorly duller but inferiorly with well-developed and conspicuous ocelli, and possessing non-angulated or but slightly angulated fore wings; and 2, a winter or dry-season race, superiorly brighter, more or less rufous, but inferiorly with very imperfect, reduced, and obsolescent ocelli, and possessing well-angulated fore wings. As in the case of Mr. Selous's example just referred to, occasional specimens of the dry-season form are met with in the wet season, and *vice versâ*; but these are so very few that they can only be regarded as accidentally late survivors of the preceding, or early precursors of the succeeding generation.

11. Melanitis libya, Dist. (Plate IV. fig. 2, ♂.)

Melanitis libya, Dist. Ann. & Mag. Nat. Hist. 5th ser. x. p. 405 (1882).

There are only two examples of this striking form, both males—one captured in Mineni Valley on 12th March, the other on the

Pungwe River on 1st September. In outline they resemble the dry-season race of *M. leda*, but have even a sharper angulation of the fore wings. The upperside inclines to a more chocolate tint of brown than that shown by *M. leda*, but its notable distinction lies in the great development and oblique position of the two subapical white spots, which have pale bluish edges and are surrounded by a rather vaguely defined deep fuscous space. Throughout all the variations of *M. leda* the corresponding white spots are small and constitute the pupils of a more or less developed compound ocellus, and the lower one is directly beneath (or even slightly *before*) the upper one, instead of almost wholly beyond it. On the underside of *libya* there is evidently (as in that of *leda*) great variation, Mr. Selous's two specimens differing widely from each other as well as from Mr. Distant's description of the type, both, however (but especially the Pungwe River example), having a yellower general tint than I have found in *M. leda*. At the same time the markings in all respects, down to the minute incomplete and partly obsolescent submarginal ocelli, are in unquestionable accordance with those of *M. leda* (dry-season brood); and the striking divergence of the upperside of the fore wings came as a surprise when expanding Mr. Selous's specimens. The captor informed me that both were taken in the shade, among the roots of trees, in the bottom of ravines.

Mr. Distant informs me that he has not seen any other specimens of *M. libya* except the type, which he recorded as inhabiting "Masasi, East Africa." I find that Masasi is placed on the maps to the north of the Rovuma River, apparently about 150 miles inland from Cape Delgado and some 600 miles north of Manica.

12. Melanitis diversa (Butl.).

Gnophodes diversa, Butl. Ann. & Mag. Nat. Hist. 5th ser. v. p. 333 (1880).

Melanitis diversa, Trim. S.-Afr. Butt. i. p. 116. n. 30 (1887).

Three examples from the valley of the Pungwe River, taken on 1st September, do not differ from typical Natalian specimens except in their smaller size, one being quite dwarfed.

Subfamily Acræinæ.

Genus Acræa, Fabr.

13. Acræa obeira, Hewits.

Acræa obeira, Hewits. Proc. Zool. Soc. Lond. 1863, p. 65; Trim. Trans. Ent. Soc. Lond. 1891, p. 172 [♀].

A single female, taken at Christmas Pass on 22nd February, differs from the Natalian and Zululand females described by me (*l. c.*) in having the hind wings and basal half of fore wings pale dull ochry-yellow instead of very dull brick-red. The females of this (the *horta*) group of *Acræa* are inclined to vary in this direction, the females of *A. horta*, Boisd., and *A. hova*, Boisd., sometimes presenting the same tint, and those of *A. boscæ*, Saalm., and *A. igola*, Trim., apparently being always of that colour. Mr. Selous's example has the last spot of the discal series in the hind wings much reduced in size, as well as the basal and subbasal spots, in comparison with the more southern specimens referred to; the former of these distinctions approximating it more to the figures given by Grandidier of Madagascar examples. Mr. Selous notes that this was the only individual of this species met with; it was flying slowly on an open hill-side.

14. ACRÆA NOHARA, Boisd.

Acræa nohara, Boisd. App. Voy. de Deleg. dans l'Afr. Aust. p. 590. n. 54 (1847).

A male and female of the usual size from the Mineni Valley, and three small males from near the Vunduzi River, all differ from the Natalian type-form in the marked reduction of all the black markings; in the fore wings the subbasal spot below the median nervure is present only in two males, while that beyond middle below first median nervule is absent in all the specimens; and in the hind wings the third and fifth spots of discal series are wanting. There is also less black on the apical half of the back of the abdomen in both sexes.

15. ACRÆA ASEMA, Hewits. (Plate IV. figs. 3, 3 *a*, ♂ ♀.)

Acræa asema, Hewits. Ent. M. Mag. xiv. p. 52 (1877); *nec* Trim. Proc. Zool. Soc. 1891, p. 68, pl. viii. figs. 9, 10.

Mr. Selous's series of both sexes of this Butterfly—3 from Christmas Pass, 1 from Sikuva River, 15 from the Mineni Valley, and 2 from the Vunduzi River—has made it clear that I was mistaken in identifying with *A. asema*, Hewits. (founded on examples from Lake Nyassa), the *Acræa* from tropical South-west Africa described fully by me *loc. cit.* In order to obtain an independent opinion as to the true *A. asema*, I sent one of Mr. Selous's specimens to my friend Mr. A. G. Butler, for comparison with the type specimens in the Hewitson Collection, and he reports it as undoubtedly belonging to the species in question. Mr. Hewitson's brief description of *A. asema* applies equally well to both the forms concerned, but as it is now settled which was actually the subject of it, and as the S.W. African form must in my opinion be pronounced a distinct species, I propose for the latter the name of *Acræa omrora* [1]. I think it well to give a fresh description of both sexes of *A. asema* from the full material supplied by Mr. Selous.

[1] For a detailed description of both sexes, the reader is referred to Proc. Zool. Soc. 1891, pp. 68–70. It will be sufficient to note here that *A. omrora* differs from *A. asema* in the following particulars, viz.:—1, more opaque wings; 2, on both surfaces a much brighter yellower ground-colour; 3, a greatly reduced condition of the black spots, which in some examples are little more than dots, and of which in most examples (especially in the hind wings) there is a varying number quite obsolete; 4, on the upperside, a narrower, more sharply defined black hind-marginal and apical edging in the fore wings, but a broader, blacker, unspotted, or indistinctly spotted, border in

Exp. al. (♂) 1 in. 8–11 lin.; (♀) 1 in. 9 lin. to 2 in.

♂. *Pale dull ochre-yellowish with a brownish tinge, semi-transparent, with numerous small black spots. Fore wing*: a very fine linear fuscous edging along costa and a slightly wider one along hind margin, the apex between 2nd subcostal and 1st median nervules being rather widely tipped with fuscous; across discoidal cell, towards extremity, an elongate spot, sometimes surmounted by a very small rounded costal spot; a small upper terminal discocellular spot; below median nervure, before middle, a rather elongate spot; an exceedingly irregular discal series of 8 spots,—of which the upper four are contiguous, forming a curved costal bar reaching the 3rd median nervule,—the fifth separate, beyond the fourth, between 3rd and 2nd median nervules, the sixth far before fifth, between median nervure and its first nervule, the seventh rather beyond the sixth, below 1st median nervule, and the eighth (very small, minute, or sometimes wanting) before the seventh, on inner-marginal edge; a submarginal series of five small rounded spots, between upper radial nervule and submedian nervure, of which the upper three form a line at an angle with the lower two, which are equidistant from hind margin (in one example there is an additional superior spot, above upper radial nervule); base usually with some limited fuscous scaling, chiefly near inner margin. *Hind wing*: fuscous hind-marginal border variable in width, regularly indented on nervules along its inner edge, and enclosing seven more or less distinct spots of the ground-colour; near base, a rounded spot in discoidal cell (sometimes obscured by some fuscous basal suffusion), followed by a curved subbasal series of five spots, of which the second is in discoidal cell, and the fourth and fifth (both smaller than the others) on inner margin; an exceedingly irregular discal series of 8 spots, of which the first, fourth, and sixth are before the rest and the third small or minute (in one specimen wanting). UNDERSIDE.—*Very much paler than upperside, glossy, the hind wing of a dull pale-creamy tint, in parts sometimes tinged with pale red; markings as on upperside, but those of hind wing more sharply defined. Fore wing*: markings somewhat fainter, especially apical fuscous, which is traversed and in some specimens almost replaced by three pale-creamy marks. *Hind wing*: two additional small spots close to base, one on costa, the other at origin of costal nervure; a pinkish-red inner-marginal suffusion, very variable in depth of tint and in extent, sometimes tinging basal half of discoidal cell but rarely rising above cell; in most examples a slight reddish tinge over the ground-colour before

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the hind wings; 5, in the male a well-defined blackish cloud at the base of both wings on the upperside; and 6, in both sexes, no trace of reddish colouring at base or along inner margin of the hind wings. The abdomen in both sexes is, apart from the dorsal black on basal third, white tinged with canary-yellow, instead of pale ochreous-yellow with prolonged dorsal black (in the female reaching to the tip, and containing two rows of pale-yellowish spots), as in *asema*; and the inferior subterminal corneous appendage in the female has a broader, less deeply forked recurved process.

the hind-marginal border; spots in the latter much larger than on upperside, pale-creamy, the fuscous reduced to a narrow very sharply defined edging to the spots [1].

♀. *Duller, varying from a somewhat browner tint than that of the male to a decidedly dusky pale brownish grey*—the fore wing usually duller than the hind wing (which retains more of the ochry-yellow tinge), and in the darker specimens exhibiting a more or less ill-defined whitish subapical cloud; spots usually larger; basal areas usually duskier than rest of wing, but rarely with the limited fuscous scaling common in male. *Hind wing*: hind-marginal border broader and blacker, its enclosed spots sometimes much paler, almost whitish. UNDERSIDE.—Much paler than upperside, but varying in correspondence with its brighter or duskier tint.

This dull-tinted *Acræa* has much of the aspect of *A. doubledayi*, Guér., the spots being very similar in size and disposition, but differs in its much shorter abdomen, shorter and much less apically-produced fore wings, the possession of three upper submarginal spots instead of linear internervular streaks in the fore wings, the better definition of the hind-marginal fuscous border (and of its enclosed spots) in the hind wings, and, in the female, in having merely an indication of white subapical clouding in the fore wings in place of a conspicuous broad white bar. The colouring and marking of the abdomen agree with those exhibited by each sex respectively of *A. doubledayi*, yet a female received from Rihatla, Delagoa Bay (Rev. H. Junod), approaches *A. omrora* in having the back and sides of the terminal half all white.

It is worth notice, as showing the intimate interrelation of the species of this genus, that every marking in *A. asema* corresponds closely in form and position with those of the totally different-looking, very strongly-marked, and richly-coloured *A. violarum*, Boisd.; and, curiously enough, a precisely similar aberration occurs in the male of both species, viz. all the spots in the submarginal series of the fore wings being crescentic instead of rounded.

16. ACRÆA DOUBLEDAYI, Guér.

Acræa doubledayi, Guér. Voy. Lefebv. en Abyss. vi. p. 378 (1847); Trim. S.-Afr. Butt. i. p. 147. n. 41 (1887).

Of this widely distributed species in Eastern and South-eastern Africa there are 23 examples, 18 being from the Mineni Valley.

17. ACRÆA AXINA, Westw.

Acræa axina, Westw. App. Oates's Matabele-land etc. p. 344. n. 33, pl. F. figs. 5, 6 (1881).

The 10 examples of this small *Acræa*, so closely allied to *A.*

[1] Two small males (*exp. al.* 1 in. 9 lin.), taken by Mr. Selous on the Shashani River, Matabeleland, in 1883, differ from the Manica specimens in having narrower, more elongated fore wings; a much clearer and brighter ochreous ground-colour; a large terminal discocellular spot in fore wings, but all the other black markings smaller, and two (the 4th and 6th) of the spots of the submarginal series in the fore wings wanting.

doubledayi, are from five different localities, four specimens being from near the Vunduzi River. The males are rather worn, but agree with other Eastern individuals in their semi-transparency and freedom from basal fuscous clouding; the three females are all dusky brownish above, but differ much as regards the subapical whitish bar in the fore wings, which in one case is unusually broad.

18. ACRÆA CALDARENA, Hewits.

Acræa caldarena, Hewits. Ent. M. Mag. xiv. p. 52 (1877); Trim. S.-Afr. Butt. i. p. 149. n. 42 (1887).

The collection contains 19 specimens of this well-marked form, 12 from Christmas Pass and 7 from the Mineni Valley. The species was first described from examples taken on Lake Nyassa; it ranges westward to Damaraland and southward to the northern Transvaal. One of the females taken in the Mineni Valley is remarkable for the different ground-colour on the upperside, which is a dingy creamy-yellow without any tinge of the ordinary warm ochreous-fulvous; the fore wings are paler, while the fuscous basal suffusion is extended over two-thirds of the hind wings.

19. ACRÆA AGLAONICE, Westw.

Acræa aglaonice, Westw. App. Oates's Matabele-land etc. p. 346. n. 35, pl. F. figs. 9, 10 (1881); Trim. S.-Afr. Butt. i. p. 151. n. 43, pl. iii. fig. 3 (1877).

The four males and two females, from the Mineni Valley (three males and a female), Lopodzi River (male), and Lower Pungwe River (female), constitute rather a striking *variety* in the direction of *A. natalica*, Boisd. In this form the male has much more fuscous basal clouding and wider apical fuscous in the fore wings, where also the peculiar subapical transparent spots are obsolete or entirely wanting; while in the hind wings the fuscous hind-marginal border is very much broader and partly radiant on the nervules along its inner edge. The Mineni Valley female nearly resembles that from Delagoa Bay described by me (*op. cit.*), but has the transparent spots of the fore wings obsolescent; while the Pungwe River female, though having this marking well expressed, is very much duller in ground-colour, and also presents the peculiarity to which so many female *Acræa* are liable, viz., a conspicuous white cloud on the middle disk of the hind wings. I have an exactly similar female to this, which was taken in Zululand (Etshowe) by Capt. A. M. Goodrich in 1887.

As regards the male, the South-African Museum possesses one agreeing with Mr. Selous's examples which was taken in the Lydenburg district of the Transvaal by Mr. T. Ayres, and I have examined two others, one taken at Etshowe by Mr. C. N. Barker, and the other at Extcourt, Natal, by Mr. C. W. Morrison.

The three males recorded by me (*op. cit.* p. 152) as taken by Mr. Selous on the Marico and Upper Limpopo are intermediate between typical *A. aglaonice* and the variety now under notice, having the transparent spots and basal fuscous moderately developed in the fore wings; but the two females differ from the Mineni Valley female only in the much clearer transparent spots.

20. Acræa natalica, Boisd.

Acræa natalica, Boisd. App. Voy. Deleg. dans l'Afr. Aust. p. 590. n. 57 (1847).

This species is numerous over a wide stretch of Eastern and South-eastern Africa. Mr. Selous's collection contains 36 specimens, 29 of which were captured in Christmas Pass.

21. Acræa anemosa, Hewits.

Acræa anemosa, Hewits. Exot. Butt. iii. pl. 8. figs. 14, 15 (1865).

The only examples are an unusually small male, captured at the Sikuva River on 4th March, and an ordinary female taken in Christmas Pass on the 16th February.

In 'South-African Butterflies' (i. p. 158) I have described an "*Aberration*—? ♀," from Damaraland, in the Hewitson Collection, in which on the upperside there is white clouding about the extremities of the nervules in the fore wings, and a large white cloud in the hind wings replacing nearly all the reddish ochre-yellow of the central band. Mr. Selous in 1889 sent me a male presenting the same peculiarities, and also the distinction of the fore wings being salmon-pink without any tinge of the usual yellow-ochreous; this very striking example was captured a little south of the junction of the Chobe and Zambesi.

22. Acræa acrita, Hewits. (Plate IV. fig. 4, var., ♂.)

Acræa acrita, Hewits. Exot. Butt. iii. pl. 8. fig. 18 (1865); Trimen, op. cit. iii. App. i. p. 381. n. 381 (1889).

There are 19 examples of this fine *Acræa* from Christmas Pass, 1 from Sikuva River, 3 from Mineni Valley, 1 from Vunduzi River, and 2 (of a larger variety) from Revué River. With the exception of the two last-named, all may be regarded as belonging to the typical form; the males expand from 2 in. 2 lin. to 2 in. $5\frac{1}{2}$ lin., the females the same. Both sexes show a good deal of variation as regards the width of the apical fuscous border in the fore wings, and in the numbers (7 or 8) and relative sizes of the rounded discal spots in the hind wings; the subbasal black spot in the fore wings is much reduced in several males and females, and is wholly wanting in two of the latter. The males also exhibit on the upperside much instability in respect of the width of the hind-marginal border of the hind wings and the distinctness of its enclosed spots, the border being usually more or less extended internally in a different manner between the third median nervule and the anal angle, and the enclosed spots giving every grade from perfect development to (in one example) complete obsolescence. This last-mentioned male has some other black markings of the upperside considerably enlarged, and the middle spot of the oblique median row of three in the fore wings is out of line, being nearer to base than usual. Variation in the female lies chiefly in ground-colour, which in most examples is much obscured with brownish-fuscous clouding from the bases to beyond middle, but which exhibits much gradation, especially as regards the red of the hind wings, which in one specimen is almost as bright as in the male. The hind-marginal border on the upperside is more or less diffused internally, and its enclosed spots quite obsolescent in all the females.

The two specimens (male and female) from the Revué River are a good deal larger (exp. 2 in. 8 lin.), with more elongated fore wings; their colouring is brighter and clearer, and all the black markings, except the few spots on the fore wings, are reduced, especially the spots and hind-marginal border of the hind wings, which latter has no diffusion internally and all the ground-colour spots it encloses quite distinct. On the underside of the hind wings the dull lake-red colouring is much reduced, forming internervular rays; and on the back of the thorax and abdomen the paired creamy and whitish spots are much larger and more conspicuous.

Mr. Selous was disposed to think that these larger brighter individuals just mentioned belonged to a species distinct from *A. acrita*, especially as they were found flying in forest tracts among lofty trees, whereas the numerous examples of typical *acrita* frequented open grassy hill-sides. But after very careful examination it seems to me more probable that they represent a seasonal (winter) form, having been captured in June, whereas all the ordinary specimens of *A. acrita* were captured between February 12th and March 18th. The male taken by Mr. Selous in Mashunaland in 1883 (exact date not recorded), mentioned by me *loc. cit.*, belongs to this form, but is a little smaller.

23. ACRÆA ACARA, Hewits.

Acræa acara, Hewits. Exot. Butt. iii. pl. 8. figs. 19, 20 (1865).

Six specimens of this species, from Christmas Pass, exhibit no difference in either sex from typical Natalian examples [1].

24. ACRÆA ENCEDON (Linn.).

Papilio encedon, Linn. Mus. Lud. Ulr. Reg. p. 244. n. 63 (1764).

There are only two examples of this widely-spread Ethiopian

[1] I described (P. Z. S. 1891, p. 72) a single female taken in Ehanda, near the Upper Cunenè River, presenting the aberration of a wide suffusion and coalescence of the black markings of the fore wings. This was the only example of *A. acara* in Mr. Eriksson's first collection from S.W. Tropical Africa; but in a second collection, made in the same region between the 15th November, 1890, and the 1st March, 1891, out of a series of eight males and three females captured in three localities between the Cunenè and the Ondonga Road, five

species, both of the typical brownish-rufous form. They were taken on the Pungwe River.

25. ACRÆA RAHIRA, Boisd.

Acræa rahira, Boisd. Faune Ent. de Madag. etc. p. 33, pl. 5. figs. 4, 5 (1833).

A male from Umtali and another from the Vunduzi, both of the typical South-African form, but with the black spots considerably reduced in the latter specimen.

26. ACRÆA BUXTONI, Butl.

Acræa buxtoni, Butl. Ann. & Mag. Nat. Hist. ser. 4, xvi. p. 395 (1875).

Twenty-seven examples taken in Christmas Pass, and six others from different localities, agree with Natalian specimens, the females varying in the same manner. One male, however, from Christmas Pass, exhibits a peculiarity on the underside of the hind wings, where in the discal series the 2nd, 3rd, and 4th spots, and also the 5th and 6th spots, are united, so that each group forms a narrow streak.

27. ACRÆA CABIRA, Hopff.

Acræa cabira, Hopff. Monatsb. Preuss. Akad. Wissensch. 1855, p. 640. n. 7.

Twelve specimens from Christmas Pass do not differ from those found farther southward.

Genus PLANEMA, Doubl.

28. PLANEMA JOHNSTONI (Godm.).

♂. *Acræa johnstoni*, Godm. Proc. Zool. Soc. 1885, p. 537.
♀. *Acræa (Planema) johnstoni*, Butl. op. cit. 1888, p. 91.

This species was founded on a single male collected by Mr. H. H. Johnston on Kilima-njaro at an elevation of 5500 ft. The female was noted by Mr. Butler (*loc. cit.*) from two examples, one of them taken in the same locality as the female, the other in the hills of Terta. So very dissimilar are the sexes (the male having the fore wings ochre-red from base up to and including the two obliquely disposed pairs of discal spots, and the female having the

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males and all the females exhibit the same strong melanic marking, and even the remaining three males show a slight tendency in the same direction.

Although *A. acara*, as noted in my S.-African Butt. i. p. 160, varies much in the development of the black markings, I have not seen any other examples that approach the very heavily black-clouded condition of Mr. Eriksson's specimens.

It should be noted that this variation is not at all in the direction of the allied *A. zetes* (L.), which is recorded from Angola and as far north on the West Coast as Sierra Leone, as in that species it is the entire ground of the fore wings that is suffused with greyish fuscous, the black markings themselves not being enlarged or confluent.

entire fore wings black with the discal spots conspicuously white), that, having only the descriptions to refer to, I was inclined to think that the female received by Mr. Butler had been erroneously associated with Mr. Godman's female. But on consulting Mr. Butler, he most kindly sent me figures and notes which leave no doubt of the specific identity of these widely differing sexes.

There are only two examples of this curious *Planema* in Mr. Selous's collection, one captured at Umtali, and the other (on February 24th) in Christmas Pass. The former is so much smaller, and has the hind margin of the fore wings so much more hollowed, than the latter, that I took it for a male although entirely of the female coloration; but closer examination has shown it to be a female. Mr. Butler, however, informs me that during 1892 he had seen both males and females in a collection from Kilima-njaro, and that one or two of the males were less unlike the female than the rest, the ochre-red covering the basal half only of the fore wings [1].

The resemblance borne by the female to *Amauris echeria* (var. *albimaculata*, Butl.) is very strong, but I hesitate to adopt Mr. Butler's conclusion that the former is evidently modified in imitation of the *Amauris*, because, firstly, both *Amauris* and *Planema* are equally protected genera and extensively mimicked by Butterflies of other groups, and, secondly, *P. johnstoni* female does not either in pattern or colouring diverge much from its congeners, coming near *P. lycoa*, Fabr.

Mr. Selous notes that he saw only a few of this Butterfly; they flew on the border of a stream and settled very frequently.

Subfamily NYMPHALINÆ.

Genus ATELLA, E. Doubl.

29. ATELLA PHALANTHA (Dru.).

Papilio phalantha, Dru. Ill. Nat. Hist. i. pl. 21. figs. 1, 2 (1770).

Of this most widely ranging species there are five specimens from Christmas Pass and one from the Mineni Valley.

[1] *Acræa proteina*, C. Oberth. (Études d'Ent. xvii. p. 25, pl. i. fig. 4; pl. ii. figs. 14, 19, 21; pl. iii. fig. 29), is apparently synonymous with *P. johnstoni*, the specimens recorded and figured being from Urogaro and Usambara in East Africa. Mr. Selous's two examples agree pretty nearly with M. Oberthür's fig. 14 on pl. ii., but one of them is considerably larger and with the median space in the hind wings of a much deeper tint of yellow. The species appears to be highly variable, M. Oberthür figuring (pl. i. fig. 4) a small male agreeing with the ordinary female except that the spots of the fore wings are pale yellow instead of white; (pl. iii. fig. 29) a female in which the hind wings on both surfaces, and the hind-marginal area of the fore wings on the underside, are deeply tinged with reddish-ochreous; and (pl. ii. figs. 19 and 21) a male of the typical (*johnstoni*) colouring, and a female in which the reddish-ochreous is strongly prevalent discally on both surfaces of both fore and hind wings. It will probably be found that in this species of *Planema*, as in *P. esebria* (see S.-Afr. Butt. i. pp. 177–78), the varieties are resolvable into two or three in which the sexes more or less agree in coloration.

Genus PYRAMEIS, E. Doubl.

30. PYRAMEIS CARDUI (Linn.).

Two examples from Christmas Pass.

Genus JUNONIA, E. Doubl.

31. JUNONIA CEBRENE, Trim.

Junonia cebrene, Trim. Trans. Ent. Soc. Lond. 1870, p. 353.

One specimen from Umtali, one from Christmas Pass, and two from Mineni Valley.

32. JUNONIA CLELIA (Cram.).

Papilio clelia, Cram. Pap. Exot. i. t. xxi. figs. E, F (1775).

Two specimens from the Mineni Valley.

33. JUNONIA BOÖPIS, Trim.

Junonia boöpis, Trim. Trans. Ent. Soc. Lond. 1879, p. 331.

The four examples (one from Umtali, one from Sikuva River, and two from Mineni Valley) agree with the typical Transvaal specimens.

Genus PRECIS, E. Doubl.

34. PRECIS CLOANTHA (Cram.)[1].

Papilio cloantha, Cram. Pap. Exot. iii. t. cccxxxviii. figs. A, B (1782).

Eighteen examples (seventeen from the Mineni Valley) are highly variable in the tint of the underside, five being of an unusually dark brown.

35. PRECIS CERYNE (Boisd.).

Salamis ceryne, Boisd. App. Voy. de Deleg. p. 592. n. 68 (1847).

Twelve specimens from the Mineni Valley and one from Lusika River are in all respects like typical examples from Natal.

[1] In my notes on this species (S.-Afr. Butt. i. pp. 220 and 223) I pointed out the exceptionally robust structure, gradually clavate antennæ, and thick hairy wings of this Butterfly, in comparison with the other species of *Precis.* Mr. Cecil N. Barker has recently reared *P. cloantha* from a larva found at Malvern, Natal; and, from the drawings and description he has kindly sent me, it is apparent that the larva presents the peculiarity of having the two rather long cephalic horns clubbed at the tip, while the pupa is much thickened about the middle and is singularly smooth, wanting all the prominent pointed tubercles so conspicuous dorsally and laterally in the pupæ of *P. octavia* and *P. sesamus.* The larva is described as golden yellow, each segment having a median transverse purplish-black bar interrupted both subdorsally and on the spiracular line; the bristled spines spring from these bars; head dull orange, with an inverted V of purplish black frontally; legs dark plum-colour with a black ring about middle. The pupa is figured as greenish yellow, with a few dull-purplish spots on underside of head, sides of thorax, and bases and hind margins of wing-covers; abdomen with seven rows (longitudinal) of dull-purplish dots. The larva was found on October 23rd, 1892; it began pupation on the 27th; and a male imago emerged on November 11th. The food-plant is not specified by name, but was a "bush herb with lilac-blue flowers."

36. Precis tukuoa (Wallengr.).

Salamis tukuoa, Wallengr. K. Sv. Vet.-Ak. Handl. 1857—Lep. Rhop. Caffr. p. 25. n. 6.

Three specimens from the Mineni Valley do not differ from more southern examples.

37. Precis cuama (Hewits.).

Junonia cuama, Hewits. Exot. Butt. iii. p. 25, pl. 13. figs. 4, 5 (1864).

Precis cuama, Trim. Proc. Zool. Soc. 1891, p. 74. n. 20.

Six examples from the Mineni Valley and two from Vunduzi River. Most of the specimens agree with those from Ehanda and the Okavango River noted by me (*loc. cit.*) as much yellower than the figure of the type, and as wanting (on both surfaces) the conspicuous white centre of the second and third fuscous spots in the discal row of the fore wings, and (on the upperside) the paler cloud in the middle of the hind wings; but two of the Mineni males are intermediate in these respects, approaching the type in tint, having the pale cloud faintly shown in the hind wings, and presenting the two white spots in the fore wings on both surfaces. The underside is most variable in colouring—only one of the two last-mentioned individuals agreeing fairly with the figure of the type, the other being dull and with little trace of rufous, but with all the markings faint, and a strong bronzy surface-gloss; while the yellower examples exhibit beneath different admixtures of ochre-yellow and ferruginous brown, with the markings ashy grey and fuscous, in some cases faintly glossed with violaceous.

This Butterfly is noted as frequenting the shade of the forest, and when settled to be scarcely distinguishable from faded leaves.

38. Precis simia, Wallengr. (Plate IV. fig. 5, ♂.)

Precis simia, Wallengr. K. Sv. Vet.-Akad. Handl. 1857—Lep. Rhop. Caffr. p. 26. n. 2; Trimen, S.-Afr. Butt. i. p. 227. n. 70 (1887).

Of this very rare species—of which the only examples hitherto known to me were the type (collected by Wahlberg) in the Stockholm Museum and a very worn male taken by Col. Bowker at Durban—there are four male examples, three from the Mineni Valley and one from Christmas Pass. The three former are typical, agreeing well with the careful figure of the type (a ♀, judging from the want of the anal-angular projection in the hind wings), except in having all the fuscous markings larger; but the fourth has on the upperside a yellowish-white median discal cloud in the hind wings, and a similar smaller lower discal cloud in the fore wings, and all the black spots of the discal series in the fore wings smaller; while on the underside the basal fuscous in both wings is much effaced by the enlargement (and in the hind wings actual confluence at many points) of the enclosed markings of the ground-colour, and there is also a streak of the ground-colour, interrupted by internervular black spots, along the hind-marginal edge of the hind wings.

Mr. Selous met with this species flying about the bed of a small ravine, and settling on the overhanging bushes. The three Mineni Valley specimens were captured on 6th March, the variety from Christmas Pass on 27th February.

39. Precis octavia (Cram.).

Papilio octavia, Cram. Pap. Exot. ii. t. cxxxv. figs. B, C (1777).

All the thirteen specimens—11 from Christmas Pass and 2 from the Mineni Valley—belong to the larger, more brightly coloured southern form, which Staudinger has figured (Exot. Schmett. pl. 38, 1885) as " var. *natalensis*."

40. Precis sesamus, Trim.

Precis sesamus, Trim. Trans. Ent. Soc. Lond. 1883, p. 347; S.-Afr. Butt. i. p. 231, pl. 4. fig. 3 (1887).)

Eight examples from Mineni Valley and one from the Pungwe River present no material variation from more southern specimens.

41. Precis archesia (Cram.).

Papilio archesia, Cram. Pap. Exot. iii. t. ccxix. figs. D, E (1782).

In the only two specimens, both male, from the Mineni Valley, the common dull-red band is throughout much narrower than in the typical form and submacular, in this respect resembling the Angolan form *P. staudingerii*, Dewitz (Nov. Act. Acad. Leop.-Carol. xli. p. 193, t. xxv. n. 15, 1879).

42. Precis pelasgis (Godt.).

Vanessa pelasgis, Godt. Enc. Méth. ix. Suppl. p. 820. n. 38–39 (1819).

Out of 14 examples collected, 5 of the males (3 from Christmas Pass and 2 from Mineni Valley) and 1 female exhibit a variation in the direction of the Zambesian form *P. chapunga* (Hewits.), having the common creamy-rufous band much narrowed on the upperside, and the corresponding creamy-white band on the underside somewhat narrowed.

43. Precis natalica, Feld.

Precis natalica, Feld. Wien. ent. Monatsch. iv. p. 106 (1860).

Five specimens from Christmas Pass and thirteen from the Mineni Valley present the usual variation in the tints of the underside.

44. Precis elgiva (Hewits.).

Junonia elgiva, Hewits. Exot. Butt. iii. p. 25, pl. 13. fig. 1 (1864).

Here also the customary variation of the underside colouring is observable in the 9 examples collected—8 from Mineni Valley and 1 from Vunduzi River.

45. Precis artaxia (Hewits.).

Junonia artaxia, Hewits. op. cit. iii. p. 26, pl. 13. fig. 6 (1864).
Precis artaxia, Trim. Proc. Zool. Soc. 1891, p. 75. n. 24

Of this very striking and singularly-coloured *Precis* there is a fine series of 41 examples, of which 37 were taken in the Mineni Valley from 6th to 26th March, 3 in Christmas Pass in the first half of February, and 1 on the Lusika River early in April. The sexes scarcely differ in colouring, the female being somewhat paler occasionally. Hewitson figures an example in which the smaller lower ocellus on the upperside of the hind wings is wanting, and in his description omits all mention of this marking, although it was present in two out of the three Zambesian specimens which I examined in his collection in the year 1867, and, although varying in size, is very rarely obsolete or even indistinct. The small ocellus in a corresponding position in the fore wings is, on the contrary, often obsolescent and never very distinct. The underside varies considerably in colour, presenting several shades in which brown or grey predominate, and being in some cases glossed with bronzy greenish or with pale dull violaceous. The markings on this surface vary in distinctness, especially the nearly straight ochre-yellow streak, outwardly bordered with dark brown, which crosses the middle of the hind wings. There is a tendency to the ocellate form in most of the very small indistinct spots of the common discal series, and two of these, considerably larger than the rest, represent respectively the upperside ocelli in the fore wings and the superior portion of the hind wings.

Mr. Selous notes that *P. artaxia* is usually numerous in the shady forests to which it is restricted. During its very short and hurried flight the large many-coloured ocelli of the hind wings are conspicuous, but it settles again almost immediately on the ground at the foot of trees, where the dead-leaf-like underside effectually conceals it. Although indisposed to take wing ordinarily, it becomes wary when alarmed by pursuit.

Genus Salamis, Boisd.

46. Salamis anacardii (Linn.).

Papilio anacardii, Linn. Mus. Lud. Ulr. p. 236. n. 55 (1764).

The specimens taken (5 at Christmas Pass, 1 at Revué River, and 6 on the Pungwe River) are like those from Natal, having a clearer paler colour, with a less intense rosy-violet gloss, than the tropical West-African examples.

47. Salamis nebulosa, Trim.

Salamis nebulosa, Trim. Trans. Ent. Soc. Lond. 1881, p. 441; S.-Afr. Butt. i. p. 246. n. 79, pl. iv. fig. 6 (1887).

The only example, taken on the Pungwe River, about 15 miles above Sarmento, is a female, larger (*exp. al.* 3 in. $2\frac{1}{2}$ lin.) and with considerably broader fuscous upperside marking than the Zululand female figured by me (*op. cit.*). I have a similar but rather smaller female, captured by Mr. H. M. Barber in the Lydenburg District, Eastern Transvaal, which presents the peculiarity of having the superior discal ocellus on the upperside of the hind wings as distinct and as brightly coloured as the constant inferior one.

Mr. Selous's specimen was captured on 21st September, settled on the leaf of a tree; other specimens were seen flying about the same spot, but were much worn.

Genus Crenis, Boisd.

48. Crenis boisduvali, Wallengr.

Crenis boisduvali, Wallengr. K. Sv. Vet.-Akad. Handl. 1857.—Lep. Rhop. Caffr. p. 30. n. 2; Trim. S.-Afr. Butt. i. p. 252. n. 81, pl. v. figs. 2, 2 *a* (1887).

Nineteen examples (12 from Christmas Pass and 7 from the Mineni Valley) agree in all respects with Natalian specimens.

Genus Eurytela, Boisd.

49. Eurytela hiarbas (Dru.).

Papilio hiarbas, Dru. Ill. Nat. Hist. iii. pl. xiv. figs. 1, 2 (1782).

A single example from Christmas Pass.

50. Eurytela dryope (Cram.).

Papilio dryope, Cram. Pap. Exot. t. lxxviii. figs. E, F (1779).

Three specimens from Christmas Pass and one from the Lopodzi River. In a female from the former locality the discal ochre-yellow band is broader than usual.

Genus Hypanis, Boisd.

51. Hypanis ilithyia (Dru.).

Papilio ilithyia, Dru. Ill. Nat. Hist. ii. pl. xvii. figs. 1, 2 (1773).

The eleven examples taken (8 at Christmas Pass and 3 in the Mineni Valley) belong to the var. *acheloïa*, Wallengr., which appears to be the prevalent Coast-district form in several parts of Africa, and specially so in Natal. All have the underside colouring pale; and in one male on the upperside the spots of ground-colour in the hind marginal black border of the hind wings are very much reduced.

Genus Neptis, Fabr.

52. Neptis agatha (Cram.).

Papilio agatha, Cram. Pap. Exot. iv. t. cccxxvii. figs. A, B (1780).

The six examples (4 from Christmas Pass and 2 from the Mineni Valley) vary a little as to the width of the white transverse bands.

53. Neptis marpessa, Hopff.

Neptis marpessa, Hopff. Monatsb. Akad. Wissensch. Berl. 1855, p. 640. n. 8.

Four specimens taken at Christmas Pass agree thoroughly with those found in Nâtal and other more southern tracts.

54. Neptis goochii, Trim.

Neptis goochii, Trim. Trans. Ent. Soc. Lond. 1879, p. 336: S.-Afr. Butt. i. p. 273. n. 89, pl. v. fig. 6 (1887).

Of this rare little *Neptis*, hitherto only known to me as inhabiting the Durban district of Natal, there is a single example, captured at Christmas Pass on 13th February.

Genus Diadema, Boisd.

55. Diadema misippus (L.).

One specimen from Christmas Pass and another from the Mineni Valley.

Genus Euphædra, Hübn.

56. Euphædra neophron (Hopff.).

Romaleosoma neophron, Hopff. Monatsb. Akad. Wiss. Berl. 1855, p. 640. n. 9.

There are two examples of this very distinct *Euphædra*, taken on the Pungwe River 15 miles above Sarmento on September 19th. This species appears to be the solitary representative of its genus in Eastern and South-eastern Africa.

Genus Hamanumida, Hübn.

57. Hamanumida dædalus (Fabr.).

Papilio dædalus, Fabr. Syst. Ent. p. 482. n. 174 (1775).

Four specimens from Christmas Pass (February 12th to 26th), one from the Mineni Valley (March 29th) and two from near Vunduzi River (April 5th), are all of the form in which the underside is warm reddish ochreous and spotted with white; but in two specimens, dated respectively March 29th and April 5th, the white spots are rather duller than in the rest.

I have for some time been disposed to think that the well-known variation in the underside of this widely-distributed African butterfly is *seasonal*, and these dated captures of Mr. Selous's tend to confirm this view. All the specimen taken by Mr. Eriksson at Omrora, tropical S.W. Africa, from 1st to 25th August, 1887, were (as I have recorded, P. Z. S. 1891, p. 80) of the dull underside colouring, wanting the white spots and with the dark markings very faint, and the same is the case with a pair taken *in copulâ* near Delagoa Bay, on the 9th August, 1891, by the Rev. H. Junod. A series of dated captures throughout the year is wanting in the case of this species, as of so many others; but the little material available favours the supposition that (as in the case of many *Satyrinæ* and *Lycænidæ*) the warmly-tinted conspicuously marked underside denotes the summer or wet-season brood (where concealment is of less importance among the herbage of that season), and the obscure underside almost devoid of markings the brood of the winter or dry season, when the open-ground vegetation is wanting or thoroughly withered.

In connection with this point, however, the published observations of Mr. D. G. Rutherford (Proc. Ent. Soc. Lond. 1878, p. xlii) and Mr. W. L. Distant (Nat. in the Transvaal, 1892, pp. 41, 42)—both of whom were acquainted with this species in life—should be considered. The former notes that this Butterfly always settles on the ground with closed wings, and that the underside colouring not only was eminently protective from its close resemblance to the colour of the soil, but was found in the various districts inhabited by the insect to vary in accordance with the particular tint of the soil characteristic of a district. Mr. Distant, on the contrary, though agreeing as to the insect's settling on open ground, states that he invariably found it resting with wings expanded, and "nearly always on greyish-coloured rocks or slaty-hued paths, with which the colour of the *upper* surface of the wings wonderfully assimilated." He adds that "large tracts of bare ground of a reddish-brown colour exist with which the under surface of the wings would be in perfect unison; but though I watched for months to see a specimen thus situated, and with its wings vertically closed, I never succeeded in doing so." On reading Mr. Distant's letter to the above effect published in 'Nature' of 26th February, 1891, I wrote to him suggesting that (1) the differences in the underside might be seasonal, and (2) that possibly the upperside might be protective in the wet and the underside in the dry season; I also intimated that all analogy pointed to the underside being protective when the insect is really *at rest*, not merely settling at intervals. To this latter view I adhere; but as regards the second of my suggestions, Mr. Distant's observation that the habits of *H. dædalus* were "uniform in the Transvaal in both the dry and wet seasons" would indicate that even during the winter the underside colouring would not in that country be protective. Mr. Distant does not mention whether the underside differs seasonally in the Transvaal, but two examples (♂ and ♀) taken by Mr. W. Morant near Pretoria in March 1872 are both of the brighter colouring with moderately developed white spots, as is also a solitary example taken near Durban, Natal, in February 1883 by Col. Bowker.

Genus Charaxes, Ochs.

58. Charaxes zoolina (Westw.).

Nymphalis zoolina, Westw. Gen. D. Lep. pl. liii. fig. 1 (1850).

The two specimens (♂ and ♀) were taken at Christmas Pass.

Both have the fuscous borders and markings strongly developed, the male indeed approaching in this respect the *variety* A from Zululand and Delagoa Bay described by me in S.-Afr. Butt. iii. p. 405 (1889); and the female having all the ground-colour spots in the border of the fore wings completely separated from the discal field.

Male examples as dark as the one here noted have been taken at Durban and sent to me by Mr. A. D. Millar.

59. Charaxes varanes (Cram.).

Papilio varanes, Cram. Pap. Exot. t. clx. figs. D, E (1779), and iv. t. ccclxxxviii. figs. A, B (1782).

The two specimens received, taken in the Mineni Valley, agree with those from the Zambesi and Quilimane, and indeed with Tropical examples generally, in having the basal white much better developed (in both fore and hind wings) than in any individual from the extra-tropical area that I have examined.

60. Charaxes lasti, H. G. Smith. (Plate V. fig. 6, ♀.)

Charaxes lasti, H. G. Smith, Ann. & Mag. Nat. Hist. ser. 6, vol. iii. p. 131 (1889); and Rhop. Exot. p. 8, pl. (*Char.*) iv. figs. 4, 5 [♂] (1890).

There are two examples (♂ and ♀) from the Mineni Valley, taken on the 18th and 14th March respectively, a male specimen from the Pungwe Valley taken on 1st September, and two (♂ and ♀) captured on the Pungwe River, about 15 miles above Sarmento, on 19th September.

I have not seen the types of this *Charaxes*, but, judging from the description and figures above cited, I do not think Mr. Selous's specimens can be held distinct from it; although all three males differ in some respects from the figures, they also differ from one another. All three agree in having the transverse irregular series of fuscous markings on the disk disconnected (except near the costa) from the hind-marginal fuscus border, and extended by an additional sagittiform mark below 2nd median nervule, and also in having the lowest and largest fulvous hind-marginal spot completely enclosed in the border; in these features differing from the figure of the upperside. The Mineni and Pungwe Valley males further diverge from the same figure in presenting a well-developed sub-marginal fuscous band in the hind wing from the costa to the 1st median nervule; and even in the male from above Sarmento, in which all the fuscous markings of the upperside are greatly reduced, there are traces of this long band. On the underside, again, all are paler and yellower than in fig. 5, and only the Mineni Valley male has the silvery-white median stripe across the hind wings (which is, however, much broader than in the figure). The two Pungwe males have all the underside markings much attenuated, and in the example from above Sarmento they are almost obsolete; and both they and the Mineni male have more or less indistinct whitish lunules (not small spots) forming a submarginal series in the hind wings.

The two females agree with their respective mates, the specimen from above Sarmento having the submarginal fuscous on the upperside of both wings completely broken up into spots, and the underside more reddish and much less distinctly marked than in the one from Mineni Valley.

The South-African Museum has for many years been in possession of a single imperfect male of this species, received with a few other Butterflies collected on the Zambesi by (I was informed) the Rev. H. Waller. It agrees pretty closely with the Mineni Valley male above noted, but has the silvery-white stripe on the underside of the hind wings still broader.

The male expands 2 in. 9–11 lin.; the female 3 in. 4 lin.

C. lasti is the Eastern representative of *C. cynthia*, Butl. (♀ *C. lysianassa*, Westw.), a widely distributed West-African species recorded from Ashanti, Cameroons, and Angola. It is distinguished by its smaller size, by the great expansion of the fulvous and the consequent reduction of the fuscous colouring on the upperside, and by the great attenuation and partial obliteration of the markings of the underside.

Mr. Last discovered this Butterfly at Mombasa, and it is interesting to find it extending so far to the south as the Manica Country.

Mr. Selous notes that both the first and second of the males above mentioned were captured while drinking at the edge of water, while the female in the Mineni Valley was settled, with wings expanded, on the leaves of a thorn-tree.

61. Charaxes azota, Hewits.

♀. *Philognoma azota*, Hewits. Ent. M. Mag. xiv. p. 82 (1877).

♂. *Charaxes azota*, Hewits. op. cit. p. 181 (1878).

♀. *Charaxes azota*, R. Monteiro, Delagoa Bay, &c. frontisp. fig. 1 (1891).

A fine female of this handsome species is noted as being the only one seen; it was taken at the Lusika River on 13th April, frequenting the same tree on which specimens of *C. castor* were found.

Since the publication of my notes on this species (S.-Afr. Butt. iii. p. 388, 1889), *C. azota* has been found in some numbers near Delagoa Bay by the Rev. H. Junod, and a series of eight males and three females has been acquired from him for the South-African Museum. In the male the "tails" of the hind wings are represented only by two short acute dentations; but in the female not only is the dentation on the 1st median nervule considerably more produced, but there is a distinct tail on the 3rd median nervule. This tail varies both in length and form, being pointed at the tip in two specimens and rounded in two others; in one of the latter (Mr. Selous's example) it is even inclined to a spatulate form.

62. Charaxes saturnus, Butl.

Charaxes saturnus, Butl. Proc. Zool. Soc. 1865, p. 624, pl. 36. fig. 1.

Of this common South-Tropical species there are one example from Umtali, seven from the Mineni Valley, and four from the Lusika River. Of the two females from the last-named locality, one expands a little over 4 inches and the other $3\frac{3}{4}$ inches.

63. Charaxes castor (Cram.).

Papilio castor, Cram. Pap. Exot. i. t. xxxvii. figs. C, D (1775).

Mr. Selous notes that *C. castor* was rare; he took but three specimens, all on the stem of the same thorn-tree (*Acacia* sp.) at Lusika River on which the female *C. azota* was captured, and on the same date, the 13th April.

64. Charaxes pollux (Cram.).

Papilio pollux, Cram. Pap. Exot. i. t. xxxviii. figs. E, F (1775).
Papilio camulus, Dru. Ill. Nat. Hist. iii. pl. 30 (1782).

A female from Christmas Pass, taken on 27th February, and a male from the Mineni Valley, taken on 16th March, are the only examples in the collection. These are both distinguished from the West-African specimens that I have seen in possessing not only considerably larger ochre-yellow hind-marginal spots in the fore wings, but also a complete and conspicuous series of ochre-yellow lunules along the hind margin of the hind wings; they further both want on the upperside of the fore wings the lowermost black spot (between 2nd and 1st median nervules). In the female not only are the tails on the hind wings considerably longer and wider than in the male, but the intermediate dentation on the 2nd median nervule is also prolonged into a short tail.

The male was captured sucking at exudations on the branches of the same tree that was frequented by *C. bohemani* (see below), the female fluttering among grass.

Manica is by far the most southern station recorded for this Butterfly, and indeed, as far as I can ascertain, the only *East*-African one near the coast; but *C. pollux* is common at Sierra Leone and extends to Cameroons and Chinchoxo (4° 22′ S.) along the West Coast, while Mr. Butler has also recorded it as among Emin Pasha's captures in Monbuttu, Central Africa, about 4° N.

65. Charaxes achæmenes, Feld. (Plate V. fig. 7, ♀.)

♂ ♀. *Charaxes achæmenes*, Feld. Reise Novara, Lep. iii. p. 446, pl. lix. figs. 6, 7 [♂] (1867).

One specimen from Umtali, one from Christmas Pass, five specimens from Mineni Valley, and five from the Lusika River; three of these are females.

Although the upperside of the male and the underside of both sexes are so completely unlike to the pattern and colouring of

C. saturnus, yet the upperside of the female is so remarkably similar to that of *C. saturnus* as to be with difficulty distinguished from the latter without close comparison.

Mr. Selous notes that nearly all his specimens of this species were taken drinking at the edge of water, but two or three at Lusika River were settled on the branches of a tree.

66. Charaxes guderiana (Dewitz). (Plate V. fig. 8, ♀.)

♂. *Nymphalis guderiana*, Dewitz, Nov. Act. Leop.-Carol. Akad. Naturf. xli. p. 200, t. xxvi. fig. 18 (1879).

This species was founded on three males captured in Angola by Dr. Pogge, and I have noticed (Proc. Zool. Soc. 1891, p. 81) the receipt of a male from Mashunaland and of sixteen males from the Ambuella Country not far from 16° S. lat. Mr. Selous collected 1 example at Umtali, no fewer than 30 at Mineni Valley, and 8 at Lusika River, and of these 5 each from the second and third localities were females; nearly all were taken in March, but one on February 28th and eight between April 1st and 25th.

As *guderiana* is unquestionably a member of the *ephyra* and *ethalion* group of *Charaxes*, it is very unexpected to find the female, as in the case of *C. achæmenes* just mentioned, on the upperside closely resembling *C. saturnus*, and so differing widely from the aspect of her nearest congeners.

♀. Strikingly different from male. *Exp. al.* 2 in. 8 lin. to 3 in. 2 lin.

Fuscous, with a common ochre-yellow discal band (in fore wing moderately broad but macular and more or less deeply cleft by downward traversing bar of ground-colour, in hind wing continuous, short, and much narrower inferiorly); bases dull ferruginous-ochreous. Fore wing: terminal discocellular spot ochre-yellow instead of white; commencement of inner series of spots forming ochre-yellow discal band represents the conspicuous outer costal white spot in male; six spots of incurved outer series of discal band represent the submarginal series of small bluish-white spots in male—in one example only, the lowest spot of this outer series is confluent, between 2nd and 3rd median nervules, with a large spot of the inner series; hind-marginal series of spots ferruginous-ochreous instead of white (the lowest and largest spot, however, more or less whitish internally), enlarged, often confluent into a submacular border. *Hind wing*: discal band simple, whitish yellow on costa and on inner edge, much indented by ground-colour on both sides inferiorly, where it is also more or less tinged and edged with metallic bluish or greenish scales; submarginal series of white, on both sides metallic-bluish or greenish bordered, lunules, much like that in male; upper four lunules of hind-marginal series ochre-yellow instead of white, the remainder to anal angle metallic greenish or bluish with ochre-yellow centres as in male; tails much longer and broad, especially that at end of 3rd median nervule, which is subspatulate instead of acute. Underside.—Rather paler, but pattern and coloration according with those of male, except that the common discal band of the upperside is represented in white (rather vaguely defined externally), and that its outer series of ochreous spots in the fore wing is faintly reproduced.

The pattern and coloration of both sexes on the underside exhibit the closest agreement with those shown in *C. ethalion*, Boisd., only differing in the greater thickness and (in parts) brighter tints of the markings, and, in the male only, by the reproduction of the costal, outer discal, and hind-marginal white spots of the fore wings. On the upperside the disparity between the female *C. guderiana* and the female *C. ethalion*, and the great likeness to *C. saturnus* in the former, are due to the ferruginous colour of the basal areas and the narrowness and decided ochre-yellow tint of the discal band.

Mr. Selous notes the interesting circumstance that while all the more numerous males were found drinking at the water's edge, the females were invariably met with sucking the exudations on a tree-stem or branches in company with the fine "Goliath" Cetoniid beetles, *Rhamphorrhina petersiana*, *Eudicella trimeni*, &c.

67. Charaxes ephyra (Godt.).

Nymphalis ephyra, Godt. Encycl. Méth. ix. p. 355 (1819).

Nine males from the Mineni Valley. Six of these present on the upperside of the hind wings the series of dull-greenish lunules before the submarginal bluish ones mentioned by Godart (*loc. cit.*) as occurring in a single specimen from the West Coast of Africa. The underside is darker, and with a more ferruginous tinge than usual.

The males of this Butterfly are noted as always found drinking at the water's edge; they were captured during March.

68. Charaxes phæus, Hewits.

Charaxes phæus, Hewits. Ent. M. Mag. xiv. p. 82 (1877); R. Monteiro, Delagoa Bay, &c. frontisp. figs. 4, 5 (1891).

The only example (a ♀) was taken on a tree at Lusika River on the 1st April.

69. Charaxes manica, n. sp. (Plate VI. fig. 9, ♀.)

♀. *Exp. al.* 2 in. 10 lin. to 3 in. 2 lin.

Allied to *C. ephyra* (Godt.), *C. phæus*, Hewits., &c.

Submetallic pale blue, more or less tinged with greenish, with very broad fuscous apical hind-marginal borders; in fore wing a rather broad obliquely transverse white band outwardly bordering the blue as in female C. bohemani, *Feld. Fore wing*: blue dull for some distance from base, thence brighter; white band commences widely on costa, encroaching internally a little on discoidal cell at extremity, and is of about even width as far as 1st median nervule beyond middle, but below this is bent inwardly from the general oblique direction, and much narrowed by diffusion of the blue as far as submedian nervure, below which it does not extend; apical area very broadly fuscous, as in female *bohemani*; two indistinct subapical whitish spots placed obliquely close to costa; beneath these, in one specimen, faint traces of three other spots, the whole indicating an elbowed series of five as in female *phæus*. *Hind wing*: blue forms a large discal space, brighter than the dull basal part which fills discoidal cell, extending from 2nd subcostal nervule to below 1st median; a rather wide costal, apical, and hind-marginal fuscous border; the usual continuous hind-marginal series of dull-red lunules as far as 3rd median nervule followed by bronzy-green lunules thence to anal angle, preceded by a submarginal series of thin, rather indistinct, whitish violet-tinged lunules, quite as in female *ethalion*, Boisd., and female *phæus*; inner-marginal border brownish-grey; tails as in the congeners mentioned. UNDERSIDE.—*General colouring and pattern very close to those shown by* ethalion *and* phæus, *but decidedly darker and more ferruginous in tint, without the strong silvery gloss, and possessing in its fore wing the same conspicuous oblique white band as on the upperside.*

It is not without hesitation that I propose a new species-name for the three females of *Charaxes* here described, because their underside, not only in marking but also in its ferruginous tint, bears so close a resemblance to that of the males of *C. ephyra* above noticed, that, were not the female of this species known, I should assign these Manica females to it. The males in question seem quite inseparable from *C. ephyra*, while the females under notice have the upperside totally different from that of the recognized female of *C. ephyra*, and so closely resembling that of the much larger female of *C. bohemani*, that they might well pass for dwarf specimens of the latter species. Only further material collected in Manica can determine whether the male of this aberrant female resembles it in the same way as in the case of the allied *C. phæus*, or whether we have here a dimorphic female of *C. ephyra*.

One example was taken in the Mineni Valley on 29th March, "on the same individual tree on which so many *C. bohemani* were captured," and the two others on a thorn-tree at Lusika River on 1st April.

70. CHARAXES BOHEMANI, Feld.

♂. *Charaxes bohemani*, Feld. Wien. ent. Monatschr. iii. p. 321, t. 6. fig. 3 (1859); Butl. Lep. Exot. p. 28, pl. x. fig. 3 [♀] (1869).

Of this very fine *Charaxes* twenty-eight specimens were taken in Mineni Valley from the 11th to the 18th March, and eight at Lusika River from the 1st to the 13th April. Of the entire thirty-six, nineteen are males and seventeen females; eleven are absolutely fresh perfect examples, twelve in fair condition, and thirteen more or less worn and broken. In expanse of wings the male varies from 3 in. 3 lin. to 3 in. 8 lin., and the female from 3 in. 9 lin. to 4 in. The tails of the hind wings are considerably longer and less acuminate in the female than in the male. There is but little variation as regards the upperside in either sex, except that the blue has in some specimens more of a greenish tinge than usual; in one male there is in the fore wings a small separate spot of blue just beyond the extremity of the discoidal cell. The underside is also very constant, but in the male exhibits some variation in the size and brightness of the yellow lunules which form a common sinuated submarginal series.

Mr. Selous informs me that he always found both sexes of this species sucking at exudations on the branches of a tree of moderate size; during flight the blue field of the upperside is conspicuous. Though not uncommon and rather widely distributed over Mashunaland, Mr. Selous was not able to secure specimens of it before visiting Manica.

71. Charaxes cithæron, Feld.

Charaxes cithæron, Feld. Wien. ent. Monatschr. iii. p. 398, t. 8. figs. 2, 3 (1859).

The only example is a much-worn female taken at Christmas Pass on the 29th February. It differs from the typical form so prevalent on the Natal coast, and approaches the female *C. xiphares* (Cram.), on the upperside of the fore wings by the more macular white median band, and by the two subapical white spots being succeeded inferiorly by a sinuated series of five whitish spots growing fainter downwards, and on the underside of the hind wings by the more pronounced markings throughout, and especially by the presence of a narrow white bar externally bounding the highly irregular median dark-blue transverse streak. On the upperside, however, the median band of the hind wings is not broad and ochre-yellow as in *C. xiphares*, but pale violaceous-blue and white as in *cithæron* and narrower than usual in the latter. The tails of the hind wings are very much shorter than in *cithæron*, shorter and narrower than in *C. xiphares* ♀, being in fact as short and acute as in *C. xiphares* ♂.

72. Charaxes selousi, n. sp. (Plate VI. fig. 10, ♂.)

♂. *Exp. al.* 2 in. 1 lin.

Black, with submetallic pale violaceous-blue white-clouded submarginal marking, developed in hind wing into a broad discal space. Fore wing: a sinuated submarginal series of eight blue and white spots, of which only the three lowest, between 2nd median nervule and inner margin, are enlarged and conspicuous, forming a short transverse band widening to inner marginal edge; the other five spots all small and very indistinct, except the 2nd and 3rd, which lie between 5th subcostal and lower radial nervules and are more white than blue. *Hind wing*: violaceous space extending over disk from costa to below 1st median nervule, and from extremity of discoidal cell to a little distance from hind margin—traversed by a whitish ray and with its inner edge white; just within hind-marginal edge a lunulated bluish-scaled streak, dull red as far as 3rd median nervule, but below that greenish yellow; just before this streak a series of seven small but very distinct and well-separated lunulate white spots, of which the two next anal angle internally edge two small blue spots; tails rather narrow but not very acuminate, of moderate and about equal length. UNDERSIDE.—*Very glossy; before middle, pale olivaceous-ochreous, with an irregular transverse blue-black white-edged streak; beyond middle, pale brownish-ochreous, traversed by a sinuated fascia whitish in fore wing, ferruginous-red in hind wing: a median blue-black line quite across both wings, bounded externally by a white stripe. Fore wing*: three blue-black white-edged spots in discoidal cell, one transversely elongate, close to base, the others subbasal, round, one above the other; transverse streak white-edged internally, interrupted on 1st median nervule; median transverse line almost straight, slightly interrupted on 2nd median nervule; discal fascia strongly sinuated superiorly, thinly fuscous-edged internally, traversed by a very faint indication of a series of pale rufous spots corresponding to the upperside series—the lowest spot being enlarged, geminate, and fuscous; apex whitish. *Hind wing*: in discoidal cell a subbasal blue-black, externally white-edged line; continuation of transverse streak of fore wing interrupted on subcostal nervure, and extending to just below median nervure; median transverse line continuous from costal to inner marginal edge; red discal fascia irregular, continuously black-edged internally, but only imperfectly so externally; white spots of hind-marginal series all larger than those on upperside and subocellate with blue and black; streak along hind-margin not bluish-scaled, ferruginous-red as far as 1st median nervule.

This very distinct species combines to some extent the colouring and pattern of the very much larger *C. violetta*, H. G. Smith, with those characteristic of the *ephyra* group of the genus, especially as regards the underside, but it is on the whole much nearer to the latter. Unfortunately the female remains unknown.

The only example was taken in the Mineni Valley, on 7th March; it was drinking at the water's edge, and the brightly-marked underside attracted Mr. Selous's notice, notwithstanding its small size as compared with its congeners.

I dedicate this *Charaxes* to Mr. F. C. Selous, a naturalist and geographical explorer distinguished no less for his high personal qualities than for his services in opening up tropical South Africa.

Family ERYCINIDÆ.

Subfamily LIBYTHEINÆ.

Genus LIBYTHEA, Fabr.

73. LIBYTHEA LAIUS, Trim.

Libythea laius, Trim. Trans. Ent. Soc. Lond. 1879, p. 337; S.-Afr. Butt. ii. p. 5. n. 118, pl. vii. fig. 3

Four specimens—a male from Christmas Pass, two males from

Mineni River, and a female from Vunduzi River—resemble those brought from Natal, but are smaller than usual.

This species was found settling on leaves in shady places; it flew with moderate speed and was easily caught. These four specimens were the only ones observed; they were taken on 15th February, 8th March, and 5th April.

Family LYCÆNIDÆ.

Genus LYCÆNA, Fabr.

74. LYCÆNA ASOPUS, Hopff.

♂ ♀. *Lycæna asopus*, Hopff. Monatsb. Preuss. Akad. Wiss. Berl. 1855, p. 642. n. 21.

Two specimens from Christmas Pass.

75. LYCÆNA PARSIMON (Fabr.).

♂. *Papilio parsimon*, Fabr. Syst. Ent. p. 526. n. 349 (1775).

Two males from Christmas Pass.

76. LYCÆNA EXCLUSA, n. sp. (Plate VI. fig. 11, ♂.)

Exp. al. (♂) 1 in. 6½ lin.; (♀) 1 in. 8–9 lin.

♂. Very like *L. parsimon* (Fabr.), ♂, on upperside. *Dull brownish-grey; a fuscous hind-marginal edging line; cilia brownish-grey basally, whitish externally; pattern of underside indistinctly shown, the most apparent marking being the darker terminal disco-cellular striola in both wings. Hind wing*: close to hind margin the usual fuscous spot, between 1st and 2nd median nervules, rather small and ill-defined, externally whitish-edged; below 1st median nervule the trace of a second similar spot; *no* tail. UNDERSIDE.—*Dull creamy-whitish, with conspicuous black spots faintly white-edged. Fore wing*: discocellular terminal striola thick and black; discal series of six spots—the upper three forming a regular continuous transverse streak between 4th subcostal and 3rd median nervules, but the other three all separate and before the upper three, the 5th spot (between 2nd and 1st median nervules) being nearer to base than the 4th and 6th spots; a submarginal ochreous-brown streak, widening downward, parallel to and not very far before hind-marginal edge, which is bounded by a black line. *Hind wing*: a subbasal series of three rounded spots, the middle one in discoidal cell; terminal cellular striola thick, black, curved; discal series of eight spots (all separate) strongly bisinuated—the 1st and 8th spots before, the 2nd and 5th about, and the remainder beyond middle; the 7th spot strongly crescentic; a black hind-marginal edging line as in fore wing, and a faint indication of a submarginal ochreous-brown line, which below second median nervule widens into two very diffuse ochre-yellow lunulate marks; immediately beyond the latter are a rounded superior and elongate inferior black spot, the upper profusely, the lower slightly scaled with metallic blue. Cilia as on upperside, but with darker base.

♀. Discal area in both wings whitish, with a pale-blue scaling from base over cell and along inner-marginal area. *Fore wing*: terminal discocellular marking very much broader than in male, reniform. *Hind wing*: 3rd and 4th spots of discal series of underside reproduced, fuscous; hind margin more or less whitish-bordered throughout; fuscous spots near anal angle much enlarged. Underside as in male.

The male and the two females above described were all taken at Christmas Pass on 11th February; the male is in good condition, but the females are greatly worn and faded. Only these three examples were seen, they were flying slowly on an open hill-side.

The large and very irregularly disposed deep black discal spots of the underside readily distinguish this *Lycæna* from all its congeners known to me, with the exception of one very near ally discovered in the adjacent district of Mashunaland by Mr. Selous, which is described below [1].

77. LYCÆNA CISSUS (Godt.).

Polyommatus cissus, Godt. Encycl. Méth. ix. p. 683. n. 210 (1823).

One specimen from Umtali, five from Christmas Pass, and one from the Mineni Valley.

78. LYCÆNA MAHALLOKOŒNA, Wallengr.

Lycæna mahallokoæna, Wallengr. K. Sv. Vet.-Akad. Handl. 1857—Lep. Rhop. Caffr. p. 41. n. 16.

Two examples from Christmas Pass, and one from the Mineni Valley. Until the receipt of these Manica specimens, the most

[1] LYCÆNA MASHUNA, n. sp.

Exp. al. (♂) 1 in. 5–6 lin.; (♀) 1 in. 6–8 lin.

Nearly allied to *L. exclusa*.

♂. *Very pale violaceous-blue, shot with pink; neuration distinctly blackish; a strongly-marked hind-marginal black edging streak; discal spots of underside faintly showing through; terminal discocellular mark distinct, slender, and angulated in both wings. Fore wing*: immediately before hind-marginal black edging a very faint tinge of ochry-yellow, preceded by a very faint diffuse greyish fascia. *Hind wing*: an extremely faint diffuse greyish border immediately before hind-marginal edging; a rather small and faint blackish spot close to hind margin, between 1st and 2nd median nervules, immediately preceded by some very faint ochry-yellowish scaling; *no* tail. UNDERSIDE.—*Ochre-yellow, with conspicuous black, very thinly white-edged discal spots arranged just as in* L. exclusa; *two series of very faint submarginal white lunules. Fore wing*: field of wing much paler than costal and hind-marginal border; 5th spot of discal series greatly reduced and but little before 4th, and 6th spot wanting. *Hind wing*: hind-marginal black spot darker than on upperside, ochre-yellow immediately preceding it darker than ground-colour.

♀. *Pale-blue field much more limited than in male, the costal, apical, and hind-marginal border being in both wings broadly brownish grey; ochry-yellowish hind-marginal stain much more developed, and in fore wing usually conspicuous between 2nd median nervule and posterior angle, while in some specimens it is also diffusedly present in hind wing. Fore wing*: discocellular terminal northern locality on the eastern side, known to me as a *habitat* of this curious species, was Pretoria; although further inland it had been found in the Bamangwato Country.

79. LYCÆNA GAIKA, Trim.

Lycæna gaika, Trim. Trans. Ent. Soc. Lond. 3rd ser. i. p. 403 (1862).

Two specimens from Christmas Pass.

When I described this species thirty years ago, I little imagined that so exceptionally fragile and slow-flying a Butterfly—one of the smallest of its genus—would be found to range over not only a great part of Africa, but also from Aden over all the Oriental Region to Java, and even into the Western Pacific (Solomon Islands).

80. LYCÆNA BŒTICA (Linn.).

Four examples from the Mineni Valley.

81. LYCÆNA SICHELA, Wallengr.

Lycæna sichela, Wallengr. loc. cit. 1857, p. 37. n. 4.

Seven specimens from Christmas Pass. With the exception of a male captured at Tati, South Matabeleland, in 1887, by the late Mr. J. L. Fry, these are the first examples known to me from tropical S.E. Africa, but I have recorded (Proc. Zool. Soc. 1891, p. 82) the occurrence of the species in the tropical S.W. area.

82. LYCÆNA TELICANUS (Lang).

Two specimens from Christmas Pass, and three from the Mineni Valley.

There can be no doubt that the widely-spread *Lycæna* generally

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marking darker and broader. *Hind wing*: 3rd and 4th spots (rarely also 5th and 7th spots) of discal series of underside reproduced, fuscous; a whitish line, preceded by traces of dark spots, just before hind-marginal edge; blackish spot larger, the yellow preceding it usually taking the ordinary lunulate form; a yellowish space at anal angle. UNDERSIDE.—As in male, but black spots larger, and discal series usually complete, the 5th spot only reduced in one example, and four others having all six as in *L. exclusa*, but with the lower three less irregularly disposed.

This species is readily distinguished from *L. exclusa* by the blue instead of brownish-grey upperside of the male, and in both sexes by the ochre-yellow instead of creamy-whitish underside; another peculiar feature, most apparent in the female, is the development of more or less ochry-yellowish along the hind-marginal border. The intense blackness of the terminal discocellular and discal spots of the underside is the same in both species, and obtains, as far as I know, in no other species of this group of *Lycæna*. The anal angular spot on the underside of *L. exclusa* is wanting in that of *L. mashuna*. The relation between these two species corresponds very near to that between *L. parsimon* and *L. patricia*, Trim.

The examples collected by Mr. Selous are two (♂ and ♀) from the Hanyani River, not far south of Fort Salisbury, received in 1886; two (♀) from Motoko's Country, East Mashunaland, captured in November 1890; and six (2 ♂, 4 ♀), without special locality, received in 1891. All had suffered some injuries from rough transit by post.

known as *L. plinius*, Fabr., is identical with *L. telicanus*, and that accordingly the range of the latter species must be extended from Aden eastward over all the Oriental Region to Formosa, and also to the Solomon Islands. The distribution of this Butterfly over the Old World is thus rendered almost coextensive with that of *L. bœtica*.

83. LYCÆNA LINGEUS (Cram.).

Papilio lingeus, Cram. Pap. Exot. iv. t. ccclxxix. figs. F, G (1782).

Three examples from Christmas Pass.

84. LYCÆNA ANTINORII, Oberth.

Lycæna antinorii, Oberth. Ann. Mus. Civ. Genova, xviii. p. 731, t. ix. fig. 3 (1883).

The only individual captured is a male, met with in Christmas Pass on 6th March. This specimen differs in one point from Oberthür's figure of the type, viz. the two series of submarginal brownish-fuscous lunules are much less regular, especially in the fore wings, and are interrupted in two or three places.

It is interesting to find this little-known *Lycæna*, which was discovered in Shoa, Abyssinia, by the late Marquis Antinori, in 1879, occurring so far to the south as Manica. The female appears to be still unknown. From the pattern of the underside, this species is clearly related to the group of *L. juba*, Fabr., but the violaceous tint of the upperside is most like that of the male *L. lingeus*.

85. LYCÆNA POGGEI (Dewitz).

♂. *Plebeius poggei*, Dewitz, Nov. Act. Leop.-Carol. Akad. Naturf. xli. p. 205, pl. xxvi. fig. 7 (1879).

Of this remarkable species, founded on a single male discovered by Dr. Pogge in Angola, there are four males in the collection, all taken at Christmas Pass, on the 6th March, drinking at the edge of water.

The ochraceous pink-shot upperside, with the very strongly marked discal series of seven unequal longitudinal black streaks between the nervules of the fore wings, renders this species easily recognizable; the underside nearly resembles that of *L. antinorii*, but is more heavily marked. A near ally is *L. artemenes*, Mabille, from Madagascar, which, judging from the figures (3 and 4) on pl. xxvii. of the "Lepidoptères" volume of Grandidier's 'Histoire Physique etc. de Madagascar,' has the black streaks much thinner and longer, and the cilia very feebly fuscous-varied in the fore wings, while the dark markings of the underside are mostly white-centred instead of uniform brownish grey. Mr. A. G. Butler notes (Ann. & Mag. Nat. Hist. ser. 5, v. p. 337 (1880)) that in the nature of the internervular black streaks the Madagascar species agrees with the West-African *L. juba*, Fabr.

Genus LYCÆNESTHES, Moore.

86. LYCÆNESTHES LARYDAS (Cram.).

Papilio larydas, Cram. Pap. Exot. iii. t. cclxxxii. fig. H (1782).

Three examples taken at Christmas Pass.

87. LYCÆNESTHES LIODES, Hewits.

Lycænesthes liodes, Hewits. Trans. Ent. Soc. Lond. 1874, p. 349.

One specimen from Christmas Pass, and another from the Mineni Valley.

88. LYCÆNESTHES NEGLECTA, Trim.

♂. *Lycænesthes neglecta*, Trim. Trans. Ent. Soc. Lond. 1891, p. 175; and (♀) 1893, p. 132, pl. viii. figs. 7, 8 (♂ & ♀).

The only specimen, a female, was captured in the Mineni Valley, on the 7th March; it agrees with the Natalian female figured by me in the paper cited above.

89. LYCÆNESTHES LUNULATA, n. sp. (Plate VI. fig. 12, ♂.)

Exp. al. 1 in. $2\frac{1}{2}$ lin.

♂. *Metallic violaceous, bordered with fuscous. Fore wing*: apical border very broad, but costal border to beyond middle and hind-marginal border below 2nd median nervule narrow. *Hind wing*: costal border of moderate width and only a little broader apically; hind-marginal border linear below 2nd subcostal nervule, but closely preceded by a fuscous lunulate line, the line separating the two being whitish towards anal angle; ordinary hind-marginal spot between 1st and 2nd median nervules small but black internally, bounded and half encircled by a broad and very conspicuous orange lunule. *Cilia* whitish-grey, in hind wing whiter towards anal angle and traversed by a dark line. UNDERSIDE.—*Brownish-grey; ordinary markings of the ground-colour but with exceedingly fine darker outlines, their white edgings on both sides slender but sharply defined. Fore wing*: discal series of incomplete touching annulets only slightly irregular, except that its lowest and largest marking is oblique and before the others. *Hind wing*: discal series of annulets rather strongly bisinuated, the costal annulet filled with black; two subbasal, small, round, black, white-ringed spots, one near costa and the other on inner margin; hind-marginal black spot and orange lunule as on upperside, except that the spot is marked externally with greenish-silvery; at anal angle a similar spot and lunule.

This species belongs to the *sylvanus* group of *Lycænesthes*, its underside agreeing more with those of that species and of *L. liodes*, while the upperside more resembles that of *L. otacilia*, Trim., but is of a much deeper and more glittering violaceous. It appears to stand very close to the *otacilia* of Hewitson (Illustr. Diurn. Lep. pl. 92. figs. 35–37), which, as I have pointed out in my S.-Afr. Butt.

ii. p. 103, is distinct from *L. otacilia*, mihi; and, though larger and darker than Hewitson's figure of the male, may prove on comparison with Hewitson's specimens to belong to the same species. The examples in the Hewitson Collection bore the localities of Sierra Leone and Angola.

The two males in Mr. Selous's collection were taken at Umtali and in the Mineni Valley, respectively, on the 28th February and 7th March.

Genus Deudorix, Hewits.

90. Deudorix antalus (Hopff.)[1].

Dipsas antalus, Hopff. Monatsb. Preuss. Akad. Wiss. Berl. 1855, p. 641. n. 15.

Two specimens from Christmas Pass and two from the Mineni Valley.

[1] Mr. A. E. Hunt, lately of Durban and now of Newcastle, Natal, has reared this Butterfly from larvæ found in the seed-pods of *Crotalaria capensis* at Pinetown and near Durban, and has sent me descriptions and drawings of the larva and pupa, from which the following diagnoses are framed.

Larva.—Above greenish grey, spotted with black (in some specimens a tinge of purplish); first and second thoracic segments chrome-yellow, the first bearing a median black mark like a broad arrow reversed, the second with two transverse rows of three black spots each; a transverse row of five black spots on the third thoracic segment and on each of the six following abdominal segments; spiracles black; head black; underside and legs dull yellowish. Last three abdominal segments obliquely flattened and sloping posteriorly, hollowed and wrinkled superiorly. Entire upper surface densely set with short black bristles; also a lateral edging of short white hairs. Length 7½ lines.

Pupa.—Thorax and wing-covers dark glossy blackish brown; abdomen dull reddish yellow thickly sprinkled with black atoms, and with a narrow dorsal median stripe of black; head reddish yellow above, shining black beneath, with a fringe of fine white hairs along the front. Entire upper surface sprinkled with very short white hairs; under surface smooth and glossy. Humped dorsally, being markedly constricted at junction of thorax and abdomen; flattened inferiorly. Attached by the tail and by a silken girth.

It will be seen that the early stages much resemble those of a near congener, *D. isocrates* (Fabr.), common in India and Ceylon, the larva of which has long been celebrated for its singular habit not only of feeding in the interior of pomegranate and other fruits but also of finding its way out shortly before the change to pupa and "spinning a strong web over the basal portion of the fruit and over some considerable length of the attaching stem, so that should the fruit be separated from the stem it will not fall to the ground" (de Nicéville, Indian Museum Notes, vol. i. no. 4, p. 194, 1890; and Butt. India, iii. p. 478, 1890). But the larva of *D. antalus* does not appear to share the very remarkable habit in question (first brought to notice by the late Prof. Westwood as long ago as 1835), as Mr. Hunt notes nothing of the kind. He writes, however, that the first pupa found was attached to the inside of a pod of *Crotalaria* which had a round hole at the tip, while the larvæ subsequently found by him were in pods without holes, and in every case left the pod after it had once been opened. He believes the latter course to be traceable to the pod's twisting as it dried and so squeezing the larva. One or two full-grown larvæ which were placed in a pod ate their way out and fastened themselves under the nest of a mason-wasp that was in the same box. The pupal state, in June and July, lasted from 18 to 21 days. Mr. Hunt adds that the pupa, on being touched or disturbed, gives a very distinct squeak, although he could not trace any movement of the insect accompanying it.

91. Deudorix cærulea, H. H. Druce.

♂ ♀. *Deudorix cærulea*, H. H. Druce, Ann. & Mag. Nat. Hist. ser. 6, vol. v. p. 28 (1890).

♂. *Deudorix obscurata*, Trim. Proc. Zool. Soc. 1891, p. 84. n. 61, pl. ix. fig. 13.

A single male, captured in the Mineni Valley on the 11th March, and a female on the 13th.

Mr. Druce pointed out the identity of my *D. obscurata* with his previously described *D. cærulea* in Ent. M. Mag. 1892, p. 65, and reference to his description shows him to be right. His specimens were from Lagos, Western Africa, while the type of my *D. obscurata* was from Omrora on the border of North Ovampoland.

Genus Hypolycæna, Feld.

92. Hypolycæna cæculus (Hopff.).

Iolaus cæculus, Hopff. Monatsb. Akad. Wiss. Berl. 1855, p. 642. n. 17.

Four males and three females from the Mineni Valley, taken from March 7th to 21st. These are the largest specimens that I have seen, the male expanding 1 in. $4\frac{1}{2}$–$5\frac{1}{2}$ lin., and the female 1 in. 6–$6\frac{1}{2}$ lin. While the males do not incline to the more violaceous tint of the upperside so noticeable in the examples recorded by me from North Ovampoland (Proc. Zool. Soc. 1891, p. 85), yet both sexes resemble the latter, and differ from the usual East-African specimens, in the much redder and decidedly broader transverse streaks of the underside, though none has these markings so strongly developed as in the supposed seasonal form figured by me *loc. cit.* (pl. ix. fig. 14). It would thus appear probable that on the eastern side the seasonal forms differ less widely than they do on the western.

93. Hypolycæna philippus (Fabr.).

Hesperia philippus, Fabr. Ent. Syst. iii. 1, p. 283. n. 87 (1793).

Three specimens from Christmas Pass, and four from the Mineni Valley.

Genus Iolaus, Hübn.

94. Iolaus sidus, Trim.

Iolaus sidus, Trim. Trans. Ent. Soc. Lond. 3rd ser. ii. p. 176 (1864).

A single example of each sex from Christmas Pass. The female is one of the largest I have seen, expanding 1 in. $5\frac{1}{2}$ lin., and has the red stripes of the underside much broader than in any other specimen that has come under my notice. It was captured on 22nd February, settled on the same bush as the *I. aphnæoides* mentioned below.

95. IOLAUS BOWKERI, Trim.

Iolaus bowkeri, Trim. loc. cit. p. 176 (1864).

Two examples from Christmas Pass and three from the Mineni Valley.

96. IOLAUS APHNÆOIDES, Trim.

Iolaus aphnæoides, Trim. Trans. Ent. Soc. Lond. 1873, p. 110; Hewits. Ill. D. Lep., Suppl. pl. iv *a*. figs. 50, 51 (1878).

One male captured at Christmas Pass on 22nd February. Of this very rare though somewhat widely distributed species I have seen only seven examples, viz.: the types (male and female) taken near Grahamstown, Cape Colony; a male from the Trans-Keian territory; a female from Panda-ma-Tenka, near the Victoria Falls of the Zambesi; two females from Lake Nyassa (Hewitson Collection); and the male now under notice[1]. Mr. Selous's example was taken at the edge of a ravine; it settled repeatedly on the same bush.

Genus MYRINA, Fabr.

97. MYRINA FICEDULA, Trim.

Myrina ficedula, Trim. Trans. Ent. Soc. Lond. 1879, p. 324.

Two females from Christmas Pass, agreeing with ordinary South-African specimens.

Genus APHNÆUS, Hübn.

98. APHNÆUS MASILIKAZI (Wallengr.).

Spindasis masilikazi, Wallengr. K. Sv. Vet.-Akad. Handl. 1857—Lep. Rhop. Caffr. p. 45.

Three specimens (2 males and a female) from the Mineni Valley, and three (females) from near Vunduzi River. These were taken on blue flowers at the side of the road.

99. APHNÆUS HOMEYERI, Dewitz.

Aphnæus homeyeri, Dewitz, Deutsch. ent. Zeitschr. xxx. p. 429, pl. ii. figs. 5, 5 *a*, 5 *b*, 5 *c* (1887); Trim. Proc. Zool. Soc. Lond. 1891, p. 88. n. 70.

A female from Sikuva River (March 4th), and two males and

[1] A description with very carefully executed coloured figures of a very closely allied form (found near Durban, Natal, in March 1893) have been sent me by Mr. A. E. Hunt. In this example the orange-yellow stripes and borders of the underside are reduced to almost linear form, the basal stripe indeed being wanting except for its lower inner-marginal portion in the hind wing, and the subbasal one represented by a discocellular short streak in each wing. The common submarginal series of black spots, and the hind-marginal black spots of the hind wing, are quite as in *I. aphnæoides*; but the costa of the fore wing has an orange linear edging, and the inner margin of the hind wing bears a small subbasal orange spot. It seems possible that this may prove to be a seasonal variation of *I. aphnæoides*, but at present I am inclined to regard it as a sport of that species.

three females from near Vunduzi River (April 6th and 12th). Mr. Selous notes that this *Aphnæus* was seen, five or six together, on the same blue flowers that were frequented by *A. masilikazi*.

All six examples agree with the summer specimens taken at Omrora, S.W. Africa, by Mr. Eriksson (see P. Z. S. 1891, p. 89), in their strongly marked and brightly tinted underside.

Genus Chrysorychia, Wallengr.

100. Chrysorychia harpax (Fabr.).

Papilio harpax, Fabr. Ent. Syst. App. p. 829. nn. 327–328 (1775).

Two (♂ ♀) from Christmas Pass, nine (5 ♂, 4 ♀) from Mineni Valley, one (♂) from Lusika River, and one (♂) from near Vunduzi River.

These examples altogether agree best with Hopffer's descriptions and figures (Peters's Reise nach Mossamb., Ins. pl. xxvi. figs. 1–3, p. 403), but the males are of a darker red on the upperside, like more southern examples, and exhibit much variation in the width of the fuscous border of the fore wing—most, however, having that border very broad indeed in apical area.

101. Chrysorychia amanga (Westw.).

Zeritis amanga, Westw., Oates's Matabele-land etc. p. 351. n. 62 (1881).

Chrysorychia amanga, Trim. S.-Afr. Butt. ii. p. 165. n. 201, pl. ix. fig. 1 [♂] (1887).

Four (3 males and a female) from the Mineni Valley, and one (male) from Vunduzi River. The latter male has the discal red on the upperside of the fore wings reduced to a triangular patch not extending (except by an obsolescent spot) above 1st median nervule; and the female exhibits on the underside much of the lilacine-whitish clouding characteristic of the male, and well developed in these Manica examples. In both sexes, but especially in the male, the discal small metallic spots of the underside are better marked than usual.

102. Chrysorychia cruenta, n. sp. (Plate VI. fig. 13, ♂.)

Exp. al. (♂) 1 in. 2–2½ lin.

♂. Allied to *C. amanga* (Westw.). *Fuscous, with a very dark red discal patch in each wing. Fore wing*: dark-red patch inferior, lying between 2nd median nervule and inner margin, narrow superiorly but widening inferiorly so as to occupy inner marginal edge from rather before middle to a little before posterior angle; costa from base to before middle rather broadly bordered with dull fulvous. *Hind wing*: dark-red patch larger than in fore wing, widest superiorly (where it is bounded by the radial nervule) and extending to hind-marginal edge, over anal angular lobe, and to inner margin for some little distance before lobe; tail long and rather wide, of the same dark red; inner-marginal border broadly hoary to a little beyond middle; lobe with a narrow silvery edging interrupted by base of tail. Cilia in fore wing white from apex to lower radial nervule, below that fuscous; in hind wing dark red with a fine basal line of fuscous. UNDERSIDE.—*Deep ferruginous red, with numerous thin, silvery, dark-edged spots, arranged as in* C. harpax (*Fabr.*), *but much more attenuated, and in hind wing forming more continuous, less macular, transverse series. Fore wing*: a broad basicostal creamy border for about one-third of length of wing; a rather indistinct lilacine cloud over upper part of disk; below median nervure a conspicuous, slender, elongate fuscous-edged white marking, curved upward at its inner extremity and lying longitudinally; a similar but much longer marking, bent downward at its outer extremity, between 1st median nervule and submedian nervure: these two markings represent the much thicker, more transverse ones in *harpax*; inner-marginal border only narrowly and faintly pale fulvous; apical silvery spot only of submarginal series well-marked, elongate, oblique. *Hind wing*: disk with a faint but extended lilacine cloud; discal series of silvery markings forming an almost continuous irregular streak angulated inferiorly; submarginal series of small spots very indistinct, scarcely darker than ground-colour, except at angulation immediately before anal angular lobe, where two are silvery, sublinear, and dark-edged.

Front of head, palpi, first and second pairs of legs (the first being very densely hairy almost to end of tarsus), and under edge of third pair all of the same creamy tint as the basicostal border of the fore wings. Antennæ without white bar beneath at base of club.

The distinguishing characters of this species of *Chrysorychia* are:—on the upperside, the extremely dark red (in some lights with a faint purplish gloss) of the discal patches, and the limitation of the hind-wing patch (whereas in *C. amanga* and *C. harpax* the red extends over the whole surface except a small basal portion); and, on the underside, the very deep red ground-colour, the thinness and regularity of the silvery markings, the very peculiar elongation and whiteness of the two longitudinal streaks below the median nervure and its first nervule in the fore wings, and the creamy (not silvery-white as in *C. amanga*) colour of the basicostal border in the fore wings. The very dense creamy hair, like wool, clothing the first pair of legs, and the absence of the inferior white bar at the base of the antennal club, are also peculiar features of *C. cruenta*, although the former is, to a much smaller extent, exhibited also by *C. amanga*.

Only two males of this handsome *Chrysorychia* were taken by Mr. Selous—one in the Mineni Valley on 6th March, the other at the Lopodzi River on 2nd April.

Genus PENTILA, Westw.

I do not concur with Scudder (Proc. Amer. Acad. Arts & Sci. x. pp. 244 & 284, 1875), Butler (Ent. M. Mag. xxii. p. 59, Aug.

1885), and Smith and Kirby (Rhop. Exot. i. Afr. Lyc. pl. ii. pp. 2 & 4, 1887) in recognizing the MS. genus *Tingra*, Boisd., with *T. tropicalis*, Boisd., as type, or in taking the same author's MS. species *Pentila undularis* as the type of *Pentila*, a genus first defined by Westwood (Gen. Diurn. Lep. p. 503) in 1851. Although Westwood undoubtedly places *P. undularis* first on the list of species included under *Pentila*, it is equally certain, on studying his diagnosis of the genus, that the characters he gives are not those presented by *undularis*, but are (out of the four species he names) solely applicable to the second species, viz. *P. abraxas*, Westw., which should therefore be held as the type of *Pentila*. With *P. abraxas*, *P. tropicalis* is unquestionably congeneric, and the MS. genus *Tingra* should consequently be abandoned, Westwood defines *Pentila* as having "labial palpi very minute;" in the fore wings, "upper discocellular arising from the postcostal at about the same distance beyond the second branch as the space between the first and second branches; it is also about equal in length to the same space and oblique; middle discocellular short, less oblique;" and in the hind wings, "lower discocellular nearly transverse and very slender, &c." *P. abraxas* presents these important characters, as well as all the others described by Westwood, whereas *P. undularis* has rather long, slender, and porrect palpi; the upper discocellular nervule of the fore wings so exceedingly short as to be scarcely distinguishable, and the middle one very short and quite transverse; and in the hind wings an open discoidal cell, the lower discocellular nervule being wanting altogether. The different arrangement of the discocellular neuration of the fore wings gives *P. abraxas* a long discoidal cell and *P. undularis* a short one. Butler (*l. c.* p. 60) recognizes that *P. undularis* "differs considerably both in neuration and palpi from the other species associated with it," and also that, if no longer held as type of *Pentila*, a new genus would have to be founded for it.

103. PENTILA TROPICALIS (Boisd.).

♂. *Tingra tropicalis*, Boisd. App. Voy. Deleg. dans l'Afr. Aust. p. 589. n. 46 (1847).

♂. *Pentila tropicalis*, Hewits. Exot. Butt. iii. pl. 60. fig. 2 (1866).

♀. *Tingra tropicalis,* Smith & Kirby, Rhop. Exot. i. p. 3, Lycæn. Afr. pl. ii. figs. 9, 10 (1887).

The examples collected by Mr. Selous (three from the Mineni Valley, one at the Lopodzi River, and three near the Vunduzi River) resemble the variation from Mombasa, named *lasti* by Messrs. Smith and Kirby (*op. cit.* Lycæn. Afr. pl. viii. figs. 1–4, 1889), in the better development of the upperside fuscous border and discocellular spots in the fore wings of both sexes, but want on the upperside the common discal series of small spots (reproducing that always present on the underside) described and figured in the Mombasa examples. As regards the macular hind-marginal border on the upperside of the hind wings of the male, it is observable that, of Mr. Selous's five specimens, two have this feature more developed than in the figure of *T. lasti*, one has it about the same, one has it considerably less, and in the last (in which the fore-wing border is abnormally broad) its only trace is some sparse black scales. As pointed out in my description of this species (S.-Afr. Butt. ii. pp. 211–212), the fuscous markings of the upperside are variable in the Natalian typical form, and this tendency seems more marked farther to the north-east.

104. PENTILA PEUCETIA, Hewits.

Pentila peucetia, Hewits. Exot. Butt. iii. p. 119, pl. 60. fig. 3 (1866).

Four examples from the Mineni Valley and ten from the Vunduzi River. Noted as always found in shady forest, flying very slowly, and towards sunset settling very often.

The locality of the type is given by Hewitson as the Zambesi, but in Mr. Kirby's Catalogue of the Hewitson Collection (1879, p. 180) the three specimens recorded are respectively from "Gaboon, Calabar, and Lake Nyassa," showing a very wide range for the species. An example received from the Rev. H. Junod was taken at Morakwen, Delagoa Bay, on 30th March, 1891; it is the only one known to me from an extra-tropical locality.

There is little or no variation observable among Mr. Selous's specimens, and the sexes differ only in size.

I find this Butterfly, as well as its close ally *P. peuceda* (H. G. Smith), from Mombasa, and *P. muhata*, Dewitz, from Mukenge and Cameroons, inseparable generically from *P. abraxas* and *P. tropicalis*, and do not see on what grounds Messrs. Kirby and Smith (*op. cit.* Lycæn. Afr. pls. ii. & ix. pp. 3 & 37) have placed them in Butler's genus *Larinopoda* (Trans. Ent. Soc. Lond. 1871, p. 172), the type of which presents a wide difference from them both in palpi and neuration.

Genus DURBANIA, Trim.

105. DURBANIA HILDEGARDA (Kirby).

♂. *Teriomima* (?) *hildegarda*, Kirby, Ann. & Mag. Nat. Hist. ser. 5, xix. p. 367 (1887); and Smith & Kirby, Rhop. Exot. i. Lycæn. Afr. p. 16, pl. iv. figs. 7, 8 (1888)[1].

Fifteen specimens were taken in the Mineni Valley from the 9th to 27th March, and two at the Lusika River on 1st April; four from the former and one from the latter locality are females. Mr. Selous notes that this Butterfly was of very slow flight, and congregated in numbers on the stems of a tall herbaceous plant with blue flowers.

The males agree fairly with the figure above cited, which represents an example from Ashanti, but on the upperside are of a slightly

[1] In *op. cit.* p. 46 (1890) Messrs. Smith and Kirby note that *T.* (?) *hildegarda* may be included in the genus *Durbania.*

deeper ochre-yellow and have the discocellular fuscous markings and extracellular costal bar heavier and more confluent, while the common fuscous hind-marginal border varies a good deal in width, being in some specimens narrower than shown in the figure.

The females [1] are distinguished from the males by their much narrower fuscous markings on the upperside; although these markings vary in development, they are at their widest narrower than in the most lightly marked male. The underside is alike in the two sexes.

This is a very close ally of *D. aslauga*, Trim., but separated by its paler ground-colour (without any tinge of orange) and well-defined fuscous hind-marginal border on the upperside—the latter character being specially noticeable in the hind wings, where in *D. aslauga* it is wanting. On the underside the markings agree with those of *aslauga*, but all the rufous spots are much more conspicuous, being larger and paler, especially those of the hind-marginal and submarginal series. *D. aslauga* inhabits the Natal coast, and has also been brought from Zanzibar.

106. DURBANIA PUELLARIS, n. sp. (Plate VI. fig. 14, ♀.)

Closely allied to *D. puella* (Kirby) [2].

Exp. al. (♂) 1 in. 3 lin.; (♀) 1 in. 3½ lin.

♂. *Ochre-yellow; fore wing with fuscous border at apex. Fore wing*: fuscous border broad on costal edge, beginning at extremity of 2nd subcostal nervule, and thence narrowing to a point on hind-marginal edge at extremity of 3rd median nervule, whence runs a linear prolongation to extremity of 2nd median nervule; inner edge of this border showing marked indentation on each nervule, the deepest being on upper radial nervule, where the border abruptly narrows; costa bordered for a little distance from base with blackish, and beyond this a small blackish spot. UNDERSIDE.—*Paler; hind wing and apex of fore wing creamy-yellow. Fore wing*: costal edge with 5 small black spots, of which the 1st and 2nd are subbasal and strongly marked; the 3rd faint, very thin, just above extremity of discoidal cell; the 4th like the 3rd and about as far beyond it as the 3rd is from the 2nd; and the 5th is largest, elongate, rather faint, extending to below subcostal nervure, and corresponding in position to the inner edge of the apical border of the upperside; a very fine black line interrupted on nervules along hind-marginal edge from apex to lower radial nervule. *Hind wing*: 5 well-marked but rather small round black spots, viz., one in the discoidal cell just before origin of 1st median nervule; one below cell, a little beyond the same point; and three discal, one being subapical between the subcostal nervules, and the other two between 3rd and 1st median nervules; on hind-

[1] *D. otlanga*, Smith and Kirby (*op. cit.* p. 46, pl. xi. figs. 9, 10), is suggested as "possibly the female of *D. hildegarda*," but is widely different as regards both colour of upperside and pattern of underside.

[2] Ann. & Mag. Nat. Hist. ser. 5, xix. p. 365 (1887); Smith and Kirby, Rhop. Exot. i. Lycæn. Afr. p. 12, pl. iii. figs. 9, 10 (1888)—*Teriomima puella*.

marginal edge, from 1st median nervule to anal angle, an extremely fine black line.

♀. Like male, but with the black markings throughout rather larger. *Fore wing*: apical border broader costally, more deeply indented on upper radial nervule, its inferior linear prolongation in two examples extending below 2nd median nervule. UNDERSIDE.—*Fore wing*: two additional subapical black spots, one on costa a little beyond large fifth spot, and the other (larger) below and beyond the same spot and between the radial nervules; hind-marginal black line well-marked, continuous from apex to 2nd median nervule. *Hind wing*: an additional small black discal spot, below 1st median nervule; in one specimen the trace of another, close to costa, near extremity of costal nervure.

Head and its appendages black: a ring round eyes, the base and tip of palpi, and a ring round the base of each shaft-joint of antennæ, white. Thorax and abdomen pale ochre-yellow. Legs black, conspicuously white-ringed.

One female has the underside concolorous, the hind wings and apex of the fore wings being no paler than the field of the fore wings.

Described from one male and three female specimens.

This form is distinguishable from Mr. Kirby's description and figure of *D. puella*, a native of the Gaboon territory, by its larger size, and on the upperside of the fore wings by its want of costal spots beyond the middle, and costally broader internally deeply indented apical border; while on the underside it wants two of the black spots present in the hind wings of *D. puella*, viz. one close to costa about middle, and the other median, just beyond the extremity of the discoidal cell.

In all structural characters *D. puellaris* cannot be separated from *D. aslauga* and *D. hildegarda*; and most probably, therefore, its close ally *D. puella* should be withdrawn from the genus *Teriomima*, Kirby, and transferred to *Durbania*.

Mr. Selous's four specimens were all taken at the Vunduzi River, on the 5th April; he found them towards sundown settling on the same stems of a blue-flowered plant that was frequented by *D. hildegarda* and *Pentila tropicalis*.

Genus ALÆNA, Boisd.

107. ALÆNA AMAZOULA, Boisd.

Alæna amazoula, Boisd. App. Voy. de Deleg. dans l'Afr. Aust. p. 591. n. 60 (1847).

The only example, a male, was captured in the Mineni Valley on the 7th March. It differs from all of the same sex that I have seen in the great enlargement of the ochre-yellow markings, and proportionate reduction of the fuscous clouding in the basi-median area of both fore and hind wings, in this respect resembling the female. A male taken by Mr. Selous in 1884 on the Umfuli

River in Mashunaland exhibits the same peculiarity in the hind wings, but in the fore wings is almost as much clouded with fuscous as usual, and I have two quite similar males captured by Mr. H. M. Barber on the Tenda River, N.E. Transvaal, in 1888.

108. ALÆNA NYASSA, Hewits. (Plate VI. fig. 15, ♀.)

Alæna nyassa, Hewits. Ent. M. Mag. xiv. p. 6 (1877).

Two females of this strikingly-marked *Alæna*—one taken in Mineni Valley on the 7th March, and the other in the Pungwe Valley on 1st September.

This species was founded on four examples sent from Lake Nyassa by Mr. Simons. Hewitson's description was evidently made from a male, as he notes the costal portion of the curved white bar of the fore wings as consisting of three "minute" divisions, while in the female (where the curved white bar, as well as the corresponding bar in the hind wings, is much broader and of a purer white) that part is of considerable size[1]. The female is much larger than the male, expanding $1\frac{1}{2}$ inches, and her wings are much broader and more rounded hind-marginally.

A male taken at the Shashina River, Matabeleland, by Mr. Selous in 1883, has the transverse black markings of the hind wings exceedingly reduced, the submarginal streak between radial nervule and inner margin being indeed quite obsolete.

Genus LACHNOCNEMA, Trim.

109. LACHNOCNEMA BIBULUS (Fabr.).

♂. *Papilio bibulus*, Fabr. Ent. Syst. iii. 1, p. 307. n. 163 (1793).
♀. *Papilio laches*, Fabr. op. cit. p. 317. n. 199.

One male and three females taken at Christmas Pass during February. The females are all different on the upperside—one being exceptionally dingy owing to the almost obsolete condition of the usual whitish or white discal marking, another with small but distinct white marking, and the third with a wide development of faint bluish-grey extending from near base over lower discal area in both fore and hind wings[2].

Mr. Selous notes that he found this Butterfly drinking at the water's edge in company with other Lycænidæ.

[1] In another Mashunaland female captured "between Makoni's and the Odzi" in 1891, by Mr. Selous, the white bar in the fore wings is a little narrower throughout, but the white subapical spot, sometimes found on the upperside between the subcostal nervure and the upper radial nervule, is elongated and conspicuous.

[2] The South-African Museum has lately received from the Rev. Dr. Holland four female specimens of *Lachnocnema* taken in the Ogové Valley, Gaboon Territory, in West Africa, which, except in size, cannot be distinguished from *L. bibulus*. They expand 1 in. $2\frac{1}{2}$–$3\frac{1}{2}$ lin., while the range of expanse in South-African female *L. bibulus* is $10\frac{1}{2}$ lin. to 1 in. 2 lin. One of these Ogové examples has only the faintest indication on the upperside of the usual pale discal markings, and in the others those markings are limited and rather ill-defined.

110. Lachnocnema durbani, Trim.

Lachnocnema d'urbani, Trim. S.-Afr. Butt. ii. p. 236. n. 238 (1887).

I refer to this species two specimens captured at Christmas Pass (a male on 1st March and a female on 16th February), finding in them no difference from the more southern specimens except their much larger size—the male expanding 1 in. $3\frac{1}{2}$ lin. and the female 1 in. $4\frac{1}{2}$ lin.

Family Papilionidæ.

Subfamily Pierinæ.

Genus Pontia, Boisd.

111. Pontia alcesta (Cram.).

Papilio alcesta, Cram. Pap. Exot. iv. pl. ccclxxix. fig. A (1782).
Pontia alcesta, Trim. S.-Afr. Butt. iii. p. 8, pl. 10. fig. 1 (1889).

Eight specimens from Pungwe River, agreeing with those found in Natal.

Genus Terias, Swains.

112. Terias zoë, Hopff.

♂. *Eurema puchella*, Geyer [*nec* Boisd.], Forts. Hübn. Zutr. Exot. Schmett. p. 8, figs. 815, 816 (1837).
♀. *Terias zoë*, Hopff. Monatsb. Acad. Wissensch. Berl. 1855, p. 640; and Peters's Reise nach Mossamb., Ins. p. 369, pl. xxiii. figs. 10, 11 (1862).

The only example of this common species is a male from Christmas Pass, in which the underside markings, especially the unusual subapical macular blackish ray of the fore wings, are strongly marked.

113. Terias æthiopica, Trim.

♂. *Eurema senegalensis*, Geyer [*nec* Boisd.], op. cit. p. 41, figs. 969, 970 (1837).
♂ ♀. *Terias æthiopica*, Trim. S.-Afr. Butt. iii. p. 21. n. 243 (1889).

A male from Christmas Pass and three males from Mineni Valley are larger (exp. al. 1 in. 8–9 lin.) than usual, and the former has the subapical ferruginous markings on the underside of the fore wings much reduced.

114. Terias butleri, Trim.

♂ ♀. *Terias butleri*, Trim. S.-Afr. Butt. iii. p. 23. n. 244 (1889).

A single male (exp. al. 1 in. 9 lin.), taken at Christmas Pass on 15th February.

115. TERIAS REGULARIS, Butl.

♂. *Terias regularis*, Butl. Ann. & Mag. Nat. Hist. 4th ser. xviii. p. 486 (1876); Trim. (♂ ♀) op. cit. p. 26. n. 246 (1889).

Three males from Christmas Pass.

In addition to the above there are three specimens of *Terias* that I am unable to assign satisfactorily to any of the species known to me. One is a male from Christmas Pass, which in the form and development of the hind-marginal border on the upperside is intermediate between *T. æthiopica* and *T. butleri*, and on the underside, although with much more distinct markings than the latter, is much more faintly marked than the former and has only the faintest indication of the ferruginous blotch near the apex of the fore wings. The other two are females, from Christmas Pass and Mineni Valley respectively, and are of a very pale whitish yellow above, but of a rather yellower tint beneath; on the upperside there is no trace of any hind-marginal border in the hind wings, and the border in the fore wings is of the width and shape of that presented by the South-African female *T. floricola*, Boisd., while the underside markings are extremely faint, without any trace of the subapical blotch, and in one example scarcely visible except as regards the terminal discocellular and (in hind wings) subbasal ones. These females approach the white and yellowish-white West-African examples which in collections are usually placed as female *T. senegalensis*, Boisd.; but I have never been able to identify this species, Boisduval (Sp. Gen. Lép. i. p. 672) describing with extreme brevity merely a yellow form from "Senegal," as very like *T. hecabe* (L.) but with the underside markings exceedingly faint, and giving no note whatever of the sexes or their differences.

Genus MYLOTHRIS, Butl.

116. MYLOTHRIS AGATHINA (Cram.).

♂. *Papilio agathina*, Cram. Pap. Exot. iii. pl. ccxxxvii. figs. D, E (1779).

Seven examples, from the Mineni Valley and the Lopodzi and Vunduzi Rivers.

Genus PIERIS, Schr.

117. PIERIS SABA (Fabr.).

♀. *Papilio saba*, Fabr. Sp. Ins. p. 46. n. 199 (1781).

♂. *Pieris orbona*, Boisd. Faune Ent. Madag. etc. p. 18, pl. i. fig. 3 (1833).

♀, and (as ♂) var. ♀, *Pieris malatha*, Boisd. loc. cit. figs. 4, 5.

Two males and a female from Christmas Pass, taken on 22nd and 26th February. The males have the hind-marginal black markings more developed than usual, and the female is of the typical heavily black-clouded form but with the hind-marginal border of the hind wings less broad.

In my S.-Afr. Butt. iii. p. 42, I noted the apparent absence of any female examples linking the var. *flavida*, Mab., with the typical female; but I have since then received two intermediate gradations from Durban, Natal. In the first of these, taken by Mr. C. W. Morrison on the 16th May, 1890, the ground-colour is tinged with lemon-yellow, the hind-marginal border of the hind wings is very little broader than in the variety, but the basal blackish in the fore wings, instead of being merely a narrow costal border, fills all the discoidal cell except its lower edge, where it becomes a sparse irroration only. In the second, taken by Mr. A. D. Miller, there is more approach to the typical female, the hind-marginal border of the hind wings being broader, and the basal black in the fore wings filling the cell, but not extending below it except in a very faint and narrow irroration at the base, while the only tinge of yellow on the white area is at the base of the hind wings.

118. Pieris alba (Wallengr.).

♂. *Pinacopteryx alba*, Wallengr. Sv. Vet.-Akad. Handl. 1857—Lep. Rhop. Caffr. p. 10. n. 7.

♂ ♀. *Pieris alba*, Trim. S.-Afr. Butt. iii. p. 48. n. 253 (1889).

A male and a female very much worn, taken at Sarmento, on the Pungwe River, on the 18th September, are apparently referable to this species.

119. Pieris simana, Hopff.

♂ ♀. *Pieris simana*, Hopff. Monatsb. Akad. Wissensch. Berl. 1855, p. 640. n. 13; and Peters's Reise n. Mossamb., Ins. p. 354, t. xxiii. figs. 3, 4 (1862).

The only specimen, a female taken at Christmas Pass, has the fuscous apical border in the fore wings widened so as to include the subapical costal streak, and the fuscous hind-marginal spots in the hind wings also larger than usual.

120. Pieris severina (Cram.).

♀. *Papilio severina*, Cram. Pap. Exot. iv. pl. 338. figs. G, H (1782).

Fourteen specimens, 4 males, 10 females; twelve from Christmas Pass, where the paired sexes were captured on 26th February. Though varying a good deal in depth of markings, all these examples belong to the larger form with more brightly-tinted underside, which I have shown (S.-Afr. Butt. iii. p. 72 & note) to be in Natal characteristic of the summer or wet season.

Genus Herpænia, Butl.

121. Herpænia eriphia (Godt.).

Pieris eriphia, Godt. Encycl. Méth. ix. p. 157. n. 134 (1819).

The only example is a fine male, captured in Mineni Valley on

28th March. It is of the typical form, proper to the wet season, without any trace of ochre-reddish colouring on the underside.

Genus Teracolus, Swains.

122. Teracolus eris (Klug).

Pontia eris, Klug, Symb. Phys. t. vi. figs. 15, 16 (1829).

One specimen only, taken in the Mineni Valley on 31st March. This is a perfect and very large male (*exp. al.* 2 in. 2 lin.), with the inner-marginal black band of the fore wings as broadly developed as in Klug's figure, but still marked externally between 2nd and 3rd median nervules with a minute white spot. In the hind wings, however, the costal black band does not extend below the 2nd subcostal nervule, but the hind-marginal nervular black marks are decidedly larger than in Klug's figure. The underside is almost pure white, with the inferior submarginal black spots (3) very strongly marked; and it also presents the peculiarity of blackish hind-marginal termination to the nervules, more pronounced in the fore wing than in the hind wing.

123. Teracolus ione (Godt.).

♂. *Pieris ione*, Godt. Encycl. Méth. ix. p. 140. n. 74 (1819).
♂ ♀. *Teracolus ione*, Trim. S.-Afr. Butt. iii. p. 101. n. 269 (1889).

Five males, taken in the Mineni Valley from 6th to 26th March, agree thoroughly with those described by me (*op. cit.* p. 102) from Transvaal and Delagoa Bay; the upperside presenting fine but complete black neuration of the hind wings, and the underside being almost uniformly white, with no markings beyond the terminal discocellular dots, a faint trace in the hind wings of the costal commencement of a discal ray, and (in one specimen only) dusky terminations of the nervules on hind margin.

North Ovampoland must be added to the geographical range of this species, Eriksson having taken six males and three red-tipped females near Ovaquenyama in February and March 1891. The males are rather small (one, indeed, being dwarfish) and approximate the Var. A described by me in S.-Afr. Butt. iii. p. 103, but on the white underside the black neuration is very variable, being pretty well expressed (though very fine) in two examples only, at extremities alone in two others, and wanting altogether in the remaining two; while the discal streak in the hind wings is developed in but two examples, and imperfectly in one of those. The females, though heavily blackish-marked on the upperside, are less so than in Transvaal examples, especially as regards the borders of the apical patch in the fore wings and the hind-marginal border in the hind wings, the latter being macular instead of continuous. Their underside is very pale yellowish, with the discal ray of the hind wings dull ferruginous and not strongly marked; there is no black neuration except in one example, where the fore wings exhibit it close to hind margin, and the hind wings on costal nervure and basal part of subcostal nervules.

124. TERACOLUS ANAX (H. G. Smith).

♂ ♀. *Callosune anax*, H. G. Smith, Ann. & Mag. Nat. Hist. ser. 6, iii. p. 125 (1889); and Rhop. Exot. i. *Callosune*, i. p. 2, pl. i. figs. 5, 6 (♂), 7, 8 (♀) (1889).

♂. *Anthopsyche ione*, Wallengr. Sv. Vet.-Akad. Handl. 1857—Lep. Rhop. Caffr. p. 15.

♂ ♀ *Anthocharis regina*, Trim., var. ♂ and var. ♀, Trans. Ent. Soc. Lond. (3) i. p. 521 (1863).

♂ ♀. *Teracolus regina*, var. A, Trim. S.-Afr. Butt. iii. p. 112 (1889).

♂ ♀. *Teracolus eliza*, E. M. Sharpe, Ann. & Mag. Nat. Hist. v. p. 441 (1890).

There are five specimens (all males) of this splendid *Teracolus*, captured in Mineni Valley from 9th to 27th March. These differ slightly from Mr. H. G. Smith's figure, above cited, of a Mombasa male, having on the underside less irroration basally, a narrower inner black border to the violet apical patch in the fore wings, and smaller nervular hind-marginal black spots in the hind wings; the last-named markings are also much reduced on the underside of the hind wings. The black spots of the discal series on the underside of the hind wings vary a good deal in size and distinctness, one example having them just as in Mr. Smith's fig. 6, two others having all but the first and last larger, another wanting the second spot, and the last wanting both second and third spots; the ground-colour is also variable, two examples presenting it creamy instead of pure white.

As usual in the genus *Teracolus*, it is impossible to define exact limits between *T. anax* and *T. regina*. The Manica males here noticed link *T. anax* to the var. A of *regina* from Damaraland, and so do two others taken by Mr. A. W. Eriksson, in 1885, in the belt of country between Transvaal and Matabeleland; while, as I have noted (*op. cit.* p. 113), another male from the latter tract is intermediate between the var. A and typical *T. regina*[1]. Of two females taken by Mr. Selous in 1882 on the Upper Limpopo, Transvaal boundary, one is typical *T. regina*, but the other is referable to var. A; the latter is on the upperside very close to Mr. Smith's figure (7) of female *T. anax*, but has both the basal irroration of the fore wings and the hind-marginal large black spots considerably broader—the latter, indeed, are so enlarged as to meet and form a continuous border, while on the underside the corresponding spots are very much smaller than in the figure (8) of *T. anax* female[2]. Looking to

[1] This male closely agrees with the male of *T. eliza*, E. M. Sharpe, from near Mombasa, as figured by Waterhouse ('Aid,' pl. 189, 1890).

[2] This female, except for its stronger basal irroration, agrees well with the female of *T. eliza*, E. M. Sharpe, as shown on the plate of 'Aid' above cited, fig. 6.

the evidence afforded by several species of the genus, I am inclined to think that the typical *T. regina*, with greatly-reduced dark markings and more or less reddish-tinged underside, and the large *anax* form (including my *T. regina*, var. A), with strongly-developed dark markings and white or creamy-white underside, will turn out to be respectively dry-season and wet-season broods of the same species.

125. Teracolus gavisa (Wallengr.).

♂. *Anthopsyche gavisa*, Wallengr. Sv. Vet.-Akad. Handl. 1857—Lep. Rhop. Caffr. p. 13. n. 6.

Seven males and three females from Mineni Valley, and one female from Vunduzi River. The paired sexes were taken on 6th March.

The males exhibit considerable variation in the development of the black markings on the upperside of the wings, especially in the longitudinal bars, which in two specimens are narrow and faint, and in another represented by sparse scaling only. One of those of normally strong black marking on the upperside is wanting altogether in the usual black neuration on the underside, in this respect approaching the very closely-allied *T. achine* (Cram.). A female also exhibits almost complete failure of the black neuration on the underside.

126. Teracolus celimene (Lucas).

♂ ♀. *Anthocharis celimene*, Lucas, Rev. et Mag. Zool. (2) iv. p. 426 (1852).

♂ ♀. *Anthocharis amina*, Hewits. Exot. Butt. iii. pl. 5. figs. 1–3 (1866).

A single male, in fine condition, taken on the Lower Pungwe River, on 26th September. Mr. Selous informs me that this was the only specimen he noticed; it was settling on herbage.

Genus Colias, Fabr.

127. Colias electra (Linn.).

Papilio electra, Linn. Syst. Nat. i. 2, p. 764. n. 101 (1767).

Two large males (*exp. al.* 2 in. 2 lin.) from Christmas Pass.

Dr. F. Karsch has noted (Ent. Nachr. xviii. p. 169, 1892) a single specimen collected by Dr. E. Zintgraff at Baliburg, interior of Cameroon. This station is stated to be at an elevation of 1250 metres, and is the first locality for a *Colias* I have found recorded in Western North-Tropical Africa.

Genus Eronia, Boisd.

128. Eronia thalassina (Boisd.).

♂ ♀. *Pieris thalassina*, Boisd. Sp. Gen. Lép. i. p. 443. n. 8 (1836).

♂ ♀. *Eronia verulanus*, Ward, Ent. M. Mag. viii. p. 59

(1871); and Afr. Lep. pt. i. p. 4, pl. iv. figs. 5 (♂), 6, 7 (♀) (1873).

Two examples from Christmas Pass—a male captured on 1st March, and a female on 21st February. The latter has on the upperside the fore wings white and the hind wings pale yellow (rather deeper externally); and on the underside the glossy hind wings and apical hind-marginal border of the fore wings so slightly tinged with yellowish as to be almost as white as the disk of the fore wings.

The female of this species evidently varies much in colouring, the example figured by Ward from Cameroon having the fore wing ochre-yellow on both surfaces while the hind wings are white; while one from Zambesi in the Hewitson Collection had the upperside yellowish throughout. Just as the female *E. argia* (Fabr.) mimics *Mylothris agathina* (Cram.), so the female *E. thalassina* figured by Ward is a manifest imitator of the female *Myl. poppea* (Cram.), var. *spica*, Möschl., with ochre-yellow fore wings, while the Manica female of *E. thalassina* strongly resembles the female *Myl. trimenia*, Butl.[1]

Manica is the most southern station known to me for this species. Mr. Selous noticed a good many males coursing rapidly along a thickly-wooded hillside, but only captured one.

Genus Callidryas, Boisd.

129. Callidryas florella (Fabr.).

♀. *Papilio florella*, Fabr. Syst. Ent. p. 479. n. 159 (1775).

Five males and five females from Christmas Pass and one female from Mineni Valley; the last-named example was taken on 16th March, but all the others from 12th to 24th February. All the males but one are strongly freckled on the underside, and all the females are of the yellow form. The male that differs from the rest has the underside not only more faintly freckled but also of a greener tint.

Subfamily Papilioninæ.

Genus Papilio, Linn.

130. Papilio leonidas, Fabr.

Papilio similis, Cram. Pap. Exot. i. pl. ix. figs. B, C (1779).
Papilio leonidas, Fabr. Ent. Syst. iii. 1, p. 35. n. 103 (1793).

The only example is a male, taken in Mineni Valley on 12th March. It agrees pretty closely with ordinary West-Coast specimens except that the tint of the greenish spots is yellower, and that the basal red stain on the underside of both fore and hind wings is considerably brighter and more extended. This latter difference also appears in two other males taken by Mr. Selous—one in the desert country south of the Mababe River in August

[1] A close mimicker of *M. trimenia* is *Pieris* ("*Belenois*") *lasti*, H. G. Smith, from Mombasa. *M. poppea* is similarly very exactly copied by *Papilio rhodope*, Fabr., and *M. agathina* by *P. thysa*, Hopff.

1884, and the other farther to the north-east, a little south of the junction of the Chobe and Zambesi Rivers, in 1889. This is not a variation in the direction of the closely-allied southern form, *P. brasidas*, Feld., in which the basal red in question is usually much duller and sometimes obsolescent.

131. PAPILIO CORINNEUS, Bertol.

Papilio corinneus, Bertol. Mem. Acad. Sci. Bologna, 1849, p. 9, t. i. figs. 1–3[1].

Five examples—a male from Umtali, two females from Christmas Pass, and a male and female from Mineni Valley.

132. PAPILIO DEMOLEUS, Linn.

Papilio demoleus, Linn. Mus. Lud. Ulr. Reg. p. 214. n. 33 (1764).

Eight specimens from Christmas Pass, and two from Mineni Valley. A rather worn female among the former has all the yellow spots deeper and duller in tint than usual, presenting some approach to the specimens sometimes met with in which these markings are of dull ochry-reddish. (See S.-Afr. Butt. iii. p. 227, footnote.)

133. PAPILIO OPHIDICEPHALUS, Oberth.

Papilio ophidicephalus, Oberth. Études d'Ent. iii. p. 13 (1878).

The solitary example of this fine *Papilio* is a female taken at Christmas Pass on 29th February. Unfortunately it is very much worn and broken, but it displays a remarkable aberration in the form of the common transverse yellow band, which in the fore wing is not only continuous and non-macular throughout but at its superior extremity is narrower than usual and farther from apex, its inner edge being immediately beyond (instead of some little distance from) the end of the discoidal cell[2]; the oblique marking crossing the cell near its termination it also greatly enlarged and very broad inferiorly. In the hind wings the band is wider than usual in the left wing, and very much wider in the right one.

Mr. Selous saw two specimens only.

134. PAPILIO LYÆUS, Doubl.

♂. *Papilio nireus*, Cram. (*nec* Linn.) Pap. Exot. iv. pl. ccclxxviii. figs. F, G (1782).

Papilio lyæus, Doubl. "Ann. Nat. Hist. xvi. p. 178 (1845)"; Gen. D. Lep. i. p. 13. n. 98 (1846).

Fourteen males and two females from Christmas Pass, and two

[1] The pagination and number of the plate are those of the separate copies of the memoir; but, from Butler's quotation of "p. 183, t. 9" for *Deilephila ranzani* (a moth described and figured on p. 19, t. 1), these appear not to be those of the original publication. Butler also gives the date of publication as 1850: the memoir is dated as *read* on "25th January, 1849."

[2] It is noteworthy that this costal incurvation is characteristic of the closely allied *P. menestheus*, Drury, from West Africa, in which, however, the band is very narrow and composed of completely separated spots in the upper parts as well as in the rest.

males from Mineni Valley. The latter and three others from Christmas Pass are the only males that exhibit to a slight extent the shining-greyish underside clouding, that characteristic feature of *P. lyæus* being absent in the rest. The other distinguishing features of *P. lyæus*, as distinct from the West-African *P. nireus*, are, however, well expressed.

135. Papilio cenea, Stoll.

♀. *Papilio cenea*, Stoll, Suppl. Cram. Pap. Exot. p. 134, pl. xxix. figs. 1, 1 A (1791).

♂. *Papilio brutus*, Godt. (pars) Encycl. Méth. ix. p. 69. n. 122 (1819).

♂. *Papilio merope*, Doubl. (pars) Gen. D. Lep. i. p. 13. n. 92 (1846).

♀. *Papilio trophonius*, Westw. "Ann. Nat. Hist. ix. p. 38, (1842)"; and Arcan. Ent. i. pl. 39. figs. 1, 2 (1845).

Twenty-four males and six females from Christmas Pass, all taken during February. The former without exception have a continuous broad or very broad discal black transverse band in the hind wings, but in four of them there is almost an interruption of the band between the 2nd subcostal and radial nervules. The tail of the hind wing is very variable in width and in the extent to which it is spatulate; in most examples it is black for three-fourths of its length, but in others for about two-thirds and in one for barely half. One specimen presents the very unusual feature of two small spots of the ground-colour in the black border of the fore wings between the 1st radial and 3rd median nervules. This strongly marked form of the male has (with the black-and-white southern form of the female so near the female of *P. merope* from West Africa named *hippocoon* by Fabricius) been named *P. tibullus* by Mr. Kirby. There is no doubt that it is characteristic of East and South-east Africa, prevailing along the coast from Natal to Zanzibar; but it occurs along with other less heavily-banded males both in Trans-Kei territory and the eastern districts of Cape Colony.

The females consist of two near the typical *P. cenea*, Stoll, but having the markings enlarged precisely as in the two examples from Delagoa Bay which I have recorded in S.-Afr. Butt. iii. p. 249, *e*; and four of the black-and-white form near the *hippocoon* ♀ of *P. merope* above referred to.

136. Papilio echerioides, Trim.

Papilio echerioides, Trim. Trans. Ent. Soc. Lond. 1868, p. 72 n. 2, pl. vi. figs. 1, 2.

Two specimens from Christmas Pass, a male taken on 19th February and a female on the 20th. The male differs from the southern type-form in having the common transverse band rather narrower and with the component spots more widely separated in the fore wings and narrower on costa in the hind wings; this band is also almost pure white instead of decidedly yellowish white, as are besides the hind-marginal spots (smaller than in typical *echerioides*) of the hind wings. The female differs similarly from the typical female as regards the size of the spots just mentioned, and the large ochre-yellow marking on the upperside of the hind wings is less of a patch and more of a band, being slightly wider near costa and considerably wider on inner margin than in typical *echerioides*.

The points of difference here noted in the male are in the direction of the allied larger species *P. zoroastres*, Druce (Ent. M. Mag. xiv. p. 226, 1878, ♂), from Fernando Po. I have not seen this Butterfly; but from a comparison of Mr. Druce's description with that of *P. jacksoni*, E. M. Sharpe (Proc. Zool. Soc. 1891, p. 188), and with the figure of the latter (*op. cit.* pl. xvii. fig. 1), I think there can be little doubt that the two are identical. *P. jacksoni* is recorded as a native of Kikuyu, British East Africa.

The range of *P. echerioides* extends to Zanzibar, M. Ch. Oberthür having figured (Études d'Ent. xiii. p. 10, pl. 2. fig. 6, 1890) a female from "Ngourou" in that territory, which differs from more southern examples only in having the discocellular spot and submarginal spots in the fore wings, and the hind-marginal spots in the hind wings, all larger than usual.

Family Hesperiidæ.

Genus Cyclopides, Westw.

137. Cyclopides metis, Linn.

♂. *Papilio metis*, Linn. Mus. Lud. Ulr. p. 325. n. 143 (1764); and Syst. Nat. i. 2, p. 792. n. 245 (1767).

A single male from Christmas Pass. This is the most northern locality from which I have seen an example of this abundant South-African species, but Mr. Druce has recorded it from Angola, and Nyassa is given as the habitat of some specimens in the Hewitson Collection.

138. Cyclopides willemi (Wallengr.).

♂. *Heteropterus willemi*, Wallengr. Sv. Vet.-Akad. Handl. 1857—Lep. Rhop. Caffr. p. 47. n. 2.

Two males from Lusika River, captured on 1st April. One of these has the spots of the discal series in the fore wings much larger than usual on the upperside.

The first female of this species that I have seen was taken by Mr. A. W. Eriksson between the Cunenè River and Ovaquenyama Iron Mines in January–February, 1891. This example expands 1 in. 3 lin., and differs from the male in having the spots of the fore wing on the upperside larger and of a clearer and more decided yellow, especially those of the discal series; while on the underside the hind wing and apex of the fore wing are of a brighter unobscured pale yellow, with fine and more sharply-defined black neuration, and in the fore wing the spots of the discal series, though smaller, are as complete as on the upperside, the 4th and

5th spots being confluent with two of the hind-marginal series, but the 6th quite separate. Another distinctive character of the female is that the cilia are pale yellow, instead of dark brown, on both upperside and underside.

139. Cyclopides mineni, n. sp. (Plate VI. fig. 16.)

Exp. al. 1 in. $2\frac{1}{2}$ lin.

Fuscous; fore wing with two discocellular and a serpentine series of eight discal small but well-defined transparent spots. Fore wing: discocellular spots terminal, rounded, separate, placed transversely one above the other; discal series of spots flexed inwardly just below costa, then strongly outwardly to near hind margin, and thence directed inwardly to below extremity of cell, so that the spots are most irregularly placed—the second being a little before the first, the third a little beyond both these, the fourth (between radial nervules) not far from hind margin, the fifth almost directly below the third, the sixth directly below the second, the seventh (rounder and rather larger than the rest) close to and only a little beyond the lower discocellular spot, and the eighth (just above submedian nervure) directly below the discocellular spots. Cilia white, with black nervular marks. Underside.—*Hind wing, and basicostal area of fore wing including discoidal cell, dull pale yellow. Fore wing:* spots as on upperside but all larger; a slight yellowish irroration along hind-marginal border. *Hind wing: a discal series of seven very conspicuous and irregularly disposed white spots in dull fuscous borders,* of which the first and seventh are largest and before the rest, and the fifth is nearest to hind margin; two moderate-sized fuscous spots—one near base between costal and subcostal nervures, the other at extremity of discoidal cell. Cilia as on upperside.

It is with some doubt that I place this Butterfly in the genus *Cyclopides*, as the only specimen, taken in Mineni Valley on March 25th, is not in good condition, and its sex cannot be determined. The antenna is rather longer and with a more elongate club than in *C. metis* (Linn.) and *C. malgacha* (Boisd.), but the first subcostal nervule in the fore wing runs free to the costal edge, and the tibia of the hind leg bears two pairs of spurs as usual. In general aspect and in the character of the markings this species reminds one of the West-African genus *Ceratrichia*, and the arrangement of the transparent spots in the fore wing is almost exactly like that in *Pamphila ophiusa* (Hewits.), from Old Calabar and Gaboon, while the colouring and spotting of the underside of the hind wing somewhat resemble those features in *P. callicles* (Hewits.).

Genus Pyrgus, Westw.

140. Pyrgus vindex (Cram.).

Papilio vindex, Cram. Pap. Exot. iv. pl. ccclii. figs. G, H (1781).

The only specimen, a male from the Mineni Valley, is of the typical form, and not, as might have been anticipated, of the larger form (with paler, larger-spotted underside) prevalent throughout the greater part of Eastern South Africa.

141. PYRGUS DROMUS, Plötz.

Pyrgus dromus, Plötz, Mitt. naturw. Ver. Neu-Vorpomm. u. Rügen, 1884, p. 6. n. 13.

A male taken at Umtali on 8th March.

142. PYRGUS ELMA, Trim.[1]

Pyrgus elma, Trim. Trans. Ent. Soc. Lond. 3rd ser. i. p. 288 (1862).

One example, apparently a female, from Christmas Pass.

Genus THYMELICUS, Herr.-Schäff.

143. THYMELICUS WALLENGRENII, Trim.

Thymelicus wallengrenii, Trim. Trans. Ent. Soc. Lond. 1883, p. 361; and S.-Afr. Butt. iii. p. 304. n. 341, pl. xi. fig. 7 [♀] (1889).

Three specimens from Mineni Valley, taken from 9th to 22nd March. This species was hitherto known to me from Natal and Zululand only.

144. THYMELICUS CAPENAS (Hewits.).

Cyclopides capenas, Hewits. Descr. New Sp. Hesp. ii. p. 43. n. 7 (1868); and Exot. Butt. v. p. 111, pl. 59. figs. 2, 3 [♂] (1874).

Var. *Cyclopides derbice*, Hewits. Ann. & Mag. Nat. Hist. (4) xx. p. 327 (1877).

A male from Christmas Pass, taken on 6th February, and four males and a female from Mineni Valley, taken from 8th to 14th March. All these examples belong to the form without yellow neuration on apical half of the hind margin on the upperside, so agreeing with the description of *C. derbice*, Hewits. In one male the upperside spots are much reduced in size and of duller yellow. The female has the upperside of a less dark brown and its spots larger.

This Butterfly was originally described from Zambesi specimens, and the var. *derbice* from examples taken on Lake Nyassa by Messrs. Thelwall and Simons. It is distinguishable from its near ally the South-African *T. macomo*, Trim., by its darker upperside, with

[1] The Butterfly from Togoland, N. West-Tropical Africa, referred to *P. elma* by Karsch (Berl. ent. Zeitschr. xxxviii. p. 245, n. 177, 1893), appears from the figure (pl. vi. fig. 12) to be of a distinct species. This figure shows the upperside of a more uniform dark tint, with more inclination to a rufous tone; the median vitreous spots in the fore wings are larger and whiter, and the median white bar of the hind wings is prolonged superiorly almost to the costa and is acuminate at its inferior extremity. On the underside the colouring is much darker and has a reddish tinge; in the fore wings the submarginal whitish streak is wanting, and in the hind wings the median white stripe is more irregular and the inner marginal border is pale brown instead of whitish.

smaller (and in hind wings differently disposed) spots; and on the underside by the greatly reduced and broken-up apical yellow in the fore wings, and larger and more numerous black spots and black (instead of yellow) inner-marginal fold in the hind wings.

Genus Pamphila, Fabr.

145. Pamphila morantii, Trim.

♀. *Pamphila morantii*, Trim. Trans. Ent. Soc. Lond. 1873, p. 112; and ♂, S.-Afr. Butt. iii. p. 311, pl. 12. fig. 3 (1889).

A single male, captured in Mineni Valley on 8th March, belongs to the variation *P. ranoha*, Westw., in which the underside colouring is yellow-ochreous, without ferruginous tinge.

146. Pamphila harona, Westw.

Pamphila harona, Westw., App. Oates's Matabele-land, p. 353. n. 75 (1881).

The six males in the collection (two from Umtali River, 28th February, and four from Mineni Valley, 7th to 25th March) differ from Westwood's description (and from two examples agreeing with this which were taken by Mr. Selous in 1883–84 in some part of the South-Tropical tract not recorded) in the following particulars, viz.:—larger size; better development of the dark markings of its upperside (especially of the lower basal and discocellular markings of the fore wings, and the hind-marginal border of the hind wings), the two Umtali specimens and one of those from the Mineni Valley having them more strongly developed than the rest; and more or less reddish-tinged underside of the hind wings and apex of the fore wings, with a greater or less tendency to inter-nervular creamy longitudinal stripes. This pale striping is least apparent in a specimen from Mineni Valley which on the upperside is nearest to the type-form; it is better indicated in those already mentioned as most strongly dark-marked on the upperside; and in two Mineni Valley examples, which present intermediate upperside markings, it is strikingly pronounced.

The specimens on which this species was founded are recorded (*l. c.*) as taken by the late Mr. F. Oates near the Victoria Falls of the Zambesi, in January.

Mr. Selous notes this Butterfly as being rather numerous, very swift in flight, but frequently settling in bushes, or drinking at the water's edge.

147. Pamphila zimbazo, n. sp. (Plate VI. fig. 17, ♀.)

Allied to *P. harona* and to *P. morantii*.

Exp. al. (♂) 1 in. 1–2 lin.; (♀) 1 in. $1\frac{1}{2}$–$2\frac{1}{2}$ lin.

♂. *Blackish-brown, with in each wing an ochre-yellow transverse discal band, long and irregular in fore wing, short and regular in hind wing. Fore wing*: basal half of costa broadly clouded with ochre-yellow; discal band of moderate width, beginning well beyond middle just below costa, elbowed outwardly and narrowed on radial nervules, thence widening and slanting inwardly as far as submedian nervure; at median nervure, on each side of its second nervule, a good-sized terminal discocellular ochre-yellow spot, subquadrate, is completely confluent with inner edge of discal band; below submedian nervure a very pale yellowish longitudinal streak from base meets termination of discal band. *Hind wing*: discal band obliquely-transverse, broad, indented irregularly on both edges, beginning abruptly on 2nd subcostal nervule with its outer edge very near hind margin, and ending above submedian nervure not far beyond middle; a longitudinal yellowish ray from base to hind margin, below submedian nervure, set with yellowish hairs; in discoidal cell a sparse clothing of yellowish hairs. *Cilia* broad, ochre-yellow, tinged with ferruginous in fore wing. UNDERSIDE.—*Hind wing and apical hind-marginal border of fore wing dull pale ochre-yellow with a tinge of olivaceous brown; the former with a submarginal series of more or less reddish spots with dark edges. Fore wing*: ground-colour pale ochre-yellow, fading into dull creamy towards inner margin; from base a broad black longitudinal stripe, traversed by median nervure and a small part of its first nervule, abruptly truncate before middle; at a little distance beyond termination of this stripe, and immediately beyond extremity of discoidal cell, an equally conspicuous wedge-shaped black marking narrowed outwardly, between first radial and 3rd median nervules; upper part of discal band of upperside indicated by thin interrupted fuscous edging lines, of which the long outer series defines the inner edge of the hind-marginal border as far as the 2nd median nervule, beneath which it abruptly expands into a broad fuscous or black marking extending to hind margin and (diffusedly) to posterior angle. *Hind wing*: submarginal series consisting of five spots, of which the first, between costal nervure and 1st subcostal nervule, is remote from the rest, which lie contiguously in an almost straight line between 2nd subcostal nervule and submedian nervure; these spots vary in their distinctness of tint from that of the ground-colour, are elongate-ovate, and are fuscous-edged both internally and externally without being completely ringed; a similar spot at extremity of cell, a less distinct one immediately below it, and a small subbasal fuscous spot between costal and subcostal nervures; at extremity of inner marginal fold, close to anal angle, a darker cloud, faint in two examples, but in the other two fuscous and conspicuous.

♀. Like male, but with the discal bands broader. UNDERSIDE.—Rather paler, with the black markings of the fore wing not so strongly developed.

This species most resembles *P. morantii*, Trim., on the upperside, but on the underside of the fore wings exhibits a remarkable likeness to the darker examples of *P. harona*, Westw., in the black markings; while the underside of the hind wings is altogether different from that of either of those species. The only palpus (that of a female) remaining shows the 3rd joint to be as in *P. harona*, long, slender, and erect.

The four males and four females described were taken in the Mineni Valley, from the 7th to the 25th March, settling on bushes in a wooded ravine.

148. PAMPHILA ZENO, Trim.

♀. *Pamphila zeno*, Trim. Trans. Ent. Soc. Lond. (3) ii. p. 179 (1864); and S.-Afr. Butt. iii. p. 313. n. 345, pl. 12. fig. 2 (1889).

Two males, from Christmas Pass and Revué River respectively.

149. PAMPHILA CHIRALA, n. sp. (Plate VI. fig. 18, ♀.)

Exp. al. 1 in. 4 lin.

♀. *Dull brown; fore wing with a few transparent whitish spots and one semitransparent yellow spot, hind wing with a suffusion of ochre-yellow from base to a little beyond middle; cilia uniform dull whitish-brown.* *Fore wing*: six transparent spots, viz.: two small ones in discoidal cell, near its extremity, disposed transversely one immediately above the other; two a little beyond and beneath these, only separated from each other by the 2nd median nervule, of which the upper is small and triangular and the lower large and quadrate; and two near costa, midway between discocellular spots and apex, only separated from each other by the 5th subcostal nervule, of which the upper is minute and subquadrate and the lower small and wedge-shaped; immediately above submedian nervure, about middle, a pale dull-yellow wedge-shaped spot, smaller than the largest of the transparent spots, with its narrow end baseward; from base to before middle a faint suffusion of ochre-yellow. *Hind wing*: without markings; ochre-yellow suffusion from base fading away beyond middle and not extending to costa. UNDERSIDE.—*Hind wing and apical area of fore wing rather bright yellow, varied with dull ferruginous.* *Fore wing*: transparent spots with a fuscous edging; field of wing fuscous-grey; costa narrowly and hind margin more widely bordered with pale dull reddish; a large subapical costal patch of yellow, beginning at extremity of discoidal cell and outwardly bounded by an oblique ferruginous streak from apex to 3rd median nervule; a hind-marginal series of small indistinct internervular brown spots; inner margin dingy-whitish. *Hind wing*: from apex to submedian nervure an oblique ferruginous band, narrowed on 3rd median nervule; hind margin evenly bordered by an even rather narrow dull-reddish band, externally brown-spotted as in fore wing, but internally edged with ferruginous; costa diffusedly edged with ferruginous; a minute subbasal ferruginous spot between costal and subcostal nervules; an ill-expressed transverse series of three very small similar spots before middle; and a small ring-spot rather beyond middle, between subcostal nervules.

Antennæ dark brown, with thin whitish rings marking the joints, and with outer third of club white. Palpi (except terminal joint) clothed with brown hair above and very densely with yellow hair beneath.

This Hesperid, though of small size, resembles in structure the group of large species represented by *P. erinnys* and *P. dysmephila*, Trim., especially in its robust body, rather slender legs, and long antennæ with elongate but thick club (the tip of which is acute and curved but not hooked); the terminal joint of the palpi is short, very slender, acuminate, and pilose.

As regards colouring and marking, *P. chirala* on the upperside resembles *P. malchus* and *P. gillias* (Mab.), from Madagascar, but has an entirely different underside, much recalling that of the North-American group represented by *P. zabulon*, Boisd. & Le C., *P. peckius*, Kirb., and *P. mystic* (Scudd.), though unlike in the oblique disposition of the ferruginous stripes.

The only example was taken in Mineni Valley on 13th March.

150. Pamphila moritili (Wallengr.).

♀. *Hesperia moritili*, Wallengr. Sv. Vet.-Akad. Handl. 1857—Lep. Rhop. Caffr. p. 49. n. 4.

♂ ♀. *Pamphila moritili*, Trim. S.-Afr. Butt. iii. p. 319. n. 349, pl. 12. fig. 4 [♂] (1889).

Three examples captured in the Mineni Valley, during March—two males and a female.

151. Pamphila borbonica (Boisd.).

Hesperia borbonica, Boisd. Faune Ent. Madag. etc. p. 65. n. 3, pl. 9. figs. 5, 6 (1833).

Pamphila borbonica, Mab. in Grandid. Madag. etc., Lepid. i. p. 360, pl. lv. figs. 6, 6 *a* (1885–86).

The only example, a male from Christmas Pass, agrees with Natal specimens in possessing a small subterminal vitreous spot in the discoidal cell which is wanting in the type-form.

152. Pamphila inconspicua (Bertol.).

♂. *Hesperia inconspicua*, Bertol. Mem. Acad. Sci. Bologna, 1849–50 (sep. cop.), p. 15, pl. i. figs. 4, 5.

♀. *Hesperia mohopaani*, Wallengr. l. c. p. 48 (1857).

♂ ♀. *Pamphila micipsa*, Trim. Trans. Ent. Soc. Lond. (3) i. p. 290 (1862).

♂ ♀. *Pamphila mohopaani*, Trim. Rhop. Afr. Aust. ii. p. 304. n. 198 (1866); and S.-Afr. Butt. iii. p. 324. n. 353 (1889).

Bertoloni's description and figures are from a single male from Inhambane; there can be no doubt that his species is identical with *H. mohopaani*, Wallengr.

A single male from Christmas Pass is somewhat greyer (less greenish yellow) in tint on the underside, and has six spots in the discal series of the underside of the hind wings[1].

[1] A male *Pamphila* from Khasia Hills, Assam, received as "*Chapra prominens*" from Mr. de Nicéville in 1889, is inseparable from the male *P. inconspicua*. I have already (S.-Afr. Butt., iii. p. 325) expressed the opinion that *mohopaani* (= *inconspicua*) will eventually be recognized as merely a larger form of the Oriental *P. mathias* (Fabr.).

153. PAMPHILA RONCILGONIS (Plötz).

Hesperia roncilgonis, Plötz, Stett. ent. Zeit. 1882, pp. 450–51.

♂ ♀. *Pamphila roncilgonis*, Trim. Trans. Ent. Soc. Lond. 1893, p. 139, pl. viii. fig. 11 [♂].

Fourteen examples, three only of which are females, from Umtali (1), Christmas Pass (1), Mineni Valley (4), Lopodzi River (1), and Vunduzi River (7). All these specimens are more or less worn, the best being from the last-named locality (5th to 12th April).

The females differ from the Delagoa Bay example described by me (*l. c.* pp. 140–41) in wanting the minute additional transparent spot in the fore wings between the 5th subcostal and upper radial nervules; and the largest and freshest of them also is nearer to the male in the fulvous-ochreous violaceous-glossed hind wings and apex of fore wings on the underside.

Mr. Selous notes this species as chiefly observed on flowers—especially on the tall spikes of blue flowers above mentioned as attracting so many *Lycænidæ*. One specimen was captured while drinking at the water's edge.

154. PAMPHILA HOTTENTOTA (Latr.).

♂. *Hesperia hottentota*, Latr. Encycl. Méth. ix. p. 777. n. 133 (1822).

♂ ♀. *Hesperia zetterstedti*, Wallengr. l. c. p. 49. n. 3 (1857).

♂ ♀. *Pamphila hottentota*, Trim. S.-Afr. Butt. iii. p. 314. n. 346, pl. 11. figs. 8, 8 *a* (1889).

Two specimens from Christmas Pass, two from the Mineni Valley, and one specimen from the Vunduzi River, all (3 males, 2 females) belonging to the var. *zetterstedti*, so widely spread over all Eastern South Africa.

Genus ANCYLOXYPHA, Feld.

155. ANCYLOXYPHA MACKENII (Trim.).

♂. *Pamphila? mackenii*, Trim. Trans. Ent. Soc. Lond. 1868, p. 95, pl. vi. fig. 8.

♂ ♀. *Ancyloxypha mackenii*, Trim. S.-Afr. Butt. iii. p. 331. n. 357 (1889).

Three males from Christmas Pass (16th to 23rd February), and a male and a female from the Mineni Valley (6th and 8th March).

156. ANCYLOXYPHA PHILANDER (Hopff.).

♂. *Pamphila philander*, Hopff. "Monatsb. Akad. Wissensch. Berl. 1855, p. 643"; and Peters' Reise n. Mossamb., Ins. p. 416, t. xxvii. figs. 1, 2 (1862).

♂ ♀. *Ancyloxypha philander*, Trim. S.-Afr. Butt. iii. p. 333. n. 358 (1889).

Five specimens: 2 males and 2 females from the Mineni Valley (6th and 7th March) and a female from the Vunduzi River (5th April). All have the lowest spot of the discal series of the fore wing on the upperside smaller and much more widely apart from the spot immediately above it than in Hopffer's figure of the male from Querimbe; both the males have the white median bar on the upperside of the hind wings considerably narrower, but this marking is in the females about as wide as Hopffer figures it in the male. On the underside the dark anal angular and lower discal patch is larger in both sexes, extending to hind-marginal edge except just about extremity of submedian nervure.

Two females from Delagoa Bay, collected by the Rev. H. Junod in 1891, present this last-named character, and agree in other respects with the single example from the same locality noted by me *loc. cit.* p. 333 [1].

Mr. Selous notes this Butterfly as very rapid in flight, but frequently settling in bushes in shady spots.

Genus PTERYGOSPIDEA, Wallengr.

157. PTERYGOSPIDEA DJÆLÆLÆ, Wallengr.

♂. *Pterygospidea djælælæ*, Wallengr. l. c. p. 54. n. 5 (1857).

♂ ♀. *Pterygospidea djælælæ*, Trim. S.-Afr. Butt. iii. p. 354. n. 368, pl. xii. fig. 7 [♀] (1889).

Eight specimens, two of which are females, from the Mineni Valley (5th to 16th March) agree with the Transvaal male noted by me, *l. c.* p. 355, in their larger size and darker underside colouring, only the females having the rufous tolerably developed.

158. PTERYGOSPIDEA MOTOZI, Wallengr.[2]

Pterygospidea motozi, Wallengr. l. c. p. 53 (1857).

Nisoniades motozi, Trim. Rhop. Afr. Aust. ii. p. 313. n. 206, pl. 6. fig. 3 (1866).

Four males and a female from the Mineni Valley (7th to 12th March), and a male from Vunduzi River (12th April).

When I described this species in S.-Afr. Butt. iii. p. 357, I had noted females only of the typical pattern, and associated with them males taken in the same locality which differed chiefly in the much smaller vitreous spots of the fore wings, the want of the discocellular vitreous spot in the hind wings, and the possession of a more or less well-defined darker fascia in the fore wings. I have since obtained both sexes of both forms, and can rectify

[1] Specimens from the Ogové Valley, Equatorial West Africa, are considerably smaller; the spots on the upperside of the fore wings are reduced in size—the lowest spot especially being very small and sublinear; the median bar on the upperside of the hind wings is, on the contrary, much broader in its upper portion; while on the underside of the hind wings the dark lower-discal patch is more reduced than in the figure of the Querimbe type and stops short at some little distance before the hind margin.

[2] The Butterfly from Bismarckburg, Togoland, figured by Karsch (Berl. ent. Zeitschr. xxxviii. pl. vi. fig. 11, 1893) as doubtfully the male of *P. motozi*, appears to be quite distinct, being very much smaller, with differently-shaped transparent spots (and 5 or 6 minute *additional* ones) in the fore wings, and having the underside of the hind wings brown with fuscous markings and without any of the characteristic yellow colouring.

the mistake as regards *motozi* by stating that the male differs scarcely at all from the female except in being darker on the upperside, and having smaller and more separate yellow markings on the underside.

159. Pterygospidea galenus (Fabr.).

Hesperia galenus, Fabr. Ent. Syst. iii. 1, p. 350. n. 332 (1793); Latr. Encycl. Méth. ix. p. 773. n. 124 (1823).

Plesioneura galenus, Staud. Exot. Schmett. i. t. 100 (1888)[1].

Three examples from Christmas Pass, captured respectively on 15th, 17th, and 27th February. They are rather larger than the West-African specimens that I have seen, expanding 1 in. $6\frac{1}{2}$ to $7\frac{1}{2}$ lin., and the discocellular fulvous-yellow spot on the upperside of the hind wings is absent in two of the specimens and only just indicated in the third; on the underside this spot is faintly marked, and the other yellow spots (apart from the large discal hind-marginal patch) are also very much reduced and in two examples obsolescent. On both surfaces the large fulvous-yellow patch of the hind wings differs in each specimen both as to shape and size.

I have found this species recorded from numerous localities along the West Coast, from Assinie (in about 5° N. lat., and 3° W. long.) as far to the south as Angola; but Mr. Selous's captures give the first instance known to me of its occurrence in East Africa—unless Shoa in Abyssinia be one (see C. Oberthür, Ann. Mus. Civ. Genova, xv. p. 733, 1883). Mr. Selous describes the Butterfly as scarce; he found it settling on low bushes in shady places and so alert as to be caught with difficulty.

160. Pterygospidea flesus (Fabr.)[2].

Papilio flesus, Fabr. "Sp. Ins. ii. p. 135. n. 621" (1781); Ent. Syst. iii. 1, p. 328. n. 286 (1793).

Papilio ophion, Drury, Ill. Nat. Hist. iii. pl. xvii. figs. 1, 2 (1782).

The eight examples from Christmas Pass and one of the two examples from the Mineni Valley are remarkable for the complete and unvarying development of the entire discal series of black or brownish-black spots on the underside of the hind wings,—a series so variable in Natal specimens that it is by no means uncommon

[1] *Pardaleodes fulgens*, Mabille (Bull. Soc. Zool. France, 1877, p. 236), from the detailed description given, does not seem to be separable from *Pt. galenus*.

[2] In S.-Afr. Butt. iii. p. 365, I explained how from M. Mabille's description (Ann. Soc. Ent. Fr. (5) vi. p. 272. n. 21, 1876) I was disposed to consider that *Tagiades insularis*, Mab., from Madagascar, was probably not separable as a species from *P. flesus*. Having since been favoured by M. Mabille with two males of his *T. insularis*, I have, however, come to the conclusion that the Malagasy Butterfly may be held distinct from the Continental species, as besides the smaller size and the straighter hind margin of the hind wings (which M. Mabille points out in vol. i. p. 354 of the Lepidoptera in Grandidier's 'Madagascar, &c.'), I find that on the underside of the hind wings there is a very much broader and complete hind-marginal brown border from the radial nervule as far as the submedian nervure.

to find two, three, four, or all five spots wanting or but faintly indicated. In the exception from the Mineni Valley, four of these spots are reduced to mere dots and the fifth is wanting altogether.

Genus HESPERIA, Fabr.

161. HESPERIA FORESTAN (Cram.).

Papilio forestan, Cram. Pap. Exot. iv. t. cccxci. figs. E, F (1782).

One specimen from Christmas Pass (27th February) and another from the Mineni Valley (27th March).

162. HESPERIA UNICOLOR (Mab.).

Ismene unicolor, Mab. Ann. Soc. Ent. Fr. (5) vii. p. xxxix. n. 47 (1887); Bull. Soc. Zool. Fr. 1877, p. 230.

Two examples: a male, in good order, captured at Christmas Pass on the 20th February, and an apparent female, very much damaged, near the Vunduzi River on 12th April.

The few specimens of this singularly dull-tinted species that have come under my notice were from Delagoa Bay and from Durban, Natal. Mabille's descriptions were from Congo examples.

Genus ABANTIS, Hopff.

163. ABANTIS ZAMBESINA (Westw.).

♂. *Hesperia* (*Oxynetra*) *zambesina*, Westw. Thes. Ent. Oxon. p. 183, pl. xxxiv. fig. 9 (1874).

Eight males: seven from Mineni Valley (13th to 29th March), and one from Vunduzi River (6th April).

This beautiful Hesperid is noted as not numerous, and always in open country; it was mostly captured while drinking at the water's edge, but some were found on the tall spikes of blue flowers already mentioned as the haunt of several *Lycænidæ* and *Hesperiidæ*.

I have not yet seen the female of this species, which is still rare in collections.

In addition to the species above mentioned, there are two forms of *Mycalesis* which I cannot with certainty refer to any described species without comparison with the types, but which I believe to be assignable to the species hereunder named.

164. ? MYCALESIS CAMPA, Karsch.

♂. *Mycalesis campa*, Karsch, Berl. ent. Zeitschr. xxxi. p. 206, t. v. fig. 4 (1893).

This species belongs to the *safitza* group, but is distinguished by the rather acute angulation of the common pale postmedian transverse streak of the underside in both fore and hind wings on the 3rd median nervule.

Two examples taken by Mr. Selous in Christmas Pass on 16th

February agree very well with Karsch's description of the male from Bismarckburg, Togoland, in Northern West-Tropical Africa, but have the angulation in question less pronounced (in one example very much less pronounced in the fore wing than is shown in the figure quoted), and also present a considerable acute dentation throughout, in both fore and hind wings, of the inner submarginal dark line. In these characters the Manica examples are nearer to *M. safitza*, but differ more than the figure of *M. campa* does from the same species in having the 4th ocellus of the series in the hind wings very much smaller than (instead of nearly as large as) the fifth [1].

165. ? Mycalesis ena, Hewits.

Mycalesis ena, Hewits. Ent. M. Mag. xiv. p. 107 (1877).

A single male from Christmas Pass, captured on 20th February, appears to me to agree with Hewitson's description of this Lake Nyassa species, the postmedian common transverse streak having the "undulated" form specified as far as the hind wings are concerned; but the brief diagnosis is too vague and of too general an application to enable any satisfactory identification to be arrived at.

EXPLANATION OF THE PLATES.

Plate IV.

Fig. 1. *Physcæneura pione*, Godm., ♂, p. 20.
2. *Melanitis libya*, Dist., ♂, p. 22.
3, 3*a*. *Acræa asema*, Hewits., ♂ ♀, p. 24.
4. *Acræa acrita*, Hewits., ♂ var., p. 28.
5. *Precis simia*, Wallengr., ♂, p. 33.

Plate V.

Fig. 6. *Charaxes lasti*, H. G. Smith, ♀, p. 39.
7. *Charaxes achæmenes*, Feld., ♀, p. 41.
8. *Charaxes guderiana*, Dewitz, ♀, p. 42.

Plate VI.

Fig. 9. *Charaxes manica*, n. sp., ♀, p. 43.
10. *Charaxes selousi*, n. sp., ♂, p. 45.
11. *Lycæna exclusa*, n. sp., ♂, p. 47.
12. *Lycænesthes lunulata*, n. sp., ♂, p. 51.
13. *Chrysorychia cruenta*, n. sp., ♂, p. 55.
14. *Durbania puellaris*, n. sp., ♀, p. 59.
15. *Alæna nyassa*, Hewits., ♀, p. 61.
16. *Cyclopides mineni*, n. sp., p. 72.
17. *Pamphila zimbazo*, n. sp., ♀, p. 74.
18. *Pamphila chirala*, n. sp., ♀, p. 76.

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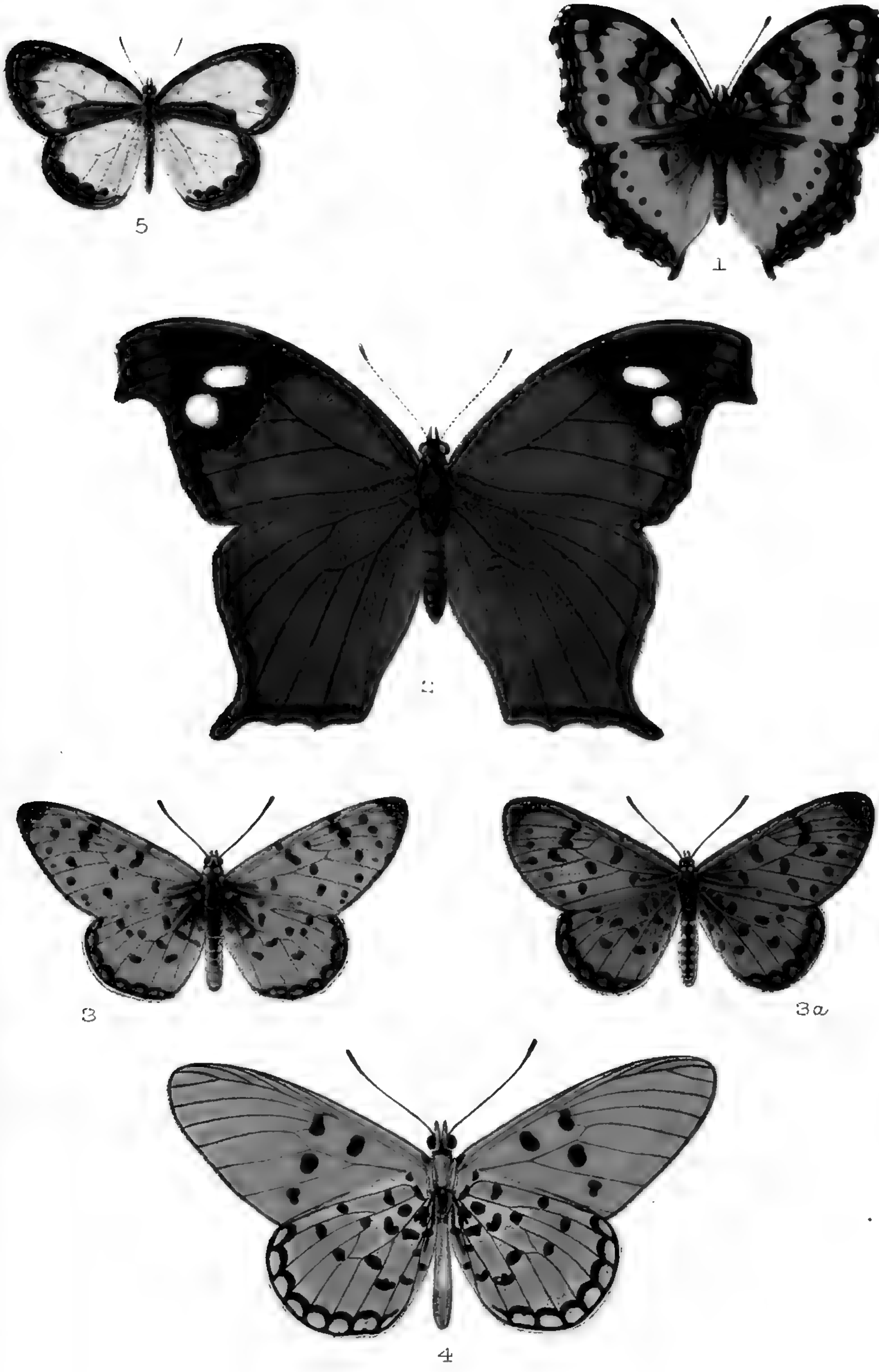
[1] I have a note referring to a Zambesi specimen in the Oxford University Museum in 1867, which seems to agree with the Manica examples here recorded.



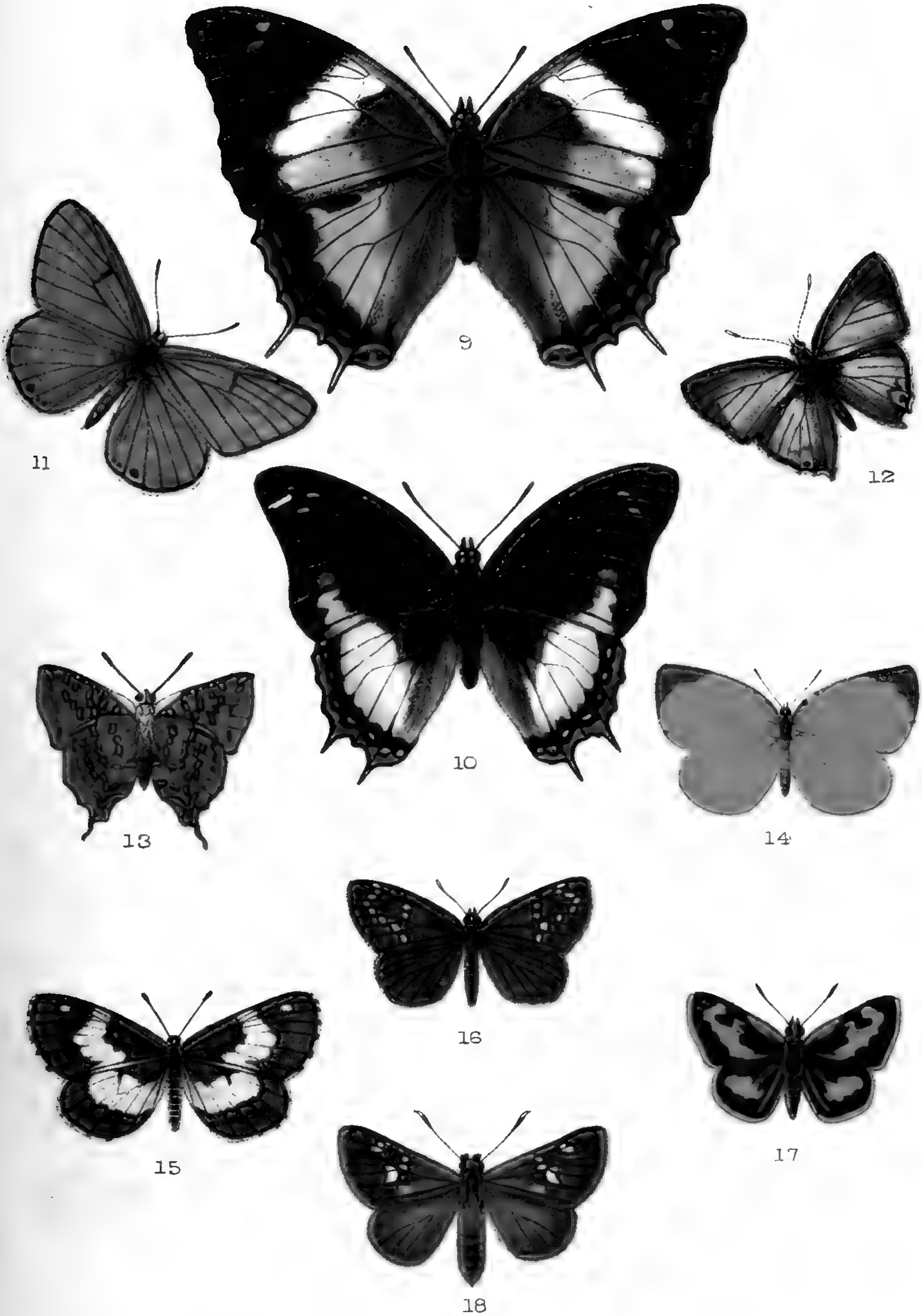
W. Purkiss chromo lith. West, Newman imp.

Butterflies from Manica, S.E. Africa.

W. Purkiss, chromo-lith.

West, Newman imp.

Butterflies from Manica, S.E. Africa.



W. Purkiss chromo lith. West, Newman imp.

Butterflies from Manica, S.E. Africa.

Mintern Bros. imp.

CERCOPITHECUS WOLFI.

3. Remarks on an African Monkey, *Cercopithecus wolfi*. By A. B. Meyer.

[Received November 21, 1893.]

(Plate VII.)

In 'Notes from the Leyden Museum' (vol. xiii. pp. 63–64, December 1890) I gave a preliminary description of this new Monkey from Inner Africa (though the exact locality is not known), after a living specimen in the Dresden Zoological Garden. At the same time I expressed my intention of giving fuller particulars after the animal's death, since it is impossible to be perfect in details when noting down the characters of a living Monkey constantly leaping from one end of its cage to the other. The animal having died in October 1891, I now offer the subjoined description, illustrated by a figure, of this remarkably fine species, and add some notes on its skeleton. In the valuable and complete list of the genus *Cercopithecus* recently published by Dr. P. L. Sclater (P. Z. S. 1893, pp. 243 & 441), the 31 known species are divided into 6 sections, and if one does not wish to create a new section for *C. wolfi*, it could be placed in Section C (Erythronoti: above rufous, beneath white), or in Section E (Auriculati: ears with long tufts), though it does not exactly agree with either.

The following is a description of the specimen:—General colour of the upper surface dark slate-grey, passing into blue-grey on the sides, each hair with two or three pale rings and tipped with black; the hair-rings from the crown downwards form a dorsal stripe 4 cm. broad, tapering off to a point towards the tail, olive-yellowish from the crown to the middle of the back, most vivid on the crown, brown-yellow towards the tail; the hair-rings on the sides are pearl-grey, on the basal half of tail above ash-grey, the tips of the hairs black, on basal half of tail below whitish; the lengthened hairs of the sides of the body orange-yellow; nose and bare skin of face blackish grey; upper lip as far as nose and bare parts of under-lip flesh-colour; iris red-brown; the diadem-like stripe across forehead, extending more narrowly to the ears, yellowish white, each hair black at the tip; eyebrows black; the hairs of the ears bright red-brown; temples and space in front of ears black, the long hairs of the whiskers washed with the same colour; the hair-rings of the whiskers, which tend to a lemon-yellow colour, are very broad in front, so that these hairs appear almost uniform yellow; chin, sides of neck, inner sides of arms, breast, belly, and inner sides of legs white, the hairs of the belly with faint orange-yellow tips; shoulders and upper arms black, with pearl-grey hair-rings; outer side of lower arms uniform glossy deep black, between this and the white inner side a narrow ochre-coloured stripe running down to the underside of the hands; hairs on hands and feet above black, becoming thinner on the fingers; skin of hands and feet blackish grey; outer side of legs bright red-brown, passing into orange towards the white inner side (the difference between the red-brown and the orange being due to the circumstance that in the former case the bases of the hairs are ash-grey, in the latter white). The colour of the legs after Ridgway (Nomencl. Col.) is tawny (pl. v. fig. 1) with a wash of Chinese orange (pl. vii. fig. 15).

Length of body 46 cm., tail ca. 60, height at shoulder ca. 32, height at hip ca. 35 cm.

The appearance of the cranial sutures, the teeth, and the bones prove that the animal is not an old one, though it appears to have attained its full size. As it was brought over from Africa in the year 1887 and died in 1891, it was at least five years old.

Skull.—Line from root of nose to upper jaw rather straight in profile, basis only of the nasal opening elevated; angle with the line of forehead about 30 degrees. Nasal opening elongated (7×16 mm.). Orbits round, projecting at their inner upper angle.

Greatest length (gnathion to occiput) 94 mm.; basal length (basion to gnathion) 64·2; greatest (zygomatic) breadth 61·2; breadth of orbit 20·7; height of orbit 22·3; interorbital breadth 4·4; intertemporal constriction 42·2; brain-case—length 70·4, breadth 53·1, height (basilar suture to bregma) 43·9; combined length of upper premolars and molars 22·4, of molars only 15·8; length of palate 33·9, breadth at inside of m^2 17·1; free length of canine 15·7.

Length of pelvis 106, breadth (*il.*) 61; length of vertebral column ca. 290; length of tail ca. 540; humerus 116, ulna 125, radius 135, manus 96, femur 145, tibia 150, fibula 143, pes 140.

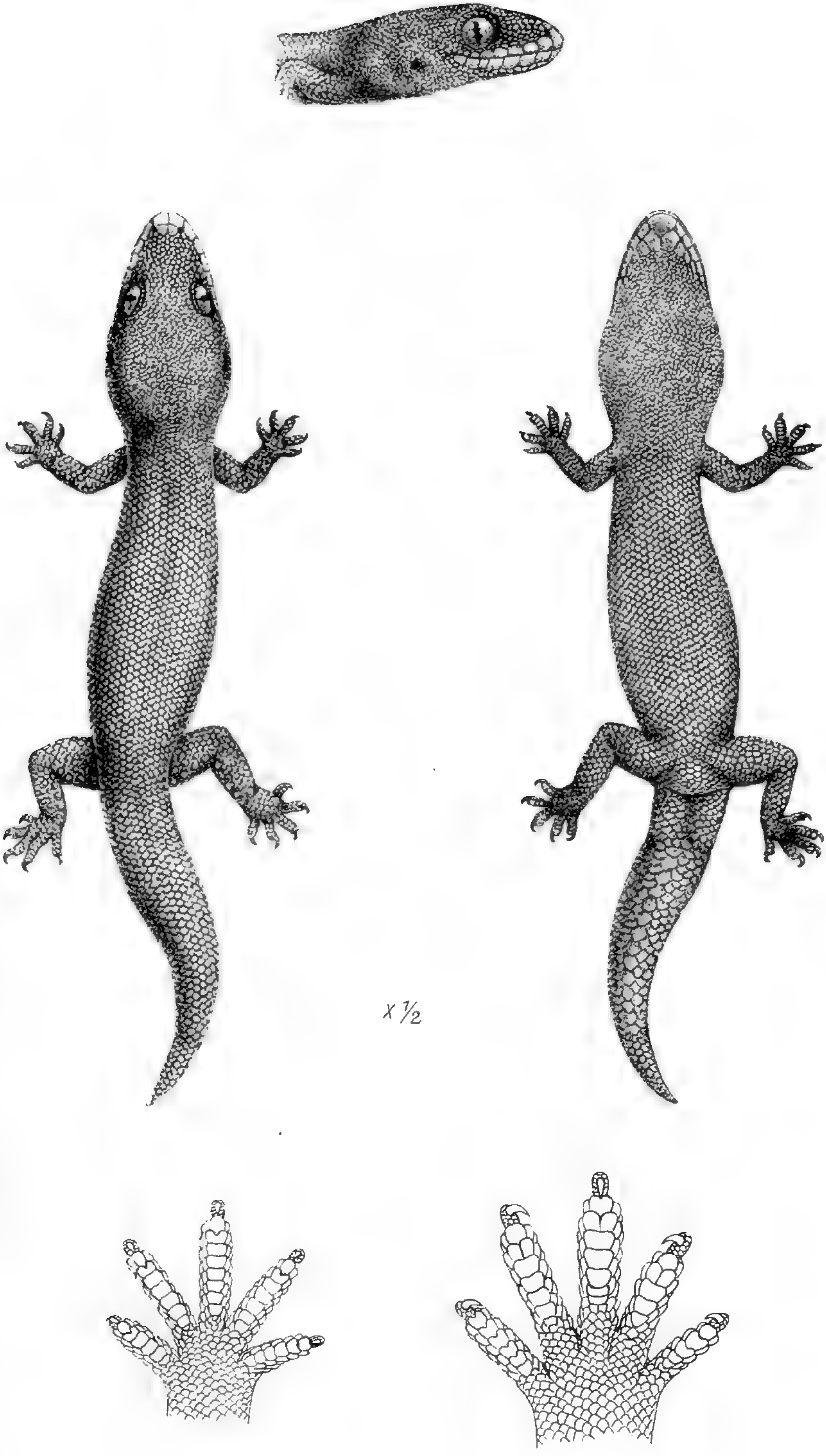
4. Report on the Collection of Reptiles and Fishes made by Dr. J. W. Gregory during his Expedition to Mount Kenia. By Dr. A. Günther, Keeper of the Zoological Department, British Museum.

[Received January 12, 1894.]

(Plates VIII.–XI.)

Considering the difficulties Dr. Gregory had to overcome in attending unaided to the various duties of a scientific traveller, and the fact that the formation of zoological collections was but a secondary object of his expedition, we may be very well satisfied with the series of Reptiles and Fishes which he was able to bring home.

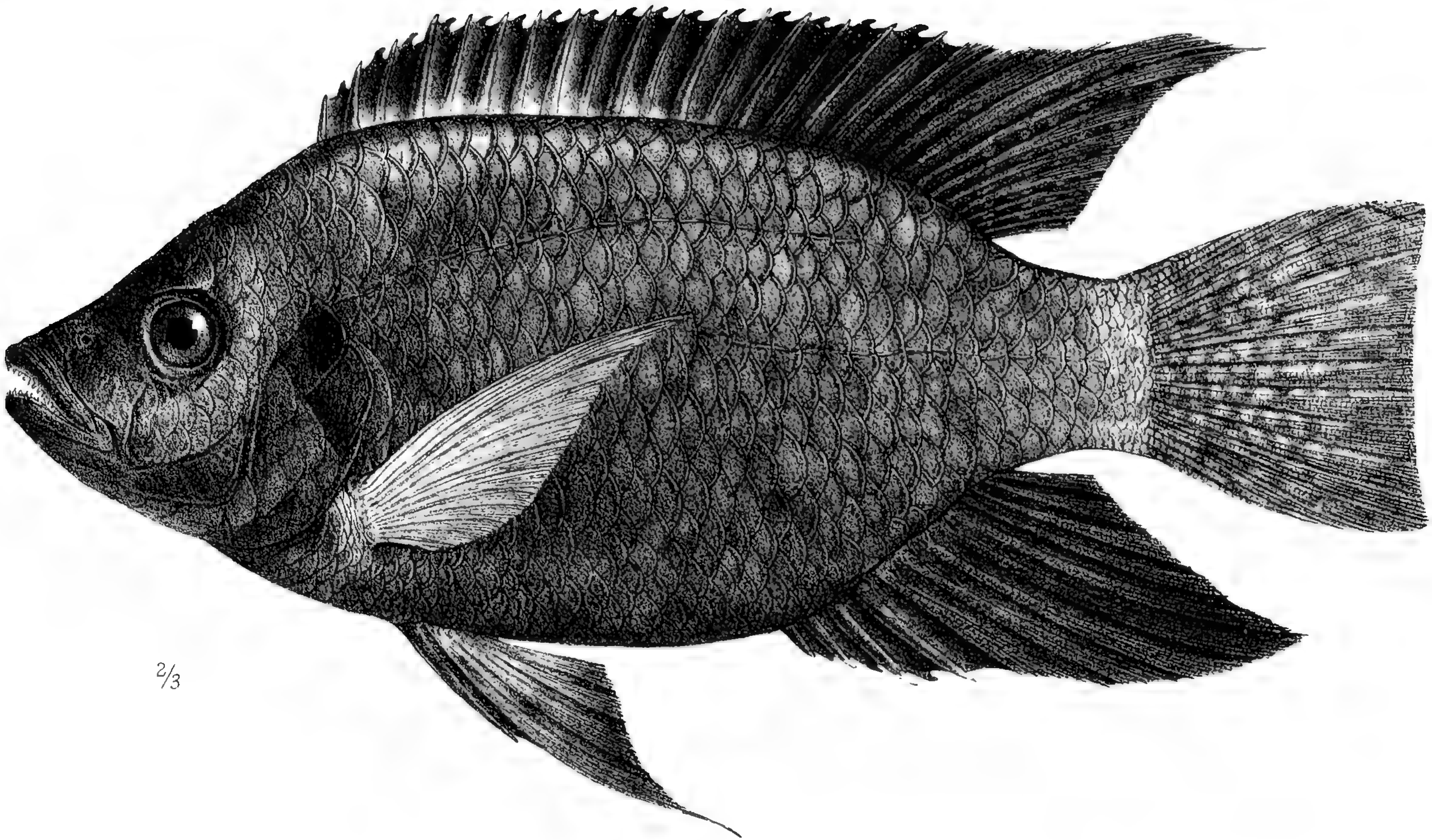
The Reptiles are referable to 38 species, the majority being well-known forms of the Central East-African Fauna, but they nevertheless form a valuable contribution to our knowledge of the range of the several species, inasmuch as the collector took great care in noting the localities where the specimens were obtained, and



J. Green del. et lith.

Mintern Bros. imp.

BUNOCNEMIS MODESTUS.



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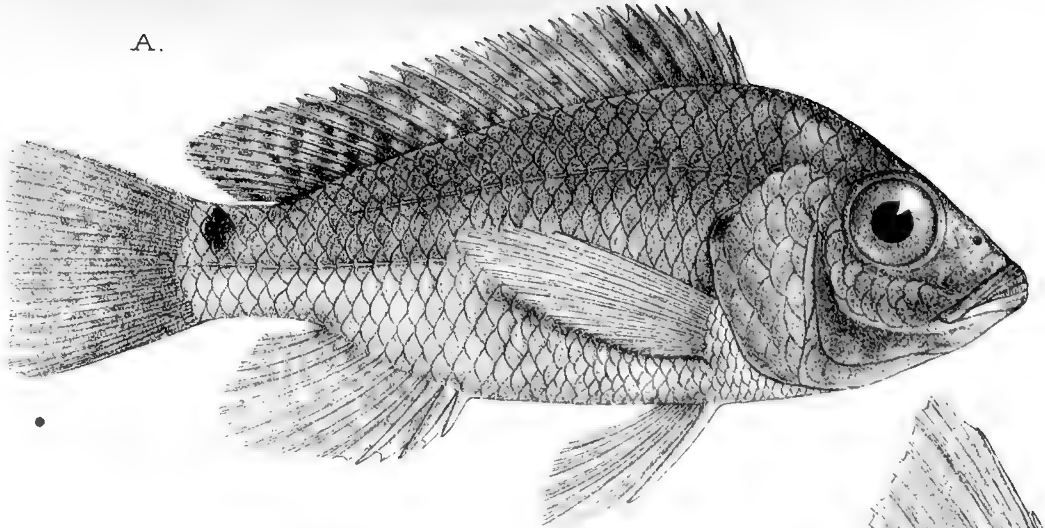
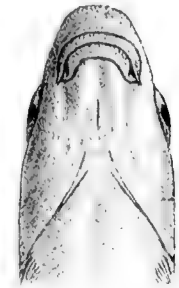
R. Mintern del et lith.

Mintern Bros. imp.

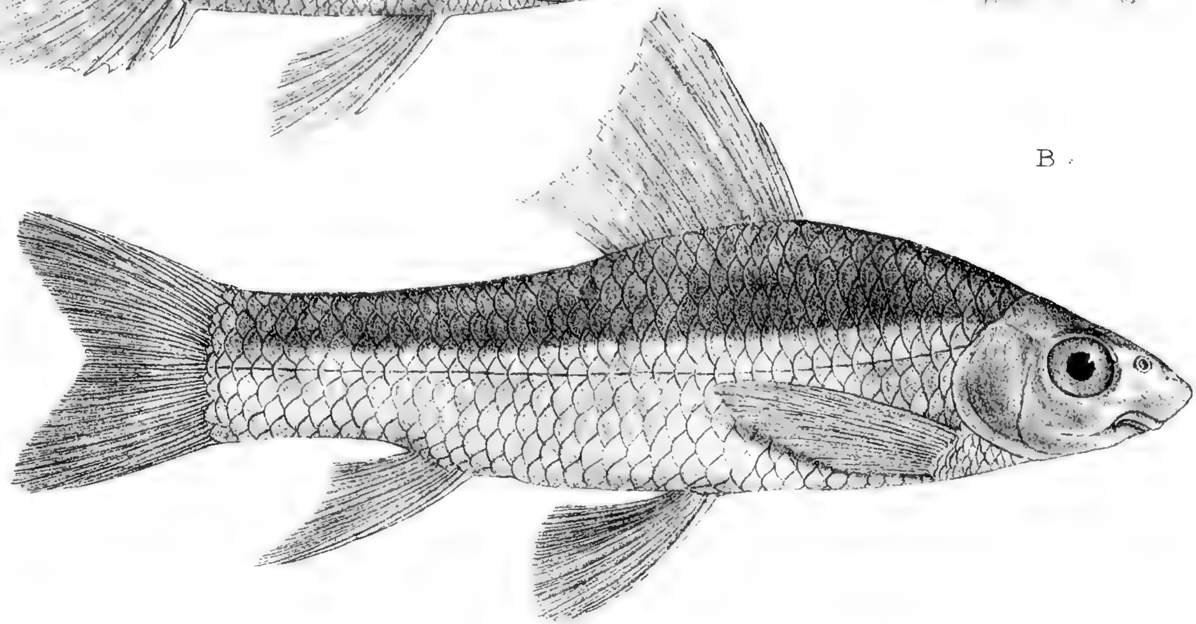
OREOCHROMIS NIGER

A.





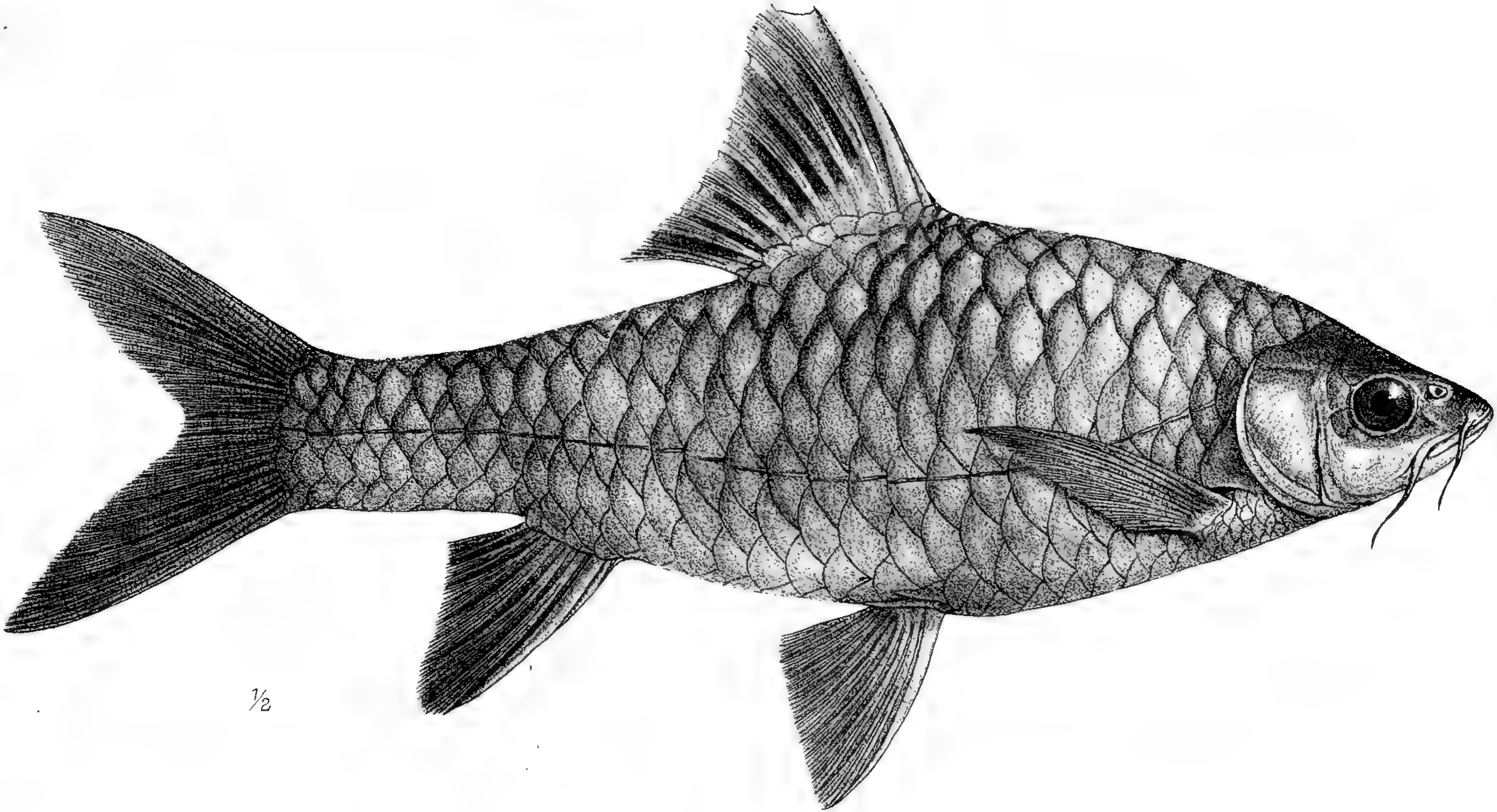
B.



R. Mintern del et lith.

Mintern Bros. imp.

A. CHROMIS SPILURUS. B. LABEO GREGORII



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R. Mintern del. et lith.

Mintern Bros. imp.

BARBUS TANENSIS.

these will be fully explained in his forthcoming itinerary of his expedition[1]. Besides, he discovered two new forms, one of the polytypic genus *Agama*, and the other a singular new genus of Geckoids. Several of the species had been previously known from one or two other localities only: the Egyptian *Dipsas obtusa* has been discovered by him to extend southwards to the Equator, and the West-African *Hemidactylus brookii* proves to be one of those which extend right across the Continent. This is also the case with *Dermophis thomensis*, one of the seven Batrachians collected by Dr. Gregory.

So far as we know at present, some of the genera of Fishes inhabiting Tropical Africa, like *Chromis* and *Barbus*, preponderate over the others as regards the number of species. Not only are the various fresh waters inhabited by distinct local forms of the genera mentioned, but almost every piece of fresh water harbours several species of the same genus. Six out of the thirteen species of which specimens have been collected by Dr. Gregory are new, and my examination of them has been greatly facilitated by the large size of the specimens and the excellent state of their preservation.

REPTILES.

1. Testudo pardalis. On the Kikuyu escarpment south of Lake Naivasha.

2. Cinyxis belliana, Gray. East of Taro, west of Witu.

3. Sternothærus sinuatus, Smith. Upper Athi R.

4. Pelomedusa galeata, Schoepff. Kapte Plains, Ukambani, alt. 3300 ft.

5. Hemidactylus mabuia, Moreau. Ngatana.

6. Hemidactylus brookii, Gray. Kibibi Basin.

Hitherto known from various localities on the West Coast.

Bunocnemis, g. n. Geckot.

Body and tail covered with small, smooth, imbricate scales. Digits and toes free, with the terminal phalanges short and clawed, those of the digits being much shorter than those of the toes. The lamellæ on the lower side of the fingers and toes are mostly undivided, though many have a more or less shallow notch in their anterior margin. A complete division takes place only in the lamellæ of the outer toe and in the penultimate lamella of the other toes. The hinder part of the legs with large tubercles. Præanal pores. Pupil vertical.

7. Bunocnemis modestus, sp. n. (Plate VIII.)

Snout rather depressed, moderately long, longer than the

[1] Geogr. Journ. vol. iii. (1894).

distance between eye and ear-opening and twice as long as the eye; ear-opening small. Lepidosis of the head granular. Rostral quadrangular, with a median cleft above, and with a pair of small shields behind; nostril pierced between the rostral, post-rostral, first labial, and two small granular shields; eight upper and seven lower labials; mental large, pentagonal, with two large chin-shields behind. The scales surrounding the body are nearly of the same size; about eighty-six longitudinal series may be counted round the middle of the body. Tail conical, with a median series of larger scutes below. The fore part of the hind limbs is covered with small imbricate scales like the body, whilst the posterior part is granular with large subconical tubercles. Similar tubercles, but fewer in number and flatter, are seen on the hinder side of the fore-arm. Fifteen pores in the præanal series, which extends for some distance on the thigh. Thumb with six lamellæ, of which the penultimate is deeply notched; seven lamellæ under the second, eight under the third, and seven under the fourth fingers. Inner toe with three lamellæ, of which the middle is notched; second toe with four lamellæ, the penultimate being divided; fourth toe with six lamellæ, the penultimate being divided; fifth toe with six lamellæ, all of which are more or less notched.

Upper parts uniform brownish, lower whitish.

Total length	78	millim.
Head	11	,,
Width of head	8	,,
Distance of snout from vent	45	,,
Tail, partly reproduced	33	,,
Fore limb	11	,,
Hind limb	15	,,

A single specimen was obtained at Ngatana.

8. Lygodactylus picturatus, Ptrs. Ngatana, Tzavo.

9. Agama doriæ, Blgr. Fuladoya (Aug. 16).

10. Agama gregorii, sp. n.

Allied to *Agama cyanogaster*.

Nostril lateral, not tubular, and below the canthus rostralis. The anterior of the upper scutes of the head are smooth, but the posterior surmounted by a small spine; occipital not enlarged; small, conical spinous scales on the sides of the throat, about the ear, and on the neck; ear larger than the eye-opening. A deep fold across the throat, but no gular pouch. Body depressed, without fold on the side of the back; back with numerous larger scales mixed among the small ones, the largest forming a tolerably regular series on each side of the median line; the two series passing into two rows of very large scutes which protect the median line of the tail. All the larger scales are keeled. Ventral scales smaller than the largest on the back, keeled, the keels terminating behind in a spine.

Limbs moderately elongate, the scales in front and on the upper part of the hind limb imbricate and strongly keeled; scales on the hinder side of the thigh small, with larger ones mixed. The third and fourth fingers nearly equal in length; fourth toe very slightly longer than the third, fifth extending beyond the first. Tail longer than the body, its scales strongly keeled, with the margins denticulated and disposed in annuli. Male with a double row of anal pores.

Upper parts bluish, with the largest scales yellow; also the head and the basal portion of the tail are yellow; throat blue; a black band across the shoulder.

	inches.	lines.
Total length	11	6
Head	1	5
Distance between vent and snout	5	2
Length of fore limb	2	6
Length of hind limb	3	6

One specimen was obtained at Mkonumbi, a grassy coast-district with salt-swamps.

11. Monitor niloticus, L. Tzavo, east of Witu.

12. Monitor albogularis, Daud. Taro plains.

13. Mabuia maculilabris, Gray. Ngatana.

14. Sepacontias modestus, Gthr. On the Athi plains, woodless grass-steppes; formerly known from Mpwapwa.

15. Latastia longicaudata, Reuss. Fuladoya.

16. Chamæleon roperi, Blgr. Taro plains, Ukambani.

17. Chamæleon bitæniatus, Fisch., = *Chamæleon hoehnelii*, Steind. Kibibi Basin, Elmeteita Basin, Gopo lal Maru (June 9), Guaso Laschau.

18. Rhampholeon kerstenii, Ptrs. Ndara, Teita Mountains, Matiliko (Aug. 3).

19. Typhlops punctatus, Leach. Mkonumbi, Guaso Narok and Guaso Nairotia in Leikipia, Tzavo.

20. Typhlops unitæniatus, Ptrs. Kibwezi.

21. Uriechis capensis, Smith. Steppes south of Tzavo.

22. Amblorhinus nototænia, Gthr. Eastern Ukikuyu.

23. Coronella olivacea, var. dumerilii, Gthr. Ngatana.

24. Dasypeltis scabra, L. Eastern Ukikuyu.

25. Rhagerrhis tritæniata, Gthr. Kibibi Basin.

26. Rhagerrhis oxyrhynchus, Rnhrdt. Taro Plains.

27. Psammophis sibilans, L. Coast-districts and Teita Mountains.

28. Psammophis biseriatus, Ptrs. Kurawa (coast-district).

29. Ahætulla neglecta, Ptrs. Mkonumbi.

30. Ahætulla punctata, Ptrs. Mkonumbi, Kurawa, Melindi.

31. Boodon lineatus, D. & B. Kapte Plains.

32. Lycophidium horstockii, Schleg. Camp at Kariti, Mkonumbi, near Fuladoya.

33. Leptodira rufescens, Gm. Coast-districts.

34. Dipsas obtusa, Reuss. Ngatana.

An Egyptian species, previously not known to extend so far southwards.

35. Causus jacksonii, Gthr. Ngatana, Mkonumbi.

36. Naja nigricollis, Rnhrdt. Leikipia.

37. Dendraspis polylepis, Gthr. Steppes south of the Kiboko River; found to live in holes of the sides of deserted termite-hills.

38. Clotho arietans, Merr. Valley of the Thika-thika.

AMPHIBIANS.

1. Bufo regularis, Reuss. Common everywhere.

2. Rana mascareniensis, D. & B. Kibibi Basin, north of Rangatan Ndari, Lamu Island.

3. Rana galamensis, D. & B. Mkonumbi.

Previously known from Senegambia.

4. Pyxicephalus delalandii, Tschudi. Kibwezi.

5. Chiromantis petersii, Blgr. Taro Plains.

6. Phrynomantis bifasciata, Smith. Mkonumbi.

7. Rappia concolor, Hallow. Guaso Nyuki near Njemps, alt. 3400 ft.

8. Megalixalus fornasini, Bianconi. Ngatana.

9. Dermophis thomensis, Bocage. Ngatana.

Previously known from the West Coast.

FISHES.

1. Protopterus annectens, Owen. Tidal creeks at Mkonumbi.

2. Oreochromis niger, sp. n. (Plate IX.)

$$\text{D. } \frac{17}{11}. \quad \text{A. } \frac{4}{9}. \quad \text{L. lat. } 29. \quad \text{L. transv. } \frac{4}{12}.$$

Teeth very small, indistinctly bicuspid, the inner cusp being much larger than the outer; about 45 teeth on each side of the outer series of the upper jaw. Scales below the eye in two series. In a specimen eleven inches long the diameter of the eye is less than the width of the præorbital, one half of the width of the interorbital space, and equal to the depth of the scaly portion of the cheek. The height of the body is contained twice and a third in the total length (without caudal), the length of the head one third. Pectoral fin extending to the anal; series of minute scales cover the rays of the caudal fin. Scales smooth. Greenish black; vertical and ventral fins and a spot on the operculum deep black.

Two specimens, of which the larger is 11 inches long, were obtained from pools on the Kibwezi River below its reappearance.

One of these two specimens has distinctly three series of scales on the cheek, but on one side of the head only.

Closely allied to *Oreochromis hunteri*, Proc. Zool. Soc. 1889, p. 70.

3. Chromis spilurus, sp. n. (Plate X. fig. A.)

$$\text{D. } \frac{15\text{–}16}{10}. \quad \text{A. } \frac{3}{8}. \quad \text{L. lat. } 30. \quad \text{L. transv. } \frac{4}{8+x \text{ small ones}}.$$

Teeth distinctly bicuspid, with the inner cusp broadest, brown at the tip, small, about thirty-six on each side of the outer series of the upper jaw. Scales smooth, those below the eye in two series. The diameter of the eye of a specimen $4\frac{1}{2}$ in. long is less than the width of the interorbital space, and more than the width of the præorbital or than the depth of the scaly portion of the cheek. Interorbital space flat. The height of the body is somewhat more than the length of the head, and contained twice and two-thirds or twice and a half in the total length (without caudal). The pectoral fin extends to or a little beyond the origin of the anal. Caudal nearly scaleless. Greenish, silvery on the sides; a blackish spot on the end of the operculum, and another on the side of the caudal peduncle, just below the upper profile and close to the root of the fin. Dorsal and caudal fins with blackish spots arranged in rows.

Several specimens were obtained from the Mwangaden River in N. Giriama; the largest is $4\frac{1}{2}$ inches long.

4. Clarias lazera, C. V. Ngatana.

A Nilotic species.

5. Eutropius depressirostris, Ptrs. Ngatana.

6. Clarotes laticeps, Rüpp. Ngatana.

Known from the Nile and West Coast.

7. SYNODONTIS ZAMBEZENSIS, Ptrs. Ngatana.

8. ALESTES AFFINIS, sp. n.

Allied to *Alestes imberi*.

D. 11. A. 18–19. L. lat. 21. L. transv. $\frac{5}{3}$.

The height of the body is one third of the total length (without caudal); the length of the head two sevenths. The origin of the dorsal fin is distinctly behind the base of the ventrals; pectoral reaching the ventral. Silvery, with an indistinct shining band along the side; a blackish spot behind the shoulder and another at the root of the caudal.

Three specimens, $3\frac{1}{2}$ inches long, were obtained at Merifano on the Tana River.

9. LABEO GREGORII, sp. n. (Plate X. fig. B.)

D. 14. A. 7. L. lat. 37. L. transv. $\frac{5}{5}$.

Mouth broad, crescent-shaped; lower lip thick and fringed with an inner fold which is covered with horny substance. Snout thick, produced, obtuse in front, much projecting beyond the lower jaw, without lateral lobe; maxillary barbel small, hidden in a deep lateral groove. Eye rather large, two sevenths of the length of the head, rather shorter than the snout, and somewhat nearer to the end of the snout than to the gill-opening. The length of the head is contained thrice and two thirds in the total length (without caudal), the depth of the body thrice and a half. Interorbital space broad, scarcely convex, its width being one half of the length of the head. There are four longitudinal series of scales between the lateral line and the root of the ventral fin. Upper margin of the dorsal fin oblique; anal extending to the caudal, the pectoral to the ventral. Greenish above, silvery on the sides and below.

One specimen, 5 inches long, was obtained at Merifano on the Tana River.

10. BARBUS TANENSIS, sp. n. (Plate XI.)

D. 12. A. 7 or 8. L. lat. 25. L. transv. $\frac{4\frac{1}{2}}{4\frac{1}{2}}$.

The osseous dorsal ray is strong, not serrated, its stiff portion being rather shorter than the head. There are one and a half longitudinal series of scales between the lateral line and the root of the ventral fin. Body compressed, its greatest depth contained twice and three fourths in the total length (without caudal). Head rather small, one fifth of the total length, measured to the end of the middle caudal rays. Snout of moderate length, with the upper jaw overlapping the lower, and with four barbels, of which the posterior reaches to the angle of the præoperculum. The diameter of the eye is two ninths of the length of the head and two thirds of that of the snout. Origin of the dorsal fin opposite to the root of the ventral and nearly midway between the end of the snout and the root of the caudal. Caudal fin deeply forked; pectoral extending to or nearly to the root of the ventral. Coloration uniform.

Numerous specimens were collected in the Thika-thika, in the Kibwezi River, below its reappearance, and in the Guaso el Narua. The largest specimens are fifteen inches long.

11. Barbus taitensis, sp. n.

D. 10. A. 8. L. lat. 31. L. transv. $\frac{5}{5}$.

The osseous dorsal ray is of moderate strength, finely serrated, and but little shorter than the head. There are two and a half longitudinal series of scales between the lateral line and the root of the ventral fin. Body compressed, its depth being equal to the length of the head and one fourth of the total length (without caudal). The diameter of the eye equals the length of the snout and is one fourth of the length of the head. The upper barbel is shorter than the lower, which is as long as the eye. Jaws of equal length. Interorbital space convex, wider than the eye. Dorsal fin about as high as the body, its origin being somewhat in advance of that of the ventral and equidistant from the end of the snout and from the root of the caudal. Fork of the caudal of moderate depth. Silvery, with a bluish band along the middle of the side, the band terminating in a small black spot on the root of the caudal fin.

I take this opportunity of describing this species here from two specimens which were collected at Teita by Mr. Wray, and of which the larger is only 3 inches long.

12. Barbus intermedius, Rüpp.

Previously known from Abyssinia. Adult specimens have the lower lip dilated into broad lobes, of which the median is divided from the lateral by a deep notch.

From the Rivers el Narua, Nyuki, and Kiroruma.

13. Anguilla bengalensis, Gray.

From the Thika-thika, Athi, and Tana Rivers.

EXPLANATION OF THE PLATES.

Plate VIII.

Bunocnemis modestus, nat. size. Fingers and toes enlarged.

Plate IX.

Oreochromis niger.

Plate X.

Fig. A. *Chromis spilurus.*
B. *Labeo gregorii.*

Plate XI.

Barbus tanensis.

February 6, 1894.

Sir W. H. Flower, K.C.B., LL.D., F.R.S., President, in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of January 1894.

The total number of registered additions to the Society's Menagerie during the month of January was 78, of which 30 were by presentation, 2 by birth, 34 by purchase, 4 by exchange, and 8 were received on deposit. The total number of departures during the same period, by death and removals, was 100.

Amongst these attention should be specially called to a young male Ounce, or Snow-Leopard (*Felis uncia*), obtained by purchase from Mr. J. S. Mackay, of Dunbar House, Kullu, Punjab, being the animal described in the letter from that gentleman read on the 7th of December last (see P. Z. S. 1893, p. 692).

Mr. Sclater called attention to a fine mounted specimen of the River-hog of Madagascar (*Potamochœrus edwardsi*) from the Tring Museum, lent for exhibition by the Hon. W. Rothschild, F.Z.S., and remarked that three distinct species of this well-marked Ethiopian genus (see Scl. P. Z. S. 1860, p. 301) of Suidæ were now known:—

1. *Potamochœrus africanus*, which is believed to range from the Cape throughout Eastern Africa up to Abyssinia, where it appears as *Nyctochœrus hassama* of Heuglin (Ant. u. Büff. Suppl. p. 7; et Fitz. Sitzungsb. Ak. Wiss. Wien, Bd. liv. Abth. i. p. 586).

2. *Potamochœrus penicillatus* of West Africa (well figured in Wolf and Sclater's Zoological Sketches, vol. i. pl. xxix.), which, as well as *P. africanus*, has been frequently exhibited alive in our Gardens (see List of Animals, 1883, p. 183).

3. *Potamochœrus edwardsi* (see P. Z. S. 1875, p. 64, pl. xii.) from Madagascar (at once known by its black under surface), of which a specimen is now before us.

Mr. J. T. Last, by whom the specimen exhibited had been obtained, had kindly furnished the following field-notes on this species:—

"Of the Wild Boars in Madagascar there are two, perhaps three, species. The largest (*Potamochœrus edwardsi*) is said to inhabit the upland forest regions; while a smaller species lives near the coast. I was told by Béfanátriki, an Antinosi king, that there is also another species, much shorter in body than the two mentioned above and of a white colour. I suggested to him that it might be a white hog run wild, but he insisted that it is not a 'kúsu' (domesticated pig) but a 'lambu,' 'lámbunála' (a wild boar). I cannot vouch for the truth of his statement because I have not seen the animal, but the king evidently believed in the information he was giving me.

"It is very difficult to say much about the habits and manners of the wild boars, the fact being that they are seldom seen alive by persons who are competent to observe them. I was nearly five years in Madagascar, and only once did I meet, as it were by accident, with a boar on his rambles; this was one morning about 7 o'clock, on some hills about 2000 feet or more above the sea-level, in the north part of Madagascar. Once again I met with it in South Central Madagascar, but this happened in the course of hunting.

"It must not be concluded that because wild boars are so seldom seen they are few in number—such is far from being the case. It is scarcely possible to go into any village, especially all along the west side of Madagascar, and not hear the natives complain of the havoc made by these animals. In the gardens, in the open country, and in the forest the wild boar makes himself busy, turning up the ground wherever he goes.

"During my stay in the Mújangá district I paid a visit to Katsépi, about lat. 15° 45′ S. I was here, travelling and roaming about all over the country, for several days—over bare hills, through dense forests, and across as rough a kind of country, full of holes and caves, as I have ever seen. The country everywhere showed that the wild boar existed there in great numbers—in fact, in no other part of Madagascar have I met with such abundant proofs of its prevalence; and yet all the while I was roaming about in this district I did not see one. The reason for this is that the boar is never about in the daytime. He has but one enemy—that is, man—and he has sufficient instinct to know that his enemy may come upon him at any time or place if he roams about in the daytime. He therefore, very wisely, sleeps all day, and in the evening, when all is quiet, starts out on his feeding-expeditions, and probably to meet his friends.

"Whilst out feeding there is but little that comes amiss to the wild boar; he may be said to be almost omnivorous. If he enters a garden he makes the greatest havoc possible; he can clear off any amount of young green rice and all sorts of garden-produce. The natives have the greatest difficulty in keeping him away. They make strong fences around their gardens, and often watch night after night to get a shot at their troublesome visitor; but he is generally more cunning and more patient than the man. At last, perhaps, the man, for some reason or other, will absent himself from the gardens for one night; he goes to look at them in the morning, but he is too late, the boar has had his revel and the gardens are spoilt. These remarks are simply the substance of a conversation I had with some men working for me, who live at Bára-máhamáî, in about lat. 13° 40′ S., and who had had their gardens destroyed in this manner.

"The wild boar can generally find something to eat in whatever kind of country he may be in. On the plains and open country (where there are no gardens to attack) he will turn up the ground in all directions, searching for various kinds of tubers, and I daresay he disposes of all grubs, insects, and other forms of animal-life which may happen to come in his way. In the forest he meets with an abundance of food—ripe fruit fallen from the trees, yam-like bulbs and tubers, the babu, valá, súza, and many others in plenty, just under the surface of the ground. In turning these out he may frequently come across the nests of mice, rats, or one of the many species of Tandrec. All these he is able to dispose of, and even snakes, it is said, do not come amiss to him.

"The wild boar does not leave his lair during the day unless he is disturbed by hunters or their dogs, and even then he is not in a hurry to move until he is close pressed. When undisturbed, he passes the day in sleep and in the evening resumes his search for food again.

"In almost every village of importance one or more of the natives know something of forestry. They keep a number of dogs, and with them spend a great part of their time in the bush. Here the dogs are trained in running down birds, especially the Crested Ibis (*Lophotibis cristata*) and the Striped Partridge (*Margaroperdix striata*), in treeing the Guinea-fowl (*Numida tiarata*), in searching the ground to find some of the various species of Tandrec, or, most important work of all, in hunting the wild boar.

"I do not think the natives are in the habit of hunting the wild boar simply from love of sport, they are generally too lazy to go hunting for the pleasure it should give; rather, when they do hunt, it is either for the sake of getting some animal food or else to rid themselves of a night visitor, which has been making a too-free use of the garden-produce.

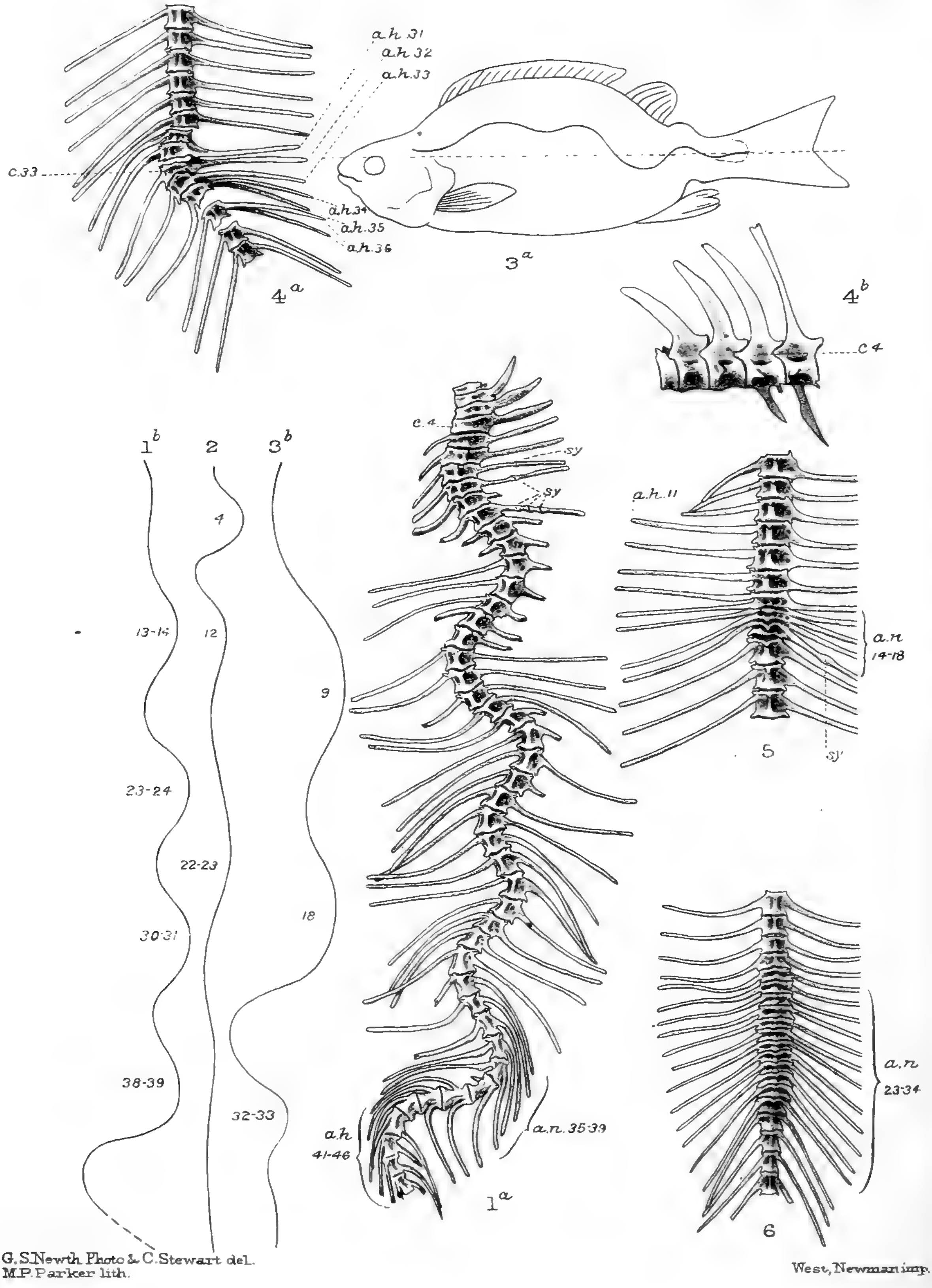
"In speaking of the range of the wild boar in Madagascar, I think I am correct in saying that there is no part of the island where it is not to be met with in numbers more or less. What I have already said shows that it is to be found on the elevated inland country as well as on the low-lying plains; that it makes its home in forest, bush, or holes, wherever it is convenient.

"These few remarks which I have been able to give concerning the wild boar are, I believe, applicable to that animal in all parts of Madagascar; but I must state that my own personal observations were confined to the west side and to the south central parts of the island."

Mr. Sclater exhibited a stuffed specimen of the White-billed Great Northern Diver (*Colymbus adamsi*) from Norway, fully adult, which had been forwarded to him by Prof. R. Collett, of Christiania, F.M.Z.S., in order to be figured in the 'Ibis,' and made remarks on the distribution of the species and on its interest as occasionally occurring on the British coast, as first recorded by him in 1859 (P. Z. S. 1859, p. 206)[1].

The following papers were read:—

[1] See also Seebohm, 'Zoologist,' 1885, p. 144; and Saunders, 'Manual of British Birds,' p. 695.



G.S.Newth Photo & C.Stewart del.
M.P.Parker lith.

West, Newman imp.

Synostosis & Curvature of the Spine in Fishes.

1. On Synostosis and Curvature of the Spine in Fishes, with especial reference to the Sole. By G. B. Howes, F.L.S., F.Z.S., Assistant Professor of Zoology, R. Coll. Sci. Lond.

[Received January 16, 1894.]

(Plate XII.)

A short time ago my pupil Mr. W. L. S. Loat placed in my hands for examination a backbone of the Sole (Plate XII. figs. 1 *a* and 1 *b*) which presents the unique abnormality of a quinque-recurrent curvature, such as I believe has never before been recorded. On turning to that rich storehouse of teratological material, the Royal College of Surgeons' Museum, for specimens which might throw light upon this extraordinary backbone, I have been so fortunate as to meet with facts which, while they show the Sole's vertebral column to be liable to a wide range of structural aberration, give us a clue to at any rate the determining cause of that form of curvature herein dealt with (*cf. infra*, p. 100)[1]. By a fortunate coincidence, two malformed backbones of this fish (figs. 4 *a* and 5) had been quite recently presented to that Institution by Prof. Bland Sutton; and to that gentleman, together with the Council of the College and my ever willing friend Prof. Chas. Stewart, I tender my thanks for permission to examine and report upon their specimens.

Mr. Loat's specimen was that of an old fish having an estimated length of from 9 to 10 inches, and 47 of its vertebræ were preserved, the terminal ones (? 3 in number) having been lost. The backbone of the normal Sole is straight, except for a feeble arching of its anterior 14–16 vertebræ[2]. In this example (fig. 1 *a*) it was, as already stated, thrown into a series of fixed sinuosities, five in number as reckoned by their vertices, a marked depression preceding the terminal one. All the vertebræ but the anterior 3 or 4 and that lying at the base of the second dip were more or less displaced in the vertical plane, and the minor details of the disturbance may be more readily gleaned from the accompaning figure (which is an accurate copy of a photograph) than expressed in words. There can be no doubt that the aberration was congenital, for the vertebral bodies (which were fully formed and independent throughout) conform in many cases to sections of a circle, owing to the adaptive modification of their articular faces.

More interesting, perhaps, than this is the condition of the arches, as is at once evident from the fact of the practical absence of any marked sinuosity of the contour described by their free ends. To

[1] "The causes producing congenital curvature of the spine are unknown," R. Coll. Surgeons' Descr. Cat. of the Teratological Series, 1893, p. 94.

[2] *Cf.* Cunningham, 'A Treatise an the Common Sole.' Plymouth: Marine Biol. Assoc., 1890.

take for example the hæmal ones, the 13th measures in total length 1 inch, the 18th $\frac{3}{4}$ of an inch, and the 23rd $1\frac{1}{16}$ inch. In the normal individual possessed of a straight backbone, the corresponding elements exhibit a progressive increase in length—here they have undergone an adaptive variation, whereby an approximately normal and regular contour of the creature's body was unquestionably maintained; and the extent to which, as the result of pure adaptation, this had been carried is most significant in the flexion to the utmost of certain of the posterior hæmals and neurals depicted in the sketch (*a.h.* 41–46, *a.n.* 35–39).

On comparison of as much of this skeleton as is preserved with the corresponding parts of a normal individual, an increase in vertical diameter proportionate to diminution in length becomes at once apparent. The total length of the vertebral column as it lies flexed is 6 inches, its actual length measured along the curves $7\frac{5}{8}$ inches, and its longest outstanding process, hæmal or neural, does not exceed $1\frac{1}{8}$ inch. I am in possession of one normal skeleton of identical proportions in which arches 25 to 28 are longer; and it would appear therefore more than likely that skeletal growth in the vertical plane was under rather than over the average in this remarkable individual.

Beyond this, the specimen bears no marked peculiarities not apparent in the accompanying figure. There was no co-ossification of parts, but the neural spines of vertebræ 7, 8, and 10 bear synostotic enlargements (*sy.*) indicative of preceding fracture. There was no lateral displacement of either the vertebral bodies or their associated arches, beyond a feeble irregularity of certain of the hæmal arches, not improbably due to shrinkage in drying.

The nearest approach to a similar condition to this which I have been able to find is that of a Perch in the Hunterian Series of the Royal College of Surgeons (figs. 3 *a* and 3 *b*). That, however, shows but three marked sinuosities, and the third of these, in contradistinction to that of the Sole, is accompanied by a displacement of the tail to the animal's left side[1]. Salient points of agreement with the Sole are, however, forthcoming in the otherwise non-sinuous contour of the animal's body, and in the fact that the shallowest spinal sinuosity is most nearly median and the deepest one posterior in position. The full number of vertebræ (viz. 42)[2] are present, and the detailed differences between the curvature of this animal's backbone and that of the Sole are sufficiently expressed in the accompanying illustrations (*cf.* figs. 1 *b* and 3 *b*).

As with the Sole, the approximation of the ends of the spinal column consequent on the curvature was accompanied by an increase in vertical diameter of the body, though to a greater extent than in that animal—for, while the greatest vertical diameter of a normal Perch (excluding its dorsal fin) is rather more than $\frac{1}{4}$th its

[1] There is in the College of Surgeons' collection an undissected Perch having a precisely similar curvature (No. 361 of the Catalogue cited). *Cf.* Postscript, p. 100.

[2] *Cf.* Günther, Introd. to the Study of Fishes, p. 53.

total length, in this specimen it is nearly $\frac{1}{3}$rd of that[1]. The hæmal and neural arches of this specimen are normal, except for a marked flexion forwards of the neurals numbering 20 to 24.

Another instance of curvature of the spine in the Sole, for which I am indebted to the Royal College of Surgeons, is that traced in fig. 2. This case differs most conspicuously from both the foregoing in the acuteness of the first two sinuosities, and in the fact that at each vertex there is a slight displacement to the left side, which in all probability involved the body as a whole. Except for the first eight neurals, which are very aberrant, the arches had so adapted themselves to the situation as to have maintained the normal regularity of contour of their extremities; and the only lesser detail worthy of remark here is the presence of synostotic enlargements[2] on the neural spines 9, 10, and 11.

48 vertebræ in all are present.

Synostosis of the vertebræ of fishes has been recorded by Erdl and Stannius[3]. While it is most generally regarded as confined to the opposite extremities of the spine, Owen has pointed out[4] that in *Pleuronectidæ* "a kind of sacrum is formed by such bony union of the bodies of the first two of the caudal series." Examination of a series of Pleuronectid skeletons will easily convince anyone that this is an inconstant feature.

The most important monograph on the subject is to be found among Hyrtl's classical contributions to the Vienna Denkschriften[5]. In a short preliminary communication which immediately preceded the aforesaid monograph, Hyrtl remarked[6] that "the number of co-ossified vertebræ is 2 to 6," and that "this synostosis takes place more frequently in the tail than in the trunk"—while, commenting on the probable ill effects of the malformation, he naïvely points out that diminution in flexibility is, at any rate in some cases, "obviated by the fact that the confluent vertebræ are not larger than the non-confluent ones, their length being so much reduced that the five coalesced vertebræ are not longer than one and a slight fraction of a non-coalesced one." In his second monograph he has described certain conditions to which this fascinating argument will not apply, for example that of a Codfish in which the six co-ossified vertebræ occupy a greater area than the two which precede them.

One of the aforementioned specimens which Prof. Sutton has

[1] Length $8\frac{3}{4}$ in., greatest vertical diameter $2\frac{5}{8}$ in.

[2] I have in no instance observed these on the hæmal side.

[3] By Stannius in *Amia* (Handb. d. Zootomie, Aufl. 2, Th. i. p. 21). His record of the fusion of "intercalary with true vertebræ" becomes one of synostosis of vertebral bodies, from Schmidt's discovery (Zeitschr. wiss. Zool. Bd. liv. p. 748) of the truly vertebral nature of the so-called inter-centra of this animal.

[4] Comp. Anat. of Vertebrates, vol. i. p. 42.

[5] "Ueb. Wirbelsynostosen und Wirbelsuturen bei Fischen," Wien. Denkschr. xx. 1862, pp. 95–110.

[6] Nat. Hist. Review, vol. ii. 1862, pp. 103–104.

recently deposited in the College of Surgeons' Museum is that of a Sole (of which vertebræ nos. 8 to 21 are unfortunately alone preserved) in which the co-ossification of the five vertebræ numbering 14 to 18 is closely approximate in condition to Hyrtl's first recorded examples. The co-ossified vertebræ (fig. 5) collectively occupy an area of less than two normal vertebræ; and in correlation with the compression which the former have undergone, their related arches, being approximated at their bases, form a series of radiating outgrowths. Except that the 18th neural spine bears a conspicuous synostotic enlargement (*sy.*), with signs of previous dismemberment, the remaining parts are normal.

More interesting than this specimen is that numbered 500 in the College of Surgeons' Catalogue (fig. 6). The vertebræ between and including the 6th and the 38th are in this case preserved, and special interest centres in the 12 postanal, which number 23 to 34 inclusive, and are very closely compressed although not co-ossified.

Except for the co-ossification of the right half of the 14th hæmal arch with the left half of the 15th, and an accompanying absence of the right half of the latter and total independence of the two halves of the former, the remaining vertebræ are in every respect normal; and as these correspond in detail with their numerical homologues in the normal column, there is little room for the supposition, which might at first present itself, that the compressed vertebræ are perhaps intercalary in nature.

The twelve compressed vertebræ are very dense, and the area which they collectively occupy is equivalent to that of the seven immediately in front of them. As compared with the specimen last described, they are in a much less compressed condition; and the feeble approximation of their arches amply testifies to this assertion. The most instructive feature of this specimen is the circumferential increase of the bodies of the compressed vertebræ over those of the rest of the column; and, in adaptation to the conditions imposed, the faces of the vertebræ (nos. 22 and 35) that immediately abut against the compressed series are sympathetically modified. At first sight these compressed vertebræ would appear to be in a condition of retarded growth, and to consist, bulk for bulk, of less osseous matter than a corresponding number of normal ones. When placed in the scale, however, they were found to be the heavier of the two[1]. It is clear from this that mere compression of bony structures over a given bodily area need not necessarily be accompanied by a diminution in bone-forming activity; and in the case under consideration the surplus material appears to have largely encroached upon the periosteal and intervertebral tissues. The arches remained free and did not participate in the excess.

The remaining specimen to which I would direct attention is

[1] ·660 grm. as compared with ·575 for the twelve next in order of succession anteriorly.

the second of the two furnished by Prof. Sutton. The entire column consists of 48 vertebræ, and its most noteworthy feature is a single flexion involving the 30th to the 35th of the series. These are so modified (fig. 4 *a*) as to form an arch, of which the 33rd (*c.* 33) is the keystone. The ventral compression of the 33rd vertebra of this specimen is more marked than that of any similarly modified vertebra with which I am familiar; and in accordance with this and the corresponding adaptive shelving of the anterior faces of the 34th and 35th, the succeeding vertebræ must in life have been disposed at a sharp angle to those in front of them.

It is characteristic of the specimens which I have thus far described that where sinuosity occurs synostosis is uneffected, but inasmuch as in the example now under consideration vertebræ nos. 31 and 32 (*cf.* fig.) are partially united, that so far bridges over the gap between the sinuous and compressed types. This union is seen to be the outcome of an extension of the right base of the 31st hæmal arch (*a.h.* 31), that structure, as it were, having welded together the two vertebræ. In correlation with this there have arisen a series of displacements involving only the right side, rendering it at first sight apparent that the 35th and 36th hæmal arches are double. This is in reality not so, for detailed analysis shows that the right half of the 32nd hæmal arch had become shifted back and confluent with the body of the 33rd vertebra, while the corresponding halves of the 33rd and 34th arches had become similarly shifted and co-ossified with the vertebræ (34th and 35th) next in order of succession behind. The two halves of the 36th hæmal had, in sympathy, but insignificantly united beneath the hæmal canal, and the right half of the 35th had entirely disappeared.

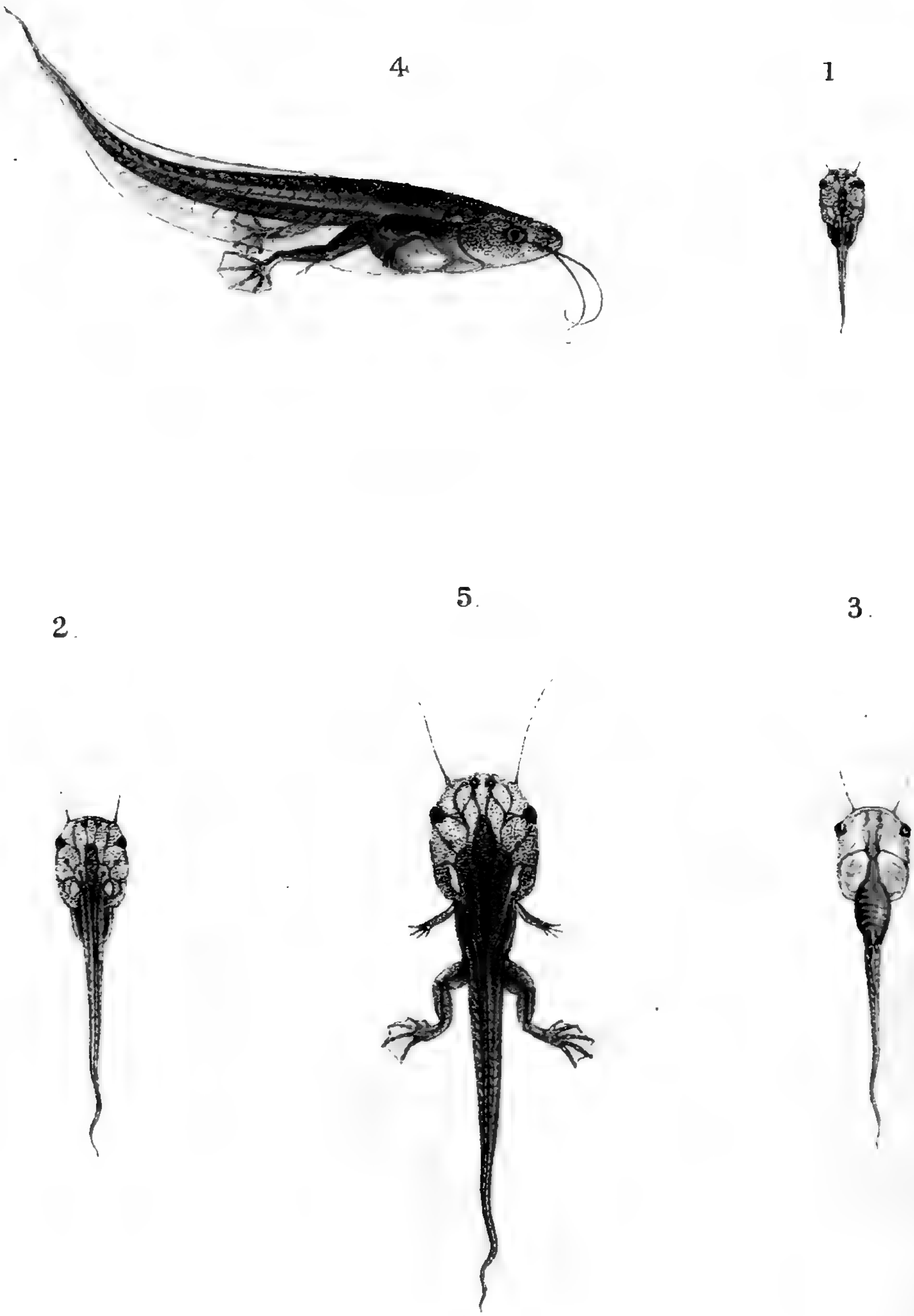
The arches of the remaining vertebræ of this specimen are normal; but those of the distorted region present, in addition to the features already described, an irregular lateral disposition, those of the 31st and 32nd especially being so modified as to conform in end view to the limbs of an S-shaped curve.

There can be little doubt that the synostoses, compressions, and sinuations afore described are, as Hyrtl surmised for the first-named, congenital in origin. As remarked at the outset (*ante*, p. 95), it is generally the custom to regard the causes producing congenital curvature of the spine as unknown. This may be so for lateral curvature, but concerning the vertical variety herein dealt with a consideration arises. The facts which I have recorded appear to me to point towards the conclusion that divergent as the conditions of sinuation and compression with or without co-ossification appear, they are in reality the opposite effects of one and the same disturbing influence; and, indeed, the indication of a sinuous arrangement in the compressed type (fig. 6) suggests that they are perhaps even more closely related. In both there results an approximation of the opposite spinal extremities, and, in relation to the vertebræ of each individually disturbed series, of the opposite faces of those which bound these. That the muscular rather than the skeletal system has been, as it were, at fault, is largely proved by the fact that there is no marked falling off in either the bulk or density of the latter where disturbance occurs; and the most logical conception of the determining cause seems to me that of an inequality of development, either in bulk or elasticity (and probably the latter), of certain muscles—those affected having either, as it were, lagged behind the skeleton or become fixed in a state of tonic contraction. If this be so, while approximation of the parts of the vertebral column stands out as the ultimate result of the disturbance, we may conveniently at least distinguish between the sinuous condition or approximation by *plecospondyly* [1] (figs. 1 and 3), and the compressed one or approximation by *sympiesospondyly* [2] (figs. 5 and 6).

The specimen last described is of interest in another connexion. Cunningham, in his monograph on the Sole (*loc. cit.* p. 39), gives 50 as the total number of vertebræ present, and points out that the first one "is rudimentary" and possessed of "two small dorsal processes which lie along the front edge of the base of the dorsal processes of the second vertebra, but do not unite to form a spine." There can be little doubt that these "dorsal processes" of the first vertebra are but a partially developed pair of neural arches—in the specimen under consideration they are reduced to absolute insignificance (fig. 4 *b*). This greater simplification of the first vertebra is the more interesting, as but 48 instead of 50 vertebræ are present, and as the well-defined characters which diagnose the 5th and 11th vertebræ of the normal spine are here realized by the 4th [3] and 10th.

P.S., March 1, 1894.—During the passage of these notes through the press, the College of Surgeons' Perch, No. 361 (*cf.* footnote, p. 96) has been dissected, thanks to the kindness of Prof. Stewart. The curvature of its backbone is, most interestingly, identical with that of figs. 3 *a* and 3 *b*, but of greater amplitude, as is expressed externally by a marked elevation of the trunk cephalad of the first dorsal fin. The vertebræ which mark its vertices number 7–8, 18, and 30. But 39 free vertebræ are present, and the displacement to the left side involves those numbering 20 to 35. Except for a feeble depression of the mid-dorsal region, the contour of the body is regular, and the arches, intermuscular bones, and associated parts are correspondingly modified.

[1] *πλέκειν*, to twist; *σπόνδυλος*, a vertebra.
[2] *συμπιέζειν*, to squeeze together.
[3] In this case on the left side only.



P. Smit del. et lith.

Mintern Bros. imp.

TADPOLES OF XENOPUS LÆVIS.

EXPLANATION OF PLATE XII.

Reference letters:—*a.h.*, hæmal arch; *a.n.*, neural arch; *c.*, vertebral body; *sy.*, synostosis. The small numerals indicate the vertebræ (or, where two occur, the intervertebræ) which form the vertices of the curves.

Fig. 1 *a*. *Sole*. Vertebral column with five sinuations. From the left side. $\frac{3}{4}$ nat. size.
1 *b*. *The same*. Lines of curvature.
2. *Sole*. Line of curvature of a backbone with three sinuations, and a feeble fourth one posteriorly. *R. C. S.* 364. $\frac{3}{4}$ nat. size.
3 *a*. *Perch*. Line of curvature of the backbone (with three sinuations), with contour of the animal's body in relation to it. *R. C. S.* 364. $\frac{1}{3}$ nat. size.
3 *b*. *The same*. Curvature, enlarged for comparison with 1*b* and 2. $\frac{3}{4}$ nat. size.
4 *a*. *Sole*. Portion of a backbone with curvature involving vertebræ nos. 30 to 35, with marked angulation of those posterior to them. $\frac{3}{4}$ nat. size.
4 *b*. *The same specimen*. First five vertebræ. × 2.
5. *Sole*. Portion of a vertebral column with vertebræ nos. 14 to 18 compressed and co-ossified. $\frac{2}{3}$ nat. size.
6. *Sole*. Portion of a vertebral column, with vertebræ nos. 23 to 34 compressed. *R. C. S.* 500. $\frac{3}{4}$ nat. size.

R. C. S. and the accompanying numbers refer to the 'Descriptive Catalogue of the Teratological Series in the Museum of the Royal College of Surgeons of England,' ed. 1893; and the specimens depicted in figs. 4 & 5 have been presented to that Institution by Prof. Sutton, but not yet catalogued.

2. Notes upon the Tadpole of *Xenopus lævis* (*Dactylethra capensis*). By Frank E. Beddard, M.A., F.R.S., Prosector to the Society.

[Received February 6, 1894.]

(Plate XIII.)

During the past summer one of the specimens of *Xenopus lævis* at the Society's Gardens deposited a quantity of ova, which duly hatched out. Ultimately a few frogs were bred from the tadpoles. I preserved a series of tadpoles from the newly-hatched larva onwards, partly in corrosive sublimate and partly with Perenyi's fluid; the following notes refer to my examination of those specimens. But, before proceeding to describe the external and a few of the internal characters of the tadpoles, I will briefly direct attention to previous work upon the subject.

The earliest description of the larva known to me is by the late Dr. J. E. Gray [1], a description which was subsequently [2] expanded and illustrated. The figure of the tadpole, showing the tentacles, does not show the dorsal fin, and is in other respects not good. In the definition of the tadpole (described as a distinct genus *Silurana*) we find the remark: "belly and underside of the

[1] "Notice of a new Genus (*Silurana*) of Frogs from West Africa," Ann. Mag. N. H. (3) xiv. p. 315.
[2] "Note on the Clawed Toads (*Dactylethra*) of Africa," P. Z. S. 1864, p. 458.

tail with a broad membranaceous fin continued to the end of the tail"—implying the absence of a dorsal fin. The next description and figures of the tadpole are to be found in the late Mr. W. K. Parker's memoir upon the Batrachian skull[1]. The dorsal and ventral aspects of the larva (*loc. cit.* pl. 56. figs. 1, 2) are very much better than the lateral view (*loc. cit.* pl. 56. fig. 3) which has been copied into the textbooks. This lateral view exaggerates the fish-like build of the larva, and even suggests armoured and extinct fishes. The dorsal and ventral fins, both of which are shown, are depicted as ceasing abruptly some way in front of the end of the tail, giving to it a totally undeserved "Chimæroid" look. There are, however, in the paper to which I refer some valuable notes upon the external characters of the tadpoles, as well as (of course) upon the skull-structure. The tentacles are correctly described, the absence of horny teeth noted, and the paired branchial orifices correctly located. On the other hand, as I shall show in the present paper, Prof. Parker was wrong in stating the absence of claspers beneath the chin.

Quite recently[2] Mr. Leslie has still further increased our knowledge of this Amphibian, though his notes with regard to the larva are only confirmatory of the results given in Parker's paper and are not wholly accurate, as I shall point out later, in the alleged absence of external gills.

The eggs laid in the Society's Gardens were deposited singly; no great masses of spawn like those of our Common Frog were found. Nevertheless I had a group of four or five adherent eggs brought to me. The eggs were laid some time in the evening of Saturday, May 27th, 1893; by Monday morning at 10 A.M. I had newly-hatched larvæ. The intervening Sunday prevented me from examining into the early stages of development. The rapidity with which the larvæ were hatched out is remarkable. At the Cape the breeding-season is early spring (August), but Mr. Leslie does not mention the period of time which elapses between the deposition of the ova and the appearance of tadpoles. The specimens which bred at the Gardens were some which Mr. Finn brought back with him from Zanzibar.

External Form and Colour.—The most remarkable point about these tadpoles is their extreme transparency. As will be seen from the accompanying drawings (Plate XIII.), the pigment is thinly scattered about, not obscuring the internal structure. The blood-vessels and even the nerves can be readily detected when the tadpole is examined alive. At first the tadpoles are in shape like those of the Common Frog; but on the third day, as Mr. Leslie correctly observes, the characteristic form of the more mature tadpole is acquired. The head and body become broader, and are not separated by a constriction as they are in the Common Frog. In

[1] "On the Structure and Development of the Skull in the Batrachia, Pt. II.," Phil. Trans. vol. 166 (1877), p. 625.

[2] "Notes on the Habits and Oviposition of *Xenopus lævis*," P. Z. S. 1890, p. 69.

the latter animal this constriction is due to a bulging of the body in the region of the pronephros. This bulging is less marked in the tadpoles of *Xenopus*. The dorsal fin commences just before the median occipital elevation begins to slope away posteriorly; the ventral fin commences just in front of the accurately median anus. The "abdomen" has a metallic glitter, and becomes much more swollen and relatively shorter in the later stages. The fins are continuous to the very end of the tail; there is no "Chimæroid lash" as depicted by Parker [1].

Habits.—The tadpoles generally rested in the water with the head downwards and the tail in constant wriggling motion. Whether this is connected with respiration or not I am unable to say. In any case I detected no special vascular supply or mechanism of any kind which might be related to such a function.

The food of the tadpoles consisted entirely of Cyprids, with which the tank, where they were housed, swarmed. Their intestines were invariably full of these Crustaceans and of nothing else. In spite of their purely carnivorous diet, the intestine was just as much coiled as in the common tadpole. The carnivorous diet, it should be remarked, was adopted from choice and not from necessity. There was plenty of water-weed upon which they could have fed. It is generally stated that the tadpole of the Common Frog is a vegetarian. It will, however, eat animal food, such as the dead bodies of its companions; it can also be compelled to take to a purely carnivorous regimen.

The following is a brief statement of the measurements and general characters of tadpoles at various stages.

Stage I.

Four specimens of the first stage were preserved in Perenyi fluid at 10 A.M. on May 29, *i. e.* 12 to 15 hours after hatching.

The total length of the tadpoles is after preservation 5 millim. Corresponding to tadpoles of same lengths figured by Marshall and Bles.

Stage II.

Preserved at 12 midday on May 30. Three individuals as nearly as possible of the same length, *i. e.* 7 millim. Corresponding more or less to 9 millim. in tadpole figured by Marshall and Bles. The relative proportions of body to tail are 2 : 3.

Stage III.

Preserved on June 1st. Length 8 millim. The form of the "adult" tadpole fully established. Length of body to that of tail as 3 : 5 [2].

[1] The appearance occurs, however, in spirit-specimens, owing to the clinging of the membranous fins to the solid part of the tail.

[2] The measurement of the body is taken to end of swollen abdomen, not to anus.

After this the tadpoles show a progressive and rapid increase in length. One of June 2nd was 10 millim., of June 5, 13 millim. A tadpole with fully developed hind limbs was 52 millim. long. A tailed frog (August 18) only 44 millim. The mature tadpole represented in the drawing (Plate XIII. fig. 4) is rather longer; it was not killed.

The *sucker* has been stated to be absent in *Xenopus*. This is not the case; I found it not only in the youngest stages, but in larvæ of 14 millim. in length; it gradually disappears, however, as the tadpole grows. An interesting point about the ventral sucker in this Amphibian is that it is a single structure apparently from the very first. It is certainly median and unpaired in the very youngest larvæ, which were 5 millim. in length. In larvæ of 7 millim. in length the chin sucker is exceedingly obvious, with a raised circular rim of a brown colour. The *circular* outline of the sucker in *Xenopus* contrasts with the *horseshoe-shaped* outline in the young tadpole of the Common Frog at the period when the two suckers have become fused. The coexistence of the suckers and the tentacles would seem to entirely disprove any possible homology between the two structures. In the youngest embryo at my disposal the sucker in transverse section occupied the whole of the ventral surface of the head, extending back to the level of the eyes. It is composed, as in *Rana*, of closely set elongated cells of a brownish colour. The cells converge upon the surface, so that in transverse sections through the head the cells are seen to be cut transversely and posteriorly, and to be covered by a layer of non-modified epidermis. The surface of the sucker at the centre is quite flat, and it stands out conspicuously beyond the surrounding integument. The cells of the sucker clearly belong to the outer of the two layers of the epiblast, into which they pass without any abrupt demarcation. In later stages the cells of the sucker get less and less unlike those of the surrounding integument. Prof. Parker's failure to find the sucker was due to the fact that his tadpoles were too old. I imagine that in tadpoles of such an age as those which he figures there would not be the least trace of these structures. It is curious, however, that Leslie makes no mention of them. He appears to have examined tadpoles of all ages, and in the youngest stages the sucker could hardly be missed if the tadpoles were examined with a hand lens.

Tentacles.—As is well known, this frog has a pair of long tentacles, which have been compared to those of a Siluroid fish [1]. These spring from the angles of the jaw just above the mouth. They get longer as the larva increases in size. More than once I have observed the tentacle of one side to be bifid. The earliest appearance of the tentacles is in the form of a little process of the integument as yet unconnected with the skull. I found the tentacles in this condition in two tadpoles preserved on June 2nd. In younger tadpoles than this I did not succeed in discovering any

[1] Perhaps better to the "nasal barbels" of *Myxine* and *Bdellostoma*.

trace of the tentacles. The tentacles in these tadpoles are in the form of a small process of the body connected with it by a narrower stalk; it is covered with a layer of columnar epidermis, and the interior is filled with a mass of dense tissue. It shows no resemblance to the sucker in its minute structure. A narrow rod of cartilage runs towards it from the ethmoid just above the joint where Meckel's cartilage articulates, but does not reach it. A slip of muscle is attached to the base of the rudimentary tentacle.

In a full-grown or nearly full-grown tadpole such as that displayed in the accompanying coloured drawing (Plate XIII. fig. 4) the tentacles are of considerable length, with a slender bar of cartilage running right along them as is figured by Parker (*loc. cit.* pl. lvii. figs. 1, 2, &c.). They are inserted so exactly at the angle of the mouth that they are deeply grooved by it. During life a blood-stream can be observed to pass along the tentacles. The histological structure is not in any way remarkable. Beneath the epidermis is a certain amount of pigment. The interior of the tentacle is taken up by a network of connective tissue. On that side furthest away from the body are two blood-channels lying side by side; the axis of cartilage is small relatively to the diameter of the tentacle. Mr. Boulenger, in a footnote appended to Mr. Leslie's paper quoted above, compares the tentacles to the "balancers" of *Triton* and *Amblystoma*. This can hardly be, if the latter are, as Mr. Orr states [1], the homologues of the external gills belonging to the mandibular arch.

Mouth-cavity and Pharynx.—In the newly-hatched tadpole (May 29) the mouth is only a depression not communicating with the gut; there are no gill-slits and no skull. On the following day the mouth was established. The most important fact with regard to the mouth-cavity has already been established by Parker and Leslie; that is, of course, the entire absence of the horny larval teeth. To confirm the absence of these characteristic structures by microscopical sections is not, perhaps, an altogether unnecessary piece of work. At no stage in the development of the tadpole of this frog did I succeed in discovering the least trace of the structures in question.

In tadpoles of May 31 some of the characteristic features of the mouth-cavity and pharynx are already obvious.

Just behind Meckel's cartilage is a deep recess of the mouth-cavity ventral in position; laterally this becomes a narrow slit, close to the cartilage, and appears to be the first visceral cleft, though I have not found any connection with the exterior. It differs from the succeeding visceral clefts in being directed more forwards, their inclination being at right angles with the longitudinal axis or oblique in the opposite direction. The first branchial cleft lying behind the hyoid arch is deep and narrow. It is at right angles to the longitudinal axis, whereas the succeeding

[1] "Notes on the Development of Amphibians, &c.," Q. J. M. S. 1889, p. 295.

clefts are slightly oblique. The epithelium which lines it differs on the anterior and posterior faces of the cleft. Anteriorly the epithelium, like that of the buccal cavity, is formed of low cells; posteriorly it is formed of tall columnar cells. These cells are continuous with the ventral epithelium of the pharynx, which has this character; the dorsal epithelium being low. This pharyngeal tract of columnar epithelium extends back over the whole of the branchial region, but suddenly stops short a little way in front of the origin of the lungs. This fact is perhaps incidentally of some little importance in view of the homology between gill-slits and lungs which was once urged. Had this modified tract of pharyngeal epithelium extended to the lung and into it, as into the hyoid and branchial clefts, the question might have been considered anew. It will be noted that the hyoid cleft differs much from the branchial clefts which follow in that the modified pharyngeal epithelium only lines its posterior surface. This cleft does not open on to the exterior.

In tadpoles of June 2nd (cut longitudinally and horizontally), in which the branchial basket was well developed with its vascular tufts, the hyoid cleft showed no traces of being a respiratory cleft and did not open on to the exterior either independently or by way of the other branchial cleft.

In a tadpole of June 5th, the opening of the hyoid cleft was effected. It has the form of a comparatively narrow tube, which, curving round shortly after its origin from the pharynx, opens into the first branchial cleft a long way from the opening of the latter on to the exterior.

Internal Gills.—The branchial arches, as in other Amphibia, fuse to form a basket-work, from the bars of which run cartilaginous processes which become tufted and form the so-called filtering apparatus. I observed the first traces of this filtering apparatus in tadpoles of May 31. These structures become later very vascular, and they must be respiratory in function, since no other internal gills are developed. In the Common Frog the tadpoles possess not only these "filters" but tufted internal gills. Messrs. Marshall and Bles [1], while admitting the vascularity of the filters, consider that, "as the blood is returned from them to the somatic veins, it is probable that they are not actively respiratory." They clearly must be in *Xenopus*, as there are no other gills.

External Gills.—As has been already mentioned, the tadpole of *Xenopus* is said by Mr. Leslie to possess no external gills. This statement is not quite accurate, though undoubtedly complex arborescent gills like those of *Rana* are not to be discovered. Messrs. Marshall and Bles have emphasized the fact, which has been rather slurred over, that the external and internal gills form a continuous series of structures. In 4–5 millim. long tadpoles of *Rana* "two pairs of external gills are present as backwardly-

[1] "The Development of the Blood-vessels in the Frog," Stud. Biol. Lab. Owens Coll. ii. 1890.

directed processes from the first and second branchial arches; they are somewhat conical in shape, with rounded or very slightly notched hinder borders." This description applies in the main to tadpoles of *Xenopus* of May 31st. The opercular fold is then only commencing to grow, and processes from the three first branchial arches just project beyond the line of the body. In the lax tissue lying in the interior of these processes is a capillary vessel derived from the vascular arch. The processes, however, are hardly conical in form; they have a long base of attachment, and are indeed rather to be described as lamellæ than processes.

Pronephros.—I carefully investigated the pronephros, but with entirely negative results so far as the discovery of anything of novelty is concerned. It is precisely like that of *Rana*, and opens into the body-cavity by three funnels opposite to its glomerulus.

Vascular System.—Messrs. Marshall and Bles have described with such minuteness the development of the heart and arterial system in *Rana temporaria* that a comparison with the corresponding stages of *Xenopus* becomes easy. It is very remarkable, as they point out, that the condition of the vascular arches should differ so much from that of the closely-allied *Rana esculenta*. In the latter, according to Maurer (quoted by Messrs. Marshall and Bles), the afferent and efferent branchial vessels are continuous with each other, forming complete arches. In one specimen of *Rana temporaria* the same continuity was noted, but as a rule the communication between afferent and efferent sections of the aortic arches was indirect through the branchial capillaries. In view of this difference between two species of one genus, the fact that *Xenopus* agrees with *Rana esculenta* is of less interest. In *Xenopus* it is quite easy to trace the four aortic arches from the heart to the dorsal aortæ.

The truncus arteriosus first divides into two branches (on each side); the posterior of these again divides into two, and a little later the vessel which is now the hindermost itself divides into two trunks; thus the four afferent branchial vessels arise. Messrs. Marshall and Bles figure (*loc. cit.* pl. xiv. fig. 6, A H) a short diverticulum of the truncus arteriosus lying in front of the fully-developed first branchial arch in tadpoles of 5 millim.; this they consider to be referable to the hyoid arch. It disappears soon. I find an entirely similar diverticulum of the first arch in *Xenopus* in a tadpole of 7 millim.; it was present on both sides of the body. In tadpoles of June 2nd there were only three vascular arches. The fourth arch, arising from the third, went straight to the lung.

EXPLANATION OF PLATE XIII.

Fig. 1. Tadpole of *Xenopus lævis* of June 5th.
Figs. 2, 3. Dorsal and ventral views of an older tadpole.
Figs. 4, 5. Lateral and dorsal views of a full-sized tadpole.

3. On some Remains of *Æpyornis* in the British Museum (Nat. Hist.). By Chas. W. Andrews, B.Sc., F.Z.S. (Assistant in the Geological Department).

[Received February 3, 1894.]

(Plates XIV. & XV.)

During the last two years several collections of vertebrate remains from Madagascar have been received at the British Museum. These include, in addition to the bones about to be described, portions of the skeleton of *Megaladapis madagascariensis* (a large lemuroid animal recently described by Dr. C. I. Forsyth Major (**8**)), and bones of a smaller species of the same suborder; *Hippopotamus* (? two species, both of small size); *Potamochœrus*; *Bos* (two species or varieties); *Haliaëtus* (? *vociferoides*); *Crocodilus robustus*; and a large *Testudo*. The localities in which these specimens were collected are all either in the centre of the island or at various points along the south-west coast. It will be convenient for purposes of description to take the remains from these two districts separately, the more so as it may hereafter be shown that the deposits in which the bones occur are of slightly different age. The reason for supposing that this may be the case is, that the species of *Hippopotamus* and those of *Æpyornis* from the centre differ from those occurring on the coast.

Remains of Æpyornis *from Central Madagascar.*

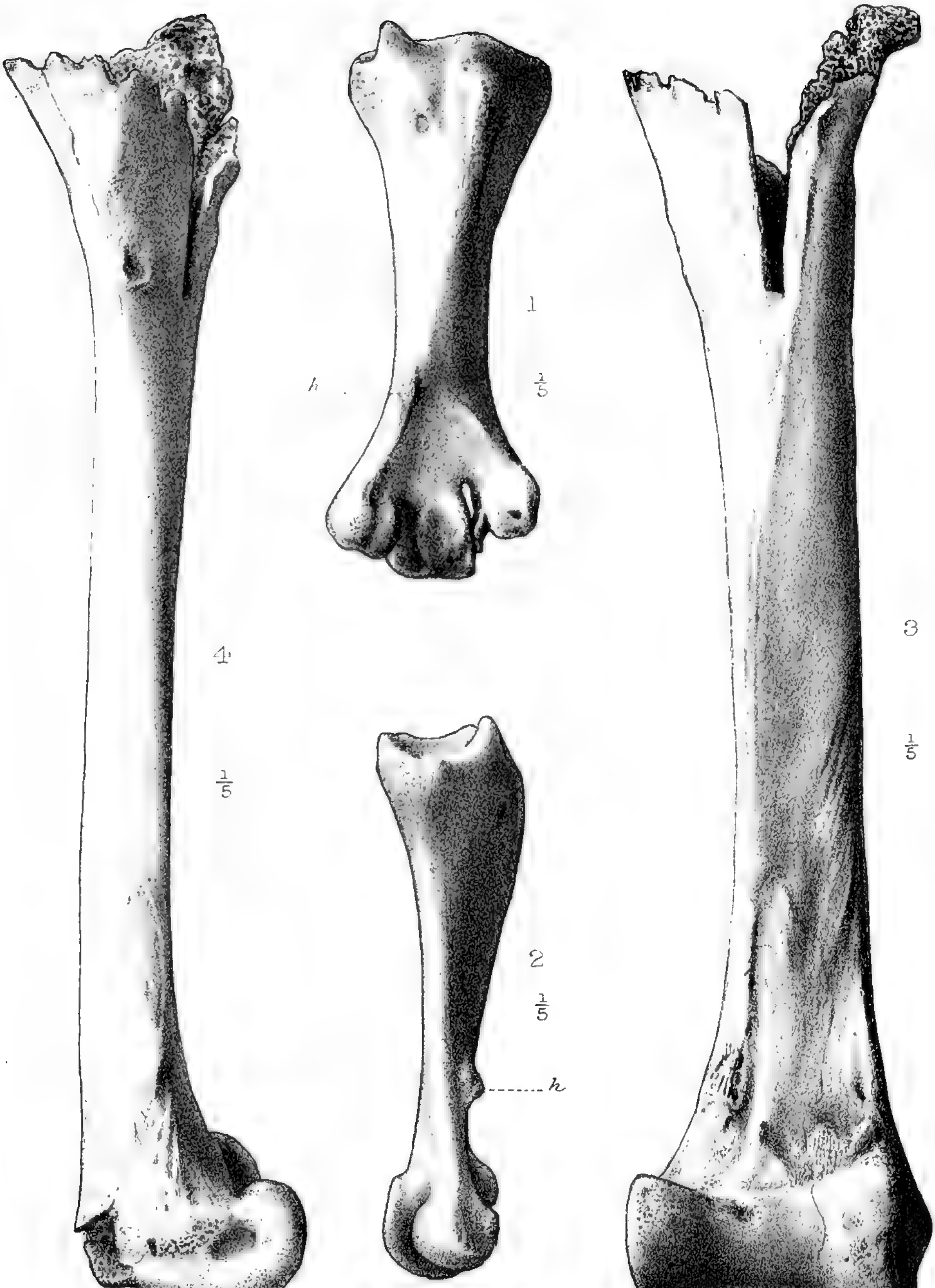
These are all from the neighbourhood of Sirabé, in the province of North Betsileo, situated on a plateau about 4000 to 5000 feet above the sea-level. In this district there are numerous hot springs, in the mud round which the bones are found. These are of a dark chocolate-brown colour, very heavy and brittle, and are impregnated with carbonate of lime, which forms crystalline masses in their cavities.

The portions of the skeleton represented are:—

(1) A complete right tarso-metatarsus.
(2) A nearly perfect right tibio-tarsus.
(3) Fragments of immature tibio-tarsi (of a large and small species).
(4) A first phalangeal of the inner toe of the left foot.

The *tarso-metatarsus* (Plate XIV. figs. 1 & 2) is very similar to that of *Æ. hildebrandti* figured by R. Burckhardt (**2**), but differs from it in size and in some points of structure. Its upper extremity is quite complete, so that it is possible for the first time to determine accurately the form of the talon and of the proximal articular surface.

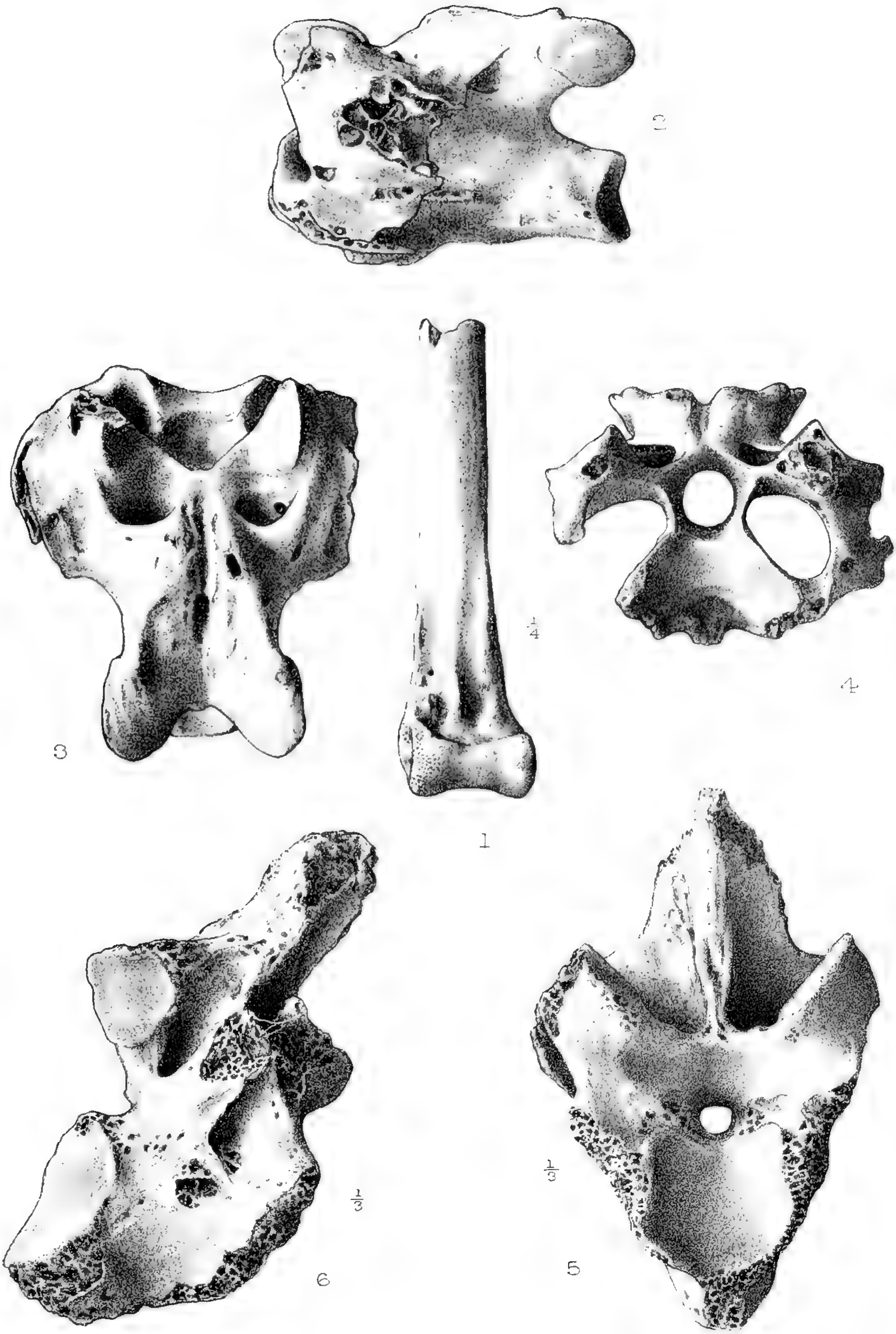
The dimensions of this bone are as follow; those of *Æ. maximus* and *Æ. hildebrandti* are given for comparison:—



E. C & G. M. Woodward del. et lith.

West, Newman imp.

Fossil Bones of Æpyornis.



E. C. & G. M. Woodward del. et lith.

West, Newman imp.

Fossil Bones of Æpyornis.

	Æ., sp.	Æ. *maximus*.	Æ. *hildebrandti*.
	cm.	cm.	cm.
Length	31·6	37·0 (?)	27·5
Width of proximal end	11·5		9·5
Width of distal end..............	11·9	14·5	10·0
Width of shaft at narrowest point	5·4	8·0 (?)	4·5
Circumference of shaft at narrowest point	13·6	20·0	11·0
Width of middle trochlea	4·7	5·2	4·3

At the proximal end the inner glenoidal cavity is the deeper of the two; it is oval in outline, the long axis being antero-posterior, and its front and hind borders are produced upwards into blunt points, of which the hinder is much the higher. The outer glenoidal cavity is shallow, and slopes down at its antero-external edge, where it has no well-defined border. These two cavities are separated by a surface, plane behind and slightly concave from side to side in front; there is no distinct median groove such as is said to occur in *Æ. hildebrandti*. There is no trace of an inter-condylar process. As in the other members of the genus hitherto described, the anterior surface of the shaft is deeply depressed in the middle line at the upper end, the depression dying away downwards, till a little above the trochleæ the bone is slightly convex from side to side. At the deepest part of the depression, about 5 cm. from the proximal end of the bone, the *foramina interossea* open. They are about 1 cm. apart and at the same level, thus differing from *Æ. hildebrandti*, where the outer is rather above the inner. Immediately below them there is a large rugose tuberosity for the insertion of the *tibialis anticus*. In the upper part of the outer surface is a rather broad groove passing obliquely from the anterior face to the posterior, where it dies away. The *talon* consists mainly of a broad blunt ridge, continuous with the upper end of the middle metatarsal and lying slightly to the outer side of the middle line. Internal to this is a broad, short, and very shallow groove, bounded internally by a low blunt tubercle lying immediately above the inner interosseous foramen.

The lower part of the posterior surface closely resembles in general appearance that of *Æ. hildebrandti*, but is remarkable from the fact that it shows a distinct trace of the presence of a hind toe. Although several authors state that *Æpyornis* possessed four toes, I am not aware that any trace of the presence of a hallux is to be found in any specimen described till now. On the postero-internal surface, about 9 cm. above the distal end of the inner trochlea, is a bony projection, measuring 3 cm. from above down, and 1 cm. from side to side; it rises to a height of about

1 cm., but the summit is broken away. This projection occupies just the position of attachment of the hallux in such birds as possess one, and it may represent the ligament by which the hind toe was attached ossified from age.

The trochleæ are large and are arranged along a slightly curved line. The middle one is broadest and projects beyond the others; its sides are deeply concave and its articular groove only very slightly oblique to the long axis of the bone. Of the other two, the inner is the smaller, but projects slightly beyond the outer. There are no projections at the lower end of the channel for the tendon of the adductor of the outer digit, such as are figured in the tarso-metatarsus of *Æ. hildebrandti.*

In both the present specimen and in that described by Burckhardt (2) the width of the distal end is greater, in proportion to the least circumference of the shaft, than it is in the tarso-metatarsi from the coast.

The *tibio-tarsus* is complete except the postcondylar processes, which are broken away. The bone on the whole resembles that of *Æ. hildebrandti*, but differs from it in size and in some other respects. The dimensions are:—

	Æ., sp.	*Æ. maximus.*	*Æ. hildebrandti.*
	cm.	cm.	cm.
Length	57·5	64·0	48·0
Width of distal end	10·0	13·5	8·2
Width of shaft at narrowest point	5·0		
Circumference of shaft at the same point	14·0	15·5	11·0

It will be seen from the above table that the tibio-tarsus, like the tarso-metatarsus, is intermediate in size between the corresponding bones of *Æ. maximus* and *Æ. hildebrandti*, and it is also rather longer in proportion to the tarso-metatarsus than is the case in *Æ. hildebrandti.* The antero-posterior flattening and the curvature of the shaft, which are characteristic of the genus, are well marked. The distal articulation fits exactly into the proximal one of the tarso-metatarsus above described, and there is no doubt that the two bones belong to the same species, if not to the same individual. The median ridge between the condyles figured in the tibio-tarsus of *Æ. hildebrandti* (2) is here wanting. The cnemial crest is moderately developed and rises a little above the proximal articular surface. On the upper outer surface of the ectocnemial crest is a foramen, probably pneumatic, the exact size of which cannot be determined, its edges being broken away owing to the thinness of the bone at that point.

It seems possible that these bones must be referred to *Æ. mulleri*, a species recently named by Milne-Edwards and Grandidier (4), but till a description and further measurements of the limb-bones are published it is impossible to be certain. The tibio-tarsus is, however, slightly smaller, and the tarso-metatarsus slightly larger, than those of which the above-mentioned authors give the dimensions.

At first it appeared possible that these bones might be referred to *Æ. medius*, Milne-Edw. & Grand., since the femur on which that species is founded is, like the bones in question, intermediate in size between the femur ascribed to *Æ. maximus* and that of *Æ. hildebrandti.* Closer examination, however, renders it evident that the femur referred by Milne-Edwards and Grandidier to *Æ. maximus* is too large in proportion to the metatarsus on which that species must be regarded as based, and that it probably belongs to the larger form described below under the name *Æ. titan.* On the other hand, the type of *Æ. medius* agrees fairly well in relative size with the other limb-bones of *Æ. maximus* and may belong to that species. If this is the case, then the name *Æ. medius* becomes a synonym, and, as was remarked above, the remains here described must be referred to another species, possibly *Æ. mulleri.*

The phalangeal bone appears to be the first of the inner toe of the left foot. It measures 5·1 cm. long; 2·7 cm. from side to side and 2·4 cm. from above downwards at the proximal end; 2·4 cm. from side to side and 1·7 cm. from above downwards at the distal end. The proximal articular surface is slightly concave; its upper and outer borders are convex, the inner flat and the lower concave. It is more compressed from above downwards than the corresponding bone of *Dinornis*; and its distal articular surface, the groove of which does not extend on to the dorsal surface, is rather wider in proportion to the length. The shortest vertical diameter is 1·1 cm.

Remains of Æpyornis *from the South-west Coast.*

The chief localities in which these were collected are Itampulu-Vé, near Murderers' Bay, and Amboulisatra.

All the bones present a very fresh appearance, and some have evidently been rolled on the beach. At least three species are represented, ranging in size from a form much larger than *Æ. maximus* to one which is probably identical with the *Æ. modestus* or the *Mullerornis agilis* of Milne-Edwards and Grandidier (4). The specimens include more or less perfect femora, tibio-tarsi, tarso-metatarsi, a fibula, several vertebræ, and a fragment of a pelvis.

In the collection from Itampulu-Vé occur some tibio-tarsi and femora of gigantic proportions; some of these have already been briefly noticed in the 'Geological Magazine,' January 1894, where they are referred to a new species, *Æpyornis titan.*

There are two specimens of the tibio-tarsus, right and left

(Plate XIV. figs. 3 & 4), both unfortunately incomplete at the upper end. The dimensions of these bones are:—

	Æ. titan.	*Æ. maximus.*	*Æ. hildebrandti.*
	cm.	cm.	cm.
Length	80·0	64·0	48·5
Width of distal end	17·0	13·5	8·2
Width of shaft at narrowest point	7·5		
Circumference of shaft at narrowest point	20·7	15·5	11·0
Shortest antero-posterior diameter	4·5		

The shaft is slightly curved, the inner border being concave. The flattening of the lower part of the anterior face, characteristic of the genus, is here more strongly marked than in the other species, and extends rather farther up the shaft. This flat surface is bounded on either side by a ridge, that on the inner side being the stronger; these sharply separate the anterior from the lateral surfaces, which with the posterior form a continuous curve from side to side, rather flattened behind, especially towards the lower end of the bone. The lateral surfaces are also flattened and rough in the same region. A *linea aspera* runs obliquely across the upper part of the anterior face from the procnemial crest to the inner border, which it reaches about 32 cm. above the lower end of the bone. In the other species of *Æpyornis* of which the tibio-tarsus is known, as well as in *Dinornis*, this ridge takes a more longitudinal course and only reaches the inner border a little above the condyles. Immediately above the latter is a short ridge running up the face of the bone and having at its lower end a rugose tubercle. Between this ridge and the inner border is the groove for the extensor tendons of the digits, deep at its lower end and dying away as it is traced upwards. As in the other species there is no ossified extensor bridge. About 2·5 cm. above the outer condyle is a large foramen for the passage of a blood-vessel into the bone.

The condyles have the form characteristic of the genus. The inner is the larger and projects more forward. The intercondylar surface is only slightly depressed and, though faintly convex from side to side, does not form a distinct ridge between the condyles such as is figured by Burckhardt in *Æ. hildebrandti.* The lateral surfaces of the condyles have very deep pits for the insertion of ligaments, that in the outer being 2·5 cm. deep. Behind these pits are large rugose tuberosities. The surface for the fibula closely resembles that of *Æ. maximus.*

The wall of the bone is very hard and compact, and is about

1 cm. thick in the middle of the shaft, where the spongy bone is wanting; above and below this point the wall becomes thinner and the bony network more developed.

A left *fibula*, broken at the lower end, probably belongs to the same species. It is compressed from side to side to a rather greater extent than the fibula of *Dinornis*, and consequently its surface for articulation with the femur is narrower. The tuberosity for the insertion of the *biceps cruris* is very strongly developed, and the distance from it to the upper end of the bone is 19 cm. The greatest antero-posterior width of the upper end is 7·5 cm.; the width of the articular surface from side to side is 2·7 cm.

A very imperfect proximal end of a left *tarso-metatarsus*, from the same locality, measures 17·5 cm. across and probably belongs to *Æ. titan*.

Among the *femora* that are provisionally referred to the same species, there is one (figs. 1 & 2, *a*, pp. 114, 115) from the left side nearly complete, wanting only the upper end of the trochanter and some portion of the condyles. Its dimensions are:—

	Æ. titan.	*Æ. maximus.*	*Æ. hildebrandti.*
	cm.	cm.	cm.
Approximate length..............	41·0	32·0 (? true length)	
Circumference of the shaft at the narrowest part	27·3	27·0	15·8
Width from side to side at the same point	9·2	9·1 [1]	5·0
Width of distal end (approximate)	21·0	19·0 (?)	10·0

The neck is short and thick, measuring 23 cm. in circumference; its anterior surface is very rugose. The trochanter is very massive; its smooth upper surface for articulation with the anti-trochanter of the ilium slopes steeply upwards and outwards from the neck, widening rapidly, and it must have risen considerably above the head, but the upper end being abraded it cannot be determined to what extent this was the case. The anterior surface of the trochanter does not appear to have projected forward so much as in *Dinornis*.

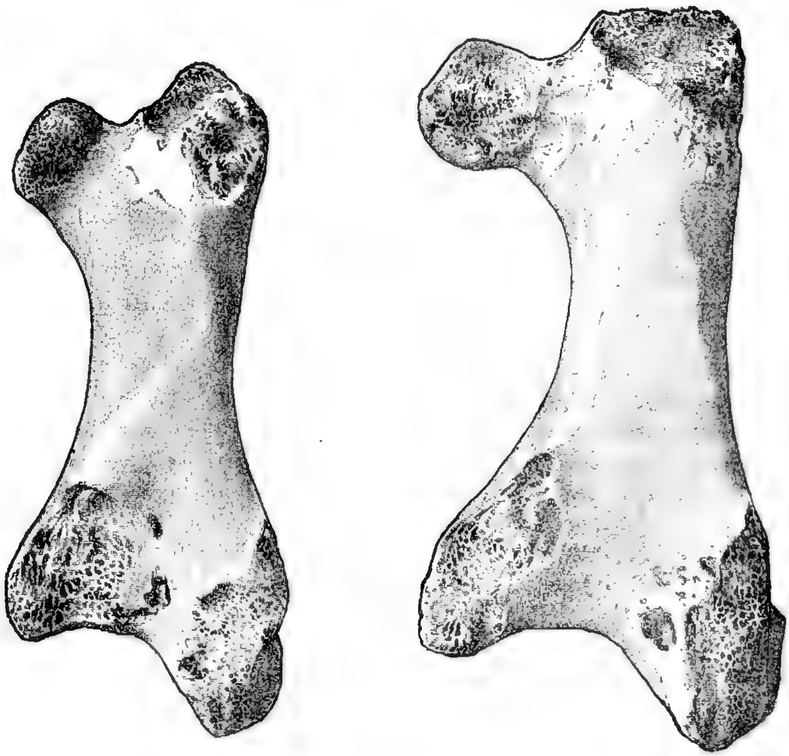
On the posterior surface near its junction with the neck is a large pneumatic foramen, the edge of which is unfortunately broken, so that its size cannot be accurately determined. This opens into a wide thin-walled passage, measuring 3 cm. from side

[1] This measurement is taken from a cast in the British Museum.

to side and 1·5 cm. from before backwards, which passes down to about the middle of the shaft, where it terminates in the bony reticulum with which the bone is nearly filled. This pneumatic foramen, though present in most Ratites, is entirely wanting in *Dinornis* and *Apteryx*.

The shaft is narrowest about 12 cm. below the upper surface of the neck, where it is oval in section, the short diameter being antero-posterior. Below this point the flattening increases, and just above the condyles the anterior surface is only slightly convex from side to side.

Fig. 1.



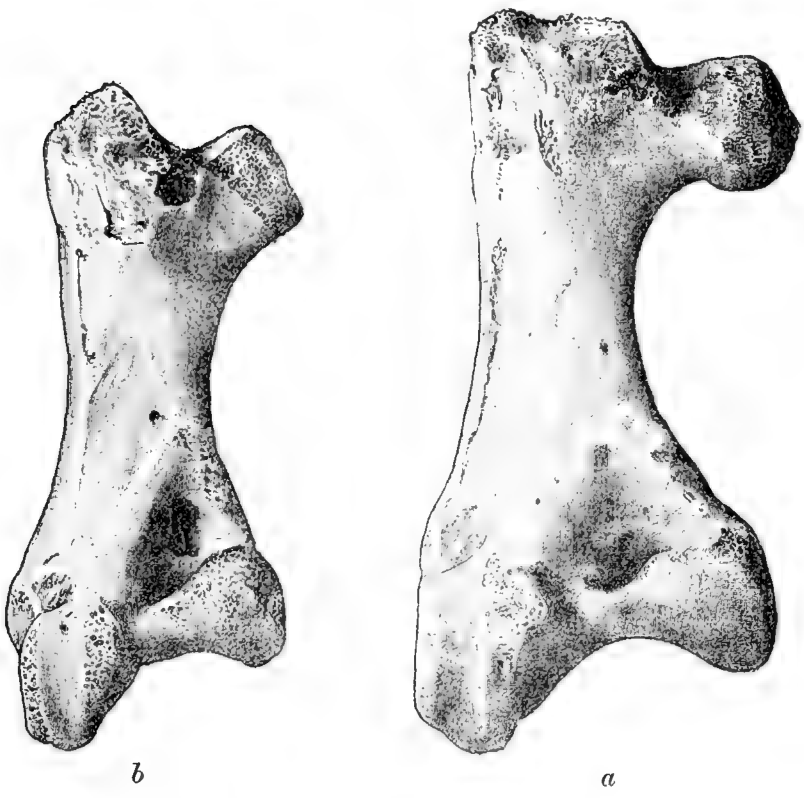
b a

a. Left femur of *Æpyornis titan* (?), from front.
b. „ „ *Æpyornis* (?), from front.
Both ⅓ nat. size.

The popliteal fossa is large and triangular in shape, its lower border being formed by the inner condyle and a strongly projecting rounded intercondylar ridge, the inner by a rough ridge terminating above in a blunt tubercle, while its outer boundary is not well defined, since the floor of the fossa slopes gently up, passing imperceptibly into the posterior face of the shaft. Into the popliteal fossa several pneumatic foramina open, the largest measuring 7 by 5 mm.

The condyles, which are very massive, are broken away in front; the outer projects considerably below the inner. Their lateral surfaces are concave and rough. The intercondylar fossa is scarcely perceptible and the surface for the fibula is narrow.

Fig. 2.



a. Left femur of *Æpyornis titan* (?), from behind.
b. „ „ *Æpyornis* (?), from behind.
Both $\frac{1}{3}$ nat. size.

In some of the broken femora referred to *Æ. titan* the internal structure can be well seen. The wall of the bone is very compact and hard, and in the middle of the shaft it is 7 mm. thick. The central cavity is very small, the bone being almost entirely filled with a complex bony reticulum, the meshes of which are for the most part more or less rectangular. If we compare this structure with that found in *Struthio* and *Dinornis*, we find in each case great variations, but of a different kind.

In *Struthio* the central cavity of the femur is large and smooth-walled for about 6 cm. in the middle of the shaft, the cellular bone being there absent. Above and below this it increases in quantity, narrowing the cavity of the shaft and completely filling the ends of the bone. As in *Æpyornis* there is a large pneumatic foramen on the posterior surface about the level of the neck, and also several smaller ones opening into the popliteal fossa.

In the larger species of *Dinornis* the central cavity of the shaft is small. This, however, is not owing to the development of the bony reticulum, but to the great thickness of the walls, which appear to consist of an outer hard compact layer and an inner much thicker layer of soft bone, the innermost portion of which alone is honeycombed so as to form the bony network. The solid wall of the shaft of a femur 31 cm. long measures 2 cm. in thickness. As in *Apteryx* there are no pneumatic foramina, and the cavity of the bone must have been filled during life with marrow.

In the same collection there is another nearly complete femur (figs. 1 & 2, *b*), rather smaller than the one just described, and differing from it so much that it will probably be found necessary to refer it to a different genus.

Its measurements are:—

	cm.
Approximate length	38·0
Diameter of shaft from side to side at narrowest point	8·5
Circumference at the same point	24·7
Approximate width of distal end	16·5
Circumference of neck	20·0

It is therefore evident that the proportions of this bone are different from those of the femur referred to *Æ. titan*. Thus, if the length be taken as 100 in the two cases, then in the present specimen the width of the distal end will be approximately 43·4, while in *Æ. titan* it will be 51·2. Similarly, if the least circumference of the shaft be taken as 100, then the proportionate width of the distal ends will be 66·8 and 76·9 respectively.

The chief points other than size in which this femur differs from that referred above to *Æ. titan* are:—

(1) The trochanter is much less massive.
(2) The head and neck, instead of projecting at right angles to the long axis of the bone, are turned somewhat upwards.
(3) The middle of the shaft is roughly quadrate in section, owing to the flattening of the outer, inner, and posterior surfaces.
(4) As was shown above, the distal extremity is proportionately less massive.
(5) The popliteal fossa has a high outer border, formed by a rounded ridge running fron the outer condyle to the tuberosity at the upper angle of the fossa.

(6) The rotular surface is very broad and flat, and makes an angle of about 90° with the inferior intercondylar surface instead of passing into it by a gentle curve.

The intercondylar fossa is slightly marked. The upper pneumatic foramen is present as in *Æ. titan*, and, the floor of the popliteal fossa being broken away, it can be seen that the inferior foramina opened into a large air-chamber. There is also a pneumatic foramen about the middle of the rotular surface, which is not found in *Æ. titan*. The nutritive foramen on the posterior surface of the shaft is single, in the femur above referred to *Æ. titan* there are two; but since this is not the case in some of the more imperfect femora belonging to the same species, it is merely an individual variation.

This femur may possibly belong to *Æ. maximus* or to either of the recently named species, *Æ. cursor* and *Æ. lentus* (4). In any case, as was remarked above, the differences between it and the femur referred to *Æ. titan* appear to be of generic value; and if this be so, then there is evidence of the existence of a third genus, since the recently named *Mullerornis* seems to include only slender forms of comparatively small size.

Until, however, it is definitely known whether the femur of the type species of *Æpyornis* resembles that of *Æ. titan* or the one just described it would be imprudent to establish a new generic name. The evidence necessary for the decision of this question is probably in the hands of MM. Milne-Edwards and Grandidier, and a full description and figures of the magnificent collection recently briefly noticed by them, especially of the skulls and sterna, will be anxiously awaited.

From the same locality there are several fragments, including the distal ends of three tibio-tarsi, which appear to belong to *Æ. maximus*. A right tarso-metatarsus with the upper end above the interosseous foramina broken away may also be provisionally referred to the same species; it is, however, slightly smaller, measuring 6·3 cm. across the narrowest part of the shaft in comparison with 6·9 cm. in *Æ. maximus*. If *Æ. medius* should be found to be a distinct species, this bone may possibly belong to it. In form it closely resembles the tarso-metatarsus of *Æ. maximus* figured by Milne-Edwards and Grandidier (3), and, like it, differs from the tarso-metatarsi from the centre of the island mainly in the fact that the shaft contracts from side to side above the trochleæ more gradually and to a slightly less extent [1].

From Itampulu-Vé and Amboulisatra are several portions of the skeleton of a much smaller form, possibly that recently named *Mullerornis agilis* by Milne-Edwards and Grandidier (4). These include the distal ends of several tibio-tarsi (Plate XV. fig. 1), which closely resemble the same bone of the larger forms in their

[1] This specimen may belong to the species recently named *Æ. cursor* by Milne-Edwards and Grandidier.

articular region, though the shaft presents considerable differences. These are:—

(1) The flattening of the lower part of the anterior surface is less marked.
(2) Above the flattened region the shaft contracts somewhat suddenly in width, becoming at the same time oval in section.
(3) The groove for the extensor tendons of the digits is somewhat deeper than in *Æ. maximus*, the ridge on its outer side being more strongly developed, while its inner border rises into an elongated blunt tuberosity, 2·5 cm. in length from above downwards, its lower end being about 3 cm. above the inner condyle.
(4) Judging from various fragments, the whole tibio-tarsus appears to have been of much more slender proportions than in the larger forms; it probably measured about 50 cm. in length [1], or rather more than the tibio-tarsus of *Æ. hildebrandti*, the other dimensions of which are considerably greater than the corresponding ones of this bone.

The other chief measurements are:—

	cm.
Width of distal end	7·5
Diameter of shaft from side to side at narrowest point	3·2
Circumference at the same point	8·7

The most nearly complete specimen of the smaller femora unfortunately wants the entire trochanter and inner condyle, while the head and outer condyle are much abraded. From the upper surface of the head to the lower end of the outer condyle, measured along a line parallel to the long axis of the bone, the length is 24·5 cm.; a similar measurement of the femur of *Æ. titan* gives 40 cm. The circumference of the shaft at the narrowest point is 13 cm., while that of the femur on which *Æ. modestus* is founded is given by Milne-Edwards as 12 cm.; two other femora in this collection measure 11·5 and 12 cm.

The bone is much compressed from before backwards, and the upper portion of the anterior face is very flat. The popliteal fossa is shallow and its borders less strongly defined than in the larger forms.

The wall of the bone is compact and thin, but, unlike the larger femora, the cavity is large, since the bony reticulum is little developed.

In the collection from Itampulu-Vé there are several nearly complete vertebræ belonging to a large and a small species. The smaller vertebræ include a nearly complete cervical, a cervico-dorsal, and two dorsals.

[1] The actual length of the tibia of *Mullerornis agilis* is 44 cm.

The cervical (Plate XV. figs. 2, 3, 4) is of the following dimensions:—

	cm.
Length of centrum	4·1
Width between anterior ends of pre-zygapophyses	2·5
Width between outer edges of post-zygapophyses	2·6
Diameter of neural canal	1·0
Longest diameter of anterior end of vertebrarterial canal	1·4

The centrum is much compressed from side to side in its middle portion, but widens out towards the ends. The articular surfaces are of the characteristic avian form; the anterior is wide from side to side and narrow from above downwards, owing to its upper and lower borders being deeply concave; the posterior is slightly wider than high and all its borders are concave, the lower deeply so. On the ventral surface of the centrum, about one third of its length from the anterior end, is a median hæmapophysis, the front of which rises steeply, while its hinder border passes by a more gradual slope into a median ridge which runs back for about 1·5 cm. in the middle ventral line. There is no pneumatic fossa in the side of the centrum.

The lateral portions of the neural arch are remarkably thin. The diapophyses and parapophyses are well developed, and, on the left side, the fused cervical rib is nearly complete, only its hinder portion being broken away. The vertebrarterial canal is very large, much larger, indeed, than the neural, a condition not occurring in the living Ratites or, to the same extent, in *Dinornis*. The interzygapophysial bar has behind and beneath it a pneumatic fossa, and above and in front of it on the dorsal surface, immediately behind the anterior zygapophyses, there is a still larger fossa into which several pneumatic foramina open. On the upper surface of the post-zygapophysis, near its outer hinder border, is a small tubercle (hyperapophysis), from which there runs forwards and inwards a ridge which increases in size as it goes; this does not meet its fellow of the opposite side to form a median neural spine, but is separated from it by a groove, which is shallow in front but deepens suddenly behind, forming a pit for the intervertebral ligament.

The cervico-dorsal vertebra differs from the one just described in possessing a broader and less compressed centrum, into the sides of which open a pair of large pneumatic fossæ. The arch also is more massive and the ridges running forward from the post-zygapophyses very much higher and broader; as in the cervical, however, they do not unite to form a median neural spine. The pneumatic fossæ of the arch closely resemble those of the cervical vertebræ. The parapophyses and diapophyses have smooth articular surfaces for the free rib.

The smaller dorsal vertebræ are very similar to the larger ones, and since the latter are the more complete they will be here described, though measurements of both will be given.

Of the two fairly complete large dorsals the one (Plate XV. figs. 5 & 6) which appears to be the anterior gives the following measurements:—

	cm.
Length of centrum	7·5
Approximate height from ventral surface to top of neural spine	22·0
Width of centrum in middle	5·0
Diameter of neural canal from side to side	1·5

The centrum, which is slightly compressed, is produced ventrally into a hæmapophysis, which has been mostly broken away. The anterior articular surface is broader than high, while the reverse is the case in the hinder. The neural arch is very massive, and its sides below and in front of the broken transverse process are excavated by a large fossa roughly pyramidal in form. The articular surface of the anterior zygapophyses is nearly circular, its diameter being about 4·2 cm.; in the posterior the surface is oval. The neural spine which slopes forward is very large and high; it is united with the post-zygapophyses and transverse processes by two pairs of thin vertical buttresses of bone, and with the anterior border of the arch by a median unpaired buttress; between these plates of bone there are deep pyramidal fossæ. The result of this arrangement is that, though the vertebræ are very large, they are at the same time extremely light. The transverse processes and the anterior lateral borders of the centrum being broken away, there is no trace of the articular surface for the ribs.

The other large dorsal appears to have been posterior to the one just described. Its centrum is less compressed than that of the latter, and, as far as can be seen, there was no hæmapophysis. Both the anterior and posterior articular surfaces of the centrum are about as broad as high. The articular surface of the post-zygapophyses are ovoid in shape and of great size, the long axis of that on the left side measuring 6·7 cm., though in this specimen that on the right side is somewhat smaller. The fossæ in the side and on the dorsal surface of the arch are much like those described above, but there is an additional median one between the post-zygapophyses, bounded in front by the neural spine and behind by the hinder border of the neural arch. The dimensions are:—

	cm.
Length of centrum	7·2
Width of centrum in middle	6·0
Height of centrum in middle	6·0

As in the last specimen the articular facets for the ribs are broken away.

As was mentioned above, the smaller dorsals closely resemble the larger in most respects; they differ, however, in the form of the anterior and posterior articular surfaces of the centrum. These are concave and convex from side to side respectively, as usual, but show scarcely any curvature from above downwards. There is, moreover, a lateral fossa in the centrum separated from that in the arch by a nearly horizontal plate of bone.

The specimen which agrees most closely with the first of the larger ones just described has a centrum measuring 4 cm. long, 3 cm. high, 2·5 wide in the middle.

Another specimen gives the following measurements:—

	cm.
Length of centrum	3·5
Height of centrum at hinder end	2·7
Width of centrum in middle	2·0

From the above descriptions it will be seen that the Æpyornithidæ must have included a large number of forms differing greatly in size and proportions; indeed, in a very recent paper (**4**) Milne-Edwards and Grandidier have given names to no less than seven new species, three of which are referred to a new genus, *Mullerornis*, and it seems probable, as was shown above, that a third genus at least will have to be established. It is to be hoped that the authors just mentioned have taken some particular bone as the type specimen of each species, and that names have not been given to miscellaneous collections of conjecturally associated bones. If it should unfortunately prove that this precaution has been neglected, then it seems probable that confusion in the nomenclature of the Æpyornithidæ will result.

It is greatly to be desired that collectors should, whenever possible, mark in some distinctive manner such bones as occur together and appear to have belonged to one individual[1]. But even when this is not done, it is still possible to avoid confusion to a large extent by applying specific names to some definite bone, preferably the metatarsus, as the type specimen of the species.

The Affinities of Æpyornis.

Concerning the affinities of *Æpyornis* the most divergent views have been held. Isidore Geoffroy in his original paper (**6**) referred it to the Brevipennes (Ratitæ), an opinion now universally accepted. Valenciennes (**9**) considered it to be a diving bird, related to the Auks and Penguins. Bianconi (**1**) in a long series of papers strove to show that *Æpyornis* was the "Roc" of Eastern fable, and that its nearest living relative is the Condor. Milne-Edwards and Grandidier (**3**) confirmed Geoffroy's original opinion and considered that *Casuarius* and *Dinornis* are the nearest allies. Von Haast (**7**), on the other hand, opposed this view and asserted that the resemblances with *Dinornis* are superficial. Recently this opinion has been endorsed by Fürbringer (**5**) and R. Burckhardt (**2**), both of whom, after an elaborate comparison of the Æpyornithidæ with the other Ratite families, come to the conclusion that such resemblances as exist between *Æpyornis* and *Dinornis* are merely the

[1] In the present instance this appears to have been out of the question, the bones occurring scattered at random.

result of convergence resulting from similar conditions of life, and that though the great massiveness of the skeleton (pachyostosis) is characteristic of both families, it is attained in quite a different manner in the two cases. This conclusion would certainly seem to be supported by the bones here described.

In the femora, for instance, apart from their great difference of form, the large upper pneumatic foramen, the numerous smaller ones opening into the popliteal fossa, and the great development of the bony reticulum are characters entirely wanting in *Dinornis*. Such points of structure as these appear to be of more importance in determining affinities than the mere external form of the bones, which may be supposed to vary more readily with changes in the conditions of life; for it is difficult to understand how such differences of structure could arise in two closely related forms, since the same end appears to be attained in the two cases in different ways. The conclusion to be drawn from this is that the divergence between the two families must have occurred before the characteristic pachyostosis had been acquired. In their recent paper (4) Milne-Edwards and Grandidier have given a brief description of the skull, which, as far as it goes, does not seem to afford much evidence in favour of the supposed close relationship with *Dinornis*; nevertheless, at the close of their communication the authors, as in their former paper, assert their belief that there is really such a relationship, and suggest the former existence of a southern land-connection to account for it. Perhaps when a complete description with figures of the skull, sternum, and pectoral girdle have been published, it may be possible to arrive at some definite conclusion concerning this interesting point.

List of papers referred to.

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2. Burckhardt, R.—"Ueber *Æpyornis*." Paläontologische Abhandlungen, Neue Folge, Bd. ii. Heft 2. Jena, 1893.
3. Edwards, Alph. Milne-, et Alf. Grandidier.—"Nouvelles Observations sur les Caractères zoologiques et les Affinités naturelles de l'*Æpyornis* de Madagascar." Annales des Sciences naturelles (Zoologie), série 5, vol. xii. Paris, 1869.
4. Edwards, Alph. Milne-, et Alf. Grandidier.—"Observations sur l'*Æpyornis* de Madagascar." Comptes Rendus de l'Acad. d. Sci. t. cxviii. p. 122. Jan. 1894. Paris.
5. Fürbringer, Max.—Untersuchungen zur Morphologie und Systematik der Vögel. II. Allgemeiner Theil, pp. 1463–6. Amsterdam, 1888.
6. Geoffroy St.-Hilaire, Isidore.—"Note sur des ossements et des œufs trouvés à Madagascar dans des alluvions modernes, et provenant d'un Oiseau gigantesque." Comptes Rendus de l'Acad. d. Sci. t. xxxii. p. 101. Paris, 1851.

7. HAAST, JULIUS VON.—"Remarks on the Extinct Birds of New Zealand." The Ibis, 1874, p. 209.
8. MAJOR, C. I. FORSYTH.—"On *Megaladapis madagascariensis*." Proc. Roy. Soc. vol. liv. 1893, p. 176.
9. VALENCIENNES. Comptes Rendus de l'Acad. d. Sci. t. xxxix. p. 837. Paris, 1854.

EXPLANATION OF THE PLATES.

PLATE XIV.

Fig. 1. *Æpyornis mulleri* (?), Milne-Edw. & Grand. Right tarso-metatarsus from behind.
2. *Æpyornis mulleri* (?). Right tarso-metatarsus from inner side. *h*, Point of attachment of hallux.
3. *Æpyornis titan*. Left tibio-tarsus from front. (Type specimen.)
4. The same from inner side.

All the figures are one-fifth natural size.

PLATE XV.

Fig. 1. (?) *Mullerornis agilis*, Milne-Edw. & Grand. Distal portion of right tibio-tarsus from front. $\frac{1}{4}$ nat. size.
2. Cervical vertebra of a small species of *Æpyornis* (?) from left side. Nat size.
3. The same from above. Nat. size.
4. The same from front. Nat. size.
5. Dorsal vertebra of large species of *Æpyornis* from right side. $\frac{1}{3}$ nat. size.
6. The same from front. $\frac{1}{3}$ nat. size.

4. On the Bones of the Æpyornis, and on the Localities and Conditions in which they are found. By J. T. LAST.

[Received February 4, 1894.]

In response to the kind invitation of the Secretary of this Society, I beg leave to offer the following remarks on the bones of the fossil Æpyornis for their consideration. There may be much of what I shall say which will, perhaps, not be new to them, yet if it confirms that which was already known it will not be altogether useless.

I first arrived in Madagascar in the summer of 1889. I made Nossy-bé, an island on the N.W. coast, my head-quarters, and then slowly worked my way down to Nossy-vé, an island near the S.W. extremity of Madagascar. It was in the early spring of 1891 that I arrived at Nossy-vé, and I remained in the south and south central parts of Madagascar till September of 1893, and then I began to turn my face towards home. During the time I was in the south parts of Madagascar I had several opportunities of searching for remains of the Æpyornis. These I made use of with varied success, and though I may not have been so unfortunate as I had hoped, yet my efforts and the experience I gained gave me an insight of the bird's former habits, and the kind of places where its remains are likely to be found.

From what is already known, the Æpyornis may be considered as having had a range over the whole, or nearly the whole, of the southern half of Madagascar. This is proved by the fact that its remains have been found at Sira-bé, a place situated in about lat. 19° 50′ S. Twice I have known its bones to have been found near Mórondáva, a small town on the W. coast in about lat. 20° 20′ S. An egg was also found at Mánanjára on the east coast in about lat. 21° 10′ S. These discoveries are sufficient to prove that the bird occupied more or less the whole of the southern half of Madagascar.

I do not believe that the whole of this large tract of country was equally overrun by these birds, but rather that their numbers were much greater in the south and south-western parts than in the more northerly and eastern parts. This is shown, I think, by the fact that, excepting an egg found at Mánanjára, few or no remains have been found in south-east Madagascar, but that nearly all the remains that have been brought to light up to the present have been discovered in the south and south-western parts. That the birds were more plentiful in the south and south-west parts of the island may be inferred from the abundance of broken egg-shells which are to be found on the rocky sides of the range of hills on the S.W. coast, whereas I do not remember having heard or read that there were such broken egg-shells on the S.E. coast. All the unbroken eggs have, almost without exception, been found on the south or S.W. coast. About two years ago I heard of a specimen which was picked up floating about on the Mórondáva River, near its mouth; but this is the only instance, so far as I know, of one being found north of St. Augustin's Bay.

Regarding my own operations in searching after fossils, I think it will be better if, in the first place, I describe my work in the Mánansúa district of the Antinosi country, in south central Madagascar, about long. 45° E. and lat. 23° S. It was only after two or three unsuccessful attempts to enter the country that I was at last able to do so, through the friendship of Béfanátriki, one of the Antinosi kings, who being about to return to his own country permitted me to accompany him. The journey occupied us eight days. On arrival at the king's chief town I was given a house to use till I could make myself one more suitable. This building-work occupied me some time, and in going about with men to collect material I came across several places which appeared to me likely to be fossiliferous. On making inquiries of the natives, I was told that there were many bones, large and small, in the peaty flats where they make their rice-gardens, but they did not know to what animal the bones had belonged. After negotiating with the king for awhile, he allowed me to dig about on one of the uncultivated bogs alongside the Ifunsi River. The soil met with was black and clayey above, then we came to a layer of whitish marly soil, followed by a friable kind of light grey limestone, resting on fine-grained red sandstone. The fossils found were chiefly bones of Crocodiles, Hippopotami, broken tortoise-shells of more than one species, with a few fragments of Æpyornis-bones and a variety of vertebral bones, some of which must have belonged to other animals than those named above. All these were found between the grey marl and the limestone. The place abounds with fossils; but one would be led to judge that the creatures had not died where the fossil remains are now found, but rather that they had died at a distance, and that the bones, being set free by decomposition of the body, had been carried down to their present positions by heavy rainfalls or other means. If this was really the case, it would account for the jumbled-up manner in which the fossils are found, and would also give a reason why we did not find a skeleton intact.

For nearly a year I made Mánansúa my head-quarters, journeying into the country in different directions as opportunity occurred. By this means, and from native report, I was able to learn a great deal about the nature of the surrounding country. It seems, from what I saw, that a great deal of the country to the south and east of Mánansúa was formerly covered with a number of small lakes. These slowly became dry, from two causes—first by being gradually silted up from the surrounding higher ground, and also by the water, when the lakes were full, cutting its way out through the soft sandstone rocks, until a passage was formed which allowed the whole of it to escape. Crocodiles abounded in these lakes, as their descendants do in the lakes which remain. A small kind of Hippopotamus and a large Tortoise lived about the lakes and near country; these have left nothing but their fossilized bones to show that they once existed.

By talking with the king and people about these fossil remains, I learnt that they were in no way confined to the Mánansúa district, but were to be found all over the country to the N.E. along the Sakamare River—at Ilunti, more north, and beyond in the Bara country, still farther north. In times of peace the Antinosi and Bara tribes interchange visits. Some men who had been there were working for me, and told me they had seen the same kind of bones in the Bara country. The natives have no knowledge of the creatures of which these fossils are the remains, and if asked, generally say they are the bones of the Pang'ani, a mythical creature, in whose existence most of the Malagasy tribes firmly believe.

From Béfatúri (an Antinosi king, living at Kiliarivo, to the N.W., and whom I met several times) I learnt that there are several bogs in his district, with fossil bones in them, and judging from the manner in which he described some of the long bones, I think it quite possible that some remains of the Æpyornis have been turned out by the natives whilst working in their gardens. He much wanted me to go and visit him at his town, but I could not get the opportunity.

Passing thence to the valley of the Táheza River one comes to another piece of country where there are a number of silted-up lakes, now dry and used as rice-gardens. Here again, undoubtedly, fossil remains abound; in fact, judging from personal observation and native information, I should say that these dry lake beds are to be found scattered over the whole of South Central Madagascar, north of the Ong'uláhi, or St. Augustin River, and that they are all more or less fossiliferous.

Whilst speaking of this part of the country, I must just call attention to a little district which extends, in a N.E. and S.W. direction, from the town of Sálu-aváratsi (situated on the right bank of the Ong'uláhi River, about a mile S.E. from where the Taheza flows into the Ong'uláhi) for about 16 miles to the small river Andránumái, which enters the Ong'uláhi on its left bank. This stretch of country, with a width of about five miles, has a number of hot springs, varying considerably in temperature. Some are so hot that any person or animal entering them would be scalded to death, as the springs at Ambúndrumbé and Andránumái; others are deliciously warm, and by bathing in them a kind of vigour seems to be imparted to the whole body. This is especially the case at the warm spring just outside the town of Sálu-aváratsi. The water when warm gives off a slight odour, something like iodoform; but this disappears when the water has cooled, when it is quite clear and pleasant to the taste. The natives always use this water, and no other, for all domestic purposes in preference to the water of the great river which flows close by. At some of the springs a kind of salt is precipitated, as at Sálu-aváratsi and Andránumái; but at the hot springs at Bezá the water rushes up through the sand, flows away, and leaves no salt marks.

Much might be said about this south central district of Madagascar, but time and the scope of my present paper will not allow it. I think, however, sufficient has been said to show that it will become a country of considerable interest to the palæontologist and to all lovers of natural science, especially when the country becomes more opened up and travelling can be accomplished with more ease and safety.

I will now, with your permission, give some account of my explorations on the south-west coast in search of fossils and other natural-history specimens. Excepting the few objects collected in Mánansúa district, all the fossil collections I have sent home were obtained on the S.W. coast of Madagascar, between Lámbuhára, about lat. 22° 10′ S., and St. Augustin's Bay, about lat. 23° 30′ S. It may be well, perhaps, to briefly describe this tract of coast-line. A range of hills extends along the west side of Madagascar at a varying distance from the coast. About St. Augustin's Bay the hill-sides, in places, descend into the sea. The rocks forming these hills are full of fossil shells. Generally there is an extensive flat, of some miles in width, between the coast-line and the foot of the hills. This flat is very low, probably lower in some places than the high-water line, from which it is separated either by high sand-dunes or stretches of elevated sandstone rocks. There are a number of lakes, varying considerably in size, dotted about over these extensive flats. Often a number of small lakes may be seen in close proximity, and these, looked upon as a whole, seem to be only the remains of what was formerly a lake of considerable extent. The boggy nature of the surrounding country also seems to indicate the same thing. Some of these small lakes dry up during the dry season, others are too large and have no outlets into the sea. The water is very brackish, and always leaves a thick deposit of salt as it slowly subsides. It is in the beds of these lakes that the various fossilized forms are found.

At Ambúlisátra, in about lat. 23° S., a place visited by M. Grandidier several years ago, I found a variety of fossil bones. These consisted chiefly of remains of the Hippopotamus, Crocodile, Tortoise, and a few of the Æpyornis. If any of these creatures died in the water, the skeletons must have been much washed about and the bones separated, for it was seldom that two bones of the same animal were found together. The formation of the country shows that there was formerly a very extensive lake at this place. In the part where I excavated, the ground was fairly dry above, but we found it full of water below. The soil is a blackish clay for about two feet; next we came to a stratum of white clay or loam from one to two feet thick; after this, some greenish sand and a layer of green sand mixed with pebbles. The fossils were found lying between the band of greenish sand and the layer of green sand and pebbles. I made two visits to this place, and during my second visit I intended to make considerable excavations in search for Æpyornis-bones, but after a few days my work was stopped by the king sending orders for my men to return home. The men were obliged to do as the king ordered. The king, personally, did not care what digging I did, for some time previously I had visited him, paid him the accustomed honours, told him my business, and he, in the presence of his chiefs, gave me leave to go where I pleased about his country and to collect what I wanted, naming one or two things which were "*fadi*" or prohibited. It was some of the big chiefs who really stopped my work. They thought I ought to be continually giving them presents; and as I held a different opinion, they resolved to cut my work off. This they easily did, by telling the king some story, that it was bad for the cattle that the white man should dig holes in places where the cattle were likely to go; they would fall in and be lost. Of course the king had to comply with their wishes, and this he easily did by sending a messenger to take away my men, in his name. This ended my work at Ambúlisátra.

From Ambúlisátra we must proceed to a place some few miles further north—Ambátumifúku, in about lat. 22° 40′ S. It was in this district that I obtained the large semi-fossil Tortoises which I have sent home during the last two years [1]. The flat country at this place, between the sea and the hills, is very similar

[1] [These have been described by Mr. Boulenger. See Trans. Zool. Soc. xiii. p. 305.—Ed.]

to that at Ambúlisátra, but the coast-line, instead of having sand-dunes as a border, has a long stretch of sandstone rocks, about 100 feet high, and extending a mile or a mile and a half inland. These rocks are very hard on the top, waterworn and cut in all directions; but the action of water is most seen on the rocks which are furthest inland. Here the softer inside stone has been washed away, sometimes to the extent of 20 or 30 feet, forming large caves—quite cosy hiding-places, such as only a native knows how to appreciate. It was in these caves that I procured the large tortoise-carapaces. Generally two were found in each cave; on two occasions I found a large and a smaller one, and in both cases the smaller one was too much broken to take away.

Another reason why I call attention to this place is because the face of the sandstone rocks along the high-water line is somewhat of a study. There is one considerable ledge which is covered with what I take to be fossilized shrubs. The rocks are soft, white, and finely grained, almost like Caen stone. I obtained some specimens of the fossil wood with the rock attached, and I hope they will shortly arrive in England along with some other of my collections. About ten feet beneath this ledge the rock is more red and coarser in grain, and contains a number of common land-shells. I also found some pieces of Æpyornis egg-shell embedded in it. Several of the shells and pieces of egg-shell I cut out and sent home with my first tortoise-carapaces in 1892. The reason why I refer to this is because the presence of these pieces of egg-shell in the sandstone tends, I think, to show how ancient a bird the Æpyornis must have been.

The next place I should like to call your attention to is Itampúlu-bé, situated on the south side of a rather extensive bay in about lat. 22° 10′ S. It was in this locality that I obtained my best specimens of Æypornis-bones, as well as an abundance of bones of the Hippopotamus, Crocodile, and other animals. This place has a rough shingly beach leading up to an extensive flat of what appears to be a kind of limestone. The rock is of a light greyish colour, rather hard and compact; it extends for a considerable distance inland, and is sparsely covered with sand in places, out of which there is a stunted forest growth. Here and there about this flat, and within half a mile from the beach, are a number of pan-like depressions, varying considerably in size; these have become silted up with washings from the surrounding country, so that though they hold a little water in the wet season the surface quickly becomes dry again, and the natives use them as small gardens. It was from these pans that I obtained my best fossils, and I think I might have done better still had I been able to be present to work the places myself.

Whilst I was at Mánansúa, in the Antinosi country, I employed a European (a man who had been many years in the country) to search for fossils and other objects of natural history. In going about he heard of these pans and that there were many strange bones in them; he at once, with the natives he had with him, set to work to see what the bones were like, and seeing they were likely to be those I wanted, he remained working at the pans for several days. According to what the man told me, the places where he dug abounded with fossil remains, the uppermost being about four feet below the surface. Apparently the pans are from eight to ten feet deep—the first two or three feet consisting of a black peaty soil, the rest of a white or grey marl, in which the bones are found. The chief difficulty in working the pans is caused by the water contained in the soil: the soil is saturated, and the water cannot escape below because of the hard rock, nor can it evaporate through the peaty top; therefore, as soon as a hole of any size is made, the water drains into it. I have no doubt that many very valuable fossils lie hid in these pans, and these can be obtained only when proper means are used for removing the water. My man told me that in the place where he found the largest bones he was obliged to leave many; he could feel them with his feet, but could not stoop down into the water far enough to get them out. I think the only way of obtaining them is by the use of a good pump and long hose to drain the water away. I am strongly of opinion, judging from the remarks my man made about the place, that the Æpyornis-skull, that great desideratum, would be found here if anywhere.

I visited Itampúlu-bé last September along with this man, and he showed me the places where he had been working. The people here are friendly. The king lives two days' march inland, and has a good name among Europeans for fair treatment. Of course presents must be given to the king and chiefs before any work whatever can be done in the country. If I have the opportunity of returning to Madagascar, I should certainly like to spend a month or so working with proper appliances at these pans.

I will now conclude my remarks about the Æpyornis with a few words concerning its egg. It is strange that the egg or even broken portions of it are never met with far inland. During all my explorations, though I have found the bird's bones a long way inland, I have never seen any fragments of eggs either with them or inland anywhere. I have never heard of whole eggs being obtained inland, and I believe that all, or nearly all, have been found in the sand-dunes which are piled up along the coast. Everywhere along the south and south-west coast fragments are to be found in abundance, especially on the hill-sides about St. Augustin's Bay. Bushels of broken egg-shells could be gathered in this district with but little trouble. From this I judge that these birds used to live generally in the more inland parts of South Central Madagascar and at certain seasons came to the coast to lay their eggs, after which they betook themselves again to their inland homes. I do not know whether this idea is quite correct, but it seems to me very probable, from the fact that their eggs, both whole and broken, are only found on or near the sea-coast.

5. Notes upon the Antelopes of the Pungué Valley. By MacDonald Barkley.[1]

[Received January 4, 1894.]

On the 27th of July, 1893, accompanied by an English friend and two gentlemen from Cape Colony, I sailed from Beira in a small lighter on a hunting-expedition up the Pungué River, taking with us a few natives as guides, or as rowers in case of the wind failing. At Fontesvilla, a small town some 50 miles up the river, the terminus of the Beira Railway, then under construction, we increased the number of our Kafirs and proceeded about 18 miles further, passing the native village of Nevisferara on our way, to a point some 6 miles beyond that branch of the river upon which is the village of Mpanda's. There, our boat running aground continually owing to the numberless shallows and sandbanks in the stream, we pitched a permanent camp and sent some of our followers back to Mpanda's to hire native dug-outs and men to manage them. Leaving a few boys to look after the boat and those trophies which we had already secured, we proceeded to the junction of the Ulemna and Dingadingue, a point about 82 miles from Beira. Our plan of campaign was to pitch a camp on one bank or the other, and to shoot the country round for several days, and then by means of our canoes to move on another day's journey to fresh ground. To a little beyond the Mpanda's branch the banks of the river are well wooded with thorn-brakes, dwarf palms, fever-trees, and some very fine timber; but the only Antelopes we saw on this part of our journey were Waterbuck, a few Blue Wildebeest, and one herd of Lichtenstein's Hartebeest, the two former species being exceedingly plentiful throughout the whole of the country we covered. On the higher reaches of the river the valley broadens out into a level plain, covered with long dry grass at this season of the year, and bounded by hills of some size, densely clothed with fine forest timber, amongst which we were lucky enough to come upon a large herd of Elephants, although these animals are said to be very rare nowadays in this district. The plains are but sparsely sprinkled with shrubs and dwarf palms, and dotted over with huge ant-heaps, and with every here and there vleys. At this time of year the vleys are for the most part dry, but the grass on them remains short and green, and forms pasture for the vast herds of Buffalo, Antelopes, and Zebras which roam over the country.

The district is infested by the Tetse fly, making it impossible to use cattle, and the climate is exceedingly unhealthy for Europeans except from June to October, when with moderate care it is possible to keep a clean bill of health.

The following are the different species of Antelope of which we succeeded in shooting specimens during this trip.

[1] Communicated by the Secretary.

1. Oreas canna.

("Eland" of the Dutch and English.)

This Antelope, though far from plentiful, is to be met with occasionally in the more open country of the Pungué Valley. At this time of the year (August and September) I never saw more than a pair together, usually feeding upon young grass at a little distance from timber-belts and never far from water. The skins of the one or two that we shot were beautifully marked with white stripes, very clearly defined, running in a downward direction, and with a dark stripe along the backbone. The animals were very fat and in splendid coat and condition, the largest standing 15 hands 2 inches.

2. Cobus ellipsiprymnus.

("Waterbuck" of the English, "Kring-ghat" of the Dutch; native name "Mpeeva.")

This Antelope is by far the commonest species throughout the Pungué Valley, and is sometimes found in herds of quite 40 head, the cows as a rule far outnumbering the bulls; they are generally discovered feeding upon the short grass of the dried vleys. They are stoutly built and heavy, but active, standing when full-grown about 12 hands. The largest pair of horns I procured measured 27½ inches along the curve, the average length of those of a full-grown bull being 26½ inches. They are lyrate, broadly annulated to within a little of the points, but much more deeply at the base than higher up. The hair of the Waterbuck is coarse and thicker round the neck than elsewhere, and this is especially noticeable in the cows, which are hornless. They vary much in colour, from a dark slate to a light brown, with a white ring round the rump, and in some cases, although not all, a white marking round the lower portion of the neck. Their spoor is noticeable for being very narrow and pointed.

3. Catoblepas gorgon.

("Blue Wildebeest" of the English, "Blau Wildebeest" of the Dutch; native name "Inkōne-kōne.")

This Antelope is found in immense herds throughout the more open country bordering the upper reaches of the Pungué, Dingadingue, and Ulemna rivers. It is not at all uncommon to find them feeding in company with herds of Waterbuck and Zebra, and solitary specimens are frequently to be met with. When disturbed they evince great excitement and go through the most exaggerated antics, and, although usually shy and difficult of approach, are victims to their great curiosity, owing to which trait in their character they more than once fell to our rifles.

They are of a bluish drab-colour, having brindled stripes down the forequarters, from which they are also known as the Brindled Gnu; their bushy tail, mane, and beard are of coarse black hair; they stand about 12 hands, both sexes carrying horns, the average spread of a bull's being about 26 inches.

4. Bubalis lichtensteini.

(Lichtenstein's Hartebeest.)

This Antelope, though rare, is to be found scattered over the rough grassy plains of the Upper Pungué Valley. It is occasionally met with in herds of considerable size, but more generally seen in small numbers. On every occasion that I came upon them they were feeding on the open veldt, keeping clear of the more hilly and timbered country, and proved very difficult to stalk. Both male and female carry horns, which measure about 15 inches, are deeply annulated, and turning slightly outwards from the base slope inwards again, the tips once more turning outwards and backwards. All those that we shot were of a uniform fawn-colour, with black legs, and with a grey patch, more or less defined, behind the shoulder. They stand about 12 hands.

5. Æpyceros melampus.

("Roode-bok" (Roy-bok) of the Dutch; "Roybuck" of the English; native name "Impālā.")

This Antelope is occasionally to be found in the thick reed-beds along the river-bank; but although we several times came upon females and shot more than one, I only once saw a male, and then was not lucky enough to secure it. Therefore I am unable to give any accurate measurements of their horns.

6. Neotragus scoparius.

This little Antelope is found in great numbers wherever the bush is fairly thick, avoiding the more open country and feeding either singly or in pairs; it is very easy to approach, but when once disturbed is remarkably swift and active, doubling about amongst the scrub in a manner very suggestive of the course of a hare. It is of a bright fawn-colour, gradually shading off to white beneath the belly, with short, straight, sharply-pointed horns, about an inch apart at the base and averaging $5\frac{1}{4}$ inches in length.

In addition to these Antelopes we came upon several Lions, a great many Buffaloes, Hippopotami, Crocodiles, Wart-Hogs, Zebras, and one large herd of Elephants. Wildfowl abound along the whole course of the river and in every vley, while many varieties of game-bird, including the Guinea-fowl, are to be found on the plains.

6. Description of a new Bat of the Genus *Stenoderma* from Montserrat. By Oldfield Thomas, F.Z.S.

[Received January 23, 1894.]

Mr. Joseph Sturge, of the Montserrat Company of Birmingham, has sent to this Society a specimen of a Bat, which is said to do much damage to the cacao plantations in the island of Montserrat, Lesser Antilles. By the kindness of Mr. Sclater I have been permitted to examine and describe it.

It proves to be new, and I propose to call it

STENODERMA MONTSERRATENSE, sp. n.

Most nearly allied to *S. nichollsi*, Thos.[1], with which it agrees in the characters which separate that from *S. rufum*, Geoffr., but distinguished by its decidedly larger size, stouter build, and by the proportions of the canines and premolars, both above and below, which are broader horizontally and less elongate vertically. The inner upper incisors are as distinctly bicuspidate as in *S. achradophilum*, Gosse. Molars $\frac{3}{3}$, their proportions much as in *S. nichollsi*; the last upper transversely oval, proportionally rather larger than in the allied species; their area in cross section nearly equal to that of the inner upper incisors.

Palatal emargination long and narrow.

External characters as usual, except that the fur on the upper surface of the arms, wing-membranes, and legs is thicker and more extended, and also that, as compared with *S. nichollsi*, the colour is more of a slaty than a brownish grey. No facial streaks or white shoulder-marks.

Dimensions of the type, an adult male in spirit:—Head and body 69 mm.; ear from notch 16·5; forearm 51·5 (= 2·03 in.); lower leg 23; knee to most distant point of hind claws 35·5.

Skull: basal length 18·2; greatest length 23·6; zygomatic breadth 16; interorbital breadth 7·1; palate, breadth outside $\underline{\text{m.}^1}$ 10·5, inside $\underline{\text{m.}^1}$ 4·4; basion to front of palatal notch 13·2; front of canine to back of $\underline{\text{m.}^2}$ 7·4, ditto below 7·4.

Hab. Montserrat, West Indies.

This Bat is said to hang all day under the branches of trees, and not to take refuge in holes and crannies as most species do.

February 20, 1894.

Prof. G. B. HOWES, F.Z.S., in the Chair.

Mr. Arthur Thomson, the Society's Head Keeper, exhibited a series of Insects reared in the Insect-house in the Society's Gardens during the past year, and read the following Report on the subject:—

Report on the Insect-house for 1893.

Examples of the following species of Insects have been exhibited in the Insect-house during the past season:—

Silk-producing Bombyces and their Allies.

Indian.

Attacus atlas.
—— *cynthia.*
—— *pernyi.*
Antheræa mylitta.
Actias selene.

[1] Ann. Mag. N. H. (6) vii. p. 529 (1891).

Japanese.

Antheræa yama-mai.

Australian.

**Antheræa*, sp. inc.

American.

Samia cecropia.
Telea polyphemus.
—— *promethea.*
Actias luna.
Hypochera io.

African.

Antheræa tyrrhea.
*—— *belina.*
Cirina forda.
Actias mimosæ.
Gonomita postica.

Diurnal Lepidoptera.

European.

Papilio podalirius.
—— *machaon.*
Thais polyxena.
Gonepteryx rhamni.
Argynnis paphia.
—— *euphrosyne.*
Melitæa cinxia.
Vanessa polychlorus.
—— *antiopa.*
—— *atalanta.*
Charaxes jasius.
Arge galathea.
Lycæna corydon.
—— *adonis.*

American.

Papilio ajax.
—— *asterias.*
—— *troilus.*
Papilio cresphontes.
—— *turnus.*
Limenitis disippus.

Nocturnal Lepidoptera.

Smerinthus ocellatus.
—— *quercus.*
—— *tiliæ.*
Triptogon modesta.
Sphinx ligustri.
—— *convolvuli.*
—— *pinastri.*
—— *carolina.*
Deilephila vespertilio.
—— *euphorbiæ.*
Chærocampa elpenor.
—— *nerii.*
Macroglossa stellatarum.
**Sesia culiciformis.*
*—— *bembiciformis.*
Zygæna filipendulæ.
**Lasiocampa monteiri.*
**Rhabdosia*, sp. inc.
Endromis versicolor.
Saturnia carpini.
—— *pyri.*
Eacles regalis.
—— *imperialis.*
Anisota rubicunda.

* Exhibited for the first time.

Of the lepidopterous insects which I have the honour to place before the Meeting this evening the following are exhibited for the first time:—*Antheræa belina*, from Natal; *Antheræa*, sp. inc., from Australia; *Sesia culiciformis* and *Sesia bembiciformis*, European; *Lasiocampa monteiri* and a species of *Rhabdosia*, both from S.E. Africa.

The specimen of *Lasiocampa monteiri* is not set out, as the upper edges of the *under* wings present a very curious hairy appearance, and look as though they had been singed. This could not be seen in a set-specimen. The specimen of *Rhabdosia*, sp. inc., is a male, and there is a single specimen (a female) in the National Collection, but it has not yet been named.

The cocoons of *Actias mimosæ*, from which the specimens exhibited emerged, were very kindly sent from S.E. Africa by the Rev. H. A. Junod, who had seen our Insect-house before leaving Europe. Other cocoons of this species were deposited by the Hon. Walter Rothschild, from which five pairs of moths emerged.

During May last I captured some wild specimens of the common Pearl-bordered Fritillary, and placed them in one of the cases, with a good supply of their food-plant (*Viola*): many eggs were laid. The young larvæ hatched in due course, and fed well at first; they then became sluggish and crawled into the corners of the case. After a time they commenced to feed again, and a second brood was produced—the first specimen emerging on the 31st July. I exhibit this evening half a dozen examples of this second brood. In a state of nature this species is single-brooded.

The specimens of the Hornet Clearwing of the Osier (*Sesia bembiciformis*) that were exhibited during the past season created great interest; and many visitors, before reading the label, thought they were really hornets or wasps.

The most remarkable and interesting insect exhibited during the past year was a Goliath Beetle (*Goliathus druryi*) from Accra, West Africa, which was presented by F. W. Marshall, Esq., on the 5th October, and which died on the 16th of December. This is probably the first specimen of this Beetle ever brought to England alive. It had been in Mr. Marshall's possession since May 1893, and had been in England some time before it was received at the Gardens. It fed principally upon fruit, and preferred ripe melons to any other food.

Of Orthoptera a large number of the Canadian Stick-insects (*Diapheromera femorata*) were reared from ova deposited in 1892. Three specimens of Leaf-insects (*Phyllium gelonus*) from the Seychelles were presented by Dr. Nowell in December; but I am sorry to say they did not live long.

Mr. Oldfield Thomas exhibited the skin of a Giraffe from Somaliland, which had been brought to his notice by Messrs. Rowland Ward and Co., and pointed out the considerable difference in the character of the markings shown by it as compared with the S.-African Giraffe. In the Northern form the dark marks were large, sharply defined, and only separated from each other by narrow pale lines; while in the S.-African form these marks were mere vaguely defined blotches, comparatively far apart from each other. These differences were well seen on a comparison of the figure given by Harris of the Southern Giraffe[1] with those given by Rüppell[2] and Brehm[3] of the Northern one.

Prof. Sundevall had already noticed the difference in the general colour of the two animals, and had given to the Northern form the varietal name of *Camelopardalis giraffa*, var. *æthiopica*[4].

A communication was read from Dr. R. W. Shufeldt, C.M.Z.S., giving particulars of the methods used in preparing certain Invertebrates, which were adopted by the experts at the U.S. National Museum, in the case of specimens sent to Chicago for exhibition at the World's Columbian Exposition. This communication was illustrated by photographs of the objects in question. After the preparation of finished moulds of these objects, gelatine casts were made from the moulds, the gelatine being made of the following composition:—

Best Irish Glue............	4	oz.
Gelatine (photographers')....	2	,,
Glycerine	4	,,
Boiled Linseed-oil..........	$\frac{1}{4}$	,,

The gelatine casts were then coloured to resemble the objects in life.

The following papers were read:—

1. On the Mammals of Nyasaland: third Contribution. By Oldfield Thomas, F.Z.S.

[Received February 13, 1894.]

The present paper contains an account of the third and fourth collections of Mammals made and presented to the National Museum by Mr. H. H. Johnston, C.B., Consul-General for British Central Africa, with the help of his able assistant, Mr. Alexander Whyte, F.Z.S. Papers on the two previous collections have already been published[5].

The series now described bears out the prophecy I ventured to make in 1892, that as Mr. Whyte's knowledge of the locality increased he would be able to obtain the rarer and more local species, and that among these there would certainly be some

[1] 'Wild Animals of S. Africa,' pl. xi. (1840).
[2] Atlas Reise N. Afr. pl. viii. (1826).
[3] 'Thierleben,' iii. p. 188 (1880).
[4] "Pecora," K. Vet.-Ak. Handl. 1844, p. 175.
[5] P. Z. S. 1892, p. 546; and 1893, p. 500.

novelties. For although there are not a very large number of species altogether represented in the present collection, yet several are new to the locality, one is a rediscovered species described thirty years ago, and two are new to science.

The Mammal-fauna is therefore evidently far from worked out, and Messrs. Johnston and Whyte should be encouraged to continue their explorations until, after the receipt of five or six more similar collections, we may perhaps be in a position to say that our knowledge of the Mammals of the district approaches completion.

1. Cercopithecus albigularis, Sykes.

a. Ad. sk. ♂. Fort Lister, Milanji, 3500 ft. 16/7/93.
b. Ad. sk. ♀. Milanji Plateau, 6000 ft. 26/4/93.

For the determination of these two Monkeys I am indebted to Mr. Sclater, who has been recently making a study of this group, and who has kindly furnished me with the following note respecting them:—

"The male is much larger, and shows no rufous on the rump and arms. The smaller female has these parts strongly tinged with rufous. This is probably a sexual distinction, as it was no doubt on a similar specimen that *C. erythrarchus*, Peters (which Dr. Matschie has lately pronounced to be = *C. albigularis*, *cf.* Sitz.-Ber. nat. Freunde Berl. 1893, p. 215), was based. The female specimen agrees well with the figure of *C. erythrarchus* in the 'Reise nach Mossambique,' and with a female specimen formerly living in the Zoological Society's Menagerie."

2. Otogale kirki, Gray.

a. Ad. sk. Blantyre. 2/93.
b–d. 3 do. Shiré Highlands. 12/92.

3. Galago moholi, A. Sm.

a. Ad. al. ♀. Zomba.

4. Epomophorus crypturus, Pet.

a. Ad. al. ♀. Zomba.

Forearm 78 mm.

I entirely agree with Prof. Du Bocage[1] in considering that *E. crypturus* of Peters is not synonymous with *E. gambianus,* as stated by Dobson, but is a valid species intermediate between *E. macrocephalus* and *E. minor.* At the time of Dobson's Catalogue there was not a specimen of it in the Museum, while *E. gambianus* was represented by two examples from the Zambesi, so that he naturally supposed Peters to have got hold of the same form, especially as the latter's very imperfect description of the palate-ridges applies perfectly to those of *E. gambianus.*

Sundevall's *Pteropus wahlbergi* from Natal appears, by the dimensions given, to be really *E. gambianus*, but *E. crypturus* also occurs

[1] J. Sci. Lisb. (2) i. p. 3 (1889).

there, as is shown by a specimen from that country presented to the Museum by Capt. Shelley in 1881.

5. Rhinolophus hildebrandti, Pet.

a. Ad. al. ♂. Zomba.

Forearm 65 mm.; ear, length 36; nose-leaf 25 × 13·5.

This fine Bat I had at first supposed to be new, owing to the fact that Peters had only re-softened skins to describe, and these scarcely showed its most remarkable characteristics, namely the great size of the ears and nose-leaf, and the development of a distinct crenulate supplementary leaflet outside the horseshoe. Nor did its describer observe that it is entirely without the minute intermediate lower premolar which most of the species possess, but which is also absent in *R. æthiops*. The British Museum, however, contains one of Hildebrandt's typical specimens, and a comparison with this proves the identity of the Nyasa example with it. The discovery of *R. hildebrandti* in Nyasaland effects a great extension of its range, as it was originally described from Taita, E. Africa.

6. Rhinolophus landeri, Mart. (?).

a. Ad. al. Zomba. 1/93.

This specimen differs from typical *R. landeri*, and equally from Peters's *R. lobatus*[1], probably synonymous with it, in the much greater breadth of the horizontal portion of the nose-leaf, which entirely covers the muzzle. As, however, a specimen quite agreeing with the true *R. landeri* was obtained on the Shiré by Kirk and Livingstone (specimen *c* of Dobson's Catalogue), I think it possible that the difference above noted may be purely an individual one, and not indicative of any local distinction. Further specimens will, however, be necessary before this point can be properly cleared up.

7. Rhinolophus capensis, Licht.

a. Ad. al. ♂. Zomba. 1/93.

8. Hipposiderus caffer, Sund.

a. Ad. al. ♀. Zomba. 1/93.

9. Vesperus megalurus, Temm.

a. Ad. al. Zomba. 1/93.

10. Vesperugo nanus, Pet.

a. Ad. al. Zomba. 1/93.

[1] Peters, 'Reise n. Mossamb.' Säug. p. 41 (1852). All reference to this species was accidentally omitted from Dobson's Catalogue, but in his supplementary report of 1880 (Rept. Brit. Assoc. 1880, p. 10) it is included among the Ethiopian species closely allied to and scarcely separable from *R. ferrum-equinum*, as is also the true *R. landeri*. Whatever may be the ultimate fate of the other forms here thrown together by Dobson, there can, I think, be little doubt as to the essential identity of *R. lobatus* with *R. landeri*.

11. Petrodromus tetradactylus, Pet.

a. Ad. sk. ♂. Zomba. 1/6/93.

12. Felis serval.

a, b. Imm. sks. ♂ ♀. Fort Johnston. 2/93.

13. Hyæna crocuta, Erxl.

a. Ad. ♂ skin and skull. Zomba. Sept. 15, 1893.

The following are the dimensions of the skull:—Basal length 233 mm.; extreme length 286; zygomatic breadth 179.

14. Rhynchogale[1] melleri, Gray.

Rhinogale melleri, Gray, P. Z. S. 1864, p. 575; Thomas, P. Z. S. 1882, pl. iii.

a, b. Ad. sks. ♂ ♀. Residency Garden, Zomba. 4/93.
c. Yg. al. Ditto.

"Wild fruits are always found inside the stomach of this Mungoose."—A. W.

The discovery of this fine Mungoose in Nyasaland is of considerable interest for two reasons. Firstly, its locality now becomes known with certainty, whereas hitherto it has been only conjectured[2] to occur on the Zambesi, a supposition that now proves to have been well-founded. Secondly and chiefly, owing to the fact that the original, and hitherto unique, specimen presented the remarkable number of five premolars on each side above, further specimens were urgently needed to show whether or not this was the normal number in the species. The importance of this point is exceedingly great, for no other known mammal has more than four premolars, and the exception presented by *Rhynchogale* has puzzled myself and other writers on the subject[3]. Believing as I do that four is and always has been the maximum number of premolars normally present, at least since middle Mesozoic times, it is something of a relief to find that the one known exception to this rule now disappears, as the perfect skull of specimen *a*[4] has simply the normal number of four premolars, and we may consequently assume that the type was abnormal in its possession of five.

The occasional abnormal development of five premolars is well known in Carnivores, notably in dogs, and is, I believe, generally due to the fission into two of one or other of the normal set of four. I quite fail to see, as Mr. Bateson would have us do[5], that such cases are any argument against a belief in the individual homologies of teeth, and are not explainable by the simple process, discovered and described by himself, of the fission of normal teeth.

[1] Nom. nov. = *Rhinogale*, Gray, P. Z. S. 1864, p. 575; *nec* Gloger, Handb. Naturg. pp. xxix and 75 (1842).
[2] P. Z. S. 1882, p. 86.
[3] *Cf.* Phil. Trans. vol. 178, Biol. p. 456, 1887 (footnote).
[4] Specimen *b* is so old that the teeth are all worn down or broken out, while specimen *c* is too young to show any teeth at all.
[5] P. Z. S. 1892, pp. 102 *et seqq.*

In the instance before us, it is practically certain that the simple and attractive explanation, often put forward in such cases, that a milk premolar has been retained, instead of being shed in the usual way, is not applicable. For although there is no marked difference in size either between the most anterior premolar of the type and that of specimen *a*, or between the third of the type and the second of the same normal specimen, so that the tooth between them in the type would seem unlikely to be the product of the fission of either $\underline{\mathrm{p}^1}$ or $\underline{\mathrm{p}^2}$, yet the $\underline{\mathrm{mp}^2}$ of other *Herpestinæ* is in form entirely unlike the styliform extra tooth under discussion, and $\underline{\mathrm{mp}^1}$ has as yet never been certainly shown to be present in any Carnivore.

Mr. Whyte's observation on the food of *R. melleri* is of great interest, as its fruit-eating habits may perhaps account for the peculiar structure and wear of the molars. In all the three specimens before me the posterior molars appear to be more worn than the anterior, as though an unusual amount of chewing had fallen to their share; but it must be admitted that this appearance may be deceptive, and that the explanation may be that $\underline{\mathrm{m}^3}$ is naturally so much flatter than usual that it appears to be *worn* flat almost at once.

The fœtal or new-born specimen *c*, preserved in spirit, shows not the slightest trace of a mesial naked line below the muzzle, and therefore lends weight to Dr. Gray's opinion as to the value of this character in dividing the genera of *Herpestinæ*.

15. Crossarchus fasciatus, Desm.

a. Ad. sk. ♀. Zomba. 1/93.
b. Yg. sk. Zomba. 1/93.
c. Yg. sk. Mpimbi, Upper Shiré.

16. Lutra maculicollis, Licht.

a. Ad. sk. ♀. Fort Johnston, Upper Shiré. 11/92.

This specimen belonged to the collection worked out in May 1893, but was accidentally omitted from my previous paper. The species is a rare one, and this exact record of its occurrence is therefore of value.

17. Sciurus palliatus, Pet.

a, *b*. Ad. sks. ♂ ♀. Milanji Plateau. 13 & 15/4/93.

18. Sciurus mutabilis, Pet.

a–i. Four adult and five young skins. Zomba. 12/92 and 1/93.

These midsummer specimens are of the greatest interest, as illustrating a little further the series of seasonal changes occurring in this remarkable species. The adult specimens are halfway through a change of fur, two of them having fresh grizzled-grey hairs on the anterior halves of their bodies and on their tails, while their posterior halves are clothed with ragged rufous or almost straw-coloured fur; the other two are not quite so far advanced. Laying them beside the skins previously received it appears, although this must be for the present a merely tentative explanation, that the grey fur characteristic of October skins gradually bleaches under the influence of the summer sun, until its black rings become first brown and then rufous, this change being quite independent of the shedding and replacement of the fur itself. At the same time there is a change in the paler rings between white and yellow, but in which direction and at what particular season the series before me does not conclusively show, chiefly because, although marked with the month of capture, the exact days have not been noted, so that there is often a little uncertainty as to their exact succession. Coincidentally with this bleaching of the dark rings the true change of fur occurs, the fur first falling off on the head, then on the shoulders and tail, and remaining on the rump until in January it is, as already noted, nearly straw-coloured, with rufous subterminal and yellowish terminal rings. The bleaching of the fur from black to rufous during life may seem almost impossible, but that it really occurs is shown by the darker rings of the tail-hairs, which in October are all deep glossy black, but in November those near the bases of the hairs, where they are not exposed to the sun, are still nearly or quite black, while the terminal ones are brownish red.

The young specimens, all apparently of about the same age, introduce a further element of complexity into the question, for while four of them (Dec. and Jan.) are in a rufous stage, the fifth (December) is grizzled grey, exactly like the grizzled grey parents killed in October. I can make no suggestion for the elucidation of the mystery, but I would suggest, to any one having the opportunity, the collection of a mother and her whole litter of young, the skins to be marked with their exact date, and with the fact of their belonging to one another.

I may venture to hope that further collections will contain more specimens of this very remarkable species, so that I may later have the pleasure of giving a complete account of its changes all the year round.

The fourth collection, made from May to August 1893, contains, unfortunately, no specimens of *S. mutabilis*.

19. Mus dolichurus, Smuts.

a. Ad. al. ♀. Zomba. 12/92.
b. Imm. al. Zomba. 12/92.

The following are the measurements of the well-preserved adult specimen:—Head and body 97 mm.; tail 155; hind foot, without claws, 22; ear from notch 15·5.

Mammæ 1 – 2 = 6.

20. Mus modestus, Wagn.

a. Ad. al. Zomba. 1/93.

21. Isomys dorsalis, A. Sm.

a. Ad. sk. Zomba. 2/93.

22. Cricetomys gambianus, Waterh.

a. Ad. sk. ♂. Zomba.
b. Ad. sk. Zomba. 27/4/93.

23. Lepus whytei, sp. n.

a. Ad. sk. ♂. Mpimbi, Upper Shiré. 4/93.
b. Ad. sk. ♀. Palombi R., Shirwa Plain. 15/8/93. *Type.*
c. Ad. sk. ♀. Zomba. 19/4/93.

Size and general colour above nearly as in *L. capensis*, but the back is more uniformly grizzled and less mottled. Fur decidedly harsher than in that species. Forehead with a white spot. Ears comparatively short; their external band brown all along, with a whitish margin; their extreme tips only black. Nape bright rufous. Sides slightly more rufous than back, but not nearly so much as in *L. capensis*. Chin white. Chest rufous fawn, as are also the upper surfaces of the hind feet. External surface of fore limb, and line down hind leg, richer rufous. Tail rather short, black, more or less mixed with rufous fawn above, white below.

Skull with a short muzzle, very broad proximally, narrow interorbital region, and narrow posterior narial fossa. Incisors broad, their groove close to their inner edge.

Dimensions of the type, an adult skin, female:—

Head and body 468 mm.; tail without hairs (c.) 47; ear, from notch, 88; hind foot, without claws, 95.

Skull: basal length 68; basilar length 65·5; greatest breadth 42·5; nasals, greatest length 37, greatest breadth 18; interorbital breadth 16·2; intertemporal breadth 12·7; diastema 21·5; anterior palatine foramina, length 20·5, combined breadth at surface 9·2; width (antero-posterior) of palatal bridge 8·6; least breadth of posterior narial fossa 5.

This Hare, which I have much pleasure in naming after Mr. Alexander Whyte, the able seconder of Mr. Johnston's efforts to investigate the fauna of Nyasa, is readily distinguishable from *L. capensis* by its harsher fur, rufous nape, shorter ears, feet, and tail, and somewhat different coloration. It is by no means improbable that the specimens from Angola which have been referred to "*L. ochropus*, Wagn.," really belong to *L. whytei*, but this point can only be determined later. The typical *L. ochropus* was described from the Cape itself, and, in agreement with Waterhouse, I can see no possible reason why it should not be looked upon as strictly synonymous with *L. capensis*.

24. Procavia johnstoni, sp. n.

a. Ad. sk. ♀. Fort Lister, 3500 ft. 20/7/93. *Type.*
b. Imm. sk. Fort Milanji. 27/7/93.

c. Yg. sk. Milanji Plain, 4000 ft. 27/10/91. (*P. capensis* of P. Z. S. 1892, p. 553.)

"Found among the rocks at base of cliffs."—A. W.

Allied to *P. capensis*, and therefore belonging to *Procavia* in the narrowest sense; no relationship to "*Heterohyrax*" or "*Dendrohyrax*.[1]"

Size large. Fur comparatively harsh, at least in the type, killed in early summer. General colour of body brown grizzled with white, the grizzling far coarser than in *P. capensis*. Underfur smoky brown. Crown of head deep reddish brown, without white grizzling, much as in some of the red-headed examples of *P. abyssinica*. Cheeks grizzled grey, blacker just beneath the eye. Ears of medium length, thinly clothed internally with whitish, externally with black hairs. A prominent blotch behind and below the ears deep black, this colour running in the type vertically down the sides of the neck. Chin black; throat and chest grizzled grey; belly deep dirty yellow. In the younger specimens the throat and chest are, like the belly, yellow. Arms and legs like back, but the upper surfaces of the hands and feet are deep black.

Dorsal spot small, roughly oval, uniform black.

Skull equalling or even exceeding in size that of *P. shoana*, of which only three skulls, all in Stage VIII., of those measured in 1892, have a greater basal length than the present typical specimen, which is only in Stage VII. Diastema rather short, but longer than in *P. capensis* both above and below. Interparietal sutures persistent. Interparietal bone, as seen in specimen *c*, Stage II., before its form has been altered by the growth of the masseter, pentagonal, its longest side the posterior one, which is directly transverse, and nearly double the postero-lateral ones.

Teeth. Molars and premolars very large and heavy, exceeding those of any other species; no doubt, however, as in *P. capensis*, they will prove to be variable in this respect. $\underline{\text{P}^1}$ sub-quadrangular, similar in shape to $\underline{\text{p}^2}$, far larger and stouter than in *P. capensis*. $\underline{\text{M}^1}$ of type no less than 8·5 mm. in breadth, thus exceeding by 0·4 mm. the largest molar (of *P. shoana*) measured in 1892; its height too much reduced by wear to be worth measuring. Lower $\underline{\text{p}_1}$ better developed and apparently more persistent than in *P. capensis*, its horizontal length in the type 3·3 mm.

Measurements of the *type*, in skin, ♀ :—

Head and body 560 mm.; [hind foot of specimen *b*, 53].

Skull (Stage VII.): basal length 90·5, greatest breadth 53; nasals, length (median) 23, breadth posteriorly 22·5; interorbital breadth 23, intertemporal breadth 26 [interparietal of specimen *c*, length 8·5, breadth 9·5]; palate, length 50; diastema, above 11, below 4; length of upper molar series 44, of lower molar series 45; height of lower jaw 50.

This fine new Dassy[2], which, as being the most striking new

[1] See "On the Species of the Hyracoidea," P. Z. S. 1892, pp. 50–76.

[2] This word, which is the common name given by the English Cape Colonists to *Procavia capensis*, may be conveniently used for any member of the genus.

Mammal discovered during Mr. Johnston's exploration of the Nyasa Fauna, I have named in his honour, is remarkable as being the only member of the genus distinguished by any colour-markings other than those of the dorsal spot. The prominent black ear-mark is in fact quite unique in the group, while its reddish-brown crown, although sometimes present in *P. abyssinica*, will readily distinguish it from its nearest ally, *P. capensis*, in which the crown is finely grizzled like the back. The unusual massiveness of the grinding-teeth will also readily separate *P. johnstoni* from all other forms.

The occurrence of this peculiar but clearly representative species between the ranges of *P. capensis* and *P. shoana* tends to confirm their distinctness from each other, on which I had thrown some doubt when writing in 1892.

Since my monograph of the genus was prepared, two species of *Procavia* have been described by Dr. Matschie[1], but both belong to the *Dendrohyrax* group, and have therefore nothing to do with *P. johnstoni*.

25. Procavia brucei, Gray.

a, *b*. Ad. & imm. sks. ♀. Mpimbi, Upper Shiré. 4/93.
c Yg. sk. Fort Lister, 3500 ft. 25/7/93.

These specimens probably represent *Hyrax mossambicus*, Peters. The youngest of them has already got its interparietal sutures closed.

The basal lengths of the three skulls are:—

a. (Stage VIII.), 79 mm.; *b*. (Stage V.), 71; *c*. (Stage III.), 63.

The ears of these examples are more prominently white than is usual in *P. brucei*, and their bellies and feet are also particularly white, characters in which they somewhat resemble the closely allied *P. bocagei*, and it is probable that when more specimens of the latter are obtained the two forms will be found to grade into one another.

In looking at the fine set of Dassies from Nyasa now sent, three of *P. johnstoni* and three of *P. brucei*, all found more or less together, one cannot fail to be struck by the peculiar method in which evolution seems to have been going on in the group. Not only do they afford a striking instance of the remark made previously[2] as to the constant occurrence together of one species of the hypsodont and one species of the brachyodont group, the competition between members of the two groups apparently not being severe enough to prevent their living together, but also, the practicability of their living together being once proved, they seem then to have tried to become as different from each other in their superficial characteristics as possible. Thus, while the hyposodont *P. johnstoni* is distinguished from its allies of the same group by its *dark* head, *black* ear-markings, *dirty yellow* belly, and *black*

[1] S.-B. nat. Fr. Berl. 1892, p. 110, and 1893, p. 112.
[2] P. Z. S. 1892, p. 57.

digits, *P. brucei* in Nyasa is distinguished from *P. brucei* elsewhere, as just mentioned, by its *white* ears, pure *white* belly, and *white* digits, each species when meeting its congener having, as it were, emphasized its own distinguishing characters in order to be unlike the other. For *P. brucei*, wherever found, is already characterized by its pale colour generally, whitish head, and white or pale yellow dorsal spots, while *P. capensis*, of which *P. johnstoni* may be looked upon as a modification, has a generally dark colour and a black dorsal spot.

Thus there seems to be between the two a sort of mutual "repulsion" in their characters, the exact converse of the better known "mimicry." Its object would very probably be that of furnishing the individuals of each species with "recognition marks" by which to know comrades from rivals.

26. Rhinoceros bicornis, L.

a. Horns. Shiré Highlands.

27. Phacochœrus æthiopicus, Pall.

a, *b*. Ad. skulls. ♂ ♀. Shiré Highlands.

28. Bubalis lichtensteini, Pet.

a. Ad. sk. and skull. Shiré Highlands.
b. Skull. Shiré Highlands.

29. Oreas canna, H. Sm.

a, *b*. 2 ad. sks. ♀. Shiré Highlands.

30. Strepsiceros kudu, Gray.

a. Ad. skull. ♂. Shiré Highlands.

31. Tragelaphus scriptus, Pall.

a. Ad. skull. Shiré Highlands.

32. Kobus ellipsiprymnus, Og.

a, *b*. 2 frontlets and horns. Shiré Highlands.

33. Æpyceros melampus, Licht.

a, *b*. 2 skulls. Shiré Highlands.

34. Oreotragus saltator, Bodd.

a. Ad. sk. ♂. Fort Lister, Milanji, 3600 ft. 17/7/93.

"Found in pairs at the base of the high cliffs among rocks, and also on the higher ridges. Also on Mt. Zomba."—A. W.

35. Manis temmincki, Smuts.

a. Ad. sk. Zomba.

P.S., March 17th, 1894.—Specimens representing the following species have arrived since the above was written, and may conveniently be added to the list here:—

36. RHYNCHOCYON CIRNEI, Pet.

a. Ad. sk. ♂. Zomba. 1/11/93.

37. CANIS MESOMELAS, Schr.

a. Ad. sk. ♂. Palombi R., Shirwa Plain. 11/10/93.

38. NANOTRAGUS SCOPARIUS (Schr.).

a, b. Ad. sks. Shirwa Plain. 10/93.

39. CERVICAPRA ARUNDINUM (Bodd.).

a. Ad. sk. ♂. Palombi R. 6/10/93.

2. On a Collection of Land-Shells from the Samui Islands, Gulf of Siam. By O. F. VON MOELLENDORFF, Ph.D.[1]

[Received December 4, 1893.]

(Plate XVI.)

Mr. C. Roebelen, a well-known collector of orchids, to whom I am indebted for a great number of interesting shells from various parts of Eastern Asia, visited, in 1888 and 1892, the small group of islands south of Bangkok, named by the Siamese Ko-Samui, and situated near the coast of the Malay Peninsula at its narrowest part. The group, from which, so far as I know, no Land-Shells were hitherto known, consists of several small islands, the largest of which is called Samui. The rock seems to be calcareous throughout: at least one small island, called Kwangtong, is, according to Mr. Roebelen, one mass of apparently madreporic limestone.

As might have been expected from their geographical position, the fauna of the Samui group is essentially Malaccan, several species being common to the adjoining mainland, and most of the forms peculiar to the group having their nearest relatives amongst the species of Siam, Tenasserim, and Perak.

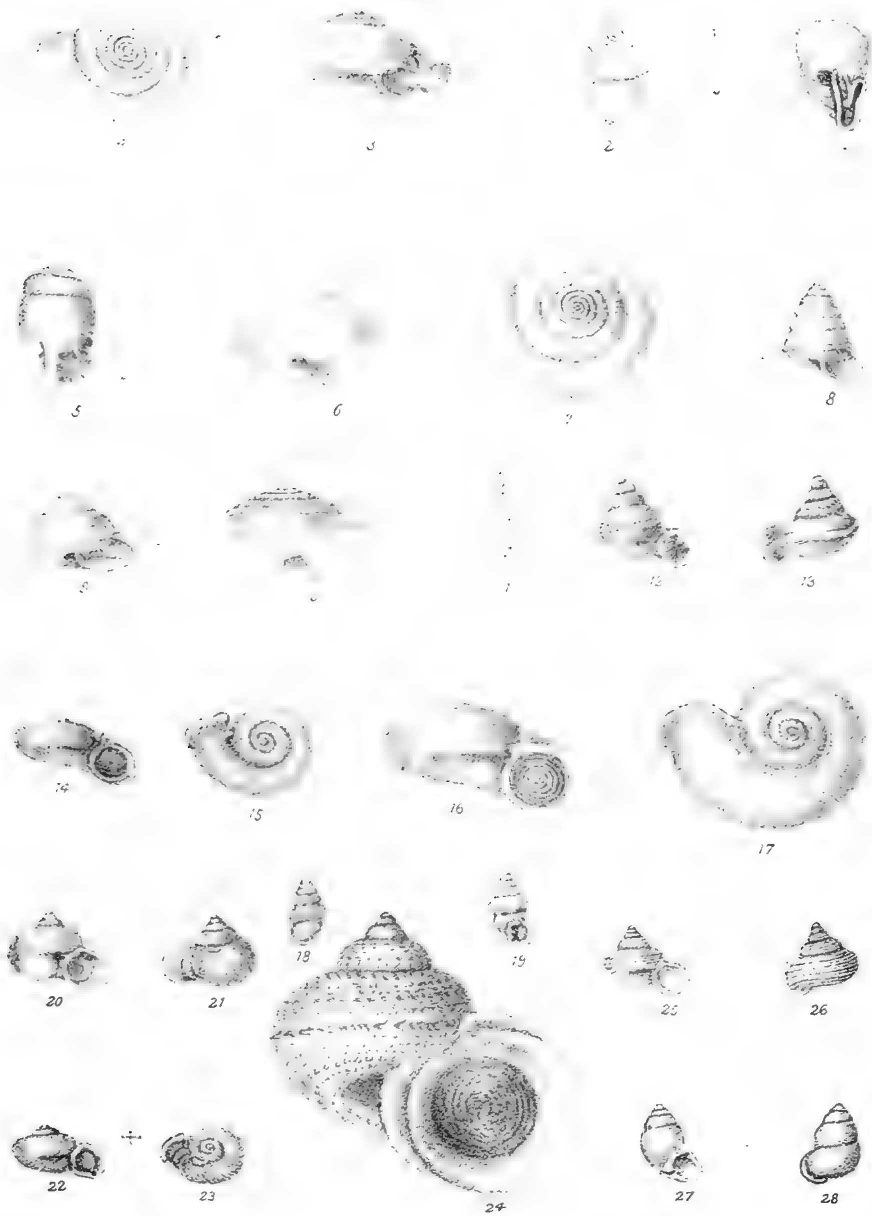
Fam. STREPTAXIDÆ.

1. STREPTAXIS SIAMENSIS, Pfr.

Streptaxis siamensis, Pfr. Mon. Hel. v. p. 449; Tryon, Man. Pulm. i. p. 79, t. xv. fig. 73.

Subsp. nov. DEPRESSA.—*Differt a typo spira magis depressa, anfractu ultimo magis distorto, penultimo subtus glabrato, dente*

[1] Communicated by Mr. G. B. SOWERBY, F.Z.S.



G.B. Sowerby del. et lith.

Hanhart imp.

LAND SHELLS FROM THE SAMUI ISLANDS.

columellari subobsoleto, nodiformi, dentibus in margine externo approximatis subæqualibus.

Diam. 10·5, *alt.* 7 *millim.*

By the flatter spire and the stronger distortion of the last whorl to the right this form appears at first sight to be very different; and as there are some differences in the dentition as well, I feel almost inclined to separate it specifically. Having only one specimen of the variety and but two of the type, I leave this question for further study.

2. Streptaxis mirificus, sp. nov. (Plate XVI. figs. 1, 2.)

T. umbilicata, depressa, subtilissime striatula, nitens, pellucida, hyalina. Anfractus 5½, *planulati, superi spiram regularem perplanam apice fere immerso efficientes; penultimus ad peripheriam acute carinatus; ultimus maxime distortus, valde excentricus, basi peculiariter impressus, ad aperturam valde compressus, subtus subacute cristatus, sat deflexus. Apertura maxime obliqua, perangusta, irregulariter cordiformis; peristoma sat expansum, albo-labiatum. Lamella parietalis peralta, valida, longe intrans, superne bicruris, utrinque in callum parietalem desinens.*

Diam. 9, *alt.* 4 *millim.*

A fine new species of the group of *S. exacutus*, Gld., and *S. hanleyanus*, Stol., both from Moulmein, distinguished by the entirely plane spire with almost immersed centre, the bifid parietal lamella, the compressed cordiform aperture, &c.

3. Streptaxis roebeleni, sp. nov. (Plate XVI. figs. 3, 4.)

T. aperte umbilicata, depressa, subtiliter arcuatim costulata, tenuis, pellucida, hyalina. Anfr. 6, *convexiusculi, sat lente accrescentes, superi spiram subregularem depresso-conoideam efficientes; penultimus vix, ultimus paullum distortus, basi subinflatus, glabratus, pone aperturam coarctatus. Apertura diagonalis, truncato-elliptica; peristoma sat expansum reflexiusculum, albo-labiatum, margine externo profunde sinuato, ad insertionem subito attenuato, recedente. Lamella parietalis valida triangulariter elevata, dentibus* 3 *lamelliformibus in margine externo et basali et nodulo in columella oppositis.*

Diam. maj. 8·5, *min.* 7, *alt.* 5·25 *millim.*

Forma major: *diam. maj.* 10, *min.* 8, *alt.* 5·5 *millim.*

Forma minor: „ 7·5 „ 6, „ 3·75 „

I find no recorded form of *Streptaxis* with which this interesting species could be united. According to the rather meagre description, *S. elisa*, Gld. (Proc. Bost. Soc. vi. 1856, p. 12; Pfr. Mon. Hel. v. p. 448), of the Mergui Archipelago, must be somewhat similar, but is larger, has one whorl more, the whorls are angulate or carinate, and there are two parietal lamellæ. Both species are by their depressed and almost regular form, with very little distortion, rather isolated among the Asiatic *Streptaxes*; in the somewhat artificial division of the genus as given by Pfeiffer they might be classed in *Discartemon*.

4. Streptaxis (Oophana) bulbulus, Morelet.

Streptaxis (Oophana) bulbulus, Tryon, Man. Pulm. i. p. 80, t. 15. figs. 41–43.

Described from Pulo Condor. The single specimen from the Samui group is rather more ventricose, the dimensions being 15 : 11·5 millim. instead of 16·5 : 11 in the type.

5. Streptaxis (Oophana) strangulatus, sp. nov. (Plate XVI. fig. 5.)

T. aperte umbilicata, ovata, sat tenuis, subtiliter arcuatim costulata, sericina, hyalina; spira subregulariter ventroso-conica, apice obtuso, glabrato. Anfr. 6, *sat convexi; ultimus paullum devians, circa umbilicum compressus, obtuse carinatus, pone aperturam subito coarctatus. Apertura parum obliqua, truncato-ovalis; peristoma late expansum, tenue, intus callosum, ad insertionem marginis externi attenuatum. Lamella parietalis valida, sat elevata; dentibus* 5, *uno in parte superiore collumellæ,* 2 *in margine basali,* 2 *in margine externo oppositis.*

Alt. 10·5, *diam.* 7·5 *millim.*

Although certainly belonging to the group of the last species, this peculiar form differs at once in the almost regular, hardly deviating last whorl and the peculiar coarctation behind the mouth, which calls to mind the similar formation in certain species of *Alycæus (Dioryx)*. The whorls also are more convex, the shell is thinner, the peristome broader, and there are 5 teeth instead of 3.

Mr. Ancey is quite right in considering his group *Oophana*, of which *S. bulbulus* is the type, to be a connecting-link between *Streptaxis* and *Ennea*. In fact *S. strangulatus* would at first sight rather be considered as an *Ennea* by many, on account of its regular shape. That this is, however, a *Streptaxis* and not an *Ennea* may be inferred from young specimens, which show no teeth, whilst all the young *Enneæ* are dentate.

Fam. Naninidæ.

6. Macrochlamys limbata, sp. nov. (Plate XVI. figs. 6, 7.)

T. perforata, discoideo-depressa, solidula, subtiliter striatula, lineis spiralibus nullis, pellucida, nitens, pallide corneo-flavescens, subregulariter corneo-strigata. Anfr. 6, *convexiusculi, lente accrescentens, sutura profunda marginata discreti; ultimus non descendens, basi convexior, circa umbilicum excavatus. Apertura fere verticalis, late elliptica, valde excisa; peristoma extus rectum, acutum, margine columellari leviter reflexo, intus callo latiusculo, sat crasso limbatum.*

Diam. maj. 19–22·5, *min.* 16·5–20, *alt.* 10·25–13·5 *millim.*

With all proper hesitation at introducing a new species of this genus, the very numerous species of which certainly require some weeding out, I cannot combine this form with any published *Macrochlamys*. Its nearest ally seems to be *M. resplendens*, Phil., var. *obesior*, Mart. (Ostas. Landschn. p. 72, t. xii. fig. 6), of Siam, which has a slight callosity behind the peristome; it is, however, only visible in very adult specimens and but a thin layer, whilst all my specimens of *M. limbata* show a distinct inner lip, which is repeated several times in the interior of the last whorl. Besides, the Samui form has a wider umbilicus, more convex whorls, equal colouring above and below, and a somewhat darker radial stripe.

7. Sitala insularis, sp. nov. (Plate XVI. fig. 8.)

T. semiobtecte et angustissime perforata, conico-turrita, subtiliter striatula, lineis spiralibus valde confertis decussata, nitens, corneo-hyalina. Anfr. 8, planulati; ultimus ad peripheriam acute carinatus, non descendens. Apertura parum obliqua, rotundato-securiformis; peristoma rectum, acutum, margine columellari superne reflexo.

Diam. 3·75, *alt.* 4·75 *millim.*

By the great number of whorls, the regular conical shape, and the very narrow spiral sculpture this species is distinguished from all forms of *Sitala* known to me.

8. Kaliella subsculpta, sp. nov. (Plate XVI. fig. 9.)

T. anguste perforata, globoso-conica, tenuis, subtiliter et valde confertim costulato-striata, corneo-fusca; spira conoidea, lateribus convexis. Anfr. 6, convexi; ultimus non descendens, basi glabratus, ad peripheriam obtuse angulatus. Apertura obliqua, late lunaris; peristoma rectum, acutum, margine columellari superne triangulariter reflexo.

Diam. 2·9, *alt.* 2·7 *millim.*

The only *Kaliella* described from the Malay Peninsula is *K. perakensis*, G.-Aust., which shows a similar outline, but is more distinctly carinate and only striated; it also has much less convex whorls. The sculpture of our species is similar to that of *K. sculpta*, Mdff., of Macao, which has otherwise a much lower spire and flatter whorls.

9. Hemiglypta siamensis (Pfr.).

Known from Siam and Tenasserim. The spire of the Samui form is generally more elevated.

10. Ariophanta weinkauffiana inflata, subsp. nov.

This variety differs from the Cochin-China type in the less distinct angulation of the periphery and the more convex, almost inflated base of the last whorl.

Fam. HELICIDÆ.

11. CHLORITIS PLATYTROPIS, sp. nov. (Plate XVI. fig. 10.)

T. sat aperte umbilicata, convexo-depressa, tenuis, transverse striatula, punctis impressis in seriebus regularibus dispositis sculpta, pilis brevissimis valde deciduis obsita, opaca, pallide corneobrunnea; spira parum elevata, apice plano. Anfr. $4\frac{1}{2}$, *fere plani, sutura impressa disjuncti; ultimus ad peripheriam carina bene exserta, obtusa, lata cinctus, basi convexus, medio gibbus, circa umbilicum infundibuliformem pervium compressus, subcristatus, ad aperturam breviter deflexus. Apertura fere diagonalis, irregulariter cordiformis; peristoma sat expansum, roseolabiatum, basi reflexiusculum, marginibus valde conniventibus, callo tenui junctis, columellari cum basali angulum obtusum formante.*

Diam. maj. 20, *alt.* 11·5 *millim.*

Hab. prope vicum Chaya, in littore peninsulæ malaccanæ insulis Samui opposito.

Subsp. nov. SAMUIANA.—*Minor, tenuior, spira paullo magis convexa, peristomate minus expanso, vix labiato.*

Diam. 16·5, *alt.* 9 *millim.*

Hab. in insulis Samui.

This fine form belongs to the group of keeled *Chlorites*, for which de Morgan has created the unnecessary subgenus *Philidora* (*cf.* P. Z. S. 1891, p. 336), and is closely allied to *C. gabata*, Gld., of Mergui and Tenasserim. The type was found by Mr. Roebelen near Chaya, a village on the Malay Peninsula just opposite the Samui group within Siamese territory, the smaller variety on our islands.

12. PUPISOMA ORCELLA, Stol.

Pupisoma orcella, Stol. J. A. S. B. xlii. 1873, p. 33, t. ii. fig. 2.

The Samui examples differ from the Penang type merely in their somewhat darker colour and slightly more elevated spire.

That *Pupisoma* has nothing to do with *Pupa*, but belongs to the parentage of *Acanthinula* and *Zoogenetes* (*H. harpa*, Say), I have tried to prove elsewhere (Jahresber. Senckenb. nat. Ges. 1890, p. 223).

Fam. BULIMIDÆ.

13. AMPHIDROMUS MONILIFERUS, Gld.

Only one dead specimen was found, which seems to agree with the above-named species described from Tavoy.

Near Chaya Mr. Roebelen collected a fine variety of *A. annamiticus*, Cr. et Fisch., with rose-coloured apex which I name var. *roseotincta*.

Fam. STENOGYRIDÆ.

14. OPEAS GRACILE, Hutt.

15. OPEAS FILIFORME, sp. nov. (Plate XVI. fig. 11.)

T. rimata, gracillime turrita, tenuis, subtiliter et maxime confertim striatula, nitens, pellucida, albida ; spira sensim attenuata, apice obtusulo. Anfr. $7\frac{1}{2}$, *convexiusculi, lente accrescentes, sutura sat impressa discreti. Apertura modice obliqua, anguste acuminato-ovalis ; peristoma rectum, acutum, margine columellari incrassatulo reflexo.*

Alt. 5·5, *diam.* 1·5 *millim.*

I do not know any similar small and slender species of *Opeas* ; the comparatively great number of whorls show that it is adult.

Fam. PUPIDÆ.

16. VERTIGO (STAURODON) MORELETI, Brown.

Subsp. nov. SAMUIANA.

Differs from the Borneo and the Philippine-Island type (v. Jahresb. Senckenb. nat. Ges. 1890, p. 252) in the slightly more contracted shell and in the somewhat deeper groove behind the outer peristome.

17. HYPSELOSTOMA TRANSITANS, sp. nov. (Plate XVI. figs. 12, 13.)

T. umbilicata, turbinata, oblique striatula, fusca. Anfr. 4, *convexi, spiram conicam apice papillari formantes ; ultimus paullum distortus, antice non ascendens, breviter solutus et porrectus, ad peripheriam crista sat prominente, altera minore ad suturam cinctus, basi subgibber, circa umbilicum compressus. Apertura parum obliqua, rotundato-tetragona; peristoma continuum, tenue, expansum, haud reflexum. Lamella parietalis validiuscula, antice bifida, dentibus* 2 *in margine externo,* 1 *in basi et* 1 *in columella oppositis.*

Diam. 2·75, *alt.* 2·66 *millim.*

This peculiar shell presents an especial interest inasmuch as it forms a decided transition from *Hypselostoma* to the Indian and Chinese *Boysidia*, Ancey, of which *Pupa hunanensis*, Gredl., is the type. As I have mentioned in the description of *Hypselostoma hungerfordianum* (P. Z. S. 1891, p. 338), the genus appears to be but an extreme development of the *Boysidia* type. *Boysidia strophostoma,* Mdff., of South China, shows already a slight distortion and detachment of the last whorl, which in the Samui species is much less developed than in the other forms of the genus. There can be no doubt, however, that it belongs to *Hypselostoma,* with which it has the peculiar quadrangular shape of the last whorl and the dentition of the aperture in common. *H. crossei,* Mor., of Tongkin seems to connect it with the other Malayan species.

18. Hypselostoma striolatum, sp. nov.

Owing to the bad state of preservation of the two specimens of this form, quite distinct from the preceding one, I cannot give a complete description of it. Its last whorl is much more detached than in *H. transitans* and distinctly bent upwards, and shows very distinct though minute spiral lines. The diameter is only 2·5 millim. It belongs to the group of *H. bensonianum* and *H. hungerfordianum*.

Fam. Asiculidæ.

19. Truncatella valida, Pfr.

20. Truncatella semicostata, Mouss.

Fam. Cyclophoridæ.

21. Opisthoporus setosus, sp. nov. (Plate XVI. figs. 14, 15.)

T. latissime umbilicata, discoidea, tenuis, transverse confertim costulato-striata, setis brevibus densis deciduis hirsuta, olivaceo-cornea; spira vix prominula, apice submucronato. Anfr. $4\frac{1}{2}$, *teretes, sutura profunda disjuncti; ultimus paullum descendens, pone aperturam tubulum suturalem brevem ad anfractum penultimum recurvatum gerens, tum subsolutus. Apertura sat obliqua, subcircularis; peristoma duplex, internum tenue, breviter porrectum, externum expansum, campanulatum, superne ad insertionem breviter auriculatum. Operculum extus fere planum, lamina calcarea anfr.* 8 *transverse costulo-striatis, sulco sat profundo ab interna tenui cornea separata.*

Diam. maj. 14, *min.* 10·5, *alt.* 5·5 *millim.*

Forma conoidea: *minor, arctius umbilicata, spira magis elevata, anfractus ultimus magis descendens, longius solutus.*

Diam. 11·5, *alt.* 7 *millim.*

In size and general outline this species agrees somewhat with *O. corniculum* of Java, but the spire is still flatter, the position of the sutural tube is different, and the hirsuteness distinguishes it from the Javan and from all other known *Opisthopori*.

22. Rhiostoma housei, Haines.

Three specimens of a fine large *Rhiostoma* agree very well with the diagnosis of this Siamese species, of which I cannot compare either examples or figures. The largest specimen measures 28 millim. in diameter and is 16·5 high, the operculum is 8·5 millim. wide, 3 high.

23. Rhiostoma asiphon, sp. nov. (Plate XVI. figs. 16, 17.)

T. late et perspective umbilicata, convexo-depressa, solida, transverse plicato-striatula, cinerascenti-brunnea, interdum indistincte marmorata et tæniata; spira parum elevata, apice subacuto. Anfr. 5, *perconvexi; ultimus antice solutus et deflexus, in parte soluta superne albo-carinatus. Apertura obliqua, circularis; peristoma valde incrassatum, multiplicatum, superne intus leviter incisum, extus in alam recedentem haud tubulum formantem productum.*

Operculum cyathiforme, subtestaceum, intus profundissime cylindrico-excavatum, læve, nitens, extus breviter cylindricum, tum semiglobosum, apice subplano, anfr. 12 *marginibus lamellatim elevatis, in interstitiis oblique striati.*

Diam. maj. 24·5, *min.* 18, *alt.* 13·5; *operculi diam.* 6, *alt.* 4 *millim.*

This very interesting form differs from all known species of *Rhiostoma* in the want of a sutural tube, whilst the operculum is quite typical. This is another proof that the formation of a tube, which is but an extreme development of the "wing" at the peristome of *Eucyclotus* and *Pterocyclus*, is of less systematic value than is generally supposed. The classification of operculate shells will have ultimately to rely upon the structure of the operculum chiefly, if not exclusively.

24. Cyclophorus malayanus, Bens.

Whilst Prof. von Martens is quite right in combining the so-called *C. malayanus* of the 'Conchologia Indica' and of Reeve with the very variable *C. aurantiacus*, Schum. (Journ. Linn. Soc., Zool. xxi. 1887, p. 159), I believe with him that the true *C. malayanus*, Bens., of Pulo Penang is a distinct species. A fine large *Cyclophorus* of the Samui group I consider to belong to it, although I cannot compare typical specimens. My largest example measures 48 by 39 millim.

25. Cyclophorus diplochilus, sp. nov. (Plate XVI. fig. 24.)

T. pro genere anguste umbilicata, subdepresse turbinata, solida, transverse leviter striatula, lineis spiralibus rugulosis decussata, pallide corneo-fusca, tæniis interruptis castaneis, interdum strigis castaneis flammulatis picta. Anfr. $4\frac{1}{2}$, *perconvexi, ad suturam subplanati; ultimus antice vix descendens. Apertura sat obliqua, circularis; peristoma duplex, externum album, late expansum, revolutum, marginibus callo junctis, columellari dilatato; internum aureum aut aurantiacum, valde nitens, continuum, late expansum, margine dextro valde dilatato, crassum, quasi multiplicatum, sulco ab externo separatum. Operculum normale.*

Diam. maj. 38, *min.* 28, *alt.* 31; *diam. apert. c. perist.* 24, *intus* 14 *millim.*

Forma minor: *diam. maj.* 30, *min.* 22·5, *alt.* 25; *diam. apert.* 18, *intus* 11 *millim.*

At first I believed this fine shell to be *C. cucullatus*, Gld., of Mergui, of which no figure has been published, and which v. Martens in his able paper on the Mergui Archipelago does not mention. According to the diagnosis of Gould's species as given by Pfeiffer (Mon. Pneum. suppl. i. p. 44), however, there appear to exist sufficient differences to justify the separation of the two forms specifically. *C. cucullatus* is considerably smaller, white, the last whorl subangulate, the columellar margin not dilatate, the outer peristome is only called "reflexiusculum," whilst in my species it is strongly recurved, &c. Otherwise the formation of the peristome, the inner yellow or orange lip contrasting with the white outer one, the widening of the peristome to the right, &c., must be analogous according to Pfeiffer's description.

26. LAGOCHEILUS LIRATULUS, sp. nov. (Plate XVI. figs. 25, 26.)

T. anguste umbilicata, turbinata, sat tenuis, nitidula, transverse subtiliter striatula, lineis spiralibus elevatis sat confertis usque ad umbilicum cincta, corneo-flava, obsolete strigata. Anfr. $5\frac{1}{2}$, *convexi; ultimus antice paullum descendens. Apertura sat obliqua, fere circularis; peristoma subduplex, tenue, breviter expansum, haud reflexum, ad insertionem breviter excisum.*

Diam. maj. 5, *min.* 4·25, *alt.* 5 *millim.*

Differs from *L. townsendianus*, Crosse, of Perak, in the smaller size, the higher and more pointed spire, the more convex whorls, the narrower umbilicus, the want of angulation in the last whorl, and the equally distant, uniform spiral lines.

Fam. DIPLOMMATINIDÆ.

27. ALYCÆUS ROEBELENI, sp. nov. (Plate XVI. figs. 20, 21.)

T. modice umbilicata, subdepresse turbinata, tenuis, pellucida, costulo-striata, lineis spiralibus microscopicis decussata, læte flava; spira modice elevata, lateribus subconcavis, apice obtusulo glabrato. Anfractus 5, *perconvexi, ad suturam profunde impressam subplanati; ultimus postice spiram altitudine multo superans, valde inflatus, gibber,* 4 *millim. pone aperturam valde constrictus, tum denuo dilatatus, ad aperturam sat deflexus. Apertura diagonalis, subcircularis; peristoma continuum, vix duplicatum, sat expansum, haud reflexum, flavo-labiatum. Operculum corneum, valde concavum, anfr.* 6. *Tubulus suturalis brevis, appressus.*

Diam. maj. 9·5, *alt.* 7 *millim.*

Var. minor: *spira paullo magis elevata. Diam.* 8·5, *alt.* 7 *millim.*

Although nearly related to *A. perakensis*, Crosse, this form must, I think, be separated specifically. It is larger, much less elevated, more widely umbilicated, the last whorl comparatively higher, about four-sevenths of the total altitude, and much more tumid, more deflected at the end, and therefore the plane of the aperture much more oblique, the constriction deeper, the peristome hardly double, not so thick, and yellow instead of white. Besides there is half a whorl less, as I count distinctly $5\frac{1}{2}$ in *A. perakensis*. Unless transitory forms exist in the, as yet, little-explored Malay Peninsula, I think these differences sufficient to consider the Samui race a distinct species.

28. ALYCÆUS CANALICULATUS, sp. nov. (Plate XVI. figs. 22, 23.)

T. sat aperte umbilicata, depressa, solidula, confertim costulata, pallide cornea; spira parum elevata, convexo-conoidea. Anfr. $3\frac{1}{2}$, *convexi; ultimus a medio inflatulus, subgibber, pone apertu-*

ram valde constrictus, tum campanulatus, sublævigatus, in media parte lævigata obtuse cristatus. Apertura diagonalis, subcircularis; peristoma duplex, externum sat expansum, internum continuum, valde porrectum incrassatulum, superne et basi effusum et subcanaliculatum.

Diam. maj. 2·25, *min.* 1·75, *alt.* 1·2 *millim.*

Evidently a near ally of the small Perak species, such as *A. microdiscus*, m., but at once distinguished by the peculiar grooves near the upper insertion and at the base of the peristome.

29. Diplommatina (Sinica) samuiana, sp. nov. (Plate XVI. figs. 18, 19.)

T. dextrorsa, elongate ovato-conica, confertim costulata, pallide cornea. Anfr. 7, *modice convexi, superi* 5 *spiram subregulariter conicam efficientes; penultimus magnus; ultimus angustior, paullum distortus, initio constrictus, antice ascendens. Apertura verticalis, subcircularis; peristoma duplex, externum modice expansum, superne interruptum, internum incrassatulum, sat porrectum, basi columella angulum distinctum formans. Lamella columellaris humilis, palatalis longiuscula, subhorizontalis, supra columellam conspicua.*

Alt. 2·5, *diam.* 1·33 *millim.*

Fam. Pupinidæ.

30. Pupina artata, Bens.

31. Pupina pallens, sp. nov. (Plate XVI. figs. 27, 28.)

T. conoideo-ovata, lævis, nitens, pallide corneo-brunnea. Anfr. 6, *convexiusculi; ultimus sat distortus, supra aperturam applanatus, antice breviter ascendens. Apertura paullum retrorsum inclinata, circularis; peristoma expansiusculum, haud reflexum, margo externus ad insertionem attenuatus, recedens cum lamella parietali triangulari valida canalem superum formans, basalis et columellaris incrassati et dilatati. Canalis inferus angustus, horizontalis, postice in foramen subcirculare desinens.*

Alt. 8, *diam.* 5·5 *millim.*

This somewhat difficult form agrees in size with *P. arula*, Bens., of Perak and Tenasserim, but differs in the more obtuse spire, the more distorted last whorl, and consequently the aperture placed more to the right and protracted at the base, the thinner outer peristome, the broader columella, the broad triangular parietal lamella, and the narrower lower incision.

Fam. Hydrocænidæ.

32. Georissa monterosatiana, Nev. et G.-A.

Subsp. nov. samuiana.—*Minor, anfr. magis convexis. Alt.* 2·5, *diam.* 1·5 *millim.*

A slight modification of the Perak type.

EXPLANATION OF PLATE XVI.

Figs. 1, 2. *Streptaxis mirificus*, p. 147.
3, 4. —— *roebeleni*, p. 147.
5. —— (*Oophana*) *strangulatus*, p. 148.
6, 7. *Macrochlamys limbata*, p. 148.
8. *Sitala insularis*, p. 149.
9. *Kaliella subsculpta*, p. 149.
10. *Chloritis platytropis*, p. 150.
11. *Opeas filiforme*, p. 151.
12, 13. *Hypselostoma transitans*, p. 151.
14, 15. *Opisthoporus setosus*, p. 152.
16, 17. *Rhiostoma asiphon*, p. 152.
18, 19. *Diplommatina samuiana*, p. 155.
20, 21. *Alycæus roebeleni*, p. 154.
22, 23. —— *canaliculatus*, p. 154.
24. *Cyclophorus diplochilus*, p. 153.
25, 26. *Lagocheilus liratulus*, p. 154.
27, 28. *Pupina pallens*, p. 155.

3. A List of the Hemiptera-Heteroptera of the Families *Anthocoridæ* and *Ceratocombidæ* collected by Mr. H. H. Smith in the Island of St. Vincent; with Descriptions of New Genera and Species. By P. R. Uhler.[1]

[Received January 22, 1894.]

A. *List of Species of which specimens were obtained.*

Anthocoridæ.

Lasiochilus pallidulus, *Reuter.*
—— variabilis, *Uhler.*
—— pictus, sp. nov.
—— fraternus, *Uhler.*
Piezostethus sordidus, *Reuter.*
Triphleps perpunctatus, *Reuter.*
Brachysteles pallidus, *Reuter.*
Cardiastethus elegans, *Uhler.*
—— consimilis, *Uhler.*

Ceratocombidæ.

Ceratocombus brasiliensis, *Reuter.*
—— minutus, *Uhler.*
Cryptostemma fasciata, *Uhler.*
Schizoptera flavipes, *Reuter.*
—— scutellata, sp. nov.
—— capitata, sp. nov.
Ommatides (gen. nov.) insignis, sp. nov.
Oncerodes (gen. nov.) robusta, sp. nov.

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[1] Communicated by Dr. D. Sharp, F.R.S., F.Z.S., on behalf of the West India Islands Committee.

[In the list of St. Vincent Hemiptera recently communicated to the Society (see P. Z. S. 1893, p. 705) it was mentioned that Prof. Uhler had been obliged to leave the Anthocoridæ and Ceratocombidæ undetermined, the material sent to him being inadequate for the study of such difficult insects. Since then Prof. Uhler has received from the Committee additional material—chiefly from the neighbouring island of Grenada—which has enabled him to complete his enumeration of the two groups of Heteroptera in question, and I now communicate to the Society the results of this part of his work. We hope that the list of Hemiptera-Heteroptera of Grenada will shortly be in the possession of the Committee.—D. S.]

B. *Descriptions of New Genera and Species.*

Fam. ANTHOCORIDÆ.

Genus LASIOCHILUS.

LASIOCHILUS PICTUS, sp. nov.

In form similar to *L. nebulosus*, Uhler, but somewhat narrower, with the head a little more tapering. Above pale rufo-flavous and testaceous, beneath pale rufo-piceous. Head moderately short, rufo-testaceous, minutely rugulose in front, with a triangular impressed line between the eyes, near which the surface is slightly granulated; the neck is a little swollen, highly polished, slightly wider than the space between the eyes, bounded in front by an impressed line with some punctures; the front narrower and longer than the neck, with the sutures bounding the tylus deeply defined; antennæ moderately slender, not setaceous, testaceous, a little dusky, the second joint much the longest, a little thicker towards the tip, the third joint much more slender, a little shorter than the fourth, which is a little thicker than it; rostrum pale fuscous, slender, reaching as far as the middle coxæ. Pronotum trapezoidal, wider than long, with the lateral oblique margin pale testaceous, reflexed, with the anterior angle a little rounded; surface rufo-testacous, polished, remotely pubescent, the callosity of the anterior lobe long, convexly prominent; collum scarcely projecting beyond the side of the head, narrow, but distinct; the posterior lobe large, punctate, the punctures continuing forward on the sides, the posterior margin hardly sinuated, with the humeral angles callous, pale, and acute. Scutellum pale reddish brown, depressed and punctate behind the middle. Hemelytra pale testaceous, minutely pubescent, closely punctate except upon the posterior part of the corium; the cuneal portion smoke-brown, but darker exteriorly, and dull testaceous on the costal border; posterior margin of the corium also brown; membrane soiled whitish. Legs dusky testaceous. Venter clouded with dusky brown, a little paler exteriorly, the posterior margins of the segments fringed with yellowish hairs, and most of the ventral surface spread with fine yellowish pubescence.

Length to tip of abdomen 2 millim.; width of base of pronotum $\frac{3}{4}$ millim.

One or two specimens were found on the leeward side of St. Vincent, and others were taken in the island of Grenada.

Fam. CERATOCOMBIDÆ.

Genus SCHIZOPTERA, Fieber.

SCHIZOPTERA SCUTELLATA, sp. nov.

In form similar to *S. rutteri*, Reuter, but with the membrane more tapering posteriorly. Subconic-ovate, black, opaque, minutely pubescent, with a broad orange band covering the clavus, except directly at base, the costa, and base of the two medial veins of the corium; the legs and antennæ yellow. Head broad, convex, narrower than the front of the pronotum, but with the eyes prominent and extending beyond the pronotum; antennæ reaching to the tip of corium, the basal joints thick, the second one longer than the first, and the remaining ones thread-like, set with fine hairs. Pronotum convexly arched, a little wrinkled anteriorly, steeply sloping forwards, minutely and closely scabrous, with the posterior margin a little decurved, and the humeri moderately prominent; the scutellum small, dull black. Clavus raised like a tabula; the veins of the corium coarse and prominent; the membrane long, dull black, with the medial longitudinal veins long, parallel, and continued to the tip.

Length to tip of membrane $1\frac{1}{2}$ millim.; width of pronotum $\frac{3}{4}$ millim.

Only one specimen was secured on the island, and as it is not labelled, nothing can be stated concerning its *habitat.*

SCHIZOPTERA CAPITATA, sp. nov.

This form, omitting the head, is nearly like *S. flavipes*, Reuter. The head departs remarkably from all the related species in being long, conical, and acutely tapering at tip; the body, head, pronotum, legs, and scutellum are pale fulvous, with the coriaceous part of the hemelytra velvety black, and the membrane and apex of the corium whitish yellow. Eyes small, lateral, subglobose, blackish; antennæ pale yellowish, reaching beyond the tip of the corium, the basal joint shorter than the second, the second a little thickened at tip, with the remaining joints very slender, dusky, and minutely fringed; rostrum projecting from behind the middle of the gula, pale testaceous, reaching to the middle coxæ, and a little piceous at tip. Pronotum transverse, trapezoidal, flat above, steeply sloping, with the lateral margins obliquely tapering and the margin a little reflexed; the anterior margin, as wide as the space between the eyes, abutting against a collum which stands between the eyes; the posterior margin almost straight, with the humeri subacute. Scutellum crescentiform, elevated at base, contracted beyond the base and acutely tapering to the tip. Corium somewhat greyish pubescent, the veins distinct, the cubital one leaving a wide areole in the interval out to the costa and keeping on to tip of membrane; the costal vein tawny towards the tip, the vein next inward running parallel with this and equally continuous.

Length to tip of membrane $1\frac{1}{4}$ millim.; width of pronotum $\frac{2}{3}$ millim.

Only one specimen was secured. It was found at locality No. 6.

In this form the hemelytra are very much wider than the abdomen and longer than usual, with the costal margin curved nearly the same as in *S. flavip's*, Reut. Mr. Reuter does not include in this genus any species with produced head; but the characters in this species, apart from those of the head, seem distinctly to connect it with the genus to which it is now referred.

OMMATIDES, gen. nov.

Coleopterine, closely resembling a short thick *Geocoris.* Eyes very large, oval, projecting diagonally against the anterior corner of the pronotum; front of the head short, bluntly tumid, with the face vertical, protracted downward, and having long lobate cheeks which converge over the base of the rostrum; antennæ filiform beyond the second joint, the basal joint shorter and a little thicker than the second; rostrum thick at base, short, tapering, quite slender towards the tip, reaching almost to the middle coxæ. Pronotum very short, almost annular, with the sides rounded off anteriorly to admit the form of the eyes, the posterior margin almost straight. The two forward pairs of legs placed near together; the anterior tibiæ greatly thickened at tip and armed with long spines. Scutellum very short, transverse, triangular. Hemelytra high convex, extending amply over the abdomen and much longer than it; the costal border moderately curved, with the middle areole moderately wide, and the thick cubital vein running back parallel with the next inner vein all the way to tip of membrane, and with the two exterior transverse veins as in *Schizoptera.*

OMMATIDES INSIGNIS, sp. nov.

Ovate, blunt and wide in front; orange, with the pronotum, scutellum, and a broad band behind the scutellum, covering the membrane, blue-black. The head reddish brown above, yellow below the origin of the tylus, obsoletely scabrous, very minutely pubescent. Legs polished, stout, bright yellow, remotely hairy. Pronotum moderately arched, opaque, a little scabrous. Hemelytra thick, opaque, velvety; the membrane but little thinner than the corium, with the inner margin straight, not overlapping at tip, the apex a little tapering and rounded at tip.

Length to tip of membrane 1 millim.; width of pronotum $\frac{5}{8}$ millim.

A single specimen of this peculiar little insect was taken, but no record is given concerning the place where it was found.

ONCERODES, gen. nov.

Coleopterine, and resembling an *Issus* in form; the hemelytra particularly wide and subglobose, blunt at the anterior end. Head nearly vertical, short and broad, moderately convex before the line of the eyes, transversely impressed between them; the cheeks separated by deep vertical lines, the tylus nearly linear; rostrum very short and thick, tapering at tip, fitting very compactly into the sternum, reaching to tip of anterior coxæ; antennæ with the two basal joints thick, the second joint a little shorter and not so thick as the first, the remaining joints thread-like, finely pubescent. Pronotum transverse, nearly crescent-shaped, moderately arched, having the anterior angles rounded off to fit the curve of the eyes. Scutellum acutely triangular, much longer than wide. Hemelytra but little longer than wide, suborbicular, narrower at base, corresponding to the width of the pronotum; the veins coarse and prominent, longitudinal, the two middle ones connected on the disk and sending back a branch parallel to the others, all of which continue out to the tip; suture of the clavus deeply defined, the clavus wide and nearly triangular. Legs stout, placed close together.

ONCERODES ROBUSTA, sp. nov.

Short, thick, very convex, opaque bluish-black, with a velvety aspect above. Base of the hemlytra, including the scutellum, clavus, and a spot expanded on the costal margin, bright yellow. Head transversely rugulose, the front piceous, with the throat and antennæ dull honey-yellow; the rostrum a little darker. Legs thick and short, honey-yellow. Venter dull black, rufo-piceous on the genital pieces.

Length to tip of hemelytra $1\frac{1}{4}$ millim.; width of pronotum $\frac{1}{2}$ millim.; width of hemelytra $\frac{3}{4}$ millim.

A single specimen was found on the leeward side of the island.

In respect to form of body and longitudinal direction of veins on the hemelytra this insect bears some relation to *Hypselosoma*, Reuter; but in all other respects it seems sufficiently different to constitute a separate genus.

4. On the Affinities of the Steganopodes. By Dr. R. W. SHUFELDT, C.M.Z.S.

[Received January 25, 1894.]

Recently I have written an account of the osteology of all the North-American Steganopodes, illustrating it with many figures of the representative species. This, extending as it would to between one hundred and two hundred pages, is altogether of too great length to submit on the present occasion; it may be of interest, however, to offer some of the conclusions arrived at with respect to the relationships of the birds constituting that suborder.

Basing then, as we do, our judgment on a study of the skeletons of the Steganopodes, we are justified in regarding them as being composed of three superfamilies. These may be designated as, first, the *Pelecanoidea*; second, the *Phaëthontoidea*; and third and lastly, the *Fregatoidea*.

Arranging these, and the North-American families of them, with their genera, a taxonomic scheme on such a basis would stand thus:—

SUPERFAMILIES.	FAMILIES.	GENERA.
Pelecanoidea.	Pelecanidæ.	*Pelecanus.* *Phalacrocorax.* *Anhinga.* *Sula.*
Phaëthontoidea.	Phaëthontidæ.	*Phaëthon.*
Fregatoidea.	Fregatidæ.	*Fregata.*

Ornithotomists are agreed that the Steganopodes, considered as a whole, constitute a well-defined group, but beyond this the majority are reticent as to the question of the affinities existing among the families and genera composing it, and its relations as a whole to other avian groups in the system.

If from among the *Pelecanidæ* we select the genus *Phalacrocorax*, there is no doubt, so far as its osteology indicates, that it is closely related to the genus *Anhinga*. This, as has been shown in my work, is evident from a direct comparison of the corresponding bones of the skeleton of any species of Cormorant with those of the skeleton of *Anhinga*.

On the other hand, and by similar methods, there is no disguising the kinship existing between *Phalacrocorax* and *Sula*, although the gap between these genera is somewhat greater than that between the Cormorants and the Anhingas.

Pelicans of the genus *Pelecanus* are aberrant forms which, as osteologically indicated, have varying relations with all three of the genera thus far mentioned. They are, however, apparently more nearly related to the *Sulidæ* than to the Cormorants.

From the *Pelecanoidea* the passage to the *Phaëthontoidea* is not far to seek, for, upon comparing the corresponding bones in the skeleton of such a Gannet as *Sula brewsteri* with those of *Phaëthon flavirostris*, we are at once confronted with so many points of similarity as to leave no doubt upon our minds that it is between the genera and families represented by such species as these that the linking of the two groups takes place.

This is important, for in another direction we are led on the one hand through *Phaëthon* to the suborder Longipennes, and on the other to the suborder Tubinares—*Phaëthon flavirostris* having some osteological characters that strongly suggest Larine affinities, and still more that bring to mind the skeleton of a *Puffinus*.

With their distinct maxillo-palatines, their perforate nostrils, their hardly coalesced palatines, their four-notched sternum, and with their ilia widely separated from the "sacral crista," taken in connection with numerous other important skeletal characters, the Tropic Birds are fully entitled to rank as a superfamily—the *Phaëthontoidea*.

There can be no doubt about *Fregata*, for the skeletal characters seen in its skull, its sternum and shoulder-girdle, its pelvis and limbs, and in its trunk skeleton, as described in detail in my account, stamp it at once, not only as being a form having many skeletal characters completely at variance with those found in average steganopodous birds—such as Cormorants and Gannets—but as a type likewise for which a superfamily must be founded in order to show that these striking departures are fully appreciated by the student of its osteology. As indicated in our scheme above referred to, this superfamily may be designated *Fregatoidea*.

The pelvis in *Fregata* is decidedly more like the pelvis in *Phaëthon* than that bone in other Steganopodes. In its extraordinary short and otherwise weak pelvic limb-bones as compared with the very lengthy pectoral ones, and the size of the rest of the bird, it stands quite unique in the suborder to which it belongs. More remarkable than all, however, are the many characters in its skull that powerfully recall the Albatrosses among the Tubinares. These are so evident that one is almost led to believe, if it be not actually the case, that the strong hooked beak in the skull of *Fregata* is a Diomedean rather than a Pelecanine character[1]. Apart from the free ends of the furcula coalescing with the coracoids, there are characters in the sternum and shoulder-girdle of *Fregata* that also recall the forms of the corresponding bones in the Albatrosses, but beyond this there appears to be nothing else in the skeleton of the Man-o'-War Bird at all reminding us of those birds.

Since this relationship exists between *Fregata* and *Diomedea*, remote as it may be, it nevertheless, taken in connection with what has been pointed out above in regard to *Phaëthon* and *Puffinus*, ought to convince us that the Steganopodes are more closely connected with the Tubinares than they are with the Longipennes.

There are those who claim to see a kinship existing between the *Accipitres* and the *Fregatoidea*, but there are surely no indications of it so far as the osteology of any of the representatives of the two suborders in question is concerned.

March 6, 1894.

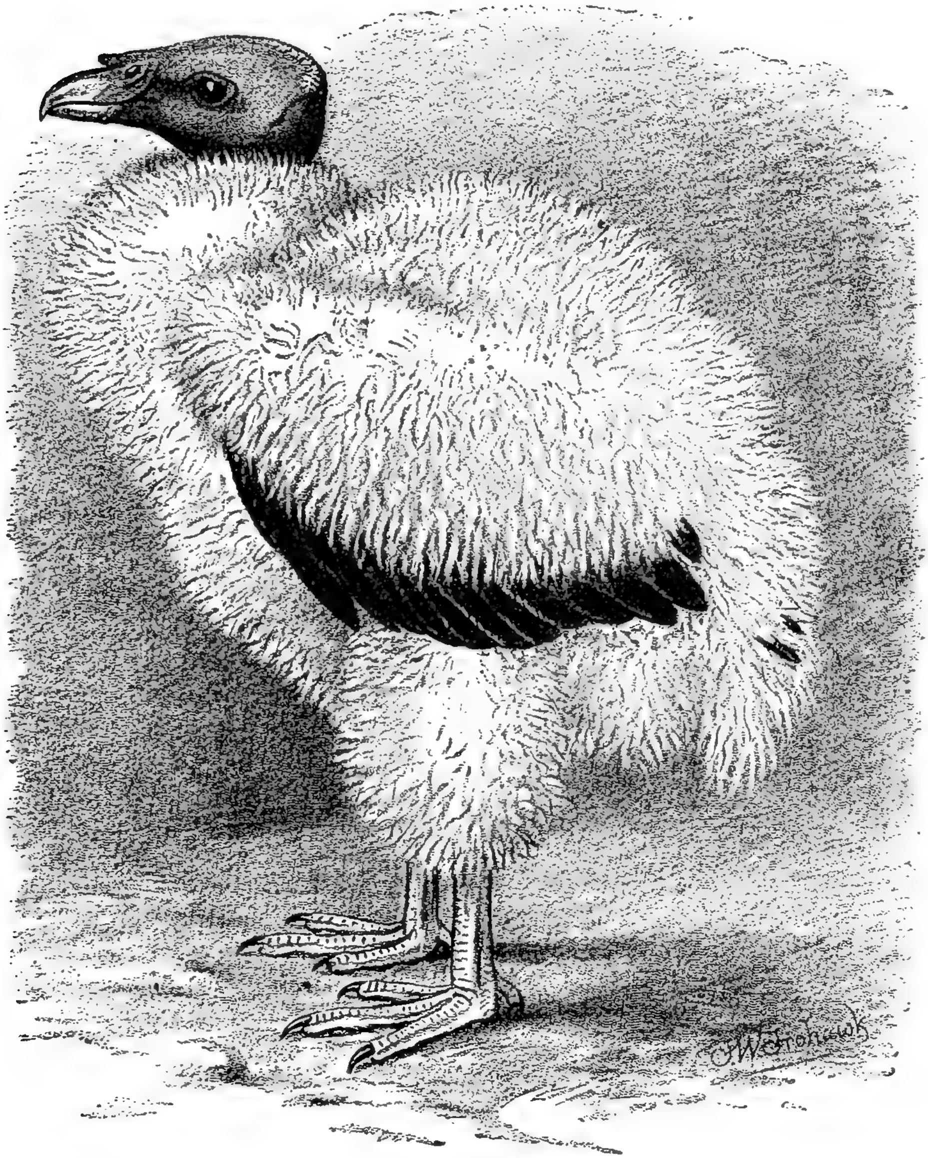
Dr. A. Günther, F.R.S., Vice-President, in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of February 1894:—

The total number of registered additions to the Society's Menagerie during the month of February was 83, of which 66 were by

[1] In my extended account of the osteology of the Steganopodes, referred to above, a full description of the skull of the Man-o'-War Bird is given, illustrated by several figures from photographs. From that account I select some of the statements:—"For example, both superficially and otherwise the skull of *Fregata* resembles the skull in some species of Albatrosses (*Diomedeidæ*) in not a few respects. This not only applies to the lower jaw, where the similarity is very evident, but also to a number of characters in the cranium and face. The long powerfully hooked superior mandibles are a good deal alike, as are the maxillo-palatines. *Fregata* has a vomer that approaches that bone in the Albatrosses; its palatines are not far off, and even still less so its pterygoids and quadrates. The lacrymals are upon the same plan of structure, and the entire cranium proper in the Man-o'-War Bird might well answer for that of an Albatross but slightly removed from the typical stock. *Fregata*, however, lacks the deep supraorbital glandular fossæ so characteristic of the *Diomedeidæ*, and, from above downwards, the skull is somewhat more compressed than it is in, for example, such a species as the Short-tailed Albatross (*D. albatrus*)." [Then follows a detailed comparison, character by character, of the skull and associate parts as found in *Fregata aquila* and *Diomedea albatrus*, but that comparison is of too great length to insert here as a footnote.]

presentation, 5 by purchase, and 12 on deposit. The total number of departures during the same period, by death and removals, was 73.



Young King Vulture in down plumage.
(Received October 20, 1893.)

I take this opportunity of calling attention to the young King Vulture (*Gypagus papa*) which we received in the down plumage on the 20th October last. It has been figured in the 'Field,' lxxxii. p. 971 (1893), by the proprietors of which the accompanying illustration has been lent to us. This bird has now moulted its nestling-plumage altogether, and has assumed the first feather-plumage, in which it is nearly of a uniform black.

The young bird was probably not more than 2 or 3 months old when received, and therefore would appear to remain about 7 or 8 months in its nestling-plumage.

Mr. W. Bateson exhibited six specimens of the Common Pilchard (*Clupea pilchardus*) showing variation in the number and size of the scales. The specimens had been received from Mr. Matthias Dunn, of Mevagissey, Cornwall. In each of them the scales over a greater or less area of the body were smaller and more numerous than in the normal fish. Similar specimens were exhibited to the Society by Mr. Bateson in 1890 and had been described in the Proceedings[1] as examples of abnormal repetition of parts. In that paper reference was made to an account of a similar specimen that had been given by the late Mr. F. Day[2], who took a different view, being of opinion that the fish was a hybrid between the Pilchard and the Herring. For reasons then given it was urged that the evidence of hybridity was unsound, and it was represented that the abnormality was more probably due to variation.

The new cases fully bore out the view then taken. Except in the matter of the scales, each of the six examples was in all respects a true Pilchard, having the normal sculpture on the opercula, the high number of gill-rakers characteristic of the Pilchard, and the histological features normally found in the scales of the Pilchard. In the matter of the gill-rakers the lowest number seen in the abnormal fishes was 70 and the highest 89, most of them having about 78. The numbers seen in normal Herrings are considerably lower than these.

In four of the new specimens the small abnormal scales extended over the posterior half of one side only. In one specimen both sides were almost uniformly covered with the small scales. In the sixth specimen the posterior half of one side showed the small scales, and on the other side there was in about the middle of its length a circular patch of very small scales, the remainder of the scaling being normal or nearly so. Unfortunately the specimens had been somewhat rubbed and the precise numbers of the scales cannot confidently be given. Speaking in general terms, it may be said that in the areas of abnormal scaling the size of the scales was about half that of the normal scales. All the specimens were well grown and in good condition, ranging from 7 to $8\frac{1}{2}$ inches in length.

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[1] Proc. Zool. Soc. 1890, p. 586.
[2] *Op. cit.* 1887, p. 129, pl. xv.

February 6, 1894 (*continued*).

February 20, 1894.

March 6, 1894.

LIST OF PLATES.

1894.

PART I.

NOTICE.

The 'Proceedings' are issued in *four* parts, as follows:—

Part I. containing papers read in January and February, on June 1st.
II. ,, ,, ,, March and April, on August 1st.
III. ,, ,, ,, May and June, on October 1st.
IV. ,, ,, ,, November and December, on April 1st.

16.e

PROCEEDINGS

OF THE

GENERAL MEETINGS FOR SCIENTIFIC BUSINESS

OF THE

ZOOLOGICAL SOCIETY

OF LONDON,

FOR THE YEAR

1894.

PART II.

CONTAINING PAPERS READ IN

MARCH AND APRIL.

August 1st, 1894.

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LIST OF CONTENTS.

PART II.—1894.

March 6, 1894.

March 20, 1894.

Contents continued on page 3 of Wrapper.

Dr. J. W. Gregory, F.Z.S., made some remarks on the factors that appear to have influenced zoological distribution in Africa, commencing with the following observations :—

"It has long been known that the phenomena of distribution in Equatorial Africa present a series of glaring contradictions and anomalies. Thus many groups extend across Africa east and west, others run north and south, while a third group occurs only as isolated patches on the summits of the highest mountains. Similarly the fishes of many rivers and lakes belonging to different basins have identical or nearly allied species. These are absent in North-east Africa and reappear in the lakes and rivers of Syria. As it was believed that the geology of Central Africa was very simple and that the country had been for ages remarkably stable, it has appeared very difficult to explain these facts of distribution. The results of more recent work, however, show that the lake-region of Africa is a district of great instability."

Dr. Gregory then gave a brief sketch of the probable changes that had occurred in the level of the country:—"Originally the Victoria Nyanza district was probably a high plateau on which rose rivers that flowed on one side into the Congo and on the other into the Indian Ocean and the Red Sea. The centre subsided and the drainage formed a great lake. This was subsequently further isolated from the Congo and the East Coast river-systems by two long cracks forming rift valleys. Subsequently the Nile cut through the mountains to the north of the Nyanza, and the waters of that lake became discharged into the Nile. The Jordan Valley was connected to the East-African river-system at a time when much of the Eastern Levant was dry land and Palestine was covered by a freshwater lake. The surplus waters of this lake discharged to the south and flowed along the valley that by later subsidence was formed into the basin of the Red Sea. The living land- and river-mollusks of Abyssinia and the fossil species to the south also show that the connexion between Syria and the Central African lakes was established by a river that flowed across Baringo and Basso Narok and thus into the south end of the Red Sea.

"The key to the distribution of the land animals and plants lies in the discovery of the former extension of the glaciers of Mount Kenia. The climate must then have been very different from the present one. The results of the former greater height of the land would have been a depression of the isobaric surfaces and the formation of a high-pressure area over the central plateau. The winds would have been different and far less regular, and the rainfall would have been greater and more evenly distributed. The surface of maximum rainfall would have been lower and more extensive. Hence the present alpine flora would have descended from the mountains to the plateaus, and the low-level flora have been luxuriant and better adapted for food than the existing scrub. There would therefore have been no such barriers to the migration of small mammals and many of the invertebrates as exist at present."

Dr. Gregory then exhibited and made remarks upon a series of photographic slides, illustrative of his recent expedition to Mount Kenia.

The following papers were read :—

1. Note on Three Species of River-crabs of the Genus *Thelphusa,* from Specimens collected in Eastern Africa by Dr. J. W. Gregory, Mr. H. H. Johnston, C.B., and Mr. F. J. Jackson. By F. Jeffrey Bell, M.A.

[Received February 7, 1894.]

During his remarkable expedition to Mount Kenia Dr. Gregory obtained, in the papyrus-swamp north of Rangatan Ndari, Leikipia, a River-crab of the genus *Thelphusa,* which may be referred to the species *T. berardi,* first figured by Savigny. From a height of from two to three thousand feet on Mount Zomba, Mr. H. H. Johnston, C.B., has lately sent a specimen which must be referred to *T. depressa,* Krauss. Mr. F. J. Jackson has also been so good as to present to the Trustees of the British Museum two examples of the same genus taken on the south side of Mt. Elgon, which are to be referred to *T. nilotica,* M.-E.

It is very interesting that three different species should reach the Museum within as many months from three distinct, though not so very distant, localities in the eastern half of Central Africa. What is of importance is that the species from the more northern localities (Mt. Elgon and Leikipia) are those which have a more northern distribution, for both are Egyptian; whereas *T. depressa* was described by Krauss [1] from Port Natal, and a variety of the same species, characterized by Mr. E. J. Miers [2] as *T. depressa johnstoni,* was found by Mr. H. H. Johnston during his expedition to Kilimanjaro in 1884.

So far as evidence is afforded by the species of this freshwater Crab, the line of demarcation between North and South Africa would lie south of Mt. Elgon and north of Kilimanjaro; and in support of this view there is the fact that, as Mr. Edgar Smith has reminded me, *Physopsis africana* and *Limnæa natalensis,* which were both described by Krauss from specimens collected in Natal, have been found in Lake Nyassa. The latter, however, extends as far north as Abyssinia, and there is some reason to suppose that it also inhabits the West Coast of Africa; so that it does not afford us much assistance in the delimitation of areas of distribution in this region of the African continent.

However, the problems of distribution in Africa are so many and so difficult, that what we need at present is a broader and firmer basis of facts.

[1] Südafrikan. Crust. (1843), p. 38, pl. ii. fig. 4.
[2] Proc. Zool. Soc. 1885, p. 237.

2. On the Hemiptera-Heteroptera of the Island of Grenada, West Indies. By P. R. Uhler.[1]

[Received February 9, 1894.]

[Two papers were recently communicated to the Society on Hemiptera from the island of St. Vincent (see P. Z. S. 1893, p. 705, & 1894, p. 156); in these it was mentioned that Prof. Uhler was engaged in working out the collections from Grenada sent to him by the Committee. I have now the pleasure of offering to the Society the memoir the reception of which we were then looking forward to. The collections studied were made by Mr. and Mrs. Herbert H. Smith under the auspices of Mr. F. D. Godman, F.R.S., in the manner that was mentioned when we were dealing with the St. Vincent insects.—D. S.]

The collection of Heteroptera here enumerated was brought together in the island of Grenada by Messrs. Herbert H. Smith and Henry E. Summers during a part of the year 1891. It represents the results of a careful search over the principal parts of the island during a period of about eight months, extending from February to November. The total number of species brought back is about 166, excluding varieties and some immature forms which could not be identified.

Although not exhaustive, the collection affords an excellent basis of comparison with the faunas of other islands and countries adjacent to the centre of America; it also supplies some hints as to the sources from which the fauna has been derived.

From a review of the species here enumerated it appears evident that the Hemipterous fauna is Central-American. It is largely composed of forms which belong to the borders of the Tropics, rather than of such distinctly tropical ones as inhabit the South-American continent. The *percentage* of small forms is remarkably large. The family most extensively represented is the Lygæidæ, of which 28 species are present, and these are correspondingly numerous in individuals. Of these species nine-tenths are found in Cuba and the other Greater Antilles, and about the same number also occur in Mexico and Central America.

Next in abundance appear the Pentatomoidea, with 24 species. Most of these, likewise, are found in the Antilles, Mexico, and Central America, and form part of the fauna which ranges from the southern United States to the borders of the equatorial region. The most conspicuous form is *Edessa rugulosa*, which is closely related to a species of Cuba and San Domingo and to another from Mexico. *Banasa lenticularis* is very closely related to another species which also occurs in the countries just mentioned.

The Reduvioidea come next, but the 24 species of this family are not generally abundant in individuals. About eight-tenths of

[1] Communicated by D. Sharp, F.R.S., F.Z.S., on behalf of the Committee for investigating the Flora and Fauna of the West India Islands.

these are widely distributed in the Antilles, Mexico, Central America, and the Isthmus of Panama.

The CAPSIDÆ are represented by 18 species, all but one of which have been found in the Antilles, Mexico, Central America, and the southern United States.

The COREIDÆ are represented by 17 species, a very few of which are of large size, while most of them are widely distributed, occurring from the Gulf States to the northern borders of South America.

In the ANTHOCORIDÆ we find a few genera and a total of 14 species. Those which are not new belong to forms peculiar to the Gulf States, Mexico, Central America, and the Greater Antilles. As these little creatures live much in concealment, amid tangled vegetation and decaying leaves, and upon twigs, fungi, and mosses, their distribution is but little restricted, and they extend over large parts of the continental areas.

In the CERATOCOMBIDÆ we meet with only 5 species, and these are of the widely distributed forms which spread north from the region of Brazil—*Ptenidiophyes mirabilis*, Reuter, being the only one of these not yet found in the corresponding island of St. Vincent. The collecting of these minute insects has been so generally neglected that the time has not yet come for adequate comparative statements to be made relative to the genera and species belonging to different localities; but the assemblage from St. Vincent, as now known, is more varied and comprehensive than that of Grenada. Four of the widely distributed species occur in both islands, while the four other peculiar forms were found in St. Vincent and not in Grenada. It is very unlikely that these types are confined to St. Vincent, and we confidently expect to see them discovered when the minute insects of Grenada shall have been more exhaustively collected.

The fauna of the littoral plain of the southern United States includes several genera and species not yet discovered in the West Indies, but it also embraces two or three species, particularly in the genera *Ceratocombus* and *Cryptostemma*, which have an extensive distribution in the central regions of America.

Turning to the VELIIDÆ, we find them comparatively well represented by fourteen species, rich in individuals. They exhibit some interesting modifications of structure. The elongation of the legs in one species of *Microvelia* points to a closer relationship than has hitherto been indicated between this group and that of the Hydrobatidæ. A genuine salt-water species, *Rhagovelia plumbea*, which also lives on the ocean about the Florida Keys and on the coasts of Southern Florida, adds new interest to this peculiar group of insects. This species is also noteworthy from the fact that the sexes unite sexually in what would appear to be a larval stage—the male being usually not more than one-half the bulk of the female, and both being of weak integumentary structure, and destitute of rudimentary wing-segments in the greater number of specimens. No specimens with wing-covers have yet been brought to notice.

A large number of specimens of the Hydrobatidæ were found, but represent only four species. They were met with more especially near the sea-coast on the flat lands and marshes.

A form closely related to *Rheumatobates* adds another to the growing list of these remarkable insects. It is a matter of regret that only one mature and winged specimen of this curious form was taken, and it is unfortunate that no observations were made respecting its mode of life and the peculiarities of its *habitat*. The pale and membranous character of its wing-covers give it the appearance of a small and slender wasp, so that this peculiarity of aspect might be of some service in protecting it from enemies which it must meet with in the water where it dwells.

The other palustrine and aquatic forms here enumerated are mostly common species which have an extensive distribution throughout the regions between Northern Brazil and the southern United States.

The presence of only two species of *Corisa* seems remarkable in a region where shallow placid and sluggish waters abound and form such suitable homes for this type of insect.

It is also difficult to account for the absence of a large number of forms of *Galgulus*, *Mononyx*, and *Notonecta*. These hardy insects abound in just such places as are mentioned above; as for example on the marshes, turbid sands, about the slime on the borders of sluggish waters, and among the roots of grass and slender plants in wet places.

In comparing this assemblage of species with that of the island of St. Vincent, the differences between them do not seem sufficient to warrant their separation into two faunas. The most divergent form from the general average is the remarkable Alydid, *Darmistidus*. This form was not among the collections from Grenada, and it is not like any that has yet been brought from any part of the American continent or its islands.

This collection adds valuable information supplementary to our previous knowledge of the faunas of the Greater Antilles, Mexico, Central America, and Colombia; but much further research will be required before we can satisfactorily recognize the limits of the great areas of distribution of the Hemiptera south of the United States.

Pachycoridæ.

Agonosoma, Lap.

1. Agonosoma flavolineata, Lap.

Agonosoma flavolineata, Lap. Hémipt., Mag. de Zool. ii. p. 69.

Examples of this species were collected at Balthazar, April 6, at an elevation of 250 feet above the sea, from foliage along the road, on dry ground, in woods of second growth. On April 30 a specimen came to the light at night. Other specimens were found on the La Force estate, August 17, on open damp ground under piles of weeds. On the Caliveny estate they were swept, September 17, from herbage on low open ground.

2. Agonosoma trilineata (Fabr.).

Cimex trilineata, Fabr., var., Spec. Ins. ii. p. 341.

At Balthazar, one specimen came to the light at night, on April 30; another was found on herbage near the leeward coast, at St. George's; a third was beaten, on September 29, from herbage, on the hillside of the Mount Gay estate.

Symphylus, Dallas.

Symphylus deplanatus (H.-Schf.).

Pachycoris deplanatus, H.-Schf. Wanz. Ins. iv. p. 3, t. cx. fig. 344.

Specimens were taken at Balthazar, April 7, which came to the light at night, and one was beaten from herbage on August 18; on September 3–10, specimens came to the light, at night, on the Mount Gay estate.

Sphyrocoris, Mayr.

Sphyrocoris obliquus (Germar).

Pachycoris obliquus, Germar, Zeitschr. i. p. 94.

Several specimens were swept from herbage at Balthazar, April 7, at an elevation of 250 feet above the sea, on open weedy places near a stream of water. Others were secured near St. George's, as also on the Mirabeau and Mount Gay estates.

Thyreocoridæ.

Thyreocoris, Schrank.

Thyreocoris pulicaria (Germar).

Odontoscelis pulicarius, Germar, Zeitschr. i. p. 39.

This species was taken on the Mirabeau estate, March 25, at an elevation of 500 feet above the sea, in open places near a stream, where it was swept from herbage. It was also found at St. George's near the botanic gardens, September 10, on grass growing in a swamp. At Mount Gay it was taken, September 17, from herbage on low ground.

The specimens differ in no important respect from those which are common in Maryland and the southern United States. In these last localities the species lives in the axils of *Eupatorium*, on low or marshy ground.

Cydnidæ.

Cyrtomenus, Am. et S.

Cyrtomenus ciliatus (Pal. Beauv.).

Pentatoma ciliata, Pal. Beauv. Ins. Afr. et Amér. p. 186, pl. 11. fig. 6.

Two specimens were captured on the Mount Gay estate, September 6, on open places near a stream.

Pangæus, Stål.

Pangæus margo (Dallas).

Æthus margo, Dallas, List, i. p. 116.

Numerous specimens of both sexes were found at Balthazar, March 7 and 31, up to an elevation of 1900 feet above the sea, on foliage, next the ground, in damp places near the water. Others were taken on the Grand Étang, September 12, at an altitude of 1300 feet, while flying at sunset.

Geotomus, Muls. et Rey.

Geotomus spinolai (Sign.).

Æthus spinolæ, Sign. Ann. Soc. Ent. Fr. 1863, p. 545, pl. 12. fig. 12.

Only one specimen was found. It was taken on the Mount Gay estate, August 28, while flying at sunset.

Amnestus, Dallas.

1. Amnestus subferrugineus, Westw.

Cydnus subferrugineus, Westw. Hope Cat. i. p. 19.

Many specimens were collected at various places on the island. At Balthazar they were taken while flying over open places at sunset, August 4. On the Mount Gay estate they were also found, August 20–25, flying at sunset; and on the Grand Étang, September 15, they were beaten from undergrowth in the forest, at an elevation of 1900 feet above the sea.

2. Amnestus pusillus, Uhler.

Amnestus pusillus, Uhler, Hayden Geol. Surv. Bulletin, i. p. 278.

This uncoloured little groundling was collected in April, at Balthazar, where it occurred on open weedy places, in second-growth thickets.

Pentatomidæ.

Macropygium, Spin.

Macropygium reticulare, Fabr.

Cimex reticularis, Fabr. Syst. Rhyng. p. 170.

This common American insect was captured at Balthazar, April 15, at an elevation of 250 feet above sea-level. It was found on shady places among the weeds, in woods of second growth, near a stream of water.

Cuba is the most northern territory from which this species is at present known. It seems to be about as common in Grenada as it is known to be on the Upper Amazons.

Podisus, H.-Schf.

1. Podisus sagitta (Fabr.).

Cimex sagitta, Fabr. Ent. Syst. iv. p. 99.

Several specimens were beaten from plants at Balthazar, April 3, in open weedy places, and from similar herbage on the Mount Gay estate, on August 22 to 31.

This species ranges all the way from Tabatinga, on the Upper Amazon, to Texas and Tamaulipas, Mexico, and extends its distribution through all the Greater Antilles.

2. Podisus gaumeri, Dist.

Podisus gaumeri, Dist. Biol. Centr.-Am., Hem.-Heter., Suppl. p. 320, pl. 30. fig. 16.

A few specimens of this form were collected at St. George's, August 22 and 31, from herbage in swampy places.

Mormidea, Am. et S.

Mormidea upsilon (Linn.).

Cimex upsilon, Linn. Syst. Nat. ed. xii. i. p. 720.

This species proved to be quite as common in Grenada as it is at Pará, at various other places on the coast of Brazil, and in the West Indies. Specimens were collected at Balthazar, April 7, on open weedy places, where they were swept from herbage; at the same place they were taken, August 15, from herbage, at night. Others were captured at light, at night, on the Mirabeau estate, and likewise on the Vendôme and Chantilly estates and Grand Étang. At Mount Gay specimens were found, September 14, at elevations of 400–600 feet above the sea, in open places upon herbage.

Euschistus, Dallas.

Euschistus crenator (Fabr.).

Cimex crenator, Fabr. Ent. Syst. iv. p. 101.

Two forms of this species, the one with acute humeri, the other with blunter ones, were found in large numbers on most parts of the island. At Balthazar it was brushed from herbage on March 23, in cocoa orchards where the soil was damp and shaded; on April 2 they were found at an altitude of 1900 feet above the sea, on a narrow strip of grassy and weedy land between the lake and the forest. Others were collected later in April on the Mount Gay and Lake Antoine estates, and as late as May 4.

Berecynthus, Stål.

Berecynthus delirator (Fabr.).

Cimex delirator, Fabr. Ent. Syst. iv. p. 103.

This is a Colombian insect which ranges from the head of the Madeira river, in Brazil, all the way to Venezuela, Central

America, and Mexico, and extends to the Lesser Antilles. It is also found in the vicinity of Pará and at a few points farther up the Valley of the Amazons.

Several specimens were secured at Balthazar, April 7, in open weedy places, from herbage, near a stream. On the Mount Gay estate they were found, August 22, on herbage in open places, at night. Two specimens were taken at St. George's, September 11 and 28, on herbage.

PROXYS, Spinola.

PROXYS VICTOR (Fabr.).

Cimex victor, Fabr. Syst. Ent. p. 705.

A few specimens were taken at Balthazar, April 1, in the swampy forest near the sea-shore, where the mangrove-tree flourishes. A single specimen was also found on the Chantilly estate.

ARVELIUS, Spinola.

ARVELIUS ALBOPUNCTATUS (De Geer).

Cimex albopunctatus, De Geer, Mém. iii. p. 331, pl. 34. fig. 6.

Specimens of normal size were found near Balthazar, April 1, in a swampy forest near the sea-shore. On the Mount Gay estate others were taken, August 28, on herbage, on the hill about 700 feet above the sea.

Specimens sometimes occur in Florida, Cuba, and Lower California which are only half the normal size.

THYANTA, Stål.

1. THYANTA PERDITOR (Fabr.).

Cimex perditor, Fabr. Ent. Syst. iv. p. 102.

This extremely common species inhabits Northern Brazil and spreads through Colombia to Mexico, and far northward in the western part of the United States into Southern Colorado. It is also found in all the principal West India islands including Trinidad. On the eastern side of the United States it extends as far north as to the vicinity of Savannah in Georgia.

The specimens collected in Grenada were found on the Mount Gay estate, August 21 and September 28, where they were beaten from herbage in open places near a stream of water. One specimen was obtained at St. George's, in August, from herbage, at night.

2. THYANTA TÆNIOLA (Dallas).

Pentatoma tæniola, Dallas, List, i. p. 250.

This is also a common species in the West Indies, and numerous specimens were secured in Grenada. It is also found in Northern Brazil, Central America, and Mexico, and it spreads over the border into California and Arizona. In San Domingo it is very common on low plants growing beside the roads near the coast. It is also quite variable in size and sometimes lacks the red band on the base of the pronotum.

In Grenada it was taken on the Lake Antoine estate, March 24 and April 13, at an elevation of 350 feet above sea-level, on herbage in open places. It was also found on the Mount Gay estate and at St. George's, in August.

3. Thyanta casta, Stål.

Thyanta casta, Stål, Stettin. ent. Zeit. xxiii. p. 104.

This species was taken on the Mount Gay estate, in smaller numbers than the preceding one, and it was beaten from herbage, August 1, in open places. It was also found on the Lake Antoine estate, March 24, on herbage, and in thickets near the sea.

Crato, Dist.

Crato urbicus, Dist.

Crato urbicus, Dist. Biol. Centr.-Amer., Hem.-Heter., Suppl. p. 457, pl. 39. fig. 22.

Only two specimens of this insect were secured; they were beaten from herbage, at night, in open places, August 22, on the Mount Gay estate.

Banasa, Stål.

Banasa lenticularis, sp. nov.

Form similar to *B. packardii*, Stål, but more convex above, especially upon the pronotum; longer oval than the related *B. imbuta*, Distant. Pale green, more or less rufous upon the pronotum, base of head, coriaceous part of hemelytra, and posterior border of the scutellum highly polished. The head, pronotum, and corium set with remote erect bristles, most of the remaining surface minutely pubescent. Head a little longer than wide, irregularly and remotely, finely punctate, the surface uneven, depressed next the base of tylus, often paler at base and near the eyes. Antennæ more or less rufous, remotely pubescent, the second joint much shorter than the third, the fourth sometimes infuscated; rostrum reaching the posterior coxæ, green, black at tip. Pronotum unusually convex in the female, somewhat less so in the male; the lateral margins reflexed, impunctate, ivory-white, hardly sinuated, the humeral angles a little prominent, with the outer margin curved and the surface near it tumid; the surface generally coarsely, remotely, deeply punctate, the punctures partly arranged in transverse, curved, broken lines; the margin, bounded behind by a line of punctures, behind the eyes reflexed, and the angles outside the eyes produced into a small tooth; the posterior margin a very little arcuated, with the edge most slenderly reflexed, and the posthumeral margin sinuated, with the submargin depressed. Scutellum very remotely, coarsely punctate, the punctures becoming denser and finer along the sides, with the apex narrow, pale, almost flat, and nearly impunctate.

Corium and clavus coarsely, deeply punctate in lines, becoming more dense and irregular on the cuneal space; the costa with about three lines of punctures, and a line of smaller ones on the inner suture; disk along the suture broadly smooth; membrane transparent, sometimes a little tinged with rufous; wings also more or less rufous or yellowish. Tergum often reddish, with the connexivum pale green, more or less yellowish or reddish, highly polished, remotely and finely punctate, angles of the posterior segment acute. Legs deep green, with the tibiæ not grooved.

Length to end of venter, ♂ $8\frac{1}{2}$–9, ♀ 10–$10\frac{1}{2}$ mm.; width of pronotum ♂ 5–$5\frac{1}{2}$, ♀ $5\frac{1}{2}$–6.

Eighteen specimens of this species were collected by Mr. H. H. Smith, who gives the following notes concerning their capture:—"Swept from herbage in open weedy places, at an altitude of 250 feet above the sea, on April 3; about cocoa orchards, on herbage, April 5; came to light at night, August 6–10, at an altitude of 250 feet; also August 25–30; August 26–31, beaten from herbage; September 3–10, came to light at night, at an altitude of 300 feet." These were collected on the Mount Gay estate, on the leeward side of the island of Grenada.

Piezodorus, Fieber.

Piezodorus guildingi (Westw.).

Raphigaster guildinii, Westw. Hope Cat. i. p. 31.

Specimens of both sexes and of two varieties (*i. e.* degrees of maturity) were found at Balthazar and other places. At the former they were taken, March 23, from herbage, at night. Others were found at St. George's, August 22, on open swampy places, upon herbage.

This species has an extensive distribution. In my collection there are specimens from Paraguay, Rio, Pernambuco, San Domingo, Cuba, Mexico, and Southern Florida. I have also examined specimens from Jamaica, Trinidad, and Central America.

This species varies in size, convexity, and depth of colour. Some of these differences are due to the degree of maturity of the specimens at the time of their capture. Immature specimens are a pale faded greenish, either with or without the red band across the pronotum. When the dorsum of the mesonotum shows through the integument the base of the pronotum appears black, but when the chitinous cover of the pronotum is maturely indurated no blackish spot appears across the base of this segment. Specimens when fresh and mature are of a clear green colour.

Nezara, Am. et S.

1. Nezara marginata (Pal. Beauv.).

Pentatoma marginata, Pal. Beauv. Ins. Afr. et Amér. p. 147, pl. 10. fig. 1.

Several specimens of this species were collected. Those from

Balthazar were taken, March 24, in open places and from thickets near the sea, from herbage; others were found at the same place in April, and one was captured on the Lake Antoine estate.

This is another Colombian form with a distribution from Northern Brazil to Southern Florida and the coast of Texas. It is found in all the Greater Antilles and Trinidad. Two specimens from Pará, in my collection, vary but little from the type as we find it in Mexico and Cuba. The specimens from Grenada vary much in size, just as they do in San Domingo, Cuba, and Mexico. The males are sometimes only about half the size of the females.

2. Nezara viridula (Linn.).

Cimex viridulus, Linn. Syst. Nat. ed. 10, p. 444.

This species is now known from the warm parts of all four of the continents. In the United States it inhabits the littoral plain from Virginia to Florida and Louisiana. It is found in all the large West India islands, including Trinidad.

In Grenada the specimens were found at Balthazar, April 2, on weeds and various kinds of herbage. On the Mount Gay estate it was taken, August 20 to 25, on herbage in open places.

Edessa, Fabr.

1. Edessa bifida, Say.

Pentatoma bifida, Say, Insects of Louisiana, p. 7; *Edessa cornuta*, Burm., and *E. cornuta*, Guérin; also *E. albirenis*, H.-Schf. Wanz. Ins. vii. p. 127, t. ccxlix. fig. 774.

Types of all the references above given have been identified for me by Dr. Stål and others, and there is no reason for keeping them apart as is done in the Catal. Gén. des Hémipt. par MM. Lethierry et Severin, pp. 188, 189.

This species is distributed from Northern Brazil and Colombia through Central America and Mexico into the southern United States and the Antilles. It is variable to a marked degree in the distribution, depth, and coarseness of the punctures, the size and length of body, and the convexity of the pronotum. The scutellum is occasionally blunter than in the average, and the pronotum sometimes shows traces of wrinkles on the convex dorsum. Mr. Distant's figure of *E. cornuta*, Burm., Biol. Centr.-Am., Hem.-Heter. pl. 9. fig. 22, well represents the *E. bifida*, Say, as we find it in Louisiana, Florida, Cuba, and Grenada. Besides this, a pair of types from the Mexican series separated by Mr. Distant in working up his material for the 'Biologia' are before me at this moment, and they are precisely like my specimens from the United States and the Antilles. In examining a series of somewhat more than a hundred specimens of both sexes, from near Samana, San Domingo, I was surprised to find abrupt differences in the length of the anterior fork of the sternum of the male, and in the depth of excavation and angularity of the sides of the genital segment. The female is usually a broader, larger, and more convex insect than the male. Occasionally the knobs on the superior surface of the connexivum are absent. When alive these insects are grass-green above, with the corium more or less bright wine-brown. Specimens from San Domingo seem to be usually more rugose upon the pronotum and wing-covers and flatter near the anterior angles of the pronotum than in the series which I have examined from the United States and Mexico. Specimens from Grenada are on the average more smooth than those from San Domingo. In my collection there is a graded series which takes in the various modifications from *E. cornuta*, Burm., with narrow and acute scutellum and coarse deep punctures, through the moderately smooth and remotely punctate *E. albirenis*, to the smooth *E. sigillata* with obsolete punctures on the pronotum and scutellum.

2. Edessa rugulosa, sp. nov.

Form of *E. rufo-marginata*, De Geer, but of the size of *E. meditabunda*, Fabr., which it somewhat resembles. Bright green, moderately polished, wrinkled on the head, pronotum, base of scutellum, and base of costal area, with the hemelytra wine-brown, and the lines of the clavus, reticulations of tip of corium, most of the costal area, and underside of the body yellow. Head short, minutely but distinctly punctate, bordered on the sides and tip with yellow; antennæ honey-yellow, the basal joint much thicker than the following ones, the second shorter than the third, the fourth only a little longer than the third; rostrum rufo-flavous, reaching midway between the fore and middle legs, and fitting into the fork of the mesosternum. Pronotum transverse, coarsely, deeply, irregularly punctate in somewhat transverse series, the sunken space in front of the callosities and behind the eyes densely and finely punctate; callosities and their diagonal continuation smooth, impunctate; lateral margin reflexed, smooth, yellow, the humeral angle prominent, a little rounded, smooth, the post-humeral submargin sunken, with two lines of close punctures; the posterior margin a little arcuated, the submargin bordered with a line of fine sunken punctures; pleural border beneath the lateral margin linearly callous, grooved and punctate in continuity with the underside of head. Sternal pieces remotely punctate; the mesosternal plate corresponds with that of *E. meditabunda*. Scutellum moderately long, very moderately convex at base, depressed next the tip, less coarsely but deeply, not closely punctate, somewhat rugose on the base and middle, more finely punctate posteriorly, the sides slenderly bordered with yellow, and the tip acute. Clavus narrow, punctate with red in two approximate lines, the margin carinately elevated; corium bordered next the clavus with two strong punctate ridges, which are hollowed inwardly by two corresponding lines of rufous sunken punctures; the punctures of the disk fine and even, those of the base coarser; costal area contracted at base, set near the base with small, yellow, transverse callosities between the reddish punctures; membrane bronze-brown, with the veins darker. Legs honey-yellow, obsoletely punctate, clothed with erect hairs. Venter and sternal pieces highly polished, finely punctate, transversely grooved, the grooves of the pleura more especially punctate; stigmatal orifices black; connexivum green, more coarsely punctate, the angles of the segments acute; ventral ridge prominent, highly polished, impunctate.

Length to end of venter 10–13 mm.; width of pronotum $6\frac{1}{4}$–7 mm.

Forty-one specimens were collected at different places on the island. At Balthazar, on the windward side, they were taken on April 1, in the swampy forest near the sea-shore, and mainly in the mangrove district; also April 13, at an altitude of 350 feet, in second-growth timber near the border of a stream on the Lake Antoine estate.

This species approaches *E. meditabunda* in the structure of the mesosternal plate, which has the anterior fork long and slender, with the sides acutely triangular, and the posterior fork shorter and more blunt; but it differs in having the tylus much longer, the sides of the head not turned up, in the evenly reflexed and not knobby border of the pronotum, in the longer and acute scutellum, and in the more contracted and less callous costal margin.

Coreidæ.

Spartocera, Lap.

Spartocera fusca (Thunb.).

Cimex fusca, Thunb. Nov. Ins. Spec. ii. p. 44.

Ten specimens of two varieties of this insect were collected on the Mount Gay estate. They were obtained, April 2, from thickets on swampy ground; also September 14, at elevations of 400–600 feet, on open places on herbage; and on September 29 they were beaten from herbage on the hillside. One specimen was taken at Chantilly, March 23, in a clearing, on the underside of a log.

Acanthocerus, Pal. Beauv.

Acanthocerus lobatus, Burm.

Acanthocerus lobatus, Burm. Handb. ii. p. 318.

Specimens of this insect were obtained in nearly every section of the island. At Balthazar they were beaten from herbage, March 19, on an open place about 250 feet above the sea. Others were taken at Chantilly, Vendôme, and particularly on the Mount Gay estate, where they were numerous in September, on herbage.

Leptoglossus, Guérin.

Leptoglossus zonatus (Dallas).

Anisoscelis zonata, Dallas, List, ii. p. 452.

The most beautiful variety of this insect proves to be quite abundant in Grenada. Specimens were taken, both in the spring and autumn, on the windward and leeward sides of the island. They were found on the Mount Gay estate, also at Balthazar, Lake Antoine, and on the Mirabeau and Vendôme estates.

PTHIA, Stål.

PTHIA PICTA (Drury).

Cimex picta, Drury, Illustr. i. p. 107, pl. 45. fig. 1.

A few specimens of this species were found at Balthazar, March 15, also on the Mirabeau estate, March 25, on herbage in open places, and on the Mount Gay estate, October 10, upon hill-sides, on herbage.

This is an exceedingly common insect in the eastern part of San Domingo, and it is not rare in Cuba, Florida, and Texas.

MADURA, Stål.

MADURA PERFIDA, Stål.

Madura perfida, Stål, Stettin. ent. Zeit. xxiii. p. 304.

Three specimens were taken on the Lake Antoine estate, in March and September, on herbage.

MARGUS, Dallas.

MARGUS INORNATUS, Dist.

Margus inornatus, Dist. Biol. Centr.-Am., Hem.-Heter. pp. 137, 365, pl. 13. fig. 18.

Two specimens were found near Balthazar, March 19, at an elevation of 1250 feet above the sea, upon an open place, on herbage. A third specimen was taken on the Mount Gay estate, August 28, at an elevation of 700 feet, on herbage.

CATORHINTHA, Stål.

CATORHINTHA SELECTOR, Stål.

Catorhintha selector, Stål, Öfv. Vet.-Akad. Förh. 1859, p. 471.

Many specimens were collected on the Mount Gay estate, April 5, at an elevation of 400 feet above the sea, where they were found on the herbage in cocoa orchards. Others were taken on the Lake Antoine estate, April 13, at an elevation of 350 feet, from herbage in the second-growth woods.

ANASA, Am. et S.

1. ANASA SCORBUTICA (Fabr.).

Cimex scorbuticus, Fabr. Syst. Ent. p. 706.

Five specimens were taken on the Lake Antoine estate, April 13, at an elevation of 350 feet above the sea, in second-growth woods on the bank of a stream.

2. Anasa bellator (Fabr.).

Cimex bellator, Fabr. Mant. Ins. ii. p. 286.

Two specimens were secured on the Black Forest estate and Balthazar, April 6, from weeds in a nutmeg orchard, at an elevation of 400 feet above the sea.

Zicca, Am. et S.

Zicca tæniola (Dallas).

Clavigralla tæniola, Dallas, List, ii. p. 514.

Six specimens were taken near Balthazar, April 2, at an elevation of 1900 feet above the sea, on grassy and weedy land, from herbage.

Alydus, Fabr.

Alydus pallescens, Stål.

Alydus pallescens, Stål, Rio Jan. Hemipt. i. p. 34.

Numerous specimens were collected in most parts of the island. At Balthazar they were brushed from herbage, in open grassy and weedy places, in April; on the Lake Antoine estate they came to the light at night, on March 15. At St. George's specimens were taken, August 22, in open swampy places on herbage, and at the same place as late as September 30.

Leptocorisa, Latr.

Leptocorisa filiformis (Fabr.).

Cimex filiformis, Fabr. Syst. Ent. p. 727.

Several specimens were taken on the Mount Gay estate, April 5, where they were brushed from herbage in the cocoa orchards. Other specimens were secured at the same place, September 16, from herbage.

Harmostes, Latr.

Harmostes serratus (Fabr.).

Acanthia serrata, Fabr. Ent. Syst. iv. p. 75.

A few specimens were swept from herbage on the Mount Gay, Mirabeau, and Lake Antoine estates in the spring and autumn.

Corizus, Fallen.

1. Corizus hyalinus (Fabr.).

Lygæus hyalinus, Fabr. Ent. Syst. iv. p. 168.

Five specimens of the ordinary type were found on the island. They were taken at Balthazar and on the Mount Gay estate in April and August.

2. Corizus sidæ (Fabr.).

Lygæus sidæ, Fabr. Ent. Syst. iv. p. 169.

Dr. Stål has described a variety of this species as *C. pictipes.* The insect is very variable in size, colour, form, and pattern of marking, much depending upon its condition at time of capture.

Numerous specimens were collected in nearly all parts of the island, both in the early part of the year and as late as the middle of August.

Jadera, Stål.

Jadera lateralis, Stål.

Jadera lateralis, Stål, Stettin. ent. Zeit. xxiii. p. 307.

Several specimens of this bright-coloured species were taken at Balthazar, April 1, and on the Mount Gay estate, April 5, also in August and September, on herbage.

Berytidæ.

Metacanthus, Costa.

Metacanthus capitatus, sp. nov.

Pale rufo-testaceous. Form similar to *M. elegans*, Curtis, but with proportionately longer legs and antennæ. Head black, rounded, polished, with a pale spot at base, the tylus prominent, vertical; antennæ very slender, yellow, the basal joint nearly as long as the posterior femur, a little thickened and dusky at tip, articulation of the next two joints a little dusky, the fourth thick, fuscous, about half as long as the third; rostrum dull yellow, reaching to the middle coxæ, becoming more slender towards the tip. Pronotum closely distinctly punctate, the posterior lobe large, swollen, with the middle line a little elevated, and tuberculate at the posterior end; antehumeral surface transversely indented, the posterior margin reflexed each side; lateral line obliterated, present as a carina on the short, collar-like anterior lobe, this lobe fulvous, with a pale anterior margin, from each side of which a pale short spine projects obliquely upwards. Legs long, slender, honey-yellow; the tibiæ setiform, paler, annulated with black; the femora a little swollen and deeper coloured at tip, tarsi blackish on the apical half. Scutellum small, tumid, armed with a long, curved, pale spine which projects backwards. Hemelytra almost transparent, tinged with testaceous, the costal border a little arcuated, costal area and clavus obsoletely and sparsely punctate. Beneath smooth, pale testaceous, the sternum pale piceous, abdomen straight; venter more distinctly pubescent at tip, hardly wider at base than at apex.

Length to end of venter $3\frac{1}{2}$ mm.; width of pronotum $\frac{2}{3}$ mm.

Six specimens of this insect were collected on the Mount Gay estate, on the leeward side of the island. They were beaten from herbage, at altitudes between 200 and 400 feet, from August 21 to 31st.

LYGÆIDÆ.

NYSIUS, Dallas.

1. NYSIUS PROVIDUS, sp. nov.

Oblong, narrow; greyish yellow, the upper surface more or less clouded with fuscous, greyish pubescent. Head long, nearly as wide between the front of the eyes as the width of the apex of pronotum; the surface closely pubescent, marked along the middle with a slender, yellow, feebly raised line; the surface between the eyes granulated, the granules each side of middle arranged in lines, punctures few, indistinct; the tylus pale fulvous anteriorly, bounded each side at base by a small knob placed next a dark band; middle of gula, including the bucculæ, blackish piceous; rostrum slender, fusco-piceous or tinged with fuscous, reaching between the posterior coxæ; antennæ dull testaceous, the base and inner side of basal joint, base and apex of second, and base of fourth joint blackish. Pronotum longer than wide, obscurely bilobed, impressed and rather abruptly sinuated on the sides behind the anterior lobe; the surface transversely wrinkled, unevenly punctate with piceous, less so on the anterior lobe, the apical border black; the surface before the humerus spread with a blackish spot, which includes the knob-like angle, but leaves a yellow spot next thereto; the lateral margin obsoletely carinate, indented before the anterior angle, the middle with a pale yellow, slender line; posterior margin a little arched, sometimes bordered with black, having the posthumeral border depressed, expanded, and pale yellow. Mesosternum black in the middle, with the costal segment and the coxa tipped with brown; the anterior and posterior coxæ mostly testaceous. Legs testaceous, the femora banded with concurrent dark brown spots; the tibiæ piceous at base and tip, and the tarsi piceous, excepting the testaceous base. Scutellum obsoletely punctate, with a dark, transverse, sublunate callosity, having a blackish cavity in front of it at base, the apical division paler, acutely carinate at tip. Hemelytra dull whitish or testaceous, punctate with fuscous, finely pubescent, acutely prolonged, with the cuneus rufous; the costal area narrow, pale testaceous, with a few brown points, the veins interrupted with brown; membrane semitransparent, with the veins more or less brownish. Venter rufo-testaceous, more or less sprinkled with darker brown; the ovipositor blackish.

Length to tip of venter $3\frac{3}{4}$–5 mm.; width of pronotum 1–$1\frac{1}{2}$ mm.

This is the common and widely distributed species which has hitherto been wrongly referred to *N. scolopax*, Say. The true *N. scolopax* has a rostrum which reaches to the middle of the venter, which is not the case in the species here described. Our species inhabits North America from Quebec to Arizona, from thence it spreads into Mexico and Central America, and following south it is found on the Isthmus of Panama, and in Colombia and Northern Brazil. In the West Indies it occurs in Trinidad, Grenada, St. Vincent, Porto Rico, San Domingo, and Cuba, and from thence it extends through Florida into all of the Eastern States as far as Maine.

Possibly it is the most variable species of the group as yet discovered, for it appears in all states of marking and colouring, from the pale testaceous with few spots to the dark grey with all degrees of clouding and specking.

In Grenada specimens were taken at Balthazar, in open weedy places on herbage, April 3, at an altitude of 250 feet; also on the Lake Antoine estate, April 13, at an altitude of 350 feet, on the shores of a stream in the midst of second-growth timber, and in August at various other localities on the island.

2. Nysius inæqualis, sp. nov.

Subovate, broad, a little more robust than *N. californicus*, Stål. Pale dull fulvous, punctate with fuscous yellowish pubescence. Head subacute, a little longer than wide, fulvous, with a pale line stretching from base to end of tylus; inner border against the eyes pale yellow, followed by a wider black stripe, the antenniferous lobe also pale yellow; gula black along the middle; antennæ dull fulvous, the basal joint blackish on the under surface at tip, the second joint longer than the third, tipped with black, the apical joint blackish, a little longer than the third; bucculæ pale; the rostrum more or less fuscous, reaching to the middle coxæ. Pronotum trapeziform, obliquely narrowing towards the apex, the sides not arcuated, with the margin feebly reflexed, the anterior lobe short, with the transverse incisure carried out to the excavation next the margin, but not through it; the surface distinctly and closely punctate, having a pale callous line each side of the middle throughout its length; the disk often infuscated, the middle line grooved, having a pale callosity on its posterior end at the margin, apex before the callous line deeply sunken, the lateral submargin grooved and lineated with fuscous; humeri with an acute knob, behind which the margin is indented; the posterior margin thick, deflexed, arched, a little scalloped; the posthumeral outer edge pale and feebly expanded. Under surface rufo-fulvous, whitish pubescent, having an interrupted blackish line along the sides, the sternum and base of venter blackish, and the venter mostly fulvous, with the black lines continued along the sides. The legs dull fulvous, pale at base, flecked with brown on the femora, the base and tip of the tibiæ and tarsi more or less fuscous. Scutellum transverse, punctate, pubescent, blackish at base, or each side of middle, the middle line and lateral raised margin pale testaceous, the apex carinate, acute on the tip. Hemelytra pale testaceous or whitish, carried back in a long tapering curve; the veins more or less interrupted with brown, as also the apical and outer border of the clavus and posterior border of the corium; apex of the cuneus darker brown; the costal area narrow, pale, with outer edge strongly reflexed; membrane long and narrow, the veins often marked with long smoky spots, the middle to tip with a long blackish stripe. Connexivum sharp-edged, thin, recurved, dull testaceous or pale fulvous; disk of the tergum black each side, middle line of the last two segments also black.

Length to tip of venter $3\frac{1}{2}$–$4\frac{1}{2}$ mm.; width of pronotum $\frac{1}{2}$–$1\frac{3}{4}$ mm.

This remarkable species was found in abundance on the Mirabeau estate, on the windward side of the island. It has also been taken in Florida and Cuba. The notes of capture are as follows:—March 25, at an altitude of 500 feet above sea-level, on herbage in open places near a stream of water; April 7, at an altitude of 250 feet, came to light in the night, and was also swept from herbage; also April 13 and 27, in second-growth woods and in weedy places.

This is a variable species, approaching very near to *N. californicus*, Stål, from which it can be at once distinguished by the longitudinal callosities of the pronotum.

Ischnorhynchus, Fieber.

Ischnorhynchus championi, Dist.

Ischnorhynchus championi, Dist. Biol. Centr.-Am., Hem.-Het. p. 193, pl. 19. fig. 3.

A few specimens were taken at several localities in the island. At Balthazar they were brushed from herbage in cocoa orchards, in shady and damp places, on March 23; at Chantilly they occurred at an elevation of 500 feet, on May 5, in second-growth thickets. Later in the year they were found on the Caliveny estate, near sea-level, September 1, on the foliage of dry scrubby growth. On October 16 they were found in a similar, but damp place, near St. George's.

Ninus, Stål.

Ninus notabilis, Dist.

Ninus notabilis, Dist. *t. c.* p. 191, pl. 19. fig. 4.

This species was found in considerable numbers on the Vendôme estate in September, where it was beaten from herbage on marshy land. It was taken also on the Mount Gay estate, and upon the Mirabeau estate, in open places near a stream of water. on herbage, March 25.

Neoninus, Dist.

Neoninus illustris, Dist.

Neoninus illustris, Dist. *t. c.* p. 192, pl. 19. fig. 5.

Specimens were taken at Balthazar, March 23, in damp and shady places, from herbage, in cocoa orchards. It was also found upon the Mirabeau estate, April 7, where it came to the light at night.

Blissus, Burm.

Blissus leucopterus (Say).

Lygæus leucopterus, Say, Heteropt. New Harmony, p. 14, no. 5.

This is the common "Chinch Bug" of the United States, Mexico, and the Greater Antilles. It attains a large size and is more variable in Grenada, both in size and marking, than is commonly found to be the case in the eastern United States. Specimens were collected on the Mount Gay and Caliveny estates in June and September, on weedy places in second-growth thickets near a stream of water.

Ninyas, Dist.

Ninyas strabo, Dist.

Ninyas strabo, Dist. *t. c.* p. 194, pl. 19. fig. 6.

This neat little insect was found at several places on the island. On the Mirabeau estate it was taken, March 25, on herbage in open places near a stream of water. It was found also at Balthazar, and on the Mount Gay estate, August 20; also at the Grand Étang, September 15, among piles of weeds and waste from the stable.

Pachygrontha, Germ.

1. Pachygrontha œdancalodes, Stål.

Pachygrontha œdancalodes, Stål, Enum. Hemipt. pt. 4, 1874, p. 139.

Two specimens of this small form were taken at Granville, April 13, at an altitude of 250 feet above the sea, where they came to the light at night. One specimen was captured at sea-level, March 26, on herbage in a thicket growing in a swamp.

2. Pachygrontha bimaculata, Dist.

Pachygrontha bimaculata, Dist. *t. c.* p. 393, pl. 34. fig. 23.

Numerous specimens of this species were secured on the Mount Gay estate, April 1–5, at the light, and September 30, at an altitude of 500 feet above the sea, in second-growth woods.

3. Pachygrontha longiceps, Stål.

Pachygrontha longiceps, Stål, Enum. Hemipt. pt. 4, 1874, p. 140.

This large species was moderately numerous at Balthazar, April 7, at an elevation of 250 feet above the sea, where it was swept from herbage in open weedy places near a stream. It was also found on the Vendôme and Mount Gay estates, August 21 and September 8, upon herbage in open and marshy places.

Myodocha, Latr.

Myodocha unispinosa, Stål.

Myodocha unispinosa, Stål, Enum. Hemipt. pt. 4, 1874, p. 147.

More than a dozen specimens of this peculiar insect were collected at Balthazar and other localities. At Balthazar it was beaten from herbage, in open places, at night, on March 19. On the Chantilly estate it was found March 7, on herbage in the cocoa orchards. One specimen was captured in August, at Balthazar.

Pamera, Say.

1. Pamera vincta, Say.

Pamera vincta, Say, Heteropt. New Harmony, p. 16, no. 3.

This common species is widely distributed throughout the littoral region of the United States south of Pennsylvania. *Pamera parvula*, Dallas, is a synonym of this form, which should be replaced by the name given above. It has a wide distribution, spreading from Central Brazil through the regions of Colombia, Central America, Mexico, and the Antilles into the United States.

In Grenada it appears to be as common as in Cuba and San Domingo. Specimens were taken at Balthazar, 1900 feet above the sea, April 2, in open grassy places, upon herbage. It was also found in August on the Mount Gay estate, and in other localities on the island.

2. Pamera bilobata, Say.

Pamera bilobata, Say, Heteropt. New Harmony, p. 17, no. 7.

This is also a common species with a wide distribution southward and westward from the United States to Brazil and Colombia. At Balthazar it occurred at an altitude of 1900 feet above the sea, April 2, on grassy and weedy lands, where it was beaten from herbage; it was also taken as late as April 25, in second-growth thickets on plants.

3. Pamera curvipes, Stål.

Pamera curvipes, Stål, Enum. Hemipt. pt. 4, 1874, p. 148.

A variety of this species was found in moderate abundance at Balthazar, Chantilly, and other places. It was met with in March under decaying vines and weeds on a damp rock; while the greater number of the specimens were obtained later in the season on rank herbage and in thickets.

Ozophora, Uhler.

1. Ozophora consanguinea (Dist.).

Davila consanguineus, Dist. Biol. Centr.-Am., Hem.-Het. p. 395, pl. 35. fig. 2.

This species is placed in *Davila* by Mr. Distant, but it is congeneric and perhaps identical with *O. burmeisterii*, Guérin, from

Cuba. Many specimens were collected at Balthazar, April 7, from herbage on open weedy places near a stream of water.

2. OZOPHORA PALLESCENS (Dist.).

Davida pallescens, Dist. *t. c.* p. 395, pl. 35. fig. 3.

This is the smallest species of the genus which has thus far been discovered. It has likewise been placed in the genus *Davila* by Mr. Distant. Specimens were collected at Balthazar, Chantilly, and other localities, on the same kinds of herbage as the preceding species.

PTOCHIOMERA, Say.

PTOCHIOMERA OBLONGA (Dist.).

Plociomera oblonga, Dist. *t. c.* p. 209, pl. 17. fig. 24.

Numerous specimens of this insect were taken at Balthazar, March 27 and later, on herbage in cocoa orchards near water.

The names *Ploxiomerus* and *Plociomera* are later inventions of authors and are not to be found in the writings of Mr. Say. That used above is the spelling given by Mr. Say, and there seems to be no satisfactory reason for changing it.

PYGÆUS, gen. nov.

Form similar to *Ptochiomera*, but with the pronotum transverse, obsoletely constricted, with the lateral raised margin callous along the sides of the almost flat posterior lobe, carried forward very slender to the anterior angle. Antennæ thick, a little longer than the head and pronotum united; the first joint not so long as the head, not thickened towards the tip; second a little longer, growing thicker towards the tip; the third much shorter, thicker, fusiform; the fourth not quite so thick as the third, subfusiform, acute at both ends. Rostrum slender beyond the basal joint, reaching the middle coxæ, the basal joint as long as the gula, the second joint a little longer. Head moderately long, in front of the eyes narrower than the apex of pronotum; eyes large and prominent; the face tapering, sloping forwards, with the tylus prominent; the bucculæ very low, slender. Prosternum collar-like in front of the anterior coxæ. Fore femora moderately thick, without spines, posterior femora long, curved at the tip. Scutellum a little longer than wide, acute and carinate at the tip, the sides strongly decurved. Hemelytra long oval, with a tapering curve posteriorly, the membrane a little protracted behind the abdomen, the costal border thick and slightly reflexed, a little sinuated, with the embolium long and broadly grooved.

PYGÆUS PALLIDUS, sp. nov.

Long oval, fulvous, polished, minutely pubescent, and feebly punctate; antennæ darker beyond the testaceous basal joint. Rostrum, coxæ, and legs testaceous. Underside highly polished. Posterior lobe of pronotum punctate, anterior lobe smooth; posterior margin a little deflexed, sometimes slenderly infuscated. Scutellum at base coarsely and deeply punctate. Claws punctate in lines, the corium a little less coarsely punctate, with the cuneus dusky; the membrane whitish, immaculate.

Length $1\frac{3}{4}$ mm.; width of pronotum $\frac{3}{4}$ mm.

This plain little insect inhabits also Cuba, Texas, Florida, the eastern side of the United States as far north as Tewksbury, Mass., and spreads into Lower Canada. It is sometimes quite common in Maryland. The four specimens from Grenada were secured at Balthazar, August 4, at an altitude of 250 feet above the sea, in open places, where they were flying at sunset, on the Mount Gay estate, August 20 to 25, and September 15, on the Grand Étang road.

Salacia, Stål.

Salacia picturata, Dist.

Salacia picturata, Dist. Biol. Centr.-Am., Hem.-Het. p. 406, pl. 35. fig. 19.

Five specimens of this species were taken at Balthazar and other places on wet sand, or on weeds close to running water, April 15, and also August 17 under bundles of weeds.

In placing this insect in the genus *Salacia*, I have merely followed the lead of Mr. Distant, because no type of that genus is within my reach, and I desire to avoid multiplying genera in this much-divided family.

Trapezus, Dist.

Trapezus fasciatus, Dist.

Trapezus fasciatus, Dist. *t. c.* p. 217, pl. 20. fig. 5.

Three specimens of this insect were collected on the Grand Étang, August 13, at an elevation of 1900 feet above the sea. They were beaten from masses of brush in a clearing of the damp forest. One specimen was taken September 15.

Petissius, Dist.

Petissius diversus, Dist.

Petissius diversus, Dist. *t. c.* p. 407, pl. 35. fig. 22.

Numerous specimens of this little insect were collected at Balthazar, April 22, in open weedy places, among second-growth thickets, and on the Chantilly estate, April 15, where they were flying about the flowers of an orange-tree.

Gonatas, Dist.

Gonatas divergens, Dist.

Gonatas divergens, Dist. *t. c.* p. 219, pl. 20. fig. 10.

Many specimens of this species were taken at Balthazar, April 8, from wet sand on the banks of a stream, where they were alighting from the air. Others were found on the Mount Gay estate, August 20–25, under piles of weeds and leaves.

RHAPTUS, Stål.

RHAPTUS COLLINUS, Dist.

Rhaptus collina, Dist. *t. c.* p. 410, pl. 36. fig. 3.

Seven specimens of this insect were found on the Mount Gay estate, where they were either beaten from herbage in open places or taken from beneath piles of weeds and leaves.

MELANOCORYPHUS, Stål.

MELANOCORYPHUS BICRUCIS (Say).

Lygæus bicrucis, Say, Journ. Acad. Nat. Sci. Philad. iv. 1825, p. 322.

Four specimens of this common North-American insect were taken on the Mount Gay estate, August 21–26, on herbage.

ONCOPELTUS, Stål.

1. ONCOPELTUS FASCIATUS (Dallas).

Lygæus fasciatus, Dallas, List, iv. p. 538.

Five specimens were found on the Mount Gay estate, August 26 and 30. They were beaten from herbage on an open flat tract near the sea.

2. ONCOPELTUS CINGULIFER, Stål.

Oncopeltus (Erythrischius) cingulifer, Stål, Enum. Hemipt. pt. 4, 1874, p. 103.

Numerous specimens were collected at Balthazar, March 7 and April 2, from herbage in second-growth woods. One specimen was secured at Granville, March 27; another was found on the Mount Gay estate, April 5, on herbage; and another at the same place on August 26.

3. ONCOPELTUS VARICOLOR (Fabr.).

Lygæus varicolor, Fabr. Ent. Syst. iv. p. 149.

A few specimens of this beautiful species were found at Balthazar and other places in April, on open places upon herbage. One was also found on the Lake Antoine estate, another on the Mirabeau estate, and yet another was found at Windsor, on the windward side of the island, March 28, on herbage in an open area at an elevation of 500 feet above the sea.

PYRRHOCORIDÆ.

DYSDERCUS, Am. et S.

DYSDERCUS ANNULIGER, sp. nov.

Form of *D. suturellus*, H.-Schf., and differing from that species in having a white ring at the base of the apical joint of the antennæ, and in lacking the white cross on the inner margin of the corium and clavus. There are two principal patterns of marking in this insect: one in which the upper surface is dusky black, with the exception of the head, the anterior two-thirds of the pronotum, and the base of scutellum, which are red; in the other the insect is red above, excepting the base of the pronotum and the membrane, which are black. In the female the underside is red with a black edge to the basal margin of the ventral segments and pleural sutures. In the male most of the venter is white, as are also the collum and posterior border of the pleural pieces. The rostrum of the male usually reaches to the middle of the second ventral segment, but in the female it extends only to the basal segment.

Varieties occur which connect the two extremes of colour. The legs vary in the amount of red upon the femora and tibiæ. Many of the specimens have these members piceous blackish.

Length to tip of abdomen ♂ 8–10, ♀ 10–12 mm.; width of pronotum $2\frac{3}{4}$–4 mm.

This species is also closely related to *D. ruficollis*, Linn., but it is a much larger insect, with a longer head, exactly as in *D. suturellus*, H.-Schf., and with a proportionally longer rostrum in both sexes. In *D. ruficollis* all the specimens I have examined were marked with a more or less distinct black dot behind the middle of the corium.

Many specimens were collected on both sides of the island.

At Balthazar they were found March 30, in considerable numbers upon decaying oranges in shady places. On the Mount Gay estate (leeward) they were taken, April 5 and 25, in the cocoa orchards, where they were brushed from the undergrowth. In August and September they were found on the Mount Gay estate and St. George's.

The white colour of the base of the fourth joint of the antennæ is sometimes indistinct, but not quite absent.

CAPSIDÆ.

LOPUS, Hahn.

LOPUS MILITARIS, sp. nov.

Long oval, pubescent, bright yellow beneath, the markings rufofulvous above. Head short, with a dusky oval loop on the cranium, open at base, and closed at the base of the tylus; the tylus stout, black, the cheeks and throat bright yellow; rostrum yellow, fuscous from the middle to the tip, reaching behind the middle coxæ, the basal joint thickened at tip, reaching upon the sternum; antennæ black, long, tapering, the second joint rod-shaped, about as long as the more slender third and fourth joints united; eyes black, very prominent. Pronotum dark brown, dull, pubescent, with the collum, and a broad reddish stripe running back from it, widening at the basal margin, narrowing between the callosities and sending off a slender line behind them; lateral margins sinuated, acutely reflexed, excepting the sides of the prominent collum; margin of the propleura also reflexed. Legs black, orange or rufous on the coxæ and base of femora. Scutellum almost flat, flavo-rufous, a little fuscous near the basal angles. Hemelytra dark brown, greyish-pubescent, with the cuneus and inner edge of the clavus fulvous; costal areole long, narrow and almost straight, the membrane dark brown, the vein of the areole pale. Venter yellow, invested with long whitish pubescence, the sides obscured with a series of spots, and the ovipositor black.

Length to end of venter 5–5½ mm.; width of pronotum 2¼ mm.

Only two specimens, a male and a female, of this bright insect were secured. They were found on an open and weedy place upon herbage, on La Force estate, at an elevation of about 350 feet above the sea.

Calocoris, Fieber.

Calocoris (Megacœlum) rubrinervis (Dist.).

Creontiades (*Megacœlum*) *rubrinervus*, Dist. Biol. Centr.-Am., Hem.-Het. p. 237, pl. 23. fig. 12.

A fine series of specimens were brought back from the island. They were found on both sides of the region. At Balthazar they were taken April 7, from plants in open weedy places near a stream of water. In March they were found on the Mirabeau and Lake Antoine estates. In August they were swept from herbage on the Mount Gay and Lake Antoine estates.

The form of the sides of the head and proportions of the antennæ seem to place this species in *Calocoris* rather than in *Megacœlum*.

Melinna, Uhler.

Melinna modesta, Uhler.

Melinna modesta, Uhler, Entomol. Americana, iii. 1887, p. 69.

Several specimens were taken on the Mount Gay estate and at St. George's, late in August and early in September, by sweeping the herbage.

In Maryland this species occurs in late summer on willows, and also on undergrowth of thin woods and on pine-trees, near streams of water.

Phytocoris, Fabr.

Phytocoris eximius, Reuter.

Phytocoris eximius, Reuter, Öfv. Vetensk.-Akad. Förh. 1875, no. 9, p. 67.

Three specimens, all different in markings, were found at Balthazar, March 2, and at St. George's in September. They came to the light at night.

This is a common species with an extensive distribution. It inhabits Colombia, Central America, Mexico, California, Washington State, Oregon, Colorado and Utah, New Mexico, Arizona, Minnesota, Lower Canada, and all the Atlantic States from Maine to Florida, and the Gulf States west into Texas, as also San Domingo and Cuba. Degrees of maturity affect its colours and pattern of marking.

Pœciloscytus, Fieber.

Pœciloscytus (Lygus) cuneatus (Dist.).

Lygus cuneatus, Dist. Biol. Centr.-Am., Hem.-Het. p. 435, pl. 37. fig. 24.

This is a common species in the Antilles and on the borders of the adjoining continent. It is found in Central America, Mexico, Texas, and Florida, and apparently as far north as Virginia. Specimens from the last-named State have passed through my hands, but, as their antennæ were mutilated, a slight element of uncertainty exists in the identification.

Many specimens were collected on the Mirabeau estate, April 7, as they came to the light at night. At Balthazar and on the Mount Gay estate they were swept from herbage in August.

Fulvius, Stål.

1. Fulvius atratus, Dist.

Fulvius atratus, Dist. *t. c.* p. 282, pl. 27. fig. 18.

Several specimens of this species were taken at Balthazar, March 7, and also early in August, in bushy places on herbage and at the light. Others were captured at Chantilly, and on the Grand Étang they were met with at an altitude of 1900 feet upon decaying weeds. In the United States this species frequents fungi in damp, shady borders of woods, and it flies freely in the sunshine.

2. Fulvius lunulatus, sp. nov.

Black, polished, oblong-ovate, with the head shorter than normal, wider than the apex of pronotum, and swollen between the eyes, vertex with a faint impressed line; antennæ dark brown, the second joint paler, very long, and white on the apical one-third, the third and fourth a little more slender than the second, but not setaceous; rostrum piceous, reaching behind the posterior coxæ. Pronotum wider than long, tumidly convex on the middle, broadly indented, and grooved in the centre behind the collum, the posterior submargin bounded by an incised line; humeral angles acutely prominent, the lateral margin deeply sinuated. Scutellum piceous black, highly polished, convex. Legs pale fuscous, the anterior femora darker. Hemelytra black, or brownish black, marked with a minute pale fleck at the base of the corium, and with the inner border of the clavus slenderly fulvous; corium with an obliquely placed lozenge-shaped white spot on the basal third, and a smaller oval spot of the same colour on the inner half of the cuneus; membrane smoke-brown, showing a slender edge of white against the margin of the cuneus.

Length to tip of venter 2–2¼ mm.; width of pronotum ⅔ mm.

Several specimens were collected on the Black Forest estate and about the Grand Étang, on the windward side of the island, from August 13 to 19, at an altitude of 1500 to 1900 feet above the level of the sea, under leaves on the ground, on bark of decaying logs in a clearing, and also beaten from masses of brush and leaves.

Eccritotarsus, Stål.

1. Eccritotarsus atratus, Dist.

Eccritotarsus atratus, Dist. *t. c.* p. 285, pl. 26. fig. 20.

This is a common species in the West Indies, Mexico, Central America, and Colombia. It inhabits also California and Texas. Numerous specimens were taken at Balthazar, at an elevation of 1900 feet above the sea, April 2, on herbage, in open grassy places near water. It was found also on the Mount Gay estate in August, flying at sunset.

2. Eccritotarsus incurvus, Dist.

Eccritotarsus incurvus, Dist. *t. c.* p. 285, pl. 26. fig. 19.

Numerous specimens were found at Balthazar, also on the Mirabeau, Mount Gay, and Lake Antoine estates, either in March or August, on grass and herbage near streams of water. In the southern United States it lives in midsummer on low herbs in open places on sandy beaches of streams.

Cyrtocapsus, Reuter.

Cyrtocapsus caligineus (Stål).

Capsus caligineus, Stål, Freg. Eugenie Resa, Ins. p. 258; Dist. *t. c.* p. xx.

Pirithous pallipes, Dist. *t. c.* p. 303, pl. xxix. fig. 11.

A few specimens were taken at Balthazar and on the Mirabeau estate in March and April in weedy places.

Engytatus, Reuter.

Engytatus geniculatus, Reuter.

Engytatus geniculatus, Reuter, Öfv. Vetensk.-Akad. Förh. 1875, no. 9, p. 83.

Neoproba varians, Dist. *t. c.* p. 271, pl. 26. fig. 7.

This species is distributed all the way from Colombia to Mexico, the Antilles, Texas, and Florida. In San Domingo it lives on various kinds of weeds growing on the sides of the roads and in neglected gardens.

Numerous specimens were collected on both sides of Grenada. On the Mount Gay estate they were found, late in August, on herbage in the open country. At St. George's they were taken during the same month, at night, from herbage.

Dicyphus, Fieber.

Dicyphus separatus, sp. nov.

Long and moderately narrow, pale greenish, erect-pubescent, with the basal joint and apex of the second joint of antennæ black; punctures of the hemelytra coarse, sparse, black; corium with a large black dot a little behind the apex, with the apex, the posterior border faintly, the tip of scutellum, and the end of the cuneus also black. Head moderately short, highly polished, remotely pubescent; eyes dark brown; antennæ pale green, minutely pubescent, a little longer than from tip of head to apex of clavus; rostrum testaceous, dusky at tip, reaching almost to the apex of the posterior coxæ. Pronotum obsoletely punctate, marked with a deeply-impressed longitudinal line, the posterior margin deeply sinuated. Legs pale greenish, with the apex of the tarsi piceous. Scutellum a little punctate, set with erect hairs. Corium and clavus with remote erect fuscous pubescence; cuneus minutely striato-punctate, long, sinuated on the inner border; the membrane long, iridescent, with the veins of the areole a little dusky.

Length to tip of abdomen 3 mm., to tip of membrane 4 mm.; width of pronotum $\frac{7}{8}$ mm.

This species extends its habitat from Cambridge, Mass., to Florida and Texas; it is also found in California.

Six specimens of this insect were taken on the Mount Gay estate, October 16, on low herbage.

Paracarnus, Dist.

Paracarnus mexicanus, Dist.

Paracarnus mexicanus, Dist. Biol. Centr.-Am., Hem.-Het. p. 445, pl. 39. fig. 2.

This species was captured at Balthazar, March 23, in a cocoa orchard in a damp situation. On the Mirabeau estate it was found March 25, on herbage near a stream of water.

Annona, Dist.

Annona labeculata, Dist.

Annona labeculata, Dist. *t. c.* p. 446, pl. 39. fig.

One specimen was found near Balthazar, March 23, in a shady damp locality, on herbage, in a cocoa orchard.

HALTICUS, Burm.

HALTICUS UHLERI, Giard.

Halticus uhleri, Giard, C. Rend. Soc. Biol. sér. 9, iv. p. 81.

Halticus minutus, Uhler, in Popenoe, Report, Kansas, 1889, p. 212, pl. 9. figs. 10 & 12.

Calocoris canus, Dist. *t. c.* p. 430, pl. 37. figs. 11 & 12.

Several specimens were found, most of which were winged. A brachypterous specimen was taken, March 25, on the Mirabeau estate; the other specimens were found, in August, among dry weeds and rubbish on damp ground at Balthazar and Chantilly.

EPISCOPUS, Reuter.

EPISCOPUS ORNATUS, Reuter.

Episcopus ornatus, Reuter, Öfv. Vetensk.-Akad. Förh. 1875, no. 9, p. 90.

Lygus uvidus, Dist. *t. c.* p. 433, pl. 37. fig. 18.

In the United States this species is distributed from New York to Florida, and from thence to Cuba and San Domingo. It abounds in midsummer in fields from which wheat has been cut, and where it lives upon the *Ambrosia artemisiæfolia*.

In Grenada it was common at Balthazar and on the Mirabeau estate, on weeds, both in April and August.

PSALLUS, Fieber.

PSALLUS POLITUS, sp. nov.

Oval, black, highly polished, minutely pubescent. Head large, triangular, almost vertical, moderately convex, rufo-piceous beneath, with a few indented points on the vertex, the width across the eyes a little greater than the apex of the pronotum; antennæ yellow, short, moderately stout, the two apical joints and sometimes the distal end of the second joint fuscous, the second nearly as long as the head and pronotum united; rostrum testaceous, piceous at base, the tylus also piceous. Pronotum transverse, simple, moderately convex, obliquely narrowed, and abruptly decurved on each side in front, the surface highly polished, sparsely pubescent, obsoletely punctate. Scutellum nearly equilateral, moderately convex, acute at tip, obsoletely wrinkled. Legs testaceous, the tarsi usually more or less dusky. Hemelytra highly polished, minutely greyish pubescent, covered with shallow punctures; the membrane smoke-brown. Pleural pieces and sternum piceous. Venter highly polished, not apparently punctate, often rufo-piceous at base.

The male has the second joint of antennæ a little thickened at apex and often fuscous there.

Length to tip of venter $1\frac{3}{4}$–2 mm; width of pronotum $\frac{3}{4}$ mm.

Nineteen specimens of this little insect were secured in various places on the windward side of the island. Of these both sexes were found on the Mirabeau estate, April 7, at an altitude of 250 feet; on the Mount Gay estate, at levels from 200 to 400, on August 21; and on the Chantilly estate, September 17, at an altitude of 500 feet. Some came to the light at night, others were taken while flying at sunset, and some others were swept from herbage in open places.

RHINACLOA, Reuter.

RHINACLOA FORTICORNIS, Reuter.

Rhinacloa forticornis, Reuter, Öfv. Vetensk.-Akad. Förh. 1875, no. 9, p. 88.

This species was found at Balthazar, St. George's, and on the Mount Gay estate in August, upon herbage growing in swampy ground.

CERATOCOMBIDÆ.

CERATOCOMBUS, Signoret.

1. CERATOCOMBUS BRASILIENSIS, Reuter.

Ceratocombus brasiliensis, Reuter, Monogr. Ceratocomb. p. 7, no. 3, fig. 3.

This species is common in both St. Vincent and Grenada, and it seems to have a general distribution from Brazil to the Antilles. Numerous specimens were collected at Balthazar, March 5, under decaying leaves on a damp rock, next the shady bank of a stream. At Woburn one specimen was found on the Windsor estate, at an elevation of 500 feet, March 28, under decaying leaves on wet sand on the shady bank of a stream. In August it was abundant on the Mount Gay estate, at an elevation of 1900 feet above the sea, in a clearing of the damp forest, with masses of brush and leaves.

Individual specimens vary somewhat in the extent of the white colour near the costal margin of the hemelytra. In some of them scarcely more than a white dot is present, while in others the colour is extended into a broad streak. In a small proportion of the specimens the white is obsolete or absent.

This form is closely related to, if not the same as, one which belongs to the Gulf States and Florida; but, as only soiled specimens have been accessible to me, it is not possible to express a settled opinion as to the identity of these insects.

2. CERATOCOMBUS MINUTUS, sp. nov.

Oblong-ovate, dull black; form similar to *C. brasiliensis*, Reut., but small, and comparatively wider across the hemelytra. Head subconical, longer than wide, a little narrower than the apex of the pronotum, minutely pubescent, sometimes tinged with rufous, indented in the middle, with the tylus wide and prominent, and the eyes projecting beyond the sides of the pronotum; underside of head testaceous, piceous on the tumid base of the gula, the rostrum testaceous, reaching upon the middle coxæ; antennæ moderately stout, testaceous, the two apical joints slender and more distinctly hairy. Pronotum transverse, moderately convex, minutely pubescent, strongly decurved behind the eyes, with the lateral margins reflexed and set with remote bristles, the humeral angles a little prominent, posterior margin a little curved; sternum piceous, transversely tumid at the collum, and smooth. Legs dusky testaceous, with the anterior femora broad and compressed. Hemelytra dull black, pubescent, gradually widening posteriorly, the membrane almost as long as the corium, opaque, and bluntly rounded at tip, with the middle area large and oval, similar to *C. brasiliensis*; costal margin broadly recurved almost to the tip of corium, the cell adjacent to the costa long and wide, subtriangular.

Length to tip of hemelytra $1\frac{3}{4}$ mm.; width of pronotum $\frac{2}{3}$ mm.

Numerous specimens were collected in various localities in the island. At Balthazar, 250 feet above tide-level, specimens were secured, April 20, in weedy open places in second-growth thickets, and at the same place on August 4, 10, 15, flying at sunset. On the Mount Gay estate they were found August 28–31 and September 6, at an altitude of 200 feet, flying at sunset. On the Grand Étang they were secured at an altitude of 1900 feet on a clearing in the damp forest, where they were beaten from masses of brush and from leaves. On the Chantilly estate they were found, August 5, at an altitude of 500 feet on open hillsides, amidst a second-growth timber, where they were swept from piles of decaying weeds and rubbish.

Cryptostemma, H.-Schf.

Cryptostemma fasciatum, sp. nov.

Dark brown, opaque, oblong-oval, gradually widening posteriorly, minutely pubescent. Head subconical, tinged with rufous in front and below; antennæ long, stout, rufo-testaceous, hairy; rostrum pale testaceous, reaching to the posterior coxæ. Pronotum a little wider than long, indistinctly grooved on the middle line, steeply decurved on the sides anteriorly, where it becomes a little narrower. Legs pale testaceous. Hemelytra apparently coriaceous throughout, dark brown, minutely scabrous and pubescent, crossed behind the scutellum by a wavy, broad, deep yellow band. Beneath dull yellow on the meso- and metasternum, and sometimes on the base of the venter. The entire underside is sometimes pale piceous.

Length to tip of venter 1 mm.; width of pronotum $\frac{1}{2}$ mm.

Four specimens were collected on the Grand Étang, August 9, at an altitude of 1900 feet above the sea, from masses of roots, phyto-parasites, and decaying leaves on trees.

Schizoptera, Fieber.

Schizoptera flavipes, Reuter.

Schizoptera flavipes, Reuter, Monogr. Ceratocomb. p. 19, no. 2, fig. 10.

The original type of this species came from Rio, Brazil; but the specimens from the West Indies agree in all respects with the description given by Mr. Reuter. This species is now known to me through specimens from Venezuela, Central America, and the Antilles.

Several specimens were taken at Balthazar and on the Grand Étang, in August and the early part of September. They were captured while flying, at sunset, and at various elevations from 500 to 1300 feet above the sea.

PTENIDIOPHYES, Reuter.

PTENIDIOPHYES MIRABILIS, Reuter.

Ptenidiophyes mirabilis, Reuter, Monogr. Ceratocomb. p. 26, no. 1, fig. 15.

Only three specimens were secured: one on the Chantilly estate, early in August, on a hillside, in the piles of decaying weeds; and the others were found on the Grand Étang, August 9, at an elevation of 1900 feet above the sea, where they were beaten from masses of roots and decaying leaves. The type was taken in Brazil.

ANTHOCORIDÆ.

LASIOCHILUS, Reuter.

1. LASIOCHILUS PALLIDULUS, Reuter.

Lasiochilus pallidulus, Reuter, Monogr. Anthoc., Acta Soc. Fenn. xiv. 1884, p. 571.

Many specimens were collected at various points on the island. At Balthazar they were taken, April 7, at an elevation of 250 feet above the sea, while flying over open places at sunset. On August 7 they were taken at the same place from vines and bushes. At the Grand Étang they were found, September 15, at an elevation of 1900 feet, among piles of weeds. Others were taken on the Mount Gay estate.

2. LASIOCHILUS VARICOLOR, sp. nov.

Oblong-oval, much less robust, narrower and more tender than *L. pallidulus*, Reut., fusco-testaceous, pale pubescent, paler beneath, and with the head, pronotum, and base of scutellum rufo-piceous. Head highly polished, shorter than the pronotum, with the eyes black, large, and extending beyond the width of the front of the pronotum; antennæ moderately slender, pubescent, testaceous, sometimes a little dusky, and darker on the ends of the joints, a little longer than the head, prothorax, and scutellum united, the second joint stout, a little longer than the head, slightly thickened at tip; rostrum pale testaceous, reaching behind the anterior coxæ, the basal joint thick, barely reaching to the eye. Pronotum polished, with slender transverse wrinkles; the collum narrow but distinct; the anterior lobe convexly elevated, with an impressed point on the middle; the lateral margin feebly sinuated behind, but strongly contracted in front; the posterior margin sinuated, with the humeral angles prominent, oblique, and a little rounded; the pro- and mesopleura piceous, with the sternum and coxal pieces paler. Legs pale testaceous. Base of scutellum transversely elevated, the surface behind this depressed, dull testaceous, with the tip almost acuminate. Hemelytra long, closely pale pubescent, dull yellowish, with the apex and inner margin dusky, the costal margin almost straight, and the basal margin of the cuneus bounded by a pale line; membrane dusky, a little paler at base. Venter fulvo-testaceous, distinctly pubescent, ovate, with the ovipositor piceous.

Length to tip of venter $1\frac{3}{4}$–2 mm.; width of pronotum $\frac{3}{4}$ mm.

Numerous specimens were collected at several points, such as Balthazar, August 8, at an elevation of 250 feet above the sea, in open fields, in piles of decaying weeds; at Chantilly, August 5, at an altitude of 500 feet above tide, on open hillsides, from piles of decaying weeds and rubbish; from Grand Étang, September 12, 15, on piles of weeds; and from the Mount Gay estate likewise on weeds and waste from stable.

3. Lasiochilus fraternus, sp. nov.

Form similar to the preceding, but more robust, closely resembling *L. fusculus*, Reuter, smaller, and with a shorter pronotum, &c. Colour fusco-piceous, paler beneath, with pale testaceous legs and rostrum. Head a little shorter than in *L. fusculus*, rufo-piceous before the line of the eyes, polished, a little shorter than the pronotum; a curved impressed line across the vertex, the eyes extending a little wider than the front of pronotum; antennæ stout, fusco-testaceous, the second joint gradually thickening towards the tip, a little longer than the pronotum, the two apical joints paler, conspicuously pubescent; rostrum reaching to the anterior coxæ, the basal joint stout and extending to the middle of the eye. Pronotum trapezoidal, wider than long, polished, transversely wrinkled, a little scabrous on the posterior lobe, punctate on the sides, the lateral margin bluntly rounded off, hardly sinuated, set with erect bristles, the apical border a little reflexed, the posterior margin moderately sinuated, with the humeral angles subacute and a little produced. Sternum, pleural pieces, and disk of venter more or less dark piceous, the deflexed margin of the pronotum placed inferiorly, sharply defined, growing much thicker anteriorly. Scutellum deeply depressed, a little scabrous, pubescent. Hemelytra dull fusco-piceous, minutely pubescent, more or less dull testaceous at base and along the length of the clavus; membrane long, pale fuliginous, paler at base.

Length to tip of venter 2 mm.; width of pronotum $\frac{7}{8}$ mm.

Some specimens have a faint pale dot on the middle at base of cuneus. This species lacks the indentation on the middle of pronotum. Specimens were collected at Balthazar, March 12, at an elevation of 300 feet, on dry hillsides, amongst second-growth woods, under piles of decaying weeds, and at the same place August 7, 8, 10–15; on the Mount Gay estate, August 20–

25, at altitudes of 150–200 feet, flying at sunset; at St. George's, August 27 and September 1, altitude 500 feet, flying at sunset.

4. LASIOCHILUS NEBULOSUS, sp. nov.

More robust than either of the preceding species, subovate, dark piceous, with a tinge of rufous, the head, pronotum, and base of scutellum highly polished. Head short, pale rufo-piceous in front of the vertex, the tablet carrying the ocelli opaque and rough, bounded in front by a transverse groove, impressed line at base of tylus deep; antennæ slender, about as long as the head, pronotum, and scutellum united, the basal joint projecting a little in front of the head, piceous, sometimes pale at tip, the second joint shorter than usual, pale yellow with a dusky tip, scarcely longer than the head, the two apical joints tinged with fuscous; rostrum dark piceous at base, pale rufo-testaceous from thence to the tip, reaching to the anterior coxæ. Sternum and venter piceous, the posterior borders of the middle pleura, as also exteriorly, yellowish. Pronotum trapezoidal, wider than long, dark piceous, fringed with a few long ciliæ; dorsal surface very moderately convex, a little scabrous and wrinkled, with a wide collar at tip; the lateral margin very obliquely convergent, emarginated at the apical angle; posterior margin moderately sinuated, the humeral angles a little prominent. Scutellum dark piceous, raised at base, depressed behind this to the tip and minutely scabrous. Legs and coxæ dull testaceous, occasionally paler, with the middle of femora dark piceous; tarsi generally piceous. Hemelytra wide, almost parallel-sided, dull pale yellowish, pubescent, coarsely punctate, the apex of the clavus, an oblong spot near the end of the corium, a streak exterior to this on the costa, and the cuneus dusky or piceous, the posterior edge of the corium marked with polished, piceous, interrupted streaks; the membrane pale, clouded with fuliginous.

Length to end of venter $1\frac{3}{4}$ mm.; width of pronotum $\frac{2}{3}$ mm.

Several specimens were collected at Balthazar, August 7, at an altitude of 250 feet, in second-growth woods, from vines and brush, also on August 17, under piles of cut weeds, in open damp ground. Others were found on the Mount Gay estate, August 20–25, and were beaten from herbage in open places, at an elevation of 200 feet.

5. LASIOCHILUS PICTUS, Uhler.

Lasiochilus pictus, Uhler, P. Z. S. 1893, p. 157.

A few specimens were found at Balthazar and on the Mount Gay estate, August 20 to 25, at elevations of 150 to 200 feet above the sea, and they were taken, while flying, at sunset.

6. LASIOCHILUS BASALIS, Reuter.

Lasiochilus basalis, Reuter, Monogr. Anthoc., Act. Soc. Fenn. xiv. p. 569.

Several specimens were taken on the Chantilly estate and at Balthazar in March and August, on the hillsides, from among rotting leaves and herbage.

7. Lasiochilus fusculus, Reuter.

Lasiochilus fusculus, Reuter, Monogr. Anthoc., Act. Soc. Fenn. xiv. p. 576.

A few specimens were obtained at Balthazar, early in August, in an open field, where they were shaken from decaying leaves. On the Grand Étang one specimen was taken, September 1, while flying at sunset.

Piezostethus, Fieber.

Piezostethus sordidus, Reuter.

Piezostethus sordidus, Reuter, Monogr. Anthoc., Act. Soc. Fenn. xiv. p. 591.

Numerous specimens were procured at several localities. Those from Balthazar were found July 11 and August 17, either flying at sunset, or on open damp ground beneath piles of cut weeds. On the Mount Gay estate and on the Grand Étang they were taken during August, from herbage in open places.

Triphleps, Fieber.

Triphleps perpunctatus, Reuter.

Triphleps perpunctatus, Reuter, Monogr. Anthoc., Act. Soc. Fenn. xiv. p. 654.

A few specimens were taken at Balthazar, August 17, on open damp ground under piles of weeds.

Brachysteles, Muls. et Rey.

Brachysteles pallidus, Reuter.

Brachysteles pallidus, Reuter, Monogr. Anthoc., Act. Soc. Fenn. xiv. p. 672.

A few specimens were secured at four different localities. At Balthazar they were found August 14, flying at sunset: others were taken on the Mount Gay and Chantilly estates, and at St. George's, in August and September, either flying at sunset or beneath piles of weeds.

Cardiastethus, Fieber.

1. Cardiastethus assimilis, Reuter.

Cardiastethus assimilis, Reuter, Monogr. Anthoc., Act. Soc. Fenn. xiv. p. 693.

Several specimens were secured at Balthazar, April 20, from weedy places in second-growth thickets, and on the Mount Gay estate, September 4, flying at sunset, or in second-growth woods.

2. Cardiastethus elegans, sp. nov.

Form similar to *C. assimilis*, Reuter, but rather more elongated, pale rufo-piceous, with the legs and antennæ yellowish. Head moderately long, highly polished, fulvous before the line of the antennæ, rufo-piceous behind this point, with a band of punctures connecting the eyes; antennæ thick on the two basal joints, the two apical ones very slender and hairy, the first joint scarcely extending beyond the tip of tylus, the second becoming thicker next the tip, longer than the head; rostrum extending over the anterior coxæ, rufo-testaceous, darker at base, the basal joint scarcely reaching to the eyes; the eyes black, a little deeper than the head, coarsely granulated; neck behind the eyes short and thick. Pronotum much wider than long, rapidly and obliquely narrowing towards the front; the collum very slender and recurved; callosities transverse, convexly prominent; the posterior lobe short, darker than anteriorly, obsoletely punctate and rugulose; the posterior margin broadly sinuated and having the humeral angles indented, moderately prominent; the lateral margin deflexed, thickened, emarginated at the anterior blunt angle. Sternum and pleural pieces pale rufo-piceous. Legs a little pubescent, darker on the femora than the tibiæ. Scutellum impressed behind the middle and rugose nearer the apex. Hemelytra bright yellow, pubescent, roughly punctate, the inner border and apex of the corium dark brown, this colour extending over the cuneus; membrane more or less tinged with fuliginous, but occasionally clear and iridescent. Venter polished, minutely punctate and pubescent, more or less spread with dark piceous.

Length to tip of venter $1–1\frac{1}{4}$ mm.; width of pronotum $\frac{2}{3}$ mm.

This is a particularly bright-coloured species, rendered more conspicuous by the dark band on the base of pronotum, and by the dark border of the hemelytra. Specimens were captured at Balthazar, April 20, at an altitude of 250 feet, on weedy open places in second-growth thickets; also on the Grand Étang, at an altitude of 1900 feet, where they were beaten from brush and masses of leaves. On the Mount Gay estate they were found August 20–25, and were beaten from herbage in open places, and they were seen flying at sunset in August and September. They were also obtained at St. George's, August 22, in open swampy places, on herbage.

Acanthia, Fabr.

Acanthia lectularia (Linn.).

Cimex lectularia, Linn. Fauna Suec. p. 909.

Acanthia lectularia, Fabr. Ent. Syst. iv. p. 67, 1.

One specimen was taken. It is very common and a great pest, especially in the poorer class of houses.

Tingitidæ.

Teleonemia, Costa.

Teleonemia sacchari (Fabr.).

Acanthia sacchari, Fabr. Ent. Syst. iv. p. 77.

Several specimens were found at Balthazar, April 5, on herbage in the cocoa orchards, also on Lake Antoine estate, April 13, among second-growth trees, and at the same place August 26, and on the Mount Gay estate, August 26–31, where it was beaten from herbage.

Typonotus, Uhler.

Typonotus planaris, Uhler.

Typonotus planaris, Uhler, P. Z. S. 1893, p. 716.

A few specimens were taken at Balthazar, April 3, from herbage in open weedy places. Also at St. George's and on the Mount Gay estate, in September, from herbage on low grounds.

Corythaica, Stål.

Corythaica carinata, sp. nov.

Oblong, narrow, pale fuscous, sinuated on the sides of pronotum, with the costal base of hemelytra less distinctly so, but more broadly and deeply behind the middle. Head short, pale brown above, the bucculæ whitish; the eyes barely projecting beyond the line of the sides of pronotal prolongation; antennæ slender, fulvo-testaceous, dark at base, the apical joint more obscurely brownish, the second joint minute, the third as long as all the rest united, very slender, minutely ciliated, dark brown at base, the apical joint with long, erect setæ; rostrum flavo-testaceous, reaching to the middle coxæ; a diagonal whitish streak beneath the eye. Pronotum tapering anteriorly, with the protuberance detached and lifted above the base of the head, becoming more compressed as it rises, and at the apex curved down beyond the head, its sides and dorsum each with a carinate line having series of large quadrangular cells between them, the lower border reflexed; the posterior lobe of pronotum broad, a little convex, with the lateral margin expanded into a white, thin, reflexed border, which is bounded on the inner side by a raised thread ending anteriorly in a small button, the three longitudinal carinate folds white, arched, the intervening surface granulated; the carinate folds are continued back to tip of the scutellum, the lateral ones arched at base, fading out posteriorly, and the middle one low and slender throughout. Hemelytra mostly opaque, testaceous behind the middle, with the raised lines whitish; the discoidal areole fusiform, fuscous behind, with the bounding veins carinate and the exterior one rising posteriorly; the surface generally granulated; a brown double spot occupies the space costally beyond the discoidal areole; costal area narrow, tapering at base, of almost equal width from thence to tip of membrane, whitish, provided with a single series of subquadrate areoles, and marked near the tip with a dark brown spot contiguous to a brown circle on the closed membrane, middle cells of the membrane large, unevenly reticulated, and with brown veins, the tip almost truncated.

Length to tip of wing-covers $2\frac{1}{4}$–$2\frac{1}{2}$ mm.; width of pronotum $\frac{3}{4}$ mm.

Collected on the Mount Gay estate, August 21–31, September 11–29, and October 7, on low grounds and hillsides up to 400 feet, beaten from herbage; also at St. George's, September 29, on herbage.

The description is chiefly derived from the dark and mature specimens. Some of these vary in marking, as well as in breadth of hemelytra, especially in the amount of dark brown on the membrane. This colour sometimes occupies the whole base and end of this part of the hemelytra, and leaves a curved whitish band or uneven spot between the two patches of colour.

Corythuca, Stål.

Corythuca decens, Stål.

Tingis decens, Stål, Stettin. ent. Zeit. xxiii. p. 324.

A few specimens were found on the Mount Gay estate, October 16, on low herbage.

Phymatidæ.

Phymata, Latr.

Phymata angulata, sp. nov.

Pale fulvous (no doubt green when alive), narrow, marked with rich dark brown on the pronotum, hemelytra, and sides of abdomen. Head of medium length and width, regularly narrowing towards the tip, the tip triangularly emarginate with the two processes short and subacute, the surface granulated, longitudinally and deeply depressed, with a curved, anteriorly tapering ridge each side conspicuously granulated, which carries the ocelli, the occiput truncated and sharpe-edged; eyes of medium prominence; the antennæ long, with the apical joint (♂) much longer than the three others united, (♀) only about one and a half times as long as the third, usually infuscated on the apical half; cheeks granulated in broken rows, neck remotely granulated. Pronotum pale fulvo-testaceous (when less mature pale testaceous), stained with pale brown across the base, on the lobes of the posterior division, and forming a diagonal spot on the side of the anterior lobes; the anterior division granulated, with the side-lobes subtriangular, a little curved, pale, bordered with granules; the posterior division coarsely punctate, marked off laterally by a deep emargination, followed by a long lamellar wing, which is deeply emarginate on the end, acutely produced at the posterior angle and more triangularly at the anterior angle, which also carries a slender diagonal carina; carinate lines of the disk spreading wider apart posteriorly, all the raised lines granulated; the humero-posterior margin reflexed, white, slightly oblique, broadly sinuated, with the inner angles produced over the clavus. Scutellum pale brown, more closely granulated at base, the middle carina marked with a whitish tip. Corium and clavus more or less dark brown, sprinkled with remote, minute, yellow granules, the veins and costal margin pale yellowish; membrane dark brown with a brassy tinge.

Legs testaceous yellow; the anterior femora more or less rufous, granulated, wide, strongly compressed and smooth on the lower anterior border; middle and posterior femora granulated, marked with a brown band, with rows of spines beneath and a small tooth near the apex; tibiæ of the same pairs more minutely granulated, with a small tooth beneath near the basal end; tarsi sometimes piceous and with black nails. Abdomen pale, widely expanded into long triangular lobes, which are brown spotted with white exteriorly, and pale with dark marks posteriorly, the outer extremity of these lobes acute, and on the underside reddish brown and carinate. Meso- and metapleura marked with a common reddish brown patch.

Length to end of venter $5\frac{1}{2}$–6 mm.; width across humeral wings $2\frac{3}{4}$–3 mm.; width across abdominal lobes 3–$3\frac{1}{2}$ mm.

The specimens were secured on the La Force estate on May 5 and August 7, at an altitude of 250 feet, and were swept from herbage in open swampy and weedy places; others were taken on the Mount Gay estate, September 28, October 3 and 12, in open places among herbage.

NABIDÆ.

CORISCUS, Schrank.

1. CORISCUS CRASSIPES (Reuter).

Nabis crassipes, Reuter, Öfv. Vet.-Akad. Förh. 1872, no. 6, p. 83.

One specimen was found on the Lake Antoine estate, March 24, where it was swept from herbage.

2. CORISCUS SERICANS (Reuter).

Nabis sericans, Reuter, Öfv. Vet.-Ak. Förh. 1872, no. 6, p. 83.

Only one specimen was obtained. It was taken at Beaulieu, March 24, upon herbage, on an open place.

3. CORISCUS CAPSIFORMIS, Germar.

Nabida capsiformis, Germar, Silb. Rev. v. p. 132.

A fine series of this insect was secured at St. George's, August 22, upon open swampy spots on herbage. Other specimens were found on the Mount Gay estate and Grand Étang, in September, upon herbage.

4. CORISCUS SIGNATUS, sp. nov.

Form very nearly that of *C. capsiformis*, but a little narrower, luteo-testaceous, marked with fuscous or clearer brown. Head as in *C. capsiformis*, with the middle of the gula fuscous; the first and second joints of antennæ long, brown at base and tip, and marked with obscure annulations; the rostrum pale testaceous, with a dark ring on the apex of the basal joint, which is followed by a pale ring on the next joint; middle line and margin of front more or less obscure; occiput a little swollen, polished, sometimes pale piceous. Pronotum marked with a narrow fuscous line on the middle, which becomes double on the anterior lobe; each side of this several short streaks of the same colour are distributed over the surface, and on the humeri and nearer the middle are two short, faint stripes of fuscous; posterior margin decurved, with the extreme edge whitish. Legs pale testaceous sprinkled with fuscous, with a black band at tip of the middle and posterior femora, and a smaller black spot on the apex of the tibiæ; the tarsi and especially the nails fuscous. The scutellum and inner edge of the clavus receives the continuation of the black stripe from the middle of the pronotum. Clavus and corium striped with obscure fuscous lines, some of which border the inner edges of the strong veins; the cuneus is also marked with a fuscous abbreviated stripe; membrane marked with fuscous lines, most of which are confined to the veins. Meso- and metasternum piceous black, the venter pale on the middle, darker on the side, and with the connexivum marked with black, irregular spots. Genital segment of male a little clavate, subtruncate at tip, and bent back.

Length to tip of venter 6–6½ mm.; width of pronotum 1–1¼ mm.

Numerous specimens were obtained at Balthazar, April 7 and August 15, at an altitude of 250 feet, on open weedy places near a stream. It was also taken at St. George's and on the Vendôme estate. A few specimens were beaten from herbage at night.

Velidia, gen. nov.

Aspect of a robust *Metacanthus*, but a genuine Nabid, with certain elements of structure, such as a blunt vertical head and deep pronotum, quite out of keeping with the ordinary members of this group. Head short, with a polished swollen base, which is separated from the space in front of the eyes by a transverse groove; the eyes oval, vertical, projecting but little beyond the occipital swelling; front short, but slightly convex. Rostrum conical at base, beyond this slender and reaching upon the posterior coxæ; the tylus vertical, narrow, tapering, the cheeks also narrow. Antennæ slender, the basal joint a little longer than the head; the second joint more slender, nearly twice as long as the basal one; the third equally slender, a little longer than the second; the fourth shorter than the second. Pronotum short, blunt, subtrapezoidal, having a recurved collum which caps the base of the head; the anterior lobe almost entirely occupied by the smooth, swollen, transverse callosities, the lateral margins carinated along the upward curve of the callosities; the posterior lobe high, sloping forwards, almost flat, a little wider than long, with the posterior border deflexed and the edge sinuated and reflexed; the pleural flaps wide, almost abruptly deflexed, forming a cap, the edges widely reflexed. Scutellum sublunate, very short, almost covered by the pronotum, with the apex acuminate. Legs of median length, the posterior femora a little clavate at tip; the anterior pair thickest, tapering at both ends armed beneath with two series of fine teeth; the middle ones scarcely longer than the anterior, also thicker in the middle; the tibiæ all filiform, very slender. Hemelytra a little narrowed in the middle, with the membrane long, bluntly rounded at tip, and a little notched on the outer margin at base; the discoidal areole very large, with the apical veins very slender, radiating like the rays of a fan.

VELIDIA BERYTOIDES, sp. nov.

Long, subcylindrical, griseo-fuscous, widest at the base of the pronotum. Head highly polished, black at base and between the eyes, the face, cheeks, and rostrum yellow; the antennæ dusky testaceous, annulated with black at the ends of the joints, and with a white band at the base of third and fourth joints, the basal joint with a broader black band a little way behind the tip. Pronotum greyish testaceous; the posterior lobe strongly punctate, the callosities black and polished, with a groove in the middle between them; the collum in front of these polished, yellow; the intrahumeral and the posterior border black, with the edge yellow; the pleural flaps punctate, pale yellow; humeri with a small whitish callosity in the angle. Scutellum mostly greyish yellow, with the apical point white. Legs yellow, all the femora with a black band before the tip, and the middle and posterior pairs, especially, marked with about three narrow black bands; the tips of tibiæ and of tarsi also black, Venter smooth, dull fulvo-testaceous, with a large black spot each side of base and the last two segments mostly black.

Length to tip of venter $2\frac{1}{2}$ mm.; width of pronotum $\frac{2}{3}$ mm.

Only one specimen was obtained. It was found at Balthazar, on April 27, at an elevation of 250 feet above tide-level, near the shady bank of a stream; beaten from a mass of bush and decaying leaves.

ALLŒORHYNCHUS, Fieber.

ALLŒORHYNCHUS ARMATUS, sp. nov.

Form similar to that of *A. flavipes*, Fieb., but rather narrower, invested with erect pubescence. Colour above mostly piceous black; abdomen, underside of body, and the legs honey-yellow, more or less tinged with piceous. Head short, black, highly polished, rufo-piceous from the eyes forward, the width across the eyes but little more than the front of the pronotum; antennæ slender, the basal joint hardly longer than the head, dull yellow, darker on the base and tip, hairy; the second fully twice as long, hairy, about as stout as the basal one, dusky; the apical joints long, much more slender, pubescent, fuscous; rostrum honey-yellow, reaching upon the middle coxæ, the base stout, following which the next joint is thick and extends behind the middle of the prosternum, the following one is compressed and shorter. Pronotum campanuliform, highly polished, deep black, with a row of coarse, remote punctures along the middle line; the anterior lobe about twice as long as the posterior, strongly convex, indented each side anteriorly, with a distinct contracted double collum in front, the incision behind it deep and distinct; the posterior lobe a little more than half as long as the anterior, but much wider, arched, with the lateral margins almost abruptly oblique, indented next the humeri. Scutellum dull black, depressed, with the margins and tip a little raised. Legs stout, bristly, the femora thick, the anterior pair armed behind the middle with a sharp piceous tooth, before which rows of very fine teeth run out to the tip; tip of tarsi piceous. Sternum and pleural pieces blackish piceous, remotely pubescent. Hemelytra pubescent, bright yellow from base to near the apex of corium; the clavus, inner margin and tip of the corium, and the cuneus piceous black; membrane tinged with smoke-brown. Venter closely yellowish pubescent, margined on the submargin with a piceous curved line.

Length to tip of venter $3\frac{1}{2}$ mm.; width of pronotum $1\frac{1}{4}$ mm.

Only one specimen of this interesting species was obtained. It was captured at Balthazar, on August 8, at an altitude of 250 feet, in an open field, where it was shaken from piles of decaying weeds.

Aphelonotus, gen. nov.

Oblong-oval, acute at both ends, pubescent. Closely related to *Pachynumus*, Klug, but having minute ocelli deep-seated and placed inside very near to the eyes. Head hardly longer than the pronotum, subcylindrical before the eyes, the vertex between the eyes forming a stout convex lobe, inserted in the thorax almost to the base of the eyes. Rostrum wide and depressed at base, reaching but a little way upon the sternum, the second and third joints much less thick. Antennæ about as long as the hemelytra to tip of membrane; the basal joint fusiform, shorter than the head; the second cylindrical, about twice as long as the first, a little more slender; the third shorter, about equally thick, attenuated at base; the following joints setaceous, set with erect long hairs. Prothorax transverse, subluniform, with a broad, contracted, collar-like apex, which is followed on the middle by a clearly bounded wedge-shaped callosity, behind this an impressed line continues to the transverse posterior suture; middle lobe moderately convex, with the sides a little decurved and bordered with a blunt carina, the sides before this contracted and indented; the posterior division is quite narrow, flat, less coriaceous than the other parts, and on the sides separated from the preceding lobe by a deep incision behind which the margin is callous; posterior margin broadly sinuated, with the humeral angles a little produced backward. Scutellum triangular, longer than wide, a little reflexed at tip. Anterior femora sublenticular, compressed, armed beneath with rows of short teeth; the tibia of this pair slender, curved, carrying a little spongiole beneath the tip, the other legs simple, bristly. Prosternum simple; mesosternum with a short carina, followed by a knobby prominence. Corium provided with an embolium, and having a triangular open space behind the apex of the scutellum ; the clavus sublinear. Abdomen depressed, closely pubescent.

APHELONOTUS SIMPLUS, sp. nov.

Obscure pale fusco-fulvous, with the head piceous and the eyes black. Antennæ sometimes infuscated beyond the second joint. Pronotum bilobate in the middle, not evidently punctate, polished, paler on the posterior border. Scutellum dull fulvo-piceous, obsoletely punctate at base. Legs paler than the upper surface, with the spines dark piceous. Corium coarsely punctate in rows, the colour dull piceous on the disk, with the border and embolium paler. Abdomen pale fulvous, closely sericeous pubescent ; the genital segment of the male tumid.

Length to tip of venter $3\frac{1}{2}$ mm.; width of pronotum 1 mm.

Seven specimens were taken on the Mount Gay estate on August 28, at an elevation of 200 feet above the sea. They were found under leaves in a thicket upon a dry hillside.

REDUVIIDÆ.

PRIONIDUS, Uhler.

PRIONIDUS CARINATUS (Forst.).

Cimex carinatus, Forst. Nov. Spec. Ins. p. 72.

This is the most beautiful variety of this remarkable species. Specimens were found on the Lake Antoine estate as early as March 24, on herbage, in littoral thickets ; and late in August at St. George's and on the Mount Gay estate, at both of which places they were beaten from herbage.

The form *P. cristatus*, Linn., which is rapidly being connected with the above by the discovery of intermediate varieties, is found in the United States late in summer and in the autumn until the chilling frosts become settled.

SIRTHENEA, Spinola.

SIRTHENEA STRIA (Fabr.).

Reduvius stria, Fabr. Ent. Syst. iv. p. 201.

Three specimens were taken at Balthazar, in April, where they were found in cocoa orchards, or came to the light at night.

RASAHUS, Am. et S.

1. RASAHUS HAMATUS (Fabr.).

Reduvius hamatus, Fabr. Spec. Ins. ii. p. 381.

Five specimens were taken at Balthazar, in April, where they came to the light at night.

2. Rasahus sulcicollis, Serv.

Peirates sulcicollis, Serv. Ann. Sci. Nat. xxiii. p. 219 (1831).

One specimen was secured at Balthazar, April 25, where it came to light at night.

Stenopoda, Lap.

1. Stenopoda culiciformis (Fabr.).

Cimex culiciformis, Fabr. Syst. Ent. p. 728.

Three specimens were found on the Mount Gay estate and at Balthazar, April 5, in cocoa orchards, upon herbage.

2. Stenopoda cana, Stål.

Stenopoda cana, Stål, Öfv. Vet.-Akad. Förh. 1859, p. 384.

One adult and a nympha were taken at Balthazar, March 19, in an open place upon herbage.

Narvesus, Stål.

Narvesus carolinensis, Stål.

Narvesus carolinensis, Stål, Öfv. Vet.-Akad. Förh. 1859, p. 385.

One specimen was found at Balthazar, May 16; it came to the light at night.

Saica, Am. et S.

1. Saica recurvata (Fabr.).

Zelus recurvatus, Fabr. Syst. Rhyng. p. 286.

Two specimens were taken at Balthazar, April 5–7, in open places upon herbage.

2. Saica annulipes, sp. nov.

Small in this genus and with the pronotum somewhat longer than usual, pale fulvo-testaceous, pubescent, rufous on most of the tergum, the legs and antennæ more especially testaceous. Head highly polished, short, rufo-testaceous, darker on the face and front; eyes large, black, prominent, but not rising as high as the posterior lobe; the posterior lobe deeply cleft, the two members almost orbicular; the neck short, strongly contracted; rostrum stout, reaching to the anterior coxæ; antennæ a little infuscated, fully as long as the head and prothorax united. Prothorax long; the anterior lobe high, very convex, sulcated, excavated in front, with a collum in front of the cavity, the upper surface tumid each side, the lateral margin composed of an arched carinate edge, and the anterior angles callous; the posterior lobe subtrapezoidal, deeply separated by the incision in front, with the middle line broadly, not deeply, grooved, the lateral margins thick, followed by a long callosity on the humerus; the posterior border steeply deflexed, slightly waved, with the posthumeral edge slenderly reflexed. Scutellum tumid and uneven at base, with the apical member dark piceous, wrinkled and armed with a small process at tip. The anterior femora closely spined beneath, the tibiæ with a few remote long teeth; middle and posterior femora unarmed, having a dark band next the tip, the corresponding tibiæ slender and simple. Hemelytra smoke-brown throughout, with the veins darker. Tergum rufous, infuscated on the middle; the venter highly polished, obscure luteous.

Length to tip of venter 5 mm.; width of pronotum 1 mm.

Only a single specimen (♀) was obtained. It was found at Balthazar, at an elevation of 250 feet above the sea, on March 18, in second growth, and was beaten from vines.

Oncerotrachelus, Stål.

Oncerotrachelus conformis, sp. nov.

Fusco-luteous, pubescent. Form narrower than *O. acuminatus*, Say. Head behind the eyes suborbicular, polished, minutely denticulated beneath; eyes black, large, round, coarsely granulated, carried a little above the surface of the front; rostrum reaching to the posterior end of the anterior coxæ, bristly rather than denticulated beneath the joints, the basal joint as long as the head; antennæ pale fuscous, set with erect bristly hairs, the basal joint about as long as the head, pronotum, and scutellum united. Pronotum clothed anteriorly with erect hairs, darker on the anterior lobe; the posterior lobe almost bald above, highly polished, with the latero-posterior margin callous, erect, pale testaceous, and ending above in a tooth; the posterior margin pale, a little sinuated each side and marked with a short suture behind each sinus. Scutellum with a pale, scarcely elevated, spine at the apex. Legs pale fusco-testaceous, distinctly pubescent. Hemelytra a little narrower than the posterior part of the abdomen; the clavus and costal margin pale yellowish, the rest of the surface dusky. Underside, including the venter, with an uneven stripe each side extending from the propleura to the tip of the venter.

Length to tip of venter 4 mm.; width of pronotum scarcely 1 mm.

Three specimens were captured at Balthazar, April 1 and August 6–10, at an elevation of 250 feet above the sea. They came to the light at night.

This species is very closely related to *O. acuminatus*, Say; it differs, however, in being narrower and smaller, in having erect sharp-pointed humeri, and in the absence of the stouter teeth on the surface of the basal joint of the rostrum.

Emesidæ.

Stenolemus, Signoret.

Stenolemus, sp.?

A larva of this genus was taken at Balthazar.

EMESA, Fabr.

EMESA ANGULATA, Uhler.

Emesa angulata, Uhler, P. Z. S. 1893, p. 717.

Three specimens of this insect were found at Balthazar, April 7–20, in open weedy places upon herbage.

LUTEVA, Dohrn.

LUTEVA GUNDLACHII, Dohrn.

Luteva gundlachii, Dohrn, Linnæa Ent. xiv. p. 244, pl. 1. fig. 19.

Seven specimens, more or less mutilated, are in the collection. They were taken at Balthazar, August 7, on vines and brush.

EMESOPSIS, Uhler.

EMESOPSIS NUBILUS, Uhler.

Emesopsis nubilis, Uhler, P. Z. S. 1893, p. 718.

Several specimens of this delicate insect were taken at Balthazar in August. They came to the light at night.

SALDIDÆ.

SALDA, auctores.

SALDA HUMILIS (Say).

Acanthia humilis, Say, Heteropt. New Harmony, p. 35.

Specimens of this species were found on the Telescope estate, August 15, on the margins of pools of water. Two different sizes occur at this locality: the one normal, such as is met with in the eastern United States and Cuba, the other longer and with a somewhat narrower abdomen.

HYDROBATIDÆ.

LIMNOMETRA.

LIMNOMETRA MARGINATA (Guérin).

Gerris marginatus, Guérin, Sagra's Hist. Cuba, Ins. p. 415.

Numerous specimens of this insect were captured on the Telescope estate, August 15, and later, on the margins of pools of water.

BRACHYMETRA.

BRACHYMETRA ALBINERVIS (Am. et S.).

Halobates albinervis, Amyot et Serv. Hémipt. p. 412.

Many specimens, mostly of the winged form, were taken on the Mount Gay estate, both in April and August. Others were found on the Mirabeau estate, at Woburn and at St. George's, on the surface of streams of water, as also on springs of water.

In the unwinged form the scutellum is not distinctly differentiated, but in the winged one it is covered by the valvular end of the pronotum.

This species has an extensive distribution from south to north. It occurs at Rio and at other places near the coast of Brazil, but the most northern limit at present known for it is the island of St. Vincent. No specimens have yet been obtained in Cuba, and I did not discover it in the island of San Domingo, where my work was particularly directed to obtaining the insects from the springs and streams of fresh water, both of the highlands and the coast. The close collecting of Prof. Poey and Dr. Gundlach, throughout a period of more than forty years, should have secured this insect if it existed in Cuba, but no specimens have been reported by either of those gentlemen.

It varies somewhat in colour and degree of marking upon the head, pronotum, and sides. The medial carina and transverse impression are not absent, as stated by Dr. Mayr (Novara-Reise p. 178); but the slender carina is not always very distinct, and it is rendered much less conspicuous through simulating the colour of the surface.

Trepobates, Uhler.

Trepobates pictus (H.-Schf.).

Halobates pictus, H.-Schf. Wanz. Ins. viii. p. 111, t. cclxxxvi. figs. 882, 883.

Stephania picta, B.-White, Challenger Rep., Zool. vii. pt. 19, p. 79.

Several varieties of this species, precisely like those which are common in Maryland and farther south, were secured at St. George's, August 28–31, on the surface of brackish water. A single specimen was found at Woburn, August 30, on a sluggish stream in the open flat country near sea-level. On the Telescope estate a pair were taken while in sexual connection, August 12, on a brackish pool next the sea-shore. The male of this pair is winged and the female unwinged. In the eastern United States this species frequents the bayed out parts of streams and the mill-ponds, and is distributed inland to near the head-waters of creeks which rise in the western portion of the Piedmont country, as in Frederick county, Maryland, and Spottsylvania, Virginia.

As the name of this genus is preoccupied, and the genus has not yet been fully described, for lack of winged specimens, it becomes necessary to give the following characters, which are in augmentation of those given by Dr. Buchanan-White:—Anterior tarsi normally three-jointed (exceptionally two-jointed); the hemelytra curved and tapering at base, gradually becoming wider towards the tip, at which point it is a little triangular and rounded; the corium subtriangular and about one half as long as the membrane, with three stout longitudinal veins, of which the costal is more bristly towards the base; the membrane has a pale longitudinal suture throughout, with a thick vein on the middle which does not quite reach the end of the loop that is formed by the two veins which run parallel to the margins and which converge on the tip; no transverse veins as in *Brachymetra*. In some specimens the acute tip of the scutellum projects from between the metanotal plates, in others it is atrophied. In two specimens the basal joint of tarsi was present on one side, and not on the other.

Hymenobates, gen. nov.

Narrower and somewhat more elongate in form than the male of *Halobates picta*, H.-Schf. Head with the front of the same form as in *Metrobates*, Uhler. Antennæ tapering in the direction of the tip; the basal joint long, fusiform, tapering narrowly on the apical third, armed beneath near base with a group of long spines and at the tip with a stronger spine; the second joint exceedingly short; the third less than one half as long as the first, armed with a stout triangular tooth which is followed by a bundle of bristles; the fourth shorter, curved and pointed like a claw. Rostrum short and stout, extending between the anterior coxæ, the first and second joints exceedingly short, the third very long and acutely tapering. Pronotum longer than wide, moderately convex, ending ovately above the scutellum; the humeral angles almost obsolete, and the narrow reflexed margin sloping anteriorly away from them. The anterior legs short, with the tibiæ thick and expanded; the middle pair very long and slender; the posterior pair shorter, with long thick coxæ; the femora a little less thick than the coxæ, but curved, and like them set with bristles, also with two long spines near the tip and a knob-like callosity at base; the tibiæ a little longer, tapering at both ends, fringed with two bundles of stiff bristles between the middle and tip; tarsi about half as long as the tibiæ, very slender, tapering almost to a bristle towards the tip. Hemelytra, including the membrane, twice as long as the pronotum; the corium narrow, almost linear, with the costa thick and the costal cell not conspicuous, but the discoidal cell very long and narrow, triangular at tip and sending off from the inner angle a single vein obliquely across the membranous part of this organ; a transverse suture with a vein forms the boundary for the base of membrane; the clavus is minute and almost concealed, the remainder of the corium is thin like a membrane; the membrane is much longer than the corium, elongate-oval, with two long veins which unite at tip to form a loop. The abdomen is short and subconical.

Hymenobates imitator, sp. nov.

Yellow beneath, black above, with the base of antennæ, a band near their tip, and a transverse spot in front of pronotum, as also the coxæ, yellow. Membranous part of the corium bluish, the membrane smoke-brown; the sutures, a curved line on the side of mesopleura, border of metapleura, bands on ventral segments, antennæ, and legs black.

Length to tip of venter $2\frac{3}{4}$ mm., to tip of membrane $3\frac{3}{4}$ mm.; width of pronotum 1 mm.

South of Grenville, windward side of island, August 4, on stagnant water. Only one specimen of the winged form is present in the collection. The others are either young specimens, or undeveloped females without indications of wings. The measurements are taken only from the winged male specimen used for description. The females have the simple antennæ and hind legs, as in *Rheumatobates*, Bergr., and *Metrobates*, Uhler. In the female, however, the antennæ are very much shorter than in either of the genera just mentioned.

VELIIDÆ.

VELIA, Latr.

VELIA STAGNALIS, Burm.

Velia stagnalis, Burm. Handb. ii. p. 212.

Several specimens were collected on the Mount Gay estate, late in August, on the surface of shady pools of small streams, on the grass growing in the water, and also gliding over the surface. Other specimens were secured about the same time and early in September at Woburn and Mount Maitland. The larval form was found at Woburn, August 30, on a sluggish stream near the sea-level. These specimens are more clearly marked with the silvery white streak at base of corium, and with similarly coloured dots on the connexivum and spots on the membrane, than is usual in specimens from the southern United States, Cuba, and Mexico. The large silvery area near the end of the tergum is evanescent, and not present in weather-beaten individuals.

RHAGOVELIA, Mayr.

RHAGOVELIA ANGUSTIPES, sp. nov.

In form similar to *R. obesa*, Uhler; black, opaque, closely pubescent. Head including the eyes a little wider than the front of the pronotum, the middle line elevated into a callosity which runs back, tapering, to near the occiput; eyes prominent, coarsely granulated; antennæ black, set with remote, erect bristles, with the basal joint curved, yellow at base, and the second and third joints shorter, subequal in length; rostrum piceous black, extending to behind the anterior coxæ. Pronotum moderately convex, yellow back of the head, trapezoidal in front of the humeral angles, triangular and a little shorter behind them, with the posterior margin flat, a little reflexed on the edge, and with the tip a little bent and almost acute; the humeral angles a little ridged, the lateral margins feebly acute, a little sinuated. Underside plumbeous. Scutellum concealed. Legs hairy; the coxæ, trochanters, and base of anterior femora bright yellow, the posterior femora very slightly thickened, armed beneath with a row of very fine teeth; the tibiæ especially clothed with stiff hairs. Hemelytra long and rather narrow, the costal vein stout, clothed at base with stiff bristles. Venter smooth, plumbeous, with the genital pieces and the middle of the border of the apical segment orange.

Length to tip of venter 3–3½ mm.; width of pronotum 1¼ mm.

Numerous specimens were obtained at Balthazar, August 7, at an altitude of 250 feet on running water; also on the Mount Gay estate, April 5, at the same altitude; and at Mount Maitland, August 20–25, at an altitude of 150 feet, on the surface of a stream of spring-water.

2. Rhagovelia elegans, sp. nov.

Larger and more robust than *R. angustipes*. Fuscous or dark rusty brown, hairy. The head short, across the eyes hardly wider than the front of pronotum, the callous ridge between the eyes not tapering posteriorly, almost touching the pronotum (♀); the eyes wider apart, with the space between them broad, coarsely granulated, and destitute of a callous ridge (♂); the cheeks and most of the face yellow; antennæ of medium thickness, remotely set with long bristles, with the basal joint yellow at base, about one third longer than the second, the second a little less thick, much longer than the third, the third and fourth a little more slender, both contracted at base, the third with a slender tooth at tip, the fourth much shorter and acute on the apex; the rostrum yellow, piceous at tip, reaching behind the anterior coxæ. Pronotum stout, convex, coarsely transversely wrinkled, bordered all round with yellow, this colour covering the anterior lobe as a broad band and extending down over the pleura; the propleura constituting a thick and broad callous smooth segment to carry the front legs, the surface behind this punctate in a curved line; middle line obsoletely carinated, the posterior margin almost equilaterally triangular, with the edge recurved and the space before the tip usually depressed; the humeral angle bluntly reflexed, obtuse, cut apart from the side below by an incised line; pleura and sternum yellow, with piceous streaks running down upon the coxæ. Legs stout, pubescent, dark brown, with the coxal plates mostly yellow; the posterior femora thick, clavate, tinged with bronze, polished, paler beneath, and armed there with about seven, chiefly long, teeth, of which the two inner ones are longer and thicker. Hemelytra dark fuscous brown, long, almost parallel-sided, and with thick prominent veins. Venter yellow, sometimes dusky, polished, with a stripe of brown each side running parallel with the outer margin; the border of connexivum brighter yellow, as also the genital segments.

Length to tip of venter 4½–5 mm.; width of pronotum 1¾–2 mm.

The prothorax is much shorter and more blunt on the posterior margin in the unwinged individuals.

Specimens of this form were met with at several localities. At Balthazar they were taken in April, on water; also on the

Mount Gay estate during the same month on spring-water; likewise on the Grand Étang, at an altitude of 1900 feet, on water.

It differs from *R. collaris*, Burm., in the coloured margins of pronotum, the more numerously denticulate femora, colour of venter, and size.

3. Rhagovelia plumbea, sp. nov.

Only the unwinged form is at present known. It is short and thick, subconical posteriorly, bluish plumbeous, opaque, minutely hairy, with the sides of the abdomen broadly reflexed. The head wide, convex, with a slender black line on the front, the orbits of the eyes bordered with yellow; the rostrum testaceous, reaching considerably behind the anterior coxæ; antennæ moderately long, brownish, finely pubescent, the basal joint yellow at base, much longer than the third, which is also much longer than the second, the fourth about as long as the second, thick, distended in the middle. Pronotum very moderately convex behind the middle, sloping posteriorly; the anterior lobe short, collar-like, with oblique sides, a yellow spot on the middle, and feebly carinate lateral margins, it is separated from the posterior lobe by a deeply incised line; the posterior lobe is somewhat abruptly wider, with strongly reflexed lateral margins and subacute humeral angles, with the posterior margin abruptly deflexed; a broad segment behind this has in the depressed outer corner a tumid callosity which occupies the position of the wing-pad. The propleural flap is mostly yellow, as is the cap of the intermediate and posterior coxæ and also the coxæ, trochanters, base of anterior femora, and the immediate base of posterior femora; other parts of legs fuscous, sericeous pubescent, and the posterior femora unarmed. The posterior border of last ventral segment and sometimes the genital segment yellow.

Length to end of abdomen, ♂ $2\frac{1}{2}$, ♀ $3\frac{1}{4}$ mm.; width of pronotum, ♂ 1, ♀ $1\frac{1}{4}$ mm.

This is a common species on the surface of salt-water around the inlets of the Florida Keys. Several specimens were secured in the Bay of St. George's, on the leeward side of Grenada, September 6, on the surface of the sea. Only specimens taken *in copulâ* were kept.

Others were captured at the southern end of the island of St. Vincent, May 24, swimming on the sea, in a sheltered and still place near the shore. Gregarious in habits, 50–60 together. They were also taken *in copulâ* at this time.

The male is very much smaller than the female, and the latter is usually marked by a carinate line on the middle of the contact of the two lobes of the pronotum.

Mesovelia, Muls.

1. Mesovelia bisignata, Uhler.

Mesovelia bisignata, Uhler, Standard Nat. Hist. ii. p. 273, fig. 324.

A fine series of this insect was secured at Woburn, Granville, Beaulieu, Grand Étang, and on the Mount Gay estate. It was found in the young stages on the Grand Étang, March 2, along the margin of running water, and in August it was found fully developed on the surface of stagnant ponds and on a sluggish stream near the sea. In the eastern United States along the seaboard its habits are essentially the same as in Grenada. Near Baltimore it lives on the ponds and around the overflowed freshwater marshes among the cat-tails and rushes, where it creeps stealthily about in search of small insects which fall into the water.

2. Mesovelia amœna, sp. nov.

Dark brown, almost black in some specimens; beneath pale brown with a plumbeous tinge, except the venter, which is yellow with transverse cloudings of darker colour on the segments, sides, and tip. Head broader in the female than in the male, obscure yellow, the vertex with a brown stripe each side and the middle line grooved, the tylus and borders of cheeks piceous; antennæ long and slender, rusty brown, paler on the basal portion of the first joint, the second joint about two thirds the length of the first and not quite as thick, the following joints long and more slender; rostrum testaceous, piceous at base and tip, reaching between the middle coxæ. Pronotum opaque, velvety brown, marked with a whitish transverse spot on the middle of the collum; the posterior margin widely sinuated; the lateral margin with the carinate edge but slightly elevated, marked with two or three small pale spots; the humeral margins more distinctly reflexed. Scutellum almost black, a little rough, opaque. Coxæ and legs ivory whitish, more or less infuscated on the tibiæ and tarsi. Pleural pieces more or less tinged with plumbeous on a brown ground. Hemelytra velvety brown, opaque, the base and a long streak each side white; behind the white band the surface is pale brown, and behind this, including the posterior part of the membrane, it is pale smoke-brown; the base of the membrane and a stripe at its tip obscure whitish. Venter glossy, often with a dark stripe each side near the lateral border.

Length to tip of venter 2 mm.; width of pronotum $\frac{3}{4}$ mm.

From Mount Maitland and Mount Gay estate, August 26–31, on the surface of a stream, and September 6, at 50 feet above the sea, on a pool of water among grass and weeds.

Microvelia, Westw.

1. Microvelia capitata, Guérin.

Microvelia capitata, Guérin, Sagra's Hist. Cuba, Ins. p. 417.

A few specimens were collected at Balthazar in June and August, on ponds of stagnant water; and others were found on the Telescope and Mount Gay estates, in August and September, on the surface of freshwater pools.

2. Microvelia robusta, sp. nov.

Shorter and comparatively more robust than *M. modesta.* Colours about the same, except that there is an absence of pale colour from the venter and no yellow border on the connexivum. The head is immersed nearly up to the eyes in the pronotum; the eyes are bordered internally with prostrate white pubescence; the front of the pronotum is shorter and less contracted, densely covered with white pubescence, which is laid upon a faintly yellow band; the pleural pieces are not broadly bordered with testaceous, and the posterior femora are only a little longer than the middle ones; the last joint of antennæ more than one third longer than the third joint. The hemelytra are smoke-brown, often pale, with two white diagonal streaks at base, pale spaces in the areoles, and a white pyriform spot in the apical areole; the costal area is almost linear, deflexed, pale, and marked with a row of remote brown dots.

Length to tip of venter 2 mm.; width of pronotum $\frac{7}{8}$ mm.

A few specimens were collected at Woburn and Beaulieu, August 25, at an altitude of 700 feet above the sea, on the surface of a stagnant pond; another specimen was taken on the Mount Gay estate, in September.

3. Microvelia marginata, Uhler.

Microvelia marginata, Uhler, P. Z. S. 1893, p. 719.

Several specimens were secured on the Grand Étang, August 9, at an elevation of 1900 feet above the sea, on pools of water in a swampy forest.

This beautiful little species has a very extended distribution, as it is now known to occur in Trinidad, St. Vincent, Central America, Mexico, Cuba, and in the United States, from Florida to northern New Jersey. In Maryland it lives on the quiet pools beside streams of water near the cities of Baltimore and Washington.

4. Microvelia longipes, sp. nov.

Long and narrow, dark brown or fuscous, paler beneath, covered with plumbeous. Head long, dark brown, sericeous pubescent, with the orbits of the eyes and the slender line on the vertex, the throat and cheeks testaceous; middle of vertex oblong-ovate, prominently elevated; rostrum pale testaceous, piceous towards the tip, reaching to the middle coxæ; antennæ slender, pale rufopiceous, a little darker at ends of the joints, the base of first and second joints testaceous, second joint shortest, third longest, about one and a half times as long as the second, the fourth a little shorter than the third. Pronotum a little longer than wide, steeply sloping anteriorly, velvety, powdered with pale grey, with a slender whitish-yellow collum interrupted in the middle by the slender black carina which runs back towards the base; the humeri triangular, a little recurved at the margin; the posterior division triangular, rounded at tip, feebly recurved, bordered with yellow;

the pleural flaps strongly curved, margined with yellow. Scutellum concealed beneath the end of pronotum. Legs slender, tinged with fuscous, paler at base; the anterior femora dull testaceous, about half as long as the middle pair, the posterior pair nearly twice as long as the middle one, and likewise the same in the tibiæ. Hemelytra whitish translucent, with the veins black and thick; when the wings are closed the submarginal areole forms a long silvery streak which is followed behind by an oval areole of like colour, and this in turn is followed at tip by a similar spot which does not fill the areole; wings milk-white. Tergum dark brown, venter at tip and coxæ pale testaceous, the connexivum bordered with pale yellow.

Length to tip of venter 3–$3\frac{1}{4}$ mm.; width of pronotum 1 mm.

Several specimens of this remarkable insect were taken on the Mount Gay estate, September 21–26, on water in a large iron kettle.

This species stands by itself as regards the remarkable elongation of its posterior legs. It thus helps to bridge over the gap between this group and the *Hydrobatidæ*, although but few of the other elements of its structure have undergone important modification.

5. Microvelia modesta, sp. nov.

Similar to *M. longipes*, but much more robust, dark brown or fuscous, velvety opaque above, paler fuscous beneath and spread with plumbeous bloom. Head long, tapering at tip, with a convex ridge on the middle line; the throat, cheeks, and border of the orbits of the eyes testaceous; antennæ of medium thickness, dull testaceous, more infuscated on the ends of the joints, the fourth joint longest, the second shortest, and the basal one a little shorter than the third; rostrum testaceous, piceous at base, on the middle line, and at tip. Pronotum steep anteriorly; the collum marked each side with yellow, spread with whitish bloom, and having the slender carina on the middle black; this carina runs back to the apex of pronotum; humeral border triangular, a little elevated at tip; apex of the pronotum triangular, feebly curved; border of the posthumeral sinus and the posterior margin of the epipleural flap testaceous; underside of collum, sternum, coxæ, and femora testaceous, remainder of legs dusky testaceous, more infuscated near the articulations and on the tarsi. Scutellum blackish, all but the tip concealed. Hemelytra wider than in *M. longipes*, milky whitish on the clavus and in all the areoles, the veins dark brown, and the costal border black or fuscous, sinuated, the apical areole with a large, ovate, white spot. Connexivum yellow; middle line of the venter and the genital segments dull fulvous, the middle sometimes with a slender black line.

Length to tip of venter $2\frac{3}{4}$–3 mm.; width of pronotum $1\frac{1}{4}$ mm. The middle femora are about one third longer than the anterior ones, and the posterior femora are nearly one third longer than the middle ones. One female is shorter and darker than the others.

Specimens of both sexes were taken on the Mount Gay estate, between September 21 and 26, on the surface of water.

6. Microvelia, sp.?

A small insect, numbered 112 and 122, belonging to this genus was found on stagnant water at Beaulieu and Woburn; but the specimens are possibly nymphs and too undeveloped for specific definition.

Hebrus, Curtis.

1. Hebrus concinnus, sp. nov.

Form of *H. pusillus*, Fallen. Fuscous or rust-brown above, minutely pubescent, with the disk of pronotum moderately flat and the collum well defined and fulvous. Head nearly as long as the pronotum, dark brown, minutely scabrous, tinged with rufous at tip; antennæ dusky testaceous, sometimes fuscous on the tips of the two basal joints, the first of these a little longer than the second, generally paler at base, the three following ones very slender, set with erect pubescence, the third longer than either of the following ones, the fourth and fifth subequal; underside of head and the bucculæ testaceous; the rostrum pale testaceous, reaching to the posterior coxæ. Pronotum with a depressed, curved, rufous margin extending a little over the base of the scutellum; the lateral margins notched behind the swollen anterior lobe; the humeral angles prominent, rounded, with a callous long submargin; the middle line impressed, and each side of it with a few coarse punctures anteriorly and with a group of less coarse ones posteriorly; the reflexed lateral margin and underside of collum rufous. Scutellum dull fuscous, rough and uneven; legs testaceous, a little dusky on the knees, tibiæ, and tarsi. Hemelytra scarcely longer than the abdomen, obscurely sericeous pubescent, pale smoke-brown at base, fuscous at tip, with a stripe of white running out from the base of the clavus, and a longer pale streak on the subcostal long areole; the membrane pale fuscous, with a pale spot each side next the cuneus; the margin of the entire wing-coverts, including the membrane, also pale next the tip; there is in some specimens a faint trace of another spot. Venter polished, fuscous black, minutely sericeous pubescent, with a slender black stripe along the middle.

Length to tip of venter $2\frac{1}{4}$–$2\frac{1}{2}$ mm.; width of pronotum 1 mm.

Three specimens of this insect were captured on the Mount Gay estate and Balthazar in June and August. During the latter month they occurred at the roots of grass, on muddy ground near pools of water. This species is a common one which has been met with in the Atlantic States and the West Indies, and it also occurs in California and Washington State. In Maryland it lives on the damp sand or mud of small pools beside streams of water, in spring and late summer. The unwinged individuals may be found skimming over the surface of quiet water from spring until the end of summer.

2. Hebrus consolidus, sp. nov.

A little more compact than *H. sobrinus*, Uhler, with the transverse suture separating the lobes not so deep; colour fuscous, the surface above finely pubescent, more or less spread with whitish bloom. The head moderately produced before the eyes, somewhat tinged with rufous, a little rough between the eyes; the throat pale rufo-testaceous; antennæ dull rufo-testaceous, usually darker at the points of articulation, the first and second joints paler, subequal in length, thickened and black at tip; rostrum yellowish testaceous, reaching the posterior coxæ; the bucculæ, coxæ, trochanters, and legs pale testaceous, with the knees and tarsi sometimes infuscated. Pronotum broad, moderately sinuated before the posterior lobe, with the lateral margins reflexed, and the humeri prominent and blunt; the collum exceedingly narrow and almost obsolete; the posterior margin deflexed, broadly rounded. The base of the scutellum lunately tabulated, with the posterior portion triangular and depressed. Hemelytra chestnut-brown, minutely pubescent, the corium marked at base with a white wedge-shaped spot, basal half of the costal border dull yellowish; the membrane long, dusky, marked at base with a short curved streak, also each side with a bent spot, and on the middle towards the tip with an oblong spot, all of which are obscure whitish. Venter rufo-piceous margined with yellow.

Length to tip of abdomen $1\frac{3}{4}$ mm.; width of pronotum $\frac{3}{4}$ mm.

Several specimens were collected on the Mount Gay estate, August 26, at the roots of grass on muddy soil adjacent to pools of water, and September 6, at an altitude of 50 feet, on grass and weeds growing out of a pool of water; also on the Telescope estate, and at Balthazar, March 5, on the open sandy shore of a stream, under decaying leaves.

Galgulidæ.

Pelogonus, Latr.

Pelogonus marginatus (Latr.).

Acanthia marginata, Latr. Hist. Nat. Ins. xii. p. 242.

Several specimens of different sizes and more than one pattern of marking were found at Balthazar, Windsor, and on the Mount Gay estate. They were found mostly in March and April, at which time they were also in the larval stage, on wet mud and sand near the river. Numerous specimens were observed, and they were found to fly quickly when disturbed. A very small specimen, with the broad yellow mark on the margin of pronotum, was found, August 26, on the Mount Gay estate, at the roots of grass, on mud, near pools of water.

MONONYX, Lap.

MONONYX RAPTORIUS (Fabr.).

Naucoris raptoria, Fabr. Syst. Rhyng. p. 111.

A nympha of this species, the only specimen in the collection, was found on the Mount Gay estate, September 6, near a pool of water where the grass and weeds grew thick.

NAUCORIDÆ.

PELOCORIS, Stål.

PELOCORIS FEMORATA (Pal. Beauv.).

Naucoris femorata, Pal. Beauv. Ins. Afr. et Amér. p. 237, pl. 20. fig. 4.

A few specimens both of adults and nymphs were captured at Woburn and on the Mount Gay estate, in August, in pools and in a sluggish stream of water near the level of the sea. The species is quite common in Canada, the United States, both east and west, and it has also been taken in the Antilles, Mexico, and Central America.

BELOSTOMATIDÆ.

ZAITHA, Am. et S.

ZAITHA ANURA, H.-Schf.

Zaitha anura, H.-Schf. Wanz. Ins. viii. p. 26, pl. 257. fig. 799.

Eleven specimens of this common insect were found at the several localities on the island. They were taken on the Mount Gay estate, and at Woburn and Chantilly in April, August, and September, from streams and pools of fresh water. The habits of this species in Grenada seem to be the same as in Florida and the South-western States, and in Cuba, San Domingo, Mexico, and Central America. This form is sometimes very common in Southern and Lower California.

NOTONECTIDÆ.

NOTONECTA, Linn.

NOTONECTA AMERICANA, Fabr.

Notonecta americana, Fabr. Ent. Syst. iv. p. 58.

A single nympha only was obtained. It was found at Woburn, August 20, in a sluggish stream in an open flat near sea-level.

ANISOPS, Spin.

ANISOPS ELEGANS, Fieber.

Anisops elegans, Fieber, Rhynchotograph. p. 61.

Many specimens, of both forms, were found on the Mount Gay estate and at Woburn, in March, April, and August, in spring-water. These insects vary in the width and proportion of the body, as well as in the extent of black on the tips of the wing-coverts, just as we find to be the case in our smaller species of *Notonecta*. This we know to be the case from frequent observation of the various forms taken in sexual connection.

PLEA, Leach.

PLEA STRIOLA, Fieber.

Plea striola, Fieber, Entom. Monogr. p. 18, pl. 2. figs. 1–3.

Several specimens of this small insect were found at Woburn, August 30, on a sluggish stream, in a flat open country near sea-level. This species is sometimes common in ponds of stagnant water in most parts of the United States; it inhabits also Mexico, Cuba, Central America, and California.

CORISIDÆ.

CORISA, Geoff.

1. CORISA CUBÆ, Guérin.

Corisa cubæ, Guérin, Sagra's Hist. Cuba, Ins. p. 422.

Two specimens, both males, were secured at Woburn, August 30, in a sluggish stream in the open flat country near sea-level. This species is also now known from Florida, Texas, and Mexico, besides the island of Cuba.

2. CORISA RETICULATA, Guérin.

Corisa reticulata, Guérin, Sagra's Hist. Cuba, Ins. p. 423.

More than a dozen specimens, including both sexes, were found at St. George's and on the Mount Gay estate, in August and September, in pools of fresh water, and also in brackish water. A specimen from the Caliveny estate was found near the sea, in a pool of fresh water.

SIGARA, Fabr.

SIGARA SOCIALIS, B.-White.

Sigara socialis, B.-White, Trans. Ent. Soc. London, 1879, p. 274.

Nearly two dozen specimens of this species, including some varieties in size and colour, were collected on most parts of the island. At Balthazar it was found June 11, flying at sunset after a heavy rain. On the Mount Gay and Telescope estates it was taken in August from spring-water; but at Woburn it was more common, August 30, in a sluggish stream in the open country near sea-level. This species occurs also in Mexico and California, but it has not yet been taken in the eastern part of the United States.

3. On new Species of Heterocera from Tropical America. By W. Schaus, F.Z.S.

[Received February 9, 1894.]

Fam. Syntomidæ.

1. Psoloptera basifulva, sp. nov.

Antennæ black. Head, thorax, and base of wings reddish; the wings otherwise and abdomen black, slightly tinged with dark blue; a small white lateral spot at the base of the abdomen. Exp. 32 millim.

Hab. Peru.

Obs. Allied to *P. thoracica*, Wlk., but differs in the reddish base of the wings.

2. Homœocera cincta, sp. nov.

Antennæ black, tipped with white. Head black, frons white. Collar black, a central orange spot and lateral metallic blue spot. Thorax black; patagia orange, margined with black. Abdomen dorsally with first segment yellow, otherwise black with metallic blue transverse lines, orange between the segments; anus orange; underneath black with some transverse white marks. Legs black. Primaries hyaline; the veins black, except the costal vein, which is reddish brown; an orange streak at the base above the submedian vein and another below it; the inner and outer margins narrowly black, the apex broadly black; a narrow black discal line. Secondaries hyaline, the outer margin finely black, the inner margin and anal angle broadly black. Exp. 28 millim.

Hab. Aroa, Venezuela.

3. Sphecosoma simile, sp. nov.

Antennæ yellow, the tips black. Head yellow, a black spot posteriorly. Collar yellow, edged with black. Thorax yellow, the patagia inwardly edged with black. Abdomen yellow, with dorsally six broad black transverse bands. Legs yellow. Wings yellowish hyaline; the subcostal and median veins yellowish, the other veins black; the fringe blackish; a small black border at the apex of the primaries. Exp. 26 millim.

Hab. Aroa, Venezuela.

Obs. Very closely allied to *S. arctata*, Walk.

4. Gymnelia aroa, sp. nov.

Antennæ black. Head and thorax black; a few dark bluish scales on the collar. Abdomen black; a subdorsal dark blue line, interrupted posteriorly on each segment; lateral orange streaks between the segments, and a lateral row of blue spots; underneath an outer row of yellow spots. Legs black; fore coxæ white.

Wings hyaline, the margins broadly black, especially the outer margins; a black spot at the end of the cell on the primaries. Exp. 33 millim.

Hab. Aroa, Venezuela.

5. Læmocharis multigutta, sp. nov.

Antennæ black. Head black, with a crimson lateral spot. Collar black, with two crimson spots. Thorax black. Abdomen black; two basal segments with crimson spots, the other segments banded with red, interrupted subdorsally. Underneath a white spot. Legs black, fore coxæ white. Wings smoky hyaline, the veins and margins black; some crimson streaks at the base of the primaries, and on the same wings a black spot at the end of the cell. Exp. 23 millim.

Hab. Aroa, Venezuela.

6. Thrinacia salta, sp. nov.

Antennæ black. Head black, frons white. Thorax crimson; tips of patagia black. Abdomen black. Legs black, fore coxæ white. Wings black; the basal half of the primaries semi-hyaline except the costal and inner margin. Exp. 20 millim.

Hab. Aroa, Venezuela.

7. Pseudomya picta, sp. nov.

Antennæ black. Head black, with a large crimson spot. Collar yellow. Thorax black, a crimson spot laterally on patagia. Abdomen dorsally crimson at the base, followed by a broad yellow space, the terminal half brownish; underneath brownish yellow. Legs black. Wings smoky brown, semi-hyaline, the margins a little darker. Exp. 22 millim.

Hab. Aroa, Venezuela.

8. Cosmosoma tigris, sp. nov.

Antennæ black. Head black, streaked with metallic blue. Collar yellow, laterally metallic blue. Thorax with a metallic blue spot posteriorly; patagia yellow, outwardly edged with blue. Abdomen bright yellow, with a narrow black transverse band on the posterior portion of each segment; segments 2 and 3 laterally blackish; a lateral row of metallic blue spots. Legs yellow with smoky streaks. Wings hyaline with narrow black margins, and the apex of the primaries broadly black; some yellow at the base of the inner margin, and a yellow streak on the costal margin. Underneath, the costal margin of the secondaries broadly orange-yellow. Exp. 34 millim.

Hab. Aroa, Venezuela.

9. Cosmosoma plutona, sp. nov.

Head and thorax black. Collar dark metallic green. Abdomen dorsally very brilliant crimson; underneath black with a white mark. Wings hyaline, narrowly and evenly bordered with black; all the veins black and a black line at the end of the cell. Exp. 30 millim.

Hab. Castro, Paraná.

10. Dycladia cingla, sp. nov.

Palpi yellow. Head black, frons grey. Collar yellow. Thorax yellow, with three black stripes and a metallic blue spot posteriorly. Abdomen yellow; the third segment dorsally black, with three blue spots and two minute yellow spots; the following two segments with a black subdorsal spot each; last segments black, with a subdorsal and lateral blue spots. Wings hyaline, narrowly margined with black; the apex of the primaries broadly black; the costal vein yellow; the inner margins yellowish. Exp. 26 millim.

Hab. Aroa, Venezuela.

11. Marissa regia, sp. nov.

Antennæ black, tipped with white. Head black, frons whitish, two metallic blue spots posteriorly. Collar black, two metallic blue spots. Thorax black, a broad white streak on patagia; a posterior blue and whitish spot. Abdomen, first three segments crimson, the second spotted with black and blue; the other segments black, with a subdorsal, two lateral, and two ventral rows of white spots. Legs black; tarsi, joints, and fore coxæ white. Primaries hyaline, the margins broadly black, still more so at the apex and inner angle; a small vitreous elongate spot on the costal margin at the base; a basal transverse black mark; a large black spot at the end of the cell, and connected by a broad black mark on vein 2 with the inner angle. Secondaries hyaline, the margins irregularly bordered with black. Exp. 34 millim.

Hab. Aroa, Venezuela.

Obs. Allied to *M. eane*, Hübn.

12. Æthria paula, sp. nov.

Body velvety black; the last three segments of the abdomen dorsally and laterally crimson; a round whitish spot on either side of the collar. Wings hyaline, the veins black and all the margins broadly black; at the end of the cell on the primaries a broad black spot from the costa to nearly the black border of the inner margin. Exp. 46 millim.

Hab. San Paulo, S.E. Brazil.

Obs. Closely allied to *Æ. hæmorrhoidalis,* Stoll, which has, however, the basal segment of the abdomen crimson, and has a black spot on the costal margin of the secondaries near the apex.

Ptychotricos, gen. nov.

Antennæ pectinated in both sexes, more so in the male than in the female. Primaries long and narrow, the outer margin very oblique; veins 4 and 5 stalked; vein 6 from upper angle of cell; veins 7, 8, 9, 10, 11 stalked. Secondaries in the male with the outer margin very oblique, slightly excavated, the anal angle very acute; on the inner margin a fold enclosing a long tuft of hairs. The female has the outer margin slightly rounded, the anal angle also rounded; veins 3 and 4 stalked; 5 absent; 6 from upper angle of cell; 8 absent. Abdomen extending far beyond the secondaries, moderately stout.

13. PTYCHOTRICOS ZEUS, sp. nov.

Head black, bordered behind with orange. Thorax brownish black. Abdomen dorsally blackish; a subdorsal small orange basal spot; laterally and dorsally on the last segments brilliant metallic blue; underneath black with white bands. Fore coxæ white. Primaries above dark brownish black; the veins brownish; some brown streaks at the base, and a terminal row of oval lanceolate spots with dark centres; two semi-hyaline spots in the cell, and three transverse similar spots beyond the cell; a diaphanous shade below the median vein; a minute metallic blue spot on the inner margin. Secondaries black; a small hyaline spot at the base crossed by the black median vein; a tuft of long yellow hairs on the inner margin near the base. Underneath black, with all the semi-hyaline spots more distinct. Exp., ♂ 49 millim., ♀ 48 millim.

Hab. Aroa, Venezuela.

Fam. ARCTIIDÆ.

14. ACLYTIA RUFIVENTRIS, sp. nov.

Palpi black, crimson at the base. Head black, with two crimson spots behind the antennæ. Collar black, with a lateral crimson spot. Thorax black. Abdomen black dorsally, crimson underneath and apparently between the segments above also; the anal segment entirely black. Coxæ and trochanters crimson. Primaries above dull brown. Secondaries with the margins broadly smoky black and the disk vitreous. Underneath, the wings are similar, but more thinly covered with scales. Exp. ♀ 41 millim.

Hab. Jalapa, Mexico.

MACHÆRAPTENUS, gen. nov.

Antennæ toothed. Body stout. Palpi very short. Primaries long and narrow; apex rounded; outer margin very oblique; inner angle rounded; inner margin slightly sinuate; vein 6 from upper angle of cell; veins 7, 8, 9, 10 stalked. Secondaries triangular, costal margin rounded; outer margin excavated; discocellular straight; vein 5 absent; veins 6, 7, 8 stalked.

Obs. Allied to *Cratoplastis*, Feld.

15. Machæraptenus ventralis, sp. nov.

Head black. Collar creamy yellow edged with black. Thorax black; patagia creamy yellow tipped with black. Abdomen dorsally black, shaded with blue on the posterior half; underneath, coxæ and abdomen orange. Primaries yellowish white; the costal margin black; the base narrowly black; the inner angle finely black. Secondaries whitish. Exp. 42 millim.

Hab. Aroa, Venezuela.

16. Idalus enervis, sp. nov.

Palpi white, pink at the base. Head white, with a transverse pink streak. Collar white, laterally shaded with pink. Abdomen crimson dorsally, white underneath. Legs white, coxæ crimson. Primaries above bright yellow; the costal and inner margins finely white, the costa otherwise pinkish; a purplish shade contiguous to the white on the inner margin; a small purplish spot in the cell, and a large spot of the same colour at the end of the cell and extending beyond it; an outer transverse row of small purplish spots. Secondaries above white, with a few rosy hairs at the base. Underneath, the primaries are bright yellow, with the cellular spots crimson instead of purplish; secondaries white. Exp. 31 millim.

Hab. Castro, Paraná.

17. Euceron aroa, sp. nov.

Head brown, two orange spots behind the antennæ. Collar brown. Thorax brown; a yellow streak on patagia. Abdomen greyish brown; anus orange; underneath banded with white. Primaries whitish grey; all the veins and apex dark grey; a subapical transverse white shade. Secondaries light greyish hyaline, the margins dark grey. Underneath, the primaries are of a uniform grey, with only the subapical white shade. Exp. ♀ 31 millim.

Hab. Aroa, Venezuela.

Obs. Closely allied to *E. costulatum*, H.-S.

18. Eucereon dentatum, sp. nov.

Head grey, posteriorly crimson. Collar and thorax grey, streaked with black. Abdomen with the first segment grey; otherwise crimson dorsally, white below, black laterally; anus tipped with black. Primaries light grey; a basal and an inner dentate transverse darker line; beyond the latter a dark spot in the cell; a median dentate line followed by a large dark blotch at the end of the cell, which reaches from the costa to vein 2; an outer dentate line crossing a dark spot between 2 and 3, and followed by a similar line which does not reach the inner margin; a terminal row of dark spots, the largest one being just above the inner angle. Secondaries grey, the disk faintly hyaline. Underneath, the wings are dull grey. Exp. 31 millim.

Hab. Coatepec, Mexico.

19. Opharus gemma, sp. nov.

Palpi, legs, and abdomen below blackish. Antennæ black. Head, collar, and thorax light greyish brown; two minute black points on the collar. Abdomen dorsally orange, with a broad subdorsal brownish line tapering towards the anal segment. Primaries light greyish brown; an indistinct dark median shade not reaching the margins; beyond the cell a large dark brown spot cut by vein 5. Secondaries greyish brown. Exp. 55 millim.

Hab. Aroa, Venezuela.

20. Pseudapistosia ordinaria, sp. nov.

Palpi, head, thorax, and primaries light brown. Secondaries whitish. Abdomen dorsally brown at the base, otherwise yellow with a subdorsal and a lateral row of short black streaks; underneath brown. Exp. 41 millim.

Hab. Castro, Paraná.

21. Halisidota pagana, sp. nov.

♂. Palpi orange, tipped with black. Head, collar, and thorax black; the patagia black bordered with orange. Abdomen dorsally black; some small yellow marks laterally and underneath; the anal segment entirely yellow. Primaries above dark brown with the veins very distinct. Secondaries dull brown. Underneath, the wings are dull brown, yellow at the base. Exp. 36 millim.

Hab. Castro, Paraná.

Obs. The ♀ differs in having the last three segments of the abdomen yellow, with an interrupted subdorsal brown line.

22. Halisidota lineata, sp. nov.

Palpi, head, and collar black. Thorax brown, shading to light buff posteriorly. Abdomen dorsally yellow, paler at the base; underneath whitish, with a ventral and lateral black line. Primaries above light buff, with a broad blackish streak extending from near the base on the median vein to the outer margin just below the apex; a marginal row of dark points. Secondaries white. Underneath whitish; the primaries with the costal margin buff, and a small subapical dark streak. Exp. 35 millim.

Hab. Castro, Paraná.

23. Phægoptera jonesi, sp. nov.

Palpi black, orange at the base. Head and collar buff, with two black spots on the latter. Thorax buff, with a few dark streaks. Abdomen dorsally orange; white below, with a ventral row of black marks, and a lateral row of small black spots. Primaries above buff; the veins brown; the outer margin broadly brown, inwardly very dentate towards the apex; a large brown spot at the end of the cell; an outer broad, irregular, transverse brown band, interrupted between veins 3 and 4, and not quite reaching either the costal or inner margins. Secondaries above whitish, narrowly margined with brown at the outer angle; a transverse brown line at the end of the cell. Underneath, the markings are indistinctly repeated. Exp. 50 millim.

Hab. Castro, Paraná.

Obs. I take pleasure in naming this fine species after its discoverer, E. Dukinfield Jones, Esq.

24. Phægoptera arpi, sp. nov.

Antennæ black, spotted with white; tips white. Palpi grey. Head yellow. Collar dark grey, laterally yellow. Thorax dark grey anteriorly, shading to yellowish posteriorly. Abdomen: base and last two segments dark grey; other segments bright yellow, black between the segments, only noticeable subdorsally; anus tipped with creamy hairs. Primaries whitish; a dark grey spot on the base of the inner margin; an inner and a median wavy grey line, the latter crossing a conspicuous round grey spot in the cell; beyond this a group of six large grey spots, two in the cell, the others between veins 2–6; an outer irregular grey line outwardly shaded with grey, dentate, extending on each vein towards the outer margin; a terminal row of large grey spots between the veins. Secondaries dark grey. Underneath grey, somewhat mottled with white. Exp. 42 millim.

Hab. Rio Janeiro.

Obs. Named after its discoverer, Mr. J. Arp.

25. Arachnis tenebra, sp. nov.

Head black, white posteriorly. Collar black. Thorax white with a large black spot; patagia black, broadly edged with white. Abdomen black. Primaries above black; some irregular quadrate white spots at the base; beyond this three large and one small white spot on the costal margin; two white blotches on the outer margin; a white spot at the origin of veins 3 and 4; a small white streak at the inner angle, and a large X-shaped white mark on the inner margin. Secondaries black. Underneath, wings black; fewer white marks on the primaries. Legs black; tarsi with white hairs. Exp. ♀ 40 millim.

Hab. Orizaba, Mexico.

Lampruna, gen. nov.

Antennæ pectinated. Primaries short and broad; the outer margin slightly oblique. Secondaries broad oval; veins 3 and 4 from lower angle of cell; veins 5 and 6 absent; vein 8 from just beyond middle of cell.

Allied to *Symphlebia*, Felder.

26. Lampruna rosea, sp. nov.

Head red. Collar orange, mottled with red; thorax reddish; patagia orange, edged with red. Abdomen red. Legs yellow, broadly banded with grey. Primaries above yellow, the veins red; a broad inner and outer transverse grey band, uniting above the submedian vein, leaving on the inner margin a large yellow spot edged with red; on the yellow basal portion some small red spots; the inner transverse band bordered with red; some greyish spots on the costa and in the cell between the two bands; a terminal row of grey spots between the veins; fringe yellow, spotted with grey. Secondaries red. Underneath, wings yellow; an outer row of black spots on the primaries. Exp. ♂ 36 millim.

Hab. Aroa, Venezuela.

GRAPHEA, gen. nov.

Antennæ finely pectinated. Abdomen fairly stout. Primaries long, narrow; apex slightly acute; outer margin rounded, then oblique; vein 6 from upper angle of cell; veins 7, 8, 9 stalked. Secondaries long, narrow; veins 4 and 5 stalked; 6 and 7 from upper angle of cell; 8 from end of cell, nearly touching 7 in its entire length.

27. GRAPHEA MARMOREA, sp. nov.

Head and thorax brownish yellow; the collar and patagia edged with brown; two brown points on the collar. Abdomen pink dorsally, yellow underneath. Anterior portion of primaries from base of inner margin to apex yellowish, covered with rows of small, irregular orange spots, interrupted by an inner broad brown band and a large black spot at the end of the cell, connected with the costal margin by a brown shade; the posterior portion of the wing brownish mottled with lilacine; a terminal white line; the extremities of the veins whitish lilacine. Secondaries pink, slightly hyaline. Underneath yellowish pink, showing indistinctly the markings of the upper surface. Exp. 45 millim.

Hab. Aroa, Venezuela.

CRESERA, gen. nov.

Antennæ finely pectinated. Primaries long; the outer margin oblique; the inner angle rounded; veins 6, 7, 8, 9, 10 stalked. Secondaries with the outer margin well rounded. Veins 3 and 4 from lower angle of cell; 5 absent; 6 and 7 stalked; 8 from half the length of cell.

28. CRESERA ANNULATA, sp. nov.

Head and collar buff, the latter brown laterally. Thorax buff; patagia outwardly brown. Abdomen pink dorsally, yellowish underneath. Primaries above brown; the costal margin and apical third of the wing, except the outer margin, buff, with a number of ring-shaped brown spots, those on the costal margin with only a minute central buff point, the others consisting of fine rings; a subapical transverse brown line; the outer margin and inner angle lilacine. Secondaries pink. Underneath yellowish; the primaries showing the marks of the upper surface; secondaries with a brown discal spot. Exp. 44 millim.

Hab. Rio Janeiro.

MUNONA, gen. nov.

Antennæ pectinated in both sexes. Wings long, fairly broad, the outer margin oblique. Primaries with vein 6 from upper angle of cell; 7, 8, 9 stalked. Secondaries with veins 4 and 5 from lower angle of cell; 8 short, from near the end of cell. Secondaries in the ♂ triangular, the inner margin and anal angle rounded.

29. MUNONA IRIDESCENS, sp. nov.

Body pale yellow; the collar posteriorly edged with orange; three orange streaks on the thorax. Fore coxæ orange. Primaries silvery yellow, all the veins slightly darker; an orange point at the base. Secondaries yellowish white, semi-hyaline. Exp., ♂ 52 millim., ♀ 65 millim.

Hab. Aroa, Venezuela.

30. ANTARCTIA VENATA, sp. nov.

Head and thorax reddish brown. Abdomen dorsally yellowish brown, ventrally black. The wings are rather thinly clothed with scales. Primaries greyish brown; all the veins white. Secondaries paler, with the white veins less distinct. Underneath, the same. Exp. ♀ 30 millim.

Hab. Castro, Paraná.

Fam. EUPTEROTIDÆ.

31. APATELODES PARVULA, sp. nov.

Palpi brown. Head, thorax, and abdomen brownish grey, the base of the abdomen and two transverse shades on the thorax darker. Primaries grey, irrorated with brown scales; a large dark brown spot on the interior half of the inner margin, but not reaching the base, and outwardly crossed by a slightly oblique light shade; from near the middle of the costal margin a brownish indistinct band extends towards but does not reach the inner angle; from this band to the outer margin all the veins are distinctly paler; a light shade crosses the end of the cell; the outer line prominent, whitish, and anteriorly slightly curved outwardly; two subapical dark brown spots followed by two semi-hyaline spots. Secondaries above brown; the inner margin and anal angle greyish brown, darker; an outer transverse whitish line. Underneath brown, shaded with grey on the costal margins of both wings and on the inner margin of the secondaries, where there are also some brown marks; the outer transverse white line indistinct on the primaries, more distinct on the secondaries. Exp. 28 millim.

Hab. Castro, Paraná.

32. OLCECLOSTERA CASTRONA, sp. nov.

Palpi dark brown. Head and thorax grey, with a central brown line. Abdomen reddish brown. Primaries above light grey, thinly speckled with dark scales; the inner and outer lines very indistinct, angular, and apparently geminate; the fringe dark brown; between veins 5 and 6 a small hyaline spot; on the costa near the apex a small dark shade. Secondaries light brown, with two indistinct wavy lines; the fringe on the outer margin near the anal angle very dark brown. Underneath greyish brown; the two lines on the secondaries distinct, and a minute black spot in the cell; on the primaries only the outer line visible, which is distinct and touches the hyaline spot. Exp. 28 millim.

Hab. Castro, Paraná.

33. OLCECLOSTERA AZTECA, sp. nov.

Body light grey; two lateral white spots at the base of the abdomen. Primaries above light grey, with two inner and two outer very distinct, slightly wavy dark grey transverse lines; the furthermost line touching a round hyaline spot between veins 5 and 6; the outer margin from below the apex to the inner angle brownish, limited by a lunular dark line; a dark point in the cell. Secondaries brownish, with two slightly curved conspicuous dark lines; the extreme margin and fringe dark grey. Underneath brownish, with the transverse lines dark, the inner lines absent on the primaries; a black discal point on each wing. Exp. 32 millim.

Hab. Jalapa, Mexico.

DUKINFIELDIA, gen. nov.

Antennæ pectinated in both sexes, but more so in the ♂ than in the ♀. Body stout; abdomen extending beyond the secondaries. Primaries with the costal and inner margins straight, the outer margin and inner angle rounded; discocellulars inwardly and deeply curved below vein 5; vein 6 from upper angle of cell; 7, 8, 9, 10 stalked. Secondaries broad, the inner margin rounded; discocellulars angled below 5, a veinlet extending from this angle to the base; veins 6 and 7 stalked.

34. DUKINFIELDIA SUPREMA, sp. nov.

Head reddish brown. Thorax mottled with long brown and and grey hairs. Abdomen dorsally black, with a few white hairs; underneath banded orange and black.

♂. Primaries above white, all the veins dark reddish brown; the subcostal, median, and submedian veins most heavily marked; the costa finely black. Secondaries white, some orange hairs at the base. Underneath white, the extremities of the veins blackish. Exp. 53 millim.

♀. Primaries reddish brown; the costal margin grey; the base and spaces between veins on outer margin irrorated with grey scales; fringe white. Secondaries dull brown; fringe white. Underneath, wings dull brown, some orange scales at the base; fringe white. Exp. 65 millim.

Hab. Castro, Paraná.

Fam. Saturniidæ.

35. Hemileuca dukinfieldi, sp. nov.

Head, collar, and thorax dark buff; patagia black. Abdomen orange dorsally; underneath black, with a lateral row of small white spots. Primaries above dark brown, with all the veins finely outlined in orange; an outer transverse narrow white band. Secondaries similar, but the transverse band is less distinct, and the veins are not so distinctly marked towards the base of the wing, where there are also a quantity of long buff hairs, more noticeable in the male than in the female. Underneath, the wings are similarly but less distinctly marked. Exp., ♂ 60 millim., ♀ 75 millim.

Hab. Castro, Paraná.

Fam. Cossidæ.

36. Zeuzera masoni, sp. nov.

♂. Head brown. Thorax and abdomen grey. Primaries light grey, with fine black transverse striæ; the basal third of the costa black; the central third of the median vein anteriorly shaded with black; a small dark space on the costa at two thirds from the base. Secondaries white; the outer margin irrorated with black; the fringe alternately white and grey. Exp. 51 millim.

Hab. Jalapa, Mexico.

Obs. Also in coll. Mason.

37. Langsdorfia dukinfieldi, sp. nov.

Palpi dark brown. Head, thorax, and abdomen light brown, the latter with a dark spot dorsally on the last segment. Primaries above fawn-colour shaded with smoky grey; a large velvety brown spot near the base, not reaching the inner margin, and containing a bright silver spot; just beyond this a pale **V**-shaped mark starts from the costal margin, nearly touches the inner angle, and then extends to the apex, turning in near the costal margin to form two curves in the direction of the cell; the space within the base of this **V** is dull grey, the upper portion reddish brown towards the apex, fawn-colour towards the base; on the outer margin the veins are slightly paler. Secondaries whitish, with smoky margins. Underneath, the primaries are dull brown, with two reddish-brown spots on the outer half of the costal margin; the secondaries whitish, irregular spots on the margins and two large brown spots on the costal margin. Exp. ♂ 38 millim.

Obs. The ♀ expands 48 millim. and has the secondaries brownish.

Hab. Castro, Paraná.

38. Langsdorfia aroa, sp. nov.

Abdomen dark brown; the patagia bordered with velvety brown. Primaries above the costa buff, spotted with dark velvety brown, each spot edged with whitish; a small triangular buff space, speckled with black, on the inner margin, the base of the triangle formed by vein 2; the rest of the wing dark velvety grey, with large dark velvety brown spots, edged with lilacine, as follows:—a subapical irregular spot; a five-sided spot at a third from the base and reaching the median vein; a small triangular spot in the cell, resting on the median vein; a large oval oblique spot near the outer margin crossing veins 3 to 5; three spots between the median and submedian veins; a terminal row of spots disappearing towards the apex; the fringe reddish brown. Secondaries dull blackish brown. Underneath, primaries brown; secondaries dark grey, irregularly spotted with a darker shade. Exp. 46 millim.

Hab. Aroa, Venezuela.

Fam. Hepialidæ.

39. Dalaca serta, sp. nov.

Body reddish brown. Primaries reddish brown, greyish along the inner and outer margins; transverse lunular lines, interrupted by the veins, cover the wings with a mass of grey lunules outwardly shaded with brown, and they are most numerous on the outer third of the wing. Secondaries reddish brown. Exp. ♂ 41 millim.

Hab. Jalapa, Mexico.

Obs. Allied to *Dalaca assa*, Druce.

Fam. Dioptidæ.

40. Polypoetes rufipuncta, sp. nov.

Palpi black, orange at the base. Head black. Collar black, laterally white. Thorax black; patagia orange, with a black and a grey streak. Abdomen dorsally black; the posterior portion of each segment narrowly yellowish; underneath white. Primaries above black; all the veins on the basal half of the wing yellowish; a round white spot just beyond the cell; a round subapical orange-red spot. Secondaries above black; a round white spot beyond the cell, connected with the base of the wing by a broad yellowish space. Underneath, the primaries are black with the two spots as on the upper surface, and a white streak at the base; secondaries white, the outer margin broadly black. Exp. 25 millim.

Hab. Castro, Novo Friburgo.

Fam. Limacodidæ.

41. Semyra cardia, sp. nov.

Palpi and head yellow. Thorax brown, mingled with yellow scales. Abdomen dark brown; at the base laterally covered with long yellow hairs. Primaries above violaceous brown; the costal margin for two thirds from the base narrowly yellow; the base of the costal vein dark brown; a basal angular silver-white line from the median to the submedian vein, followed by an irregular golden-brown spot, outwardly shaded with dark brown; a dark velvety-brown streak in the cell, followed by a golden-brown spot between veins 5 and 6, and separated from it by an indistinct whitish line which extends from the costa to vein 2, where it joins a submarginal white line extending from the apex to the inner margin; this submarginal line is inwardly heavily shaded with dark brown, and is outwardly contiguous to some small brown spots. Secondaries yellowish white. Underneath, the primaries are light brown, the inner margin broadly white; the secondaries yellowish, the costal margin broadly light brown. Exp. 20 millim.

Hab. Castro, Paraná.

Obs. Very closely allied to *S. bella*, H.-S.

42. Trabala rubens, sp. nov.

Palpi and head golden brown. The thorax purplish. Abdomen light golden brown, with a few purplish anal hairs. The primaries above golden brown, with the veins darker; the costal margin broadly suffused with purplish; an irregular dark line extends from the apex to the middle of the submedian vein, and is followed by an indistinct marginal shade. Secondaries above yellowish white; the fringe on both wings very long, the inner half golden brown, the outer half purplish. Underneath, the wings are light golden brown. Exp. 26 millim.

Hab. Castro, Paraná.

43. Trabala (?) truncata, sp. nov.

Palpi, head, and collar brown. Thorax and abdomen yellowish brown. Primaries above yellowish brown; an indistinct basal and a median irregular transverse brown line; an outer heavily marked straight brown line, closely followed by an irregular indistinct line. Secondaries above brownish yellow, with an indistinct median brown line. Underneath yellowish brown, the outer margins paler; two distinct, irregular, outer brown lines; on the secondaries a brown dot at the end of the cell. Exp. 28 millim.

Hab. Castro, Paraná.

44. Perola admirabilis, sp. nov.

Palpi crimson, tipped with white. Head white, with all the scales around the eyes crimson. Thorax and body white; the patagia edged with crimson. Primaries above yellowish; at the base some crimson scales on the costal margin and a few black scales scattered on either side of the submedian vein; an indistinct curved band of blackish scales beyond the cell, and beyond this a short, indistinct crimson shade extends from the costal margin. Secondaries above white. Underneath, wings yellowish, the costal half of the primaries crimson. Exp. 22 millim.

Hab. Castro, Paraná.

45. DALMERA FUMATA, sp. nov.

Palpi and head orange. Collar whitish. Thorax and abdomen orange. Primaries above pinkish yellow, palest along the costa; at the end of the cell an oblique black streak; below this and from near the base of the subcostal vein to nearly the middle of the outer margin a heavy smoky-black shade, and from this a similar but smaller shade extends towards the inner margin. Secondaries above bright yellow; orange along the inner margin. Underneath, the wings are orange, the primaries having the base of the costa and a mark at the end of the cell black. Exp. 31 millim.

Hab. Castro, Paraná.

Obs. Closely allied to *D. tijucana*, Schaus.

Fam. LASIOCAMPIDÆ.

46. OCHA BRUNNEA, sp. nov.

Above entirely dark brown. The primaries with two indistinct transverse median lines, slightly flecked with white; a submarginal irregular row of small black spots, almost imperceptibly flecked with greyish scales. Underneath lighter brown, with a few white scales on the costal margins of both wings at about two thirds from the base. Exp. 20 millim.

Hab. Castro, Paraná.

47. OCHA FALSA, sp. nov.

Above light brown. The primaries with the base and a broad shade through the cell darker; a black discal point and a marginal row of conspicuous black points; the basal lines indistinct; the outer line geminate, angular; a few black streaks between the end of the cell and the apex. Underneath light brown, with a marginal row of indistinct dark spots. Exp. 22 millim.

Hab. Castro, Paraná.

48. OCHA FAMATA, sp. nov.

Head and thorax light brown. Abdomen dorsally blackish, otherwise light brown. Primaries above light reddish brown; a dark streak at the base of the cell; the inner line fine, dark, geminate, wavy, and outwardly curved; the outer line also geminate, wavy, and outwardly shaded with whitish; veins 6–10 distinctly whitish; from the cell to the outer margin between veins 4 and 7 a dark shade containing three clusters of reddish-brown scales, which are contiguous to an irregular, fine, white marginal line; a small dark subapical spot between veins 9 and 10; the fringe pale, with dark spots. Secondaries above dark brown, with the costal margin broadly light brown, crossed by wavy white lines; some paler scales along the inner margin; fringe alternately buff and dark brown. Underneath dark brown; the costa finely and the inner margin of the primaries broadly buff; the fringe on the secondaries paler, and on both wings a marginal row of indistinct dark spots. Exp. 25 millim.

Hab. Castro, Paraná.

49. OCHA MARGINATA, sp. nov.

Head and thorax brown, mingled with buff hairs. Abdomen brown. Primaries light brown, slightly hyaline, the veins all dark; some dark violaceous striæ at the base and on either side of a pale outer line, which forms a large wavy curve before reaching the middle of the inner margin; a broad marginal greyish shade; a terminal buff line; the apex light grey; the fringe dark at the inner angle. Secondaries brown; a greyish marginal line near the apex. Exp. 26 millim.

Hab. Jalapa, Mexico.

50. HYDRIAS CASTRENSIS, sp. nov.

Palpi yellowish. Head and thorax grey, the abdomen lighter. Primaries above grey; some brown scales at the base and also two contiguous transverse brown lines, the inner one wavy, the outer slightly dentate; a brownish-black spot in the cell; an outer indistinct transverse line, slightly dentate and outwardly shaded with buff; a wavy submarginal dark grey shade. Secondaries above white; the costal margin with the basal half brown, the outer half grey; the fringe grey. Underneath, the primaries are smoky-brown, whitish along the inner margin, a submarginal dark shade; the secondaries white, with two indistinct greyish lines on the costa. Exp. ♂ 25 millim.

Hab. Castro, Paraná.

Fam. LITHOSIIDÆ.

51. LITHOSIA PERUVIANA, sp. nov.

Head yellow, with a transverse grey band. Collar yellowish. Thorax pink. Abdomen yellowish, shading to deep orange at the anal segment. Primaries dark grey; the costal and inner margins, also a central longitudinal streak, yellowish. Secondaries yellow, shading to orange at the anal angle; the apex dark grey. Exp. 20 millim.

Hab. Peru.

52. LITHOSIA VENOSA, sp. nov.

Palpi and head orange, grey posteriorly. Collar, thorax, and abdomen greyish white. Primaries above light grey, all the veins and fringe white. Secondaries white, the costal margin tinged with grey. Underneath, primaries dark grey, fringe white; secondaries white, the costal margin and apex dark grey. Exp. 28 millim.

Hab. Castro, Paraná.

53. Choria separata, sp. nov.

Head deep yellow, with a transverse grey band; collar yellow. Thorax dark grey; patagia yellow, inwardly shaded with grey. Abdomen yellowish; in the female a black dorsal spot on the last segment denuded of scales. Primaries above silvery white; the inner margin broadly dark grey, anteriorly shaded with yellow; the costal margin finely yellow. Secondaries yellowish white; the apex broadly smoky grey. Underneath, the secondaries are the same; the primaries are smoky grey, with two thirds of the costal margin, a streak beyond the cell, and a streak above the inner margin yellowish. Exp. 27 millim.

Hab. Castro, Paraná.

Obs. In the female the secondaries are entirely yellowish white, and the primaries below are whitish with the inner and outer margins smoky.

54. Crambomorpha marcata, sp. nov.

Head, collar, and thorax dark grey; the collar laterally and base of patagia yellowish. Abdomen whitish grey, shading to yellow at the last segment. The primaries above silvery white; the costal margin chrome-yellow; the inner margin broadly dark grey, with a whitish streak at the base. Secondaries white, faintly tinged with grey on the outer margin. Underneath white, the primaries tinged with grey, and the chrome-yellow costal margin very conspicuous. Exp. 34 millim.

Hab. Rio Janeiro.

Obs. I have a female absolutely similar from Peru.

55. Crambomorpha virginia, sp. nov.

♀. Palpi luteous. Head dark grey. Collar and abdomen fawn-colour. Thorax white. Wings pure white, the primaries silvery; secondaries thinly covered with scales. Exp. 31 millim.

Hab. Castro, Paraná.

Obs. Allied to *C. argentea*, Feld., but smaller and a more delicate insect. The colour of the collar distinguishes the species at once.

56. Crambidia corcovada, sp. nov.

Head and thorax grey. Abdomen dorsally grey, underneath yellowish. Primaries above whitish, the inner margin greyish; secondaries yellowish white. Underneath, the primaries are greyish, the basal half tinged with yellow; the secondaries whitish, the costal margin yellow. Exp. 21 millim.

Hab. Rio Janeiro.

57. Crambidia petrola, sp. nov.

♂. Body grey; anal segment of abdomen yellowish. Primaries white; the costal margin finely chrome-yellow; the inner margin shaded with brownish grey. Secondaries white. Underneath, the primaries are yellowish white. Exp. 24 millim.

Hab. Tijuca, Petropolis.

Obs. The female similar in every respect.

58. Salopola vestalis, sp. nov.

♂. Silvery white; the inner margin of the primaries very light brown. On the costal margin of the secondaries a long tuft of yellow hairs. Underneath white; a tuft of yellow hairs on the primaries just above the median vein, and curling over the origin of veins 2, 3, and 4. Exp. 33 millim.

Hab. Castro, Paraná.

Obs. This species is closely allied to *S. argentea*, Walk., but differs in its white secondaries and tufts of hairs, which are longer in *S. argentea* and black on the underside of the primaries.

59. Areva perpensa, sp. nov.

♂. Body white above, yellow underneath. Primaries white; the costal margin pale yellow; the inner margin faintly brownish. Secondaries white, with a few long yellow hairs in the cell. Underneath white; the primaries with the outer margin slightly smoky, the costal margin orange, and there is a large oval cluster of long hairs. The primaries are a little longer than the secondaries and very broad. Exp. 31 millim.

Hab. Jalapa, Mexico.

Fam. Notodontidæ.

60. Œdemasia tropica, sp. nov.

Palpi, head, and collar brown. Thorax whitish. Abdomen light brown. Primaries above light grey; the costa and base shaded with brown; a wavy, fine, geminate, black median line, inwardly shaded with brownish, and followed at the end of the cell by an inwardly curved black crescent-shaped line; an outer geminate black line, interrupted and very indistinct; a terminal black wavy line, with inwardly a short black streak on each vein. Secondaries brown. Underneath, primaries brown, secondaries whitish margined with brown. Exp. 39 millim.

Hab. Aroa, Venezuela.

61. Rifargia masta, sp. nov.

Palpi, head, and thorax brown, thickly mottled with green scales. Abdomen dark grey, with still darker clusters of scales subdorsally. Primaries above moss-green, mottled with brown, and paler beyond the cell; at the base a fine black streak surmounting a pale spot on the inner margin; the basal and median lines almost imperceptible; a dark brown transverse streak at the end of the cell; the outer line represented by two series of minute dark spots on the veins separated by white scales; the submarginal line indistinct, forming towards the inner angle some brownish spots; a terminal row of lunular green spots between the veins; the fringe dark grey. Secondaries greyish, with the extreme outer margin much darker. Underneath greyish, the extreme margins brown. Exp. 40 millim.

Hab. Jalapa, Mexico.

62. EDEMA ASTUTA, sp. nov.

Palpi brown. Head dull yellow. Collar brown. Thorax light lichen-green. Abdomen brown above, dull yellow underneath, with a dark ventral line. Primaries above dark brown, with the inner margin broadly greyish; the veins flecked with alternately dark and light scales; the middle of the costal margin, a quadrate spot in the cell, and some surrounding shades of a very dark and dull brown; a submarginal series of triangular dark spots, followed by a row of small clusters of black scales; the apex yellowish white, with some subapical light brown streaks; the fringe brown, spotted with yellowish. Secondaries above brown, with the fringe dull yellow. Underneath, the wings are brown with a pale shade at the apex of the primaries and a marginal row of brown dots. Exp. 48 millim.

Hab. Jalapa, Mexico; Aroa, Venezuela.

Obs. This species is very closely allied to *E. mandela*, Druce.

63. LIRIMIRIS (?) MEPHITIS, sp. nov.

Palpi, head, and thorax brownish grey; the abdomen paler, except dorsally on the first segment, where there is a tuft of rich brown hairs. Primaries above greyish brown, slightly darker towards the outer margin, except a submarginal transverse shade which is very indistinct; the inner margin irrorated with much lighter scales, amongst which a few small clusters of dark brown scales are very conspicuous; at the end of the cell two dark brown spots, the lower one much the larger. Secondaries above brown, with a few dark scales at the anal angle, surmounted by a small yellow spot. Underneath, the wings are light brown, with a few small black streaks on the costal margin of the primaries near the apex. Exp. ♀ 46 millim.

Hab. Jalapa, Mexico.

Obs. Also in coll. Mason.

64. LOPHODONTA (?) PALLIDA, sp. nov.

Head and thorax greyish white. Abdomen greyish brown. Primaries above greyish white, the base shaded with brown; an inner transverse, dark brown, geminate line, indistinct towards the costa; a small brown shade in the cell, followed by a dentate brownish transverse line; a geminate, dark brown, outer line, dentate, followed by two yellow spots between veins 2 and 3, and 3 and 4, outwardly shaded with brown; a dark greyish costal space beyond the outer line; a terminal, fine, brownish line from the costa to vein 2. Secondaries brownish, the costal margin mottled with white; fringe white. Underneath, primaries brownish, secondaries greyish. Exp. ♀ 44 millim.

Hab. Aroa, Venezuela.

65. Heterocampa paranensis, sp. nov.

Head and thorax grey, mottled with greenish scales; the collar somewhat paler. The abdomen grey above, yellowish white underneath. The primaries above light grey; two thirds of the costa from base darker grey, and also the base of the inner margin darker; a green shade extends from the base of the costal margin to the middle of the inner margin, and continues to the inner angle; the outer margin greenish, the extremities of the veins black; the apical third of the costa broadly amber-green, and an indistinct greenish shade from the costa, passing beyond the cell and extending to the outer margin. Secondaries above white; the costal margin brown, with transverse white shades; the inner margin brown, and the extreme outer margin narrowly brown. Underneath, the wings are white; the costal margin of the primaries yellowish, and the extreme outer margin and tips of the veins on the same wings brown. Exp. 35 millim.

Hab. Castro, Paraná.

66. Blera bolivari, sp. nov.

♂. Body greyish brown; patagia white. Primaries above white; a brown patch on the costa at a fourth from the base; a similar spot on the costa at three fourths from the base, followed by two small brown spots; the inner margin mottled with brown, forming in the female a triangular space connected by a brown line with the inner costal spot; the fringe white, spotted with brown. Secondaries greyish brown; fringe whitish. Underneath, primaries brown, the fringe and apical half of the costa spotted with brown; secondaries whitish, the costal and outer margins broadly shaded with greyish brown. Exp. 52 millim.

Hab. Aroa, Venezuela.

4. On the Habits of the Flying-Squirrels of the Genus *Anomalurus*. By W. H. Adams.[1]

[Received January 26, 1894.]

Along the whole length of the Colony of the Gold Coast, and parallel with and some 15 miles from the sea-shore, runs a range of high hills with deep gorges and ravines covered with almost impenetrable bush. These hills vary from 500 or 600 feet to a much greater height, and it is in this bush that I obtained the specimens of the peculiar Flying-Squirrels of the genus *Anomalurus* which I have presented to the British Museum[2].

[1] Communicated by Oldfield Thomas, F.Z.S.

[2] [With one single exception, the "small brown skin" mentioned on p. 245 (which is *A. fraseri*, Waterh.), all the skins obtained by Mr. Adams belong to

I do not know what the indigenous native name for these Squirrels is, but they are called Flying-Foxes by the English-speaking natives and are very numerous. They live in hollow trees, not being particular as to their height or as to whether they are situated in the ravines or on the hills. Owing to the density of the bush it is very difficult for the white man to get at them, the only chance being to stand on a clearing and shoot them as they fly across, and this can only be done on a night when the moon is at the full.

The first skin I ever saw was when I was at Accra. It was in the possession of a native who was brought before me for some offence, and, being struck with it, I asked if some more could be got. The native of the Coast, however, does not hurry himself, and, hearing nothing more of it, I quite forgot the matter. Some months after, in April 1893, I went to the Sanitarium at Aburi, a village situated at a height of some 800 feet among the hills before mentioned. The rains were just beginning and were very heavy. While watching a big cotton-wood tree being felled, I saw an animal which I mistook for a cat run out of a hole some 50 feet up and then return. When the tree fell, with the help of a native I extricated the occupant, which turned out to be one of these Squirrels. It was very fierce and bit and scratched savagely till killed. The hole was about 5 feet deep, and covered at the bottom with sticks and small branches to such an extent that it was evident some sort of a nest was intended. I took the skin, and the "boys" at once seized on the body, which they told me was the greatest delicacy that existed, and, as my servant said, "When you catch one man-fox you shut your door and don't want your friend to come and see you," meaning that it was too good to be shared. Finding that these Squirrels were to be had on the hills, I set to work to collect them.

They come out of their holes in the trees some hours after sunset, returning long before daybreak. They are only to be seen on bright moonlight nights, and in fact the natives say they do not come out at all in stormy weather or on very dark nights. They live on berries and fruits, being specially fond of the palm oil-nut, which they take to their nests to peel and eat. The most I have seen in one hole is three, though the natives say five or six are sometimes found. They pass from tree to tree with great rapidity, usually choosing to jump from a high branch to a lower one, and then climbing up the tree to make a fresh start. The temperature on the hills varies considerably. During the time I was there—the rainy season, from the middle of April to the middle of June—it was never very hot, and one night I remember the thermometer

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the large black-and-white species discovered by Pel, and named in his honour *Anomalurus peli* (Temm. Esq. Zool. Guin. p. 146, 1853). The astonishing abundance in which Mr. Adams found this species is rather remarkable, as previously only three or four specimens of it seem to have reached European Museums.—O. T.]

going down to 44° on the ground. Of course in the dry season it is much hotter, but the natives say these animals are much more plentiful in the rains and that the rainier the season the more they see. They litter twice a year, once about September, the young remaining in the nest for about nine weeks, during which they are fed by the old ones on shoots, kernels, &c., and do not attempt to jump before the end of that period, extending the length of their jumps with their growth. I do not know the other time of breeding or whether they have a regular season. The hunters told me that 2 or 3 were usually born at one birth, never more than 4, and that there are several varieties, different in colour and size—some being black, some brown, some red, &c.; the specimens I obtained, some of which are now in the Natural History Museum, being the most plentiful. A native's description is always very vague, and the interpretation is another great difficulty; but I feel sure, both from what I saw and what I heard, that there must be several different sorts.

I managed before I left Aburi to get some dozen skins—all of the same kind—and instructed two native hunters to collect as many skins as they could for me, as I was much pleased with the fine fur and thought they would make a very good coat. I gave the men each a "book" or note promising to buy as many skins as they could collect at 1*s*. each.

I left Aburi in June and returned across the plain to Accra. About a month afterwards one of my hunters arrived from Aburi with 60 skins and his "book." I was rather surprised, but bought them. A few days after the other man arrived with 140 skins and his book, which he sternly insisted on my redeeming. I had not quite expected this, but chose 50 of the best, and at last got rid of the man, though not without much murmuring. However, having got an extra "dash," he was quite satisfied at last. He must have done very well, as from the look of the skins he must have collected them from all quarters, some being very old. This man had several different ones, *i. e.* apparently so; but I regret to say, with the exception of one small brown one, which is here to-night, and which was thrown in as a "dash," and one reddish-orange one which I bought by mistake, and which is now at South Kensington, I did not secure them. Some had a broad orange stripe down the back, some a large spot of orange on the back, and the brown skin was, I distinctly remember, similar to a small brown skin shown me by Mr. Oldfield Thomas, and which I believe was brought from Gaboon[1]. These curious ones I did not buy, as my fur coat was prominent in my mind.

The shower, however, was not yet over, as in a few days one of my bailiffs turned up with 25 skins, and an old chief named Addo, from whom I used to buy curios, having once got it into his head that flying-foxes were the thing, turned up at almost daily intervals with half a dozen or so fresh skins, till I got sick of the very name of a flying-fox.

[1] *A. fraseri.*

His Excellency the Governor brought, I think, some 20 or 30 skins home. Messrs. Swanzy's agent, with whom I travelled home, was bringing some more which he thought might be commercially valuable, but which have turned out useless, and I obtained altogether 125. With these exceptions I never heard of any being brought from the Gold Coast. Very few of the Europeans in Accra to whom I showed them had seen them before, and I hear my hunters declined to get any more; but when I go back to Accra I shall obtain some of the different varieties, now I know where to get them and also know that they are worth getting, for that the hilly countries of the two Akims and Ashanti—to say nothing of other districts—are full of them there can be no doubt.

I think from what I could gather that these orange-marked ones are in the nature of an albino variation, for the marks vary in size and brilliancy, some of them being quite small, while others cover the whole skin.

The habitat, food, and habits of these varieties are exactly the same as those of the black species, among which they are found.

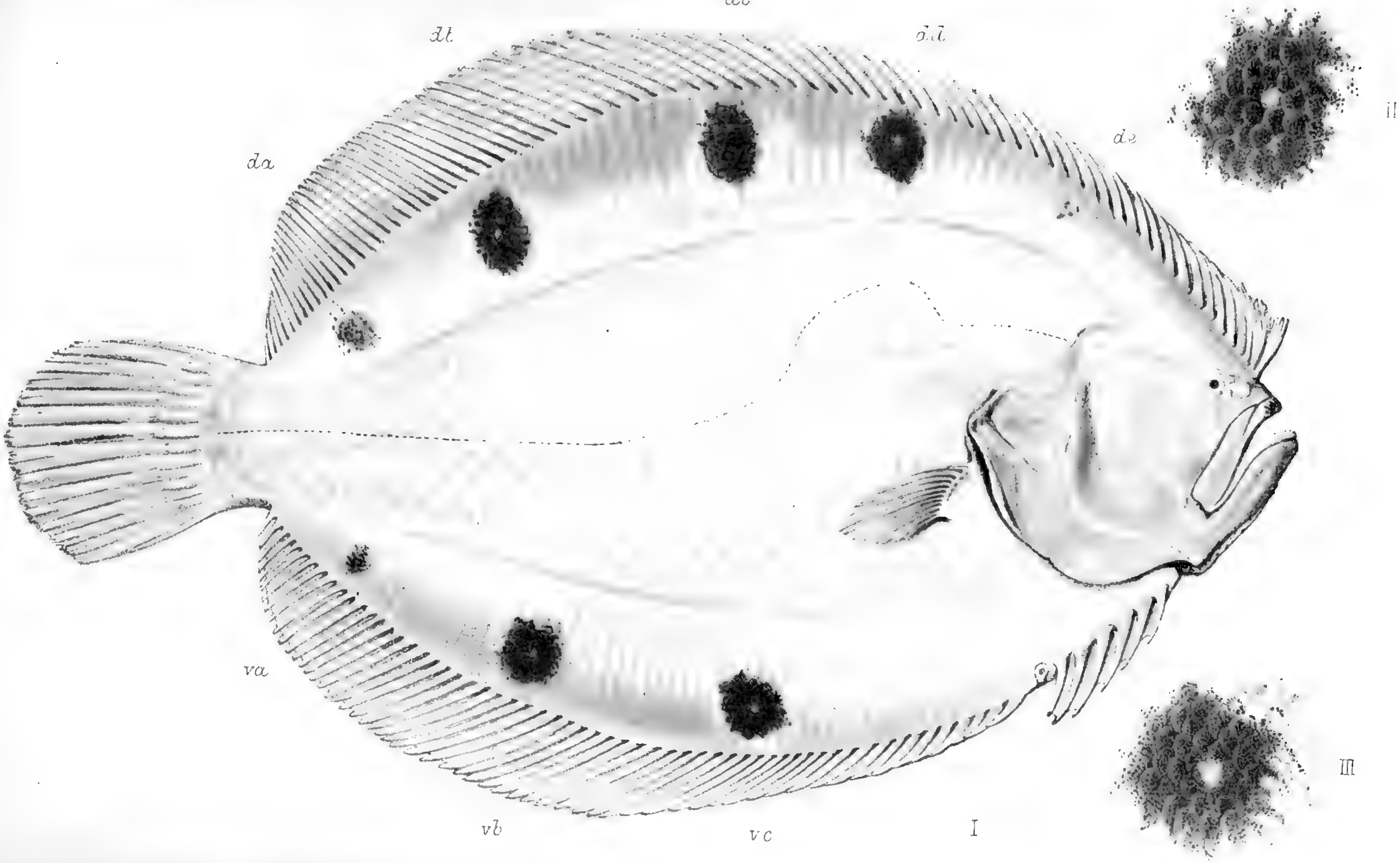
5. On two Cases of Colour-variation in Flat-fishes illustrating principles of Symmetry. By W. Bateson, M.A., Fellow of St. John's College, Cambridge.

[Received March 6, 1894.]

(Plate XVII.)

The two cases of Variation here described are both examples of abnormal deposit of pigment in the skin of the normally unpigmented or "blind" side of Flat-fishes. The two cases are unlike each other, but both are remarkable illustrations of the ways in which the phenomenon of Symmetry may be manifested and may contribute to the production of a definite result in Variation that is presumably sporadic.

The first specimen is a small Brill (*Rhombus lævis*), kindly sent to me by Mr. Matthias Dunn, of Mevagissey, Cornwall. It is $9\frac{3}{4}$ inches long, and $6\frac{1}{2}$ inches wide in the widest part. The dorsal fin, the eyes, and other parts are normal in form and position. The only abnormality seen consists in the presence of a row of five spots of colour along the dorsal border of the body on the blind side, and of another row of three spots along the ventral border on the same side. The spots are on the body, central to the dorsal and anal fins, which are both of normal colour. The interest of the case lies in the remarkable symmetry with which the spots are distributed with reference to the longitudinal axis of the body. On reference to the plate (Plate XVII.) it will be seen that each of the three ventral spots stands at very nearly the same transverse level as one of the spots of the dorsal series. The two anterior spots of the dorsal series have no representatives in the ventral series. This appearance of symmetry, so striking to the eye, is



E. W. del.

VARIETY OF RHOMBUS LÆVIS.

upon examination found to be an expression of the fact that the ordinal positions of the neural spines crossing the centres of the spots of the dorsal row are, if reckoned from behind forwards, almost exactly the same as those of the hæmal spines crossing the centres of the ventral spots.

The particulars are as follows:—The centre of the most posterior dorsal spot stands almost exactly over the neural spine of the 11th fin-ray, reckoning from behind. The centre of the next spot is upon that of the 26th fin-ray reckoned from behind; that of the next is on the 42nd.

Of the ventral spots the centre of the most posterior is on the hæmal spine of the 11th fin-ray from behind; that of the next is on the 24th, and that of the most anterior is on the 40th. It will be seen that the numbers in the two rows closely correspond.

Continuing the dorsal series there is a spot on the neural spine of the 52nd fin-ray, another very minute and faint spot over the 63rd. In front of this there are 16 more fin-rays.

The whole number of fin-rays in the dorsal fin is 79, and in the anal fin 58.

On detailed examination it may be seen that the spots are not wholly shapeless blotches of colour, but that some of them consist of several irregular zones of colours. Each of these spots is thus a somewhat indefinite ocellar mark. The spots *dd*, *vc*, and *vb* have each a minute centre of light colour, which is chiefly due to the presence of a whitish scale in the middle of the spot. This light colour is not altogether confined to the one scale, but spreads a little on to the edges of the adjacent scales. The spot *db* has *two* of these small whitish centres. The spot *dc* alone of the five chief spots has no light centre. Around the centre of each spot are scales of a brown tint bearing specks of very dark pigment. These deeply pigmented scales form a zone about four rows deep in the case of the larger spots. Outside this is an irregular zone of fine pigment-granules giving a neutral tint. Beyond this again there was in the case of spots *dd*, *dc*, *db*, and *vc* a vague and imperfect band of silvering, forming a border to the proximal limbs of the spots.

It is thus seen that the colours of the dorsal and ventral borders have, so far as the last three spots are concerned, varied *similarly and simultaneously*, producing a result that is nearly symmetrical about the horizontal axis. This phenomenon is precisely comparable with the much more common phenomenon of similar and simultaneous variation of the right and left sides of a bilaterally symmetrical body. It is to be remembered that in many fishes, and especially in Flat-fishes, there is an imperfect relation of bilateral symmetry subsisting between the parts dorsal and ventral to the horizontal median plane. This symmetry is generally manifested both in form and colour, and is an indication that at some time these parts have undergone similar variation. The present example illustrates the principle that parts, which in the normal are in symmetry with each other, are related to each other in such a way that they may undergo similar variations *simultaneously*. Upon the deductions from this principle I have dwelt elsewhere.

Several forms of abnormal pigmentation upon the "blind" side of Flat-fishes are of course familiar, but of the particular variation here seen I have met with no other case. In a recent paper, however, Cunningham [1] makes allusion to cases apparently of this nature, saying that they are frequent in the Brill. So far as I know, the occurrence is not mentioned by the other authors who have treated of the colour-variations of flat-fishes.

The other specimen is one to which I lately made reference in writing on the subject of pigmentation in the blind sides of Flat-fishes [2]. The description that I gave was very brief and not quite correct, and I take this opportunity of amplifying and correcting it. It may appropriately be considered here inasmuch as it also illustrates the influence of Symmetry in determining the manner of occurrence of Variation, though in a way different from that seen in the Brill described above. The fish is a Plaice (*Pleuronectes platessa*), also received from Mr. Dunn. Its fins, eyes, &c. were normal. The posterior half of the "blind" side was fully pigmented, the pigmented area being sharply limited at a sinuous line slightly behind the level of greatest width. This pigmented area was of the same colour as the skin of the upper surface, and, like it, bore spots of a full orange colour. Of these spots there were, in all, thirteen—eight being on the body, three on the dorsal fin, and two on the anal. The interest of the case lies in the fact that by passing pins vertically through the body it was proved that the centres of *nine* of these spots coincided exactly with the centres of spots on the upperside. Four of these coincident spots were ventral to the lateral line, two being on the body and two on the anal fin. One large spot was upon the lateral line. Three were upon the dorsal fin, and one, a large spot, was also upon the body, just anterior to the base of the caudal fin. There was one spot over the muscles of the dorsal fin which very nearly corresponded with a similar spot on the upperside.

In the same region were two more spots on the lower side that were each represented on the upper side, but they were not in correspondence with their representatives, but *alternated* with them. *One* large spot on the lower side, ventral to the lateral line, anterior to the base of the caudal fin, was wholly unrepresented on the upper side.

The manner of occurrence of this variation proves that, though in a normal flat-fish there is a great dissimilarity between the coloration of the upper and lower sides, yet that, when the lower side assumes the characters of the upper, it may do so in such a

[1] Cunningham, J. T., Phil. Trans. 1894, clxxxiv. B, p. 807.

[2] 'Materials for the Study of Variation,' 1894, p. 467. The account there given contains a misprint. For "of these, 13 spots on body and fins coincided" read "of these 13 spots on body and fins, 9 coincided."

way as to produce a result which is approximately bilaterally symmetrical. Of the general significance of this phenomenon I have spoken in the place referred to.

It should be observed that this specimen does not at all precisely conform to the principle of symmetry illustrated by the Brill described above. There was nevertheless in it also an imperfect correspondence between the distributions of the spots upon the areas dorsal and ventral to the median axis. Asymmetry, however, was exhibited in the presence of one spot on the dorsal fin, and of one spot over the dorsal neural spines, that were not represented in the area ventral to the lateral line.

I am not aware that Flat-fishes having pigment upon their "blind" sides have before been examined with a view to this question; and owing to the importance of the matter with regard to the defining of the principles of Symmetry, such an examination should be made in all cases where the presence of definite spots or marks makes the determination possible.

In contrast with these cases of symmetrical variation were exhibited photographs of a sample of Flounders (*Platessa flesus*) from the shallow water near Bournemouth. In this locality there is a high percentage of specimens having pigment on the "blind" sides. Of a sample of 32 all but 3 were to some extent spotted with pigment. In 5 this spotting was so great as to give them a piebald appearance, and of these one was over the greater part of the "blind" side of a full brown colour. No regularity whatever could be detected in the distribution of the pigment. This sample represented the normal condition of the Flounders of the locality, and had not been in any way selected.

EXPLANATION OF PLATE XVII.

Fig. 1. View of the "blind" side of abnormal specimen of *Rhombus lævis*. $\frac{2}{3}$ nat. size.
2. Enlarged view of the spot *dd*.
3. Enlarged view of the spot *vb*.

March 20, 1894.

Prof. G. B. Howes, F.Z.S., in the Chair.

The Secretary exhibited a photograph of a young male Gaur or Indian Bison (*Bos gaurus*)[1], forwarded by Major G. S. Rodon, of the Royal Scots Regiment. Major Rodon had captured this animal when out Bison-shooting in the Neelampattry Hills, in Cochin, in August 1893, and had kindly offered to present it to the Society. The Secretary was now endeavouring to make arrangements for its transmission home. He remarked that no Gaur, so far as he was aware, had ever reached Europe alive, except the specimen

[1] See Blanford, P. Z. S. 1890, p. 592, pl. xlix.

received from Pahang in October 1889 (see P. Z. S. 1890, p. 592, pl. xlix.), which had died on the 27th June, 1892, so that the acquisition of the present individual would be most desirable.

A communication was read from Dr. R. W. Shufeldt, C.M.Z.S., containing an account of the osteology of certain Cranes, Rails, and their allies, with remarks upon their affinities.

After a review of the opinions of previous writers upon this subject, Dr. Shufeldt concluded with the following statement of his views on the taxonomy of the North-American Paludicoline birds:—

"So far as this suborder—the *Paludicolæ*—of the United States is concerned, it is primarily divided into two main stems. The first of these is represented by the Cranes and Courlans; while the second contains all the Rails proper, or such generic groups as *Rallus*, *Crex*, *Porzana*, *Ionornis*, *Gallinula*, and *Fulica*.

"Structurally the Courlans possess a greater number of Gruine than they do of Ralline characters, and these characters are of equal importance and weight. But their generic characters are by no means always typical, and the differences seen are frequently of a degree that distinguish families among birds rather than genera. This being true, the fact settles the position of the Courlans in the system as a family—the *Aramidæ*, of the Crane-group. The species which has been osteologically described here—*Aramus giganteus*—is the only representative known to our avifauna, and it is a most perfect link connecting the Cranes with the typical *Rallidæ*.

"The Cranes must then constitute a family of themselves, and the *Gruidæ* has long been created to contain them. But the osteological and other morphological characters held in common by the *Gruidæ* and the *Aramidæ* are of a rank, when we come to compare them with the corresponding ones in the *Rallidæ*, which proclaim them to be higher than those commonly employed to define family lines, and yet not of a rank entitling them to subordinal distinction. To express this relationship a superfamily *Gruoidea* may be made to contain all the true *Gruidæ*, the *Aramidæ*, and perhaps the *Psophidæ*, from another quarter of the world. Another group to contain all the true Rails may be created, and designated as the superfamily *Ralloidea*. A scheme as follows would show these divisions as expressed for the forms we have had under consideration:—

Suborder.	Superfamilies.	Families.	Genera.
PALUDICOLÆ	GRUOIDEA	Gruidæ	*Grus.*
		Aramidæ	*Aramus.*
	RALLOIDEA	Rallidæ	*Rallus.*
			Crex.
			Porzana.
			Ionornis.
			Gallinula.
			Fulica.

"The bird-forms connecting the *Paludicolæ* with other avian groups are mostly not far to seek. It is plain that we have in the *Jacanidæ* a small group of birds that unmistakably link the present suborder with the *Limicolæ*, through certain species in the Plover-Sandpiper line. Through *Podica* and *Heliornis* it is equally clear that they lead in this direction towards the Pygopodes, and such existing ancestral types as *Chionis* probably connect them with the Longipennes. Less remotely than through this latter affinity, however, they are probably connected by various links with the Herodiones, through *Rhinochetus* and *Eurypyga*. By some it has also been claimed that the *Paludicolæ* may also have Accipitrine kinships through a line in which would occur such forms as the Seriema and the Secretary-bird (*Serpentarius*).

"Professor Fürbringer believes that the *Apteryges* are far more closely related to the *Rallidæ* than has heretofore been realized; and if this prove to be true, another linking line for the *Paludicolæ* is opened up to the Struthious types—with all the *Gallinæ* likewise only a little more remotely related."

The following papers were read:—

1. On the Myology of the Sciuromorphine and Hystricomorphine Rodents. By F. G. Parsons, F.R.C.S., F.Z.S., F.L.S., Lecturer on Comparative Anatomy at St. Thomas's Hospital.

[Received February 12, 1894.]

In commencing this series of dissections nearly three years ago, I intended to work out the musculature of all the Rodents which I could collect. Before long, however, the size of my manuscript made it evident to me that I must be content to take up the subject in two parts, and I have accordingly devoted my first attention to the Hystricomorpha and Sciuromorpha because I was able to obtain a more representative series of animals in these groups.

The following is a list of the animals which I have dissected[1]:—

Aulacodus swindernianus.	*Sphingurus prehensilis.*
Capromys pilorides.	*Lagostomus trichodactylus.*
Myopotamus coypus.	*Chinchilla lanigera.*
Octodon cumingii.	*Dasyprocta cristata.*
Hystrix cristata.	*Cœlogenys paca.*

[1] For the opportunity of dissecting these animals I am indebted to the kindness of the Prosector to the Society, Mr. F. E. Beddard, F.R.S.

Cavia cobaya.
Ceredon rupestris.
Dipus ægyptius.
Dipus hirtipes.
Alectaga indica.
Sciurus prevosti.
Pteromys oral.
Xerus getulus.
Spermophilus mexicanus.
Arctomys marmotta.
Castor canadensis.

Full use has been made of the accounts of the myology of *Capromys fournieri* by Owen, of *Capromys melanurus* by Dobson, of *Erethizon dorsatus* by Mivart, and of *Erethizon epixanthus* by Windle. I have been also much indebted to the thorough account of the myology of the Crested Agouti by Mivart and Murie, to the writings of Dobson, and to the French translation of Meckel, as well as to work done by other authors.

In this manner six families of the Hystricomorpha have each been illustrated by types of two or more orders, and although more material would no doubt have added to the accuracy of the generalizations, it is hoped that a step has been taken in the road commenced by Mivart and Murie nearly thirty years ago. In the Sciuromorpha the supply of material has not been so plentiful, but this is less to be regretted because these animals do not seem to differ so much in their myology as the Hystricomorpha.

The Dipodidæ have been included among the Hystricomorpha, although, as will be pointed out in the general summary, they differ from the rest of the group in certain important particulars. Want of space has prevented the exact attachments of the muscles being chronicled in each animal, and I have contented myself with generalizations wherever possible.

Occasionally from various causes the whole of the muscles of some of the animals were not available for dissection or were overlooked ; I have therefore, whenever it seemed necessary, placed in brackets the names of the animals on which the generalizations are founded.

Muscles of the Head and Neck.

Temporal.—The temporal muscle is always small, and rises from the side of the head above the external auditory meatus, the two muscles usually coming into contact in the middle line. It also derives some fibres from the inner side of the zygoma. The portion coming from the side of the head changes its course when it reaches the posterior root of the zygoma, which it uses as a pulley. The whole muscle is inserted into both surfaces and the anterior border of the coronoid process and part of the bone below. M. J. Kunstler, in his article "L'appareil masticateur des Rongeurs,"[1] describes the temporal of *Arctomys* as consisting of three parts—a superior from the parietal bone, a middle from the temporal, and

[1] Annales des Sciences naturelles, sér. 7, t. iv. p. 150.

an inferior from the zygomatic arch. I have verified this in *Arctomys*, and find the description applies to all the Sciuromorpha. In the Hystricomorpha it is difficult to satisfactorily separate the upper and middle portions.

In those animals, such as *Dipus*, *Chinchilla*, and *Xerus*, where the posterior part of the skull is broad, the two temporals do not meet in the mid line above.

Masseter.—For the purposes of description it is most convenient to divide this muscle into four parts—anterior and posterior superficial, and anterior and posterior deep. These parts do not always show a distinct line of demarcation.

The anterior superficial part rises by tendon from the side of the maxilla, and is inserted into the lower border and internal surface of the mandible, extending up to the insertion of the internal pterygoid. The posterior superficial rises from the whole length of the zygomatic arch, and is inserted into the lower part of the external surface as well as the lower border of the mandible. The anterior deep part differs in the Hystricomorpha and the Sciuromorpha. In the former, among which the Dipodidæ are included, this portion rises from a large area on the side of the maxilla, and then passes backwards and downwards through the enlarged infraorbital foramen to be inserted by a narrow flat tendon into the alveolar margin of the mandible, external to the molar teeth. In the Sciuromorpha this part of the muscle rises from the top of a vertical groove in front of the anterior portion of the zygomatic arch, the muscle runs down in the groove without passing through the infraorbital foramen and is inserted as in the Hystricomorpha.

The posterior deep part rises from the lower border and some of the internal surface of the zygoma, and is inserted into the greater part of the external surface of the ramus of the mandible. The arrangement used here is practically the same as that adopted by Meckel, the only difference being that he describes the whole superficial part under one name (*jugo maxillien*), although he states that the anterior border has a very strong superficial tendon; this anterior tendinous portion I have found to be easily separable from the rest in the Hystricomorpha, while in the Sciuromorpha it is separated by a distinct interval.

Buccinator.—This muscle is always well developed in Rodents, but in most cases shows no special points of interest. It rises from the maxilla and mandible opposite the molar and premolar teeth, and running forwards blends with the orbicularis oris.

In *Spermophilus* it is produced into the long cheek-pouch which, when empty, lies folded back on the cheek, having a muscular slip passing from the end of the pouch to the region of the shoulder.

Facial Muscles.—The orbicularis palpebrarum is not very strongly developed; from the anterior margin of it a muscle rises by a narrow origin, but spreads out to be inserted into the upper lip blending with the orbicularis oris, it probably represents the levator labii superioris of human anatomy. The anterior belly of the occipito-frontalis may be made out as a thin layer of muscle running upwards from the upper border of the orbicularis palpebrarum; it is quite distinct in *Hystrix*. The other facial muscles, including those of the lower lip, are indistinguishable from the facial panniculus. (See fig. 10.)

Pterygoid Muscles.—The external pterygoid is small and rises from the very feebly marked external pterygoid plate or rather ridge; it is inserted into the inner side of the neck of the condyle and the bone just below. The internal pterygoid rises from the outer side of the internal pterygoid plate or pterygoid bone, and has the usual human insertion. In *Sphingurus* the internal muscle consists of two distinct layers; with this exception the above description applies to all the animals examined.

Digastric.—The digastric is attached posteriorly to the front of the paroccipital process, while anteriorly it is inserted into the inner surface of the mandible. There are two absolutely distinct types of the muscle. In the Hystricomorpha the two bellies are not separated by a real tendon as in Man, although there is a slight constriction of the muscle, and a thin layer of tendon on the surface especially below; the attachment to the hyoid bone is very feeble, and the two anterior bellies are separated from one another by a distinct interval in which the mylo-hyoid is exposed. The anterior attachment is a considerable distance from the symphysis.

In the Chinchillidæ the attachment to the hyoid bone is well marked.

In the Hystricidæ the above description applies in *Hystrix*, but in *Sphingurus* the posterior belly ends in a tendon which is firmly inserted into the hyoid bone; from the anterior or upper side of this tendon the anterior belly runs to its attachment on the mandible.

The sciuromorphine type of digastric is well described by Kunstler[1] in the Marmot. The anterior and posterior bellies are separated by a distinct tendon which is firmly attached to the hyoid bone. From the inner surfaces of the tendons of the two sides fibrous bands run inwards to meet one another, forming a tendinous arch with its convexity in front. From the front of this arch the two anterior bellies spring; they are in contact in the middle line nearly as far as the symphysis, where they separate a little to expose the transverse mandibular muscle.

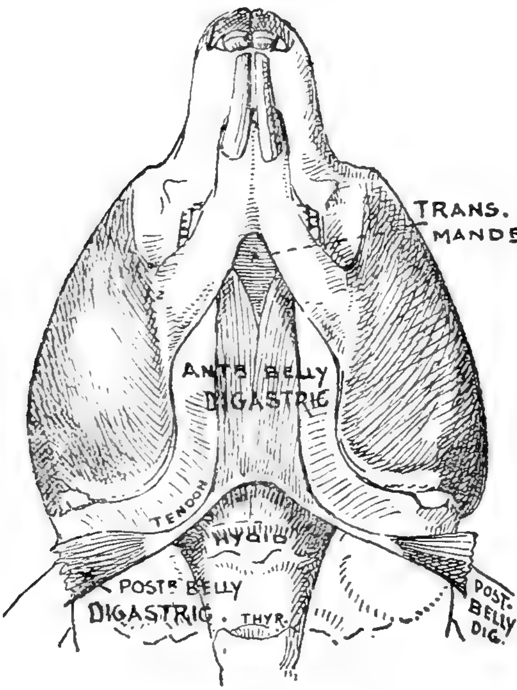
The tendinous arch gives attachment to some of the fibres of the mylo-hyoid as well as the anterior bellies of the digastric. This arrangement is common to all the Sciuromorpha (*Sciurus*, *Pteromys*, *Xerus*, *Spermophilus*, *Arctomys*, *Castor*) as well as the Dipodidæ (*Dipus ægyptius*, *D. hirtipes*, *Alectaga indica*).

Transverse Mandibular Muscle.—This muscle is accurately described by Kunstler in the Marmot; it was present in all the Rodents with a movable symphysis menti examined. I have not

[1] Annales des Sciences naturelles, sér. 7, t. iv. p. 150.

seen it at all in the true Hystricomorpha, but it is present in the Dipodidæ; it is also present in all the Sciuromorpha except *Castor*. It consists of a round bundle of fibres running across between the two halves of the mandible close to the symphysis; it is superficial to the mylo-hyoid but deep to the digastric. Its nerve-supply is from the mylo-hyoid of the inferior dental.

Fig. 1.



Digastric of *Pteromys*.

Mylo-hyoid.—The mylo-hyoid in the Hystricomorpha resembles the same muscle in Man; in the Sciuromorpha it is connected posteriorly to the tendinous arch of the digastrics.

Genio-hyoid.—In the Caviidæ and Dasyproctidæ this muscle rises by a thin tendon from the symphysis; in the Sciuromorpha the two muscles tend to coalesce before reaching the hyoid bone. The muscle has the usual human attachments.

Genio-hyoglossus.—This muscle has the human attachments. In *Myopotamus* it was noticed that the part running to the tongue was fleshy in its origin, while that going to the hyoid bone was tendinous.

Styloid Muscles.—The stylo-hyoid rises from the base of the skull just internal to the paroccipital process; it passes deep to the digastric to be attached to the epihyal cartilage close to the hyoid bone.

The styloglossus rises lower down than the last from the cartilaginous rod joining the hyoid bone to the skull and is inserted into the tongue.

The stylo-pharyngeus has pratically the same origin as the stylo-hyoid, but is seldom well marked. The animal in which it was most clearly seen was *Sphingurus*.

Sterno- and Cleido-mastoid.—These two muscles are distinct in their whole length. Except in the exact origin of the cleido-mastoid they are subject to very little variation.

The sterno-mastoid rises from the side of the anterior portion of the sternum, and is inserted into the side of the paroccipital process and the curved line of the occipital bone running inwards from this. The cleido-mastoid rises from the bony clavicle and is inserted nearer the middle line (dorsal) and often under cover of the sterno-mastoid. In all cases the spinal accessory nerve runs deep to both muscles and supplies them entirely.

In the Dipodidæ the muscles are of equal size; the sterno-mastoid is inserted ventral to the cleido-mastoid and does not cover it. The cleido-mastoid rises from the middle third of the clavicle in *D. ægyptius* and *D. hirtipes*, but from the outer third in *Alectaga indica*.

In the Octodontidæ the cleido-mastoid rises from the inner third of the clavicle and at its insertion overlaps the sterno-mastoid instead of being overlapped. In the Hystricidæ and Chinchillidæ the muscles are normal, except that in the Chinchilla they are inserted into the back of the great tympanic bulla.

In the Dasyproctidæ the cleido-mastoid is small and rises from the middle of the clavicle near the junction of the bony and ligamentous parts (*Dasyprocta*, *Cœlogenys*).

In the Caviidæ the two muscles are separated by a much greater interval than in other cases. The cleido-mastoid is the larger and runs from the rudimentary clavicle to the curved line of the occipital bone internal to the insertion of the sterno-mastoid. The two muscles are separated by a larger interval in *Ceredon rupestris* than in *Cavia cobaya*; in the latter the origin of the cleido-mastoid blends with the deltoid.

In the Sciuromorpha the two muscles are much more fused towards their insertion, the cleido-mastoid rising from the innermost part of the clavicle.

In *Arctomys*, *Xerus*, and *Spermophilus* there seem to be two cleido-mastoids, owing to some of the fibres of the trapezius being separated from the rest by the levator claviculæ (see *Trapezius*). In *Castor* the sterno-mastoid has a large origin from the ventral surface of the presternum overlapping the pectoralis. The cleido-mastoid rises from the inner half of the clavicle.

Sterno-hyoid and Thyroid.—These muscles present the human attachments and characteristics.

In *Myopotamus* the sterno-hyoid is inserted into the hyoid bone and raphe between the mylo-hyoids for some distance, so that the borders near the insertion become superior and inferior instead of lateral. In the Caviidæ the sterno-thyroid is very small.

In *Pteromys* the sterno-hyoid is inserted by a thin tendon.

Omo-hyoid.—The omo-hyoid may be present or not. When it is present it has the human attachments to the hyoid bone and anterior border of the scapula, but it never has any tendinous interval; it runs, moreover, a straight course between its two attachments.

In the Dipodidæ it is present (*D. ægyptius*, *D. hirtipes*, *Alectaga indica*; in the last it is specially well marked).

In the Octodontidæ it is not constant. In *Octodon* and *Capromys* it is feebly developed, in *Myopotamus* it is absent, while in *Aulacodus* it is well marked. In the Hystricidæ it is well marked in *Sphingurus* and *Erethizon*[1], but in *Hystrix* it was seen as a thin layer of muscular fibres disappearing in the fascia under the sterno-mastoid.

In the Chinchillidæ and Dasyproctidæ it is absent (*Chinchilla*, *Lagostomus*, *Dasyprocta*, *Cœlogenys*).

In the Caviidæ it is also absent (*Cavia cobaya*, *Ceredon rupestris*, *Dolichotis*).

In the Sciuromorpha it is always present (*Sciurus*, *Pteromys*, *Xerus*, *Spermophilus*, *Arctomys*, *Castor*).

Levator Claviculæ.—The levator claviculæ rises either from the basioccipital behind the origin of the scalenus anticus, or from the ventral arch of the atlas; it is inserted chiefly into the acromion and metacromion and the fascia of the shoulder, but sometimes it extends to the acromial end of the clavicle. It is supplied by branches from the cervical plexus.

In the Dipodidæ it rises from the front of the atlas and runs to the outer end of the clavicle. In the Octodontidæ it is not constant. In *Aulacodus*, *Capromys melanurus*[2], and *Myopotamus* it rises from the basioccipital, but in *Octodon* from the atlas. In the Hystricidæ it rises from the atlas in *Sphingurus* and *Erethizon*[3], but in *Hystrix* it comes from the base of the skull and is inserted into the acromion and fascia of the arm as low as the elbow. (See fig. 10.)

In the Chinchillidæ it rises from the atlas in *Chinchilla*, and from the basioccipital in the Viscacha; in the latter animal it is inserted into the outer half of the clavicle as well as the metacromion.

In the Dasyproctidæ it rose from the atlas in the specimen of *D. cristata* which I dissected; in the specimen dissected by Mivart and Murie it rose from the basioccipital[4]. In *Cœlogenys* it rises from the basioccipital and is very large.

In the Caviidæ it rises from the basioccipital in *C. cobaya*, *Ceredon rupestris*, and *Dolichotis*.

In all the Sciuromorpha it rises from the atlas and is inserted into the metacromion, never seeming to reach the clavicle. In

[1] Journal of Anatomy, vol. xxii. p. 126.
[2] Dobson, P. Z. S. 1884, p. 234.
[3] Mivart, P. Z. S. 1882, p. 271.
[4] P. Z. S. 1866, p. 383.

Castor it is entirely covered by the trapezius, and is inserted into the upper border of the acromial process and the outer part of the spine of the scapula.

The above observations show that the levator claviculæ is a muscle of very little use for classificatory purposes among the Hystricomorpha; in this group it seems to vary even in different individuals of the same species; it is possible that it is in process of shifting its attachment from the basioccipital to the front of the atlas. The number of observations, however, are not sufficient for generalization.

Rectus Capitis Anticus Major and Minor.—The rectus capitis anticus major rises in the Hystricomorpha from the transverse processes of two or three cervical vertebræ below the atlas, and is inserted into the basioccipital bone in front and internal to the scalenus anticus; except in the Caviidæ it is difficult to separate from the longus colli. In the Sciuromorpha the muscle usually rises from a greater number of transverse processes. The rectus capitis anticus minor and lateralis have the human attachments; the latter is large and closely connected to the superior oblique.

Longus Colli.—The longus colli closely resembles the same muscle in Man; it consists of two oblique and one straight part. The posterior oblique part rises from the bodies of the anterior three or four thoracic vertebræ, and is inserted into the transverse processes of the posterior cervical vertebræ. The anterior oblique portion runs from the insertion of the last part to the longus colli tubercle on the ventral arch of the atlas. The straight part runs from the bodies of the anterior thoracic vertebræ to those of the anterior cervical. In *Castor* it extends a long way into the thorax.

Scalenus Anticus.—As there is a good deal of difficulty in identifying the scalene muscles of Rodents with the three scalenes of human anatomy, I have given the name of scalenus anticus only to a muscle inserted into the first rib between the subclavian artery and vein. This muscle when present rises by a tendon from the basioccipital in front and internal to the levator claviculæ; in *Cœlogenys* it also derives a few fibres from one or two cervical transverse processes. It is absent in the Hystricidæ (*Hystrix*, *Sphingurus*) and in all the Sciuromorpha, but present in the other animals examined.

Scalenus Medius and Posticus.—These two muscles are most conveniently described together, as it is often impossible to say where one ends and the other begins.

In *Aulacodus*, which is a good type of the arrangement in the Octodontidæ, one muscle, which I take to represent the scalenus medius, rises from the transverse processes of the first four cervical vertebræ and is inserted into the sides of the 4th and 5th ribs between the serrations of the serratus magnus. Another muscle, probably the scalenus posticus, rises from the posterior three cervical transverse processes and is inserted into the first and second ribs.

In *Chinchilla* the arrangement is almost identical.

In *Hystrix* and *Sphingurus* only one muscle can be made out; it rises from all the cervical transverse processes and is inserted into the anterior four ribs.

In *Lagostomus*, *Agouti*, and *Cœlogenys* the muscle rises from all the cervical transverse processes; the fibres from the anterior three or four are attached to the outer surfaces of the ribs from the second to the fifth and interdigitate with the serratus magnus; in *Lagostomus* the sixth rib is reached. The fibres from the posterior transverse processes are attached to the first rib behind the subclavian artery.

In the Caviidæ the fibres which are attached to the side of the chest come from the 3rd and 4th cervical transverse processes, and are inserted into the 3rd and 4th ribs. The slip to the first rib comes from all the cervical transverse processes.

Muscles of the Anterior Extremity.

The Pectoral Muscles.—As the pectoralis major and minor are not always distinct muscles, I have followed Owen's example in his description of *Capromys* [1], and have divided the whole pectoral mass into four different parts, which are usually easy to make out. These four parts have generally the following attachments:—

(α) The most superficial part, rising from the anterior portion of the sternum and sometimes the sternal end of the clavicle, is inserted fairly low down on the humerus, often crossing obliquely the fibres of the next part, which is on a deeper plane.

(β) This portion rises from the greater part of the sternum posterior to the last and is inserted into the pectoral ridge of the humerus.

(γ) The abdominal portion rises from the linea alba; being closely connected to and embraced by the panniculus carnosus, its fibres pass deep to β, and are usually inserted into the top of the pectoral ridge and the upper extremity of the humerus.

(δ) The deep portion, which perhaps corresponds to the pectoralis minor of human anatomy, rises from the cartilages of some of the true ribs, close to their junction with the sternum. The fibres run upwards and outwards to the outer part of the clavicle, coracoid, or shoulder-capsule.

In the Octodontidæ α and β are almost if not completely fused. γ goes to the lesser tuberosity of the humerus. δ rises from the cartilages of 3rd to 6th ribs and is inserted into the outer part of the clavicle and coracoid process. This arrangement applies to *Myopotamus*, *Aulacodus*, and *Capromys pilorides*; it also agrees with Dobson's description of the muscle in *Capromys melanurus* [2].

[1] P. Z. S. 1832, p. 74.
[2] P. Z. S. 1884, p. 234.

In *Octodon*, α and β rise respectively from the anterior and posterior halves of the sternum and are not so closely united.

In the Hystricidæ α forms a separate band which runs obliquely across the rest of the muscle to be inserted quite at the lower half of the humerus, some fibres passing to the fascia of the fore-arm. γ and δ are inserted with β; so that this family is remarkable for having the insertion of the pectoral almost entirely into the humerus (*Hystrix*, *Sphingurus*, *Erethizon dorsatus*[1]).

The Chinchillidæ resemble the Octodontidæ in having α and β fused. δ in the Chinchilla is inserted into the outer part of the clavicle, but in the Viscacha it is inserted into the coracoid process and first rib external to the origin of the subclavius.

In the Dasyproctidæ α is a distinct oblique slip as in the Hystricidæ. γ is inserted into the upper extremity of the humerus. δ in *Dasyprocta* goes to the outer part of the clavicle blending with the sternoscapular. In *Cœlogenys* this part was not seen. This description differs from that of Mivart and Murie[2] in classing part of their pectoralis as deltoid. I find that the portion in question is supplied by the circumflex nerve and not by the anterior thoracic; as the circumflex also supplies the deltoid it is probable that the slip belongs to that muscle instead of to the pectoralis. (See *Deltoid*.)

In the Caviidæ there are no special fibres rising from the costal cartilages (*Cavia cobaya, Ceredon rupestris*).

In the Sciuromorpha α has the usual origin and is inserted about the middle of the humerus. β rises from the whole of the sternum and runs almost horizontally to the whole of the pectoral ridge. γ joins δ at its insertion. δ rises from the 2nd, 3rd, and 4th cartilages in *Sciurus* and *Pteromys*; from 2nd, 3rd, 4th, 5th, and 6th in *Arctomys* and *Spermophilus*. The insertion is into the shoulder-capsule and the coracoid process.

Sterno-scapularis.—This muscle consists of two parts which display a good deal of variety in different members of the group. The internal part or subclavius rises from the first rib at its junction with the sternum and is inserted into the posterior surface of the outer third of the clavicle. The outer part or scapulo-clavicularis, when it is present, rises from the clavicle close to the insertion of the subclavius, with which it is usually more or less continuous, and is inserted into the spine and vertebral border of the scapula, covering the supraspinatus as a broad thin sheet.

In the Dipodidæ the scapulo-clavicularis is absent but the subclavius is well marked (*D. ægyptius, D. hirtipes, Alectaga indica*).

In the Octodontidæ the two parts of the muscle communicate very slightly if at all in *Octodon, Myopotamus, Capromys pilorides* and *C. melanurus*[3], but in *Aulacodus* many fibres are continuous.

In the Hystricidæ the two parts are continuous in *Hystrix*, but quite separate in *Sphingurus*.

[1] P. Z. S. 1882, p. 281.
[2] P. Z. S. 1866, p. 383.
[3] Dobson, P. Z. S. 1884, p. 234.

In the Chinchillidæ the muscles are largely attached to the clavicle.

In the Dasyproctidæ the scapulo-clavicularis is especially well developed, being considerably larger than the supraspinatus.

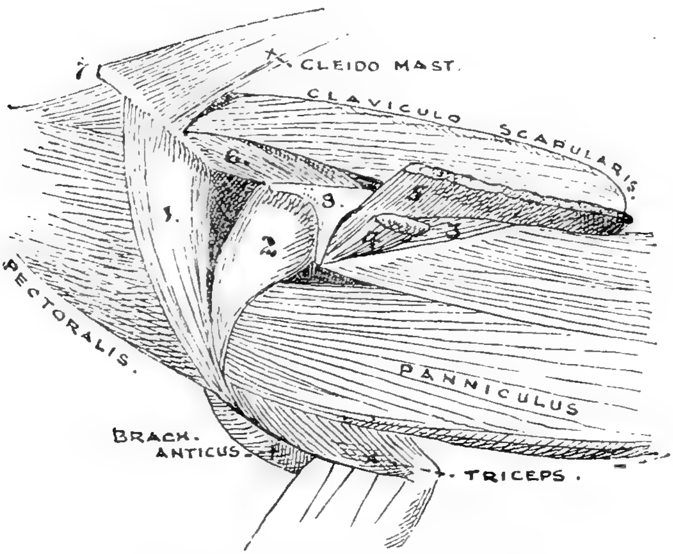
In the Caviidæ the small clavicle is between the two muscles in *Cavia cobaya*, having both attached to it; but in *Ceredon rupestris* the subclavius was found to send a few fibres into the clavicle and a few into the scapulo-clavicularis, but its insertion was chiefly into the anterior border of the acromial process. The scapulo-clavicularis rose chiefly from the clavicle.

In the Sciuromorpha the subclavius had the usual human attachments, but the scapulo-clavicularis was absent in all the animals examined.

It is interesting to notice that the Dipodidæ, so far as this muscle is concerned, differ from all the rest of the Hystricomorpha.

The nerve-supply of both parts of this muscle is from a branch from the upper part of the outer cord of the plexus, corresponding to the human nerve to the subclavius.

Fig. 2.



Shoulder-muscles of *Ceredon rupestris*.

1. Deltoid (clavicular).	5. Trapezius (cut).
2. ,, (acromial).	6. Subclavius.
3. ,, (spinous).	7. Clavicle.
4. Levator clav. (cut).	8. Acromion and metacromion.

Deltoid.—The deltoid in Rodents consists of three parts, which are liable to become more or less fused with one another. The first part rises from the outer part of the clavicle, the second from the acromial and metacromial processes, while the third part comes from the spine of the scapula and fascia over the infraspinatus. Mivart and Murie, in their description of the myology of the Agouti [1], prefer to describe the clavicular portion as part of the pectoralis, but I have been able to satisfy myself that its nerve-supply is derived from the circumflex and not the anterior thoracic. The insertion of the deltoid is into the pectoral ridge close to that of the pectoralis. The clavicular fibres are often prolonged to the elbow and in all cases are inserted lowest, while the part from the spine is inserted deep to the acromial slip.

In the Dasyproctidæ the clavicular portion is continued down almost to the external condyle.

In *Sciurus* and *Pteromys* the clavicular and acromial fibres are closely united owing to the development of the clavicle. *Sphingurus* has the same arrangement.

In *Arctomys* and *Spermophilus* the clavicular part divides into a superficial and deep portion; the latter has the usual insertion, but the former is continued down to the coronoid process of the ulna. In *Castor*, owing to the great development of the muscle, the intervals between the three parts are slight. The other animals examined present nothing remarkable in this muscle.

Supraspinatus, Infraspinatus, and Subscapularis.—These muscles have the human attachments and, except in their comparative size, do not vary at all.

Teres Major.—This muscle rises from the posterior quarter (more or less) of the axillary border of the scapula, and is inserted either into the tendon of the latissimus dorsi or into the humerus close to the insertion of that muscle.

In the Dipodidæ the insertion is posterior to that of the latissimus dorsi as in Man (*D. ægyptius*, *D. hirtipes*, *Alectaga indica*).

In the Octodontidæ it is inserted into the front of the tendon of latissimus dorsi (*Aulacodus, Myopotamus, Octodon, Capromys pilorides* and *C. melanurus*) [2].

In *Lagostomus* among the Chinchillidæ, owing to the great size of the infraspinatus, the muscle only rises from about $\frac{1}{8}$th of the axillary border of the scapula and from the surface of the infraspinatus and subscapularis, which overlap the bone. The insertion is into the rudimentary bicipital groove somewhat above the latissimus dorsi tendon, with which it is closely connected. *Chinchilla* has very much the same arrangement, but the muscle rises from more of the axillary border.

In the Hystricidæ the lower border of the muscle is wrapped round by the latissimus dorsi close to the insertion (*vide* latissimus dorsi) (*Hystrix, Sphingurus*).

In the Dasyproctidæ it was inserted nearer the shoulder than the latissimus dorsi in my specimen of *Dasyprocta*, but according to Mivart and Murie [3] the two muscles are inserted together. In *Cœlogenys* it is inserted with, and in front of, the latissimus dorsi.

[1] P. Z. S. 1866, p. 383.
[2] Dobson, P. Z. S. 1884, p. 234.
[3] P. Z. S. 1866, p. 383.

In the Caviidæ the arrangement is the same as in *Cœlogenys* (*C. cobaya*, *Ceredon rupestris*).

Teres Minor.—The teres minor rises from the humeral third to half of the axillary border of the scapula, and is inserted just below the insertion of the infraspinatus. It is sometimes a perfectly distinct muscle, but in most cases is so closely united to the infraspinatus that, were it not for its being supplied by the circumflex nerve, it would be most conveniently described with that muscle. The teres minor was seen most distinctly in *Lagostomus*, in which animal a fibrous band was found running from the metacromial process to the origin of the long head of the triceps, covering the infraspinatus and teres minor near their insertions.

In the Sciuromorpha the muscle is specially indistinct.

Biceps Cubiti.—The biceps always rises by a strong tendon from the margin of the glenoid cavity at the base of the coracoid process; it may or may not have a second head rising from the tip of that process, or from the surface of the coraco-brachialis. Its insertion is into the radius, ulna, or both bones just below the sigmoid cavity, occasionally, however, it is prolonged farther down the bones. The semilunar fascia from the inner side of its tendon to the fascia of the forearm is very indistinct, but by careful dissection a few fibres may be traced.

In the Dipodidæ there is only one head, and the insertion is almost entirely into the ulna (*Dipus ægyptius*, *Alectaga indica*).

In the Octodontidæ there are two heads; the insertion is into both radius and ulna (*Myopotamus*, *Aulacodus*, *Capromys*, *Octodon*).

In the Hystricidæ there is only one head in *Hystrix*, but two in *Sphingurus* and *Erethizon dorsatus*[1]; it is inserted largely into the radius in the Tree-Porcupines, but chiefly into the ulna in *Hystrix*.

In the Chinchillidæ there are two heads; the insertion is into the coronoid process of the ulna and the oblique line of the radius (*Chinchilla*, *Lagostomus*). In the Viscacha I dissected there were three heads to the biceps on the left side, the extra one rising from the front of the great tuberosity of the humerus.

In the Dasyproctidæ there is only one head, and the insertion is entirely into the ulna (*Dasyprocta*, *Cœlogenys*).

In the Caviidæ the arrangement is the same as that in the Dasyproctidæ (*Cavia cobaya*, *Ceredon rupestris*, *Dolichotis*[2]). In the Sciuromorpha, *Sciurus*, *Pteromys*, *Arctomys*, and *Xerus* have the muscle rising chiefly by the glenoid or long head, but also by some fibres from the front of the coraco-brachialis (representing a short head). The insertion is almost entirely into the tubercle of the radius so as to act as a supinator. *Spermophilus* differs in the absence of the short head. *Castor* has only one head and the insertion is entirely into the ulna.

Coraco-brachialis.—The three parts of this muscle described by

[1] Mivart, P. Z. S. 1882, p. 271.
[2] Beddard, P. Z. S. 1891, p. 236.

Wood[1] are well illustrated in the Rodents, though all three parts are seldom present together. They all rise from the tip of the coracoid process—the first part (rotator humeri) being inserted into the surgical neck of the humerus above the insertion of the latissimus dorsi tendon, the second part into the middle of the shaft of the humerus, while the third part runs down to the internal condyle. The musculo-cutaneous nerve always passes between the first and second parts when these are present.

In the Dipodidæ the first and third heads are present in *D. ægyptius* and *D. hirtipes*, but in *Alectaga* apparently the second only.

In the Octodontidæ only the second head is present (*Aulacodus*, *Octodon*, *Capromys pilorides* and *melanurus*[2], *Myopotamus*).

In the Hystricidæ only the second part is present in *Hystrix*, while in *Sphingurus*, *Erethizon dorsatus*[3] and *E. epixanthus*[4] the second and third heads are found. The third head in *Sphingurus* differed from the same part in the other animals I dissected in having the median nerve separating it from the rest of the muscle.

In the Chinchillidæ only the second head is present in *Chinchilla*. In *Lagostomus* the muscle was entirely absent on both sides, but possibly this specimen was abnormal.

In the Dasyproctidæ the first and second parts are present (*Dasyprocta*, *Cœlogenys*).

In the Caviidæ only the second head is found (*Cavia cobaya*, *Ceredon rupestris*, *Dolichotis*[5]).

In the Sciuromorpha the rotator humeri is always present. In *Sciurus*, *Pteromys*, *Xerus*, and *Spermophilus* all three parts are found, but the second and third are blended. In *Arctomys* the first and second are present, while in *Castor* apparently the first and third are found. The lower part in this animal is inserted by a narrow tendon just above the inner condyle.

Brachialis Anticus.—This muscle generally consists of an external and an internal part. The external rises from the back of the neck of the humerus and winds round to the front, lying just external to the pectoral ridge, which, when it is well marked as in *Aulacodus*, has a broad shallow groove for it to lie in. The internal head, when it is present, is much smaller and rises from the anterior border of the humerus below the pectoral ridge. The two parts are inserted into the ulna just below the lesser sigmoid cavity, a smaller slip being often sent to below and behind the tubercle of the radius. The muscle is supplied by the musculo-cutaneous and musculo-spiral nerves, but I was unable to satisfy myself that each head had a different nerve-supply.

In the Octodontidæ both heads are present.

In the Hystricidæ, *Hystrix* has both heads, while *Sphingurus* only has the external.

[1] Journ. Anat. vol. i. p. 45.
[2] Dobson, P. Z. S. 1884, p. 234.
[3] Mivart, P. Z. S. 1882, p. 271.
[4] Windle, Journ. Anat. vol. xxii. p. 126.
[5] Beddard, P. Z. S. 1891, p. 236.

In the Chinchillidæ, *Chinchilla* has one head, *Lagostomus* two.

In the Dasyproctidæ both heads are found in *Dasyprocta* and *Cœlogenys*, although the inner head in the latter is very small and blended with the outer.

In the Caviidæ only the outer head is found in *Ceredon* and *Cavia cobaya*, but in *Dolichotis*, according to Beddard [1], both parts are present.

In the Sciuromorpha both heads appear to be present, but they are so closely blended as to be indistinguishable (*Sciurus*. *Pteromys*, *Xerus*, *Spermophilus*, *Castor*). In *Arctomys*, however, no trace of the inner head was seen.

Triceps and Anconeus.—The triceps consists of the usual three heads. The external head has a small origin from the back of the neck of the humerus just above that of the brachialis anticus. The middle or long head rises from a large part of the humeral end of the axillary border of the scapula. The inner head rises from the greater part of the posterior surface of the humerus and is continuous with the anconeus. The insertion is into the posterior part of the upper surface of the olecranon, the internal head usually being inserted separately in front of the other two; the anconeus is attached to the outer side of the process.

The triceps showed little variation in the different animals examined; in the Beaver it is well developed and attached to both sides of the olecranon as well as to the top; the anconeus is especially well marked and rises from the enormous external supracondylar ridge, it is inseparable from the inner head of the triceps.

Epitrochleo-anconeus.—In all the Rodents examined a small round fleshy muscle rises from the internal condyle of the humerus and is inserted into the inner side of the olecranon process, covering the ulnar nerve. In *Castor* it is specially well developed.

Pronator Radii Teres.—This muscle rises from the internal condyle of the humerus; it never has a deep head from the ulna, and the median nerve always lies deep to it. It is inserted into the convexity of the radius, usually about the middle. In *Sciurus* and *Pteromys*, which possess a supracondylar foramen, the muscle rises from the arch of bone forming it.

In *Aulacodus*, *Hystrix*, *Erethizon dorsatus* [2], *Arctomys*, and *Xerus* the muscle is inserted near the distal end of the radius. In all the other animals examined its insertion, as above stated, was into the middle.

In the Agouti I did not see the continuation of this muscle to the carpus described by Mivart and Murie [3].

Flexor Carpi Radialis.—This muscle presented the usual human attachments and relations in all the animals examined.

Palmaris Longus.—The palmaris longus rises from the internal condyle, and is inserted into the ulnar cartilaginous disk which

[1] P. Z. S. 1891, p. 236.
[2] P. Z. S. 1882, p. 271.
[3] P. Z. S. 1866. p. 383

seems to be developed in the palmar fascia. In *Octodon* and *Myopotamus* it rises only from the inner side of the olecranon process, while in *Castor* it comes from both the olecranon and internal condyle.

In *Cœlogenys* and *Xerus* the muscle was formed by some of the internal and superficial fibres of the flexor sublimis digitorum: this arrangement corresponds to what Mivart and Murie found in *Dasyprocta*, though in the specimen of this animal which I dissected the muscle was absent. In *Myopotamus* the insertion was into the radial and ulnar palmar cartilages. The muscle was not seen in *Chinchilla* or *Sciurus*. In *Spermophilus* the tendon was broad and fascia-like in its whole length. Apparently this muscle is liable to great individual variation in Rodents as in Man.

Flexor Sublimis Digitorum.—This muscle rises from the internal condyle in common with part of the flexor profundus; it divides into slips for the middle phalanges of the 2nd, 3rd, 4th, and usually the 5th digits, which slips are perforated for the passage of the profundus tendons. Just before the perforation there is usually a strong fibrous loop, which passes under the profundus tendon and comes into contact with the sesamoid bones in front of the metacarpo-phalangeal joints; this is very well marked in *Cœlogenys*.

In the Octodontidæ and Dasyproctidæ there are only three tendons for the 2nd, 3rd, and 4th digits. This is also the case in *Castor*. Mivart and Murie[1] found a slip to the 5th digit in the Agouti on one side but not on the other. In *Cœlogenys* I met with a more interesting arrangement still; in it the tendinous loop representing the perforated portion of the tendon was present in the 5th digit on one side, but was entirely unconnected with the flexor sublimis, which sent no slip to this digit.

Possibly the explanation of these facts may be that the Dasyproctidæ show a stage in the gradual suppression of the slip to the 5th digit, a process which is complete in the Octodontidæ. In *Castor* the muscle has an extra origin from the olecranon.

Flexor Carpi Ulnaris.—This muscle usually rises, as in Man, from the inner side of the olecranon process, from the internal condyle, and, by aponeurosis, from the upper part of the posterior border of the ulna. It is inserted into the pisiform bone. In the Octodontidæ and Dasyproctidæ the condylar origin is wanting, as it is also in *Castor* and *Spermophilus*.

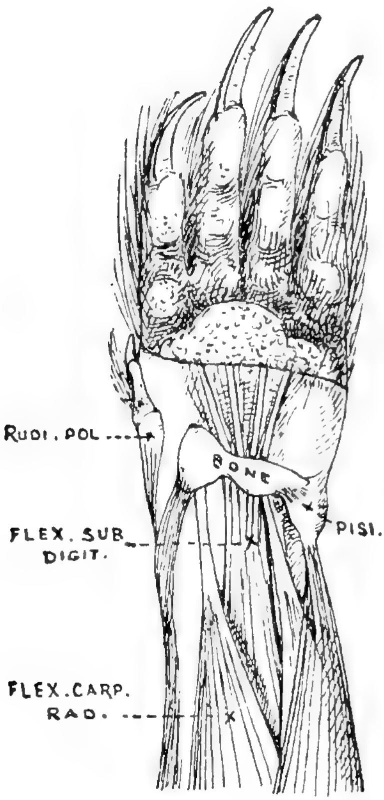
Flexor Profundus Digitorum.—This muscle, which includes both flexor profundus digitorum and flexor longus pollicis of human anatomy, rises usually by four heads; two of these come from the internal condyle, one from the flexor surface of the ulna, and the last from the flexor surface of the radius. The muscle usually divides into four tendons for the outer digits, and often gives off a small tendon at right angles to the rest for the pollex. The tendons perforate the flexor sublimis and are inserted into the terminal phalanges of the digits.

[1] P. Z. S. 1866, p. 383.

In the Octodontidæ there are always four tendons to the digits and one to the thumb. There are also four lumbricales.

In the Hystricidæ no slip is sent to the thumb in *Hystrix* and *Sphingurus*, but Mivart describes the muscle as dividing into five tendons in *Erethizon dorsatus* [1].

Fig. 3.



Left fore foot of *Sphingurus prehensilis* (superficial dissection).

There were three lumbricales in *Hystrix* and *Erethizon*[1], four in *Sphingurus*.

The Chinchillidæ have no slip to the thumb and four lumbricales. In the Dasyproctidæ there is no slip to the thumb and three lumbricales. In the Caviidæ the arrangement is the same.

In the Sciuromorpha there are four tendons in *Sciurus*, *Pteromys*, and *Arctomys*, but *Xerus* and *Castor* have five.

The number of the lumbricales in Rodents seems liable to individual variation, as a rule the one on the ulnar side is larger than the rest and rises from the front of the flexor profundus before it divides.

Pronator Quadratus.—This muscle is usually well marked,

[1] P. Z. S. 1882, p. 271.

although, as a general rule, pronation is only allowed through about one-eighth of a circle. The extent of the muscle varies from one-third to the whole of the interosseous space, being much more extensive in the Hystricomorpha than in the Sciuromorpha.

In *Aulacodus* and *Dasyprocta* it is attached to the whole length of the contiguous margins of the radius and ulna.

In *Cœlogenys* to the lower three-quarters. In *Lagostomus* to the lower two-thirds.

In *Hystrix*, *Sphingurus*, *Myopotamus*, *Octodon*, and *Ceredon* to the lower half.

In *Castor* to the middle third. In the other Sciuromorpha to the lower third.

Supinator Longus.—This muscle is present in the Dipodidæ, some of the Hystricidæ, and the Sciuromorpha except *Castor*.

In the Dipodidæ, as in all the animals in which the muscle was found, the origin is from the external supracondylar ridge; the insertion, however, instead of being normal, is into the base of the metacarpal bone of the pollex (*D. ægyptius*, *D. hirtipes*, *Alectaga indica*).

In the Hystricidæ it is absent in *Hystrix cristata* and *Sphingurus*, but present in *Erethizon dorsatus* [1], and, in a rudimentary condition, in *E. epixanthus* [2]; its attachments are normal. In the Sciuromorpha the muscle is well marked and the attachments normal; as above mentioned, it is absent in *Castor*.

Extensor Carpi Radialis Longior and Brevior.—These muscles are always present, and only differ from the same muscles in Man in that they are attached to the middle of the shafts of the metacarpal bones instead of near the bases. The two muscles are about the same size except in *Myopotamus*, in which the brevis is much the larger and rises from a more extensive origin than its neighbour.

Extensor Communis Digitorum.—This muscle rises from the external condyle, and is inserted into the middle and distal phalanges of the 2nd, 3rd, 4th, and 5th digits. On each side of the slip to the terminal phalanx there is a strong elastic band running from the head of the middle to the base of the distal phalanx; this serves to keep the terminal joint of the digit in a state of constant extension. The four divisions to the fingers are connected by vincula, which in *Myopotamus* are broad and membranous.

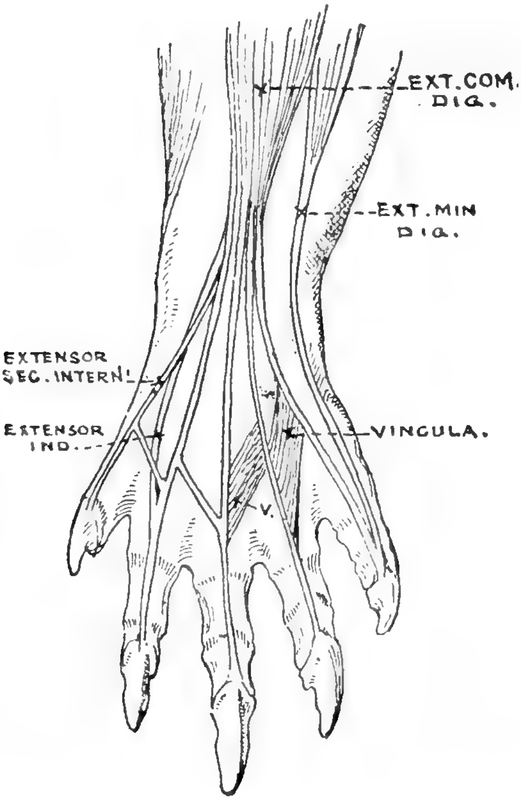
In *Dasyprocta* the muscle rises from the upper two-thirds of the posterior surface of the shaft of the ulna as well as from the external condyle; it divides into three slips, of which the middle goes to the 2nd, 3rd, and 4th digits, the radial one joins the tendon of the middle part to the index, while the ulnar slip goes to the 3rd and 5th digits. This practically corresponds to what Mivart and Murie found [3].

[1] Mivart, P. Z. S. 1882, p. 271.
[2] Windle, Journ. Anat. vol. xxii. p. 126.
[3] P. Z. S. 1866, p. 383.

In *Cavia cobaya* there are two slips, the radial goes to the index and middle, the ulnar to middle, ring, and little fingers.

In *Pteromys* and *Arctomys* the radial slip goes to all the fingers, while the ulnar only goes to the middle and ring.

Fig. 4.



Left fore foot of *Castor canadensis* (extensor tendons).

Extensor Minimi Digiti.—The extensor minimi digiti rises from the external condyle in common with the extensor communis digitorum, and is usually inserted into the tendons of that muscle on the dorsum of the 4th and 5th digits. Its tendons are also usually connected to the ulnar sesamoid bones on the palmar surface of the metacarpo-phalangeal joints. In the following animals the insertion differed from the above description :—

Sphingurus and *Sciurus* to 3rd, 4th, and 5th digits; *Chinchilla*, *Pteromys*, and *Castor* to 5th only. In *Aulacodus* the muscle was completely fused with the extensor communis. From the difference in the number of tendons in animals otherwise closely allied I should suspect this muscle of being liable to a good deal of individual variation.

Extensor Carpi Ulnaris.—This muscle possessed the same attachments as in Man with the exception of *Sphingurus*, in which the insertion had worked round to the palmar surface of the base of the fifth metacarpal bone.

Supinator Brevis.—This muscle rises from the external condyle, and is inserted into the upper third of the extensor surface of the radius, wrapping round that bone very little. It only consists of one layer, which lies entirely superficial to the posterior interosseous nerve.

Extensor Ossis Metacarpi Pollicis.—This muscle, which is generally well developed, rises from the extensor surfaces of the radius and ulna, or of the ulna alone, and from the interosseous membrane; its insertion is into the base of the first metacarpal bone and sometimes into the trapezium. In *Hystrix* the insertion is into the metacarpal bone and trapezium. In *Cavia cobaya* the insertion is into the trapezium, but in Mivart and Murie's case it also sent a slip to the base of the second metacarpal [1]. In the Sciuromorpha except *Castor* it rises from the ulna only. In *Castor* the muscle was double: the first part rose from the radius and was inserted into the first metacarpal, while the second rose from the radius and ulna and was inserted into the radial sesamoid bone of the palm.

Extensor Primi Internodii Pollicis.—This muscle was absent in all the animals examined. Meckel suggests that it may be incorporated with the extensor ossis metacarpi.

Extensor Secundi Internodii Pollicis.—This muscle was only found in *Hystrix* and *Castor*; in the former it arose from the ulna below the extensor ossis metacarpi, and was inserted by a thin tendon into the terminal phalanx of the first digit. In *Castor* it rises from the upper part of the dorsal surface of the ulna in common with the extensor indicis; it is inserted into the thumb as in *Hystrix*, but sends a slip to the common tendon on the dorsum of the index.

Extensor Indicis.—The extensor indicis rises from the dorsal surface of the ulna about its middle, and joins the tendon of the extensor communis digitorum on the dorsum of the index. In *Hystrix* a small slip was noticed, which ran down to lose itself on the dorsum of the fourth metacarpal bone. In *Castor* the muscle is blended with the extensor primi internodii as above stated.

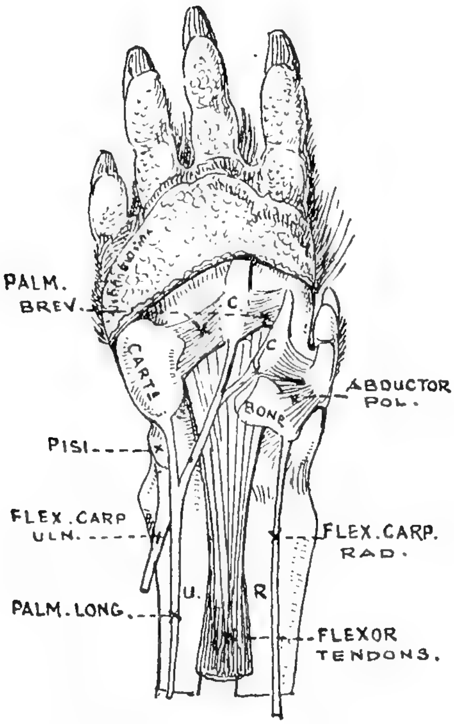
Palmaris Brevis.—This muscle is usually well marked and is attached to the pisiform bone and skin on the inner side of the palm; from this it runs transversely across to the radial side, being interrupted by the palmar cartilage or cartilages to which it is attached. In the Dipodidæ, in which a transverse bar of bone runs across the palm, it is very slightly marked.

In *Capromys melanurus* Dobson [2] describes it as sending a slip to act as the flexor perforatus of the little finger; this slip is what I describe, after Mivart and Murie, as flexor brevis manus.

[1] P. Z. S. 1866, p. 383.
[2] P. Z. S. 1884, p. 234.

In *Cœlogenys* the muscle is interrupted by three palmar cartilages.

Fig. 5.



Right fore foot of *Cœlogenys paca.*

Flexor Brevis Manus.—This muscle rises from the palmar ossicle on the radial side of the palm, and runs obliquely across to form the flexor perforatus for the fifth digit, usually joining the small flexor sublimis slip to that digit. It is supplied by the ulnar nerve.

Muscles of the Thumb.—Owing to the slight development of the thumb these muscles are difficult to define accurately. The abductor pollicis is the most definite; it always rises from the radial part of the palmar cartilage, and is inserted into the base of the proximal phalanx of the thumb. In the Dipodidæ and Caviidæ this and the other thumb-muscles are practically absent.

When the flexor brevis is present it rises either from the semilunar cartilage over the bases of the metacarpals (as in *Cœlogenys*) or from the palmar cartilage (*Capromys* according to Dobson [1]).

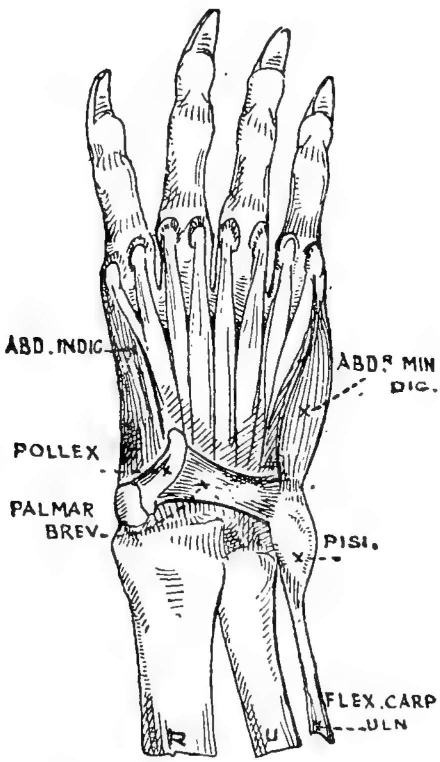
The opponens consists of a very few fibres; it is found in most of the Sciuromorpha except *Castor*; its attachments are from the above-mentioned semilunar cartilage to the metacarpal bone.

The adductor is best marked in the Octodontidæ (*Octodon, Myopotamus,* and *Capromys* [1]); in *Myopotamus* it is quite distinct,

[1] P. Z. S. 1884, p. 234.

and runs from the base of the third metacarpal to the proximal phalanx of the thumb.

Fig. 6.

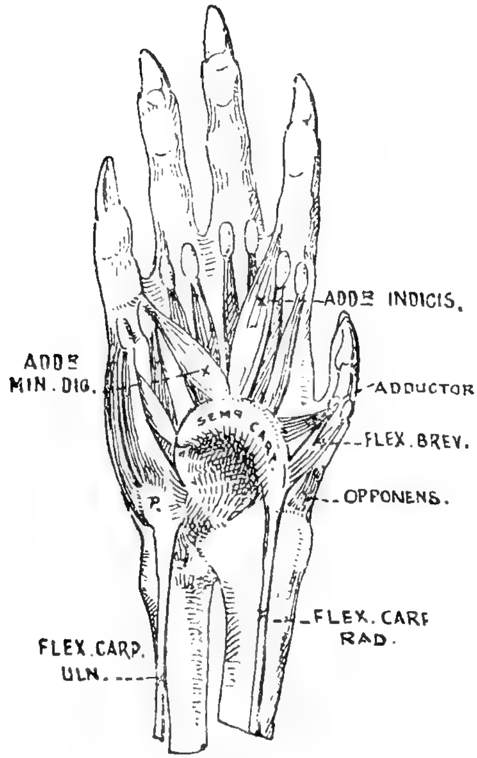


Left fore foot of *Ceredon rupestris.*

Muscles of the Little Finger.—Two muscles in most cases rise from the pisiform and run to the inner sesamoid bone on the palmar surface of the head of the metacarpal bone, and so to the base of the proximal phalanx; both of these I regard as abductor minimi digiti. The flexor brevis minimi digiti is represented by the ulnar slip of the interosseous layer of muscles going to the same place as the last. The opponens minimi digiti I have never seen. The adductor minimi digiti is sometimes present, running from the centre of the semilunar cartilage, superficial to the interossei, to the outer sesamoid bone of the little finger; it is present in *Myopotamus*, *Hystrix*, *Cœlogenys*, and *Xerus.* (See fig. 7.)

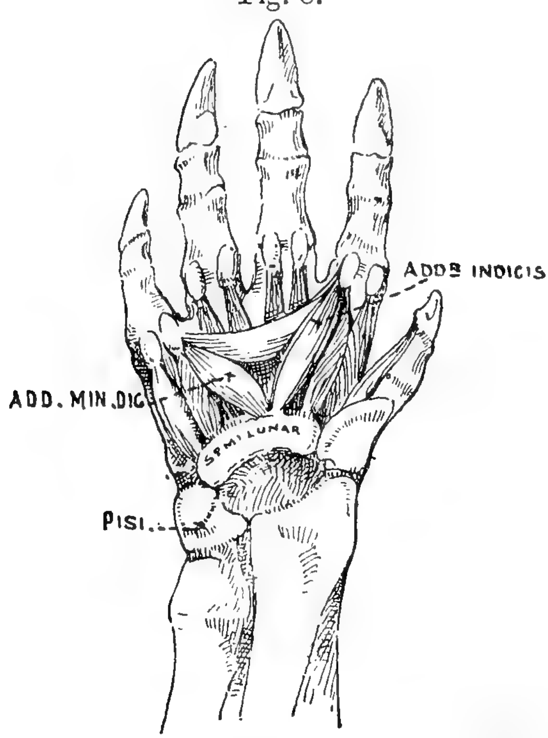
Adductor Indicis.—Rises by the side of the adductor minimi digiti, and is attached to the ulnar sesamoid bone of the index. In *Hystrix* a muscle rises from its insertion, and runs across the metacarpal bones to the insertion of the adductor minimi digiti in a semilunar curve, with the concavity towards the tips of the fingers. (See fig. 8, p. 273.)

Fig. 7.



Right fore foot of *Cœlogenys paca* (deep dissection).

Fig. 8.



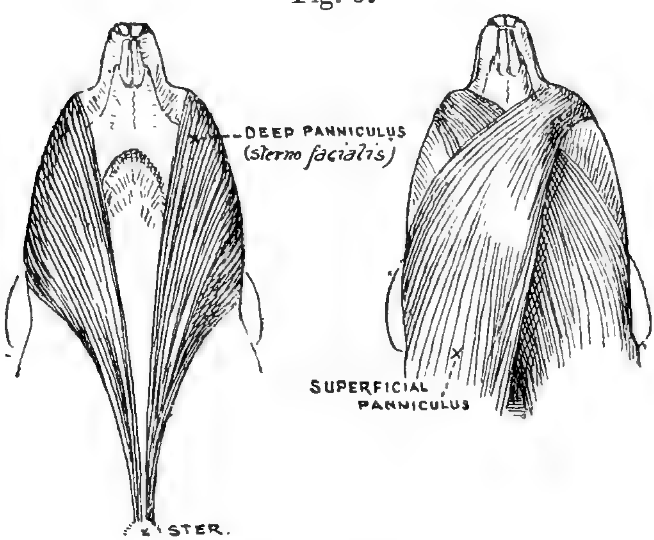
Right fore foot of *Hystrix cristata* (deep dissection).

Interossei.—There are eight interossei, which all lie in the same plane, rising from the semilunar cartilage and being inserted into the eight sesamoid bones in front of the four metacarpo-phalangeal joints. The most ulnar of these has already been described as the flexor brevis minimi digiti. In *Castor* only six of these are present.

Muscles of Trunk.

Panniculus Carnosus.—The panniculus is well marked in Rodents, and consists in many places of two or more layers of fibres running in different directions. The superficial panniculus in the neck rises from some of the face-muscles, more especially the orbicularis oris, and runs back along the side of the neck to be attached to the spine of the scapula; it probably corresponds to the human platysma. In *Spermophilus*, in which the cheek-pouches are present, part of this muscle is specially developed, and runs from the end of the pouch to the metacromial process. On the ventral surface of the neck the fibres decussate across the middle line, and run backwards and outwards over the pectoral region; as a rule, these decussating fibres are more or less scattered, but in *Octodon* they are very well marked, rising from a small origin a little to the side of the symphysis menti, and spreading out in a fan-shaped manner to cover the opposite side of the neck. Deep to these fibres lies the sterno-facialis, which is attached to the anterior part of the sternum and runs forwards to spread out over the masseter, covering the sterno-mastoid in its course; it is very well marked in all the Octodontidæ.

Fig. 9.

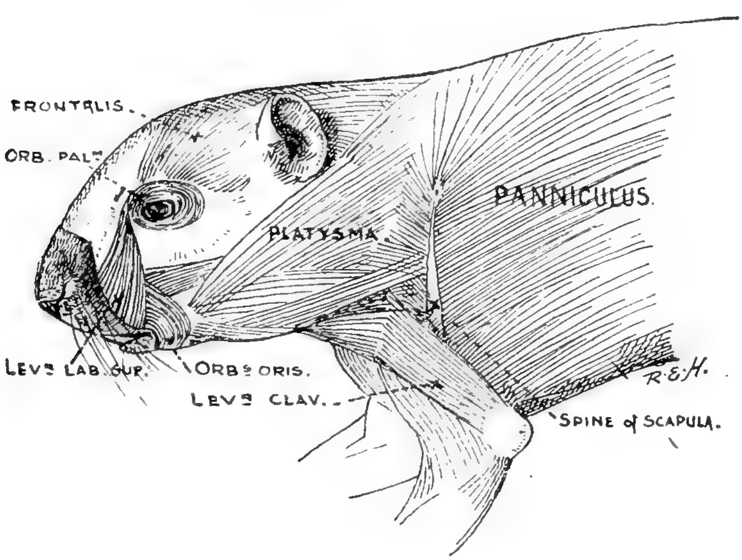


Panniculus of *Octodon.*

The panniculus is not well marked on the dorsum of the neck, but over the trunk it is found as a thick mass; over the shoulders the fibres of this converge to be attached to the acromion and spine for a variable extent, as well as to the fascia of the outer side of the arm and the pectoral ridge of the humerus. In the Caviidæ these fibres to the arm are specially well developed, and in *Ceredon* some of them extend as far as the internal condyle.

The abdominal panniculus divides about the lateral line of the body into a superficial and a deep layer, which, as they approach the ventral region, embrace the pectoral, the superficial fibres passing over the muscle to be lost on its surface, the deep being attached to the cartilages of some of the true ribs close to the sternum and deep to the pectoral[1]. Posteriorly the panniculus

Fig. 10.



Panniculus of *Hystrix cristata.*

ends in a fairly well-defined margin over the gluteal muscles; the fibres of this part running round to the front and inner side of the thigh to terminate in the fascia there. I have never seen any attachment to the femur. Over the inguinal region there are several planes of fibres; some of these unite in the middle line under the ventral surface of the penis, forming a sling to keep that organ close to the body; this arrangement is well seen in *Cœlogenys.* The ventral and lateral parts of the panniculus of the body are supplied by the great internal anterior thoracic nerve, which runs back from the internal chord of the brachial plexus: the cervical part is supplied by the superficial cervical and facial nerves.

Latissimus Dorsi.—The latissimus dorsi rises from a large number of the posterior thoracic spinous processes, the posterior three or

[1] See author's contribution to Proc. Anat. Soc., printed in the Journal of Anatomy, xxvi. p. x (1892).

four ribs, and the lumbar aponeurosis. It is inserted by a flat tendon into the upper part of the anterior surface of the humerus internal to the pectoral ridge. Its relation to the teres major has already been noticed under the head of that muscle. Very often some of the fibres of the muscle are continued across the axilla to blend with the pectoralis major. The dorso-epitrochlearis is always present, occasionally blending with the fascia over the triceps, but more often being well marked and inserted into the olecranon process. In the Hystricidæ and in *Castor* the tendon of the muscle is inserted in front, behind, and below the teres major in such a manner that a section of it would appear like the letter **J**. In *Capromys* and *Castor* a number of fibres were seen passing in front of the axillary vessels to the pectoral. The dorso-epitrochlearis is, perhaps, least well seen in *Lagostomus* and *Dasyprocta*, best in *Sphingurus*.

Trapezius.—The trapezius may or may not be divided into an anterior and posterior portion, separated by a fascial interval. Its origin is from the occipital curved line, ligamentum nuchæ, and the thoracic spines, except the last three or four. It is inserted into the spine and acromial process of the scapula, and often into the clavicle.

In the Dipodidæ the muscle is divided into two distinct parts, the anterior of which is the larger, and goes to the acromion and the greater part of the spine: the posterior is only attached to the root of the spine (*D. ægyptius*, *D. hirtipes*, *Alectaga indica*).

In the Octodontidæ the two parts of the muscle may be made out, but they are practically continuous: the insertion is continued on to the outer part of the clavicle (*Octodon*, *Aulacodus*, *Capromys*).

In *Hystrix* the muscle is single and does not reach the clavicle.

Among the Chinchillidæ, *Chinchilla* has an extended cranial origin from the surface of the bulla, while in both it and *Lagostomus* some of the fibres pass over the clavicle to blend with the deltoid.

In the Dasyproctidæ the muscle is divided into two parts, some of the cranial fibres being prolonged down on the outer side of the humerus for some distance (*Dasyprocta*, *Cœlogenys*).

In the Caviidæ the muscle is divided into two distinct parts and does not reach the clavicle (*C. cobaya*, *Ceredon rupestris*, *Dolichotis patagonica* [1]).

In the Sciuromorpha the muscle has one continuous origin: in *Sciurus* and *Pteromys* it is not attached to the clavicle, while in *Castor* it just reaches the outer end of that bone. In *Arctomys*, *Spermophilus*, and *Xerus* the inner part of the muscle is separated from the rest by the levator claviculæ, and lies over the cleido-mastoid, making that muscle appear double: in *Arctomys* this slip is shifted so far inwards that it becomes attached to the front of the sternum.

Rhomboideus.—The rhomboideus capitis major and minor rise by one continuous origin from the superior curved line of the

[1] Beddard, P. Z. S. 1891, p. 236.

occiput, from the ligamentum nuchæ, and from the anterior three or four dorsal spines and supraspinous ligaments; the insertion is into the whole length of the vertebral border of the scapula, the occipital fibres also going to the fascia over the inner part of the supraspinatus.

Sciurus and *Pteromys* differ in having a slight separation between the occipital and cervical portions, but this is not seen in *Xerus* and *Spermophilus*.

Serratus Magnus and Levator Anguli Scapulæ.—These two muscles are in the same plane and usually have a continuous origin, so that it is difficult to define their line of demarcation. They rise from the transverse processes of several cervical vertebræ, and from the sides of 7 to 9 of the anterior ribs by fleshy digitations. The insertion is into the vertebral border of the scapula. In the following animals a separate slip rising from the atlas was found:—*Myopotamus*, *Sphingurus*, *Lagostomus*, *Sciurus*, *Pteromys*, and *Arctomys*.

The exact number of vertebræ and ribs from which these muscles arise in various Rodents are as follows:—

Dipus ægyptius	1–7 c. v.	1–8 ribs.
Capromys pilorides	2–7 „	1–9 „
„ *melanurus*[1]	3–7 „	1–6 „
Aulacodus	2–7 „	1–9 „
Myopotamus	1st & 3–7 „	1–8 „
Octodon	5–7 „	1–8 „
Hystrix	4–7 „	1–8 „
Sphingurus	1–7 „	1–7 „
Chinchilla	2–7 „	1–9 „
Lagostomus	1–7 „	1–8 „
Dasyprocta cristata	2–7 „	1–8 „
Cœlogenys	1–7 „	1–8 „
Cavia cobaya	1–7 „	1–9 „
Ceredon	2–7 „	1–9 „
Sciurus	1st & 3–7 „	1–8 „
Pteromys	1–7 „	1–7 „
Xerus	4–7 „	1–8 „
Arctomys marmotta ..	1st & 3–7 „	1–9 „
Castor canadensis	2–7 „	1–7 „

Serratus Posticus.—This muscle varies very much in different genera and apparently in different individuals. *Aulacodus* seems to show most satisfactorily its full development. In this animal the anterior part of the muscle rises from the ligamentum nuchæ and spines of the anterior dorsal vertebræ to be inserted into the ribs from about the 4th to the 12th, the direction of its fibres being backwards and outwards. The posterior part rises from the spines of the posterior dorsal and lumbar vertebræ by means of the lumbar fascia, and runs forwards and outwards to the posterior

[1] Dobson, P. Z. S. 1884, p. 234.

ribs from about the 9th to the last: there are thus two distinct layers of fibres running in opposite directions in the dorsal region. The variations that are met with consist of more or less complete suppression of these parts. In *Dasyprocta* and *Cavia cobaya*, for example, the posterior part is wanting and the anterior well developed, so that in the former there is a continuous layer of muscle, the fibres of which run in the same direction, stretching from the 4th to the 13th rib.

In *Sphingurus*, on the other hand, each part is equally diminished, so that there is a space between them resembling the arrangement in Man.

In the Dipodidæ the muscle is almost entirely represented by fascia.

Among the other animals examined *Ceredon* and *Pteromys* resembled *Aulacodus*, while *Cœlogenys*, *Arctomys*, and *Xerus* had the arrangement found in *Dasyprocta*. *Octodon* resembled *Sphingurus*, but was remarkable for having the posterior part of the muscle better developed than the anterior.

Sacro-lumbalis.—This muscle has the usual attachments. It is continued forwards by the accessorius, the limits of which are indistinguishable. This is succeeded by the cervicalis ascendens, which is attached to the transverse processes of the posterior three cervical vertebræ, except in *Dasyprocta* and *Cœlogenys*, where it only goes to the last two.

Longissimus Dorsi.—This muscle, as well as the semispinalis and multifidus, has the usual arrangement: their exact attachments vary with the number of vertebræ.

Transversalis Capitis and Colli.—When both these muscles are present they are continuous. The latter is attached to the transverse processes, except sometimes the first and often the last one or two. The transversalis capitis or trachelo-mastoid is attached to the base of the paroccipital process, except in *Castor*, where it goes to the base of the mastoid process. It is present in all the Sciuromorpha, as well as in the Octodontidæ, Hystricidæ, and Dasyproctidæ. In the Caviidæ it is present in *Ceredon*, but absent in *Cavia cobaya*. In the remaining families the muscle was not examined.

Splenius Capitis et Colli.—The splenius capitis is always present, and has the human attachments and relations.

The splenius colli was found in the Dasyproctidæ, where it was inserted into the anterior three transverse processes in *Dasyprocta* and into the transverse process of the atlas only in *Cœlogenys*.

A small slip representing this muscle was found in *Myopotamus*, but in no other animal was it seen.

Complexus.—This muscle has the usual attachments. It shows signs of being divided longitudinally into two parts; of these the outer is inserted by tendon and the inner by flesh. In some of the Hystricomorpha a slight tendinous intersection was seen in the inner part, reminding one of the biventer of Man; but this arrangement was not seen in the Sciuromorpha, except in *Castor*, in which, moreover, the inner and outer halves of the muscle were very distinct.

Intercostals and Triangularis Sterni.—These muscles have nothing remarkable in their attachments: the latter usually rises from the posterior 4 or 5 pieces of the sternum.

Tail-Muscles.

The following muscles can be identified:—Extensor caudæ, externus and internus; Abductor caudæ, externus and internus; Flexor caudæ, externus, internus, and profundus.

With the following exceptions these muscles correspond to Meckel's general description of the tail-muscles of mammals [1]:—The abductor caudæ internus rises from one transverse process and arches over to the next but one, passing dorsal to the intermediate transverse process.

The abductor caudæ externus in *Myopotamus* does not rise from the tuber ischii, its usual origin, but from the pelvic fascia by the side of the lower part of the rectum.

In *Sphingurus* the ischial origin of this muscle is very well marked, as are also all the tail-muscles. In the flexor caudæ internus the most internal of the superficial tendons are inserted first, the deeper tendons coming to the surface round the outer side of these. In the flexor caudæ externus the most external tendons are first inserted, and the deeper ones reach the surface round the inner side of these.

In *Castor* a series of fleshy bellies rose from the articulations of the chevron bones to the caudal vertebræ; these soon became tendinous and ran backwards and outwards to be lost in the fat over the transverse process of the next vertebra but one. Each tendon was perforated by the one behind it.

Obliquus Externus Abdominis [2].—This muscle rises by fleshy digitations from a large number of the posterior ribs, generally about two-thirds of the total number, as well as from the lumbar aponeurosis. The fibres pass downwards and backwards to be inserted into the crest of the ilium, from which they pass across as Poupart's ligament to the anterior part of the body of the pubes. The next fibres are separated from these by a large triangular gap, the external abdominal ring, and are inserted into the anterior part of the body of the pubes. The fibres anterior to these pass ventral to the rectus to reach the linea alba. In the anterior part of the abdomen the fibres blend with those of the rectus, and in some cases are continued forwards with that muscle to the first rib. The intercolumnar fibres over the ring are well marked and form a pouch for the testes. There is very little aponeurosis near the linea alba, the most tendinous part being at Poupart's ligament.

[1] Traité général d'Anatomie comparée, p. 175.

[2] Owing to the fact that many of the animals I dissected had been eviscerated before they came to me, my observations on the abdominal muscles are not so complete as I could have wished.

In *Lagostomus*, *Hystrix*, and *Sphingurus* the muscle, on careful dissection, was found not to be continued forwards to the first rib with the rectus. In *Arctomys* it went not only to the first rib, but also to the junctions of the 2nd, 3rd, and 4th with the sternum.

Internal Oblique and Transversalis.—These muscles are closely blended, requiring careful examination to make out their separate attachments.

The internal oblique rises from the lumbar fascia, the crest of the ilium, and a large part of Poupart's ligament. The fibres run forwards and inwards to a few of the posterior ribs and to the linea alba. At the abdominal ring a muscular pouch representing the cremaster supports the testis. There is usually more aponeurosis ventrally than in the external oblique. The transversalis rises from the inner surfaces of a large number of the posterior ribs, from the lumbar fascia, from the iliac crest, and from the outer part of Poupart's ligament, and is inserted into the linea alba, passing deep to the rectus in its whole extent.

In *Aulacodus*, *Octodon*, *Dasyprocta*, *Cavia cobaya*, and *Sciurus* the muscles are practically inseparable, but in *Dasyprocta* a white line was noticed running downwards and backwards from the cartilage of the last false rib to the outer edge of the rectus, which appeared to mark the place where the internal oblique became aponeurotic. In *Lagostomus* the internal oblique becomes aponeurotic near the edge of the rectus, forming a linea semilunaris. It passes superficial to the rectus, while the transversalis remains fleshy and passes deep to it.

In *Hystrix*, *Sphingurus*, *Cœlogenys*, and *Arctomys* the muscles are more separable, and the internal oblique rises from the outer three-quarters of Poupart's ligament as well as its other origins, and is inserted into the posterior ribs—into three in *Hystrix*, five in *Sphingurus*, and six in *Cœlogenys*.

Rectus Abdominis.—The rectus arises by one head from the ventral surface of the symphysis pubis and runs forwards between the internal oblique and transversalis, with which it is closely blended, to the ventral surface of the first rib near its junction with the sternum; it is also inserted into the succeeding four or five costal cartilages at their sternal ends by small slips. It has already been noticed that the external oblique is usually continued forwards with it. In *Sphingurus* it only reaches as far forwards as the second rib. The lineæ transversæ are very feebly marked; they are usually five or six in number, but in *Arctomys* only three could be made out.

The Octodontidæ are remarkable for having a well-marked decussation of the two recti close to their origin; this has been pointed out by Owen[1] and Dobson[2] in *Capromys fournieri* and *C. melanurus*, as well as by Martin in *Myopotamus*[3] and *Octodon*[4].

[1] P. Z. S. 1832, p. 68.
[2] P. Z. S. 1884, p. 234.
[3] P. Z. S. 1835, p. 176.
[4] P. Z. S. 1836, p. 72.

Owen describes the left rectus in *Capromys fournieri* as passing through a slit in the right, the right being therefore both superficial and deep to the left; this is practically what I found in *Octodon*, the only difference being that each rectus rose by two heads, the two belonging to the left muscle passing together between the two belonging to the right. In *Myopotamus*, according to Martin, the four heads alternate, one of the left being most superficial. The rectus in *Aulacodus* was not noticed.

Mivart and Murie [1] describe a well-marked decussation in the Agouti; this I did not see; indeed, in none of the animals examined was there any decussation approaching in distinctness that found in the Octodontidæ.

Psoas Parvus.—The psoas parvus varies very much in development among the Hystricomorpha; it rises from the sides of the bodies of a variable number of lumbar vertebræ, and is inserted into the ilio-pectineal eminence on the brim of the pelvis.

In the Dipodidæ the muscle is large and rises from all the lumbar vertebræ except the last one or two (*D. ægyptius, D. hirtipes*).

Among the Octodontidæ it is small and rises from the anterior 3 or 4 vertebræ, and from the crura of the diaphragm in *Aulacodus*, *Myopotamus*, and *Capromys*. In *Octodon* it was absent.

In the Hystricidæ it has the same arrangement (*Hystrix*, *Sphingurus*).

In the Chinchillidæ the muscle is large, and rises from all or nearly all the lumbar vertebræ (*Chinchilla*, *Lagostomus*).

In the Dasyproctidæ it is small, and rises from two or three of the central lumbar vertebræ.

In the Caviidæ it is very small and apparently often absent. In one specimen of *Ceredon* it was absent, while in another it rose from the 4th and 5th vertebræ. In two specimens of *Cavia cobaya* it was present, in one it was absent.

In the Sciuromorpha it is always present and well marked; it usually rises from the anterior four or five lumbar vertebræ.

Psoas Magnus.—This muscle shows much less variation than that of the psoas parvus. It rises from the sides of the bodies and ventral surfaces of the transverse processes of all the lumbar vertebræ, and occasionally from the first sacral. The muscle is usually more or less distinctly divided into an inner and outer part by some of the branches of the lumbar plexus, this division being specially well seen in *Spermophilus*. It has the usual insertion as in Man.

Iliacus.—The iliacus rises from the iliac surface of the ilium; it soon joins the psoas, with which it is inserted. Nothing characteristic was noticed about it in the different animals examined.

Quadratus Lumborum.—This muscle rises from the sides of the bodies of the posterior dorsal vertebræ, usually the last six, and from the tips of the transverse processes of the lumbar vertebræ; it is inserted by a narrow tendon into the ventral surface of the

[1] P. Z. S. 1866, p. 383.

ilium just external to the synchondrosis. Its arrangement is very constant.

Muscles of Posterior Extremity.

Gluteus Maximus, Tensor Fasciæ Femoris, and Sartorius.—These three muscles in Rodents are so closely united that they form practically one sheet, which rises from the anterior extremity or crest of the ilium, and from the fascia over the gluteus medius by which they are connected to the spinous processes of the posterior lumbar, sacral, and anterior caudal vertebræ. Occasionally it also rises from the outer part of Poupart's ligament and the inferior border of the ilium. The fibres which rise most anteriorly cross the front of the thigh obliquely, and are inserted into the fascia above and to the inner side of the patella; these fibres correspond to the sartorius. The fibres rising behind these run down the outer side of the thigh and are inserted into the fascia, there forming the tensor fasciæ femoris. The rest of the muscle, or the gluteus maximus proper, is inserted partly into the fascia of the outer side of the thigh, and partly into the femur, sometimes quite high up, at others near its lower end. The nerve supply of these three muscles is the superior gluteal.

In the Dipodidæ few, if any, fibres were noticed going to the femur (*Dipus ægyptius*).

In the Octodontidæ the sartorius is well developed, reaching to the patella, while the bony insertion of the gluteus maximus is into the posterior surface of the femur at the junction of the middle and lower thirds (*Myopotamus*, *Capromys*, *Pilorides*, *Aulacodus*).

In the Hystricidæ the arrangement is the same, except in *Sphingurus*, in which the insertion of the gluteus maximus is into the middle of the femur (*Hystrix cristata*, *Sphingurus*, *Erethizon dorsatus*[1]).

In the Chinchillidæ and Dasyproctidæ the arrangement is the same (*Chinchilla*, *Lagostomus*, *Dasyprocta cristata*, *Cœlogenys*).

In the Caviidæ the gluteus maximus has the same bony attachment as in *Sphingurus* (*Cavia cobaya*, *Ceredon rupestris*).

Among the Sciuromorpha the sartorius rises from the outer part of Poupart's ligament and runs to the inner side of the knee, where it blends with the gracilis in *Sciurus*, *Spermophilus*, and *Pteromys oral.* The gluteus maximus is inserted by two slips, one into the third trochanter, the other into the lower part of the femur. It also has, of course, the usual fascial insertion.

In *Xerus* the arrangement is the same, except that the gluteus maximus has its bony insertion into the junction of the upper and middle thirds of the femur.

In *Arctomys marmotta* this muscle is inserted into the third trochanter and fascia.

In *Castor canadensis* no sartorial portion was seen, the gluteus maximus being inserted into a ridge halfway down the femur.

[1] P. Z. S. 1882, p. 271.

Gluteus Medius.—The gluteus medius rises from the fascia over the posterior part of the erector spinæ, and its continuation into the tail-muscles, from the crest of the ilium and the inferior border of that bone for some distance. It is usually a very large muscle. It is inserted into the outer side of the great trochanter by a number of tendinous slips placed close together.

This description applies to all the animals dissected, except the Octodontidæ, in which there is no origin from the ilium (*Myopotamus, Capromys, Aulacodus*).

Gluteus Minimus.—This muscle rises from the external surface of the ilium, below the great sciatic notch, and is inserted into the top and front of the great trochanter. It is usually small and very difficult to clearly separate from the gluteus medius, scansorius, and pyriformis. In *Aulacodus* it is a large muscle folded on itself, rising from the fascia over the tail-muscles as far forwards as the crest of the ilium, then from the outer side of the ilium as far back as the acetabulum; it thus springs from a horseshoe-shaped origin above, below, and in front of the sacro-sciatic notch, which it encloses in the concavity of the horseshoe. *Capromys* presents a somewhat similar arrangement, but in the other animals examined there was no variation of any importance from the normal.

Scansorius.—The scansorius may be present as a distinct muscle, or may be so blended with the gluteus minimus as to make it impossible to distinguish it. When it is distinct it rises from the inferior border of the ilium, and is inserted into the anterior surface of the great trochanter.

In the Dipodidæ it is present as a distinct muscle (*Dipus ægyptius*).

In the Octodontidæ it is probably represented by the inferior portion of the gluteus minimus; in *Myopotamus* it is more distinct than in *Capromys* or *Aulacodus*.

In the Hystricidæ nothing was seen of it in *Hystrix* or *Sphingurus*; in *Erethizon dorsatus* it is absent according to Mivart[1], but in *E. epixanthus* it is well marked according to Windle[2].

In the Chinchillidæ I made it out in *Viscacha*, but failed to in *Chinchilla*.

In the Dasyproctidæ it is present both in *Dasyprocta* and *Cœlogenys*, but is much more distinct in the former.

In the Caviidæ it is present, and is inserted into a tubercle on the outer side of the great trochanter at its junction with the shaft (*Cavia cobaya, Ceredon rupestris*).

It was absent in all the Sciuromorpha examined (*Sciurus, Pteromys, Xerus, Spermophilus, Arctomys, Castor*).

Pyriformis.—The pyriformis rises from the ventral surface of the sacrum close to the sciatic notch, through which its fibres pass, and from the outer surface of the ilium in front of the notch; by the latter part of its origin it is often fused with the gluteus minimus. It is inserted into the top of the great trochanter.

[1] P. Z. S. 1882, p. 271. [2] Journ. Anat. vol. xxii. p. 126.

The intra-pelvic portion seems often to be wanting, in which case it is very difficult to define the muscle.

In the Dipodidæ it is continuous with the gluteus minimus (*Dipus ægyptius*).

Among the Octodontidæ it is found between the two layers of the folded gluteus minimus in *Aulacodus* and *Capromys*; in *Myopotamus* and *Octodon* it is normal.

In the Hystricidæ it was not seen in *Hystrix*, but was present in *Sphingurus*.

In the Chinchillidæ it was not seen in *Chinchilla*, but was made out with some difficulty in *Viscacha*.

In the Dasyproctidæ it is large and well marked, partly overlapping the gluteus medius (*Dasyprocta, Cœlogenys*).

In the Caviidæ it rises from the sacrum, but is continuous with the posterior border of the gluteus minimus (*Cavia cobaya, Ceredon rupestris*).

In all the Sciuromorpha examined it was present and normal, except in *Castor*, where it was not seen.

Obturator Internus and Gemelli.—These muscles usually have the same origin as in Man, but they are inserted into the digital (trochanteric) fossa of the femur. The gemelli are large, especially the anterior one.

When the obturator internus is cut through a number of tendons are seen on its deep surface converging to the digital fossa; this is well shown in *Cœlogenys*. In *Castor canadensis* the origin of the obturator internus and gemellus posterior was taken up by the great tail-muscles, so that the anterior gemellus was the only part of this group present.

Obturator Externus.—In all the Rodents dissected, this muscle had the usual human attachments. Its insertion into the digital fossa is deep to that of the obturator internus.

Quadratus Femoris.—The quadratus femoris rises from the outer side of the tuber ischii, and is inserted into the back of the femur midway between the great and small trochanters. In the Hystricomorpha it is usually inserted by a narrow tendon, but in *Sphingurus* and the Sciuromorpha the insertion is fleshy and the muscle quadrilateral.

Biceps Femoris.—The biceps rises from the spines of the anterior caudal vertebræ and the fascia over the tail-muscles; also by a deep head from the tuber ischii. These two parts, as a rule, unite and are inserted into the outer side of the patella, and the fascia of the leg from the knee almost, if not quite, to the ankle.

This arrangement obtains in all the Rodents dissected, with the following exceptions:—In *Sphingurus* the two parts remain distinct, the superficial or caudal portion being inserted into the outer side of the patella and ligamentum patellæ, while the deep portion from the tuber ischii is joined by a slip from the posterior sacral vertebræ and is inserted into the fascia of the leg continuing the plane of insertion of the former part. In *Erethizon dorsatus* [1]

[1] P. Z. S. 1882, p. 271.

and *E. epixanthus*[1] the same arrangement is found. This corresponds to the arrangement that Mivart and Murie[2] have described in the Agouti, but presents a clearer illustration of it than is found in that animal.

In *Sciurus* and *Pteromys* the superficial head is small, and instead of rising from the caudal vertebræ comes from the deep surface of the gluteus maximus. *Xerus*, *Spermophilus*, *Arctomys*, and *Castor* as well as all the other rodents have the typical arrangement. In *Myopotamus* a strong tendon runs to the head of the fibula.

Semitendinosus.—The semitendinosus rises by two heads, the most superficial of which springs from the sacral and anterior caudal spines and slightly from the lumbar fascia. The deep head rises from the tuber ischii deep to the biceps. These two parts unite in the upper part of the thigh, and are inserted into the cnemial crest of the tibia and the fascia of the leg below this.

This arrangement applies to all the animals dissected, except the Hystricidæ and *Pteromys*.

In the Hystricidæ the muscle rises only from the sacral and caudal spines, but in *Hystrix cristata* and *Erethizon dorsatus*[3] a small slip is given to reinforce the biceps from this. In *Sphingurus* no slip goes to the biceps. In *Pteromys* the muscle rose from the tuber ischii; but I am inclined to regard this as an individual variation, because all the other Sciuromorpha, including *Sciurus*, have both heads.

Semimembranosus.—This muscle consists of two parts, which are sometimes distinct, at others blended. The main part of the muscle rises from the tuberosity and adjacent part of the ramus of the ischium, and is inserted by a rounded tendon into the internal tuberosity of the tibia. It is supplied by the great sciatic nerve.

The second portion is often included in the description of the adductors, with which it is frequently closely blended; its insertion is always into just above the internal condyle of the femur where, in Man, the adductor tubercle is situated; this insertion is separated from that of the adjacent adductors by the femoral artery. The origin of this part of the muscle is not constant—sometimes it rises separately from the sides of the caudal vertebræ, sometimes from the tuberosity of the ischium in common with the other head of the muscle, and sometimes from the ramus of the ischium, as part of the adjacent adductor magnus. Whatever its origin it is always supplied by the great sciatic nerve and never by the obturator which supplies the adductors.

In the Dipodidæ the muscle rises from the tuberosity of the ischium, and is inserted into the lower part of the back of the femur and the internal tuberosity of the tibia; the oblique condylar slip is separate and also rises from the tuber (*Dipus ægyptius*).

In the Octodontidæ the origin is from the tuber and ramus of

[1] Journ. Anat. 1888, p. 126.
[2] P. Z. S. 1866, p. 383.
[3] P. Z. S. 1882, p. 271.

the ischium; the insertion is normal, but an expansion is continued forwards deep to the internal lateral ligament of the knee.

The oblique slip in *Myopotamus* and *Octodon* rises from the tuber ischii, but in *Aulacodus* it comes from the sacral vertebræ as in *Hystrix* (*Aulacodus*, *Capromys melanurus*[1], *Myopotamus*, *Octodon*).

In the Hystricidæ the arrangement is not constant: *Hystrix* and *Erethizon* entirely resemble *Aulacodus* in the origin of the two parts, but in *Sphingurus* the second slip rises from the tuber ischii with the rest of the muscle instead of from the sacral vertebræ; it soon becomes distinct to run to the internal condyle.

Among the Chinchillidæ, *Lagostomus* has the same arrangement as *Hystrix* and *Aulacodus*, but *Chinchilla* resembles *Sphingurus*.

In the Dasyproctidæ the two parts of the muscle rise together from the tuber and ramus and only separate towards the lower part of the thigh (*Dasyprocta*, *Cœlogenys*).

In the Sciuromorpha the condylar portion of the muscle is separate from the rest and closely connected to the adductor mass, with which it will for convenience be described; it is, however, still supplied by the great sciatic nerve (*Sciurus*, *Pteromys*, *Xerus*, *Spermophilus*, *Arctomys*, *Castor*).

It will be seen that the Rodents illustrate the changes by which part of the semimembranosus becomes part of the adductor magnus. In *Cœlogenys*, for example, the slip going to the condyle of the femur is part of the semimembranosus: in *Sphingurus* it rises with that muscle but soon separates from it; in *Hystrix* it is a perfectly distinct muscle, having a different origin to the semimembranosus or adductors, while in *Sciurus* it is intimately blended with the adductors, though still preserving its original nerve supply. It is remarkable, too, that, except for its constant arrangement in the Sciuromorpha, it seems to be of very little classificatory value.

Gracilis.—The gracilis is very often double. The most anterior portion, which has sometimes been described as the sartorius, rises from the ilio-pectineal line and from the anterior part of the ventral surface of the symphysis pubis; it is inserted into the inner border of the patella and ligamentum patellæ. The posterior gracilis usually rises from the posterior part of the ventral surface of the symphysis and from the subpubic arch; its insertion is into the cnemial crest of the tibiæ and the fascia of the leg, which makes it a powerful internal rotator of the tibiæ. The two muscles are always supplied by the obturator nerve.

Sometimes the gracilis is a single muscle, but it then usually shows signs of a separation.

The general rule seems to be that the Hystricomorpha have two graciles and the Sciuromorpha one. The two exceptions that I have met with are *Aulacodus*, in which the muscle is single, and *Castor*, in which it is double.

Pectineus.—The pectineus rises from the ilio-pectineal eminence and line under cover of the anterior gracilis, and is inserted into

[1] P. Z. S. 1884, p. 234.

the upper third to half of the linea aspera of the femur. The only exceptions to this that I have met with are the Caviidæ, in which the muscle rises by a tendon from the ilio-pectineal eminence only (*Cavia cobaya*, *Ceredon rupestris*), and *Castor*, in which it is very strongly developed and is inserted into the whole length of the shaft of the femur.

Quadriceps Extensor Cruris.—The four muscles composing the quadriceps have the same origin and insertion that they have in Man, and are practically the same in all the Hystricomorpha and Sciuromorpha. The rectus rises by two heads, which are sometimes quite distinct, but at others so short as to be almost indistinguishable. They are perhaps most distinct in the Hystricidæ, least so in the Sciuridæ. The crureus rises from the whole of the anterior surface of the femur by a series of about 30 fleshy arches. The two vasti can usually be separated easily from the crureus; as a rule the vastus externus is the larger.

Adductors.—It is extremely difficult in dissecting a Rodent to say which part of the adductor mass corresponds to the adductor longus, brevis, or magnus of human anatomy.

In *Dipus ægyptius* the adductor longus rises from the front of the pubes under cover of the gracilis and runs to the inner side of the patella. The adductor magnus and brevis come from the whole subpubic arch and are inserted into the upper two-thirds of the back of the femur. A good deal of the adductor mass, however, in this animal seems to be blended with the semimembranosus.

In the Octodontidæ and Chinchillidæ the adductors longus and brevis seem to be fused, although in *Aulacodus* and *Octodon* a division was readily made out. These coalesced muscles rise from the inner part of the pectineal line and ventral surface of the symphysis, and are inserted into the upper half of the linea aspera.

In the Hystricidæ, as Meckel[1] observes, the three parts of the muscle can be seen; this is especially the case in *Sphingurus*, but it is doubtful whether the three parts correspond morphologically with the three adductors in Man.

Among the Dasyproctidæ, *Dasyprocta* has very much the same arrangement as the Chinchillidæ, but in *Cœlogenys paca* the adductor brevis has a distinct insertion by a ribbon-like tendon into the upper part of the linea aspera.

It will be noticed that nothing has been said here about fibres passing to just above the internal condyle; these have already been described with the semimembranosus.

Among the Sciuromorpha the adductor mass is much more broken up.

In *Sciurus*, which serves as a good type, there are five portions inclusive of the slip already described with the semimembranosus. The following is the arrangement in *Sciurus*:—(1) Most anterior portion from the ilio-pectineal line to the middle of the posterior border of the femur; this part is distinct from the pectineus. (2) A slip from the posterior part of the pubic symphysis to above

[1] Traité général d'Anatomie comparée, vol. vi. p. 378.

the internal condyle. (3) A slip rising behind this by a very thin tendon from the same origin and running to the middle third of the posterior border of the femur. These three probably represent the adductors longus and brevis. (4) A slip from the tuber ischii running obliquely across the leg to above the internal condyle and also to the posterior surface of the femur above it. This is supplied by the great sciatic nerve instead of the obturator, and is the second part of the semimembranosus joined to the adductors. (5) A massive muscular slip from the outer side of the tuber ischii to the upper part of the shaft of the femur. In *Spermophilus*, *Xerus*, *Arctomys*, and *Castor* the arrangement is essentially the same, but in *Pteromys* an extra deep slip was observed running behind the obturator nerve to the upper part of the femur, while the portion described as No. 4 in *Sciurus* had a much more extensive attachment up the femur. Meckel describes five heads in *Arctomys*. In *Castor*, although the arrangement is identical with that of *Sciurus*, the muscle is very massive and the separate parts much less easy to identify.

Tibialis Anticus.—This muscle usually rises from the upper part of the outer surface of the tibia, and is inserted into the internal cuneiform and first metatarsal by two slips. In those cases in which the halux is absent or rudimentary the tendon does not divide into two at its insertion.

In *Dipus ægyptius* its insertion is into the inner side of the base of the great metatarsal bone.

Among the Octodontidæ, *Myopotamus* and *Capromys* have a double insertion, *Aulacodus* and *Octodon* a single one. In the Hystricidæ it has a double insertion (*Hystrix*, *Sphingurus*, *Erethizon*). Meckel[1] says that in *Hystrix* it is blended with the extensor proprius hallucis; but this I did not find. In the Chinchillidæ it not only rises from the tibia but from the tendon of origin of the extensor longus digitorum (*Chinchilla*, *Lagostomus*).

In the Dasyproctidæ it rises from the front of the external condyle of the femur by a tendon which is anterior to that of the extensor longus digitorum, as well as by fleshy fibres from the upper part of the tibia; it is inserted by a single tendon, which in *Dasyprocta* goes to the base of the internal (2nd) metacarpal, and in *Cœlogenys* to the internal cuneiform. In the Caviidæ it has the same origin as in the Chinchillidæ, and is inserted into the rudimentary fused internal cuneiform and first metatarsal, which is found under the base of the internal (2nd) metatarsal.

Mivart and Murie[2] found a femoral origin, as in the Dasyproctidæ, in some of the Guinea-pigs they dissected. Beddard[3] describes the same arrangement in *Dolichotis patagonica*.

In three Guinea-pigs I have not found a femoral origin once, and the specimen of *Ceredon rupestris* I dissected did not show it. I also did not see it in *D. patagonica*. Further observation is needed

[1] *Op. cit.* p. 410.
[2] P. Z. S. 1866, p. 383.
[3] P. Z. S. 1891, p. 236.

to show how far a femoral origin of this muscle is characteristic of the Caviidæ.

In the Sciuromorpha the muscle is specially well developed and encroaches on to the head of the fibula. There is no femoral head except in *Castor*, but here it is not nearly as well developed as in the Dasyproctidæ and does not rise as in them by a definite tendon (*Sciurus*, *Pteromys*, *Xerus*, *Spermophilus*, *Arctomys*, *Castor*).

Extensor Longus Digitorum.—This muscle in all cases rises by a tendon from the front of the external condyle just outside the patellar surface on that bone. This is its only origin, except in *Sphingurus* and *Dipus*, where a few accessory fibres rise from the outer tuberosity of the tibia. The muscle passes down and becomes tendinous in the lower part of the leg, being bound down by two well-marked annular ligaments, the lower of which is attached to the calcaneum and forms a distinct sling.

The tendon divides for the four outer toes, when these are present, being inserted into the middle and terminal phalanges. When there are only three toes the middle one sometimes has a double tendon, as in *Lagostomus* and *Cavia cobaya*. The tendons are united by vincula, which in *Myopotamus* spread out in the web between the toes; they are strongly marked in *Castor*.

Extensor Proprius Hallucis.—This small muscle rises from the middle or lower third of the front of the fibula and is inserted into the terminal phalanx of the hallux, when that toe is present. In *Dipus ægyptius* it is absent. In the Octodontidæ it either unites with or sends a slip to the extensor longus digitorum tendon to the second toe (*Aulacodus*, *Octodon*, *Myopotamus*). In the Hystricidæ it rises from the lower part of the shaft of the fibula.

In the Chinchillidæ it is absent (*Chinchilla*, *Lagostomus*).

In the Dasyproctidæ it is a large muscle and rises from the upper three-quarters of the fibula; in *Cœlogenys* it is inserted as in the Octodontidæ; while in *Dasyprocta*, in which the hallux is wanting, it goes entirely to the second toe, joining the long extensor tendon there.

In the Caviidæ it is present and runs to the second (internal) toe; it is bound down to the inner side of the base of the innermost metatarsal by a short fibrous tunnel (*Ceredon rupestris*, *Cavia cobaya*, *Dolichotis patagonica* [1]).

Among the Sciuromorpha it rises from the middle of the fibula and is inserted only into the hallux in *Sciurus*, *Spermophilus*, *Xerus*, and *Arctomys*. In *Pteromys* it springs from the lower third of the bone and sends a small slip to the second toe. In *Castor* it rises from a strong oblique fibrous band which runs from the head of the fibula to the lower end of the tibia, so that the muscle has no bony origin; it rises opposite the middle of the fibula, and is inserted into the first two toes.

Extensor Brevis Digitorum.—This muscle rises from the upper and anterior part of the calcaneum, and runs to join the tendons of

[1] Beddard, P. Z. S. 1891, p. 236.

the extensor longus on the dorsum of the toes. It is present in all the Sciuromorpha and Hystricomorpha except *Dipus*. In no case was it seen to give a tendon to the hallux, but tendons to the second and third toes were always met with. In *Cœlogenys*, *Arctomys*, and *Erethizon dorsatus*[1] it sends a small slip to the fourth toe, but it does not follow that when the four outer toes are well developed a tendon goes to each; for in *Octodon*, in which all the five toes are present, the muscle only sends slips to the second and third.

Peroneus Longus.—The peroneus longus showed very little variation in the Rodents examined. It rises from the head and the upper part of the outer surface of the shaft of the fibula, also in many cases by a few fibres from the external lateral ligament of the knee. Its tendon passes through a groove on the outer side of the external malleolus, grooves the cuboid, and is inserted into the base of the first metatarsal bone, or, when that is absent, into the second. In one specimen of *Hystrix* I failed to find it, but it was present in another which I looked at.

Peroneus Brevis.—The peroneus brevis rises either from the upper or middle portions of the outer surface of the fibula. Its exact origin is very variable and is not constant for animals of the same group. It passes behind the external malleolus and is inserted into the base of the fifth metatarsal bone.

In *Dipus ægyptius* it is absent.

In the Octodontidæ, Hystricidæ, and Chinchillidæ it is present.

In the Dasyproctidæ it is absent in *Dasyprocta*, but present in *Cœlogenys*.

In the Caviidæ it is present in *Cavia cobaya* and *Ceredon*, but absent in *Dolichotis*[2]. In the two former it is inserted into a nodule of bone (rudimentary fifth metatarsal?) under the base of the fourth metatarsal. In one specimen of Guinea-pig I found it dividing into two parts; the anterior, which was the smaller, had the usual insertion, while the posterior was attached to the anterior and upper part of the external surface of the calcaneum. Beddard describes a somewhat similar arrangement in the peroneus quarti digiti of *Dolichotis*[2].

The muscle is present and normal in all the Sciuromorpha.

Peroneus Quarti Digiti.—This muscle arises from the lower part of the outer surface of the fibula below the origin of the peroneus quinti, when that muscle is present. When the p. quinti is absent the p. quarti rises from the upper part of the outer surface of the fibula. The insertion is into the extensor tendon on the dorsum of the fourth toe.

In *Dipus ægyptius* it is present and rises from just below the p. longus. In the Octodontidæ it rises from the lower part of the fibula (*Octodon*, *Myopotamus*, *Capromys*, *Aulacodus*).

In the Hystricidæ it is present in *Hystrix*, but absent in *Sphin-*

[1] P. Z. S. 1882, p. 271.
[2] P. Z. S. 1891, p. 236.

gurus, and presumably in *Erethizon dorsatus* and *epixanthus*, as it is not mentioned by Mivart[1] or Windle[2].

In the Chinchillidæ it rises from the upper part of the fibula, the p. quinti being absent (*Chinchilla, Lagostomus*).

In the Dasyproctidæ it rises from the whole outer surface of the fibula in *Dasyprocta*, in which there is no p. quinti; in *Cœlogenys* it only rises from the lower third of the bone.

In the Caviidæ it resembles the Chinchillidæ in *Ceredon* and *Cavia cobaya*. Beddard mentions that it is present in *Dolichotis*.

It is always present in the Sciuromorpha, having the usual attachments.

In *Sciurus, Pteromys, Xerus*, and *Spermophilus* it rises from the lower quarter of the fibula and runs to the fourth digit.

In *Arctomys marmotta* it sent an additional slip to the third toe.

In *Castor* it was joined by a small muscular slip from the calcaneum, probably part of the extensor brevis digitorum.

It will be noticed that the only animals in which this muscle was wanting were the Tree-Porcupines.

Peroneus Quinti Digiti.—The p. quinti when it is present rises from the outer surface of the fibula above the last muscle, and is inserted into the extensor longus tendon on the dorsum of the fifth toe. It is present in the Octodontidæ (*Myopotamus, Capromys, Octodon, Aulacodus*), in the Hystricidæ (*Hystrix, Sphingurus, Erethizon*), in *Cœlogenys*, and in all the Sciuromorpha examined.

It is absent in *Dipus ægyptius*, in the Chinchillidæ (*Chinchilla, Lagostomus*), in the Caviidæ (*Cavia cobaya, Ceredon, Dolichotis*), and in *Dasyprocta*.

The presence or absence of the p. quinti seems to depend entirely on the degree of development of the fifth toe. It is not nearly as persistent a muscle as the extensor proprius hallucis, which is so often found when no hallux exists; it seems indeed to precede the disappearance of its toe, because in *Chinchilla* the muscle is wanting, although there is a small fifth toe.

Gastrocnemius.—The gastrocnemius rises by two heads from the upper and back part of the two condyles, fabellæ often being present. The two heads unite with the soleus to form the tendo Achillis. The fibres of this tendon are twisted so that those that are derived from the inner head of the gastrocnemius become superficial and eventually external. In *Castor canadensis* the two heads remain separate as far as their insertion.

The presence or absence of the fabellæ does not seem to depend on the affinities of the animal, as they are large in *Aulacodus* on both sides, while in *Myopotamus* only the outer one is present. In *Dasyprocta* they are both present, in *Cœlogenys* both absent.

In the Sciuromorpha, however, they were found in every case except that of *Castor canadensis* (*Sciurus, Pteromys, Xerus, Spermophilus, Arctomys, Castor*).

Soleus.—The soleus rises in all cases from the posterior aspect

[1] P. Z. S. 1882, p. 271.
[2] Journ. Anat. vol. xxii. p. 126.

of the head of the fibula and in most cases joins the outer head of the gastrocnemius to help form the tendo Achillis. In *Cœlogenys* and *Cavia cobaya*, however, the muscle continued separate to its insertion in the tuber calcis, while in *Ceredon* it was inserted into the os calcis by a round tendon from its inner portion, while the outer portion blended with the tendo Achillis.

Plantaris.—The plantaris rises just above the outer head of the gastrocnemius; it forms a muscular belly as large as, or larger than, either one of the gastrocnemius. It soon contracts into a narrow tendon, which winds round the inner side of the tendo Achillis, and passes over the back of the tuber calcis to the sole, where it spreads out into a broad fascia, which eventually splits into slips for the four outer toes or as many as are present.

Each of these slips acts as a flexor perforatus, allowing the long flexor tendons to pass through, and is then inserted in the same way as the flexor sublimis in the fore limb. In *Castor*, where the muscle is perhaps better developed than in any other Rodent, the tendon divides into a superficial and a deep layer when it reaches the commencement of the sole. The superficial layer is fibrous and corresponds to the plantar fascia; the deep layer develops muscular fibres and doubtless represents the flexor brevis digitorum of human anatomy. In many cases a loop is given off from the deep surface of each tendon before it is perforated; this loop embraces the long flexor tendon as in the anterior extremity.

Popliteus.—The popliteus always has the usual human attachments, except that it is often inserted only into the inner border of the upper third of the tibia instead of into the posterior surface right across.

Flexor Longus Hallucis (*Flexor Fibularis*).—The long flexors of Rodents have been so thoroughly described by Dobson[1] that it would be waste of space to do more than refer the reader to his Monograph. I have repeated his dissections in many animals and can confirm the accuracy of his descriptions. The additional animals that I have dissected fully bear out his point that among the Hystricomorpha the flexor fibularis is joined in the sole by the flexor tibialis and is inserted into the terminal phalanges of all the toes. In the Sciuromorpha, on the other hand, the flexor fibularis goes to all the toes without being joined by the flexor tibialis in the sole. In *Aulacodus* and *Dasyprocta* no fibres were continued to the innermost toe from the flexor fibularis.

Flexor Longus Digitorum (*Flexor Tibialis*).—This muscle, as Dobson[1] points out, rises from the back of the tibia and in the Hystricomorpha joins the flexor fibularis in the sole, its fibres being continued chiefly to the inner toes. In the Sciuromorpha it does not join the flexor fibularis, but in *Sciurus*, *Xerus*, *Spermophilus*, and *Arctomys* is inserted into a sesamoid bone below the internal cuneiform, from which some ill-marked fibrous tissue is continued on to the hallux. In *Castor* it terminated in the inner half of the double scaphoid. The only exception to this arrange-

[1] Journ. Anat. vol. xviii. p. 159.

ment that I have seen was in *Pteromys oral*, in which the flexor tibialis divided into two slips, one of which had the usual Sciuromorphine insertion below the internal cuneiform, while the other joined the tendon of the flexor fibularis. Possibly this was an individual variation foreshadowing the arrangement in the Hystricomorpha.

Tibialis Posticus.—The description of the tibialis posticus is included in that of the "Long Flexors of Rodents" by Dobson[1]. In *Castor* it is inserted into an extra bone on the inner side of the internal cuneiform.

Lumbricales.—The number of the lumbricales seems to depend on the number of toes; thus all the Sciuromorpha and the Hystricomorpha possessing five toes, such as *Myopotamus*, have four lumbricales. *Cœlogenys*, although it has five toes, has only three lumbricales. Animals having three toes usually only possess two lumbricales, e.g. *Dasyprocta*, *Cavia cobaya*, and *Ceredon rupestris*. In *Dolichotis* Beddard only found one[2], but in another specimen which I had the opportunity of looking at there were two.

Muscles of the Foot.

The accessorius is absent in the Dipodidæ and Caviidæ, but present in the other animals examined, including the Sciuromorpha. It rises from the outer surface of the calcaneum, usually from the anterior part, and is inserted into the plantar surface of the flexor tendon just before it divides for the toes. The angle which it forms with the flexor fibularis is a very open one, about 45°, but in *Hystrix* it must be about 70° or 80°.

When the foot is well developed there are two interossei to each metatarsal bone. When the hallux is well developed, as in *Myopotamus*, the abductor hallucis rises from the sustentaculum tali, or from the scaphoid, as in *Octodon*, but when it is not developed the muscle is absent. In the Sciuromorpha the abductor minimi digiti often rises from the calcaneum as well as from the base of the fifth metatarsal; in this case the part between the calcaneum and the metatarsal will form an abductor ossis metatarsi quinti.

On the plantar surface of the interossei there are frequently found two muscles rising from the deep cartilage of the sole which forms the sheath of the peroneus longus tendon; from this they run forwards, diverging from one another like the limbs of a **V**. The inner of these is in some of the Sciuromorpha inserted into the outer sesamoid bone under the head of the metatarsal bone of the hallux, forming an adductor hallucis, but more often, as in *Myopotamus*, *Octodon*, *Hystrix*, and *Cœlogenys*, it is attached to a corresponding situation on the second toe forming an adductor secundi digiti. The adductor minimi digiti (the outer of the two muscles) is attached to the inner sesamoid bone of the little toe. These two muscles are wanting in the Dipodidæ and the Caviidæ,

[1] Journ. Anat. vol. xvii. p. 159.
[2] P. Z. S. 1891, p. 236.

except in *Ceredon*, in which a small adductor secundi digiti was found, but no adductor minimi digiti.

General Summary.

The amount of facts at my disposal does not, of course, justify anything like an attempt at a definite and complete summary of the muscles of the Hystricomorpha and Sciuromorpha. The following generalizations are merely suggested for future investigation.

A. *Differences between the Hystricomorpha and Sciuromorpha.*

1. In the Hystricomorpha the anterior deep part of the masseter passes through the infraorbital foramen. In the Sciuromorpha it does not.

2. In the Hystricomorpha, with the exception of the Dipodidæ, the digastric has no complete division into two bellies, and the muscles of opposite sides do not communicate. In the Sciuromorpha, as well as in the Dipodidæ, a tendon completely divides the two bellies, and the muscles are connected across the middle line by a tendinous arcade.

3. The transverse mandibular muscle is absent in the Hystricomorpha, with the exception of the Dipodidæ. It is present in the Sciuromorpha, with the exception of *Castor*.

4. The genio-hyoid muscles of opposite sides coalesce posteriorly in the Sciuromorpha, but not in the Hystricomorpha.

5. The omo-hyoid is present or absent in the Hystricomorpha. It is always present in the Sciuromorpha.

6. The levator claviculæ rises either from the atlas or the basi-occipital in the Hystricomorpha. Always from the atlas in the Sciuromorpha.

7. The scalenus anticus is present in the Hystricomorpha, except in the Hystricidæ. It is absent in the Sciuromorpha.

8. The trapezius is often divided into an anterior and posterior part in the Hystricomorpha. Never in the Sciuromorpha.

9. The sterno-scapular muscle is composed of the subclavius and the scapulo-clavicularis in the Hystricomorpha. In the Sciuromorpha, as well as in the Dipodidæ, only the subclavius is present.

10. The first part of the coraco-brachialis (rotator humeri) is always present in the Sciuromorpha. In the Hystricomorpha it is present or absent.

11. The pronator quadratus is always attached to more than a third of the bones of the forearm in the Hystricomorpha. In the Sciuromorpha it is attached to a third.

12. The supinator longus is present in all the Sciuromorpha except *Castor*. It is absent in the Hystricomorpha except in *Erethizon* and the Dipodidæ.

13. The scansorius is always wanting in the Sciuromorpha. It is often distinct in the Hystricomorpha.

14. The quadratus femoris usually has a tendinous insertion in the Hystricomorpha. It is fleshy in the Sciuromorpha.

15. The supracondylar slip of the semimembranosus is either separate or connected to the rest of the muscle in the Hystricomorpha. In the Sciuromorpha it is fused with the adductors, but has a distinct nerve supply.

16. The flexor longus digitorum joins the flexor longus hallucis in the sole in the Hystricomorpha. In the Sciuromorpha the two muscles do not join.

B. *Chief characteristics of the different Families of the Hystricomorpha.*

Dipodidæ.—The Dipodidæ, as has been pointed out, agree with the Hystricomorpha in the arrangement of the masseter and in the tendons of the foot, but differ from them and approach the Sciuromorpha in the arrangement of the digastric, in the presence of a transverse mandibular muscle, and in the absence of the scapulo-clavicularis. They present in addition the following characteristics:—(1) The teres major is inserted posteriorly to the latissimus dorsi. (2) There is only the long head to the biceps cubiti, which is inserted chiefly into the ulna. (3) The supinator longus is present. (4) The trapezius is in two portions. (5) There is no bony insertion to the gluteus maximus. (6) The scansorius is distinct. (7) The supracondylar slip of the semimembranosus rises from the tuber ischii. (8) The extensor proprius hallucis is absent. (9) The peroneus brevis is absent. (10) There is no peroneus quinti digiti. (11) The omo-hyoid is present.

Octodontidæ.—(1) The teres major is inserted in front of the latissimus dorsi. (2) Both heads of the biceps cubiti are present, and the muscle is inserted into the radius and ulna. (3) The coraco-brachialis only consists of the second part. (4) The flexor sublimis digitorum gives no slip to the fifth finger. (5) The flexor profundus digitorum sends a slip to the thumb. (6) The trapezius is undivided. (7) The rectus abdominis decussates at its origin with the opposite muscle. (8) The gluteus medius does not rise from the ilium. (9) The scansorius is not a distinct muscle. (10) The extensor proprius hallucis communicates with the extensor longus digitorum on the dorsum of the second toe.

Hystricidæ.—It is difficult to point out many points which are characteristic of the Porcupines as a group, owing to the great differences between the muscles of the Ground- and Tree-Porcupines. Whether these differences are due to their different mode of life, or indicate that the animals are less nearly allied than the genera of other families, requires further investigation to determine. The following are some of the chief distinctions:—(1) The digastric differs in *Hystrix* and *Sphingurus*. (2) The omo-hyoid is rudimentary in *Hystrix*, large in the Tree-Porcupines. (3) The levator claviculæ comes from the skull in *Hystrix*, from the atlas in the Tree-Porcupines. (4) The two parts of the sterno-scapularis are continuous in *Hystrix*, separate in *Sphingurus*. (5) The biceps cubiti has one head in *Hystrix*, two in the Tree-Porcupines.

(6) The coraco-brachialis has only the second part in *Hystrix*, in the Tree-Porcupines the second and third parts are present. (7) The brachialis anticus consists of two parts in *Hystrix*, while in *Sphingurus* only the external is present. (8) The extensor secundi internodii pollicis is present in *Hystrix*, absent in the Tree-Porcupines. (9) The pyriformis is absent in *Hystrix*, present in *Sphingurus*. (10) The biceps femoris is normal in *Hystrix*, while the two parts are distinct in the Tree-Porcupines. (11) The peroneus quarti digiti is present in *Hystrix*, absent in the Tree-Porcupines.

The only two definite muscular characteristics of the Hystricidæ as a family are: (1) The latissimus dorsi at its insertion wraps round the lower border of the teres major. (2) The scalenus anticus is absent.

Chinchillidæ.—(1) There are two heads to the biceps cubiti, which is inserted into both bones of the forearm. (2) The tibialis anticus rises from the tendon of origin of the extensor longus digitorum, as well as from the tibia. (3) The extensor proprius hallucis is absent. (4) There is no peroneus quinti digiti. (5) The omohyoid is absent.

Dasyproctidæ.—(1) The scapulo-clavicularis is specially well developed. (2) The deltoid reaches down as far as the elbow. (3) The biceps cubiti has only the long head and is inserted into the ulna. (4) The first and second heads of the coraco-brachialis are present. (5) The trapezius is divided into an anterior and a posterior part. (6) A splenius colli is present. (7) The scansorius is distinct. (8) The supracondylar slip of the semimembranosus rises from the tuber ischii. (9) The tibialis anticus rises by tendons from the front of the external condyle of the femur, as well as from the front of the tibia. (10) The omo-hyoid is absent.

Caviidæ.—(1) The biceps cubiti has one head and is inserted into the ulna. (2) The coraco-brachialis only has the second part. (3) The trapezius is double. (4) There is a distinct scansorius (5) The pectineus rises by a narrow tendon. (6) Tibialis anticus rises from tendon of origin of extensor longus digitorum as well as from the tibia. (7) The extensor proprius hallucis goes to the second toe. (8) The peroneus quinti digiti is absent. (9) The omo-hyoid is absent. (10) The levator claviculæ rises from the basioccipital.

2. Notes on *Cynogale bennetti*, Gray.

By Babu Ram Bramha Sányál, C.M.Z.S.

[Received January 29, 1894.]

The acquisition by the Zoological Garden, Calcutta, of a specimen of *Cynogale bennettii*, Gray, from Borneo, has enabled me to have a water-colour sketch made of this interesting mammal whilst alive, which I beg leave to forward to the Society, together with a few notes regarding its external characters and habits in captivity. On referring to the literature of the species, I find that the animal has been figured by S. Müller (Zool. Ind. Archip., Mamm. pl. xvii.) under the name *Potamophilus barbatus*, and by MM. Eydoux and Souleyet (Voyage de la Bonite, Mamm. pl. vi.). But a comparison of the present sketch with the figures given by the above-named authors will at once show that their figures could not have been drawn from life, and that both are practically useless for the purpose of identification.

In form and size this animal resembles partly a *Prionodon* and partly a *Paradoxurus*. The head is elongated, muzzle broad and depressed, the breadth of the muzzle appearing more pronounced owing to the exceptional character of the upper lip, which is much thickened in order to support the roots of the abundant and well-developed whiskers. A bunch of whiskers below each ear and close to the outer angle of the eye; also an intermediate set on each side of the nose between the eye and the lip. A tuft of vibrissæ on the chin between the lower lip and the throat. Eyes large and oblique; ears small and round; nostrils with distinct lobes adapted for a subaquatic life. Tail moderate and thick. Prevailing colour of the coat grey, grizzled white on the back, rump, and outer aspects of the limbs; a dark band on the crown and nape; eyebrows white to a certain extent; a white spot on each side of the head below the ears corresponding with the place of insertion of the whiskers in this region; lips white. Under-parts blackish. Tip of the tail whitish. Toes slightly webbed, resembling those of *Lutra leptonyx* from a distance. Length of the head and body about 32 inches, tail about 9·5 inches.

Except very early in the morning I have never seen this animal leave its cage during the day, and though it never appears to be particularly savage, it always resents the approach of its keeper or anyone else by a sort of low subdued snarling. The presence of a strong Civet-like smell near its cage, especially at night, unmistakably indicates the possession of odoriferous glands. Although said to be omnivorous, it shows greater partiality for an animal than a vegetable diet, and relishes fish more than flesh. I have never observed it indulging in its aquatic habits here.

Calcutta, January 10, 1894.

3. Field-Notes on the Mammals of Uruguay.

By O. V. Aplin.

[Received March 3, 1894.]

The following notes relate almost entirely to the Departments of Soriano and Rio Negro, and were made during a residence in the country from October 1892 to June 1893. My thanks are due to Mr. Oldfield Thomas for his kindness in naming such of the species as were unknown to me, and in giving me the correct modern names for some others.

I may draw attention to the fact that, so far as purely terrestrial animals are concerned, Uruguay is geographically separated from the Argentine States by effective natural boundaries—the Rio de la Plata on the south and the Rio Uruguay on the west. The latter river has apparently proved less passable than the muddy Rio Paraná.

Geoffroy's Cat (*Felis geoffroyi*).

The beautiful spotted "Gato del Monte," or "Monte Cat," is now becoming rare in the part of Soriano where I was living. The skins exhibit a little variety, some having the spots larger and more distinct than others. It is kept down as much as possible on sheep-camps by trapping.

Paja Cat (*Felis passerum*).

The Paja or Grass Cat ("Gato pajéro") is also getting scarce in this district owing to the systematic trapping which is carried on. Two kittens which were brought in (dead, alas!) on the 29th October were spotted on the legs and lower parts, and it was suggested that they might be the result of a cross with the Monte Cat; but as the skins of two more kittens, brought in with that of the old female a few days before, were just the same, the spotted dress in youth is evidently natural to this species. Exactly the same thing happens in the case of the Puma (*vide infra*).

Puma (*Felis concolor*)[1].

The Puma is now extinct in many parts of the country, but in the monte along the Uruguay river it is still found. An estanciero living at Cordova in Argentina tells me he has seen both Pumas and Jaguars coming down the big rivers on tree-trunks. In this way stray examples might very well turn up in a district long after the native breed was extinct. I heard that it was still found, although very rarely, in the monte of the Rio Negro on that part of the coast of the river which I visited in the Department of that name; but all I could hear of it in South Soriano was a report that one had been seen on the Arroyo de Monzon some years ago. We had on board the ship I came home in two Puma cubs, the smaller of which was indistinctly spotted. A German friend living in the South of Patagonia tells me that very young ones are always so.

Azara's Fox (*Canis azaræ*).

Azara's Fox, the common "Zorro," is still numerous despite systematic trapping, and affords moderate sport to some Englishmen; among others to a neighbour of my host, whose pack included two imported foxhounds, a rarity indeed, and has achieved signal success. This fox is quite as bold as the English one in coming about the houses at night. Going out of my room one moonlight night I saw a fox bolt out of the patio! One which was caught

[1] See figures of young Pumas, P. Z. S. 1861, p. 141, pl. xxii.

as a small cub and brought up at Santa Elena became perfectly tame. He was kept on chain, and upon being visited would jump up like a dog, and also throw himself at full length on his side upon the ground to have his back and sides tickled, closing his eyes and making a whining noise. The difficulty was to get away from him, and his mode of pressing his visitor to stay was to take hold of the latter's breeches with his little sharp teeth. It has sometimes been doubted whether foxes wag their tails. This animal certainly used to wave his tail gently from side to side when he was pleased. He would follow the peon who attended to him like a dog, and ultimately (with a companion) was brought by me to England.

AGUARÁ (*Canis* sp. inc.).

We had also another species of Dog known to the peones as the Aguará. This animal is said by them to live in the rocky cerros and in the least frequented parts of the district, and to put in an appearance chiefly at lambing time. They also say that it is "muy brava," and that a dog which has no difficulty in overcoming an ordinary "Zorro" always has a hard fight with, and is sometimes turned by, an "Aguará." I procured some skins, but unfortunately the only skull I got could not be brought home. The points in which this animal differs from the ordinary grey fox are these:—(i.) It has the head shorter and broader in proportion. (ii.) The ears are short and rounded instead of long and pointed. (iii.) The general colour of the body is warmer, there being a flush of reddish yellow in the fur. (iv.) The brush is shorter in proportion. (v.) There is a line of nearly black hairs beginning at the scruff of the neck and passing down the line of the backbone; this hair is thickest at the scruff of the neck and above the shoulders, and approaches in character the mane of the *Canis jubatus*. The blackness is continued on to the brush. (vi.) The whole animal is stronger and more robust. (vii.) The appearance of the animal and the general aspect of the head in life are (judging from a supposed hybrid between the Aguará and Zorro) very different. This is caused by the ears being farther apart and slanting outwards more than those of the Zorro.

One or two of these were trapped at Santa Elena about April and May, when the Merinos were lambing, and I saw skins of others. The marks of difference are not so clear in all cases, and it is probable that interbreeding takes place (if indeed this Aguará is a distinct species).

I hope to obtain a skull, and then perhaps the identity of the Aguará of Uruguay may be settled.

It agrees with Dr. Burmeister's description of *Canis cancrivorus*, Desmarest, better than with any other I have read (Desc. Phys. p. 143).

One of these intermediate specimens, a half-grown example, was trapped and brought up to the estancia alive. Its different appearance, consequent upon the width of the skull and the distance the ears were apart (these sloping outwards and being less upright, when pricked, than in the fox), was very marked. It was so unruly and savage that I gave up all hopes of bringing it home, as I was leaving the camp very shortly. The first night it managed to gnaw its way out of a new hutch just completed for the transport of my tame Zorros, but it was captured in one of the buildings early in the morning, being encumbered with a strip of raw hide tether.

The name Aguará has given rise to great confusion, and the identity of the species (probably more than one) is not yet settled.

I am aware that the Aguará has been described by some writers as a large reddish beast, but here I only describe the animal (easily distinguished from the Zorro) well-known as the Aguará by the residents in the camp where I was living.

Admiral Kennedy (Sporting Sketches in South America, p. 37) applies this name to the Maned Wolf, *Canis jubatus*, "a fine animal, with a bright ruddy coat, black mane and pads," saying that it was found in the Chaco (Northern Argentina). But this is not my animal. Mr. Hudson ('Naturalist in La Plata') distinguishes between the Aguará-guazú (*C. jubatus*) and the Aguará, writing that the former is the nearest ally of the latter, but that the latter is smaller and has no mane; that it is like the Dingo in size, but slimmer, and with a sharper nose, and has a much brighter red colour. This description does not agree with my animal, however. Dr. Burmeister identifies the Aguará-guazú of Azara with *C. jubatus.*

Señor Don Luis Cincinato Bollo, in a little book published at Montevideo in 1891, on Mammals, containing "la descripcion de los animales indigenas de las Repúblicas Oriental y Argentina," distinguishes between the "*Aguará-chay*" (which he says lives in nearly the whole of South America, especially in the north of Argentina and in Paraguay and the Chaco) and the "*Aguará-guazú*," intermediate between a wolf and a fox (and doubtless *Canis jubatus*), which lives in "el alto Uruguay," on the banks of the lagunas of Corrientes, and also in the Chaco, Paraguay, Mendoza, and San Juan. But he does not describe either, merely saying that the former commits ravages among the sugar-plantations and fowl-houses, and that the latter feeds on eggs and small animals. Neither does this Aguará-chay seem to be my animal. Burmeister makes the Aguará-chay of Azara a synonym of *C. azaræ.*

River Plate Otter (*Lutra platensis*).

This Otter was fairly numerous in the rivers. The Otter in South America is not the shy animal that we are accustomed to here. It is indeed reported as "muy bravo," and even as apt to resent an intrusion on its haunts when it has young. A friend, long resident in the country, and a great fisherman, told me that once when he had hooked and was playing a big fish, an Otter suddenly came at the fish before his face; I forget whether it broke the line or wrenched the fish away, but it was one or the other. I asked my friend why he did not write to the 'Field' about it; to which he replied, "Because I didn't want to be considered a bigger liar than common." For my part I can very well believe in the truth of the incident from what happened to me. I had shot with my little collecting-gun, and only wounded, a Cormorant (*Phalacrocorax brasiliensis*), a bird measuring nearly 30 inches in total length, which had been sitting on a dead branch in the small river along which I was walking. The wounded bird flapped away down the laguna, which curved rather sharply and was clothed slightly with sarandi bushes on the banks. I therefore lost sight of the bird for a minute, and when I came in sight of it again I saw a great commotion going on in the water. Hurrying up I saw the smooth sleek head of an Otter, which had the Cormorant (still flapping its wings) in its mouth. As I ran up the Otter dived out of sight with the bird, and although I waited a long time I saw neither again. The whole thing happened rather quickly, and I was so astonished that I never thought of trying a shot with my pistol, if, indeed, I should have had time to do so. I certainly expected the Otter to drop my bird when I appeared on the scene, as I was then ignorant of the extent of "cheek" possessed by the South-American Otter.

Just as they miscall the Coypú "Nutria," which means an otter, so in the camp they miscall the Otter "Lobo," which means sometimes a wolf, but on the South-American coast a seal or sea-lion, "Lobo de Mar" (*Otaria*); *e. g.* the Isla de los Lobos near Maldonado, Uruguay, where these animals (perhaps *Otaria jubata*) congregate.

WHITE-CHESTED OTTER (*Lutra brasiliensis*).

I only once caught a glimpse of the "Lobo de pecho blanco." While staying at an estancia on the north bank of the Rio Negro, several of us one blazing morning had ridden up on to a little cerro (one portion of which was whitened with the bones of a flock of sheep cut off here by a flood a few years before) which commanded a view of a fine bending reach of this beautiful river. We looked right down upon the varied greens of the monte bordering the river, and just in front of us upon a rapid, the sound of which came to us in waves borne by the hot breeze. A Black Cormorant was flapping heavily up stream, and at the head of the rapid an Otter showed itself occasionally; the glance of the sun on his white chest showed that we were looking at one of those Otters, the fierceness of which is always alluded to by anyone who knows their habits at all. One man, very fond of swimming, told me he should be afraid to bathe in a laguna which he knew to be inhabited by White-throated Otters with young. Another friend told me how he and his companion were annoyed by Otters taking the fish from their set lines at night in the Rio Negro.

Dr. Burmeister mentions this species being taken by chance on the Rio Uruguay on the Entre-Rios coast.

CRAB-EATING RACCOON (*Procyon cancrivorus*).

Soon after I arrived in Uruguay I heard a good deal about an animal called the "Mano peluda," but no one seemed to know what it was. In December, when riding up to the Rio Negro, we heard the name again, and stopping for an hour or two at a "pulperia" a league or two south of the river, where they had several very tame "bichos" of various kinds, I was delighted to find a Mano peluda. From vague descriptions I had heard on the way the Mano peluda might have been a sloth, an ant-eater, or a monkey, but I found (as Mr. C. J. F. Davie, of Montevideo, had suspected) that it was a Raccoon. To the latter gentleman I am indebted for a flat skin of this species, and through his kind offices, just before I left the country, I was enabled to procure a living specimen from Florida, where they are not *very* rare. This example reached England safely, and was pronounced by the authorities at the Society's Gardens to be identical with the Crab-eating Raccoon. I do not think the presence of this animal in Uruguay has been previously recorded. The specimen at the "pulperia," so wonderfully tamed by Don Luis or one of his sons, amused us by eating Huntley and Palmer's biscuits, which it held between its paws, sitting up meanwhile on its haunches. It moved rather in kangaroo fashion, but was less upright; the head is very pointed and foxy in appearance, though broader in proportion at the base and shorter. It had been captured in the neighbourhood, but was said to be rare. One or two people spoke of the desperate fights these animals engage in with dogs. The specimen I brought home lived chiefly on beef and was a great water-drinker.

SKUNK (*Conepatus mapurito monzoni*, subsp. nov.).

The Skunk which I procured in Uruguay is distinct in coloration from the typical White-backed Skunk (*C. mapurito*) which (subject to much variation) inhabits South America generally, and is described as being from 18 to 24 inches long, with a short tail of from 9 to 10 inches, and having the back white, sometimes marked with a median black stripe, and the tail white. In Mr. Hudson's 'Naturalist in La Plata' a Skunk is figured menacing a dog (p. 123), with the back, as far as can be seen, white, and a large bushy white tail laid over the animal's back and reaching nearly to its head. The Uruguayan Skunk has the whole of the body and the tail blackish brown, varying a little in shade, with a narrow white line (not more than three quarters of an inch wide at its thickest part and narrowing towards each extremity) on each side of the body, starting on the top of the head (where they are joined together) and reaching sometimes to the root of the tail, but in other cases not so far. I killed a good many Skunks and saw others, but they all answered to this description. I only once saw one with any white at all on the tail. This was at the end of autumn, when we killed one which had some of the long hairs of the tail just tipped with white, giving the tail a frosted appearance when seen at close quarters, but not noticeable at a little distance. I made inquiries, but could not find anyone who had seen a white-backed or tailed Skunk in Uruguay. A dried skin measures 22 inches from the nose to the root of the tail; the tail itself is 8 inches long.

Dr. Burmeister ('Description Physique de la République Argentine,' tome iii. p. 162) includes the Argentine Skunk under the name of *Mephitis suffocans* of Illiger (which is, I suppose, a synonym of *C. mapurito*). The Skunk he describes agrees with mine tolerably well with the exception of the white lines, which are said to rise on each side of the head separately. In a note he says expressly "les deux raies sont toujours séparées sur le front." In this respect my animal agrees with Gray's description of the Skunk of Chile, which, however, has a white tail (*M. chilensis*). I would suggest giving the various Neotropical Skunks, which differ in a greater or less degree from one another, subspecific names.

The variation in the Uruguayan Skunk being constant, I have given it a name, and have called it after the river upon which I had my headquarters during my residence in Uruguay.

A skin and skulls of this subspecies are now in the British Museum.

It is curious that Burmeister makes no mention of a white-backed, white-tailed Skunk (as figured by Mr. W. H. Hudson) inhabiting Argentina.

The Skunk is very common in Soriano and Flores, and very tame and impudent. We were often annoyed by their coming about the estancia at night, probably after the fowls. In the still summer nights an overpowering smell of Skunk used to make us aware that one of these little beasts was wandering about, perhaps actually in the patio, and you never knew whether on going out you might not stumble over one or find it in your bedroom!

A Skunk will seldom trouble to get out of your way, and faces a dog rather than run from it. I only once saw one run away, and that was after I had peppered him at long range with a charge of snipe-shot. When out feeding on the camp in the evening the Skunk's paces are a shambling trot and a gallop. But they can go pretty fast when they like, *e. g.* the one I spoke of just now; every now and then it turned and faced the dog, who was not very keen to attack it, simply and solely because he had just killed another and was suffering all the penalties. This dog ("Jim") was a short-legged, heavily-built terrier—something between bull and fox—and the best vermin dog I ever saw. I never knew him turn from a Skunk, and always had great difficulty in getting him to leave one "stuck up" in a difficult position. I have seen him kill a good many, and in the course of his rather long life he must have killed hundreds. The strong smell did not seem to have affected his scenting powers, for he had a splendid nose and would line a lizard or anything else. When I heard him give tongue I always knew he had "stuck up" a "bicho" of some kind, and he always barked until he fetched up his human companions (coming out into the open or mounting a big rock occasionally, either to look for them or to show where *he* was), but not after. This tribute to the good qualities of a great Skunk-slayer may perhaps be excused. But I believe all the dogs in the camp will tackle Skunks—many I know will—and there are lots of dogs which always seem to smell of Skunk more or less strongly. Even a pair of easy-going, good-natured Labrador dogs, whose only delight in life was to swim in the river, I have seen tackle a Skunk and take their dose like their betters. The discharge is certainly very severe—though I never saw any sign of dogs being blinded by it—and makes the best dogs wince, blink, and sneeze. They seem to like to make the Skunk discharge the first shot (for he can fire more than once) while they are as far off as possible; and for this purpose they make feints at it and bark violently, while the Skunk (if out in the open) menaces them with tail erect and back a little arched, every now and then advancing on the dog with little jumps and beating the ground with its fore feet. The dog, having taken one or more shots, finally rushes in (old hands do not, as a rule, run in at once). I saw "Jim" take a Skunk out of an old ant-hole (the entrance to which he had to enlarge) on one occasion, and get shot in the operation. He then made a rush and jerked the Skunk suddenly out on to the camp, where it stood in a menacing attitude; but the old dog walked deliberately up, took the Skunk by the head, and so dragged it about, cracking its skull at his leisure. Dogs are undoubtedly much distressed after killing a Skunk, rubbing their eyes and head in mud or dust, frothing at the mouth, and "snuffling" a good deal; but all the dogs I came across appeared to be fond of the amusement, and some were desperately keen on it. Late one still autumn afternoon, when the dogs had stuck up a Skunk among some "paja," I actually saw the discharge of the effluvium, like thin white spray or steam.

When discharging, the Skunk faces the dog, and erects its tail in an upright position, at a right angle, or a shade less perhaps, with the line of the body; but does not lay it along the back.

As for the effect of the smell on the human nose, to be near to and to leeward of a Skunk when it discharges is enough to scent one's clothes for a few days; and although a slight smell of Skunk in the open air is not unpleasant, yet of the stale smell, whether upon clothes or brought about a house by dogs, one gets terribly sick. What it is to be actually *hit* by a Skunk, I am glad to say I do not know.

The statement (often repeated) that it is possible to pick up a Skunk by the tail before it has time to discharge, and that while being swung by the tail the animal cannot discharge, has been laughed at as a joke practised on the credulity of those who believed in it. All I can say is that it is astonishing that anyone with an extended acquaintance with the camp should doubt this fact—but it is only natural that people should laugh at it if they doubt it. On my making inquiries upon the point, the man I was staying with at once told me that riding one day up to one of his puestos, he was in time to see the peon come out of the rancho swinging a Skunk round his head; it made no smell and was dashed down on the ground and killed, inodorous. The Skunk had got into the house in some way. I also heard that the possibility of the thing was well known. Secondly, there was brought to me the skin of a Skunk which was "tailed" by a little boy as it was busily digging roots—so said the boy's father on my inquiring how it was caught; and he intimated that it was not by any means an unusual thing. Then one of the peons at the estancia, finding a Skunk asleep under his catre "tailed" it out; but unfortunately I did not see him do it. But at last I did see the operation. One of the peons found a Skunk one morning behind some wood piled up at the side of the big galpon—with a quick snatch he caught its tail and jerked it out. There he stood for five minutes swinging it gently round and round, there being no smell (beyond that which always clings about a Skunk). Another man then gave it a tap on the head with a stick, and the peon, thinking it was killed, threw it away. But no sooner was it on the ground than it was on its feet: up went the danger signal, and—well, we all had to clear out! The beast ran off and got into another galpon, where the dogs killed it; the whole place then smelt of Skunk, but until the beast touched the ground it was innocuous and inodorous.

It seems that the "scent"-gland cannot be opened unless the tail is at a right angle, or something near it, with the line of body; and that therefore when held by the tail the weight of the Skunk's body keeps the tail more or less in a line with it, and the Skunk is unable to discharge its vile secretion. The actions of the one mentioned above seem to prove this. To perform this operation it is of course necessary to catch the Skunk asleep, or otherwise deeply occupied (digging roots for instance), and to run the risk of its waking up or turning round and seeing you. I believe I could have easily done it myself, as I have more than once seen a Skunk lying curled up asleep in the daytime. Indeed, while looking for a parrot I had shot among some bushes, I very nearly stepped upon one which was curled up on the ground; and there it remained until (having picked up my bird) I put a revolver bullet through its body. However, I never cared to risk the loss of useful garments, it having been proved, I believe, that clothes once *well* dosed at close quarters may as well be burnt.

The Skunk passes the daytime in sleep, when undisturbed. In Soriano I used to find them laid up in holes under and clefts in the granite boulder rocks, in deserted ant-nests, among paja grass or in the crown of a big hassock of this, and in one or two cases on the ground among bushes. In the latter case it lies on its side curled round. When roused in a hole by a dog it presents a rather diabolical appearance as it pops its little vicious head out. Notwithstanding demonstrations of this kind, I have only once seen a Skunk use its teeth. In this case one fastened on to Jim's flanks, and the old dog walked about with it hanging on for half a minute, looking round at it in much astonishment at this unusual and unseemly behaviour—the fact being that he could not get hold of his enemy, which turned with him. The Skunk's teeth are small in proportion to its size of body: a certain class of theorists would probably say that they had become smaller from disuse, the animal having another means of defence.

The Skunk seems to be an omnivorous feeder. Its long strong claws are well adapted for digging, and places where they have been scratching are to be seen all about the camp. They probably feed on small mammals, reptiles, and insects as well as roots, and are always credited with robbing hen-roosts.

With regard to the distance at which you can smell a Skunk, I cannot give an opinion; but you often smell them when you cannot see them, and just about sun-down the smell is a usual and familiar one about the camp; at night, too, a strong whiff of it as you sit or stroll in the patio is a very common occurrence. At a hundred yards to leeward with the slightest breeze the smell of a discharge would be very pungent. The smell is said to be a good "*remedio*" for the headache!

The local name for the Skunk is "*Zorillo.*"

The Skunk being numerous, despite human persecution, it might be supposed to be prolific; and from the very meagre evidence I obtained it seems to be so—this evidence is that on the 31st October a female was killed close to the house with 13 young.

GRISON (*Galictis vittata*).

This savage and diabolical-looking weasel, known as the "Hurón," coal-black except on the top of the head, back, and tail (on which parts the hair is grey and longer than the rest of the body), was not uncommon. The line of demarcation between the black of the face and the grey crown is cleanly cut, and gives the animal a curious and most spiteful appearance. Nor do its looks belie it. It is about the size of a medium-sized polecat, and resembles this animal in disposition and habits to some extent. But one of its characteristic habits is that of hunting in company. I have seen three hunting down a nearly dry cañada, and, just before, a friend had seen five together. When staying with a neighbour in February one of his sons trapped a Hurón in a box trap baited with an Apereá. We had some considerable difficulty in transferring him to a small cage, and so far from being timid, he would always come at your fingers with an angry barking squeal, if you put them near the bars of the cage. Moreover, when irritated he emitted one of the strongest and most pungent animal smells I ever experienced. In some respects it was more disgusting than Skunk. The cage was fifty yards or more from the house, out of sight behind the kitchen buildings, and, when it was to windward, it was quite possible when sitting outside the house-door to tell when anyone went to look at the Hurón. For this reason it would be difficult to bring home an example captured when full-grown; I can imagine the captain ordering the cage to be heaved overboard! On the other hand, the same friend told me that he once caught some young ones, and that they became so tame that they were allowed to run about where they liked.

Vesperugo montanus (Phil.): Dobson, Cat. Bats, p. 189.

This was the only Bat of which I brought home specimens. It was common about the house, flying rather low among the ombús gums, wattles, and other trees in the patio, but not easy to knock down.

On the 3rd February, when riding across the camp and passing a small group of boulder rocks, I saw a Bat on the wing about 9 A.M. Of this day my Journal says:—"Blazing hot day, over 80° at 8 A.M., going up to 94° in the day, and standing at 86° at 9 P.M."

Another species is found in Uruguay with the fur of a very dark rich mahogany colour; but I omitted to keep the very poor specimen I came across and never got another.

MULITA (*Tatusia septemcincta*).

This Armadillo is, I hear on good authority, still numerous in parts of the Department of Florida, but in Soriano where I was it was uncommon. The only live specimen I obtained escaped in my temporary absence; it was exceedingly quiet and gentle in its manners. The "Mulita" occasionally figures on the menu at the hotels in Montevideo.

TATÚ (*Tatusia novemcincta*).

The Tatú is said to be found outside the monte along the Rio Negro. I saw the skull of a freshly-killed specimen hanging up in a paraiso tree in the patio of a house at which I stopped the night between the Rio Negro and Porongos. A puestero at Santa Elena said that a few years ago several were caught near the Paso del Durazno on the Arroyo Grande; and Mr. Davie wrote me word that the Tatú had occurred at Guaycurú, in the same pago, in his recollection. The Tatú is apparently disappearing gradually from the more populated camps. The Tatú is much larger than the Mulita, and is rather narrow in proportion to its length.

PELÚDO ARMADILLO (*Dasypus sexcinctus*).

The Pelúdo, or Hairy Armadillo, said to be less particular as to its diet than its congeners, and not to despise carrion beef and mutton, was quite rare in the vicinity of Santa Elena, Soriano. The specimen I brought thence was caught close to the Arroyo Grande. It is always called Pelúdo in the camp, but it is not the Hairy Armadillo found about Buenos Ayres (*Dasypus villosus*, Desm.). In the list of animals in the Zoological Society's Gardens (1883) the habitat of the latter is given as "La Plata," and of the present animal "Brazil." The specimen I brought home is now in the British Museum, and has been identified by Mr. Oldfield Thomas.

Scapteromys (*Hesperomys*) *tumidus*, Waterh.

I procured one specimen of this Rat in the monte of the Arroyo Grande. Mr. Thomas tells me that the British Museum previously only possessed the type of this species, an immature and much faded skin, and that the one I brought home is a very old example.

Habrothrix olivaceus (Waterh.).

I procured one specimen of this dark grey short-tailed Mouse.

House-Mouse (*Mus musculus*).

There were plenty of Mice about the estancia house at Santa Elena, and they were often trapped. They seemed to me of a warmer colour than English examples, and I brought home a skin and another example in caña, thinking they were distinct from ours; Mr. Thomas, however, tells me they are identical. This is a good illustration of the travels of the House-Mouse. These colonists would of course manage the sea-voyage easily; but having evaded the vigilance of the custom-house (for who would pay a live-stock duty on them?), they would have to make their way to the railway-station and proceed by train to San José. Thereafter a journey of about seventy miles would lay before them, to be accomplished in the course of from three or four to ten days by bullock, mule, or horse-cart. They might easily come from San José among bales of alfalfa hay; but doubtless most of the journey was made in a cargo of "stores" and inside some case containing food for man.

Tuco-Tuco (*Ctenomys brasiliensis*).

Tuco-Tuco (*Ctenomys magellanicus*).

It is probable that there are more than these two species of Tuco-Tuco inhabiting the parts of Uruguay which I visited. About Santa Elena they lived in little colonies wherever there was a high-lying bit of ground of which the subsoil was light and sandy instead of granite rock. North of the Rio Negro, where the soil was more suitable, this animal was abundant, still living in colonies called "tuco-tuconales," over which it was necessary to ride slowly, the ground often giving way under your horse's feet. I have a vivid remembrance of laboriously walking over a big and very soft sandy tuco-tuconale one very hot day, terribly thirsty in consequence of being unable to obtain water at the place where we had eaten our breakfast, to another streamlet, and finding that dry!

I picked up a very few bones and remains about Santa Elena; but I never saw a live Tuco-Tuco, nor had a friend on the Rio

Negro who took some interest in such things. I have since my return, however, received from him the skin and skull of one. The measurements of this specimen are: head and body 10 inches, tail 3 inches. The fur is very soft and silky, and the hairs composing it on the back measure from ·7 to ·8 inch in length. The general colour of the upper parts is light hair-brown, the individual hairs being tipped with this colour for ·2 of their length; the basal part of each hair is mouse-colour. The chin and throat are of the same brown as the rest of the head, the latter being a shade darker than the back. The rest of the underparts are dirty white. The tail is clothed only sparsely with bristly hairs. The incisors are orange-colour, the lower ones measuring ·5 inch from where they emerge from the jaw-bone to their tips. It has been kindly identified by Mr. Oldfield Thomas as *Ctenomys brasiliensis*, while a skull which I brought from a tuco-tuconale at Santa Elena, Soriano, has been referred by him to *Ctenomys magellanicus*.

Not only were the colonies where the latter specimen was found smaller than those north of the Rio Negro (this might be occasioned by the nature of the ground), but the individual burrows and earths were smaller.

From the description of some writers it might be imagined that anyone being on a tuco-tuconale, whether by night or by day, would hear continually the loud double or treble note from which the animal takes its name. I was not so fortunate, for although I have very often passed over and waited quietly about on tuco-tuconales I have only once heard the sound, and that very slightly. Yet the fresh workings showed that these places were inhabited.

Restless Cavy (*Cavia aperea*).

The "Apereá," exactly like our fancy guinea-pigs, but of a grey mouse-colour, paler underneath, is numerous, frequenting pajonales, and, near estancia houses, strips of camp fenced in for the protection of young plantations. Here they make runs among the grass, coming out chiefly about sundown to feed. They are almost as destructive as rabbits, and where foxes (which with the Hurón are their chief natural enemies) have been killed down they are apt to increase inconveniently. The fur is long and pretty, but generally seems very loosely attached to the skin. The Apereá does not burrow in the ground, though it drives tunnels in the thickest pajonales; nevertheless I have seen one, when surprised on a bare river-bank, go to ground in an old ant-hole, and it is probable that when the camp is very *pelado* they take refuge in any convenient shelter. I have known them run into a hole in the rocks and to find shelter about a shed erected for the benefit of some pure-bred stock.

Capybara (*Hydrochœrus capybara*).

The Capybara or Carpincho, as it is always called in Uruguay, was found in some numbers along the Arroyo de Monzon, the Arroyo Grande, and some other smaller rivers near where I was living in Soriano, but especially so along the banks of the Saúce, which runs through the camp belonging to my host at Santa Elena. The Carpinchos there were also very tame indeed,—from the fact that they were not molested. Accordingly I had exceptional advantages for observing this, the largest rodent in the world, in a state of nature.

A favourite locality is a broad laguna in the river, furnished with open water, and also beds of "camelotes,"—a sloping open grassy bank on one side, where the Carpinchos can lie in the daytime in the cooler weather, sleeping and basking in the sunshine; on the other a low shelving bank, clothed with "sarandi" scrub growing out into the black reeking mud and shallow water beyond. The stems of the sarandi in the festering mud have a gloomy appearance, sometimes brightened in spring by the large pink flower of a convolvulus climbing up the stems. In one or two places of this description I could almost always make sure of seeing some Carpinchos—sometimes a herd of a dozen or fifteen together, for they are sociable. You might meet with them at any part of the rivers where there was plenty of water, or in the monte on the banks, and I have "put one up" in thick dry paja fifty yards or more from a river. At night they are said to wander for some distance, to visit maize chacras and quintas. When alarmed they snort violently, and rush impetuously into the river with a great splash and noise. It is said that a frightened Carpincho making for the river will not turn out of its way for anything, and that if you are between them and the river they will knock you over. I can well believe it, for they give one the idea of being the most stupid animals in existence; and an examination of their skulls shows they are literally exceedingly thick-headed. The paces of the Carpincho are a walk and a hurried gallop reminding one of that of a pig, but most likely differing little in character from that of a guinea-pig, which the Carpincho resembles in shape and make. Probably their habit of rushing impetuously into the rivers is the reason why some horses are so frightened at these animals; the horses may have been scared when they went down to drink, or perhaps even charged by two or three lumbering brutes. Two horses which I rode were both frightened at Carpinchos, and one of them at the first sound of a snort became almost unmanageable and always tried to "clear out."

Sometimes Carpinchos are much more tame than at others. If they are on the opposite side of a small river they often take no notice at all; and I have watched them in the autumn sitting up on their haunches like dogs sunning themselves, or lying asleep on their bellies with their fore paws stretched out in front of them and their heads in some cases laid on their paws, a little on one side. I have also on more than one occasion walked up within half a dozen yards of them. Sometimes when you approach a little herd of them they sound their alarm and merely watch you, walking slowly down to the water as you get nearer. At other times they rush impetuously into the water at the first sign of danger. They are said to be much wilder on the larger rivers, the Rio Negro for instance, probably because they are less accustomed to seeing any people except those who hunt them. No doubt the protection they were afforded in the Santa Elena camp contributed largely to their tameness there, but I always noticed they were less tame on the Arroyo Grande than on its tributary the Saúce.

When disturbed and rising to their feet the Carpinchos get upon their fore legs first. The hair of the Carpincho is scanty, not much more plentiful than some pigs' bristles, which it greatly resembles. Their colour varies from dull brown to bright chestnut, and this irrespective of age, or size, or season either, for I have noticed all colours from spring to late autumn; smaller animals are, however, generally of the dull brown colour and *vice versâ*. Their skins tan into splendidly thick, soft leather, which is used for belts, slippers, saddle-covers, &c. Like other thick-skinned animals, they like to wallow in mud. They work out hollows in the ground in which they wallow; these are known as Carpincho baths. The Carpincho does not go to ground, but lives on the banks of the rivers in such cover as it can find. It is capable of remaining under water and of proceeding for some distance under the surface; but when a herd has been disturbed at a laguna the members probably "lie low" by putting just their noses above water under the shelter of a bed of camelotes or other water-plants.

I should imagine, from the size of its incisor teeth, that the Carpincho would be capable of inflicting a most serious bite. One day late in autumn, as my friend's hounds were drawing the monte of the Arroyo Grande for a fox, we heard a tremendous "worry," but before the whip could get to them (and on his small active animal, really only a pony, he could, I believe, get anywhere) the pack went on. A pointer (one of a famous short-tailed breed), belonging to the estanciero at whose house we had met, came limping out of the monte with a fearful gash and incised bite in his neck, bleeding like a pig. It was said to be the work of a Lobo, but as I heard the snort of a Carpincho at the beginning of the worry I strongly suspect that it was the work of one of these beasts, of which there were a good many in that part of the river. The Carpincho, from its great weight and size, and thick, clumsy shape, would be a very awkward beast for dogs to hold, whereas they would probably master a Lobo if they had come to close quarters on land.

The Carpincho's hind feet are furnished with a kind of hoof in three divisions, each ending in a point; and I should be very sorry to get a fair kick from the hind leg of a living or dying animal.

Upon this point I quote from Señor Bollo, in whose book is depicted with photographic accuracy a group of eight Carpinchos in various life-like attitudes on the bank of a river. Señor Bollo writes:—"If the dogs follow it, it flies while it can; when it is exhausted by the blood it has lost, it places itself among the camelotes (a kind of water-plant) and defends itself from its persecutors, giving them bites with its long incisors."

When they take to the water they sometimes dive beneath the surface at once and sometimes merely swim away; they can when swimming along suddenly submerge themselves and disappear, and they can progress under water. I have watched them swimming in a laguna while I stood on the bank in full view. The upper half (or rather less), taking in the eyes, nose, and ears, of their oblong square heads is alone above water, the heads looking like logs of dead wood mysteriously propelled. They swim very slowly. When uneasy the Carpincho gives vent to its alarm-note as it swims along, raising its muzzle out of water for the purpose.

To produce this extraordinary noise considerable exertion is evidently necessary; the animal's sides are momentarily inflated (perhaps to take in air for the purpose), when the sudden jerky heave comes and the whole massive body of the beast is shaken. The sound produced is very peculiar. It is very explosive, something between a grunt and a bark, and not unlike the sound of a big dog clearing its throat for a good choke, but is fuller and has more volume.

The Carpincho, with its heavy-looking head, apparently nearly all jaws, certainly presents a curious appearance. Señor Bollo says that it is so ugly that it has given rise to the saying in La Plata, "feo como un Carpincho."

I am inclined to think that the Carpincho takes more than a year to attain its full growth, as there were always a good many to be seen about half the size of the quite old ones, and that they breed before they are full-grown.

I am unable to say at what season they have young, or whether they breed at any particular season. I shot a young one about two feet long at the end of spring (26th November), and saw two not more than 18 inches long on the 8th May.

I am also puzzled to say how many young they have at a birth. On the 8th May I saw two females each with a young one, about 18 inches long, at her side. I have never seen more than one young one with a female, but this I have often seen; the young one keeps close to its mother's side and they plunge into the water together. I am aware that the supposition that the Carpincho has only one young one at a birth is contrary to what has been written about this animal, but I merely give my own observations for what they are worth.

The Carpincho is a nuisance to the sportsman, as by plunging into the lagunas when he comes to close quarters they disturb any birds which may be there. They seem liable to scab, also to some fatal disease, to judge from the number one sees dead or in skeleton. After a long drought, with the rivers drying up and ceasing to flow for weeks, we had a heavy dash of rain, which put the rivers in flood for a day or two, stirred up the rotten mud, and brought down a lot of half-decayed bodies of cattle and bones; when, therefore, the rivers sank again they were not very pleasant to the olfactory organs. About that date I saw several Carpinchos only just dead, with no marks of violence, except an eye cleaned out after death, no doubt by a Carancho or Vulture. One cannot imagine these strong beasts being drowned, as they do not go to ground, but live in cover on the surface.

When shot and dying in deep water they sink at once, but will float in an hour or two.

In concluding these notes on the Carpincho I can only echo Señor Bollo's regret:—"Desgraciadamente este animal tan útil tiende á desaparecer de las tierras pobladas, porque continuamente se le persigue."

Coypu (*Myopotamus coypu*).

The Coypu or Nutria, to use the name by which it is always known in Uruguay, was not uncommon in some of the larger cañadas or watercourses. Here it inhabits the larger permanent lagunas. I have heard it stated that if a laguna is inhabited by Nutrias it is a sign that it never dries up in a drought. But during the seca which prevailed during the time I was in the country, and may well be distinguished as the seca grande, some places inhabited by Nutrias did dry up, but it was probably many years since they had done so previously. In the steep banks of the lagunas the Nutrias make drives, the mouths of the tunnels being half in and half out of the water when it is at its normal height. The Nutria is not a very shy animal. Some of them inhabited a little cañada by the side of which the sheep-dipping bañadéro at Santa Elena was situated, and adjoining the little potrero where the pigs were kept and all the sheep killed; they were probably attracted by the head of water kept up by a small dam. The Nutria swims with hardly a ripple and disappears noiselessly in the drive at the water-line. The body is dull brown, muzzle greyish, and there is a little warm brown on the side of the head. It swims with the nose, the top of the head, and a narrow line of the back out of water, all on a dead level, or almost so; the nostrils being very high up in the line of the skull, they are kept out of the water without the nose being poked up towards the sky. A half-grown one brought to me alive ate green maize readily, but died in my absence. An old male, when captured, made most extraordinary wailing cries of complaint.

[The Viscacha (*Lagostomus trichodactylus*), so common in the Argentine Republic, is not found in Uruguay, the great river of that name having apparently proved a bar to its extending its range into the Banda Oriental.]

Pampas Deer (*Cariacus campestris*).

In the neighbourhood of Santa Elena this species—the Gama, as it is called—has been exterminated, with the exception of a small herd preserved in a distant part of the camp belonging to that estancia, in the rincon of the Arroyos de Monzon and Grande. The herd in 1892–93 consisted, so far as was known, of about a dozen does and seven bucks. On that part of the Rio Negro which I visited it is also rare, but in some parts of Florida it is still numerous. One day at the end of January I rode up pretty close to a buck, with a nice head, and two does, which had been feeding in a low green pajonale. They were then of a warm tawny, with large and conspicuous light-coloured stern-marks. The peculiar strong musky odour (rather like cat) was apparent after they had cleared out.

This species has no "brow"-tine. The ordinary head of a full-grown buck possesses the "tray" and has the beam branched once, six points in all on the head. I have, however, known a case in which the tray branch of one antler had bifurcated and the head had seven points. This head was carried by one of the Santa Elena deer which (it is believed) died a natural death and was most likely very old. The head approached even more nearly than usual that form of the normal Rucervine type assumed by Schomburgk's Deer (*Cervus schomburgki*), omitting of course the brow-tine, which is not carried by the Guazus. The bifurcations of the hind branch of the beam in this specimen are much closer together than in most other examples I have examined (including one other from Santa Elena), which resemble the figure in Admiral Kennedy's 'Sporting Sketches in South America,' p. 38. The does, at all events in their youth, have a few whitish spots on each side of the back. At a pulperia near the south bank of the Rio Negro I saw a tame fawn, a lovely little creature.

The other deer of Uruguay are the Red Deer or Ciervo (*C. paludosus*), "el Ciervo de los pantanos" of Señor Bollo, now rare, found in the monte of the Rio Uruguay, and, as Mr. C. J. F. Davie of Montevideo tells me, also about Olinar, and in the jungles of the Department of Salto; and the little Swamp Deer, or Guazu-virá, a single-pronged-horned deer of the brocket type, now also rare (probably *Cervus simplicornis*, Illiger)—*vide* 'Description Physique,' p. 466. Mr. T. W. Burgess told me it used to be found on the north bank of the Rio Negro about the Rincon de las Palmas, and I believe it is also met with in the monte of the Rio Uruguay.

Azara's Opossum (*Didelphys azaræ*).

Azara's Opossum, or the "Comadréja" as it is always called, is common and very fond of visiting estancias at night to rob hen-roosts and pick up any flesh food lying about. Dogs often give the alarm at night, but it is not easy to distinguish an opossum among the rafters or the branches of a tree. I remember one moonlight night coming on one suddenly as it sat on a low roof close to the house, but it is needless to say he was not there when I returned with a pistol. Another night the dogs at the same place stuck one up in a shed roof, which was at last discovered and potted by the light of a match. The Comadréja has a peculiar sour, sickening smell, emitted when it is irritated or frightened. The smell is not strong, but very pertinacious, and to some people it is more disgusting than that of a Skunk.

The feet of the Comadréja are formed for climbing, and it runs on the ground in an awkward tip-toe fashion. Yet it lives in a nearly treeless country, the river monte in South Soriano being the only natural wood (composed of low thorny trees and big willows), and the Comadréja preferring to live on the higher camp, where it lies up in clefts and holes among the granite boulder rocks; among these a few low thorny bushes are found in some cases. I have never seen a Comadréja in the monte or up any native tree, but have no doubt they often climbed the trees at the estancias, which Mr. Davie tells me they are well able to do. Yet this animal has a very prehensile tail, naked and scaly. Having hauled one out of a cleft by the tail, I found that it twined the latter tightly round my fingers, the muscular power being considerable. They run up the boulder rocks with great agility. At bay, whether in rocky holt or old ants'-nest, laid up in a soft bed of dead grass, or "drawn" and facing a dog with arched back and grinning teeth, they make a snarling, grunting growl and a hiss. It is necessary to kill those taking up their quarters near houses, but they are often very difficult to kill. I have hammered one with a stick and thrown its heavy body against a rock time after time, and then, after carrying it by the tail for some distance, discovered that it was still alive. Much of the difficulty arises from their habit of shamming. Once I smoked out a female and two one-third grown young ones. A young one came first and was apparently laid out with a blow from my stick; I had to run round the rock after the next, and when I came back (in less than half a minute) the first had come to life again and departed! An old buck, worried by a dog and finished off with a shot in the head from a collecting-gun and left for dead, was found an hour or so after partly recovered.

A female was brought in on 30th October with ten young, naked, pink, and blind; head and body 2 inches, tail $1\frac{1}{2}$ inch long. Inside the mother's pouch were 9 teats only, which calls to one's mind the complaint of the eleventh little pig!

THICK-TAILED OPOSSUM (*Didelphys crassicaudata*).

The Comadréja colorada, as this species is called, is rare in the part of Soriano where I was living, only one having been killed there during my stay so far as I know. It is said by the residents to be excessively savage ("muy brava") for so small an animal. Responding to a suggestion of Mr. Davie, I inquired whether the female had a pouch capable of carrying her young, and one rather sharp and observant puestero's boy declared that it had. Although the adults are so savage, a lady of my acquaintance had a young one, taken from the body of its dead mother in the camp south of the Rio Negro in February, which was perfectly tame. It unfortunately shared the fate of so many ladies' pets and was slain by a large tom-cat belonging to a house at which she was staying on her way to the coast, a day or two before I went over there. The fur of this animal is very beautiful. It is of a warm, light chestnut, paler and yellower on the sides and lower parts. The upper parts have a flush on them of what can only be described as crimson.

April 3, 1894.

Sir W. H. Flower, K.C.B., LL.D., F.R.S., President, in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of March :—

The registered additions to the Society's Menagerie during the month of March were 69 in number. Of these 47 were acquired by presentation, 13 by purchase, 2 were born in the Gardens, and 7 were received on deposit. The total number of departures during the same period, by death and removals, was 86 :—

Dr. Günther exhibited specimens of *Lepidosiren paradoxa*, collected by Dr. Bohls in the backwaters of the tributaries of the Upper Paraguay River (swamps of the Chaco). He pointed out a peculiar modification of the skin of the upperside of the hind limbs, which is beset by tentacle-like papillæ. These, when fully developed, are arranged in fan-like sets with from 2 to 7 branches each. This structure, he stated, is peculiar to the male sex, and is fully developed only in sexually mature specimens.

Dr. Günther expressed his doubts as to the validity of the species recently described by Professor Ehlers [1] as *Lepidosiren articulata*, from Dr. Bohls's specimens.

The specimens exhibited to the meeting did not bear out the constancy of the characters on which Professor Ehlers relied for the distinction of two species of *Lepidosiren*.

The following papers were read :—

1. Further Field-Notes on the Game-Animals of Somaliland. By Capt. H. G. C. Swayne, R.E., C.M.Z.S.[2]

[Received February 24, 1894.]

Waterbuck (*Cobus ellipsiprymnus*). Native name "*Balanka*" of the Adone (Webbe Negroes), corrupted to "*Balango*" by the Somalis.

I believe there are no Waterbuck in the whole of Somaliland, except on the banks of the Webbe Shabeyli. The only other place in Somaliland which might possibly contain Waterbuck would be the Lower Nogal, near the east coast. There are none on the Tug Fafan, at any of the points where I have crossed it. There are said to be plenty all along the Webbe Ganana (Juba), the course of which lies chiefly through Gallaland.

[1] Nachrichten der k. Gesellsch. Wiss. Göttingen, 1894, No. 2 (March 10).

[2] In continuation of his paper "On the Antelopes of Northern Somaliland," P. Z. S. 1892, p. 300.

The first important collections of the Waterbuck were made by Colonel Paget and myself on two independent but simultaneous expeditions to the Webbe last spring.

I found these Antelopes very plentiful all along both banks of the river, from Imé down to Burka in the Aulihan tribe, which was as far as I followed the stream.

They lie up in the dense forest which clothes both banks of the river for some 200 yards from the water's edge; and they go out to feed in the open grass-flats outside the forest.

They go in small herds up to about fifteen individuals, though most of the herds I saw consisted of only four or five, with one old buck.

The habits of the Somali Waterbuck are similar to those of the same species all over Africa. They feed chiefly on grass, delight in a mud-bath, and take to the water readily; a wounded buck I was following in thick forest tried to escape by swimming the Webbe, some 90 yards across, and we shot him as he galloped along the further bank. The Waterbucks on the Webbe vary much in colour, from brownish grey to nearly black.

The white lunate marking over the tail is always present; some heads have the forehead bright rufous brown, and others are nearly black in this part. The flesh is eaten by the Negroes, but not by Somalis.

The horns obtained on the Webbe are small compared to Waterbuck horns in other countries; out of some 15 heads collected by me at different times, none reached 25 inches. The females are hornless.

Bushbuck (*Tragelaphus decula*). Native name "*Dól.*"

The Bushbuck is common in the dense forest on the Webbe banks; and it is the most wary and difficult to shoot of all the game-animals I have ever encountered. I never heard of its existence till my second expedition to the Webbe last autumn.

At Karanle I bought several skins and horns of "Dól" from the natives, which had been obtained by means of disguised pits, with a stake in the bottom of each. The Webbe pits are made by the Adone, and are about eight feet deep and five in diameter at the top. They are dug in the densest jungle in the paths frequented by the "Dól" when going to and returning from the water. Some of these paths are long tunnels 3 feet high, bored through the masses of vegetation for 50 yards or more. Sometimes I could only get to the river by creeping on all-fours through these tunnels; this is exciting work when it is considered that many kinds of game use them.

On my arrival at Karanle I sent skilled Negroes to repair all the pits within a mile or two of my camp, in the hope of getting a specimen.

During a month on the Webbe banks I shot only one young buck with my own rifle; but I organized three or four drives, in one of which my men shot a buck with their Sniders.

On this occasion the buck was in company with one female, which broke back through the line in spite of the firing, and in rather a curious manner. The only way of crossing the line was to jump over the head of one of my men who was standing erect; and this she did, striking him in the centre of the forehead with her hoofs and knocking him down; and so she got away.

The longest pair of horns were a pair which I picked up, measuring about 17 inches in length. Females hornless.

The young of both sexes are of a distinct reddish brown, getting darker as they grow older, and the natives say the old bucks become nearly black. The hair is generally curiously worn off along the spine.

There are four or five transverse white stripes and white spots up to about thirty on each side, more numerous in the young animals. The necks are scantily covered with short hair, and in the two young bucks we killed were very slender. The flesh is very good eating. I am not aware that the Bushbuck exists anywhere in Somaliland but in the dense forest close to the banks of the Webbe-Shabeyli river.

Clarke's Gazelle (*Ammodorcas clarkei*). Somali name "*Dibatag*" or "*Diptag*."

The Dibatag is common enough where it is found at all, but it is very local in its distribution.

Since Mr. Clarke first discovered it in the distant Marehan country, to the south-east, and in the Dolbahanta country, a few have been met with and shot by sportsmen in the eastern parts of the Haud Waterless Plateau.

I have been singularly unfortunate with this Antelope, never having been in the country inhabited by it till I went to the Nogal Valley three years ago. At that time the "Jilal," or dry season, was at its height, and all game scarce and shy. I never got a Dibatag till last June, when on my return journey from Ogaden across the Waterless Plateau I made a detour of several days to the east on purpose to shoot one.

I searched for Dibatag at Tur, a jungle due south of Toyo grass-plains, the distance being some eighty miles from Berbera.

I was lucky in getting one good buck and in picking up two pairs of horns. I saw a good many Dibatag, but all were wild and shy. This is their extreme western limit, and they never by any chance come so far south as the Golis range. Further east, towards Burö, they are more plentiful and less shy.

Dibatag are very difficult to see, their purplish-grey colour matching with the high "durr" grass in the glades where they are found. Its glossy coat, shining like that of a well-groomed horse, reflects the surrounding colours, making it sometimes almost invisible; and at the best of times its slender body is hard to make out.

I have often mistaken female Waller's Gazelles for Dibatag, and shot one of the former in mistake for the latter. The habits and gait are much the same, save that the Dibatag trots off with head held up, and the long tail held erect over the back like a stick, nearly meeting the head, while Waller's Gazelle trots away with its head down and its short tail screwed round. Like Waller's Gazelle, the Dibatag goes singly or in pairs, or small families up to half a dozen or so.

Like Waller's Gazelle also, the Dibatag is enabled by its long neck and long upper lip to reach down branches of the mimosa bushes from a considerable height. As I have mentioned before, the shape of head and way of feeding of both the Dibatag and *Lithocranius walleri* are giraffe-like, and I have seen both animals standing on the hind legs, fore feet planted against the trunk of a tree, when feeding. I think Waller's Gazelle subsists almost entirely on bushes, as they are constantly found in places deserted by Oryx and all other antelopes because there was no grass. I have seen Dibatag feeding both on thorn-bushes and on the "durr" grass. Both antelopes can live far from water.

The country most suitable for Dibatag is jungle of the "Khansa" or umbrella mimosa alternating with glades of "durr" grass, which grows about six feet high. The females are hornless.

THE SAKÁRO ANTELOPES (see P. Z. S. 1892, p. 307).[1]

There are certainly two of these small Antelopes, which are called by the natives "*Sakáro Gussuli*" or "*Gussuli*," and "*Sakáro Gol-ass*" or "*Gol-ass*" (*i. e.* red-belly).

There is also a third Sakáro recognized by the Somalis, which I have often shot and generally classed with the Gol-ass. It is smaller than the Gol-ass and has yellowish grey on the sides of the belly instead of red, but is in every other respect similar. The Somalis call it "*Sakáro Guyu*" or "*Guyu*," and declare it to be a distinct variety from the Gol-ass, to be known by its smaller size and the yellow belly. It appears to be found wherever the Gol-ass is found.

I have often noticed, in about two hundred specimens that I have shot for food at one time or another during eight years, that the skulls appear to vary much in size in adult animals, but my attention was called to the third native name only at the end of my last expedition.

I will therefore consider, in the absence of proof, that there are only two kinds of this small antelope, viz. the Gussuli and the Gol-ass.

The Gol-ass is the ordinary Somali "*Sakáro*," which I have mentioned in my former paper.

I came on the "Gussuli" for the first time a day's journey south of Seyyid Mahommed's village in the Malingur tribe and all over the Rer Amaden country. Its range is very similar to that of the Rhinoceros, and it is found in many parts of the Haud,

[1] [On these Antelopes see also Mr. Oldfield Thomas's paper, below, p. 323.—P. L. S.]

where it overlaps with the range of the Gol-ass. The female Gussuli appear to be much larger than the male; and it is a pretty safe rule, when looking for a buck, to fire at the smaller one.

The Gussuli have long snouts, in shape quite different from that of the Gol-ass, being much longer and tapering to a point. They are also somewhat larger than the Gol-ass, and are recognizable in the bush by their grey colour. They start up in pairs or in threes. Sometimes the bush is alive with them, and I have seen more than a dozen run off together; but they do so only when alarmed, and are not naturally gregarious.

The Beira Antelope (see P. Z. S. 1892, p. 308).

"I first heard of the 'Beira' near Ali-Maan, in the Gadabursi country, among very rugged hills, in the autumn of 1891. Then my brother (Capt. E. Swayne, Bengal Staff Corps) saw two for the first time, but failed to get a shot.

"He described them as reddish Antelopes, rather larger than the Klipspringer, with small straight horns, bounding away among the rocks exactly as a Klipspringer does.

"On my last trip the Somalis assured me that I should find 'Beira' on the Wagar Mountain and on Negegr, which is its eastern continuation, is about 40 miles S.S.E. of Berbera, and rises to nearly 7000 feet. They said it was nearly as large as an ordinary flabby-nosed Gazelle, but reddish—that it inhabited ground similar to the Klipspringer, but was shy and difficult to shoot. This no doubt accounts for no European having shot one, though my brother heard of them so far back as 1891.

"I tried vainly to get 'Beira,' having no time to go again to Wagar myself. On leaving the coast last November, I sent men in to look for 'Beira,' offering a reward of 20 rs. for a good head and skin of a male and female, and gave full instructions to my agents in Berbera and Aden to pay the reward and to send me the specimens. I received the two skins and pair of horns direct from Aden, without explanation, but have no doubt whatever they are the specimens of 'Beira' which I sought. They have evidently been killed by natives, and that accounts for the imperfect condition of the specimens. To my brother is due the credit of the discovery."[1]

Grévy's Zebra (*Equus grevyi*). Somali name "*Fer'o.*"

Grévy's Zebra was, I think, first shot in Somaliland by Colonel Paget and myself on our simultaneous expeditions last spring.

I found them first at Durhi, in Central Ogaden, between the Tug Fafan and the Webbe, about 300 miles inland from Berbera. I shot seven specimens, all of which were eaten by myself and my

[1] [Since this paper was read the "Beira" has been described by Herr Menges (Zool. Anz. xvii. (1894) p. 130) as a new species, and called *Oreotragus megalotis*.—P. L. S.]

thirty followers; in fact for many days we had no other food; and this was no hardship whatever, as the meat is better than that of many of the antelopes. The flesh is highly prized by the Rer Amaden and Malingur tribes.

The Zebra was very common in the territory of these two tribes. The country there is covered with scattered bush over its entire surface, and is stony and much broken up by ravines; the general elevation is about 2500 feet above sea-level.

The Zebras, of which I saw probably not more than 200 in all, were met with in small droves of about half a dozen, on low plateaux covered with scattered thorn bush and glades of "durr" grass, the soil being powdery and red in colour with an occasional outcrop of rocks. In this sort of country they are very easy to stalk, and I should never have fired at them for sport alone. I saw none in the open flats of the Webbe valley, and they never come near so far north as the open grass-plains of the Haud, Durhi south of the Fafan being their northern limit.

The young Zebras have longer hair and the stripes are rather light brown, turning to a deep chocolate, which is nearly black in adult animals.

After firing at one of a drove of Zebras I was sorry to find on going up to it that it was a female, and that its foal was standing by the body, refusing to run away though the rest had all gone. We crept up to within ten yards of it, and made an unsuccessful attempt to noose it with a rope weighted by bullets, but it made off after the first try. We must have been quite five minutes standing within ten yards in the thick bush while we were preparing the noose.

Zebras are very inquisitive; when I was encamped for some days at Eil-Fúd, in the Rer Amaden country, the Zebras used to come at night and bray and stamp round our camp, and were answered by my Abyssinian mule. The sounds of the two animals are very similar.

Black Rhinoceros (*Rhinoceros bicornis*). Native name "*Wiyil.*"

For many years the Two-horned Rhinoceros has been known to exist in the interior of Somaliland, and going further in every year I have constantly been expecting to come upon their ground.

The first Somali Rhinoceroses were shot by my brother and myself in our expedition to the Abyssinian Border in August 1892, and since then only a few have been shot by Europeans.

They come far north of the range of the Zebras, sometimes wandering as far as the open grass-plains of Toyo, a hundred miles south of Berbera, where they hide in the patches of "durr" grass. They are common in the south-eastern Haud; I never found any signs of them in many expeditions in the Habr Awat, Esa, and Gadabursi countries. They are most common in the valley of the Tug Fafan, and thence in the whole of the country as far as the

Webbe, and they are plentiful beyond in Galla-land. They are said to exist to the south-east of Berbera, but I never saw any traces of them.

We found the Rhinoceros the most stupid game-animal we have encountered, and easily approached if the wind is right. They were not more prone to charge than Elephants, and I only had one narrow escape. I have never seen more than three together.

The ground they like best is very stony broken hills with some river-bed not too many miles distant, where they can go at night to drink and bathe. They travel considerable distances to the river and wander all night up and down the channel looking for a convenient pool, and making a maze of tracks in the soft sand.

The Abbasgul, Malingur, and Rer Amaden tribes eat their flesh when hungry, and I found it very good and lived for a week on it.

We could usually cut from 15 to 30 shields from each Rhinoceros, $\frac{3}{4}$ inch thick and 15 inches in diameter, worth about a dollar apiece at the coast.

Everywhere in Central Ogaden the caravan-tracks are furrowed in grooves a yard or more long and six inches deep, which look like the work of a plough. This is done by the Rhinoceros plunging his front horn and hard thick lip into the ground as he walks along.

A good pair of bull's horns measure 19 inches for the front and 5 inches for the back one.

Miscellaneous Notes.

Besides the animals mentioned in this and my previous paper, the game-animals seen by me in Somaliland include Lions, Elephants, Leopards, Wart-Hogs, and Ostriches.

The Spotted Hyæna is very common, and the Striped Hyæna rather rare. There is a wild dog, called "Yey," which I have never seen or shot.

Crocodiles swarm in the Webbe-Shabeyli river. I had a horse dragged into the river and killed by one. There are a few schools of Hippopotami, one of which had its usual abode near Sen-Morettu, but I failed to find it, only coming upon the fresh tracks.

There are Giraffes in the Aulihan country, three days from Burka, but I gave them up for the chance of going to the Arussi Gallas.

While on the Webbe I heard that four Buffaloes, all bulls, had strayed from the Geriré Galla country, through eighty miles of bush, and had taken up their abode in the forest on the Webbe banks at Sen-Morettu, four years before my visit to that spot. My informant, a Gilimiss Somali, told me his father had killed two of them, two years before, with poisoned arrows, and that two remained.

I found their fresh tracks, the first I had ever seen, and tried very hard for two days to get a sight of them. We put them up eight times at a few yards distance in the fearfully dense forest, without once seeing them, and organizing a drive next day they broke through the line of beaters and got away, making for the distant Galla Hills. These are the only Buffaloes I ever heard of in Somaliland.

They are said by the Gallas to be plentiful on the Webbe Web, a tributary of the Juba, three days distant from Karanle.

2. On the Dwarf Antelopes of the Genus *Madoqua*. By Oldfield Thomas, F.Z.S.

[Received March 17, 1894.]

The genus *Madoqua* (by which name, as Mr. Sclater has pointed out, *Neotragus* of most authors should be known[1]) consists up to the present of three species—*M. saltiana*, Blainv., from Abyssinia, *M. kirki*, Günth., from S. Somali and E. Africa, and *M. damarensis*, Günth.[2], from Damaraland. During the recent opening up of the fauna of Somaliland, the North-Somali specimens, without any very detailed comparison, have been referred to *M. saltiana*, and the Central-Somali ones to *M. kirki*, these being indeed their nearest allies in each case; but now, on a careful examination of the whole genus, which has been helped by the further material recently collected by Capt. H. G. C. Swayne, and presented to the Museum by Mr. Sclater, I have come to the conclusion not only that these two are each different from the species to which they have been respectively referred, but also that there is a third Somali species, different again from the other two. I have therefore now to describe all three species as new.

It happens most unfortunately that a good deal of the material before me has been collected by sportsmen who have not been trained as professional collectors, and who, in crossing the ranges of the three Somali species, have killed and brought home a number of skins and skulls, but the exact reference of these each to the other is not always quite certain. By care in the selection of type specimens, howéver, risk of error from this cause is minimized, much as it has added to my difficulties in working out the genus.

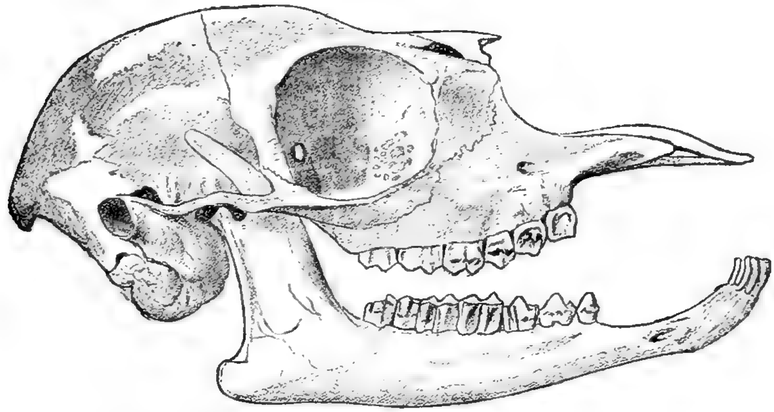
The genus is readily divisible into two very distinct groups, of which *M. saltiana* and *M. kirki* are respectively typical; the

[1] *Madoqua*, Ogilb. P. Z. S. 1836, p. 137. Type *M. saltiana*, Blainv.
Neotragus, Gray et auct. plurim. (nec H. Sm. in Griff. An. King. iv. p. 269. Type *N. pygmæus*, L.).
The genus which has hitherto borne the name of *Nanotragus*, Sund. (1846), must therefore now be known by that of *Neotragus*.

[2] Mr. True, in his paper on the Mammals of Kilima-njaro (P. U. S. Nat. Mus. xv. p. 477, 1892), has suggested that *M. kirki* and *M. damarensis* are the same, and uses for them the latter of these two names, unaccountably as it appears to me, *kirki* having been the first described. In my opinion, however, *M. damarensis* is really distinct from *M. kirkii*, being considerably larger than the latter, as may be seen by the synopsis and measurements given below.

characters that divide them are practically those brought out by Dr. Günther in his description of the latter[1], at least so far as the skulls and teeth are concerned.

Fig. 1.



Skull of *Madoqua guentheri*, side view. Reduced.

The first species to be described belongs to the *kirki* section, and of this, which I propose to name in honour of Dr. Günther, who first described the remarkable cranial peculiarities of the members of the section, the Museum possesses the following material:—

a. Immature skull, ♂. Central Somaliland. E. Lort Phillips. B.M. 86.11.19.2[2].
b. Adult skull, ♀. Central Ogaden, 3000 feet, Aug. 1893. Capt. H. G. C. Swayne. 94.2.21.18. *Type.*
c, d. 2 ad. skins, ♀. Central Ogaden, 3000 feet, Aug. 1893. Capt. H. G. C. Swayne. 94.2.21.16,17.

Taking as the type the skull *b*, which in all probability belongs to one or other of the skins *c, d*, the species may be briefly diagnosed as:—

MADOQUA GUENTHERI, sp. n.

Essential characters of *M. kirki*, but the lower, premaxillary part of muzzle much longer and narrower, while the nasals are much shorter. Tip of nasals, and also the front edge of the upper part of the secondary process of the maxillæ, where it meets the nasals, level with the front edge of $\underline{\text{p. 4}}$ instead of $\underline{\text{p. 2}}$. Premaxillæ not reaching to nasals. Breadth of muzzle halfway between gnathion and $\underline{\text{p. 2}}$ less than a quarter the distance

[1] P. Z. S. 1880, p. 17.
[2] The skull mentioned by Sclater, P. Z. S. 1886, p. 504. The skin referred to at the same time, as is clearly shown by its size and other characters, did not really belong, as was supposed, to this skull, but to another, younger one (86.11.19.3), and is referable to the species described below as *M. phillipsi.*

between these two last-named points, while in *M. kirki* this breadth is about one-third. Teeth rather smaller than in *M. kirki*. $\overline{\text{M. 3}}$ with the additional third lobe found in *M. kirki* and *damarensis*, but it is decidedly smaller than in either of these species.

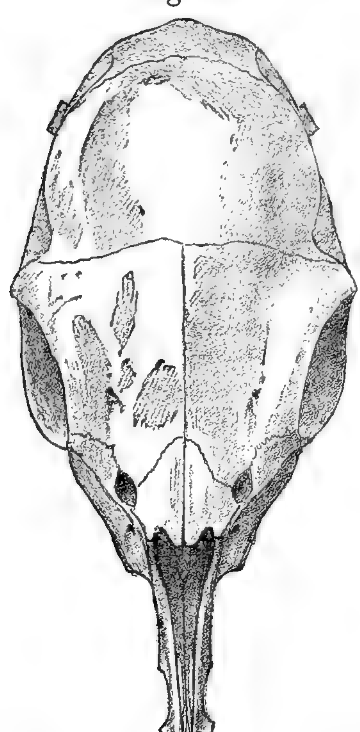
For dimensions of the typical skull see table, p. 326.

Externally, the species, as judged by the skins *c* and *d*, is coloured almost precisely as in *M. kirki*, and the only obvious difference is that the snout is far more elongated and proboscis-like, and fully justifies the remarks on its extraordinary length often made by Somali sportsmen, remarks which, taking them as applied to *M. kirki*, have always appeared to be somewhat exaggerated.

The function of the proboscis is as yet quite unknown, but one might put forward as a suggestion the possibility of its being of service in searching for bulbs under the surface of the soil.

The second species, which I propose to name in honour of Mr. E. Lort Phillips, who was the first to obtain it and to whom the Museum is indebted for so much interesting Somali material, belongs to the *M. saltiana* group, distinguished by the absence of the third lobe on $\overline{\text{M. 3}}$ and by its less specialized muzzle.

Fig. 2.



Skull of *Madoqua guentheri*, top view. Reduced.

Of this, which has hitherto been put down as *M. saltiana*, there are before me the following specimens :—

a, b. Adult ♂ & ♀, in spirit. Dobwain, in the Maritime Hills, *Table of Skull-measurements* (in millimetres).

Species	*M. saltiana.*	*swaynei.*	*phillipsi.*	*damarensis.*	*kirki.*	*guentheri.*
No.	69.10.24.4.	94.2.21.20.	88.6.20.7.	79.12.28.1.	79.12.18.2.	94.2.21.18.
Sex	♂	♂	♂	♀	♂	♀
Basal length	96	77·5	82·6	—	90·5	97
Greatest breadth	55·2	48·2	51·7	(c.) 56	53·5	51·6
Nasals, length	23·6	15	19	21·7	12·2	17·5
Nasals, combined breadth	20	14·9	16	18·1	14·5	15·5
Interorbital breadth (on frontals).	41·5	35	36·2	41·5 [1]	38	36
Intertemporal breadth	39	36	38·7	42	37·5	40
Breadth of brain-case	40·2	37·4	38·5	44·5	38·5	41·5
Gnathion to junction of nasals and maxillæ (or premaxillæ).	32	27·5	28	37	35·5	42·3
Gnathion to orbit	53·5	41	46	56·5	51·2	53·5
Gnathion to front of alveolus of p. 2	27·5	21	22·5	30	25	28·2
Length of upper molar series	35	31	33	38	35·2	33

[1] Taken so as to be correctly comparable with the corresponding measure in other species; but there is in *M. damarensis* a peculiar notch on each side along the junction between the frontals and maxillæ, so that the true frontal interorbital measure is only 35·7.

40 miles S. of Berbera, Jan. 1888. E. Lort Phillips. 88.6.20.7,8. *a* the *type*.

c. Imm. skin[1], ♂. "Central Somali." E. Lort Phillips. 86.11.19.2.

d. Young skull (probably belonging to *c*). E. Lort Phillips. 86.11.19.3.

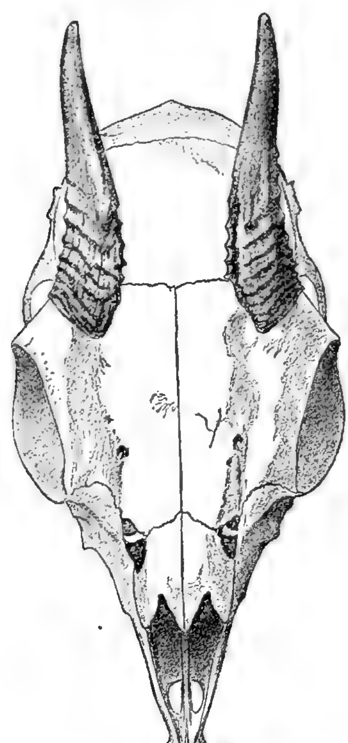
e–i. 2 skins and 3 skulls. Berbera. Capt. H. G. C. Swayne. 93.12.1.8,9; 94.2.21.12,13, & 19.

As compared with Abyssinian examples of *M. saltiana*, the following are the characteristics of

MADOQUA PHILLIPSI, sp. n.

Size decidedly smaller than in *M. saltiana* (see skull-measurements below). Back finely grizzled ashy grey; sides, shoulders,

Fig. 3.



Skull of *Madoqua phillipsi*. Reduced.

and limbs bright rufous ("cinnamon," Ridgway), as compared with the faint rufous of the shoulders and limbs of *M. saltiana*. Head-colours and markings apparently as usual.

[1] The skin mentioned by Sclater, *l. c.*

Dimensions of the type, an adult male in spirit:—Head and body 470 mm., hind foot to base of hoof 159, ear from notch 59. For skull-measurements see table, p. 326.

Hab. Northern half of Somaliland.

This, the ordinary "Dik-Dik" of Northern Somaliland, seems to be very common throughout its range. Capt. Swayne tells me that during every day's march they are constantly being put up and shot, exactly like the common European hare, the habits of which they closely imitate.

Although undoubtedly very closely allied to the Abyssinian species, its differences, both in size and colour, appear to be so marked and so constant that I no longer feel justified in assigning it to that form. The name of *M. saltiana* should therefore be entirely struck out of the list of the Somali fauna.

Lastly we have to deal with a species which, found, like *M. phillipsi*, near Berbera, is there well-known as distinct both to sportsmen and natives, and has a different local name. I propose to name it after the enthusiastic naturalist and sportsman who first drew my attention to its distinctness, and whose notes on it have been already published in the 'Proceedings.'

MADOQUA SWAYNEI, sp. n.

Colour approximately as in *M. saltiana*; size less than in *M. phillipsi*, and therefore far less than in *M. saltiana*. Colour of back grey with a strong fulvous suffusion ("isabella" of Ridgway seems the nearest, but is not yellowish enough). Limbs rufous, and sides faintly so, but very different from the strong well-defined rufous of *M. phillipsi*.

Of this species the Museum has three skins, brought home by Capt. Swayne from Berbera, and of these No. 94.2.21.15 is selected as the type.

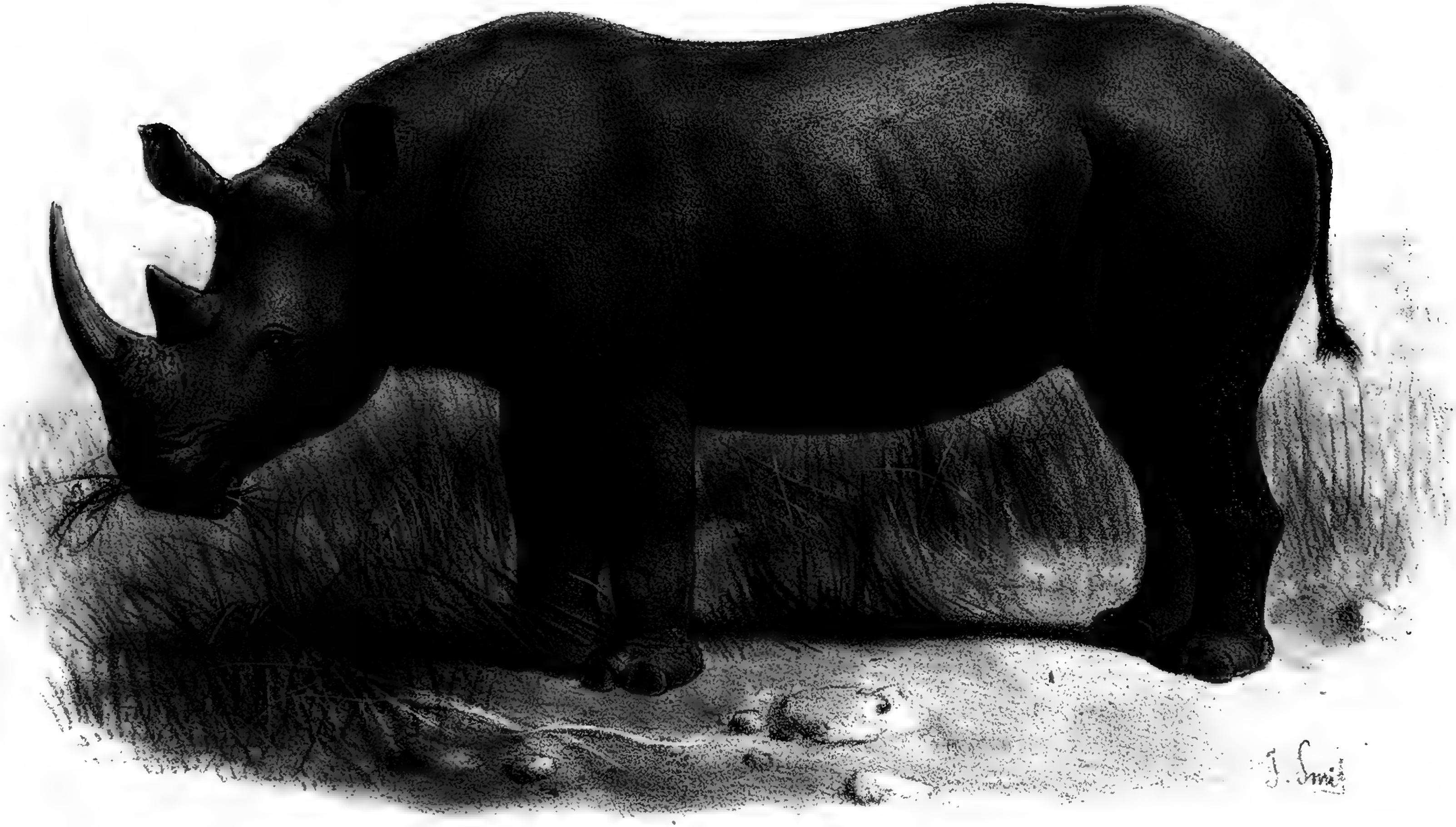
The measurements are as follows:—Head and body (*c.*) 500 mm., hind foot without hoofs 149, length of hoof 22.

Besides the skins, one skull of Capt. Swayne's (94.2.21.20) and another one (85.11.16.3), collected at Gerbatir, N. Somali, by Herr Menges, are referred provisionally to this species, and the measurements of the former given in the table on p. 326.

Capt. Swayne tells me that the native name of *M. swaynei* is "Guyu," of *M. phillipsi* "Gol-ass," and of *M. guentheri* "Gussuli."

The following rough synopsis of the species of *Madoqua* will help to summarize the results arrived at:—

A. Last lower molar without a third lobe; upper line of premaxillæ slanting, scarcely curved. Proboscis less developed.
  a. Back yellowish or fulvous grey, sides scarcely more rufous.
    a^1. Size larger, basal length of skull 95 mm. Abyssinia.
      1. *M. saltiana*, Blainv.
    b^2. Size smaller, basal length of skull about 78 mm. N. Somali.
      2. *M. swaynei*, Thos.



J. Smit del et lith.

Mintern Bros. imp.

RHINOCEROS SIMUS, ♂.

b. Back grey, sides and shoulders rich rufous or cinnamon; size intermediate between last two (skull 84 mm.). N. Somali.
3. *M. phillipsi*, Thos.

B. Last lower molar with a third lobe; upper line of premaxillæ S-shaped. Proboscis more developed.

c. Tip of nasals about level with front edge of anterior premolar, about 33 mm. from end of premaxillæ (gnathion).

c^1. Back of orbit to gnathion about 86 mm. Damaraland.
4. *M. damarensis*, Günth.

d^2. Back of orbit to gnathion about 76 mm. S. Somali to Kilima-njaro.
5. *M. kirki*, Günth.

d. Tip of nasals about level with back of middle premolar and about 42 mm. from gnathion.

e^2. Plateau of Central Somaliland. 6. *M. guentheri*, Thos.

P.S. (*April* 13*th*, 1894).—Since this paper was read Dr. E. Donaldson Smith has presented the British Museum with further examples of the two Northern Somali species—*M. phillipsi* (from Milmil, 1894) and *M. swaynei* (also from Milmil).

3. On the Occurrence of the White or Burchell's Rhinoceros in Mashonaland. By R. T. Coryndon.

[Received March 30, 1894.]

(Plate XVIII.[1])

This subject cannot but have a melancholy interest, not only to zoologists, but to sportsmen and naturalists all the world over, for it is more than probable that before the close of this century the White Rhinoceros, the largest of all the mammals after the Elephant, will be extinct, and this, too, with but very few preserved specimens in existence to give the natural-history student of the future an idea of its enormous size and peculiar structure.

In the early hunting days in Matabililand, and in the high well-watered country which has since come to be known as Mashonaland, Rhinoceroses of both kinds were comparatively common: the White (*Rhinoceros simus*) was found usually in the open grass-country, the Black (*R. bicornis*) usually in the rugged hill-country. It is now generally recognized that there are in Africa only two varieties

[1] [The figure (Plate XVIII.) is taken from one of the male specimens shot by Mr. Coryndon, which has been excellently mounted for the Tring Museum by Mr. Rowland Ward, F.Z.S., of Piccadilly. It is described ('Land and Water,' April 14, 1894, p. 571) as follows:—

"The specimen stands 6 feet $1\frac{1}{2}$ in. at the withers; length between uprights 12 feet 1 in.; length from lip, along bases of horns, up between ears, and following curves of back to root of tail, 13 feet; to tip of tail 15 feet $8\frac{1}{2}$ in; girth behind shoulders 10 feet $3\frac{1}{2}$ in.; girth round fore-arm 3 feet $4\frac{1}{2}$ in. The development of the muscle of the fore-arm attracts attention at once. The width of the lip between the greatest depth of the nostrils is just under 12 inches. The anterior horn measures 2 feet 3 in. round the base, and is 1 foot $10\frac{1}{2}$ in. from base to 'tip.'"

Mr. Rothschild asks me to add the following remarks:—"In years gone by, when this species was common throughout the Cape Colony, those found in the south-west are said to have been much paler and whiter in colour than those in the north-east, and may have justified to a certain extent the name of White Rhinoceros."—P. L. S.]

of the Rhinoceros, the black and the white; the old Dutch elephant-hunters always believed in several, and advanced as their reasons the different lengths of the anterior horn, and made their decisions by this standard alone. Both Rhinoceroses are easy to shoot, and it is small wonder that when a long train of carriers has to be fed, or when natives are hunting for a supply of meat to carry back to their kraals, rhinoceroses were shot in preference to buck, wary and difficult to stalk as they are and as a rule more tenacious of life. Furthermore, it is natural that a White Rhinoceros should be shot in preference to a Black, for they generally carry a good deal more fat, are very much larger, and as a rule have larger and more valuable horns.

As time went on both white and native hunters carried on their work until, a few years ago, naturalists and sportsmen woke up to the fact that there were very few of the White Rhinoceros left in the country. This happened at an unfortunate time, for just then Mr. F. C. Selous, whom I consider the only scientific hunter between the Crocodile and the Zambesi Rivers, was engaged by the Chartered Company to guide the Pioneer Expedition up to Mashonaland, and was in consequence unable to afford the time necessary for a trip to the country where they were supposed still to exist. Needless to say, all this time the natives were shooting in the ordinary course and naturally did not understand the view taken in England; had they fully appreciated it, however, I do not suppose it would have made any material difference to them.

Thus it was that, thanks to their greater size and to the fact that they carried more fat and finer horns than the Black, the Square-mouthed Rhinoceros has gradually disappeared, and was, until we shot those obtained in 1892, considered by zoologists to be very nearly, if not quite, extinct.

How these names—the Black and White—originated, I do not know, and I have heard of no satisfactory theory.

No serious assertion has, I believe, ever been put forward that the Square-mouthed Rhinoceros occurs north of the Zambesi; certainly no horns in any way resembling the massive growths of *R. simus* have been brought from there. Count Teleki claims to have shot a White Rhinoceros in N.E. Africa, not far, I think, from Kenia. It is interesting to see that he bases his claim upon the fact that this rhinoceros was of a distinctly lighter colour than the ordinary varieties; but, as a matter of fact, there is no difference between the colours of the two African species. If anything, I fancy the so-called White Rhinoceros is the darker-coloured animal of the two.

I have lately heard of two events which are certainly interesting, but which, I think, bear no real significance. About 12 years ago Colonel Coke made a short shooting-expedition into Somaliland; he started, I believe, from Witu, and while hunting some distance inland he purchased from a caravan several rhinoceros horns. One of these horns, Dr. Günther tells me, it is more than probable is a White Rhinoceros horn. Should this surmise prove to be correct, it is difficult to conjecture how this solitary horn got into Central Africa. The second instance is this: I hear that information from Lisbon has been received in London to the effect that the White Rhinoceros has been seen upon the borders of Angola, on the West Coast of Africa. Now it is possible, I suppose, that continued persecution may have driven this animal from the north-eastern part of Mashonaland to the upper grounds—still absolutely undisturbed—of the Zambesi; though it is extremely improbable that it would go so far as Angola. Besides, the White Rhinoceros is so entirely connected with the country south of the Zambesi that it is more than possible that the traveller who brought this information may have been mistaken.

The main points of difference between the two African Rhinoceroses are the shape of the mouth and the manner of feeding. *R. bicornis* has a prehensile upper lip and a much smaller head altogether than *R. simus*; he feeds entirely upon leaves and twigs and prefers a rough, bushy, inhospitable country; he is wary and shy, quick to anger and exceedingly obstinate, inquisitive, and suspicious. *R. simus* has a disproportionately large head with a great jaw which is cut off quite square in front, and the great rubber-like lips are suited for the grass upon which he feeds entirely, though in the autumn and winter, when vast stretches of country have been burnt away, it is a puzzle how he manages to get enough nutriment to sustain his great bulk. He carries his head very low, and has long ears slightly tipped with curly black hair; he is not so inquisitive or suspicious as his black brother, and is slightly more sluggish in his movements, though upon occasion he can cover the ground with unexpected speed. Another curious fact is that the calf of *R. simus* always runs in front of the cow, while the calf of *R. bicornis* invariably follows its mother: this habit never varies.

Rhinoceroses drink every day—or rather every night, and as a rule do not go down to the water till after midnight. When the sun gets very warm they generally enjoy a siesta, sometimes in the bush and sometimes out in the glaring, quivering heat; and though they will occasionally lie in thick bush they do not make a point of choosing the deepest shade. When fairly asleep they do not waken easily, and they may then be readily shot or photographed.

I am convinced, along with Mr. Selous, that the temper of the rhinoceros has been put down very generally as much worse than it really is. One strong proof of this is that a native hunter will seldom lose the opportunity of a shot at a rhinoceros, whereas he will very rarely take advantage of any chance he may get at a lion, elephant, or buffalo. When rudely awakened from a comfortable doze by such a sudden shock as a 10-bore bullet most probably produces, it is not surprising that a rhinoceros should feel annoyed or that he should express such annoyance by a charge; but I cannot believe that the majority of the "vicious attacks" sustained—by their own account—by hunters were intended as such by the somewhat slow-witted animal.

I will now describe a curious habit of *R. simus*; it is in the manner of dropping its dung. *R. bicornis*, after doing this, proceeds to stamp upon the dung and to tear and dig up the ground in the immediate vicinity, so that there is absolutely no chance of any one missing the place where a *R. bicornis* has spent the day. *R. simus*, however, leaves his dung alone and does not trample and scatter it about; moreover, he is conservative in these matters; he always drops his dung in one place until he has raised a huge heap, then he starts the same operation in another place, and so on.

For this reason it is impossible to confound the species when following spoor, in addition to which the footprints of *R. simus* are much larger than those of *R. bicornis*, and one observes also the marks that each leaves upon the twigs or the grass they feed upon.

I think the longest horn of *R. simus* known measures 56½ inches, and I believe specimens of the horns of *R. bicornis* are in existence which measure 40 inches. It goes, of course, without saying that all the long-horned examples of *R. simus* have been shot out of the country years ago. Should, in the future, another specimen be shot and preserved, I fancy the hunter will not cavil at the length—or rather the shortness—of the horn it may carry.

Until 1892, the last White Rhinoceros shot was, I believe, in 1886. John Engelbrecht and another Dutchman then killed ten of them, and five more were shot in the same season by native hunters from Matabililand.

It is a curious fact that under the skin of the two animals which I shot I found six native bullets, which the Rhinoceroses must have carried about with them for years; two of these bullets were of hammered iron and four were of lead. This remarkable fact is decidedly in favour of my argument that it is impossible to *preserve* the very few remaining specimens, as the natives of course do not look at the matter from the same point of view as savants at home; they want meat, and when they shoot or trap an animal, which is luckily seldom, they do not preserve the skin.

If the Rhinoceroses are not shot by white men they will most assuredly be shot by natives. In the former case the skeletons and hides will be set up for the public benefit in our museums; in the latter—well, a few jackals and vultures, and some small kraal hidden away in the bush in the almost unexplored flats in Africa, will alone benefit—and at a cost which I fancy Europeans do not as yet sufficiently appreciate. As time goes on zoologists will the more regret that the largest of land mammals after the Elephant has become extinct—and this, too, although almost unrepresented in all the splendid museums in Europe and America.

I will now give a short account of the specimens of the White Rhinoceros that I have lately shot.

About the middle of 1892 I was on the Zambesi, and after spending some time with the Portuguese, I proceeded to return to Salisbury in Mashonaland. On the way we found three White Rhinoceroses and shot the calf; the two old ones, though badly wounded, managed to escape. Next morning my companion, Mr. Arthur Eyre, succeeded in shooting an old cow; she had a small calf with her, and we captured it with the intention of bringing it to England. In spite of our greatest care, however, it died on the ninth day. I wrote an account of this to the 'Field,' and received subsequently a commission from a great English collector to shoot a specimen for him. In the first few days of June 1893 I started alone from Salisbury and, by the greatest of good luck, found some spoor in North-east Mashonaland before the end of July. I then formed a permanent camp, and began to work up and trace the spoor. For five days from sunrise till dark I patrolled and quartered every yard of country for a good number of miles, and on the sixth day I saw—though so far off that they appeared like dark specks—two of the huge brutes I was searching for. The first thing to do of course was to get below the wind, as when they were first sighted the wind blew directly from me to them. In an hour's time I was crawling towards them through the fringe of bush that lay about 150 to 170 yards below the open position they had chosen for their midday siesta. I thought they might give me some trouble, so I took my coloured boy with me—he could shoot rather well and carried a single 12-bore rifle. As I crawled on my stomach towards them with the greatest possible care, I saw one of them had become suspicious and had got on to his feet, evidently much disturbed. When this happened I flattened myself lower if possible into the sharp grass stubble and black ash—this latter was the result of a devastating grass fire which had occurred a few weeks before. It seemed hours before this very painful crawl brought me to the small tuft of dry grass I was making for. After waiting for some time I was relieved to see the other brute stand up; I whispered a few words to the boy, and then kneeling right up quickly we lifted the rifles. The larger bull stood on the left and almost facing me, the other stood broadside on; I did not wish to break any great bones, so I did not fire at the point of the shoulder—which would have been the usual shot under the circumstances—but put the bullet from the 10-bore "Paradox" between the first two ribs and into the lung: as the huge brute spun round, I put the second shot behind the ribs; it travelled forwards and also, I found afterwards, reached the lungs. The boy fired his rifle almost simultaneously with my first shot, and as the animals went off in opposite directions we jumped up and followed them at our best pace. For over a mile the old bull went like a steam-engine; he gradually, however, settled down, and I came up and gave him two more bullets from behind: this helped him on again, but not for more than half a mile, when he slackened again. I soon ran up to him and found him beginning to stagger, for all this time he had been throwing blood by the gallon from his nostrils. One more shot finished him, and as he sank down with a kind of sob the buffalo-birds (*Buphaga*) left him and with shrill notes of alarm they flew up and, circling for a few minutes over us, disappeared in the direction that the other rhinoceros had taken. I was completely exhausted by the severe run, and taking out my pipe I sat down for a short rest upon the huge grey head. The second bull succumbed about half a mile from where I had first fired. It was now well on in the afternoon, and my "skerm" was about six miles away; so, leaving the animals where they were, I went to the camp, packed up my goods, and came back again. It was then close to sunset, and I had only time to take two quick shots with the camera and make a cut in the stomach and bush the carcass up for the night. I then went to the second bull, cut him open, bushed him up, and then in the pitch darkness proceeded to make a large skerm, for it was to be permanent for several days at any rate. Next morning the carcasses had swelled up considerably, but I managed to take a few measurements and make some sketches before skinning them. For eleven days I stayed at that skerm, cleaning the bones, drying the skins, and watching the boys, for they had an annoying habit of throwing the smaller bones away; it may be imagined that, with the quantity of small scraps of meat lying about in the hot sun, in a few days the place had grown—well, unpleasant!

I stayed about that country a few days longer, then brought the specimens into Salisbury—not without a very considerable amount of trouble. A few days after that I left Salisbury with the troops for Matabililand, served through the whole of the war, and then in January I came home. The Rhinoceroses preceded me by a few weeks. One of them will be set up in the Natural History Museum at South Kensington; of the other, the skeleton goes to the Cambridge University Museum, and the skin to the Hon. Walter Rothschild's Museum at Tring.

4. List of Butterflies collected by Captain J. W. Pringle, R.E., on the March from Teita to Uganda, in British East Africa. By Emily Mary Sharpe[1].

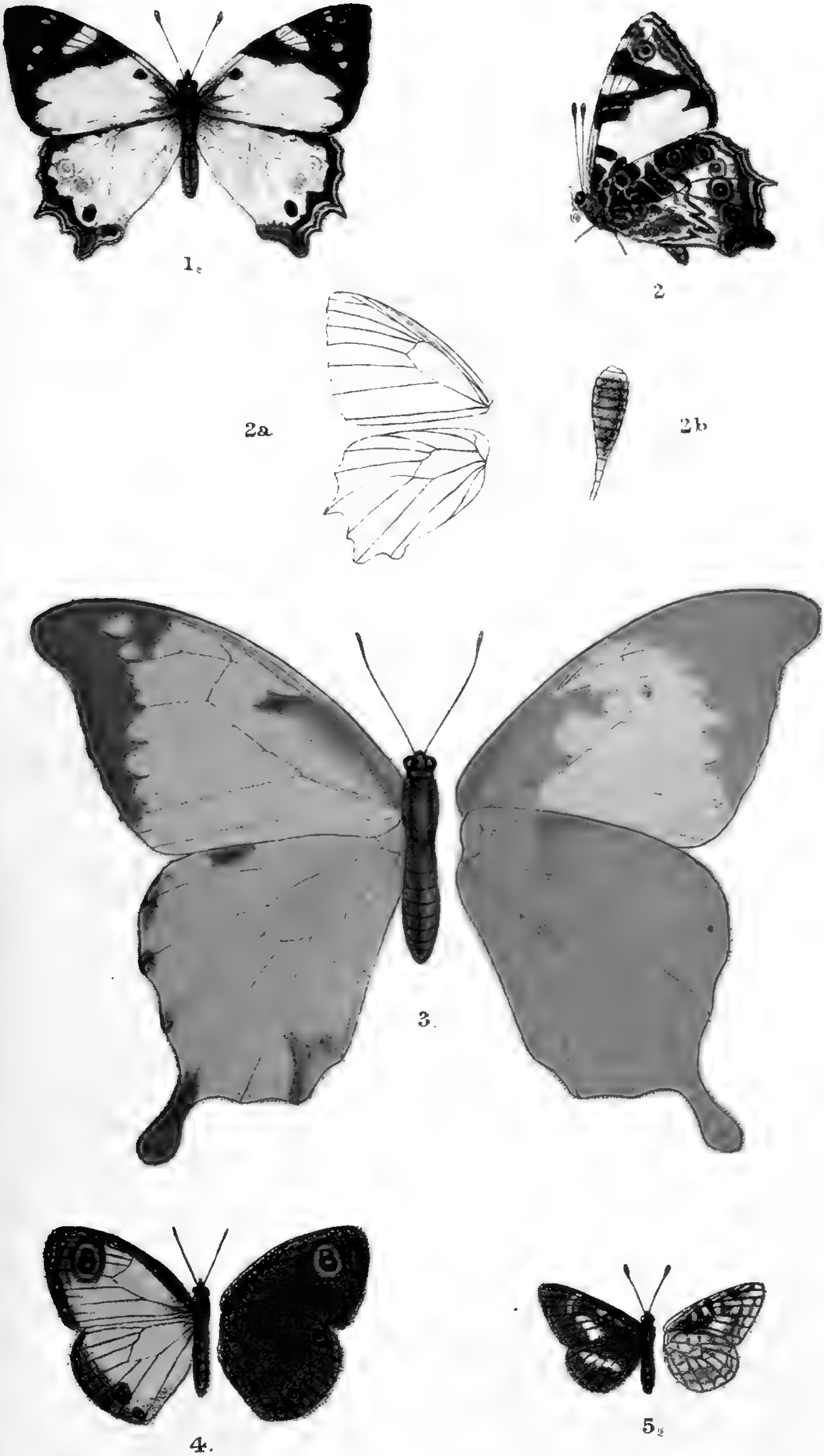
[Received March 20, 1894.]

(Plate XIX.)

The collection of Butterflies described in the present paper was made by Captain Pringle, R.E., during his survey for the projected railway to Uganda on behalf of the Government, under the auspices of the Imperial British East-African Company. The care with which the elevations have been recorded by him renders the collection of especial value to the student of the geographical distribution of Lepidoptera, and it is much to be regretted that such an accurate observer as Captain Pringle was not enabled to make a longer stay in East Africa.

In this communication I have referred especially to Mr. Kirby's 'Catalogue of Diurnal Lepidoptera,' to Dr. Roland Trimen's work on South-African Butterflies, and to a paper by Mr. Hampson

[1] Communicated by Dr. R. Bowdler Sharpe, F.Z.S.



M. Horman Fisher del et lith. Mintern Bros. Chromo.

NEW BUTTERFLIES FROM BRITISH EAST AFRICA.

entitled "Lepidoptera from the Sabaki River," Ann. Nat. Hist. (6) vii. 1891.

I am much indebted to Dr. A. G. Butler for his kind help in identifying the more obscure species mentioned in the present paper.

Family Danaidæ.

1. Limnas klugii.

Limnas klugii, Butler, P. Z. S. 1885, p. 758; Hampson, Ann. Nat. Hist. (6) vii. p. 179 (1891, Sabaki River).

a. Nzoi, 3500 feet, Feb. 1–15, 1893.
b. Teita, 3500 feet, to Voi River, 2100 feet, Jan. 1892.
c. Teita to Ndara Hill, 3300 feet, Feb. 3, 1892.
d. Kibwezi, 3000 feet, Feb. 4–6, 1892.
e. March from Mbololo in Ndi to Tsavo, 2300 to 1650 feet, Jan. 9–11, 1892.

2. Melinda formosa.

Danais formosa, Godman, P. Z. S. 1880, p. 183, pl. xix. fig. 1 (Gnuru Hills, E. Africa).

Melinda formosa, Moore, P. Z. S. 1883, p. 229.

a. Kikuyu to Victoria Nyanza *viâ* Sotik, May 4, 1892.

3. Amauris echeria.

Amauris echeria (Stoll); Kirby, Syn. Cat. Diurn. Lepid. p. 8 (1871); Trimen, S. Afr. Butt. i. p. 57 (1887).

Nebroda echeria (Stoll); Moore, P. Z. S. 1883, p. 228.

a–c. Teita to Ndara Hill, 3300 feet, Feb. 3, 1892.
d. Teita, 3500, to Voi River, 2100 feet, Jan. 5–6, 1892.

Family Satyridæ.

4. Melanitis leda.

Melanitis leda (Linn.); Kirby, op. cit. p. 43 (1871); Trimen, op. cit. i. p. 112 (1887).

Melanitis solandra (Fabr.); Butler, Cat. Lepid. Satyr. p. 3 (1868).

Melanitis bankia (Fabr.); Hampson, op. cit. (6) vii. p. 180 (1891, Sabaki River).

a. Voi River, 1600 feet, Jan. 20, 1892.

5. Monotrichtis safitza.

Mycalesis safitza, Hewits.; Kirby, op. cit. p. 87 (1871); Butler, Cat. Satyr. p. 128 (1868); Trimen, op. cit. i. p. 105 (1887).

Mycalesis (Monotrichtis) safitza, Hampson, op. cit. (6) vii. p. 180 (1891, Sabaki River).

a. Maungu to Maragoyakanga, 3100 to 2400 feet, Dec. 30, 1891.
b–d. Teita to Ndara Hill, 3300 feet, Feb. 3, 1892.

6. Mycalesis perspicua.

Mycalesis perspicua, Trim.; Kirby, op. cit. App. p. 707 (1877); Trimen, op. cit. i. p. 107 (1887).

Samanta perspicua, Butl. P. Z. S. 1888, p. 59 (Tobbo).

a, b. Nzoi, 3500 feet, Feb. 1–15, 1892.

c. Maungu to Maragoyakanga, 3100 to 2400 feet, Dec. 12, 1891.

7. Mycalesis socotrana.

Calysisme socotrana, Butl. P. Z. S. 1881, p. 175, pl. xvii. fig. 7 (Socotra).

a. Maungu to Maragoyakanga, 3100 to 2400 feet, Dec. 30, 1891.

8. Ypthima doleta.

Mycalesis doleta, Kirby, Proc. Roy. Dubl. Soc. (2) ii. p. 336 (1880); Godm. & Salv. P. Z. S. 1884, p. 220 (Lower Niger).

a. March from Mreru in Ndi to Tsavo, 2300 to 1650 feet, Jan. 9–11, 1892.

b. Voi River, 1600 feet, Jan. 20, 1892.

9. Ypthima albida. (Plate XIX. fig. 4.)

Ypthima albida, Butl. P. Z. S. 1888, p. 59 (Fóda).

a. Teita District.

10. Neocœnyra duplex.

Neocœnyra duplex, Butl. P. Z. S. 1885, p. 758 (Somaliland).

a. Maungu to Maragoyakanga, 3100 to 2400 feet, Dec. 30, 1891.

b. Mreru in Ndi to Tsavo, 2300 to 1650 feet, Jan. 9–11, 1892.

c. Nzoi, 3500 feet, Feb. 1–15, 1892.

Rhaphiceropsis, gen. nov.

Similar to the genus *Neope*, but easily distinguished by the spatulate club to the antennæ. The type is

11. Rhaphiceropsis pringlei, sp. n. (Plate XIX. figs. 1, 2.)

Colour very pale primrose-yellow with black markings. Fore wing: basal half pale yellow, the apical half black as well as the hind margin beyond the posterior angle. There are three small spots of yellow, one in each of the second and third median nervules, and the third above the subcostal nervure. From the costal margin is an oblique mark of yellow reaching to the apical end of the discoidal cell; base of wing blackish; near the base is a small black spot.

Hind wing almost entirely primose-yellow, the mottlings of the under surface visible; a black line along the costa and hind margin to the anal angle; on the first median nervule is a small maroon spot; above the hind marginal border a black spot between the first and second median nervule, the marginal line being divided by a thread of primrose-yellow from the anal angle to the third median nervule.

Expanse 1·7 inch.

a, *b*. Kikuyu to Victoria Nyanza *viâ* Sotik, May 5, 1892.

Family Acræidæ.

12. Acræa regalis.

Acræa regalis, Oberthür, Études d'Ent. p. 20, pl. ii. fig. 20 (1893).

a. Maungu Hill, 3100 feet, Dec. 30, 1891.
b. Kibwezi, Feb. 5, 1892.

13. Acræa circeis.

Acræa circeis (Drury); Kirby, op. cit. p. 132 (1871).

a. Usoga to Uganda, June 1892.

14. Acræa bræsia.

Acræa bræsia, Godm. P. Z. S. 1885, p. 538 (Kilimanjaro); Hampson, op. cit. (6) vii. p. 180 (1891, Sabaki River).

a, *b*. Teita to Voi River, 1600 feet, Jan. 20, 1892.
c. Kibwezi, Feb. 5, 1892.

15. Acræa natalica.

Acræa natalica, Boisd.; Kirby, op. cit. p. 132 (1871); Trimen, op. cit. i. p. 155 (1887); Hampson, op. cit. (6) vii. p. 180 (1891, Sabaki River).

a, *b*. Teita to Ndara Hill, 3300 feet, Feb. 3, 1890.
c. March from Maungu Hill to Maragoyakanga, 3100 to 2400 feet, Dec. 30, 1891.

16. Acræa buxtoni.

Acræa buxtoni, Butl.; Trimen, op. cit. i. p. 170 (1887); id. P. Z. S. 1891, p. 74 (South-western Africa).

a. Nzoi, 3500 feet, Feb. 15, 1892.

17. Acræa vinidia.

Acræa vinidia, Hew.; Kirby, op. cit. App. p. 720 (1877).

a–*h*. Uganda.

18. Acræa cabira.

Acræa cabira, Hopff.; Kirby, op. cit. p. 132 (1871); Trimen, op. cit. i. p. 173 (1887).

a. March from Teita, 3500 feet, to Voi River, 2100 feet, Jan. 6, 1892.
b. Nzoi, 3500 feet, Feb. 15, 1892.

19. Acræa pharsalus.

Acræa pharsalus, Ward; Kirby, op. cit. App. p. 720 (1877).

a. Uganda.

20. Acræa perenna.

Acræa perenna, Doubl. & Hewits.; Kirby, op. cit. p. 135 (1871).
Gnesia perenna, Butl. P. Z. S. 1888, p. 66 (Kangasi).

a. Uganda.

21. Acræa lycia.

Acræa lycia (Fabr.); Kirby, op. cit. p. 131 (1871).

a. March from Teita, 3500 feet, to Voi River, 2100 feet, Jan. 6, 1892.

22. Acræa oreas.

Acræa oreas, E. M. Sharpe, P. Z. S. 1891, p. 193, pl. xvii. fig. 5 (Mt. Elgon).

a–c. March from Kikuyu to Victoria Nyanza *viâ* Sotik, May 4 1892.

23. Planema johnstoni.

Acræa johnstoni, Godm. P. Z. S. 1885, p. 537 (Kilimanjaro); Butler, P. Z. S. 1888, p. 91.
Acræa proteina, Oberthür, Études d'Ent. p. 25, pl. i. fig. 4 (1893).

a. March from Teita, 3500 feet, to Voi River, 2100 feet, Jan. 6, 1892.

24. Planema fulvescens.

Acræa proteina fulvescens, Oberthür, Études d'Ent. p. 26, pl. ii. fig. 21 (1893).

a. March from Teita, 3500 feet, to Voi River, 2100 feet, Jan. 6, 1892.

This specimen does not entirely agree with M. Oberthür's figure, having less black on both wings. It is probably a variation of *P. johnstoni*, Godm., with which *P. proteina* of Oberthür is undoubtedly identical.

25. Planema montana.

Planema montana, Butl. P. Z. S. 1888, p. 91 (Kilimanjaro).

a. Ndara Hill, Teita, 3300 feet, Jan. 3, 1892.
b. March from Teita, 3500 feet, to Voi River, 2100 feet, Jan. 6, 1892.

26. Alæna johannæ. (Plate XIX. fig 5.)

Alæna johannæ, E. M. Sharpe, Ann. Nat. Hist. (6) v. p. 442 (1890).

a. Tsavo River, 1500 feet.

Family Nymphalidæ.

27. Hypanartia delius.

Hypanartia delius (Drury); Kirby, op. cit. p. 181 (1871).
a, b. Teita District.

28. Junonia clelia.

Junonia clelia (Cram.); Kirby, op. cit. p. 187 (1871); Trimen, op. cit. i. p. 214 (1887).
Junonia œnone (Linn.); Hampson, op. cit. (6) vii. p. 180 (1891, Sabaki River).
a. March from Maungu to Maragoyakanga, 3100 feet to 2400 feet, Dec. 30, 1891.
b. Tsavo River, 1500 feet.
c. March from Teita, 3500 feet, to Voi River, 2100 feet, Jan. 6, 1892.
d. Kibwezi, 3000 feet, Feb. 6, 1892.
e. Nzoi, 3500 feet, Feb. 15, 1892.

29. Junonia cebrene.

Junonia cebrene, Trimen, op. cit. i. p. 210 (1887).
Junonia crebrene, Hampson, op. cit. (6) vii. p. 180 (1891, Sabaki River).
a. Tsavo River, 1500 feet.
b, c. March from Maungu to Maragoyakanga, 3100 to 2400 feet, Dec. 30, 1891.
d. March from Teita, 3500 feet, to Voi River, 2100 feet, Jan. 6, 1892.

30. Junonia westermanni.

Junonia westermanni, Westw.; Kirby, op. cit. App. p. 734 (1877).
a. Teita District.

31. Precis terea.

Precis terea (Drury); Kirby, op. cit. p. 189 (1871).
a, b. Teita District.

32. Precis natalica.

Precis natalica, Feld.; Kirby, op. cit. p. 190 (1871); Trimen, op. cit. i. p. 238 (1887).
Junonia natalica, Hampson, op. cit. (6) vii. p. 180 (1891, Sabaki River).
a. March from Maungu to Maragoyakanga, 3100 to 2400 feet, Dec. 30, 1891.
b. March from Teita, 3500 feet, to Voi River, 2100 feet, Jan. 6, 1892.
c. March from Voi River to Ndi, 2300 feet, Jan. 8, 1892.
d. Ndara Hill to Teita, 3300 feet, Feb. 3, 1892.
e. Nzoi, 3500 feet, Feb. 16, 1892.

33. Precis limnoria.

Precis limnoria (Klug); Kirby, op. cit. p. 190 (1871); Butl. P. Z. S. 1885, p. 759 (Somali-land).

a–c. March from Maungu Hill to Maragoyakanga, 3100 to 2400 feet.

d. March from Teita, 3500 feet, to Voi River, 2100 feet, Jan. 6, 1892.

34. Precis sinuata.

Precis sinuata, Plötz; E. M. Sharpe, P. Z. S. 1893, p. 555.

a, b. Kibwezi, 3000 feet, Feb. 6, 1892.

35. Precis cuama.

Precis cuama (Hewits.); Kirby, op. cit. p. 191 (1871).

a, b. Tsavo River, 1500 feet.

c–e. March from Maungu Hill to Maragoyakanga, 3100 to 2400 feet, Dec. 30, 1891.

36. Precis sesamus.

Precis sesamus, Trimen, op. cit. i. p. 231 (1887).

a. March from Kikuyu to Victoria Nyanza *viâ* Sotik, May 4, 1892.

37. Precis cloantha.

Precis cloantha (Cram.); Kirby, op. cit. p. 191 (1871); Trimen, op. cit. i. p. 222 (1887).

a. March from Teita, 3500 feet, to Voi River, 2100 feet, Jan. 6, 1892.

b. March from Kikuyu to the Victoria Nyanza *viâ* Mau and Sotik, 8000 feet, May 4, 1892.

38. Ergolis enotrea.

Ergolis enotrea (Cram.); Kirby, op. cit. p. 195 (1871).

a. Teita District.

39. Eurytela hiarbas.

Eurytela hiarbas (Drury); Kirby, op. cit. p. 195 (1871); Trimen, op. cit. i. p. 258 (1887).

a. March from Kikuyu to the Victoria Nyanza *viâ* Mau and Sotik, 8000 feet, May 4, 1892.

40. Eurytela dryope.

Eurytela dryope (Cram.); Kirby, op. cit. p. 194 (1871); Trimen, op. cit. i. p. 261 (1887); Hampson, op. cit. (6) vii. p. 180 (1891, Sabaki River).

a–c. Voi River, Teita, 1600 feet, Jan. 20, 1892.

41. Eurytela ophione.

Eurytela ophione (Cram.); Kirby, op. cit. p. 195 (1871).

a–c. Voi River, Teita, 1600 feet, Jan. 20, 1892.

42. Diadema misippus.

Hypolimnas misippus (Linn.); Kirby, op. cit. p. 225 (1871).
Diadema misippus, Trimen, op. cit. i. p. 277 (1887); Hampson, op. cit. (6) vii. p. 180 (1891, Sabaki River).

a. March from Teita, 3500 feet, to Voi River, 2100 feet, Jan. 6, 1892.
b. Kibwezi, 3000 feet, Feb. 6, 1892.
c, *d*. Nzoi, 3500 feet, Feb. 15, 1892.

43. Neptis agatha.

Neptis agatha (Cram.); Kirby, op. cit. p. 242 (1871); Trimen, op. cit. i. p. 270 (1887).

a–c. Ndara Hill, Teita, 3300 feet, Feb. 3, 1892.

44. Hamanumida dædalus.

Hamanumida dædalus (Fabr.); Kirby, op. cit. p. 249 (1871); Trimen, op. cit. i. p. 309 (1887); Hampson, op. cit. (6) vii. p. 180 (1891, Sabaki River).

a. Voi River, 1600 feet, Jan. 20, 1892.

45. Salamis anacardii.

Salamis anacardii (Linn.); Kirby, op. cit. p. 192 (1871); Trimen, op. cit. i. p. 244 (1887).

a. Kibwezi, Feb. 6, 1892.
b. Nzoi, 3500 feet, Feb. 15, 1892.

46. Salamis aglatonice.

Salamis anacardii, Godt., pt.; Kirby, op. cit. p. 192 (1871); Trimen, op. cit. i. p. 244 (1887).

a, *b*. Tsavo River, 1500 feet.
c, *d*. Voi River, 1600 feet, Jan. 20, 1892.

47. Philognoma varanes.

Palla varanes (Cram.); Kirby, op. cit. p. 274 (1871); Hampson, op. cit. (6) vii. p. 181 (1891, Sabaki River).

a. Usoga, 4000 feet.
b. March from Maungu to Maragoyakanga, 3100 to 2400 feet, Dec. 30, 1891.
c, *d*. Ndara Hill, Teita, 3500 feet, Feb. 3, 1892.

48. Philognoma ussheri.

Palla ussheri (Butl.); Kirby, op. cit. p. 273 (1871).

a. Uganda, 4000 feet.

49. Charaxes tiridates.

Nymphalis tiridates (Cram.); Kirby, op. cit. p. 269 (1871).

a. March from Usoga to Uganda, 4000 feet, June 1892.

50. Hypanis ilithyia.

Hypanis ilithyia (Drury); Kirby, op. cit. p. 196 (1871); Trimen, op. cit. i. p. 264 (1887).

Byblia ilithyia, Hampson, op. cit. (6) vii. p. 180 (1891, Sabaki River).

a–c. March from Maungu to Maragoyakanga, Jan. 1, 1892.

d, e. March from Teita, 3500 feet, to Voi River, 2100 feet, Jan. 6, 1892.

f. Kibwezi, 3000 feet, Feb. 6, 1892.

51. Cyrestis camillus.

Cyrestis camillus (Fabr.); Kirby, op. cit. p. 220 (1871).

a–d. Uganda, 4000 feet.

52. Euryphene calabarensis.

Euryphene calabarensis, Feld.; Kirby, op. cit. p. 246 (1871).

a. Uganda, 4000 feet.

Family Erycinidæ.

53. Abisara gerontes.

Abisara gerontes (Fabr.); Butler, P. Z. S. 1888, p. 67.

a. Uganda, 4000 feet, June 1892.

Family Lycænidæ.

54. Lachnocnema bibulus.

Lucia bibulus (Fabr.); Kirby, op. cit. p. 337 (1871); Trimen, op. cit. ii. p. 235 (1887).

a. Ndara Hill, 3300 feet, Feb. 3, 1892.

55. Zeritis perion.

Axiocerses perion (Cram.); Kirby, op. cit. p. 338 (1871).

Chrysorychia harpax, Fabr., pt.; Trimen, op. cit. ii. p. 162 (1887).

a. Ndara Hill, Teita, 3300 feet, Feb. 3, 1892.

56. Lycæna juba.

Cupido juba (Fabr.); Kirby, op. cit. p. 349 (1871).

a. March from Kikuyu, 6500 feet, to Victoria Nyanza *viâ* Sotik, May 4, 1892.

b, c. Uganda, 4000 feet.

57. Lycæna moriqua.

Cupido moriqua (Wallgr.); Kirby, op. cit. p. 351 (1871); Trimen, op. cit. ii. p. 75 (1887).

a–d. Teita, Jan. 1892.

e. March from Mreru in Ndi to Tsavo, 2300 to 1650 feet, Jan. 11, 1892.

58. Lycæna bætica.

Cupido bœticus (Linn.); Kirby, op. cit. p. 354 (1871).
Lycæna bœtica, Trimen, op. cit. ii. p. 58 (1887).
a. March from Kikuyu to Victoria Nyanza *vid* Mau and Sotik, 7000 to 8000 feet, May 4, 1892.

59. Lycæna gaika.

Cupido gaika, Trim.; Kirby, op. cit. p. 362 (1871).
Lycæna gaika, Trimen, op. cit. ii. p. 50 (1887).
a. Nzoi, 3500 feet, Jan. 15, 1892.
b. Voi River, 1600 feet, Jan. 20, 1892.
c. Ndara Hill, Teita, 3300 feet, Feb. 3, 1892.
d. Uganda, 4000 feet.

60. Lycæna pulchra.

Lycæna pulchra, Murray, Trans. Ent. Soc. 1874, p. 524, pl. 10. figs. 7, 8.
Tarucus pulcher, Butler, P. Z. S. 1888, p. 68.
a–e. March from Mreru in Ndi to Tsavo, 2300 to 1650 feet, Jan. 11, 1892.
f–h. Ndara Hill, Teita, 3300 feet, Feb. 3, 1892.
i–m. Kibwezi, 3000 feet, Feb. 6, 1892.
n. Nzoi, 3500 feet, Feb. 16, 1892.

61. Lycænesthes ligures.

Lycænesthes ligures, Hewits.; Kirby, op. cit. App. p. 783 (1877).
a. Uganda, 4000 feet.

62. Lycænesthes larydas.

Lycænesthes larydas (Cram.); Kirby, op. cit. App. p. 783 (1877); Trimen, op. cit. ii. p. 96 (1887).
a. Uganda, 4000 feet.

63. Tatura pachalica.

Hypolycæna (*Tatura*) *pachalica*, Butl. P. Z. S. 1888, p. 69 (Wadelai).
a. Tsavo, 1500 feet.
b. March from Mreru in Ndi, 2300 to 1650 feet, Jan. 11, 1892.
c, d. Uganda, 4000 feet, June 1892.

64. Castalius margaritaceus.

Castalius margaritaceus, E. M. Sharpe, P. Z. S. 1891, p. 636, pl. xlviii. fig. 3.
a. March from Kikuyu to Victoria Nyanza *viâ* Mau and Sotik, 7000 to 8000 feet, May 4, 1892.

65. Castalius melæna.

Lycæna melæna, Trimen, op. cit. ii. p. 82 (1887).
a. Voi River, 1600 feet, Jan. 20, 1892.

Family Pieridæ.

66. Nychitona alcesta.

Pontia alcesta (Cram.); Kirby, op. cit. p. 439 (1871); Trimen, op. cit. iii. p. 8 (1889).

a. Ndara Hill, Teita, 3300 feet, Feb. 3, 1892.

67. Terias brigitta.

Eurema brigitta (Cram.); Kirby, op. cit. p. 447 (1871).
Terias brigitta, Trimen, op. cit. iii. p. 14 (1889).

a. March from Mreru in Ndi to Tsavo, 2300 to 1650 feet, Jan. 9, 1892.

68. Terias zoë.

Eurema brigitta, var. *d*, Kirby, op. cit. p. 448 (1871).
Terias zoë, Hopff.; Trimen, op. cit. iii. p. 16 (1889).

a, b. Maungu Hill, 3600 feet, Dec. 30, 1892.
c. March from Mreru in Ndi, 2300 feet, to Tsavo, 1600 feet, Jan. 9, 1892.
d, e. Ndara Hill, Teita, 3300 feet, Feb. 3, 1892.
f, g. Nzoi, 3500 feet, Jan. 15, 1892.

69. Terias orientis.

Terias orientis, Butler, P. Z. S. 1888, p. 71.

a. Teita District, 3000 feet.

70. Pinacopteryx pigea.

Pieris pigea, Boisd.; Kirby, op. cit. p. 455 (1871); Trimen, op. cit. iii. p. 46 (1889).

a. Voi River, 1600 feet, Jan. 20, 1892.
b. Ndara Hill, Teita, 3300 feet, Feb. 3, 1892.

71. Pinacopteryx simana.

Pieris simana, Hopff.; Trimen, op. cit. iii. p. 50 (1889).
Pieris charina, Boisd., pt.; Kirby, op. cit. p. 456 (1871).

a, b. Voi River, 1600 feet, Jan. 20, 1892.

72. Pinacopteryx spilleri.

Pieris spilleri, Staudinger; Trimen, op. cit. iii. p. 54 (1889).

a, b. Voi River, 1600 feet, Jan. 20, 1892.

73. Pinacopteryx nigropunctata.

Pinacopteryx nigropunctata, E. M. Sharpe, Ann. Nat. Hist. (6) v. p. 336 (1890); Waterh. Aid, pl. 189. fig. 4 (1882–90).

a, b. March from Teita to Voi River, 3500 to 2100 feet, Jan. 6, 1892.

74. Belenois severina.

Pieris severina (Cram.); Kirby, op. cit. p. 457 (1871); Trimen, op. cit. iii. p. 68 (1889).

Belenois severina, Hampson, op. cit. (6) vii. p. 182 (1891, Sabaki River).

a–c. March from Maungu to Maragoyakanga, 3100 to 2400 feet, Dec. 30, 1891.

d–f. March from Teita, 3500 feet, to Voi River, 2100 feet, Jan. 6, 1892.

g. March from Voi River to Ndi, 1925 to 2300 feet, Jan. 8, 1892.

h–k. Ndara Hill, Teita, 3300 feet, Feb. 3, 1892.

75. Belenois agrippina.

Pieris agrippina, Feld.; Kirby, op. cit. p. 457 (1871).

Pieris severina (Cram., pt.); Trimen, op. cit. iii. p. 68 (1889).

a–d. March from Maungu to Maragoyakanga, 3100 to 2400 feet, Dec. 30, 1891.

e–h. March from Voi River to Ndi, 1925 to 2300 feet, Jan. 8, 1892.

i–l. Ndara Hill, Teita, 3300 feet, Feb. 3, 1892.

76. Belenois boguensis.

Pieris boguensis, Feld.; Kirby, op. cit. p. 457 (1871).

Pieris severina (Cram., pt.); Trimen, op. cit. iii. p. 68 (1889).

a. March from Maungu to Maragoyakanga, 3100 to 2400 feet, Dec. 30, 1890.

b. March from Teita, 3500 feet, to Voi River, 2100 feet, Jan. 6, 1892.

c. Ndara Hill, Teita, 3300 feet, Jan. 3, 1892.

77. Belenois zochalia.

Pieris zochalia, Boisd.; Kirby, op. cit. p. 457 (1871); Trimen, op. cit. iii. p. 57 (1889).

a. Ndara Hill, Teita, Feb. 3, 1892.

b, *c*. March from Kikuyu to Victoria Nyanza *viâ* Sotik, May 1892.

78. Belenois infida.

Belenois infida, Butler, P. Z. S. 1888, p. 78 (Wadelai).

a. March from Maungu to Maragoyakanga, Jan. 1, 1892.

b. Teita, 3500 feet, to Voi River, 2100 feet, Jan. 6, 1892.

c–k. March from Mreru in Ndi to Tsavo, 3300 to 1680 feet, Jan. 11, 1892.

l. Kibwezi, Feb. 5, 1892.

m. March from Kikuyu to Victoria Nyanza *viâ* Sotik, May 1892.

79. Belenois gidica.

Pieris gidica, Godt.; Kirby, op. cit. p. 457 (1871); Trimen, op. cit. iii. p. 64 (1889).

Belinois gidica, Hampson, op. cit. (6) vii. p. 182 (1891, Sabaki River).

a, *b*. Uganda, 4000 feet.

80. Belenois thysa.

Pieris thysa, Hopff.; Trimen, op. cit. iii. p. 44 (1889).

a–d. Kibwezi, 3000 feet, Feb. 6, 1892.

81. Mylothris agathina.

Tachyris agathina (Cram.); Kirby, op. cit. p. 464 (1871).

Mylothris agathina, Trimen, op. cit. iii. p. 30 (1889).

a–b. Kibwezi, 3000 feet, Feb. 6, 1892.

82. Mylothris rhodope.

Tachyris rhodope (Fabr.); Kirby, op. cit. p. 463 (1871).

a–d. Teita, 2000 to 3000 feet.

83. Mylothris narcissus.

Mylothris narcissus, Butler, P. Z. S. 1888, p. 95 (Kilimanjaro).

a. March from Teita, 3500 feet, to Voi River, 2100 feet, Jan. 5, 1892.

b. Ndara Hill, Teita, 3300 feet, Feb. 3, 1892.

84. Mylothris jacksoni.

Mylothris jacksoni, E. M. Sharpe, P. Z. S. 1891, p. 190, pl. xvi. fig. 3.

a, *b*. March from Kikuyu to Victoria Nyanza *viâ* Sotik, May 4, 1892.

85. Eronia dilatata.

Eronia dilatata, Butler, P. Z. S. 1888, p. 96.

a–g. Maungu Hill, 3900 feet, Dec. 30, 1891.

h. March from Maungu to Maragoyakanga, 3100 to 2400 feet, Dec. 30, 1891.

i. Ndara Hill, Teita, 3300 feet, Feb. 8, 1892.

86. Eronia leda.

Eronia leda (Boisd.), Kirby, op. cit. p. 480 (1871); Trimen, op. cit. iii. p. 174 (1889).

a. Maungu Hill, Dec. 31, 1891.

b. March from Maungu to Maragoyakanga, 3100 to 2400 feet, Dec. 31, 1891.

c. Kibwezi, 3000 feet, Feb. 6, 1892.

87. Nepheronia thalassina.

Eronia thalassina (Boisd.); Kirby, op. cit. p. 481 (1871).

Nepheronia thalassina, Hampson, op. cit. (6) vii. p. 182 (1891, Sabaki River).

a–f. Kibwezi, 3000 feet, Feb. 6, 1892.

88. Nepheronia argia.

Eronia argia (Fabr.); Kirby, op. cit. p. 481 (1871); Trimen, op. cit. iii. p. 179 (1889).

a. Teita, 2500 to 3000 feet.

89. Nepheronia buquetii.

Eronia buquetii (Boisd.); Kirby, op. cit. p. 481 (1871); Trimen, op. cit. iii. p. 177 (1889).

a. March from Teita, 3500 feet, to Voi River, 2100 feet, Jan. 5, 1891.

b. March from Voi River to Ndi, 1925 to 2300 feet, Jan. 8, 1892.

90. Callidryas florella.

Catopsilia florella (Fabr.); Kirby, op. cit. p. 481 (1871); Trimen, op. cit. iii. p. 185 (1889).

a. March from Maungu to Maragoyakanga, Jan. 1, 1892.

b. March from Voi River to Ndi, 1925 to 2300 feet, Jan. 8, 1892.

c–d. March from Mreru in Ndi to Tsavo, 2300 to 1650 feet, Jan. 9, 1892.

e. Nzoi, 3500 feet, Feb. 15, 1892.

91. Callidryas pyrenne.

Catopsilia florella (Fabr., pt.); Kirby, op. cit. p. 481 (1871).

a–b. March from Teita, 3500 feet, to Voi River, 1200 feet, Jan. 6, 1892.

c. March from Mreru or Mbololo in Ndi to Tsavo, 2300 to 1650 feet, Jan. 11, 1892.

d. Nzoi, 3500 feet, Feb. 15, 1892.

92. Colias electra.

Colias electra (Linn.); Kirby, op. cit. p. 490 (1871); Trimen, op. cit. iii. p. 165 (1889).

a. March from Kikuyu to Victoria Nyanza *viâ* Mau and Sotik, 7000 to 8000 feet, May 1892.

93. Teracolus chrysonome.

Idmais chrysonome (Klug); Kirby, op. cit. p. 498 (1871).

a, b. March from Maungu to Maragoyakanga, Jan. 1, 1892.

c, d. Teita District.

94. Teracolus aurigineus.

Teracolus aurigineus, Butler, P. Z. S. 1888, p. 72 (Wadelai).
a–d. March from Teita, 3500 feet, to Voi River, 2100 feet, Jan. 6, 1892.
e, f. Voi River, 1600 feet, Jan. 20, 1892.

95. Teracolus eris.

Idmais eris (Klug); Kirby, op. cit. p. 499 (1871).
Teracolus eris, Trimen, op. cit. iii. p. 93 (1889); Hampson, op. cit. (6) vii. p. 181 (1891, Sabaki River).
a. March from Maungu to Maragoyakanga, Jan. 1, 1892.
b. March from Teita, 3500 feet, to Voi River, 2100 feet, Jan. 6, 1892.
c–e. Voi River, 1600 feet, Jan. 20, 1892.

96. Teracolus phlegyas.

Callosune phlegyas, Butl.; Kirby, op. cit. p. 500 (1871).
Teracolus phlegyas, Trimen, op. cit. p. 109 (1889); Hampson, op. cit. (6) vii. p. 181 (1891, Sabaki River).
a–c. March from Teita, 3500 feet, to Voi River, 2100 feet, Jan. 6, 1892.

97. Teracolus imperator.

Callosune imperator, Butl.; Kirby, op. cit. App. p. 804 (1877).
Teracolus imperator, Hampson, op. cit. (6) vii. p. 181 (1891, Sabaki River).
a. Maungu Hill, 3600 feet, Dec. 30, 1891.
b. March from Teita, 3300 feet, to Voi River, 2100 feet, Jan. 6, 1892.
c. March from Voi River to Ndi, 2300 feet, Jan. 8, 1892.

98. Teracolus hetæra.

Callosune hetæra, Gerst.; Kirby, op. cit. App. p. 804 (1877).
a–k. Maungu Hill, 3100 feet, Dec. 30, 1891.
l. Ndara Hill, Teita, 3300 feet, Feb. 3, 1892.

99. Teracolus omphale.

Callosune omphale (Godt.); Kirby, op. cit. p. 502 (1871).
Teracolus omphale, Trimen, op. cit. p. 142 (1889).
a. Maungu Hill, 3100 feet, Dec. 30, 1891.
b, c. Voi River, 1600 feet, Jan. 20, 1892.
d. Ndara Hill, Teita, 3300 feet, Feb. 3, 1892.

100. Teracolus phillipsii.

Teracolus phillipsii, Butl. P. Z. S. 1885, p. 772, pl. xlvii. fig. 11.
a. March from Maungu to Maragoyakanga, Jan. 1, 1892.
b. March from Teita, 3500 feet, to Voi River, 2100 feet, Jan. 6, 1892.
c. March from Voi River to Ndi, 1925 to 2300 feet, Jan. 8, 1892.

101. Teracolus minans.

Teracolus minans, Butler, Ent. M. Mag. xviii. p. 229 (1881–82).

a, *b*. March from Maungu to Maragoyakanga, 3100 to 2400 feet, Dec. 30, 1891.

c. March from Voi River to Ndi, 1925 to 2300 feet, Jan. 8, 1892.

d–f. March from Mreru in Ndi, 2300 feet, to Tsavo, 1650 feet, Jan. 9, 1892.

102. Teracolus ignifer.

Callosune ignifer, Butl.; Kirby, op. cit. App. p. 804 (1877).

a. Ndara Hill, Teita, 3300 feet, Feb. 3, 1892.

b. March from Kikuyu to Victoria Nyanza *viâ* Mau and Sotik, May 4, 1892.

103. Teracolus phœnius.

Callosune phœnius, Butl.; Kirby, op. cit. App. p. 805 (1877).

Teracolus phœnius, Hampson, op. cit. (6) vii. p. 181 (1891, Sabaki River).

a, *b*. March from Voi River to Ndi, 1925 to 2300 feet, Jan. 8, 1892.

c, *d*. March from Mreru in Ndi, 2300 feet, to Tsavo, 1650 feet, Jan. 9, 1892.

e. Voi River, 1600 feet, Jan. 20, 1892.

f, *g*. Nzoi, 3500 feet, Feb. 15, 1892.

104. Teracolus hanningtoni.

Teracolus hanningtoni, Butler, Ann. Nat. Hist. (5) xii. p. 104 (1883).

a. Nzoi, 3500 feet, Feb. 15, 1892.

105. Teracolus calais.

Idmais calais (Fabr., pt.); Kirby, op. cit. p. 499 (1871).

a. March from Teita, 3500 feet, to Voi River, 2100 feet, Jan. 6, 1892.

b–e. March from Mreru in Ndi, 1330 feet, to Tsavo, 1650 feet, Jan. 9, 1892.

f, *g*. Voi River, 1600 feet, Jan. 23, 1890.

106. Teracolus incretus.

Teracolus incretus, Butl. P. Z. S. 1888, p. 93 (Kilimanjaro).

a. Maungu Hill, 3100 feet, Dec. 30, 1891.

b. March from Maungu Hill to Maragoyakanga, 3100 to 2400 feet, Dec. 30, 1891.

c. March from Voi River to Ndi, 1925 to 2303 feet, Jan. 8, 1892.

d. Tsavo River.

e. Ndara Hill, Teita, 3300 feet, Feb. 3, 1892.

f–l. Nzoi, 3500 feet, Feb. 15, 1892.

107. Teracolus hildebrandti.

Callosune hildebrandti, Staudgr. Exot. Schmett. i. p. 44, pl. 23. fig. 12 (1888).

a–e. Teita, 3500 feet, to Voi River, 2100 feet, Jan. 6, 1892.
f. March from Voi River to Ndi, 2300 feet, Jan. 8, 1892.
g. Voi Kiver, 1600 feet, Jan. 20, 1892.

108. Teracolus leo.

Anthocharis leo, Butl. Ann. Nat. Hist. (3) xvi. p. 397 (1865).
a–c. March from Maungu to Maragoyakanga, Jan. 1, 1892.

109. Herpænia iterata.

Herpœnia iterata, Butler, P. Z. S. 1888, p. 96 (Kilimanjaro).

a–e. March from Maungu to Maragoyakanga, 3100 to 2400 feet, Dec. 30, 1891–Jan. 1, 1892.
f. March from Voi River to Ndi, 1925 to 2300 feet, Jan. 8, 1892.

110. Glutophrissa contracta.

Glutophrissa contracta, Butler, P. Z. S. 1888, p. 75.
a, b. Tsavo River, 1500 feet.

Family Papilionidæ.

111. Papilio leonidas.

Papilio leonidas, Fabr.; Kirby, op. cit. p. 520 (1871); Trimen, op. cit. iii. p. 211 (1889).
a. Voi River, 1600 feet, Jan. 20, 1892.

112. Papilio demoleus.

Papilio demoleus, Linn.; Kirby, op. cit. p. 543 (1871); Trimen, op. cit. p. 223 (1889); Hampson, op. cit. (6) vii. p. 182 (1891, Sabaki River).

a, b. March from Maungu to Maragoyakanga, 3100 to 2400 feet, Dec. 30, 1891.
c. March from Teita, 3500 feet, to Voi River, 2100 feet, Jan. 6, 1892.
d. March from Voi River to Ndi, 2300 feet, Jan. 8, 1892.
e. Ndara Hill, Teita, 3300 feet, Feb. 3, 1892.
f. Nzoi, 3500 feet, Feb. 15, 1892.

113. Papilio nireus.

Papilio nireus, Linn.; Kirby, op. cit. p. 562 (1871).

a. Maungu Hill, 3100 feet, Dec. 30, 1891.
b. March from Teita, 3500 feet, to Voi River, 2100 feet, Jan. 6, 1891.
c–e. Kibwezi, 3000 feet, Feb. 6, 1892.

114. Papilio brontes.

Papilio brontes, Godm. P. Z. S. 1885, p. 540 (Kilimanjaro).
a. Kikuyu, 4500 feet.

115. Papilio phorcas.

Papilio phorcas, Cram.; Kirby, op. cit. p. 563 (1871).
a–c. Kikuyu, 6500 feet.

116. Papilio hesperus.

Papilio hesperus, Westw.; Kirby, op. cit. p. 563 (1871).
a. Teita, 2000 to 3000 feet.

117. Papilio merope.

Papilio merope, Cram.; Kirby, op. cit. p. 563 (1871).
Papilio cenea, Stoll, pt.; Trimen, op. cit. iii. p. 243 (1889).
Papilio dardanus, Brown, pt., Hampson, op. cit. (6) vii. p. 182 (1891, Sabaki River).
a. Teita, 1500 to 2500 feet.

118. Papilio cenea.

Papilio cenea, Stoll; Trimen, op. cit. iii. p. 243 (1889).
Papilio merope, pt., Kirby, op. cit. p. 563 (1871).
a–c. Kibwezi, 3000 feet, Feb. 6, 1892.
d. Kikuyu, 6500 feet.

119. Papilio colonna.

Papilio colonna, Ward; Kirby, op. cit. App. p. 812 (1877); Trimen, op. cit. iii. p. 209 (1889); Hampson, op. cit. (6) vii. p. 182 (1891, Sabaki River).
a–d. Kibwezi, 3000 feet, Feb. 6, 1892.

120. Papilio nyassæ.

Papilio nyassæ, Butl. Ann. Nat. Hist. (6) vii. p. 49 (1891).
a–c. Kibwezi, 3000 feet, Feb. 6, 1892.

121. Papilio jacksoni.

Papilio jacksoni, E. M. Sharpe, P. Z. S. 1891, p. 188, pl. xvii. figs. 1, 2.
a–d. March from Kikuyu to Victoria Nyanza *viâ* Sotik, May 1892.

122. Papilio mackinnoni.

Papilio mackinnoni, E. M. Sharpe, P. Z. S. 1891, p. 187, pl. xvi. fig. 1.
a. March from Kikuyu to Victoria Nyanza *viâ* Sotik, May 1892.

123. Papilio pringlei, sp. n. (Plate XIX. fig. 3.)

General colour saffron-yellow, the hinder wings more clouded, the markings chestnut-brown; the apical portion of the wing chestnut-brown, extending down the hind margin to the first median nervule; the apical portion broken by two spots of saffron-yellow between the 4th and 5th subcostal nervules. The costal margin and base of fore wing brown, with a large spot of chestnut-brown near the end of the discoidal cell, which is irregular in shape.

Hind wing yellow, rather darker than the fore wing, having the tail chestnut-brown, and a spot of the same colour, varying in shape, at the end of each nervule.

Expanse 3·7 inches.

a. Kikuyu to Victoria Nyanza *viâ* Sotik, May 1892.

124. Papilio constantinus.

Papilio constantinus, Ward; Kirby, op. cit. App. p. 812 (1877); Trimen, op. cit. iii. p. 232 (1889); Hampson, op. cit. (6) vii. p. 182 (1891, Sabaki River).

a. Maungu Hill, 3100 feet, Dec. 30, 1891.

b–f. Kibwezi, Feb. 6, 1892.

125. Papilio ophidicephalus.

Papilio ophidicephalus, Oberthür; Trimen, op. cit. iii. p. 229 (1889).

a–c. Kibwezi, 3000 feet, Feb. 6, 1892.

Family Hesperidæ.

126. Ismene anchises.

Ismene anchises, Gerst.; Kirby, op. cit. App. p. 819 (1877).
Hesperia anchises, Trimen, op. cit. iii. p. 374 (1889).

a–d. Tsavo River, 1500 feet.

127. Pamphila zeno.

Pamphila zeno, Trim.; Kirby, op. cit. p. 599 (1871); Trimen, op. cit. iii. p. 313 (1889).

a. Tsavo River, 1500 feet.

128. Pamphila hottentota.

Pamphila hottentota (Latr.); Kirby, op. cit. p. 599 (1871); Trimen, op. cit. iii. p. 314 (1889).

a. Nzoi, 3500 feet, Feb. 15, 1892.

b. Kikuyu, 6500 feet.

129. Pyrgus inconspicuus.

Pamphila inconspicua (Bert.); Kirby, op. cit. p. 605 (1871).

a. Tsavo River, 1500 feet.

130. Hesperia diomus.

Hesperia diomus (Hopff.); Kirby, op. cit. p. 615 (1871).
Pyrgus diomus, Trimen, op. cit. iii. p. 287 (1889).
a. Nzoi, 3500 feet, May 15, 1892.

131. Hesperia sataspes.

Hesperia sataspes (Trim.); Kirby, op. cit. p. 615 (1871).
Pyrgus sataspes, Trimen, op. cit. iii. p. 289 (1889).
a, *b*. March from Mreru in Ndi to Tsavo, 2300 to 1650 feet, Jan. 9, 1892.

132. Hesperia dromus.

Pyrgus dromus (Plötz); Trimen, op. cit. iii. p. 283 (1889).
a. Kikuyu, 6500 feet.

133. Cyclopides metis.

Heteropterus metis (Linn.); Kirby, op. cit. p. 623 (1871).
Cyclopides metis, Trimen, op. cit. iii. p. 266 (1889).
a. Ndara, Teita, 3300 feet, Feb. 3, 1892.

134. Pterygospidea djælælæ.

Nisoniades djælælæ (Wallgr.); Kirby, op. cit. p. 630 (1871).
Pterygospidea djælælæ, Trimen, op. cit. iii. p. 354 (1889).
a–d. March from Mreru in Ndi to Tsavo, 2300 to 1650 feet, Jan. 8, 1892.

EXPLANATION OF PLATE XIX.

Fig. 1. *Rhaphiceropsis pringlei*, p. 336.
2. *Rhaphiceropsis pringlei* (underside).
2 *a*, 2 *b*. Figures of structure of do.
3. *Papilio pringlei*, p. 352.
4. *Ypthima albida*, p. 336.
5. *Alæna johannæ*, p. 338.

April 17, 1894.

W. T. Blanford, Esq., F.R.S., Vice-President, in the Chair.

Mr. Sclater called attention to the attempts about to be made to induce the specimens of *Protopterus annectens* to breed in the Society's Reptile-house, where one of the large oval open tanks had been specially fitted up for their accommodation. There were now six adult examples of this Mud-fish in the Collection, two presented by Mr. H. H. Lee in 1887 and four purchased in 1889. These had been until now all kept together in one of the large water-tanks, and had thriven well, the largest having attained a length of 18 or 19 inches—except that they were all more or less mutilated from the loss of their fins, which were continually eaten away by the Mud-fishes from each other.

The mode of reproduction of *Protopterus* seemed to be wholly unknown, except as regards the information contained in an article recently published in 'Le Mouvement Géographique' (1894, p. 30), in which it was stated, from observations made by the French Missionaries at Mpala on the western shore of Lake Tanganyika (lat. 6° 45′ S.), that the embryos of the *Protopterus* (there called locally *Sembé* or *Sompé*) were carried about in an elongated gelatinous sac attached to the sides of the back of the parent and were very numerous.

1. On the Bones and Muscles of the Mammalian Hand and Foot. By Prof. Karl von Bardeleben, M.D. Berol.

[Received April 16, 1894.]

(Plates XX. & XXI.)

As the Committee of the "Anatomische Gesellschaft" has asked me to give a Report on the Mammalian Hand and Foot at the next meeting of the Society at Strassburg, I wish previously to publish my own investigations on this subject made since 1885 at Jena, Leyden, Amsterdam, Brussels, Berlin, and Paris, and especially in 1889 and 1890 in the Natural History Museum, in the Royal College of Surgeons, and in the dissecting-room of the Zoological Society's Gardens in London, of which I have only published short abstracts in the Proc. Zool. Soc. 1889 (p. 259, pl. xxx.), in the Anat. Anz. 1890, and in the Verhandlungen d. anat. Ges. P. V. 1891.

I have examined the distal parts of the fore and hind limbs in all orders of Mammals either in skeletons or in specimens dissected by myself.

Naturally I have paid greatest attention to the "præpollex" and "præhallux" and to the "postminimus"[1], especially to the muscles and other soft parts of these structures. Apart from all theory, I think everybody may agree with me in calling a bone or a thumb-like outgrowth on the radial side of the pollex "præpollex," and a structure behind the minimus "postminimus."

The name "sesamoid bone" is much more misleading, and as I cannot agree that the structures I am speaking of are "sesamoids," or that they consist only of *bone*—for there are also soft parts, such as muscles, vessels, nerves—I must use the abbreviations Pp., Ph., and Pm.

This paper will be divided into three parts: the first concerning the skeleton, and the second relating to the muscles; in the third the bones and the muscles will be compared, and the conclusions concerning the meaning of Pp., Ph., and Pm., and concerning the homologies between the bones of hand and foot, will be given.

[1] I will use the abbreviations Pp., Ph., Pm.

A.—ON THE SKELETON.

As the pisiform and the calcaneum are present in *all* mammals, and as it is of no importance whether these bones are large or small, and whether they are directly connected with the ulna or the fibula, or not, I will not give here details on this point. Nobody will doubt that these bones are constant and that the large pisiform of lower mammals is homologous to the smaller one of the highest, *e. g.* Man—nor that the calcaneum of Monotremata, though it is directed forwards or outwards, is homologous to the calcaneum of higher mammals, where it is always directed backwards. Further, I must recall what I published in these Proceedings in 1889, that the pisiform is divided into *two* pieces in *Bathyergus*, being the only animal in which I met with this separation.

As I cannot tell here the names of *all* mammals in which I have found the Pp. and Ph., I will only mention those in which I made a sketch or measured these structures.

I am sorry I did not pay attention to the carpus and Pp. in my first investigations made in 1885 in Berlin, when I examined the mammalian foot for the "intermedium tarsi" or "os trigonum."

To the names of the animals which I examined in London, Berlin, Leyden, and other places I put the letters Lo., Be., Le., Pa. (Paris), Je. (Jena), A. (Amsterdam), Br. (Brussels); otherwise London, especially the Nat. Hist. Museum, is intended. I use the following abbreviations:—long or length l., breadth br., thickness th.; do.-vo. (dorso-volar), do.-pl. (dorso-plantar), sag. (sagittal), tr. (transverse), r. (right), l. (left); 0 = no, or not present. The numbers mean millimetres.

N.B.—As the Pp. and Ph. are often lost in preparing and cleaning the skeletons, I am often doubtful whether a Pp. or a Ph. had been present (and lost) or not. In such cases I put a "?".

MARSUPIALS.—The Pp. is situated on the trapezium (carp. dist. 1), the Ph. on the internal cuneiform.

Macropus (*Halmaturus*) *bennetti*: Pp.

Trichosurus vulpecula: Pp.

Phascolomys wombat: Pp. 7 l.; 4 br.; 3 do.-vol.

(Be., Lo.) *Didelphys marsupialis* [*cancrivora*, Be., Je.; *aurita*, Be.]: Pp. Ph., 4·5 l.; about 3·0 br.; 2 do.-pl. "*D. aurita*": 5 l.; 3 br.; 2 th.

Didelphys elegans: Pp. Ph. consists of *two* bones!

(Be.) *Didelphys azaræ*: Pp. Ph.

Didelphys philander: Pp. Ph.

Didelphys crassicaudatus: Pp. Ph.

(Le., Be.) *Chironectes minimus* (*variegatus*): Pp. Ph. 2·5 l.; 1·8 do.-pl.; 1·2 br.

EDENTATA.—The Pp. is attached on the scaphoid and trapezium; the Ph. on the naviculare and first cuneiform.

(Be., Lo.) *Tamandua* (*Myrmecophaga*) *tetradactyla*: Pp. Ph. (Be.), 10 l.; 5–6·5 do.-pl.; 2·5 sag.

Myrmecophaga jubata: Pp. Ph. 18 l.
Dasypus sexcinctus: Pp. Ph. (*vide* Plate XX. fig. 1).
Euphractus minutus (dissected): Pp. Ph.
Euphractus minutus (skeleton): Pp. Ph. very well developed, resembles metatarsal bone.

UNGULATA.—Naturally neither a Pp. nor a Ph. is present in the Ungulata vera nor in *Hyrax*.
Proboscidea, or *Elephas africanus*, "Embryo" (R.C.S.) has a large Pp.; it is longer than the pollex. The Ph. is also very strong.
In *Cetacea* the Pp. has been found by Prof. Kükenthal.

INSECTIVORA.—Pp. on the scaphoid; Ph. on the naviculare and internal cuneiform.
(Je., Le., Be., Lo., A., Pa.) *Centetes ecaudatus*: Pp. Ph. 2 l.; 1 br.; 1 th. (*vide* Plate XX. figs. 2, 3).
(Le.) *Hemicentetes nigriceps*: Pp. Ph.
Hemicentetes variegatus: Pp. Ph.
(Le., Lo.) *Ericulus setosus*: Pp. Ph.
(Je., Le., Be., Pa., Lo.) *Talpa europæa*: Pp.! sickle-shaped. Ph.! sickle-shaped.
(Le., Lo.) *Talpa wogura*: Pp.! sickle-shaped. Ph.! sickle-shaped.
Scalops argentatus: Pp. sickle-shaped.
(Be., Le.) *Myogale moschata*: Pp. Ph. very long, transv.
(Le.) *Urotrichus talpoides*: Pp. Ph.
Tupaja tana: Pp. 1 l.; 0·75 br. Ph.
(Je., Le., Be., Pa., Lo.) *Erinaceus europæus*: Pp. Ph.
Gymnura rafflesii: Pp. Ph.? (single bones in a box).
Galeopithecus philippinensis: Pp. Ph.

RODENTIA.—Pp. on the scaphoid (and metac. I.). Ph. on the internal naviculare and internal cuneiform.
Sciurus arizonensis, *S. niger*, *S. vulgaris*: Pp. large. Ph.
Xerus erythropus (Monbuttu, Emin Pasha): Pp. 1 l.; 0·6–0·7 br. Ph. small.
Cynomys ludovicianus: Pp. 7·2 l.; 4·7 br. Ph.
Arctomys marmotta: Pp.! sickle-shaped (though thumb reduced). Ph. 2·5 l.; 3 do.-pl.; 2 transv.
(Je., Be., Le., Lo.) *Castor fiber*, *canadensis*: Pp. and Ph. enormous.
(Be.) *Myoxus glis* (*avellanarius*): Pp.?
(Be.) *Spalax typhlus*: Pp.? Ph.
(Be., Lo.) *Bathyergus maritimus*: Pp. 7·5 l.; 4·5 br. Ph.—(Be.) 6 l.; 2·5 do.-pl.; 1 th. (1885): (Lo.) 7 l.; 3 do.-pl.; 1 th. (1889), ending cartilaginous (*vide* Plate XX. fig. 4).
Georychus capensis: Pp.? Ph. 2·7 l.; 2·5 do.-pl.; 1 tr.
Myoscalops (*Heliophobius*) *argentocinereus*: Pp. and Ph. resemble *Bathyergus*, but much smaller.
Geomys hispidus: Pp. 9·5. Ph.?
Dipus jaculus: Pp.?

Pedetes capensis (*caffer*): Pp. two bones,—prox. 13 l., 4·5–5·5 br.; dist. 7 l., 5·2 br. No Ph.

(Be.) *Myopotamus bonariensis*: Pp. 7 l.; 5·5 br.

Aulacodus swindenerianus: Pp. very large. No Ph. (hallux rudimentary).

Chætomys subspinosus: Pp. Ph. very large.

(Be., Lo.) *Cercolabes* (*Synetheres*) *insidiosa*: Pp. and Ph. triangular.

Synetheres prehensilis: Pp. about 8 l.; 4·5 br. Ph. 12·5 l.; 7·5 br.

(Pa., Lo.) *Erethizon dorsatus*: Pp.? lost. Ph. 9 l. (int. cuneiform divided into *two* bones) (*vide* Plate XX. figs. 5, 6).

Hystrix malabariensis and *H. javanica*: Pp. large. Ph. 5 l.; 3 br.

CARNIVORA.—Pp. on the scapho-lunatum and trapezium. Ph., if present, on the naviculare and internal cuneiform.

Felis macroscelis: Pp.

Felis paguros: Pp.

(Be., Le., Lo.) *Felis tigris*: Pp. ca. 15 l.; 10 br.

(Be., Le., Lo.) *Felis pardus*: Pp.

Felis tigrina: Pp.

Felis macrura: Pp.

Cynælurus jubatus: Pp. large.

(Be., Le., Lo.) *Cryptoprocta ferox*: Pp. Ph. lost?

Viverra tangalunga: Pp. 3·2 l. and do.-vo.

Viverricula malaccensis: Pp.

Genetta pardina: Pp. lost?

Linsang (*Prionodon*) *pardicolor*: Pp. very small (almost 1 mm.).

Linsang (*Poiana*) *gracilis*: Pp.

Paradoxurus philippinensis: Pp. 5 l.; 2 br. Pp. has a transv. direction. Ph.! 5 l.; 2·75 br.; 2 th.

(Be.) *Paradoxurus typus*: Pp. 5 l.; 3 br.; 1 th. Ph.!

(Be., Lo.) *Herpestes fasciatus*—(Be.) Pp. 2 l.; 1·5 br.; 1·5 th.: (Lo.) Pp. 2·5 l.; 2·5 do.-vo.

Herpestes griseus: Pp. No Ph.

Herpestes javanicus: Pp.

Herpestes ichneumon: Pp. 3·8 l.; 2·5 do.-vo.

(Le.) *Herpestes pulverulentus*: Pp.

Cynictis penicillata: Pp. seems to be united with the scapholunatum.

Galidea olivacea: Pp.

Hemigalea (= *Herpestes*) *galera*: Pp. 2 l.; 2 br.

Hemigalea hardwickii: Pp. 3 l.; 3 br.; 2 th. Ph.! 2·8 l.

Eupleres goudotii: Pp. 2 l.; 2 br.; 1 th.

Proteles cristatus: Pp.? lost?

Hyæna striata: no Pp.; no Ph.

In the *Canidæ* there are separated neither Pp. nor Ph.

In the *Ursidæ* Pp. seems to be coalesced with the scapholunatum. No Ph.

(Le.) *Procyon lotor* (3 spp.): Pp. and Ph.
(Le.) *Procyon cancrivorus* (3 spp.): Pp. 4 l.; 2·5 br. Ph. (Lo. no Ph., always lost).
Ælurus fulgens: Pp. 6 l.; 4 br.; 3 th. Ph. 7 l.; 2·5–2 br.; ending cartilaginous (*vide* Plate XX. figs. 7, 8, 9).
(Le., Lo.) *Nasua narica* (*nasica*): Pp. Ph.
(Je., Be.) *Cercoleptes caudivolvulus*: Pp.
(Be., Lo.) *Lutra brasiliensis*: Pp. Ph. (Be.) 12 l.; 6–4 br. (pointed); 4th on the proximal end; like a metatarsal.
Lutra canadensis: Pp. Ph. 0!
(Be.) *Lutra platensis* (2 sp.): Pp.
Latax lutris: Pp.
Mephitis mephitica: Pp. 4 l.; 1·5–1·8 br. (top ends cartil.); shaped like a metacarpal. Ph. 2·3 l.; 2 br.
Conepatus mapurito: Pp. Ph.
Mydaus meliceps: Pp. 2·5 l.; 1·2 br.
Meles taxus: Pp. 4·8 l.; 3 br.; pointed.
Traces of a suture (Ph.?) in the internal cuneiform.
Taxidea americana: Pp. 7·7 l.; 3 br.; a little sickle-shaped, pointed.
Helictis orientalis: Pp. 3·5 l.; 1·6 br. Ph. 2·5 l.; 1·5 br.
Ictonyx (*Zorilla*) *capensis*: Ph. on the l. hand separated and isolated; on the r. hand coalesced with the scapho-lunatum.
(Le.) *Galictis* (*Grisonia*) *barbara* (2 spec.): Pp.
Galictis (*Grisonia*) *vittata* (young): Pp. 3·2 l.; 1·5 br.; resembles a metacarpal bone. Ph. 2·5 l.; 2 br.
Gulo borealis: Pp.! 16 l.; 5 br.; 3 th.; comma- or sword-like; top cartilaginous.

PINNIPEDIA:—
(Br., Lo.) *Trichechus rosmarus*: Pp.
Phoca vitulina: Pp.?
Arctocephalus cinereus: Ph. (Pp.?)

CHIROPTERA.—Pp. attached to the scaphoid, small. Ph.?
Pteropus medius: Pp.
Cynopterus marginatus: Pp.
Vesperugo: Pp.
Phyllostoma hastatum: Pp.

LEMUROIDEA.—Pp. situated on the side of the trapezium, before the scaphoid, behind and on the side of the metacarpale 1.
(Je.) *Indris brevicaudata* (*Lichanotus indri*): Pp.
Avahis (*Microrhynchus*) *laniger*: Pp. 3·0 l.; 1·5 br. Ligament to the trapezium.
Lemur catta: Pp. 3·0 l.; 2·0 br.
Lemur macaco: Pp.
Lepidolemur mustelinus, Geoffr., and *L. microdon* (Forsyth Major): Pp. 4 l.; 2 br.; pointed, at the free end cartilaginous.
(Je.) *Otolicnus galago* (*Galago* sp.): Pp.
(Je.) *Nycticebus* (*Stenops*) *tardigradus*: Pp.

(Je., Lo.) *Loris gracilis*: Pp.
Perodicticus calabariensis: Pp.
Tarsius spectrum: Pp.
Chiromys madagascariensis: Pp. 4·3 l.; 3 br. on the basis.

PRIMATES s. s. (Anthropoidea).—Pp., if situated on the trapezium, connected by ligaments with the scaphoid.
Cebidæ:—*Chrysothrix sciurea*: Pp. 2 l.; 2 th.
Cercopithecidæ:—
(Je.) *Cynocephalus anubis*: Pp.
Cynocephalus (*Hamadryas*) *ægyptiacus*: Pp. r.! (l. lost).
Macacus leoninus: Pp. 6 l.; 5·5 do.-vo.
Maccaus laniger: Pp. 4 l., 3·1 do.-vo.
Macacus sp? (young spec.): Pp.
Macacus inornatus: Pp.
Cercopithecus ruber: Pp. 4 l.; 3·5 do.-vo.
Cercopithecus cephus: ? lost.
Cercopithecus mona: ? lost.
(Je.) *Cercopithecus cynosurus*: Pp.
Semnopithecus mitratus: Pp. seems to be coalesced with the scaphoid.
Colobus bicolor: Pp. ? lost.
Colobus ursinus (2 spec.): Pp. 3 viz., 3 l.
Simiidæ:—*Hylobates lar*: Pp. 5·8 l.; 4 do.-vo.
In *Simia, Gorilla, Anthropopithecus* no Pp. (= tuberos. scaph.?); no Ph.
Homo: no separated Pp. or Ph.

B.—ON THE MUSCLES AND NERVES.[1]

I. FOREARM AND HAND.

a. MARSUPIALS.

1. DIDELPHYS MARSUPIALIS. (Plate XXI. figs. 1, 2.)

a. Flexores.

The nerv. medianus and art. brachialis pass the supracondylar foramen of the humerus. Nerv. ulnaris accompanied by the ulnar artery runs behind the internal condyle.

The *pronator radii teres* arises from the radial border of the humerus (or entepicondyloideum); it is not perforated by the median nerve.

The *n. ulnaris* supplies the following muscles:—

Forearm:—(1) The *ulnaris internus* (flex. carpi ulnaris) arises by two heads (humeral and ulnar) which become united; inserted into the pisiform.

(2) The *palmaris longus* takes origin connected with the ulnar head of the former muscle; it is divisible into two layers, a radial and superficial one and a deep or ulnar: the super-

[1] I am very sorry to say that my notes and sketches concerning the Monotremata, Edentata, and some of the other lower mammals have been lost.

ficial muscle ends in a weak aponeurotic expansion (fascia palmaris) and the Pp.; the deep one goes to the lig. carpi transversum.

Hand:—(3) The "*piso-metacarpeus*" comes from the pisiform and the lig. c. transv., and is inserted into the fifth metabone.

(4) A muscle from the lig. carp. transv. (tendon of the deep palmar muscle) to the fifth metacarpal and first phalanx of the minimus, divides into

$$\left.\begin{cases} (a) = \text{the } \textit{opponens} \\ (b) = \text{the } \textit{flexor brevis} \end{cases}\right\} \textit{minimi digiti.}$$

(5) A muscle from the tendon of the superficial *palmaris* to the second phalanx of the fifth digit; the tendon is perforated by the tendon of the *fl. profundus*.

I consider the muscle (4) and its homologue—also in Man—as the vestiges of an old *flexor brevis superficialis* (comp. *Hyrax*).

Supplied by the *n. ulnaris* and *medianus*:—

(1) The *flexor digitorum sublimis*, connected with the *profundus* at the origin and with the lumbricales of the 4th and 3rd digits (*vide* below).

The *fl. sublimis* arises—(i.) from the humerus, connected with the humeral head of the ulnaris internus and two heads of the palmaris longus; (ii.) from the radius, in common with the radial head of the profundus; (iii.) from the ulna, with the ulnar part of the profundus.

Insertion: digits 2–4; ends in tendon-sheaths and on the phalanges.

(2) The *flexor digitorum profundus*.

Origin: (i.) humerus, with the radialis internus; (ii.) radius, with the sublimis; (iii.) ulna, with the sublimis.

Insertion: by five tendons to digits 1–5 and eight lumbricales-like muscles to the tendon-sheaths of digits 2–5.

(3) The 8 "*lumbricales*" are quite remarkable:—

	Origin.	*Insertion.*
(*a*)	Tendon for the 5th dig., radial side.	Radial border of the 5th dig.
(*b*)	Tendon for the 4th dig., above.	Tendon of the flex. subl. to the 4th dig., and sheath.
(*c*)	Tendon for the 4th dig., rad. side.	Rad. border of the 4th dig.
(*d*)	Tendon for the 3rd dig., above (ulnar).	Tendon of the flex. subl. for the 3rd dig., and sheath.
(*e*)	Common tendon and tendon for the 3rd dig., rad. side.	Rad. border of the 3rd dig.
(*f*)	Tendon for the 3rd dig., rad. side.	Ulnar border of the 2nd dig.
(*g*)	Tendon for the 2nd dig., above (ulnar side).	Tendon of the flex. subl. 2nd dig., and sheath.
(*h*)	Common tendon, tend. 1st and 2nd dig.	Radial border of the 2nd dig.

I think the muscles *a*, *c*, *e*, and *h* are real "*lumbricales*." What the others mean I do not know. Perhaps we have here the explanation of the two-headed *lumbricales* of higher mammals, which, *e.g.* in Man, are so very often met with.

β. Extensores.

	Origin.		*Insertion.*
The *supinator longus* (brachio-radialis).	Humerus	as in man.	*Pp.*, with the tendon of the abd. (ext.) pol. longus.
The *radialis ext. longus.*	Humerus		Metacarpus II.
The *radialis ext. brevis.*	Humerus		Metacarpus III.
The *extensor dig. comm. rad. s. subl.*	Humerus, radius.		digits 2–5.
The *extensor dig. comm. uln. s. prof.*	Ulna.		digits 1–3.
The *extensor dig. IV. and V.* (*ext. minimi*, Man.)	Ulna.		4th and 5th digits.
The *ulnaris externus.*	Humerus.		Metacarpus V. and into *volar* ligaments.

The *præpollex* gets a very long *nerve* from the n. medianus, and *vessels* from the art. brachialis.

2. Trichosurus vulpecula. (Plate XXI. fig. 3.)

a. Flexores.

The *ulnaris internus*: origin, humerus and ulna; insertion, pisiform.

The "*palmaris longus*" consists of two muscles, a superficial and a deeper one; the superficial one is inserted into the Pp. and the ligam. c. transv., some fibres going to the pisiform; the deeper palmaris ends in the fascia palmaris (*vide* Plate XXI. fig. 3).

The *flexor digitorum sublimis* is weak; it divides into four rather slender tendons which go to digits 2–5, mostly ending in the thin sheaths of the deep tendons.

The *flexor digitorum profundus* is strong; it comes from the humerus and both ulna and radius. The five tendons spring from a united tendinous mass; they become almost superficial on the digits.

There are *four lumbricales.*

β. Extensores.

The *supinator longus*, a strong muscle, arises from the humerus and is inserted on the radial side of the scaphoid (Pp.?).

The *radiales externi longus* and *brevis* are almost quite separated.

N. medianus supplies the Pp.; a strong nerve goes to the dorsum of the hand for the supply of the thumb and the radial side of the 2nd digit.

3. Macropus bennetti.

(Zool. Soc. Gardens, London.)

The *palmaris longus* ends in a long narrow tendon which continues into a triangular aponeurotic expansion on the wrist, sending a distinct tendinous strip to the Pp., 3rd digit, and Pm.,—not only to the bones but also to the pads and even to the skin. Nerve-supply by the ulnaris.

From the *pronator radii teres* goes a muscular belly to the *radialis internus* (comp. Rodentia and Carnivora).

A muscle arises from the Pp. and is inserted into the metacarpal I. (as in Carnivora)=Interosseus 0?

There is an *extensor pollicis et præpollicis.*

A very strong muscle is present on the *hypothenar*, arising from the distal end of the pisiform and the tendon of the *palmaris longus.*

b. INSECTIVORA.[1]

The "*palmaris longus*" gets its nerve only from the ulnaris, the muscle being situated rather on the ulnar side and inserted into the pisiform.

The *ulnaris internus* is also implanted in this bone (perhaps there are two ulnares?)

c. RODENTIA.

1. Sciurus arizonensis. (Plate XXI. fig. 4.)

(Zool. Soc. Gardens.)

Bone and pad of the Pp. are large, the thumb being small; on the Pm. a large pad.

The *palmaris longus* has on the wrist an aponeurotic expansion of triangular shape; it is inserted into the Pp., Pm., the other pads of the volar manus, and the sheaths of the digits. Nerve-supply from *medianus* (from the ulnaris no branch being found).

Very strong muscles are met with in the pad of the minimus digit, connected with the palmaris longus and the ulnaris internus; the muscular fibres reach the Pp. *N. ulnaris*: the tendons of the *fl. digit. sublimis* (phalanx II.) are weak, those of the *fl. profundus* (phalanx III.) are very strong.

There is an *extensor* (or *abductor*) *pollicis et præpollicis* arising from the ulna (comp. *Herpestes*).

2. Bathyergus maritimus.

On the Pp. and Pm. there are nail-like formations (comp. *Pedetes capensis*). Its Pm. consists of *two* bones (P. Z. S. 1889, p. 260); there are also two muscles, one for each bone. Whether these muscles be *two ulnares interni* or one of them be a *palmaris longus* I cannot say. Both are supplied by the *ulnaris* nerve.

On the wrist there are five muscles:—(1) A superficial muscle running obliquely from the Pm. to the Pp. and pollex, it continues the supposed palmaris (or ulnaris int.); (2) a superficial muscle from the Pp. to the thumb (nerv. medianus); (3 & 4) deep transverse muscles on the carpal joints (nerv. ulnaris); (5) a deep muscle between Pp. and pollex.

Each digit has two "*interossei*" or deep short flexors.

Extensor pollicis et præpollicis longus runs obliquely from the

[1] My notes and sketches concerning *Centetes* and other Insectivora having been lost, I can for the present give these few remarks only.

ulna to the aponeurotic sheaths of these digits, like the *ext. pollicis* in Man.

3. Dipus jaculus.

From the Pp., which is of enormous size, a strong muscle—*m. transversus carpi*—arises; it is inserted into the fifth metacarpal bone.

A very large superficial muscle is situated on the flexor side of the forearm and hand: it takes origin from the humerus and the ulna and ends by tendons on the Pp. and on the top of the pisiform (Pm.). As there is another superficial muscle with distinct tendons running down to the hand, and there are also *flexores digitorum sublimis* and *profundus*, I suppose that those two superficial muscles are parts of the *palmaris longus* (the *flexor digitorum superficialis*).

I could not make further investigations, this animal not being well preserved.

d. UNGULATA.

1. Hyrax brucei.

α. Flexores.

From the tendons of the *palmaris longus* arises a *flexor brevis superficialis*; this is common in the foot, but *very seldom* met with in the hand.

As this animal has not four digits (*Mivart*) but five (*Dobson*), there are muscular bellies to each digit except the third, i. e. *four*. (*Dobson* describes only three.)

The belly for the thumb is 3·5 mm. long and 2·5 mm. broad.

The tendons of this superficial flexor are cleft and let pass the deep tendons.

The three inner bellies of the *flexor brevis* are supplied by the *medianus*, the outer one (5th digit) by the *ulnaris*.

Ulnaris internus consists of *two* muscles (taking origin from the humerus and the ulna).

β. Extensores.

The *radialis externus*, situated under the *ext. poll. longus*, ends by *four* tendons:—the first is inserted into the second metacarpal bone; the second and third into the third metacarpal; the fourth into the unciform.

The *ext. pollicis* is very strong, its broad tendon ends on the small rudimentary thumb (quite as in the Pp. in animals with "five" digits).

The *ulnaris externus* is also very strong, it is inserted into the *fifth metacarpal* bone.

The *extensor digitorum communis* is perforated by the (2) tendons of the *extensor minimi* (*et quarti*) *digiti*.

2. Elephas africanus (Embryo).

(Roy. Coll. Surg.) The specimen was already dissected for the Collection.

The *palmaris longus* is large, it ends in the *fascia palmaris.*

There is only one *flexor digitorum*, which gets an accessory belly from the ulna.

From the very large Pp. arises a strong muscle which goes to the pollex.

From the deep layer of the wrist comes a muscle which is inserted into the Pp. and the pollex. It may be called *flexor pollicis et præpollicis brevis*, or, as it is also a "little adductor," perhaps "*opponens poll. et præpollicis.*"

e. CARNIVORA.

1. Linsang gracilis. (Plate XXI. fig. 5.)

(*Viverra, Prionodon.*)

a. Flexores.

There are *two palmares longi* and *two ulnares interni.*

The *palmaris longus radialis* is supplied by the *n. medianus*; the *palmaris longus ulnaris* by the *n. ulnaris*; both *ulnares interni* (*radialis, ulnaris*) being supplied by the latter nerve.

The *palm. long. rad.* arises with the *m. ulnaris int. uln.* from the internal condyle of the humerus, and ends in the volar pads and in digits 2–5, also *between* them in the webs.

The *palm. long. uln.* arises with the former muscle and goes to both the radial and ulnar pads on the wrist, mainly to the ulnar one.

The *ulnaris int. rad.* (*humeralis*) takes origin from the internal condyle of the *humerus*, while the *ulnaris int. ulnaris* s. *proprius* comes from the *ulna*; *both* are inserted together into the pisiform.

In this animal can be observed the fissure of main tendons and the coalescence of its delicate parts, and the development of a fascia or aponeurosis from tendons.

Muscles on the wrist :—

Connected with each other.
(1) An almost transverse muscle, like the *palmaris brevis* of Man, ending in the ulnar pad.
(2) An oblique muscle, ending in the thumb.

(3) A muscle representing the greatest part of the "lig." carpi transversum of Man; this "ligament" consisting *partly* of the tendon of the *palmaris longus ulnaris,* for the greater part of muscular fibres.

The *flexor digitorum sublimis* sends four tendons to the second phalanx of digits 2–5; the tendons are very weak, they are not so distinctly divided in two parts as in Man; a strong tendon joins the profundus and continues mostly into the 2nd and 3rd digits.

The *flexor digitorum profundus* forms a fibrous mass near the wrist; from this mass arise five strong tendons for digits 1–5.

There is to be observed the first stage of a crossing of the tendons of the sublimis and profundus, as in the planta pedis.

β. *Nerves* of the *extensor* side :—

Ramus superficialis of the musculo-spiral *nerve* (*n. radialis*) runs just as in Man.

The deep branch, situated between the *m. brachialis internus* and the *supinator longus*, ends in branches for the skin which provide the *whole dorsum manus*, except only the ulnar border of the fifth digit.

2. Herpestes griseus.

(Zool. Soc. Gardens.)

α. *Flexores.*

From the *pronator r. teres* come tendinous fibres to join the *radialis internus* (comp. *Sciurus*).

The *palmaris longus* ends partly in the pads, partly it is inserted into digits 2–5 by delicate tendons which are a little connected with each other.

Nerve-supply : *n. medianus* (only).

There are *four* strong superficial muscles on the wrist, connected with the ligam. c. transv. and also (partly) with the deep ligaments of the carpus :—

Nerv. medianus.
- (1) Origin : Pp. ; insertion : pollex.
- (2) Origin : tendon of the *palmaris longus* and the former muscle ; ins.: pollex.
- (3) Origin : tendon of the *palmaris l.* ; ins. : pad of the Pm. (or the pisiform) = *musc. transversus carpi.* (Nerve-supply not quite sure.)

N. ulnaris : (4) A deep muscle like the former, separated from it by the nerv. ulnaris.

There are *two m. ulnares interni*, as in *Linsang* :—

The *ulnaris int. ulnaris* (proprius), the stronger one, arises from the humerus and the *ulna* ; it is inserted by a flat tendon into the pisiform, more superficial and ulnar than the following muscle.

The *ulnaris int. rad.* (*humeralis*) springs from the humerus (cond. int.) and ends fleshy on the pisiform.

The *flexor digitorum sublimis*, supplied by both the median and *ulnar* nerves, divides in four thin and narrow tendons, which end in the tendon-sheaths of digits 2–5.

The *flexor digitorum profundus* has five very strong tendons for the 1–5 digits.

The four *lumbricales* are also connected with the *fl. sublimis* ; they form a mass filling the space between the *sublimis* and the *profundus*.

β. *Extensores.*

The *supinator longus* is fleshy as far as the carpus ; its insertion is not quite distinct on *one* bone ; there is one insertion into the lower end of the radius, but also an aponeurotic expansion reaching to the first and second metacarpal bones.

The *extensor digitorum communis* ("*sublimis*") arises from the humerus and goes to digits 2–5.

The *extensor digitorum* "*profundus*," as I should like to call it, takes origin from the ulna and has the following insertions:—

(1) Three tendons for digits 3–5 (ulnar border); (2) a tendon dividing and going to the 3rd and 2nd digits; (3) a strong muscular belly with a very broad tendon divides into two, which end on the first metacarpal and on the Pp.

3. Paradoxurus, sp.

a. Flexores.

There are *two palmares longi* (as in *Linsang*), the stronger radial one being supplied by the *n. medianus*, the other (ulnar) by the *ulnar* nerve.

Two m. ulnares interni are present, both being supplied by the *ulnar* nerve:—

(1) The *uln. int. rad.* (*humeralis*) comes from the humerus and is inserted into the top of the pisiform; (2) the *uln. int. ulnaris* springs from the ulna and ends in the wrist in a fascia (ligam. carpi transversum).

These muscles are supplied by the ulnar nerve.

The "*flexor digiti brevis superficialis*" is present in this animal; it springs from an aponeurotic expansion on the wrist (which is connected with the Pp.) and has three bellies, two of them being inserted into the fifth digit, one into the fourth ending on phalanx I. and on the sheaths of the tendons.

The tendon of this *flexor br. superfic.* for the 4th digit is cleft and perforated by the corresponding tendon of the *flexor sublimis.*

Both *flexores longi*, *sublimis*, and *profundus* take origin from the humerus, the radius, and the ulna; the sublimis is weak and goes to phalanx II. of digits 1–4 (!), the profundus is strong and ends on phalanx III. of digits 1–5.

There are four *lumbricales*; the third is the strongest, the fourth arises from the tendon of the *sublimis* (4th digit).

On the radial border of the forearm runs a strong muscle from the humerus (*internal* condyle) to the radius and the Pp., where it ends in an aponeurotic expansion which is perforated by the art. radialis.

The superficial muscles on the Pp. are connected with the tendon of the *pronator radii teres.*

β. Extensores.

The *extensor pollicis et præpollicis longus* (*ext. poll. l.*, Man) is present; it arises from the ulna and the radius.

The *supinator longus* is weak.

The *radialis ext. long.* and *brev.* are both present.

The *ulnaris ext.* is extremely strong; it takes origin from the humerus and the ulna and is inserted into the pisiform and the fifth metacarpal bone.

The *extensor digit. long.* (*radialis subl.* ?) goes to digits 3–5.

The "*extensor dig. minimi proprius*" ends by three tendons on digits 3–5 (1st phalanx).

The *ext. indicis et pollicis* comes from the distal end of the ulna.

4. Viverricula malaccensis. (Plate XXI. fig. 6.)

Flexores.

The "*palmaris longus*" arises (very broad) from the internal condyle (hum.) and ends by four tendons (connected with each other) on digits 2–5, some fibres going to the Pp. and to the neighbourhood of the Pm.

As this muscle has *two* nerves (from the medianus and the ulnaris) it may perhaps be considered as formed by union of two *palmares*.

On the wrist there are *four* little muscles :—

N. ulnaris.
(1) From the pisiform and the tendon of the *ulnaris internus* to the ulnar border of the manus.
(2) From the pisiform :
(3) From the Pp :
continue into *one* tendon, which ends on the sheath of the *flexor longus* on the fifth digit.

N. medianus : (4) From the Pp to the thumb.

Underlying these four muscles there is a strong transverse ligament.

N. medianus and ulnaris.
The *flexor dig. subl.* has delicate and narrow tendons which are cleft and perforated by the following muscle.
The *flexor dig. prof.* has very strong and broad tendons, which are connected with those of the *perforatus* where they pass it.

The radial part of the *profundus* goes to the pollex and index.

II. Leg and Foot.

a. MARSUPIALS.

1. Didelphys marsupialis. (Plate XXI. figs. 1, 2.)

a. Flexores.

There are strong nerves and vessels running to the Ph.

The *gastrocnemius* consists of *two* separate muscles arising from the inner and the outer condyle of the femur, joining each other only on the insertion on the calcaneum.

The *plantaris* takes origin in common with the lateral *gastrocnemius*, runs down, crossing the tibial or inner *gastrocnemius* at an acute angle; it is fixed on the calcaneum and ends in the "fascia" plantaris, the tendinous fibres going mostly to the Ph.

Beneath this tendon there is an oblique muscle like a *musc. transversus* s. *obliquus carpi.*

From the fascia arises a weak muscle which seems to be the remains of the *flexor brevis superficialis.*

There are also an *abductor minimi* and an "*opponens*" which forms the outer part of the *flexor brevis superficialis.*

The *tibialis posticus* (or *medialis*?) is inserted:—

(1) By an aponeurotic triangular expansion on the Ph.; (2) it gives origin to a strong muscular belly (like a *lumbricalis*) ending in a tendon which goes to phalanx II. of the 2nd toe; it is perforated by the tendon of the *profundus* (*fibularis*); (3) it continues into a tendon which joins the *flexor digit. profundus,* where it sends the tendon to the hallux.

"*Tibialis quartus*" I should like to name a muscle which is situated on the outer side of the "*tibialis posticus.*" It seems to be rudimentary or reduced; I could not find the insertion, because the tendon was torn on the back of the os trigonum.

The *flexor digitorum sublimis* (*tibialis*) goes to toes 3–5; first it is fleshy for a long way, then tendinous, and finally fleshy again (=*lumbricalis*?). The *sublimis* is largely connected with the *profundus* (*fibularis*), contra *Dobson.*

β. Extensores.

The nerv. peronæus goes to the 5th, 4th, 3rd, and 2nd toes (half).

There are *four m. peronæi*:

Origin.	*Peculiarities.*	*Insertion.*
(1) Cond. lat. femoris.	Superficial, strong, behind (2).	Planta.
(2) Cond. lat. fem., head of the fibula (lat.), representing a fleshy lig. laterale.	First flat, then rounded.	Metat. V., 5th toe.
(3) *a.* Middle third of fibula, outside.	Strongest tendon of all peronæi.	Outer border of the foot.
b. Femur, connected with (1).	Between (1) and (3 *a*).	
(4) Anterior surface of the fibula, upper half.		Dorsal aspect of the 5th, 4th, 3rd toes.

2. Trichosurus vulpecula.

The 2nd and 3rd toes reduced and united; hallux *widely diverging.*

a. Flexores.

The *gastrocnemius* is strong, two-headed, takes origin from the femur; inserted into the tuberositas calcanei.

The *plantaris* is also strong; inserted into the tuberos. calc. and fascia plantaris.

The *flexor brevis digitorum superficialis* arises from the tendon of the *plantaris* and ends on the outer border of the foot.

(Nerv. plantaris medialis supplies the four toes 1–4 and the inner half of fifth, but there is an anastomosis between the lateral branch of the nerve and the medial.)

The tendons of the *flexor digitorum sublimis* (*tibialis*) are weak; they are perforated by the tendons of the *profundus*. The *sublimis* goes to the 5th, 4th, 3rd, and 2nd toes; it ends on the I. phalanx and on the tendon-sheath of the *profundus*, especially on the ligg. annularia.

The *flexor digit. profundus* (*fibularis*) gives five tendons to toes 1–5, the tendons for the 2nd and 3rd toes being more connected than the others.

I have found only *two lumbricales*, to the 4th and 5th toes; they are very strong.

The *adductores* (plantar layer, *Cunningham*) go to the hallux, 2nd and 5th toes.

The *abductor dig. minimi* arises from the calcaneum and ends on phalanx I. of the 5th toe.

The tendon of the *tibialis posticus* is cleft, both parts ending on the naviculare.

β. Extensores.

The *tibialis anticus* is inserted into the internal cuneiform, the tendon being a little divided.

The *peronæus longus* is very strong; it crosses almost transversely on the planta and ends on the first metatarsal bone.

b. EDENTATA.

1. Euphractus minutus.

α. Flexores.

The *plantaris* (?) arises from the femur (lower end) and the fibula (upper end), or the knee-joint; it ends in the fascia plant. superfic. and tendons which go to the Ph. and the "five toes," ending there in the tendon-sheaths.

No *flexor brevis superficialis* is present.

The *flexores longi* (*subl.* and *prof.*) are connected with each other but divisible; they form *one* large tendon which divides into separate tendons. Each tendon is cleft, but there is no perforation.

A muscle arises from the fibula and is inserted into:—(1) the proc. transversus calcanei; (2) the tendon-sheath of the peronæus brevis and minimi; fascia dorsalis; (3) the ligam. transversum on the ankle-joint.

β. Extensores.

The *extensor digitorum et hallucis longus* goes to all five toes, the fourth toe getting two tendons.

There is an *extensor hallucis "proprius"* (like the *ext. poll. longus*) arising from the *fibula* and inserted into the first phalanx of the great toe together with the *extensor brevis*.

c. RODENTIA.

1. Sciurus arizonensis. (Plate XXI. fig. 4.)

(Zool. Soc. Gardens.)

The *nerv. plantaris medialis* supplies all 5 toes except only the outer half of the 5th.

An *abductor* (*extensor*) *præhallucis* (*tibialis medialis*) (v. *Bathyergus*) is present; it takes origin from the inner (tibial) surface of the tibia and ends in the Ph.; the muscle is covered in by the *tibialis posticus*. Nerv. tibialis.

The *plantaris* arises in common with the lateral head of the *gastrocnemius*; it is a little fixed on the calcaneum and ends in four tendons, which are provided with a weak fleshy belly each (=*lumbricales*?).

2. Sciurus niger.

α. *Flexores.*

The *gastrocnemius* is a two-headed, strong, and flat muscle; it is inserted into the tuberos. calcan.

The *plantaris* is large; it arises from the external condyle, becomes tendinous near the calcaneum, where it is fixed by connective tissue, and is inserted by four tendons into toes 2–5. These tendons are cleft and perforated by those of the *flexor longus*.

A muscle (*soleus*?) taking origin from the capitulum fibulæ joins the tendon of the *gastrocnemius*.

The two *flexores longi* are united into *one* muscle coming from the tibia and fibula and ending in five tendons. One tendon of the flexor communis joins the tendon of the plantaris which goes to the 5th toe.

There are present four large *lumbricales* muscles.

The *tibialis posticus* is inserted into the naviculare tibiale.

The *abductor* (*extensor*) *præhallucis* (*tibialis medialis*) arises from the internal surface of the tibia (in the upper half) and is inserted into the Ph. and the first metatarsal bone and phalanx I. of the hallux.

There are five *flexores breves profundi.*

β. *Extensores.*

The *tibialis anticus* is so very large that it covers the *ext. hall. l.* and *ext. dig. com. l.* in the upper part of the leg.

There are four *peronæi* muscles:—(1) the *peronæus longus*; (2) the *peronæus brevis*, both very strong; (3) the *peronæus* "*tertius*," arises from the fibula (upper end) and goes to the *capitulum* metatarsi quinti; (4) the *peronæus* "*quartus*" takes origin from the middle and lower third of the fibula and joins the outer border of the *extensor digitorum brevis*.

The *extensor brevis* goes to toes 2–5, the tendon to the fifth toe being very delicate.

3. Bathyergus maritimus.

Flexores.

The *biceps femoris* remains fleshy on the leg and ends tendinous ("fascia") on the foot.

The *gastrocnemius* is strong, and also the *plantaris*; the latter is inserted into the fascia and continues in the *flexor brevis.*

The insertion of the *soleus* is separated from that of the *gastrocnemius.*

The *abductor præhallucis* (*tibialis medialis*) is very strong (23 mm. l., 5 mm. br., more than 2 mm. thick; the tendon measures 25 mm.), supplied by the n. tibialis. It arises from the upper, inner, and anterior parts of the tibia, until close to the origin of the *tibialis anticus*; it ends on the tibial surface of the Ph.

The *flexor digitorum subl.* and *prof.* are not divisible; there are m. *lumbricales* as usual and a m. *accessorius.*

There are two "*interossei*" for each toe, except for the third toe, which has only one. The *interosseus medialis* of the hallux comes from the Ph., the *inteross. lateralis* of the fifth toe comes from an accessory ossicle situated on the top of the Pm.

d. UNGULATA.

1. Hyrax brucei.

The muscles of the leg and foot of this animal show some peculiarities which are of less interest for our subject.

2. Elephas africanus (Embryo).

(Roy. Coll. Surg.)

Length of the leg 15 cm.

The *biceps femoris* ends on the foot.

The *gastrocnemius* arises only from the *inner* side of the femur and from the planum popliteum.

The *plantaris* is strong and, after passing behind the calcaneum, ends in the fascia plantaris. From this fascia springs only *one* muscle, which joins the *flexor digitorum communis.*

Four *lumbricales* are present.

The *flexor digit. subl.* and *profundus* join each other in the planta.

The *tibialis posticus* goes on the inner border of the tibia to the dorsum pedis, where it ends on the third and second toes.

Beside this muscle there is another which continues partly the *semitendinsous* (!) and goes to the *hallux* and the *præhallux.*

The *extensor digitorum longus* goes to toes 2–5, the fourth getting *two* tendons; as the *extensor brevis* ends on toes 2–4, the fourth is provided with *three* tendons.

There are *three* muscles arising from the Ph.:—(1) to the hallux; (2) to the capitulum of the metatarsal II.; (3) to the 2nd toe, a long thin tendon, besides that of the *flex. longus.*

e. CARNIVORA.

1. Linsang gracilis.

The *gastrocnemius* consists of two heads; insertion, tuberos. calcanei (behind).

The *soleus* is represented only by a weak tendon (as very often the plantaris in Man).

The *plantaris*, connected with the *gastrocnemius*, but divisible by the forceps, is very strong, fleshy till near the calcaneum; it then becomes tendinous, passes the calcaneum, connected with it by the tendon-sheath, becomes again fleshy, and ends on the toes. No "fascia" plantaris is present (as in the Cat, *Mivart*).

Nerve-supply by the plantaris medialis (proximal) and lateralis (distal).

The *flexores longi* (*subl.* and *prof.*) do not cross each other, but continue separate and run down parallel, the *profundus* or *fibularis* being the stronger; the *accessorius* joins the latter (*Dobson*).

The *lumbricales* spring from the *profundus* (fibularis).

2. Viverricula malaccensis.

The *plantaris* is quite separate from the *gastrocnemius* and continues in the planta into the *flexor brevis*; nerve-supply as in *Linsang* (plant. med. and lat.) (very similar to *Linsang*).

3. Herpestes griseus.

In this animal there is also a continuation from the "plantaris" into the "flexor brevis." Nerve-supply as in *Linsang* and *Viverricula*, two branches coming from each nerve.

C.—CONCLUSIONS AND GENERAL REMARKS.

On comparing the bones and muscles of the distal parts of the mammalian limbs we see:—

(1) That the *palmaris* ends on the Pp. in Marsupials, Insectivora, some Rodentia,—while in some Carnivora there are only tendinous fibres going to that bone, and in higher mammals only traces of those connections are found. The palmaris can be separated into two muscles.

(2) That the *plantaris* is inserted into the Ph. in Marsupials, Edentata, some Insectivora, while in higher forms it goes only to toes 1–5 or 2–5; finally we see the tendons being united to an aponeurosis.

In the superficial layer of the forearm and the leg we have also the *ulnaris internus* (often separated into two muscles) going to the pisiform, and the *gastrocnemius* going to the calcaneum.

I am not quite sure about the meaning of the *tibialis medialis* ("*abductor præhallucis*"), but I am inclined to take this muscle together with the *gastrocnemius* (and *soleus* when present) as the superficial *flexor digit. longus*. I do not know how to interpret the *radialis internus* and, as I suppose, its homologue the *tibialis posticus*, but I think that they may have been formerly real *flexores digitorum*.

A question of great importance is, on which bones of the hand and foot are muscles inserted and on which not? I will answer this question here:—

	Hand.		*Foot.*	*Muscles.*
(1)	"True" carpal bones, except pisiform	—proximal row—	tarsal bones: except calcaneum:	no insertion, no origin.
(2)	Carpal bones	—distal row—	tarsal bones:	no insertion.[1]
(3)	Pisiform	"Pm."	calcaneum:	insertion and origin.
(4)	Præpollex		præhallux:	only origin.
(5)	Metacarpal bones		metatarsal bones:	insertion and origin.
(6)		Phalanges:		only insertion, no origin.

Or in the form of a table (+ = present, 0 = absent):—

	Insertion.	*Origin.*
(1) True carpal and tarsal bones, proximal row	0	0
(2) True carpal and tarsal bones, distal row	0	+
(3) Pisiform, calcaneum	+	+
(4) Præpollex, præhallux	+	+
(5) Metacarpal and metatarsal bones	+	+
(6) Phalanges	+	0

Therefore I conclude, if in our subject the muscles are true guides as to the homology of bones (and I do not doubt it), that neither the pisiform and calcaneum (as Gegenbaur and others have supposed long ago) nor the so-called præpollex and præhallux are true carpal and tarsal bones, but that they have the same rank and position as the metacarpal and metatarsal bones. If other authors prefer to call bones on which is an insertion and an origin of a muscle a "*sesamoid bone*," then they ought also to call the metacarpal and metatarsal bones (which may be often reduced and very small ossicles) "sesamoid bones."

Further evidences for my view on the præpollex and præhallux are the following:—

The bones I call Pp. and Ph. are generally present everywhere in all orders and families of mammals which have five true digits.

These bones have everywhere the same situation on the radial and tibial border of the hand and foot, and almost the same relations to the surrounding parts.

In some animals there are distinct pads on the apex of Pp. and

[1] The insertions of the *tibialis anticus* and *posticus* are not really on tarsal bones, but originally either on digits or on the free bone or bones of the border of the foot.

Ph., and in *Pedetes* there is a true nail (in some specimens only a nail-like structure).

The resemblance of Pp. and Ph. to a reduced thumb or great toe is very striking (*e.g.* foot of Carnivora).

If the first digit of the mammalian hand and foot had always been lost as a true digit, and if we knew only mammals with *four* digits, then we might be in the same doubt about this reduced structure—"præ-index"—as many of my colleagues are now about my præpollex.

The Pp. and Ph. are much better developed in lower mammals than in higher ones—they are present and free in primitive types; they are lost or become united with their neighbours in higher or more differentiated mammals, or they get the appearance of "sesamoid bones."

In lower mammals the Pp. may consist of *two* bones, in higher there is always only one bone.

The Pp. consists of at least *two* bones in *Theriodesmus phylarchus*, the position of that animal being not yet sufficiently ascertained. Five years ago (P. Z. S. 1889) I supposed it to be a Promammal, but, as Prof. Seeley kindly told me this March, there is now evidence for this interesting animal being a true *reptile*.

We must make a clear distinction between the *fission* of digits which occurs in Cetacea (and Ichthyosauria perhaps) and the existence of rudiments of digits. In Cetacea there is also a real Pp., as Prof. Kükenthal has shown.

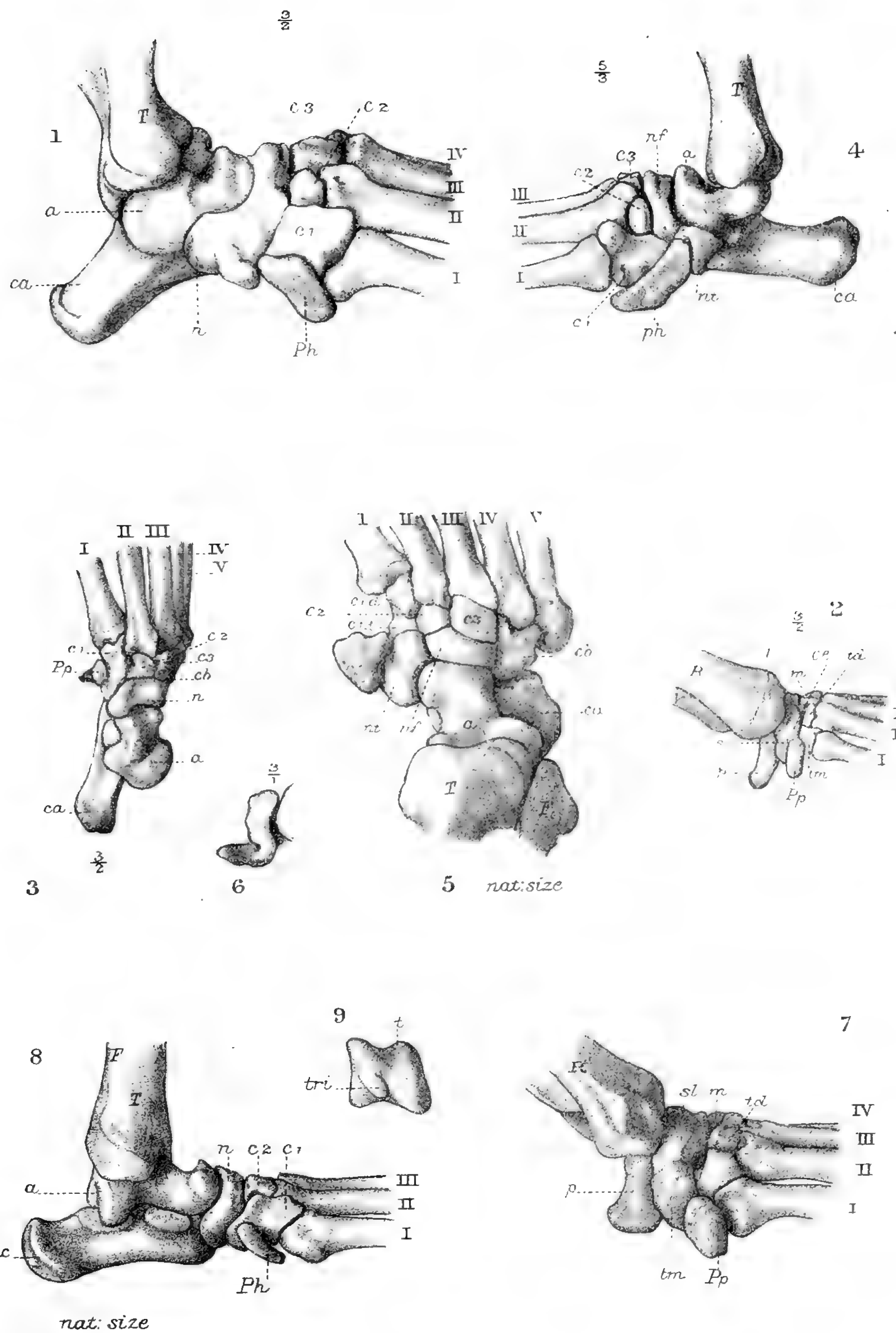
It may be that the Pp. and Ph. of many animals represent not only an old (reduced) structure, but also a partly new one, and that only the basis of the Pp. of *Pedetes* was inherited in those species and that it gradually increased in size.

There are many muscles in the mammalian hand and foot which have to do with the Pp. and Ph. exclusively or nearly so. When the Pp. and Ph. disappear or coalesce with other bones, these muscles may also vanish or they may become united with other muscles, or they may get inserted in those parts of bones which have been originally free and more or less movable, as *e. g.* Pp. and Ph.

Concerning the nerve-supply of muscles I found that the following muscles are provided with *two* nerves:—

the flexor digitorum superficialis brevis manus et pedis
the palmaris longus or flexor digitorum superficialis longus
the ulnaris internus (flexor postminimi)
the flexor digitorum sublimis
} in lower mammals.
the flexor digitorum profundus, in all mammals.

Concerning the homology of the *true* carpal and tarsal bones I give here a table which, though it may be incomplete, I hope may contain definite results:—



E. C. & G. M. Woodward del. et lith.

West, Newman imp.

Bones of Mammalian Hands and Feet.

	Hand.		*Foot.*	
Prox. row.	Scaphoid.	Radiale.	Naviculare tib. (tuberos.).	Naviculare.
	Centrale.	Centrale.	Naviculare fib. (lat.).	
	Lunatum.	Intermedium.	Talus s. s.	Astragalus.
	Triquetrum (pyramid.).	Ulnare.	Trigonum.	
	(Pisiform.)		(Calcaneum.)	

As regards the distal row there cannot be any doubt that the trapezoid and uncinatum are homologous with the middle cuneiform and the cuboid.

As the internal cuneiform (*Erethizon*, Man sometimes) and the external (*Cryptoprocta*) can be divided into *two* bones, we must look for the homologous bones in the hand; and I think that the radial part of the trapezium (sometimes a free ossicle in Man) corresponds to the tibial or the plantar internal cuneiform, and that the head or proximal part of the magnum (Man), or the lateral part of the centrale (e. g. *Centetes*), corresponds to that bone which is situated proximally to the external cuneiform in *Cryptoprocta*. I cannot prove beyond all doubt that this is the second centrale, but there seems to be no other explanation. Consequently the distal row would be as follows:—

Hand.		*Foot.*	
Trapezium.	Carp. tars. dist. 1.	Internal cuneiform.	Plantare. Dorsale.
Trapezoid.	Carp. tars. dist. 2.	Middle cuneiform.	
Magnum.	Carp. tars. dist. 3. Centrale 2.	External cuneiform s. s. Triangulare, B.	
Unciform. (separated: *Ziphius*).	Carp. tars. dist. 4. Carp. tars. dist. 5.	Cuboid.	

P.S. (*April* 23, 1894).—Since I read this paper I have found a specimen of *Euphractus minutus* in the Nat. Hist. Museum in which there is a very well-developed præhallux, like a metatarsal bone (see Plate XXI. fig. 7). There is also a muscle between the Ph. and the first metatarsal bone.

EXPLANATION OF THE PLATES.

Plate XX.

Skeleton *of Mammalian Hands and Feet.*

Fig. 1. Right foot of *Dasypus*, 3/2 enlarged (p. 356).
2. Right hand of *Centetes ecaudatus*, 3/2 enlarged (p. 356).
3. Right foot of *Centetes ecaudatus*, 3/2 enlarged.
4. Right foot of *Bathyergus maritimus*, 5/3 enlarged (p. 356).
5. Right foot of *Erethizon dorsatus* seen from above, nat. size (p. 357).
6. Præhallux of *Erethizon*, seen from behind, 3/1 enlarged.
7. Right hand of *Ælurus fulgens*, 5/4 enlarged (p. 358).
8. Right foot of *Ælurus fulgens*, nat. size.
9. Astragalus of *Ælurus* seen from behind, showing the division into "talus" s. s. and "trigonum."

Reference Letters.

(*a*) HAND:—*R*, radius. *U*, ulna. *s*, scaphoid. *sl*, scapho-lunatum. *tm*, trapezium. *td*, trapezoid. *m*, magnum. *ce*, central. *Pp*, præpollex. I–V, metacarpal bones, first to fifth.

(*b*) FOOT:—*T*, tibia. *F*, fibula. *a*, astragalus. *ca*, calcaneum. *n*, naviculare. *nt*, tibial, *nf*, fibular naviculare. *c* 1, *c* 2, *c* 3, internal, middle, external cuneiform. *c* 1 *d*, dorsal, *c* 1 *p*, plantar part of the internal cuneiform. *cb*, cuboid. *Ph*, præhallux. I–V, metatarsal bones, first to fifth.

PLATE XXI.

MUSCLES *of Mammalian Hands and Feet.*

Fig. 1. Left foot of *Didelphys marsupialis*, 2/1 enlarged (p. 359).
2. Second toe of *Didelphys marsupialis*, 4/1 enlarged.
3. Forearm of *Trichosurus vulpecula* (p. 361).
4. Hand of *Sciurus arizonensis* (p. 362).
5. Forearm and hand of *Linsang gracilis* (p. 364).
6. Wrist of *Viverricula malaccensis* (p. 356).
7. Præhallux of *Euphractus minutus* (nat. size): *m.*, interosseus præhallucis (p. 373).

Reference Letters.

(*a*) FORE LIMB:—*Pp*, præpollex. *Pm*, postminimus. *po*, pollex (thumb). *pis*, pisiform bone. *plm*, m. palmaris longus. *plm. r*, *plm. u*, m. palmaris l. radialis, ulnaris. *u.i.*, m. ulnaris internus (flexor c. uln.). *r.i.*, m. radialis internus (fl. c. radialis).

(*b*) HIND LIMB:—*Ph*, præhallux. *h*, hallux (great toe). 2 *t*, second toe. *pla*, m. plantaris. *tib. p*, m. tibialis posticus. *w*, web.

2. On two Sea-pens of the Family *Veretillidæ* from the Madras Museum. By G. HERBERT FOWLER, B.A., Ph.D., Assistant Professor of Zoology in University College, London.

[Received April, 2, 1894.]

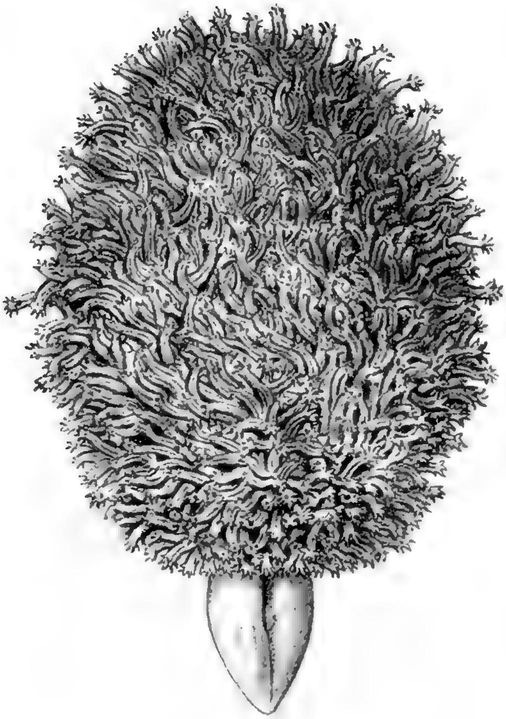
(Plate XXII.)

For the opportunity of examining these specimens, I am indebted to Prof. F. Jeffrey Bell, who received them from Mr. Thurston of the Madras Museum.

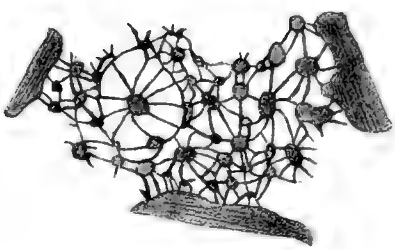
CAVERNULARIA MALABARICA, sp. n.

This beautiful species (Plate XXII. fig. 1) differs from all other Veretillidæ with which I am acquainted in the great breadth of the rhachis, and in the sharpness of the curvature by which the rhachis is marked off from the stalk; the result is to give the colony a club-shaped outline described only in *Cavernularia glans*, of this family. To what extent such a difference of form as this may be produced, or at least accentuated, by different degrees of expansion or contraction of the colony, I am unable to say; and I have therefore sought for other specific marks.

The **dimensions** of the colony in millimetres are as follows:—



1.



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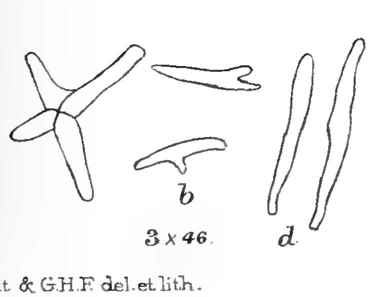
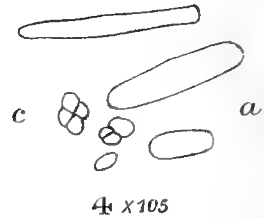


3 x 46.



4 x 105

P. Smit & G.H.F. del. et lith.

Mintern Bros. imp.

CAVERNULARIA MALABARICA.

piece, 3 mm. long, was about 7 mm. distant from the upper end of the rhachis; the lower end of the other piece, 9 mm. long, was about 5 mm. from the lower end of the stalk. The two fragments together measured therefore about 12 mm. and were 30 mm. apart. Nothing in the appearance of the colony indicated, either before or during dissection, that the fracture of the axis was attributable to rough treatment after death, and from the appearance of the fractured surfaces I incline to think that the break occurred during life. In the second specimen the axis was unbroken; it measured a little less than 12 mm. in length, and lay at the junction of stalk and rhachis. In both cases the axis was pointed at both ends, and measured ·43–·48 mm. in diameter; its surface was covered by irregular warts and knobs, and its colour was a brilliant white.

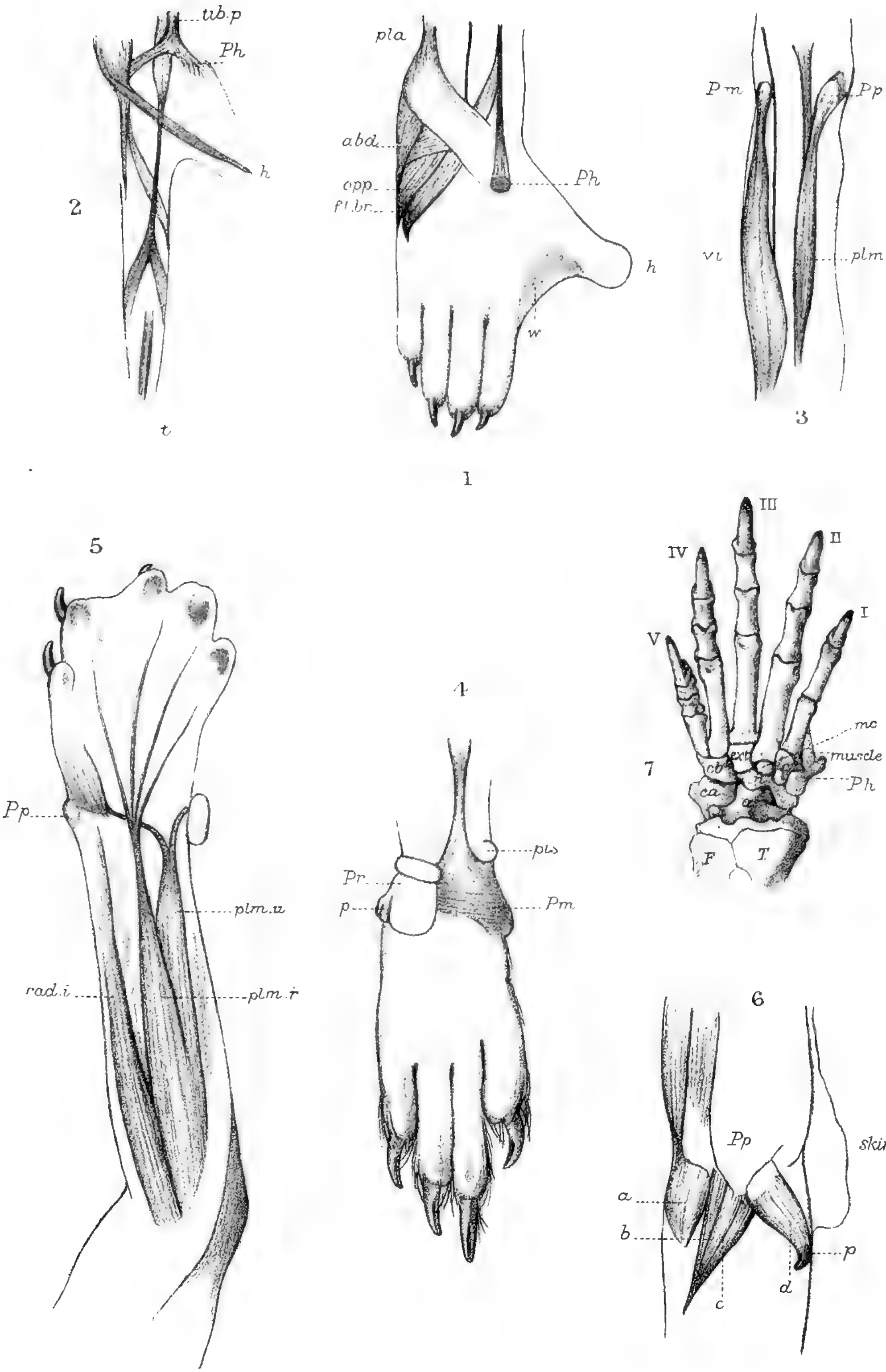
The **spicules** are of different size and character in rhachis and stalk. In the rhachis (fig. 3) they take the shape of elongate needles of irregular form (*d*). These are very numerous, and are distributed throughout the cœnosarc. A few are bifurcated (*a*), or carry a prominence at one side (*b*); rarely one meets with "Vierlinge." An average spicule of the needle type measures $480\,\mu \times 32\,\mu$.—In the stem (fig. 4) the spicules were very much smaller than in the rhachis, as will be seen by the magnification of the two figures. By far the greater number are regularly elliptical (*a*), an average specimen measuring $49\,\mu \times 24\,\mu$. Scattered sparsely among these are needles of the same character as those of the rhachis (*b*), but very much shorter; they are about $208\,\mu \times 32\,\mu$. "Vierlinge" are fairly numerous (*c*).

It is possible, but, I think, unlikely, that the specimens under description may prove to be old specimens of *Cavernularia lütkeni* (Köll.), which also came from the Bay of Bengal. The proportionate dimensions of the colony are not quite close enough to allow of this determination; expressed in percentages of total length they are:—

	Rhachis.		Stem.		Axis.
	Length.	Breadth.	Length.	Breadth.	Length.
C. lütkeni ……	70	37	28·5	14	36 ?
C. malabarica…	78	58	22	14	24

Further, the very numerous elliptical spicules of the stalk are not mentioned by Kölliker ('Pennatulida,' p. 347); the polyps of *C. lütkeni* are described as "entferntstehend," and the shape of the colony (Köll. Penn. pl. xxii. fig. 211) is quite unlike that of our specimens.

Locality. Calicut, Malabar Coast.



E.C & G.M.Woodward del. et lith.

West, Newman imp.

Muscles of Mammalian Hands and Feet.

LITUARIA PHALLOIDES (Pallas).

A single specimen of this, labelled "Dutch Bay, Ceylon," was sent along with the *Cavernularia* just described. It presented no features of special interest, and differed from other specimens which have already passed through my hands (Marshall and Fowler, "Pennatulida of the Mergui Archipelago," Journ. Linn. Soc., Zool. xxi.) only in the point that the siphonozooids practically filled all the space between the autozooids, instead of forming rings round them. A plane of bilateral symmetry, mentioned in the paper quoted, was also indicated here. The specimen, as so often happens with Pennatulids, had been apparently truncated above and scarred over; a new autozooid and several siphonozooids had been formed on the scar.

EXPLANATION OF PLATE XXII.

Fig. 1. *Cavernularia malabarica*, sp. n.; view of the colony.
Fig. 2. Surface of the cœnosarc, showing the siphonozooids filling up the space between the bases of three autozooids.
Fig. 3. Spicules of the rhachis.
Fig. 4. Spicules of the stalk.

3. On Two new Genera, comprising Three new Species, of Earthworms from Western Tropical Africa. By FRANK E. BEDDARD, M.A., F.R.S., Prosector to the Society.

[Received April 2, 1894.]

The specimens of worms now described I owe to the kindness of Mr. Alvan Millson, Assistant Colonial Secretary at Lagos, to whom I have frequently had to express my indebtedness for material. Within the last few weeks I have received from him a number of tubes containing a large number of specimens of Earthworms, which proved to be referable to four species. Of these I only describe three in the present communication; the fourth was not new, but was found to be a particularly fine specimen of my species *Siphonogaster millsoni*; this specimen I have sent to the Oxford Museum. The remaining species belong to the family Cryptodrilidæ, which is not well represented on the African continent, so far as our present knowledge enables a judgment to be formed. The most characteristic family of Earthworms of the Ethiopian region are unquestionably the Eudrilidæ, which are indeed limited to that continent, with the sole exception of the almost ubiquitous genus *Eudrilus*. So abundant are the members of this family that it is really a remarkable fact to receive a collection of Earthworms from that part of the world which does not include representatives of that family. Such, however, is the case with the collection upon which I report here. It may be noted, however, that the Cryptodrilidæ are rather more abundant in

Western than in Eastern Africa. I have already described several species of a genus nearly confined to Western Africa, viz. *Gordiodrilus*; and at Lagos a species of *Pygmæodrilus* also exists. The same two genera also occur on the West Coast, but the former is there not nearly so common. The present paper increases the number of West-African Cryptodrilids by three; and I refer these worms to two new genera. *Nannodrilus africanus* seems, from the large number of specimens sent to me, to be an exceedingly common species.

It is a curious fact that both of the two genera show certain resemblances to the Eudrilidæ: there is, in my opinion, little doubt but that the Eudrilidæ are derivatives of the Cryptodrilidæ; but I cannot agree with those who would unite two such extremely diverse types in one family. I shall now direct attention to the anatomical characters of the new species, beginning with a definition of the first genus, which I propose to call after Mr. Alvan Millson.

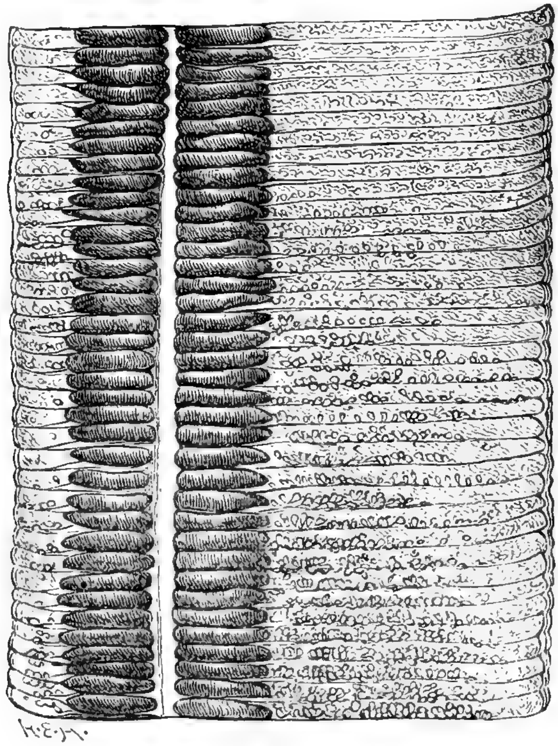
Millsonia, gen. nov.

DEF. *Large worms with strictly paired setæ. Male pores (single or paired) upon xvii. Two gizzards in v., vi.; calciferous glands, three pairs in xv.–xvii.; intestine with about* 30 *pairs of cæca, a pair to each segment. Nephridia diffuse. One pair of spermathecæ without diverticula; spermiducal glands tubular; no penial setæ.—Hab. West Africa.*

This definition will differentiate the present genus from any other Cryptodrilid at present known. The two most salient characters of the genus which are peculiar to itself concern the nephridia and the intestinal cæca. These alone would serve to distinguish the genus; it is principally on account of them that I unite the two species, which I shall describe, into a single genus. These two species, as will be seen in the course of the following pages, differ from each other in a good many points of, as I believe, subsidiary importance. The two matters referred to are not exactly novelties of structure in the group, but they are exaggerations, so to speak, of characters already found in allied forms. The cæca are precisely like those of the genus *Perichæta* only that there are so many of them. In *Perichæta sieboldi* and in one or two other species there are, it is true, six or seven pairs of these appendages of the intestine; but then they are all contained in one segment; whereas in the genus *Millsonia* they are contained in as many segments as there are pairs of cæca. The existence of these cæca is interesting as tending to knit still closer together the, in other ways not very remote, Cryptodrilidæ and Perichætidæ.

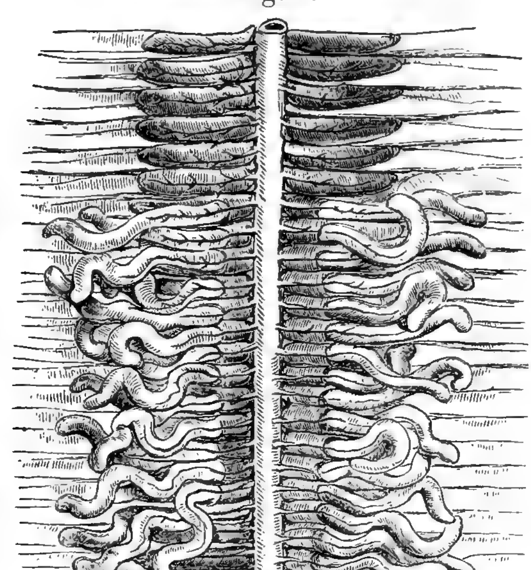
The second peculiarity of this genus concerns the nephridia. The structure of these organs will be described more at length immediately; but in the meantime attention may be directed to the fact that they present the curious appearance illustrated in the accompanying drawing (fig. 1, p. 381). The excretory tubes of the posterior segments of the body have ceased altogether to look

Fig. 1.



Millsonia nigra.
Part of the posterior region of the body cut open to display the excretory system.

Fig. 2.



Millsonia rubens.
Intestinal cæca.

like excretory tubes in the usual "plectonephric" genera; they give the impression rather of minute pouches opening on to the exterior. A closer survey, however, of their structure shows that there is really nothing anomalous about them. The vesicular layer of cells commonly found attached to the exterior of the tubules is here so largely developed that the appearance referred to is produced.

Most of the other characters of the genus are such as are to be met with in other Cryptodrilids. The affinities which they indicate are, however, not very plain. The presence of two gizzards—to commence with perhaps the least important of these characters—is found in the genera *Digaster* (with which I unite *Didymogaster* and *Perrisogaster* of Fletcher), *Dichogaster*, and *Microdrilus*. All of the genera mentioned also agree with *Millsonia* in the diffuse nephridial system. The last two Cryptodrilids, as well as *Typhæus*, agree with *Millsonia* in that the male pores are upon the xviith instead of the more usual xviiith segment. Finally the calciferous glands are, as in *Microdrilus*, in segments xv.–xvii. The absence of the penial setæ distinguishes *Millsonia* from all the Cryptodrilids mentioned except *Dichogaster*. *Millsonia* shows, as I have already intimated, some likeness to the Eudrilids. This likeness, however, is shown only by the species *Millsonia nigra*. The resemblance consists first of all in the unpaired male pore; the unpaired genital orifices are not absolutely unknown in the Cryptodrilidæ, since they are met with in the genus *Fletcherodrilus*. But in addition to their being unpaired in the worm now under discussion, there are a pair of terminal muscular sacs which are like the bursa copulatrix of many Eudrilids. The genus *Nannodrilus* which I describe in the present paper is the only other Cryptodrilid in which there is a similar bursa or rather a pair of them. But I am disposed to consider that the terminal sac which is found appended to the end of the duct of the spermiducal glands in many *Perichætæ* is the homologue of the structure so universal in the Eudrilids. So that the existence of well-developed bursæ in *Millsonia* is not a fact of absolute novelty for the family.

Millsonia rubens, n. sp. (Fig. 2, p. 381.)

Def. *Length* 320 *mm.; diameter* 12 *mm. Number of segments* 363. *Male pores paired. No bursa copulatrix.*

External characters.—This worm was remarkable on account of its peculiar coloration. In alcohol the front end of the body, in front of the clitellum, is of a pale violet-grey. The clitellum itself is of a pale brown. Behind the clitellum the colour is a brick-red, a tint that I have never before seen in any Earthworm. The prostomium is large and does not at all encroach upon the buccal segment. The setæ, as already mentioned in the definition of the genus, are very strictly paired; they lie entirely upon the ventral surface of the body. A distance of 2 mm. separates the two couples of each side, while the ventral couple of one side is separated from its fellow of the other side by a distance of 2·5 mm. I could not find any trace of setæ at all upon the first five segments of the body. If this absence of setæ upon the head end be confirmed it is of interest, as this cephalization is rare among the Cryptodrilidæ, though a common character in the family Geoscolicidæ. *Geodrilus* in fact is the only Cryptodrilid in which I can recall anything of the kind. Segments vii.–xii. are bi-annulate. The dorsal pores are very obvious. They commence on the borderline of segments x./xi., possibly one or two segments earlier. There are three of these pores upon the clitellum—one marks its posterior boundary, while two lie on the first two segments. The clitellum is rather extensive, occupying segments xiii.–xxii. The median ventral region behind the male pores seems to be free, at any rate to a large extent, of glandular tissue. The two male pores lie upon segment xvii.; they are highly conspicuous and are transversely elongated orifices, which correspond in position to the missing ventral setæ of the segment. Neither the oviducal nor the spermathecal pores were visible. The body-wall of both the present species and *Millsonia nigra* is exceedingly tough. Mr. Millson informs me that this was also the case during life.

Vascular system.—The dorsal blood-vessel of the worm is single from end to end of the body. In segments xvi. and xvii. it is distinctly dilated, forming thus a kind of heart. A local dilatation of the dorsal vessel is not unknown, though rare, among the Oligochæta. In the Geoscolecid *Microchæta* I and Benham have described the same kind of thing, while many Enchytræids also show a dilatation of the dorsal blood-vessel just after its emergence from the peri-intestinal sinus (or plexus). I regard all these local expansions of the dorsal blood-vessel as having some relation to the heart of the Arthropods. The last pair of circumœsophageal trunks are in segment xii.; the five pairs which lie in front of these are equally large.

Intersegmental Septa.—The first distinguishable septum lies between segments iv./v. It is tolerably stout and runs in a straight course across the body. The four following septa are excessively delicate and are pushed back by the stout gizzards so as to have lost their definite relation to the segments which they separate. After these thin septa come a number which are very strong and muscular. The septa dividing segments ix./xvii. are stout, diminishing in thickness posteriorly. The anterior of these and those which lie in front of them as far back as septum xiv./xv. are traversed by or give rise to muscular straps which are also attached to the parietes and to the alimentary canal.

Nephridia.—I do not give a long account of the nephridia under the present species as they are constructed upon the same plan as those of *Millsonia nigra*, in which species it so happens that I investigated them more closely. The peculiarity of the nephridia of this genus, to which I have already referred, is not quite so strongly marked in the present species as it is in the next to be described.

In the middle region of the body the nephridia form a denser coating of the parietes than I have before noticed in any worm with plectonephric excretory organs.

Alimentary Canal.—The pharynx of *Millsonia rubens* ends with the fourth segment; in each of segments v. and vi. is a strong gizzard which measures about 7 mm. in length and not less in breadth. The two gizzards are separated by an interval of soft walled œsophagus. Calciferous glands are present and show a rather unusual appearance. There are three pairs of them, which lie in segments xv., xvi., and xvii. These segments, be it noted, are the same in which the calciferous glands of the Acanthodrid genus *Benhamia* lie. I have already pointed out that another Cryptodrilid, viz. *Microdrilus*, is distinguished by the same position of its calciferous glands. These glands in *Millsonia rubens* have a very remarkable appearance; the surface is so much furrowed as to give them the look of a small though highly convoluted mammalian brain. In microscopic examination they are seen to present the characters usually found in these glands; the interior is occupied by numerous long folds of the lining epithelium, whose cells are rather flattened. The intestine begins in segment xviii. This part of the gut is most remarkable for a long series of cæca, which I have already referred to as a character of the genus. I counted altogether 32 pairs of these cæca, which begin at about the 28th segment. They begin and end abruptly; the first pair and the last are neither larger nor smaller than those which precede and follow them. The shape of the cæca is precisely that of the cæca of the genus *Perichæta.* They taper gradually towards the free extremity and are in fact exactly like the finger of a glove. The length averages some 6 mm. In the region of the intestine occupied by these cæca, the dorsal blood-vessel gives off in each segment two equi-sized trunks; one of these—the most anterior—is entirely concerned with the blood-supply of the cæcum of its side. The other supplies the walls of the intestine and appears not to run over the cæcum; in the section of intestine in front of the region where the cæca are I only noticed a single pair of intestinal trunks in each segment. It will be understood that these cæca are entirely metameric in arrangement—that is to say, there is a pair to each segment; they arise at first more laterally in position, afterwards their origin is nearer to the dorsal line.

Reproductive Organs.—There are two pairs of testes and of sperm-duct funnels, which occupy the usual segments, *i. e.*, segments x., xi. The sperm-sacs are in segments xi., xii. attached to the front walls of these segments; the sacs are not particularly large and do not stray beyond their segments. The spermiducal glands lie entirely within the xviith segment; they are coiled into a compact mass. The muscular duct is of a moderate length and has a nacreous appearance. I am unable to state what is the relation between the gland and the sperm-ducts. The ovaries are large and occupy the xiiith segment. There are only a single pair of spermathecæ; these lie in the viiith segment. The sacs are rather thin-walled, but have a stout duct leading to the exterior. I could not see the least trace of a diverticulum. It is rare for the members of the family Cryptodrilidæ, indeed for any worm belonging to the Megascolicidæ, to be without diverticula to the spermatheca. There are here and there a few cases, but these are mostly of worms which have a simple structure and are perhaps rather degenerate in their organization. Examples are furnished by the genera *Gordiodrilus* and *Ocnerodrilus*. I know of no large and well-developed genus like *Millsonia* in which the spermathecæ are devoid of diverticula. It may of course be that there are really diverticula, but that they are concealed in the thickness of the muscular walls of the duct of the spermatheca.

Millsonia nigra, n. sp. (Fig. 1, p. 381.)

DEF. *Length 230 mm.; diameter 7 mm. Male pore single. Spermiducal glands open each into a bursa copulatrix.*

External characters.—This species, judging from the single specimen at my disposal, is rather smaller than the last. It is also rather different in colour, being of a dark brown thoughout, almost black in parts. The setæ, dorsal pores, and prostomium are as in the last species; the clitellum was undeveloped. The most salient external difference, apart from colour, that distinguishes this species from the last is in the orifices of the male organs. The male pore, as stated in the definition of the species, is single and median. It is of some size and occupies an area equal to that which would be occupied by the missing ventral setæ of its segment. It is surrounded by a smooth area of skin, doubtless the commencement of the otherwise wanting clitellum. The spermathecal pores are also fairly conspicuous, but they are paired, though the orifices are very close together. These orifices correspond in position to the ventral setæ. They are on the boundary line of segments viii./ix., though, as will be pointed out later, the pouches themselves lie principally in the viith segment.

Intersegmental Septa.—The character of the septa plainly distinguishes this species from the last. They commence at the same segment, *i. e.*, between segments iv./v., but they are from the first thickened; the last of the series of thickened septa separates segments xiii./xiv. Numerous stout muscular strands tie them together and to the parietes. These bands are found also attached to the septa separating segments xiv./xvi.

Nephridia.—This species shows the peculiar character of the nephridia better than does the last. On opening the body the nephridia of the anterior segments were seen to present the usual characters of the diffuse nephridia; those of the fourth and fifth segments seemed to be a little thicker than the others, but whether these formed a compact "peptonephridium" I am unable to say. Elsewhere (in the anterior segments) the nephridia were scattered tubules not quite so densely packed as in *Millsonia rubens*. Further back the coiled masses of tubes seem to disappear and to be replaced by flattened oval vesicles of various sizes, which have much the look of small spermathecæ, such as characterize many Geoscolicidæ, e. g. *Microchæta*. The transition is not abrupt, but gradual. By the thirteenth segment, or even a little before, the transition is accomplished and the nephridial system has the curious appearance indicated in the accompanying drawing (woodcut, fig. 1). When the vesicles are removed separately and examined in glycerine they are seen to be sacs with excessively delicate walls and crammed with cells. These cells are oval to rounded in shape and are sometimes granular, sometimes homogeneous in appearance. In transverse sections these globular sacs were seen to overlie the nephridial tubes. I am of opinion that they are merely an exaggeration of the covering of peritoneal cells, which often take on a glandular appearance and give to the nephridia which they cover a white colour, owing to the granules with which they are laden. The cells are very differently acted upon by the borax carmine which was used as the staining reagent. The homogeneous cells were very deeply stained; the more granular cells were not at all stained. In these sections the masses appeared oval or circular; at the side nearest to the body-wall were one or two nephridial tubules cut transversely.

Alimentary Canal.—As in the last species, there are two stout gizzards in segments v. and vi. The calciferous glands also occupy the same segments as in *Millsonia rubens*; they are perhaps a little less furrowed and appear to be smaller. The intestine has a moderate typhlosole and also the cæca of the last species. I counted the same number of these and they begin at the same point; their commencement is indicated by the dark pigmentation of the intestine. The posterior set of cæca are rather shorter.

Reproductive Organs.—The testes are two pairs of little white tufted bodies, which lie on the anterior septa of segments x. and xi. The ovaries are rather larger, but occupy an exactly similar position in the xiiith segment. There are three pairs of sperm-sacs in segments xi., xii., xiii.; they are attached in every case to the anterior walls of their respective segments. Only those of segment xiii. are of any size, and they are not very large. The terminal part of the male efferent apparatus has a very unusual structure. It has been already mentioned that the external pore is single; the internal organs, however, are double, only uniting just at the pore. When the worm is dissected and the intestine removed, two large elevations, one on either side of the nerve-cord, are exposed. Each of these is about five millimetres long and is quite conspicuous. They are tied down to the parietes by thin straps of muscle, which doubtless serve to retract them after protrusion. The nerve-cord sends to each two nerves on either side, which are the ordinary nerves of the segment. These nerves, instead of coming off at right angles to the cord, run, the anterior pair forwards, the posterior pair backwards. The terminal chamber of the efferent apparatus bears a close resemblance to the terminal chamber of the efferent apparatus in the genus *Geoscolex*, and it is of course also comparable, as I have already mentioned, to the bursa copulatrix of the Eudrilidæ. The walls are thick and muscular and of a spongy texture. At the posterior inner boundary of each sac opens the spermiducal gland. The gland has the tubular character of that of the last species, but it is decidedly more slender; it is, as usual, divisible into two parts—the non-glandular duct, and the glandular portion. The former is of a fair length and slender. It widens out at its actual orifice into the terminal sac. The glandular part of the tube is long and coiled and slender; it is attached to the posterior border of the bursa by a mesentery, which supports it and gives to it somewhat the appearance of a minute vertebrate intestinal tract. The sperm-ducts cross the sac towards the outer border; they are enclosed in a muscular sheath, as is the case with the sperm-ducts of *Microdrilus* and *Pygmæodrilus*. The thickness of this muscular coat makes the sperm-ducts hardly, if at all, thinner than the duct of the spermiducal gland. The sperm-ducts pass beneath the terminal sac, so that it is just hidden on a superficial view and opens into it at the posterior outer border, at the opposite "corner," as it were, to that occupied by the orifice of the spermiducal gland. There is, as in the last species, no trace whatever of penial setæ.

There are but a single pair of spermathecæ, which have moved a segment further in front and lie in the viith instead of the viiith segment. They have a remarkable arrangement which I have not seen paralleled elsewhere. The two spermathecæ are very close together; in fact they are in actual contact above, but they are separated below by the nerve-cord which runs between them. The area in which the two pouches lie is walled off from the surrounding space by a perfectly circular fold of muscle, which arises posteriorly from the septum, but anteriorly from the ventral parietes. This is really produced by a perforation of the septum to let the spermathecæ pass through it. Each spermatheca passes through a foramen, so that it lies in segment vii. to a great extent, but opens on to the exterior between segments viii./ix. The spermatheca itself is the shape of a sock with a very short foot; the toe is directed backwards. The spermatheca is thick-walled but very soft; there is nothing apparent in the shape of a diverticulum.

The following is a table of the differences between the species:—

	Millsonia rubens.	*Millsonia nigra.*
Male pores..........	Paired.	Unpaired.
Spermathecal pores ..	VII./VIII.	VIII./IX.
Stout septa	IX./XVII.	IV./XIV.
Sperm-sacs..........	in XI., XIII.	in XI., XII., XIII.
Bursa copulatrix	Absent.	Present.

Nannodrilus, nov. gen.

DEF. *Small worms with paired setæ. Nephridia paired. Calciferous gland in ix. Spermiducal glands two pairs lined by a single layer of glandular cells, opening on to exterior in xvii., xviii.; the anterior pair open in a bursa copulatrix with, but independently of, sperm-ducts. Spermathecæ without diverticula.—Hab. West Africa.*

This new genus evidently belongs to that group of small-sized Cryptodrilidæ which includes the genera *Ocnerodrilus*, *Gordiodrilus*, and *Pygmæodrilus*. They all agree in the fact that the spermiducal glands are lined by a single layer only of glandular cells, a character not found anywhere else except in the Acanthodrilid genus *Kerria*. The present genus comes nearest to *Gordiodrilus*; but it should be, I think, regarded as the type of a new genus on account of the bursa copulatrix. In other respects it agrees fairly closely with *Gordiodrilus*.

Nannodrilus africanus, n. sp.

DEF. *Length an inch to two inches. Clitellum xiii.–xvii. Two rudimentary gizzards in vii., viii. Nephridia begin in v. Spermathecæ two pairs in viii., ix.*

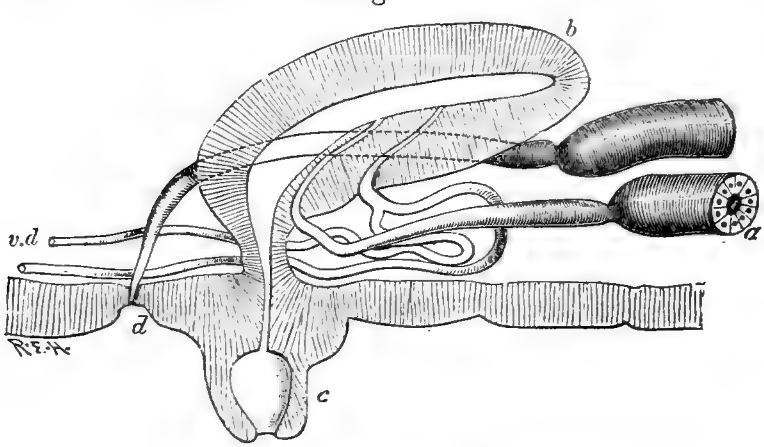
As the present is the only species of the genus, the above definition of the species is of course only very tentatively put forward.

The clitellum occupies the segments stated in the definition; it extends right round the body and is conspicuous in mature specimens. Such specimens are also always obvious on account of the protruded penes. These are as long as the diameter of the body. Their structure will be more conveniently deferred until the description of that of the efferent apparatus in general. The intersegmental septa in the anterior region of the body are much prolonged backwards and lie within each other like a series of cups; those separating segments v./ix. are particularly thickened. The œsophagus runs in a perfectly straight uniform way without dilatations from the pharynx to segment ix; in segments vii. and viii. it is furnished with rudimentary gizzards, whose calibre is not greater than that of the œsophagus.

On a dissection these gizzards would be hardly recognizable; the increased thickness of their muscular walls entitles this section of the œsophagus to be termed gizzard, but the epithelium has no trace of the thick chitinous lining so constantly associated with the gizzard. In the ninth segment is the calciferous gland, which appears to be an unpaired structure. It is constricted in the middle, dividing it into an anterior and a posterior section. The minute anatomy appears to be most like that of *Gordiodrilus*. The mass of the gland has a granular structure and contains numerous nuclei; but in spite of the undoubted nuclei no cell-boundaries could be detected. The tissue is in fact quite like that which makes up the greater part of the calciferous gland of *Gordiodrilus*. Through this tissue pass numerous small blood-vessels of equal calibre, which radiate out from the top of the gland but run parallel through its substance. A single diverticulum from the œsophagus dips down into it, but appears to end cæcally and not to be continued on into a few intracellular tubes such as I have described in *Gordiodrilus*. In the xth and xith segments the œsophagus to some extent retains the structure of the calciferous gland; outside the lining epithelium of the tube is a granular and nucleated mass which is precisely like the glandular mass of the calciferous gland; outside of this are the muscular layers and the peritoneal covering of the gut; it seems therefore probable that the granular tissue of the calciferous gland is of hypodermic origin and is not formed out of the modification of the peritoneum. The intestine begins in the xiith segment. The nephridia commence in segment v.; they have no muscular end sac. The last heart is in segment xi.

The reproductive organs are constituted upon the plan of those of *Gordiodrilus*, but there are differences of detail. The testes and sperm-duct funnels are in x. and xi. The two sperm-ducts run side by side along the ventral body-wall until about the xvith segment; after this they get to lie in the body-cavity and are to some extent coiled; they pass back beyond the point where they open on to the exterior, which is no doubt correlated with the protrusible termination of the efferent apparatus. When the worm is dissected the most obvious part—indeed practically the only part to be seen on account of the small size of the worm—of the efferent apparatus is a pair of oval or pear-shaped sacs; these

Fig. 3.



Nannodrilus.

Male efferent apparatus.

a. Spermiducal glands.
b. Bursa copulatrix.
c. Penis.
d. Orifice of one of the spermiducal glands.
v.d. Sperm-ducts.

have a nacreous appearance on account of the thickness of their muscular walls. These sacs end blindly and are not, as I at first thought them, the dilated ends of the muscular duct of the spermiducal glands. They occupy two or three segments and open on to the exterior in the xviiith segment through the penes. Their walls are excessively thick and the lumen therefore is not wide. The penis on to which each of them opens is a portion of the body-wall which projects; it does not appear to be simply the everted portion of the sacs. The extremity of the organ is vascular and has a wide lumen; but where it traverses the body-wall the lumen of the bursa is narrow. The two sperm-ducts become united just where they dip into the thickness of the walls of the bursa; they are ciliated on their passage through the bursa and open into its interior. The spermiducal glands have the structure which has been referred to in the definition of the genus. One pair of them opens into the bursa near to, but quite independently of, the orifice of the sperm-ducts; the other opens in front of this on to the xviith segment. The accompanying diagram (woodcut, fig. 3) shows the relations of the different parts of the male efferent apparatus. The ovaries and oviducts are in the usual places for these organs to occupy. There is a single pair of spermathecæ in the viith segment; they are long and tubular without a diverticulum. The very extremity of the pouch differs from the rest in that its walls are very thin; this is brought about by the absence or very slight development of the muscular layers and the thinness of the epithelium. Elsewhere the epithelium is tall and folded. The pouch was filled with spermatozoa, arranged in a peculiar fashion. The heads of the spermatozoa were attached to the cells lining the pouch and presented quite a regular appearance, so much so that they might easily be mistaken for cilia.

May 1, 1894.

Dr. A. Günther, F.R.S., Vice-President, in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of April 1894:—

The total number of registered additions to the Society's Menagerie during the month of April was 160, of which 87 were by presentation, 6 by birth, 49 by purchase, 2 received in exchange, and 16 on deposit. The total number of departures during the same period, by death and removals, was 83.

Amongst these I wish to call particular attention to the collection of Mammals and Reptiles sent to us by Dr. J. Anderson, F.R.S., being the proceeds of his recent expedition to Egypt and Suakim.

March 20, 1894 (*continued*).

April 3, 1894.

April 17, 1894.

LIST OF PLATES.

1894.

PART II.

NOTICE.

The 'Proceedings' are issued in *four* parts, as follows:—

Part I. containing papers read in January and February, on June 1st.
II. " " " March and April, on August 1st.
III. " " " May and June, on October 1st.
IV. " " " November and December, on April 1st.

PROCEEDINGS

OF THE

GENERAL MEETINGS FOR SCIENTIFIC BUSINESS

OF THE

ZOOLOGICAL SOCIETY

OF LONDON,

FOR THE YEAR

1894.

16. 2

PART III.

CONTAINING PAPERS READ IN

MAY AND JUNE.

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LIST OF CONTENTS.

PART III.—1894.

May 1, 1894.

June 5, 1894.

June 19, 1894.

Contents continued on page 3 of Wrapper.

The collection, when shipped by Dr. Anderson at Alexandria on the 13th March last, contained 42 specimens representing in all 19 species. They were all beautifully packed, and only one animal (a Hedgehog, *Erinaceus æthiopicus*) died during the voyage, while a single Gerbille was reported as missing. Besides the Long-legged Jackal, *Canis variegatus*, three other species of *Canis* belonging to the large-eared section of Fennecs are represented in the collection. There is also a beautiful Genet with a long black vertebral stripe, which I take to be *Genetta senegalensis*, and examples of two distinct species of Zorilla (*Ictonyx*). The Rodents of the genera *Gerbillus*, *Dipodillus*, *Acomys*, and *Isomys* I must leave Dr. Anderson to determine.

There can be no doubt that this fine collection will be of great use to Dr. Anderson in the preparation of his proposed work on the Zoology of Egypt.

Dr. Günther exhibited the hollow trunk of a Tree-Euphorbia (*Euphorbia grandidens*) which a pair of Hornbills (*Buceros melanoleucus*) had selected for nidification. The trunk, with the female bird and eggs, had been obtained by Dr. Schönland in the neighbourhood of Grahamstown, Cape Colony, and transmitted by him to the British Museum. The female when taken was unable to fly and was simultaneously moulting all the wing- and tail-feathers, thus presenting the appearance of a half-fledged young bird. This specimen, therefore, confirmed the observation which had also been made on other species of the genus, viz. that the female Hornbills pass through a complete moult in the six or eight weeks during which they are imprisoned with their eggs and young.

Mr. W. Bateson exhibited several hundred specimens and coloured drawings of *Gonioctena variabilis*, a Phytophagous Beetle, from Granada, Spain, in illustration of discontinuous variation in colour. These specimens, which were to form the subject of a future paper, were exhibited in the fresh state, as, after death, their colours faded rapidly.

Dr. H. E. Sauvage (Director of the Station Aquicole, Boulogne-s.-Mer) exhibited a vertebra of what was believed to be the earliest known Snake yet discovered. It was from the Gault of Portugal.

The following papers were read:—

1. On the Echinoderms collected during the Voyage of H.M.S. 'Penguin' and by H.M.S. 'Egeria,' when surveying Macclesfield Bank. By F. JEFFREY BELL, M.A., Sec. R.M.S.

[Received March 5, 1894.]

(Plates XXIII.–XXVII.)

Mr. P. W. Bassett-Smith, Surgeon R.N., was, fortunately for marine zoology, appointed after her cruise had begun to H.M.S. 'Penguin,' Capt. W. U. Moore, who was under instructions to survey parts of North-west Australia and the Macclesfield Bank. Mr. Bassett-Smith had already had experience not only in collecting in the Eastern Seas, but of the sympathy his captain had in his work, while on this cruise he had the further advantage of the co-operation of the chief engineer, Mr. J. J. Walker, who, when Mr. Bassett-Smith joined the ship, had already commenced to make his extensive collection of Insects—a collection so extensive that he was able to give over to the Museum no less than 12,000 specimens.

The Trustees of the British Museum have already expressed[1] their appreciation of the services rendered by Messrs. Bassett-Smith and J. J. Walker while on the 'Penguin,' and it now only remains for the zoologist to do his work of description and cataloguing.

After the 'Penguin' was paid off Mr. Bassett-Smith had offered him the opportunity of paying on board H.M.S. 'Egeria,' Commander A. M. Field, yet another visit to Macclesfield Bank; and it was well he did so, for it was on this occasion that he obtained the most interesting and valuable part of his collection of Echinoderms. He secured, for example, a specimen of a new species of *Eudiocrinus* allied to *E. indivisus*, the type of which is now in the private collection of Mr. W. Percy Sladen; *Ophiopteron elegans*, known hitherto only in the Brock collection, was obtained in several dredgings; and *Ophiocrene ænigma* is a type of Ophiuroid which is perfectly new.

Interesting and valuable as this collection of Echinoderms is, it has offered peculiar difficulties in working out. I have never before had passing through my hands a collection containing so large a proportion of young specimens, or, in other words, forms in which the specific characters stated in the diagnoses are not distinctly marked[2]. In some cases the series has been sufficiently long and gradual to enable me to assign quite young examples to what I think is their correct species, but I have had to query a larger proportion of my determinations than I can allow to pass without this word of explanation, and a number of specimens have been merely referred to their genera.

[1] [Annual] Return [Parliamentary] British Museum, 1893, p. 83.

[2] I find that the essential part of these remarks is true also of the Crustacea.—14th June, 1894.

In fact I have had forced on me the conviction that Macclesfield Bank is a nursery; with a rim submerged 9 fathoms[1] beneath the surface any pelagic larvæ that will can enter within its boundary; being 76 miles long and 36 miles broad, it affords some opportunities for the larvæ to settle, and the average depth within the rim is from 40 to 50 fathoms.

I may therefore suggest that it is of great importance that as full collections as possible should always be made in areas resembling the inside of this reef, for not only are questions of synonymy to be by this means settled, but the more interesting study of the changes that occur during growth can only be carried on with extensive series, the relationships of species can be more satisfactorily considered, and material be brought together of immense value to the morphologist.

It would be quite possible so to arrange the material for this paper as to make it of intolerable length, but I think I can so dispose of it as to bring all I have to say within reasonable compass.

I propose to give three lists:—(A) of the species from N.W. Australia; (B) of those from the Arafura and Banda Seas; and (C) of those from the Macclesfield Bank, in all of which the observed range in depth will be duly noted; after each species I place the name of the author who first described it. After these lists I give notes and descriptions in systematic order.

The point of greatest interest is the discovery that the sygygial joints at the bases of the arms of Comatulids by no means exhibit the regularity which is ordinarily believed to be one of their chief characteristics and their best claim to be used as aids and guides to the grouping of the species—that is to say, they have been taken as being very much more valuable than mere specific characters. *Antedon bassett-smithi* (see p. 399) shows how the syzygies may vary in one individual specimen; while the broken and nameless *Actinometra* (see p. 402) is positively appalling to a student of Comatulids, for it has no syzygy on either second or third brachial.

Where there is no large series it is very difficult to speak with any confidence as to the significance of unexpected irregularities, which may, of course, be merely individual, but, in systematic zoology, we have to beware always of the influence of generalizations based on material which is always becoming proportionately smaller. The general acceptation of Dr. P. H. Carpenter's classification removes the "idol" from the category of "idola specus" to that of "idola fori"; but we must not only remember, we must always keep before ourselves the doctrine of Macleay that "no character is natural until it has been proved to be so."[2]

This is, of course, saying in as many words that there is no

[1] See Bassett-Smith, Ann. & Mag. Nat. Hist. vi. (1890) p. 356.

[2] See J. D. Macdonald in Trans. Linn. Soc. xxiii. p. 75. Pupils of the late Prof. Rolleston need not be told whence I derived my knowledge of this principle.

fixity of tenure in zoology, no certainty that the doctrines accepted to-day will not be derided to-morrow; most men of science see this and act accordingly; the systematic specialist is apt to forget it, and to bear himself as though the motto of his science were "Quod semper, quod ubique, quod ab omnibus."

I cannot but hope that the description I have given of the very remarkable Ophiuroid which I have called *Ophiocrene œnigma* will result in the search for more, and perhaps more fully matured, specimens; it is a matter of regret that the material is not sufficient to allow of a complete judgment as to the systematic position of what all will allow to be a very remarkable form.

A.—*List of Echinoderms of North-west Australia*[1].

I. HOLOTHURIOIDEA.

	Observed range in depth.
Colochirus tuberculosus, *Semper*	15–36 fms.
Actinocucumis typica, *Ludwig*	15–20 „

II. CRINOIDEA.

Antedon milberti, *Müller*	8–15 fms.
„ serripinna, *P. H. C.*	24–39 „
„ variipinna, *P. H. C.*	9–38 „
„ sp. (near *macronema*)	?
Actinometra pectinata, *Retz.*	20–36 „
„ nobilis, *P. H. C.*	65 „
„ paucicirra, *Bell*	8–15 „
„ parvicirra, *P. H. C.*	9 „
„ variabilis, *Bell*	9–38 „
„ multifida, *Müller*	?
„ multiradiata, *L.*	?

III. ASTEROIDEA.

Astropecten polyacanthus, *M. Tr.*	32–34 fms.
„ schoenleini, *M. Tr.*	?
„ zebra, *Sladen*	8–36 „
Luidia hardwickii, *Gray*	36 „
„ aspera?, *Sladen*	15–38 „
Iconaster longimanus, *Möbius*	15–38 „
Stellaster incei, *Gray*	8–34 „
Pentaceros nodulosus, *Perrier*	15 „
Culcita pentangularis, *Gray*	?
Ophidiaster helicostichus, *Sladen*	15–24 „
Linckia marmorata, *Michelin*	15–22 „
„ megaloplax, *Bell*	15–24 „
Nardoa tuberculata, *Gray*	9–38 „
Metrodira subulata, *Gray*	39 „
Echinaster purpureus, *Gray*	8–15 „

IV. OPHIUROIDEA.

Pectinura megaloplax, *Bell*	?
„ sphenisci	15 fms.

[1] The chief localities are Holothuria Bank, Magnetic Shoal, Cossack Island; and Baudin Island (14° 8′ S., 125° 36′ E.).

Ophiopeza conjungens, *Bell*	38 fms.
Ophiolepis annulosa, *M. Tr.*	24 „
Ophionereis dubia, *M. Tr.*	8–36 „
Ophiothrix longipeda, *M. Tr.*	15 „
„ martensi, *Lyman*	15–34 „
„ melanogramma, *Bell*	36 „
„ melanosticta, *Grube*	38 „
„ smaragdina, *Studer*	9 „
„ trilineata, *Lütk.*	20–35 „
Ophiomaza cacaotica, *Lyman*	8–20 „
„ obscura, *Lyman*	9 „
Astrophyton clavatum, *Lyman*	?
Euryale aspera, *Lamk.*	8 „

V. ECHINOIDEA.

Phyllacanthus annulifer, *Lamk.*	8–15 fms.
Diadema saxatile, *L.*	12–15 „
Temnopleurus bothryoides, *Ag.*	40–47 „
Salmacis sulcata, *Ag.*	12 „
Echinanthus testudinarius, *Gray*	32–44 „
Laganum decagonale, *Less.*	20 „
„ depressum, *Ag.*	15 „
Lovenia elongata, *Gray*	34–36 „
Breynia australasiæ, *Leach*	?

B.—*Echinoderms of the Arafura and Banda Seas.*

I. HOLOTHURIOIDEA.

0.

II. CRINOIDEA.

Actinometra maculata, *P. H. C.* (Parry Shoal, 12 fms.)

III. ASTEROIDEA.

Astropecten polyacanthus, *M. Tr.* (Evans Bank, 12–15 fms.)
Linckia megaloplax, *Bell.* (Parry Shoal; Damma Id., 9–15 fms.)
Scytaster novæ-caledoniæ, *Perrier.* (Damma Id.)
Nardoa tuberculata, *Gray.* (Parry Shoal.)

IV. OPHIUROIDEA.

Ophioplocus imbricatus, *M. Tr.* (Damma Id.)
Ophiolepis irregularis, *Brock.* (Damma Id.)
Ophiocoma scolopendrina, *Lamk.* (Franklin Shoal, 9 fms.; Flinders Bank, 9 fms.; and Evans Bank, 12–15 fms.)
Ophiocoma pica, *M. Tr.* (Flinders Bank, 9 fms.)
Ophiothrix punctolimbata, *Mart.* (Parry Shoal, 12 fms.)
Ophiomyxa australis, *Ltk.* (Flinders Bank, 9 fms.)
Euryale aspera, *Lamk.* (Parry Shoal, 12 fms.)

V. ECHINOIDEA.

Cidaris baculosa, *Lamk.* (Parry Shoal, 12 fms.; Damma Id., 9–15 fms.)
Diadema saxatile, *L.* (Evans Bank, 12–15 fms.)
Salmacis globator, *A. Ag.* (Damma Id., 9–15 fms.)
„ sulcata, *Ag.* (Parry Shoal, 12 fms.)
Echinometra lucunter, *Leske.* (Damma Id., 9–15 fms., and between tide-marks.)

C.—*Echinoderms from Macclesfield Bank.*

I. HOLOTHURIOIDEA.

	Observed range in depth.
Colochirus tuberculosus (? yg.), *Semper*	45 fms.

II. CRINOIDEA.

Eudiocrinus granulatus, sp. nov.	34–40 fms.
Antedon carinata, *Lam.* (? jr.)	29–32 „
„ ? spicata, *P. H. C.*	20–35 „
„ inopinata, sp. nov.	31–36 „
„ bassett-smithi, sp. nov.	13–36 „
„ vicaria, sp. nov.	30–40 „
„ brevicirra, sp. nov.	20–35 „
„ flavomaculata, sp. nov.	13 „
„ moorei, sp. nov.	13 „
„ fieldi, sp. nov.	22–30 „
„ sp. n. inq.	?
„ sp. n. inq.	?
„ ? variispina, *P. H. C.*	50 „
Actinometra fimbriata, *Lam.*	22–45 „
„ parvicirra, *Müll.*	10–36 „
„ bennetti, *Bölsche*	13 „
„ simplex, *P. H. C.*	13 „
„ ? duplex, *P. H. C.*	13 „
„ maculata, *P. H. C.*	13–36 „
„ rotalaria, *Lam.*	13–36 „
„ regalis, *P. H. C.*	30 „
„ peregrina, sp. nov.	55–60 „

III. ASTEROIDEA.

Archaster typicus, *M. Tr.*	23–50 fms.
„ tenuis, sp. nov.	35–41 „
Astropecten polyacanthus, *M. Tr.*	30–41 „
Luidia ? aspera (yg.), *Sladen*	20–35 „
„ forficifer, *Sladen*	30–40 „
„ hardwickii, *Gray*	31–37 „
„ longispinis, *Sladen*	30–45 „
„ maculata (yg.), *M. Tr.*	30–41 „
Goniodiscus rugosus (yg.), *Perr.*	45 „
Culcita (yg.), sp. nov.	40–50 „
Patiria briareus, sp. nov.	30–45 „
Chætaster moorei, sp. nov.	36–40 „
Asterina cepheus, *M. Tr.*	17–30 „
Fromia milleporella, *Lamk.*	22–40 „
Leiaster ? leachi (yg.), *Gray*	41–44 „
„ speciosus (yg.), *Mart.*	41–44 „
Nardoa tuberculata, *Gray*	30–46 „
Rhipidaster ? vannipes, *Sladen*	32 „
Mithrodia clavigera, *Lamk.*	41–44 „
Echinaster purpureus, *Gray*	29–40 „
Asterias volsellata, *Sladen*	32 „

IV. OPHIUROIDEA.

Pectinura elegans, sp. nov.	13–35 fms.
„ infernalis ?, *M. Tr.*	17 „
Amphiura olivacea, *Brock*	30–40 „
Ophiocoma pica, *M. Tr.*	17 „

Ophiocoma scolopendrina, *M. Tr.*	30–40 fms.
Ophiarachna clavigera, *Brock*	32 „
Ophiomastix caryophyllata, *Lütk.*	17 „
Ophiothrix capillaris, *Lyman*	41–44 „
„ melanogramma, *Bell*	35–41 „
„ purpurea, *v. Martens*	23–46 „
„ comata (et var.), *M. Tr.*	30–35 „
„ punctolimbata? (yg.), *v. Martens*	5 „
„ rotata? (yg.), *v. Martens*	5 „
Ophiopteron elegans, *Ludw.*	23–47 „
Ophiomyxa australis, *Lütk.*	31–39 „
„ brevispinis, *v. Martens*[1]	13–72 „
„ longipeda, *Brock*	29–32 „
Ophiocrene ænigma, sp. nov.	45 „

V. ECHINOIDEA.

Cidaris baculosa, *Lamk.*	30–44 fms.
„ metularia, *Lamk.*	26–46 „
Diadema saxatile, *Linn.*	34–46 „
Astropyga radiata, *Leske*	30–40 „
Temnopleurus toreumaticus, *Leske*	?
„ reynaudi, *Ag.*	50 „
„ bothryoides, *Ag.*	40–47 „
Salmacis rufa, sp. nov.	30–44 „
Mespilia globulus, *Linn.*	13–34 „
Tripneustes gratilla, *Linn.*	30–40 „
Pseudoboletia maculata, *Troschel*	45 „
Clypeaster scutiformis, *Gmel.*	30–40 „
Laganum decagonale, *Less.*	20 „
Echinoneus cyclostomus, *Leske*	30–40 „
Arachnoides placenta, *Linn.*	35–41 „
Lovenia elongata, *Gray*	35–41 „

I now proceed to give descriptions of the new species represented in the present Collection, and notes on others previously described.

I. HOLOTHURIOIDEA.

It is remarkable that the collection of Holothurians should be so very scanty; Mr. Bassett-Smith tells me that it always struck him "as being a most remarkable thing that in the 100 odd dredgings on the Macclesfield Bank and China Sea only two minute specimens were obtained."

II. CRINOIDEA.

EUDIOCRINUS GRANULATUS, sp. nov. (Plate XXIII.)

Like *E. indivisus*[2] in having the first two brachials united by syzygy and the first pinnule on the left side of the second brachial.

[1] As pointed out by Brock (Zeit. f. w. Zool. xlvii. p. 530), this species is omitted by Mr. Lyman from his 'Challenger' Report; I doubt if research will ever find another case of omission. It may be useful to add the original reference; it is Arch. f. Nat. xxxvi. (1870) p. 249.

[2] See P. H. Carpenter in Journ. Linn. Soc., Zool. xvi. (1883) p. 495.

But the whole creature is much stouter altogether, with longer, stronger cirri, wider arms, much stronger pinnules, and a granular covering to the joints. It has a spread of 240 mm., and the cirri are about 12 mm. long. The arrangement and number of the cirri is as described for *E. indivisus*; indeed there are many points in a written description of the one species which would hold for the other. However, in the new species the first two pinnules have more massive joints than the third and fourth and are quite as long, the second, indeed, being longer than the third. The other striking point of difference is the granulation of the surface of the basal joints of the arms.

From the descriptions of Semper and P. H. Carpenter, bearing in mind that they had only one specimen and I only one, I was inclined to regard the Macclesfield Bank specimen as belonging to Semper's species; but when I was, by the kindness of Mr. W. Percy Sladen, enabled to put the new specimen side by side with Semper's type, which is now in his possession, it was easy to see that the two could not be united.

The syzygial union of the first two brachials would of itself separate *E. granulatus* from the three species described by Carpenter, but they are, further, all much stouter than *E. granulatus*, though the latter is itself very much stouter than *E. indivisus*, which is quite delicate.

Of the latter, Dr. Herbert Carpenter says, "colour of skeleton brownish white;" it is now (January 1894) quite white; in the new species the ambulacral surface of the pinnules is a purplish brown, the rest yellowish white.

The single specimen, which is in fairly good condition, was dredged at a depth of 34–40 fathoms off Macclesfield Bank.

ANTEDON INOPINATA, sp. nov.

This species stands closest to the late Dr. Herbert Carpenter's *granulifera*-group, but it is distinguished from both sections thereof by having a syzygy in the third brachial.

Centrodorsal large, hollowed in the centre, which is bare of cirrus-pits; the cirri in three irregular rows on the side, long and stout, but not composed of so many as forty joints, variable in length, and about forty-five in number; the terminal joints faintly spinous.

About forty-five arms, the joints of which are much compressed from side to side. The first and second radials are wide and stout, the third is short at the sides; there are three distichals of which the axillary is a syzygy; the arms nearly always divide again, when there are three palmars, of which the axillary is a syzygy; in rare cases there are also two post-palmars. The pinnules generally are pretty stout and stiff, the basal one very markedly stout. There is a syzygy on the third brachial, but not again for about twenty-five joints; the arm-joints are wide, low, and very regular.

Colour, in spirit, light brown, the ambulacral surface of the pinnules somewhat darker.

Arms about 100 mm. long; diameter of disc 10 mm.; length of cirri up to 28 mm.

Macclesfield Bank, 31–36 fms. H.M.S. 'Penguin.'

ANTEDON BASSETT-SMITHI, sp. nov. (Plate XXIV.)

This is one of the late Dr. H. Carpenter's *spinifera*-group, and belongs to that section in which there are from fifteen to twenty-five cirrus-joints. The cirri are not arranged in definite rows, and the sides of the distichals are not flattened.

Centrodorsal rather large, slightly hollowed in the centre, which is bare of cirrus-pits; the cirri in three planes at the side, about forty in number, with from twenty to twenty-five joints, some of which are considerably elongated; in the distal half they have a slightly projecting free edge, but there is no distinct spine.

Arms, probably, more than forty in number, stout, widely separated at their bases, where the disc-incisions are deep. First radial obscured, the second wide, the third almost triangular; two distichals, two palmars; the latter may or may not be united by syzygy. In the syzygies of the arms the most extraordinary variations occur: sometimes the first two brachials are united by syzygy, sometimes (to use the usual terminology) the third is a syzygy, sometimes both first and second and third are. The first arm-joints are squarish, the succeeding alternately wider and narrower on either side. The second and third pinnules ordinarily have the two basal joints much wider than the rest and of a characteristic shape (Plate XXIV. figs. 5 & 6); none of the pinnules are either stout or long.

I must confess that I am quite at a loss to know how to explain the extraordinary divergencies exhibited by the syzygies of this species. It is, of course, a great pity that there is only a single example of it, and it would be rash to say that it destroys the generalizations to which long study of a number of species and specimens led Dr. H. Carpenter; but, on the other hand, it cannot but shake our belief in the universality of the conclusions drawn up by Carpenter on pp. 44–46 of the 'Challenger' Report on the 'Comatulæ.' If it be merely an abnormality it is a case in which monstrosity is really carried too far, and is one that is, probably, quite unequalled by any known Crinoid. So far as I know, and, indeed, so far as I can, after diligent search, discover, the only recorded case of striking irregularity in the position of the syzygies is that of the Göttingen specimen of *Antedon macronema*, of which Dr. C. Hartlaub remarks [1]:—"Bemerkenswerth ist an ihm die unregelmässige Lage der ersten Syzygie, die zwischen dem 3. 4. und 6. Brachiale wechselt." But here we have not only two conditions which have been supposed to be mutually exclusive in different arms of one specimen, but these very two conditions occur on one arm. Did we know something of the function of the syzygies, it would be easier to come to a decision, but as our knowledge of that function appears to be summed up in the state-

[1] Nova Acta Acad. Cæs. L.-C. lviii. no. 1, p. 78 (Halle, 1891).

ment that the syzygial mode of union makes the arms more fragile at the points where it occurs, those who believe in the efficiency of Natural Selection will not accept the view that this doubling of the syzygies is of advantage to the possessor.

I hope, therefore, that the peculiarities of this specimen (I will not say of this species) may come under the notice of those who work at Crinoids, and that material may be gathered sufficient for us to make up our minds as to whether we have to do with an individual eccentricity or a true character specifically distinctive of its possessor.

There remain to be noticed five bidistichate species with more than ten arms of which I cannot give full descriptions, as the single specimens by which they are represented are not always well preserved. Diagnoses, however, are possible.

They may be thus arranged, in accordance with Dr. H. Carpenter's scheme on pp. 211, 212 of the Report on the 'Challenger' Comatulæ:—

A. Over 30 cirrus-joints		i. *Antedon vicaria.*
B. 30 or less than 30 cirrus-joints.		
Cirri without definite arrangement.		
Flattened sides to brachials.	25 cirri of 9 joints each	ii. *Antedon brevicirra,*
	About 30 cirri of 16 smooth joints	iii. *Antedon flavomaculata.*
Sides hardly flattened.	Faint spinous process on later cirrus-joints	iv. *Antedon moorei.*
	Very broad spinous process on later cirrus-joints	v. *Antedon fieldi.*

Antedon vicaria, sp. nov.

Bidistichate, with wall-sided radials, strong pinnules, and about 30 cirrus-joints, of which the more distal are spiny. With so much resemblance to *A. macronema*, it has shorter cirri (20 mm.) and has numerous (30) joints. Arms probably about 25 in number. Neither radial nor distichal palmars syzygial. Cirri white, arms white with middle dorsal line of purple, pinnules purplish.

Spread 100 mm.; diameter of deeply incised disc 4 mm.

Macclesfield Bank, 30–40 fms.

Antedon brevicirra, sp. nov.

Bidistichate, with flattened sides to brachials, 25 cirri of 9 joints, rather more than 40 arms, and a long first pinnule.

Colour light brown.

Macclesfield Bank, 20–35 fms.

This species is so much broken that I should not have described it did I not wish to call attention to the short cirri set at the edge of the disc, recalling in every way the cirri of an *Actinometra.*

Antedon flavomaculata, sp. nov.

Bidistichate, with (in the single known specimen) exactly 20 arms; about 30 cirri, with 16 smooth joints, and the centre of the low centrodorsal bare of cirrus-sockets. The first syzygy is on the third brachial, the next on or about the thirteenth. The most proximal brachials are square, those that succeed them are triangular. The second pinnule is very long and stiff, much longer than the first or third. Arms purplish, with yellowish dots and patches; the cirri yellowish at base and purplish at tip.

Spread 120 mm.; diameter of disc 6 mm.

Macclesfield Bank, 13 fms.

Antedon moorei, sp. nov.

This species is probably most nearly allied to *A. compressa*, P. H. C., but it has only faint spinous processes on the cirrus-joints. Cirri 25 to 30, with 25 joints. Centrodorsal bare in the middle. No syzygies on radials, distichals, or palmars. There may be post-palmars. The third brachial syzygial; arm-joints iii.–vi. squarish, the succeeding triangular, and the more distal gradually overlapping.

Colour purplish, with the free ends of the arms white.

Macclesfield Bank, 13 fms.

The single specimen is a good deal broken, but it is interesting as belonging to a series of the group of which Dr. Carpenter knew only one type.

Antedon fieldi, sp. nov.

Allied to *A. moorei*, but distinguished from it by the broad spine on the cirrus-joints. Cirri about 20, with 18 joints, almost completely covering the centrodorsal. No syzygy on radials or distichals; the first on the third brachial.

Colour bright purple with lighter cirri.

Macclesfield Bank, 22–30 fms.

I offer a brief diagnosis of this species, as the peculiarity of the broad spines on the cirrus-joints ought to be known.

I associate with these two species the names of the commanding officers of H.M. ships 'Penguin' and 'Egeria,' Captain W. U. Moore, R.N., and Commander A. M. Field, R.N.

There is yet another bidistichate species, which is altogether too much broken for description (13 fms., Macclesfield Bank), which has about 30 cirri and 20 smooth cirrus-joints. There are distinct signs that a re-arrangement of the useful key given by Carpenter of the "Spinifera-group" will soon be needed. Considering the large number of new species assignable to this group found by Mr. Bassett-Smith, I cannot but wonder that none were found by the lamented Dr. Brock in his expedition to Amboina, the neighbouring region. I do not know what led Dr. C. Hartlaub to say of the group that it "umfasst . . . Formen, die in Wesentlichen dem Caraibischen Meere angehören"[1], but it was not the then known facts of distribution; still less is the statement accurate after the discoveries at Macclesfield Bank.

[1] *Op. cit.* p. 75.

Actinometra peregrina, sp. nov.

This species belongs to Carpenter's series ii. (*tom. cit.* p. 300), every known species of which, except *A. cumingii* (from Malacca and Queensland) and *A. echinoptera* (of unknown habitat), belongs to the West Indian fauna. From the two species just named *A. peregrina* may be at once distinguished by the characters of its cirri, for whereas *A. echinoptera* has cirri with eleven joints the new species has as many as twenty-five, while there are at least twenty-five cirri arranged in two rows, and not twelve only arranged in one as in *A. cumingi.*

The following characters will serve to diagnose the species:—

Centrodorsal moderately large and a good deal obscuring the radials; bare in its middle, with about 25 cirrus-pits, the cirri of moderate length with about 25 joints, of which the 5th and 6th seem to be distinctly the longest. The basal joints of the arms very irregular, and no two alike; the free edge of the joints soon become very finely denticulate. The first syzygy is on the third brachial, the succeeding on the eleventh and eighteenth. Pinnules remarkably well developed even at some distance from the base of the arms.

Colour brownish.

Macclesfield Bank, 55-60 fms.

Mention also must be made of an *Actinometra* to which I think it would be wrong to give a specific name, so broken is it, but of which it would be more wrong not to say something. It will be remembered that the late Dr. H. Carpenter divided the tridistichate species of this genus into those in which there is a syzygy on the second brachial and into those that have it on the third. In the specimen now before me there is no signs of any syzygy on either the second or the third brachial.

This is another very remarkable fact, and it is most important that we should obtain several specimens of this form, so as to learn whether the absence of syzygies from both second and third brachials is a constant character. If it is, it is certainly one of the most unexpected results, and taken in conjunction with what has been observed in *Antedon bassett-smithi* it will severely shake our faith in the value of the site of the syzygy as an aid in specific diagnosis.

III. ASTEROIDEA.

Archaster typicus.

Archaster typicus, M. Tr. Ber. Ak. Berlin, 1840, p. 104.

In two small specimens dredged, with a large example, in 23–24 fms. of water there are no signs of any spines on the inferomarginal plates; in a somewhat larger specimen (from 40–46 fms.) there are on some of the plates indications of the growth of spines.

Archaster tenuis, sp. nov. (Plate XXV. figs. 4–6.)

This seems to be a species of *Archaster* in the sense of

Mr. Sladen, who has cleared from the genus a number of species that do not appear to belong to it.

$R=40$, $r=6$; or R nearly $=7r$.

Arms very delicate, only 5 mm. wide at their base, with about 45 marginal plates; the supero-marginals nearly twice as deep as wide at base, but gradually becoming more shallow, so that they are nearly square in the distal two-thirds of the arm. The infero-marginals ordinarily have one spine long enough to reach the upper surface of the supero-marginal; occasionally there is a second smaller, but still evident spine. The adambulacral armature is diplacanthid, and there are ordinarily three divergent spines in each row.

On the upper surface "the medioradial line of plates" becomes somewhat indefinite in the distal portion of the arm.

It is not easy to be sure that the specimen from which this description is drawn up is mature; it is, at any rate, old enough to have lost one arm and part of another; the latter has already begun to repair itself. There were taken at the same dredging (35–41 fms.) several obviously young specimens of this species; they have a marked Astropectinine appearance, owing doubtless to the fact that the medioradial line has not yet been differentiated.

LUIDIA MACULATA.

Luidia maculata, M. Tr. Syst. Ast. (1842) p. 77.

All the specimens collected were of small size.

LUIDIA LONGISPINIS?

Luidia longispina, Sladen, Chall. Rep. Ast. xxx. p. 254 (1890).

I have not much hesitation in referring several young specimens to this species.

LUIDIA FORFICIFER.

Luidia forficifer, id. op. cit. p. 258.

I have been able to recognize this species of Mr. Sladen's in Mr. Bassett-Smith's collection; the types come from or near Torres Strait.

LUIDIA sp.

I am unable to assign to any described species known to me three young specimens, which have suffered a considerable loss of arms and have undergone repair by gemmation.

GONIODISCUS sp.

There was taken at a depth which cannot now be certainly ascertained a young specimen of what may perhaps prove to be a juvenile example of *G. rugosus*, Perrier.

CULCITA sp. (Plate XXVI. fig. 1.)

A quite young, nearly spherical, specimen with a diameter of

12 mm. was taken between 40 and 50 fms. on Macclesfield Bank. I have had an enlarged figure drawn by Mr. Berjeau, as I hoped to be able to get some light on the morphology of the skeleton; but I must own myself very much disappointed.

If I have correctly identified the plate I have marked C as the representative of the central plate of a typical calyx, it is clear that we have here an unsymmetrical central plate, for it has neither five sides nor ten, and the line of plates connecting it with the terminal (T) is so curved that it seems to be fanciful to compare it in any way with an arm of a Crinoid. In the intermediate plates there is neither order nor symmetry apparent to me; but as others may be better endowed with sagacity than myself, I give the figure in the hope that it may be of some service.

Patiria briareus, sp. nov. (Plate XXV. figs. 1–3.)

It is with the greatest hesitation that I refer to this genus the very curious specimens dredged between 30 and 46 fathoms off Macclesfield Bank, which have seven or eight arms, and which, therefore, if correctly assigned generically, are appropriately called *briareus*.

It is very difficult to find specific characters.

$$R = 6{\cdot}3\ r.$$

Arms taper very gradually, with rather straight deep sides, and flat actinal surface; adambulacral spinulation monacanthid, about five spines to each plate. The plates on the upper surface are very inconstant in shape, the papular pores among them are rarely anything but solitary. Madreporite obscure. Colour in spirit brownish, lighter when dry.

$R=38$, $r=6$. Breadth of arm at base 6. Depth 5.
$R=29$, $r=6$. Breadth of arm at base 5·5. Depth 4·5.

This is, I am aware, a very slight description; but, as I have already said, it is extremely difficult to find any specific characters; what is most remarkable is that every one of the specimens exhibits restoration of the arms by budding. In one there are three complete and subequal arms and four papilliform growths together; another has four subequal arms and four very much smaller, of the latter one is a good deal shorter than the rest; in a third there are three longer arms and four shorter arms, and in a fourth these latter (again four in number) are a good deal longer than in the preceding specimen—in both these cases the shorter arms were neighbours. In another example there is a group of four subequal arms which are hardly shorter than the other three; in the last case the eighth arm is much shorter than any of the others.

Chætaster moorei, sp. nov.

$$R = 6\ r.$$

Disc small; arms elongate, high and straight at the sides, tapering very gradually; they are made up of thirteen very regular rows of plates, some of which have rising from their centre a sharp spine; the plates that bear such spines are most numerous near the bases of the arms. There are eight fine spines bordering the narrow ambulacral groove, the shortest of which are at the sides, and the whole set of which forms a fan-like expansion; there follow on these four upright and stouter spines. The arm-plates are covered with fine projecting glassy spines, which, on the disc, are blunt.

R=87·5, r=9·5. Breadth of arm at base 7·5. Height of arm 7·5.

Macclesfield Bank, 30–40 fms.

If I am right, which I very much doubt, in assigning this species to the genus *Chætaster*, the diagnosis of the genus will have to be so far altered as to include the possible possession by the plates of the arms of central projecting spines. A difference in the combination of circumstances makes it sometimes right, sometimes wrong, to form a new genus or a new species on the evidence afforded by a single specimen; in the present case I can only briefly give the evidence of the existence of a type hitherto unrecognized.

Ophidiaster helicostichus.

Ophidiaster helicostichus, Sladen, Chall. Rep. Ast. xxx. p. 405.

Two fine specimens, one from Holothuria Bank (15 fms.) and the other merely reported as from N.W. Australia, are so much larger than the specimens which I have referred to my *Linckia megaloplax*, that I cannot assert that they are all members of one species, but I have very little doubt on the point.

Rhipidaster vannipes.

Rhipidaster vannipes, Sladen, Chall. Rep. Ast. xxx. p. 448.

I am inclined to think that two small specimens, one of which is quite minute, from 32 fms. may, when a full series is obtained, be shown to be the young of this species founded on a single specimen, the spread of which is more than 170 millim. Between them at present it seems useless to make a comparison. Both the small specimens have nine arms.

Asterias volsellata.

Asterias (*Stolasterias*) *volsellata*, Sladen, Chall. Rep. Ast. xxx. p. 584.

A small example of this species, the only other known example of which is the one that formed the basis of Mr. Sladen's description, is another of the finds on which Mr. Bassett-Smith is to be congratulated. The whole spread of this new specimen is less than 30 millim., but its *Brisinga*-like appearance is no more marked than that of the "type."

It has unfortunately been in recent years so rare an occurrence for me to be able to agree with the views of the describer of this species, that I gladly seize the opportunity of saying that he seems to me to be fully justified in regarding *Asterias volsellata* as a sign that the difference between the Asteriidæ and Brisingidæ is not so great as has been generally supposed. If I do not accept his view of the origin of the latter family, it is only because my capacities are not sufficient for me to be able to understand how it has been possible for "complete isolation" to have had an "action" on them. On this point I, and I believe many others, would be glad of a more detailed explanation.

The "type" is said to have come from 95 fms., and Mr. Bassett-Smith's example from 45 fms.

IV. OPHIUROIDEA.

PECTINURA SPHENISCI, sp. nov. (Plate XXV. figs. 7–9.)

This species stands with *P. spinosa*, *P. arenosa*, *P. infernalis*, and *P. heros*, of Mr. Lyman's arrangement, and *P. capensis*, Bell; for it has the disc covered under its granulation with coarse scales (much coarser than in *P. capensis*), and there are no pores between the under arm-plates. There are five or six short arm-spines and two tentacle-scales.

Radial shields not constant, but the typical arrangement probably is that they are small, naked, triangular, and separated from one another by a third triangular plate. The granulation of the disc is coarse, and the peripheral plates large. The arms are not wider at their base than at some distance outside the disc, nor carinated; accessory mouth-shields moderate in size, irregularly oval or quadrate. Six quite short arm-spines; fourteen mouth-papillæ. As often is the case the outermost is by far the smallest, and the penultimate distinctly the largest of the series. Mouth-shields almost triangular; granulated space between mouth-papillæ and shield well-marked.

The side arm-plates encroach on both the upper and lower surfaces; the upper arm-plates are wider distally than proximally, and the lower are irregularly hexagonal.

Ground-colour, when drying, greyish, with brown patches on disc and regular bands of brown extending over three or four joints on upper surface; lower surface uniformly pale.

Diam. of disc 5·5 mm.; length of arm about 40 mm.

Holothuria Bank, 15 fms.

PECTINURA ELEGANS, sp. nov.

This species belongs to Mr. Lyman's second division; but differs from all in having no pores between the under arm-plates. There are six rather short, moderately stout arm-spines and two tentacle-scales.

Radial shields naked, quite distinct, moderate in size, darker than the rest of the test; granulation rather fine, similar over the whole of the dorsal surface of the disc. The arms taper very gradually from their base; accessory mouth-plates small, semioval. Twelve mouth-papillæ to each angle of the jaw; a single row of large granules between them and the triangular mouth-plate. Upper arm-plates oblong, much wider than long; the lower have their distal ends much encroached on by the side-plates; the spines are quite stout, and the lowest is long enough to reach the free edge of the plate next in front.

Colour, when dried or in spirit, pale brown, with eight or nine rings of a yellowish hue at distances along each arm; bands or patches of a yellowish colour on the disc.

Diameter of disc 7 mm.; 6; 5.

Length of arm 60·5 mm. (broken a little); 60 (ca.); 50.

Macclesfield Bank, 13–35 fms.

Ophiothrix.

As may be supposed, there were a large number of examples of this genus in the collection; how many species are represented it is quite impossible to say, but I have determined twelve with very great difficulty. My experience in this particular is, however, no different to that of any other zoologist who attempts to name specimens of this remarkable genus—unless, indeed, he be one who has no knowledge at all of its peculiarities. No one who has dredged our common British *Ophiothrix*, and has seen how varied are its colours and the characters of its spinulation, will attempt to name exotic specimens with a light heart. It would, of course, be easy enough to do so if one were to take no note of the experience gained by a study of British specimens, for with a few specimens one can always make new species. With considerations such as these before me, it will be no matter for wonder that I have refrained from describing any "new species" from the present collection. To confess the whole truth, I had intended to make an exception in favour of a remarkably coloured and fairly well represented species from Macclesfield Bank. When, however, it was compared with *O. purpurea*, with which, indeed, I had at first no idea of comparing it, I found that the new specimens and the old so intergraded that there could be no doubt they were one and all members of an almost protean species.

It would be worth the while of a student with unlimited leisure—and less, I fear, will hardly do—to work out large series of *Ophiothrix*. In saying this I should like to add that the late Dr. Brock made a very useful beginning in his essay on "Die Ophiuridenfauna des indischen Archipels"[1].

It has sometimes been supposed that colour is a good guide in the identification of species of this genus. Thus no less an authority on Ophiuroids than Dr. Lütken writes:—"Le système général de coloration constitue un caractère important qu'il ne faut pas négliger dans la distinction spécifique des *Ophiothrix*"[2]. Or, if I may trust myself to translate the fuller Danish text,

[1] Zeitschr. f. wiss. Zool. xlvii.; see especially pp. 511 & 516.
[2] Danske Vid. Selsk. Skrift. viii. (1869) p. 104.

Dr. Lütken's view is expressed thus[1]:—"One has some help in this difficult work from colour-markings, but it is not to be understood that all individuals of the same species present the same colour, or have quite the same design (Tegning); but as a rule one will find that every species has its characteristic pattern or system, in the details of which it rarely makes exceptions."

While much of this is true, it is on the other hand perfectly certain that any one who attempts to name species of *Ophiothrix* with colour or pattern as his guide will soon find he can make very little way. I can, indeed, only repeat and enforce what I said in 1884[2] on this point. For example, *Ophiothrix martensi* was said by its describer, Lyman, to be bright indigo on the dorsal surface of the disc, but there is in the present collection a specimen which is light green.

The identification of specimens of *Ophiothrix* is such a difficult matter that it is unnecessary to express the hope that other workers will imitate my reserve. The difficulty is to get any one to work at the genus at all!

OPHIOPTERON ELEGANS.

Ophiopteron elegans, Ludwig, Zeitschr. f. wiss. Zool. xlvii. (1888) p. 459.

Mr. Bassett-Smith is to be warmly congratulated on taking examples of this species, which is known only from the single well-preserved and the one ill-preserved specimen brought to Europe by the late Dr. J. Brock, and fully described by Prof. Ludwig in 1888. I have made a careful examination of the seven specimens in the present collection, and have nothing material to add to Prof. Ludwig's account. I notice, however, a pinkish hue on the dorsal surface of the arms.

The examples were taken at various depths between 23 and 47 fathoms.

The most remarkable and interesting find of Mr. Bassett-Smith when on the 'Egeria' was an Ophiurid, of which it is difficult to exactly assign the systematic position.

Description of the Specimen.—With the general appearance of a young *Astrophyton* (see Plate XXVII.), the joints of the arms are distinctly marked off from one another by brown lines; the joints of the more distal branches are slightly coiled on themselves, but the more proximal trunks and branches appear to be quite stiff. The disc is covered above and below by a number of plates; there are teeth and mouth-papillæ; the bursal clefts are small and on the side of the arm, or in the same position as in *Trichaster* or *Astrophyton*. The surface of the arms is coarsely granular, and there are spiny hooks at the side of the arm; so that there is so far no essential difference from the typical Astrophytid structure.

[1] Tom. cit. p. 51.

[2] Report . . . . Voyage H.M.S. 'Alert' (London, 1884). See particularly pp. 117, 141 & 142.

When, however, we come to closely examine the disc we find it to present an arrangement of plates that is quite unknown in any Astrophytid; for there is on it a set of plates which cannot be supposed to be anything but the remnants of a calycinal system[1] (see fig. 3, *c* & *r*); the centre of the disc is occupied by a rounded plate, and midway between it and the base of every arm but one there is a plate which cannot but be the homologue of the radial plate; just as distinctly there is to be seen at the base of the arms a pair of plates which are surely the so-called radial shields[2]. Though radial shields are not diagnostic of Ophiuroids, for they are, at any rate, absent from such simple Streptophiuræ as *Neoplax*, they are exceedingly characteristic of the group, and are of large size in Cladophiurans[3]. In the specimen before us they exhibit some irregularity, but they do not present the characteristic of the Cladophiuran; they are not "rippenartig" and they do not extend over the whole semi-diameter of the disc. Their smaller size may be correlated with the presence of calycinal plates, the existence of which in true Cladophiurans has only indistinctly been hinted at by Mr. Lyman; but the result is that we have an almost typical Zygophiuran disc, above. On the lower surface the arrangement of the mouth-plates (Plate XXVII. figs. 4 & 5) is most nearly paralleled among known forms by *Trichaster palmiferus*, and I know of nothing resembling it that has been detected in any fossil form; the distinctness of the two halves of the oral apparatus is very marked, and must be supposed to be a primitive character.

With regard to the systematic position of this very remarkable form, I feel inclined, after much reflection, to adopt an attitude of reserve; some years since I should not have hesitated in taking it to be the type of, at least, a new family. But, if it be true that "cœlum, non animum, mutant qui trans mare currunt," it is equally true that the "fugaces anni" carry away with them the cause of many a bad new species or group. It is possible still to use the diagnoses propounded in 1892 for the Cladophiuræ[4], as the size and extent of radial shields is not there used as a diagnostic character. So far as the descent of the Cladophiuræ is

[1] That is, by those who accept the doctrines first broached by Lovén and enforced with such vigour in this country by my lamented friend Dr. Herbert Carpenter. I understand that there is, among the younger workers, some scepticism as to the validity of these homologies.

[Since this was written Mr. E. W. MacBride has published an abstract of his observations on the organogeny of *Asterina gibbosa* (Proc. Roy. Soc. Lond. liv. pp. 431–6). I am sure many morphologists await with interest the proofs of his statement that there is no homology between the abactinal poles of Crinoids and Asteroids.]

[2] If we are to continue to recognize homologues of the radials of the Crinoid calyx (see P. H. Carpenter, Quart. Journ. Micr. Sci. xxiv. (1884) p. 1), it might be well to make some alteration in nomenclature, as the presence of "radial" plates and "radial" shields on the same disc is confusing. It is obvious enough that Johannes Müller, the first user of both the terms, had no idea of any homologies between the Crinoid calyx and the Ophiuroid disc.

[3] Is it quite certain that what are called radial shields in Cladophiurans are homologous with the parts called by the same name in Zygophiurans?

[4] P. Z. S. 1892, p. 180.

concerned *Ophiocrene* seems to show that some ancestor of this group was provided with distinct radial shields, the presence or absence of which is so variable a character in the Streptophiuræ, which I have, I think, shown to be ancestral to the Cladophiuræ.

OPHIOCRENE[1].

An Ophiuroid with branching arms and the habit of an Astrophytid, but with calycinal plates on the disc, and rounded radial shields of comparatively small size.

OPHIOCRENE ÆNIGMA, sp. nov. (Plate XXVII. figs. 1–5.)

As there is only one specimen, and that small, it is impossible to say whether or no it is adult. It may be provisionally defined thus:—Small, with delicate arms and few branches, of a milky-white colour, the joints separated by fine brown lines.

Macclesfield Bank, 45 fms.

It may be pointed out that, at present, there is no evidence that would justify us in regarding this as the young of some already known Astrophytid of large size, but it is quite within the bounds of possibility that a series of stages may show it to be so.

V. ECHINOIDEA.

TEMNOPLEURUS BOTHRYOIDES.

Pleurechinus bothryoides, A. Agass. Chall. Rep. Ech. iii. p. 108 (1881).

Temnopleurus bothryoides, Bell, Rep. Voy. 'Alert' (1884) p. 119.

It is quite clear that this is by no means a rare species; the 'Challenger' and the 'Alert' both brought home examples, and the 'Egeria' took it in at least four dredgings between 40 and 47 fathoms. In the smallest specimen, which is not 4 mm. in diameter, the deep and extensive pitting characteristic of the species is quite well marked.

I have a pretty strong conviction that the progress of research will result in showing that *Pleurechinus variabilis* and *P. ruber* of Dr. Döderlein are synonyms of this variable species.

TEMNOPLEURUS REYNAUDI.

Temnopleurus reynaudi, Agass.

An examination of two specimens covered with spines confirms me in the view I expressed in 1880[2] that *T. reynaudi* and *T. granulosus* are distinct species. The examples now before me are somewhat larger than the spined specimens collected by H.M.S. 'Challenger;' the spines are rather long, creamy white, with bands of red, or with the free end red.

[1] As the word *Egeria* has been several times used in Zoology, and as κρήνη means a fountain, and Egeria was, it is said, changed into a fountain by Diana, I have, in this roundabout fashion, succeeded in associating H.M.S. 'Egeria' with this interesting genus.

[2] P. Z. S. 1880, p. 424.

SALMACIS RUFA, sp. nov. (Plate XXVI. figs. 2 & 3.)

There are several specimens of what I take to be an undescribed species of *Salmacis*. It may be diagnosed as follows:—

Spines pale whitish, with red rings or bands of inconstant breadth. Denuded test bright red, with patches of white more numerous within than between the poriferous zones. Test rather flat, not stout, circular, with a rather small mouth distinctly depressed. Primary tubercles small and numerous; only one row in each vertical set of plates extends from pole to pole, but at and below the ambitus each plate has a transverse row of four or five tubercles in the interambulacral and of two or three in the ambulacral areas. There are about 27 primary tubercles in a row in a specimen measuring 32 mm. in diameter. The anal area is chiefly occupied by a few large plates; the madreporite is of proportionately large size, and the 'oculars' are ordinarily shut out from the edge of the anal space. The edge of the mouth is deeply inflexed, and the cuts are wide but not very deep. In a specimen in which the lantern of Aristotle was examined, the teeth were found to project very little from the alveolus; this was stout and wide, with two deep grooves, and had the tooth connected with it by a descending but not by an ascending process. The apophysis is almost straight.

		Diameter of		
Diam.	Height.	Calyc. area.	Periproct.	Peristome.
32 mm.	16	6·5	2·5	8·5

Hab. Macclesfield Bank, between 30 and 44 fms.

It is a somewhat difficult matter to suggest what are the nearest allies of this species; although the characters just enumerated appear to be constant for the fairly large number of examples which were collected, none of them are of large size, and, possibly, better grown specimens will throw more light on this question.

TRIPNEUSTES GRATILLA.

Echinus gratilla, Linn. Syst. Nat. x. (1758) p. 664.

Tripneustes gratilla, Lovén, Bih. Svensk. Vet.-Akad. Hdlgr. xiii. iv. no. 5 (1887) p. 77.

An interesting young example of this species was taken in 30–40 fms.; its proportions are somewhat different to the smallest specimen I was able to measure some years since (see P. Z. S. 1879, p. 662).

		Percentage value of			
Absol. diam. in millim.	Height.	Abact. system.	Anal system.	Act. system.	Porif. zone.
28	69	23	12·5	30	8·2

LAGANUM DECAGONALE. (Plate XXVI. figs. 4 & 5.)

Scutella decagonalis, de Bl. Dict. Sci. Nat., s. v. *Scutella*, p. 229.

A fine series of this species, commencing with specimens less than half an inch in diameter, shows that the form of the test is at first circular rather than decagonal. So far it bears out the remark of Prof. Alex. Agassiz, who, speaking of *Peronella orbicularis*, says (Rev. Ech. p. 521), "I have but little doubt that this species will prove to be the young of *Peronella decagonalis*"; at any rate, the series shows that when sufficiently small specimens are obtained they differ in form from the adult. Whether the type of Leske's species corresponds with any one of these I am unable to say. I sent the drawing here reproduced to Prof. Selenka at Erlangen, as I imagined that Leske's type was in the University Museum there[1]. Dr. Fleischmann, who was kind enough to attend to my letter in Prof. Selenka's absence, says:—"Das Originalexemplar zu *Echinodiscus orbicularis* war, wie ich den alten Catalogen entnehme, niemals in Erlangen. Wie besetzen nur Originalexemplare der Kleins'chen Sammlung." Leske compares his specimen with a Zeeschelling, and Mr. Grueber, of the Department of Coins, who has been kind enough to measure a Zeeschilling for me, tells me it is ·65 inch in diameter. The specimen here drawn has about that diameter, but has already ceased to be truly orbicular.

It is impossible, therefore, to speak certainly, but I think we may safely take it that *L. orbiculare* is the young of *L. decagonale*; this at any rate is certain—a set of specimens collected on Macclesfield Bank form a continuous series, of which the smaller are circular and the larger decagonal in form.

ARACHNOIDES PLACENTA.

Echinus placenta, Linn. Syst. Nat. x. (1758) p. 666.

Though commonly taken in distinctly southern waters as those of New Zealand and Australia, this species has already been recorded from Luzon, and is known as far west as Burmah and Mergui. Not only therefore has it a wide intertropical range, but it is found south of the tropics; it is to be regretted that on p. 171 of the 'Alert' Report I put a sign against the name of this species which indicated that it was not known south of the tropics.

EXPLANATION OF THE PLATES.

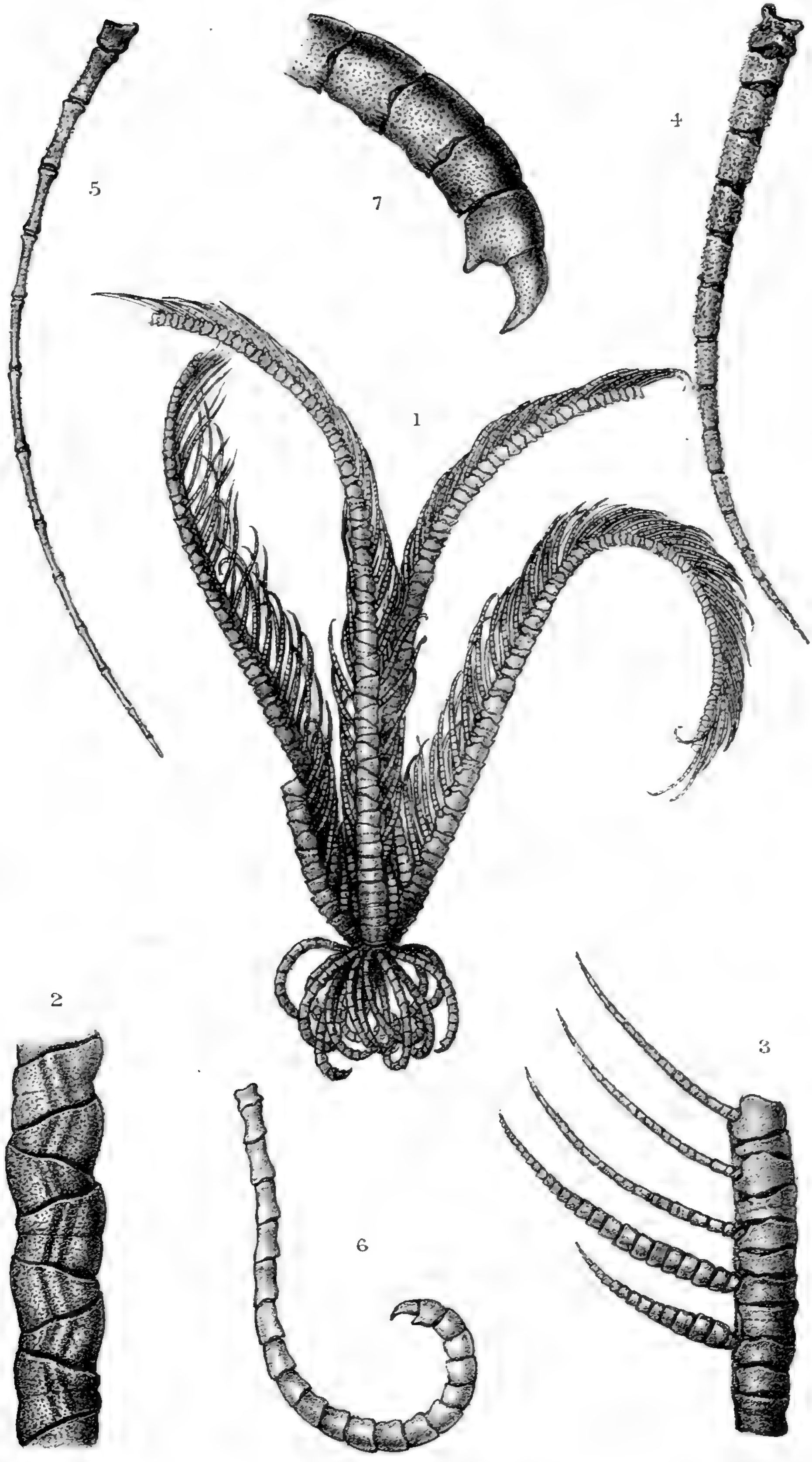
PLATE XXIII.

Fig. 1. *Eudiocrinus granulatus*, to show the habit of the species, × 2.
2. A portion of an arm from above (joints 14–20), × 6.
3. The most proximal joints of the arm, with their pinnules, × 4.
4. The seventh pinnule, to show the form and ornamentation of the joints, × 12.
5. One of the most distal pinnules, × 12.
6. A cirrus, × 4.
7. The distal joints of a cirrus, × 12.

PLATE XXIV.

Fig. 1. *Antedon bassett-smithi* × 2, showing the disc and the bases of the arms with Sz, the first brachial syzygy, varying in position.
2. Side view of arm of do., × 2.
3. A cirrus, × 2.
4. 1st pinnule, to show the form of the joints, × 4.
5 & 6. 2nd and 3rd pinnules, to show the form of the basal joints, × 8.

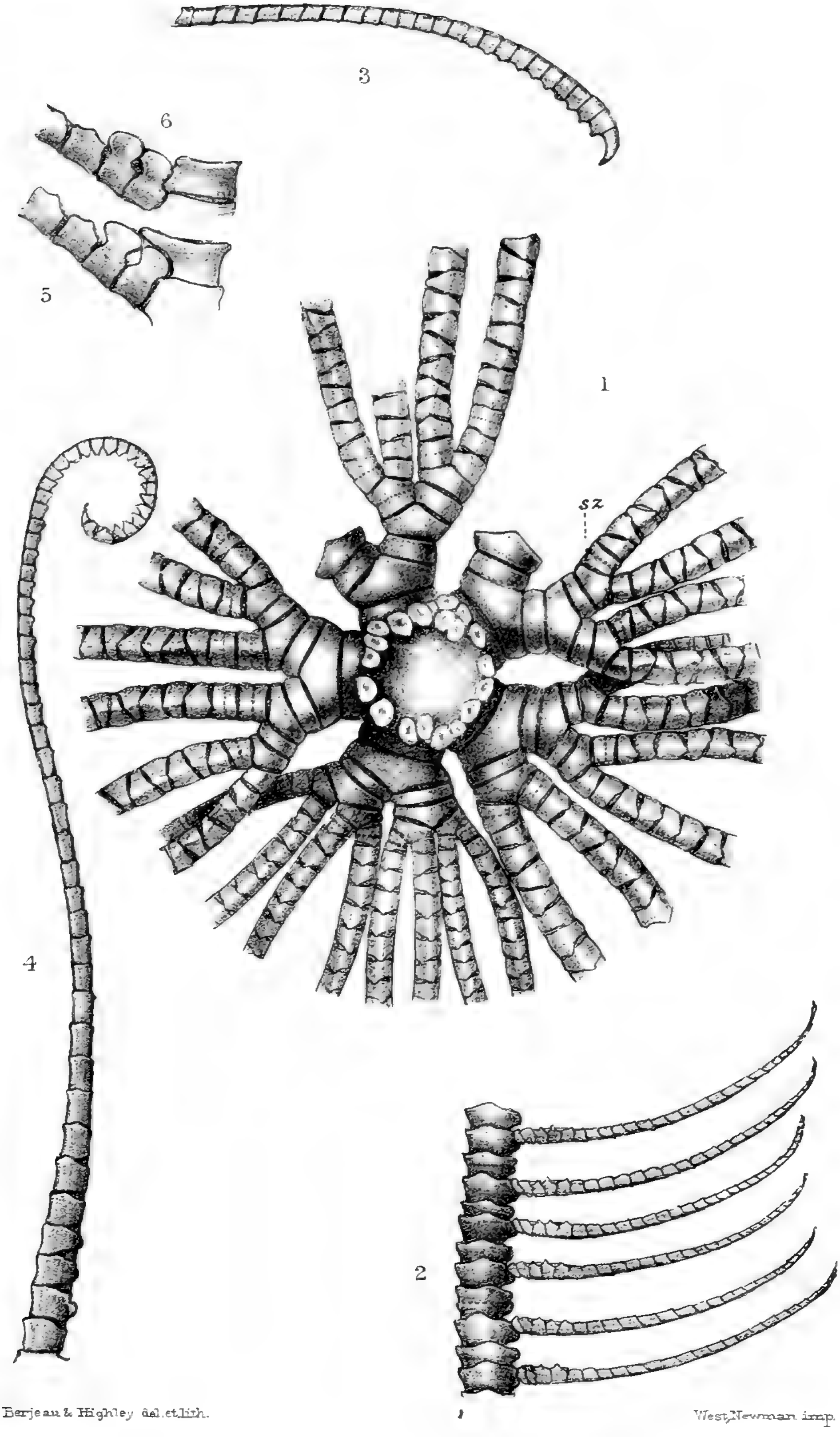
[1] See Agassiz, Rev. Ech. p. ix.



Berjeau & Highley del. et lith.

West, Newman imp.

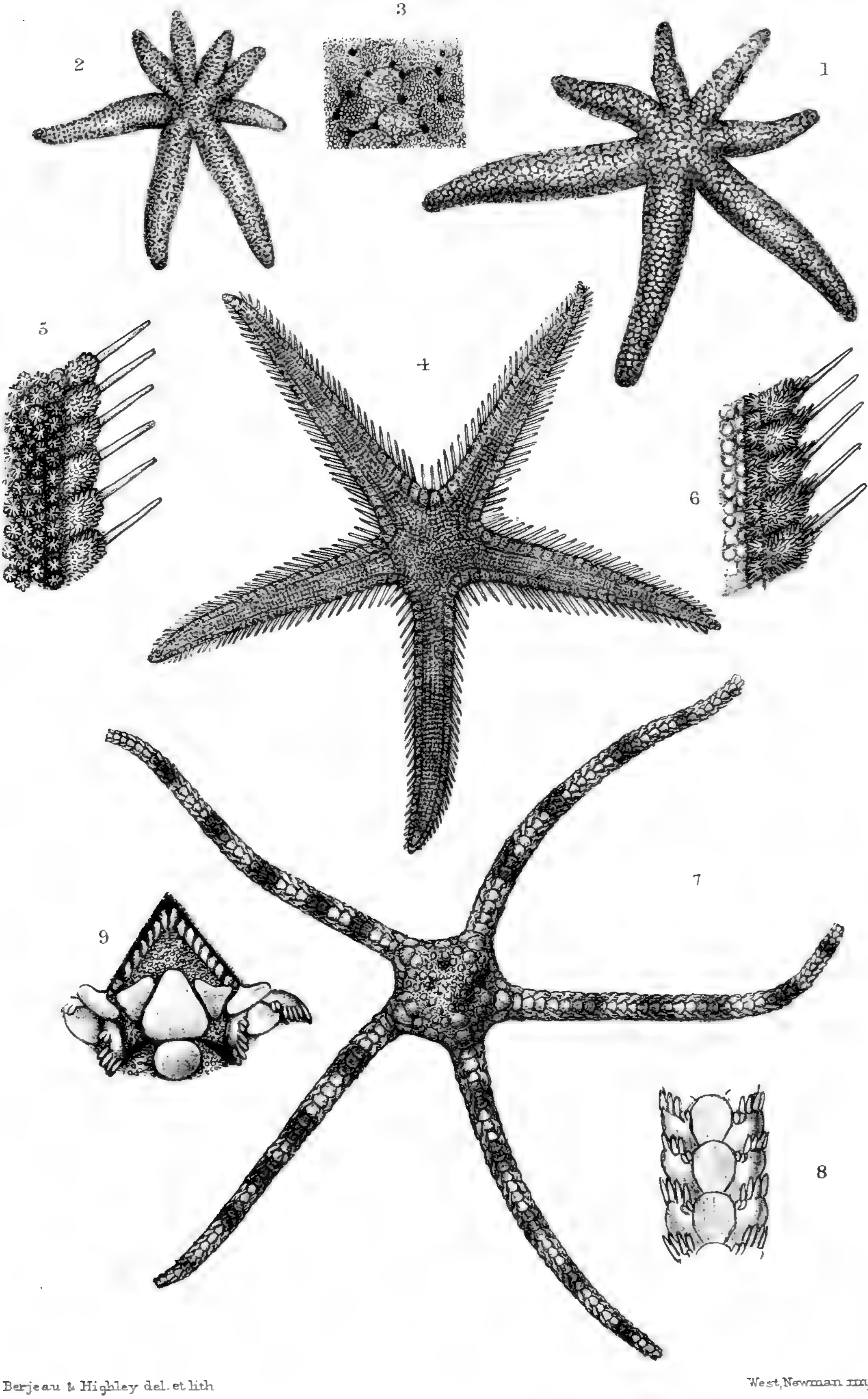
Eudiocrinus granulatus.



Berjeau & Highley del. et lith.

West, Newman imp.

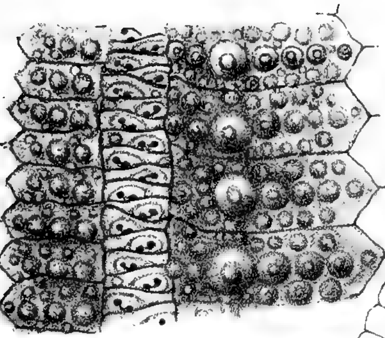
Antedon bassett-smithi.



Berjeau & Highley del. et lith

West, Newman imp.

1-3. Patiria briareus. 4-6. Archaster tenuis.
7-9. Pectinura sphenisci.



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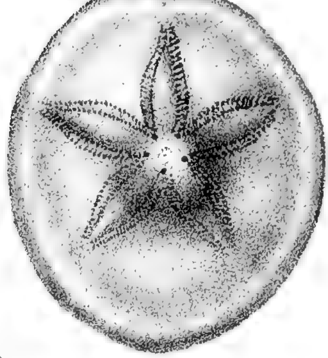

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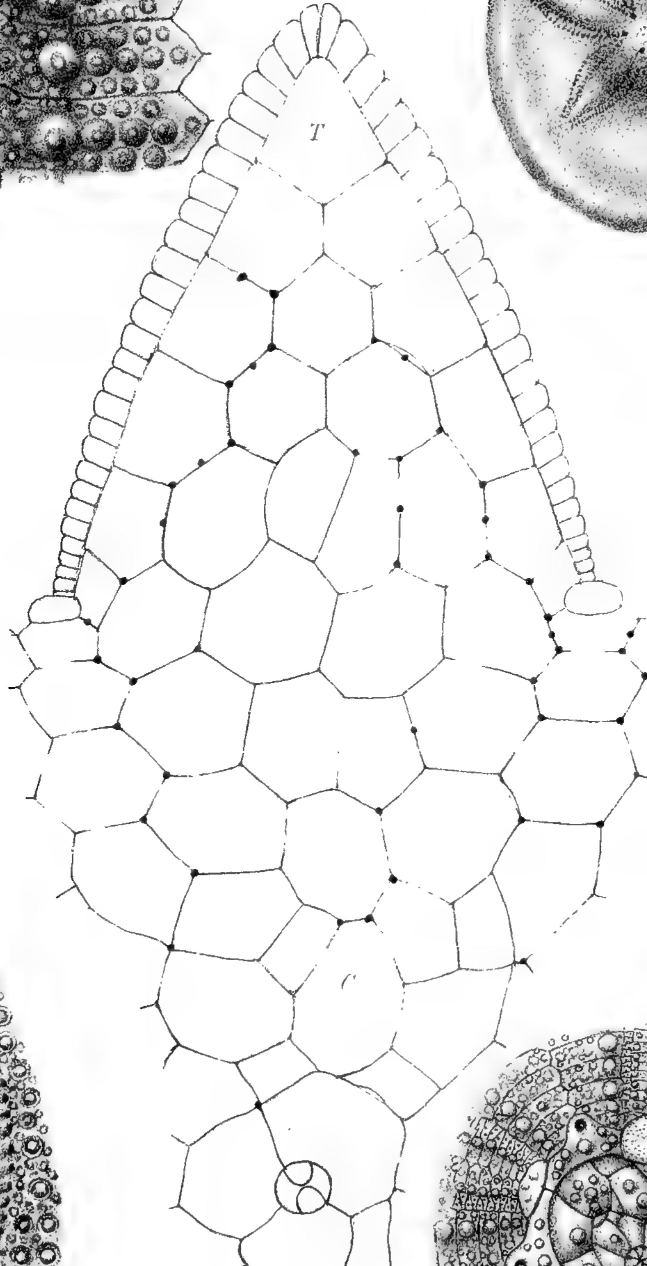

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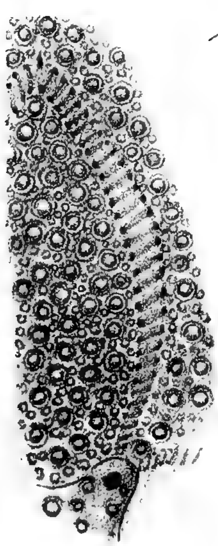

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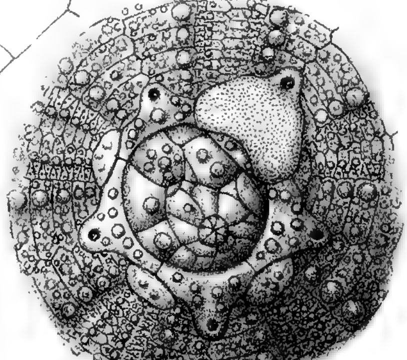
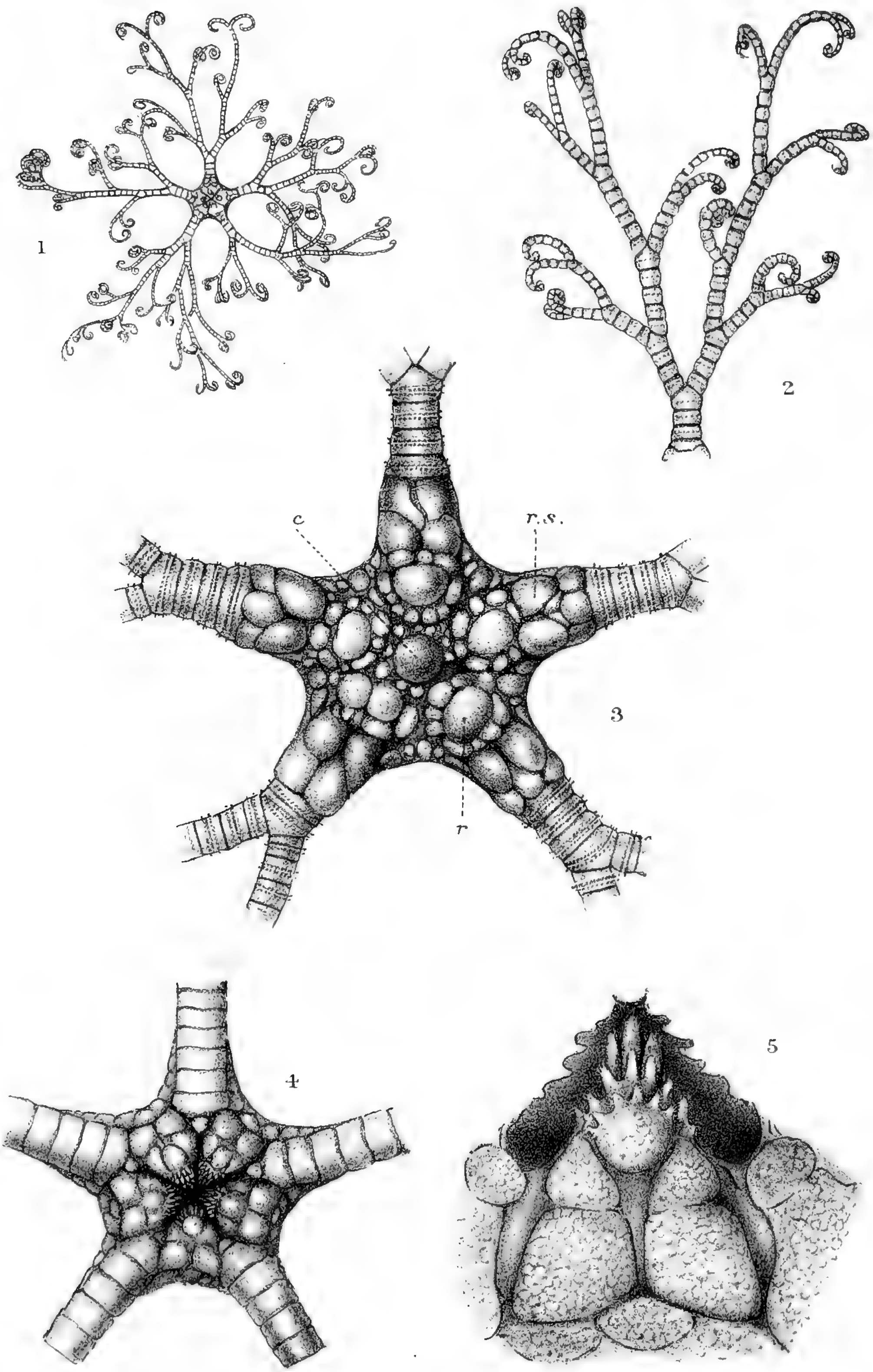


Berjeau & Highley del. et lith.

West, Newman imp.

1. Culcita. – 2. 3. Salmacis rufa.
4 & 5. Laganum decagonale.



Berjeau & Highley del. et lith.

West, Newman imp.

Ophiocrene enigma.

PLATE XXV.

Figs. 1 & 2. Two views of *Patirio briareus* from above, to show the habit of the species, nat. size.

Fig. 3. Part of arm of do. from above, to show the character of the granulation, × 4.

4. *Archaster tenuis* from above, × 2.
5. Part of arm of do. from below, × 4.
6. Part of arm of do. from above, × 4.
7. *Pectinura sphenisci* from above, × 2.
8. Part of arm of do. from below, × 4.
9. An angle of the mouth of do., × 8.

PLATE XXVI.

Fig. 1. A figure of a young *Culcita* set out from the region of the apical pole to the mouth, so as to show all the plates of rather more than ⅕th of the whole test, × 8; *C*, supposed central plate, *T* the terminal.

2. Apical area of *Salmacis rufa*, × 3.
3. Portion of test of do., × 3, to show ornamentation.
4. A small specimen of *Laganum decagonale* (*L. orbiculare*), × 2.
5. Part of petal of same, to show ornamentation, × 8.

PLATE XXVII.

Fig. 1. *Ophiocrene ænigma* seen from above, of the natural size.

2. One of the arms of the same, × 3, to show the mode of branching and the form of the arm-joints.
3. The disc and bases of the arms of the same from above, × 8, showing the central calycinal plate (*c*), the radial plates of the calyx (*r*), the radial shields (*r.s.*).
4. The disc and bases of the arms of the same from below, to show the general relations of the parts of the peristomial area, × 6.
5. One mouth-angle, × 24, to show the teeth and the oral plates and deep median cleft.

2. Studies in Teleostean Morphology from the Marine Laboratory at Cleethorpes.[1] By ERNEST W. L. HOLT, Naturalist on Staff, M.B. Assoc.[2]

[Received March 7, 1894.]

(Plates XXVIII.–XXX.)

I. ON SOME SPECIMENS OF THE BIRKELÄNGE (*Molva abyssorum*, Nilsson) FROM ICELAND AND FAROË.

Principal References and Synonymy.

Byrkelänge, Ström, Trondhj. Handl. iii. p. 446, tab. 8; Sönd. Beskriv. ii. p. 275.

Molva abyssorum, Nilsson, Prodrom. Ichth. Scand. p. 466; Günther, Cat. Fish. Brit. Mus. iv. p. 362.

Molva byrkelänge, Collett, Norg. Fisk. p. 116; Lilljeborg, Sver. o. Norg. Fisk. ii. p. 139.

[1] In virtue of an arrangement between the Marine Biological Association and the Marine Fisheries Society of Grimsby, the laboratory, which belongs to the latter body, is at present under the control of the Association for the prosecution of investigations dealing with the North Sea fisheries.

[2] Communicated by Dr. GÜNTHER and Prof. HOWES.

Molua dipterygia, Smitt, Hist. Skand. Fishes, ed. ii. p. 521, pl. xxvi. fig. 3.

Introduction.

The specific name adopted by Collett and Lilljeborg originated with Walbaum (' Petri Artedi sveci Genera Piscium,' 1792, p. 135), and is therefore older than Nilsson's name, the date of which is 1832. Professor Smitt identifies the fish with the *Gadus dipterygius* of Pennant (Introd. Arct. Zool. ed. ii. vol. i. p. cxxiv), which is not included in the synonymy by the other Scandinavian authors referred to.

The retention of Nilsson's name, as the earliest in post-Linnæan literature, is justified by the rules of scientific nomenclature, and, since it is used in Günther's catalogue and in the 'Challenger' monograph, appears to be for the convenience of British readers.

At the time this paper was written the only drawing of the species with which I was acquainted was that given by Ström (*op. cit.*). The work of this author is sufficiently rare, and his figure, though accurate enough, is merely a small outline. One of my chief objects was therefore to put forward a recognizable figure in a publication easy of access to British readers, while at the same time extending the known horizontal range of the species, and recording certain anatomical peculiarities which had escaped the notice of previous writers.

Within the last few months, however, ichthyological literature has been enriched by the appearance of Professor Smitt's new edition of Fries, Ekström, and Sundevall's 'History of the Scandinavian Fishes.' This contains a description, with figure, of the species under consideration.

The text, as I think, is not so complete as to render my own remarks altogether superfluous, the more especially since only Skandinavian examples were known to the author, while the figure differs from all examples known to me in rather important details (to be referred to below). It being too late to so far rewrite my remarks as to incorporate the whole of the necessary references to Smitt's work in the text, I have interpolated them chiefly in the form of notes.

The resemblance borne by the Mediterranean form, *M. elongata* (Risso)[1], to the species now under discussion has attracted the attention of Lilljeborg, who gives a careful comparison of the measurements of specimens of each species. He notes that a difference exists in the texture of the scales, and is unable to establish their complete identity. It would appear, from his description, that the Mediterranean form approaches the Faroë and Iceland specimens of *M. abyssorum* in the reduction of the caudal peduncle, a point in which it differs somewhat from Skandinavian examples. While inclined to suppose that the characters

[1] *Lotta elongata*, Risso, Faun. Eur. Mérid. iii. p. 217, fig. 47; Costa, Faun. del regno di Napoli, Pesc. i. p. 15, tav. xxxviii.

which separate the species may ultimately prove of less than specific value, I do not feel justified, in the face of the opinion of so accurate an observer as Lilljeborg, in including *M. elongata* in my synonymy. I have never had the opportunity of examining an example of this form, and am acquainted with no description of its anatomy.

Distribution.

The species is known to occur along the whole of the western coast of Scandinavia and in the Cattegat, but does not seem to have been observed elsewhere. It is a deep-water fish, abundant between 100 and 300 fathoms in that region [1]. Of the examples before me, seven in number, two came from the neighbourhood of Ingolfs Hofde Huk, on the south coast of Iceland, in the summer of 1892. One of these was taken on a long-line, in the immediate neighbourhood of the 100-fathom line, in company with another example, which did not come into my hands. The other was trawled, at a depth which certainly could not have greatly exceeded 40 fathoms, and may very probably have been considerably less. I am indebted for these two specimens to the courtesy of Messrs. W. Hoole and F. Barrett respectively. My other five examples I bought in the Grimsby Fish-market in December 1893, and ascertained that they had all been taken in one shot of the long-lines at about 160 fathoms, 28 miles N.W. of Fugaelo, Faroë Islands.

From the information of fishermen it appears that specimens are taken from time to time on the Faroë "Bank," but are sufficiently rare to be unknown to many who regularly work that region. I could hear of no previous instance of the fish having been taken off the coast of Iceland.

The Birkelänge is one of those forms which our fishermen regard as hybrids, the imputed parents being the Hake (*Merluccius vulgaris*) and the Common Ling (*Molva abyssorum*), whilst taint of Conger blood is sometimes suggested.

The fish appears to be used as food in Norway, but, according to Mr. Hoole, who made culinary experiment of one which fell into his hands, it is very rank, and the flesh of one which I had removed for osteological purposes failed to commend itself to the not very delicate palate of a seal. Smitt, however (*op cit.* p. 524), remarks that the fish is more esteemed, when fresh, than the Common Ling, so that tastes would appear to differ. The Scandinavian vernacular name, which means "Trade Ling," is cited as testifying to the commercial value of the species.

Diagnosis of Species.

Head and body elongate, covered with minute imbricating scales. The length of the head contained about five times in the total length without the caudal fin, and much greater than the height

[1] Also at 35 and 80 fathoms (Smitt).

of the body. The length of the eye, greater than its height, contained about five times in the length of the head, and once and a half or nearly twice in the length of the preorbital region. *The length of the eye always greater than the width of the interorbital space*, which is usually less than the height of the eye, but may be equal to or even a little greater than that measurement. *The lower jaw the longer, projecting beyond the snout*, the barbel small, much less than the length of the eye. *The height of the caudal peduncle less than the height of the eye.* The vent opposite about the seventh or ninth ray of the second dorsal. The mouth more or less closely speckled with black chromatophores.

The italics are intended to denote such characters as serve at a glance to distinguish this species from the Common Ling (*M. vulgaris*, Fleming), and the close resemblance which the Birkelänge bears to that well-known form renders it unnecessary to elaborate the diagnosis further.

The diagnosis is based on the examination of the seven specimens forming the subject of this note, which range in total length from 42 to 50½ inches. Hence it may not be strictly applicable to smaller examples, since the proportions, especially those of the eye, are subject to developmental changes in all fish. I am led by this to suppose that Lilljeborg, who describes the interorbital space as much less than the height of the eye, may have based his remarks on the examination of smaller fish; but it is quite possible that a variation in this, as apparently in some other respects, exists between Scandinavian and more Western examples of this species.

The condition exhibited by my specimens renders it also probable that the relative length of the lower jaw increases with the size of the fish, so that in young examples it may even be less than that of the upper jaw[1]. We know this to be the case in the Coal-fish (*Gadus virens*), in which the lower only passes the upper jaw when a length of about twelve to fifteen inches has been attained. There remain, however, other characters sufficiently well marked to distinguish the species at any size. The Birkelänge is not known to reach a length greater than 60 inches[2], and is therefore a much smaller fish than the Common Ling.

[1] It may be remarked that very large Common Ling occasionally exhibit an infinitesimal projection of the lower jaw. Such a projection is given by Lilljeborg as a specific character in the case of the species before us. Smitt, however, states that in all his specimens the upper jaw was distinctly the longer, and his figure (*op. cit.* pl. xxvi. fig. 3) shows this condition clearly enough. From internal evidence the material forming the subject of his remarks seems to have consisted of four examples, stated to be adult, ranging in size from 56·2 to 82·8 cm., and therefore all smaller than our Iceland and Faroë specimens. It is, nevertheless, by no means clear that all small examples have the snout projecting, as Lilljeborg (*op. cit.* iii. Append. p. 787) mentions an example of 60 cm. without qualifying his previous remarks on the conformation. On the whole it seems most probable that the majority of adults, whether from Scandinavian or other waters, have the lower jaw the longer.

[2] Smitt (*op. cit.* p. 522) observes that the species seldom exceeds a length of one metre (39 inches *ca.*), but it does not appear that his acquaintance with this fish is very extensive.

The fin-ray formula is enumerated by Lilljeborg as follows :—

D I. 13–14. D II. 78–85. A. 75–80. Pelv. 5–6.

The examples before me give

D I. 12–15. D II. 69–75. A. 70–74. Pelv. 6–7.[1]

The difference in the number of rays in the second dorsal and anal is considerable, but the small number of my specimens and the absence of any information as to the number represented in Lilljeborg's formula render it impossible to say whether such difference is indicative of local variation, or depends on nothing more important than chance.

Description of the Specimens.

I append a table of dimensions, since such facts are often of more importance in the eyes of an ichthyologist than an author's deductions therefrom. The specimens A to E are those from Faroë, and the measurements were taken from the fresh condition; the Iceland examples, *x* and *y*, were measured after preservation in alcohol.

The anterior extremity as here denoted is the extremity of the lower jaw when the mouth is closed. The measurements are given in inches.

Specimen	A	B	C	D	E	*x*	*y*
Total length	$50\frac{1}{2}$	$49\frac{1}{4}$	$47\frac{1}{8}$	$46\frac{1}{2}$	42	47	46
Total length without caudal...	$47\frac{1}{2}$	47	$44\frac{3}{8}$	$45\frac{7}{8}$	$39\frac{1}{2}$	44	$42\frac{3}{4}$
Length of head	$10\frac{1}{4}$	$10\frac{1}{4}$	$9\frac{3}{4}$	$9\frac{1}{4}$	$8\frac{1}{4}$	9	$9\frac{1}{4}$
Preorbital length	$3\frac{3}{4}$	$3\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{4}$	3	3	$3\frac{1}{4}$
Horizontal diameter of eye ...	2	$2\frac{1}{8}$	$2\frac{1}{8}$	2	$1\frac{3}{4}$	2	2
Vertical diameter of eye	$1\frac{3}{4}$	$1\frac{7}{8}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{8}$	$1\frac{3}{4}$	$1\frac{3}{4}$
Width of interorbital space...	$1\frac{1}{2}$	$1\frac{9}{16}$	$1\frac{7}{8}$	$1\frac{7}{8}$	$1\frac{1}{16}$	$1\frac{5}{16}$	$1\frac{1}{4}$
Greatest height of body	$5\frac{7}{8}$	$5\frac{1}{2}$	$5\frac{3}{4}$	6[2]	$5\frac{7}{8}$	5*ca*	5*ca*
Greatest girth of body.........	$13\frac{1}{2}$	15	15	13[2]	$12\frac{1}{2}$		
Height of caudal peduncle ...	$1\frac{3}{8}$	$1\frac{3}{8}$	$1\frac{3}{8}$	$1\frac{1}{2}$	$1\frac{1}{4}$	$1\frac{3}{8}$	$1\frac{3}{8}$
Ant. extremity to 1st dorsal...	$14\frac{1}{4}$	$13\frac{1}{2}$	$13\frac{3}{8}$	$12\frac{7}{8}$	$11\frac{1}{8}$	13	$12\frac{1}{2}$
Ant. extremity to 2nd dorsal.	$18\frac{3}{8}$	$17\frac{3}{4}$	$17\frac{1}{8}$	$16\frac{5}{8}$	$14\frac{7}{8}$	17	$16\frac{1}{4}$
Ant. extremity to anus	22	22	21	$20\frac{1}{2}$	18	19	20
Length of pectoral	5	$4\frac{1}{2}$	$4\frac{3}{4}$	$4\frac{3}{4}$	$4\frac{1}{4}$	$4\frac{5}{8}$	$4\frac{5}{8}$
Length of pelvic	$4\frac{1}{8}$	$4\frac{1}{4}$	$3\frac{3}{4}$	$3\frac{3}{4}$	$3\frac{3}{4}$	4	$3\frac{3}{4}$
Length of barbel	?	$\frac{5}{8}$	$\frac{9}{16}$	$\frac{1}{2}$	$\frac{7}{8}$	$\frac{1}{2}$	$\frac{11}{16}$

The lower jaw projects from $\frac{1}{8}$ to $\frac{3}{4}$ inch beyond the upper, and the angle of the gape reaches to about a vertical from the centre of the eye. The teeth are not distinguishable either in structure

[1] For purposes of comparison I append the fin-ray and vertebral formula of *M. vulgaris*, taken from Lilljeborg (*op. cit.* pp. 131 and 137), as dealing with the most Northern examples as to which information is available :—

D I. 13–16. D II. 62–70. A. 57–66. Vert. 64–65.

[2] The eversion of the stomach in this specimen renders the value of these measurements uncertain.

or arrangement from those of the Common Ling, but the large teeth of the inner row of the mandible and of the vomer, which exhibit the lateral compression and spatulation of the points most strongly, are fewer in number by comparison with Common Ling of the same size; this is due, no doubt, to the latter being considerably younger than the examples before us. The tongue is broad and free, with a sharp anterior edge. There are about 80 pores in the lateral line.

Colours.—The dorsal region of the head and body is a brownish slate colour, shading ventrally into a brownish grey on the sides, which have a cupreous lustre in very fresh examples, and becoming nearly white in several examples in the ventral abdominal region. The jaws and under surface of the head brownish grey, the branchiostegal membrane not darker than the surrounding region, but the tip of the lower jaw and barbel dark. A dark spot on the axilla; the pectoral dark slate-grey; the pelvic pale, but speckled with dark pigment. The dorsals slate-grey, both fins darkest in the submarginal region, especially the posterior part of the second dorsal; the extreme margin light, nearly white in some examples. The anal resembling the second dorsal, but fading into a pale slate colour anteriorly. All these fins have a bluish lustre on their darker parts. The mucous membrane of the mouth may be almost colourless, but is usually rather profusely speckled with black pigment. I am told that it is sometimes black, but have not seen any specimen to which such description would apply. The peritoneum of the body-cavity dark grey or black.

The Birkelänge thus differs conspicuously enough from Ling taken from the comparatively shallow water in our own seas; but comparing it with Faroë specimens of that species, I find that the principal difference (so far as concerns external pigmentation) that can be affirmed is that the commoner form is rather the paler of the two. We know from Lilljeborg[1] that the two species resemble each other in being more vividly coloured in the young condition than when adult.

In order to emphasize the external differences of the two species I have appended a figure of both. The Ling (Plate XXVIII. fig. 2) is actually some ten inches shorter than the Birkelänge (fig. 1), and, the figures being drawn to such scales as to be practically of the same size, the difference in the size of the eyes is not so marked as it would be had examples of the same actual length been represented, since the size of the eye varies in inverse ratio to that of the individual. Nevertheless the eye is seen to be largest in the Birkelänge, and its relatively greater length as compared with that of the head is still more conspicuous. Such dimensions as the height of the body and of the caudal peduncle in relation to the total length are practically constant during the interval of size which separates the two specimens, and consequently the value of the figures for purposes of comparison is not thereby impaired.

[1] This author (*op. cit.* iii. Append. p. 787) describes the coloration of an example of *M. abyssorum* 60 cm. long.

Anatomical Features.

The Alimentary Viscera.—The abdominal cavity is much elongated, extending back rather beyond the first third of the anal fin, and terminating in a narrow process, the apex of which, in a specimen $47\frac{1}{8}$ inches long, is 32 inches from the snout. The alimentary tract, as compared with that of the Common Ling, exhibits features of some interest. The cardiac portion of the stomach, which, as in the Ling, is prolonged backwards beyond the small bulbous pyloric portion, occupies the whole length of the visceral cavity except the narrow canal-like process already referred to. It is extremely thin-walled and flaccid, and thus in marked contrast to the firm muscular stomach of the Ling. The pyloric cæca are numerous, as in the Ling, but somewhat larger. The delicacy of the walls may be said to be characteristic of the whole of the alimentary canal in the Birkelänge. It reaches its maximum in that part of the intestine which is beyond the origin of the pyloric cæca. The walls are here so thin as to be ruptured at the slightest attempt to lift the gut, and, in one specimen, were found to have been ruptured before the visceral cavity was opened. The intestine is very much shorter, as well as more delicate, than in the Ling, as will be readily understood by a glance at Plate XXIX. figs. 3 and 4[1]. It also appears to be subject to variation in its arrangement, the condition in two examples, both females, being shown in figs. 3 and 3 *a*. The liver is very much larger than in the Ling. It consists of a single ventral lobe, in which the coalescence of lateral elements appears to be indicated by the presence of deep sulci. It is somewhat expanded anteriorly, while the posterior process appears to pass indifferently either to the right or left of the rectum. In the Gadidæ a greater development of the liver seems to be frequently characteristic of the more abysmal members of a genus. The mesenteries are as stout as in the Ling.

The Air-bladder.—This is a simple fusiform structure, occupying the roof of the abdominal cavity from the anterior extremity to the origin of the ureter. It differs from that of the Ling chiefly in that its anterior cornua, which lie external to the attachments of the pharyngeal muscles to the vertebral column, possess no lumen, and that its dorsal wall is somewhat more spongy and less definite than that of the commoner species. The rete mirabile, a single structure, 4 inches long by 1 inch broad in a specimen $47\frac{1}{8}$ inches long, occupies the usual position, and is, if anything, a little smaller than in the Ling.

The Kidneys.—These terminate posteriorly in a small expanded process, from which the ureter passes obliquely forward to the region of the vent. The posterior process is much larger in the Ling, and blocks the narrow end of the visceral cavity. On the

[1] Smitt (*op. cit.* p. 524), in a very brief account of the visceral anatomy, notes that no part of the intestine, in a male 65 cm. long, extended beyond the anus.

other hand, in the Birkelänge the so-called head-kidney is more definite in outline, and its histological structure leaves no doubt that it is perfectly functional. In the Ling the proportion of reniform matter is much less, but the head-kidney does not appear to be wholly functionless.

The Reproductive Organs.—Three specimens examined proved to be females. The ovaries are much like those of the Ling. From their condition it appears probable that the species spawns off Iceland and Faroë late in the summer or in the autumn.

The Skeleton.—One of the Faroë specimens has 78 vertebræ, the first complete hæmal arch occurring on the 32nd. Lilljeborg gives the total number as 78–79, of which 30–31 belong to the trunk. In other respects the skeleton is much like that of the Ling.

Morphological Considerations.

It appears that we have before us a form very closely allied to the common species, and in which almost all the distinctive characters are illustrative of specialization along one definite line. To take them *seriatim*, we may consider first the relative length of the jaws.

The protrusion of the lower jaw is a feature most obviously associated with the feeding-habits of the fish, and the fact that the Northern Gadoids usually exhibit this character might be found, could the matter be satisfactorily investigated, to indicate nothing more than that the food-supply available in the higher latitudes is not adapted to the requirements of bottom-feeders. At the same time the protrusion of the lower jaw in the larvæ of all Teleosteans that have been studied may indicate that this condition in the adult has an ancestral significance, such fish as exhibit it being in this respect less specialized than others which do not, though here again the pelagic habit of the said larvæ may go far to prove the character to be merely one of adaptation. Thus, like most other scientific facts in the present state of our ignorance, we may derive therefrom whatever interpretation appears most convenient to preconceived theory. That there is no necessary connection in Gadoids between this character and an abysmal habitat is sufficiently demonstrated by the Macruridæ, but the fact remains that such association usually exists in the less specialized members of the group (cf. *Merluccius*, *Mora*, &c.). The reduction of the barbel is a character so obviously related to the elongation of the lower jaw that it requires no separate discussion, since it is difficult to see what benefit an "underhung" fish could derive from such an appendage, however well developed. Nevertheless the presence of a well-developed and functional barbel in the closely-allied species with the shorter mandible almost forces us to regard the appendage in *M. abyssorum* as vestigial, and, if that be admitted, it is not difficult to arrive at a conclusion as to which condition of the jaws is least indicative of specialization.

The next feature is the relative size of the eye, and it may at once be said that in the enlargement of this organ *M. abyssorum* exhibits a character equally associated in Gadoids with either an abysmal or a Boreal habitat. *Gadus saida* may be taken as an instance of the last, as one of the few Gadoids which are known to be confined to Northern regions and which have not hitherto been met with in deep water. Speaking generally, it may be said that all Gadoids have rather large eyes, and it is questionable whether their reduction in the more littoral forms, such as some of the *Motellæ*, may not be as much illustrative of modification in one direction as their enlargement in the deep-sea forms appears to be in another. This group of fishes appears, in fact, to be the present representatives of a stock that had become adapted for life at moderate depths rather than in either deep water or at the extreme margin.

With regard to the characters of the alimentary viscera a reduction of the length of the gut has been shown by Dr. Günther[1] to characterize a deep-sea member of the Percoid fishes; but I am not aware of any observation that bears on the relative strength of the walls of the intestine. It is evident, however, from their fragility in the species before us that life would be impossible in a region exposed to any violent action of the tide, nor is it easy to understand that the fish could display any great activity, without risk of internal injury. That it is not an active fish, as compared with its congener, may be judged from the reduction of the caudal peduncle and fin, and by the attenuation of the whole caudal region, a character we find invariably present both in deep-sea and Northern Gadoids. The same may be said of the elongation of the body, which carries with it the increase in the number of the vertebræ and of the rays of the dorsal and anal fins, and it will be remembered that Collett found a constant increase in the number of these structures in the more Northern examples of a series of *Hippoglossoides platessoides*[2].

A point which appears worthy of a moment's notice is the pigmentation of the mucous membrane of the mouth and of the peritoneum. It is a matter of common knowledge that these structures are more or less black in deep-sea fishes, whereas in their more littoral allies they are usually destitute of dark pigment, and this is well illustrated by comparing the two species of *Molva*. We know that whatever light there may be in the abysses of the ocean is at all events not directly derived from that which illuminates the surface. Without committing ourselves to an opinion of the value of any particular theory, we may be inclined to accept the broad fact that there is a connection between light and pigmentation, and, in the case of flat-fishes, we are familar with attempts which have been made from time to time, with more or less success, to demonstrate this connection. Passing from external to internal pigmentation, if we open the

[1] 'Challenger' Reports, vol. xxii. p. 14.

[2] 'Norwegian North Atlantic Expedition, Fishes,' Christiania, 1880, p. 147.

abdominal cavity of a flat-fish, we find that the peritoneum of the ocular side is beset with dark pigment, while that of the blind side is not. It seems clear enough that whatever cause governs the presence or absence of external pigment in these fishes is equally potent with regard to the dark pigment of the internal region[1]. If this cause be the light, we have in the condition of round-fishes an apparent anomaly, not in the absence of pigment from the peritoneum in littoral fishes, since the difference of position involves a much greater interruption of the light from above, but in its conspicuous development in the deep-sea fishes, the peritoneum of which can be in no way subject to any action of the sun's light.

In conclusion it may be remarked that *M. abyssorum* is a form such as might well be descended from a parent stock not greatly differing from the Common Ling of the present day, and that the extensive vertical range of that species would appear to offer facilities for the establishment of such an abysmal offshoot[2].

II. On the Recessus orbitalis, an Accessory Visual Organ in Pleuronectid Fishes.

In making an examination of the cephalic anatomy of the

[1] Since this was written, I find that Messrs. Cunningham and MacMunn, in their monograph "On the Coloration of the Skins of Fishes" (Phil. Trans. 1894, p. 809), consider that the "difference can only be explained as the effect of light falling on the upper side of the fish, and not on the lower." I omit further reference to their results, since they are discussed at some length in No. II. of this series of papers.

[2] It is interesting to find that Professor Smitt (*op. cit.* p. 525) arrives at a precisely opposite conclusion, viz., that "from a systematic and genetic point of view, *M. dipterygia* must be regarded essentially as a predecessor of the Common Ling, though the former has evidently adopted in certain respects a distinct direction of development from the common original type which we are entitled to assume." "This," he remarks, appears from an appended table of averages of certain measurements in the two species. No further explanation being forthcoming, I am unable to say in what way the table may be supposed to support his conclusions, nor am I inclined to attach any great value to a series of averages based in no case on more than three specimens.

The right of the author to form any opinion he chooses, as to the relative antiquity of the types of structure exhibited by the two species, is undoubted; but it seems impossible to limit its application, and the logical conclusion is, that if Smitt holds this opinion in the present instance, he also regards all Gadoids which exhibit an abysmal type of structure as more primitive than their littoral brethren. This view is, of course, in direct opposition to that held, as I suppose, by all other ichthyologists, viz., that the abysmal forms are descended from littoral ancestors.

Elsewhere (p. 520) Smitt notes that the trace of division in the second dorsal fin is more marked in the Birkelänge than in the Common Ling, but it does not appear that this was taken into consideration in formulating the conclusion quoted above. To most ichthyologists it would appear as rather important evidence as to the greater antiquity of the type exhibited by the commoner species. Again, when dealing with *Gadus esmarkii*, the author considers that the persistence of the barbel brings that species nearer to the common origin of the Cods than the Pollack, which has no barbel (p. 499), so that the same facts would appear, in the hands of Professor Smitt, to be capable of diametrically opposite interpretations.

Common Sole, my attention was arrested by a sac-like structure lying immediately behind the lower eye, external to the membranous wall of the orbital cavity. The absence of any mention of such a structure in Cunningham's monograph of that species[1] suggested that the specimen under examination might be in that respect abnormal; but I have since found it in every Sole which I have examined, and there can be no doubt but that it is a regular feature in the anatomy of the species.

The organ in question is almost certainly homologous with a rounded process of the membranous wall of the orbital cavity discovered by Dr. Günther[2] in *Chorisochismus dentex*, one of the Gobiesocidæ, and conjectured by him to represent the *saccus lacrymalis* of higher animals. Beyond this I have been able to find no reference to the existence of any structure at all corresponding to that now under consideration.

It was my intention, before publishing, to work out the development of the organ as completely as possible, since any opinion that might be formed as to the homologies of the structure would be of little value unless supported by a knowledge of its ontogeny. The material at my command, however, has proved unsuitable for the purpose, and, since some considerable time must elapse before fresh specimens of the required stages are available, I have thought it best to put forward such information as I have already collected, imperfect as it is, in order to attract the attention of others who may find themselves in a position more favourable for the prosecution of the inquiry.

I have ventured to apply to the organ the name (*Recessus orbitalis*) which appears at the head of this section.

Distribution in Species.

I have found the organ present, in some form or another, in every species of flat-fish examined for this purpose, and believe that it will be found to occur in all. The species examined comprise the Halibut (*Hippoglossus vulgaris*), Long Rough Dab (*Hippoglossoides platessoides*), Plaice (*Pleuronectes platessa*), Flounder (*P. flesus*), Common Dab (*P. limanda*), Lemon "Sole" (*P. microcephalus*), Common Sole (*Solea vulgaris*), and Brill (*Rhombus lævis*).

Topography and Structure.

The organ consists usually of a sac-like process of the membranous wall of the orbit, and in all the forms mentioned, except the Halibut, both orbits are furnished with such a process. The condition in the Plaice may be taken as fairly representative of that met with in the genera *Pleuronectes*, *Hippoglossoides*, and *Solea*, so far as their anatomy is known to me in this respect.

[1] 'A Treatise on the Common Sole,' Plymouth, 1890.
[2] Cat. Fish Brit. Mus. vol. iii. p. 490.

The organ of the lower orbit—*i. e.*, that belonging to the ocular side of the body, in this case the right side—may be found immediately under the skin overlying the membranous wall of the orbital cavity just behind the eye. To expose it without rupture requires rather careful handling, as, in the fresh condition, the organ is extremely delicate, and it is bound to the skin anteriorly by connective tissue. It is generally of a roughly trihedral outline, occupying a space bounded dorsally by the backward prolongation of the interorbital ridge of the skull, anteriorly by the eye, and postero-ventrally by the anterior face of the superficial jaw-muscles of the same side. To expose it fully it is necessary to remove a part of these muscles. The organ will then present much the appearance shown in figure 5 (Plate XXX.), according to the state of expansion. Various branches of the V-cranial nerve, which, for the sake of clearness, are omitted from the figure, will be seen in its neighbourhood, mostly passing internal to it. The distribution of these branches varies somewhat in the different species, but usually two small branches pass to the external face of the organ, which receives its nervous supply from one of them. In the Sole the course of the nerves not infrequently affects the shape of the sac, which may assume a bilobate or even a trilobate appearance therefrom.

The sac is almost translucent in very fresh examples, save for certain milky-white streaks observable about the periphery. It is smooth externally, and firmly bound on its inner face to the wall of the orbital cavity. If the internal structure is exposed, by a partial removal of the outer wall, as shown in Plate XXX. figure 6, it will be seen that a number of white muscular bands are attached to the inner surface of the walls, which are otherwise extremely thin and delicate, while other bands traverse the lumen, either independently, or so associated together as to form more or less definite septa. The bands on the walls, while they interlace with each other in all directions, show nevertheless some attempt at a radiate disposition around an orifice which communicates with the orbital cavity itself. There may be more than one such orifice; in fact, in the specimen figured there are two of considerable size (*o.*, *o.*), while several smaller ones are hidden by the septum (*s.*). Even in cases where only one distinct orifice occurs, which is perhaps the commonest condition in the Plaice and Common Sole, I am not certain that minute openings do not also occur in its neighbourhood. The larger opening, or openings, always show a distinctly thickened rim. The specimen figured appeared to be completely subdivided by the septum, but this is not of constant occurrence in the species. Indeed, in speaking of the dextral forms which I have studied, it is only possible to say of the internal structure of the accessory organ of their lower orbit that it is more or less subdivided by muscular septa, and communicates with the orbital cavity by one or more openings, placed close together, of which one is always distinctly larger than the rest. It is advisable, in studying this structure, to partially harden it by an injection of alcohol previous to dissection, owing to its great contractility in the perfectly fresh condition.

In fresh examples the organ will be found to contain a colourless fluid, which becomes a milky-white coagulum when the fish is rather stale. The same fluid exists also in the orbital cavity, and it can readily be passed from one to the other by pressure. The organ, owing to its internal structure, will be found to be extremely elastic, and this elasticity is retained to some extent for a considerable time after death. In figure 5 the organ is shown in a moderate state of expansion, slight pressure being applied to the eye at the time of drawing. Inflated with air the organ becomes singularly lung-like, the resemblance being even more marked in the case of its fellow of the blind side.

The organ is rather more developed in *Pleuronectes* than in *Solea*, otherwise there is no important difference between the two genera. In the Brill the organ of the lower eye is much smaller than in *Pleuronectes* and *Solea*. The membranous wall of the orbital cavity, otherwise undifferentiated, expands in a conical process behind the eye, and the apex of this process is furnished with internal muscular bands similar to those met with in the definite sac-like organ of *Pleuronectes*. There does not seem to be a definite narrow opening between the muscular apex and the rest of the conical process of the Brill, and the whole apparatus is not very conspicuous unless pressure is applied to the orbital cavity.

The lower orbital cavity of the Halibut is destitute of a definite sac-like process, but a portion of its membranous wall is differentiated. On removing the skin behind the eye, more or less fibrous and a great deal of adipose matter is found to overlie the orbital cavity. Removing this, the membranous wall, otherwise translucent, is seen to exhibit a trihedral opaque whitish patch in the position occupied in *Pleuronectes* by the sac, or a little posterior thereto. It is seen that the orbital membrane is thickened by the development of a number of minute lobules or sacculi. Their saccular nature is easily proved by inflating the orbital cavity, which causes them to stand out distinctly. They collapse again as soon as the pressure is reduced, and cannot be expanded by merely depressing the orbit. Examination of the internal surface of this part of the membranous wall shows a complex arrangement of white muscular bands, forming a network pierced by numerous smaller and larger orifices, one, in a specimen examined, being considerably larger than the rest. The structure is thus essentially the same as that of the organ in *Pleuronectes*, the only difference being in the number of orifices by which the organ communicates with the general lumen of the orbital cavity. A small branch of the V-cranial distinctly terminates on the outer face of the differentiated area.

The organ of the upper orbit, that belonging morphologically to the blind side of the body, is saccular in all Pleuronectids which I have examined, and is invariably larger than that belonging to the ocular side. It is always situate on the blind side, communicating with the cavity of the orbit to which it belongs through a foramen in the skull. In all but *Rhombus*, the organ lies partly in front of the superficial jaw-muscles, immediately under the skin, and partly between those muscles and the skull. In figure 8 the organ of the Halibut is displayed by the removal of the anterior part of the muscles, and by clearing away such part of a great pad of adipose matter as interfered with the view. It is seen that the organ is divisible into an anterior and a posterior limb, the division being due to the effort of the organ to accommodate itself to the available room—viz., in front of and internal to the muscles named. An arrow shows the passage of the anterior limb to a funicular region leading to the foramen through which access is gained to the general orbital cavity. The foramen in question is that between the parasphenoid and the bony bridge formed by the union of the ectethmoid and sphenotic of the blind side; it also gives exit to a palatonasal branch of the V-cranial.

The organ of the blind side in its internal structure is similar to that of the ocular side in such forms as *Pleuronectes* and *Solea*. It is somewhat noticeable that it is rather larger in the Halibut than in any of the species which possess a definite sac-like organ of the ocular side, but the description given for the Halibut is sufficiently applicable to all the forms enumerated except the Brill. In this species the difference is brought about by the more forward extension of the jaw-muscles, which completely overlie the organ. In consequence it is flattened: it is semicircular in outline, the arc being ventral, and communicates with the orbital cavity by a short narrow neck arising from the centre of its dorsal surface. It is smaller than that of any other species mentioned, but agrees with them in internal structure, and is considerably larger than its fellow of the opposite side.

Figure 7 of Plate XXX. shows a dissection which exposes the upper, or left, orbital cavity in the Plaice, a dextral flat-fish, by the removal of a great part of the right and left frontals, including the whole of the bony interorbital septum, and of the right and part of the left ectethmoid. It is seen that the orbital cavities are now separated only by the fibrous band which forms the internal (morphologically ventral) continuation of the interorbital septum. The recti muscles and the optic nerve have been cut through, and the membranous wall of the cavity has been slit along the margins of the eye to allow of the latter being turned forwards. The orbital cavity is thus fully exposed; it is seen to be roughly ovoidal in shape, with a conspicuous funnel-like depression on the left side near the posterior end. The membranous wall, which lines the whole of the cavity, is continued into this funnel, which is the opening into the accessory organ which we have already studied from the other side. A seeker can readily be passed through the opening, and the organ can easily be injected with fluid through the medium of the orbital cavity. It is worthy of notice that the upper orbital cavity is bounded on most sides by structures which yield little or not at all to pressure. In front and behind are the solid walls of the skull; below is the interorbital septum; above, the firm dorsal muscles and anterior interneural spines. On the left or inner side are the coalesced limbs of the left ectethmoid and sphenotic, separated from the parasphenoid by the foramen already mentioned. Thus expansion is only possible on the right or outer side, occupied by the eye, and on such part of the left or inner side as is pierced by the foramen.

The organ is rather richly supplied with blood by a branch coming from the vessel corresponding to the external carotid artery of higher animals. This branch passes to the inner face of the organ, whether left or right, and breaks up into numerous smaller vessels on that surface.

I have already mentioned the large pad of adipose tissue which underlies and more or less surrounds the left organ in the Halibut. It consists optically of a mass of connective tissue very closely beset with minute oleaginous globules. The whole is more or less elastic, and must add considerably to the contractility of the organ it surrounds. To a less extent adipose matter is found in the neighbourhood of the organ of the blind side in most species which I have examined.

I have studied the internal structure of the organ in various species in the ordinary way, by means of microscopic sections, but can find no trace of any glandular structure. The walls of the organ and the interlacing muscular bands are merely lined with ordinary flat epithelium cells. The liquid noticed as occurring both in the organ and in the general orbital cavity is coagulated, by the action of reagents, into a finely granular plasma, taking on a faint pink stain in borax-carmine. It is indistinguishable optically from the substance met with in similar preparations of some of the brain-cavities of young fish.

Professor Howes has drawn my attention to the fact that a similar fluid is met with in mesenteric and synovial cavities, and, in the absence of any definite secretory apparatus, is assumed to be deposited there by the blood-vessels through the medium of the ordinary epithelium cells. It seems permissible to draw the same inference in the case of the organ now under discussion, and to consider that the richness of the blood-supply is associated with the production of the fluid. Similar fluid is present in the orbital cavities of fish in which the *recessus* is not developed, but of course in a less quantity.

Function.

We have seen that the cavity of the orbit and of the *recessus orbitalis* is filled during life with a fluid which has, without doubt, the function of supporting the orbit, since the sinking of the eyes which is always, unless averted by artificial means, to be observed in stale fish, seems to be chiefly due to the coagulation and consequent shrinkage of the fluid contents of the orbital cavities.

It will be familiar to most observers that, whereas in a "round fish" like the Cod the movements of the eye are such as can easily be attributed to the action of the eye-muscles, in flat fish, and especially in the genus *Pleuronectes*, when the fish is at rest or on the look-out for food, the eyes are considerably elevated above the rest of the head. If the fish is frightened by placing some object near the eyes, the latter are suddenly withdrawn into their sockets, but quickly rise again as soon as the cause of terror is removed. By close observation it may be seen that the retraction of the eyes is accompanied by a simultaneous swelling immediately behind the lower eye, *i. e.* in the region occupied by the *recessus orbitalis* of that eye. The swelling disapppears with the subsequent elevation of the eye. If a fresh fish is taken, and the skin removed as in Plate XXX. fig. 5, it will be seen that pressure on the lower eye has the effect of filling the *recessus*, but that as soon as the pressure is relaxed the organ empties itself back into the orbital cavity and the eye rises again. The same connection between the elevation of the eye and the elasticity of the *recessus* can be demonstrated in the case of the upper orbit, by pressure of the upper eye in either a living or a moderately fresh specimen, and no doubt the voluntary retraction of the upper eye when the fish is frightened is accompanied by a swelling of the region of the *recessus* on the blind side. I have not seen this, having no vessel suitable for making the experiment.

Now the eye is an organ of considerable weight, and is furnished with no protractor muscle, and it is impossible that such considerable protraction as one actually observes in the eyes of flat fishes can be effected by the mere relaxation of the oblique and recti muscles.

Further, if the *recessus* of the upper orbit becomes in any way ruptured, the fish is no longer capable of elevating the upper eye, though its fellow continues to be raised and lowered as before.

We have seen that the structure of the *recessus* is such as to impart the greatest possible amount of elasticity to that organ, and I think that beyond doubt its function is simply to protract the eye and to regulate its vertical movements. It acts, as it were, after the fashion of a "push-ball." Assuming the protracted condition of the eye to be the normal state, it is obvious that it could not be retracted, even partly, into the orbital cavity without displacing a corresponding amount of the fluid contents of the latter. In the absence of a special diverticulum this would involve a stretching of the undifferentiated membranous wall; and though this structure is to a certain extent elastic, it is obvious that the stretching could not take place unless the cavity were entirely or mainly surrounded by non-resistant bodies. This, however, as we have seen when examining the topographical anatomy of the *recessus*, is not the case.

It therefore follows that to admit of the retraction of the eye a special diverticulum must exist for the reception of the orbital fluid, and this we find in the *recessus*.

The eye being retracted, we have seen that there is no apparatus more potent than the relaxation of the recti and oblique muscles to re-effect its protraction, and here again the elastic nature of the *recessus* completely supplies the want.

The action therefore, except in so far as it is, or may be, concerned in the deposition of the orbital fluid, is purely mechanical, and appears to be almost, if not quite, involuntary. I qualify the statement thus because it appears to me that flat-fish have their eyes very slightly more elevated when expectant of food than at other times. A fish of the genus *Pleuronectes* usually shows that it anticipates food by bending its body into a crescent shape, the head and tail off the ground, ready for an instant dart; but the greater degree of elevation of the eyes under such circumstances may in reality only signify that a slight contraction of the orbital muscles is characteristic of the resting condition.

An involuntary organ might be expected to show some connection with the sympathetic system, but such a connection I have not found, though I am far from stating that it does not occur. The only nervous supply with which I am acquainted is that derived from the V-cranial, but whether from sensory or motor roots, or from both, is a point which I have not yet investigated. We have seen that the organ is most developed in *Pleuronectes*, moderately so in *Solea*, and least developed in *Rhombus*; and I can say from observation that the power of elevating the eyes is precisely in the same proportion in those three genera. I have had no opportunity of studying the habits of *Hippoglossoides*, as the Long Rough Dab is very difficult to obtain in a healthy condition. The habits of the Halibut are also unknown to me in this respect; but the fact that it shows the maximum development of the left or upper accessory organ and the minimum development of the right or lower organ, amongst the series of forms which I have studied, is very probably due to the greater difference in the level of its eyes, or of its orbital cavities, than in other flat-fishes. The ocular surface of the head is very convex, while the left eye never gets far beyond the ridge, and is consequently at a much lower plane than the right eye. To bring the two eyes to the same level, if that condition is actually attained by the living fish, must certainly need a greater inequality in the elevating apparatus than prevails in any other flat-fish known to me.

The fact that the *recessus* of the eye belonging morphologically to the blind side is the larger of the two in all the species studied is susceptible of a very simple explanation. The eye of the ocular side, the lower eye, has its orbital cavity bounded on the outer side in great part by loose skin and connective tissue, thus allowing whatever elasticity may be possessed by the undifferentiated membranous wall in this region to come into full play when the eye-muscles are contracted. The elasticity of the skin, combining with the pressure of the external element over a surface greater than that of the eye itself, must certainly afford some assistance in elevating the eye as soon as the muscles are relaxed.

In the case of the upper orbit, however, no such aid is forthcoming. We have seen, when examining fig. 3, that the orbital cavity is bounded by walls which are practically rigid. It would in fact be impossible for the eye to be retracted at all if the cavity had no such secondary chamber as is furnished by the *recessus*, and it is therefore by no means surprising that this structure is always most developed in the orbit in question.

The position of the *recessus* of the upper eye on the side of the head to which this eye morphologically belongs seems to indicate that the organ is developed before the union of the ectethmoid and sphenotic of the blind side, a union which does not take place until after the eye has crossed the ridge[1].

Conclusions.

The function of the *recessus orbitalis* seems sufficiently clear, but its homologies must remain in doubt for the present. It is almost certainly homologous with the pouch-like diverticulum of the membranous wall of the orbit discovered by Dr. Günther in *Chorisochismus dentex*. I have examined the examples of this fish which are contained in the National collection and have made a dissection of one. The organ exhibits no features not noted by Dr. Günther, except that it is rather flattened in the case of my specimen. It occupies a position immediately below the eye in a rather large subdermal cavity, which is plainly visible through the skin in all examples. The orifice by which it communicates with the orbital cavity is of moderate width, perhaps wider than in the case of any flat-fish which I have studied. Internally I could see no distinct muscular bands; but the walls of the sac are rather stout, and appear to be muscular. As the specimen has been for many years in alcohol, which had no means of reaching the sac except through the tissues, it is quite possible that the internal parts may be to some extent altered by decomposition, and that muscular bands similar to those of the *recessus* in flat-fish may have originally been present. Slight pressure of the eye caused the discharge into the sac of a considerable amount of opaque yellowish matter, evidently decomposed tissue of some sort.

It is evident, by comparison of the specimens, that the eye is capable of some vertical movement, and it appears most likely that the sac is functional in the same way as the *recessus*.

The difference in position is merely such as might be brought about by the rotation of the eyes in Pleuronectids. This is plainly indicated in the posterior displacement which takes place in the choroidal notch of the lower eye in a metamorphosing flat-fish larva, and the *recessus* in the adult appears merely to have retained

[1] Since this was written my attention has been drawn by Professor Howes to some observations of Dr. Georg Pfeffer (Verh. Deutsch. zool. Gesell. 1894, p. 83), in which the formation of a bony orbital wall on the blind side of the upper eye is recorded as a regular feature in the development of the skull after that eye has completed its transit.

what was presumably its original relationship to the morphologically ventral side of the eye.

Dr. Günther considered that the structure he described might represent a *saccus lacrymalis*, but I do not see there is any reason to regard the *recessus* of flat-fishes in that light. The *saccus* is a superficial structure developed altogether outside the eye, never acquiring any but a topographical (and physiological) relationship therewith. It is always in intimate relationship with the lacrymal scute; but no flat-fish with which I am acquainted possesses anything that can be homologized with this scute, while such other fishes as I have examined, which do exhibit structures to which that name has been applied, show no trace of an accessory visual organ.

The lacrymal gland suggested itself to me at one time as a possible homologue; but beyond a certain similarity of position, of innervation, and of blood-supply, there is little evidence in favour of this hypothesis either. The lacrymal gland arises in Mammalia as a solid outgrowth of the conjunctival epithelium into the underlying connective tissue, subsequently becoming hollowed out to form the cavities of the gland and ducts [1], and never enters into any relations with the inner orbital cavity. Of the development of the *recessus* I have no knowledge; but if it is ever connected with the conjunctival region, the position of the organ of the upper orbit shows that this connection must be lost at a very early period prior to the migration of the eye. If a gland at all, it is destitute of glandular epithelium, or, at all events, I have failed to find any.

It is, of course, equally possible that a gland might in process of evolution take on new functions and lose its glandular nature, or that a non-glandular ancestral structure might become specialized for a glandular function; but, in the absence of any information as to the origin of the lacrymal gland of higher animals, speculation on this point is more or less idle.

From what we have seen of the anatomy of the *recessus* in its fully developed condition, it appears to me most reasonable to regard it merely as a part of the ordinary membranous wall of the orbital cavity, specialized to perform certain definite functions in connection with the elevation of the orbit, and not homologous with any organ known to exist in the eye-apparatus of higher animals, and I have been guided by this opinion in my choice of a name. It may probably occur rather widely in Telosteans which have the habit of burying themselves in the sand. Of such forms I have only examined *Trachinus draco* and *T. vipera*, in both cases with negative results.

In conclusion, my thanks are due to my friend and teacher, Professor Howes, for many valuable suggestions.

[1] *Cf.* Kölliker, Entwick. des Mensch., Leipzig, 1879, p. 699. I am indebted to my friend Mr. M. F. Woodward for this and other references bearing on the same subject.

III. On an Adult Specimen of the Common Sole (*Solea vulgaris*, Quensel) with Symmetrical Eyes, with a Discussion of its bearing on Ambicoloration.

The specimen forming the subject of this note was obtained in the Grimsby Fish-market in the autumn of 1892. It was caught in the North Sea, but on which particular fishing-ground I could not find out, nor is the matter of great importance.

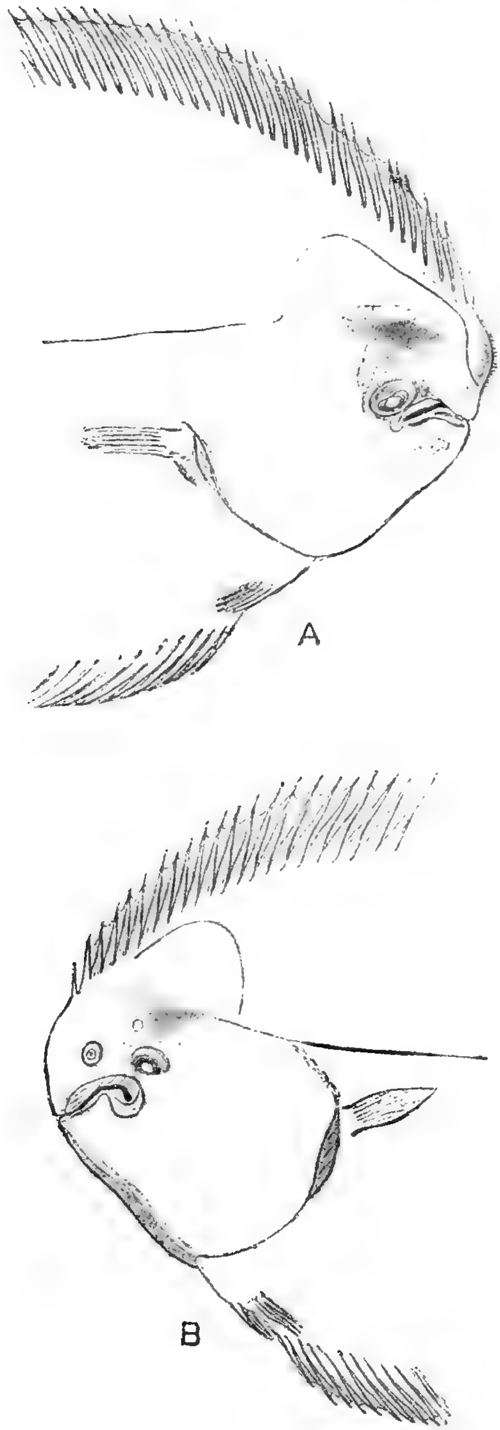
It measures $15\frac{1}{4}$ inches in total length, the head is $2\frac{1}{2}$ inches long, and the greatest height of the body is $5\frac{5}{8}$ inches. The total length without the caudal fin is $13\frac{3}{8}$ inches. The specimen may therefore be said to have the normal proportions of a Sole of that length. It is a female, and it is apparent, from the condition of the germinal epithelium and from the presence of a few ripe but decomposing ova in the ovary duct, that it had spawned in the preceding spring or summer.

Of the right or upper surface it may be sufficient to say that the only point in which it differs from a normal example is in the absence of the upper or left eye. In the normal adult of this species, as is well known, the upper eye is about an eye-length above and about half a length in front of the lower or right eye, occupying the front portion of an ovoidal depression, quite visible in living fish and even more conspicuous in spirit preparations.

In the example before us, the depression is present, but the eye is wanting. The only other point, one which would not in itself attract particular notice in an otherwise normal example, is that the final curve of the dorsal cephalic branch of the lateral line is rather less abrupt than usual. The scales being omitted in fig. A, this structure is shown as a bold line, which, of course, it is not in the actual condition. It will be understood that scales are present wherever they are found in normal examples, extending also over the site normally occupied by the upper eye. The dorsal fin extends forward to the normal extent, and the number of its rays, 87, is within the known limits of variation in normal examples of the species. The pigment of the upper side is perfectly normal.

Turning to the left or under surface, we find the divergence from the normal type again practically limited to the eye. Amongst minor points, the posterior opening of the nostril of this side is very slightly in rear of its usual position, and a downward curve of the lateral line, which, starting at the same point as the dorsal cephalic branch, passes, in some normal Soles now before me, in an almost semicircular sweep to the posterior region of the mouth, cannot be detected in the abnormal example. But as this structure, and also the dorsal branch, is altogether omitted in Cunningham's figure of the blind side[1], it may be presumed that it is not always noticeable even in normal specimens. A slight extension of pigmented and scaled skin on to the under surface of the head (fig. B) below the mouth is due, as I suppose, simply to the action

[1] 'A Treatise on the Common Sole,' Plymouth, 1890, pl. v.



A. Adult Sole with symmetrical eyes. Anterior region from right side: scales and pigment omitted. $\times \frac{1}{2}$.
B. The same from left side: scales and sensory filaments omitted. $\times \frac{1}{2}$.

of the preserving fluid. The scales and sensory filaments of the under surface are perfectly normal, subject to the trifling exception just noted, and have therefore been omitted from fig. B. It may be remarked that in North-Sea Soles filaments extend on to the bases of the first few dorsal fin rays, but otherwise have the same distribution as is depicted in Cunningham's figure.

The left eye is situated nearly opposite to the right eye, but is slightly dorsal to it, and about half a length further back. Relative to the mouth the two eyes occupy nearly the same position, the difference being accounted for by the greater length and dorsal displacement of the gape on the left side. But, whereas on the right side the whole of the iris is exposed, and the whole eye is somewhat elevated and within certain limits freely movable (either by the muscles or by the peculiar mechanism dealt with in the previous section of this paper), on the left side the eye is to a great extent embedded in the skin (see fig. B). Only about half the iris is visible, and even some part of the lens is obcluded, and the sensory filaments, which extend right up to the cornea on the ventral side, must, when erect, have considerably interfered with the animal's vision. The whole eye is antero-ventrally rotated from what we may suppose to have been its original nearly lateral aspect, and I should think the fish could see but little except in the directions indicated, while the prominence of the lips must have been a further impediment to its sight. No movement could have been possible except such as involved a general movement of the skin in this region; but, as the skin is always loose here to allow of the expansion of the accessory visual sac, one may suppose that the eye may have been shifted to whatever extent the length of the eye-muscles permitted. The appearance it presents is that of being gradually overgrown by the skin, or of being withdrawn by some internal agency within the tissues of the head.

The whole of the left surface of the fish is absolutely devoid of pigment, with the exception of a slight extension of colour below the mouth, which I have already attributed to post-mortem changes, and of certain patches of colour on the caudal fin and a small dark spot near the posterior end of the body. Such markings of the extreme posterior region of the under surface are, however, as often present as absent in normal Soles.

The left eye is as bright as its fellow of the opposite side and of the same colour, and, staring out of a dead white surface, presented rather a bizarre effect in the fresh condition.

The whiteness of the underside is perhaps one of the chief peculiarities of the specimen. The Cyclopean condition, comparatively common in the Flounder (*Pl. flesus*) and, according to my own experience, commonest of all in the Turbot (*Rh. maximus*), is always accompanied by a more or less complete pigmentation of the blind side. In fact, as has been pointed out by Cunningham and MacMunn[1], complete ambicoloration has been observed only

[1] "On the Coloration of the Skins of Fishes, especially of Pleuronectidæ," Phil. Trans. 1894, p. 806.

in specimens exhibiting the Cyclopean malformation: behind a line drawn through the preopercular keel the blind side may be almost entirely coloured in Turbot which are otherwise perfectly normal [1]. Now the Cyclopean condition may be described as the failure of the anterior part of the dorsal fin, and of the interneural bones and muscles belonging to it, to become united to the top of the head, accompanied with a partial, if sometimes very slight, arrest of the normal transit of the upper eye. No one has had an opportunity of watching the development of a Flat-fish so deformed, but the variability in the different phases of metamorphosis which one notices in looking over a collection of partly symmetrical larvæ suggests a more or less plausible explanation of the mere mechanical process. Each part appears, as it were, to change independently, so that, assuming a slight want of harmony in the movement of the upper eye and the forward extension of the dorsal (whether by retardation of the first or acceleration of the last), it is conceivable that a condition might arise in which the eye would obstruct the progress of the dorsal, and so compel its anterior extremity to project instead of proceeding as usual along the top of the head. Since the dorsal wall of the upper orbit is formed in normal specimens (of the Turbot) by the base of the dorsal, the failure of the latter to advance in the normal manner would leave the eye devoid of its usual support, so that it would rest, as it actually does in Cyclopean specimens, against the ridge of the skull, and so be more dorsally and less laterally directed than in normal examples.

The authors referred to arrive at no conclusion as to why Cyclopean examples should be ambicolorate, but (p. 808) reject Giard's theory that young fish so affected remain pelagic for a longer time than usual, and so expose the blind side longer to the light, whereby it retains its pigmentation instead of becoming colourless. In this I am inclined to agree with them, but since we know from Mr. Cunningham's own observations that metamorphosing Flat-fish, if pelagic, swim in such a position as to keep both eyes in one horizontal plane [2], it would seem to follow that in young Cyclopean examples, the period of pelagic life being the same, the change in position is never carried to quite the same extent as in the case of normal larvæ. Hence the side normally colourless in the adult would be a little more exposed to the light, without any elongation of the pelagic period. It can hardly be contended, however, that a difference so comparatively trifling is sufficient to account for so marked a discrepancy in the coloration of all Cyclopean and most normal Turbot.

Another abnormality, exemplified by a Turbot and a Brill in my possession, is referred to by Messrs. Cunningham and McMunn (p. 807), from a description of the Brill, at that time living in the Cleethorpes aquarium, communicated by myself. In these specimens the eyes are normal, but a short portion of the anterior end

[1] See postscript, p. 446.
[2] Nat. Science, vol. i. March 1892.

of the dorsal is free. Besides the specimens in question, I have seen similarly malformed Turbot on several occasions in the Grimsby market, and have no doubt but that the malformation is common enough. As the authors remark, this condition differs from the Cyclopean only in degree, and I would suggest that the explanation offered above as to the process of development of the Cyclopean malformation is equally applicable to that now under consideration, allowing, of course, for a less degree of want of harmony in the metamorphosis. But, again, quoting Messrs. Cunningham and MacMunn, "it is a very great difference of degree, and does not contradict the conclusions . . . . formulated as to the correlation of the typical malformation with ambicoloration." That is true enough, but since the partial malformation is not necessarily accompanied by ambicoloration, it would seem possible to restrict the correlation to the abnormality of the eyes.

The Brill, as described by the authors, is colourless on the blind side, except for a small patch of pigment just behind the notch of the dorsal, and continuous, through the notch, with the pigment of the ocular side. The inner face of the notch is rounded, there being no abrupt line of demarcation between the ocular and blind sides; and I am inclined to regard the intrusion of colour as due simply to a migration of chromatophores. Pigment commonly extends on to the blind side of the ventral part of the head in *Pl. microcephalus*, the ventral edge being in this form rounded instead of somewhat abrupt. I have also a young Plaice (*Pl. platessa*) which has in some manner been cut through down to the backbone. The wound has healed without the anterior and posterior regions re-uniting, and a certain amount of pigment extends through to the blind side. I think it may therefore be assumed that the Brill is practically normal in the coloration of the blind side.

The Turbot has a good deal of pigment on the posterior region of the blind side, but others, with a similar hook of the dorsal, I have noticed to be entirely colourless on the blind side, and pigment, as noticed by the authors referred to and others, occurs so commonly, and sometimes to so considerable an extent, on the blind side of otherwise perfectly normal Turbot that there is no reason to suppose that the malformation of the dorsal in this particular specimen has any necessary connection with its partial ambicoloration.

The authors mention the frequent occurrence of Turbot and Brill with a row of spots along the interneural and interhæmal regions of the blind side, and certainly, in the North Sea, Brill so marked are extremely plentiful. I have not observed it so commonly in Turbot, the reason being, as I supposed, that such spots are usually marked by a more or less diffuse arrangement of the pigment in ambicolorate Turbot. I do not find any suggestion that these markings of the blind side of the Brill are precisely those which are the most conspicuous in the metamorphosing and pelagic stage, yet such, in fact, is the case. In almost all flat-fish there is a tendency, even before the yolk is absorbed, towards an arrangement of the pigment into several series of patches, transverse to the long axis of the body. Each series consists mainly of a group of chromatophores on the dorso-lateral and ventro-lateral regions of the trunk, and is completed by corresponding groups on the dorsal and ventral parts of the marginal fin [1]. The pigment is, of course, equally developed on either side, and, as the body of the larva increases in depth and the basal ridges of the median fins appear, the chief colour-patches extend on to these, and ultimately come to be confined almost entirely to these areas. Between the primary patches of each ridge, secondary markings commonly make their appearance and shortly become little inferior to the original. The process is illustrated, incidentally, in the drawings of almost every author who has studied the development of flat-fish. The Brill, so far as I am acquainted with its ontogeny, exhibits these spots as conspicuously as any metamorphosing larva, and more so than the Turbot, in which the early development of a diffuse body-pigment tends to mask them somewhat. Nevertheless they are easily visible in the later pelagic stages of that form, and can be made out, even on the blind side, in a specimen the eye of which has arrived at the ridge of the head, and in which, of course, the pigment of the blind side is considerably less abundant than that of the coloured side. On the ocular side of a Brill at a similar stage of cephalic metamorphosis they are shown clearly enough by Cunningham in his 'Treatise on the Common Sole' (pl. xv. fig. 5).

In later life in both the species mentioned, as also in most other flat-fishes, the dark spots cease to be conspicuous, the lighter intervening areas being the only markings which attract attention in half-grown and adult fishes (on this part of the body). In the Topknots, however, the markings remain visible throughout life in *Rh. punctatus* and *Phr. unimaculatus*, while in full-grown *Rh. norvegicus* they are as conspicuous as in the younger stages of any Pleuronectid.

The Brill of which we have been speaking less commonly exhibit another marking on the blind side, in addition to the rows of spots on the interspinous ridges. This is situated on the lateral line rather behind the middle of the body. A mark is very usually present in this position in metamorphosing flat-fish of other species, and in the Brill it persists as a rather large roundish black spot on the ocular side in half-grown and perhaps also in full-grown fishes, though I have not myself observed it in the latter. It corresponds in position to the ocellus of *Ph. unimaculatus*, to the posterior spot of *Rh. punctatus*, and to a similar marking in *Rh. norvegicus*.

[1] Such an arrangement of the larval pigment is by no means confined to the Pleuronectidæ, and any deductions that may be drawn as to the ancestral significance of such pigmentation may probably be capable of a wider interpretation than that which, for the purposes of the present paper, I have thought necessary to suggest for them.

We have therefore, in the ambicolorate but otherwise normal Brill, a reproduction on the blind side of those markings which are most conspicuous in the young of the same and of most other species of Pleuronectids, and which are characteristic, of course on the ocular side, of the smallest species of the genus *Rhombus* and its immediate allies. I wish to draw especial attention to these facts, as I consider that they have a distinct bearing on the interpretation of the phenomenon of ambicoloration.

Mr. Cunningham, in the Royal Society memoir so frequently referred to, establishes the fact that pigment can be produced by the action of light on the colourless under surface of an already metamorphosed flat-fish, noting, at the same time, the great variation which exists in the susceptibility of individuals to this treatment. The authors reject, however, the hypothesis that the ambicolorate condition so commonly met with can also be explained as due to the action of light, since there is "not the slightest evidence at present that these abnormal specimens have been exposed to abnormal conditions, or have had abnormal habits of life," and, for my own part, I most certainly agree with them in the main. There is, however, one colour abnormality, so common as perhaps hardly to merit such a designation, which I think is probably due to the action of light. This is the presence of more or less pigment on the blind side of the median fins. It may be present merely in the form of irregular dull streaks or splashes, as in the caudal fin of the Sole, which forms the subject of this paper, or it may be developed to such an extent that practically the whole of the marginal fins are coloured. This last condition is exemplified by a Dab (*Pl. limanda*) in my possession, but the pigment of the blind is as brilliant as that of the ocular side, and there are a few bright spots on the blind side of the body as well. I find no difficulty in attributing such a dull and partial pigmentation as is present on the caudal fin of the Sole to the action of light through the transparent tissues of the fin, but the brilliant coloration of the Dab's fins, associated, as it is, with a partial, if very slight, development of colour on the non-transparent body, seems to require some further explanation.

Messrs. Cunningham and MacMunn find a difficulty in accepting reversion or atavism as an explanation of the ambicolorate condition, in that the hypothetical vertically swimming ancestor of the Flat-fish must have "had an unpigmented white or silvery ventral surface, as other symmetrical fishes have," whereas completely ambicolorate flat-fish are uniformly pigmented all over. The difficulty certainly arises if we assume that the ancestor really was paler on the ventral region than elsewhere; but is it not equally reasonable to assume a stage of evolution in which the fish resembled such forms as *Platax* or *Dascyllus*, to take instances from families widely separated from each other by systematists? Both forms have high compressed bodies, and in some species, at any rate, in both genera the ventral region is as deeply pigmented as the dorsal. Even in the John Dory (*Zeus faber*), in which the ventral abdominal region is flattened, it is nevertheless rather darkly pigmented, and to me it certainly seems more probable that the Pleuronectidæ of the present day began to take on their asymmetrical characters as compressed and uniformly coloured forms than in the condition of ordinary round fish.

A feature which appears to me to be of the highest importance is the fact that ambicolorate fish appear to be always what one may term "ambiciliate" also. That is to say, whenever pigment is found on the blind side of a fish, the scales in that region are as rough as those of the other side (in such forms as exhibit asymmetry in this respect), or, at all events, are rougher than on the blind side of normal examples of the same species. The Turbot, for instance, which normally has no spines on the blind side, always possesses them if ambicolorate. They are usually confined to the pigmented region, but may occur also on the white part of the skin, but only, according to my own experience, in specimens which exhibit some pigmentation or other of the blind side [1].

I am not aware that it has been contended that the action of light can have any effect on the development of the spines or scales, and Mr. Cunningham's experiments yield no information on the subject, since in his most perfectly coloured Flounders (*op. cit.* pl. 53) practically no pigment manifested itself in the regions corresponding to the site of the only tubercles which British examples of *Pl. flesus* possess. If we admit the inefficacy of light in this respect, it becomes evident that we are dealing with a phenomenon in which the pigmentation is not the only element of importance. The reversion, in fact, if such it is, extends to the derma generally, and not merely to its power of producing the various elements of coloration.

I have shown [2] that the Turbot in its early pelagic stages is possessed of a very powerful cephalic armature, and that the larvæ of another sinistral form, perhaps the Brill, are equally well armed, though in a different manner [3]. It is possible to regard these cephalic spines either as protective structures, in essential relation to the pelagic period of existence, or, perhaps with greater probability, as of merely ancestral significance. In a future communication I hope to be able to show that the dermal spines or tubercles of our British Turbot are undergoing, or have undergone, a reduction in number, so that the condition of the

[1] I am speaking now of British examples only, since Turbot from the Norwegian Fjords not uncommonly possess spines on the colourless blind side. Norwegian Turbot, however, are much more profusely spined on the ocular side than their British allies, and the spinulation of the blind side, when present, is always much inferior to that of the other. I have never seen an ambicolorate example from Norway; but only a few hundred fish have come under my notice, and it is possible that "double" specimens may have been withdrawn by the consignors, since such are not supposed to have a high market value, except for naturalists. Besides being more spinous, these Turbot appear to be also considerably smaller than our own.

[2] Journ. M. B. Assoc. 1892, p. 402.

[3] Trans. R. Dubl. Soc. v. 1893, pl. xii.

spines in the smaller Norwegian examples is the more ancient. Since symmetry of dermal armature must have been as characteristic of the hypothetical Pleuronectid ancestor as symmetry of colour, the presence of spines or tubercles on both sides of ambicolorate flat-fish seems to me an important evidence of reversion; further, the fact that when colour is present on the blind side of the Brill (and also of the Turbot, though the feature is less conspicuous) it commonly assumes the distribution characteristic of the young stages of nearly all Pleuronectids, and of the adult stages of the Topknots (the smallest and most strongly ciliated, and probably the most primitive of its allies), appears to strengthen the case considerably.

A difficulty undoubtedly arises in the want of any known instance in which ambicoloration has been accompanied by a development of the muscles of the blind side equivalent to that which takes places on the coloured side, or of equal development of the pectoral fins. The dermal tubercles, however, even in Cyclopean Turbot, are never developed on the blind side to an extent corresponding to that of the ocular side, so that at best only a partial reversion can be argued for any feature which manifests itself in ambicolorate examples.

In partially ambicolorate specimens, in which the pigment of the blind side is irregular, and not arranged in definite series of markings, as in the Brill, the theory of reversion would inculcate that the reversion to colour-activity and symmetry of scales is confined to certain areas of the derma. Total ambicoloration, as Messrs. Cunningham and MacMunn remark, has only been recorded in association with the Cyclopean condition. It appears to me that this may possibly imply that the reversion is so general that it has affected the normal metamorphosis, that there is in fact a partial reversion to symmetry of the head (as well as to symmetry of the pigment and scales) exemplified by such a want of harmony in the migrations of the eye and dorsal fin, as I have already suggested may be the mechanical cause of the Cyclopean result.

It is evident, however, from the usually normal colour condition of specimens in which the structural abnormality of the head is confined to the projection of a small part of the dorsal, that such abnormality is not necessarily accompanied by any tendency towards a reversion of pigmentation, nor does it appear to be indicative of even the slightest reversion towards symmetry of the head.

In the Sole now under consideration, as we have seen, the under surface is white. The muscles of the blind side are reduced in the normal manner, and the ciliation of the scales is feeble. The dorsal fin has completed its usual forward migration, but the eyes remain practically symmetrical.

We have seen that there is no reason to suppose that ambicolorate examples, whether Cyclopean or structurally normal, differ in any of their habits from perfectly normal fish, since Cunningham's observations of the behaviour of a living Cyclopean

Plaice rebut such a supposition, while no evidence is forthcoming in its favour. The same authority has also failed to detect any difference in the habits of partially ambicolorate but structurally normal fish. Plaice and Flounders, more or less coloured on the underside, are extremely common in the Humber, and having kept a considerable number of such fish in the Cleethorpes tanks and watched their behaviour attentively, my own experience is precisely to the same effect as Cunningham's. The young Brill, with the hooked dorsal, structurally abnormal but not ambicolorate, differed in its habits in no respect from several normal Brill of about the same size, taken at the same place, and kept in the same tank.

Of the habits of the Sole under discussion I have of course no knowledge, the fact that it was trawled in company with a number of normal examples being of little value, since I have occasionally trawled such essentially pelagic fish as Mackerel and Herrings. The complete asymmetry of everything but the eyes seems, however, to refute the idea that it could possibly have maintained a vertical position, and the complete absence of pigment from the blind side of the head and trunk would seem, in the light of Cunningham's investigations, to show that that side could not have been exposed to the light, unless the susceptibility of the individual were so slight that the power of pigment-production was practically lost by the derma of that side.

The bearing that the condition of our specimen has upon the question of ambicoloration, into which I have entered at so great a length above, appears to me to be this,—that the phenomenon of complete ambicoloration, as typified by some Cyclopean Pleuronectids, cannot be held to depend on the mere arrest of the migration of the eye, unaccompanied by other structural abnormality [1]. The proposition, as laid down by Cunningham and MacMunn, that complete ambicoloration occurs only in Cyclopean examples, is in no way affected thereby, but, as it seems reasonable to suppose that any abnormality of habit (whether in the pelagic or later stages), such as Giard [2] considers to exist in Cyclopean Turbot, would surely be intensified in a specimen like that now before us, I should say that the theory of the French observer may be considered to be finally disposed of.

Anatomical Features.

Most of my superficial and all my subdermal observations were made after the specimen had been some months in alcohol.

On removing the skin from the right (normally the ocular) side

[1] That ambicoloration may exist in a specimen not essentially differing in external characteristics from the Sole now under consideration is shown by a young Turbot in the St. Andrews Museum, described and figured in the 'Fauna of St. Andrews Bay' by Professor McIntosh. The specimen is only a few inches in length and normally developed, except that the eyes are on different sides of the head, and pigment exists on both sides of the body.

[2] "Sur la Persistance partielle de la Symétrie bilatérale chez un Turbot," C. R. Soc. Biol. Jan. 22, 1892, p. 31, and Nat. Sci. i. 5, p. 358.

of the head the disposition of the muscles was found to be almost normal, the only difference being that the ventral face of the anterior dorsal muscles, which normally exhibits an almost semicircular indentation for the reception of the dorsal hemisphere of of the upper orbit, is, in the specimen before us, only slightly concave in the same region. The space usually occupied by the upper eye was filled with a mass of connective tissue, and to some extent also by an extension of a pad of gelatinous and adipose matter, which is always found above the right nasal organ. Removing this, the right ectethmoid and the interorbital septum have the usual appearance from this aspect, and the right orbito-nasal nerve is seen passing as usual below the anterior notch of the left ectethmoid. There is nothing in the condition of the right orbital apparatus that calls for remark. The bony ridge on the left edge of the top of the skull is, as usual, united to the ventral face of the dorsal muscles, and to the great sickle-shaped ligament-bone [1] imbedded therein, by a very tough white ligament.

The morphology of the Pleuronectid skull having been very clearly defined by Traquair [2] many years ago, and that of the Common Sole having received special attention in Mr. Cunningham's monograph on that species, it is unnecessary for me to refer except very briefly to the normal features of its component parts. In any Flat-fish the top of the skull in the orbital region consists of two bony ridges. Of these, that on the side of the fish occupied by the eyes consists of the interorbital septum formed by the coalesced anterior limbs of the two frontals (very unequally developed of course) running forward to the ectethmoid of the ocular side. The opposite ridge, that of the blind side, is the pseudomesial process of Traquair, formed by the union of an anterior process of the sphenotic of the blind side with a posterior process of the ectethmoid of the blind side, and between these two ridges is the upper orbital cavity, the optic nerve and oblique and recti muscles thus reaching the eye. Accordingly in the normal Sole we find the nerve and muscles of the left or upper eye to the right of the pseudomesial process.

In the abnormal Sole, as I have already mentioned, the eye is *not* on the right side of this process, and in fact is completely shut off from the right side of the head by the fibrous connection of the process to the ventral face of the dorsal muscles. In fact, all that is to be seen of the left orbital apparatus consists of the

[1] This bone, which supplies a firm base of attachment for the dorsal muscles to the skull, is not found in *Rhombus* and *Pleuronectes*, the genera to which the observations of Cunningham and MacMunn limit the occurrence of the Cyclopean malformation. It is possible that its presence in the Sole may supply the wished-for structural peculiarity correlated to the non-occurrence of the malformation in *Solea*, since, as the authors remark, the dorsal fin in *Solea* actually extends further forward than in the Turbot, and much further than in the Flounder, both of which are commonly Cyclopean (see these authors, *op. cit.* p. 806). It may be remarked, however, that the burrowing-habits of the Sole might well preclude the survival of specimens so malformed, since the longish dorsal hook would be a serious inconvenience.

[2] Trans. Linn. Soc. Lond. xxv. p. 263.

proximal parts of the two oblique muscles, which are, as usual, attached to the posterior face of the expanded front part of the left ectethmoid; these muscles are seen to pass to the eye to which they belong by dipping under the pseudomesial process.

On turning the specimen over and laying bare the left side of the skull, it is found to have the appearance shown in Plate XXX. fig. 9; a figure of the skull of a normal Sole (fig. 10) is added for purposes of comparison.

Below the pseudomesial is seen in either specimen a tolerably large foramen, which is considerably largest, however, in the abnormal fish. It would appear from Mr. Cunningham's figure (*op. cit.* pl. xi. fig. 6) that it may be much smaller in normal Soles than in the specimen from which my drawing was made, but the bones of Teleosteans are notoriously variable. This foramen in normal Flat-fish, as we have seen in the second part of this paper, puts the left accessory visual organ into connection with the left orbital cavity and gives exit to a cranial nerve.

In the specimen before us, however, the whole of the left orbital apparatus protrudes through this foramen, the left accessory visual organ being rather backwardly displaced. It was not very well preserved, and I did not ascertain the position of its opening into the orbital cavity, but this appeared to be external to the skull. The eye itself is resting internally against the left ectethmoid and the anterior part of the pseudomesial. The length of the oblique muscles does not allow it any outward displacement, and the width of the foramen is not sufficient to allow it to be drawn inwards. The recti muscles pass to their usual place of insertion on the inner face of the parasphenoid, and the optic nerve to its origin on the ventral face of the brain.

Comparing the normal and abnormal skulls from the left side we find only two points of difference, viz. (*a*) the foramen is largest in the abnormal example, (*b*) the left ectethmoid is less developed and lacks the usual antero-dorsal prominence in the abnormal example.

That the left ectethmoid has nevertheless undergone the usual rotation is shown by the position of the insertions of the oblique muscles. We have already noticed from the outside that the eye is partially withdrawn from the surface. Internally its connection with the skin is very slight, in fact it is difficult to avoid separating the outer from the inner layer of the cornea in making the necessary observations. The mandibulary branch of the V-cranial, passing directly below the eye-muscles, appears in some degree to restrict the eye to the position it now occupies.

To recapitulate, we have before us a specimen in which there has been practically no migration of the left eye, and yet in which the skull presents, save for a slight deficiency in the left ectethmoid, all the characters which one finds in a specimen in which the usual migration has taken place. The rotation of the mouth-apparatus is quite normal, but I have omitted to consider this because, as Cunningham truly remarks, it is a feature entirely independent of that of the orbital part of the skull.

There is, as it were, an attempt on the part of the eye to get to the right side of the head by passing through the tissues, as in the larval *Plagusia* or, at any rate, in the Pleuronectid larvæ which Steenstrup and, subsequently, Agassiz, whether correctly or incorrectly, attributed to that genus[1]. This process, however, has been frustrated by the interposition of impenetrable bony structures. The Sole has been shown, independently by Raffaele[2] and Cunningham[3], to be one of the flat-fishes in which the migration of the eye is throughout external[4], and this interposition of the pseudomesial process coupled with the constant presence in all flat-fish of one of the accessory visual organs on the blind side of the head, lends support to the view that the union of the ectethmoid and sphenotic of the blind side cannot take place until after the eye has passed the ridge of the head[5].

Conclusion.

It remains for us to consider, as briefly as may be, what light our specimen throws upon the theory of Pleuronectid evolution. The rotation of such part of the skull as is in intimate connection with the eyes is attributed by Mr. Cunningham (Treatise &c. pp. 52, 53) to the heredity of a character acquired by the efforts of an originally symmetrical fish to look with its lower eye beyond the edge of its head: in fact, "to the accumulation, by inheritance,

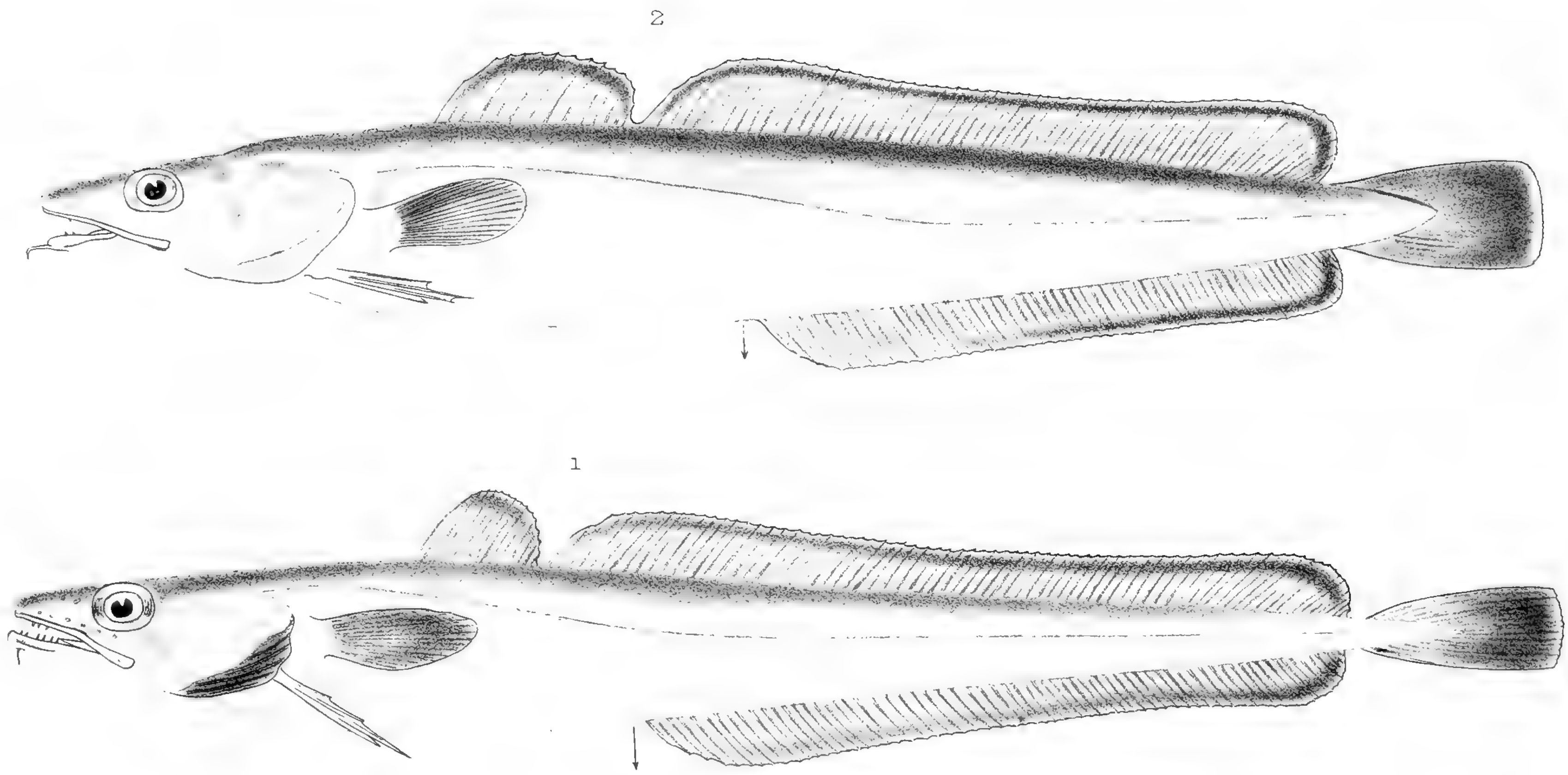
[1] "Development of the Flounders," Proc. Am. Ac. Arts & Sci. xiv. 1878, p. 7.

[2] Mitth. zool. Stat. Neap. Bd. viii. tav. iii. figs. 8, 9.

[3] Journ. M. B. Assoc. N. S. vol. ii. no. iv. p. 327, pl. xiv. fig. 2.

[4] It is somewhat surprising, until, by perusal of his work, one has become accustomed to his consistent neglect of recent authors other than Scandinavian, to find that Professor Smitt (Hist. Scand. Fishes, ed. ii. 1893, p. 365) still considers that the Common Sole is probably one of the forms in which the dorsal fin, or at all events its predecessor, the embryonic vertical fin, extends so far forward on the dorsal edge of the head that the eye must force its way under the base of this fin. In support of this assertion he appends a figure (*loc. cit.* fig. 103), after Malm, of a young Sole 12 mm. long, in which both eyes are already on the right side of the head. The base of the permanent dorsal fin is clearly enough shown to commence at a point marked x, which is about opposite the posterior margin of the upper eye; in front of this a point y is shown on the dorsal profile of the head, and x–y is said to be "that part of the future base of the dorsal fin under which the left (upper) eye has probably passed." So far as one can judge by the drawing, all that part of the dorsal profile in front of the point x is in reality formed by the skin simply, and not by an anterior prolongation of the embryonic fin. Besides overlooking the work of Raffaele and Cunningham already referred to, Smitt is evidently unacquainted with those observations of the Italian zoologist which show that the cephalic prolongation of the dorsal fin is brought about by a forward migration of the fin-rays and interneural elements, and not by the formation of new fin-rays. The figure, showing as it does the anterior end of the true dorsal fin (at the point x), is of some value, since it completely proves the fallacy of the theory it is intended to support. I need hardly say that this criticism is intended to apply only to the compiler, since Malm's observations were prior to those of Raffaele and Cunningham.

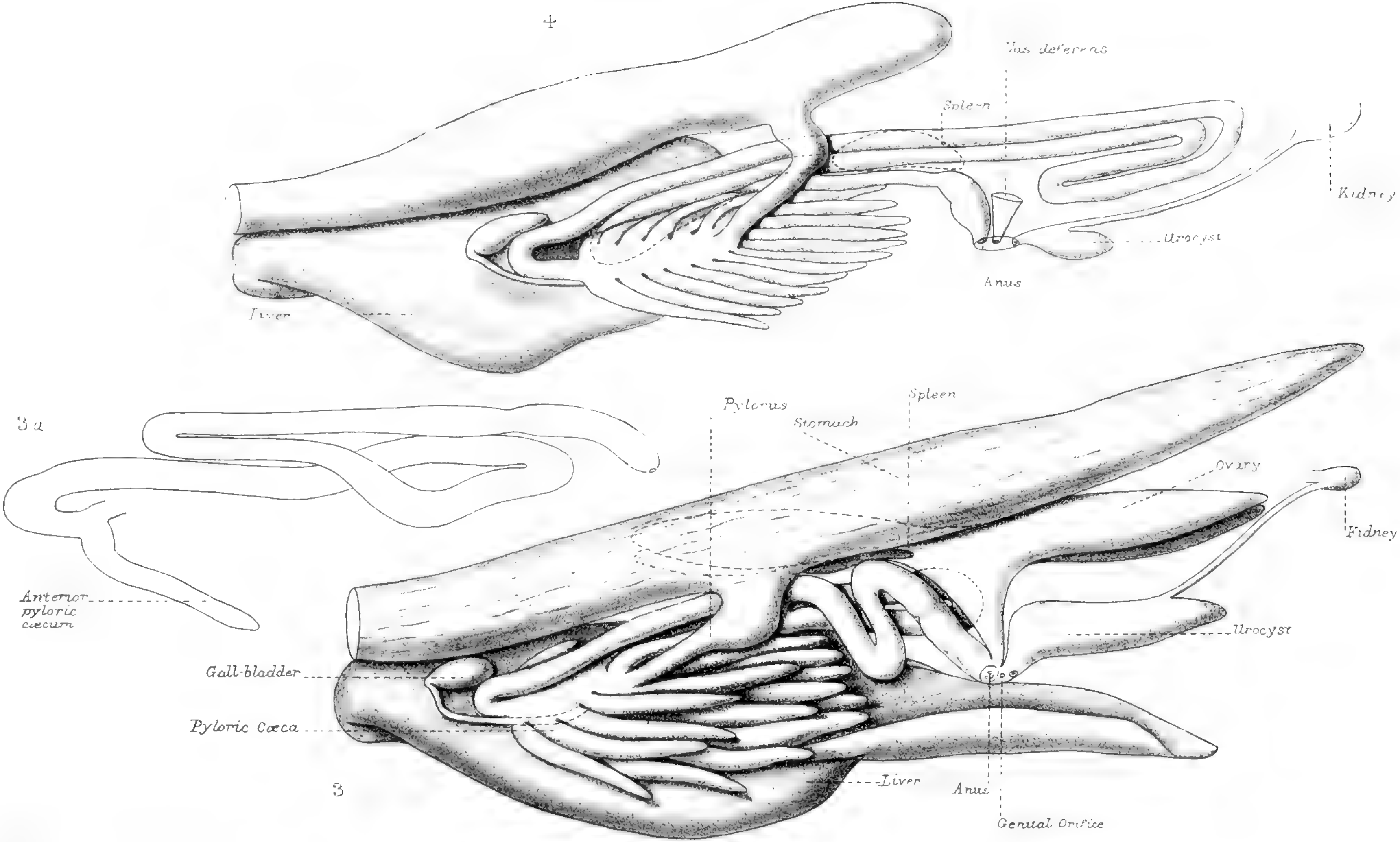
[5] The correctness of this view is confirmed by the observations of Pfeffer, alluded to in the second part of this paper.



E.W.L.H. del. ad nat.
M.P. Parker lith.

Fig.1. Molva abyssorum. Fig.2. Molva vulgaris.

West, Newman imp.



E.W.L.H. del. ad nat.
M.P. Parker. lith.

West, Newman imp.

Abdominal viscera of Molva. Figs. 3-3a. M. abyssorum. Fig. 4. M. vulgaris.

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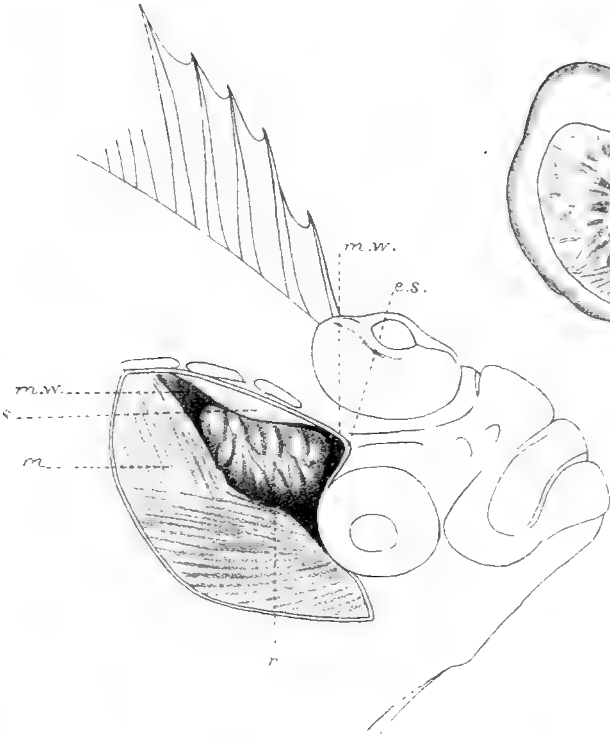

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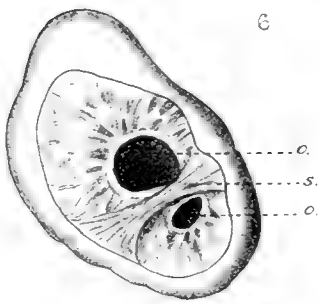

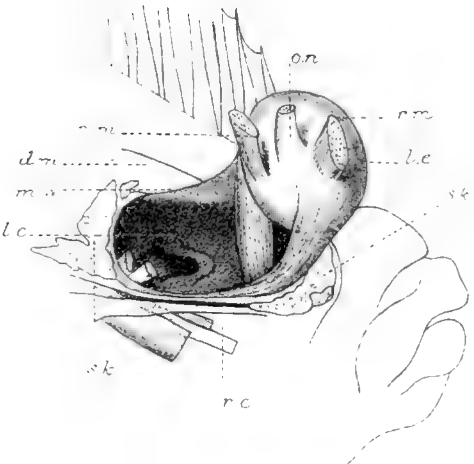

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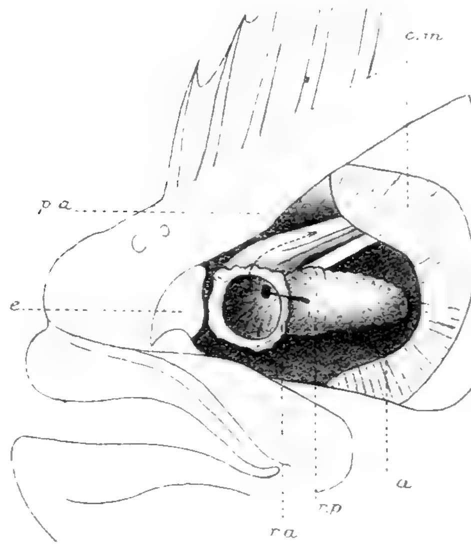

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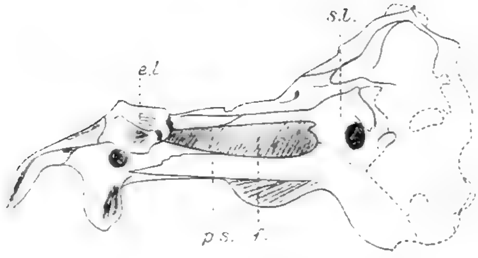

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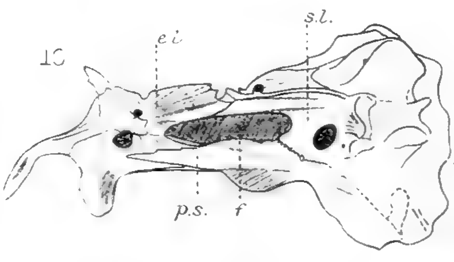


E.W.L.H. del.
M.P. Parker lith.

West, Newman imp.

Dissections of Flat-fishes. Figs. 5, 6, 7. Pleuronectes platessa.
Fig. 8. Hippoglossus vulgaris. Figs. 9, 10. Solea vulgaris.

of the modifications due to known physiological effects of functional activity."

It is evident, in the specimen before us, that whether the fish made any efforts to look upwards or not, it could certainly never have succeeded in doing so, so that the supposed original stimulus of the rotation may in this instance be considered as wanting. Yet the metamorphosis of the skull has proceeded on the normal lines, and so far from the efforts of the eye having apparently affected the rotation of the ectethmoid, the condition we have observed suggests rather that the rotation of the ectethmoid has slightly displaced the eye. It may be said that the eye, intercepted too soon by the pseudomesial, may nevertheless, by the continuance of its efforts, be responsible for the rotation of the ectethmoid; but, as the direction of the strain would be diverted, by the oblique muscles having to pull round the obstacle instead of directly, one would expect that any resulting rotation would be less normal than in the present instance. At the same time the reduction in the anterior part of the ectethmoid seems very possibly connected with functional inactivity.

In the present state of our knowledge, it may be argued that an acquired character may become so fixed that the defection of what was originally the cause becomes of no moment in development; so that the condition of our specimen is no bar to the acceptance of this theory in the case of Flat-fish evolution. While unwilling to dispute such a proposition, I am inclined to think that the almost entire absence of modifications from the normal type, which might be attributed to the physiological effects of the arrest of the migration of the eye, point rather to the theory of Natural Selection as the true interpretation of the evolution in question.

EXPLANATION OF THE PLATES.

Plate XXVIII.

Fig. 1. *Molva abyssorum*, 47 inches long. $\times \frac{5}{34}$ *ca.*
2. —— *vulgaris*, $35\frac{3}{8}$ inches long. $\times \frac{5}{24}$ *ca.*

Plate XXIX.

Fig. 3. Abdominal viscera of *M. abyssorum*, ♀, from the left side; slightly displaced.
3 *a.* The intestine of another specimen of *M. abyssorum.*
4. Abdominal viscera of *M. vulgaris*, ♂, from the left side; slightly displaced.

Plate XXX.

Fig. 5. Ocular side of head of Plaice. Skin and part of superficial jaw-muscles (*m.*) removed so as to expose the membranous wall of the right orbital cavity (*m.w.*) and the right *recessus orbitalis* (*r.*). $\times \frac{4}{5}$ *ca.*
c.s. Cut edge of skin.
i.s. Bony interorbital septum.
6. Right *recessus orbitalis* of Plaice; the outer wall partly removed. Enlarged and slightly diagrammatic.
o. Opening into orbital cavity.
s. Muscular septum.

Fig. 7. Dissection of left orbital cavity of Plaice. Bony interorbital septum and part of skull (*sk.*) in front of and behind cavity removed. Optic nerve (*o.n.*) and recti muscles (*r.m.*) cut through, and eye turned forward so as to expose the funicular depression leading into the left *recessus orbitalis.* $\times \frac{4}{3}$ *ca.*

d.m. Dorsal muscles.
f.s. Fibrous interorbital septum.
l.c. Left orbital cavity.
l.e. Left eye.
r.c. Right orbital cavity.

8. Blind side of head of Halibut. Skin and part of superficial jaw-muscles and adjacent adipose tissue (*a.*) removed so as to expose the left *recessus orbitalis.* The anterior limb of the organ (*r.a.*) is laid open by an incision of its outer wall, and the course of the arrow shows the passage of the duct to the left orbital cavity. Size reduced.

c.m. Cut edge of superficial jaw-muscles.
e. Ethmoid cartilage.
p.a. Part of skull formed by union of left ectethmoid and sphenotic.
r.p. Posterior limb of left *recessus orbitalis.*

9. Skull of adult Sole with symmetrical eyes, from the left side. The posterior part, shown in dotted lines, is conjectural. Natural size.

e.l. Left ectethmoid.
f. Foramen between pseudomesial process and parasphenoid.
ps. Parasphenoid.
s.l. Left sphenotic.

10. Skull of normal adult Sole, from the left side. Natural size. Lettering as in figure 9.

P.S. (*June 20th*, 1894).—The restriction formulated by Cunningham and MacMunn as above, and confirmed by my own previous experience, is controverted by a specimen obtained since this paper was read. The fish is structurally normal, but exhibits some pigment on the blind side of the jaws and on other parts anterior to the line indicated.

3. Field-Notes on the Wild Camel of Lob-Nor. By St. George Littledale, F.R.G.S.

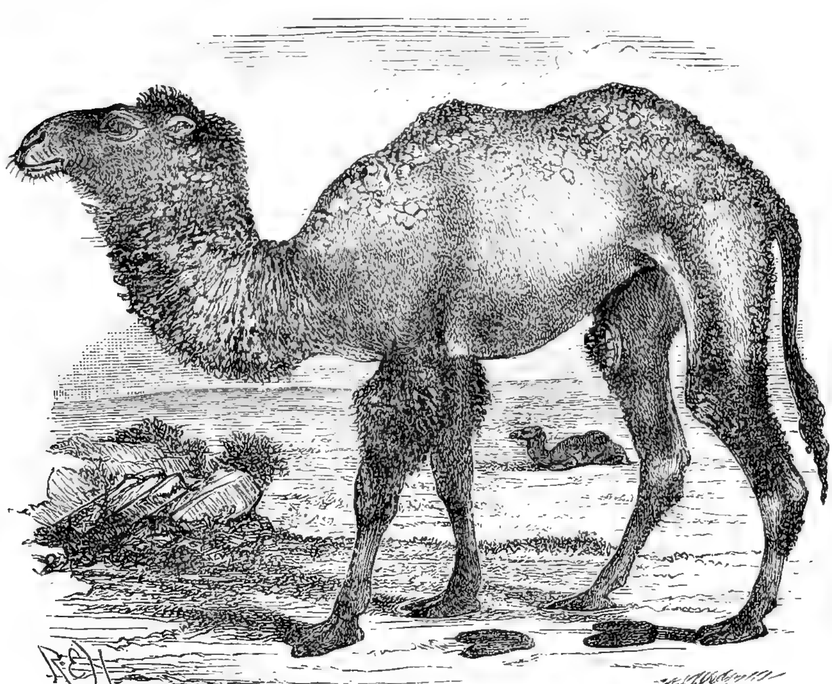
[Received March 28, 1894.]

One of the objects of the journey that Mrs. Littledale and I made last year across the centre of Asia[1], was to obtain specimens of the Wild Camel (*Camelus bactrianus*). On reaching Lob-Nor in May 1893 we were pleased to hear that the natives confirmed my opinion that we should probably find Wild Camels on the slope of the Altyn Tag; but when I asked them in what particular district these animals were likely to be found at that season of the year, they were so very vague and general in their answers that it was evident they either did not know or were unwilling to say.

On the 8th day after leaving the Lob we found, on the north side of the Altyn Tag, the fresh tracks of a camel. The animal had come in the night or early morning within a mile of our camp, but winding us it had turned and bolted away. After this we

[1] *Cf.* Geogr. Journ. iii. p. 445.

occasionally saw more tracks, but we never beheld the animal in the flesh till the 16th day; we were then in the most forlorn country imaginable, not a blade of grass for our animals was to be had, and water was only procurable about every second day. The country was totally uninhabited, the nearest settlement being Abdul on the Tarim River near Lob-Nor. A few marches back we saw Kyang occasionally, and now and then the track of a Yak or a sheep, but in this dismal place there was nothing. We had seen on the rocks and stunted shrubs patches of camel-hair, and as these tracks became more numerous our hopes rose. On the morning of the 19th June I had stayed behind with one man to follow up some tracks, and Mrs. Littledale had gone on ahead with the other. The latter discovered two camels and tried to shoot them before I came up. Fortunately luck favoured me, and I was able to get them both. Finding a small quantity of water in some rocks a couple of miles from where the camels lay, we stopped a day to clean and dry the skins and the skeleton, as I was anxious to bring complete specimens home for the South Kensington Museum. On examining the skulls we found the nostrils were full of soft grubs, about $1\frac{1}{4}$ inch in length; they must have been very disagreeable tenants. We put some of these into spirit and brought them home along with other specimens.



Wild Camel of Lob-Nor.
(From the mounted specimen in the British Museum.)

On the next march we saw another pair of camels, but the wind was wrong, and I could not get a shot. Soon after this we saw three more lying down, and I made a long stalk after them. Owing to their height Wild Camels are rather difficult to approach, for even when lying down their heads are so high that it is not easy to keep out of sight, for there is little or no cover in the desert. Out of the last-mentioned herd I got a fine old male. We were now evidently in the thick of the camel-district, for a few miles farther we came on a herd of nine, but the wind being westerly they smelt us long before we got near them. That day we had to camp in an arid desert, where there was neither water nor grass. Towards evening an animal was seen in the distance, and turned out to be another camel. On getting up to it I had to fire at a desperately long range. The beast spun round and then dropped in his tracks. The stalk had been watched from camp with a good deal of interest, and our two Lob hunters, who were in disgrace, were much put out at the result, for, when they saw me preparing to shoot, they announced to our men that I was a madman to attempt to kill a camel at that distance. This specimen fortunately proved to be a female, which I particularly wanted. It was the last camel of any kind that we saw. The natives told me that if a camel saw or smelt a man they would not return to that place for a year. This is probably an over-statement, but they certainly were very wild, for I saw with my telescope two camels, which I did not fire at, striding away far across the desert, and when last visible they showed no sign of slackening speed.

I brought home 3 skins, 1 complete skeleton, and all the skulls of these camels. The animals being shot in summer, unfortunately their skins were not in a very good condition.

Whether these camels are remnants of the original Wild Camel or simply the descendants of some tame ones run wild, I leave to more learned heads than mine to discover. There are round the Gobi Desert the remains of many cities that have been overwhelmed with sand; that the catastrophe was sudden in some instances is proved by the fact that when the wind blows away the sand and exposes the ruins, cooking and other things are found in the houses; and it is quite reasonable to suppose that some camels might have survived a sandstorm severe enough to have annihilated their owners and buried their towns.

4. On some Specimens of Mammals from Oman, S.E. Arabia. By Oldfield Thomas.

[Received April 3, 1894.]

(Plate XXXI.)

Dr. A. S. G. Jayakar, whose magnificent collections and donations of Muscat fishes are known to all ichthyologists through the papers upon them by Mr. Boulenger, has, during the past few years, collected and presented to the National Museum a certain number

J. Smit del. et lith.

Mintern Bros. imp.

HEMITRAGUS JAYAKARI.

of mammals, and he has now sent home a further consignment, of such value as to demand a proper account.

So far as I am aware, no list of mammals from this very interesting region has ever been published, and Mr. Blanford's description of *Erinaceus niger* [1], the same author's passing reference to a Muscat specimen of *Vulpes leucopus* [2], Sir V. Brooke's description of *Gazella muscatensis* [3], and Sir O. St. John's notes on *Oryx beatrix* [4], appear to be the only references to this locality that occur in mammalian literature. Dr. Jayakar having obtained examples of all these four species, his collection includes specimens of all the mammals known to occur in this part of Arabia.

The geographical relationships shown by the mammals of Muscat are, as might be expected, about equally with Africa and India, three of the species being distinctly African in affinities, three Indian, and the remainder either peculiar or widely-spread and of no special significance.

Of the 17 species included in the list, two are new, one of them, *Hemitragus jayakari*, the new Goat, forming a most striking and interesting discovery, on which Dr. Jayakar is much to be congratulated. The new Hare, *Lepus omanensis*, is also markedly distinct from any of its allies.

1. Xantharpyia amplexicaudata, Geoff.

a, *b*. 2 ad. al. Muscat. 23/12/93 [5].
c. Ad. al. ♀. Muscat. 1885.
d, *e*. 2 do. Muscat. 1889.

2. Taphozous nudiventris, Cr.

a. Ad. al. Khode, 30 miles N.W. of Muscat. 6/11/92.

3. Rhinopoma microphyllum, Geoff.

a–c. 3 ad. al. Khode. 6/11/92.
d–g. 4 do. Wadi Bani Ruha. 20/11/91.
h–k. 4 do. Muscat. 1885.

4. Erinaceus niger, Blanf.

a. Ad. al. ♀. Muscat. 6/93.
b, *c*. 2 do. ♂ ♀. Muscat. 1885.
d. Ad. sk. ♂. Muscat. 1885.
[*e*. Do. ♀. Muscat. 5/77. Col. Miles, 1877. *Type* of species.]

5. Crocidura murina, L.

a–c. 3 ad. & imm. al. Muscat.

[1] J. A. S. B. xlvii. pl. ii. p. 212 (1878).
[2] Mamm. Brit. Ind. p. 152 (1888).
[3] P. Z. S. 1874, p. [redacted]. p. 95
[4] P. Z. S. 1872, p. [redacted]. b. 1445.
[5] The specimens with exact dates are those of the recently received collection, which has been throughout most carefully labelled with the particulars by Dr. Jayakar. The other specimens belong to the earlier sets, received in the years noted.

6. Herpestes albicauda, G. Cuv.

a. Ad. sk. Khode. 6/11/92.
b. Imm. al. ♀. Rui, near Muscat. 26/10/91.
c, *d.* 2 ad. sks. Muscat. 1888.
e. Ad. al. ♂. Muscat. 1889.

7. Canis pallipes, Sykes.

a. Ad. sk. Muscat. 1891.

If I am right in referring this skin to *C. pallipes*, the present example shows a great extension of the western range of the species, as it has been hitherto only recorded from India. The specimen is, however, barely adult, so that proper comparison is rather difficult; but its skull agrees very fairly with that of a Karachi specimen, and there is little inherent improbability of the Indian Wolf occurring as far west as Muscat.

8. Vulpes leucopus, Bly.

a. Ad. sk. Muscat.
b, *c.* Adult in spirit, and a separate head. Muscat. 1885.
[*d*, *e.* Ad. sks. ♂ ♀. Muscat. Col. Miles, 1877.]

9. Gerbillus (Dipodillus) dasyurus, Wagn.

a. Ad. al. ♂. Gobia, on the coast 10 miles N.W. of Muscat.
b. Ad. al. Muscat. 1887.

The type of this species was sent over by the authorities of the Munich Museum at the request of Dr. Anderson, and I had then the opportunity of examining it. These Muscat specimens are undoubtedly conspecific with it, while their similarity to *G. nanus*, Blanf., renders it probable that the latter will prove to be synonymous with *G. dasyurus*. The typical *G. nanus* is, however, a somewhat smaller animal than these are.

10. Mus rattus, L.

a–c. Khode. 6/11/92.
d–f. Miti, Wadi Bani Ruha, foot of Jebel Akhdar. 11/91.

Specimens *a–c*, which are marked as "Tree Rats" by Dr. Jayakar, are brown, while *d–f* are bright rufous, and seem to closely correspond to the Indian *M. rattus rufescens*, Gray. All have pure white bellies.

11. Lepus omanensis, sp. n.

a. Ad. sk. ♀. Ziki, in Oman Proper. 26/10/92. *Type.*
b, *c.* 2 ad. al. Ziki. 26/10/92.

Size remarkably small, smaller than in any other Old-World Hare, except the abnormal *L. netscheri* of Sumatra. Form exceedingly slender and delicate; head small, ears long, limbs very long and thin. General colour dull greyish brown, not far from, but a little yellower than, Ridgway's "hair-brown"; the hairs broadly tipped with cream-buff, and with a subterminal band of black; their basal three-fourths dull whitish. Head like back; supraorbital edges scarcely paler. Ears very long, laid forward in a spirit-specimen they surpass the tip of the muzzle by more than an inch; their visible bands brown, edged with long fringes of buff hairs; their extreme tips externally black. Nape dull brown, with a faint tinge of rufous. Sides paler and greyer than back. Chin and belly dull yellowish white; chest browner. Outer sides of arms and legs brown, inner sides paler. Hands and feet dull buff above, the long hairs of the palms and soles deep yellowish, almost "ochraceous." The number and thickness of these palm- and sole-bristles, combined with the extreme tenuity of the forearms and lower legs, gives a most unusual appearance to the whole animal, whose proportions are, however, merely an exaggerated development of those common to many of the N.E. African group of Hares. Tail rather long, black above, white below.

Dimensions of the type, an adult female, measured in spirit, before skinning:—

Head and body 360 mm.; tail without hairs 60; hind foot without claws 89; ear, length from head 118, from notch 99, breadth 53.

Skull: basal length 60 mm.; greatest length 74; greatest breadth 34·6; nasals, greatest length obliquely 28, greatest combined breadth 16·1; intertemporal breadth 10·6; breadth of brain-case 25·5; length of palatine foramen 18·2, combined breadth of do. 8·4; least breadth of palatal bridge 4·4; length of upper molar series (crowns) 10·8; transverse diameter of $\underline{m^1}$ 3·7.

This interesting little Hare is at once distinguished from all other allied members of the genus by its slender proportions and its extremely small size. Its hind foot is nearly an inch less than in any of the species described by Hemprich and Ehrenberg, while the small size of its skull is paralleled only by some of the little American species, if the abnormal *L. netscheri* be put aside.

12. Gazella muscatensis, Brooke.

Gazella muscatensis, Brooke, P. Z. S. 1874, p. 142.

a–c. 3 ad. sks. Khode. 7 & 8/11/92.

d. Ad. sk. Barkeh-al-Moze. 24/10/92.

e. Do. Sharkeeyeh, or eastern part of Oman. 20/1/93.

[*f.* Ad. sk. ♂. Muscat. Major C. B. E. Smith, 1873. *Type* of species.]

These specimens, which are very valuable as having been wild-killed, all agree very closely with Sir Victor Brooke's excellent description and figure.

13. Oryx beatrix, Gray.

a. Imm. sk. ♀. Adam, Oman Proper. 7/5/93.

This wild-killed specimen of the beautiful Beatrix Gemsbuck is of much value, as the specimens we have hitherto had have been brought alive to England, and their fur appears to have been altered in character by the great difference in the climate.

What seasonal change in the length of the coat actually takes place in Arabia I would suggest as a fitting subject of inquiry for Dr. Jayakar. The present specimen has an exceedingly short close coat, quite different from that of the other examples.

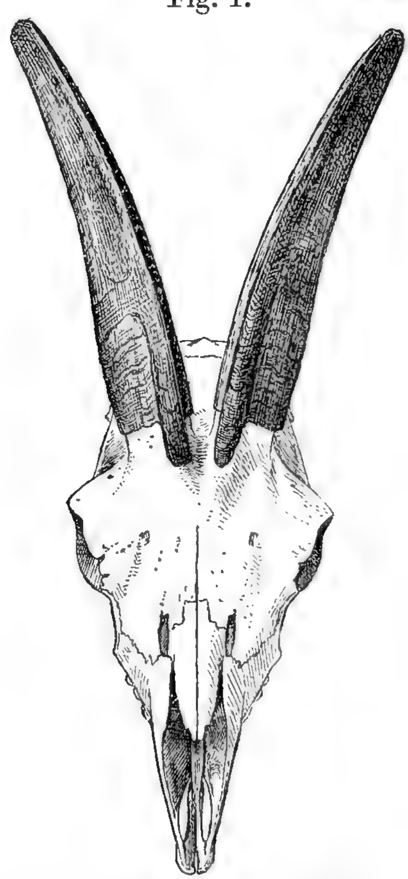
14. HEMITRAGUS JAYAKARI, Thos.[1] (Plate XXXI.)

a. Ad. sk. ♂. Jebel Taw, Jebel Akhdar Range. 7/11/92. *Type* of species.

b. Do. (stuffed). Jebel Taw. 7/11/92.

This fine animal, which it has given me great pleasure to name in honour of its discoverer and donor, is the great prize of the collection, both from a scientific and a sporting point of view.

Fig. 1.



Skull of *Hemitragus jayakari*.

As a matter of geographical distribution, its occurrence on the

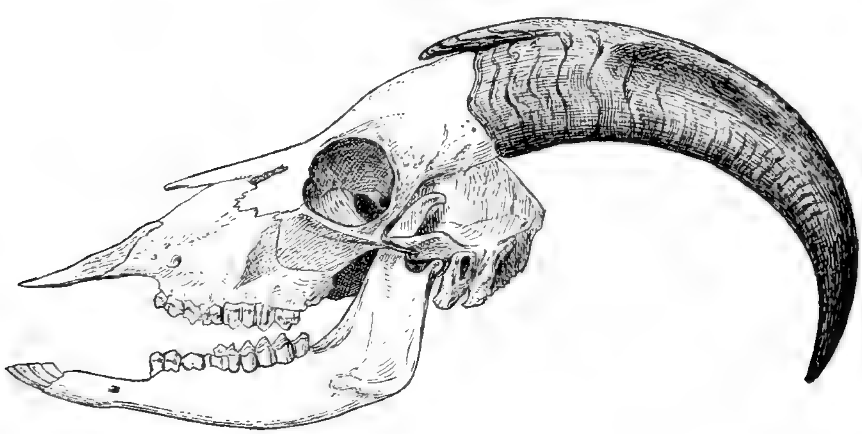
[1] Ann. Mag. N. H. (6) xiii. p. 365 (1894).

mountains of Oman is a matter of the highest interest, for while it is unquestionably a member of the group to which the name *Hemitragus* has been given, its locality is in the middle of a region inhabited only by true Goats (*Capra*), and therefore to some extent its discovery confirms the separation of the two groups, and shows that *Hemitragus* is not merely a local modification of *Capra*, due in any sense to geographical conditions.

In 1886 Mr. Sclater contributed to this Society [1] a very useful account of the genus *Capra*, recognizing ten species, among which were included the two *Hemitragi*. How little the discovery of a new Goat might have been expected is indicated by the fact that of these ten species, the latest discovered, the Markhor, was described in 1839 [2] (and *C. cylindricornis*, omitted by Sclater, in 1841), so that there has not been a new valid species found for over half a century, although no animals have been more keenly sought after by sportsmen or more willingly investigated by naturalists.

The species has been already described elsewhere, but it may be useful to recapitulate some of its more important characters, especially such as cannot be readily observed in the accompanying figure.

Fig. 2.



Skull of *Hemitragus jayakari*.

Size small, the stuffed specimen standing only about 620 mm. ($24\frac{1}{2}$ inches) at the withers; in fact this appears to be, judging by the skull, the smallest species of Wild Goat. Form comparatively light and slender. Fur coarse, shaggy, and brittle, in texture

[1] P. Z. S. 1886, p. 314.

[2] I am, of course, aware of the description by Dr. Reichenow of *Capra dorcas*, Zool. JB. iii. p. 591 (1882), from the island of Joura; but there appears to be so much doubt as to whether this may not be a feral Domestic Goat that it can hardly be said to affect the remarks above made. Nor can the recent distinction, whether right or wrong, of a third species from the Caucasus (*C. severtzovii*, Menzb.); for it seems probable that this animal was known before the date above mentioned, even if not distinguished from the others until recently.

more like some of the larger Sheep, or even of the Musk Deer; quite unlike the soft fine hair of the Himalayan Thar; the fur over the greater part of the body is of medium length, shorter than in *H. jemlaicus*, longer than in *H. hylocrius*; but on the nape and middle line of the back anteriorly it is lengthened into a mane, while the hairs below the angles of the lower jaw, on the humeri, and on the femora are also elongated, so that at the knees and hocks there are formed more or less distinct ruffs.

General colour pale sandy or brownish white, the dorsal mane broadly tipped with blackish brown. Face, cheeks below eyes, backs of ears, tail, and a mark on each fetlock black or blackish, the relative prominence of the different markings as shown in the figure.

Knees callous, naked; a bare glandular space on the chest; no interdigital pits; mammæ two [1].

The skull (fig. 2, p. 453) is in many respects a miniature of that of *H. jemlaicus*, to which it undoubtedly shows greater affinity than to that of *H. hylocrius*. The following are, however, some of the differences observable:—The forehead where the horns rise is narrower and with a much greater development of a supraorbital boss, almost suggesting that of *Capra walie*, Rüpp.; on the other hand, the bases of the horn-cores do not overhang the occipital region so much, so that the occipito-parietal plane, instead of pointing nearly horizontally backwards, slants up at an angle of about 45°; this is also the case in *H. hylocrius*; the nasals are broader posteriorly, and nearly fill up the prefrontal vacuities.

The muzzle is longer and slenderer, and the nasal opening decidedly longer in proportion, this being apparently produced by a shortening of the nasals. The inferior wall of the orbit is less thickened externally. On the posterior part of the bony palate the nasal notch reaches further forward, some 4 mm. in front of the lateral notches, while in the allied species these latter are as much in front of the median one.

The horns are in direction and general form similar to those of *H. jemlaicus* again, rather than to those of *H. hylocrius*, but they are longer in proportion, conspicuously slenderer, more evenly oval in section, and less rigid on the sides and less knotted in front. The horns of both specimens are much worn down, probably from a habit, shared, as Mr. Lydekker informs me, by many Thars, of rubbing the horns against trees or rocks.

The differential characters here noted are drawn up on a comparison of an old male skull of the Thar with the typical, very aged, skull of the Arabian species, and some of them will no doubt in time prove to be due either to age or individual variation.

The following skull and horn measurements (in millimetres) of the three species of *Hemitragus* may be useful; all are from old male specimens:—

[1] Males only examined.

	H. jemlaicus.	*H. jayakari.*	*H. hylocrius.*
Greatest length, occiput to gnathion	271	218	(*c.*) 285
Greatest breadth	128	109	133
Nasals, length	94	60	116
Tip of muzzle to orbit	180	133	(*c.*) 184
Greatest diameter of orbit	39	38	47
Interorbital breadth	91	78	93
Breadth of forehead below horns	96	61	109
Length of longest horn round curve	344	295	367
Antero-posterior diameter of horn at base	84	57	78
Transverse diameter of horn at base	60	30	53
Circumference	230	136	210

Dr. Jayakar has favoured me with the following notes on this interesting animal:—

"I should think, from the description given to me, that these Goats were in all probability shot at a great height, between 1500 and 2000 feet. I have no personal knowledge of the habits of the animal, but am informed by the Arabs that it does not go in large herds, but in groups of a few. As there appears to be a good deal of vegetation above a certain height, it seems that they rarely, if ever, come down into the valley below. I believe the same species to be found throughout the whole of the hilly part of Oman; it occurs in Jalan Sharkeeyeh and the Jebel Akhdar range, and in all its offshoots."—A. S. G. J.

15. Procavia syriaca jayakari, Thos.

Procavia syriaca jayakari, Thos. P. Z. S. 1892, p. 63.

a, b. Ad. al. ♂ ♀. Dofar, S.W. of Muscat. 24/2/92 & 8/11/91.

c. Ad. sk. ♀. Dofar, S.W. of Muscat. 1891. *Type* of subspecies.

d. Yg. al. Dofar, S.W. of Muscat. 1891.

The female specimen has, as might be expected, 1—2 = 6 mammæ.

The considerable extension of the known range of the genus effected by Dr. Jayakar's discovery of this new form of Dassy has been already noted.

16. Tursiops tursio, Fabr.

a. Skin and imperfect skeleton. Muscat. 1888.

b. Skeleton. Muscat. 1888.

17. Grampus, sp.

a, b. 2 young skins, with skeletons. Muscat. 1891.

Too young for certain determination.

June 5, 1894.

Sir W. H. Flower, K.C.B., LL.D., F.R.S., President, in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of May:—

The registered additions to the Society's Menagerie during the month of May were 112 in number. Of these 54 were acquired by presentation, 28 by purchase, 2 by exchange, 8 were born in the Gardens, and 20 were received on deposit. The total number of departures during the same period, by death and removals, was 99.

Mr. Sclater offered some remarks on the animals he had noticed in the Zoological Gardens of Rotterdam, Amsterdam, Hanover, Berlin, and Hamburg, which he had recently visited.

At Rotterdam the Jackdaws had effected an entrance through the wide meshes of the net that covered the large Aviary, and had somewhat disturbed the breeding birds. But the colony of Wild Herons outside (*cf.* P. Z. S. 1892, p. 471) was still thriving, and consisted of 28 nests. Amongst the Mammals at Rotterdam one of the greatest interest was a beautiful male example of the Bush-loving Antelope (*Cephalophus sylvicultrix*) from Congo-land (*cf.* P. Z. S. 1892, p. 471), presented by Heer A. de Bloema on the 25th May, 1891, now quite adult, and of about 2 ft. 8 in. high. Mr. Sclater exhibited a water-colour drawing by Mr. Keulemans representing this animal.

The Gardens of the Royal Zoological Society of Amsterdam were in their usual flourishing condition, the series of Cranes and Storks being, as in former years, of special excellence. The herd of the beautiful Antelope *Tragelaphus gratus* (*cf.* P. Z. S. 1892, p. 471) now consisted of seven examples, and an additional male having been imported there was every reason to hope that this fine Antelope (see P. Z. S. 1883, pl. viii.) would become thoroughly acclimatized in Europe. One of the hot-water tanks in the Reptile House contained seven living examples of the Surinam Toad (*Pipa americana*), which Mr. Sclater had never seen alive before. They appeared to keep entirely in the water, in which they swam about freely.

In the Zoological Garden of Hanover (now under the direction of Dr. Ernst Schäff) Mr. Sclater had seen several interesting Antelopes, amongst which were examples of *Hippotragus equinus*, *Bubalis caama*, and both species of Gnu. He had also obtained there for the Society specimens of both the European species of Marten, which were now rather difficult to procure.

The Zoological Garden at Berlin (now under the direction of Dr. Heck) contained an excellent series both of Mammals and Birds, and a large new Aviary was in process of erection. Here a pair of Giraffes were still to be found; and examples of the Zebra from German East Africa, lately described by Herr Matschie as *Equus boehmi*, had attracted Mr. Sclater's special attention. Amongst the Birds were noticed specimens of *Parus varius* from Japan, *Garrulax picticollis* from Formosa, of the splendid *Cotinga cincta* from South-east Brazil (now four years in the Gardens and in full adult plumage), of *Chrysotis hecki* (the type of the species), of the rare *Ara azaræ*, of both species of *Bucorax* from Africa, of several species of *Meliphagidæ* (*Entomyza cyanotis auricomis*, and *Anthochæra carunculata*), and of *Anas andamanensis*. The Eagles' Aviary contained examples of both *Haliaëtus pelagicus* and *H. brannickii*, the latter quite adult, the former just coming into full plumage.

The Hamburg Garden (under the direction of Dr. H. Bolau) presented, as usual, many attractions. Amongst the Mammals there was an example of a black Jaguar (*Felis onca*) from Santa Catarina, Brazil, also of *Felis passerum* from Argentina, and of *Viverricula schlegeli* from Madagascar. There was likewise a good series of the larger Antelopes, amongst which was a beautiful pair of the Sable Antelope (*Hippotragus niger*), accompanied by a young one now about six weeks old, and believed to be the first specimen of this species born in Europe. Amongst the Birds were noticed examples of *Polyboroides typicus*, *Musophaga violacea*, and *Struthio molybdophanes* from Somali-land, the last being quite adult, and remarkable for its blue-coloured naked skin varied by a bright red patch on the front of the tarsus and for the horny plate on the vertex.

The following papers were read:—

1. Critical Gleanings on the *Didelphyidæ* of the Serra dos Orgãos, Brazil. By Dr. Emil August Goeldi, Director of the Colonia Alpina (Theresopolis)[1].

[Received March 29, 1894.]

1. Didelphys aurita.

I have in my collection of Mammals made here in the Serra dos Orgãos, 800 m. above sea-level, nine specimens of a *Didelphys*, evidently all belonging to the same species or variety, although they show some slight differences in size, colour, and fur. Of all of them I possess both skin and skull; one specimen is stuffed and mounted. Seven are adult, while two are rather less than half-grown, as they have still their milk-dentition in place.

How shall I call the animal? If I should guide myself merely by the exposition given by the most modern monographer of the Marsupials—Mr. Oldfield Thomas[2]—this question would be very quickly decided. This author admits only one living species of

[1] Communicated by Dr. A. Günther, F.R.S., V.P.Z.S.

[2] 'Catalogue of the Marsupialia and Monotremata in the Collection of the British Museum' (London, 1888), p. 315.

the subgenus *Didelphys*—*D. marsupialis*—with two varieties: *D. marsupialis typica*, very widely spread over the American continent and including even *D. virginiana* and *D. californica* of other zoologists, with a range extending to Chili and Brazil; *D. marsupialis* var. *azaræ*, on the other hand, being confined to the countries bordering the Amazonian Basin, but ranging on the eastern coast to South Brazil. The characters are purely external and may be briefly referred to as follows:—Face without, or with indistinctly defined, black and white markings—var. *typica*; face with sharply defined black and white markings—var. *azaræ*. In the list given of the specimens contained at that date in the collection of the British Museum from Brazilian localities I find four of var. *typica* (3 from "Brazil," 1 from "Rio de Janeiro") and two of var. *azaræ* (both from Taquara, Rio Grande do Sul, collected by my friend and colleague Dr. H. von Ihering).

Well, according to the exposition of Mr. Oldfield Thomas, there is absolutely no doubt that I should have to determine my specimens from the Serra dos Orgãos as belonging to *D. marsupialis* var. *typica*.

To anybody who has occupied himself seriously with the study of Marsupials, it is evident that the family Didelphyidæ in general, and the genus *Didelphys* in particular, is, even in our days, what is called a "crux zoologica." On this point Mr. Oldfield Thomas says:—"With the exception of the short-tailed Opossums the series available for examination in the European museums seems to be fairly complete, but in the case of these more specimens are urgently needed before the species can be at all satisfactorily worked out and the present arrangement of that, the most difficult, group must be looked upon as merely tentative in its nature." And some lines above he writes:—"The systematic arrangement of the Opossums has formed the subject of an unusually large number of memoirs, of which the best have been written by Temminck, Waterhouse, and Burmeister. These and all other authors appear, however, to have erred in the admission of by far too great a number of species, formed on the most trivial characters of colour and size, and therefore a large reduction has been found to be necessary in the present work."

I perfectly agree with Mr. Thomas as to the great difficulty presented by the group, and I even partly share his opinion that the number of species admitted by former authors is too large and that the synonymy has been much overburdened. But when he chooses the radical method of cutting the Gordian knot by condensing all the species into one and grouping all older synonyms around two varieties only, it seems to me that he goes too far.

On reviewing the writings of the three principal authors who have discussed the Mammals of this region—Burmeister[1,2],

[1] 'Systematische Uebersicht der Thiere Brasiliens, welche während einer Reise durch die Provinzen von Rio de Janeiro und Minas Geraes gesammelt oder beobachtet wurden,' vol. i. (1854).

[2] 'Erläuterungen zur Fauna Brasiliens,' Berlin, 1856.

Winge [1 2], and Hensel [3]—it appears that, however many recognizable forms of the subgenus *Didelphys* there may ultimately be, all the Opossums obtained by myself in the Orgãos Mountains are exclusively *D. aurita*, whether this be itself reckoned as "species" or "variety." This is distinctly the animal so well represented by Burmeister, plate iii. of his 'Erläuterungen.' And the determination becomes certain from the cranial views (Burmeister, pl. v. fig. 3, pl. vi. fig. 1) and the osteological details given by Hensel (figs. 3, 6). Evidently it was not one single character, but a complexity of features, which engaged Winge not to drop *D. albiventris* as a remarkable and constant Campos-variety of *D. marsupialis*. The same complexity of features occurs to me in regard to *D. aurita* of the forest coast-region of Rio de Janeiro [4]; and I may now add that during a stay of more than ten years in this province, in the hot and low zones, as well as in the mountains of the Serra dos Orgãos, I have always met with exactly the same form among the hundreds of specimens I had occasion to see.

Some of the specimens in my collection agree exactly with Burmeister's plate iii., showing the same general reddish-brown colour of fur, with longer whitish or greyish piles on the whole back or at least on the posterior part. Others are more or less blackish, with longer piles or bristle-hairs of the same colour, the points of these piles being split, as a rule, into many branches, especially on the dorsal median line, and appearing dirty white. No correlation with age, sex, or season could be discovered in regard to the presence or absence of the whitish piles, and I made exactly the same observation referred to by Hensel (p. 112). I took notes about the last twelve specimens I saw: seven of them had white bristle-hairs intermixed, while five were more or less blackish. Of these seven specimens four were adult males, one a young male, one an old female, and one a half-grown female. They were collected in August 1891, April 1892, February 1893, May 1893, and three in December 1893. The five blackish specimens were caught in October 1892, February, March, July, and August 1893, and three of them were males (old, medium, and young); two were females, both half-grown [5]. The face-

[1] 'Jordfundene og unlevende Pungdyr (Marsupialia) fra Lagoa Santa, Minas Geraes, Brasiliens,' Kjöbenhavn, 1893.

[2] Lagoa Santa. Et Bidrag til den biologiske Plantegeografi af Egnens Värming,' Kjöbenhavn, 1892. (Lagoa Santa Egnens Hvirveldyr.)

[3] "Beiträge zur Kenntniss der Säugethiere Süd-Brasiliens," Abhand. d. königl. Akad. d. Wissensch. Berlin, 1892.

[4] It can be seen by Pelzeln's 'Brasilische Säugethiere' (Wien, 1883), p. 109 *et seq.*, that Natterer also determined all his specimens of large *Didelphys*, collected in the neighbourhood of Rio de Janeiro and the coast-region, as belonging to *D. aurita*. About six specimens collected in Sapitiba (district of Rio de Janeiro) Natterer noted on the label a sign of question, but Pelzeln adds the words:—"Dürfte wohl zu *D. aurita* zu rechnen sein, während die echte *D. cancrivora* dem Norden Süd-Amerikas angehört." It is to be regretted that Pelzeln's work on Natterer's Brazilian Mammals is not provided with good illustrations, especially of the smaller Didelphyidæ and Rodents.

[5] Hensel states that among 57 individuals of *D. azaræ* he noted 11 black

markings are on the limit between distinct and indistinct, and I consider this circumstance as a good external character for a rapid discernment of *D. aurita*. Only in one case—a young female—were these face-markings very distinct, as yellowish longitudinal stripes.

All the figures I know of *D. cancrivora* represent this animal with very indistinct face-markings (compare Burmeister, pl. iv.); and on the other hand the authors always draw *D. azaræ* and *D. albiventris* with most conspicuous face-markings (*cf.* Burmeister, pls. i., ii.). In regard to the colour of the ears, I repeat what I said in my little work on the Mammals of Brazil [1], that *D. aurita* and *D. cancrivora* have uniformly dark-brown coloured ears, and, so far as concerns the first, I had full occasion to make this statement on the living animal.

Dentition.—Much has been written about the dentition of *Didelphys*, and the literature has been thoroughly co-ordinated by Mr. H. Winge, 'Pungdyr,' p. 113 and p. 122 *et seq.* For the present I have no mind to write at all fully on this matter and I will restrict myself to the remark that abnormalities are so rare that I have never yet seen a single skull of an adult *D. aurita* with a formula other than strictly $\frac{5.1.3.4}{4.1.3.4}$. This contrasts somewhat with some of our Brazilian carnivorous animals; the Tayras (*Galictis*), for example, often show some symmetrical abnormalities in the number of molars.

2. Metachirus quica.

Of the subgenus *Metachirus*, established by Burmeister in 1856, no other form was observed by me in the Serra dos Orgãos than the common "Quica" (*Didelphys opossum*, Linn., of Thomas), which is frequently seen in the forest as well as in the neighbourhood of Tazendas. In snares destined especially for Rodents I constantly found this beautiful but stupid and incautious marsupial. My collection contains about a dozen individuals from this locality. There is great uniformity in the general colour: all show the same clear glistening grey above and a yellowish belly. I never met with a female of the reddish tone indicated by Burmeister, pl. viii. [2] I may mention here that some years ago I took an

ones (6 ♂, 5 ♀) and 45 white ones (22 ♂, 23 ♀), and that among 9 young individuals, still contained in the mother's pouch, he observed one black, two mixed, and six white ones. This observation, together with my own above cited (young male and half-grown female), proves that Burmeister is wrong when he denies the existence of young *Didelphys* with white bristle-hairs with the words:—"Kein junges Thier hat weisse Grannen" (Erläut. p. 58).

[1] E. A. Goeldi, 'Os mammiferos do Brazil.' Rio de Janeiro (Alves e Cie.), 1893. Monographias brazileiras, vol. i.

[2] I confess that I was doubtful as to the existence of such reddish "Quicas" until recently. Almost at the moment of posting these notes, my family in Rio de Janeiro gave me on my return from Colonia Alpina a great surprise by a present of a nice young *male* "Quica," very well corresponding to Burmeister's figure. Its eyes are also reddish brown (cherry-colour), somewhat like those of an albino, and its tail is throughout, but especially on the basal

adult "Quica" from Brazil safely to Switzerland, feeding it on board the steamer mainly on fruits. The individual was presented to the Basel Zoological Garden.

3. Micoureus griseus.

My collection contains a single specimen of a fine grey *Micoureus*, somewhat doubtful as regards the species. The dimensions of the dry skin are:—length of body 120 mm., tail 155 mm.; the basilar length of the skull is 32 mm. The colour of the fur (which is notably soft and velvety, much more than in *Metachirus quica*) is greyish above, with a rufous tone on the shoulders and more bluish in the region of the legs; pure white on the underside. Distinct blackish face-markings surround the eyes and run forward to the neighbourhood of the nose. There is no white spot above the eye as in the "Quica." The tail is furry at its basal part for about 1 cm., and becomes suddenly naked and scaly on the remainder; its colour is uniformly greyish, and does not show the contrast of black and fleshy, so apparent on the tail of a young "Quica."

The number of grey species of Didelphyidæ is small, embracing (besides *M. quica*) *Didelphys cinerea*, *D. grisea*, *D. velutina*, and *D. elegans*. *D. cinerea*, which I know principally from the figure given by Burmeister, pl. xii., and the description of Mr. O. Thomas (p. 342 *et seq.*), is larger and presents other differences. *D. velutina* (Burmeister, pl. xiv.) differs, as we know by Natterer's type in the Vienna Museum, in having a tail inferior in length to the body, and shows (if Burmeister's figure is approximately correct) a pale circular eye-marking, not running forward to the nose. For some time I believed my animal to be *D. elegans*, and I was brought to this idea by Burmeister's pl. xv., showing a small marsupial very similar to my specimen, and even now I do not consider the question satisfactorily settled.

Some doubts arose only when I obtained the work of Mr. Thomas and read his description of *D. grisea*, a species not cited by Burmeister in his 'Systematische Uebersicht' and only mentioned in a very short note in his 'Erläuterungen' (p. 83) as a form never met with by him. Mr. Thomas gives the following description:—"Fur close, soft, and rather fluffy. General colour above uniform deep grey, with scarcely a tinge of rufous. Face rather pale grey; the dark eye-markings confined to the front of the eye and comparatively inconspicuous. Ears very large, leafy. Chin, chest, and belly pure sharply-defined white, the line of demarcation, especially on the neck, with a slight rufous or fulvous wash. Pouch absent [1]. Tail long, slender, tapering, its basal half-inch furry, the remainder practically naked; grey above, white below." The characters here

part, irregularly spotted with pale dark marks of different size. The face-markings are as yet very indistinct. The bright bluish tinge of the scrotum, which is comparatively very large as a rule in Didelphyidæ, is also very noticeable. (24/2/94.)

[1] My specimen is a male, therefore I am in doubt about the pouch.

given, together with the measurements, agree tolerably well with those presented by my specimen. The basal length of the skull of an adult individual is equally mentioned as being 32 mm.; and as "habitat" Mr. Thomas gives "Central and Eastern Brazil." The individuals in the British Museum are from "Rio de Janeiro."

On the other hand, *D. elegans* is said to be a Chilian form. Mr. Thomas indicates as its habitat "South Brazil and Chili," but in the list of the British Museum individuals of *D. elegans* I cannot discover any Brazilian locality.

4. MICOUREUS PUSILLUS. (*Grymæomys agilis.*)

A second member of the subgenus *Micoureus*, frequently observed by me here in the Serra dos Orgãos, is *M. pusillus*, almost impossible to be confounded with any other little *Didelphys*, except perhaps *D. lepida*, recently described from the Amazons. Its bright rufous fur, its very dark and conspicuous eye-markings, and strongly-developed "vibrissæ" readily distinguish this most graceful and really very beautiful "pygmy Opossum." Burmeister's figure on plate xv. is not entirely satisfactory, as the rufous general colour is not sufficiently marked.

Mr. O. Thomas says (p. 354) about the smaller Didelphyidæ, especially of the subgenus *Peramys*: "The habits of the species are as yet undescribed, but they are probably far less arboreal than the other Opossums." I think this observation is applicable also to the smaller forms of the *Micoureus*-group; and as I have had considerable opportunities of observing the habits of these animals, both in freedom and in captivity, it may be of interest to relate some of the most peculiar features.

Everybody acquainted with the European Dormouse (*Muscardinus avellanarius*) will easily gain an idea of *Micoureus pusillus*. In spite of the different orders they belong to, the likeness of the two animals is a most striking one as regards the size, the fur-colour, the movements, and the confident demeanour.

Micoureus pusillus is often brought to me by our workmen when occupied in new "rocas." Persons not knowing about the common Brazilian system of agriculture, may learn that a wise law obliges the owner to clear of forest a certain space around the homestead, the trees being afterwards burnt when dried by the sun ("derubada"). The continued line of accumulated sweepings (dry leaves and branches) formed by this process is called "aceiro." I found that these "aceiros," especially when running in the neighbourhood of some watershed, are a favourite resort of our marsupial.

During the day it will rarely be seen, and only some accident will oblige it to leave its hiding-place, but only for an instant until it has again found a refuge. Such an accident is the fire, when the dry "derubada" is kindled. When made prisoner it does not oppose much resistance nor bite severely. Placed in a hollow tube of bamboo, it bears easily a journey of several hours.

Several times I had specimens of *Micoureus pusillus* of both sexes alive for some time in my study. In order to obtain certainty about the feeding in freedom, the most natural way was to examine the excrements of fresh captured specimens. These I always found to be composed principally of hard remnants of insects and small Arthropoda—elytra of beetles, legs and scales of butterflies, and wings of flies. Having at my disposal a flourishing brood of meal-worms (*Tenebrio molitor*), which I had obtained from Europe as a convenient food for the numerous birds, reptiles, and batrachians which I have always around me for daily observations of their habits, generally most insufficiently known, it was not very difficult to accustom these marsupials to take the worms. Soon they became very fond of meal-worms and ran to meet the offering hand or pincers. The prey seized, they sit up like a squirrel and so many rodents, and, holding the insect with the hands (opposing sometimes only the first finger, sometimes the first two to the remainder), they crush it rapidly with visible eagerness and audible smacking. This aspect of the graceful animal always reminds me of the European Dormouse. The eyes, like black resplendent pearls, give to the physiognomy of the face an expression particularly confident. All the movements are sudden, rapid, and executed with elegance. The animal is fond of water and milk, and will not delay long when these liquids are offered in a spoon. It drinks often and continuously, lapping like a dog or a cat, and water seems to be a most important article with it. During the day it likes to sleep in some hiding-place, formed by leaves, cotton, or tow; but the sleep is not very deep, and short diurnal excursions in its cage are frequently observed. It seems to be most susceptible to cold and moisture. Towards the evening the little marsupial becomes more and more lively and agile, and during the night it is more or less in constant movement. There is thus no doubt that its habits are by preference nocturnal, and it is easily comprehensible why these animals are comparatively seldom met with during the day, except by the accidents above mentioned. Nearly all of my prisoners of *Micoureus pusillus* succeeded in finally escaping during the night; one was observed for nearly a fortnight after his escape in my study, without any possibility of discovering his hiding-place during the day. He plundered my caterpillars and chrysalids on his nocturnal depredations.

The gait of *Micoureus pusillus* is somewhat different from that of a rodent of equal size. It is a trot, generally not so rapid as that of a house-mouse. When sleeping the tail is rolled up; in movement it is extended in a straight line. I have sufficient proofs that *Micoureus pusillus* is not entirely unable to climb, but I am sure that in general it lives principally on the ground and that it has to be considered as very little arboreal.

5. Peramys tristriatus.

With certainty I can distinguish only one member of the subgenus *Peramys* among the material of Didelphyidæ collected in the Serra dos Orgãos. I identify it with the *P. tristriatus*

(*Hemiurus*, *Microdelphys*) of most authors, and may say that this species is here almost more frequent than *Micoureus pusillus*.

Mr. O. Thomas (*l. c.* p. 363 *et seq.*) admits two species of three-lined *Peramys*—a larger (*P. americanus*) and a smaller (*P. iheringii*), giving a good figure of the latter on plate iv.

The habitat of *P. americanus* is mentioned as "Brazil" (type not in existence), and that of *P. iheringii* as "South-Brazil," especially Rio Grande do Sul (type in British Museum). Mr. Thomas says of *P. iheringii*:—"This species appears externally to be merely a dwarf form of *P. americanus*, but it may always be distinguished not only by its much smaller size, but by the different shape of the skull, and especially by the marked flattening of the frontal region."

I confess my scepticism about the opinion of Mr. Thomas, and I think I have serious reasons to do so. Concerning the measurements this author states that he follows Burmeister, "Erlaüt." p. 84, giving the dimensions of the same individual. But Burmeister writes:—whole length 7″ (that is 7 Prussian inches), tail 2″ 2‴ (2 Prussian inches 2 lines). The Prussian inch is 2·6154 cm., and the dimensions are equal therefore to 183 mm. (whole length) and 57·53 mm. (tail), while Mr. Thomas reduces them to 189 mm. and 59 mm.—a perceptible difference for a small animal. The dimensions of a second individual preserved in the Berlin Museum are said to be 168 mm. (whole length) and 61 mm. (tail). On the other hand, the dimensions of the type specimen of *P. iheringii* (adult?) described by Mr. Thomas are 110 mm. (whole length) and 43 mm. (tail). So long as the minimum size of *P. americanus* and the maximum size of *P. iheringii* are not exactly determined by large series of authentic adult specimens, a definite conclusion seems to be a very difficult matter; and as the question now stands it may be allowed to interpret the difference of size as the expression of different age, the more as the shape of the skull is evidently also affected by growth, as proved by R. Hensel in his memorable investigations. I see that H. Winge shares this opinion, writing:—"*P. iheringii*, Thomas, synes at stemme ganske med smaa Individer af *Hemiurus tristriatus*" ('Pungdyr,' p. 108); and confronting the figures of skulls given by Mr. O. Thomas (Catalogue, pl. xxvii. fig. 8), H. Winge ('Pungdyr,' pl. ii. fig. 9), and Burmeister ('Erläuterungen,' pl. xi. fig. 7), I am unable to find any other essential character to warrant the admission of two different species.

I have had occasion to examine dozens of three-striped Opossums of all ages, and I can assert the existence of variations in colour and size. As regards the colour, young individuals are frequently seen with a yellowish or greyish tinge and exceedingly well-defined and conspicuous black stripes, just as in figure 2 of plate iv. of the Catalogue of Marsupials in the British Museum. Older individuals, generally more rufous, often show only pale stripes, and, not rarely, specimens will be met with apparently stripeless, the stripes only appearing against the light. I frankly confess that I have had moments when I became doubtful whether the *P. henseli*, a second new *Peramys* of South Brazil, recently described by Mr. O. Thomas, and figured on the same plate, might not also be such a pale-striped individual of *P. tristriatus*. Burmeister's figure of *P. tristriatus* (pl. xvi. fig. 2) I consider deficient in regard to several points.

Peramys tristriatus, not at all a "rare animal," as is stated by Burmeister (Syst. Ueb. p. 141), inhabits localities more or less similar to those of *Micoureus pusillus*. It is often seen in forest-paths, especially in the neighbourhood of water. When in 1891 we dug a deep channel for our sawing-engine, this channel running about a kilometre through the forest, nearly every day a *Peramys* was found in it, and even now the water often brings down some individual specimen of this marsupial. It is entirely terrestrial, and for arboreal life it is improperly built.

I also know *Peramys tristriatus* quite well as concerns its habits and character, from studying captured specimens. Its food in freedom is similar to that of *Micoureus pusillus*; but I learned that it attacks comparatively larger animals than the former, and assails without hesitation birds and mammals nearly as large as itself. I was once imprudent enough to put together in the same cage an adult *Peramys* and a young *Hesperomys squamipes*. The next morning I found nothing more of the latter than a small piece of the skin, and the cage soiled with undeniable traces of a terrible combat. The disposition of this species is not nearly so attractive as that of *Micoureus pusillus*; bloodthirstiness and a blind delight in cruelty are the prevailing features, and a low degree of intelligence renders taming a very ungrateful matter. An almost stupid restlessness and unbounded fondness for liberty, together with an unsatiable need of food, are generally the causes of a wonderfully rapid decay and death. Young individuals, however, are pleasing creatures, remarkable for their large heads. With milk and insects they can be kept alive some time by persons having the necessary time and leisure. I know here of a person who observed the copulation of *Peramys*, and was once told of a mother carrying her young on her back; unfortunately I arrived too late to see it.

It is also necessary to say that the habits of *Peramys* are equally by preference nocturnal.

The measurements of three individuals before me are:—

a. ♀ (spirit pres.)	total length	157 mm.,	head and body	105 mm.
b. ♂ (dry skin)	,, ,,	179 mm.	,, ,,	120 mm.
c. ♂ (,,)	,, ,,	201 mm.	,, ,,	145 mm.

The basilar length of the skull of specimen *b* is 28·5 mm., of specimen *c* 28 mm. (Mr. O. Thomas mentions for an adult ♂ of *P. americana* 28 mm., for an adult (?)[1] ♂ of *P. iheringii* 22·2 mm.).

6. Chironectes palmatus.

The singular and beautiful Water-Opossum, so well represented

[1] [This query is Dr. Goeldi's, not mine.—O. T.]

by Burmeister, plate ix., is really rare, and seems, as I mentioned in my 'Mammals of Brazil,' p. 146, to be approaching extinction. Till now I have only obtained two specimens in the Serra dos Orgãos, a male and a female, and have not had the good fortune to make any special observations on its habits in freedom.

Thus six species of Didelphyidæ have come under my observation during a stay of several years in Serra dos Orgãos. Mr. O. Thomas admits 24 species of this family, exclusively American, therefore we note a numeric proportion of 6 : 24, which is $\frac{1}{4}$ of the whole.

I cannot conclude these notes without calling the attention of zoologists to the necessity of cancelling a species of *Didelphys*, established on the authority of Prince Maximilian zu Wied-Neuwied at the beginning of the present century and still admitted.

Mr. O. Thomas writes (Catalogue of Marsupials in the British Museum, p. 366):—

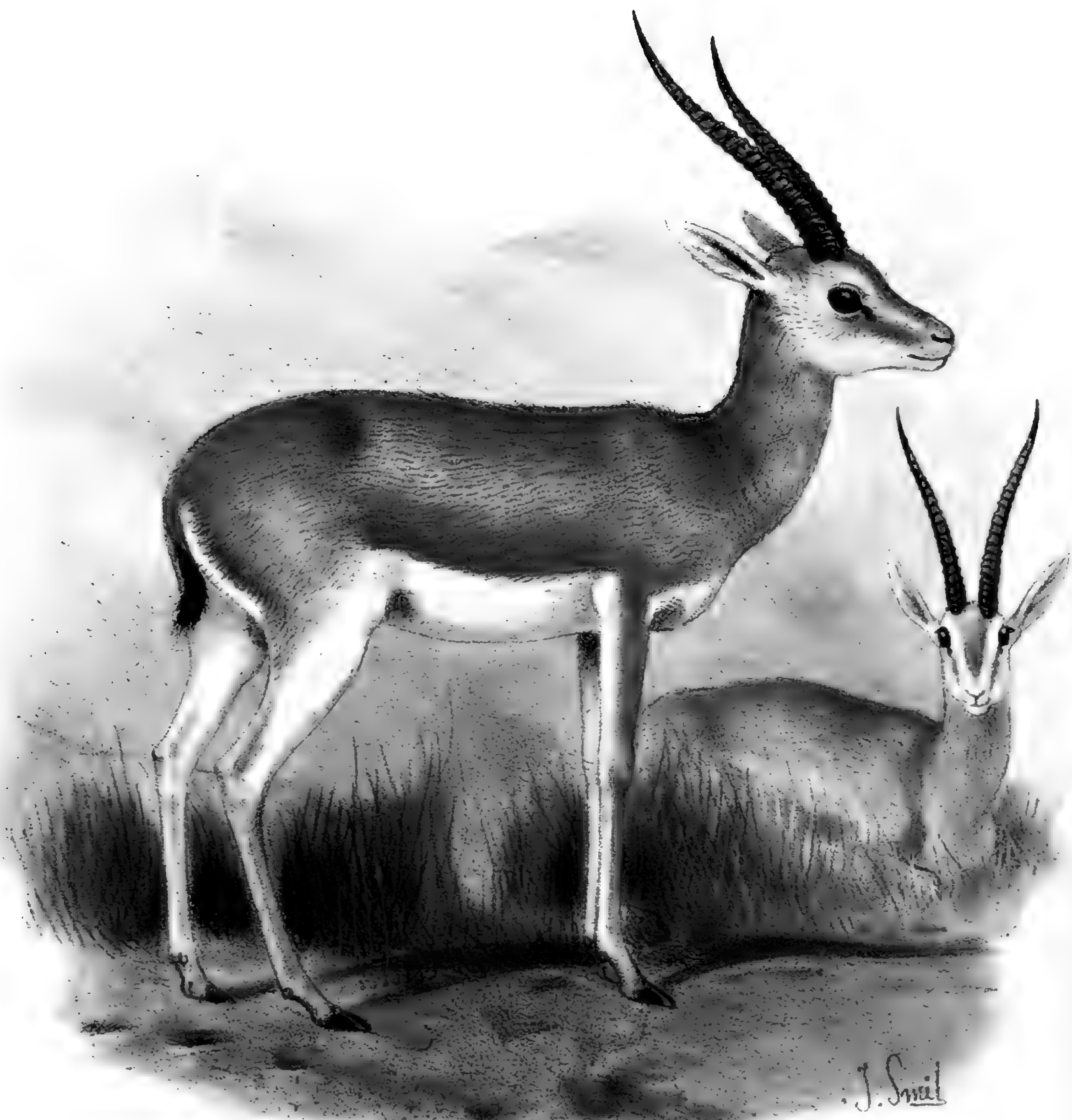
"23. DIDELPHYS ALBOGUTTATA (White-spotted Opossum).

"Rather smaller than *D. americana*; mouse-grey, with many rows of white spots on its back. Habitat: Brazil (Forest-region). Type in the Museum of Rio de Janeiro. The above is the only information as yet published about this species, of which I have never seen a specimen."

I knew what Prince Maximilian had written about this supposed *Didelphys* (Beiträge, vol. ii. p. 412), and also Burmeister in 1854 (Syst. Ueb. vol. i. p. 340) and in 1856 (Erlaüt. p. 87); and when in 1884 I assumed the direction of the Zoological Section of the National Museum of Rio de Janeiro [1], I submitted to a thorough review the small and very imperfect series of Brazilian Didelphyidæ preserved there. I readily found the supposed *D. alboguttata*, an old specimen certainly dating from the period of Dom João VI., and soon recognized it to be a specimen of *Dasyurus viverrinus*, an Australian marsupial. Considering the intimate relations between the Portuguese colonies in Asia and South America in former times, the presence of this *Dasyurus* becomes explainable. The specimen still exists and is now properly labelled. It is one of the most droll mistakes that ever happened in zoology, and it is somewhat singular that Prince Maximilian and Burmeister, both good naturalists, showed themselves liable to make such an error. Entirely incomprehensible it is for me how Burmeister should make the matter still worse by the words:—"Das Thier lebt im Waldgebiet, und war Hrn. Besckc [2] aus eigner Ansicht bekannt, allein noch nie hatte er es, in den 20

[1] This position I lost in 1890, as Fritz Müller and Herman von Ihering lost theirs, through the political changes in Brazil. In spite of seven years' incessant labour, I had not been able radically to reform the zoological collections and to get them out of the bad state in which I found them.

[2] A collector who resided for a long time in Novo Friburgo (Serra dos Orgãos), and whose name is often met with in the different works of German travellers and naturalists.



J. Smit del. et lith.

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GAZELLA LODERI.

Jahren seiner Anwesenheit, sich verschaffen können" (Syst. Uebers. i. p. 340).

I believed *D. alboguttata* "dead and buried," when I saw its resurrection in 1888 in the 'Catalogue of Marsupials.' I consider it my duty to give to this supposed Brazilian species of *Didelphys* eternal repose, and to deliver zoological literature from an error threatening to become hereditary from generation to generation.

2. On some Gazelles brought by Sir Edmund Loder from Algeria. By Oldfield Thomas.

[Received June 5, 1894.]

(Plate XXXII.)

By the kindness of Sir Edmund Loder I have been permitted to examine and describe some Gazelles brought by him at different times from Algeria, a country in the Natural History of which he has always taken much interest.

Of late years two Gazelles have always been recognized as natives of Algeria, namely *G. dorcas*, the Common Gazelle, and *G. cuvieri*, the Mountain Gazelle, or "Edmee." Many Gazelle-horns, however, evidently belonging to neither of these, having come into his possession, Sir Edmund undertook an expedition to obtain specimens of this unknown Gazelle, a quest in which he was fortunately successful. On his bringing back the specimens thus secured, together with another he had had some time in his possession, I was surprised to recognize no less than *four* species, two of them requiring description as new. The first of these is the Reem, an account of which is contained in the field-notes now to be read by Sir Edmund; while the other, being based on a skin purchased at Algiers many years ago, must unfortunately still remain a mystery as to exact locality until some other enterprising sportsman is able to find out where it really lives.

Sir Edmund Loder is much to be congratulated on the success of his expedition, and on the increase of our knowledge about the Gazelles which has resulted from it.

The following are the four species represented:—

1. Gazella dorcas, L.

The Common Gazelle of the Algerian Sahara generally.

2. Gazella cuvieri, Og.

A fine male specimen of the "Edmee" from the mountains north of Biskra is among Sir E. Loder's trophies. (Its skull-measurements are given on p. 472.)

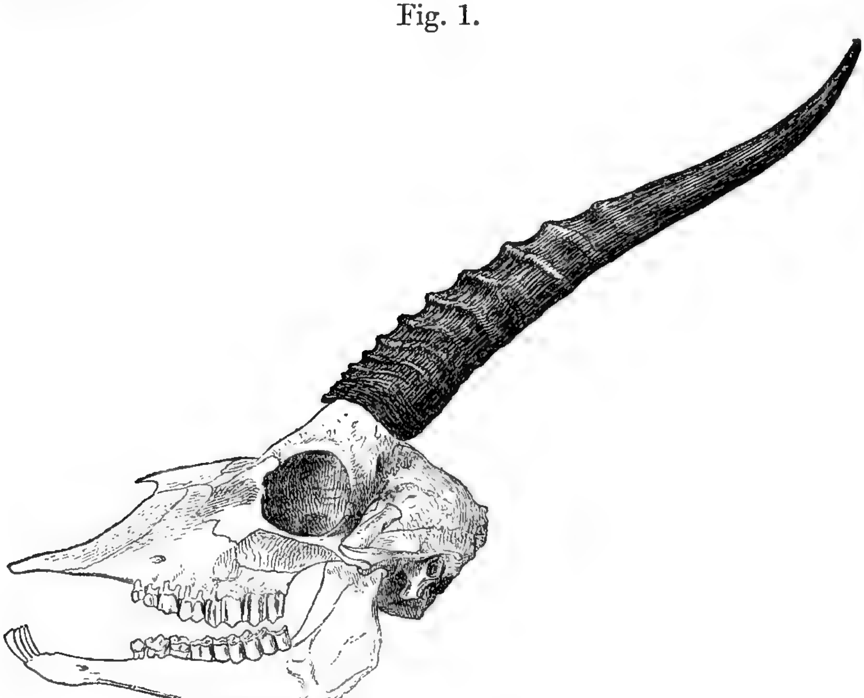
3. Gazella rufina, sp. n.

Very similar in coloration to *G. rufifrons*, Gray, but distinguished by its much larger size, heavier skull, stouter hoofs, and by the indistinctness of the light facial bands.

The general colour is a bright rich rufous, very different to the pallor of *G. loderi*. The central facial band is especially rich, almost approaching chestnut, while the light bands on each side of it, although distinguishable, are only slightly paler than the general body-colour, contrasting markedly with the white and prominent corresponding bands in other species. Crown, cheeks, and sides of neck pale rufous. Ears proportionally rather short, their exterior surfaces rufous, similar to the body in general; their edges and inner surfaces whitish. Dark lateral bands very strong and well-defined, although narrow (1 to $1\frac{1}{2}$ inch broad), nearly black; light lateral bands sharply defined from the deep colour of the middle back, concolorous with the neck, cheeks, and crown. Dark pygal band but little developed. Belly white. Limbs rufous in front, whitish behind; knees without tufts, but with a narrow ridge of rufous hairs running down the metacarpus just below the knee. Hoofs large and heavy, twice the bulk of those of *G. rufifrons*. Tail rufous basally, black terminally.

Skull (fig. 1) stout and heavily built, with short broad nasals, large and widely open anterior nares, broad heavy muzzle, and large teeth.

Fig. 1.



Skull of *Gazella rufina*.

Horns unusually short in proportion to the general size, those of the type, which is unquestionably full-grown, less than once and a half the basal length, while in an equally aged *G. cuvieri* they are nearly twice that length; they are, however, very thick and strong. As to direction, they are rather far apart basally, and diverge evenly but slightly upwards; for their basal two-thirds they curve backwards, but so far less than in other species that their hinder profile is scarcely concave; their tips bend again equally slightly upwards. Of rings they have only about 10, strongly developed in front, but obsolete postero-externally.

Measurements of the type, a flat skin, probably somewhat stretched:—

Head and body (c.) 1400 mm.; tail without hairs 160, with hairs 220; ear from notch 132; fore hoof, length 54; hind hoof 54.

(Skull, see p. 472.)

Hab. Doubtful. Type bought at Algiers.

In describing this very handsome Gazelle as new the first point to be considered is its distinctness from *G. rufifrons*, Gray, the Senegal Gazelle, of which the typical specimens are in the British Museum. These specimens are two, male and female; but the male is unfortunately far younger than the type of *G. rufina*, so that the great difference in size between the two species has had to be discounted in the case of one co-type by considerations of age, and in the other of sex. But a careful comparison of a set of other Gazelles, including *G. granti*, *sœmmerringi*, *bennetti*, and *muscatensis*, has shown (1) that size does not greatly increase, however much the horns may elongate, after m^3 is up; and (2) that the sexes, widely different as the horns are, do not differ in bulk to anything approaching the extent by which the type of *G. rufina* exceeds the female co-type of *rufifrons*.

The two species, though undoubtedly closely allied, are therefore evidently separable on account of their difference in size.

Secondly, the question of *Gazella corinna*[1], Pall., has to be considered. This name was based on Buffon's "La Corine," described from a specimen which lived in the menagerie of the Duke of Orleans, and of the locality of which no mention is made[2].

Although the figure given of this animal shows undoubtedly much resemblance to *G. rufina*, the measurements, both those of the body and those of the skeleton[3], are absolutely incompatible with it, Buffon's animal, whatever it was, having been if anything smaller than *G. rufifrons*, from which, as already noted, *G. rufina* is distinguished by its considerably greater size. The true determination of the Corine is, and perhaps must always remain, impossible of solution, as Buffon's own statement that, in common

[1] La Corine, Buff. H. N. xii. p. 261, pl. xxvii. (animal ♀) (1764). *Antilope corinna*, Pall. Misc. Zool. p. 7 (1766).

[2] Buffon's reference to the Corine of a horn brought from Senegal by Adanson must not be mistaken for a statement as to the locality of the living type specimen.

[3] An unfortunate misprint in the headline of Buffon's page 265 has given rise to some misapprehension as to the pertinence of the long table of measurements there given. Instead of "du Kevel" the line should run "de la Corine," as is clearly shown by the text of the preceding page.

with "La Gazelle" and "Le Kevel" (both undoubtedly referable to *G. dorcas*), it had knee-brushes and was of much the same size and colour as they were, conflicts with his plate, in which the artist has depicted it as without knee-brushes, bulkier in general build, and with a far better marked lateral line than in the other two. This being the case, all attempts to determine it with certainty may be abandoned as futile.

It is unfortunate that for the present the exact habitat of *G. rufina* is unknown, as the skin was merely purchased in Algiers. From the richness of its colour it is not likely to be the inhabitant of an arid sandy district such as is the home of *G. loderi*, but it may come from some of the more brush-covered downs of the Sahara.

4. Gazella loderi, Thos.[1] (Plate XXXII.)

Size small; form light and delicate; weight of an adult male (*teste* Loder) about 34 lb.

General colour very pale sandy or buff, the richest colour of the after-back approximately "pinkish buff" of Ridgway, and even this becomes paler and almost white anteriorly on the neck and crown, and posteriorly on the sides of the rump. Face-markings very faint, the central facial band and dark facial streaks only "buff," and contrasting but little with the ill-defined pale facial streaks. Crown nearly white, as are also the long and well-clothed ears. Light lateral bands scarcely visible, and the indistinct dark ones below them hardly as deep as Ridgway's "clay colour," as is also the case with the dark pygal band. Tail sandy at base, darkening terminally to blackish brown. Front of fore legs pale sandy buff, of hind ones whitish. Knees with short but distinct brushes. Hoofs very peculiar, and evidently specialized for progress over light yielding sand. They are much elongated, very narrow, and produced above into a sharp knife-edge; the angle at which their plane of wear lies shows that they are habitually widely divergent in life, as might indeed be expected.

Skull (fig. 2) of about the size and proportions of that of *G. bennetti*, but rather lighter and more delicate.

Horns very slender, close together at base, widely divergent above, their tips from 8 to 10 inches apart in well-marked examples. Viewed from the side they are seen to curve slightly but evenly backwards for four-fifths of their length, while their slender tips are slightly recurved upwards, but there is nothing to call a terminal hook; their annulations are well defined and rather near together, amounting in number to 20 or more, the most out of a large number of horns being 27 in a particularly fine and graceful pair belonging to Sir E. Loder.

Measurements of the type, an adult male skin, with perfect skull:—

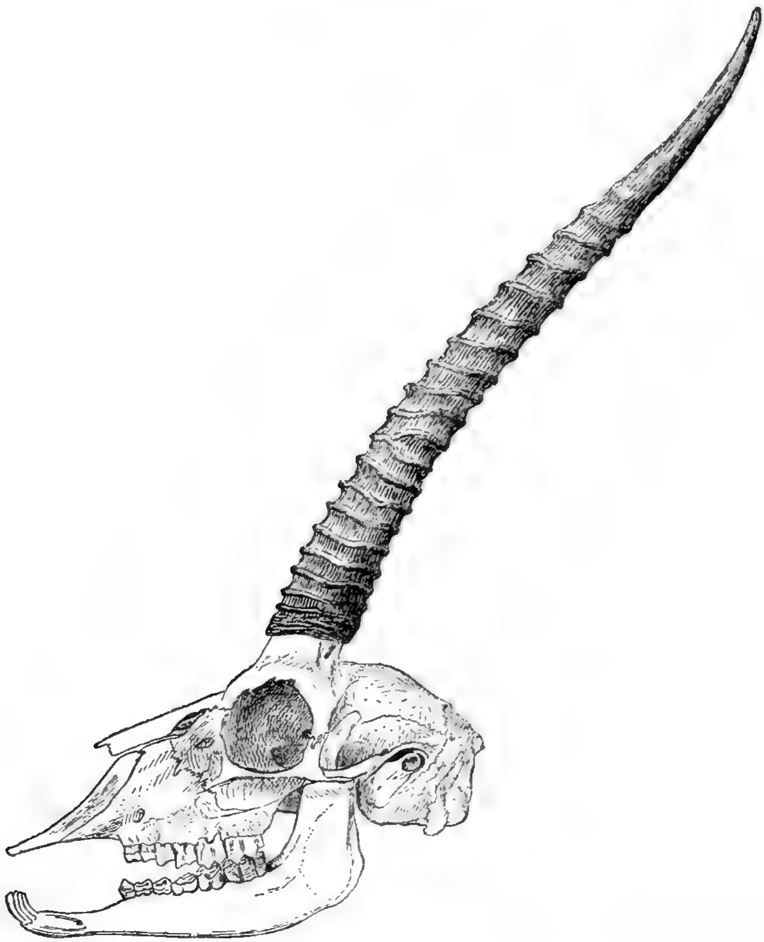
Length of body (approximate) 900 mm.; ear from notch 130;

[1] Ann. Mag. N. H. (6) xiii. p. 452 (1894).

hind-foot, without hoof (c.) 280; length of fore hoof 64, of hind ones 56; tail without hairs, 90.

(Skull, see p. 472.)

Fig. 2.



Skull of *Gazella loderi.*

Hab. Sand-dunes of Oued Souf, about 100 miles south of Biskra. (See field-notes by Sir E. Loder, p. 473.)

This remarkable little Gazelle is readily distinguishable from all other species by its pallid colour, semi-obsolete markings, slender divergent horns, and long narrow hoofs.

Its habitat, as may be seen by the field-notes of its collector, is somewhat inaccessible, and it is therefore the less surprising that examples fit for description have not previously fallen into the hands of naturalists. Its horns have, however, long been purchasable at Biskra, and the first I had seen were bought there by Mr. Rowland Ward, and submitted to me for examination about two years ago, but the horn characters were too little marked for the species to be described merely on the specimens I then saw.

Loche, in his work on the Mammals of Algeria, speaks of a Gazelle known to the Arabs as "el Rim," the name now used by them for *G. loderi*, and no doubt the same species was intended. His reference runs as follows:—"Les Arabes distinguent encore sous les noms de *el Rim* et *el Chergui* deux autres Gazelles que nous n'avons pas jusqu'ici eu occasion d'examiner, et qui pourraient être des métis des espèces précédentes"[1]. This sentence was quoted by Lataste in 1885[2], but he had no information of his own to add to it.

It has therefore been reserved for Sir E. Loder to clear up the history of this interesting Gazelle, so long known by reputation, but until now an unsolved mystery to the scientific world. As his expedition into the desert was undertaken expressly to obtain the Reem, and thereby settle a doubtful problem, it is only right that the species should bear his name, which I have therefore had great pleasure in attaching to it.

Whether the companion problem of "el Chergui" is equally solved by Sir E. Loder's specimen of *G. rufina* above described is a point which can be settled only when we know the exact locality and Arab name of the latter.

Skull-measurements (in millimetres) of the Algerian Gazelles referred to.
(All adult males.)

	Gazella dorcas.	*G. cuvieri.*	*G. rufina.*	*G. loderi.*
Greatest length	170	210	—	194
Basal length	158	187	(c.)204	173
Greatest breadth	78	92	93	85
Anterior nares, length (gnathion to nasal tip)	50	60	69	54
Anterior nares, greatest breadth	20	25	30	24
Nasals, length	44	65	52	57
Nasals, breadth	19	27	34	24
Gnathion to orbit	85	113	124	101
Palate, length	83	111	120	98
Gnathion to alveolus of front premolar	37	51	59	44
Length of molar series	55	60	66	55
Horns—length round curves in front	303[3]	348	292	330
Basal circumference	99[3]	108	119	95
Least distance of horns apart at base	16[3]	105	22	14
Breadth across outside bases of two horns	70[3]	73	86	65
Tip to tip	112[3]	110	141	192

[1] Expl. Alg., Mamm. p. 69 (1867).

[2] Mamm. Barb. p. 174 (1885) (Act. Linn. Soc. Bord. xxxix.).

[3] In another finer specimen, whose basal length is about 5 mm. longer than in that measured.

3. On the "Reem" Antelope of Algeria[1]. By Sir Edmund Giles Loder, Bart., F.Z.S.

[Received June 1, 1894.]

Seventeen years ago (in 1877) I bought in the bazaar at Biskra several pairs of Gazelle horns. They obviously belonged to three species: *Gazella dorcas*, called by the Arabs "Rezal"; *Gazella cuvieri*, which they call "Admi"; and a third called "Reem," which I was not able to identify with any described species. All these horns were on frontal bones only. It is very rarely that the Arabs bring in any whole skulls or skins for sale, and I have never seen anything but frontlets of the "Reem."

In 1891 and again in 1893 I went out to Algeria for the purpose of hunting Mouflon (*Ovis tragelaphus*).

In 1877 I had been prevented from going after them except for a few hours at a time. On these later trips I was more successful and secured some fine male Mouflon, a female of the large Mountain Gazelle (*Gazella cuvieri*), and a few specimens of *Gazella dorcas*.

At Biskra I again found horns of the Reem, but got no information about it except that it was reported to live in the sand. I heard a French name for it for the first time, "Gazelle des Sables."

As my friend Mr. Alfred Pease was spending a second winter at Biskra and had made the acquaintance of several native hunters, I requested him to try what he could do to find out the habitat of the Reem. About Christmas-time last year he wrote to me that he believed he had reliable information that the Reem was to be found in the desert near Chegga, only about 50 kilometres south of Biskra on the caravan-route to Touggourt.

We made arrangements for a camping trip, and I left England on February 1st, and started from Biskra with Mr. and Mrs. Alfred Pease on February 8th of this year.

After two days' marching we got to Chegga and made inquiries respecting the Reem. No one seemed to know anything about the animal except one Arab, who said that if we went on farther south we should come to a place called Ain Gebberah, where there were a few Reem, but if we went on still farther to Hamraia we should find the Reem in quantities.

We therefore travelled on for two or three more days until we came to Hamraia, but on making inquiries about the Reem the answers were very unsatisfactory. We determined, however, before giving up the search, to stay here a day to hunt and see what game there was in this part of the desert.

In the early morning of the next day Pease started off from camp with an Arab in one direction, while I went off in the other. By the evening we had covered a considerable extent of country and had used our glasses from every available rise in the ground. We

[[1] Gazella loderi, Thomas, above, p. 470.—Ed.]

saw several small herds of *Gazella dorcas*, but no tracks even of any other Gazelle. We did not seem to be any nearer to obtaining a Reem than when we started from Biskra.

At night, when we got back to camp, we were told that a negro camel-herd had been there during the day, and had said that we were not at all in the right country for Reem, that he was well acquainted with the animal and knew where it was to be found. He came into camp again the next morning and told us that the Reem had long slender hoofs and tender feet, lived only in the soft sand, and would be unable to run on hard stony desert such as that round Hamraia. He said he could take us to the Reem country, in rolling sand-hills, but we should not be able to camp very near as there was no water for our horses and pack-animals.

We agreed to go with him, and he led us a day's march still farther south towards the Oued Souf, and then turned off the caravan-track to the east and chose a camp in the sand about an hour and a half from water. (Almost all the water in the desert is brackish and bad, but the water we got here was positively nasty.)

The next morning we left camp very early on horseback, with the negro on foot and an Arab hunter riding a mule. The negro led the way at a tremendous pace, keeping up a good trot in the soft sand and sometimes running fast for a couple of miles without a stop across the dry arm of a chott, keeping us at a hand-gallop most of the time.

After two hours and a half the negro pointed out the first track of the Reem, which is quite easily to be distinguished from that of *Gazella dorcas* from its much greater length. We now unsaddled the horses, tied them up, and went off in two parties to hunt for Reem. The negro led the way in front of me, going slowly and with great caution, as the Reem is extremely wary and against the nearly white sand can detect a moving object a long way off. We had not walked very far when we saw the head of a Reem looking over the top of a sand-ridge at about 300 yards distance. We stayed for a long time perfectly still behind a tuft of tall alpha grass, till at last the head disappeared. As soon as it was out of sight we ran as hard as we could across the bare sand to the top of the next ridge, and again sheltered ourselves behind a tuft of alpha. When we looked out cautiously we saw that the Reem had moved on to another sand-hill more to our left, and was again showing just the top of his head over it. We had, however, considerably reduced the distance. Again he stopped perfectly still for a long time and then turned and moved off. We ran to another ridge, and I caught sight of him trotting to the top of the sand-hill beyond at about 150 yards. At the top he turned and I fired at once and got him. A lucky shot! as the distance was long for so small an animal. It was a good male, with horns 13 inches long. I have not seen any much longer than these.

After taking the Reem back to the place where we had left the horses, we started off again, and during the day saw several small lots containing both males and females (4, 5, and 2), but did not get a chance of another shot. Pease also saw a few.

We hunted the sand-hills for two more days; on the third day our negro guide took us much farther from camp, running before us with surprising speed and endurance for three and a half hours before we halted and tied up our horses. In the evening, after walking all day in a hot sun and on soft sand, he showed himself still untired and ready to run at the same pace back again to camp. This remarkable man said that he had lived for seven years in the desert without sleeping in a house or tent, and had hardly tasted water, meat, or bread; during the whole of that time his food consisted of dates and camel's milk, and he attributed his strength to this diet. The long distance of our camp from the sand-hills where the Reem is found was a great hindrance, as we could not hunt for them at the time they were feeding. By the time we got to the ground they were already lying down for the day, generally on the top of the sand-ridges, and keeping a watchful look-out. We saw several small herds each day, but neither of us ever got another chance of a shot.

We were lucky in having calm weather, as a sand-storm in that country is a very serious matter. The air gets as thick as during a bad London fog and one cannot see even a few yards ahead, making it quite impossible to regain camp, all tracks being blotted out in a few minutes by the wind. Our experience of sand-storms was limited to *one* day, our last day in the desert, luckily for us well outside the region of the sand-hills, when leaving our caravan behind we rode in 50 kilometres to Biskra in the teeth of a cutting wind filled with dust and sand, an extremely painful experience; but we were in no danger of losing our way as we were then on the broad track worn by the caravans travelling between Biskra and Touggourt.

The Reem is remarkable for its light and uniform coloration, the ordinary Gazelle-markings being hardly noticeable. The long slender hoofs are also very peculiar, reminding one of those of *Tragelaphus spekii*, which lives in the swamps on the borders of lakes and rivers.

It is quite certain that the Reem can never drink, as there is no water in this country at all, except in the comparatively deep wells dug by the natives.

The following measurements of the male Reem were taken directly after it was killed:—Height at shoulder 2 ft. 4 in.; girth at brisket 2 ft. 1 in.; length of horns 13 in. It weighed, after being brought into camp (without entrails), 34 lb. These are about the measurements and weight of *Gazella dorcas*.

For comparison I give the measurements of a good male *Gazella cuvieri* which I killed in the mountains a few weeks after the Reem: Height at shoulder 2 ft. 7 in.; girth at withers 2 ft. $8\frac{1}{2}$ in.; weight without entrails 58 lb.

As to the distribution of these species, I may say that *Gazella cuvieri* is found entirely in the mountains, never down in the true desert. It climbs like a Chamois to the tops of the highest mountains in the rockiest ground, and is often found in the juniper-forests on the mountain-slopes. These are also the haunts of the Mouflon, the two animals being constantly seen on the same ground.

Gazella dorcas is found all over the hard stony desert and also on the foot-hills, so that it sometimes overlaps the range of the Admi. I have seen a few in the sand-hills, the true country of the Reem; but I believe that still farther south it is not found, its place being taken entirely by the Reem. I quite believe the statement of the natives that the Reem is never found off the soft sand.

4. Note on the Period of Gestation of the Indian Antelope, *Antilope cervicapra* (Linn.). By Sir Edmund Giles Loder, Bart., F.Z.S.

[Received June 1, 1894.]

Well known as is the Indian Antelope, the period of its gestation does not seem to have yet been ascertained. Blanford, in his 'Fauna of British India,' 1888–91, quotes Elliot, "The rutting-season commences about February or March, but fawns are seen of all ages at every season;" and adds a note of his own, "I cannot find the period of gestation recorded." Jerdon, in his 'Mammals of India,' 1874, gives the same quotation from Elliot. Sterndale, 'Natural History of the Mammalia of India,' 1884, copies this quotation but not quite correctly:—"The *breeding*-season begins in the spring, but fawns of all ages may be seen at any time of the year."

Having kept a herd of these Antelopes for several years, practically in a wild state, in a park of considerable extent, I should like to take this opportunity of putting on record my own observations.

I find that the does of this species breed *regularly* here twice every year. One particular doe, which is tamer than the others, and therefore perfectly well known, had a young one on April 10, 1892, and another young one on November 10 of the same year.

It is usually very difficult, if not impossible, to tell the *exact* date of the birth of a fawn, as the does hide their young ones very closely in the heather and bracken for a fortnight or three weeks, visiting them only during the night.

When the young ones are first seen with the herd they are probably three weeks to a month old.

Another doe had a young one on May 7, 1893, and a second on October 14, 1893. The period of gestation must therefore be about 5 months.

5. Notes on a particularly Abnormal Vertebral Column of the Bull-frog; and on certain other Variations in the Anuran Column. By W. Blaxland Benham, D.Sc. (Lond.), Hon. M.A. (Oxon.), Aldrichian Demonstrator in Comp. Anat. in the University of Oxford.

[Received April 4, 1894.]

(Plate XXXIII.)

Among the skeletons of *Rana mugiens* which are kept in spirit and used for class purposes at Oxford I came across one specimen which exhibited certain striking abnormalities. Like the rest of the vertebral columns this had not been entirely macerated, so that the vertebræ were still connected by connective tissue; and as the outlines of the vertebræ were not well defined, the specimen looked at a first glance merely slightly curved—the curvature being more marked on the ventral than on the dorsal surface.

I have had drawings made of this column, natural size, viewed from below and from above. (See Plate XXXIII.)

There are the normal number of transverse processes on each side, viz. eight, but it will be noticed how curiously these eight are distributed. There are only six separate vertebral pieces (A, B, C, D, E, F), three of them being "compound vertebræ" and showing more or less distinct signs of their fusion. The first "piece" consists of the normal "atlas" fused with the second vertebra, which possesses the usual pair of transverse processes. The second piece (B) consists of $2\frac{1}{2}$ vertebræ; on the right side it carries two transverse processes, on the left three. The next two vertebral pieces appear to be perfectly normal vertebræ, each with a pair of transverse processes, and, as far as can be judged, they are symmetrical.

The fifth vertebral piece (E) consists of $1\frac{1}{2}$ vertebræ, and bears two transverse processes on the right side, and only one on the left—thus it is the complement of the second piece.

The last, or ninth, vertebra is normal and articulates with a normal urostyle.

The separate vertebral pieces, which present abnormalities, are drawn the natural size; but their side views are represented twice the natural size.

The first piece (A), figs. 3–6, consisting of "atlas" and second vertebra, is asymmetrical; the fusion is greater on the right than on the left side, for on the latter there is a large intervertebral foramen, just in front of the transverse process, whilst on the right side there is an extremely small perforation through which even a very fine needle will not pass, and it is scarcely likely that the "hypoglossal" nerve could issue here. On this side, however, the neural arch of the "atlas" is less extensive than on the left; and it is possible that the first spinal nerve, instead of issuing between the vertebræ, passed in front of the arch, for there is a well-marked notch (*x*, fig. 6) between it and the facet for the occipital condyle. The dorsal limit of the neural arch of the "atlas" is fairly distinct, except on the right side; elsewhere the hinder margin overlaps the anterior margin of the second vertebra in the usual way, but synostosis of the zygapophyses and arches has taken place: there is no hole between them.

The centra, too, are entirely anchylosed, but the line of fusion is very distinct, and, as Howes has noted [1], is marked out by a prominence or ridge. This line of fusion is not symmetrical, as the drawing shows.

The second vertebral piece (B) (figs. 7–11) possesses three neural spines (*a*, *b*, *c*), but is composed of only two vertebræ on the right side, each with a transverse process (III.', IV.'); whilst on the left there are distinctly three vertebræ represented by three transverse processes (III., IV., V.).

If this compound piece be viewed from below (fig. 8), certain faint lines are seen crossing the compound centrum in oblique directions: they are not by any means distinct, and result rather from differences in structure than from any ridge; but they indicate the planes of fusion and suggest that this piece consists of the normal 3rd vertebra (III.), followed by a semi-vertebra (IV.) on the left side, and this again by a complete vertebra (IV.', V.). This suggestion seems to receive a certain amount of confirmation from the fact that the compound centrum is curved, the concavity being towards the right. This interpretation acquires further justification from the fact that there is a half neural arch with its spine (*b*) separating, on the left side, the more normally constituted arches. The first of these is, however, distorted, the neural spine (*a*) being directed distinctly towards the left side; the anterior zygapophyses are asymmetrical, and other evidences suggest strong compression of the arch, resulting in a forward thrusting of the left half of the arch (III.) by the extra half vertebra (IV.).

The hinder region of this compound piece is symmetrical. Here, as before, the fusion between the arches dorsally is complete, but laterally the intervertebral foramina exist—a small one on the right side (fig. 10), just admitting an ordinary needle; two larger ones on the left (fig. 9).

The transverse processes are curiously unsymmetrical (figs. 7, 8, 11). The first on the left side (III.), the strongest, is bent downwards; the third (V.) on this side is directed nearly straight outwards as in the normal Frog; whilst on the right side the first transverse process (III.') is quite short and ends in an irregular fashion; the second (IV.') is long, and appears to correspond in size with that of the fourth vertebra in a normal column, and, like it, is curved upwards. The corresponding transverse process of the left side (IV.) is smaller and irregular; whilst that marked V. is directed upward and agrees with that carried by a normal fifth vertebra.

[1] Howes, "Notes on the Variation and Development of the Vertebral and Limb-skeleton of the Amphibia," Proc. Zool. Soc. 1893, p. 268.

The next two pieces (C, D) appear to be entirely normal vertebræ, and separated from the rest would undoubtedly be regarded as such.

The third compound piece (E) (see figs. 12–15) consists of the normal eighth vertebra, with an extra half neural arch and transverse process on the right side (VII.'). Ventrally, the centrum is only slightly unsymmetrical, being a little longer on the right than on the left side. There is no sign or mark of an extra centrum. But dorsally there is evidence, in the existence of two neural spines (*d*, *e*), together with a deep groove halfway along the right arch, as well as in the presence of two transverse processes, of fusion of an extra half vertebra (VII.').

There is an intervertebral foramen between the two transverse processes of the right side: of the latter the anterior (VII.') is directed straight out; the posterior (VIII.') is flattened, and its distal extremity curves upwards, in a manner only slightly different from the normal.

I have used the word "fusion" of vertebræ; but in the case of the second or fifth vertebral pieces I do not feel at all sure that such is the proper term to employ.

Bateson ('Materials for the Study of Variation'), in describing a somewhat analogous case of an extra half vertebra in a Python, remarks (p. 104) that the bone in question (which is closely like the 5th piece (fig. 12) of *Rana mugiens*) "is not two vertebræ simply joined together, as bones may be after inflammation or the like, but it is two vertebræ whose adjacent parts are not formed, and between which the process of division has been imperfect: with more reason it may be spoken of as one vertebra partly divided into two, but this description also scarcely recognizes the real nature of the phenomenon."

Bateson refers to one or two other similar cases in Reptiles.

But in the specimen of *Rana mugiens* we have this point of difference, that the normal *number* of vertebræ and transverse processes is retained on each side—there being, however, 9 neural spines to the first eight vertebræ. There is evidently no "intercalation" of half a vertebra; but it seems to me that during development the lines separating the mesoblastic somites were oblique instead of at right angles to the axis of the body, and that the wrong halves met across the middle line, as we find in cases of abnormal segmentation of the body in Chætopods (see Cori, Buchanan, &c.), giving rise to "spiral segments."

Thus the sclerotome destined to give rise to the right half of the fourth vertebra has united, not with its corresponding left sclerotome, but with the left sclerotome of the fifth vertebral segment. If this be the case, then the apparently symmetrical vertebral pieces C and D are not really so, but, as is indicated on the drawings, the third piece consists of $\frac{1}{2}$ V. and $\frac{1}{2}$ VI., and the fourth piece of $\frac{1}{2}$ VI. and $\frac{1}{2}$ VII.—resulting in two entire, and seemingly normal, vertebræ. But what is as curious as anything is the rectification which occurs in the fifth vertebral piece (E).

This piece, taken by itself, as we have seen, shows very little asymmetry—it is quite similar to the Python's vertebra figured by Bateson, and his description (p. 105) and explanation would equally apply here. But we see that, in the Frog, no asymmetry of the entire column results. It would, no doubt, be too laborious to count the entire number of ribs in a Python, but the suggestion may be made that the apparent "partial division" on one side (fig. 10, II., of Bateson) may be due to the same cause as I suggest above, and that it might be "rectified" further back by another half on the opposite side. He mentions, however, that the 185th vertebra of this same Python "had a similar doubling of the right side," so that, no doubt, he would have observed any corresponding doubling on the left side if it had existed.

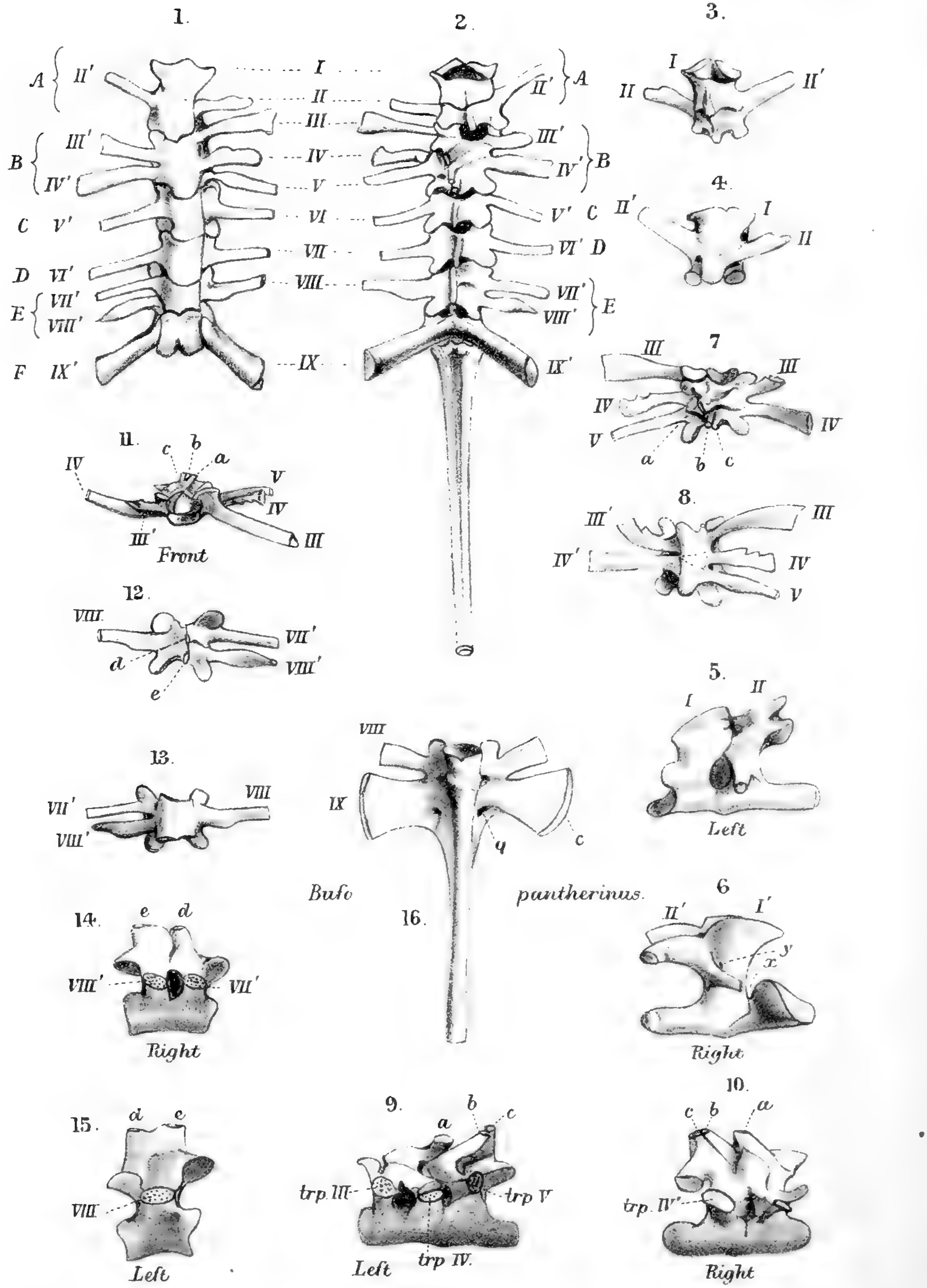
In his paper on abnormal Frogs' vertebræ, just mentioned, Howes refers to the rarity of the "fusion" of the eighth and ninth in *R. esculenta*, so that it seems worth while to add to his specimens two others which I have met with; whereas Adolphi[1] found only one such case in 212 Toads examined, I have met with two cases in eight skeletons of *R. mugiens* (exclusive of the abnormal specimen just described). In each of these two skeletons, in fact, the conditions of the sacral and eighth vertebræ are precisely those described and figured by Howes on p. 269 (figs. 1 *a*, 1 *b*, 1 *c*), and, as there, my specimens present the slight ridge at the line of fusion. It seems, then, that *R. mugiens* presents great scope for Mr. Bateson: various kinds of "variations" occurring evidently with considerable frequency.

Having met with these instances, it seemed desirable to look over the skeletons in our Museum, so as to note any other abnormalities in the vertebral column which might be presented by them. I was rewarded by finding two cases in species of Toads. The first case occurs in a dried skeleton of *Bufo agua*, in which the "atlas" is co-ossified with the second vertebra.

The second and more remarkable case I noted in *B. pantherinus*. Here the seven anterior vertebræ are perfectly normal, but the eighth and ninth are united with one another, and the latter with the urostyle (see fig. 16, nat. size). The transverse process of the eighth is fairly stout, that of the ninth is, as usually the case in the genus *Bufo*, very considerably expanded; whereas the union of the eighth and ninth centra is indicated by "Howes' ridge," there is no indication of the junction between ninth and the urostyle, the centrum is here quite smooth. The sacral transverse process is continuous with the lateral flange or ridge of the urostyle, and there is no "coccygeal foramen" for the tenth spinal nerve, such as usually occurs, the last perforation being just behind the enlarged transverse process.

Similar instances of fusion of the ninth vertebra with the urostyle

[1] Adolphi, Morph. Jahrb. xix. p. 320.



B Benham del. J. Smit lith. Mintern Bros. imp.

ABNORMAL VERTEBRAL COLUMN OF RANA MUGIENS appear, according to Hoffman ('Bronn's Amphibia'), to be normal, or at any rate very frequent, in *Pipa*, *Pelobates*, and *Dactylethra* (*Xenopus*).

EXPLANATION OF PLATE XXXIII.

Figs. 1–15 illustrate the abnormal vertebral column of *R. mugiens*, and were drawn by my wife, to whom my thanks are due.

Fig. 1. The vertebral column, ventral view: natural size. A, B, C, D, E, F, the six movable vertebral pieces. The Roman numerals indicate the corresponding vertebræ of the two sides.

Fig. 2. The vertebral column, dorsal view: natural size. Lettering as in fig. 1.

Figs. 5, 6, 9, 10, 14, 15 are drawn twice the natural size.

Figs. 3–6 represent the first vertebral piece, A, from above, below, and from each side.

x. The deep notch on the right side between the neural arch and the articular cup for the occipital condyle.

y. The minute intervertebral foramen.

Figs. 7–11 represent the second vertebral piece, B, from above, below, the two sides, and in front. *a*, *b*, *c*. The three neural spines. *tr.p.* The transverse processes, which are supposed to be cut short in fig. 9.

The dotted lines in fig. 8 represent the lines of union, but are more strongly marked than in the specimen.

Figs. 12–15 represent the fifth vertebral piece, E, from above, below, and from each side. *d*, *e*. The two neural spines.

The transverse processes are represented as being cut short.

Fig. 16. *Bufo pantherinus*, ventral view of terminal region of the vertebral column, natural size. 9. The foramen for last spinal nerve. *c*. Cartilage.

6. On the Pupils of the *Felidæ*.

By George Lindsay Johnson, M.D., F.R.C.S., F.Z.S.

[Received May 31, 1894.]

There has been considerable controversy with regard to the shape of the pupils of the eye of the Felidæ. In the text-books the statements vary: some say that all the Felidæ have more or less vertically oval (or oat-shaped) pupils, others, again, state that the pupil is round in some and oval in others. Most naturalists merely refer to the domestic cat, and some go so far as to divide all domestic cats into two classes, viz. those with round and those with oval pupils.

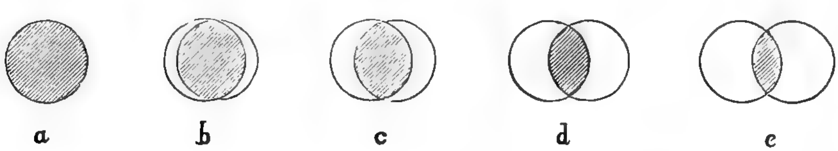
In the course of my investigations on the ophthalmology of the Mammalia I have had abundant opportunities of noticing the shape of the pupils in the Felidæ. As a knowledge of the shape of the pupils of animals and of the comparative anatomy of their irides may contribute to our knowledge on accommodation generally, and clear up some important questions connected with Astigmatism, the observations I am about to record may have some practical value.

I will first refer to domestic Cats, 180 of which, comprising the chief varieties met with in this country, were examined by me with the same degree of luminosity and classed according to the shape of their pupils, as shown in the following table, in which I use the terms relating to shape in the sense hereinafter indicated and illustrated.

I examined the animals twice over, first by day-light, and then by gas-light, the results on both occasions being the same.

Tortoiseshell.	Number examined.	Round.	Nearly round.	Round oval.	Pointed oval.
Short-haired Cats (Males)	30	20	1	4	5
Short-haired Cats (Females)	33	17	2	9	5
Short-haired dark-blue and silver-grey tabbies..	14	13	1	0	0
Siamese Cats (Males)......	4	3	0	1	0
,, ,, (Females)...	2	0	0	1	1
Short-haired gelded	25	19	1	2	3
Kittens (tabbies)	7	4	1	1	1
Long-haired Cats (Males)	22	16	0	5	1
Long-haired Cats (Females)	29	15	2	10	2
Long-haired gelded	14	4	2	7	1
Total	180	111	10	40	19

Fig. 1.



I understand by :—

Round—Practically a perfect circle. (Fig. 1, *a*).

Nearly round or Obtuse round—The area common to two equal circles whose centres are separated by not more than a $\frac{1}{16}$ part of their diameter. (*b*.)

Round oval or Rectangular oval—The common area formed when the circles are separated by about $\frac{1}{8}$ part of their diameter. (*c*.)

Pointed oval or Acute oval—The common area formed when the centres of the circles are separated by $\frac{1}{4}$ or more than a quarter of their diameter. (*d* & *e*.)

It will be seen by the above table that no general rule can be established as regards variety, with the exception perhaps of the blue tabbies, in which no oval pupils were observed.

The colour of the iris seems to have no bearing whatsoever on the shape of the pupils. Sex likewise does not seem to be any guide, as the following summary of the above table shows :—

	Number examined.	Round.	Nearly round.	Rect. Oval.	Acute Oval.
Males..............	55	38	1	10	6
Females............	64	32	4	20	8
Gelded	37	21	3	9	4

The only condition which appears to have an influence on the shape of the pupil seems to be age. My observations on the above-mentioned cats, and on a number of others, all lead me to the conclusion that the younger the cats the rarer the cases in which the pupil is round, and conversely, the older the cats the greater the prevalence of round pupils. This I think may be due to a decrease of the elasticity and consequent contractility of the iris as the animals grow older.

In no case have I noticed any convergence of the eyes or any contraction of the pupil in accommodation for near objects. Sudden bright illumination, however, invariably causes contraction.

The cat's iris contracts in a very definite and curious way. It may be imitated most accurately by causing two discs to overlap, so as to form the figures indicated in the diagrams shown above, until the horizontal diameter is equal to half the vertical (Acute oval), when the contraction ceases in the vertical direction, but continues horizontally until the sides meet, forming two parallel vertical lines in close contact (see fig. 3). At the extremities of this vertical slit there are always two round pinholes, which are caused by the inability of the fibres of the iris to come further together; if examined with a strong magnifying-glass, the radiating fibres of the iris are seen surrounding these points.

Fig. 2.

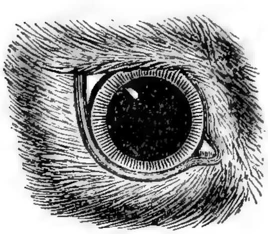
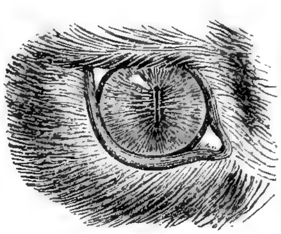


Fig. 3.



When I held a cat's face so that the unobscured sun shone directly on the centre of the pupil, and its image could be seen on the cornea, I noticed the pupil immediately contract to the above-mentioned vertical slit. So close was the contact between the free margins of the iris that, so far as I could judge, no light entered the eye except through the two pinholes. In fact, I found I could hold a cat with the lids held apart so that the sun shone directly on to the pupils without it showing any signs of discomfort, nor did the animal trouble to use its nictitating membranes. In this respect it had the advantage over the big Felidæ with pupils which contract in a circular manner, since a circular pupil can never contract completely so long as it remains a circle.

I obtained precisely the same contraction with a solution of eserine, whilst atropine or cocaine invariably dilated the pupil to its utmost extent, so that under the influence of these two latter alkaloids all pupils became perfectly circular (fig. 2, p. 483).

In all Mammalia which I have so far examined I have noticed that when atropine is first dropped into the eye a slight contraction invariably precedes the dilatation. This is most noticeable in the Felidæ, as the pupils are so large. In man it may easily be overlooked, owing to the small size of the pupil.

Suddenly alarming a cat has the effect of momentarily dilating the pupil; whilst I have noticed that during sleep the pupil is contracted to an oval, but dilates to its normal condition as soon as the animal wakes.

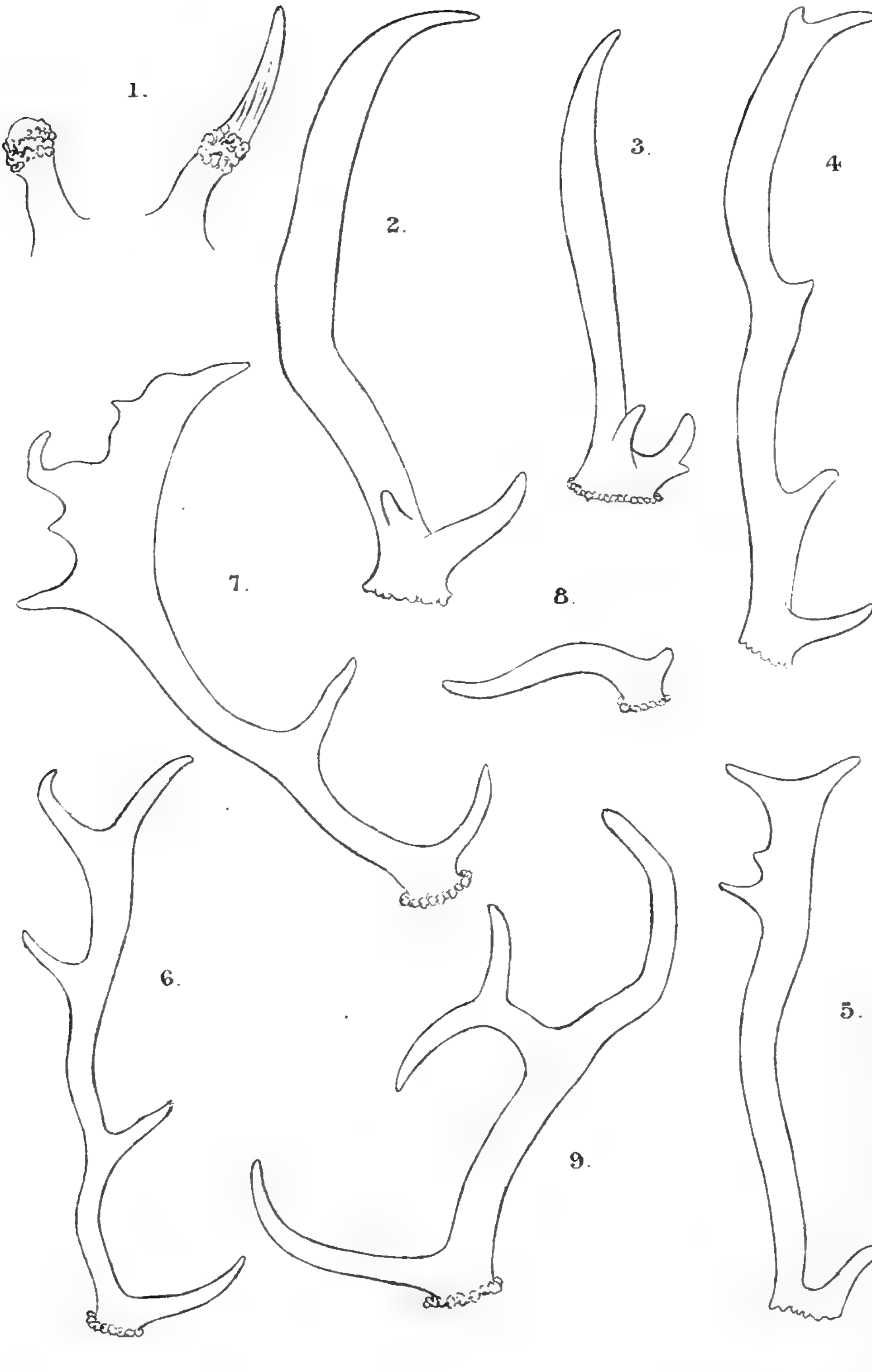
In the Wild Cat, the Geneta, and the Civet I found the pupils to be very large and round, but in bright light they contracted to an oval in the same manner as in the domestic cat. In the Lion, Tiger, Puma, and Leopard, in fact in all the large Felidæ, the pupil is invariably round, and as a rule retains its circular shape when contracting, thus forming a decided contrast to the smaller Felidæ.

June 19, 1894.

Dr. A. Günther, F.R.S., Vice-President, in the Chair.

Mr. Sclater laid on the table the skin of a Monkey of the genus *Cercopithecus*, which had been deposited in the Society's Gardens by Mr. Wall, of 4 Lansdowne Place, Russell Square, on the 5th of March, 1894, and had died shortly afterwards. He pointed out that this Monkey unquestionably belonged to the local form which he had spoken of in his paper on the *Cercopitheci* (P. Z. S. 1893, p. 255) as *Cercopithecus diana ignitus*, and which differed from the ordinary Diana Monkey in its bright chestnut thighs, shorter beard, and other smaller particulars. Mr. Sclater had lately seen a mounted specimen in the Berlin Museum, apparently also referable to this form of *C. diana*.

Mr. Sclater also exhibited the typical specimen of *Cercopithecus grayi*, Fraser, formerly in the Knowsley Collection, and now belonging to the Free Public and Derby Museum, Liverpool (*cf.* P. Z. S. 1893, p. 256), which had been kindly sent to him for examination by Mr. Henry O. Forbes, Director of that Museum. Mr. Sclater pointed out that there could be no doubt that this



G.H.Fowler del. J. Smit lith.

Mintern Bros. imp.

HORNS OF FALLOW DEER.

species, which in his paper on *Cercopithecus* he had placed in the appendix as unknown to him, was the same as *C. erxlebeni* of Pucheran (*op. cit.* p. 254). Therefore, if the strict law of priority were followed, Fraser's name would be adopted for this species; but, as it was doubtful whether Fraser's name (Cat. Knowsley Coll. p. 8), though in print, had ever been published, Mr. Sclater did not propose to use it.

Mr. H. Scherren, F.Z.S., exhibited the nest of an Amphipodous Crustacean (*Amphithoe littorina*), and made the following remarks:

"The Amphipods in the bottle are probably *Amphithoe littorina* of Spence Bate. They were taken at Jersey on May 14th, and have lived ever since in the bottle in which they are now exhibited. The nests and runs are at the bottom of the bottle. I have had the opportunity, which Mr. Spence Bate did not enjoy, of watching the nests made. The Amphipod gathered sand-grains and vegetable débris with its antennæ, till the material was within reach of its gnathopods. The material was then applied to the mouth, probably in order to cover it with some adhesive secretive, and then pressed down by the feet to the structure, the creature lying on its side the while. There are tubes in the floating weed constructed probably by this species. An individual now in the possession of Mr. Pocock, of the British Museum (Natural History), made such a tube in the course of one night."

Prof. Ray Lankester, F.R.S., read a paper on the external characters which distinguish the two Dipnoid fishes *Lepidosiren* and *Protopterus*, and pointed out that there could be no doubt that these two forms should be referred to distinct genera.

This memoir will be printed in the Society's 'Transactions.'

The following papers were read:—

1. Notes on some Specimens of Antlers of the Fallow Deer, showing Continuous Variation, and the Effects of Total or Partial Castration. By G. Herbert Fowler, B.A., Ph.D., Assistant-Professor of Zoology, University College, London.

[Received May 18, 1894.]

(Plate XXXIV.)

By the kindness of my friend Mr. J. A. Wallace of Loch Ryan, N.B., I am enabled to exhibit to the Society an interesting pair of antlers of the Fallow Deer, put up by a 'rig,' or buck castrated on one side. I have not been able to trace any description of specimens of this species which show the effects of partial castration on secondary sexual characters, although the point is of considerable interest; but dogmatic and contradictory statements on the matter are plentiful enough. When searching for similar specimens at the College of Surgeons and the British Museum, I found apparently undescribed specimens illustrating other points; and I venture to submit these incomplete notes to the Society, chiefly in the hope of directing the attention of gentlemen who have herds of Fallow Deer to abnormalities in the antlers, especially with reference to the condition of the generative organs.

The earliest account of experiments on the subject which I have been able to find is contained in the Introduction to an Essay entitled 'The Oeconomy of Nature in Acute and Chronical Diseases of the Glands,' by Richard Russell, M.D., F.R.S. (London 1755, 8vo; there is also a Latin edition of the same date).—Exper. i. A " very young deer " was castrated, which never put up any horns. —Exper. ii. A young deer "some months older" was castrated; he had " one little velvet bud instead of a horn on one side, and an irregular velvet horn, about six inches long, on the other side; both were cartilaginous; and the longest had not stability enough to keep it straight, as in the Pricket Deer, but inclined horizontally." —Exper. iii. A deer, " somewhat older than the second," was castrated, " but not cut clean, as they term it. The event was this: he had two most irregular horns that never cast their velvet; and the left testicle and spermatics being least spoiled, the left horn was (for that reason probably) one third longer than the right." From the velvet hung " soft pensile glands."—Exper. iv. Two old bucks were castrated at the end of February; their horns dropped off on the 21st March, or about five weeks too soon. " These horns were renewed next year, and were longer than the bucks of the same age, but the palms or collateral branches were less and shorter; and neither the velvet of the horns nor the horns themselves were cast ever afterwards." A postscript states that a year afterwards these horns had diminished—in the one case to stumps three or four inches in length; in the other case, the one horn was about half wasted, the other not so much so, " possibly because this buck might not be cut so clean as the former."

In the Osteological Museum of the Royal College of Surgeons is a series of antlers and frontlets, illustrating the experiments [1] made by Sir Philip Egerton for Sir Richard Owen upon the effect of various degrees of castration on the antlers of Fallow Deer. The specimens are recorded in the Museum Catalogue of 1853, and this record is repeated in the present Catalogue; it is unfortunately silent on many points of importance. The conclusions of Owen on this matter constitute the most authoritative statement with which I have been able to meet, and supersede the older statements of Redi ('Experimenta circa Res diversas Naturales,' Amstelodami, 1675, 12mo), which have been copied into

[1] The only experiments on Fallow Deer, except Russell's, of which I have found record.

many later books. Owen's views are as follows:—"If a Fallow-buck, with antlers, be castrated, they are shed earlier than usual [1], and by a more active absorbent process, which leaves an irregular concavity at the base[1]; the antlers that are subsequently developed are small, seldom branched[2], retain the 'velvet' longer than usual[2], and become thickened by irregular tuberculate masses of bone. If a young buck be castrated before it has 'put up' antlers, it does, afterwards, in some cases develop them, but of reduced size and abnormal shape, retaining them with their formative covering longer than usual[3]. Occasionally, though rarely, they are shed and renewed; but such shed antlers of a 'heavier' or castrate deer are characterized by the excavation of their base" [4] (Comp. Anat. Phys. Vert. 1868, vol. iii. p. 631). A footnote to this passage states that Sir Philip Egerton's experiments yielded "in the main" these results, and I have given references above to the specimens, of which the Catalogue-record confirms the statements of Owen.

Since, so far as I know, none of these specimens have been figured, and some of them are not included by the passage quoted above, I append a brief description of the series, and outlines of the more interesting specimens, by the kind permission of the Council of the College of Surgeons.

R. Coll. Surg., Ost. Ser.

1555. Castrated at birth. The skull exhibits slender frontal processes, about two inches in length, resembling those of a Giraffe. They are stated to have been covered during life by a hairy skin rather than true velvet. Texture, hard and bony.

1556. Castrated at birth (fig. 1). The frontlet shows somewhat similar Giraffe-like frontal processes, of more cancellous texture. They have a distinct, though slight, burr, and measure respectively two and four inches.

1563. "One of a pair that were put up by a castrated buck and retained." This is a dag still attached to the frontal bone, six inches in length, covered by coarse irregular exostoses.

1569. A similar specimen to the former two, but with longer processes covered by very coarse exostoses. The specimen was figured in Knight's 'English Cyclopædia of Natural History,' i. 844 (1854), art. Cervidæ, as "the horns of a Fallow Deer that were not shed at the usual time in consequence of the castration of the animal."

All these specimens exhibit a single short stem or "dag," such as is first put up by a buck, and all are still attached to the frontal bones.

1566. No statement of age at castration. The frontlet carries antlers which show a rudimentary brow-tyne; both it and the beam are very short, and are covered by huge exostoses. They are stated to have been retained long after the usual time for shedding.

This differs from the previous specimens only in showing signs of a brow-tyne. It is possible that all these specimens were castrated at birth, and that the antlers of this type are not shed

[1] R. C. S. Osteol. specimen 1560.
[2] R. C. S. Osteol. specimen 1565.
[3] R. C. S. Osteol. specimens 1555, 1556.
[4] R. C. S. Osteol. specimens *passim*.

at all; this appears also to have been Owen's opinion. They are more or less cancellous above the burr.

There is, however, a more complex type of antler formed after simple castration. Of the four specimens in the College of Surgeons which illustrate this type, the age at which castration was performed is implied in only one case; but it is probable, from a comparison of this specimen (1565) and its group with specimens recorded as having been castrated *at birth* (1555, 1556) and their group, that these next four are from deer castrated fairly late in life, after they had put up horns.

In three of these four specimens there has made its appearance between brow- and tray-tynes, a third tyne, which, I suggest with some diffidence, may be regarded as a bay-tyne. In an Elaphine deer this bay-tyne lies a little above the brow, often somewhat towards the outer side of the beam; and this is the position of the third tyne in these abnormal antlers.

1561. No statement of age at castration. The outline here given (fig. 2) is of the right antler from the outer side; it consists of a heavy beam, a brow-tyne, and a smaller extra tyne above it. Measurements: burr to tip, along the curve, 16 in.; brow-tyne 3 in.; extra tyne 1 in. The left antler was $1\frac{1}{2}$ in. longer, and devoid of the extra tyne.

1565. "The antlers of a castrated buck eight years old." "They were developed after castration, and were retained two years before the animal was killed." Presumably therefore the buck was castrated at the age of six years. A remarkable feature of these antlers, which are still on a frontlet, is their very unequal development. The left might pass for the antler of a "sore," or buck in its fourth year; it has a well-developed brow- and tray-tynes, and two points on the palm. The right antler, on the other hand (fig. 3), strongly resembles the preceding specimen (1561); it has a strong thickened beam, a short bifurcating brow-tyne, and the little extra tyne which may perhaps represent a bay-tyne. On the inner side, at the level of this lesser tyne, is a minute wart. Measurements: burr to tip, along the curve, $15\frac{1}{2}$ in.; brow-tyne $2\frac{1}{2}$ in.; extra tyne $1\frac{3}{4}$ in. It is possible, judging from two heads shortly to be described (1567 and Mr. Wallace's specimen), that the castration in this case was less completely effected on the left side than on the right.

1562. No statement of the age at castration. The single antler (fig. 4) exhibits three tynes and a beam with two points, but little palm. Measurements: burr to tip, along the curve, $19\frac{1}{2}$ in.; fork of brow to fork of extra tyne 3 in.; fork of extra tyne to fork of tray, 4 in.; brow-tyne projects $2\frac{1}{2}$ in., extra tyne $1\frac{1}{4}$ in., tray-tyne $0\frac{1}{2}$ in.

1564. No statement of age at castration. The single antler (fig. 5) exhibits a well-developed brow-tyne, and a palm with four points, but no tray-tyne. Measurements: burr to tip, along the curve, $15\frac{1}{2}$ in.

Of these four specimens, of which one certainly, the rest probably, were castrated after they had put up horns, all had been shed except the specimen which had been killed (1565); that is to say, the horns of castrated bucks can be shed; the burr is always excavated below, instead of being convex or flat.

1560. The buck which carried these antlers was castrated in August (probably in its fourth year); by that date the antlers were already "burnished," *i. e.* the skin or velvet had been rubbed off from them, and the antler was incapable of further development. They were shed in the following October, instead of May. In this specimen therefore the effect of castration was to hasten the shedding or "mewing." Unfortunately the antler put up in the next year is not recorded. The antlers are of course normal.

1558 and 1559. Antlers in the fifth and sixth year of a buck "from which the testes, but not the spermatic cords, had been removed soon after it was born." I do not understand this statement, since the spermatic cords are never "removed" in castration, but at most their lower ends. It may perhaps mean that the testis was simply cut away from the epididymis; in this case I cannot help fancying that some part of the testis must have escaped the operation, for the antlers are perfectly normal. They were formed and shed annually; but they are slightly smaller, were retained longer, and retained their velvet longer than those of entire bucks. The specimens, as they stand with their present label, are in direct contradiction to all the other specimens of this series, and are probably an example of the same result as the next specimen (1557).

1557. Antler of a specimen from which the half of each testicle had been removed soon after birth (fig. 6). The general development of the antler is normal, but much slighter than in the entire buck; as the palm is narrow, the three points appear unusually long. The antler was shed after the fourth year. Measurements: burr to tip, along the curve, $18\frac{3}{4}$ in.

The remaining specimen of this collection has the same history as that of Mr. Wallace.

1567. Cranium and antlers of a buck, "from which the left testis had been removed, showing a corresponding arrest of development of the left antler." "The velvet was retained longer than usual on both antlers." The right antler (fig. 7) is that of a full-grown buck, showing not more than the usual individual variation in the points. The left one (fig. 8) is very short, carries a rudimentary brow-tyne, and is curved backwards over the parietals. Measurements: right antler, burr to tip, along the curve, $20\frac{1}{2}$ in.; left antler, same measurement, $5\frac{1}{2}$ in.

Mr. Wallace's specimen (fig. 9) is stated also to be from a "rig," or half-gelding. The right antler is slightly developed, but shows a very great abnormality; it has brow- and tray-tynes and three points, of which the lowest is further inwards towards the middle line than is usual except in old heads. The left antler has a well-developed brow, a bifurcating (? tray-) tyne, and a thin beam. Measurements: left antler, burr to tip along the curve $11\frac{1}{2}$ in.; brow 5 in.; tray to bifurcation $2\frac{1}{2}$ in., its forks $3\frac{1}{4}$ in., $2\frac{3}{4}$ in. respectively: right antler 14 in. The tradition of the head is to the effect that in this case the right testis, *i. e.* that of the side *opposite* to the abnormal antler, was removed.

Summary of the foregoing specimens :—

1. *Complete castration at birth* may result in the formation of simple dags (1555, 1556). Three other specimens (1563, 1569, 1566) resemble these, but the age at castration is not stated.
2. *Castration late in life* is recorded of only one specimen (1565). There is great asymmetry in the antlers [1], the one being of a

[1] It is of course not always easy to castrate an adult completely, and a small portion of testis may have been left on this side (*cf.* 1567, and Mr. Wallace's specimen and Russell's Exper. iii.). But even if castration have been completely effected, the presence of spermatozoa in greater quantity in one epididymis or vas deferens may be sufficient to affect that side; I am informed that in horses gelded late in life (*e.g.* funeral horses, in which the operation is deferred in order to obtain the crest) the temper is as bad as or worse than in a stallion, until they have been put to a mare—an observation which shows the marked effect of the mere presence of spermatozoa in the vas deferens upon the organism.

normal type, but of a grade characteristic of bucks much younger than this specimen, the other is profoundly modified. Other modified specimens, which appear to me likely to have the same history, are 1561, 1562, 1564.

3. *Antlers of castrated deer can be shed* (? if castrated at birth). This is shown by 1561, 1562, 1564; if castrated after the horns for the year are "burnished," the animal may shed them prematurely (1560); antlers put up after castration may be retained for at least two years (1565). When shed the burr is concave below, not flat or convex (*passim*).
4. *Partial castration soon after birth* may result in a comparatively feeble but normal development of the antlers (1557)[1].
5. *Castration on one side* may result in the nearly normal development of one antler, and the abnormality and reduction of the other (1567, and Mr. Wallace's specimen). This reduction may occur on the castrated side of the animal (1567), but is *traditionally* stated in the second specimen to be of the opposite side to castration.

There remain two doubtful specimens, the one (1558 and 1559 *supra*) with the rather incomprehensible label; the other (1568) a fine head of eight points, which is said to have been castrated; the catalogue is, however, uncertain on this point.

Very interesting in the light of the specimens gelded on one side are the observations of Collyns ('Notes on the Chase of the Wild Red Deer,' London, 1862, 8vo):—"Not unfrequently I have found deer killed by the hounds with horns deformed, or wanting. I used to attribute this to injuries done to the horns during their growth by fighting or otherwise; but from frequent investigations and dissections I have come to the conclusion that the appearances have generally been due to the shot or slug of the poacher injuring the deer in the testicle before his horns are shed, or during the growth of the new horn." He figures a pair of antlers of a specimen killed by the Devon and Somerset hounds; one of these was abortive, the other fairly well developed; there were shot-wounds in the testis of the *same* side as the defective horn.

At the Natural History Museum at South Kensington is an interesting series of abnormal antlers of *Cervus dama* from the New Forest, to which Mr. Oldfield Thomas has kindly called my attention (50.2.5.1 to 46). While there is no history as to the generative organs of these specimens, I have personally little doubt, after comparison with the R. C. S. specimens, that in the bulk of cases the abnormality is due to disease, removal, or incomplete development of the generative organs[2]. Apart from

[1] This appears to be commonly practised in some parks (Shirley, 'Some Account of English Deer Parks,' London, 1867, 8vo, p. 241) and among the Lapps (Caton, 'Antelope and Deer of America,' Boston, 1881, 8vo).

[2] A belief exists that an injury of almost any kind will affect the development of the antler; this may be illustrated by two specimens in the Roy. Coll. Surg.

this, however, which is pure speculation, a few notes on them seem to be justified from the standpoint of the increasing interest in Variation.

They fall into three chief groups :—

i. Antlers in which the abnormality or arrest is approximately symmetrical on both sides.

36.[1] 29. 35. 24. 26. 39.	Belong to the same type as the first group of the College of Surgeons; they form short dags, often overgrown by exostoses, cancellous in structure, white in colour, and are probably covered by skin throughout life.
23. 42.	Are compact rough dags, obviously burnished, growing backwards and downwards. This curious direction is taken in several specimens of the next group (*cf.* Roy. Coll. Surg. 1567).
34. 11. 12. 19. 27. 3. 22. 16. 41.	These specimens increase in size and complexity, in something like the order given. Beginning with no. 34, which exhibits a pair of simple burnished dags, measuring R. $4\frac{1}{2}$ in., L. $7\frac{1}{2}$ in. in length, we reach, not by regular steps, but with increase in size corresponding on the whole to increase in complexity, to no. 41, which has brow, tray, and two points, and is $13\frac{1}{2}$ in. in length.

ii. Antlers of which the one is fairly developed and of more or less normal growth, the other arrested at a lower grade and frequently of abnormal form.

These specimens are sufficiently interesting from the point of view of "Continuous Variation" to justify more detail than has been given of the previous group. The following Table exhibits the relations of the shorter antler; the lengths are given in inches. No tray-tyne occurs in any specimen.

The specimens are approximately arranged in the Table (p. 492) according to their *general* development, together with that of the corresponding antler; not according to total length, brow, or points. Still there is a fairly regular agreement among these, and the

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Pathological Series:—No. 1730 is the head of a Red Deer with the R. antler less developed than the L., and 1731 the L. tarsal, &c., bones of the same specimen, evidently severely broken during life, and covered by spongy new bone; "it is *supposed* that the injury to the leg was the cause of the defective growth of the antler." No. 1732 is a left antler of imperfect development, "*probably* in consequence of an injury to the right elbow-joint." I have italicized two words in the citations from the Catalogue: fractures of the limbs are not uncommon in deer, and, apparently, abnormality of the antler is not uncommon; it is natural therefore that they should occasionally coincide in the same animal. These two cases relate to the *opposite* side. On the other hand, Scrope and Whitaker both cite cases in which a wound, not apparently in the testis, produced abnormality in the antler of the *same* side. This is merely one instance of many which show how necessary is a renewed study of the whole question.

[1] The full reference numbers are 50.2.5.36, 50.2.5.29, &c., of the Osteological series of Mammalia.

List of Specimens of Abnormal Antlers of Fallow Deer.

Specimen.	Antler.	Length including burr.	Brow.	Points.	Remarks.
50.2.5.28	R	0	0	0	Represented by a mere roughness on the frontal bone.
33 *a*	R	1	0	0	
31	L	$1\frac{1}{4}$	0	0	
Label, no number.	L	$1\frac{1}{2}$	0	0	
18	R	$2\frac{1}{2}$	0	0	Curved outwards at tip.
9	R	3	0	0	Curved forwards at tip.
15	L	$3\frac{1}{2}$	0	0	Curved backwards and inwards.
8	R	$6\frac{1}{2}$	0	0	Curved backwards, outwards, forwards, inwards; crosier-like.
33 *b*	L	5	Minute ridge.	0	Curved backwards, downwards, outwards.
25	L	4	$\frac{3}{4}$	0	
32	R	10	Ridge.	0	Curved outwards, upwards, inwards.
2	L	12	Wart.	0	Several warts besides the one in the position of the brow.
10	R	16	0	0	Curved backwards, outwards, upwards.
4	R	$15\frac{1}{2}$	Wart.	2	
5	L	$15\frac{1}{2}$	0	3	

Note.—Specimen no. 1 exhibited on the right antler an anterior tyne $4\frac{1}{2}$ in. long, and a posterior $1\frac{1}{2}$ in. long; there was no burr (the only case that I have so far met with). As it was doubtful whether the smaller tyne was to be regarded as a beam or as an extra tyne, I have not included it in the Table.

specimens form a fairly continuous series considering their small number.

The continuity of the variation is equally completely shown in the case of the brow-tyne:—

50.2.5.33, L.—a ridge.	50.2.5.19, L.—$1\frac{1}{4}$ in.
33, R.—$\frac{1}{8}$ in.	22, R.—$1\frac{1}{2}$ in.
2, L.—$\frac{1}{4}$ in.	25, R.—$1\frac{3}{4}$ in.
22, L.—$\frac{3}{8}$ in.	27, R.—$2\frac{1}{4}$ in.
45, L.—$\frac{1}{2}$ in.	31, R.—$2\frac{1}{2}$ in.
25, L.—$\frac{5}{8}$ in.	10, L.—3 in.
10, R.—1 in.	41, R.—$3\frac{3}{4}$ in.

I have not taken it beyond $3\frac{3}{4}$ in., as it is then within the ordinary age-size limits of the normal antler.

A similar if less perfect continuity of variation could be demonstrated for the length and thickness of the beam and tray-tyne, but enough has been said to demonstrate its existence in antlers of the Fallow Deer.

It is not probable that the continuity of the series is appreciably attributable to the increasing age of the specimens, although it is not possible to prove this; at least, the condition of the bones and the sutures does not point in that direction. The age at death was probably determined by the suitability of the deer for venison, as the antlers are all on the frontals; none of these B. M. specimens had been shed.

iii. Antlers exhibiting extra tynes, &c.

43. One antler still attached to a portion of the frontal bone. The burr is very thick (5 in. circumference); the antler above it is also very thick ($1\frac{3}{4}$ in. high) and carries 3 tynes ($1\frac{1}{2}$, 2, and 3 in. in length).

37. Frontlet with both antlers. L. antler: from the burr spring 3 tynes $5\frac{1}{4}$, $6\frac{1}{4}$, and 12 in. long. From the relative position of the three tynes, and from a deep groove between the two larger, which cuts right through the burr, these two may represent a split beam.—R. antler: brow, tray, and a palm with 6 points.

40. Right antler on frontal. From the burr spring almost at once four tynes—one in the position of a brow-tyne ($6\frac{1}{2}$ in. long), one in the position of a bay-tyne (10 in.), a bifurcating tyne presumably representing the beam ($13\frac{1}{2}$ in.), and lastly a tyne which springs posteriorly and grows downwards and outwards.

20. Frontlet with both antlers. R. antler has a curved beam ($7\frac{3}{4}$ in.); and, growing on the usual process of the frontal bone, a small tyne with a separate burr (3 in.), apparently representing the brow-tyne. L. antler has brow-tyne and beam (14 in.) only.

Here, again, we have apparently steps in a continuous series of variations; from the little warts of B. M. specimen no. 2 (see Table), through the Roy. Coll. Surg. specimen 1561, and through B. M. 43, we reach B. M. 37[1]. I have seen no steps leading up to B. M. 20, except the deep groove interrupting the burr in B. M. 37. A continuation of such a groove in a half-circle would cut off a tyne

[1] The occurrence of extra beams (? tynes) in the Roebuck is recorded by Bateson in 'Materials for the Study of Variation,' London, 1894, 8vo (p. 286, fig. 75).

with a separate burr[1]; but it must be remembered that, so far, I have only been able to handle a few specimens, and there is room for surprise that on these few such continuity should be shown.

The remaining specimens of this British Museum series are not of immediate interest, but are recorded here for the sake of completeness.

14. Heavy antlers, broken across below the tray-tyne, apparently after full growth but before burnishing. A tyne had grown outwards from one of them at the fractured surface[2].
44. A single antler of the character of R. C. S. specimen 1567 (fig. 8), with a slight brow-tyne, and a bifurcating tyne a little above this.
45. A similar specimen to 44, but with only a brow-tyne.
46. A single antler of stunted growth, with a brow and three points.

In conclusion, I have but to express my thanks to Sir William Flower, Prof. Charles Stewart, and Mr. Oldfield Thomas, for the facilities granted to me in the examination of specimens, and to Mr. J. E. Harting for help with the literature of the subject; and my hopes that the incomplete character of these notes may induce Fellows of the Society, who own a herd of Fallow Deer or have influence with their owners, to arrange a series of systematic observations on the abnormalities of antlers.

EXPLANATION OF PLATE XXXIV.

Fig. 1. R. C. S. Osteol. Cat., 1556.
2. R. C. S. Osteol. Cat., 1561: right antler from outer side.
3. R. C. S. Osteol. Cat., 1565: right antler from outer side.
4. R. C. S. Osteol. Cat., 1562: left antler from inner side.
5. R. C. S. Osteol. Cat., 1564: right antler from outer side.
6. R. C. S. Osteol. Cat., 1557: left antler from inner side.
7. R. C. S. Osteol. Cat., 1567: right antler from outer side.
8. R. C. S. Osteol. Cat., 1567: left antler from inner side.
9. Specimen in the possession of J. A. Wallace, Esq.: left antler from outer side.

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[1] It is of course possible to regard the small tyne of B. M. specimen 20 as a separate beam with its own burr, but its direction and position with regard to the other tyne distinctly indicate that it is really a separate brow-tyne, and not an instance of reduplication. Of this reduplication, however, an example is afforded by specimen 382 of the Roy. Coll. Surg. Teratological Series. This is a calvarium of the Axis Deer, with brow-tyne and a broken beam on the R. side: on the L. side the usual process of the frontal bone (1) carries a burr, from which spring a brow-tyne (8 in. from burr to tip; only 1 in. shorter than that of the other side) and three little tynes about $1\frac{1}{2}$ in. in the clear; one of these bifurcates slightly, and they surround the spot from which the beam should spring; (2) below this burr it grows outwards and downwards, at an angle to the horizon of about 45°, and carries another burr, a thick brow-tyne, and beam of 6 in. in length. Here, therefore, are two distinct antlers, carried on different points of an elongated and bent process of the frontal bone. The first one is in the usual position with respect to the head; the second lies parallel to the long axis of the head, with tyne and beam in the same line, and therefore, as regards the curvature of the brow-tyne, is not an optical reflection of even a normal antler.

[2] Collyns (*op. cit.*) records that from the stump of the sawn-off antler of a Red Deer a dag was put up after four years.

2. On the Perforated Flexor Muscles in some Birds. By P. Chalmers Mitchell, M.A., F.Z.S.

[Received May 30, 1894.]

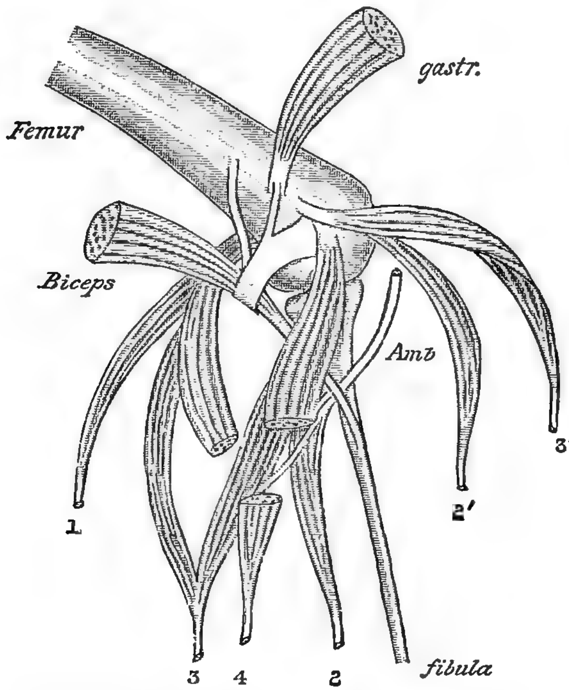
However opinions may differ as to the value of muscles in classification, few would dispute that the *ambiens* muscle of birds, in the peculiarity and isolation of its position and course, and in the constancy of its relations, is an anatomical character difficult to overlook in classification. The ambiens, as all anatomists know from the researches of Garrod, is a slender muscle which, after origin from a spine or ridge immediately in front of, or below, the acetabulum, runs along the inner side of the thigh to end in a thin tendon which usually crosses the knee and joins the *flexor perforatus digitorum*. Its presence and absence are associated with so many other peculiarities of structure that Garrod divided all birds into the *Homalogonatæ*, which possess the muscle in question, and the *Anomalogonatæ*, in which the ambiens is absent.

While taking advantage of the abundant opportunities afforded by the laboratory in the Society's Gardens, by the kindness of my friend Mr. F. E. Beddard, the Society's Prosector, I have dissected the leg- and thigh-muscles in the following birds:—

Balearica chrysopelargus.	*Aramides ypecaha.*
Haliaetus leucogaster.	*Hæmatopus ostralegus.*
Psophia leucoptera.	*Nycticorax gardeni.*
Thaumalea amherstiæ.	*Eclectus roratus.*
Fulica leucoptera.	*Corvus capellanus.*
Leptoptilus crumeniferus.	*Bubo maximus.*
Palamedea cornuta.	

In the first nine of these the ambiens is present, and the relation of its tendon to the flexor perforatus digitorum is constant. In these, as in other birds which I have dissected, the perforated flexors lie immediately under the two "perforated and perforating" flexors, those of the second and third digits. Fig. 1 (p. 496), which I have drawn from a dissection of the Cape Crowned Crane, shows an arrangement which is, in the main, typical of the other eight birds. Distally, the three tendons pass respectively to the second, third, and fourth toes. These tendons arise from a mass of muscle innervated by that branch of the ischiadic nerve that also supplies the middle head of the gastrocnemius muscle. The mass of muscle has three distinct origins—an inner head, which arises from the intercondylar notch very close to, and sometimes in common with, the head of the *flexor longus hallucis*; an outer head, from the outer condyle of the femur under and partly in common with the origins of the *flexores perforati et perforantes*, and from which a strong fibrous connection, sometimes double, runs to the short arm of the *biceps* sling; and an *ambiens* head, sometimes fleshy, sometimes tendinous, from the tendon of the ambiens. From these the three tendons arise in a very definite manner. That of the fourth digit is always the most superficial; in every case it had a separate connection with each of the three heads. That of the third digit lies next below; it had origin in all but one case from each of the three heads. The exception is the Pheasant, in which the outer head was absent, while the head from the *ambiens* was much more muscular than in the others. The tendon of the second digit comes from the deepest part of the muscle and lies nearest the fibula. In *Aramides*, in *Psophia*, and in *Leptoptilus* it arose from each of the three heads; in *Hæmatopus* it arose from the *ambiens* and the inner head; in all the others from the *ambiens* and the outer head, as in the figure of the Crane. Thus in each of the nine birds the ambiens is connected with the perforated flexor of each toe.

Fig. 1.

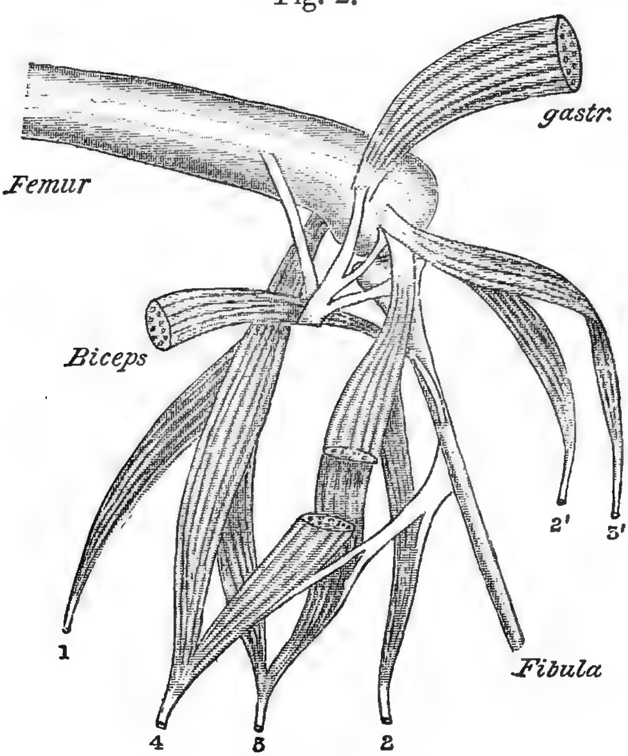


Dissection of the right leg of *Balearica chrysopelargus*, seen from the outer side.

gastr. Outer head of gastrocnemius, cut and reflected.
Biceps. Biceps, cut across shortly after its passage through the sling.
1. Flexor longus hallucis.
2. Flexor perforatus indicis.
3. „ „ medii.
4. „ „ annularis.
2′. Flexor perforatus et perforans indicis.
3′. „ „ „ „ medii.

In *Nycticorax gardeni*, as may be seen from fig. 2 (p. 497), a condition very closely resembling that in the Crane is present, but there is a difference of great interest. The three tendons of the perforated flexors have relations to the outer and inner heads of the muscle exactly as in the Crane. The *ambiens* is absent in the Heron, and in place of the heads from the *ambiens* a broad tendinous band arises from the *fibula* and is distributed to the three parts of the muscle, precisely as the *ambiens* is distributed in those birds which have it. I had the advantage of being able to show the actual dissection to my friends Mr. F. E. Beddard and Mr. Parsons, who are experts in muscular anatomy, and they both agreed with me that the relations of this slip from the fibula strongly suggested that it was a surviving vestige of the distal end of the *ambiens* tendon.

Fig. 2.

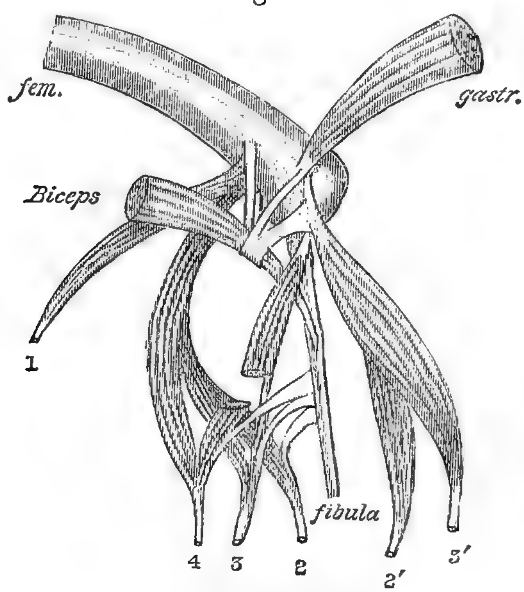


Dissection of the right leg of *Nycticorax gardeni*, seen from the outer side. Lettering as in fig. 1.

In *Eclectus roratus*, from a dissection of which fig. 3 (p. 498) was drawn, a similar possible relic of the *ambiens* is present. In that Parrot the relations of the perforated flexor of the fourth digit to the inner and outer heads of the muscle and to the tendinous band from the fibula are exactly as in the Heron. The outer head of the tendon to the third digit is represented by only a few muscular fibres, and the inner instead of the outer head of the tendon of the second digit is present, but both these tendons have a strong connection with the tendinous band from the *fibula*.

Now this Parrot and the Heron, though belonging to widely separated groups of birds, are alike in that they each belong to groups which Garrod unhesitatingly placed among the *Homalogonatæ*, although he knew that in their cases the *ambiens* was absent. In other genera of Parrots the *ambiens* is present; in the Storks, those near allies of the Herons, the *ambiens*, as Garrod showed, is absent in two cases, present in most. The existence of this possible rudiment in *Eclectus* and *Nycticorax* is therefore not surprising when the affinities of the birds are considered; and if it be found in other specimens, and still more in the case of those other members of Garrod's group that have no *ambiens*, the case for the *ambiens* as a character of great importance in classification will be confirmed.

Fig. 3.



Dissection of the right leg of *Eclectus roratus*, seen from the outer side. Lettering as in fig. 1.

In *Corvus capellanus*, which is of course a Passerine and therefore one of Garrod's *Anomalogonatæ*, the three perforated flexor tendons arise by a single head, in common with one head of the longus hallucis which corresponds with the inner head mentioned in this paper. In *Bubo maximus* there are representatives of the inner and outer heads for each perforated flexor, but there is no ambiens nor representative of a rudimentary ambiens, so that with regard to this point the Owl is intermediate between birds with a reduced ambiens and birds with no ambiens.

I hope to have further opportunity of pursuing the points mentioned in this note, but I bring it forward now in the hope that other observers into whose hands may come any of the few members of the *Homalogonatæ* without an ambiens may look for the vestige which I have described.

3. Biological Notes upon some of the Ophidia of Trinidad, B. W. I., with a Preliminary List of the Species recorded from the Island. By Messrs. R. R. Mole and F. W. Urich.

[Received May 3, 1894.]

The following biological notes are based on observations on a number of Ophidia kept in confinement from time to time, and on others seen in the field during the past four years. As we have not had access to any literature bearing on this subject, we hope to be pardoned if we have reiterated any well-known facts. Most of the determinations have been the results of the examination, by Mr. G. A. Boulenger of the British Museum of N. H., of living specimens sent to the collection of the Zoological Society of London, and of spirit-specimens determined by Professor Dr. O. Boettger of Frankfort-on-the-Main. We are indebted much to the Society and to these gentlemen for their kindness. We append a preliminary list (necessarily incomplete) of the snakes found in the island by others and ourselves up to the present time. The following species do not seem to have been previously recorded from Trinidad:—

1. *Epicrates cenchris*, L., var. *fusca*, Gray.
2. *Corallus cookii*, Gray, var. *ruschenbergii*, Cope.
3. *Streptophorus atratus*, Hallow.
4. *Liophis reginæ*, L.
5. *Spilotes pœcilostoma*, Wied.
6. *Herpetodryas macrophthalmus*, Jan.
7. *Ahætulla liocercus*, Wied.
8. *Homalocranium melanocephalum*, L.
9. *Leptognathus nebulatus*, L.
10. *Lachesis muta*, L.
11. *Bothrops atrox*, L.

Epicrates cenchris.

A snake of this species in captivity gave birth to twelve young ones. The little snakes are very beautifully marked with dark brown spots and stripes upon a light or coloured surface. Although called "Thick-necked Tree-Boas," we have only heard of one being caught in a tree, though they can climb well. They are more usually found in holes, and often frequent the palm-thatched roofs of kitchens in the country, where they go after mice and rats. They are also caught under houses, and often in or near water. The species exhibits many of the habits of the Anaconda, being fond of lying in water. In order to enjoy a bath it will contrive to get into a bottle of water, in which it would be almost impossible to put a dead specimen. So tightly does it coil, that it is with difficulty that it extricates itself from the bottle. It will remain in such a situation for a week or ten days at a time.

When given a large vessel of water it lies in it with the nose just above the surface, and when in this position woe to the unhappy mouse or rat which goes to drink, for it is immediately seized by the nose or foot, dragged into the water, and put to death by drowning and constriction with the rapidity of a flash of lightning—a convulsive flourish of an escaped limb or tail, a gasp for breath from lungs from which all air has been expelled, and all is over. The snake then devours its prey in the water, sometimes being as long as a quarter of an hour or twenty minutes without coming to the surface for air. Snakes of this species, newly born, only nine or ten inches long, will frequently prey in this manner. The species is possessed of great constrictive power, and, though it has a much smaller head than most snakes in proportion to its size, will devour very large animals, as the following incident will show:—On Nov. 20, 1893, a female common rat, in good condition—which after death gave the following measurements: $10\frac{1}{2}$ inches from tip of nose to root of tail; tail $8\frac{1}{2}$ inches long; $5\frac{1}{2}$ inches round the chest; head $2\frac{1}{2}$ inches from immediately behind the ear to the tip of nose—was put into a cage containing two Boa Constrictors and three *Epicrates cenchris.* The rat was exceptionally ferocious, and frequently rushed at the big Boas and nipped them. Not being hungry they coiled themselves up closely in a corner, as also did the *E. cenchris* with the exception of one, which at that time was 47 inches long, and the circumference of which at its thickest part was only $4\frac{3}{4}$ inches, while its head was only $1\frac{1}{4}$ inch long. This snake, which was in poor condition was born in captivity on June 14th, 1890, and for twelve months previously having had very little food, had reached a stage when it was with difficulty persuaded to eat. The rat in running about the cage passed once or twice near this snake, which on the third occasion seized it by the ear, threw it on its back, and encircled the animal with a couple of coils round the chest. Blood gushed from the rat's mouth, its eyes projected from their sockets, the hind legs and tail were violently convulsed, and in less than a quarter of a minute the rat was dead. The snake then proceeded to devour it, but was not allowed to do so because of its emaciated condition, as the meal would probably have resulted in its death or, at least, permanent injury. This snake eventually got so low, that it had to be fed compulsorily, and after months of careful attention is now showing signs of returning health.

Epicrates cenchris is essentially a night snake. We have never known it to eat lizards, in which it differs from *Corallus.* On one occasion, however, a large lizard, *Polychrus marmoratus*, being introduced into the cage of one of these snakes, threatened its rightful inmate. The snake resented the opened mouth and fierce attitude of the lizard, and seizing it threw several coils round it, gave it a tight squeeze and then let go again. The lizard thoroughly cowed retreated into the furthest corner. On another occasion one of these snakes was given half a dozen young hairless rats. They were so small that the snake could not constrict them. He bolted them one after the other, and one of them moving after it had been swallowed, he flew at the spot and buried his teeth in his own side.

This snake soon learns to know the person who habitually feeds it, and will manifest considerable interest when he approaches the cage, coming up to the glass and crawling out of the box, when opened, on to his hands and arms. It will often take mice and small birds from the fingers when offered to it. Like many poisonous snakes (*Crotalus horridus*, for instance), *E. cenchris* knows when an animal is disabled. A rat given to one was constricted. Contrary to the usual habit, the snake let go before all pulsation had ceased. The rat crawled away. The snake seemed surprised at this, but soon recovered its wits, and, taking hold of the rat by the tail, dragged it into the centre of the box and without constricting it a second time (not even attempting to do so), waited until the rat was dead, when it swallowed it in the usual manner.

A pair under our observation coupled in January.

We have seen specimens 7 feet in length, but the largest we have had under observation have not exceeded 5. One specimen we had inflated its neck when irritated in the style of *Coluber corais* and *C. boddaerti*, but not quite so prominently. When the snake has recently changed his skin the dark or reddish-brown closely scaled coat, when seen in sunlight, is glorious, with a lovely iridescent peacock-blue, which earns for the reptile the Creole name of Velvet Mapepire.

CORALLUS COOKII, var. RUSCHENBERGII.

These snakes couple in the months of February, March, and April, when many are found in the localities they frequent in close proximity. They produce some 20 or 30 young ones at a time, generally about August and September, though we have a young one which was given us when very young in May, so perhaps there is not much reliance to be placed in information as to breeding-time [1]. The young ones are very small and thin, with enormous heads, and probably their first meals consist of small lizards, such as *Anolis alligator*, very young birds, mice, and rats. The lizards they constrict. They are soon able, however, to catch full-grown mice, and it is really wonderful how the young snakes manage to pass down their excessively slender necks, which are not so thick as a lead-pencil, adult mice. These snakes sometimes lie in water, but very occasionally. The adults attain a length of 7 or 8 feet, and are sometimes of a yellowish-brown colour. More often they are of a deep dark brown, and as they lie in the slender twigs at the furthest extemities of the thick branches of the tree partially screened by the leaves are singularly inconspicuous.

[1] Mr. O. Reilly caught a pair coupling in February, and the young were produced the following August. They have coupled in our cages in February, March, and April.

When the snake is in motion, however, if he can be induced to move in sunlight he presents a remarkably beautiful appearance. The dull dark brown seems to change to a rich mosaic, over which shimmers a lovely bluish iridescence as he wends his sinuous way along the branches. Each scale is of a dark brown colour at the extremity furthest from its attachment to the skin, but underneath, where they are overlapped by the other scales, they are pale or bright yellow. The ventral scales are dark brown and rich yellow, sometimes punctured with black.

These snakes have very large and prominent eyes with a vertical pupil. Their teeth are numerous, long, and sharp, and when disturbed the snakes are always ready to bite, throwing their heads forward with a ferocious lunge, which is very formidable to those unused to snakes' ways; but they are not at all sure of their aim, and their widely distended jaws can be easily avoided. They rarely if ever retreat when threatened. This makes their capture very easy, and the boys who catch them do so by advancing upon them boldly, presenting to them the palm of the open hand, fingers and thumb erect and close together. The snake thrusts forward its muzzle to examine the strange object, and the boy simply closes his hand and secures its head. The reptile can then be disentangled from the branches and placed in a bag. This snake is known in Trinidad as "Cascabel Dormillon," which is *patois* for "sleeping rattlesnake"—Cascabel being the name given by the Venezuelan Spaniards to *Crotalus horridus.* The species is frequently found in bamboo clumps, and in bushes in the vicinity of or overhanging streams. They feed principally upon birds and rats, and are often met in the trees on the banks of the Caroni river, where no doubt the Porcupine Rat, *Loncheres guianæ* (Thos.), is its chief food.

Boa constrictor.

Boa Constrictors in Trinidad are known as "Macajuel" or "Macacouile," and tremendous stories are told of the enormous dimensions they are supposed to attain. Mr. A. B. Carr of Caparo, a very careful observer, who has seen and caught many of these reptiles, says that the largest he has ever seen was a female 11½ feet long. It contained 41 eggs. We have frequently seen them 6, 8, and 10 feet, and one in our possession now, which came from Chaguaramas, and the dimensions of which were taken the day after its purchase, measured from tip of nose to extremity of tail 10 feet 6 inches, but it is probable that it is at least 6 inches longer, as the difficulty of getting it to remain quiet was very great, and it could not be pulled out straight. It was 15½ inches in circumference at the thickest part of the body. Its head measured 4 inches long; the circumference of the head at the widest part was 8 inches; the tail from anus to tip was 11½ inches; and it weighed 50 lbs. exactly. It is probable that Boas (in Trinidad, at any rate) never exceed 12 feet. Boas are frequently found in trees, but we have never heard of large ones in such situations, those thus caught averaging 6 or 7 feet. Individuals vary considerably in the animals they prefer for food. One which we had from the time it was a baby (having the umbilical still attached) was brought up on mice and now eats rats with avidity, but will also eat opossums, snipes, and pigeons. After a meal of the latter he is loath to take rats when feeding-time comes round again. He would not eat a guinea-pig repeatedly offered to him at long intervals. Another fed readily upon two rats soon after it was caught, and a month later on a guinea-pig. A third, after a fast of 5 months and 20 days, during which he refused rats and guinea-pigs, ate a couple of pigeons. A large Boa fed on fowls and pigeons, and on one occasion ate an old fowl weighing 6 lbs. These snakes are essentially night animals, being very sleepy in the daytime; but it is questionable whether they are great travellers, one which escaped from an open shed being caught 12 days afterwards disappearing under the floor of the same building only a few yards distant from the box in which it had been confined. Another one after an absence of two months was similarly recovered. If well fed when young, Boas change their skins about every six weeks. A Boa we have watched for some three years changes its skin at intervals varying from five to seven weeks, during which periods it devours six or seven rats.

In their wild state Boas are found in damp localities, but not in swamps. In the woods at Mayaro hunters frequently have had their dogs caught by them, and Boas have been killed with young deer, *Cariacus nemorivagas*, and Ocelots in their stomachs. Their droppings contain evidences of the fact that they feed largely on agouti. In captivity they will frequently devour dead rats and other animals, but this is rather the exception than the rule. They all seem to have an aversion to the domestic cat. These snakes differ considerably in their general coloration, but the marking is always very much the same. The ground-colour varies from deep brown to light grey. This difference is probably owing to the various localities from which they come. In Trinidad these snakes couple in February and March—sometimes earlier. Like all the snakes belonging to the Boidæ, Boas have anal hooks, which are much more largely developed in some individuals than in others, probably owing to a difference in sex. Boas have been described as using these hooks in climbing trees. Although we have watched them carefully, we have never discovered them making the slightest use of their hooks for the purposes of arboreal locomotion, and their small size would appear to point to the impracticability for such a purpose. These claws, however, are capable of being slightly protruded and are endowed with considerable mobility. When about to couple, the male extends these hooks at right angles to the body and vibrates them in an extremely rapid manner, scratching, as he does so, the back and sides of his companion. The claws scratching the scales of his mate make a noise which can be distinctly heard two yards off. This habit has also been observed in *Epicrates cenchris*. Young

Boas soon know those who feed them and get exceedingly tame. These snakes are very tenacious of life; one which had been a long time in captivity—eight or nine months,—during which it had refused all food, had a hopeless cancer in the nose. It was deemed necessary to kill it, but as the skin was wanted uninjured it was resolved to strangle it, and a small rope was placed round its neck and drawn as tightly as two men could pull it. It was then hung up. At the end of two hours the snake was apparently dead. It was placed in a sack and sent to the person who wanted it. Next morning on being turned out of the sack it fiercely snapped right and left, and it was some time before it could be secured. Yet another instance. On April 9th, 1894, Mr. S. A. Cumberland asked us to assist him in poisoning a large Boa, caught on April 5th at St. Bartholomew Estate, Guanapo. At 4.55 P.M. we injected into the animal's mouth with a syringe half an ounce of prussic acid. Beyond expelling the air from its lungs a little violently the snake seemed uninjured. Mr. Mole was holding it at the time, and it gave his leg round which it had coiled a squeeze which lasted for about 15 seconds—had it lasted longer it would soon have been unbearable. He had had considerable experience, but never felt such tremendous pressure before, and had it been round his chest he believed the result would have been serious—broken ribs at least, if not worse. At 5.15 this poisoned snake crawled round the room, curiously examining with its tongue tables, chairs, boxes, &c. It got into a corner amongst some broken furniture, from which it was taken with considerable trouble. It coiled its tail round a table-leg and was dislodged with difficulty. It then seized with its tail a heavy chair which was carried with it into the middle of the room, and it was some time before the chair could be disengaged. There being no visible signs of an immediate approach of death, 5 grains of strychnine were injected into its throat at 5.30. This brought on a strong muscular contraction, but still the animal did not knot up. At 5.45, when a gentleman present went up to its head from behind to examine it, it made a strong effort to turn round and strike but failed. A rope was then tied to its neck and it was hung up, only about a foot of its length being on the floor. At 5.50 all life was apparently extinct. After it was hung up and all movement had ceased, it was measured and found to be 10 feet $2\frac{1}{2}$ inches long. Of this length the tail occupied $11\frac{1}{4}$ inches and the head 4 inches. Its girth was $14\frac{1}{2}$ inches. The weight was unfortunately not taken.

EUNECTES MURINUS.

This snake, known in Trinidad as the "Huilia," is the largest reptile found in the island. Specimens have been frequently killed 18 and 20 feet in length. It inhabits the rivers and lagoons on the east coast and has been found, but less seldom, at Cedros in the south-west portion. In shape it is very much like *Epicrates cenchris*, its neck being the same size as its head. The eyes are placed far forward and near the top of the head, so that it can lie in water and show very little more than the nostrils and eyes above the surface. Its body is thick and powerful. A fine young specimen lying before us as we write is of a dark greenish-brown colour, and its back is ornamented with a series of ovally-shaped bluish-black spots, arranged more or less regularly in pairs, sometimes joining and then exhibiting the appearance of an irregular hour-glass-shaped stripe across the back; towards the tail these spots become round. The sides are marked with irregularly proportioned spots, some of them dark with yellow centres. The under surface is mottled without pattern in dark buff and black. The upper surface and sides of the tail are much lighter than the rest of the body. The black mark, so characteristic of all the Boa Constrictors we have ever seen, which extends from the eye backwards to the junction of the lower and upper jaws, is a conspicuous feature in *Eunectes murinus.* Its length is about 4 feet. This specimen, however, is not a native of Trinidad, and is one of five received from Pedesnales, Venezuela, on the 12th July, 1892. It was captured on the 1st July of the same year. The mother, which was 22 feet long, was on that date observed on the bank of one of the mouths of the Orinoco, giving birth to young ones. She was shot, and the 30 young ones, with the exception of 8, were killed. These eight were sent to Mr. Urich, three dying in transit. When they were received they had still traces of the umbilical cord. In length they were about 20 inches. They were placed in a zinc tank, with a thick branch to climb out upon. They habitually lay on the log, but upon the slightest disturbance slid quietly into the water. On the 22nd July one of them took a mouse, but the killing occurred when the snakes were not under observation. When in water they often anchored themselves by a turn of the tail round the submerged portion of the branch. At other times they would individually roll themselves into a tight ball and float on the surface. On August 1st one of them changed its skin. Eventually all died except the one under observation. On September 14, upon two mice being thrown into the tank, one of them swam across the water. A young Anaconda darted across the whole breadth, seized it, and constricted and swallowed it underneath the water. On March 20, 1893, it killed and ate a three-quarter grown common rat. On May 10th it killed two one-quarter grown rats. The first was sitting on the edge of the tank, and the snake, instead of seizing it with his teeth as these reptiles usually do, slid up over its back very gently and quietly, and then threw round it several coils without once biting it. Since then this Anaconda has progressed rapidly and is now in splendid condition. It kills full-grown rats, sometimes launching its head out of the water a distance of 15 inches to seize them. The victims are always dragged back into the water, and there constricted and swallowed. After killing them the snake comes up to take air, but does not do so again until after the prey is swallowed, a process which it assists with a coil of the body round the corpse of the rat. Gorging occupies from 10 minutes to three-quarters of an hour. This particular Anaconda refuses food out of the water, but, upon a rat in a trap being held close to the edge of its tank, has darted into the open door and seized the rat and constricted it inside the trap, trying to drag itself back into the water at the same time. After he has gorged, the part of his body containing the rat is naturally much swollen and frequently floats on the surface, the other portions of the snake except the head being submerged. Mr. J. S. Wilson informs us he has frequently seen Anacondas in the rivers of Demerara with a part of their bodies floating in this manner above the surface.

Anacondas are fond of lying on logs close to or over the water; their swallowing capacities are enormous, and they are probably assisted in this by the fact that they invariably take their food in the water. The one we have always knows when preparations are being made to give it food, and comes up to that side of the box (not always the same) it expects the rat will be driven in from. Anacondas know those who feed them, but they are uncertain in temper and allow very few liberties, biting when irritated with amazing quickness. The Trinidad Anaconda is, judging from the skins we have seen, identical with the Venezuelan snakes we have had under observation. We also kept for some time two larger specimens, each about 7 or 8 feet in length; one of them was remarkably quiet, but the other would not permit itself to be handled at all, biting fiercely, and when seized by the neck constricting with great strength so as to almost stop circulation in hands and wrists. It also used to ball.

GEOPHIS LINEATUS.

This very handsome little ground-snake is found, as a rule, tightly coiled up under stones and rubbish in yards and gardens. When it has changed its skin it is very iridescent. It probably is never more than 12 inches in length, and specimens of this size are extremely rare. It increases in numbers rapidly in the yards and gardens in towns, where they are safe from their principal enemies the Coral Snakes. They lay comparatively large eggs. One specimen contained five eggs.

LIOPHIS MELANOTUS.

This little snake rarely exceeds 2 feet in length. Its back is of a blue-black colour. Two longitudinal stripes run from head to tail on either side. The underpart is a bright yellowish colour. They are very harmless creatures, never attempting to use their tiny teeth on anything but the little lizards and frogs on which they feed. They sometimes constrict their prey—especially lizards, when rather too large to be easily managed. One snake of this species which we had for some time constantly quarrelled with other small snakes in the same box, and always threw several tight coils round them. So savage was he towards his companions that he had ultimately to be kept alone. *Liophis melanotus* breeds freely in captivity, but we have not been able to get any of the nine or ten eggs which they lay to hatch. They are exceedingly fond of water, in which they will lie for days at a time. They often fall a prey to *Elaps lemniscatus*, of which they stand in the greatest fear. They only survive its bite about four minutes. The Creoles call these snakes "Beh belle chemin," or "Beauty of the Road." They are frequently to be seen crossing dusty roads in the early morning or evening, probably for the purpose of hunting in the ditches which run on either side of our thoroughfares.

Liophis reginæ.

The adult snake is a very beautiful one, being in colour greenish yellow when it has freshly cast its skin, and looking as if a piece of black mosquito curtain had been strained over it. Sometimes the ground-colour is brighter. It feeds well on frogs and lizards and is not at all fierce. Perfect specimens are rare, a large part of the tail being usually missing. They flatten their necks when irritated. They are found in mangrove-swamps and in the vicinity of streams.

Liophis cobella.

This interesting little creature is found in the mangrove-swamps, sometimes in brackish water and close to the sea. It is known to the Creoles as "Mapepiri Mangue." It feeds almost solely on frogs, which it pursues with great energy and devours very quickly, sometimes eating as many as 12 or 14 at a meal of the little Yellow-throated Frog, *Phyllobates trinitatis* (Garman).

The females have usually faint transverse stripes on the back, caused by the arrangement of slate-coloured scales with grey edges. The general appearance, however, is mottled slate and grey. The male is more gorgeous, being mottled with black, olive-brown, and dirty yellow; the scales of the lower jaw are grey. The ventrals are chequered with large black spots on a white surface. We have seen these snakes 3 feet in length, but the average size is 18 inches. Once, and only once, have we known a Cobella to devour a lizard—a gecko, *Thecadactylus rapicauda*. These snakes are good swimmers, and on one occasion we watched one for half an hour swimming in a little pool in the swamps. It constantly dived and thrust its head amongst the weeds at the bottom, from whence, after remaining a few minutes, it came to the surface for air. A snake of this species laid several eggs, one of which hatched. The young one was perfectly black; being deformed it only survived a week or two, refusing all food.

Coluber boddaerti.

This snake is known locally as "Machete couesse," which is explained as meaning "Grass Machete." Machete is Spanish for cutlass, and many snakes are known as Machetes because their backs are somewhat ridged, reminding the Creole labourer of a cutlass. But this description does not apply to *Coluber boddaerti*, the back of the species being rounded. When adult they are of a uniform greenish-brown or olive colour, with two lighter longitudinal stripes between back and side, extending the greater length of the body, one on either side. They are white underneath. When young these snakes are prettily mottled, the back being ornamented with cross bands of a lighter hue. The scales in these bands are edged with white. These bands extend as far as where the stripes will appear when the snake is adult, and there they abruptly end. Between these cross bands, beginning on the lower side of the stripes, are similar bands to those on the back. These latter extend as far as the ventrals. Towards the tail all these markings grow fainter, and at its beginning they cease altogether, the tail being of the colour which the snake will wear when adult. These snakes probably reach a length of 4 feet. They are tolerably common, and feed on frogs and lizards when young and mice and birds when full-grown. The adults have rarely perfect tails, these appendages being probably damaged in their fights with mice. They move with great swiftness, and when caught bite with determination, trying to work their tiny teeth well into the skin before letting go. They are found in trees and on the ground indiscriminately.

COLUBER CORAIS.

This reptile in Trinidad, called the "Cribo," is one of the commonest in the island and averages 4 or 5 feet in length, though specimens are not uncommon of 7 and even 8 feet. In colour it is black with a dirty yellowish-brown tail, which is brighter towards the extremity. The plates on its head and the labials frequently exhibit a tawny hue. It moves at a smart pace, especially when in long grass; climbs and swims well. When captured it turns fiercely on the aggressor, and, inflating its neck, bites him, emitting at the same time an offensive odour, which reminds one of the habit of the English ringed snake, *Tropidonotus natrix*. So long, however, as the person holding the Cribo has sufficient presence of mind not to withdraw the bitten part, the wounds inflicted by its teeth are the merest punctures; but if the bitten one forgets this axiom and pulls back, the Cribo, which is somewhat of a bulldog in disposition, does not let go without a struggle, and his teeth then inflict long ugly scratches. The Cribo lays from nine to twelve eggs, rather larger in size than a pigeon's. The Cribo preys upon frogs, young birds, and rats, and old specimens have invariably lost the tips of their tails, and are marked all over with the scars of wounds which they have received in battles with their victims. The Cribo, on seeing a rat, rushes on it with a sudden motion and seizes it by head, tail, or middle of the body, whichever part comes first, and at once begins to swallow. The victim turns round and buries his long rodent teeth in the Cribo's skin. But the snake keeps on rapidly working his jaws, and the wretched rat ultimately lets go in order the more freely to gasp for breath, when he is promptly engulfed in the snake's jaws.

Cribos are therefore invaluable to the cocoa and sugar planters, who are always much troubled with rats. Cribos, however, are not averse to young chicken, which they devour in the boldest fashion, in spite of the noisy but impotent demonstrations of their mother. The Cribo moves in bold, graceful, rapid, and continuous curves, and the worst that is said of him by the people of the island is that he is a terror to chicken—otherwise he bears a good character. They are said to be susceptible of kindness, and will even live in the houses of the peasantry if unmolested, when they amply repay this toleration by the relentless war they wage on rats and mice. A Cribo once in our possession struck at a mouse and caught his own tail; this he diligently swallowed, until at least one-fourth of his entire length disappeared down his own throat. In this position he looked like the numeral eight (8). After some minutes' consideration he disgorged. These snakes frequently devour their own and other species, and the country people credit them with killing the formidable Crotalines *Lachesis muta* and *Bothrops atrox*.

SPILOTES VARIABILIS.

This snake, which is sometimes entirely black, has, as a rule, pale yellow stripes and spots upon the first third of its length, the remaining portions and the tail being of a shining jet-black; underneath and as far back as where the black begins it is pale yellow, the ventral scales being edged with black. It is more slender in appearance than *Coluber corais*. Its scales are large and of a pointed oval form and are slightly keeled. Its teeth are small and it makes a great show of fighting, inflating its neck to treble its ordinary thickness, but, though darting its head at the offender, it seldom bites. Its length is usually 8 or 9 feet, and we have heard of specimens measuring 11. One we had laid nine eggs. They are with difficulty kept in captivity. They feed on frogs and birds; and the following incident related to us by Mr. A. B. Carr of Capard shows they have some claim to be called rat-snakes, though perhaps not such a strong one as the *C. corais*. One Sunday afternoon, as he was lying in his hammock in a house on a plantation he has formed on the verge of the primeval forest, he saw a Tigre (local name for *S. variabilis*) come out of the long grass a little way off, cross the pathway, and make for the house. It ascended one of the supports of the roof of the verandah in which he was taking his siesta and disappeared in the palm-leaf thatch. It had not been there long before sundry squeals and rustlings betrayed the fact that the Tigre had good reasons for its visit. The snake had caught and was swallowing a rat. It then descended and made off by the way it had come. The Tigre is very rapid in its movements when alarmed, and is frequently to be seen in cocoa estates in the higher branches of the trees. Like *Scytale coronatum* and *Coluber boddaerti*, it vibrates its tail when alarmed very quickly, making a noise amongst leaves like that produced by the rattle of *Crotalus horridus*. The Tigre's back is strongly ridged.

Herpetodryas carinatus.

This is another very lively and swiftly moving serpent, and we recollect chasing one a distance of 40 yards before catching it. Its underparts or rather sides are bright yellow; the ventral scales are paler, being edged with silver and a line of dark brown. The back is of a bronze-green colour, and the yellow scales on the sides have an edging of dark brown. The scales covering the spine are in pairs and are keeled, while the remainder are smooth. Another peculiarity about the scales is that those beginning at the back of the head for a considerable distance along the spine are minutely pitted at the extremities furthest away from their attachment. This snake is one of the most beautiful in the island. It feeds on frogs, and is found alike in trees and grassy savannas. We recollect well the first time we encountered it. We were shooting on the Caroni River when our attention was attracted by a streak of pale yellow dangling from a palm (*Bactris*, sp.) over the water. The reptile was gracefully turning its small head and brilliant eyes from side to side, as if admiring its perfect symmetry of form mirrored in the water beneath it. When caught, the Machete (local name) bites with surprising rapidity and lashes with its long tail in a manner not at all pleasant to its captor. One we had in our possession laid five eggs—each 2 inches long and as thick as the little finger.

Ahætulla liocercus.

Locally known as "Lora," a Spanish word for parrot, because the sheeny iridescent greenish gold on the neck and anterior portion when inflated is thought to be like the hues of the feathers on the neck of the yellow-crested green parrot. Ordinarily, this snake has a commonplace grey colour. Its head is of a dark greenish-brown colour, with an under surface of white. When caught, it opens its enormous mouth to its fullest extent and threatens in a most ferocious, but at the same time somewhat absurd, manner. It rarely bites, but when it does it is apt to inflict small wounds with the two long teeth which are placed one on each side in the posterior parts of the upper jaw-bones. They are exceedingly slender reptiles and their heads at first sight appear large and disproportioned to the rest of their bodies. They frequently reach a length of $3\frac{1}{2}$ and even 4 feet. They feed on frogs and lizards. On several occasions lizards which have been partially swallowed by these snakes and have escaped have died soon afterwards. The Lora is swift in its movements, and when rushing along on a level surface the outside portions of its curves do not appear to touch the earth.

Oxybelis acuminata.

This remarkable-looking tree-snake has a sharply pointed snout, which in some individuals has the under jaw tinged with yellow, in others white. The general colour is greenish drab, sometimes minutely punctured with black. It much resembles the trailing branches of the shrubs which it rests upon. It has a peculiar habit of simulating the swaying of the branches under a gentle breeze, and it is only when one catches sight of the brilliant eyes that one realizes he is gazing at a beautiful tree-snake. When about to seize its prey, which consists principally of lizards, this reptile projects its head in the direction of the unfortunate saurian, at which it stares intently for a few minutes, advancing at the same time—almost imperceptibly—and sometimes imparting to its head and neck the swaying motion above referred to. It next puts out its long, brown, yellow-margined tongue once or twice. Just when about to seize the lizard it pauses and puts its tongue out, points together, stiffly standing upwards, sometimes at nearly right angles to the snout. After resting a few seconds, often half a minute in this attitude, it darts forward and catches the lizard usually by the middle of the body and draws back again. Its actions up to this point are so deliberate that the observer is always surprised at the sudden movement, and we have never been able to follow it well. One second the snake is simply watching the lizard, and the next he has it in his mouth; how it got there, one can hardly tell, so rapidly is it done. The lizard is now suspended in mid air. The snake holds its victim in this position for some time, and then slowly working its jaws towards the head swallows it. These snakes are frequently $4\frac{1}{2}$ feet in length, and, except when distended with eggs or after having devoured an unusually large morsel, are rarely thicker than an ordinary lead-pencil. They seldom attempt to bite, and never inflict a wound. They are called by the Creoles "Liguis," a corruption of "Rigoise" or "horsewhip." They are exceedingly difficult to observe when wild and often disappear in the most mysterious and uncanny manner when an attempt is made to catch them, so stealthily rapid are they in their movements.

Dipsas cenchoa.

This is another very peculiar and at the same time extremely beautiful serpent. It is often $3\frac{1}{2}$ feet in length and even longer. Its triangular-shaped body is marked with a series of saddle-like dark spots on a light-coloured ground. Its head is as blunt and round as the Horsewhip's is acuminate. Its eyes are very prominent. The Dipsas is even thinner than the Horsewhip, and on account of its attenuated appearance and its markings, which somewhat resemble those of *Lachesis muta*, is known by the Creole labourers as "Mapepire corde violon," or "Fiddlestring Mapepire." It is very inoffensive, and lives almost entirely upon the tiny *Gonatodes vittatus*, which frequents old walls, trunks of large trees with a rough bark, and tree-parasites and orchids. The growers of the latter plants frequently find a Dipsas amongst their treasures. In captivity it is of a most retiring disposition, during the daytime coiling its great length in a little heap in one corner of its cage. At night it moves about in a tolerably lively and a very graceful manner. It is most curious to watch these snakes passing from branch to branch, the distances which they manage to bridge over without any support, except that given by a small portion of their bodies and their long tails, being almost incredible.

LEPTODIRA ANNULATA.

This pretty snake, which never exceeds, so far as we have had opportunities of judging, 30 inches, has many of the habits of the last-named species, but is more active in its movements, is not triangular in shape, being more rounded, and has a longer head. It has a chain of dark brown spots down the back and its ground-colour is generally light brown. We have only had two specimens, one of which was caught in the rotten bough of a tree on a river-bank. The greater part of the bough was occupied by an ants' nest. *Leptodira annulata* feeds well on frogs and lizards, and when very much irritated attempts to bite, and when it has hold of a finger tries to work into the skin the large back teeth, one on either side of the upper jaw. One we kept for some months laid several eggs, which she afterwards devoured.

SCYTALE CORONATUM.

This snake when young is a bright coral colour, with a dark brown, sometimes nearly black, head, sometimes with a white collar. As the snake grows older it becomes brown, with a whitish-grey under surface. It is remarkable for its extreme shortsightedness, not being able to see its prey even when close to it. They feed largely on mice, and when one watches the clumsy efforts of these snakes to capture their nimble prey it is a matter for surprise how they manage to exist at all. The snake, when a mouse is in its cage, lunges out wherever he imagines the mouse to be. The nimble mouse avoids him with the greatest ease. It is only after hours of persevering effort the snake manages to get the mouse, probably when he is tired out with jumping about. There would be absolutely no chance for the snake at all if he had to catch his food in the open. In their wild state, therefore, they follow the mice and Ameiva lizards on which they feed into their holes and devour them in the furthest recess of their burrows. When the *Scytale* catches a mouse in the open or in a trap or bottle he constricts it, throwing as many as three coils round it and pulling hard with his jaws, just as the Boas do. If *Scytale* finds a nest of young mice he does not take the trouble to constrict them, but bolts them as *Coluber corais* does. *Scytale* has a very smooth coat, and there is a peculiar shimmer about it which gives it a slimy-looking appearance. They are fond of making their homes underneath houses (West-Indian houses are, with few exceptions, raised from a few inches to several feet above the ground) and are useful snakes because of their mice-eating propensities. One in our possession laid nine eggs, which stuck together after being deposited. The following incident occurred in our snake-boxes :—

A pair of *S. coronatum* occupied a box together with a Grenada Tree-Boa (*Corallus cookii*) which was about the same size. A mouse was introduced and one of the *Scytales* immediately made several frantic efforts to seize it. The *Corallus* on hearing the disturbance woke up from his sleep on a branch above and partly uncoiled, bringing his head near the level of the floor and retaining his hold on the branch. As the mouse passed he deftly caught and constricted it. *Scytale*, finding that the mouse had ceased to jump about, happening to come near the Tree-Boa found that he had killed the coveted morsel, and just as its rightful captor was preparing to swallow it (having relaxed his coils) it seized the mouse by the head. Boa finding the mouse being pulled away from him tighened his coils again and presently seized the mouse by the hind quarters and tried to swallow it in that way, whilst *Scytale* tried at the head, which he succeeded in getting into his throat, but was not able to proceed further because of the Boa's coil. The Boa gave up trying to swallow and simply climbed up to his former lofty perch, still holding the mouse with the *Scytale* dragging at its head. The Boa then formed his body into a loop and threw a coil round the free ends of it. In the loop he held the mouse firmly and then settled down quietly until the *Scytale* had tired of his futile efforts. At length the *Scytale*, after a quarter of an hour's fruitless endeavour, released the mouse's head, which was promptly seized by the Boa, who protected the rest of the body with coils. Just as the Boa had swallowed his well-earned meal and the tail was disappearing down his throat, the *Scytale*, who had been searching for the body, discovered that the *Corallus* had outwitted him. He then seized the victor by the throat and threw four coils round him. As the Boa was the most valuable snake, being our only one and having been obtained from Grenada only after considerable trouble, and fearing it might be injured, we put an end to the duel by removing the *Scytale* to another cage.

Elaps riisei.

This snake varies considerably from *E. lemniscatus* in coloration and distribution of the annuli, and in size being smaller. Its habits are also at variance with those of *lemniscatus*. *Elaps riisei*, though lively at night, is not averse to feeding in the day. It is passionately fond of water, and one which we kept for some months used to bathe regularly every morning. If the bath was not changed at least twice a week the reptile neglected to take its diurnal "tub." Being much smaller than the *lemniscatus* to be referred to subsequently, it was with difficulty that snakes small enough could be obtained for it, and resort had to be made to the tiny ground-snake, *Geophis lineatus*, the largest specimens of which rarely exceed 12 inches in length. These snakes it would eat at any time during day or night, but it was noticeable that they did not succumb to its venom before they were swallowed. On March 17th, 1894, a *G. lineatus* 4 inches long was placed in the box. It was seized at 9.14 P.M., precisely in the manner of *lemnis-*

catus, and was swallowed by 9.24½ P.M. At 9.27 another one 9 inches long was introduced, and then directly it was caught just above the vent. At 9.59 the Coral got its victim's muzzle in its mouth, and swallowed it by 10.5½. Neither of these snakes, nor many more besides which we have seen swallowed, were dead when their tails disappeared down the Coral's throat. These little snakes resist the Coral vigorously to the very last, twining their bodies round their devourer's head in almost inextricable knots and doing everything in their power to hinder the gorging process.

ELAPS LEMNISCATUS.

This snake sometimes reaches the length of 4 feet, but specimens of this size are not at all common. Opinions in Trinidad are divided as to their being poisonous, owing probably to the fact that they have been frequently handled without disastrous consequences. There are, however, cases on record of persons having lost their lives through the bites of these reptiles when they have been inadvertently trodden upon. They usually lie dormant during the day under the dead leaves on sugar estates, but they are more frequently found in cocoa plantations. At night they are exceedingly lively and quick in their movements. The species feeds, so far as we can find out, exclusively upon other snakes, all efforts to induce *E. lemniscatus* and *E. riisei* to take frogs and lizards having been failures. *E. lemniscatus* wanders about at night searching in holes and crevices for the small diurnal Ophidia, and catches them when they are asleep. Being possessed of a comparatively solid head and, for a snake, very small mouth, in which are two short fangs (situated further back than those of the vipers), it is very difficult indeed for them to bite anything large. Naturalists, we understand, are divided in their opinions as to the use of the poison in these serpent-devouring Ophidia, and it is asserted that the Indian Ophiophagus does not use his venom to kill his prey. Though this may be the case with other snakes, it is certain that the Trinidad *Elaps lemniscatus* relies upon its poison very considerably in overcoming its victims: otherwise it would not be able to secure its active prey even when surprised asleep. A snake of this species 33 inches long, brought to us in the first week of May 1893, was placed in a small glass-fronted box with a jar of water and a wet pad of blotting-paper—it being an absolute condition for the well-being of these creatures that they should be kept damp. On May 15 we introduced a *Liophis melanotus*. The next day it had disappeared, and there was a slight increase in the Coral's circumference. On the night of May 23rd a *Coluber boddaerti* similarly vanished. Three days later another *L. melanotus* was disposed of. All these snakes manifested the greatest uneasiness and even terror of the Coral, giving it the largest berth possible, although, so long as daylight lasted, the Coral paid no attention to them.

On the night of June 11th we gave a *L. melanotus* (17¼ inches long) to the Coral. The moment it entered the box the Coral raised its head, but immediately resumed its quiescent attitude. Subsequently it suddenly bit the visitor near the tail. The poor little victim was at once released and crawled about as lively as possible, but with the tail raised. Five minutes later it laid its head down—slightly on one side; its body twitched as if in pain, and three minutes later it was dead. The Coral at once seized the dead snake four inches from the head, then worked it through its jaws to within an inch of its head. It then let go, and, seizing it again, worked down the body for about three-quarters of its length. It let go again, and then went up to within an inch of the head, worked up to the muzzle, and got it into its mouth, and proceeded to swallow by sharp sidelong jerks following each other in rapid succession. After it had got the dead snake half down, it began to make the drawing muscular motions which is a characteristic in the feeding of Boa Constrictor and other Ophidia, the jaws doing no work at all. After swallowing the Coral yawned several times. During the first part of the operation the Coral held its victim down by a bight of its body $2\frac{1}{2}$ or 3 inches from where its jaws were working. The swallowed snake was nearly as thick as the Coral, and when the latter was going through the preliminary of passing the former through his jaws, there were to be heard sundry little cracks as if the bones were being broken. The whole operation of killing and gorging lasted an hour. In consequence of a fright the Coral disgorged during the night.

On the night of July 3rd another snake of the same species (15 inches long) was introduced at 7.59 P.M. It crawled about cautiously. At 8.4 the Coral raised its head, and the visitor lay down perfectly quiet. The Coral began to move about, and at $8.11\frac{1}{2}$ caught its prey $2\frac{1}{2}$ inches from the tip of the tail, and, contrary to the first occasion, retained its hold. At $8.15\frac{1}{4}$ the victim was dying and turned over on its back. At 17 minutes past 8 when examined it was quite dead—$5\frac{1}{2}$ minutes from the time of being bitten.

On July 21st at 8.15 P.M. the Coral was lying in a corner of its box, on a lamp-lighted table, perfectly indifferent to its surroundings. A *Liophis melanotus* (17 inches long) was introduced. The Coral roused immediately, and glided about with such rapidity and attacked its victim with such vigour that it was bitten three times, almost before we realized the fact. At the last bite the Coral held the *Liophis* about the middle of the tail. Four minutes afterwards the victim was dead. The quick lateral motion in swallowing was again observed, and the operation in this case lasted ten minutes.

These observations are interesting because they prove that the assertion that snake-poison has very little immediate effect upon the Ophidia, thus being useless in the capture of their prey, is an erroneous one. They are interesting also because they prove that the creatures feed on other snakes besides the Calamaridæ.

On July 29th we shaved the thigh of a large full-grown male rat, and forced the Coral to bite it at 8.3 P.M. The rat appeared to get drowsy almost immediately. It subsequently began to pant violently, but was still drowsy. Then the tail began to twitch, also the muscles in the region of the backbone. At 8.11 convulsions set in. At 8.14 the heart had ceased beating. In biting the Coral held on for about 15 seconds. This snake subsequently died, owing to being accidently exposed by a careless porter to the sun.

LACHESIS MUTA.

This snake is locally called "Mapepire Zanana," because its carinated scales are thought to be somewhat of the colour and the shape of the leaf-like scales on the pineapple fruit. "The average length," says Mr. A. B. Carr, "of those I have met and measured accurately (about fifty) is a little under $7\frac{1}{2}$ feet; the largest of these having been 8 ft. 2 in. and the shortest 6 ft. 2 in. There is an instance on record (by de Verteuil) in the island, I believe, of an 11-footer." The Mapepire, unlike its cousin *Bothrops atrox*, prefers rising ground, and is often found on the crest of small hillocks, apparently because it prefers dry soil. According to Mr. Carr, the Mapepire is frequently found in holes, into which, when chased, the Lappe (*Cœlogenys paca*) and the Armadillo (*Tatusia novemcincta*) run; but rarely, if ever, is he found inhabiting the same hole (as has been for years believed) with either of these animals. Most of the bites from this snake occur at their holes. He rarely strikes without provocation, but once agitated he becomes vicious and may strike many times in succession. Dogs when hunting are bitten, and men occasionally, but seldom fatally. In a paper on Quenck, or Peccary-hunting, read before the Field Naturalists' Club, in No. 11, vol. i., Mr. Carr stated that on one occasion a pair of peccaries took refuge in the rotten trunk of a fallen balata tree. They were killed, and subsequently two more rushed out of the trunk. The dogs went in a third time and dragged out a Mapepire about 7 feet 10 inches long. In the fight which ensued it bit four dogs, and the two last bitten died in a very few minutes, owing to the inability of their masters to capture them for treatment with local bush remedies; the first two bitten recovered. The Mapepire is a sluggish brute. On one occasion one was seen on the top of a small hillock. The man who found it went to tell Mr. Carr. He was busily engaged at the time and could not go then. Subsequently he went home and had his dinner. A heavy shower of rain came on, which delayed him half an hour longer still. When he at last went he found the Mapepire as described still coiled on the ground, the water streaming down from his coils. His servant then went and cut a stick, and the snake, after all this delay of at least $2\frac{1}{2}$ hours, was captured alive. The Mapepire and *Bothrops atrox* suffer from large parasitic worms in their lungs. The young ones of *L. muta* are very rarely seen, while those of *B. atrox* are often found. The few specimens of Mapepire we have seen have not done well in captivity.

BOTHROPS ATROX.

Found only in swampy places. It ascends a short distance little bushes 5 feet or so from the ground. *B. atrox* is very fierce, and sometimes ejects its poison a considerable distance. One which was being teased with a stick ejected its poison in this way. It fell on the face of a woman some twelve feet off. It is rather more active than the *Lachesis muta* and bites more readily. The largest specimens we have seen were about 6 feet long. The *B. atrox* is locally called "Mapepire Balsain," which is said to mean striped. It is called in some localities "Valsain," which no doubt means dancing (from the French), an allusion to the circling motion when in the attitude of defence, which all vipers exhibit.

A Preliminary List of the Ophidia of Trinidad, B. W. I.

NOTE.—The snakes found by us in Trinidad are marked with an asterisk; where we have not seen the snakes ourselves the name of the recorder is given.

The names of authorities given within square brackets after the species are those of the naturalists to whose kindness we are indebted for the determinations of the species.

OPHIDIA.

TYPHLOPIDÆ.

*1. *Typhlops reticulatus*, L.
Recorded from Trinidad by Boettger.

GLAUCONIIDÆ.

2. *Glauconia albifrons*, Wagl.
Recorded from Trinidad by Boulenger and Garman.

BOIDÆ.

*3. *Epicrates cenchris*, L. [Boulenger].

*4. *Epicrates cenchris*, L., var. *fusca*, Gray [Boettger].
New to Trinidad.

5. *Corallus cookii*, Gray, var. *melanea*, Gray.
Recorded from Trinidad by Boulenger.

*6. *Corallus cookii*, Gray, var. *ruschenbergii*, Cope [Boettger].
New to Trinidad.

*7. *Boa constrictor*, L. [Boettger & Boulenger].

8. *Boa diviniloqua*, Laur.
Recorded from Trinidad by Boulenger.

*9. *Eunectes murinus*, L.

Colubridæ.

a. *Colubrinæ.*

*10. *Streptophorus atratus*, Hallow. [Boulenger].
New to Trinidad.

*11. *Geophis lineatus*, Dum. & Bibr. [Boettger].

*12. *Liophis melanotus*, Shaw [Boettger & Boulenger].

*13. *Liophis reginæ*, L. [Boettger & Boulenger].
New to Trinidad.

*14. *Liophis cobella*, L. [Boettger & Boulenger].

*15. *Coluber boddaerti*, Seetz. [Boettger & Boulenger].

*16. *Coluber corais*, Boie [Boettger & Boulenger].

*17. *Spilotes variabilis*, Wied [Boettger & Boulenger].

*18. *Spilotes pœcilostoma*, Wied [Boettger].
New to Trinidad.

*19. *Herpetodryas macrophthalmus*, Jan [Boettger].
New to Trinidad.

*20. *Herpetodryas carinatus*, L. [Boettger & Boulenger].

*21. *Ahætulla liocercus*, Wied [Boettger & Boulenger].
New to Trinidad.

*22. *Petalognathus nebulatus*, L. [Boettger & Boulenger].
New to Trinidad.

b. *Dipsadinæ.*

*23. *Homalocranium melanocephalum*, L. [Boettger].
New to Trinidad.

*24. *Oxybelis acuminatus*, Wied [Boettger].

*25. *Dipsas cenchroa*, L. [Boulenger].

*26. *Leptodira annulata*, L. [Boettger].

*27. *Scytale coronatum*, Schneid. [Boettger & Boulenger].

28. *Oxyrrhopus plumbeus*, Wied.
Recorded from Trinidad by Boulenger.

c. *Elapinæ.*

*29. *Elaps riisei*, Jan [Boettger].

*30. *Elaps lemniscatus*, L. [Boettger].

31. *Elaps corallinus*, L.
Recorded from Trinidad by Günther.

Viperidæ.

*32. *Lachesis muta*, L. [Boettger].
New to Trinidad.

*33. *Bothrops atrox*, L. [Boettger & Boulenger].
New to Trinidad.

4. On the Spiders of the Island of St. Vincent.—Part II.[1] By E. Simon[2].

[Received May 2, 1894.]

Familia Pholcidæ.

Artema atalanta, Walck. Apt. i. 1837, p. 656.

Pholcus convexus, Blackw. Ann. Mag. Nat. Hist. ser. 2, iii. 1858, p. 332 (pars).

? *Pholcus rotundatus*, Karsch, Stettin. entom. Zeitung, 1879, p. 106.

Insula Sancti Vincentii.

Espèce répandue dans l'Amérique du sud et les Antilles.

Smeringopus elongatus, Vinson, Ar. Réun. &c. 1864, p. 135 (*Pholcus*).

Pholcus phalangioides, Dolesch. Act. Soc. Sc. Ind. Neerl. v. 1859, p. 47 (pars).

Pholcus tipuloides, L. Koch, Ar. Austr. 1872, p. 281, t. xxii. f. 5.

Pholcus distinctus, Cambr. J. Linn. Soc., Zool. x. 1876, p. 380, t. xi. ff. 28–30.

Pholcus elongatus, Thorell, St. Rag. Mal. &c. ii. 1878, iii. 1881; v. Hasselt, Tijds. v. Ent. xx. 1877, p. 53.

Pholcus margarita, Workman, Ann. Mag. Nat. Hist. 1878, ii. p. 451, t. xviii. ff. 1, 2.

Pholcus tipuloides, Marx, Pr. Acad. N. S. Phil. 1889, t. iv. f. 5.

Insula Sancti Vincentii.

Espèce répandue dans toutes les régions tropicales du monde.

Physocyclus globosus, Tacz.

Pholcus gibbosus, Keyserl. Verh. z.-b. Ges. Wien, 1877, p. 208.

Physocyclus gibbosus, E. Sim. Hist. Nat. Araig. éd. 2, 1893, p. 470.

Insula Sancti Vincentii.

Espèce répandue dans presque toutes les régions tropicales du monde.

Modisimus glaucus, E. Sim. Ann. Soc. ent. Fr. 1893, p. 322.

Insula Sancti Vincentii.

Espèce propre aux Antilles : je la possède de S. Domingue, de S. Thomas et de la Jamaïque.

Psilochorus nigrifrons, sp. nov.

♂. *Long. 4 mm.—Cephalothorax paulo latior quam longus, utrinque ample rotundus, parte thoracica profunde longitudinaliter sulcata, lurido-testaceus, regione frontali clypeoque valde infuscatis et macula thoracica nigricante magna, latiore quam longa, antice recte truncata, utrinque dentata et postice breviter*

[1] For Part I., see P. Z. S. 1891, p. 549.

[2] Communicated by Dr. D. Sharp, F.R.S., F.Z.S., on behalf of the Committee for Investigating the Fauna and Flora of the West-Indian Islands.

acuta, notatus. Oculi ordinarii, quatuor antici (apicibus) lineam rectam formantes, medii minutissimi lateralibus plus sextuplo minores, inter se contigui sed a lateralibus distincte separati. Abdomen anguste elongatum, supra omnino luteo-testaceum, subtus dilutius, macula epigasteris subquadrata, linea ventrali angusta et abbreviata, et postice utrinque macula

Fig. 1.

Psilochorus nigrifrons.
Præmaxillaris maris.

confusa, nigricantibus, ornatum. Partes oris, chelæ et pedes-maxillares nigricantes. Sternum luridum. Pedes longissimi et gracillimi, obscure fulvi, femoribus tibiisque ad apicem sat late albido-annulatis. Chelæ, antice ad apicem, prope radicem unguis, dente parvo obliquo granuloque armatæ. Pedum-maxillarium femur claviforme ad basin angustum et apophysi inferiore parva et obtusa munitum, ad apicem subtus valde inflatum et subglobosum; patella brevis; tibia sat longa, convexa; apophysis tarsalis longa, leviter sinuosa, antice, prope medium, minute dentata, apice longe attenuata et laciniosa. (Femina adulta ignota.)

Insula Sancti Vincentii.

Dans les forêts sur les troncs d'arbres.

Psilochorus lemniscatus, sp. nov.

♂. *Long. 5 mm.—Cephalothorax paulo latior quam longus, utrinque ample rotundus, parte thoracica profunde longitudinaliter sulcata, fulvus, regione oculari utrinque nigra, clypeo infuscato, parte thoracica vitta media lata, antice bifida, subparallela sed leviter dentata, vittaque marginali lata et leviter sinuosa, fuscis, ornatus. Oculi ordinarii, quatuor antici (apicibus) lineam rectam designantes, inter se subcontigui et valde inæquales, medii lateralibus saltem sextuplo minores. Abdomen longum, teretiusculum, supra testaceo-viride, maculis nigro-virescentibus biseriatis 5–5 (maculis 2i paris reliquis majoribus) et utrinque maculis plurimis ornatum, subtus vitta nigricanti late leviter attenuata et truncata et apicem haud attingente, notatum. Chelæ, partes oris sternumque fusca, hoc late testaceo-marginatum. Pedes longissimi et gracillimi, fusci; femoribus tibiisque apice sat anguste albido-annulatis. Chelæ antice, prope medium, dente crasso attenuato sed obtuso instructæ. Pedes-maxillares fere præcedentis, sed fulvo-rufescentes.*

♀. *Mari subsimilis. Pedes-maxillares fusci. Chelæ muticæ. Plaga genitali simplex, fusco-nitida, semicircularis, a petiolo sat late remota sed dimidium ventris haud attingens.*

Insula Sancti Vincentii.

Familia Theridiidæ.

ARGYRODES CANCELLATUS, Hentz.

Theridion cancellatum, Hentz, Bost. J. N. H. vi. 1850, p. 278, t. ix. f. 8.

Lasæola cancellata, Emerton, Tr. Conn. Acad. 1882.

Argyrodes cancellatus, Keyserl. Spinn. Amer., Therid. ii. 1886, p. 243, t. xx. f. 297.

Insula Sancti Vincentii.

Répandu dans tout le sud des États-Unis, les Antilles, et le Vénézuela.

ARIAMNES PARADOXUS, Taczanowski.

Argyrodes paradoxus, Tacz. Hor. Soc. ent. Ross. ix. 1872, p. 58, t. v. f. 13.

Ariamnes paradoxus, Keyserl. Spinn. Amer., Therid. i. 1884, p. 168, t. viii. f. 103.

Insula Sancti Vincentii.

Répandu dans une grande partie de l'Amérique tropicale.

ARIAMNES LONGISSIMUS, Keyserl.

Ariamnes longissimus, Keyserl. Spinn. Amer., Bras. Spinn. iii. p. 202, t. vii. f. 145.

Insula Sancti Vincentii.

Existe aussi au Vénézuela et au Brésil.

SPINTHARUS FLAVIDUS, Hentz.

S. flavidus, Hentz, Bost. J. N. H. vi. 1850, p. 284, t. x. f. 8; Keyserl. Spinn. Amer., Therid. i. 1884, p. 176, t. viii. f. 107.

Insula Sancti Vincentii.

Très répandu dans le sud des États-Unis.

THERIDION STUDIOSUM, Hentz.

Theridion studiosum, Hentz, Bost. J. N. H. vi. 1850, p. 275, t. ix. f. 5; Emerton, Trans. Conn. Acad. vi. 1882, p. 14; Keyserl. Spinn. Amer., Therid. i. 1884, p. 20, t. i. f. 7.

Insula Sancti Vincentii.

Répandu dans toute l'Amérique depuis les États-Unis jusqu'à la République Argentine.

THERIDION FRONDEUM, Hentz.

Theridion frondeum, Hentz, loc. cit. p. 274, t. ix. f. 7; Emerton, loc. cit. p. 15, t. iii. f. 1; Keyserl. loc. cit. p. 69, t. iii. f. 42.

Insula Sancti Vincentii.

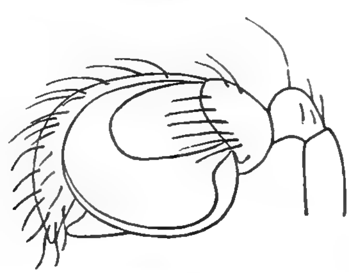
Répandu dans une grande partie de l'Amérique.

THERIDION ANTILLANUM, sp. nov.

♀. *Long.* 4 *mm.—Cephalothorax albido-testaceus, lævis, parte thoracica linea media longitudinali abbreviata nigra notata. Oculi singulariter et tenuiter nigro-cincti, parvi, inter se æquales et late distantes, medii postici inter se quam a lateralibus remotiores (spatio interoculari oculo plus quadruplo latiore). Area oculorum mediorum paulo latior quam longa et antice quam postice paulo angustior. Abdomen globosum, parcissime et longe pilosum, pallide luteum, supra punctis nigris minutissimis, quadratum magnum designantibus, ornatum. Chelæ, partes oris pedesque albido-testacei subpellucentes; patellis, tibiis metatarsisque* (3^i *paris exceptis*) *apice minutissime nigro-notatis. Pedes longi inter se valde inæquales (antici posticis multo longiores) sat longe setosi. Vulva simplex, plagula parva subrotunda notata.*

♂. *Long.* 3·6 *mm.—Feminæ subsimilis, sed abdomine multo minore. Pedes-maxillares albidi, tarso bulboque luteis; patella brevi, nodiformi, convexa, seta longa supra munita; tibia breviore sed latiore cupuliformi; tarso maximo, compresso, apice sat abrupte subacuto et inflexo; bulbo maximo, valde compresso, stylo longo, circumdato.*

Fig. 2.



Theridion antillanum.
Bulba genitalis maris.

Insula Sancti Vincentii.

T. sexmaculato, Keyserl., verisimiliter affine sed certe distinctum.

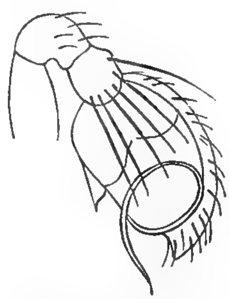
THERIDION FUESSLYI, sp. nov.

♀. *Long.* 3 *mm.—Cephalothorax lævis et nitidus, læte fulvo-rufescens, utrinque sat anguste nigro-marginatus, linea media nigricante, sæpe obsoleta, abbreviata (foveam thoracicam postice haud superante), interdum in parte cephalica ampliata et ramosa, notatus. Oculi postici in lineam levissime procurvam, magni, medii lateralibus paulo majores et a lateralibus quam inter se paulo remotiores, spatio interoculari oculo paulo angustiore. Oculi antici in lineam subrectam, vix procurvam, medii lateralibus paulo majores et inter se remotiores. Area mediorum circiter æque longa ac lata et antice quam postice paulo latior. Sternum fulvo-rufescens concolor vel rarius anguste nigro-marginatum, læve. Partes oris fuscæ vel nigræ. Chelæ fulvæ nigricanti-variatæ. Abdomen globosum, obscure cinereo-testaceum, nigricanti-variatum et subsegmentatum, parce albido-punc-*

tatum, vitta media integra, leviter dentata, crebrius albido-punctata ornatum, subtus obscure fulvum et vitta transversa nigra validissime arcuata, fere semicirculari, leviter sinuosa et in medio, prope mamillas, sensim angustiore, notatum. Pedes luridi concolores, interdum femoribus tibiisque ad apicem tenuissime nigro-cinctis, interdum nigricanti-variati et subannulati, sat longe pilosi, setis erectis patellarum et tibiarum longis, tibiis metatarsisque anticis circiter æquilongis. Area vulvæ fusco-rufula, convexa, fovea superficiali ovato-transversa impressa.

♂. *Long.* 3 *mm.—A femina differt abdomine minore et præsertim multo angustiore, pedibus, præsertim anticis, multo longioribus. Pedes-maxillares luridi; femore gracili; patella brevi, convexa, valde arcuata; tibia brevi sed subtus ampliata, rotunda atque ad*

Fig. 3.



Theridion fuesslyi.
Bulba genitalis maris.

marginem longe ciliata; tarso ovato, apice breviter uncato; bulbo ad apicem stylo longo, circulum formante, munito.

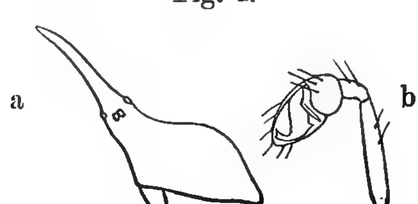
Insula Sancti Vincentii.

Th. differenti, Emert., et *T. antonii*, Keyserl., affine.

Theridion stylifrons, sp. nov.

♂. *Long.* 1·8 *mm.—Cephalothorax lævis, fulvo-rufescens, fronte valde acclivi turbinata, ad apicem (inter oculos medios) processu longissimo (cephalothorace toto vix breviore) sat gracili, recto et apice acuminato insigniter instructa. Oculi postici inter se*

Fig. 4.



Theridion stylifrons.
a. *Cephalothorax maris.* b. *Præmaxillaris maris.*

æqui, in lineam valde recurvam, medii a lateralibus quam inter se plus duplo remotiores. Oculi antici inter se parum inæquales, *in lineam valde procurvam. Clypeus altissimus et obliquus. Sternum late cordiforme, convexum et sublæve sed parcissime rugosum, fulvo-rufulum. Abdomen globosum, album, subtus plagula epigasteris fulvo-nitida munitum. Pedes sat longi et graciles, olivacei, femoribus dilutioribus. Pedes-maxillares fulvi; femore gracili, recto; patella brevi, leviter convexa; tibia brevi sed subtus ampliata et apice truncata; tarso bulboque magnis et ovatis.*

♀. *Long.* 2 *mm.—Cephalothorax pallide luteo-rufescens, versus marginem leviter infuscatus. Oculi postici in lineam plane rectam, inter se fere æquidistantes (spatiis interocularibus oculis angustioribus), medii leviter elongati et obtusissime triquetri. Oculi antici in lineam vix procurvam, posticis paulo minores et inter se æquales, medii a sese quam a lateralibus remotiores. Clypeus area oculorum paulo latior, sed chelis brevior. Sternum pedesque pallide lurida, sternum haud longius quam latum, leviter convexum, postice, inter coxas, sat late obtusum. Abdomen magnum, globosum, cinereo-testaceum, supra vitta media abbreviata et utrinque vittis obliquis radiantibus paulo obscurioribus sed parum distinctis ornatum.*

Insula Sancti Vincentii.

Se trouve aussi au Vénézuela.

Nota.—Cette espèce appartient à un groupe remarquable assez répandu dans l'Amérique du sud mais jusqu'ici peu connu. Les femelles sont normales et voisines du *Theridion pallens*, Blackw., d'Europe; tandis que les mâles présentent des déformations frontales analogues à celles qui s'observent dans les genres *Cornicularia* et *Lophocarenum* du groupe des *Erigonineæ*.

Gen. Sphyrotinus, nov.

A Theridio *imprimis differt oculis anticis inter se valde inæqualibus, mediis lateralibus plus duplo minoribus et area oculorum mediorum antice quam postice multo angustiore.*

Sphyrotinus luculentus, sp. nov.

♀. *Long.* 1·2 *mm.—Cephalothorax fusco-olivaceus, tenuiter nigromarginatus et leviter nigro-reticulatus, versus marginem subtilissime coriaceus. Oculi postici in lineam leviter recurvam, magni, inter se fere æque et anguste separati (spatiis interocularibus oculis angustioribus), medii lateralibus paulo majores et late ovati. Oculi antici in lineam rectam, medii lateralibus plus duplo minores. Abdomen globosum, cinereo-lividum, vitta media fusca sæpe interrupta, angusta sed postice sensim ampliata supra notatum. Sternum fuscum. Pedes longi et graciles, pallide luridi, femore tibiaque* 4[i] *paris apice minute fusco-notatis; tibiis subtus setis longis paucis munitis.*

♂. *Long.* 1 *mm.—Cephalothorax subtiliter coriaceus, obscure rufescens, ad marginem et supra fusco-lineatus. Oculi feminæ. Abdomen minus, ovatum, antice leviter emarginatum, albo-*

testaceum, postice vitta pennata nigra notatum, subtus obscure fulvum. Sternum fusco-rufescens, subtiliter nigro-cinctum. Pedes valde inæquales, antici reliquis multo longiores, femoribus incrassatis, fusiformibus aurantiaco-tinctis, reliqui pedes graciles pallide luridi; femoribus tibiisque 4i paris apice leviter infuscatis. Pedes-maxillares flavidi, parvi et debiles; patella globosa; tibia cylindracea; tarso bulboque sat anguste ovatis.

Insula Sancti Vincentii.

J'en ai trouvé une seconde espèce voisine au Vénézuela: *S. bimucronatus*, E. Sim.

Gen. Janulus, Thorell.

Janulus, Thorell, St. Rag. Mal. &c. iii. 1881, p. 163.

Theridium, Keyserling, Spinn. Amer., Bras. Spinn. iii. p. 193 (ad part.: *T. bicorne*, Keyserl.).

Cephalothorax fere Episini *sed paulo latior, striis cephalicis foveaque thoracica parva transversa et utrinque leviter ampliata, impressus, fronte angusta. Oculi postici magni inter se subæquales, in lineam valde recurvam, medii inter se anguste distantes a lateralibus haud vel vix separati. Oculi medii antici valde prominuli, lateralibus paulo majores. Area oculorum mediorum subparallela, paulo longior quam lata, pone oculos anticos tuberculis binis geminatis insigniter munita. Oculi laterales utrinque contigui. Chelæ, partes oris pedesque* Episini. *Abdomen haud longius quam latum, trapezoidale, postice ampliatum truncatum et plerumque utrinque angulosum.*

Ce genre qui a pour type une espèce de Malaisie *J. bicornis*, Thorell, a des répresentants dans toutes les régions tropicales du monde; une espèce du Brésil a été décrite par Keyserling sous le nom de *Theridium bicorne* (*J. bicorniger*, E. Sim.).

Janulus erythrophthalmus, sp. nov.

♂. *Long. 2 mm.—Cephalothorax pallide luridus, linea marginali exillima lineaque submarginali latiore sinuosa, nigricantibus notatus, tuberculis frontalibus contiguis et obtusis nigris, oculis, saltem posticis, singulariter rufulo-cinctis. Oculi postici in lineam valde recurvam, subæquales, medii inter se distantes (spatio interoculari oculum circiter æquante) sed a lateralibus haud separati. Abdomen circiter æque longum ac latum, antice rotundum, postice ampliatum, truncatum, cum angulis prominulis atque in medio, supra mamillas, plus minus productum, supra pallide luridum, grosse et inordinate albo-guttulatum, utrinque et postice linea nigra sinuosa marginatum, postice in declivitate fuscum. Sternum pedesque pallide flavida. Pedes longi, antici leviter rufulo-tincti, tibiis ad apicem minute fusco-notatis, femoribus tibiisque 4i paris sat late nigricanti-annulatis et subvittatis. Pedes-maxillares luridi, femore fusco-lineato, tarso rufulo, patella tibiaque gracilibus et circiter æquilongis, tarso sat parvo et ovato.*

♀. *Long. 2·5 mm.—Mari subsimilis, sed cephalothorace vittis marginalibus latioribus, interdum omnino fusco-reticulato, abdominis pictura dorsali valde variabili, plerumque fulva nigricante reticulata et postice, in declivitate, late nigricanti-vittata, sterno fusco, pedibus luridis, femoribus tibiisque 4i paris apice nigricanti-annulatis.*

Insula Sancti Vincentii.

Espèce très répandue au Vénézuela.

THERIDULA OPULENTA, Walck.

Theridion opulentum, Walck. Apt. ii. 1841, p. 322.

Theridion sphærula, Hentz, Bost. J. N. Hist. vi. 1850, p. 279, t. ix. f. 22.

Theridion gonygaster, E. Sim. Aran. Nouv. 2e mém., Liège, 1873; id. Ar. Fr. v. 1881, p. 109.

Theridula sphærula, Emerton, Keyserling, &c.

Chrysso niveopicta, Butler, P. Z. S. 1882, p. 763.

Insula Sancti Vincentii.

Espèce extrêmement disséminée, car elle existe dans la région Méditerranéenne (*T. gonygaster*, E. Sim.), dans l'Afrique occidentale et australe, à Madagascar (*Chrysso niveopicta*, Butler), à Ceylan, et dans l'Amérique du nord, d'où elle a été décrite pour la première fois par Walckenaer sous le nom de *Theridion opulentum*.

5. Description of a new Species of Slug of the Genus *Janella*. By WALTER E. COLLINGE, Demonstrator of Zoology and Comparative Anatomy, Mason College, Birmingham [1].

[Received May 8, 1894.]

I have recently received from Mr. H. Suter, of Christchurch, New Zealand, a series of Slugs belonging to the genus *Athoracophorus*, Gould, better known to European malacologists under the generic name of *Janella*. Although this latter name is preoccupied by a synonym, I am decidedly in favour of its retention, for reasons set forth by Professor Cockerell [2].

Of the above specimens, six are *J. bitentaculata*, Q. & G., four *J. papillata*, Hutton, and two I am here describing as belonging to a new species, which I shall term *J. maculata*.

To what extent *J. bitentaculata* varies I am not aware; certainly no two of the above six specimens are alike. The two examples which I am naming *J. maculata* Mr. Suter included with *J. bitentaculata*; but he has evidently not examined the series, or I feel sure he would have noticed the very distinct form and colour of these particular two.

[1] Communicated by E. R. SYKES, B.A., F.Z.S.

[2] 'The Conchologist,' 1893, vol. ii. p. 215.

Janella maculata, sp. nov.

Animal much flatter than *J. bitentaculata.* Dorso-median groove distinct and continuous to the tip of the tail. Ground-colour dirty yellow, with numerous irregular black spots and dashes; a large, black, oval-shaped mark immediately behind the pulmonary orifice. Head slightly lighter than the rest of the body. Foot dirty yellow, marginal portions distinct from median plane. Pulmonary orifice small and inconspicuous.

Length in alcohol 33 millim.

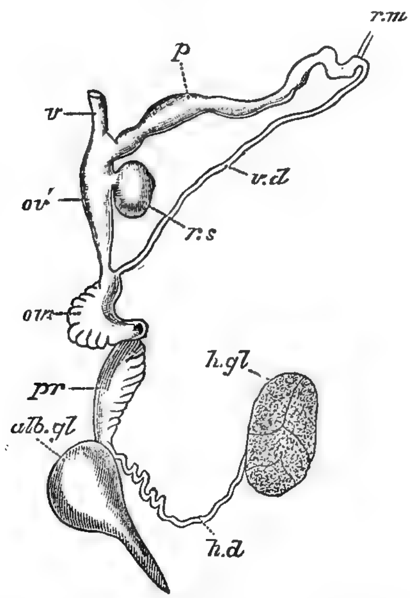
Habitat. Forty Mile Bush, North Island, New Zealand (*H. Suter*).

The flat back of this species reminds one of *Veronicella*, whilst the colouring is similar to dark-coloured examples of *Geomalacus maculosus*, Allm., which I have occasionally seen.

Anatomy.

Generative System.—There is a single vestibule, from which the penis passes off as a lateral organ. In its natural position it is twisted upon itself, as shown in fig. 3. Its first portion is slightly

Fig. 1.



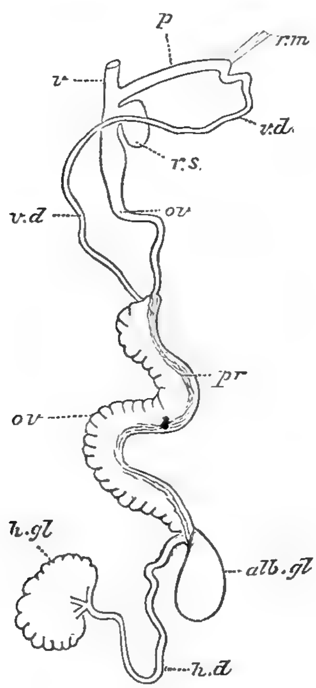
Generative system of *Janella maculata*.

(Lettering of this and the four following figures.)

alb.gl, albumen gland.	*ov*, oviduct.
b.c, buccal cavity.	*pr*, prostate.
c, crop.	*p*, penis.
h.d, hermaphrodite duct.	*r*, rectum.
h.gl, hermaphrodite gland.	*r.m*, retractor muscle.
i, intestine.	*r.s*, receptaculum seminis.
l, liver.	*st*, stomach.
œ, œsophagus.	*v*, vestibule.
ov', free oviduct.	*v.d*, vas deferens.

constricted, and again a little higher up; its upper portion is convoluted and opens into a long thin tube—the vas deferens. In *J. bitentaculata* the penis is much shorter, and usually exhibits a sharp distinction between that organ and the vas deferens (*cf.* Keferstein [1] and Macdonald [2]). Attached to the distal end of the penis is a small short retractor muscle; its point of attachment to this organ affords a ready means of distinguishing between penis and vas deferens. The continuation of the vestibule forms a simple pouch-like cavity—the free portion of the oviduct. From reference to figs. 1 & 3, it will be seen that in *J. maculata* the long

Fig. 2.



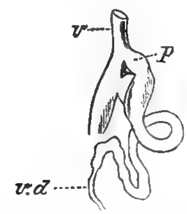
Generative system of *Janella bitentaculata*.
(For lettering see p. 527.)

tube-like portion of the free oviduct is absent, whilst in *J. bitentaculata* it is quite as long as the pouch-like portion. The receptaculum seminis is a large oval or circular sac, opening into the lower portion of the free oviduct, just above the opening of the penis into the vestibule. The combined oviduct and prostate form a short convoluted tube, not more than two-thirds the length of that organ in *J. bitentaculata*. Covered partly by the large hermaphrodite gland and its duct is a very peculiarly shaped albumen-gland, consisting of a large oval-shaped mass with a thin flattened upper portion. The hermaphrodite duct is large and oval in form,

[1] Zeit. f. wiss. Zool. 1865, Bd. xv. t. xxxiv. fig. 3.
[2] Ann. & Mag. N. H. 1856, vol. xviii. (ser. 2) pl. iii. fig. 6.

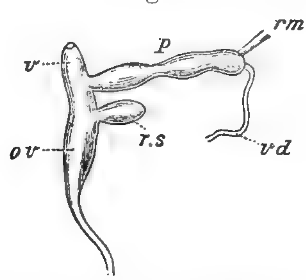
and consists of a number of loosely-connected lobes. This same organ in *J. bitentaculata* is very definite and compact in form, and may readily be divided into two villiform portions (fig. 2, *h.gl*). A long convoluted duct connects the gland with the common duct.

Fig. 3.



Portion of the generative organs of *Janella maculata* in natural position. (For lettering see p. 527.)

Fig. 4.



Showing the distinctness between the penis and vas deferens in an example of *Janella bitentaculata*.
(For lettering see p. 527.)

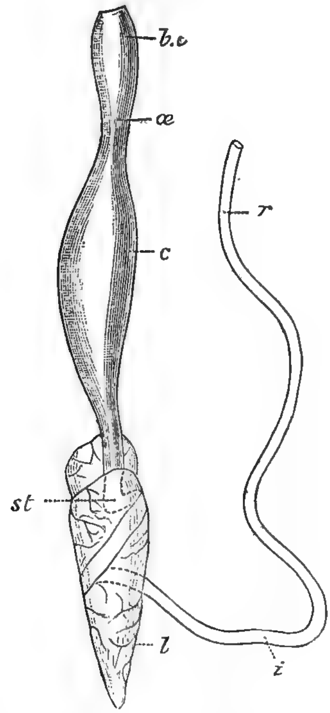
Digestive System.—The mouth, which has the usual ventral position common to the genus, opens into the buccal cavity, which passes into a short œsophagus leading into a wide crop. In neither this species nor *J. bitentaculata* have I been able to trace any diverticulum of the crop as figured by Keferstein[1]. The intestine makes a double fold in the lobes of the liver, which is proportionately larger and more loosely folded than in *J. bitentaculata*. Embedded in the lobes of the liver is the small ovoid stomach. The intestine continues as a long convoluted tube terminating at the anus.

The two specimens of *J. maculata* measured 33 and 34 millim. in length, and the specimen of *J. bitentaculata* which was dissected 48 millim. Professor Cockerell[2], in describing the characteristics of *Neojanella dubia*, states that it was 53 millim. long (in alcohol), while the example of *J. bitentaculata* he examined was only 16 millim., and he further mentions that Gray's type in the British Museum collection is only 19 millim. long. Of course, if these sizes were characteristic of the species named, they would lend

[1] *Op. cit.* fig. 3.
[2] *Op. cit.* p. 226.

great weight to the separation of *N. dubia* from *J. bitentaculata*, the specific distinctness of which yet remains to be proved [1]. It will be as well, perhaps, to here state the sizes of the specimens I have received from Mr. Suter, as indicating possibly the average length which *J. bitentaculata* attains: these sizes are 32, 32, 40, 43, 45, and 48 millim. In a recent communication received from Mr. Charles Hedley, he states that he has seen *J. papillata* 53 millim. in length. My largest specimen, in alcohol, measures 32 millim.

Fig. 5.



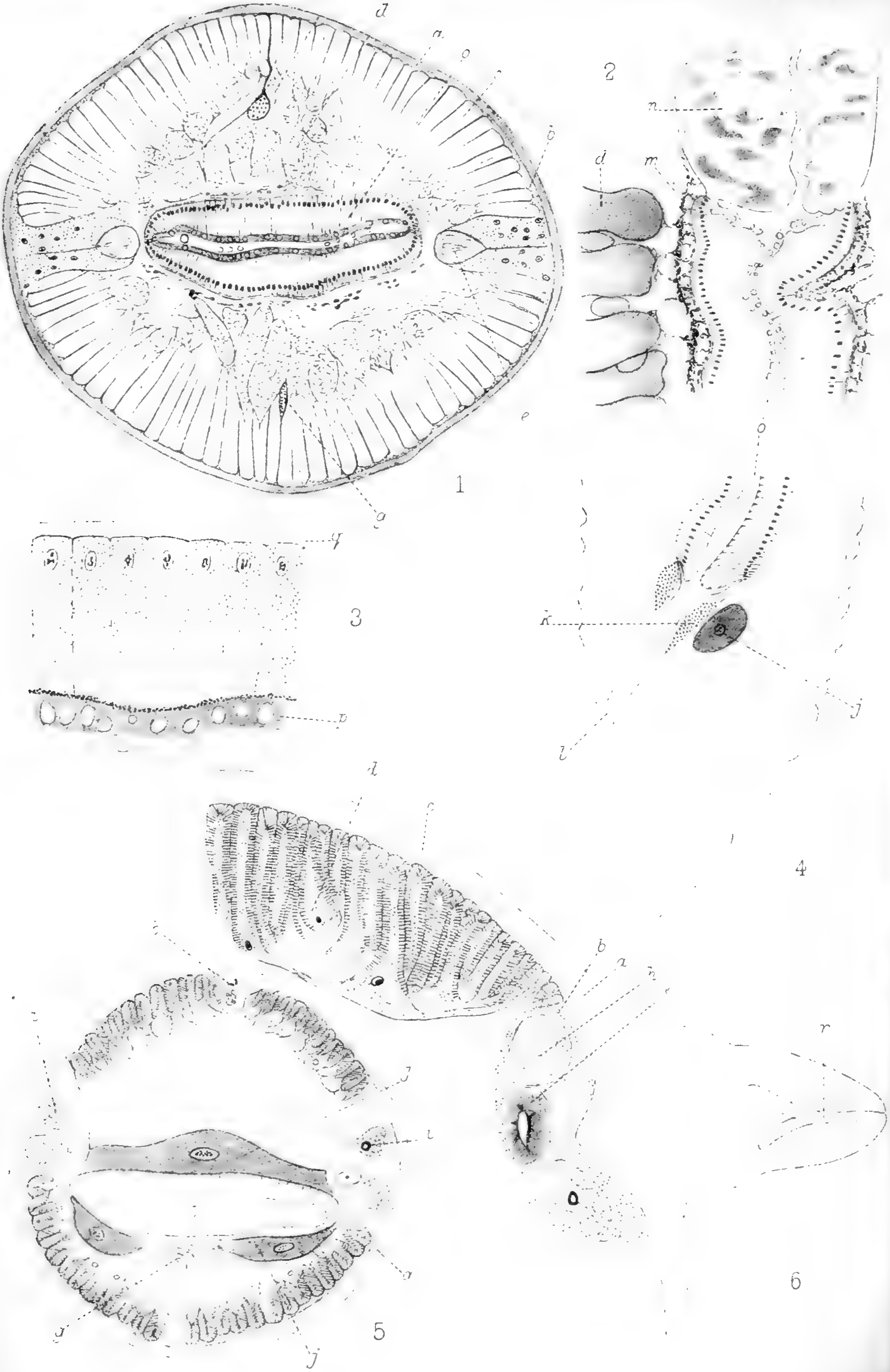
Digestive system of *Janella maculata*.
(For lettering see p. 527.)

The chief points of difference between *J. maculata* and *J. bitentaculata* may be summarized as follows:—

The form and length of the free oviduct and penis, the shortness of the common duct, the form and divisions of the hermaphrodite gland, the distinct form of the albumen-gland, and the minor differences in the liver, colour of the animal, and general flattened form of the whole of the body.

In concluding this description I would remark that the whole family *Janellidæ* requires revision. It is very desirable that we should have a series of coloured drawings taken from actually living specimens of each species and variety, with careful drawings of their anatomy.

[1] Ann. & Mag. N. H. 1892, vol. ix. (ser. 6) pp. 169–171; Trans. New Zealand Inst. 1892, pp. 156–162; Journal of Malacology, 1894, vol. iii. p. 13.



SECTIONS OF ASCARIS TRANSFUGA

Edwin Wilson, Cambridge

6. Notes on Nematode Parasites from the Animals in the Zoological Gardens, London. By Arthur E. Shipley, M.A., Fellow and Tutor of Christ's College, Cambridge.

[Received June 8, 1894.]

(Plate XXXV.)

The materials for the following notes on internal parasites found during the post-mortem examination of various animals which died in the Gardens of this Society were forwarded to me by my friend Mr. F. E. Beddard during the autumn of 1893.

The collection included examples of five species of Nematodes and of one specimen of *Pentastoma*. I was unable to identify one small species of Nematode, of which there was but one specimen, taken from the walls of the lower intestine of a *Canis virginianus*. The other Nematodes belonged to the following four species:—

1. Dicheilonema bispinosum, Diesing.

There was but one specimen of this species, and this was rather shrivelled and distorted. It was a male, 28 cm. in length, about 3 to 4 mm. in breadth in the middle of the body, and tapering gradually at either end.

The specimen was taken from the tissue surrounding the intestine of a *Boa constrictor*; according to Diesing it is found under the skin as well as in the abdominal cavity of this snake, and also amongst the coats of the intestine in *Ophis saurocephalus*, and in the membranes surrounding the lungs and œsophagus of *Thamnobius pœcilostoma* in Brazil.

This species was first called *Filaria boœ-constrictoris* by Leidy in the 'Proc. of the Acad. of Philadelphia,' vol. v. Diesing in his 'Systema Helminthum,' 1851, refers to it under the name *Filaria bispinosa*, a name accepted by Leidy in the 'Proc. of the Acad. of Philadelphia,' 1856, p. 56; but in his "Revision der Nemotoden," in the 'Sitzungsberichte der k. Akad. in Wien,' Bd. xlii. 1861, Diesing mentions it under the name quoted above, *Dicheilonema bispinosum*.

2. Physaloptera turgida, Rud.

Numerous specimens of this species were taken from the stomach and intestine of Azara's Opossum, *Didelphys azaræ*. The species is described by Dujardin in his 'Histoire Naturelle des Helminthes,' 1845, p. 92, under the name *Spiroptera turgida*, and by Schneider in his 'Monographie der Nematoden,' 1866, p. 62. It has also been found in *Didelphys cancrivora* and *D. nudicaudata* and *virginiana*.

3. Ascaris transfuga. (Plate XXXV.)

Numerous specimens taken from the stomach and small intestine of *Ursus arctos*, var. *piscator*. This seems to be the commonest nematode parasitic in the intestine of Bears. Dujardin ('Histoire Naturelle des Helminthes,' 1845, p. 158) describes specimens from the alimentary canal of *Ursus arctos* and *Ursus maritimus*, and Linstow in his 'Compendium der Helminthologie,' 1878, adds *Ursus americanus* and *U. labiatus* to the lists of its hosts. Blanchard gives a short description of this species in the 'Annales des Sciences Naturelles,' sér. 3, vol. ii., and a figure of the anatomy of a male.

4. Ascaris lumbricoides.

A single specimen from the small intestine of *Simia satyrus*.

Note on the Histology of Ascaris transfuga.

The histology of *Ascaris transfuga* has not been described, and although the structure of the animal departs in but few particulars from that which obtains in the unusually monotonous group of Nematodes, I have added a few notes on some of the more interesting features.

The subcuticular layer of Nematodes has recently attracted a good deal of attention; in *Ascaris transfuga* it exhibits the usual structure—that is, it is composed of numerous fine fibrils closely matted together, with occasional nuclei scattered through the mass. The nuclei are small and seem to be degenerating. This subcuticular sheath surrounds the single layer of muscles, and is heaped up along the ventral and dorsal middle lines and around the lateral excretory canals; it is most abundant in the latter position, especially in the region of the middle of the body; here it shows signs of being divided into two halves by a line which runs from the canal towards the cuticle (Plate XXXV. fig. 1), and in longitudinal sections it often splits along this line. In this region this tissue with the lateral canal may reach a quarter the breadth of the body, but anteriorly and posteriorly the bands are much more flattened. The dorsal and ventral accumulations of this tissue are much less bulky, only a narrow membrane, compressed between two contiguous muscles, passes from the subcuticular layer and surrounds the dorsal and ventral nerves (fig. 1).

Jammes[1] is of the opinion that this subcuticular layer forms with the nerves a single tissue, whose basis is the ectodermic neuro-epithelial element. He attributes the loss of the cellular outline of the embryonic ectoderm to the direct influence of the cuticle, which is formed at a very early stage in the life of the individual, and serves to protect the embryo from the action of digestive juices of the host in which it lives. This explanation of the early formation of the cuticle applies, however, only to the

[1] Ann. des Sci. Nat. vol. xiii. 1892, pp. 321–342.

parasitic forms, and does not include the numerous cases of free-living Nematodes, unless we are justified in assuming that the latter are descended from parasitic forms.

Rohde[1] describes the contractile part of the muscle-cells of *Ascaris* as consisting of homogeneous pillars, arranged in two radial rows on the outer side of each fibre; between these pillars is an "Interfibrösmasse," the fibrils composing which are continuous on the one hand with the fibrils of the spongioplasm of the medullary part of the muscle-cell, and on the other with the fibrils which compose so large a part of the subcuticular tissue. In the dorsal and ventral longitudinal ridges the fibrils of the subcuticular layer form a sheath round the nerve-cords. The exact function of this fibrillar tissue which so closely connects different systems of tissues is still obscure, but as Rohde points out, in criticizing the work of Apathy (and the same applies to Jammes), it can hardly be nervous in function.

My sections of *Ascaris transfuga* confirm the work of Rohde. Thus in Nematodes we have a very intimate connection between the subcuticular tissue (ectoderm) and the muscular and nervous systems.

The best account of the nervous system of Nematodes is contained in Hesse's paper "Ueber das Nervensystem von *Ascaris megalocephala*."[2] The lateral nerves which he describes, lying on each side of the lateral line, are in *Ascaris transfuga* very large at the anterior third of the body, and lie surrounded by the heaped up subcuticular tissue which forms the lateral line; behind they diminish in size and are difficult to distinguish from the subcuticular tissue in which they are embedded. At the posterior end nerves again became conspicuous in the same position; these are the bursal nerves connected with the ventral median nerve and they run forward along the lateral line. I believe them to be connected with the anterior lateral nerves by a very fine filament.

The lateral lines are continued beyond the opening of the cloaca and at the extreme posterior end pass into one another. In this region of the lateral lines the cells, which more anteriorly seem to be degenerate and show little or no structure beyond a broken-down nucleus, are more distinct.

The alimentary canal consists of three very clearly marked regions—the muscular œsophagus, the intestine, and the proctodæum; these pass suddenly into one another (figs. 2 and 4). Of these three divisions the intestine is by far the longest; it is lined throughout by the familiar high columnar epithelium, which does not change in character from one end to another. Both inside and out this tube is lined with a well-marked cuticle, which on the inner surface is frequently charged with vacuoles or vesicles, which seem to make their way into the lumen of the tube in which many of them lie freely (figs. 1 and 3, Plate XXXV.). The nuclei are arranged

[1] "Apathy als Reformator der Muskel- und Nervenlehre," Zool. Anz. no. 439, p. 38.
[2] Zeitschr. f. wiss. Zool., Bd. liv.

very regularly towards the external end of the cells, and the body of the cell is crowded with granules, in some cases a thin layer of black granules lies just within the internal ends of the cells (fig. 3). There is no differentiation into parts of this long tube of columnar cells, but the tube is a compressed one, its long axis lying between the two lateral lines; at the sides, as is shown in fig. 1, the lining cells are much flatter, and instead of being columnar become cubical. As seems to me not unfrequent in parasitic Nematodes, the intestine contains no trace of food, only the above-mentioned vesicles, and these sometimes in great numbers.

The body-cavity, which, as Hamann [1] has pointed out, cannot be regarded as homologous with the cœlom of, for instance, a *Lumbricus*, contains a fluid in which numerous small deeply staining granules, probably cells, float. It had coagulated in the anterior end of the body of my specimens in irregular strands and fibrils, which formed a loose network running between the inner ends of the muscles and the outside of the intestine, as shown in fig. 2. At first I was almost inclined to regard this as evidence of the existence of a splanchnic layer of mesoblast, but its true nature soon became apparent.

The proctodæum is very short and lined by a cuticle, continuous on one side with that of the intestine and on the other with the external cuticle. The line of demarcation is very sharply marked (fig. 4). The columnar epithelium ceases suddenly, and just behind this is a recess or groove, partly formed by the increase at this spot of the thickness of the wall of the tube by a muscle which probably acts as a sphincter.

In this region of the body the distribution of the nerves has been admirably described by Hesse for *Ascaris megalocephala*, and although the preservation of my material did not permit me to follow out all finer details of this system, I have no reason to doubt the correctness of his observations.

Immediately behind, or at about the same level as the sphincter muscle, lie three problematical bodies, which are very conspicuous in both longitudinal and transverse sections, yet which have as a rule escaped the notice of workers at this group. Hesse mentions these structures and calls them "Gewebepolstern," which does not help us much; he suggests they may have an excretory function. It is of course not impossible that these bodies may serve as a place where the waste nitrogenous material is stored up within the body of the animal, such as is found in some Ascidians; but there is no evidence of this, and the canals in the lateral line, which are usually regarded as excretory, have a quite adequate opening to the exterior.

At first sight these "Gewebepolstern" might easily be taken for three gigantic cells encircling the rectum close behind the level where the columnar cells of the intestine cease and the rectum

[1] "Zur Entstehung des Exkretionsorganes der Seitenlinien und der Leibeshöhle der Nematoden," Centralbl. für Bakteriologie, Bd xi. 1892.

commences (figs. 4 and 5), two being situated on the ventral surface and one, by far the largest, on the dorsal. In the centre of each is an oval body, which stains more deeply than the substance in which it lies, though that also stains well, and which to this extent, at any rate, resembles a nucleus. On the other hand, its structure is not that of a very typical nucleus; it consists of a thick coat which encloses a number of deeply staining large granules, which have the appearance of concretions. The substance of the matrix in which these oval bodies lie is also differentiated; it consists of a number of apparently homogeneous bodies pressed together, with thin lines or triangular chinks between them, which stain somewhat more deeply than the rest. In spite of the peculiarities of the structure of these "Gewebepolstern," I am inclined to regard them as cells, but I can offer no suggestion as to their function. I could not trace in my sections any connection between them and the lateral lines or with the nerves; they seem to fade away at their ends into the connective tissue which in this region surrounds the rectum.

DESCRIPTION OF PLATE XXXV.

Sections of *Ascaris transfuga*.

Fig. 1. Transverse section of the middle of the body. The body-cavity is almost occluded by the medulary part of the muscle-cells.

2. Longitudinal section through the line of junction of the œsophagus with the intestine. The coagulated fluid of the body-cavity is seen broken up into strands and strings.
3. A transverse section of part of the wall of the intestine.
4. A longitudinal section through the line of junction of the intestine with the rectum and the anus, to show the position of the problematical bodies and of the sphincter muscle.
5. A transverse section through the rectum showing the relations of the problematical bodies.
6. Section of the integument in the anterior region, to show the lateral line and the fin strengthened by the forked plate.

Explanation of lettering in all the figures.

a. Cuticle.
b. Subcuticular layer.
c. Contractile portion of muscle-cells.
d. Body of muscle-cell containing the nucleus.
e. Lateral canal.
f. Dorsal nerve-cord.
g. Ventral nerve-cord.
h. Dorso-lateral nerve-cord in lateral line.
i. Bursal nerves.
j. Problematical organs surrounding rectum.
k. Sphincter muscle surrounding rectum.
l. Anus.
m. Coagulated fluid of body-cavity.
n. Muscular œsophagus.
o. Intestine.
p. Layer full of vesicles at inner end of cells lining intestine.
q. Cuticle covering intestine.
r. Forked plate which strengthens the lateral flaps on anterior end of body.

7. On the Anatomy of *Palamedea cornuta*. By F. E. Beddard, M.A., F.R.S., Prosector to the Society, and P. Chalmers Mitchell, M.A., F.Z.S.

[Received June 18, 1894.]

The Horned Screamer which had been in the Society's Gardens since September 9, 1890, having died upon April 5, 1894, we determined to examine its anatomy with some minuteness, as it is a member of a small group of birds about the position of which systematists differ in opinion. Moreover, although *Chauna* has been dissected more than once, there is no account extant of the anatomy of the soft parts of *Palamedea*.

§ External Characters.

Our specimen was a female. The skin was very emphysematous, as in the case of *Chauna*; but there were patches of skin not blown out with air upon the under surface of the humerus near the shoulder, and the under surface of the greater part of the arm was similarly undistended.

The number of rectrices was 14. The wing was quintocubital and the large oil-gland was natiform, covered with feathers and tufted. This tuft did not completely surround the aperture of the gland, but formed an arch over the dorsal and lateral margins of the aperture. From this a median line of feathers bisected the aperture of the gland. All these feathers were black; two small white feathers form the middle of each half of the lower margin.

§ Viscera of Abdomen.

When the body-wall was cut through near the midventral line only the left lobe of the liver was exposed. The falciform ligament was pressed to the right side and neither lobe of the liver was shut off from the subomental space. The omentum was attached to the parietes and to the oblique septa in front up to the level of the proventriculus. The stomach was covered by an emphysematous patch.

A large gall-bladder was present. The cystic duct entered the intestine at the summit of the ascending lobe of the duodenum; next below it, and therefore nearer to the stomach, the hepatic duct entered, and below that again a single pancreatic duct.

The proventriculus was large relatively to the gizzard; the proventricular glands, clearly visible from the outside, formed a continuous cap interrupted only by the entrance of the œsophagus over the upper end of the proventriculus. The lower margin of this cap reached to the end of the first quarter of the length of the proventriculus.

The small intestine was 8 feet 2 inches in length; where it joined the large intestine the calibre of the gut increased very greatly. The two large and peculiar cæca are represented in fig. 1; each was sacculated on a fibrous band and rapidly narrowed to a blunt-pointed extremity. We did not stretch the cæca, as we desired to preserve them. Measured in a straight line

Fig. 1.

Cæca of *Palamedea.*

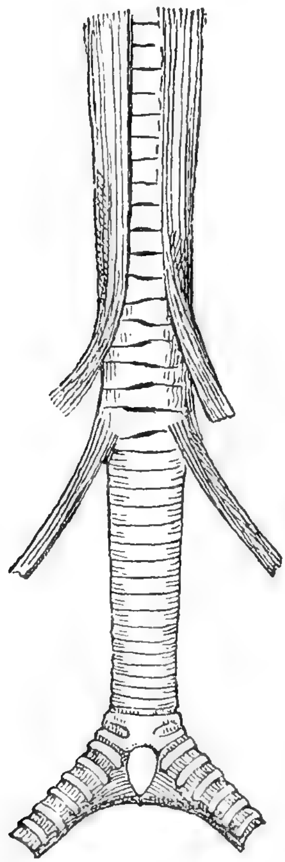
from their wide aperture into the gut to their extremities the left cæcum was 4 inches long, the right an inch shorter. The large intestine, measured from the origin of the cæca to the cloaca, was 15 inches.

§ Wind-pipe.

The tracheal rings are ossified; this occurs in no bronchial semiring; of these latter there were 9 in the left bronchus, 8 on the right. The syrinx is deeply notched in front and behind. A ligament, which may represent an intrinsic muscle, passes from the tracheal ring which is fifth from the end to be inserted in the first bronchial semiring. The sternotracheal muscles arise unusually high up the trachea. The superior pair of extrinsic muscles come very close together on the ventral face of the trachea.

The syrinx, with its muscles, is displayed in the accompanying drawing (fig. 2).

Fig. 2.



Syrinx of *Palamedea.*

§ Myology.

Muscles of Neck and Trunk.

Biventer cervicis.—The two muscles are perfectly separate from each other. They arise tendinous from the spinous process of the first dorsal vertebra. Then follows a tendon of an inch long, a belly of two inches, again a tendon of four inches, then another muscular belly of one and a half inches, which is inserted fleshy on to the occipital below the *complexus.*

Complexus.—This muscle arises from the transverse processes of the third and fourth cervical vertebræ, and from the fibres covering the *intertransversarii* of the same. It is inserted, separated from its fellow by a septum, on to the transverse ridge of the occipital. The muscle is entirely fleshy.

Longissimus dorsi.—It arises by a series of fleshy fibres from the front edge of the ileum, becomes tendinous in the middle, and then is inserted by fleshy fibres on to the lateral surface of the vertebral spine next in front; the next anterior part arises tendinously from the spinous process of the most posterior uncovered dorsal vertebra, and is inserted on to the vertebra next in front; then follow two of precisely similar relations; the next is carried on to the dorsal surface of the longissimus dorsi, as also is the last or most anterior portion.

Ileo-costalis.—This complex muscle lies laterally to the foregoing muscle; it is fused at the edge with its fibres. It arises from the ileum and from the transverse process beside the attachment of the rib; two similar slips in front of this arise from the transverse process and from the adjacent surface of the rib. The ends of the slips are inserted partly on to the surface of the ribs and partly pass on to the lateral musculature of the neck.

Cervicalis ascendens.—This is the lateral muscle anterior to the ileo-costalis. It consists of five distinct slips arising from the transverse processes of vertebræ XVI.–XI. with the exception of XII. The two posterior are inserted on to the vertebræ next in front; the next two are inserted on to the surface of the oblique muscles next in front; the last one on to oblique muscle next but one in front. Behind these slips, which were obvious, there were indications of additional slips both in front and behind, but these were not sufficiently differentiated from the adjacent muscles for separate description.

Longus cervicis.—We were not able to separate this median muscle from the forward continuation of the longissimus dorsi and from the median underlying part of the spinalis complex.

Spinalis complex.—This system of muscles lies deeper than the foregoing. It is divisible into three parts. Part I. (sometimes called the spinalis dorsi) arises apparently only from the longissimus dorsi; it gives off six fleshy bellies which increase in length from the posterior to the anterior; they are inserted on to the upper posterior surface of the oblique processes of cervicals X.–XVI. In addition the superior fibres from these heads form a well-marked rounded muscular cord, which runs forward to form the *longus colli posticus.* Part II. consists of only four well-differentiate slender bellies; these arise from the spinous processes of cervicals XIII.–XV., and they are inserted on to a continuous longitudinal band, the posterior part of which sends slips to the three posterior branches of the *spinalis dorsi*, while the anterior end is inserted on to the oblique processes of cervicals X., XI., at the roots of the anterior two *spinalis dorsi* bellies. Part III. (*longus colli posticus*) arises from the sides of the spinous processes of cervicals II.–XI., and from part I. of the spinalis complex; it is inserted by digitations which merge with the intervertebral muscles in front of its origins.

Rectus capitis posticus.—It arises from the spinous process of atlas and axis; its fibres spread out over the occipital under the complexus.

Intertransversales.—These muscles were obvious all the way along from the ilium to the neck.

Obliqui (*transverso-spinales*).—They are clearly differentiated only from the last to the VIIth cervical. They are large fleshy digitations arising from the transverse processes, and inserted on to the lateral face of the spinous processes next but one in front.

Rectus capitis anticus major.—It arises all along the neck from the hypapophyses and from fascia; about the middle of the neck it grades into the *longus colli*, from a slip of which it first arises about the level of the seventh vertebra. Its broad fleshy insertion is tendinous on the outside, is fused with its fellow in the middle line, and extends for about a quarter of an inch on the anterior outer edge of the basi-occipital.

Rectus capitis anticus minor.—This is a fleshy broad muscle underlying the preceding. Its origin is fleshy and continuous from first four vertebræ. It has a broad fleshy insertion to the extreme outer posterior face of the ridge behind the meatus auditorius.

Longus colli.—It arises from the middle of the centrum of the second dorsal vertebræ tendinously, and then by a series of tendons from each vertebra up to the overlap of the *rectus capitis*. It is inserted by a series of slips to the vertebræ in front of its origins.

Intertuberculares.—These are present, apparently normal.

Interappendiculares costarum.—The first arises from the end of the last free rib, and runs backwards and downwards to the lateral anterior process of the sternum; the second from the junction of the sternal and costal parts of the first complete rib, it shortly fuses with the third, which arises from the costal part of the next rib. These two are then inserted together. The fourth arises from the third, fourth, and fifth costal ribs and from the space between them, and is inserted immediately behind the others. The posterior ones are smaller.

Intercostales externi.—These are confined to the whole of the costal part; the fibres run from above in front and downwards towards the caudal end.

Intercostales interni.—These are confined to the lower half of the costal ribs, and are chiefly tendinous.

Costi-sternales.—Four slips arising tendinously from the sternal ribs, and inserted fleshy to the sternum.

Costo-sternalis externus.—The peculiar muscle to which we have given this name apparently replaces physiologically the uncinate processes, as its broad ribbon-like belly runs diagonally across the outer surface of the ribs. It arises by a very thin flat tendon from the third, fourth, and fifth ribs, and from the interspaces between them. It is inserted to the costal edge of the sternum half an inch from the posterior end.

Head-Muscles.

Dermo-temporalis.—Arising by a narrow but fleshy head from about half an inch behind and above temporal fossa, contiguous with upper anterior border of biventer maxillæ, spreads out on to the skin of sides and ventral surface of throat.

Platysma myoides.—This is a narrow fleshy muscle arising from the ramus of the mandible just at the angle of the jaw. It spreads out fanwise both anteriorly and posteriorly and is inserted on to the skin between the jaws, meeting the last-mentioned muscle behind.

Biventer maxillæ.—It arises from a well-marked area on the squamosal above and behind the ear, contiguous above and behind with the complexus. It is inserted on to the inner side of the angle of the lower jaw.

Digastric or *depressor mandibulæ.*—This muscle is divided into an outer and inner part.

Temporal.—This muscle is divided into three external portions, which lie so close together as to form a continuous mass separated only by fibrous septa. An internal portion is quite distinct.

Pterygoid.—This muscle consists of three parts. Part I., usually present in birds, is absent. Parts II. and III. are well-marked. Part IV. is not separable.

The Hyoid Group.

Mylohyoid anterior.—This muscle is divided into two parts. The posterior is larger and quite free of the hyoid; the fibres run right across the lower jaw, there being no distinct raphæ. They meet the fibres of the *platysma myoides* behind. The anterior part is much thinner and has a distinct raphe. It is attached to the front end of the hyoid.

Mylohyoid posterior.—It springs tendinously from the lower posterior margin of the quadrate and from the posterior outer surface of the angle of the jaw; it at once divides in two. The posterior smaller portion has been already described as *platysma myoides.* The anterior part is a broad mass of muscle (*stylohyoid*), which runs to be inserted along the cornu of the hyoid, reaching as far as just under the *mylohyoid anterior* and meeting its fellow of the other side.

Geniohyoid.—This muscle springs from the inner side of the jaw just behind the anterior *mylohyoid*; it passes dorsally to posterior *mylohyoid.* It is wrapped round the thyrohyoid bone to the very end. The texture of the muscle is somewhat coarse.

The genioglossus is entirely absent.

Ceratoglossus[1].—This muscle is divided into two parts. The first part arises from the side of the *os entoglossum* by a fleshy belly which meets its fellow in the middle ventral line. It is inserted by a long tendon to the tip of the tongue.

The second part arises fleshy from the upper and outer side of

[1] This is in accordance with Gadow's description of the muscle, but in fig. 33 of plate xxxii. of his volume in Bronn's 'Klass. u. Ordn.' he letters it *cerato-hyoid.*

thyrohyal under the geniohyoid, extending nearly to its tip. It ends in a long tendon inserted at the side of the *os entoglossum.*

Ceratohyoid.—This is a broad fleshy muscle arising from the inner side of basal joint of thyrohyal; the fibres run inwards and forwards, meeting those of the other side, and are inserted into the base of urohyal.

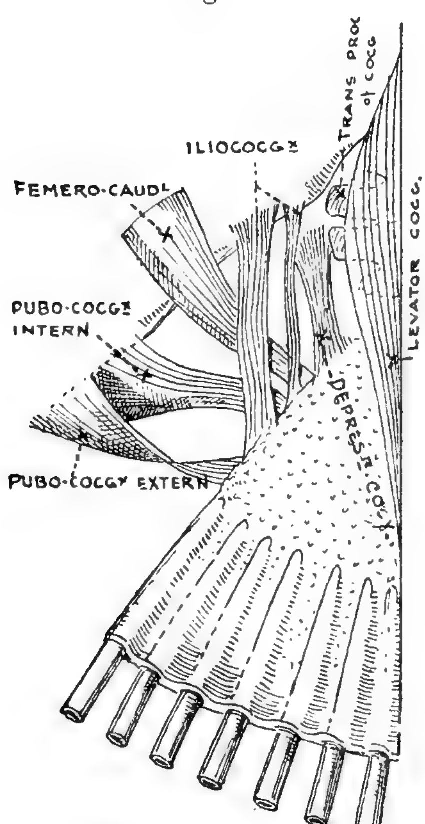
Hypoglossals.—These muscles cannot be separated from part I. of *ceratoglossus.*

Sternohyoid.—This system is represented by a band of muscle which arises from the basihyal and entoglossus. It spreads out over thyroid cartilage and trachea.

Caudal Muscles.

Levator coccygis.—One pair of these muscles, two and half inches long, very fleshy. It arises from the os ileum and from the lateral

Fig. 3.



Caudal muscles of *Palamedea.*

faces of the spinous processes and from lateral processes of anterior to posterior caudal vertebræ. It is inserted on to membrane covering rectrices, meeting its fellow in the median line.

Ileo-coccygeus.—This muscle is divided into two slips. The outer thicker slip is entirely fleshy; it arises from the dorso-medial face of distal ileum only. It is inserted on to the outermost rectrix.

The inner thinner portion of the muscle is also entirely fleshy. It arises from the sacro-ileal ligament. It is only one quarter the size of the outer muscle.

Pubo-coccygeus externus.—This muscle is a flat band with its wide and fleshy origin from outer posterior dorsal margin of the pubis behind its connection with ischium. It narrows to be inserted fleshy upon the under surface of the external rectrix.

Pubo-coccygeus internus.—It arises from the ends of the pubis and ischium under the last-named muscle. It is inserted on to the underside of the last one or two caudal vertebræ.

Depressor coccygis.—It arises partly from the transverse process of the last sacral vertebræ, and partly from adjacent surface of ileo-sacral ligament. It is inserted on to the transverse processes and hæmapophyses of last three or four caudal vertebræ.

Shoulder-girdle.

Rhomboideus externus.—This muscle arises tendinously, the width of the tendinous part being about the same as that of the muscular part from the last cervical vertebra and all the dorsal except the last. The fibres run forwards to be inserted fleshy along the whole length of the scapula. The extreme front part of the muscle is double, and may represent a portion of the cucullaris.

Rhomboideus internus.—This muscle arises tendinously, but has much less tendon than the last. The fibres run backwards, both the origin and insertion of this muscle being shorter than in the case of the externus.

Serratus anticus.—This consists of three portions. The first arises from the last incomplete and from the first complete rib. It is inserted on to the scapula between the two parts of the *sub-scapularis.* The second part arises from the upper part of last incomplete rib and runs to the scapula. The third part arises from the upper part of the first complete rib.

Serratus posticus.—Pars metapatagialis arises from the fifth complete rib. Part 2 consists of two digitations arising from complete ribs 3, 4, 5, at the points where the uncinate processes should be and from the fascia between them. Insertion is on to the tip of the scapula.

Latissimus dorsi.—This muscle, as usual, consists of two parts, which are quite separated by a wide space. The anterior part arises from dorsals 1 to 3; it has a broad and fleshy insertion one inch long ending just before the end of the deltoid. The posterior division of the muscle is narrow and strap-like; it arises from the last three dorsals and from the anterior margin of the ileum. It bifurcates just before its insertion; part goes to form a metapatagialis fascia and the anterior tendon is inserted as is described under the anconæus.

Pectoralis major.—This muscle arises from the entire length of the carina sterni, from the lateral and posterior regions of the sternum, and from the clavicle. There is no origin from the ribs. The posterior margin of the muscle is entirely tendinous. It is inserted on to the fasciæ covering the biceps and on to the deltoid ridge of the humerus.

Pectoralis minor.—As usual a markedly bipinnate muscle. It arises from the entire keel of the sternum, except the extreme anterior end, from the adjacent part of the sternum to a distance of about half an inch of the keel, from the lower half of the coracoid, and from the anterior part of the ligament between coracoid and clavicle. It is inserted on to the beginning of the deltoid crest by an apparently unusually short though strong tendon.

Sterno-coracoid.—This muscle is entirely fleshy. It passes from the anterior lateral border of the sternum to the adjoining part of the coracoid.

Coracobrachialis longus.—This arises from the distal half of the coracoid, with a slight overlap on to the sternum. It is inserted on to the great tuberosity of the humerus, on the side of the insertion of the biceps remote from that of the teres major.

Coracobrachialis brevis (*subcoracoideus*).—This arises entirely from the coracoid, not at all from the ligament between the coracoid and the clavicle. A little before its insertion it is fused with the ventral half of the subscapularis.

Coracobrachialis anterior.—This muscle is large and springs from the anterior process of the coracoid dorsal to the biceps head. It is inserted fleshy over a very broad area of the anterior face of the humerus under the deltoid crest, where it is covered by the pectoralis major.

Coracobrachialis internus.—This small muscle lies immediately under the deltoid minor. It is inserted by a very short flat tendon on to the end of deltoid ridge, just above but internal to insertion of deltoides major.

Deltoides major.—This arises from the junction of the scapula and clavicle. There is a trace of division into two parts, of which the more dorsal is inserted further down on to the humerus, with a strongly tendinous insertion; the other part is inserted fleshy, but this is quite continuous with that of the last. The entire insertion of the muscle extends for three inches down the humerus.

Deltoides minor.—This springs entirely fleshy from the scapula and clavicle at their junction. It lies under the patagial muscle, but is narrower than that. It is inserted on to the anterior edge of deltoid crest.

Patagialis.—This arises as a broad band covering the junction of the scapula and clavicle, external to but broader than the *deltoides minor.* It gives rise chiefly to the *brevis* tendon, but gives off a narrow slip to the *longus* tendon; the pectoral part is represented by a broad tendinous slip. From this the thickened anterior edge goes to the longus and the broader thinner portion to the brevis. A band of tendon arising from the humeral ridge also runs to the *brevis*.

The *longus* tendon passes straight along the edge of the patagium and gives off to the brevis a rather widish slip, which goes to the brevis just at the emergence of the nerve.

The *brevis* tendon is thickened on the outer side; the nerve passes beneath the outer half of it and superficial to the inner half, but there are no signs of distinct division of the tendon into two. Just below the emergence of the nerve a branch is given off which is fused below with the fleshy head of the *extensor metacarpi radialis*. Another branch is given off on the outer side, which is inserted in common with the origin of the *extensor metacarpi radialis* tendon. The main part of the tendon passes towards the elbow, and ends on the radius by a short tendon.

There is no *biceps patagialis*.

Teres major.—This arises from the whole of the outer border of the scapula. Its tendon is inserted on to the great tuberosity of the humerus distal to the biceps.

Teres minor (*supraspinatus*).—This is an excessively delicate and slender muscle. It arises from the lower border of the scapula anteriorly, and is inserted on to the humerus between the two heads of the triceps.

Subscapularis.—There are two heads of origin, from the anterior half of the under surface of the scapula; the deep head is also from the coracoid. Both are fleshy, and the superficial muscle arises exactly above the scapular head of the deeper muscle, the first part of the serratus anticus being inserted between the two. The two parts of the muscle fuse about halfway between origin and insertion.

Expansor secundariorum.—This arises fleshy from the quills covering the elbow-joint, and ends in a characteristically ciconiine manner.

Biceps.—The long head arises in common with the deltoid; the short head in common with the insertion of a portion of the pectoralis major. The latter head is narrow. The insertion of the muscle is double, and the division into two parts commences in the fleshy belly of the muscle. The radial tendon is more than twice the width of the other, and itself divides into two.

Anconæus longus.—It arises by a forked tendinous head from the scapula, the lower head being thicker than the upper. There is a double accessory head formed by two equisized tendons separated by a space, across which run two tendinous bars. With the upper of these the tendon of the latissimus dorsi posterior is fused and the extreme superior tip of the latissimus dorsi anterior fuses with the lower accessory head. There is a broad tendinous insertion to the ulna, and on to the fascia covering the elbow-joint.

Triceps.—This arises right down the humerus, and the origin bifurcates above.

Extensor metacarpi radialis.—This has two heads, and the outer of these is tendinous and is connected with the tendon of the patagium. The inner head is fleshy, but is covered with fascia on the side turned towards the radius. The tendons from the two heads remain separate to about half an inch from the common insertion at the base of the metacarpal spine; but the two tendons are wrapped together by fascia.

Ectepicondylo-radialis.—This is a strong muscle arising from the outer condyle of the humerus, where it is covered by a ligament passing from the outer condyle to the ulna. Its flat tendon of origin is in common with that of the extensor digitorum communis. It passes over to be inserted fleshy on to the second eighth of the proximal surface of the radius.

Ectepicondylo-ulnaris.—This is a stronger muscle than the last. It arises tendinously from the outer condyle to the humerus, and passing over to the ulna is inserted fleshy to the first third of its radial face.

Extensor metacarpi ulnaris.—This arises from the outer condyle of the humerus, its tendon being immediately external to that of the foregoing. It is also connected by a strong band of fascia with the proximal end of the ulna. It is inserted just above the junction of the second and third metacarpals.

Extensor digitorum communis.—The tendon of this arises from the external condyle of the humerus. Its slender belly extends a quarter of the length of the ulna, but it receives no fibres from the ulna. After passing over a groove in the distal end of the ulna its tendon forks, a short branch going to the phalanx of the thumb, and a long branch to the base of the first phalanx of the second digit.

Extensor longus pollicis.—This arises fleshy from four inches after the first of the shaft of the radius and from the third proximal inch of the ulna. The tendons from the two heads fuse about half an inch from their common insertion to the tendon of the extensor radialis metacarpi.

Extensor indicus longus.—Of the two heads of this the first arises fleshy from the third quarter of the radius. The second is much smaller and arises from the ligaments binding the radial carpal to the distal ends of the radius and ulna. The insertion is to the second phalanx of the index at its base, but it sends a broad ligament to the base of the first phalanx.

Pronator sublimis.—This arises proximal to the inner condyle of the humerus, and its fleshy insertion is at the end of the first third of the radius.

Pronator profundus.—This has exactly the same length as the sublimis. It arises from the inner condyle of the humerus, and its tendon of origin sends a slip to the flexors. It is inserted fleshy on to the radius and on to fascia covering the sublimis.

Brachialis inferior.—This flat entirely fleshy muscle arises from the distal end of the humerus, passes over the radius to be inserted for an inch after the first half inch of the ulna.

Flexor digitorum sublimis.—A strong band of tendon arises from the inner condyle of the humerus immediately below the origin of the pronator profundus. This band is attached by strong fasciæ to the ulna, and runs parallel with that bone to be attached to the ulnar carpal bone. From the dorsal surface of this two inches above its insertion there arises by a small fleshy head the flexor sublimis. It is inserted by a tendon to the base of the second phalanx of the second digit.

Flexor digitorum profundus.—This arises fleshy from the two middle quarters of the ulna. Its tendon is inserted halfway down the second phalanx of digit 2.

Flexor carpi ulnaris.—This arises from the inner condyle of the humerus by a strong tendon in which there is a well-marked sesamoid; it runs down the inner side of the ulnar to be inserted in the great tuberosity of the ulnar carpal bone. A thinner muscle arising from this passes into a tendon which is connected with the secondary feathers and is inserted alongside the great tendon of this muscle.

Ulni-metacarpalis ventralis.—This arises fleshy from the radial face of the last quarter of the ulna. Its tendon after passing over a groove in the radial carpal is inserted into the base of the first metacarpal proximal to the spur.

Extensor brevis pollicis.—This small muscle arises fleshy from the base of metacarpal one; it is inserted to the end of the first quarter of the phalanx of the thumb.

Abductor pollicis.—This arises fleshy from the ventral surface of the tendon of the extensor metacarpi radialis; its insertion is fleshy to half of the first phalanx of the thumb. A ligament continuous with it runs to the second phalanx of the thumb.

Flexor pollicis.—This arises fleshy between the root of the metacarpal spur and a knob on the ventral side of the metacarpal; its tendon is inserted on to the inner side of the base of the first phalanx of the thumb, but its fleshy belly gives rise to a slip of muscle which passes to the abductor indicis.

Abductor pollicis.—This arises from the outer surface of the metacarpal just beyond the articulation of the thumb; its belly runs across and is inserted by slips to the feathers on the thumb having no connection with the thumb-bones.

Abductor indicis.—This arises as a delicate fleshy slip from the flexor pollicis and from nearly the whole of the shaft of the second metacarpal. Its tendon is inserted at the base of the first phalanx.

Flexor digiti III.—This arises fleshy from the last two-thirds of metacarpal 3, and its tendon is inserted at the base of the first phalanx.

Radio-metacarpalis ventralis.—The tendon of origin comes from the lateral face of the distal end of the radius; the muscular belly divides in two. The superficial division is inserted by a short broad tendon to the upper surface of metacarpal III. The deep division is inserted fleshy to immediately below the superficial tendon.

Interosseus dorsalis.—The fleshy heads of this muscle arise from the greater part of the internal surface of the shaft of the second metacarpal and from the first quarter of the third metacarpal. The common tendon is inserted at the base of the second phalanx of the second digit.

Interosseus palmaris.—The origin of this is partly from the shaft of metacarpal III., but chiefly from the second metacarpal. The tendon is inserted to the flat part of the first phalanx of the second digit.

Muscles of the Thigh and Leg. (Figs. 4, p. 549, & 5, p. 552.)

Sartorius.—This is very large and strong, it is separated by a wide space from the gluteus maximus. It arises from fascia over the gluteus medius, and from the anterior upper and lower margins of the ileum. It is inserted on to the ligament containing the patella and on to the crest of the tibia. The patella was not ossified, but was represented by a cartilaginous nodule.

Gluteus maximus.—There is no postacetabular part of this muscle. The origin is entirely tendinous from fascia over the gluteus medius and from the ridge of the ileum above the acetabulum as far as the anterior margin of the biceps, with which it was fused for a short distance. The insertion is entirely tendinous to fascia covering the vastus and the cruræus. The innervation of the muscle, so far as it has yet been described, was from the crural plexus. At the posterior margin of the muscle is a separate well-developed muscular slip innervated by a twig from the ischiadicus. This part probably represents the postacetabular division of the muscle.

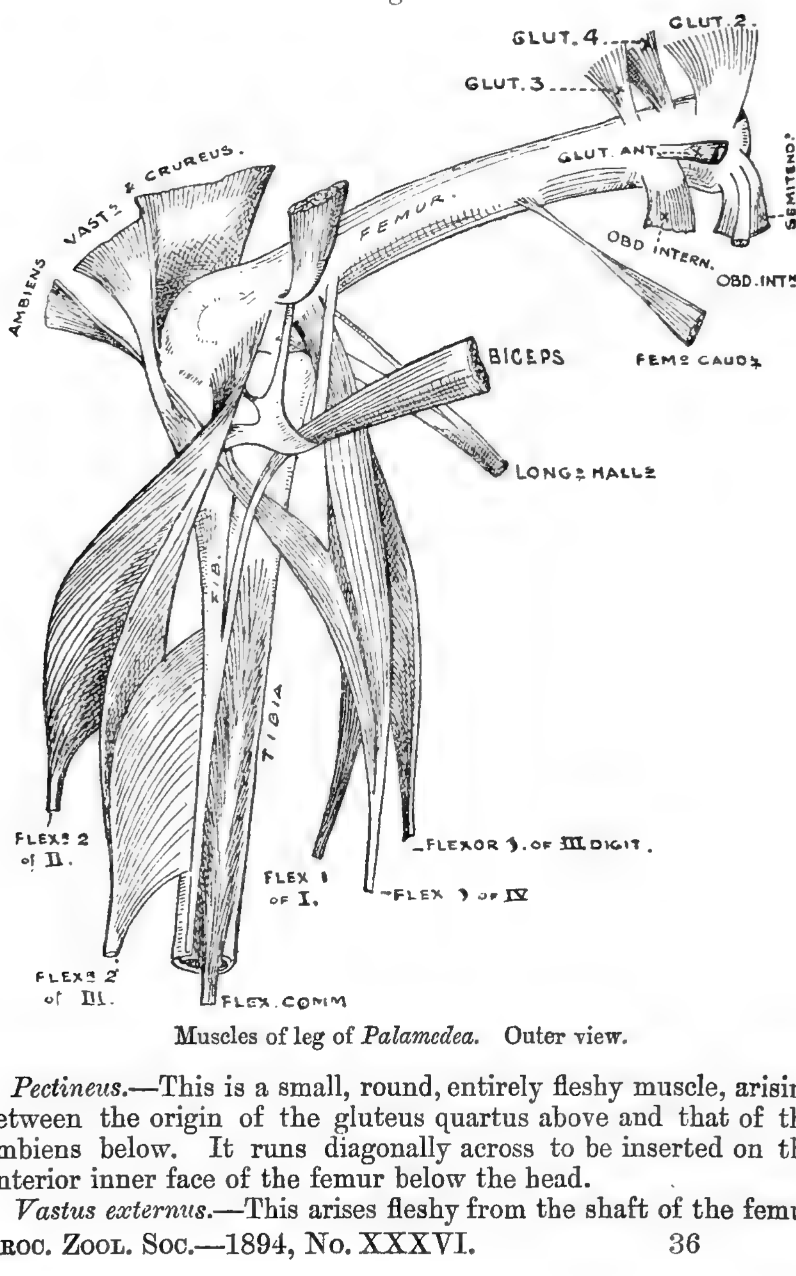
Gluteus anterior.—This is a small but very distinct triangular muscle arising fleshy from the ridge of the ileum above the acetabulum, being covered exactly by the part of the preceding muscle which arises from the same region; its tendon rapidly narrows to its insertion on the outer face of the femur between the tendons of the external obdurator and those of the third and fourth gluteals. It is the most superficial of the muscles inserted on to the upper extremity of the femur. Its nerve comes from the ischiadic plexus.

Gluteus medius.—The origin of this strong muscle underlaps that of the sartorius, but does not extend to the anterior edge of the ileum. The fleshy origin is confined to the ileum, and the strong short tendon is inserted broadly on to the outer face of the head of the femur; it has a double innervation, a large branch from the crural plexus, and a small twig from that branch of the ischiadicus that supplies the gluteus anterior.

Gluteus minimus.—This muscle arises fleshy from the anterior lower border of the ileum, not reaching on to the ribs, and contiguous with the lower margin of the medius in its anterior region, while near its insertion it is separated from that muscle by the gluteus quartus. It is inserted tendinously on to the upper end of the shaft of the femur lower down than the insertion of the other gluteals. It is supplied by a large branch from the crural plexus.

Gluteus quartus.—This small muscle lies between the last two muscles, from both of which it is quite distinct, though partially overlapped and concealed by them. It arises fleshy from the lower edge of the ileum between the minimus and the acetabulum. Its insertion is by a broad tendon to the femur between the insertions of the medius and minimus. Its nerve is a V-branch of the crural plexus.

Fig. 4.



Muscles of leg of *Palamedea*. Outer view.

Pectineus.—This is a small, round, entirely fleshy muscle, arising between the origin of the gluteus quartus above and that of the ambiens below. It runs diagonally across to be inserted on the anterior inner face of the femur below the head.

Vastus externus.—This arises fleshy from the shaft of the femur from the gluteus to the biceps sling. It is fused with the crureus in front and terminates in the patellar ligament.

Crureus.—This is tendinous on the outer surface at its origin from the neck of the femur; it also arises from a considerable part of the shaft of the femur and is inserted with the vastus.

Vastus internus.—This arises from the whole length of the inner surface of the shaft of the femur, starting from immediately below the insertion of the pectineus. It is inserted on to the tibia alongside the tibial insertion of the sartorius.

Biceps.—This arises fleshy from the whole of the postacetabular ridge of the ileum to the anterior edge of the semitendinosus. It ends in a tendon which passes through a sling and is inserted on to the fibula.

Femoro-caudal.—This was a large thin tendon at each end. No accessory is present.

Semitendinosus.—This arises entirely from the ileum behind the biceps; it is half an inch broad, and after being joined by the somewhat small accessory, it sends a flat tendinous slip to the tendon of the membranosus. The rest of the tendon joins the middle head of the gastrocnemius, with which the accessory semitendinosus is fused all along its length.

Semimembranosus.—The origin of this is fleshy from the pubis and ischium. It passes into a flat tendon half an inch broad, which after receiving the slip from the tendinosus, runs in to be inserted on to the tibia between the inner and middle heads of the gastrocnemius.

Obturator externus.—This arises from the postacetabular part of the ileum, and is inserted exactly opposite the minimus.

Obturator internus.—This has an elongated oval origin and its insertion is tendinous to the outer surface of the head of the femur.

Gemellus.—This is single and entirely fleshy, surrounding the tendon of the foregoing muscle.

Adductors.—The outer muscle is much the shorter and narrower of the two; its fibres are coarse and run from the tendinous origin on the ischium to the posterior face of the femur, and a few fibres are continued to the gastrocnemius.

The deeper adductor is longer and broader, and its fibres are more delicate. They arise along the whole length of the ischium, reaching under the semimembranosus behind. The posterior edge of the muscle is doubled upon itself, the insertion is double. One set of fibres run to the femur under the other adductor, the other set join the middle head of the gastrocnemius.

Ambiens.—This muscle is well marked; it arises as described above by a tendon under the *pectineus*; the belly of the muscle ends above the knee-joint in a flat narrow tendon, which runs through the capsule of the joint to the front of the leg, and then passing under the origin of the perforated and perforating flexors, joins the perforated flexors in a manner presently to be described. The ambiens is innervated by a twig which comes off the crural plexus with the nerve for the *sartorius*.

Gastrocnemius.—The outer head is entirely tendinous, and arises from the femur distal to the long head of the *biceps* sling. The short arm of the *biceps* sling arises from the underside of this head of the *gastrocnemius* very close to its origin. From this short arm of the sling a broad tendinous band, thicker at the lower edge, runs in to join the origins of the perforated and perforating muscles. The outer head becomes tendinous halfway down the leg, and joins the *tendo Achillis* just above the ankle. The middle head arises tendinously from the inner condyle of the femur in common with the *accessory semitendinosus*, with which it is fused. It is joined by the outer *adductor* and by the tendon of the *semitendinosus*. This muscle then passes into a tendon which joins the tendon of the tibial head halfway down the leg. The inner or tibial head arises fleshy from the *crista tibiæ* and from the fascia covering the *peroneus longus*; it then joins the middle head. It is the broadest and strongest part of the *gastrocnemius*.

Soleus.—This small muscle arises by a fleshy head from the tibia for a space of three quarters of an inch below its head on the inner face. Its long slender tendon is inserted on the under and inner surface of the ankle-cartilage.

Peroneus longus.—This arises from the fascia covering the tibialis anticus, and from a small part of the upper end of the fibula, from the fascia over the knee-joint, and from the septum between itself and the perforated and perforating flexor of the index. Its broad thin tendon sends a wide fork to the cartilage of the ankle-joint, and a narrower tendon which joins the tendon of the perforated muscle of the third digit.

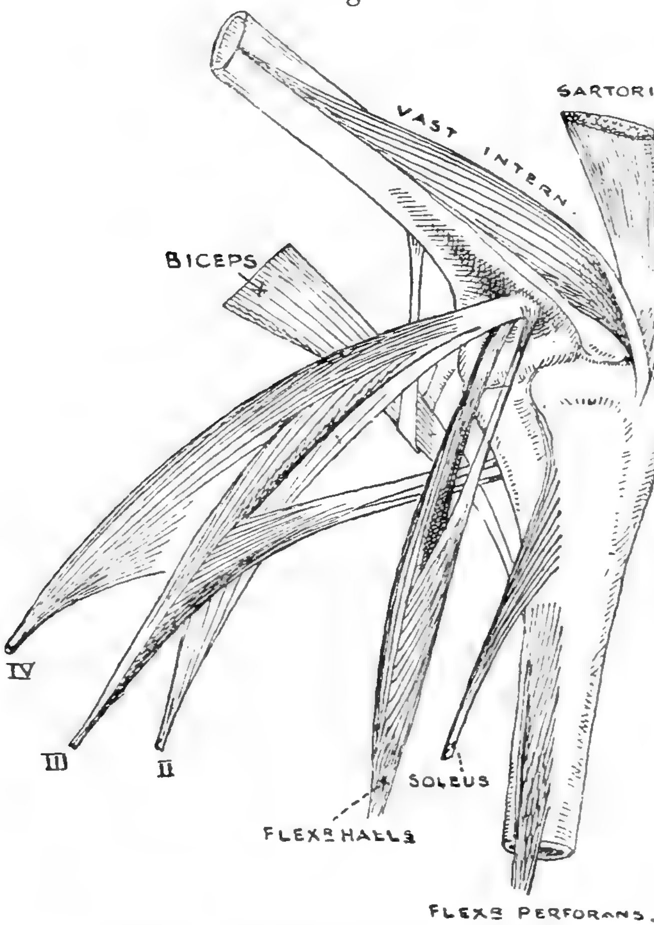
Tibialis anticus.—This has two muscular bellies: the smaller and rounder arises by a strong tendon from the outer condyle of the femur; the inner springs fleshy from the crista tibiæ. The muscular part of the two heads unite halfway down the leg, and give rise to a strong tendon which is bifid just at its insertion. Through this fork a nerve passes.

Extensor communis digitorum.—This arises fleshy from the tibia from its crest and from halfway down the shaft exactly under the tibial head of the tibialis anticus. Its tendon passes through first a bony and then a membranous bridge, and then runs down the anterior surface of the foot. Halfway down the tarsus metatarsus it divides in two. Each branch again forks. The forks of one branch are inserted on the second and third digits; the forks of the other branch on the third and fourth digits.

Peroneus brevis.—This very slender muscle arises from the anterior face of the fibula and a small portion of the tibia. Its tendon is inserted on to a knob on the outer side of the tarsus metatarsus.

Flexor perforans et perforatus indicus.—In the woodcut the perforated and perforating flexors are distinguished by the figure 2 placed before the roman number, which indicates the digit to which they are attached, while the perforated flexors are distinguished by the figure 1 correspondingly placed. This is the most superficial of the flexors; it arises from the outer condyle of the femur and from the septum between itself and the peroneus longus, and from the septum between itself and the flexor perforatus et perforans of the middle finger. Its tendon is inserted to the base of the second phalanx of its digit.

Fig. 5.



Muscles of leg of *Palamedea*. Inner view.

Flexor perforatus et perforans medii.—This has a similar origin to the last, which it underlies; but in addition it has an extensive origin from the fibula. Beginning opposite the insertion of the biceps, its tendon is inserted to the base of the second phalanx of the middle finger. Above the first phalanx a short tendinous connection runs down to it from the flexor perforatus tendon of the same digit.

Flexor perforatus.—The parts of this muscle are closely united. The mass arises from two heads. The inner head is large and fleshy and comes from the intercondylar notch. The outer head arises tendinously from the outer condyle of the femur, below the origins of the perforated and perforating flexors. With this outer head the tendon of the ambiens unites after it has crossed the fibula. Each of the three tendons running to the digits has a share in both tendons, and the ambiens tendon can be traced splitting up to each. The tendons of the index and of the middle finger are inserted to the base of the first phalanges of their digits. The tendon of the fourth digit is inserted similarly, but in addition has a tendinous slip running to the base of the second digit, taking the place of the absent perforatus and perforans.

Flexor longus hallucis.—This has two heads—one fleshy from the lower face of the external condyle, with a tendinous slip from the outer side of the intercondylar notch; one tendinous and slight in common with the inner head of the flexor perforatus. The whole muscle is very slender. The tendon passes through the ankle-joint alongside that of the flexor communis, then crosses over that, giving off to it a slip which is thick relatively to the very slender tendon which runs to the base of the first phalanx of the thumb.

Flexor profundus.—This common deep plantar tendon arises fleshy from the fibula and tibia, halfway down the tibial shaft, and its tendon after receiving slip from the longus hallucis breaks up into a branch, which runs to the base of the claw on digits II., III., and IV.

Popliteus.—There is only one popliteal running from its fleshy origin from the head of the fibula to a fleshy insertion just under the head of the tibia.

In the ankle-cartilage the tendons of the perforated and perforating flexors are most superficial; the tendon of the perforated muscle of the third digit wraps round that of the fourth. The tendon of the perforatus of the index is more deebly situated, and the tendon of the longus hallucis passes through the cartilage of the extreme outer side.

Flexor brevis hallucis.—This is stronger than the longus hallucis. It arises from the upper part of the shaft of the tarso-metatarsus on the inner side. It is inserted at the base of the phalanx.

Flexor brevis hallucis secundus.—This arises from the posterior side of the greater part of the shaft of the tarsus metatarsus and is inserted in common with the last.

Flexor brevis indicis.—This is a short broad muscle lying in between the diverging ends of the metatarsal shaft, and inserted to the base of phalanx I.

Adductor annularis.—This is a large muscle arising from the whole of the metatarsal shaft.

Extensor hallucis.—A fleshy muscle from the middle quarter of the metatarsal shaft to the middle of the first phalanx.

Extensor hallucis secundus.—A short entirely muscular slip with origin similar to the last, and insertion to the base of the first phalanx.

Abductor indicis.—This is a very short muscle from the metatarsal shaft to the inner side of the basal phalanx.

Extensor medii.—This is represented by a rudimentary patch of muscle attached to the fascia covering the base of the first phalanx.

Adductor annularis.—This long muscle arises down the upper surface of the metatarsal shaft. Its tendon passes through a foramen in the metatarsus, and is inserted about the middle of the first phalanx.

§ Comparison of *Palamedea* with *Chauna*.

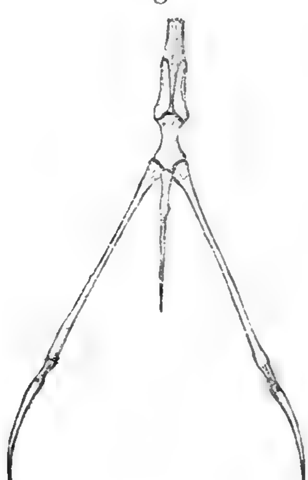
We have not deemed it necessary to give a detailed separate account of the osteology of *Palamedea*, as all the differences between it and *Chauna* will be found set out in the subjoined table. We have, however, thought it worth while to figure the pelvis of *Palamedea*, because of the great difference in the angle of inclination of the postacetabular region.

Fig. 6.

Pelvis of *Palamedea*.

We also figure the hyoid, because there is not, so far as we are aware, any figure of this bone in the Palamedeidæ.

Fig. 7.



Hyoid bone of *Palamedea*.

The *basihyal* or *copula* is longer than it is broad, and in form is intermediate between the short, broad, *copula* of Ducks, Accipitres, and Parrots, and the long slender *copula* of Waders.

The *urohyal* is very long, and cartilaginous at the extremity. As in the Tinamu, it is movable upon the *copula*.

The *entoglossum* is in the extremely primitive condition of being paired. This paired condition is indicated by a central aperture in Geese and some other birds.

The *ceratohyals* consist each of two bony pieces, with a short cartilaginous segment between them.

Table of Chief Differences between *Palamedea* and *Chauna*.

	PALAMEDEA.	CHAUNA DERBIANA.
Pterylosis and cutaneous system.	Differences very slight, as *Nitzsch* has stated.	
Rectrices	14.	12.
Proventricular glands.	Continuous cap.	Single patch.
Liver-lobes	Right layer.	Subequal.
Duodenum	Hepatic and pancreatic ducts enter at summit of ascending loop.	Ducts enter at the bend (*Garrod*).
Cæca	Identical in their very peculiar structure, but slightly larger in *Palamedea*.	
Bronchial semirings	Unossified; 9 and 8 in number.	First two are ossified; 7 at each side.
Syrinx	Deeply notched back and front.	Notched only at back.
Sternotracheal muscles.	Two pairs; arising 4 rings higher up.	Two pairs.
Expansor secundariorum.	Ciconiine.	Ciconiine.
Biceps patagialis	Absent.	Absent.
Brevis tendon	Ends on radius.	Passes over to ulna (*Fürbringer*).
Pectoralis minor	Does not reach the posterior margin of the sternum.	
Origin of obdurator internus.	Elongate oval.	Elongate oval.
Postacetabular part of gluteus maximus.	Represented by a small slip with separate nerve from the *ischiadic plexus*.	Absent.
Ambiens	Present.	Present.
Semitendinosus	Present.	Present.
Accessory semitendinosus.	Present, but fused with gastrocnemius middle head.	Present.
Femoro-caudal	Present.	Present.
Accessory femoro-caudal.	Absent.	Present.
Long flexor to hallux	Present.	Absent.
	Skeleton.	
	The whole skeleton generally slighter and long bones longer.	
Sternum	Posterior lateral processes shorter and broader.	More anserine.
Ribs	No uncinate processes. 6th and 7th ribs are broad and have a faint	No uncinate processes

	Palamedea.	Chauna derbiana.
	Skeleton (continued).	
	projection in region of uncinates.	
	8th sternal rib short and does not reach sternum.	8th sternal rib articulates with costal rib and with sternum.
	Penultimate sternal rib plain.	Penultimate sternal rib has a sharp backwardly directed process near articulation with costal rib.
Clavicle	V-shaped; broadest region just beyond coracoid.	U-shaped; broadest region halfway down from coracoid.
Pelvis	Ilea cover fourth but last ribs; hinder part of pelvis is bent down on the fore part (see fig. 6, p. 554). 'Waist' of pelvis very broad.	Ilea cover third but last rib; long axis of pelvis straight and more duck-like. Waist narrow.
Wings	Proportionately much longer and bones slighter. This especially so with second metacarpal.	
Legs........................	Femur and tibia more slender; fibula and digits much longer.	
Cervical vertebræ	16.	17.
	Ventral processes of anterior cervicals much less marked.	
Dorsal vertebræ.........	First pair have a ventral process.	First three have a ventral process.
	Neural processes flatter and higher.	
Ploughshare bone	More short and slender.	
Skull	In proportion and absolutely much smaller. The horn arises from a bony process on middle line, a quarter of an inch from the anterior margin. Flatter.	
	Foramen magnum larger.	
	The anserine oval space between periotics and supraoccipitals absent.	Ibid.
	Anterior part of the face from tip of bill to end of palatines broad, long, and goose-like.	Ibid.
	Desmognathous.	Ibid.
	Outer long edge of palatine with a sharp angular projection as in Geese.	Ibid.
	Basipterygoid facets wide apart, not close together as in Geese.	Ibid.
	Middle superior ramus of premaxilla separate from the lateral pieces as in gallinaceous birds, *not* fused as in Geese.	Ibid.
	Angulare of lower jaw nearly straight.	Angulare of lower jaw sharply upturned as in Geese.

For the present we are content merely to point out the very wide distinctions existing between the genera *Chauna* and *Palamedea*. Those who are best acquainted with the anatomy of birds will realize most readily how considerable these distinctions are. We hope on a subsequent occasion, when we have had the opportunity of examining again and more minutely some points in the structure of *Chauna*, to deal with the systematic position of the Palamedeidæ. The fact that so great differences obtain between the genera is confirmatory of the generally received opinion that this form is one of great antiquity.

8. On a Collection of Lepidoptera from British East Africa, made by Dr. J. W. Gregory between the Months of March and August 1893. By Arthur G. Butler, Ph.D., F.L.S., F.Z.S., &c., Assistant-Keeper Zoological Department, British Museum (Nat. Hist.).

[Received June 8, 1894.]

(Plates XXXVI. & XXXVII.)

The present collection is rich in species and in number of specimens, though, unfortunately, many of the latter are not in first-rate condition: indeed most of the small moths are unidentifiable. Nevertheless the collection contains several novelties, a fair series of specimens in good preservation, and is particularly interesting as including a considerable number of grades between species which hitherto have been easy to distinguish, but are now clearly shown to be, at most, localized dimorphic developments from one widely-distributed species.

Of the species which it has been possible to name, or, at any rate, to assign to their genera, there are no less than 215, of which 10 are described as new to science. Of the remainder several are new to the Museum, whilst others have previously only been represented by single examples.

Of Butterflies previously received from Somali-land the collection contains the following:—

1. Limnas chrysippus (vars. *dorippus* and *klugi*).
2. Ypthima asterope.
3. Neocœnyra duplex.
4. Junonia (Precis) limnoria.
5. Junonia cebrene.
6. Byblia ilithyia (*Hypanis ilithyia* of my Somali paper).
7. Hamanumida dædalus.
8. Polyommatus bæticus.
9. Catochrysops osiris.
10. Terias zoe.
11. Teracolus helvolus (separated subsequently to the publication of my paper on Somali Lepidoptera).

12. TERACOLUS PROTOMEDIA.
13. TERACOLUS NOUNA.
14. TERACOLUS THRUPPI.
15. BELENOIS LORDACA=var. of *B. mesentina*.
16. SARANGESA DJÆLÆLÆ.

Of the above-named species, *Neocœnyra duplex*, *Teracolus helvolus*, and *Teracolus thruppi* were only known from Somali-land; but the others are more or less widely distributed. The species obtained from Kilima-njaro are represented in about an equal degree, as also those from Nyassa-land.

RHOPALOCERA.

1. AMAURIS DOMINICANUS.

Amauris dominicanus, Trimen, Trans. Ent. Soc. 1879, p. 323.

Steppes of Thika-Shika, among patches of acacia-scrub; Kibwezi and Ndoli.

Some of the specimens obtained have the black outer border of the secondaries considerably narrower than in the typical form.

2. LIMNAS CHRYSIPPUS.

Papilio chrysippus, Linnæus, Mus. Lud. Ulr. p. 263 (1764).

♂ ♀, Steppes N.W. of Longari.

The typical form of this species appears to have been rare.

2 *a*. LIMNAS KLUGI.

Limnas klugii, Butler, P. Z. S. 1885, p. 758. n. 2.

Thiriati, 12th June; Kithu-Uri, Maranga, 13th June; Ngatana, December; Barra, near Merifano; Ndara; Guaso, Narok; Ukikuigu, Thika-Shika, 16th July; Ndangi River; Kibwezi.

This seems to have been the prevalent form of the species.

2 *b*. LIMNAS DORIPPUS.

Euplœa dorippus, Klug, Symb. Phys. pl. 48. figs. 1–4.

♂, Ngatana in January; ♀, Alng'aria.

One male and two females were obtained, all of them less varied with white on the secondaries than in the typical form of this race.

3. TIRUMALA PETIVERANA.

Danais limniace, var. *petiverana*, Doubleday, Gen. Diurn. Lep. p. 93. n. 37, pl. 12. fig. 1 (1847).

Steppes of Thika-Sika; Tana, 16th July.

Only three examples were obtained, west of the Lower Falls.

4. MELANITIS SOLANDRA.

Papilio solandra, Fabricius, Syst. Ent. p. 500 (1775).

♂ ♀, Ngatana, 29th January, 1893.

5. Mycalesis (Monotrichtis) eusirus.

Mycalesis eusirus, Hopffer, Ber. Verh. Ak. Berl. 1855, p. 641. n. 13.

Ngatana, December and January; shores of Lake Dumi, 13th February; Njempo; steppes of Thika-Shika on grassy plateau west of the Lower Falls, 16th July.

6. Enotesia, sp.

One poor example of a species near to *E. ankoma* (*Mycalesis ankoma*, Mabille); the primaries, however, are a little less angular than in that species, and the outer edge of the dark central belt is zigzag throughout.

Ndoro; steppes at base of Kenya, 7000 feet.

Neocœnyra, Butl.

The present collection proves that this genus must be much more extensive than I had supposed. In the first place, there are sexes of my *N. duplex* agreeing very closely in pattern, the female being entirely without the red markings of my supposed female from Somali, thus proving that the latter is a distinct species (for which, therefore, I propose the name of *N. rufilineata*). Secondly, there is a species allied to *N. duplex* and *N. ypthimoides*, but nearer to the former.

Neocœnyra, at first sight, would appear to be scarcely distinct from *Strabena*, Mab., if we were to accept that author's decision as regards the type of his genus. Although in 1877 M. Mabille had already described a single species under the generic name *Strabena* (*S. smithii*, Pet. Nouv. p. 157), he stated in M. Grandidier's 'Hist. de Madagascar' that *Satyrus tamatavæ*, Boisd., was the type of his new genus.

If this loose treatment of the types of genera is permitted, it will necessitate alteration of the names of scores of well-known groups, the types of which have been figured or referred to by both Hübner and Felder, without any definite statement that the species thus indicated are the types of their genera.

The only safeguard is strictly to follow the method adopted by Scudder, accepting the author's first mention of his genus, as then used, and ignoring all his subsequent decisions: the first species recorded under a new generic name, if unaccompanied by other species, or any statement as to the type of the said genus, thus becomes, and must for ever after remain, the typical species.

The genus *Strabena*, as represented in the 'Histoire de Madagascar,' contained heterogeneous material, and the so-called type differs in no structural character from one of the species placed by the same author under *Pseudonympha*: thus M. Mabille says that the latter genus is characterized by its long antennæ, the club of which is distinct, oboval, and laterally compressed; but his *P. goudotii* has the club cylindrical and with a longitudinal groove below, as in *S. rakoto*, *vinsonii*, *ibitina*, *tamatavæ*, &c.; it also has the median vein somewhat swollen at the base, though less so than in *Ypthima*, of which genus the whole of these Madagascar forms might well be considered a section, the angulated-winged species being alone kept distinct under the generic name of *Strabena* [1].

The absence of any swelling at the base of the median vein in *Neocœnyra* at once separates it from *Ypthima*, and, as a matter of course, from Mabille's second version of *Strabena*.

7. NEOCŒNYRA GREGORII, sp. n. (Plate XXXVI. fig. 2.)

Nearest to *N. duplex*: considerably larger. Olivaceous brown, slightly rufescent in certain lights on the basal half, which is always slightly darker; a well-defined dark brown submarginal line, somewhat sinuated on the secondaries, particularly towards the apex; a second more slender line close to outer margin: primaries with a large, rounded, subapical, black bipupillated ocellus; the pupils white, edged with blue or lavender scales; iris tawny orange, with external dark brown zone: secondaries with three or four similarly coloured, but smaller and unipupillated ocelli as follows:—one subcostal towards apex, very small in the male but large in the female, and three in an oblique series from third median branch to near anal angle, the third smaller than the others and sometimes wanting in male examples. Wings below slightly more olivaceous than above, the submarginal lines sienna-red externally, the inner one of the secondaries zigzag towards apex; two other irregular lines, dark brown in the male but red in the female, crossing the wings, angulated on the secondaries; base of costa and discoidal cell red in both sexes; ocelli nearly as above, but the subanal ocellus of the secondaries always present and usually double or geminate, the opposite wings sometimes showing two small ocelli near together or one geminate ocellus respectively. Body blackish, with a red spot on the patagia. Expanse of wings, ♂ 43 millim., ♀ 46 millim.

Karianduri, ascent of Kilima Meza, Elmeteila Basin, Nawashi to Baringo Valley, Kariandur, 6100 feet, wooded ravines and cliffs to the east and salt marshes to the west; Alng'aria; Thegu and steppes north of Thegu; Ndora steppes at base of Kenya, 7000 ft.; Rangatan, Ndari.

8. NEOCŒNYRA DUPLEX. (Plate XXXVI. fig. 1.)

♂. *Neocœnyra duplex*, Butler, P. Z. S. 1885, p. 758. n. 4.

The true female of this species has the tawny area on the primaries much larger than in the male and continued downwards to the first median branch, enclosing a second small and unipupillate ocellus on the first median interspace; the secondaries show a sinuous dark brown line beyond the cell on the under surface. Expanse of wings 36 millim.

Ngomeni to Kinani.

[1] Apart from colour characters, I fail to see any good reason for distinguishing "*Strabena*" *tamatavæ* and allies, even as a Section, from true *Ypthima*, the only structural distinction being one of degree.

Physcænura, Wllgr.

In my last paper (on Mr. Johnston's collections) I failed to recognize this genus as the *Periplysia* of Gerstäcker, and consequently, in going through the Records, I overlooked Mr. Godman's *Physcœnura pione* and renamed it as a new *Periplysia*.

9. Physcænura leda.

Periplysia leda, Gerstäcker, Arch. für Naturg. 1871, i. p. 358; Van der Decken's Reisen, iii. 2, p. 371, pl. 15. figs. 3, 3 *a* (1873).

Ngatana.

10. Ypthima asterope.

Hipparchia asterope, Klug, Symb. Phys. pl. 29. figs. 11–14 (1832).

Ngomeni to Keriani.
One rather poor example was obtained.

11. Eurytela dryope.

Papilio dryope, Cramer, Pap. Exot. i. pl. lxxviii. E, F (1779).

Ngatana, 29th January, 1893; Kibwezi and Fuladoya.

12. Eurytela ophione.

Papilio ophione, Cramer, Pap. Exot. ii. pl. cxiv. E, F (1779).

Ngatana, December or January.

13. Byblia ilithyia.

Papilio ilithyia, Drury, Ill. Exot. Ent. ii. pl. 17. figs. 1, 2 (1773).

Ngatana, 29th and 30th January, 1893; Golbanti; Ndara in the afternoon; Kinani; Mtoto wa Ande; steppes N.W. of Longari; steppes of Kiroruma.

14. Byblia cora.

Hypanis cora, Feisthamel, Ann. Soc. Ent. France, 1850, p. 249.

Ndara and Thagana, in woods beside and park-land between Ukikuya.

15. Byblia acheloia.

Hypanis acheloia, Wallengren, Lep. Rhop. Caffr. p. 29 (1857).

Urtu in garden; Ngatana; Mtoto wa Ande.

16. Charaxes guderiana.

♂. *Nymphalis guderiana*, Dewitz, Nova Acta Akad. Naturf. Halle, 1879, p. 200, pl. 2. fig. 18.

♀. *Charaxes guderiana*, Butler, P. Z. S. 1893, p. 648. n. 18; Trimen, P. Z. S. 1894, pl. v. fig. 8.

♂, Fuladoya.

17. Charaxes candiope.

Nymphalis candiope, Godart, Enc. Méth. ix. p. 352. n. 10 (1823).

Summit of Mt. Höhnel, 16,000 feet.

18. Palla varanes.

Papilio varanes, Cramer, Pap. Exot. ii. pl. clx. D, E (1779).

No record of exact locality on the specimen: probably Sabaki Valley.

Dr. Gregory informs me that the bulk of the specimens obtained in the Sabaki Valley were not labelled; thus nearly all unlabelled examples would be from that locality.

19. Hypolimnas misippus.

Papilio misippus, Linneus, Mus. Lud. Ulr. p. 264 (1764).

♂ ♀, Ngatana, December and January.

19 *a*. Hypolimnas inaria.

Papilio inaria, Cramer, Pap. Exot. i. pl. ccxiv. A, B (1779).

♂, Lamu; ♀, Witu; Ngatana, 28th December, 1892; Kinani; Njempo; Athi, plains near Chjanjavi.

20. Euralia deceptor.

Diadema deceptor, Trimen, Trans. Ent. Soc. 1873, p. 105.

Euralia deceptor, Trimen, South Afr. Butt. i. p. 286. n. 93, pl. vi. fig. 3.

♀, Sabaki Valley.

21. Junonia ethyra (or a nearly allied new species).

Salamis ethyra, Feisthamel, Ann. Soc. Ent. Fr. 1850, p. 250.

Alng'aria.

22. Junonia natalica.

Precis natalica, Felder, Wien. ent. Monatschr. iv. p. 106. n. 65 (1860).

Sandy steppes of the Kiroruma, Tana; Thika-Shika, west of the Lower Falls.

23. Junonia limnoria.

Vanessa limnoria, Klug, Symb. Phys. pl. 48. figs. 6, 7 (1845).

Kibwezi.

24. Junonia simia.

Precis simia, Wallengren, Kongl. Svenska Vetensk.-Akad. Handl. 1857, p. 26. n. 2; Trimen, South Afr. Butt. i. p. 227 (1887); P. Z. S. 1894, p. 33, pl. iv. fig. 5.

Junonia micromera, Butler, Ann. & Mag. Nat. Hist. ser. 4, vol. xviii. p. 482 (1876).

Kinani; Mtoto wa Ande; Njempo, shores of Lake Baringo, taken at night.

Evidently a common though somewhat local species. Mr. Trimen says that he recognized it by the help of a coloured drawing of the type. I have only recently recognized it through Mr. Trimen's plate, a coloured proof of which was submitted to me to pass for printing. In the description by Trimen (South Afr. Butt.) this species is clearly compared with my *J. calescens*, which I find that Staudinger has superseded in his letterpress, though not on his plate, by calling it *Precis octavia*, var. *natalensis*. That it is not a variety (as Staudinger imagined from the fact that he had, apparently, only one example from Natal) is certain; for it occurs in localities where the allied *Junonia octavia* is not found, and which it evidently replaces, as *J. simia* does in the present collection. Whether the names *natalica* and *natalensis* should both stand may be questioned.

25. Junonia terea, var.

Papilio terea, Drury, Ill. Exot. Ent. ii. pl. 18. figs. 3, 4 (1773).

♂, Gopo lal Mavari, Laitsipia; ♀, Alng'aria.

A very dark suffused pair with orange band almost as narrow as in *J. elgiva*, which it tends to link to *J. terea*.

26. Junonia cuama.

Junonia cuama, Hewitson, Exot. Butt. iii. *Jun.* pl. 1. figs. 4, 5 (1864).

Kinani, afternoon; Mtoto wa Ande; steppes of Thika-Shika.

27. Junonia cloantha.

Papilio cloantha, Cramer, Pap. Exot. iv. pl. cccxxxviii. A, B (1782).

Guaso Laschau, Guaso Nyiro.

28. Junonia sesamus.

Precis sesamus, Trimen, South Afr. Butt. i. p. 231, pl. iv. fig. 3 (1887).

Maka.

29. Junonia boöpis.

Junonia boöpis, Trimen, Trans. Ent. Soc. London, 1879, p. 331.

Witu; Njempo.

30. Junonia clelia.

Papilio clelia, Cramer, Pap. Exot. i. pl. xxi. E, F (1779).

Witu; Ngatana, December and January; Njempo; Guaso Laschau; Thagana woods beside Ukikuya; steppes between Athi and Thika; Sabaki Valley at Tanganyika.

In some of Dr. Gregory's examples the blue patch is unusually large on the secondaries, exhibiting the first step in the direction of *J. boöpis*: it varies from cobalt to lilac in tint.

31. Junonia cebrene.

Junonia cebrene, Trimen, Trans. Ent. Soc. London, 1870, p. 353.

Kinani; platform on Kikuyu escarpment, Kedong, Naiva; shores of Lake Baringo; Njempo; Guaso Narok; Guaso Laschau; steppes N.W. of Longari; Thagana; steppes of Thika-Shika; steppes between Athi and Thika; Athi plains, Chjanjavi; Maka; Ndoli; Sabaki Valley at Tanganyika and near Makongeni.

As regards the form of the tawny patches and the size, shape, and colouring of the blue or violet spot on the secondaries the specimens vary not a little; it therefore seems doubtful whether the Malagasy form, *J. paris*, will prove to be specifically distinct.

32. Pyrameis abyssinica.

Pyrameis abyssinica, Felder, Reise der Nov., Lep. iii. p. 397. n. 589 (1867).

No exact locality on the specimen; probably Sabaki Valley.

This interesting little species is quite intermediate between *P. atalanta* and *P. dejeanii*; but, as Felder says, belongs to the *P. atalanta*-group. In colouring it more nearly resembles *Eurema schœneia*, Trimen, but has a short ochreous bar beyond the cell of the primaries representing the white bar in *P. atalanta.*

Trimen observes that I evidently included *E. schœneia* under my *Hypanartia commixta* (in which he is quite correct); but whether the date printed with Oberthür's paper was that of its actual publication is, I think, open to question.

33. Pyrameis cardui.

Papilio cardui, Linnæus, Faun. Suec. p. 276. n. 1054 (1761).

Guaso Laschau; Thagana; Kenya, camp below the old ice-fall; steppes between Athi and Thika; Ndangi River.

34. Protogoniomorpha aglatonice.

Vanessa aglatonice, Godart, Enc. Méth. ix. p. 299. n. 8 (1819); ♂, Lucas, Lep. Exot. pl. 57. fig. 2 (1835).

Var. ♂. *Salamis definita*, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. iv. p. 230 (1879).

♀. *Protogoniomorpha definita*, Butler, P. Z. S. 1893, p. 653.

♂ ♀. *Salamis nebulosa*, Trimen, Trans. Ent. Soc. Lond. 1881, p. 441; South Afr. Butt. i. p. 246. n. 79 (1887).

♀ ♀. Sabaki Valley.

Three examples exactly corresponding with typical females of the three supposed species; thus distinctly proving that they are mere sports of one variable form, as I previously suggested.

35. Protogoniomorpha anacardii.

Papilio anacardii, Linnæus, Mus. Lud. Ulr. p. 236 (1764).

Lanjoro, south of Guaso Thegu.

36. Euphædra violacea.

Euryphene violacea, Butler, P. Z. S. 1888, p. 91.

No exact localities on the pair obtained; probably from the Sabaki Valley.

An example from Zanzibar in the series of *E. neophron* recently presented to the Museum by Messrs. Salvin and Godman shows a decided approach to the colouring of *E. violacea*, but has the wing-form of typical *E. neophron*. The latter varies remarkably in colouring, examples from Lake Nyasa being bright green above, those from Delagoa Bay bluish green or greenish blue, those from Zanzibar having a more or less pronounced violaceous suffusion, usually confined to the external area. None, however, have the produced primaries or uniform violaceous colouring of my species, though it is possible that more transitional forms may hereafter be obtained.

37. Hamanumida dædalus.

Papilio dædalus, Fabricius, Syst. Ent. p. 482. n. 174 (1775).

Golbanti; steppes of Thika-Shika; Ndoli; Ndangi River.

38. Godartia wakefieldii.

Godartia wakefieldii, Ward, Ent. Month. Mag. x. p. 152; Afric. Butt. pl. vi. fig. 3 (1873).

No exact localities on specimens, which were therefore probably obtained in the Sabaki Valley.

39. Neptis agatha.

Papilio agatha, Cramer, Pap. Exot. iv. pl. cccxxvii. A, B (1782).

Ngatana; Guaso Laschau; Thiriati; steppes of Thika-Shika.

40. Atella columbina.

Papilio columbina, Cramer, Pap. Exot. iii. pl. ccxxxviii. A, B; iv. pl. cccxxxvii. D, E (1782).

No exact locality on the specimens; probably Sabaki Valley.

41. Acræa cabira.

Acræa cabira, Hopffer, Ber. Verh. Akad. Berlin. 1855, p. 640. n. 7; Peters, Reise nach Mossambique, p. 378, pl. 23. figs. 14, 15 (1862).

Thiriati (shrub-covered plateau, with deep gorges) in Tana river-basin.

42. Acræa ventura.

Acræa ventura, Hewitson, Ent. Month. Mag. xiv. p. 51 (1877); Butler, P. Z. S. 1893, p. 655. n. 61.

Rangatan, Ndari, Laitsipia.

43. Acræa planesium.

Acræa planesium, Oberthür, Études d'Entom. 17th livr. p. 24, pl. 1. fig. 11 (1893).

Thiriati; Machakos; Kavaluki Valley; Maka.

Apparently not a rare species.

44. Acræa perrupta.

Telchinia perrupta, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xii. p. 102. n. 4 (1883).

Golbanti; Mbololo near summit, 5600 ft.; shores of Lake Baringo, S.W. corner; Njempo; Gopo lal Mavari; Guaso Laschau; Thiriati.

45. Acræa lycia.

Papilio lycia, Fabricius, Syst. Ent. p. 464. n. 94 (1775).

Ngatana; Ndara; Njempo; shores of Lake Baringo.

45 *a*. Acræa cæcilia.

Papilio cæcilia, Fabricius, Spec. Ins. ii. p. 34. n. 142 (1781).

Ngatana.

One example of the variety noted P. Z. S. 1888, p. 66. The true *A. cæcilia* is probably a seasonal (certainly a dimorphic) form of *A. lycia*: it only differs from the typical phase in its tawny coloration.

46. Acræa doubledayi.

Acræa doubledayi, Guérin, Lefebvre's Voy. en Abyss. vi. p. 378 (1847).

No exact locality recorded; probably Sabaki Valley.

47. Acræa pudorina.

♂. *Acræa pudorina*, Staudinger, Exot. Schmett. p. 84, pl. 33 (1888).

Acræa acrita; var., Trimen, P. Z. S. 1894, p. 28, pl. iv. fig. 4.

Ndara, in the afternoon; steppes of Thika-Shika and between Athi and Thika; Athi plains near Chjanjavi; Bondoni and Kapte plains; Kibwezi.

Described, according to Staudinger, from a single fresh male; this does not appear from the illustration, for fresh males have the wings far more rosy above, and, below, the apical area of the primaries and disc of the secondaries are cream-coloured, with internervular reddish tawny streaks; after they have flown for a time the cream-colouring seems to get worn (or perhaps darkened) and the streaking is thereby lost; most males show three black spots in a slightly angular oblique series across the centre of primaries, but in some examples the two lower spots are wanting (Staudinger's figure shows a trace of the lowest, but not the middle spot). The female above is of a smoky vinous tint, blackish towards the base, and quite black at base of cell in secondaries; the apical area of primaries smoky fulvous, the costal third and the outer margin more broadly black than in any of the male examples; the external border of the secondaries black, with faint brownish indications of the submarginal spots. Expanse of wings 56 millim.

There is not the slightest question that this is a local representative of *A. acrita*, from which it only differs in the absence of the broad apical black patch on the primaries; in well-marked examples all the spots (on the absence of which Dr. Staudinger relies) are well defined; one specimen even shows an additional spot on the subcostal area, nearer to apex.

48. Acræa natalica.

Acræa natalica, Boisduval, Voy. de Deleg. p. 590. n. 57 (1847).

Ngatana, December and January.

49. Acræa menippe.

Papilio menippe, Drury, Ill. Exot. Ent. iii. pl. 13. figs. 3, 4 (1782).

One worn female from Ngatana.

50. Acræa anemosa.

Acræa anemosa, Hewitson, Exot. Butt. iii., *Acr.* pl. 3. figs. 14, 15 (1865).

Two good specimens without labels of locality, but probably from the Sabaki Valley.

51. Acræa insignis.

Acræa insignis, Distant, P. Z. S. 1880, p. 184, pl. ix. fig. 4.

No exact locality; probably Sabaki Valley.

52. Planema montana.

♂. *Planema montana*, Butler, P. Z. S. 1888, p. 91.

♀. Pattern of male, decidedly larger, the primaries to outer border of secondaries fuliginous; the band of primaries and central area of secondaries white, interrupted by blackish veins; base of secondaries suffused with dull tawny buff, the black spots of the under surface showing through. Expanse of wings 82 millim.

♀, Kibwezi.

We have received both sexes of this species from Kilimanjaro.

53. Hyreus æquatorialis.

Lycæna æquatorialis, E. M. Sharpe, P. Z. S. 1891, p. 637, pl. xlviii. fig. 5.

♂ ♀, Summit of Mount Höhnel, 16,000 feet; Kenya and camp below the old ice-fall, 10,500 feet.

Strictly speaking this species and *H. webbianus* hardly belong to *Hyreus*, as their hind wings are not tailed.

The figure is taken from a somewhat abnormal specimen; most examples have the dark discal band toothed in the centre, the prominence emitted from the centre of the band and sometimes entirely dividing the white submarginal band; this is the case with Dr. Gregory's pair of the species, and with several unset specimens shown to me by Miss Sharpe.

54. Zizera knysna.

Lycæna knysna, Trimen, Trans. Ent. Soc. Lond. 3rd ser. vol. i. p. 282 (1862).

♂ ♀, Mtoto wa Ande; shores of Lake Baringo; Njempo.

55. Zizera gaika.

Lycæna gaika, Trimen, Trans. Ent. Soc. Lond. 3rd ser. vol. i. p. 403 (1862).

♂ ♀, Njempo.

56. Lycænesthes amarah.

Polyommatus amarah, Guérin, Lefebvre's Voy. en Abyss. p. 384, pl. 11. figs. 5, 6.

♂ ♀, Larabwal, Laitsipia.

57. Lycænesthes kersteni.

Lycæna kersteni, Gerstäcker, Archiv für Naturg. 1871, p. 359. n. 27; Van der Decken's Lep. Ost-Sibiriens, p. 373. n. 27, pl. xv. fig. 5 (1873).

One fragmentary male, from Mtoto wa Ande.

I am at a loss to understand why Mr. Trimen regarded this species as synonymous with *L. larydas*; the two forms appear to me as distinct as any of the species in the genus and only show a resemblance to each other on the upper surface; but even there the shade of deep blue in the males differs and the form is strikingly different, the front wings of *L. kersteni* being elongate-triangular, those of *L. larydas* comparatively short in the costa and consequently with the outer margin almost straight instead of very oblique. Taking the entire outline of *L. larydas* it roughly represents a semicircle, whilst that of *L. kersteni* more nearly approaches a triangle with truncated apex.

58. Catochrysops osiris.

Lycæna osiris, Hopffer, Ber. Verh. Ak. Berlin, 1885, p. 642. n. 21; Peters's Reise nach Mossambique, v. p. 409, pl. 26. figs. 11, 12 (1862).

No exact locality given; probably Sabaki Valley.

59. Polyommatus bæticus.

Papilio bœticus, Linnæus, Syst. Nat. i. 2, p. 789. n. 226 (1767).

♂ ♀, Ngatana *in coitu*; Kavaluki Valley, Ukamba.

60. Castalius gregorii, sp. n. (Plate XXXVI. fig. 3.)

♂. Allied to *C. calice* and *C. cretosus*; above nearest to the latter, the white area of the primaries still wider, the submarginal spot crossed by the radials larger, but no white spots on the outer border below it: secondaries above with the basal third greyish, traversed by nearly straight blackish bars, partly visible through the wing, and further obscured by long greyish hair; outer border rather narrow and quite regular; only the first of the disco-submarginal series of spots being present, close to apex; white submarginal lunules small and inconspicuous. Below, the primaries are almost the same as in *C. calice*, but the black spots on the submarginal white band are smaller, the lowest being absent; the white areas generally are also broader: the secondaries below differ from those of *C. calice* in that the two irregular series of black spots crossing the basal half are confluent, forming black bands, the discal series of spots being only represented by a small subapical dot; the submarginal partly blue-edged black spots smaller and reduced to five in number. Expanse of wings 31 millim.

Bondoni and Kapte Plains.

Only one example was obtained, but in tolerably good condition.

61. Azanus occidentalis.

Azanus occidentalis, Butler, P. Z. S. 1887, p. 571. n. 32.

♀, Gopo lal Mavari; ♂, Thagana, woods beside Ukikuya.

62. Plebeius trochilus.

Lycæna trochilus, Freyer, Neuere Beitr. v. pl. 440. fig. 1 (1844).

Njempo.

63. Plebeius, sp.?

One much-worn and broken female example of a species which I have been unable to identify.

Rangatan, Ndari.

64. Tatura philippus.

Hesperia philippus, Fabricius, Ent. Syst. iii. 1, p. 283. n. 87 (1793).

No exact locality recorded.

65. Virachola anta.

Lycæna anta, Trimen, Trans. Ent. Soc. ser. 3, vol. i. p. 402 (1862).

Sabaki Valley.

66. Stugeta bowkeri.

Iolaus bowkeri, Trimen, Rhop. Afr. Austr. p. 225. n. 130, pl. 4. fig. 4 (1866).

S.W. corner of Lake Baringo.

This is quite distinct from *S. marmorea*, from the White Nile; that species shows no trace of the conspicuous blue colouring of *S. bowkeri.*

67. Spindasis nyassæ. (Plate XXXVI. fig. 4.)

Aphnæus nyassæ, Butler, Ent. Mo. Mag. xx. p. 250 (1884).

Two females, without exact locality.

68. Axiocerses perion.

Papilio perion, Cramer, Pap. Exot. iv. pl. ccclxxix. B, C (1782).

♂, Steppes N.W. of Longari, Laitsipia.

69. Cigaritis abbottii.

Chrysophanus abbottii, Holland, Entomologist, xxv. (Suppl.) p. 90 (1892).

Guaso.

70. Mylothris agathina.

Papilio agathina, Cramer, Pap. Exot. iii. pl. ccxxxvii. D, E (1782).

Mbololo near summit, 5600 feet; Kibwezi.

71. Mylothris rüppellii.

Pieris rüppellii, Koch, Indo-Austr. Lep. Fauna, p. 88 (1865).

♀, Alng'aria, Laitsipia.

72. Nychitona alcesta.

Papilio alcesta, Cramer, Pap. Exot. iv. pl. ccclxxix. A (1782).

Ngatana, December and January.

73. Colias edusa, var. electra.

Papilio electra, Linnæus, Syst. Nat. i. 2, p. 764. n. 101 (1767).

Steppes N.W. of Longari; Thagana, in woods; Thegu, in parkland; Mt. Kenya, below the old ice-fall, 10,500 feet; Karati, Konu, Ukikuya, beside swamp; Thiriati, Konu, on shrub-covered plateau.

In British East Africa this species is very variable, both in size and depth of colour: one of the males from the first-mentioned locality has all the appearance of typical *C. edusa* (nor do I believe that it possesses a character to distinguish it therefrom), and none of the distinctive points indicated in Trimen's 'South African Butterflies' avail to separate it, seeing that it does not possess them. The "inward nervular dentations of the hind-marginal border" are very variable in both types; indeed a male in the Museum from Malta shows stronger dentations than those normally exhibited in *C. electra*, whilst in the specimen above mentioned they are hardly so well marked as in the majority of typical *C. edusa*, and a specimen in the Museum from Kilimanjaro, though dark in colour and smaller than usual, shows no inward dentation of the border.

74. Terias brigitta.

Papilio brigitta, Cramer, Pap. Exot. iv. pl. cccxxxi. B, C (1782).

Steppes N. of Thegu.

75. Terias zoë.

Terias zoë, Hopffer, Ber. Verh. Ak. Berl. 1855, p. 640. n. 5; Peters, Reise nach Mossamb., Zool. pl. 23. figs. 10, 11 (1862).

Ngomeni to Kinani; Mtoto wa Ande; Miviruni, Baringo Valley, Mguki; shores of Lake Baringo; steppes of Thika-Shika; Athi plains near Chjanjavi; Machakos; Bondoni and Kapte plains; Ndangi River.

76. Terias regularis.

Terias regularis, Butler, Ann. & Mag. Nat. Hist. ser. 4, vol. xviii. p. 486 (1876).

Mbololo, near summit, 5600 feet.

77. Terias desjardinsii.

Xanthidia desjardinsii, Boisduval, Faune Ent. de Madag. p. 22, pl. 2. fig. 6 (1833).

♂, Mbololo, near summit.

One rather ragged, but very singular, male specimen, in which the outer border of the primaries is formed as in *T. formosa*, Hübn., and the black edging of the costal margin is wanting.

78. Terias boisduvaliana.

Terias boisduvaliana, Mabille, Hist. Nat. de Madag. i. pl. 32. figs. 4–7.

Ngatana in wood, 30th January, 1893; Njempo; Larabwal, Laitsipia; Ndoro, steppes at base of Kenya, 7000 feet.

This species is not unlike a pale brimstone-coloured representative of my *T. ceres*, to which Mr. Trimen has unaccountably given the new designation of *T. ethiopica*; our examples of the latter are from S. Africa, Natal, Mauritius, and Madagascar. The outer border of the primaries in *T. boisduvaliana* usually resembles that of *T. brenda*.

79. Terias orientis.

Terias orientis, Butler, P. Z. S. 1888, p. 71. n. 87.

♂ ♀, Ngatana, December and January.

Specimens of the preceding species sometimes agree closely with this on the upper surface, but not below.

80. Teracolus calais.

Papilio calais, Cramer, Pap. Exot. i. pl. liii. C, D (1779).

Ngatana, near wood on barra, 30th January, 1893; east shore of Lake Losugata, on grass and scrub.

81. Teracolus hanningtonii.

Teracolus hanningtoni, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xii. p. 104. n. 8 (1883).

♀, Sabaki Valley. We originally received this species from the Victoria Nyanza.

82. Teracolus catachrysops.

Teracolus catachrysops, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. ii. p. 178 (1878).

♂ ♂, Ndoli.

Described from specimens collected at Masasi, and since received from Kilimanjaro.

83. Teracolus aurigineus.

Teracolus aurigineus, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xii. p. 103. n. 7 (1883).

Njempo; Guaso Narok; Guaso Laschau; Guaso Nacrotia; steppes N.W. of Longari; Thagana, woods beside Ukikuya; Thegu.

84. Teracolus helvolus.

Teracolus helvolus, Butler, P. Z. S. 1888, p. 94.

Sabaki Valley, at Tanganyika.

My supposition that *T. helvolus* would prove to be restricted to Somaliland is thus proved incorrect.

85. Teracolus protomedia.

Pontia protomedia, Klug, Symb. Phys. pl. 8. figs. 13, 14 (1829).

♂ ♀, Golbanti.

86. Teracolus agoye, ♀ ? (=*Idmais fatma*, Feld.)

♂. *Anthopsyche agoye*, Wallengren, Kongl. Svensk. Vet.-Akad. Handl. 1857; Lep. Rhop. Caffr. p. 15. n. 11.

♂ ♀. *Anthocharis agoye*, Trimen, Rhop. Afr. Austr. p. 325. n. 219 (1866).

♀. Var.? without indication of exact locality; probably Sabaki Valley.

This female differs from that described by Mr. Trimen in having traces of two spots on the median interspaces of the primaries, and a faintly indicated internal streak ending in a third spot; it comes nearest to the form which I described under the name of *Teracolus johnstoni* (the descriptions of which and of *T. opalescens* Mr. Trimen seems to have overlooked), Ent. Month. Mag. xxiii. p. 29 (1886). I strongly suspect it to be the female of the "♂ from the Lydenburg District of the Transvaal," which Mr. Trimen mentions, as the underside of the hind wings and apex of fore wings are tinted with pale creamy pinkish; it clearly demonstrates the affinity of *T. agoye* to the *T. eris* group.

Since Mr. Trimen examined our collection, we have added, through the generosity of Mr. C. G. Barrett, two pairs of *T. johnstoni* from Amshaw, King William's Town. The male is very distinct from that of typical *T. eris*; the apical area of the primaries is more restricted, with the ochreous spots brighter, broader, shorter, and only separated by slender black veins; on the second (upper) median interspace also there is a very large oval white marginal spot, and below this again the black is externally undulating, leaving three pure white indentations confluent with the white fringe. On the secondaries the black costal border, instead of extending almost to the apex, is cut across transversely and therefore terminates much more abruptly. I have no doubt that both this and *T. opalescens* constitute constant local races, far more worthy of specific rank than many of the species which my excellent, but, as I think, inconsistent, friend has considered distinct [1].

The markings in Dr. Gregory's example are less strongly defined than in Felder's figure; but there cannot be a question as to the identity of the species; at the same time, I should doubt whether the two males associated in the Hewitson collection under the name of *T. agoye* are actually one species.

87. Teracolus puniceus. (Plate XXXVI. figs. 5, 6.)

Teracolus puniceus, Butler, P. Z. S. 1888, p. 72. n. 92.

♂, without label of exact locality; probably Sabaki Valley.

The female we received from the Victoria Nyanza.

88. Teracolus foliaceus, sp. n. (Plate XXXVI. fig. 7.)

♀. Above chalky white, the basal third irrorated with fine grey scales: primaries with a conspicuous spot at the end of the cell; the apical two-thirds of costa and the apical third of wing to inner margin, as well as a large almost wedge-shaped spot only separated from the latter by a large round white spot near external angle, black, slightly suffused with brown near outer margin; a series of six sordid white spots in an arched series between costa and the above-mentioned large white spot, the first small, the second large and pyriform, the remainder regularly decreasing in size, the second, third, and fourth spots flecked with magenta; submedian vein, base of inner margin, and subcostal vein of secondaries tinted with sulphur: secondaries with a very broad external black border, occupying about one-fourth of the wing, its inner edge strongly dentated on the veins, and an oblique squamose subapical black streak from costa to centre of third median branch: body normal. Primaries below white, the base primrose-yellow, followed in the cell by a transverse greyish nebula; black spot at end of cell as above; costa and a broad apical border, tapering to first median branch, buff-yellowish, the latter transversely striated with grey and bounded internally by whitish spots, of which the first three are defined by an inner diffused bordering of argillaceous brown shading into grey-brown, and the remainder by a series of more or less acutely angulated black spots curving inwards to submedian area, the upper ones also placed on a diffused grey-brown area answering to the inner edge of the black area of the upper surface: secondaries whitish, tinted with pearl-grey and

[1] It has always been a puzzle to me that Lepidopterists, who in one genus allow unlimited variability and extraordinary ranges to the species, in a nearly-allied genus restrict both in an equally remarkable degree.

buff and transversely striated with grey; base of costal margin saffron-yellow; a rounded pale buff spot at end of cell upon a triangular greyish testaceous area, partly bounded externally by a well-defined dull copper-brown oblique bar from costa to third median branch; this bar is continued, almost at right angles, by three brown spots on a buff-tinted nebula; outer border buff; abdominal area creamy whitish: body below white. Expanse of wings 43 millim.[1]

No exact locality given; probably Sabaki Valley.

Although evidently belonging to the *T. regina* group, this female is much more heavily black-bordered than any other species of the group; the striated and clouded under surface give the insect (when its wings are closed) the appearance of a dead and mouldering leaf.

89. TERACOLUS PHLEGYAS.

Anthocharis phlegyas, Butler, P. Z. S. 1865, p. 431. n. 3, pl. xxv. figs. 3, 3 *a*.

♂ ♂, no exact locality recorded; probably Sabaki Valley.

90. TERACOLUS IMPERATOR.

Teracolus imperator, Butler, P. Z. S. 1876, p. 132. n. 20.

♂ ♂, no exact locality recorded; probably Sabaki Valley.

91. TERACOLUS PHŒNIUS.

♂. *Teracolus phœnius*, Butler, Ann. & Mag. Nat. Hist. ser. 4, vol. xviii. p. 488 (1876).

♀. *Albino form*, Butler, P. Z. S. 1888, p. 74. n. 95.

Ngatana; shores of Lake Baringo; Njempo; steppes of the Kiroruma; Kavaluki Valley; Ndangi River.

Three of the four females in the above series have crimson tips to the primaries and therefore differ very slightly from females of *T. miles*. The latter will, I think, have to be considered synonymous with this species.

92. TERACOLUS INCRETUS.

♀. *Teracolus incretus*, Butler, Ent. Month. Mag. xviii. p. 146 (1881).

♂. *Callosune vulnerata*, Staudinger, Exot. Schmett. pl. 23.

♂ ♂, Steppes of Thika-Shika and Ndangi River.

One of the specimens is larger than any previously received.

93. TERACOLUS SYRTINUS.

♂. *Teracolus syrtinus*, Butler, P. Z. S. 1876, p. 163. n. 124.

♀. White, with black markings above almost exactly as in the female of *T. phillipsii*; the base of the wings more suffused with grey, but less so than in *T. xanthevarne*, ♀; apical area pale

[1] The under surface of Westwood's reputed female of *T. buxtoni* somewhat approaches this species.

salmon, sometimes extending beyond the subapical irregular black band; under surface nearly as in *T. phillipsii*, but more strongly tinted with yellow, buff, and pink, and with the discal brown markings larger and better defined.

Expanse of wings 42–43 millim.

Ngatana; platform on Kikuyu escarpment, Kedong, Newà in forest; shores of Lake Baringo; Njempo.

This is evidently an abundant species.

93 *a*. Teracolus citreus.

Teracolus citreus, Butler, P. Z. S. 1876, p. 162. n. 120.

Kinani, in the afternoon; also probably Sabaki Valley.

This differs from *T. syrtinus* in its usually inferior size, less black-bordered primaries, and the pink colouring on the under surface of the secondaries. It probably bears the same relationship to *T. syrtinus* that *T. eucharis* of India does to *T. titea*. Unfortunately only one example has an indication of exact locality, so that it is impossible to tell whether the two types occur together; but with our present knowledge of the variability of species I hesitate to consider them distinct.

94. Teracolus nouna.

Anthocharis nouna, Lucas, Expl. Alg., Zool. iii. p. 350. n. 14, pl. i. fig. 2 (1845).

♂, Machakos, two damaged specimens.

95. Teracolus theogone?

Anthocharis theogone, Boisduval, Sp. Gén. Lép. i. p. 575. n. 23 (1836).

♂, Thagana, woods beside Ukikuya; ♀, park-land between Thegu and Ukikuya.

Only one damaged pair was obtained. The male is almost exactly like typical *T. theogone*, but has larger marginal spots to the secondaries: the female has no trace of the inner marginal broad black band to the primaries, and therefore nearly approaches that sex of *T. epigone*; the under surface of the secondaries also is pink, not yellowish. Possibly this is a species between *T. theogone* and *T. epigone*; but the two specimens are not good enough to describe.

96. Teracolus pyrrhopterus, sp. n. (Plate XXXVI. figs. 8, 9.)

Allied to *T. theogone*; the male above with the patch upon the black apical area orange-vermilion, as in the female of that species; the costal margin black quite to the base; a broad truncated black streak on internal area from base to second third of wing: secondaries with a similar though less regular costal streak; two ill-defined unequal spots on third median and radial veins (recalling the marking of female *T. hippocrene*), and a marginal series of hastate black spots, almost confluent: body normal. Primaries below white, the costa, apex, outer margin, and fringe soft rose-colour, but towards external angle the fringe is tipped with white; a large subapical patch of deep orange-salmon, blending with the rose-colour at apex: secondaries rose-colour; a white diffused subapical nebula; the surface, especially towards the base, sparsely irrorated and striated with blackish; a black-dotted orange-salmon spot at end of cell and an imperfect angulated band, as in *T. theogone*, of brown: body below white. Expanse of wings 40 millim.

♀. Rather smaller than the male: in pattern nearly resembling *T. procne*; but the orange subapical band coloured as in the male, and the base of both wings much more widely and densely dusted with blackish; the fringe of primaries rosy as in the male: below as in the male, but slightly deeper in colour, especially on the secondaries, where the interrupted band is gravel-red. Expanse of wings 36 millim.

One slightly damaged pair, at Thagana, in woods beside Ukikuya.

In the fiery colouring of the under surface this species is quite remarkable. A male variety also occurs which above more nearly approaches *T. omphale*, and below has the apical border of primaries and ground-colour of secondaries creamy whitish, with the band of secondaries brick-red.

97. Teracolus zera.

♂ ♀. *Anthocharis zera*, Lucas, Revue et Mag. de Zool. iv. p. 423 (1852).

♂, Guaso Laschau; ♀, Guaso Nacrotia; ♂, Ndoro, steppes at base of Kenya, 7000 feet.

The description by M. Lucas probably confounds several different types (species?); the only safe guide in the description seems to be the orange tint which he mentions as pervading the under surface of the secondaries in the male; he, however, fails to note that on the under surface the veins are dusky; in the examples above recorded they are black towards anal angle and on the abdominal fold. The absence of the small orange spot attached to the black discocellular dot is not likely to be a constant character.

98. Teracolus helle.

Teracolus helle, Butler, P. Z. S. 1876, p. 149. n. 75.

Gopo lal Mavari, Laitsipia; Guaso Narok; Guaso Laschau; Guaso Nacrotia; steppes N.W. of Longari; Ndoro, steppes at base of Kenya, 7000 feet; Karati, Konu, Ukikuya, Tana, in dense forest; sandy steppes on the south bank of the Kiroruma.

99. Teracolus subvenosus.

Teracolus subvenosus, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xii. p. 105. n. 10 (1883).

♂ ♀, Miviruni, Elmeteila Basin, Baringo Valley, Mjaki; Gopo lal Mavari, Laitsipia; Alng'aria; Guaso Laschau; Thagana, woods beside Ukikuya; Thegu; Kavaluki Valley, Ukamba.

100. Teracolus hero.

Teracolus hero, Butler, P. Z. S. 1876, p. 150. n. 81, pl. vi. fig. 12.

♂ ♀, no exact locality recorded; probably Sabaki Valley.

101. Teracolus antevippe.

Anthocharis antevippe, Boisduval, Sp. Gén. Lép. i. p. 572. n. 18, pl. 18. fig. 3 (1836).

♂ ♀, Guaso Narok.

In *T. zera, helle, subvenosus*, and *hero* the veins are more or less blackened on the under surface, but in *T. antevippe* they are uniform with the white ground-colour; the black veins when present do not result from abrasion, but are clothed with black scales. Of course it is possible that this character may prove to be unimportant, but that remains to be seen.

102. Teracolus omphale.

Pieris omphale, Godart, Enc. Méth. ix. p. 122. n. 12 (1819).

♂ ♀, no exact locality recorded; probably Sabaki Valley.

103. Teracolus exole.

♂. *Anthocharis exole* (part), Reiche, Ferr. Gal. Voy. Abyss., Ent. p. 460, pl. 31. fig. 4 (1849).

♀. *Anthocharis achine*, Lucas (not Cramer), Lep. Exot. pl. 37. fig. 2 (1835).

♀, no exact locality recorded; probably Sabaki Valley.

This is probably an extreme form (possibly a brood) of the preceding.

104. Teracolus thruppi.

Teracolus thruppi, Butler, P. Z. S. 1885, p. 771, pl. xlvii. fig. 10.

Barra near Merifano; S.W. corner of Lake Baringo, Ukikuya.

105. Teracolus minans.

Teracolus minans, Butler, Ent. Month. Mag. xviii. p. 229 (1882).

♂ ♀, Njempo.

A melanistic form of the female occurs in this, as in other allied species.

106. Catopsilia pyrene.

Colias pyrene, Swainson, Zool. Ill. i. pl. 51 (1820–21).

♂ ♀, Ngatana; Kinani; Thika-Shika.

107. Catopsilia florella.

Papilio florella, Fabricius, Syst. Ent. p. 479. n. 159 (1775).

♂ ♀, Ndoro, steppes at base of Kenya, 7000 feet; Ndangi River.

108. Glutophrissa contracta.

Glutophrissa contracta, Butler, P. Z. S. 1888, p. 75. n. 102.

♂, Ngatana; ♀, Lake Losuguta.

109. Phrissura lasti.

Mylothris lasti, Grose-Smith, Ann. & Mag. Nat. Hist. ser. 6, vol. iii. p. 124 (1889).

Belenois lasti, Smith & Kirby, Rhop. Exot. ii. pl. *Belen.* ii. figs. 1–3 (1892).

♂ ♀, Sabaki Valley, at Tanganyika.

This is probably the species mimicked by *Mylothris narcissus.*

110. Belenois thysa.

Pieris thysa, Hopffer, Ber. Verh. Ak. Berl. 1855, p. 639. n. 1; Peters's Reise nach Mossamb., Zool. v. p. 349, pl. 21. figs. 7–10 (1862).

Kibwezi.

111. Belenois severina.

Papilio severina, Cramer, Pap. Exot. iv. pl. cccxxxviii. G, H (1782).

Ngatana; Barra near Merifano; Golbanti; Miviruni; steppes of Thika-Shika.

The majority of the specimens were obtained at Golbanti.

111 *a*. Belenois infida. (Plate XXXVII. figs. 1, 2.)

Belenois infida, Butler, P. Z. S. 1888, p. 78. n. 111.

Golbanti; Miviruni; Lake Losuguta; shores of Lake Baringo; Njempo; Gopo lal Mavari; Guaso Narok; steppes N.W. of Longari; Thagana; Thegu; Ukikuya; Kithungulu; steppes of Thika-Shika; steppes between Athi and Thika; Athi plains near Chjanjavi; Machakos; Maka; Ndangi River; Sabaki Valley.

The enormous series of this species collected by Dr. Gregory proves, beyond dispute, that *B. infida* is only a Central and East African development of *B. severina*, to which every possible link exists; it is only by eliminating all the specimens having dark veins on the under surface from the series, that *B. severina* can be at all distinguished from this race. The black bar at the end of the cell, in this genus, proves to be a most unreliable character for the discrimination of species; indeed I have very little doubt that *Pieris ogygia* of Trimen will prove, when a large series can be obtained, to be simply a development of *Belenois thysa* of Hopffer. *Belenois zochalia* (as will be shown presently) varies in the same way.

112. Belenois mesentina.

Papilio mesentina, Cramer, Pap. Exot. iii. pl. cclxx. A, B (1782).

Golbanti; Kinani; Njempo; Guaso Laschau; Kithungulu, Konu, Ukikuya, on shrub-covered plateau with deep gorges; sandy steppes on the south bank of the Kiroruma, Tana river-basin; steppes of the Thika-Shika; steppes between Athi and Thika; Athi plains near Chjanjavi; Bondoni and Kapte Plains; Ndangi River.

Represented by the form *B. lordaca*, and the larger but otherwise exactly similar *B. agrippina*.

113. Belenois gidica.

Pieris gidica, Godart, Enc. Méth. ix. p. 131. n. 37 (1819).

Witu, in garden; Golbanti; Njempo; Ukikuya; steppes of Thika-Shika; steppes between Athi and Thika; Ndoli; Kibwezi.

One female nearly approaches typical *B. abyssinica.*

114. Belenois zochalia. (Plate XXXVII. fig. 3.)

Pieris zochalia, Boisduval, Sp. Gén. Lép. i. p. 508. n. 100 (1832).

♂ ♀, Gopo lal Mavari, Laitsipia; Guaso Laschau; steppes N.W. of Longari; Thagana, in woods beside Ukikuya; Thegu; Ndoro, steppes at base of Kenya, 7000 feet; on shrub-covered plateau at Kithungulu, Konu, Ukikuya, Tana river-basin.

Two forms of this species were obtained, the first only differing from the southern type in its usually slightly superior size; the male with slightly narrower oblique black bar at end of cell, larger white hastate spots on the apical black area, and primrose-whitish colouring of the under surface of the secondaries. The second form, however, has the black discocellular bar reduced to a spot at the inferior angle of the cell in the male, but in the female only slightly narrower than in the first form; on the under surface the veins are more heavily defined and sometimes quite black. It is useless to attempt to separate the latter from *B. zochalia*; and as it shows a decided tendency in the direction of *B. crawshayi*, it is within the range of possibility that, as the fauna of Africa becomes better known, a series of gradations between *B. zochalia* and that apparently distinct form will be discovered. Indeed, after seeing the series of grades between typical *B. infida* and *B. severina* nothing will surprise me in the way of linking the African species of *Belenois.* I am quite satisfied that *B. gidica* and *B. abyssinica* cannot be regarded as distinct species.

115. Synchloë johnstonii.

Synchloë johnstonii, Crowley, Trans. Ent. Soc. 1887, p. 35, pl. iii. figs. 1–3.

Gopo lal Mavari; Guaso Laschau; steppes N.W. of Longari; Thagana, in woods beside Ukikuya.

116. Pinacopteryx ortygna.

♂. *Mylothris ortygna*, Hübner, Exot. Schmett. Zutr. figs. 985, 986 (1832).

♂ ♀, on grassy steppes at Miviruni.

117. Pinacopteryx liliana.

♂ ♀. *Belenois liliana*, H. Grose Smith, Ann. & Mag. Nat. Hist. ser. 6, vol. iii. p. 122 (1889).

Pinacopteryx liliana, Smith & Kirby, Rhop. Exot. ii. *Pinac.* 1, figs. 7–9 (1893).

♀, Ngatana, 30th January 1893, near wood.

118. Pinacopteryx pigea.

Pieris pigea, Boisduval, Sp. Gén. Lép. i. p. 523. n. 124 (1836).

♂, Steppes of Thika-Shika.

119. Herpænia iterata. (Plate XXXVII. fig. 4.)

Herpœnia iterata, Butler, P. Z. S. 1888, p. 96. n. 8.

Njempo.

120. Nepheronia capensis.

Eronia buquetii, var. *γ. capensis*, Hopffer, in Peters's Reise Mossamb. p. 363 (1862).

Nzoai.

Only one example, somewhat shattered, was obtained.

121. Nepheronia buquetii.

Callidryas buquetii, Boisduval, Sp. Gén. Lép. i. p. 607. n. 1 (1836).

♂ ♀, Shores of Lake Baringo. (Common.)

122. Nepheronia thalassina.

Pieris thalassina, Boisduval, Sp. Gén. Lép. i. p. 443. n. 8 (1836).

♂, no exact locality recorded; probably Sabaki Valley.

123. Nepheronia argia.

Papilio argia, Fabricius, Syst. Ent. p. 470. n. 118 (1775).

♂ ♀, no exact locality recorded; probably Sabaki Valley.

The female corresponds with that noted by me (P. Z. S. 1888, p. 96, from Kilimanjaro), excepting that the patch of red is wanting on the upper surface of the primaries.

124. Eronia dilatata.

Eronia dilatata, Butler, P. Z. S. 1888, p. 96. n. 9.

Eronia cleodora, var. *latimarginata*, Weymar, Stett. ent. Zeit. 1892, p. 96. n. 13.

Kibwezi.

125. Papilio kirbyi.

Papilio kirbyi, Hewitson, Ent. Month. Mag. ix. p. 146 (1872); Exot. Butt. v., *Pap.* pl. 13. fig. 42 (1873).

No record of exact locality; probably Sabaki Valley.

126. Papilio colonna.

Papilio colonna, Ward, Ent. Month. Mag. x. p. 151 (1873).
Papilio tragicus, Butler, l. c. xiii. p. 56 (1876).
Kibwezi.

127. Papilio nyassæ.

Papilio nyassæ, Butler, Ann. & Mag. Nat. Hist. ser. 4, vol. xix. p. 459 (1877).

No exact locality recorded; probably Sabaki Valley.

128. Papilio philonoë.

Papilio philonoë, Ward, Ent. Month. Mag. x. p. 152 (1873).
Ngatana.

129. Papilio demoleus.

Papilio demoleus, Linnæus, Mus. Lud. Ulr. p. 214 (1764).
Ndara; Guaso Laschau; Ndaugi River.

130. Papilio constantinus.

Papilio constantinus, Ward, Ent. Month. Mag. viii. p. 34 (1871); Afr. Lép. p. 1, pl. i. figs. 1, 2 (1873).
Kibwezi.

131. Papilio erinus.

Papilio erinus, Gray, Cat. Lep. Ins. B. M. i. p. 35. n. 127 (1865).
Kibwezi.

132. Papilio phorcas.

Papilio phorcas, Cramer, Pap. Exot. i. pl. ii. B, C (1775).
Alng'aria; Rangatan, Ndari.

133. Papilio merope.

Papilio merope, Cramer, Pap. Exot. ii. pl. 151. figs. A, B (1779).

One female, in bad condition, of the form figured by Trimen (Trans. Linn. Soc. xxvi. pl. 43. fig. 4, 1869).
Golbanti.

134. Sarangesa motozioides.

Sarangesa motozioides, Holland, Ann. & Mag. Nat. Hist. ser. 6, vol. x. p. 288. n. 9 (1892).

Mtoto wa Ande; Karianduri; shores of Lake Baringo, Njempo.

135. SARANGESA DJÆLÆLÆ.

Pterygospidea djælælæ, Wallengren, Kongl. Svensk. Vet.-Akad. Handl. 1857; Lep. Rhop. Caffr. p. 54.

Ndoro, steppes at base of Kenya 7000 feet; Athi Plains, near Chjanjavi.

136. OSMODES RANOHA.

Pamphila ranoha, Westwood, in Oates's 'Matabele-land,' p. 353 (1881).

Fuladoya.

137. GEGENES LETTERSTEDTI.

Hesperia letterstedti, Wallengren, Kongl. Svensk. Vet.-Akad. Handl. 1857; Lep. Rhop. Caffr. p. 49.

Guaso Nacrotia, Laitsipia.

When Mr. Samuel Scudder was last in Europe, he brought with him a number of carefully coloured drawings of *Hesperiidæ* for comparison with types in various collections. Among other species thus cleared up, he proved, by camparison with Latreille's type of *G. hottentota*, that (instead of being a form of *G. letterstedti*) it was the *G. obumbrata* of Trimen.

138. BAORIS FATUELLUS.

Pamphila fatuellus, Hopffer, Monatsber. k. Akad. Wiss. Berlin, 1855, p. 643. n. 25; Peters's Reise nach Mossamb. v. p. 417, pl. 27. figs. 3, 4 (1862).

No record of exact locality; probably Sabaki Valley.

139. BAORIS INCONSPICUA.

Hesperia inconspicua, Bertoloni, Mem. Acc. Bol. 1849, p. 15.

Ngatana; Njempo.

140. RHOPALOCAMPTA PISISTRATUS.

Hesperia pisistratus, Fabricius, Ent. Syst. iii. 1, p. 345. n. 311 (1793).

Kibwezi.

141. RHOPALOCAMPTA KEITHLOA.

Rhopalocampta keithloa, Wallengren, Kongl. Svensk. Vet.-Akad. Handl. 1857; Lep. Rhop. Caffr. p. 48.

No exact locality recorded; probably Sabaki Valley.

There is also one much damaged male, apparently of *Cyclopides quadrisignatus*, from Rangatan.

The Moths, unfortunately, are, in many cases, too much injured for identification, but I have succeeded in determining the following:—

142. Macroglossa trochiloides.

Macroglossa trochiloides, Butler, P. Z. S. 1875, p. 5. n. 6.
Ngatana.

143. Chærocampa celerio.

Sphinx celerio, Linnæus, Syst. Nat. i. 2, p. 800 (1767).
One worn example at Alng'aria.

144. Ægocera meneta.

Noctua meneta, Cramer, Pap. Exot. i. pl. lxx. D (1775).
One worn example from Kinani.

145. Ægocera tricolor.

Ægocera tricolor, Druce, Ent. Month. Mag. xx. p. 155 (1883).
One fairly good female, without record of exact locality, but probably from the Sabaki Valley.

146. Charilina amabilis.

Noctua amabilis, Drury, Ill. Exot. Ent. ii. pl. 13. fig. 3 (1773).
Ngatana.
Either all the specimens are uniformly faded, or they represent a distinct race in which the whole of the black and red of typical *C. amabilis* are replaced by pale brown, almost like dead gold; the markings are absolutely normal in pattern.

147. Euchromia africana.

Euchromia africana, Butler, Journ. Linn. Soc. vol. xii. p. 364.
No record of exact locality; probably Sabaki Valley.

148. Deiopeia pulchella.

Tinea pulchella, Linnæus, Syst. Nat. i. p. 534. n. 238 (1758).
No record of exact locality; probably Sabaki Valley.

149. Argina cingulifera.

Deiopeia cingulifera, Walker, Lep. Het. ii. p. 569 (1854).
Var. *Deiopeia ocellina*, Walker, l. c. p. 571 (1854).
Ndoli.

150. Ghoria nigricostata, sp. n. (Plate XXXVII. fig. 5.)

Primaries dull silvery white with golden reflections; costal margin black: secondaries pale golden buff; thorax above silvery, vertex of head brownish; abdomen golden ochreous. Primaries below leaden grey, with costal and external borders golden ochreous; secondaries and body below golden ochreous. Expanse of wings 37 millim.
Platform on Kikuyu Escarpment, Kedong.

151. LITHOSIA ?, sp.

One much damaged example of a species with coarsely pectinated antennæ; probably new, but not in condition to describe.

Ukikuya.

152. RHANIDOPHORA PHEDONIA.

Bombyx phedonia, Cramer, Pap. Exot. iv. pl. cccxlvii. C (1782).

Alng'aria; Maka.

Two much-damaged examples were obtained.

Single examples of *Nolidæ* and *Sarrothripinæ* in poor condition are also in the collection, including one specimen of a species of *Siccia* allied to *S. caffra*. With one exception, these are without exact localities; therefore probably from the Sabaki Valley.

153. SÆNURA LINEATA.

Spilosoma lineata, Walker, Lep. Het. iii. p. 672. n. 17 (1855).

No exact locality recorded; probably Sabaki Valley.

154. ALPENUS PURUS.

Alpenus purus, Butler, P. Z. S. 1878, p. 382.

Two examples from Njempo.

155. TERACOTONA SUBMACULA, var. RHODOPHÆA.

Spilosoma submacula, Walker, Lep. Het. iii. p. 672. n. 15 (1855).
Var. *Aloa rhodophæa*, Walker, l. c. Suppl. i. p. 302 (1864).

No exact locality recorded; probably Sabaki Valley.

It is just possible that *T. rhodophæa* may prove to be a constant local form: the chief differences from typical *T. submacula* consist in the absence of the black discocellular spot on the upper surface of the primaries, the white variegation of these wings, and the uniformly rosy ground-colour of the secondaries; this last character is, however, shared by a specimen from Natal, to which I gave the name of *T. roseata*.

156. PLERETES TIGRIS.

Hypercompa tigris, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xii. p. 106. n. 13 (1883).

No exact locality recorded; probably Sabaki Valley.

The three specimens obtained are all more or less damaged; they differ from the types in the much broader leaden-grey bands, the more creamy ground-colour of the primaries, and the deeper orange of the secondaries.

157. SECUSIO PARVIPUNCTA.

Secusio parvipuncta, Hampson, Ill. Typ. Lep. Het. viii. p. 46, pl. 139. fig. 6.

Secusio strigata, Hampson (? Walker), Fauna of Brit. India, Moths, vol. ii. p. 50. n. 1272, fig. 23.

Steppes of the Thika-Shika; steppes between Athi and Thika, and Kavaluki Valley, Ukamba.

It is quite possible that this may be only a variety of Walker's *S. strigata*=*hymenæa*, Gerst.; but, hitherto, intermediate links between the two forms have not been received, and therefore, for the present, I prefer to keep them separate; at the same time the difference between them is no greater than between individual examples of *S. parvipuncta*.

158. Leptosoma restrictum, sp. n.

Allied to *L. leuconoë*, of which it appears to be an Eastern representative; it differs in having the band of primaries pure semitransparent white, without the strong indentations on the veins which are present in *L. leuconoë*; the white area of the secondaries much more restricted, owing to the considerably greater width of the external black border. Expanse of wings 49 millim.

Sabaki Valley.

We have a male from Wasin in the Museum; it is slightly smaller than female examples, but otherwise similar in pattern and coloration.

159. Lacipa gracilis.

♂ ♀. *Lacipa gracilis*, Hopffer, in Peters's Reise nach Mossamb. pl. xxviii. figs. 4, 5.

♂, Tzavo, at night; ♀, var. Sabaki Valley.

The female example has lost all the black spots on the primaries and is larger than in Hopffer's figure, but I believe it to be a simple variety.

160. Psalis securis.

Psalis securis, Hübner, Samml. exot. Schmett. Zutr. figs. 291, 292.

Sabaki Valley.

Does not differ at all from Ceylonese examples.

161. Lymantria, sp.

A single example, probably from the Sabaki Valley, of a species new to us; but it is without head, and is too much worn for certain determination.

162. Heteranaphe, sp.

One very rubbed example of a species which I have hitherto been unable to identify; it is not good enough to describe.

Mbololo, near summit, 5600 feet elevation.

Phasicnecus, gen. nov. (*Lasiocampidæ*).

Aspect of *Lemonia*, but differing entirely in neuration. Costal vein of primaries normal; discoidal cell short and narrow, terminating at basal third; subcostal branching beyond the end of cell, the first branch thrown off just beyond the cell, running obliquely upwards to costal vein, which it joins just beyond its middle; the two other branches forming a long fork to outer margin immediately below apex; upper radial also emitted from the subcostal vein immediately beyond the cell; upper discocellular oblique and slightly inangled at its upper extremity; lower discocellular nearly transverse; costal vein of secondaries normal; discoidal cell short, narrow, almost elliptical, not quite extending to basal third of wing; subcostal branches emitted from a long footstalk, upper discocellular very oblique, almost in a line with the radial; lower discocellular less oblique, half the length of upper; radial and median branches nearly equidistant, the first and second branches being widest apart at their origins.

163. Phasicnecus gregorii, sp. n. (Plate XXXVII. fig. 6.)

♀. Wings semitransparent buff; primaries with ochreous costal margin and basal hairy clothing; a slightly sinuous series of six vinous spots across the disc from below subcostal vein to below first median branch; body ochreous; antennæ rufous brown with buff pectinations: under surface paler and immaculate, antennæ below somewhat greyish. Expanse of wings 40 millim.

Sabaki Valley.

One slightly rubbed female example.

164. Lebeda, sp.

A very much shattered female specimen of a species very close to (if distinct from) *L. ferruginea*; in pattern it seems to correspond almost exactly; but it is smaller and more sandy in colouring; in any case it has been too much injured by *Dermestes* to be worth preserving.

Clearing through forest six miles east of Witu, 22nd December, 1892.

165. Trilocha varians, var. albicollis.

Naprepa albicollis, Walker, Journ. Linn. Soc. vi. p. 171 (1862).

Ngatana.

166. Saturnia oubie.

Bombyx oubie, Guérin, Voy. in Abyss. p. 387, pl. xii. figs. 1, 2.

Platform on Kikuyu Escarpment above Kedong, Newia.

One much shattered example.

167. Saturnia, sp.

Two extremely worn pairs of a species close to *S. wallengrenii*; possibly that species.

♂ ♀, Tzavo.

Felder's figure is not very good, and the specimens now received are much shattered and rubbed; so that it is impossible to be certain whether they are really distinct.

168. Antheræa arata.

Antheræa arata, Westwood, see Maassen & Weymer, Beitr. Schmett. fig. 59 (1881).

♂, in wood on flanks of Mbololo, 4000 feet

169. Gynanisa maia.

Saturnia maia, Klug, Neue Schmett. pl. 5. fig. 1 (1836).

♀, Ndara, 31st March, 1893.

Slightly larger and more varied with white than southern specimens, in which respects it is intermediate between the latter and the example mentioned in P. Z. S. 1893, p. 678.

170. Duomitus capensis.

Zeuzera capensis, Walker, Lep. Het. vii. p. 1533. n. 11 (1856).

Lari lal Morjo, Laitsipia.

171. Azygophleps inclusa.

♀. *Zeuzera inclusa*, Walker, Lep. Het. vii. p. 1534. n. 12 (1856).

♂, Sabaki Valley.

A third species of *Cossidæ*, from Njempo, is too much shattered for determination: this is also the case with many of the species in the remaining families of Moths; but the following can be determined:—

172. Heliothis armigera.

Noctua armigera, Hübner, Noct. pl. 79. fig. 370 (1805–24).

One very worn example from Njempo.

173. Leucania torrentium.

Leucania torrentium, Guenée, Noct. i. p. 88. n. 132.

Sabaki Valley.

174. Microsemyra, sp.

Sabaki Valley.

Not in good condition; but apparently the same as a species from Amshaw, S. Africa, presented by Mr. Barrett.

175. Acrapex, sp.

Sabaki Valley.

One worn example of a species allied to *A. leucophlebia*, Hampson, without palpi or antennæ.

176. Laphygma orbicularis.

Caradrina orbicularis, Walker, Lep. Het. x. p. 294. n. 26 (1856).

Maka.

177. Caradrina indicata.

Caradrina indicata, Walker, Lep. Het. x. p. 299. n. 39 (1856).
Sabaki Valley.

178. Perigea conducta.

Caradrina conducta, Walker, Lep. Het. x. p. 296. n. 32 (1856).
Thiriati.

179. Ilattia axis.

Amyna axis, Guenée, Noct. i. p. 407. n. 378 *b*.
Sabaki Valley.

180. Euphasia umbrigera.

♀. *Acontia umbrigera*, Felder, Reise der Nov., Lep. Het. pl. cviii. fig. 34.

♂, Tzavo, at night.

Felder's figure is peculiar, the secondaries being intermediate between the white coloration of the male and the brown of the female.

181. Tarache insocia.

♂. *Acontia insocia*, Walker, Lep. Het. xii. p. 788. n. 18 (1857).

♀, Tzavo.

The female was described by Walker under the name of *Acontia pyralina*.

182. Tarache secta?

Acontia secta, Guenée, Noct. ii. p. 221. n. 997.

♂ ♀, Njempo.

183. Tarache upsilon.

Calophasia upsilon, Walker, Lep. Het. Suppl. iii. p. 763 (1865).
Sabaki Valley.

184. Tarache tropica?

Acontia tropica, Guenée, Noct. ii. p. 217. n. 988.
Ngatana. (Very much faded!)

185. Metachrosta mianoides.

Ozarba mianoides, Hampson, Ill. Typ. Lep. Het. ix. p. 98, pl. clxii. fig. 16 (1893).

Sabaki Valley.

Perhaps slightly greyer than specimens from the Nilgiris, but not otherwise differing.

186. Eublemma reducta, sp. n. (Plate XXXVII. fig. 7.)

Allied to *E. olivacea*, Walk., but considerably smaller; primaries of male whity brown irrorated with grey, of female brownish grey;

subbasal line only indicated by a dusky costal spot, antemedial line by an oblique costal dash and greyish irregular scaling; the female also with a short oblique line from inner margin almost to cell; one or two additional badly-defined costal dusky spots from middle of costa and a little group of ferruginous scales towards apex partly enclosed by a horseshoe-shaped dark grey marking, the outer arm of which is confluent with a dark grey apical patch enclosing two black dots; fringe of male creamy white: secondaries of male white, of female greyish brown; body of male white, of female greyish white; under surface white, the costal area of primaries more or less sprinkled with grey scales, a dusky spot in cell, and a second, better defined, at end of cell. Expanse of wings, ♂ 16 millim., ♀ 17 millim.

Sabaki Valley.

187. Cyligramma latona.

Phalæna (Noctua) latona, Cramer, Pap. Exot. i. p. 20, pl. xiii. B (1779).

Kinani; shores of Lake Baringo; Larabwal, Laitsipia; Thagana; Thiriati.

188. Cyligramma limacina.

Cyligramma limacina, Guérin, Icon. Règne Anim., Ins. pl. 89. fig. 2, texte, p. 520.

Thagana and steppes of Thika-Shika.

189. Baniana intorta.

Athyrma intorta, Swinhoe, Trans. Ent. Soc. 1891, n. 150.

Baniana intorta, Hampson, Ill. Typ. Lep. Het. ix. p. 106, pl. clxiii. fig. 3 (1892).

Sabaki Valley.

190. Plecoptera reversa.

Poaphila reversa, Walker, Lep. Het. Suppl. iii. p. 991 (1865).

Sabaki Valley.

191. Colbusa pentagonalis, sp. n. (Plate XXXVII. fig. 8.)

Primaries above cupreous brown, purplish beyond the middle; costal edge creamy white; a white very oblique stripe commencing near base of inner margin, bounding the subcostal vein to end of cell, where it is acutely angulated, and passing obliquely backwards across the wing to just below first median branch, where it is again abruptly angulated and runs inwards to inner margin; this stripe thus encloses a large purplish-black pentagonal patch; a broad blackish marginal band, its inner edge diffused, its outer edge bounded by a white stripe and then a slender black line; fringe white: secondaries with the basal half sericeous whity brown, bounded externally, from anal angle to cell, by a white stripe; external half dusky greyish; a submarginal slender white line from anal angle to radial vein; fringe white. Head and front of thorax purplish black; shaft of antennæ and a connecting line across the head white; back of thorax dusky, abdomen whity brown. Primaries below sericeous greyish brown; the black patch of the upper surface faintly indicated by a wedge-shaped whitish-bordered patch; fringe white: secondaries whity brown, speckled with grey-brown, which becomes denser and forms a diffused patch at apex; a dusky elongated spot at end of cell; a slender blackish marginal line; fringe white: body below sericeous whitish. Expanse of wings 25 millim.

Sabaki Valley.

192. Trigonodes hyppasia.

Phalæna-Noctua hyppasia, Cramer, Pap. Exot. iii. p. 99, pl. ccl. E (1782).

Nzoai.

193. Acantholipes circumdata.

Hydrelia? circumdata, Walker, Lep. Het. xv. p. 1763 (1858).

Nzoai and Sabaki Valley.

194. Drasteria mutuaria.

Remigia mutuaria, Walker, Lep. Het. xiv. p. 1506. n. 7 (1857).

Kithungulu.

195. Remigia repanda.

Noctua repanda, Fabricius, Ent. Syst. iii. 2, p. 49. n. 133 (1793).

Ngatana; Ndara.

Two much-worn examples of species belonging, probably, to different genera allied to *Zethes* complete the typical *Noctuæ*.

196. Ophiuche masurialis.

Hypena masurialis, Guenée, Delt. et Pyral. p. 38. n. 40.

Sabaki Valley.

197. Ophiuche echionalis.

Hypena echionalis, Walker, Lep. Het. xvi. p. 230 (1858).

Mkonumbi, grassy steppes.

198. Hypena vulgatalis.

Hypena vulgatalis, Walker, Lep. Het. xvi. p. 82 (1858).

Hypena palpitralis, Walker, l. c.

Karati; Konu District; Ukikuya country; Tana river-basin, beside swamp.

Three very much-worn examples.

Three other specimens in the collection I have been unable to name: two of these may be modifications of *H. tristalis*; the third is probably new, but too bad for description.

The *Pyralidæ* are poorly represented by about a dozen species in worn condition.

199. Pyralis, sp.

A single damaged specimen of a species apparently distinct from any in the Museum; probably most nearly related to *P. ocellalis*.

Sabaki Valley.

200. Udea martialis.

Scopula martialis, Guenée, Delt. et Pyral. p. 398. n. 517.

Camp below the old ice-fall, Mount Kenya, 10,500 feet; upper bamboo zone, 9000 feet; lower bamboo zone, 8000 feet; Ndoro, steppes at base of Kenya, 7000 feet; Karati and Kithungulu, Ukikuya.

201. Eudioptes indica.

Eudioptes indica, Saunders, Zoologist, ix. p. 3070 (1851).

Ngatana.

202. Hydriris ornatalis.

Asopia ornatalis, Duponchel, Lép. viii. 2, p. 207, pl. 223. fig. 8.

Nzoai.

203. Duponchelia fovealis.

Duponchelia fovealis, Zeller, Isis, 1847, p. 588.

Sabaki Valley.

204. Coptobasis, sp.

A single example of a species near *C. tricolor* in poor condition.

Karati, Ukikuya.

205. Hymenia recurvalis.

Phalæna recurvalis, Fabricius, Ent. Syst. iii. 2, p. 237. n. 407.

Mkonumbi and Njempo.

206. Bocchoris inspersalis.

Botys inspersalis, Zeller, Caffr. p. 33.

Sabaki Valley.

207. Paramorpha, sp.?

One much-rubbed example of a species probably referable to this genus.

Kithungulu.

208. Antigastra catalaunalis.

Botys catalaunalis, Duponchel, Lép. viii. p. 330, pl. 232. fig. 8.

Sabaki Valley.

The remainder of the *Pyralidæ*, the *Crambidæ*, *Phycitidæ*, and *Tineidæ* I can do nothing with, excepting that there is one rather good example of *Dysphylia viridella*, Ragonot, from the Sabaki Valley.

The *Geometridæ* are also mostly in bad condition, but the following are identifiable :—

209. Tephrina observata.

Tephrina observata, Walker, Lep. Het. xxiv. p. 963. n. 32 (1861).

Nzoai.

210. Sterrhanthia sacraria.

Phalæna-Geometra sacraria, Linnæus, Syst. Nat. i. 2, p. 863. n. 220.

Ndara and Njempo.

211. Ortholitha monosticta, sp. n. (Plate XXXVII. fig. 9.)

Nearest to *O. megalaria*: wings silvery greyish white, with faint brassy reflections; costa of primaries slightly browner; an oblique black bar on the discocellulars; a slightly arched grey stripe crossing the disc parallel to outer margin and followed by two very badly-defined submarginal stripes, the inner one often partly obliterated; two more slender stripes traverse the fringe of all the wings. Head, prothorax, and patagia brownish grey; remainder of body whitish; antennæ white, with blackish pectinations in the male. Wings below greyer, all the veins pale buff; costa of primaries with a golden reflection, irrorated with grey, traces of the commencement of the first two transverse stripes as far as upper radial vein; discocellular bar replaced by a cuneiform oblique whitish-edged black spot: secondaries white irrorated with grey; the costa tinted with pale buff; a black spot on upper discocellular and a series of four black dots on the median and radial veins; a submarginal squamose brownish-grey line; margin also grey: body below brassy, legs slightly dusted with grey. Expanse of wings 32 millim.

Guaso Nyiro; steppes N.W. of Longari; Thegu.

212. Cataclysme argyridia, sp. n. (Plate XXXVII. fig. 10.)

Primaries above silver-grey, divided into three nearly equal parts by two white irregular stripes, which indicate the central band, the inner stripe }-shaped, the outer wider, better defined, undulated, almost in the form of the Greek letter ξ (but with the tail continued almost to the length of the character) on the left hand side; on the right hand it consequently more nearly resembles a figure 3, also with the lower extremity continued: secondaries pure white, crossed before the middle by an equally bisinuate grey band, the centre between the two sinuations forming an acute angle directed outwards; a dotted grey line, duplex at abdominal margin, followed by an external rather broad grey border; a submarginal series of ill-defined whitish spots on the border; fringes of all the wings white spotted with grey. Antennæ ochraceous; thorax grey; abdomen grey, with white segmental bands; anal extremity ochreous. Wings below slightly paler than above, otherwise similar: body below creamy whitish, tarsi tinted with ochreous. Expanse of wings 29 millim.

Mount Kenya, in bamboo-jungle at 7500 feet, and in the upper bamboo zone at 900 feet.

I know of no species nearly related to this very pretty little Geometer.

213. Philereme natalata.

Scotosia natalata, Walker, Lep. Het. xxv. p. 1351. n. 19 (1862).

♀, Nzoai.

214. Lasiochlora saliata.

Racheospila saliata, Felder, Reise der Nov., Lep. iv. pl. cxxvii. fig. 36.

Ngatana.

215. Problepsis vestalis.

Argyris vestalis, Butler, Ann. & Mag. Nat. Hist. ser. 4, vol. xvi. p. 419. n. 132 (1875).

Sabaki Valley.

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	II.	,, ,, ,,	March and April, on August 1st.
	III.	,, ,, ,,	May and June, on October 1st.
	IV.	,, ,, ,,	November and December, on April 1st.

PROCEEDINGS

OF THE

GENERAL MEETINGS FOR SCIENTIFIC BUSINESS

OF THE

ZOOLOGICAL SOCIETY

OF LONDON,

FOR THE YEAR

1894.

PART IV.

CONTAINING PAPERS READ IN

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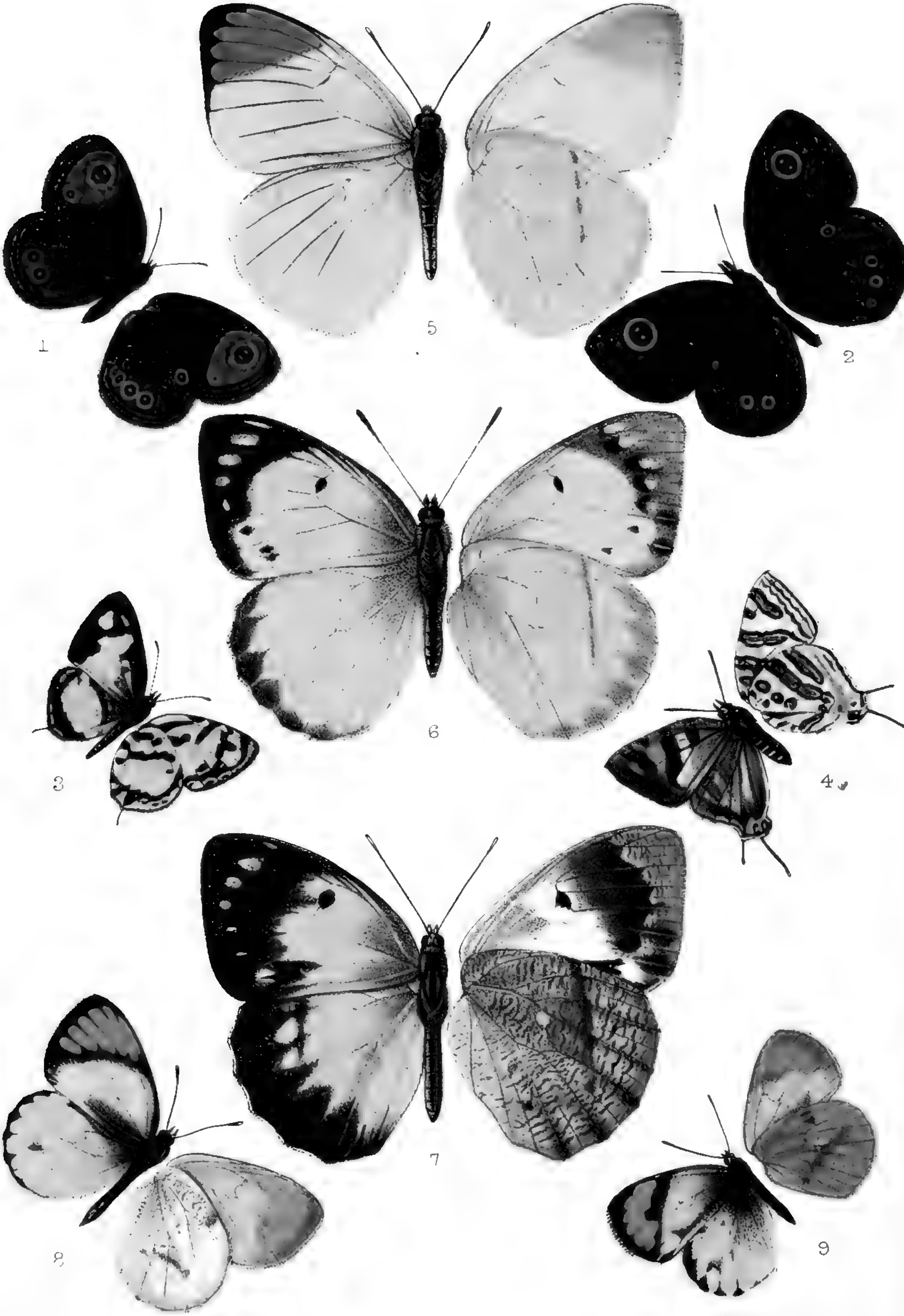
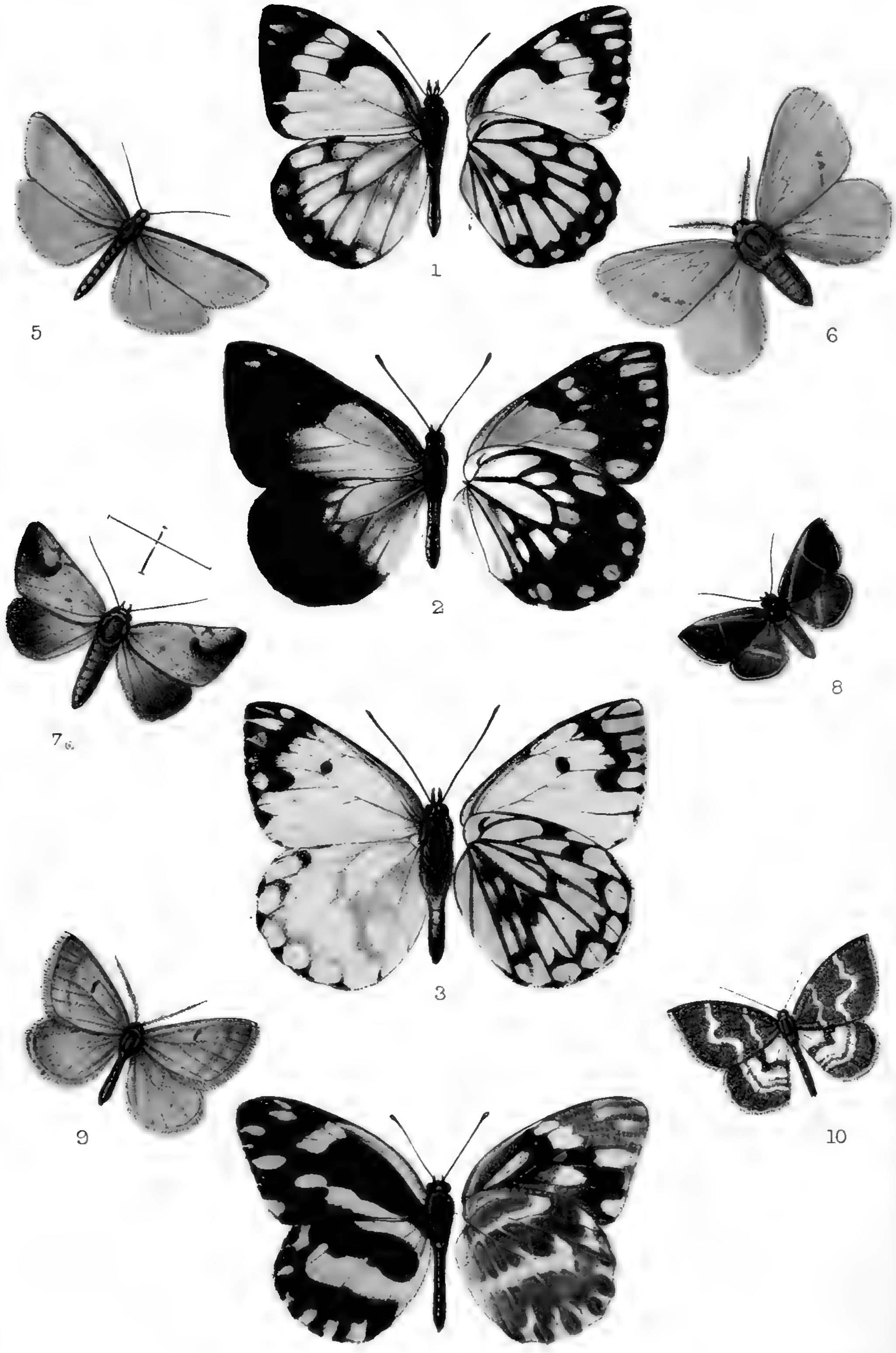


Horace Knight del. et lith

West, Newman chromo

New Lepidoptera from British East Africa.



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November 6, 1894.

Sir W. H. Flower, K.C.B., LL.D., F.R.S., President, in the Chair.

The Secretary read the following reports on the additions made to the Society's Menagerie during the months of June, July, August, and September, 1894:—

The total number of registered additions to the Society's Menagerie during the month of June was 113, of which 17 were by birth, 56 by presentation, 16 by purchase, 2 by exchange, and 22 were received on deposit. The total number of departures during the same period, by death and removals, was 165.

Amongst the principal additions were the following:—

1. Three remarkably large and fine specimens of the Hamadryad Snake of India and Burmah (*Ophiophagus elaps*), received in exchange and on deposit on the 6th and 8th June[1]. We have previously had but one example of this species in the Society's Reptile-house (see P. Z. S. 1875, p. 316).

2. A series of Mammals and Birds from British Central Africa, presented by Mr. H. H. Johnston, C.B., F.Z.S., and carefully brought home by Mr. Alexander Whyte, F.Z.S., the Naturalist on his staff, on June 28th.

It embraces examples of the following species:—

English Name.	Scientific Name.	Locality.
1 Black Mangabey.	*Cercocebus aterrimus.*	N. of Lake Tanganyika.
1 Yellow Baboon.	*Cynocephalus babouin.*	Shiré Highlands.
1 Duyker Bok.	*Cephalophus mergens.*	Upper Shiré.
1 Æthiopian Wart-Hog.	*Phacochœrus æthiopicus.*	Lake Mweru.
1 Banded Ichneumon.	*Herpestes fasciatus.*	Shiré Highlands.
1 Milky Eagle-Owl.	*Bubo lacteus.*	Lower Shiré.
1 Black-crested Eagle.	*Lophoaëtus occipitalis.*	Shiré Highlands.
2 Green-necked Touracous.	*Gallirex chlorochlamys.*	"
2 Livingstone's Touracous.	*Turacus livingstonii.*	"
1 Marabou Stork.	*Leptoptilus crumeniferus.*	Lower Shiré.
1 Bell's Cinixys.	*Cinixys belliana.*	Shiré Highlands.

As regards the fine Black Mangabey in Mr. Johnston's series, I am unable to say while the animal is living whether it should be referred to *C. albigena* (Gray), *C. aterrimus*, Oud. (Zool. Gart. xxxi. p. 267, 1890), or to a new species, but it certainly belongs to this section of the genus, and is probably referable to *C. aterrimus*.

[1] See Sir Joseph Fayrer's letter in 'Nature,' June 21st, 1894.

Mr. Johnston writes to me as follows respecting this animal:—

"This is the history of the Black Monkey. He was brought from the country of Burundi, at the north end of Tanganyika, by Rumaliza, the Arab who has been fighting recently with the Belgians. Rumaliza gave it at Ujiji to Mr. Swann, then in the service of the London Missionary Society. Mr. Swann brought him down to the south end of Tanganyika, and gave him to the Mission Station. The missionary in charge of the station, subsequently hearing that I was collecting all sorts of beasts, sent him to me. I got him fetched down from Tanganyika to Zomba, and thence, as you know, to England. He is undoubtedly a native of the country at the north end of Lake Tanganyika: in other words, of the north-eastern border of the great forest-region of West Africa. Even there he would seem to have been rare, since he was given by the natives to Rumaliza as a curiosity."

3. A young male White-tailed Gnu (*Connochætes gnu*), born in the Menagerie on June 23, being the produce of the male and one of the females that were purchased of Mr. C. Reiche, March 7, 1893 (see P. Z. S. 1893, p. 325).

This is the first occasion of this Antelope having bred in the Society's Gardens.

The registered additions to the Society's Menagerie during the month of July were 106 in number; of these, 48 were acquired by presentation, 10 by purchase, 4 by exchange, 26 by birth, and 18 were received on deposit. The total number of departures during the same period by death and removals was 97.

Among these special attention may be called to the following:—

1. A fine female Eland of the striped form (*Oreas canna livingstonii*), from the Transvaal, obtained by purchase July 10th, being the first individual of this variety received by the Society.

2. Two Giant Tortoises from the Aldabra Islands (*Testudo elephantina*), presented by Rear-Admiral W. R. Kennedy, F.Z.S., July 12th.

3. A young male Pleasant Antelope (*Tragelaphus gratus*), bred in the Zoological Gardens, Hamburg, received July 27th.

The following extract from a letter received from Admiral Kennedy gives particulars respecting the Tortoises:—

"By the kindness of Capt. Cragie, R.N., H.M.S. 'Crescent,' I am able to send you the two Giant Tortoises I promised you some time ago. They are now in very fine condition and very tame; I have kept them in our grounds at Trincomalee, where they were very happy and had plenty to eat. I also gave them pumpkins, cabbage-leaves, bananas, Cape gooseberries, &c. In the wild state they feed on cactus and jungle-leaves.

"These two are male and female; the former weighs 178 lbs., the latter 162 lbs.

"They are of an inoffensive and affectionate disposition and will probably breed, as the female laid an egg some time ago. I am sure you will value and appreciate these rare and curious creatures. I estimate their ages at about 50 years, but this is mere guess-

40*

work; I can only judge approximately by the old Tortoise at Mauritius, which is twice as big as these and is over 100 years old.

"The dimensions of these Tortoises are as follows:—

"*Male*:—Length, over curve of back, 42 inches.
Height 19 inches.
Plastron, $26\frac{1}{2}$ inches long, 22 inches wide.

"*Female*:—Length, over curve of back, $40\frac{1}{2}$ inches.
Height 17 inches.
Plastron, 26 inches long, 19 inches wide."

The registered additions to the Society's Menagerie during the month of August were 61; of these, 37 were acquired by presentation, 4 by purchase, 5 by birth, and 15 were received on deposit. The number of departures during the same period, by death and removals, was 87.

The registered additions to the Society's Menagerie during the month of September were 131; of these, 74 were acquired by presentation, 6 by purchase, 7 by exchange, 7 were bred in the Gardens, and 37 were received on deposit. The number of departures during the same period, by death and removals, was 86.

The President stated that he had just received a letter addressed to him by the late Dr. Emin Pasha, C.M.Z.S., without date, but apparently written very shortly before his assassination by the Arabs on the Upper Congo in the autumn of 1892. The letter had been brought from the Congo by M. Dhanis, of the Congo Free State Service, and transmitted to the President by M. Baerts, "Chef de Cabinet" of the Congo Free State at Brussels. It was as follows:—

"The notes hereby joined will prove you that I never forgot how kindly you acted in working out the collections previously sent by me to England. Twice I have tried to forward you specimens I collected, and twice I have been disappointed by the misdirection of my boxes by those entrusted with them.

"The collections now made, and of which the joined notes give some idea, are small, but they hail from the remotest corners of the Continent never before visited by a naturalist, and scarcely to be visited again for years to come. Such is their only merit; if there are novelties amongst them I dare not to decide. Certainly they are a contribution to the knowledge of species as well as of their geographical range, and if they are welcome to you my amplest wishes are fulfilled.

"As for some weeks I shall have to stay here, and the Arabs very kindly promise to make their people collect for me, I hope to be able to obtain many interesting objects, amongst which, in first line, I shall try for a White Chimpanzee.

"The specimens collected for you shall be forwarded with first opportunity by way of Stanley Falls [1], where letters for me should be addressed, and where you may kindly send whatever you can

[1] These specimens have unfortunately not been recovered.

spare of zoological papers, pamphlets, &c. From two years now I am hungry for some zoological pasture.

"If time and circumstances permit, I should greatly like to make an excursion into the Manyuema country, where never collections were made. I shall try to refit myself with arseniate of soda, naphthaline, shot, &c., at Stanley Falls. I shall address the specimens to the Zoological Society, but you may inform Mr. Sclater that such specimens as you choose for your own collection should be given to you.

"Believe me to be, Sir,
Yours very sincerely,
DR. EMIN."

The Journal (written in English) which accompanied the letter was as follows. It appeared to be a continuation of the journal originally written in English, but translated and published by Dr. A. Reichenow in the 'Journal für Ornithologie' for 1894 (pp. 162–171):—

"Left Manyuema settlement on Ituri (29° 50′ L.E., 1° 22′ L.N.) on May 29, 1892, and reached chief Amende's place, Ipurungu, the same evening. Distance 27–28 km. N.N.W. Primæval forest. Observed: *Psittacus erithacus* (frequent); a big Woodpecker; *Smithornis*; many kinds of *Criniger*; an orange-brown *Turdus*, with white throat; a very small *Muscicapa* abundant, underneath lighter grey, basal half of bill light yellow, rest black; *Ceuthmochares australis*; *Cuculus solitarius*; *Musophaga rossæ*; *Corythaix* spec. (previously collected); *Oriolus brachyrhynchus* (very frequent); *Nigrita canicapilla* (near villages in the open); *Lophoceros semifasciatus*.

"Indekaru village, June 10, 1892.

"The extreme poorness of animal life is a striking fact in the forest we have just traversed. Suppose even the birds being frightened by the noise of a passing caravan—a fact scarcely to be admitted, as they frequent mostly the high trees—there is always a lack of life one can scarcely explain. The ubiquitous Grey Parrot, *Cuculus solitarius, Oriolus brachyrhynchus*, and some sp. of *Criniger* are to be heard; sometimes the harsh scream of *Buceros* sounds through the forest; flocks of tiny, tit-like birds twitter, and *Irrisor sharpei* chatters. No Pigeons. At night-time occasionally an Owl is heard. Nevertheless there is life in the forest, but it concentrates in the river parts, on old clearings, deserted villages, and escapes the notice of the traveller. Only these last two days I have heard the call of *Corythæola, Centropus, Peristera*, and a *Corythaix*. Here in the village I might have procured some specimens but for the rank vegetation, in the midst of which any bird killed is hopelessly lost. Shot: *Hapaloderma narina*, ♀ jr., broken.

"No. 1807. *Lophoceros camurus*, Cass., ♀; *cf.* no. 1409.

"In leaving Indekaru, flocks of a screaming *Coracias* were seen, and a big species of Hornbill, probably *Ceratogymna atrata*, was rather common. A belt of very different forest without any village or inhabitants was then traversed, and on June 18, 1892, we reached Ipoto, Kilongo-longa's place, long. 28° 47′ 50″ E. and lat. 1° 07′ N., where a probably long stay is expected.

"No. 1808. *Corythaix* (an *schuetti*, Cab.?), June 20/92; *cf.* no. 1695 &c.

"No. 1809. *Spermestes poensis*, Fras., ♂. The easternmost point where I obtained this pretty species is Bukoba on Victoria Nyanza; it was there frequent and many specimens were collected. I may also record it from the forests of the Semliki valley, but on Albert lake it seems not to occur. I cannot agree with the statement 'sexes alike;' and if not every female bird I obtained were a young and every male bird an adult, there is some difference, as my specimens will show. In company with these birds, which fly in flocks of from 10 to 40, there is here another apparently yellow-billed Finch.

"No. 1810. *Ploceus nigerrimus*, Vieill., ♂ ad. A very common bird through the forest country, never entering the steppe. The whole of Monbuttu and the Niam-niam country up to Macraca (where I collected it in Tomaja), South Macraca, Kalika, the west coast of Albert Nyanza from Mrva down to Nssabé, the forest in the Semliki valley, and all along the Ituri; finally Bukoba. On Victoria Nyanza were my collecting stations for this species, which is just as gregarious as its congeners. It has a marked predilection for forest villages, often very small, where, infallibly, the biggest tree in the midst of the huts is full of their nests. They are very noisy birds, and as every bird coming in is greeted by all his neighbours, the chatter never ceases.

"No. 1811. ♀. *Laniarius* (?). Small: all over olive-green with white throat.

"Observed: *Motacilla vidua*; *Anthus*, sp.; *Cisticola*, sp., red-headed; *Corythœola cristata*; *Psittacus erithacus*, very common; *Nigrita canicapilla*; *Cuculus solitarius*; *Pycnonotus*, sp.; *Ploceus abyssinicus*, Gm., similis; *Tympanistria tympanistria*; *Treron calva*, very common; *Artomyias*; *Malimbus malimbicus*; *Lophoceros camurus*, and a second, small, black and white species; *Spermestes poensis*; *Columba*, dark grey with white belly, eyelids red; *Astur*, sp.; *Agapornis*, sp., not *pullaria*; a small Parrot, not *P. meyeri*; *Telophonus*; *Centropus*, sp.; *Chrysococcyx cupreus*; *Lamprocolius*, small; *Oriolus brachyrhynchus*; *Ceuthmochares australis*; different *Cinnyris*.

"No. 1812, 13. *Malimbus malimbicus*, Daud., ♂ ♀.

"No. 1814. ♂.

"No. 1815. *Lophoceros camurus*, Cass. Frequent.

"No. 1816, 17. *Lophoceros* ♀ ad., ♂ jr.; *cf.* no. 1660. Probably new species, as the young resemble the adult.

"No. 1818. *Spermestes poensis*, Fras., ♀ ad. Eggs well-developed. Having dissected this specimen very carefully and found a pea-sized and several smaller eggs, my statement above (*cf.* no. 1809) becomes invalid. *Sexes exactly alike.*

"No. 1819. *Diaphorophyia castanea*, Fras., ♀. Common.

"No. 1820. *Halcyon senegalensis*, L. Common.

"No. 1821. *Agapornis*, ♂. This species, never before met with, is very near to, if not identical with, the Liberian *A. swinderniana*, with which it convenes in general colour, black stripe on the neck, and size. I can, however, not remember if the Liberian bird has likewise the orange-brown broad belt below the black of the neck. Iris pale yellow; feet olive-greenish; bill dark plumbeous, the under mandible paler. In flocks from 3 to 4 these birds may be seen and heard at morning and evening time, when leaving the trees they roost in and returning to them; their shrill twitter is at those times most loudly heard. During the morning they frequent with predilection the new ripening sesame and the rice-fields, and are often on the soil, where they move quickly enough. They are great friends of water, and the Manyuema tell most earnestly their feeding on liquid mud. At noon they take repose on the best trees, congregating there to 10–15; at 2 or 3 o'clock they are off again in the fields, take then a second time to the water, and turn in to sleep towards sunset. Their flight is rapid and not so awkward as that of the *Pœocephalus*, of which a small species here exists.

"No. 1822. *Asturinula monogrammica*, Temm. Monbuttu, Niam-niam, Macraca, &c. The commonest Hawk in the forest, where Hawks are rare.

"No. 1823. *Laniarius*, ♀. Entirely black.

"No. 1824, 25. *Spermestes poensis*, Fras., ♂ ad., ♂ jr.

"No. 1826. *Spermestes cucullatus*, Swains. Goes up with the forest to 4° 30′ L. N. Found in Macraca nesting in straw thatch.

"No. 1827. *Anthreptes*, ♀.

"No. 1828. *Elanus* (*cæruleus*, Desf.). Differs from the typical bird by having only the median tectrices white, whereas the remainder show a grey outer web and a white inner web. This species seems particularly given to skin-diseases: 3 out of 5 specimens had fleshy excrescences on the base of the bill or on the feet. Likes open country; never on high trees; fond of insects and mice, hovering in the air and falling suddenly on its prey like a Kestrel. Macraca, Lado (winter), Nile valley to Albert lake.

"No. 1829. *Ploceus*, ♂. *P. nigricollis*, Vieill.

"No. 1830, 31. *Laniarius affinis*, Gray. Monbuttu, Niam-niam; not existing in the Nile valley.

"No. 1832, 33. *Pytelia*, *P. schlegeli*, Sharpe, affinis sed diversa: ♂ capite coccineo lavato. The first specimen of this species, a badly damaged ♀, was procured at Bukoba, Victoria Nyanza. The present pair, ♂ in moult, was found amongst rushes on the ground. The female has an ochraceous orange face; the male shows on head and throat bright crimson spots, and will, no doubt, when fully moulted, have a red head and prove different from the typical *P. schlegeli*, to which otherwise it entirely resembles. ♂ and ♀ are, the red except, alike; the spotting is the same.

"No. 1834. *Barbatula* (an *scolopacea,* Temm.?).

"No. 1835. *Lamprocolius splendidus,* Vieill.

"No. 1836. *Artomyias.*

"No. 1837, 38. *Psalidoprocne nitens,* Cass. Flocks hovering over the settlement towards evening.

"No. 1839. *Pytelia* (*P. schlegeli,* Sharpe, affinis) ♂ in moult, whole head in moult.

"At night big Owls come to my courtyard.

"No. 1840. *Erythropygia ruficauda,* Sharpe. A very common bird on Albert lake and southwards to Usukuma. Has a pleasant, loud note.

"No. 1841. *Agapornis swinderniana,* Kuhl, ♀. Differs from the male by slightly smaller dimensions; the blue on hind back and uropygium is not very dark; the throat and breast more yellowish; the bill lighter coloured. Congregates in the morning to flocks feeding together on fruit.

"No. 1842. *Picus* ♀.

"No. 1843. *Cuculus solitarius,* Steph., jr. I am not sure if truly this species.

"No. 1844. *Psalidoprocne nitens,* Cass.

"No. 1845. *Syrnium nuchale,* Sharpe, ♂. This is the third specimen of this fine Owl coming into my hands. The first, of a more reddish colour, was obtained at Trumaja, Macraca; the second at Sconga, A-Lendù (1440 m.), on October 9th, 1891, and now the third. The two latter are somewhat darker coloured.

"No. 1846, 47. *Lamprocolius purpureiceps,* Verr., ♂ ♂. *Cf.* no. 1143. The differences between this species and *L. cupreicauda* are not present to my memory; I leave, therefore, the determination doubtful.

"No. 1848. *Pogonorhynchus*; *cf.* no. 1677.

"No. 1849. *Pytelia schlegeli,* Sharpe (?), ♂ ad. Without tail. Head bright crimson!

"No. 1850. *Coccystes cafer,* Licht. Although somewhat small, I believe this bird with the striped throat to range with the said species.

"No. 1851. *Alseonax* (an *minima,* Heugl.?). Very dark. Basal half of lower mandible yellow. In pairs near water.

"No. 1852. ♂. Probably an *Onychognathus* or *Pilorhinus,* but no rusty red on the primaries.

"No. 1853. ♀. Probably an *Onychognathus* or *Pilorhinus,* the inner web only of the primaries rusty red with black tips. Flocks of this Starling, from 10–30, on trees, very noisy.

"No. 1854, 55. *Picus,* ♂ ♂. Small, spotted underneath.

"No. 1856, 57. *Pytelia schlegeli,* Sharpe?, ♂ ♀. These birds were in moult.

"No. 1858, 59. *Bubo,* sp. inc., ♂ ♀. Very dark, long-tailed form, long ear-tufts. I have no descriptions of *B. leucostictus.* When the male with broken leg and wing came down from the tree, the female followed it spontaneously and tried to bite and claw.

"No. 1860. ♂; *cf.* no. 1852. No rusty red on primaries.

"No. 1861. ♀.

"No. 1862. *Spermestes cucullatus*, Swains.

"No. 1863. *Nigrita canicapilla*, Strickl.

"No. 1864; *cf.* no. 1339 etc. This is a very fine species, of which I got a matched pair, exactly alike in size and colour, on June 30, 1891, at Kitimba, Uvamba, 0° 43′ L. N. Unfortunately only one specimen was fit to be preserved, and this is the second I obtained now. Head and neck shining bluish black, mantle earth-brown; tail cuneate, black; whole underparts creamy white. 120, 9; 49, 13; 13. Sexes fully alike.

"No. 1865. *Agapornis* (an *swinderniana*, Kuhl?), ♂.

"No. 1866. *Anthreptes*, ♀: 93; 12; 48; 17; 14; tail underneath olive not black; perhaps *C. chloropygius*?

"No. 1867; *cf.* no. 1823. Entirely black.

"No. 1868. ♂, not before collected.

"No. 1869. *Turdus icterorhynchus*, Pr. Würt. Seems slightly different from specimens collected at Lado and elsewhere.

"No. 1870; *cf.* no. 1860. A fine specimen of this Starling, without any rusty red on primaries; tail long.

"No. 1871. *Pytelia schlegeli*, Sharpe?, ♂ moult.

"No. 1872. *Alseonax* (an *minima*, Heugl.?), ♀; *cf.* no. 1851. Dark coloured. This will prove a different species.

"No. 1873. *Ploceus nigerrimus*, Vieill., ♀. I have never yet seen a ♀ of this species coloured like the ♂.

"No. 1874. *Psalidoprocne nitens*, Cass., ♂. An apparently young bird.

"No. 1875. *Asturinula monogrammica*, Temm., ♀ ad.

"No. 1876. *Pogonorhynchus*; *cf.* no. 1848. More reddish brown.

"No. 1877. *Erythropygia ruficauda*, Sharpe.

"No. 1878. *Agapornis* (an *swinderniana*, Kuhl?), ♂.

"No. 1879. *Trachyphonus purpuratus*, Verr., ♂. Exactly like specimens from Njangabo, the only locality where I have collected this species.

"No. 1880. *Cuculus clamosus*, Lath., ♂ jr. Without gloss; underneath mottled, only under tail-coverts barred.

"No. 1881. *Artomyias*, ♂.

"No. 1882–86. *Agapornis* (an *swinderniana*, Kuhl?). A flock of more than 30 birds surprised at the drinking-place.

"No. 1887. *Trachyphonus purpuratus*, Verr., ♀. Smaller and duller in colour than ♂.

"No. 1888. *Pogonorhynchus*; *cf.* no. 1876. Forehead with light coloured stripes, no feather-shafts.

"No. 1889; *cf.* no. 1870 etc. Primaries without rusty red.

"No. 1890. *Laniarius*, ♂. An *L. verreauxi*, Cab.?

"No. 1891. ♂. New to me: 132, 9, 84, 43, 17·5. Entirely black, head slightly glossed and scaly; wing-coverts and primaries with bluish-grey edgings; irides scarlet. Bill tit-like, strongly compressed from the sides. A single specimen obtained.

"No. 1892. *Diaphorophyia blissetti*, Sharpe. A fine male specimen.

"No. 1893. *Ploceus nigricollis*, Vieill., ♀.

"No. 1894, 95. ♀ ad., ♂ jr. A very striking, probably new species, found on the ground under low brushwood, where it behaved itself like the *Erythropygia*.

"No. 1896. *Alseonax*; *cf.* no. 1872 etc., ♀.

"No. 1897; *cf.* no. 1889 etc., ♀. Exactly alike to no. 1853; inner web of primaries rusty red with black tips. I have very carefully dissected this specimen and found it a ♀. It seems, therefore, that the ♂, besides being black, show no rusty red, whereas the ♀ are grey and show rusty red.

"No. 1898. *Accipiter* ♂. Never before collected; seems not fully adult, as the colour of iris and the rusty tips of some secondaries show. Measurements: 332 mm. (9″·28); 16 (0″·04); 138 (5″·52); 99 (3″·8); 35 (1″·4). I do not know if this is a younger bird of *A. hartlaubi*, Verr., of which I have no description.

"No. 1899. *Eremomela badiceps*, Fras., ♀. This is only the second specimen of this pretty species I ever collected. The first was obtained on June 29, 1891, at Kitimba, Uvamba (0° 43′ L.N.), in the forest bordering the western hills of the Semliki-valley. It seems, therefore, with many western birds, to find its eastern limit with 30° L. E.

"No. 1900; *cf.* nos. 1894, 95. A happy encounter, being the ♂ to the above noted ♀ ad. and ♂ jr. A probably new species. It is to be distinguished from the ♀ only by its colours being somewhat darker and the bill being entirely black.

"No. 1901. *Agapornis* (an *swinderniana*?), ♂.

"No. 1902. *Terpsiphone* (an *cristata*, Gm.?), ♂. Seems somewhat different from the dark-bellied species, and has certainly no white vent nor thighs.

"On August 1 we left Ipoto for Urumbi; another Manyuema settlement in the forest. On our way to the Ituri, which has to be crossed, we observed numerous *Criniger*, *Corythæola*, *Cuculus*, *Halcyon senegalensis*, several *Malimbus*. The banks of the Ituri being thickly clothed with high forest, there were, besides a few *Glareola* on the rocks in mid-stream, no water-birds visible. Abundant are here everywhere different species of Hornbills, from the small *Lophoceros camurus* to the big *Ceratogymna atrata*. I may here observe that during our stay at Ipoto no Raven nor Crow was seen, and of *Columbidæ* only *Treron calva* and *Tympanistria tympanistria* were seen. Once I have seen a big *Columba* (*Turturœnas*?), entirely stone-grey, somewhat scaly, belly and vent pure white, broad circles around eyes bright red: quid?

"On August 9th, by the carelessness of our Manyuema headman, the whole batch of collections was thrown in the river Lenda, which had to be crossed by boat. Pity! On the banks of Lenda river—primæval forest—numbers of a small entirely black Swallow with white markings on tail or rump. All specimens shot were swept away by the current.

"No. 1903. *Terpsiphone nigriceps*, Hartl., ♂. Never before collected.

"No. 1904. A broken specimen of *Muscicapa lugens*, Hartl.

"No. 1905. *Bubo* ♂; *cf.* nos. 1858, 59. A fine male of this pretty Owl, shot on the march between Lenda river and the Urumbi station.

"On August 20th we reached, after 19 days' forest march, the Urumbi station, the westernmost point of this journey, the road lying now to south until we reach Kirundi (Kabongi's place), on the Upper Congo, where I think Herr Bohndorff collected before me.

"No. 1906. *Barbatula leucolæma*, Verr., ♂. Abundant through the forest region: northwards to Monbuttu and Macraca (4° 20′ L. N.), and eastwards to the western shore of Victoria Nyanza (Bukoba).

"No. 1907. *Camaroptera* ♂ *brevicaudata*, Cretzschm.
"No. 1908. *Camaroptera* ♀ (probably younger).

"Shot together. The lighter form, not *Syncopta tincta*, Cab.

"No. 1909.

"No. 1910. *Eurystomus gularis*, Vieill.

"No. 1911; *cf.* no. 1904. Broad yellowish superciliary stripes.

"No. 1912. ♂
"No. 1913. ♀ } *Cinnyris chloropygius*, Jard. Very common.

"No. 1914. *Passer diffusus*, A. Smith, ♂ in moult. Very common. I cannot see very valid difference between *P. swainsoni* and *P. diffusus*.

"The last evening at Majoja brought a novelty in the shape of:—

"No. 1915. *Pœocephalus gulielmi*, Jard., ♂. A pair of this pretty species was seen and, although both brought to bay, only the male secured, the female (apparently without red forehead) hiding itself in the high grasses. Seen and heard at Ipoto also but never obtained. Always in pairs, nesting in tree-holes, selecting always a branchless spot. Not rare, but shy. Its voice not like *Psitt. erithacus*, but a stronger action of that of *Pœoc. meyeri*.

"On August 27 we crossed the Lindi river and stopped at Valiasnge on the western bank. Here a very rich avifauna but no time to collect, the preparation for a new forest march being made. Obtained:—

"No. 1916. *Totanus hypoleucus*, L. A small ♀.

"No. 1917. *Pycnonotus layardi*, Gurn., ♂.

"Two entirely spoilt specimens of a *Haplopelia* brought in, but found useless.

"No. 1918. *Turturœnas*, sp., ♂. The whole day fruitlessly spent in pursuit of this species! I had given up all hope of obtaining a specimen when, after having started, a man overtook me on the road and brought me the present one living but badly handled, some primaries and the secondaries having been plucked out: I kept it, however, just for identification. At Kilongo-longa's place this species was not infrequent, but very shy and never came within range. Here, in Valiasnge, it frequents in the early morning and towards evening the rice- and Indian-corn fields, and hides during the day in the adjacent forest. They catch numbers of them on sticks smeared with a viscous matter.

"On August 28th we left the bank of the river Lindi for another eight days' forest march. This part of the country seems rich in birds; the weather is, however, very inclement and we can scarcely dry our clothes. Everywhere lots of Grey Parrots, a favourite nesting-place of which seems to be the banks of a neighbouring river: Hornbills are abundant. I should have collected, but as my two boxes are filled with water, nearly every day, specimens would perish quickly, and I have no shot to squander—being from time to time forced to make shot for myself from bullets.

"September 7th, we reached after a very trying march Ubúre, another Urumbi station; one day has to be spent here.

"No. 1919. *Camaroptera brevicaudata*, Cretzschm., ♂.

"No. 1919 *a*. *Cisticola*, ♂.

"No. 1920. *Cisticola*, ♂.

"Very frequent *Barbatula leucolæma*, Verr.

"From Ubúre another march through mud and water to Ulike Urumbi, a village left by its inhabitants, in the midst of extensive plantain-groves, surrounded by dense forest. Here provisions have to be made for 10–12 days' march to Kiuene, from where the Congo is easily reached in ten short marches. Everyone is collecting plantains, which dried and pounded form our only food; no fat, no animal food being to obtain. At Madjambanis we were seed-eaters (Indian corn, Caffre corn); at Ismaili's we became plantain-eaters; at Kilongo-longa's rice-eaters (*Oryzornis*!); and now we are anew plantain-eaters!

"No. 1921. *Spermestes poensis*, Fras., ♂.

"No. 1922. *Andropadus*, ♂.

"No. 1923. *Cossypha* (an *barttleloti*, Shell.), ♂. This bird differs from the plate in having back and wings dark slate-colour, the centre pair of the tail-feathers entirely black, and the remainder edged with black on their outer webs. Underparts pale, belly nearly white. Measurements exactly like those given by the describer, only tail shorter.

"No. 1924. *Picus*; *cf.* nos. 1684, 85.

"No. 1925. *Stiphrornis*, ♀. Next to *H. gabonensis*, Sharpe.

"No. 1926. *Zosterops virens*, Sund., ♂.

"No. 1927. *Smithornis rufolateralis*, Gray, ♂.

"No. 1928. *Corythura cinnamomea*, Less. Formerly obtained in Monbuttu, 1 spec. at Bukoba, Victoria Nyanza, and 1 spec. very mangled, brought by natives on the upper Ituri; 2 spec. at Mrva, Albert Nyanza. Contrary to its habit of hiding always in the grass and reeds near brooks, the present species was found under a fig-tree—not far from the brook—busily picking at figs covered with small stingless bees which abound here. This species seems not exactly rare, but by reason of its hiding always in the grass and reeds and taking to flight only when forced, it is rarely seen.

"No. 1929. *Turturœnas*? ♀ ad.; *cf.* no. 1918. At last a fair specimen shot while drinking; the male escaped. Here seen in pairs only and not frequently. The present specimen is somewhat darker in colour than the male previously obtained; its head is, however, with a very slight metalled gloss, whereas the broad iridescent coppery belt on the lower neck is mostly the same as in the male. White on tips of rectrices only very limited. Soft parts resembling to those of the male but duller. The ovary contained a small cherry-sized and two smaller eggs.

"No. 1930, 31. *Picus*, ♂ ♀? Collected at Ismaili's and here, Maika forest, frequent.

"Our last halting-place, before reaching the Congo, was reached on Oct. 12, 1892. It is Muyoméma, commonly called Kinene, the name of its headsman, a drunken Uniamuezi slave—Said bin Abeids.

"No. 1932. *Cinnyris chloropygius*, Jard., ♂. Very common.

"No. 1933. *Ploceus nigricollis*, Vieill., ♂. Common.

"No. 1934. *Pycnonotus layardi*, Gurney, ♂. Very common.

"No. 1935, 36. *Laniarius leucorhynchus*, Hartl., ♂ ♀. Black bills; female slightly greyer in colour than male.

"No. 1937. *Cinnyris*, ♂ jr. Perhaps *chloropygia*.

"No. 1938, 39; *cf.* no. 1894–95. An adult female and a very young male of this interesting species. The young, still younger than no. 1895, has the underparts pure white without any trace of barring.

"No. 1940. *Halcyon senegalensis*, Linn., ♀.

"No. 1941–42. *Corythaix*, ♂ ♀; *cf.* no. 1808 et 19. This is apparently the most frequent of plantain-eaters through the Eastern forest. Always in pairs, it feeds with avidity on different fruit and berries, of which the stomach is always full. Spec. no. 1941 had in the stomach besides an olive-like fruit a small shell, probably swallowed while adhering on the fruit.

"No. 1943. *Corythaix*; *cf.* no. 1941–42, ♀ ad.

"No. 1944, 45. *Lophoceros camurus*, Cass., ♂ ♀. Common.

"No. 1946. *Estrelda*, ♂. If this is *E. nonnula*, Hartl., collected by the late Mr. Jameson at Yambuya and by Hr. Bohndorff at Stanley Falls, it is certainly different from my birds from Macraca and Monbuttu, and from its dark colour, great extension of red, colour of bill, and black vent I should surely range it with *E. atricapilla*, Verr. It differs, however, from the beautiful figure given by Capt. Shelley in having chin, throat, and sides of head more whitish; and the existence of two different species in localities so near to each other as Stanley Falls and here is scarcely to be believed. I call it, therefore, *E. nonnula* with some doubt.

"No. 1947. *Bubo*, ♂; *cf.* no. 1905. Not infrequent. Stomach: two field-mice.

"No. 1948, 49. *Spermestes poensis*, Fras., ♂ ♀. Very frequent everywhere on clearings.

"No. 1950. *Estrelda*, ♂; *cf.* no. 1946. Of the same dark colour as the above specimen; red very bright and extended; under of belly and vent black.

"No. 1951. *Prinia mystacea*, Rüpp., ♀.

"No. 1952. *Cinnyris*, ♂. A small dark bird, perhaps referable to *C. chloropygia*, Jard.

"No. 1953. *Spermestes poensis*, Fras., ♂.

"Observed: *Malimbus cristatus*; *Halcyon senegalensis*; *Diaphorophyia castanea*; *Psalidoprocne nitens*.

"No. 1954. *Corythaix*, ♂; *cf.* no. 1943. The common species; always in pairs; call, like a turtle-dove's. Very lively.

"No. 1955. *Andropadus latirostris*, Strickl., ♂ jr. Although the lower mandible is damaged by shot, an interesting specimen in so far that the malar stripes are still very faintly developed.

"No. 1956. *Terpsiphone nigriceps*, Hartl., ♂. Only the second specimen obtained. Not rare.

"Guinea-fowls rather frequent. *Corythœola* frequent. I am unable to decide if this Trogon is *Hapaloderma narina* or *H. constantiœ*.

"No. 1957. *Passer diffusus*, A. Smith, ♀. The common species.

"No. 1958. *Hapaloderma narina*, Vieill., ♂. Not unfrequent.

"No. 1959. *Centropus senegalensis*, ♂ ♀. Quills and secondaries without any dark tips, uniform brown.

"No. 1960. *Andropadus*, ♂. The commonest forest bird, the voice of which is everywhere and always heard."

The Secretary exhibited comparative drawings of the heads of two North-American Swans (*Cygnus americanus* and *C. buccinator*), of which Mr. F. E. Blaauw, C.M.Z.S., had lately received living examples in Holland, and read the following extract from a letter received from Mr. Blaauw on this subject:—

"I send you a water-colour drawing of the head of the *Cygnus americanus* which I received in a living specimen some weeks ago. For comparison I have had the head of *C. buccinator* drawn on the same paper. You will notice that the yellow part of the bill of *C. americanus* is of a *pale* yellow, more or less mixed with blackish spots; moreover, the line formed by the feathers of the front in *C. americanus* goes in a nearly straight line from the eye to the frontal base of the bill, whilst in *C. buccinator* this line first goes a little forward, before it bends upward to the front. In both birds the edge of the mandibles, especially of the lower one, near the corner of the mouth, is of a pinkish colour. The line formed by bill and head is also quite different in *C. americanus*. On the whole, *C. americanus* is of a slighter build than *C. buccinator*. The plumage in my *C. americanus* is of a *pure* white, without addition of yellow or greyish feathers on the head."

The following extracts were read from a letter addressed to the Secretary by Mr. R. Trimen, F.Z.S. (dated South-African Museum, Capetown, June 25, 1894), with reference to Dr. A. G. Butler's remarks on his paper on Butterflies from Manica:—

"With reference to Dr. Butler's remarks (P. Z. S. 1894, p. 14, footnote) on my paper descriptive of the collection of Manica Butterflies formed by Mr. F. C. Selous, I wish to note my regret that—unaware, of course, of what species had been described in Mr. Butler's then unpublished paper on Mr. Johnston's Nyasa-land collection—I should have redescribed as new *Charaxes whytei*, Butl. (as *C. selousi*), and *Castalius hypoleucus*, Butl. (as *Lycæna exclusa*). As to these two species there can be no doubt attaching to Mr. Butler's identification; but with respect to his opinion that *Cyclopides mineni*, mihi, = *Ceratrichia stellata*, Mabille, and that *Pamphila zimbazo*, mihi, = *P. ranoha*, Westw., I do not feel at all sure that the synonymy is accurate. It is true that I have not seen the type either of Mabille's or of Westwood's species, and, unfortunately, the diagnosis in each case is very brief and leaves much to be desired; but I wish to specify here the apparent discrepancies between the two insects that I have described and the respective diagnoses of Mabille's and Westwood's species.

"1. In the first place, my *Cyclopides mineni* is certainly not a *Ceratrichia*; although, as I have remarked (*l. c.* p. 72), its general aspect and markings remind one of that genus, the short (instead of very long) antennæ at once indicate a very distant relationship. M. Mabille (Ann. Soc. Ent. Belg. xxxv. p. lxv, 1891) describes his *Cer. stellata* as exhibiting 'huit points blancs vitrés' in the fore wings, and notes the position of five of them (including 'deux dans la cellule'); my *Cyc. mineni* has *ten* small but well-defined spots, including two in the discoidal cell. He adds 'dessous des ailes inférieures avec la côte rousse'; in my insect this part (including the discoidal cell) is *dull pale yellow*, 'inférieures à bord abdominal poudré de jaune'; in *Cyc. mineni all* the hind wing is yellow, 'un point blanc dans la cellule et une rangée circulaire de huit autres points semblables plus petits'; in *Cyc. mineni* the disco-cellular spot is *fuscous*, and the discal series consists of *seven white spots rather large and very conspicuous.*

"2. Westwood's diagnosis of *Pamphila ranoha* (App. Oates's Matabeleland, p. 353) agrees very fairly with my *P. zimbazo* as far as the upperside of the wings is concerned; but 'alis posticis fulvis nigro-guttatis' is not applicable to the underside in my species, which (as noted by me, *l. c.* p. 75) is *dull pale ochre-yellow*, with a tinge of olivaceous brown or less *reddish* incompletely fuscous-edged spots.

"As stated in my 'S. Afr. Butt.' (iii. p. 311), I refer *P. ranoha*, Westw., to a variety of *P. morantii*, mihi; but, until comparison with Westwood's type can be made, I admit that the identification is only provisional.

"It is to be wished that the excellent figures illustrating my paper had given the undersides of the species concerned, as in that case the differences above pointed out could be more readily observed.

"There is a small but not unimportant mistake in the figure of the underside of *Chrysorychia cruenta* (pl. vi. fig. 13), where the longitudinal white streak, which is actually a marking of the *fore wings* between the first median nervule and the submedian nervure, is depicted as a costal marking of the hind wings.

"In the figure of *Lycænesthes lunulata* (pl. vi. fig. 12) the characteristic generic character of slender tufts of hairs at the extremity of both 2nd and 1st median nervules in the hind wings—in this species white and rather conspicuous—is not indicated."

A communication received from Dr. R. W. Shufeldt, C.M.Z.S., contained the following correction to his paper "On the Affinities of the Steganopodes" (P. Z. S. 1894, p. 160):—

"Owing to the fact that I was unable to correct the proof of my paper on the *Steganopodes*, which appeared in the 'Proceedings' of the Society for 1894, an unfortunate error crept into it, which I here desire to rectify. There is no question but that the Cormorants, the Anhingas, and the Gannets, each and all, constitute good families, and my taxonomic scheme should stand as given below, instead of the way it appeared, thus:—

Superfamilies.	Families.	Genera.
Pelecanoidea	Pelecanidæ	*Pelecanus.*
	Phalacrocoracidæ	*Phalacrocorax.*
	Anhingidæ	*Anhinga.*
	Sulidæ	*Sula.*
Phaëthontoidea	Phaëthontidæ	*Phaëthon.*
Fregatoidea	Fregatidæ	*Fregata.*"

Mr. Salvin exhibited a pair of the newly described Butterfly (*Ornithoptera paradisea*, Staudinger, Iris, Dresden, vi. p. 350) from the Finisterre Mountains, German New Guinea, belonging to the Godman and Salvin collection.

Mr. Boulenger exhibited an interesting Gecko from South Africa, with the following remarks:—

"This Gecko has been sent to me by Mr. Richard T. Lewis, with the remark that it was captured during the recent winter (July 1894) on the snow upon the highest portion of the Drakensberg range, N.W. Natal, very active and apparently enjoying life on ice and snow. The fact of a Gecko being found under such circumstances is highly interesting, considering that this group of Lizards is almost entirely confined to the hotter parts of the globe, only a few species extending to the borders of the Mediterranean and to China and Japan in the Northern Hemisphere, and to New Zealand in the Southern Hemisphere. But the Lizard itself deserves special notice as belonging to a genus, *Œdura*, which, until very recently, was believed to be confined to Australia. In 1888, however, I described a South-African species from Damaraland under the name of *Œdura africana*. The present Lizard, although closely allied, differs in the smaller and more convex granules on the upper surface of the head and in the rostral shield not bordering the nostril; I propose for it the name *Œdura nivaria.* A description will be published in a forthcoming Report on additions to the Collection of Lizards in the British Museum"[1].

Mr. C. Davies Sherborn exhibited and made remarks on a copy of the reprint of George Ord's 'North-American Zoology,' recently published in the United States (Haddonfield, New Jersey, 1894).

The following papers were read:—

1. Descriptions of new Species of Coleoptera of the Genera *Œdionychis* and *Asphæra*. By Martin Jacoby, F.E.S.

[Received August 1, 1894.]

(Plate XXXVIII.)

In 1860 a Catalogue of Halticidæ was published by the Rev. Hamlet Clark, forming one of the British Museum Catalogues. With very few exceptions, no species of *Œdionychis* and its allies were described, although they amount to some 450 in number. To make a beginning I have described those species which are at present represented in my own collection, and which I have in all instances compared with the specimens contained in the British Museum and named by Clark, retaining in every case the latter author's name.

The genus *Œdionychis* almost rivals in number of species the genus *Diabrotica* amongst the *Galerucidæ*, and is as variable in the coloration as is the case with species of the latter genus. All species of *Œdionychis* can be separated from the allied genus *Asphæra* by the shape of the thorax, which has broadly flattened sides, with generally slightly outward pointed anterior angles, the same parts in *Asphæra* being straighter and produced forward, not outward; the metatarsus of the posterior legs is also in all cases very short in *Œdionychis* and the inflated terminal claw is globular. In *Asphæra* the corresponding joint is longer, and the claw is but moderately swollen; intermediate degrees I have not observed to any marked extent. With two exceptions, all the species described here are from tropical South America.

Œdionychis albipennis (Clk. Catal.).

Pale testaceous, the intermediate joints of the antennæ and the disc of the thorax black; elytra very finely punctured; a spot on the shoulder black.

Var. *a.* Obscure fuscous, the elytral spot absent, the tibiæ and tarsi black.

[1] [*Vide infrà*, p. 722.—Ed.]

Var. *b*. Thorax with the anterior and posterior margins partly black, the rest of the surface unspotted.

Length 3–3½ lines.

Head impunctate, the eyes large, the intermediate space narrower than their diameter, the frontal tubercles short and broad, bounded behind by a deep groove; antennæ slender, extending nearly to the middle of the elytra, the basal four and the apical two joints pale fulvous, the others black, the third and fourth joints equal; thorax a little more than twice as broad as long, the anterior and posterior margins nearly straight, the disc black, the sides rather strongly rounded, narrowed anteriorly, the anterior angles not produced outward, the surface impunctate, the sides rather broadly flattened; elytra very finely and closely punctured, pale testaceous, with the extreme base and an elongate spot on each shoulder black; legs streaked with black above.

Hab. Amazons, Ega.

This is a rather variable species and one of those in which the eyes are larger than the intermediate space; in the normal form the disc of the thorax is black, but in many specimens only the anterior and posterior margins are more or less marked with this colour; the femora are either spotted above with black as well as the tibiæ, or are entirely testaceous; the antennæ also vary, having sometimes the first and the last joint testaceous only, or this colour is spread over several joints.

Œdionychis tabida (Clk. Catal.).

Pale testaceous, the head, breast, and the apex of the posterior femora black; thorax impunctate; elytra closely and distinctly punctured.

Length 2¾ lines.

Head finely punctured, the vertex piceous, the labrum flavous, frontal elevations subquadrate; antennæ fuscous, the basal three joints flavous, third joint scarcely shorter than the fourth; thorax with strongly rounded lateral margins, the anterior angles acute but not produced into a tooth, the surface impunctate, the scutellum piceous; elytra very closely and rather strongly punctured throughout; abdomen and legs testaceous, the posterior femora with a piceous spot at the apex, posterior claws piceous.

Hab. Brazil.

Of this species a single specimen, named by Clark, is contained in my collection; the general colour is a uniform obscure testaceous, but the dark head, breast, and the femoral spot, as well as the very close and rather strong elytral punctuation, will separate this species from others similarly coloured.

Œdionychis nigroscutata, n. sp. (Plate XXXVIII. fig. 3.)

Robust, convex, black; head and thorax impunctate, the latter flavous with a central black spot; elytra testaceous, rather strongly punctured, the suture narrowly black.

Length 4 lines.

Of broadly robust shape, the head black, with a narrow flavous margin near the eyes, and a few fine punctures; clypeus and labrum black; antennæ not extending to the middle of the elytra, black, the third joint shorter than the fourth; thorax three times broader than long, the anterior margin deeply concave, the posterior one slightly rounded, sides strongly rounded in front, nearly straight at the base, the anterior angles thickened and produced into a short tooth pointing outward, the surface impunctate, flavous, the middle with a short irregular-shaped black spot; scutellum black; elytra strongly convex, closely and rather strongly punctured, the interstices somewhat wrinkled, testaceous, the suture narrowly black; underside and legs black.

Hab. Brazil, Sta. Catharina.

From the species having uniform pale elytra, the present one may be known by the black suture, the spot on the thorax, and the black head.

Œdionychis discicollis (Clk. Catal.).

Black, the margins round the eyes, the basal joints of the antennæ, and the margins of the thorax testaceous; elytra very finely punctured, testaceous or flavous, the suture, two elongate spots at the base, a transverse spot below the middle and another near the apex black; the base of the anterior femora and tibiæ flavous.

Var. Thorax testaceous, with a black spot on the posterior margin.

Length $2\frac{1}{4}$ lines.

Head impunctate, piceous or black, the margins round the eyes, the clypeus, and the palpi testaceous; frontal tubercles transverse, strongly raised; antennæ black, the lower two or three joints testaceous, third and fourth joints elongate, equal; thorax three times broader than long, short and nearly parallel, the sides rounded in front, straight at the base, the anterior angles not produced outward, the surface impunctate, testaceous, with a transverse black band across the disc, the anterior margin of which is indented at the middle, the sides of this band extend as far as the flattened portion of the thorax; scutellum black; elytra extremely finely punctured (the punctures in some specimens scarcely perceptible), testaceous, the suture, two spots at the base (sometimes confluent), a subquadrate larger spot below the middle, and another smaller one near the apex black, none of these spots extend quite to the sutural or lateral margin; elytral epipleuræ testaceous; underside and legs black, the greater part of the base of the four anterior femora and their tibiæ flavous.

Hab. Brazil, Therezopolis.

Allied to *O. spilota*, Baly, but differing in the colour of the thorax and the nearly impunctate elytra.

Œdionychis evanida (Chevr. *in litt.*).

Black, the lower portion of the face and the thorax fulvous, the latter impunctate; elytra very finely punctured, flavous, a triangular spot surrounding the scutellum, a small spot on the shoulder, and a narrow transverse band before the apex black.

Length 3 lines.

Head impunctate, black, the lower part flavous, frontal tubercles obliquely transverse, strongly raised, carina short and convex; antennæ rather slender, black, the lower three joints obscure fulvous, third and fourth joints equal; thorax parallel, the anterior and posterior margins straight at the middle, the sides rounded, thickened as well as the anterior angles, which are not produced outwards, the surface impunctate, shining, fulvous, the base with an obsolete transverse sulcus; scutellum black; elytra very minutely punctured, with a narrow flattened margin, flavous, the base with a narrow transverse black band which widens at the suture into a triangular spot and terminates at the shoulders in a small spot, another narrow band is placed at a little distance from the apex, the sutural margin also is narrowly marked with black, neither of the transverse bands extends quite to the lateral margins; underside and legs black.

Hab. Brazil.

Closely allied to *Œ. faceta*, Har., but in that species the head is entirely black, the thorax is of entirely different shape and has a black spot, and the elytral bands are purplish violaceous.

ŒDIONYCHIS DILECTA (Chevr. *in litt.*).

Fulvous; antennæ (the basal joints excepted) black; head with one, thorax with two black spots, impunctate; elytra closely and strongly punctured, a broad transverse band at the base and the posterior half metallic blue, the lateral margin fulvous.

Length $2\frac{3}{4}$ lines.

Head impunctate, fulvous, the vertex black, the space between the eyes depressed, with some punctures; antennæ with the three lower joints fulvous, the others black, third and fourth joints equal; thorax more than twice as broad as long, the sides straight at the base, strongly rounded before the middle but scarcely narrowed anteriorly, the anterior angles tuberculiform, the surface smooth, shining, fulvous, the disc with two black oblique spots; scutellum black; elytra convex, with a narrow flattened margin, very closely and distinctly punctured, the punctures stronger anteriorly near the suture than posteriorly, the base slightly raised, the blue bands interrupted at the middle by a narrow fulvous band and not extending laterally to the margins, the posterior margin of the basal band sinuate, the anterior margin of the posterior band convex; underside and legs fulvous.

Hab. Constancia, Brazil (*Gray*).

ŒDIONYCHIS QUADRIPUSTULATA (Clk. Catal.). (Plate XXXVIII. fig. 7.)

Rather narrow and elongate, ferruginous; antennæ (the basal joints excepted) black; thorax pale flavous, with a ferruginous spot anteriorly; elytra closely and distinctly punctured, pale flavous, the lateral and sutural margin, a transverse band at the base, and another below the middle ferruginous.

Length $2\frac{1}{2}$ lines.

Head impunctate, ferruginous, shining, the frontal elevation scarcely raised, the carina acute; antennæ short, black, the lower two joints more or less flavous, the fourth joint very elongate, quite double the length of the third, the following joints short, equal; thorax but slightly narrowed anteriorly, the sides nearly straight, the anterior angles not produced outward, the surface impunctate, yellowish white, the anterior margin with a ferruginous spot at the middle; scutellum fulvous; elytra closely and rather strongly punctured, of the same colour as the thorax, the base with a narrow transverse brown band, which is connected by the lateral and sutural margins with a similar band below the middle, these bands have a slight tinge of purple; if the dark colour is taken for that of the ground, the elytra may be described as brown with a large discoidal ovate spot and the apex whitish; underside and legs ferruginous, tibiæ and tarsi rather darker.

Hab. Sta. Catharina, Rio Janeiro, Brazil; also Bolivia.

ŒDIONYCHIS CRUCIFERA, n. sp. (Dej. *in litt.*).

Black; thorax flavous, impunctate; elytra finely punctured, metallic blue, a rounded spot at the base and a more transverse one below the middle, not extending to either margin, flavous.

Length $3\frac{1}{2}$ lines.

Head entirely black, scarcely punctured; antennæ nearly extending to the middle of the elytra, black, the intermediate joints slightly widened, the third joint only half the length of the fourth; thorax three times broader than long, flavous, the sides broadly flattened, bounded within by a deep longitudinal groove, the lateral margins rounded in front, the anterior angles dentiform, the surface impunctate; scutellum black; elytra widened at the middle, broadly margined, the shoulders prominent, bounded within by a deep depression, very finely punctured, the apex impunctate; underside and legs black, the last abdominal segment of the male with a broad, rounded, and produced medial lobe.

Hab. Brazil.

If the flavous colour of the elytra is taken as the ground-colour, the blue portion extends across the middle in shape of a narrow and somewhat oblique band, and a triangular patch is placed at the apex, all the margins are also narrowly blue; the epipleuræ are flavous within, bluish at the outer margin. The species named by Clark *Œ. murrayi*, in his Catalogue, does not differ from the present one except in the black, not blue, elytral markings.

ŒDIONYCHIS CRUX-NIGRA (Chevr. *in litt.*).

Black; thorax flavous, impunctate; elytra rather closely and strongly punctured, flavous, the base, suture, a lateral stripe extending to the middle, and connected with a transverse narrow band below the middle, metallic violaceous.

Length $3\frac{1}{2}$ lines.

Head black, impunctate, frontal elevations piceous; antennæ not extending to the middle of the elytra, black, third and fourth joints equal; thorax about twice and a half broader than long, the sides strongly rounded and broadly flattened, the anterior angles produced into a short tooth, the surface impunctate, flavous; scutellum black; elytra slightly widened towards the middle, rather closely and strongly punctured, flavous, the basal margin, the suture, a transverse narrow band below the middle, and an equally narrow stripe near the lateral margin violaceous blue, all these stripes are connected with each other; underside and legs black.

Hab. Brazil.

Not unlike *Œ. crucifera* in design and colour, but the transverse elytral stripe in that species is placed before, not below, the middle, and the entire lateral margin is of a blue colour.

Œdionychis beatula, n. sp. (Clk. Catal.).

Ovately rounded, short, piceous below; vertex of head black; thorax flavous, impunctate; elytra nearly impunctate, flavous, a broad transverse band at the base and another equally broad one at the posterior half dark violaceous.

Length $2\frac{1}{2}$ lines.

Head impunctate, the vertex nearly black, lower part of the face flavous, labrum black; antennæ with slender joints, black, the lower three flavous, third and fourth joints equal (last three joints wanting); thorax more than twice as broad as long, the sides but moderately rounded in front, the anterior angles produced into an acute point or tooth, the surface impunctate, flavous; scutellum black; elytra strongly widened at the middle, almost impunctate, the surface somewhat uneven, the anterior portion with a broad transverse violaceous band not extending to the lateral margins, its posterior edge rather rounded and not reaching quite to the middle of the elytra, a narrow flavous band separates it from another broad violaceous patch of similar shape not extending to the apex nor the sides; underside obscure piceous, posterior femora and the abdomen of mottled appearance, partly obscure fulvous.

Hab. Amazons.

The nearly impunctate elytra and the narrow flavous band dividing the two darker ones at the middle will help to distinguish this species from several nearly similarly coloured forms.

Œdionychis quadriplagiata (Clk. Catal.).

Black, the head greenish black at the vertex; thorax flavous, nearly impunctate; elytra finely punctured, flavous, with a transverse bluish band at the base extending nearly to the middle, and another band below the latter not extending to the apex nor the margins, the lower edge of the posterior band emarginate at the apex.

Length $2\frac{1}{2}$–$3\frac{1}{2}$ lines.

Head greenish black at the vertex, with some punctures near the eyes, the space surrounding the latter and the lower portion of the face flavous; labrum black; antennæ short, reaching only to the base of the elytra, black, the apical joint obscure fulvous, the basal joints stained with testaceous at the apex, the fourth joint very slightly longer than the third; thorax nearly three times as broad as long, the sides straight at the base, rounded in front, the anterior angles produced outward into a tooth, the surface with a few minute punctures, the sides broadly flattened; scutellum black; elytra convex, nearly parallel, the lateral margins narrowly and a transverse straight narrow band at the middle as well as the apex flavous, the rest of the surface occupied by two broad transverse metallic blue bands, the lower edge of the posterior band emarginate near the apical angle, the punctuation very fine, more strongly marked in the flavous portion; underside and legs black.

Hab. Brazil.

Closely allied in coloration to several other species, notably to *Œ. honesta*, Illig., *Œ. eburata*, Germ., *Œ. bifasciata*, Baly, and *Œ. steinheili*, Jac., but differing from *Œ. honesta* in the shape of the posterior blue elytral band, which does not extend to the lateral margins as is the case in the last-named species, and in the black colour of the legs: *Œ. eburata* is described as having a black hind margin to the thorax and black elytral bands; *Œ. bifasciata* has a fulvous underside and legs as well as similarly coloured head; *Œ. steinheili* is much larger and differs likewise in the colour of the head, antennæ, and underside; while *Œ. blanda*, Har., has only the base and the apex of the elytra blue. In the present species the blue elytral bands are divided by a perfectly straight fulvous band at the middle, which is half the length of the dark band at the base; the emargination of the posterior band near the apex will further help to distinguish *Œ. quadriplagiata*, in one specimen the flavous central band does not quite reach the suture.

ŒDIONYCHIS CENTURIO (Clk. Catal.).

Flavous, the base of the head and the antennæ (the basal joints excepted) black; thorax flavous, impunctate; elytra finely punctured, a transverse band at the base, another below the middle, and the extreme apex metallic blue.

Length 2 lines.

Head with a few deep punctures on the vertex, bluish black, the lower part of the face flavous; antennæ black, the lower three joints obscure fulvous, third and fourth joints equal; thorax twice and a half broader than long, the sides moderately rounded, very obsoletely angulate at the middle, the anterior angles dentiform, the surface impunctate, flavous, very obsoletely sulcate near the base; scutellum black; elytra closely and finely punctured, flavous, a broad transverse band at the base, not extending to the sides and anteriorly as far as the shoulders, an equally broad band below the middle touching the lateral margins and the apex, metallic blue; the epipleuræ, underside, and legs flavous, the femora rather darker, the tarsi piceous.

Hab. Colombia.

A small species, differing from somewhat similar coloured ones by the blue apex of the elytra; the flavous bands dividing the metallic colour are narrow, but the central band is wider than that which separates the posterior band from the apical spot.

Œdionychis trimaculata (Clk. Catal.).

Black, the clypeus flavous; the thorax impunctate, flavous; elytra convex, testaceous, closely punctured and finely rugose, a transverse band at the base and a subtriangular spot below the middle bright metallic blue.

Length 4 lines.

Head bluish black, sparingly but distinctly punctured, the clypeus flavous; antennæ black, the third and fourth joints equal, terminal joints shorter; thorax with very strongly rounded sides, flavous, the anterior angles produced but not dentiform, the surface impunctate, the sides flattened; scutellum black; elytra convex, rugose and closely punctured, testaceous, the base with a transverse light blue band, not extending to the lateral margins, and a large subtriangular spot of the same colour and transverse shape near the apex; underside and legs black.

Hab. Colombia.

Principally distinguished by the rugosely punctured elytra.

Œdionychis osculans (Clk. Catal.).

Black, the sides of the head testaceous; thorax very minutely punctured, testaceous, the disc with three black spots; elytra very finely and closely punctured, testaceous, a sutural, two discoidal, and a sublateral stripe violaceous.

Length 4 lines.

Head greenish black, the space surrounding the eyes flavous, strongly punctured, labrum partly flavous; antennæ black, the extreme base of the first joint flavous, third joint much shorter than the fourth; thorax nearly three times broader than long, the sides nearly straight at the base, rounded in front, the posterior margin evenly rounded, the anterior angles tuberculiform, the surface very minutely punctured, testaceous, a large spot at each side and a small spot at the middle of the base greenish black; scutellum greenish; elytra extremely finely punctured, with four narrow longitudinal stripes, a sutural one, two at the disc, joined at the apex but not extending to the latter, and a sublateral broader stripe which joins the sutural one at the apex; elytral epipleuræ flavous; underside and legs black.

Hab. Rio Grande, Brazil.

A great many species of *Œdionychis* with longitudinal dark stripes have been described, principally by von Harold, but I am not able to identify with either of them the present species, which perhaps is most nearly allied to *Œ. inconstans*, Schauf., and *Œ. formosa*, Har.; none of these or others have, however, three longitudinal stripes on each elytron besides the sutural one as is the case in *Œ. osculans*; there are besides this other differences which must be compared in the descriptions; my specimen agrees entirely with the one contained in the British Museum and which served Clark for his type.

ŒDIONYCHIS INTERSIGNATA, n. sp. (Chevr. *in litt.*).

Very convex, black; thorax impunctate, the sides flavous; elytra very finely punctured, metallic violaceous, a transverse band at the middle, not extending to the suture, and a spot at the apex flavous.

Length $3\frac{1}{2}$ lines.

Head black, impunctate, shining; the antennæ extending only to the base of the thorax, black, the third joint shorter than the fourth; thorax more than twice as broad as long, the sides strongly rounded, the anterior angles tuberculiform, the surface impunctate, shining, black, the sides as far as the flattened portion flavous; scutellum black; elytra very convex, finely and closely punctured, of a dark purplish violaceous colour, a broad transverse band at the middle, interrupted by the suture, and a subtriangular spot at the apex bright flavous; epipleuræ violaceous within, flavous at their outer margin; underside and legs black, shining.

Hab. Surinam.

Not unlike *Œ. libentina*, Germ., in coloration, but larger, more convex, the elytral band much narrower and not extending to the suture.

ŒDIONYCHIS OBLONGA (Clk. Catal.)

Fulvous, the apical joints of the antennæ black; thorax impunctate; elytra fulvous, impunctate, a broad transverse band at the base and another below the middle, not extending to the sides, violaceous blue.

Length 3 lines.

Head entirely impunctate, fulvous, the frontal elevations not strongly raised, carina short and thick; antennæ extending to the middle of the elytra, the lower four or five joints fulvous, the others nearly black, fourth joint very elongate, slightly longer than the fifth, third joint scarcely half the length of the fourth; thorax about twice and a half broader than long, the sides rather evenly rounded, with the usual flattened margins, the surface entirely impunctate, with a narrow transverse impressed line or sulcus near the base, anterior angles rather acutely pointed; scutellum fulvous; elytra pale fulvous, entirely impunctate, the base with a broad transverse violaceous band extending nearly to the middle but not to the sides, the posterior margin of this band obliquely rounded at the latter place, a similar band is placed below the middle, the outer margins of this band are also rounded and do not quite extend to the sides or the apex; underside and legs fulvous, clothed with fine yellowish pubescence.

Hab. Amazons.

Œdionychis pulchella (Chevr. *in litt.*).

Black, the clypeus and thorax flavous, the latter impunctate; elytra finely and very closely punctured, fulvous, a narrow transverse band at the base, the suture, and a broad band below the middle, nearly extending to the apex, metallic blue.

Length $2\frac{3}{4}$ lines.

Head rather closely punctured at the vertex, bluish black, the frontal tubercles oblique, the carina indistinct; clypeus flavous; antennæ extending to the middle of the elytra, black, the lower three joints flavous below, the third joint distinctly shorter than the fourth; thorax with rounded sides, rather strongly narrowed in front, the anterior angles produced into a small tooth, posterior margins straight, the surface impunctate, flavous; scutellum black; elytra finely but distinctly and very closely punctured, the suture, connected with and widened at the base into a narrow transverse band which does not quite extend to the sides, and a broad and nearly straight band immediately below the middle, extending to the sides but not to the apex, metallic blue; epipleuræ flavous; underside and legs black, abdomen partly testaceous at the middle.

Hab. Venezuela.

If the blue colour of the elytra is taken for that of the ground, they may be described as metallic blue, with a broad transverse fulvous band, not extending to the suture, commencing directly below the base and extending to the middle, and a small fulvous spot at the apex; the anterior edge of the fulvous band is very convex and obliquely rounded towards the suture; the blue colour forms a triangular patch at the suture at the base and narrows to a band near the shoulders; the anterior margin of the posterior blue band is nearly straight, the posterior margin rounded.

Œdionychis cyaneo-fasciata, n. sp.

Black, the clypeus flavous, basal joints of the antennæ fulvous; thorax flavous; elytra minutely punctured, flavous, a broad transverse band at the base and a similar band below the middle dark blue.

Length 3 lines.

Head black, shining, with a few punctures near the eyes, the latter widely separated, the frontal tubercles rather flat, subquadrate; the clypeus flavous, labrum and palpi piceous; antennæ fuscous, the basal five or six joints fulvous, third joint distinctly shorter than the fourth; thorax bright flavous, the sides nearly straight, flattened as usual, the anterior angles acutely produced into a tooth, pointing outwards, the posterior margins somewhat rounded, the surface convex, flavous, with a few minute punctures when seen under a strong lens; scutellum black; elytra extremely finely punctured, the posterior portion impunctate, the blue transverse bands very broad, of equal width and not extending to the lateral nor apical margin, the anterior band with a short but deep indentation in front of the humeral callus, the posterior band emarginate near the suture at the apex; underside and legs black, tibiæ piceous.

Hab. Bolivia.

Narrower in shape than *Œ. steinheili*, Jac., the head and underside differently coloured, the elytral bands of different shape. *Œ. quadriplagiata*, Jac., has more strongly punctured elytra, differently coloured antennæ, a much broader thorax, and no emarginate anterior blue band of the elytra; the finely punctured elytra and shape of the bands distinguish the species also from *Œ. ornamentalis*, Har.

ŒDIONYCHIS NIGRONOTATA, n. sp.

Testaceous; the head, the intermediate joints of the antennæ, and the scutellum black; thorax impunctate; elytra finely punctured, testaceous, a transverse stripe at the middle, two spots at the base, and two others near the apex black.

Length 3 lines.

Head black, sparingly and finely punctured, frontal tubercles subquadrate, palpi testaceous; antennæ with the basal four and the apical three joints testaceous, the others black, third joint very slightly shorter than the fourth; thorax narrowed in front, the posterior margin straight, the anterior one semicircular, the anterior angles acutely pointed but not produced outwards, the sides broadly flattened, the surface impunctate, pale testaceous; scutellum black; elytra very closely and finely punctured, coloured like the thorax, with the following black spots—an elongate spot on the shoulder, a small round one near the scutellum, two small spots placed transversely below the middle, and a narrow transverse band at the latter place not extending to either margin; underside black, the legs and the sides of the abdominal segments testaceous, the posterior femora with a black spot at the apex.

Hab. Brazil.

Of this species I possess a single specimen, without exact locality: the pale ground-colour, that of the antennæ, and the position of the elytral spots will help in the recognition of the species.

ŒDIONYCHIS PALPALIS, n. sp.

Pale fulvous, the head and part of the breast black, palpi incrassate, thorax impunctate; elytra extremely finely punctured, a bifurcate band at the base and a transverse curved band near the apex black.

Length $3\frac{1}{2}$ lines.

Head black, impunctate; the eyes very large, larger than the space dividing them; frontal tubercles and carina strongly raised, the penultimate joint of the palpi strongly incrassate; antennæ long, fulvous, the third joint much shorter than the fourth; thorax scarcely more than twice as broad as long, narrowed anteriorly, the anterior angles produced outwards into a small tooth, the surface impunctate, flavous; scutellum flavous; elytra extremely finely punctured, flavous or obscure fulvous, with an elongate bifurcate black mark, placed on the shoulder and near the suture, open at its lower end, and a transverse narrow and slightly curved band near the apex not extending to either margin; underside and legs pale fulvous.

Hab. Amazons.

The strongly thickened palpi, the narrow space between the eyes, long antennæ, the comparatively narrow thorax, and the shape of the elytral markings well distinguish this species; the spot at the base of the elytra consists of two short longitudinal stripes, joined at the base, one of which is placed on the shoulder, the other near the suture, the first of these is slightly longer than the sub-sutural one, but both are rather thick.

ŒDIONYCHIS CHAPUISI, n. sp.

Testaceous, antennæ and legs fulvous, vertex of the head black; thorax impunctate; elytra scarcely perceptibly punctured, a transverse band at the base and another one below the middle, connected with a triangular spot at the apex, bluish black.

Length $2\frac{3}{4}$–3 lines.

Head impunctate, blackish at the vertex, the clypeus and labrum flavous; antennæ extending to the middle of the elytra, fulvous, the third joint slightly shorter than the fourth; thorax with strongly rounded sides, the anterior and posterior margins straight, the lateral margins narrowly thickened, the anterior angles not dentiform and but little produced, the surface impunctate; scutellum piceous; elytra nearly impunctate, slightly depressed below the base near the suture, with a narrow flattened margin, the transverse bands broad, only divided by a narrow band of the ground-colour, and not extending to the sides but to the suture, the anterior margin of the posterior band obliquely cut near the suture, the posterior margin connected at the suture with a triangular-shaped spot which occupies the apical angle; legs rather darker than the underside, the femora with an obscure piceous spot at the apex.

Hab. Amazons.

From most of the transversely banded species *Œ. chapuisi* may be known by the extra triangular-shaped spot at the apex of the elytra, which is connected by a narrow sutural stripe with the posterior band. *Œ. labiata*, Schauf., seems to be a closely allied species, but is said to have a distinctly punctured head and elytra, which is not the case here, both in *Œ. chapuisi* being nearly entirely impunctate; the elytral bands in *Œ. labiata* are further described as being interrupted at the suture, in the present insect they extend entirely across the latter place. Three specimens contained in my collection show no differences in these respects, but in a fourth the pale narrow space which divides the elytral bands does not quite extend to the suture. Whether another specimen from Bolivia which I possess, and which has the elytral bands more distantly apart, represents the same species, it would not be safe to say; this specimen agrees otherwise with those from the Amazons, but has a black underside and legs, beside the other difference pointed out.

ŒDIONYCHIS SEMIDIVISA, n. sp.

Flavous, the base of the head black, antennæ and legs dark fulvous, thorax impunctate; elytra closely and finely punctured, a subquadrate patch at the base and a more elongate one, more or less indented at the posterior portion, dark violaceous.

Length $2\frac{1}{2}$–3 lines.

Head with a few punctures near the eyes, the vertex black, the margin in front of the eyes and the clypeus flavous, labrum black; antennæ extending nearly to the middle of the elytra, dark fulvous, the third and fourth joints equal; thorax three times broader than long, flavous, the sides rounded, the anterior angles slightly produced outwards, the surface rather convex, flavous, shining; scutellum black; elytra very closely and finely punctured, flavous, a large subquadrate patch at the base not extending to either margin and indented at its anterior margin at the shoulders, violaceous black, this patch is followed immediately below the middle by a similar but a more elongate patch, which is sometimes strongly constricted at the middle, or if entire encloses a small spot of the ground-colour.

Hab. Peru.

From other nearly similarly coloured species the present one may be distinguished by the shape of the elytral markings, the anterior one of which shows a short encroachment of the ground-colour near the shoulders, and the posterior mark a semi-division at the middle in one specimen or an inclination to divide in the other. I believe that the shape of these markings and their dark violaceous colour constitute a specific distinction; none of the dark patches quite extend to either margin, but are divided at the middle by a very narrow band of the ground-colour.

The species seems allied to *Œ. biloba*, Illig.

ŒDIONYCHIS JAMAICENSIS, n. sp.

Flavous; antennæ robust, thorax strongly transverse, impunctate; elytra entirely impunctate, metallic violaceous blue.

Length 4 lines.

Head impunctate, flavous, shining, depressed between the eyes, the frontal elevations obsolete; palpi strongly thickened; antennæ robust, flavous, the third and fourth joints nearly equal; terminal joints slightly darker; thorax nearly four times broader than long, the sides strongly rounded, the anterior angles strongly thickened, but not produced, the sides with a comparatively narrow flattened margin, the surface shining, impunctate; elytra convex, with a short obsolete depression below the base, strongly convex, entirely impunctate, of a bright metallic violaceous colour; underside and legs flavous.

Hab. Jamaica.

Œ. jamaicensis is readily distinguished by its very transversely shaped thorax and the entirely impunctate and violaceous elytra.

It is the only species known to me from Jamaica.

Œdionychis princeps (Clk. Catal.). (Plate XXXVIII. fig. 4.)

Widened posteriorly, black; thorax impunctate, black, the sides flavous; elytra metallic blue, rugose and finely punctured, the apex flavous.

Length 3 lines.

Head with a few fine punctures, blackish, the eyes rather closely approached, frontal elevations oblique, clypeus flavous; antennæ slender, extending beyond the middle of the elytra, black, the fourth joint slightly longer than the third, all the joints rather elongate and pubescent; thorax strongly narrowed in front, the sides moderately rounded, the anterior angles thickened but scarcely produced outwards, the disc impunctate, black, the lateral margins flavous, posterior margin perfectly straight; scutellum black; elytra rugose and finely punctured, metallic blue, a triangular spot at the apex flavous, the outer edge of the epipleuræ flavous, the inner portion black; underside and legs black.

Hab. Brazil or Bogotá.

Clark gives Brazil as the habitat of this species; a specimen in my collection has Bogotá as the locality attached to it, but I am unable to say whence I obtained it. The species may be recognized by the rugose elytra and the colour of the thorax.

Œdionychis peruviana, n. sp.

Flavous, the intermediate joints of the antennæ black; head and thorax impunctate; elytra extremely finely punctured, bluish black, the apex flavous.

Length 3 lines.

Head flavous, impunctate, rather flattened, the frontal elevations feeble; the antennæ not extending to the middle of the elytra, the lower four joints and the apical one flavous, the others black, third and fourth joints equal; thorax much narrowed at the middle, the sides strongly widened, their margins nearly straight, the anterior angles acutely produced but not dentiform, the surface impunctate, flavous; scutellum black; elytra widened at the middle, the disc extremely finely and rather closely punctured, bluish black, the extreme apex in shape of a narrow transverse band, flavous; elytral epipleuræ, the underside, and legs flavous.

Hab. Peru.

Allied in coloration to *Œ. högei*, Jac., but the antennæ are of different colour, the thorax differently shaped, and the elytra of a blackish blue.

Œdionychis beskii (Clk. Catal.).

Black, the sides of the head and the thorax flavous; elytra black, finely punctured, the extreme lateral margin and a spot at the apex flavous.

Length 3 lines.

Head black, the extreme base with a few punctures, the space surrounding the eyes and the sides of the clypeus flavous; antennæ not extending to the middle of the elytra, black, the lower three joints and the apical one obscure piceous; thorax rather strongly convex, three times broader than long, the sides strongly rounded in front, the anterior angles not produced outwards, the sides with a broadly flattened margin, posterior margin sinuate at each side, the surface impunctate, flavous; scutellum black; elytra very finely but not very closely punctured, with a double row of deeper punctures within the shoulders, black, the extreme and thickened lateral margin, as well as the epipleuræ and a rounded spot at the extreme apex, flavous; some rows of deeper punctures also accompany the lateral margin; underside and legs black; sparingly pubescent.

Hab. Brazil.

Allied in coloration to *Œ. extrema*, Har., from Mexico, but in that species the thorax has mucronate angles, the epipleuræ within as well as the underside and legs are piceous, and the elytra are blue.

ŒDIONYCHIS APICATA (Clk. Catal.). (Plate XXXVIII. fig. 9.)

Black, the sides of the thorax flavous, the surface impunctate; elytra dark violaceous or purplish, impunctate, the apex with a round flavous spot.

Length 3 lines.

Head impunctate, black, shining, the frontal elevations entirely wanting, carina acute, palpi flavous; the antennæ not extending to the middle of the elytra, black, the first joint stained with fulvous, the apical one entirely of that colour, the second and third joints very short, subequal; thorax with the anterior margin deeply concave, the anterior angles very prominent but not produced outwards, the sides evenly rounded, the surface impunctate, black, shining, the sides broadly pale flavous; scutellum black; elytra obscure metallic purplish or violaceous, impunctate, the apex of each elytron with a round flavous spot; underside and legs black.

Hab. Brazil.

This species may not only be recognized by its coloration, but by the absence of any frontal elevations on the head and by the short second and third joints of the antennæ.

ŒDIONYCHIS MOROSA, n. sp.

Black, opaque, impunctate, thorax and elytra narrowly margined with flavous.

Length 3 lines.

Of a uniform black, opaque colour; the head impunctate, the frontal tubercles narrowly transverse; the antennæ black, short, the third and fourth joints equal; thorax twice as broad as long, the sides rounded in front, straight at the base, anterior angles produced forwards, without acute tooth, rather blunt, the surface entirely impunctate, black, opaque, all the margins narrowly flavous, the sides but narrowly flattened; scutellum black; elytra without any punctuation, of exactly similar coloration as the thorax; underside and legs black.

Hab. Rio Grande do Sul, Brazil.

This species will be easily known by the sombre coloration, the proportionally long thorax, and the entire absence of any sculpturing.

Œdionychis fasciaticollis (Clk. Catal.). (Plate XXXVIII. fig. 5.)

Black or piceous; thorax fulvous, with a transverse black band, impunctate; elytra flavous, a transverse band at the base, angulate at the shoulders, another broader band below the middle, widened at the suture, and a spot at the apex black or fulvous.

Length 3 lines.

Head with a few fine punctures between the eyes, black, rather flattened, the frontal elevations obsolete, carina short and thick; antennæ extending to the base of the elytra, black, the basal three joints dark fulvous, third joint slightly longer than the second but a little shorter than the fourth joint; thorax with the anterior and posterior margins rounded, parallel, the sides strongly rounded, the anterior angles slightly produced outwards, the surface impunctate, fulvous with a black transverse band, not extending to the sides, the edges of this band irregularly notched; scutellum black: elytra wider at the base than the thorax, widened at the middle, finely and closely punctured, flavous, with a narrow transverse black band at the base which turns downwards at the shoulders to about one third the length of the elytra, but does not extend to the lateral margin; another broader band is placed below the middle, this band extends quite to the sides, widens at the suture, and has the anterior and posterior margins deeply sinuate or dentate, it is connected by the suture with a small spot at the extreme apex: underside and legs black.

Hab. St. Paulo, Brazil, also Bolivia.

The band at the thorax is in some specimens divided into two spots, and the elytral bands may be of bluish-black or fulvous colour; their shape and position will help to distinguish the present species from others having transverse bands.

Œdionychis brunneofasciata, n. sp. (Plate XXXVIII. fig. 8.)

Below fulvous, above testaceous, head fulvous; thorax scarcely perceptibly punctured, testaceous; elytra very finely and closely punctured, testaceous, two elongate spots at the base and a transverse band at the middle, not extending to the sutural or lateral margin, pale brown.

Length 4 lines.

Head fulvous, shining, with a few punctures near the eyes and a deep transverse groove between the latter, frontal tubercles transverse, strongly raised, carina and clypeus also strongly swollen;

antennæ fulvous or fuscous, the third joint slightly shorter than the fourth; thorax strongly transverse, the sides straight at the base, strongly rounded in front, the anterior angles produced outwards into a short somewhat truncate tooth, the surface with a few extremely minute punctures, testaceous; scutellum fulvous; elytra closely and finely punctured, pale testaceous, an elongate spot on the shoulders, a more rounded one at the suture near the scutellum, and a transverse band at the middle pale fulvous; underside and legs dark fulvous or piceous.

Hab. Bolivia.

ŒDIONYCHIS FUSCOANNULATA, n. sp. (*nigropunctata*, Clk. Catal.). (Plate XXXVIII. fig. 6.)

Dark fulvous; thorax flavous, with a few fine punctures; elytra closely and strongly punctured, chestnut-brown, each with six flavous spots margined with black (1.2.2.1).

Length 4 lines.

Of strongly convex shape, the head punctured near the eyes, fulvous, frontal tubercles transverse, labrum piceous; antennæ short, black, the lower three joints fulvous, third joint slightly longer than the fourth, the following joints equal; thorax scarcely narrowed in front, the sides straight at the base, rounded anteriorly, anterior angles slightly produced outwards, the surface with a few fine punctures, flavous; scutellum fulvous; elytra rather strongly and very closely punctured, chestnut-brown, a round spot at the middle of the base, two before and two below the middle, placed transversely and slightly oblique, and another spot at the apex, flavous, margined with fuscous; underside and legs dark brown, pubescent.

Hab. Bahia.

The position, number, and the colour of the elytral spots will distinguish this species; the name of *nigropunctata* given by Clark being misleading, I have altered it.

ŒDIONYCHIS MULTOMACULATA (*brunneicollis*, Clk. Catal.).

Black; thorax flavous, with seven black spots; elytra black, with a very narrow discoidal and lateral flavous stripe, connected at the apex by a small transverse branch, opaque, nearly smooth.

Length $2\frac{1}{2}$ lines.

Head greenish black, coarsely punctured round the eyes; antennæ very short, black, the third joint only half the length of the fourth; thorax more than twice as broad as long, pale flavous, very finely and sparingly punctured, the sides strongly rounded, with a narrow flattened margin, the anterior angles not produced into a tooth, the disc with four black spots placed transversely, another one near the base at the middle and a smaller spot at each side, there are also two narrow black markings at the sides of the anterior margin; scutellum and elytra bluish black, opaque, nearly impunctate except at the base, where a few very minute punctures are visible, a narrow longitudinal stripe near the suture from the base to the apex, the extreme lateral margin joining the other stripe at the apex, flavous, these stripes are further connected by a very short transverse band near the apex which includes a spot of the ground-colour; elytral epipleuræ black within, flavous at the outer edge; underside and legs black.

Hab. Brazil.

The many-spotted thorax, the opaque colour of the elytra, and the apical markings will separate this species from its allies. The name of *Œ. brunneicollis* given to this species by Clark having no reference to it, I have altered it.

Œdionychis advena (Clk. Catal.).

Entirely obscure testaceous, the head and thorax impunctate; elytra closely punctured, with an obsolete longitudinal discoidal stripe not extending to the apex and another extremely faint stripe nearer the suture.

Length 1½ line.

A very small species of unattractive appearance, obscure testaceous or fulvous, the head impunctate, the antennæ fuscous, the lower three or four joints obscure fulvous; thorax rather more than twice as broad as long, the sides but slightly rounded, the anterior angles thickened but not produced, the surface with a rather distinct transverse sulcus near the base, impunctate or with a few very fine punctures; elytra very closely and rather strongly punctured, the shoulders prominent, the disc with an obscure piceous stripe not quite extending to the apex and a similar but scarcely perceptible stripe near the suture; epipleuræ, underside, and legs coloured as above.

Hab. Brazil, Rio Janeiro.

Clark was uncertain as to the habitat of this species, but two specimens named by Clark and formerly contained in the Baly collection are labelled Rio Janeiro.

Œdionychis turpis (Clk. Catal.).

Black, the sides of the thorax and the base of the femora flavous; thorax nearly impunctate; elytra extremely minutely punctured, flavous, the extreme apex black.

Length 2½ lines.

Head impunctate, the vertex shining, black, eyes large, frontal elevations transverse, strongly raised, carina acute, convex, the clypeus and the labrum flavous; antennæ rather slender, black, the lower three joints flavous below and partly above, third and fourth joints equal, the eleventh with a short appendage or twelfth joint; thorax three times broader than long, the sides very strongly rounded and flattened, the anterior angles not produced outward; the disc black, shining, very minutely punctured when seen under a strong lens, the sides, as far as the flattened portion, flavous;

scutellum black; elytra very closely and slightly more strongly punctured than the thorax, widened at the middle, with a narrow flattened margin, flavous, the extreme apex with a transverse black spot; below black, the prosternum and the base of all the femora flavous.

Hab. Upper Amazons.

ŒDIONYCHIS PARDALIS, n. sp. (Plate XXXVIII. fig. 1.)

Dark fulvous, the vertex, antennæ, the scutellum, and the tibiæ blackish; thorax extremely minutely punctured; elytra closely and strongly punctured, fulvous, a spot on the shoulders, another near the scutellum, a transverse spot below the middle, and two small ones near the apex, black.

Length 4 lines.

Head punctured round the eyes, the vertex greenish black, the lower portion fulvous, labrum and palpi piceous; antennæ black, joints three and four nearly equal; thorax three times broader than long, the sides straight at the base, rounded in front, the anterior angles slightly dentiform, the sides broadly flattened, the surface very finely punctured, only visible under a strong lens; scutellum black; elytra rather strongly and closely punctured, each with five small black spots, of which one is placed on the shoulder, another near the suture below the scutellum, the third, of transverse and oblique shape, below the middle, and two very small spots placed transversely near the apex; underside and legs dark fulvous, the anterior tibiæ obscure piceous, abdominal segments rather closely and distinctly punctured, with some yellowish pubescence.

Hab. San Paulo, Brazil.

ŒDIONYCHIS VIGINTINOTATA (Clk. Catal.). (Plate XXXVIII. fig. 10.)

Black, the terminal segments of the abdomen flavous, above dark greenish, subopaque; thorax impunctate, with six flavous spots, anteriorly and posteriorly; elytra with seven flavous spots each (2.2.2.1), these finely punctured, rest of surface opaque, impunctate.

Length $2\frac{3}{4}$ lines.

Head flat, opaque, with a few punctures near the eyes only, dark greenish, the frontal tubercles and carina almost entirely wanting; antennæ short and stout, black, the joints scarcely longer than broad, slightly thickened towards the apex; thorax scarcely more than twice as broad as long, the sides straight at the base, slightly rounded anteriorly, the anterior angles not produced, rather blunt, the sides with a narrow reflexed margin, the surface entirely impunctate, more shining than the elytra, the anterior margin with three small bright flavous spots, one at each angle, the third at the middle, the base with three similar spots placed in the same positions; scutellum broader than long, blackish; elytra of silky, opaque appearance, with four flavous spots placed in a row near the suture and three others at the lateral margin, these spots show some fine punctuation; underside and legs black, the last three abdominal segments flavous.

Hab. Rio Grande, Brazil.

This is a curiously marked species and not difficult to recognize; the thorax has scarcely any flattened sides, but a narrow reflexed margin, and is entirely impunctate; the short antennæ, silky elytra, and the spots will further assist in the recognition of the species.

Œdionychis sexsignatus (Clk. Catal.). (Plate XXXVIII. fig. 2.)

Fulvous or piceous, the head, antennæ, and the legs black; thorax flavous, impunctate; elytra greenish or violaceous black, each with a round spot at the base, a transverse band at the middle, another spot below the latter, and a short lateral stripe near the apex, as well as the lateral margin, flavous.

Length 3 lines.

Head impunctate, black, the clypeus flavous; antennæ black, the lower two joints obscure piceous below, the third joint slightly shorter than the fourth; thorax rather convex, the sides rounded, with a broad flattened margin, the anterior angles thickened and produced forward, anterior and posterior margins nearly straight, the surface impunctate, flavous; scutellum black; elytra not perceptibly punctured, black or bluish black, a round spot near the scutellum, a similar one near the apex and close to the suture, a narrow oblique short stripe joining the similarly coloured lateral margin below the posterior spot, and a narrow transverse band at the middle flavous; legs black or piceous.

Hab. Colombia.

Closely allied to *Œ.* 10-*guttata*, Fab., but the shape and the position of the elytral spots different, as well as the nearly smooth elytra.

Œdionychis africana, n. sp. (Plate XXXVIII. fig. 12.)

Head, the apical joints of the antennæ, and the breast black; thorax testaceous, finely punctured; elytra testaceous, the suture, a spot at the apex, a spot at the base, and an elongate mark at the middle, black; legs fulvous, spotted with black.

Length 2 lines.

Of nearly parallel and narrow shape; head broad, black, punctured near the eyes; the antennæ comparatively widely distant, separated by a smooth space; palpi piceous, the apical joint acutely pointed, the penultimate one moderately incrassate; antennæ short, the lower four joints testaceous, the others black, third joint distinctly longer than the fourth, terminal joints transversely widened; thorax three times broader than long, the sides strongly rounded, the anterior margin straight, the posterior one sinuate at the sides and at the middle, anterior angles oblique, posterior ones acute, the surface with a distinct sinuate transverse sulcus near the base, finely and remotely punctured, the sides broadly flattened; scutellum broader than long, black; elytra rather strongly and closely punctured anteriorly, the punctures nearly absent below the middle, testaceous, a rounded spot at the base, a more elongate mark pointed posteriorly, placed at the middle of the disc and the suture, connected with a round spot at the apex, black; abdomen and legs flavous, the knees, base of the tibiæ, and the apex of the posterior femora black, breast black, posterior femora fulvous, posterior tibiæ emarginate at the apex, the posterior claw-joint strongly subglobular.

Hab. Africa, Sierra Leone.

This small species differs in many respects from its South-American congeners: the short antennæ, their incrassate terminal joints and the broad space dividing them, the thoracic sulcus, and the general shape of the thorax are not generally found in this genus: these differences are, however, more those of degree, and the species may well be included in *Œdionychis*, which contains already several other African forms.

Œdionychis siamensis, n. sp. (Plate XXXVIII. fig. 11.)

Black, thorax nearly impunctate, the sides flavous; elytra finely punctured and slightly rugose anteriorly, flavous, a spot on the shoulder and a transverse band below the middle black.

Length $3\frac{3}{4}$ lines.

Head with a few punctures near the eyes, black, shining, the frontal tubercles transverse, strongly raised; antennæ slender, not extending to the middle of the elytra, black, third and fourth joints equal; thorax three times broader than long, the sides strongly rounded and flattened, the surface with a few fine punctures and a transverse depression near the base at each side, shining, black, the flattened sides flavous; scutellum black; elytra very finely and closely punctured, the punctures nearly obsolete near the apex, flavous, the suture, immediately below the scutellum, a spot on the shoulders, and a broad, strongly curved, transverse band below the middle black; underside and legs black.

Hab. Siam.

Asphæra haroldi, n. sp.

Flavous, the vertex of the head, the antennæ, and the tibiæ and tarsi black; thorax impunctate; elytra metallic green or blue, impunctate.

Length 3 lines.

Head flavous, the vertex and the labrum black, the space between the eyes with a deep sinuate, strongly punctured groove, the frontal tubercles broad, moderately strongly raised; palpi flavous, the last joint piceous; antennæ extending slightly beyond the middle of the elytra, black, the basal joint flavous below, third joint as long as the fourth; thorax about twice as broad as long, the sides rounded at the middle, with a very narrow margin, the anterior angles produced and thickened but not toothed, the surface rather convex, impunctate, flavous, posterior margin slightly sinuate at the sides; scutellum black; elytra with a depression below the base, very bright metallic green, impunctate; underside and femora flavous, the tibiæ and tarsi black.

Hab. Amazons, also Bolivia.

Allied to *A. xanthocephala*, Har., but the clypeus and the entire underside flavous, the elytra more brilliant metallic.

Asphæra melanocephala, n. sp.

Flavous, the head, antennæ, and tibiæ and tarsi black; thorax impunctate; elytra bluish black, impunctate.

Length $2\frac{1}{2}$ lines.

Head black, with a single puncture near the eyes, frontal tubercles transverse, rather feebly raised; clypeus strongly developed, black, the sides flavous; palpi strongly thickened; antennæ rather long, black, all the joints, the second one excepted, of nearly equal length; thorax more than twice as broad as long, the sides nearly straight, narrowly margined, the anterior angles thickened but not toothed, the surface impunctate, pale flavous; scutellum black; elytra with a small depression below the base, bluish black, impunctate; underside and femora flavous, tibiæ and tarsi black, the first joint of the posterior tarsi as long as the following two joints together.

Hab. Amazons.

Principally distinguished by the colour of the head and that of the clypeus.

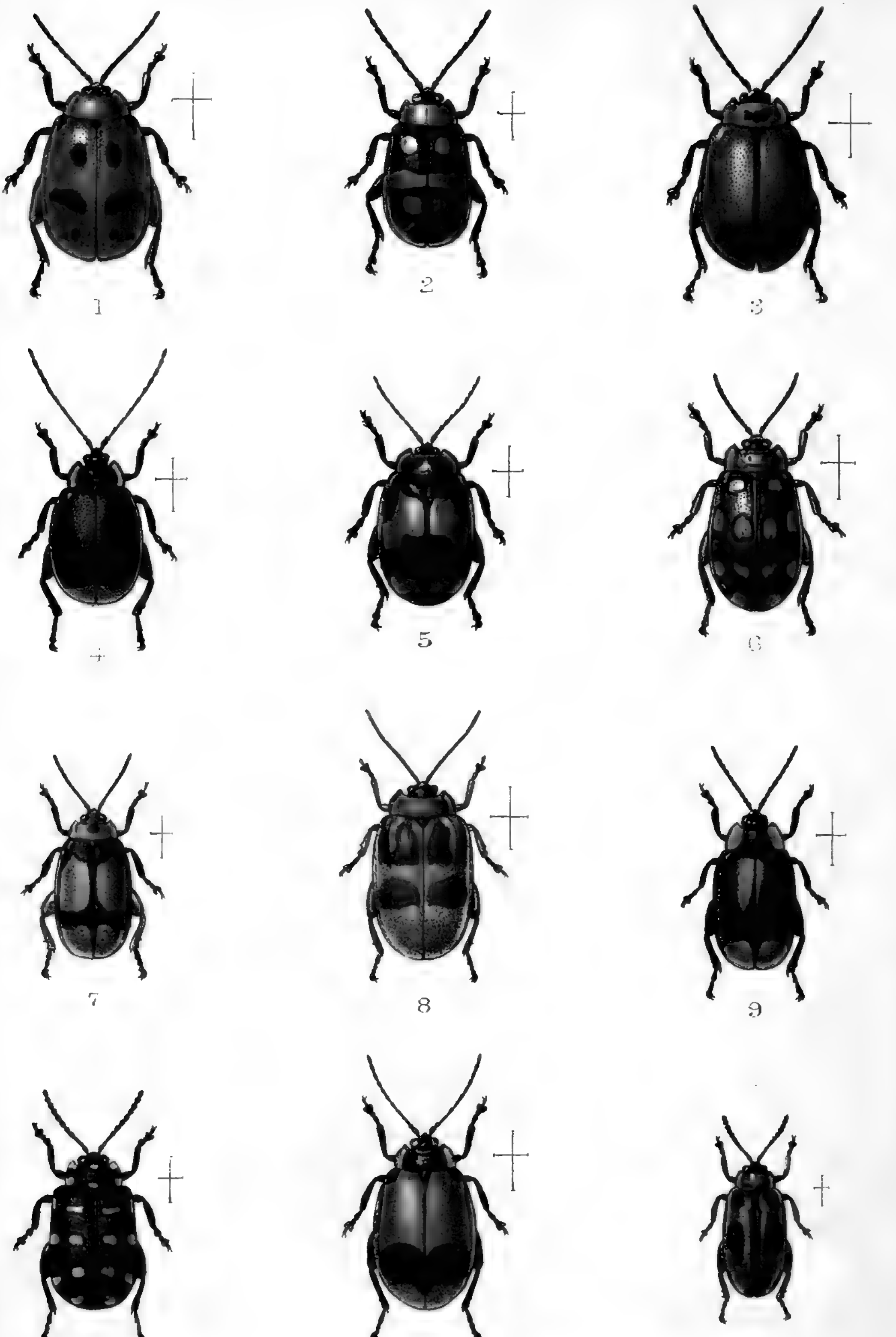
Asphæra clarki, n. sp.

Flavous, thorax rather narrow, scarcely margined, nearly impunctate, scutellum piceous; elytra impunctate, a transverse band at the base and another below the middle violaceous blue.

Length $2\frac{1}{2}$ lines.

Head pale fulvous, with a few punctures near the eyes, the latter large, the dividing space scarcely broader than their diameter, frontal tubercles trigonate; antennæ fulvous, extending to the middle of the elytra, the basal two joints shining, the others pubescent, third and following joints equal, elongate; thorax scarcely more than twice as broad as long, the sides but slightly rounded, narrowly flattened, anterior angles produced into a small tooth, the surface with some very minute punctures when seen under a very strong lens; scutellum piceous; elytra with a broadly flattened margin, sculptured like the thorax, flavous, with a transverse band slightly widened at the suture and not extending to the sides, and a similar band below the middle, violaceous blue; underside and legs flavous, the apex of the femora generally darker or stained with piceous, the first joint of the posterior tarsi as long as the following joints together, claw-joint moderately swollen.

Hab. Amazons.



W. Purkiss lith.

West, Newman imp.

New Coleoptera of the genus Œdionychis.

The coloration of this species resembles many species of *Œdionychis* and also some of the present genus, especially *A. 4-maculata*, Clark, and *A. oblecta*, Baly, but the shape of the thorax and other details must be taken into account to separate it; the thorax in *A. clarki* is proportionately narrow and the flattened portions of the sides are not well separated from the rest of the surface; the head is rather darker in colour and narrowed between the eyes; the first band of the elytra is slightly widened at the suture and extends to about one third of their length, the posterior band is quite straight and of the same width as the basal one. The long metatarsus of the posterior legs and the but moderately swollen claw will separate the species from any true *Œdionychis*.

Asphæra plumbea, n. sp.

Flavous, the head fulvous, the antennæ black; thorax impunctate, narrowly margined; elytra scarcely perceptibly punctured, metallic bluish black.

Length 4 lines.

Head fulvous at the vertex, the latter with a few fine punctures near the eyes, frontal tubercles broadly oblique, clypeus flavous; antennæ rather long, black, the basal joint flavous below, the second joint very short, the third and fourth joints equal; thorax about twice as broad as long, the sides moderately rounded, very narrowly margined, anterior margin deeply concave, anterior angles thickened, not produced, the surface impunctate, flavous; scutellum black; elytra almost impunctate, of a leaden-blue colour, very shining; underside and femora flavous, the tibiæ and tarsi black, the claw-joint but moderately swollen.

Hab. Venezuela.

Closely allied to *A. xanthocephala*, Har., but larger, without the black markings of the head and breast, and of a darker bluish colour.

EXPLANATION OF PLATE XXXVIII.

Fig. 1. *Œdionychis pardalis*, p. 627.
2. —— *sexsignatus*, p. 628.
3. —— *nigroscutata*, p. 610.
4. —— *princeps*, p. 622.
5. —— *fasciaticollis*, p. 624.
6. —— *fuscoannulata*, p. 625.
7. —— *quadripustulata*, p. 612.
8. —— *brunneofasciata*, p. 624.
9. —— *apicata*, p. 623.
10. —— *vagintinotata*, p. 627.
11. —— *siamensis*, p. 629.
12. —— *africana*, p. 628.

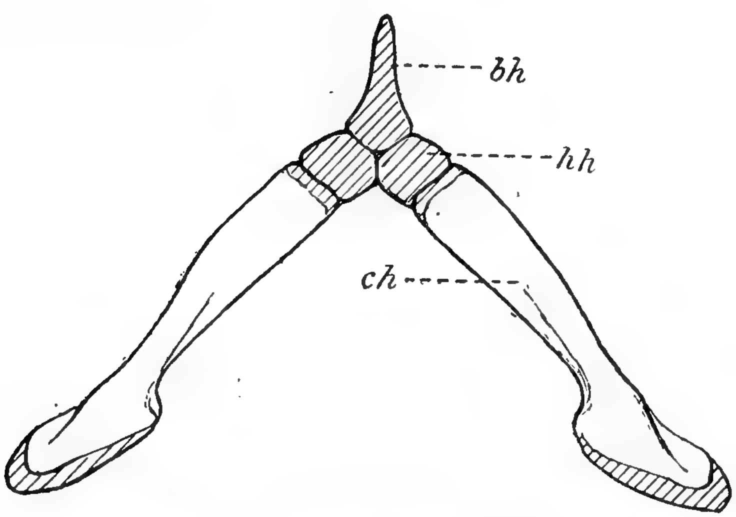
2. On the Hyoid Arch of *Ceratodus*. By W. G. Ridewood, B.Sc., F.L.S., Lecturer on Biology at St. Mary's Hospital Medical School.

[Received October 8, 1894.]

Since the discovery by Huxley (5) of the hyomandibular cartilage of *Ceratodus*, but little has been published in the way of a detailed description of the hyoid arch, and as the intermediate position occupied by the Dipnoi between the Fishes and Amphibia renders a minute knowledge of every part of their anatomy of the greatest importance, the following short contribution may, by collating the views of various observers, be of some assistance to the student of ichthyopsidan anatomy.

The most conspicuous element of the hyoid arch is the large ossified *ceratohyal* (figs. 1 and 2, *ch*), the extremities of which remain cartilaginous.

Fig. 1.



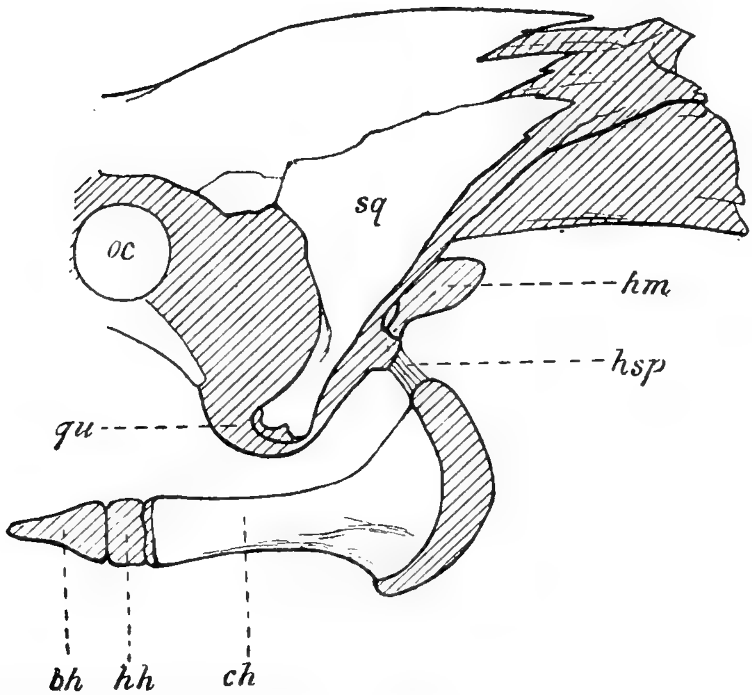
Ceratodus forsteri.—Hyoid arch, ventral view. (The hyomandibular is not shown.) *ch*, ceratohyal; *hh*, hypohyal; *bh*, basihyal.

Towards its anterior end it is nearly circular in section, but proximally it becomes vertically compressed, with a delicately curved posterior edge ending abruptly against the terminal cartilage.

The cartilage of the distal or anterior end articulates by a flat surface with the hypohyal.

The *hypohyal* (figs. 1 and 2, *hh*) is paired, cartilaginous, and isodiametric, and the two hypohyals are applied to one another in the middle line by flat, vertical, articular surfaces which open out in front to receive the wedge-shaped posterior extremity of the basihyal.

Fig. 2.



Ceratodus forsteri.—Hinder portion of the skull with the hyoid arch; left side. The opercular and interopercular bones are removed. *bh*, basihyal; *hh*, hypohyal; *ch*, ceratohyal; *hm*, hyomandibular; *hsp*, hyosuspensorial ligament; *sq*, squamosal or pre-opercular; *qu*, quadrate condyle; *oc*, eye-capsule.

The *basihyal* (figs. 1 and 2, *bh*) is a median unpaired cartilage which tapers off to a blunt point in front.

In Günther's (4) original description of *Ceratodus* the hypohyals are called basihyal, while the figures, and the words (p. 526) "the basihyal is short, thick, cartilaginous, interposed between the ends of the ceratohyals and the acutely conical glossohyal," fail to indicate the paired nature of these cartilages. Seeing, however, that they *are* paired and that the term basihyal is always applied to a median copula, and seeing that they are, from their relation to the ceratohyal, evidently homologous with the hypohyals of the

Ganoid fishes and Rays, the application of this name needs no further support.

The term basihyal is here applied to the median conical cartilage in preference to Günther's original name glossohyal, because the cartilage is a ventral copula, corresponding in all essential respects with the basihyal of the Sharks, and it is with the Elasmobranch and Ganoid, rather than with the Teleostean fishes, that comparisons should be instituted.

The chief feature of interest in connection with these three anterior cartilages is the contact of the hypohyals in the median plane, in addition to their articulation with the basihyal.

Brühl (**2**) (Taf lxi. Fig. 1) follows Günther in calling the hypohyal the basihyal, but in another place (Taf lxvii. Fig. 1) he describes it as the epiphysis of the ceratohyal[1]. This, in addition to being an inconsistency, is an error, since there is a cartilaginous epiphysis to the ceratohyal in addition to the hypohyal cartilage in question, assuming even then that the term epiphysis may be employed in describing the skeleton of animals other than mammals.

Brühl also claims to have discovered a small median *urohyal*, projecting back from the hypohyals and lying between the anterior ends of the ceratohyals. There is certainly a small rod of cartilage in this situation, but, from its position between the lower ends of the first ceratobranchials, it is more reasonable to regard it as a basibranchial than as a constituent of the hyoid arch.

On comparing the hyoid arch of *Ceratodus* with that of a Shark, but little doubt can be entertained as to the homology existing between the elements called in each case the ceratohyal; the proportionate size, position, and the relations to the hyoid demibranchia and to the mandibular and branchial arches, the nature of the ligamentous attachment to the mandible (seen better in *Protopterus* than in *Ceratodus*), all point to this conclusion. So that, arguing along these lines, the small cartilage (*hm*, fig. 2) closely bound to the cranial cartilage, if an element of the hyoid arch at all, is a much reduced representative of the well-developed and functional hyomandibular of the Shark, a view first propounded by Huxley (**5**), and which has not been challenged except by Brühl (**2**), who proposes to call this cartilage the "stylhyale," without, however, giving his reasons for the change.

Van Wijhe (**12**) accepts Huxley's determination, but in a footnote remarks:—"Es scheint mir jedoch nicht unmöglich, dass dieses Knorpelstück ein *Interhyale* repräsentire."

In a revolutionary paper by Pollard (**10**), this cartilage is regarded as an opercular. This author, however, elects to compare the skull of *Ceratodus* with that of the Siluroids, which are by no means the most typical nor the most primitive of the Teleostei;

[1] Brühl calls the ceratohyal the epihyal, and is supported by so recent a writer as Teller (**11**).

and on comparing his figs. 3 and 4 it will be seen that the hyoidean nerve passes in front of the hyomandibular in *Silurus* and behind the suspensorium of *Ceratodus*, which in his figure he separates from the palatine cartilage by a firm line and designates the "hyomandibular." Nerves, from their early distribution, may safely be employed as tests of homology of parts, and the spiracle, being as it is a visceral cleft, has claims of equal importance, so that Pollard's deduction, drawn from his conclusion of the non-homology of the hyomandibular of Teleostei and Elasmobranchii, that the spiracle and the hyoidean nerve are not constant in their relations to the hyomandibular, tends to falsify the premises. It is not, however, on this account to be assumed that the hyomandibular of Teleostei is here considered homologous with that of the Elasmobranchii, for, as first suggested by Parker, later researches may subsequently show their want of correspondence.

Seeing that accessory nodules of cartilage are so common as fringes to the opercular and interopercular bones and on the cranial ribs (as also in the Sturgeon), it might certainly be suspected that the "hyomandibular" of *Ceratodus*, lying as it does on the inner side of the operculum, belonged to this category, but its relation to the seventh nerve and to the ceratohyal, and its position between the quadrate cartilage and the first branchial arch, all point to its being a constituent of the hyoid arch.

Gadow (**3**) writes (p. 458):—"The outer surface of this hyomandibular remnant is loosely connected with the small cartilaginous operculum, which we know to be the result by fusion of the branchiostegal rays, carried by the hyomandibula."

The name opercular has hitherto been applied in *Ceratodus* to the large bone of the dermal series, situated behind the pre-opercular and fringed with accessory cartilages, and to re-apply the name, without apology or argument, to a small cartilage must necessarily lead to confusion.

There is no synovial articulation, in *Ceratodus*, between the hyomandibular and the opercular, on the inner surface of which it lies, such as occurs in the Teleosteans and the bony Ganoids. The anterior edge of the hyomandibular is united with the skull just where the cranium proper passes into the suspensorium; and the distance between this spot and the auditory capsule, in the vicinity of which the hyomandibular of fishes usually articulates, marks the extent of the reduction which the upper part of the hyoid arch has undergone. This hyomandibular cartilage was apparently overlooked by Günther (**4**), who figures (pl. xxxiv. fig. 3, *r*) a tubercle for the suspension and articulation of the hyoid arch.

A comparison of the original specimen with this figure, which by the kindness of Dr. Günther I was allowed to make, shows that this is, as he states, a protuberance of the suspensorium for the attachment of the ligament suspending the ceratohyal; and

Huxley (5) was therefore unduly confident in assuming that this tubercle was the hyomandibular cartilage which he had discovered, and in writing (p. 34) that "this is neither a process of the suspensorium, nor does it articulate with, nor take the principal share in, suspending *Hy*, which is Dr. Günther's 'hyoid arch.'"

The hyomandibular is still present in this specimen, and lies dorsally to the "tubercle," to which a portion of the ligament still remains attached.

The lower end of the hyomandibular cartilage, which Huxley calls the symplectic, is not embedded in the hyosuspensorial ligament, but, as a careful dissection will show, is articulated to the dorsal surface of the suspensorial tubercle, whereas the hyosuspensorial ligament is attached to its posterior surface at a slightly lower level.

Gadow's replacement of Huxley's accurate term "hyosuspensorial ligament" by "ligamentum hyomandibulo-hyoideum" is thus singularly unfortunate.

The hyomandibular is not connected directly with the ceratohyal, but indirectly by means of a process of the palato-quadrate cartilage, so that, by a slight stretch of the imagination, the skull of *Ceratodus* might be regarded as partially hyostylic; the bulk of the evidence, however, is distinctly opposed to this view.

Brühl (2) (Taf. lxiii. Fig. 6), in a figure said to be copied from Huxley, shows a ligament running from the ceratohyal to the mandible and to the opercular, but not to the suspensorium nor to the hyomandibular, and in his original figures he is hardly more fortunate.

Assuming the determination of the ceratohyal and hyomandibular correct, it is worthy of note that the region of union of these elements, in the Sharks just behind the mandibular articulation, is here, in *Ceratodus*, raised considerably above the level of the quadrate condyle of the upper jaw (see fig. 2).

The shape of the hyomandibular is by no means constant, but is subject to great individual variation, and this even on the right and left sides of the same skull.

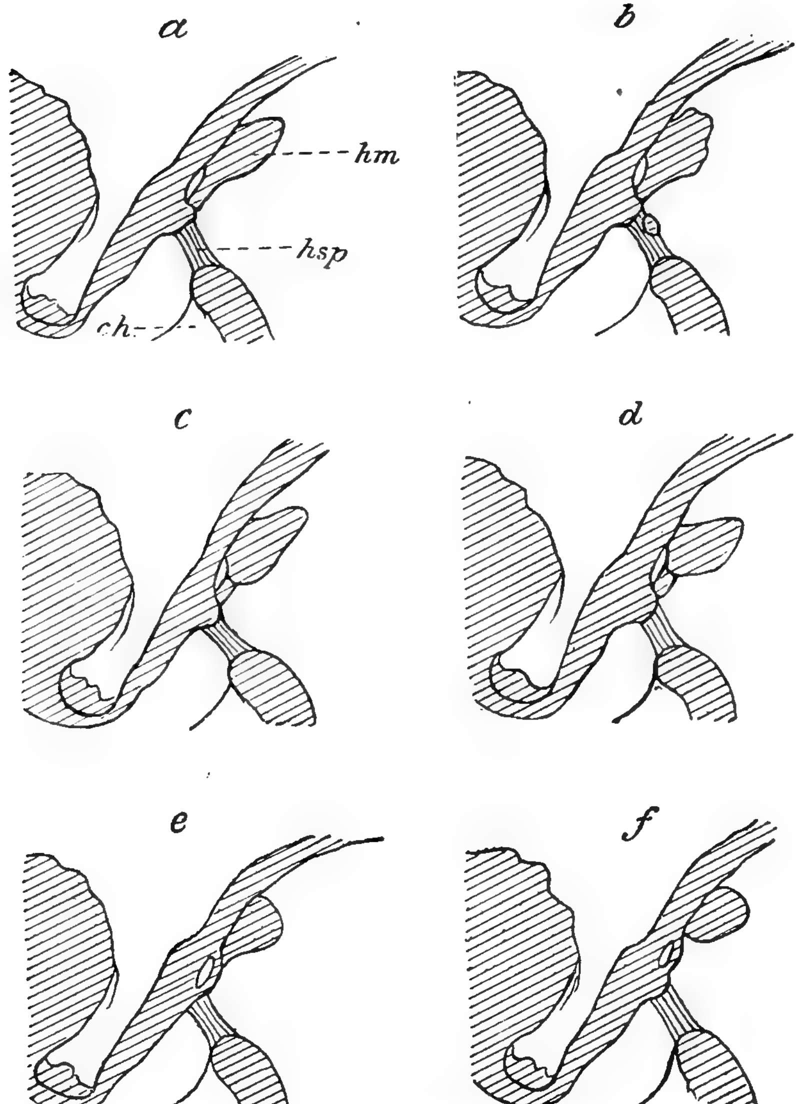
By far the commonest form is that shown in fig. 3, *a* (p. 637). The cartilage is rhombic in shape and applied by its anterior edge to the cranial cartilage, while a ventral process, separated from the skull by a space for the passage of the hyoidean branch of the seventh nerve, is attached to the upper surface of the suspensorial tubercle.

In one case examined (fig. 3, *b*) there is in addition a nodule of cartilage in the hyosuspensorial ligament which may possibly have the value of an interhyal. A similar nodule is mentioned by Pollard (10), but not figured.

The two sketches, fig. 3, *c* and *d*, show what variation may occur in the relative lengths of the vertical and horizontal diameters of the cartilage, and also that when the longer diameter is horizontal the extent of the attachment to the cranium is reduced to a minimum.

In each of these cases the ventral process mentioned above is segmented off as a separate cartilage. This may possibly be a symplectic from its position, as suggested by Huxley (5), but, in

Fig. 3.



Ceratodus forsteri.—The hyomandibular and adjacent parts.
Letters as before.

view of the great variability exhibited by the hyomandibular, it is doubtful whether any importance can be attached to its independence. In the last two cases (fig. 3, *e* and *f*) the aperture for the hyoidean nerve, instead of lying between the hyomandibular and the cranium, penetrates the cranium itself, and the hyomandibular is separated by a wide gap from the tubercle to which the hyosuspensorial ligament is attached.

It is not impossible that the bar of cartilage behind the nerve-aperture is the symplectic process, which has fused above with the cranium and below with the tubercle (which latter in the specimen represented in fig. 3, *e*, is practically obsolete); but it is more reasonable to suppose that the nerve has been enclosed by the posterior union of the edges of the notch in the cranial cartilage in which it originally ran, parallel cases of the enclosure of nerves and blood-vessels being not uncommon.

Little doubt can be entertained of the fact that the whole branchial and hyoid system has become reduced in *Ceratodus* in relation with the partial adoption of pulmonary respiration; and the hyomandibular thus furnishes another and a very interesting example of individual variation in vestigial structures.

This reduction of the branchial skeleton is even more pronounced in *Protopterus*, where the hyomandibular is absent and where only the second and third branchial arches have epibranchial elements, the other four consisting of slender ceratobranchials only.

The hyoid gill-filaments in *Ceratodus* are set on the ventro-internal edge of the ceratohyal, and the series extends backwards and upwards, internal to the hyosuspensorial ligament, but stops short for about a quarter of an inch in the region of the hyomandibular and is continued again in a line running back, parallel to the long axis of the body, to meet the upper end of the series of gill-filaments of the first branchial arch. Thus not only is the continuity of the gill broken in the region of the hyomandibular, but the direction of the series of filaments becomes changed.

The gill-rakers, on the other hand, form a continuous series running along the upper and inner edge of the ceratohyal, curving forwards and upwards in front of the hyomandibular, and terminating at the upper extremity of the first branchial cleft.

While the series of hyoid gill-rakers and gill-filaments are close together along the inner surface of the ceratohyal, they become widely divergent above, the upper end of the first branchial arch being situated some little distance behind the pharyngeal opening of the cleft.

The upper gill-filaments are not supported by any part of the hyoid skeleton, but simply project from the mucous membrane and readily come away when the latter is stripped off, and the lower filaments, although supported by the ceratohyal, are but very feebly attached to it and leave no marks on removal, the gill-filaments of *Ceratodus* not being supported by gill-rays.

As before mentioned, the hyoid arch of *Ceratodus* is less reduced than in the other living Dipnoi.

In *Protopterus* there is a pedicle for the attachment of the hyosuspensorial ligament, situated much as in *Ceratodus*, and to the inner side of this short ligament lies a much longer and whiter ligament, more strongly developed than in *Ceratodus*, running upwards and inwards from the upper and inner end of the ceratohyal to the base of the skull at the side of the parasphenoid.

There is no basihyal nor hypohyal, but the lower ends of the ceratohyals are connected by ligament.

No cartilage which might correspond with the hyomandibular of *Ceratodus* is to be distinguished.

Owen (7), evidently describing an improperly articulated skull, writes: "a strong cylindrical and almost straight *styloid* bone is articulated by a somewhat compressed and expanded upper extremity to the cartilaginous petrous element of the temporal; it extends downwards and forwards, parallel with the *os tympanicum* [1] and is articulated to the upper part of the expanded posterior extremity of the ceratohyoid bone." The ceratohyal is named correctly, but is unfortunately articulated with the lower end of the cranial rib, which, in the figure, is made to point forwards instead of backwards and is called "styloid."

Writing later (**8**) in 1866 he adopts Bischoff's (**1**) view that this latter bone is the suspensor of the pectoral girdle, for, in his fig. 41. no. 51, it is called scapula and is articulated at its lower end with the shoulder-girdle, which is called coracoid.

Two years later Parker (**9**) described it as the first pharyngobranchial; and it was left to Günther (**4**) in 1871 to demonstrate that this bone, which had suffered such vicissitudes of nomenclature, is simply the first rib which has acquired a secondary connection with the skull.

There are no careful descriptions of the hyoid arch of *Lepidosiren*, but it may be concluded that it differs but little from that of *Protopterus*.

Brühl (**2**) (Taf. lxiii. Fig. 8, Punkt 2) speaks of an articular *cavity* in the postero-external border of the chondrocranium for insertion of the hyoid apparatus; and Hyrtl (**6**) states that the hyoid is attached to a blunt *process* of the quadrate, and that the ventral ends are united by a rigid synchondrosis and not by a ligament as in *Protopterus*.

Günther (**4**, p. 526) mentions the absence of basihyal and glossohyal (*i. e.* the elements named in this article the hypohyal and basihyal).

We may, happily, now look forward to more minute descriptions of the visceral skeleton of this once rare Dipnoan in the publications of the numerous investigators who are prosecuting their researches on the specimens recently collected by Dr. Bohls in Paraguay.

A careful examination of the hyoid system of living Dipnoi leads one to conclude that there is no connection between the reduction of the hyomandibular in these fishes and its adaptation as a secondary suspensorium in the Elasmobranchii (excluding the Holocephali) and the osseous fishes, and there appears to be very little evidence in support of Gadow's view (**3**, p. 459) that the reduction of the

[1] Pre-opercular.

hyomandibular has resulted from the *loss* of a suspensorial function.

It is unfortunate that the remains of extinct Dipnoi do not furnish any clue to the solution of this problem; but it is highly probable that the Dipnoi are derived from a stock in which the hyomandibular was as free from this suspensorial function as in the modern representatives of the group.

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3. Third Report on Additions to the Batrachian Collection in the Natural-History Museum.[1] By G. A. Boulenger, F.R.S.

[Received October 12, 1894.]

(Plates XXXIX. & XL.)

I. *List of the Species, new or previously unrepresented, specimens of which have been added to the Collection since April* 1890.

(An asterisk indicates type specimens.)

Ecaudata.

1. *Rana limborgii*, Sclater f., P. Z. S. 1892, p. 344.—Karin hills (*Fea*).
*2. *Rana palavanensis*, Blgr. Ann. N. H. (6) xiv. 1894, p. 85.—Palawan (*Everett*).
*3. *Rana holsti*, Blgr. Ann. N. H. (6) x. 1892, p. 302.—Great Loo Choo Islands (*Holst*).
4. *Rana boylii*, Baird.—Marin Co., California (*Eigenmann*).
*5. *Rana græca*, Blgr. Ann. N. H. (6) viii. 1891, p. 346.—Parnassos (*Krüper*); N. Morea (*Douglass*).
6. *Rana chrysoprasina*, Cope.—Costa Rica (*Underwood*).

[1] *Cf.* P. Z. S. 1890, p. 323.

*7. *Rana quecketti*, Blgr., *infra*.—Natal (*Queckett*).

*8. *Rana nyassæ*, Gthr. P. Z. S. 1892, p. 558.—Nyassaland (*Johnston*).

*9. *Rana johnstonii*, Gthr. P. Z. S. 1893, p. 620.—Nyassaland (*Johnston*).

*10. *Rana tenasserimensis*, Sclater f., P. Z. S. 1892, p. 345.—Tenasserim (*Indian Museum*).

11. *Rana lateralis*, Blgr. Ann. Mus. Genova, (2) v. 1887, p. 483.—Rangoon (*Fea*).

12. *Rana monticola*, And.—Darjeeling (*Gammie, Blanford*).

13. *Rana granulosa*, And.—Assam (*Peal*); Burma (*Limborg, Fea*).

*14. *Rana varians*, Blgr. Ann. N. H. (6) xiv. 1894, p. 86.—Palawan (*Everett*).

*15. *Rana nigrovittata*, Blyth.—Burma (*Theobald, Fea, Oates*).

*16. *Rana oatesii*, Blgr. Ann. N. H. (6) ix. 1892, p. 141.—Toungoo (*Oates*); Bangkok (*Greening*).

*17. *Rana hosii*, Blgr. Ann. N. H. (6) viii. 1891, p. 290.—Sarawak (*Hose, Everett*).

*18. *Rana cavitympanum*, Blgr. P. Z. S. 1893, p. 525.—N. Borneo (*Everett*).

19. *Rana whiteheadi*, Blgr. Ann. N. H. (5) xx. 1887, p. 96.—N. Borneo (*Whitehead*); Sarawak (*Everett*).

*20. *Rana aluta*, Peracca, Boll. Mus. Tor. viii. 1893, no. 156, p. 12.—Madagascar (*Peracca*).

*21. *Phrynobatrachus ranoides*, Blgr., *infra*.—Natal (*Queckett*).

*22. *Rhacophorus liber*, Peracca, Boll. Mus. Tor. viii. 1893, no. 156, p. 14.—Madagascar (*Peracca*).

*23. *Rhacophorus everetti*, Blgr. Ann. N. H. (6) xiv. 1894, p. 87.—Palawan (*Everett*).

*24. *Rhacophorus macrotis*, Blgr. Ann. N. H. (6) vii. 1890, p. 282.—Sarawak (*Hose*); Balabac, Palawan (*Everett*).

25. *Rhacophorus colletti*, Blgr. P. Z. S. 1890, p. 36.—N. Borneo (*Everett*).

*26. *Rhacophorus otilophus*, Blgr. P. Z. S. 1893, p. 527.—N. Borneo, Sarawak (*Everett*).

*27. *Rhacophorus edentulus*, F. Müll. Verh. nat. Ges. Basel, x. 1894, p. 840.—Celebes (*Sarasin*).

*28. *Rhacophorus acutirostris*, Mocq. Le Natur. 1890, p. 163.—Mt. Kina Baloo (*Paris Mus., Everett*).

*29. *Rhacophorus verrucosus*, Blgr. Ann. Mus. Genova, (2) xiii. 1893, p. 337.—Karin hills (*Fea*).

30. *Rhacophorus dulitensis*, Blgr. P. Z. S. 1892, p. 507.—Mt. Dulit, Sarawak (*Hose*).

*31. *Rhacophorus feæ*, Blgr. Ann. Mus. Genova, (2) xiii. 1893, p. 338.—Karin hills (*Fea*).

32. *Rhacophorus dennysii*, Blanf.—Foochow (*Rickett*).

33. *Rhacophorus madagascariensis*, Ptrs.—Madagascar.

*34. *Ixalus travancoricus*, Blgr. Ann. N. H. (6) viii. 1891, p. 291.—Travancore (*Ferguson*).

*35. *Ixalus longicrus*, Blgr. Ann. N. H. (6) xiv. 1894, p. 88.—Palawan (*Everett*).
*36. *Ixalus carinensis*, Blgr. Ann. Mus. Genova, (2) xiii. 1893, p. 339.—Karin hills (*Fea*).
*37. *Ixalus parvulus*, Blgr. l. c.—Karin hills (*Fea*).
38. *Ixalus pictus*, Ptrs.—N. Borneo (*Everett*).
39. *Ixalus latopalmatus*, Blgr. Ann. N. H. (5) xx. 1887, p. 97.—N. Borneo (*Whitehead, Everett*).
*40. *Chirixalus doriæ*, Blgr. Ann. Mus. Genova, (2) xiii. 1893, p. 341.—Karin hills (*Fea*).
*41. *Phrynoderma asperum*, Blgr. l. c. p. 342.—Karin hills (*Fea*).
*42. *Cassina obscura*, Blgr., *infra*.—Shoa (*Doria*).
*43. *Hylambates millsonii*, Blgr., *infra*.—Mouths of the Niger (*Millson*).
*44. *Sphenophryne celebensis*, F. Müll. Verh. nat. Ges. Basel, x. 1894, p. 841.—Celebes (*Sarasin*).
45. *Engystoma albopunctatum*, Bttgr. Z. f. Naturw. lviii. 1885, p. 240.—Paraguay (*Bohls*).
46. *Engystoma muelleri*, Bttgr. l. c. p. 241.—Paraguay (*Bohls*).
47. *Mantipus hildebrandti*, Ptrs. SB. Berl. Ac. 1883, p. 166.—Madagascar (*Peracca*).
48. *Phrynocara tuberatum*, Ptrs. l. c. p. 167.—Madagascar (*Peracca*).
49. *Elosia bufonia*, Gir.—Theresopolis (*Göldi*).
50. *Hylodes latrans*, Cope.—Texas (*Taylor*).
51. *Hylodes melanostictus*, Cope.—Monte Redondo, Costa Rica (*Underwood*).
52. *Hylodes urichii*, Bttgr. J. Trinid. Club, ii. 1894, p. 88.—Trinidad (*Caraciollo*).
*53. *Leptodactylus bufonius*, Blgr. Ann. N. H. (6) xiii. 1894, p. 348.—Paraguay (*Bohls*).
*54. *Phanerotis fletcheri*, Blgr. P. Linn. Soc. N. S. W. (2) v. 1890, p. 593.—Dunoon, N. S. Wales (*Fletcher*).
55. *Nectophryne misera*, Mocq. Le Natur. 1890, p. 182.—Kina Baloo, N. Borneo (*Everett*).
*56. *Nectophryne signata*, Blgr., *infra*.—Dutch Borneo (*Everett*).
*57. *Nectophryne hosii*, Blgr. P. Z. S. 1892, p. 508.—Sarawak (*Hose, Everett*).
58. *Bufo spinulifer*, Mocq. Le Natur. 1890, p. 181.—Kina Baloo (*Everett*).
59. *Bufo nigricans*, Wiegm.—Tarapaca, Chili (*James*).
*60. *Bufo surdus*, Blgr. Ann. N. H. (6) vii. 1891, p. 282.—Baluchistan.
*61. *Bufo pentoni*, Anders. Ann. N. H. (6) xii. 1893, p. 440.—Suakin (*Penton, Anderson*).
*62. *Bufo fergusonii*, Blgr. J. Bomb. Soc. vii. 1892, p. 317.—Travancore (*Ferguson*).
*63. *Bufo luetkenii*, Blgr. Ann. N. H. (6) viii. 1891, p. 455.—Costa Rica (*Oersted*).

64. *Chorophilus feriarum*, Baird.—N. Carolina.
65. *Chorophilus ornatus*, Holbr.—Texas (*Indian Mus.*).
66. *Hyla punctatissima*, Ptrs.—Theresopolis (*Göldi*).
67. *Hyla spegazzinii*, Blgr. Ann. Mus. Genova, (2) vii. 1889, p. 247.—Paraguay (*Bohls*).
68. *Hyla prosoblepon*, Bttgr. Kat. Batr. Senck. Ges. p. 45 (1892).—Costa Rica (*Senckenb. Mus.*).
*69. *Hyla goeldii*, Blgr., *infra*.—Theresopolis (*Göldi*).
*70. *Hyla chloris*, Blgr. P. Linn. Soc. N. S.W. (2) vii. 1892, p. 403.—Dunoon, N. S. Wales (*Fletcher*).
71. *Hyla congenita*, Ptrs. & Doria.—N. Guinea (*Doria*).
*72. *Hylella parvula*, Blgr., *infra*.—Brazil (*Michaëlis, Göldi*).
73. *Agalychnis helenæ*, Cope, P. Am. Phil. Soc. xxii. 1885, p. 182.—Guatemala (*Greening*); Nicaragua (*Rothschuh*).
74. *Pelobates syriacus*, Bttgr. Zool. Anz. 1889, p. 145.—Smyrna, (*Christiania Mus.*); Haifa (*Senckenb. Mus.*); Damascus (*T. Barrois*).
*75. *Leptobrachium pelodytoides*, Blgr. Ann. Mus. Genova, (2) xiii. 1893, p. 345.—Karin hills (*Fea*).
*76. *Leptobrachium parvum*, Blgr. l. c. p. 344.—Karin hills (*Fea*).
*77. *Leptobrachium carinense*. Blgr. op. cit. (2) vii. 1889, p. 748.—Karin hills (*Fea*).

Caudata.

1. *Salamandra caucasica*, Waga.—Near Batoum (*Senckenb. Mus.*).
*2. *Tylototriton andersonii*, Blgr. Ann. N. H. (6) x. 1892, p. 304.—Loo Choo Islands (*Holst*).

Apoda.

*1. *Dermophis gregorii*, Blgr., *infra*.—Ngatana, E. Africa (*Gregory*).
2. *Herpele ochrocephala*, Cope.—Panama (*Christiania Mus.*).
3. *Siphonops paulensis*, Bttgr. Kat. Batr. Senck. Ges. p. 62 (1892).—S. Paulo, Brazil (*Ihering*).
4. *Typhlonectes compressicauda*, D. & B.—Manaos, Brazil (*Antony*).

II. *Descriptions of new Species.*

Rana queckettii. (Plate XXXIX. fig. 1.)

Vomerine teeth in two short transverse series between the choanæ. Head a little longer than broad; snout obtusely pointed, a little longer than the diameter of the orbit; nostril a little nearer the eye than the tip of the snout; canthus rostralis obtuse; loreal region very oblique, concave; interorbital space narrower than the upper eyelid; tympanum a little smaller than the eye.

Fingers moderate, first not extending beyond second; toes moderate, two-thirds webbed; subarticular tubercles feeble; a small, elliptic metatarsal tubercle. The tibio-tarsal articulation reaches between the eye and the nostril. Back with narrow, interrupted folds. Olive above, with black spots and a yellow vertebral stripe; a blackish canthal streak and a brown temporal spot; limbs with blackish cross-bars; lower parts white.

From snout to vent 48 millim.

A single female specimen from near Pietermaritzburg, Natal. Presented by Mr. F. J. Queckett.

Phrynobatrachus ranoides. (Plate XXXIX. fig. 2.)

Tongue with a free conical papilla in the middle. Habit slender. Head as long as broad; snout obtuse, as long as diameter of orbit, with indistinct canthus; interorbital space as broad as the upper eyelid; tympanum distinct, two thirds the diameter of the eye. First finger as long as second; toes two-thirds webbed; tips of fingers and toes not dilated; two small metatarsal tubercles; a small tubercle on the inner side of the tarsus and another higher up below the heel. The tarso-metatarsal articulation reaches far beyond the tip of the snout, the tibio-tarsal articulation between the eye and the tip of the snout. Above with small smooth warts, larger on the sides; no folds. Olive-grey above; a darker cross-bar between the eyes; limbs with faint darker cross-bars; lips with dark spots; lower parts white.

From snout to vent 22 millim.

A single female specimen from near Pietermaritzburg, Natal. Presented by Mr. F. J. Queckett.

Cassina obscura. (Plate XXXIX. fig. 3.)

Vomerine teeth in two small, oblique, rather indistinct groups between the choanæ. Head once and two fifths as broad as long; snout rounded, without canthus, hardly as long as the diameter of the orbit; interorbital space as broad as the upper eyelid; tympanum hidden. Fingers moderate, first shorter than second; toes moderate, one-third webbed; a very indistinct metatarsal tubercle. The tarso-metatarsal articulation reaches the posterior border of the orbit. Above with flat smooth warts, beneath with large granules. Dark olive above, sides lighter, with numerous roundish chestnut-brown spots; a white (red?) inguinal spot; greyish brown beneath, with small dark brown spots. Male with a large, black, external vocal sac on each side of a subcircular gular disk.

From snout to vent 39 millim.

A single male specimen from Let Merafia, Shoa, received from the Marquis Doria.

Hylambates millsonii. (Plate XXXIX. fig. 4.)

Vomerine teeth in two small groups between the choanæ. Head a little broader than long; snout as long as the diameter of the eye; interorbital space as broad as the upper eyelid; tympanum two thirds the diameter of the eye. Fingers fully half webbed; toes nearly entirely webbed; disks well developed; a small, oval, inner metatarsal tubercle. The tibio-tarsal articulation reaches between the eye and the tip of the snout. Skin shagreen above, granular beneath. Dark purple above, sides with white dots; no white line along the upper lip; indistinct dark cross-bands on the head and limbs; whitish beneath, with small brown spots.

From snout to vent 65 millim.

Two female specimens from the mouths of the Niger. Presented by Mr. Alvan Millson.

NECTOPHRYNE SIGNATA. (Plate XL. fig. 1.)

Habit slender. Snout prominent, obliquely truncate; loreal region vertical; interorbital space broader than the upper eyelid; tympanum very distinct, two thirds the diameter of the eye. Fore limb very slender, as long as the distance between the vent and the eye. Fingers moderate, webbed at the base, dilated and truncate at the end; first finger very short, half as long as second; toes three-fourths webbed, the disks smaller than those of the fingers; two small metatarsal tubercles. The tibio-tarsal articulation reaches the tip of the snout. Above with small scattered warts of unequal size; belly granular. Olive above, with black spots surrounding an X-shaped light marking on the back; limbs yellowish, barred with black; whitish beneath, spotted with black.

From snout to vent 15 millim.

Two specimens from Robong Mt., Kapuas district, Dutch Borneo. Collected by Mr. A. Everett.

HYLA GOELDII. (Plate XL. fig. 2.)

Tongue subcircular, slightly nicked behind, slightly free behind and on the sides. Vomerine teeth in two oblique groups close together just behind the level of the choanæ. Head as long as broad; snout rounded, as long as the diameter of the orbit; canthus rostralis angular; loreal region concave; interorbital space broader than the upper eyelid; tympanum distinct, half the diameter of the eye. Fingers free; no distinct rudiment of pollex; toes one-third webbed; disks nearly as large as the tympanum; no tarsal fold. The tibio-tarsal articulation reaches the eye. Skin smooth above, granular beneath, the granules strongest on the belly. Olive or brown above, with a few large, darker, light-edged spots, the anterior extending to between the eyes; a dark canthal streak and a dark, light-edged temporal band; limbs with dark cross-bars; lower parts dirty white or pale brown. Male with an internal vocal sac.

From snout to vent: ♂ 26 millim., ♀ 40 millim.

Two specimens, male and female, from Colonia Alpina, Theresopolis, Brazil. Presented by Dr. E. A. Göldi, who will shortly publish some highly interesting notes on the breeding-habits of this frog.

HYLELLA PARVULA. (Plate XL. fig. 3.)

Tongue circular, entire. Head as long as broad; snout short, rounded; no canthus rostralis; eye large and very prominent; upper eyelid very narrow; interorbital space broad and convex; tympanum distinct, hardly one third the diameter of the eye. Fingers distinctly webbed at the base, first slightly shorter than second; toes two-thirds webbed; disks moderate. Tibio-tarsal articulation reaching a little beyond the tip of the snout. Skin smooth above; belly and lower surface of thighs granulate. Greyish or pale brown above, speckled with white; lower parts white.

From snout to vent 17 millim.

Two specimens. One from Lages, Santa Catharina, collected by Hr. Michaelis; the other from Theresopolis, presented by Dr. Göldi.

This species appears to be most nearly allied to *H. carnea*, Cope, but the tympanum is perfectly distinct and the coloration is entirely different.

DERMOPHIS GREGORII. (Plate XL. fig. 4.)

15 teeth on each side of the upper jaw, 12 on each side (outer row) of the lower jaw. Snout rounded, moderately prominent; eyes distinct, the distance between them a little less than the length of the snout; tentacle in front of and below the eye, twice and a half as distant from the nostril as from the eye. Body moderately elongate; 160 folds, the posterior close together (duplicated), all except the anterior and posterior interrupted above and often also beneath. Tail indistinct, rounded. Dark brown above, paler beneath.

Total length 280 millim.; greatest diameter of body 10 millim.

A single specimen was obtained at Ngatana, E. Africa, by Dr. J. W. Gregory. It was referred to *D. thomensis*, Bocage, by Dr. Günther (P. Z. S. 1894, p. 88). The latter species (Pl. XL. fig. 5) differs in the more pointed snout, the length of which does not exceed the interocular width, and the distance between the tentacle and the nostril is four to five times as great as between the tentacle and the eye (*cf.* Pl. XL. fig. 5).

EXPLANATION OF THE PLATES.

PLATE XXXIX.

Fig. 1. *Rana quecketti*, Blgr., p. 643.
2. *Phrynobatrachus ranoides*, Blgr., p. 644.
3. *Cassina obscura*, Blgr., p. 644.
4. *Hylambates millsonii*, Blgr., p. 644.

PLATE XL.

Fig. 1. *Nectophryne signata*, Blgr., p. 645.
2. *Hyla goeldii*, Blgr., p. 645.
3. *Hylella parvula*, Blgr., p. 646.
4. *Dermophis gregorii*, Blgr., p. 646. (× 2.)
5. —— *thomensis*, Bocage, p. 646. (× 2.)

Peter Smit del et lith.

Mintern Bros. imp.

1. RANA QUECKETTII. 2. PHRYNOBATRACHUS RANOIDES.
3. CASSINA OBSCURA. 4. HYLAMBATES MILLSONII.

Peter Smit del et lith. Mintern Bros. imp.

1. NECTOPHRYNE SIGNATA 2. HYLA GŒLDII 3 HYLELLA PARVULA.
4. DERMOPHIS GREGORII. 5. DERMOPHIS THOMENSIS.

4. On some Foraminifera from the Microzoic Deposits of Trinidad, West Indies. By R. J. Lechmere Guppy, C.M.Z.S.

[Received August 27, 1894.]

(Plate XLI.)

§ 1. *Introductory.*

A paper of mine on the Microzoic deposits of Trinidad was read before the Geological Society of London on the 8th June, 1892, and published in the November 1892 part of the Journal of the Society. Subsequently I communicated to a local scientific society of Trinidad a notice on the subject. But in these papers I did not deal with the novelties I had discovered in these rocks. Having been prostrated by a most serious illness I was unable for a long time to follow up the subject; and when I did so my work progressed but slowly. Hence I am only now in a position to make known some forms which appear to be new, and to bring forward some observations which may possibly throw light on the evolution of certain forms of the Foraminifera.

The species of Foraminifera have possibly as definite a form as most other species of organic beings. The amount of variation among what are called the higher animals is very great, as is shown by the fact that in some cases a single natural species has been made into a dozen or more by naturalists. We are not always acquainted with the limits of variation of a species, and we are often misled, or surprised and puzzled, by the occasional appearance and partial persistence of an embryonic condition which we do not understand; for example, the exceptional appearance of a specimen of *Frondicularia* or *Nodosaria* with a Cristellarian commencement. But in what are called the higher animals we are are not unfamiliar with the occurrence or persistence of what are known as embryonic characters. Such characters have thrown most valuable light upon the affinity and course of development of animals and plants. So they will probably do in the case of Foraminifera.

§ 2. *On the Initial Stage of* Frondicularia.

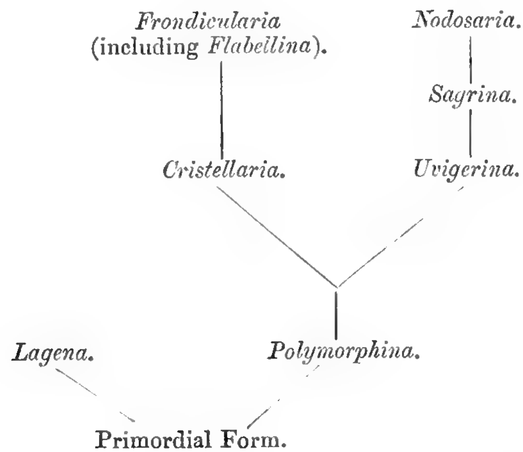
The specimen exhibited (Plate XLI. fig. 7) might, by some rhizopodists, be called *Lagena globosa*. It is in all essential respects similar to the specimens figured under that name by Sherborn and Chapman (Journ. R. Microsc. Soc. 1886, pl. xiv. figs. 11, 12). But my impression is that it is none other than the initial chamber of a *Polymorphina*. Messrs. Parker and Jones, in a memoir on North-Sea Foraminifera (Ann. & Mag. Nat. Hist. ser. 2, vol. xix. p. 273, 1857), perceived that the primordial segment of *Polymorphina* resembled a *Lagena*[1]. They remark of specimens of this kind

[1] See also the specimens figured by Reuss, 'Lagenideen,' pl. i. figs. 1–3. The figures of *L. globosa* in the 'Challenger' Report are true *Lagenæ*, and do not exhibit this form.

that "they exhibit an early condition of *Polymorphina*, in which we see an entosolenia, slightly modified, playing the part of the primordial chamber of this form. This entosolenian condition of *Polymorphina* is nearly always apparent in specimens sufficiently small or unadvanced to leave the early chambers translucent and open to examination. . . . . As they advance in growth the individual *Polymorphinæ* are invested with additional chambers after a type peculiar to themselves, but in a very irregular manner as regards the capacity and shape of the chambers."

If such a unicellular *Polymorphina* as the one shown in my fig. 7, or in Parker and Jones's figure just referred to, takes on additional chambers in a regular series on one side only instead of alternately on different faces of the shell, it becomes a *Cristellaria* either straight, curved, or involute. In further explanation it may be stated that in *Polymorphina* the chambers are developed alongside of, and adherent to, each other and the primordial chamber like drops of resin which have exuded from a tree. But if the chambers are developed in a single symmetrical and regular series, straight or curved, each segment being developed from and adherent to the preceding one only, the organism is a *Cristellaria*, and so may attain a considerable development in this shape. The Cristellarian segments are added consecutively on one side only of the previous segment, and may be represented as one of the branches of a letter **V** inverted, the aperture being at the one end (the apex) of the **V**; the other branch, in the case of a true *Cristellaria*, not being developed. If, however, at a certain stage, the other branch of the **V** becomes developed, the previous segment being embraced, not on one side only, as in the Cristellarian form, but on both sides, and the aperture being at the apex, we have a Flabelline *Frondicularia*. In this form, generally speaking, the segments are extremely compressed, the whole test being scarcely as thick as ordinary paper.

In fig. 1 (Plate XLI.) we have a shell with a Cristellarian beginning, passing into a *Nodosaria*. This may be called the *Amphycoryne*-form of *Nodosaria*, just as the specimen delineated in fig. 3 may be called the *Flabellina*-form of *Frondicularia*. The specimens figured illustrate the development of the genera to which we give the names of *Frondicularia* and *Nodosaria*, and suggest the conclusion that the primordial forms from which they were evolved resembled a *Lagena* and that the next steps of the evolution were represented by *Polymorphina* and *Cristellaria*. *Frondicularia* is no doubt the next step in one direction; whilst in another the evolution takes the line of *Nodosaria*. Hence it appears that *Nodosaria* is not directly developed from *Lagena*. The generic forms called *Polymorphina*, *Uvigerina*, and *Sagrina* intervene. We have thus an explanation of facts hitherto not quite easily explicable, namely, for example, the development of many Foraminifera from a more complex (biserial, triserial) form to a simpler (uniserial) form. In most individuals belonging to genera such as *Frondicularia* and others of the Nodosarian series what may be called the embryonic development is hidden and masked within so small a space (generally a mere lump or boss) that its details cannot be made out. But here and there a specimen delays, as it were, the development of its mature form beyond the usual period, and enables us to catch a glimpse of the genealogy of the type. What I have endeavoured to express and explain in the preceding remarks may be represented in a tabular form as follows:—



This, of course, represents the development of the Nodosarian and Frondicularian series only. The biserial and triserial structure of the Textularians, Bulimines, &c. suggests that their development has lain through *Polymorphina* also. The Globigerine, Rotaline, and Milioline series may have risen from the same primordial form; but in these the course of development was different.

§ 3. *Descriptions of new Forms of Foraminifera.*

1. Stilostomella rugosa, nov. gen. et sp. (Plate XLI. figs. 10, 11.)

Test usually consisting of 3–4 (but occasionally more) nodosariform chambers, rather rapidly increasing. The axis is generally slightly arcuate. Texture rough. Aperture crescentic, often situated in a produced neck. Internally the aperture is furnished with a hollow conical process, shaped somewhat like a shoe-horn, the open side of the process being on the inner side of the crescentic aperture.

The shape of the shell is fairly represented by the figure of D'Orbigny's model of *Nodosaria radicula* given by Parker, Jones, and Brady in Ann. & Mag. Nat. Hist. ser. 3, xvi. 1865, pl. i. fig. 27. The last chamber is, however, often more produced and terminates in a neck, at the end of which is the aperture. The texture of the shell is apparently of the character of that of *Lagena aspera*, or of the *Nodosaria* from the Naparima beds of Trinidad I have identified (rightly or not) with *N. rugosa*, D'Orb. Mr. Joseph Wright, F.G.S., gave it as his opinion that it was a new species of *Clavulina*; but the internal structure, including the hollow pillar, seems to suggest a relationship to *Ellipsoidina* and *Pleurostomella.*

From the Naparima Microzoic beds, Trinidad.

2. Ellipsoidina subnodosa, n. sp. (Plate XLI. fig. 12.)

Elongate, cylindrical, smooth, shining, generally tapering, having 4–12 chambers. Aperture crescentic, with a hooked and projecting lip and an internal hollow pillar.

Notwithstanding the resemblance in shape to a *Nodosaria*, this may generally be distinguished by its more regularly cylindrical shape, the separation between the chambers being less strongly marked than in most *Nodosariæ.* The aperture and interior structure are more distinct marks of difference. The species represents a close approach to *Pleurostomella*; but the aperture is not situated in a depression as it is in that genus, it is terminal or nearly so. Further, in our new species the segments rarely show a tendency to alternate as they do in *Pleurostomella*, though it is to be observed that in one or two specimens there is an indication of such a tendency near the apex. The aperture resembles that of *Ellipsoidina ellipsoides*, as represented by Brady's figure (Quart. Journ. Geol. Soc. vol. xliv. 1888, pl. i. fig. 1). Some specimens of *Pleurostomella subnodosa* come very close; see, for instance, the figures given by Burrows, Sherborn, and Bailey (Journ. R. Microsc. Soc. 1890, pl. viii. figs. 27–30). The shape varies from almost strictly cylindrical to subclavate and tapering. The texture is usually very close and fine and rather waxy-shining; but in what appear to be old specimens the surface becomes very finely roughened and seems to put on an arenaceous appearance. In this respect it makes an approach to *Stilostomella rugosa* (described above), whose aperture is somewhat similar.

Ellipsoidina subnodosa is a lengthened-out form of the type I have indentified as *E. exponens*, Brady, MS. (see Brady's remarks, quoted by Jukes-Browne and Harrison, Quart. Journ. Geol. Soc. 1892, p. 196). It is found in the Tertiary Microzoic rocks of Naparima, Trinidad.

3. Ellipsoidina exponens, Brady, MS. (Plate XLI. fig. 13.)

A smooth ovoid Foraminifer, having a crescentic aperture with a projecting hooked lip. The aboral end is generally smaller than the other extremity, and shows several successive chambers divided by very slightly sunk sutures.

It has the internal structure of *Ellipsoidina* (Ann. & Mag. Nat. Hist. ser. 4, vol. i. (1868), p. 333, pl. xiii.), and I believe it to be identical with the form so named by H. B. Brady, in Jukes-Browne and Harrison's paper on the Geology of Barbados (quoted under the foregoing description of *E. subnodosa*). It runs into forms near *E. ellipsoides*; indeed the three species (*E. subnodosa*, *E. exponens*, and *E. ellipsoides*) may turn out to be only extreme variations of one species. *E. subnodosa* and *E. exponens* are found in the Tertiary Microzoic rocks of Naparima in Trinidad; and, as already stated, *E. exponens* is found in the oceanic deposits of Barbados. Brady truly remarks that it is more than probable that specimens belonging to the group may have been mistaken for forms of *Lagena*, *Glandulina*, and *Nodosaria*. I add that *Ellipsoidina* may be found to bear a somewhat similar relation to *Pleurostomella* that *Glandulina* does to *Nodosaria*.

4. Frondicularia flabelliformis, n. sp. (Plate XLI. figs. 5, 6.)

Test fan-shaped, widening rather rapidly, sometimes with angular projecting ends to the segments. The aperture is a narrow (linear) fissure between thickened everted and plaited or corrugated lips. The form delineated in fig. 6 is stouter and of more even outline, the ends of the segments not projecting. Some examples (not figured) have the ends of the segments very decidedly projecting.

This is wonderfully like *Pavonina flabelliformis*, which occurs with it in the Microzoic rocks of Naparima, Trinidad; so much so that at first I confounded the two, and sent specimens of the *Frondicularia* to the British Museum (Natural History) under the name of the *Pavonina*. But the aperture distinguishes it easily; and when once recognized there is no likelihood of one being mistaken for the other.

5. Gaudryina pariana, n. sp. (Plate XLI. figs. 21, 22.)

A *Gaudryina* of somewhat angular sectional contour. The triserial initial portion is triangular, the test afterwards taking on the biserial Textularian form. The test is roughened by minute sand-grains.

This species is very much smaller than the dimensions usually attained by other members of the genus, e. g. *G. pupoides*; and the other Foraminifera found in the same deposits are with certain exceptions also of small size. It is from the *Ditrupa*-bed of Pointapier, Trinidad.

6. Gaudryina lobata, n. sp. (Plate XLI. fig. 20.)

Test elongate, somewhat compressed, tapering, subarcuate, the chambers projecting in the form of lobulated segments. Aperture large, surrounded by a raised lip.

The nearest relation of this species is probably *G. baccata*, Schwager; but its segments are prominent and distinct. It also recalls *Bolivina lobata*, Brady. It occurs in the Microzoic rocks of Naparima, Trinidad.

7. Gonatosphæra prolata, nov. gen. et sp. (Plate XLI. figs. 14–19.)

Test a many-chambered somewhat prolate sphæroid, the initial end generally of rather smaller diameter than the other. Chambers closely embracing. Sometimes each successive chamber embraces all the previous ones; in other cases some of the initial chambers are visible as indistinctly marked annular segments. A thread-like ridge, like a flange, surrounds the sphæroid in the direction of its length. This ridge, which often appears to be double, expands at the larger end of the test, and its two elements separating, leave between them a fissurine aperture. This is an elongated narrow opening between two pouting lips, the lips being a continuation and extension of the ridge or flange. Many specimens show a ridge at right angles to the longitudinal ridge; but this is produced by the breaking-away of the last chamber at the line of suture.

This singular organism appears to differ in some essential characters from any Foraminifer hitherto known, at least so far as I have been able to find out. It varies in shape from an almost perfect sphere to a sphæroid of very prolate shape, the initial (aboral) end being sometimes a very rounded and blunt projection. The longitudinal ridge is sometimes obsolete towards the aboral pole, sometimes it is single, and occasionally it is triple, the two lateral elements being the most raised. In shape the test resembles a very round *Glandulina*, like *G. obtusissima*, Reuss (Tert. Foram. Fauna, 1863, pl. viii. fig. 93; also *G. globulus*, figs. 94, 95), or *G. abbreviata*, Neug. (Sherborn and Chapman, London Clay Foram., Journ. Microsc. Soc. 1886, pl. xiv. fig. 20), or a *Lagena* like *L. obtusa*, Egg. (Reuss, 'Lagenideen,' 1862, pl. vii. figs. 92, 93). The test is hyaline, glistening, and very fine and close-grained in texture.

It has only been found in the *Ditrupa*-bed of Pointapier, Trinidad.

EXPLANATION OF PLATE XLI.

Fig. 1. Amphicoryne-form of *Nodosaria hispida*, D'Orb., var.

2. *Cristellaria aculeata*, D'Orb., var. A form found abundantly in the *Ditrupa*-bed of Pointapier, Trinidad. Closely allied to *C. wetherellii*, Jones, and *C. fragaria*, Gümb. Compare also *Marginulina cristellarioides*, Gümb. For comparison with fig. 1.

3. *Frondicularia complanata*, Defr. Flabelline variety showing Cristellarian initial portion.

4. *Frondicularia alata*, D'Orb. (*complanata*, Defr.). Specimen showing (*a*) Cristellarian initial portion, and (*b*) portion reproduced after loss by fracture of the original oral portion.

5. *Frondicularia flabelliformis*, n. sp. Usual form. In many specimens the ends of the chambers project more than is shown in this drawing

6. *Frondicularia flabelliformis*, n. sp. A thicker and stouter form than the preceding. This may be compared with *F. spissa*, Terquem (Rupert Jones, 'Monthly Microscopical Journal,' 1876, pl. cxxviii. fig. 24).

7. Initial segment of *Polymorphina*, comparable with *Lagena globosa*, Mont.

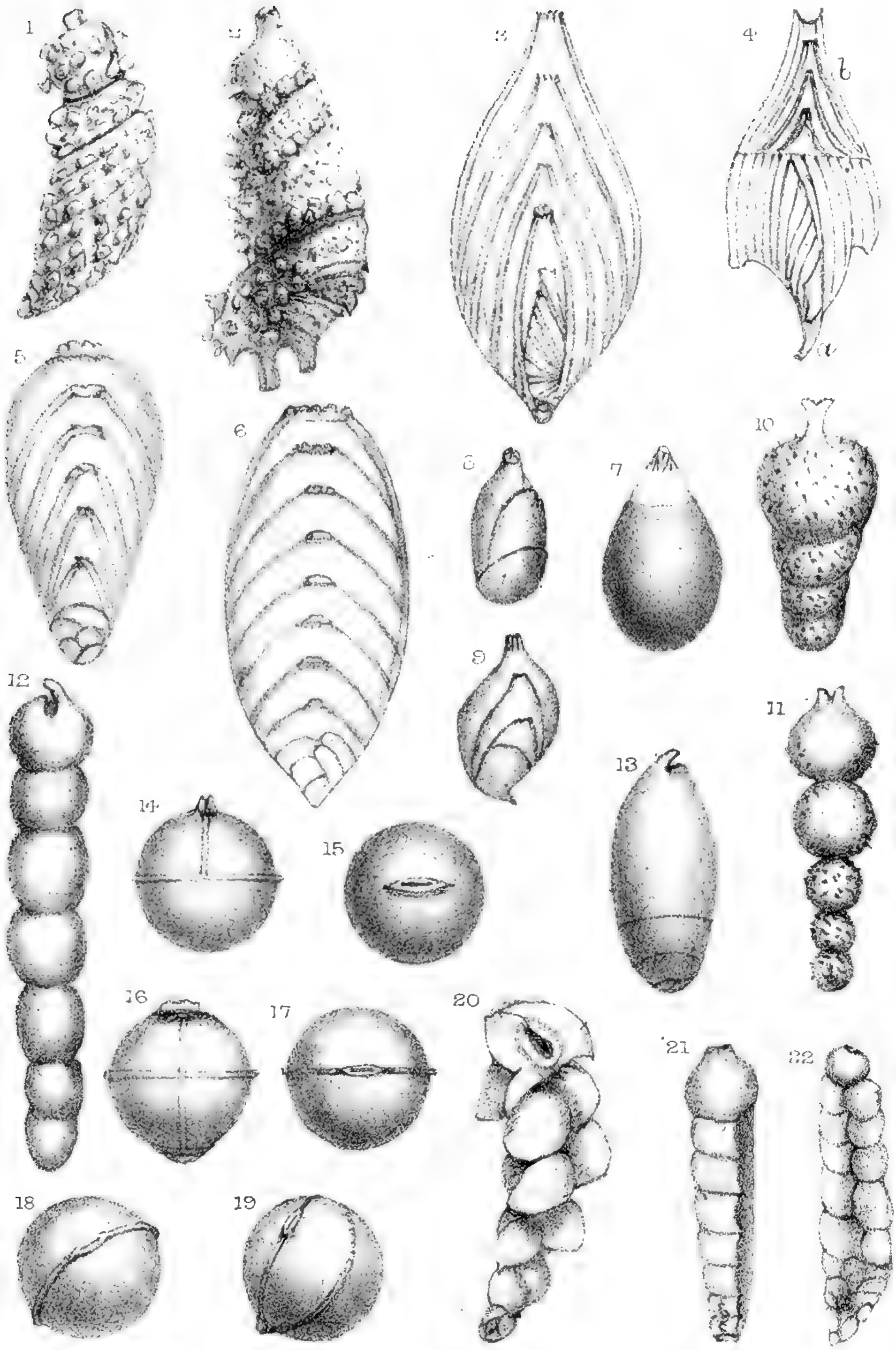
8, 9. Specimens showing the development of *Frondicularia* from a *Polymorphina* segment. These may be compared with *Flabellina ponderosa* and *triquetra*, Terquem (Rupert Jones, 'Monthly Microscopical Journal,' 1876, pl. cxxviii. figs. 25, 26).

10. *Stilostomella rugosa*, n. sp. A specimen with a protuberant neck.

11. The same. A specimen with a less protuberant neck.

12. *Ellipsoidina subnodosa*, n. sp.

13. *Ellipsoidina exponens*, Brady, MS.



L. L. Walter del.
F. H. Michael lith.

West, Newman imp.

Foraminifera from the microzoic deposits of Trinidad.

Fig. 14, 15, 16, 17, 18, 19. *Gonatosphæra prolata*, n. gen. et sp. Specimens figs. 15, 17, and 18 showing the unbroken test with the aperture and ridges; and figs. 14, 16, and 19 the ridge left by the breaking away of the last chamber.
20. *Gaudryina lobata*, n. sp.
21, 22. *Gaudryina pariana*, n. sp.

5. Note on the Petrel named *Œstrelata leucophrys* by Captain Hutton. By Sir Walter L. Buller, K.C.M.G., F.R.S., C.M.Z.S., &c.

[Received August 15, 1894.]

I am indebted to Captain Hutton for a copy of his paper "On a Collection of Petrels from the Kermadec Islands," which appeared in the 'Proceedings' of the Zoological Society for last year (see P. Z. S. 1893, p. 749).

In this paper Captain Hutton describes what he takes to be a new species of Petrel under the name of *Œstrelata leucophrys*, as to which I desire to offer one or two observations. But before doing so, I should like to notice another point, although it is of only trivial consequence. It is this: Captain Hutton, in writing of *Puffinus chlororhynchus* gives the following as a synonym:—"*P. carneipes*, Cheeseman (*fide* Buller), Trans. N. Z. Inst. vol. xxiii. p. 226, not of Gould." Now I should like to know what authority Captain Hutton has for quoting me here. I never saw Mr. Cheeseman's specimen and was never consulted about it. On turning to Mr. Cheeseman's paper, cited above, I find that he says:—"I am not quite certain whether this species is correctly identified, all my specimens being fledglings that have not yet lost their down."

The same remark, as to want of authority, applies to the following quotation, as a synonym of *Œ. nigripennis*, Rothschild:—"*Œ. cookii*, Cheeseman (*fide* Buller), Trans. N. Z. Inst. vol. xxiii. p. 224, not of Gray."

Where Mr. Cheeseman sought my assistance in the identification of species he has mentioned the fact in his paper.

As to "*Œstrelata leucophrys*" (of which an excellent figure is given in the 'Proceedings') I may mention that I took to England with me on my last visit a good series of specimens which I had received from the Kermadec Islands. These I submitted to Mr. Salvin, our acknowledged authority on the *Procellariidæ*, and he unhesitatingly referred them to the highly variable *Œstrelata neglecta*. At his suggestion I afterwards called at the Zoological Society's rooms to examine the specimen sent home by Captain Hutton, and the type of his new species, of which a drawing was then being prepared for the 'Proceedings.' It was undoubtedly of the same species.

November 20, 1894.

Sir W. H. Flower, K.C.B., LL.D., F.R.S., President, in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of October 1894:—

The total number of registered additions to the Society's Menagerie during the month of October was 103, of which 66 were acquired by presentation, 12 by birth, 14 by purchase, 4 by exchange, and 7 were received on deposit. The total number of departures during the same period, by death and removals, was 108.

Amongst the additions are a pair of Somali Ostriches (*Struthio molybdophanes*), from Somaliland, purchased Oct. 26th. This is the first pair of the blue-skinned form of Ostrich, which inhabits Eastern Africa, that has reached us. These birds have been placed in the Giraffe-House, along with a pair of the ordinary form and with an example of a curious pied variety of the Ostrich, deposited by the Hon. W. Rothschild, F.Z.S.

The Secretary exhibited, on behalf of Dr. C. Kerbert, C.M.Z.S., a photograph of a Mountain-Antelope (*Nemorhædus sumatrensis*) from a specimen living in the Gardens of the Royal Zoological Society of Amsterdam, and remarked that he had never seen a living example of this rare animal, and that specimens of it in Museums were very scarce.

Mr. R. Lydekker exhibited photographs and a model of a unique egg, the original of which had been obtained many years ago in Southern Patagonia, and was now preserved in the Museum at La Plata. If not an abnormal specimen, it could not be assigned to any known species of bird.

When travelling in the district where the specimen was obtained, Dr. P. Moreno, Director of the Museum at La Plata, many years ago saw numbers of small Ratite birds, which he at first took to be small Rheas. By the natives, to whom they were well known, he was, however, assured that they were adult birds, allied to the Rheas. Desirous of confirming this information, Dr. Moreno applied to a friend acquainted with the district; who replied that not only did he well know the birds, but that he possessed an egg, that egg being the original specimen of which a model was now exhibited.

Assuming the egg to be a normal one, Mr. Lydekker was of opinion that, taken in connexion with the evidence of two independent witnesses who had seen the birds, it pointed to the existence in Southern Patagonia of a small unknown Ratite bird more or less nearly allied to the Rheas.

Mr. Tegetmeier exhibited the felted covering of a long-haired

Angora Rabbit which had shed its entire coat in one piece for two years in succession. This seemed to show an analogy in a mammal to the simultaneous moulting of certain birds.

Sir William Flower exhibited a specimen of a Hairy Armadillo (*Tatusia pilosa*), obtained by M. J. Kalinowski in the Maraynioc district of Central Peru. It had been acquired by the British Natural History Museum in exchange from the Branicki Museum, Warsaw, through the kind offices of Dr. Stolzmann. In dimensions and other characters it exactly resembled the specimen belonging to the Scarborough Museum, that Sir William Flower had brought before the Society on November 16, 1886 (see P. Z. S. 1886, p. 419), which was identified with *Cryptophractus pilosus* of Fitzinger (32[te] Versamml. deutsch. Naturf. u. Aerzte, 1856, Tageblatt No. 6, S. 123), and with *Praopus hirsutus* of Burmeister.

A communication from Mr. J. T. Cunningham treated of the significance of diagnostic characters in the Pleuronectidæ. In this paper the specific and generic characters of the so-called Top-knot (*Zeugopterus*) were first considered. The principal generic characters were the perforation of the gill-septum, found also in *Arnoglossus megastoma*, and the prolongation of the dorsal and ventral fins on to the right side at the base of the tail. The marked peculiarity of habit was that of adhering to vertical surfaces. It was shown that this was independent of either of the characters mentioned, and was due to the pumping-action of the longitudinal fins and their muscles posteriorly, the enlargement of these parts being also a generic character. No evidence of the utility of the specific characters could be discovered. The characters of other Pleuronectidæ were similarly examined, and the conclusion reached was that there are two kinds of characters, the adaptive and the morphological.

The following papers were read :—

1. A Description of the so-called Salmonoid Fishes of the English Chalk. By A. Smith Woodward, F.Z.S.

[Received November 6, 1894.]

(Plates XLII. & XLIII.)

It is remarkable that among British fossils many of the commonest and most typical species have been the least satisfactorily studied and described. Among fishes this is more especially the case, and none have received less attention than those of the English Chalk. Some of them, such as the so-called

Salmonoids, have been assiduously collected since the days of Mantell, and are well represented in many museums; but nothing of importance with reference to their osteology has been published within the last half-century. It is impossible to make further progress in comprehending the fish-fauna of the Cretaceous period until a detailed study of all the known skeletons has been accomplished; and it is the object of the present communication to begin such a review of the materials at present available for discussion.

A beginning is made with the so-called Salmonoids of the English Chalk, because these have been the least elucidated by recent discoveries in corresponding strata elsewhere. The great Sauroid fishes like *Portheus* and the long-snouted *Protosphyræna* have been discovered in perfection in the Chalk of North America, while *Enchodus* and *Dercetis* have been found beautifully preserved in Westphalia and the Lebanon; but tolerably complete specimens related to the supposed Salmonoid *Osmeroides* are known only from the Chalk of Bohemia, and as these exhibit merely natural casts of the actual fossil they are comparatively unsatisfactory for study.

The generic name *Osmeroides* was originally given by Agassiz to some fishes from the Cretaceous of Westphalia, regarded by Pictet and the present writer as undoubted Scopeloids. Many examples of these species exhibit very distinctly the characteristic exclusion of the maxilla from the margin of the upper jaw; and they have few, well-spaced branchiostegal rays, without any gular plate. When the same name was afterwards applied to fossils discovered by Dr. Mantell in the English Chalk, it was expressly stated by Agassiz that the determination of generic identity was uncertain and provisional; and the following description will demonstrate that the Westphalian and English fishes in question belong even to distinct families. Although Agassiz himself hesitated to distinguish between Salmonoids and Clupeoids when dealing with fossils, preferring to combine them in one family "Halecidæ," subsequent authors appear to have unanimously assigned the English *Osmeroides lewesiensis* to the Salmonidæ. It is thus of much interest to turn to a detailed examination of the known specimens.

1. Osmeroides lewesiensis. (Plate XLII.)

Osmeroides lewesiensis, L. Agassiz, Poiss. Foss. vol. v. pt. i. p. 14, pt. ii. p. 105, pl. lx. *b.* figs. 1, 2, 5–7 (*nec* figs. 3, 4), pl. lx. *c.* (1834–44); A. S. Woodward, Proc. Geol. Assoc. vol. x. p. 322 (1888).

Salmo lewesiensis, G. A. Mantell, Foss. South Downs, p. 235, pl. xxxiii. fig. 12, pl. xl. fig. 1 (1822).

Osmeroides mantelli, L. Agassiz, Neues Jahrb. f. Mineral. 1839, p. 121 (name only); G. A. Mantell, Wonders of Geology, ed. 3, vol. i. p. 427 (1839).

Though many of the smaller features in the skeleton of this fish still remain to be discovered, nearly all its principal characters can now be ascertained. The beautiful series of specimens in the

British Museum exhibit both the head and trunk with fins, and these form the basis of the following detailed description.

The hinder half of the cranial roof, the facial and opercular bones, and the upper branchiostegal rays are ornamented with rugæ, mostly radiating. The cranial roof is flattened, with a faint tendency to a depression mesially, and the occipital border is excavated by a re-entering angle. The *parietal* bones (Plate XLII. fig. 2, *pa.*) are relatively small, longer than broad, and meet throughout their length in the median line, excluding the supra-occipital from the roof. The *squamosals* (fig. 2, *sq.*) flank the parietals, forming the postero-external angle of the cranial roof, and produced forwards a little along the outer margin of the frontals. The *frontals* (figs. 2, 3 *a*, *fr.*) are very large, broad, and rugose behind, tapering and nearly smooth forwards. In their hinder half the median suture between them is feebly dentated; the anterior extremity of each exhibits a Λ-shaped excavation (fig. 3 *a*). Occupying an indent in the outer margin of each frontal above and partly in advance of the orbit is a rugose elongated membrane-bone covering the prefrontal region, which is perhaps best named *supraorbital* (fig. 2, *sp.o.*). The depressed and expanded *ethmoidal region* (fig. 3 *a*, *eth.*) is widest at the palatine articulation. The *supraoccipital* exhibits a large vertical keel on its hinder face, but neither the occipital nor otic elements are sufficiently well displayed for description. In the pterygo-palatine arcade the *quadrate* (figs. 3, 4, *qu.*) is often seen. It is triangular in shape, with a robust articular head, and an upwardly directed process arising from the lower end of its hinder border, clasping the thick styliform *symplectic* (fig. 4, *sym.*). The whole of its upper margin is apposed to the thin triangular *metapterygoid* (figs. 3, 4, *m.pt.*), and its anterior edge is similarly in contact with the downwardly curved hinder extremity of the *ectopterygoid* (fig. 3, *ectp.*). The twisted and expanded *hyomandibular* is also shown in one specimen, reaching the upper end of the symplectic; and there are remains of a relatively large and thin, antero-posteriorly elongated *entopterygoid*. In specimen no. P. 5680 there is evidence of minute clustered, pointed teeth on some thin internal bone; and this may have been either ecto- or ento-pterygoid. The *maxilla* (figs. 3, 5, *mx.*) is robust and arched, with a large upwardly directed process at its anterior end and a convex oral margin. The upper portion is overlapped by two large *supramaxillaries* (figs. 3, 5, *s.mx.* 1, 2), the hinder the deepest, and sending a narrow process forwards above the upper margin of the anterior plate. The *premaxilla*, underlapping the maxilla, is small, and both this and the maxilla are provided with very minute clustered teeth. The *dentary* portion of the mandible (figs. 5 *a*, 6, *d.*) is very robust at the symphysis, with a cluster of minute teeth in several series; the points of attachment of these teeth are shown in fig. 5 *a*. The dentary rises in the coronoid region, and its hinder margin is excavated for the reception of the large *angular* (fig. 6, *ag.*). The lower border of the mandible is slightly bent inwards; and just below the angle there extends the sensory canal, opening by a series of pores (seen in Brit. Mus. nos. 4294, P. 6456). There are two large *postorbital cheek-plates* (fig. 3, *pt.o.*), thinner than the other external bones (except the gular plate), and there are also remains of *suborbitals* extending to the anterior border of the preoperculum.

The opercular apparatus is complete and the bones are robust. The *operculum* (fig. 3, *op.*) is trapezoidal in form, about two-thirds as broad as deep, and marked with coarse branched rugæ radiating from the point of suspension. The *suboperculum* (fig. 3, *s.op.*), likewise ornamented, is almost sickle-shaped and deeply overlapped by the operculum, and bears a large ascending process at its antero-superior angle. The *interoperculum* is small, smooth, and much overlapped. The *preoperculum* (fig. 3, *p.op.*) is sharply angulated and marked with radiating rugæ. There are not less than eighteen *branchiostegal* rays (as shown by B.M. no. P. 5680), the uppermost large, broad, and rugose; and five of these are supported by the epihyal. In advance of the branchiostegal rays, between the rami of the mandible, there is also a conspicuous *gular plate* (fig. 1, *gu.*), remarkably thin and elongated, but shown both in the specimen figured and in others in the British Museum numbered 4207, 4296, 4299, and 49891.

The axis of the trunk is only imperfectly known. The *vertebral centra* are strengthened by secondary calcifications in the form of small irregular longitudinal ridges; those of the anterior abdominal region and the hinder caudal region are deeper than long, while the remainder are about as long as deep. *Ribs* are observable, and there are much thickened neural and hæmal arches fused with the centra towards the base of the tail (B.M. no. 4303). Some styliform bones in the abdominal region of no. 49892 also appear to be *intermuscular* elements.

There is nothing worthy of remark in the pectoral arch, of which the long *supraclavicle* and relatively large and smooth *clavicle* are shown in a British Museum specimen, no. P. 5680. The *pectoral fin-rays* (fig. 1, *pct.*) are unjointed for a considerable distance proximally, and the foremost ray (shown in B.M. no. 49894) exhibits an oblong expansion at its base of attachment. The rays of the *pelvic fins* (fig. 1, *plv.*) are not less than 11 in number and are similarly only divided quite at the distal end; their supporting elements are unknown. The *dorsal fin*, placed in the middle of the back, opposite to the pelvic pair and arising somewhat in advance of the latter, is incompletely known, but consists of robust rays unjointed for a long distance proximally, very closely divided at the distal end; the supports (shown in B.M. no. 49892) are large and dagger-shaped, having wide "wings." The *anal fin* (fig. 1, *a.*) is small and remote; the *caudal fin* appears to have been forked (B.M. no. 49891).

The *scales* are very deeply overlapping, the covered portion being marked by few radiating grooves terminating at the anterior truncated margin. The posterior border is gently rounded, and the exposed portion of the scale sometimes shows only the concentric lines of growth, sometimes is ornamented with very fine closely-arranged radiating lines of tubercles. The latter ornamentation is probably normal and varies with the state of abrasion of the fossil. The scales of the *lateral line* are not enlarged; the course of the sensory canal is marked by a feeble ridge and a notch in the hinder border of most of the scales.

2. Elopopsis crassus. (Plate XLIII. figs. 1, *a–c*.)

Osmeroides crassus, F. Dixon, Geol. & Foss. Sussex, p. 376 (1850); A. S. Woodward, Proc. Geol. Assoc. vol. x. p. 322 (1888).

The name of *Osmeroides crassus* was given by Dixon to a unique specimen from the Chalk of Sussex now in the Brighton Museum, but the fossil has hitherto been only briefly noticed without detailed description. The writer has thus availed himself of the kindness of Henry Willett, Esq., and the ex-Chairman of the Museum Committee (Edward Crane, Esq.), to examine the original specimen more closely. It comprises the head with the anterior part of the abdominal region of a large fish, much fractured and crushed and exhibiting part of the pectoral fin on the left side. The right side of the head is represented in Pl. XLIII. fig. 1; an upper view of the ethmoidal region is given in fig. 1*a*; and separate drawings of the left premaxilla and dentary are given in figs. 1 *b*, *c*.

The superficial bones exhibit no ornamentation, merely the lines of growth and in places sensory canals. The cranial roof is much crushed and fractured and thus too imperfect for description. The great extent of the *frontals*, however, is well shown, and the much-expanded and truncated *ethmoid* (fig. 1 *a*, *eth.*) is completely preserved. The *postorbital* plates (fig. 1, *pt.o.*) cover the cheek between the orbit and the preoperculum, and there are also remains of well-developed *suborbitals* (*s.o.*). The *premaxilla* (figs. 1, 1 *b*, *pmx.*) is relatively small, elongate-triangular in shape, and furnished on its oral margin with a close series of small conical teeth. Within the mouth, and apparently fixed on the same bone, are also two much-enlarged teeth, laterally compressed but without trenchant edges; the foremost, placed at the anterior end of the bone and shown only by the base, is the smaller of the two; the second, well-preserved on each side, occurs at about the middle of the bone. In the fossil the anterior ends of the premaxillæ are widely separated, but this may be due to crushing. The *maxilla* (fig. 1, *mx.*) is very large, extending backwards beyond the orbit, and overlapped above by either one or two *supramaxillary* bones (*s.mx.*), which are too much crushed for description. The oral margin of the bone is convexly arched, and in the fossil curves slightly inwards; it bears a single regular series of very short and stout conical teeth, larger than the marginal teeth of the premaxilla, and there are appearances of a second series of smaller teeth occuring immediately within. The *dentary* bone of the mandible (fig. 1 *c*) is deep behind and tapers rapidly to an almost pointed symphysis; it bears a single series of well-spaced, large, conical teeth, laterally compressed but without trenchant edges. There is also a pair of still larger teeth of a similar character immediately within the symphysis of the mandible. All the teeth are smooth. The *preoperculum* (fig. 1, *p.op.*) is relatively thin, broad at its angle, and marked with radiating sensory canals. The limits of the *operculum* and *suboperculum* are not quite clear; and of the *branchiostegal rays* it can only be said that they are numerous, perhaps about 20 on each side. A *gular plate* may or may not have been present, but no remains of it are preserved.

The centra of the anterior abdominal vertebræ are deeper than long, and strengthened by peripheral secondary calcifications in the form of irregular longitudinal ridges. The scales are large and smooth.

As shown by the characters of its dentition, the fossil thus described evidently pertains to a genus distinct from that to which *Osmeroides lewesiensis* is referred. In the absence of the trunk, however, it is difficult to determine its precise position; and it can only be said to approach most nearly the *Elops*-like fishes from the Chalk of Bohemia and Dalmatia to which the generic name *Elopopsis* has been applied. It agrees with these especially in the nature of the dentition, the form of the mandible, and the characters of the preoperculum. As a temporary expedient, the Brighton fossil may therefore bear the name of *Elopopsis crassus*.

3. Aulolepis typus. (Plate XLIII. figs. 2–6.)

Aulolepis typus, L. Agassiz, Poiss. Foss. vol. v. pt. i. p. 14, pt. ii. p. 109, pl. lx.*a*. figs. 5–8 (1834–44); A. S. Woodward, Proc. Geol. Assoc. vol. x. p. 324 (1888).

Another generic type from the English Chalk commonly regarded as a Salmonoid is named *Aulolepis*. Only a single species, *A. typus*, is known; but this is represented by so large a series of specimens in the British Museum that it makes an important contribution to our knowledge of the osteology of the Cretaceous physostomatous fishes.

The head is known almost exclusively by the external bones. The cranial roof (fig. 2) is flattened mesially, but somewhat arched downwards at the lateral margin; and the occipital border is either straight or with a slightly re-entering angle. The *supra-occipital* exhibits a median vertical keel on its hinder face, but the bone is almost or quite excluded from the superior aspect of the skull. The *parietals* (*pa.*) meet in an irregular wavy suture, as also does the hinder portion of the *frontals* (*fr.*), and the former bones scarcely attain one-third of the length of the latter; the transverse suture between these two pairs of elements is likewise unsymmetrically wavy. The *squamosals* (*sq.*) are as broad as the parietals, but extend further forwards on the outer margin in a narrow process. Each frontal (fig. 3) is very broad behind and much tapering in front, while the longitudinal sensory canal opens on its surface in a series of small pores. The *ethmoidal region* of the cranium can only be described as narrow, not much expanded at the extremity.

The *cheek-plates* are large, but comparatively thin; and the only evidence of ornament consists in radiating lines on the large postero-inferior suborbital (B.M. nos. 49903, P. 5681). The *maxilla* is very robust and arched so that the oral margin is convex (fig. 4, *mx.*). Anteriorly it is produced upwards and inwards as a long narrow process (*p.*) above the premaxilla towards its attachment in the front of the ethmoidal region; the upper portion is a thin lamina overlapped by two supramaxillary plates (figs. 3 *a*, 4, *s.mx.*), of which the hindermost is deepest and has an anteriorly directed process at its front upper angle. The *premaxilla* (fig. 4, *pmx.*) is shown to have been moderately extended beneath the maxilla. The mandible is deepest in the coronoid region, and the *angular* element (fig. 2 *a*, *ag.*) is very large, extending for a length of more than two-thirds that of the *dentary* (*d.*) on the outer surface. The inferior border of the ramus is slightly bent inwards, and along the angle thus formed the sensory canal opens in a longitudinal series of small pits (fig. 5). The teeth are very minute and clustered on the margin of both jaws.

Behind the occipital on each side there is a small *supratemporal* plate, and partly covered by this is a large *post-temporal* element. The *operculum* (fig. 5, *op.*) is trapezoidal in form, nearly twice as deep in front as behind. The *suboperculum* (*s.op.*) is somewhat less than half as deep as the latter, and has a prominent ascending process at its antero-superior angle. The *preoperculum* (fig. 4, *p.op.*) is well exposed, with the inferior limb sharply bent forwards; and its outer face is marked by a sharp vertical ridge giving rise to a few radiations at the angle. The *interoperculum* (fig. 5, *i.op.*) is long and narrow, and the *branchiostegal rays*, shown to the number of eight or nine in fig. 5 (*br.*), are broad. It is also interesting to observe that between the rami of the mandible (fig. 5, *d.*) there is a long narrow azygous *gular plate* (*gu.*), quite smooth on the outer face and regularly rounded at each end.

One specimen (no. 47932) exhibits at the back of the head remains of a close series of small styliform bones, acutely pointed at the anterior end, attached by a slight expansion at the hinder end. These are probably *gill-rakers*.

The *vertebral centra* are robust and the secondary lateral ossifications are in the form of delicate longitudinal ridges. Appearances in nos. 49903 and P. 4247 suggest that there was a perforation in the middle of each centrum allowing for the passage of a persistent thread of notochord; while it is clear that the neural arches throughout and the hæmal arches in the caudal region are fused with the supporting centra. *Ribs* also are seen in the abdominal region, not extending quite to the ventral border. The number of vertebræ cannot be counted, but there seem to have been not less than twenty in the abdominal region. The anterior abdominal vertebral centra are deeper than long—those most posteriorly at least as long as deep.

The *pectoral arch* is obscure, but the remains, shown from the inner aspect in fig. 6, exhibit the relatively large elongated *supra-*

clavicle (*s.cl.*) and the arched *clavicle* (*cl.*) expanded at its lower end. Posteriorly may also be seen the large *scapula* (*sc.*), pierced by an oval foramen. The *pelvic arch* (fig. 6, *plv.*) is of the ordinary form, the two halves separate, each expanded at the origin of the fin and tapering forwards. It is situated in a remarkably advanced position, for the figured specimen seems to show that the anterior fins represented in the type specimen are truly the pelvic pair; while each of these fins is very well developed and comprises not less than eight rays [1]. The dorsal fin (fig. 2, *d.f.*) occupies about the middle of the back and seems to comprise two or three spinous rays anteriorly.

The *anal fin* is small and remote, consisting of robust rays which are unjointed for a considerable length at their base.

The *scales* are thick, cycloid, and very deeply overlapping; the external markings are merely those produced by the concentric lines of growth, but there are a few traces of radiating lines and crimping in the covered portion. The peculiar longitudinal elevations, described by Agassiz as marking the course of the "lateral line," are apparently confined to the scales of the caudal region.

4. ACROGNATHUS BOOPS.

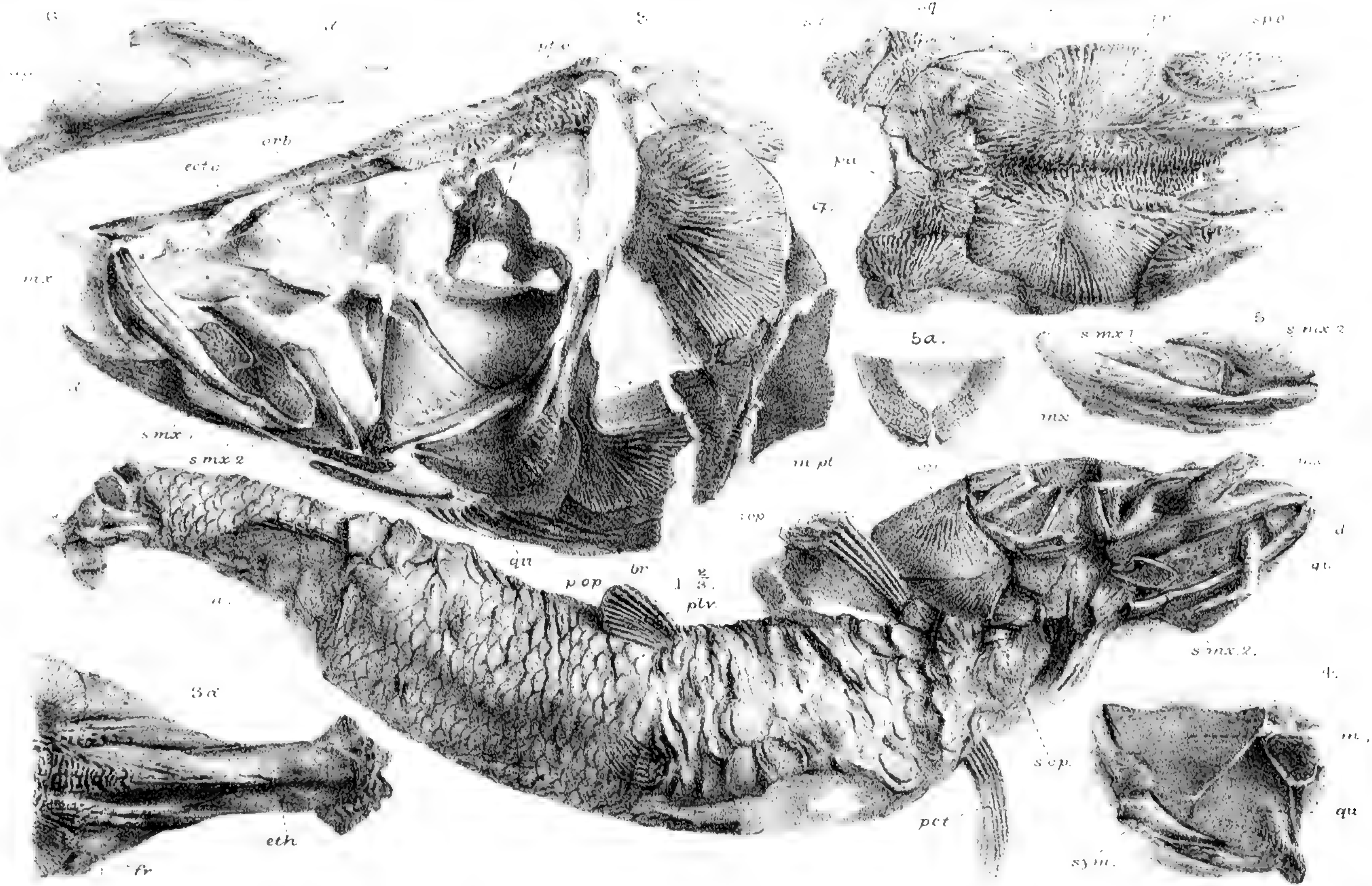
Acrognathus boops, L. Agassiz, Poiss. Foss. vol. v. pt. i. p. 14, pt. ii. p. 108, pl. lx. *a.* figs. 1–4 (1834–44); A. S. Woodward, Proc. Geol. Assoc. vol. x. p. 323 (1888).

No new evidence is forthcoming as to this supposed deep-sea Salmonoid. It is represented in the British Museum only by the type specimen and a fragment.

Conclusion.

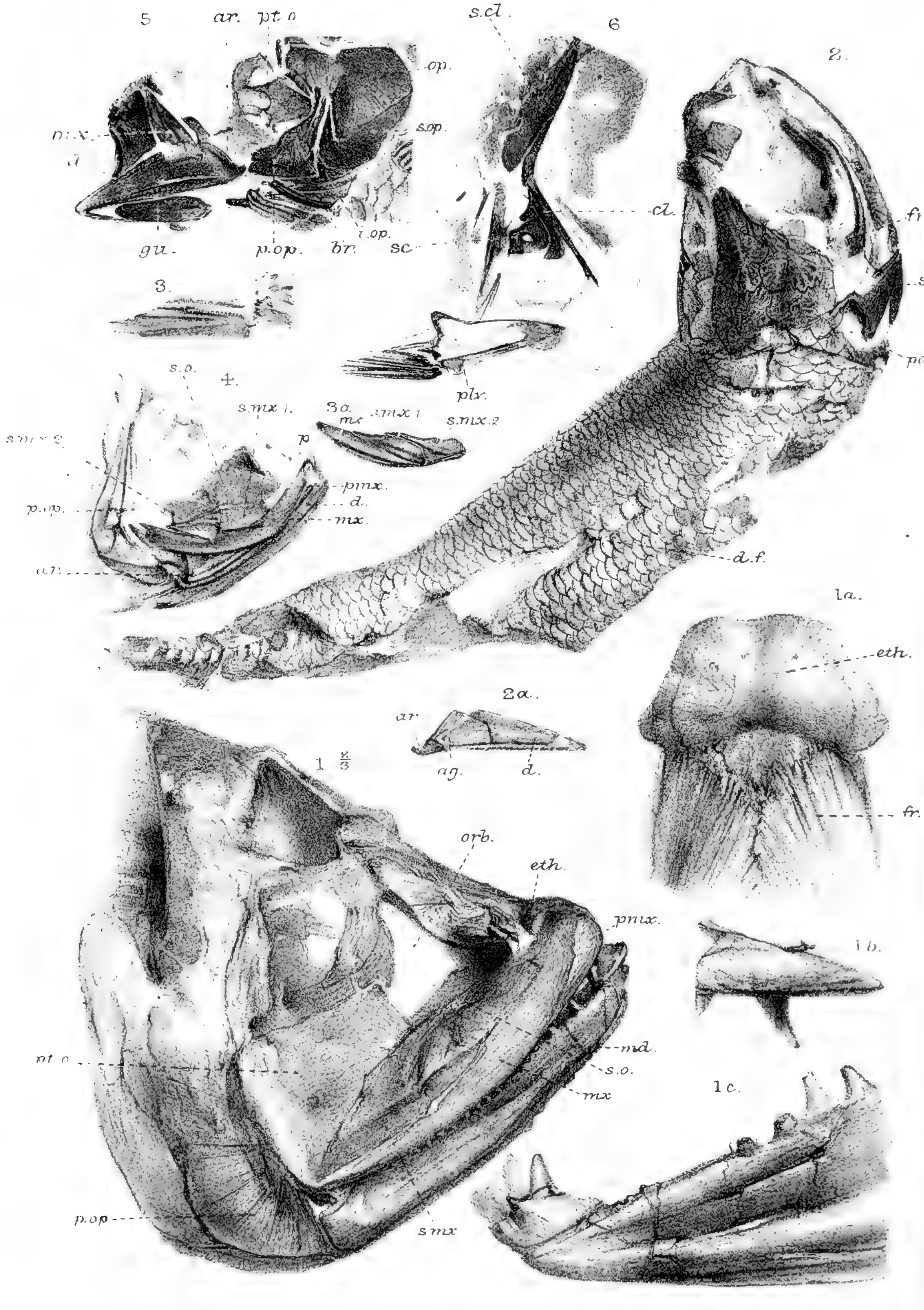
In determining the systematic position of these fishes from the English Chalk it is, of course, impossible to refer to the most distinctive external feature by which Salmonoids can be separated from Clupeoids. The nature of the matrix would not admit of the preservation of an adipose dorsal fin, even if it were originally well-developed. Three osteological characters of *Osmeroides* and *Aulolepis*, however, now made known for the first time, combine to suggest comparisons only in one direction, namely, with the modern genera *Elops*, *Megalops*, and their extinct allies. These characters are:—(i.) the union of the parietal bones mesially to the exclusion of the supraoccipital from the cranial roof; (ii.) the arched maxilla overlapped above by two large supramaxillary bones; and (iii.) the presence of a large gular plate. It is true that although in the typical Salmonidæ the supraoccipital separates the parietals on the cranial roof, there are rare instances (*e.g.*, *Thymallus*) in which the parietals are in contact throughout their

[1] Since this paper was read the writer has observed a specimen in the Woodwardian Museum, Cambridge (Forbes-Young collection), in which the pelvic fins are beautifully preserved in the advanced situation here described.



F. H. Michael del. et lith. West, Newman imp.

Osmeroides lewesiensis.



F.H. Michael del et lith.

West, Newman imp.

1. Elopopsis crassus.
2-6. Aulolepis typus.

length. Further, it is known that the double supramaxilla is not quite constant in the Clupeoids, Elopines, and their allies. It may also be argued that, as Dr. Günther admits to the Clupeidæ living fishes with a gular plate (*Elops*, *Megalops*), there is no reason for excluding from the Salmonidæ any primitive fishes which differ only from the living members of this family in the possession of such a plate. Nevertheless, so far as the present writer is aware, supramaxillaries of the form described above in *Osmeroides* and *Aulolepis* have not hitherto been observed in any Salmonoid, while they are a very common feature among Clupeoids and Elopines. The two Cretaceous genera under discussion may therefore be provisionally associated with the latter. The fishes named *Osmeroides* from the Chalk of Mount Lebanon may also be placed here, for they likewise exhibit a large gular plate; and *Elopopsis* is already assigned to the same systematic position by common consent. *Elops* and *Megalops*, indeed, have many more close allies in Cretaceous and early Tertiary strata than has hitherto been suspected, and the type they represent seems to have been dominant among the earliest Physostomi.

EXPLANATION OF THE PLATES.

Plate XLII.

Fig. 1. *Osmeroides lewesiensis*; fish from ventral aspect, two-thirds nat. size. *a.*, base of anal fin; *d.*, dentary; *gu.*, gular plate; *mx.*, maxilla; *op.*, operculum; *pct.*, pectoral fins; *plv.*, pelvic fins; *s.mx.2*, posterior supramaxillary; *s.op.*, suboperculum. [P. 7188.]

2. Ditto; hinder portion of cranial roof, upper aspect. *fr.*, frontal; *pa.*, parietal; *s.t.*, supratemporal; *sp.o.*, supraorbital; *sq.*, squamosal. [4295.]

3. Ditto; side view of head. 3 *a*. Rostral region of same specimen, upper aspect. *br.*, branchiostegal rays; *m.pt.*, metapterygoid; *d.*, dentary; *ectp.*, ectopterygoid; *eth.*, ethmoid; *fr.*, frontal; *mx.*, maxilla; *op.*, operculum; *orb.*, orbit; *p.op.*, preoperculum; *pt.o.*, postorbital; *qu.*, quadrate; *s.mx.* 1, 2, supramaxillaries; *s.op.* suboperculum. [4296.]

4. Ditto; right quadrate (*qu.*), metapterygoid (*m.pt.*), and symplectic (*sym.*), outer aspect. [P. 5680.]

5. Ditto; left maxilla (*mx.*) and supramaxillaries (*s.mx.* 1, 2), outer aspect. 5 *a*. Symphysis of mandible, oral aspect, showing attachment of teeth. [49891.]

6. Ditto; right mandibular ramus, outer aspect. *ag.*, angular; *d.*, dentary. [4296.]

Plate XLIII.

Fig. 1. *Elopopsis crassus*; lateral view of head, two-thirds nat. size. 1 *a*. Upper view of ethmoidal region. 1 *b*. Left premaxilla, outer aspect, 1 *c*. Left dentary, outer aspect. *eth.*, ethmoid; *fr.*, frontal; *md.*, mandible; *mx.*, maxilla; *orb.*, orbit; *p.op.*, preoperculum; *pmx.*, premaxilla; *pt.o.*, postorbital; *s.mx.*, supramaxillary; *s.o.*, suborbital. [Willett Collection, Brighton Museum, no. 61.]

2. *Aulolepis typus*; imperfect fish, dorsal aspect. 2 *a*. Right mandibular ramus. *ag.*, angular; *ar.*, articular; *d.*, dentary; *d.f.*, dorsal fin; *fr.*, frontal; *pa.*, parietal; *sq.*, squamosal. [P. 5681.]

3. Ditto; right frontal, upper aspect. [P. 1854.]

Fig. 4. *Aulolepis typus*; head, right lateral aspect. *p.*, palatine process of maxilla; other letters as above. [P. 4247.]
5. Ditto; head, left lateral aspect, with gular plate (*gu.*). *br.*, branchiostegal rays; *i.op.*, interoperculum; *op.*, operculum; *s.op.*, suboperculum; other letters as above. [49903.]
6. Ditto; pectoral and pelvic arches. *cl.*, clavicle; *plv.*, imperfect pelvic bone with fin; *s.cl.*, supraclavicle; *sc.*, scapula. [47932.]

All the specimens were obtained from the English Chalk, and unless otherwise stated the figures are of the natural size. Except the original of Pl. XLIII. fig. 1, the specimens are preserved in the British Museum, and the numbers placed in brackets refer to the Register of the Geological Department.

2. On the Gastropod *Colpodaspis pusilla* of Michael Sars. By Walter Garstang, M.A., F.Z.S., Fellow and Lecturer of Lincoln College, Oxford.

[Received November 20, 1894.]

(Plate XLIV.)

The mollusk which forms the subject of the present communication has been so rarely seen, and presents such interesting peculiarities, that no apology is needed for the description of a new specimen. In the main my observations confirm those of the discoverer of *Colpodaspis*, Michael Sars; but the few points in which I have to modify, or supplement, Sars's interpretations seem to render the position and relations of the genus somewhat clearer than has hitherto been the case.

The literature on *Colpodaspis pusilla* is not extensive, as the only original observations on the creature are contained in Sars's memoir [1] on the fauna of the Christiania fjord. Two specimens were found by Michael Sars at Dröbak, one in August 1864 at a depth of 70–80 fms., the other in June 1865 at a depth of 20 fms. A slightly larger specimen was obtained a little later by G. O. Sars at Horten in 14–20 fms. Since the capture of these Norwegian specimens thirty years ago no additional individuals appear to have been obtained until on Feb. 21st of the present year (1894) I found [2] a specimen in the results of a day's dredging in the immediate neighbourhood of Plymouth, about two miles south of the Mewstone, at a depth of some 15 fms. The ground was rough, and consisted of hard clean red sandstone covered with *Caryophyllia*, with which were associated *Sertularia argentea*, *Henricia* (*Cribella*) *sanguinolenta*, and a sponge resembling Bowerbank's figure of *Isodictya dissimilis* (Brit. Spong. iii. pl. lv.).

This Plymouth individual was one eighth of an inch (3·125 mm.) in length. In colour it was snow-white, speckled with opaque white spots. When the animal was inverted, a position which it

[1] M. Sars, Bidrag til Kundskab om Christianiafjordens Fauna, ii. (Christiania, 1870), pp. 70–74, plate xi. figs. 1–6.

[2] Garstang, "Faunistic Notes at Plymouth during 1893–94," Journal Mar. Biol. Assoc. iii. 1894, p. 219.

frequently assumed in captivity in order to creep, after the manner of so many Nudibranchs, along the surface-film, a large glandular mass of an orange colour could be seen through the skin in the anterior part of the posterior prolongation of the mantle, where this organ lay beneath the foot. This glandular mass of an orange colour in all probability represents the "rounded brownish-yellow mass" observed by Sars in a similar position and termed by him the liver. The anterior edges of the foot, the dorsal and posterior edge of the tentacles, and parts of the ventro-lateral region of the mantle were ciliated.

The animal consists of a foot, a small tentaculated head, an elevated globose body, and a posterior tail-like pallial appendage.

The Foot.—Sars states that the foot is well-developed and of about the same length as the mantle; that in front it is as broad as the mantle, but becomes considerably narrower behind, and terminates in an obtusely rounded extremity. He further states that its anterior edge is divided in the middle by a deep incision into a pair of lappets with rounded extremities. These statements are perfectly borne out by his figures (pl. xi. figs. 1, 4); but comparison with those supplied by myself shows that a somewhat different interpretation must be made of the anterior parts of the foot. The two lappets, which in Sars's figures are shown to be directed forwards, are not really, as he maintains, the divaricated halves of the anterior part of the foot, but are rather to be regarded as a pair of expansions of the antero-lateral margins of the foot, analogous to the anterior horns of the foot in many Æolids, but differing from the latter in their greater size and obtuse extremities (Pl. XLIV. fig. 2). Sars's figures also indicate that they are capable of being directed forwards; but I never observed them in this position myself, and must regard the condition represented in my figures as more normal than the former. These antero-lateral processes are so considerable that, in view of the affinities indicated by other organs of *Colpodaspis,* I am strongly inclined to regard them as homologous with those pleuropodial [1] expansions so frequently met with among Opisthobranchiate mollusks. This view receives strong support from the fact that in *Haminea hydatis* of the Mediterranean (which appears to be a different species from the *H. hydatis* of British naturalists) the pleuropodia, according to Roule[2], are scarcely developed except on the sides of the anterior region of the body. Here—to judge from Roule's figure—they form elongated obtuse flattened expansions of the foot remarkably like those of *Colpodaspis*, differing only in their greater size and in their power of retroflexion over the back of the body.

[1] The term *pleuropodia* was suggested by me in 1890 as a substitute for the undesirable word *parapodia* as applied to the lateral pedal expansions of Opisthobranch mollusks, and has been accepted by Bergh and other writers (Journ. M. B. A. i. p. 419).

[2] Roule, "Recherches sur les Tectibranches etc.," Ann. Mus. Hist. Nat. Marseille, ii. 1885, Mém. no. 3, p. 22, fig. 13.

The foot, upon this interpretation, must accordingly be described as T-square shaped, with gracefully arched anterior wings and rounded extremities, and of about the same length as the shell-bearing portion of the mantle. The median furrow of its plantar surface is shown in my drawing (fig. 2) to have the same extent as in Sars's specimens.

The Head.—The grooved tentacles in my specimen correspond with Sars's description, except that no mention is made in the latter of a low curved ridge which can be seen in my figure 1 crossing the anterior part of the head from side to side and connecting the postero-dorsal edges of the two tentacles with one another. The eyes also are much closer together in the Plymouth individual than they are represented to be in Sars's figures; and the statement of the latter that they are situated "close behind and within the base of the tentacles" cannot be said to be applicable in the present case. I do not, however, think that any great importance should be attached to these slight discrepancies.

When *Colpodaspis pusilla* is creeping upon a flat surface, the antero-lateral horns of the foot are just perceptibly in advance of the tentacles (fig. 1); but when the creature is swimming inverted at the surface of the water the tentacles are then seen to be considerably in front of the horns of the foot (fig. 2).

The Body.—I have no addition to make to Sars's account of the body proper, except that in the Plymouth specimen the edges of the pallial siphon were more closely apposed than seems to have been the case with Sars's individuals.

Pallial appendage.—When the animal is creeping upon the bottom of a vessel, a broad flattened tail-like appendage projects behind the mantle and seems at first sight to be the posterior section of the foot. Examination of the animal from the ventral aspect, however, reveals that this appendage is in reality a posterior prolongation of the hinder margin of the mantle to the morphological left of the pallial siphon (fig. 2).

Sars adduces no homologue of this peculiar appendage, but it is, in my opinion, to be directly compared with the posterior pallial lobes of various genera of Bulloid Tectibranchs. For example, in *Haminea cornea* Roule[1] writes as follows:—"*.. à sa partie postérieure le manteau devient assez charnu et forme alors une expansion arrondie que de prime abord on serait tenté de considérer comme l'extremité du pied. Cette expansion nous paraît être l'analogue du lobe palléal postérieur de droite que l'on observe chez le* Doridium meckelii, *mais qui serait privé de son flagellum.*"

Forbes and Hanley[2] mistook this pallial lobe for a "supra-caudal (equivalent to opercular) lobe," but they correctly describe it in *Haminea hydatis* as being "large and reflected on the spire."

In *Philine catena* also, according to Roule[3], the mantle terminates posteriorly in a convex margin, a little below which are two fleshy

[1] *L. c.* p. 19.
[2] 'British Mollusca,' vol. iii. p. 542, pl. UU. fig. 3.
[3] *L. c.* p. 36.

prolongations, "which can be mistaken for the posterior border of the foot when the animal is contracted." His figures unfortunately do not show this point at all well (pl. i. fig. 25), and Forbes and Hanley's figure, though clearer, does not seem to represent the anatomical relations correctly (*l. c.* pl. UU. fig. 4).

In *Philine aperta* the plantar surface also consists both of foot and mantle; but this part of the mantle does not correspond with the pallial appendage of *Colpodaspis*, as it contains the viscera and shell. If it be examined, however, from the ventral aspect, the pallial siphon is seen on the left hand, as in *Colpodaspis* (fig. 2), and, to the right of the siphon, the mantle is seen to be prolonged into a short free membranous border, which overhangs the siphonal groove and even extends slightly behind it. The relations of this slight expansion are such that I think it may be regarded as the rudimentary, or probably vestigial, representative of the pallial appendage of *Colpodaspis*.

Radula.—This organ was not described in Sars's original paper, but a figure of it was given (without description) in a later work by G. O. Sars[1]. There is a single admedian series of sickle-shaped denticles on either side, and two series of slender laterals, the formula thus being 2, 1, 0, 1, 2. I was unable to lay open the contracted radula of my specimen, owing to its excessive minuteness; but I determined that the number of rows in the radula was from 25 to 30, and isolated individual denticles and half-rows by teasing with needles. Some of these are drawn as figure 3 of my Plate. The admedian denticles of this radula differ from those figured by Sars in presenting a sharp distinction between their terminal and proximal parts. The handle of the sickle shows an angular projection from its inner or concave edge, like the corresponding denticle in *Colobocephalus costellatus* as figured on the same plate (fig. 16). The lateral denticles also furnish an additional point of resemblance between the radulæ of these two types in that their points are slightly bent in a plane at right angles to that of their general surface, so that, when the denticles are mounted flat upon a slide, their points are directed upwards towards the observer.

Shell.—Sars has described the shell so accurately that I have nothing to add to his description; but my figures, being on a larger scale, represent its form and wonderful delicacy rather better.

Summary.—On the whole, I think this Plymouth specimen presents features which indicate a slight advance on the organization of those described and figured by Sars. I may mention its greater size (3·125 mm. as compared with 2·5 mm.), the greater differentiation of the tentacles, pallial siphon, and admedian denticles, and perhaps some increased extension of the free margin of the shell.

Affinities.—Sars was not quite certain whether *Colpodaspis* belonged to the Opisthobranchia at all, and was much impressed by the fact that the foot is attached to the body by a somewhat

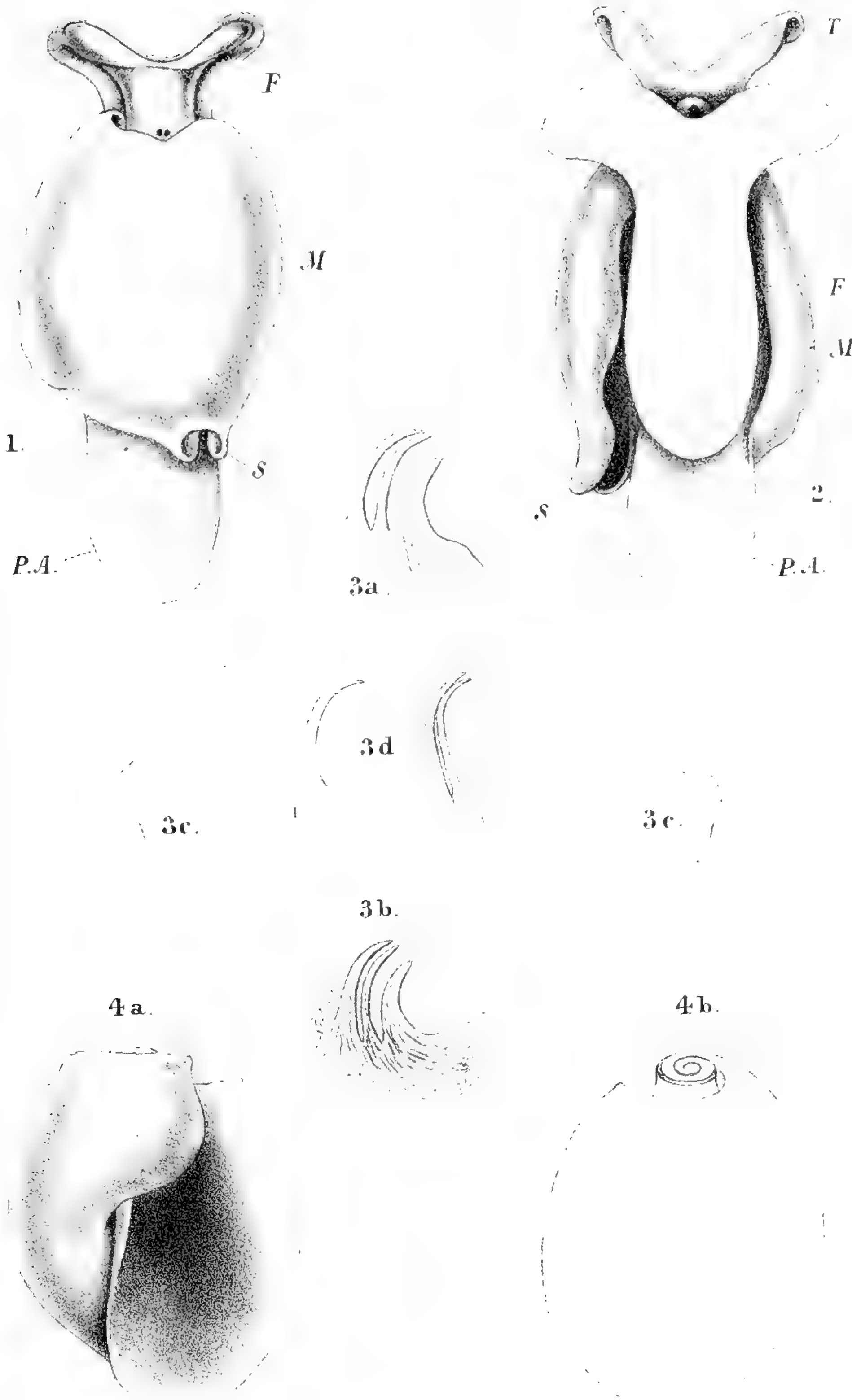
[1] 'Bidrag til Kundskaben om Norges Arktiske Fauna. I. Mollusca Regionis Arcticæ Norvegiæ' (Christiania, 1878), plate xii. (Tabulæ anatomicæ) fig. 15.

narrow stalk—a feature which it shares with most Prosobranchs. Gwyn Jeffreys even informed him that he was inclined to consider *Colpodaspis* as the young of *Cypræa europæa*—a view which now, at any rate, can no longer be entertained.

In spite of our ignorance of the anatomy of *Colpodaspis* we may, however, as a result of the above observations, be certain that *Colpodaspis* is a true Opisthobranch. It resembles various Cephalaspidea in the pleuropodial expansions of its foot (cf. *Haminea*), in the posterior appendage of the mantle (*Haminea*, *Philine*), in its inflated shell (*Haminea*, *Utriculus*), and in its radula (*Philine*). On the other hand it resembles the Notaspidea, and differs from the above types of Cephalaspidea, in the great extent of the mantle and in the form of the head and tentacles. In the latter point it again resembles the Anaspidea, for in the young *Aplysia*, as I have often observed, there is only one pair of tentacles (the anterior one) for a considerable period, and these are grooved just as in *Colpodaspis* and *Pleurobranchus*. These various points of resemblance are all explicable if we regard *Colpodaspis* as a very primitive type of Tectibranchiate mollusk, belonging indeed to the Cephalaspidea, but retaining in an unspecialized condition an unusual number of those primitive characters which the common ancestors of the Cephalaspidea and Notaspidea alike possessed. It supplies an indubitable connecting-link between these two great subdivisions of the Tectibranchia; but it belongs to the group Cephalaspidea, in spite of the inappropriateness of the name, owing to its acquisition of pleuropodial expansions and a posterior pallial appendage—two associated features which are especially characteristic of this group.

The question still remains open whether or not the creature described by Sars and myself has assumed its adult features. Fischer[1] has suggested that *Colobocephalus costellatus* and *Colpodaspis pusilla* are possibly only young stages of *Philine* or of neighbouring genera of Tectibranchs, owing to the radula in these two types resembling very closely the radula of certain species of *Philine* (*velutinoides*, *lima*, *angulata*). This theory, however, is, in my opinion, altogether untenable in the case of *Colobocephalus*, which, beyond the radula, presents no particularly Cephalaspidean, or even Opisthobranchiate, features. The probability, on the other hand, that the Philinidæ have been derived phylogenetically from a *Colpodaspis*-like ancestor is sufficiently great to render Fischer's view in this case worthy of consideration. The white colour of the body and the early enclosure of the shell by the mantle support this view; but the fact that all the specimens so far taken, which have been captured at such different times of the year as June, August, and February, have been practically identical in structure, and have shown no special approach towards the adult organization of *Philine*, seems to me to render the view improbable. The possession of a similar radula by so different a creature as

[1] 'Manuel de Conchyliologie,' 1887, p. 564.



W. Garstang ad nat del. R. Mintern lith.

Mintern Bros. imp.

COLPODASPIS PUSILLA.

Colobocephalus rather minimizes than supports the view which Fischer has expressed.

EXPLANATION OF PLATE XLIV.

Fig. 1. *Colpodaspis pusilla,* from Plymouth. Dorsal view of the animal creeping upon a flat surface; enlarged.
F. Foot.
M. Mantle enclosing shell.
P. Pallial appendage.
S. Pallial siphon.
2. Ventral view of same, as creeping inverted on the surface-film.
Pl. Pleuropodial expansion.
T. Tentacles.
3. Denticles from the radula of same. Zeiss, Obj. D, Oc. 4, Cam. luc.
a. A half-row, showing the sickle-shaped admedian and the pair of lateral denticles. The apices are recurved upwards towards the observer.
b. Same as *a*, but from the growing part of the radula. The denticles are seen to be connected by a chitinous sheet.
c. Two admedian denticles.
d. Lateral denticles.
4. Two views of shell of same, enlarged.

3. On a singular case of one Snake swallowing another in the Society's Reptile-House. By A. D. Bartlett, Superintendent of the Society's Gardens.

[Received November 5, 1894.]

Since January last, two fine examples of the Common Boa (*Boa constrictor*) have lived together on friendly terms in one of the large compartments in the Reptile-House. One of these, rather the larger, was presented by Messrs. Mole and Urich, Oct. 12, 1892, the other, rather smaller one, was purchased on Jan. 9, 1894.

The Snakes are usually fed at dusk once a week, and on the evening of October 5th, Tyrrell, the keeper of the Reptile-House, placed two pigeons in the den of the two Boa Constrictors. The larger one seized one of the pigeons, and no doubt swallowed it, after which the keeper closed the house and left. On his return the next morning he was astonished to find only one Boa in the compartment instead of two, and from the enormously increased size of the remaining one, he concluded at once that the larger Boa had swallowed its companion. That this was so was evident to all who visited the house. The enormous enlargement of the creature's body was most remarkable. It had no longer the power of curling itself round, as snakes usually do, but remained extended nearly its full length in a straight line, and appeared to be at least three times its normal size in circumference. It was almost painful to see the distended skin, which had separated the scales all over the middle of the body. After examining the snake, my expectation was that it would ultimately disgorge its companion. I have, however, been disappointed. Recalling to mind a former and very similar case, in which the decomposing body of the snake swallowed caused the death of its destroyer, I had much doubt about the digestive powers of this animal. But in the present instance the snake has not only digested its companion, but has regained its appetite as well as its normal size. On Friday, Nov. 2nd, the keeper, finding the creature moving about as if in search of food, placed a pigeon in its den, which was seized and swallowed immediately.

I have had this voracious serpent measured, and find it to be 11 feet in length. The one which it swallowed was about 9 feet in length. It will be seen by this that a serpent of 11 feet in length can not only swallow and digest another serpent only about two feet shorter, but is ready to feed again twenty-eight days afterwards.

4. On a new Agonoid Fish (*Agonus gilberti*) from Kamtschatka. By R. Collett.

[Received October 29, 1894.]

(Plate XLV.)

I propose to call this new Fish

Agonus gilberti, sp. nov. (Plate XLV.)

Diagn.—*Body very elongate and compressed, the tail everywhere higher than broad. Head* $3\frac{3}{4}$–4 *times in total length (caudal included); height of body* 8 *times. Snout very long,* 3 *times longer than the interorbital space. Barbels on lower side of snout and on the jaws. Teeth in villiform bands on the jaws; none on vomer or palatines. Spines on head and plates on body much as in* A. acipenserinus, *the spines very high and pointed; plates on breast about* 10. *First dorsal begins at the end of* 4*th scale;* 3 *scales between the dorsals. Ventrals received in a longitudinal groove. Greyish brown with darker spots; head with shortish bands.*

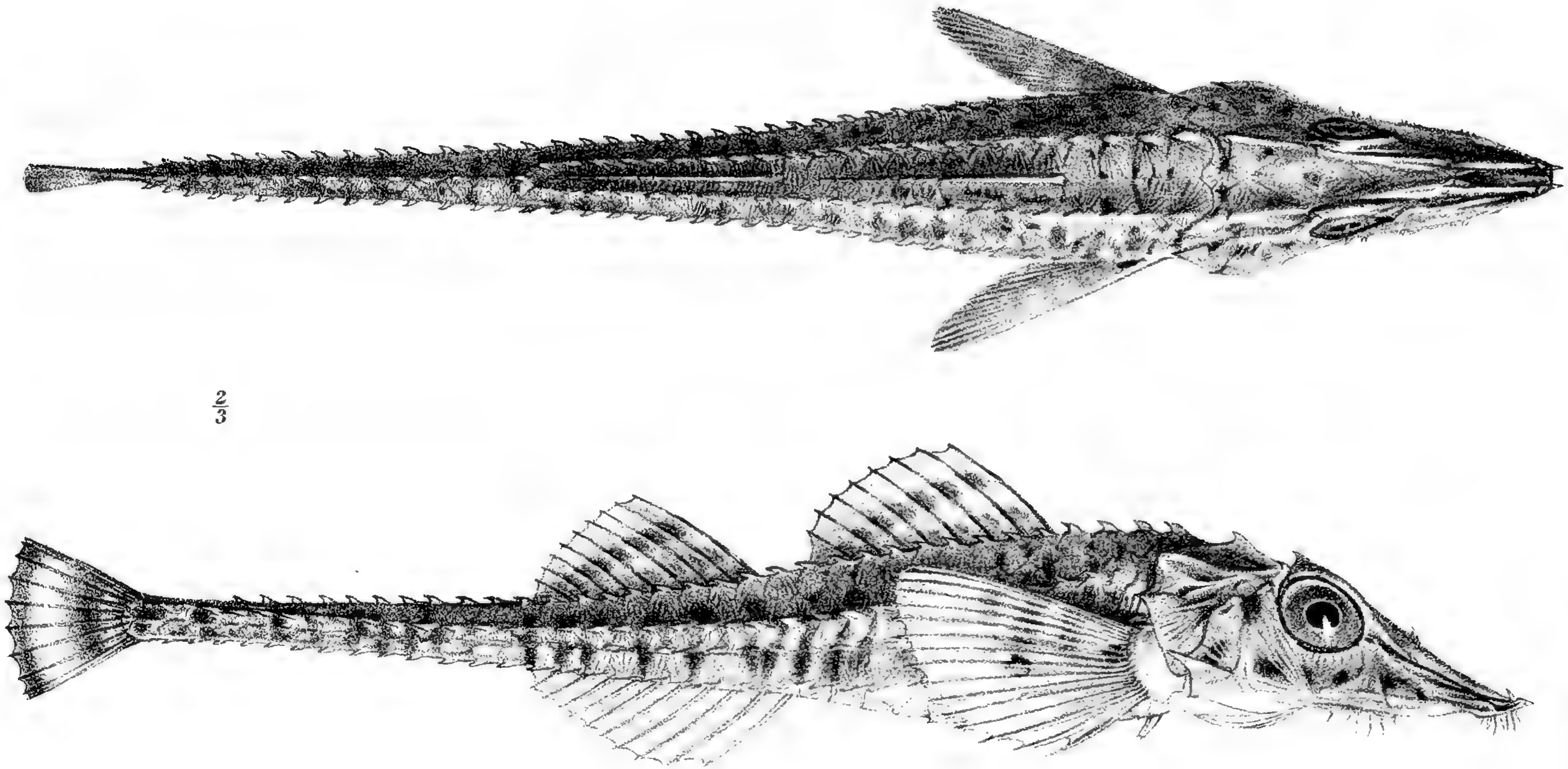
1 D. 8. 2 D. 8–9. A. 10–11. P. 15–17. Lin. lat. 38.

Habitat. Kamtschatka (type specimens in the Christiania Museum).

Description.—*The body* is very elongated and compressed, rather high in front, and tapering to the tail. Its height (from ventrals to first dorsal scale) equals the length of the snout, and is contained in the total length about 8 times.

The tail is compressed, long and slender; its height everywhere greater than its breadth.

The head.—Its length is contained in full-grown specimens 4 times, in younger ones about $3\frac{3}{4}$ times in the total length (caudal included).



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F.W. Frohawk del. et lith.

Mintern Bros imp

AGONUS GILBERTI.

Thus in four specimens of different sizes the proportions are the following:—

Total length 183 millim.	Head-length	3·66	times.
Total length 254 millim.	„	3·73	„
Total length 277 millim.	„	4·01	„
Total length 290 millim.	„	4·02	„

Snout very long, 3 times longer (or more) than the interorbital space (between the bases of the supraocular spines).

Posterior part of the head comparatively smooth, the interorbital space rather concave; no quadrangular pit on the occiput in front of the dorsal scales.

Eye comparatively large; the horizontal diameter a little larger than the vertical. It is contained a little more than 2 times in the length of the snout, and rather more than 4 times in the length of head.

Cirri on lower side of snout (in front of the premaxillary) and at the angles of the jaws [1]. Their length equals that of the eye.

Mouth entirely inferior; distance from premaxillaries to tip of rostral spines about equal to the length of the eye.

Teeth in the jaws; vomerine or palatine teeth none.

Armature of the head.—Much like that of *A. acipenserinus.* The rostral spines 4, two projecting horizontally forwards, two (behind the first) curved backwards. A third pair on the snout (much nearer the eye than the rostral spines).

Orbital ridge with a single spine (supraocular, no preocular); the lower ridge finely serrated.

Occipital ridges, operculum, and preoperculum as in *A. acipenserinus*, but the spines more pointed and longer.

Suborbital with a double ridge at its lower margin, the upper ridge with two distinct spines behind, and a third (sometimes indistinct) at equal distance from the eye and the tip of the snout.

Head with about 18 distinct spines altogether.

Armature of body.—Plates on the back and sides of the same number as in *A. acipenserinus*, but the spines are longer and curved more backwards, and strong everywhere from head to caudal. Between the two dorsal keels and between the two lateral keels there are no traces of another keel (as in *A. valsus*).

Breast with about 10 polygonal plates, 4 of which form a series on each side and 2 a median series; bases of pectorals and ventrals also surrounded with plates. All the plates have a short spine in their centre.

Dorsal plates numbering:—

		Plates.
From occiput to first dorsal	(Pair)	4
First dorsal extending over........	„	8
Between the dorsals..............	„	3
Second dorsal extending over......	„	9+1
From second dorsal to caudal......	(Single)	15

[1] All the specimens are in a bad state of preservation and most of the barbels are lost.

The dorsal keel (coalescing with the keel on the other side at the 15th plate in front of the caudal fin) is consequently composed of 38 to 39 plates; the lower lateral keel, extending from lower base of the caudal to base of the 10th pectoral ray, contains 35 plates.

Abdominal plates numbering:—

		Plates.
From ventrals to anal	(Pair)	11
The anal extending over	,,	10
From anal to caudal	(Single)	17

The abdominal keel (coalescing at the 17th plate in front of the caudal) is formed by a series of 38 plates.

Lateral line distinct; 38 pores.

Fins.—In the 10 specimens, at present preserved in the museum at Christiania, the fin-rays are the following:—

1 D.	2 D.	A.	P.
8	8	10	17–17
8	9	10	? 16
8	9	10	16–16
8	8	10	15–16
8	8	10	17–17
8	8	10	17–17
8	8	10	16–17
8 (+1)	8	11	16–17
8	8	10	15–16
8	9	10	17–17

First dorsal begins behind the fourth dorsal plate and has 8 rays (one specimen has an additional slender ray in the space between the two dorsals). Its height equals its distance from the head. It extends over 8 scales; the first two rays in the space between the fourth and fifth plate.

The dorsal fins are separated by 3, sometimes by 4 plates.

Second dorsal has 8, sometimes 9, rays, and extends over 8 plates; behind the last ray is one pair of plates, before the unpaired series begins.

Anal has commonly 10 rays (in one specimen 11); its height equals that of the 2nd dorsal, and is rather less than that of the 1st dorsal. It commences between the 11th and 12th pairs of scales in the abdominal series.

Ventrals short in the female, shorter than the vertical diameter of the eye; longer in the male, equalling the length of the snout. Each has one short spine and three articulated rays, two of which are divided to their base. They are received in a longitudinal common groove ("*Podothecus*").

Pectoral has 16–17, rarely 15 rays, some of which are sometimes branched in their upper half, but not always. The first ray is short, about equal to half the second ray; the lowermost rays a little thicker than the rest. Its form is a little emarginate, the 5th lower ray being a trifle longer than the 6th and 7th. The tip extends to a distance from the anal of 2 or 3 plates.

COLOUR.—Greyish brown, with dark spots and shortish bands; belly whitish.

On the upper part of head the spots form longitudinal bands—one of these (single) running down in the median line of front, between the eyes. A second (and more distinct) band extends on each side of the snout from the tip to the anterior margin of the eye, hence running under the orbital rim; in some specimens it is continued as a narrow ring round the eye, but commonly this is broken and indistinct.

On the opercles and sides of the snout the spots are roundish and well marked.

On the body also the spots are roundish, rarely oblong, their size equalling that of the pupil. They are darkest and most distinct on the back, being sometimes almost obliterated on the sides.

The colour of the fins is rather indistinct in the badly-preserved specimens before me. The pectorals have a dark oblong spot at their bases (from about 6th to 11th ray); the dorsals have two dark bars, separated by whitish, and with the tip in 1st dorsal also blackish (in 2nd whitish). The caudal has a dark cross-bar a little behind the base, and a dark margin. The anal is apparently whitish to the margin in the female; in the single male specimen at least the outer half is blackish.

Measurements (in millimetres).

Nos. 1 to 9 are females, No. 10 is a male.

No.	Total length. (C. incl.)	Length of head.	Height of body.	Snout to anus.	Snout to dorsal.	Diameter of eye.	Length of snout.
1 ...	183	50	22	48	61	9	26
2 ...	254	68	35	66	84	15	34
3 ...	258	64	31	64	80	14	31
4 ...	263	63	31	60	81	14	32
5 ...	263	65	30	61	80	14	31
6 ...	270	68	33	64	84	15	34
7 ...	274	68	31	69	86	15	34
8 ...	277	69	35	70	86	16	34
9 ...	290	72	32	72	89	16	38
10 ...	258	63	30	65	80	14	31

OVA.—Several of the females were filled with ripe ova; their number in the two ovaries together about 3000. The roe had a diameter of 1·2 millim.

Locality.—Kamtschatka. In 1879 the museum of Christiania received from Consul Henry Lund in San Francisco a small collection of fishes and marine invertebrates, collected by a Norwegian sailor at Kamtschatka. Amongst the first were 12 specimens of this species, some of which were rather defective and in a bad state of preservation. All except one were full-grown specimens. The exact locality was not given.

Remarks.—*A. gilberti* is allied to *A.* (*Podothecus*) *acipenserinus*, Tiles. 1810, but differs from that species in several characters, viz.:—

The more elongated body. In *A. gilberti* the end of the 2nd dorsal is midway between the caudal and the middle of 1st dorsal; in *A. acipenserinus* between the caudal and the beginning of the 1st dorsal.

The more compressed body. From head to caudal everywhere higher than broad; in *A. acipenserinus* much broader than high.

The longer snout. The interorbital space is contained 3 times in the length of the snout; in *A. acipenserinus* a little more than twice.

Dorsals more separated; interdorsal space with 3 or 4 plates, in *A. acipenserinus* only 1 plate (sometimes 2), or the fins almost contiguous.

Ventral groove present in *A. gilberti*, absent in *A. acipenserinus*.

Colour with distinct stripes on head and spots on body; in *A. acipenserinus* cross-bars on the body, the head being almost unspotted.

The other species of the same subgenus, *A.* (*Podothecus*) *valsus*, Jord. and Gilb. 1880, has the body everywhere broader than high. The spines of the head are more numerous (more than 70 spines and tubercles on the head); there is a deep quadrangular pit on the occiput; no barbels on lower side of snout; the 1st dorsal commences behind the seventh dorsal plate, and the fin-formula is different.

The genus *Podothecus* was established by Gill in 1861[1] for a species called *P. peristethus*, which is commonly believed to have been based on a badly-preserved specimen of *A. acipenserinus*. But it must be borne in mind that one of the characters of the said genus (the very one from which the name is derived), "ventral fins received in a long lanceolate groove," is not shown by *A. acipenserinus*.

As other essential characters of the genus are mentioned "the longer spinous dorsal and the greater number of plates on the breast."[2] None of these characters, however, are of sufficient importance to justify the establishment of a new genus.

As another character for *Podothecus*, Jordan and Gilbert state[3]

[1] Proc. Acad. Nat. Sci. Philad. 1861, p. 258.

[2] Proc. U.S. Nat. Mus. vol. iii. 1880, p. 332.

[3] "Synopsis of the Fishes of North America" (Bull. U.S. Nat. Mus. no. 16, p. 714, Wash. 1882).

"that the gill-membranes are united to the isthmus, not forming a fold across it." But this character is not always constant. The museum of Christiania has three specimens of *A. acipenserinus*, received through the kindness of Dr. Gilbert from the Stanford University, Cal. In two of these the gill-membranes form a short but distinct fold across the isthmus; in the third it is hardly perceptible. In *A. gilberti* some of the specimens show a trace of a similar fold, whilst in others the isthmus is smooth.

A. decagonus, Bl. Schn. 1801, forms another transitional stage between the last group and the other, in which the gill-membranes form a distinct fold across the isthmus (as in *A. cataphractus*). In the first species the fold is always present, but very short.

Consequently *Podothecus* can hardly rank as a *genus*, but forms in the typical genus *Agonus* a group of species which, by the structure of the snout and the dentition, may be separated from all *Agonidæ*.

Christiania, Oct. 1894.

5. On the Anatomy of *Atherura africana* compared with that of other Porcupines. By F. G. Parsons, F.R.C.S., F.Z.S., F.L.S., Lecturer on Comparative Anatomy at St. Thomas's Hospital.

[Received October 12, 1894.]

The specimen of *Atherura africana* from which the accompanying notes were made was kindly placed at my disposal by Mr. F. E. Beddard, Prosector to the Society. I was induced to make a rather more exhaustive examination of certain parts of it than I otherwise might have done because I hope that some day I may have the chance of dissecting its Eastern relative, *Atherura macrura*, and of comparing the anatomy of the two. Professor Mivart's account of the anatomy of *Erethizon dorsatum* was of great value in comparing *Atherura* with the Tree-Porcupines; but I was unable to find a complete account of a dissection of a Ground-Porcupine, and am indebted to Professor Stewart for the gift of a spirit-specimen of a young *Hystrix cristata*, which I dissected *pari passu*. I am also indebted to Professor Howes and to Mr. Oldfield Thomas for their kindness in allowing me the use of their osteological collections.

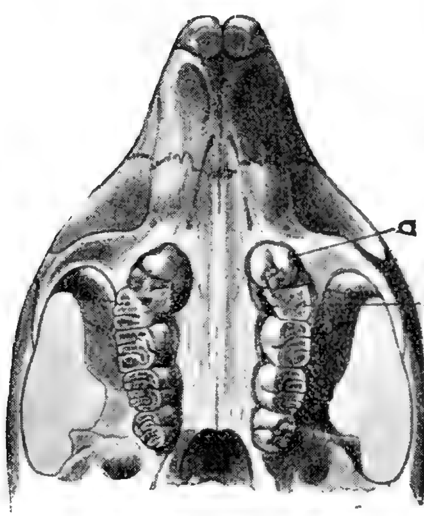
Osteology.

The skull of *Atherura* has already been described by Gray[1] and by Günther[2]. The former gives the chief characteristics of it and

[1] P. Z. S. 1847, p. 104.
[2] P. Z. S. 1876, p. 743.

describes the teeth; the latter figures the base of the skull in *A. africana* and *A. macrura*, and mentions several points by which they can be distinguished. The teeth of the animal I examined agree with Gray's description, except that I was unable to make out any folds on their hinder edge. The premolars were in the process of being replaced by the permanent teeth, and this process was much further advanced in the upper than in the lower jaw. As I believe that the date of the shedding of the milk-premolars is unknown, it may be worth recording that the following epiphysial lines could be distinctly made out:—Upper end of humerus, lower end of femur, tip of olecranon, lower end of radius, upper and lower ends of tibia, lower end of fibula, hinder margin of ramus of ischium. The epiphysis for the crest of the ilium had practically disappeared.

Fig. 1.



Base of Skull, showing the temporary premolar tooth being replaced by the permanent one.

a. Permanent premolar.
b. Temporary premolar.

In addition to the points noticed by Gray and Günther, which it is unnecessary to recapitulate here, there are one or two others which seem of value in distinguishing the skull. In the first place, in *A. africana* the frontal bone projects forward as a triangular spine for some little distance between the nasal bones. This characteristic was noticed in six out of seven skulls of *A. africana*, while in only one out of four specimens of *A. macrura* was it present. All the other Porcupines which I have examined have a straight suture between the nasals and the frontal.

In *A. africana* the suture between the malar bone and the maxilla is much further forward than in *A. macrura*, its distance from the nearest point of the great infraorbital foramen being from $\frac{1}{8}$ to $\frac{1}{4}$ in., while in *A. macrura* it is considerably over $\frac{1}{4}$ in.

Another point worthy of notice is that in 4 out of 6 skulls of *A. africana* an os antiepilepticum or Wormian bone at the junction of the coronal and sagittal sutures was present. In four skulls of *A. macrura* it was not seen once[1].

The cervical vertebræ are remarkable for the large and recurved spine of the atlas. The sixth shows a large ventral tubercle on the transverse process corresponding to the carotid tubercle of human anatomy. In the seventh this tubercle is suppressed.

The thoracic vertebræ are 14 in number, the anticlinal being the 13th. The transverse processes gradually broaden and tend to bifurcate until at the 8th there is a fairly distinct metapophysis projecting from the anterior part and an anapophysis from the posterior.

The lumbar vertebræ (fig. 2, p. 678) are 5. The anapophyses are well marked until the last one, where they disappear[2]. Ventral to the disc between the first and second vertebræ are two ossific nodules about the size of pins' heads, which apparently are serially homologous with the chevron-bones in the caudal region, and probably correspond to the intercentral in the Mole, although I believe that these structures have not yet been described in Rodents. In another specimen which I examined I found these nodules between the 2nd and 3rd, 3rd and 4th, and 5th and 1st sacral[3].

The sacral vertebræ are sometimes three, sometimes four. All the costal processes are completely fused into a horizontal plate, while the spines are only slightly fused. In the structure of the sacrum *Atherura* agrees with *Hystrix* and differs considerably from the Tree-Porcupines.

There are 24 caudal vertebræ, the first four of which have projections from the ventral surfaces of the costal processes. Between the last sacral and first caudal vertebræ chevron-bones are seen as small nodules. Between the first and second caudals there is a small hæmal arch ending ventrally in a point; beyond this the hæmal spines broaden out anteriorly but are compressed laterally; there are altogether 16 of them.

The sternum consists in one case of five and in another of six sternebræ. In front of the anterior one there is a leaf-shaped cartilage. The anterior sternebra or manubrium is remarkable in the animal I dissected in that the first and second costal cartilages

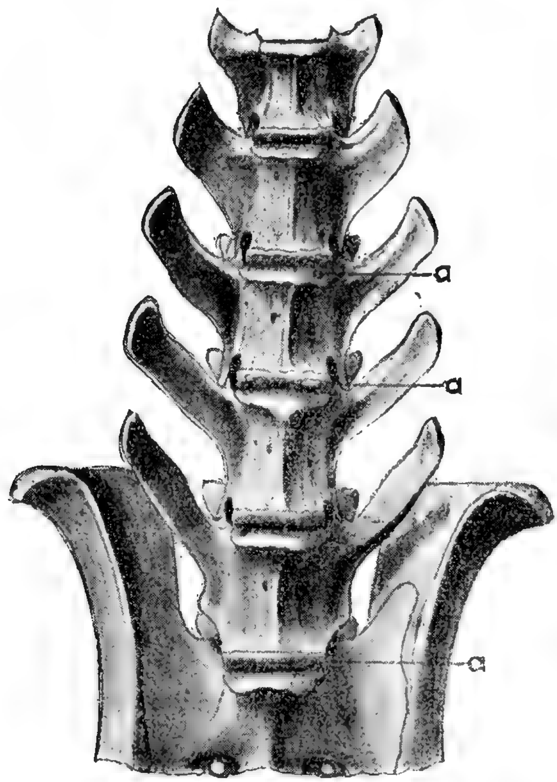
[1] W. Gruber in 'Mémoires de l'Académie de St. Pétersbourg,' xix. no. 9, describes the presence of this bone in several Rodents, but not in Porcupines.

[2] In another specimen they were absent in the last two.

[3] The occurrence of these paired intercentra is interesting when compared with a paper by Boulenger, P. Z. S. 1891, pp. 114 & 170. In it he points out that, in Lizards, the intercentra or hypapophyses may be either paired or median.

are attached to it, close together, about its middle[1]. In all other Porcupines the second rib is attached to the junction of the first and second sternebræ, as it is in most other mammals.

Fig. 2.



Lumbar Vertebræ, showing the position of the intercentra.
a a a. Intercentra.

The xiphisternum is long and narrow and tipped with a crescentic piece of cartilage.

There are fourteen ribs, of which eight are vertebro-sternal, two vertebro-costal, and four vertebral.

The clavicle is thin and curved and is cartilaginous at each end. Internally a rod of cartilage half an inch long connects it with the sternum, while externally there is a leaf-shaped cartilage which overlaps the coracoid process. The clavicle is firmly attached to the coracoid by the coraco-clavicular ligaments, but there is practically no connection between it and the acromion.

[1] In another specimen at the British Museum, the second cartilage was in its normal position.

The scapula is remarkable for the straightness of the axillary border, which always shows more or less of a curve in the other Porcupines. The metacromial process is flat and triangular and fairly broad at its base; it is situated at the extreme end of the spine, and the acromion is aborted beyond it. This arrangement is the same in *Hystrix* and *Erethizon*, but differs from *Sphingurus*, where the metacromion is some distance from the tip of the acromion.

The humerus closely resembles that of *Hystrix*; it differs from that of the Tree-Porcupines in the patency of the supratrochlear foramen.

The radius is more arched than in *Hystrix*, but less so than in the Tree-Porcupines. The grooves for the radial extensors of the wrist and the extensor ossis metacarpi pollicis are well marked.

In the ulna the lower epiphysis is united to the shaft; it ends in a well-marked styloid process which fits like a pivot into the cuneiform bone. In adult specimens of *Erethizon* and *Sphingurus* the lower epiphysis of the ulna was separate.

The first row of carpal bones consists of a scapho-lunar, cuneiform, and a large pisiform. The radial sesamoid lies across the palm and articulates with the scapho-lunar. The bones of the second row are normal except that, owing to the smallness of the unciform, the 5th metacarpal articulates largely with the cuneiform. The phalanges of the thumb are distinct as they are in *Hystrix*. In *Erethizon* and *Sphingurus* they are fused together.

The os innominatum resembles that of *Hystrix* in the prominence of the anterior and posterior ventral spines (corresponding to the anterior superior and anterior inferior spines of human anatomy), in the length of the symphysis pubis, and in the pyriform shape of the obturator foramen. The iliac surface is narrow and looks downward. In the Tree-Porcupines the iliac surface is broader, the spines less marked, the symphysis shorter, and the obturator foramen more rounded.

The femur of *Atherura* agrees with that of *Hystrix* and differs from that of the Tree-Porcupines in that the trochanters project more and the digital fossa is deeper. A third (gluteal) trochanter is only present in *Erethizon*.

There are two fabellæ in *Atherura*.

The tibia, as in all Porcupines, shows a prominent cnemial crest about the middle of the shin.

The fibula is broad and flat above but soon becomes prismatic below; it articulates at both ends with the tibia and below with the astragalus.

The tarsus shows a calcaneum singularly flattened from above downward, forming a very deep groove for the flexor longus hallucis.

The navicular, as in all Porcupines, consists of two portions lying side by side; articulating with the inner one there is a large triangular bone, presumably the prehallux, which is folded under the sole, lying beneath the head of the astragalus instead of projecting from the inner side of the foot as in the Tree-Porcupines. There are three cuneiforms and a cuboid.

The two phalanges of the hallux are distinct, as they are in *Hystrix* and *Erethizon*; in *Sphingurus* they are fused together.

The Muscular System.

The muscles of *Atherura* were found to resemble very closely those of *Hystrix*, described in the "Myology of the Sciuromorphine and Hystricomorphine Rodents."[1] In that paper I stated that I had only noticed two definite muscular characteristics of the Hystricidæ as a family:—

1. The latissimus dorsi at its insertion wraps round the lower border of the teres major.

2. The scalenus anticus is absent.

Both of these points are noticeable in *Atherura*.

The points of difference suggested between the Tree- and the Ground-Porcupines were much more numerous, and I have carefully tested them on *Atherura*:—

1. The digastric agrees with *Hystrix* in only having a slight constriction between the two bellies, in this constriction a thin layer of tendinous fibres is found on the surface. It differs from *Sphingurus* in not having a strong tendinous slip from the posterior belly to the hyoid bone.

2. The omo-hyoid is absent, agreeing with *Hystrix*, in which it is either absent or rudimentary, and differing from the Tree-Porcupines, in which it is a large muscle.

3. The levator claviculæ rises from the basioccipital bone as in *Hystrix*. In the Tree-Porcupines it comes from the atlas.

4. The sterno-scapularis rises from the first part of the bony sternum, not the leaf-shaped cartilage. A few fibres go to the outer part of the bony clavicle, the rest are continued as the claviculo-scapularis, which runs to the spine of the scapula but only covers the outer part of the supraspinatus. This arrangement corresponds with that found in *Hystrix*, in which the two parts of the sterno-scapularis are continuous, in *Sphingurus* they are practically separate.

5. The biceps cubiti has only the long head as in *Hystrix*. In the Tree-Porcupines both heads are present.

6. The coraco-brachialis is inserted from just below the insertion of the latissimus dorsi to just above the internal condyle by one continuous attachment. The musculo-cutaneous nerve passes through the muscle, *i. e.* a few fibres which are inserted lowest pass superficial to it. If we regard the musculo-cutaneous nerve as the separation between the second and third heads of the coraco-brachialis, both these heads are present in *Atherura*, and

[1] P. Z. S. 1894, p. 251.

in this respect it differs from *Hystrix* and agrees with the Tree-Porcupines.

7. The brachialis anticus consists of two parts as in *Hystrix*, but these two parts are closely blended. In *Sphingurus* only the external or long head is present.

8. The extensor secundi internodii pollicis is absent in *Atherura* as it is in the Tree-Porcupines. It was found in *Hystrix*.

9. The pyriformis is present, as in the Tree-Porcupines. It is absent in *Hystrix*. I am not inclined to place any great reliance on the presence or absence of this muscle, as it seems occasionally to miss its attachments to the sacrum and to rise from the upper margin of the great sciatic notch; in these cases it becomes so closely connected with the gluteals as to be almost indistinguishable.

10. The biceps femoris consists of two parts, as in the Tree-Porcupines.

11. The peroneus quarti digiti is present as in *Hystrix*. In the Tree-Porcupines it is wanting.

It will thus be seen that in most of these points *Atherura* agrees in its musculature with *Hystrix*, although in a few it approaches that of the Tree-Porcupines.

Further observation is, however, necessary in order to eliminate individual variation, and to determine which muscles are really valuable for classificatory purposes.

The rest of the muscles were examined, but were found to correspond so closely with those of *Hystrix* that it would be almost a recapitulation of that animal to describe them in detail.

The Digestive System.

The *tongue* is long and narrow, and is marked by a median furrow which is most distinct in the anterior part. The anterior third of the dorsum is covered by transverse rows of horny scales, the free edges of which are directed backwards and are serrated, but not so deeply as in *Hystrix*. There are usually three scales in each row. The posterior two-thirds of the dorsum of the tongue is covered with fine, backwardly directed, filiform papillæ, which give the organ a velvety appearance. The fungiform papillæ occur on each side of the median furrow, but are most numerous in the anterior and posterior thirds of the organ. There are two circumvallate papillæ. The papillæ foliatæ consist of about ten parallel vertical slits, their posterior margin extending as far back as the level of the circumvallate papillæ.

On the under surface of the tongue the fungiform papillæ are seen to extend over the tip and, with some of the filiform, to cover about a quarter of an inch of the lower surface. The rest of this surface is quite smooth.

On comparing the tongue of *Atherura* with that of *Hystrix* *cristata* and *H. javanica*, it will be noticed that the general resemblance is very great. The chief points of difference are:—

1. That the scales are more deeply serrated in *Hystrix*.
2. That the fungiform papillæ are more numerous.
3. That the foliate papillæ have more ridges and grooves. In the specimen of *H. javanica* examined there were sixteen parallel grooves, while in that of *H. cristata* there were twenty. I do not know whether the number of ridges and grooves in the foliate papillæ is constant in different individuals of the same species.

The tongue of *Erethizon dorsatum* described by Mivart[1] differs a good deal from that of *Atherura*. There is no median groove except at the hinder margin, while the serrated scales so remarkable in *Atherura* and *Hystrix* are not noticeable.

Buccal cavity. On each side of the mouth there is a small cheek-pouch lined with hair, and opening between the incisor and premolar teeth.

The *pharynx* is a continuation of the œsophageal tube up to the posterior nares. There is a small round opening into the mouth in its anterior wall, just above the laryngeal aperture. There is no uvula.

The *œsophagus* is narrow above and is remarkable for the thickness of its mucous membrane.

The *stomach* is simple and resembles that of Man in its shape; it differs from *Hystrix cristata* and *javanica* in the absence of the sacculus, and from that of *Erethizon* in not being bent on itself and in its less elongated form.

The pylorus has a very thick muscular ring with a calibre only large enough to admit a small quill. Immediately to the outer side of this is the opening of the large bile-duct.

The *pancreas* is a solid tongue-like gland situated behind the stomach; as the viscera were somewhat decomposed before they came under observation, I failed entirely to find the pancreatic duct or its place of opening.

The *spleen* resembles that of *Hystrix* in being a tongue-like gland, without any notches, situated close to the great *cul-de-sac* of the stomach. Its total length is $3\frac{1}{4}$ inches. In *Erethizon* this organ is oval.

The *duodenum* forms a large open loop, its calibre at first is very great, but it narrows rapidly.

The *great omentum* is about 1 inch long, it reaches a little beyond the umbilicus, but not as far as the bladder.

The *small intestine* is 15 ft. 4 in. long, including the duodenum.

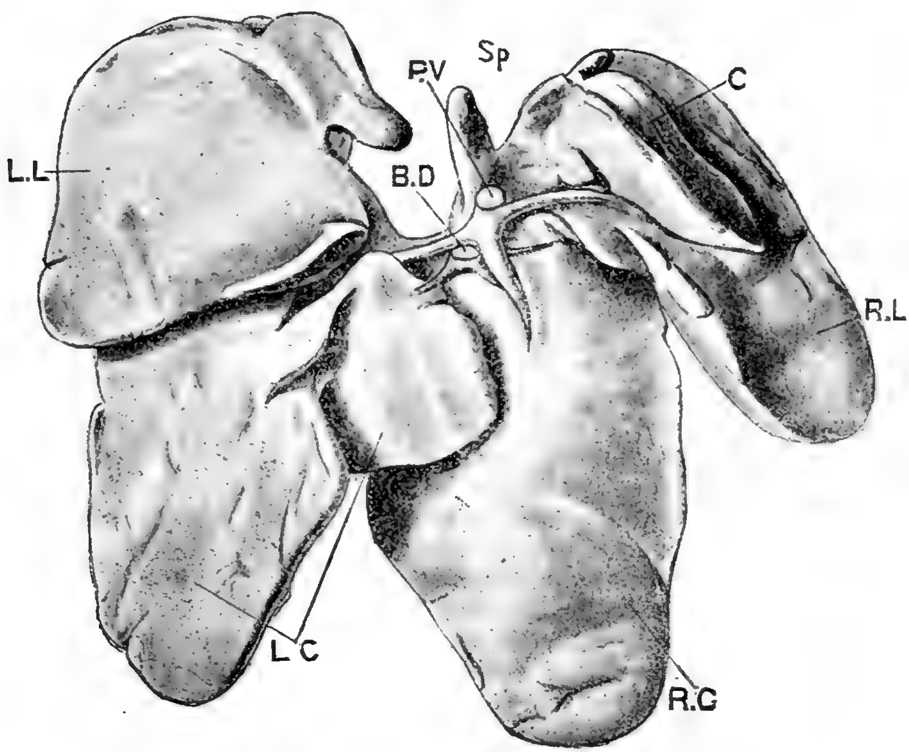
The *cæcum* is very much shorter than in *Erethizon*, being only $7\frac{1}{2}$ inches instead of 28. The ileo-cæcal valve is an oval opening $\frac{1}{4}$ inch long, the lips of the valve are slightly patulous. There is no sacculus rotundus and no constriction as in *Erethizon* at the place where the cæcum joins the colon. The mucous membrane

[1] P. Z. S. 1882, p. 271.

is puckered, but there is no appearance of a spiral valve. The three longitudinal muscular bands are well marked on the outside, but disappear in the colon; one of them marks the attachment of a mesentery which is continuous with the mesocolon and which maintains the horseshoe curve of the cæcum. Sacculations between the bands are well marked.

The *large intestine* measures 34 inches from the ileo-cæcal valve to the anus; its muscular coat is quite smooth, as is also its mucous coat. Several round or oval agminated glands are seen in the mucous membrane.

Fig. 3.



Posterior surface of the Liver.

L.L. Left lateral lobe.	*C.* Caudate lobe.
L.C. Left central lobes.	*Sp.* Spigelian lobe.
R.C. Right central lobe.	*P.V.* Portal vein.
R.L. Right lateral lobe.	*B.D.* Bile-duct.

The *liver* (fig. 3) agrees in its lobulation very closely with that of *Hystrix cristata* and *javanica*. As in these animals, the right central lobe is larger than the right lateral, while the left central has a small portion near the middle line of the liver cut off, so that in the Ground-Porcupines there are practically two left central lobes, a large one externally and a small one internally. I found no gall-bladder in *Atherura* or in the specimen of *Hystrix cristata* with which I compared it, but the liver of *H. javanica* in the Museum of the College of Surgeons shows a very large and somewhat sacculated one. In *Erethizon*[1] the left central lobe is undivided, and the right lateral is as big as, if not bigger than, the right central. In this specimen also there was no gall-bladder[2].

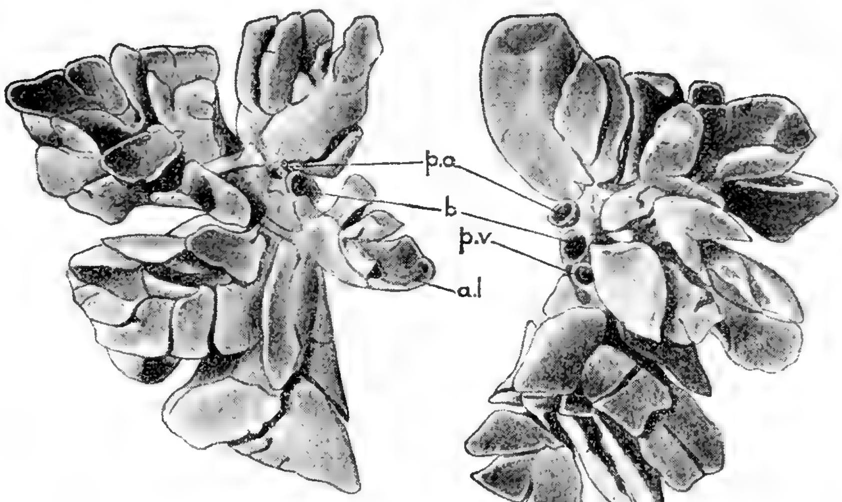
The *kidneys* are smooth on the surface, and on section show several papillæ; the right one is, as usual, in advance of the left.

Circulatory and Respiratory Systems.

The *suprarenals* are closely adherent to their respective kidneys. On section they show a yellow cortex and a red medulla.

The *thymus* is large.

Fig. 4.



The Lungs from the front.

a.l. Azygos lobe. | *p.v.* Pulmonary vein.
p.a. Pulmonary artery. | *b.* Bronchus.

The *larynx* is remarkable for the great size of the cricoid as compared with the thyroid cartilage. The epiglottis is broad and notched; on its laryngeal surface is a vertical ridge corresponding

[1] P. Z. S. 1882, p. 276.
[2] Neither is there any in *Sphingurus*.

to the cushion of the human larynx. The arytenoids project backward a good deal and are concave towards one another; they are attached to the side of the ring of the cricoid, facing one another, instead of at the back as in Man. The true vocal cords are therefore short, but they are well marked. There are no sacculi laryngis or false vocal cords [1].

The *lungs* (fig. 4) are perhaps the most remarkable part of the anatomy of this animal; they are divided into a great number of distinct lobules, which are kept in position by connective tissue. Of these lobules the left lung contains 34, while the right has over 40. Five lobes can be indistinctly made out in the right lung by their more patent furrows, including the azygos lobe, which itself has five lobules [2]. There is no eparterial bronchus on either side.

The *heart* is rounded at the apex. There is no definite moderator band. The musculi papillares are very long and the chordæ tendineæ short.

The *aorta* has one trunk coming off from the summit of the arch, which immediately gives off tho left subclavian and soon after the left carotid. As a rule the left subclavian is a separate branch in Porcupines.

There are two anterior venæ cavæ and only one azygos vein.

Reproductive System.

The Reproductive System of the male resembles that of *Hystrix*. Only the globus minor of the epididymis lies in the inguinal pouch, to the bottom of which it is connected by the gubernaculum.

The vesiculæ seminales are double on each side, the upper pair being very large and the lower quite small. The prostate is large, and the posterior part is more glandular than the anterior. When the prostatic urethra is opened, a very prominent verumontanum is seen with a small utricle in the anterior part of it, about $\frac{1}{8}$ in. deep. On each side of this are two large crescentic openings, the outer pair leading to the small (lower) vesiculæ seminales, the inner being the opening of the ejaculatory ducts formed by the large vesicles and the vasa deferentia. About $\frac{1}{2}$ inch in front of the prostate is the thin-walled vascular bulb, on each side of which

[1] Owen says, 'Anatomy of Vertebrates,' p. 585:—"In the Porcupines both the vocal cords and ventricles are wanting; they are mute save at the rut, when the male emits a low grunt."

[2] The lobulation of the lungs of *Hystrix cristata* is figured by Aeby, 'Der Bronchialbaum der Säugethiere,' pl. vi. fig. 12; and I found a similar arrangement in a specimen of the same animal. I am doubtful, however, whether it is a constant condition, because Owen, 'Anatomy of Vertebrates,' p. 577, says:—"In the Porcupine the right lung has four lobes besides the azygous lobe." Mivart describes the upper lobe of the left lung of *Erethizon* as being divided by two deep notches.

lie Cowper's glands. The penis is 4 inches long, and has embedded in the dorsum of the glans a triangular os penis, into the base of which the tendons of the levatores penis are inserted.

The Nervous System.

The Brain of *Atherura* (figs. 5, 6), when viewed from above, differs very much in its general appearance from the brains of other Porcupines. Beddard says[1] that "the Hystricidæ form a perfectly natural family. Their brain is characterized by its peculiar shape, rounded in front, and by the fact that the convolutions for the most part are transverse and not longitudinal in direction." This description, although it is true for every other Porcupine I have seen, unfortunately would not give a good idea of the brain of *Atherura*, for in this animal the frontal part of the cerebral hemispheres is quite narrow and the transverse width increases to nearly the posterior end. At the posterior end of the central longitudinal fissure the hemispheres form a deep notch, in which the corpora quadrigemina would be exposed were it not for the great development of the anterior part of the central lobe of the cerebellum. Two fissures are marked, but not deeply; they are the posterior part of the longitudinal and the Sylvian. The Sylvian fissure does not reach the rhinal fissure below.

The convolutions and fissures of the brain of *Atherura* are less well marked than those of *Hystrix*, but better than those of *Erethizon* or, apparently, *Sphingurus*. On the base of the brain the chief points of interest are, the large size of the tuber cinereum, from which the pituitary body depends, and the great development of the external arcuate fibres, which run just behind the pons to join the anterior pyramids at right angles. The same points are present in *Hystrix* and, according to Mivart's figures[2], in *Erethizon*.

In a sagittal section of the brain, the chief point that attracts attention is the peculiar funnel-shape of the aqueduct of Sylvius; this is of very small calibre where it leaves the third ventricle, but rapidly dilates so that the posterior end of the lamina quadrigemina which forms its roof, and on which the corpora quadrigemina are situated, is tilted up.

The Spinal Nerves.

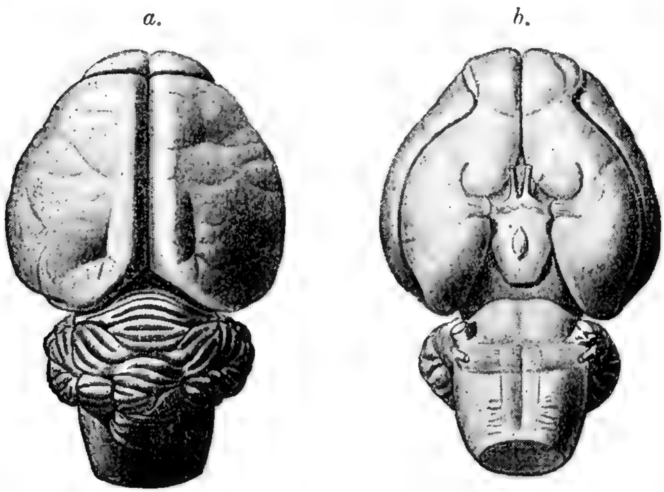
Owing to injuries inflicted on the head in removing the brain and tongue before the animal came into my possession, I was unable to make a complete dissection of the cranial nerves. I have therefore contented myself with a description of the nerves supplying the extremities.

[1] P. Z. S. 1892, p. 596.
[2] P. Z. S. 1882, p. 278.

The brachial plexus (fig. 7, p. 688) is remarkable for its complexity; in other words, the different nerves of which it is composed are not bound together into cords as in Man and the higher mammals, but each one can be traced into the different nerve-roots from which it is derived.

The plexus is formed by the 5th, 6th, 7th, and 8th cervical, and the greater part of the 1st dorsal nerve.

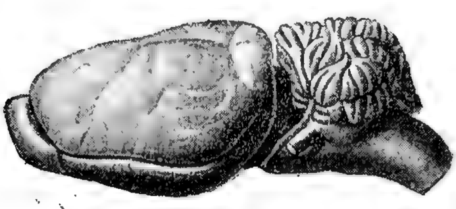
Fig. 5.



The Brain.

a. From above. | *b.* From below.

Fig. 6.



The Brain from the side.

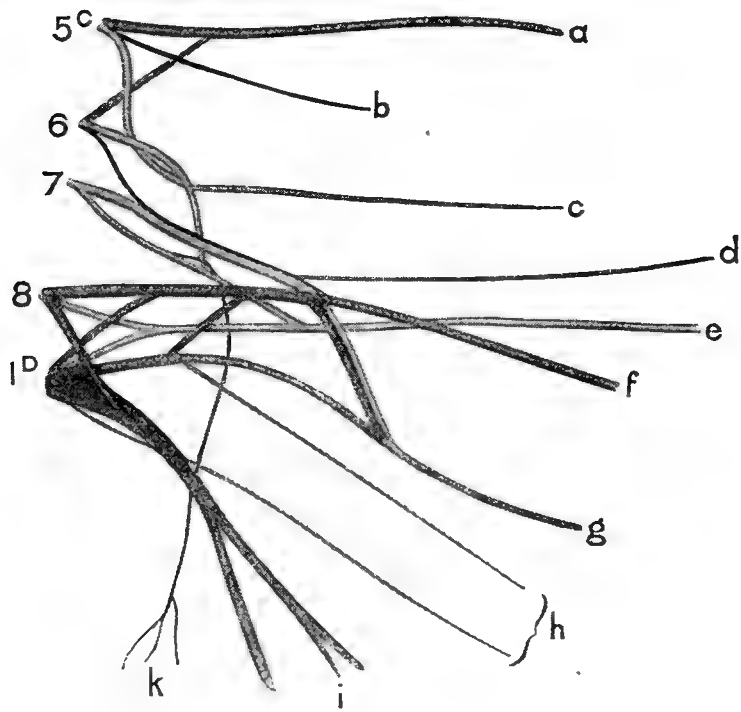
The following are its branches:—

The suprascapular nerve rises from the fifth and sixth cervical and supplies the supra- and infraspinatus.

The phrenic comes entirely from the 5th C. and runs to the diaphragm. The nerve to the subscapularis comes from the 5th C.

The circumflex nerve rises from the 5th and 6th C. and winds round the neck of the humerus in the usual way, supplying the teres minor and deltoid muscles.

Fig. 7.



Brachial Plexus.

a. Suprascapular.
b. Nerve to subscapularis.
c. Circumflex.
d. Musculo-cutaneous.
e. Musculo-spiral.
f. Median.
g. Ulnar.
h. Internal cutaneous.
i. Internal anterior thoracic.
k. Nerve to Latissimus dorsi. (The origin of this is only approximate.)

The external cutaneous is bound up for some little distance with the median, its fibres being derived from the 6th and 7th C. It supplies and pierces the coraco-brachialis and then divides into two branches, the larger of which supplies the biceps, while the smaller runs down to the front of the elbow, where it communicates with the median and sends a small branch to the short head of the brachialis anticus; after this it crosses deep to the biceps and supplies part of the outer side of the forearm.

The median nerve rises from the 6th, 7th, and 8th C. and 1st D. In the lower third of the arm it gives off a large branch to supply the outer side of the forearm as far as the dorsum of the hand. Just below this twigs are given off to the brachialis anticus, after which the nerve enters the forearm and supplies all the flexor muscles except the flexor carpi ulnaris, but there is no definite anterior interosseous nerve. In the hand the median supplies the thumb-muscles and the skin of the palmar surface of all the fingers.

The musculo-spiral derives fibres from all the roots forming the brachial plexus; it winds round the back of the humerus, supplying the triceps, dorso-epitrochlearis, and skin of the upper arm, but I was unable to find any branch going into the brachialis anticus. Just above the elbow it divides into radial and posterior interosseous; the former runs through the substance of the extensor carpi radialis longior, supplying it and the brevior, after which it is continued down to the back of the hand to supply the skin of the dorsum of the radial three and a half fingers. The posterior interosseous passes deep to the supinator brevis and breaks up into a brush of nerves for the extensor muscles.

The ulnar nerve rises from the 8th C. and 1st D. and runs down behind the internal condyle, supplying the epitrochleo-anconeus, flexor carpi ulnaris, and palmaris brevis, but not the flexor profundus digitorum. In the hand it supplies all the deep muscles of the palm but no skin. Before it reaches the wrist a dorsal cutaneous branch is given off, which supplies the skin of the back of the ulnar one and a half fingers.

The internal cutaneous nerves come from the 1st D. and supply the skin of the inner side of the arm and forearm.

The anterior thoracic nerve rises from the 8th C. and 1st D., and is one of the largest nerves in the plexus; it supplies the pectoral muscles and the ventro-lateral part of the panniculus.

The posterior thoracic nerve comes from the 7th C. and runs back behind the plexus to supply the serratus magnus.

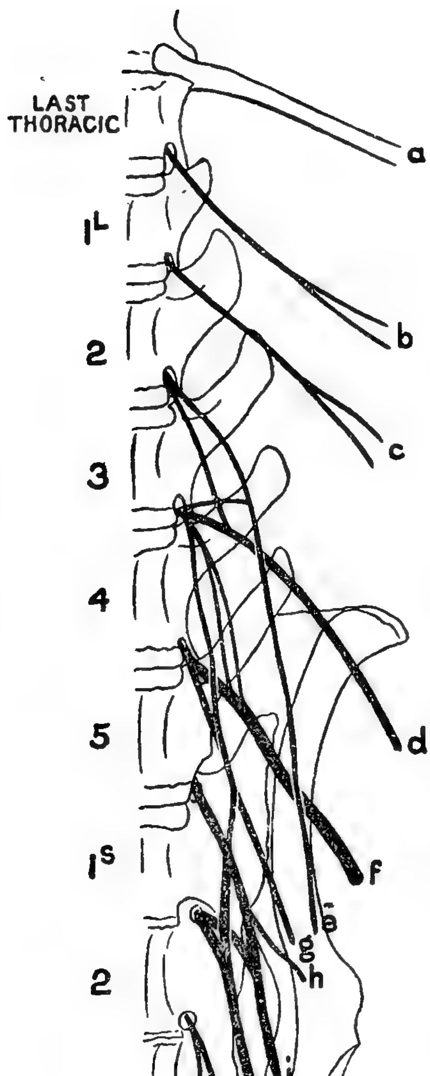
I am not certain of the origins of the nerves to the teres major and latissimus dorsi. The former does not supply any of the subscapularis.

The lumbar plexus is formed by the 2nd, 3rd, and 4th lumbar nerves. The first lumbar is quite separate and runs round the body-walls after the manner of the intercostal nerves; it divides into two branches, which probably correspond to the ilio-hypogastric and ilio-inguinal nerves of human anatomy.

The genito-crural nerve rises from the 2nd L. and appears on the surface of the psoas magnus, after which it crosses the tendon of the psoas parvus from within outwards; it then runs back to supply the skin over the region of the groin. I failed to notice any branches going to the muscular wall of the inguinal pouch.

The external cutaneous nerve comes from the 2nd and 3rd L. and appears on the surface of the psoas magnus external to the

Fig. 8.



Lumbo-sacral Plexus.

a. Last rib.	*f.* Anterior crural.
b. Last thoracic nerve.	*g.* Obturator.
c. Ilio-hypogastric and ilio-inguinal.	*h.* Superior gluteal.
d. External cutaneous.	*i.* Nerve to hamstrings.
e. Genito-crural.	*k.* Great sciatic.
	l. Pudic.

tendon of the psoas parvus; it supplies the skin of the outer side of the thigh.

The anterior crural nerve rises from the 3rd and 4th L. and emerges from the front of the psoas beneath Poupart's ligament; it then gives off a large cutaneous branch, which soon divides into anterior and posterior branches to supply the inner side of the leg; the anterior branch supplies the skin of the front of the inner side of the thigh and leg as far as the dorsum of the foot. In company with this cutaneous branch, from the superficial surface of the anterior crural, a branch is given off to the pectineus, which enters it on its deep surface. The rest of the anterior crural supplies the quadriceps, but does not supply the sartorius.

There is no long saphenous nerve apart from the cutaneous branch already described.

The obturator nerve rises from the 3rd and 4th L. and emerges from the inner side of the psoas; it pierces the obturator membrane supplying the obturator externus, after which it divides into branches for the pectineus, adductors, and graciles.

There is no accessory obturator. The sacral plexus is formed by the 5th L. and the 1st and 2nd S., joined by a branch from the obturator. From the cord formed by the last L. and the branch of the obturator, a nerve is given off to supply the sartorius, tensor vaginæ femoris, and gluteus maximus, while close by twigs are given off to the other gluteals and short external rotator muscles.

The nerve to the hamstrings is nearly as large as the great sciatic; it is derived from the 5th L. and 1st S.

The great sciatic comes from the whole of the plexus, but the twig from the 2nd S. is very small. It runs down the back of the thigh as in Man, and gives off a cutaneous branch corresponding to the small sciatic. It divides into external and internal popliteal in the lower third of the thigh. The external popliteal gives off a branch corresponding to the communicans fibularis of human anatomy, which pierces the biceps to supply the skin of the back and outer side of the leg; after this it divides into musculo-cutaneous, anterior tibial, the nerves to the peronei and nerves to the extensor muscles of the leg. The musculo-cutaneous runs down to the dorsum of the foot. The anterior tibial supplies the extensor brevis digitorum and the skin of the contiguous sides of the 2nd and 3rd and 3rd and 4th toes. The internal plantar nerve gives off the short saphenous nerve to the back of the leg and outer side of the foot, after which it runs down the leg as the posterior tibial, supplying the superficial and deep muscles of the calf. At the ankle it divides into the external and internal plantars, which, in their distribution, correspond to the ulnar and median nerves of the hand. The external plantar supplies all the muscles of the sole except the flexor brevis digitorum and abductor hallucis, but gives off no cutaneous branch. The internal plantar supplies these two muscles and the skin of all the toes on their plantar surface. I was unable to satisfy myself as to the nerve-supply of the lumbricales.

The pudic nerve comes almost entirely from the 2nd S. and supplies the muscles and skin of the perineum.

In comparing the plexuses of *Atherura* with those of *Erethizon* as figured by Mivart [1], it will be noticed that the brachial plexus of the latter receives no branch from the 5th C. as it does in *Atherura* and Man, but that all the branches of the plexus are as easily traced to their origins from the spinal cord as they are in *Atherura*. In the sacral plexus the small sciatic of *Erethizon* seems to rise from the same place as the pudic of *Atherura*, viz. the 1st and 2nd sacral, but then no indication is given in the figure of the origin of the pudic in *Erethizon*.

The nerves of a specimen of *Hystrix cristata*, which I dissected in order to compare with those of *Atherura*, show a striking resemblance to the latter animal.

The following are the only differences I noticed:—The circumflex comes from the 6th and 7th C. instead of the 5th and 6th. The external cutaneous communicates with a branch of the median going to the brachialis anticus and sends no cutaneous branch to the forearm. The median rises from 5th, 6th, 7th, and 8th C. and 1st D., and receives a large branch from the external cutaneous, which branch is bound up with the median, and eventually comes off to supply the outer side of the forearm. The nerves to the teres major and latissimus dorsi which I failed to notice in *Atherura* rise in *Hystrix* from the circumflex.

The supplies of the fingers and toes are identical in both animals.

The arrangement of the nerves in the hand and foot already mentioned seems of some interest from the point of view of variation.

In Man the ulnar supplies one finger and a half on the palmar surface, and the external plantar one toe and a half on the plantar surface. In *Atherura* and *Hystrix* neither of these nerves supplies any of the fingers or toes.

I do not think that this arrangement is peculiar to the *Hystricidæ*, because it occurs also in the Hamster and possibly in other Rodents. Since Man and the Porcupines agree in having the same arrangement of nerves in the hand as in the foot, but differ in that arrangement, it looks as if the cause that brought about the change of arrangement was identical for the two extremities.

[1] P. Z. S. 1882, p. 279.

J. Smit del. et lith. Mintern Bros. imp.

DENDROLAGUS BENNETTIANUS.

December 4, 1894.

Henry Seebohm, Esq., F.Z.S., Vice-President, in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of November 1894:—

The total number of registered additions to the Society's Menagerie during the month of November was 169, of which 65 were by presentation, 16 by birth, 8 by purchase, 10 by exchange, and 70 were received on deposit. The total number of departures during the same period, by death and removals, was 122.

Amongst the additions I wish to call special attention to the following:—

1. Ten Surinam Water-Toads (*Pipa americana*), kindly presented by Mr. F. E. Blaauw, C.M.Z.S., and received November 14th, 1894 These have been placed in one of the large tanks in the Reptile-House, where they are kept at a temperature of between 75° and 80°. They are free swimmers, and in their present stage appear to pass the whole of their time in the water. They were in rather poor condition on arrival, but have since fed well on worms and small fishes, and appear to be thriving. We may, therefore, hope to see the extraordinary phenomena of their development exhibited in the Gardens.

2. A fine example of Pel's Owl (*Scotopelia peli*), brought home from Sierra Leone by the Hon. C. B. Mitford, C.M.Z.S., Deputy Governor of the Colony, and presented November 16th. A single other specimen of this species was received by the Society from the Gambia in 1866. (For a figure of this Owl, see 'Ibis,' 1859, p. 445, pl. xv.) The iris in the present species is dark.

3. Two Tree-Kangaroos from Queensland, received in exchange from the Zoological and Acclimatisation Society of Victoria, Melbourne, as examples of Bennett's Kangaroo (*Dendrolagus bennettianus*), which appears not to have yet been sufficiently described[1].

I exhibit a coloured drawing of this animal by Mr. Smit (Plate XLVI.). It is apparently quite distinct from *Dendrolagus lumholtzi*. Mr. Le Souef has kindly sent me a photograph of four examples of this rare animal, taken when high up in a leafless tree in the Zoological Gardens at Melbourne, which I now exhibit.

An account of the capture of these interesting animals at Wyalla, near Bloomfield, in Northern Queensland, by Mr. D. Le Souef will be found in the 'Victorian Naturalist' for April 1894 (vol. xi. p. 11). Mr. Le Souef speaks of them as follows:—"The Tree-climbing Kangaroo (*Dendrolagus bennettianus*) is generally found on or near the top of these ranges, where the timber is not so high or difficult to climb. They remain during the day on the highest branches of a tree, and descend at night to pass from one tree to

[1] See Thomas, 'Catalogue of the Marsupialia and Monotremata in the Collection of the British Museum,' 1888, p. 96.

another. They seem to feed on bird's-nest ferns, leaves of certain trees, creepers, and probably on wild fruits."

Our specimens may be shortly described as follows:—

Dendrolagus bennettianus. (Plate XLVI.)

Dendrolagus bennettianus, De Vis, Abstr. Proc. Linn. Soc. N. S. W. p. v (Oct. 27, 1886)?

Dark mouse-brown above and beneath, head and sides of neck rufescent; muzzle and ears blackish; patch on back above the tail black; hands and feet blackish; lower surface of tail and tip of tail blackish. Length of body about 24 inches, of tail about 30 inches.

Hab. Queensland.

Prof. F. Jeffrey Bell, F.Z.S., called attention to the acquisition by the Natural History Museum of some specimens of remarkable Corals of great size from North-west Australia, of which he showed some admirable photographs taken by Mr. Percy Highley. Prof. Bell urged the necessity of the acquisition of large specimens of Corals, before coming to any conclusion as to their specific distinctions.

The following papers were read:—

1. On some Points in the Anatomy of *Ornithorhynchus paradoxus*. By T. Manners-Smith, B.A. (Cantab.), M.R.C.S., Chief Demonstrator of Anatomy, Mason College, Birmingham.

[Received October 30, 1894.]

The following is a series of notes upon certain points in the anatomy of *Ornithorhynchus paradoxus*. Though the muscular system of this animal has been frequently described, *e. g.*, by Meckel [1], Owen [2], and more recently by Coues [3], it has occurred to me that there is room for a description of the muscles of the limbs, together with the nerve-supply in those cases where such supply is peculiar, wholly or partially, to the animal under examination.

The work of Coues was undertaken without reference to Meckel's memoir, and Coues differs, in some particulars, from the description of the muscles as given by Owen.

In view of these circumstances, and considering the development

[1] 'Ornithorhynchi paradoxi Descriptio Anatomica,' 1826; and 'Traité général d'Anatomie Comparée,' vi.

[2] Article on Monotremes in Todd's 'Cyclopedia of Anatomy and Physiology,' vol. iii.

[3] Proceedings Essex Institute U.S. 1868, vol. vi.

of opinion during recent years as to the value of nerve-supply in determining muscular homologies, the present seems opportune for a re-examination of the limb myology, and a description of the nerve-plexuses of this animal.

I injected the animal with the intention of giving an account of the vascular system, but as I proceeded I observed that an investigation of the arterial and venous systems would be more successfully undertaken upon a fresh specimen. I have incorporated a few preliminary observations on the trunk and head arteries, and I hope to give a complete description of this part of the anatomy of the animal.

My best thanks are due to Professor Windle for kindly providing me with the specimen.

Trapezius.—This muscle consists of two portions, an anterior and posterior. The upper portion is broad. It arises from the occipital bone and from the ligamentum nuchæ. It is inserted into the spine and acromion of scapula and into the outer third of clavicle. The lower portion is triangular in shape. It arises from the seventh, eighth, ninth, and tenth dorsal vertebræ, and from the ninth, tenth, and eleventh ribs. It is inserted by its narrow apex into the spine of the scapula. Both parts of the muscle are supplied by the same nerve: this passes out just below occiput, gives small branches to anterior part, turns round posterior edge of this portion of the muscle, and ends in posterior part.

Latissimus dorsi.—This muscle has an extensive origin from the lower eleven ribs, all the dorsal and lumbar vertebræ, and the crest of the ilium. It is inserted by two portions, upper and lower, into the humerus, reaching down nearly to the elbow. Both parts are supplied by a nerve derived from the seventh cervical. Coues speaks of the slight spinal and extensive costal origin of this muscle[1]. Costal origin seventh to fourteenth ribs. Spinal origin from dorsal vertebræ fourth to ninth. No lumbar origin is mentioned by him. I found both origins more extensive than those mentioned by Coues, and agreeing more with the description given by Owen. The muscle gives off a distinct dorsi-epitrochlearis.

Rhomboideus.—Is a single muscle having both an occipital and a nuchal origin. It is inserted into the base of the scapula.

Epicoraco-brachialis.—This is a triangular muscle. It arises from the epicoracoid and is inserted close to the anterior portion of the deltoid.

Pectoralis major.—This is a large muscle, extending posteriorly almost as far as pubes. It arises from the sternum and from the upper six ribs. The lower part unites with the muscle of the opposite side in a thin aponeurosis. It is inserted into the pectoral ridge of humerus. The muscle is supplied by a large nerve derived from the front of the lower trunk of brachial plexus. It divides into several branches before passing to the muscle.

Levator anguli scapulæ (Trachelo-scapular).—This muscle arises

[1] *Vide* Proceedings of Essex Institute U.S. vol. vi. 1868, p. 142.

from the transverse process of the atlas in conjunction with the trachelo-acromial. Below, it is inserted into the superior border of the scapula, blending with serratus magnus. It is supplied by a branch of the same nerve which supplies the next muscle. This muscle is called atlanto-scapularis by Coues [1].

Trachelo-acromial.—Is a fairly large muscle. It arises by a narrow strong tendon from the transverse process of the atlas. Below, it is inserted into the spine and acromion process, and also into a small portion of outer end of clavicle. It is supplied by a branch from cervical plexus. Mivart mentions two muscles in this position in *Echidna* as levator claviculæ [2]. This muscle is called atlanto-acromialis by Coues [3].

Serratus magnus.—This is a large compound muscle. It arises in separate slips from the lower five or six cervical vertebræ [4] and from the upper three ribs. It is this costal portion only which Coues describes as serratus magnus, costo-scapularis, or s. anticus. The vertebral portion of the muscle consists of two parts, an anterior and a posterior. The anterior passes to the acromion, the posterior to the base of scapula. It is this portion which is continuous posteriorly with the costal part of the muscle; this latter passing also to the base of the scapula. The whole of these muscles, viz., trachelo-acromial, trachelo-scapula, together with cervical and costal part of serratus magnus, appear to be segmentations of one large muscular sheet. The whole sheet might be called costo-scapular.

Supra-spinatus.—Is a narrow slender muscle arising from a small portion of costal surface of scapula. It is inserted into top of radial tuberosity. In *Echidna* it is much larger and fills the whole costal surface of the bone.

Infra-spinatus.—Arises from the scapula immediately below the spine and from the vertebral border. It is inserted just below the head of humerus into the radial tuberosity, beneath epicoraco-brachialis. It is supplied from the upper trunk of the brachial plexus. Testut [5] (quoting Sabatier) says that the infra-spinatus and teres minor are fused in *Ornithorhynchus.* Coues also considers them probably fused.

Teres major [6].—Arises from posterior part of vertebral border of scapula. It is inserted into the humerus just below the head.

Teres minor.—Is placed underneath infra-spinatus. It arises from the scapula just below the spine, and is inserted close to the head of humerus, more anteriorly than the infra-spinatus. It is supplied by a special branch from the upper part of the brachial plexus. Testut says the muscle is fused with infra-spinatus.

[1] *Vide supra.*
[2] Proceedings of Linnean Society, 1866.
[3] *Vide supra.*
[4] This vertebral portion is described by Coues as levator anguli scapulæ.
[5] 'Les Anomalies Musculaires,' Testut, 1884.
[6] This is the part corresponding to the muscle described by Coues as lower part of teres major. The part described by Coues as upper part of teres major would appear more probably to belong to subscapularis.

Owen does not mention it in this animal. Mivart says it is absent in *Echidna.*

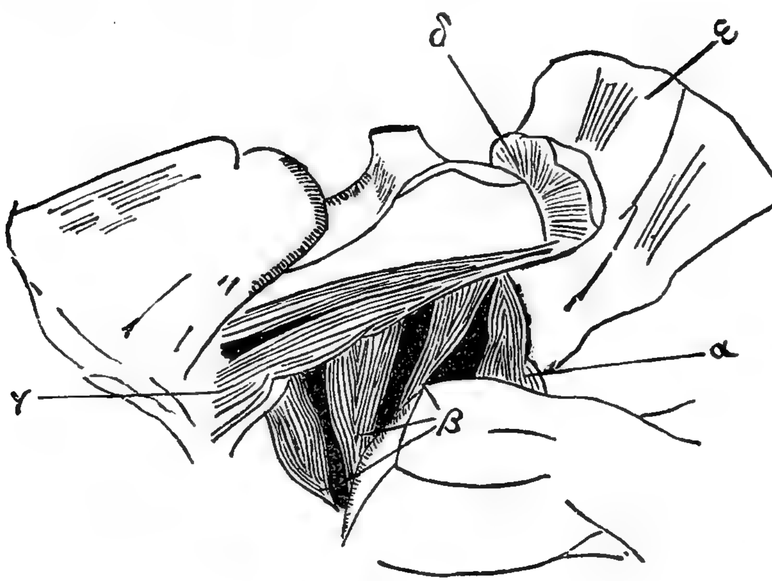
Subscapularis.—There would appear to be a difference in the origin of the two muscles supra-spinatus and subscapularis in the two species of Monotremes. According to Mivart, in *Echidna*, supra-spinatus occupies the whole of the costal surface of scapula, while subscapularis is confined to outer surface. Owen states that subscapularis is a narrow muscle in *Ornithorhynchus.* It would appear, rather, to be a large muscular sheet arising from the so-called subscapular fossa, *i. e.*, posterior part of outer surface, and from almost the whole of the costal surface, so-called supra-spinous fossa. The two parts are intimately blended, as they pass beyond scapula to humerus, and are inserted together on the ulnar tuberosity. In the portion of the tendon which springs from the costal surface is a sesamoid bone; the other portion is inserted into the ulnar tuberosity just below the sesamoid bone. It is, however, an artificial dissection to separate the two portions. The larger portion, containing the sesamoid bone, would seem from its insertion to represent the subscapular muscle of human anatomy; the portion arising from the so-called subscapular fossa, *i. e.*, posterior part of outer surface, would seem to represent that portion of the subscapularis of human anatomy which arises close to axillary border of scapula. This portion is often separate, and is called in human anatomy subscapulo-capsularis by Macalister. It is in Man inserted just below the chief portion of the sub-scapular muscle. In this animal it is also inserted below the rest of the muscle. If we imagine the axillary border of the human scapula twisted backwards, so that it, together with the origin of triceps, comes to occupy the middle of the bone, then this sub-scapulo-capsularis would be also twisted backwards and its origin would occupy the exact position which it has in *Ornithorhynchus.* The two portions of the muscular sheet are supplied by the separate branches of the same nerve which is a branch from the upper part of brachial plexus. Coues describes this muscle as upper part of teres major, *i. e.*, the muscle which he speaks of as arising from both sides of scapula and embracing the bone. Since, however, the two portions of his teres major are quite distinct from their origin to their insertion, and separated, moreover, by the long head of the triceps, this would lead one to think that that portion which passes to ulna tubercle is subscapularis.

Muscles of Arm.

Deltoid.—Consists of two parts, anterior and posterior. They are both inserted into strongly marked deltoid ridge of humerus, and are quite distinct to their insertion.

Biceps.—Arises by two heads; both are coracoid in their origin and both are radial in their insertion. The larger arises from sternal extremity of coracoid, the smaller arises nearer the glenoid cavity from epicoracoid. They blend about the middle of the arm and are inserted into the radius at the junction of the upper and middle thirds. Between the two heads of origin a muscle is inserted which is probably the pectoralis minor. Only one head is present in *Echidna* (Mivart, *loc. cit.*).

Fig. 1.



Muscles of Arm.

α. Brachialis anticus. β. Triceps. γ. Infra-spinatus. δ. Epicoraco-brachialis. ε. Deltoid.

Coraco-brachialis.—Two portions of the typical coraco-brachialis are present. A longer superficial portion, arising in conjunction with inner (larger) head of biceps from sternal portion of coracoid; it is inserted into the bar of bone bridging over the well-marked supra-condyloid foramen. The deeper portion arises from coracoid and whole of epicoracoid, just below and in front of glenoid cavity; it is inserted into the upper third of the humerus. The two portions are entirely distinct, the tendon of latissimus dorsi separating them from below; both parts are supplied by a branch from the median nerve. The first portion only is called by Coues coraco-brachialis; the second he describes as epicoraco-brachialis; the same two portions are found in *Echidna* (Mivart, *loc. cit.*). There is a distinct epicoraco-brachialis, but in addition two portions of the typical coraco-brachialis are present, as described above.

Brachialis anticus.—Arises from humerus, its origin extending as high as the head of the bone. The muscle is inserted into the upper fourth of the shaft of the ulna.

Triceps.—This is a very large, strong muscle, consisting of four heads. The long head may be split up into three portions. It arises from the glenoid ridge, on outer surface of scapula, and passes down as a large separate muscle to the large expanded olecranon. The inner head, also large, arises from and covers the posterior surfaces of humerus; it is inserted into olecranon beneath outer and long heads. The outer head, smaller and longer, arises by a narrow tendon from outer surface; it blends with the long head at olecranon. Beneath the inner head is a fourth head, arising from posterior surface of humerus just above the lower extremity; it is inserted into the olecranon beneath inner head. It is this portion of the muscle with which the anconeus externus is continuous. Coues describes this part of the muscle as a portion of anconeus.

The triceps is supplied from posterior trunk of brachial plexus.

Anconeus externus.—Is a small muscle having the usual origin and insertion. It is supplied by a branch of one of the nerves which supplies triceps.

Anconeus internus.—Passes from internal condyle to olecranon. It is supplied by the ulnar nerve.

Muscles of the Forearm.

Flexor digitorum.—This is a large muscle. It arises by three heads:—(α) from the internal surface of the ulna; (β) from the lower end of humerus; (γ) a central portion also arises from lower end of humerus. The three portions blend in the lower part of the forearm, where the muscle becomes tendinous, just above the wrist. The tendon expands into two portions, inner and outer, each portion containing a sesamoid bone. From the outer of these divisions tendons pass to the terminal phalanges of the fourth and fifth digits; from the inner, tendons pass to the first, second, and third. At the under surface of the muscle at the wrist is a strong tendinous band arising from cuneiform and passing to the sesamoid bone in the radial division of the tendon. The whole muscle has a very regular arrangement. The ulnar portion is supplied by the ulnar nerve, *i. e.*, the larger posterior portion of the plexus, from seventh and eighth C. and first D.; the central and humeral portions are supplied by median nerve. Four heads to this muscle are described by Mivart[1] in *Iguana*. Two are humeral, one is ulnar. His fourth head arises from the carpus and is inserted into the deep surface of a tendon containing a palmar sesamoid. The tendinous band mentioned above might represent the fourth head of the muscle as described by Mivart in the muscle of this Saurian.

Flexor sublimis digitorum.—There is a small sublimis. It consists of four distinct muscular bellies. They arise from the front part of the tendon of longus (profundus), which contains the sesamoid bones. They pass to the first, second, third, and fourth digits. The fibres of these small muscles arise both from the

[1] "Myology of Iguana," Mivart, P. Z. S. 1867, p. 785.

tendon and from the sesamoid bones in the tendon. They terminate in very slender tendons, which, after resting upon the corresponding tendon of sublimis, spread out into a thin fascia which blends with the digital sheaths of the profundus. The first, third, and fourth are larger than the second, which is very small. The first is more probably an abductor than a flexor of the pollex. The others give off two slender fascial slips, one on each side of the profundus tendon, to first phalanx, and send a third slip forwards to blend with the digital sheaths of the tendons of profundus. This muscle is not mentioned by Owen. Mivart says that flexor brevis is most probably absent in *Echidna* and *Ornithorhynchus*. Whilst the origin of a sublimis from the tendon of a profundus is common in Amphibians, it is rare amongst Mammals.

Flexor carpi radialis is a large muscle. It arises from the lower end of the internal condyle, and is inserted below into a fairly large radial sesamoid bone. From the sesamoid bone slips pass on the radial side to the scapho-lunar and trapezium; on the ulnar side to pisiform and, downwards, to second metacarpal. The muscle is supplied by the median nerve. In *Echidna* this muscle passes to metacarpal bones of pollex and index.

Pronator radii teres.—Arises from the inner condyle of humerus. It is inserted into middle of radius, a little below and on the opposite surface to supinator brevis.

Flexor carpi ulnaris is a large flat muscle, arising by two heads from the internal condyle of the humerus: from the posterior border of the ulna and expanded upper extremity of olecranon. The tendon is inserted into the pisiform, and sends slips to the fourth and fifth metacarpals. This muscle is supplied by the ulnar nerve.

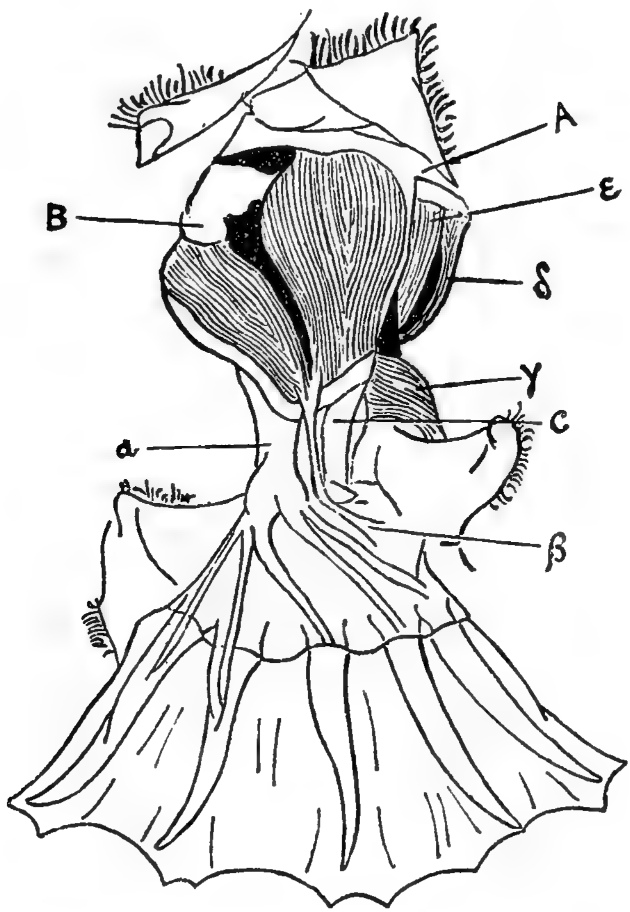
Supinator brevis.—This is a somewhat triangular muscle. It arises from the external condyle, beneath the radial extensors of the wrist. It is inserted into the upper and middle fourths of the shaft of the radius. It is supplied by the posterior interosseous nerve. This muscle is not mentioned by Owen.

Extensor carpi radialis longior.—Arises from the lower third of the supinator side of the shaft of the humerus. Below it divides into three tendons, which pass to the bases of the second, third, and fourth metacarpal bones.

Supinator longus.—Arises from the lower end of the humerus, beneath the longior. It is inserted into the posterior surface of the peculiar large scapho-lunar. The muscle having this origin and insertion in *Echidna* is described by Mivart as the extensor carpi radialis longior. Only one radial extensor is described by Owen in *Ornithorhynchus* corresponding to longior. Supinator longus is not described by him.

Extensor communis digitorum.—Arises by a common tendon from the external condyle. It expands on the back of the wrist, the expansion containing a fibro-cartilage. The expansion divides into two parts, each part giving off three tendons. Two go to the middle finger, one from each part; the remaining digits have one each. A slip is sent round radial side of manus. Nerve-supply from posterior interosseous.

Fig. 2.



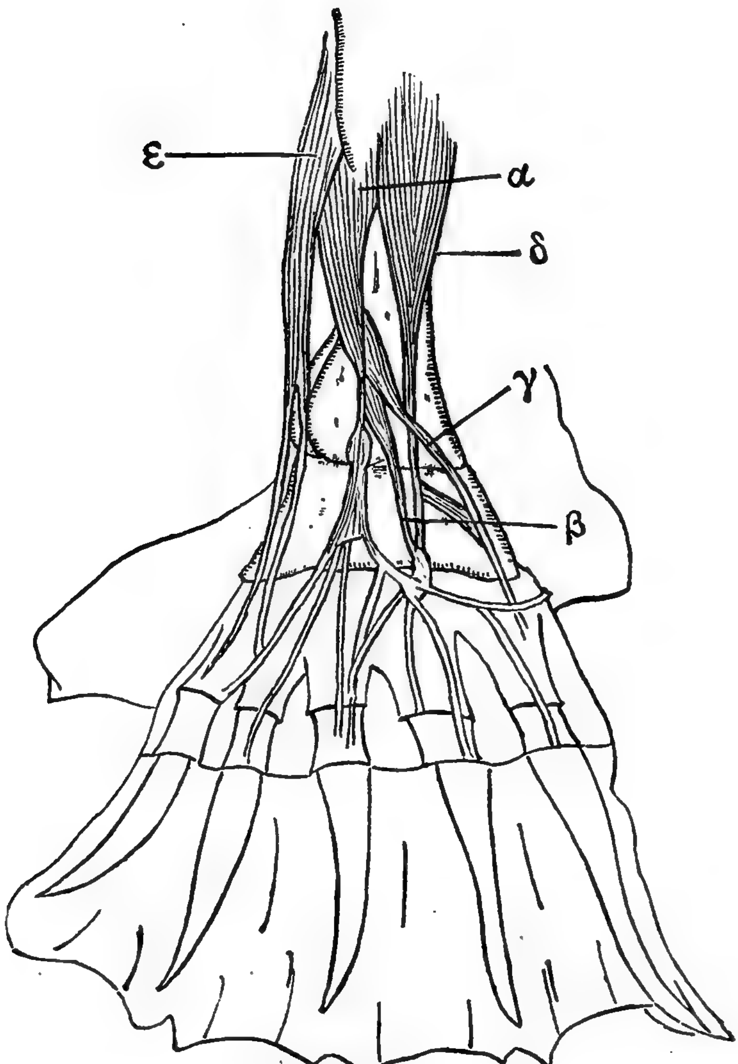
Muscles of Front of Forearm and Hand.

α. Flexor profundus digitorum.
β. Flexor carpi ulnaris.
γ. Portion of insertion of Panniculus.
δ. Extensor minimi digiti. } Muscles of posterior surface seen at left side
ε. Extensor indicis. } of diagram.
A. Expanded olecranon.
B. Lower end of internal condyle of humerus.
C. Lower part of shaft of ulna.

Extensor minimi digiti.—This is a fairly large muscle. It arises from the lower end of the humerus, in common with the other extensors. It is inserted into the fifth digit. There is also a slender special extensor passing to the fourth digit.

Extensor indicis.—Arises from the posterior border of ulna and from expanded olecranon. It divides into two tendons which go to the second and third digits. This muscle is not mentioned by Coues as distinct; he describes an abortive slip of communis as probably representing an indicis. In my specimen indicis was a most distinct separate muscle, situated on a deeper plane than extensor communis.

Fig. 3.



MUSCLES OF POSTERIOR SURFACE OF FOREARM AND HAND.

α. Extensor communis digitorum.
β. Extensor indicis going to 2nd and 3rd digits.
γ. Extensor ossis metacarpi pollicis.
δ. Extensor carpi radialis.
ε. Extensor minimi digiti.

Extensor ossis metacarpi pollicis.—Arises chiefly from ulna; slightly also from radius. It is inserted, in usual position, into base of first metacarpal bone. There is a tendinous band arising from the cuneiform, which crosses the back of the carpus to join the ulnar margin of the tendon.

Myology of Manus.

There is a small short muscle of the thumb, which is most probably a combined flexor and abductor. There is a small muscle passing to the little finger, which appears to be an abductor.

Palmar inter-ossei.—Are fairly well marked and are three in number.

Muscles of the Posterior Extremity.

Gluteus maximus.—Is a large flat muscle, which arises from the posterior part of the crest of the ilium, from the sacral, and upper eight caudal vertebræ. It is inserted into the lower end of the tibia, this part being closely united with the inter-tibialis, and into the sole of the foot, this portion going partly to os calcis and partly to bone supporting the heel. The muscle has a very similar origin and insertion in *Echidna*[1]. Meckel mentions its attachment into the bone supporting the heel in the male.

Beneath the gluteus maximus is a muscle which arises from the first four caudal vertebræ. It is inserted into the femur about its middle, just below the gluteal ridge. This deeper portion is supplied by a branch from great sciatic. This is the muscle described by Meckel as medius; Mivart, too, in *Echidna* describes a muscle having a similar position. The next-mentioned muscle they both look upon as minimus. Mivart, however, mentions that the muscle described above may represent a deep part of maximus. Its insertion would point to that conclusion. Coues describes this muscle as pyriformis: neither its origin nor insertion would indicate that it corresponds to the ordinary pyriformis.

Gluteus medius.—This is a large thick muscle divided at its origin into two parts, superior and inferior. The superior, the larger, arises from the crest and posterior surface of the ilium. The anterior has a narrow origin, from the same surface, close to the cotyloid border of the bone. The two portions are united below, at their insertion into the great tuberosity of the femur. The superior part is supplied by a branch from the sacral plexus. The anterior part is supplied by a branch which arises in abdomen from the anterior crural, and, passing under the rectus, is distributed to this portion of the muscle. Meckel and Mivart in *Echidna* describe this as minimus. From the nerve-supply it would seem that only posterior portion corresponds to ordinary gluteus medius. The anterior portion may be a muscle divorced from the muscles in front of the thigh. There is a small muscle

[1] Mivart.

placed deeply between superior and inferior portions of medius; at its insertion it is blended with medius. It arises from dorsum ilii just behind the superior part of medius. It is a very narrow muscle. It may represent minimus.

There is a muscle arising from the lateral processes of the caudal vertebræ, and inserted into the upper part of the femur. A muscle is described by Mivart in *Echidna*, in this position, which he states he is disposed to regard as the pyriformis. Meckel says pyriformis is present and fairly large. Owen does not mention it. This is apparently the muscle described by Coues as quadratus femoris. Its origin and insertion would approximate it more to pyriformis than the muscle described by Coues under that name.

Muscles of Front of Thigh.

Sartorius.—Is a long muscle. It arises from the pectineal spine of the pubes and is inserted into the head of tibia.

Rectus femoris.—Arises from the cotyloid border of ilium and is inserted into the patella. It is supplied by a branch of the anterior crural, which arises within the abdomen below the nerve which supplies the anterior part of the gluteus medius. This muscle is quite distinct from the rest of the quadriceps.

The remainder of the extensor mass can be separated where the nerve enters into two portions, inner and outer vastus; the two vasti arise from the superior surface of the shaft of the femur, the outer vastus extending as high as greater tuberosity. They are inserted into patella and are supplied by the anterior crural nerve.

Psoas magnus and *Iliacus* have the usual position, relations, and attachments. Their insertion into femur extends as far as a little below the middle. They are supplied by the obturator nerve.

Adductor Group.

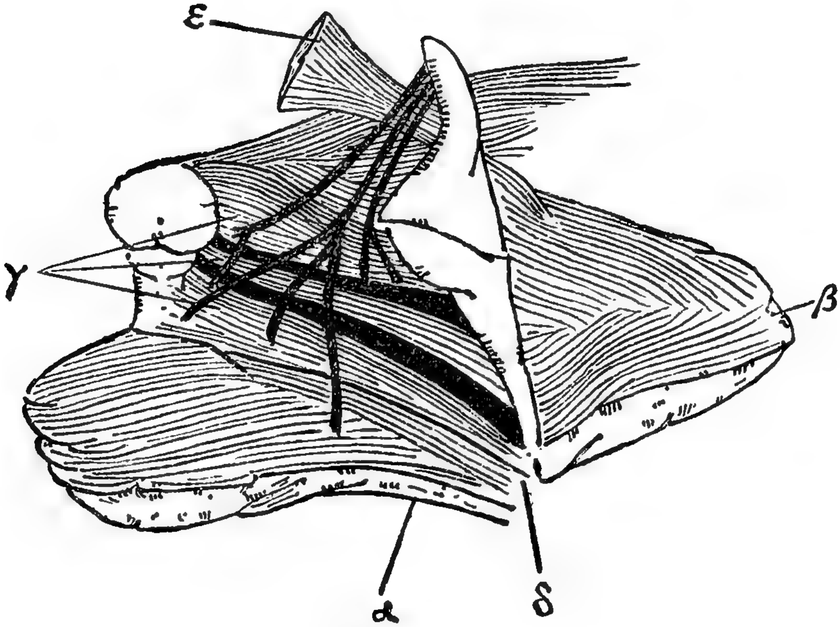
Gracilis.—This is a large muscle concealing the other adductors. It arises from the marsupial bone and from the inferior surface of the pubes. It is inserted into the inner side of tibia. The muscle sends a slip to sphincter ani. It is supplied by the obturator nerve. It has much the same origin and insertion in *Echidna* (Mivart).

The named adductors consist of well-marked and easily separable longus, brevis, and magnus. Meckel mentions two only.

Adductor longus.—Arises from the pubes close to marsupial bone. It is inserted into the lower end of femur. It receives a distinct branch of the obturator nerve on its deep surface. This muscle is apparently absent in *Echidna* (Mivart).

Adductor brevis.—This is a narrow muscle, arising by a flat tendon from the mesial portion of the inferior surface of the pubes; it is inserted into the lower end of the femur. In position it is situated between the longus and the magnus. It receives a fine branch of the obturator nerve.

Fig. 4.



Muscles of Thigh.

α. } Gracilis reflected.
β. }
γ. Adductor mass. 1. Upper one, going to femur, is longus. 2. Middle, slender one is brevis. 3. Lowest, going to tibia, is magnus.
δ. Is a small portion of semi-membranosus seen from the front.
ε. Sartorius cut through.

Adductor magnus.—Is a thick muscle which has a comparatively narrow origin from the inferior surface of ramus of ischium, its origin extending as far back as tuberosity. It is inserted by its base into the upper third of tibia. It may be separated into two parts, anterior and posterior. Each part receives a branch from the obturator nerve. The anterior portion receives in addition a branch from great sciatic, which enters it on its superior surface. The nerve supplies three muscles, adductor magnus, semimembranosus, and two slender branches to supposed inferior gemellus. In *Echidna*, this muscle is inserted into linea aspera, in common with brevis (Mivart, *loc. cit.*). The muscle Coues describes as adductor magnus is inserted into thigh-bone. He homologizes it by its insertion into femur. Its nerve-supply, however, together with the fact that in many mammals adductor magnus is inserted into tibia, lead me to think that the one described above is true adductor magnus.

Pectineus.—There are two pectinei, an internal and an external. The internal arises from the lesser spinous process, as it is called by Owen. The muscle is inserted into the femur just below lesser tuberosity and close to the obturator externus. It is supplied by the obturator nerve. The pectineus externus arises from the pectineal spine (greater spinous process of Owen). It is inserted into the femur halfway down the shaft.

Obturator externus.—Occupies the usual situation. At first sight it appears to be divided into a superior and an inferior portion. Superior portion is more probably inferior gemellus, or, since it receives two branches from the same nerve, it may represent inferior gemellus and quadratus femoris. Its origin, too, would correspond in position to the combined origin of those muscles. The two parts of the obturator externus are easily separated at their origin, but not so at their insertion. The inferior portion is supplied by obturator nerve; the superior by two fine twigs from that branch of great sciatic which supplies adductor magnus in part and semimembranosus[1]. Quadratus femoris is present in *Echidna* and appears to have a similar origin and insertion to the muscle described as superior part of obturator externus. The muscle is most probably combined quadratus femoris and gemellus inferior.

Obturator internus is absent. The muscle which occupies the usual situation of origin of this muscle is one of the ischio-caudal muscles. Coues describes three ischio-femoral muscles in the region of externus, *a*, *b*, and *c*: *a*, and probably *b*, he considers represent obturator externus; *c* he considers represents obturator internus.

Hamstring Muscles.

Semi-membranosus.—This is a fairly large muscle arising from the tuber ischii. It is situated between the muscle representing semi-tendinosus and biceps above and the adductor group below. It is inserted into the inner side of the head of the tibia. The chief nerve-supply is from the sciatic, the nerve reaching the muscle on its superior surface. There is, in addition, a very slender branch of the obturator nerve, which supplies the inferior posterior portion of the muscle[2].

Semi-tendinosus, with which biceps appears to be blended, is a large sheet which arises by a narrow tendon from the tuber ischii. The muscle spreading out is inserted by its anterior fibres into the expanded upper extremity of the fibula and into a strong tendinous band which passes from this process to patella. These portions most probably represent biceps; the posterior part becomes thin and apneurotic and is inserted into the crest of the tibia. Coues describes this muscle entirely as biceps, looking upon semi-

[1] Macalister mentions a large gemellus ('Vertebrate Morphology'). Meckel says they are both absent in *Ornithorhynchus*.

[2] It appears to have very much the same attachment and position in *Echidna* (Mivart, *loc. cit.*).

tendinosus as a portion of the muscle described above as semi-membranosus.

Muscles of the Leg.

Gastrocnemius.—Is a large muscle. It arises by two distinct heads: a larger from the upper expanded portion of the head of the fibula; a smaller head arises from the lower end of the femur. The two portions blend and the tendon is inserted into the os calcis. It does not fuse with the soleus. The femoral head is supplied by the internal popliteal.

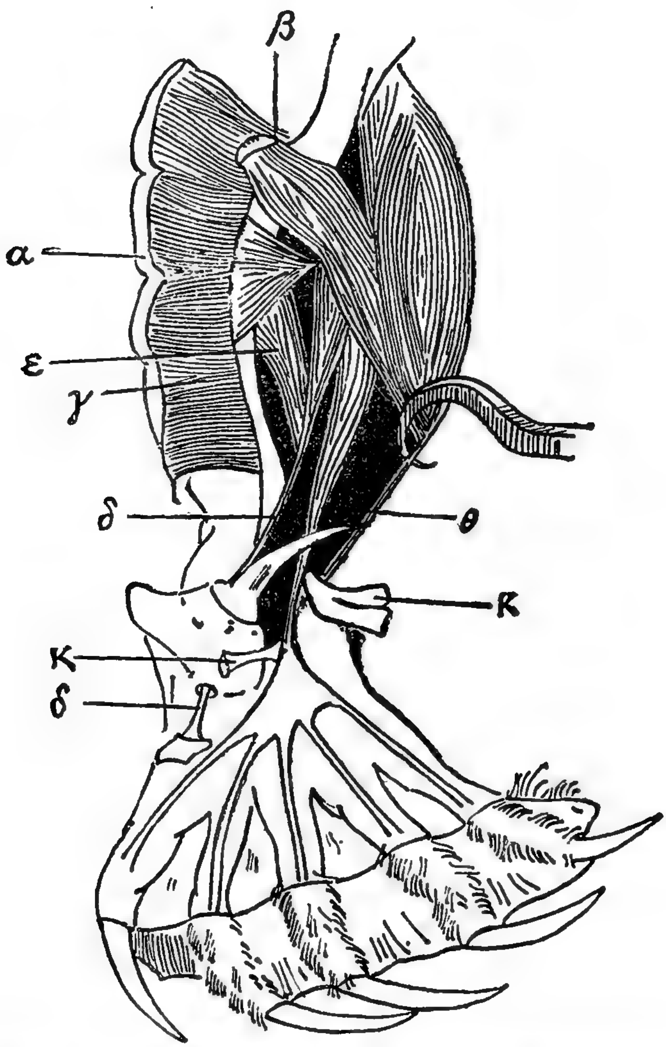
Soleus.—Arises from the expanded head of the fibula and from the shaft of the same bone. A few fibres arise also from the tibia. The fibres from the fibular shaft arise on the anterior aspect of the bone, and pass backwards between the tibia and fibula to join the other fibres. The two heads blend and pass deeply in a groove beneath the bone supporting the spur on heel. The tendon is here in company with the tibialis posticus. In this situation the soleus divides into two tendons—one passes to the astragalus, the other to the bone supporting the heel. Tibialis posticus passes between the two tendons. Owen states that soleus arises from a large proportion of tibia. This is certainly a mistake; a few fibres only arise from this bone.

Flexor longus digitorum.—Is a large strong muscle. It arises from the upper expanded extremity and from the shaft of the fibula. At the ankle it passes between a process of calcaneum and the bone which supports the spur. In the sole it expands and divides into five strong tendons, one for each digit. Coues describes three tendons.

Flexor brevis digitorum (perforatus).—This muscle is in two parts. One portion springs from superficial surface of flexor longus and passes to the second and third toes. Another portion arises from the calcaneum and passes to the remaining toes. There is a small flexor accessorius seen on reflecting flexor longus, having the usual relationship of that muscle to the longus tendon, *i. e.* passing from calcaneum to deep surface of flexor tendon. The flexor longus is also attached to os calcis by a strong tendinous band. Coues describes the portion arising from flexor longus only as flexor brevis. The part arising from the calcaneum he describes as a dismemberment of flexor fibularis. The two portions have, however, an entirely similar relationship to the longus tendons. I am disposed to regard both the tendinous part and the calcaneal part as dismemberments of the same muscle, *i. e.* a plantaris, which has contracted separate attachments in its course. The resemblance of the tendinous part to the flexor sublimis (brevis) of the anterior extremity will be at once apparent.

Tibialis posticus.—Arises from the upper expanded extremity of the fibula. The tendon passes deeply at the ankle together with the soleus, and, after perforating the latter muscle, very much in the same way that the profundus passes through sublimis in human anatomy, is inserted into a sesamoid bone at junction of the scaphoid and ento-cuneiform. In the leg it is superficial to soleus.

Fig. 5.

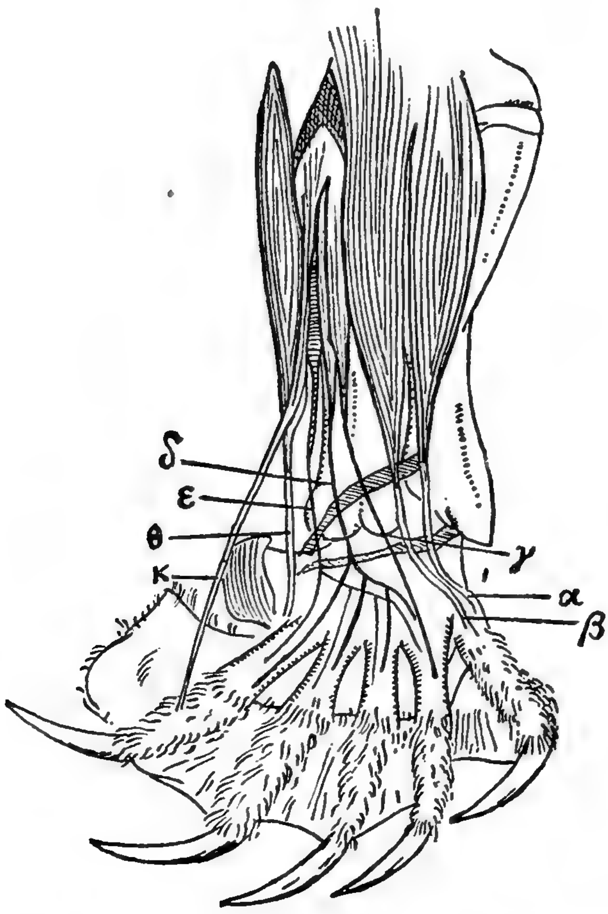


Muscles of the Posterior Surface of Leg and Sole of Foot.

- α. Adductor magnus.
- β. Femoral head of gastrocnemius.
- γ. Inter-tibialis.
- δ, δ. Tibialis posticus (its tendons seen below).
- ϵ. A part of soleus.
- θ. Flexor longus digitorum.
- κ, κ. Tendinous and calcaneal parts of flexor brevis digitorum.

Extensor longus hallucis.—Arises by two heads, the superficial head from the expanded upper extremity of fibula and the deeper one from the shaft of the bone. The muscle is inserted into the first digit; the superficial portion from the upper extremity of fibula is supplied by a branch of the same nerve which supplies tibialis anticus.

Fig. 6.



MUSCLES OF ANTERIOR SURFACE OF LEG AND DORSUM OF FOOT.

α. Tibialis anticus.
β. Extensor longus hallucis.
γ. Extensor indicis.
δ. Superficial extensor of the toes.
ε. Deep extensor of the toes.
θ. Peroneus longus.
κ. Peroneus brevis.

Extensor longus digitorum.—There are two long extensors of the toes, superficial and deep. They both arise from the expanded upper extremity of the fibula. Superficial extensor also from part of shaft of bone. They both expand on the dorsum of foot and give tendons to the second, third, fourth, and fifth digits. Superficial extensor is supplied by the same nerve which supplies the extensor indicis. There is a distinct extensor for second digit arising from upper expanded extremity of fibula, from head of bone, and from a tendinous band between these two points; it is supplied by a slender branch from the peroneal nerve. It will be noticed that index receives three tendons—one from superficial extensor, one from deep, together with a special extensor.

Tibialis anticus.—Arises by two heads: a superficial from upper expanded extremity of fibula, from a strong tendinous band passing from fibula to patella, from patella itself, and from tibia. The deep head from shaft of tibia. It is inserted into ento-cuneiform. Both heads are supplied by a nerve from the front of the thigh, which passes beneath the above-mentioned tendinous band.

Peroneus longus.—Arises from the upper expanded extremity of the fibula. Passing down the outer side of the leg, it reaches the interval between the large os calcis and the cuboid, and passes deeply into the sole of the foot, traverses the sole, and is inserted in the usual situation. It is supplied by the peroneal nerve.

Peroneus brevis.—Arises beneath longus from the expanded extremity of fibula. Its tendon divides below into two slips, one passing to first, the other to second phalanx of fifth toe. It is supplied by the peroneal nerve. Coues describes this as peroneus tertius. Its origin and nerve-supply would rather correspond to that of brevis.

Myology of Pes.

Of the muscles of the big toe, flexor brevis hallucis is the only one which can be made out, and this is extremely small.

Of muscles of the litttle toe, the flexor brevis, the adductor, and the abductor, and a small abductor minimi digiti can be made out.

Plantar and dorsal inter-ossei are also present.

Plexuses.

Brachial plexus.—This is formed by the fifth, sixth, seventh, eighth cervical and first dorsal nerves. There is a small filament, in addition, from the fourth cervical, and the first dorsal receives a small branch from the second. The plexus consists of two main trunks—an upper and a lower. The fifth and sixth unite and form the upper trunk. Immediately beyond the formation of this trunk two nerves arise: one passes upwards and forwards and, joining the branch to the plexus from the fourth cervical nerve, it is distributed to the so-called infra-spinatus muscle; the other nerve passes downwards and backwards and forms one head of median. The trunk itself passes backwards in a somewhat similar manner to the circumflex of human anatomy, gives off a branch to subscapularis, and divides into two parts—one passes into fore-arm and supplies the skin on the outer posterior aspect of the hand, and gives off a branch to the sup. longus and extensor carpi radialis longior. The lower trunk, formed by the seventh and eighth cervical, first dorsal, and a filament from second dorsal, is much the larger of the two. This trunk divides into three terminal branches about the middle of the arm :—(α) One passes downwards, enters forearm, and is distributed to the cleft between the index and middle fingers on palmar aspect; (β) The next, also a cutaneous branch, is about the same size as the first; it is distributed to the third and fourth clefts. The above two nerves would seem to represent superficial portion of median and part of ulna. (γ) The third branch of the lower trunk, the largest of the three, passing down arm, gives off two branches to the triceps, which curve round the lower border of latissimus dorsi. One of these is the posterior interosseous, which passes through triceps, winds round humerus something like the musculo-spiral of human anatomy. This nerve next passes between brachialis anticus and muscles arising from the radial condyle of humerus, and, passing into forearm, perforates the supinator brevis and supplies the usual muscles on the back of the forearm, with the exception of extensor carpi radialis brevior, extensor primi and secundi inter-nodii pollicis, all of which muscles are absent.

The continuation of the third branch passes into forearm, beneath the anconeus internus, and, after supplying the muscle, gives off branches to the flexor carpi ulnaris and the ulnar portion of the flexor sublimis digitorum; it then continues its course down forearm and ends by supplying the ulnar side of the fifth digit. It communicates in the forearm with the branch to the fourth cleft.

Other branches from lower part of plexus :—The seventh nerve gives off a branch to latissimus dorsi before it joins the plexus. From the lower part of plexus a branch is given to the pectoralis major. The median nerve arises by two roots, and, after supplying the biceps, coraco-brachialis, and brachialis anticus, passes through supracondyloid foramen into the forearm.

Lumbar Plexus.

Obturator nerve.—Its chief origin is from the sixteenth dorsal nerve, allowing two lumbar vertebræ. The nerve passes out between the sixteenth and seventeenth dorsal vertebræ. It is joined by a slender branch from the seventeenth dorsal, a subcostal nerve. The nerve passes along pelvis in the usual position and supplies the usual muscles, together with a slender branch to the semi-membranosus. It also gives off a branch in the abdomen, which, after dividing into several branches, passes to psoas and iliacus.

The anterior crural nerve arises by two fairly large branches from the seventeenth dorsal and the first lumbar nerves. The rest of the first lumbar together with the whole of the second pass into the pelvis, forming the lumbo-sacral cord.

Sacral Plexus.

The nerves entering into this plexus are a large part of the first lumbar, the whole of the second lumbar, and the whole of the first sacral. Portion derived from lumbar nerves divides into two branches; the first sacral also divides into two branches. One of the branches from lumbar part of plexus fuses with one of the branches from sacral part of plexus and forms the peroneal nerve; this, as it passes down the leg, divides into two branches, which seem to represent peroneal and external plantar. Peroneal divides into a muscular branch passing to muscles mentioned in text and a cutaneous branch to the dorsum. The external plantar divides into a cutaneous branch to outer side of foot, and supplies certain muscles of the sole. The remaining branch from lumbar part of plexus unites with remaining branch from sacral part, and forms the internal popliteal nerve; this divides into three branches: two lateral, to the inner and outer heads of the gastrocnemius; one to outer head supplying flexor longus digitorum in addition; one to inner head supplying soleus and tibialis posticus. The continuation of the trunk passes down and becomes the internal plantar, which is mainly cutaneous.

A NOTE ON THE ARTERIAL SYSTEM.

The arch of the aorta has the usual mammalian arrangement, turning to the left side. It gives off the three large cervical and brachial branches in the usual order, viz. innominate, left carotid, left subclavian.

The trunk aorta passes down to the nineteenth vertebra (last lumbar), where it ends by dividing in a peculiar tree-like manner into three small and exceedingly short trunks on each side and a median caudal continuation of the vessel itself—thus there are seven trunks in all.

Passing from without inwards, the outermost of the three trunks divides almost immediately into the following branches:—A small outermost branch for the region of the crest of the ilium. A large branch which passes beneath the psoas parvus and divides here into three branches, which, running down parallel to each other, are all distributed to the deep part of the front of the thigh, as seen in the diagram. A fairly large branch which soon divides into three, two passing to the superficial part of the front of the thigh, the remaining branch to the abdominal wall. These arteries pass over the psoas parvus; they may represent superficial femoral and epigastric. The last branch from the outermost trunk is a vessel which is partly distributed to abdominal wall and also gives off branches which descend into pelvis, together with two obturator arteries—large and small.

The second trunk division of the abdominal aorta: this 2nd division corresponds in its distribution with Hyrtl's[1] internal iliac,

[1] Denkschriften Wiener Akademie, Bd. v.

This divides at once into the following branches proceeding from without inwards:—

A slender branch to bladder. This is Hyrtl's cystic artery.

A large branch, which runs downwards and backwards; leaves pelvis beneath symphysis pubes; runs down on the side of the rectum, and is distributed to the penis and to Cowper's gland. This may represent internal pudic; it gives off branches to bladder, rectum, and an artery, which divides into a pencil of fine vessels and passes to the under surface and side of middle of tail. This artery Hyrtl speaks of as the common pudendal.

A pencil of fine vessels, four in number, which descend into the pelvis parallel to each other, soon subdivide, and passing from thence are eventually distributed to the sides of the tail. This pencil has divided into a set of ten or twelve fine vessels at the side of the anterior part of caudal region.

The innermost of the three trunk branches divides at once into three vessels; these descend into pelvis parallel to each other, and emerging from thence are distributed to the gluteal region; the largest of the three passes to the back of the thigh. These arteries represent gluteal and sciatic.

The central caudal artery descends in the middle line to tip of tail.

The whole arrangement is repeated on the opposite side.

Branches of the Trunk Aorta.

The only branches given off from thoracic trunk are the intercostal arteries. These are nine in number on each side. The first supplies the third and fourth spaces, running along the line of the fourth rib and giving off branches anteriorly and posteriorly to third and fourth spaces. The fifth to the twelfth intercostal intervals are supplied by the second, third, fourth, fifth, sixth, seventh, and eighth arteries. The thirteenth, fourteenth, and fifteenth intervals are supplied by the ninth aortic intercostal. The sixteenth interval is supplied by the first and second lumbar arteries. The upper two spaces are supplied by a superior intercostal. There are five lumbar arteries. They come off by a common trunk which immediately divides into the arteries of opposite sides; the first and second supply the last intercostal spaces; the others are quite below the ribs; the last one passes backwards to the posterior surface of the sacrum and traverses the sacral arcade of Howes [1].

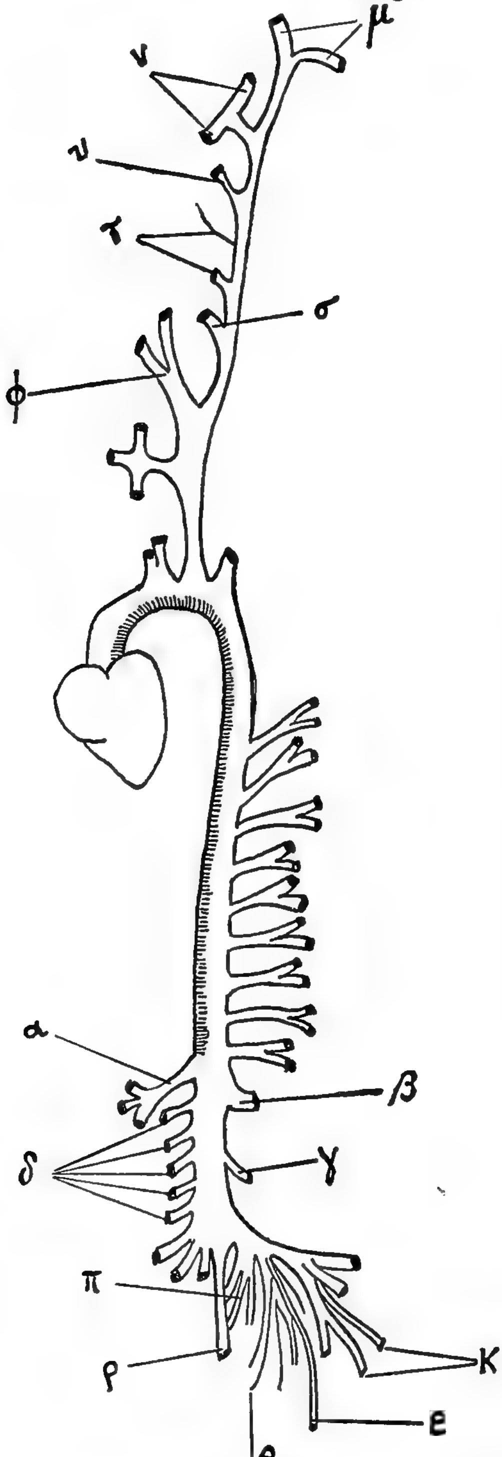
Visceral Branches.

There is a cœliac or cœlio-mesenteric axis dividing into gastro-hepatic, splenic, and superior mesenteric. They are distributed to the structures indicated by their names.

Renal arteries.—There are two short renal arteries, which are not very large. Midway between the renal and the division of the aorta is a slender spermatic artery which is extremely tortuous.

[1] 'Journal of Anatomy and Physiology,' vol. vii., n. s., 1892–93.

Fig. 7.



- *α*. Cœlio-mesenteric axis.
- *β*. Renal.
- *γ*. Spermatic.
- *δ*. Lumbar arteries.
- *ε*. Internal pudic.
- *θ*. Lateral caudal.
- *κ*. Superficial and deep branches to front of thigh.
- *π*. Branches to back of thigh and gluteal region.
- *ρ*. Central caudal.
- *σ*. Branch to supra-hyoidian region.
- *τ*. Lingual arteries.
- *υ*. Sub-mental.
- *ν*. Arteries which seem to represent internal and external pterygoid vessels. The one curving downwards going to the cheek-pouch.
- *μ*. Terminal vessel.
- *φ*. Internal carotid.

Scheme of Arteries of Trunk, Head, and Neck.

There is no separate inferior mesenteric artery, in this respect agreeing with certain Marsupials.

Arteries of Head and Neck.

The common carotid.—Is a large artery arising from arch of aorta on left side, from innominate on the right. It divides at about the level of the thyroid cartilage into external and internal carotid. Just at the point of bifurcation an artery is given off which passes directly inwards and divides in a regular cross-like manner into ascending, transverse, and descending. The ascending and descending pass to the pre-vertebral muscles; the transverse to the back of the larynx and trachea.

The external carotid.—Passes upwards and backwards; gives off a branch to the supra-hyoid and genio-hyoid muscles. More anteriorly a small lingual artery arises. There is a second smaller lingual just above this, next to submental branch which runs along the whole length of the inferior surface of the lower jaw, close to the bone. Coming off here, in addition, are two slender branches, one passing to the sub-lingual gland, the other to superficial structure, skin, &c. A little higher arises an artery which divides almost immediately into two branches, one passing to the inner surface of the lower jaw, the other to the outer surface; they may represent internal and external pterygoid arteries. The internal is fairly large and gives off several branches to the cheek-pouch. The trunk artery passing a little further on divides into two branches; one, passing to the superficial structures on the side and roof of the skull, is distributed to the deep structures in these regions.

Internal carotid.—Passes deeply at the neck and divides into two branches. The smaller passes deeply beneath pharynx and in front of the longus colli muscle to the anterior margin of foramen magnum. The other is the continuation of the trunk, passes upwards and enters the skull.

2. On some Points in the Visceral Anatomy of *Ornithorhynchus*. By Frank E. Beddard, M.A., F.R.S., Prosector to the Society.

[Received December 4, 1894.]

Mr. B. P. Lascelles, assistant master at Harrow School, was so good as to allow me to examine a frozen *Ornithorhynchus* which he had obtained for the purpose of making a skeleton for the Butler Museum at Harrow. After thawing, I found the viscera in a very fair condition for anatomical investigation, though they were naturally somewhat softened.

The first point to which I directed my attention was the epigastric vein. Some years since I described[1] in the Echidna "a large vein running along the ventral wall of the body in very close connection with it," which I identified with the Anterior Abdominal Vein of the lower Vertebrata, and regarded as a persistent Allantoic Vein, persistent nowhere else among the Mammalia.

I am not quite certain whether Prof. Gegenbaur[2] actually saw this vein himself two years later. But in any case he quotes its existence to emphasize the remoteness of the Monotremata from other Mammalia—"den Besitz einer Abdominalvene theilen sie mit Reptilien." This sentence seems to imply an agreement between *Echidna* and *Ornithorhynchus*, which is not the fact, as our principal authority upon the vascular system of the Vertebrata, Prof. Hochstetter, has quite recently pointed out[3]. In the paper referred to, the author entirely confirms my discovery of the vein in *Echidna*, without entirely pledging himself to the comparisons made by me. He examined *Ornithorhynchus* with quite negative results. If the vein in question were present in that animal and happened to be turgid with blood, it could hardly, judging from my experience of *Echidna*, be missed, even in a spirit-specimen. But if not in this favourable state, it might conceivably be passed over. The matter therefore appeared to be worth looking into again, particularly since Prof. Howes has dealt with it from a far different point of view.

Prof. Howes[4] has recently directed attention to the matter in connection with the visceral anatomy of the Australian Torpedo, *Hypnos subnigrum*. He considers that the falciform ligament of the liver in mammals is a vestige of the continuous ventral mesentery preserved in the Dipnoi and Amphibia, and remarks as follows[5]:—"Beddard has briefly described (P. Z. S. 1884, p. 553) a median epigastric vein in the adult *Echidna*. It is most desirable that the relationships of this vessel should be more fully worked out. I cannot reconcile with this the belief (Balfour, Comp. Embryology, vol. ii. p. 623) 'that the falciform ligament is not a remnant of a primitive ventral mesentery.' Beddard's discovery would appear to me fatal to this consideration, and it calls for a re-investigation of the matter."

My investigation of the fresh *Ornithorhynchus* fully bears out Prof. Howes's criticism of the late Prof. Balfour's opinion of the falciform ligament. I am also able to confirm Hochstetter's statement that the epigastric vein is wanting in *Ornithorhynchus*. The confirmation is of some little importance, as it might con-

[1] "Note on the Presence of an Anterior Abdominal Vein in *Echidna*," P. Z. S. 1884, p. 553.

[2] 'Zur Kenntniss der Mammarorgane der Monotremen.' Leipzig, 1886.

[3] "Ueber die Entwicklung der Abdominalvene bei *Salamandra maculata*," Morph. Jahrb. xxi. 1894, p. 26.

[4] "On the Visceral Anatomy of the Australian Torpedo (*Hypnos subnigrum*), with especial reference to the Suspension of the Vertebrate Alimentary Canal," P. Z. S. 1890, p. 669.

[5] *Loc. cit.* p. 673, footnote.

ceivably be a variable structure. The animal, after having been skinned, was carefully opened to the left of the middle line so as not to interfere with any structures which might be there. I found *in the middle ventral line a fold of thin membrane depending from the parietes into the body-cavity.* This fold was crumpled up, but could be readily extended and was then seen to be fully a quarter of an inch in diameter. *This fold was attached posteriorly to the bladder, and anteriorly became continuous with the falciform ligament of the liver.* This fold must, I think, be regarded as the remains of the primitive ventral mesentery. I strongly suspect, but have unfortunately an insufficient recollection of the facts to confirm my suspicions, that a similar fold exists in *Echidna.* That it should be anangious in the one case and bear a blood-vessel in the other is interesting but not unintelligible. To quote one out of many analogous instances, certain of the mesenteries supporting the cæcum in the Lemurs may or may not have blood-vessels [1].

The *Alimentary viscera* have been described by so many authors, including Home [2], Meckel [3], and Owen [4], that I can limit myself to a very few remarks. The expression "de grandeur moyenne," applied by Meckel to the stomach [5], and repeated by Sir R. Owen [6], is less applicable to the stomach which I examined than the expression used by the translators of Meckel, viz. "extrêmement petit." In Meckel's original figure, copied by Owen in the 'Comparative Anatomy,' the dimensions are too great. I found the greatest diameter of the stomach to be $1\frac{1}{2}$ inch (exactly Sir E. Home's measurement), as against 5 feet 4 inches total length of alimentary canal.

When the viscera were fully displayed by cutting and reflecting the abdominal parietes, the omentum was seen to extend right back to the pelvic region. It is attached to about the last four inches of the large intestine.

The slender cæcum is about one inch long and is about 11 inches from the cloaca. The valvulæ conniventes of the small intestine have been figured by Meckel; but as his figures are a little rough and do not quite do justice to the structures, I have thought it worth while to have the accompanying drawing prepared (fig. 1, p. 718). At about the distance of one foot from the cæcum the valvulæ conniventes come to an end. Their termination is rather more abrupt than I should have supposed from

[1] Beddard, "Additional Notes upon *Hapalemur griseus,*" P. Z. S. 1891, p. 451 *et seqq.*

[2] "A Description of the Anatomy of the *Ornithorhynchus paradoxus,*" Phil. Trans. 1802, p. 67.

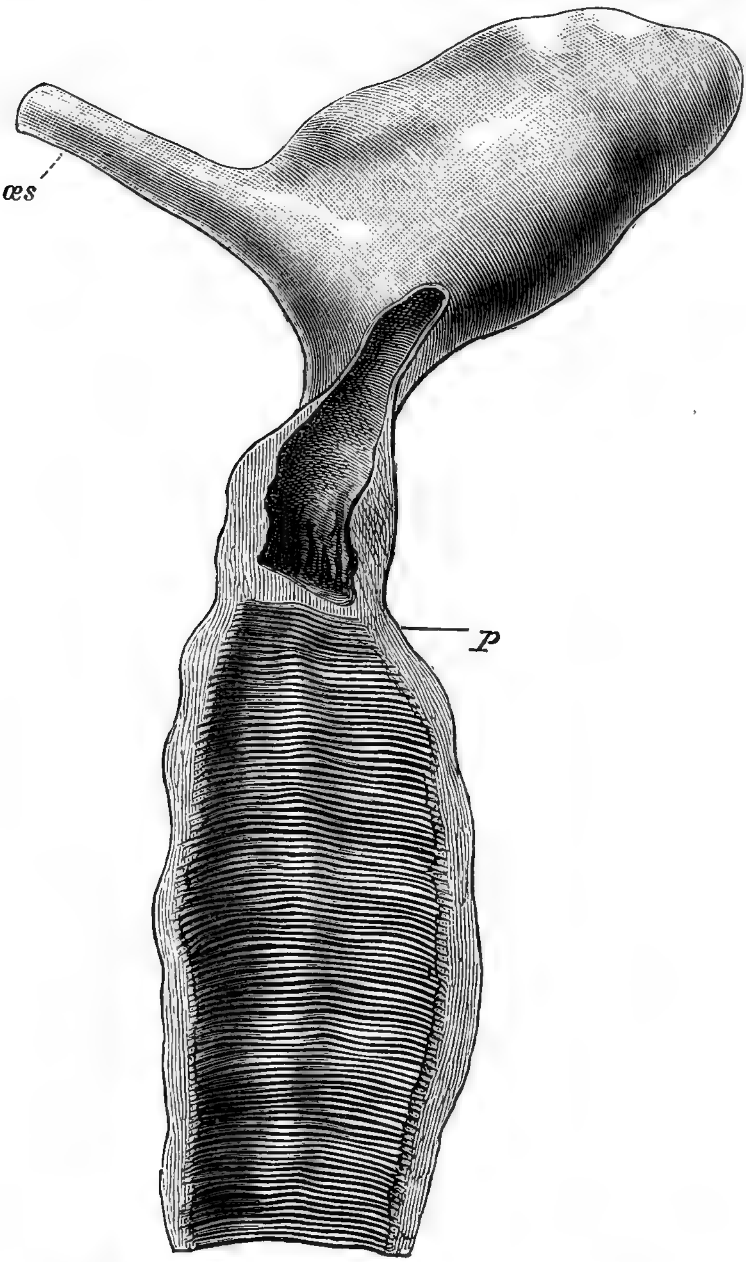
[3] *Ornithorhynchi paradoxi* descriptio anatomica.

[4] "On the Young of the *Ornithorhynchus paradoxus,* Blum.," Tr. Z. S. vol. i. p. 221

[5] 'Traité général d'Anatomie Comparée,' Trad. Fr. (Paris, 1838), vol. viii. p. 539.

[6] 'Comparative Anatomy of Vertebrates' (London, 1868), vol. iii. p. 410.

Fig. 1.



Stomach and commencement of duodenum of *Ornithorhynchus*.

œs, œsophagus. | *p*, pylorus.

reading the current descriptions of the gut. Though they are not, as Owen remarks, nearly so close together in the posterior as in the anterior part of the gut, I could detect no oblique disposition of the folds. The Peyer's patches are very slightly developed in this animal; I only found one about 2 feet from the cæcum and a second one just below the origin of the cæcum.

The spleen in the animal dissected by myself was not bifid as it has been described. It was a flat band lying diagonally across the body-cavity and looked almost exactly like a coil of intestine.

§ *Male Generative Organs.*

Meckel's figure of these organs, which is copied by Sir Richard Owen, does not appear to me to be accurate in every particular. The testis is of a loose texture and is enveloped in a tough membrane which can be readily dissected off. This is continuous with a sheet of mesentery which supports the anterior convoluted portion of the sperm-duct. It is not, however, only attached to one side and to only a portion of that, as shown in the drawing of Meckel, but is disposed as in the accompanying drawing (fig. 2, p. 720), an inspection of which will render a detailed description unnecessary. The appearances presented are chiefly due to the fact that the mesorchium is attached to the sperm-duct, not along a straight, but a curved line. This brings about the formation of a pocket which is faint comparable to a similar pocket which is usually found between the ovary and the Fallopian tube in female Mammalia. The convoluted character of the sperm-duct is well illustrated in Meckel's figure referred to. It could be readily injected with coloured fluid.

§ *The Heart.*

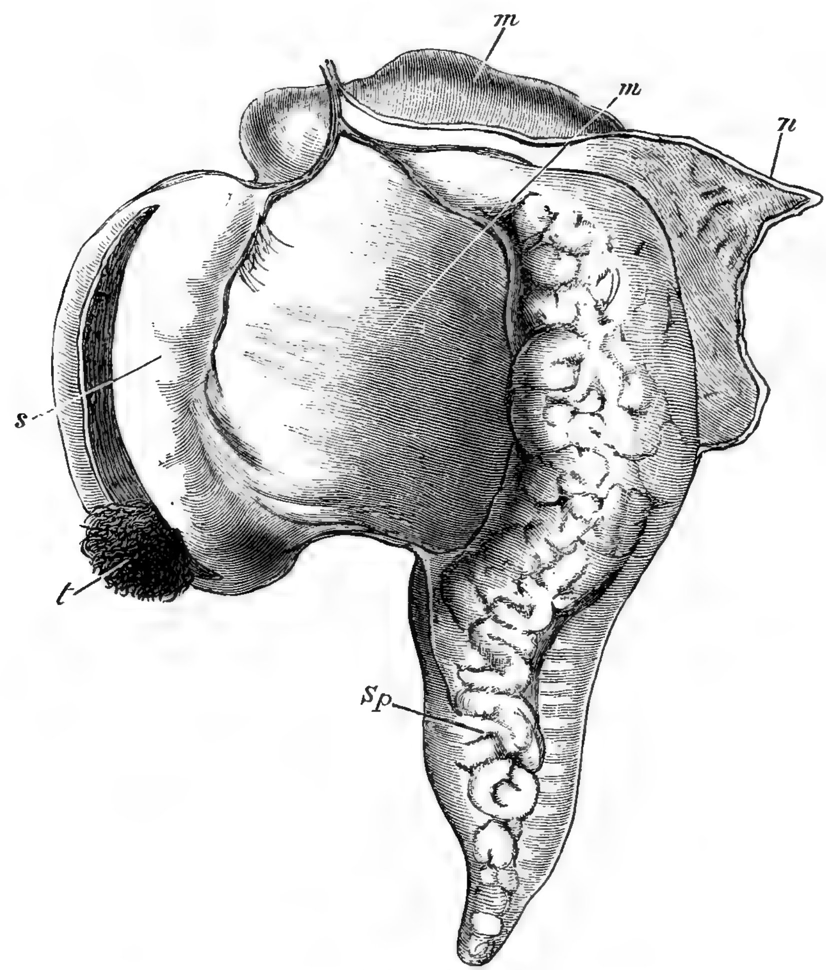
The heart of *Ornithorhynchus* has been so recently described, with a full account of the previous memoirs relating to the matter, by Prof. Lankester [1], that I need not trouble the Society with any general description. There are, however, some new facts to record concerning the right auriculo-ventricular valve (fig. 3, p. 721). I have thought it worth while to have a drawing prepared of one of the two hearts in my possession, which differ from each other to some extent. Prof. Lankester found in the hearts examined by himself that the "septal flap" of the valve in the half of the collar which borders the septal side of the ostium was either entirely wanting or but slightly represented by a small flap on the right side. This statement was contrary to that of Gegenbaur, who asserted the existence of a complete circular valve like that of other Mammalia. It appeared to Prof. Lankester that the absence or rudimentary character of the septal flap was of greater import-

[1] "On the Valves of the Heart of *Ornithorhynchus*, &c.," P. Z. S. 1882, p. 549; and "On the Right Cardiac Valve of *Echidna* and of *Ornithorhynchus*," P. Z. S. 1883, p. 8.

ance as diagnostic of the Monotreme heart than the fact of the greater muscularity of the valve.

This conclusion was obviously warranted by the facts discovered by Prof. Lankester; but the heart of *Ornithorhynchus* is more variable, apparently, as regards this valve than would be inferred

Fig. 2.

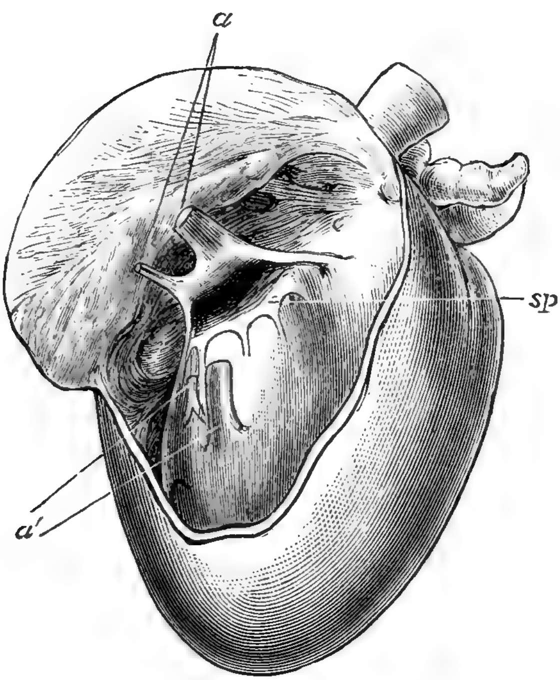


Testis and vas deferens of *Ornithorhynchus.*

t, remains of testis.
s, sac in which it is enclosed.
m, membrane attaching this sac to vas deferens (*Sp*).
n, membrane attaching sperm-duct to body-wall.

from Prof. Lankester's paper. The first of the two hearts which I dissected was, at first sight, almost exactly like that figured by Prof. Lankester in fig. 14 of plate xl. of his memoir. The muscle "*b*" was single and there was a small membranous septal flap "*bc.*" But between the apparent end of this flap and the muscle "*e*" was a slight thickening, ligamentous in texture, of the interventricular wall of the heart. I hardly noticed this until I had examined the second heart. In the latter *the septal flap of the*

Fig. 3.



Heart of *Ornithorhynchus*, with right ventricle opened.

sp, septal flap of valve. | *a*, *a'*, severed muscles of outer valve-flap.

right auriculo-ventricular valve was completely developed. It was tied down to the interventricular septum by two slight papillary muscles, which, however, did not, as in the case of the other half of the valve, at all invade the tendinous tissue of the valve. They were attached to its edge merely by the tendons. This septal half of the valve lay close to the interventricular wall, as, indeed, is generally the case among mammals; in the first of the two hearts it was so little detached from the ventricular wall as almost to suggest a case of cardiac disease rather than a normal structure. But the state of affairs in the second heart showed plainly how it was necessary to interpret the first heart. It will be noticed that my observations agree entirely with those of Gegenbaur, particularly in the case of the first heart, in which (to quote from Prof. Lankester's translation of Gegenbaur's paper) "no trabeculæ pass to its (the septal half of the valve's) free margin, and, moreover, no muscular fibres can be detected in its substance."

It is very desirable that more hearts of *Ornithorhynchus* should be examined. At present it is uncertain whether the hearts described by Prof. Lankester or those described by Prof. Gegenbaur and myself have the stronger claim to be regarded as the normal.

Postscript, added Dec. 31.—Since writing the above I have seen, through the kindness of Prof. Weldon, another specimen of *Echidna*. There was, as he pointed out to me, an epigastric vein turgid with blood, supported by a fold of membrane in parts at least an inch deep.

3. Second Report on Additions to the Lizard Collection in the Natural-History Museum[1]. By G. A. Boulenger, F.R.S.

[Received November 20, 1894.]

(Plates XLVII.–XLIX.)

I. *List of the Species, new or previously unrepresented, added to the Collection since February* 1890.

(An asterisk indicates type specimens.)

1. *Tropiocolotes tripolitanus*, Ptrs.—Tunisia (*Lataste*); Egypt (*Anderson*).
*2. *Gymnodactylus peguensis*, Blgr. Ann. Mus. Genova, (2) xiii. 1823, p. 314.—Pegu (*Fea*).
*3. *Gymnodactylus baluensis*, Mocq. Le Natur. 1890, p. 144.—Kina Baloo, N. Borneo (*Paris Mus., Everett*).
4. *Phyllodactylus androyensis*, Grand.—Madagascar.
5. *Phyllodactylus julieni*, Cope.—Curaçao (*Hartert*).
*6. *Œdura nivaria*, Blgr., *infra*.—Natal (*Lewis*).
7. *Hemidactylus greeffii*, Bocage.—S. Thomé (*Bocage*).
*8. *Bunocnemis modesta*, Gthr. P. Z. S. 1894, p. 85.—Ngatana, E. Africa (*Gregory*).
9. *Phyllopezus goyazensis*, Ptrs.—N. Paraguay (*Turin Mus.*).
*10. *Lygodactylus miops*, Gthr. Ann. N. H. (6) viii. 1891, p. 287.—Madagascar (*Majastre*).
*11. *Lygodactylus angularis*, Gthr. P. Z. S. 1892, p. 555.—Shiré Highlands (*Johnston*).
*12. *Geckolepis polylepis*, Bttgr. Kat. Senck. p. 35 (1893).—Madagascar (*Senckenb. Mus.*).
13. *Eurydactylus vieillardi*, Bavay.—New Caledonia.

[1] *Cf.* P. Z. S. 1890, p. 77.

14. *Phelsuma dubium*, Bttgr.—Madagascar (*Senckenb. Mus.*).
*15. *Elasmodactylus tuberculosus*, Blgr., *infra*.—Lower Congo (*Pinnock*).
*16. *Sphærodactylus vincenti*, Blgr. P. Z. S. 1891, p. 354.—St. Vincent, W.I. (*Godman*).
17. *Delma impar*, Fisch.—S. Australia (*Stirling*).
*18. *Draco quadrasi*, Bttgr. Katal. Senck. p. 41 (1893).—Sibuyan Island, Philippines (*Senckenb. Mus.*).
*19. *Draco walkeri*, Blgr. Ann. N. H. (6) vii. 1891, p. 279.—Timor (*Walker*).
*20. *Draco modiglianii*, Vincig. Ann. Mus. Genova, (2) xii. 1892, p. 523.—Engano (*Modigliani*).
*21. *Draco microlepis*, Blgr. P. Z. S. 1893, p. 523.—N. Borneo (*Everett*).
*22. *Draco maximus*, Blgr. P. Z. S. 1893, p. 522.—Sarawak (*Hose*).
23. *Gonyocephalus boydii*, Macleay.—Herbert R. (*Boyd*).
24. *Acanthosaura kakhienensis*, And.—S. Shan States (*Oates*); Karin hills (*Fea*).
25. *Japalura ornata*, v. Lidth de Jeude, Notes Leyd. Mus. xv. 1893, p. 251.—Kina Baloo, N. Borneo (*Everett*).
*26. *Agama gregorii*, Gthr. P. Z. S. 1894, p. 86.—Mkonumbi, E. Africa (*Gregory*).
27. *Phrynocephalus vlangalii*, Strauch.—Swan Sje (*St. Petersburg Mus.*); E. Turkestan and W. China (*Littledale*).
28. *Phrynocephalus przewalskii*, Strauch.—S. Aljarchan (*St. Petersburg Mus.*).
*29. *Phrynocephalus arabicus*, Anders. Ann. N. H. (6) xiv. 1894, p. 377.—Hadramut (*Anderson*).
30. *Amphibolurus decresii*, D. & B.—Australia (*Christiania Mus.*).
*31. *Aporoscelis bentii*, Anders. Ann. N. H. (6) xiv. 1894, p. 376.—Hadramut (*Anderson*).
*32. *Anolis wattsii*, Blgr. Ann. N. H. (6) xiv. 1894, p. 375.—Antigua, W.I. (*Watts*).
33. *Anolis limifrons*, Cope.—Nicaragua (*Rix*).
*34. *Anolis rixi*, Blgr., *infra*.—Nicaragua (*Rix*).
*35. *Anolis rhombifer*, Blgr., *infra*.—Nicaragua (*Rix*).
36. *Polychrus gutturosus*, Berth.—Nicaragua (*Rix*); Panama (*Christiania Mus.*); Ecuador (*Gunter*).
*37. *Anisolepis grilli*, Blgr. Ann. Mus. Genova, (2) x. 1891, p. 909.—Parana (*Grillo*); S. Paulo (*Ihering*).
*38. *Aptycholæmus longicauda*, Blgr. Ann. N. H. (6) viii. 1891, p. 85.—Riacho del Oro, Argentina (*Copenhagen Mus.*).
*39. *Ctenoblepharis jamesii*, Blgr. P. Z. S. 1891, p. 3.—Tarapaca, Chili (*James*).
*40. *Urocentrum guentheri*, Blgr., *infra*.—Yquitos, Peru.
*41. *Sceloporus bulleri*, Blgr., *infra*.—Jalisco, Mexico (*Buller*).
42. *Sceloporus melanorhinus*, Bocourt.—S. Domingo de Guzman, Mexico (*Buller*).

43. *Sceloporus orcutti*, Stejn. N. Am. Faun. no. 7, pt. 2, p. 181 (1893).—California (*Gilbert*).
*44. *Sceloporus heterolepis*, Blgr., *infra*.—Jalisco (*Buller*).
45. *Phrynosoma coronatum*, Blainv.[1]—California (*Christiania Mus.*).
46. *Zonurus vittifer*, Reichen. Zool. Anz. 1887, p. 372.—Zululand (*Christiania Mus.*).
*47. *Zonurus jonesii*, Blgr. Ann. N. H. (6) vii. 1891, p. 417.—Transvaal (*Jones*).
*48. *Chamæsaura miopropus*, Blgr., *infra*.—Brit. C. Africa (*Carson*).
*49. *Diploglossus bivittatus*, Blgr., *infra*.—Nicaragua (*Rothschuh*).
*50. *Ophiodes intermedius*, Blgr. Ann. N. H. (6) xiii. 1894, p. 343.—Paraguay (*Bohls*).
*51. *Varanus heteropholis*, Blgr. P. Z. S. 1892, p. 506.—Sarawak (*Hose*).
52. *Varanus togianus*, Ptrs.—Macassar (*M. Weber*).
*53. *Centropyx viridistriga*, Blgr. Ann. N. H. (6) xiii. 1894, p. 343.—Paraguay (*Bohls*).
54. *Cnemidophorus arubensis*, v. Lidth de Jeude, Notes Leyd. Mus. ix. 1887, p. 132.—Aruba (*Hartert*).
*55. *Amphisbæna bohlsii*, Blgr. Ann. N. H. (6) xiii. 1894, p. 344.—Paraguay (*Bohls*).
56. *Amphisbæna camura*, Cope.—Paraguay (*Bohls*).
57. *Amphisbæna quadrifrons*, Ptrs.—Kalahari (*Cuninghame*).
*58. *Lepidosternum latifrontale*, Blgr. Ann. N. H. (6) xiii. 1894, p. 345.—Paraguay (*Bohls*).
*59. *Tachydromus holsti*, Blgr., *infra*.—Chimabara, Japan (*Holst*).
*60. *Tachydromus formosanus*, Blgr. Ann. N. H. (6) xiv. 1894, p. 462.—Formosa (*Holst*).
61. *Lacerta simonyi*, Steind. Anz. Ak. Wien, 1889, p. 260.—Zalmor, near Hierro, Canary Islands (*Tristram*).
62. *Algiroides moreoticus*, Bibr.—Morea (*Douglass*); Cephalonia (*Werner*).
63. *Eremias sextæniata*, Stejneger, Proc. U. S. Nat. Mus. xvi. 1894, p. 718.—Lamu, E. Africa (*Jackson*).
*64. *Eremias erythrosticta*, Blgr. Ann. Mus. Genova, (2) xii. 1891, p. 10.—Somaliland (*Robecchi*).
65. *Mabuia pulchra*, Matschie, Sitzb. Ges. nat. Fr. 1893, p. 29.—S. Arabia (*Anderson*).
66. *Mabuia hildebrandtii*, Ptrs.—Somaliland (*Robecchi*).
67. *Lygosoma sanctum*, D. & B.—Java (*M. Weber*).
*68. *Lygosoma florense*, M. Weber, Zool. Ergebn. p. 173 (1890).—Flores (*M. Weber*).
69. *Lygosoma striolatum*, M. Weber, l. c. p. 172.—Damma Island (*Walker*).

[1] The specimens referred to *P. coronatum* in the Catalogue belong to a distinct species, *P. blainvillii*, Gray, as pointed out by Stejneger, N. Am. Faun. no. 7, pt. 2, p. 187 (1893), and Vanderburgh, Proc. Cal. Ac. (2) iv. 1894, p. 296.

*70. *Lygosoma amabile*, F. Müll. Verh. nat. Ges. Basel, x. 1894, p. 385.—Celebes (*Sarasin*).
*71. *Lygosoma subcæruleum*, Blgr. Ann. N. H. (6) viii. 1891, p. 289.—Travancore (*Ferguson*).
72. *Lygosoma variabile*, Bavay.—New Caledonia.
73. *Lygosoma delicatum*, De Vis, Proc. Linn. Soc. N. S. W. (2) ii. 1888, p. 820.—Queensland (*Boyd*).
74. *Lygosoma pectorale*, De Vis.—N.W. Australia (*Walker*).
*75. *Lygosoma maccooeyi*, Rams. & D. Ogilby, Rec. Austral. Mus. i. 1890, p. 8.—Brawlin, N. S. Wales (*Australian Mus.*).
*76. *Lygosoma spenceri*, Lucas, Proc. R. Soc. Vict. (2) vi. 1894, p. 81.—Victoria (*Lucas*).
77. *Lygosoma whiteheadi*, Mocq. Le Natur. 1890, p. 144.—Labuan (*Everett*).
*78. *Lygosoma luzonense*, Blgr., *infra*.—N. Luzon (*Whitehead*).
*79. *Lygosoma decipiens*, Blgr., *infra*.—N. Luzon (*Whitehead*).
80. *Lygosoma anchietæ*, Bocage.—Angola (*Bocage*).
*81. *Lygosoma relictum*, Vincig. Ann. Mus. Genova, (2) xii. 1892, p. 524.—Engano (*Modigliani*).
*82. *Lygosoma maccoyi*, Lucas, Proc. R. Soc. Vict. (2) vi. 1894, p. 85.—Victoria (*Lucas*).
*83. *Lygosoma walkeri*, Blgr. Ann. N. H. (6) viii. 1891, p. 405. —N.W. Australia (*Walker*).
*84. *Ablepharus boulengeri*, D. Ogilby, Rec. Austral. Mus. i. 1890, p. 10.—Brawlin, N. S. Wales (*Australian Mus.*).
*85. *Ablepharus carsonii*, Blgr., *infra*.—Brit. C. Africa (*Carson*).
*86. *Ablepharus festæ*, Peracca, Bull. Mus. Torin. ix. 1894, no. 167, p. 8.—Syria (*Festa*).
*87. *Tropidophorus mocquardii*, Blgr., *infra*.—N. Borneo (*Everett*).
88. *Eumeces schwartzii*, Fisch.—W. Indies (*Christiania Mus.*).
89. *Scincopus fasciatus*, Ptrs.—Suakin (*Penton, Anderson*).
90. *Ophiomorus brevipes*, Blanf.—Transcaspia (*Eylandt*).
*91. *Chalcides boulengeri*, Anders. P. Z. S. 1892, p. 17.—Tunisia (*Anderson*).
92. *Chalcides delislii*, Lataste.—Suakin (*Anderson*).
93. *Scelotes astrolabi*, D. & B.—Madagascar.
94. *Sepsina tetradactyla*, Ptrs.—Nyassaland (*Johnston*).
*95. *Chamæleon longicauda*, Gthr. Ann. N. H. (6) viii. 1891, p. 287.—Madagascar.
96. *Chamæleon tavetensis*, Steind. Sitzb. Ak. Wien, c. 1891, p. 310.—Taveta, E. Africa (*Anstruther*).
*97. *Brookesia stumpffii*, Bttgr. Zool. Anz. 1894, p. 182.—Nossi Bé (*Senckenberg Mus.*).
*98. *Rhampholeon platyceps*, Gthr. P. Z. S. 1892, p. 556.—Nyassaland (*Johnston*).
*99. *Rhampholeon brachyurus*, Gthr. l. c. p. 557.—Nyassaland (*Johnston*).

II. *Descriptions of new Species.*

ŒDURA NIVARIA. (Plate XLVII. fig. 1.)

Head moderate, much depressed, oviform; snout as long as the distance between the eye and the ear-opening, once and a half the diameter of the orbit; ear-opening small, oval, oblique. Head covered with small, round, convex granules, largest on the snout; rostral twice as broad as deep, without cleft; nostril between five scales, the upper largest and separated from its fellow by a granule; eight or nine upper and as many lower labials; mental and anterior lower labials followed by small flat shields, gradually passing into the small granules of the throat. Back covered with uniform granules, as large as those on the snout; ventral scales larger, subimbricate, smooth. Digits strongly dilated, the basal portion not quite so broad as the distal expansion; two pairs of large plates at the extremity of the basal portion, followed by smaller single plates. Male with a curved series of 15 præanal pores. Tail slightly longer than head and body, depressed, tapering to a fine point, its basal portion divided into distinct segments composed of six transverse series of scales above and five beneath. Pale brown above, mottled with darker and with undulous dark brown transverse bands; tail above with blackish transverse spots and with whitish annuli in its distal half.

	millim.		millim.
Total length......	118	Fore limb........	20
Head	15	Hind limb	25
Width of head....	13	Tail	62
Body	41		

A single male specimen, captured on the snow on the Drakensberg Range, Natal (see above, p. 608). Presented by Mr. R. T. Lewis.

ELASMODACTYLUS, g. n. Geckonidarum.

Digits strongly dilated, free, with transverse undivided lamellæ below; all digits with a minute claw fitting in a notch of the distal lamella. Body covered with unequal-sized juxtaposed tubercles. Pupil vertical.

In its digital structure this new form approaches *Rhoptropus*, Peters (= *Dactychilikion*, Thominot[1]), and to a certain extent bridges over the gap separating the latter from *Gecko*. But it is well distinguished from *Rhoptropus* by the shorter digits expanding more gradually towards the end, the incomplete palpebral ring, and the dorsal lepidosis.

[1] One of the principal characters on which *Dactychilikion* was founded, viz. the hair-like fringe of the subdigital lamellæ, is common to all Geckos and more or less easily visible when the outer layer of the epidermis has been removed. These cuticular hairs were first noticed in the Geckos by Cartier, Arb. Zool. Inst. Würzb. i. 1872, p. 86, in the Anoles by M. Braun, *op. cit.* v. 1879, p. 31.

ELASMODACTYLUS TUBERCULOSUS. (Plate XLVII. fig. 2.)

Body stout, limbs short. Head longer than broad, moderately depressed, distinct from neck; snout obtusely pointed, a little longer than the distance from the eye to the ear-opening, once and a half the diameter of the orbit; ear-opening oval-subtriangular, its greatest diameter not quite half that of the orbit. Upper surface of head covered with small granules, which are intermixed with larger ones behind; nostril pierced between the rostral and four scales; rostral once and a half as broad as deep, with median cleft above; ten upper labials; nine lower labials; mental large, posterior border rounded; no chin-shields; throat finely granulate. Body and limbs above with granules and tubercles of unequal sizes, the largest of which are subconical and concentrically striated; the vertebral line with uniform small granules; belly covered with very small, subimbricate, cycloid, smooth scales. Digits moderately elongate, not very unequal in length, depressed at the base, dilated into an elongate ovate disk in the distal half; 20 lamellæ under the median toe. Uniform dark grey-brown above, dirty white beneath.

From snout to vent	70	millim.
Head	20	"
Width of head	15	"
Fore limb	22	"
Hind limb	27	"

The only specimen, collected by the Rev. J. Pinnock in the district of the Lower Congo, is a female with the tail in an early stage of regeneration.

ANOLIS RIXI. (Plate XLVIII. fig. 1.)

Head once and two-thirds as long as broad, slightly longer than the tibia; forehead concave; frontal ridges strong, divergent; upper head-scales mostly keeled, very small on the snout; scales of the supraorbital semicircles strongly enlarged, strongly keeled, separated by one series of small scales; five or six large, strongly keeled supraoculars; occipital small, separated from the supraorbital semicircles by two series of rather large scales; canthal scales three; loreal rows nine; nine upper labials to below centre of eye; ear-opening large, vertically oval. Gular appendage moderately large; gular scales keeled. Body slightly compressed; no dorso-nuchal fold. Dorsal scales large, larger than the ventrals, irregular, and rather unequal in size, feebly imbricate, feebly keeled; flanks covered with small granular scales; ventrals subrhomboidal, scarcely imbricate, keeled. The adpressed hind limb reaches the centre of the eye; digits very feebly dilated; 14 lamellæ under phalanges II. and III. of the fourth toe. Tail slightly compressed, once and a half length of head and body. No enlarged postanal scales. Coppery brown above, with a dark brown lateral stripe proceeding from the eye; a pale stripe from the shoulder to the groin, edged below by a dark brown line; upper lip white, crossed by two oblique brown streaks on each side of the snout; limbs with brown cross-bars; lower parts white, the gular appendage greyish on the sides.

	millim.		millim.
Total length	147	Fore limb	23
Head	15	Hind limb	44
Width of head	9	Tail	88
Body	44		

A single male specimen from Chontales, Nicaragua, collected by Mr. R. A. Rix. Presented to the British Museum by Mr. W. M. Crowfoot.

Anolis rhombifer. (Plate XLVIII. fig. 2.)

Head nearly once and two-thirds as long as broad, longer than the tibia; forehead concave; frontal ridges feebly marked; upper head-scales feebly keeled; scales of the supraorbital semicircles strongly enlarged, separated by one or two series of small scales; twelve to fourteen enlarged supraoculars, separated from the supraorbital scales by a series of very small scales; occipital as large as the ear-opening, separated from the supraorbitals by three or four series of scales; canthal scales four; loreal rows seven; six upper labials to below centre of eye; ear-opening large, vertically oval. Gular appendage moderately large; gular scales keeled. Body slightly compressed; no dorso-nuchal fold. Dorsal scales small, subimbricate, strongly keeled, much smaller than ventrals; flanks covered with minute, granular scales; ventrals imbricate and strongly keeled. The adpressed hind limb reaches the centre or the anterior border of the eye; digits moderately dilated; 14 or 15 lamellæ under phalanges II. and III. of the fourth toe. Tail scarcely compressed, once and one-fourth to once and one-third length of head and body. No enlarged postanal scales. Pale greenish golden above, with two brown stripes originating on the nape above and behind the ears; between these stripes five large rhomboidal brown spots, the last between the hind limbs; a small blackish ring on the base of the tail; lower parts whitish.

	♂. millim.	♀. millim.
Total length	90	128
Head	12	15
Width of head	7·5	9
Body	28	40
Fore limb	19	24
Hind limb	34	44
Tail	50	73

Two specimens, male and female, from Chontales, Nicaragua, collected by Mr. R. A. Rix. Presented to the British Museum by Mr. W. M. Crowfoot.

Urocentrum guentheri. (Plate XLVII. fig. 3.)

Snout short, rounded; nostril directed upwards; upper head-scales with small granular asperities; a series of four or five large transverse band-like supraoculars, separated from the supraciliaries by a single series of very small scales; occipital longer than broad, narrower than the supraocular region; four or five upper and five lower labials; ear-opening as large as the eye-opening, without denticulation on its anterior border. Sides of head plicate; second gular fold strongest. Lateral and anterior dorsal scales very small, granular, smooth; posterior dorsal scales larger, smooth or very obtusely keeled; ventrals larger, squarish, feebly imbricate, smooth. Digits slender. The adpressed hind limb reaches the axilla. Tail shorter and narrower than the body, flat inferiorly, twice as broad as deep, with whorls of very large, obtusely keeled, spinose scales, the spines strongest on the sides. Head and nape bluish grey, back and limbs pale olive; head spotted with black; nape and anterior part of back with curved black cross-bands; posterior half of body with a wide-meshed black network; belly greenish white.

	millim.		millim.
Total length......	122	Fore limb........	32
Head	18	Hind limb	38
Width of head....	11	Tail	34
Body	70		

A single female specimen from Yquitos, Peru.

Sceloporus bulleri. (Plate XLVIII. fig. 3.)

Head moderate; snout much flattened. Head-shields smooth; a series of four large, transversely enlarged supraoculars, bordered inwards by one series of small scales; two canthal scales; occipital (interparietal) as long as broad or longer than broad, much larger than the parietals; four or five pointed scales form a denticulation on the anterior border of the ear. Dorsal scales much larger than ventrals, a little broader than long, keeled, mucronate and denticulate, converging towards the median line; 36 to 39 scales between the occipital shield and the base of the tail; 8 or 9 scales correspond to the length of the shielded part of the head; lateral scales graduating into the dorsals and ventrals, directed obliquely upwards and backwards; ventrals smooth, bi- or tricuspid; 41 or 44 scales round the middle of the body. The adpressed hind limb reaches the shoulder or the ear; tibia as long as the shielded part of the head; the distance between the base of the fifth toe and the extremity of the fourth equals the distance between the end of the snout and the ear. 15 to 18 femoral pores on each side. Caudal scales as large as dorsals. Male with enlarged postanal scales. Dark olive above, with a black uninterrupted collar, which may be more or less distinctly edged with yellowish or greenish; sides of belly dark blue, black-edged, in both sexes; a patch of blue may be present on the throat, the greater part of which is black or dark olive.

	♂. millim.	♀. millim.
Total length	231	194
Head	26	22
Width of head	22	18
Body	70	69
Fore limb	42	38
Hind limb	64	55
Tail	135	103 (reproduced)

This species appears to be nearest allied to *S. dugesii*, Bocourt. Several specimens were obtained in the State of Jalisco, at Colonia Brizuela and at La Cumbre de los Arrastrados, 8500 feet altitude, by Dr. A. C. Buller.

Among the Reptiles brought home by Dr. Buller from the Isthmus of Tehuantepec there are specimens which I refer to *S. melanorhinus*, Bocourt. As that species is still very imperfectly known, and as the specimens I have referred to it differ in a few points from Bocourt's diagnosis, I append the following description:—

Sceloporus melanorhinus, Bocourt, Journ. de Zool. v. 1876, p. 401.

Head large; snout much flattened. Head-shields smooth; a series of four large transverse supraoculars, separated from the frontal and from the supraciliaries by one series of small scales, the fourth in contact with the parietal; occipital (interparietal) a little broader than long, as broad as or broader than the parietals, which are large and broader than long; ear-opening nearly hidden under the large pointed scales in front of it. Dorsal scales much larger than ventrals, as broad as long, strongly keeled and mucronate, entire or feebly denticulate, forming parallel longitudinal series; 26 or 27 scales between the occipital scale and the base of the tail; 6 or 7 scales correspond to the length of the shielded part of the head; lateral scales keeled, directed upwards and backwards, graduating into the dorsals and ventrals; latter smooth, bicuspid; 36 to 40 scales round the middle of the body. The adpressed hind limb reaches the shoulder or the ear; tibia a little shorter than the shielded part of the head; the distance between the base of the fifth toe and the extremity of the fourth equals the distance between the end of the snout or the nostril and the ear. 19 or 20 femoral pores on each side. Caudal scales nearly as large as dorsals. Male with enlarged postanal scales. Yellowish or greyish olive above; a yellowish, black-edged cross-bar between the eyes; a yellowish band from behind the eye to above the axilla, between which a blackish blotch or bar extends across the scapular region; some less distinct dark cross-bars may follow on the back; male with the lower surface of the head black and white in front, pale blue behind, yellowish green on the sides; the breast and median line of belly salmon-red; the belly pale blue near the median line, yellowish green on the sides.

	♂. millim.	♀. millim.
Total length	208	193
Head	25	28
Width of head	22	28
Body	73	77
Fore limb	43	46
Hind limb	57	63
Tail	110	95

Three specimens (male, female, and half-grown) obtained at Santo Domingo de Guzman, Mexico, by Dr. A. C. Buller.

SCELOPORUS HETEROLEPIS. (Plate XLVIII. fig. 4.)

Head small. Head-shields smooth; one or two more or less irregular series of transversely enlarged supraoculars; two canthal scales; occipital large, as long as broad or broader than long; parietals small, sometimes indistinct; anterior border of ear with a denticulation formed by three or four pointed scales. Dorsal scales very unequal in size, irregular, some nearly smooth, others strongly keeled; a pair of vertebral and a latero-dorsal series of large strongly keeled scales form sorts of crests along the body; ventral scales smooth, mostly bicuspid. The adpressed hind limb reaches the shoulder or the ear; tibia as long as the shielded part of the head; the distance between the base of the fifth toe and the extremity of the fourth exceeds the distance between the end of the snout and the posterior border of the ear. 14 to 19 femoral pores on each side. Caudal scales as large as largest dorsals, strongly keeled, spinose. Male with strongly enlarged postanal scales. Coloration very much as in *S. microlepis*. Greyish or pale brown above, with indistinct darker and lighter blotches and symmetrical blackish markings in the form of transverse or angular lines, the first of which crosses the frontal and supraocular regions; male with a black bar (sometimes interrupted) across the throat and with a large pale blue blotch on each side of the belly, broadly edged with blackish blue on the median ventral line.

	♂. millim.	♀. millim.
Total length	135	125
Head	16	14
Width of head	14	12
Body	44	46
Fore limb	29	26
Hind limb	39	37
Tail	75	65

Several specimens were collected by Dr. A. C. Buller at various localities in the State of Jalisco (La Cumbre de los Arrastrados, Real Alto, Riocho La Berberia, Sierra de Bolaños), at altitudes varying between 7800 and 8500 feet.

CHAMÆSAURA MIOPROPUS.

Fore limb reduced to a minute clawed vestige, no longer than a scale; hind limb much more developed, nearly half as long as the head, ending in a single claw, as in *C. anguina*. One femoral pore. Head-shields and scaling of the body as in *C. anguina*. Yellowish, with four pale brown stripes, the median pair edged with black on the outer side.

	millim.
Total length	550
Head	15
Tail	430
Fore limb	1
Hind limb	7

A single specimen from Fwambo, British Central Africa. Collected by Mr. A. Carson.

In the first Report I described a species (*C. didactyla*) intermediate between *C. ænea* and *C. anguina*. The one now established fills up the gap between *C. anguina* and *C. macrolepis*.

The five species of *Chamæsaura* may be distinguished as follows:—

A. Both pairs of limbs very distinct.

Limbs pentadactyle; 28 scales round the body	1. *ænea*, Wgm.
Limbs didactyle; 26 scales round the body	2. *didactyla*, Blgr.
Limbs monodactyle; 26 scales round the body	3. *anguina*, L.

B. Fore limb very minute or absent; hind limb monodactyle.

Fore limb distinct; 26 scales round the body	4. *miopropus*, Blgr.
No trace of fore limb externally; 22 scales round the body	5. *macrolepis*, Cope.

DIPLOGLOSSUS BIVITTATUS. (Plate XLVIII. fig. 5.)

Head slightly distinct from neck; snout moderate, with obtuse canthus; ear-opening small. A large azygous præfrontal, in contact with the frontal and the first and second supraoculars, in contact with the second loreal, and separated from the rostral by two pairs of shields; frontal twice as long as broad; parietal separated from the frontal and supraoculars by two shields; nasal in contact with the rostral, followed by two superposed postnasals, two loreals, and a præocular; rostral a little narrower than the symphysial; the suture between the sixth and seventh upper labials falls below the centre of the eye; three chin-shields on each side, first in contact with the second and third lower labials. Scales smooth, 33 round the middle of the body. Limbs short, not meeting when adpressed; digits moderate, claws exposed. Tail cylindrical, covered with smooth scales. Black above, with two greenish-white stripes from the end of the snout, where they unite, to the base of the tail, passing above the eye; lips and sides of neck whitish with black bars; throat whitish; belly greyish; tail salmon-pink.

	millim.		millim.
Total length	75	Fore limb	8
Head	9	Hind limb	10
Width of head	5	Tail	43
Body	23		

A single young specimen from the Hacienda Rosa de Jericho, Nicaragua, 3250 feet; collected by Dr. E. Rothschuh.

Tachydromus holsti. (Plate XLIX. fig. 1.)

Head rather short. Rostral forming a suture with the frontonasal, entirely separating the nasals; supraoculars in contact with the supraciliaries; a small shield separates the large anterior supraocular from the loreal; temporal scales very small, obtusely keeled; three or four chin-shields on each side[1]. Six longitudinal series of strongly keeled dorsal shields, the two median smaller; eight longitudinal series of keeled ventral shields; three series of smaller keeled shields on each side of the ventrals. Two inguinal pores on each side. Olive above, greenish white beneath; a white streak from the eye to the shoulder, passing through the tympanum.

	millim.		millim.
Total length	113	Fore limb	16
Head	10	Hind limb	22
Width of head	7	Tail (reproduced)	58
Body	45		

Two specimens, from the Osen Mt., Shimabara, Japan; collected by Mr. Holst.

Lygosoma luzonense. (Plate XLIX. fig. 2.)

Section *Hinulia*. Body elongate; limbs weak; the distance between the end of the snout and the fore limb is contained once and a half in the distance between axilla and groin. Snout short, obtusely pointed. Lower eyelid scaly. Nostril pierced in the nasal; no supranasal; frontonasal broader than long, forming a suture with the rostral; præfrontals in contact; frontal not quite so long as the frontoparietal, which is single, in contact with the first and second supraoculars; four supraoculars, first largest; seven supraciliaries; parietals forming a suture behind the interparietal; no enlarged nuchals; fourth to sixth upper labials below the eye. Ear-opening round, small, not larger than the pupil. 28 smooth scales round the middle of the body; dorsals as large as ventrals, laterals smaller. A pair of feebly enlarged præanals. The length of the hind limb equals the distance between the posterior border of the eye and the fore limb; fourth toe a little longer than third. Tail thick, once and one-fourth the length of

[1] The adult has three chin-shields on the right side and four on the left; the young has four shields on each side.

head and body. Pale reddish brown above, with small darker spots, a slightly undulous blackish line on each side, and a series of blackish spots forming an interrupted vertebral line; sides dark brown, with light dots; lower parts whitish.

	millim.		millim.
Total length........	88	Fore limb......	8
Head	8	Hind limb	10
Width of head	4·5	Tail	50
Body	30		

A single specimen from Mt. Benguet, N. Luzon, collected by Mr. Whitehead. Presented by the Subscribers to the Whitehead Exploration Fund.

LYGOSOMA DECIPIENS. (Plate XLIX. fig. 3.)

This small Scink so much resembles the preceding in coloration and in the scaling of the head that one would at first be inclined to refer it to the same species. It differs, however, in several important characters. The ear-opening is much larger and oval, nearly two-thirds the size of the eye-opening. The rostral forms a much broader suture with the frontonasal; the frontal is slightly longer than the frontoparietal. The body is shorter, the distance between the end of the snout and the fore limb once and one-fourth to once and one-third in the distance between axilla and groin. The length of the hind limb equals the distance between the nostril and the fore limb. There are 36 scales round the middle of the body. The tail tapers gradually from the base. As stated above, the coloration is much the same as in *L. luzonense*; there are, however, no other dark spots on the back but those forming the interrupted vertebral line; a well-defined dark brown streak, continued as a dorso-lateral line, extends along each side of the head and neck, passing through the eye, and the temple and neck below it are white.

	millim.		millim.
Total length......	80	Fore limb........	10
Head	9	Hind limb	12
Width of head....	5	Tail	45
Body	26		

Both this species and the preceding connect the sections *Hinulia* and *Homolepida*, but should be referred to the former, as defined by me[1].

Two specimens were obtained by Mr. Whitehead on Isabella, N.E. Luzon.

[1] Through an oversight, the section *Hinulia* is stated in my Catalogue to be characterized by distinct frontoparietals; *L. acutum* forms an exception in having these shields fused.

Ablepharus carsonii. (Plate XLIX. fig. 4.)

Snout very short, obtuse. Eye entirely surrounded by a circle of granules. Rostral forming an extensive suture with the frontonasal, which is in contact with the frontal; no supranasal; frontal small, hardly one third the size of the single shield formed through fusion of the frontoparietals and interparietal; three supraoculars, first largest and in contact with the frontal; five or six supraciliaries; a pair of nuchals; four upper labials anterior to the subocular. Ear-opening roundish, as large as the pupil. 26 scales round the middle of the body, laterals a little smaller than dorsals or ventrals. Præanals scarcely enlarged. Limbs pentadactyle, narrowly separated when adpressed. Bronzy brown above, greenish white beneath; a black vertebral line; a black line edged above with yellow, on each side, from the end of the snout to the base of the tail.

	millim.		millim.
Total length......	80	Fore limb	8
Head	6	Hind limb	10
Width of head....	4·5	Tail	46
Body	28		

A single specimen from Fwambo, British Central Africa. Collected by Mr. A. Carson.

Tropidophorus mocquardii.

This species, specimens of which have been referred to *T. beccarii* by Dr. Mocquard in his paper on the reptiles of Kina Baloo (N. Arch. Mus. [3] ii. 1890, p. 135), agrees with *T. beccarii* in its smooth scales, with *T. brookii* in its smaller postmental, behind which two pairs of shields are in contact, and in its larger head, which is more swollen at the temples; it differs from both in the greater number of scales round the body, viz. 34. The coloration is the same as in *T. brookii*. From snout to vent 95 millim.

Two specimens, male and female, from Kina Baloo, N. Borneo, received from Mr. A. Everett.

The female contains four fully developed young, measuring 30 millim. from snout to vent.

EXPLANATION OF THE PLATES.

Plate XLVII.

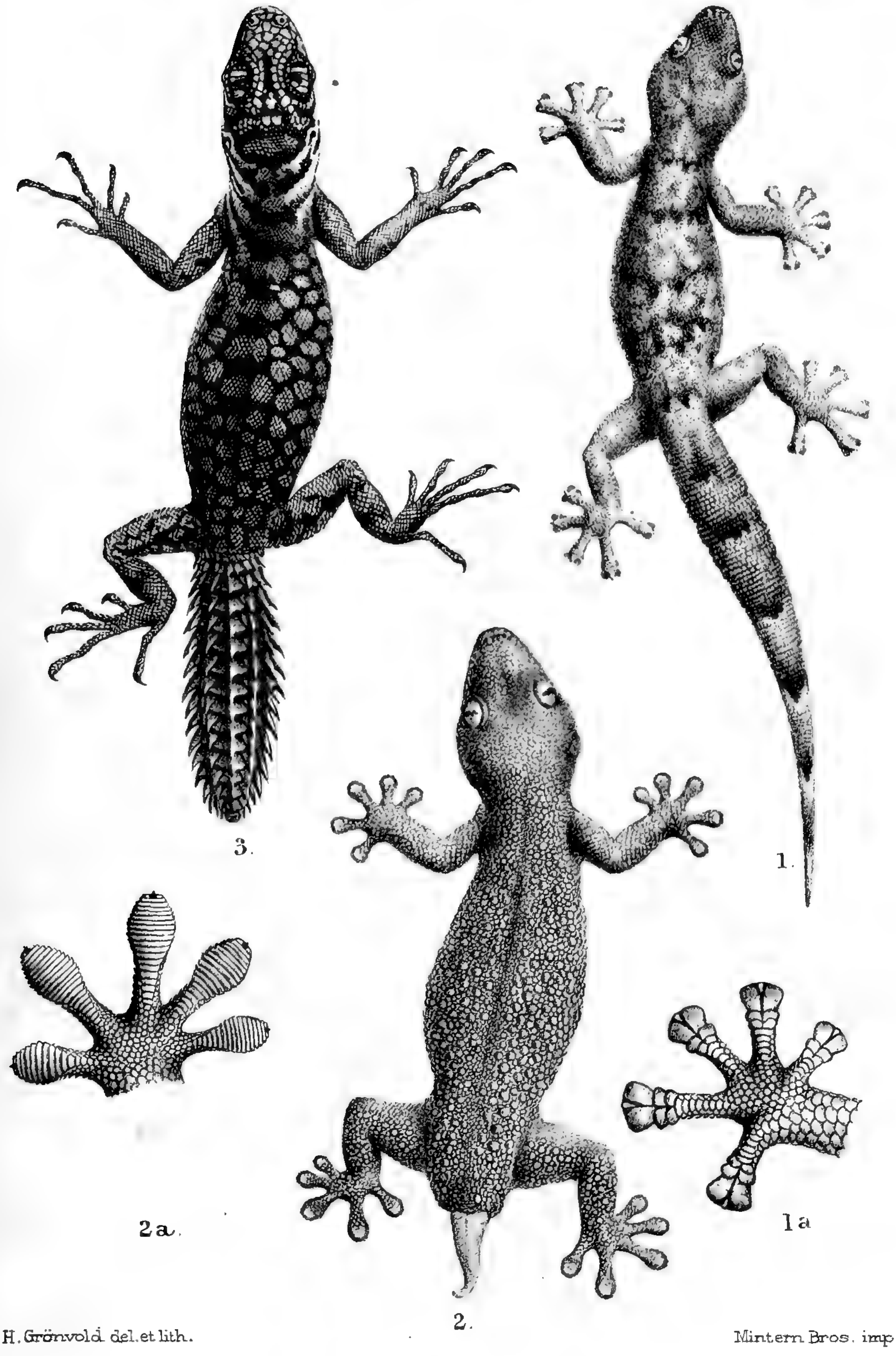
Fig. 1. *Œdura nivaria*, Blgr., p. 726.
1 *a*. „ „ Lower surface of foot, × 2.
2. *Elasmodactylus tuberculosus*, Blgr., p. 727.
2 *a*. „ „ Lower surface of foot, × 2.
3. *Urocentrum guentheri*, Blgr., p. 729.

PLATE XLVIII.

Fig. 1. *Anolis rixi*, Blgr., p. 727. Upper surface of head, × 2½.
2. *Anolis rhombifer*, Blgr., p. 728. Upper surface of head, × 2½.
3. *Sceloporus bulleri*, Blgr., p. 729. Head and anterior part of body.
4. *Sceloporus heterolepis*, Blgr., p. 731.
5. *Diploglossus bivittatus*, Blgr., p. 732.
5 *a*. ,, ,, Upper surface of head, × 2½.

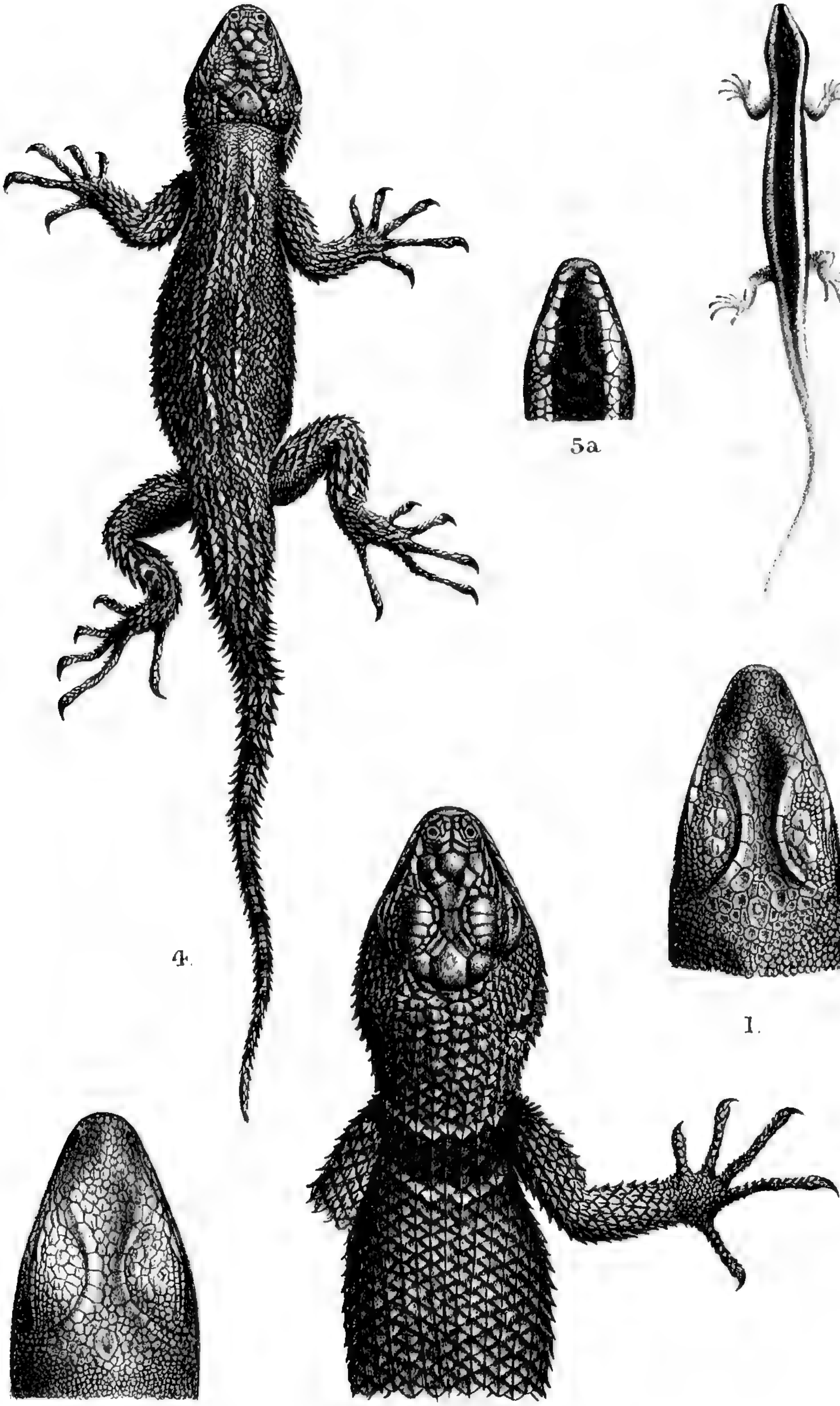
PLATE XLIX.

Fig. 1. *Tachydromus holsti*, Blgr., p. 733.
1 *a*. ,, ,, Upper surface of head, × 3.
1 *b*. ,, ,, Lower surface of head, × 3.
2. *Lygosoma luzonense*, Blgr., p. 733.
2 *a*. ,, ,, Upper surface of head, × 3.
3. *Lygosoma decipiens*, Blgr., p. 734.
3 *a*. ,, ,, Upper surface of head, × 3.
4. *Ablepharus carsonii*, Blgr., p. 735.
4 *a*. ,, ,, Upper surface of head, × 3.



H. Grönvold del. et lith. Mintern Bros. imp.

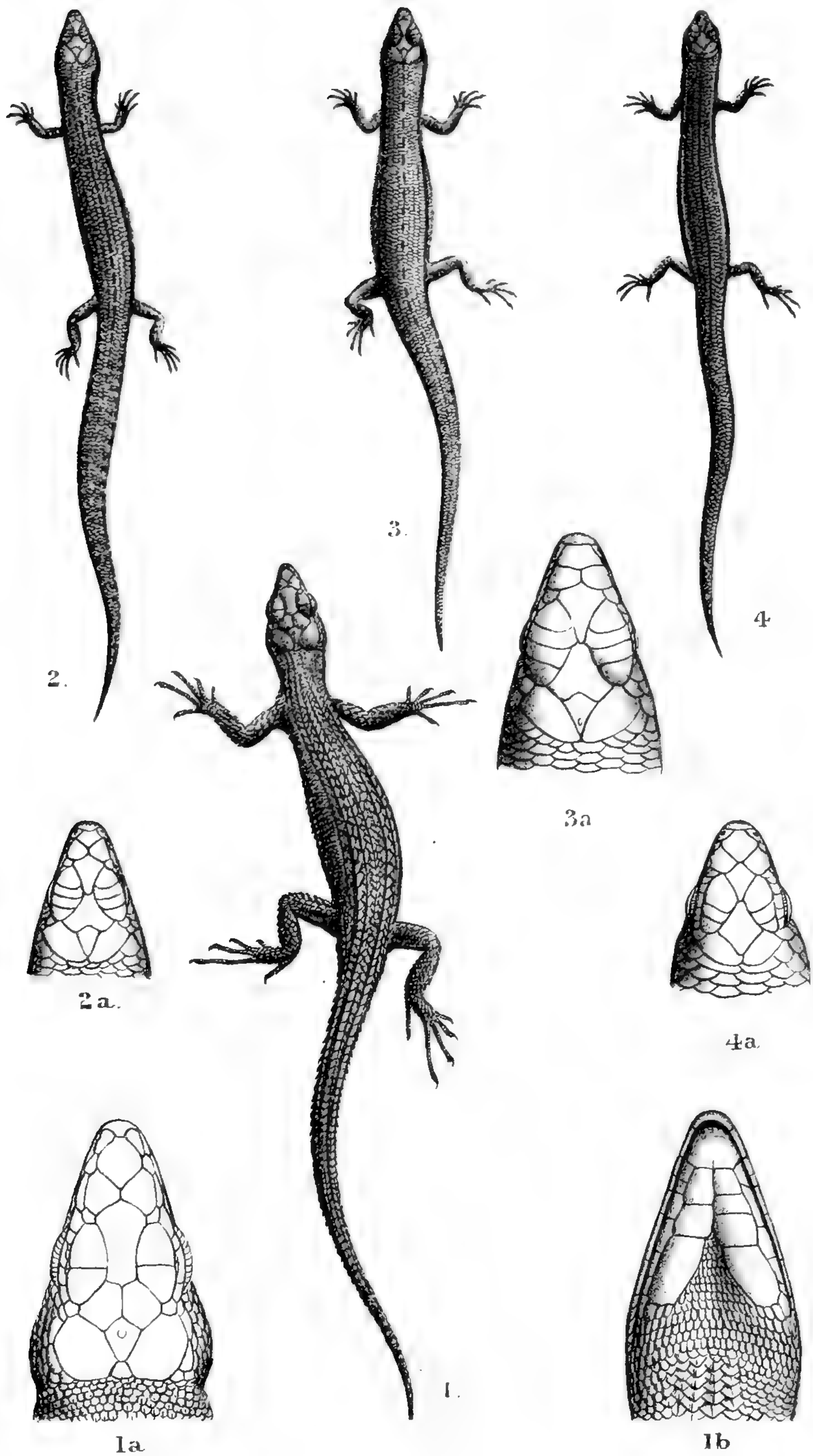
1. ŒDURA NIVARIA. 2. ELASMODACTYLUS TUBERCULOSUS
3. UROCENTRUM GUENTHERI.



H. Grönvold del. et lith.

Mintern Bros. imp.

1. ANOLIS RIXI. 2. ANOLIS RHOMBIFER. 3. SCELOPORUS BULLERI.
4. SCELOPORUS HETEROLEPIS. 5. DIPLOGLOSSUS BIVITTATUS.



H. Grönvold del. et lith.

Mintern Bros. imp.

1. TACHYDROMUS HOLSTI. 2. LYGOSOMA LUZONENSE.
3. LYGOSOMA DECIPIENS. 4. ABLEPHARUS CARSONII.

APPENDIX.

LIST OF ADDITIONS TO THE SOCIETY'S MENAGERIE

DURING THE YEAR

1894.

Jan. 1. 2 Purple-capped Lories (*Lorius domicella*). Purchased.
1 Long-billed Butcher-bird (*Barita destructor*). Deposited.
2. 1 Coot (*Fulica atra*). Presented by Mrs. L. Spender.
3. 1 Black-handed Spider-Monkey (*Ateles ater*), ♀. Presented by Mr. L. Clarke.
2 Wedge-tailed Eagles (*Aquila audax*). Presented by F. W. Burgess, Esq.
1 Diademed Amazon (*Chrysotis diademata*). Purchased.
7. 1 Yak (*Poëphagus grunniens*). Born in the Menagerie.
8. 1 Snow-Leopard (*Felis uncia*), ♂. From Lahoul, Punjab, Himalayas. Purchased. See P. Z. S. 1894, p. 92.
2 Common Marmosets (*Hapale jacchus*). Presented by Mrs. Brightwen.
1 Common Hamster (*Cricetus frumentarius*). Presented by Mrs. Brightwen.
1 Alpine Marmot (*Arctomys marmotta*). Purchased.
9. 2 Hairy Armadillos (*Dasypus villosus*). Purchased.
1 Black-necked Swan (*Cygnus nigricollis*). Purchased.
2 Rufous Tinamous (*Rhynchotus rufescens*). Purchased.
4 Brazilian Caracaras (*Polyborus brasiliensis*). Purchased.
2 Common Teguexins (*Tupinambis teguexin*). Purchased.
1 Common Boa (*Boa constrictor*). Purchased.
10. 1 Mozambique Monkey (*Cercopithecus pygerythrus*), ♂. From Beira, E. Africa. Presented by H. P. East, Esq.
2 Lapwings (*Vanellus vulgaris*). Received in Exchange.
2 Dunlins (*Tringa alpina*). Received in Exchange.
11. 2 Jackdaws (*Corvus monedula*). Presented by Miss Williams.
1 Melodious Jay-Thrush (*Leucodioptron canorum*). Purchased.
1 Malaccan Parrakeet (*Palæornis longicauda*), ♂. Deposited.
12. 1 Mozambique Monkey (*Cercopithecus pygerythrus*), ♂. From Mauritius. Presented by Mrs. Adams.
13. 1 Clifford's Snake (*Zamenis cliffordi*). From Egypt. Presented by W. L. Tod, Esq.
15. 1 Himalayan Monkey (*Macacus assamensis*), ♀. From Sikhim. Presented by Capt. Edmund A. Grubbe.

Jan. 16. 1 Bonnet-Monkey (*Macacus sinicus*), ♀. Presented by the Rev. Thos. Rickards.
17. 2 Japanese Pheasants (*Phasianus versicolor*), ♂ ♀. Presented by W. Rudge Rootes, Esq., F.Z.S.
2 Gigantic Salamanders (*Megalobatrachus maximus*). Deposited.
18. 1 Cuvier's Podargus (*Podargus cuvieri*). Purchased.
20. 3 Gigantic Salamanders (*Megalobatrachus maximus*). Deposited.
2 Spanish Terrapins (*Clemmys leprosa*). From Mellila, N. Africa. Presented by Bennet Burleigh, Esq.
21. 1 Dwarf Chameleon (*Chamæleon pumilus*). Presented by E. Wingate, Esq.
22. 4 Fishes (*Nemachilus*, sp. inc.). From China. Presented by A. Herbert Allen, Esq., M.D.
23. 1 Ring-tailed Coati (*Nasua rufa*). Deposited.
1 Crossbill (*Loxia curvirostra*), ♂. Presented by Mr. W. S. Berridge.
8 Undulated Grass-Parrakeets (*Melopsittacus undulatus*), 4 ♂, 4 ♀. Purchased.
24. 2 Abyssinian Guinea-fowls (*Numida ptilorhyncha*). From Somaliland. Purchased.
2 Burrowing Owls (*Speotyto cunicularia*). Purchased.
25. 1 Rose-ringed Parrakeet (*Palæornis docilis*), ♀. Presented by J. Hickman, Esq.
2 Black-eared Marmosets (*Hapale penicillata*). Presented by Mrs. G. E. Russell.
26. 1 King Snake (*Coluber getulus*). From Florida. Presented by Lawson Reuss, Esq.
27. 2 Weka Rails (*Ocydromus australis*). Presented by the Hon. Lancelot Lowther.
29. 1 Hog-Deer (*Cervus porcinus*), ♀. Born in the Menagerie.
31. 1 Waxwing (*Ampelis garrulus*). Purchased.
2 Long-tailed Titmice (*Parus caudatus*). Purchased.

Feb. 2. 2 Eyed Lizards (*Lacerta ocellata*). Presented by T. Keen, Esq.
20 European Tree-Frogs (*Hyla arborea*). Presented by T. Keen, Esq.
3. 1 Chilian Conure (*Conurus smaragdinus*). Presented by Mrs. Gibney.
1 Madagascar Porphyrio (*Porphyrio madagascariensis*). Purchased.
2 Swainson's Lorikeets (*Trichoglossus novæ-hollandiæ*). Presented by John Biehl, Esq.
5. 1 Green-winged Trumpeter (*Psophia viridis*). Deposited.
6. 1 Bonnet-Monkey (*Macacus sinicus*), ♀. Presented by Col. J. T. North.
1 Red-eared Bulbul (*Pycnonotus jocosus*). Presented by C. S. Simpson, Esq., L.R.C.P.
1 Yellow-bellied Liothrix (*Liothrix luteus*). Presented by C. S. Simpson, Esq., L.R.C.P.
3 Indian Silver-bills (*Munia malabarica*) (vars.). Presented by C. S. Simpson, Esq., L.R.C.P.
1 Chestnut-breasted Finch (*Donacola castaneothorax*), ♂. Presented by C. S. Simpson, Esq., L.R.C.P.
2 Java Sparrows (*Padda oryzivora*) (vars.). Presented by C. S. Simpson, Esq., L.R.C.P.

Feb. 6. 1 Crimson-crowned Weaver-bird (*Euplectes flammiceps*), ♂. Presented by C. S. Simpson, Esq., L.R.C.P.

2 Russ's Weaver-birds (*Quelea russi*), ♂ ♀. Presented by C. S. Simpson, Esq., L.R.C.P.

2 Saffron Finches (*Sycalis flaveolus*). Presented by C. S. Simpson, Esq., L.R.C.P.

1 Grey-necked Serin Finch (*Serinus canicollis*). Presented by C. S. Simpson, Esq., L.R.C.P.

7. 1 Macaque Monkey (*Macacus cynomolgus*), ♀. Presented by F. Reynolds, Esq.

8. 1 Moustache Monkey (*Cercopithecus cephus*), ♀. Deposited.

9. 1 Pinche Monkey (*Midas œdipus*). Presented by Miss M. A. Farmer.

1 Bonnet-Monkey (*Macacus sinicus*), ♀. Presented by Mrs. Hewett.

1 Chaffinch (*Fringilla cœlebs*)). Presented by L. V. Druce, Esq.

1 Brambling (*Fringilla montifringilla*). Presented by L. V. Druce, Esq.

1 Greenfinch (*Ligurinus chloris*). Presented by L. V. Druce, Esq.

3 Lesser Redpolls (*Linota rufescens*). Presented by L. V. Druce, Esq.

1 Linnet (*Linota cannabina*). Presented by L. V. Druce, Esq.

1 Hedge-Sparrow (*Accentor modularis*). Presented by L. V. Druce, Esq.

10. 1 Banded Ichneumon (*Herpestes fasciatus*), ♂. Presented by Capt. W. H. Besant.

2 Vulturine Guinea-fowls (*Numida vulturina*). Presented by Capt. W. H. Besant.

4 Red-bellied Waxbills (*Estrelda rufiventris*). Deposited.

2 Madagascar Weaver-birds (*Foudia madagascariensis*). Deposited.

2 Alario Sparrows (*Passer alario*). Deposited.

13. 1 Viverrine Phalanger (*Phalangista viverrina*), ♂. Presented by Mrs. Percy Morton.

14. 1 Macaque Monkey (*Macacus cynomolgus*), ♂. Presented by Mr. James Carter.

1 Goshawk (*Astur palumbarius*) ♀. Presented by Duncan Parker, Esq.

15. 1 Jackdaw (*Corvus monedula*). Presented by Mrs. Dixon-Brown.

16. 2 Garden Dormice (*Myoxus quercinus*). Presented by Dr. R. B. Sharpe, F.Z.S.

17. 2 Striped Hyænas (*Hyæna striata*). Purchased.

1 Reichenow's Guinea-fowl (*Numida reichenowi*). Purchased.

1 Vulpine Phalanger (*Phalangista vulpina*), ♀. Presented by Mr. W. Hughes.

20. 1 Hairy Porcupine (*Sphingurus villosus*). Deposited.

21. 1 Hooded Crow (*Corvus cornix*). Presented by Mrs. Wroughton.

24. 2 Mozambique Monkeys (*Cercopithecus pygerythrus*), ♂ ♀. Presented by Lieut.-Gen. Owen L. C. Williams, F.Z.S.

1 Puff-Adder (*Vipera arietans*). Presented by J. E. Matcham, Esq.

1 Hoary Snake (*Coronella cana*). Presented by J. E. Matcham, Esq.

27. 2 Ceylonese Hanging-Parrakeets (*Loriculus asiaticus*). Purchased.

Mar. 1. 1 Bar-tailed Godwit (*Limosa lapponica*). Purchased.
1 Grey Plover (*Squatarola helvetica*). Purchased.
1 Dunlin (*Tringa alpina*). Purchased.
2. 1 Eland (*Oreas canna*), ♀. Born in the Menagerie.
1 Kite (*Milvus ictinus*). Presented by the Crystal Palace Company.
1 Common Kestrel (*Tinnunculus alaudarius*). Presented by the Crystal Palace Company.
1 Golden Eagle (*Aquila chrysaëtus*). Presented by the Crystal Palace Company.
1 Great Eagle-Owl (*Bubo maximus*). Presented by the Crystal Palace Company.
1 Spotted Eagle-Owl (*Bubo maculatus*). Presented by the Crystal Palace Company.
1 Barn-Owl (*Strix flammea*). Presented by the Crystal Palace Company.
1 Tawny Owl (*Syrnium aluco*). Presented by the Crystal Palace Company.
2 Levaillant's Francolins (*Francolinus levaillanti*). Presented by J. E. Matcham, Esq.
2 Barn-Owls (*Strix flammea*). Presented by J. E. Matcham, Esq.
5. 1 Diana Monkey (*Cercopithecus diana ignitus*), ♀. Deposited.
6. 1 Bluethroat (*Cyanecula suecica*). Purchased.
3 Alpine Accentors (*Accentor collaris*). Purchased.
8. 1 Wild Cat (*Felis catus*), ♂. From Inverness-shire. Presented by Mrs. Ellice.
11. 1 Solitary Thrush (*Monticola cyanus*). Presented by J. Young, Esq., F.Z.S.
14. 2 Collared Peccaries (*Dicotyles tajaçu*), 2 ♀. Presented by H.E. Sir Alfred Moloney, K.C.M.G.
1 Globose Curassow (*Crax globicera*), ♂. Presented by H.E. Sir Alfred Moloney, K.C.M.G.
2 Cape Bucephalus (*Bucephalus capensis*). Presented by J. E. Matcham, Esq.
1 Cape Viper (*Causus rhombeatus*). Presented by J. E. Matcham, Esq.
2 Crossed Snakes (*Psammophis crucifer*). Presented by Messrs. H. M. & C. Beddington.
1 Smooth-bellied Snake (*Homalosoma lutrix*). Presented by Messrs. H. M. & C. Beddington.
1 Rhomb-marked Snake (*Psammophylax rhombeatus*). Presented by Messrs. H. M. & C. Beddington.
1 Crossed Snake (*Psammophis crucifer*). Deposited.
1 Hoary Snake (*Coronella cana*). Deposited.
1 Puff-Adder (*Vipera arietans*). Presented by Messrs. H. M. & C. Beddington.
15. 1 Diana Monkey (*Cercopithecus diana*), ♀. Presented by Miss L. D. Summerbell.
2 Redshanks (*Totanus calidris*). Purchased.
17. 1 Wild Cat (*Felis catus*), ♀. From Inverness-shire. Presented by Mrs. Ellice.
19. 1 Coypu (*Myopotamus coypus*). Born in the Menagerie.
2 Cockateels (*Calopsitta novæ-hollandiæ*), 2 ♂. Presented by Mrs. Tidey.
20. 1 White-bellied Sea-Eagle (*Haliaëtus leucogaster*). Presented by Mrs. Scales.

Mar. 20. 1 Leadbeater's Cockatoo (*Cacatua leadbeateri*). Presented by J. Ward, Esq.
2 Alpine Accentors (*Accentor collaris*). Purchased.
21. 2 Black Apes (*Cynopithecus niger*), 2 ♂. Deposited.
1 Vervet Monkey (*Cercopithecus lalandii*). Presented by Mrs. White.
1 Ring-necked Parrakeet (*Palæornis torquatus*), ♀. Presented by Miss Castle.
22. 2 Peregrine Falcons (*Falco peregrinus*). Presented by Penn C. Sherbrooke, Esq.
1 Great Eagle-Owl (*Bubo maximus*). Presented by H. Godman, Esq.
24. 1 Greater Sulphur-crested Cockatoo (*Cacatua galerita*). Deposited.
26. 2 Syrian Bears (*Ursus syriacus*). Presented by Arnold Pike, Esq.
27. 1 Striped Hyæna (*Hyæna striata*). Presented by Señor Don D. M. Macleod.
1 American Turkey (*Meleagris gallo-pavo*), ♂. Presented by A. Blayney Percival, Esq.
28. 1 Kinkajou (*Cercoleptes caudivolvulus*). Presented by A. Murray, Esq.
29. 1 Hairy Armadillo (*Dasypus villosus*). Presented by Capt. W. E. Clift.
1 Common Teguexin (*Tupinambis teguexin*). Presented by Capt. W. E. Clift.
30. 1 Rhesus Monkey (*Macacus rhesus*), ♀. Presented by Mr. W. Chrystal.
1 Squirrel Monkey (*Chrysothrix sciurea*). Presented by Mrs. E. M. Parkinson.
2 Noisy Pittas (*Pitta strepitans*). Purchased.
1 Green Tree-Frog (*Hyla arborea*). Presented by Thomas Plowman, Esq.
31. 2 Pink-footed Geese (*Anser brachyrhynchus*). Presented by Col. W. H. Feilden, C.M.Z.S.
1 Greek Tortoise (*Testudo græca*). Presented by George Hollis, Esq.

April 2. 1 Vulpine Phalanger (*Phalangista vulpina*), ♂. Presented by Raymond W. Cooper, Esq.
1 Tawny Owl (*Syrnium aluco*). Presented by G. L. Hunt, Esq.
3. 2 Leopards (*Felis pardus*), ♂ ♀. Presented by J. Gardiner Muir, Esq.
4 Bahama Ducks (*Dafila bahamensis*), 2 ♂, 2 ♀. Purchased.
2 Mandarin Ducks (*Æx galericulata*), 2 ♀. Purchased.
1 Spotted-billed Duck (*Anas pœcilorhyncha*), ♀. Purchased.
1 Ruddy Sheldrake (*Tadorna casarca*), ♀. Purchased.
4 White-backed Pigeons (*Columba leuconota*). Purchased.
4. 1 Burrhel Wild Sheep (*Ovis burrhel*), ♂. Received in Exchange.
1 Greek Tortoise (*Testudo græca*). Presented by Miss Leigh.
1 Malabar Parrakeet (*Palæornis columboides*), ♀. Deposited.
1 Maculated Snake (*Ungalia maculata*). Deposited.
5. 1 Sand-Badger (*Meles ankuma*). Purchased.
6. 1 Pointed Tree-Snake (*Dryiophis acuminata*). From Trinidad, W. I. Presented by R. R. Mole, Esq.

April 6. 1 Clouded Snake (*Leptognathus nebulosus*). From Trinidad, W. I. Presented by R. R. Mole, Esq.

1 Coralline Elaps (*Elaps corallinus*). From Trinidad, W. I. Presented by R. R. Mole, Esq.

7. 1 Brown Capuchin (*Cebus fatuellus*). Presented by Mrs. Walter Palmer.

1 Crab-eating Opossum (*Didelphys cancrivora*), ♂. Presented by Mr. G. Stephen.

9. 1 Cape Zorilla (*Ictonyx zorilla*). Deposited.

1 Rose-Hill Parrakeet (*Platycercus eximius*). Presented by Mrs. Carter.

1 Adorned Ceratophrys (*Ceratophrys ornata*). Deposited.

3 Raccoons (*Procyon lotor*). Born in the Menagerie.

10. 1 Rhesus Monkey (*Macacus rhesus*), ♂. Presented by Robert O'Callaghan, Esq., F.R.C.S.

1 Hairy Armadillo (*Dasypus villosus*). Deposited.

1 Smooth Snake (*Coronella lævis*). Presented by Ignatius Bulfin, Esq.

11. 1 Tayra (*Galictis barbara*). Purchased.

1 Yellow-billed Coot (*Fulica leucoptera*). Purchased.

1 Orange-thighed Falcon (*Falco fusco-cærulescens*). Purchased.

1 Meller's Duck (*Anas melleri*). Presented by H. H. Sharland, Esq., F.Z.S.

12. 1 Bennett's Wallaby (*Halmaturus bennetti*), ♀. Received in Exchange.

3 White's Tree-Frogs (*Hyla cærulea*). Deposited.

4 Golden Tree-Frogs (*Hyla aurea*). Deposited.

14. 1 Macaque Monkey (*Macacus cynomolgus*), ♀. Presented by J. Pearson Callum, Esq.

2 Rabbit-eared Perameles (*Perameles lagotis*), ♂ ♀. Deposited.

1 Crested Porcupine (*Hystrix cristata*). Born in the Menagerie.

16. 1 Water-Vole (*Arvicola amphibius*). Presented by Col. L'Estrange.

1 Buzzard (*Buteo vulgaris*). Presented by Col. C. B. Rashleigh.

17. 1 Slow Loris (*Nycticebus tardigradus*). Presented by Capt. Spalding.

18. 2 Barbary Wild Sheep (*Ovis tragelaphus*), 2 ♀. Born in the Menagerie.

19. 1 Lioness (*Felis leo*). From India. Presented by H.G. The Duke of Newcastle, F.Z.S.

1 Raven (*Corvus corax*). Presented by Miss I. L. Graham.

2 Pin-tailed Sand-Grouse (*Pterocles alchata*), ♂ ♀. Presented by H. H. Sharland, Esq., F.Z.S.

1 Black Gallinule (*Limnocorax niger*). Presented by H. H. Sharland, Esq., F.Z.S.

2 Madagascar Moorhens (*Gallinula pyrrhorhoa*). Presented by H. H. Sharland, Esq., F.Z.S.

20. 1 Chimpanzee (*Anthropopithecus troglodytes*), ♀. Purchased.

2 Sooty Mangabeys (*Cercocebus fuliginosus*), 2 ♀. Presented by the Rev. Canon J. Taylor Smith.

1 African Civet Cat (*Viverra civetta*). Presented by the Rev. Canon J. Taylor Smith.

2 Royal Pythons (*Python regius*). Presented by the Rev. Canon J. Taylor Smith.

1 Short-tailed Parrot (*Pachynus brachyurus*). Purchased.

Apr. 20. 1 White-backed Trumpeter (*Psophia leucoptera*). Purchased.
2 Golden Agoutis (*Dasyprocta aguti*). Purchased.

21. 2 Crested Porcupines (*Hystrix cristata*). Presented by Adrian Vanderbyl, Esq.
4 Swainson's Francolins (*Francolinus swainsoni*), 2 ♂, 2 ♀. Presented by J. E. Matcham, Esq.
1 Delalande's Lizard (*Nucras delalandii*). Presented by J. E. Matcham, Esq.
1 Rough-keeled Snake (*Dasypeltis scabra*). Presented by J. E. Matcham, Esq.
1 Blackish Sternothere (*Sternothærus subniger*). Purchased.

23. 1 Wattled Crane (*Grus carunculata*). Presented by Sir Henry B. Loch, G.C.B., K.C.M.G.
2 Cape Crowned Cranes (*Balearica chrysopelargus*). Presented by Sir Henry B. Loch, G.C.B., K.C.M.G.
1 Grey Ichneumon (*Herpestes griseus*). Presented by John Penn, Esq., M.P., F.Z.S.
2 Indian Cobras (*Naia tripudians*). Purchased.

24. 1 Macaque Monkey (*Macacus cynomolgus*), ♀. Presented by C. Palmer, Esq.
1 Long-legged Buzzard (*Buteo ferox*). Captured in the Red Sea. Purchased.
2 Robben-Island Snakes (*Coronella phocarum*). Presented by Barry McMillan, Esq.

25. 1 Mexican Deer (*Cariacus mexicanus*), ♂. Purchased.

26. 1 Macaque Monkey (*Macacus cynomolgus*), ♀. Presented by Miss A. Orvis.
2 Variegated Jackals (*Canis variegatus*). From Suakin. Presented by Dr. John Anderson, F.R.S., F.Z.S. See P. Z. S. 1894, p. 391.
2 Fennec Foxes (*Canis cerdo*). From the Libyan Desert. Presented by Dr. John Anderson, F.R.S., F.Z.S.
2 Pale Fennec Foxes (*Canis pallidus*). From Suakin. Presented by Dr. John Anderson, F.R.S., F.Z.S.
1 Syrian Fennec Fox (*Canis famelicus*). From Suakin. Presented by Dr. John Anderson, F.R.S., F.Z.S.
1 Fettered Cat (*Felis maniculata*). From Suakin. Presented by Dr. John Anderson, F.R.S., F.Z.S.
1 Senegal Genet (*Genetta senegalensis*). From Suakin. Presented by Dr. John Anderson, F.R.S., F.Z.S. See P. Z. S. 1894, p. 391.
1 Libyan Zorilla (*Ictonyx libyca*). From the Libyan Desert. Presented by Dr. John Anderson, F.R.S., F.Z.S.
1 Zorilla (*Ictonyx frenata*). From Suakin. Presented by Dr. John Anderson, F.R.S., F.Z.S.
1 Crested Porcupine (*Hystrix cristata*). From Suakin. Presented by Dr. John Anderson, F.R.S., F.Z.S.
2 Lesser Egyptian Gerbilles (*Gerbillus ægyptius*). From Egypt. Presented by Dr. Anderson, F.R.S., F.Z.S.
2 Larger Egyptian Gerbilles (*Gerbillus pyramidum*). From Suakin. Presented by Dr. John Anderson, F.R.S., F.Z.S.
2 Dwarf Jerboas (*Dipodillus*, sp. inc.). From Egypt. Presented by Dr. John Anderson, F.R.S., F.Z.S.
3 Hunter's Spiny Mice (*Acomys hunteri*). From Suakin. Presented by Dr. John Anderson, F.R.S., F.Z.S.
4 Cairo Spiny Mice (*Acomys cahirinus*). From Egypt. Presented by Dr. John Anderson, F.R.S., F.Z.S.

Apr. 26. 3 Varied Field-Rats (*Isomys variegatus*). From Egypt. Presented by Dr. John Anderson, F.R.S., F.Z.S.
3 Long-eared Hedgehogs (*Erinaceus auritus*). From Egypt. Presented by Dr. John Anderson, F.R.S., F.Z.S.
6 Adorned Uromastix (*Uromastix ocellatus*). From Suakin. Presented by Dr. John Anderson, F.R.S., F.Z.S.
3 Egyptian Jerboas (*Dipus ægyptius*). From Alexandria. Presented by Dr. John Anderson, F.R.S., F.Z.S.
27. 1 Indian Civet (*Viverricula malaccensis*). Deposited.
28. 4 Red-headed Pochards (*Fuligula ferina*), 2 ♂, 2 ♀. Purchased.
2 Australian Waxbills (*Estrelda temporalis*). Purchased.
30. 2 Glass Snakes (*Pseudopus pallasi*). Purchased.
4 Dark-Green Snakes (*Zamenis atrovirens*). Purchased.

May 1. 2 White Storks (*Ciconia alba*). Purchased.
1 Chicken-Snake (*Coluber quadrivittatus*). From Gainsville, Florida, U.S.A. Presented by Master James W. Philips.
2. 1 De Filippi's Meadow-Starling (*Sturnella defilippi*). Presented by Sir Harry B. Lumsden, C.B., F.Z.S.
2 Common Peafowls (*Pavo cristatus*), 2 ♀. Presented by Richard Hunter, Esq.
4. 1 Jaguar (*Felis onca*), ♂. Purchased.
2 Plumed Ground-Doves (*Geophaps plumifera*). Purchased.
2 Four-lined Snakes (*Coluber quadrilineatus*, var. *leopardinus*). Purchased.
2 Vivacious Snakes (*Tachymenis vivax*). Purchased.
4 Green Lizards (*Lacerta viridis*). Purchased.
1 Common Boa (*Boa constrictor*). From Trinidad, W. I. Presented by Messrs. Mole and Urich.
2 Tree-Boas (*Corallus hortulanus*). From Trinidad, W. I. Presented by Messrs. Mole and Urich.
1 Thick-necked Tree-Boa (*Epicrates cenchris*). From Trinidad, W. I. Presented by Messrs. Mole and Urich.
1 Carinated Snake (*Herpetodryas carinatus*). From Trinidad, W. I. Presented by Messrs. Mole and Urich.
5. 2 Barbary Wild Sheep (*Ovis tragelaphus*), 2 ♀. Born in the Menagerie.
1 Ring-hals Snake (*Sepedon hæmachates*). Presented by J. E. Matcham, Esq.
2 Cape Vipers (*Causus rhombeatus*). Presented by J. E. Matcham, Esq.
7. 1 Yellow-billed Sheath-bill (*Chionis alba*). Deposited.
8. 1 Green Lizard (*Lacerta viridis*). Presented by Miss S. Borgaes.
7 Say's Snakes (*Coronella sayi*). Deposited.
9. 1 Derbian Wallaby (*Halmaturus derbianus*). Born in the Menagerie.
1 Black Iguana (*Metopoceros cornutus*). Deposited.
10. 1 Tuatera Lizard (*Sphenodon punctatus*). Presented by Dr. W. J. Mackie.
11. 1 Mozambique Monkey (*Cercopithecus pygerythrus*), ♀. Presented by H. Tattenhall, Esq.
2 Laughing Kingfishers (*Dacelo gigantea*). Presented by A. E. Henniker, Esq.
2 Berigora Hawks (*Hieracidea berigora*). Presented by A. E. Henniker, Esq.
1 Red-and-Blue Macaw (*Ara macao*). Deposited.

May 12. 7 Spanish Blue Magpies (*Cyanopolius cooki*). Presented by H.R.H. The Comte de Paris.
1 Geoffroy's Terrapin (*Hydraspis geoffroyana*). Deposited.
1 Egyptian Trionyx (*Trionyx ægyptiacus*). From Beulah River, W. Africa. Presented by F. W. Marshall, Esq.
14. 1 Maholi Galago (*Galago maholi*). Born in the Menagerie.
2 Japanese Deer (*Cervus sika*), ♂ ♀. Born in the Menagerie.
16. 1 Common Peafowl (*Pavo cristatus*), ♂. Presented by Mrs. Tannenbaum.
17. 1 Monteiro's Galago (*Galago monteiri*). Deposited.
1 Grey-breasted Parrakeet (*Bolborhynchus monachus*). Presented by C. W. Prebble, Esq.
18. 2 Pinche Monkeys (*Midas œdipus*). Deposited.
1 Black-eared Marmoset (*Hapale penicillata*). Presented by H. M. Dodington, Esq.
21. 1 Brown Capuchin (*Cebus fatuellus*), ♂. Presented by Charles Gordon-Frazer, Esq.
2 Hoary Snakes (*Coronella cana*). Presented by J. E. Matcham, Esq.
1 Crossed Snake (*Psammophis crucifer*). Presented by J. E. Matcham, Esq.
1 Infernal Snake (*Boodon infernalis*). Presented by J. E. Matcham, Esq.
22. 1 Brown Capuchin (*Cebus fatuellus*), ♂. Presented by Miss Florence Marryat.
1 Reindeer (*Rangifer tarandus*), ♀. Born in the Menagerie.
1 Japanese Deer (*Cervus sika*), ♀. Born in the Menagerie.
1 Yellow-cheeked Amazon (*Chrysotis autumnalis*). Deposited.
2 Alligator Terrapins (*Chelydra serpentina*). Deposited.
23. 1 White-bellied Sea-Eagle (*Haliaëtus leucogaster*). Purchased.
2 Wonga-Wonga Pigeons (*Leucosarcia picata*). Purchased.
24. 2 Four-horned Antelopes (*Tetraceros quadricornis*), 2 ♂. Presented by W. F. Sinclair, Esq.
3 Stock-Doves (*Columba œnas*). Presented by Lionel A. Williams, Esq.
25. 4 Commou Swans (*Cygnus olor*). Presented by the Lord Braybrooke, F.Z.S.
26. 2 Jameson's Gulls (*Larus novæ-hollandiæ*). Presented by Sir Ferdinand von Mueller, K.C.M.G., C.M.Z.S.
27. 2 Natterjack Toads (*Bufo calamita*). Presented by Miss Peckham.
28. 1 White-handed Gibbon (*Hylobates lar*). Deposited.
2 Gazelles (*Gazella dorcas*), ♂ ♀. From Suakin. Deposited.
1 Two-spotted Paradoxure (*Nandinia binotata*). Presented by Joseph Wells, Esq.
29. 2 Hamadryad Snakes (*Ophiophagus elaps*). Purchased.
30. 1 Silky Bower-bird (*Ptilonorhynchus violaceus*), ♂. Purchased.
1 Garrulous Honey-eater (*Myzantha garrula*). Purchased.
4 Vinaceous Turtle-Doves (*Turtur vinaceus*). Purchased.
4 Cape Doves (*Œna capensis*), 2 ♂, 2 ♀. Purchased.
2 Goliath Beetles (*Goliathus druryi*). Presented by Capt. G. L. Mitchell.
31. 1 Raccoon (*Procyon lotor*). Presented by Harry Burgess, Esq.
1 Grey Parrot (*Psittacus erithacus*). Presented by Mrs. Lemming.
2 Stanley Cranes (*Tetrapteryx paradisea*). Purchased.

June 2. 1 Beech-Marten (*Mustela foina*). Purchased.
1 Pine-Marten (*Mustela martes*). Purchased.
1 Timneh Parrot ((*Psittacus timneh*). Purchased.
4. 1 Cape Crowned Crane (*Balearica chrysopelargus*). Presented by Luscombe Searelle, Esq.
2 Common Peafowls (*Pavo cristatus*), ♂ ♀. Presented by A. Tannenbaum, Esq.
1 Puff-Adder (*Vipera arietans*). Presented by J. E. Matcham, Esq.
5. 1 Bennett's Wallaby (*Halmaturus bennetti*). Born in the Menagerie.
1 Triangular-spotted Pigeon (*Columba guinea*). Bred in the Menagerie.
6. 1 Raven (*Corvus corax*). Presented by Robert O'Callaghan, Esq., F.R.C.S.
1 Hamadryad (*Ophiophagus elaps*). Deposited. See P. Z. S. 1894, p. 594.
4 Common Snakes (*Tropidonotus natrix*). Presented by Mr. Harold Attewell.
1 Common Viper (*Vipera berus*). Presented by Mr. Harold Attewell.
7. 1 Macaque Monkey (*Macacus cynomolgus*), ♀. Presented by F. Erskine Paton, Esq.
1 White-throated Capuchin (*Cebus hypoleucos*). Presented by F. Erskine Paton, Esq.
1 Ashy-black Macaque (*Macacus ocreatus*), ♂. Purchased.
1 Turkey Vulture (*Cathartes aura*). Purchased.
1 Yellow-headed Vulture (*Cathartes urubitinga*). Purchased.
1 Guianan Crested Eagle (*Morphnus guianensis*). Purchased.
1 Grey Ichneumon (*Herpestes griseus*), ♂. Presented by Miss Florence Marryat.
3 Varied Field-Rats (*Isomys variegatus*). Born in the Menagerie.
1 English Wild Cow (*Bos taurus*, var.). Born in the Menagerie.
8. 1 Beech-Marten (*Mustela foina*). Purchased.
1 Red-and-Yellow Macaw (*Ara chloroptera*). Purchased.
1 Hamadryad (*Ophiophagus elaps*). Deposited.
4 Yellow-bellied Liothrix (*Liothrix luteus*). Deposited.
1 Natterjack Toad (*Bufo calamita*). Presented by F. Wallace, Esq.
9. 1 Smooth Snake (*Coronella lævis*). Presented by Harry Furniss, Esq., F.Z.S.
11. 1 Isabelline Bear (*Ursus isabellinus*), ♂. From Cashmere. Presented by E. C. Haag, Esq. (18th Hussars).
1 Sloth Bear (*Melursus ursinus*). From the Hills of Orissa, Bengal. Presented by J. W. Currie, Esq.
1 Mouflon (*Ovis musimon*), ♀. Born in the Menagerie.
1 Yellow-footed Rock-Kangaroo (*Petrogale xanthopus*), ♂. Born in the Menagerie.
2 Japanese Teal (*Querquedula formosa*). Purchased.
1 Black Stork (*Ciconia nigra*). Purchased.
12. 1 Great Anteater (*Myrmecophaga jubata*). Purchased.
1 Eroded Cinixys (*Cinixys erosa*). From Cape Lopez, Gaboon. Presented by Commander J. L. Marx, R.N.
13. 1 Wapiti Deer (*Cervus canadensis*), ♂. Born in the Menagerie.
3 Hawk's-billed Turtles (*Chelone imbricata*). Presented by J. Arthur, Esq.

June 14. 1 Puma (*Felis concolor*), ♀. Presented by Miss Florence Dickinson.

1 Leopard (*Felis pardus*), ♂. Presented by Major Owen, F.Z.S.

1 Cheetah (*Cynælurus jubatus*). Presented by Major Owen, F.Z.S.

15. 1 Black-winged Peafowl (*Pavo nigripennis*), ♂. Deposited.

16. 1 Moor Macaque (*Macacus inornatus*), ♀. Presented by Mrs. Florence Firman.

1 Hoolock Gibbon (*Hylobates hoolock*). Deposited.

1 Black-handed Teetee (*Callithrix melanochir*). Deposited.

2 Chaffinches (*Fringilla cœlebs*). Presented by Miss E. G. Woodd.

1 Downy Owl (*Pulsatrix torquata*). Presented by Dr. E. A. Goeldi.

1 Greek Tortoise (*Testudo græca*). Presented by H. K. Bartlett, Esq.

5 Helodermas (*Heloderma suspectum*). Deposited.

18. 1 Black-headed Lemur (*Lemur brunneus*), ♂. Presented by the Hon. Mrs. Fellowes.

1 Maholi Galago (*Galago maholi*). Deposited.

1 Muscat Gazelle (*Gazella muscatensis*), ♂. From Bushire. Deposited.

1 Slender-horned Gazelle (*Gazella leptoceros?*), ♀. From Muscat. Deposited.

2 Fossas (*Cryptoprocta ferox*), 2 ♂. Deposited.

1 Black-faced Kangaroo (*Macropus melanops*), ♂. Presented by G. Lindsay Johnson, Esq., M.D., F.Z.S.

3 Ypecaha Rails (*Aramides ypecaha*). Bred in the Menagerie.

19. 1 Leonine Monkey (*Macacus leoninus*), ♂. Presented by J. W. Hunter, Esq.

1 Golden Eagle (*Aquila chrysaëtus*). From Scotland. Presented by the Maclaine of Lochbuie.

1 Stump-tailed Lizard (*Trachydosaurus rugosus*). Presented by Capt. Jamieson.

20. 1 Military Macaw (*Ara militaris*). Deposited.

1 Spotted Pigeon (*Columba maculosa*). Bred in the Menagerie.

22. 1 Brown Capuchin (*Cebus fatuellus*), ♀. Presented by Mrs. J. L. Johnson.

23. 1 Black Mangabey (*Cercocebus aterrimus*), ♂. From Lake Tanganyika. Presented by H. H. Johnston, Esq., C.B., F.Z.S. See P. Z. S. 1894, p. 594.

1 Yellow Baboon (*Cynocephalus babouin*), ♀. From British Central Africa. Presented by H. H. Johnston, Esq., C.B., F.Z.S. See P. Z. S. 1894, p. 594.

1 Duyker Bok (*Cephalophus mergens*), ♀. From British Central Africa. Presented by H. H. Johnston, Esq., C.B., F.Z.S. See P. Z. S. 1894, p. 594.

1 Æthiopian Wart-Hog (*Phacochœrus æthiopicus*), ♂. From British Central Africa. Presented by H. H. Johnston, Esq., C.B., F.Z.S. See P. Z. S. 1894, p. 594.

1 Banded Ichneumon (*Herpestes fasciatus*), ♂. From British Central Africa. Presented by H. H. Johnston, Esq., C.B., F.Z.S. See P. Z. S. 1894, p. 594.

1 Milky Eagle-Owl (*Bubo lacteus*). From British Central Africa. Presented by H. H. Johnston, Esq., C.B., F.Z.S. See P. Z. S. 1894, p. 594.

June 23. 1 Black-crested Eagle (*Lophoaëtus occipitalis*). From British Central Africa. Presented by H. H. Johnston, Esq., C.B., F.Z.S. See P. Z. S. 1894, p. 594.

1 Marabou Stork (*Leptoptilus crumeniferus*). From British Central Africa. Presented by H. H. Johnston, Esq., C.B., F.Z.S. See P. Z. S. 1894, p. 594.

2 Green-necked Touracous (*Corythaix chlorochlamys*). From British Central Africa. Presented by H. H. Johnston, Esq., C.B., F.Z.S. See P. Z. S. 1894, p. 594.

2 Livingstone's Touracous (*Corythaix livingstonii*). From British Central Africa. Presented by H. H. Johnston, Esq., C.B., F.Z.S. See P. Z. S. 1894, p. 594.

1 Bell's Cinixys (*Cinixys belliana*). From British Central Africa. Presented by H. H. Johnston, Esq., C.B., F.Z.S. See P. Z. S. 1894, p. 594.

1 Green Monkey (*Cercopithecus callitrichus*), ♀. Presented by Mrs. Flowers.

1 White-tailed Gnu (*Connochætes gnu*), ♂. Born in the Menagerie. See P. Z. S. 1894, p. 595.

1 Black-headed Conure (*Conurus nanday*). Presented by A. Harrison, Esq.

25. 1 Rhesus Monkey (*Macacus rhesus*), ♂. Presented by Mrs. McHugh.

3 Barbary Turtle-Doves (*Turtur risorius*). Presented by the Misses E. and P. Mackenzie.

26. 1 Thar (*Capra jemlaica*), ♂. Born in the Menagerie.

27. 1 Burrhel Wild Sheep (*Ovis burrhel*), ♂. Born in the Menagerie.

28. 1 Ostrich (*Struthio camelus*), ♀. Purchased.

1 Æthiopian Wart-Hog (*Phacochærus æthiopicus*), ♀. Received in Exchange.

2 Red-headed Merlins (*Hypotriorchis chicquera*). Purchased.

29. 1 Great Kangaroo (*Macropus giganteus*), ♀. Born in the Menagerie.

30. 1 Cuckoo (*Cuculus canorus*). Presented by Mr. W. Green.

2 Horned Lizards (*Phrynosoma cornutum*). Presented by Miss Maitland.

July 1. 1 Anomalous Snake (*Coronella anomala*). Deposited.

2. 3 Indian Cobras (*Naia tripudians*). Received in Exchange.

3. 1 Rhesus Monkey (*Macacus rhesus*), ♂. Presented by Conrad W. Cooke, Esq.

1 Crowned Lemur (*Lemur coronatus*), ♂. Deposited.

4 Carolina Anolises (*Anolis carolinensis*). Presented by the Southern Curio Co.

4. 1 Macaque Monkey (*Macacus cynomolgus*), ♀. Presented by Mrs. Wheeler.

1 Cheetah (*Cynælurus jubatus*), ♂. From Somaliland. Presented by Wm. Mure, Esq.

4 Hedgehogs (*Erinaceus europæus*). Presented by F. C. Smith, Esq.

1 Mediterranean Peregrine Falcon (*Falco punicus*). Captured in the Mediterranean. Presented by Arthur L. Sclater, Esq.

2 Obsolete Tinamous (*Crypturus obsoletus*). Purchased.

5. 1 Smooth Snake (*Coronella lævis*). Purchased.

6. 2 Senegal Touracous (*Corythaix persa*). Presented by Miss E. R. Redwar.

July 6. 3 Philander Opossums (*Didelphys philander*). Deposited.
9. 1 Thar (*Capra jemlaica*), ♀. Born in the Menagerie.
1 Brush-tailed Porcupine (*Atherura africana*). Presented by W. H. Boyle, Esq.
10. 1 Mona Monkey (*Cercopithecus mona*), ♂. Presented by Charles Gardiner, Esq.
2 Lesser White-nosed Monkeys (*Cercopithecus petaurista*), ♂ ♀. Presented by W. H. Boyle, Esq.
1 Campbell's Monkey (*Cercopithecus campbelli*), ♀. Presented by W. H. Boyle, Esq.
1 Eland (*Oreas canna*), ♂. Purchased.
1 Livingstone's Eland (*Oreas canna livingstonii*), ♀. From the Transvaal. Purchased. See P. Z. S. 1894, p. 595.
11. 1 Crowned Lemur (*Lemur coronatus*), ♀. Deposited.
12. 2 Elephantine Tortoises (*Testudo elephantina*), ♂ ♀. From Aldabra Island. Presented by Rear-Admiral W. R. Kennedy, F.Z.S. See P. Z. S. 1894, p. 595.
13. 1 Japanese Deer (*Cervus sika*), ♀. Born in the Menagerie.
14. 1 Wapiti Deer (*Cervus canadensis*), ♀. Born in the Menagerie.
2 Short-toed Hedgehogs (*Erinaceus brachydactylus*). From Somaliland. Purchased.
16. 1 Long-eared Fox (*Otocyon megalotis*). Deposited.
1 Leopard (*Felis pardus*). Presented by Mrs. J. R. W. Pigott.
1 Monk Seal (*Monachus albiventer*). From Madeira. Presented by C. F. R. Blandy, Esq.
17. 1 Lioness (*Felis leo*). From East Africa. Presented by Major Owen, F.Z.S.
1 Common Jackal (*Canis aureus*). Presented by Gerard Gurney, Esq.
1 Cockateel (*Calopsitta novæ-hollandiæ*). Presented by Miss Sloane Stanley.
1 Puff-Adder (*Vipera arietans*). Presented by J. E. Matcham, Esq.
1 Ring-hals Snake (*Sepedon hæmachates*). Presented by J. E. Matcham, Esq.
18. 2 Tiger Cubs (*Felis tigris*), ♂. From Pahang, Malay Peninsula. Presented by Lieut.-Col. Sir Charles B. H. Mitchell, K.C.M.G.
2 Collared Fruit-Bats (*Cynonycteris collaris*). Born in the Menagerie.
1 Geoffroy's Terrapin (*Platemys geoffroyana*). Deposited.
1 Ceylonese Terrapin (*Clemmys trijuga*). Deposited.
1 Ocellated Monitor (*Varanus ocellatus*). From Lake Tanganyika. Deposited.
2 Black-and-White Snakes (*Pituophis melanoleucus*). Deposited.
1 Smooth Snake (*Coronella lævis*). Presented by Willingham F. Rawnsley, Esq.
19. 1 Black-winged Peafowl (*Pavo nigripennis*), ♀. Purchased.
1 Muscat Gazelle (*Gazella muscatensis*), ♀. Received in Exchange.
20. 6 Grey-winged Francolins (*Francolinus afer*). Presented by J. E. Matcham, Esq.
4 Mandarin Ducks (*Æx galericulata*). Bred in the Menagerie.
6 Australian Wild Ducks (*Anas superciliosa*). Bred in the Menagerie.
2 Slender Ducks (*Anas gibberifrons*). Bred in the Menagerie.

July 20. 1 Magellanic Goose (*Bernicla magellanica*). Bred in the Menagerie.
1 Black-headed Gull (*Larus ridibundus*). Bred in the Menagerie.
21. 1 Moustache Monkey (*Cercopithecus cephus*), ♀. Presented by W. Clayton Pickersgill.
23. 1 Vervet Monkey (*Cercopithecus lalandii*), ♂. Presented by J. E. Matcham, Esq.
1 Hygian Snake (*Elaps hygiæ*). Presented by J. E. Matcham, Esq.
1 Thar (*Capra jemlaica*), ♂. Born in the Menagerie.
3 Cairo Spiny Mice (*Acomys cahirinus*). Born in the Menagerie.
2 Hunter's Spiny Mice (*Acomys hunteri*). Born in the Menagerie.
24. 1 Common Paradoxure (*Paradoxurus typus*). Presented by E. Stallard, Esq.
1 Rat-tailed Opossum (*Didelphys nudicaudata*). Deposited.
1 Murine Opossum (*Didelphys murina*). Deposited.
1 Common Cassowary (*Casuarius galeatus*). Deposited.
2 Slowworms (*Anguis fragilis*). Presented by Mr. T. E. Gunn.
1 Red Deer (*Cervus elaphus*), ♂. Born in the Menagerie.
26. 1 Suricate (*Suricata tetradactyla*). Presented by Miss Champneys.
2 Hamadryads (*Ophiophagus elaps*), ♂. Deposited.
1 Indian Cobra (*Naia tripudians*). Presented by Angus M. Kinloch, Esq.
27. 1 Pleasant Antelope (*Tragelaphus gratus*), ♂. Purchased. See P. Z. S. 1894, p. 595.
1 Macaque Monkey (*Macacus cynomolgus*), ♂. Presented by J. A. Brand, Esq.
1 Hawk-headed Parrot (*Deroptyus accipitrinus*). Deposited.
31. 1 Mozambique Monkey (*Cercopithecus pygerythrus*), ♀. Presented by Mrs. Keirnander.
1 Blotched Genet (*Genetta tigrina*). Presented by Miss M. Clode.
1 Condor (*Sarcorhamphus grypus*), ♂. Purchased.

Aug. 1. 1 Smooth Snake (*Coronella lævis*). Presented by John Gray, Esq.
2. 1 Grey Ichneumon (*Herpestes griseus*). Presented by Miss Sullivan.
2 Triangular-Spotted Pigeons (*Columba guinea*). Bred in the Menagerie.
3. 1 Blackcap (*Sylvia atricapilla*), ♂. Presented by Capt. John Richardson, H.L.I.
4. 1 Four-horned Sheep (*Ovis aries*, var.), ♂. Presented by Frank C. Strick, Esq.
1 Red-and-Blue Macaw (*Ara macao*). Deposited.
1 Common Viper (*Vipera berus*). Presented by — Anderson, Esq.
7. 1 Black Ape (*Cynopithecus niger*), ♂. Presented by Gambier Bolton, Esq., F.Z.S.
8. 1 Black-backed Jackal (*Canis mesomelas*). Deposited.
9. 4 Alpine Newts (*Triton alpestris*). Presented by Mr. Malcolm O. Smith.
10. 1 Slender Loris (*Loris gracilis*). Presented by Thomas E. Remington, Esq.
4 Guanhami Land-Crabs (*Cardisoma guanhami*). Presented by Percy Walter Jarvis, Esq.

Aug. 11. 1 Cayenne Lapwing (*Vanellus cayennensis*). Bred in the Menagerie.
1 Common Chameleon (*Chamæleon vulgaris*). Presented by Capt. Philip Langdale.
1 Weka Rail (*Ocydromus australis*). Purchased.
13. 1 Common Viper (*Vipera berus*). Presented by Barry Burge, Esq.
15. 1 Herring-Gull (*Larus argentatus*). Presented by Mr. George Haynes.
2 Ring-Ouzels (*Turdus torquatus*). Deposited.
16. 1 Rhesus Monkey (*Macacus rhesus*), ♀. Presented by H. P. Nicholls, Esq.
1 Ocelot (*Felis pardalis*), ♀. Presented by Miss Edith Zambra.
20. 1 Yak (*Poëphagus grunniens*). Born in the Menagerie.
2 Sharp-nosed Crocodiles (*Crocodilus acutus*). Presented by D. Poole, Esq.
21. 1 Hairy Armadillo (*Dasypus villosus*), ♂. Presented by Mr. George Simpson.
2 Heloderms (*Heloderma suspectum*). Deposited.
2 Chameleons (*Chamæleon vulgaris*). Presented by E. Palmer, Esq.
2 Smooth Snakes (*Coronella lævis*). Presented by E. Penton, Esq.
22. 1 Impeyan Pheasant (*Lophophorus impeyanus*), ♂. Presented by Capt. R. H. R. Helpman.
3 Blood-breasted Pigeons (*Phlegœnas cruentata*). Purchased.
23. 1 Large Bamboo-Rat (*Rhizomys sumatrensis*). Presented by Angus M. Kinloch, Esq.
1 Spotted Pigeon (*Columba maculosa*). Bred in the Menagerie.
2 Common Vipers (*Vipera berus*). Presented by Hugh Bromley, Esq.
24. 1 Sykes's Monkey (*Cercopithecus albigularis*). Deposited.
27. 1 Pinche Monkey (*Midas œdipus*). Presented by W. N. Gordon, Esq., Lieut. R.A.
1 Stone-Curlew (*Œdicnemus crepitans*). From Norfolk. Presented by Col. H. W. Feilden, C.M.Z.S.
1 Elephantine Tortoise (*Testudo elephantina*). From the Seychelles. Presented by Arthur Gladstone, Esq.
28. 1 Diana Monkey (*Cercopithecus diana*), ♀. Presented by Darent McDonald, Esq.
29. 5 Meyer's Parrots (*Pœocephalus meyeri*). Deposited.
2 Brown-throated Conures (*Conurus æruginosus*). Deposited.
2 Hawk's-billed Turtles (*Chelone imbricata*). Presented by Capt. E. Fleetham, s.s. 'Cyrus.'
31. 1 Black-headed Lemur (*Lemur brunneus*), ♀. Deposited

Sept. 1. 1 Puma (*Felis concolor*), ♂. Presented by Ponsonby Ogle, Esq.
2 Javan Wild Swine (*Sus vittatus*), ♂ ♀. Presented by E. J. Kerkhoven, Esq.
4. 1 Diana Monkey (*Cercopithecus diana*), ♂. Deposited.
1 Raven (*Corvus corax*). Presented by W. R. Ogilvie Grant, Esq.
2 Shamas (*Cittocincla macrura*). Received in Exchange.
5. 1 Japanese Teal (*Querquedula formosa*). Purchased.
1 Brazilian Blue Grosbeak (*Guiraca cyanea*). Received in Exchange.

Sept. 5. 1 Red-headed Marsh-bird (*Agelæus ruficapillus*). Received in Exchange.

6. 2 Wild Swine (*Sus scrofa*), ♂ ♀. From Turkish Arabia. Presented by F. G. Beville, Esq., I.S.C., H.B.M. Consul.

7. A collection of Marine Fishes. Purchased.

8. 1 Slender Loris (*Loris gracilis*). Presented by Miss Grace Thompson.

3 West-Indian Agoutis (*Dasyprocta antillensis*). From Tobago, W.I. Presented by Hon. William Low.

2 Orange-winged Amazons (*Crysotis amazonica*). From Tobago, W.I. Presented by Hon. William Low.

9. 1 Green Turtle (*Chelone viridis*). Presented by Mr. E. Leach.

10. 1 Bosch-bok (*Tragelaphus sylvaticus*), ♀. Presented by J. E. Matcham, Esq.

11. 1 Malbrouck Monkey (*Cercopithecus cynosurus*), ♀. Deposited.

1 Slowworm (*Anguis fragilis*). Presented by G. H. Morton Middleton, Esq.

12. 1 Cape Bucephalus (*Bucephalus capensis*). Presented by Mr. A. W. Arrowsmith.

13. 1 Silver Pheasant (*Euplocamus nycthemerus*), ♂. Presented by Thomas Harris, Esq.

1 Blue-fronted Amazon (*Crysotis æstiva*). Deposited.

14. 1 Common Marmoset (*Hapale jacchus*). Presented by Mr. J. C. Alleyne.

1 Large Hill-Mynah (*Gracula intermedia*). Presented by Charles E. Brooke, Esq.

2 Vinaceous Turtle-Doves (*Turtur vinaceus*). Bred in the Menagerie.

1 Mitred Guinea-fowl (*Numida mitrata*). Purchased.

1 Redstart (*Ruticilla phœnicurus*). Purchased.

20 Painted Terrapins (*Clemmys picta*).
5 Stink-pot Terrapins (*Aromochelys odorata*).
1 American Box-Tortoise (*Terrapene carinata*).
} Presented by the Museum of Comparative Zoology, Cambridge, Mass.

15. 1 Common Chameleon (*Chamæleon vulgaris*). Presented by Mr. G. T. Elphick.

1 Bull Frog (*Rana catesbiana*). Purchased.

1 Collared Hedgehog (*Erinaceus collaris*). From Karachi. Purchased.

17. 20 European Tree-Frogs (*Hyla arborea*). Presented by G. B. Coleman, Esq.

1 Red-sided Eclectus (*Eclectus pectoralis*). Received in Exchange.

1 Diamond Snake (*Morelia spilotes*). Received in Exchange.

18. 2 Alligators (*Alligator mississippiensis*). Presented by L. Watson, Esq.

1 Axis Deer (*Cervus axis*), ♂. Born in the Menagerie.

1 African Wild Ass (*Equus tæniopus*), ♂. Born in the Menagerie.

19. 2 Giant Toads (*Bufo marinus*). Presented by F. E. Blaauw, Esq., C.M.Z.S.

1 Sykes's Monkey (*Cercopithecus albigularis*), ♂. Presented by Miss Marion E. Leitch.

1 Toco Toucan (*Rhamphastos toco*). Received in Exchange.

1 Field-Rat (*Nesokia*, sp. inc.). From Suez. Presented by Dr. John Anderson, F.R.S.

Sept. 20. 1 Ostrich (*Struthio camelus*), ♂. Deposited.
1 Greater Sulphur-creasted Cockatoo (*Cacatua galerita*). Deposited.
1 Common Tench (*Tinca vulgaris*). Presented by T. G. Bridgman, Esq.
22. 1 Macaque Monkey (*Macacus cynomolgus*), ♀. Presented by Capt. W. Townsend.
24. 1 Common Marmoset (*Hapale jacchus*). Presented by A. E. W. Burns, Esq.
25. 1 Bonnet-Monkey (*Macacus sinicus*), ♂. Presented by Mrs. Ling.
1 Bonnet-Monkey (*Macacus sinicus*), ♂. Presented by Philip E. Morel, Esq.
1 Brush-tailed Kangaroo (*Petrogale penicillata*), ♀. Presented by Lady Isabel Clayton.
26. 1 Deadly Snake (*Trigonocephalus atrox*). From Trinidad. Presented by Messrs. Mole and Urich.
27. 1 Patagonian Cavy (*Dolichotis patachonica*). Born in the Menagerie.
1 Mouse (*Mus*, sp. inc.). Deposited.
2 Cerastes Vipers (*Vipera cerastes*). Deposited.
2 Egyptian Eryx (*Eryx jaculus*). Deposited.
1 Clifford's Snake (*Zamenis cliffordi*). Deposited.
1 Simony's Lizard (*Lacerta simonyi*). From the Island of Hierro, Canaries. Presented by Sydney Crompton, Esq.
28. 3 Australian Cranes (*Grus australasiana*). Presented by E. W. Marshall, Esq., F.Z.S.
1 Brown Crane (*Grus canadensis*). Presented by E. W. Marshall, Esq., F.Z.S.
1 Indian White Crane (*Grus leucogeranos*). Presented by E. W. Marshall, Esq., F.Z.S.
1 South-African Ground Hornbill (*Bucorvus cafer*). From Beira, S.E. Africa. Presented by H. H. Johnston, Esq., C.B., F.Z.S.
2 Californian Quails (*Callipepla californica*), ♂ ♀. Presented by H. H. Howard-Vyse, Esq.
3 Pratincoles (*Glareola pratincola*). Presented by Lord Lilford, F.Z.S.
4 Night-Herons (*Nycticorax griseus*). Presented by Lord Lilford, F.Z.S.
1 Great Bustard (*Otis tarda*). Presented by Lord Lilford, F.Z.S.
29. 1 Papuan Wreathed Horn-bill (*Rhytidoceros plicatus*), ♂. Presented by Mrs. Wilkinson.
3 Dwarf Chameleons (*Chamæleon pumilus*). Presented by C. Stonham, Esq., F.R.C.S., F.Z.S.
1 Axis Deer (*Cervus axis*), ♀. Born in the Menagerie.
1 Rufous Rat-Kangaroo (*Hypsiprymnus rufescens*), ♂. Born in the Menagerie.

Oct. 1. 1 Moose (*Alces machlis*, jr.), ♂. From Sweden. Presented by Guy Nickalls, Esq.
2 Horned Screamers (*Palamedea cornuta*). From Para, Brazil. Presented by H. A. Astlett, Esq.
3 Bar-tailed Pheasants (*Phasianus reevesi*), 2 ♂, 1 ♀. Bred in the Menagerie.

Oct. 1. 1 Amherst Pheasant (*Thaumalea amherstiæ*), ♀. Bred in the Menagerie.
2. 1 Macaque Monkey (*Macacus cynomolgus*), ♂. Presented by Mrs. Morris.
1 Mexican Guan (*Penelope purpurascens*). Purchased.
3. 1 Two-spotted Paradoxure (*Nandinia binotata*). Presented by Dr. Sydney W. Thompstone.
1 Banded Parrakeet (*Palæornis fasciatus*), ♀. Presented by Thomas Hodgson, Esq.
5. 1 Diana Monkey (*Cercopithecus diana*), ♀. Presented by Mrs. Collcutt.
1 Mozambique Monkey (*Cercopithecus pygerythrus*), ♀. Presented by H. J. Clowes, Esq.
1 Leopard (*Felis pardus*, jr.). Presented by Thomas E. C. Remington, Esq.
1 Bennett's Wallaby (*Halmaturus bennetti*), ♂. Presented by Capt. G. W. Banks.
1 Green Turtle (*Chelone viridis*). Deposited.
1 Hawk's-billed Turtle (*Chelone imbricata*). Deposited.
6. 2 Raccoons (*Procyon lotor*). Born in the Menagerie.
1 Persian Gazelle (*Gazella subgutturosa*), ♂. Born in the Menagerie.
1 Short-tailed Parrot (*Pachynus brachyurus*), ♂. Purchased.
9. 2 Pig-tailed Monkeys (*Macacus nemestrinus*), ♂ ♀. Presented by the Rev. Sidney Vatcher.
1 Vervet Monkey (*Cercopithecus lalandii*), ♀. Presented by the Rev. Sidney Vatcher.
2 Robins (*Erithacus rubecula*). Presented by A. T. Binny, Esq.
4 Bright-spotted Finches (*Spermospiza guttata*). From Mashonaland. Purchased.
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2 Brazilian Caracaras (*Polyborus brasiliensis*). Presented by Lord Lilford, F.Z.S.
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1 Egyptian Jerboa (*Dipus ægyptius*). Deposited.
19. 1 Ring-tailed Coati (*Nasua rufa*). Presented by Mrs. J. C. Symonds.

Oct. 19. 1 Patagonian Conure (*Conurus patagonus*). Presented by Mrs. Novelli.

23. 1 Barbary Ape (*Macacus inuus*), ♀. Presented by Alfred J. Gosling, Esq.

1 Turtle-Dove (*Turtur communis*). Presented by Alfred J. Gosling, Esq.

4 Barbary Turtle-Doves (*Turtur risorius*). Presented by Alfred J. Gosling, Esq.

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1 Caracal (*Felis caracal*). Presented by J. E. Matcham, Esq.

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1 Lanner Falcon (*Falco lanarius*?). Presented by A. J. Elliott, Esq.

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25. 1 Brown Capuchin (*Cebus fatuellus*), ♀. Presented by T. A. Jenkins, Esq.

2 Long-nosed Crocodiles (*Crocodilus cataphractus*). Presented by J. Banks Elliott, Esq.

3 Rusa Deer (*Cervus hippelaphus*), 1 ♂, 2 ♀. From Mauritius. Presented by Rear-Admiral Kennedy, F.Z.S.

26. 2 Somali Ostriches (*Struthio molybdophanes*), ♂ ♀. Purchased. See P. Z. S. 1894, p. 654.

4 Plumed Ground-Doves (*Geophaps plumifera*), 2 ♂, 2 ♀. Received in Exchange.

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1 Triangular-spotted Pigeon (*Columba guinea*). Bred in the Menagerie.

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30. 2 Lions (*Felis leo*), 2 ♂. Deposited.

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31. 3 Crossbills (*Loxia recurvirostra*), 2 ♂, 1 ♀. From Russia. Presented by Capt. A. Newnham, F.Z.S.

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Nov. 2. 1 Double-ringed Turtle-Dove (*Turtur bitorquatus?*). Presented by the Hon. Rose Hubbard.
1 Bonnet-Monkey (*Macacus sinicus*), ♀. Deposited.
6. 2 White-shafted Francolins (*Francolinus leucoscepus*), 2 ♂. Presented by Lord Lilford, F.Z.S.
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14. 10 Surinam Toads (*Pipa americana*). Presented by F. E. Blaauw, Esq. See P. Z. S 1894, p. 693.
15. 2 Ibean Baboons (*Cynocephalus ibeanus*). Presented by Charles Palmer, Esq.
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4 Lapwings (*Vanellus cristatus*). Purchased.
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1 Pel's Owl (*Scotopelia peli*). Presented by the Hon. C. B. Mitford. See P. Z. S. 1894, p. 693.
1 Angola Vulture (*Gypohierax angolensis*). Presented by the Hon. C. B. Mitford.
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1 Augural Buzzard (*Buteo auguralis*). Presented by the Hon. C. B. Mitford.
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5 Rough-tailed Lizards (*Zonurus corylus*). Deposited.
1 Delalande's Lizard (*Nucras delalandii*). Deposited.
1 Yellow-throated Lizard (*Gerrhosaurus flavigularis*). Deposited.
1 Crossed Snake (*Psammophis crucifer*). Deposited.
21. 1 Snowy Owl (*Nyctea scandiaca*). Captured in Mid-Atlantic, 700 miles from land. Presented by F. Harston Eagles, Esq., R.N.
1 Allied Goshawk (*Astur approximans*). Deposited.
3 Long-necked Chelodines (*Chelodina longicollis*). Deposited.
17 White's Tree-Frogs (*Hyla cærulea*). Deposited.
22 Golden Tree-Frogs (*Hyla aurea*). Deposited.
1 Peron's Tree-Frog (*Hyla peroni*). Deposited.
3 Peron's Frogs (*Lymnodynastes peroni*). Deposited.

Nov. 22. 2 Bennett's Tree-Kangaroos (*Dendrolagus bennettianus*), ♂ ♀. From N. Queensland. Received in Exchange. See P. Z. S. 1894, p. 693.

4 Brush-Turkeys (*Talegalla lathami*), 4 ♂. Received in Exchange.

2 Bennett's Tree-Kangaroos (*Dendrolagus bennettianus*). From N. Queensland. Deposited.

24. 1 Black Lemur (*Lemur macaco*), ♂. Presented by John D. Roche, Esq.

2 Carolina Conures (*Conurus carolinensis*). Purchased.

26. 1 Sykes's Monkey (*Cercopithecus albigularis*), ♂. Presented by J. H. Prestwich, Esq.

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27. 1 Leopard (*Felis pardus*). Presented by John Christie, Esq.

1 Arctic Fox (*Canis lagopus*). Deposited.

2 Spotted Eagle-Owls (*Bubo maculosa*). Presented by R. A. Langford, Esq.

4 Nutcrackers (*Nucifraga caryocatactes*). Purchased.

1 Pepoaza Tyrant (*Tænioptera nengeta*). Captured at Sea. Presented by C. F. Reed, Esq.

28. 1 Antipodes Island Parrakeet (*Cynorhamphus unicolor*). Presented by Sir Walter L. Buller, K.C.M.G., F.Z.S.

7 South-Island Thrushes (*Turnagra crassirostris*). Deposited.

Dec. 1. 1 Rhomb-marked Snake (*Psammophylax rhombeatus*). Presented by J. E. Matcham, Esq.

4. 2 Common Cassowaries (*Casuarinus galeatus*). Deposited.

1 Red-vented Parrot (*Pionus menstruus*). Deposited.

2 Orange-flanked Parrakeets (*Brotogerys pyrrhopterus*). Deposited.

5. 1 West-African Love-bird (*Agapornis pullaria*), ♂. Presented by Mrs. Robinson.

1 Reticulated Python (*Python reticulatus*). Presented by Sigismund Bruzaud, Esq.

6. 1 American Black Bear (*Ursus americanus*, var. *cinnamomea*). From the Rocky Mountains. Deposited.

1 Short-billed Toucan (*Rhamphastos brevicarinatus*). Received in Exchange.

1 Spotted Owlet (*Athene brama*). Presented by E. W. Harper, Esq., F.Z.S.

4 Grey Francolins (*Francolinus ponticerianus*). Presented by E. W. Harper, Esq., F.Z.S.

3 Rain-Quails (*Coturnix coromandelica*). Presented by E. W. Harper, Esq., F.Z.S.

1 Spotted Turtle-Dove (*Turtur meena*). Presented by E. W. Harper, Esq., F.Z.S.

Dec. 6. 1 Indian House-Sparrow (*Passer domesticus*). Presented by E. W. Harper, Esq., F.Z.S.

2 Red-headed Buntings (*Emberiza luteola*). Presented by E. W. Harper, Esq., F.Z.S.

2 Nutmeg Finches (*Munia punctularia*). Presented by E. W. Harper, Esq., F.Z.S.

4 Chestnut-bellied Finches (*Munia rubro-nigra*). Presented by E. W. Harper, Esq., F.Z.S.

7. 4 Dunlins (*Tringa alpina*). Purchased.

1 Redshank (*Totanus calidris*). Purchased.

8. 1 Smooth-footed Scops Owl (*Scops glabripes*). From Formosa. Deposited.

13. 1 Common Fox (*Canis vulpes*). Presented by Mr. Harold von Löhr.

2 Curlews (*Numenius arquatus*). Purchased.

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28. 1 Bonnet-Monkey (*Macacus sinicus*), ♂. Presented by Mr. J. Hussey.

2 Red-eared Bulbuls (*Pycnonotus jocosus*), 2 ♂. Presented by Brig.-Surg. Lieut.-Col. E. F. Drake Brockman, F.R.C.S.

29. 1 Cape Bucephalus (*Bucephalus capensis*). Presented by J. E. Matcham, Esq.

1 Rhomb-marked Snake (*Psammophylax rhombeatus*). Presented by J. E. Matcham, Esq.

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PHILIP LUTLEY SCLATER, M.A., Ph.D., F.R.S.,
Secretary.

3 Hanover Square, London, W.,
August, 1894.

November 20, 1894 (*continued*).

December 4, 1894.

LIST OF PLATES.

1894.

PART IV.

NOTICE.

The 'Proceedings' are issued in *four* parts, as follows:—

Part I. containing papers read in January and February, on June 1st.
II. „ „ „ March and April, on August 1st.
III. „ „ „ May and June, on October 1st.
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